

POPULAR MECHANICS

MAGAZINE

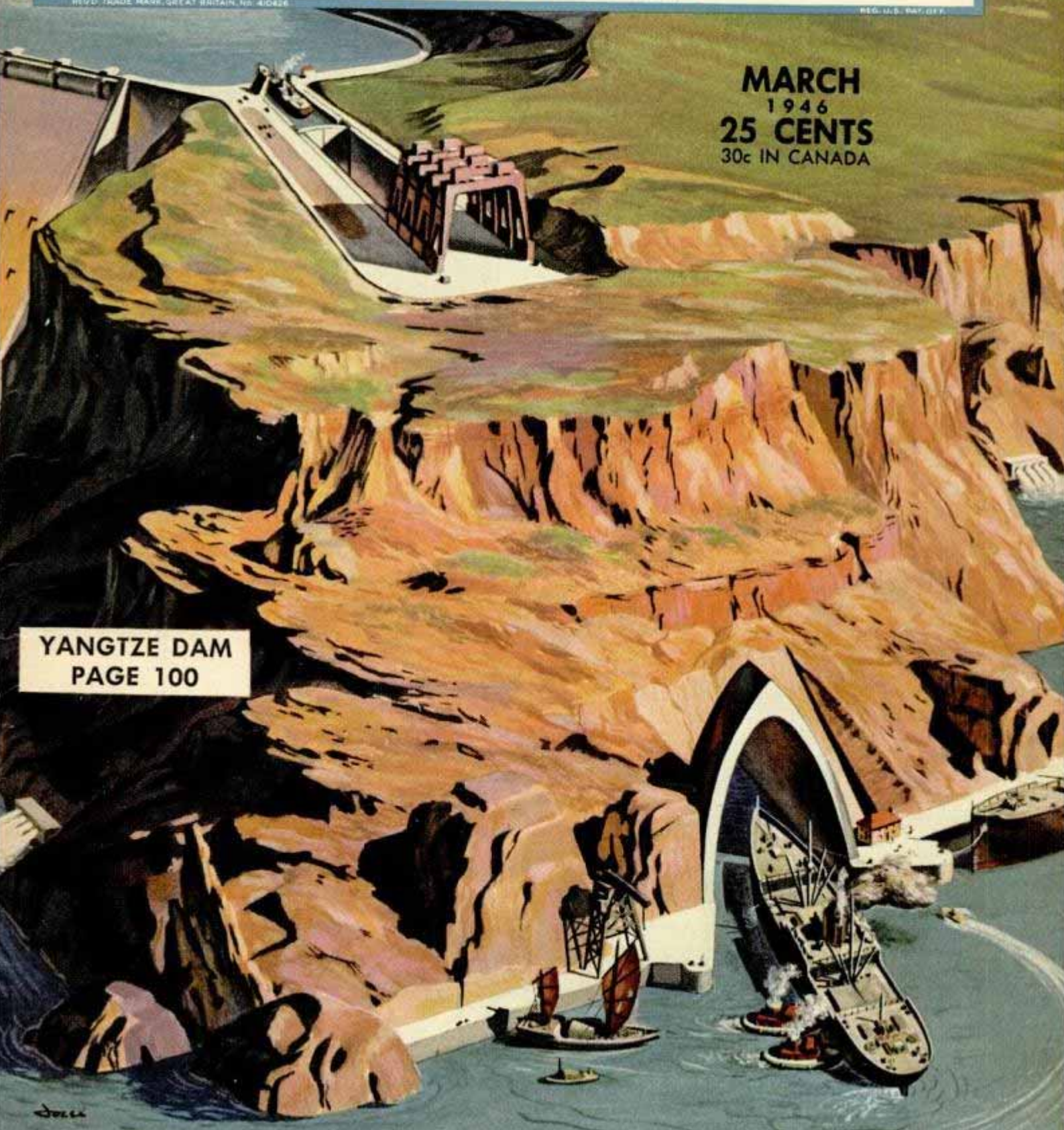
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MARCH
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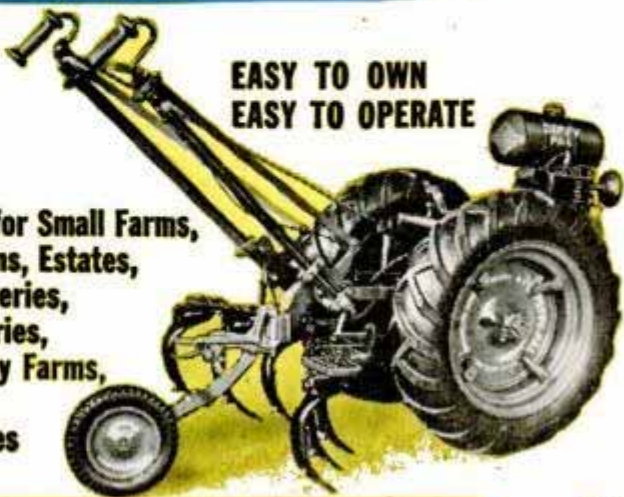
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**Ideal for Small Farms,
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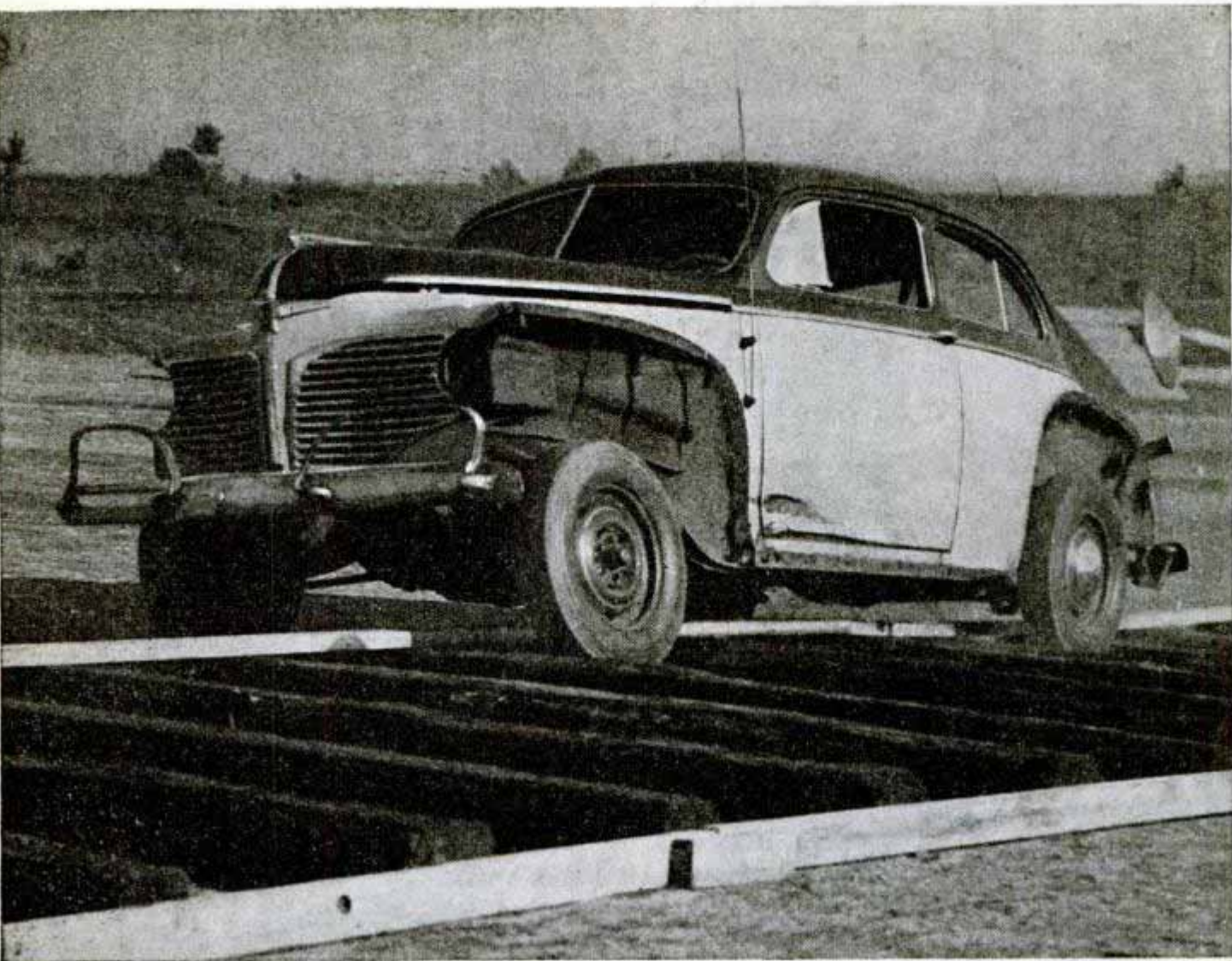


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Name _____



Stunt driver tests new tire that

OUTWEARS PREWAR TIRES

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

HERE'S Jimmie Lynch, stunt driver, giving the new B. F. Goodrich Silvertown tire the beating of its life. The photo was taken at one-thousandth of a second. You can't see Jimmie, he's crouching too low, but you can see that hub cap sent flying into the air by the jolting impact of the railroad ties.

What does it prove? It proves that the new tire will stand worse treatment than you're ever likely to give it. In laboratory tests it has resisted bruising better than prewar tires.

It outwears prewar tires. Tests prove that, and most of these tests

were made at high speeds. The new tire has had nearly 17 million miles of tests on B. F. Goodrich test cars, taxi fleets, and police cars. They were made in all kinds of weather, on all kinds of roads.

If you could get a closer look at the tire, you'd see that its tread is slightly wider and flatter than most tires. This new tread design spreads the wear over the whole face of the tire. Engineers had wished for years to make a tire with a flatter tread, but that shape always set up strains in the tire body, or "carcass," as it is called. B. F. Goodrich developed an entirely new and stronger cord,

designed it into a carcass that stands these strains and permits the use of the flatter, longer-wearing tread.

We hope it will not be too many weeks before you are able to buy one of these new tires. Supplies are still very limited, of course, but we hope to have much larger quantities in the hands of most dealers within the next few months. *The B. F. Goodrich Company, Akron, Ohio.*

More miles with

B.F. Goodrich

FIRST IN RUBBER



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"A leaping trout awakens the still pool to life in waves that move in silent rhythm."

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How to produce, transmit and receive

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Bell Telephone Laboratories, which exist primarily to invent and develop better communications for the Bell System, devote the teamed efforts of physicists and mathematicians to the production and control of electric waves in all forms.

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Thomas E. Stimson, Jr. Bill Reiche

Meet the Western and Eastern Editors of Popular Mechanics. *Bill Reiche* joins the staff as Eastern Editor with offices in the Empire State Building, New York City. He was formerly manager of the central publicity division of Westinghouse Electric Corporation and has won a national reputation for brilliant reporting of scientific and mechanical news. *Thomas E. Stimson, Jr.*, our Western Editor, has been a contributor for 15 years and is recognized as a leading writer in the field.

Next Month

THIS being a land of tourists, some hundred million Americans are dreaming now about hitting the highway. The folks who build trailers tell us you're going to vacation in cottages on wheels with fluorescent lights and shower baths. An article in the April issue gives you a foretaste of trailer travel next summer.

POPPING corn by radio waves is old stuff. Now radio heat "sews" plastic fabrics, hardens metals, may some day replace nails. An article next month tells how "Industry Cooks with Electrons."

"PLANT two seeds—one for the bugs and one for yourself" is an old maxim of gardeners; but the Craftsman Section in April offers advice to those who'd rather fight insects than feed them.

REMEMBER 'way back when the Indianapolis Speedway was the capital of the world on Memorial Day? The classic is coming back this year, and in our next issue you'll see the track demons souping up their two-miles-a-minute racers for the grand reopening of the 500-mile grind.

Volume 85 MARCH 1946 Number 3

Managing Editor.....Roderick M. Grant
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Shop Notes and Crafts Editor.....James R. Ward
Radio and Electronics Editor.....Frank L. Brittin
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For the Craftsman

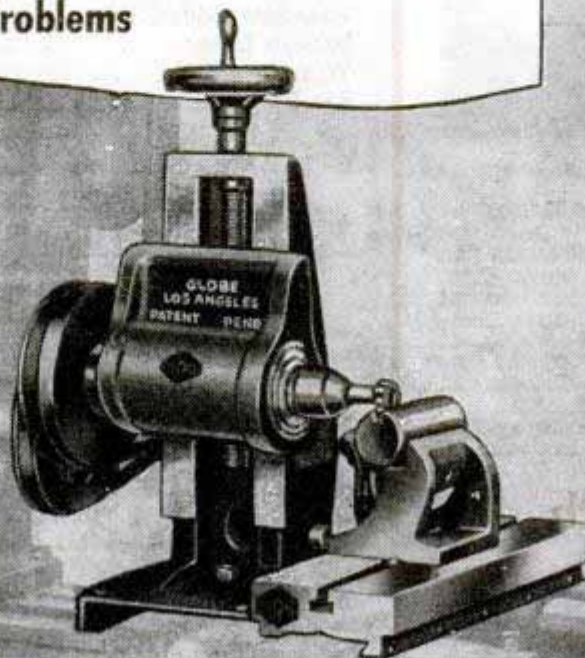
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Ingenious New Technical Methods

To Help You with Your Reconversion
Problems



New Unit Makes Milling Machine Out of Lathe in 3 Minutes!

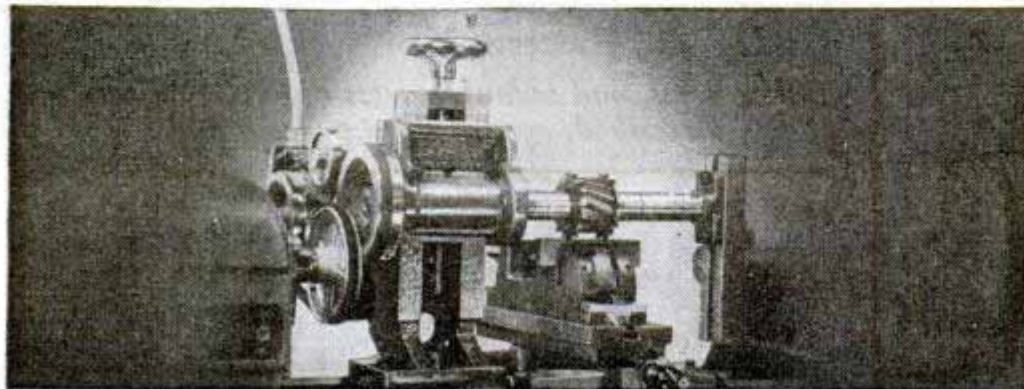
The Globe Miller, a unit quickly attached to a standard lathe, performs the same operations as a costly milling machine. Installed in 3 minutes or less, the Globe Miller operates almost identically to a standard milling machine. All controls are simple, highly accurate—and the miller is designed to utilize all speeds and feeds of the lathe.

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AA-58

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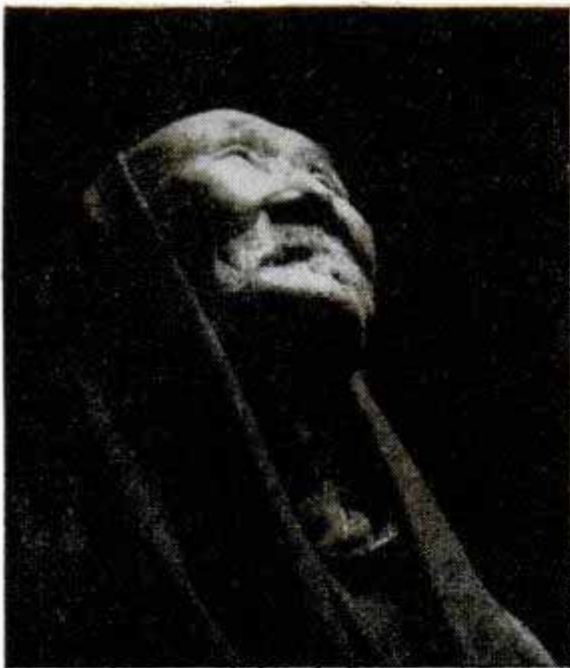


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Says Aged Lama

CAN WE RECOLLECT OUR PAST LIVES?

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Prejudices, fears, and superstitions have denied millions of men and women a fair and intelligent insight into these *yesterdays of their lives*. But in the enigmatic East, along the

waters of the once sacred Nile, and in the heights of the Himalayas, man began a serious search beyond this veil of today. For centuries, behind monastery walls and in secret grottoes, certain men explored the *memory of the soul*. Liberating their consciousness from the physical world to which it is ordinarily bound, these investigators went on *mystical journeys* into celestial realms. They have expressed their experiences in simple teachings. They have disclosed whereby man can glean the true nature of self and find a *royal road* to peace of mind and resourceful living.

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suppose that a better job had opened up in your company—carrying with it promotion and more money—could you qualify?

If you were boss, would you select "YOU" for that better job?

Consider before you answer.

First of all, could you *fill* the job? Has your experience fitted you for the step forward—have you been preparing for promotion apart from experience gained on the job?

Or have you just been filling a niche, doing daily tasks well but making no real and intelligent effort to learn and qualify for the job ahead so that if an opening should occur you would be ready to fill it?

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directing the efforts of other men is a valuable asset to any business organization. He never wants for a good

job and above average earnings. He gets ahead.

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So send it today—right now—tomorrow never comes for the man who consistently puts things off.

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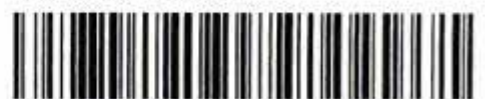
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Jerry, the talking dog, is entertaining hospitalized veterans by courtesy of the PYROIL Company.

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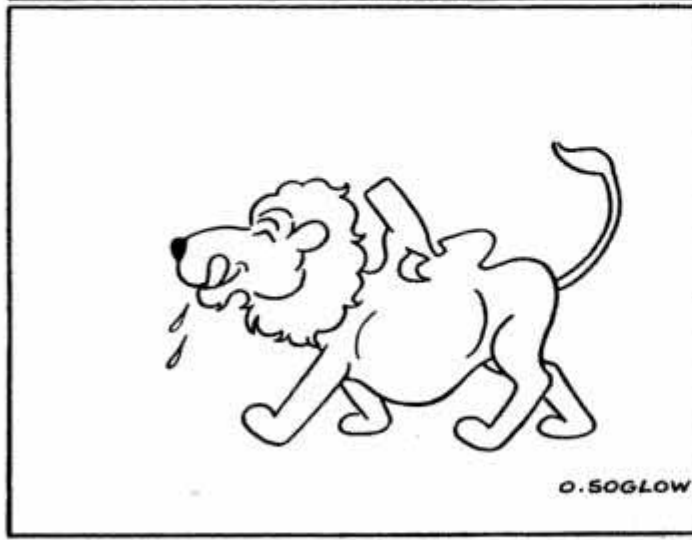
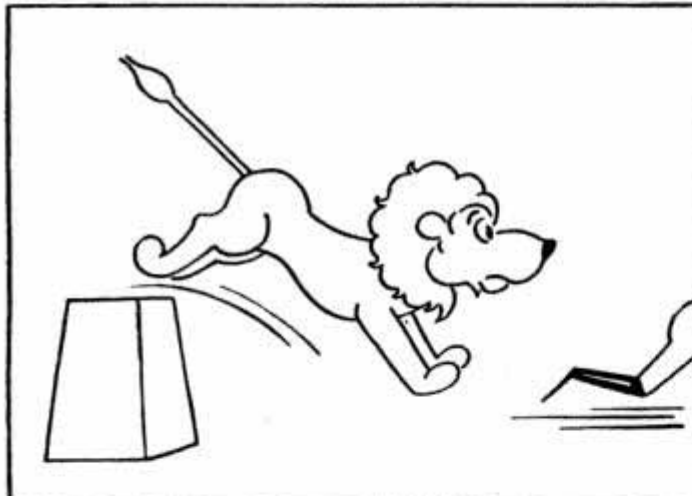
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<input type="checkbox"/> Sheet-Metal Worker
<input type="checkbox"/> Ship Drafting <input type="checkbox"/> Ship Fitting
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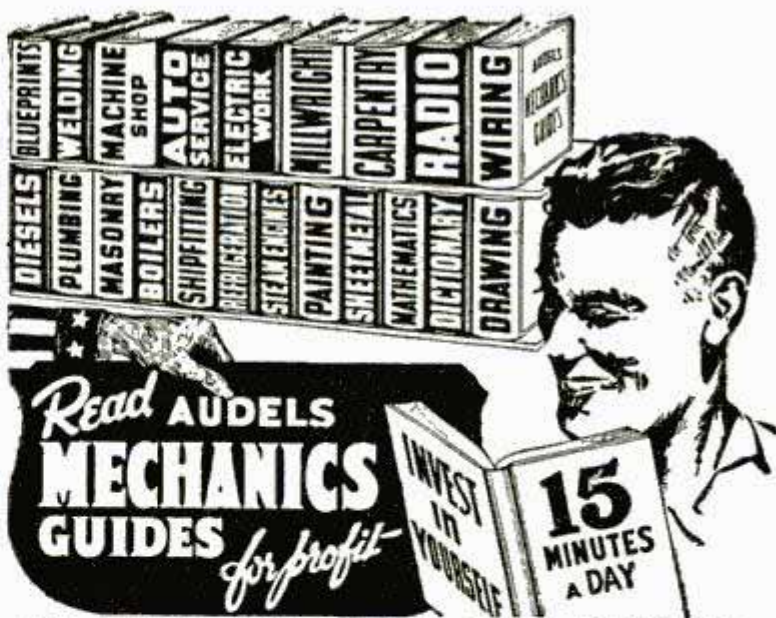
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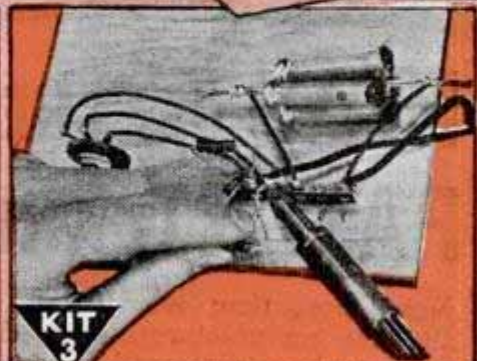
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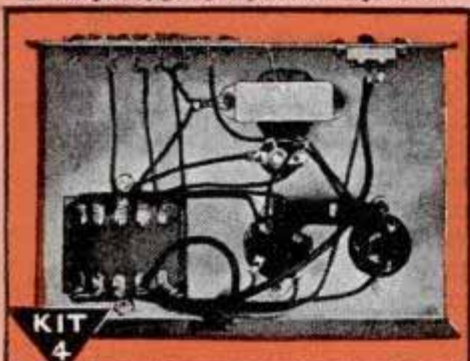
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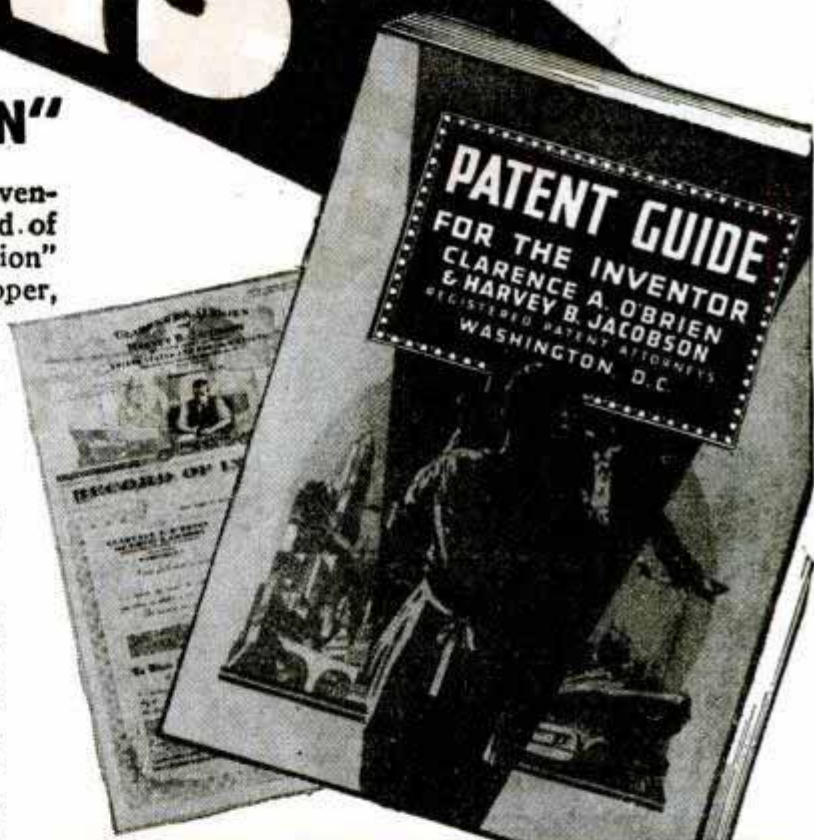
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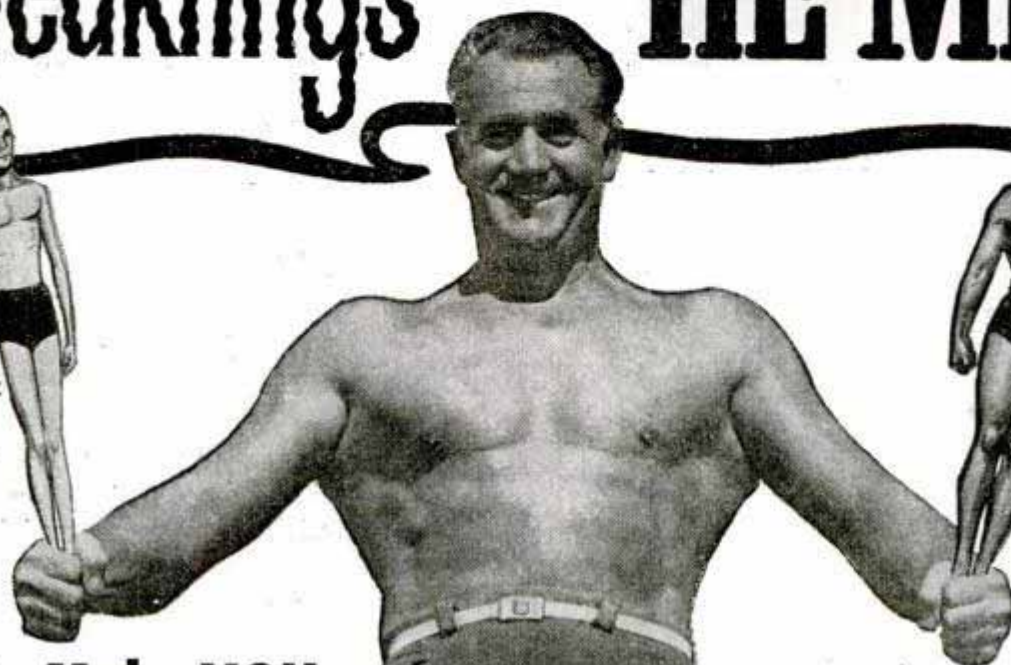
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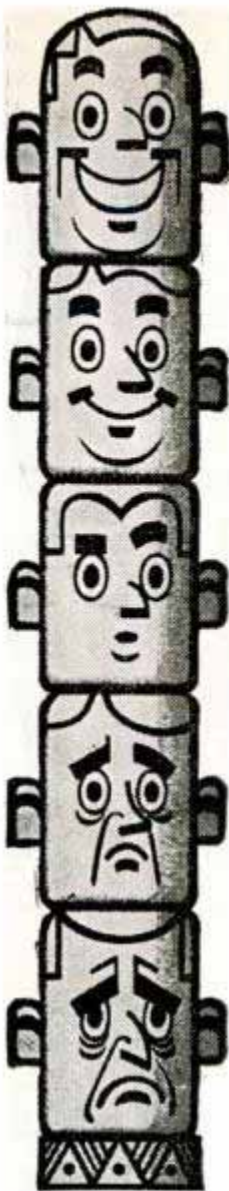
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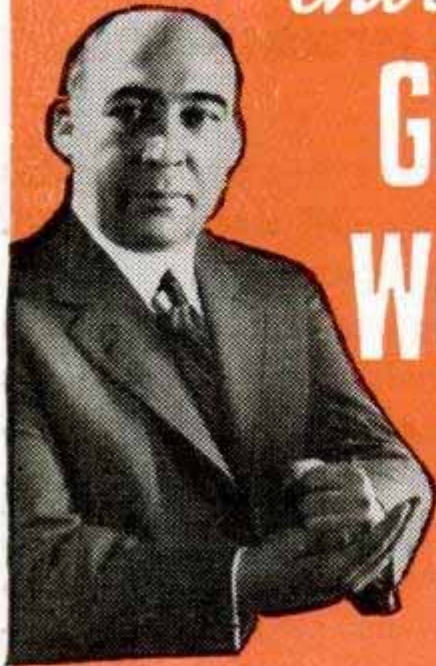
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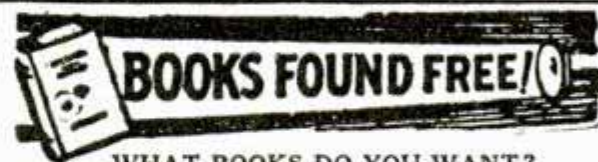
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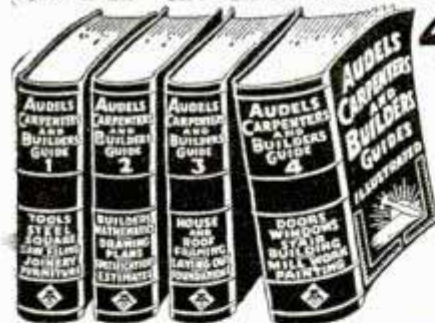
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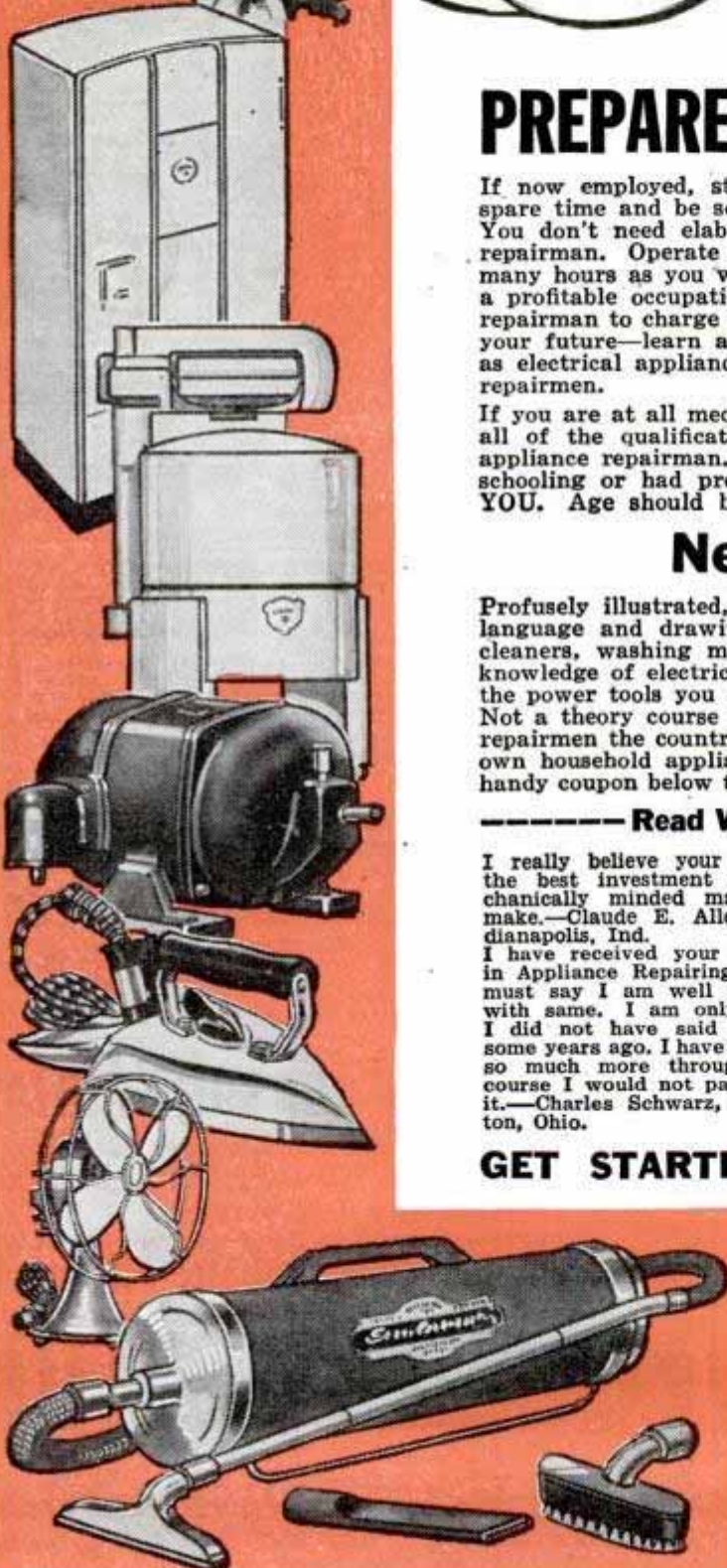
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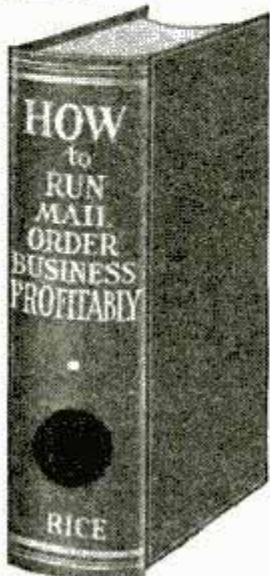
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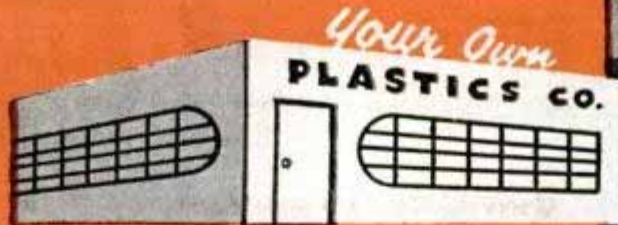
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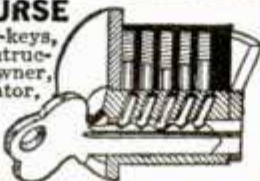
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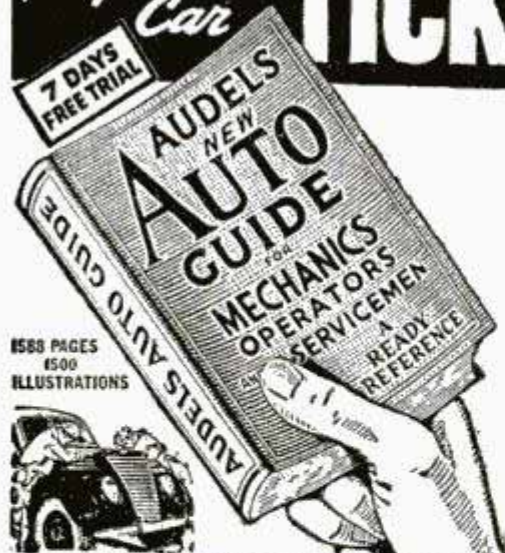
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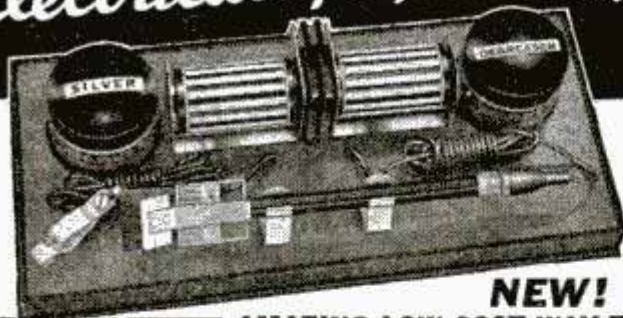
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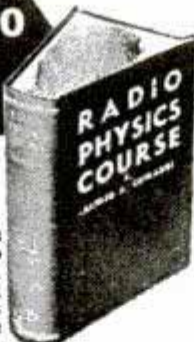
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Advertisements in this section 50 cents per word, each insertion, minimum 10 words, payable in advance
To be inserted under proper classification in April issue, copy should be in our office March 4th

April issue on sale April 1st

F. W. Johnson, Manager, Classified Advertising
Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Illinois

1507 CLASSIFIED ADVERTISEMENTS 1507 OPPORTUNITIES FOR YOU

AUTOMOBILES, MIDGET CARS

PHOTOS Famous race car drivers with their cars. Today's fascinating hobby for everyone. Present these pictures at races to be autographed. Experience new thrills. Pictures taken by Frank Smith, famous retired race driver. Special offer, assortment 7 famous drivers, size 4x5—\$1.00, including free autographed photo of Ted Horn. Photo Ted Horn only 25c postpaid. Midland Park Studio, Midland Park, N. J.

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PROFESSIONAL Midget racer, motor-scooter, midget roadster, and midget motorcycle. Plans, specifications for all four contained in illustrated handbook, 25c. Big list used motors, motorscooters, Servicycles, etc., included free! Midwest, 3839 Drummond, Toledo, Ohio.

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PHOTOGRAPHS, World's finest automobiles. List 10c. Box 1028, Minneapolis, Minnesota.

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

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NO More worries about flat tires! Ernie airline tire inflater! Send \$1. Distributors wanted. Box PM3145, Euclid 17, O.

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WHIRLGAS Turbinator. \$3 carburetor amplifier, increases mileage, power. Universities verify. Auto make, year required. John Hanley, 5719 Loraine, Detroit 8, Mich.

HAVING Car trouble? New, used, guaranteed auto, truck parts save money. Transmission specialists. Describe needs; immediate reply. Victory, 2930 1/2 North-western, Chicago 18.

AUTO Parts for all autos and trucks. Trans., motors, differentials, fenders, carburetors. Also body parts. Security Auto and Truck Parts, 1941 BJ Eddy, Chicago 13.

GASOLINE Saving device. Chevrolet, Ford 1932-1942, Dodge, Plymouth, 1933-1938. Walert Company, 3429 North 10th Street, Milwaukee 6, Wisconsin.

GRILLES For all cars. Meyers Auto Parts, 820 Dryades, New Orleans, La.

OIL Pumping motors—Brought back to normal without ring job. Write for particulars. Joe Mullner, Box 3102, St. Paul 1, Minn.

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

AUTO TRAILERS

AUTOMOBILE-Trailer Travel, monthly magazine, \$1 year. Kimbel, Plant City, Fla.

BUILD Streamlined trailer coach. Has everything. Large manual, drawings \$1.00. Circulars 10c. Craftsmann Books, Box 1153-P3, Milwaukee 1, Wisconsin.

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

MOTORCYCLES, BICYCLES, MOTOR-SCOOTERS AND SUPPLIES

"MODERN Motorcycle Mechanics" enlarged, revised, second edition, 560 pages, 300 illustrations. The most up-to-date and complete motorcycle book published. Extensively covers design, operating, and servicing Harley-Davidson, Indian and English makes. Price \$3.00 postpaid. Nicholson Brothers, Motorcycle Engineers, Saskatoon, Canada.

HARLEY-DAVIDSON Service, parts, accessories. Buddy seats \$17.75, tandems for 45" models \$12.50 (shipping paid). Can be fitted to other models. Send \$2.25 for Army Motorcycle Manual, 10c for bulletins. Knuth's (Harley-Davidson factory dealer), 2491 W. Fond du Lac, Milwaukee 6, Wis.

BICYCLES Brand new, men's, ladies', boys' and girls'. Accessories. Send dime for list. Century Cycle Company, 3447 Lawrence Ave., Chicago 25, Illinois.

MOTORSCOOTER Plans for boys. Speedy. Simple to build. Uses washing machine gas motor. \$1.00. Strachan Scooter Shop, Howard 2, Kansas.

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BOLENS Factory-built midget racer \$40 complete; boys midget car less motor \$8; twin-cylinder motorbike \$35; Indian twin motorcycle \$60; Harley \$70; motorscooters \$35 up; Briggs-Stratton motors as low as \$5. Over 1500 balloon tires for midget cars and motorscooters in stock \$1.50 up. Parts plans. Mailorder only. Send 25c for big war-bargain catalogue Number 12 just out listing the above and almost 400 other motorized bargains. (35c by first class mail.) Midget Motors Directory, Athens, Ohio.

NEW Bikes, \$34.50 delivered. Tricycles, speedometers, chromium handle bars, luggage carriers. Hillman Cycle Co., 142 Wilson St., Havre De Grace, Maryland.

BICYCLE Book, how to buy, rebuild, sell used bicycles 50c. John Collett, Handley, Texas.

BUILD Scooters, trailers, midgets, conversions. Large manual \$1.00. Circulars dime. Craftsmann Books, Box 1153-P2, Milwaukee 1, Wis.

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GENUINE Moto-Scoot parts. Complete wheels, tires, tubes, 4:00x7, 3:50x6. AMSCO centrifugal clutch. Windshield, side cars. All other parts and accessories. Write for parts list. Also genuine engine parts for Briggs and Stratton, Lauson, American Moto-Scoot Co., 1319 W. Carroll Ave., Chicago 7, Ill.

MOTORSCOOTER \$10. Motor \$3, tires \$2. New catalog, 25c, lists these and many other sensational bargains in motors, wheels, motorscooters, and motorbikes! Associated, Box CS-1764, Toledo, Ohio.

COMPLETE Motorcycle parts list, 10c. All models Indian and Harley. Pistons, chains, sprockets, generator repairs, carburetor rebuilding, motor rebuilding, repair manuals. Bootz, 622 E. Grand, Des Moines 9, Iowa.

MOTORCYCLE Cams ground for speed and power. For information write Harold Schaller, 247 West Main, Turlock, Calif.

FLOYD Clymer's Motorcycling Manual, 120 illustrations. Information, specifications, descriptions dozens motorcycles. Engines, transmissions, carburetors, square four, two piston singles, overhead camshafts, spring frames, hydraulic forks, sidecars, riding instructions. Two cycle engines and power bicycles described, illustrated. \$2.00 postpaid. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

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

LARGE Stock Indian parts. Expert motor rebuilding. Indian Motorcycle Sales, Kansas City 1, Mo.

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

FLOYD Clymer's popular motorcycle, automobile books. See advertisement under Automobiles! Clymers, 2125 W. Pico, Los Angeles 6, Calif.

TIRES, Tubes, wheels, for industrial trucks, carts, wheelbarrows, scooters, midget cars, coaster wagons. Nationally known makes, first-line quality. Sizes 8" to 18" o.d. in 2, 4, and 6 ply tires, separate inner tubes, heavy duty demountable wheels. Also caster forks, straight and swivel types. Free illustrated circular and prices. Jahant Co., 626 East Exchange Street, Akron 6, Ohio.

ENGLISH "Motorcycling" Magazine. Interesting, educational, foreign motorcycles. Racing, new-old models, advertisements. 50c sample copy. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

PLANS, Scale drawings, specifications, illustrations for building attractive motor scooter complete \$2.00; plans electrically driven bicycle \$1.50. Postpaid. Clymers, 2125 W. Pico, Los Angeles 6, Calif.

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

AVIATION

FLEECE Lined air forces leather helmets \$2.95, small, medium, large. Wool lined air forces dark brown leather gloves 8 and 9 \$2.95. Mae West life preserver vests \$3.95. All new. Prices postpaid. Send money order, certified check or cash. E. K. Cargill, 654 Mulberry Street, Macon, Georgia.

ALUMINUM Airplane floats, dandy for air driven or water propelled amphibious craft and catamarans. Two cylinder 8 h.p. aircooled engines. Small pneumatic tired wheels. Airplane wings. Write for literature. Karl Ort, York, Pa.

JET Propulsion circular sent builders bikes, airplanes. Byrum, Buffalo, Okla.

AERO-SLED Blueprints, open job, \$3.00. Adastik Bros., Grand Rapids, Mich.

PROPELLERS—Airliner 3 blade, fit any motor. Ice-snow sleds, boats, aircraft. Lists free. Fast delivery. Aircool conversion diagrams 50c. Illustrated light-plane literature. Standard Aircraft, Ft. Worth, Texas.

\$200.00 ON Up, Cubs, Taylorcraft, Aronca, Interstates, Motors, parts, parachutes, gliders, hangers, propellers, flying suits, caps, tires, everywhere in United States. Send 25c for big catalogue. Aircraft Bargains, Box 409, Aberdeen, Idaho.

HELICOPTER Plans, Rush name for free literature. Wayne Engineering, Greenville 1, Ohio.

SEND 25c For big war-bargain catalogue of used airplanes located everywhere, some probably near you. (35c by first class mail.) New issue just out. Used Aircraft Directory, Athens, Ohio.

PORTERFIELD \$275, Waco \$125. New catalog, 25c. Lists thousands of sensational bargains in airplanes, motors, parts; parachutes, supplies. Aviation "Business Opportunity" section included free! National, Box 1682-CS, Toledo, Ohio.

LIGHTPLANE! How to build them. Illustrated circular 20c. Craftsmann Book, Box 1153-P1, Milwaukee 1, Wis.

JET Propulsion experiments. New principle to drive boats, bicycles, model helicopters. Circular on plans. Rush name. Houston Maupin, Tipp City 53, Ohio.

WELDING, SOLDERING, PLATING

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-MP3 Canal St., New York City.

ACETYLENE Welding outfits, used \$25.00 up; arcwelders, acetylene generators. Eagle Welding, Dept. PM, 5085 Broadway, Chicago 40, Ill.

ARC Welders wanted by the thousands. Learn with 516 page lessons manual. Over 500 how-to-do-it photos. \$2.00 copy. Money-back guarantee. Hobartweld, Box M-364, Troy, Ohio.

ACETYLENE Generator plans that equal the commercial product. Detailed plans \$1.50. Hasco, Box 103, Hastings, Nebr.

WELDING Shops. Build and sell all steel rubber tired farm wagons, dual wheel tractor trailers, utility type trailers. Plans \$1.00 each, all three \$2.50. "Doc" Fixit's, Mt. Vernon, Ohio.

FARMERS, Garagemen, repairmen: guaranteed 110/220 volt, 10 to 125 amperes, a.c. welder handles 1/16" to 5/32" rods, complete supplies, \$68.00 F.O.B. Chicago. Details free. Others to \$245.00. Williams Sales Co., Box 4100, Portland 8, Oregon.

BUILD 110 Volt a.c. welder. Plugs in socket. Plans \$1.00. Easily built. Frank's, Box 555, Louisville, Ky.

OKINAWA "Flame thrower" slip-on soldering tip for fender men. Fits all torches. Postpaid anywhere in U. S. \$2.35. L. E. Kelly, 1947-19th Avenue, San Francisco 16, Calif.

ANY Handyman can make a heavy duty a.c. arc welder using field coils from old auto generators. No extra wire or rewinding. Instructions \$1.00. Excel Electric, Route 4, Box 586, Traverse City, Michigan.

WELDING, Cutting, aircraft welding and soldering equipment. Electric arc welders. Superior Oxy-Acetylene Co., Hamilton, Ohio.

"THUNDERBOLT"—Transformer welder, dial-control, 3 heat stages, 60 amps., 110 volts-a.c., takes up to 3/32 rod, carrying case, all accessories, illustrated instructions. Professional heavy duty welding, brazing outfit. \$39.50. Also light-work welder, 110-volts, a.c.-d.c. \$19.95. Save 2%, send check. Or order C.O.D. Super-Welder Mfg. Co., Dept. PMC, 23 E. 20th St., New York 3, N. Y.

BUILD D.C. arcwelder without rewinding armature. Plans \$1.00 each. 25 to 600 amperes from automotive d.c. motors, light plant generators, automobile starter-generators. Welders Club, AB-3432, Chicago 54.

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STAR Fuse tester and plier. Tests home electric outlets, locates and removes blown fuses. For home owners, electricians, maintenance men. Replaceable lamp tests 110 to 250 volts. Pulls fuses 10 to 100 amperes. Transparent shockproof plastic. Obtain from General Electric, Westinghouse stores, or your local dealer at \$2.75. Leads \$1.50 additional. (10c postage.) Star Plier Company, 233 Canal Street, New York.

ROYAL Beauty electric irons \$5.30, electric heaters \$4.95, electric broilers \$13.95, 8" a.c. 110V fans \$8.95. Two burner electric stoves \$6.95. Jeannette Electric Co., Inc., 159 West 23rd St., New York 11, N. Y.

ELECTRIC Wire—Improve your product with glass covered plastic insulated wire. Tinned copper strands. Single conductor; No. 16, No. 20 and No. 22 gauges. Coils 250 ft. to 1000 ft. One cent per foot postpaid. Specify size. Write for quantity prices. Penn Electric Company, 461-8th Avenue, New York 1, N. Y.

3 ALNICO Magnets, \$1.00. Will lift 2 1/2 pounds. Satisfaction guaranteed. Ronald Eyrich, Box 849, Milwaukee, Wis.

HEATING Element welding flux. Free sample. Raymond Dow, 2922 164th Street, Flushing 31, N. Y.

ELECTRICAL Appliance repair. Open your own shop. Learn house wiring; electric motors, vacuum cleaners, washers, etc. Complete illustrated course shows how. Free booklet. Pacific Training School, Dept. AP-2, 7217 So. Broadway, Los Angeles 3, Calif.

WRINGER Rolls as low as \$1.98 each. Also most washing machine parts. Write for details. Hoover Elect. Shop, 1 N. Main St., New Madison, Ohio.

NOW—Repair your own electrical appliances with Chanite Self-welding Electrical Heating Element Flux. Instructions delivered, price \$1.00. Stick form 25c ea., \$2.00 doz. Chanite Sales Company, 914 South Main, Fort Worth, Texas.

"IDEAL" Electrical tools, BX armor cutter, cuts BX easily without injury to wire insulation \$3.50; wire stripper and cutting pliers, strips wire quickly, cleanly \$5.50; pocket size fuse pullers \$1.25; test Glo Neon circuit tester \$1.50. All prices postpaid. Send POMO to H. H. Barnes, P.O. Box 301, Plainville, Conn.

FREE Catalog of welders, welding supplies, generators, fencers, and other electrical items. Write LeJay Company, Minneapolis 8, Minn.

FLUORESCENT Tubes burned-out? You can relight and use indefinitely. Complete instructions \$1.00. Wallingford, 121 Burlington, York, Nebr.

ELECTRIC Pencil: Writes-engraves all metals \$1.00 postpaid. Beyer Mfg., 4515-H Cottage Grove, Chicago 15.

BROKEN—Burned out electrical heating elements quickly repaired. Use new amazing Nichrocite Paste, simply overlap ends and turn on current. Family size \$1.00 bill. Satisfaction guaranteed. Armstrong Mfg., 861-X, Minneapolis, Minn.

MACHINERY, TOOLS AND SUPPLIES

SAW-ARBORS 5/8 Shaft double bearing block \$1.98. Single block \$1.00. Pillow blocks 40c. Grinding arbors 70c. 100.000 other items. When ordering include 10% for postage. Sorry, no C.O.D.'s. All merchandise 30 day money back guarantee. For list and assorted samples send 10 cents. Describe your needs. Wilson Manufacturing & Sales, 2233 Summit St., Columbus 1, Ohio.

GEARS For inventors, experimenters, model makers, schools, work shops, laboratories, etc. Government surplus made of brass, bronze, dural, steel, and stainless steel. 12 matched pairs; 24 gears, bevel, spur and ratchet. List price \$12.00, our price \$2.50. 25 matched pairs; 50 gears, includes larger gears, also sets of worm gears. List price \$30.00, our price \$5.00. 50 matched pairs; 100 gears better assortment, including internal set and worm sets. List price \$75.00, our price \$10.00. Limited quantity. Order now. Write for our bulletins on ball bearings, rectifiers, Selsyns, Horns and government surplus materials. Met Exchange, 323 Canal Street, New York.

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

HOBBYISTS! You can equip your workshop at a fraction usual cost by building your own mill, shaper, drillpress, bandsaw and other shop tools for metal and wood-working from Lewis castings, materials and blueprints. Easy to complete, and ideal for home use. Send 10c to cover cost of mailing latest catalog describing 23 items. Lewis Machine Tool Co., P. O. Box 116, Station A, Dept. M-62, Los Angeles 31, California.

FAST, Easy, smooth running portable bench grinder, 5" wheel. For home, garage and shop use. Postpaid \$5.95. Hardware Sales Corp., 242 Canal St., New York 13, N. Y.

TREASURE Finders. See Goldak advertisement in Miscellaneous section.

"PEPY" Governors make automobile motors power units. \$9.50 up. Circular, Harris Machinery, Minneapolis 14, Minn.

TURBINE Water motors. Attaches to faucet. \$7.75. James Woodward, Jackson, S. C.

TOOLS, Hardware, taps, drills, pulleys, saw mandrels, brass, steel. Catalog 10c. Terek, 6304 Patterson, Chicago 34.

WAR Surplus, machines, tools, etc. Rush name for free literature. Wayne Engineering, Greenville 1, Ohio.

DRILL Grinder for twist drills \$2.95, and other craftsman's tools. See ad on page 277.

EVERY Shop can use assorted aluminum rivets for models and repairs. 3 pounds 69c. Arizona Mfg. Co., Box 2091, Phoenix, Arizona.

EXPERIMENTERS—400 Valuable new springs, 75 kinds, numerous sizes, 10,000 uses. \$2.00. Deluxe assortment, \$3.00. Jumbo, \$5.00. Guaranteed. Technico, Box 246-A, West Hartford, Conn.

HIGH Speed drills, taps, milling cutters, end mills, tungsten carbide tipped tool and lathe bits, etc. Reasonable prices. Send for price list. Box 212, Milwaukee 9, Wis.

SELSYN Motors, weight 5 lbs. each., set of 4—2 differentials, 2 transmitters, 110 volts, 60 cycles, a.c. special \$25.00, charges prepaid within the U. S. Manufactured by Bendix, suitable for remote control, beam antennas, bingo signalling, wind indicators and many other uses. .06 h.p. Westinghouse motors 115 volts, 60 cycle, a.c., 3 phase, 945-1145 intermittent speed \$12.50, charges collect. Also complete oil gear unit for elevation model M-1. .06 h.p. motor, 115 volt, a.c., 3 phase, 945-1145 Intermittent speed motor, 1 set Selsyn motors, \$35.00, charges collect. Weight 172 lbs. Alnico magnets, gap 16 m/m, 20 m/n, pole faces, 4860 Gauss. Charges prepaid, \$7.50 ea. Columbo Trading Co., Inc., 304 Canal St., New York City 13.

INDEX Heads for sale. Very inexpensive. Sixty-two different divisions. Used on small lathes, drill press, milling machines, etc. Make gears, hobs, cutters, etc. Very accurate, and durable. Not a toy. Used by defense schools and hobbyists. Write for free folder. Long's Index Heads, 2117 East B St., Torrington, Wyo.

ROTARY Vacuum pumps \$60.00. 28" vacuum 3 c.f.m. at 850 r.p.m. William Reid Co., Chicago 14, Ill.

ARBORS. Ball bearing, 5/16" to 1" shaft. Specifications on request. Don G. Jennes Co., 1017 Santa Fe Ave., Los Angeles 21, California.

ENGINES, MOTORS, DYNAMOS

BIG Pay jobs in welding. Complete welding lessons and reference books. 516 pages. 41 lessons. \$2.00 copy. Money-back guarantee. Hobartweld, Box 365-M, Troy, Ohio.

SELSYN Motors. Write for illustrations, description, etc. J. A. Weber, 150A Maple, Hershey, Penna.

150 AMPERE Generator for welding \$47.50. Extra flexible cable, 10 ft. lengths \$2.75. Other bargains. Butler Electric Company, 1885 Milwaukee, Chicago 47.

COMPARE Our catalogue on engines, etc., 10c. Howard-A3, 2417 N. Ashland Ave., Chicago 14, Ill.

NEW Kohler electric plants a.c. and d.c. Other electric plants rebuilt. Write E. P. Schmalz, 314 Wyoming Ave., Kingston, Penna.

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

BOATS, OUTBOARD MOTORS, ETC.

TENTS For body scouts, wall tents, car-bide lamps, Swedish kerosene stoves, canvas for canoes, kayaks, airplane dope, cement, paints, canoe enamels. Alan-Clarke, 96 Chambers, New York City 7.

OUTBOARD Cabin cruiser plans. Fast. Simple to build. Sixteen foot. \$3.00. Strachan Boats, Howard 2, Kansas.

MOTOR Installation instructions, fishing boat, skiff, barge and houseboat plans, each \$1. Albert Schantz, Baden, St. Louis, Mo.

USED Outboard motor parts. Outboard Exchange, 1194 Remsen Ave., Brooklyn, 12, N. Y.

REBUILT 22 H.P. Johnson outboard motors; many others; new and used marine engines; propeller straightening and balancing; parts for most all makes; boat paints; marine hardware; Ford conversion kits; new propellers. W. L. Masters and Son, 214 W. Chicago Ave., Chicago, Ill.

RUBBER Boats! Holds four men. About 10 ft. long, 5 ft. wide. Deflated it collapses into carrying case 3 ft. long, weighing 40 lbs. These boats are new and unused, but slightly shopworn. Complete with automatic instant inflation equipment also hand pump, oars and carrying case. Just like the boats which kept Rickenbacker afloat for twenty-one days. Original cost about \$300.00. They're a real bargain at \$89.50. Boat only without inflation equipment, oars, pump or carrying case \$69.50. Other types: new one-man size complete with 17 accessories and automatic inflation cylinder weighs 18 lbs., collapses into package 13"x15"x4", \$39.50. New Navy type dual automatic inflation life belts, 98c each without inflation cartridges. New pneumatic Mae West life saving vests, \$3.95 without inflation cartridges. Satisfaction guaranteed or money back. Cartridges for inflating belts and vests \$1.00 per dozen. Order from this ad or send for literature. Dealers wanted! Karl Ort, Dept. PM-8, York, Pa.

FORD-Mercury-Zephyr marine conversions. Catalog 10c. Lehman Manufacturing Company, Dept. D, Newark 2, N. J.

MARINE Muffler—Simple, low cost, cinch to install yourself. Guaranteed. Send for free folder. Savage Marine Co., P.O. Box 772, Boston, Mass.

WANTED, Experimenters to work with jet propulsion. Free literature. Shea, 374 Grant, San Lorenzo 16, California.

OUTBOARD Motor brackets—New models for canoes, rowboats, sailboats. Send for free descriptive folder. Outboard Motor Brackets Co., P.O. Box 772, Boston 2, Mass.

ONE-MAN Boats—Ideal for hunters, fishermen. 7½ foot long. Weighs only 30 pounds. Easily carried. Army surplus auxiliary fuel tank sections, of Terne plate steel, that convert easily to one-man boats. Approximately \$1.00 worth of welding will seal fuel outlets. Only \$4.75, prepaid anywhere in U. S. Address: Irving Goodman, P.O. Drawer 191, Galesburg, Illinois.

PLASTIC Boats now! Make your own for pleasure or sale with these streamlined 9'x4' one-piece reinforced molded hulls. Makes Adirondack car-top boat, sailing dinghy and ten other craft. Won't leak. Won't crack. Won't rot. Plastic Boats, Box 187, Lake Placid, N. Y.

BUILDING The Small Boat, new book, due out in March, by Cliff Bradley, 74 pages, sent C.O.D. \$2.50 plus fees when ready. Kimbel, Plant City, Fla.

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MARCH 1946 55

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SILVER Plating liquid. (NuSilver trade mark.) Apply with a cloth. Simply rub-on with a saturated cloth, dry-off and buff-up bright with a dry soft polishing cloth. All done in 1 minute. It cleans, silverplates and polishes from the one application. Easily done at home or in the office by anyone. NuSilver Plating Liquid is a more than 50% ($\frac{1}{2}$ plus) genuine U. S. government treasury department domestic silver solution, 1000 fine (pure silver), sterling. It renews all sterling and plated silverware. It also silverplates onto brass, copper, bronze, zinc, nickel-silver, german-silver, and some other composition metals. Over 100 uses listed to date. NuSilver is a permanent lasting finish. Won't wash off. Won't brush off. Won't boil off. Once applied as directed it is there to stay. NuSilver Plating Liquid is a widespread and intensive seller. Working sales distributors are wanted for areas not now being worked. Easily sold to merchants in dozen lots by a sales set-up which furnishes free printed guarantees, printed advertising leaflets and one store counter display card for each one dozen, any kind of a store or business place can sell NuSilver. Any kind of an average distributor-Salesman can sell NuSilver. You sell, deliver and collect your big cash profits as you work. Details by letter-mail. For U.S.A. territory only. Can sell both wholesale and retail, and to jobbers, or any way you like. NuProcess Products Laboratories, Dept. 210, Aurora, Ill.

AT Last! Something new and sensational in everyday greeting cards. Gorgeous "glass bead" designs never before offered. Get orders fast. Up to 100% profit. Other fast-selling box assortments. Samples sent on approval. Write today. Puro Company, Inc., 3041 Locust, Dept. 640-C, St. Louis 3, Mo.

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SELL Ultra-blue store stock signs. 35c sellers. Cost 5c—\$1.00 brings 15 samples postpaid. Lowy, 8 West Broadway, New York, Dept. 271.

WHOLESALE, Cigarette lighters, flashlights, leather billfolds, tobacco pouches, etc. Write for illustrated price list. National Sales Co., 221 Page St., Dept. 113, Flint 5, Michigan.

AGENTS! Earn big money, selling personalized soap with names and designs that will not wash off. Sells on sight. Particulars free. The D. & P. Sales, P.O. Box 1471, Dept. P. Uniontown, Penna.

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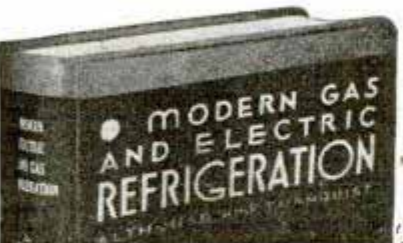


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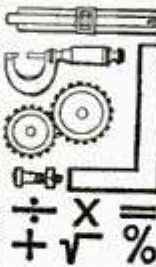
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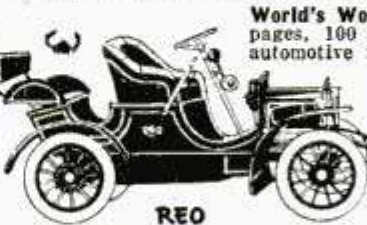


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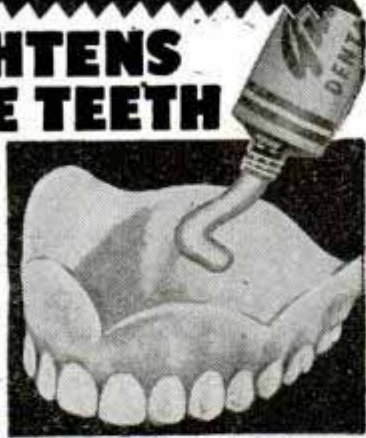
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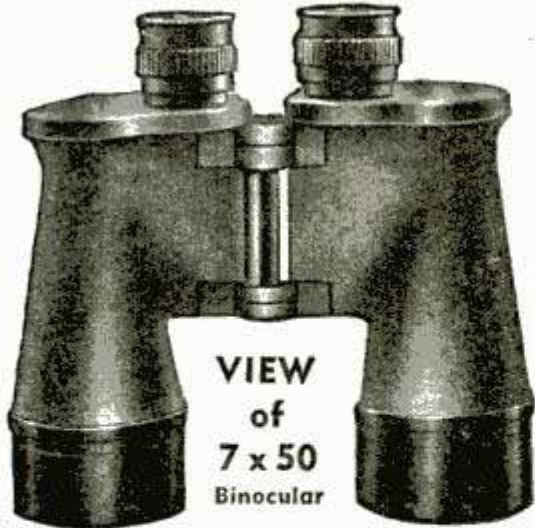
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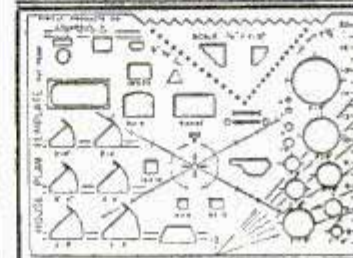
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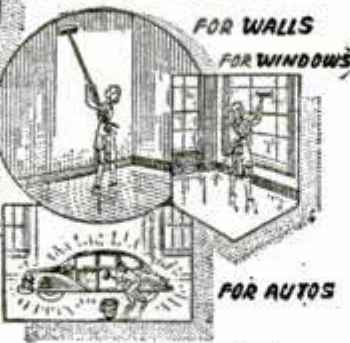


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• Technicians helped win the war. Now technical skill will be a major factor in guarding the peace. . . . The Army Air Forces need your ability in the vital job of keeping America strong in the air. The possibilities of radio, radar, new types of engines and jet propulsion are unlimited. They must be developed.

• Men between the ages of 17 and 34 have a great future ahead of them in aviation. During the war the Army Air Forces established the finest technical schools in the world and now they are yours. Your special skill will be developed to the fullest extent in the excellent technical training schools maintained by the Army Air Forces. You will be trained by the finest men in modern aviation using the newest techniques. And you will earn as you learn.

• A private earns \$50 per month. Enlisted men's pay can rise to as much as \$200 per month. Promotions for tech-

nicians are rapid. You will receive the finest of medical and dental care without ever having to worry about a bill.

• Under the Army's new enlistment program, enlistments are for 1½, 2 or 3 years. Men who enlist for three years may choose their theater of operation and branch of service. There's a 30-day paid furlough each year. Service overseas brings 20% extra pay and flight pay 50%. There are generous family allowances for the dependents of men who enlist before July 1, 1946. You are offered the right to retire after 20 years of service at half pay, increasing to three-quarters pay after 30 years' service. All this while you are developing your special skill or trade!

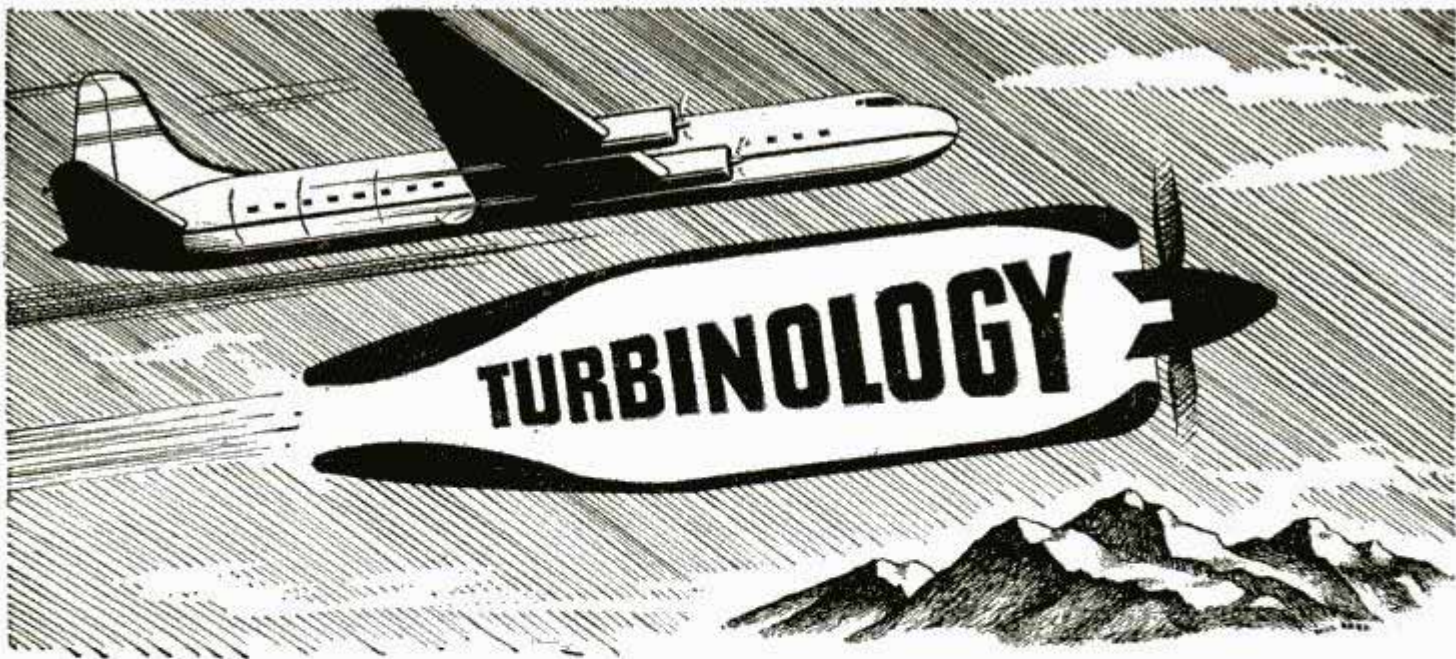
• If you are physically fit you can enlist today. Stop in at your nearest Army Recruiting Station and let them tell you more about your big part in the post-war AIR FORCES.

SEE THE JOB THROUGH

U.S. ARMY AIR FORCES

BE A "GUARDIAN OF VICTORY"





Wright Aeronautical Announces a New Type of Aircraft Engine . . . the Propeller Turbine

A tremendous and radically new source of aviation power, double the output of present engines is being developed by Wright Aeronautical. It is a propeller turbine, for use in gigantic new long-range planes racing through the stratosphere. The first Wright turbine will have double the power of today's largest Cyclone. Other models will be much larger.

WHAT IS A TURBINE?

Blow on the blades of an electric fan. They will begin to turn, though slowly. Direct the nozzle



FAN SPINS WITH WATER SPRAY

of a garden hose against the blades. They will turn faster. Or turn the air stream of a filling station tire pump on them. They will spin much faster.

In a regular turbine, much the same result occurs. There is a turbine wheel made up of fan-like blades placed close together.

A stream of super-heated steam or high-pressure water strikes against the blades with thousands of times the energy of a garden



DAMS HAVE TURBINES

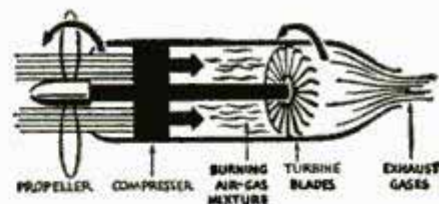
hose and forces them to turn the turbine wheel and its shaft. In ocean liners, the rotary motion of the turbine is used to turn the ships' propellers. On land, the turbine is made to turn by steam or the force of water dropping over a dam or waterfall, and usually drives an electric generator.

NEW PROBLEMS ARISE

Lacking both waterfalls and boiler houses in the air, Wright Aeronautical had to devise a new method of creating a high pressure stream to strike the turbine blades and thus put power into a propeller shaft. Wright engineers turned to gasoline, burning it with compressed air. The result is a terrific expansion of exhaust gasses and air made to expand by heat. The only way the gasses can escape is through the turbine blades. Just as you set a revolving door in motion by pushing against it as you go through, so the gasses set the turbine wheel in motion by

pushing against the blades as they pass through.

The turbine is simple in theory but years of research have gone into making it a fact. New metal alloys were evolved, to withstand temperatures far above super-heated steam. To fill the job of waterfall or steam boiler, Wright engineers added an air pump, driven by the turbine shaft, to supply a constant source of compressed air. They geared down the furious turbine speed to a proper propeller pace.



Their total result is a turbine of unprecedented horsepower. And just as the first Cyclone doubled, then quadrupled in power, so this first Wright turbine will be replaced by steadily larger models.

This is the first of a series of explanatory ads on the Wright Aeronautical propeller turbine.

WRIGHT

AIRCRAFT ENGINES

DIVISION OF

CURTISS  WRIGHT

FIRST IN FLIGHT

Wright Aeronautical Corporation • Paterson, New Jersey

CAN YOU IMAGINE a ray so powerful that it will penetrate a solid mass of lead as high as a four-story building, or as thick as five sixths of the distance between the pitcher's box and home plate? The cosmic ray does exactly that—

Unlocking the Universe

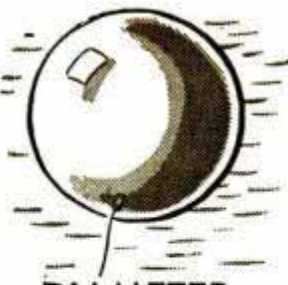
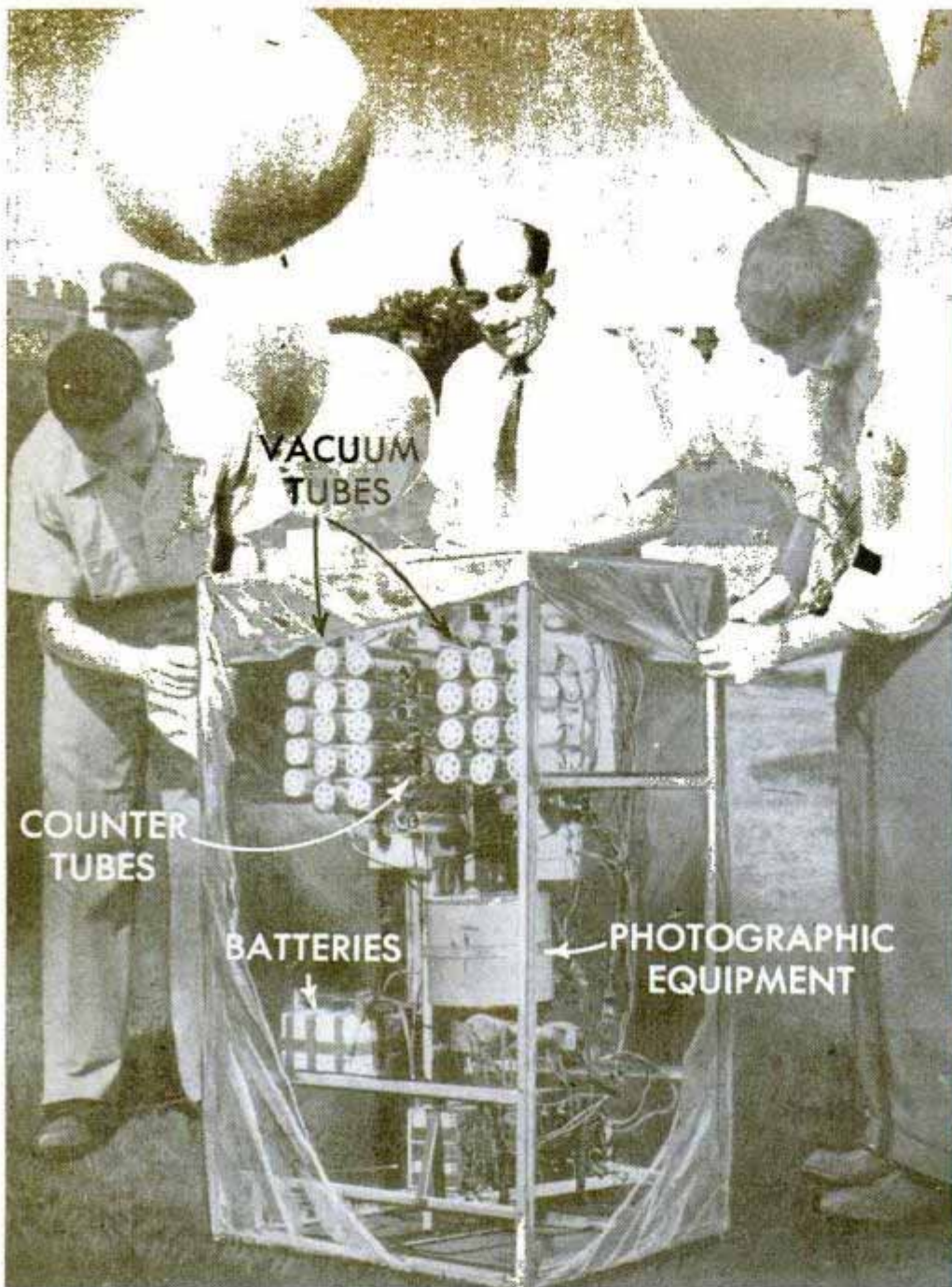
By William F. McDermott

and, even more, it gives promise of unlocking several of the major secrets of the universe.

Coming apparently out of the nowhere—possibly from the Milky Way, maybe from interstellar space beyond this universe—cosmic rays beat down upon us, day and night, like rain. In fact, 20 rays pass through your body—head to foot if you are standing—every second. Whether one climbs to the top of the highest mountain, hides away in the deepest mine, or plows the surface of the sea as a typhoon rages, the incomparably powerful

University of Chicago athletic field is launching site for balloons which will lift cosmic ray equipment into the stratosphere





DIAMETER
20 FEET
AT 16 MILES



BALLOON FOR
COSMIC RAY
TESTS



DIAMETER
5 FEET
AT SEA LEVEL



Dr. Marcel Schein (center) inspects apparatus which makes photographic record of cosmic rays in sky

cosmic rays reach him. Radium rays, X-rays—even atomic rays—bow to the gargantuan might of this king of all radiations.

For more than two decades many of the world's greatest scientists have kept relentlessly on the trail of the cosmic ray. Expeditions have ascended great peaks, invaded deserts, ridden ocean liners for months at a time, ascended into the stratosphere by planes and balloons and sent delicate registering instruments higher into the sky than man has ever flown—all to fathom the mystery of the giant of rays.

In their quest to solve it, scientists have taken cosmic ray "soundings" in the Paris catacombs, in gigantic glacier cracks, in the fjords of Norway and inside the barrels of cannon big enough to hold the equipment and the researchers alike. They have gone down into brine pits to test the ray under

crystallized salts of the sea; they have invaded mines where iron, coal or copper are dug and they have dived deep into the sea for underwater registration of the rays.

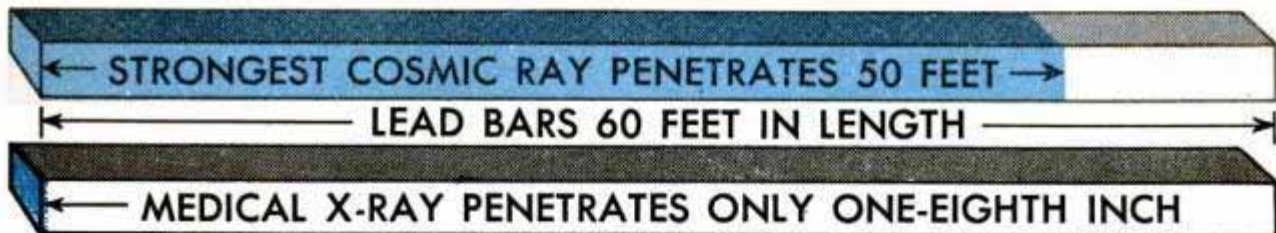
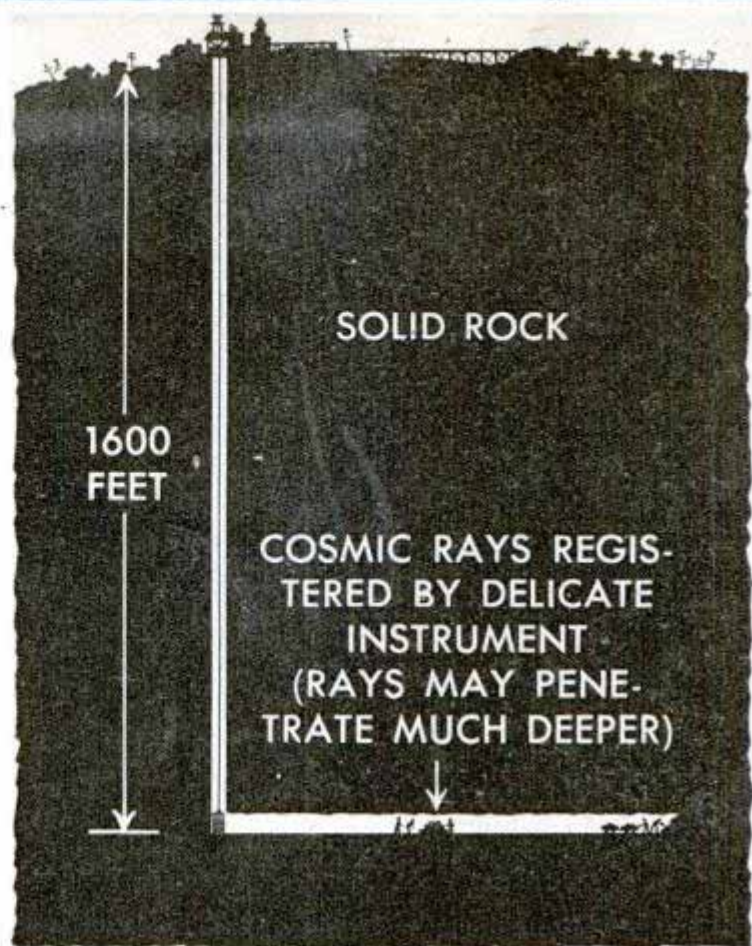
They improvised watertight diving bells, complete with cosmic ray equipment from storage batteries to photographic apparatus and automatic registering instruments, which they sank from a quarter to a half mile deep, letting them lie there for days at a time. They built specially designed "cloud chambers" for high altitude studies. They improvised special instruments for registering the rays in the crevasses of glaciers.

The present stage is still that of the hunt. Until more is known about the cosmic ray, little can be done to harness it. To date, rays are controlled to the point of being heard over loudspeakers, operating delicate automatic photo equipment and light-

MOST PENETRATING RAY IN HISTORY



ABOUT 20 COSMIC RAYS PASS THROUGH BODY EVERY SECOND



Cosmic rays raining down upon the earth penetrate everything with energy measured in billions of volts

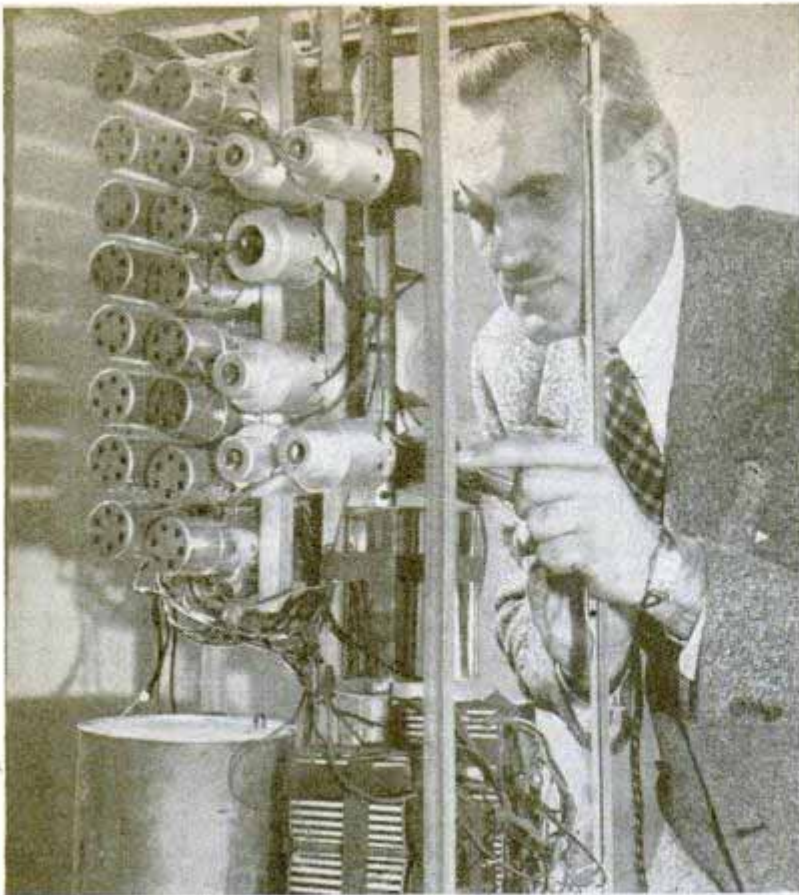
ing up indicator lamps. But the world's best minds say that its secrets will be revealed, and then it may be mastered for the use of man. Scientists, with their usual caution, do not speculate on its practical possibilities. But they do admit that they are illimitable.

Those possibilities are as intriguing a subject as ever comes to the mind of man. Unlimited power is the key—not only that, but unlimited power already created and ready for use. We think of atomic energy, but realize mammoth machinery will be necessary to produce it—at present, an atomic energy driven auto would weigh at least 100 tons! But cosmic power may some day be pulled out of the air by a receiver, exactly as we pluck radio waves out of the air with our sets. In that near or distant day, put a cosmic aerial on your house or

your auto, and presto! Power flows in like a Niagara.

To those who puzzle over the composition of the universe, its age, and whether the universe is building up, self-sustaining, or running down, the cosmic ray holds fascinating potentialities. About unlocking the history of the universe, none other than Dr. Arthur H. Compton, one of the world's greatest physicists, Nobel prize winner for his research on the cosmic ray, and now chancellor of Washington University, St. Louis, had this to say:

“Very possibly cosmic rays are older than the earth itself, for their energies are so high that calculation shows that if a particle (cosmic ray) is once thrust out into space, it can continue, before it is stopped by the matter in interstellar space, for a time equal at least to the estimated age of



Dr. Arthur H. Compton adjusts cosmic ray counter before balloon test. Right, vertical streak is path of cosmic ray photographed in "cloud chamber." It has struck an electron (center) and knocked it out of orbit

the earth. Thus, there is reason to hope that future study of these rays may bring us valuable information regarding the ancient history of the universe."

Some physicists estimate the rays as 10 billion times stronger than radium rays; the most penetrating variety enter outer space with the energy of 15 billion volts.

Not only does the cosmic ray possibly contain the key to terrestrial antiquity, but it also may hold the solution to that even more fascinating proposition: What of the

future of the universe? One theory projected by scientists is that the cosmic ray is produced in the building up of atoms, thus indicating that the universe is perpetually renewing itself. Other eminent men hold to the opposite belief; namely, that the cosmic ray is produced in the destruction of atoms and that the universe is running down. Many affirm that cosmic rays are the basic form of energy.

The romance of the cosmic ray at the present stage is not in actual achievement

ALTITUDE AND DENSITY TABLE

Above

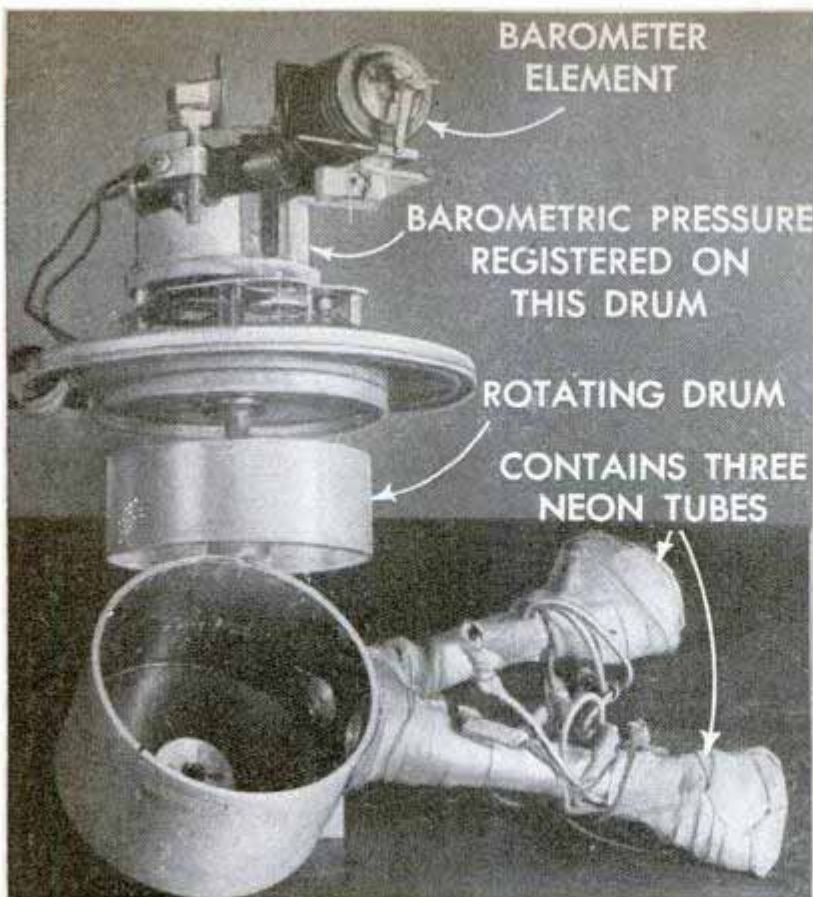
90,000 Feet . . . Primary cosmic rays, probably protons of unknown origin.

80,000 Feet . . . One half of primary cosmic rays have been absorbed in atmosphere. Rays here are a proton and mesotron mixture. A mesotron is a particle with mass between a proton and electron and can carry a positive or negative charge.

40,000 Feet . . . Primary cosmic rays practically nonexistent. Secondary rays are mesotrons and electrons. The latter originate from disintegration of the mesotrons. Ratio here is four electrons to one mesotron. Wherever electrons are found there are always approximately the same number of gamma rays.

25,000 Feet . . . Thinning of rays—fewer mesotrons and electrons. Ratio is three electrons to one mesotron.

Sea Level Ratio two mesotrons to one electron. The cosmic radiations known as mesotrons are the most penetrating particles in the history of scientific research. Protons and neutrons also are found in cosmic radiation but their contribution is unknown.



When cosmic ray passes through counter, photographic equipment is tripped to register dot on film attached to rotating drum

with it, but in the indefatigable and ingenious research for it. Twenty years ago, Dr. Robert A. Millikan, Nobel prize winner, professor of physics at the California Institute of Technology and pioneer in cosmic ray study, declared, after he had conducted research in the Andes mountains, that "we cannot even begin to assert what change in man's view of the universe this ray will bring about."

The rays, which have been ranging the cosmos for possibly a billion years or more,

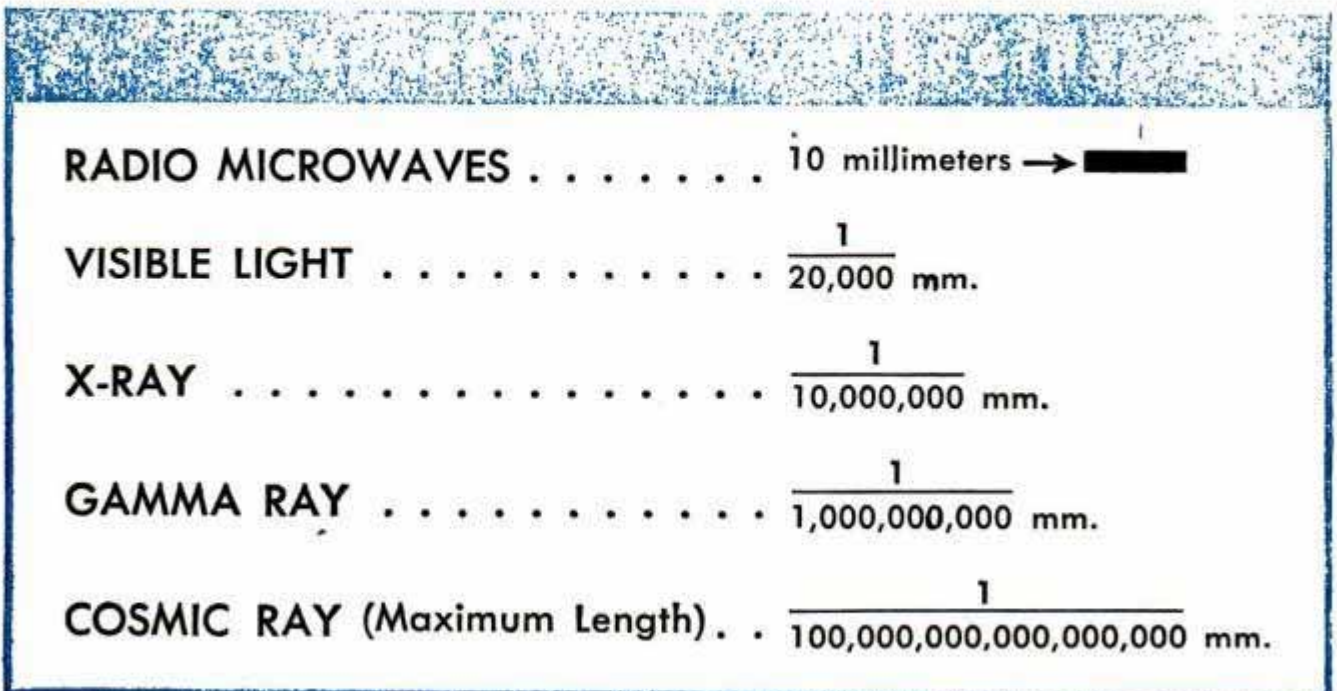
first caught the attention of man about 1900, when it was found that nonelectrical gases, perfectly insulated, continued to act like electric current conductors. Scientists tightened up all possible leakages of electricity and radiations but found themselves against a blank wall of mystery.

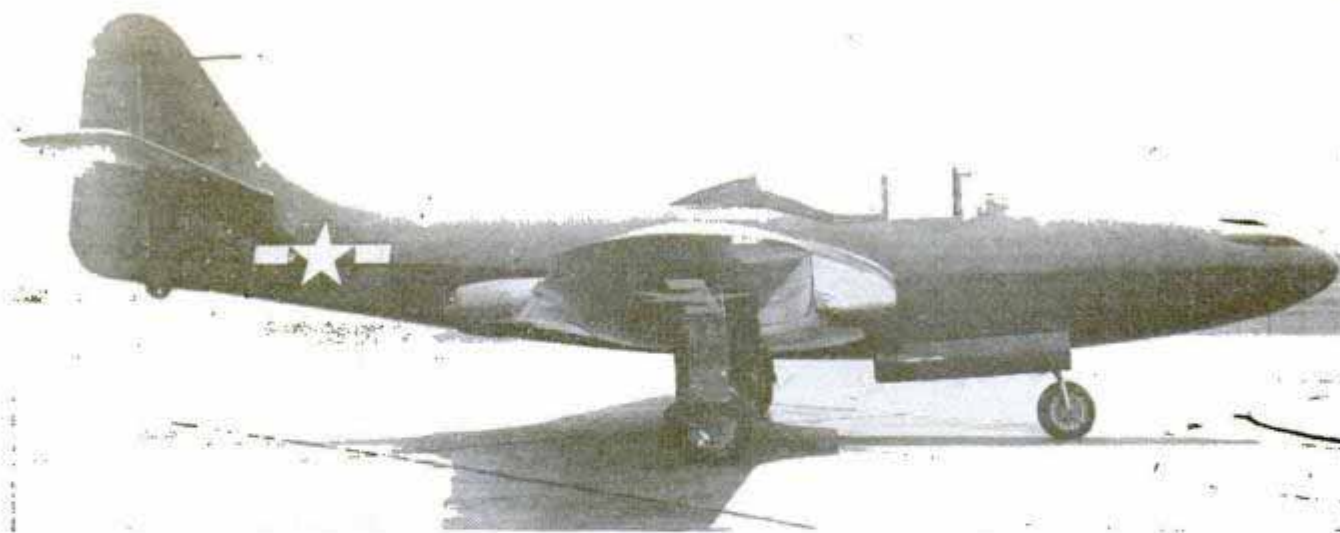
Two scientists, Lord Rutherford and H. L. Cook, at McGill University in Montreal, buried an electroscope in five tons of lead, a metal then accepted as a substance through which no rays or radiations known to man could penetrate. Yet the delicate instrument continued to register a mysterious electrical action. They could discover no earthly connection. But they, and many others, refused to yield to what seemed inscrutable—their restless minds would not be conquered. In different lands, scientific pioneers kept on the elusive trail. They began to suspect dimly that something beyond terrestrial origin was

causing the "trouble." Spasmodically the search continued. In 1910 a notable contribution was made by a Swiss scientist, Dr. Gockel, who reached unparalleled altitudes in a balloon. His studies tended to show the rays came from somewhere out in space. A year later, V. F. Hess, an Austrian scientist who won the Nobel prize for his research, wrote of his investigations:

"During the past two years I have made seven balloon ascensions. I find no decrease

(Continued to page 252)





Navy's First Jet Carrier Plane Tops 500 Miles an Hour

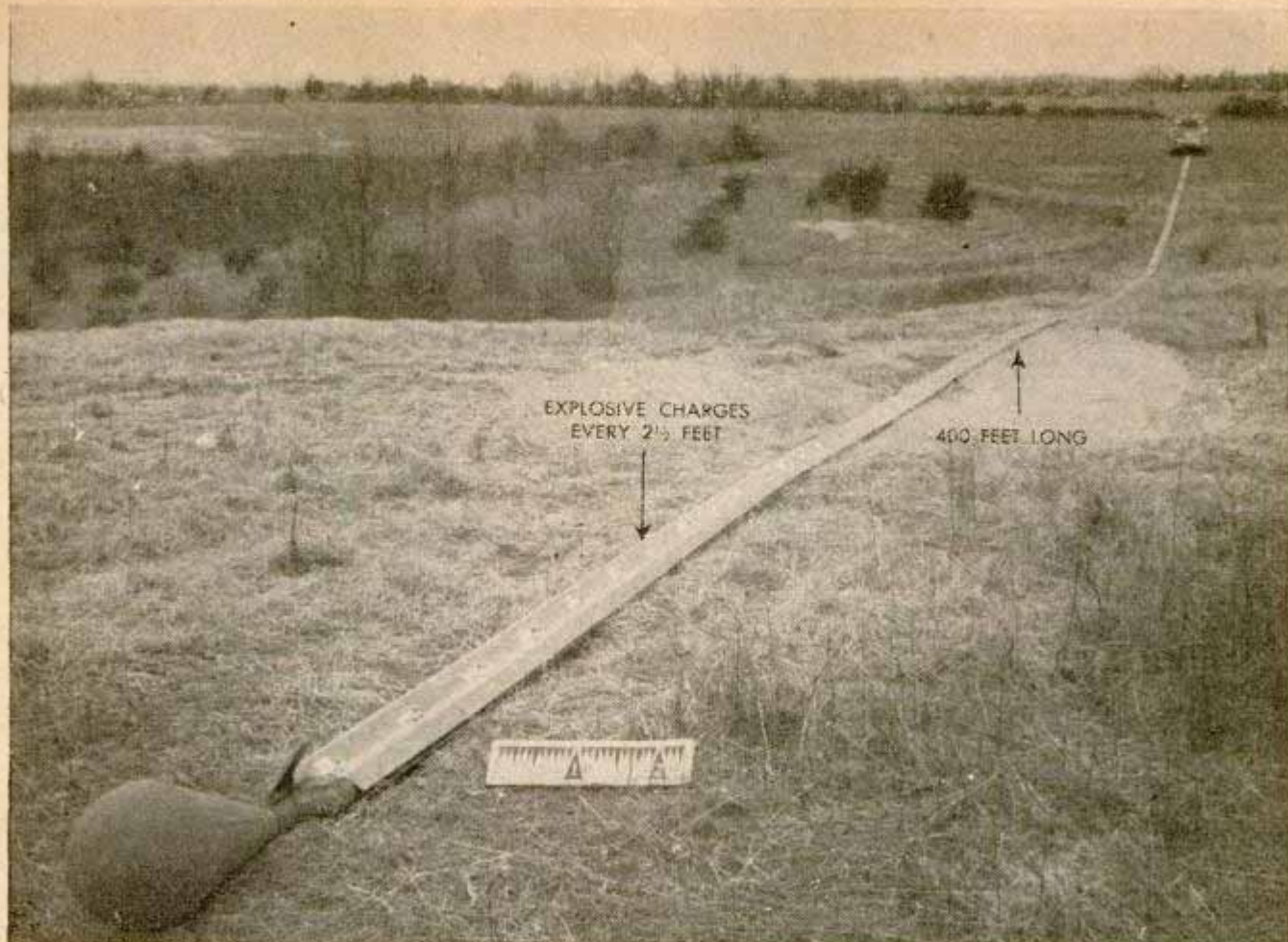
First Navy fighter to exceed 500 miles an hour, the FD-1 Phantom also is the service's first exclusively jet-powered carrier plane. It has a service ceiling well over seven miles and a range of about 1000 miles. Built by McDonnell Aircraft, the Phantom is powered by twin axial-flow Westinghouse turbojet engines of American design. The plane is made of light aluminum alloy, polished to a glasslike finish, and weighs less than 10,000 pounds loaded for combat.

The tricycle landing gear is completely enclosed when retracted. With wings electrically folded for carrier storage the plane's width is reduced from approximately 40 feet to 16. Despite its swiftness, the new jet-propelled craft has a landing speed comparable to that of conventional carrier-based planes. For conditions where take-off assistance is necessary, standard carrier catapults or JATO, jet devices for an added boost, may be used.



Electrical Gearless Tachometer

No gears or gear shifts are used in a new type tachometer for measuring cutting speeds of lathes and milling machines, linear speeds of shapers and rotational speeds of motors, generators, turbines and engines. The instrument consists of a head, which is placed in contact with the rotating unit, and an electrical indicating unit to which the head is connected by electric cable. The head contains a rotating shaft which operates a set of contacts through a positive, straight-line-motion cam mechanism.



Snake Blows Up Mines To Aid Tank Charges

Slithering its 400-foot length through grass and underbrush at two miles an hour, a new type mine destroyer called the "Snake" was used by our Army in Europe to detonate enemy explosives and cut wires. In combat, it cleared a path for a column of tanks. The Snake is a metal trough loaded with explosive charges encased in corrugated aluminum plates and bolted together to form a rigid assembly which can be towed or pushed by a light tank. A pear-shaped flexible "nose" guides it over rocks and around trees. It is 14 inches wide and five inches high and weighs about 9000 pounds when fully loaded with 4480 pounds of special explosive cartridges. The cartridges are spaced in the trough at intervals of

Loaded with explosives spaced 2½ feet apart, "Snake" is pushed along by tank and, below, exploded by fuse detonated from tank



about 2½ feet and exploded by an impact fuse detonated by machine-gun fire from the propelling tank.

Record Horsepower Per Pound Set by Wright Cyclone Plane Engine

World's lightest aircooled engine per horsepower is the new Wright Cyclone 9HD being built for the Douglas DC-4, the Curtiss SC-2 Seahawk and several experimental military aircraft. The engine weighs 1352 pounds and develops 1425 horsepower,

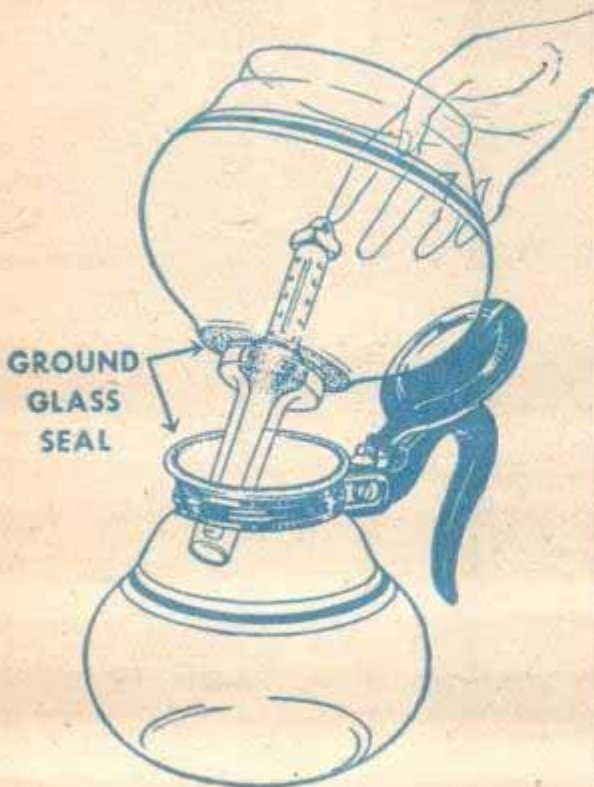
or one horsepower for each .85 pounds. In the DC-4s, where it is "packaged" in a pre-fabricated nacelle that attaches directly to the wing, it is expected to add 25 miles an hour to the cruising speed, boost the payload half a ton and simplify maintenance.



"Inside Stubb"

for
Your Home

Pull out the center of this versatile and roomy chest and you have a writing desk. Below, ground glass seals rubberless coffee brewer. Right, proposed transparent bag would show when a vacuum cleaner needed emptying.





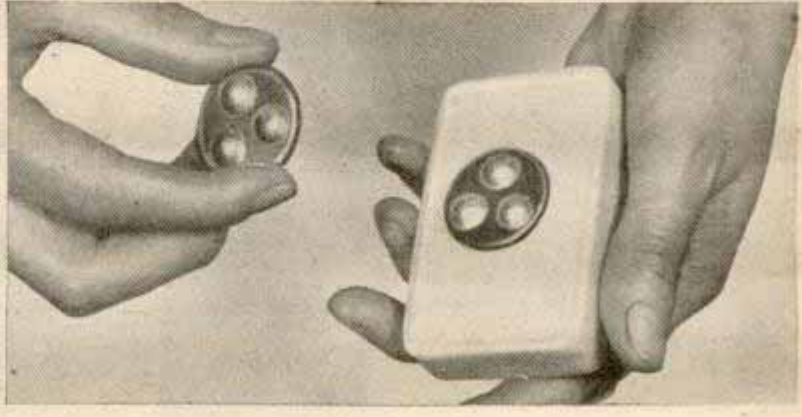
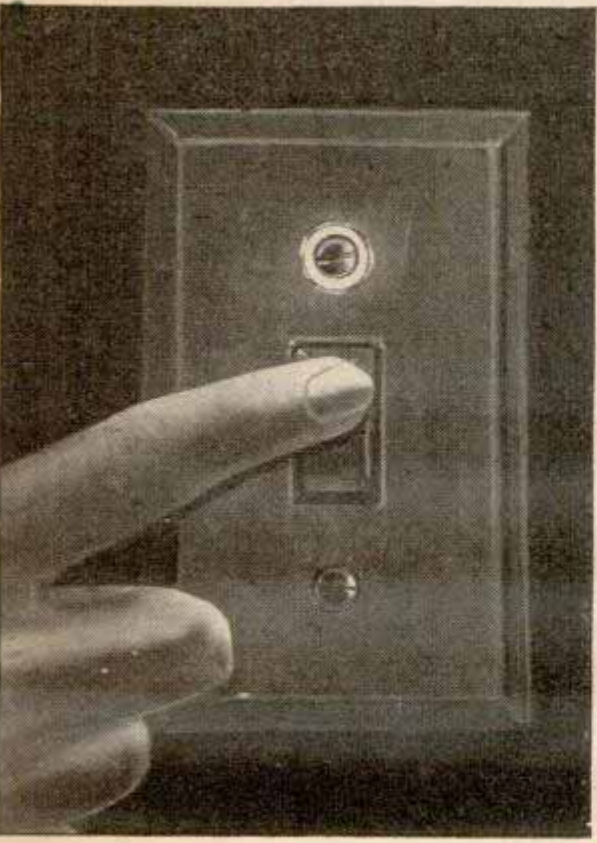
↑ A comfortable rocking footstool adjusts itself readily to every movement of the user. The rockers on the stool also keep it from sliding out of range of the feet

Steel mesh makes this ironing board → air-conditioned, with 61 percent of the surface open for ventilation, permitting faster ironing by allowing steam to escape

↓ Small luminous buttons can be attached to light switches and stair steps



↓ "Tripod" trays that can be pressed into bars of soap avoid waste by holding cakes above the surface of basin or bathtub



Biggest Photo "Recon" Plane Expected to Go 400 m.p.h.



Giant of all long-range planes built for photo reconnaissance, and believed capable of 400-mile-an-hour speeds, the AAF's new XF-12 has armor plating, three camera stations and dark room facilities for loading cameras and developing prints. Built by Republic, it is 98 feet nine inches long and has a wing span of 129 feet two inches. Each of the four Pratt & Whitney Wasp Major engines is equipped with two turbosuperchargers. Although the Army has not released performance data on the XF-12, it has been announced that its commercial version, the Rainbow, would cruise at better than 400 miles an hour at 40,000 feet, with a range of more than 4000 miles.



Handy Sealed Packet Holds Chemicals for Developing Snapshots



Hermetically sealed powdered chemicals for developing photographic film can be obtained now by snapshot enthusiasts in a compact packet about the size of a deck of cards. Each packet contains enough chemical to make 32 ounces of solution for tank development of film and plates or 12 ounces of solution for tray development of films, plates and papers. The sealed packet prevents deterioration of the chemicals.

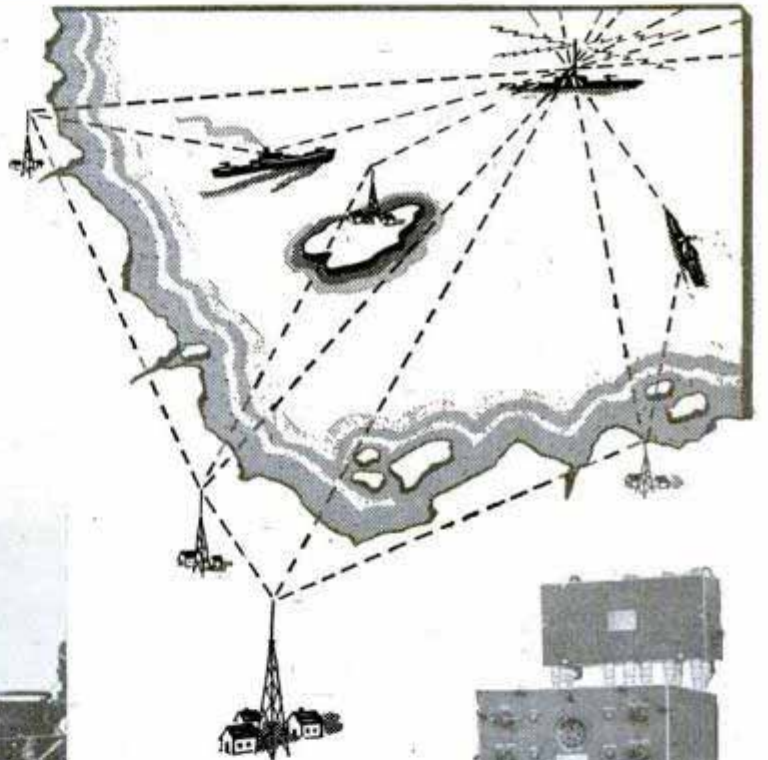
Transport planes of the future may fly much higher and with greater safety when final development work is completed by the General Electric Company on an alternating current system to supply power for radios, landing gears, lights and navigation instruments. It will reduce weight of the power system 30 to 40 percent and overcome difficulties with brush wear and other motor damage at extremely high altitudes.

"HUFF DUFF" DOOMED SUBS

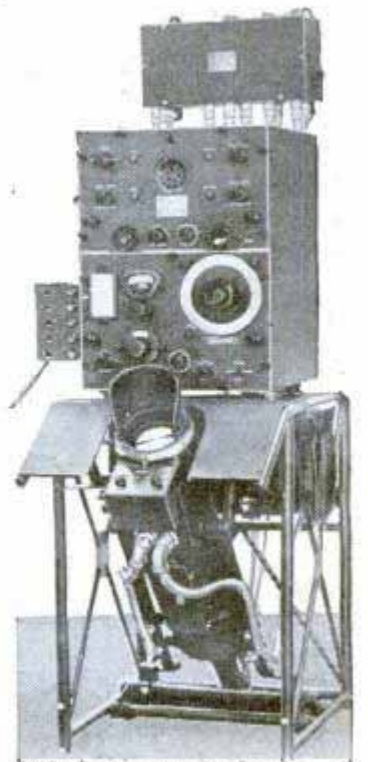


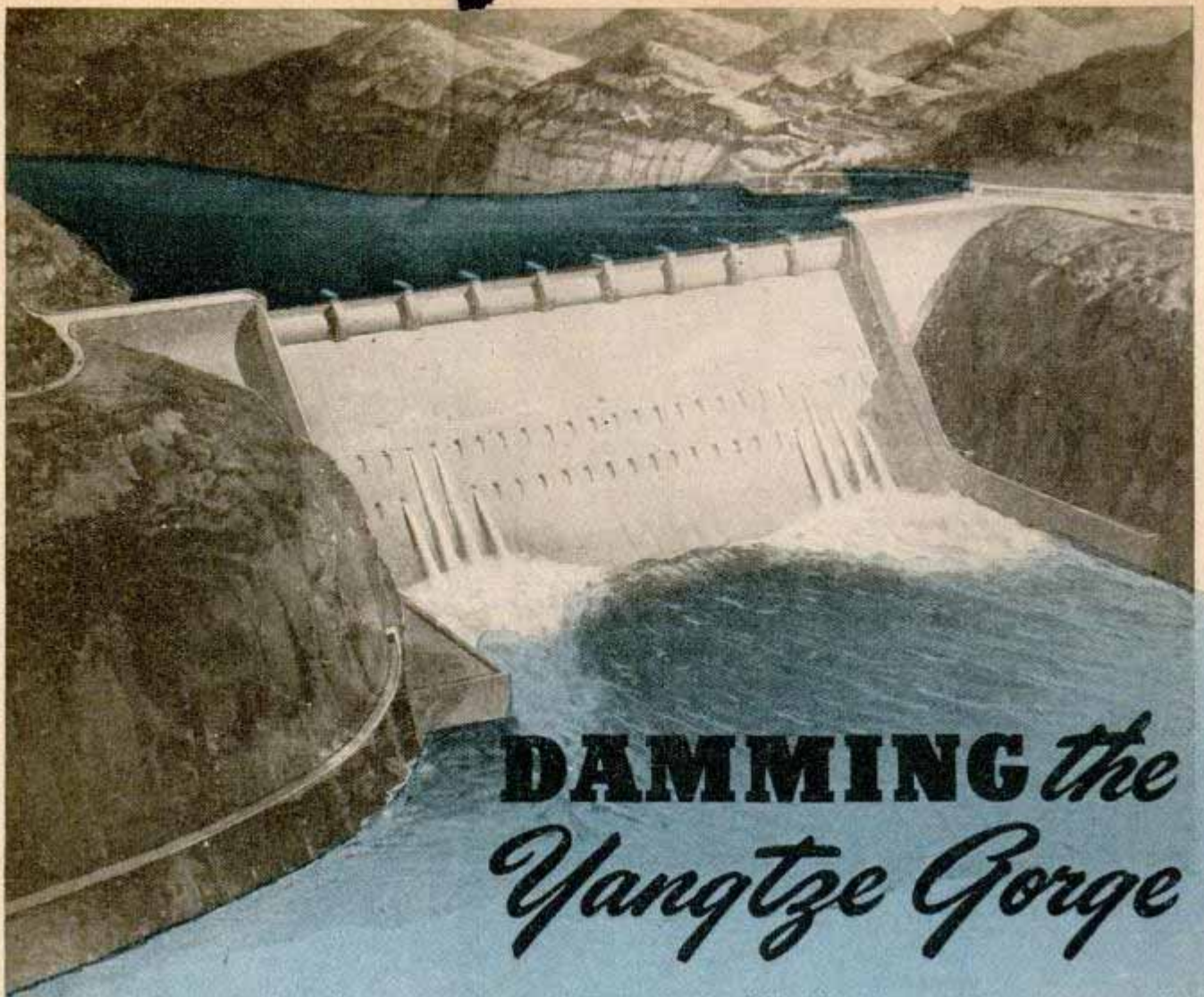
U. S. Navy photos

German submarines were spotted in the Atlantic with high-frequency radio direction finders which accomplished the "impossible"—fixing direction of short waves. Called "Huff Duff" (from the initials HF-DF) the sets were used on ships (above), planes and shore stations. Two or more huff duff bearings on a sub's radio made it a simple matter to plot position as shown in sketch. A streak of light on a cathode-ray tube shows the direction from which a signal comes. Transatlantic air-line pilots will be able to call huff duff stations for a "fix" on their position if they are lost over ocean



← Huff duff antenna on destroyer automatically scans entire horizon 20 times in one second. Germans used 15-second "squirt" signals from subs in effort to evade detection and failed. Control unit for direction finder used on ships is shown at the right. The cathode-ray viewing screen on finder is marked off with 360 degrees of circle





DAMMING the Yangtze Gorge

By Roscoe Fleming

IMAGINE, if you can, cranes so powerful they can pick up a 10,000-ton ship and hoist it over a lock 530 feet high.

Eight such cranes are conceived as part of a colossal plan for the world's largest dam across the Yangtze River in China which would supply irrigation water for some 10,000,000 acres of barren land and provide hydroelectric power to rebuild the nation.

The cranes, as visualized by American engineers "blueprinting" the project,

will straddle the dam and compensate for the 530-foot difference between water levels on each side of the structure. Ships going up or down the river will be raised or lowered like matchboxes and sent on their journey. Leaving the dam downstream, ships will pass through a ¼-mile tunnel cut through mountain rock and connecting with a tributary of the Yangtze.

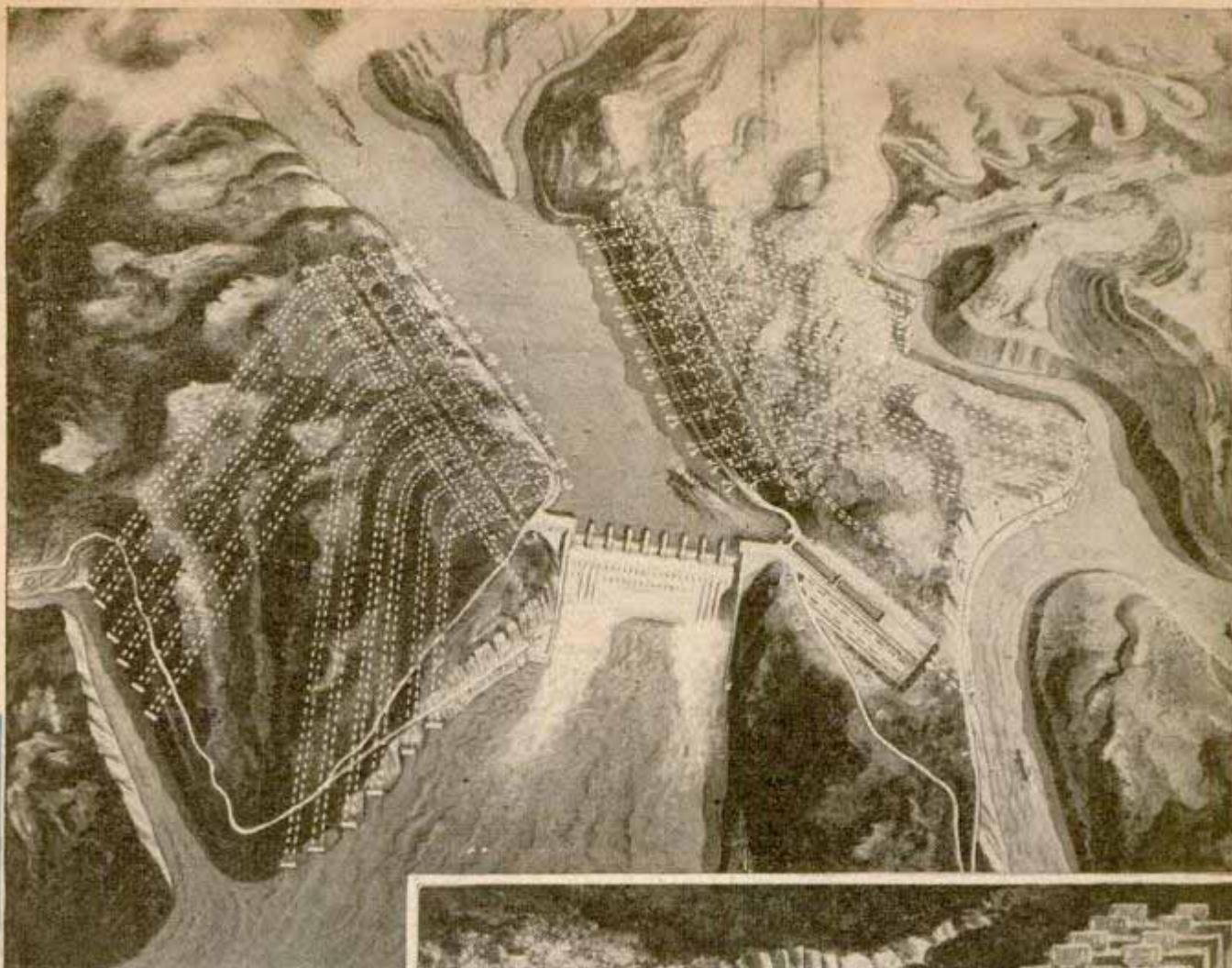
Plans for the dam are being worked out at Denver by the U. S. Bureau of Reclamation with the assistance of Chinese government engineers. China is paying the United States \$500,000 to design the dam.

John Lucian Savage, former chief designing engineer for the Bureau and now its design consultant, is supervising the planning.

In bulk alone this giant dam will outmatch Grand Coulee, Shasta and Boulder. It will contain 23,000,000 cubic yards of concrete, as against 11,000,000 for



Artist's drawing (top) of world's largest dam, 750 feet high, planned for China's "Father of Waters"

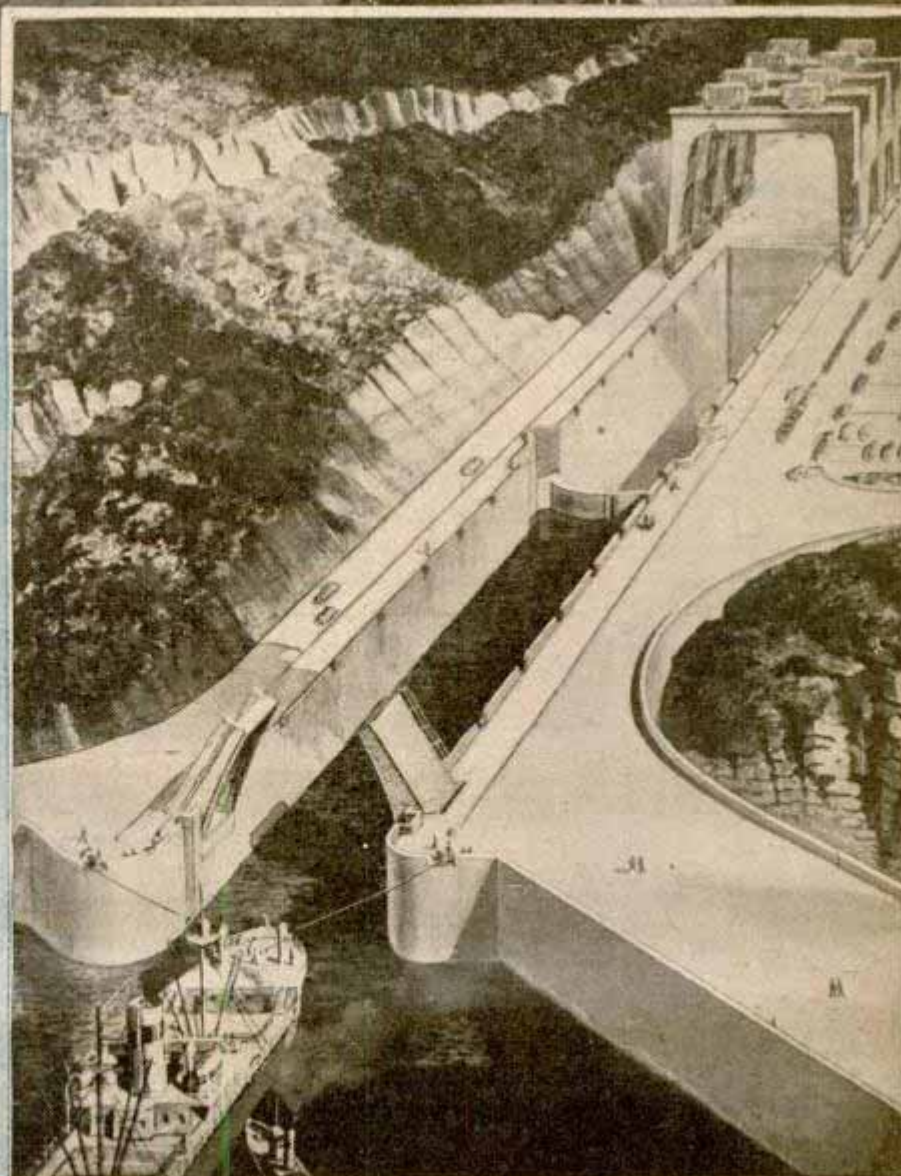


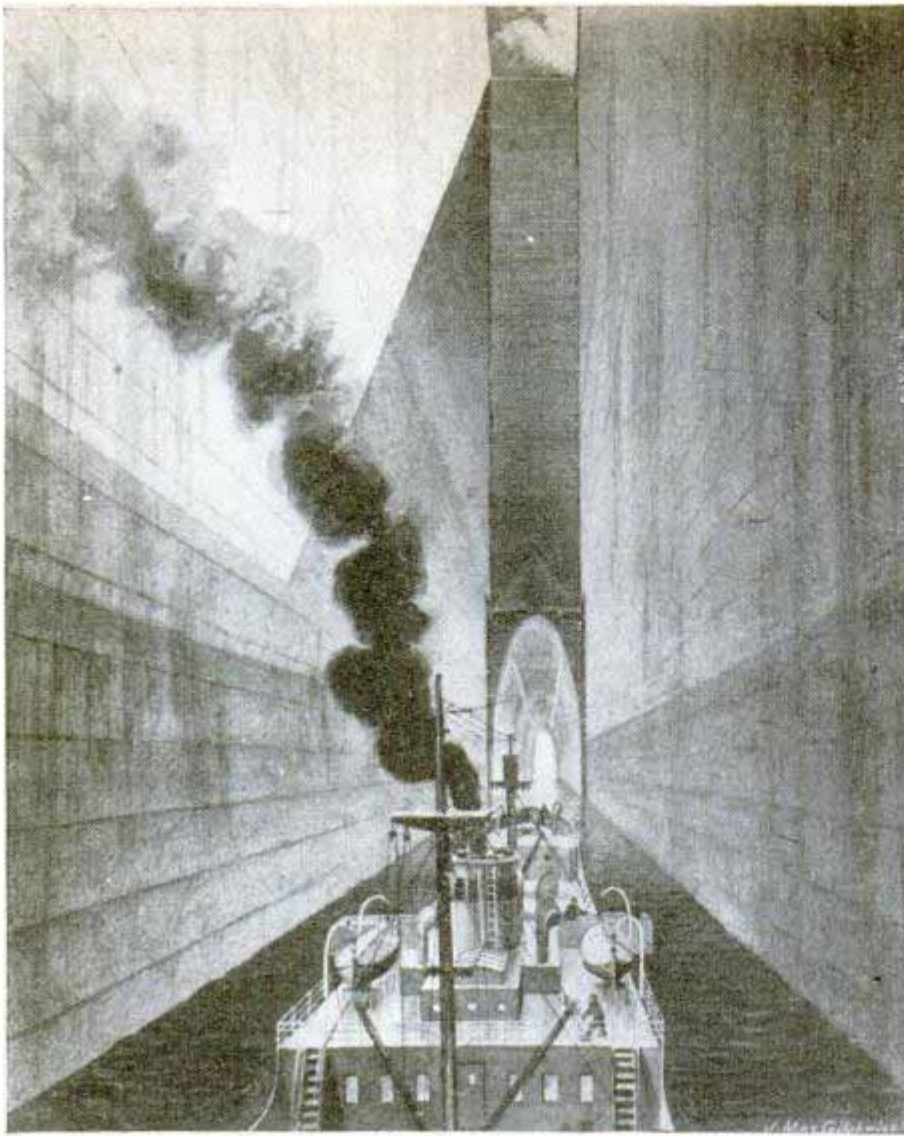
Tunnels (dotted lines) will carry water to the underground generators. The giant cranes at the right will raise or lower 10,000-ton ships

Grand Coulee. It will be 750 feet high, the world's tallest dam. Boulder is 726 feet high.

The Yangtze is as great a river as our Mississippi, yet the gorge at Ichang where it finally plunges out on the plains of Central China is so narrow that the dam will be only about a half mile long at its top. Behind this mighty bulwark, however, will be backed up 50,000,000 acre-feet of water, or 70 billion tons—enough to cover the state of Illinois to a depth of about 18 inches. The lake will reach back above Chungking, or more than 250 miles. From the pool level above the dam to the pool level below will be 530 feet, or just a little less than the height of the Washington monument.

The potentialities of the





Drawings by courtesy U. S. Bureau of Reclamation
Below the dam, ships will pass through a tunnel and emerge in a tributary

dam are as huge as its size. It will produce 10,560,000 kilowatts of electric power (more than 14,000,000 horsepower). This is about five times the amount that ultimately will be available at Grand Coulee, now the world's biggest power plant.

From 96 mighty generators will come power to turn the wheels of China's new industry. It is only the master-work: China has plans under way for other great dams on the Yangtze and other river basins. But the Ichang dam is the first.

The reservoir will make available for irrigation some 74,000,000 acre-feet of water yearly which will permit two crops to be raised instead of one, besides irrigating lands now arid and draining the marshy malarial lakes below the gorge.

The dam will prevent floods which occur almost every year, the greatest of which, in 1931, caused \$478,000,000 in damage and drowned thousands of Chinese.

Lastly, the dam will be built to permit the movement of river traffic. Steamers of 10,000 tons or possibly even larger will go right up to, and perhaps beyond, Chungking.

Mr. Savage went to India in 1943 and later to China at the request of our State

Department to give advice on sites for dams and basin-wide developments. But at the Yangtze the Japanese held Ichang, just below the final gorge from which the river emerges. Detailed topographic maps were not available, but the Chinese general in command obligingly dug some up out of a file. They had been taken by the Japanese from the air and later captured by the Chinese.

The site is an engineer's dream. The giant Yangtze, after leaving the high mountains, runs for hundreds of miles through a succession of valleys and gorges, of which the last is the Ichang gorge, some 10 or 12 miles long.

Mr. Savage's concept, which has been accepted, reaches its most daring scope in two respects:

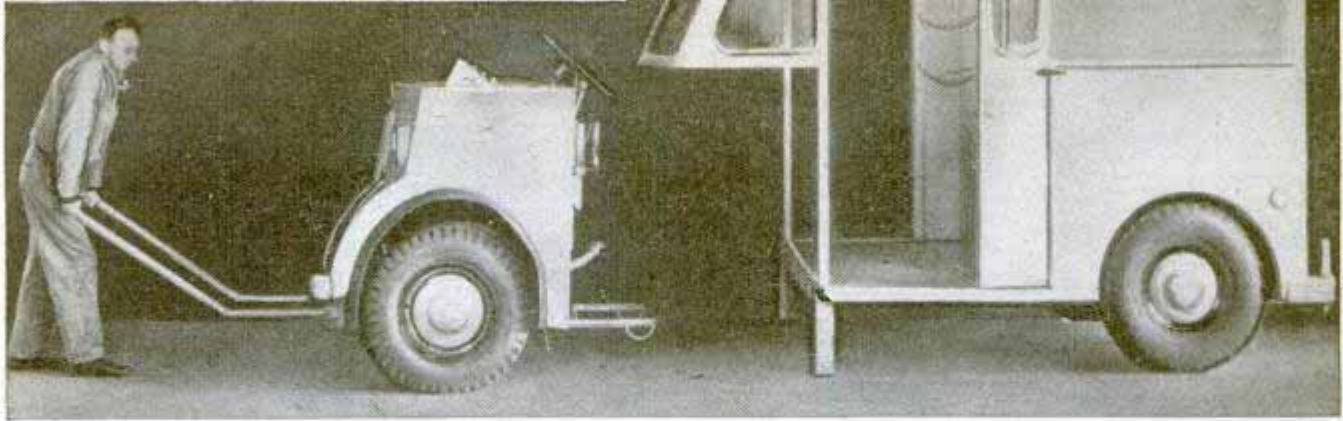
First, the dam will be the first to have its power and other auxiliary installations completely underground, protected by hundreds of feet of rock against possible bomb raids. Construction will

begin by the boring of 20 great tunnels, each 50 feet in diameter, from the river bed into two nearby tributaries of the Yangtze on opposite sides of the river. These are to carry the flow of the river past the site while the dam is being built. Then two or more large tunnels and possibly a smaller one will be dug on each side, or 26 in all. New inlets into the reservoir will be bored at a higher level, so the tunnels then will slant steeply down from the lake. At the bottom of this steep slant, in each of the 24 major tunnels, giant 108,000-kilowatt generators will be installed, four to a tunnel. Smaller turbines to operate the dam itself will be installed in the two smaller tunnels.

So much power will be produced that the cost of the dam will be small by comparison. Mr. Savage says sale of power at two mills per kilowatt-hour, and of secondary or part-time power at one-half mill, will more than pay for the cost of the project in less than 20 years. Meanwhile it will help produce a tremendous flood of goods, heavy and light, for the modernization and industrialization of China. Also it will help build other large dams and power works. Seen

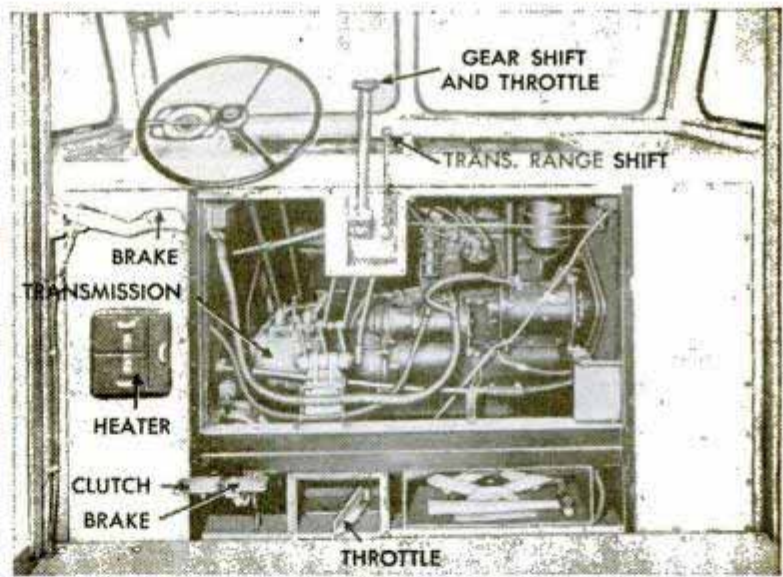
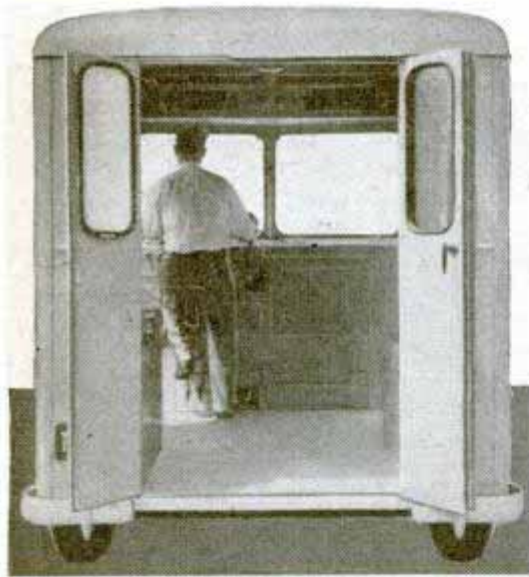
(Continued on next page)

Wheel Out Engine In Servicing Truck



Like a horse moving in and out of its traces, the engine of a new delivery truck can be detached from the truck body and returned to its place quickly and easily for servicing. Engine, steering gear and operating controls are in one unit that may be wheeled away from the vehicle. A short wheelbase gives the truck exceptional ma-

neuverability. Other features include wide low entrances with folding doors, a large carrying compartment and driving controls that can be operated from either a standing or sitting position. The floor of the truck is only 13 inches above ground level to minimize driver fatigue. A four-cylinder, 60-horsepower engine provides power.



as a future possibility are industrial plants near the dam site, built with the machinery that built the dam, with lighter industry farther away. Completion will take a decade, but power will be available much sooner than that.

Second of the revolutionary features is the device that will enable 10,000-ton ocean steamers to go up and down the Yangtze despite the 530-foot difference in water level created by the dam.

Ships will be raised or lowered the entire distance—more than twice the height of Niagara—by just one lock, a wide "well" 530 feet deep. A ship entering the lower side will be lifted in one operation to steam out on the blue surface of the great reservoir and on up to Chungking. This origi-

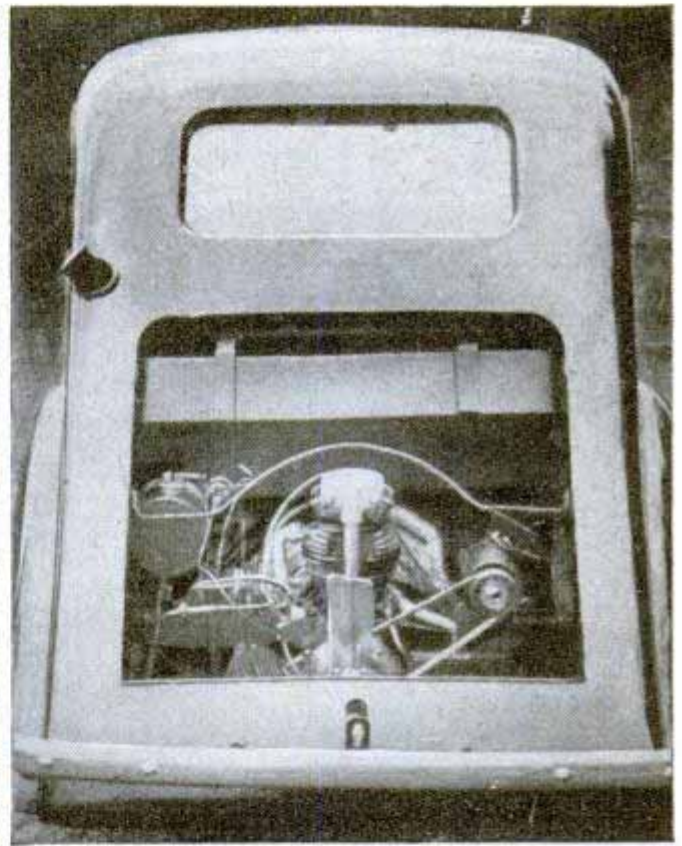
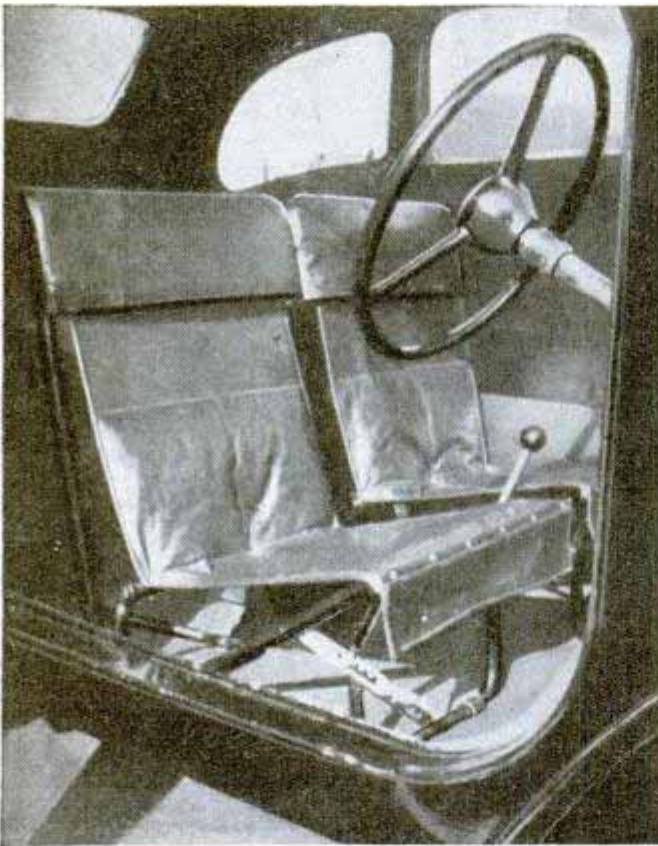
nally called for gates of unexampled size and strength to handle the pressure of 530 feet of water in one column. Mr. Savage had these worked out.

Then he realized that after all it would take a lot of water to fill and empty a well of that size and depth several times daily. So the design now calls for eight huge gantry cranes which will run on rails and straddle the top of the "well." These cranes will waddle forward, lower slings into the water and under the keels of the ships, which will be lifted or lowered 530 feet. As for smaller craft, Mr. Savage's plan is to gather several of them up at once, in a sort of dock also equipped with slings or hooks, and lift or lower them as a housewife lifts a pan full of dishes from the sink.

Miniature Bomber Engine Powers British Car



Britishers will take to the highways in this lightweight car which carries luggage under the hood and the aircraft-type engine over the rear axle. Note the single headlight and the hammock seats on a tubular framework

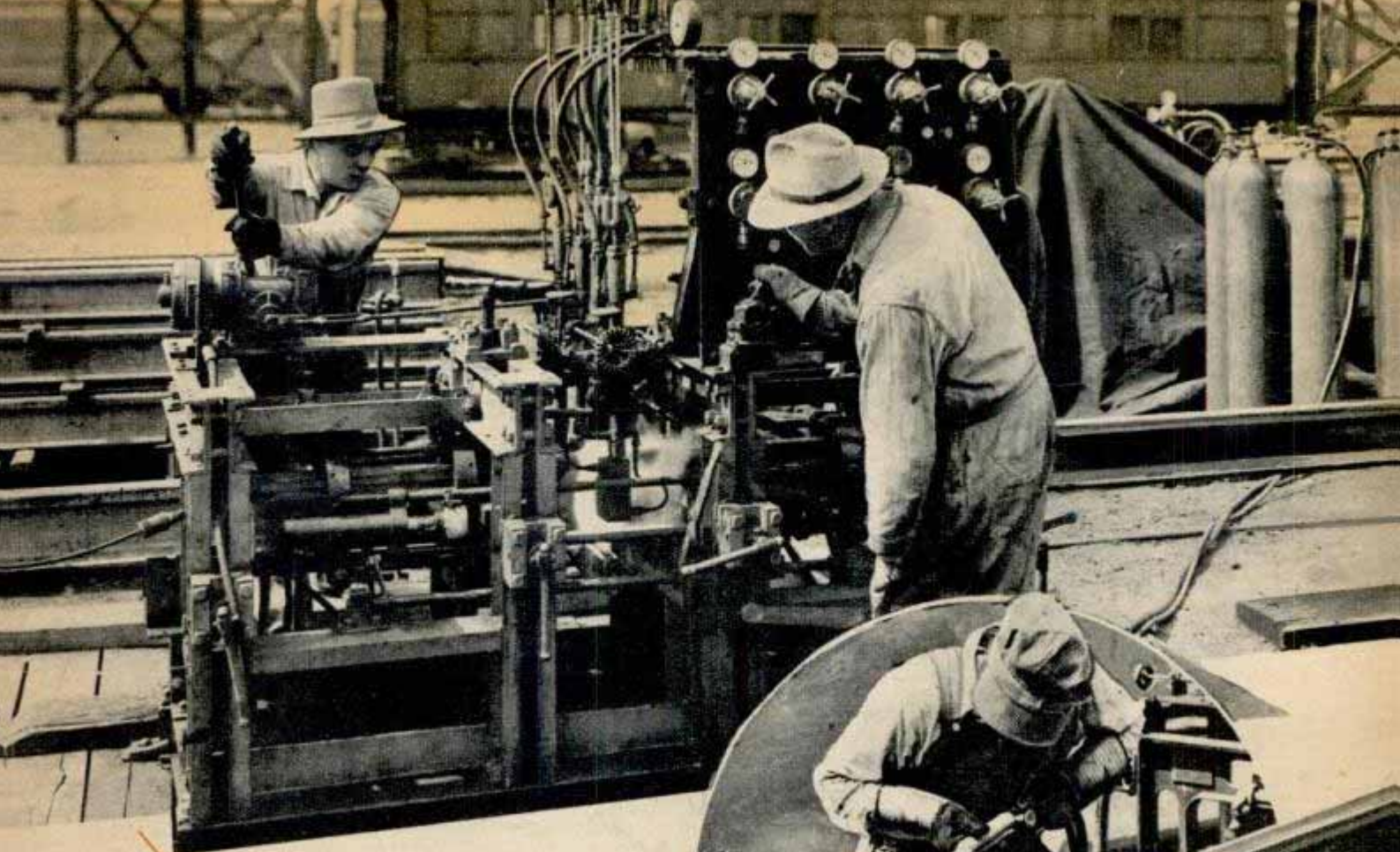


Built to sell for about \$400, a two-passenger British "People's Car" soon will be in mass production. Its many revolutionary features include a three-cylinder, radial, air-cooled engine which is similar in design to the huge multicylinder power plants in British bombers. The engine, mounted in the rear, will develop more than 20 horsepower. The car has a top speed of 60 miles an hour and will travel 40 miles on a gallon of gas, according to William D. Kendall, the manufacturer. The gasoline tank is above the engine and there is no fuel pump or radiator. Air to cool the engine passes through the dummy front and along a duct underneath the body. There are no springs in the car, which has a hydraulic suspen-

sion system, and each wheel is independently sprung. The pressed steel body and chassis are a unit and so are the engine, gearbox and transmission. A roomy luggage compartment is under the hood.

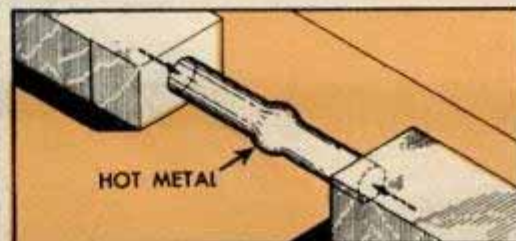
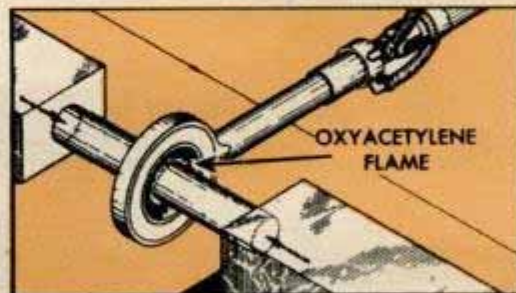
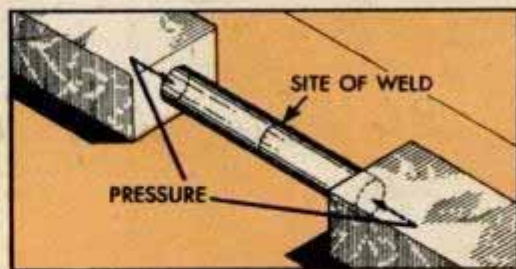
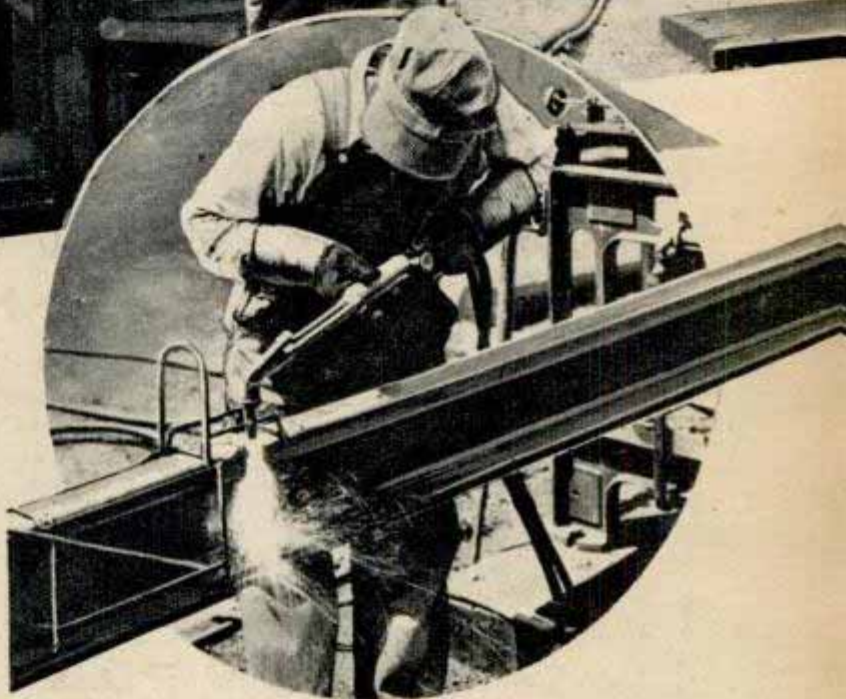
Barrage Balloons "Go to Work"

War-weary barrage balloons, now on sale by the government as surplus, are being converted to more than 40 different peacetime uses by enterprising purchasers. Whole balloons are used for advertising purposes. Others will be cut into raincoats, industrial aprons, tents and lampshades. One purchaser expects to use the fabric as a covering for houses on his chicken ranch.



PRESSURE WELD Takes Click Out of Rails

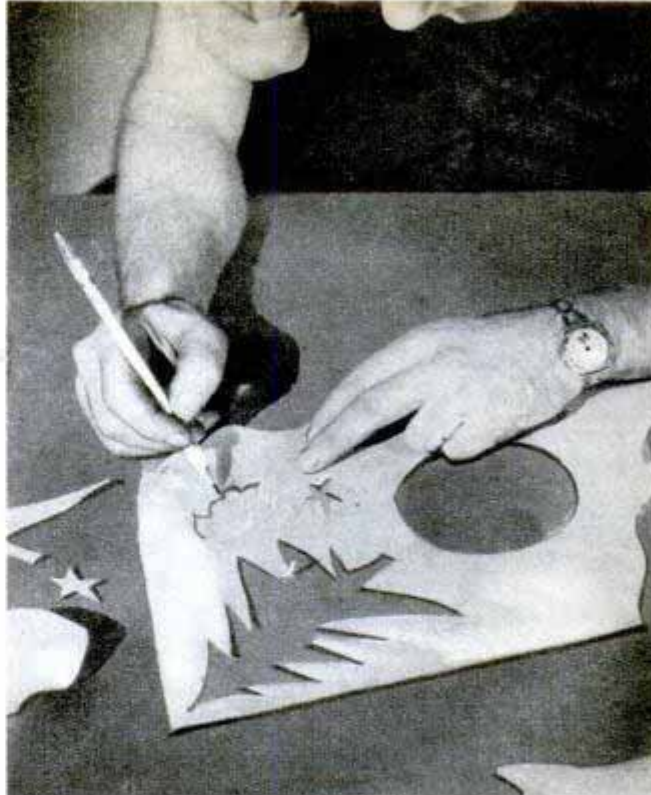
If you hold two pieces of sealing wax over a flame and press the softened ends together until they become one, you are performing an operation similar to the one done above with an oxyacetylene pressure-welding machine. This machine applies about 2000 pounds pressure per square inch to join ordinary 39-foot rails into lengths of a mile or more. It not only takes that familiar click out of the rails but reduces maintenance costs. The wear on bolted joints is great. Workman at right is trimming off excess metal after welding operation. Below, polishing welded area. Drawings show welding principle
Oxweld Railroad Service Co. photos





• Drinking-Glass Milk Bottle

Drinking milk directly from the bottle is easy and sanitary with a bottle designed as a drinking glass, invented by Ensign Robert L. Smith, commissary officer at the Hospital Corps School in San Diego, Calif. The container is especially suited to restaurants and cafeterias. A waxed paper leakproof cover fits over the drinking edge, extending 1½ inches down the sides of the bottle where it clamps around a shoulder in the glass. The top is discarded and the milk consumed directly from the bottle.



Dual-Purpose Aluminum Pencil

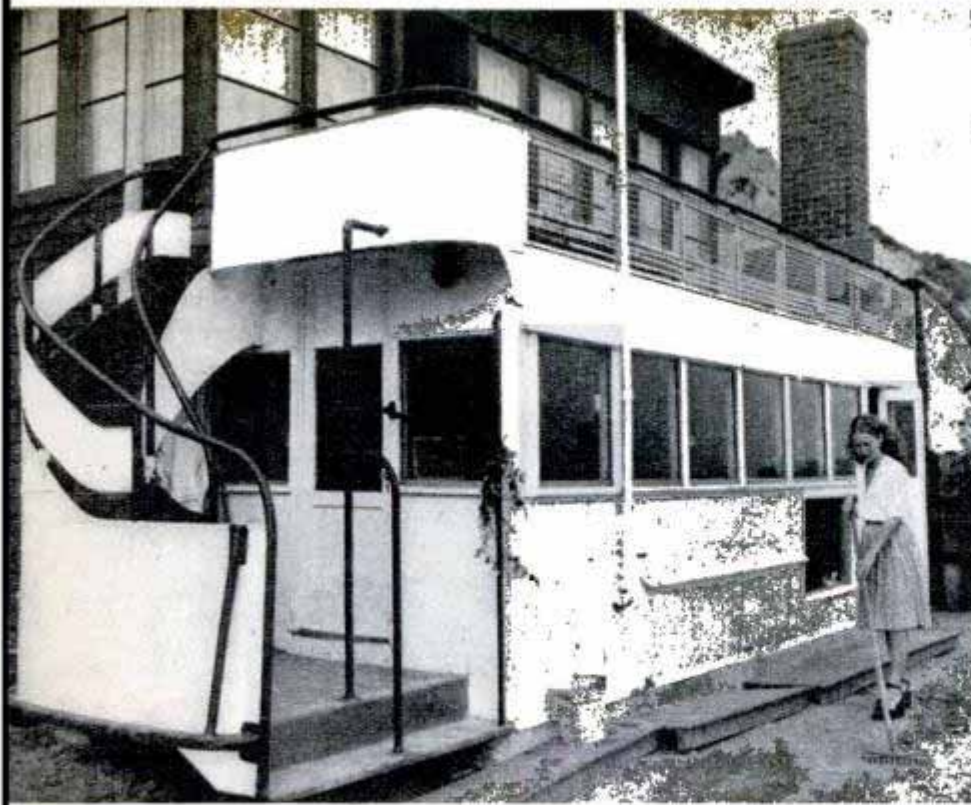
Equipped with a small knife blade, a double-end mechanical pencil permits marking and cutting with the same instrument. The pencil will be useful to model makers, as the knife is designed to cut light wood. The blade can be reversed for safety in carrying the pencil. Two pieces of lead run the length of the tube. Both ends of the pencil can be used to hold lead, with the knife blade inside. Six and three-quarter inches long, the pencil is made of aluminum to reduce weight.

Navy's P2V Neptune Is Fastest, Longest-Ranged Patrol Bomber

Reported to exceed any patrol and search bomber yet developed in speed, range and armament, the new Lockheed P2V Neptune

is the first land-based plane designed for the U. S. Navy for its specific assignment. Two Wright Duplex engines, same as those used on the C-69, B-29 and B-32, give the craft a speed above 300 miles per hour. Range with a full load is 3500 miles and with bomb bay tanks 5000 miles. It can carry 8000 pounds of explosives in addition to its armament of six 20-millimeter cannon, 16 five-inch high-speed aircraft rockets and four .50-caliber machine guns. The wing span is 100 feet and the length 75 feet six inches, with an overall height of 28 feet one inch, equivalent to a three-story building. It carries a seven-man crew including a radar operator.





"Miss the Bus" on Housing? Scrapped Bus Makes Compact Home

With a little imagination, no one need "miss the bus" in the current housing shortage, according to Thelma Burnette of Santa Monica, Calif. She made a compact beach home of a scrapped double-deck bus which she purchased from a transit company for \$50. Her father, a carpenter, cut away the chassis and set the body into a cement foundation. One entire side and the motor

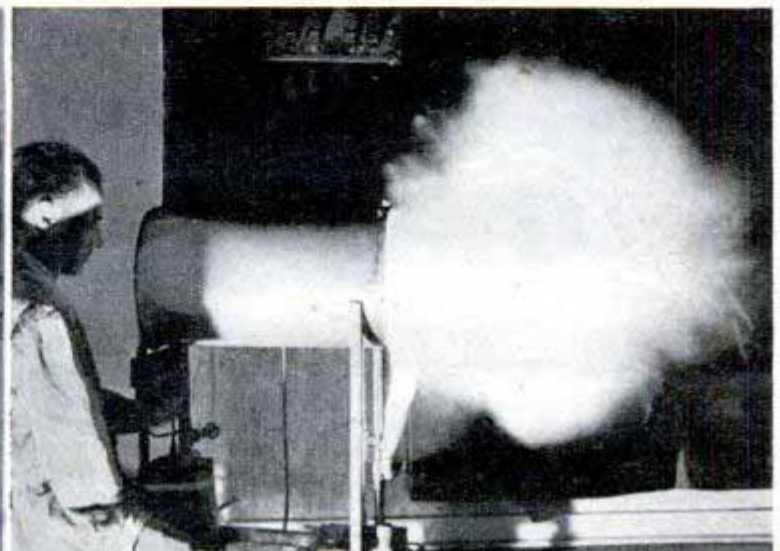
hood were removed. A bedroom, dressing room and bath were built on the open side. The bus itself provided a tiny living room and kitchen, with the top deck converted into a sun porch. A fireplace now occupies one end of the living room in place of the motor and hood. The ingenious owner sold the seats she removed from the bus for more than her original investment.

Sealed Motor Snuffs Out Sparks and Flames for Safer Airplanes

Inducing sparks into a tank filled with 100 octane gasoline vapor provides a convincing test for explosion-resistant electric motors designed for the AAF. The motors were developed for use in airplane compartments that might become filled with gasoline vapors if the plane were hit by flak. Their casings are made so that sparks and flame are snuffed out inside the motor before gas fumes on the outside can be

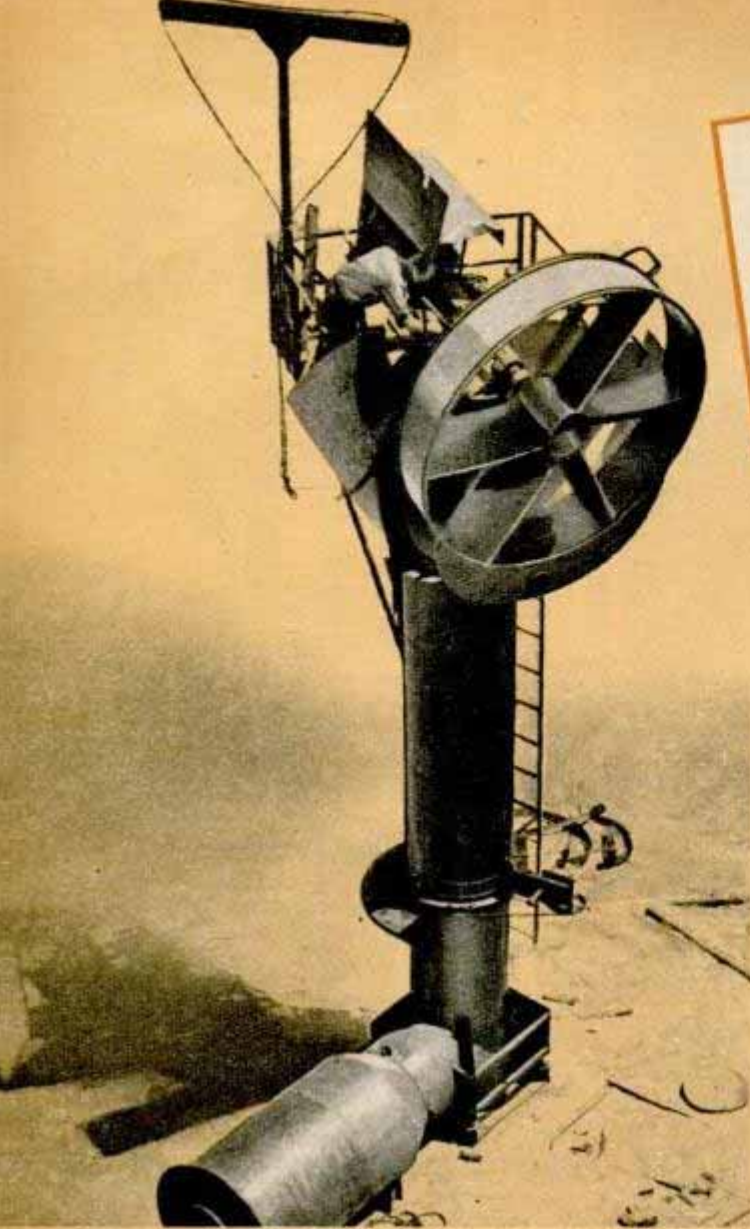
ignited. Necessary openings in the shell are very narrow with paths of such great length that gases, traveling along them, are cooled below the ignition point. In testing the motors, workers at Westinghouse Electric Corporation place them inside a tank into which gasoline fumes are blown. A spark plug ignites the vapor inside the motor. If the fumes fail to ignite, they are set off by hand to prove the mixture was explosive.

Motor is surrounded by gas fumes in tank. When vapor fails to ignite, spark explodes it to prove test

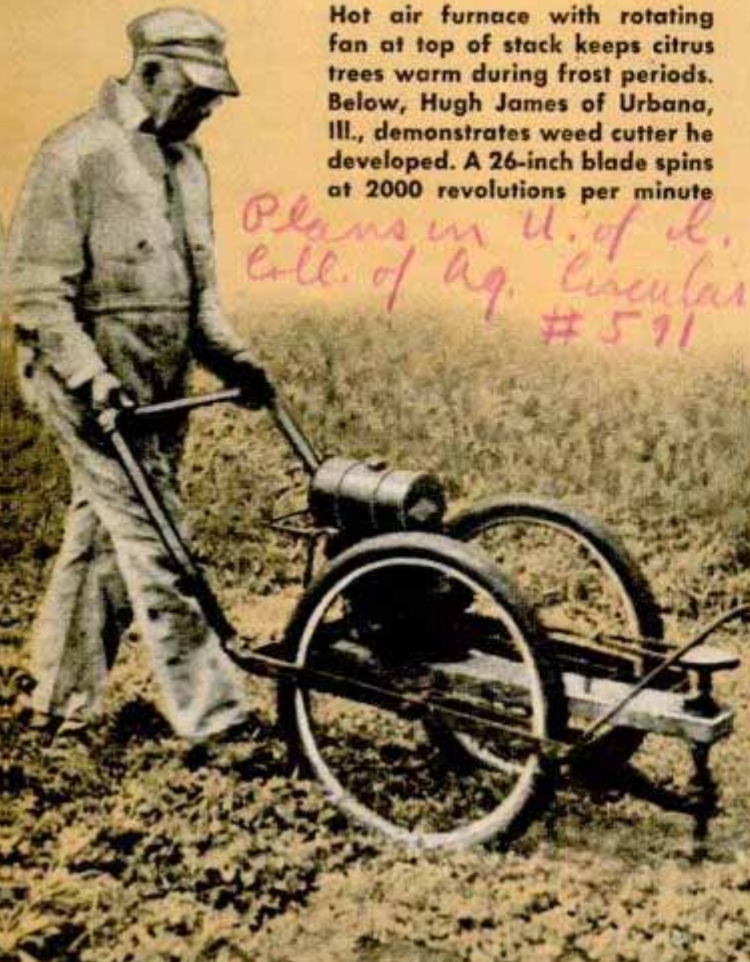


MECHANICS ARE POPULAR ON THE FARM

The city dweller is apt to phone the plumber or carpenter or electrician when something needs fixing. Not the farmer—he does it himself. Yankee inventiveness got its start on the American farm



Hot air furnace with rotating fan at top of stack keeps citrus trees warm during frost periods. Below, Hugh James of Urbana, Ill., demonstrates weed cutter he developed. A 26-inch blade spins at 2000 revolutions per minute



Plans in U. of C. Coll. of Ag. Circular #591



Electric huller has paddles that knock peas from hulls and deposit them in a tray. Homemade bale loader (below) is attached to truck to scoop up and load bales of hay quickly



Univ. of Cal. Col. of Agric. Agricultural Experiment Station Berkeley, Cal.



International Harvester Co. photo

Mechanical cotton picker with hydraulic lift dumps a load of cotton into a farm trailer in less than 30 seconds

PRUNES were ready for harvest on the farm

By Thomas E. Stimson, Jr.

of Guy McMartin in Tenama County, California, but instead of advertising for a large crew of pickers as he used to do, McMartin and his helper laid out a row of empty boxes under a prune tree, propped up a couple of big cloth-covered frames under the tree so that they slanted down to the row of boxes, and attached a cable from the tree to his tractor.

He started the tractor engine and threw in a clutch that yanked the cable back and forth. The cable shook the tree and the prunes fell to the slanting frames and rolled downhill into their boxes. Then McMartin was ready for the next tree. The first one had been picked clean, by two men, in 10 minutes.

The mechanical tree shaker and the portable catching frames are examples of the numerous labor-saving devices that farmers have invented during the last couple of years to help them produce food in spite of the shortage of farm labor.

Today mechanical tree shakers are being widely used for harvesting walnuts, apricots and other tree crops that ripen uniformly. The shaker consists of a reciprocating device powered by the tractor engine, with a cable that may be attached to small trees or with a long boom that can

reach up to the main limbs of a large tree. A hook-type collar holds the limb securely while it is being shaken.

The simple fruit catching frames consist of light lumber over which wire netting and thin canvas are stretched. Less fruit is broken and none is soiled by falling on the ground, and the frames may be wheeled easily from tree to tree.

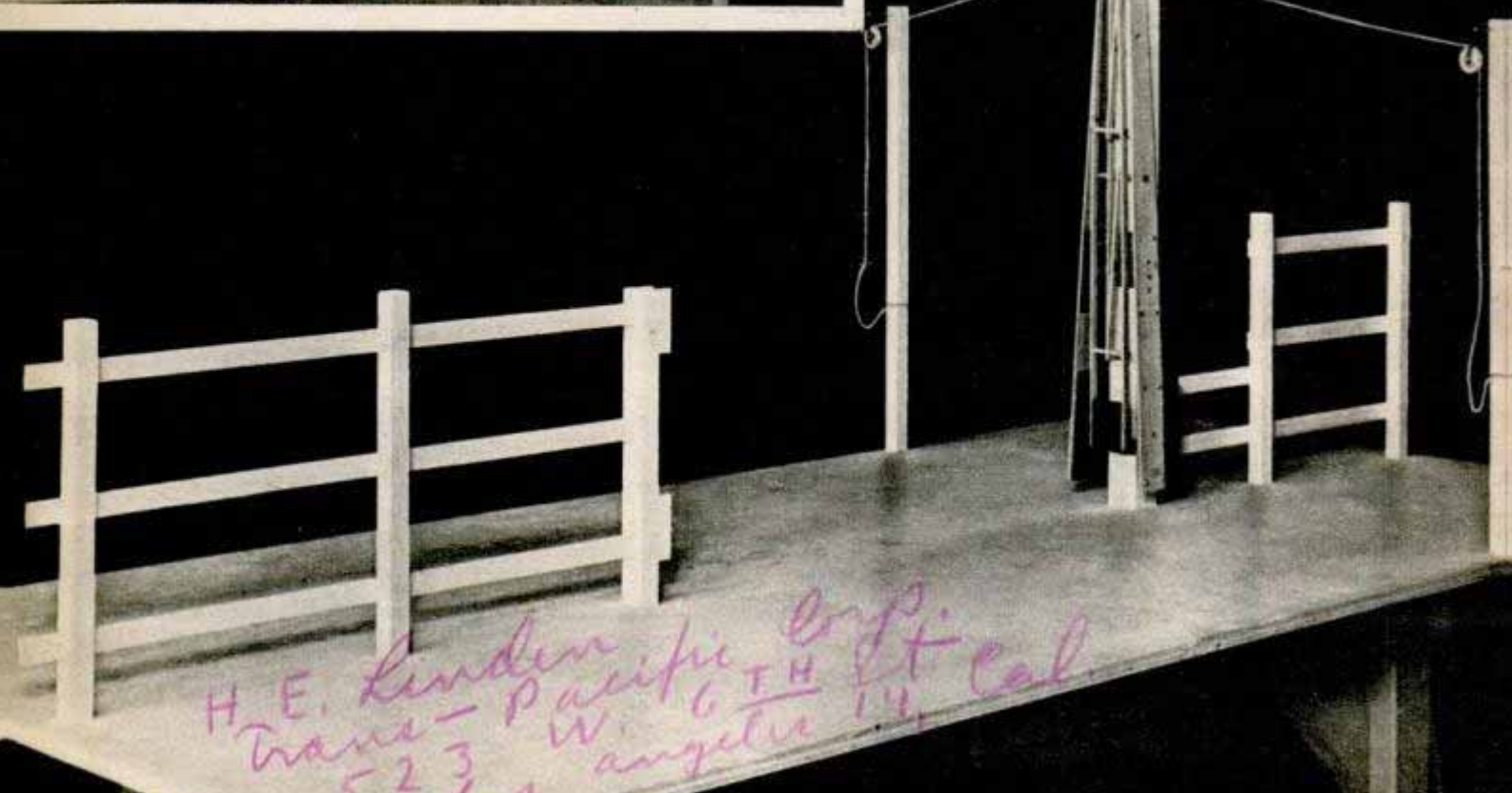
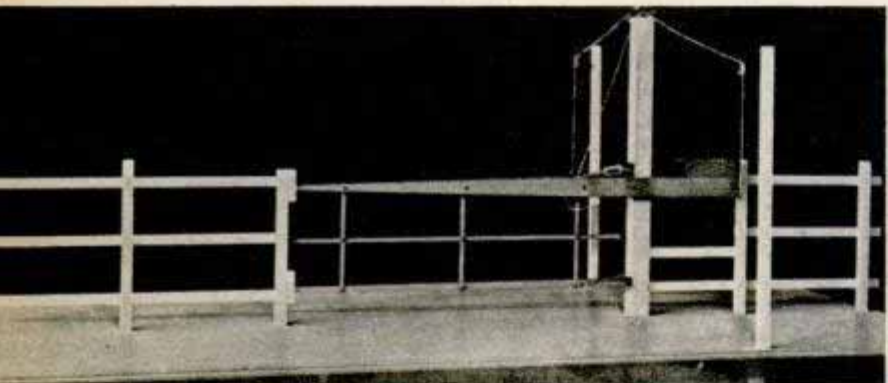
Instead of using a row of boxes for catching the fruit, some orchardists place a pair of mechanically operated canvas conveyor belts between the frames, extending out from each side of the tree trunk. After being shaken from the tree to the conveyor the fruit is moved out to empty boxes at the end of the belt.

Common sense application of mechanical principles to typical farm needs has led to the development of a small fanning mill that separates leaves and twigs from fruit and nut crops, a portable chain drag elevator powered by a small engine or electric motor to move bulk grain to and from storage, and a handy puller for steel or wood fence posts that operates on the leverage principle.

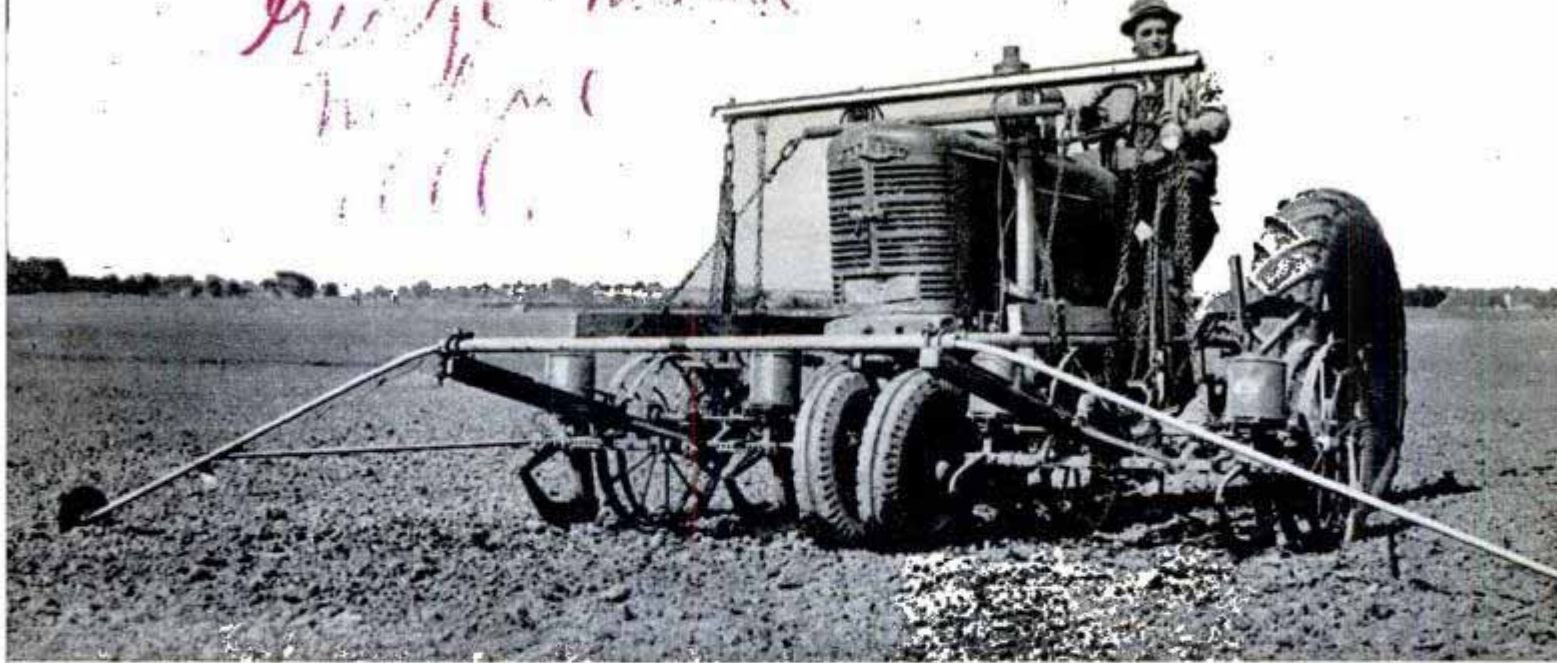
A homemade loader that raises bales of hay from the ground to the bed of a truck, a pickup loader that does the same with sacked grain, and a "transport buck rake"



Apricots roll from the "catcher" to the crank-operated conveyor belt which carries them to a packing box. Below, two views of mechanical farm gate which can be opened and closed by a driver without alighting



*George Mitchell
March 1946*



Four-row tractor planter is equipped with "floating" arm for covering uneven ground and making short turns

mounted on the back of a truck by which a large load of hay can be picked up and carried to the barn by one man are other machines developed to replace hand labor on medium-sized farms. Old automobile parts, standard black pipe and lumber are the chief materials required for most such equipment.

Depending on a farmer's individual needs, some of these devices pay for themselves in a short time although in other cases their original cost may make them just as expensive as hand labor. In the latter instances their value is that they can help get an operation completed faster than it can be done by hand, permitting a whole crop to be harvested at once at the height of its maturity, the peak of the market or in time

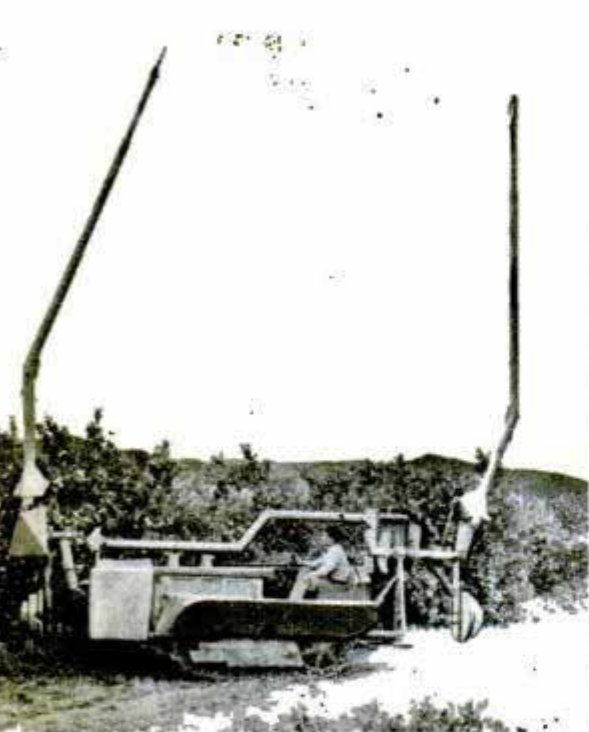
to save it from adverse weather conditions.

Construction details and plans for all of the above devices, including the tree shakers and catching frames, have been prepared by the College of Agriculture, University of California, and may be obtained by writing to the college at Berkeley, Calif.

Most agriculturists depend on general utility equipment for doing many kinds of jobs, but now the trend is toward the development of specialized mechanical devices to replace hand labor for particular tasks. Sugar beets, for instance, are an ideal crop in some parts of the Southwest and yet the cost of growing sugar beets, because of the necessary hand labor, has been so high that domestic sugar could not compete with sugar imported from abroad. The per-

Buck rake attached to rear of truck is operated by truck transmission. Operator drops rake, backs into windrow of hay and the rake picks up the whole load





Fumigation tents are placed over citrus trees by a tent setter whose arms are raised by power from a tractor

fection of three machines now allows sugar to be produced in the United States with fewer man-hours of labor than anywhere else in the world. One of these machines is a precision planter, the second is a mechanical thinner, and the third is an ingenious harvester that cuts the tops off the beets, picks up the beets and shakes them clean, then delivers them to a storage bin.

Similarly, spraying machines now almost completely have replaced hand labor in the task of spreading insecticide over foliage. One typical "speed sprayer" performs work that once required 36 men, saving 85 percent of the labor and 20 percent of the materials once used. Towed by a small tractor, the spray machine ejects insecticide from numerous small nozzles, then uses a blast of wind from an enclosed airplane-type propeller to spread the spray into the foliage of trees. As much as 15,000 gallons of spray can be applied in a 10-hour day.

Another development for protection against both orchard and field crop pests is an Army smoke generator that volatilizes the insecticide. The generator produces a rolling cloud of fog that appears to reach every square inch of the surfaces of a crop. In one test this "death fog," consisting of atomized oil that contained DDT insecticide, completely killed a heavy infestation of citrus thrips in a 150-acre grove of grapefruit trees. Fogging a 32-acre beet field that was infested with thrips and cabbage loopers resulted in a 100 percent insect kill. The treatment took seven minutes and used five gallons of oil.

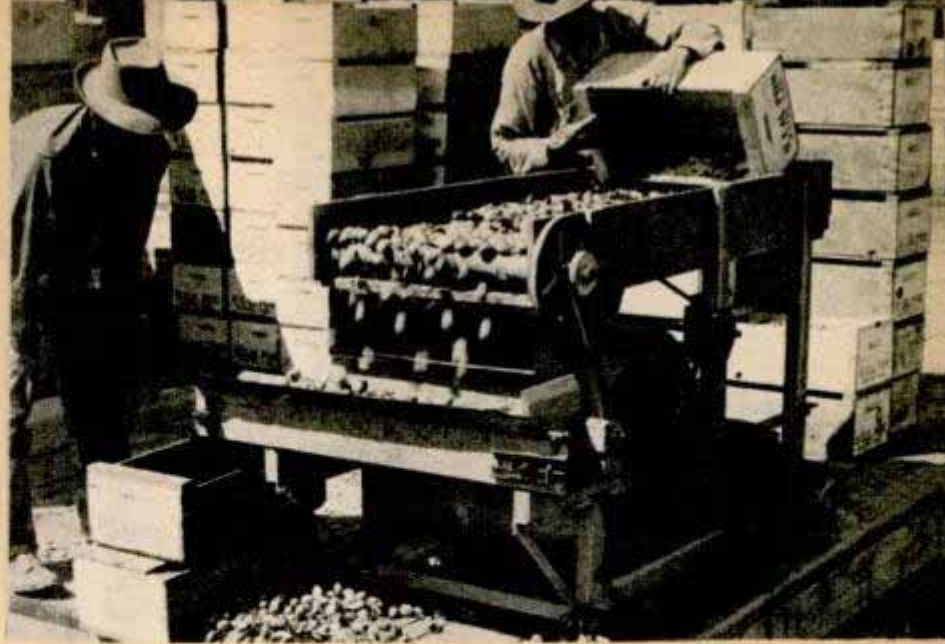
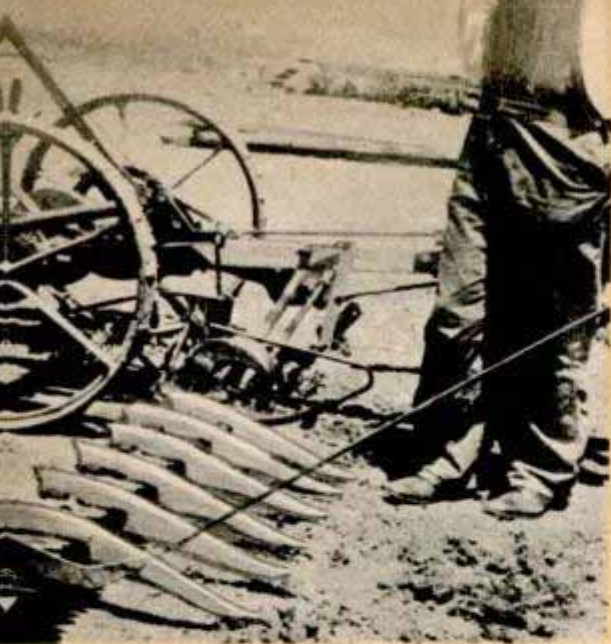
Some orchard pests are eliminated by a fumigation process during which the whole tree must be covered by a tent. Hauling the canvas tents over the trees once re-

quired a crew of five men but now this job is done better and faster by a mechanical tent puller consisting of two long steel arms that project from a framework mounted on a tractor. The two arms raise one end of the tent overhead, up and over the tree in one easy operation. Without such mechanical tent pullers, spraying machines and smoke generators, it would have been impossible to maintain the necessary pest-control program in some areas during the war.

Canned peas might have been a wartime casualty but for the development of a machine that shells peas on a tonnage basis, fast enough to insure the "vine fresh" quality needed for canning. This viner machine has removed practically all hand labor from harvesting peas. The vines are cut in the field and left in rows, after which a power-driven loader picks them up and deposits them on a truck. Then they are transported to the viner machine, which first separates the pods from the vines and then extracts the peas from the pods.

Nuisances in nearly all farming and ranching areas are the swinging road gates that are used to keep livestock from straying. An automobile driver or horseman who approaches such a gate must swing the gate open, move his vehicle or horse through it and then close the gate before he proceeds.

Most of this bother is avoided by a new patented type of road gate that operates something like the upswinging arm of a railroad crossing gate. It consists of a section of fence that folds together as it swings upward. It may be opened or closed without dismounting by pulling on ropes that are attached to posts at either approach. The gate is counterbalanced for easy oper-



Prongs attached to blade guard of mowing machine lift up vetch and other crops for easy mowing

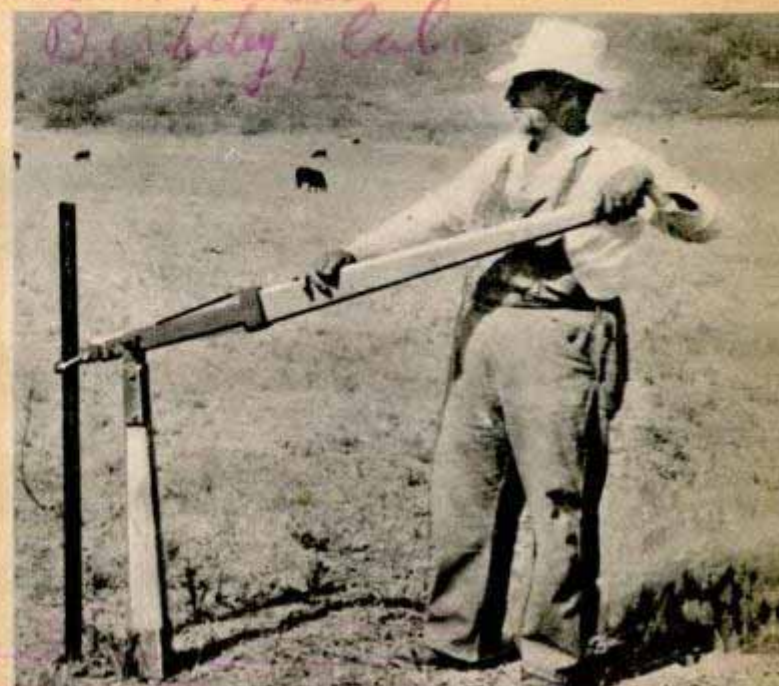
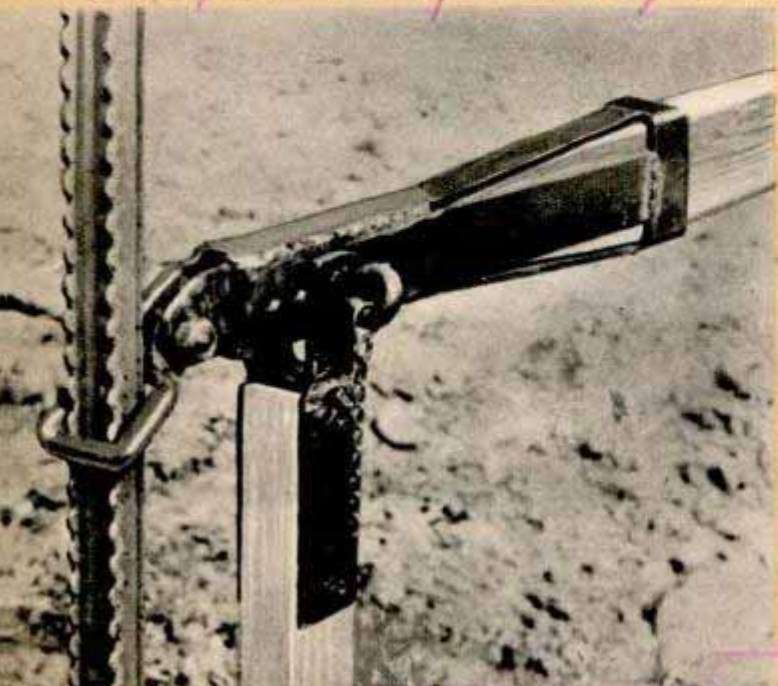
Leaves and debris are blown from fruit passing through fanning mill equipped with squirrel cage fan to provide blast



Tractor delivers a load of peas to a pea thrasher which also is powered by a tractor. Below, closeup and action views of steel fence puller with adjustable lever. Short chain replaces stirrup for pulling wooden posts

Plans from: U. of Cal. Agricultural Extension Service

Burbank, Cal.



*University of Cal.
Berkeley, Cal.*

Clinton, Iowa



"Death fog" from Army smoke generator kills insects. "Till-master" (right) plows, disks and harrows at same time

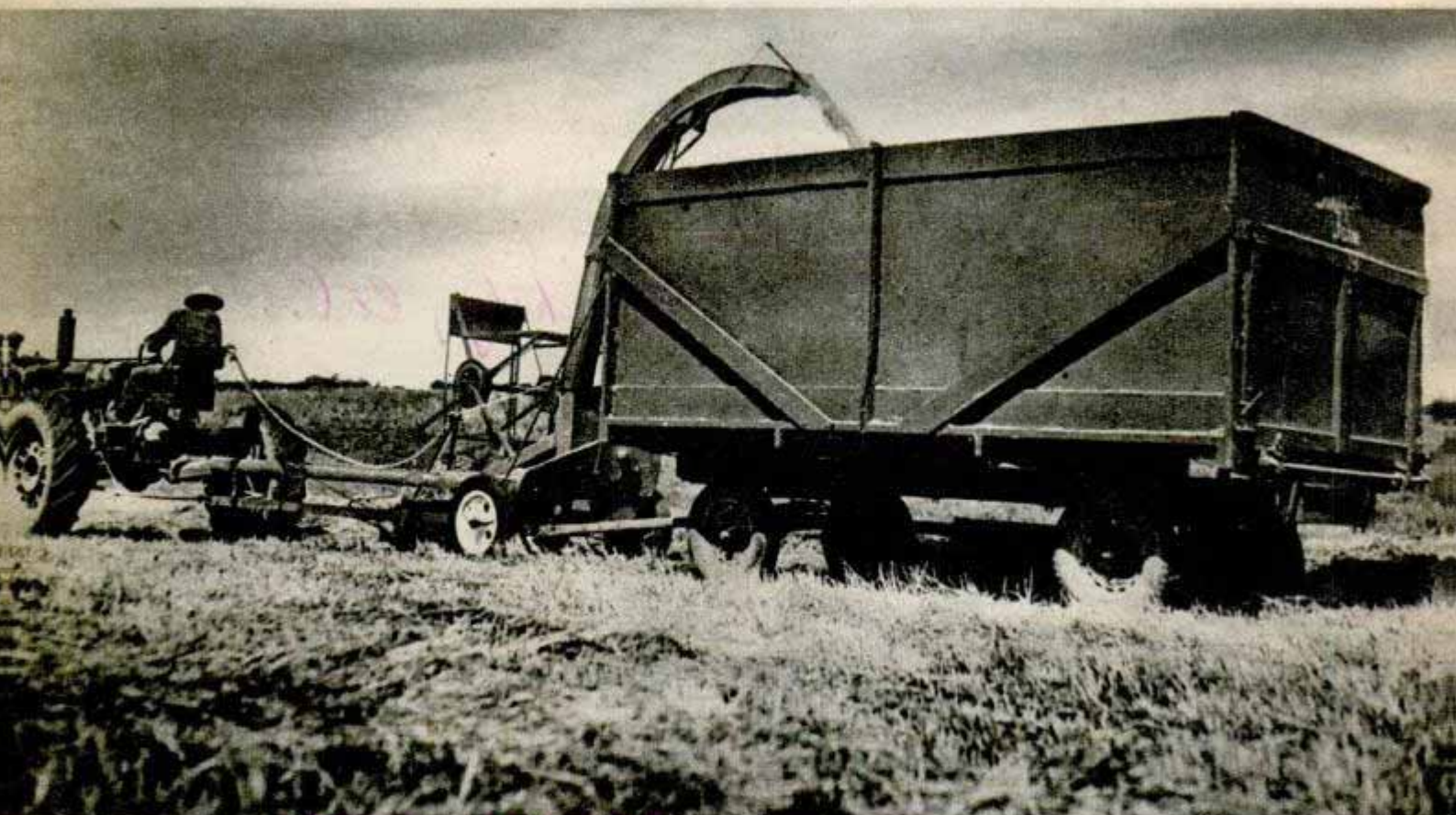
ation, automatically locks into position, and its efficiency is not hindered by snow or weeds that must be cleared away from gates of the swinging type. It now is being manufactured.

for fruit and nut crops that fall on the ground.

Mechanization of individual farm jobs has hardly started. A practical machine for picking tomatoes on a mass basis, for instance, is one device that still is needed. A better way to harvest Ladino clover seed is being sought, as well as a good harvester

Even so, farm machinery is one of the important reasons why the United States was able to produce almost 50 percent more food in the last two years than during the comparable war years of 1917 and 1918. The amazing thing is that this increase was accomplished on about the same acreage and with some 4,000,000 fewer people at work on the farms.

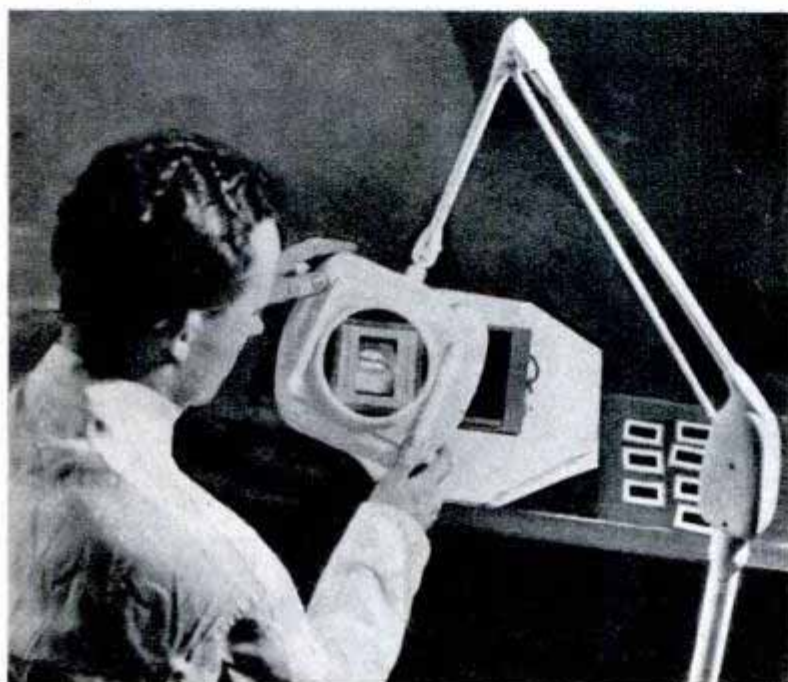
Hay is picked up and cut into fine bits by chopping machine which deposits the feed into self-unloading wagon



*Port Byron
Cloyd Walter
Lloyd Walter
University of Cal.
Berkeley, Cal.*

Golf-Bag Folding Cart Fits in Small Locker

Knee-action wheels on one type of golf-bag cart can be retracted like airplane wheels, forming a compact unit easily stored in a locker or automobile. The bag can be left on permanently, since it's not necessary to detach the bag before folding up the cart, which is made of strong, lightweight aluminum alloy.



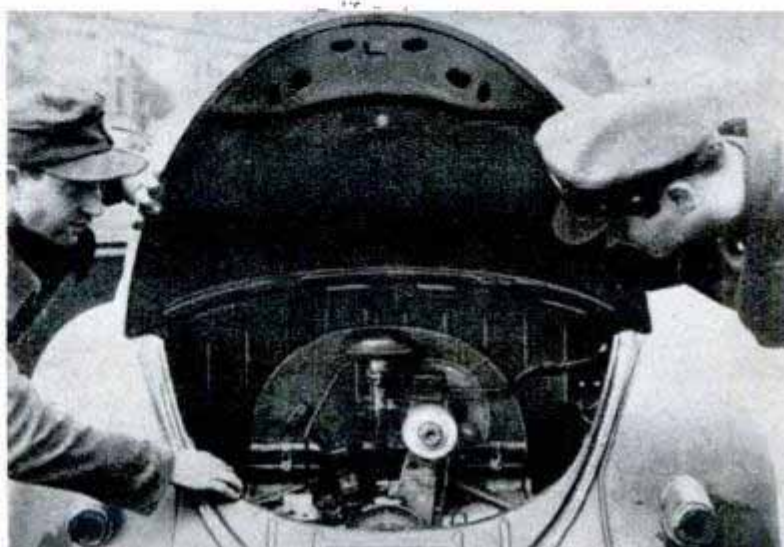
Light in Magnifying Lens Diffused for Open Eyes

Light and a magnifying lens are combined in an instrument recently devised for doctors, dentists and oculists. It also is useful for first aid or laboratory purposes. The light is so soft and diffused that open eyes can be examined through the instrument. Clamps, for table and wall installation, and floor braces are provided. The unit is so balanced that it can be moved with the fingertips to any position and it will remain there. Lenses are provided in either four or five-inch diameters. The instruments are available in either white or statuary bronze finishes.

Rear Engine German Auto Rolls Off Assembly Line

Hitler promised the Germans a lightweight "Volkswagen," or "people's car," before the war and even took initial payments, but the first ones to be mass produced recently rolled off the production line in the British Occupation Zone. A few for party favorites were made during the war. The engine is in the rear and the car is heated by exhaust gases.

Right, front view of "Volkswagen" and, below, how engine is housed in rear end

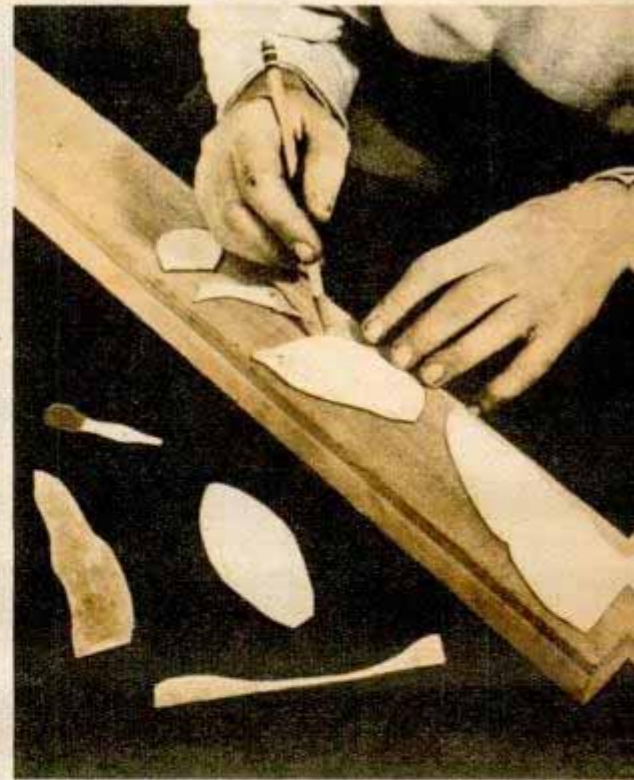


Electric eels long have employed principles somewhat similar to radar, sending out electric impulses which, upon striking such food possibilities as fish or frogs, bounce back and affect the senders' sensory apparatus.

Birds with **WOODEN FEATHERS**



A bird in the hand isn't worth as much as one in wood to John Lacey of New York. Lacey has converted his hobby, carving realistic game birds, into a prosperous business. At left he photographs real pheasant wing as it appears in flight to achieve exact scale reproduction



Left, jigsaw roughs out head and body of Canadian goose. Tail and wings will be fastened into notches later. Above, templates traced from photographs are cut from light plastic. They will be used as patterns in carving the wing parts, head and neck from wood blocks



Birds in majestic flight look alive when mounted against an imitation sky. Left to right are a bobwhite quail, a dainty pintail hen, and a mallard carved in graceful flight

Lacey's dog contemplates a pheasant wing critically as an assistant paints the finishing touches on a pintail





Flying howitzer shells and rockets are photographed on "still" film

by a camera which makes 120 exposures per second. The camera does not have conventional shutters. Exposures are made through slots in two concentric drums revolving in the same direction but at different speeds. The inner drum is connected directly to an electric motor and rotates 30 times a second; the outer drum is connected

Camera "Stops" Flying Shells 120 Times Per Second

by a gear and revolves 24 times per second.

This difference in rotating speed and the varying size of the solid sections of the drums produce exposures that record the movement of a projectile at various stages. The film is 3¼ inches wide and 35 inches long. Images are recorded from left to right on the film on narrow ribbonlike strips. About 200 exposures are made on each roll of film.



"Skull-Crackers" Drop 96 Ft. To Make Scrap of Castings

Six and eight-ton balls falling 96 feet crash down on large pieces of scrap, breaking them into furnace size for melting at the Sheffield Steel Corporation, Kansas City, Mo. Magnets powered by a 25 kilowatt generator lift the "skull-crackers" to the top of the hoist in 45 to 60 seconds. A Diesel engine operates the unit. The balls shatter 90 to 100 tons of large castings to furnace size each day.

Transparent "Coat" for Concrete Prevents Too-Quick Drying

Instead of building earth dams or covering newly laid concrete with moist sand to prevent quick drying — processes that require many hours of labor—a one-man machine is used. Mounted on wheels on a raised platform, the machine closely follows the finisher and lays a coating of membranous curing compounds. The transparent coating seals the water in the concrete and prevents too-rapid evaporation which causes minute cracks. It was used in building roads and concrete runways during the war.

CANOE TO FIT AUTO TRUNK IS ASSEMBLED IN 10 MINUTES



Full-length plastic canoe fits into two zipper bags. The 10 sections lock together and may be assembled in 10 minutes. A canvas sheath is strapped snugly in place over the hull to make the craft waterproof



Packing a full-length canoe into the trunk of an automobile is no magician's feat with a portable, sectional canoe. The 65-pound craft can be stowed in two zipper bags and carried as luggage. Its 10 sections require only 10 minutes to assemble. The sections are made of a light, durable plastic that is nonabsorbent, impervious to salt water and gasoline and will not warp. Sections are locked together with special metal clamps. To make the canoe waterproof, a canvas sheath is fastened snugly over the entire hull with elastic airplane shock cord. Even the paddles are sectional. When separated at a joint in the middle, they form the handles of the zipper carrying bags. Oarlocks and an attachment for an outboard motor

also are available. The craft was built by Ed Link, inventor of the famous Link Trainer for training airplane pilots.

Crater Believed Formed by Volcano

More than \$1,500,000 has been spent in searching for Arizona's famous Crater Meteor. The meteor never will be found, according to Dr. N. H. Darton of the U. S. Geological Survey, because he believes it never existed. The scientist says the crater was formed by a volcanic steam explosion instead of an enormous projectile from outer space. As supporting evidence, he points out that the region is volcanic and that a similar crater nearby has a cinder cone in its core.



PART 2

RADAR *Cues the Navy Fighters*

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

A former college English professor and a one-time advertising executive, turned Navy radar experts, continue their account of radar's brilliant role as the "eyes" for both carrier and land aircraft



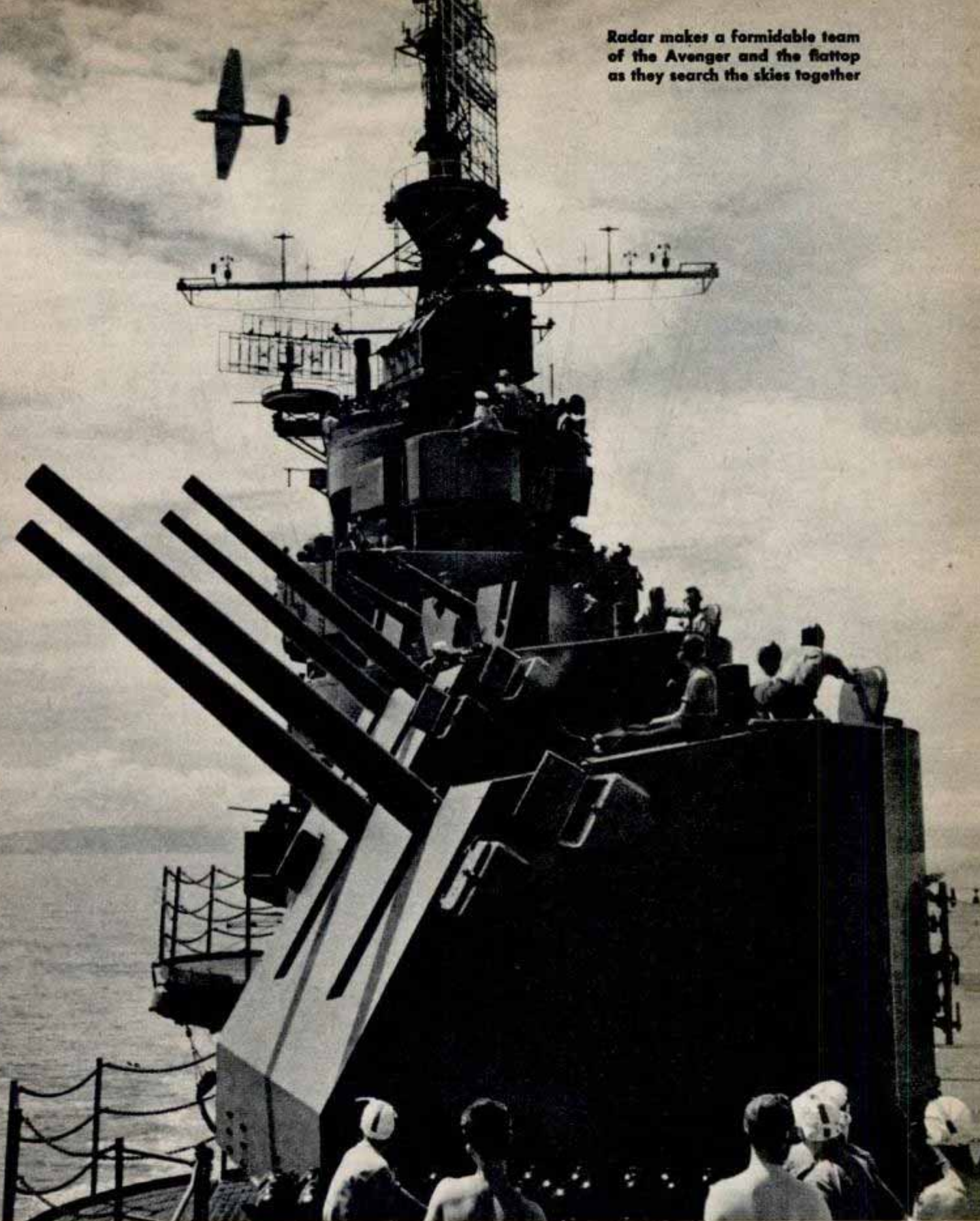
Two Corsairs with short-range airborne radar gear on right wing's leading edge

SIMPLE in its essence yet so vital to the defense of the Fleet, the business of directing planes to intercept enemy planes is known as fighter direction. A mainstay of Fleet and island-seizing operations, it has been made possible by radar. How potent a weapon fighter direction can be is demon-

strated in the World War II files of the Army and Navy, which bulge with tales of its achievements.

Among the more notable of the Navy's heretofore untold stories concerns the role of fighter direction and radar in the now-famed Marianas "turkey shoot" of June

Radar makes a formidable team of the Avenger and the flattop as they search the skies together



1944 when the Japanese lost the heart of their carrier aircraft in a day-long battle with Admirals Spruance's and Mitscher's Task Force 58. Warned by radar when the Japs were well over a hundred miles away, we were able to launch, in plenty of time, hundreds of fighter planes and use them to

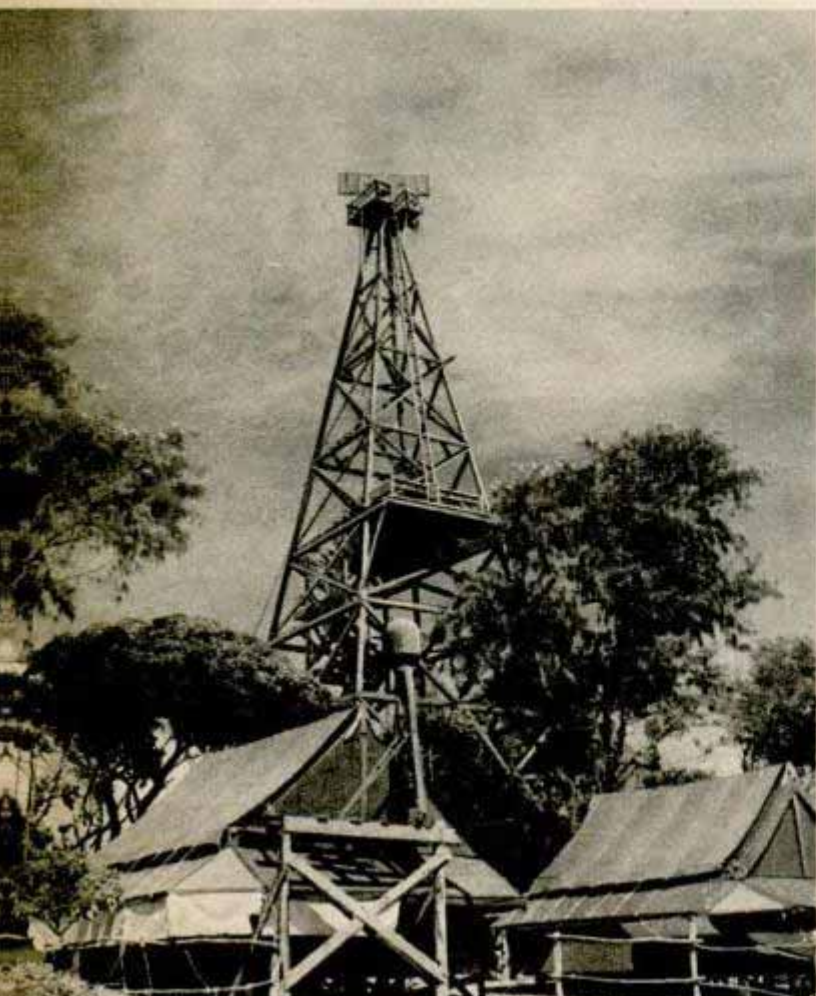
such excellent effect that no more than a dozen planes ever broke through to the carrier task force. Of the 432 planes splashed on that momentous day, all but this dozen were downed 30 to 70 miles from the center of the force by pilots who located the enemy through fighter direction.



An Argus unit hits the beach with mobile radar unit. Some followed the marines a few hours after H-hour



Above, operators at the console in a radar van of a mobile unit. Below, Navy island radar post with both mast and radome type antennae for instructional use



Packed in these same heretofore confidential Navy files on fighter direction are the reports of the once highly secret activities of the Argus units. Argus—"a thousand eyes in the night"—was the code name of the original land-based fighter direction units that went in with the marines at Tarawa, the Admiralties, Roi, Eniwetok, Peleliu—in most cases setting up radar gear a very short time after D-day.

There is the famous case of the unit at Rendova that was operating several hundred yards behind enemy territory—giving warnings of approaching Japanese aircraft to the amphib force landing on the beach. There is the story of the unit on Betio atoll, Tarawa, that set up and was operating a CIC (Combat Information Center) in a Japanese blockhouse that still held the Japanese dead. At Roi, in the Kwajalein atoll, the dead and wounded had to be removed by the men of Argus Unit 21 before the radar van could move into its proper site.

The shorebased CIC, or Air Defense Control Center—its official designation—was called Flops by the Argus unit personnel and for the first month on every island operation the name was suggestive of its appearance. On each invasion, a temporary, completely mobile radar unit was pulled up on the beach and put into operation as an air warning set for the first few days. This was a stopgap until heavy, more accurate radar equipment could be set up. Only a few fighter directors were needed to run the van; usually there were no air strips for planes to land on, or, if there had been a Japanese field, the big guns of the Navy made it slightly impractical for the time being. With no planes to direct, the duty of the fighter director in the radar van was to warn hard-working Seabees and marines of approaching enemy aircraft so they could hit the foxholes. The duties of the rest of the Argus unit those first few days after D-day were to dig foxholes, dig out space for CIC and dig graves to bury the dead.

Come with us into the CIC or ADCC on an atoll in the Gilbert Islands. You should be wearing shorts and as little else as possible for you are less than 20 miles from the equator. Perhaps you'll have to shove



Fully equipped Argus unit moving in on the heels of landing marines to set up vital early warning radar sets

your way through curious natives—Micronesians just released, as of two weeks ago, from under Japanese rule. Some of them still bow—a gesture they were taught by the Japanese—but others salute in the best Yankee fashion. Those are the ones who have been mingling with the marines. All wear grass skirts, men and women alike, and chatter in a language you never heard before. You know one word that sounds like “Sockabu” and you use it. They smile and repeat it after you, and it doesn’t matter too much that it means good-bye and not hello.

In contrast to the shipboard CIC, there are few shiny gadgets, no suggestion of Flash Gordon, nor any indication that here is the nerve center of the atoll. This is a small cave or dugout, five feet down in the tough coral topped with layers of coconut logs and sandbags. The dugout is no more than seven feet square with a plotting table in the center. Along one wall of the cave is a long line of field phones connected to the island commander’s headquarters, to the communication dugout, to lookouts in tree-high towers, to the marine headquarters and every gunnery post on the island. There are microphones and speakers, but the radio consoles are all in a tent a few yards away from the dugout, and the radar sets themselves are “dug in” at various points on the atoll.

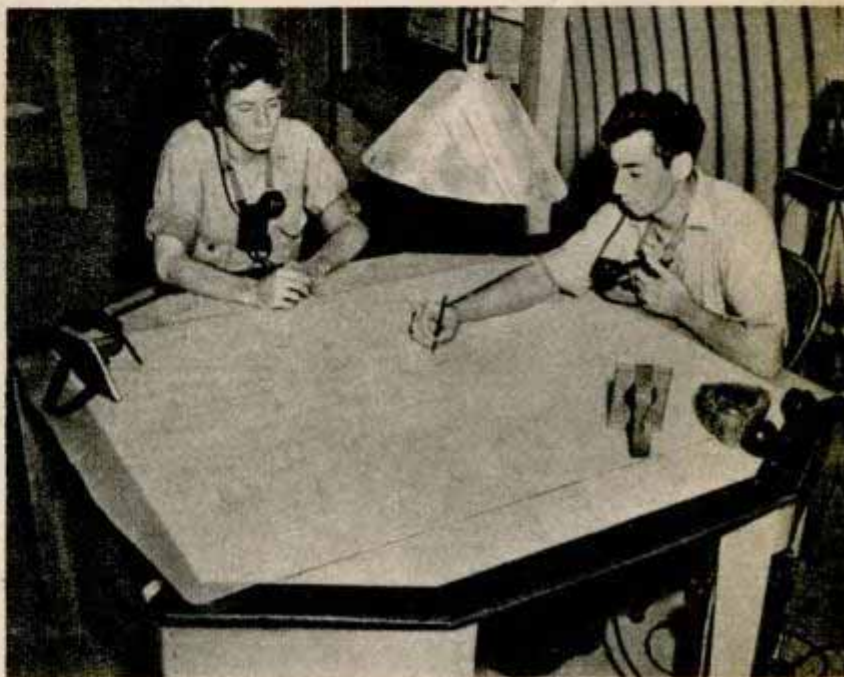
Here, as in the shipboard CIC, enlisted plotters wearing earphones are plotting symbols on the table in the center of the dugout. The fighter director officers on duty are wearing a week’s growth of whiskers and green shirts and trousers that could use a hot iron. The plotters are stripped to the waist.

As you enter, a loudspeaker is blaring forth: “Hello, Copper base, this is Pastel base . . . Pastel base calling Copper base, over—”

An ensign picks up the hand microphone: “Pastel, this is Copper base, over—”

“Copper base, this is Pastel . . . we have a bogey for you—10 miles north of you . . . we are in condition red, over—”

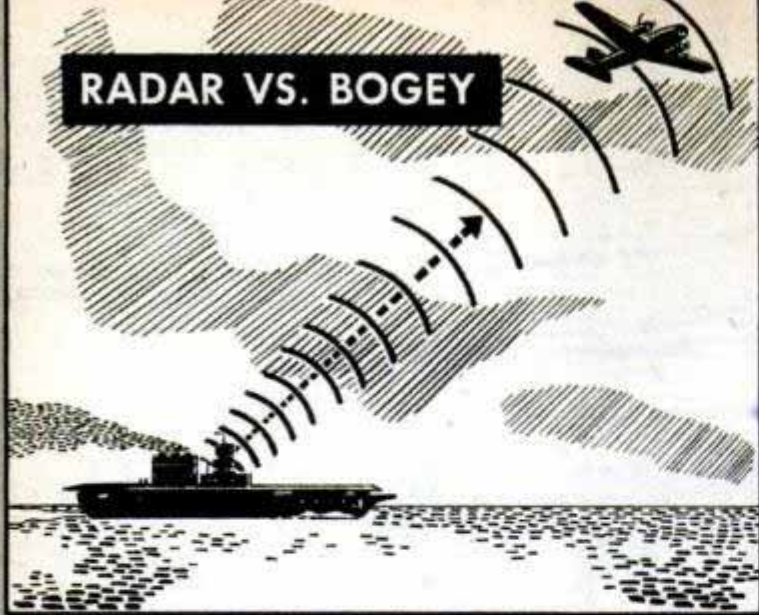
The officer looks down at the plotting board as the plotter indicates with his pencil that our radar has picked up the bogey.



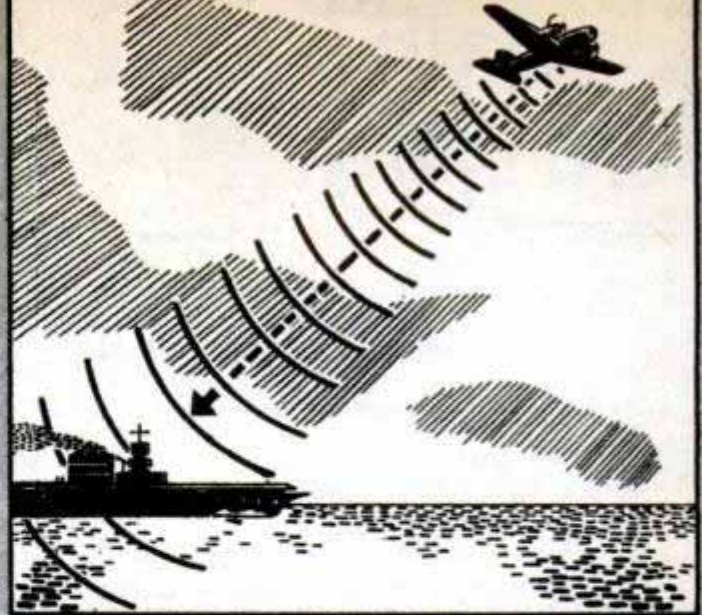
Radar plotting table in a Quonset hut. When Makin was taken during the Pacific campaign a Japanese radar station, below, was captured along with the bare atoll



RADAR VS. BOGEY



1 Radar beams traveling at speed of 186,000 miles a second push out in search of bogey



2 Ship's beams detect bogey and bounce back, revealing enemy presence to CIC observers

"Pastel from Copper," the officer speaks into the microphone. "We have the bogey—we are in condition red, out."

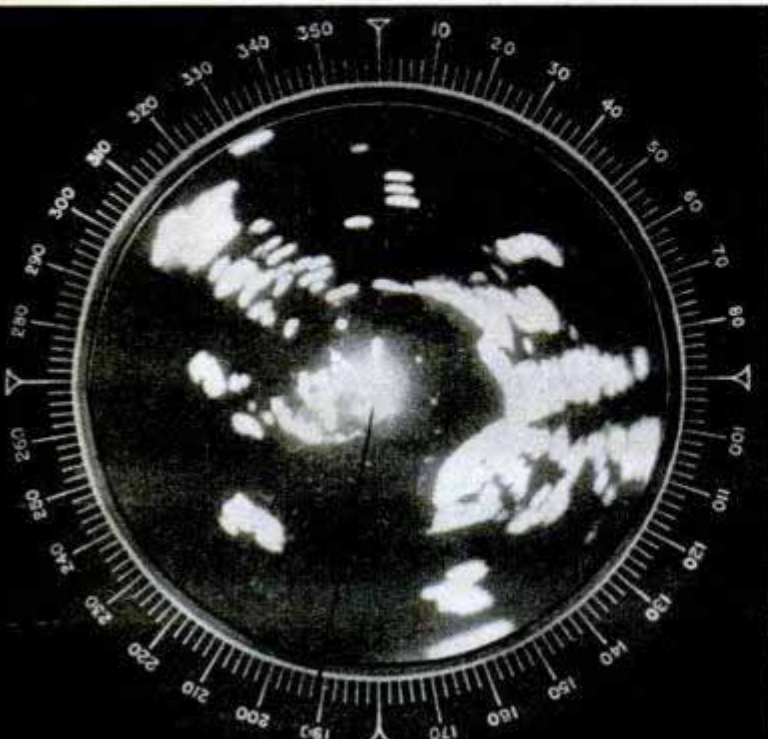
The ensign, tired and a little hungry looking, says: "Everyone's been alerted. It's another snooper—I think he's taking pictures of the island. Wish to hell we had some planes to send up after him—" He stops, nods, grins: "Wish to hell we had an air strip," he says. "That was Makin calling. You know, Makin takin'?"

Everyone's been alerted. That means that everyone on the island has been warned, by loud air raid warning sirens or some pre-arranged signal, that Japanese planes are in the vicinity. For the first week or two, the duty of the fighter director in an Argus unit is not to down enemy planes by directing friendly planes out for interceptions; rather his job is one of warning the men to hit the foxholes.

Revisit this Flops or landbased CIC a few weeks later after the air strip is completed and bombers are being sent out on strike missions. Now you go down a long ramp into a steel Quonset hut that has been buried completely in the coral. The Seabees have done a terrific job of camouflage—even to the extent of replanting coconut trees on top of the coral on the roof of the hut.

This approximates the spit-and-polish of the shipboard CIC with the big six-foot Plexiglas board, the PPI scopes, a large fighter direction platform and a radio room filled with elaborate consoles reminding you, somewhat, of the transmitter room of a small radio station back home. The men are cleaner—the officers are shaved. A gigantic status board takes up the entire bulkhead beside the fighter director's platform, and on this board are written the call numbers of the planes and the pilots flying

Left, Tokyo Bay on ship radar scope. Right, "shrubby" on wire net camouflages fighter director post on island





3 Small blob of light appearing on PPI scope gives interceptor officer warning of bogey



4 Location of bogey is plotted on Plexiglas "window" showing all aircraft in vicinity

the planes "somewhere 500 or 1000 miles north of here bombing hell out of the Marshall Islands."

One of the most important duties of the island-based fighter director is to keep track of every strike mission that goes out and try to locate those planes that may have been forced to land on some other island. Bombers take a lot of room for landing and they need a lot of light for night landings, so the fighter director controls the searchlights on the island. He controls the black-out conditions on the island, in direct contrast to the shipboard fighter director who almost always is working under blacked-out conditions. Captured islands have to be rebuilt in a hurry, which is a 24-hour-a-day proposition, and to black-out an island for an air raid represents thousands of work hours lost.

(Continued to page 240)

Sandbags shelter radar personnel from Jap snipers

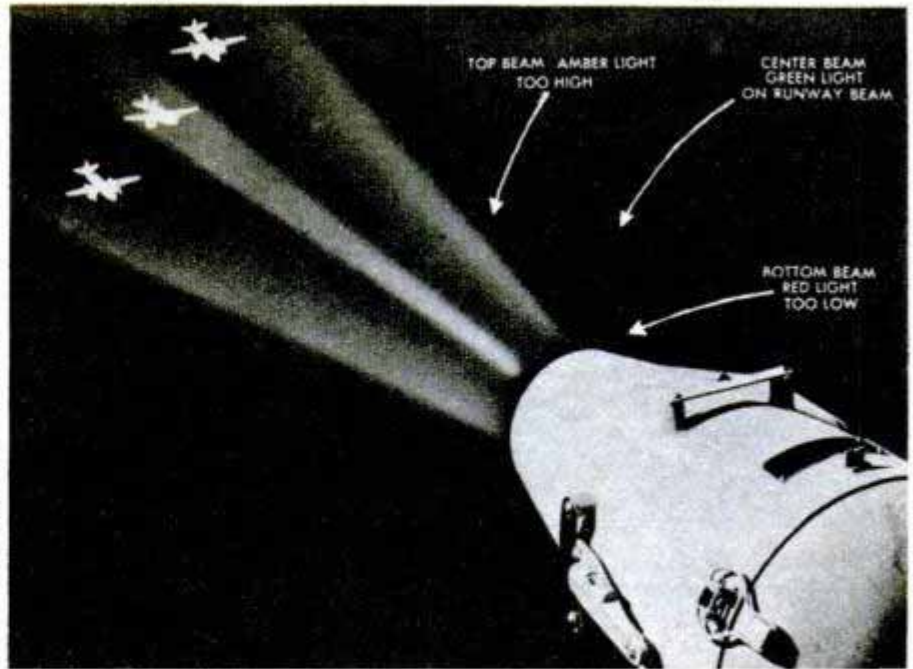


5 Fighter director officer radios to pilot full information on the bogey's movements

6 Following FDO's instructions, the fighters intercept enemy planes and go into action

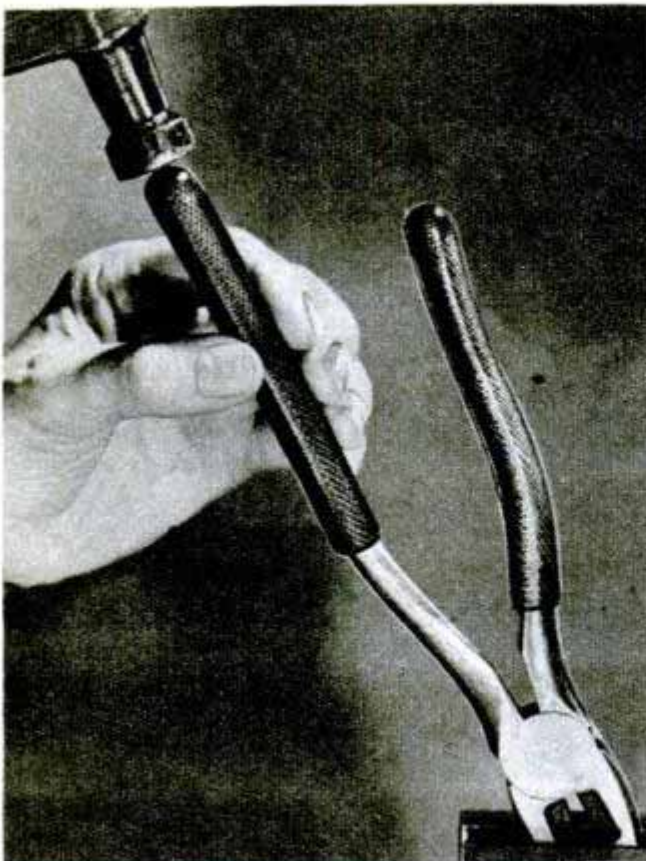


Indicator "Paints" Path in Sky to Guide Pilots in Landing Aircraft



"Painting" a path in the sky for pilots to follow in landing their planes, an angle indicator uses colored lights as a guide in runway approaches. The indicator projects wedges of red, green and amber lights at predetermined angles above the runway. When a pilot sees only the green light he knows he is approaching properly. If the plane drops too low he sees a red glow. Amber indicates that his approach is too high. The path of light can be seen four to six miles under normal conditions. In low visibility the light appears at the same distance as contact lights on the runway. It is es-

pecially effective in guiding pilots in the last 50 to 100 feet before contact with the ground. The device uses only a 100-watt bulb as a light source with a reflector and lenses to separate the beam into the three colors. To avoid glare a shutter mechanism projects the light at a frequency of 40 times a minute. W. A. Pinnow, Westinghouse engineer who developed the indicator, predicts that pilots using it in training will learn to make good landings in one fifth the normal time. For planes equipped with radar, the indicator provides a visual link between contact and instrument flying.



Slip-On Handles Insulate Pliers Against Electrical Shock

Pliers can be insulated with a pair of plastic slip-on handles. Conforming to all shapes and sizes of pliers, the red handles can be added to the pliers with ordinary tools and without heating the plastic. They insulate against average voltage, provide greater leverage, protect hands in cold weather and will not slip. The bright color of the handles makes it easy to find pliers in a toolbox or on grass or snow. Handles are available in 6, 7 and 8-inch lengths.

Plastics Glow Eight Hours After Exposure

Luminous plastics that glow from six to eight hours after exposure to sunlight or other illumination are being produced from phosphorescent compounds developed during the war. Colors available include green, green-blue, blue and bright blue, which have daylight colors ranging from green to gray. The plastics will be used for street markers, switch plates, clocks, instrument dials and door numbers.

BY RADAR TO THE MOON

THE MYSTERY about where cosmic rays come from (see [UNLOCKING THE UNIVERSE](#), page 89) may be solved by the ultra-high-frequency radar beams that recently were bounced off the moon. Rocket projectiles will carry counter tubes and other delicate instruments into solar space. Electrically recorded readings will be sent back to earth at the speed of light. To reach the moon with radar, the Army Signal Corps built a huge antenna at the Evans Signal Laboratory, Belmar, N. J. The pulse of energy hurled into space was so powerful that water-cooled vacuum tubes were used in the transmitter. The beam penetrated the ionosphere, the electrified outer area of the earth's atmosphere which turns back ordinary radio waves. This will make possible radar-guided rocket ships or missiles. It also will aid in mapping the planets.

238,857 MILES - 2 1/2-SECOND ROUND TRIP BY RADAR

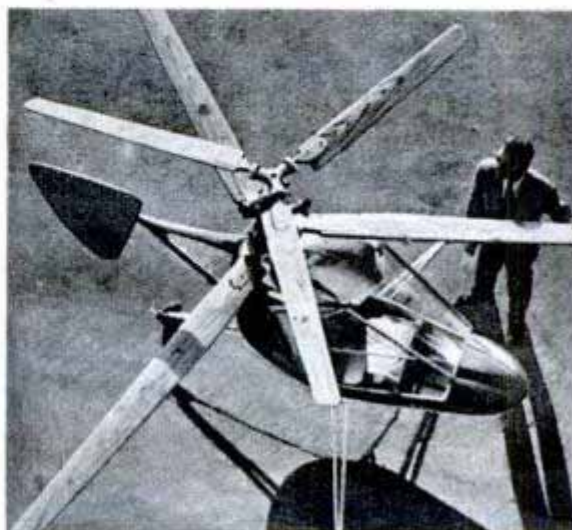
ROUND TRIPS BY RADAR

Venus	—25 million mi. when closest to earth—	4 min. 29 sec.
Mars	—35 million mi. when closest to earth—	6 min. 16 sec.
Mercury	—50 million mi. when closest to earth—	8 min. 58 sec.
Sun	—92,900,000 mi.	—16 min. 39 sec.

World's Smallest Helicopter, With 25-Hp. Engine, Weighs Only 242 Pounds

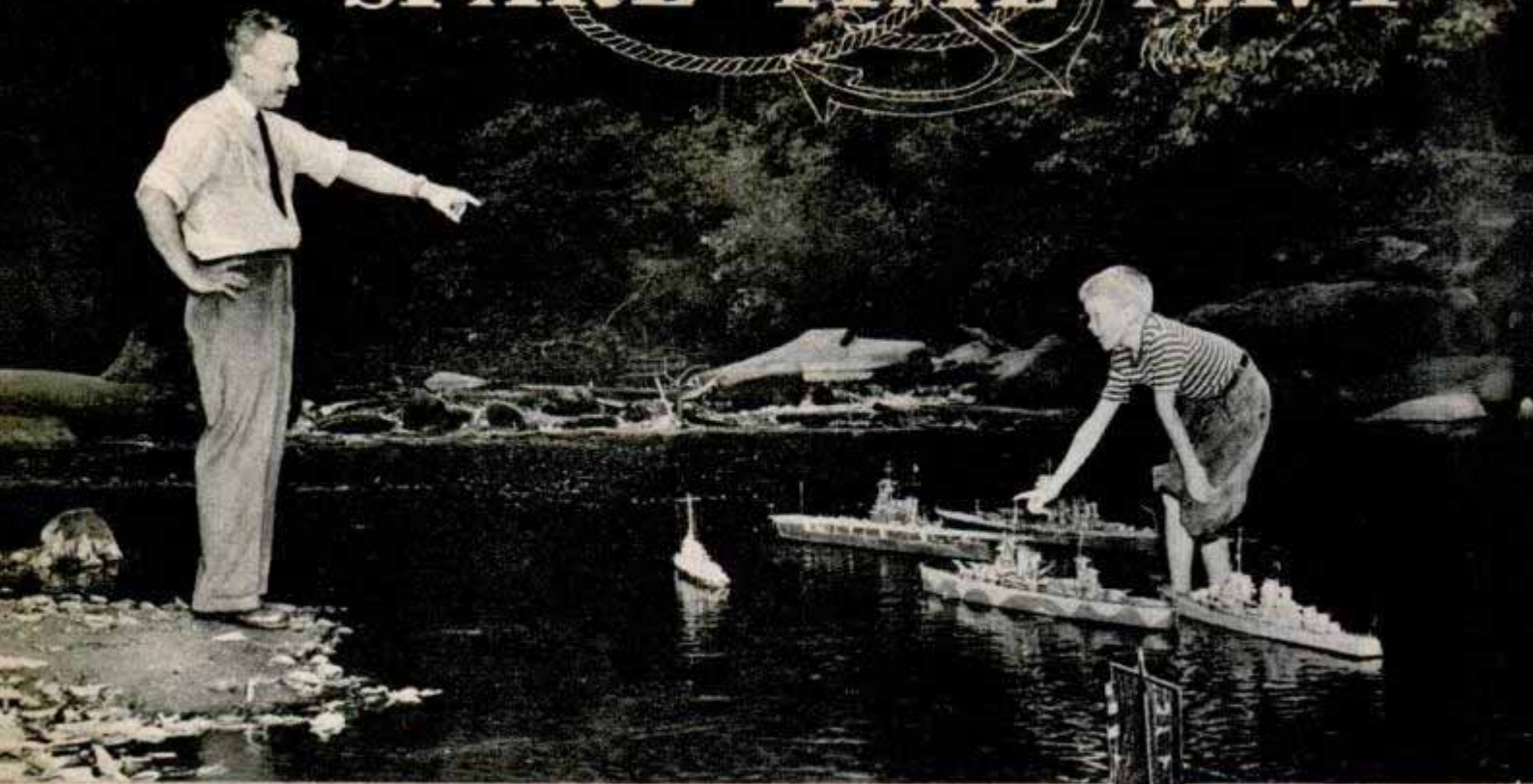
Weighing only 242 pounds, the Roteron, designed by four Southern California men, is said to be the smallest helicopter in the world. A 25-horsepower motor of original design furnishes power for the midget from a position between the two sets of rotors,

thus eliminating many gears and clutches. Wooden blades are used on the rotors of the plane and the diameter of the larger rotor is only 15 feet. The designers expect the helicopter to cruise at 100 miles an hour and have a top speed of 110.

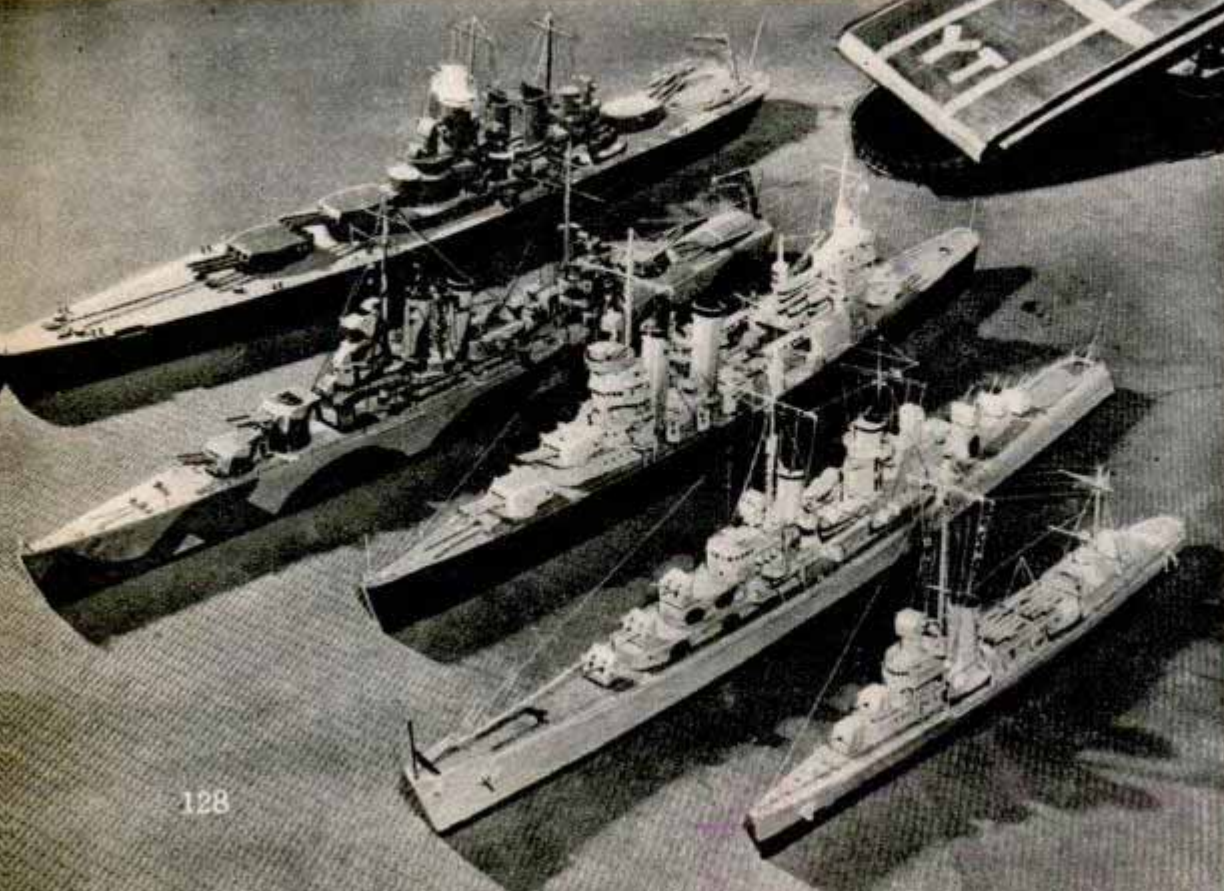


*Norman L. Goss
Roteron*

SPARE TIME NAVY



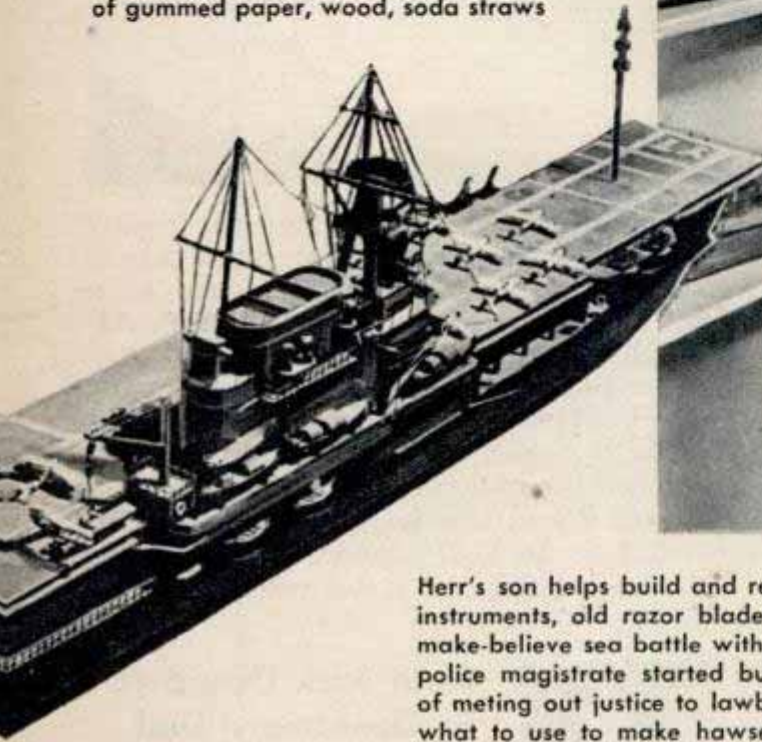
Police Magistrate Gordon R. Herr of Upper Darby, Pa., uses his spare time to build model warships from such odds and ends as old cigar boxes, discarded spools and even pieces of candy. Made to a scale of one inch to 13 feet, the ships float on an even keel and have working gun turrets. Right, two examples of Herr's precision work. In the foreground, the aircraft carrier USS Yorktown has a plane elevator that works and a complement of miniature planes. Smallest item on the ship is its bell, 1/16 inch in diameter. In the background is a camouflaged destroyer, the Aaron Ward



Five units of the magistrate's midget navy, front to rear, are Buck, Atlanta, San Francisco, Wichita and Washington. They are not powered. Herr tried experimental steam propulsion but gave up the idea after his model of the liner Kungsholm blew up in a bathtub. One cardboard model, made previously, ran by steam propulsion for 20 minutes. Herr now has a 36-ship navy. Six coats of enamel cover the trim ships



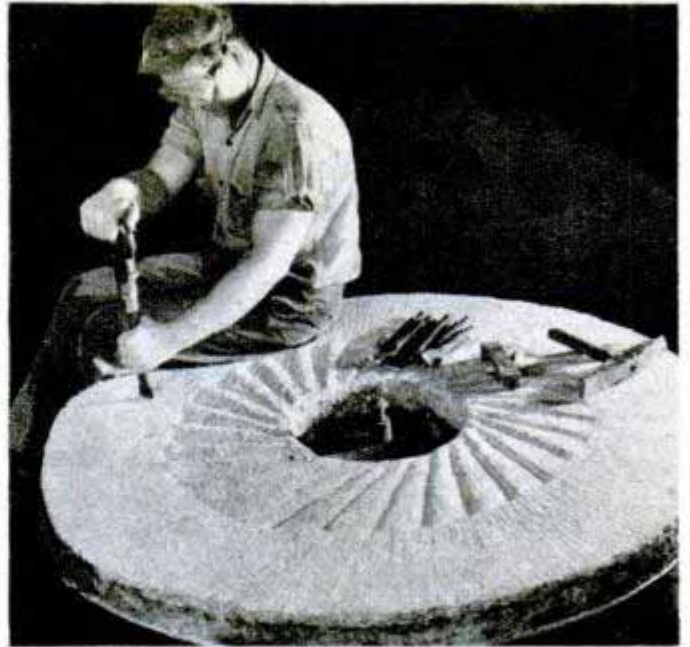
Battlewagon USS Washington made of gummed paper, wood, soda straws



Herr's son helps build and repair the model ships, using for tools discarded dental instruments, old razor blades and scissors. Below, a youngster gets ready for a make-believe sea battle with four of Herr's handmade warships. The Pennsylvania police magistrate started building model ships in 1931 to relax from his duties of meting out justice to lawbreakers. For a while he found it difficult to figure out what to use to make hawsehole blisters. Transparent candy mints filled the bill

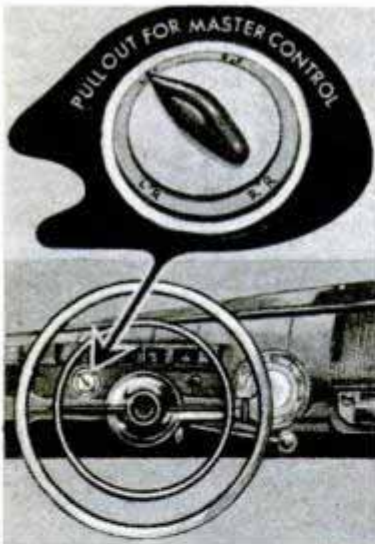


Experts "Sharpen" Huge Millstones to Carry on Century-Old Craft



Exponents of an ancient skill, two stone dressers at a manufacturing plant in Decatur, Ill., "sharpen" the faces of huge gray millstones. The stones, some weighing nearly two tons, are still preferred in grinding corn kernels and other grains into fine powder from which syrup, starch and meal are made. Stone dressers, knowing every line of the surface, use special hammers to sharpen inner faces of the stone. Outer surfaces are sharpened by chiseling deep grooves at varying depths and distances.

The only modern improvements in the art include the use of power-operated chisels and electricity to turn the stones at a rate of 250 revolutions per minute. Although the profession remains relatively unchanged since long before the Pyramids were built, stone dressers are so rare that the A. E. Staley Manufacturing Company searched the nation to find one of the men, Edward Bland, who learned the trade from his father. R. V. Jungman, his coworker, has worked 12 years in the profession.



Auto Jack Operates By Dashboard Dial

Long a dream of motorists, an automatic jack system now can be installed in automobiles to raise one or all wheels in 90 seconds by the turn of a dial on the dashboard. The four jacks mounted between the body and each wheel are operated hydraulically by a pump driven by a $\frac{1}{35}$ -horsepower electric motor.

Vacuum Treatment Prolongs Life Expectancy of Cut Flowers and Plants

Cut flowers and plants stay fresh longer when given a vacuum treatment developed by the New York State Agricultural Experiment Station and Cornell University. Vacuum-treated narcissus flowers with six-inch stems were in good condition after six hours' exposure to bright sunlight at a temperature of 80 degrees. Untreated flowers wilted in 30 minutes and in five hours

their petals were dry and crisp. Lilac branches placed in water immediately after a vacuum treatment stayed fresh for five days, whereas untreated branches began to wilt in two days. The treatment consists of placing plants or flowers in a container of water and then putting this in a drier. Air is pumped out and replaced in the plants and flower stems with water.

Bantamweight Challengers



Aluminum and magnesium, the light metal twins, now compete with steel in every field from shotgun shells to ships

*Dow Chem Company
1000 S main St. Midland, Mich*
By Andrew Hamilton

"AL" AND "MAGGIE" have returned from battle and are beginning to assume an important role in the postwar world—which enthusiastic metallurgists already have dubbed "the age of light metals."

Production of aluminum and magnesium, the lightweight miracle metals (whose chemical symbols, Al and Mg, provide their nicknames), was a small industry before the war when compared with other American industries. But now the babies have become young giants.

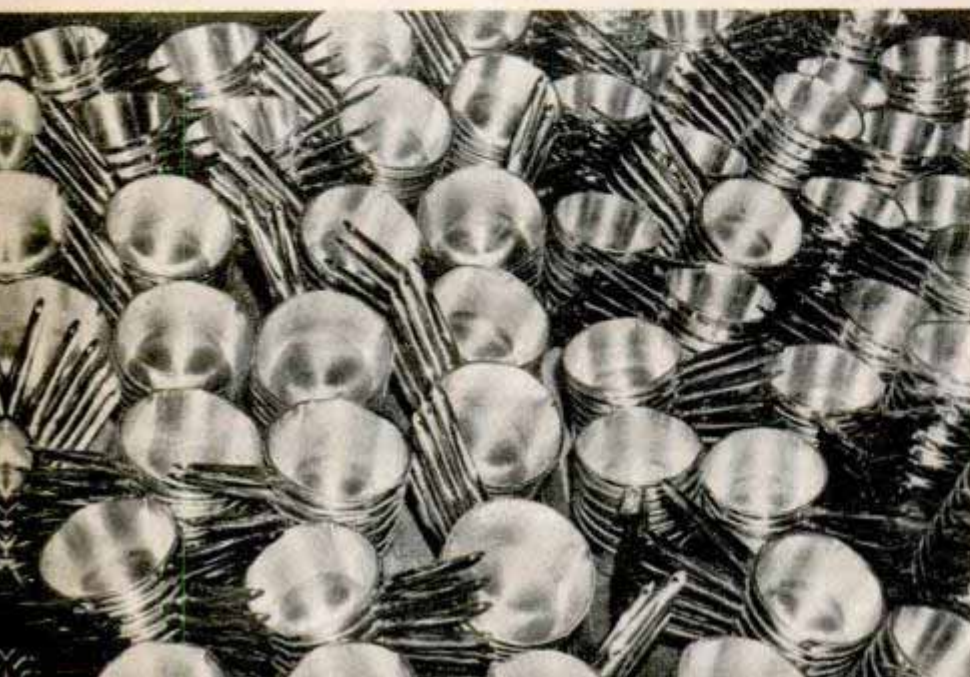
Both featherweight metals will be fabricated into a multitude of peacetime objects that are pushed, propelled and picked up—automobiles,

Above, a magnesium griddle distributes heat evenly. Lower left, construction worker easily lifts 30-pound wheelbarrow of the same metal. Below, magnesium landing wheels for large aircraft resist sudden shock





Above, aluminum roofing requires no paint, resists corrosion. Two of the workers wear aluminum helmets. Below, stacks of lightweight utensils for postwar kitchens



Shipping containers of aluminum, designed to reduce freight costs, are moved easily

vacuum sweepers, trains, baby carriages, furniture, sporting goods, airplanes, printing presses, trailers and countless others. More than 2000 objects, from ships to watch parts, have been earmarked to be built of aluminum alone.

In 1940 the United States produced 163,000 tons of aluminum and 3300 tons of magnesium. When war came the government invested \$670,000,000 in aluminum plants and \$389,000,000 in magnesium facilities. This

stepped up aluminum production seven times to a total of 1,119,000 tons and increased magnesium output almost 100 times to a total of 293,000 tons.

As war spurred production of the two light metals, prices fell. Aluminum ingots dropped from 20 to 15 cents a pound; magnesium slid from 27 to 20½ cents a pound.

The lightweight metals cannot compete in price on a pound for pound basis with steel. But experts point out that aluminum is one third the weight of steel while magnesium is one fourth. On a volume basis, therefore, "Al" and "Maggie" are seen as serious postwar competitors.

Improvements in light metal refining and alloy processing during the past five years have given aluminum and magnesium (1) amazing strength not heretofore possessed, (2) easier machining qualities and (3) new erosion resisting properties.

Both metals exist in abundance. Aluminum is the most plentiful

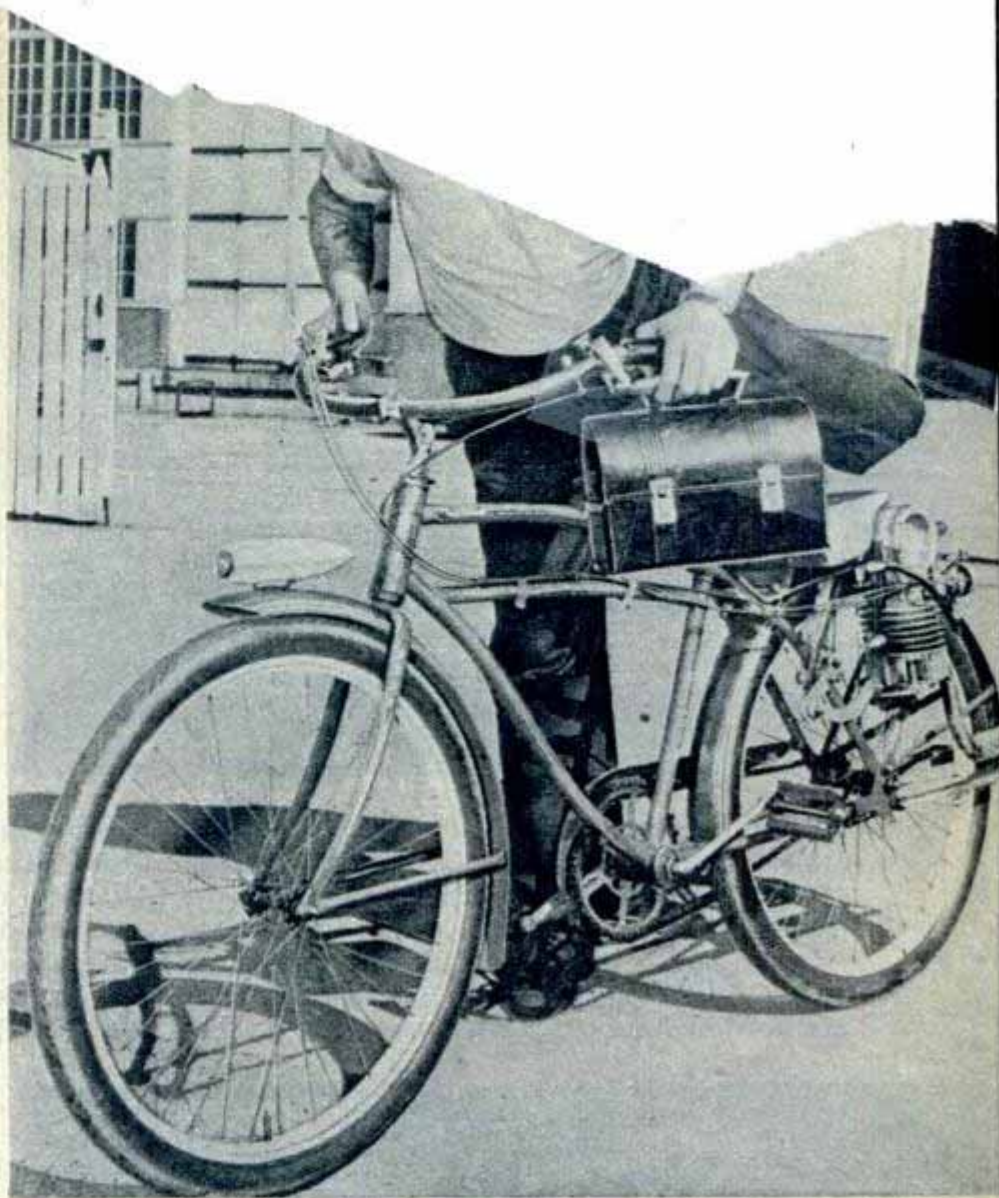


metallic mineral in the earth's crust. It is manufactured principally from bauxite at the present time, but experiments promise that it may be removed from other ores. Magnesium is the third most abundant metal and is manufactured from dolomite ore, underground brines and sea water. With conservationists pointing a warning finger at shrinking iron deposits it is comforting to know that the world has plenty of aluminum and magnesium on tap in earth and sea.

Fifty years ago "Al" was a curious product of the laboratory. It had no practical use until C. M. Hall, an American, and Paul Heroult, a Frenchman, working independently, discovered the electrolytic method of producing aluminum from bauxite. It took the war to change it from a metal of relative scarcity and limited utility to a metal of abundance and extreme usefulness.

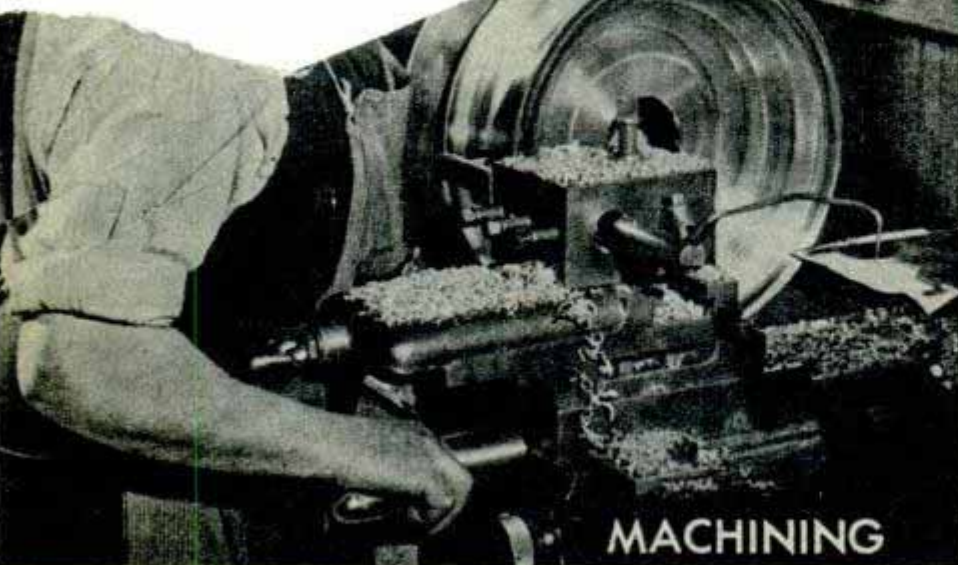
Number 1 consumer of aluminum alloys is transportation. Since 1923 when Charles Ward Wall, consulting civil engineer, used the light metal in building a twin-float Navy seaplane to save 54 percent in weight, the aviation industry has been an enthusiastic convert to aluminum alloys.

Lightweight trains, trucks and buses made of aluminum already were speeding down the rails and highways of America before the war, but their numbers will increase sharply in the postwar period. Although 1946 model automobiles are similar in construction and appearance to their 1942 ancestors, several manufacturers are planning to manufacture lightweight cars next year.



Above, all-aluminum bicycle engine weighing 32 pounds eliminates shimmying caused by heavier engines. Below, aluminum foil will be used in wrapping foods for storage





MACHINING



Photos from Dew Chemical Co.

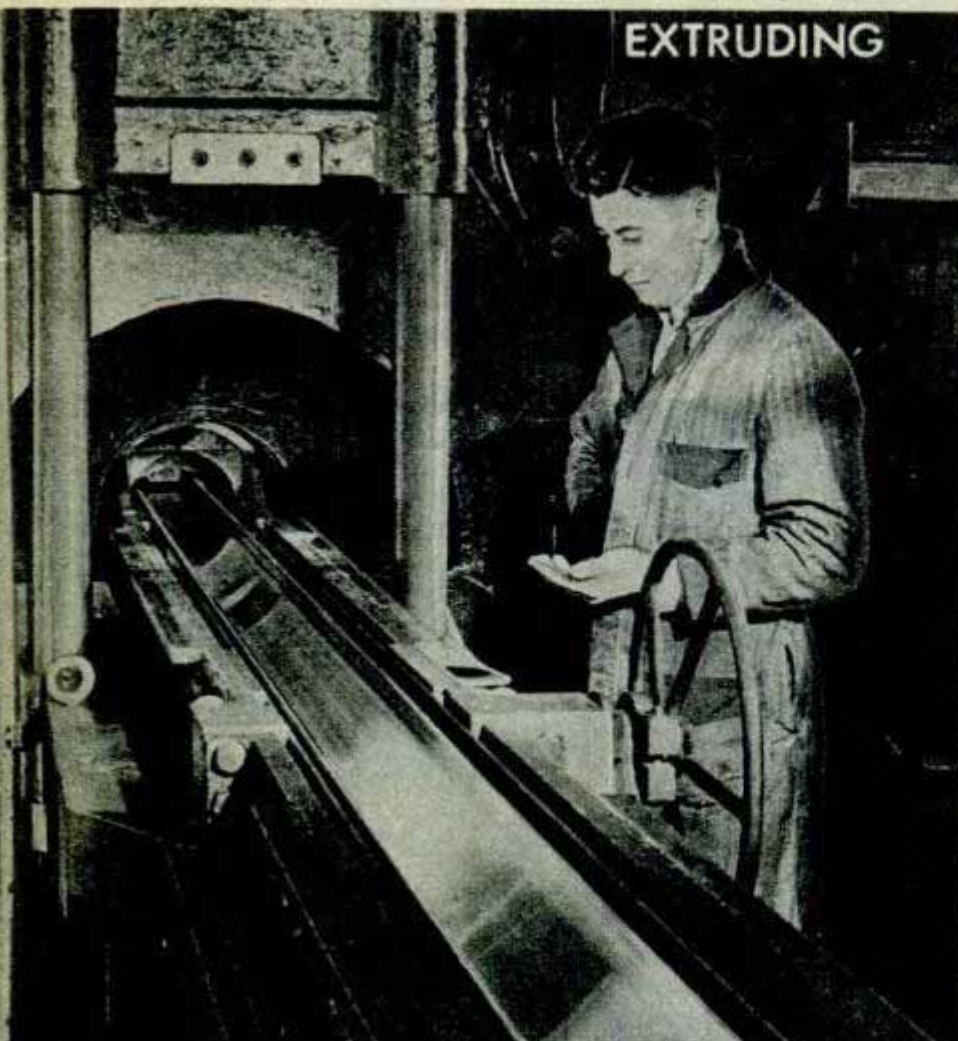
Even marine transportation is looking thoughtfully in the direction of light metals. Complete plans for an aluminum alloy destroyer capable of 60 knots have been drawn and submitted to the Navy. Aluminum hulled cargo ships are said to distribute weight to better advantage. The

Grumman Aircraft Engineering Corporation already has converted wing assembly lines to manufacturing an aluminum alloy canoe—one half to two thirds the weight of the wooden type, nonsinkable because of air tanks in the bow, tough enough to deflect anything up to a bullet.

But aluminum supporters do not depend upon lightness alone for their sales appeal. New aluminum alloys have been developed with greater strength than that of most structural steels. They can be used for girders, supports and beams where both high strength and lightness are required—in the construction of large auditoriums, aircraft hangars, bridges and open-air markets, for example.

Aluminum alloys are high in heat transfer ability and electrical conductivity, important factors in designing jacketed kettles for canneries and meat packing plants, resin heat exchangers, varnish kettles and other industrial apparatus. Pound for pound, aluminum exceeds in conductivity other metals used for this purpose. For equal current carrying capacity "Al" weighs less than half as much as copper and is nonmagnetic and nonsparking.

Because aluminum alloys are resistant to fruit acids, fumes, smoke, salt, water and oil they can be used safely in the manu-



EXTRUDING

MAGNESIUM



ROLLING



FORGING

facture of chemical and food machinery and storage equipment. Other proposed uses for aluminum are:

Shotgun shells with aluminum cases; instead of discarding the shells the hunter will take them back for a refill.

Special lifetime awnings, shingles and window frames for postwar homes, guaranteed to outlast the house itself.

Aluminum beer barrels which require no pitching or coating on the inside, no painting outside.

Lightweight aluminum tents for circuses.

Aluminum foil packaging for food, tobacco, soft drinks and cosmetics.

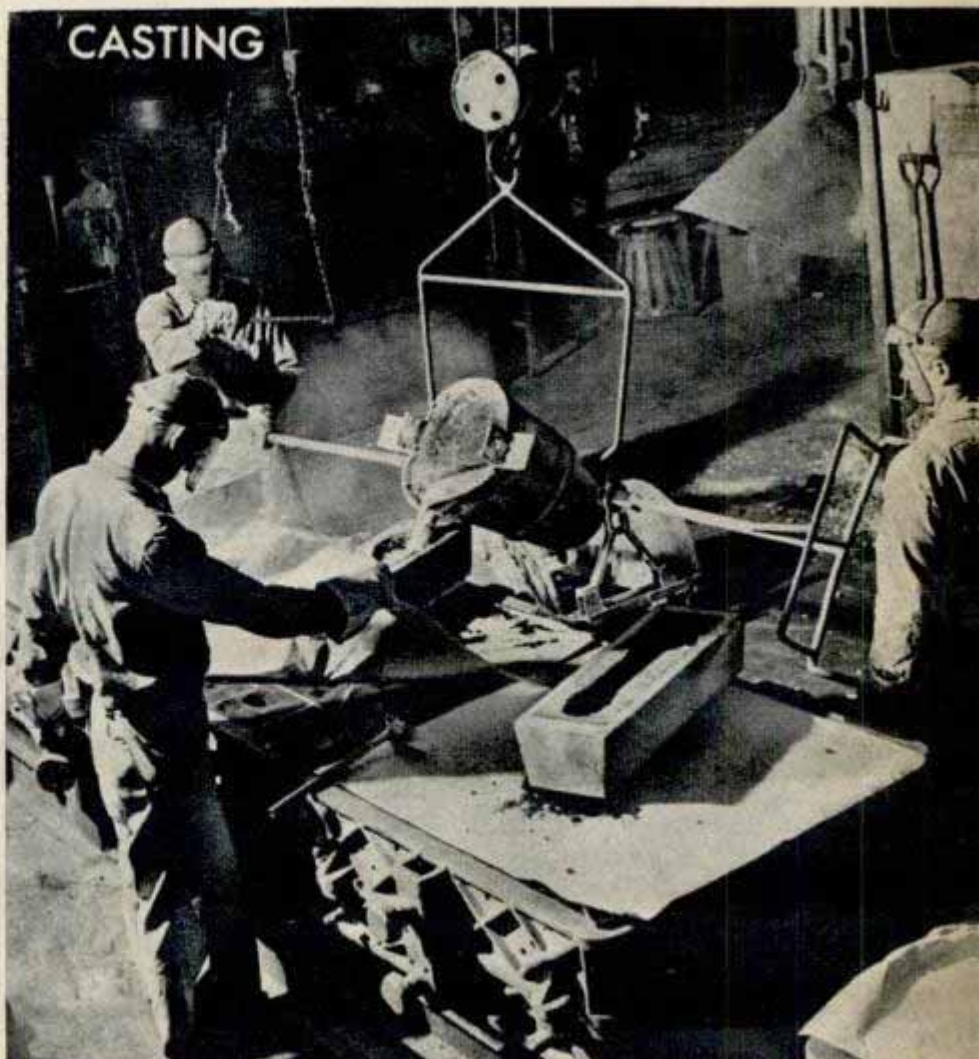
Magnesium, the other lightweight twin, is a soft, white, silvery metal in its pure state. When combined with small amounts of manganese, zinc and aluminum, it produces an alloy of high strength and stiffness. "Maggie" formerly was considered temperamental because in powdered or chip form it readily caught fire, burning with a fierce white heat. But metallurgists have solved this annoying problem and today magnesium alloys are safe to handle.

Magnesium got off to a slower start than aluminum in the consumer field, but thanks to a fine war record is fast closing the gap.

In 1941 two German planes that

were shot down over England commanded particular attention. Scientists who examined them were astounded to find that their engines had forged magnesium alloy bearings five to six feet in length. This indicated that the Nazis had forging presses

(Continued to page 250)



Compass Equipped With Knife



With a new beam compass, craftsmen can cut out circles as they trace them. A small knife that will cut paper, cardboard, or even light wood fits into an adjustable clamp on the beam. The clamp also will hold pencils or ruling pens. A similar clamp holds the pivot, which uses a removable phonograph needle as a point. The clamps permit easy adjustments in the diameter of circles from either end of the compass. The beam is a nickel-plated steel bar $\frac{3}{16}$ inch square and 18 inches long, although any length can be furnished.

Flexible Pipe for Hot Air Ducts

Made of glass, cloth and rubber, a material developed to insulate heating equipment in warplanes now is used for hot and cold air ducts in factories and office buildings. It withstands temperatures from 60 degrees below zero to 300 above and holds up under internal pressure of 50 pounds per square inch. It is unaffected by air, light, water, gasoline, oil and most acids. Its flexibility makes it useful where vibration is encountered.



Hand Flash for Photographers



Aluminum hand flash units for photographers who do not desire a synchronized flash in taking pictures are now available. The unit is designed so that it can be aimed easily without straining the wrist. The deep reflector, spun from a single piece of aluminum, has a brushed inner surface. The handle is in line with the bulb to facilitate aiming, with a "D" cell inside to touch off the flash. A switch at the end of the handle is under the thumb when the unit is aimed.

Pistol Air Hammer Strikes Fast



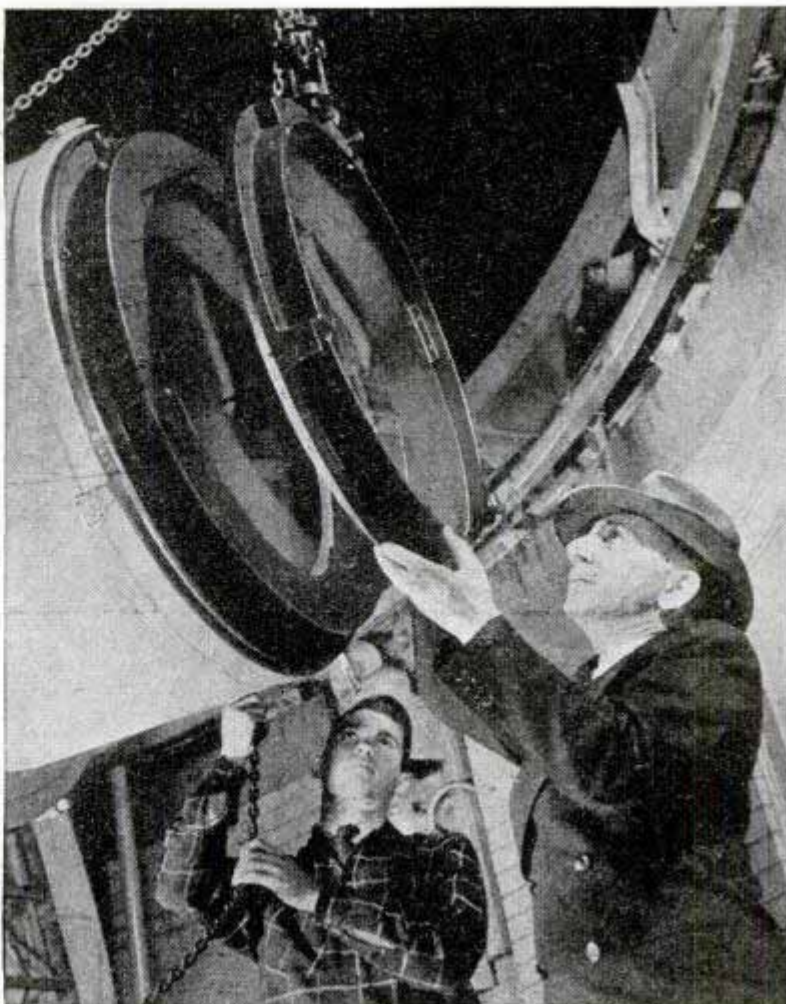
Trigger operated, a pistol-sized air hammer that weighs only two pounds can deliver 13,000 controlled blows—from featherweight to full strength—per minute. Operating on two cubic feet of air per minute, the hammer can cut metal, rip flash from welding joints, draw, bend or flatten steel, form light metal and clean castings.

Stars Come Out of Hiding

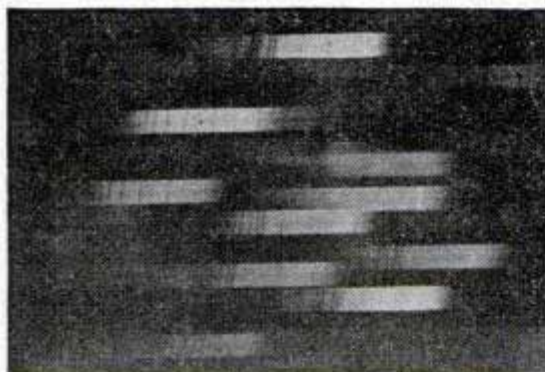
ONE of the largest pieces of optical glass ever manufactured in America is making it possible to photograph stars 100,000 times fainter than any star visible to the naked eye.

Produced by the Bausch & Lomb Optical Company, an objective prism 24.5 inches in diameter and weighing 280 pounds before grinding has been installed in a Schmidt-type telescope at the Warner and Swasey Observatory of the Case School of Applied Science at Cleveland.

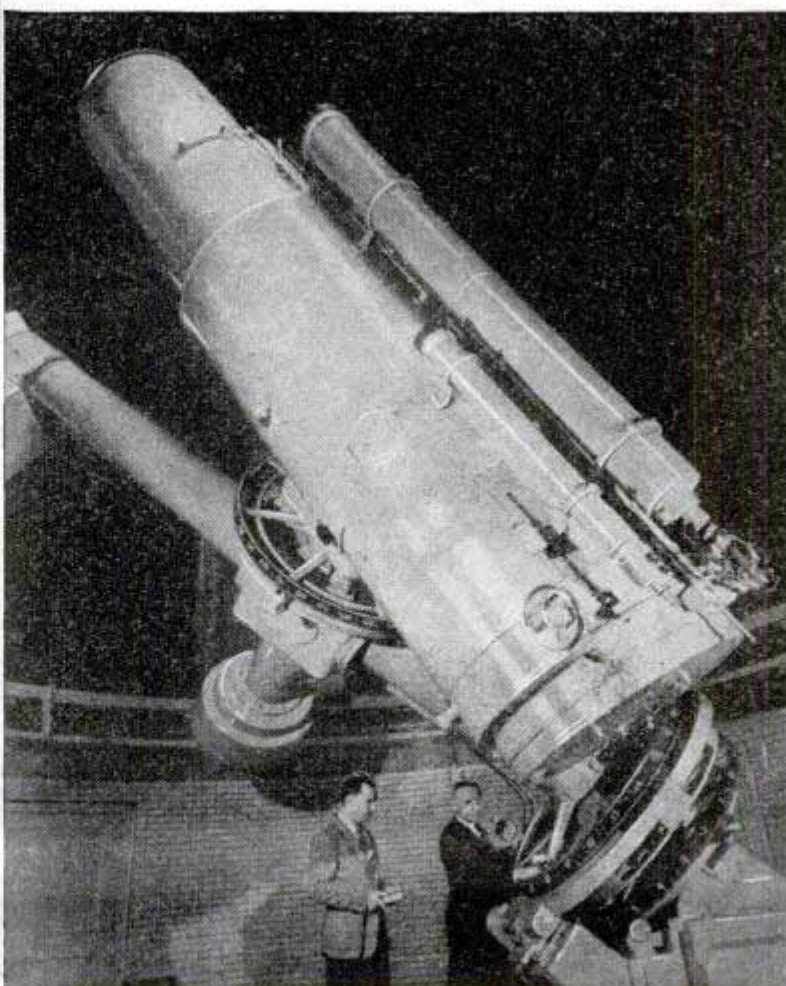
As the result of this piece of glass—whose surfaces were checked to an accuracy of four millionths of an inch—star images in the form of threadlike spectra are reproduced on photographic plates, enabling astronomers to conduct studies to ascertain the elements present in stars, the degree of ionization, the surface temperature, color and brightness, or candlepower.



Mounting the 24-inch objective prism. Below, the powerful telescope photographs unseen stars, helps explore the unknown



Photographs of stars appear as threadlike spectra. Below, prism blank inspected to an accuracy of four millionths of an inch



Tips on Tackle

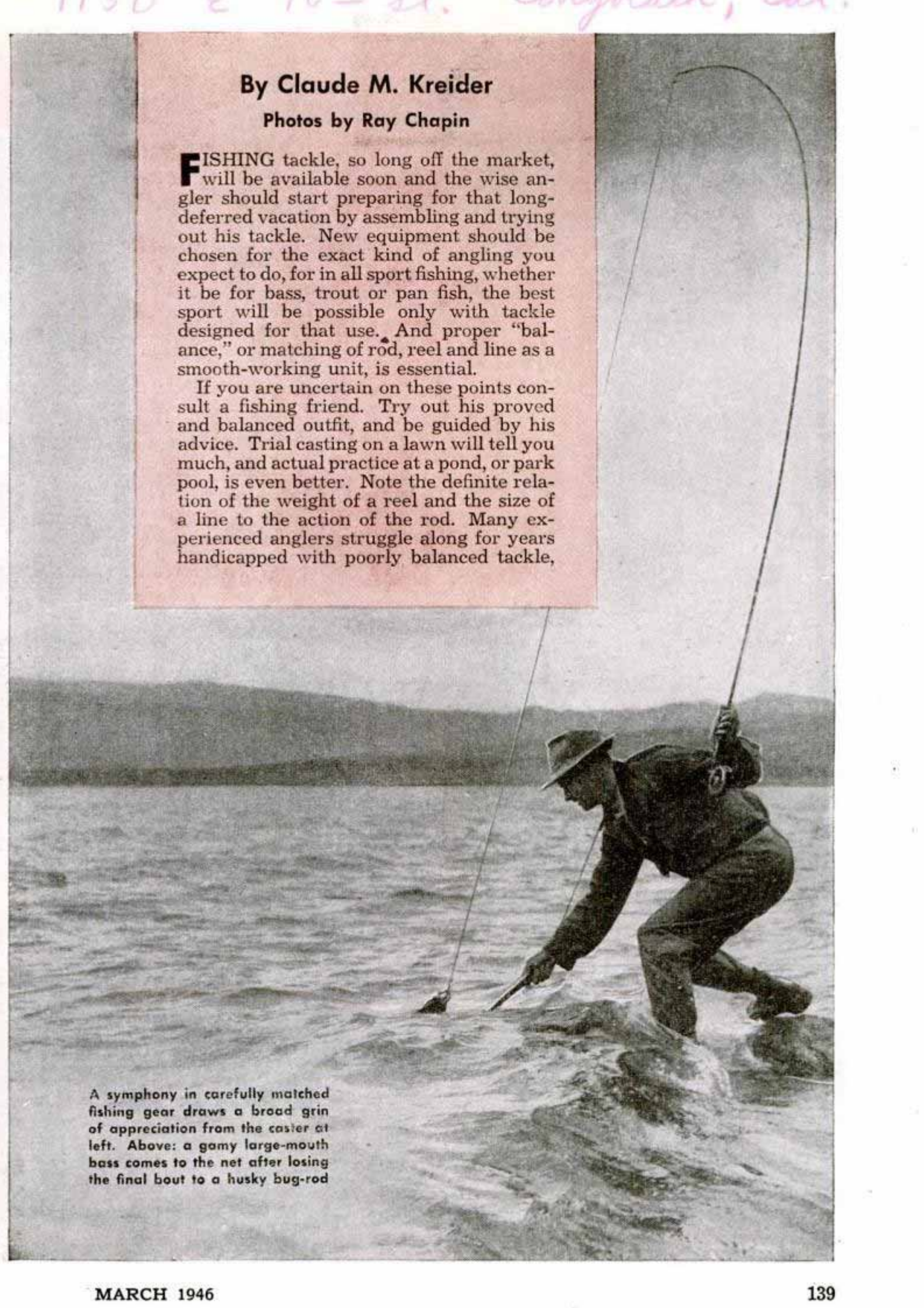


1150 E. St. ...
By Claude M. Kreider

Photos by Ray Chapin

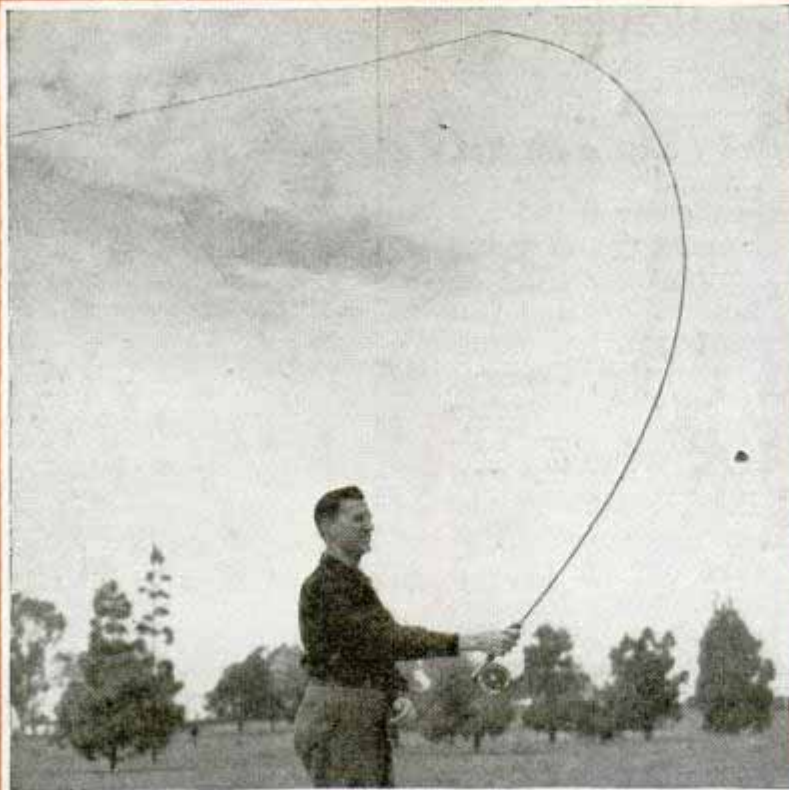
FISHING tackle, so long off the market, will be available soon and the wise angler should start preparing for that long-deferred vacation by assembling and trying out his tackle. New equipment should be chosen for the exact kind of angling you expect to do, for in all sport fishing, whether it be for bass, trout or pan fish, the best sport will be possible only with tackle designed for that use. And proper "balance," or matching of rod, reel and line as a smooth-working unit, is essential.

If you are uncertain on these points consult a fishing friend. Try out his proved and balanced outfit, and be guided by his advice. Trial casting on a lawn will tell you much, and actual practice at a pond, or park pool, is even better. Note the definite relation of the weight of a reel and the size of a line to the action of the rod. Many experienced anglers struggle along for years handicapped with poorly balanced tackle,

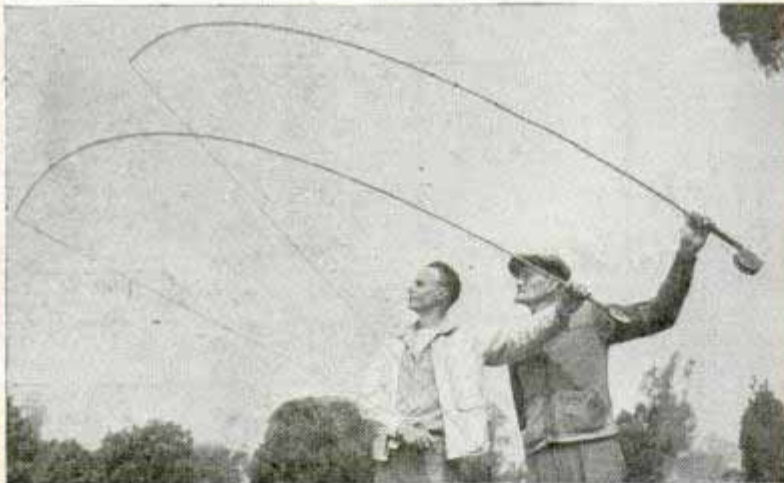


A symphony in carefully matched fishing gear draws a broad grin of appreciation from the caster at left. Above: a gamy large-mouth bass comes to the net after losing the final bout to a husky bug-rod

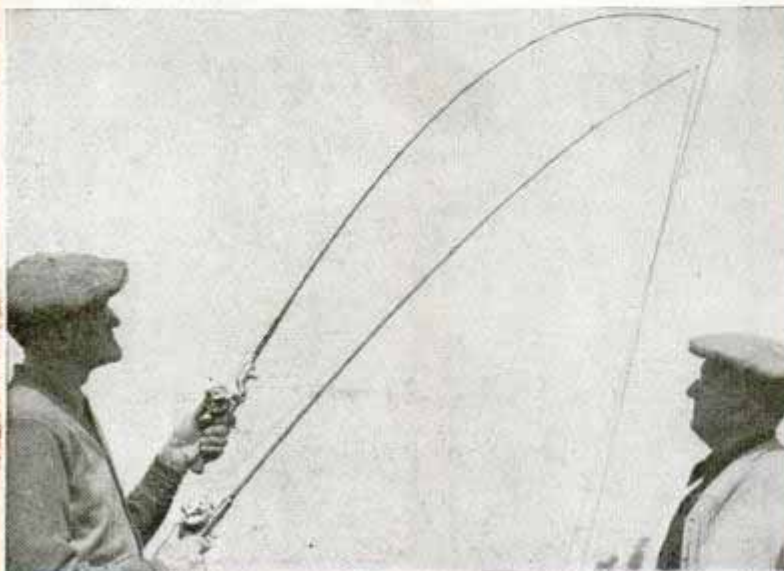
A rod should bend to suit its purpose



Angler tests back cast "pull," which powers long forward cast



↑ Top rod suited for all-around fly fishing, bottom for pan fish.
↓ Flexible rod is for bass casting, stiff rod only for trolling



when perhaps one new line, or a trade for a different reel, would cure their troubles.

Let's consider fly fishing tackle first. Fly rods come in lengths from 8 to 9½ feet, weighing from about 4 ounces to 6½ ounces. The smaller rod is suitable for pan fish and small stream trout fishing. It should have a reel weighing not more than 5 ounces, which will just hold the 30 yards of enameled or oiled silk fly line to "fit" the rod. This means a line heavy enough to bring out the rod's action, but not so heavy as to strain—and soon ruin—the slender bamboo. A size "E" line, which measures by micrometer .040 inch thick, should be about right, but only an actual trial outdoors will tell.

The heavier 9 or 9½-foot rod for bass fly use needs a line of "C" or "B" size, measuring .050 inch or more, to permit easy, effortless casting. And this larger rod requires a reel with a spool about 3½ inches in diameter to hold sufficient line of the heavier size. You should make sure the line is the right kind for the reel before purchasing, remembering that a fly reel is really only a "line holder" and need not be expensive nor finely finished. The lighter its weight the better your fly rod will perform.

Fly rods of similar appearance and size often vary in action. Try out those you like by threading the line through the guides and pulling down the tip end of the rod to study its arc. Some will bend rather evenly throughout, a so-called "soft action." This is an all-purpose type of rod and is not easily damaged by legitimate use. It is good for wet fly and light spinner work and also will do for bait fishing. Other rods will have little bend through the lower part but a decided, sharp arc in the tip section. This denotes "dry fly" action, which is desirable for delicate dry fly fishing. Also, in modified form, it is a good design for all-around fishing. A rod so built, 9 feet

long, weighing $5\frac{1}{2}$ to $5\frac{3}{4}$ ounces, is the best you can find for all-purpose work. The comparatively light tip permits careful handling of small fish, yet the rod is capable of taking good husky trout or bass in big water.

Before final decision, examine the rod fittings. They are important. A good, screw-locking reel seat of either metal or plastic material is essential. The ferrules should be snug fitting and require considerable pressure to seat. They should be of nickel or German silver, rather than of nickel plated brass, for strength and long life. Guides should be of the "snake" type of hardened steel. A sufficient number of them, properly spaced for ease of casting, distributes strain throughout the rod, indicating a well-designed tool. Ten guides should be the minimum number on a 9-foot fly rod.

Now we take up bass casting tackle.

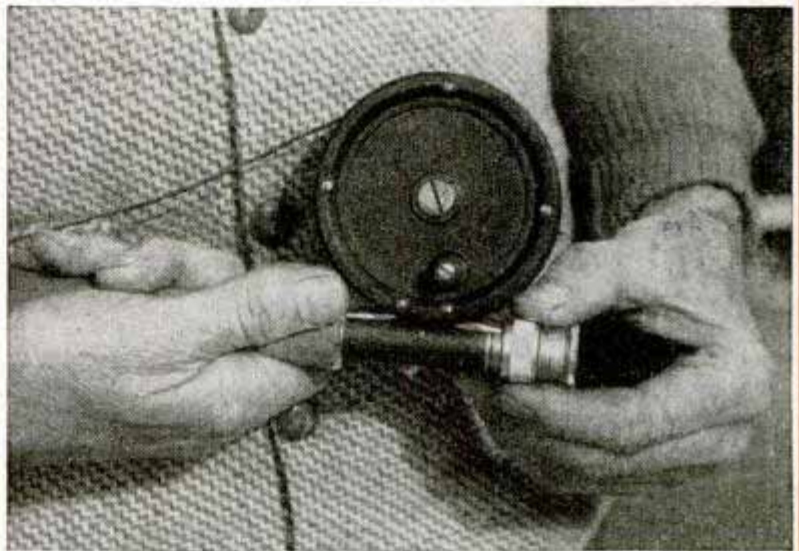
Rods for plug casting, so popular for large and small bass, pike, pickerel and other fish, come in practical lengths from 5 to 6 feet. The shorter ones are stiff and suitable only for trolling. A $5\frac{1}{2}$ or 6-foot rod with considerable "whip" to cast a lure effectively is the best choice. It too may be used for spinner trolling. Try the rod for arc, as suggested for fly rods. Then hang a standard $\frac{5}{8}$ -ounce bass plug from the tip and whip the stick to get the feel, remembering that smooth, flexible action, especially toward the tip, will permit accurate casting with little more than a flip of the wrist. Again, an outdoor casting test at a target—an old bicycle tire laid on the lawn is ideal—will give you a real analysis of your rod and reel.

The reel is your most important tool for this work if you would send that lure out 100 feet, straight and smooth, without troublesome backlashes, the bane of every bass angler. It should be precision built throughout with jewel or phosphor bronze bearings

Check guides, screw reel seat and ferrules



The number of guides determines strain on rod and wear on line



↑ Screw reel seat with duralumin fittings holds reel securely.
↓ Ferrules should fit snugly with sufficient length for long wear





Rod, reel and line should work as a team. Left, 9 1/2-foot bass-rod has heavy line. Smaller rod at right is all-purpose

and a well-designed level wind device to spool in the line accurately as you retrieve your lure. Choose a light, compact reel, for it will hold all the casting line of 12 or 15-pound test you will need. It should fit snugly in the locking device of the rod and be close to the cork grip to permit easy and natural "thumbing," the one delicate and all-important action in bass lure casting. Your practice sessions soon will demon-

strate that an "educated thumb" is the one great essential. Bass casting line needn't be so carefully fitted to rod action as the fly line but avoid the usual mistake of buying one too heavy. A 20 or 25-pound test line will cast poorly because of its actual weight and the increased friction as it leaves the reel and goes through the guides. One of 15-pound size—even 10-pound is entirely practical—is amply strong for any fish your rod could handle. Once more, this comparison of lines can be demonstrated best by actual trial. Either braided silk or nylon in soft finish is the best casting line and most of these now are cravenette finished in order to render them waterproof. In choosing your fishing tackle, never forget that equipment worth having is carefully made, that it is a sound investment that will last for years, and that it justifies the payment of a good price. A split bamboo rod, for example, is the product of numerous hours of fine craftsmanship. A good reel is built with watchlike precision and, if kept clean and well oiled, will last a lifetime. Yet, in a well-made standard grade, it need cost you only the price of a golf club. So shun the shiny but too-cheap one. And don't forget that one faulty, poorly made piece of fishing equipment may let you down, deep in the forest or mountains, and quite possibly spoil a long-planned trip.

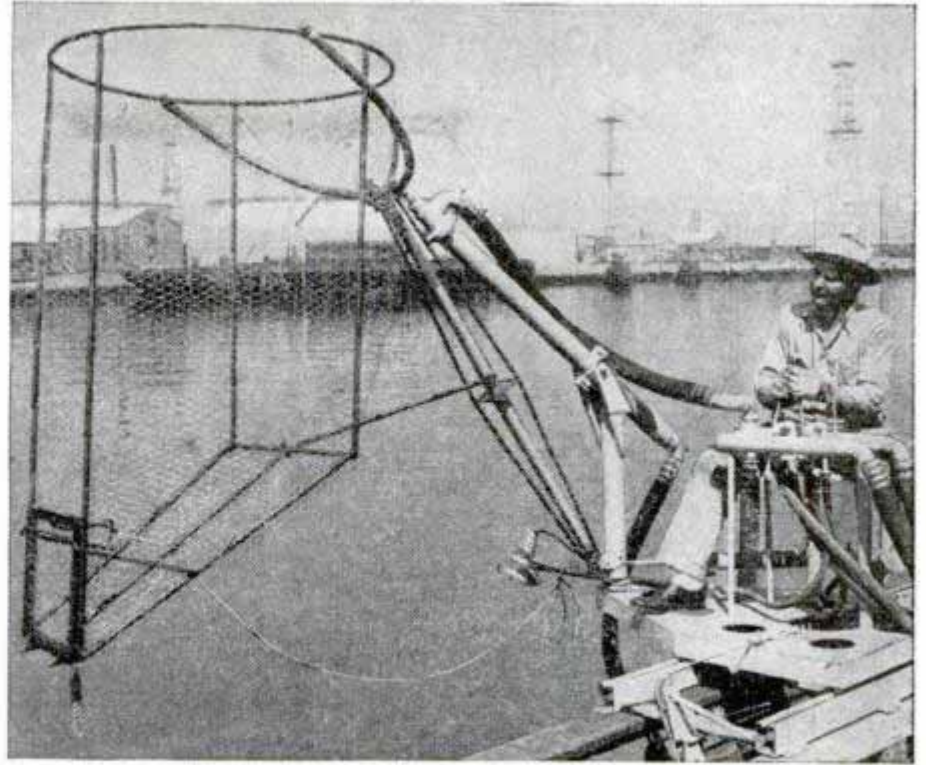
Bait-casting reels are fitted with cork hand-grip to provide easy and natural "thumbing" of the spool when lure is shot out



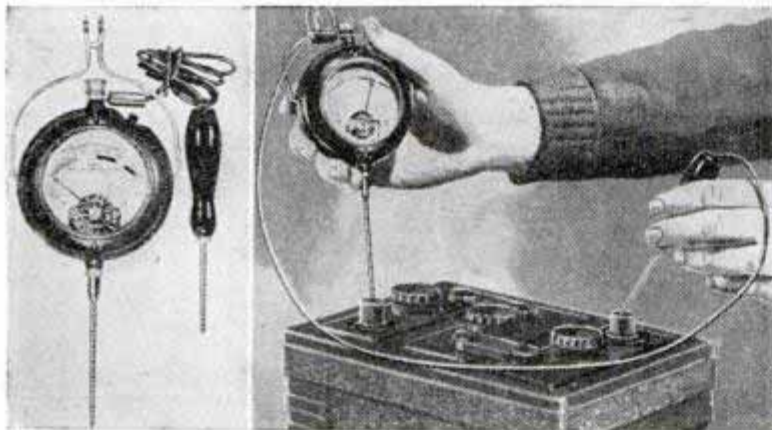
Finally, with that cherished new outfit assembled, continue to practice with it beyond the initial "balancing up" stage. Take the old bicycle tire or a tin plate out on the lawn and learn through practice the art of scientific casting. There is no secret to it—practice pays big dividends when you seek the canny trout or bass. If there is a fly and bait casting club in your vicinity, visit it and talk to the experts there. They will be glad to offer advice and teach you the proper casting technique. Remember, "it is not all of fishing to catch fish."

Hydraulic-Drive Fish Net Makes Huge Mackerel Catch

Operated by hydraulic oil pressure, a mechanical fish net has been invented by Morris Whaley, Long Beach, Calif., to catch mackerel. The net, which resembles a cage and has steel rods for supports, is lowered from the side of a fishing boat as a floodlight is turned on the water and bait is tossed in to attract mackerel. The net picks up as much as 400 pounds of fish at one time. The device is operated by three hydraulic cylinders and a valve for each. One cylinder moves the net fore and aft, a second raises and lowers it, and the third swings it inboard and outboard.



Easy-to-Use Tester for Battery Registers Charge on Dial



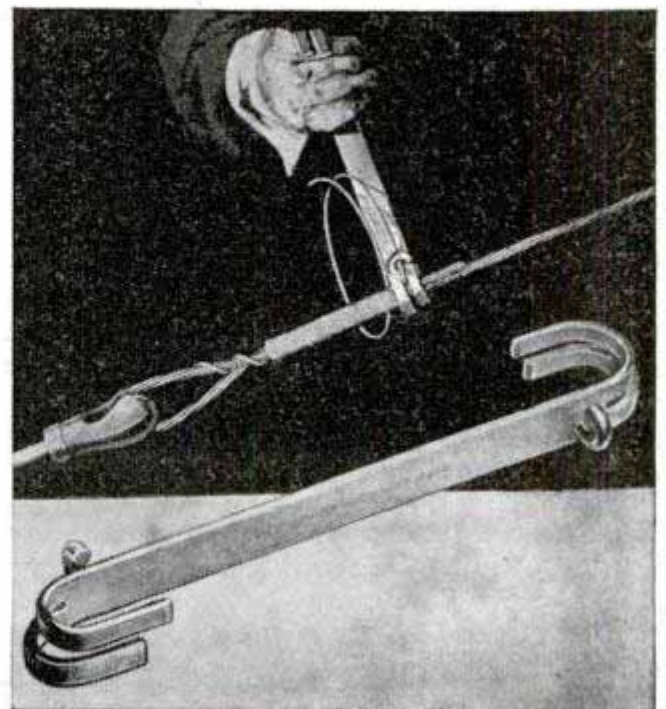
Batteries are tested without the use of acid-dripping hydrometers with an electrically operated tester. Without placing a load on the battery, the simple unit shows what charge rate to use for either trickle charging or high-rate charging. It also shows on a dial the percentage of charge and warns of overcharging. Weak or defective cells can be spotted before failure occurs. The unit can be used as a portable tester.

Revolving Tool Binds Wire

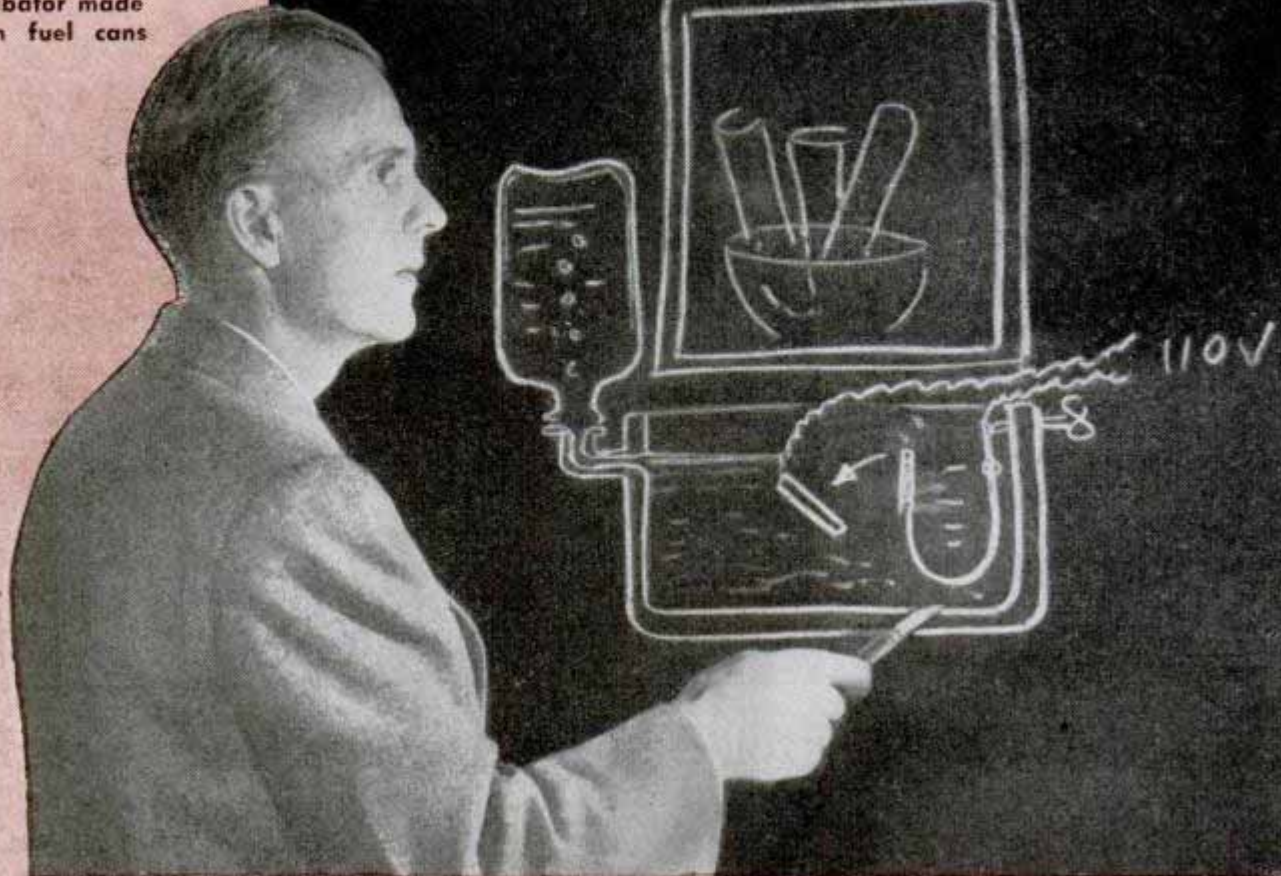
To hold looped wire to eyebolts and anchor eyes, a tool now available neatly wraps as many closely woven turns as necessary around the free ends of the strands. When the guy wire is doubled into a loop, the two loose ends are bound closely simply by revolving the tool, which is especially useful to linesmen for fastening dead-end guy wires to telephone poles.

Magnets Made of Iron Rust

Iron rust, the obstinate enemy of garden tools, now is being used to make small but powerful magnets that are said to be the lightest in weight ever developed. The new type magnet is a combination of iron oxide ore, chemically the same as iron rust, and cobalt oxide. The two oxides are mixed in powder form and then heat-treated.



Harry Petterson points with his jackknife to sketch of first incubator made from fuel cans



The Genius of Shinagawa

With a jackknife his only tool, a Norwegian in a Jap prison fashioned medical instruments that saved many American lives

MANY American inmates of Shinagawa, a Jap prisoner-of-war hospital, owe their lives to the mechanical genius of Harry Petterson, a Norwegian who was captured by a German submarine and taken to the prison.

Petterson made intricate surgical instruments of scrap metals. From gasoline cans, discarded safety razor handles and bits of brass came a motor-driven dental drill. He built an X-ray machine and an incubator for cultures with automatic temperature control. He fashioned the large American flag that greeted American forces when they arrived at Shinagawa.

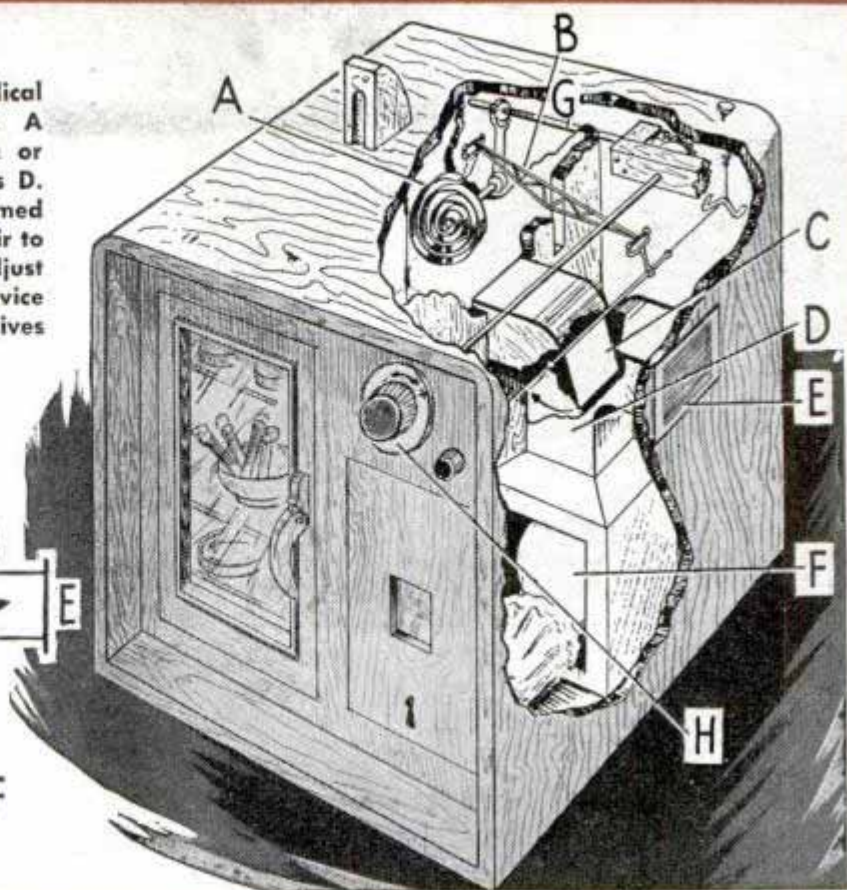
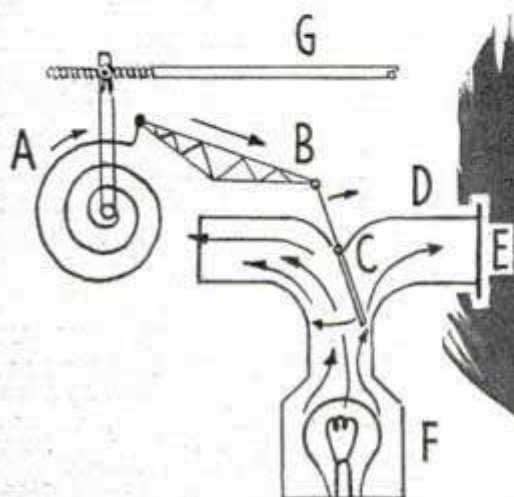
From the Nazi submarine Petterson brought five sacks of food and medicine which the German captain had given him. These precious supplies he immediately turned over to the American naval officer who commanded the prisoners. Then, with a jackknife as his only tool, he went to work to make the Shinagawa prison enclosure a veritable hospital.

First he fashioned more tools. A metal strip, edged with teeth cut by his knife, provided a saw. A railroad spike was forged into a hammer—after he had built a charcoal furnace. These homemade tools produced all the hospital equipment. The dental drill relieved the suffering of over 100 men requiring dental treatment in the hospital. He fashioned spoons, the prisoners' most urgent need, from strips cut from gasoline cans, welded to handles of scrap wire.

But Petterson saved more lives with a "Rube Goldberg" contraption purposely designed so that it wouldn't work. Dr. Takuda, a Japanese medical officer now on trial for his "guinea-pig" experiments on prisoners of war, wanted to "cure" American patients by injecting into their veins an acid made from coconut oil. He demanded that Petterson build him a machine that would mix the acid with distilled water. When the mechanic consulted American surgeons they confirmed what he feared—the acid in-

By E. B. McLaughlin

Hand-made incubator for medical cultures. Temperature control A turns floating lever B to open or close vane C over air channels D. Inlet F lets in cold air to be warmed by lamp. E permits excess hot air to escape. Shaft G and knob H adjust temperatures. The ingenious device is credited with saving many lives



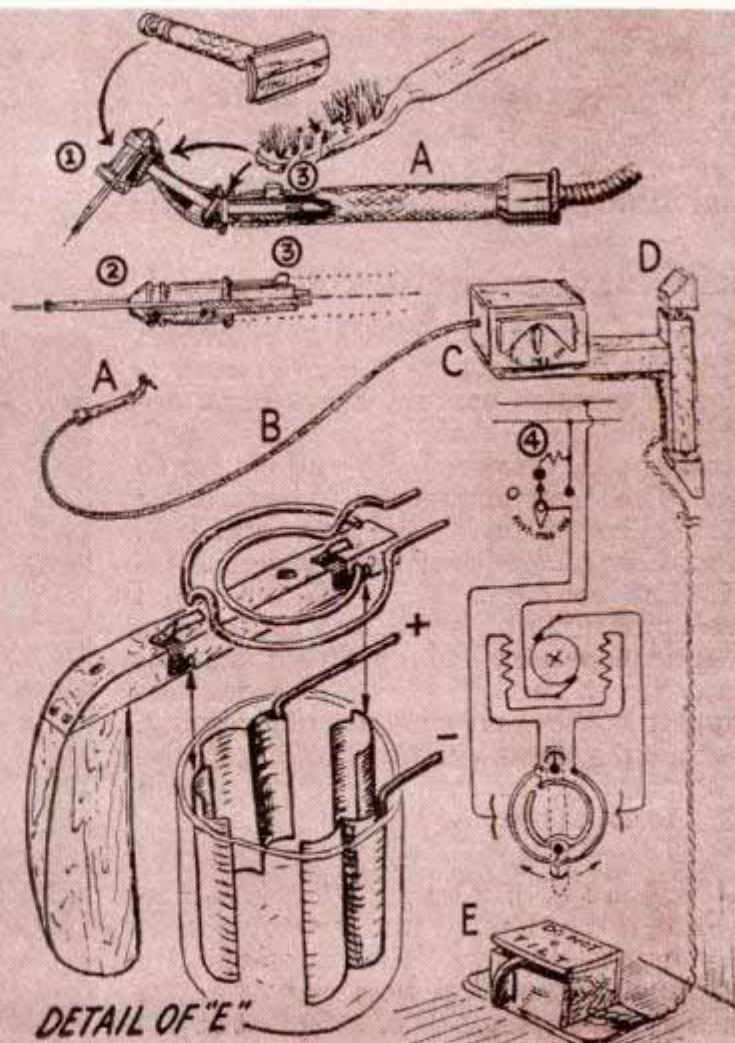
Author's own drawing shows work he did with jackknife

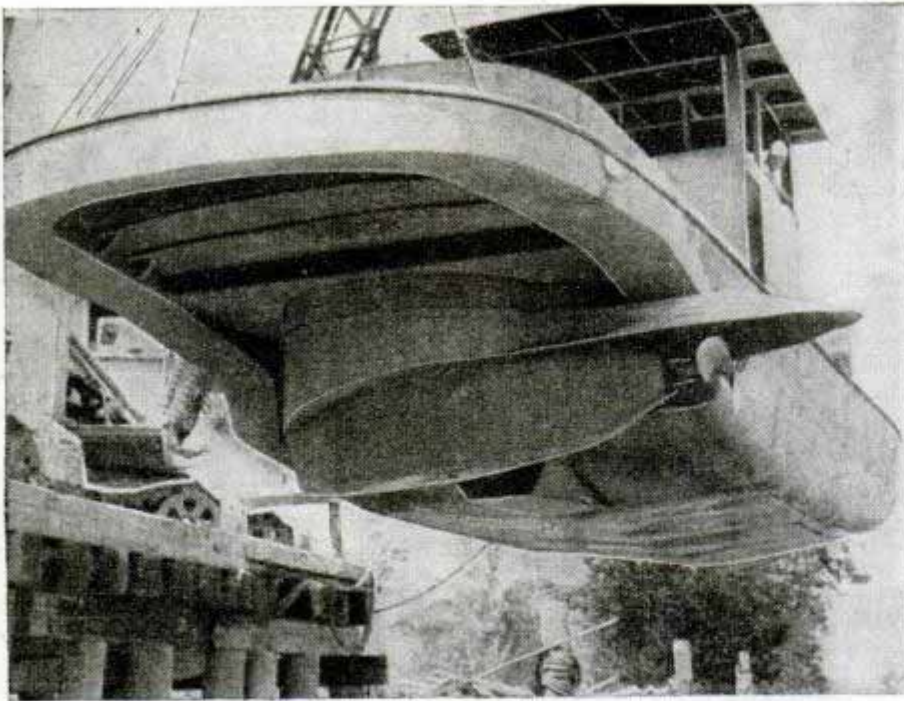
Dental drill was built from scraps. Handpiece A with changeable heads 1 and 2 and pushbutton 3 was made of razor and toothbrush. Flexible cable B came from speedometer of Jap truck. Discarded American motor C mounted on wall bracket D provided power. E is a water rheostat control

jections likely would be fatal.

He produced a machine that was an intricate mass of pipes with lights flickering on and off, steam bursting through openings, and a faucet that poured out a steady stream of the "mixture." Dr. Takuda was delighted. But when injections were started, none of the patients died. Only Petterson knew the secret. His machine steamed away the acid, leaving only pure water.

Petterson is now in the United States condensing a four-year mathematics course into three months before entering California Institute of Technology—probably still carrying his jackknife.





Towboat Turns "On a Dime"

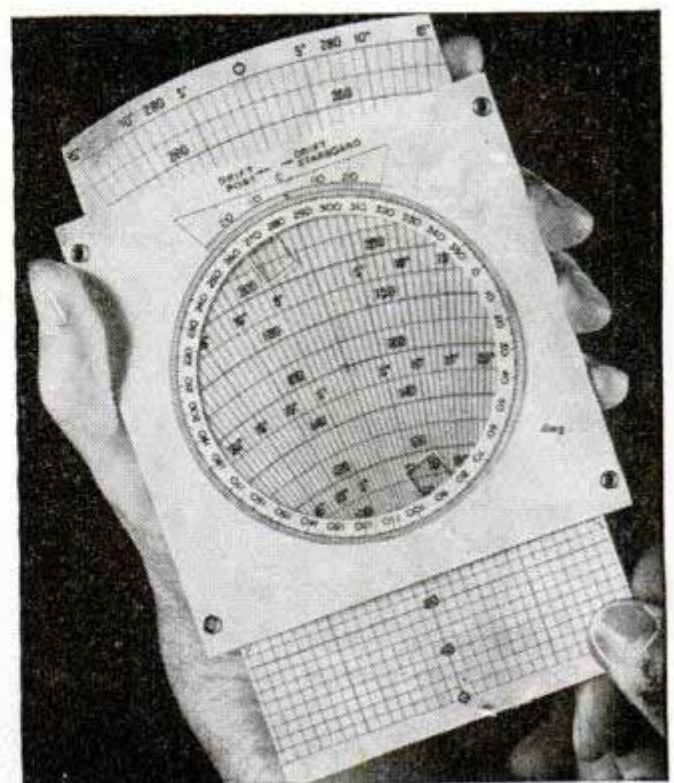
Eliminating the need for a separate rudder, a power unit for towboat propulsion combines the engine, shaft and propeller in one housing that can be rotated through 180 degrees, permitting a full turn in the boat's length. The housing has a streamlined exterior to minimize water resistance. Other advantages are that propulsion power is increased, as is the steering power to push the stern in any direction. The unit can be removed easily for adjustment or repair. The manufacturer plans to use Diesel-electric engines up to 750 horsepower for power, with multiple units that would provide 2000 horsepower or more. Towboats of this type equipped with derricks to salvage seaplanes were built for the Navy.

Bottom view of towboat shows housing containing rudder and power unit. Start of a 360-degree turn is demonstrated at left

Aerial Navigation by 'Slide Rule' Teaches Pilots How to Steer Course

To overcome some of the bewilderment of students beginning the study of air navigation, a practice computer has been devised to plot an aircraft's true track speed, ground speed, wind velocity and course to steer. The instrument was designed by S. A. Walling of the British Navy and J. C. Hill of Cambridge University Press, England. The computer has a sliding panel made up of a fan of tracks and speed arcs, and a transparent "window" surrounded by a compass rose. By using the practice computer in the early stages of his training, the student gains an understanding of the workings of precision instruments which he will learn to operate later.

[No figment of the imagination is a man weighing a thousand pounds with blood as heavy as molten iron. That is essentially what an airplane pilot becomes when he makes a turn in a radius of 1000 feet at 300 miles an hour, according to studies made at the RAF Physiological Laboratory.

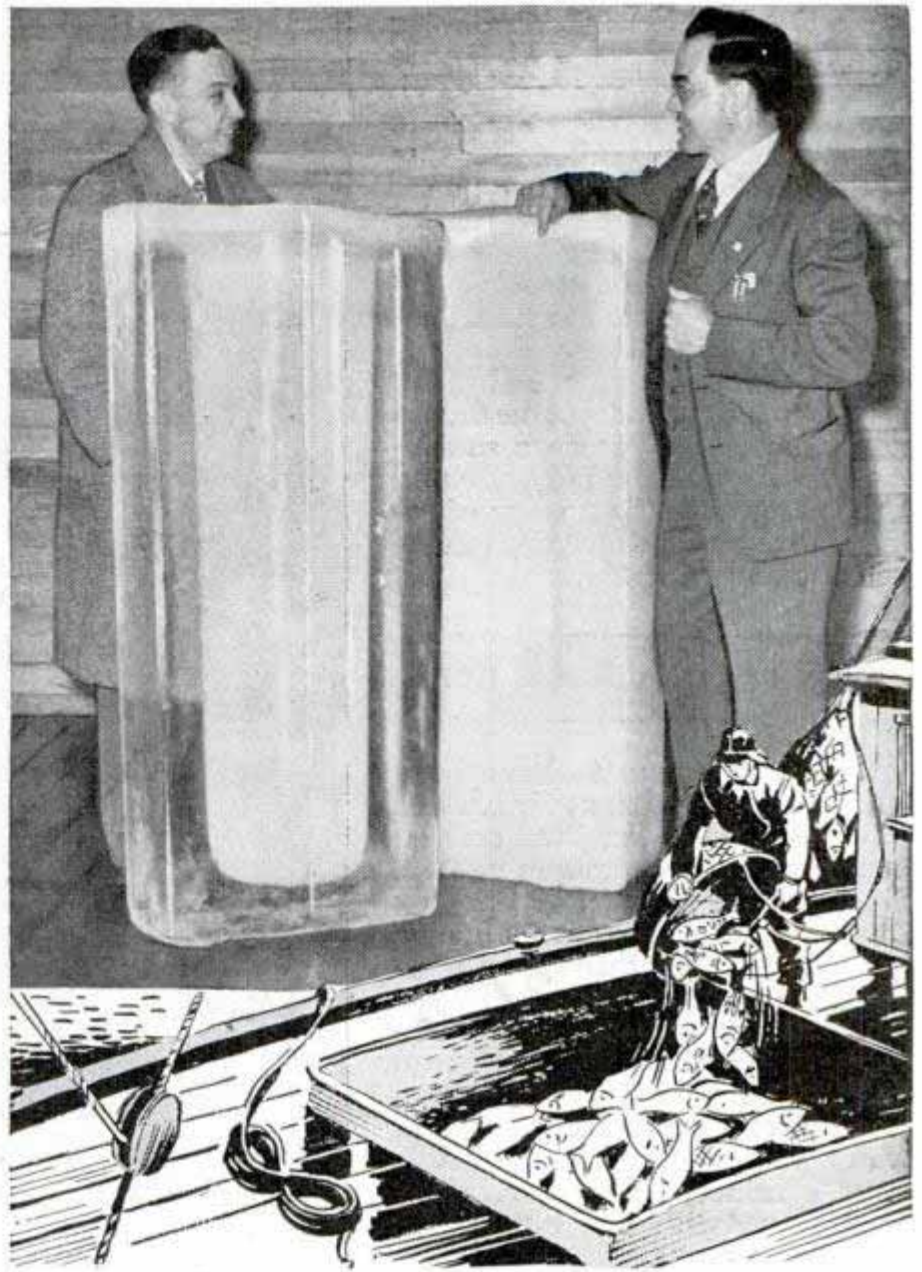


Ice-Water Solution Kills Bacteria

Ice treated with a special chemical compound produces a bacteria-killing solution as it melts and thus keeps foods fresh longer than does ordinary ice. Developed by the science department at Seattle Pacific College, the new ice is being used on fishboats to protect the freshness of halibut and salmon.

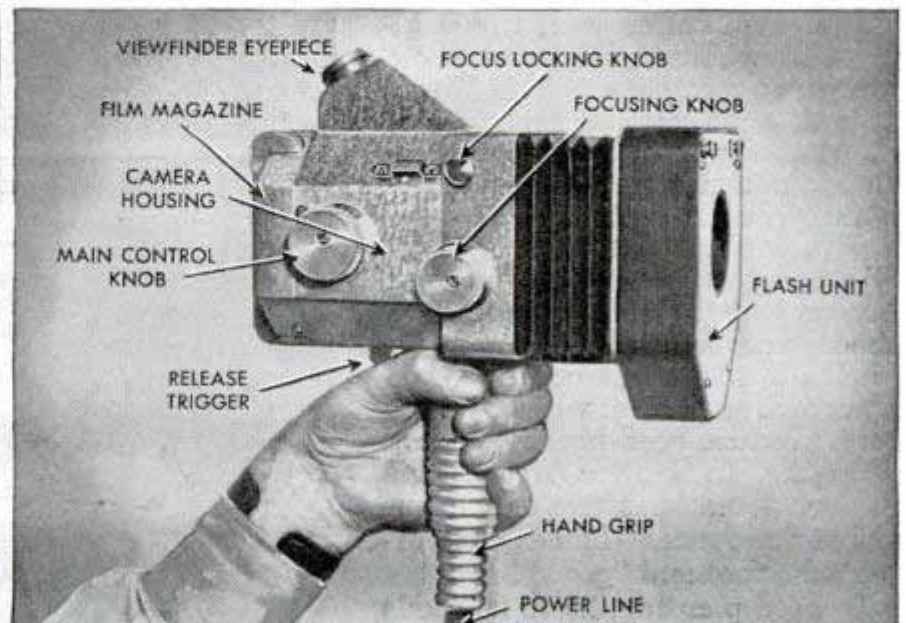
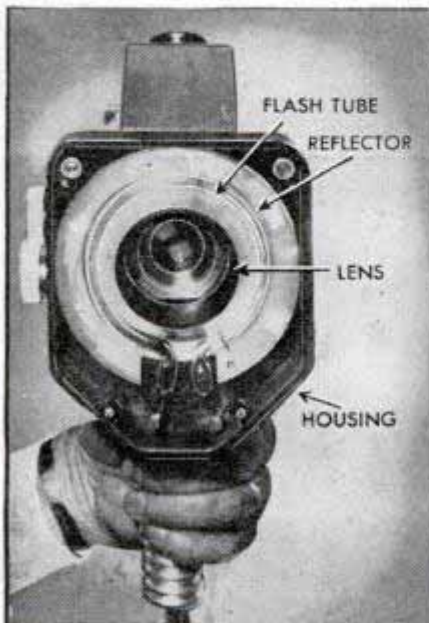
Automatic Camera "Freezes" Motion

Capable of "freezing" a moving fan blade, a 35-mm. camera developed by the Army's Pictorial Service uses an ultra-high-speed self-contained light source. Every step of picture taking except focusing and clicking the shutter is automatic. The device contains a coiled quartz vapor tube that supplies a "motion-stripping" flash, brighter than sunlight, of approximately 1/25,000 second duration. The camera weighs 5½ pounds and may be operated either from a portable electric power pack weighing 27 pounds or from an ordinary current line. Black and white or color photographs can be taken. The Medical Corps has used the camera to photograph open



Chemically treated ice (right) is compared with a cake of ordinary ice

eyes at close-up ranges. Developed at the request of the Army's Surgeon General, the camera was conceived by Captain Rollin W. King and Emanuel Berlant.



ON A LONELY OUTPOST in the Pacific, two of Uncle Sam's soldiers serving with the occupation forces exchange passwords in the cool night. One of them, relieved by the other after two hours as a sentry, heads for the mess hall's friendly lights. The soldier quickens his step as a familiar aroma meets his nostrils—coffee! Hot coffee!

As he sits at a scrupulously scrubbed mess hall table, he drinks a beverage once reserved as special privilege of the holy. Behind this "Cuppa Joe" is a story of romance involving intrigue, misadventure and hardship.

By Staff Sgt. John L. Kent

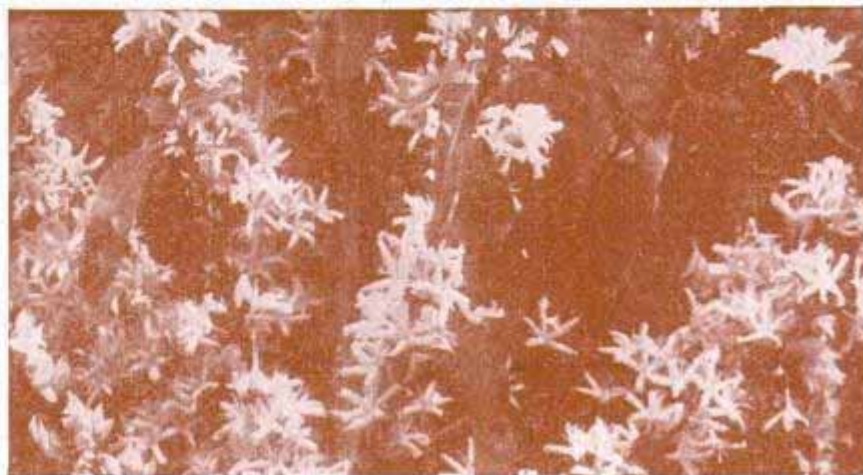
Coffee is known to have been cultivated in Arabia as far back as 575 A.D. The coffee plant arrived in America at Martinique in 1720. Sailing from France, Gabriel de Clieu, a captain of French infantry, brought with him three young coffee plants. A delay caused by a violent storm exhausted food provisions, and water was rationed daily to the passengers and crew. The officer sprinkled his share of water on the plants and, by this great sacrifice, finally arrived in Martinique with one out of the three original plants.

Seedlings were sent to plantations in Santo Domingo, Guadeloupe and other islands of the Caribbean. Today we find coffee growing in Mexico, all of Central America, the West Indies and practically all of South America.

Although coffee will grow almost anywhere in the tropical belt, it requires certain even conditions of soil, sunlight and moisture to flourish. It particularly likes earth rich in potash, so many of the best plantations are on the slopes of extinct volcanoes. Coffee trees usually are grown from selected seed, but propagation also is done from shoots and cuttings. In the latter method, slips are cut from the upright branches, which, taking root, produce seed-bearing lateral branches. In Central America the natives sometimes use coffee uprights for fences—fences that often take root and "grow"!

In seed planting, 10 to 20 seeds

..... **CUPPA**



COFFEE, CHUM?



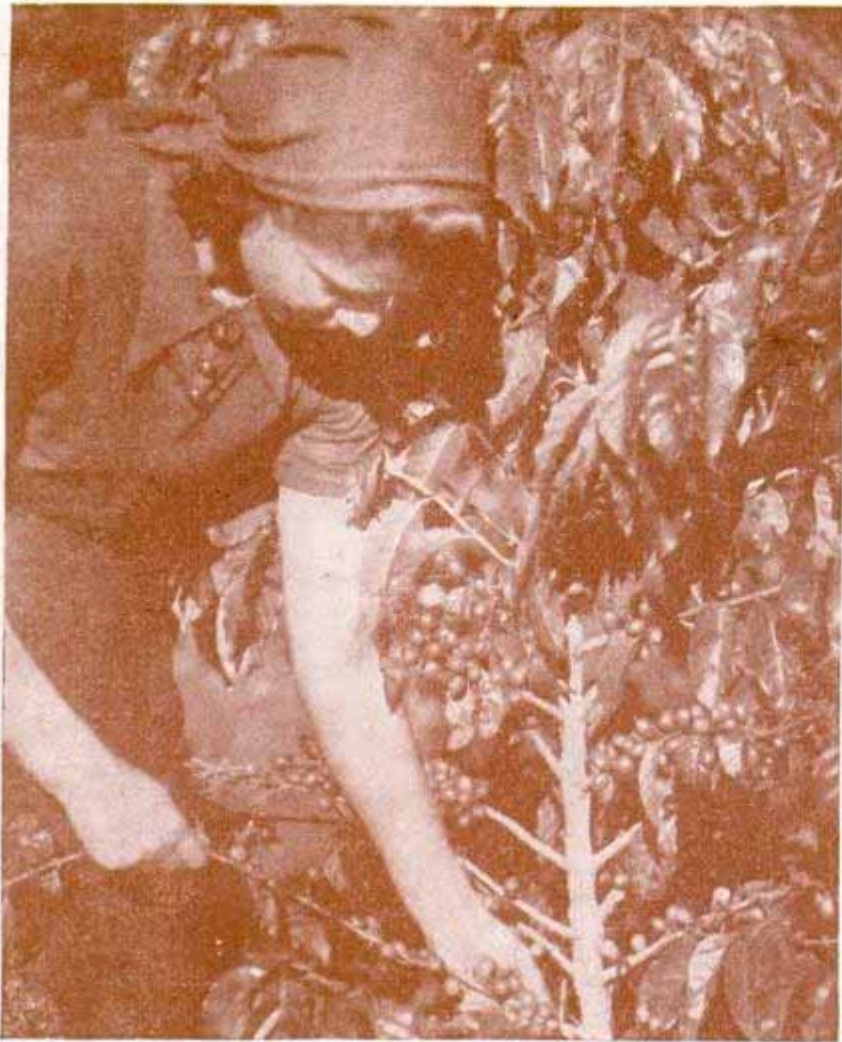
are dropped into a hole about 18 inches in diameter and two feet deep. They are covered lightly with dirt, and pieces of wood are placed over the hole to shade the young trees. The seeds germinate in six to seven weeks. Young trees are thinned down to four to eight per hole at the end of the first year. The trees grow rapidly after the first year, the four stems merging into one at the base. The tree begins to bear when three years of age, reaching its full strength in six or seven years and flourishing for about 10 more years.

Ever growing and ever green, the coffee tree produces beautiful blossoms with dramatic suddenness. The flowers soon disappear and in their place in about seven months ripe cherries develop. These cherries are the "fruit" of the coffee tree. The immature fruit is green in color and gradually turns red, later becoming dark red and, when fully ripe, almost black.

The cherries must be picked off the branches by hand. Examination for unripe and imperfect berries is carried on with amazing rapidity as the laborers deftly strip perfect berries from the branches.

Once off the branches, coffee cherries must be "cured," or have their pulp removed. This can be done by either a wet or dry process. In the wet process, cherries are dumped into tanks filled with water where they are washed and all foreign matter eliminated. The fruit then is put

In Burma or Tunisia, on Guam or Adak, the word is the same—"Cuppa coffee, Joe?" On opposite page, it's blossomtime on a coffee plantation. Left, an acre of beans drying in the sun



Skilled worker deftly strips only ripe cherries from the branches. Below, beans from roaster are dumped into huge pans for cooling

through a machine which removes the pulpy portion to liberate the two beans in each cherry. These beans are the seeds. Then the beans are spread out to dry.

In the dry process, the cherries, after having the impurities washed out, are spread on drying grounds for about 20 days, during which the pulp dries. Just as in the wet process, the cherries have to be hulled.

After hulling, a thick, resistant covering called parchment remains on the beans. This is removed in revolving cylinders. With the removal of the parchment, the beans still are covered by a thin layer, called spermoderm—the skin of the seed. This is removed either in polishing machines or during the process of roasting. The dry beans are airblasted to remove dust, graded according to size by automatic sorters, and hand-picked by skilled operators to remove discolored beans.

The product now is known as "green" coffee. Green coffee is packed for shipment in 132-pound bags and is sent



from plantations to coastal ports and markets.

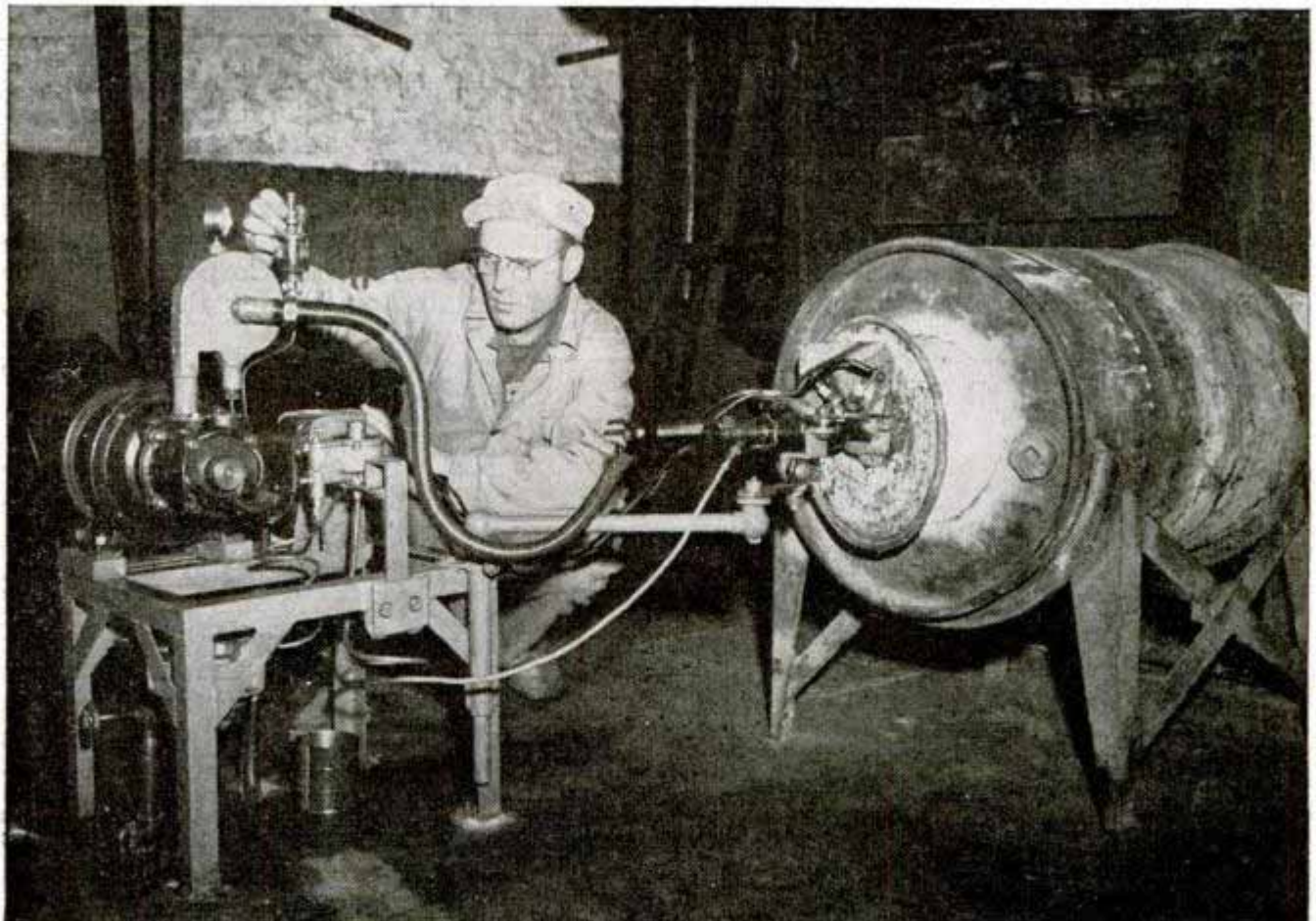
Before consumption, coffee must be roasted. This is done in the consuming country just before the coffee beans are sent to retail markets, as roasted coffee begins to lose its aroma immediately. Roasting changes the appearance, consistency, smell, flavor and composition of the coffee. During roasting coffee loses from 12 to 20 percent of its weight, but increases its bulk by about a third. Because of this increase our Army decided to roast its own coffee. For, in addition to saving war-precious tin, ship space was saved by roasting coffee near points of consumption. One hundred pounds of roasted coffee occupies the same space as 150 pounds of green coffee.

At the height of the war, Army "coffee factories" operated in several overseas locations. One of these installations was in a factory in Marseilles, France, where 12,000 pounds of coffee a day were roasted for the troops in southern France.

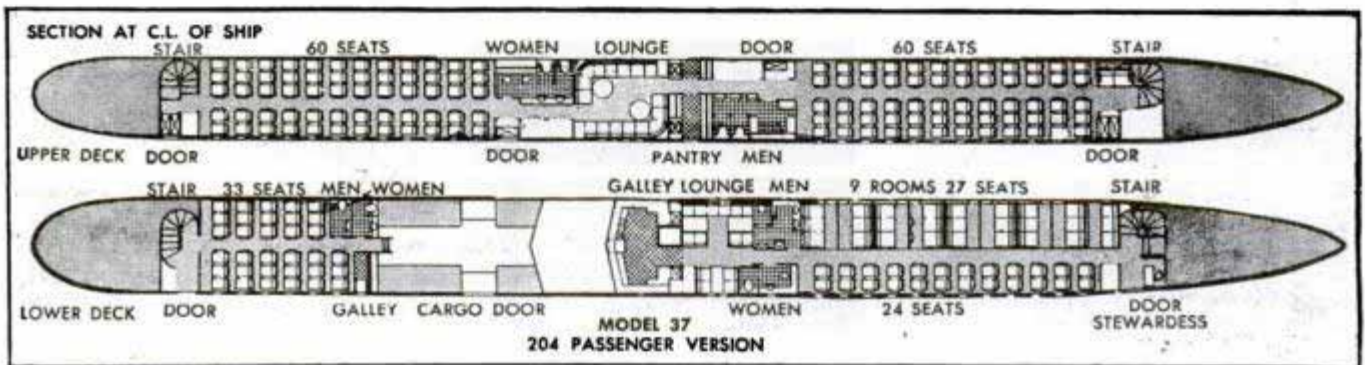
(Continued to page 238)



Inspecting the "grind" of coffee coming from an Army roller mill. Below, roaster's heating unit was improvised from gasoline drum
Signal Corps photo



Transport-Bomber Dwarfs B-29 in Size, Cruising Range



A new bomber that will put present "very heavy" types into the middleweight category is scheduled to be test flown by the Army Air Forces this summer. It's the 65-ton XB-36, equipped with six pusher-style Pratt & Whitney engines capable of producing more than 20,000 horsepower. By comparison with the B-29, which has a wing

span of 141 feet and a length of 99 feet, the XB-36's wing span is 230 feet and the fuselage is 163 feet long. It has a pressurized cabin and an anticipated range that will make Tokyo-New York flights routine operations. The manufacturers, Consolidated-Vultee Aircraft Corporation, have labeled the air line version the Model 37.

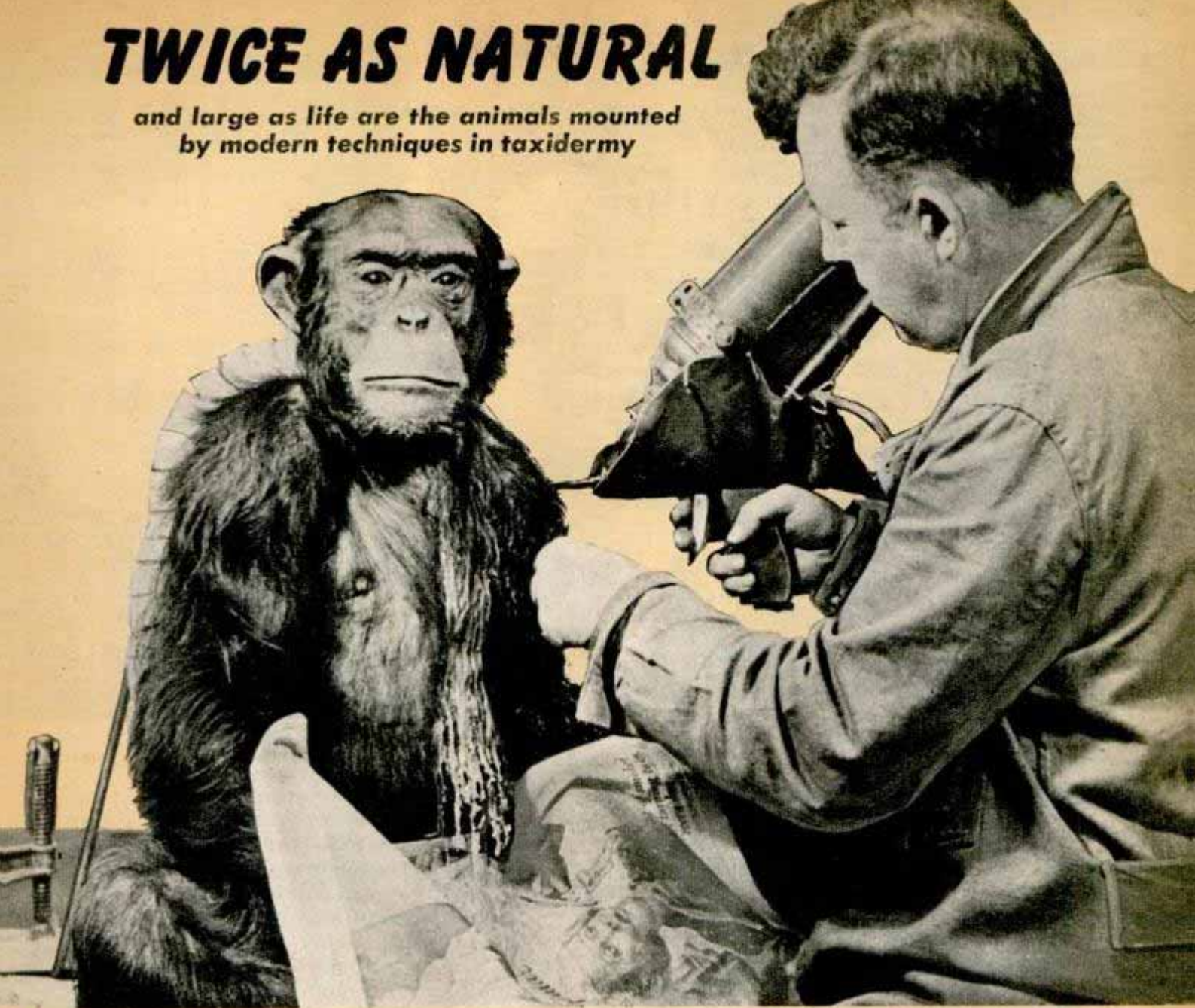


Zipper "Overcoat" Makes It Air-Tight

Attached to a rubber material, a metal slide fastener operated like a zipper can be used to seal flaps to prevent seepage of water, gas or air. The zipper is fastened between overlapping rubber lips which can withstand as much pressure as the zipper itself. It can be used on metal, fabric or sheet rubber. One application is for divers' suits.

TWICE AS NATURAL

and large as life are the animals mounted
by modern techniques in taxidermy



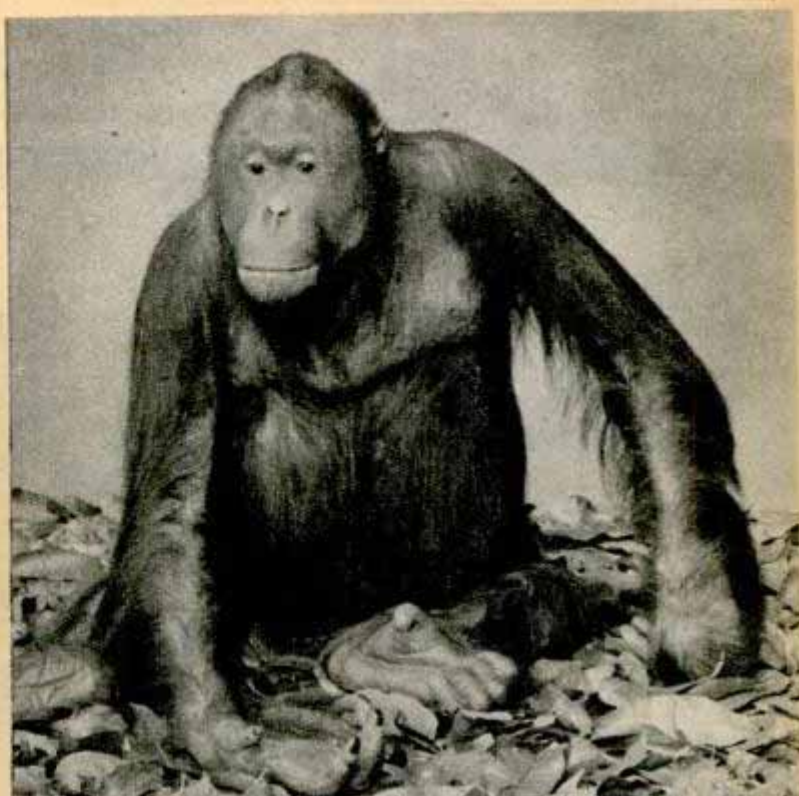
By M. J. Bauer

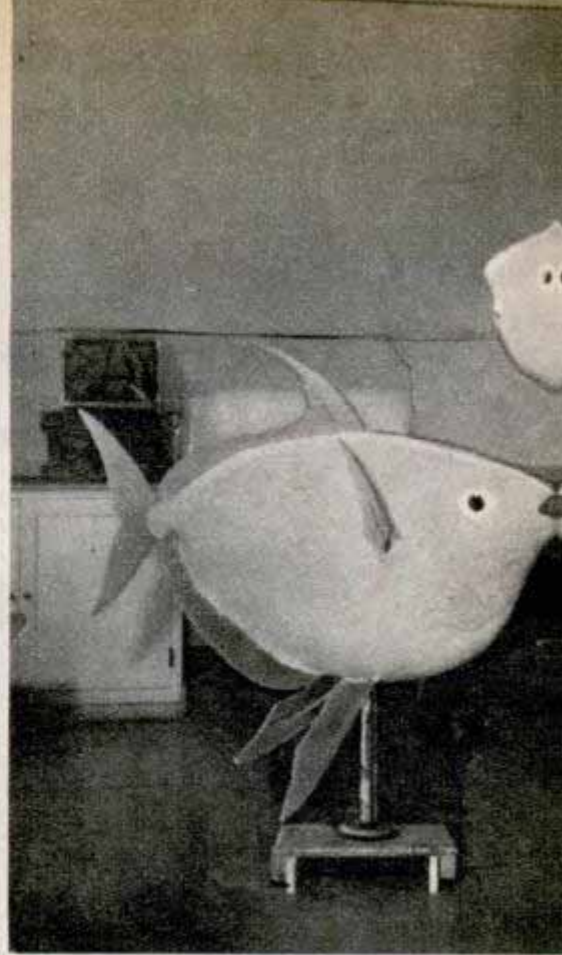
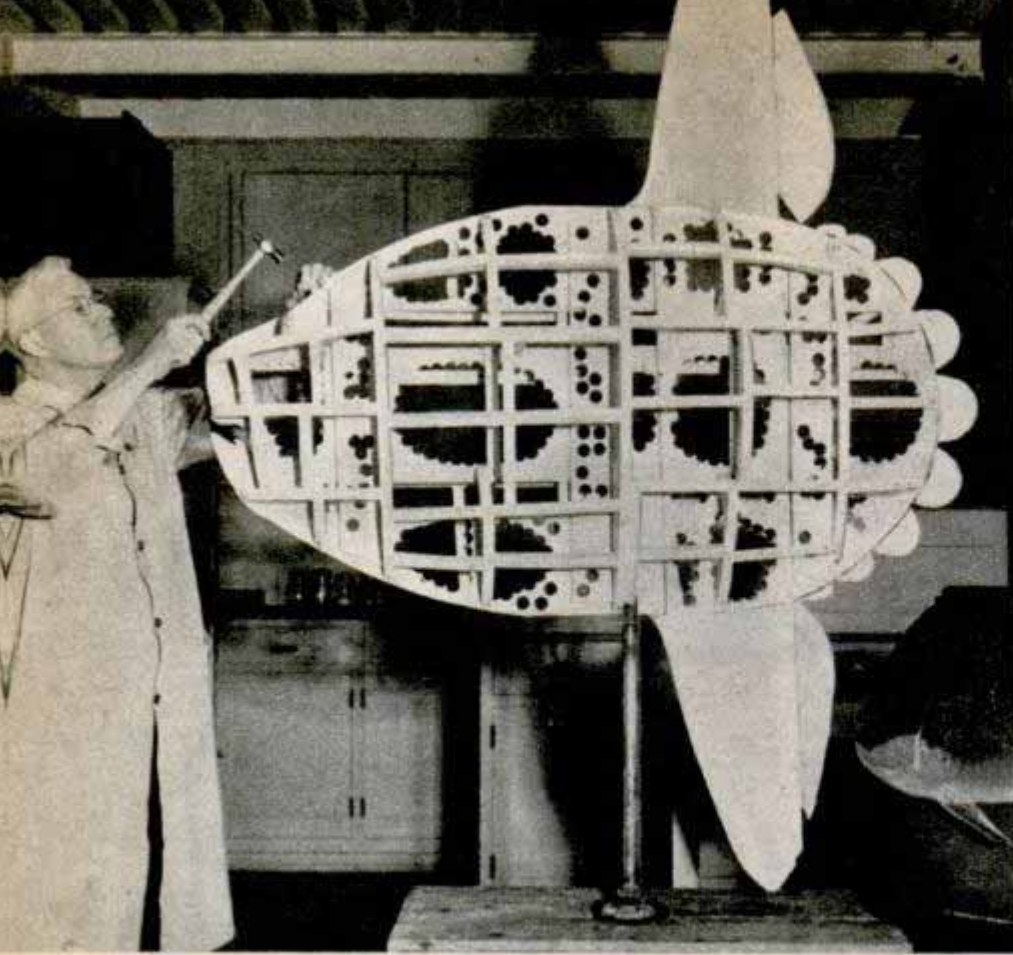
Chimpanzee specimen posed for molding gets a hot wax bath. The orangutan below has a tough celluloid hide

THE GREATEST compliments that can be paid taxidermists are to jump when you meet a stuffed gorilla and to recoil at sight of a synthetic cobra.

In the past, the public seldom was fooled. We are all familiar with the prized fish over the mantel, fins curled and shriveled, head oozing oil, and little resembling the freshly caught pride and joy of the sportsman; or the mounted pet squirrel with mangy coat and glazed eyes. No matter how expert the taxidermist, animal substances lose character, colors fade and the mounted animal looks exactly that.

Museum taxidermists have experimented with various techniques to achieve some startling results. Leon L. Walters and L. L. Pray of the Chicago Natural History Museum have brought the technique of making replicas of animals into the realm approaching perfec-





Chicago Natural History Museum photos

Wooden framework for rare mola is mounted on a pivot; next step is to cover frame with wire mesh and paint

tion. Mr. Walters, the originator and developer of the Walters celluloid process, began experimenting with plastics years ago. He foresaw that if an animal is to appear lifelike either its skin must be treated so that it will retain its true translucent color and plumpness, or a substitute skin must be made. As Mr. Walters believed that anything that had form and color could be translated successfully into other material, he discarded the idea of treating the original skin and concentrated on making a substitute. Plastics seemed the answer.

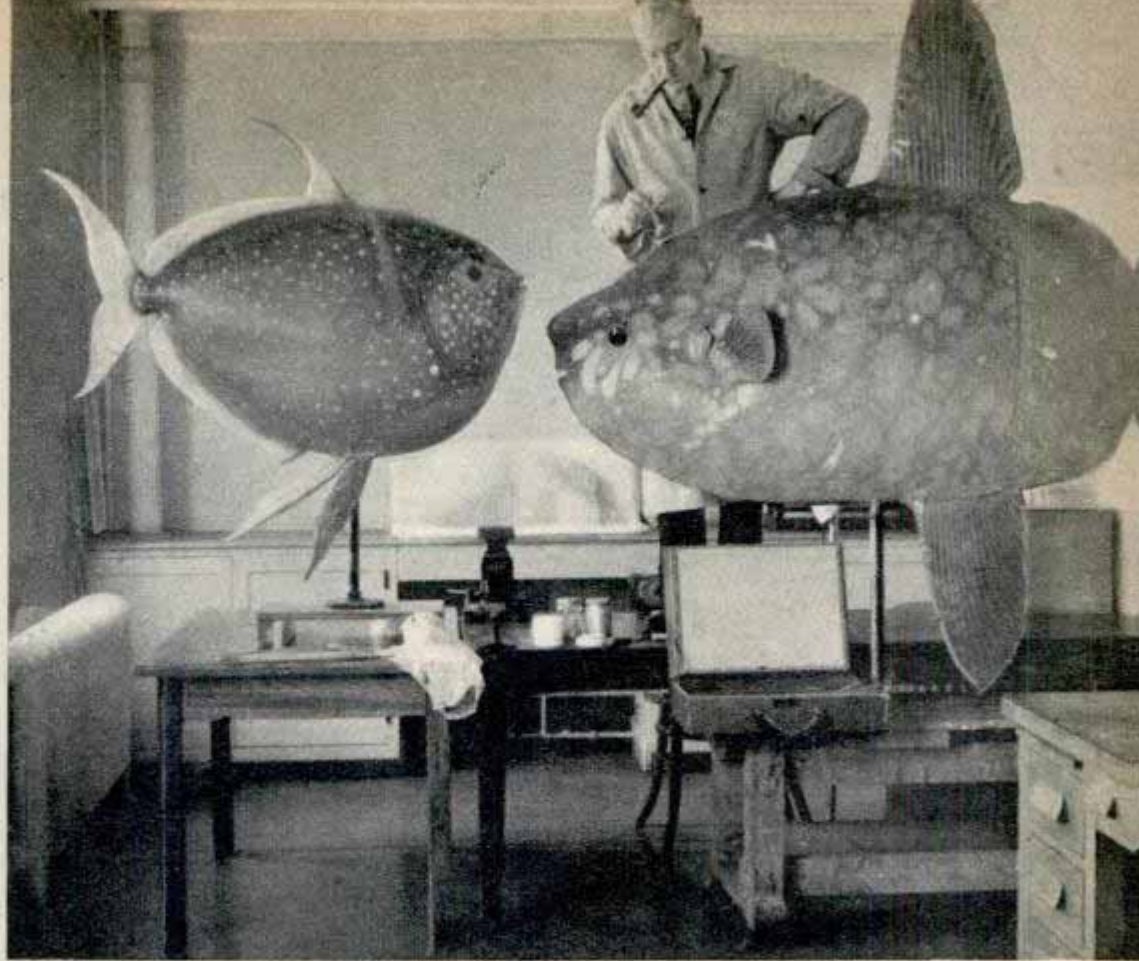
The result is that many of the animals now on exhibition in the Chicago Natural

History Museum are entirely ersatz. One museum visitor is reported to have come back three times to look at a Walters model of a boa constrictor to see if it had moved.

Mr. Walters concentrated first on skin replacement on reptiles. Mounting the skins of these creatures always has been a headache. The tanned skin little resembles the original, and the mounted skin invariably cracks. If possible, Mr. Walters obtains a live specimen and watches its behavior and the positions it takes. He takes careful color notes, often mixing his colors on the spot. After all the necessary notes have been taken, and a pose decided upon, the reptile

Here are steps by which vulture head changes its skin for celluloid; coating of hot wax is covered with plaster





After casein paint is smoothed on, the lifelike models are tinted. Facing the big mola is an opah or moonfish

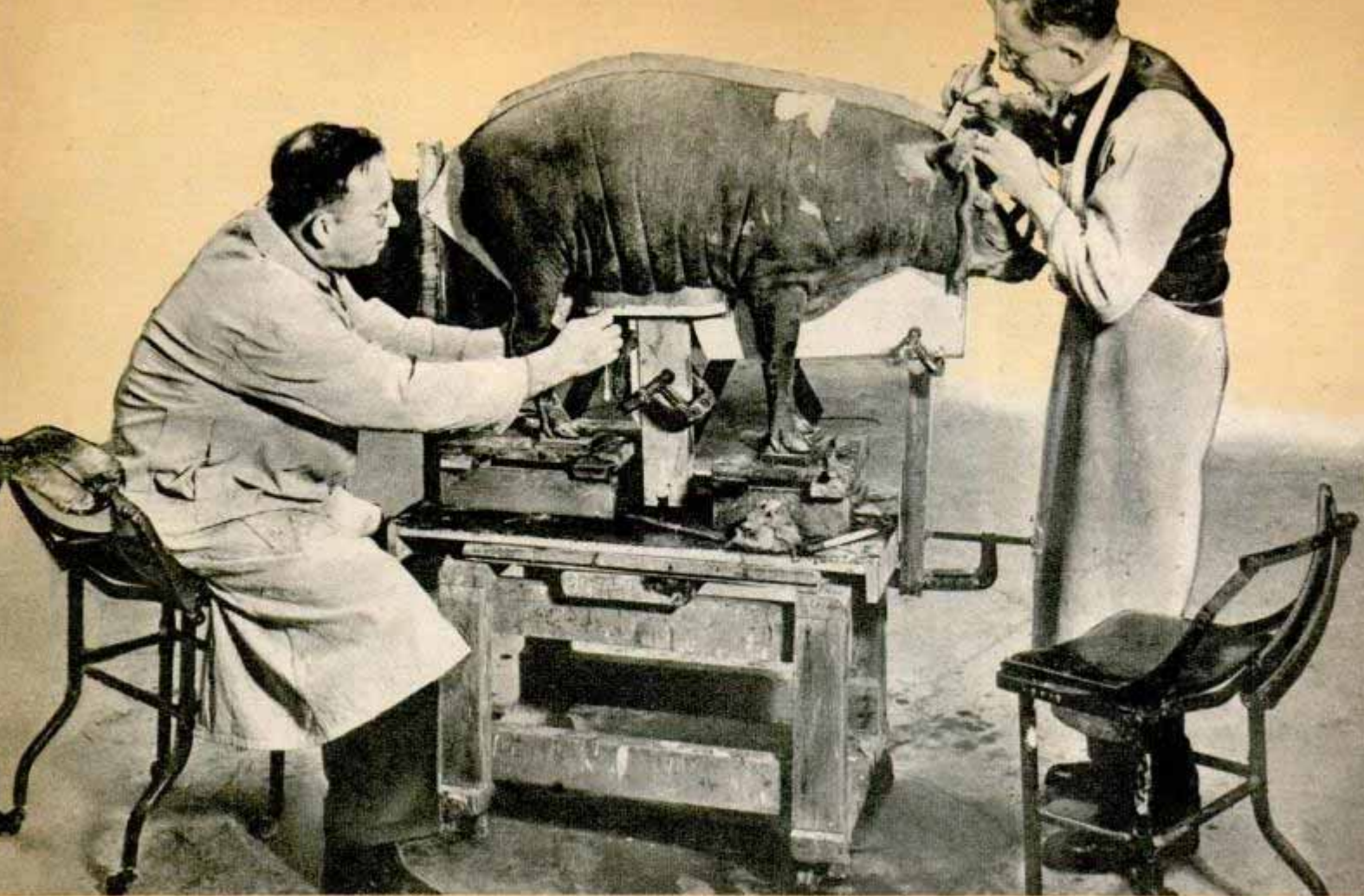
is killed. It then is posed and a mold is made before the skin dries or loses its freshness. This is done by pouring a creamlike mixture of plaster and water over the reptile. In most cases only a one-piece mold is necessary. When the plaster has hardened the reptile is removed from the mold. To the

impression on the inner surface of the mold Mr. Walters applies liquid celluloid, which previously has been colored to match the tones and shades of the original animal. With the dead specimen to guide him, plus the notes taken in life, Mr. Walters paints in the pattern of the animal with the colored celluloid. In many cases it is necessary to apply many differently hued coats to give the necessary translucent color found in real life.

After skin has been removed and feathers anchored with celluloid, wax is dissolved with gasoline, leaving finished head of griffin vulture



To permit the celluloid to dry evenly and to prevent it from destroying the pattern by flowing, Mr. Walters devised a large wheel, which revolves very slowly, synchronizing with the flow of the plastic. After the celluloid inner lining of the mold has dried thoroughly, it is strengthened with burlap, cotton, ground glass or whatever meets the need. The next step is the removal of the plaster shell, which must be done carefully. Usually, the mold with the celluloid model in it is soaked in water until the plaster has absorbed as much as it will take. The plaster then becomes soft and spongy. With careful chipping, the plaster mold then is removed, leaving a remarkably light and firm facsimile of the animal. The celluloid surface is hard



Clay model of a babiroussa is fitted with fresh skin; half of the model is covered with a plaster mold

enough to bear thorough brushing with a wire brush.

Sometimes it is impossible to obtain a live specimen. Then the taxidermist must work with an old mounted specimen, a dried skin, an alcoholic, a fresh salted skin or a skin in pickle. In such cases the skin is placed in a bath of salt water with an anti-

septic added to soften and freshen the skin. A clay manikin is made of the animal and the freshened skin is drawn over this. Then a mold is made and celluloid applied.

Mr. Walters now is using this same technique in the making of furred and feathered animals. Basically, the procedure is the same as with amphibians and reptiles. In-

Clay and skin are removed from inside of mold to make way for celluloid solution to form ersatz skin





Babiroussa model gets shower bath to soften plaster which is chipped away (right) from artificial hide

stead of plaster, wax is used in making the mold, and the original skin of the animal (whose hairs now are embedded in wax) is allowed to macerate. This skin is washed away, leaving the hair roots exposed on the inside of the mold. Liquid celluloid is painted into this mold just as was done for the cold-blooded animals. When the celluloid has dried and the cast has been strengthened with a lining of burlap or cloth, the wax is removed with benzine. The finished product has every single hair, formerly set

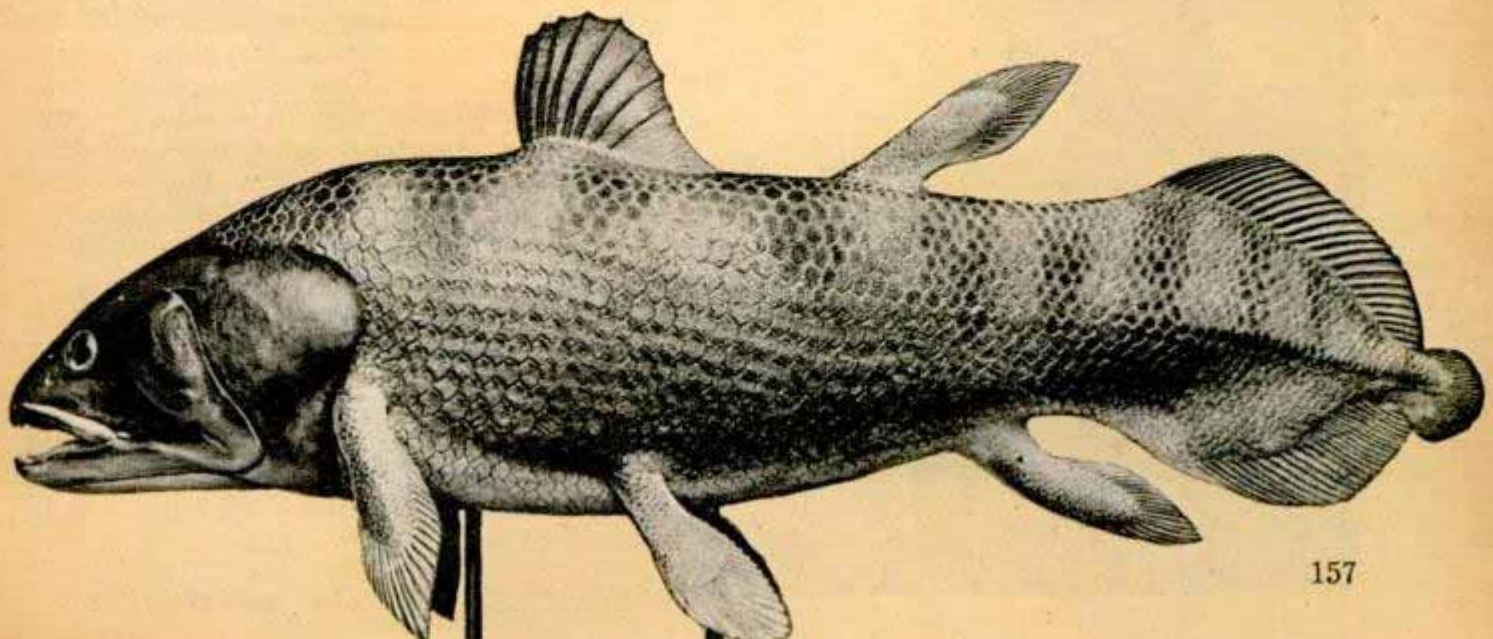
in its own follicle in the natural skin, set permanently in the celluloid skin.

Leon L. Pray specializes in fish taxidermy. He long had been dissatisfied with the usual method of scraping the fish skin free of flesh and mounting it on a wooden or papier-mache manikin. Such a specimen soon loses its lifelike appearance.

Mr. Pray began experimenting with plaster casts. When assigned to make a particular fish for exhibit, he first would obtain

(Continued to page 246)

This model of the rare latimeria (a fossil type fish) was made entirely from descriptions and photographs





Swordfish-Nosed Bomber Has Speed Of Fighter Plane

Combining the size of a medium bomber with the speed of a fast propeller-driven fighter, a plane designated by the Army Air Forces as XA-38 was developed shortly before the war's end by the Beech Aircraft Corporation. The XA-38 was built around a 75-millimeter automatic cannon extending from the nose of the ship. The plane also mounts six .50-caliber machine guns. Pilot and gunner compose the crew. The craft was designed as an attack plane with a primary mission of destroying tanks, armored vehicles, light surface vessels, ground installations and submarines



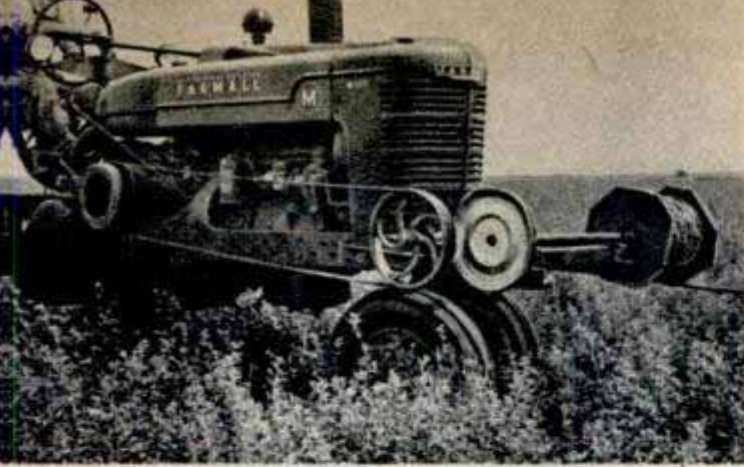
by gunfire. By mounting bombs, depth charges and chemical tanks, the plane also is capable of bombing attacks and laying smoke screens. The ship weighs 23,230 pounds empty and 36,332 pounds when fully loaded. It is 51.7 feet long and has a wing span of 67.08 feet.



Bull's-Eye Projected on Target Improves Aim With Shotgun

One-eye sighting of shotguns no longer is necessary if a gun sight that projects a bull's-eye on the target is used. The new sight throws a ring and a dot on the hunter's line of vision. When the dot is on the target, the gun is properly sighted. Even though the eye is moved, the sight picture remains the same if the gun is stationary. The projected ring aids in "leading" moving targets. A similar sight was used during the war on airplane guns. The device is constructed of blue steel and can be mounted on both breakdown and automatic guns.

More of a boon to the pilot than the passenger, an automatic trim tab keeps a plane in level flight despite shifting of the center of gravity. Passengers can move about or cargo be shifted without the pilot having to trim ship. The tab, developed by Curtiss-Wright engineers for the C-46, adds only 10 pounds to the plane's weight.



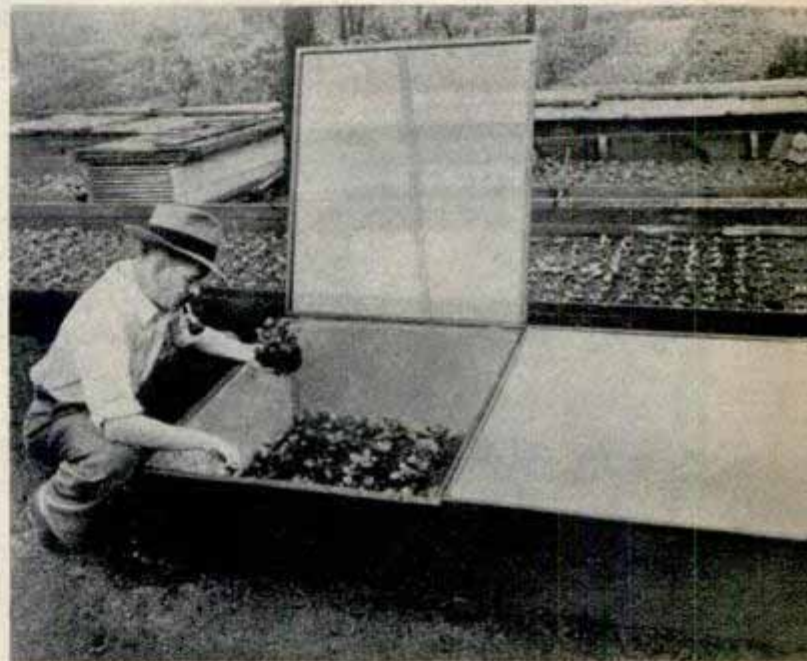
AUTOMATIC SPOOL attached to a tractor unreeles barbed wire for fence while the farmer sits at the wheel. The winder, which can be used on any tractor with a side pulley, also comes in handy to wind corn planter wire, electric light wire or telephone wire



THREE-WHEELED MIDGET AUTO built by Dr. Willard Geer, University of Southern California physics professor, is steered by a control wheel from a wrecked B-17 bomber. Total cost of parts, all salvaged materials, was \$150. The car can go 30 miles an hour



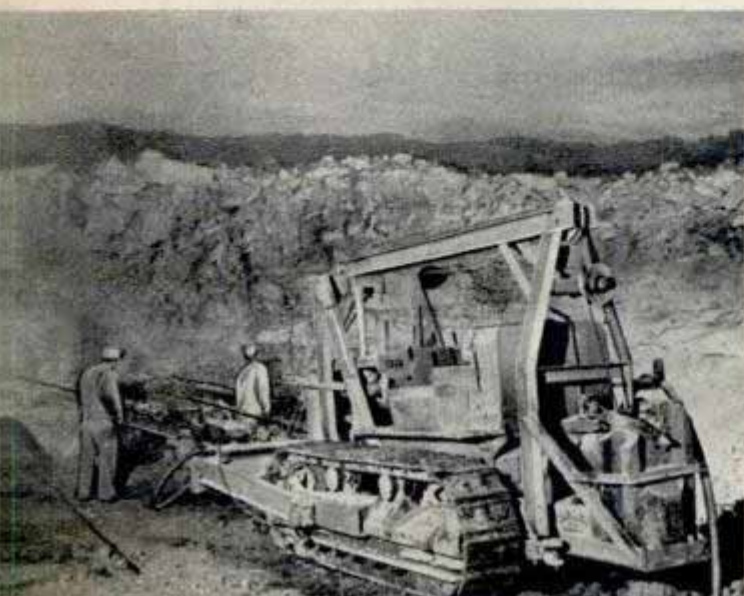
"CUB" TRACTOR weighing 1050 pounds (two thirds weight of previous small tractors) is capable of plowing three acres in 10 hours. Driven by a four-cylinder, 10-horsepower engine, it has three speeds forward

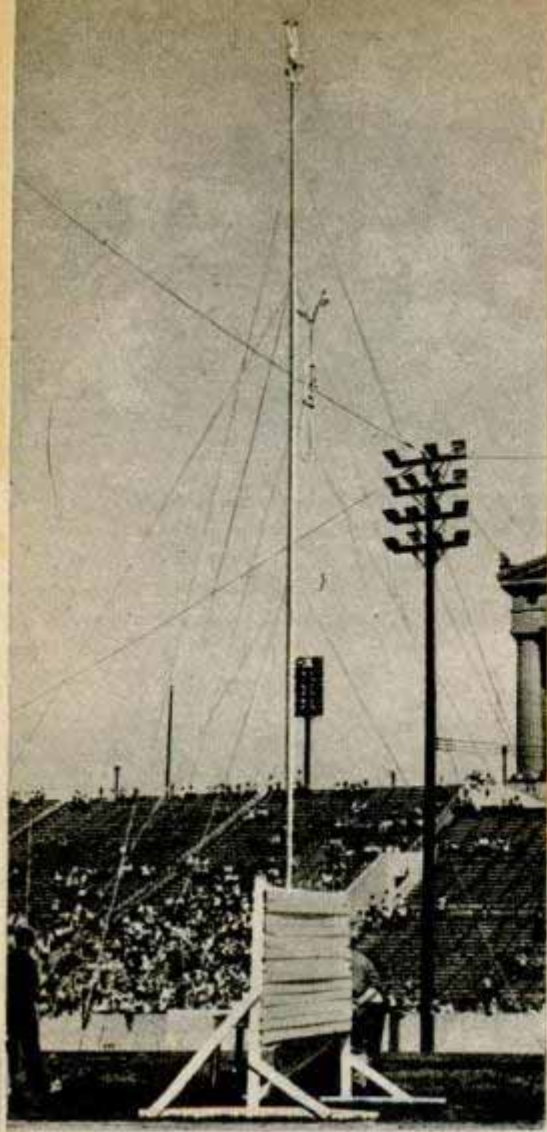


WIRE-REINFORCED PLASTIC COVERS protect seed beds from unseasonal cold, snow and hailstones. Lighter than glass, transparent 36-inch-square panel admits ultraviolet and infrared rays from sunlight

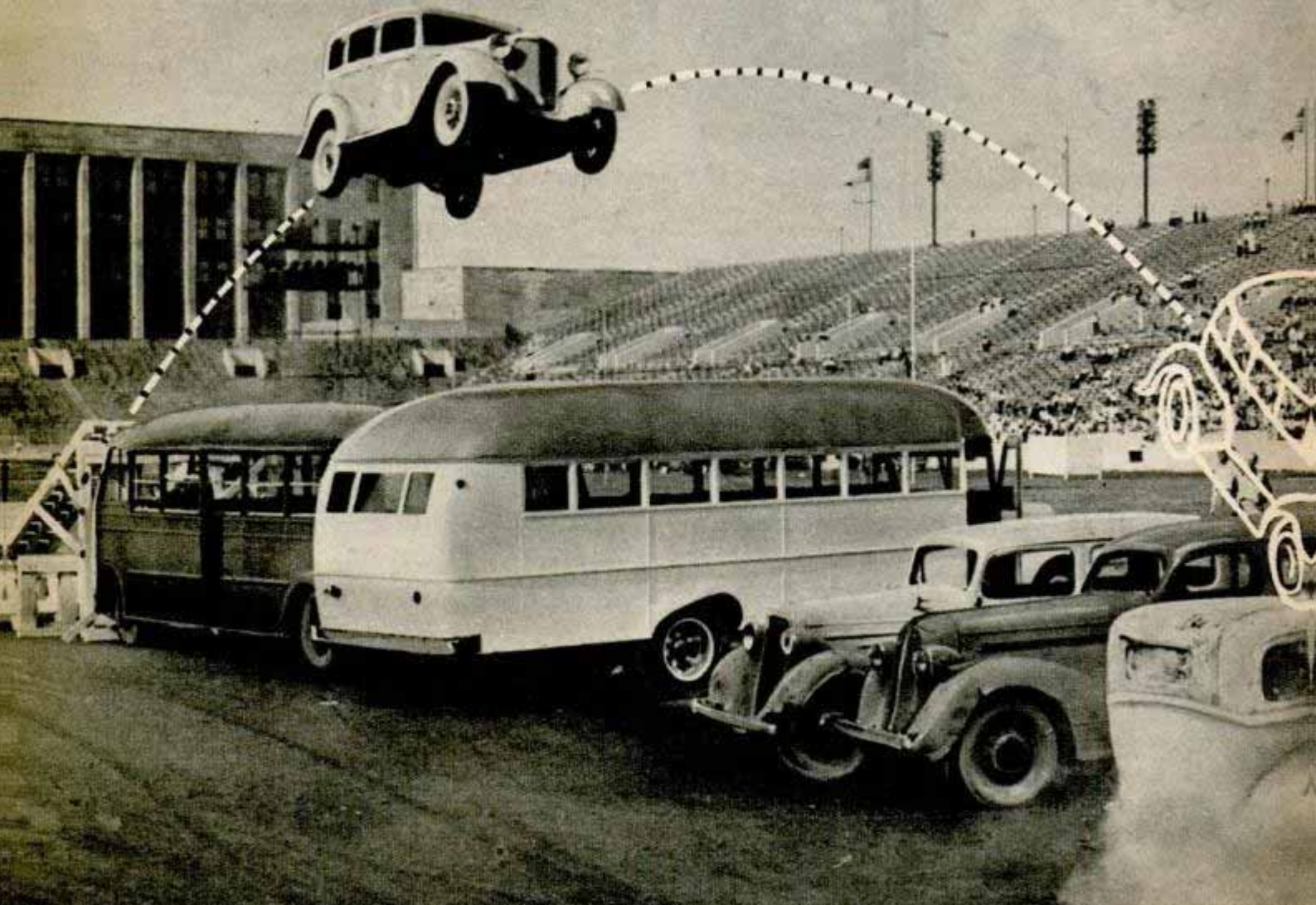
SELF-PROPELLED DRILLS mounted on a tractor replace conventional wagon-drill and jackhammer to bore holes in limestone mine at Independence, Mo. Drills make 16-foot holes for 500-ton limestone "shootings"

MINIATURE VILLAGE built of white pine by Marko Picio of Detroit has buildings equipped with tiny elevators that work. In structures are models of police, doctors and barbers posed to depict real action





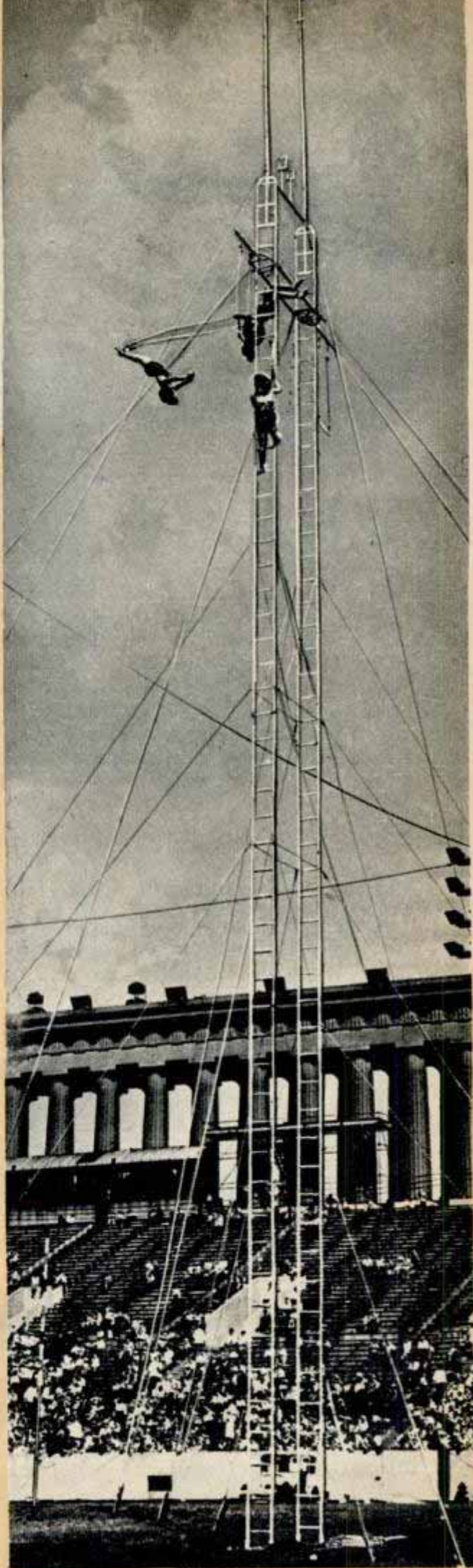
Risking life for a livelihood is the stock in trade of circus performers. Ace Lillard, member of one troupe of thrillers, stands on his head on the hood of a car traveling 30 miles an hour. Another performer stands feet up atop a 130-foot pole without a safety net. Below, Ace speeds his car up a ramp, sails over two buses and a pair of automobiles spanning approximately 80 feet of space, lands on a wrecked automobile and bounces to earth. He is strapped in the car and wears a football helmet

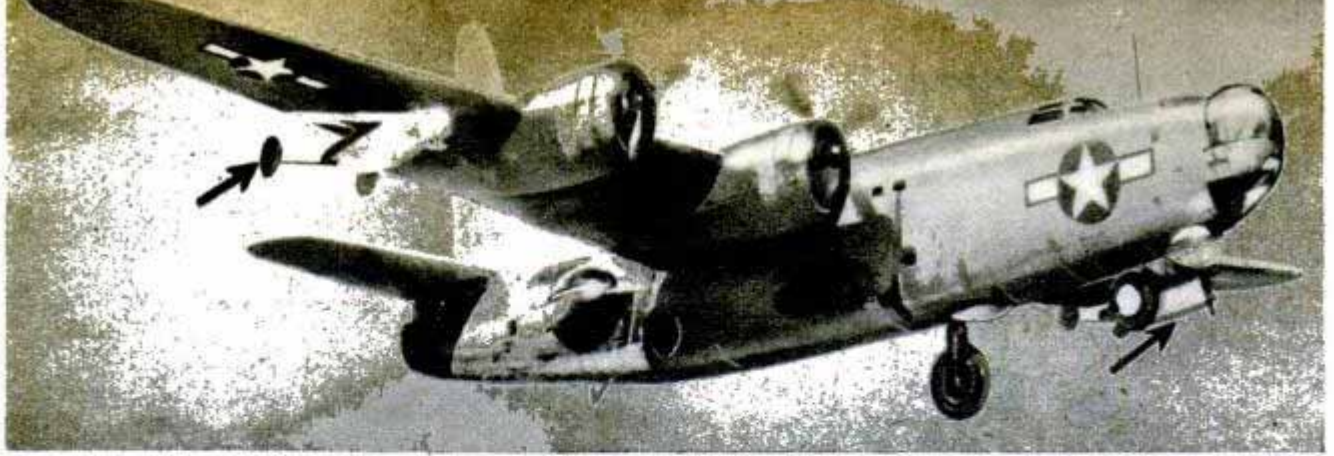


FLIRTING WITH DEATH



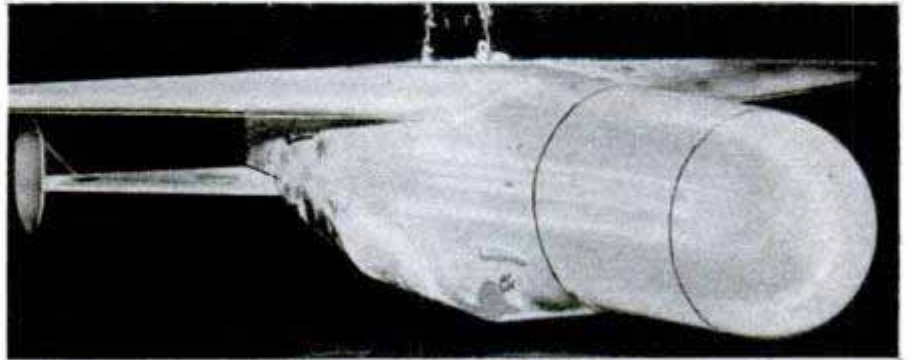
Ace Lillard drives an ordinary sedan through a flaming tunnel of fire at 35 miles an hour—and lives. Right, three members of the Hollywood Aerial Ballet perform daring antics on 130-foot-high trapeze and swings without any safety nets





Radar "Bat" Bomb Chased Jap Ships

The "Bat," a self-guided missile launched from a mother plane, chased and exploded Japanese combat and merchant ships no matter how they turned or dodged. The Navy weapon destroyed many tons of Japanese shipping late in the war. The missile operates on the principle of near-blind live bats, which send out short sound waves, guiding themselves in flight by the echoes bouncing off objects nearby. Similarly, the "Bat" has an automatic radar pilot that sends out radio waves and is guided by the direction and time interval of their return. If the target dodges, the

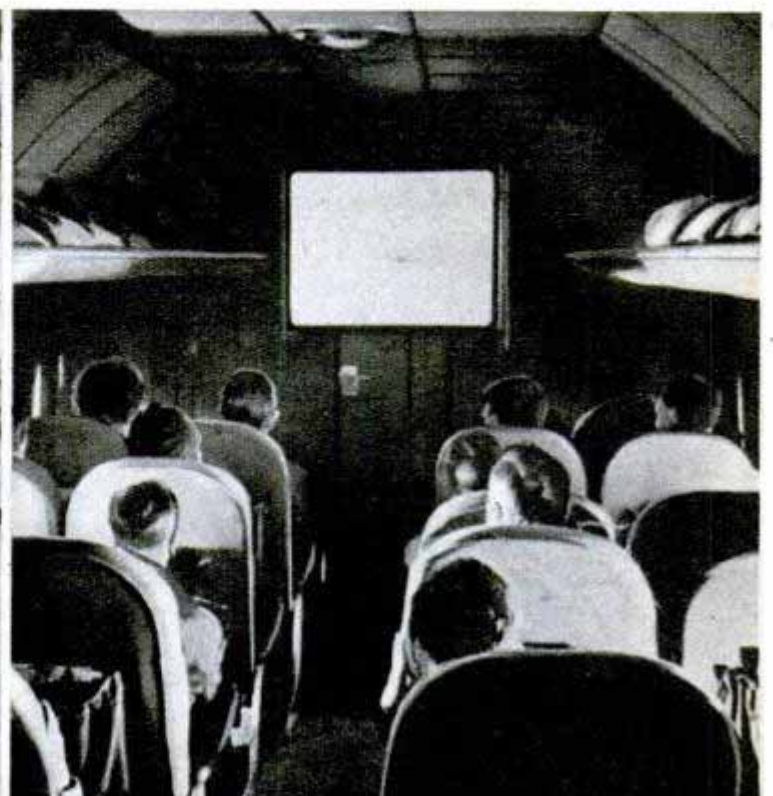


bomb turns with it. Much more efficient than the Jap "Baka" bomb guided by a human pilot, the "Bat" could see in darkness or fog and was quicker to react than a human being. Navy patrol bombers remained out of range of Japanese anti-aircraft fire to launch the bombs. The weapon, 12 feet long with a 10 foot wingspread, carries a heavy explosive charge.

Sound Movies Help Pass Time for Passengers on Transatlantic Clipper

Sound movies among the clouds now are enjoyed by passengers aboard Pan American World Airways' transatlantic clippers. The screen is placed at the front of the cabin, enabling travelers to view the pic-

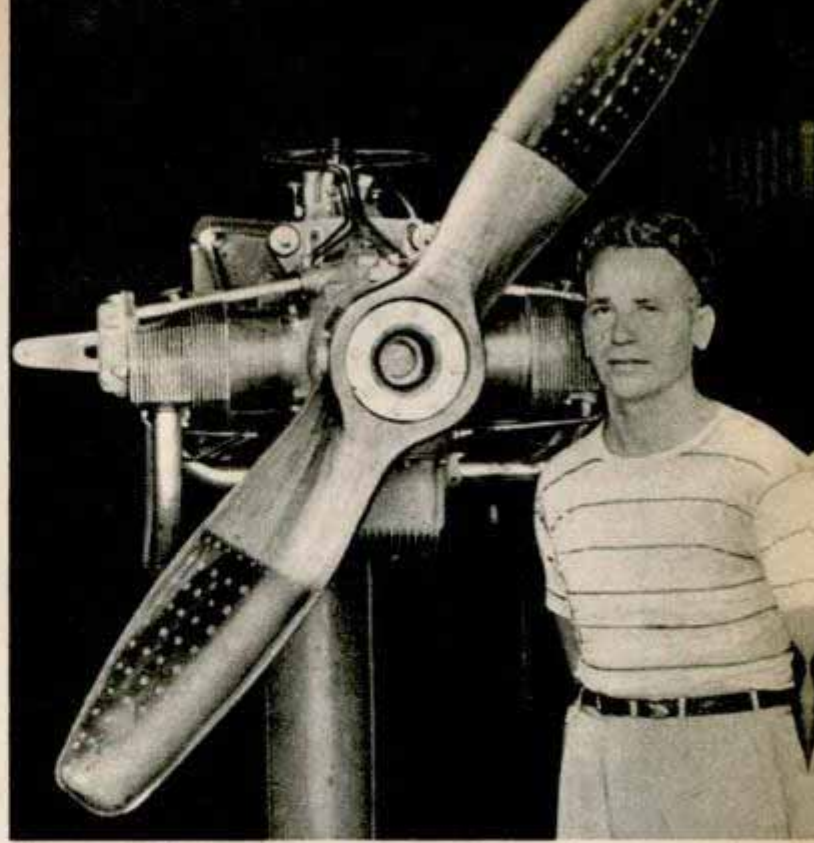
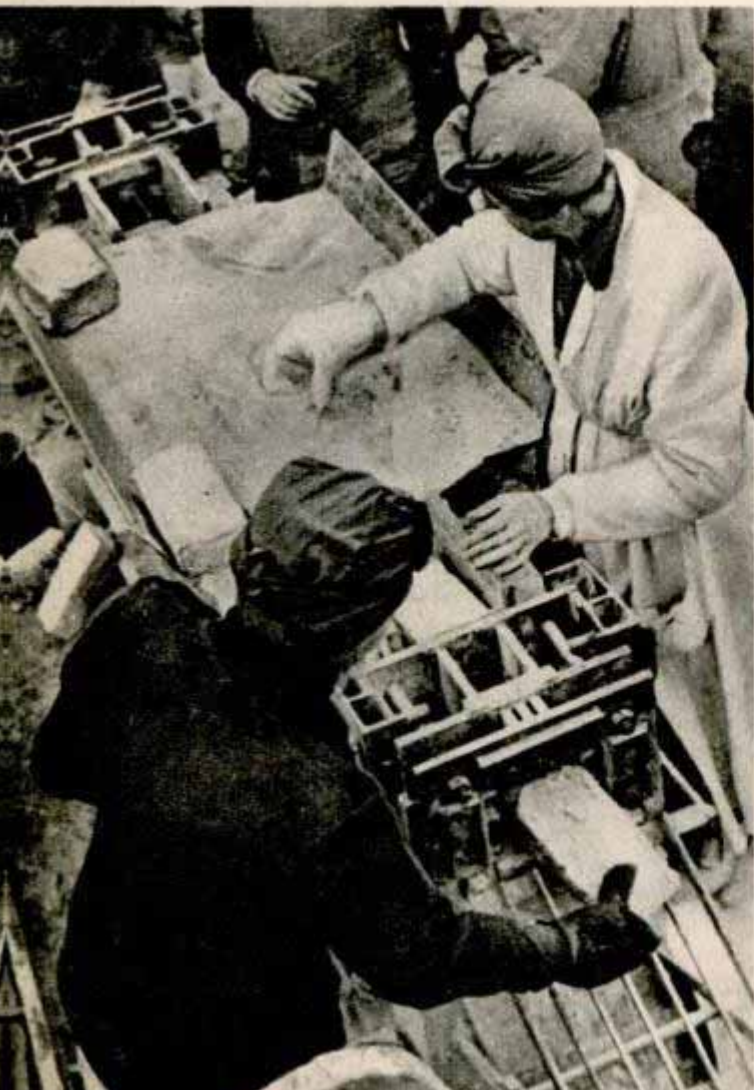
tures from their seats. The flight stewardess operates the 16-mm. projector from the rear of the cabin. Each clipper's film library includes late Hollywood pictures, newsreels, short features and educational subjects.





DIESEL LOCOMOTIVES are running again in France. The French kept them out of Nazi hands by dismantling them early in the war and hiding the parts. Now the mechanical "jigsaws" have been reassembled

SALVAGE MACHINE contrived by the Germans "rescues" brick from bombed ruins and aids in rebuilding bombed Berlin. Cutting blades shear waste from 1800 bricks per hour, compared with 40 cleaned by hand



FOUR-CYLINDER Diesel engine built by Fred A. Thaheld of Brea, Calif., was designed to propel two or three-place planes 130 miles per hour on three gallons of fuel per hour is either 100 or 125 horsepower

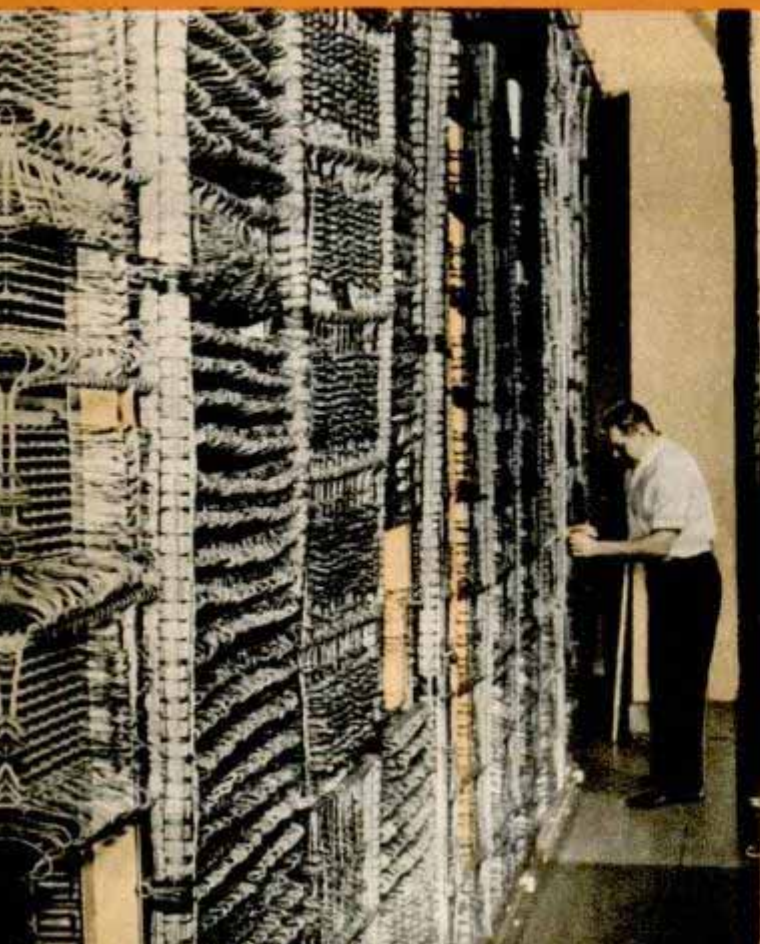
HOME CRIB heated by 100-watt light bulb assists mothers in caring for sick babies. The mattress is set back from the side to let warm air rise. High side-walls insulated with fiberboard keep out drafts





Input table of the electromechanical differential analyzer where the operator "presents" the problem in graphic form to the machine. Below, maze of more than 200 miles of wiring connects machine's 150 motors

All the Answers



SEVERAL months ago a group of distinguished scientists, engineers and Army and Navy officers gathered at Cambridge to watch a man perform the most difficult of the three "Rs"—arithmetic.

In a specially built laboratory of the Massachusetts Institute of Technology they were given a demonstration of a new type of differential analyzer, a giant 100-ton calculating machine which during the war figured such complex problems as rates of change in chemical processes, computations associated with the design and operation of aircraft, analysis of radar wave patterns and atomic wave functions.

Yet, just a little over fifty years ago, in this same city of Cambridge, a patient inventor was putting together a machine which he hoped would at least add and subtract. In 1893, after many trials, the inventor, George B. Grant, produced a "calculating machine" which was manufactured and sold commercially. Because of its many outstretched operating parts it was referred to as the "Grasshopper Machine."

The differential analyzer is man's latest effort to free himself from the tedium imposed by mental calculation. The calculator is a mathematical automaton, designed not merely to relieve human brains of the time-consuming drudgery of difficult calculation and analysis, but to attack and solve mathematical problems which are economically beyond the reach of ordinary methods of solution. Some 2000 electronic tubes, several thousand relays and about 150 motors are part of the giant machine, which in operation generates so much heat that a special ventilating system had to be installed.

Since the earliest times man has endeavored to make mathematics easier. The counting of things began with the primitive Roman abacus, which stated an arithmetical problem in terms of physical counters and permitted the Romans to see their calculating while they were solving it mentally. Even today in some parts of the Orient the abacus is in use. It is given to children to help them visualize arithmetic.

The first refinement upon the abacus was in the 17th century, when Pascal designed a mechanical calculator which produced answers after a number of figure-setting disks were manipulated. By the middle of the 19th century key-driven calculators, roughly resembling those in use today,

at Your Fingertips

were invented. Many of these comparatively recent devices may be seen in the Smithsonian Institution in Washington.

One of the earliest is the Thomas Hill "Arithmometer," built in 1857. This key-driven calculator in appearance anticipated the really operative machines of 30 years later. Keys like those found on modern machines were used to push numeral wheels. But the machine lacked the essential provision for overcoming the great momentum of the wheels which resulted from the sud-

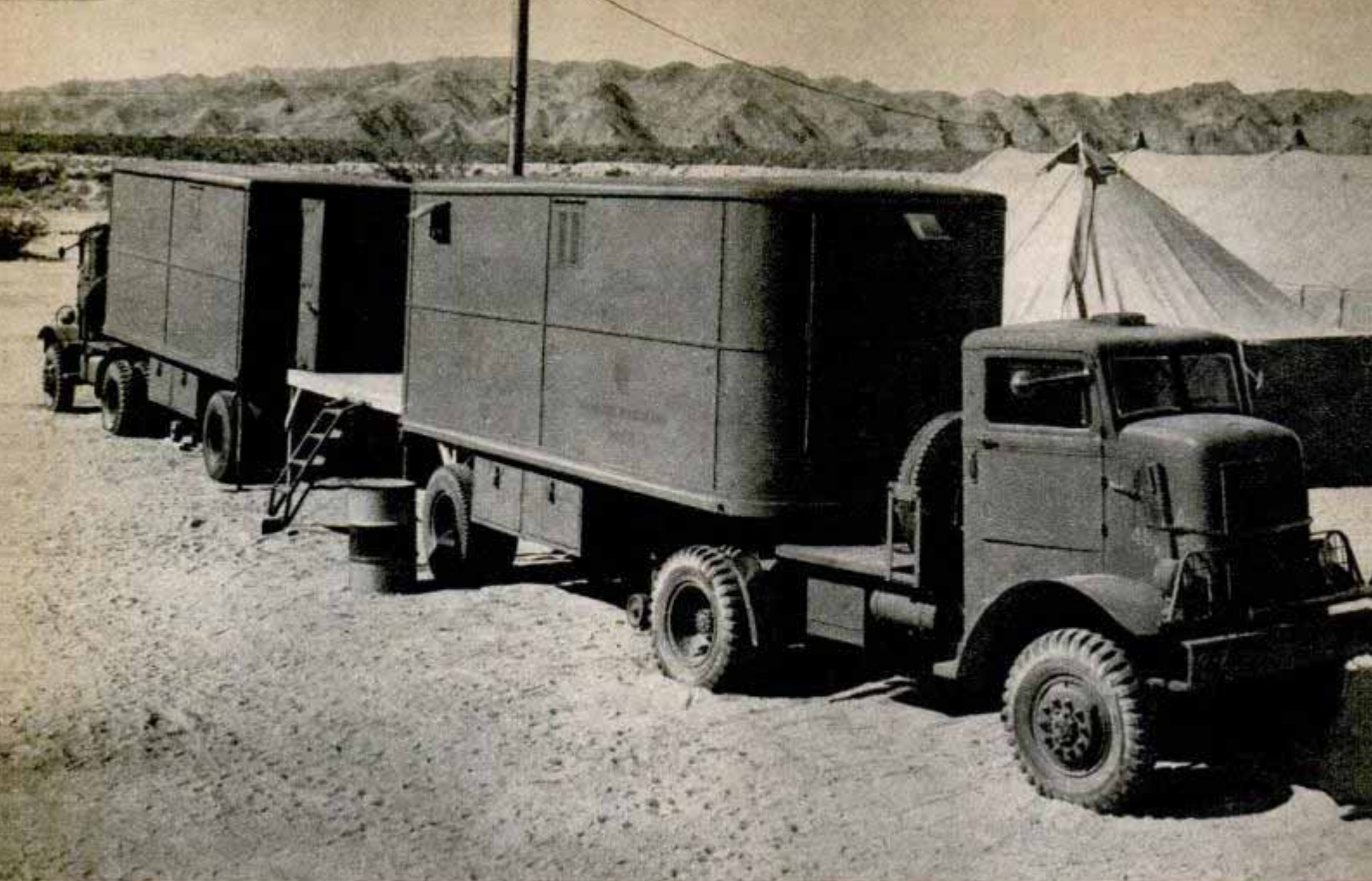


Above, microfilm camera photographs 400 cards per minute. Below, automatic punch reproducing machine



Below, tabulating Army morning report data on key punch unit. Left, inserting forms for posting in a Burroughs high speed automatic bookkeeping machine





Two trailers, carrying the Army's mobile machine records units, in operation, with connection and steps in place

den whirl given them by a quick depression of a key. The user obviously had to pause for a second or two until the wheels stopped before he was able to continue. On modern calculating machines this action often is completed in 1/165 second.

During the latter half of the 19th century, inventors spurred by the need of expanding commercial operations continued working on mechanical calculators. Many models

Machine equipped to make photographic copies up to 24x36 in. of anything printed, drawn, typed or written



were built, but few were sold commercially. One improvement was that mechanical calculation was made automatic and the visualization feature was dropped.

This principle of sight-unseen problem solving was put to use during the 1880s by Dr. Hollerith, a noted statistician engaged by the United States Government as special agent during the taking of the 1880 census.

Owing to population increases, it was feared the next census would be worthless by the time the calculation of all facts could be completed, and some mechanical aid to expedite the complicated task was needed. Dr. Hollerith set to work and devised a system for transcribing the census data onto paper strips by means of holes punched instead of numbers written. The punched holes were made to actuate automatic tabulating machines by a very simple electromagnetic principle. The paper strip used by Dr. Hollerith later was replaced with a card. This card now is the basis of the punch card method of accounting and tabulating used on modern machines utilizing basic principles developed by Dr. Hollerith.

Did you ever wonder how the Army kept track of its millions of men all over the world without losing one occasionally? Well, punch card machines were the watchdogs. In 1940 the Army's adjutant general installed the electromechanical system at



Interior of an Army machine records unit trailer showing two sorters, printing punch and reproducing machine

headquarters. When our armies went overseas, these machines followed for the dual mission of keeping track of individuals and maintaining daily strength reports based on unit morning reports. Mounted in two large truck vans, the mobile machine records units followed on the heels of our advancing troops.

These machines speeded up the demobilization of millions of men. As each new critical score was announced, the magic machines went into action. The sorting machine, seeking men with the score making them eligible for discharge, ran through 400 cards per minute. This sorting machine is the heart of the punched card system. Without it there would be no widespread commercial application of this mechanical accounting.

The machine which starts the ball rolling, however, is the alphabetic printing punch, which records both alphabetical and numerical data on tabulating cards in punched and printed form. The depression of a key causes the machine to punch the card and at the same time to print the corresponding letter or figure at the top of the card above the column being punched. After the key is depressed, the card is advanced automatically to the next punching position. The operator merely depresses the keys as though typewriting and an experienced operator can punch 25,200 digits per hour.

During the war the use of tabulating machines for traffic control at ports of embarkation prevented a chaotic tie-up of traffic such as was experienced in World War I. At one time during World War I more than 200,000 loaded freight cars converged on eastern ports, paralyzing traffic as far back as Chicago for weeks and months while waiting to be unloaded. In World War II, tabulated reports were used

(Continued to page 250)

Lightweight, compactly built portable adding machine





Pilots flying air routes over the Far North can enjoy a feeling of greater safety, now that "Parapups" have joined the Alaskan Wing Search and Rescue Squadron. Parapups are huskies trained to parachute in pairs from planes. This unique rescue service was developed by Maj. Joseph F. Westover, commander of the squadron, who decided to experiment with the idea of dropping dogs by parachute to help downed flyers mush to safety. In the first test at Fort Nelson, British Columbia, two huskies were flown to a 1500-foot alti-

"Parapups" Drop From Plane To Aid Snowbound Flyers

tude, attached to a 28-foot cargo chute and pushed from the plane.

The dogs descended without a yelp and landed in perfect condition, ready to pull a sled carrying a flyer. In other tests, huskies bailed out in a temperature of 48 degrees below zero and stood ready for action. Parapups, which must weigh 100 pounds or more, are completely "GI." They have service records, serial numbers, enlistment papers and receive paratrooper wings after five jumps. They even are given special shots to guard against disease.



Ray Lamp Kills Bacteria in a Minute

Invisible rays sprayed by a U-shaped ultraviolet lamp reduce the bacteria count in milk cans as much as 96 percent in one minute, Westinghouse Lamp Division research workers recently discovered. Curved lamps 30 inches long were used to provide maximum radiation for the entire interior of milk cans, including the hard-to-reach areas in the shoulder. The lamps operate on standard 110-120-volt alternating current, consume less electricity than a 25-watt light bulb, and fit all conventional cans.

Zigzags Warn Pilot of Ignition Failure

Dancing lines projected on the small instrument panel screen of a British ignition analyzer inform an aircraft pilot of the performance of his ignition system while in flight. As long as the line pattern remains constant the flyer knows the system is performing efficiently. A sudden change to dark, zigzagging shapes indicates trouble and reveals whether it is in a spark plug, magneto or distributor.

Raising the Dead Ships

AS WEATHER PERMITS, hardy salvage men are attempting to retrieve valuable cargo from the torpedoed Netherlands freighter *Arundo*, sunk 15 miles off the New Jersey coast in water 150 feet deep.

Some mystery surrounds the cargo of the *Arundo* but it is known that she carried Diesel-electric locomotives worth millions and a variety of instruments and other supplies for the Allied Middle East Command at Alexandria. Operated by the British Ministry of War Shipping, the 5163-ton, 412-foot vessel sailed from New York on April 28, 1942, and was sunk that same night by a German U-boat lurking off Atlantic City.

The 37 survivors of the crew of 43 were picked up next day and the *Arundo* was undisturbed until last fall. The Diamond Salvage Company then put divers to work surveying the wreck with the goal of salvaging at least the more valuable parts of

By Tom Mahoney

the *Arundo's* mysterious cargo.

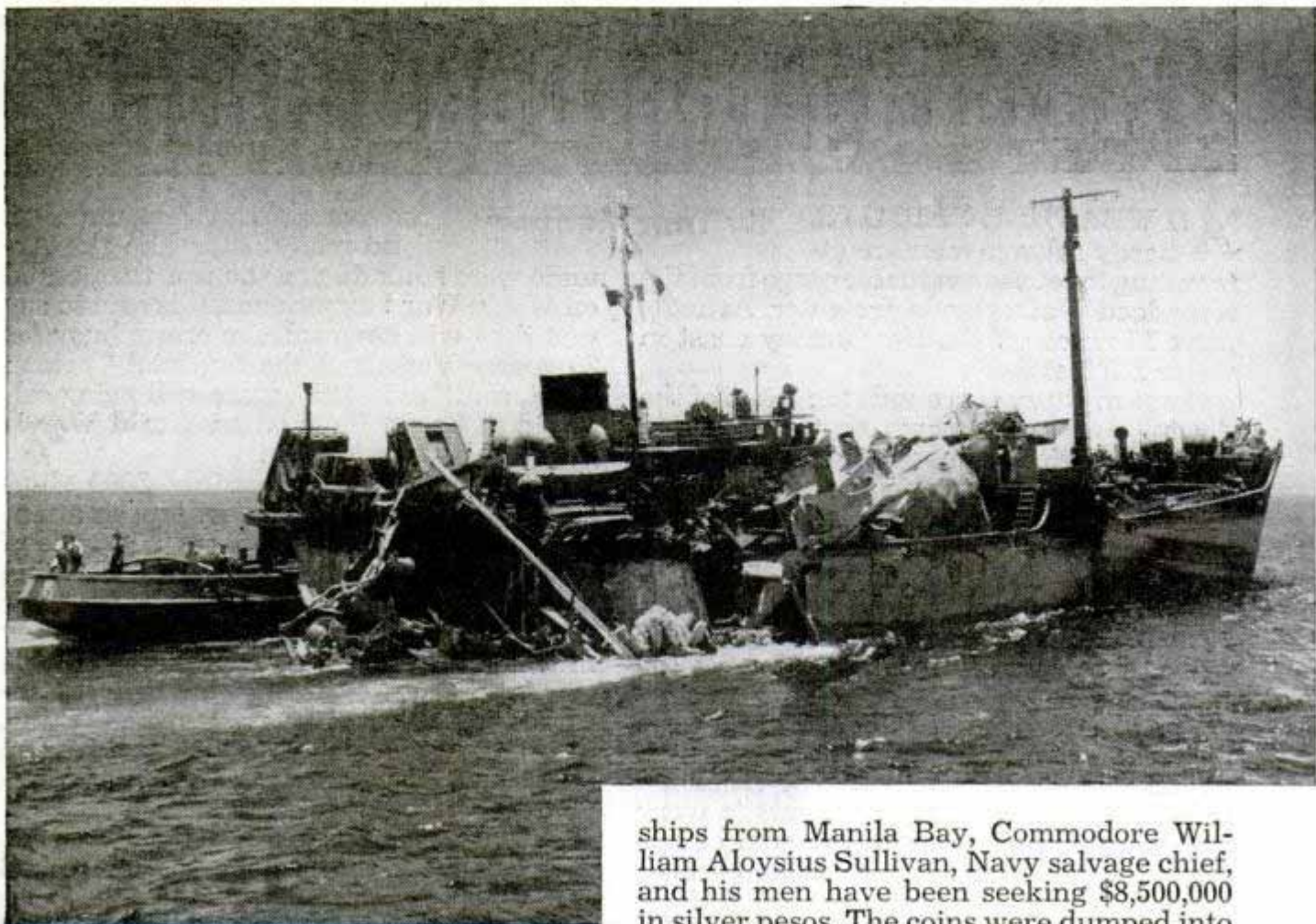
So many ships like the *Arundo* were sunk during the war that, based on World War I experience, it is safe to say that they will keep salvage crews busy for 20 years. Vessels of the Imperial German Fleet, scuttled in 1919, were still being salvaged at Scapa Flow when World War II began in Europe in 1939!

How many of the possibly 3000 ships sunk in the last five years will merit attention is a matter of conjecture. The price of scrap will determine whether those lying in deep water and valuable only for their metal will be disturbed. But where they are menaces to navigation or have valuable cargo like the *Arundo*, they are being steadily raised or cleared away. During the war, the U. S. Navy calculated that it recovered \$600,000,000 worth of sunken ships and cargo in coastal salvage operations.

Actual treasure is involved in many cases. As a sideline to the clearing of 600 wrecked

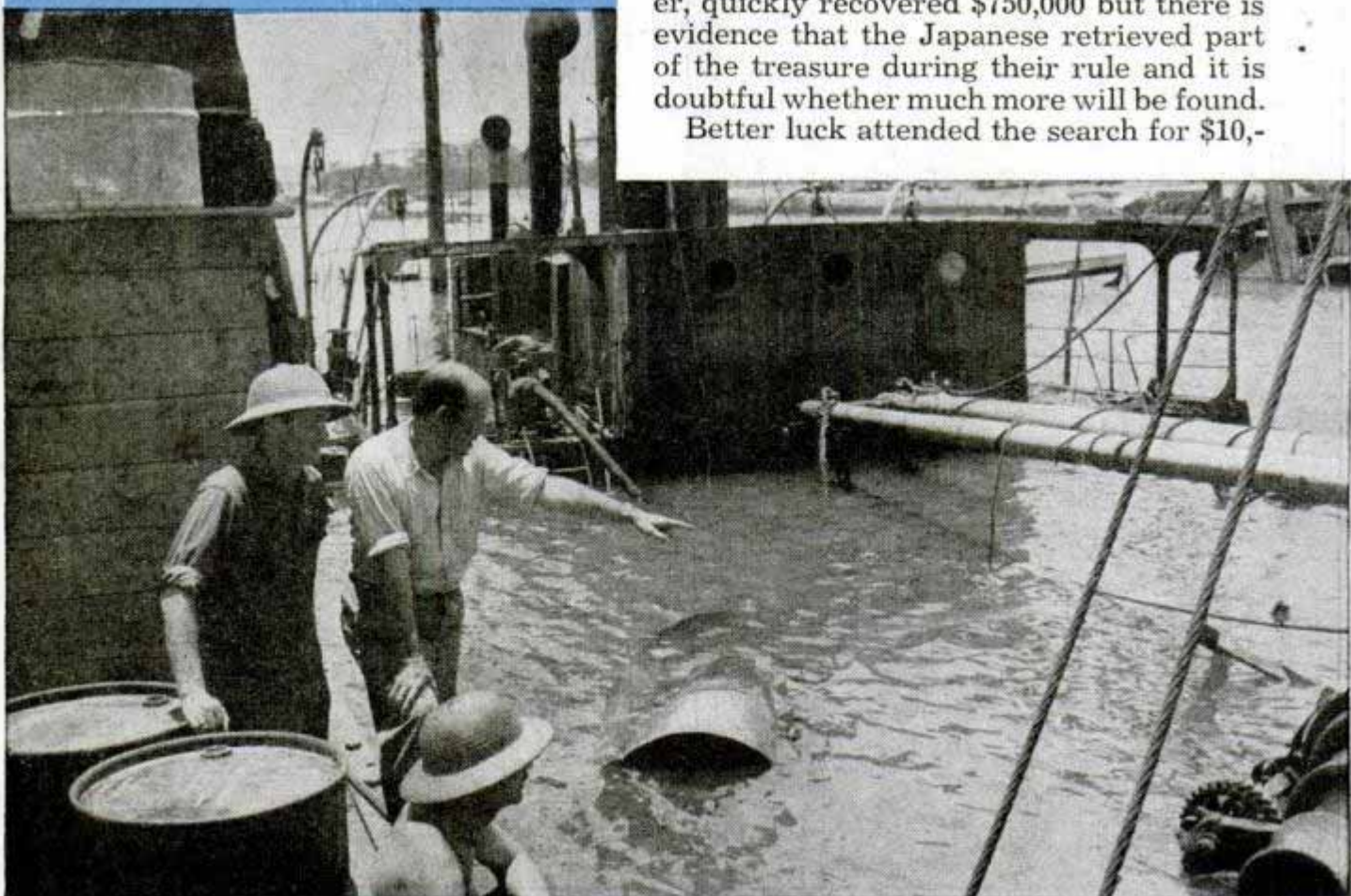
Navy divers go under water from barge alongside scuttled German ship preparatory to raising operations





Demolitionists prepare to sink wrecked ship and eliminate navigational hazard. Below, Seabees examine visible portion of sunken freighter

ships from Manila Bay, Commodore William Aloysius Sullivan, Navy salvage chief, and his men have been seeking \$8,500,000 in silver pesos. The coins were dumped into water more than 100 feet deep by Philippine government officials just before Corregidor's surrender in 1942. Divers from the USS Teak, a converted Navy net tender, quickly recovered \$750,000 but there is evidence that the Japanese retrieved part of the treasure during their rule and it is doubtful whether much more will be found. Better luck attended the search for \$10,-





000,000 in gold that went to the bottom of the Pacific when the 13,400-ton liner Niagara, en route to Canada, struck a German mine after leaving Auckland, New Zealand, in 1940. Water in the vicinity was about 500 feet deep but Captain J. P. Williams, managing director of a Melbourne, Australia, salvage company, contracted to recover the gold.

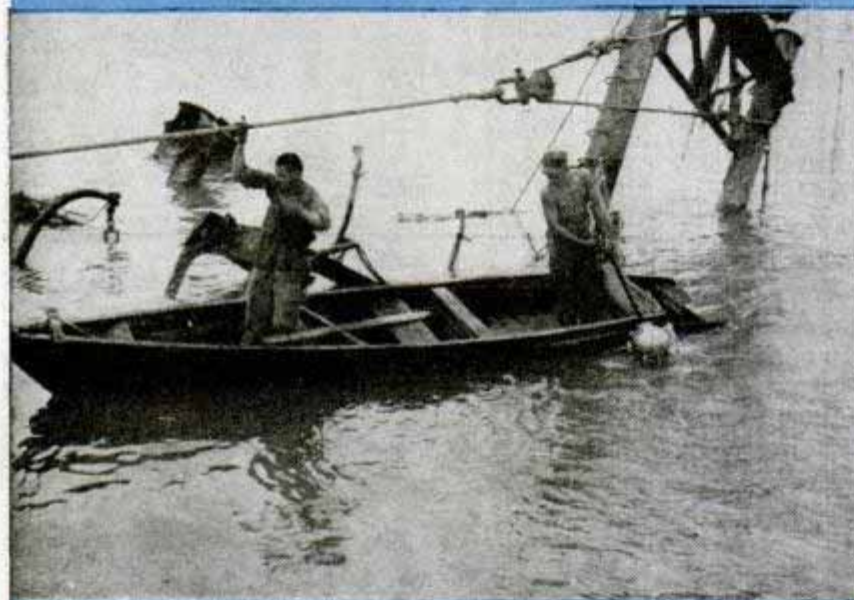
A 40-year-old steamer, the Claymore, then rusting in Auckland harbor, was refitted and equipped with derricks, grabs and other machinery. An observation bell, a

The SS Elihu Thompson, being towed to harbor after striking mines, is back at sea. Below, diver goes down in Thompson salvage operations





Instructor describes uses of shallow-water diving gear to a group of students at the Navy diving school on New Caledonia



Army diver shown surfacing during joint salvage operations at Okinawa. Below, adding insult to injury, Seabees use captured diving gear to raise Jap hulk sunk during battle for island



steel cylinder weighing nearly three tons and equipped with plate glass windows that could withstand water pressure of 350 pounds to the square inch, was obtained for the diving. After seven months the Niagara was located lying on her side 438 feet beneath the surface, and the salvage ship anchored over the wreck.

With explosives lowered into place as directed by a diver and then detonated electrically after the bell had been pulled to the surface, the salvors began to blast their way into the wreck. Bad weather, wounded sharks and floating mines delayed the work but the door of the bullion room finally was blown away and the grabs began to bring up gold bars. Operations ceased 18 months after the sinking when eight tons of the metal, worth 2,397,900 Australian pounds, or roughly 94 percent of the \$10,000,000 treasure, had been recovered!

If the fantastic legends of ancient galleons are disregarded, only one ship ever yielded more gold than the Niagara. This was the old White Star liner Laurentic, torpedoed off Ireland in 120 feet of water in World War I, from which British Navy divers in seven years recovered \$19,000,000 in bullion.

A salvage record for bigness was established in righting the accidentally burned 83,423-ton liner Normandie, second largest ship in the world, in New York harbor during the war. In this epic operation, Navy men and workers of the Merritt, Chapman & Scott Corporation plugged 6000 underwater openings in the vessel and raised her at a cost of \$3,750,000, only to find that it would be uneconomical to make the additional repairs required and she therefore saw no war service.

For the Normandie job, however, a school for Navy divers was established and some 250 officers and 1500 enlisted men obtained priceless experience that since has helped speed operations in

North Africa, France, Italy and the Pacific. This force and the 700 trained workers of the Merritt, Chapman & Scott Corporation, under contract to the Navy, have done most of the ship salvage of the war years under the direction of Commodore Sullivan and Captain Bernard E. Manseau.

Army engineers and other companies likewise have performed some notable feats. At Naha, Okinawa and many other places harbor clearance has been a joint operation, with the Army engineers clearing docks and the Navy taking care of channels and harbors.

The crack Army 1055th Engineer Port Construction and Repair Group was given the job of removing a small vessel blocking a berth at Isigny, France, needed for supplying Allied troops. The divers went down with cutting torches and underwater demolitions, cleared the hulk and brought it to the surface. To their surprise and horror, they found that the vessel was a German flak ship and their torches and explosives had been used next to a cargo of high explosive flak ammunition.

Other American salvage men had a similar narrow escape in clearing the harbor at Massawa, Eritrea, on the east coast of Africa. They were just beginning to work on the 8000-ton freighter *Liebenfels* when an Italian waiter, grateful for a package of cigarettes, revealed that she and most of the 26 scuttled ships were booby-trapped. The explosives were removed and work proceeded in the blazing tropical heat until the harbor was restored as a base for the forces turning back Rommel.

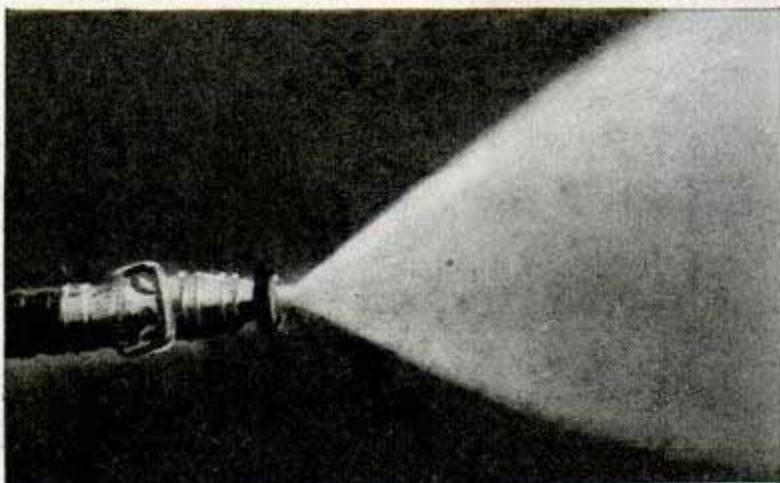
A notable British salvage job in the Middle East was the raising of the 31,000-ton battleship *Queen Elizabeth*. Two Italian sailors in a midget submarine penetrated Alexandria harbor and sank the big ship at her moorings by attaching a delayed action bomb to her hull. Preliminary repairs were

(Continued to page 236)



Salvage diver being helped into complicated deep-sea gear. Below, student divers attend class in recompression chamber





Four-Way Fire Fighter Throws Smoke Shield

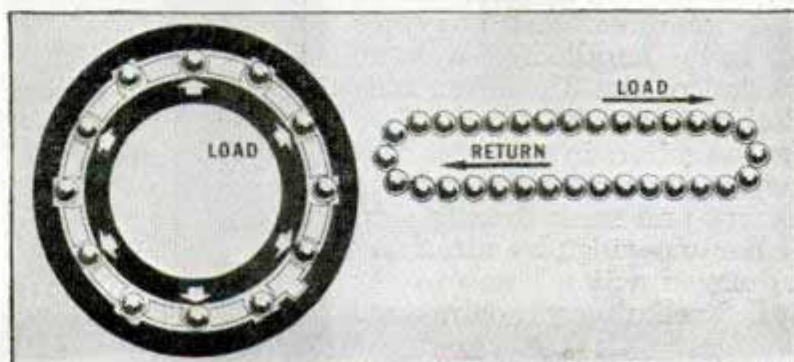
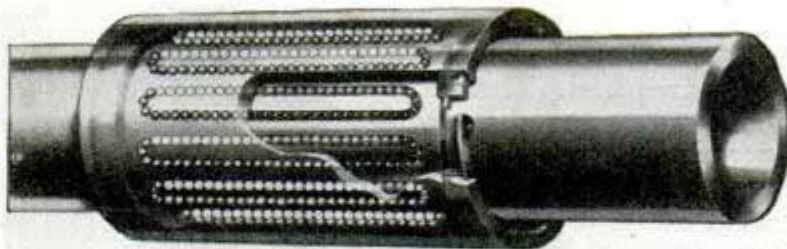
Firemen are protected from heat and smoke by a hose nozzle that forms a water curtain. The curtain drives the smoke ahead and permits the firemen to reach the main source of the fire quickly. In addition, the nozzle can be adjusted to give a solid stream combined with the water curtain. Further adjustment provides a water fog with only 90 pounds of pressure. The fog, which floats through the air and smothers the blaze, is emitted in the form of a ball which is said to be superior to the hollow-cone-shaped stream from conventional nozzles. The diameter of this ball of moisture can be varied from one to 30 feet. This nozzle produces four different types of spray, saving firemen the inconvenience of carrying a variety of tips.

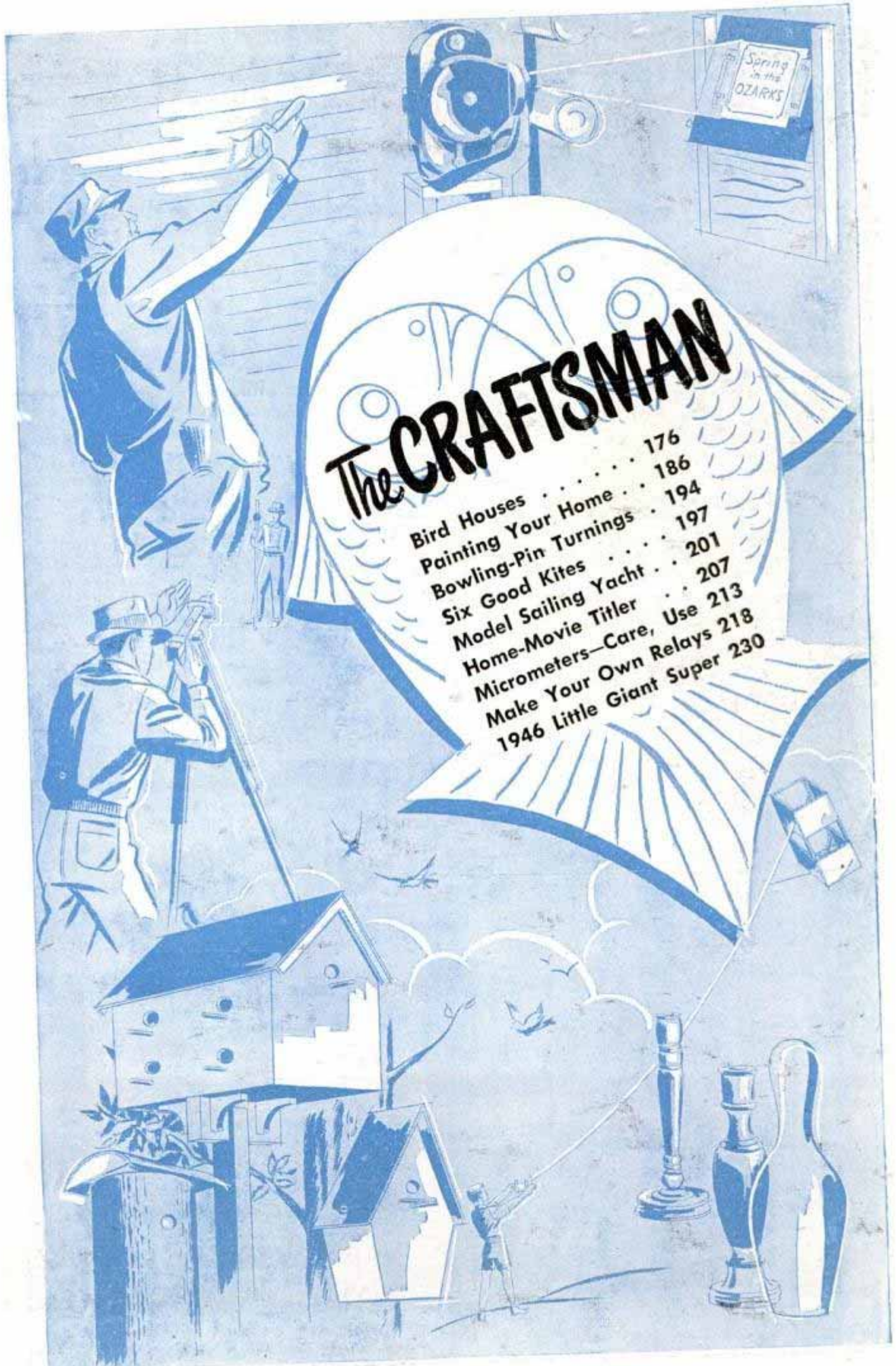
Fireman (top) demonstrates how the new nozzle combines a solid stream and water curtain. Solid stream only is shown in center and fog below

Some 441,000 officers and enlisted men of the Army Air Forces intend to seek jobs in aviation and 87,000 plan to buy personal planes, the AAF predicts from the results of questioning 1278 officers and 2215 enlisted men. The survey revealed also that approximately 62,000 officers wanted to remain in the service, but no interviewed enlisted men expressed such a desire.

Push-Pull Shaft Slides on Ball Bearings With Sealed-In Lubrication

Friction in push-pull reciprocating shafts is reduced to a minimum with a ball bearing bushing. The reciprocating member may be round or square and still gain the advantage ball bearings have long afforded rotating parts. The ball bushing contains a series of ball circuits. One side of the circuit carries the bearing load while the other side returns the balls in a clearance provided in the outer race member of the bushing. The continuous rolling contact and sealed-in lubrication give long life to the sliding parts. Ball bushings permit the use of smaller drive motors and otherwise reduce size and weight.

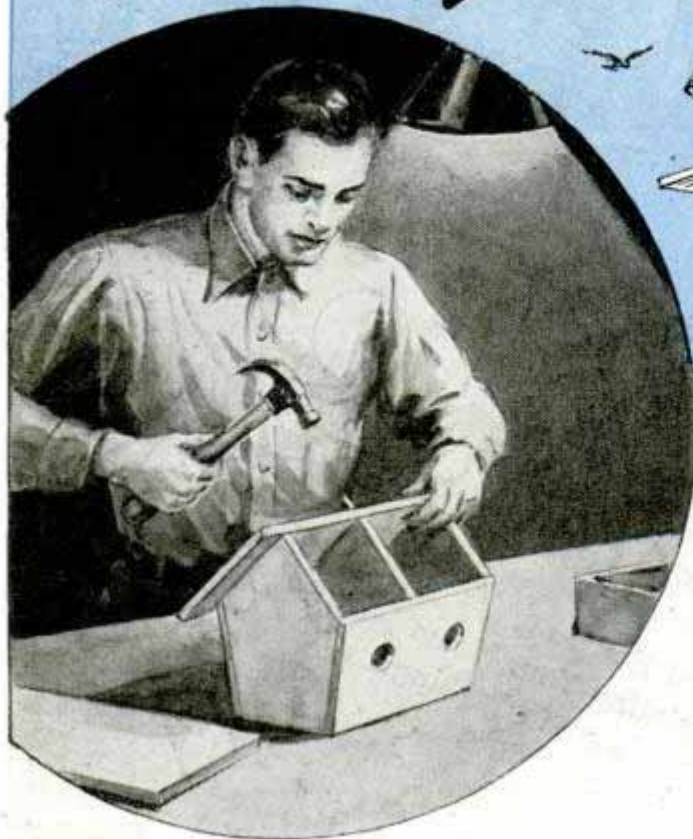




The CRAFTSMAN

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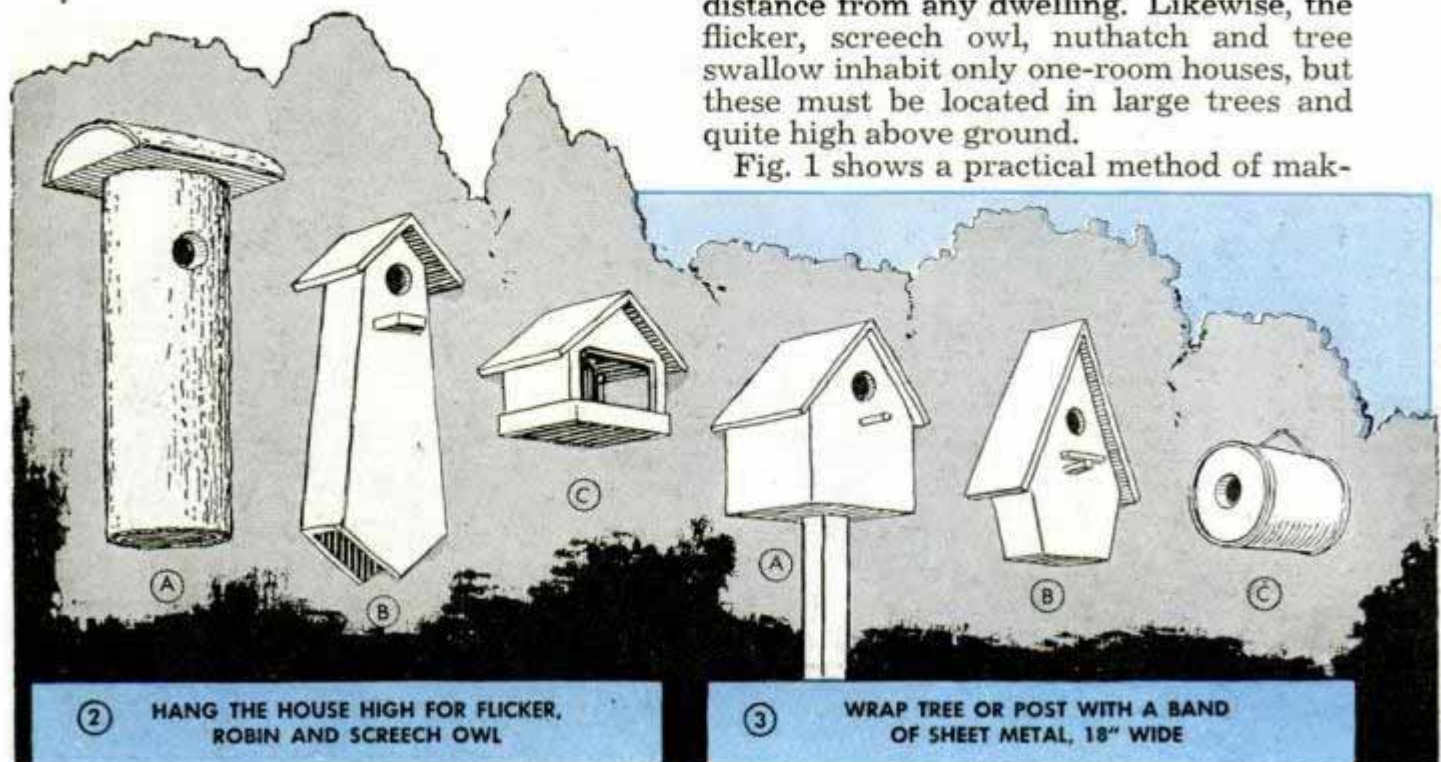
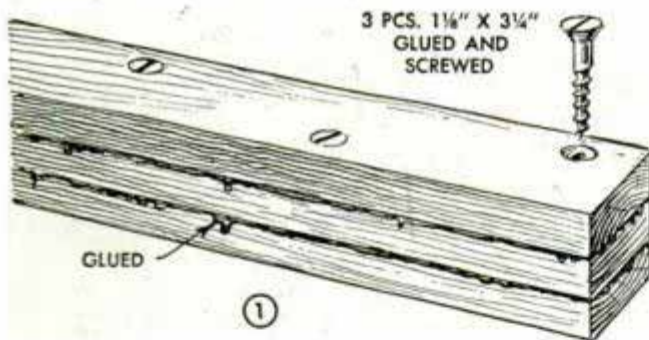
It's Time for the Birds Again...



Migratory house-nesting birds will soon return to your garden. Properly located homes encourage them to stay for the season

MANY of the house-nesters have decided preferences. They require houses located near sources of food and water and nest-building materials. Also, the house they are to occupy for the nesting season must be placed at the right height to give all possible protection from natural enemies and, at the same time, give the occupant a sense of the natural habitat. Of course, the rules are not hard-and-fast, but, as an example, the well-known purple martin, Fig. 4, feels more at home in a colony house placed on a high pole or post in the open, well away from tall trees and buildings where it has plenty of wing-room in all directions. The martin does not object to "across-the-hall" neighbors; in fact, it prefers to live in large colonies. By way of contrast in habit and preference, many of the other house-nesters will occupy only a single-room home, and most of them are more or less "choosy" about where the house is placed. For instance, the bluebird, like the martin, prefers its home in the open but will take only the one-room type, which must be near the ground and some distance from any dwelling. Likewise, the flicker, screech owl, nuthatch and tree swallow inhabit only one-room houses, but these must be located in large trees and quite high above ground.

Fig. 1 shows a practical method of mak-



② HANG THE HOUSE HIGH FOR FLICKER, ROBIN AND SCREECH OWL

③ WRAP TREE OR POST WITH A BAND OF SHEET METAL, 18" WIDE

ing a sturdy post or "pole" for mounting a large colony house. Laminated in this way the pole is much stronger and stiffer than any of solid wood of equivalent size, thus providing better resistance to the wind. It can, of course, be made in various sectional sizes suitable for supporting large or small houses. Detail C in Fig. 10 shows how the pole may be mounted so that the house can be lowered for cleaning or eviction of undesirable tenants. A short creosoted post is set in concrete to project from 2 to 3 ft. above ground, Figs. 7 and 10, depending on height and size of the pole. Then the latter is attached with a bolt and heavy door hinge. Another way of mounting both large and small houses is shown in details A and B, Fig. 10. Here a 3-ft. length of pipe is set in concrete; a number of 1/4-in. holes are drilled through the pipe and short lengths of iron rod inserted as shown. This helps to reinforce the concrete column. For these supports it's usually best to use a mixture of equal parts sharp sand and cement. This will give the strength necessary to prevent the column being broken by action of the frost during winter months. The diameter of the concrete column should be at least three times that of the post for small houses at lower heights. Larger houses mounted high will require a larger column of concrete to give adequate support. Be sure before mounting the house that the concrete is thoroughly cured.

Where the house is to be placed in or near trees the height above ground is as important as is the location of the house. Fig. 2, A, B and C, show the type of house suitable for flicker, screech owl and robin, respectively. All three should be placed on or near the trunk of the tree and fastened securely so that they do not sway. The robin "shelf," detail C in Fig. 2, is simply a shelter open on two sides as indicated. Fig. 3, A, B and C, show smaller homes suitable



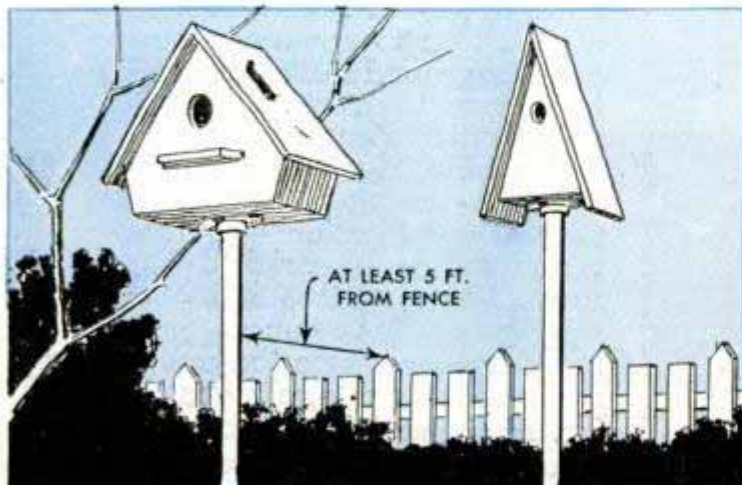
④ HOMES FOR THE PURPLE MARTINS SHOULD BE IN THE OPEN

⑤ BIRDHOUSE SPECIFICATIONS

Bird	Floor area in inches	Depth in inches	Diameter of entrance (ins.)	Height above ground (in ft.)
Bluebird	5 X 5	8	1½	6-10
Robin	6 X 8	8	(a)	8-15
Chickadee	4 X 4	8	1½	8-15
White Breasted Nuthatch	4 X 4	8-10	1¼	12-20
House Wren	4 X 4	6-10	¾	6-10
Tree Swallow	5 X 5	6	1½	10-15
Martin	6 X 6	6	2-2½	16-20
Red-Headed Woodpecker	6 X 6	10-12	2	12-20
Downy Woodpecker	4 X 4	8-10	1¼	10-20
Flicker	6 X 8	10-12	2¾	15-20
Screech Owl	8 X 8	12-15	3¼	20-25
Sparrow Hawk	6 X 8	12-15	2¾-3	20-25
Crested Flycatcher	6 X 6	10-12	2	12-20

(a) Two sides open

Note—Floor area and depth dimensions are only approximations

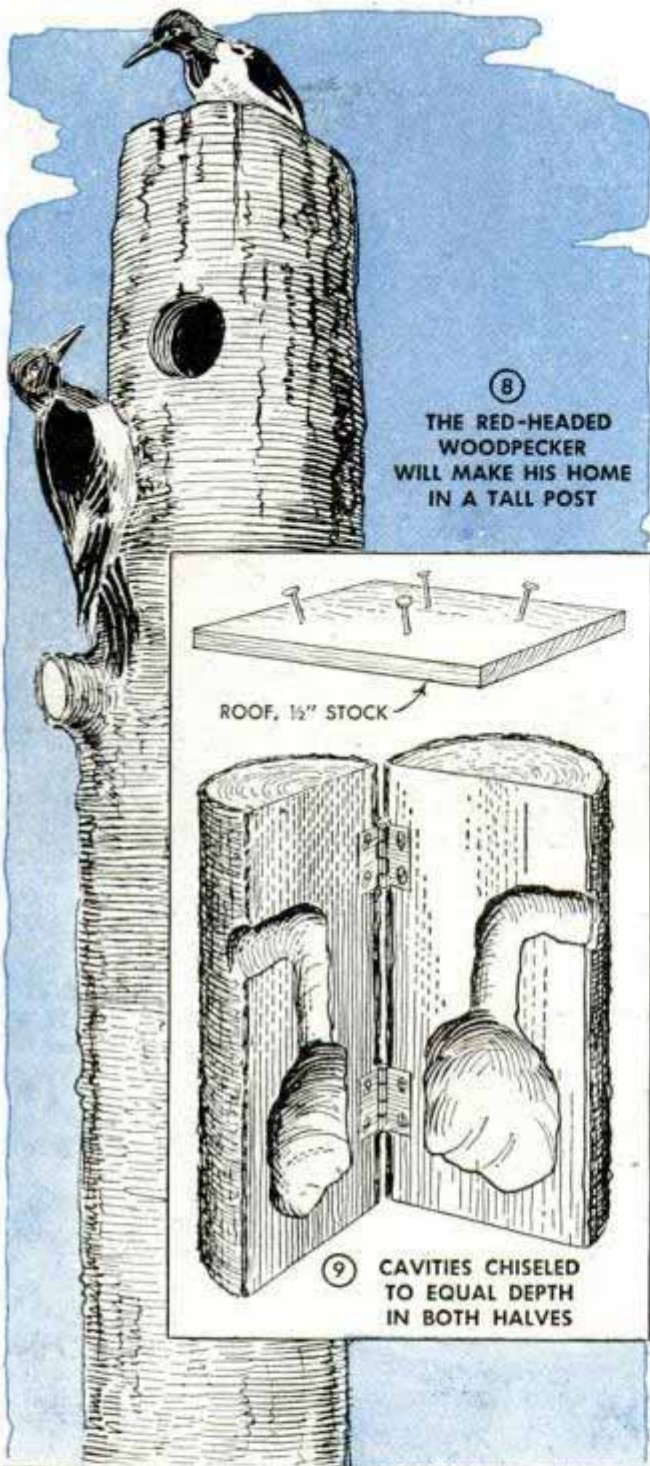


AT LEAST 5 FT. FROM FENCE

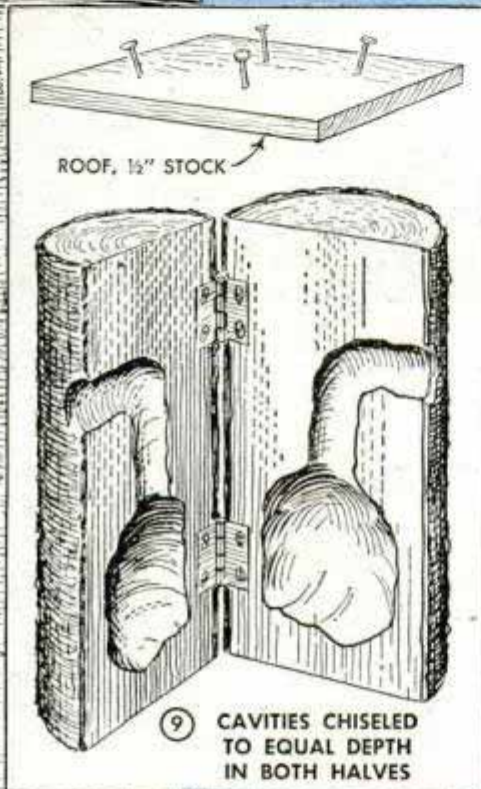
⑥ HOUSES NEAR SHRUBBERY OR FENCES SHOULD BE ON MOUNTINGS OF PIPE



⑦ USE LEAD-AND-OIL PAINT



8
THE RED-HEADED
WOODPECKER
WILL MAKE HIS HOME
IN A TALL POST



ROOF, 1/2" STOCK

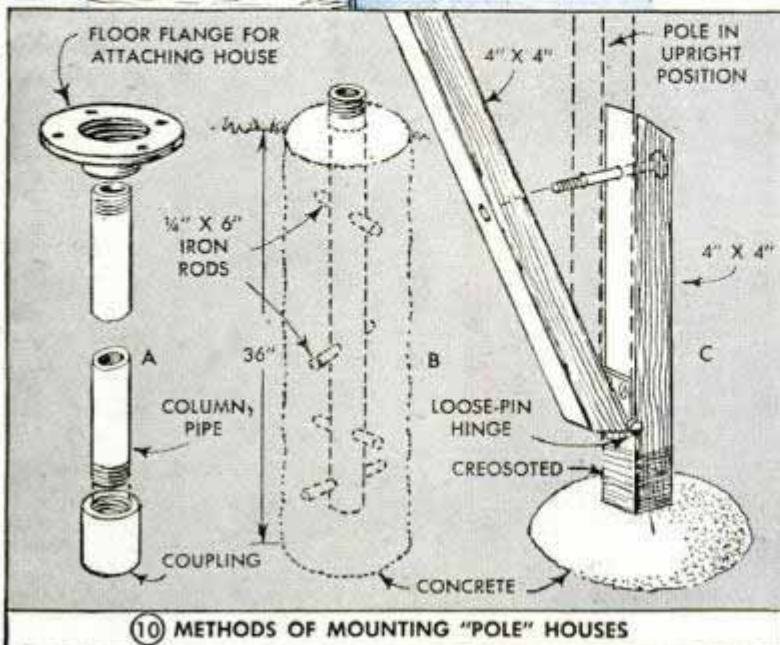
9
CAVITIES CHISELED
TO EQUAL DEPTH
IN BOTH HALVES

for bluebirds, chickadees and brown wrens. For bluebirds, the first, A, should be placed on a pole in the open but for house wrens and others the two shown at B and C may be hung from a low tree limb or attached directly to the trunk. Wrens will occupy houses placed on low poles or posts but they should be located near shrubbery. The simple home shown in Fig. 3, C, may be made by wrapping roll roofing around two wood disks of suitable size, or it can be made by fitting a wood disk in the open end of a tin can. House wrens especially will be attracted to such a home.

Figs. 8 and 9 show two ways of making homes for both the red-headed woodpecker and the downy woodpecker. The first, Fig. 8, is simply a tall post—the trunk of a dead tree about 8 in. in diameter is just the thing—set securely in the ground in the open. Before setting up the post you can cut out an 18-in. section at the top and hollow out the two parts with a gouge to make a compartment with a proper-sized hole leading to it, similar to that shown in Fig. 9. Replace the piece which was cut away and fasten securely with wire or screws. Fill the crack at the top with roofing cement. Fig. 9 shows another way of making a home for the smaller woodpeckers by splitting and hollowing a section of a small log. The halves then are hinged together as indicated and a board over the top keeps out the rain. No need to be particular about the exact size or shape of the hollowed compartment, as Mr. and Mrs. Woodpecker will fix this up to suit themselves. However, if you make the entrance hole the right size to begin with it will encourage the birds to become tenants.

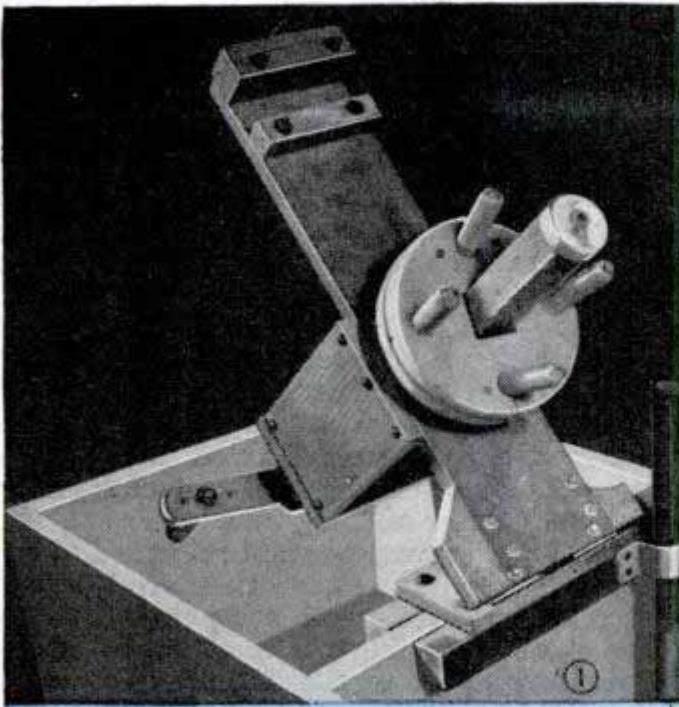
Bird homes placed low near fences or shrubbery should be mounted on posts made of pipe which gives protection against prowling cats, Fig. 6. Moreover, these mountings are exceptionally neat, thus adding an attractive feature to the yard, and are easily taken down in winter. If this is done, it's a good idea to screw a pipe cap over the ground section of the pipe to prevent the remaining section filling with water and dirt.

The table, Fig. 5, lists a number of house-nesting birds and gives general specifications for houses which should be provided for them. The variations in floor area refer generally to houses made of stock lumber where the compartment is nearly square or rectangular. However, in the rustic type of bird home, a close approximation is sufficient. Sizes given for the holes or openings always should be followed quite closely.

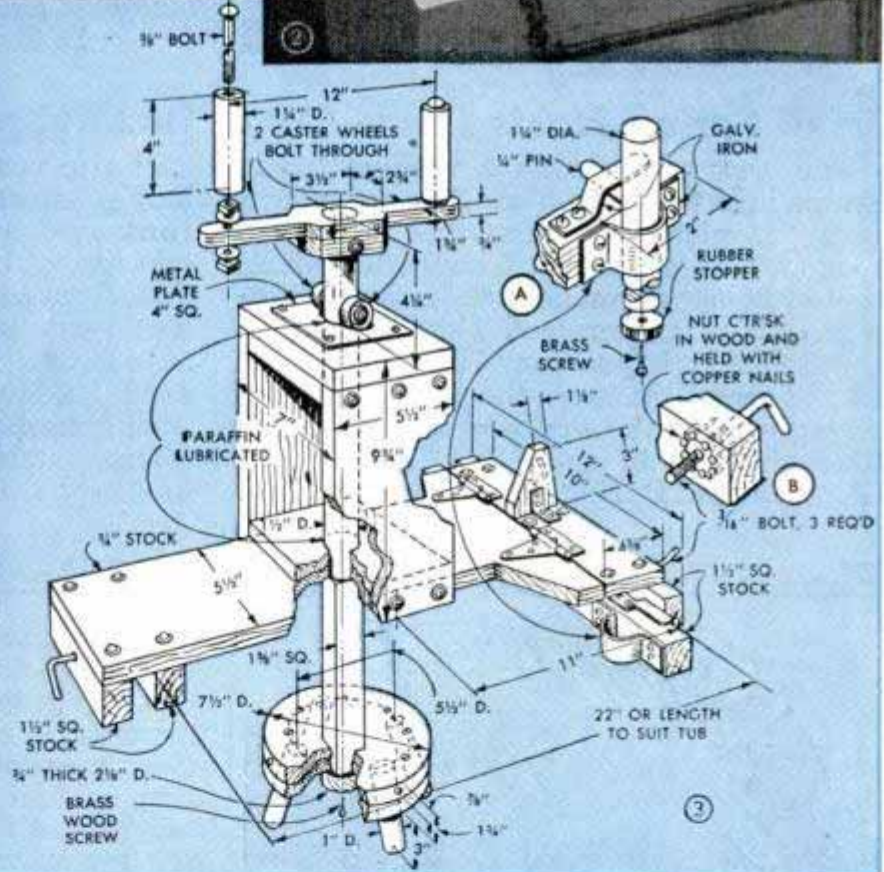


10 METHODS OF MOUNTING "POLE" HOUSES

Hand-Power Washer Replaces "Rubbing" Board



Where the facilities of a power washing machine are not available, this hand washer will fit over a laundry tub and enable you to do a washing without rubbing, and you can use water hot enough to assure clean clothes. The unit is light and compact for easy storage in a closet. One unusual feature of the washer is that the rubber stopper for the tub is fastened to a handle, detail A, Fig. 3, for easy removal from hot water. Fig. 1 shows the unit clamped in place with the agitator in the raised position and Fig. 2 shows the washer in use. In Fig. 3 and details A and B are given the construction dimensions, some of which are made to fit the tub on which the machine is used. Any light wood can be used and the hardware is standard. For a finish, several coats of shellac will protect the wood from the water. George W. Newton, Paxton, Ill.



"Plunged" House Plants Grow Better in Porous Clay Pots

Potted house plants will grow better in unpainted clay pots if they are "plunged" instead of standing exposed to air as is usually done. A "plunged" pot is one sunk to its brim in sand or peat moss that is kept moistened. The soil in the flower pot draws moisture through the porous clay. This simplifies watering and holds the moisture content of the soil at a more uniform level. Also, there is less danger that the soil will pack too firmly for the good of the plant,

and the plant food will not leach away with surplus water. Water moves even more rapidly through the clay walls than through the soil. In plunged pots, water moves outward if the peat moss or sand is dryer than the soil and inward if the soil is dryer. Pots that are exposed to air require more frequent watering. For plunging house plants it is necessary to have a watertight container, perhaps of sheet metal, in which to place the pots.

Sheet-Metal Strips Used for Casting Cement Flagstones



Artificial flagstones of any shape, size and color can be made by using a strip of thin sheet metal as a form, filling it with cement and troweling in colored oxides. The strip, which can be taken from a packing case or cut from light sheet stock, need be only about $\frac{3}{4}$ in. wide. When bent to shape, the strip is held by sheet-metal fingers on which weights are laid to keep the form flat on the work surface, as indicated in the detail. The mix, composed of cement and plaster sand, should be medium rich and not too wet. When poured, it is floated flush with the form. To use the oxides sparingly, they are sprinkled over the cement and trowelled in with a steel finishing trowel. After a "flagstone" has set, the strip may be removed and reformed to another shape. The stones then are laid and the intervening spaces are pointed with a mix of contrasting color. A space of approximately 1 in. between flagstones is recommended.

D. Curtis, Santa Monica, California

Small Spring Holds Bottle Cork

The cork which seals a vacuum bottle can be held firmly in place if an expansion spring is placed between the top of the cork and the metal cap. The spring, which should be approximately $\frac{5}{8}$ in. long by $\frac{1}{2}$ in. in diameter, is screwed into the top of the cork to hold it in position. When assembled in the usual manner, the tension of the spring against the inside of the cap holds the cork firmly in place.

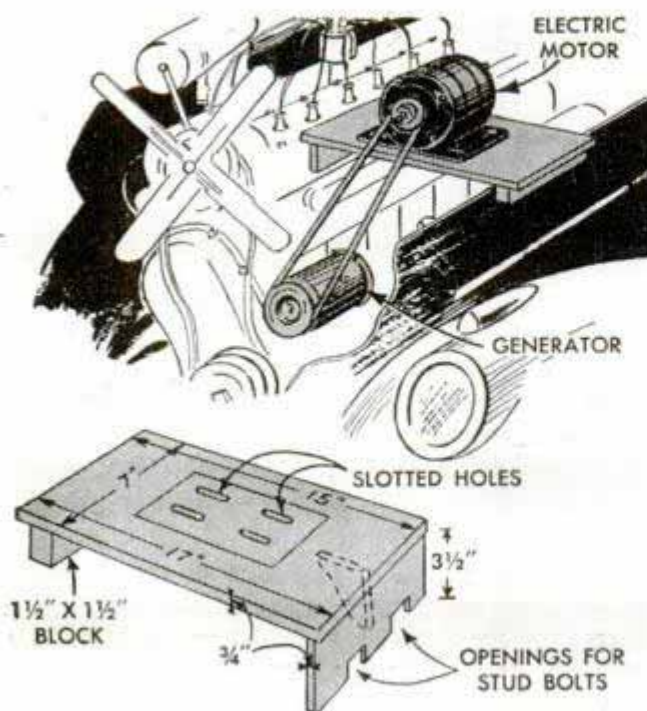
Frank D. Hammer, Altadena, Calif.

Bottle Cap Replaces Umbrella Tip

If the tip of a lady's umbrella is lost and a new one cannot be obtained, a plastic bottle cap may be substituted. The cap is held in place with household cement or some other colorless waterproof adhesive that will hold the tip on firmly.



Electric Motor Mounted on Board Recharges Auto Battery

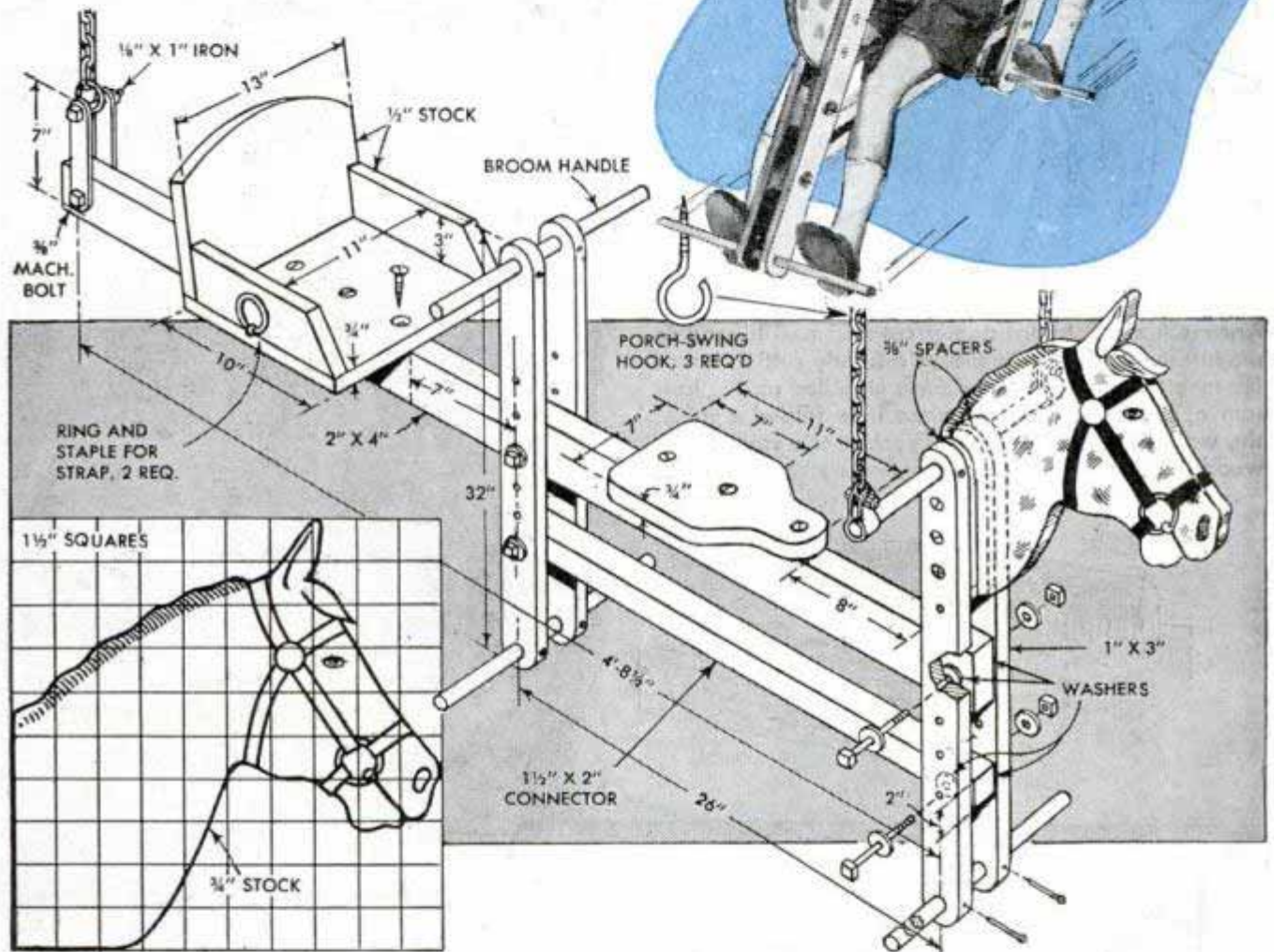
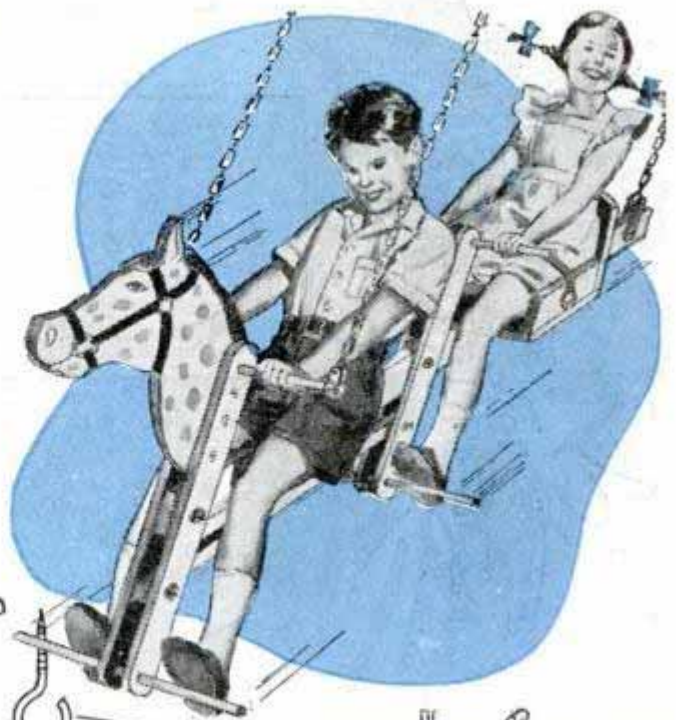


To keep an auto battery charged, a small electric motor belted to the car generator can be installed in a few minutes. The motor must rotate in the same direction as the generator, and is mounted on a board long enough to extend from the engine to one side of the hood. The board is slotted for motor mounting bolts and provided with end cleats high enough to keep it level when in use. It may be necessary to notch the end cleat resting on the engine block to fit over studs; however, installation will vary on cars of different design. To use the unit, remove the fan belt and slip the drive belt over the generator pulley to connect it to the motor. Correct tension is obtained by adjustment of the mounting bolts. In no case should the motor be used on automobiles not having current and voltage regulators unless the battery is watched closely for overcharging.

N. R. Bangert, Sacramento, Calif.

"Flying-Horse" Swing Has Novel Dual Controls

Suspended from the porch ceiling, a sturdy tree limb or, in winter, from floor joists in the basement play-room, this tandem swing will provide hours of safe fun for the children. It has controls and foot treadles so arranged that each rider has to do his share of the work. A special feature of the construction is the three-point suspension which helps to prevent the frame from tipping or swinging sidewise. Details show all the principal dimensions for a two-seated swing. Although any softwood can be used in the construction, the use of hardwoods, such as birch or oak, makes a more durable job that is easier to finish



Tips That Will Help in Washing and Cleaning Your Car

If you are inexperienced in washing and cleaning a car, the following tips will help you do a better job and also avoid trouble afterward. To keep water under pressure from entering the brakes, set them before washing the car. This presses the shoes tightly against the drums and helps prevent the linings from getting wet, which might cause a temporary faulty condition.

Also, it is a good idea to protect the ignition coil with a rubber sleeve made from an inner tube. If water gets on the spark plugs, distributor, etc., spray the damp parts with carbon tetrachloride, which will remove the moisture. Insects, tarnish and other stains can be removed from plated

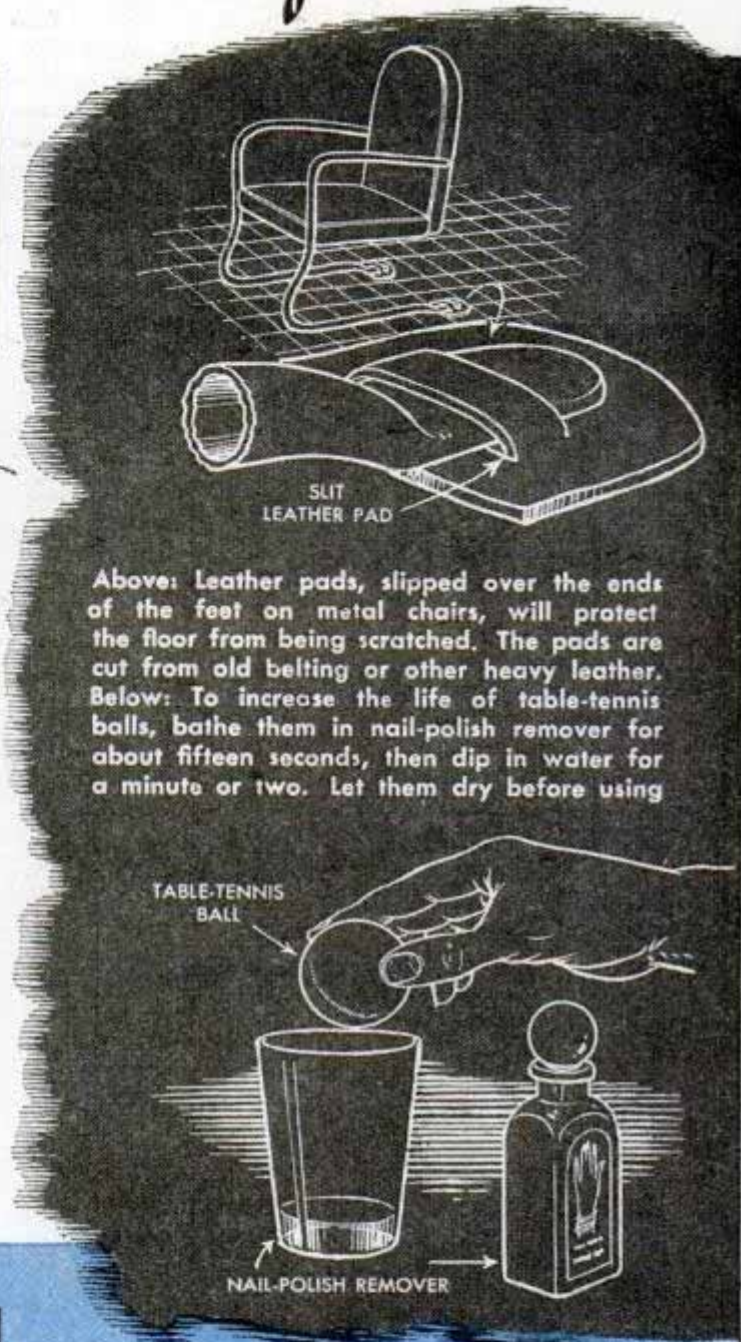
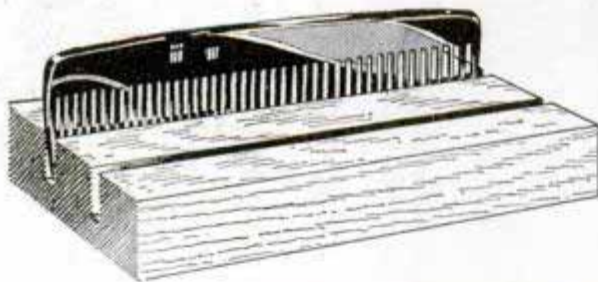
parts of the car by rubbing them with a compound used to cut lacquer finishes, which will leave a high polish. After the car has been washed, polish the plated parts with petroleum jelly. The thin film of jelly left on the metal protects it against moisture. If you have white-wall tires, they can be cleaned with lacquer thinner, which not only removes stains, but also light abrasion spots.

☐ After using polishing cloths, store them in an empty coffee can that has a tight lid. This prevents the polish from evaporating and also provides a place where the cloths may be kept out of sight.

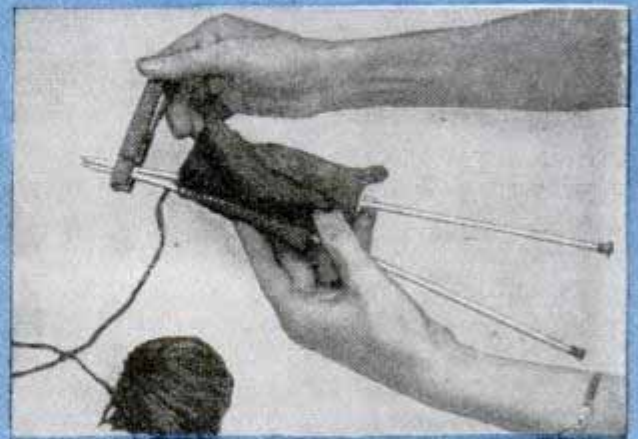
Solving HOME



Above: A small board neatly covered and hinged to the kitchen-cabinet base makes a handy cutting board for meats and cheeses. A design stenciled on the bottom of the board shows when it is folded against the wall. Below: The grooved rack, made from fancy wood, holds combs neatly and protects the fine teeth

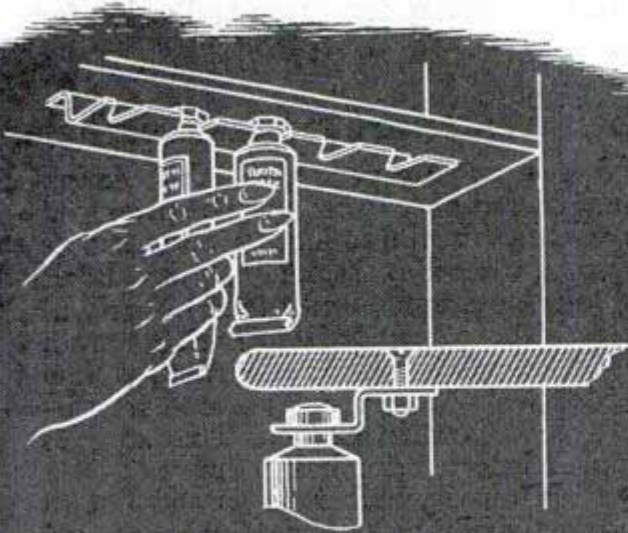


Above: Leather pads, slipped over the ends of the feet on metal chairs, will protect the floor from being scratched. The pads are cut from old belting or other heavy leather. Below: To increase the life of table-tennis balls, bathe them in nail-polish remover for about fifteen seconds, then dip in water for a minute or two. Let them dry before using

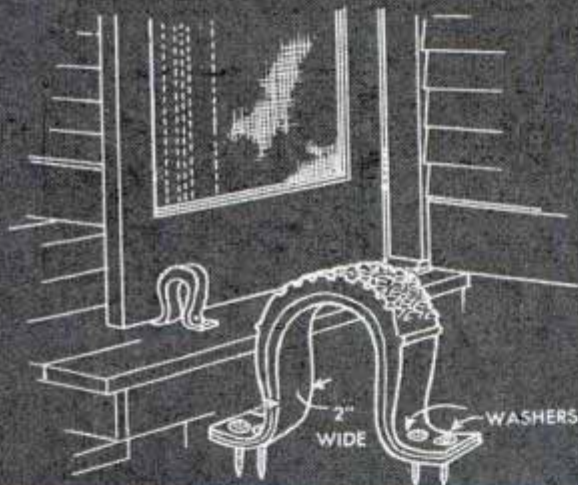


Left: Keep several bobby pins in your sewing basket and use them to prevent balls of crochet thread from unrolling. Each time you finish working, slip a pin over the loose end and over several adjacent threads. Right: If knitting must be put aside before a row is finished, clip a spring-type clothespin over the ends of the knitting needles. Then there is no danger of raveling. The clothespin is kept in the knitting bag

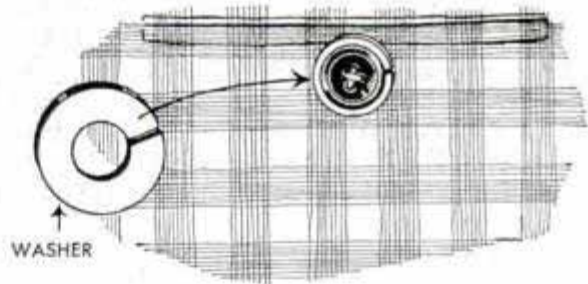
PROBLEMS



Above: Shaving cream and toothpaste tubes will not clutter the bathroom cabinet when they are suspended from this slotted rack. If the rack is made of aluminum, it will not rust. Below: One householder found that by cutting a rubber stop from an old tire and screwing it to the porch floor, he could prevent the door from banging during high winds



Above: When a mailbox is mounted on spring-steel brackets as illustrated, large envelopes, magazines and small packages are accommodated much more easily. Below: An oversize buttonhole on a hip pocket may cause loss of your billfold. A split washer slipped under the button will serve to "lock" the pocket



Left: Pencil erasers can be used for rubber stoppers in bottles containing volatile liquids that evaporate through cork stoppers. A small piece of dowel or wood section of pencil is inserted tightly in the eraser and cut off flush. Right: A wooden match dipped in ink is a good substitute for a pen when addressing packages. It will save using a fine pen point on coarse wrapping paper and the writing is bold and clear

Putty Knife Is an Efficient Tool When Removing Flooring

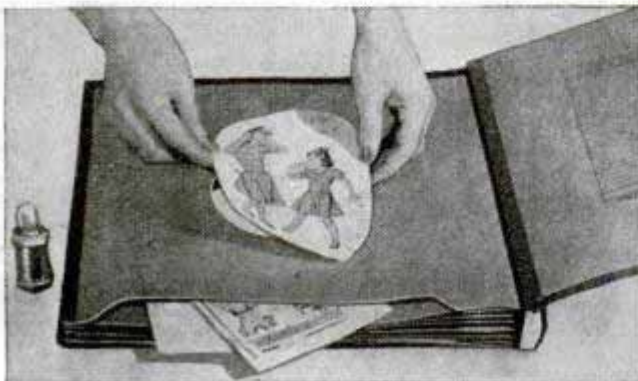


To get at piping or wiring concealed beneath tongue-and-groove flooring, a putty knife will aid in removing the floor boards. The blade is shortened about an inch and one edge is sharpened. To remove a section of flooring, locate the joists by tapping with a hammer and bore a hole at each one. Then saw across the boards, parallel with the joists, for the desired distance. The putty knife is inserted between the boards and used to cut the tongue off the flooring, permitting removal of the section. The flooring is replaced by nailing strips of wood to the joists and then nailing the section to these strips, as shown.

Joseph Roth, Chicago

Patterns Stored in Record Album

An old or discarded phonograph-record album will make an excellent file for keeping all the pieces of sewing patterns together for quick and ready reference. Slip the pieces of each pattern into a windowed compartment, then paste or cement a pic-



ture of the finished garment over the circular opening as illustrated, so that any pattern may be identified quickly. Nail polish can be used as a quick-drying adhesive for this purpose.

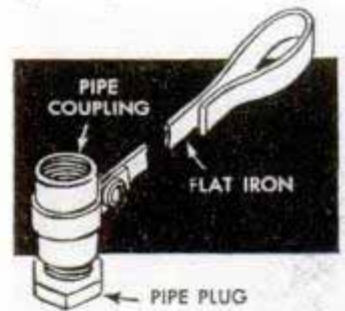
Paper Treated to Simulate Leather

Brown wrapping paper, which is tough and somewhat absorbent, may be prepared to resemble thin tinted leather and used as a covering over albums, lamp shades, book ends, picture frames and other household articles. The paper first is moistened in water, then splotches of red, green, yellow and blue water colors are painted irregularly over the entire surface. The paper is crumpled into a tight ball to squeeze out the water, after which it is spread flat to dry. When dry it will have a finely creased texture and an overall tint resembling leather. The paper is pasted over the object to be covered, then coated with clear shellac to protect it from wear.

Nathan Bogoch, Winnipeg, Man., Can.

Ladle for Solder Is Improvised From Pipe Coupling and Plug

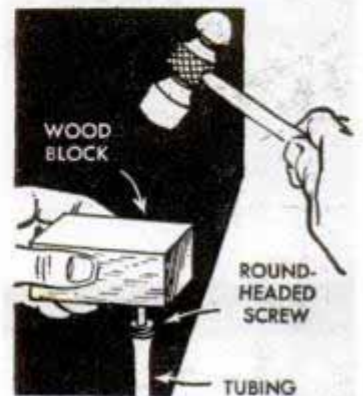
If you have no ladle for soldering wire connections when installing electric fixtures one can be improvised from a pipe coupling, plug and a length of flat iron; or you can use a nipple and cap to hold the solder. The iron is clamped around the coupling with a bolt and nut, the other end of the iron being formed into a hand grip. Then the plug is screwed into the coupling, which is filled with solder ready for use.



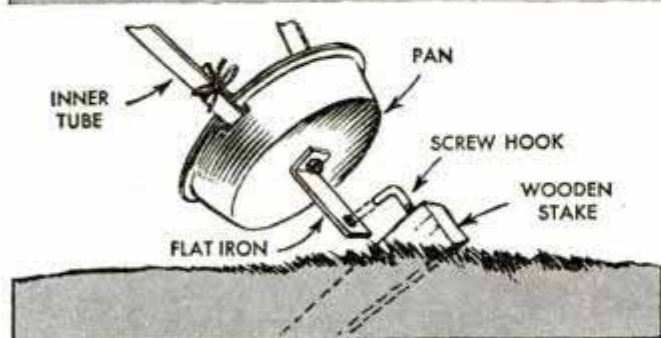
William Riederich, Elmhurst, Ill.

Roundhead Screw Flares Tubing

Roundhead screws can be used to flare copper tubing in an emergency if flaring tools are not available. Select a screw with a head of the desired diameter and drive it halfway into a block of wood. The head then is placed in the end of the tubing and the block is tapped with a hammer until the desired flare is obtained. —H. Klein, Pittsburgh, Pa.



Between-Seasons Practice With Your Shotgun



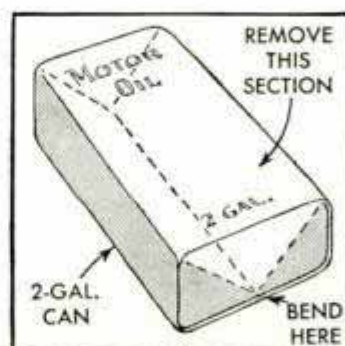
This simple "trap" throws tin cans, bottles and other small objects into the air in a high, curving flight. Getting away, the thrown object closely simulates the swift rise of a bird flushed in heavy cover, and in falling it presents an equally difficult target to the shotgun pointer—that of a live bird dropping steeply downhill. The sharp rise of the target teaches the beginner in shotgun handling the trick of swinging the gun muzzle above a rising bird, and shooting at the object as it falls is good practice in the knack of holding under a game bird dropping down from a height in a swift, curving flight. When two shooters alternate, one operating the trap, it's possible for the gunner to vary the angle of the shots by simply moving right or left or back to the range limit. The detail above shows

the construction of the trap, which is somewhat like a slingshot. Posts to which the rubber bands are attached should be spaced about 2 ft. The trap is released by pressing the iron catch off the end of the screw hook with the left foot. If you throw bottles or other glass objects locate the trap where the broken pieces will not injure anyone.

Double Feed Trough for Small Poultry Cut From Oil Can

A discarded oil can of about 2 gal. capacity will make a feed trough which is suitable for small poultry. With a pair of tin shears, cut and remove the prism-shaped portion which is shown unshaded. Then bend on the longitudinal center of the can to form the proper shape. Sharp edges of the trough can be turned for ease in handling. After completion, the trough should be painted so that it will not rust.

Ronald Eyrich, Milwaukee, Wis.

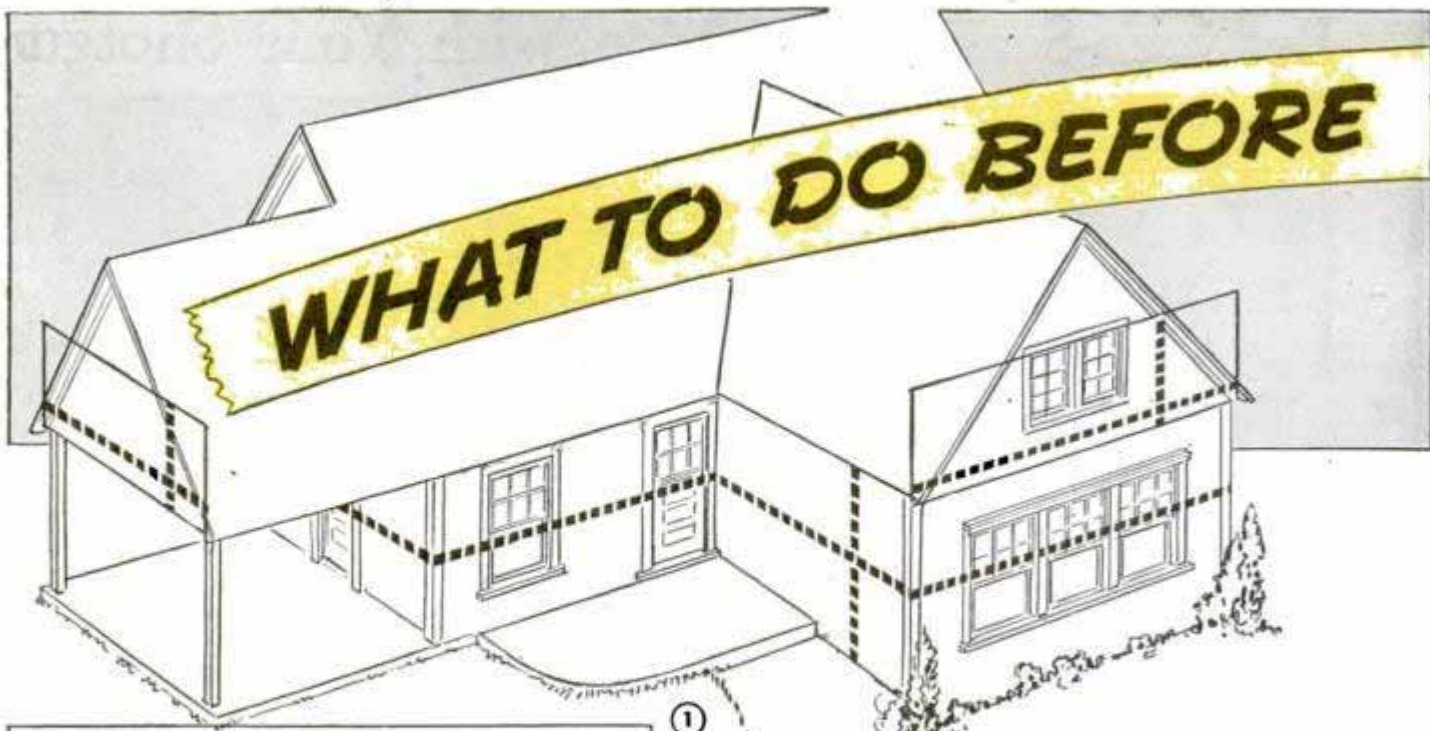


Paper Padding Preserves Oilcloth

When a kitchen table is to be covered with oilcloth, first place several layers of newspaper over the table. Then fold the paper over the ends of the table and tack the oilcloth over the paper. Oilcloth that has been put on in this manner will wear much longer.



WHAT TO DO BEFORE



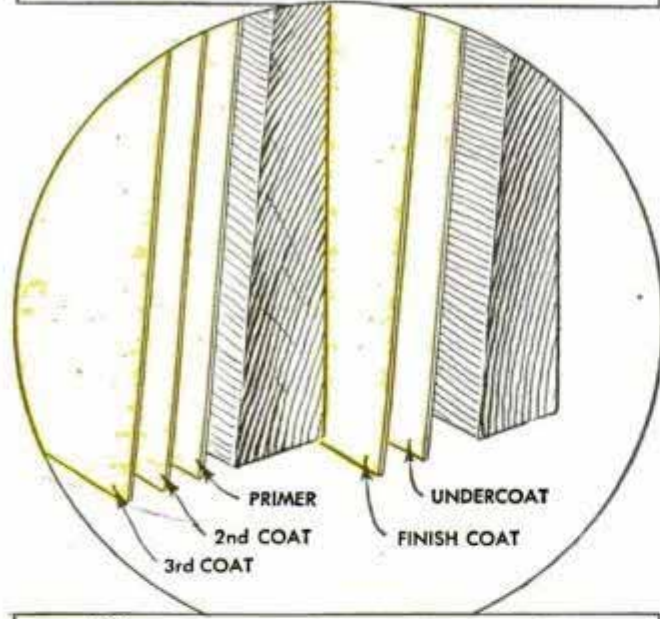
RULE FOR FINDING NUMBER OF GALLONS REQUIRED

Measure distance around house in lineal feet. Multiply by height to eaves. Divide by 600 where surface is in good condition—by 400 if surface is in poor condition. Measure width of gables and multiply by half the height

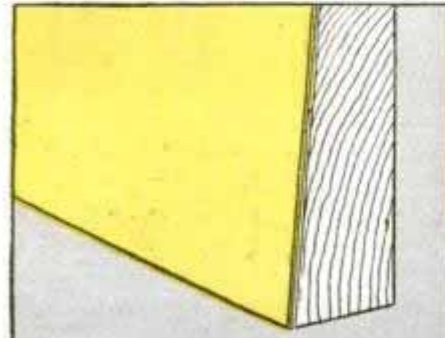
By W. Clyde Lamme

GOOD paint will stick to almost any surface—for a while. How long it stays on is something else, for in the matter of durability it's what's under the paint film that counts. In general, the appearance of a house is not always a reliable guide to the condition of the surface over which paint is to be applied. Rather, adhesion of the paint film, original quality and formula of the paint and the condition of the building structurally are usually the factors determining the amount of work it will take to get the surfaces in proper condition for repainting.

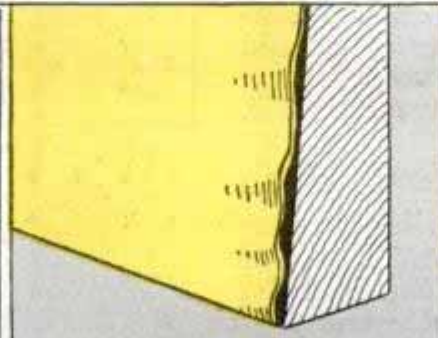
Old paint worn thin by slow chalking and weathering—both normal processes—may appear to be in poor condition. But because of tight adherence to the wood and a solid bond between what remains of previous coatings, it still will provide a good painting surface, Fig. 3. However, if the surface presents one or more of the defects shown in Figs. 4, 5, 10 and 11, which have been somewhat exaggerated for purposes of illustration, then the job of preparation



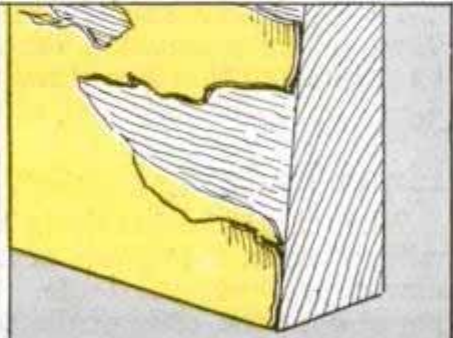
② TWO ACCEPTED METHODS OF PAINTING THE AVERAGE FRAME HOME



③ GOOD "OVER-PAINT" BASE



④ UNBROKEN FILM BUT WEATHERING



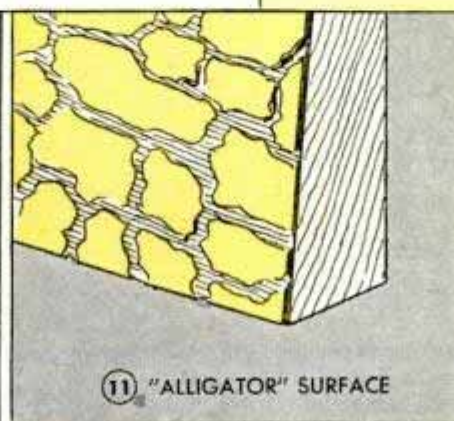
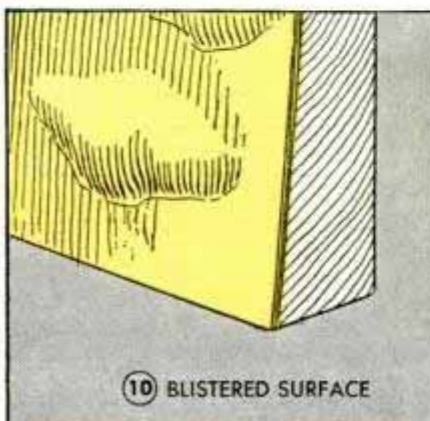
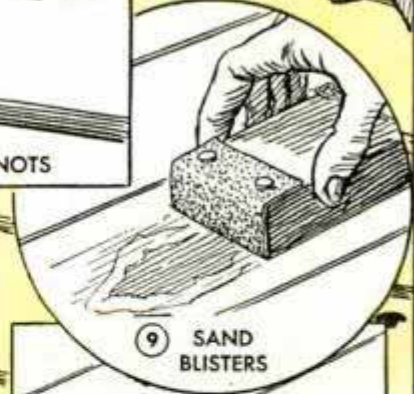
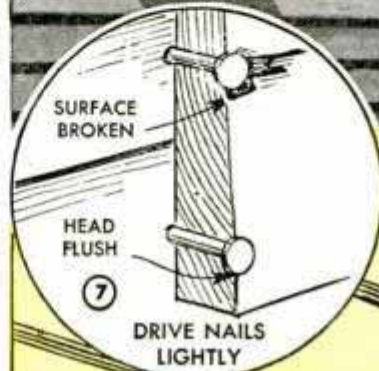
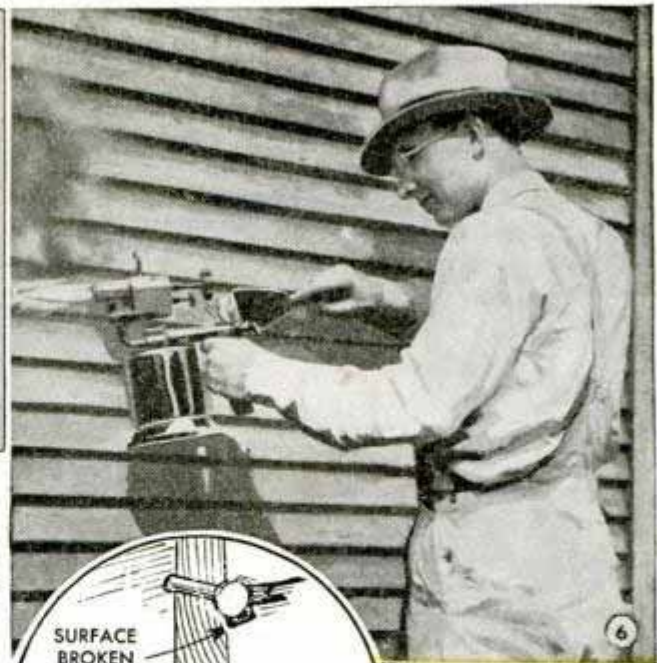
⑤ PEELING TO WOOD REMOVAL NECESSARY

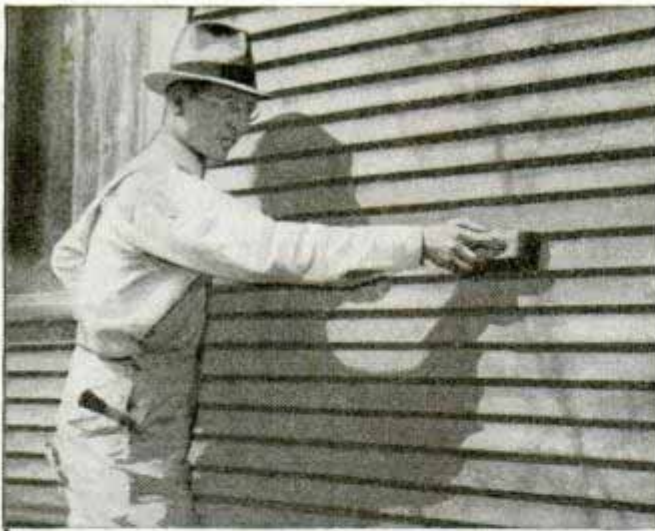
YOU PAINT

CAREFUL ATTENTION TO
SIMPLE PREPARATORY
DETAILS WILL ASSURE
A LASTING JOB

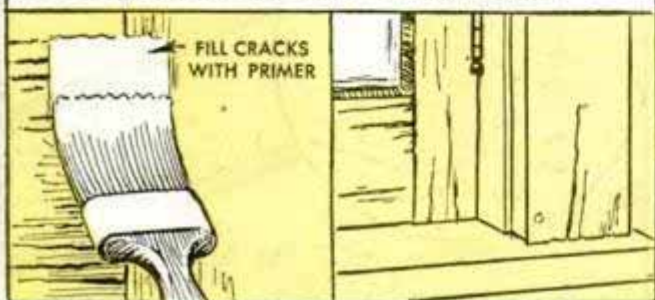
for repainting will be more extended. Scaling paint can be removed by scraping or wire-brushing, after which the surfaces are treated similar to new wood. But extensive blistering of the paint film and the peculiar "alligator," or "crackled-lacquer," surfaces less frequently seen are among the most difficult of all defects to remedy. In most cases complete removal is necessary, but if a blistered area is small a thorough scraping and sanding to level the paint film which still adheres sometimes will suffice. Paint remover in the paste form also is effective on small areas. Likewise, the prepared remover may be used in cleaning off small spaces presenting cracked, chipped or alligator surfaces. It also is especially effective in cleaning up turnings, newels and ornamental work which frequently adorns porches and cornices of very old houses. However, where the area is large, such as a side or gable end of the building, burning off the defective paint film to the wood with a blowtorch, Fig. 6, is considered the best practice. Unless you are accustomed to the work it's best to get experienced help for this job. In any case, it's essential that the siding be tight, that the flame be directed against the surface at an angle and slightly downward, and that the torch be moved continually to prevent charring the wood. Follow the flame with a scraper to remove the softened paint immediately. And always work with the torch on a quiet day—never when it's windy.

Fig. 2 illustrates two accepted methods

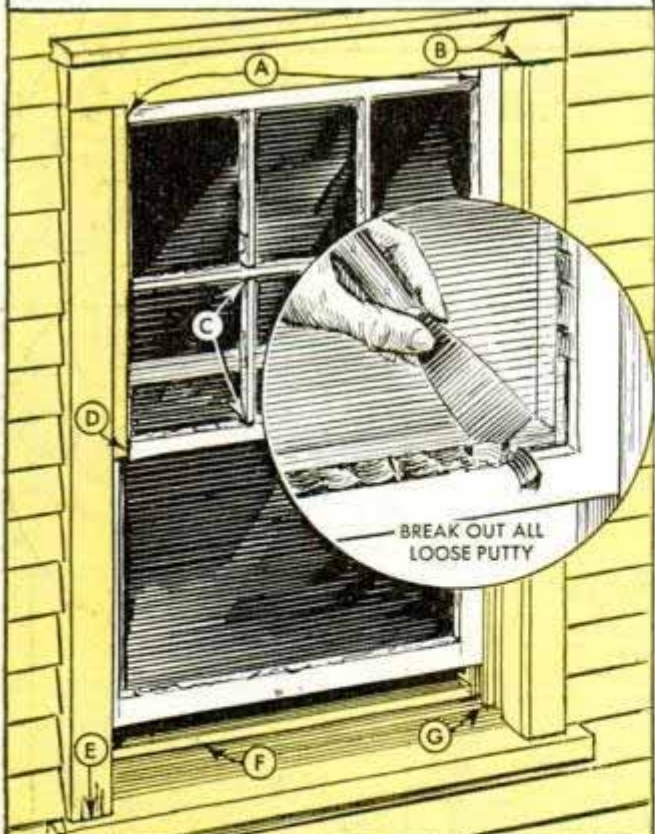




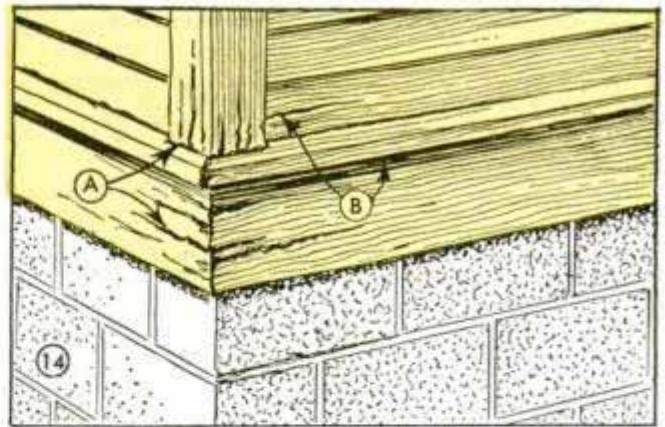
13 Siding should be thoroughly wire-brushed to remove all loose pigment. Follow wire-brushing with a light dusting immediately before applying fresh paint to the surface



15 End checks and cracks in trim boards, door stiles and rails, sash and window frames should be cleaned and coated with primer before filling with white-lead putty

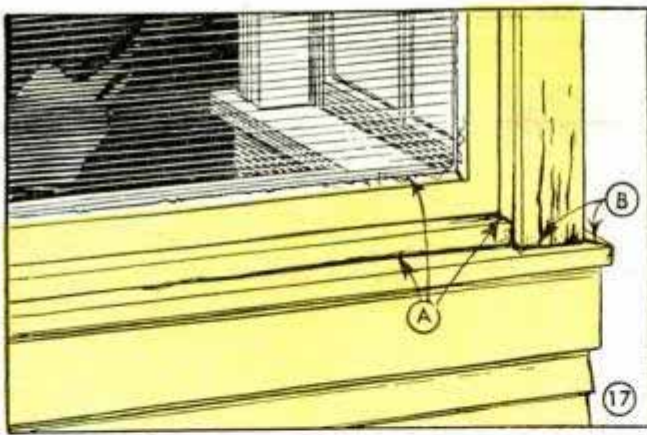


16 Reconditioning old sash and frames preparatory to painting involves breaking out all loose putty, priming and filling cracks and checks, and in some cases tightening up the sash frames by nailing loose rails to stiles



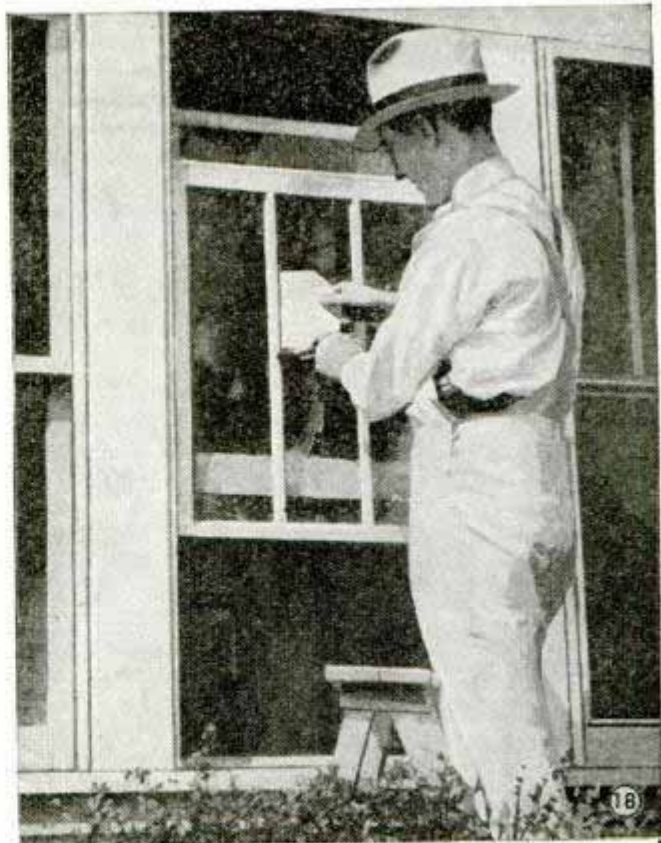
of painting the average frame home—two coats over a primer, or one finish coat over a prepared undercoater. If you paint at intervals of less than four or five years the latter method is sufficient. But if the painting schedule calls for renewal only once in five years or longer, the three-coat job usually is recommended. Preparation begins with an estimate of the amount of paint required for the job. Unless the surfaces are in unusually poor condition this can be calculated with fair accuracy by means of the simple procedure and formula shown in Fig. 1. Of course, in using the formula other factors should be taken into account. For example, where there are more than the ordinary number of windows or glass-paneled doors, it is safe to deduct the area of the glass. "Cut-up" gable construction and varying heights to the eaves also will affect the accuracy of the calculation.

Next, where the house is of frame construction, the siding comes in for a thorough going over. Often it will be necessary to renailed the siding, especially where it is exposed to weathering. Siding "cupped" outward between the studding calls for care in renailed. Use short, galvanized nails as these hold better when driven into the sheathing boards, and drill undersized pilot holes through the siding. Usually it's better to use two nails for each space between studs as in Fig. 7. Drive the heads flush, but do not sink them below the surface. After renailed go over all the siding, window frames, trim and cornices with a wire brush as in Fig. 13. This will remove any loose material that might flake off under the new coats of paint. It's a good idea to wear an approved respirator if you do much of this work. If any knots show through, sand off the paint and shellac as in Fig. 8. Some painters use spar varnish for this purpose. Any blistered spots where the paint chips off to the wood should be treated as in Figs. 9 and 12. Go over all sash and break out the loose putty as in the circular detail of Fig. 16. Conditions such as shown in Figs. 14, 15, 16, 17, 19 and 20 are quite common on the older houses. First clean the dirt out of all cracks and

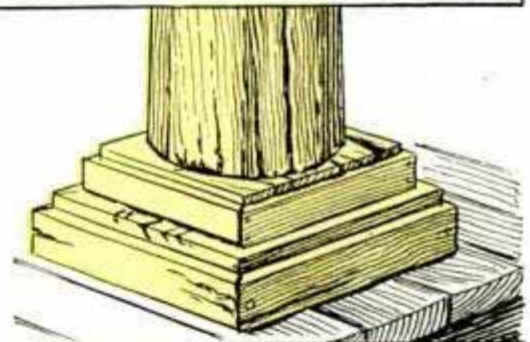


openings of the kind shown, then apply the first coat of primer as it comes from the container, without thinning. Brush at right angles to the cracks as in Fig. 15 to work the paint well into them. At the same time coat all bared spots on the sash where old putty has been removed as in Fig. 18. After this paint coating is thoroughly dry fill the cracks with a paste white-lead putty, using a regular glazier's putty only on the sash. Paste white lead as it comes in the container usually will serve, but if it should be too soft it may be brought to proper consistency by adding a small quantity of whiting. It's important to fill the cracks completely, otherwise the putty soon will loosen and drop out. At this stage some master painters remove all outside doors and prime-coat the bottom edges, first making sure that the doors close easily without sticking. When applying paint in the manner described it's essential to brush out all excess to a thin film so that it does not show through succeeding coats. Siding boards which are lapped at the corners frequently warp and split and the end grain weathers badly in time. No amount of paint will hide this unsightly defect. Treat these corners as shown in Fig. 20, first renailing if necessary. Siding boards mitered at the corners sometimes warp slightly and pull apart, opening the joint. Master painters often gently pry these joints open far enough to fill the space with white-lead putty. Then renailing will tighten the joints once more to a neat fit. In any of these preparatory jobs where white-lead or glazier's putty is used it is of the greatest importance that the putty be allowed to dry thoroughly before paint is applied over it.

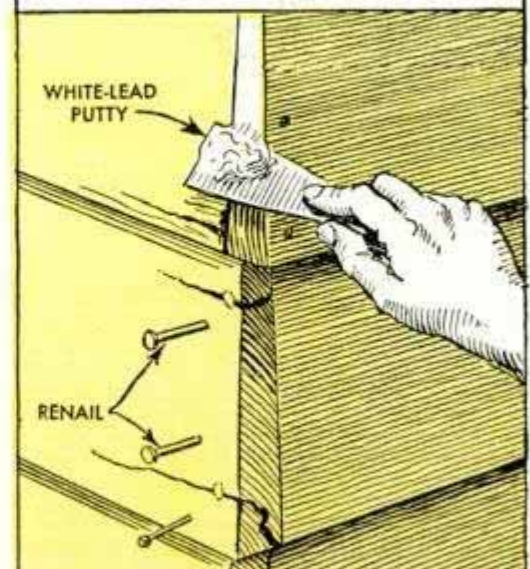
Fig. 16, details A to G inclusive, show the common defects one finds on old sash and window frames, particularly where intervals between paintings are longer than average. Frequently the lower rail will be loose, perhaps dropped partially at one or both ends due to opening of the joints and weight of the glass, as at D. In many cases this defect can be repaired by wedging the rail back into place and nailing through into the stile, using a single large finishing nail. Paint the cracks in the trim boards and fill with the lead putty as already described. Do the same with the sash frame where necessary, Fig. 17, A and B. Also, you may find small openings where the siding boards butt against the



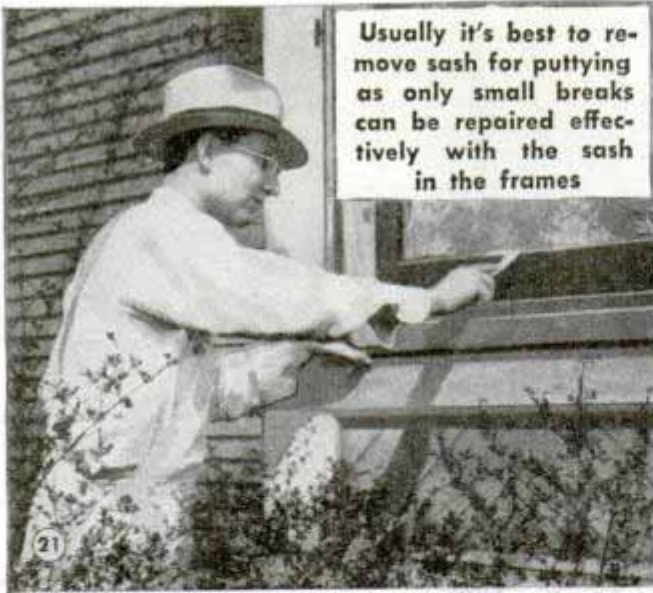
All spaces bared by removal of loose putty from sash should be coated with primer



Cracks in old porch columns must be filled with white-lead putty before painting



Coat the end grain of corner-lapped wide siding boards with white-lead putty and renail the corners if it is necessary to close wide cracks

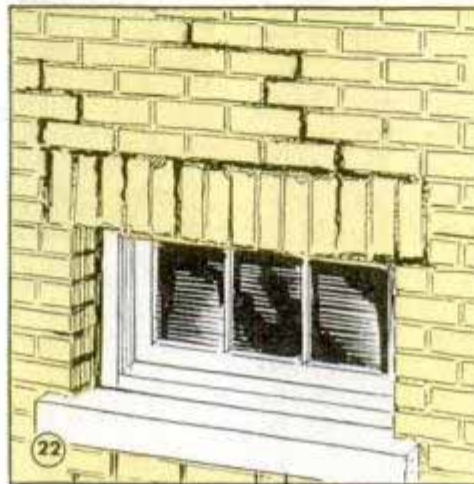


window frames or the corner boards, B in Fig. 14. Here's where the caulking gun comes in handy. Run a line of caulking compound into corner board and siding cracks and all around the window frames, also into the crack under the sill, as at A in Fig. 17. If the stops, G in Fig. 16, are loose, gently pry out the strip, prime-coat it and tap it back into place. Finally, putty the sash in the manner described, Fig. 21. In most cases, it is better to remove the sash from the frame for puttying, as it is easier to do the job properly with the sash flat and on a solid support. Smooth the putty into place with considerable pressure of the knife so that it will bond properly to both the wood and glass without any open spaces beneath. Open cracks usually will be found underneath boxed cornices, Fig. 27, and, although the wood is not subjected to weathering, the open cracks allow passage of cold air in winter and insects in summer. Fill with a caulking gun as indicated. If you find it necessary to seal the joint between a porch roof and the siding with roofing compound, Fig. 28, this should be done before painting. Such roofs should be flashed to the siding, of course, but in some instances it is easier to maintain the seal with roofing compound where flashing was not originally used.

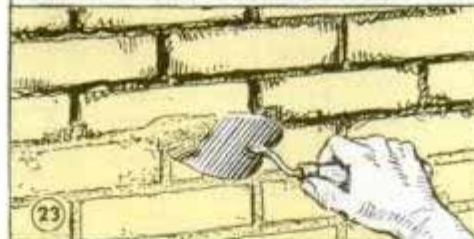
Figs. 22 and 23 show two common defects, due largely to natural causes, which must be remedied before painting brick walls. Caulking around window and door

frames of brick buildings is a regular practice and usually the caulking should run all around the frame, including sills and thresholds, Fig. 24. Frequently, rather fine, irregular cracks following the mortar joints will be seen in brick walls. Those shown in Fig. 22 are quite common and are generally due to settling. Usually caulking compound gunned into such cracks makes a suitable repair as it will remain semiplastic after drying and will not break out even though there be slight movement between the edges. It also effectively keeps out water and frost. However, if the crack is wider than $\frac{1}{4}$ in. the repair generally should be made by pointing up with mortar. Likewise, brick walls in rather bad condition,

Fig. 23, with brick faces eroded and mortar crumbled out of the joints, should be pointed before painting. Buildings and homes of ornamental brick seldom are painted, but homes of all other types of brick—common, soft, pressed and de-aired—often are made more attractive architecturally and more durable by painting. Either the so-called white-lead-and-oil paints or the water-soluble paints made especially for outside masonry can be used satisfactorily on brick. The oil paint dries with a slight gloss on brick in good condition while the water paints dry with a flat, nongloss surface. Either paint is especially effective in "dressing up" old homes of brick. Except for the hard-pressed and de-aired



Caulking will effectively seal small cracks in both brick and stonework



Brick walls in badly eroded condition should be pointed with mortar before painting



Window frames in old brick homes must be recaulked before painting. Be sure that the cracks are filled flush with the surface

types, brick is porous and absorbs paint faster than most kinds of unpainted wood. For this reason the coverage per gallon on brick painted for the first time generally is considerably less than on any bare wood.

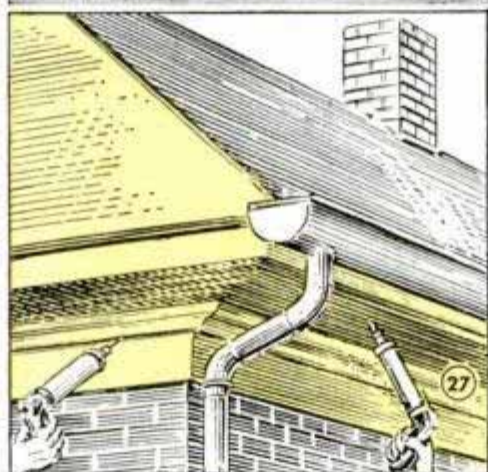
If the brick is in good condition and all common defects have been repaired as previously described, there need be little other preparatory work, except that on very old brick homes a light wire-brushing is helpful in removing dirt and loose sand. Sometimes there are discolorations beneath windows due to rusty screens, soot or dirt. Usually a thorough brushing with a handled wire brush will suffice. Discolorations due to other causes, such as mildew or "sweating" chimneys, should be treated with a zinc-sulphate solution or white asphaltum before painting. Follow the manufacturer's directions when applying any of these preparations.

Before painting brick with a water-soluble paint it generally is recommended that the wall be kept moist just ahead of the paint application. This can be done with a wheelbarrow sprayer, wetting only a small area at a time. A damp wall retards drying, making it possible to apply these fast-setting paints without brush marks or laps showing. On the other hand, when applying a lead-and-oil paint it is essential that the brick be thoroughly dry.

Two more points to think of before you paint



"Before" and "after" views show how painting changes appearance



Cracks around cornices usually are best filled with a caulking gun. Be sure to force sufficient compound into the opening so that the soft material will bond to the wood



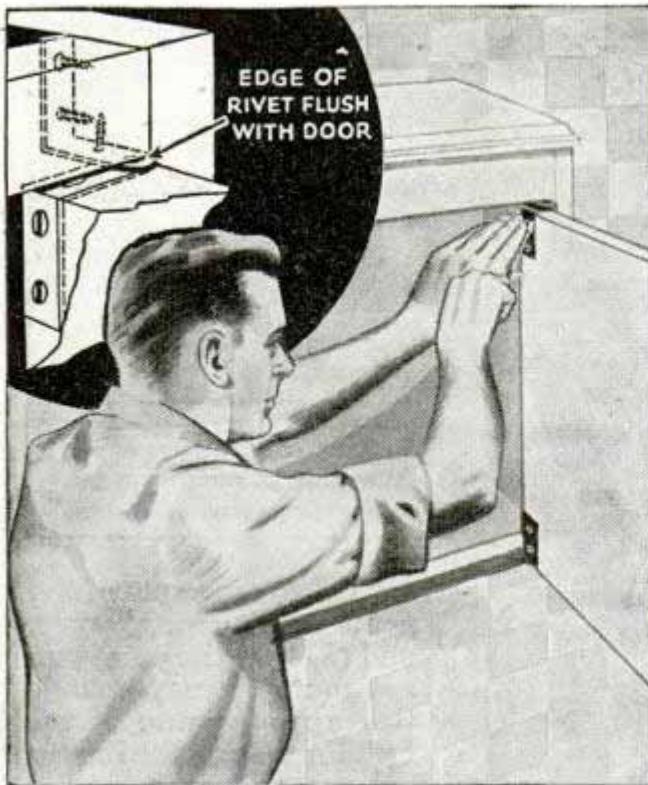
Joints between siding and roofs should be resealed with paste roofing compound before painting, or better, flashed to the siding if this was not done on the original work

are (1) the formula of the paint applied previously, and (2) how the paint you are to apply may change the appearance of the building. Using the lighter colors and white over a surface previously coated with a paint containing a tinting pigment of any of the so-called "earth" colors may under certain conditions cause "bleeding," that is, the darker color underneath may bleed through to the surface of the new paint, resulting in spotty discolorations. However, on old work in reasonably good condition where the previous paintings have been oxidized thoroughly, a good wire-brushing to remove all loose material down to the hard surface underneath and the use of

a prepared undercoater is sufficient precaution against the possibility of bleeding.

Figs. 25 and 26 are an example of how painting sometimes changes the appearance of an old house, of either brick or frame construction. Note in this instance how certain constructional details have been almost completely hidden by the paint job, while other features, particularly the size of the house, have been emphasized. Generally the lighter colors, including white especially, will tend to make the house appear larger in its setting. It's always well to bear in mind that painting can be used to accentuate or minimize certain details of a structure as well as to preserve its surface.

Brackets Make Concealed Hinges For Kitchen Cabinets

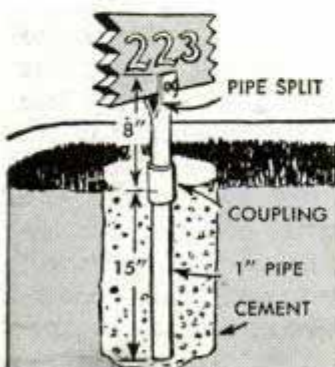


Hinges for kitchen cabinets are made easily with small right-angle brackets, and they have the advantage of being concealed. It may be that the brackets you get will have to be drilled and countersunk if they are not provided with holes of the right size and number to take two screws in one leg and a screw and a rivet in the other. If brackets are not available, they can be formed from strips of sheet metal and then drilled. After this has been done, place the brackets as indicated to form a hinge. Then rivet them together through the outer holes and round the corners of the ends. The hinges are fastened to the back of the door and inside the front of the cabinet with flathead wood screws.

House Number on Pipe Standard Removed When Mowing Grass

Two lengths of 1-in. pipe joined by a coupling will support a house number on the front lawn where it will be seen easily, and will allow it to be removed when the

grass is mowed. Split an 8-in. length of pipe at one end with a hacksaw and spread it to fit over the number, which then is bolted to it. The other length of pipe, which carries the coupling, is set in cement so that the



coupling is flush with the ground surface. The sign should be at right angles to the house to be visible from the street.

Pen-and-Ink Drawing From Photo Resembles Etching

You can make a pen-and-ink drawing from a photograph by inking in the image with waterproof ink and then bleaching out the photographic image. To do this, thumb-tack the photoprint to a drawing board and, with a fine pen and India ink, trace the lines and then work in the shading and texture. When the ink is dry, soak the print in water, then bleach out the photographic image by immersing the print in a solution made by mixing resublimed iodine, 1 teaspoonful, in water, 16 oz., and adding potassium iodide, 1 teaspoonful. These chemicals are available at photo supply houses. Or you can use tincture of iodine, 1 part, in water, 5 parts, leaving the print in the solution for about 5 min., after which only the pen-and-ink lines will remain. The lighter the print, the sooner it will become bleached. The chemicals will stain the print a deep brown, but if you wash it in water and place it in

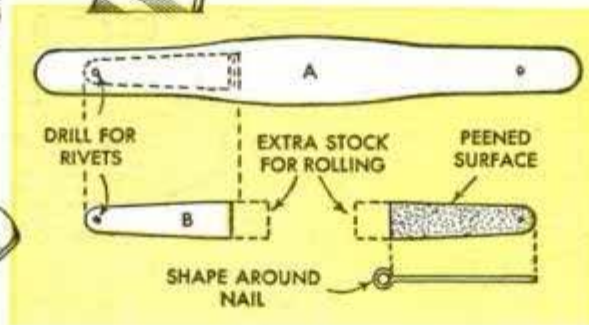
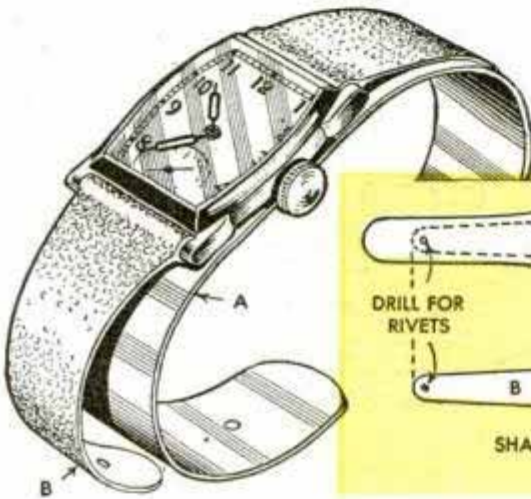


a hypo fixing bath, the discoloration will disappear. The picture now should be washed in clear water to remove the hypo, after which it is dried.

Chalk Paste Removes Grease

To remove a grease spot from wallpaper, French chalk is mixed with dry-cleaning fluid to the consistency of a thick paste and applied to the spot. After remaining overnight, it then is brushed off carefully. The process can be repeated if the spot is still visible. — Joseph Greene Cleveland, Minneapolis, Minn.

Hammered-Metal Wrist Band Holds Your Watch

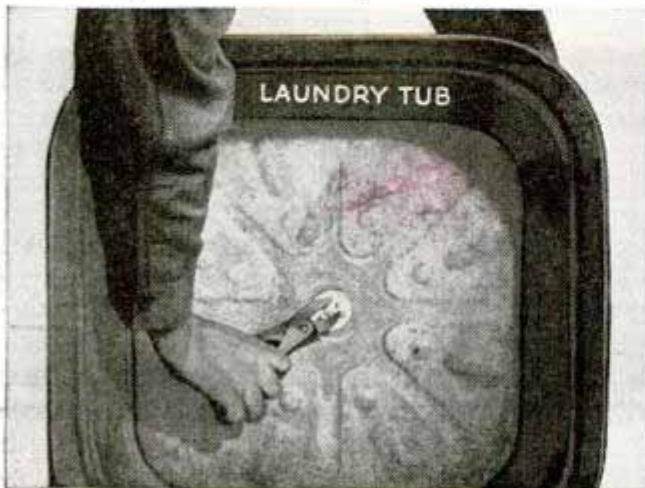


You can make this attractive watch band from 24-ga. stainless steel, half-hard aluminum or spring brass. First cut a paper pattern to a shape similar to that shown in detail A above. Use this pattern and measure your wrist to determine the size and length of the band desired. Cut the band to outline from the sheet metal and bend over an oval form of wood, hammering the

metal to shape with a small rawhide mallet. Smooth and round the edges with fine emery cloth and polish the band with fine steel wool. The secondary bands or "keepers," detail B, which fasten to the watch are cut to the shape indicated and then are peened lightly on one surface. Bend an eye in one end of each and determine the location of the rivet holes with the watch and keepers in position. Drill the holes and rivet the keepers in place, then lightly peen the rivets also. This type band holds the watch securely and is perspiration proof.

Pfc. Stanley J. Drazek, Tyndall Field, Fla.

Damaged Laundry Tubs Can Be Converted Into Useful Containers

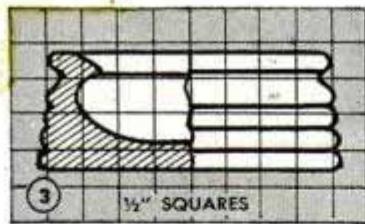
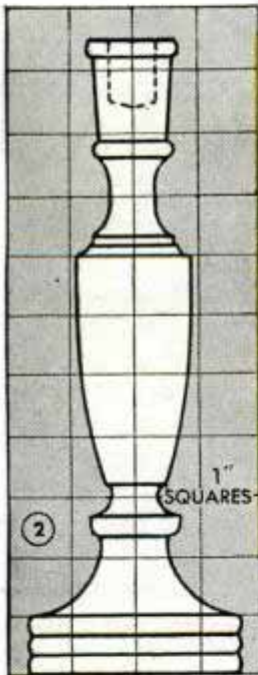


Laundry tubs having hose connections that are broken can be converted to other uses by removing the connection and stopping the opening. The original hose attachment is removed and the hole is plugged with a metal patch of the type used by electricians for closing knockouts in outlet and fuse boxes. A gasket should be inserted between the patches to prevent leakage.

H. Leeper, Canton, Ohio

☞ Since warm furniture polish penetrates wood pores faster, you can do a more efficient polishing job by first warming the bottle of polish in hot water.

DISCARDED Make Attractive



Photos courtesy Chicago Servicemen's Center

MADE from the highest grade seasoned hard maple, discarded bowling pins are an excellent source of material for wood turnings. In the average bowling alley the life of the pins is only a couple of months or so. Of course, this may vary somewhat, depending on the activity of the alleys, but in all cases the pins must be replaced at regular intervals. Usually, the owner of your local alley will be glad to give you the discarded pins.

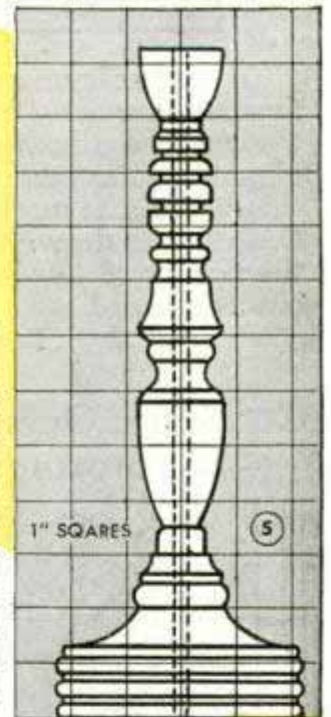
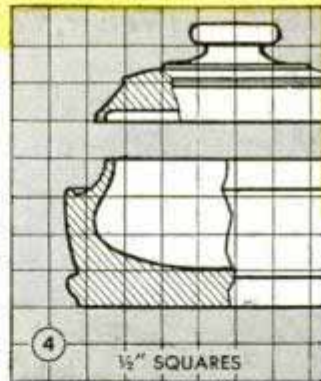
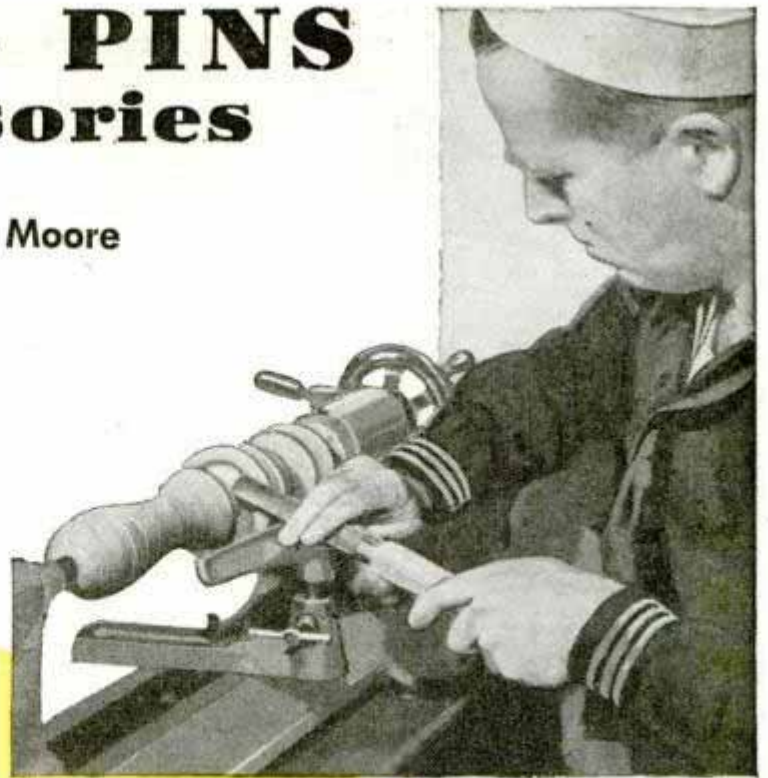
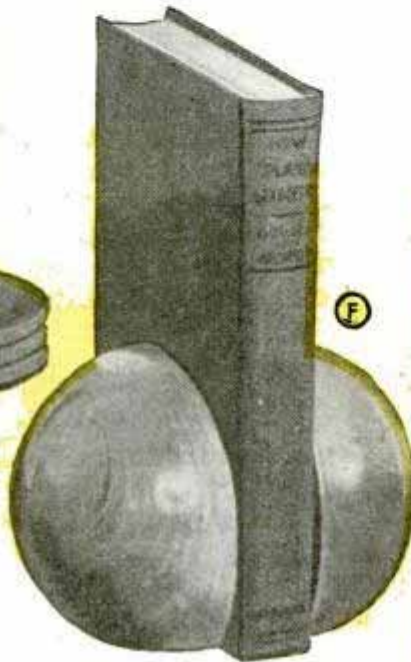
Their size and shape make them especially suitable for a variety of useful and attractive articles, such as those shown in Fig. 1, photos A to G inclusive. In addition to these there are a number of other practical accessories which can be made from the discarded pins, among them being large

buttons, wheels for small wagons or shopping carts, knife handles, coasters, etc. Standard pins have an overall height of $14\frac{3}{4}$ in. but most of them have a tapering hole at the bottom about $1\frac{5}{8}$ in. deep. For most uses the hole must be cut away, so the net height for all practical purposes is approximately $13\frac{1}{8}$ in. The largest diameter usually is $4\frac{3}{4}$ in. and the smallest diameter is about $1\frac{1}{2}$ in. Thus the range of single turnings or one-piece articles to be made from pins is limited by these dimensions, although articles of larger size, such as the blotter, Fig. 1, B, can be produced by cutting two pieces from a single pin. Being made originally from selected stock, the condition of used pins generally permits working close to the overall size, but occasionally there will be one with splits, checks or other damage due to severe usage. This defect will prevent it from being used for any turning that requires a full dimension near to the overall diameter of the pin. All old pins should be examined carefully to make sure that splits, checks or other defects do not go so deep as to spoil the work being planned. Some pins with only minor defects, especially those from which turnings are to be made, can be repaired with colored stick shellac or "wood-turner's ce-

BOWLING PINS

Home Accessories

By E. N. Moore



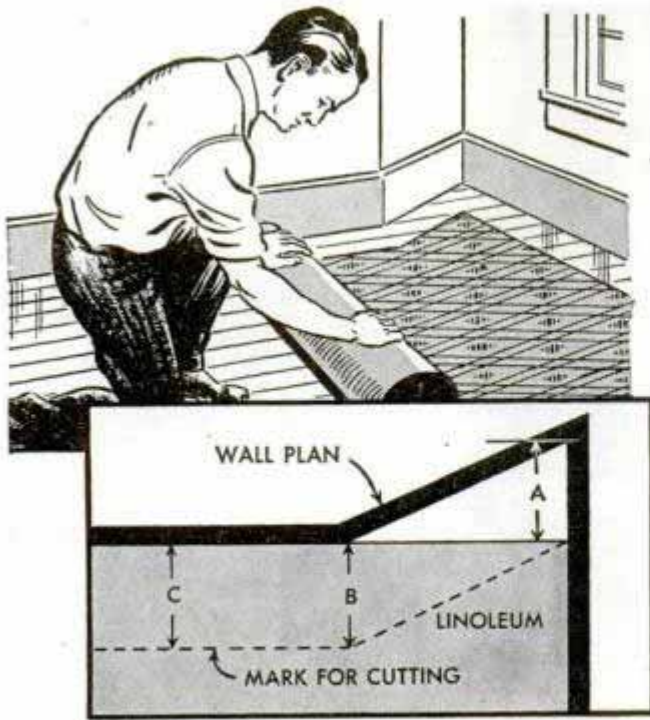
ment." Melt it into narrow checks, cracks, or deep dents with a soldering iron heated to low temperature.

Among the most popular and attractive articles that can be made from bowling pins are candleholders and lamp bases, Figs. 1, 2 and 5. In making either of these the first step is to mount the work in the lathe and turn to the style desired. Next you sandpaper to a glass-smooth finish, using progressively finer grades of sandpaper. Run the lathe at a moderate speed for sanding. Then apply linseed oil and a paste wood filler, or, if it is desirable to darken the wood, mix a stain with filler and omit the oil. In any case, allow the filler to dry thoroughly, then sandpaper again lightly to remove the surplus. Finish with several coats of paste wax. Polish the wax with a folded piece of cheesecloth or muslin, and run the lathe at a comparatively slow speed for polishing.

Drilling holes for the lamp cord and candle socket comes next. A candleholder should have a hole at the top approximately $\frac{3}{4}$ in. in diameter and $\frac{3}{4}$ in. deep. Use a $\frac{5}{16}$ -in. drill to make the hole for the lamp cord. Drilling usually can be done from both ends, that is, halfway in from the top and then finishing from the bottom.

Powder and jewel boxes and ash trays, A and G in Fig. 1, are easy to turn from the large portions of the pins. Figs. 3 and 4 give the cross-hatched patterns. One of the simplest of all the projects, the semicircular book ends, F in Fig. 1, can be turned first to the spherical form and then cut in half with a parting tool while in the lathe. Finish the sphere before cutting into halves, using filler, or filler and stain, and wax. Sand a flat on each and if necessary weight with lead. As a finishing touch, glue soft leather, flannel or felt to the bottom of the bases of candleholders, lamp bases, book ends, ash trays, etc. Line jewel boxes with velvet or other suitable fabric carefully glued in place so that it is free of wrinkles.

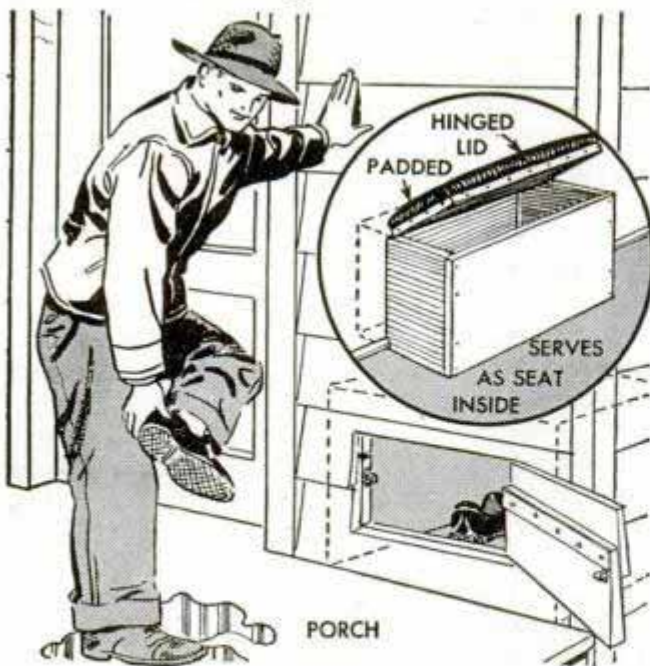
Linoleum Is Fitted Accurately By Measuring Depth of Corner



To lay linoleum on an irregularly shaped floor, fit it exactly into all corners by using the method illustrated. The linoleum is aligned against the wall and distance A in the diagram is marked off at points B and C. A line is drawn through these points to the corner of the linoleum, which then is cut as marked.

Jack Bronte, Grass Valley, Cal.

Concealed Opening in House Wall For Storing Wet Rubbers



By cutting an opening in a house wall adjoining the back porch and building a cabinet around it on the inside of the house, you can provide a handy compartment in which to store wet or muddy rubbers and over-

shoes. The cutaway siding swings on concealed hinges so that the opening is not easily detected, and is held shut by a friction catch. A padded lid is hinged on the cabinet to serve as a seat when you put on the rubbers, and the compartment is lined with linoleum, the outside being painted or varnished to match the trim.

B. A. Rhoades, Omaha, Neb.

Wax Paper Wrapped on Dry Cells Protects Flashlight Case

To prevent dry cells from corroding the case of a flashlight when they wear out and begin leaking, they can be wrapped in wax paper before inserting in the case. The strip should be long enough to fold over the ends of each cell, leaving just the contacts exposed. A wrapping of this kind also will help in removing cells that have swollen within the case.

Ben L. Ashley, Santa Monica, Calif.

Shoe-Polishing Kit in a Brush

Those who like to travel light will find that this shoe-polishing kit takes up very little space. It consists of a brush, a piece of wood of the same size and shape as the brush handle and a $\frac{1}{4}$ -in. lid hinged at one end and provided with an eye for a hook as illustrated. The brush handle is planed down flat, then the piece of wood is recessed to take a can of polish and a strip of cloth, after which the piece is glued to the brush handle. Two coats of varnish will add to the appearance of the kit as well as protect it against hard usage.—D. E. Horn, River Forest, Ill.

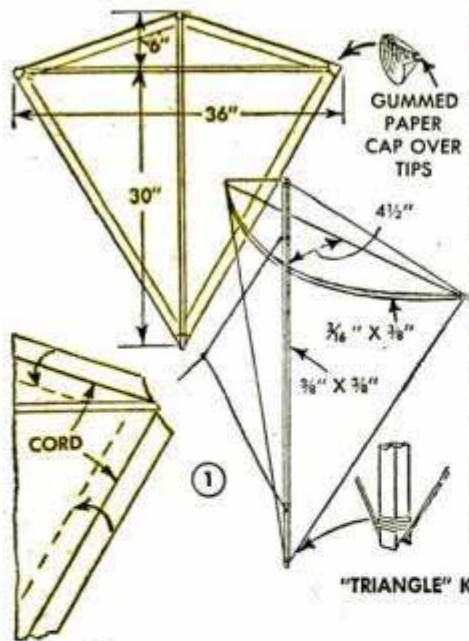


Proper Way to Slide Down a Rope

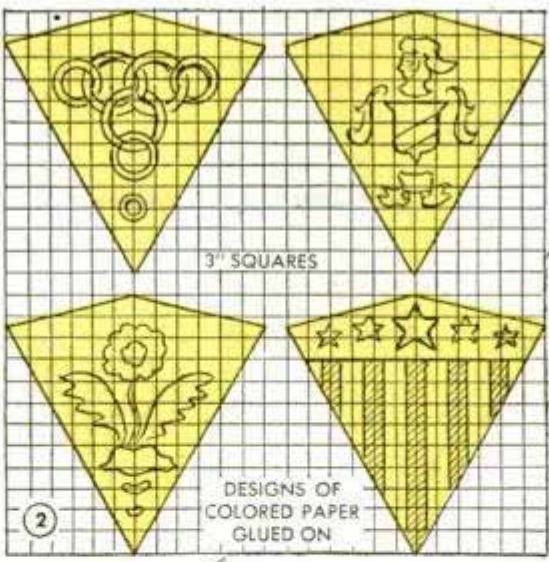
The correct way to slide down a rope is to stand upright, extend your right leg, and by swinging it in a circular motion, wrap the rope around it one complete turn. Then grip the rope in the crook of your right elbow to steady your descent. In this way, your clothes will prevent the rope from being in contact with the skin and burning it if you descend rapidly. By straightening your leg you will release tension on the rope so that you can slide down rapidly, and by bending your hip you increase the grip to slow your speed.

Mrs. Louise G. Royston, Los Angeles, Cal.

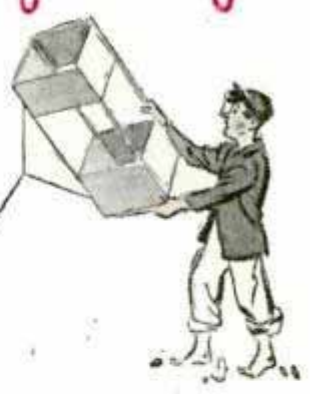
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"TRIANGLE" KITE



DESIGNS OF COLORED PAPER GLUED ON

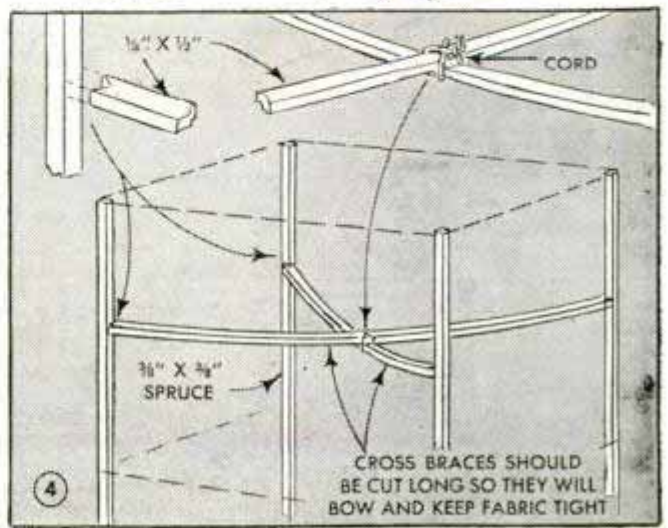
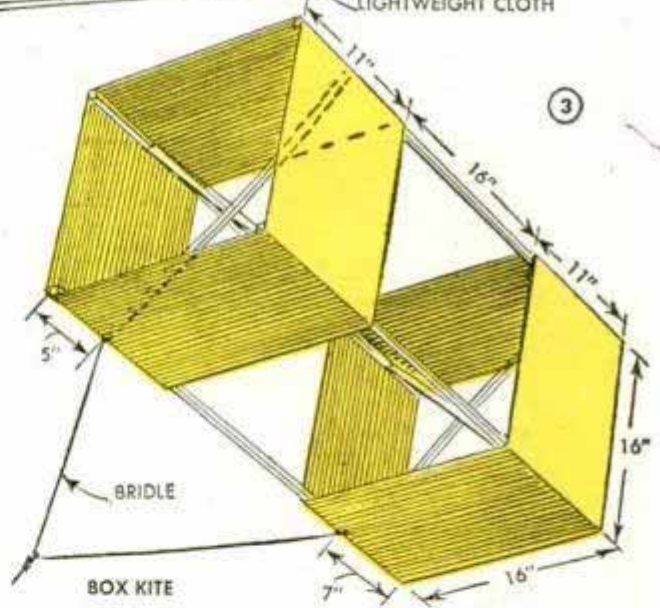


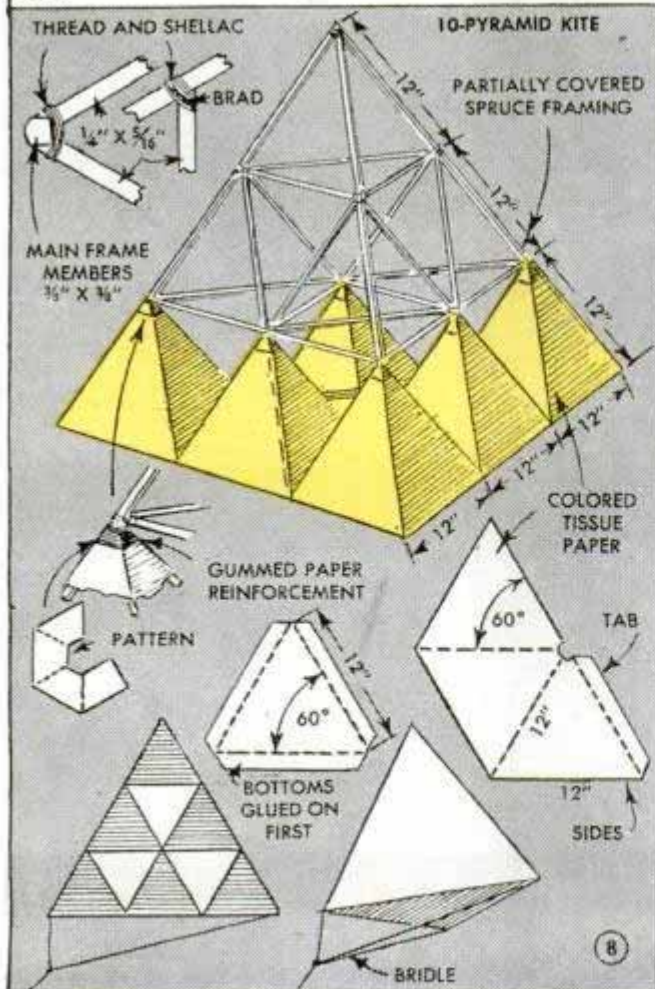
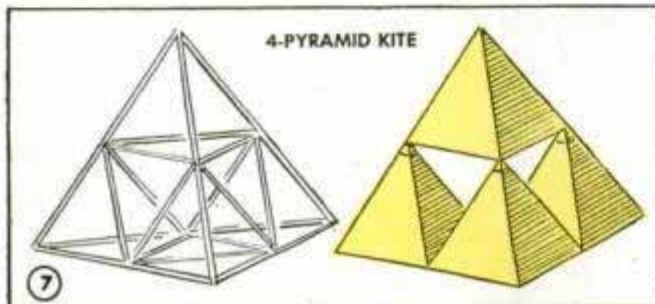
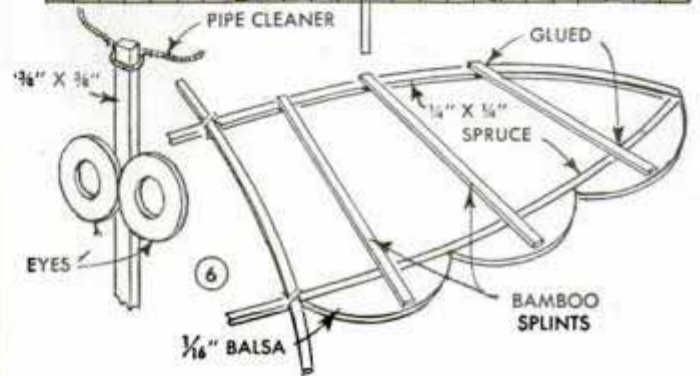
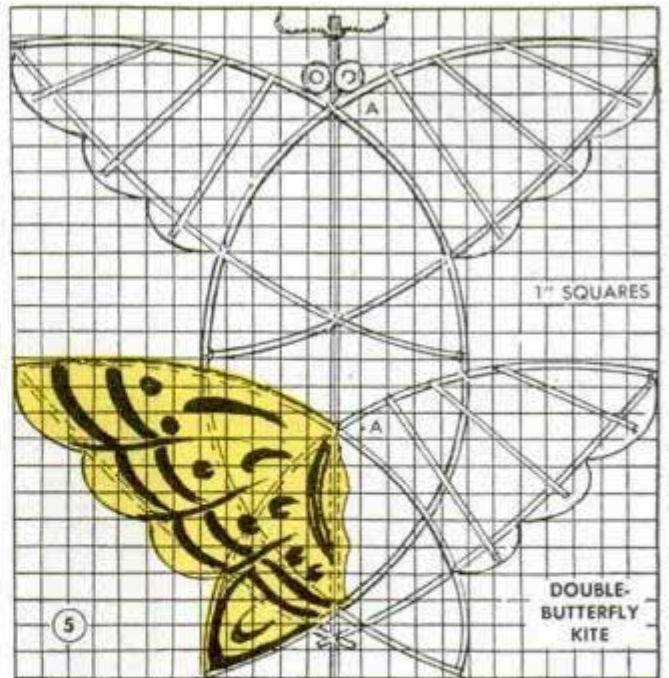
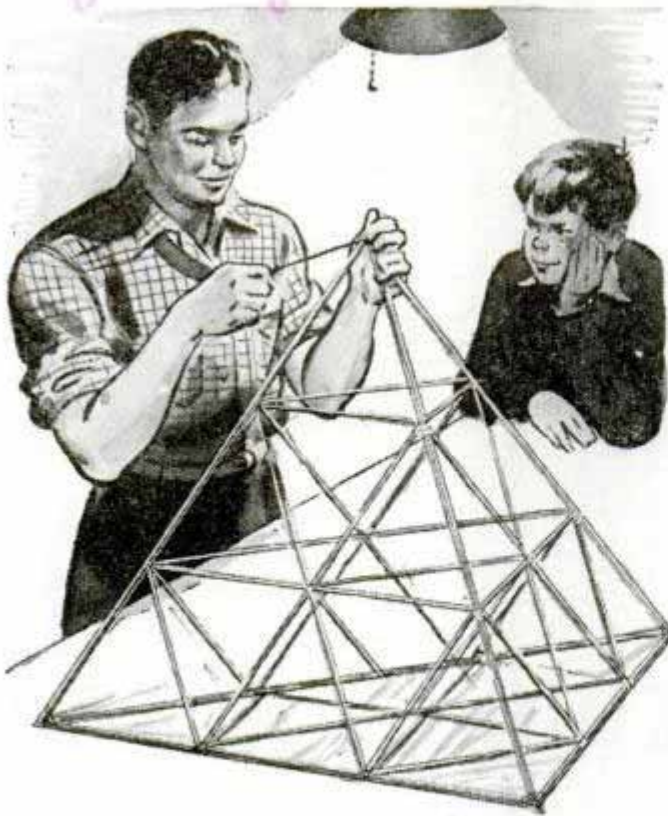
SIX GOOD KITES

By Hi Sibley

UNLESS you prefer the more complicated designs, kites are simple to build. You need only a few sticks, string, paper and a tube of glue to build a flying kite. A few details are important. Where there are curved surfaces it's necessary that the curves be regular, and most kites do not fly well unless you have the bridle properly attached. Some need a tail to hold them steady in the air.

Figs. 1 and 2 detail the reliable tail-less kite which has always been a favorite. The dimensions given are for a convenient size, but the same proportions should be maintained for larger or smaller ones. This kite consists essentially of two sticks tied together at right angles, the shorter one bowed as indicated. A string drawn taut over the ends of the sticks holds the parts in position under tension. Fig. 2 suggests four designs that may be used to decorate the kite. Note that the cross stick is six inches from the top. The sticks are joined at the center with glue and a brad and then tied with heavy thread. The cross stick is bowed after the paper is glued on.

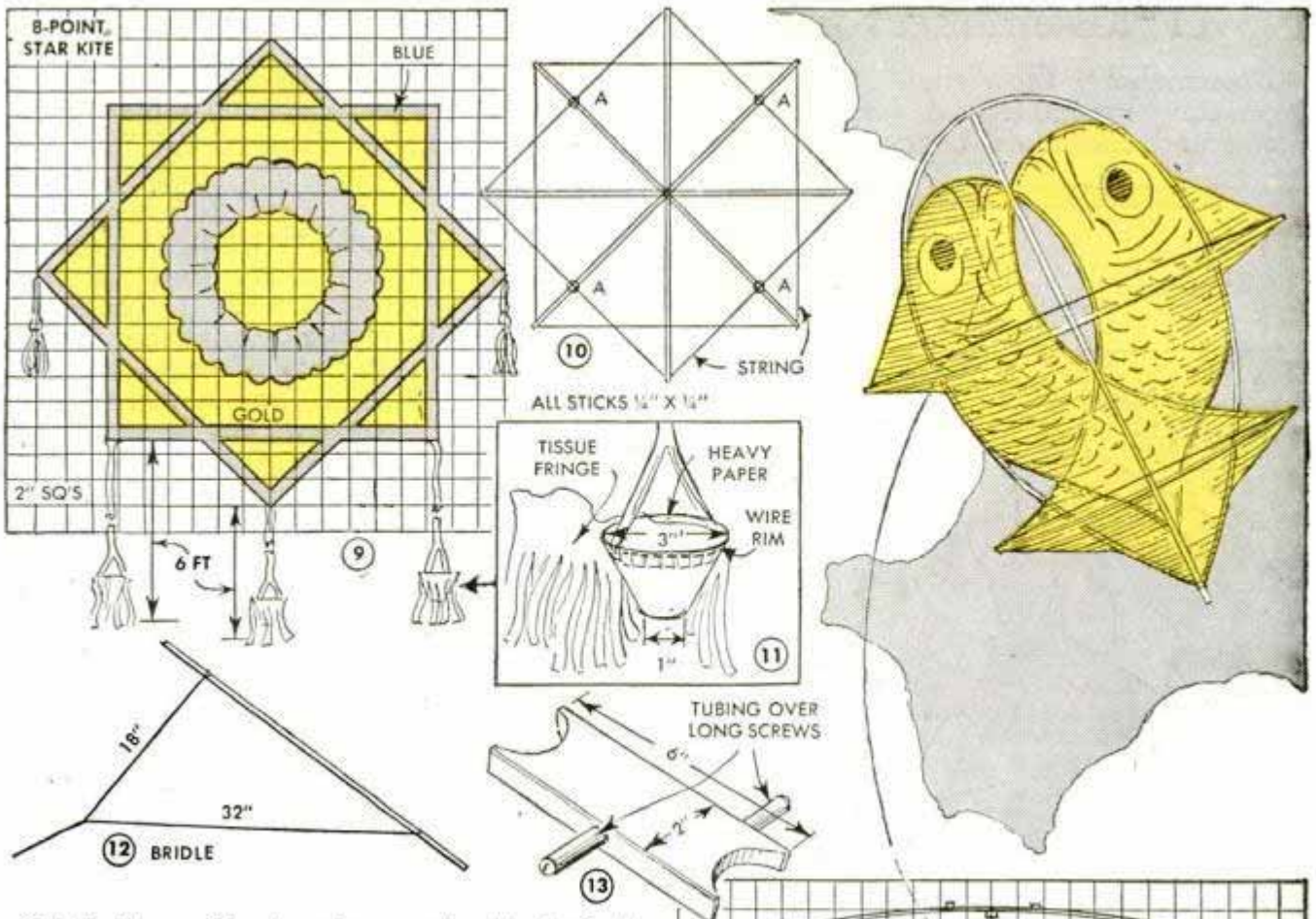




The details in Fig. 3 show how to make a high-flying box kite. Be sure the corner sticks are an equal distance apart and mark the cloth covering accordingly. Note that the diagonal braces are cut slightly longer than the actual measurement so that when installed they will keep the covering under tension, Fig. 4. Fabric is glued or stitched to the corner sticks and the diagonal braces are installed last.

The tetrahedral kite, Figs. 7 and 8, can be built in any size. The smallest one, Fig. 7, has four units. Each side of the individual unit is an equilateral triangle. The main pyramid is made first, and then the horizontal members are installed, followed by the separate units. The main frame members are rounded at the outer corners with joints glued and tied. The tissue covering is glued to the individual units bottom first, lapping the edges over the framework. Unusual effects can be achieved by using paper of contrasting colors on adjacent units. The bridle is attached to the three bottom corners.

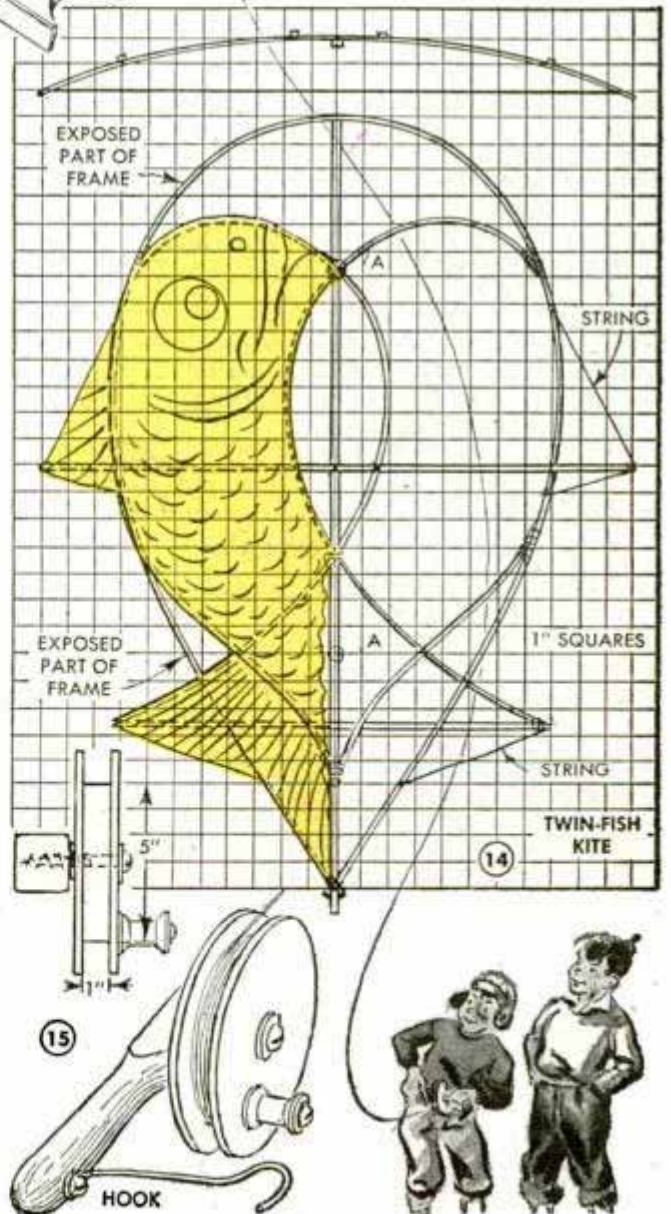
It takes a little more time and care to make the butterfly kite, shown in Figs. 5 and 6, because of the several curved parts, but properly made it's a vigorous flyer and novel in design. The curved framework is made from spruce or rattan strips braced with balsa and bamboo splints. Wings are



slightly bowed by tension cords attached at the tips and are covered with tissue paper in the pattern shown. The left-hand detail of Fig. 6 shows how the eyes and antennae are made. The bridle is attached at points A-A. A conventional tail is required for this kite. In bending spruce wood for this type of frame the strips should be soaked in water overnight.

The twin-fish kite, Fig. 14, is similar to the butterfly kite in construction, consisting of a curved spruce frame with back fins and part of the tail covering fastened to string, which shapes the fish. Paper coverings may be hand painted or separate scales of blended blues glued to a light-tinted ground, with red eyes and gills. The kite is bowed with a cord tied to tips of the horizontal member. It requires a tail made in the conventional manner. The star kite, Figs. 9, 10, 11 and 12, depends upon its decoration and balancing cups for novelty. The bridle is attached at four points, A-A-A-A, using two 18-in. strings at the top and two 32-in. strings at the bottom as indicated in Fig. 12. Balancing cups, Fig. 11, are open at the bottom to permit air to pass through and furnish a light drag.

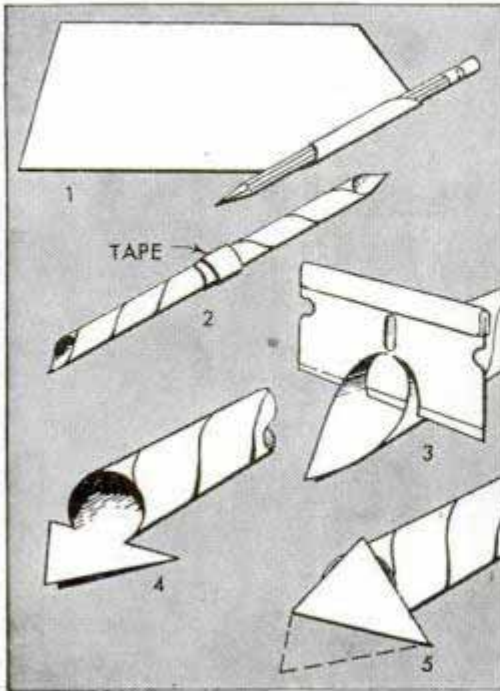
Two easily made reels are shown in Figs. 13 and 15. One consists of a flanged wood disk mounted on a handle, Fig. 15. A hook bent from heavy wire locks the disk. The other reel, Fig. 13, is simply a piece of 1-in. pine shaped as shown and provided with handles for turning. A reel is a necessity in handling the larger kites.



Novel Noisemaker for Children Made From Sheet of Paper

Noisemakers, the delight of all small boys, can be made from paper, and, unlike metal and cardboard horns, are safe for

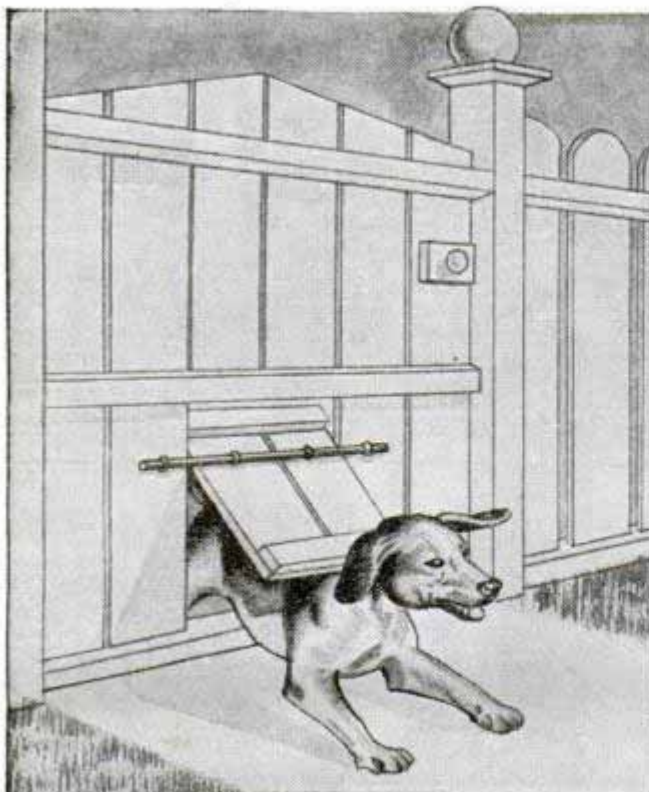
young children as there are no detachable mouthpieces or sharp edges to cause injury. Begin by rolling a sheet of thin but stiff paper on a pencil, dowel or round stick to form a tube, starting at one corner of the sheet as indicated in Fig. 1. The rolled paper then is secured with a strip of cellulose tape, Fig. 2, and the pencil is removed. One projecting end of the tube is sliced with a razor blade, Fig. 3, to form a tab, Fig. 4. This is bent upward against the tube as shown in Fig. 5. When the tube is placed in the mouth, breathing in and out will make the tab vibrate against the end of the tube and produce a whirring or rasping sound.—Paul Le Bel, Pembroke, Ont., Can.



Dog's Own Private Entrance Installed in Large Gate

Every dog has his day, but not every dog has his own gate. You can, however, cut a square opening in a large gate, nail a cleat at top and bottom to hold the pieces together, and pivot the cutout on a rod as illustrated. Then the dog can leave the back yard without your help, and he'll let himself in again just as independently.

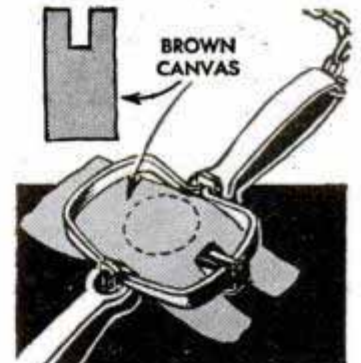
Donald Schlichting, Brownsdale, Minn.



Canvas Covers for Animal Traps

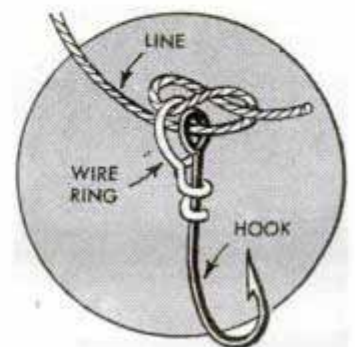
To prevent stones, dirt and other objects from becoming wedged under the pans of animal traps and clogging the spring release, lightweight brown canvas covers can be slipped over the pans. A paper pattern should be made first to fit the traps exactly, after which the outline is traced on the canvas and then cut out.

R. Jenkins, Los Angeles, Calif.



Ring on Fishhook Grips Line

Formed into an eye and twisted around the shank of a fishhook, a short length of light wire will grip the line so that it cannot loosen and become untied. This method is especially suitable for lines made of plastics and similar material, which may become slippery when wet. When the line is tied, the ring clamps against it to prevent loosening.—L. Meehan, Toronto, Ont., Can.



"KILTIE" A Model Racing Yacht

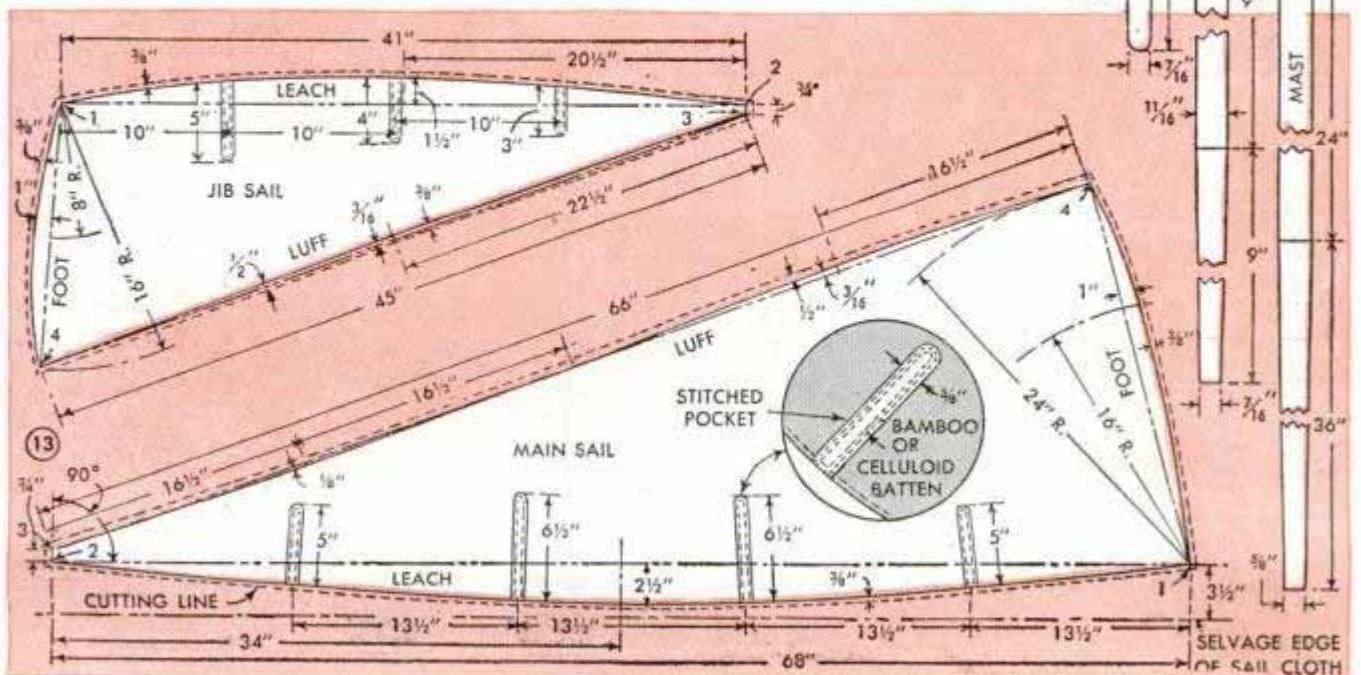
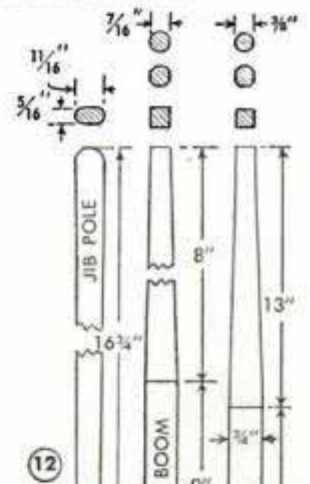
By John Black

Ex-President International Model Yacht Racing Union
(Continued from last month)

AFTER completing the hull of Kiltie described last month, you are ready to rig her for the "maiden voyage." The stock for the mast, boom and jib pole should be clear, straight-grained spruce or white pine tapered to the dimensions given in Fig. 12. This is best done by first planing the stock to 4-square, tapering the ends 4-square and trimming the corners for the full length to produce eight-sided pieces. You now can round the work with a block plane as in Fig. 14 and finish with sandpaper. Give all spars one coat of white shellac at this time.

Next to the shape of the hull the most important parts of a yacht are the sails. Every skipper is desirous of getting the best-cut sails and is very careful how he uses them. Do not use new sails in a strong breeze until they have been stretched thoroughly. If new sails are to be used in wet weather, stretch them loosely on the spars.

Material for the sails should be a strong, closely woven fabric, preferably long-staple sea-island cotton. Number 4 sailcloth is a very good material for sails and can be purchased in white or bright colors. When laying out the sails dimensioned in Fig. 13, place the cloth on a table or the building board used in making the hull and tack or weight down the corners. Be careful not to stretch the material as this may alter the cut of the sails. From one corner of the selvage edge measure $3\frac{1}{2}$ in. in from each edge and make a pencil mark. Label this point No. 1. From this position measure 68 in. along the selvage edge and make a second mark $3\frac{1}{2}$ in. in from the edge, and mark this No. 2. From this position measure $\frac{3}{4}$ in. at right angles from a light line drawn between Nos. 1 and 2, and mark this No. 3. Now measure 66 in. from No. 3 and 24 in. from No. 1; the point where

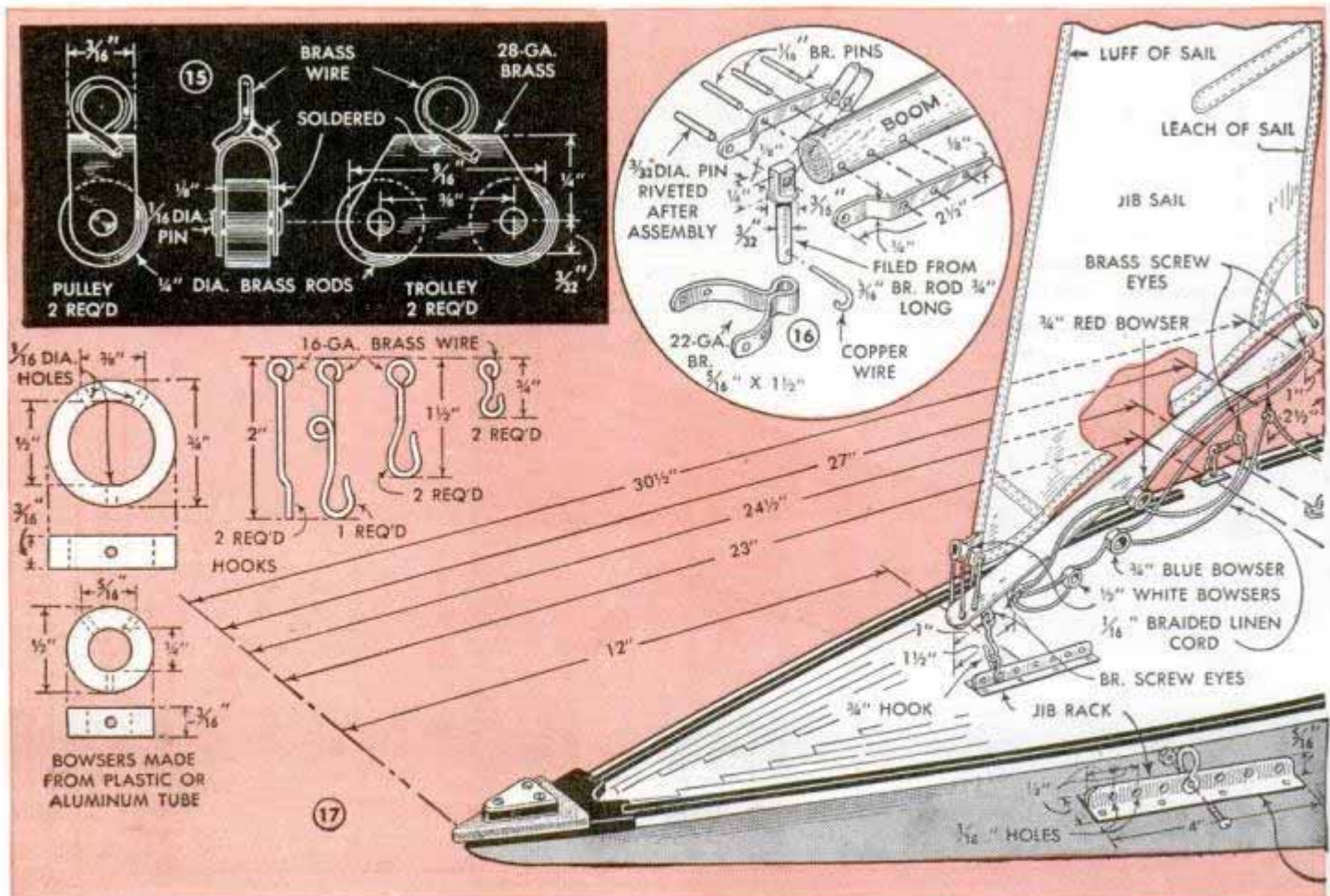


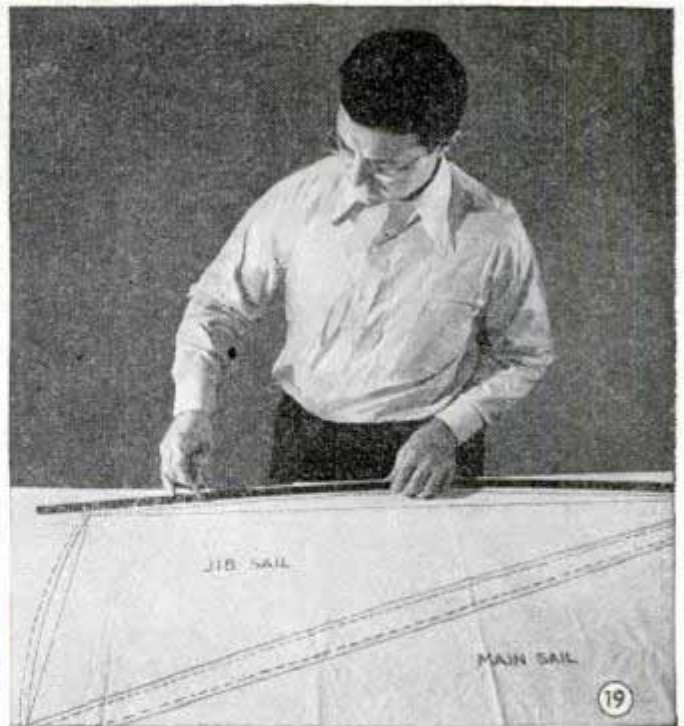
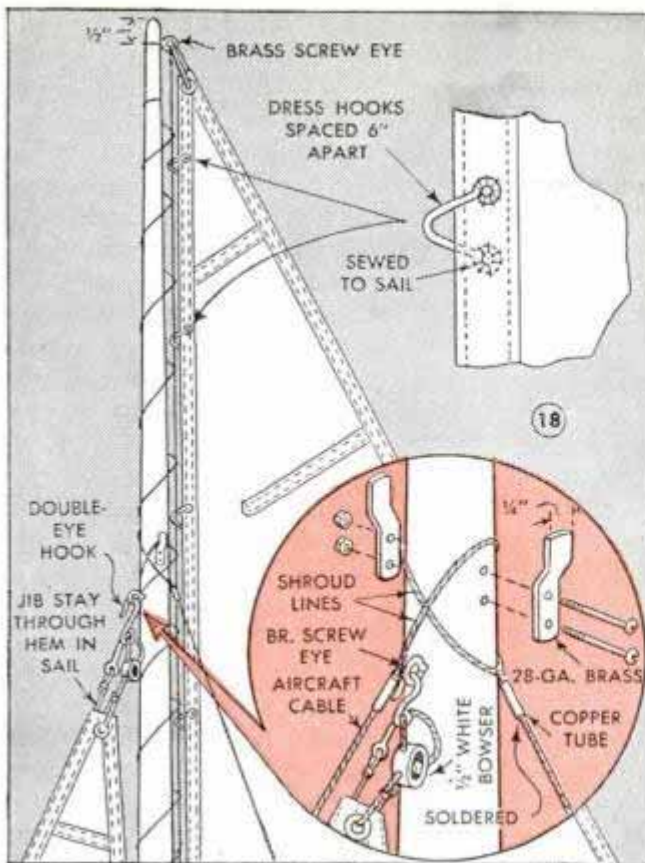


dimensions shown in Fig. 13, which allow $\frac{3}{8}$ in. for hemming the foot and $\frac{1}{2}$ in. for the luff. Make the same allowances on the jib sail. Before cutting the sails, $\frac{1}{4}$ -in. or $\frac{3}{8}$ -in. linen tape should be sewed on both sails inside the solid curved line between corners 3 and 4, and sewed straight between 4 and 1. The tape will keep the cloth from stretching while the edges are being cut. Corners of the sails should be reinforced by sewing a triangular piece of cloth across each one before hemming. The batten pockets are made from linen tape $\frac{3}{8}$ in. wide with the outer end left open to allow the battens to be inserted. When the sails have been completed, press them with a hot iron and put an eyelet in each corner. Dress hooks spaced as shown in Fig. 18 are sewed to the luff of the main sail to attach it to the mast by means of the wire jack line.

Although model-yacht fittings can be purchased at a reasonable cost many builders like to make them because of the desire to have every part of the model hand made. For those who wish to make their own, complete detailed drawings showing materials to be used are given in Figs. 15 to 18 inclusive and 20 and 21. Note that there are two travelers required. The forward one should be $\frac{1}{2}$ in. high and the after one $\frac{3}{4}$ in. high. Be sure to assemble the trolleys in position on the travelers before soldering the traveler hold-down flanges in place. The following sizes of bowsers will be needed:

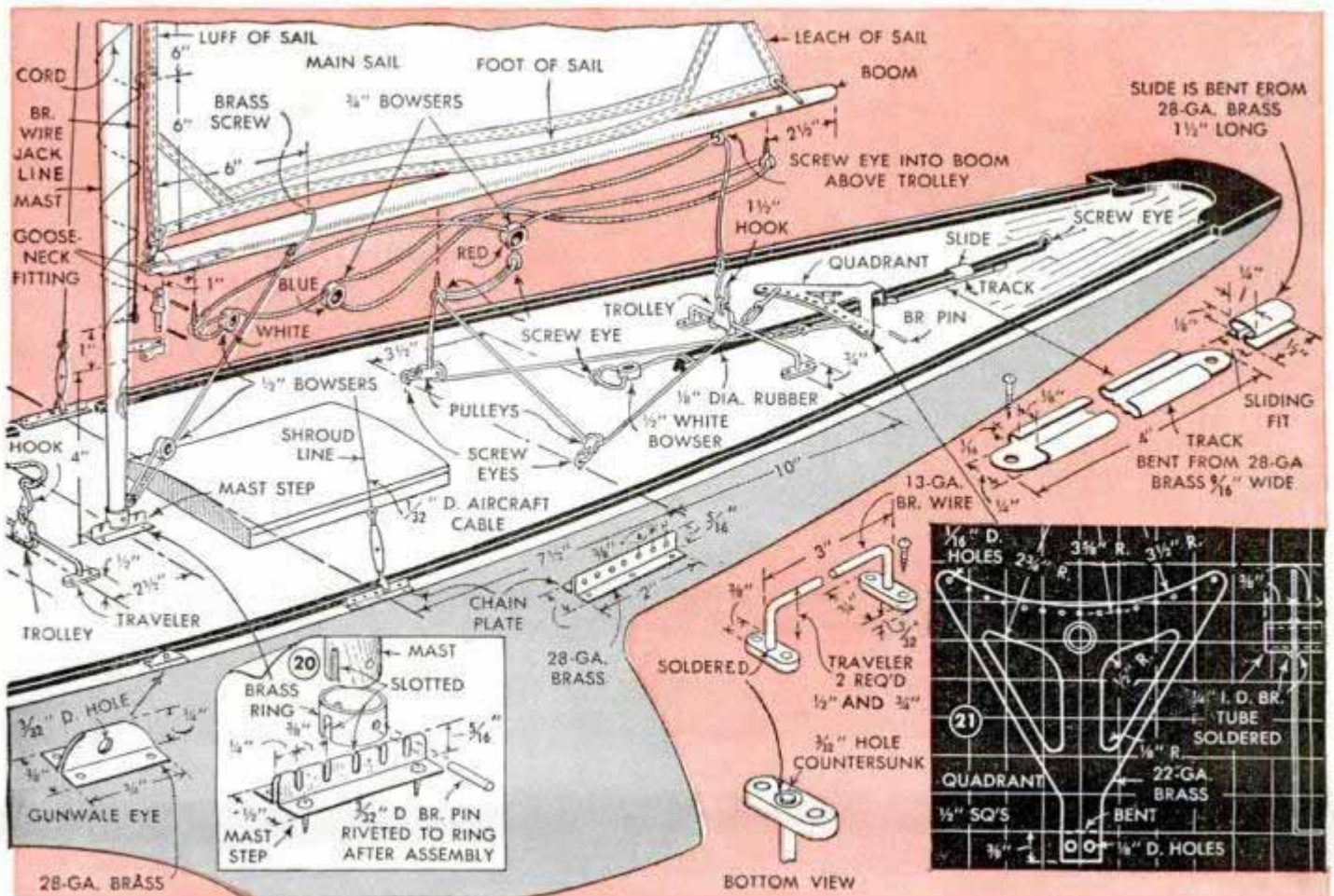
these two lines intersect will be the tack of the main sail, or No. 4. From the center of the light line measure $2\frac{1}{2}$ in. towards the selvage edge, and with a strip of wood or batten, Fig. 19, draw a curve between Nos. 1 and 2, passing through the $2\frac{1}{2}$ -in. mark. Then measure $\frac{3}{8}$ in. outside of this line and draw a second line; this is indicated by the dotted line in Fig. 13 and is the cutting line which allows $\frac{3}{8}$ in. for the hem. Repeat this procedure on the other sides using the





two $\frac{3}{4}$ -in. red, two $\frac{3}{4}$ -in. blue and six $\frac{1}{2}$ -in. white. These may be made from colored plastic tubing or from aluminum tubing and painted. The track detailed in the upper right-hand corner of Fig. 17 is formed over a strip of metal $\frac{1}{16}$ by $\frac{1}{4}$ by 6 in. which has the long edges rounded. When finished the

track should have a slot $\frac{1}{8}$ in. wide. The slide shown just to the right of the track should move easily in it. In making the quadrant it is suggested that the layout be transferred to the stock from a scaled enlargement of Fig. 21. The center lines of the various arcs are on the line that passes through the center of the $\frac{1}{4}$ -in. tube. The latter can be cut from the same tubing as used in making the rudder tube. When the fittings have been made file all the edges



round and smooth with fine emery cloth.

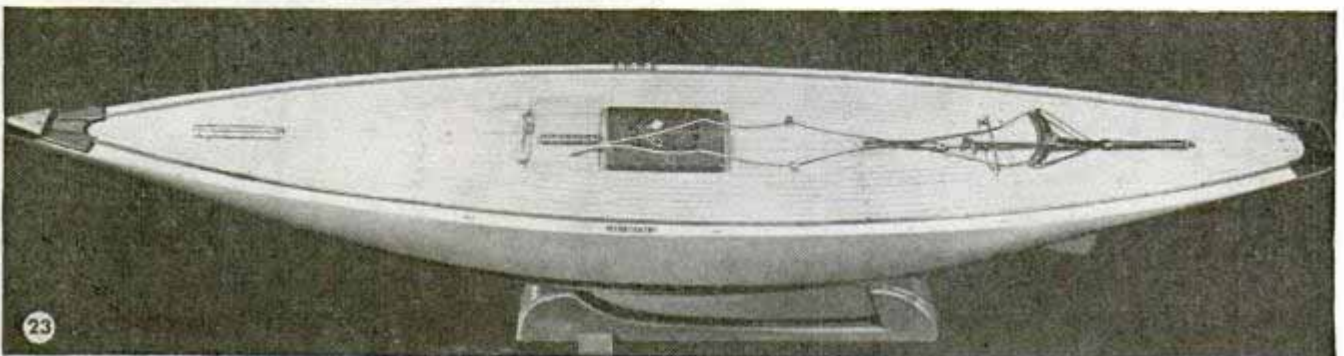
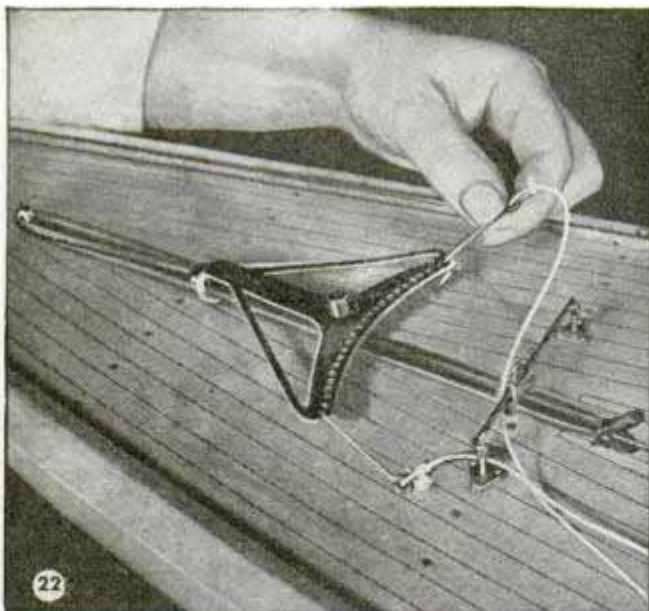
You now are ready to assemble the spars, fittings and sails. It is best to start from the bow and secure each fitting in its order according to the dimensions given in Fig. 17. Note that the dimensions are shown to the center of the fittings. When assembling the quadrant to the rudder post be sure the rudder is centered exactly and is free enough to move at the slightest touch. The track and slide are placed directly astern of the tail of the quadrant. A screw eye $\frac{1}{2}$ in. aft of the end of the track holds the $\frac{1}{8}$ -in. round rubber, which should be about 18 in. long. The ends of the rubber are inserted through the slide, the two holes in the tail of the quadrant and then forward on each side of the rudder tube, Fig. 17. A $\frac{1}{2}$ -in. bowser and piece of braided cord about 50 in. long is passed through the pulleys on the deck and fastened to the quadrant by means of long hooks as shown in Fig. 22. With all the fittings in place the deck should appear as in the photo Fig. 23. The bottom of the mast is fitted with a $\frac{5}{8}$ -in. brass ring or ferrule $\frac{3}{8}$ in. long, which is slotted $\frac{1}{4}$ in. deep through the center to fit over the mast step. The $\frac{3}{32}$ -in.-dia. pin placed $\frac{3}{16}$ in. from the bottom will engage the notches cut in the mast step. Place a $\frac{1}{4}$ -in. screw eye 51 in. from the bottom on the forward side of the mast. This is to anchor the linen-cord jib stay, which passes through the hem of the luff on the jib sail. The other end of the

jib stay is fastened to a hole in the jib pole as are the two lower corners of the jib sail. A hook on the lower edge of the pole is fastened to the jib rack to brace the mast against the two shroud lines that are held on the mast by the brass fittings shown in the circular detail of Fig. 18. Adjust the jib stay line and the shroud-line turnbuckles to give the mast a rake aft of about 2 in. The jib sheets then can be rigged as shown in Fig. 17. The rigging of the main boom is slightly different from the jib pole. First fasten the boom to the mast with the gooseneck fitting. Then a piece of $\frac{1}{16}$ -in. cord about 58 in. long is threaded carefully through the various screw eyes and bowser as in the illustration. The line from the trolley to the bottom hole in the blue bowser passes through a screw eye placed in the mast directly above the traveler and should be about 16 in. long. The running sheet passes through a screw eye placed in the mast directly above the pulleys and is fastened to an open screw eye in the bottom hole in the red bowser. The main sail then is lashed to the boom and mast at the three corners and a fine brass jack line is threaded through the dress hooks on the luff of the sail. A cord around the mast and jack line will hold it securely in place.

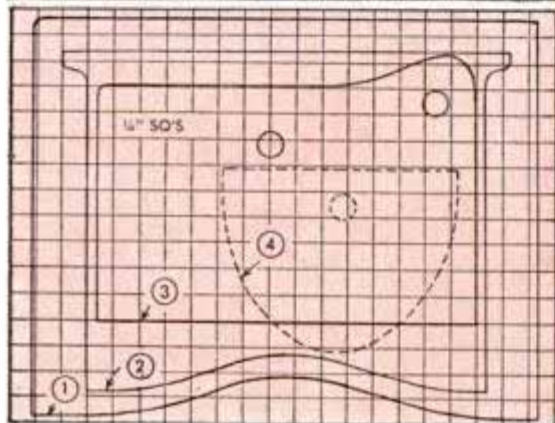
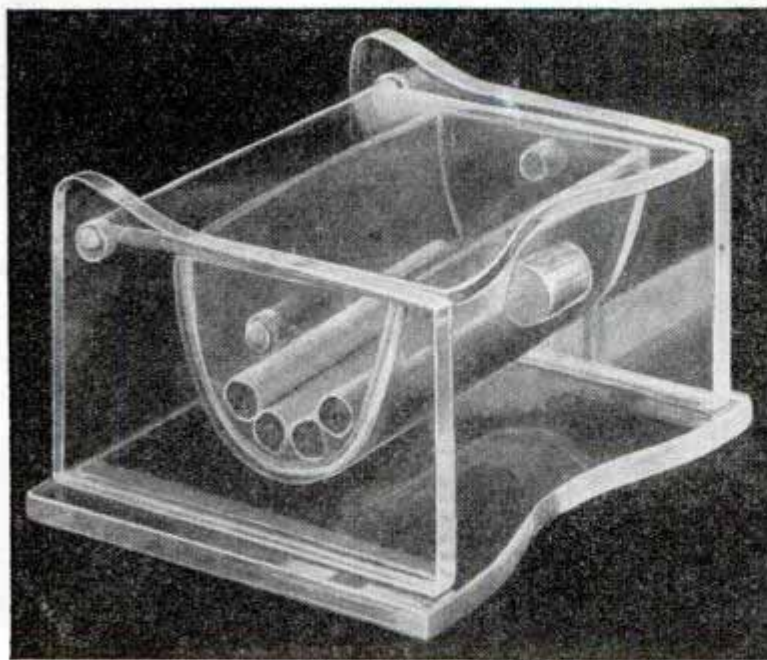
The kicking strap is a short length of cord which has one end fastened to a screw eye at the bottom-afterside of the mast. The other end is held in place around the boom with a small round-head screw placed in the top of the boom. The bowser can be adjusted to suit the tension desired on the boom. The mainsail now is rigged with the exception of placing the battens in the pockets and sewing the ends to prevent them from working loose in a strong breeze.

Kiltie now is ready to sail. There is one thing a beginner should remember when sailing a model and that is to have the jib set a trifle flatter than the mainsail. This is to keep the jib full at all times and to prevent the boat from coming up into the wind and shaking. When reaching across the wind, hook up the running sheet and allow for a slight helm or rudder. Every fitting on Kiltie is simple and effective and a few trials will teach a skipper the use of each.

(Conclusion)



Plastic Cigarette Box Has Novel Tilting Cover

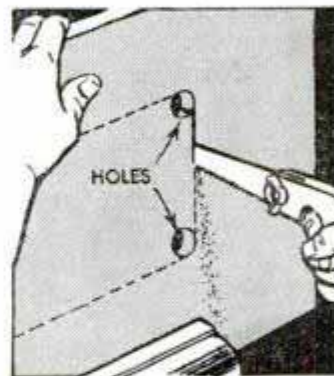


Made from transparent plastic, this cigarette box consists of a tilting compartment or tray pivoted in a frame formed by two ends and a base as shown. The tray is of sufficient size to hold twenty or more cigarettes, either regular or "king" size. The cover also is pivoted between the ends. Pressing the knob tilts the tray and lifts the cover simultaneously. When the tray is released it swings back to the horizontal position and the cover automatically closes. All parts are shown in the cross-hatched diagram above, the two end pieces of the frame, part No. 3, and those of the tray, part No. 4, being duplicates. Parts Nos. 1 and 2 are the bottom and top. Pivot pins for the tray are cut from $\frac{3}{16}$ -in. plastic rod and the lifting knob is cut from the same material, $\frac{1}{2}$ in. in diameter and $\frac{3}{4}$ in. long. A flat is filed on one side of the knob as shown so that it can be cemented to the tray easily. All other parts are cut from $\frac{3}{16}$ -in. sheet plastic to the sizes indicated in the cross-hatched details, except the curved portion of the tray, which is $\frac{1}{8}$ in. thick. Material can be cut with a bandsaw or jigsaw if slow-speed attachments and metal-cutting blades are available, otherwise by hand with a hacksaw or

coping saw. Finish the edges of the plastic with fine wet-or-dry sandpaper and be sure the joining edges of bottom and ends are square. The entire assembly is joined with plastic cement.—E. N. Moore, Chicago.

Easy Way to Cut Square Opening

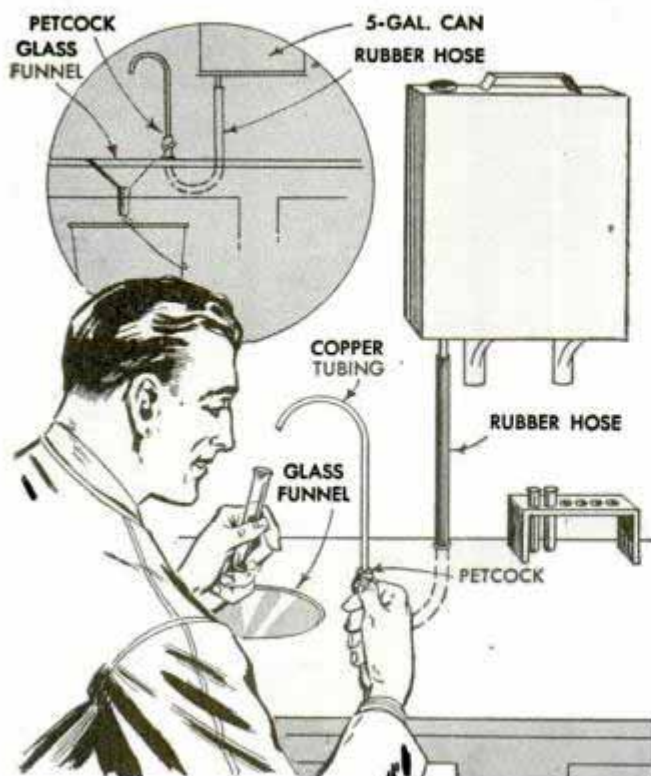
Cutting a square or rectangular opening with round corners in a piece of wood is easily done if you drill holes of the proper radius for the corners. Then all you have to do is saw straight down from one hole to the next, and the opening will be of the right dimensions with corners of the correct radius.



Charles W. Eckenlaub, Altoona, Pa.

☐ Hanging shelves can be supported by old skid chains hung from the ceiling with the shelf board resting on the cross chains.

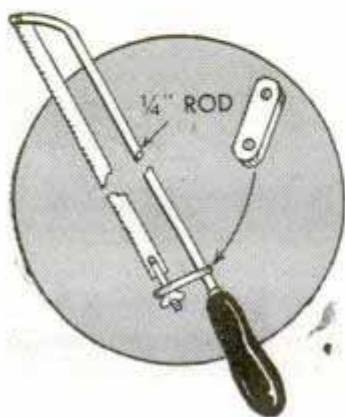
Running-Water Supply and Sink Provided for Home Laboratory



Suitable for the home laboratory located where running water is not available, this improvised water system will provide a ready supply. The reservoir and sink consist of a 5-gal. can mounted on shelf brackets above the workbench, some rubber hose and copper tubing, a radiator petcock and a glass funnel. A hole is punched in the bottom of the can and a short length of copper tubing is soldered to it so that rubber hose can be connected. This is run through two holes that have been drilled in the bench, as illustrated, then joined to the petcock which controls the flow of water. A length of copper tubing bent to form a spout is soldered to the petcock to direct water into the funnel which is set in a hole in the workbench with a pail beneath it to catch the water.

John F. Stewack, Downers Grove, Ill.

Narrow Hacksaw Frame Allows Working in Close Quarters



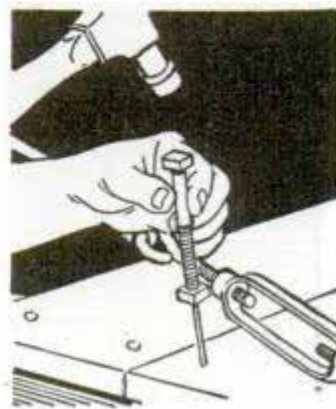
For working in restricted places where a regular hacksaw will not enter, this improvised saw frame will solve the problem. It consists of a length of rod and a piece of flat iron in which two holes are drilled, one to permit it to slide

snugly over the rod and the other to take a slotted bolt. The rod is bent at one end and is slotted to take a saw blade, which is held by a retaining screw. The other end of the blade is held by the bolt, which in turn is held in the piece of flat iron by a wing nut. When the nut is tightened, this piece is pulled at an angle and prevented from sliding on the rod, allowing the blade to be tightened.

Robert A. Horacek, Burbank, Calif.

Machine Bolt Helps Drive Nails In Hard-to-Reach Places

When you have to drive a nail that cannot be reached with a hammer, use a long bolt as a nail set in the manner shown. To prevent the bolt from slipping off the nail, screw a nut only part way on the bolt so that the end is recessed slightly within the nut, leaving a pocket in which the nailhead will be held.



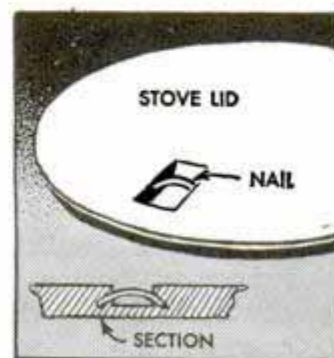
Bert L. Force, Washington, D. C.

Renovating Your Briar Pipes

After briar pipes have been used for some time they develop a soiled, dark appearance so that the grain cannot be seen. To bring back the original luster, remove the stem and plug the shank and bowl. Rub soapsuds over the outside, then rinse and dry thoroughly. The briar now will have a dull finish, but the application of a very small quantity of olive oil will restore the luster.—Donald Munson, Boston, Mass.

Repair for Broken Coal-Stove Lid

If the projections for a lifter have been broken away from the slot in a coal-stove lid, a nail will serve the purpose. Blind holes are drilled at an angle in the sides of the slot near the inner end, and a headless nail is inserted in the holes to form a strap under which the lifter will fit. After being bent up to fit into the holes, the nail will not come out if it is tapped lightly with a hammer to force in the ends. —P. Criton, Jr., Kayville, Sask., Can.



How to Make Your Own MOVIE TITLER

by
WALTER E. BURTON

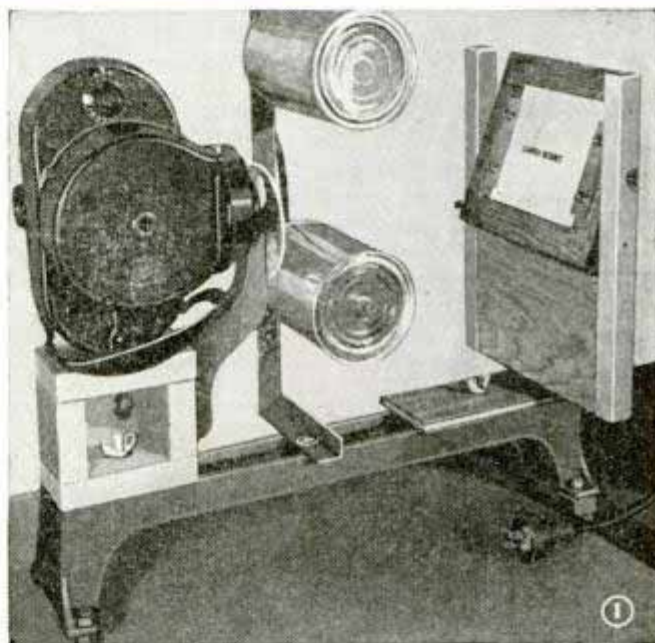


PICTURES tell the story, but it's the words with the story that give it continuity. Movie titles identify and date each reel. Subtitles explain the scenes and tie them in with the action.

The titler illustrated has several features not commonly found in title-making outfits, such as the turret mount for auxiliary lenses, Fig. 4, title-card board for producing novel effects, Figs. 10 to 14 inclusive, and lamps mounted horizontally instead of vertically for greater freedom in making adjustments and manipulating camera and title-card controls.

First make a base for the titler of seasoned hardwood as shown in Fig. 6 and fit one leg with leveling screws, Fig. 9. The camera block, base of the lamp support, and other parts are provided with $\frac{1}{4}$ -in.-wide strips that slide in the opening between the horizontal members of the base. The sliding parts clamp to the base members, or "ways," with small bolts fitted with wing nuts and washers.

Because of the lighting arrangement it is necessary to support the camera on a sliding auxiliary base so the lens is 8 in. or

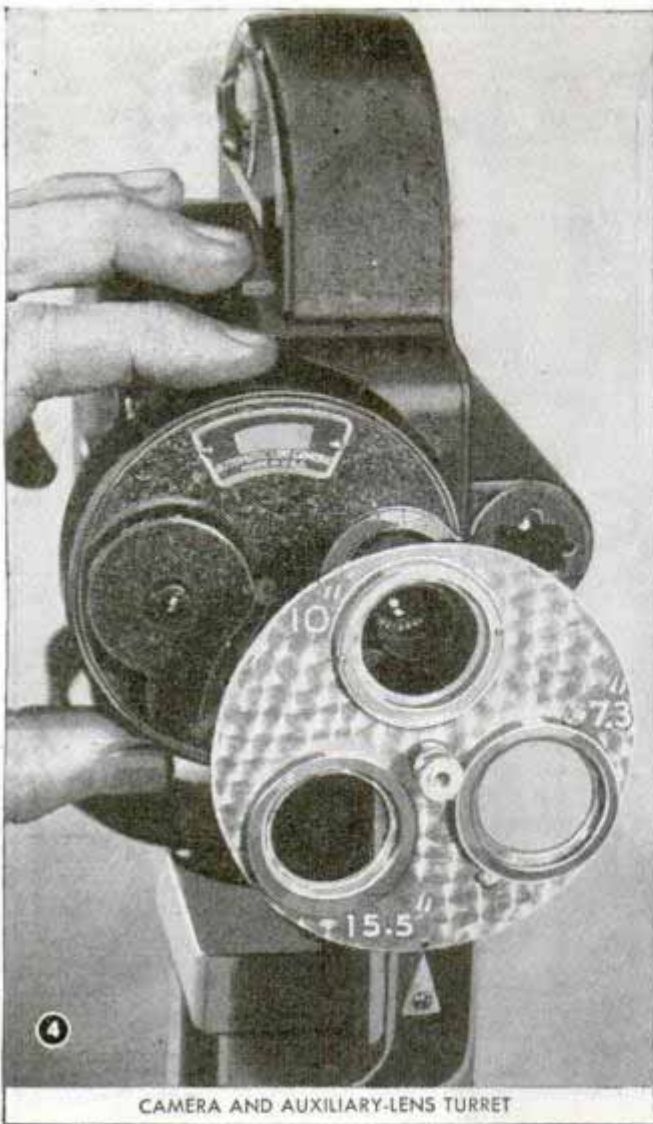


so above the top of the titler base. Drill the sliding base for a clamping bolt and also for a $\frac{1}{4}$ -No. 20 thumbscrew made from a bolt and washer as in Fig. 9. This latter bolt is used to attach the camera rigidly to the base. Dimensions given will vary with different makes of cameras.

In making titles, an auxiliary lens, which is a positive supplementary lens, is placed directly in front of the camera lens. With the latter set at infinity, the title card is placed so the distance from it to the auxiliary lens is the same as the focal length of that lens. Thus for a 10-in. auxiliary lens the title card is placed 10 in. away. Auxiliary lenses of different focal

Focal length	Diameter	Lens-to-card distance*	Approximate field covered**
186 mm. 7.33"	31 mm.	7.33"	2 $\frac{1}{8}$ " X 2 $\frac{1}{4}$ "
254 mm. 10"	28 mm.	10"	2 $\frac{7}{8}$ " X 3 $\frac{1}{2}$ "
393 mm. 15.5"	28 mm.	15.5"	4 $\frac{1}{2}$ " X 6 $\frac{3}{8}$ "

*With camera lens set at "infinity" or in fixed-focus position.
**By 1" lens on 16-mm. camera or $\frac{1}{2}$ " lens on 8-mm. camera. ③



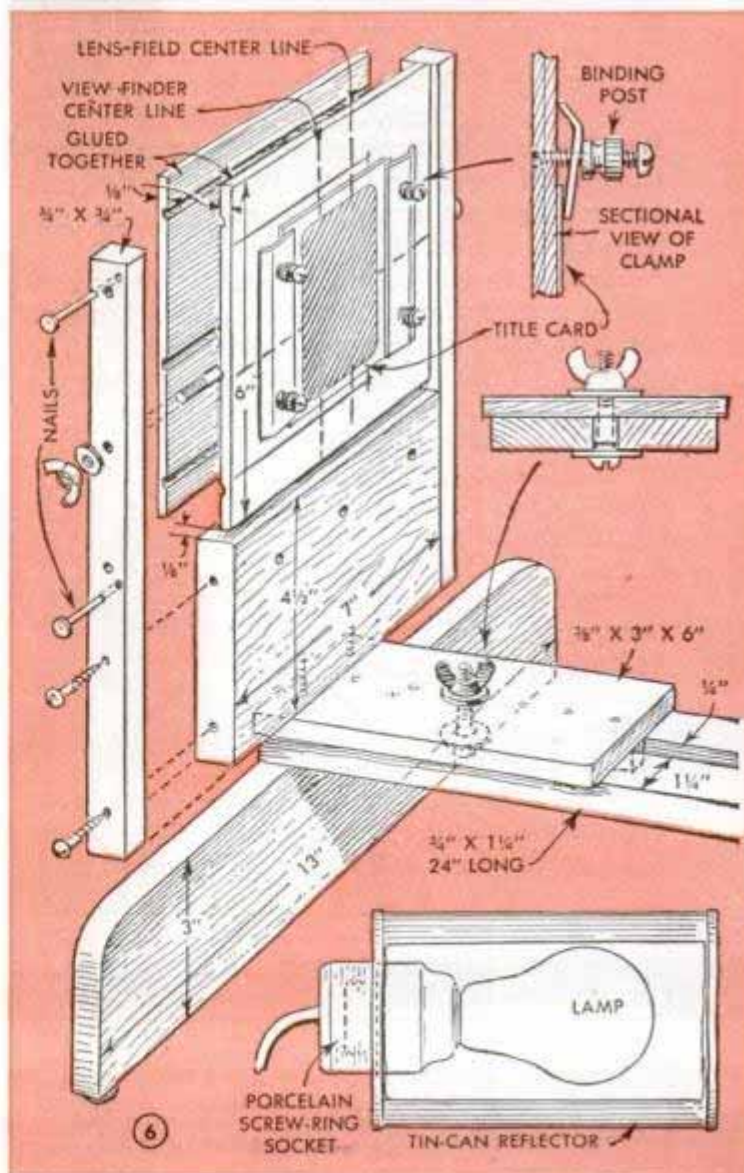
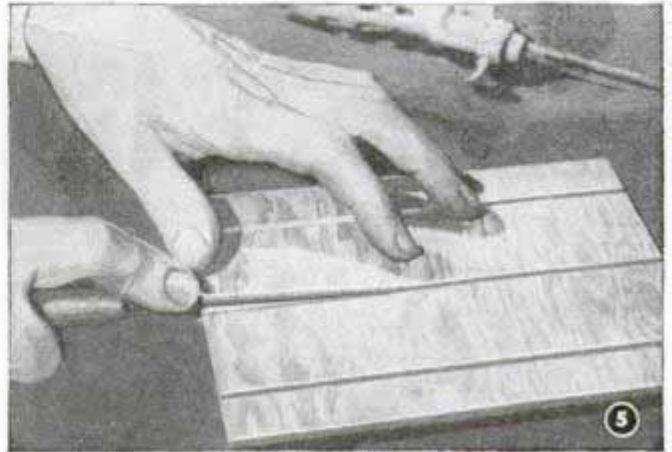
CAMERA AND AUXILIARY-LENS TURRET

lengths permit use of different-sized title cards. Also, the titler may be used for shooting close-ups of flowers, insects, etc.

It is convenient to have a selection of ranges and areas in focus, so, to avoid handling several auxiliary lenses individually, a three-lens turret arrangement was constructed as in Figs. 2, 4 and 9. This consists of a $3\frac{1}{4}$ -in. disk of sheet metal pivoted on a curved hardwood turret arm screwed to the camera support as in Fig. 9. Select auxiliary lenses that range in diameter from about 25 mm., 1 in., to 35 mm., 1.37 in. The turret illustrated is fitted with three lenses whose characteristics are listed in the table, Fig. 3.

Scribe a 2-in. circle on the turret disk and at equidistant points mark centers for three holes about $\frac{7}{8}$ in. in diameter, Fig. 9. For each lens, machine a brass ring as in Fig. 2. The turret disk is locked on the No. 6-32 screw with a knurled binding-post nut to which a short length of tubing has been soldered as in Fig. 9. Just below the disk screw a small metal pointer to the arm, Fig. 4, and opposite it make marks on the disk to indicate when each auxiliary lens is centered over the camera lens. Mark the focal length of each lens beside its ring.

The title-card support is assembled as in Fig. 6. Before gluing the $\frac{1}{8}$ -in. panels together, flutes are cut and filed in each panel as in Fig. 5, the flutes being equally spaced on both panels so that when the latter are placed together three longitudinal round holes are formed as in Fig. 6. A long stud, threaded at both ends, passes through the center hole. A nut is soldered to the threads at one end of the stud. A wing nut and washer on the other end provide a quick means of tightening the title board between the uprights. For novel effects in which the title swings into or out of focus from



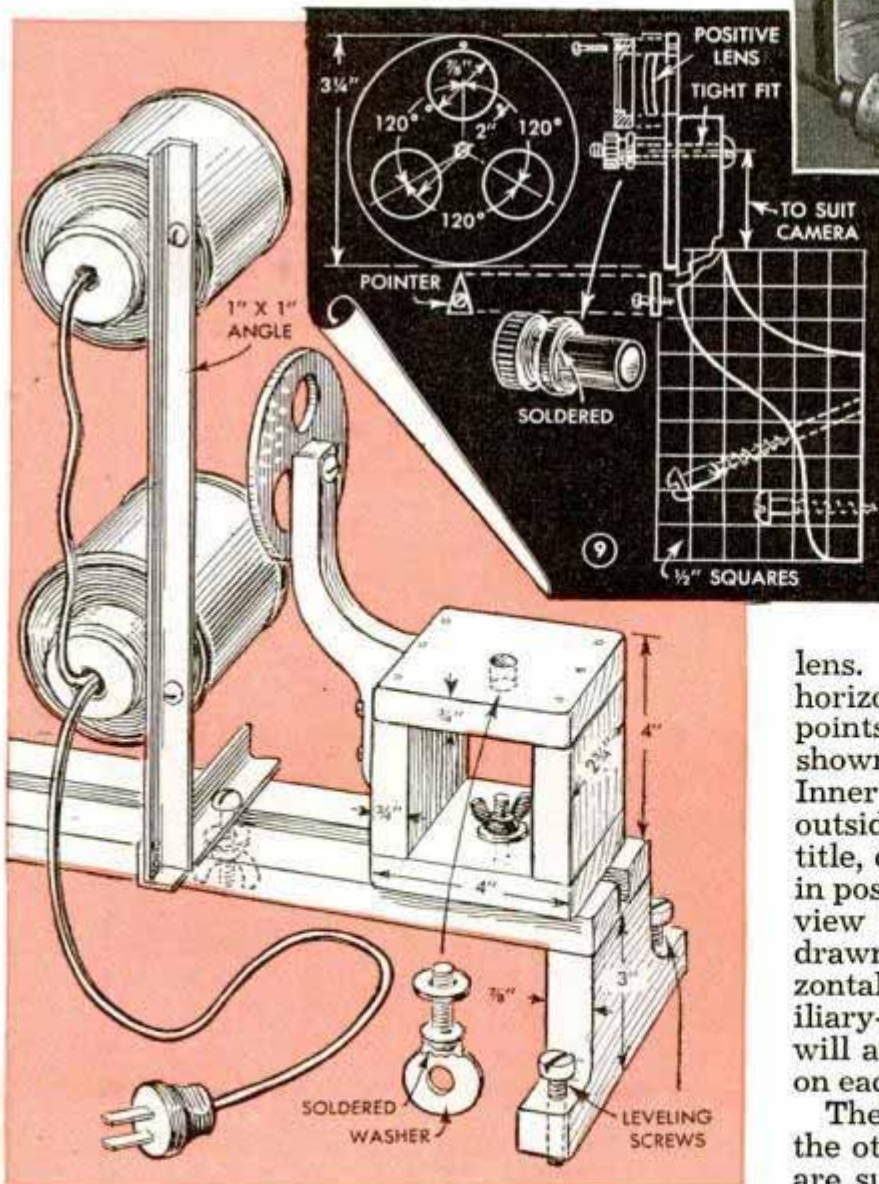
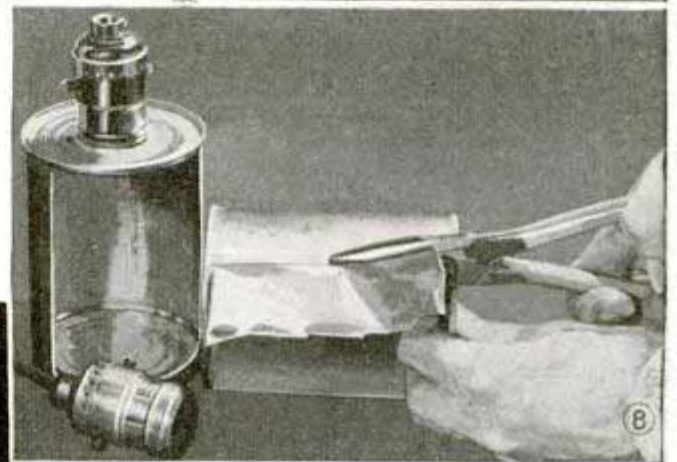
above or below, pass the stud through the top or bottom hole, and do not tighten the nut. To hold the title in focus, drill two holes in one of the uprights as shown in Fig. 6 and insert nails.

Camera and title card are aligned with the aid of the camera view finder as in Fig. 7. Clamp the blank title board securely in position. Fasten the camera so its lens is directly above the center of the titler base and the lens axis is at right angles to the title board. Be sure the distance from the board to the auxiliary lens is equal to the focal length of that lens. Look through the camera finder and, with a pencil, mark on the board the boundaries of the finder field. Then correct for parallax. If the finder is notched or ruled to indicate the center lines of the field, mark these also. Now remove the title board from its mount and continue.

Measure carefully the distance from the center of the camera lens to the center of the finder lens. If the finder is not directly



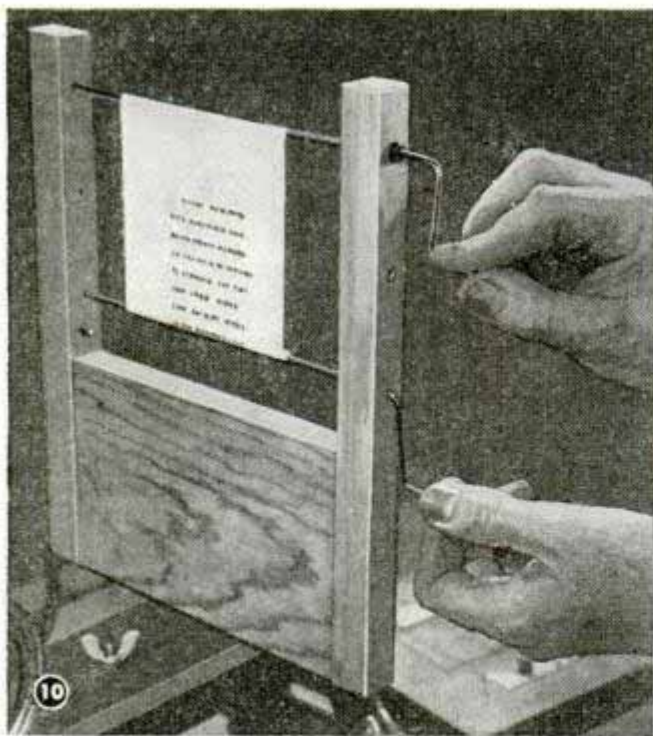
ADJUSTING CAMERA BY SIGHTING THROUGH VIEWFINDER



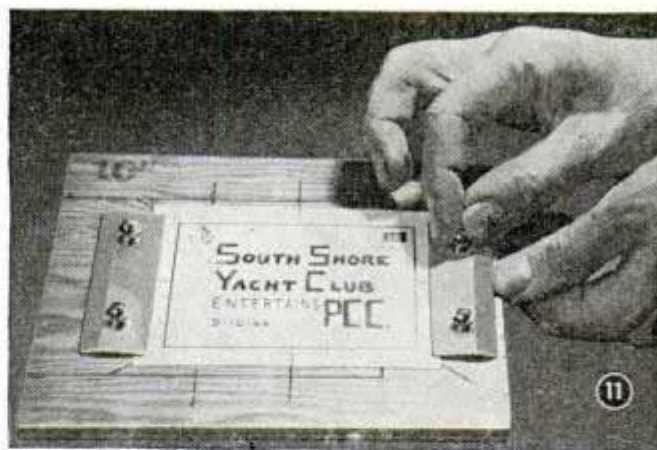
above or directly at one side of the camera lens, measure both the vertical and horizontal displacements. Lay off the same distances on the title board, using the center of the finder-field area as a starting point. This gives you the center of the field covered by the camera lens. Draw a vertical and a horizontal line through this center point. When you make a title card, draw a line around it indicating the precise size of the field covered by the

lens. Outside the frame draw vertical and horizontal center lines, indicating mid-points of the frame sides. Clamps made as shown in Fig. 6 hold the cards as in Fig. 11. Inner edges of the clamps should be just outside the camera field. When shooting a title, center the card, clamp the title board in position, and adjust the camera until the view finder field matches the finder area drawn on the board. Alignment in the horizontal plane is automatic. Mark the auxiliary-lens focus on each panel. One board will accommodate two title-card sizes, one on each surface.

The lamp units are located one above the other as in Figs. 1, 7 and 9. The lamps are supported on a lightweight angle-iron

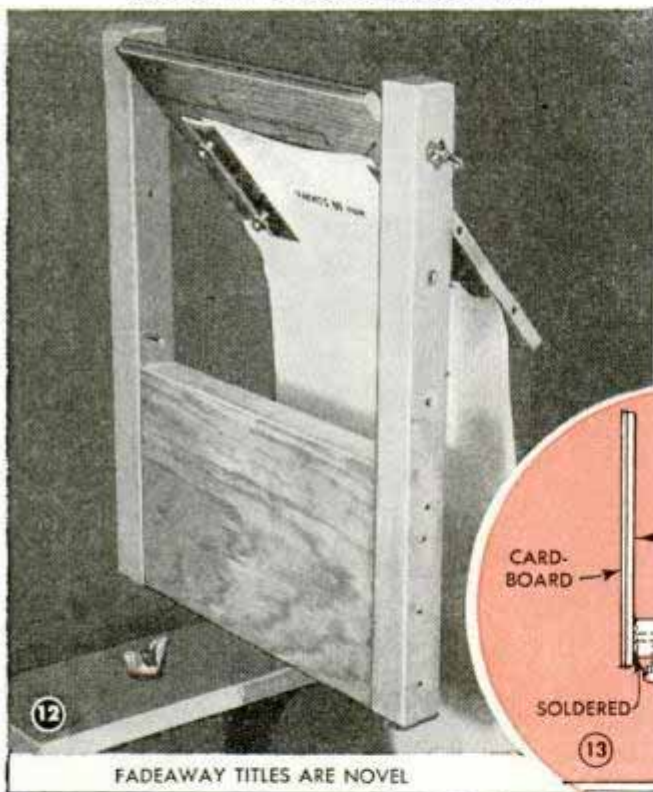


USE A STRIP TITLE FOR LONG DESCRIPTION

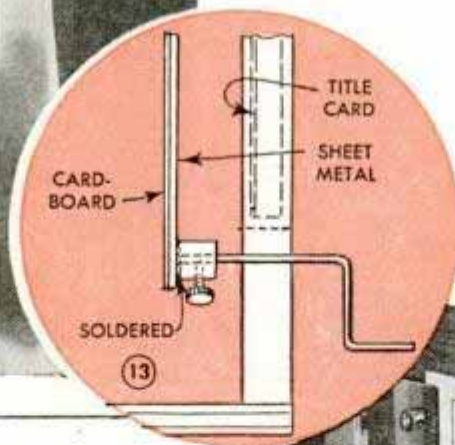


When fast film is used, 40 to 60-watt lamps usually are adequate. Strip titles are printed on paper wound around two cranks bent from stiff wire and inserted into upper and lower holes in the title-board uprights as in Fig. 10. Wind the strip slowly from the lower crank to the upper one.

"Wipe-on" and "wipe-off" effects are produced by a simple arrangement consisting of a bent-wire crank extending through holes below the title board and supporting a piece of black or white cardboard or metal, Figs. 12, 13 and 14. The wiper "fan" is shaped so it completely covers the title card in one position, Fig. 13, and uncovers it in another, Fig. 14. When using positive film that is to be developed as a negative the fan is white. For reversible film it is black. Likewise, use black letters on white for positive film, white on black for reversible. For close-up shooting of flowers and small objects you can use a board having the camera-field opening cut out so the board serves as a mask, finder and range finder.



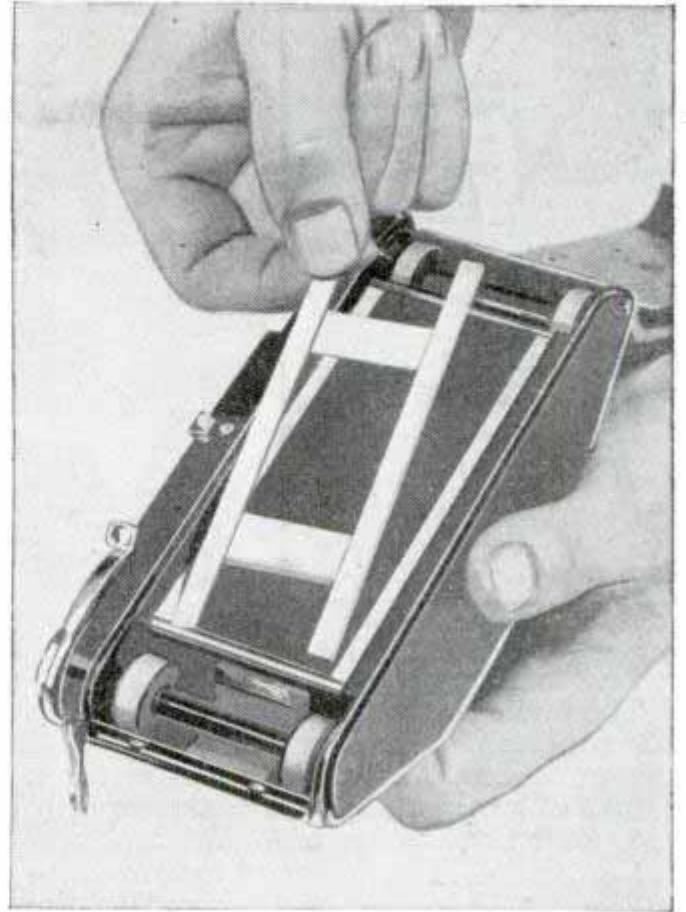
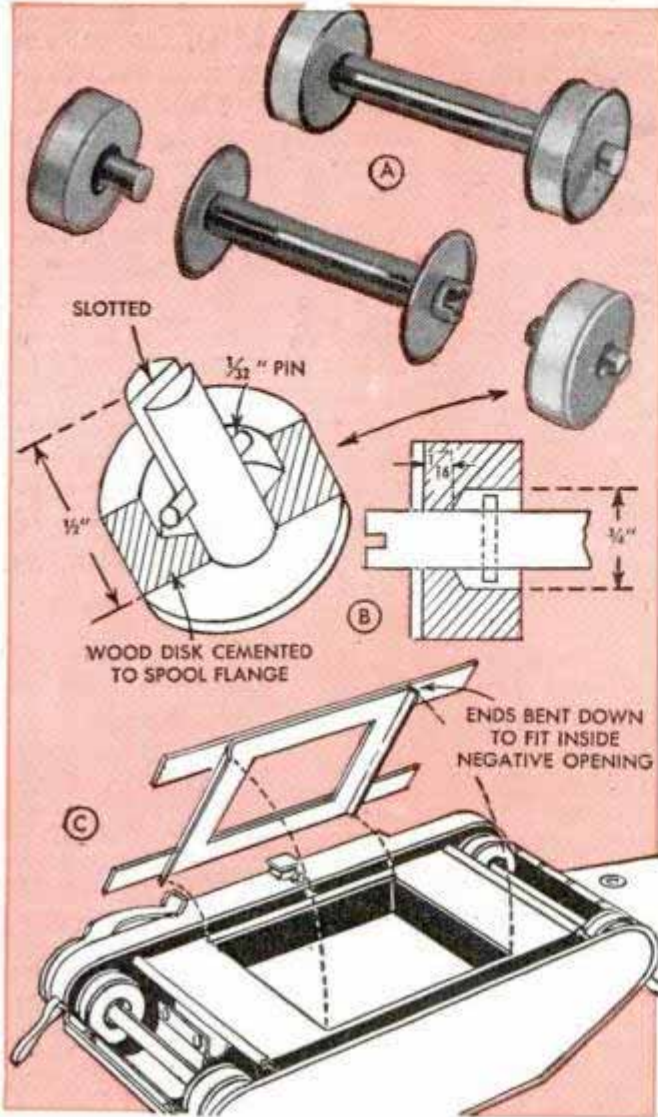
FADEAWAY TITLES ARE NOVEL



TITLES WITH WIPE-ON AND WIPE-OFF EFFECT

frame, 13½ in. high and 5 in. across the leg, which is held in place with a ¼-in. bolt. The lamp reflectors can be made from No. 2 tin cans which are large enough to house No. 1 photoflood lamps. Porcelain screwing sockets are soldered to the ends if they and the lamp will fit in the reflector, otherwise use metal sockets. Insides of the reflectors are coated with white casein paint. Use small bolts or metal screws to fasten reflectors to the upright. The reflectors are located about 7 in. apart, center-to-center distance. Aim the openings, Fig. 8, at the title card. For making titles directly on positive film, use No. 1 photoflood lamps.

Adapting Your Camera for Color Transparencies



If you want to take 35-mm. transparencies for projection but do not have a 35-mm. camera, you can adapt your camera for this film by making a mask and spools of the proper size. Although the one shown takes No. 127 film, many roll film cameras can be converted by making a mask and spools to fit the model in question. Small spools, approximately 35 mm. between flanges, are used and their width is increased by adding wooden disks and the flanges from spools that fit your camera, as indicated in details A and B. The pin which is shown in detail B need be on one side only so the spool will turn with the winding key.

The mask which fits over the aperture plate is made of two pieces of fiber cardboard or light metal, with the ends of the lower piece bent to fit inside the negative opening, detail C. The opening which frames the film should be a little under 1 in. by 1 1/2 in. After the mask has been cut and fitted, it should be finished with a lusterless black paint. Then paste a piece of opaque paper over the indicating window in the back and the job is complete.

The camera can be loaded with either bulk film or film taken from a regular car-

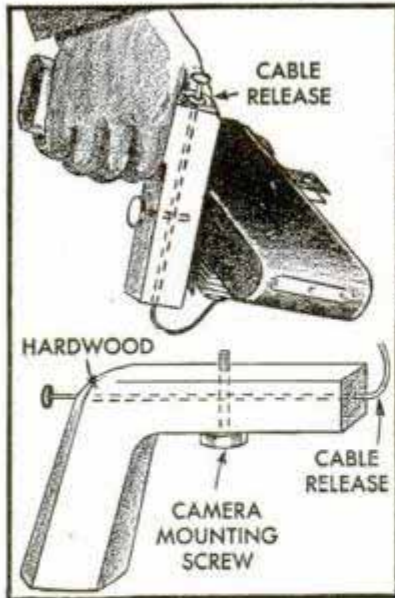
tridge. This operation must be performed in the dark, of course, and you can save film by pasting a leader strip on to start the roll over the empty spool. To indicate how many turns are necessary to expose a new frame, place marks on the side of the camera near the key. These marks can be located by experimenting with exposed film. Since the negative area is reduced, allowance must be made for this reduction in the view finder.

How to Test an Exposure Meter

Check your exposure meter while it is in good condition so that if it is dropped, or you have reason later to question its accuracy, you can compare readings. To check it, remove the lens board of your enlarger and place the meter over the opening with the "eye" or cell turned toward the lamp. Then, with the light turned on, note the meter reading and the position of the enlarger bellows. By comparing later readings with this data, you can tell quickly whether or not the meter is accurate.



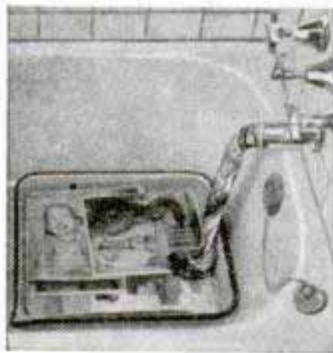
Pistol Grip Aids in Taking Fast-Action "Shots"



For taking fast-action pictures, where split-second viewing and focusing are necessary, a pistol grip like the one shown allows you to hold the camera with both hands for greater steadiness while pressing the cable release with the thumb. The grip is made of hardwood and is drilled for the camera mounting screw and release, the dimensions being made to suit your particular make or type of camera.—Ken Murray, Baltimore, Md.

Noise of Water in Tray Reduced

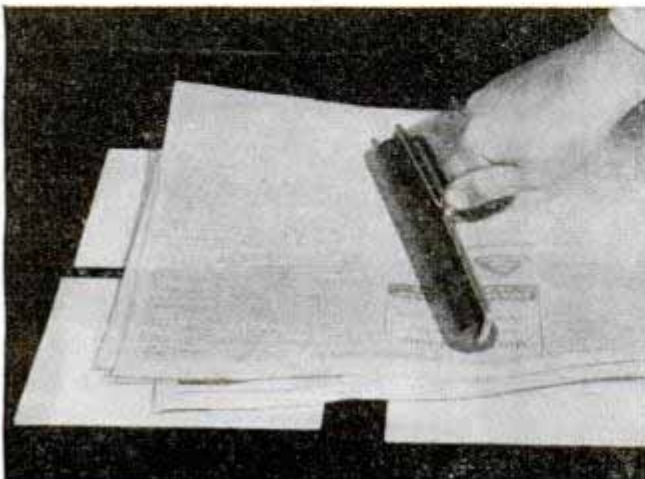
The photographer who washes prints in a tray placed in a sink or bathtub may find the noise made by the flow of water a source of annoyance. An effective remedy is to fasten one corner of a large handkerchief around the faucet and let the remaining ends trail in the tray.



A smooth and quiet flow of water, which gently agitates the prints, results.—H. Schlossberg, Washington, D. C.

Prints Will Not Crumple on Tin

In ferrotyping small prints, the operation may be difficult because the pictures slide and crumple on the tin. To avoid this and do the job faster, place a few sheets of newspaper over the prints to serve as a combination blotter and backing sheet.



Rounded Corners Protect Films

When several negatives are handled at one time, the corners of one negative may scratch the emulsion on another. One



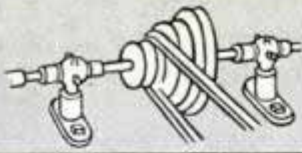
photographer avoids this by trimming the corners with a nail clipper. Any other rough edges can be smoothed with a fingernail file or nail board.

William Swallow, Brooklyn, N. Y.

Wiper Blade Used to Spread Paste

A windshield wiper blade provides a handy applicator for spreading paste on the backs of photoprints that are to be mounted. The prints can be laid face down on newspapers so that any paste wiped over the edges will not damage the table on which the work is being done.

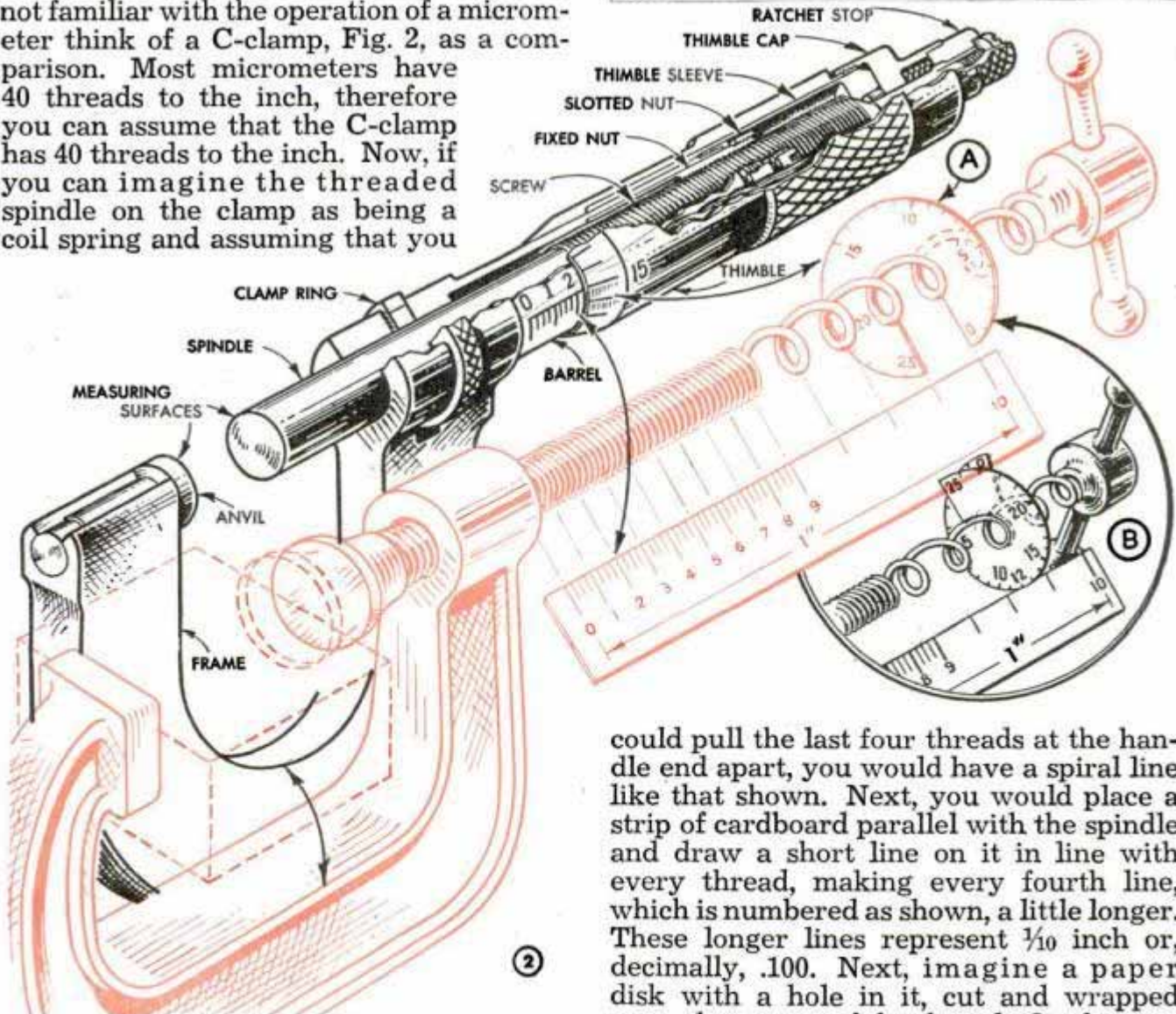




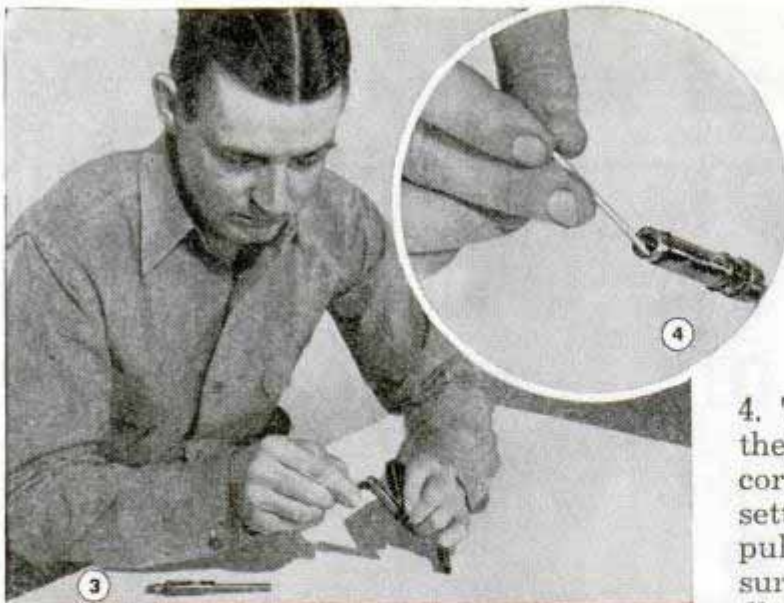
Care and Use of THE MICROMETER

By Arthur Youngquist

ALTHOUGH micrometers are made in many shapes, types and sizes, the principles of operation are very much the same and should be understood thoroughly by anyone attempting to clean or adjust these delicate measuring instruments. If you're not familiar with the operation of a micrometer think of a C-clamp, Fig. 2, as a comparison. Most micrometers have 40 threads to the inch, therefore you can assume that the C-clamp has 40 threads to the inch. Now, if you can imagine the threaded spindle on the clamp as being a coil spring and assuming that you



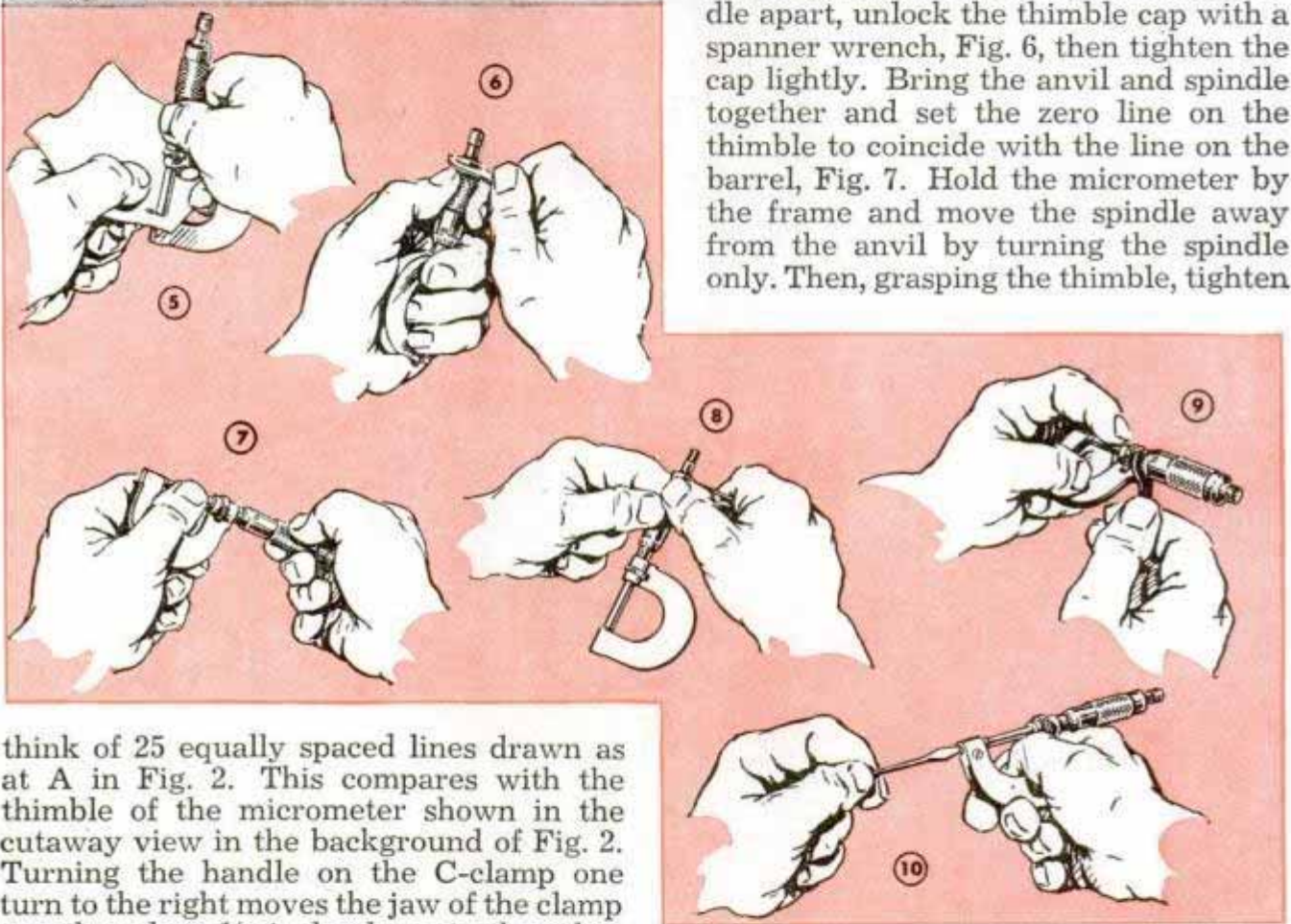
could pull the last four threads at the handle end apart, you would have a spiral line like that shown. Next, you would place a strip of cardboard parallel with the spindle and draw a short line on it in line with every thread, making every fourth line, which is numbered as shown, a little longer. These longer lines represent $\frac{1}{10}$ inch or, decimally, .100. Next, imagine a paper disk with a hole in it, cut and wrapped around one turn of the thread. On this you



C-clamp, but by studying the comparisons you will have a better understanding of the micrometer mechanism.

If the micrometer does not give a correct reading due to play in the threads, adjust it with the slotted nut, Fig. 2. Remove the screw spindle from the barrel and clean with pure naphtha, Fig. 1. Then place a few drops of light oil on the threads with a toothpick as in Fig.

4. Tighten the slotted nut on the end of the barrel, Fig. 3, by stages to secure the correct adjustment. To adjust for zero setting clean the anvil and spindle by pulling a piece of soft paper between the surfaces, Fig. 5. With the anvil and spindle apart, unlock the thimble cap with a spanner wrench, Fig. 6, then tighten the cap lightly. Bring the anvil and spindle together and set the zero line on the thimble to coincide with the line on the barrel, Fig. 7. Hold the micrometer by the frame and move the spindle away from the anvil by turning the spindle only. Then, grasping the thimble, tighten



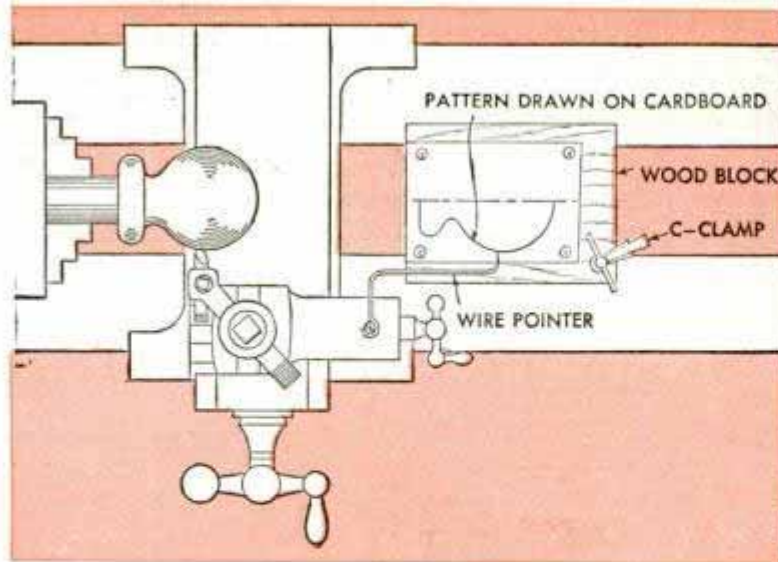
think of 25 equally spaced lines drawn as at A in Fig. 2. This compares with the thimble of the micrometer shown in the cutaway view in the background of Fig. 2. Turning the handle on the C-clamp one turn to the right moves the jaw of the clamp one thread, or $\frac{1}{40}$ inch, closer to the other jaw. Decimally this would be .025. By turning the handle one mark on the paper disk A the jaw would move $\frac{1}{25}$ of $\frac{1}{40}$ inch, or .001.

Now, if you turn the handle until the C-clamp jaws lightly touch the "block" indicated by the broken lines, the paper disk will advance to the position shown in detail B, Fig. 2. To read this imaginary "mike," you first count the number of lines representing $\frac{1}{40}$ inch and write it decimally .900; then the $\frac{1}{40}$ -inch lines, which is $\frac{2}{40}$ or .050, and finally the paper-disk lines $1\frac{1}{25}$ of $\frac{1}{40}$ inch, or .012. The sum of these values is .962 of an inch, which is the thickness of the block. Of course, it would be impossible to measure within .001 inch with an ordinary

the cap with the wrench as shown in Fig. 8.

On some types of micrometers the zero setting is made by first cleaning and then bringing the spindle and anvil together, then turning a friction sleeve on the barrel until a line on the sleeve coincides with the zero line on the thimble, Fig. 9. If the micrometer is the adjustable-anvil type the zero setting can be made by loosening the binding screw in the frame next to the anvil and adjusting the anvil screw as in Fig. 10. Micrometer readings should be taken occasionally with a precision gauge block of known dimensions to determine the accuracy of the instrument.

Inside-Outside Turning Done Without Template



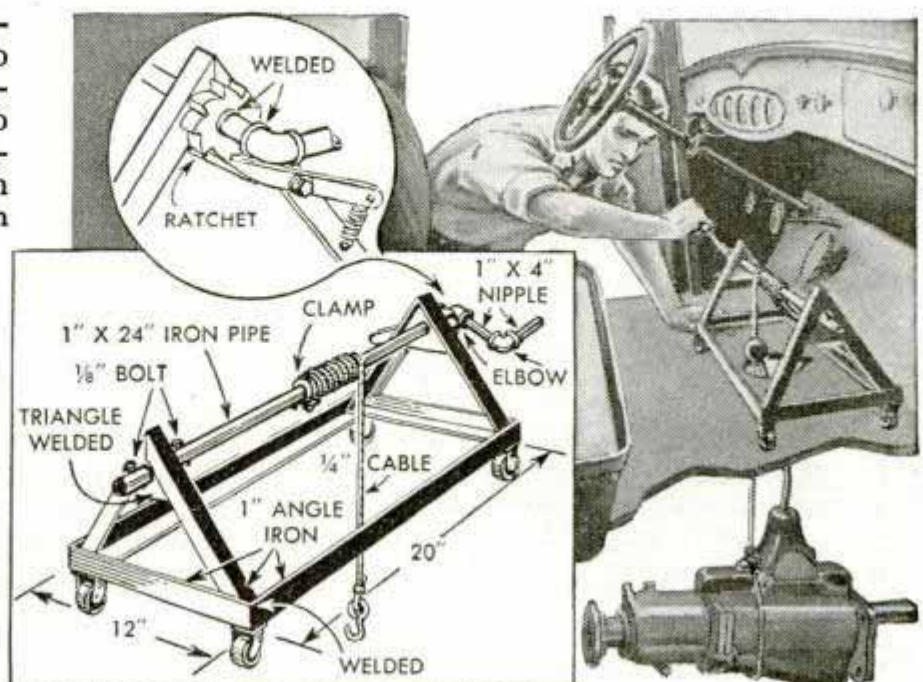
By Axel E. Jensen

When turning a sphere, a sphere-and-bead form or other similar shapes, you must have some means of accurately truing the profile after roughing the work to approximate shape. The method shown makes a separate template unnecessary and is much faster and more accurate because both hands are always free to handle the lathe carriage. The setup is simple, consisting merely of a rigid pointer attached to the tool-post saddle in the position indicated, and a wood block which is clamped to the lathe bed. The block can be of any convenient size that will provide space for tacking the full-size pattern on the top surface. In most cases a length of heavy wire will do for a pointer. One end

is ground to a sharp point and a round eye is bent in the opposite end so that the pointer can be fastened securely with a machine screw. Just how the pointer is bent or shaped will depend on the nature and length of the pattern and also on the type of lathe. In use the work is mounted in a chuck and turned down to the rough shape. Then the wood block, with the pattern outline attached as shown, is clamped to the lathe bed. The tool is located at the start of the cut. Then either the pointer or pattern, or both, is moved so the starting point on the pattern corresponds to the position of the tool on the work. The same setup can be used when boring a blind hole to a given depth.

Auto Transmission Is Removed by One Man With Hoist

This hoist has been designed to enable one man to remove and install the transmission in a car. Of a size to fit into the front compartment, the hoist is placed on the floorboards and the chain is fastened around the transmission which then is lowered after being disconnected from the clutch and drive shaft. The framework is of welded-steel construction and the crank is made of iron pipe. All other parts, such as the casters and ratchet wheel, are standard hardware items which are easily obtained.—Jerome J. Ford, Lancaster, Ohio.



Holes Drilled From Opposite Sides Simplify Slotting Flat Iron



Here's a good way of drilling a length of heavy flat iron preparatory to slotting it. Ordinarily, if the holes are spaced far apart, much stock is left to be filed or chiseled out, and if the holes are closely spaced, the drill has a tendency to lead back into the hole previously made. But by drilling half-way through from either side, as shown in the upper detail, this trouble is avoided. Or you can stagger the holes from opposite sides, as indicated in the lower diagram. By the latter means, the holes will overlap, yet the drill will not be drawn to either side.

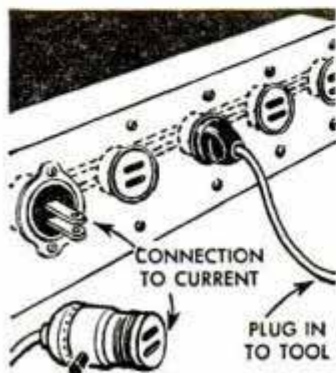
Leigh B. Freed, North Manchester, Ind.

Filled Screw Slots Protect Box

When shipping wooden boxes that have lids held on with screws, you can discourage tampering by filling the slots in the screw heads with solder and wiping off the excess metal with a cloth. A hot soldering iron applied to the heads will melt the solder when the box is to be opened again.

S/Sgt. Chas. L. Ganong, Alexandria, La.

Multiple Outlets for Power Tools From One Connection

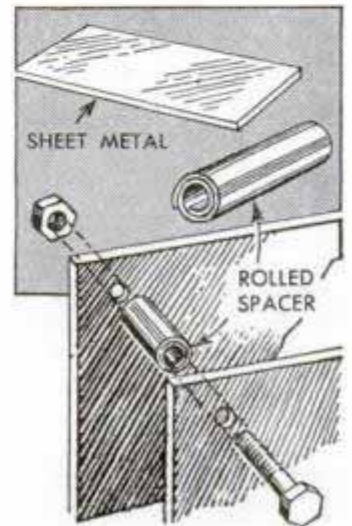


If you do not have enough electrical outlets for your light power tools, you can make this multiple box with as many connections as are required. In no case, however, should the total

load taken from the box exceed the wattage or amperage for which it and the other fixtures on the circuit have been rated. The box is made of sheet metal with base plug outlets which are well insulated to prevent metal-to-metal contact between the fixtures and the sheet metal. One male outlet to connect to the current source, and as many female outlets as are needed for the tools, are mounted in the box. All of the fixtures are wired in parallel, as is indicated by the illustration.

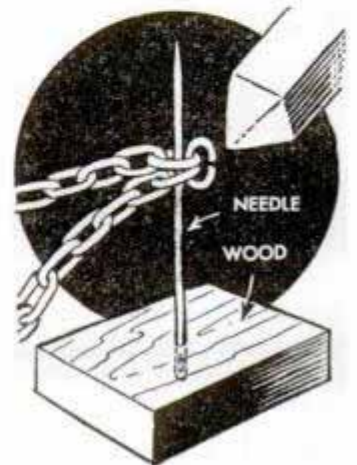
Rolled Metal Strip Forms Spacers

For sheet-metal work where spacers of exact length are required to hold pieces of steel the same distance apart, they can be cut from a strip of sheet metal and rolled to fit around the fastening bolt. The metal used should be a light gauge so it can be bent easily. Insert the bolt through the two pieces and run the nut on the threads to hold the bolt in place. Then cut a short length of steel from the strip and wind a number of turns around the bolt to form the spacer. Tightening the nut will hold the parts firmly in place.



Fine Jewelry Chain Is Soldered On Needle Fixture

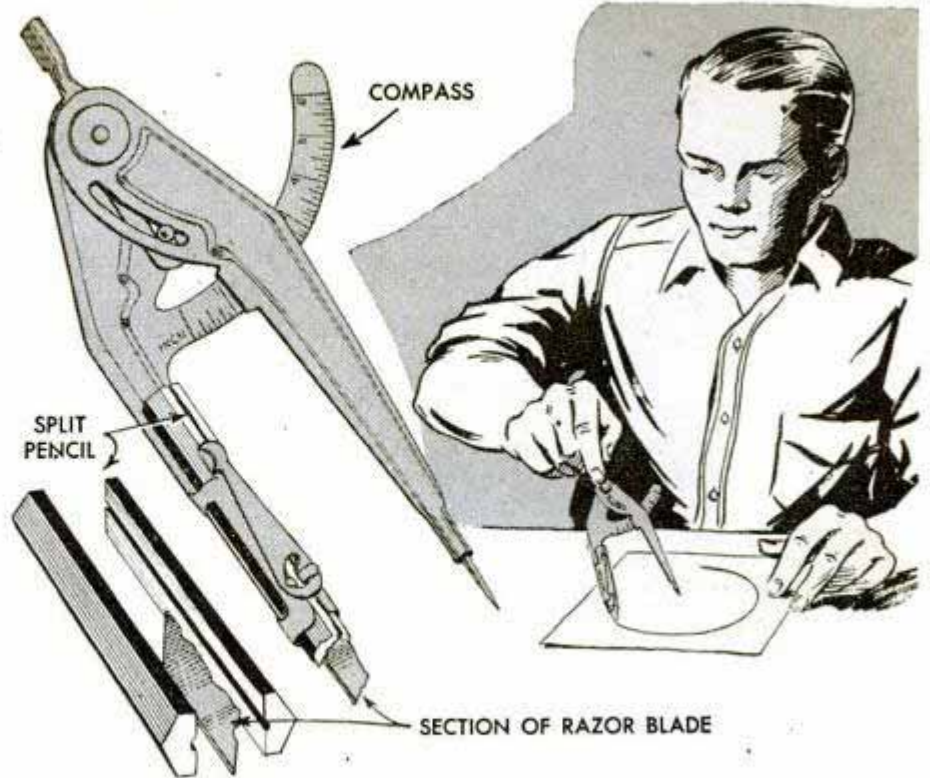
A needle stuck vertically into a wooden block will provide a fixture for holding fine jewelry chains to solder a broken link. Slip the two links adjoining the broken one over the needle as indicated. This will hold the broken link in position for soldering with a small soldering iron. In some cases, it may be better to support the needle at an angle or in a horizontal position. You can do this by gripping the fixture in a small vise. Size of the needle to use will depend on the size of the chain links. These should not slide more than halfway down the length of the needle.—Ed Pelczar, Wilkes Barre, Pa.



Attachment on Compass to Cut Paper Patterns

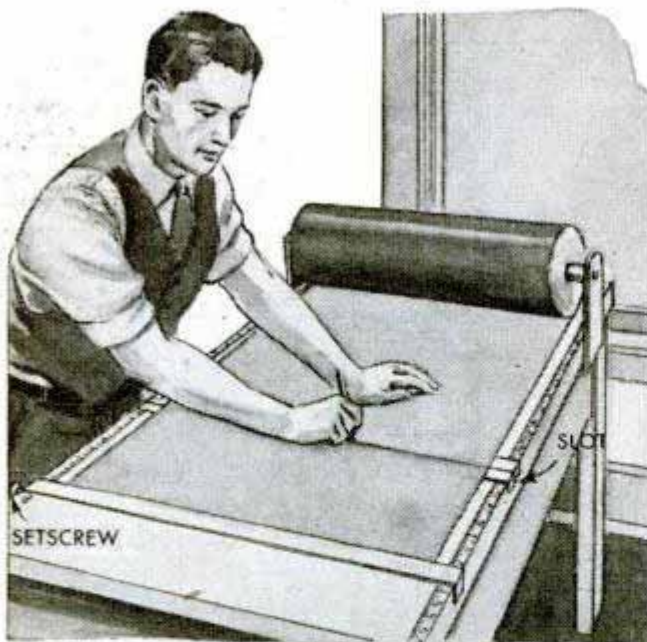
When scribing or cutting circles to make patterns for sheet-metal work, gaskets, etc., the compass shown here is handy. Since the knife is the narrow section of a razor blade, it is renewed easily when worn. The blade is held between the split halves of a pencil and clamped to one arm of the compass. Note that only a short length of blade extends beyond the end of the holder. So that both arms of the compass will be of equal length, it may be necessary to shorten the point. A knife for straight cutting can be made by splitting a pencil, removing the lead and inserting a strip of razor blade. If the pencil were cut only far enough to hold the blade and the lead left in the remaining section, the pencil end could be used for marking.

R. Boettinger, Englewood, N. J.



to fit the table, and provided with a set-screw to fasten it at any point along the edge, which is graduated to form a measuring rule.

Guide Used to Measure and Cut Drafting Paper



If two metal strips are recessed in a table, as shown, they will serve as a knife guide for cutting drafting paper squarely and quickly. Countersunk holes are drilled through the strips and flathead wood screws are used to hold them in place. To measure off required lengths of paper, use is made of a flat metal stop, bent over at both ends

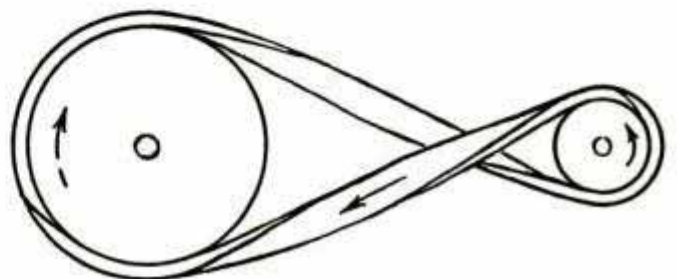
Mercury Makes Solder Brittle

Ordinary wire solder, which is very pliable, will be almost as brittle as glass when coated with mercury. Pass the solder through a small pool of mercury and then rub it until it shines. After this treatment, the wire will snap like glass.

Rotation of Crossed-Belt Drives Arranged to Lessen Wear

To prevent scarfed joints on crossed-belt drives from tending to pull apart due to the rubbing action where the belts cross, have the belt rotate in such a direction that the rubbing will press the edge of the joint down. If rotated in the opposite direction, the edges may catch and the lap will be opened. Another cause of breakdown of this type of belt occurs when the belt is run over pulleys of too small diameter. In such a case use of a lighter belt is indicated.

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



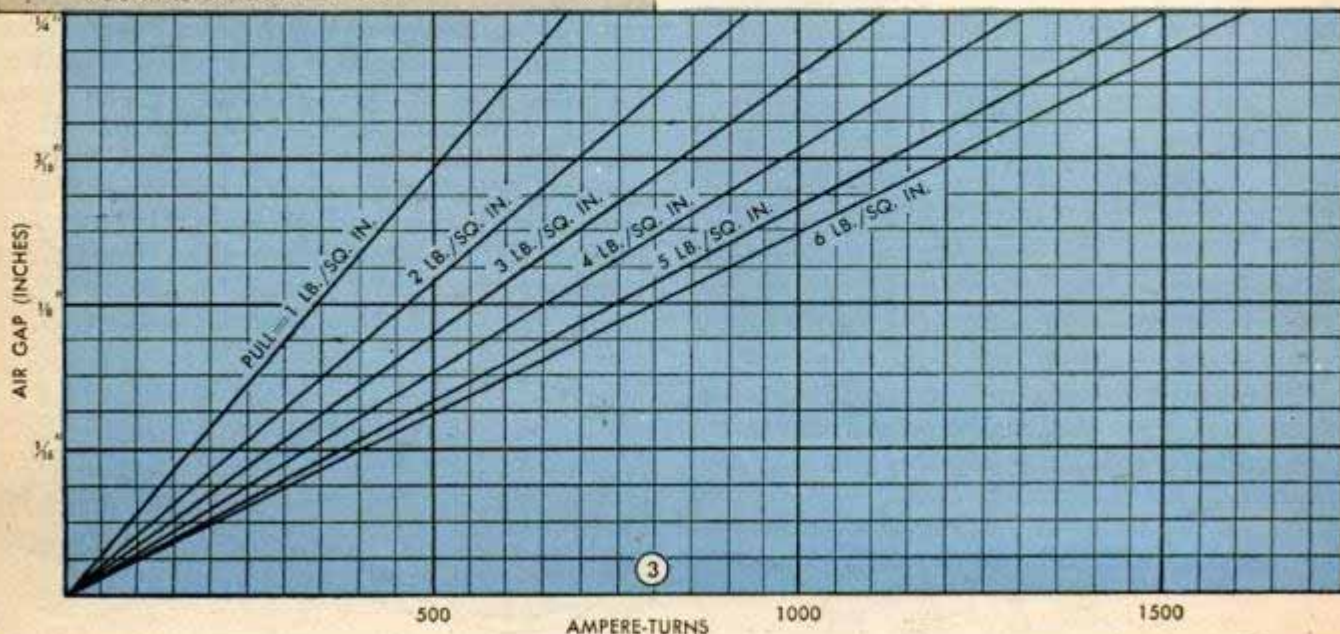
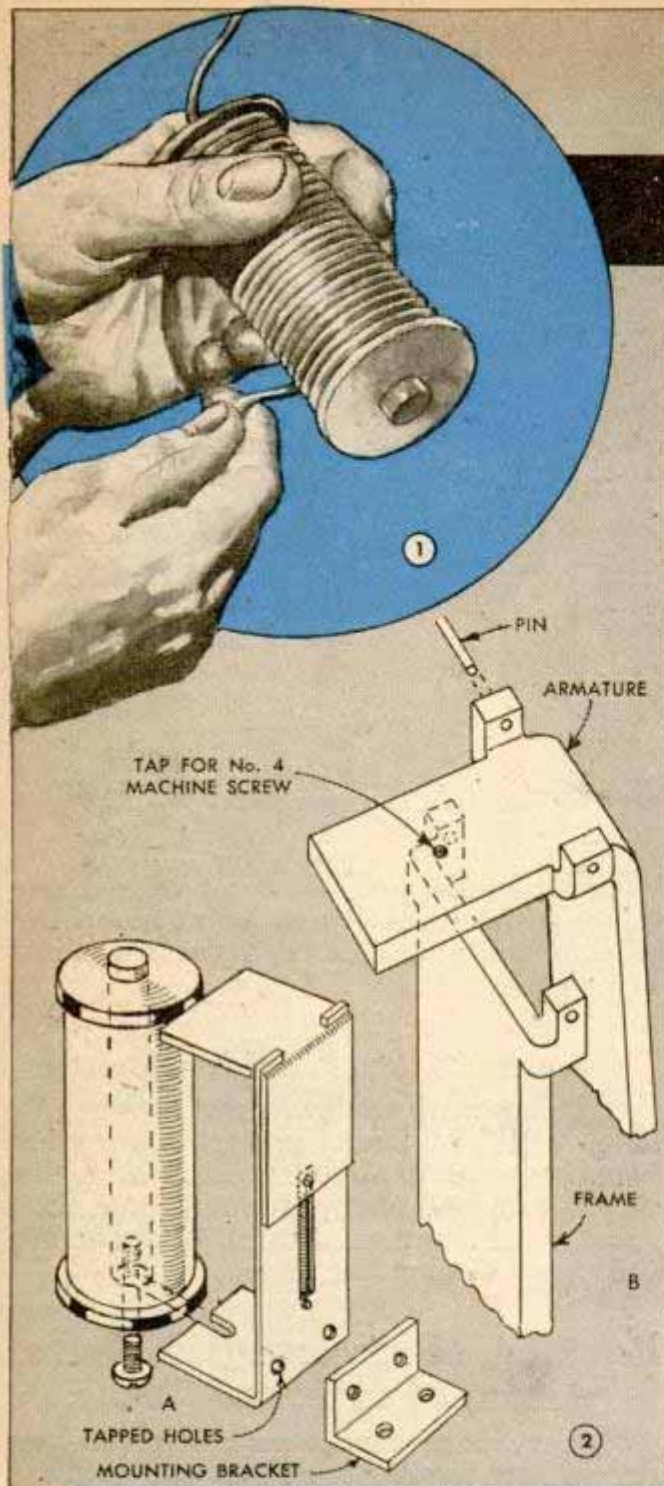
Build Your

PART 1-D.C. RELAYS

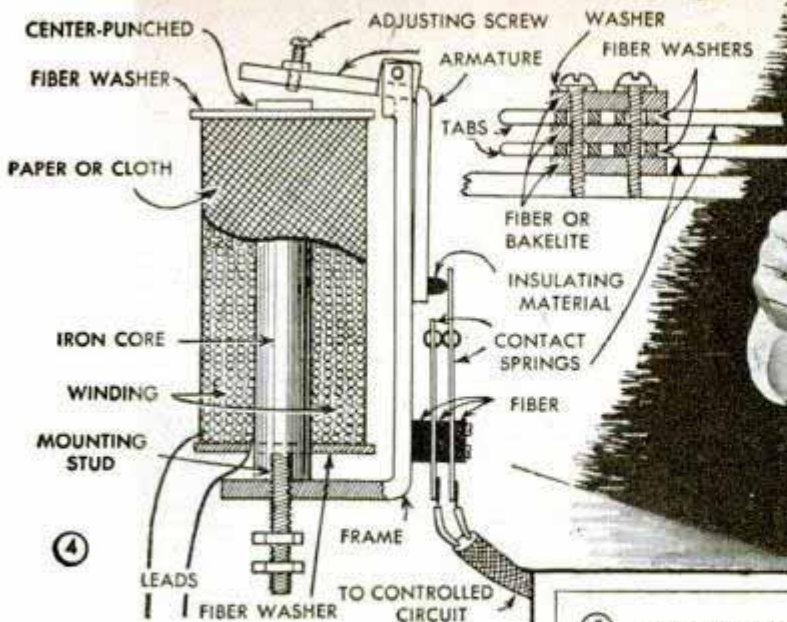
By C. A. Crowley

A RELAY is a simple device for controlling one electrical circuit by means of another. A low-voltage current flowing through the coil of a relay energizes it and causes movement of the relay armature, which, in turn, opens or closes one or more circuits to be controlled. Relays are important in places where a controlling device such as a home or office thermostat, a photoelectric cell, a burglar alarm, a fire alarm or other equipment is used, that can stand only a small current, but which must control a heavy current such as that required by a heater or motor. Relays also can be used to control shop motors remotely at a number of locations with ordinary push buttons.

It will be seen from Fig. 4 that the relay consists of a core, a coil wound on the core, a frame or "heel" piece, an armature and an arm on the armature which moves the contact springs. In some designs there are additional springs as in Fig. 6, A, where the moving contact is placed directly on the armature, while in Fig. 6, B, as well as in other designs shown, the fixed and moving contacts are insulated from the frame, and the moving contact is operated by a fiber "button" mounted on the armature. This form of construction generally is preferable to grounding the moving contact to the frame and armature. In any case, the contact springs must be insulated



Own RELAYS



carefully and completely from each other as shown in the detail Fig. 4.

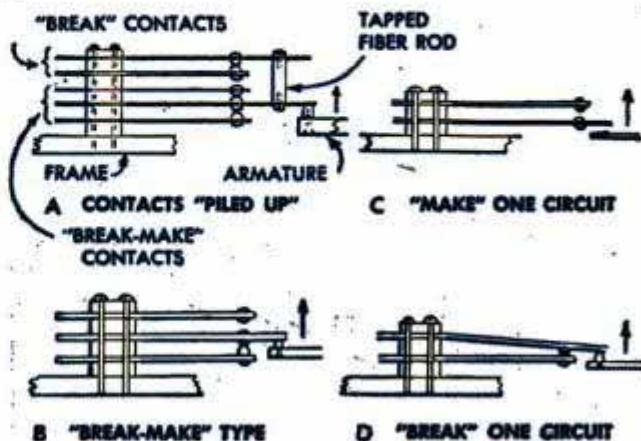
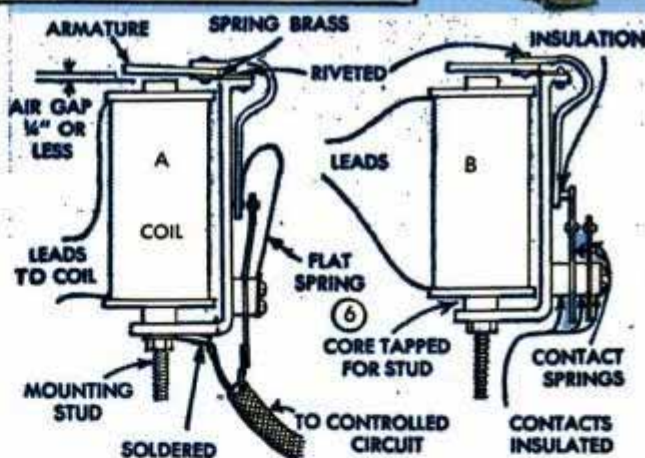
When deciding upon the type to use for a given purpose the following generalizations will be helpful: Heavy contact springs to handle large currents—use designs shown in Fig. 2, B, and Fig. 4; light contact springs to handle medium or small currents—use design shown in Fig. 6, B; simple two-contact relays for low voltages—use design shown in Fig. 6, A, and for sensitive relays to operate on very small currents such as those available from photoelectric cells, radio tubes, etc., use design shown in Fig. 2, A.

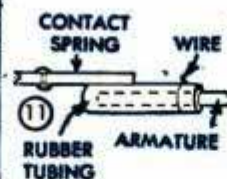
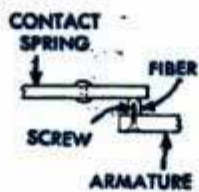
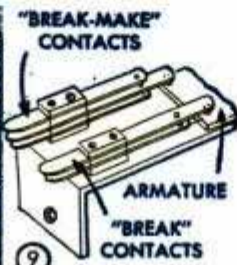
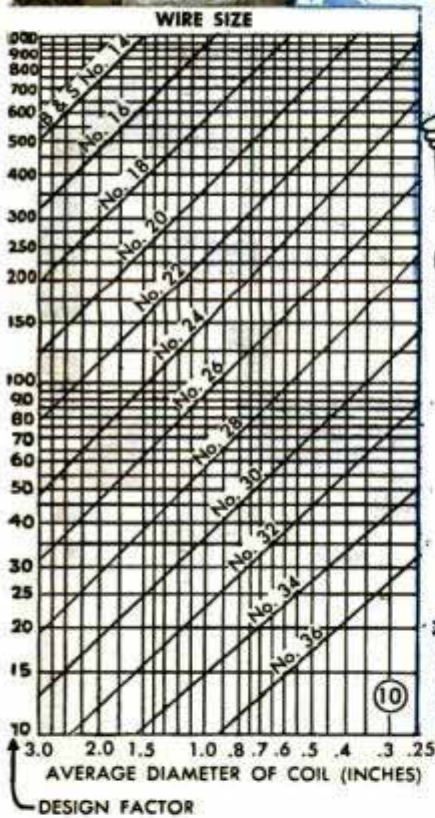
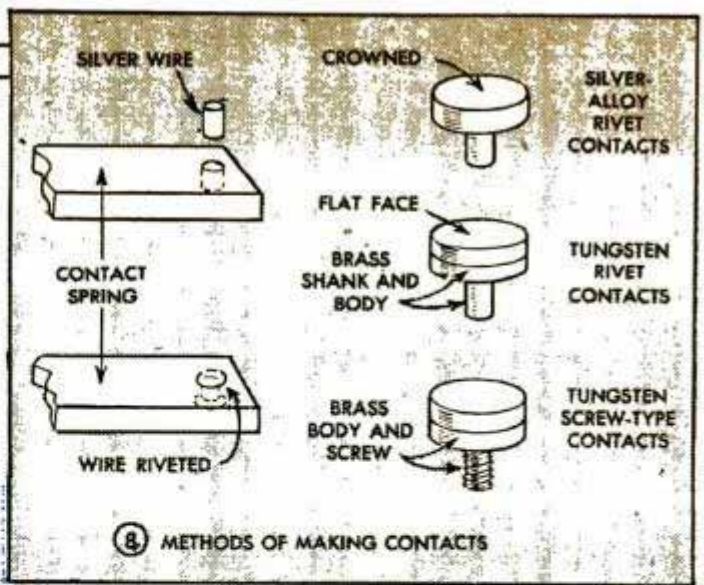
The frame and armature should be formed from 1/8-in. soft flat iron, which should be about the same width as the diameter of the coil to be wound. Contact springs are made from nickel silver or spring brass, and contact units may be assembled as in Fig. 7, details B, C and D. Two or more spring units also can be operated by one armature, either "piled up" as shown in Fig. 7, A, or side by side as in Fig. 9. Contact points for light and medium currents can be made from silver wire, forced into a hole drilled in the spring and then riveted down as in Fig. 8. For heavier currents, silver rivets or tungsten contacts of the type shown in Fig. 8 should be used. The arm which opens and closes the contact springs must be an integral part of the armature or must be rigidly attached to it. It also should be insulated from the contact springs as in Fig. 11.

Having determined the general design characteristics the next step is to calculate the coil size and winding data. The gov-

5 TOTAL PULL FOR VARIOUS SIZES OF MAGNET CORES

Diameter of Core	Lb. Pull Per Sq. In. of Core Area					
	1	2	3	4	5	6
1/4"	.05	.10	.15	.20	.25	.30
3/8"	.11	.22	.33	.44	.55	.66
1/2"	.20	.39	.59	.78	.98	1.17
3/4"	.31	.61	.92	1.22	1.53	1.84

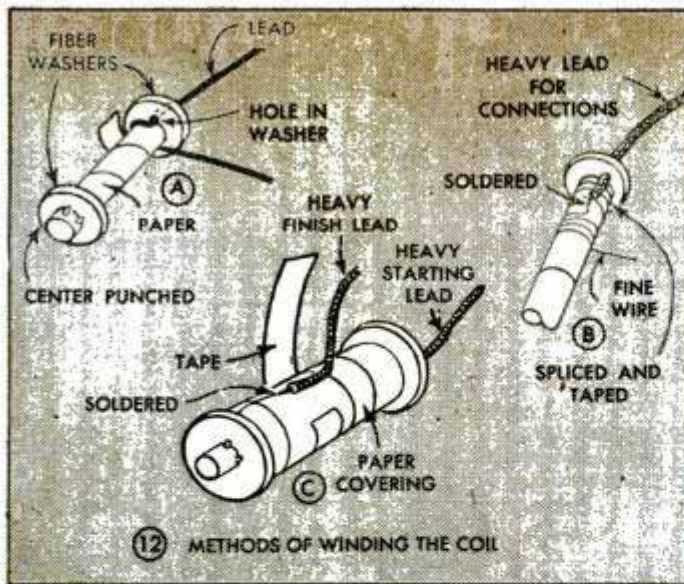




poses a $\frac{1}{4}$ -in. diameter core will be ample. However, for larger or heavy-duty relays, a heavier core may be more desirable. Refer to Fig. 5, from which it will be easy to calculate the pull required per sq. in. of core area, that is, the cross-sectional area of the core. As an example, suppose it is desired to construct a relay to operate three light springs. The pull required would be .0625 by 3 or .1875 lb. Now, referring to the table it will be seen that a $\frac{1}{4}$ -in.-diameter core wound to give a pull of 4 lbs. per sq. in. of magnet surface will pull .2 lb., or a little more than the requirement. However, as indicated in Fig. 5, a $\frac{3}{8}$ -in. core wound for a pull of 2 lbs. per sq. in. or a $\frac{1}{2}$ -in. core wound for a pull of 1 lb. per sq. in. would also meet the need. Since it is desirable to use the smallest practical core diameter, the $\frac{1}{4}$ -in. core is selected. However, for low-voltage relays it is sometimes desirable to use a larger core to reduce the current required.

Next step is to determine the number of ampere-turns required to give the desired pull. This depends on the air gap, or space between the end of the core and the armature when the relay is in the open position. See Fig. 6, A. This gap should be not more than $\frac{1}{4}$ in. and preferably should be less. In highly sensitive relays the allowable gap usually is between $\frac{1}{32}$ and $\frac{1}{16}$ in. For purposes of illustration use an air gap of $\frac{1}{8}$ in. Referring to Fig. 3, find the air gap, $\frac{1}{8}$ in., along the left-hand edge of the chart, then read straight across to the line marked with the required pull per sq. in. Then read down to the bottom where the number of ampere-turns required will be found, in this example approximately 660. Thickness of the coil should roughly equal the diameter of the magnet core, in this case approximately $\frac{1}{4}$ in., making the overall diameter of the coil $\frac{3}{4}$ in. Length of the coil proper should be about $1\frac{1}{2}$ in., which is the length of the winding space. The core

erning characteristic is the pull required of the magnet which will operate the relay. This, in turn, depends on the tension of the springs which hold the armature and contacts in their normal positions. Tension on an average contact spring should not exceed 1 oz., or .0625 lb., and may be less with very light springs. For a greater number of contact springs operated by one armature, or if an auxiliary spring is used, the pull required will be correspondingly greater. After estimating the pull required, the next step is to determine the core size. The core required will range from $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter for most relays. For ordinary pur-

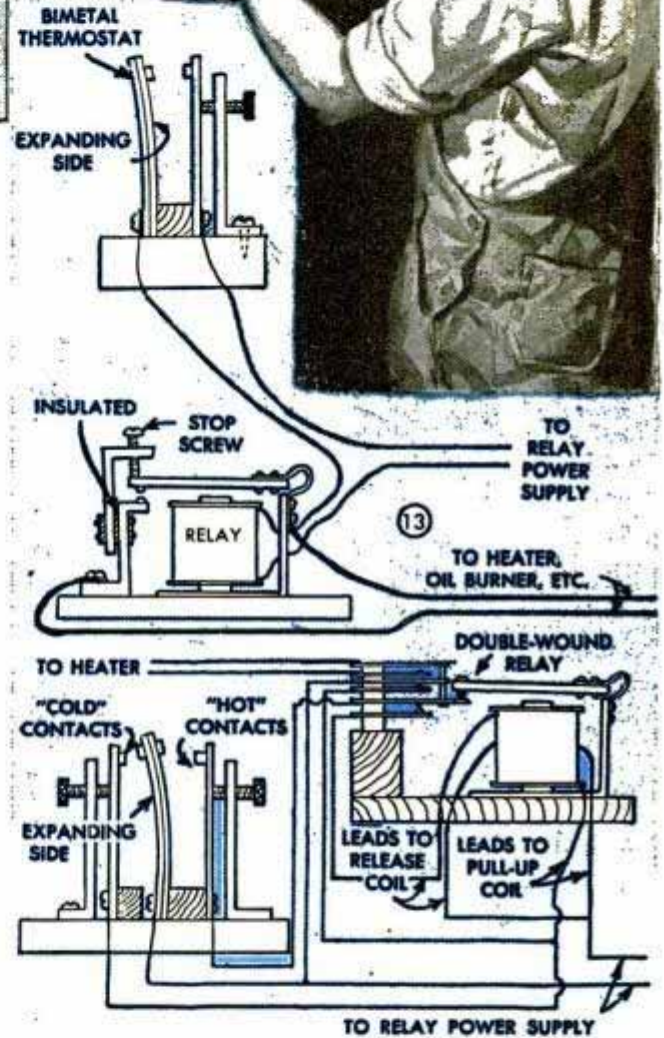
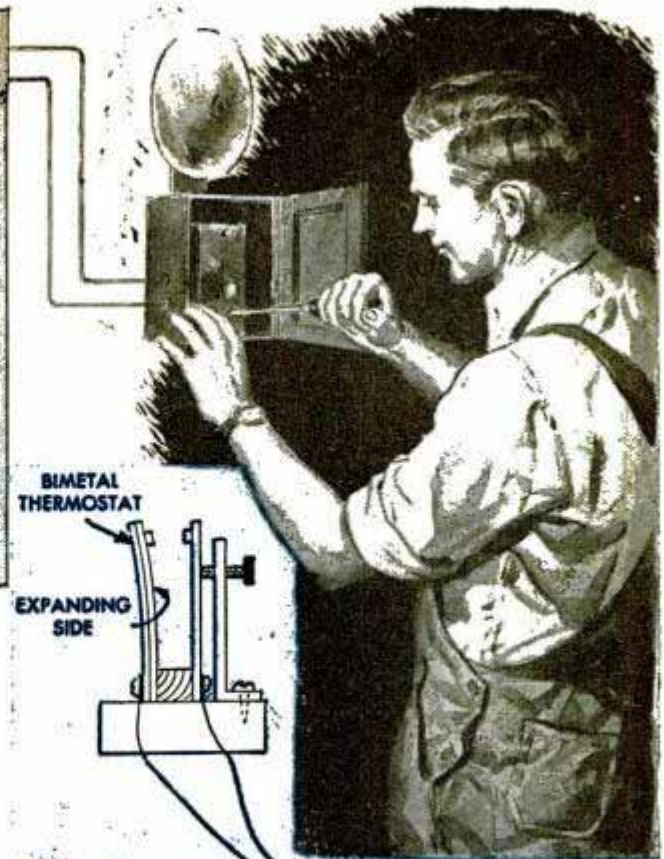


12 METHODS OF WINDING THE COIL

must be somewhat longer to allow for thickness of the insulating washers. However, these dimensions are not critical. The coil can be made longer or thicker.

The wire size for the coil is determined by the operating voltage. As an example assume that the relay is for an alarm system which will be operated on four No. 6 dry cells in series, giving a total of 6 volts. The "design factor" for a d.c. relay is found by dividing the ampere-turns by the voltage, that is, 660 ampere-turns divided by 6, or 110. Next determine the average diameter of the coil by adding the diameter of the core to the outside diameter of the coil and dividing by 2. From this it will be found that the average diameter of a coil $\frac{3}{4}$ in. outside diameter, wound on a $\frac{1}{4}$ -in. core, is 0.5 in. Now, with the aid of the chart, Fig. 10, find the design factor, 110, along the left-hand margin. Next, find the average diameter of the coil, 0.5 in., along the bottom. Finally, read straight across from the left and straight up to the intersection of the two lines. This intersection is nearest the line marked "No. 28 B & S," which is the size of wire required.

With these calculations completed you're ready to wind the coil after the manner shown in Fig. 1. First, cut the core $1\frac{3}{4}$ in. long and fit a fiber insulating washer at each end with a space of $1\frac{1}{2}$ in. between. Washers should be a tight fit and slightly larger than the outside diameter of the finished coil. Wrap the core with several turns of brown paper and coat with shellac. Start the winding as in Fig. 12, A and B, which suggest two methods of anchoring the starting end of the wire. Each two or three layers of winding should be wrapped with thin paper and coated with shellac. In winding d.c. relays it is not necessary to count the turns of wire but care should be taken to wind evenly so that the space will be filled uniformly. When the coil is finished it should be wrapped with paper or

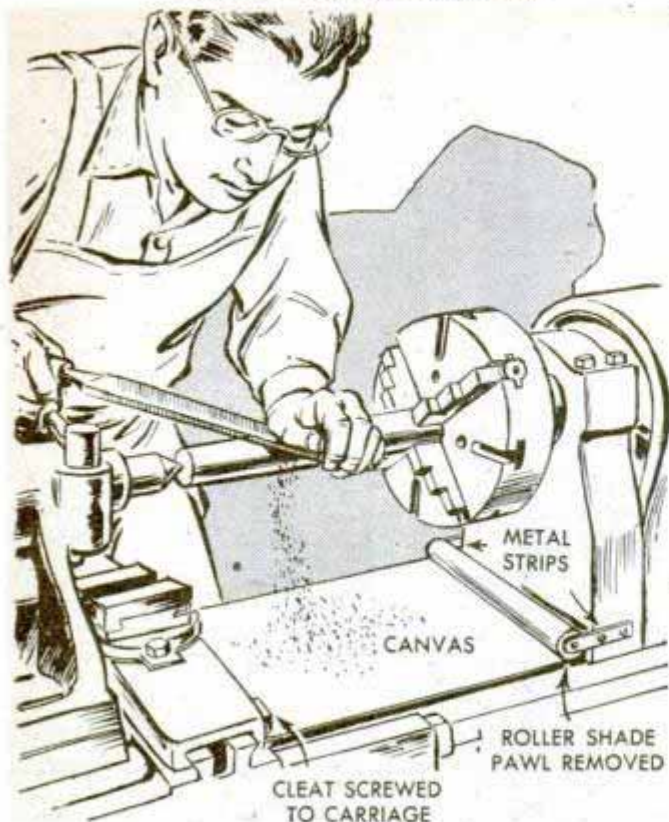


varnished cloth. If wound with fine wire, heavier leads should be soldered on and taped securely as in Fig. 12, B and C. The coil then can be mounted in the frame in the manner indicated in Fig. 4.

Contact springs should be fastened rigidly to the frame and fully insulated from it with fiber, bakelite or a similar insulating material, as in Fig. 4. Usually it will be found that the greatest sensitivity is secured when this adjusting screw just barely extends below the lower face of the armature. Provide a lock nut so that the screw can be held in the proper position. Fig. 13 details the connections for two practical applications of relay-controlled circuits.

(Continued next month)

Canvas Cover Protects Lathe Bed From Metal Filings



Instead of putting a cover over your lathe bed when filing a piece of work, you can use a roller shade and some canvas to make the one shown here. If desired, the cover can be detachable so that it is easily removed for cleaning. The catch on the shade should be removed so that it will roll in either direction.

Axel E. Jensen, New York

Arrow Points to Latest Notice On Bulletin Board

An arrow which is made of sheet metal and lettered to read "Latest Notice" or "Special Notice" can be tacked on a bulletin board to attract attention to the last item posted. The background of the arrow is



painted white and two thumbtacks are soldered on the back to hold it and to permit changing its position easily. The utility of this arrow lies in the fact that where a number of notices are posted, a new one frequently is overlooked.

Disks Prevent Triangle Smudge

If round pieces of plastic or celluloid are glued near the angles on one side of a triangle, the entire surface will not rub on the paper and smudge the pencil lines on the drawing, as will occur when the triangle rests flat on the paper. Doing this also makes it easier to pick up the instrument. The disks must be cut fairly thin since drawing a straight line is difficult if the guide is not close to the paper. Similar disks could be glued to French curves, celluloid scales and other ruling instruments.



Sante Vananzini, Astoria, N. Y.

Pencil Pointer From Match Book

A good substitute for a pencil sanding block that can be carried with you is made by removing the matches from a paper-match book and inserting several sheets of fine sandpaper cut to fit the book. The sheets are fastened with a staple. When the top sheet has been covered with pencil lead and no longer is usable, it is torn out to expose the one below it.



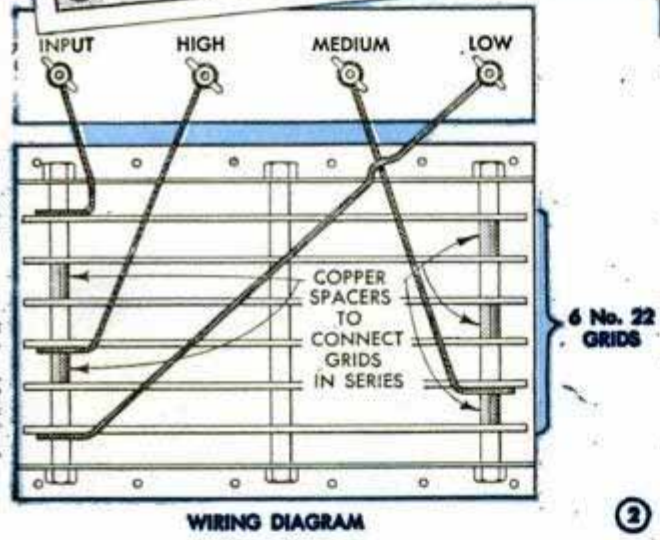
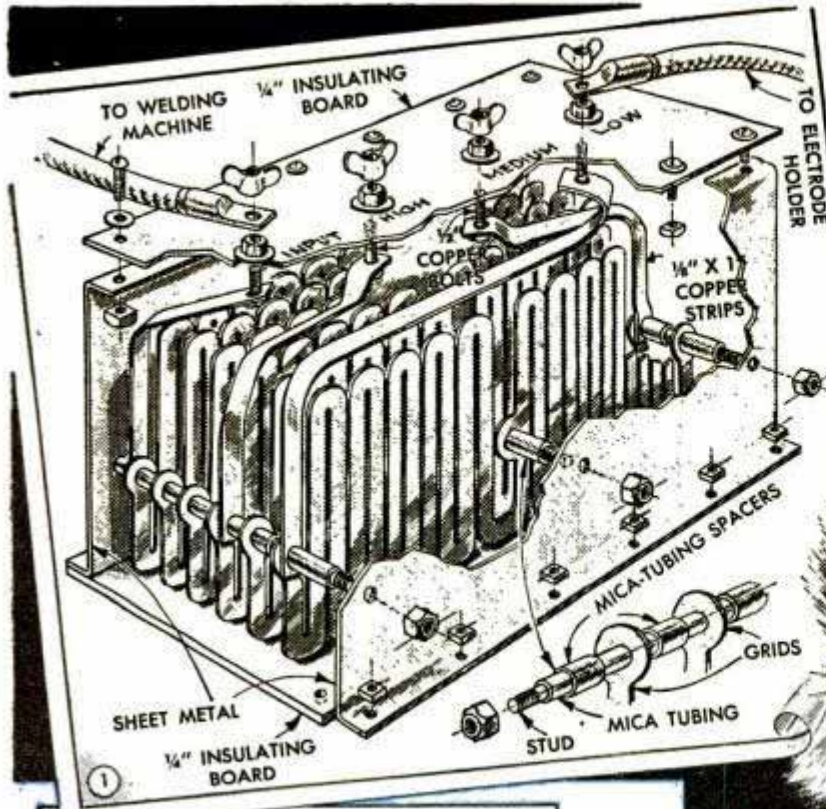
Orville Buser, Kankakee, Ill.

Ink for Writing on Glass

Ink that will adhere to glass can be made by mixing, drop by drop, a 13-percent alcoholic solution of shellac, 3 parts by volume, to a 13-percent solution of borax in water, 5 parts by volume. If a precipitate forms the solution will clear on being heated. As the amounts used are not critical, approximate volumes will do, as, for instance, 2 oz. of borax to a half pint of water. To obtain different and contrasting colors methylene blue, gentian violet or any other similar dye can be dissolved in the solution.

Arthur Beiser, New York

Resistance Unit for Welding Light Sheet Metal



This resistance unit permits welding light-gauge sheet metal as thin as No. 26 gauge, using a regular 300 or 400-ampere welding machine on which you ordinarily would be unable to limit heat sufficiently to prevent "blowing" holes in the metal, even at the lowest setting. Using this device, the heat may be cut down sufficiently to permit a smooth, uninterrupted weld. The unit consists of six No. 22 cast-iron resistance grids mounted in series, with taps to the output terminals at the end of the fourth, fifth and sixth grids. Since each of the grids is of approximately $\frac{1}{4}$ -ohm resistance, taps are therefore at 1, $1\frac{1}{4}$ and $1\frac{1}{2}$ ohms respectively. Input terminal connects, of course, with the outside end of the first grid. No. 22 grids are of sufficient size to prevent undue heating. Details above show the layout and connections. The taps, which provide

various heats for metals of different thicknesses, are ordinary $\frac{1}{2}$ -in. bolts with wing nuts and are connected to grids at the points indicated with $\frac{1}{8}$ by 1-in. copper strips. The three studs shown in the side of the box run through the grids and hold the unit together, being insulated from the grids by mica tubing and washers. Both baseboard and top panel on which terminal bolts are mounted are of $\frac{1}{4}$ -in. asbestos-type insulating board. Sides are of sheet metal. Use copper tubing instead of mica tubing, Fig. 2, where grids are connected in series. The unit is connected in series with either the electrode or ground lead when working alone, but in cases where a number of welding machines are working off a common ground it is essential that the unit be placed in the ground lead—especially if some of the machines are using straight polarity and the others reversed polarity.

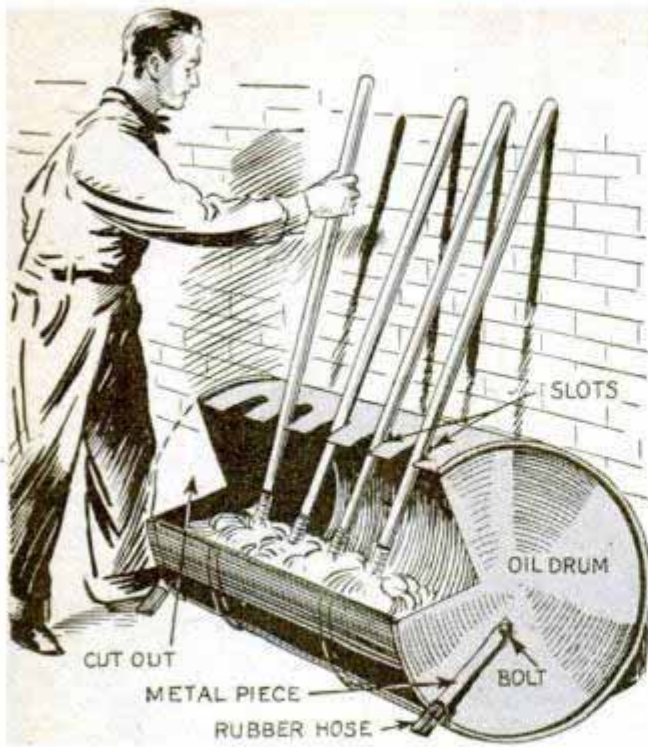
William R. Lewis, San Francisco, Calif.

'Gummed' Manifold Sandblasted To Improve Motor Operation

Sometimes deposits are built up on the inside of the intake manifold of a car which affect the efficient vaporization of the fuel. If this occurs, you can sandblast the inside to remove the deposit. At the same time it would be well to clean the exhaust manifold and install new gaskets.

Charles P. Fitz Patrick, Philadelphia, Pa.

Oil Drum Converted to Container For Greasy Mops



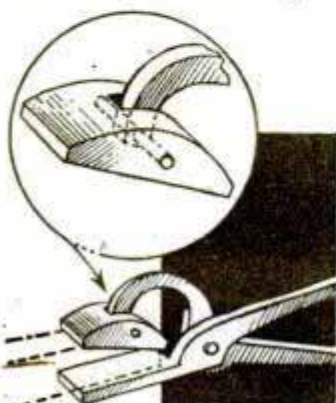
Handy for holding greasy mops, this rack is used in a garage where, since the container prevents oil and grease from spreading over the floor, it serves to reduce fire hazard. It is made by cutting a V-shaped section from an oil drum and notching it to hold the mops upright. To complete the rack, legs with rubber-hose tips are bolted to the drum to prevent it from rolling.

Keep Star-Drilled Holes Clean

When vertical holes are driven in concrete or brick with a star drill, the removal of dust presents a problem since this accumulation creates a pad that slows the action of the drill. To overcome this, one mason bushed a piece of rubber tubing to fit the auxiliary connection on a vacuum cleaner and then removed the dust by inserting the other end of the tubing in the partially drilled hole.

A. K. Brumbaugh, Jr., Inglewood, Calif.

Tongs to Grip Tapered Work

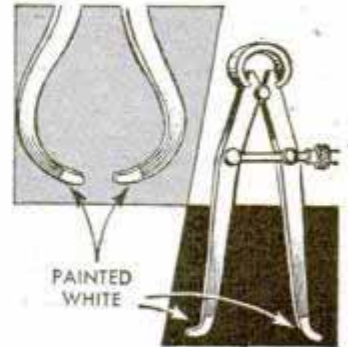


For handling tapered work, a pair of tongs having a small piece of metal shaped as indicated and pivoted to one jaw will be found useful, especially in a blacksmith shop or where hot forgings are handled. The

jaw is forged to the shape shown to fit into a recess in the pivoted member, and then a hole is drilled through this piece and the jaw for a pin to hold the jaw. The pivoted member will adjust to the surface of the work and afford a firm grip to hold the material securely.

Caliper Efficiency Is Increased By Painting Ends White

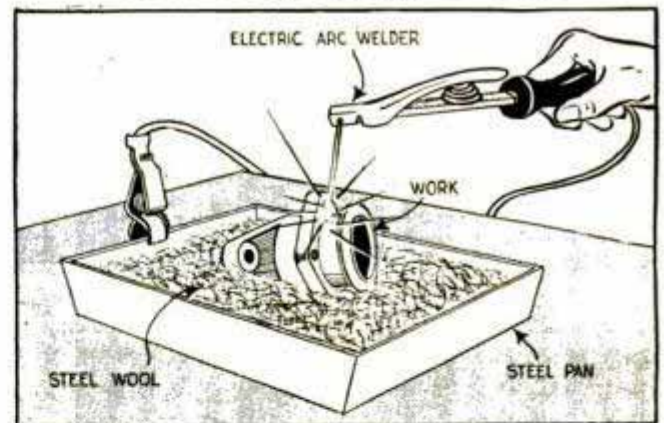
Where illumination is insufficient when using either inside or outside calipers, you can avoid eyestrain, as well as possible error in taking the caliper reading from a scale, by painting the ends of the calipers



white. This will enable you to see the ends more clearly. If accuracy is critical, remove the paint from the surfaces of the calipers that contact the work. It is best to use a flat white paint as glossy paint might cause light reflections that would result in an inaccurate reading.

Thomas Trail, Baltimore, Md.

Castings Supported on Steel Wool While Welding Them



Sometimes when using an electric welding outfit on work that is irregular in shape it is difficult to attach the ground clamp to it. Try making a nest of steel wool in an iron or steel pan to hold the work and fasten the ground clamp to one edge of the pan. The steel wool assures a good electrical contact with the work and assists in holding the parts together in the desired position for welding.

☛ If the front of a fabric typewriter cover is identified with a bright spot of nail polish, replacement will be easier because the mark will show how the cover fits.

POST-HOLE AUGER Driven By Tractor

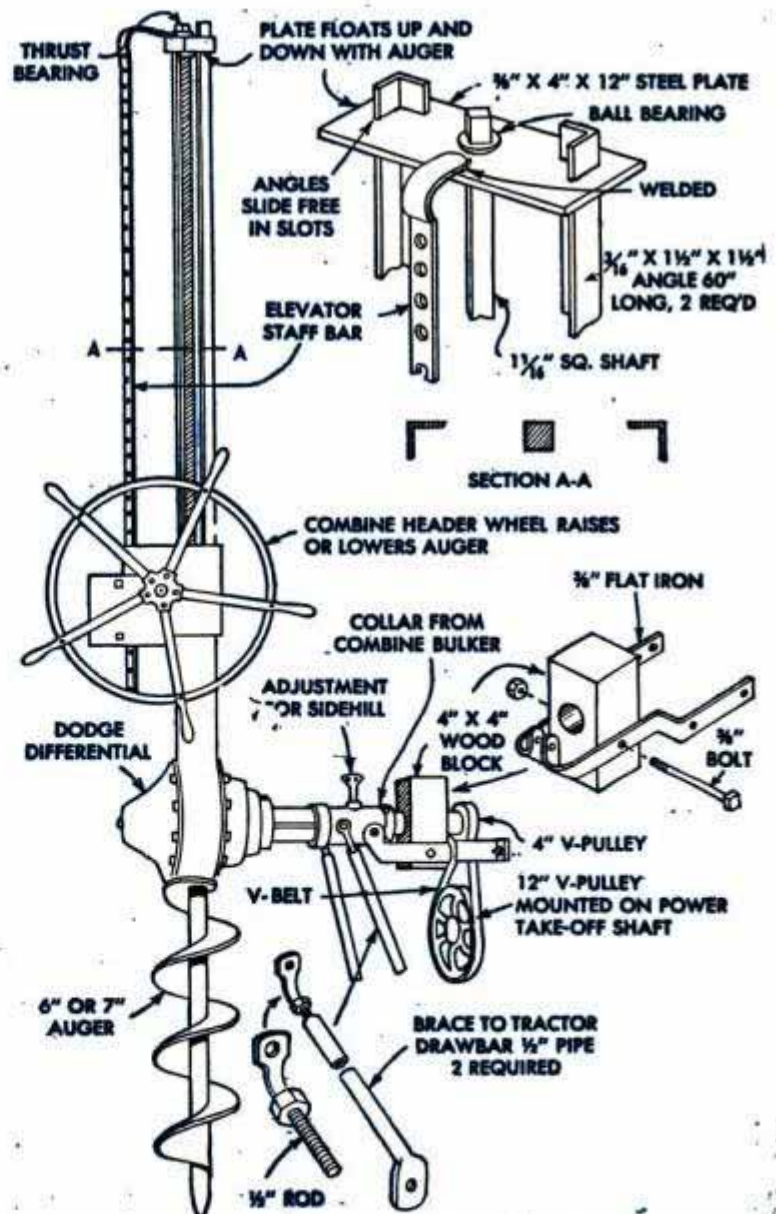
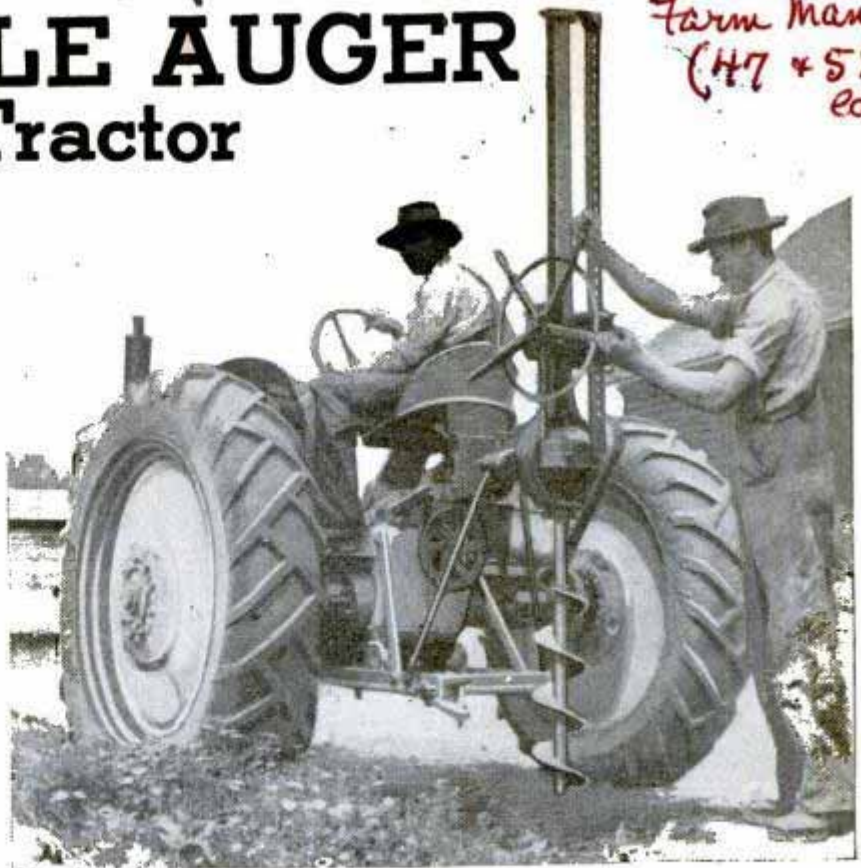
*Farm Manual
(47 + 55
eds.)*

Assembled from junk parts, this post-hole auger makes easy work of a tiresome job

DRIVEN from the tractor power takeoff through a V-belt, this post-hole auger has the advantage of an easily controlled hand feed which makes it possible to dig holes in fence rows where roots, stones and other obstructions sometimes cause delay and breakage. The necessary angle drive is made by adapting an old Dodge differential, but any of the older automobile differentials having square holes for the axles can be used. Of course, complete dimensions cannot be given in the detail drawing, nor can the arrangement be followed closely when mounting the auger on the various makes of tractors. Hence the details shown at the right are only suggestions on how to make the assembly of the various parts.

In this case the square drive shaft was taken from a rod weeder, but any square steel shaft of good quality material can be used. The top end of the shaft is carried in a single ball bearing and fitting this properly likely will require some alteration, such as turning down the end of the shaft to fit the inner ball race. On a tractor of a different make than that shown it will be necessary to alter the horizontal drive-shaft support so that it will fit the tractor transmission housing. It also will be necessary to change the braces to the tractor drawbar. The details show one way of making these adjustable for length. Other methods of accomplishing this can be used when necessary. The combine header lift makes a handy arrangement for lowering and raising the auger and controlling the rate of feed. Although one man can operate the auger there is less danger of breakage where there are two operators, one to drive the tractor, the other to handle the digger.

Photo and certain constructional details courtesy of State College of Washington



Slit Cut in Mitten Helps Surveyor Take Transit Readings

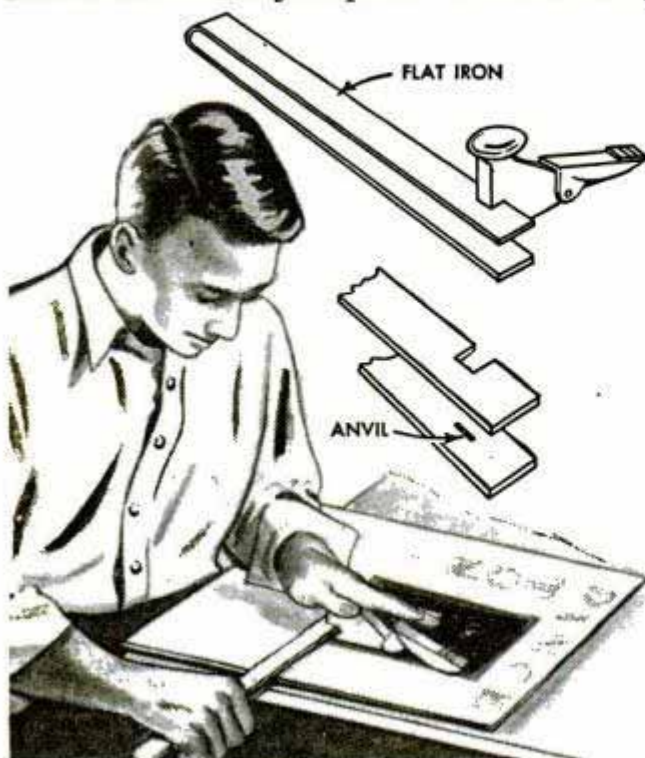


Surveyors and others whose work keeps them in the open during cold weather will find that a mitten with a slit in the palm is handy. Instead of withdrawing the hand from the mitten to make adjustments on the transit, the fingers are extended through the slit and the rest of the hand is protected.

G. E. Hendrickson, San Diego, Calif.

Extension Anvil on Office Stapler For Tacking Large Work

Large cutouts, notices and pictures can be posted on an office bulletin board or announcement poster without a special stapler for this purpose by adding an extension to an ordinary stapler. The extension,

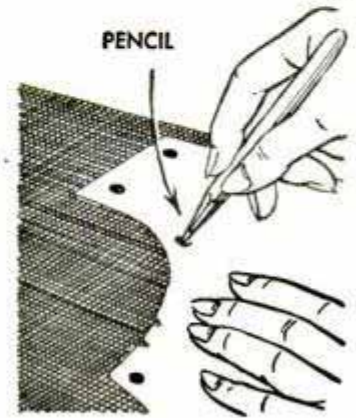


which is a 4-ft. 4-in. length of $\frac{1}{8}$ by 1-in. flat iron, is bent to a U shape, the two ends being about $1\frac{1}{2}$ in. apart. These are prepared as shown in the detail, one being notched to fit snugly over the sides of the stapler and the other grooved to form an anvil to clinch the staple. In use the extension is slipped over the edges of the poster board, the notice is positioned and the staple is driven in.

Pencil Is Marker for Dressmaking

A white manicure pencil is a good marker when a dressmaker is working on dark materials. The pencil should be moistened. After the work is completed the marks can be brushed off.

—M. T. Fox, Wellesley Hills, Mass.



Heating Will Clean Brake Lining

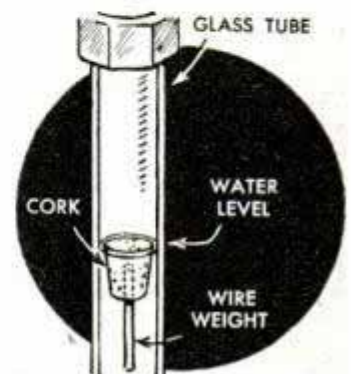
Brake linings that are saturated with grease not only are unreliable but may be the cause of a serious accident. Greasy brake linings may hold for a second or two, but as soon as heat caused by friction softens the grease they are almost as bad as no brakes. It is best to replace greasy linings, but they can be made partially effective by removing the grease with heat. This is applied directly to the band to drive out the grease which is wiped off with a cloth, repeating the operation until most of the grease has been removed.

Robert R. Kottmeier, Hamilton, Ont., Can.

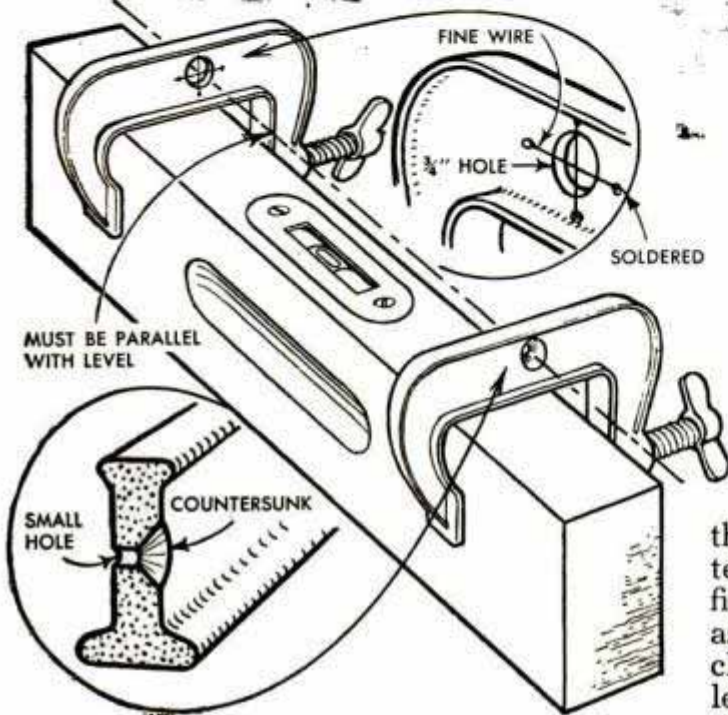
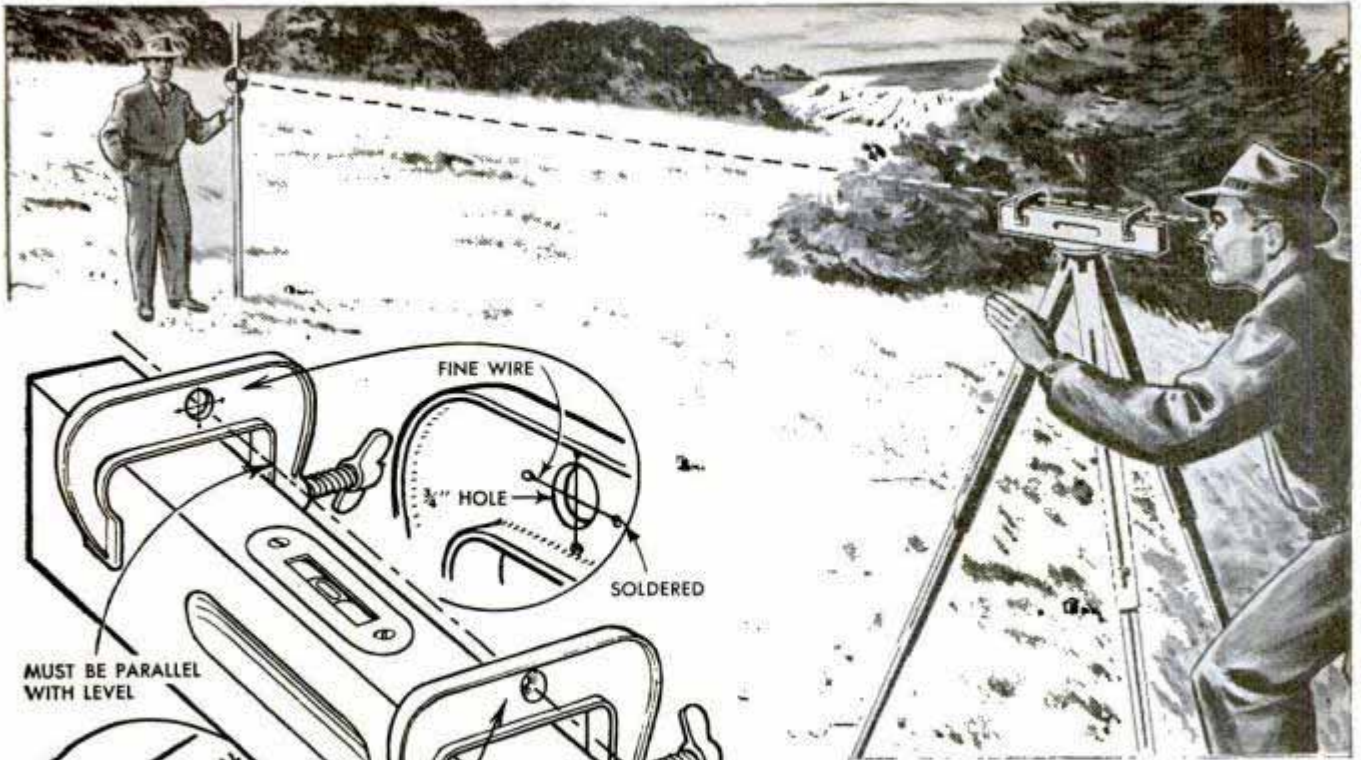
Water-Level Float in Gauge Tube Made From Cork and Wire

When the water level on a boiler gauge glass cannot be seen easily, a colored float can be placed in the tubing to show the height of the column. The float is made from a piece of cork that fits loosely inside the tubing, and a short length of wire is driven into the cork to weight it so that it will not adhere to the sides of the glass. Because the cork is colored, it will be noticed readily even in a boiler room where it is semidark.

—F. T. Brown, Chicago.



Handy Level Sights Made From Small C-Clamps



same distance from the inside face of the frame on both clamps. Then countersink the smaller hole with a "rose"-type countersink as shown. "Cross hairs" made from fine wire are soldered over the larger hole as indicated in the detail. Then the two clamps are tightened on the frame of the level. With this assembly mounted on a tripod you can do quite accurate work in determining grades for ditches, field terraces and the settings for walls and foundations, using the conventional surveyor's rod and target. For rough work you can easily improvise a target from a 1 by 2-in. wood strip and a colored disk cut from heavy paper.—Charles F. Murray, Omaha, Neb.

An ordinary wood-frame carpenter's level and a pair of small C-clamps can be made a satisfactory substitute for more expensive leveling instruments. Center a $\frac{3}{4}$ -in. hole through the frame of one clamp and a $\frac{1}{8}$ -in. hole through the other. Be sure that the holes are centered exactly the

Movable T-Square Blade Pivots on Protractor Set in Head

A T-square can be made adjustable so that lines can be drawn at predetermined angles if the blade is removed and pivoted over a small protractor, which is attached to the head of the T-square in the position indicated. The blade is rounded at the pivoted end to correspond with the inner arc of the protractor and is attached to the head with a carriage bolt held by a wing nut over a washer. A witness mark then is cut in the curved end of the blade to coincide with the 90-deg. mark on the protractor when the blade is set at a right angle to the head.—S. S. Palestrant and E. I. Russ, Bronx, N. Y.



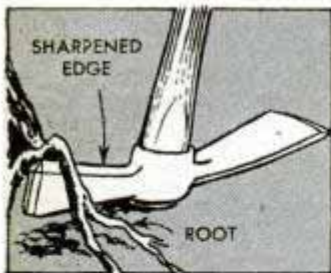
☛ To make a temporary repair in a leaky iron pipe, fill the hole with iron cement and hold it with a band around the pipe.

Rubber Grip Allows Better Hold On Large Oil Cans



Because the handles on five and ten-gallon oil cans are small, one filling-station operator made a rubber grip which affords a better handhold. A piece of $\frac{1}{2}$ -in. rubber hose is cut $1\frac{1}{2}$ to 2 in. longer than the handle and slit lengthwise. It then is notched as shown in the center detail. To use the grip, slip it on the handle and turn it around so the notches catch on the wire, as illustrated in the lower detail.

Ground Edge Improves Mattock



By grinding the inner edge of the chopping blade to a sharp cutting edge all along its length, the usefulness and efficiency of a mattock is greatly increased.

When the blade becomes wedged under a root, a quick upward pull will sever a small root and free the blade.

Robert Hewitt, West Hartford, Conn.

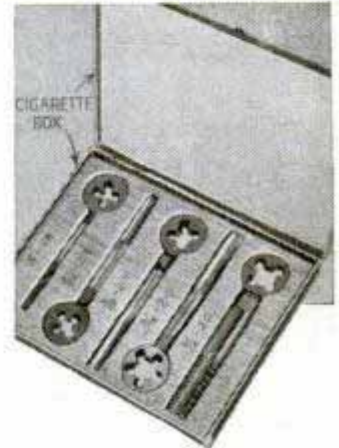
Method of Varnishing Armatures

When rewinding the armatures of electric motors, it is necessary to have the windings thoroughly impregnated with insulating varnish. One way to do this is to soak the finished winding in the varnish. The armature is placed on end by resting the shaft in a hole drilled in a block of wood with the commutator end up. A rubber sleeve, cut from an inner tube, is pulled down over the armature and fastened

around the shaft at the lower end with two or three twists of wire. Varnish then is poured into the sleeve up to the commutator level. After soaking several hours, excess varnish is drained off, the sleeve is removed and the armature set aside to dry. Sidney Wooler, Fort Erie North, Ont., Can.

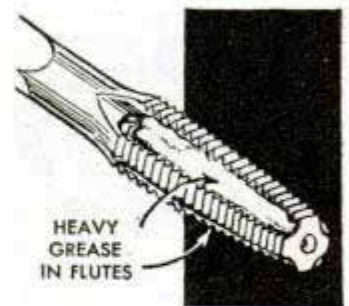
Cigarette Box Is Ideal Container For Taps and Dies

Flat cigarette boxes of the type illustrated are ideal as a storage place in which to keep small taps and dies. A block of wood which has been sawed to hold the pieces, as shown in the photograph, is fitted in the box. When kept in this manner, threads on taps and dies will not become dulled by contact with other tools. Taps, dies and any other tools kept in small boxes over a period of time always should be coated with light oil to prevent rusting.



Grease Holds Chips in Tap Flutes

Chips from a cut may drop into oil sumps, bearings or elsewhere and damage machinery when tapping holes. To prevent this, one machinist fills the flutes of the tap with heavy grease to hold the chips while the hole is being threaded. It may be necessary to add grease during the operation. If you can't run the tap clear through to free it of chips, be especially careful when backing the tap out that the chips do not "ball" and cause breakage. Also, when tapping deep holes it's a good idea to back the tap out occasionally and clean it in gasoline. Regrease the flutes each time after this has been done. — H. Funkey, San Francisco, Calif.



ⓁAgricultural gypsum, available at poultry and feed stores, is useful around chicken coops and rabbit hutches not only as a deodorant but as an absorbent that retains the ammonia and so preserves the nitrogen content of droppings which are used as a fertilizer. A handful sprinkled over the dropping boards occasionally is all that is needed.

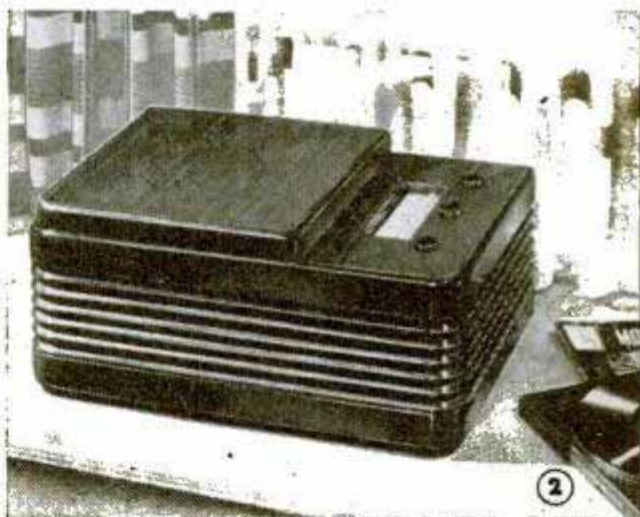


Postwar Sets of Advanced Design

SOME manufacturers are claiming up to 60 percent greater sensitivity and selectivity for their postwar models, also better reception unmarred by interference from extraneous sources.

RCA Victor's new "personal" radio illustrated in photo 1 is small enough to fit into a topcoat pocket. It weighs only 3½ pounds complete with batteries but has sufficient volume for room-level performance. Compactly housed in a wear-resistant plastic case, it turns on automatically as the lid swings open. Photos 2 and 3 show Stewart-Warner's 6-tube a.c. table-type combination radio and phonograph, the phono section of which has an automatic record changer. Single control changer operation eliminates switches, levers and knobs. From one to twelve 10-in. records or up to ten 12-inch records are handled by the automatic changer. Other features include a sensitive floating-point needle claimed to be good for five thousand or more playings. Record surface sounds and motor noises are eliminated. The receiver employs a built-in loop antenna and the audio output is four watts.

Period dignity and elegance in some of the new console receivers will be a selling factor. This is clearly indicated in the "concert grand" which appears in photo 4. Fashioned of seasoned hardwood and rich mahogany veneers, this Westinghouse phono-radio 7-tube combination console is claimed to be of true 18th century design in its distinctive bow-front.



1946 "LITTLE GIANT" A.C.-D.C. SUPER

By S. A. Johnson

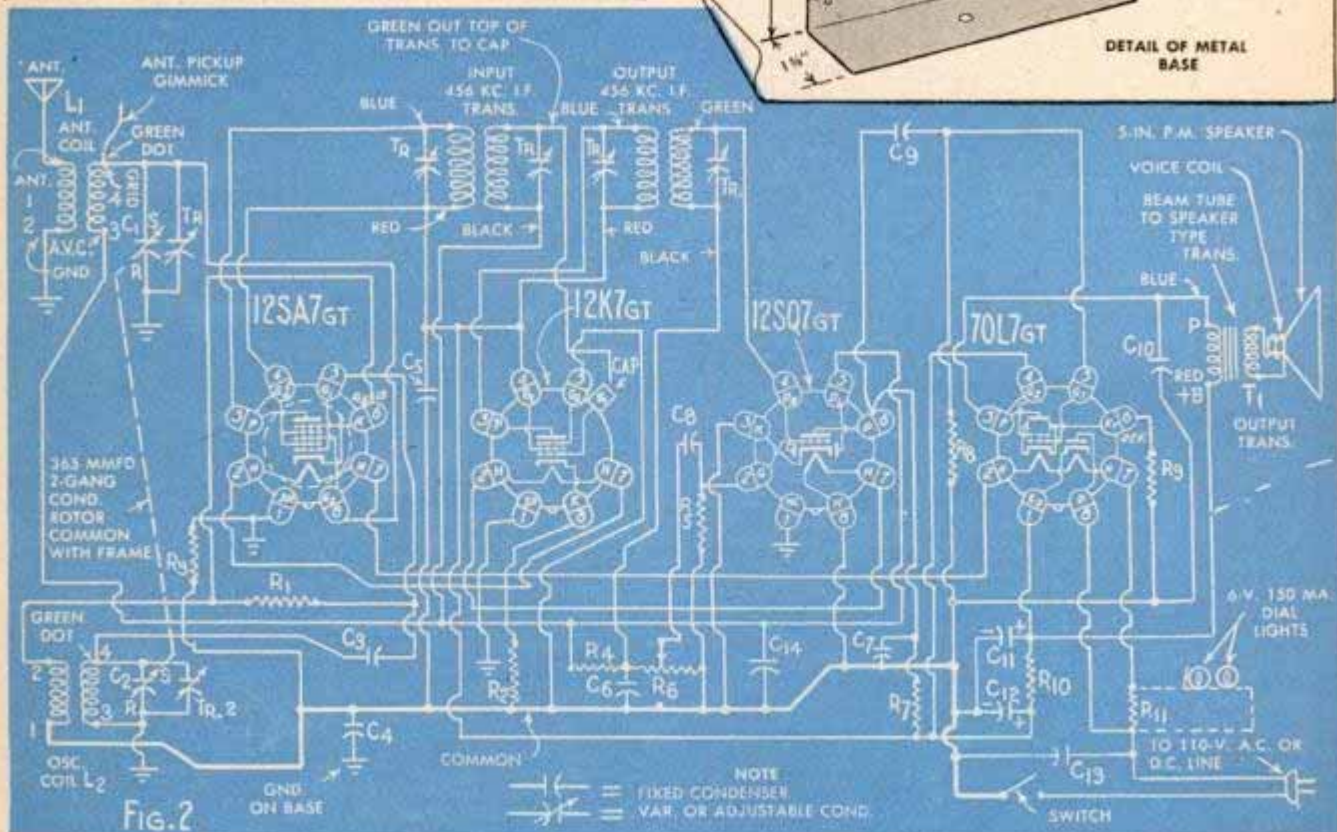
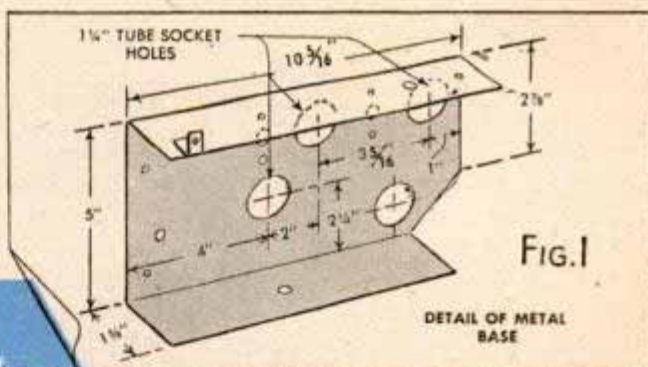
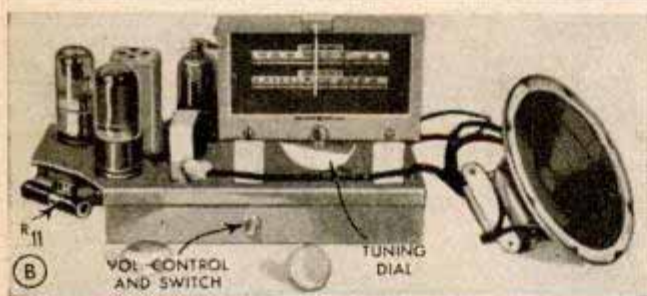
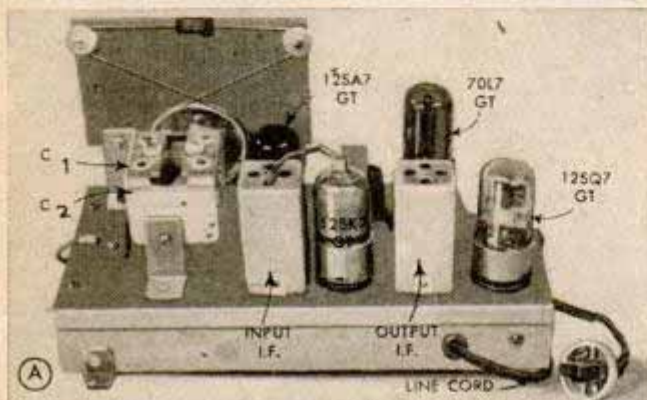
NOW that radio parts are gradually becoming available this postwar model of the popular Little Giant student set employs standard coils.

Although the receiver uses but four tubes it is a full-fledged superheterodyne. As three of the tubes are of the dual-purpose type it has 7-tube efficiency and excellent tone. The cabinet is a blank stock model which includes the speaker grille; it is 13½ in. long, 6½ in. deep and 8 in. high.

Owing to the fact that tubes are still scarce, the 6 series may be substituted for the 12's, if desired. For example, a 6SA7 for the 12SA7 mixer tube, a 6K7 for the 12K7 I.F. amplifier and a 6SQ7 for the 12SQ7 2nd detector-1st audio tube. If these substitutions are made, use a type 32L7 instead of the 70L7, change value of resistor R11 to 220 ohms and omit pilot lights.

Chassis base details appear in Fig. 1 and various views of the set are shown in the photos. A schematic circuit diagram is given in Fig. 2 and a pictorial wiring diagram in Fig. 3.

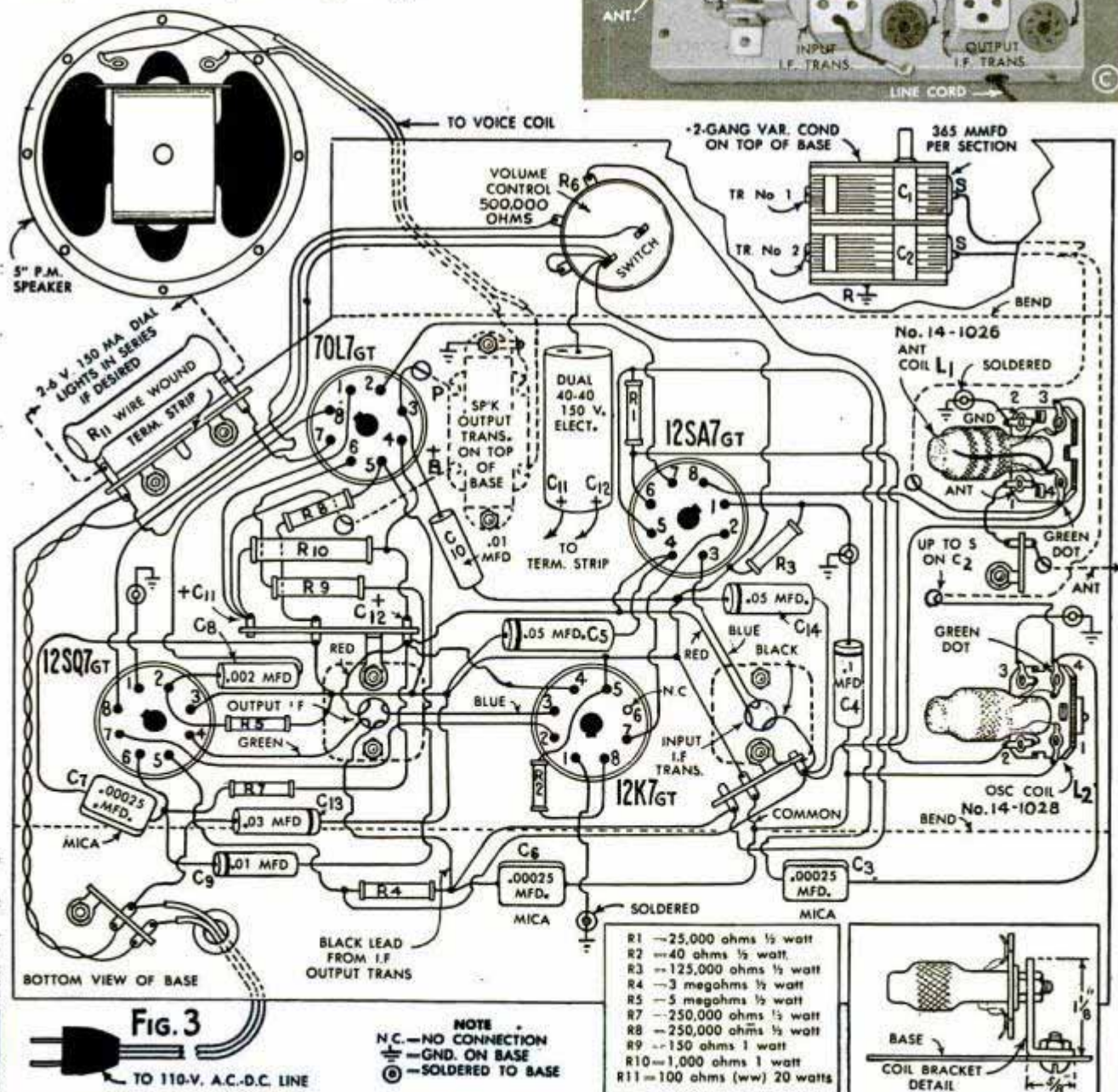
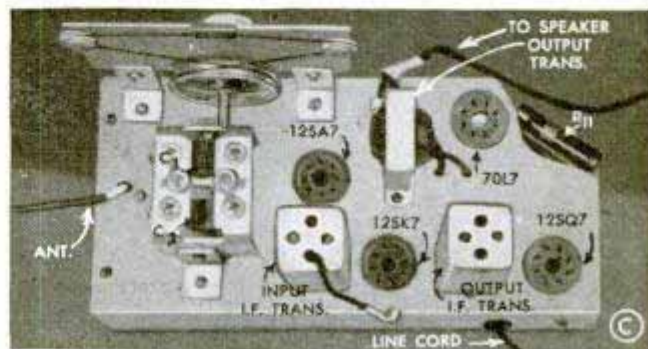
The variable ganged condenser used in



USES DUAL-PURPOSE TUBES

the final model has a cut plate oscillator section in C2 which does away with the need for a padder condenser. If your condenser does not have a cut plate section, insert a 350-mmfd. padder condenser in series with the green dot (S) lead from the oscillator coil. The antenna and oscillator coils are unshielded adjustable "universal" Meissner types and the I.F. coils are 456 kc. shielded Meissner standard transformers.

To line up the set use a 50-ft. antenna and tune in a weak station; adjust trimmers on I.F. transformers with an insulated screwdriver for maximum signal. Set the dial to some known station near 550 kc. and adjust the iron core in the base of the oscillator coil until the station is at the proper dial setting; then adjust the iron core in the antenna coil for loudest signal. Detailed student material list R-342 is available upon receipt of ordinary letter postage.



Helpful RADIO SUGGESTIONS



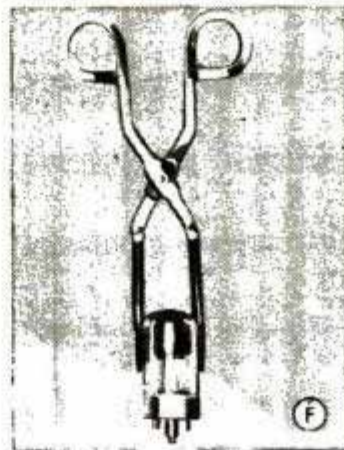
(A) Fragile cones often are damaged when the speaker is removed from the cabinet unless it is handled correctly. Grasp the speaker by the metal enclosure and place it cone down on a flat surface as illustrated



(B) Do not hold the speaker near the outer rim as shown in the photo as this forces the fingers through the cone. Always remove wrist watch before handling a speaker to avoid troublesome magnetizing



(C) Voice coil centering is checked easily by pressing on the cone rim as illustrated and listening for rubbing sounds; often scraping on the pole pieces is felt through the fingers. This is a common cause of distortion and indicates a recentering operation



(D) To center the speaker voice coil loosen the "spider" supporting screws behind the cone and insert thin celluloid or cardboard shims between the center pole piece and the voice coil at equal distances apart. The screws holding the "spider" then are tightened, after which the shims are removed and speaker is rechecked

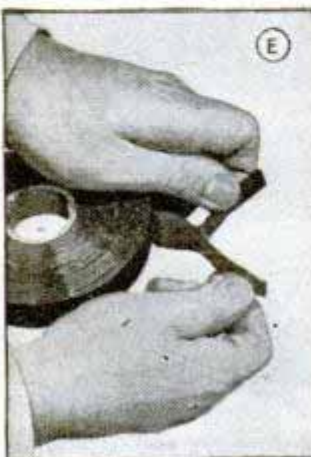


(G) Adjustable unit in new speaker permits recentering cone without removing speaker from the chassis

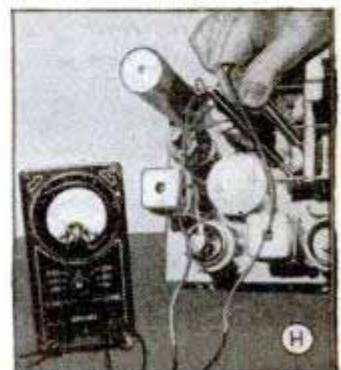


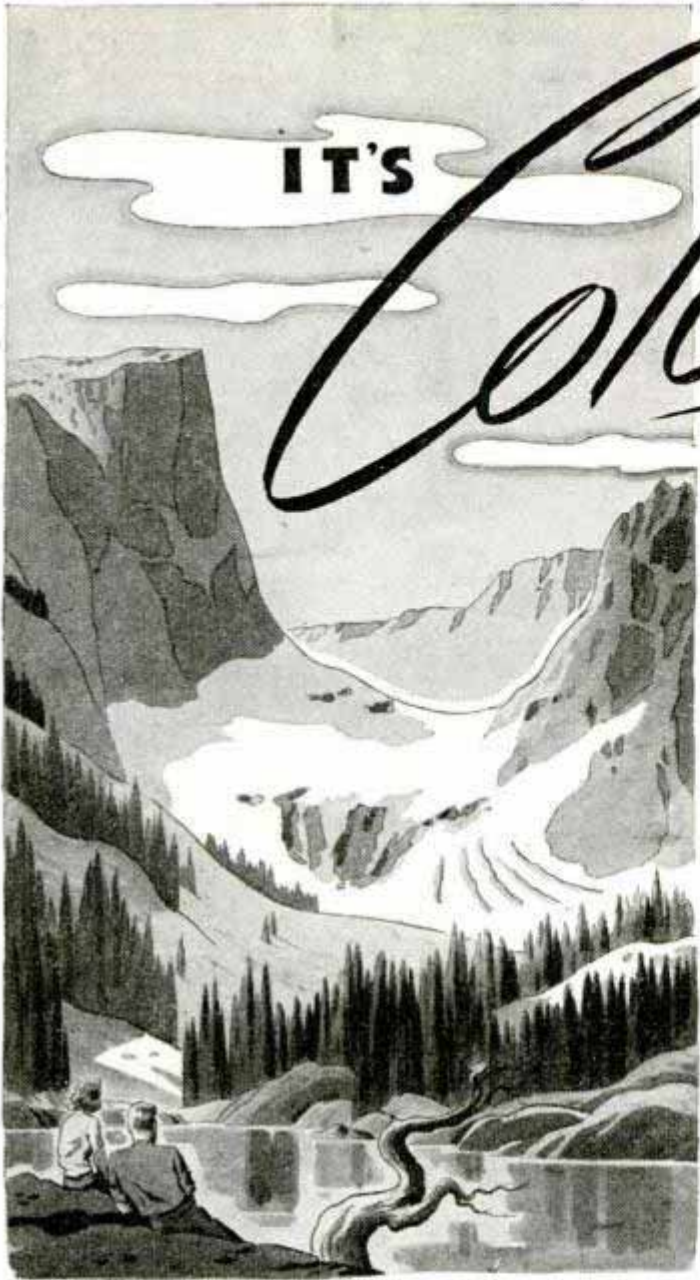
(E) Split friction tape and use half width for taping small wire connections

(F) "Scissorslike" tube extractor has rubber-covered gripping prongs for extracting delicate miniature and straight-side glass tubes in radio receivers and electronic equipment. These tube pullers are available in four standard bulb sizes for production, inspection and service uses



(H) Shorting plates in variable ganged condensers may be detected easily if you have a low reading ohmmeter. As rotor plates often become bent they touch the stator plates at certain settings. To check, connect one test probe to the rotor, or frame, and touch the other probe to the stator while rotating the condenser. If plates touch at any point, the meter will read zero ohms





IT'S

Colorado

CALLING

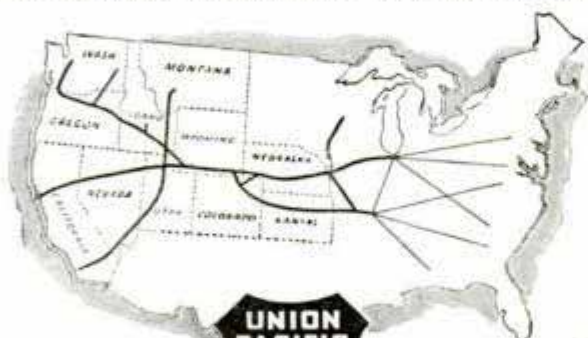
"As soon as summer arrives—and with rail travel conditions greatly improved—we'll be looking for you."

Yes, it's Colorado calling . . . the Colorado of mighty mountains and singing streams . . . invigorating sun-warmed days and restful blanket nights.

When you go, there's the swift Union Pacific Streamliner "City of Denver"—overnight, everynight, between Chicago and Denver; also fine train service from other points east and west of Denver. Your journey by rail will be the high spot of your vacation or business trip.

Remember that Union Pacific also serves California, the Pacific Northwest, and a number of famous National Parks such as Yellowstone; more western scenic regions, in fact, than any other railroad. It's the world's greatest vacation travel bargain.

For unexcelled rail service, to or from the West, go Union Pacific.



*be Specific—
say "Union Pacific"*



The Progressive

UNION PACIFIC RAILROAD

ROAD OF THE Streamliners AND THE Challengers

HAWAIIAN WIGGLERS Get Bass!



(Left to right) Wayne Ballard, M. L. Knight, Homer Patton and Buster Patton.

Texas Anglers Say "There's Nothing To It!"

Ed Cromer, member of the Fort Worth Anglers Club and editor of the *Fisherman*, sends us this photo of four of their members with catfish and bass. In his story he reports:

"These boys say there's nothing to it. All you have to do is to go to Lake Texoma, fish in the Cedar Bayou and haul them in. The bass were caught on Hawaiian Wigglers."



No. 2 Shallow Running
Hawaiian Wiggler \$1.10

Send For Free Catalog

How would you like to see the photographs of catches of bass and read letters from anglers all over the country telling where and how they made record catches

with Hawaiian Wigglers? Catalog also beautifully illustrates and describes Jitterbug, my famous surface bait that runs fish crazy day or night. A copy is yours for the asking.

FRED ARBOGAST & CO., 1603 North St., Akron 3, Ohio

LIGHTER MOMENTS

with **fresh** ^

Dated

"Eveready"

Batteries

FOR A LONG TIME, you had to take whatever flashlight batteries you could get!

But that time has passed. "Eveready" Flashlight Batteries are back. You can buy them. Ask for them at your dealer's.

And that's good news indeed. For, although flashlight batteries may look alike on the outside, that similarity is only skin-deep. There are important differences inside every "Eveready" Battery — differences that mean a longer life of stronger light. Differences that have made the "Eveready" flashlight battery the largest seller in the world!



"I'm afraid he isn't quite reconverted yet!"

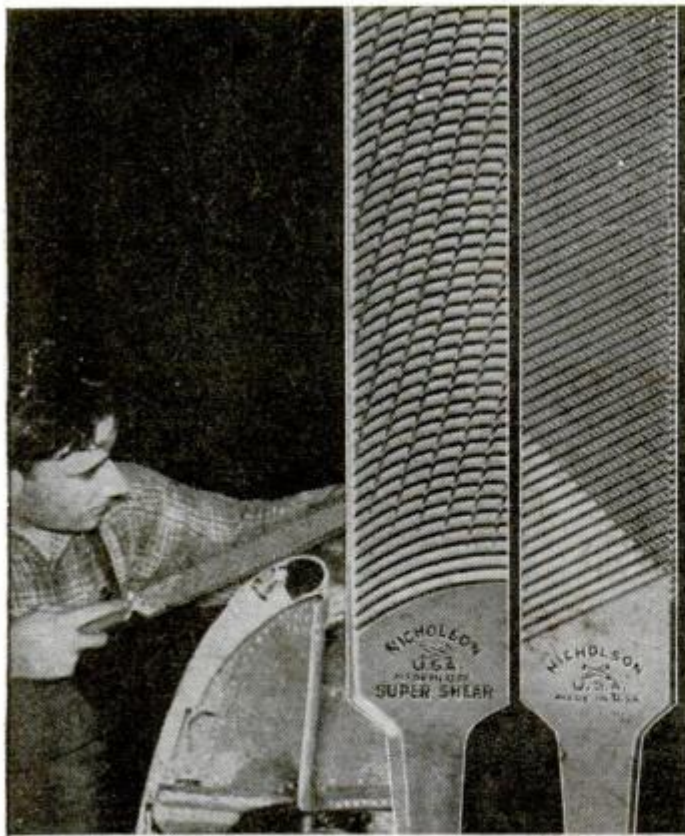
Fresh
DATED BATTERIES
Last Longer
Look for the date line



EVEREADY

TRADE-MARK

The word "Eveready" is a registered trade-mark of National Carbon Company, Inc.



Files for aluminum

MANY of today's tools for working aluminum far outmode those of pre-war days. In files Nicholson has perfected these two distinctive types (illustrated above):

NICHOLSON SUPER-SHEAR FILE (left)—This is a recently developed curved-tooth file that "smooths as it roughs." Its milled "razor-sharp" edges can whittle down a piece of aluminum in amazingly fast time, with the final stroke leaving the surface scratchlessly smooth. Excellent also for plastics, bronze, brass, babbitt, cast iron and annealed tool steel.

NICHOLSON ALUMINUM "TYPE A" FILE—a special-cut file combining moderate cutting speed with good finishing qualities. Deep, "open-throat" upcut and fine overcut break up the soft aluminum filings, permit file to clear itself, overcome chatter, and prevent taking too large a bite.

FREE BOOK, "FILE FILOSOPHY"—48 illustrated pages on kinds, use and care of files.

NICHOLSON FILE CO., 22 Acorn St., Providence 1, R. I.
(In Canada, Port Hope, Ont.)

NICHOLSON
FILES FOR EVERY
PURPOSE

NICHOLSON
U.S.A.
MADE IN U.S.A.

Raising the Dead Ships

(Continued from page 173)

made and she was pumped dry and refloated, eventually coming to America for overhauling and refitting.

Battleships of even greater weight were salvaged after more serious damage in the great cleanup of Pearl Harbor under Rear Admiral William R. Furlong. How the battleships California, Nevada, West Virginia and Oklahoma were patched, refloated and sent to sea again is a familiar story of American war enterprise.


Salvage teams from Pearl Harbor, San Diego, Pier 88 in New York and from a later established diving school on New Caledonia had vital roles in all of the campaigns of the war. Wreckage of 26 vessels, for example, clogged a 300-foot channel near Bizerte, Tunisia. Seven had been sunk purposely by the fleeing Germans to shut off the harbor. Within a week, Commodore Sullivan's crews blasted out the obstructions, and within three weeks 800 Allied vessels assembled there for the invasion of Sicily.

Air and sea bombardment ruined all docks at Casablanca but salvage provided berths for all ships requiring them six weeks after the Allied landing. The story was the same at Palermo, Naples and Cherbourg. A month after the Germans fled Naples, 18 Liberty ships were unloading there at the same time, and piers for 28 vessels were provided within two months. A total of 170 ships were cleared from the Bay of Naples and 90 vessels were removed at Cherbourg.

While divers are the mainstays of salvage work, it is a team operation that requires usually 20 men on the surface for every one below even when operating in less than 50 feet of water, the depth in which most economical salvage takes place. Tenders, winchmen, wreckers, engineers, carpenters

(Continued to page 238)

Model Builders
Attention!



	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Silliment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION

SPARK PLUG COMPANY • TOLEDO 1, OHIO

Here's why most Truck Fleets specify Champion Spark Plugs



THEY'RE DEPENDABLE!

When most of the country's leading truck fleets—to whom spark plugs are a cold matter of cost per ton mile—specify dependable Champions, you have substantial proof that Champions will insure maximum economy and peak performance in your engine. Champion Spark Plug Company, Toledo 1, Ohio.



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

NEXT TIME SAY BRIGHT STAR

and you will get a
FLASHLIGHT & BATTERIES
famous since 1909
for QUALITY,
STYLE and
SERVICE



BRIGHT STAR BATTERY CO. CLIFTON N. J.

and welders are needed to help the divers.

Where practicable, the hull of a ship is used as an air compartment to aid in salvaging. Openings are sealed and the water is pumped or blown out. Sometimes engineers build a cofferdam on deck, seal it tightly and then pump out the water. Pontoons occasionally are used. Compartmented floating dry docks are considered by Navy men the easiest to salvage, with tankers next. Cargo ships are considered the most difficult. Stranded vessels that can be pulled off with tugs or anchors are the most profitable operation. Capsized and sunken ships, especially in deep water and badly damaged, present the hardest salvage problem.

Not all salvageable wrecks are being salvaged by the Navy, but only those where it appears that the chances are good of recovering a value greater than the expenditure. For salvage work the Navy now has about 50 ships and special equipment costing more than \$12,000,000.

Cuppa Coffee, Chum?

(Continued from page 151)

Soldiers who operated the Marseilles factory were trained in Oran by an international coffee team of Arabs, Spaniards and Frenchmen. Moving with the invasion forces into southern France, the soldiers set up shop in an old factory, assisted by a platoon of Italian soldiers. Improvisation was a necessity. One of the GIs summed up his first coffee roasting experience this way: "If it weren't for good old American ingenuity, we'd never have turned out a finished bean."

A network of bins and pipes carried the green coffee through a half-dozen technical processes, up and down three floors. The bins were made of large French oil refinery tanks purchased on reverse lend-lease. The pipe line system was made of sheet metal, five-gallon cans, powdered-milk cans and unused petroleum pipe line.

Oil-burning and coke-burning ovens roasted the coffee, turning out fresh batches every 20 minutes. From the ovens coffee was poured into cooling bins where rotary blades shuffled the beans automatically until they were cool.

The roasted coffee next was ground into a fine powder. Pneumatic tubes blew it to the third floor, where it was left to accumulate in 500-pound bins. Air jets were controlled so that just enough pressure was used to blow the coffee grounds upstairs. Foreign particles that may have mixed with the coffee stayed out of the top bins. Ground coffee from the bins was fed into

(Continued to page 240)



**"WE'RE GOING TO SEE OUR COUNTRY
from the saddle of a HARLEY-DAVIDSON"**

"We want to tour all sections of the good old U. S. A. on new Harley-Davidsons!" That's what thousands of Harley-Davidson fans told us during the war, in letters which poured in from all over the country and the world. Now, the new Harley-Davidsons are

rolling off the production line in ever-increasing numbers — the beauty and fun spots of America are waiting for your coming! See your Harley-Davidson Motorcycle dealer EARLY — and get set to make the most of the glorious touring months that are ahead!

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Motorcycles

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Please send at once free copy of 24-page "ENTHUSIAST" Magazine, filled with motorcycle action pictures and touring stories.

Name.....

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City..... State.....



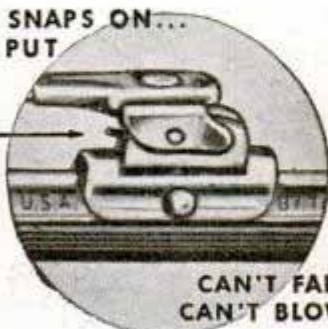
ANCO RAIN-MASTER

"Dead-Locker"

WINDSHIELD WIPER
ARMS and BLADES

BLADE SNAPS ON...
STAYS PUT

FINGER-
TIP
RELEASE



CAN'T FALL OFF
CAN'T BLOW OFF

(A war-born invention—by ANCO—first)
for military aircraft—now for your car.)

DON'T SHOOT YOUR GAS-PUMP MAN!

He's doing the best he can. Sure, he knows how dangerous it is for you to drive your car... in stormy weather... with your dull old windshield wipers that smear and smear. He'd gladly put on for you quickly a pair of keen new ANCO RAIN-MASTER Wiper Blades and Arms. He has them—Newest Models! But he forgets to remind you? Too busy? You can't shoot him for that!



After all, it's *your* car to protect. So *you* remind *him*. Get RAIN-MASTERS...patented features...original equipment on many makes of high grade cars and trucks... used in war—on our fighting tanks and trucks and ships and bombers too...because ANCO RAIN-MASTERS clean quicker, clean cleaner... last longer. May save you a costly smashup.

Ask for RAIN-MASTER Windshield Wiper Arms and Blades next time you buy gas.

THE ANDERSON COMPANY
Established 1918
GARY, INDIANA

four gravity-flow spouts to the second floor where soldiers held bags on scales under the spouts.

Since ground coffee loses body and flavor after 10 days, the object was to get the coffee to Army kitchens as quickly as possible. Weighed and packaged coffee was loaded on trucks and sent out immediately.

Grand touch to the whole job, definitely beyond the line of duty, was a mimeographed recipe for making good coffee which the men slipped into every bag. It was addressed to mess sergeants and cooks, and started: "Listen, fellow, we have done a lot of work to put good coffee in this sack—how about you following through...?"

Radar Cues the Navy Fighters

(Continued from page 125)

We mentioned the fact that fighter direction was inherently a simple proposition, but take the land-based fighter director on the island of Apamama who was faced with this situation: a night raid, with Japanese planes orbiting a few miles north, south, east and west of the air strip; returning planes from a strike mission suddenly appearing on the radar screen, with all of these friendly planes low on gas and anxious to land on a well-lighted field; two Army planes in the air as night fighters, neither equipped with airborne radar gear; thousands of impatient Seabees waiting in foxholes, fretting and stewing because they don't know—as the fighter director knows—if there actually are enemy planes in the area or if it would be like last night, a false alarm due to the fact that returning strike planes failed to show the IFF (Identification—Friend or Foe) signals.

Would you turn on the field lights for the returning strike? Then you would be a perfect target for the enemy orbiting all around you, waiting for that stray bit of light. Will you keep a complete black-out? How about the returning pilots who have finished a bombing mission and deserve a break? Send your Army planes to intercept the Japanese? Without airborne radar, it is an impossible task to direct your friendly planes close enough to enemy planes to see them on a completely dark night—or a moonlight night, for that matter. Maybe the returning strike does have enough fuel to stay up another hour. Still, you have the Seabees anxious to finish that extra fighter strip in record time—have you ever spent an extra hour in a foxhole?

Of course, you might be fortunate enough to be dealing with the red-helmeted bombers of the Japanese air force who—you

(Continued to page 242)



*"Switch to
Auto-Lite Spark Plugs"*

DICK HAYMES

*"They make sweet
music in any engine"*

HELEN FORREST



*"Ignition Engineering
helps give economy, too"*

GORDON JENKINS



Tune in the Dick Haymes Show with Helen
Forrest • Gordon Jenkins' Orchestra and
Chorus • Saturdays, 8:00 P.M.—E.S.T. on CBS



*Money
cannot buy
a better
Spark Plug*

AUTO-LITE spark plugs are designed by the same engineers who design complete electrical systems for leading cars and trucks. This specialized engineering experience is one reason why money cannot buy a better spark plug. A complete set of ignition engineered Auto-Lite spark plugs in your car, helps give you quick starts and full mileage from every gallon of gas. So switch to Auto-Lite when faulty spark plugs need replacing. See your friendly Auto-Lite Spark Plug Dealer today.

THE ELECTRIC AUTO-LITE COMPANY
Toronto 1, Ontario Toledo 1, Ohio

AUTO-LITE SPARK PLUGS
"Ignition Engineered"



*So inconspicuous

CAN'T YOU SEE—I'm wearing a new Zenith Hearing Aid and I can hear again! You don't have to shout any more.

Sure... I admit I used to think it was *my* business if I didn't choose to wear an aid. But when folks stopped *trying* to make me hear because they had to shout... I realized my defective hearing involved more than just *myself*.

So I got smart and tried a Zenith. Wear it as casually as eyeglasses now because its Neutral-Color Earphone and Cord are so inconspicuous. (Even *you* didn't notice it, remember?) And I'm getting out among people more... getting on better with my work, too.

Smartest thing I ever did for myself *and* my friends was putting on a Zenith. No one will ever have to raise his voice to *me* again.

* * *

If you are hard of hearing—do yourself *and* your friends a favor. Visit your local Zenith dispenser for a *free* demonstration of the New Zenith Radionic Hearing Aid.

No one will press you to buy. You adjust the Zenith yourself to your own hearing needs with the flick of a finger. It's easy as focusing binoculars! See your dispenser soon... and drop a note to Zenith Radio Corporation, Dept. PM-3B, Chicago 39, Illinois, for *free* descriptive literature.

Choice of Amplifier Colors at no Extra Cost.

- Super-powered Model A-3-A \$50
- Model B-3-A (Bone Conduction) \$50
- Standard Model A-2-A \$40



THE NEW
ZENITH
 RADIONIC
 HEARING AID
 BY THE MAKERS OF ZENITH RADIOS

found out through intelligence—are proud of their teamwork and ability to stay alive, a distinct contrast to the later Kamikaze tactics. You know of their fear of the American fighter pilot and it may have been an accident that you suddenly revealed to those red-helmeted bombers of the Mikado that you have night fighter planes up by quickly spotting a friendly plane with a searchlight, then quickly extinguishing the light. It worked! The raid soon left the area and finally, 100 miles north, disappeared from your radar screen.

This, of course, was at a time when few, if any, planes in the forward areas were equipped with radar. The story of the Navy's use of night fighters already has been told. Wartime restrictions, however, prevented telling the tale behind the tale—the use of fighter direction in the control of night-flying aircraft. The other half of the story recording the triumphs of Air Group 41 night fighter pilots is the effort and skill displayed by night fighter controllers operating in the CICs of the Enterprise and Essex on which the air group embarked.

Night fighting, certainly, is almost solely an enterprise of radar. From the moment the bogey is first picked up it is the magic, electronic eye of radar, both ship and airborne, which guides pilot and guns to the kill. Essentially a specialized development of the daytime interception, night fighting is done entirely by instrument up to seconds before the shooting begins.

The drama of a night shutdown begins in CIC. It is, let us say, 0300 (3 a.m.). The task force is steaming toward its objective—a strike against one of the innumerable airfields of the Philippines. The night fighter director, who has come on at midnight, has been manning his PPI scope or disk, watching his two airborne “chickens”—night fighter planes—orbiting slowly to the west and north of the force, checking occasionally to see that communications are okay and to coach the planes back when they drift off station.

“Hello, One. This is Silver. You are drifting off station. Vector three-four-zero for five miles, over.”

“Wilco, vector three-four-zero for five miles, out.”

Communications five by five, which means perfect! In two minutes, Silver One will be back at his assigned station of 270, 15 miles west of the force. To the north, at 300, 15 miles, Silver Two is a tiny white dot moving slowly in a wide orbit.

Suddenly, at the far edge of the screen, another white dot or blob of light appears, drifting down toward the task group. Plotters mark an X on the board. The familiar

(Continued to page 244)

Know your
Hardware Dealer
better!



To your hardware dealer you are a preferred customer—because you read this magazine.

You like *Popular Mechanics* because you have the kind of mind that insists on knowing all there is to know about new inventions, new ideas, better ways of doing things. It's the "P. M. Mind"—active, alert, inquisitive—and it sets you apart from ordinary customers.

That is why your hardware dealer likes to serve *you*. He talks your language, you talk his—and both of you know that *quality* tools and hardware always do a better job.

With his huge stock of thousands of *quality* items . . . his wide experience in solving problems for men who like to do things and do them *right* . . . your hardware dealer is ready to help you any time you say.

Your HARDWARE DEALER sells QUALITY Tools and Hardware
...BUY FROM HIM

**POPULAR
MECHANICS**

SWIVEL-HEAD

FLASHLIGHT

nothing else like it!

HEAD TURNS LIGHT AT ANY ANGLE



Greatest advance in flashlight design in a generation. Turn powerful pre-focused beam where you want it . . . stand it up . . . clip it on . . . both hands are free. A handsome, durable, all-purpose flashlight for everyone. Ask your dealer.

No. SW-22
Patented

No. 75 Heavy-Duty Dated Cell. Fresh Lasts longer. 10¢



\$2 LESS
BATTERIES



Flashlights & Batteries

If dealer cannot supply, send \$2.00 to Dept. P
UNITED STATES ELECTRIC MFG. CORP., New York 11, N. Y.

*USAILITE Red-Head Safety Flashlight -
a "MUST" for the motorist.

Thompson
BEATS
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**Better Built
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Canoes

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Light Boat for Auto

Safe Boats With Full Length Spray Rails
Keep passengers perfectly dry—even at high speeds. Catalog also shows two new models of "Take-Along" Boats. Two big factories—save you freight.

CATALOG FREE
Write for your copy. State kind of boat in which you are interested.

THOMPSON BROS. BOAT MFG. CO. (151)
213 Ann St. PESHIGO, Wis. (Write to either place)

113 Elm St. CORTLAND, N. Y.

checkback through the other ships begins: "Bogey at two-five-zero . . . 60 miles . . . closing . . . altitude 3000 . . . a snooper, Air Intelligence says . . ." A snooper because it does not show IFF and none of our own search planes is expected in this area!

The night fighter director adjusts the gain on his set to the greatest brilliance and waits for the signal from the flagship. He does not have long to wait.

"Hello, Silver. This is Tar-Baby. Intercept bogey at two-four-zero with Silver Two."

The night FDO picks up his microphone. This is a job for a man who can make quick decisions and give orders in a voice that inspires confidence, for he is talking to a pilot who is sitting up there in the darkness with only the faint glow of an instrument panel and the far glow of the stars, the only lights in the world. The pilot must put complete trust in the night fighter director officer down there in CIC thousands of feet below.

"Hello, Two. This is Silver," says the FDO. "I have a customer for you. Vector port two-four-zero, buster, angels two point five—"

"This is Two. Wilco, vector two-four-zero, buster, angels two point five—"

Armed with computers which will figure out mechanically the air speed of the bogey, plotters begin tracking on a horizontal board at the night FDO's elbow. Since night fighter direction involves bringing the friendly plane into very close proximity to the bogey—into visual range, as a matter of fact, for firing purposes—the bogey's exact speed is important. The plot too is necessary in case the tiny blobs of light which represent the enemy and the friendly begin to fade as a result of atmospheric disturbances as they sometimes do. Now the steady flow of information to the pilot begins to go out:

"Hello, Two. This is Silver. Your customer looks like a single."

A few moments later:

"Hello, Two. This is Silver. Bogey's course zero-four-zero indicating 260 (speed)."

Still later: "Hello, Two. This is Silver. Bogey at 3000. Your angels okay."

The pilot, flying through the dark, begins to see the picture in his mind's eye. His enemy is a single aircraft, flying at 3000 feet. At 500 feet beneath that altitude he is in the best position to spot and attack when the planes draw close together. So far all of this information has come from the ship's CIC and all of it has been provided by radar in the ship.

The night fighter director, noting that the planes are drawing close now, begins to position his fighter for the final approach—the crucial moment when the plane's short-

(Continued to page 246)

VanRoy *Ajustomatic*

with the NEW STEM



The one and only Pipe of its Kind

There is nothing in screw-stem pipes like the VanRoy Ajustomatic! With this new kind of pipe the stem can't lock at an off-angle—can't freeze out of line . . . That's because the patented stem is "float-mounted". It can be turned repeatedly yet stem and bowl hold their precision alignment for the life of the pipe . . . Take a turn for the better in a screw-stem—get the VanRoy Ajustomatic pipe for permanent smoking contentment. . . .

VANROY CO. INC., EMPIRE STATE BLDG., N. Y. 1, N. Y.



VanRoy Ajustomatic Bard \$5



SIGNET OF QUALITY IN PIPES

MAKE MORE MONEY

APPLYING OR SELLING

CORKSTONE PLASTIC FLOORING

EASY TO APPLY

Here's your opportunity to get into business for

yourself applying or selling Corkstone, the economical, top-grade plastic flooring. Plenty of profit. Act without delay!



Dealers & Agents Wanted

WRITE FOR DETAILS OF OUR PROPOSITION

We believe in teamwork and cooperation. We'll help you get started. No cost; no obligation. Act today!

LASTING PRODUCTS COMPANY

MANUFACTURERS OF PAINTS, PUTTIES, PLASTICS, FRANKLINTOWN ROAD PLANT, BALTIMORE 23, MARYLAND

Say you saw it in Popular Mechanics

\$1 RIDES YOUR LAWN OF UGLY WEEDS!



WEED-NO-MORE

Magic Weed Killer

Destroys Ugly Weeds but Won't Harm Common Lawn Grasses!

NO MORE back-breaking digging! Destroy ugly leafy weeds with WEED-NO-MORE!

The 8-ounce lawn-size package treats 1600 square feet! Now you can enjoy a beautiful weed-free lawn for only \$1!

WEED-NO-MORE kills dandelion, plantain and other ugly weeds—yet won't injure soil.

Get it today! Rid your lawn of ugly weeds for only \$1. Just spray on . . . WEED-NO-MORE!

On Sale at Paint, Hardware, Garden Supply, Department and Drug Stores

WEED-NO-MORE

THE AMAZING NEW WEED KILLER

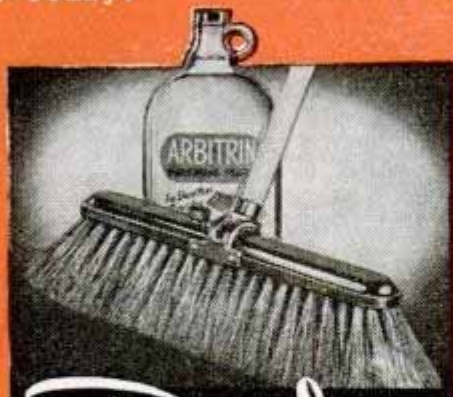
Made by THE SHERWIN-WILLIAMS Co. Cleveland, Ohio

NO MORE SWEEPING COMPOUND



Sweeping the modern "Dustless" way forever eliminates sweeping compound.

Here's why: As you sweep with a Dustless brush, Arbitrary sweeping fluid, fed from a reservoir in the back of the brush, moistens the dust. Instead of rising into the air, the dust itself is converted into a sweeping compound that sweeps many times cleaner and safer than any commercially prepared sweeping compound at any price. Thousands of factories, shops, offices, and schools have adopted this "Dustless" method of sweeping. You ought to know more about it. Write for complete facts today.



Dustless
DOES MORE FOR LESS

- Dustless
- Speed Sweep
- Speed Wash brushes

MILWAUKEE DUSTLESS BRUSH COMPANY

528 N. 22nd Street • Milwaukee 3, Wisconsin

er range airborne radar will be switched on to pick up the unsuspecting bogey.

"Hello, Two. This is Silver, Bogey 12 o'clock, 20." To the pilot in the air, that means the bogey is dead ahead of him, 20 miles away.

"Hello, Two. Bogey one o'clock 10. Vector starboard 30."

Now the pilot realizes he is to one side of the bogey. He glances at his compass, swings his plane slowly to the right to the new course which should bring him behind and below the bogey.

"Hello, Two. Throttle back 30."

Down in CIC the night fighter director officer has noted that the planes are approaching each other at too rapid a rate.

A series of orders . . . changes in vectors . . . speed . . . and then the night FDO gives the order:

"Punch!"

"Wilco, punch," replies the pilot and switches on his own airborne gear. He turns a handle and the antenna begins a slow scan of the area in front of him.

"Hello, Two. Bogey 12 o'clock, two."

The pilot centers his antenna dead ahead. Suddenly, on his own scope, a little dancing blob leaps up from the screen.

"Contact!"

The night fighter director officer's work is done for the present—the pilot is ready for the kill.

(Continued next month)

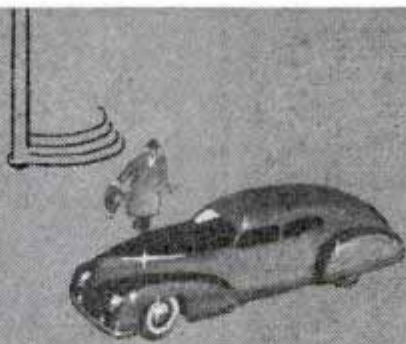
Twice as Natural

(Continued from page 157)

the fresh fish and take careful color and pattern notes. After this was done, the fins and eyes of the fish were removed, care being taken to preserve the fins in one piece. The fish then was placed in a lifelike position on a bed of damp sand. Since most fish specimens are displayed against a panel or screen with only one side showing, such mounts naturally require only that a one-piece mold be made. After the fish is removed, the inside of the plaster mold is coated with a plaster separator, composed of wax, vaseline and kerosene. Another batch of plaster is poured and patted into the mold. The thickness of the cast varies according to the size of the fish. Usually a 1/2-inch-thick shell is ample for a fish the size of a five-pound bass.

Next the original fins are laid on a sheet of celluloid of the desired thickness and a tracing made of each. The celluloid fins then are cut out with tinner's shears or a coping saw and carved and scraped to the correct thickness, with attention to natural details. Fish eyes also are made from celluloid. They are filed to convexity, sanded

(Continued to page 248)



WHEN IT'S AN EXIDE... *you start*



Discriminating buyers rely on brand names not only to help them select good merchandise, but also to identify dealers from whom dependable service may be expected.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

BUY TO LAST

Depend on the Exide dealer for good products, good service.

with the **MASTER**

Streamline

you get the
right
MEASUREMENT



without
**MENTAL
ARITHMETIC**

The ingenious design of the MASTER Streamline Rule permits the positive, accurate, inside measurement to be read direct from where the tape enters the case . . . no mental arithmetic . . . No adding or subtracting . . . or making allowances for thickness of case . . . And the Streamline can also be used as a caliper, scribe or height gauge.

Your hardware dealer carries the Streamline, with spare blades. Or you may use the coupon to order direct from MASTER.



MASTER

WOOD AND TAPE RULES

TRADE MARK

MASTER RULE MFG. CO., INC.

815 E. 136th St., New York 54, N. Y., Dept. F-3

Branch: P.O. Box 1587, Oakland, Cal.

Enclosed find \$2.00 for the new 6 ft. "Streamline"
(Spare blade 65¢ extra.)

NAME _____
ADDRESS _____
CITY _____ STATE _____

smooth and lacquered on the front surface. Fins and eyes are anchored in grooves and sockets with papier-mache.

The case then is ready for painting. A great majority of fishes have a silver or bronze sheen, which is lost in the dried specimen. This can be reproduced by using silver or bronze powder mixed in translucent oil colors. Extra-brilliant aluminum and bright gold and copper powders are most durable.

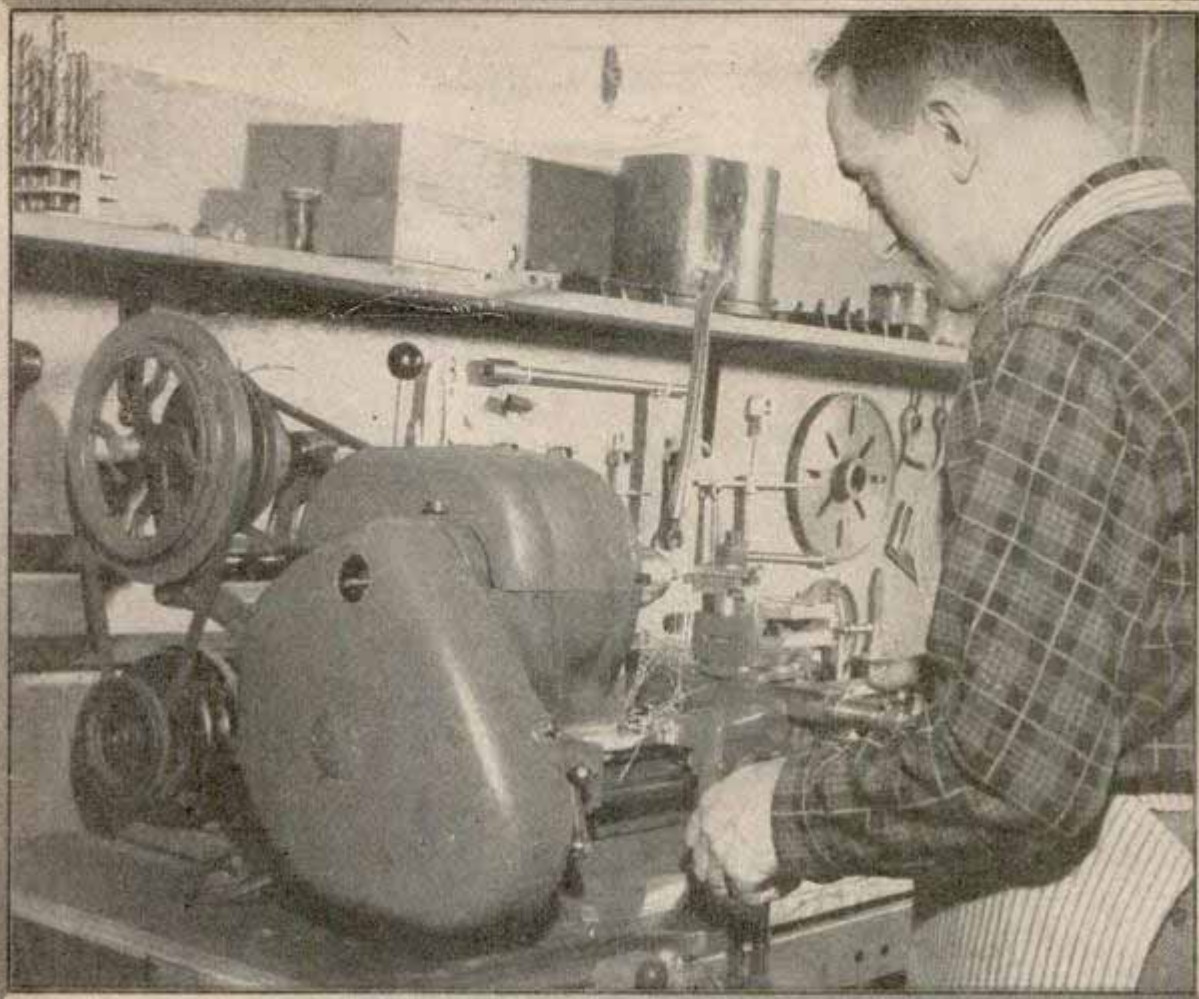
When fresh specimens are unavailable, Mr. Pray uses a model-making process with preserved specimens and photographs as guides. He begins his model with a wooden framework. When the fish is exceptionally large the wooden armature has to be made from many pieces of wood screwed and nailed together to make the outline of the fish. For easier handling Mr. Pray attaches his wooden outline to a simple core board silhouette and mounts this on a pivot. This process was used recently to make the rare oceanic fishes, the mola and the opah, more commonly known as the ocean sunfish and moonfish.

Celluloid fins, which are made to represent the natural details of the fresh fins, are attached to the wooden frame. To build up the width of the model, Mr. Pray saws wood ribbing to the required outlines and nails these pieces lattice-fashion to the sides of the fish. The form then is covered with a wire mesh. The next step is to spread a composition of casein paint and chopped tow over the wire mesh. Casein paint makes a hard and durable surface to receive the oil colors that produce the lifelike finish.

One of these days the Walters and Pray specimens may add a new expression to the English language: "As lifelike as a stuffed animal in a museum!"

Vegetables Given "Acid" Test As Aid in Preserving

In canning experiments at Ohio State University garden vegetables were kept from spoiling by adding enough dilute hydrochloric acid to make them very sour. Hydrochloric acid was selected as the bacteria killer because, although this acid is poisonous in concentrated form, it is harmless in a dilute condition and is a normal part of gastric juice. In the first experiments it was found that the acid made the vegetables too sour to eat. This was overcome by stirring in a little baking soda before preparing the vegetables for use. An added benefit of acid canning, the university chemists reported, was the retention of most vitamins in the vegetables.



Portrait of a **HAPPY MAN!**

Relaxation and recreation to the hum of busy tools . . . making useful things for home or business . . . making quick repairs to home equipment — you're lucky if you have such a practical hobby!

Atlas tools will be available soon to help you equip your shop — at exceptionally low cost — for every project you want to undertake. They will give you the precision you need for close tolerance work — the strength required for heavy cuts. They are tools designed in every way to help you make the

most of your mechanical skill and ability on useful home projects.

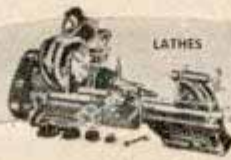
Ask your distributor to let you know when you can see and operate Atlas tools in his showroom.



SEND FOR FREE CATALOG

You can get a preview of what to expect by sending for this new 64-page Atlas catalog. Hundreds of illustrations of special tools and operating views. Write for your copy today. Atlas Press Company, 343 N. Pitcher St., Kalamazoo 13D, Michigan.

Atlas 4 TOOL TEAM



for that Professional
FINISH...

Use **PLASTIC WOOD**



in your **HOME WORKSHOP!**

- **PLASTIC WOOD** is the most versatile material for the wood working hobbyist... Not only can you do many things with **PLASTIC WOOD**, such as special moldings, decorative effects in relief, and strengthened joints, but you can cover any mistakes or fill in knot holes for a perfect surface.
- **PLASTIC WOOD** can be carved, sanded, planed, sawed, drilled, or nailed . . . and it won't split, crack or chip.

PLASTIC WOOD is an all purpose material for any wood working shop. Sold in cans or tubes in all hardware, paint, and 10¢ stores.

Did you ever use **PLASTIC WOOD** for dowel pins?

PLASTIC WOOD

A CELLULOSE FIBRE FILLER



Bantamweight Challengers

(Continued from page 135)

of 10,000 to 20,000-ton capacity. It meant that the Germans were using magnesium alloys to build fast, lightweight bombers that could outfly anything the United States or England then had in production.

The Allied aircraft industry sat up with a start. Congress appropriated the money necessary for the United States to build a magnesium industry that would top Germany's. Uncle Sam became superior in the light metals field.

During the war about half the United States' production of magnesium alloy went into airplane wheels, wings, fuselages, motor parts, rocket launching tubes, gun carriages and other mechanical equipment. The rest was used in pure form as incendiary bullets, tracer ammunition, signal flares and fire bombs.

Shortly before the war, Pan American Airways replaced its aluminum seats with seats made of magnesium alloy. Such weight saving enabled each plane to carry one additional passenger. With an average passenger fare of \$100 and a total of 20,000 trips a year, Pan American stood to boost its gross revenue \$2,000,000.

Wartime experience indicates that "Maggie" is extremely suitable for aircraft wheels and landing gear because of its shock resistant properties. It also may find widespread use in the manufacture of train, bus and automobile wheels.

Because of its extremely light weight, magnesium may replace steel or even aluminum in production of objects that must be moved by hand. Magnesium alloy can be machined more easily than any other commercial metal. Thus it offers economies in power, machinery deterioration, tool costs, handling and transportation expense.

The surface has just been scratched in the use of light metals. Large stockpiles of both lightweight miracle twins now are available in the United States, with war-born facilities for making more.

"Maggie" and "Al" are at your service whenever you, the customers, say the word.

All the Answers at Your Fingertips

(Continued from page 167)

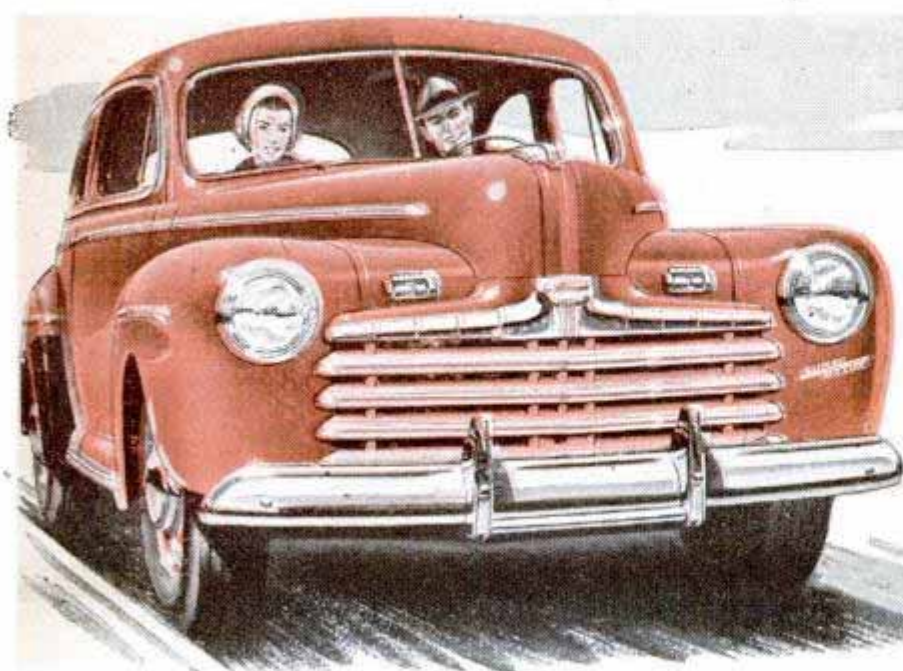
to single out for special attention any material remaining in port unattended for only five days. Punched cards enable the Transportation Corps to know at all times the volume and direction of traffic and to provide for the proper coordination of loading and unloading operations.

(Continued to page 252)

*Young looking...
with lots of "hustle"*

Any way you look at it—this new 1916 Ford has what it takes! New comfort. New economy. New beauty. And under the hood, new stepped-up power to match its eager, youthful look... Inside, you'll find colorful fabrics and trim in smart two-tone combinations. Seats that are wide and deep... For a smooth and level ride, this car has new multi-leaf springs—long and slow-acting. While extra-large hydraulic brakes of a new design assure you quick, soft stops... Two great engines to choose from: the V-8, now increased from 90 to 100 horsepower—the 90 horsepower Six... See this smartest Ford car ever built—at your Ford dealer's today.

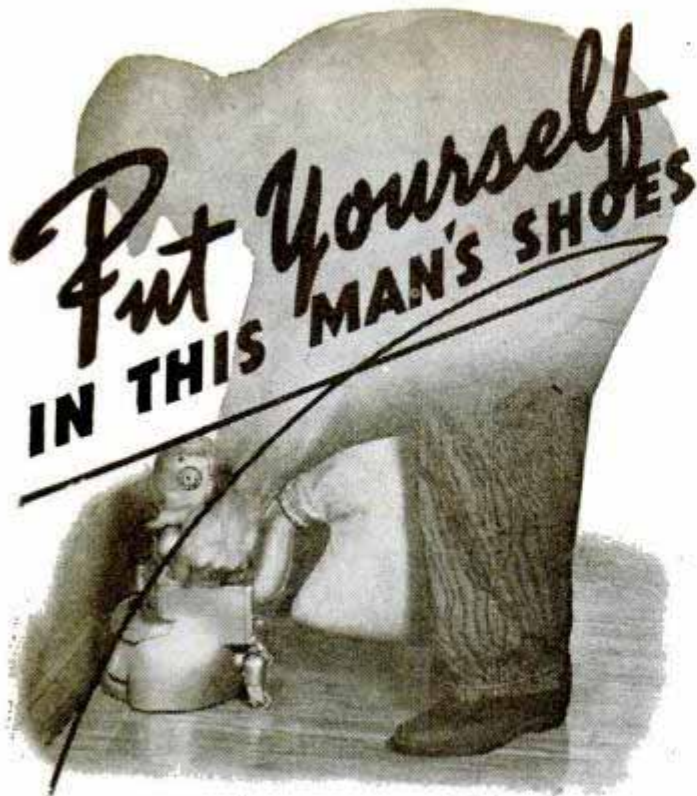
FORD MOTOR COMPANY



THERE'S A
Ford
IN YOUR FUTURE



TUNE IN... THE FORD SHOW... CBS, Tuesdays. 10-10:30 P.M., E.S.T. THE FORD SUNDAY EVENING HOUR... ABC, Sundays. 8-9 P.M., E.S.T.



**Put Yourself
IN THIS MAN'S SHOES**

You, too, can follow the path to success in floor surfacing. American floor sanders have made hundreds of men like yourself, independent with a good income.

The investment is very small compared with most enterprises... work is pleasant, indoors... all the profits go into your own pocket... and your success is only limited by your ambition to get ahead.



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"tell-all" booklet on the
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Who of going into some-
thing for yourself. Send
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copy of "Opportunities in
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Gentlemen:
Enclosed find 25c in stamps or coin for book-
let "Opportunities in Floor Surfacing," telling
me how I can start my own floor sanding business.

Name _____
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Complicated calculations necessary in machinery design problems have been made practically effortless by General Electric engineers who have learned that these standard accounting machines can do the "mental work" automatically in less than one quarter of the time previously required manually.

Calculations required for designing large turbine generators involve a tremendous amount of numerical work, and punched card machines have been found to do the work automatically in a much shorter time and completely eliminate mental fatigue.

While the calculations of the critical speeds of turbine generators are not too difficult in a theoretical sense, the most tiring part of the previous manual calculations was encountered in writing down the extremely large number of calculated quantities and then reading them to set up on hand comptometers.

Alongside the growing use of more complicated tabulating machines, inventors kept steadily at the task of making a simple calculating machine for everyday business use. Today several manufacturers make an easily operated calculator light enough to be carried about the shop or office.

Adaptations of mechanical calculators to various specific purposes were made, chiefly to bookkeeping. These bookkeeping machines are combined typewriters and calculators, ranging from simple billing machines, which automatically total the amounts on each bill, to complicated posting machines. Ordinarily, the handling of customers' accounts requires several separate operations—posting, making ledger entries, preparing the journal and writing customers' statements. A fast and simple method has been provided by one bookkeeping machine which posts the customer's account, writes the statement, proves the figures on both and provides a journal—all in one speedy operation. Each day's work is a completed job. The statements are ready for mailing immediately upon completion of the last posting. The machine takes care of everything except one minor detail, which is left for the recipient of the statement—it doesn't pay the bill.

Unlocking the Universe

(Continued from page 93)

in the intensity of the penetrating radiations at higher altitudes. In fact, there is a truly significant increase. Since, at great heights, any contribution of rays from the earth should have decreased, I have concluded that these radiations almost cer-

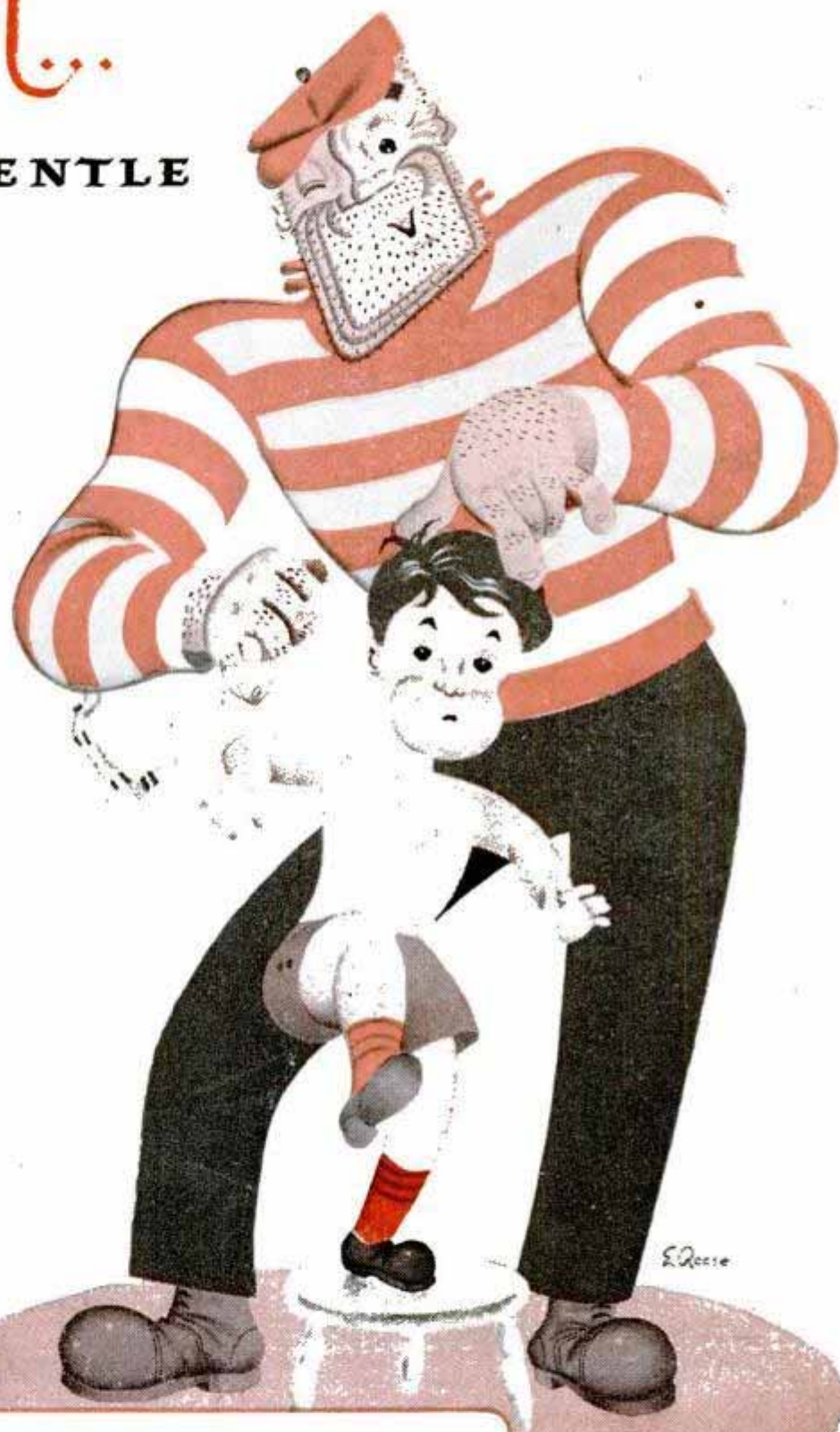
(Continued to page 254)

Tough..

BUT OH SO GENTLE

When you install new piston rings, it will pay you to get Hastings rings. They *stop* oil-pumping, *check* cylinder wear and *restore* engine performance . . . Ask your motor specialist.

HASTINGS MANUFACTURING COMPANY
HASTINGS, MICHIGAN
Hastings Ltd., Toronto

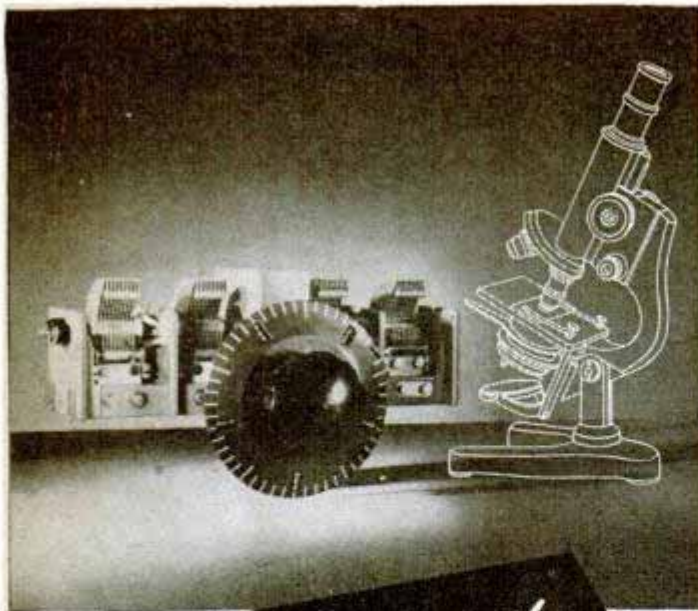


HASTINGS STEEL-VENT PISTON RINGS

U. S. PAT. 2,148,997



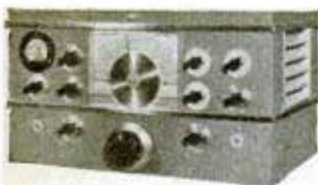
TOUGH ON OIL-PUMPING GENTLE ON CYLINDER WALLS



Marconi and the Microscope

When Marconi developed the wireless and for many years thereafter, there was no such thing as "microscopic tuning" of a receiving set. Signal fading and overlapping of signals plagued all radio listeners, whether they were "hams" or householders, shipboard operators or commercial store stations.

For a number of years, National Company has been building increased sensitivity and selectivity into its radio receivers and during the war developed them to a new high stage of perfection. In the NC-2-40C you will find a radio that will bring in a



NC-2-40C

station if only one-millionth of a volt of signal strength is present.

Such precision can be found only in a few high-quality receivers and National is one of them.



NATIONAL COMPANY

EST.  1914

MALDEN, MASS.

THE MOST DISTINCTIVE NAME IN RADIO COMMUNICATIONS

tainly come from beyond the atmosphere itself."

The cosmic ray hunt was interrupted for virtually a decade by World War I, but the delay seemed to have added impetus once the search was renewed. Scientists the world over, fascinated and challenged by this Mystery Visitor No. 1 to our universe, got on the trail with the vim of crusaders.

As early as 1922 Dr. Millikan made cosmic ray measurements 50,000 feet high in the stratosphere by suspending instruments from a 15-foot cord strung between two balloons. The instruments included electroscope, barometer and thermometer. The experiment was repeated and material results were attained in determining the energy of the cosmic rays falling upon the earth. Dr. Millikan also took soundings deep in a lake, where the resistance to the rays was the equivalent of 25 feet of lead.

Within a decade, research was going on in various parts of the earth, but the most intense center of all was the University of Chicago, where Dr. Compton directed a "world survey of cosmic rays." Preparation of this stupendous project was as orderly as the preparation of a nation for war. Large expeditions were outfitted, the best available scientific minds were enlisted and strategy was developed on a global scale. The climax of action was reached between 1931 and 1934 when 12 expeditions from the great Chicago institution scattered to their observation points. In their travels, the crews covered 250,000 miles.

One went to South Africa, another to Peru, a third to Alaska, a fourth to Australia, and so on. They visited the tropic and arctic regions alike. The earth was used as a gigantic magnet and the mountain peaks as laboratories. Cosmic radiations were measured at high altitudes and compared with those on the surface of the earth and deep in mines.

Compton's experiments were conducted on the principle that lines of magnetic force are passing constantly around the earth between the north and south magnetic poles. These lines of force deflect the needle of a compass and all substances electrically charged, but they do not affect substances that are electrically neutral. Compton's expeditions found that cosmic rays were much denser in the Arctic Circle than near the equator. At the time this seemed to indicate that cosmic rays are deflected toward the magnetic poles of the earth and are therefore electrically charged.

Cosmic ray research reached a high spot in spectacularity during the Century of Progress Exposition in Chicago in 1933-34.

(Continued to page 256)

**"IT'S A SNAP-ON
... THAT'S ALL YOU
NEED TO KNOW"**

"... take a look, Mac — it's funny how you never lose the kick a good tool gives. When I was still a cub I got smart to what every old-timer knows . . . the heap of difference that fine tools make. You know — the fun of working with them, and the extra dollars they put in the old pay envelope. Snap-ons taught me that, and Snap-ons keep right on proving it, year after year. And I've saved a lot of time and trouble buying tools the Snap-on way. That's why the Snap-on man is welcome in every shop . . . he saves our time, keeps our kits in shape . . . and gives us a chance 'to see and try before we buy.'"

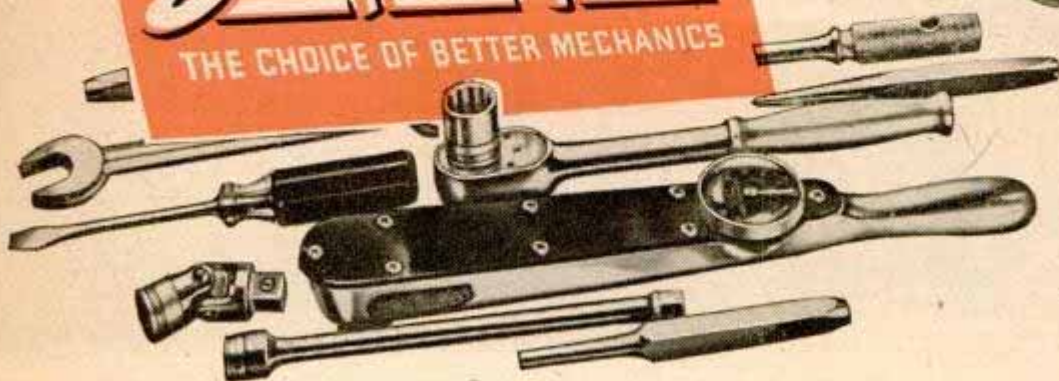
The complete catalog of more than 3,000 Snap-on tools is yours for the asking—write for it today!

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Snap-on Tools

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Knock-Out DRILL CHUCKS

SLIP-PROOF

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KEYLESS

ACCURATE

FIVE SIZES

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Write for bulletin DC. 42-TD



K. O. LEE CO.
ABERDEEN, S. DAK.

Airplane and balloon flights were sponsored by the Chicago Daily News, the National Broadcasting Company and the Exposition. One of them was made by Professor Auguste Piccard, the famous French pioneer of the stratosphere, who attained a height of 15½ miles.

In 1934 a mammoth instrument, called "a new sentinel for cosmic rays," was designed by Dr. Compton, and seven of them, labeled "scientific outposts," were set up at far corners of the earth. One, operated by the Massachusetts Institute of Technology, was carted to the top of Mt. Evans, more than 14,000 feet high. The instrument weighed a ton and a half, and the idea was to conduct cosmic ray tests not only at high altitudes but also under violent weather changes. Studies were made where the temperature often dropped from a balmy 60 above zero to below freezing in five minutes, and where also, with equal brevity, summer sunshine would shift to a blinding blizzard. The meters were designed to operate for a long period, under the most severe conditions, each having an automatic photographic recording device and equipment to compensate for temperature and atmospheric pressure changes. As we said of them at the time:

"They will record the tides in the ceaseless rain of invisible rays which penetrate their thick lead shields and produce a flash of light in the argon-filled chamber. They will show the direction of the rays over a long period of time and any rise or fall in their numbers. They will record changes, if any, of the rays with the time movements of the stars, with fluctuations of the earth's magnetic field and the frequency of sunspots."

Other ray meters were distributed from Peru to Greenland.

Thus the hunters followed the trail with relentless zeal. Danger meant nothing to them. An entire Russian group of scientists and helpers plunged to their death in a balloon crash, while a similar American outfit had to take to their parachutes. A noted scientist, Dr. Allen Carpe, and his assistant, who scaled Mt. McKinley and made observations, were killed while making explorations of a huge Alaskan glacier. Cosmic ray observations were made in airplanes soaring 30,000 feet over huge volcanoes in the southern Andes. A specially built electromagnet weighing more than eight tons was brought into use to observe the deflection of rays passing through a magnetic field. Observations were taken regularly at 40 widely separated stations—one of them a copper mine near Mohawk,

(Continued to page 258)

Lubricated-for-life Ball Bearings...

—double-sealed against
harmful shop dust...

—an advanced
engineering feature that
assures greater operating
satisfaction from your

Delta
MILWAUKEE
REG. U.S.
PAT. OFF.
Power Tools



Other Delta features include:

- ✓ **Pre-loaded Bearings.** This is the result of an extra manufacturing operation that reduces the "play" in the bearings, to help you enjoy long-time operating efficiency and accuracy.
- ✓ **Precision-bored Bearing Seats.** These bearing seats help keep all parts lined up properly, so that you have greater assurance of producing finished pieces exactly according to dimensions.
- ✓ **Precision-ground Shafts.** These are shafts built to run without any "wobbling" which might throw off your measurements.
- ✓ **Dynamically-balanced Pulleys.** The pulleys which transmit the power from your motor to your power tool are balanced to help eliminate annoying, damaging vibration.

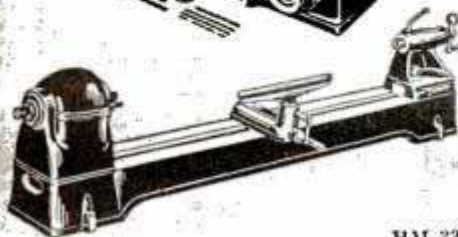
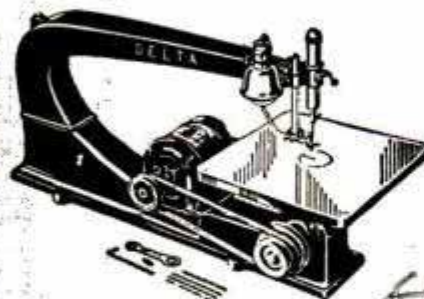
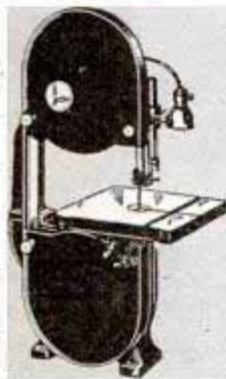
IN YOUR favorite store, Delta-Milwaukee Power Tools don't look much different from most other makes of power tools. But — see Delta tools in action. Actually use them. Then you can tell there is a difference.

Delta's advanced engineering features make this difference. You can't always see them with your eyes. For they are "hidden values" in construction. But the trouble-free performance and safety of Delta-Milwaukee Power Tools tell you that *they're there*.

The accuracy and precision built into Delta tools largely replace the manual skill of the old-time hand craftsman. Once you set a tool for the job, it takes care of keeping the work true and straight... helps you know the thrill of producing attractive, professional-looking work.

It's because *quality* is so important to satisfactory results that Delta-Milwaukee Power Tools are used by happy woodworking hobbyists everywhere.

There's a store near you — perhaps right in your own neighborhood — that carries Delta tools. The people there are looking forward to giving you the complete Delta story. Drop in to see them soon.



HMI-33

HAPPINESS HERALD

Educator Urges Hobby for Health



FREE!

"Happiness Herald"

—an illustrated tabloid newspaper that gives interesting facts about woodworking, a fascinating hobby. Tells about woodworking as an aid to mental health and happiness. Pictures typical shops and projects. Shows how the hobby can pay its way. Enjoy its inspiration and ideas. Send coupon for your free copy now.

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of the "Happiness Herald."

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Cracked Engine?

TAKE IT EASY:
That's nothing to
worry about
these days!

Right! When your service man speaks lightly of cracked engine heads and blocks—relax! It's a sure sign he stands ready to serve you quickly and economically with

K & W METALLIC SEAL MECHANICAL METHOD

—two war-proved methods that restore cracked engines to unimpaired service. Imagine—heads and blocks once consigned to the junk heap are easily repaired at an amazing low cost! 85% of all repairs are made in only 30 minutes with one can of K & W Metallic Seal—the other 15%, of unusually serious nature, are repaired in a matter of hours the Mechanical Method way.

For years, K & W Metallic Seal and Mechanical Method repairs have been standard practice among leading engine rebuilders, fleet operators, railroads and military repair centers. Today, these amazing time and money saving services are available to car owners at better service shops everywhere. Remember—all K & W repairs are guaranteed for the life of the engine!

**INVESTIGATE K & W
GUARANTEED PRODUCTS
FOR BETTER CAR SERVICE**

Want finer car performance, appearance? Ask for these K & W products: Knock 'Er Loose (fast-acting penetrating compound), Radiator and Block Cleaner, Chrome Cleaner, Rust Inhibitor and Radiator Seal.



If you cannot locate a K & W Mechanical Method Shop, wire or write Kerkling & Company, Bloomington, Indiana, for names of those nearest you.

Michigan, where rays were found to have penetrated 1600 feet of rock.

One of the most ambitious experiments in cosmic ray research was staged shortly before World War II, when a 21-passenger air liner was used in Chicago to take soundings. The plane reached a height of 26,000 feet, flying 450 miles in three hours with the temperature below zero. At that height, Dr. Marcel Schein and Dr. Volney C. Wilson, of the University of Chicago, kept constant watch over the ray meter, which was composed of copper tubes and excluded all but cosmic rays. They observed that the more penetrating cosmic rays beat down 10 times faster at that elevation than at the earth's surface. It also was found that a recently discovered particle—the mesotron—was created by the action of neutral rays in the lead filter placed above the counters.

For three years before the war, cosmic ray observations were conducted on a ship running regularly between Vancouver, B. C., and New Zealand. The effort was to discover whether the rays originate in our universe or outside. A year later another cosmic ray research plane reached an elevation of 29,000 feet with photographic equipment that effectively used the "cloud chamber," an apparatus which includes a glass-walled chamber in which is produced an artificial cloud. As the cosmic ray shoots through the air, it breaks the molecules into ions. In the artificial cloud, the ions form drops of moisture and these mark the track of the rays. The track is photographed by the aid of bright lights.

Cosmic rays from the direction of a "star cloud," estimated to be 5000 light-years away, were employed to turn on a cluster of fluorescent lights at the Hayden Planetarium, New York, on June 17, 1941, which in turn, illuminated a "letter to the future" to be opened 5000 years hence.

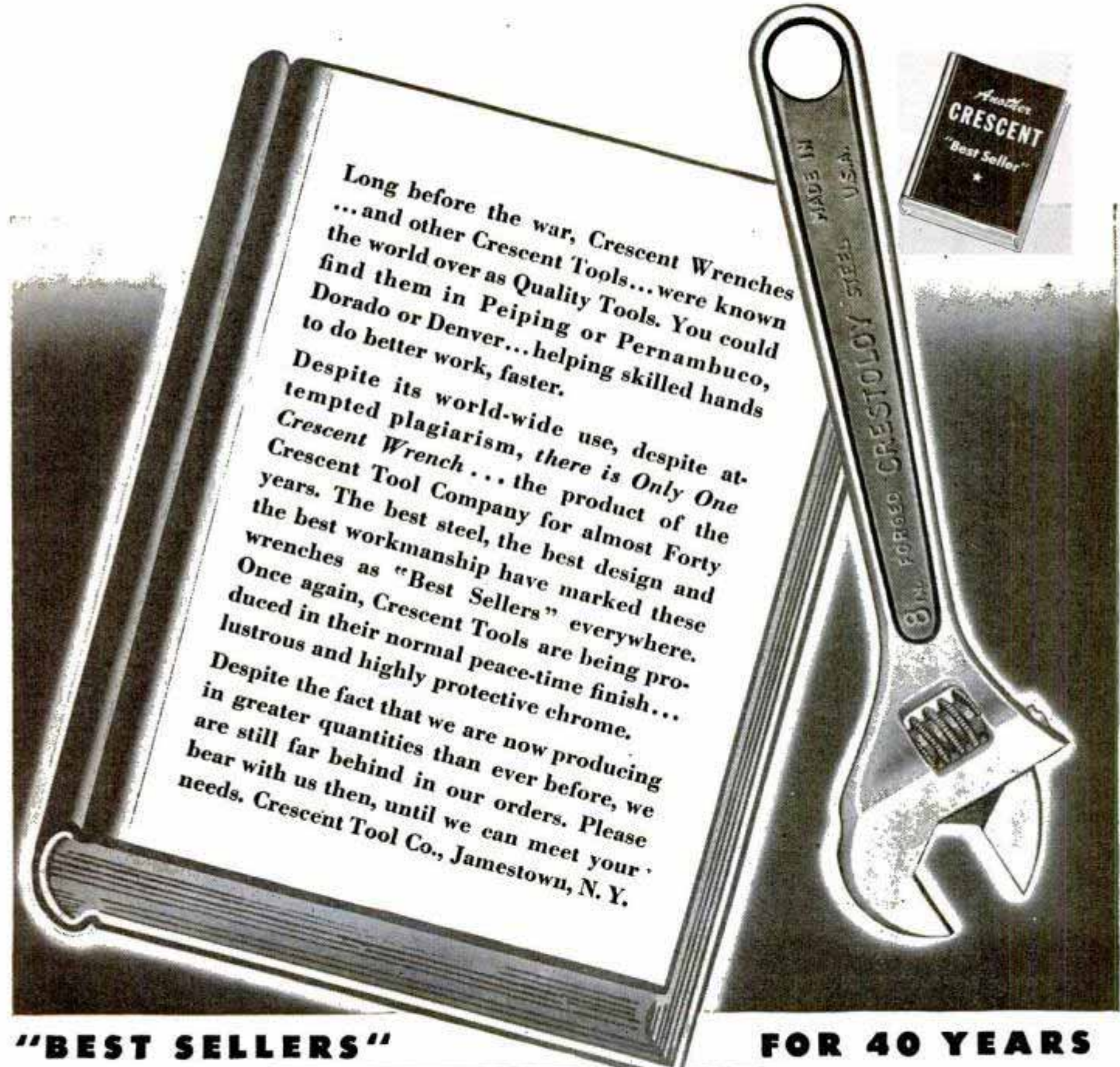
Much research has been done through the years by means of "free" balloons which are sent aloft with delicate registering apparatus in cosmic ray research. Many of the balloon experiments were conducted by Dr. Compton and Dr. W. P. Jesse of the University of Chicago. Two years ago cosmic ray equipment supported by 29 balloons was sent up from Chicago and came down 40 miles from Columbus, Ohio. The device consisted of a 30-foot pole with two sets of three cosmic ray counters and batteries designed to register cosmic ray showers. Dr. Schein reported that cosmic ray showers were discovered at heights of more than 50,000 feet.

Six months later, another "free" balloon ascension was made, the equipment coming

(Continued to page 260)

CRESCENT

...The Wrench known the World over



Long before the war, Crescent Wrenches ... and other Crescent Tools... were known the world over as Quality Tools. You could find them in Peiping or Pernambuco, Dorado or Denver... helping skilled hands to do better work, faster.

Despite its world-wide use, despite attempted plagiarism, there is *Only One Crescent Wrench*... the product of the Crescent Tool Company for almost Forty years. The best steel, the best design and the best workmanship have marked these wrenches as "Best Sellers" everywhere. Once again, Crescent Tools are being produced in their normal peace-time finish... lustrous and highly protective chrome. Despite the fact that we are now producing in greater quantities than ever before, we are still far behind in our orders. Please bear with us then, until we can meet your needs. Crescent Tool Co., Jamestown, N. Y.

"BEST SELLERS"

FOR 40 YEARS

CRESCENT TOOLS

Give Wings to Work

POWER KING TOOLS ARE BACK!

TO SPEED YOUR WORKSHOP "PRODUCTION"

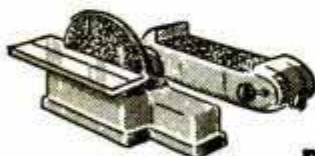
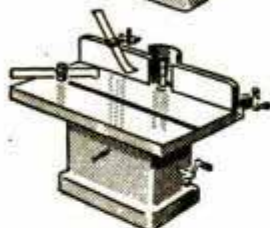
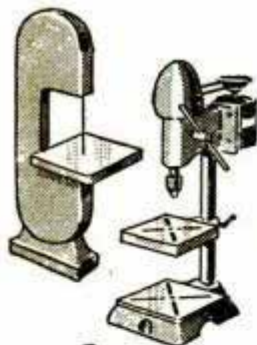
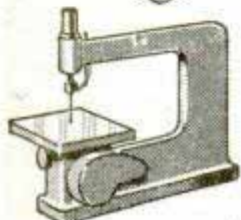
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POWER KING TOOL Corp.
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down in Virginia after a 500-mile record-breaking flight. A little more than a year ago University of Chicago physicists launched 36 balloons bearing a 60-pound cosmic ray photographic apparatus. The "free" balloons have carried automatic cosmic ray apparatus more than 17 miles in the air on different occasions, or upwards of 90,000 feet! The balloons, inflated with hydrogen, are made of extraordinarily elastic material, so that while they measure only five feet in diameter at the start of the ascent, they inflate to 20 feet in diameter when 16 miles or more in the air. Sometimes when a cluster of the balloons descends people take them for paratroopers. A note offering a reward for return of the equipment to the sender is attached to each unit, and nine times out of 10 the records and material are returned. Free balloon flights have registered up to 100 miles an hour in cross-country flight. They ascend at the rate of 700 to 1000 feet a minute. One of the strangest happenings was when a cluster was sent up from the University of Chicago, traveled several hundred recorded miles, and returned like a boomerang to a point within five miles of the campus!

Another device is a short-wave radio system that sends the impulses to scientists on the ground, dispensing with the need for a film record. Still another unique experiment was conducted late last fall when 49 balloons were released from Stag Field at the University of Chicago. This experiment was in charge of Dr. Schein of the university. Along with 70 pounds of cosmic ray apparatus were sent 200 flour beetles to determine the effect of cosmic rays on insect life. This experiment was thwarted by the accidental death of the beetles through escaping gases, but the effort will be repeated as the objective is considered of paramount importance.

Other studies show that gamma rays found in cosmic radiation are the shortest known. X-rays are too short to be visible, and gamma rays in radioactive materials are from 10 to 100 times as short as X-rays. However, the shortest known gamma rays of cosmic radiation are 100 million times shorter than the gamma rays of radioactive bodies. Research shows there are various kinds of cosmic rays, particularly the "soft" (electrons and gamma rays) and the "hard" (mesotrons). The former are easy to absorb, but the hard rays of high energy are the ones that penetrate anything. They are millions of times stronger than any other known radiation and shoot like irresistible bullets through every known thing.

Another dramatic discovery is the fact

(Continued to page 262)



CHECK truth-of-taper
or any angle, to
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With a set of Ford Jo-Blocks and Sine Bar, you can quickly establish or verify angularity. Hundreds of other daily shop uses, from checking mikes to precision set-up of machine tool jobs, verifying marks, locating, laying-out, scribing, etc.



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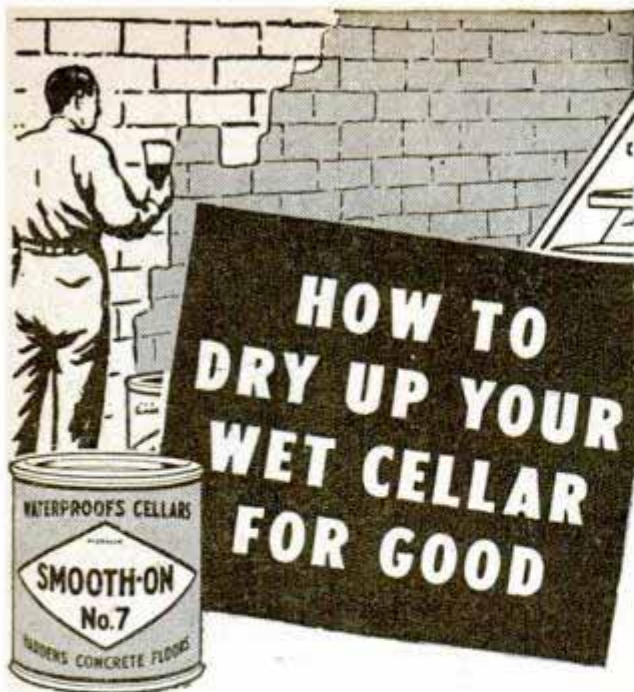
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that there are frequent cosmic ray "showers," the particles falling like heavy rain over an area equal to two or three acres. As many as a million rays are contained in a single shower and 50 or 60 showers fall in a single hour. They are called "Auger showers" in honor of the famous French scientist, Pierre Auger, whose research in the Alps mountains brought the new discovery to light. You can listen in, through an ingenious loudspeaker device, on a cosmic ray shower, and it sounds something like a summer storm. It is a roaring sound, like rain driven by wind, then sudden quiet for a moment, followed by another squall.

While we are struck constantly by both the continuous downpour of cosmic rays and the occasional heavy blast of a shower, they do not register any known effects on us. People living at high altitudes get a double dose, while men working deep in mines receive only a fraction of the rays, but neither seem in the least affected.

The latest scientific effort is mostly in the field of relating the cosmic rays to atomic radiations. Nearly 15 years ago one scientist predicted that cosmic ray study would throw light on the problem of how the core of the atom is built, and thus open the way for the release of atomic energy for human uses. As far as it can be gathered from guarded statements by scientists, it is likely that the cosmic ray is the key to the release of atomic energy and to the analysis of the atomic ray. In fact, it is reported that the cosmic ray is held to be the means of unlocking the secret of X-ray and radium as well. Further than that, a professor, John Archibald Wheeler of Princeton University, holds that by studying cosmic rays man eventually may discover means of transforming any kind of matter, not uranium alone, into atomic energy.

A new giant, called the betatron, invented by 34-year-old Donald W. Kerst, a University of Illinois professor, is soon to come into the field of cosmic ray research. The instrument uses electric magnetic energy to speed the flight of electrons up to 185,000 miles a second, virtually the same as that of light. It is expected to reproduce cosmic rays for close study, possibly eliminating the need for scientists to fly into the stratosphere or burrow into mines.

How long must the relentless search move on before the cosmic ray finally is brought into captivity and tamed? No one knows. Most scientists say that, if human cussedness in the form of war will lie dormant long enough to let science carry on its hunt uninterrupted, 10 to 20 years ought to be enough to make us master of the supreme source of unlimited power.

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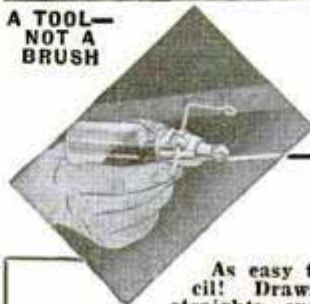
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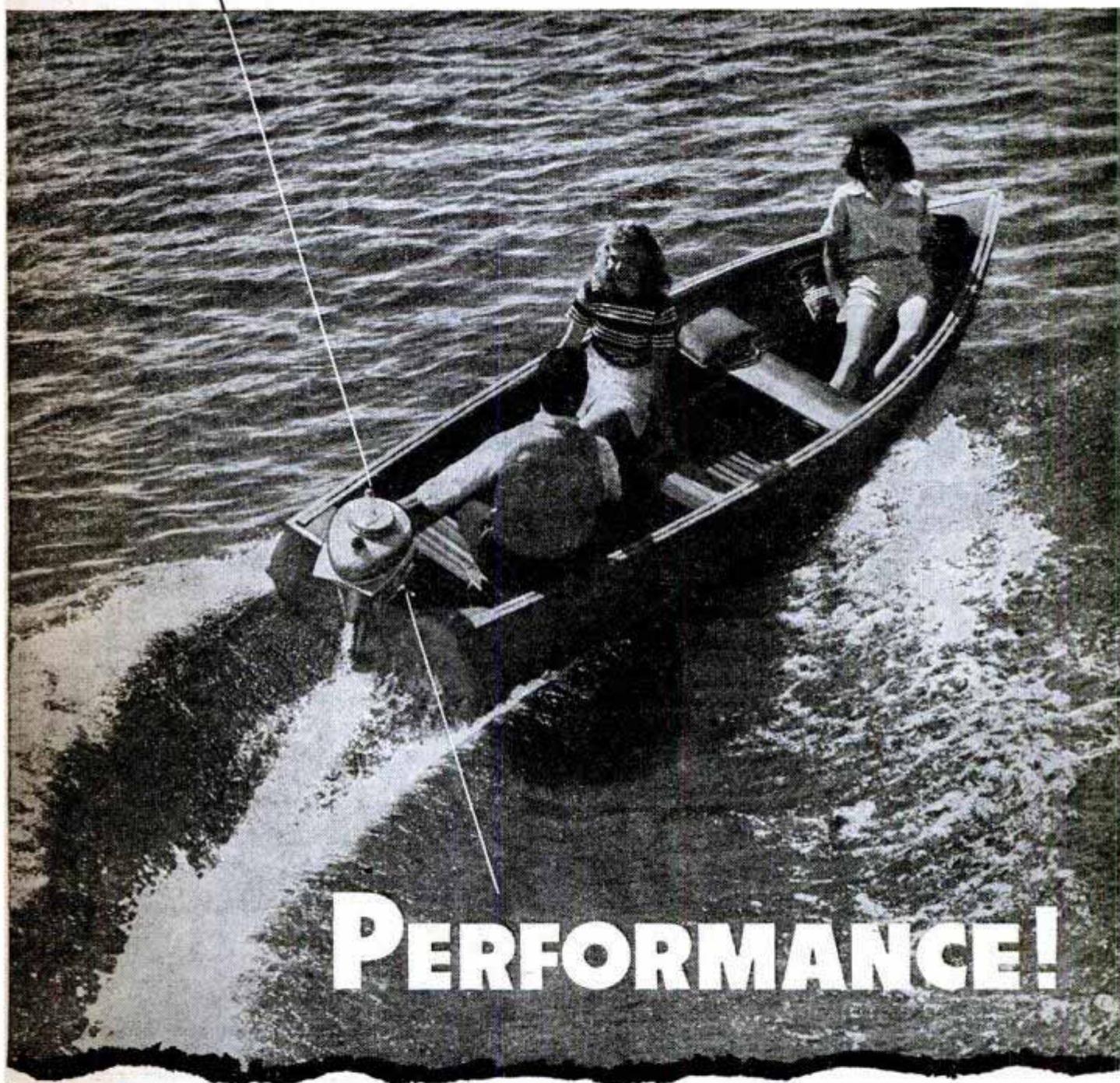
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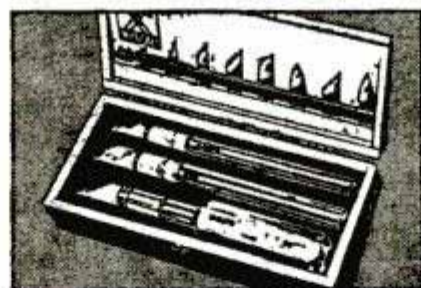
At Midwood High he made wooden puppets for the school play against black markets. X-acto Knives, he says, were "perfect for getting just the right expression on the puppets' faces".

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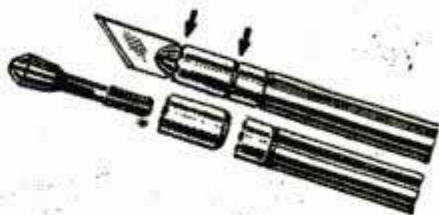
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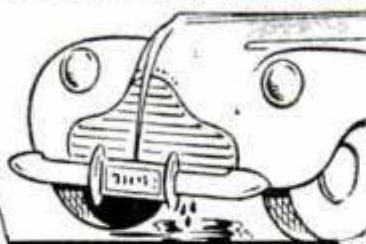
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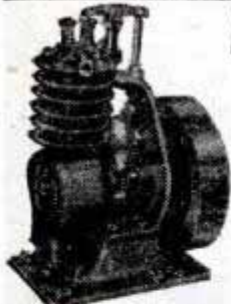
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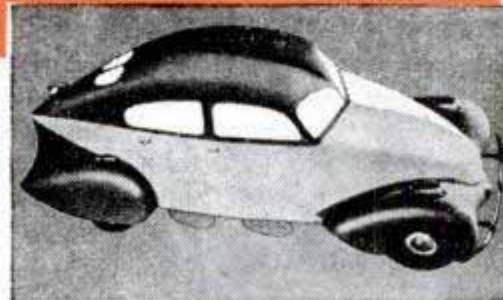
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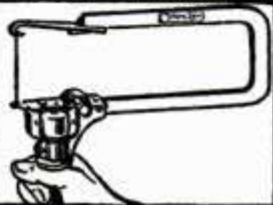
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Dremel Moto-Saw... the sensational electric scroll saw... will be back as soon as materials are available.



DREMEL MFG. CO. 116-G RACINE, WIS. U.S.A.

QUICK WARMTH FOR ROOMS WITH THE CHILLS



Equipped with safety automatic shut-off, Thermo Electric Control and other advantages.



Now you can bring *real steam heat* into any room! WITTIE Electric Steam Heater is a new revolutionary heater that provides quick, uniform warmth wherever and whenever you need it. Luggage-light, good-looking as a piece of furniture, and so economical to operate! Safer, too, because WITTIE is steam heat—no glowing coils. You'll want to see the WITTIE Portable Heater, so send coupon right away!

Weights only 37 lbs.; baked Hammerloid mahogany color; 110 volts AC

WITTIE MFG. & SALES COMPANY

1414 S. Wabash Ave., Dept. 17, Chicago 5, Ill.

Please tell me where and when I can see the new Wittie Portable Electric Steam Heater.

Name

Address

City State

OVER **75** MILES PER GAL!

Cushman
MOTOR SCOOTER



For getting there Quick—Comfortably—and at Lowest Possible Cost, you can't beat the Cushman—and the new 1946 model is 'way ahead of anything you have ever seen!

POWER TO BURN! Rugged 4 H. P. engine with 2-speed transmission speeds you up steepest hills!

COSTS LITTLE! \$1 worth of gas takes you 400 miles! Any speed up to 35 miles an hour!

TRULY COMFORTABLE! Long wheel base, improved spring action, big balloon tires, insure smooth riding!

Many 2-wheel or 3-wheel models—with or without side or front package-box for carrying big loads.

WRITE See your dealer or send for Free Folders, Prices.

CUSHMAN MOTOR WORKS
Dept. P-73, Lincoln, Nebr.

OTHER MODELS



SIDE-KAR—3 wheels. Package-box carries 200-lbs.



PACKAGE-KAR—3 wheels. Front package-box carries 250-lbs.

PRECISION DRIVES for your POWER EQUIPMENT

CONGRESS

PULLEYS & COUPLINGS

Available in a large range of sizes, **CONGRESS DRIVES** increase the performance of your workshop. They are the same precision drives that are being used as standard equipment by many of the worlds largest manufacturers of high priced precision machinery.

Better hardware, hobby shop and farm equipment dealers are selling **CONGRESS DRIVES**. They are available in all popular sizes with diameters ranging from 1½" to 14". You pay no more for **CONGRESS** than for ordinary drives.

CONGRESS DIE CASTING DIVISION
Detroit 12, Michigan



LOOK FOR THIS DISPLAY

It identifies the dealer selling superior **CONGRESS** pulleys and couplings.



SAY YOU SAW IT IN POPULAR MECHANICS

ELECTRICITY FOR ANY JOB ANYWHERE



Reliable, economical electric service anywhere, anytime, with an Onan Electric Generating Plant. Driven by Onan built, 4-cycle, gasoline engines, these power plants are of single-unit, compact design and sturdy construction. Suitable for all types of service.

Models range from 350 to 35,000 watts. A.C. types from 115 to 660 volts; 50, 60, 180 cycles, single or three-phase; 400, 500 and 800 cycle, single phase; also special frequencies. D.C. types range from 6 to 4000 volts. Dual voltage types available. Write for engineering assistance or detailed literature.

ONAN

D.W. ONAN & SONS, 2515 Royalston Ave., Minneapolis 5, Minn.

FISHERMEN

MAKE OR REPAIR YOUR OWN STEEL LEADERS... QUICKLY... EASILY

Any fisherman now can make tightly wrapped, factory-perfect steel leader connections with "HOOK-ON." This new winding tool takes all the "chore" out of attaching hooks and swivels to steel wire leaders. Also simplifies repairing broken leaders. Stainless steel, precision made, lifelong construction.

"HOOK-ON" Only \$1.50

If your dealer does not yet have "HOOK-ON," order direct. Mailed postpaid upon receipt of cash or money order.

HOOK-ON



PARAMOUNT MACHINE PRODUCTS
1361 Newton Street, Los Angeles 21, California, Dept. PM-3



LOCATES TROUBLE INSTANTLY IN ALL ELECTRICAL DEVICES

HANLAN APPLIANCE TESTER

In this single unit are combined all the necessary tests for examining every appliance. Checks thermostats under actual working conditions. Tells instant it opens or closes. Controls the heat on soldering irons. Prevents over-heating. Tests continuity, open circuits, etc. Checks automatic irons, vacuum cleaners, motors, shavers, bulbs, appliances with 3-way switches, etc. Great time, effort and money saver! ONLY \$9.50 COMPLETE.

Pat. Pend.

FREE with each Tester. New, Complete Practical Course in electrical appliance repairing. **WRITE FOR CIRCULAR.**
HANLAN CO., 1419-A, West Jefferson, Los Angeles 7, Calif.

THERE'S NO OIL... just like 3-IN-ONE!

INSIST ON 3-IN-ONE

For over 50 years the accepted household oil in America... Sold everywhere.



Light or Heavy Body

One or Three Oz. cans



3-IN-ONE Oil

SpeedWay

No. 6 1/4" drill \$9.95

No. 8 1/4" drill \$32.50

SpeedWay announces that an even better and more complete line of SpeedWay Electric Tools will soon be available to you at the same attractive pre-war SpeedWay prices. Already coming off the line, these are tools worth waiting for. Ask your dealer about them NOW!

SPEEDWAY MFG. CO.
1863 S. 52nd Ave.
Cicero 50, Ill.

VICE-GRIP WRENCH

Mightiest OF ALL HAND TOOLS

GIVES I HAND A TON GRIP!

See the DOUBLE LEVER!

Vise-Grip does more things, easier, than any other tool! Remains locked to the work with hands removed. Holds anything, any shape, with a grip that never slips. Built with strength to back up its tremendous power. Is actually Hand-Vise, Clamp, Super-Plier, Adjustable End-Wrench, Pipe-Wrench, Locking Wrench and Toggle-Press—ALL IN ONE! Light, trim, handsome. Made of fine alloy steel. Electro plated. 7" and 10" sizes.

Sold by Tool Jobbers and Dealers.
PETERSEN MFG. CO., Dept. P-36, DeWitt, Nebr.

HULL Gets You There

Know directions in rain, snow, fog or night driving. **HULL AUTO-MOBILE COMPASS** is accurate, dependable. Easily installed. Circular free. At your dealer's. Price \$3.50.

HULL MFG. CO.
P. O. BOX 246-D3 WARREN, OHIO

IT'S EASY! IT'S FUN!

Build Your Own

• Transmitter Kits • Phono Amplifier Kits • Antenna Kits • Crystal Sets and many others.

FREE NEW 52 PAGE PARTS CATALOG SEND FOR YOUR COPY TODAY!

Write for these exclusive items:
 Tube and Circuit Book 10c
 Giant Radio Reference Map 15c
 Handy Tube-Base Calculator 25c

Address PM-3, Council Bluffs, Iowa

Wholesale RADIO LABORATORIES



GET NEW-CAR PEP AND ECONOMY WITH BURD "GRAF-FLOX" PISTON RINGS

● If you're not one of the fortunate few who have a new 1946 Model car, give your engine a brand new lease on life by installing Burd "Graf-Flox" Piston Rings. You'll be surprised at the new-car pep it gives and be pleased when you add up your fuel and oil savings. The secret of Burd's superior performance lies in (1) the use of electric furnace iron—scientifically controlled, producing piston ring castings having uniform tension; (2) precision grinding and finishing operations, which include the removal of all harmful metal surface particles; (3) the exclusive Burd process of applying deeply penetrating colloidal graphite, preventing the finished rings from scuffing, scoring, seizing, or sticking in grooves. Mail the coupon today for two FREE booklets described below.

BURD PISTON RING CO. DEPT. PM ROCKFORD, ILL.



THIS COUPON BRINGS FREE BOOKS

BURD PISTON RING CO., DEPT. PM
Rockford, Illinois
Gentlemen:

I'd like a FREE copy of your "Handy Handbook" which tells how to keep my car in good working order. Also send a "Car Economy Record Book."

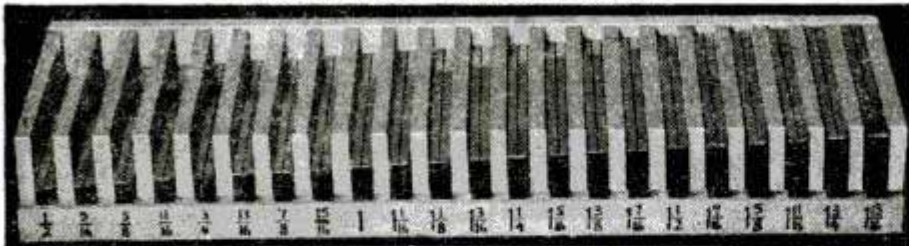
Name.....
 Address.....
 City..... State.....

Handy Handbook
 Victory

ANTON PARALLELS

AVAILABLE NOW — IMMEDIATE SHIPMENT

**INCREASE PRODUCTION
IMPROVE QUALITY OF WORK**



ANTON PARALLELS COME IN THREE STANDARD SIZES—

3/4" Thick x 6" Long—1/2" to 1-13/16" High in Steps of 1/16" \$85.00 per set—22 pairs

1/2" Thick x 6" Long—1-3/16" to 1-13/16" High in Steps of 1/16" \$71.00 per set—11 pairs

3/4" Thick x 6" Long—1-3/16" to 1-13/16" High in Steps of 1/16" \$106.00 per set of 11—3 each size

Price per set includes a large Wooden Container — Large Stock of Single Pairs also Available — All Prices are F.O.B. New York

ROCKWELL "C" HARDNESS 65 UP.

MAXIMUM SIZE TOLERANCE .001 INCH ON GROUND SIDES—Maximum Variation in Parallelism and Straightness within Length, .0001.

ALL PARALLELS FULLY GUARANTEED—To be within the Limits Specified.

ANTON PARALLELS FILL A LONG-FELT NEED—permanently straight and accurate, yet priced for everyday general machine shop use.

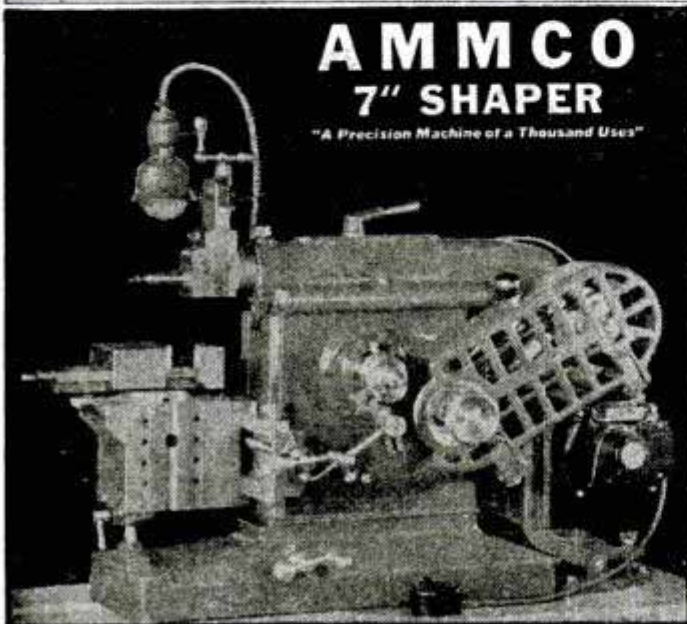
ANTON PARALLELS COME IN THREE STANDARD SIZES—

ANTON MACHINE WORKS

52 SANDS STREET
BROOKLYN 1, N. Y.

AMMCO 7" SHAPER

"A Precision Machine of a Thousand Uses"



A wide variety of jobs can be done accurately, quickly, easily, and economically on the AMMCO Shaper (7" stroke).

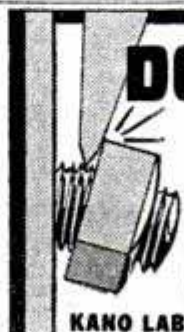
Construction incorporates many features you would expect to find only in larger, more expensive machines. For example: WAYS of ram, tool head, and front face of the main frame are of the "VEE" type, hand scraped to insure accuracy and long life. Available for stationary installation or as portable unit.

Write today for specifications and prices

AMMCO

2140 Commonwealth Ave. North Chicago, Ill.

DON'T USE CHISEL



Use KROIL, the new chemical lubricant that creeps into millionth inch spaces, dissolves rust and dried grease.

KROIL LOOSENS FROZEN PARTS

The fastest penetrating oil known, 5000 industrial plants used Kroil to keep war production going. Try it on money back basis. AT YOUR DEALER or send \$1 for two 8 oz. spout cans, postpaid, send dealers name.

KANO LABS., 3023 LINCOLN TOWER, CHICAGO 1, ILL.



DRILL-INDEX A compact container for indexing and filing twist drills. Eliminates search. Made entirely of steel in nine sizes. See your dealer or write to

HUOT MFG. CO. St. Paul 1, Minn.

KEEP YOURSELF UP-TO-DATE ON WOOD LUMBER & SUPPLIES

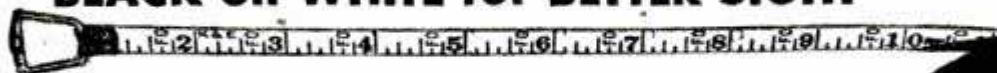
with CONSTANTINE'S MASTER MANUAL

Published by the leading suppliers to woodworkers, the most complete book ever offered. More than a catalog, contains valuable information on lumber inlays, veneers, wood finishing, etc. 88 inlay border designs in full color, 6 pages of full color inlays plus a wood identification chart showing over 60 rare woods in natural color. Send only 25c today and we will include FREE a year's subscription to our publication, Chips & Chats.

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BLACK on WHITE for BETTER SIGHT



WYTEFACE Steel Tapes have black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Faster measurements with fewer errors. Designed for hard service. Resists abrasion from rails, pipe, rocks, concrete. Protected against rust.

WYTEFACE
STEEL MEASURING TAPES

KEUFFEL & ESSER CO.
EST. 1867

NEW YORK • HOBOKEN, N. J.
CHICAGO • DETROIT • ST. LOUIS
SAN FRANCISCO • LOS ANGELES
MONTREAL



Drafting
Reproduction
Surveying Equipment
and Materials
Slide Rules
Measuring Tapes

Mows and Trims Lawns

In One Simple
Easy Operation

8¼ Lbs.

Save Time
and Labor with a
MONTAMOWER

New model. New type metal handle has special device to adjust cutting height. Drive shaft now mounted on free rolling, factory lubricated, and sealed ball bearings. No tired backs or aching arms. 8¼ lbs. of live precision made mechanism that first gathers, then cuts smoothly a clean 16" swath through grass, dandelions, spike grass and weeds. No noise or clatter. As modern and efficient as your electric razor. Cuts right up to walls, fences, trees or posts; leaves no fringes to be trimmed by hand. Cutters are self-sharpening. Built to last many years. Many thousands in use. Sold direct from factory. Costs little. Write at once for guarantee information and literature.

MONTAMOWER DISTRIBUTING CO.
821 Keeler Bldg. GRAND RAPIDS 2, MICHIGAN

ONE TOOL . . .
THE **SEAMAN TILLER**
DOES COMBINED WORK OF

PLOW DISC HARROW

Saves time and labor. Tears up and pulverizes soil in one trip over field under favorable conditions. Increases yields. Mixes nutrient elements into seedbed, assuring better availability of plant food; aids production of nitrogen by aerating soil; takes up and holds more moisture . . . protects against drought. Kills weeds. The most efficient tool ever developed for eradicating quack grass and other crop-choking weeds.

Write for Seaman Tiller Circular

SEAMAN MOTORS 327 No. 25th St., MILWAUKEE 3, WIS.

FACTORY TO YOU!
KITSELMAN FENCE
Buy Farm, Poultry, Hog Fence, Steel Posts, Barbed Wire at **FACTORY PRICES!** Save too on quality Paints, Roofing, Hay Tools, Hog Feeders, Fountains, Poultry Supplies and other farm needs! **WE PAY FREIGHT.** Write today for **FREE Catalog!**
KITSELMAN BROTHERS
Dept. 94 Muncie, Indiana.

If They'll Bite You Can **CATCH 'EM** With The **FISHIN' GADGET** Sets Hook Automatically

The greatest fishing invention since the fishhook! Automatically sets the hook on fish that bite. First day's results insure lifetime use. Will last for years. Made of non-corrosive metal. Use on any line . . . for any kind of fishing. See your dealer or send coupon and \$1 bill for your Fishin' Gadget . . . now!

Send Coupon and \$1 Bill
Sent Postpaid
Get Yours Now!

Graham - Campbell Co.
1405-7 Walnut St.
Kansas City 6, Mo.
Here is a \$1 Bill. Send me a FISHIN' GADGET quick!

Money Back Guarantee

TRIGGER GUIDE "E"
TRIGGER "H"
SLIDE "C"
MOORING "D"
LINE GUIDE "F"

NAME.....
TOWN.....
STREET..... STATE.....

the making of *Marlin* GUNS

Marlin brings to sportsmen, through this series of advertisements, interesting facts on gun-making—to enhance appreciation of fine sporting firearms and to encourage their thoughtful handling and care.

BARREL-MAKING... A FINE ART • The barrel gives rifle and shotgun their accuracy. The steel used, the science and skill with which the barrel is made vitally affect the life and safety of the firearm as well. Barrel-making is a fine art of manufacture.

STEEL • Special-analysis steel, developed by metallurgical engineers to withstand proof loads 150% of normal pressure is the "raw material" of a Marlin barrel.

BORING • The solid steel bar is bored with special cutting tools.

TURNING • Cut to length, the special steel bar is turned on a lathe to proper diameter. A continuous "taper" is turned on rifle barrels to make for scientific strength distribution and "balance." The barrel is then highly polished and blued.

ALIGNMENT • The alignment of Marlin barrels touches a peak in the art of gun-making. Only one in hundreds of craftsmen has the "eye" for this delicate job. Marlin barrels are aligned at three distinct and separate times in the process of manufacture. Final alignment is the most exacting and gives the barrel its high potential of accuracy.

RIFLING • The Ballard rifling—which has long been a prime factor in the accuracy of Marlin Rifles—is done with specially-designed cutting tools. This operation is in charge of highly-skilled, experienced craftsmen.



Rifling a Marlin Barrel

(The next advertisement in this Marlin series will reveal more interesting facts on fine gun-making.)

THE *Marlin*
FIREARMS CO.
New Haven, Conn.

**SEE MARLIN 1946 MODELS ON
DISPLAY AT YOUR DEALER'S**

Say you saw it in Popular Mechanics

WELD IT YOURSELF!
SAVE TIME—SAVE MONEY
 with the Portable
Magic Wand
WELDER



DO your own welding and brazing! Any metal—iron, steel, bronze, brass, aluminum, etc. Just plug the Magic Wand Welder in on any 100-V, 60-cycle AC line and make all kinds of metal repairs that now cause you inconvenience, delay, expense. Do electric flame torch and metallic arc welding, brazing, light and heavy soldering, all with this one handy outfit. Six ranges of welding heat. A complete professional welder, consisting of heavy-duty transformer built into a sturdy, shock-proof carrying case, 15-amp. polarized outlet plug, electrode holders and a supply of brazing rods, fluxes, extra carbon electrodes, welding helmet, instruction manual, etc. Weighs less than 30 lbs. packed. Quickly pays for itself in savings. If your hardware dealer or automotive jobber hasn't the Magic Wand Welder, write us.

COMPLETE
\$34.50
 F. O. B. FACTORY

For Descriptive Folder, address:
JOHN H. GRAHAM & CO., Inc.
 General Sales Agent
 Dept. P, 105 Duane St., New York 8, N.Y.

MADE BY PATENT SPECIALTIES, INC., NEW YORK, N. Y.

Say you saw it in Popular Mechanics



Have
YOUR OWN
 Business

SAW FILING

You can have a good, steady, cash business of your own reconditioning saws with the Foley Automatic Saw Filer, which makes old saws cut like new again. The Foley is the **ONLY** machine that files all hand saws, also band and circular saws. Easy to operate—no eyestrain.



SEND FOR FREE PLAN—shows how to start in spare time—no canvassing. Send coupon today—no salesman will call.



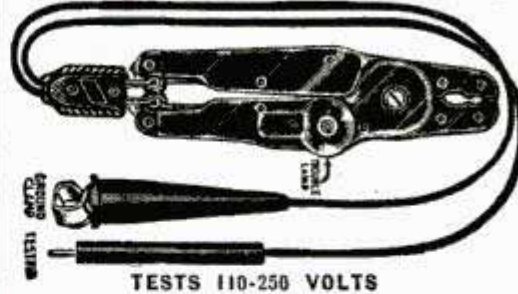
FOLEY Automatic SAW FILER

FOLEY MANUFACTURING CO.
 316-6 Foley Bldg., Minneapolis 13, Minnesota
 Send Free Plan on Saw Filing business, no obligation

Name _____

Address _____

Fuse Puller—Circuit Tester



For
 Home
 or
 Factory

TESTS 110-250 VOLTS

When motors stop and lights go out, this tool quickly **LOCATES DEAD CIRCUITS** and safely removes blown Fuse. The Star Test Pocket Plier is made of a Transparent Plastic having in one of the legs a small lamp in series with a resistance and can be used to test 110 to 250 volts circuit. The Plier will pull fuses from 19 to 100 Amperes. Thousands of Electricians find this tool handier than Test Lamps. Price \$2.75 each without Leads, \$1.50 additional for Leads. Can be obtained from General Electric or Westinghouse Stores or from your local dealer or jobber. Order NOW. **STAR FUSE CO., 235 Canal St., New York 13, N. Y.**

FIND UNDERGROUND MINERALS and METALS with M-SCOPE

Employs same principle as Army Mine Detector. Unsurpassed in Efficiency. Write for Free 16 page booklet.



FISHER RESEARCH LABORATORY
 PALO ALTO CALIFORNIA

Sand Casting—Forging—Heat Treating—Case Hardening
BRONZE FOUNDRY



is again available in limited quantity without priority. Orders filled in sequence as received. **INVENTORS—SCHOOLS—CRAFTSMEN** use **FOUNDRYETTE** for making castings quickly for new inventions, for instruction, and general purpose. Order now for early delivery. Three sizes are available capable of making bronze castings of 1½, 3, and 6 pounds weight, aluminum, copper, brass, etc., \$17.50, \$24.00, \$34.50, f.o.b. Kansas City. Domestic gas supply and 110 volt AC or DC energy required for operation. Write for circular.

KANSAS CITY SPECIALTIES CO.

Box 6022, Dept. P-64

Kansas City, Mo.

HAUCK FLAME GUN KILLS WEEDS ★



2000° F controlled heat quickly, easily destroys seeds, roots, brush, poison ivy, wild morning glory, Canada thistle, other unwanted growths. Many uses: splitting rocks, burning stumps, sterilizing poultry houses. Burns kerosene. Does the work of 4 men. Safe, easy to use. 10 day trial. Satisfaction guaranteed. Free catalog.

HAUCK MFG. CO.

122 Tenth St.

Brooklyn 15, N. Y.

New - Improved OIL FOR ALL ---
HOUSEHOLD-SPORTSMAN-MECHANIC
 Lubricates - Prevents Rust - Cleans Metal

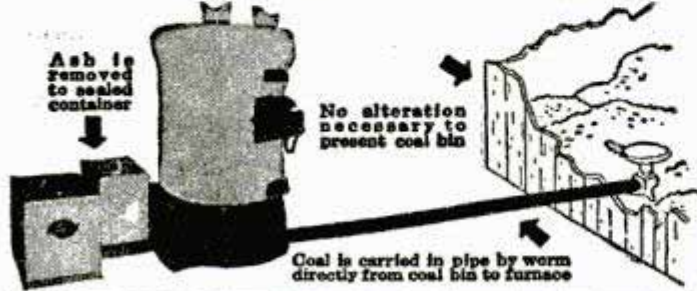
3 oz. 40c

FIENDOIL

STOKER EMPTIES OWN ASH!

A remarkable stoker already used by thousands of home owners—fits into any furnace or boiler. Manufactured since 1934. So automatic it takes the coal from your present coal bin through a pipe to the furnace, going around corners if necessary. Keeps house at even temperature, empties its own ash in sealed containers, no coal to shovel, no clinkers to dig, only bituminous stoker of its kind on the market. Send for full information NOW!

POCAHONTAS FUEL COMPANY INCORPORATED
344 EAST 131st STREET • CLEVELAND 8, OHIO



Army-Navy Type HEADPHONES

TYPE HS-23

Save up to 70% on genuine U.S. Signal Corps headphones. These are the better \$10.00 headphones for only \$2.95. Leather-covered headband, detachable rubber cushions, lightweight construction, impedance 8000 ohms. Ea. **\$2.95**

Signal Corps TELEGRAPH KEY

Genuine U.S. Signal Corps key with switch to close contacts, polished durable enameled metal base mounting on a bakelite base, key lever is nickel-plated brass, silver contacts; **95c** packed in new original boxes. Shipping wt., 1 lb. Ea.

Write for our illustrated literature featuring all types of radio parts.

Plus shipping charges.

Arrow Radio Co., Dept. G, 2205 W. Division St., Chicago 22, Ill.

SANDING "HANDEE RUBLOK" POLISHING

USED BY BIG MANUFACTURERS . . . NOW AVAILABLE FOR WORKSHOP, HOME AND SHOP USE

Rub wood, metal surfaces to a smooth factory finish . . . quickly, easily. Fine for paint work, waxing, polishing . . . gives even pressure over entire surface . . . gets into corners, irregular shapes. Special rubber cushion relieves hand fatigue. 6" x 2" rubbing surface. Complete with 6 durable, quick change covers only \$1.00 C.O.D.; postpaid if cash with order. Established dealers and agents invited.

FELD ENGINEERING CORP., DEPT. HB132, 12264 WASHBURN, DETROIT 4, MICH.

REPAIR YOUR OWN ELECTRIC APPLIANCES WITH NEW AMAZING NICHROCITE

Simply overlap ends, apply Nichrocite paste and turn on the current—a perfect weld results. Used by big utility companies and repair shops. Just the thing for that broken or burned out heating element in your electric iron, stove, toaster or heater. Does the job in a jiffy. Trial order, \$1; 4 ozs., \$2.50; 1 lb., \$8.00.

Handy for Home or Industrial Use

ARMSTRONG ELECTRIC CO., Box 861-MP, Minneapolis, Minn.

A TOOLSHOP IN YOUR HAND!

- GRIND • DRILL • ROUT
- POLISH • ENGRAVE
- CUT • SAND • SAW, etc.

Make Things From Wood—Plastics—Metals—Glass—Linoleum—Leather—Alloys—Horn—Stone—Bone, etc.

HANDEE TOOL OF 1001 USES

Smooth, steady power at your fingertips! You can turn out professional looking projects for pleasure or profit—ship, plane or train models, costume jewelry, wood carvings, puppets, initialed tumblers, etc. Handee, first small portable tool and today's finest, uses 300 different accessories. AC or DC. 25,000 r.p.m. Weight, 12 oz. With 7 accessories, postpaid..... **\$18.50**

GET A GOOD START

Get the **HANDEE KIT**

HANDEE Too and 45 of the most popular accessories, all packed in handsome, compact steel carrying case. You'll be amazed at what you'll accomplish!

Complete, postpaid, **\$25.00**

FOR YOURSELF OR A FRIEND... THE GIFT OF A LIFETIME!

HANDEE PRECISION ATTACHMENTS

Magically, easily, your offhand carving, routing, shaping, etc. will be perfect as to depth of cut, accuracy of line. These remarkable new tools for novice or experienced craftsman fit Handee only. Set of 6 attachments, with full instructions, complete, postpaid..... **\$7.95**



ORDER NOW—USE COUPON

FREE 64-PAGE Catalog

CHICAGO WHEEL & MFG. CO.
1101 W. Monroe St., Dept. PM
Chicago 7, Ill.

Send me HANDEE TOOL HANDEE KIT PRECISION ATTACHMENTS

Remittance enclosed. Send C.O.D.

Send 64-page Catalog.

Name.....

Address.....

POST-WAR Special



6 TUBE "SUPER HET" RADIO KIT

Complete, including Attractive Walnut Cabinet. Diagram Furnished. Uses One 25L6—One 25Z6—Two 6SJ7—One 6SQ7—One 6SK7—or—One 50L6—One 35Z5—Two 12SJ7—One 12SQ7—One 12SK7

ALL PARTS MOUNTED

To assemble, all one needs is a soldering iron and 30 minutes of your time.

\$16⁹⁵ LESS TUBES

Limited Quantity on Hand

TERMS: 10% DEPOSIT WITH ORDER—BALANCE C. O. D.

LIBERTY SALES CO., INC.

115 WEST BROADWAY · NEW YORK 13, N. Y.

TELESCOPING MEASURING TOOLS

Measure All Holes, Slots, Etc.—5/16 Inch to 6 inches . . . Gives You Outside Micrometer Accuracy on Inside Measurements
FINISH YOUR OWN SET OF FOUR TOOLS



Only **\$2⁹⁵** C.O.D.

Plus Usual Small Postal Charge
PART OF THE MACHINE WORK ALREADY DONE—ONLY SIMPLE LATHE WORK NECESSARY TO COMPLETE. No special tools required—Threading, Knurling, etc., already done. Kit includes all material (part machined); simple drawings, and detailed instructions. Send \$2.95 cash with order and we pay postage.
ALCO SHOP, Dept. 6, 1459 Sunset Blvd., Los Angeles 26, Calif.



WRITE FOR YOUR FREE COPY OF THE NEW KRW HYDRAULIC PRESS BOOK

Describes all manner of Production and Shop Work on KRW Hydraulic and Bench Type Arbor Presses. 32 pages illustrating the new KRW Hand-operated, Electric-operated and Air-operated Hydraulic Presses.
Write for your copy today.



K. R. WILSON, DEPT. 17, 215 MAIN ST., BUFFALO 3, N. Y.

Builders of Shop Equipment for Ford Dealers Since 1916

READY CUT HOMES

Order Now

Homes \$1182 and up, freight paid. Orders filled in order received. Post war delivery. Save at least \$500 on modern production method homes. Much more compared with builders' prices. Anyone can assemble with simple plans furnished. Complete, including paint, hardware, roofing, glass, nails, etc. Send 25c in coin for full color catalog showing 56 modern low-priced homes and floor plans. Complete building plans ready for filing at low cost.

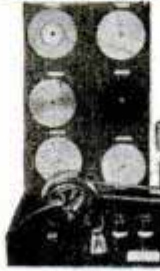


NEW COLOR CATALOG FOR ONLY **25¢**

Dept. P.M.36
INTERNATIONAL MILL & TIMBER CO.
Bay City, Mich.

THE GEM MAKER

Amateurs or professionals . . . hobbyists or jewelers . . . Polish your own gems with a B&I Gem Maker. You will find this a profitable adventure. All necessary lapidary equipment is furnished, including a super-charged diamond blade for sawing, and all wheels for grinding, shaping and polishing, also complete instructions. The complete equipment as shown, less motor and belt, for only \$29.50, f.o.b. Burlington, Wis. Write today for information and literature on the Gem Maker and accessories.
B&I MFG. CO., Dept. S, Burlington, Wis.



ONLY \$9.95 — ENGINES IN STOCK



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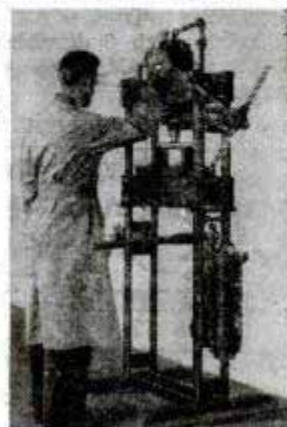
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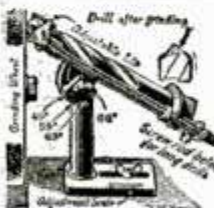
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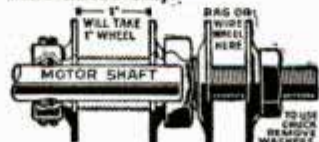
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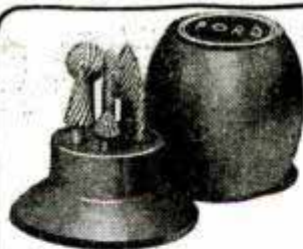


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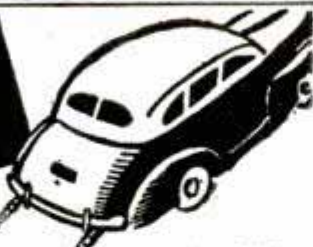
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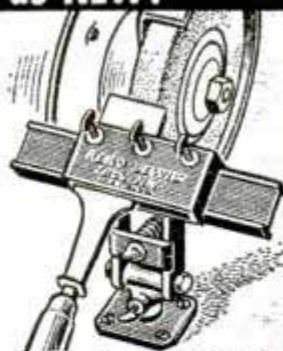
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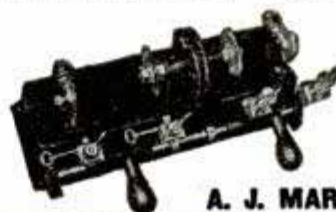


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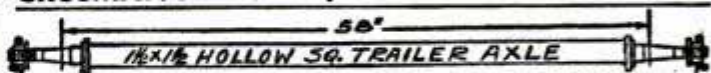


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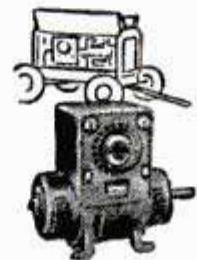


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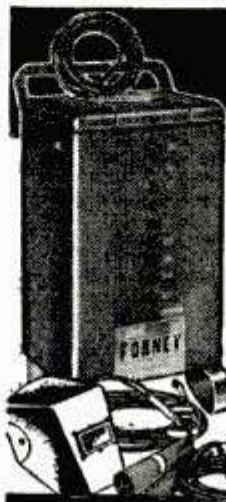
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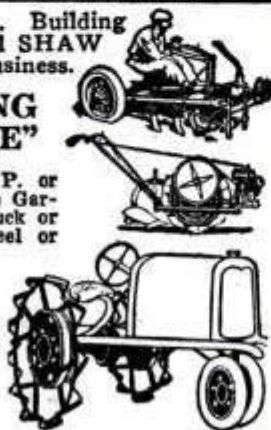
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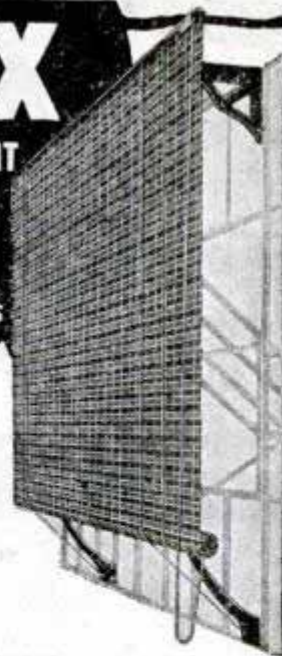
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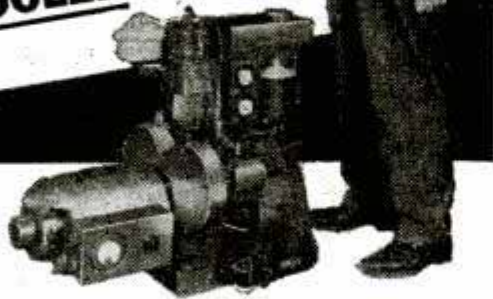
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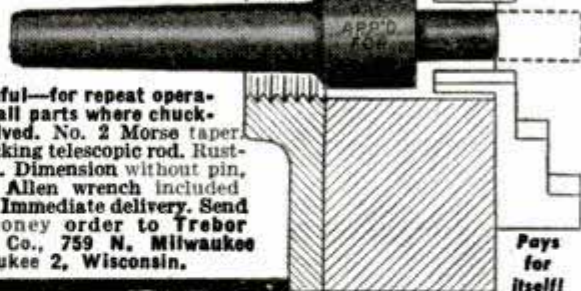
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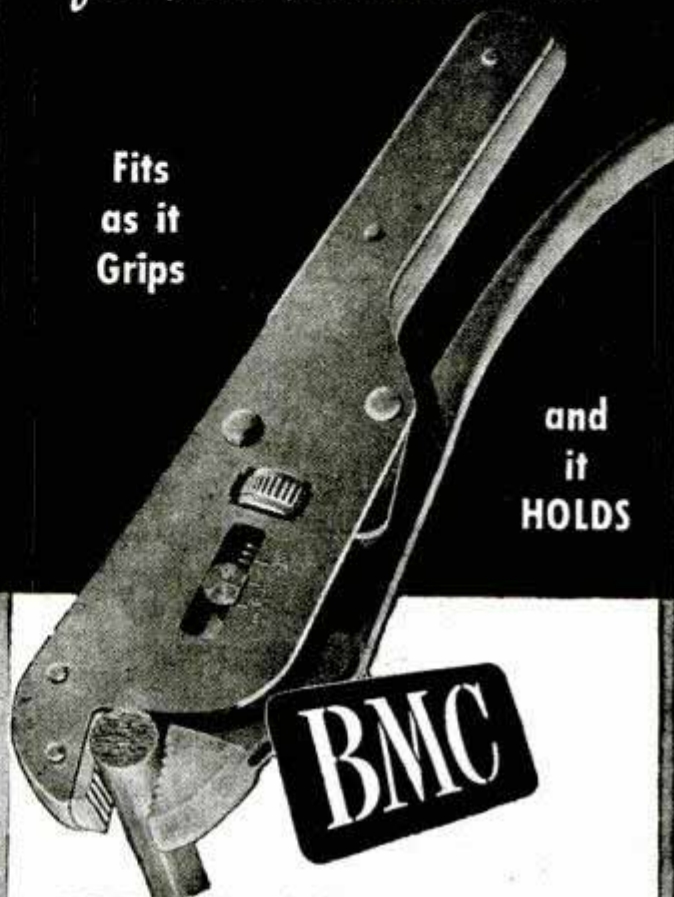
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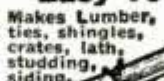
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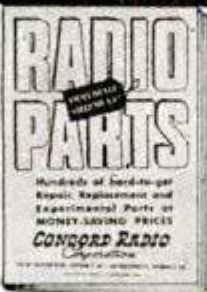
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"1001" Knife as above, \$1.29
 Knife with 3 extra, different blades and honing stone, \$1.59

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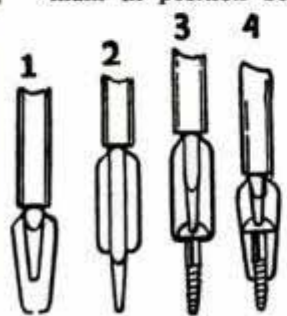
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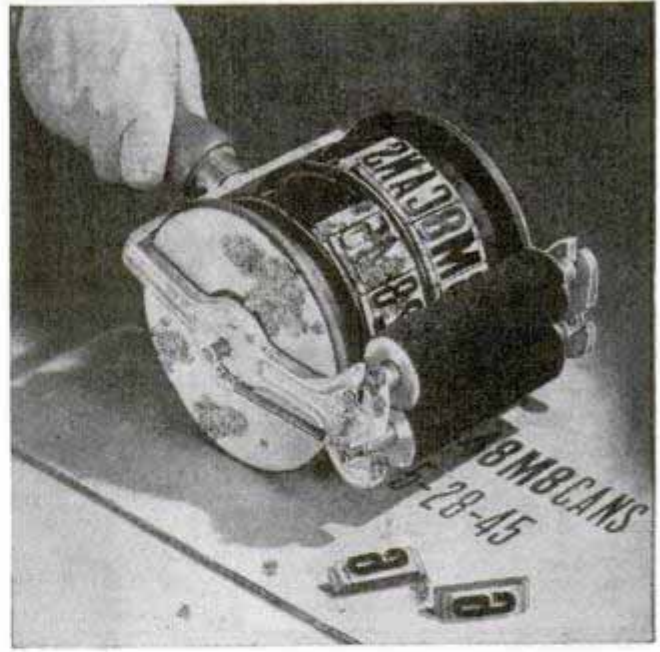
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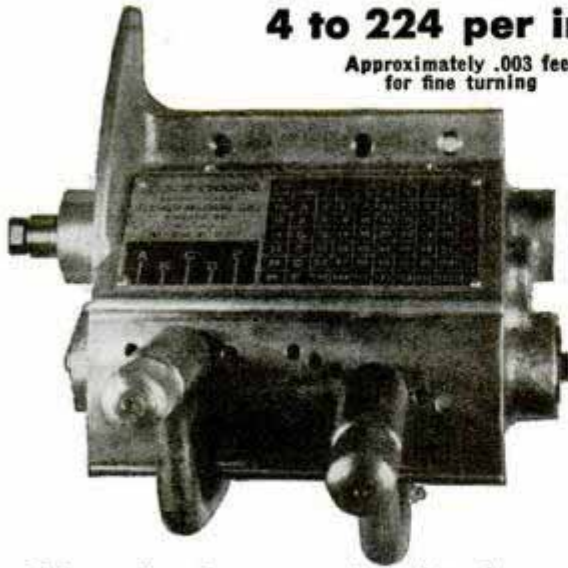
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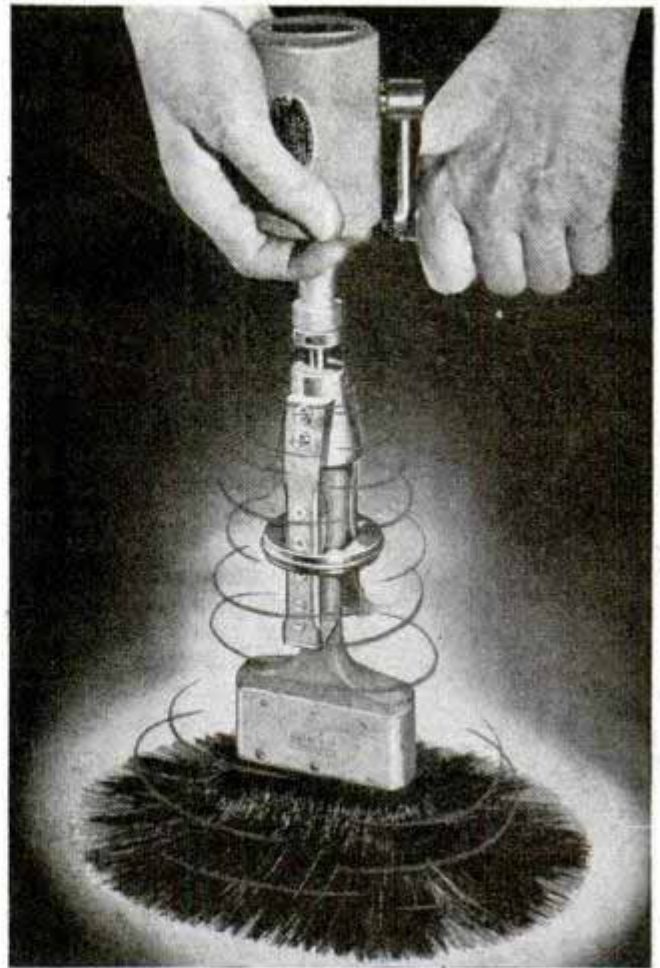
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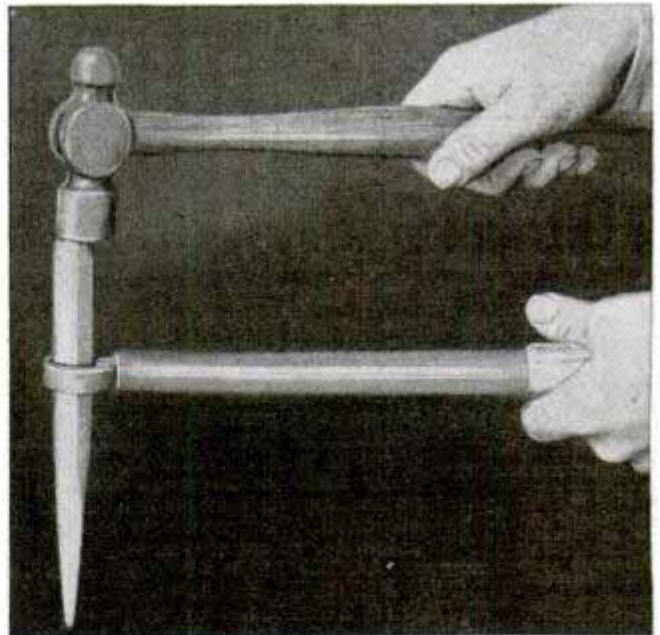
National Fluorescent Sales and Service Co.

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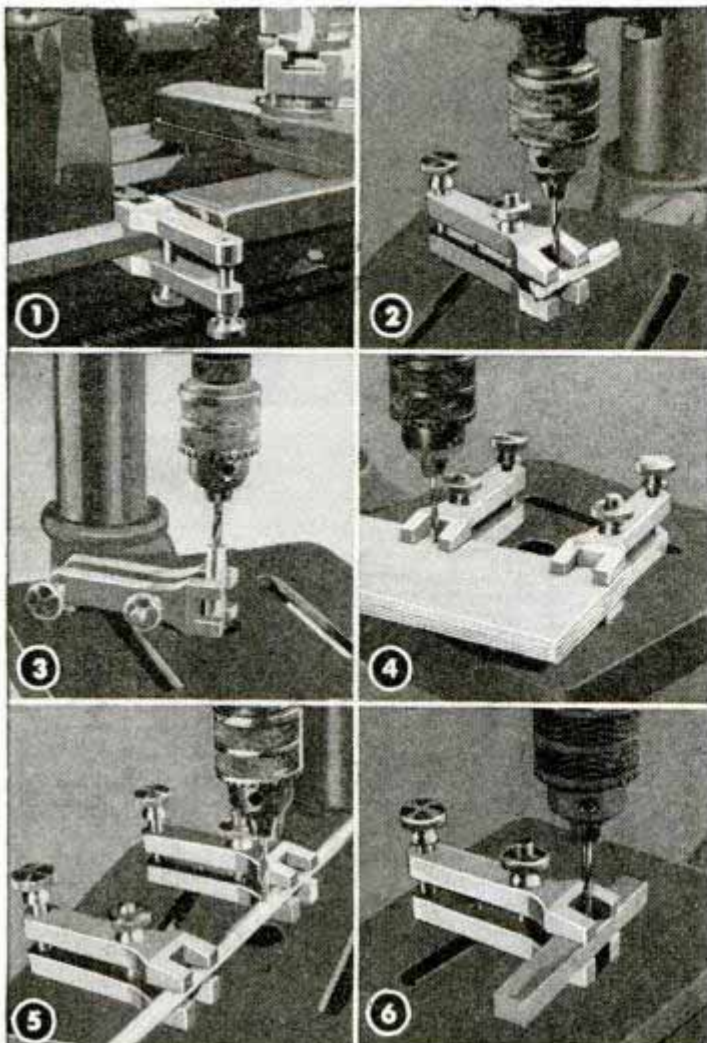


Spinning Paint-Brush Cleaner makes possible painting in several successive colors with only one brush. Requiring only 90 seconds to clean a brush thoroughly, the unit operates easily, is geared 8 to 1, has oil-less bearings and weighs only three pounds.



Tool Holder Grips Chisels and does away with the possibility of banging your hand with a hammer. The device has a metal loop on the end that is tightened over chisels, punches and star drills up to 1 1/16 inches in diameter simply by turning the handle.

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OVER 100 USES

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Patent Pending

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and TWO MANDRELS all for **NO PRIORITIES NEEDED!**

For an additional assortment of 6 grinding stones with your order add only **\$1**

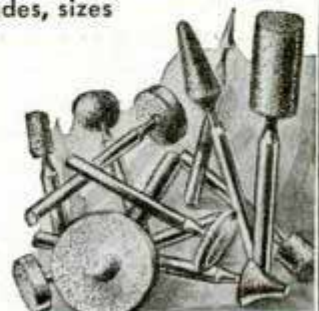
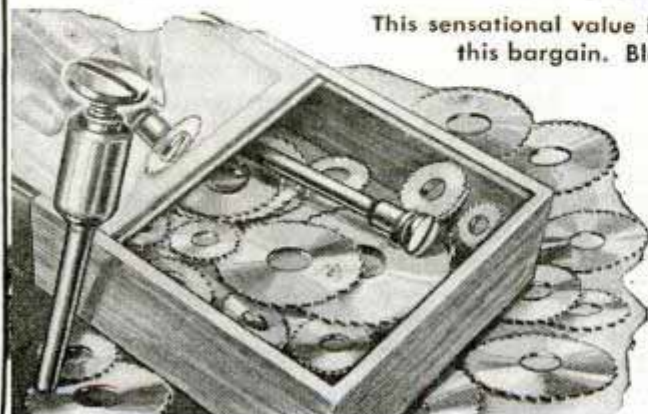
This sensational value is limited to supply on hand. Act fast if you want to get in on this bargain. Blades are of laboratory tested fine tool steel (total carbon, 1.19; Manganese, .53; Nickel, Nil; Chromium, .03; Vanadium, .005; Molybdenum, .04). Sixty assorted blades, sizes

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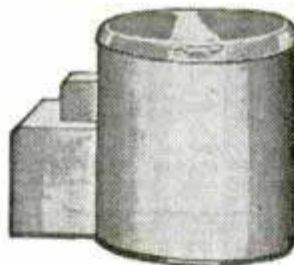
Gives power to your craft skill in embossing, tooling, carving, slicing, engraving, and a host of other craft and shop jobs where "hand work" quality is desirable.

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QUICK
FREEZER**



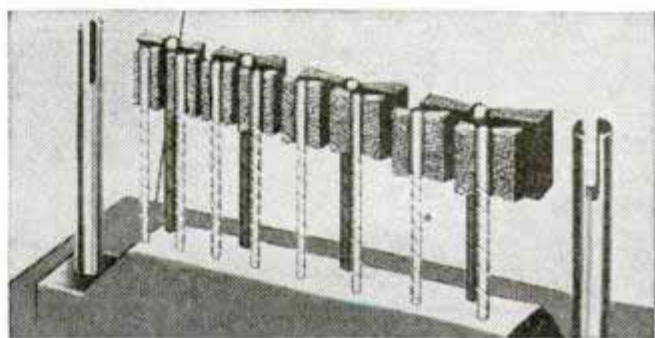
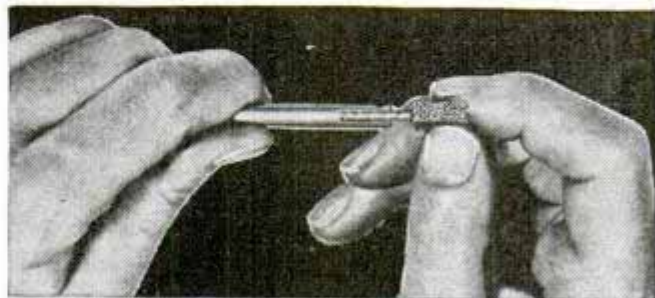
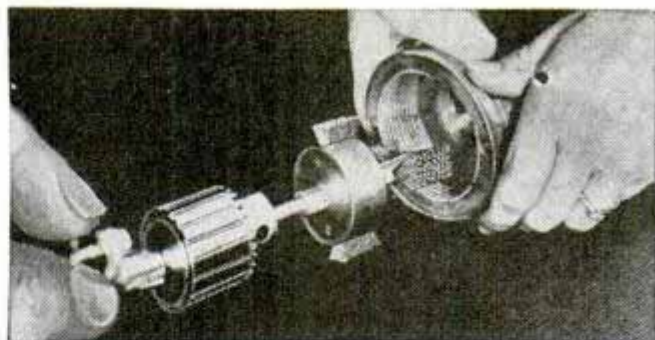
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Materials now available . . . anyone with hand tools and these specific plans can build this freezer.

- Complete Easy-To-Follow Plans — First Time Offered. No inventing to do, no catalogues . . . plans come as large dimensioned drawings; pages of explanation; list of materials; recommended sources of supply.
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DAVIS ENGINEERING COMPANY
911 E. Elmwood Burbank, California

Power Brushes Clean Out Holes

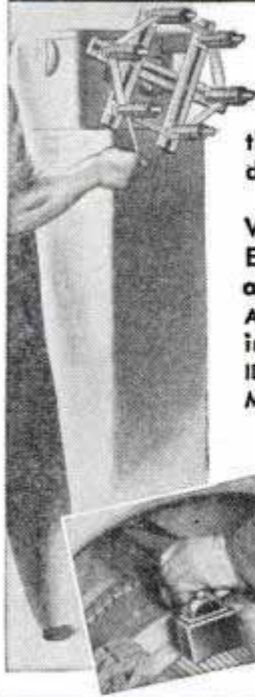


Brushes ranging in size from 1/4 to 1 1/4 inches in diameter are helping eliminate production bottlenecks. The power brushes, made of high grade crimped wire, are designed for use in drill presses, bench grinders and other production and deburring tools. They finish or clean hard-to-get-at parts, removing insulation, rust and mold marks, and are especially useful in smoothing and cleaning drilled holes. The brushes are available in kits containing 12 different sizes. Special holders are furnished in two sizes, one of which fits into the standard 1/4-inch air chuck of portable tools.

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with DU PONT

Cooling System CLEANSER

Drain out your anti-freeze, and clean out winter's accumulation of scum, scale and rust. Neglect now may mean trouble and costly repairs later. Just pour a can of DU PONT COOLING SYSTEM CLEANSER into your radiator, run the engine 30 minutes or more, and drain.



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After cleaning out the radiator, you can keep it free from rust all season by pouring in a can of DU PONT ACID and RUST INHIBITOR. It prevents rust forming, and keeps out acid, too.



AVOID RADIATOR LEAKS

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You can stop leaks quickly and securely—and make the cooling system LEAK-PROOF—by pouring in DU PONT COOLING SYSTEM SEALER. It will not clog the radiator.



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PLUS TAX
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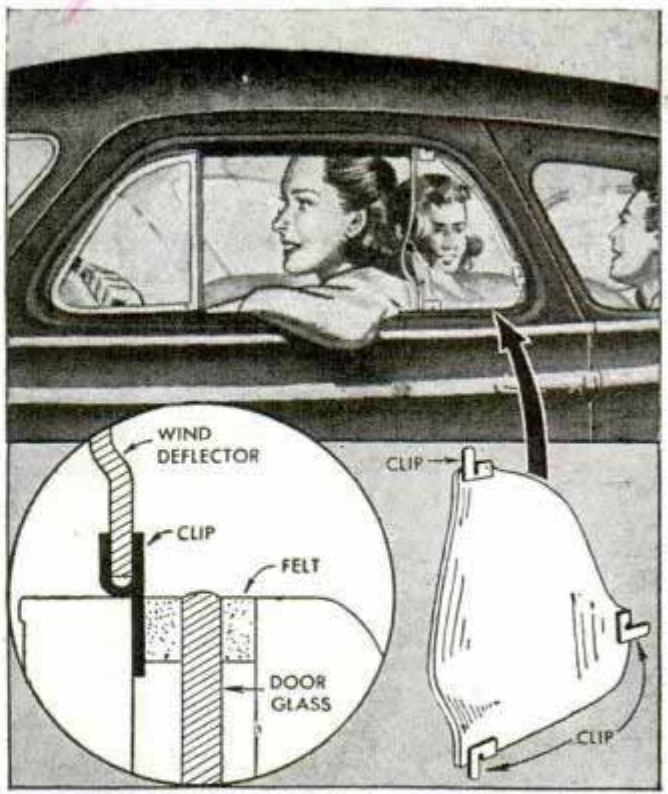
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The MINIJET is a highly engineered, precision-built engine. It is the lightest engine in existence for the power it develops. It can be used as the fuselage of a Model plane with surfaces attached directly to the engine body.

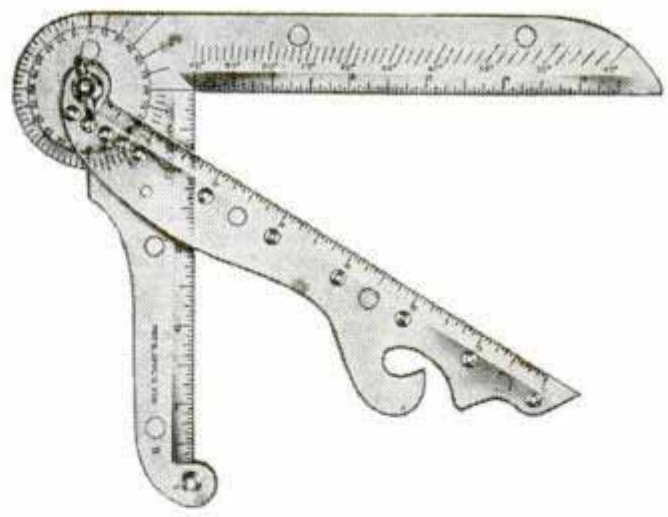
Ask your dealer for a —

minijet MINIATURE JET ENGINE

(REG. U. S. PAT. OFFICES)



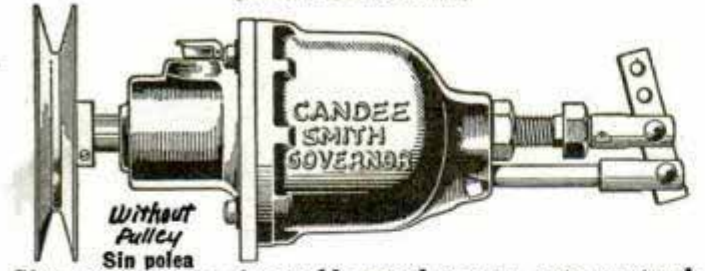
Wind Deflector for Automobiles, made of transparent plastic, is easily installed inside front window frames of closed cars to prevent air from blasting rear seat occupants. When installed, the wind wing (as illustrated in the sketch above) does not interfere with the driver who likes to rest his arm on the door frame while driving.



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(REGULADORES)



Give constant or changeable speed to any auto or truck engine, when used for power. Guaranteed. Instructions. Oil ring bearing, \$12.50. Full ball bearing, \$19.00. Postage west of Miss., 50c; east of Miss., 85c. Sent COD or—Postage to any country in the world \$1.00 each. Pulleys to 3", \$1.00, wt. 1 lb.; to 6", \$1.50, wt. 1 1/2 lb. Governor speed 1400 to 2400 rpm. Figure your pulley size.

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These valves used where carburetors have outside attachments. State size of opening and distance between bolt holes. 1", \$3.75; 1 1/4", \$5.25; 1 1/2", \$6.50; 1 3/4", \$7.50; V8, \$7.00. Mailing weight, 3 lbs. If remitting, enclose for postage. You may order from this ad, or we will send circulars. Stocks carried: In Montreal 15, Canada: 7546 Wiseman St. In Auburn, N. Y.: 3 Seminary Ave., Auburn Welding Supply.

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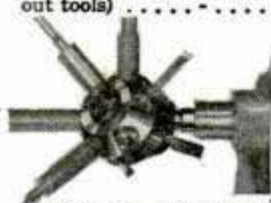
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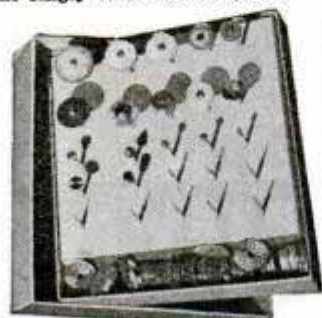
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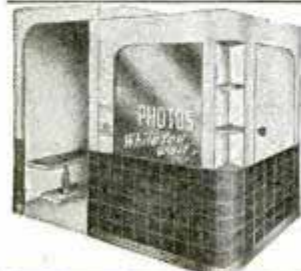
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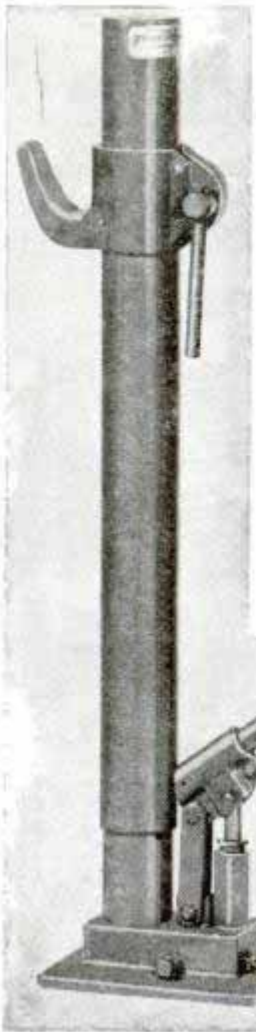
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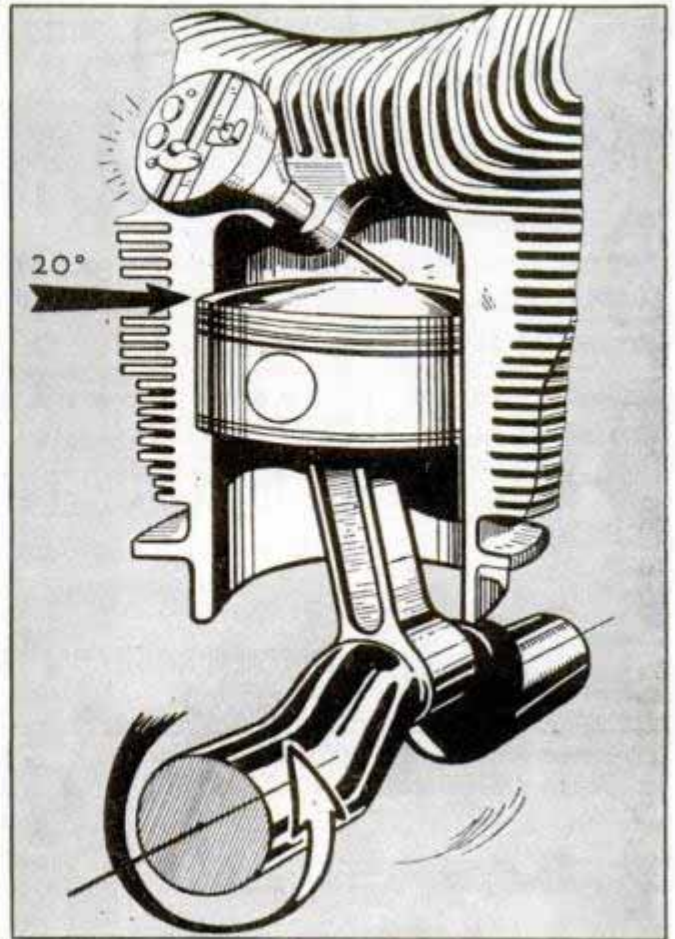
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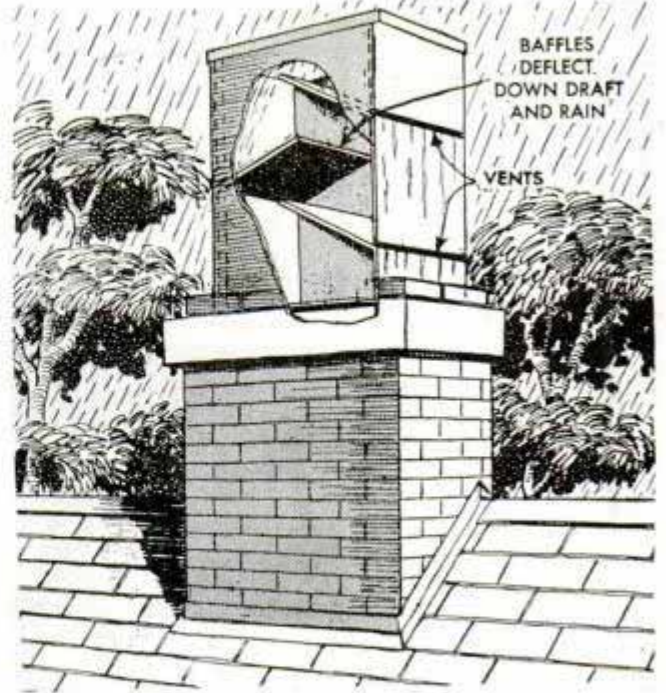
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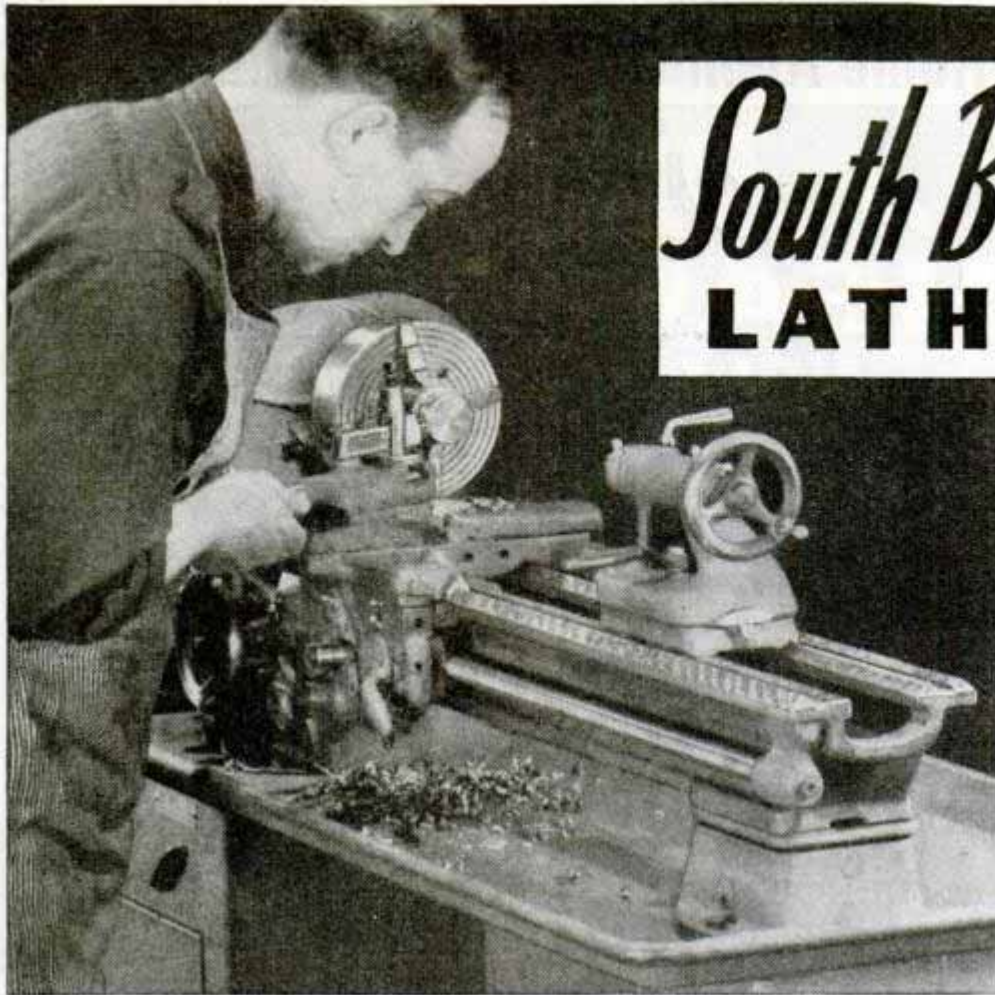
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Write for free catalog which illustrates South Bend Engine Lathes, Toolroom Lathes and Turret Lathes, gives detailed specifications, shows attachments and accessories. No obligation. State size lathe in which interested—9", 10", 13", 14½", or 16".



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feel

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be

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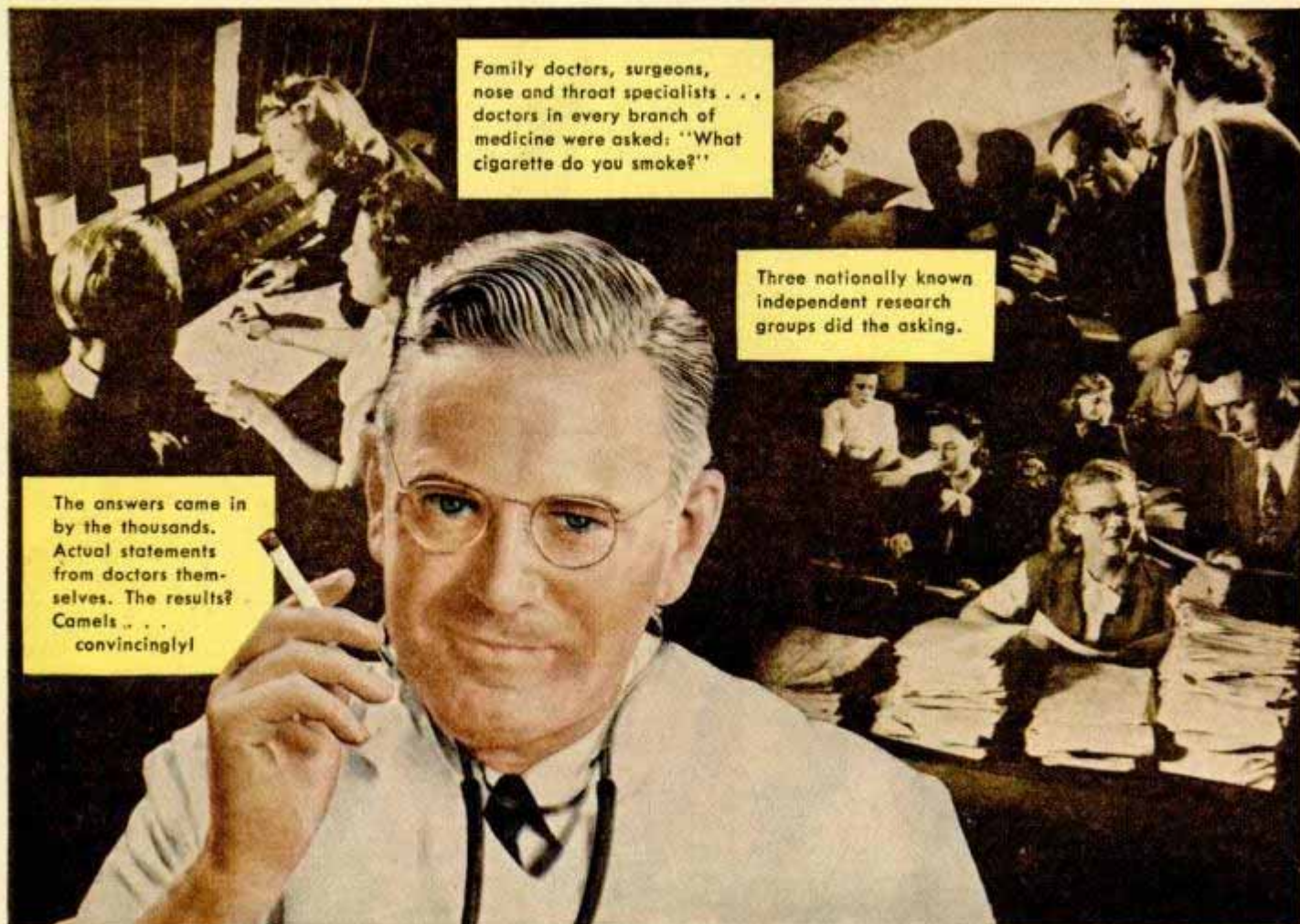
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