

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



REG'D. TRADE MARK, GREAT BRITAIN, NO. 410224

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DECEMBER
1946 25c



NEW RIVERS FOR THE WEST
PAGE 98

Doyle



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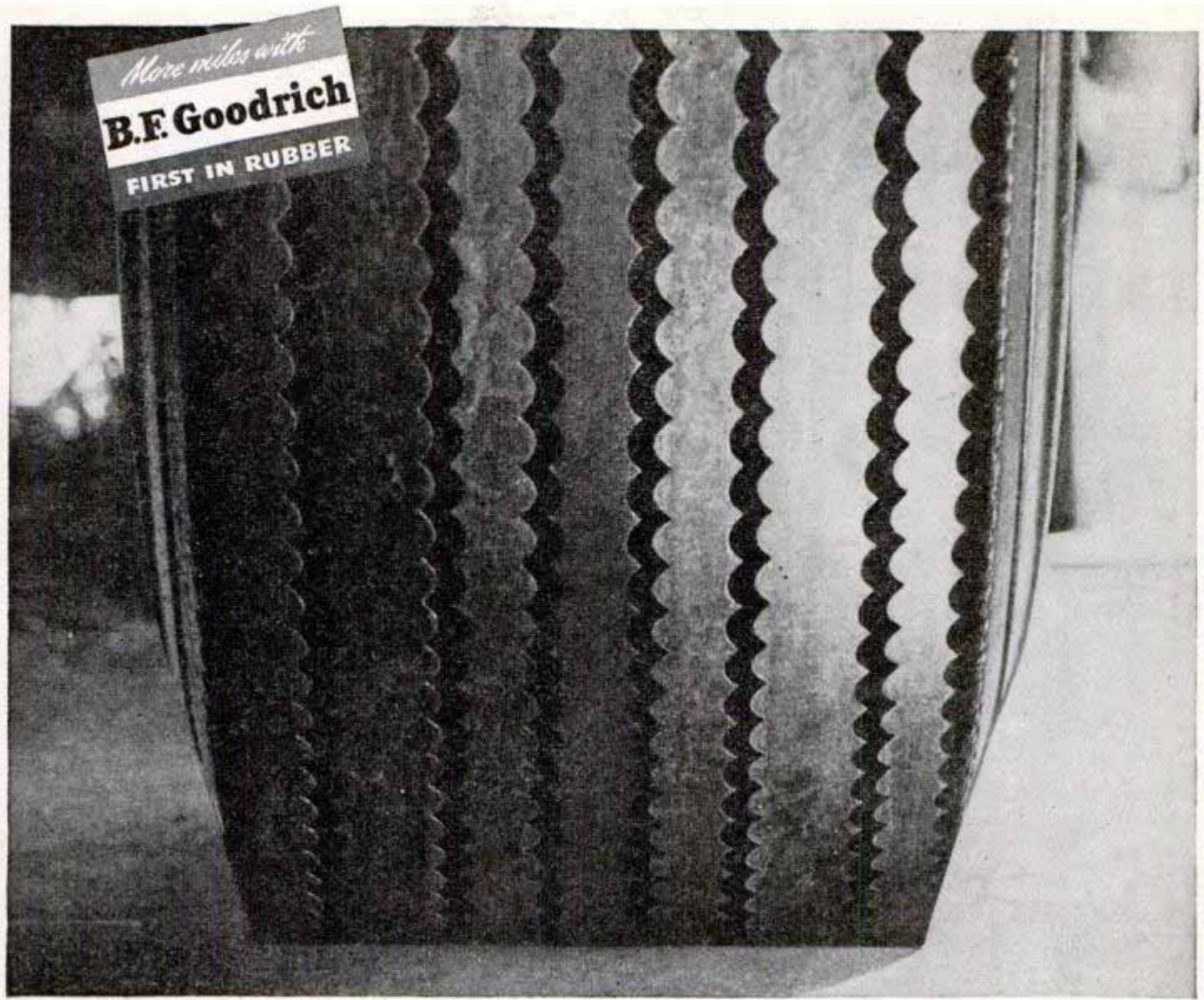
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copilot and en-
gineering officer
on the Truculent
Turtle, tells his
story of the rec-
ord-breaking 11,-
236-mile flight

from Perth, Australia, to Colum-
bus, Ohio, in this issue. "I Rode
the Turtle" is the real inside story
of an amazing flight that accom-
plished two important missions.

NEXT MONTH a front-row seat
awaits you for our own "European
Auto Show"—a five-page picture
layout of some postwar cars that
should make Detroit sit up and
take notice. Europe is fighting for
export business in automobiles.
Another January feature tells how
electrically operated machines are
becoming the right hand of medi-
cal science. Then there's an article
on America's most dangerous busi-
ness which takes a toll of 45 lives
every 24 hours. This business—
surprisingly enough—is farming.

FIVE-SECOND sequence, "injec-
tor" cooling, electric shutter and
"eyewink" speed of slide chang-
ing—these are the top features of
a new-type color-slide projector
fully described with how-to-build
plans in the January Craftsman
section. Another story tells how
to make an incubator for the biol-
ogy lab. If it is built in the school
woodworking shop every student
will have an opportunity to under-
stand its construction and operat-
ing principles. And of course you'll
want to read the article on tree
pruning so that you'll be ready
for the work when dormant-prun-
ing time rolls around.

BEGINNERS will find a 1-tube
dual-regenerative a.c. loud-speak-
er set in the Radio and Electronics
section next month, also simple
diagrams for individually con-
trolled extension speakers for any
receiver.

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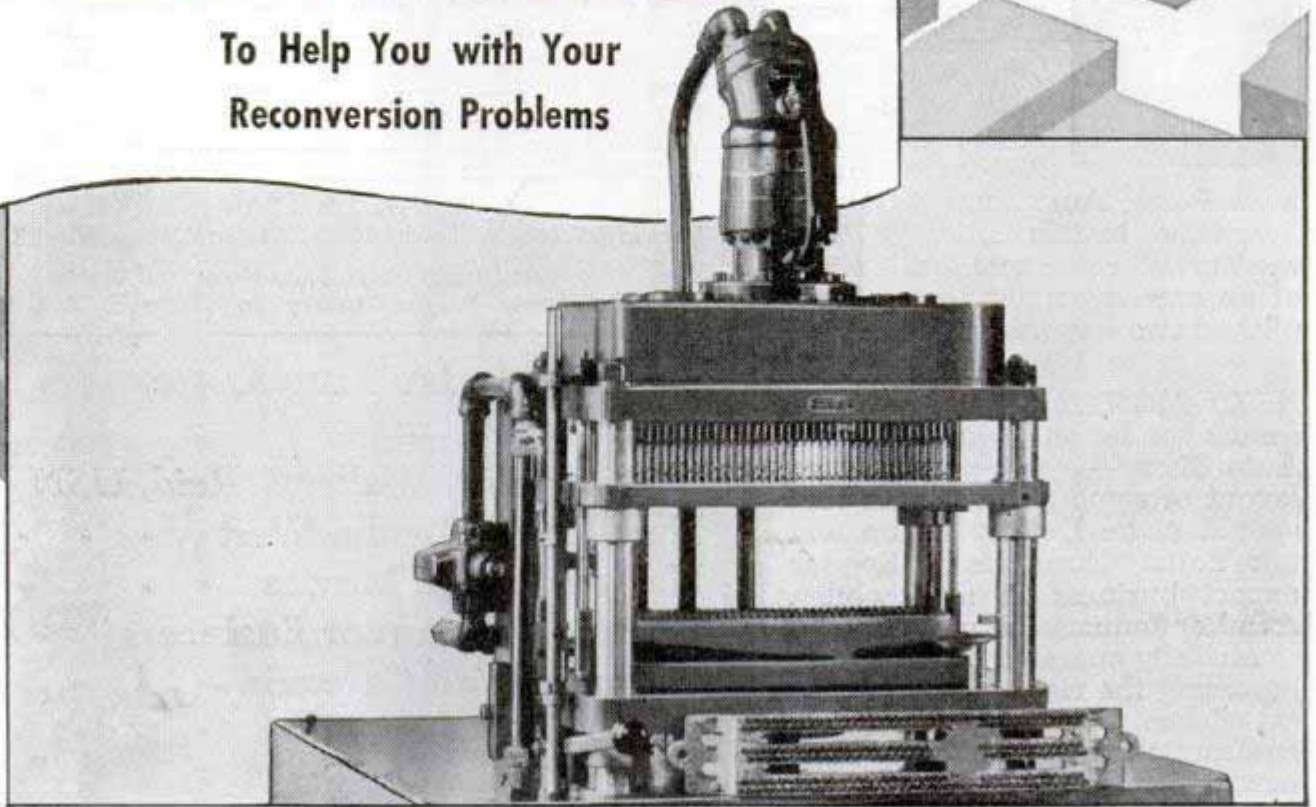
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Published monthly by POPULAR MECHANICS COMPANY, 200 East Ontario Street, Chicago 11, Ill. H. H. Windsor, Jr., president; Paul H. Dunakin, vice president and general manager; D. F. Windsor, vice president and secretary-treasurer; William Harrison Fetridge, vice president and assistant to the publisher; Clover L. Perkins, advertising manager; Alan M. Deyoe, circulation manager. Single copy in the United States and Canada, 25 cents; subscription rates in United States and possessions, Canada, and countries of the Pan-American Postal Union, 1 year, \$2.50; 2 years, \$4.50; 3 years, \$6.00. To all other countries add \$1.00 a year over United States prices for overseas postage. If you plan to move, notify us at least 60 days in advance so you will not miss an issue. Give both old and new addresses. Entered as Second Class Matter, September 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3, 1879. Entered as Second Class Matter at Post Office Dept., Canada. Copyright 1946, by Popular Mechanics Company, Copyright under International Copyright Union. Copyright in France. All rights reserved under Pan-American Copyright Union. Printed in the United States of America.

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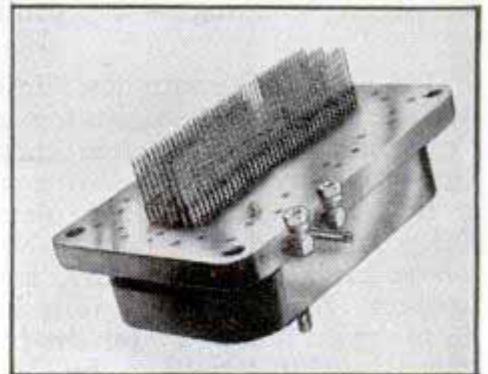
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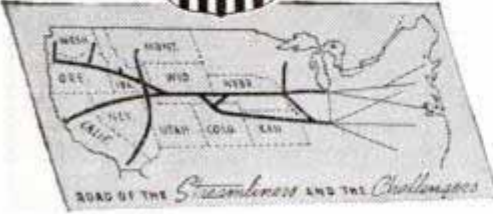
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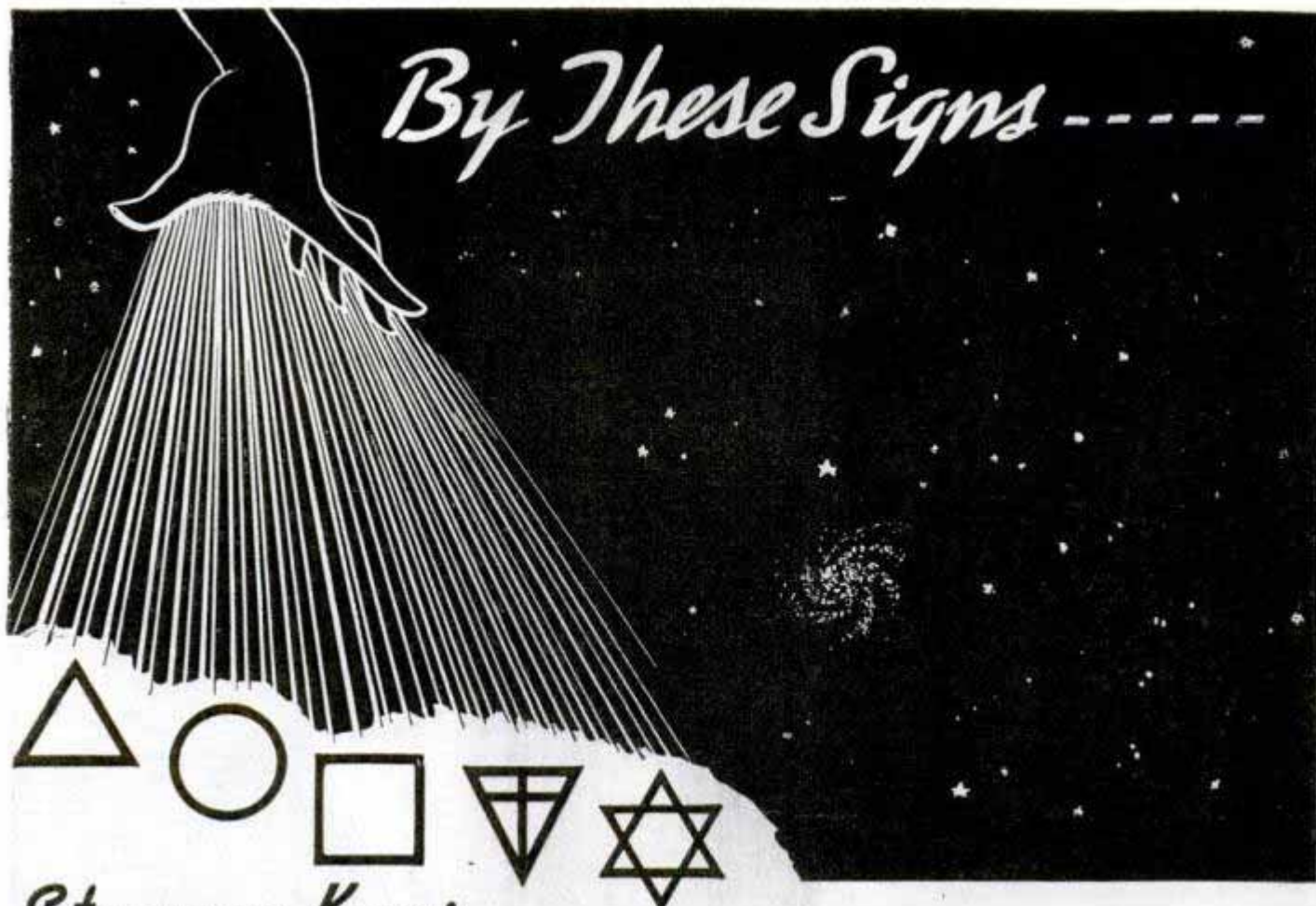
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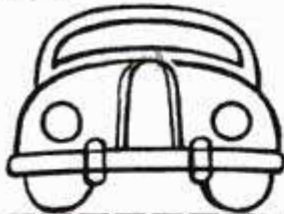
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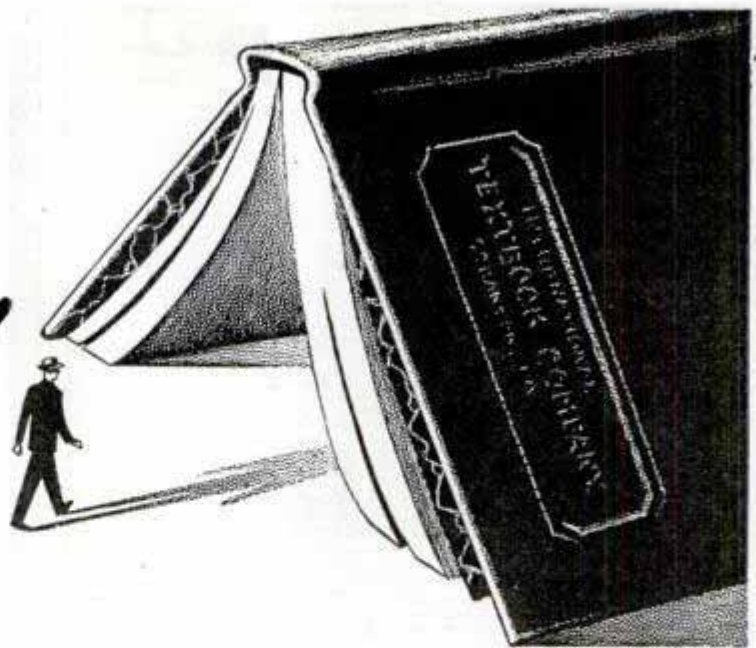
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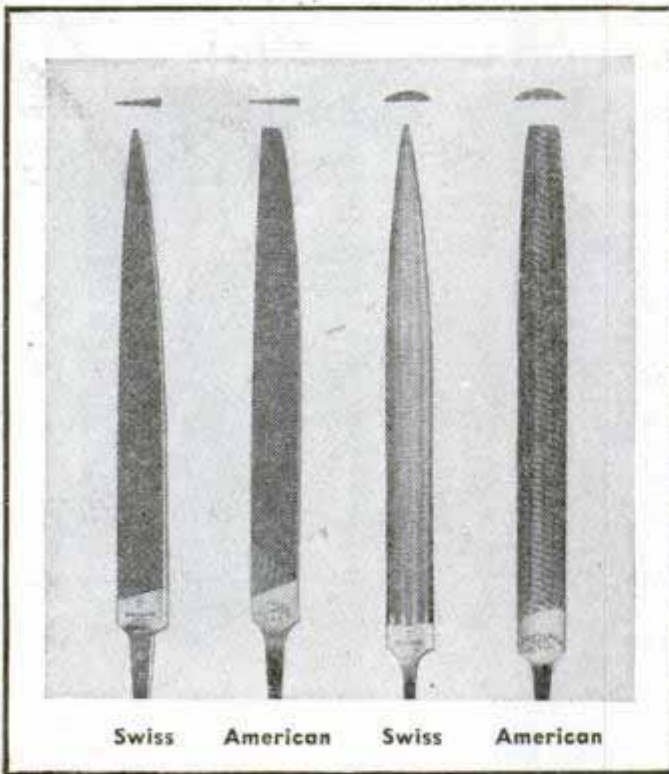
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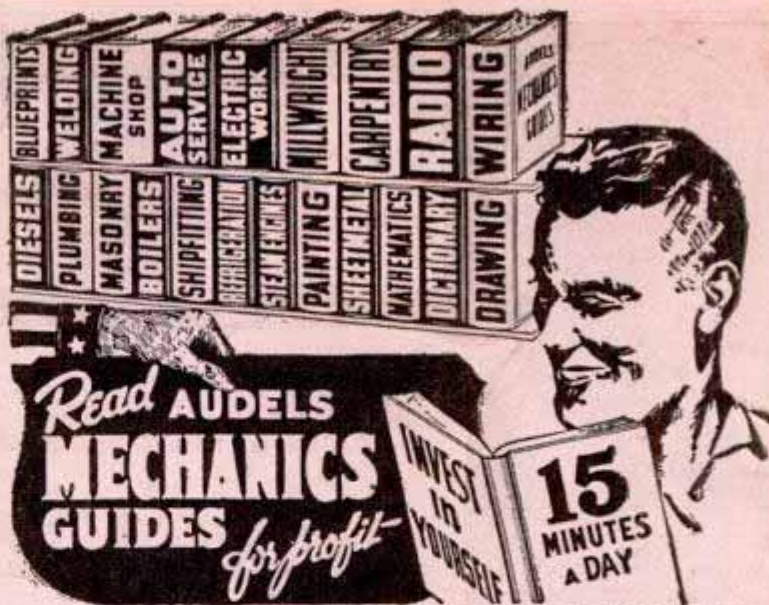
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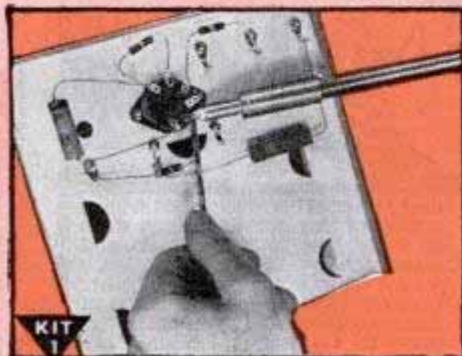
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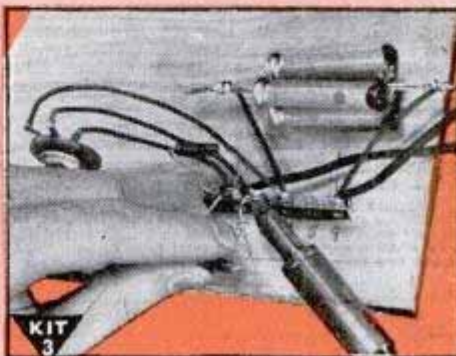
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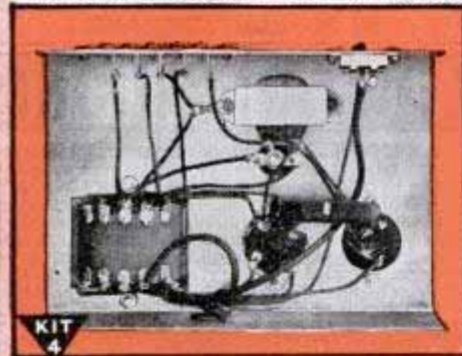
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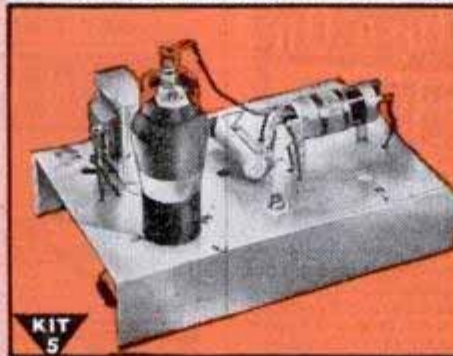
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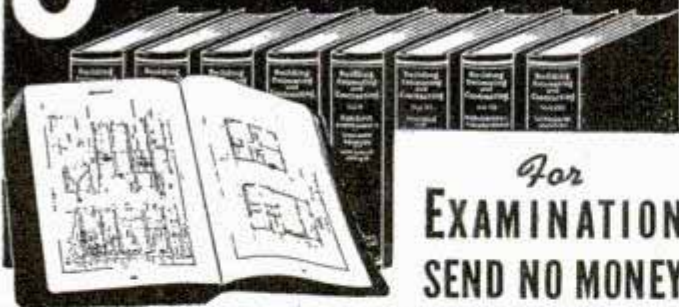
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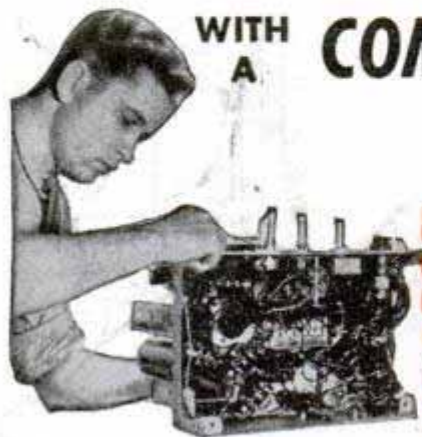
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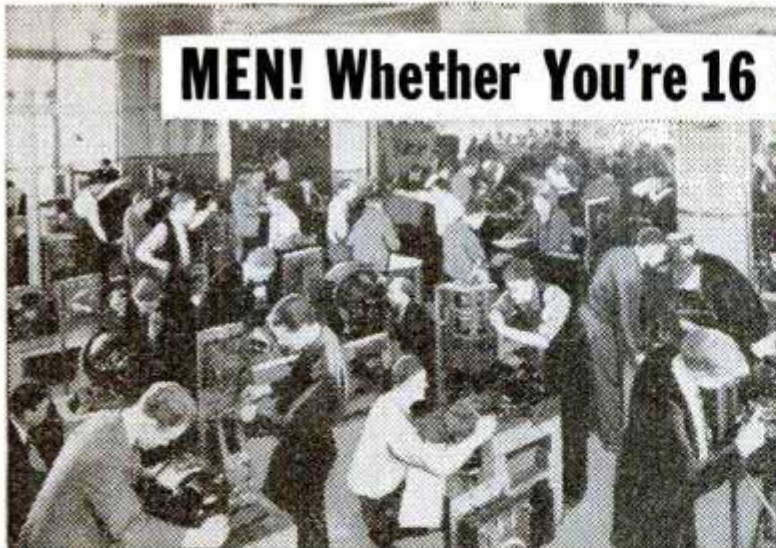
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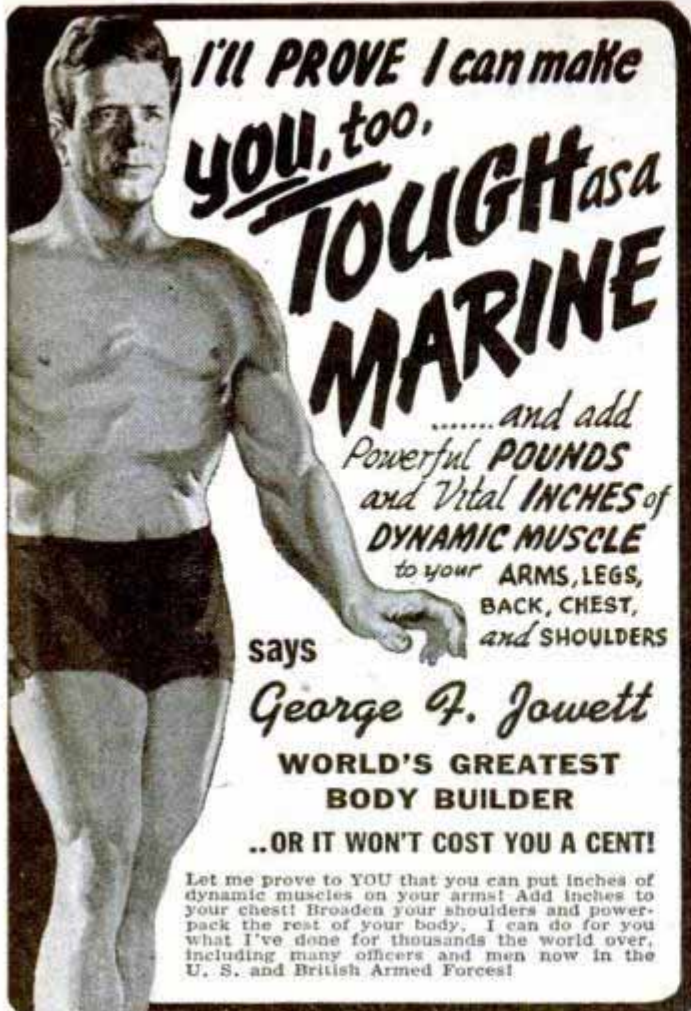
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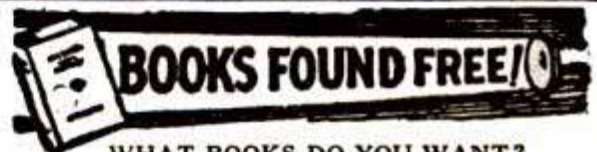
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SO IT NEEDS FIXING

By S. T. CHRISTENSEN

the "Fix-it Man"

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

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At first, I let the owner decide the charge and, frankly, I was amazed at what I earned per hour. But then, when one figures what initial costs are involved in buying most electrical appliances, one can readily see that spending extra dollars for repairs is well worth while. Before long I was making more in my spare time repairing than from my regular job. The result . . . I went into business for myself. When war came, business boomed, for new appliances were not available.

For a while, repair parts (needed on some

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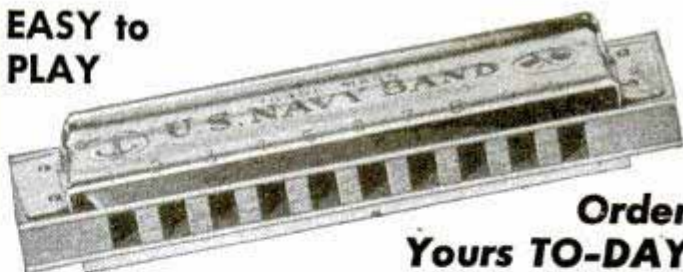
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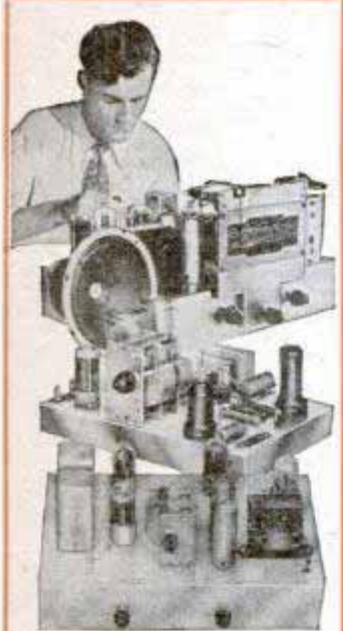
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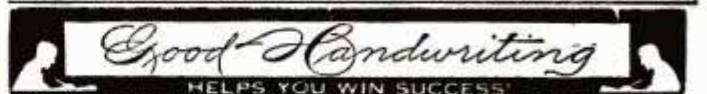
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Foreword by Capt. Juan Cano, of the "Health Service," Spanish Loyalist Army. — Discussion of Student Height Increase by head of Barnard College. — The Truth About Heredity in Height Increase. — Food for Stature Building. — U. S. Surgeon General's Dietary Advice. — Natural and Artificial Bone Growth. — How the Ductless Glands Affect Growth; "Gains in Height Varying from 1½ to 6 inches." — A Famous Dwarf: Doubled His Height at 39. — Advice of U. S. Director of Physical Fitness. — Improved Stature in Women Brings Easier and Better Child Bearing. — Stretching Exercises Which Cure Painful Menstruation. — Stature Gaining Factors According to Dr. Krogman. — Use of Weights for Stretching. — Body Suspension. — His Height Increased 6 inches in 12 Months. — Instructions for Making Suspension Apparatus. — Jobs as Instructors. 368 pages. Thoroughly illustrated by Photographs and Sketches. Most Practical, Mailed in Plain Wrapper.

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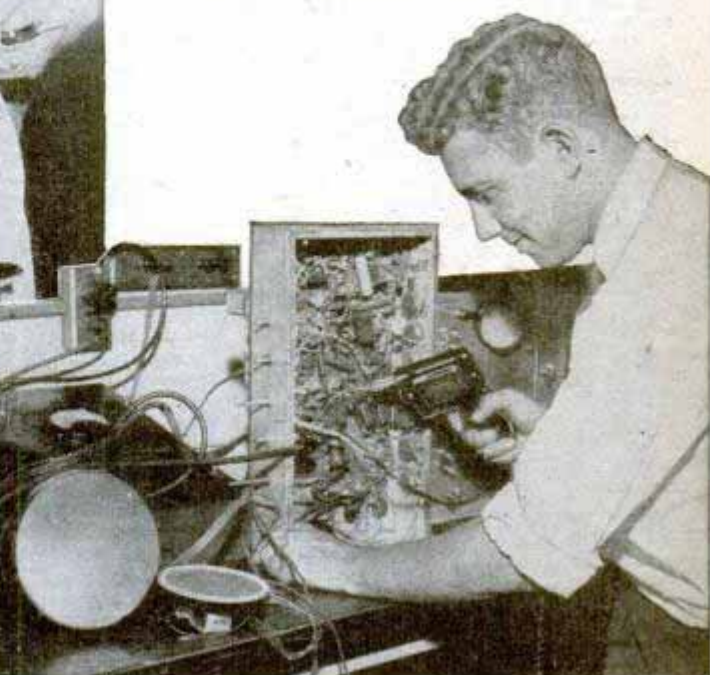
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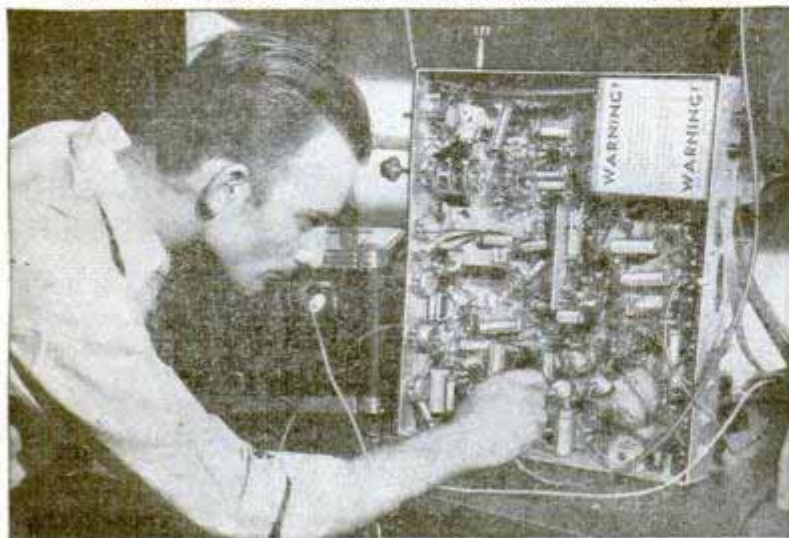
Expert Television Technician, Bob Cohen, using \$625.00 RCA Sweep Generator to check television set for engineering inaccuracies. It is expected that television test equipment will be reduced in cost as the television industry gets into its stride.



THEY BUILT THEIR OWN

MANY veteran students are now attending N.Y.T.I. of N.J. under the generous provisions of the G.I. Bill of Rights, which allows any approved school of the veteran's choice to charge the Veterans Administration up to \$500 a school year against the educational expenses of qualified veteran students. Full-time students, with dependents, are also paid a sub-

Student Walter E. Stevens, making engineering checks with \$395.00 United States Television Sweep Generator. The school is lavishly equipped with the most advanced test equipment.



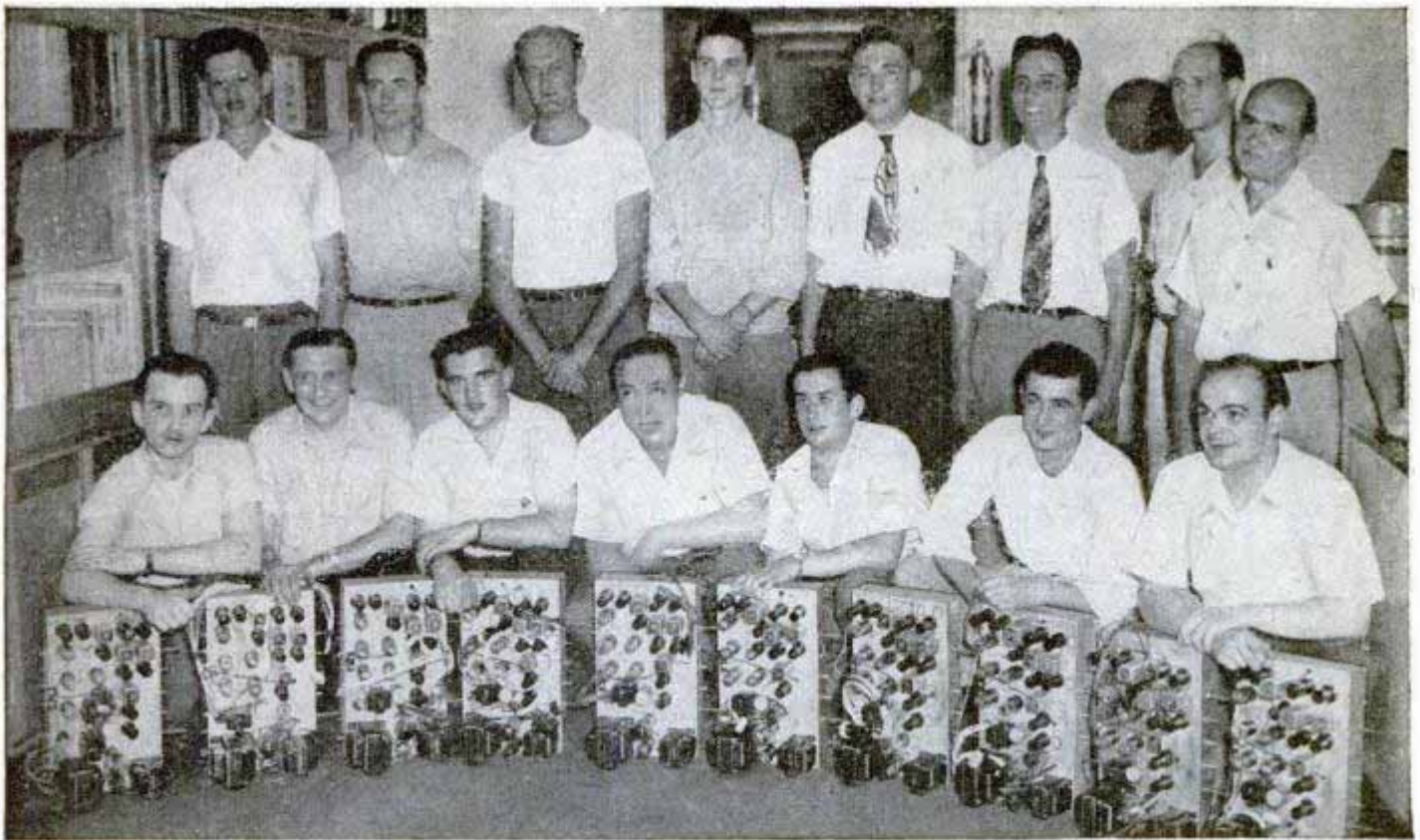
sistence allowance of \$90 monthly by the VA, and those without dependents, \$65. Many students hold part-time jobs, thus augmenting their monthly payments. However, you do not have to be a veteran to be accepted as a student.

A considerable number of out-of-state students attend the school because of its excellent, practical type of radio and television courses,

so difficult to get anywhere else in the world today. Living quarters are obtainable by single students, but married students report considerable difficulty in finding quarters for their families.

No high-school diplomas are required. Every student must have at least a grammar-school education, however. And the school requires that a student be earnest, sincere and technically inclined. Students without proper mathematical backgrounds are taught the radio and television mathematics they need.

You probably have been wondering what N.Y.T.I. of N.J. means. It stands for the New York Technical Institute of



An Advanced Class in Television at N.Y.T.I. of N.J., famous television school, and the 17-tube television sets they built. Students at this school have been building television sets as part of their courses since 1939, when television programs were first broadcast regularly. School officials

found that this practical method of instruction is productive of very satisfactory results. Each student may build a set and keep it to use in his own home laboratory, if he chooses to. The school is located in the heart of the radio, television, electronics industry.

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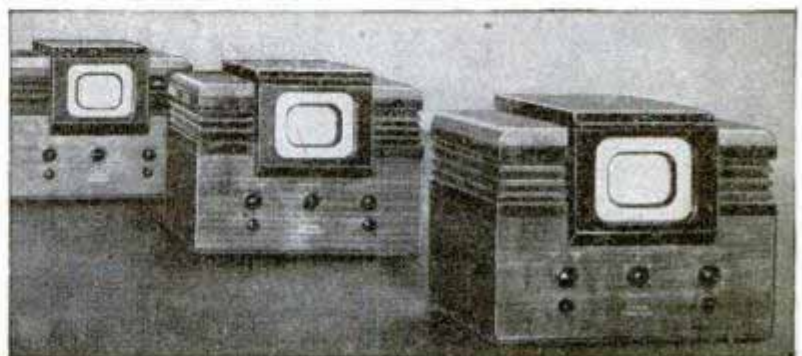
New Jersey, a resident school located in Newark, N. J., just across the river from New York City (Only 20 minutes from Broadway by subway or train). The school is located in the heart of America's great radio and electronics industry. Such leading television, radio and electronics manufacturers as Western Electric, Du Mont, Federal and Edison are nearby. Newark also is near Radio Stations WJZ, WEA, WABC and WOR; each a leader in broadcasts going on networks all over the country. This means that the school offers numerous advantages, as it is in touch with most recent developments in radio and television. This also means that qualified radio and television engineers are available to the school for teaching purposes.

During the war N.Y.T.I. of N.J. was approved for the training of Signal Corps personnel by the Army. When the war ended the enrollment increased because of the influx of veterans desirous of getting practical television training. At the present time, there are

120 openings for new students for the several classes beginning in October & November 1946.

The school issues a special Bulletin, Numbered 212, which illustrates and describes its facilities and equipment and shows students using its varied laboratory equipment. Bulletin 212 also describes classes that may be attended, housing conditions, costs, hours, etc. To get complete information write for Bulletin 212 (for which no charge is made) to the New York Technical Institute of New Jersey, 158 Market Street, Newark, New Jersey.

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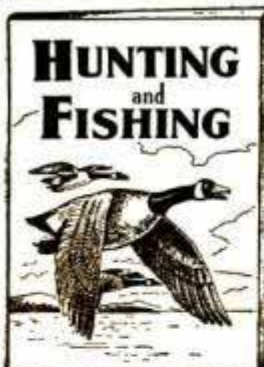
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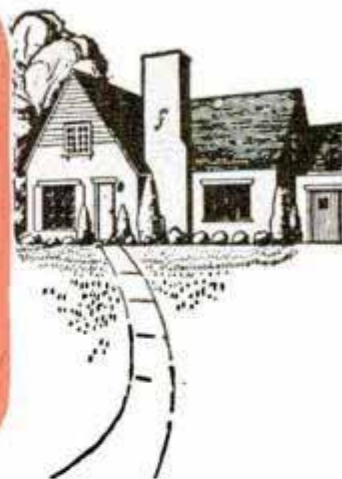
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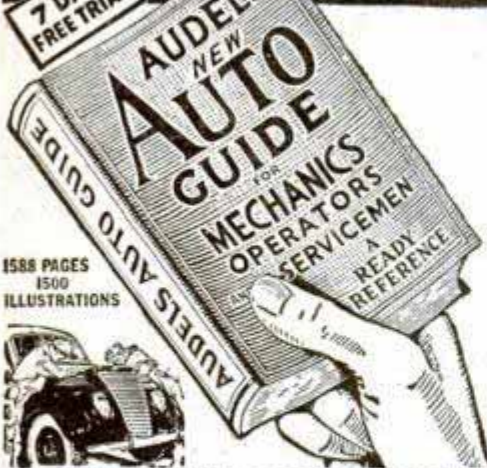
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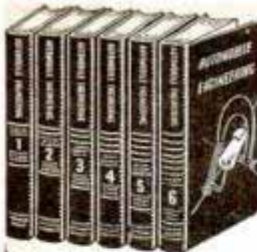
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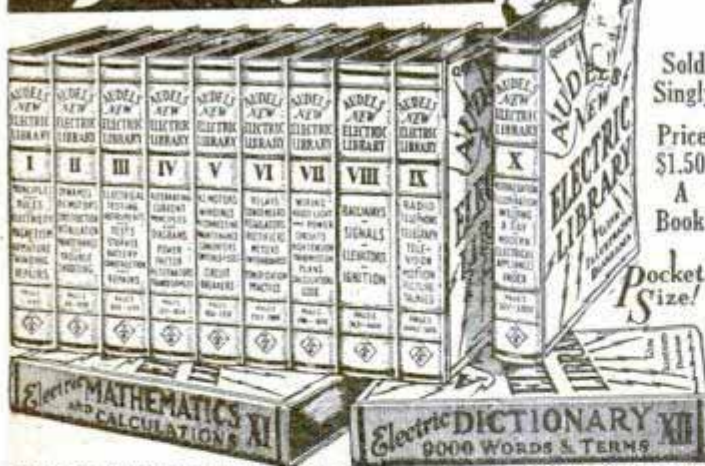
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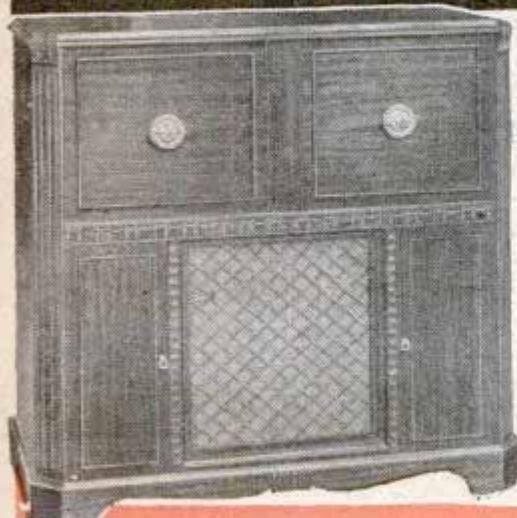
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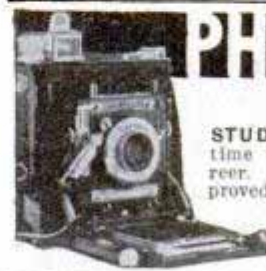


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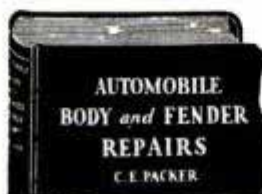
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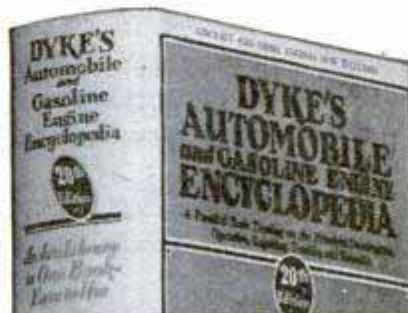
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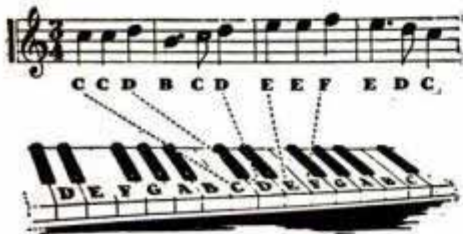
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LEARN Piano tuning, repairing, at home. Tremendous field! Piano parts, tools furnished. Established 1935. Empire School of Piano Tuning, 606-B East University Ave., Champaign, Ill.

YES, You too can mail a 32 page catalog, your name, address printed. Other supplies. All free particulars. Manning, 3259 Decatur Ave., Bronx, N. Y.

ANYONE Can learn. Tune pianos by my system. \$1 2 lessons and chart. Oscar Fylling, 841 Robinson, Oroville, Calif.

MAIL Order profit maker. Beginners, dealers, no matter what you've tried or are selling by mail now, get next to this new, different, fast seller. 25c brings sample, plans, details. Pass judgment on this fast selling profit maker. Money back if you say so. L. Mallory, Neillsville, Wisconsin.

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START Home business! Manufacture plaster novelties! Free details! H. Tooker, 63-M Chestnut, Hamilton, Ohio.

YOUR Own mail order business at home, spare time. Details dime. Midwest, Box 4001 Station A, Kansas City 7, Mo.

BOOKKEEPERS: General ledger and tax report experience. Operate permanent, profitable accounting service for the smaller business. Part or full time. Simplified method. Write now! L. A. Bell, 1404 West 25th Street, Cleveland 13, Ohio.

OPERATE Profitable appliance and building repair business. Information free. Cline-Porter, Box 6346D, Pittsburgh 12, Penna.

OPERATE profitable mail order business. Splendid opportunity. For details write Albert Tayes, Zolfo Springs, Fla.

UPHOLSTERING—Do your own, free details. Lyle, Box 385-A, Lombard, Illinois.

AMAZING Information. Outstanding opportunities. Investigation invited. Enterprises, 578F Prospect, New York 55.

START Your own advertising agency, in spare time at home. Opportunity for big earnings and permanent business. Complete operation revealed. No stock or equipment needed. Folder and proof free. P. Snyder, Box 4907-A, Philadelphia 19, Penna.

SELL By mail!—Books and novelties! 35 different items! Large profits! Catalog free! Elfo, 432 N. Wells, Chicago 10.

40 MAIL Order publications, magazines, ad-sheets and circulars. A barrel of opportunity for 25c. Theodore Gordon, Box 1223, New Haven, Conn.

PROFITABLE Home sparetime business, making wallets, belts, other fast-selling leather novelties. Simple to make. Tools not necessary. Amazing opportunity. Send for free catalog. Gold Leathercraft, 632 Desplaines, Forest Park, Ill.

WORLD'S Shortest complete bookkeeping and income tax record; copyrighted; \$2.00 postpaid; boon to small businesses; book-keeper's aid; vest pocket income tax digest included free. Mixon, Postoffice Box 2048, Los Angeles 53, California.

STOP—Be your own boss. Operate fifty profitable mail order business plans. Free details. Star, Box 41, Brooklyn 14, N. Y.

WHOLESALE Catalog, directory 10c. Thousands of articles. Stafford, 961½ N. Jefferson, Indianapolis 1, Ind.

EARN Money with textile painting course. Free details. George Gundrum, LeRoy, Michigan.

FREE Details—How to operate a profitable mail order business. Beier's, 837-A North Hoffer, Bethlehem, Penna.

"A BUSINESS Of My Own." Arthur E. Morgan. Select your business carefully. Hundreds of successful small enterprises described. Second, enlarged edition. 185 pages. \$2.00 (paper, \$1.00). Community Service, Yellow Springs, Ohio.

START Your own candy business. Wholesale. Retail. Small investment. Good profit. Complete course. \$1.00 postpaid. Sokola, 8751 Portland, Detroit 17, Mich.

ESTABLISH Profitable mail order business in spare time. Operate anywhere. Free details. Kelley Service Bureau, 215-K South Monroe, Kansas City 1, Mo.

MEN—Women who can sew. Write, Lyle, Box 385-A, Lombard, Illinois.

SOAP Powder for mechanic, factory, printing trades. Ample supplies. Big opportunity. Profits selling users, retail stores. Schultz Laboratories, Boone, Iowa.

FORTUNES In formulas and trade secrets. Practical, authentic, reliable. Details free. Stillman, 555 Kingston Ave., Brooklyn 3, N. Y.

SUPER X liquid molding rubber. Sample jar 25c, quart \$3.00, gallon \$10.00. Free sample. W. Wooley, 115-A Donald, Peoria, Ill.

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500% PROFIT. Cast our fastest sellers. Magic rubber liquid for 20 rubber molds, model, instructions, \$3. Hugue, 571 Central Avenue, Brooklyn 7, N. Y. Established 1902.

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GO Into business for yourself. We have open territory for crunchy chips. Sample sent. No obligation. Write, Crunchy Chips, P.O. Box 310, Binghamton, New York.

"KEMO-PLASTIK"—Amazing new rubber molding liquid. Dries quickly. Easy to apply. Quart \$3.00. Gallon \$6.95. Mold-making instruction included free. B. Belfort, Engineering Bldg., Chicago.

PLASTIC—Liquid glass; China glazes, protects plaster objects, seals wood. Pint \$1.00, gallon \$3.00. New Era Products, 1321-N Belmont, Chicago.

OPERATE Profitable mail order business. Splendid opportunity. Free details. Johnson, Box 93, Lansdowne, Penna.

MAIL Order procedure. 13,000 words, 25c. Stav, 936 North Harvey, Oak Park, Illinois.

"BULK Vending" machines make easy steady income. Have you considered or would you like to learn this fascinating business. Post card brings free booklet. Vending, 1051 "L" St., San Bernadino, Calif.

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FAST-SELLING Patriotic book, just published; with free deal \$1, 100% profit. Portent, Box 62, New York 67.

\$46 FROM Square foot plywood. Jigsaw necessary. Write, Woodarts, X-33, Bridgewater, Mass.

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USED Battery business, start in your home, no equipment needed, send postal. Pioneers, 2012 Clement, Alameda, Calif.

OPERATE Profitable mail order business, splendid opportunity. For details write, J. M. Watson, 758 Royal St., Baton Rouge 10, La.

START Profitable business, sell merchandise under your name, mail—local. Sample 25c. Linnell Co., Box 1720A, Cleveland, Ohio.

SELL By mail to huge Negro market. This is over-prosperous field of prospects. Details free. Fredericks Books and Supplies, Box 1810-P, Houston, Texas.

\$500 SALES Every business; \$500 month mail orders. "Skip" Tracers-Collector's Manual tells secrets. Sample directives. Supplies \$1. School of Credits, 424 S. Broadway, Room 900, Los Angeles 13, Calif.

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CASTONE—Hardest coldcasting composition on earth, any mold. White and colors, 10 pounds assorted colors, \$2.00; hundred pounds, \$6.00. New Era Products, 1321-N Belmont, Chicago.

VENDING Machines. Be independent. Own a big money business operating coin machines. Earn as high as \$7.00 weekly on machines costing as low as \$11.75 each. Car and experience unnecessary. Routes can be operated either in your spare or full time. Act quickly. Write for details and catalogue showing our amusement games, postage machines, candy-gum-nut vendor and scales. Parkway Machine Co., 623J W. North Ave., Baltimore 17, Md.

RUBBER Molds. Make big money duplicating hundreds of items, own your own business, start in spare time, make your own genuine rubber production molds, duplicate expensive molds for only a few dollars cost, latest factory and shop methods. Information free. Write Shop Technician, 1832 E-9th Street, Kansas City, Mo.

YOUR Town is ripe for a profitable Collection Agency. \$5,000 first year easily possible. We train you, coach you, get you started and help develop your business. Send \$1.00 for Starter Course, or ask for facts. American Collection Associates, 226 State Street, Schenectady 5, New York.

OPERATE Profitable business at home by mail. Write F. Webster, Box 1553B, Sacramento, Calif.

\$10 STARTS Well paying business. Complete course in shellcraftsmanship. Materials and instructions. Write Brace Mail Shop, Dept. 11-a, 528 White Bldg., Buffalo 2, N. Y.

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"FIFTY Plans for Mail Order Operation" guide you to a profitable business. Free details. Leroy Harris, 310 W. 14th Street, Cincinnati, Ohio.

FELLOW Hustlers—Salute two aristocrats that bring cash instead of promises. Particulars including "free" copy. Additional money maker 10c. Word Products, 2742 Boulevard, Jersey City, New Jersey.

OWN Your own medical company. Operate from home. Employ agents, big profits. Quaker Medical Company, 220 George St., Cincinnati 2, Ohio.

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EVERYBODY'S Feet hurt. Sell guaranteed cream. Excellent repeater. Free advertising. Write IDI, Quakertown, Penna.

FREE Weekly lists new government, civilian surplus and closeouts. Toys, hardware, jewelry, household items, clothing, novelties, etc. Sell to stores and users. Small quantities available at fraction of original prices. Royalee, 5210 3rd Ave., Brooklyn 20, N. Y.

MORE Power to you! Success—money, whatever needed, soon yours. Simply follow compelling, startling idea just published in Victor Tooley's amazing new book, "Yours is the Power," 50c postpaid. Author's special individual personal advice privilege to each purchaser. Liberal quantity discount for distribution to handicapped or discouraged. Dulco, Box 5259M, Pittsburgh 6, Penna.

PROFITABLE Business of your own. Spare or full time. Write Tes-Co Enterprises, Wilkes Barre, Penna., Box 189-PM.

OWN A mail-order paper products business. Sell envelopes, tags, bags, boxes by mail, wholesale. Tremendous demand. Steady profits. No capital necessary. Write Omaha Envelope Service, Dept. 177, 4721 California, Omaha 3, Nebr.

METALLIZE Baby shoes! Learn this money making business from nationally recognized consultant. Get "know how" from outstanding authority! See Kushner ad, page 271.

METALLIZE Baby shoes and plaster casts! New, easily followed complete step by step instructions. Written by a plating engineer. Electroplating by brush included. Make own equipment. Complete instructions \$2.00. H. C. Pedrick, 1419 West Ontario Street, Philadelphia 40, Penna.

BOOKKEEPERS. Cost clerks, accountants, time study men. Earn \$10 hour installing cost reduction programs. Learn direct from successful firm of management engineers through ten sets instructions at \$10 each. Unusual opportunity. Suite 665, 120 S. La Salle, Chicago 5.

WHOLESALE Distributors: Turn to page 271, read important display ad. Millen Mfg.

EARN \$10-\$25 Weekly spare time. No canvassing. Experience unnecessary. Unique Service, Box 851P, Minneapolis, Minn.

START Home business making statuary, plaques, novelties, garden furniture, artificial marble flooring, liquid marble. Make your own flexible molds. Amazing profits. Folder free. Creative Publishers, Box 236-L, Winnetka, Illinois.

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WORLD'S Best floor wax, 40c gallon. Use in your own home. Resell others. Big profits. Lifetime business. Write Westholz, Box 7324, New Orleans, La.

CASH In now with tested profit maker, Advertising Tips on Selling by Mail. Circular free. Winkelpost, Box 517, Grand Central Annex, New York 17.

MAKE Strange, plastic Rub-R-Slate—1c pound. Makes durable, attractive floors, walls, roofs. Build for half. Bays Laboratory, Oklahoma City 9.

COLOR Concrete with chemicals. Make Hollywood style pottery; home or shop. Marbling, water-paints, 10c brings sample, pictures. Hollywood Cementcraft, 8527 Wonderland, Hollywood 46, Calif.

MAIL Order beginners! How to start, create and develop a profitable mail order business of your own with small capital! Instruction guide 25c. Send for it today. Kraft, Aurora 5, Mo.

MOLD—Model, mold making liquid, material supply catalogue free. Novelty manufacturing instructions, sales outlets. Aircure, 3873A California, San Diego, California.

START Profitable concrete block business. Details free. Wm. Horne, 206 West Wilder, Tampa 3, Florida.

DOLLARS Daily! Cleared \$1900.00 in two months. Details. Duffy, J56, Covington, Ky.

ADVERTISEMENT Writer. Long, successful experience creating powerful mail-order letters, literature, campaigns. Investigate! Les Finkle Advertising, 408 South Spring, Los Angeles 13, California.

START Profitable mail business, booklet 25c. Colin Couch, Elkin, N. C.

20th CENTURY "business opportunities book." 144 pages of formulas, mailorder, homeworkers plans. \$1.00 postpaid or c.o.d. plus postage. Money back guarantee. Silver Crest Products, Dept. 1A, 3040 North Ave., Chicago 47.

ARE You "fed up" working for a boss? Own a permanent mail order business. Write: Gordon Crompton, P.O. Box 2567, Hollywood 28, Calif.

INVESTIGATE Mail selling! What's the one best thing to sell, happily, honestly, profitably? We know! Get free particulars. Free samples. What-to-Do Shop, Box 1082, Tacoma, Wash.

BUILD Your own independent, fascinat-ing and very profitable business at home, spare, or full time, \$75.00 and upwards weekly easily possible making beautiful brilliant, sparkling novelties and religious figures. Fast sellers through you, salesmen, stores. Quickly learned and few dollars starts you making real money. Successful manufacturer can tell you how and furnish everything. Start small, grow big. Write for full information and "amazing story of my success" at once, Inghram Company, 2845 Sixth Street, Detroit 1, Michigan.

BECOME A finance man. Particulars free. George Lenhoff, Lincoln 8, Nebr.

AIRCURE: Liquid latex for flexible molds. Directions. 22 ounces \$2.50. Gallon \$9.00. Rubbercoat, 3873A California, San Diego, California.

EARN Up to \$400.00 monthly. Details free to mail order beginners only. F. C. Bradford, P.O. Box 246, Morenci, Arizona.

INTERESTED In immediate mail order cash? Read "Advance"—Voice of mail order. Offers money-making opportunities. Personal guidance and benefits to all. Sample copy 25c. American Mail Trade Association, 313 East 21st Street, Dept. 400, New York 10, N. Y.

WHY Job worry? Learn electroplating. Highly paid, uncrowded, interesting business. Gold, silver, nickel, chromium, etc. Send postcard for free booklet and proof. Plater Hyde, Dept. MC, P.O. Box 176, National City, Calif.

COPUBLISH Leading m.o. paper. Latest copy Mail Sale Advertiser and proposition, commemorative stamp. Vanroy Shirk, Lebanon, Penna.

GO INTO the mail order business. My 32 years' experience tells how. Send 25 cents for instructions. Mail Order Institute, Box 1902, Cleveland 6, Ohio.

PLASTIC Flooring offers profitable lifetime business! Write Palmer Company, Station A, Berkeley, California.

START Profitable mail order business, write Harry Punch, 1329 Grace, Cincinnati 8, Ohio.

PARATOL—Amazing new rubber latex moulding compound for perfect detail castings of all kinds tested and approved in long service. No worries—easy to apply, quick drying, maximum strength and long life. Why pay more—buy direct! Quarts—\$1.60, 1 gal.—\$4.90, 5 gals. \$4.45 gal. 4 oz. samples on request. Send 25c to cover mailing and handling charges. Full instructions sent with each order. Testworth Laboratories, Inc., Manufacturers of coating and adhesive products of all kinds, 407 S. Dearborn Street, Chicago 5, Illinois.

START Your own business! Free information. Reim, 3931 Bayo, Oakland 2, California.

REAL Opportunity! Start clean, legitimate mail order business with only \$80.00 capital. May not make you rich, but should bring \$30 weekly or more—in spare time. Details free. Opportunity Press, 5015 Lake Park, Chicago 15, Illinois.

START Profitable mail order business. PMT lists new propositions available; products, sources, accurate methods. Covers ad writing, letter logic, trade information. Send 10c for copy and get free instruction folio offer. Progressive Magazine, Sheboygan, Wisconsin.

MERCHANTISE At half the standard advertised price. Ken Solomon Company, 813 Broadway, New York 3, N. Y.

BOOKKEEPERS. Cost clerks, accountants may earn fees of \$500 to \$5,000 as cost consultants installing modern cost control systems. Learn direct from successful firm of industrial analysts and cost consultants, through ten sets instructions at \$10.00 each. Unusual opportunity, territory limited. Room 1504, Fidelity-Philadelphia Building, Philadelphia 9, Pa.

FLASH. Classic novelty. Big business for you. Hurry, dime. Robert Martin, PM 57 Hart, New Britain, Connecticut.

LOOKING For new opportunities? Mail order and others? Get "The Practical Idea." Write: Veteran, Charleston 6, Ill.

MAKE Extra money now. Build to financial independence. Sell office supplies by mail from your home. I tell you how. Jo Troutwine, 8654 S.W. Ninth, Portland 1, Oregon.

ESTABLISH Own specialized, profitable advertising business. Make big money practically giving away advertising. E. J. Matteson, P.O. Box 580, Hanford, Calif.

WORK Evenings at home collecting names and addresses. Sell them by mail. Details free. MacAndrews, 8 Buick Street, Calais, Maine.

SELL By mail. Part or full time. Free details. Write Glenn Heck, Box 81, Russell, Kentucky.

OPERATE Profitable home business selling merchandise by mail. Fast sellers. Large profits. Powell Service, 5713 Euclid, Cleveland 3, Ohio.

START A home business in spare time. Make extra money. Experience unnecessary. Literature free. Elmar Services, Muncy, Penna.

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ASTOUNDING Modern mailorder plans bring quick profits. Darrah, Orono, Maine.

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1946 GIGANTIC Directory of opportunities, advertisers supplies, sources, trade information, mail order ideas, products, wholesalers, valuable tips—just published! Descriptive literature free. Wilkin & Co., 118-AP East Main St., Hillsboro, Ohio.

INVITATION To income. Contact Mib Associates, Fitzsimmons Building, Pittsburgh 22, Penna.

BIG Paying jobs in welding. Complete welding lessons and reference books, 516 pages, 41 lessons, \$2.00 copy. Money-back guarantee. Hobartweld, Box M-1065, Troy, Ohio.

BELTS! Make'm and make money. No tools! Sample 50c. Artinic Leather, 411 Joseph Ave., Rochester 5, N. Y.

START A clock shop. Fascinating, easily learned profitable business requiring little capital. We teach you how to repair all kinds of clocks. Information free. Houston Clock Shop, P.O. Box 5086A, Houston 12, Texas.

START Home manufacturing business making Cleaning Compounds, Soaps, Insecticides (DDT), Cosmetics, Polishes. No machinery. Literature free. Kemix, Park Ridge, Ill.

MEN, Women, "Everybody Likes Candy." Learn to manufacture professionally at home. (Our 36th year.) Ragsdale Candies, East Orange 2, N. J.

SYNTHETIC Latex with Neoprene base for making flexible molds! Quick drying! Safe! For home, classroom, or industry. Quart \$2.00. Gallon \$5.95. Full instructions. Plastercraft Supply Company, 1406 East 43rd Street, Cleveland 3, Ohio.

10c BRINGS You hundreds of money-making propositions, plans, ideas, tips, wholesale supply sources, magazines. Gardenville Publishers, Gardenville 4, N. Y.

200 MONEY Making deals, Plans. Rare formulas. Schemes. Folio free. Formico Mart, Box 572, Dayton, Ohio.

WOULD You pay 3%—first \$350 made? Color-illustrated book "505 Odd, Successful Enterprises" free! Some plans offer occasional "day off." Start at home, office. Expect something odd! Pacific, 2207 1/2 Cloverfield, Santa Monica, Calif.

RAISING Canaries pays good profits. Valuable bird book—"Its Care, Breeding and Training." Price \$1.00. American Canary, 2839 N. Halsted, Chicago.

INCORPORATE Your business. Delaware laws. Many advantages, free details. Tax Research Bureau, Inc., Delaware Trust Building, Wilmington, Delaware.

SPECIALTY Manufacturing, the big money business that can be operated anywhere, start on a very small capital; we supply dependable formulas and complete instructions; get interesting free booklet, "Money-making Opportunities in Specialty Manufacturing." Howard Robinson, Ph.G., 1300-A South Ohio Street, Sedalia, Mo.

FELLOW Workers—Down with bosses—Start own business—Be independent—Booklet describing 137 tested plans, free. P. Padney, 307 York St., Jersey City, N. J.

MINK Raising, information free. Complete. Lake Superior Mink Farm, Superior, EE, Wisconsin.

PROFITABLE Mailing merchandising business. Write Riegel, 1111 Harrison, Phila. (24), Penna.

TADPOLES Make frogs, tremendous demand. Both make you money. 25c brings tell-how information. Chariton Corporation, Century Building, Chicago 4.

COPPERIZE Baby-shoes, complete instructions, tested sales plan. Metalloids, Box 8087-b, Pittsburgh 16, Penna.

MAKE "DDT" Products. My ten master formulas show how. Literature free. Howard Robinson, Ph. G., 1302-A So. Ohio, Sedalia, Missouri.

MAKE Flexible molds! Few cents each! Cast plaques, novelties, bookends! Free sample! H. Tooker, 630-A Chestnut, Hamilton, Ohio.

WE Start you in business, at home, sparetime, earning \$10-\$30 weekly selling by mail. Stamp appreciated but not necessary. Driscoll Sales Service, Box 2771-A, Denver, Colo.

COLORGLAZED Concrete pottery made without molds. New, low cost, patented method. Cemetery products, novelties, tiles, floors, etc. Basement leaksealing. Other money-making projects. Booklet, details free. Men only. National Potteries Company, Fergus Falls, Minnesota.

ELITE Collection contains 137 practical money-making plans; local and mail order. New edition. Particulars free. Elite Co., 220-A Grand St., New York 13.

PLASTIC Homes—Build yourself! Re-surface old buildings! Wonderful building material. Particulars free. Marbleizing Service, Edwardsville, Illinois.

YOUR Own business. Big profits, very small capital. National organization teaches, helps, supplies everything. Interesting service business. Big demand everywhere. Americlean, 211 North 7th Street, St. Louis 1, Mo.

HANDY Men—Earn money home operating Community "Fix-It" Shop. Write Stafford, 708 Rawlings, Carbondale, Ill.

MAIL Order business course shows you how to make money, spare or fulltime. Teaches professional mail order technique—not penny-snatching schemes. Fascinating 100-page illustrated success-catalog free! Write—Nelson Company, Dept. 4-02, Chicago 5.

BUILD Miracle homes. Yours. Others. Chamberlain, Fitzsimmons Building, Pittsburgh 22, Penna.

BOOKKEEPERS—Operate your own "Dollar-A-Week" bookkeeping and tax service. Full or spare time. Details free. Ellis, Box 200, Cedar Grove, No. Carolina.

RECAST Old batteries into new. Latest achievements. Battery Laboratories, Minneapolis.

START Mailorder bookshop—Everything furnished; publisher cooperation. 25c brings booklet, exclusive setup, samples, exciting ideas. General Publications, Ossining, N. Y.

\$25 WEEKLY Working two hours daily. No canvassing. No manufacturing. Lycke, Box 2471, Cleveland 12, Ohio.

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MONEYMAKING OPPORTUNITIES

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CARNIVAL Ride plans: Kiddie auto, \$5; Toonerville trolleys \$8. Brill, 228-M North University, Peoria, Illinois.

SILVOGOLD, America's finest 1000 signature embossing \$1.00 kit. Glass packed, two toned. Proposition free. Bender Products, Mastic 2, N. Y.

MECHANICALLY Inclined men—Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply, Dept. 1171, 2835 N. Central Ave., Chicago.

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THREE Mail order magazines free. Thompson, Box 133-ZB10, Tonawanda, N. Y.

EARN Up to \$2,000 year, inventing simple items for special cash markets. Ideas only. No patents. Hendrickson, Argyle (7), Wisconsin.

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BE A magician! Have fun! Make money! Send 25c for large professional magic apparatus catalog. "Magic" magazine included free. Robbins Co., 152-P West 42nd Street, New York.

THERE'S Big money in junk." and repairing batteries. Write, Batteryman, Grand Junction 5, Colorado.

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EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle (1), Wisconsin.

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IMPRINT Circulars. New 2-color samples free. Fowl Printing Co., Muncie 2, Indiana.

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SELL Books by mail. Large profits! Details free. Cline-Porter (Publisher), Box 6346-H, Pittsburgh 13, Penna.

CO-PUBLISH Magazine. Many profits. 16-page booklet 10c (refundable). Goldenberg, 5209-G Lindsay, Houston 3, Texas.

EARN While you learn clock repairing. With our method your income can start immediately. Write Akron Clock Clinic, 964 Wye Drive, Akron 3, Ohio.

ENTER Profitable export field. Send \$2.00 for list over 100 oriental firms urgently desiring all types American merchandise. Box 2183, San Francisco 26, Calif.

NYLONS—Supply sources, 50 manufacturers. \$1.00. Bonafide information. Enterprises, 578N Prospect, New York 55.

UNUSUAL Mail order opportunities. Guthrie, 3215 Brest Ave., Norfolk 2, Virginia.

256 PLANS, Formulas, tips, ideas, publications 25c. Dancer, Mansfield, Ohio.

NEW Money making opportunity ready now. Write, Sharp, 904 Pennsylvania, Kansas City 6P, Missouri.

DOLLARS Daily! Learn how. Read "Timely Tips Magazine." Paulding 2, Ohio. 19th year, \$1.00. Three copies, 25c.

OPPORTUNITY Knocks. \$50 weekly in your spare time. Complete exclusive plans and details for Xmas novelty. Send 50c. Novelty, Box 1278, Middletown, Conn.

"LUMINOUS Paint." Soap, weed killer, antifreeze, fly spray, etc. One hundred and fifty moneymaking formulas. \$1.00 postpaid. Columbia Publications, Aberdeen, Idaho.

"GOLDEN Magic" raised effect ink transforms handwriting into matchless beauty. Dollar item with wide profit margin. Rotex, 216 Degraw, Brooklyn 2, N. Y.

MAKE Popular, fast-selling stainless steel bracelets at home, full or spare time. Easy profit. Special introductory kit makes work quick, easy. Facts free. Ar-Clo Products, 2055 West Summerdale, Chicago 25, Ill.

OPERATE Profitable mail order business. Splendid opportunity. Z. J. Wass, 3802 W. Chicago Ave., Chicago 51, Ill.

EMBOSS Christmas cards, letterheads yourself. "Embosso," gold, silver, \$1.00. Dexter, 45 Pleasant, Battle Creek, Mich.

SMALL Capital "moneymaker." New. Unusual. Write, Jones, Bethany 2, Okla.

OPERATE Profitable part time business in your own home. Free details. General Mail Trade Service, 2272M-Andrews Avenue, New York 53, New York.

EARN Money at home, make seashell brooch and earring sets. Kits include materials, actual photographs, instructions for one set \$1.00—6 sets \$5.00. Black's Shells, 601 S. Newport Ave., Tampa 6, Fla.

MAKE Sell over 100 fast repeating products under your name without machinery. Kohen, 506 W. 45th St., Chicago 9.

EARN Extra cash—full time or spare time—selling Pines' 1947 Greetings. Profits over 100% for producers. These sensational easy-selling boxed assortments must be seen to be fully appreciated. The complete line includes over 100 different moneymaking assortments for all occasions—birthday, anniversary, convalescent, congratulations, announcements, invitations, gifts, special occasion and holiday cards; distinctive social stationery for men and women. Climb this big-profit band wagon by sending \$3.00 now for your saleable samples (value \$6.00) of six different current feature dollar box assortments together with full details of our no-risk money back guarantee on our complete line. Just print your name and address, attach \$3.00, and mail to: Pines, Box 32, Flushing 1, New York.

ADVERTISING Offers you interesting profitable career. Start your own advertising business immediately. Others do the work; you collect your profits immediately. No merchandise to sell. Information free. Robert Theis, Rydal, Pennsylvania.

SELL By mail! Mail order business is shortest cut to profitable sales. Inspiring, constructive, instructive literature sent without obligation. Earl Cratty, 385 Lenzen Ave., San Jose 11, California.

"LUMINOUS Paint." Resilvering Mirror formulas 25c each. "50 Single Ingredient Formulas" \$1.00. Ideal Service, 300, Park Ridge, Ill.

RAISE Own capital, start own business! Copyrighted method. 25c brings proven money making offers. McCann, Ravine, Nutley 10, N. J.

MAKE Big money selling top quality, artistic chenille bed spreads. Sample \$7.95—big profit. Order today and get full details. Michigan Brokerage Co., 123 N. Baum Street, Saginaw, Mich.

WANTED Agents, advertisers, co-publishers. Sample and details 25c. J. W. Arthur, Box 4, Montgomery, W. Va. Member N.M.D.A.

MAKE Big money preserving baby shoes in metal, bronze, pearl, gold and silver! Kiktavi Company, 6820 South Ruthelen, Los Angeles 44, California.

STOP Looking for work! Here is something you can put your hands on. Good paying jobs available in Florida. Send for free booklet, "Florida Opportunities." Florida Businessmen's Service, Box 767-B, Panama City, Florida.

ASSEMBLE Fast-selling jewelry with colorful plastic and metal parts. Profitable hobby; simple—inexpensive—fascinating! Free details. Hughes, 712 Kimball, Danville 3, Illinois.

UNPAINTED Figurines, plaques. List. Progress Company, 4033 Chowen, Minneapolis 10, Minn.

\$25 WEEKLY Working two hours daily. No canvassing or manufacturing. Lycke, Box 2471, Cleveland 12, Ohio.

EARN Money at home—steady income. Write Successful Income Builders, 508-A, Hollywood 28, California.

LEARN Metascience. Remarkable drugless healing. No manipulation. No apparatus. Unbelievable simplicity and results. Inexpensive correspondence course. Write Metascience, De Land, Florida.

RAISE Giant Chinchilla rabbits. Tremendous profits from gorgeous fur, delicious meat. Ideal business. Willow Farm, R15A, Sellersville, Penna.

LEARN Battery repairing, rebuilding. Engineer offers money making methods. Battery Bureau, 2225 North 44th St., Milwaukee, Wis.

WIN Contest money. General contest bulletin shows how. 16 big pages of help. Many current contests listed. Sample 25c. General Contest Bulletin, 1609 1/2 East 5th, Duluth 5, Minn.

FREE "Prize Contest Bulletin" describes many contests. Money making opportunity. Cash Register-G, 210 Fifth Ave., New York 10.

200 MONEY Making deals, plans, rare formulas. Schemes, Folio free. Formico-Eng., Box 572, Dayton, Ohio.

WOULD You pay 3%—first \$350 made? Color-illustrated book "505 Odd, Successful Enterprises" free! Proven by "Little Fellows." Start at home, office. Expect something odd! Pacific, 2207 1/2 Cloverfield, Santa Monica, Calif.

FORTIFY The future! Start own business; home, office. Booklet describing "Collection of 137 Tested Plans" free. Elite Co., 220-A Grand St., New York 13.

PUBLISH Your own magazine. Handsome 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 25c brings sample details. National, Ord, Nebr.

I MAKE Big money in the mail-order business. You can do the same at home with my copyrighted system. Write me. I'll tell you how. F. Little, Box 8, Glenshaw P.O., Pittsburgh, Penna.

FORMULAS, PLANS, ETC.

21 POPCORN, Candy apple, etc. formulas. All money-makers, \$1.00. We can supply equipment. Concession Supply Co., Dept. "A," Box 133 Sta. "B," Toledo, O.

CHEMISTS—Chemical questions answered. Formulas, analyses. Lewitsky, 26 Erwin Place, New Britain, Conn.

MANUFACTURE Cleaners, flavors, cosmetics. Formula catalog 10c. Kemico, Park Ridge 20, Illinois.

FORMULAS Are fortunes. Send 25c. May be turning point of your life! Write! CPB, 540 Amity, Muskegon, Michigan.

NEED Chemists? Formulas? Analyses? Technical services? Consulting Scientific Company, Swarthmore, Pennsylvania.

SOAPLESS Soap! Easily, cheaply made-sold. Formula, 25c. Duffy, L52, Covington, Ky.

FORMULAS Guaranteed manufacturing. Expert chemist. Lists free. Riviere, 521 Provident Bank Building, Cincinnati, Ohio.

10,000 FORMULAS And trade secrets. Free literature. Stillman, 555 Kingston Ave., Brooklyn 3, N. Y.

MAKE Toilet, laundry and liquid soap. 5 formulas \$1. M. Elsbury, 717 N. Dearborn, Chicago 10.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

MAKE 25 Pounds soap for 25c in about 25 minutes. Three ingredients. No lye or grease. (Original). Also bubble liquid, Carpet cleaner, Soap substitute, Garment cleaning soap. All 25c coin. Smart circular free. Teycer, Chemist, Box 1287 1/4, Chicago 90.

MECHANIC'S Soap powder and 109 other money making formulas for 50 cents. K. Reeves, 3226 Tularosa Street, El Paso, Texas.

FORMULAS—Latest, best. Analysis. Giant formula catalog and chemical instruction sheet 10c. Refunded first order. Belfort, Engineering Building, Chicago 6.

MANUFACTURE Cleaners, flavors, cosmetics. Formula catalog free. Kemico, Park Ridge 16, Illinois.

PLASTICS

ACETATE Plastic 3/000 transparent. Two 20"x50" sheets \$1.00; dozen \$4.95; 100—\$34.75. Two dozen 5"x20" \$1.00. Daniels Press, Statesville, N. Car.

PLEXIGLAS Sheets. 10"x12"x15" —85c; 1/8"x11 1/2"x12"—60c; 3/16"x12"x16"—\$1.35. Plastic rod assortment, 9 colors and phosphorescent, \$4.00. Julian Rhodes Muench Co., 1527 W. Alabama, Houston 6, Texas.

PLEXIGLAS, Clear masked: 12"x12" 1/16"—\$1.25; 1/8"—\$1.60; 3/16"—\$2.00; 1/4"—\$2.30. Also thicker and colored sheets. Cement 4 oz.—60c. Free instructions and complete price list. Postpaid. Money orders only. Plasteco, 1800 Stuart, Houston 4, Texas.

PLEXIGLAS, Clear, masked. Prices per square foot. 1/16"—\$1.17, 1/8"—\$1.46, 3/16"—\$1.77, 1/4"—\$2.09, 3/8"—\$3.10, plus 10% postage. M. Raffel, Rethel Plastics, 15 Walnut Street, Steelton, Penna.

PLASTICS And supplies—new Plexiglas, Lucite, Catalin sheets, rods, tubes, etc. Exceptional kits, \$2.00, \$5.00, \$8.00. Attractive prices. We pay postage. Free list. Plas-met Sales and Engineering, 4648 Shirley Pl., St. Louis 15, Mo.

PLEXIGLAS—Everything for the plastic craftsman. Free catalogue. Novalte Plastic, P.O. Box 106, Brooklyn 19, N. Y.

LUCITE—Special offer, catalog 10c. Midwest Plastic, 1717 No. 66, Omaha 4, Nebr.

MAKE Money assembling our pre-fabricated plastic kits. Sample kit 50c. Catalog free. Fabros, Box 156 Station F-1, Buffalo 12, N. Y.

SENSATIONAL Plastic injection molding machine. Low price Plexiglas, dyes, cements, shellcraft kits; molding sets, polystyrene rods. Free literature. G. Baker Company, River Edge, New Jersey.

PLASTIC Craftsmen—Plasticast liquid plastic kits are again available. Cast your novelties, book ends, jewelry. Kit contains one pint of plastic, accelerator, mold material, mold parting compounds, complete instructions. \$5.00 prepaid. Alexandria Brass and Plastics, Box 221, Silver Spring, Maryland.

NEW Liquid plastic. Clear colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Manual tells how. Send \$2.95 plus 20c postage for complete kit including one pound liquid Castolite. Castolite, Box B211, Kenilworth, Ill.

LUCITE Sheets—\$1.00 per lb. postpaid. Sizes available (inches)—1x2, 1x4, 2x2, 2x3. Send order with payment to Bellite Company, 173 Utica Ave., Brooklyn 13, N. Y.

LUCITE, Plexiglas. Prices you can't beat. Prime grades. Masked sheets 12"x12" 1/16"—\$1.00; 1/8"—\$1.25; 3/16"—\$1.55; 1/4"—\$1.85; 10% postage. Jewelry findings, shells, accessories. Free listings. Craft Plastics, Box 129M, Somerville, N. J.

PLEXIGLAS Lucite slashed, free listings. Douglas Home Craftsman, Dept. M, Stamford, Conn.

PLASTICS, Material and supplies. Information folio, list free. Art Plastics of Calif., 8127 East 14th St., Oakland 3, Calif.

PLEXIGLAS, Lucite, Cellulose Acetate for hobbies, money-making opportunities. Sheets, rods, tubes, clear or colored. Full range of sizes. Cements, dyes, polishing compounds, buffs. Free price list. Plastic Parts & Sales, 1157 S. Kingshighway, Dept. H-2, St. Louis 10, Mo.

PLASTIC Gifts—Assembled from pre-fabricated kits. Ideal Xmas gifts. Catalog 10c. Plastic Products Co., Box 384-T, Massillon, Ohio.

PLASTICS—10c Brings illustrated 1947 catalog containing kits, bulk assortments, plastics and national contest. Write Dept. D12, Bellico Plastics, 147 W. Sidney, Mt. Vernon, New York.

WRITE Today for generous free samples "Lucy-Plex" and "Coty-Bak" fast action; dustless, greaseless, non-burning, optical polish plastic buffing compounds. 5000 plastic hobbyists now use them. Enclose 12c postage. Plastic Masterpieces, 529 West Manchester Ave., Los Angeles 44, Calif.

PLASTIC Discs, shapes, metal findings, wholesale, free catalog. "Secors," Bradenton Beach, Florida.

MAKE Plastic novelties with Hollywood kit containing 2 lbs. of Lucite and Plexiglas; 3 colors of dye, bottle of cement and complete instructions. Postpaid \$3.25. Hollywood Items Co., Box 1151, Hollywood 28, Calif.

PLASTICS; Sheets, rods, tubes. Free list. Plastic Supply Co., 2618 St. Louis Ave., St. Louis 6, Mo.

GUARANTEED! We are America's lowest priced plastic supply house. Write for free price lists. Allcraft Products, Box 212, Hempstead, N. Y.

WRITE Today for generous free samples "Lucy-Plex" and "Coty-Bak" fast action; dustless, greaseless, non-burning, optical polish plastic buffing compounds. 5000 plastic hobbyists now use them. Enclose 12c postage. Plastic Masterpieces, 529 West Manchester Ave., Los Angeles 44, Calif.

PLEXIGLAS And Lucite liquid cementing dye kit. Full color range. Excellent for cementing or dipping. \$2.00 postpaid in United States. Money orders only. Handicraft Supply, 409 N. Akard, Dallas, Texas.

\$100 CASH. Plus up to \$1000 "royalties." Enter "Allcraft Products Contest." Write immediately: Allcraft Products, Box 212, Hempstead, N. Y.

PLASTICOR Injection molding press produces 100 1/4 oz. Tenite moldings per hour! Mechanical pressure, electric heat, sixteen colors, 2 1/2"x2"x1" molds. Commercial results! Magazine featured! Money-back guarantee! \$34.95 complete! Limited supply! Technicraft, 1156 Commonwealth, Boston 34, Mass.

MONEY In plastics! Lucite plastic hobby kit. Two pounds Lucite materials, coloring dye, cement. Instructions. Send \$2.50 to Plastic Specialty Co., (Dept. M), 192 Lexington Ave., New York 16. Also Swiss music movements, \$3.50 each.

LUCITE—Complete illustrated fabricating instructions, used in craft classes throughout the world, price list on lucite, dyes, complete supplies. Booklet 10c, with sample, 35c. "Gem-O-Lite," P.O. Box 686-B North Hollywood, California.

LEARN At home "Working With Plastics." Full information on sheets, blocks, rods, tubes. Trade names, sizes, colors for fabrication. Designing, tooling, bending, cementing, polishing. Also for homework-shop. Only \$1.25 postpaid. Money back guarantee. Modern Technical Book Co., Dept. MMC, 55 West 42nd St., New York 18.

PLASTICS. Make yours at home. Formula and moulding instructions \$1.00. Forester, Zone 84, Station K, Toronto, Canada.

CHEMISTRY

THE House of Winn, home of supplies for amateur chemists. See Winn's New Idea chemical kits and apparatus outfits for home experimenting. Send 10c for retail catalog. Established 1931. John H. Winn, Dept. 512, 124 West 23rd St., New York 11, N. Y.

BUY Laboratory supplies at big savings direct from the manufacturer. Catalogue 10c. Est. 1916. National Scientific Co., 2204 W. North Ave., Chicago 47, Ill.

HYDROGEN! 10 Charges \$1.00. Inflate balloons, etc. Miles Specialties, Kokomo, Indiana.

HANDBOOK For chemical experimenters, illustrated, hundreds of experiments, 50c. Experiment booklet 15c. Supply catalog 5c. Reading Scientific Company, Reading, Penna.

STUDENTS' Laboratory supplies. Send 5c for catalog. Mel-Glo Chemical Co., 258 Fourth Ave., Brooklyn, N. Y.

APPARATUS. Chemicals, ounce quantities, catalog 5c. Fleischer's Laboratories, Everett 49, Mass.

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

FREE Catalog. Chemistry, mineralogy, biology, optics. Tracey Laboratories, Evanston, Illinois.

LABORATORY Supplies. Chemicals and apparatus all descriptions. 36 page book 10c. Standard Science Supply Co., 1232 N. Paulina St., Chicago 22, Illinois.

HELP WANTED

"LATIN America Opportunities." \$1.00 brings copyrighted 1947 research report listing specific firms and tells how-when-where to apply for opportunities in mining, oil, aviation, etc. Many men have secured lucrative jobs through this research report. Pan Americana, 1663 N. Highland Ave., Hollywood 28, Calif.

AGENTS WANTED

AGENTS. Substantial profits. Repeat order product. Not mere "job" but opportunity establish steady income. Additive lubricant. Limitless field. Factories, autoists, service stations, fleet owners buy in huge quantities. Write Kidder Oil Company, LaCrosse 1, Wis.

ODOR "Mufflers" finest refrigerator deodorizer for ice boxes, closets, kitchens. Retail \$2.00. Sell consumer and retailer. Big profits, exclusive territory. Write L. A. Muller, Continental Bldg., Los Angeles.

FREE Illustrated catalog—hard to get merchandise. Get it now! American Merchandising, Dept. PM-WC, 12 Adams, Montgomery, Alabama.

JOBBER. Distributors for high-grade line of tropical feather bird pictures native to Mexico; birds made entirely of "genuine feathers," artistically framed. Feather-craft Studios, 220 South State Street, Chicago 4, Illinois.

MAKE Up to \$50 a week in spare time selling greatly in demand kitchen oil burners. Write: Oil Burner Supply Outlet, P.O. Box 327, Cambridge, Mass.

AGENTS—Co-publish, world's largest mail-trade magazines. Complete details. 25c in coin. Briggs & Garberina Co., 3446 Cottman Ave., Philadelphia, Penna.

2 PROFITABLE Sellers: Silver Plating Liquid (NuSilver—RePlateO—trademarks). Simply apply with a cloth and polish-up, or immerse article in Liquid 1 minute and polish-up. This is a method of chemically applying silverplating in 1 minute to certain affinitive metal surfaces, like Sterling and silverplated ware, nickel-silver, german-silver, brass, copper, bronze, zinc, and some other metal compositions. Deposits genuine pure silver 1000 Fine. Gives a durable and lasting finish. Formula perfected in 1926-27 and sold successfully now for over 19 years. Has over a thousand uses. A very profitable seller at about 4 for 1. Lectrik Silver Kleener Atomic Metal Electrode Plates, for de-tarnishing silverware (and other metals, too) quick. As many as 100 pieces of tableware can be de-tarnished in 1 minute. This is the original metal de-tarnishing Plate invented in 1907, and now sold successfully for over 39 years. This is a demonstrating money-maker with a margin of 5 for 1. Both of these items are thrilling demonstrators. To any one who will get out and cover territory and demonstrate and sell, real money can be made. Exclusive territory demonstrating sales—distributors are wanted in all territory not being worked now. Wholesale and retail. Men and women. Work yourself and appoint agents and dealers throughout territory. This work is permanent if you will do the job. Complete details free by letter mail. Nu-Process Products Laboratories, Dept. 260, Aurora, Illinois.

\$1 STARTS You in business. Sell De-Luxe ties, 100% wool interlining. Costs you only \$7 per dozen, you make \$5.00 dozen. Send \$1.00 for special introductory offer two DeLux ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. K-6, New York 10.

PLASTONE—Amazing new polishes for floors, furniture, autos. Beautifully packaged. Low priced. Whirlwind seller to stores, gas stations, homes. Fast repeater. Big profits. Unconditional money back guarantee. Write for free samples offer now! Plastone Company, 2207-A West Chicago Ave., Chicago 22, Ill.

\$1.44 PROFIT On \$2.00 sale to dealers. Klisem Baits, Painesville, Ohio.

BALLOONS. Available now in all colors and sizes. Write for prices. Unger Novelty, 506 South Canal St., Chicago, Illinois.

STRANGE "Dry" window cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 129, Akron, Ohio.

SELL Fast moving punch board premium deals to taverns, roadhouses, drug stores, cigar stores, etc. Send for big profit deal. Howard Machine Products Company, 2754 Diversey Blvd., Chicago 47, Ill.

100% PROFIT. History World War II. Tremendous seller. Schlake, Box 813, Cincinnati 1, Ohio.

GREETING Card money-makers. Write for folder. Greenport Art Company (Dept. 128), Brooklyn 15, New York.

AGENTS—Big money for men, women, boys, girls—selling gorgeous night-glowing orchids, gardenias; perfect imitation real flowers, last for years, all the rage for wear on hair or clothes. Write for wholesale prices. Marney's, Dept. M-5, P.O. Box 581, Ogden, Utah.

CASH In on OPA restaurant price removals. Sell menu display signs, banners. We ship hand painted to order. Thirty dollars daily easy. Juanita Mitchell, La Verne, California.

SELL Personalized soap. Name on every cake. Ideal for gifts. Get sample offer. Dunbar Soap, New Brunswick, N. J.

AGENTS—Cash in on this amazing new Xmas gift item—"The Champ" Giant Piggy Bank, holds \$1000 in coin, large as a watermelon, hand-painted decorations. \$3.98 retailer, samples are \$2, f.o.b. Chicago, refund if not satisfied. Act now! Nation-Wide Merchandise Co., 64 W. Randolph St., Chicago 1, Ill.

100% PROFIT! \$20.00 Worth polishes, etc., \$10.00. Renschler's, Carrollton (2), Kentucky.

NEWLY Patented attachable pipe device. Cooler, cleaner, drier smoking. Less re-lighting. 50c each, three for \$1.00. Agents free demonstrator, profitable. Morris Sales, P.O. Box 1136, Atlanta 1, Ga.

WONDER Rat boards. A new type trap made of special glue. No poisons, no disagreeable odors. "Like catching flies on flypaper." Cost \$4.00 dozen, \$45.00 gross. Resell at \$9.00 dozen, \$100.00 gross. Star Exterminating Co., 2958 Nostrand Ave., Brooklyn 29, New York City.

SELL Reflective name plates. Business signs. Elmer Vandrey, Truman, Minnesota.

RUBERLYKE Plastic foneholder. New, novel, fast selling. Retail, 60c. Fair-traded. Everybody a prospect. You also sell retail outlets. Fits all phones. Telephone rests on shoulder. Leaves hands free. Sample 50c. Reyam Plastic Co., Dept. P-12, 1525-A-East 53rd St., Chicago 15.

SENSATIONAL. Exciting, new, fully enameled any color, chrome-plated, durable, non-tarnishing miniature midget racing car pins, tie holders, belt buckles. Write Hook-Fast, Box 425, Providence, R. I.

MEXICAN Curiosities. Biggest line. Lowest prices. Prompt delivery. List free. I.I.E.A. Lucerna 63-8, Mexico City.

MAKE \$15.00 Daily in plastics. How? Send your favorite snap shot and \$1.00 for sample and complete details. Plexart, Box 1976, San Antonio, Texas.

SILVER Plating liquid (contains pure silver). Simply apply with a cloth. Silver plates permanently onto silver, copper, brass, bronze and zinc. Once applied it is there to stay. Shines to a brilliant lustre. Sample free. Nu-Lustre Products, 88 Paterson Ave., Paterson 2, New Jersey.

BIG Profits operating as our exclusive distributor your territory. State agencies open. Quaker Medicine Co., 220 George St., Cincinnati 2, Ohio.

FREE—Mexican novelty curiosities. Fastest selling items. Biggest profits. "Productos," Apartado 9218, Mexico City.

WONDER Cleaner, new bubble bath, Glasklean—three profits. Fast sellers, homes and stores. Circulars free. Courier, 3829-I Delmore, Cleveland Heights 21, O.

SELL Full, part time individualized belts, buckles, cap badges, tie holders, 2,000 emblems to choose. Fast profits. Repeats. Write today special outfit offer. Hookfast Specialties, Box 1425, Providence, Rhode Island.

SELL Superb line personal printed stationery. High quality items, year 'round sales. Attractive sample book, supplies free. Writewell Stationery, Dept. 113, 108 Massachusetts Avenue, Boston.

LOOK: Agents. Golden rays kit. New, different. Fast seller, big profits. Sample kit \$1.00. Clinton Sales Co., 237 So. 4th St., Hamburg, Penna.

MEXICAN Feather pictures. Christmas novelty. 50c (stamps) bring \$2.00 worth samples, details. Refunded if unsatisfied. Aztec Art, Apartado 762, Mexico City.

NO Money or experience required. Spare or full time writing orders for guaranteed men's hosiery. We deliver and collect. Advance profit and 33% cash bonus. Huge demand everywhere. Steady repeat business. Write for free sales outfit including everything needed to make money. Kentcraft, 44 Court St., Dept. KM, Brooklyn 2, N. Y.

SELLING To housewives? Double your sales with inexpensive premiums. Postal brings interesting details. A. Kinford, Wayne, Penna.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also make money applying initials on automobiles. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

HOUSE Numbers that glow in the dark. Luminous pictures, etc. Large mfr. wants factory representative. Wonderful new product. Fast seller. Free samples. Madison Mills, 303 4th Ave., New York City.

AGENTS: Do you want \$50 per week? Selling a profitable line of fibre brooms, mops and floor dusters. Write, Burtz Fibre Broom Co., Columbia, Pa., Dept. A.

AGENTS—Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big profit offer with gift. Ho-Ro-Co, 2796 Dodier, St. Louis 7, Mo.

SELL Books by mail. Mammoth sales and huge profits. Everything furnished. Send 10c for complete details. Business Plans Foundation, Box 56-R, New York 10.

AMAZING Seller: "Soilless Garden Chemical." Grow plants, vegetables, fruits, flowers all year round without soil. In or outdoors. Tremendous demand. Excellent profits. Literature free. Nega & Co., 1824 W. Dickens, Chicago 14.

SCHOOL Seniors—Sell classmates America's most beautiful, distinctive graduation name cards. 40% commission. Largest selection. Lowest prices. Free cards and sample kit. Printcraft, 1425 E. Elm Street, Scranton 5, Penna.

JUST Out! History of World War II. Huge volume. Popular price. Authentic text. Official photographs. Big profits. Riverside Book Company, Iowa Falls, Iowa.

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

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

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

200 MONEY Making deals. Plans, rare formulas. Schemes. Folio free. Formico Service, Box 572, Dayton, Ohio.

137 COMPLETE Plans for starting own business: local—mail order. Particulars free. Elite Co., 220-A Grand St., New York 13.

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

\$3 FIRE Extinguisher; quick sales, wholesale or direct; liberal profits. "Fire-Killer," 109 N. Franklin, Syracuse 1, N. Y.

PLATING Outfits for autoparts, reflectors. Connect to a battery. No tanks necessary. Free booklet and particulars. Gunmetal Co., Ave. N, Decatur, Ill.

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

"OUR Flag"—famous picture. Four colors. 500,000 sold. Sample print—free. Our Flag Sales Corp., Dept. C1076, Excelsior Springs, Mo.

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

HIGH-GRADE SALESMEN

SELL Gift shops, department stores, etc. Write Kimley, 103 Highland, Williamsville, N. Y.

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

"WORLD'S Latest" Since advertising specialty and calendar samples ready for high grade representatives. Effective as atomic power! Inquire by letter. Postcard applications not considered. The H. W. Singleton Co., Dept. P.M., Salt Lake City, Utah.

LARGE Earnings! Your own business supplying household food and drug necessities to consumers! Free details. Hollenbush Products, Dept. PM, Pottsville, Penna.

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

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding—to restaurants, menu covers, signs. Pricing Press, 124 White St., Dept. P, New York 13, N. Y.

SALES Representative to call on radio, music, appliance dealers, servicemen with nationally advertised line of test equipment. Generous commission. Metropolitan Electronics, 6 Murray St., New York City.

ADVERTISING Calendar. New, 12-in-one! Entirely different. Samples 25c. Simplex, 225 Second, Lombard, Illinois.

COALOID—The chemical saves fuel, money, labor. Unconditionally guaranteed. 1945-46 no refunds, dissatisfaction. 10 ton treatment \$2.00. Sample 18c postage. Coaloid Company, Waterloo 2, Iowa.

WAGON—Jobbers, agents! Big profits selling stores, individuals sensational ball point pen. \$2.98 retailer. Free details; also list hundreds fast sellers. Salesmanager, Box 27, Atlanta, Georgia.

TAX Law forces merchants keep records, sell Green's; every merchant your prospect; big commissions; yearly repeat business. Mill-Green Publishing Company, 370 Seventh Avenue, New York.

GOOD Income, spare or full time, selling large selection national woolen mills fabrics by the yard for men's, women's tailoring. Natural opportunity. Write samples, information. Western Fabrics, 832 S. Spring, Los Angeles 14, Calif.

SALESMANAGERS Needed every city. Make surveys for management engineering firm. (See our ad under Special Services.) Valuable training available. Gerald E. Sims & Associates, 120 S. La Salle, Chicago 3.

TIRE Reliners. Every filling-station a prospect. Hottest item in years. Allied Rubber Company, East St. Louis, Illinois.

SELL Record of Service certificates. All data from discharge paper may be copied on certificate for framing. Sales made easily. Sample \$1. Wilbur Sales Company, Box 451, Plymouth, Mass.

ORANGES, Most delicious, bursting full with health giving juice and vitamins, from our famous Indian River groves direct to consumers. Employers are placing now Christmas gift orders for employees and customers. Salesmen earn over \$100.00 commission weekly. Sunset Valley, Oak Hill 7, Florida.

QUICK Profits with individualized belts, buckles, cap badges, tie holders, uniforms. Choice of thousand emblems. Sure repeat orders. Easy-selling outfit offer. Write Hook-Fast Company, Dept. 12, Roanoke, Virginia.

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THE Inventor who believes he has a new and useful invention, and needs advice, should consult a competent registered patent attorney. Without obligation, write for full information on how to secure patents and trademarks. Randolph & Beavers, Registered Patent Attorneys, 11-E-Columbian Bldg., Washington 1, D. C.

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MERCURY—Highest prices. Free containers. Write. Wholesale Terminal, Norwood, Mass.

MERCURY (Quicksilver). Write for quotation stating quantity. Metallurgical Products Co., 35th and Moore Sts., Philadelphia, Penna.

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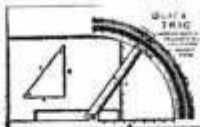
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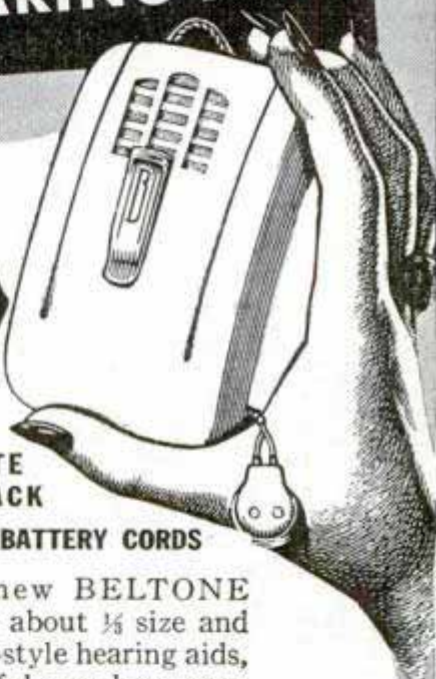
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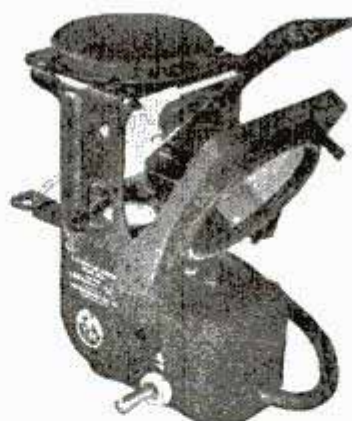
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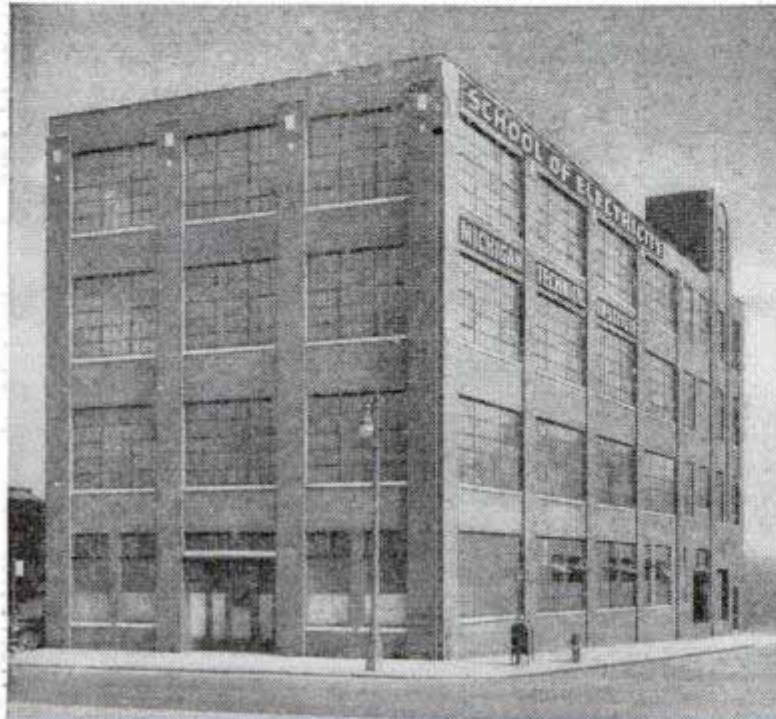
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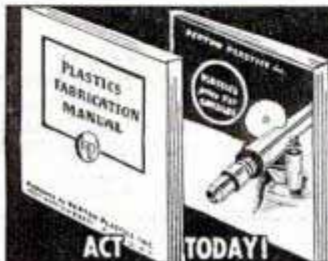


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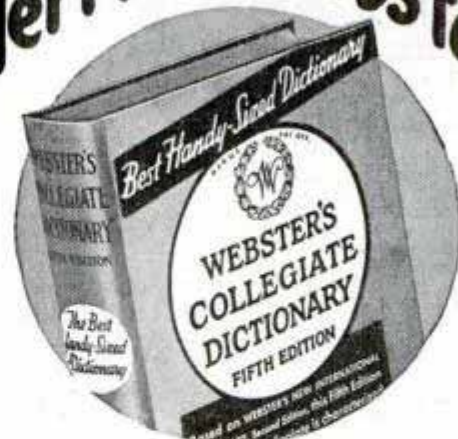


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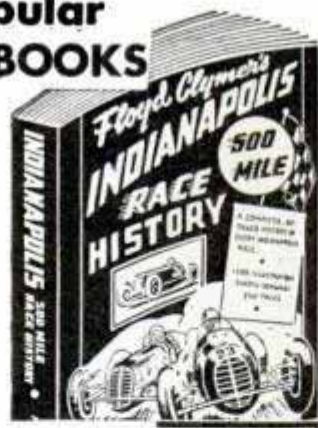
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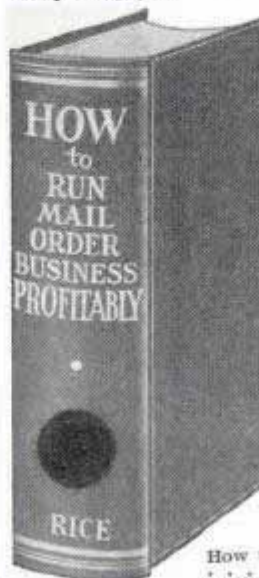
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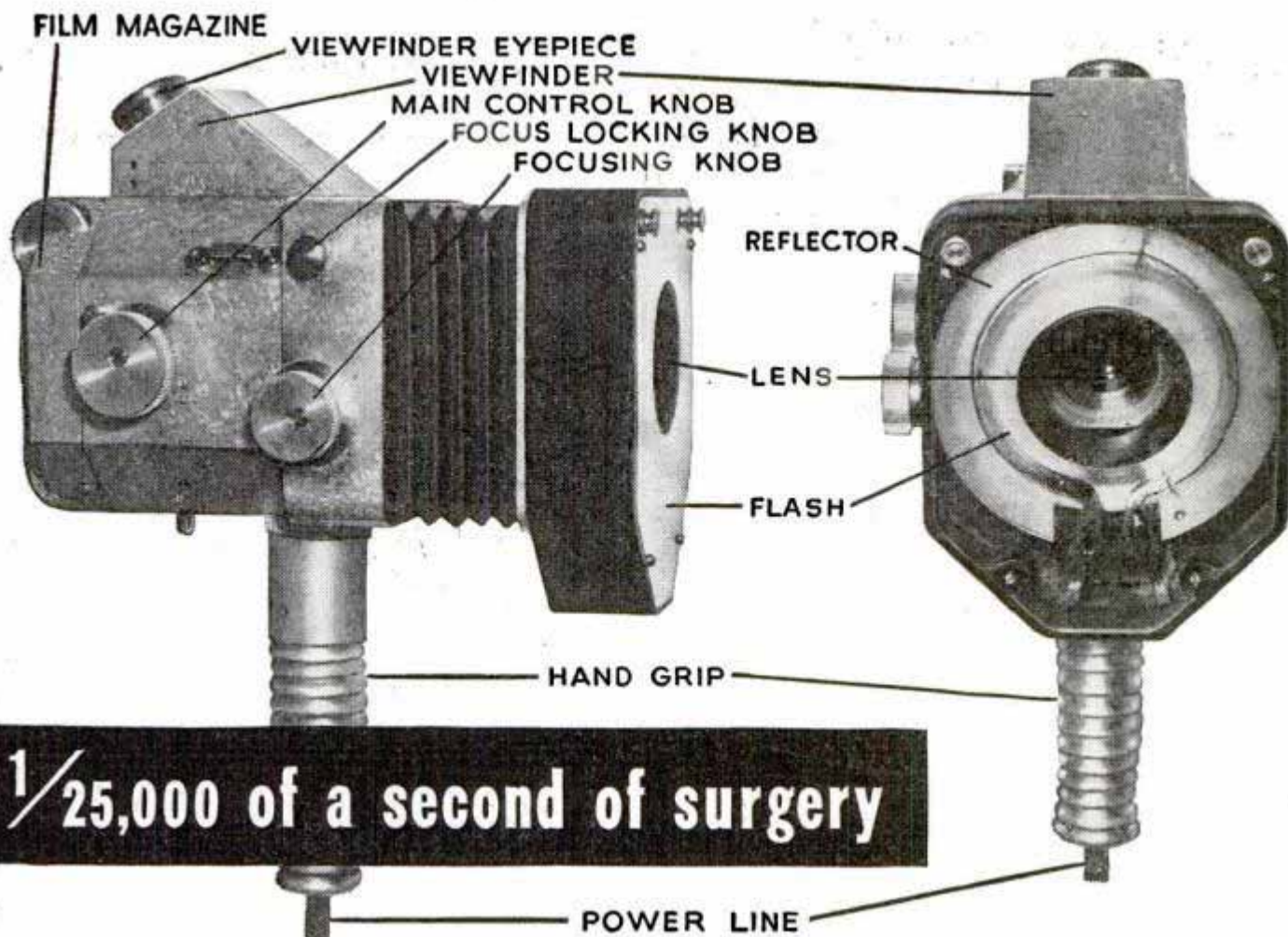
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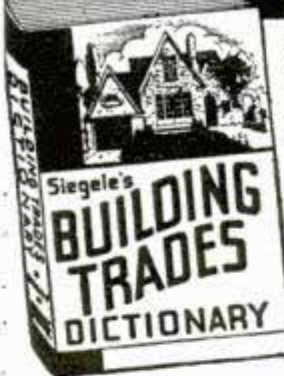
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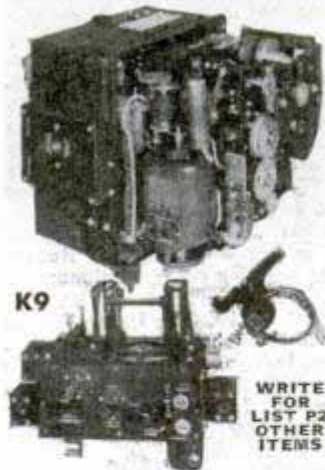
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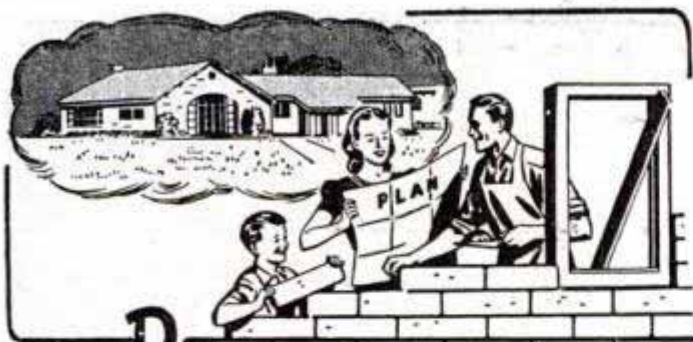
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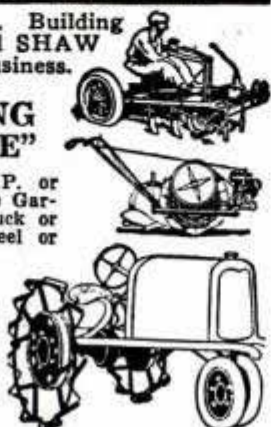
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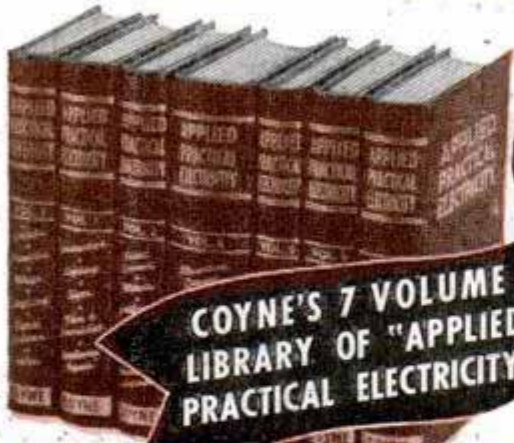
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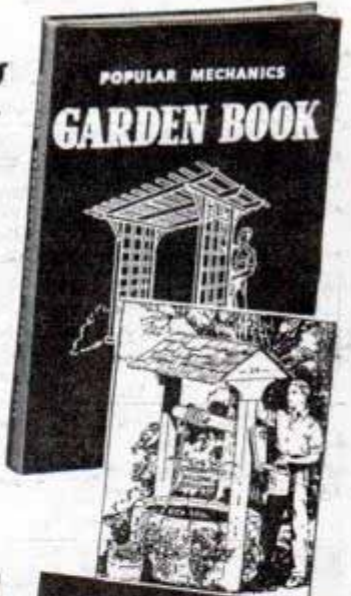


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#514—Plastic case. Has scout knife, safety razor, blades, plastic oil can, whistle, fire tabs.

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U.S.N. Sheath Knife #703 **2⁵⁰**

#703—Parkerized no-glare 6" blade. Leather washer handle. Genuine leather sheath.

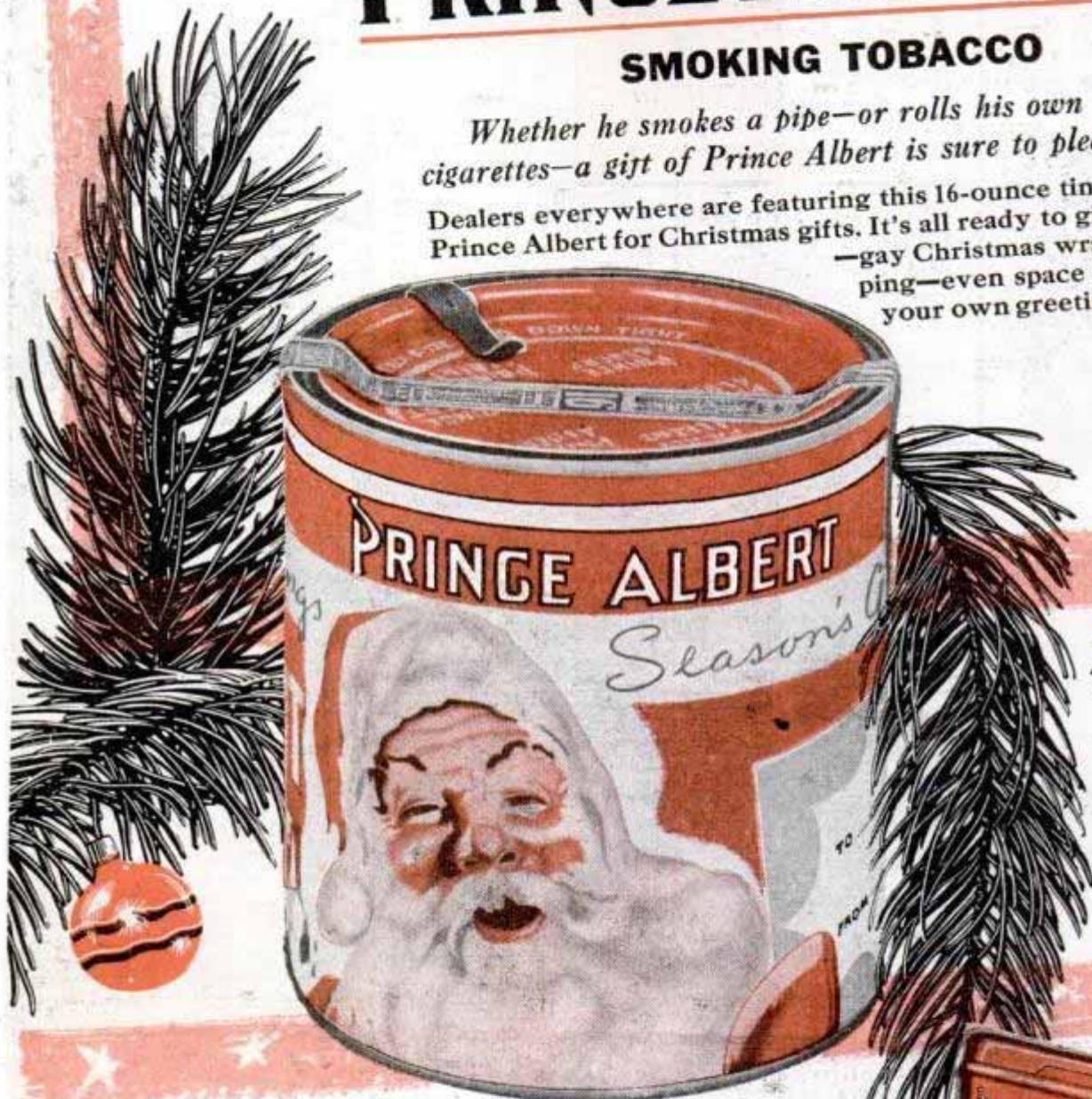
FEDERAL SURPLUS CORP. 3 EAST 4th ST. NEW YORK 3. HOW TO ORDER: Order by number. Remit by money order or bank draft. Send 30% deposit on C.O.D. orders. No C.O.D. orders for less than \$3.00 total.

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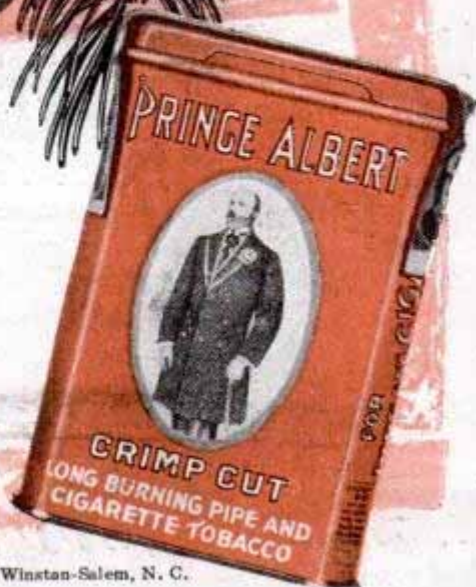


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By Commander Walter S. Reid, USN

OUR RECORD FLIGHT nearly half-way around the world was not done for melodrama. It did have its thrilling moments, probably the greatest of which was that uncertain moment of takeoff.

The 11,236-mile nonstop flight from Perth, Australia, to Columbus, Ohio, in the "Truculent Turtle" was carefully planned to accomplish two main missions: First, to test standard equipment for long flights and, second, to observe the physical and psychological reactions of personnel on long flights and learn at what point dangerous fatigue sets in.

For the most part our airplane utilized standard equipment and we practiced standard operating flying techniques during the 55 hours and 5 minutes we were in the air. We relied entirely on celestial navigation across the Pacific. With the exception of extra fuel capacity, everything on the flight was normal, even to the feeding and sleeping arrangements.

We took off from a 6000-foot macadam runway at Pearce Airdrome (RAAF airfield), 35 miles north of Perth, into an estimated seven-knot wind. The Turtle,

Copilot and engineer of the "Truculent Turtle" on her record-making 11,236-mile flight, the author, right, had his most trying moment at takeoff, with 8450 gallons of high-test gasoline against his back. Above is the plane's insignia and, top, JATO units boosting the huge "flying gas tank" into the air

I RODE

THE TURTLE





U. S. Navy photo

Attaching a jet-assist takeoff bottle to the fuselage

with her 8450 gallons of fuel and 220 gallons of oil, weighed more than 85,000 pounds, the greatest weight ever lifted by a two-engine airplane. While high wing loadings are common in high-speed aircraft, the

wing loading in excess of 85 pounds per square inch, which the Turtle had at takeoff, was one of the highest ever attempted for this type and size of aircraft.

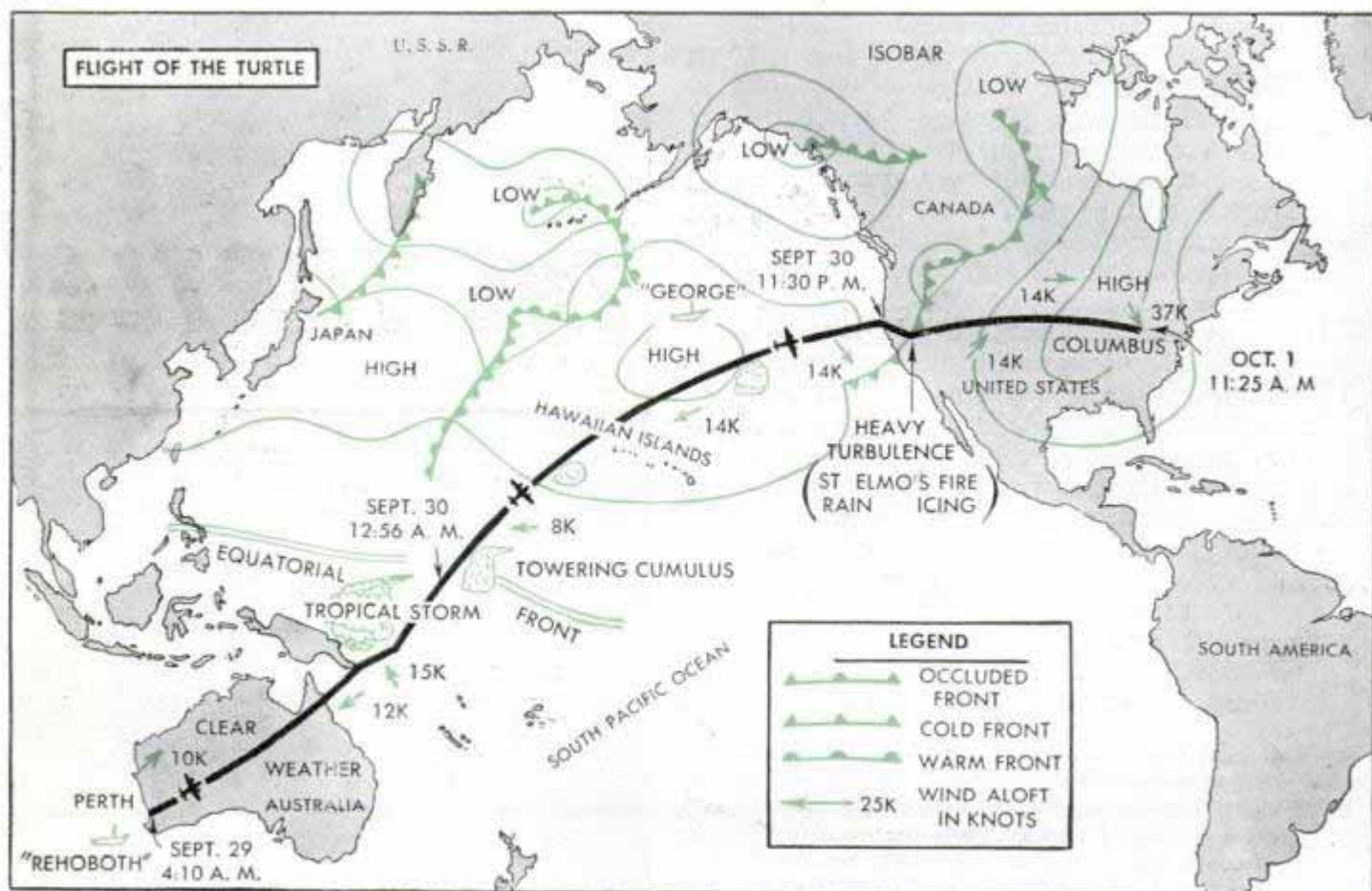
My position during the takeoff was the fuel dumping station, which is next to the aft fuselage tanks. If we crashed during takeoff I would have been in for a hot time with all the high-test gasoline against my back. As the Turtle roared down the runway I was mentally calculating the time it would take me to crawl out the aft emergency hatch.

The technique for takeoff consisted of the pilot's holding the brakes and running up the engines to full power. Upon reaching full power, the brakes were released and the benefit of full power realized immediately as the Turtle began to roll. Acceleration of the heavy load was slow and gradual. At about 3500 feet, 85 knots (93 miles per hour) was reached and the four JATO (jet-assisted takeoff) units were fired. This burst of extra power gave the Turtle the kick in the pants she needed. She left the runway at the 4700-foot mark, indicating 110 knots (127 miles per hour).

The wheels were pulled up immediately and were almost fully retracted by the time the end of the runway was reached. Flaps had been set at 20 degrees and were retracted by small stages after the airplane had reached 140 knots and 300 feet.

The flaps are designed to form a contin-

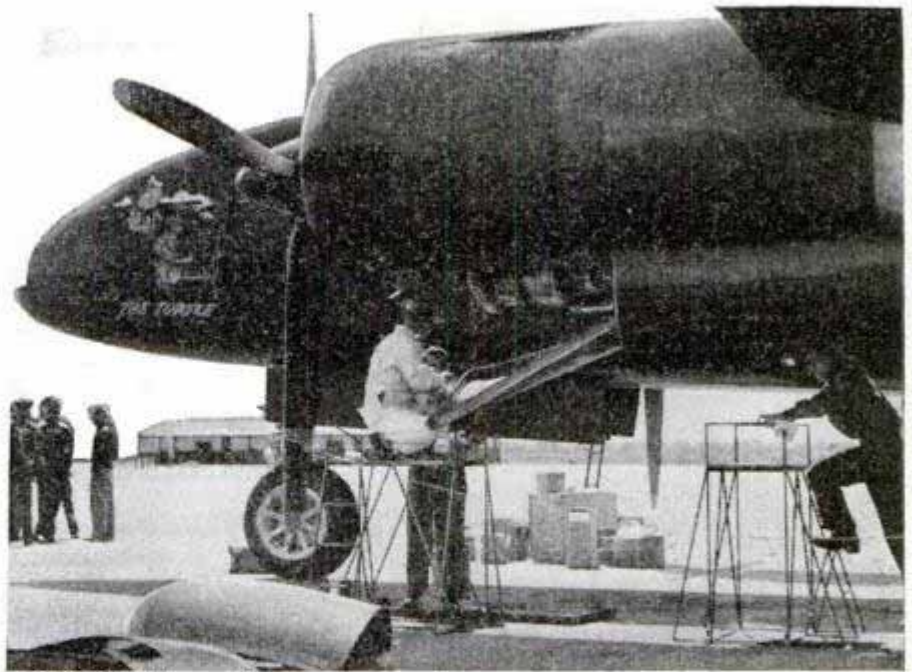
U. S. Navy map showing weather conditions encountered en route during the 55-hour trip from Perth to Columbus



uation of the trailing edge of the wing when they are partially or fully extended. The top side of the flaps is smooth and unbroken. The underside is broken only at the screw jacks. The flaps retract along the underside of the wing in the typical Fowler flap fashion.

While the main gear tires were changed from 16-ply to 18-ply for the flight, no other alterations were made to the landing gear or retracting mechanism. The landing gear can be handled by either the main hydraulic or emergency hydraulic systems. These systems can be operated electrically or manually, giving the airplane four separate systems for raising or lowering the landing gear.

The fuel system consisted of the normal inboard and outboard wing fuel tanks, extra outboard wing cells (nylon), a bomb-bay tank, a nose tank, an aft fuselage tank and a wing-tip tank on each wing. The engines took suction only from the main right and left inboard service tanks. The



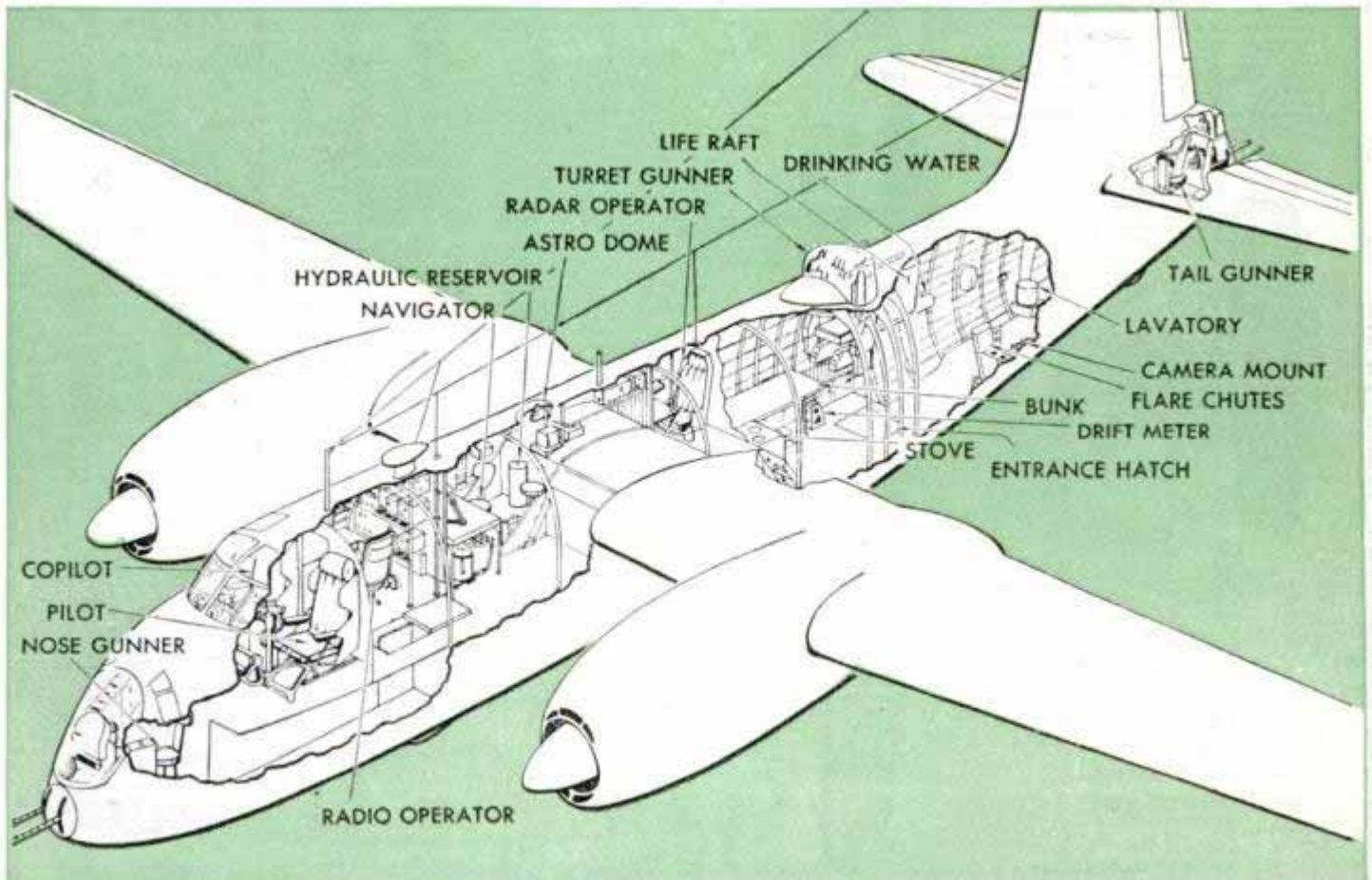
U. S. Navy photo

Lockheed technicians giving engines a last-minute check before takeoff

fuel from other tanks was transferred into the main inboard tanks from time to time to augment the main supply.

The transfer was regulated to maintain a minimum shift of the center of gravity of the airplane. Transfers were made from the fuselage tanks first, in order to keep the weight properly distributed throughout the wings. The shifts were made in 400 to 500-gallon lots which were evenly

Cutaway diagram of crew stations in combat version of the Lockheed P2V Neptune. Its wing span is 100 feet and length 75 feet 6 inches. Its height of 28 feet 1 inch is equivalent to that of a three-story building



Aerodynamically one of the cleanest airplanes ever built, the long-range Neptune is driven by two 2500-horsepower Curtiss-Wright engines



distributed between the two service tanks.

Through a system of piping, valves and pumps, the fuel from all auxiliary tanks except the wing-tip tanks passed by the fuel transfer station from which all pumps and valves were controlled. The fuel transferred registered on electrical flow meter counters.

A positive fuel transfer indicating system was set up to indicate, by means of a light, everything that passed through the fuel lines. If air was passing in the line a bulb would light; if a combination of air and fuel was passing, the light would blink; if only fuel was passing the light was out.

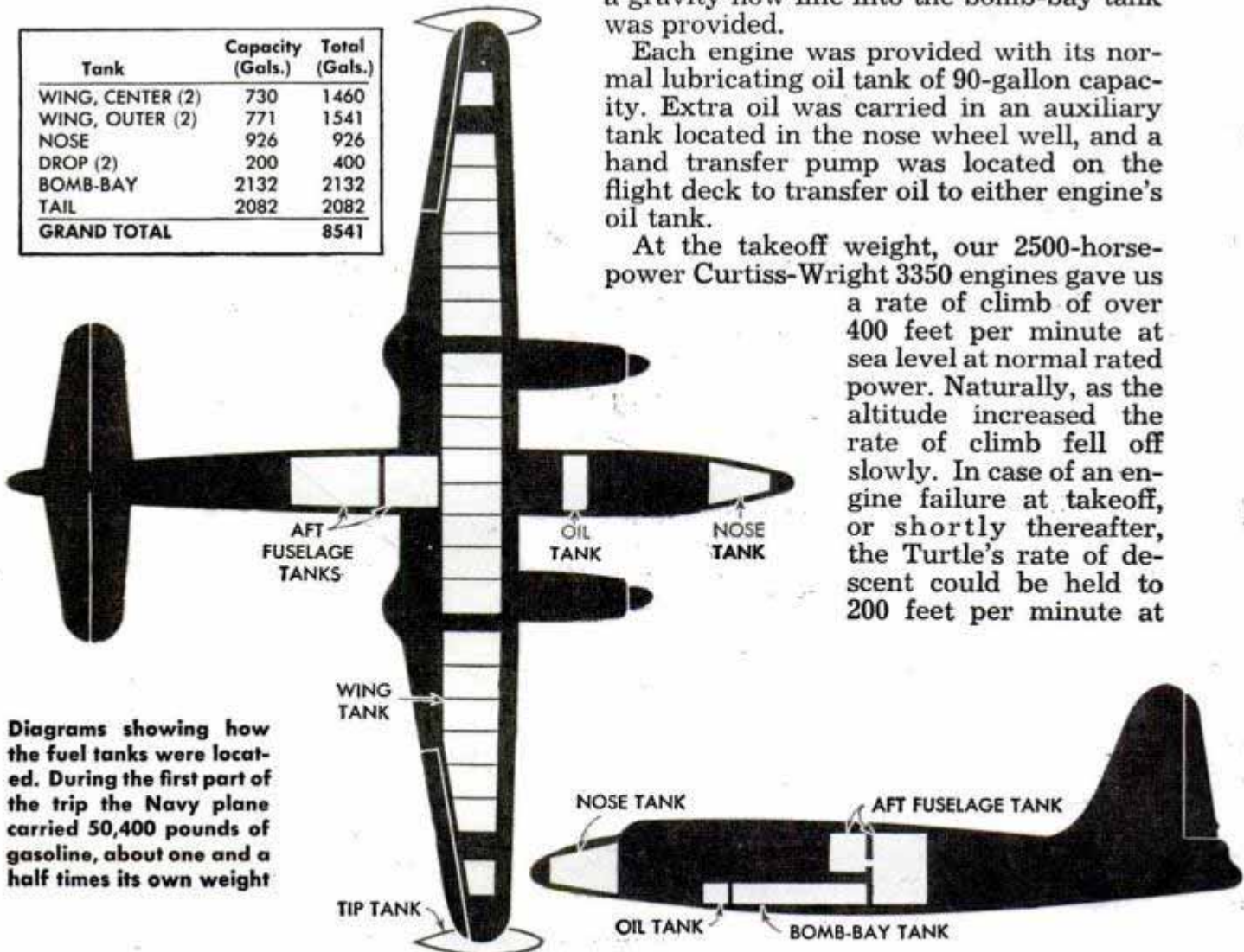
Each wing-tip tank had its own submerged electric pump controlled from the fuel transfer station. After the wing-tip tanks were emptied they were dropped off their bomb shackles, electrically, in the same manner that auxiliary fuel tanks are dropped off carrier airplanes.

The electric fuel transfer pump at the fuel transfer station was augmented by a high-capacity hand transfer pump. Fortunately it was not necessary to use it. Also as a positive means of getting the fuel from the outboard wing tanks into the main fuel tanks, if the normal inlet lines to the pumps clogged or topside tank connections broke, a gravity flow line into the bomb-bay tank was provided.

Each engine was provided with its normal lubricating oil tank of 90-gallon capacity. Extra oil was carried in an auxiliary tank located in the nose wheel well, and a hand transfer pump was located on the flight deck to transfer oil to either engine's oil tank.

At the takeoff weight, our 2500-horsepower Curtiss-Wright 3350 engines gave us a rate of climb of over 400 feet per minute at sea level at normal rated power. Naturally, as the altitude increased the rate of climb fell off slowly. In case of an engine failure at takeoff, or shortly thereafter, the Turtle's rate of descent could be held to 200 feet per minute at

Tank	Capacity (Gals.)	Total (Gals.)
WING, CENTER (2)	730	1460
WING, OUTER (2)	771	1541
NOSE	926	926
DROP (2)	200	400
BOMB-BAY	2132	2132
TAIL	2082	2082
GRAND TOTAL		8541



Diagrams showing how the fuel tanks were located. During the first part of the trip the Navy plane carried 50,400 pounds of gasoline, about one and a half times its own weight

military power (which would be used) on one engine. It was felt by us, the pilots, that at an altitude of a thousand feet or more we could save the airplane—and ourselves—by dumping fuel.

The Turtle was equipped with a fairly simple, easy, quick-operating fuel dumping system connecting the fuselage tanks and located at the fuel transfer station. A vertical dump chute which was almost completely retracted at takeoff—its rigged stowage position—could be lowered by one man and connected ready for dumping operations in about 1½ minutes. Just forward of the dump chute connection were located three quick-opening, handle-operated gate valves connecting the nose tank, the bomb-bay tank and the aft fuselage tank in a common joint.

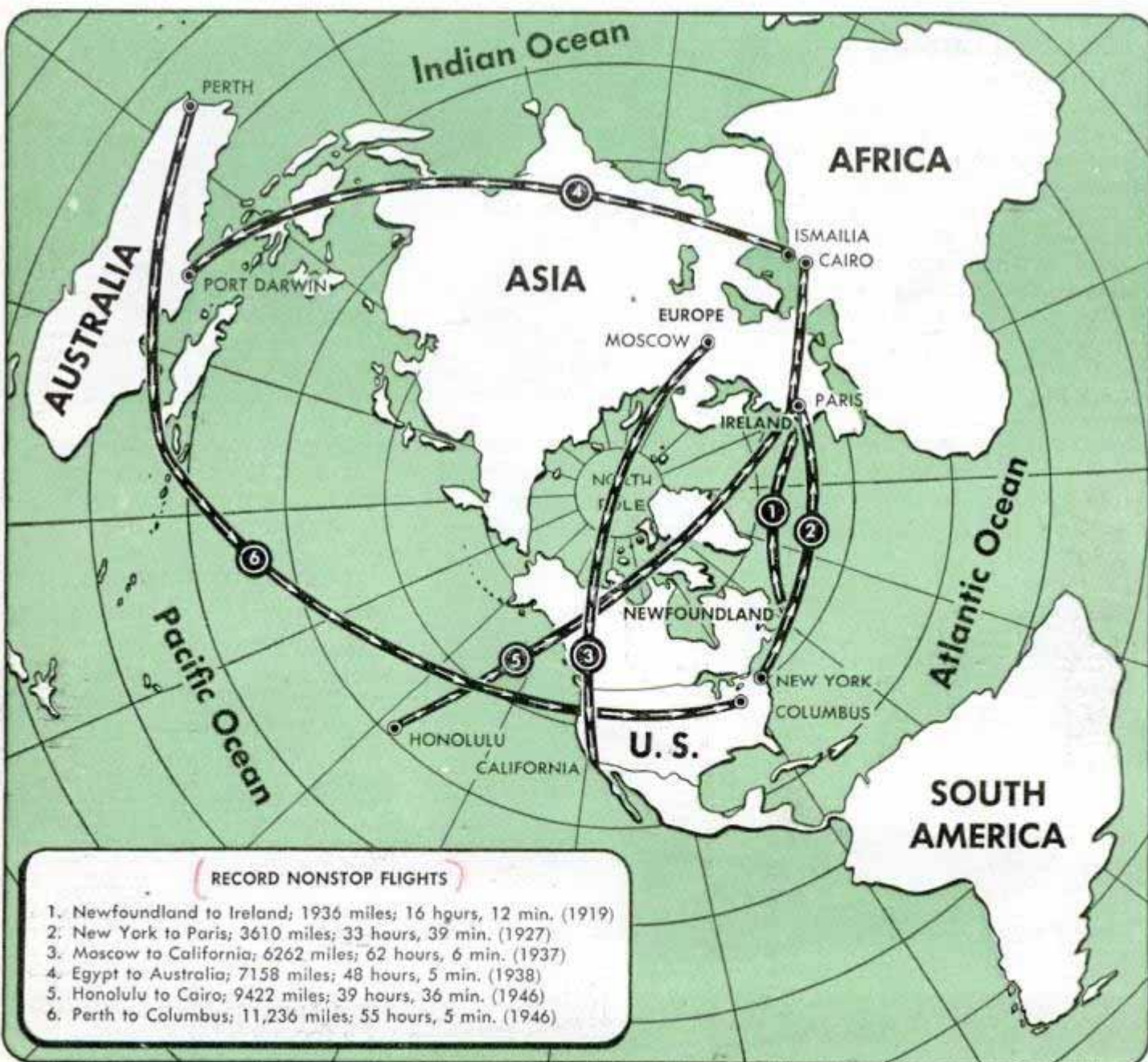
Great care would have to be exercised by whoever manned the dump valves to dump tanks in a certain sequence in order not to pull the center of gravity of the air-

plane off the flyable limits. The bomb-bay tank, being located at the center of gravity, generally could be dumped completely and quickly. The nose tank and the aft fuselage tank would have to be alternated to keep the center of gravity centrally located.

Tests conducted prior to "the big jump" indicated that all the fuselage tanks could be completely dumped in six to eight minutes. The wing-tip tanks, of course, would be dropped immediately at engine failure, thus lightening the plane by 2600 pounds. By dumping the nose, bomb-bay and aft fuselage tanks, another 29,000 pounds of fuel could be released overboard.

In broad terms, the Turtle had approximately 37,500 pounds of immediately dropable weight. In 10 minutes the weight at takeoff could be down to an entirely feasible single engine weight and safe landing weight. From an engine failure at one thousand feet shortly after takeoff, we felt

(Continued to page 268)



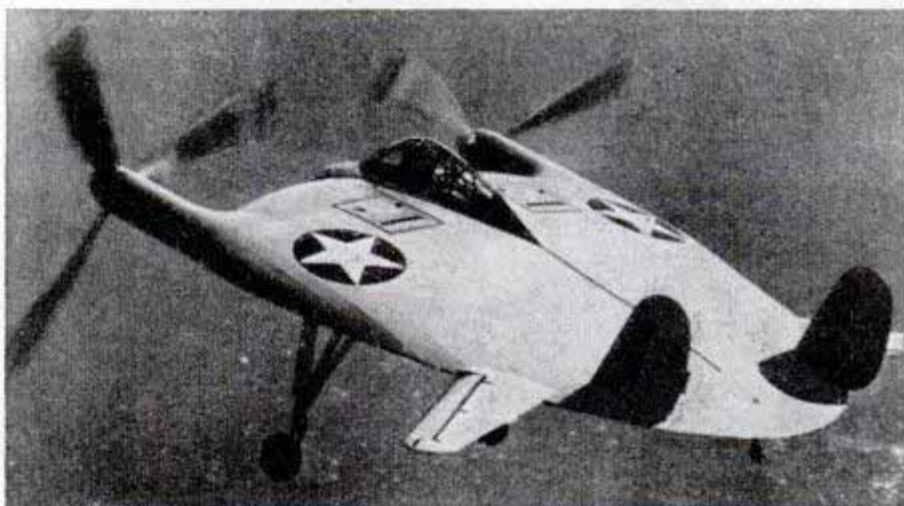
Snowplow Built From Garden Tractor Clears Sidewalks



Sidewalks at Coulee Dam, Washington, the town occupied by employees of the big dam, are cleared of snow by an efficient snowplow converted from a garden tractor by U. S. Bureau of Reclamation mechanics. The plow blades were improvised from light steel plates. The ingenious mechanics riveted scraps from an old belt conveyor to the continuous tractor treads to prevent damage to the sidewalks and to lessen noise. The snowplow is powered by a two-cylinder motor.

Heart-Shaped Plane Flies Fast or Slow

Two-speed engines permit an experimental fighter plane built for the Navy to fly fast or slow. Speeds up to 460 miles an hour or as slow as 20 miles an hour are possible. The new plane, designated the XF5U1, is patterned after an earlier low-powered flying model of wood and fabric construction. The structure of the new heart-shaped plane is stronger than that of conventional aircraft. It is powered by twin engines which, through a transmission system, turn the two propellers at approx-



imately one fifth the number of revolutions per minute of the engines. In case one engine fails, the other can drive both propellers through the transmission system.

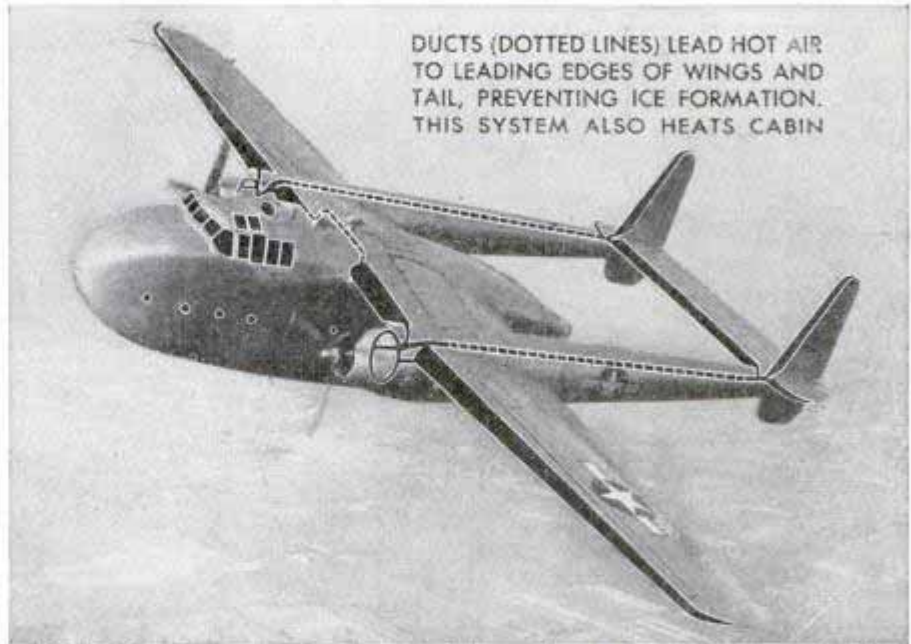


Largest Helicopter Carries 1½ Tons

World's largest and first twin-engine helicopter, the Navy's XHJD-1 will cruise over 100 miles per hour carrying a useful load of more than 3000 pounds. The big 40 or 46-foot blade rotors turn in opposite directions, intermeshing when the latter are used. Either of the two 450-horsepower engines can be hooked up to drive both rotors. The twin-rotor system does away with the need for an anti-torque rotor at the tail.

Hot Wing and Tail on C-82 Melt Path Through Icy Storm

Leading edges of wing and tail surfaces heated hot enough to fry an egg prevent formation of ice on the Fairchild Packet. The first cargo plane with a built-in wing-heating system, the Packet can be made so hot it literally melts a path through icy storms. The thermal anti-icing system extracts heat from engine exhausts and forces hot air through ducts into the wings and tail. To reach the tail surfaces, the ducts pass through the twin booms. Air scoops bring the air in and feed it to four crossflow-type heat exchangers, two for each engine, that are installed in the nacelles. The heat exchangers warm the air to 350 degrees Fahrenheit. The hot air is released through small holes in the ducts to heat the leading edges of the wings and tail to 130 degrees. The system keeps the entire wing free of ice although the heated area includes only 15 percent of the wing chord. It also supplies heat for the pilot's cabin.



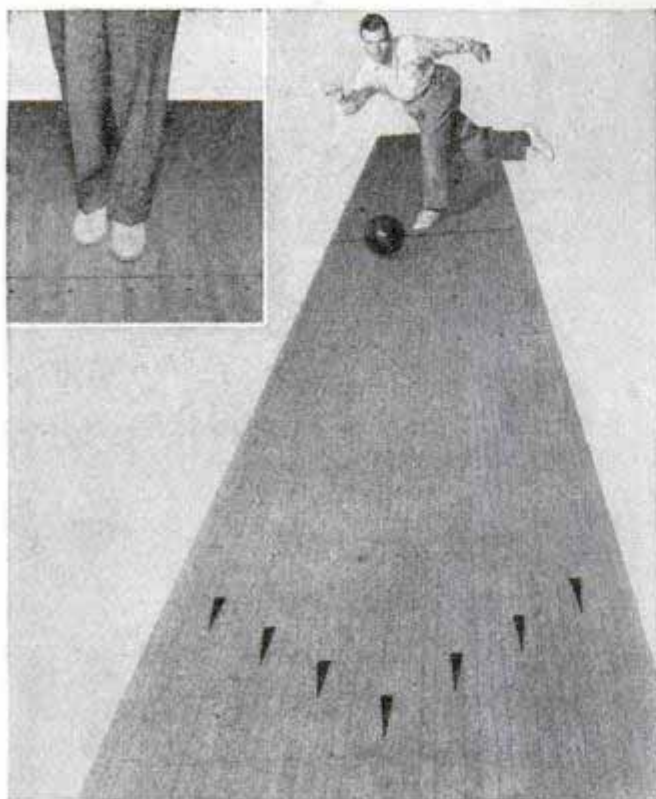
Drinking Fountain Attachment on Pump Gives Constant Water Flow



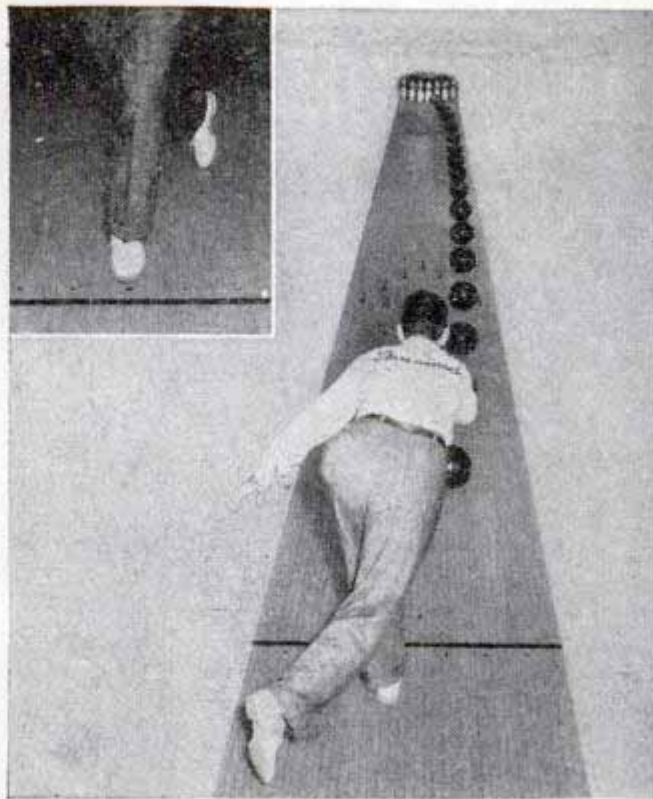
For safer drinking in areas outside the reach of public water systems, a pump designed for use as a drinking fountain makes it possible to discard the old tin cup with its rust and dirt. Sustained pressure provides a constant flow of water from a well through the fountain-pump. A few strokes with the handle build up enough pressure so that the user can take a drink without more pumping. A step for children is built on one side of the bubbler. A basin below can be used as a watering place for dogs, birds or other pets.

You may wish to obtain additional information about the new products described each month in Popular Mechanics. If you want to know the name and address of the manufacturer or distributor, just write to Bureau of Information, Popular Mechanics Magazine, 200 East Ontario Street, Chicago 11, Illinois. Your letter will be answered promptly.

Bowling Markers Provide "Rifle Sight" Aim



Crack bowler Buddy Bomar keeps his eye on new type alley marker to improve his aim. Dots on runway (inset photo) enable bowler to check starting position



String of bowling balls duplicates path of a Bomar strike hit and shows how he aims at second marker from right. Inset, position of foot at the foul line

Thousands of bowlers would improve their game if they did *not* look at the pins. The explanation is this: By drawing an imaginary line from the foul line to the head pin and aiming at a spot on that line, five to 15 feet from the foul line, a bowler increases his accuracy.

Spot bowling enables him to come closer to keeping the ball on the imaginary line than if he looks at the pins as he approaches the foul line. In the past, spot bowlers have sighted on a light or dark board in the alley when throwing their first ball and aiming at the "one-three pocket" for a strike hit slightly to the right of center of the head pin.

Recently the American Bowling Congress approved the idea of putting special markings on the alley as a guide to bowlers. This will make spot bowling as simple as aiming through the sights on a rifle.

The Brunswick-Balke-Collender Company has designed what it calls "Range-Finder" marking for bowling alleys. The photographs above show the spots and arrowhead markings used on these new alleys to help bowlers aim.

The markings consist of 10 fiber dowels (dots) in a line across the alley seven feet from the foul line, and seven arrowhead inlays—called darts—erected in the shape of a giant arrowhead with the point 15 feet 10 inches from the foul line. In aiming,

the bowler can use a dot or a dart or he can sight on both dot and dart in the manner of a hunter looking through rear and front sights on a rifle. Hook bowlers have to take into consideration the amount of hook they put on a ball. By experience they learn how far to the right of a marker they must aim to make allowance for the curve.

In addition to the alley markings, Range-Finder alleys are equipped with three rows of dowels, or dots, on the runway to guide the bowler as he approaches the foul line. Many bowlers unconsciously fail to keep on a straight line as they run toward the foul line. They veer to the right or left and spoil their chances for a strike or spare.

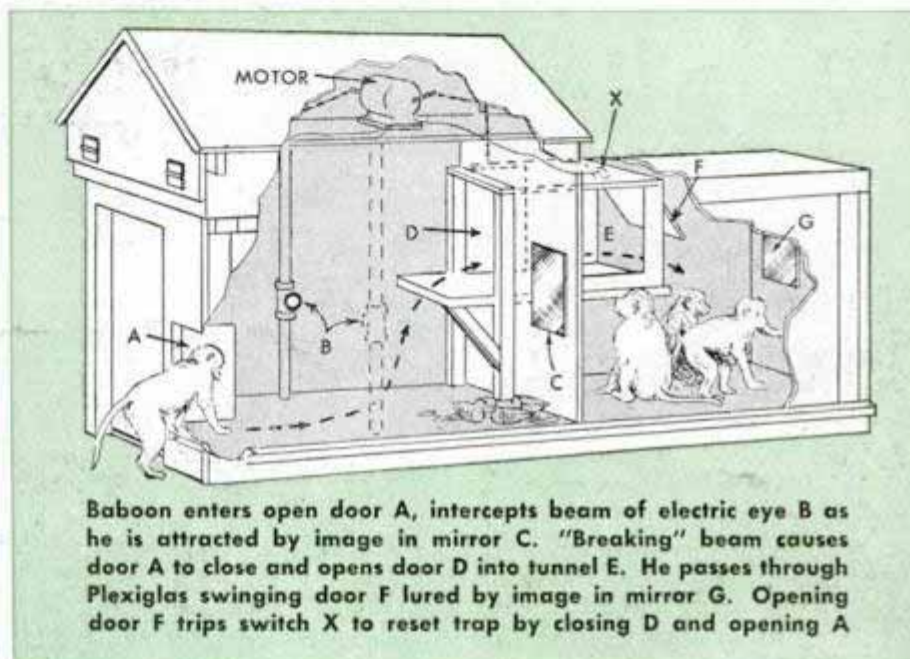
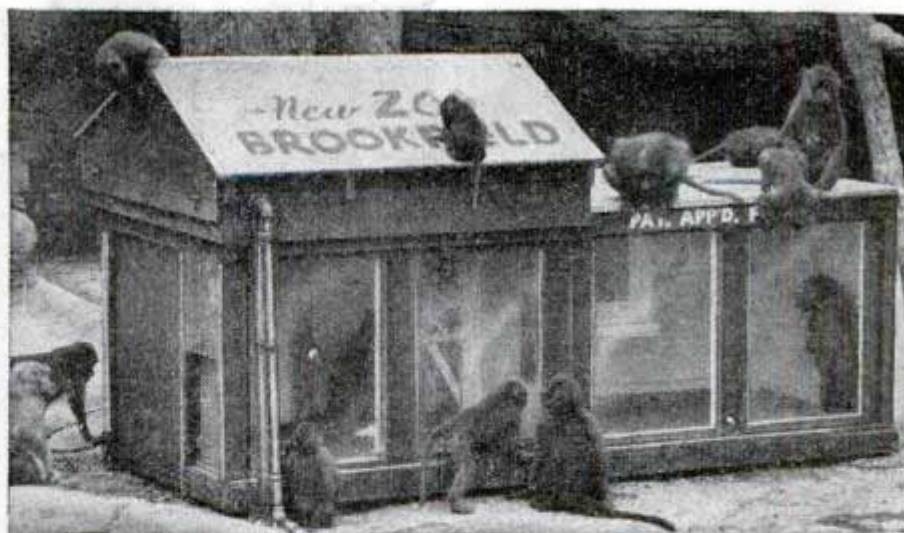
To eliminate this tendency Range-Finder alleys have seven dots 15 feet back from the foul line, seven dots 12 from the foul line, and seven dots at the foul line. By noting the position he takes at the 15 or 12-foot line, the bowler can check his position at the foul line and find out if his approach is on a straight line.

Main purpose of all these markers is to help the bowler get a strike. However, the same system can be applied to shooting spares. For a spare, the bowler takes the proper position, draws the imaginary line, sights and shoots.

A number of Range-Finder, or "rifle shot" alleys, were installed at Army camps and naval stations during the war.

Electric-Eye Trap Fools Baboons

Harassed keepers at Chicago's Brookfield Zoo have solved the annual problem of catching apes on "monkey island" with a homemade electronically operated trap. The picturesque island of towering rocks and sharp drops was not designed for the convenience of keepers corralling baboons for winter quarters. The two-room trap attracts the wary baboons with food and strategically arranged mirrors. As an ape walks across the first chamber he intercepts an electric eye beam. This closes the front door and opens another door leading to a short tunnel. At the end of the tunnel is a swinging Plexiglas door through which the baboon can see his image in a mirror on the back wall of the inner chamber. As the ape kicks this door open and leaps ahead, a switch is tripped which resets the entire mechanism, closing the middle door and opening the front door. As the inner chamber fills up, a cage is pulled to a back door and the baboons are removed. The trap was built by Ralph Graham and Holly



Jeffries. Robert Bean, director of the zoo, believes it has possibilities for catching wild animals in the jungle.

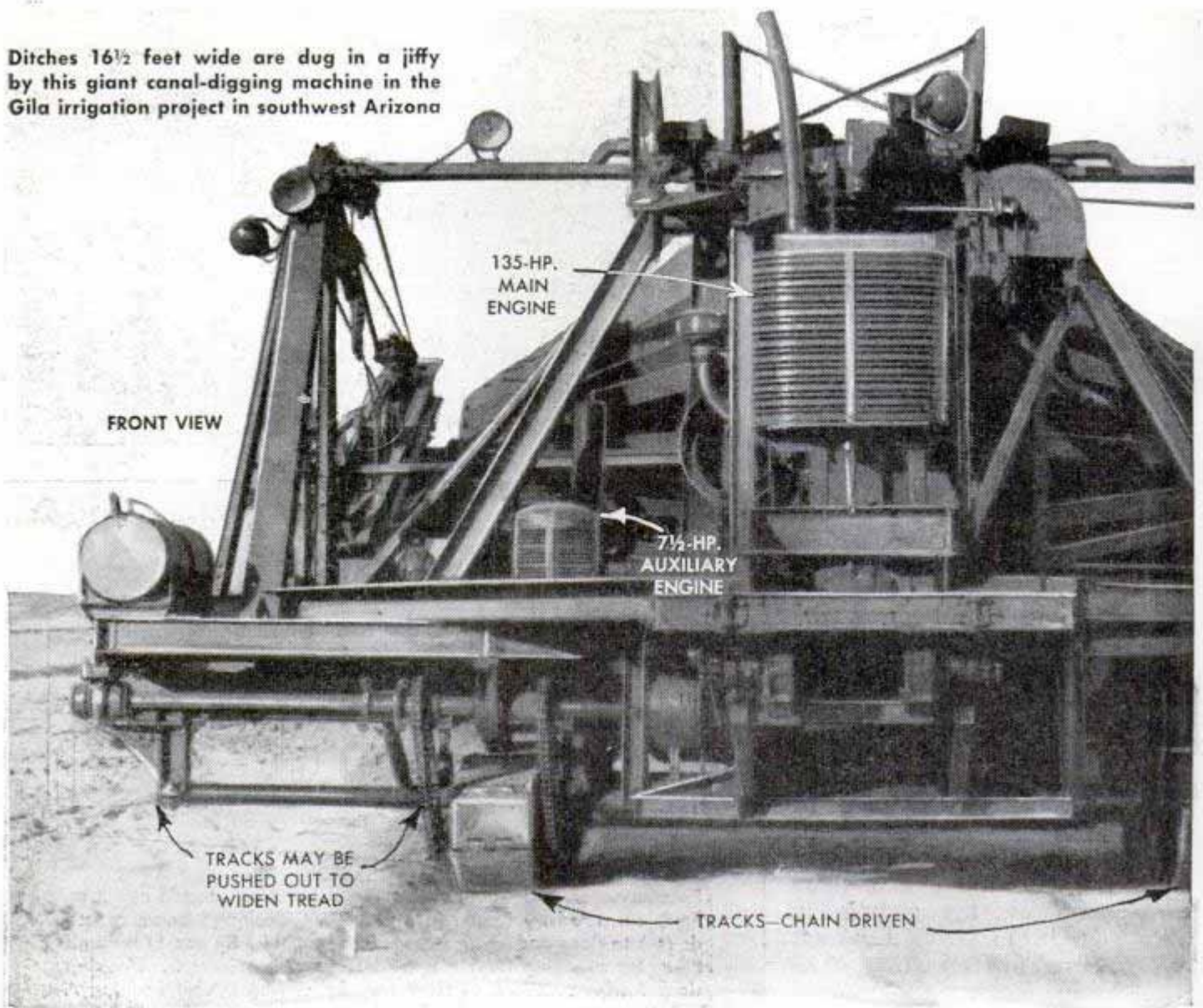


Fountain Brush With Felt Point Writes on Glass or Fabric

Resembling a fountain pen even to the pocket clip, a fountain brush writes on any surface, including glass, Cellophane, plastic, wood and fabrics. Suitable for writing, drawing and marking, it writes in colors that dry instantly. When dry, the writing can be removed only by a special cleanser. Three types of felt nibs provide variety in the size of writing. A valve control adjusts the flow of the coloring. In addition to marking packages, the pen brush can be used for sketching, drawing, painting window signs and marking laundry.

☐ To make electrical conductors for atom bomb production during the war, 14,000 tons of silver worth \$400,000,000 were withdrawn from the U. S. Treasury to substitute for copper needed for ammunition.

Ditches 16½ feet wide are dug in a jiffy by this giant canal-digging machine in the Gila irrigation project in southwest Arizona



NEW RIVERS FOR THE

TREMENDOUS canal-digging machines that leave miles of open channel behind them as they move ponderously across country are being used in the West to speed up the nation's program of utilizing excess river waters for irrigation.

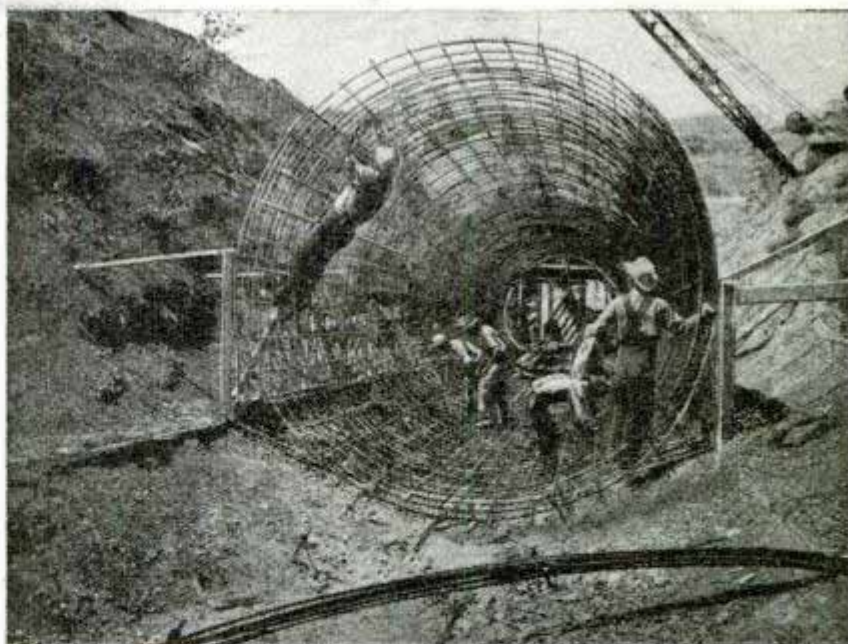
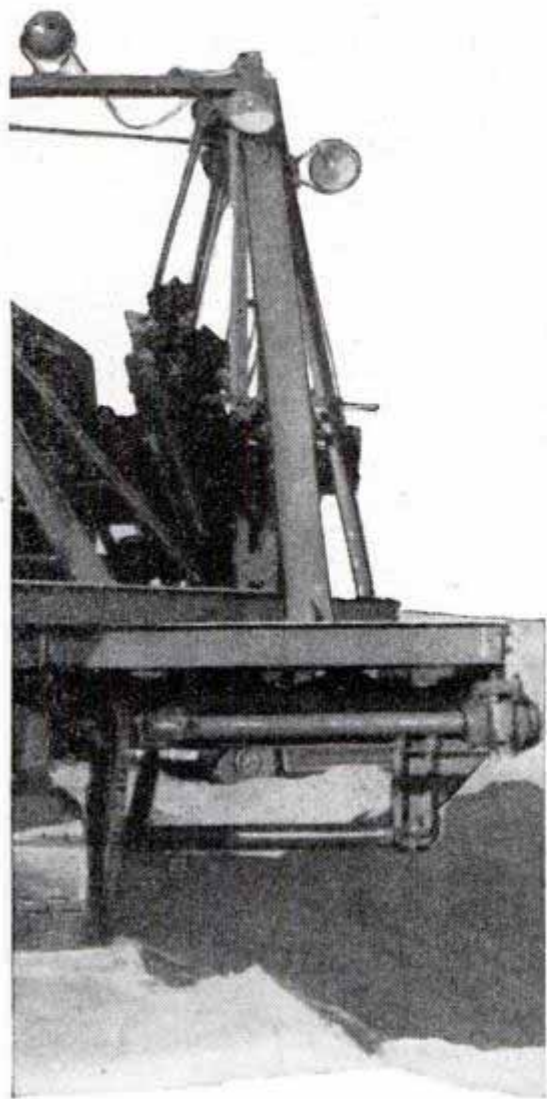
On the new Gila project in southwest Arizona where half a million thirsty desert acres are to be watered by the Colorado, a big canal digger is scooping out an entire canal at the rate of one foot per minute. The wide rotating blades of the machine take a succession of never-ending bites and create a channel 16½ feet wide at the top, 3 feet wide at the bottom, and 4½ or 5 feet deep.

Behind the machine a crew of men smooths down the sides of the canal, lays steel reinforcing mesh and applies liquid concrete to the floor and walls. The finished canal, ready for use, is completed in the one operation.

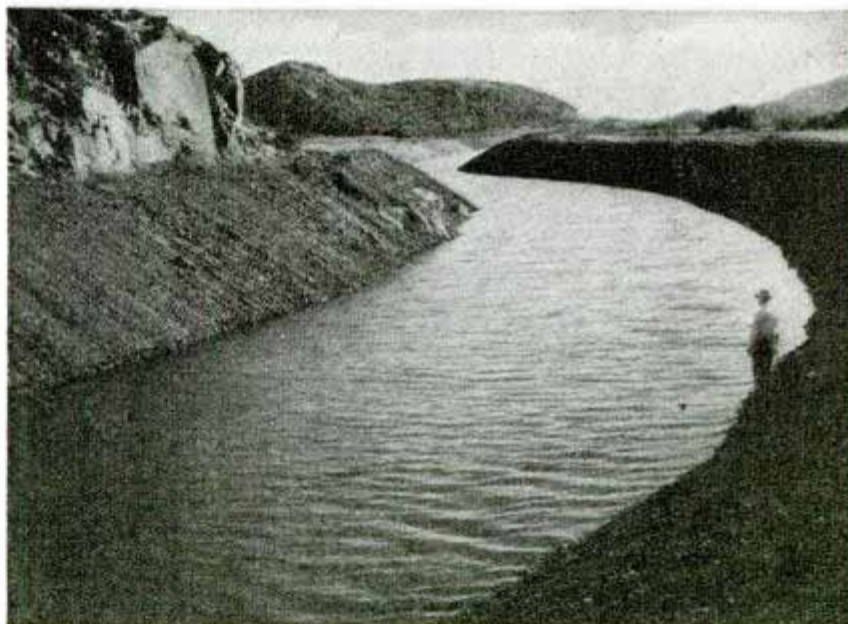
Invented by the engineers of the Macco

Construction Company, the canal digger operates on the same principle as a ditch digger. Dirt scooped up by the blades falls onto endless belts inside the digging cone and is transported outward to be discharged at each side of the canal. The digging machine is powered by a 135-horsepower main engine that operates the digging cone and also moves the machine ahead on its track-type treads. An auxiliary 7½-horsepower gasoline engine spins a generator that supplies electricity to the motors that move the endless belts and also furnishes current for seven powerful lamps that are used after dark.

In all, thousands of miles of artificial rivers and streams are under construction west of the 100th meridian today. Before the war the U. S. Bureau of Reclamation had started numerous vast irrigation projects. Now work is progressing at top speed both night and day in a hurry-up program



↑ Steel reinforcing bars are installed to hold concrete for siphons to carry the big Conchas irrigation canal across the bed of a stream



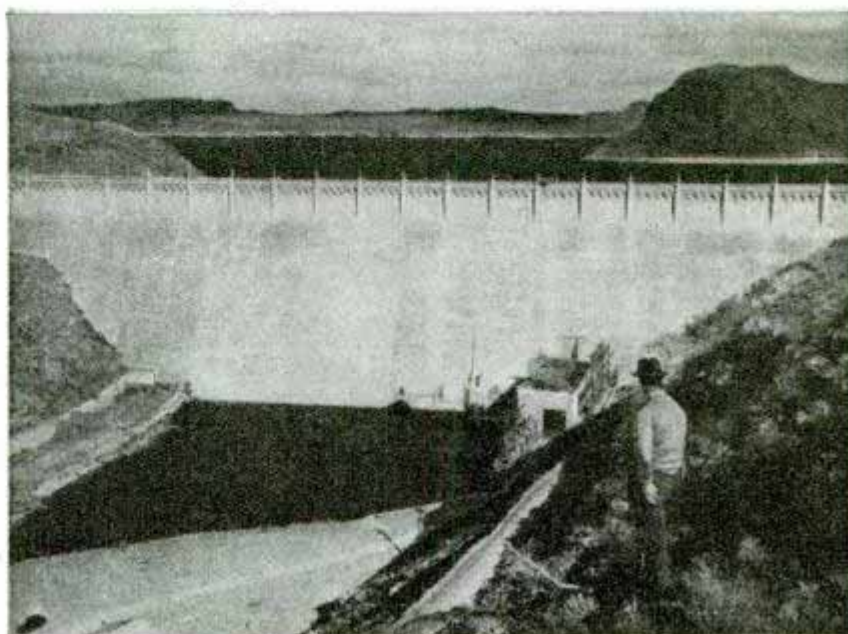
↑ Altus Canal in Oklahoma carries water for irrigating 70,000 acres
↓ Butte Dam, New Mexico, feeds canals to irrigate 155,000 acres

WEST

to get the projects completed.

Representative of the larger developments is the huge Central Valley project in California, encompassing two thirds of the state's agricultural acreage. Some of the valley now receives more water than it can use while other parts can't be farmed for lack of water.

To provide a more even distribution of life-giving moisture, much of the flow of one great river is being diverted from the area it now irrigates and transported to the arid portion of the valley by a new canal system. Meanwhile, excess water from a second river is being rerouted in order to serve the tracts from which





Dragline hauls five cubic yards of earth in one scoop. Below, side view of mechanical ditch digger

the water of the first river was diverted.

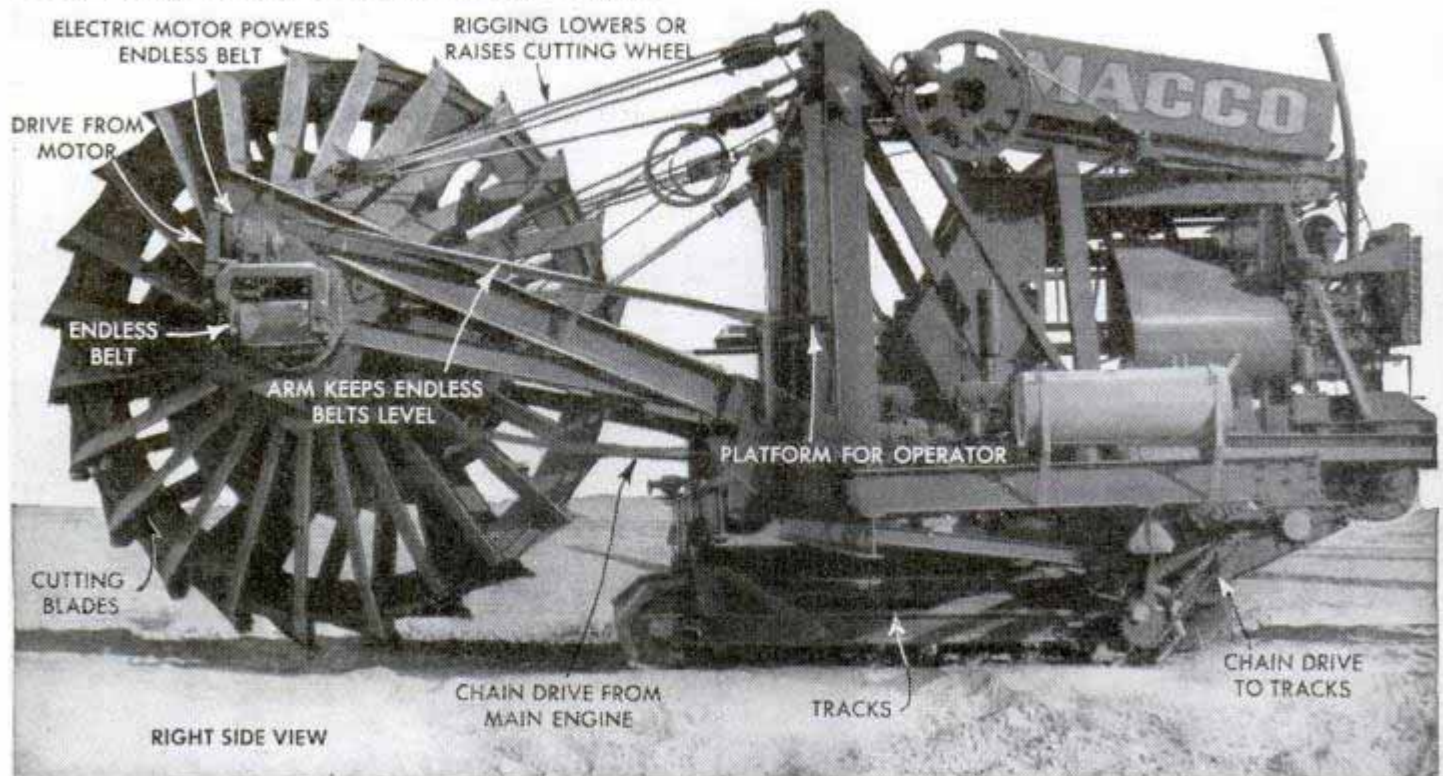
The first step in this project was to build two great dams. Shasta Dam in the northern end of the valley now controls the flow of the Sacramento River and Friant Dam east of Fresno now stems the San Joaquin River. The two dams are, respectively, the second and fourth largest concrete structures in the world.

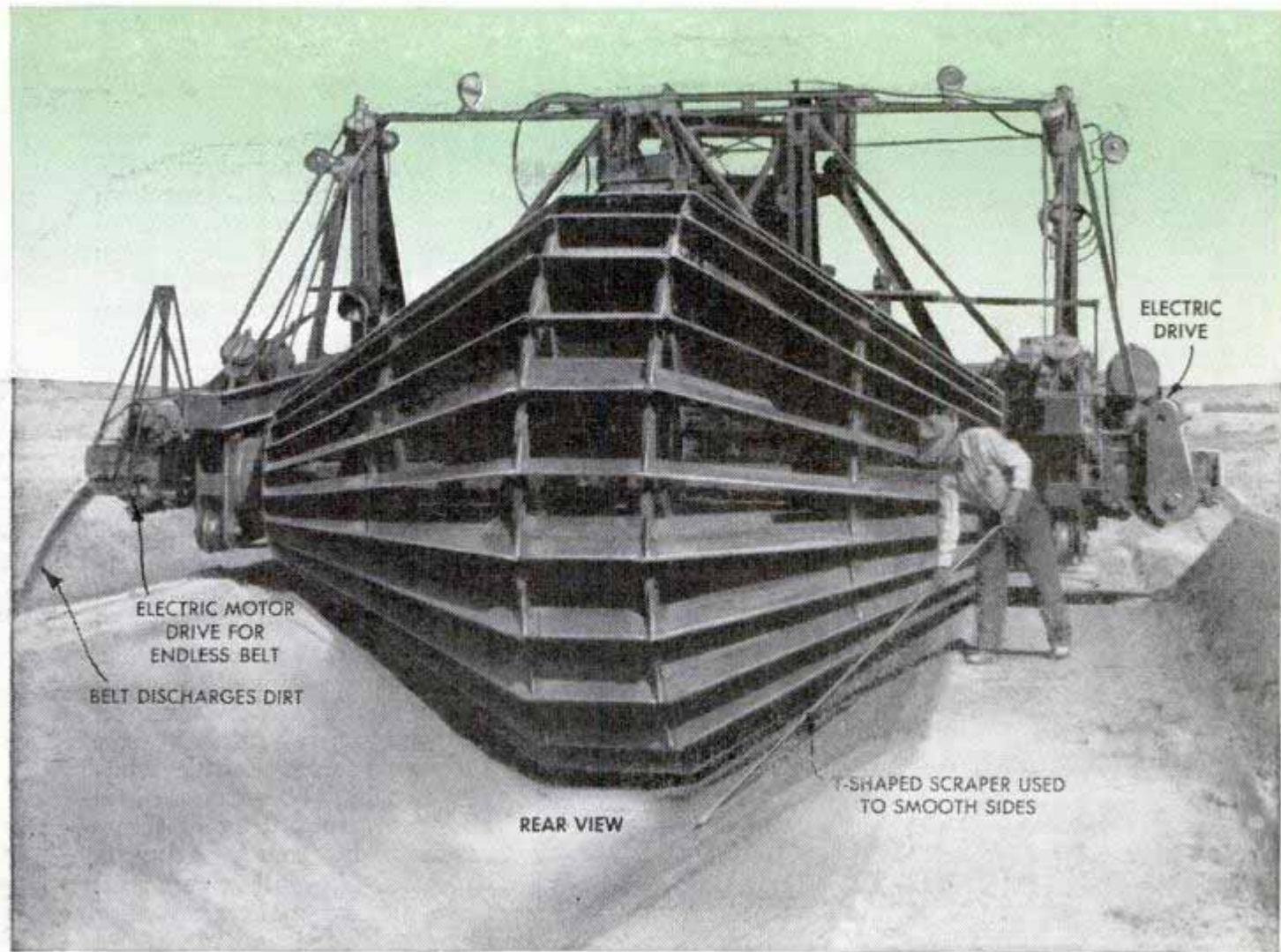
Water from the San Joaquin will be taken from behind Friant Dam by means of the new Friant-Kern Canal, now under construction, to the arid southern end of the valley 160 miles away. The initial section of the canal is 15 feet deep, 15 feet across the bottom, and 70 feet wide at the top of its concrete lining.

Much too large to be excavated by one of the new canal-digging machines, the channel is being scooped out by giant draglines and in some places blasted out of solid rock. It is conducted under existing cross-streams by means of reinforced concrete siphons. A companion canal, the Madera, diverts 1000 cubic feet of water per second from behind Friant Dam to an irrigation district 40 miles north of the dam.

These diversions rob thousands of acres along the lower San Joaquin of the water to which they are entitled. In compensation a "cross delta" canal taps the Sacramento River in the north and carries its excess flow across country to the depleted area. This water must be raised 200 feet uphill during its journey and this is done "free" by power transmitted from Shasta Dam, 200 miles north. In all, some 350 miles of major canals are included in the project.

Already under heavy bondage, the Colorado River that runs from the west slope of



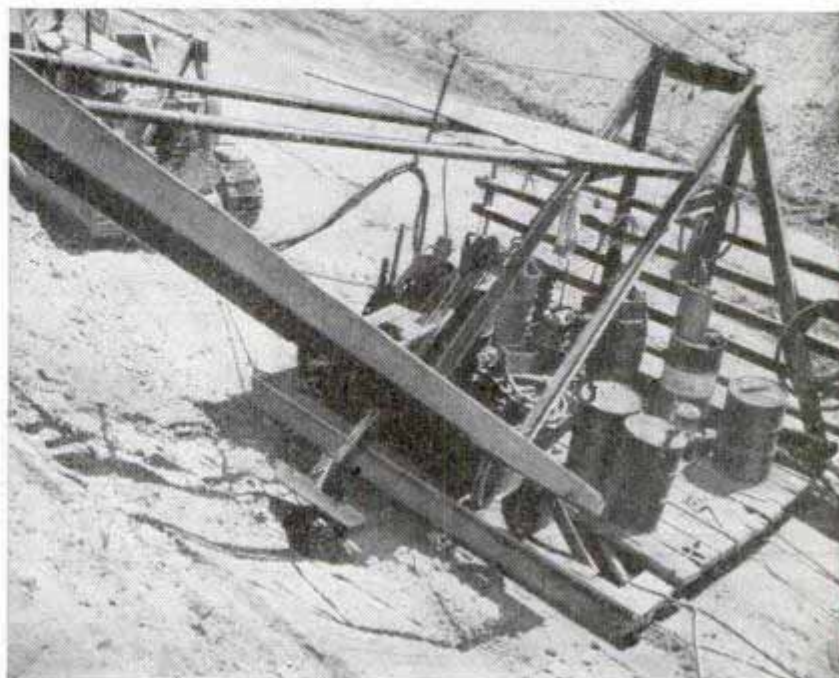


With mathematical precision the "paddle-wheel" digger carves out a canal at the rate of one foot per minute

the Rockies to the Gulf of California is to be made to contribute still more of its moisture and hydroelectric strength to civilization. New chains being forged will make this useful river perform more work than ever. Up near the headwaters of the river, work is well along on the Colorado-Big Thompson project by which Colorado River water will flow under the Continental Divide to the east slope of the Rockies, making use of the 13-mile Adams tunnel through the mountains. After completion of more tunnels and canals, 615,000 acres in northeastern Colorado will receive the benefit of water that otherwise would make its way down to the Pacific.

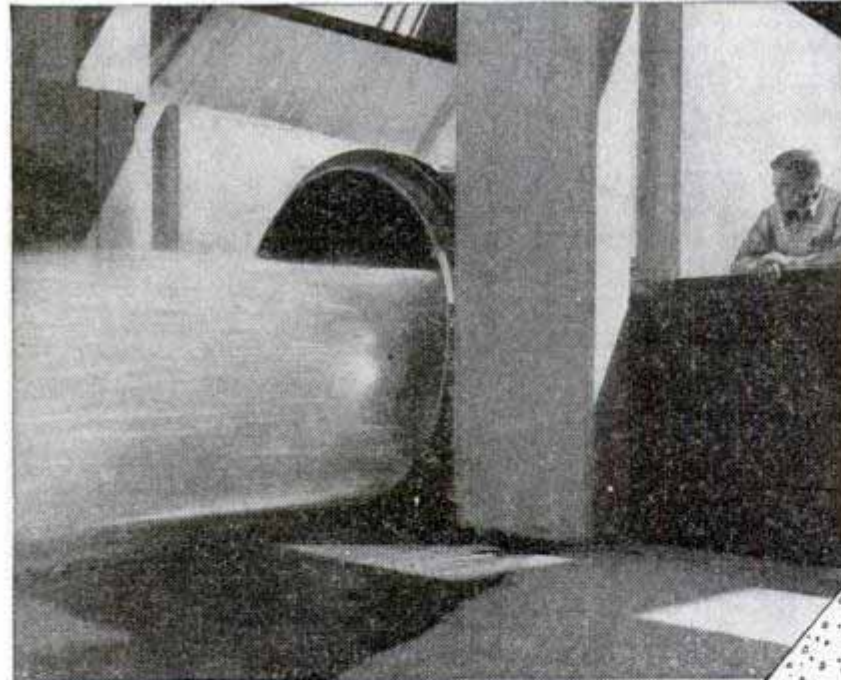
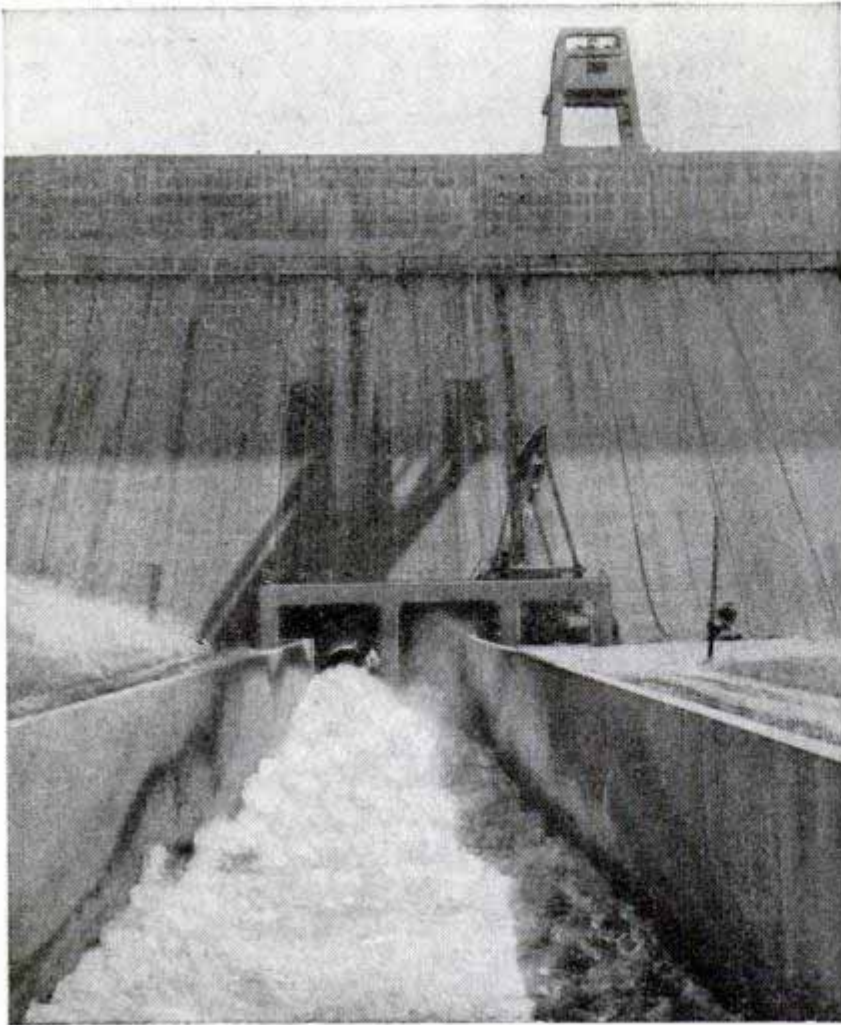
Far to the south, the Colorado is being tapped again at Imperial Dam for water for the Gila project. Seventy thousand acres in Yuma County, Arizona, are to be irrigated first. Ultimately the plan is to provide water for

half a million acres on which can be grown alfalfa, cotton, flax, cantaloupes, winter vegetables, citrus fruits and dates. About 15,000 acres of the initial development consist of public lands that are to be opened for homesteading, with preference given to veterans of World War II. Temperatures in the Gila Valley range from slightly be-

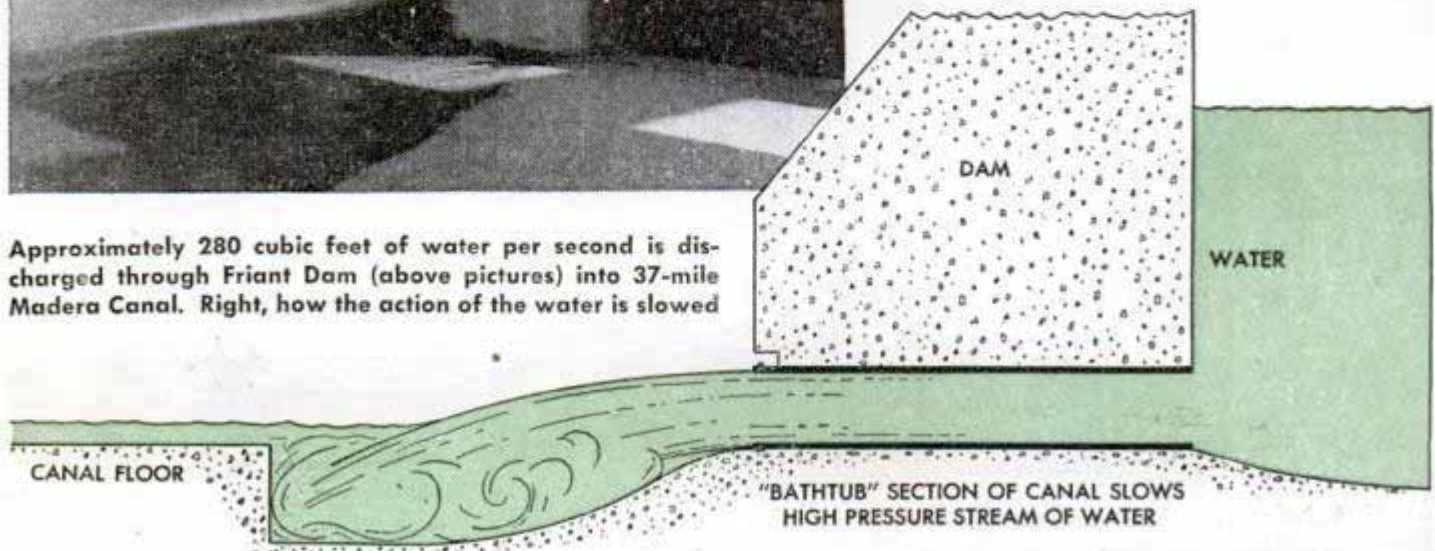


Sides of canal are hammered firm by machine similar to ordinary pile driver

DETAILS FROM: DIRECTOR, BUREAU OF LAND MANAGEMENT, WASHINGTON 25, DC.



Approximately 280 cubic feet of water per second is discharged through Friant Dam (above pictures) into 37-mile Madera Canal. Right, how the action of the water is slowed



low freezing to 120 degrees Fahrenheit, with an average annual precipitation of only 3.5 inches.

Water from behind Imperial Dam is supplying the present 80-mile All-American Canal that leads to California's Imperial Valley. This canal has a capacity of 15,155 second-feet, greater than the flow of some rivers, and can furnish water for the irrigation of more than a million acres of ground. From the All-American Canal a 130-mile branch is being constructed to Coachella Valley.

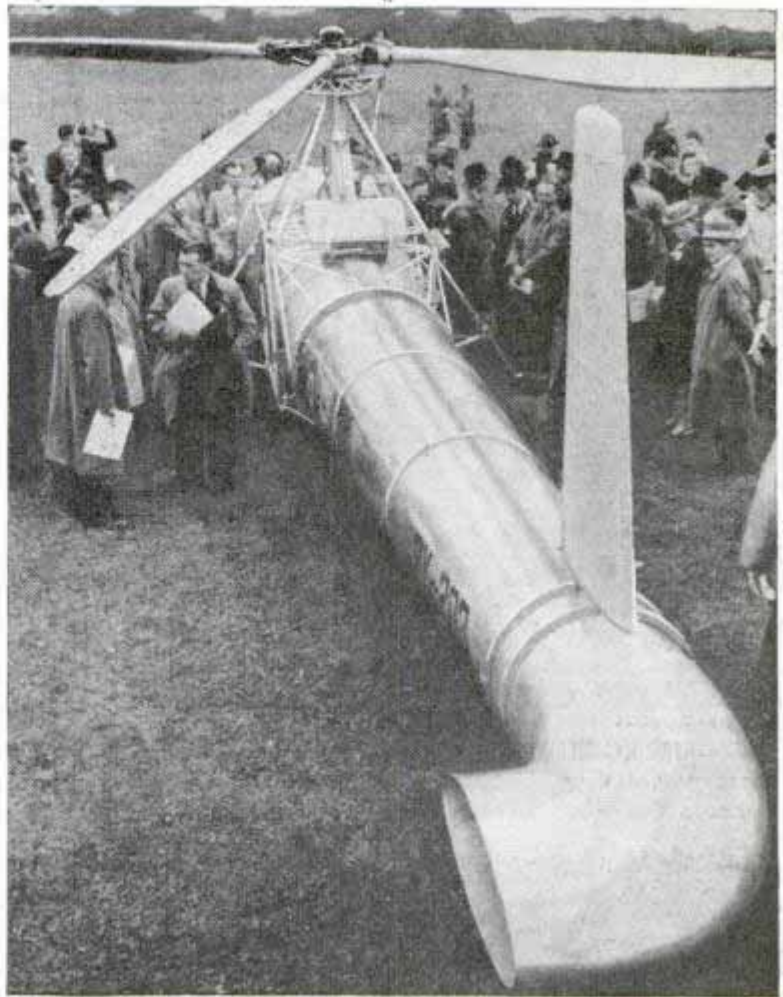
Water from the Colorado is so heavily loaded with silt and mud that the All-American Canal would be clogged up in a short time except for a desilting operation at the head of the canal. Water intended for the canal flows first through a series of settling basins in which 80 percent of its silt load, amounting to thousands of dry tons per day, is dropped. The silt is removed from the basins by rotating scraper blades and is sluiced back into the Colorado below the dam. Similar desilting works will be constructed at the head of the new Gila irrigation system.

Forty-five thousand acres in New Mexico will receive water when the Tucumcari project, now under way, is finished, and in Oklahoma water from behind the new Altus Dam is to be used to irrigate 70,000 acres of land.

(Continued to page 276)

Push of Helicopter Tail Jet Balances Torque Thrust

Jet thrust from its right-angle tail keeps an experimental British helicopter, nicknamed the "Flying Drainpipe," from turning in the opposite direction to its lifting rotor. In some helicopters a tail propeller has been used to overcome this torque thrust. A 200-horsepower engine mounted behind the cabin drives a three-blade rotor and its exhaust gas feeds the jet orifice. The pilot's compartment has no doors and is entered through two large holes in either side of the canopy, resembling eyes in the head of a giant dragonfly.



'Memory Circuits' in Mines Strangled Jap Shipping

Air-dropped magnetic mines with "memory circuits" had almost completely severed Japanese shipping lanes when the war ended, the U. S. Navy reveals. The mine fuses, developed by Bell Telephone Laboratories, could be set to permit one ship or several ships to pass over them before exploding. Their magnetic action caused them to blow up at the closest point of the designated victim's approach. Thus the Japs never knew when a waterway was safe. The mine had an attachment that rendered the weapon impotent after a predetermined period to elim-

inate the chance of blasting an Allied ship. With all these complex magnetic and electronic controls, the fuses were small, lightweight and practically indestructible. One mine fell 10,000 feet from a plane and hit solid ground, but the fuse was undamaged.

Auger Bores Holes in Thick Ice With Bit-Brace Action

← Cutting through 12 to 16 inches of ice per minute, an ice auger is a handy tool for a winter fisherman. It is four feet tall and made like a brace and bit so the operator does not have to stoop over. Blades on the cutting head, cast of aluminum to prevent freezing or clogging, may be replaced when worn. It weighs only three pounds.



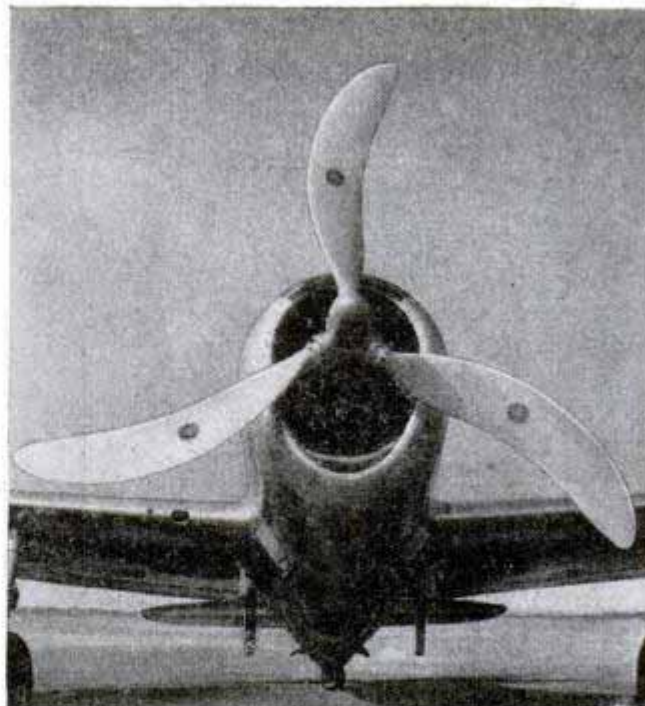
Pierce Interstellar Dust Cloud

Using infrared light, astronomers have pierced the interstellar dust cloud for the first time and observed the center region of the Milky Way galaxy. The light's effect was the same as using a color screen and red-sensitive plates to photograph distant landscapes more clearly. A 60-inch telescope was attached to a photocell and filter glass giving greater sensitivity than that of the human eye. Apparently less than 1/1000 of the ordinary blue photographic light penetrates the interstellar dust cloud.



Douglas Aircraft photo

AIRBORNE ROCKET POWER with an explosive wallop more potent than the guns of a light cruiser hangs beneath the wings of a Navy attack-type Skyraider



Curtiss-Wright photo

SWEPT-BACK BLADES are now being tested to boost propeller efficiency into the 700-mile-an-hour class to keep pace with the newest turbo-jet developments



AIR TRIP INSURANCE contracts are dispensed in a few minutes by an automatic vending machine



SPEEDS OVER 600 miles an hour are anticipated from the new British Supermarine fighter, powered by a Rolls-Royce Nene turbo-jet. Below, a Lancaster flies experimentally with both jet and conventional engines





NARROW GAUGE MOVIES

Sixteen-millimeter movies, long a tool of industry, are finding a new niche in television and small theaters

WHEN television really gets going, one of its most popular programs will be the nightly "news views" of events of the last few hours. Collisions at sea, spectacular fires and all the other happenings of public interest will appear on your home video screen to the accompaniment of sound picked up at the spots.

The machinery that will provide these up-to-the-minute broadcast news reels already has been perfected and tried out. Movies of blazing oil wells, for instance, have been made on 16-millimeter film, rushed to a television studio for automatic 20-minute processing, and put on the air a few minutes later. The handy 16-mm. camera is ideal for gathering television news shots.

Most television stations broadcast 16-mm. films as a regular entertainment feature. Their crews are being trained in the operation of 16-mm. cameras and most of the stations plan to keep one of the cameras on hand for making visual transcriptions. When a station is televising a local program that

shouldn't be interrupted, the camera will be used to record important scenes that happen to come in over the network's "pipe." The film can be processed in plenty of time for use as soon as the local program ends. At a dinner recently, 16-mm. movies that were made of the guests while they were enjoying their soup were projected on a wall screen in the dining room a short time later just as the guests were finishing dessert.

Narrow gauge movies have grown up in the last few years and their employment in television is only one of their important uses. Ten years ago 16-mm. cameras were used mostly by amateur movie makers, by the manufacturers of educational films for classroom use, and by explorers and others who couldn't lug a full-size 35-mm. camera around with them. To the professional the "16" was a toy that couldn't begin to compete with the big cameras.

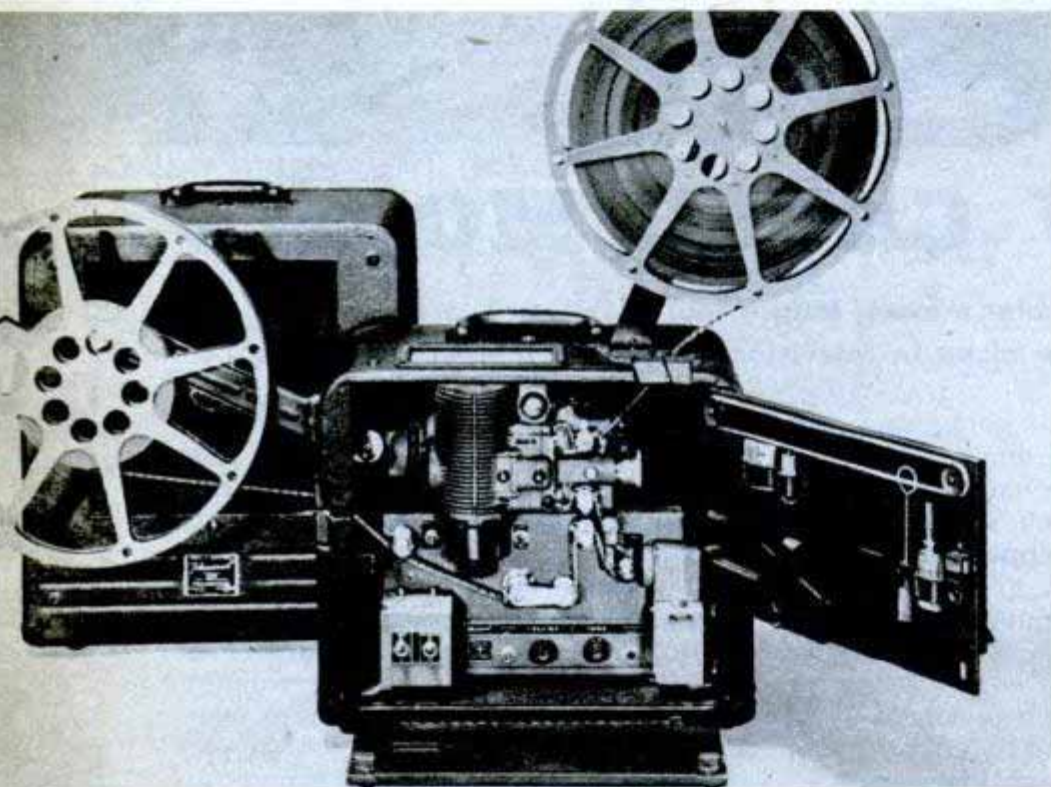
Mitchell professional "16," small version of 35-mm. studio camera, operates on 110 volts





↑ In preliminary step to making 16-mm. sound-on-film master prints, picture reels must be matched and synchronized with three sound-track reels

Telefilm photo



↑ One big advantage of modern 16-mm. sound-movie projectors is that they are portable. This Bell & Howell machine folds inside carrying case

↓ Shooting an educational film in the kitchen with 16-mm. equipment

Telefilm photo



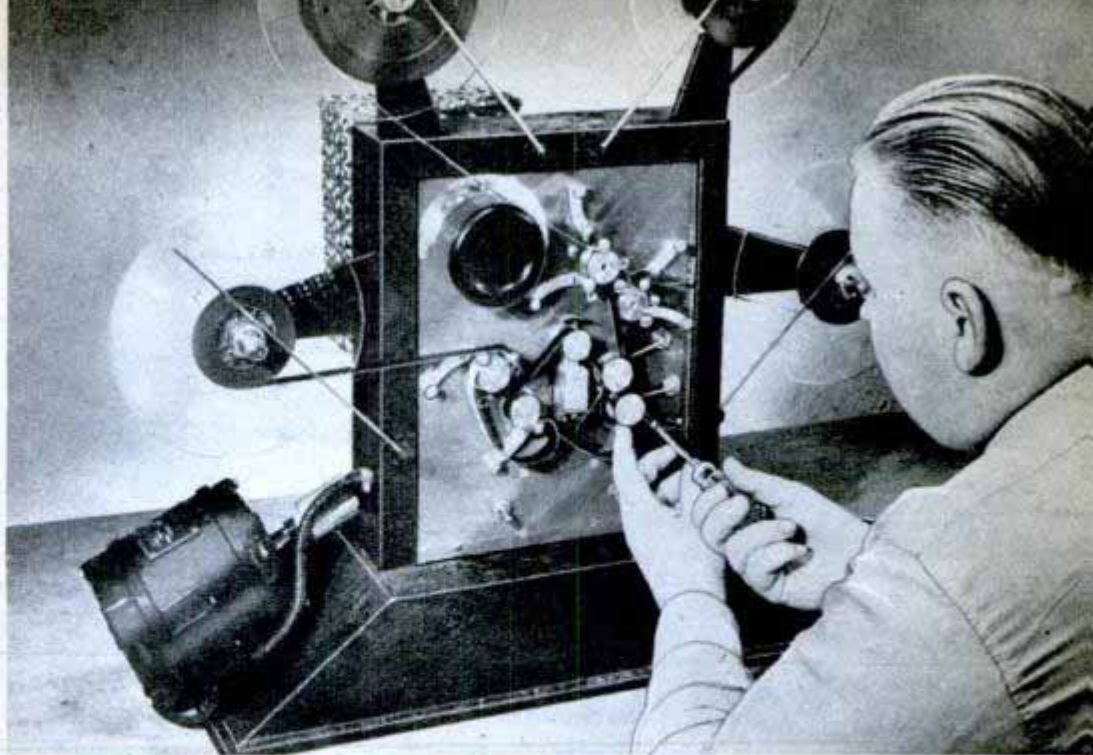
The portability of 16-mm. equipment, its relative cheapness and the increasing demand for motion pictures that would instruct special audiences all combined to increase the popularity of the small-size film. Now precision types of cameras and projectors are being built. Manufacturers of the Mitchell movie camera in Hollywood, for instance, are introducing a new "16" that virtually is a duplicate of their big studio camera. Intended for the mushrooming 16-mm. professional field, its cost is beyond the average amateur pocketbook. To assist in making time-motion studies, Bell & Howell has developed a new electrically driven 16-mm. speed camera that can operate at up to 4000 frames per minute. Other recent improvements in narrow gauge movies include better fine grain development, a tiny but adequate sound track alongside the image on the film, mono-pack color film and new arc-type projection lamps.

On several occasions theater audiences have watched full-color movies, with sound, projected on full-size theater screens with perfect satisfaction, unaware that they were being entertained by 16-mm. movies. Arc lamps that deliver about three times the illumination of standard 1000-watt projection lamps made this possible.

Eastman Kodak is fitting 16-mm. projectors with Lumenized lenses, coated with a microscopically thin layer of magnesium fluoride. This permits screen area to be enlarged one third without using projector bulbs of higher wattage and at the same time increases screen brilliance one third.

Black-and-white 16-mm. movies as used in the average projector can cover a 12 by 16-foot projection screen but more often are shown on portable screens up to 8 by 12 feet in size.

Today in hundreds of communities that are too small to support regular motion picture theaters, modern 16-mm. sound movies are being shown to audiences of several hundred people. These so-called movie road shows are a new development in entertainment. An operator purchases a projector, arranges for the leasing of 16-mm. films and news reels, and exhibits in a different community each night. Each show is held in an empty store building, schoolhouse or tent. His portable projector uses fireproof film, hence no special projection booth is needed. His film rentals cost possibly \$20 per night and he charges from a quarter to a half dollar per head for admission. Each night he tacks up adver-

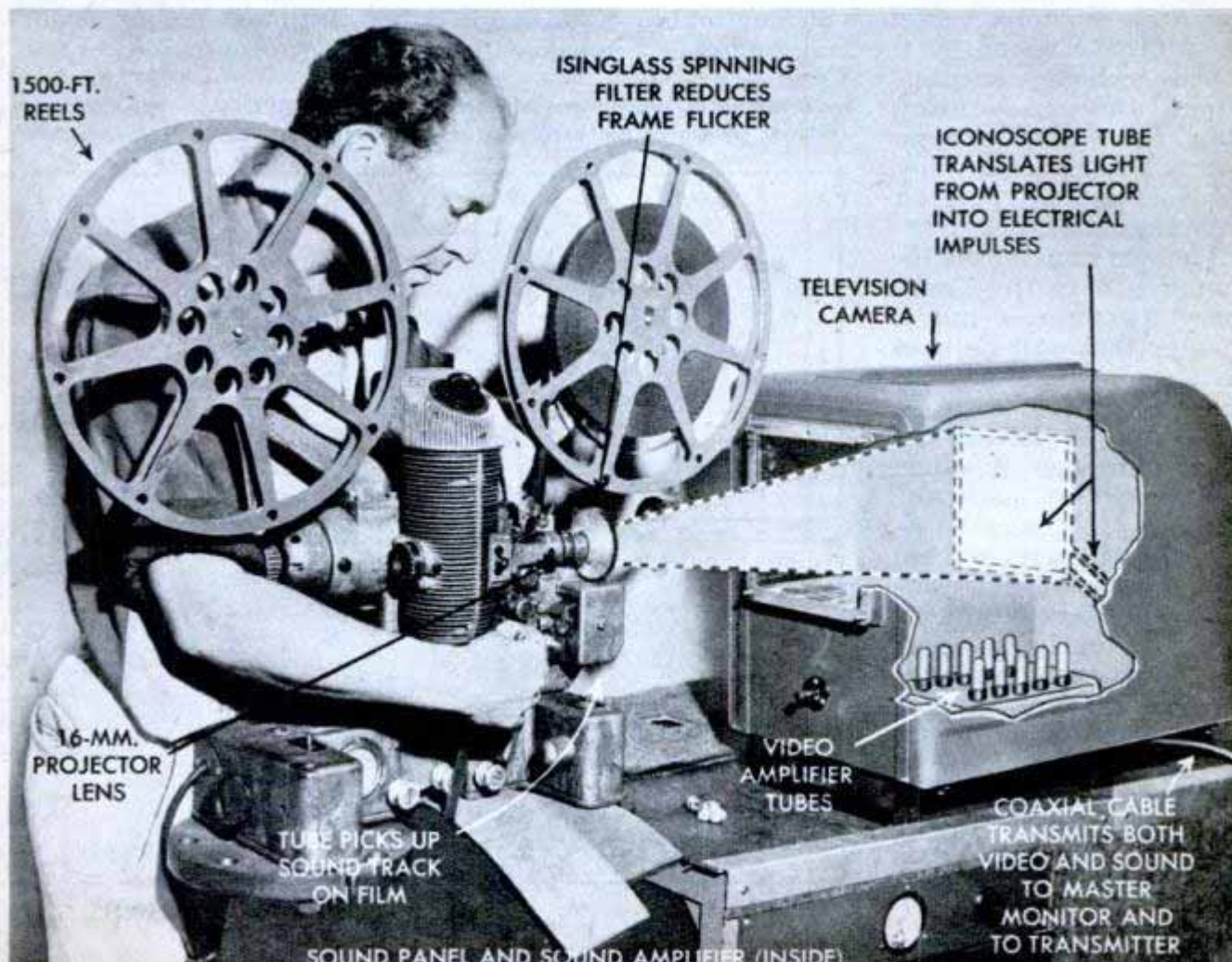


Electrically driven precision sound printer puts the reversed sound track on a 16-mm. color film. Printer's reels are made of transparent plastic

tising placards that describe the films he will exhibit the following week.

So important has this new field become that the major studios are optically reducing their full-length feature pictures of several years ago and are releasing 16-mm. prints. Some of them, in fact, are printing their latest releases on 16 as well as on 35

Operator threads film through sound head of projector and television camera so sound is transmitted over air simultaneously with the picture. Scanning tube of camera is located inside housing to avoid extraneous light





Narrator supplies voice accompaniment to the film as he watches screening in the studio. Mixer handles the controls that record voice on film

movie enthusiasts own 16-mm. projectors and many of them, now that they can rent films on nearly every subject from the film libraries, are holding movie shows at home for their own entertainment. Rentals start at \$1.50 for short black-and-white silent subjects. Grade A Hollywood features can be rented for \$17.50. Too, there are hundreds of "message" films that can be borrowed. The only costs are postage and insurance. Railroads are one of many large industries which have numerous full-length movies that describe their functions. Government departments

for distribution abroad. Today several companies in Hollywood and elsewhere are producing entertainment pictures solely for this 16-mm. market. Planet Pictures, started several years ago by a group of Lockheed employees, plans to release 104 first-run full-length melodramas, mysteries, musicals, westerns and other subjects in 1947. With them will be 104 short subjects including comedies, news reviews and animated cartoons.

In addition, operators of the 16-mm. theaters can draw upon the tens of thousands of subjects stocked by the major film libraries, which have representatives in every state. Films of every type and on practically any subject can be rented from these libraries.

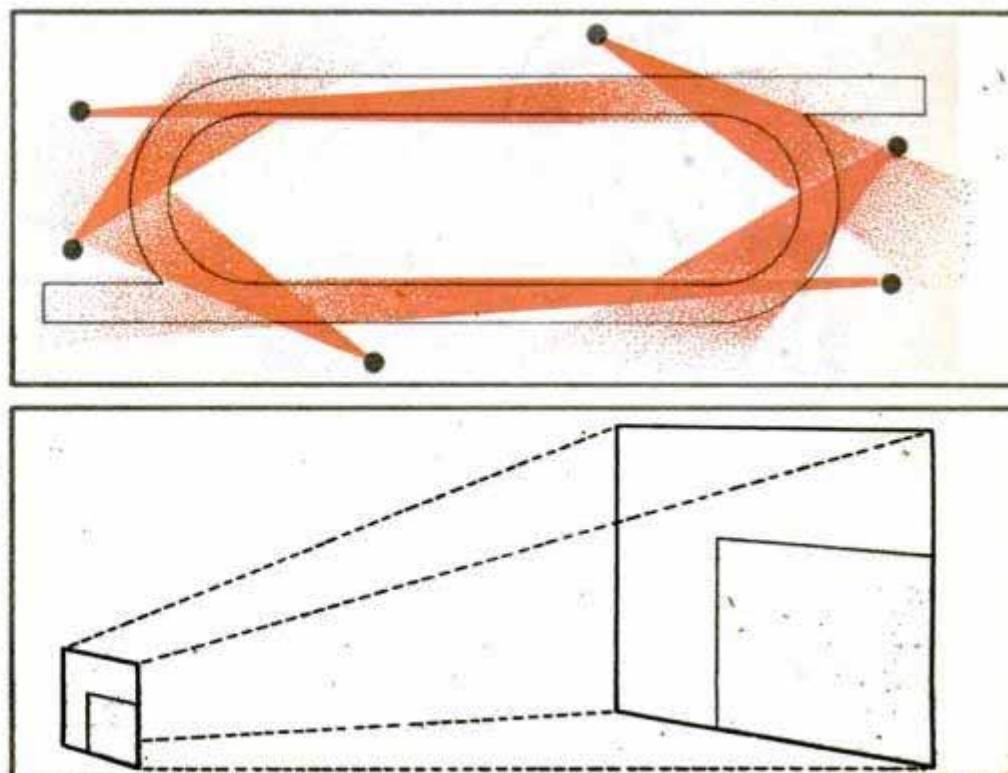
Planned soon for the 16-mm. field is the "one-man" automatic movie theater that will be sold on a percentage basis to those who wish to open small movie houses in store buildings or other locations. The "package" will include several hundred theater seats, screen, automatic reloading projector, an untended coin-operated entrance gate, air-conditioning apparatus and cardboard baffles for installation along the walls of the theater to balance the sound and prevent echoes.

Thousands of amateur

such as the Department of Agriculture have spent thousands in telling the story of their work on 16-mm. educational reels. Other government agencies also have films ready for use. The camera store at which you bought your movie equipment can tell you how to borrow these films.

Most high-grade modern projectors come complete with sound attachment. Older silent projectors that can't take advantage of the sound track can be fitted with an attachment that scans the track and plays it through your ordinary home radio speaker. The sound head is attached to the

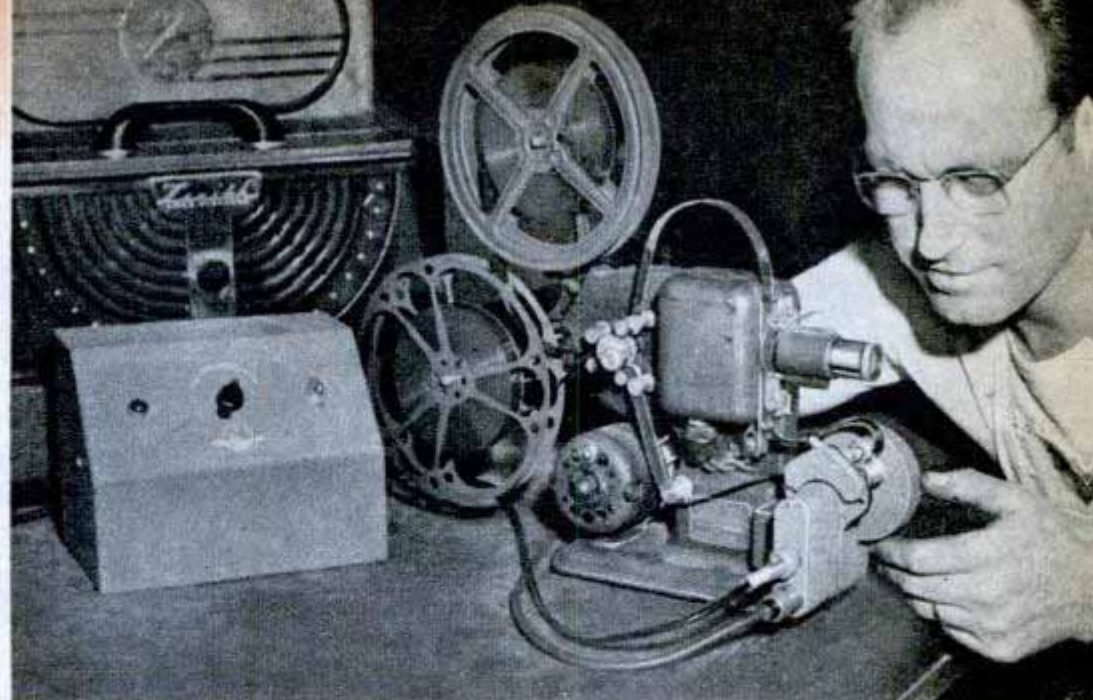
Six strategically located movie cameras, top, film entire horse race. Bottom, diagram compares the projection areas covered by 16 and 35-mm. film



projector by means of a bracket and the film is threaded through both the projector and the sound head. A photocell tube in the sound head scans the sound track and relays the impulses to an electrical adapter that in turn is hooked to any radio broadcast receiver. Theaterlike sound that can be varied in volume and tone is produced. The adapter costs about \$100 and can be fitted to any silent projector. Another accessory on the market is an extension arm that enables most projectors to make use of reels up to 2000 feet in capacity.

Narrow gauge film came into its own for mass instruction during the war, when it was used to instruct millions of war workers, from aircraft pilots to munitions factory employees, in their particular jobs. There are many examples. One, a 30-minute picture titled "Starting the engines of the B-29," speeded the transition of pilots who were learning to fly the big bombers. The picture outlined the cockpit controls that were used to start the engines, the sequence in which they should be operated, the action of each control at the engines and remedial measures to be taken if a control balked.

Telefilm, Inc., of Hollywood, producers



If sound head (at left hand) is attached to silent 16-mm. projector, sound movies can be shown. Sound is played through speaker of radio receiver

When equipped with a hood, 16-mm. projector can show clear movies in ordinary light. Top of the hood is one side of the projector carrying case

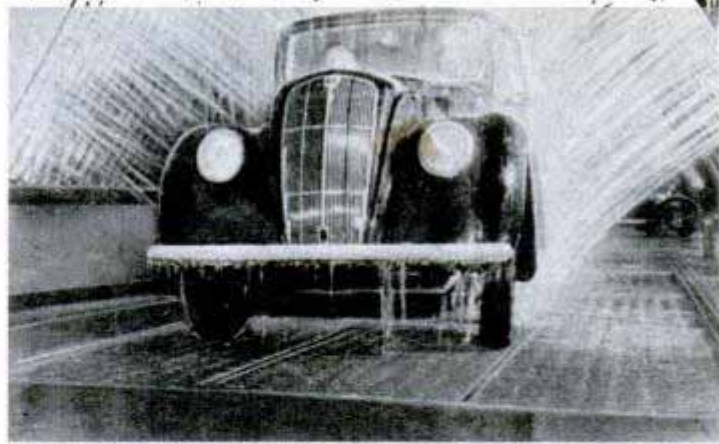


of the B-29 picture, developed the technique of making movies of horse races to help the judges settle any questions as soon as a race is over. In the telefilm system now used at a number of tracks, six 16-mm. cameras are mounted on towers so that each camera commands a portion of the track. Each camera is operated until the horses pass that post, then the cameraman unloads the film and sends it down a slanting wire to the ground where it is immediately picked up by a station wagon. The collected reels are processed in seven minutes or less and, when a question is raised,

are projected on a screen in front of the judges. On a number of occasions jockeys have been relieved of their racing privileges or have been vindicated of suspicious riding because of the movie records.

One of the major producers of 16-mm. pictures makes upwards of a dozen commercial films per year for use in public relations by large national concerns. Nearly all the bigger pictures are in color with sound and some of them cost \$50,000 each.

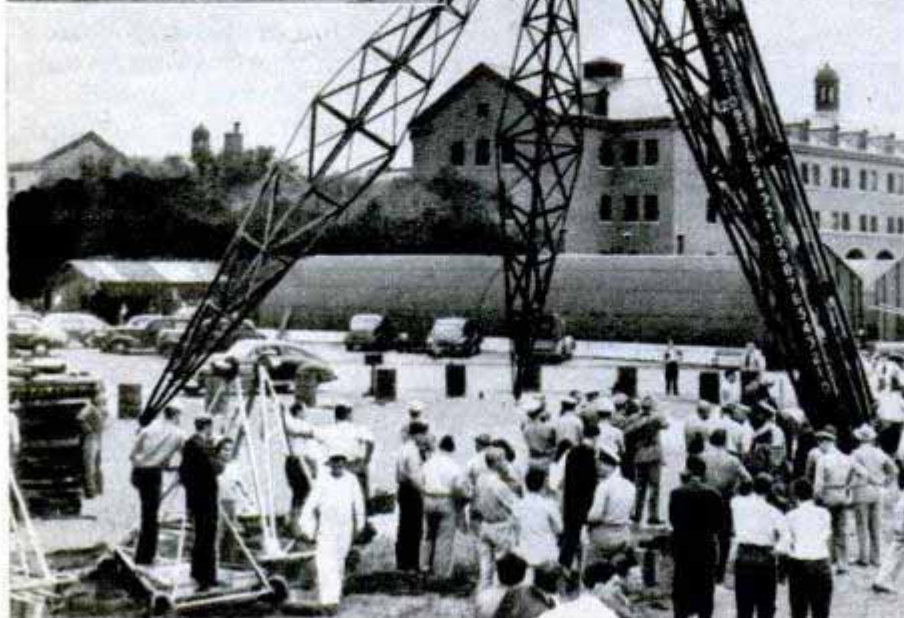
Such is the quality of a modern 16-mm. movie that, aside from the smaller screen usually used, you can't tell it from a release by one of the big studios.



Automobile builders in England are exporting 1000 cars a week to overseas buyers. Since the cars will be subjected to every kind of climate on roads in all parts of the world, exhaustive weather tests are being made at the factories. Two weeks in the weather laboratories equal two years on the road. Heat lamps brighter than

Rain and Ice Test British Cars

the most brilliant sunlight check resistance of paint, rubber and exterior finishing material. Next an artificial downpour tests waterproofing of doors, windows and windshields. In the cold room, cars are exposed to subzero temperature for three days to check ignition systems and ability of engines to start in cold weather.



Navy's Pilot Ejector Tested on Tower Track

Tests of the Navy's explosive seat-ejection unit are made with a 110-foot track on a steel tower to guide the pilot seat. The apparatus, operated by a self-fired charge, is designed to throw the pilot 60 to 100 feet clear of a plane flying at supersonic speed. After being "ejected" on the test equipment, pilot and seat slide safely down the track.

Colored Poison Grain Kills Rodent Pests

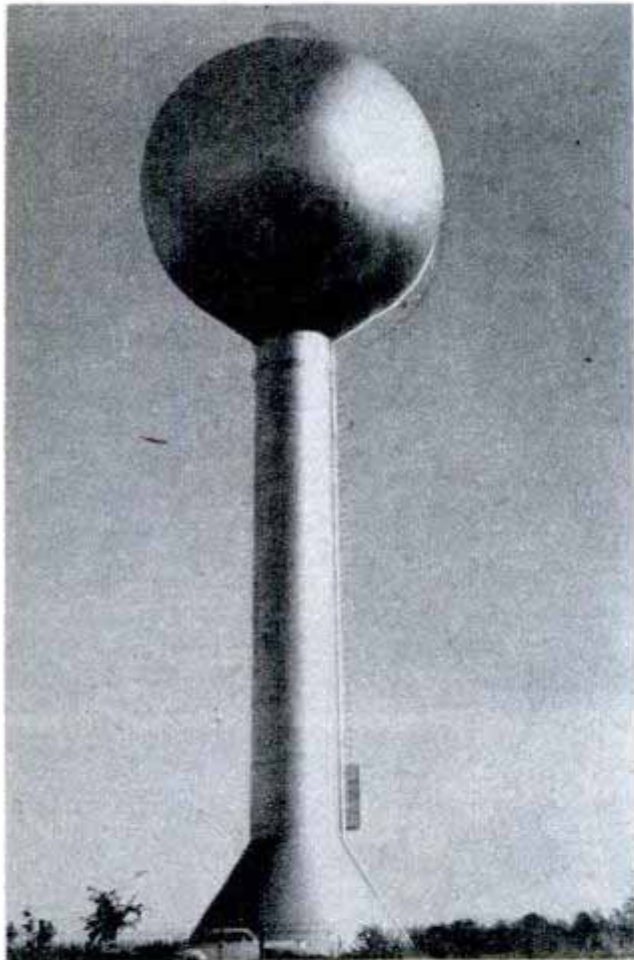
Because they apparently are color-blind, rodents eat poison grain dyed yellow or green but birds reject the deadly bait. The discovery was made by the U. S. Fish and Wildlife Service during a search for a method to prevent birds from eating bait intended for rodent pests. The birds seemingly are repelled by the bright colors.

Airplane Metal in Hand Truck Cuts Weight to 26.6 Pounds

So light that a child can lift it, a new 26.6-pound hand truck is made of cast magnesium alloy—a metal widely used in airplane parts. The truck body is cast in one piece except for a nose of rustproof steel. All stress points are reinforced, and edges and corners are curved to eliminate snags. The wheels, also of magnesium, are equipped with ball bearings and rubber treads. The truck is balanced to tip forward automatically when unloaded.

"Silver Mushroom" Water Tank Holds 300,000 Gallons

Landmark at Shakopee, Minnesota, is an unusual water tower shaped like a giant mushroom that rises 130 feet into the air. The shining ball atop the steel shaft is 43



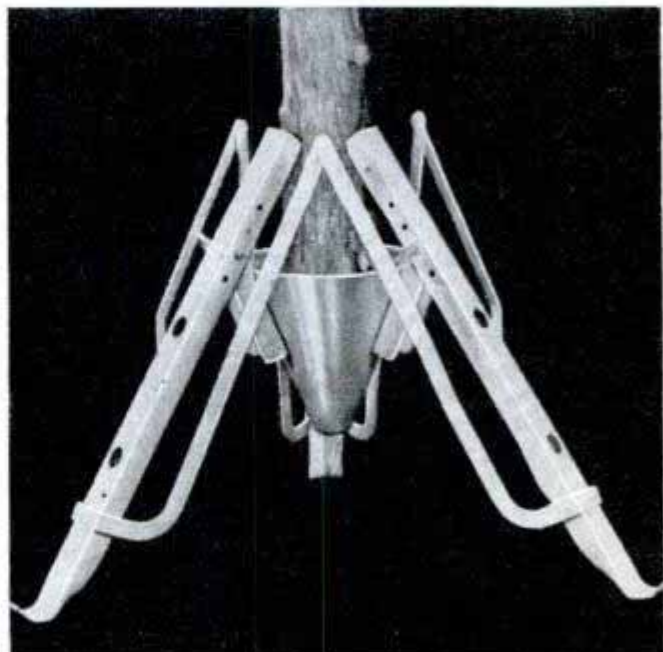
feet in diameter and has a capacity of 300,000 gallons. The conical support for the tower is smaller than the ball, measuring approximately 30 feet in diameter.

Popular Mechanics is always ready to supply further information to readers about various products described in any issue. Just write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Ill., for a prompt reply.



Self-Adjusting All-Steel Stand Supports Christmas Tree

It's easy to set up a Christmas tree with a self-adjusting all-steel stand operated by the weight of the tree itself. The base of the tree is placed in an inverted cone cup on the tripod stand. Angle-clamp legs grip it, center it in the stand and hold it perpendicular. The stand holds trees from one to four inches in diameter at the base and from five to nine feet high.





ILLEGAL DRIBBLE. Opposing team gets ball to put into play from out-of-bounds

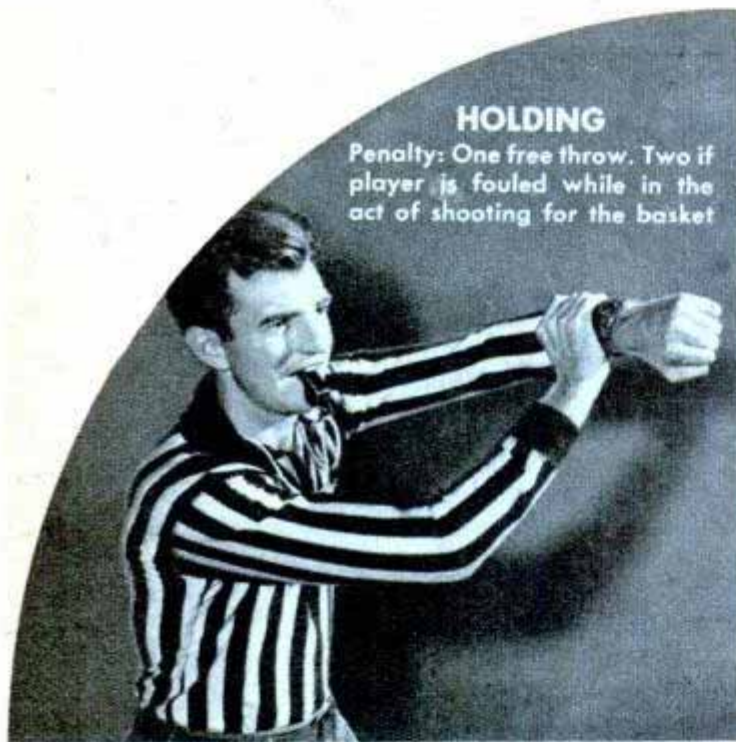


CANCEL SCORE because ball entered basket after a rules violation



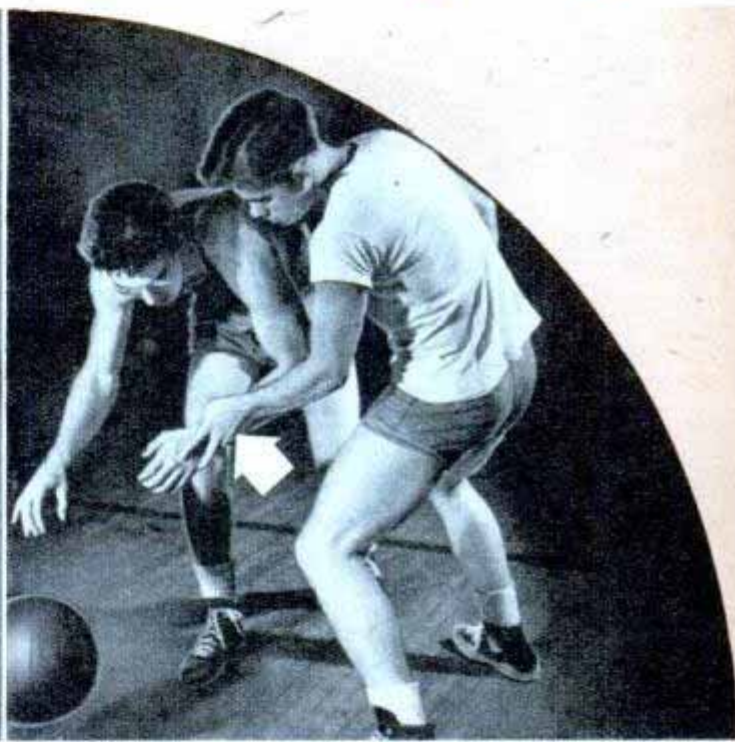
INDICATING NUMBER of player committing foul to scorers at officials' table

Basketball's Sign Language



HOLDING

Penalty: One free throw. Two if player is fouled while in the act of shooting for the basket



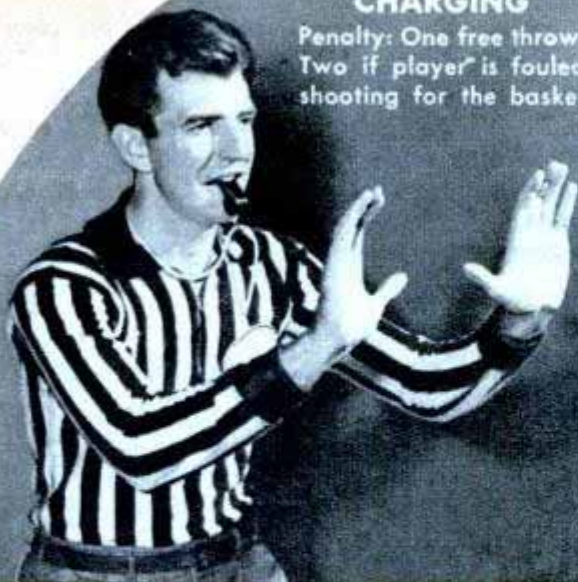
ILLEGAL USE OF HANDS

Penalty: One free throw. Two if player is fouled shooting for the basket



PUSHING OR CHARGING

Penalty: One free throw.
Two if player is fouled shooting for the basket



A. SCORE COUNTS

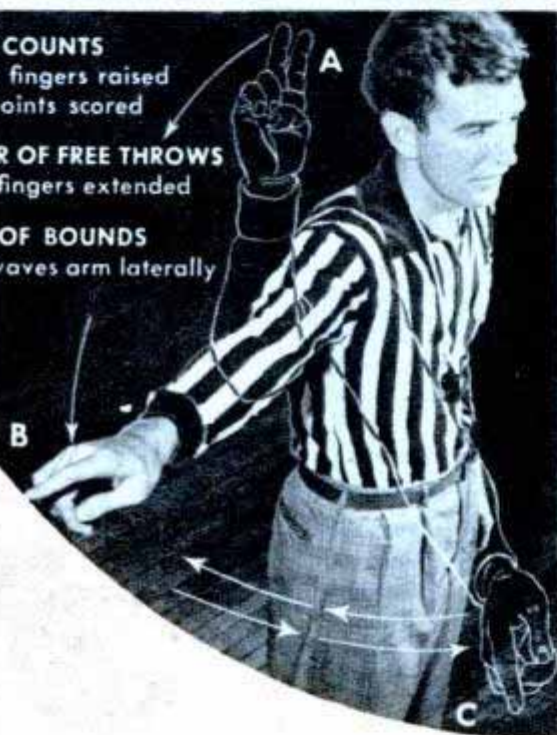
Number of fingers raised indicates points scored

B. NUMBER OF FREE THROWS

Shown by fingers extended

C. OUT OF BOUNDS

Official waves arm laterally



TIME OUT (With foul)

Palm open if play is halted for substitution or any other reason



Basketball spectators, unaided by running commentaries, have to understand the official's pantomime to know exactly what happened. An average of 31 fouls, many not

easily discerned, are called in a game. Some of the more common signals and their meanings are shown, posed by Bob Neu, assistant coach, DePaul University, Chicago.

RUNNING with ball. Opponent puts ball into play from out-of-bounds

JUMP BALL. Generally called when opposing players have one or both hands firmly on ball

TECHNICAL FOUL for a rules violation, not for illegal contact





Wheel-Mounted Snowplow Clears 20-Inch Path

Snow five inches deep can be cleared from a sidewalk with a single-wheel snowplow as fast as a person can push it. With blades set in line, the plow clears a path 20 inches wide. The blades can be set in a V-shape to clear 16-inch paths for auto driveways. When the bottoms of the blades become worn they can be reversed, doubling their life.

X-Ray Counter Checks Radiation

X-rays of widely varying intensities are measured and recorded in a fraction of a second by an instrument which gives science its first all-purpose tool for this task. Developed by Dr. Fitz-Hugh Marshall and Dr. John W. Coltman of the Westing-

Pocket-Size Shoeshine Outfit Applies Polish From Buttons

Folding to the size of a billfold, a shoe-shining outfit has 32 "wax buttons" attached to a pad used as a mitt to apply the polish. A wool buffer adds the gloss. The buttons are available in brown or black, or brown on one side of the mitt and black on the other. Each set of buttons provides approximately 100 shines.



house Research Laboratories, the X-ray "detective" is expected to be useful for both scientists and manufacturers. The counter is an adaptation of an electronic photomultiplier tube used in the past to measure light output. About the size of a radio tube, the photomultiplier tube is converted into an X-ray counter by wrapping it in a sheet of fluorescent screen which is itself wrapped in black paper. While the black paper blocks out all room light, X-rays penetrate to the fluorescent screen. Measurement of the fluorescence by the photomultiplier tube provides a record of the X-ray intensity.

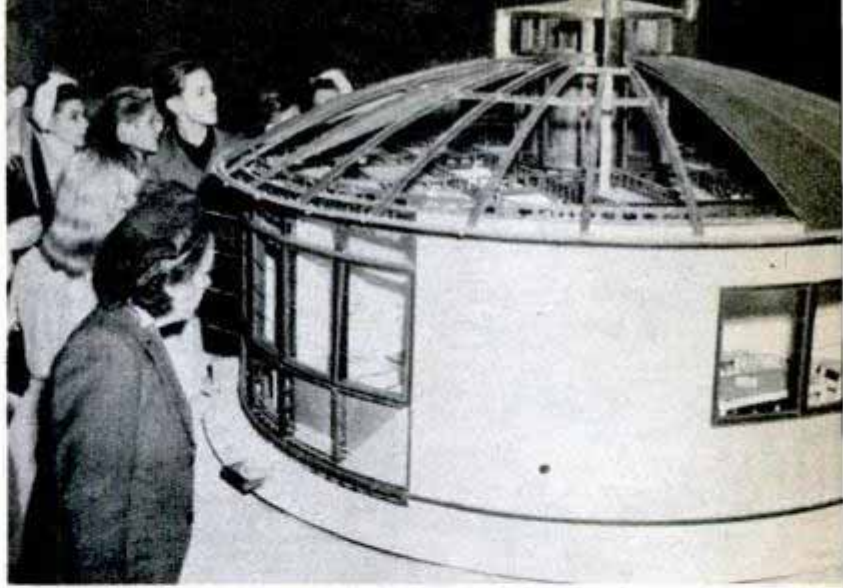
Prefabricated Plastic "Igloo" Featured at Berlin Show

National tastes and needs in housing are reflected in a Berlin exhibition of model prefabricated one-family units made entirely of plastics. They were made from plans submitted by the four occupying powers as representative of the type of homes suitable for export by Germany to their countries. A round house is suggested as the French home and the English model is flat-roofed and oblong. Plumbing, washbowls, bathtubs and other fixtures will also be of plastics wherever practical.

Interest at Berlin centered on model of round house to be built for the French. Below, English selection

Future Farm Tractor

What the farmer needs is a two-way tractor with the same speeds forward and reverse, according to agricultural engineers. It should be able to handle all farm machines. Plowing and cultivating implements must be quickly interchangeable, perhaps through a power hoist operated by the engine. It should have proper tread and clearance for easy steering and minimum crop damage. These ideas were advanced in response to a survey conducted by the Department of Agriculture.



Hard Rubber Spurs on Climbers Grip "H" or "I" Beams

Hard rubber spurs on steel climbers keep workers from slipping from vertical "H" or "I" beams. Strapped over a worker's shoes, the spurs grip the beam section firmly when the wearer rests his weight on the climbers. They support both ball and heel of the foot so that the worker's feet are parallel with the ground in a normal standing position.



Nonflammable Hydraulic Fluid

Airplane fire hazards have been lessened by the development of a hydraulic fluid for aircraft which will not burn. The fluid is used under high pressure to operate brakes, landing flaps, landing gear, controls and automatic pilots. The mixture was concocted in the Navy research laboratory. It is composed of a water base and other liquids which can be used in hydraulic pumps without corrosion at temperatures as low as 50 degrees below zero Fahrenheit. Petroleum oil now used as hydraulic fluid is flammable. The formula for the mixture has been released to all airplane manufacturers and air lines.



1



2

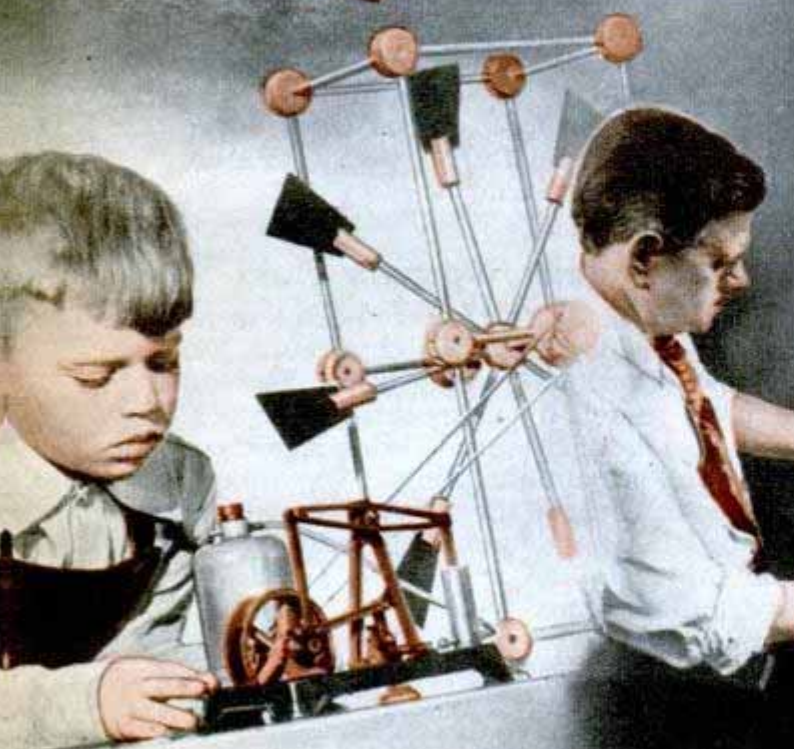


3

- 1** Power from toy electric motor drives colorful Airplane Whirl
- 2** Worm gears control azimuth, elevation of Long Tom cannon
- 3** Bucket loader, dump truck are scale models of big machines
- 4** Electronic doll dances to beat of music from radio or piano
- 5** Electric steam engine shuts off automatically if boiler is dry
- 6** In Foto-Electric football, player can see ball carrier moving



4



5



6

Designed for Junior Engineers



By Maston M. Jacks

THE Junior Engineer of the great American partnership of Father & Son right now is inspecting critically a vast assortment of new equipment he thinks the firm should acquire.

There is a large reconversion program under way in the basement workshop and recreation room and playroom. Wartime "substitutes" are being replaced by post-war equipment—things that work: miniature trains operated by electronic controls, building construction sets with girders locked by tiny rivets, casting sets for plastics and metals, electric tools for the young



↑ Miniature pulse-jet engines develop over two pounds of thrust to drive model racing boats, cars or planes

↓ Precision attachments on Handee tool help Junior Engineer control depth of cut when routing or shaping





↑ Electric pistol will shoot table tennis balls 20 feet
← Handee drill press table raises workpiece to tool

craftsman, and jet-driven boats and planes.

Father, of course, is the firm's purchasing agent and this Christmas he has some half billion dollars' worth of American-made playthings to choose from.

When Dad himself was a kid, a good percentage of his toys were marked "Made in Switzerland" or "Made in Czechoslovakia." Long before the war, the trend was toward the growing American toy industry, and today there is little representation of foreign

playthings in the department store aisles.

Being a "sidewalk superintendent" himself, Dad is likely to be influenced by his own unconfessed longing for electric trains and model airplanes and miniature steam shovels that work—rather than by the Junior Engineer's own desires, which might be as simple as a pencil set or an empty cigar box for filing away marbles.

Most toys, as a matter of fact, are designed to appeal to the Purchasing Agent. And a big percentage are designed to teach as well as amuse. Many a chemical genius got his start with a toy outfit that intrigued Father & Son together, if it did frighten the feminine part of the family with thoughts of tear gas and TNT in the basement. Many an electrical wizard got his first impulse

Small magnetized metal pellets replace pointed darts in modern version of dart game. Scoring board is metal

Front wheels automatically turn in the desired direction when the body of this toy car is tilted slightly



Carbon dioxide cartridges supply propelling charge for miniature V-2 rocket

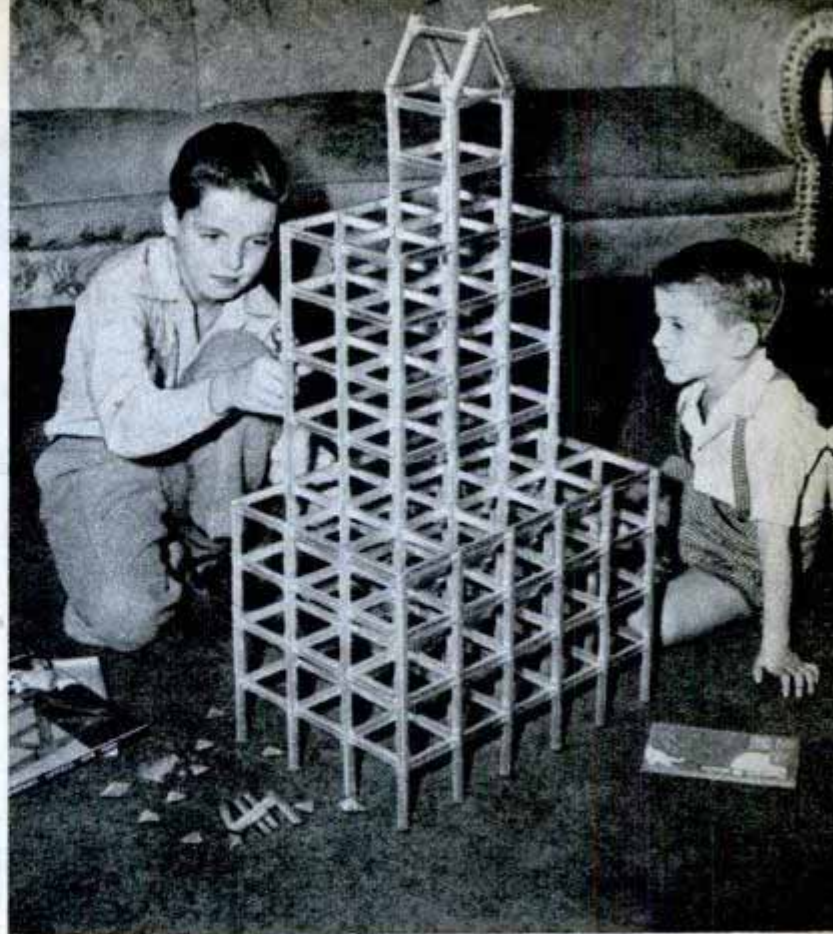


toward his career by tinkering with a battery telephone set or an electric motor kit.

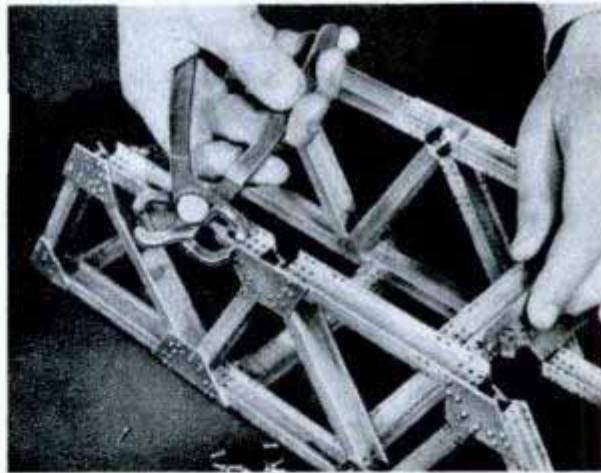
During the war, at least 150 manufacturers stopped making toys and went to work on \$100,000,000 worth of contracts for such things as rocket motors, bomb cases, parachute flares and proximity fuses. Other toy makers substituted paper and wood for scarce metal and rubber and kept turning out toys. As a result of war production experience and the finding of new materials, many of the 35,000,000 children under nine this year will be running durable electric trains that puff real smoke, pushing buzzing vacuum cleaners that actually pick up lint and playing with plastic dolls covered with lifelike synthetic rubber skin. One manufacturer is making scale models of heavy earthmoving equipment. To go with a dump truck there will be a chain-drive bucket loader which fills a working model earthmover with sand for a toy concrete mixer that mixes real concrete.

A firm that once made kitchen utensils is building an all-metal car that parks itself, backs up or turns corners. Another is mak-

Lead soldiers are formed in Cast-Rite molds, below. Chemical action and evaporation change weight distribution in thirsty penguin, right, causing it to drink



Steel beams in playroom skyscrapers are riveted together. Same tool, below, is used to remove rivets





↑ Geared cable drums operate booms of toy derrick

↓ Tiny Diesel engines are available for model planes



ing a plastic car with front wheels that turn when the body is tilted.

So far children haven't demanded toy atomic bombs. But most of the other weapons of World War II are available as playthings, including a V-2 rocket powered by small carbon dioxide cylinders of the type used in charged-water siphons and aviator's life jackets.

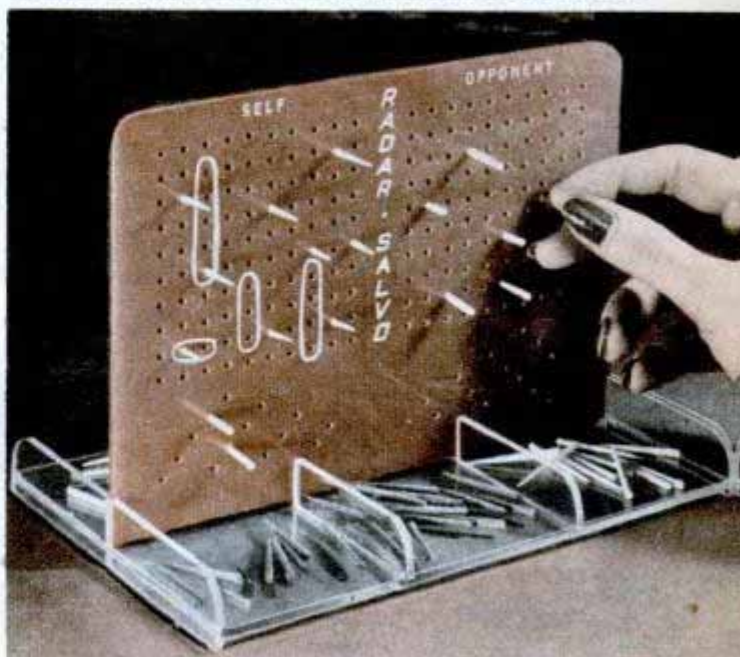
Although many parents and educators deplore warlike toys for children, youngsters keep right on playing soldier. Today the Junior Engineer can make his own soldiers of plastics, formed at home in an electrically heated toy injection mold. There are also cannon resembling the 155-millimeter Long Tom. One fires 10 wooden shells when an electric switch is depressed. An electric mortar fires table tennis balls as fast as they are dropped into the barrel. A spring operated cannon, with worm drive gears controlling elevation and azimuth, shoots marbles. The old fashioned water pistol has become an atomic rocket weapon. It has a long brass barrel with plastic grip and water cylinder. On one filling, it will fire 25 to 30 bursts of

water up to 50 feet, enough to wet down all the opposition in back-yard battles.

Materials shortages forced some manufacturers to switch to plastics and their use is continuing. Dolls, doll houses and furniture are of plastics. Water flows in a plastic doll-house sink, part of a toy kitchen set.

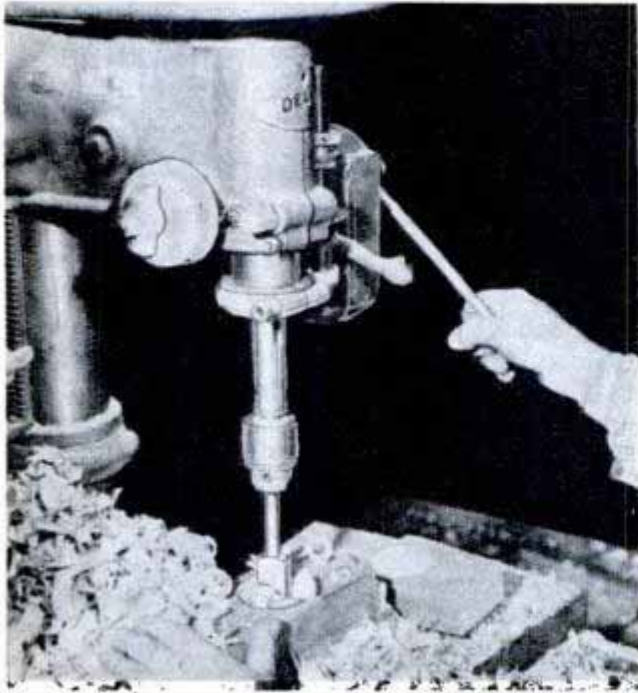
(Continued to page 264)

New version of battleship game is played on red opaque Plexiglas board so players can't see opponent



Straight-Shank Expansive Bit Fits Electric Drill

Made with a straight shank for use in an electric drill or drill press, an expansive bit bores holes from 1½ to 3½ inches



in diameter in wood. Sturdily constructed, the center lip of the bit extends back to form a clamp which holds the adjustable blade at the diameter set. The clamp is locked tight by a screw. The screw point is extra-long and finely threaded for greater efficiency.

Stairstep-Type Gathering Rack Speeds Assembly of Book Pages



Pages to go in booklets can be gathered in sequence at the rate of 3500 sheets per hour with a sectional gathering rack. Permitting the operator to stand or sit, the rack fits on a table, bench or desk. It consists of six sections, and other units can be added to permit the handling of a greater number of pages.

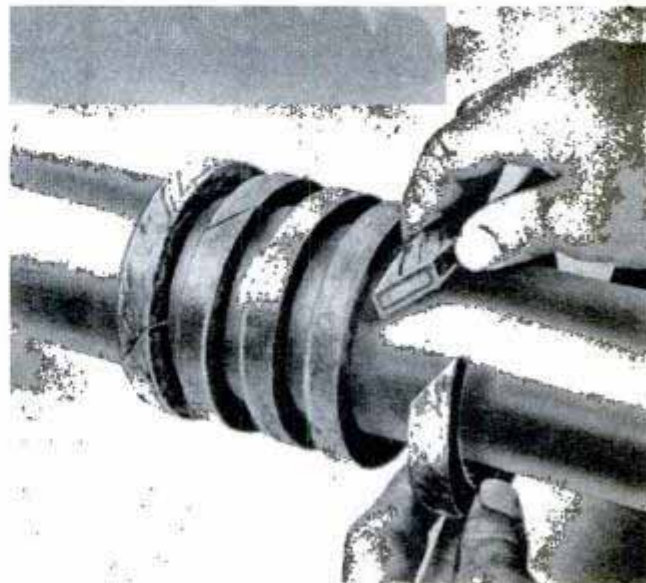


Round Edge on Darkroom Tongs Prevents Damage to Film

Rounded edges on the long lips of photographer's tongs made for darkroom use speed the handling of film and prevent damage to film or paper. A spring mechanism causes the stainless tongs to grasp the paper firmly. The user opens them easily with finger pressure. A hole is provided in one arm so the tongs may be hung up.

Plastic and Metal Packing for Pumps Withstands 900° Heat

Metal and plastic are combined with lubricated asbestos fibers to form a resilient packing made as either spirals and rings. It conforms easily to any shape and is used in standard stuffing boxes of pumps, agitators, mixers and valves. Impervious to steam, acids, oils or caustics, one type of the packing withstands temperatures to 450 degrees Fahrenheit and another to 900.



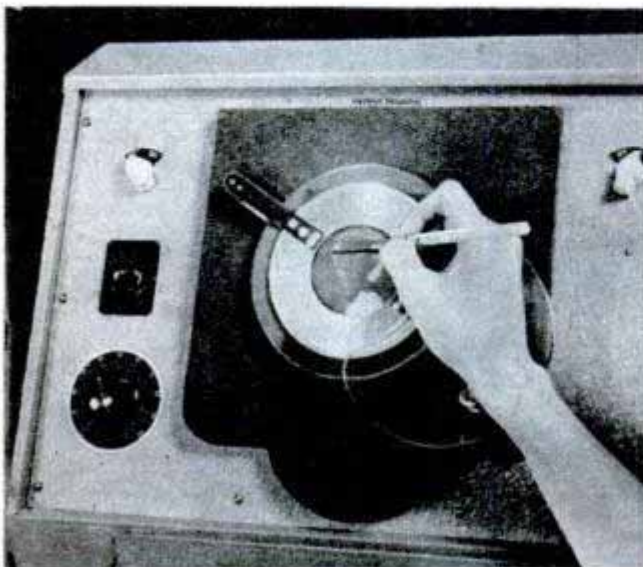
"Accordion" Rack Files Papers In 12 Expandable Compartments



Sorting mail and office papers is simplified by an expanding rack equipped with alphabetical or numerical file guides. Twelve compartments hold up to 100 folders, with a minimum opening of 25 inches and a maximum of four feet. When not in use, the rack collapses for easy storage.

Electronic Photo Retoucher Cuts Work Time to One Third

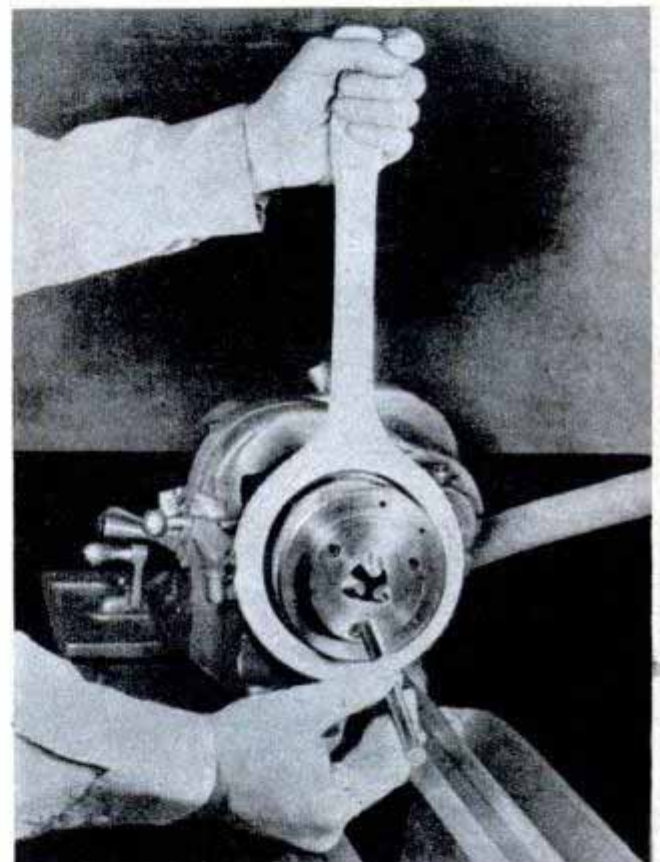
Electronic control is embodied in a photo retouching machine to produce finer work and in approximately one third the time required with former methods. By making a single line with a standard retouching pencil, the operator gets a correctly



diffused pattern of strokes at the rate of 2000 per minute, with no visible motion of the negative. An adjustable rheostat knob governs fineness of diffusion, and fingertip control regulates cool fluorescent light to provide proper illumination for any negative intensity. Housed in an all-metal case, the instrument weighs 18 pounds, is 12 by 18 inches in size and operates on 110-volt alternating current.

Slight Move Opens Speed Chuck Without Stopping Motor

For any turning operation, a high-speed chuck is designed so that it can be opened or closed by slight movement of a handle without stopping the motor or spindle. If desirable to stop the spindle, the handle can be used as a brake. For facing, thread-



ing, centering or drilling, an adjustable stop accessory may be installed and used as part of the chuck. The jaws can be adjusted for close-tolerance concentric or eccentric turning operations. The chuck will hold any size or shape of bar stock in its size range.

"Leather" Coating for Work Gloves

Cloth work gloves will soon be coated with a tough, flexible plastic called vinyl butyral, affording protection similar to leather. The plastic coating is washable and grease, oil and grime can be removed with a solvent. It has demonstrated good wearing qualities and an excellent grip.



HUMMINGBIRD CAFETERIA

By Richard W. Emery

Photos by H. S. Melvin

FOR a ringside seat at a spectacular air circus, build a hummingbird cafeteria. That may sound pretty tame. After all, a hummingbird is no bigger than your thumb. But oh, brother, what a pilot he is!

He's got the bravest heart under feathers. He has a power plant which, by ratio of weight to speed, makes mankind's latest and best look clumsy. He's good for 3600 r.p.m., so to speak—60 wingbeats a second.

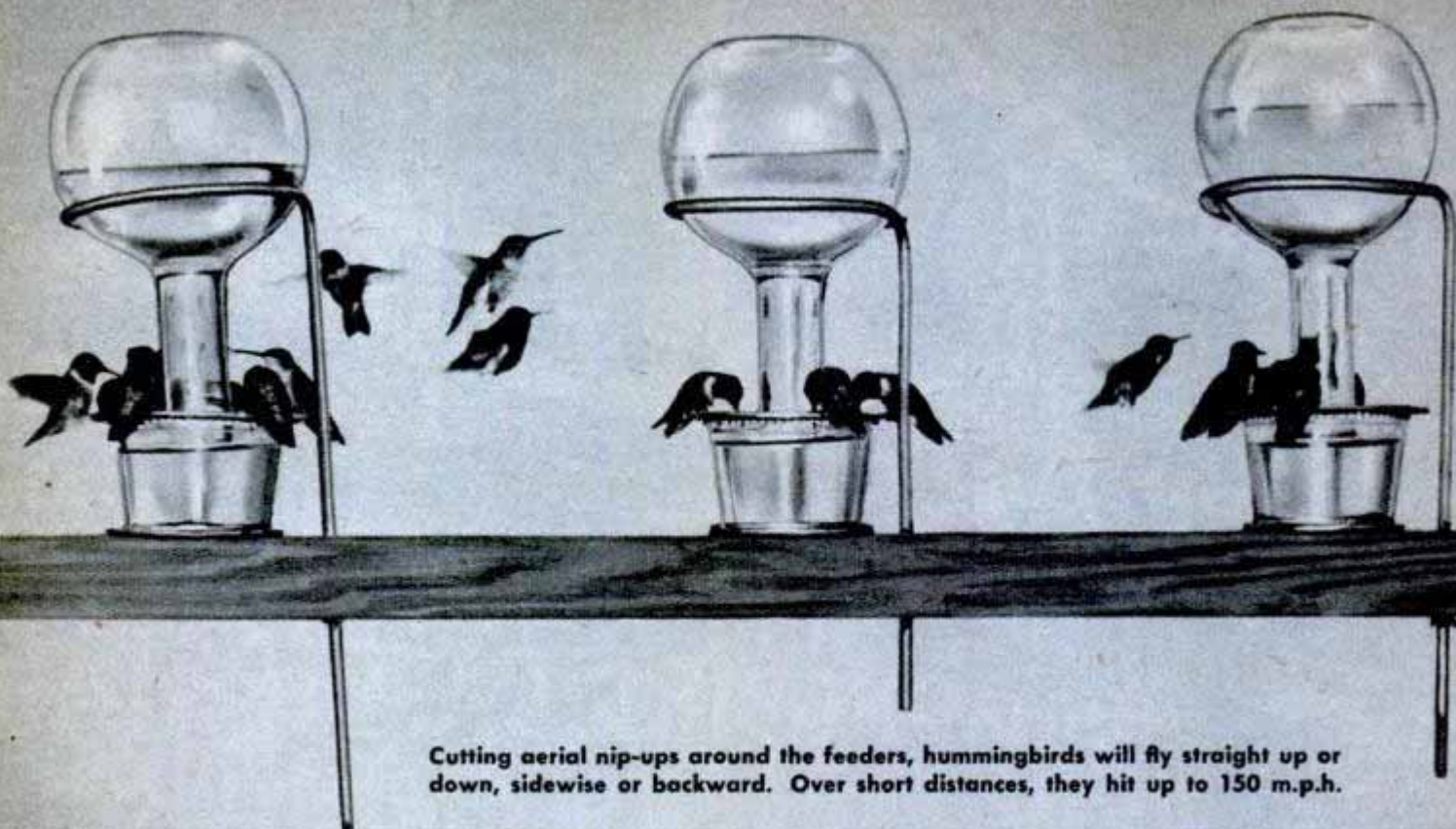
When he turns on full power for a brief burst, he can cover a quarter mile at 150 miles per hour. But he's good for a steady 100 miles per hour for seven or eight hours. Twice a year he zips across the Gulf of Mexico, traveling 700 miles in seven hours.

For acrobatics in the air, he's matchless! He can fly straight up or straight down, stop as if he'd hit a brick wall, zigzag like a ricocheting bullet or hang in midair, motionless except for his whirring wings. He can fly sidewise and he can fly backward.

He knows every trick of combat flying



Up to 6000 hummingbird guests per day have hovered over the serving beakers at the Tucker supercafeteria near Orange, Calif. In return for a little sugar water, the winged acrobats will put on a great air show



Cutting aerial nip-ups around the feeders, hummingbirds will fly straight up or down, sidewise or backward. Over short distances, they hit up to 150 m.p.h.

and aerobatics. With a needlelike bill as his only weapon, he'll tackle a sharp-shinned hawk and send the hawk screeching for help. The big tough boys of the air have great respect for the needle that blinds them in flight!

Flying is so easy for a hummingbird that he'll fly one inch, instead of hopping. He uses his feet only to perch, not to hop or walk. He's an aerialist all the way, cocky and self-assured, a joyous acrobat who looks at you with beady eyes as if to challenge you to come out and fly with him.

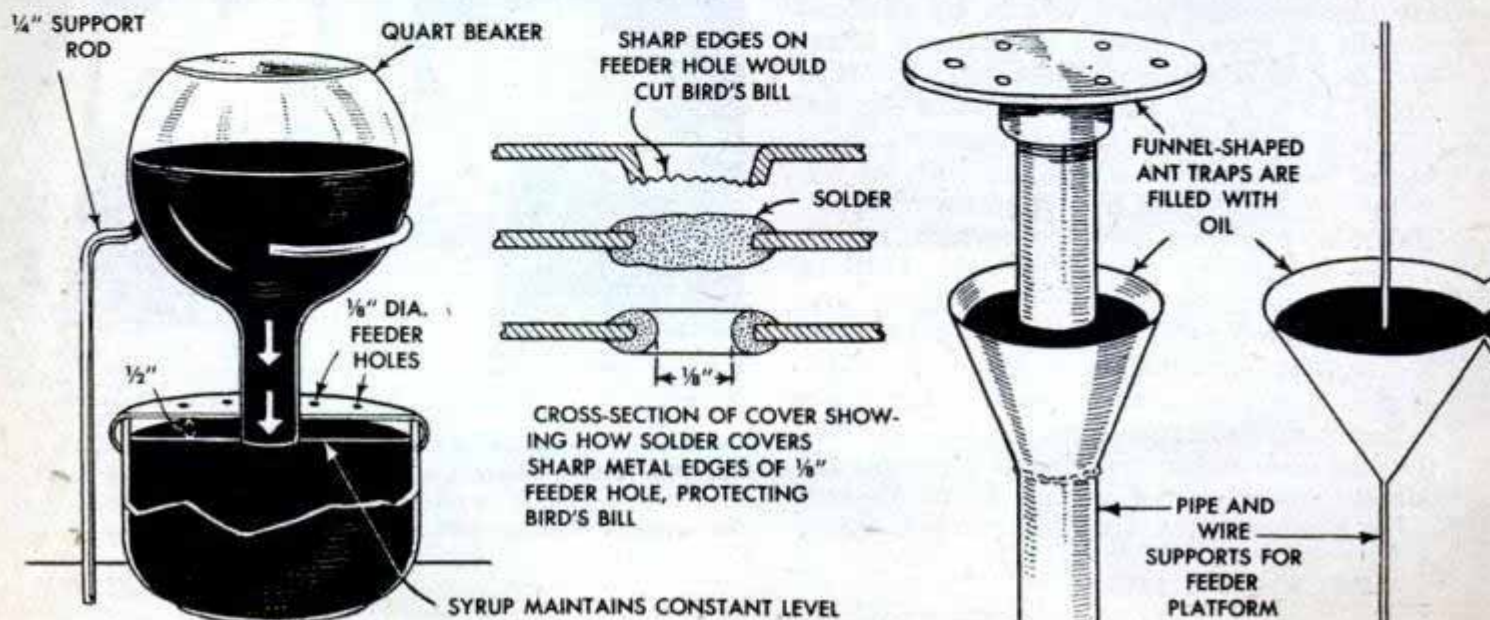
You can't watch hummingbirds without catching some of that gay confidence. They

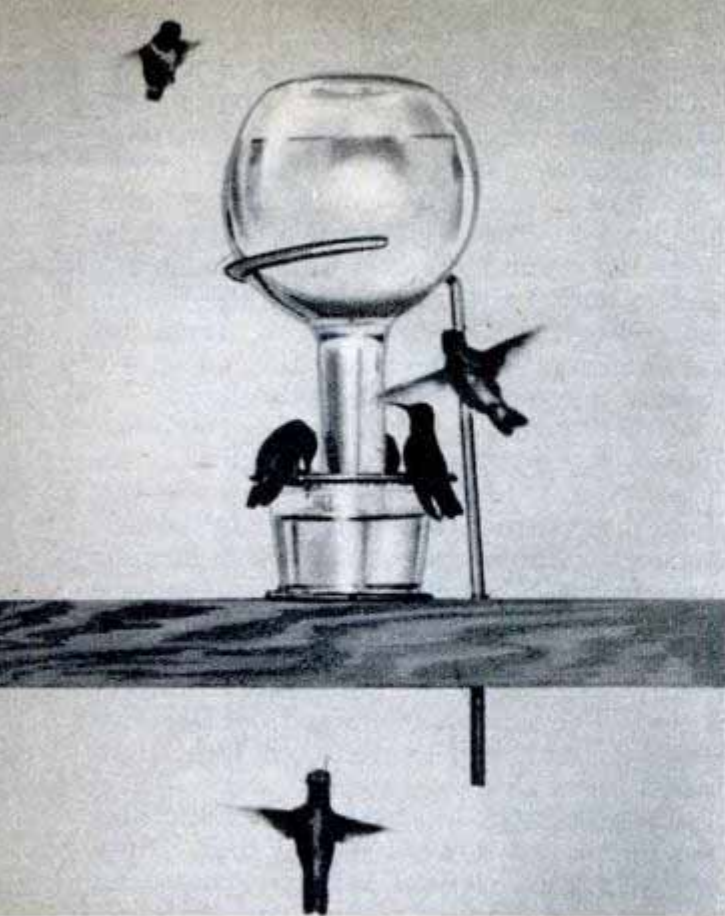
radiate spunk. They're not the least down-hearted at being so peanut-sized. If their size matched their spirit, they'd look eye-to-eye with the mighty eagle!

If you want them to perform for you, the birds will meet you halfway. If you do your part, they'll do theirs.

It's a matter of eating. The hummingbird likes a balanced diet—half meat and half nectar. Left to himself, he'll search for a neighborhood where he can find both. If the flowers dry up, although there are still lots of tiny insects, he'll leave. Or if the flowers are blooming, but there's a bug shortage, he'll leave.

SYRUP FEEDERS ATTRACT HUMMINGBIRDS AND REPEL ANT!





If you supply artificial nectar—half water and half sugar—he'll stay long after flower blooming time and he'll eat tiny insect pests to pay for his keep.

He and his pals will perform aerial nips right in front of your window. That's where you'll place the permanent cafeteria. But first you must make some preparations.

You start out with a test tube or similar small bottle, enough sugar syrup to fill it, a two-foot piece of wire, and a flower. Choose a flower from a patch you've seen a hummingbird visit—a deep-throated flower, preferably red.

Nip off the deep end of the flower, where

Benjamin F. Tucker, above, founded the sanctuary. He warns visitors that quick movements frighten the birds

the nectar lies. Stick this open end down into the test tube. The idea is that the hummingbird will look for nectar and find, instead, a Thanksgiving dinner.

Twist one end of the wire around the test tube so that the tube will be held upright. Place the free end prominently in the same flower patch your flower came from.

With any luck at all, eventually you'll find a taker. He'll return frequently. Once he's sampled the syrup, he's yours. After a few days he'll drink from the test tube without the flower.

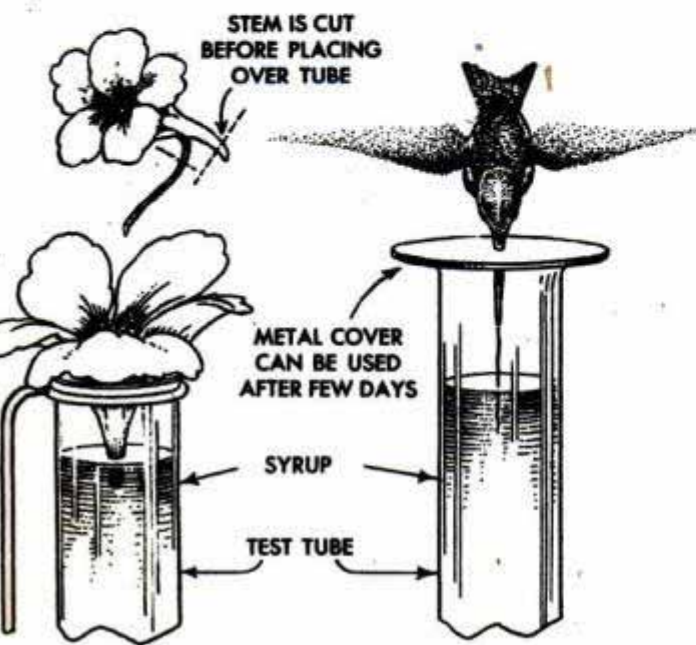
When you have "captured" a bird by the test tube and flower method, you can bring him over to your ringside seat at the window by moving the test tube a few feet closer every day. Choose a spot above reach of children and cats.

Perhaps you'll decide that one test tube on a wire stem is enough. If you keep it full of syrup, it will have visitors aplenty.

But if you want a bigger show you'll provide a multiple feeder or two. You won't have a great many customers in the first year, but your fame will spread mysteriously in hummingbird society, and year by year your cafeteria will grow in popularity.

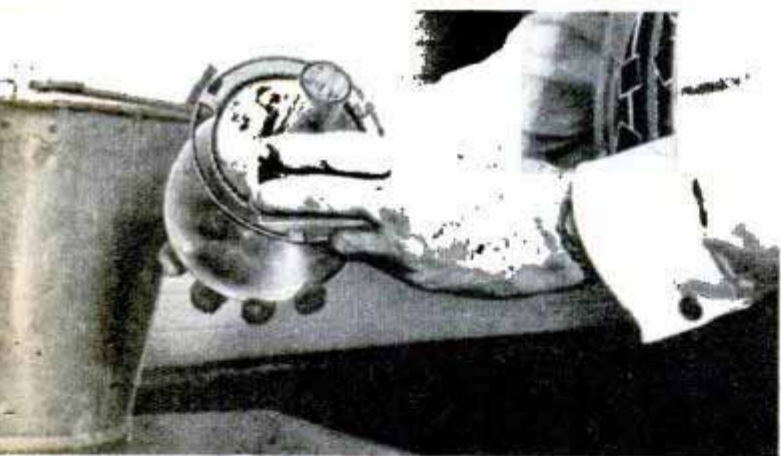
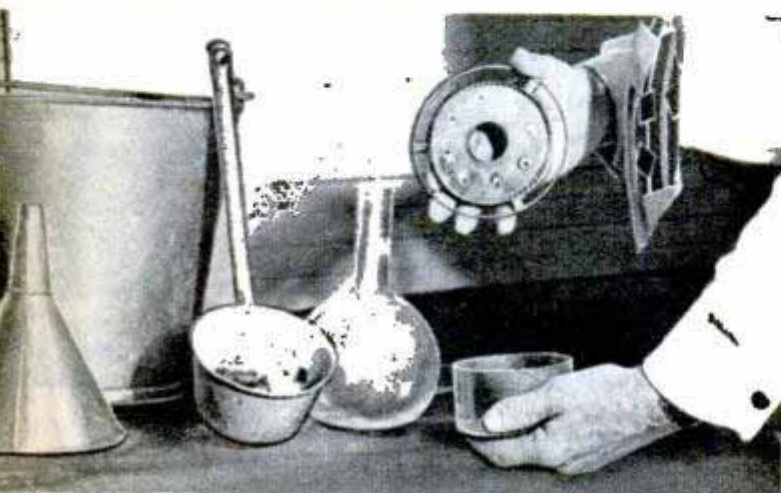
Twenty years ago a California businessman started playing host to hummingbirds at his foothill cabin. He used a cactus flower and a test tube to win the first bird. It took two weeks for the bird to decide to follow the source of free nectar, as the tube was

LOWER LURES BIRD TO TUBE

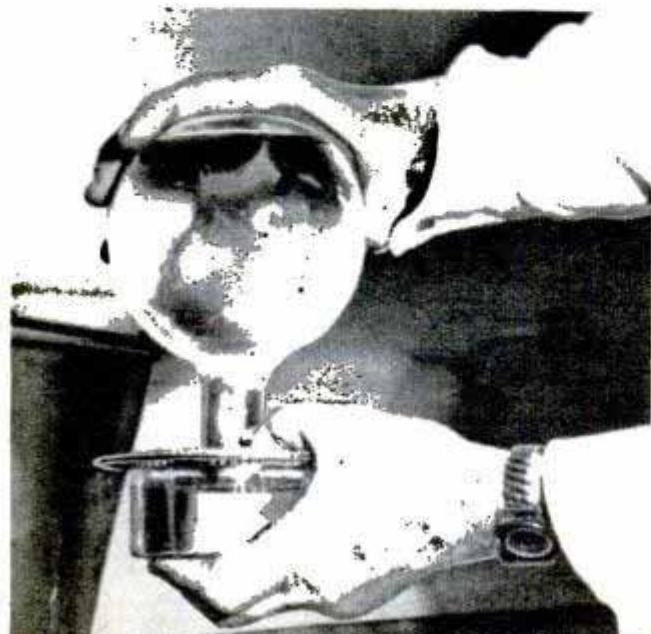




Make nectar half sugar and half water. Hummingbirds repay you for it by killing insect pests. Fill the beaker through a funnel; after filling it slip the perforated metal cover over neck. Then place cup upside down over open end of beaker. If you spill the nectar, wash it up because it also attracts bees and ants



After turning beaker upside down, below, regulate level of liquid by adjusting height of beaker support



moved a little nearer the cabin each day.

The first year, three birds were regular visitors; the next year, six or eight. The third year, 30 or 40 birds arrived and stayed.

Curious to see what would happen, and delighted by the aerial antics of the tiny birds, Benjamin F. Tucker built a dozen big feeders and got them ready for the fourth year. When the birds began to arrive, he was amazed. More than 100 swarmed around, joyously doing loop-the-loops.

After 10 years, the cabin had become nationally famous for its hummingbirds. As many as 6000 of the wee flyers made the place their spring, summer and fall headquarters. Hummingbird nests were located everywhere, in the oaks and sycamores, under the eaves of the cabin, even on telephone wires. Several years ago Mr. Tucker deeded the place to the California Audubon Society. The sanctuary, named the Dorothy May Tucker Bird Sanctuary, is located 16 miles east of Orange, Calif.

Hummingbirds like red flowers best and orange-colored flowers second best. They dip their long, slender bills into the deep tubes of such flowers as larkspur, trumpet vine, honeysuckle, petunias and verbenas, and hoist up nectar through an extensible split tongue which forms two tubes. They capture insects on the wing and also in flowers and in the bark of trees.

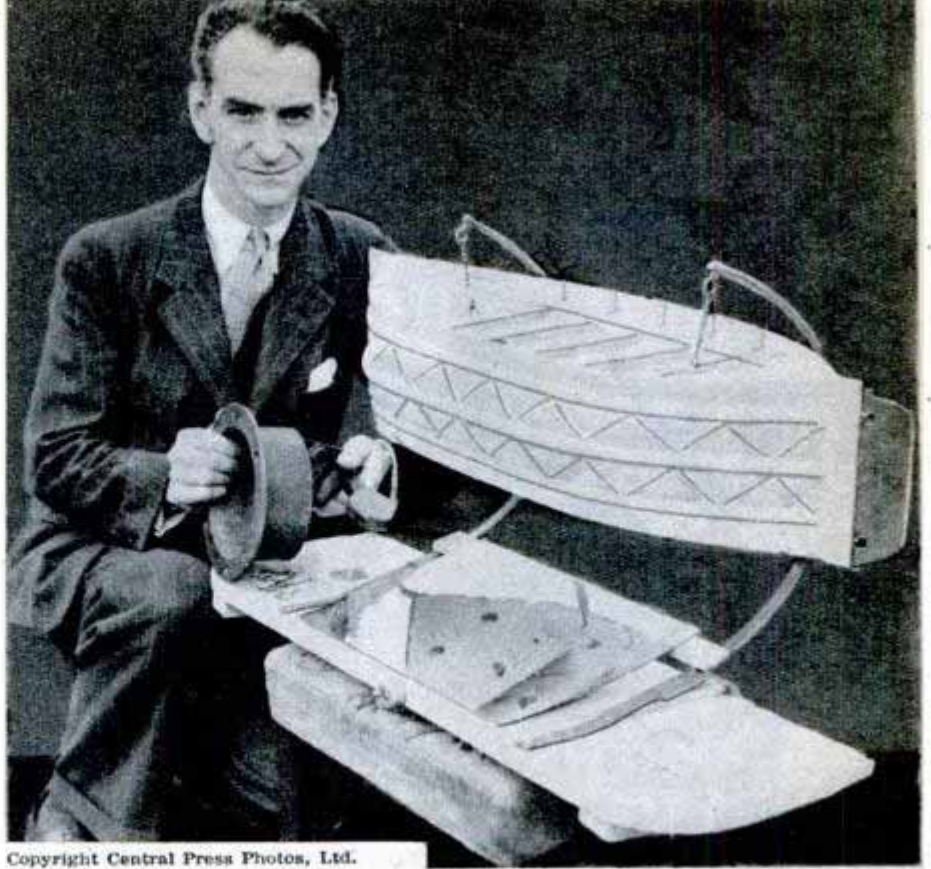
Hummingbirds are found only in the Americas. Most of them migrate southward when cold weather comes, winging away for some South American retreat. They return in spring. West of the Rockies, a species known as the Annas loyally stays through the winter season.

You can lure hummingbirds to eat from feeders, but you'll never succeed in luring a hummingbird to use a man-made nest. Within five minutes after mating, the hen hummingbird starts to build her own nest of cobwebs and tree sap. She always builds her own nest and she won't use it a second time. If disaster takes her first brood of one or two nestlings, she grieves for a day and then mates again and builds another nest.

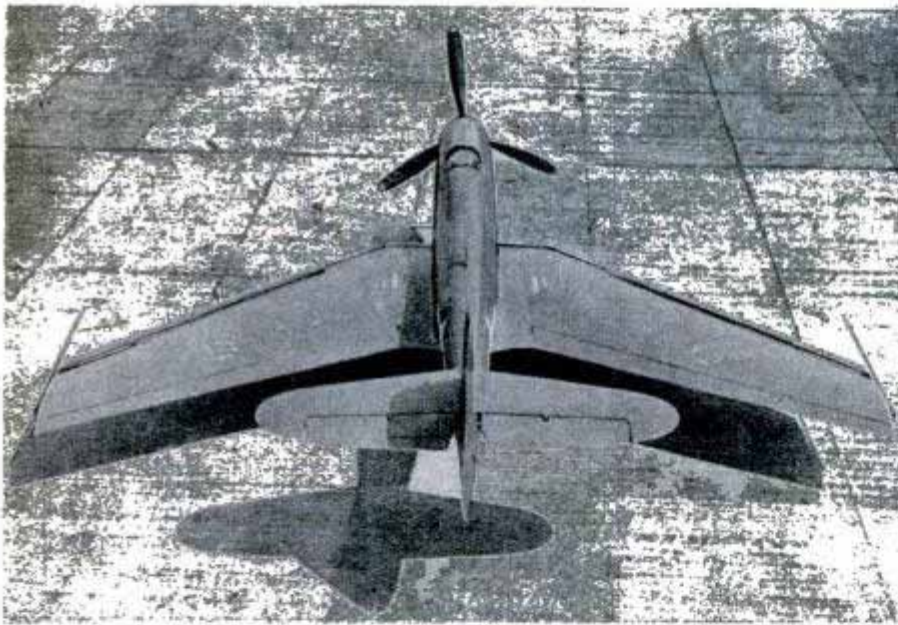
The male hummingbird is a gay and dazzling fellow, but he's no help to his bride when time comes to take care of the baby birds. From the domestic point of view, he's a tramp. He abandons his bride when she starts to build the nest. She lays one or two tiny white eggs. Two weeks later they hatch. The infants look like black bugs. They have neither feathers nor bill. Mama Bird works hard to feed them and she'll appreciate your syrup cafeteria! When the young birds are 21 days old, they already have grown bills and feathers and they fly out of the nest like arrows zipping from a bowstring. They seem to know, right from the start, that they're aerial acrobats.

Boat Won't Sink or Capsize And Holds 80 Persons

Two-in-one lifeboats that are said to be unsinkable, noncapsizable and self-emptying have been approved by the British Board of Trade and tested by American authorities. The new craft looks like two boats fastened bottom-to-bottom. Regardless of which section is uppermost, the bottom section furnishes an air cushion beneath the craft to make it unsinkable, according to inventor H. A. Gaskin of London. The Diesel engine that powers the boat will work either side up, and nonreturn valves empty the boat of any water that is shipped in, making bailing unnecessary. The lifeboat is 45 feet long and 10 feet broad with a capacity of 75 passengers and a crew of five. Compartments in the boat hold six months' supply of food and water.



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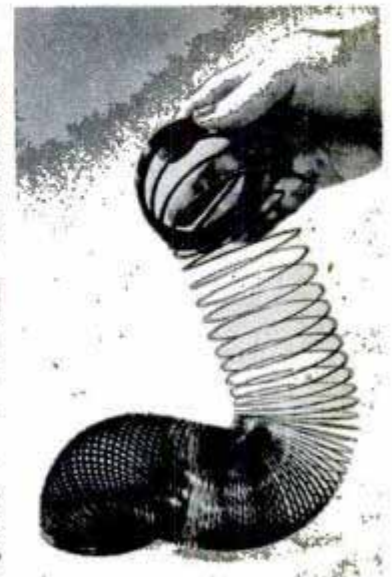
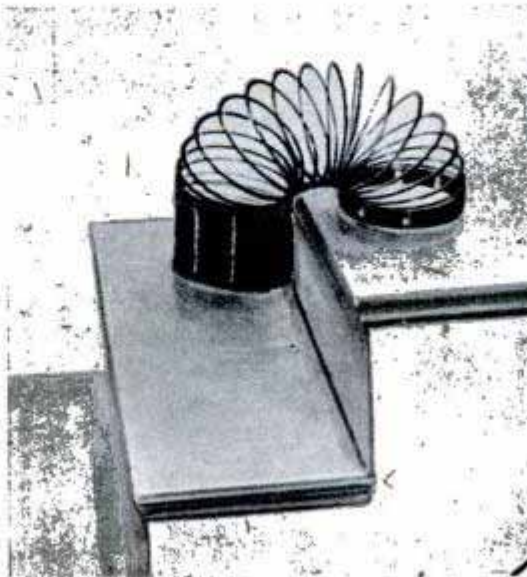
Test Swept-back Wing On Modified Fighter

Possibilities of the swept-back wing in the quest for supersonic plane speeds are now being tested in the Navy's L-39. A modified version of the P-63 Kingcobra, also built by Bell Aircraft, the L-39's wings have a rearward angle of 35 degrees. It is believed to be the first conventional American craft to be equipped with swept-back wings. Swept-forward wings are also being tested.

Coil Toy Made of Spring Steel Walks Slowly Down Steps

Made of Swedish steel, a spring coil toy vibrates as though it's alive and walks down a slanting surface, end over end. When placed on a flight of stairs with the two ends on different steps, the coil walks slowly down the stairs, coiling and uncoiling by its own action. It is made of about 100 turns of the tempered steel.

Using a diamond drill, a tiny machine tool developed by the Russians can bore holes as small as .0001 inch in diameter.

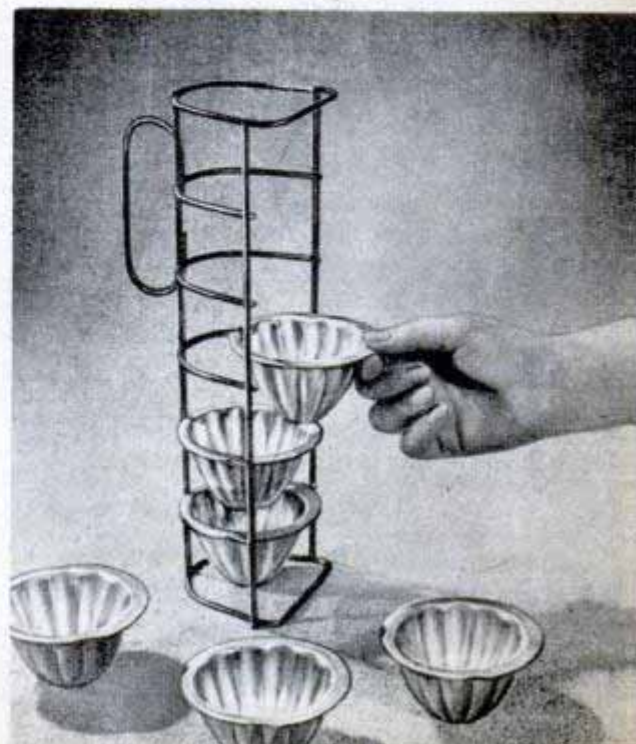


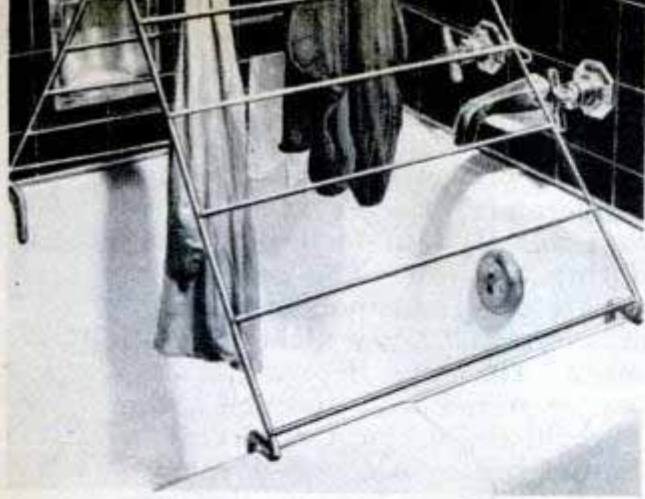


Slide-away kitchen table pulls out of a wall cabinet or sink to seat five persons. Below, six gelatin molds can be stacked vertically in rack for refrigerator.

*"Inside
Stubb"*

for
Your Home





Tent-shaped clothes drier fits over bathtub which catches water drops from laundered lingerie, hosiery and baby garments. Below, pump-type catsup dispenser eliminates shaking or pounding the bottle



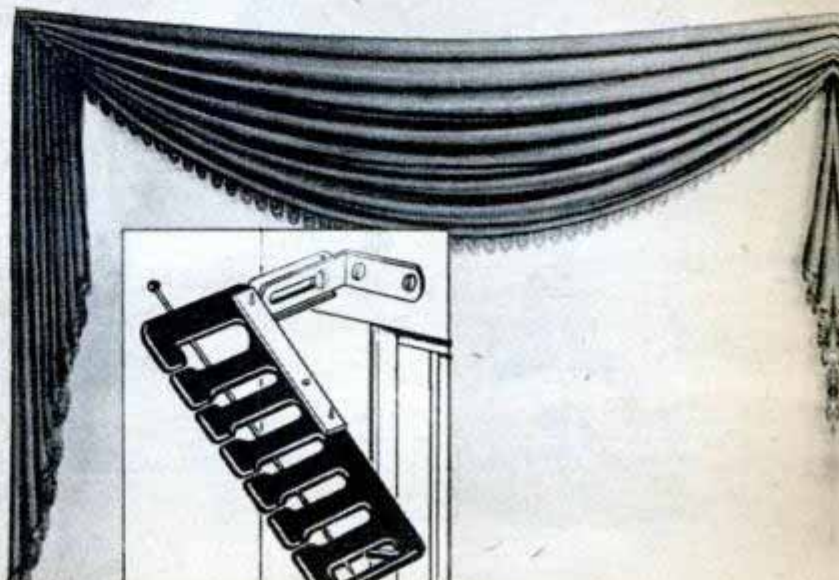
Four or five potato slices the right size for French frying can be cut with one movement of the hand when a special cutter is used. Made of aluminum, it has a series of small sharp blades that do the job



Aluminum frame for bottom half of window holds the screen in summer and storm window in winter season



Hot pans, canning jars and cans are picked up easily with the assistance of aluminum tongs. Below, valance hanger has slots to hold drapery in graceful, sweeping curves





Lamp Kills Refrigerator "Bugs" With Ultraviolet Rays

Rays that deal death to bacteria are emitted from a midget lamp designed for home refrigerators. Larger sterilizing lamps were installed in food processing plants during the war. The new lamp, about the size of an automobile headlight bulb, can be screwed into a niche in small refrigerators. The rays improve sanitation, preserve stored food and check the growth of mold and bacteria, according to Westinghouse engineers who developed the bulb. In addition to the rays the lamp produces ozone, a form of oxygen that purifies the air. Ozone retards the "swapping" of odors that can affect the taste of fresh foods stored in refrigerators. The lamp operates at a cost of about a nickel a month.

Aluminum House-on-Wheels Accommodates Six Persons

When Mr. and Mrs. Max Ranney and their four children, of Wichita, Kan., take a trip, their house goes with them. It's a combination automobile and cabin. The living quarters, designed and built by Ranney, are in an aluminum structure 7½ feet wide and 24 feet long mounted on a six-wheel Franklin chassis. Interior walls are lined with plywood. The house-on-wheels has a kitchen, 24 square feet of window space, sleeping accommodations for six, and its own lighting system.

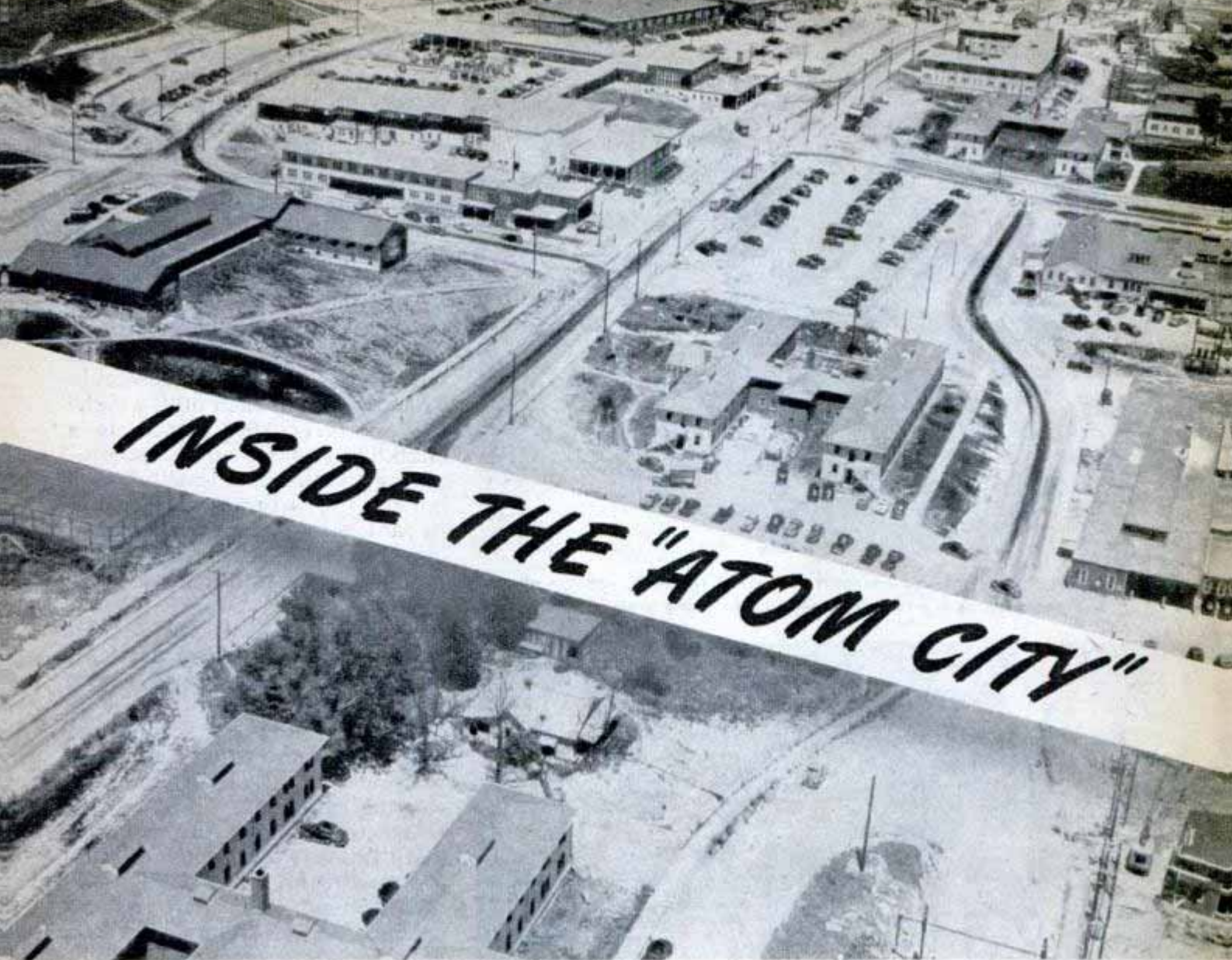


Automatic Lock on Flexible Cable Makes Drain Cleaning Easier

For easier cleaning of stopped drains, a flexible cable type drain cleaner has an automatic cable lock built into the lower swivel handle. When the handle is moved up, the lock releases its grip. When the handle is moved down, the cable is locked in place for rotating by hand or by an electric drill attached to the T-handle. The aluminum shell holds 25 feet of cable.

Vacuum Control Valve Stops Carbon

Through a special valve, controlled quantities of air are admitted into an automobile engine to reduce the vacuum pressure which builds up on deceleration. The valve permits air to enter only when the throttle is closed. This prevents suction of gasoline and oil into the motor where it forms carbon or blows out of the exhaust in smoke or fumes.



By Chester B. Farnham

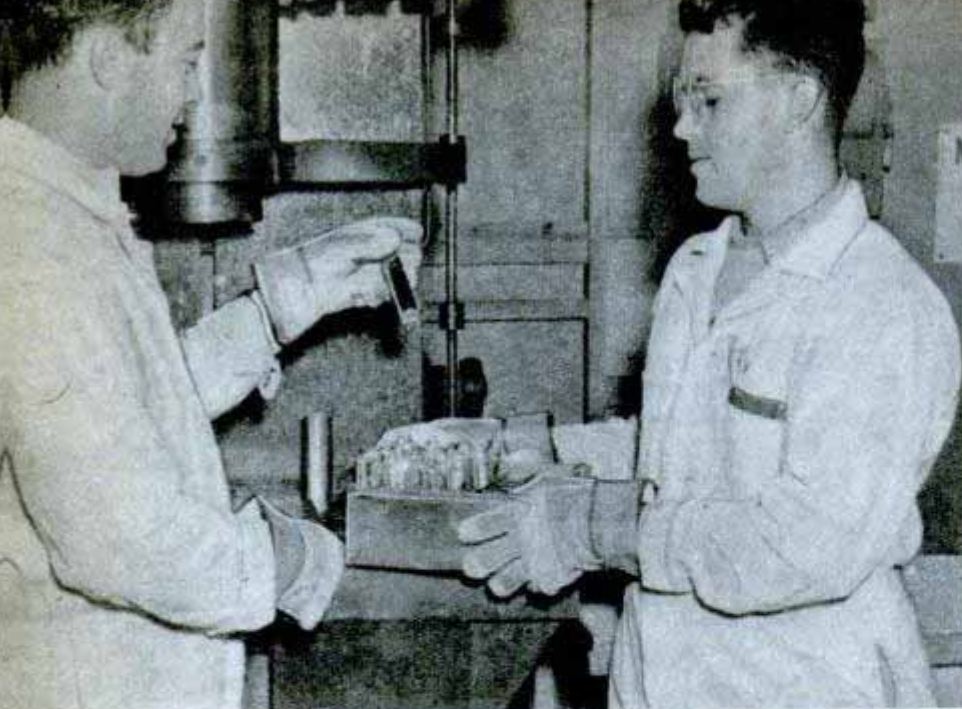
STRANGE SIGHTS greet the visitor to the "Atom City" of Oak Ridge, Tenn. As a member of the first group of writers permitted to enter this fabulous place, I saw scientists "canning" atomic energy; researchers producing "RI," medicine's sensational new A-weapon; men peering into periscopes; physicists creating the kind of "capped" energy that blotted out Hiroshima but which may some day help retard the effects of old age in humans.

Standing near the spot where materials for the atom bomb were made, I observed scientists handling by remote control the deadliest substances the world has ever known.

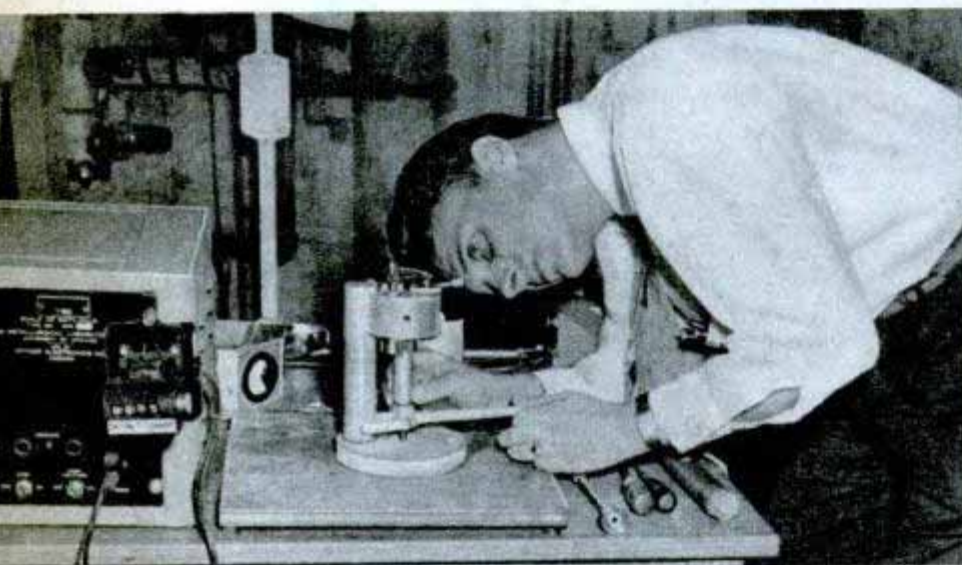
Daily they work with amounts as small as $1/500,000,000$ pound. Many of these by-products of the atomic bomb are in units too small to be seen with the naked eye; some are in liquid form, while others, weighing an ounce or so, are solids. Some are not dangerous at all, while others emit rays able to snuff out a life in less than a minute.

Top, air view of Oak Ridge.
Right, measuring activity of
radio-isotope in Geiger counter





In "canning" atomic energy for medical research, calcium nitrate is measured as a powdered solid before being pressed into pellets



Isotope can is sealed prior to being inserted in atomic pile. Below, removing shielding plugs from uranium pile before freeing isotope. Uranium is bombarded behind protective walls of concrete



The occasion was the official reconversion of the atom bomb factory to peacetime, when the government turned over to research institutions the first "canned" products of atomic energy made in the Clinton Laboratories at Oak Ridge, research center operated for Uncle Sam by Monsanto Chemical Company.

Directors of five medical research institutions received the first units of Carbon 14, which will be used in cancer research. The material in each unit, weighing about 1/10,000 ounce, is a chalklike powder made by combining two kinds of barium carbonate, the ordinary variety and its radioactive type. It was placed in a tiny bottle set in a steel container housed in a six-inch rectangular wooden box.

This strange substance will emit beta (atomic ray) particles for many thousands of years, starting at the rate of about 37 million particles a second. In 10,000 years the rate of emission will decline to about half the starting rate.

Greatest hope of the research institutions is to discover whether some of the radioactive materials (50 all told) that can be produced in an atomic pile will help find a means of preventing cancer. Furthermore, ray-emitting forms of various common elements will be used as "tracers" in studying other diseases.

RI is the scientific nickname for radio-isotope, medicine's new atom weapon. Radio-isotopes (of which Carbon 14 seems the most promising) are radioactive forms of elements with the same chemical properties as the stable element but having a different atomic weight. Their structure is complicated but it is possible, by man-made devices such as an atomic pile or other nucleus-bombarding instrument like the cyclotron, to make RIs which do not occur in nature and which are radioactive.

An RI is made by placing in the pile a stable element, which may be a metal, salt, liquid or gas, and leaving it there for a given length of time. This is the basic process and it applies regardless of whether the material inserted is fissionable, such as

uranium, a common salt like sodium chloride, or an ordinary metal like iron.

Some RIs can be made in a few days while others require several months. Care must be taken to protect the material put into the pile from the temperatures it will meet (hence liquids and gases are not usually used) and from the action of oxygen and water vapor in the air. Not only for these reasons must the material be enclosed in a container but also for purposes of handling.

Furthermore, the form and purity of the material exposed, as well as the material of which the exposure can is made, must be such as to minimize neutron loss. That is, the drain on the power of the atomic pile must be kept to a minimum. These conditions usually are met by carefully selecting the form of the element to be exposed and by using aluminum for the can in which it is enclosed.

A major consideration is the subsequent separation of the newly created radioactive species from the "parent" element or compound put into the pile. Such separation may be very complex, as in the case of the extraction of the individual fission products from the parent uranium. It may be relatively simple, as in the extraction of radioactive iodine from the parent tellurium. Or it may be skipped altogether, as in the case of radioactive phosphorus, produced by the exposure of phosphorus itself.

In "canning" atomic energy, Oak Ridge scientists use two types of aluminum cans to enclose material for isotope production in the pile. One is a welded, tight-fitting aluminum jacket for uranium and calcium nitrate salt. Parent materials for all the other RIs produced in the Clinton pile are placed in aluminum cans about the size and shape of a man's index finger. These cans then are set into holes in a graphite block running into the center of the pile. When the graphite block, containing a number of cans, is loaded, it is pushed into the pile and left there during the period of irradiation.

While the pile is being loaded or unloaded, the control rods

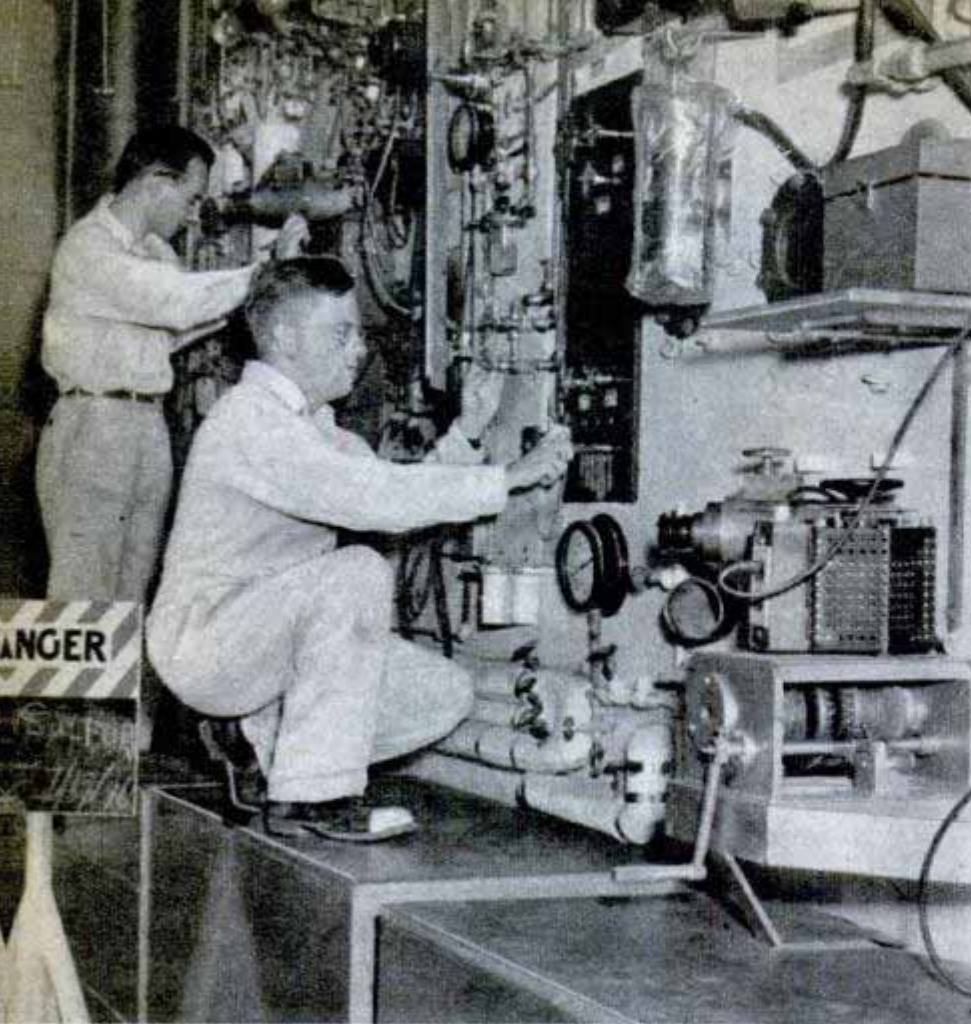


Remote control device—out of range of dangerous radiation—is used to remove atomic energy (radio-isotopes) from uranium pile



Can of radio-isotopes (above) removed from the pile is placed in a lead shipping container. Below, physicist (right) uses radiation-measuring device to be sure no dangerous rays are emitted





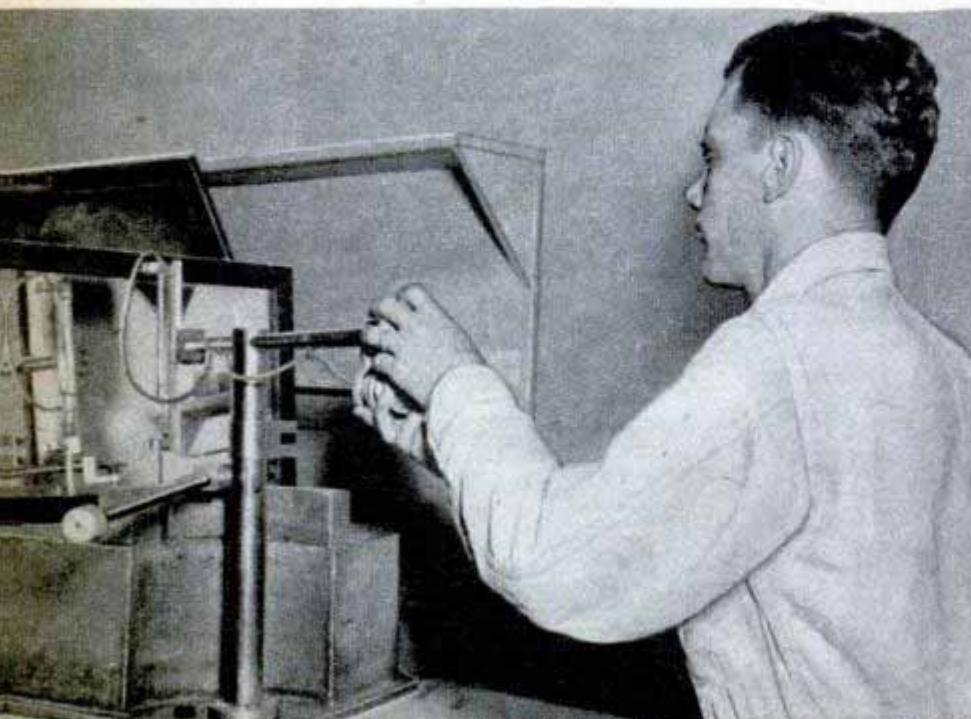
Atomic chemists operate remote control apparatus, including periscope, to peer behind concrete walls during separation of uranium

which stop the chain reaction are in place. This is to prevent the escape of dangerous neutrons from the pile during loading.

After the loading has been accomplished and the loading hole has been blocked so that neutrons cannot escape, the pile is started up. Usually the material is left in the pile from one to several weeks.

When it's time to remove the batch of

Remote control device measures out tiny portions of radioactive products in solution. Sample, shielded by lead, is viewed in mirror



ner and see the material with which he is working.

Where low intensities of radiation are encountered, the operator may use tongs and work behind shields within one or two feet of the radioactive species. For the separation of high-intensity fission products, however, a cell 4 by 6 by 8 feet is placed inside a larger room with all controls on the outside. By means

of air pressure, vacuum processes, rods and grappling devices, the operator is able to put the radioactive material through the required chemical and physical steps without entering the cell or removing the "hot" material from it.

Instruments to measure radiation are needed not only for the scientists who work with radiation but also for the success of the chemical work. Devices are built right into certain parts of the apparatus so the operator always knows how much of a radioactive material is at a given point.

Almost infinite are the potential uses of radio-isotopes. With a unit of Carbon 14 the

(Continued to page 260)

samples the pile is shut down and left long enough to permit the gamma radiation, which would come from the open hole, to die off to a relatively low intensity. Then the hole is opened and the graphite block is pulled out into a lead "coffin." This precaution is necessary because of the radiations being emitted by the exposed material and by the containers.

Technicians stand by with radiation-measuring devices to insure that no person exposes himself unduly. The samples are removed from the block by means of long tongs, examined with instruments and then placed in a lead safe for temporary storage.

Manufacturing RIs on a large scale, which involves working with radiations of the most dangerous types, requires a special type of large research chamber known as a "hot" laboratory. Here the operating chemist uses heavy shielding of concrete and lead, besides periscopes which allow him to look around a cor-

HOW THE GEIGER COUNTER WORKS



Types of counters reacting to different kinds of rays

The Geiger counter tube was developed in 1908 to detect single ionizing particles from radioactive elements, ultraviolet rays, X-ray generators, X-ray sources and cosmic rays.

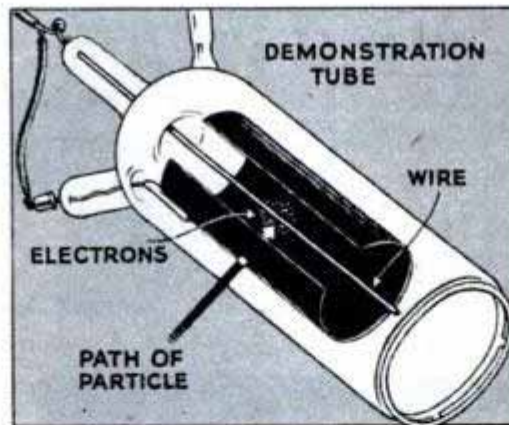
What it consists of: A conducting cylinder (usually copper) down the axis of which is stretched a fine insulated wire attached at either end with small springs. The cylinder and wire inside it are surrounded by a thin glass shell, forming a tube in which gas (usually hydrogen or argon) is contained at a few centimeters of pressure. The wire is frequently

five mils tungsten. Though the tubes vary, they are generally less than an inch in diameter and about five inches long.

Operation: A voltage of 300 to 5000 is introduced (depending on the gas used in the tube, its pressure and the geometry of the counter). This voltage must be just less than enough to break down the wire-to-cylinder gap. When an ionizing particle—for instance a beta ray—enters the space between the wire and the cylinder, the electrons produced in the gas will be speeded toward the wire with increasing kinetic energy and, in the strong electric field near the wire, obtain sufficient energy to ionize the gas, producing more electrons. These in turn are accelerated, and an avalanche of electrical charges is initiated. In addition, the recombination of the positive ions produces light quanta which eject photoelectrons from the metal cylinder.

Results of action: The avalanche sets up a flow of current in the external circuit which may be electronically amplified to produce a click in a loud-speaker. It also can be fed to various radio instruments that record both number and intensity of the ionizing particles.

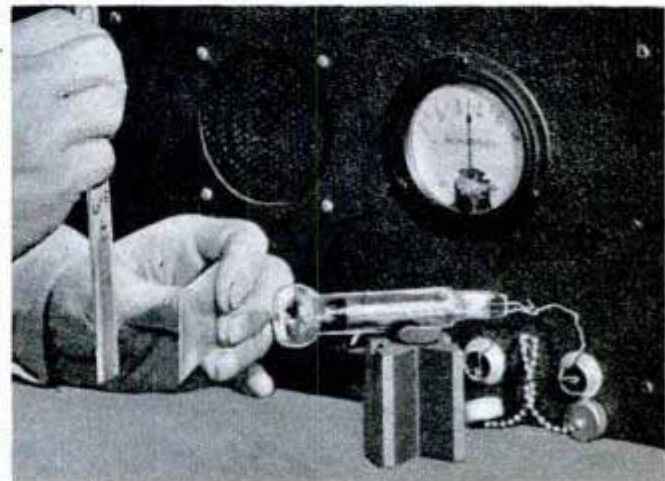
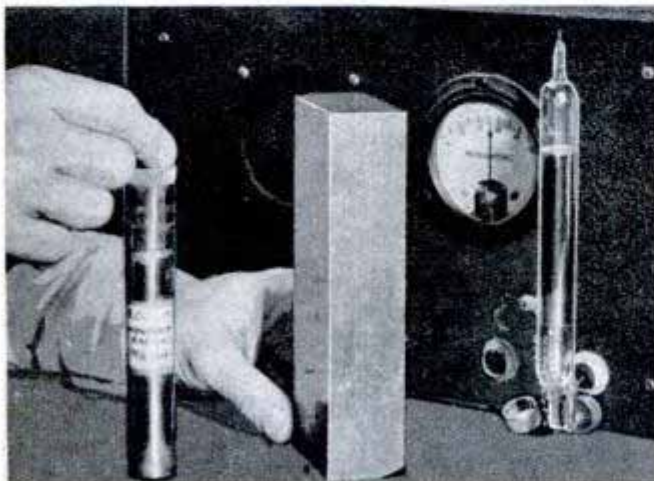
Extinguishing of action: When a discharge is started, it has to be extinguished rapidly so the tube may be sensitive to the next ionizing particle. After the short is extinguished, the circuit is ready to act again. In general it may be said that the action in a Geiger counter is such that the incident particle causes the counter tube to break down electrically once for each particle entering the counter tube.

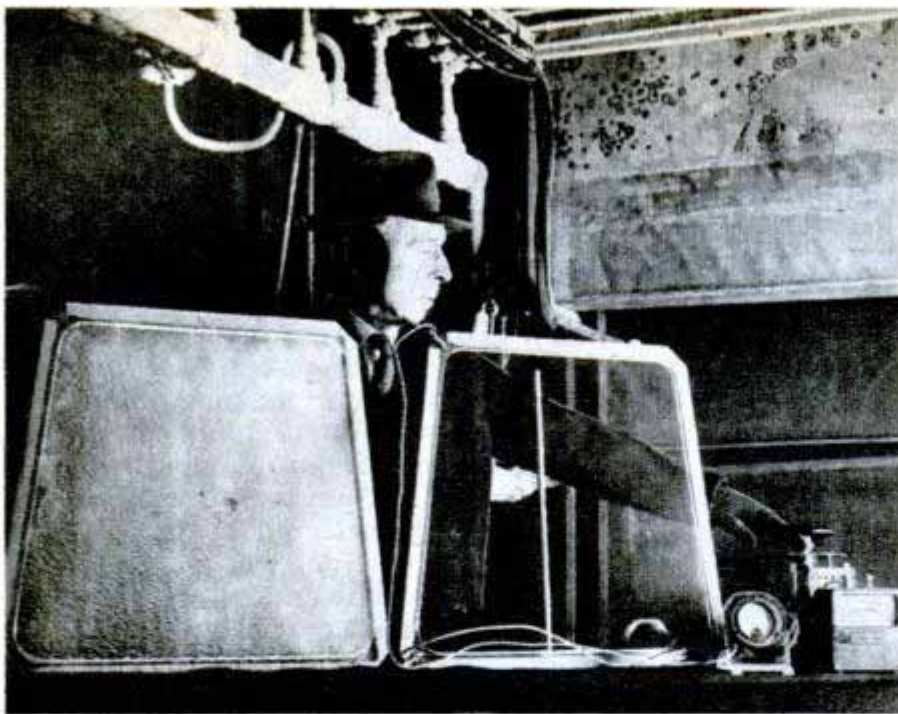


Heavy metal bar blocks less than half the gamma rays

Thin brass sheet halts less penetrating beta radiation

Westinghouse photos



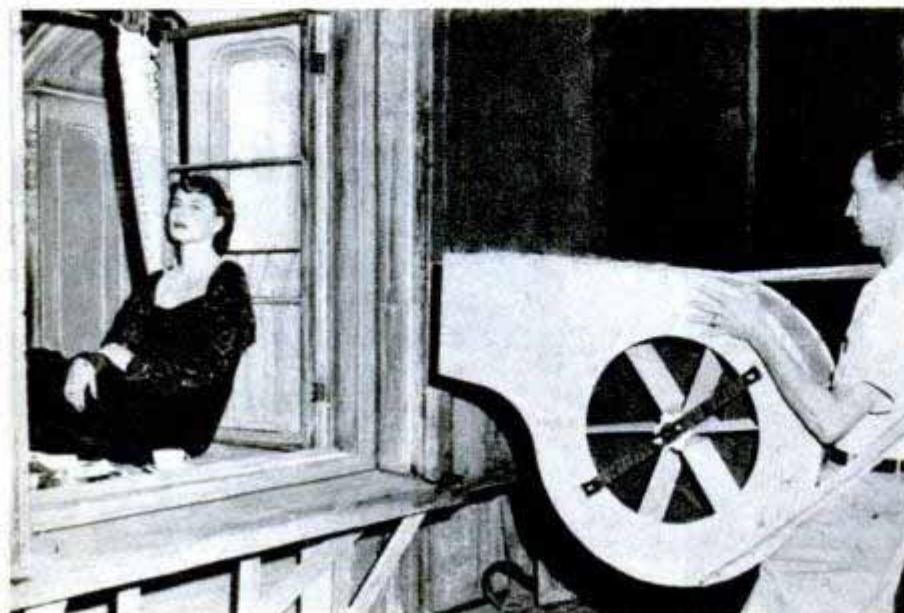


'Electric' Windshield Keeps Ice Away

Ice formations on airplane windshields are eliminated by a transparent coating for glass that conducts an electric current to keep the windshield at above-freezing temperatures. The coating also eliminates interior fogging. Electrical resistance of the coating is relatively low and converts the electric energy into heat. The coating does not distort vision through the glass. Metal bars on the edges provide electrical contact.

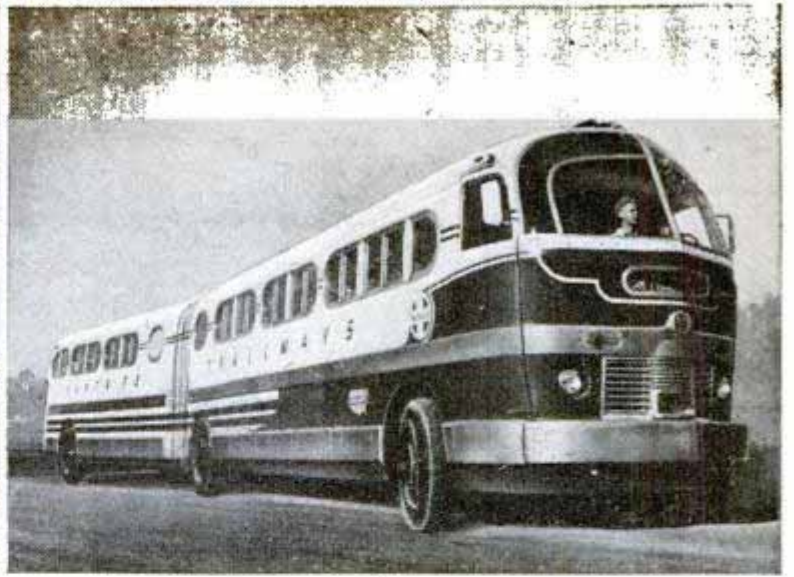
Self-Powered Recording Unit Turned by Spring Motor

No outside power of any kind is needed by a new portable recording machine imported from England for on-the-spot broadcasts of special events. Power is supplied by a spring-wound motor similar to the type used in old-fashioned phonographs but modern in construction. The unit weighs only 34 pounds. Long-range pickup without amplification and a microphone that hooks to the coat lapel are additional features. The unit, imported by Station WOR of New York, records three minutes on each platter at 78 r.p.m. The quality of the recording is claimed to equal that of conventional portable units.



Movie Breeze-Maker Keeps Actors Cool

Cool air is dispensed from a portable air conditioner to keep movie stars comfortable while they are acting under the heat of floodlights. When Ingrid Bergman was making interior scenes for "The Arch of Triumph," Hank McCleed, a special effects technician, devised the portable blower. It was also used to stir up breezes for special photographic effects.



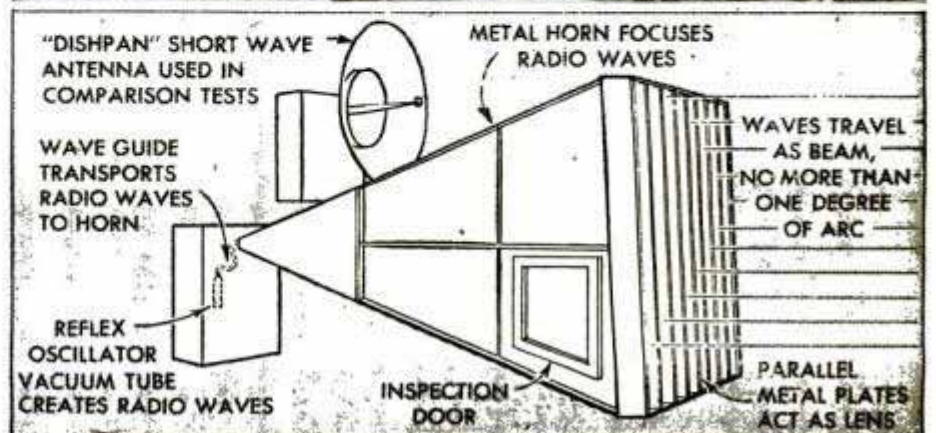
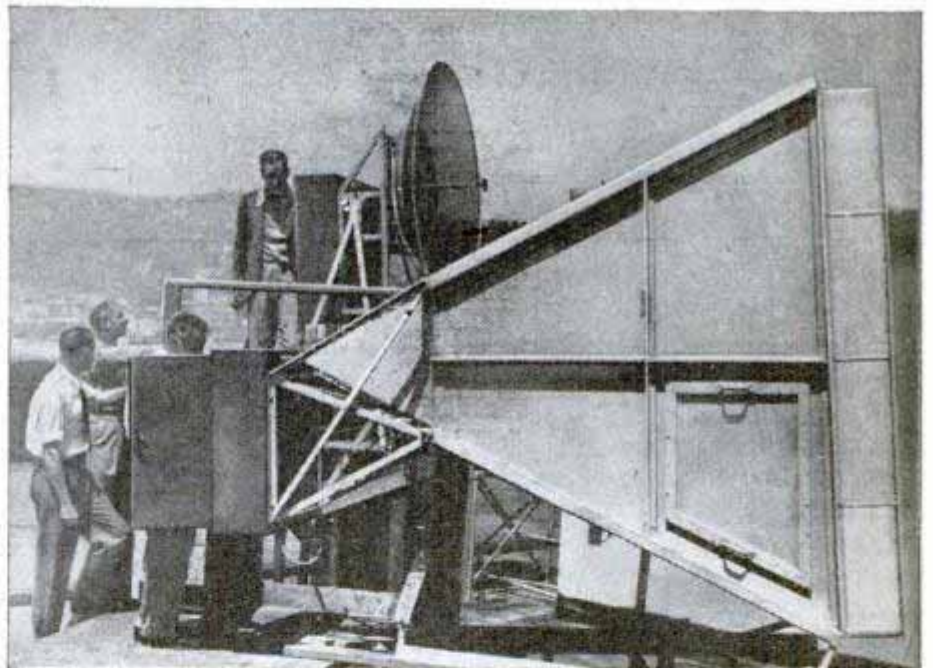
Standard buses are dwarfed by a huge 60-foot bus built in two sections for greater maneuverability. The bus is 25 feet longer than most standard buses and carries 63 passengers, 26 more than other buses operated by the same line. It has a pay load of 28,000 pounds, 4000 pounds greater than the older buses. The rear section rolls on

Two-Section Bus Seats 63

only two wheels with part of its weight supported on the double rear wheels of the front section. Passengers are seated three abreast. The vehicle, built of magnesium-aluminum alloy, is powered by a 275-horsepower Diesel engine. It was built by Henry J. Kaiser's Permanente Metals Corporation for Santa Fe Trailways.

Horn-Type Antennas Sharpen Weak Television Signals

Huge metal horns focus television signals into a sharp beam in a video system now under development for the Los Angeles area. The horns, developed by the Southern California Telephone Company and the Bell System, transmit programs from Hollywood studios to Mt. Wilson, 17 miles away, where they are picked up and re-broadcast over the Los Angeles area. Focusing "lenses" for the horns are parallel metal plates spaced half a wave length apart. Only four tenths of a watt of power, concentrated into a very sharp beam by the antenna, will produce strong, clear reception at the mountain. The television band is four million cycles wide at a frequency of about 4000 megacycles. The pictures received on the mountain are transmitted back to Hollywood by a "dishpan" antenna to be checked for clarity.



As Told to Andrew Hamilton

AN ESTIMATED \$30,000,000,000,000 in gold beneath the sea awaits anyone who will take it. Not pirate treasure, but tiny particles of the yellow metal held in suspension in the water. This represents about \$15,000 apiece for every man, woman and child in the entire world.

But it would cost more to extract this gold than it is worth at the present market value. And besides, the ocean holds even greater wealth in animal, vegetable and mineral resources that can be used advantageously by man.

Approximately 200,000 species of animals and 8000 species of plants grow in the ocean, many of which are edible. Almost every known mineral element has been found and some exist in commercial quantities. The continental shelf may be our last source of petroleum and man's ingenuity some day may be



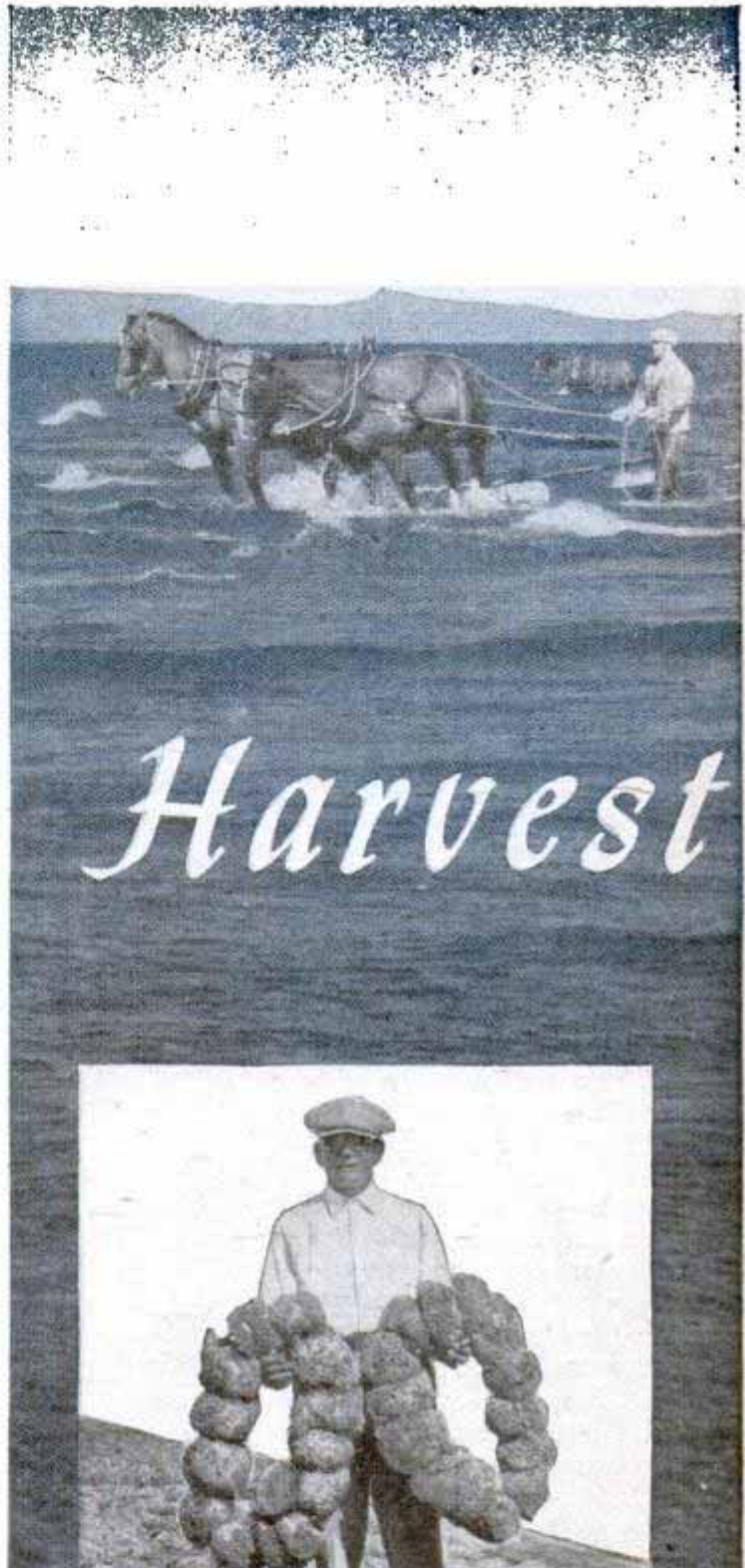
able to harness the enormous power of the tides, now going to waste.

Before the war a few thickly populated nations, such as Japan, Belgium, Holland and the Scandinavian countries, were profitably practicing aquiculture or the cultivation of shellfish and seaweeds for food. Scientists say that aquiculture can be as productive as agriculture and may offer a solution to the present world-wide shortages of food, clothing, building materials, fuel and medicinal drugs.

Sea water contains an average of 3.5 percent of mineral matter. Most of it is sodium chloride, or common table salt, but traces of almost every other mineral known to science have been found as well.

Large quantities of salt are reclaimed each year from the sea, solar salterns in California yielding more than 2,000,000 barrels annually. The Pacific Ocean contains enough salt to cover the continental United States to a depth of about a mile. In spite of the fact that the rivers of the world carry 5,000,000,000,000 tons of salt into the ocean yearly, its salinity is not rising perceptibly.

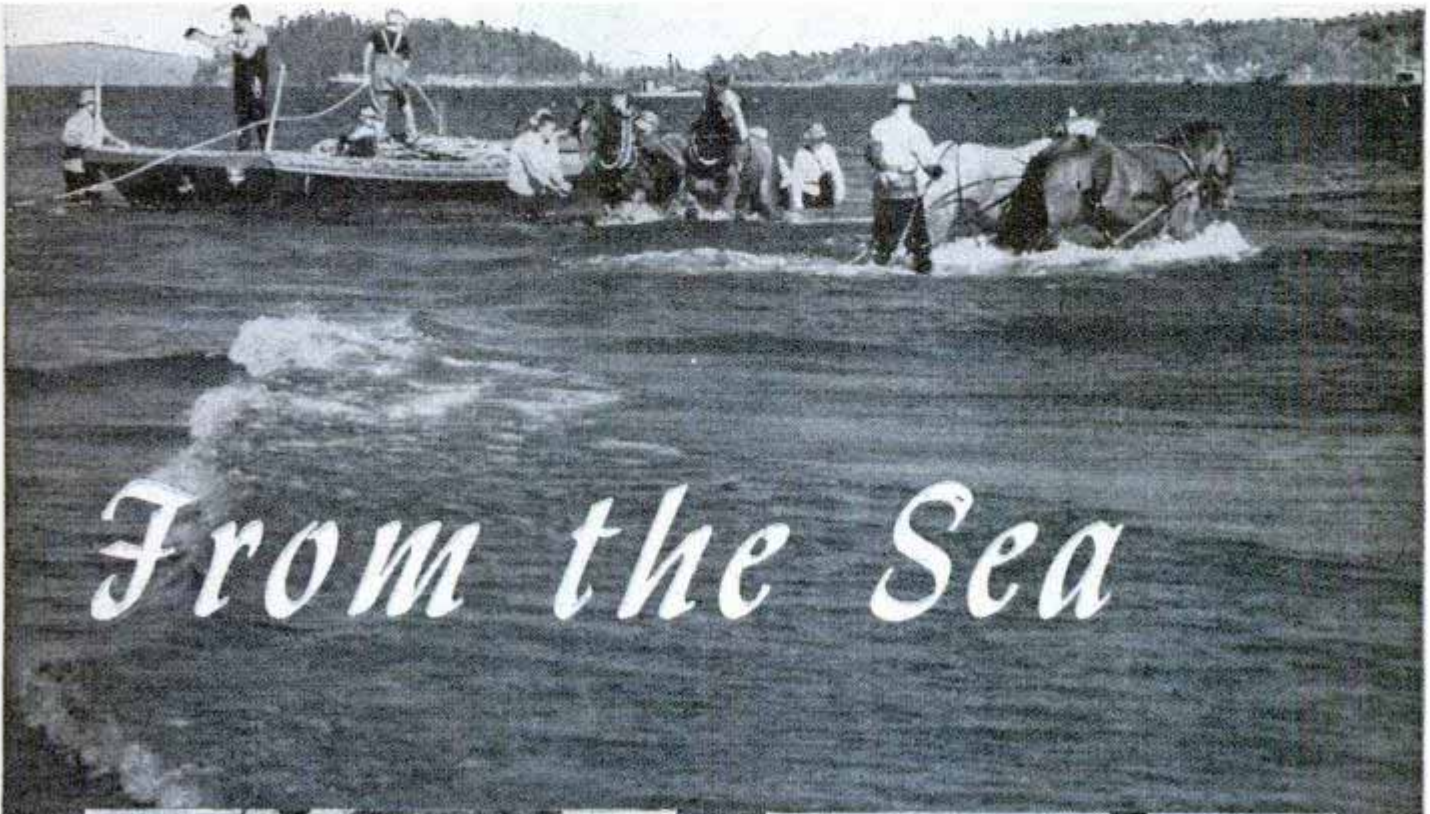
In addition to salt, other important minerals are mined from the sea. Magnesium, which teamed up with aluminum to make the United States a leader in the light metals field during the war, is processed in great quantities in the Dow Chemical plants at Freeport, Texas, and Cape Fear, North Carolina.



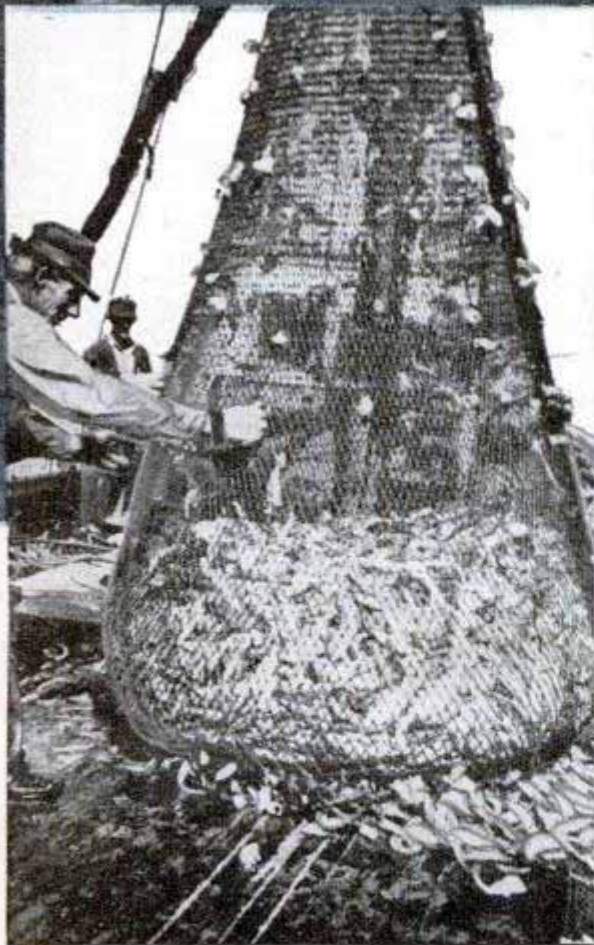
Fish and Wildlife Service photo

Inspecting sponges at Tarpon Springs, Florida, center of the U. S. sponge fishing industry

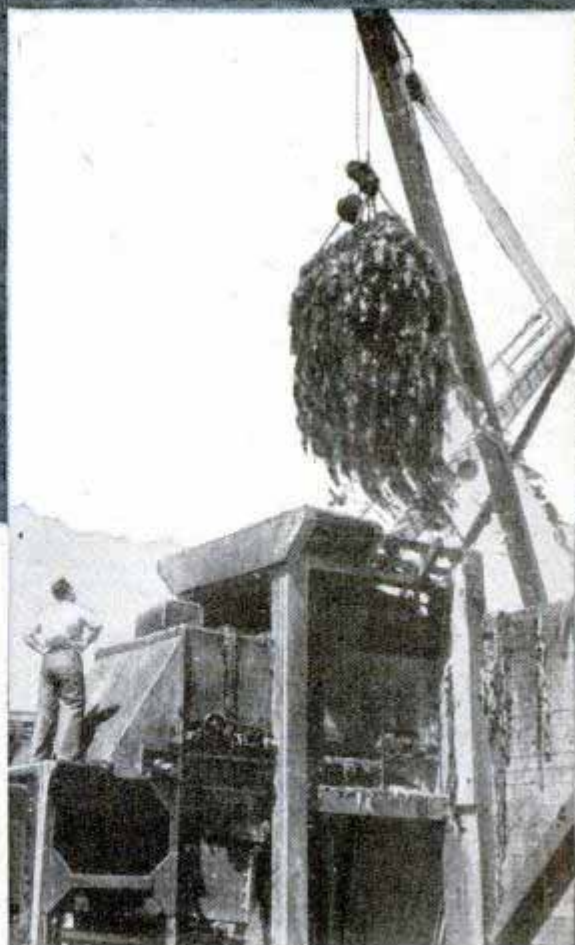
In the shallow waters of the Columbia River horses are used to drag in nets of salmon, one of the richest of fish crops



From the Sea



Pulling the "purse string" at the bottom of a loaded trawl sends the catch flopping on deck



Barge loads of harvested seaweed begin the conversion process in this mechanical chopper

Bromine, necessary in preparing lead tetraethyl used in high-compression motor fuels, is found in sea water in concentrations of .0065 percent. However, there should be no appreciable shortage in this essential material for many years as a cubic mile of sea water contains 250,000 tons of bromine and methods of its extraction are being steadily improved.

Tremendous quantities of chlorine, used in chemical industries and manufacturing, are being extracted from the sea.

Accumulating evidence indicates that, acre for acre, the sea is more productive than the land. The primary production (production of organic matter by photosynthetic organisms) of certain marine areas, such as the Gulf of California, appears to compare favorably with that of fertile garden soil.

Aquiculture would seem to offer these advantages over agriculture: (1) there is



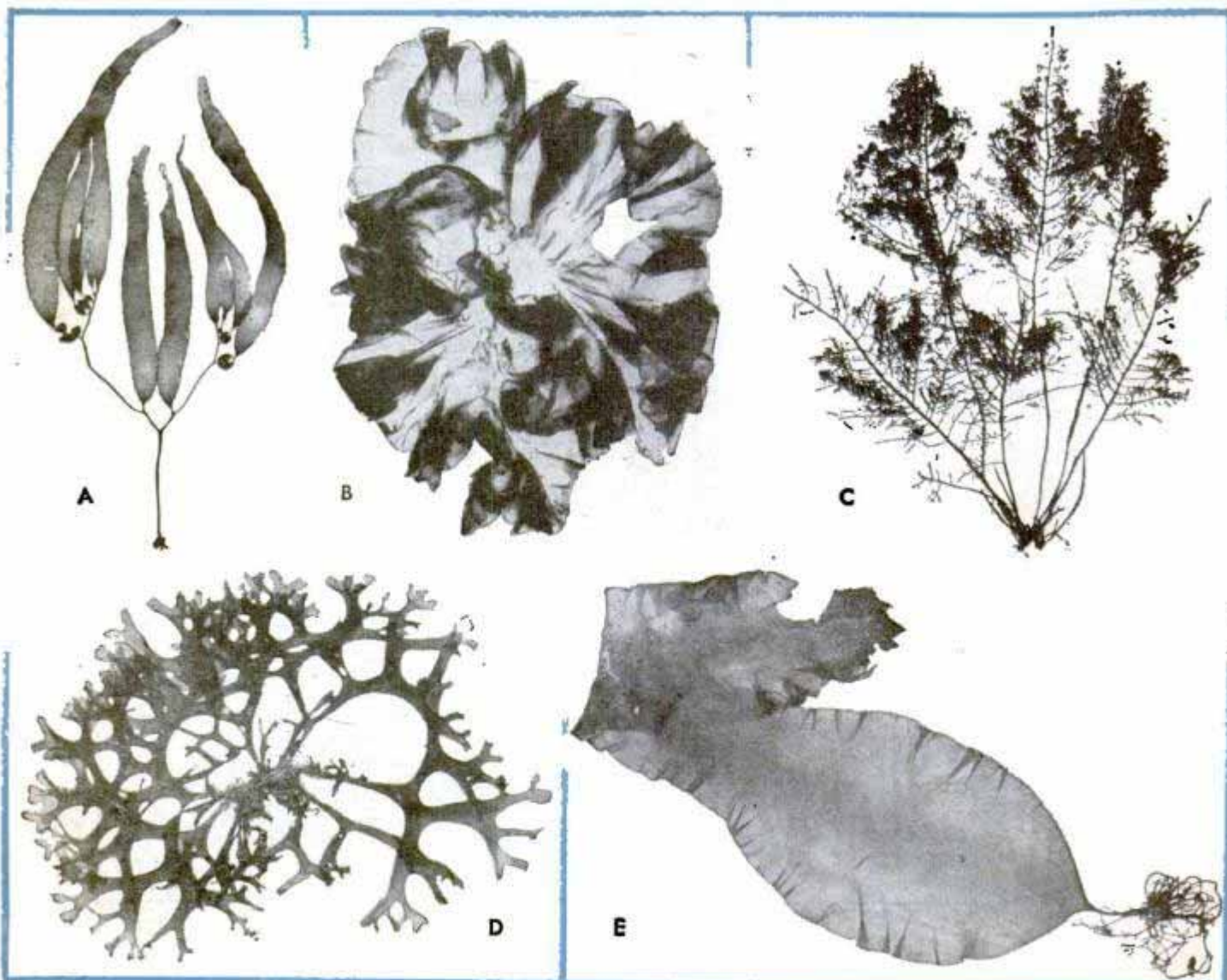
never any drought in the sea, (2) even temperatures prevail, (3) sea water is a perfectly balanced salt solution with only nitrates, phosphates and silicates as factors which might limit plant growth, (4) instead of a growing area of the few top inches of soil, the sea is productive to the limit of sunlight, 200 to 800 feet, and (5) it has fewer barren acres than land, with even the arctic and antarctic waters fertile.

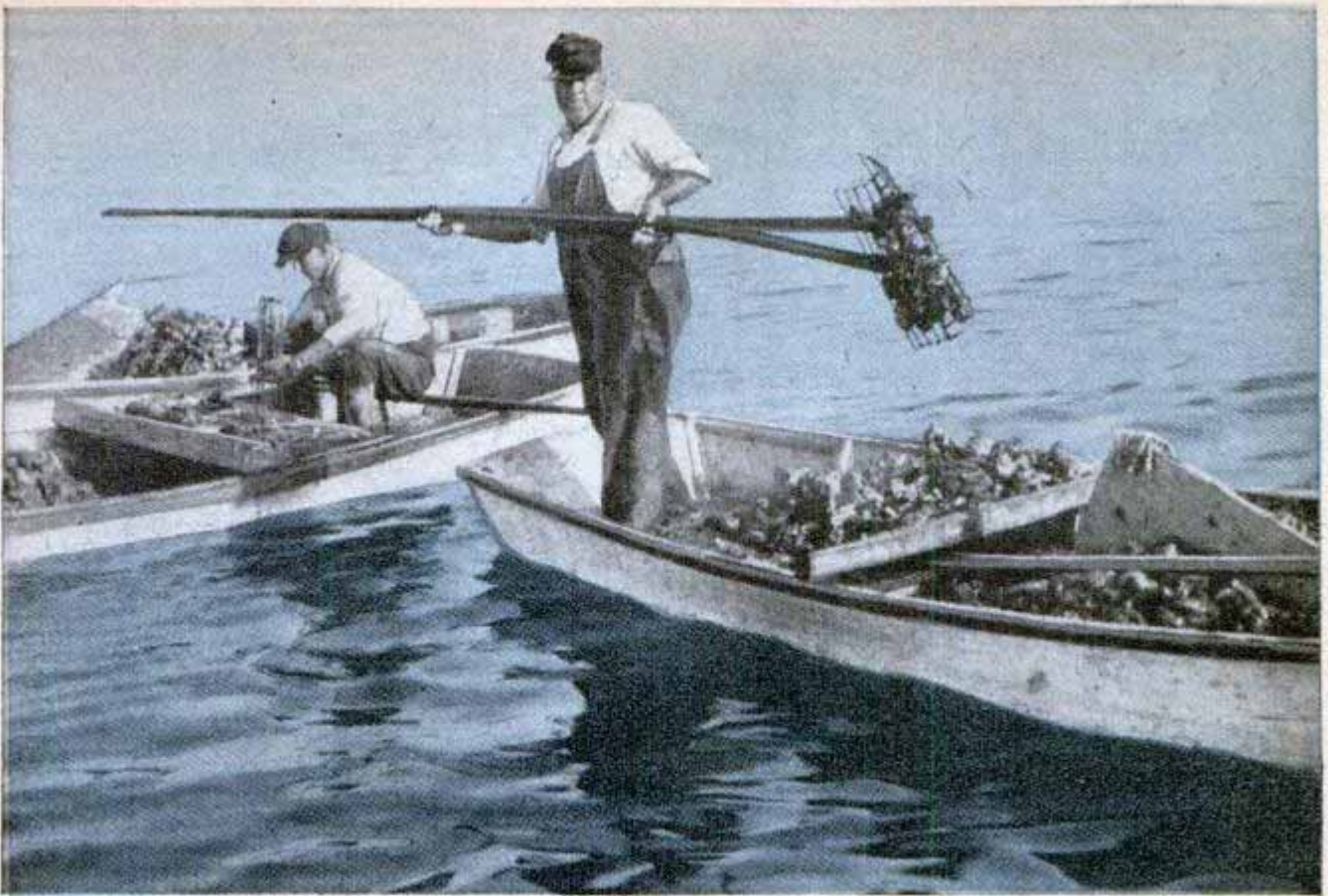
We have already made a good start. More than \$500,000 worth of kelp is harvested each year for fertilizer, cattle feed, solvents, tars and alginic acids.

Algin has become one of the most important of our kelp products. It is used as a dispersing agent in lacquers, in sulfa and burn ointments, in latex insulation for wires, in a variety of food products such as ice cream, bakery goods, jams and jellies, and as a coating for paper containers.

Seaweeds concentrate potassium and io-

Seaweeds are used in many ways: (A) young specimen of the California giant kelp, a source of acetone and potash; (B) purple laver, used in soups and eaten raw; (C) California agarweed, a basis for microbiological culture media; (D) Irish moss from Massachusetts, which produces carrageenin, used in candy, jellies and salad dressing; (E) East Coast broadleaf kelp, producing algin used in ice cream, cake icings and dental impressions





Fish and Wildlife Service photo

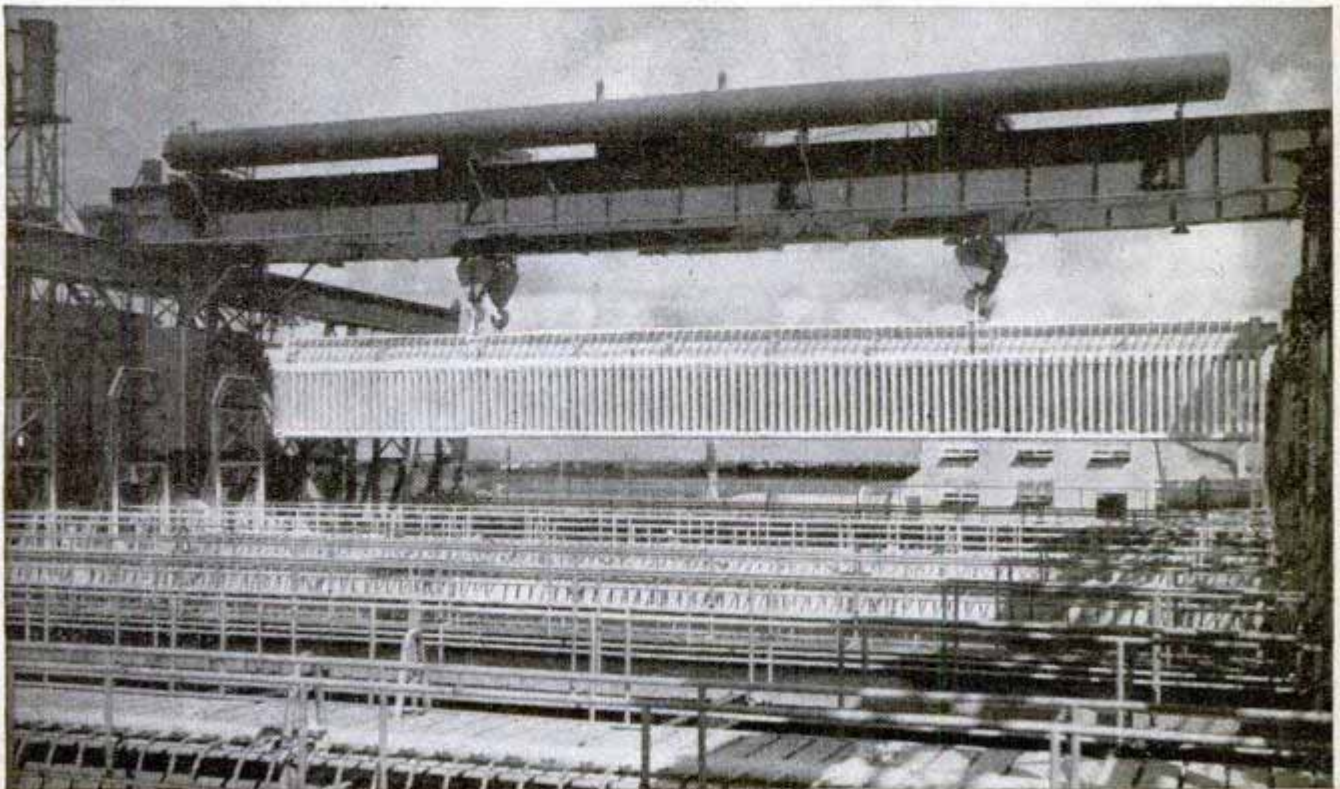
East Coast fishermen "tonging" for oysters, the most common method of collecting this popular shellfish

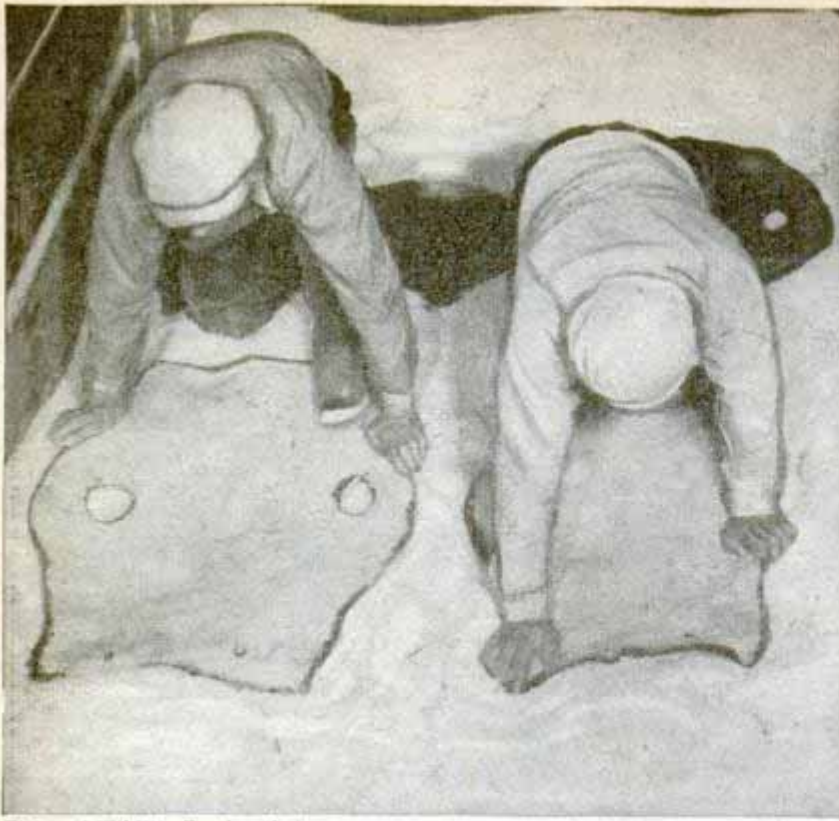
dine so that they can be extracted profitably. Sea water itself contains only .037 percent of potassium, while dried kelp contains from 10 to 14 percent. Similarly, there is only .0000005 percent of iodine in sea water while certain seaweeds contain .2 to .5 percent when dried.

Certain red algae produce agar, or vege-

table gelatine, which is used medicinally, as a medium for bacteria culture and in several kinds of confections and desserts. Before the war the United States was using agar at the rate of 600,000 tons a year, mostly imported from Japan. Since 1941, however, we have gathered our own supply along the California and Mexican coasts.

Crane at a coastal chemical plant moving filter leaves so that valuable magnesium hydrate may be blasted off





Fish and Wildlife Service photo

"Kenching" or salting down sealskins to improve their preservation

Many seaweeds make palatable and nutritious foods. For example, in the Hawaiian Islands more than 70 species of marine plants are eaten, while the Chinese and Japanese make use of nearly as many. Irish moss, purple laver, dulse, seatron, kombu, amonori, kijiki, arame or murlins harvested from the sea make dishes which are really more palatable than the term

pollock, flounders and rosefish, as well as clams, lobsters and scallops. The Middle Atlantic coast is known for its oysters, crabs, shad and striped bass. The Gulf of Mexico produces tons of shrimp each year. Along the California coast, tuna and sardines represent the largest catches, while the waters of the Northwest are a source of fish-liver oils. Alaska both catches and

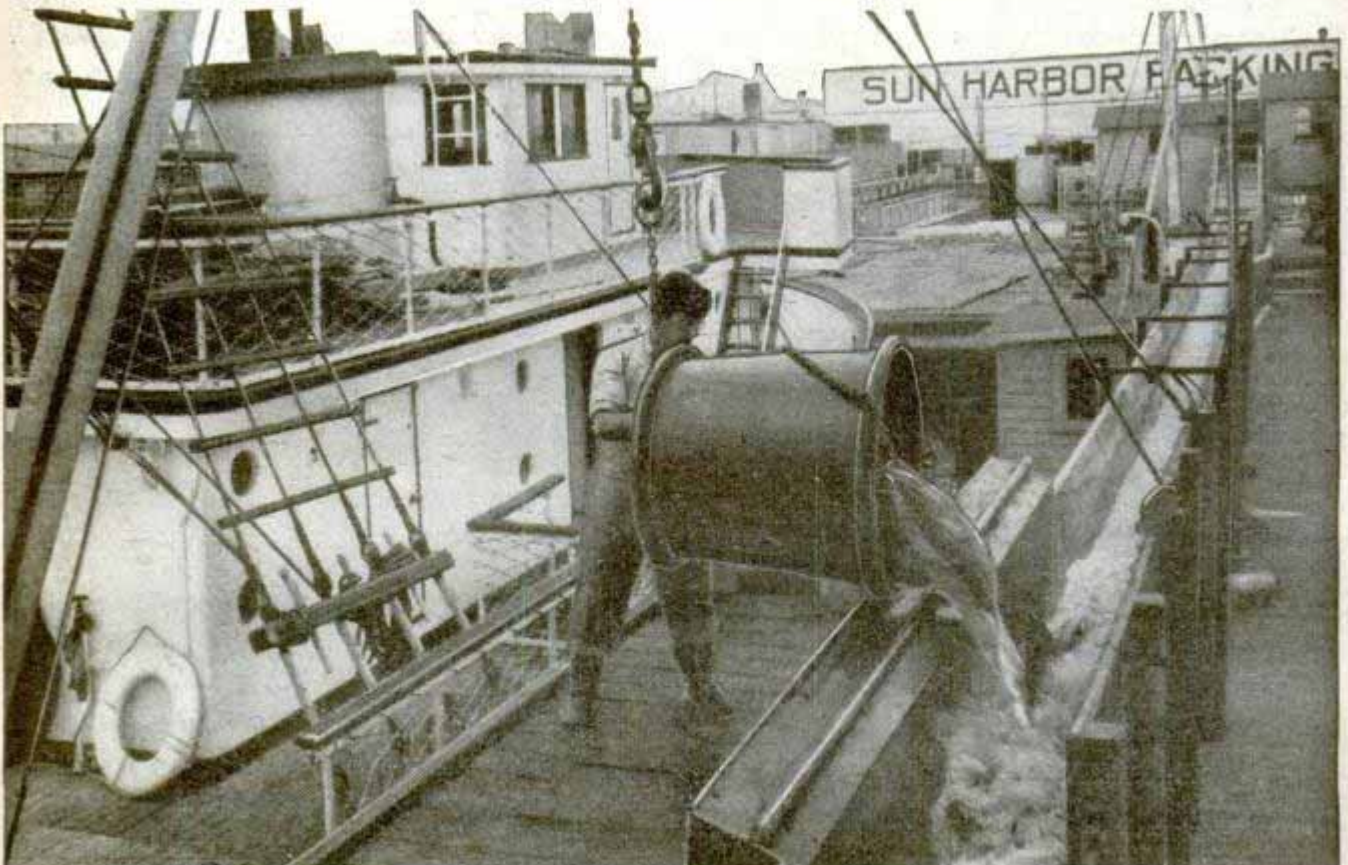
"seaweed" suggests. Some are eaten fresh, as in a salad, while others are dried.

Although many large, easily harvested plants grow in the sea, it is principally the microscopic plants called phytoplankton which are most important. The phytoplankton is to the grazing animals of the sea what grass is to those on land. It is often called "ocean pasturage" because it is eaten by smaller sea animals which, in turn, are eaten by fish.

Marine animal products worth \$30,000,000,000 annually are harvested from the oceans of the world and give employment to between 15,000,000 and 20,000,000 men in the northern hemisphere.

The United States is especially rich in its fisheries resources. The New England coast and the Newfoundland banks produce cod, haddock,

Fish are dumped into this trough of flowing water and carried into the cannery untouched by human hands





Tightly packed cluster of males, females and young seals in harem at Zapadni Rookery, St. Paul Island

packs 90 percent of North America's most valuable fish product—salmon.

Judging from the vast quantities of fish taken from the sea, it would seem that marine resources are unlimited. However, the ruthless slaughter of whales and sea otter proves that unlimited exploitation can lead to disaster. If the world is to profit from the wealth its oceans produce, there must be an international program of cooperation and conservation.

With the United States using 5,600,000 barrels of petroleum a day, and with little or no slackening of production, the world may have to explore the sea for new petroleum and power resources.

It is generally believed that buried organic matter is the source of petroleum, although the exact transformation of it is not well understood. Since

(Continued to page 244)

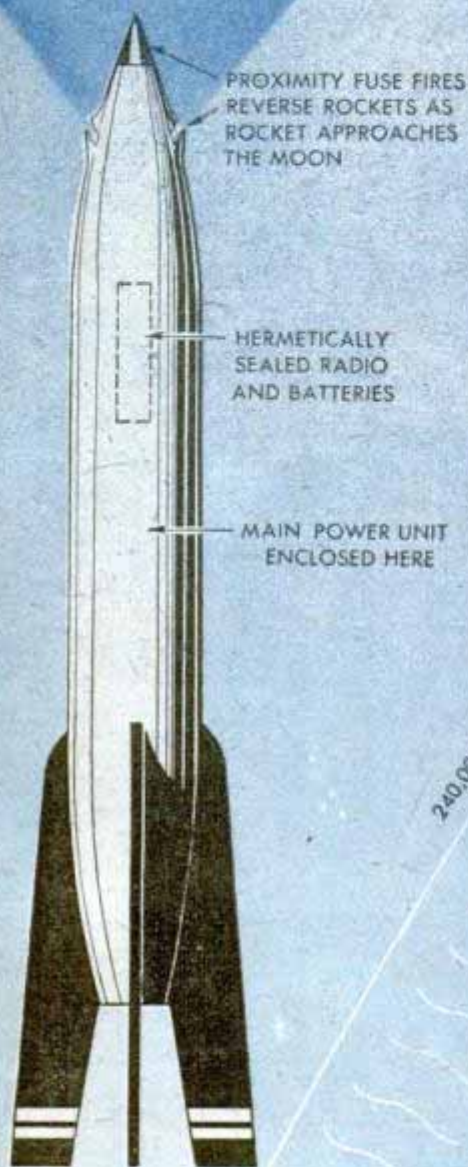


Upper, American Can Co. photo
Lower, Morton Salt Co. photo

Releasing salmon from a trap on the Columbia River, and, right, another product of the sea, salt, being moved by a small scoop

Station

M-O-O-N



ROCKET SPEED
4000 M.P.H.

240,000 MILES TO MOON

IT'S possible to shoot a 100-pound radio weather station to the moon and land it undamaged, according to Dr. A. J. Hutcheson of Westinghouse Research Laboratories, commenting on moon-bound rockets the Army plans to build within 15 months. The meteorological findings of sensitive instruments carried in the rocket could be transmitted 240,000 miles to earth by ultrashort waves. Resistance of wire changes according to temperature and this change, for example, could be made to vary the frequency modulation and tone of the earthbound signal. A "soft" landing could be achieved by reverse rockets set off by a tiny radio set, in the manner of a proximity fuse, when the missile neared the moon. The 100-watt transmitter, weighing under 50 pounds, and small storage batteries of about the same weight, would fit in a cabinet three feet long and a foot in depth and width. It would be hermetically sealed for operation in the near vacuum of the ionosphere and on the surface of the moon itself.

ULTRA SHORT
WAVE BROADCAST
EVERY HOUR

104 MILES—
NEW MEXICO V-2

165 MILES—
GERMAN A-10

IONOSPHERE

STRATOSPHERE

TROPOSPHERE

12 MILES—FUTURE AIRPLANE CEILING

7.5 MILES—B-29

RECORD MANNED BALLOON
ASCENT 13.7 MILES

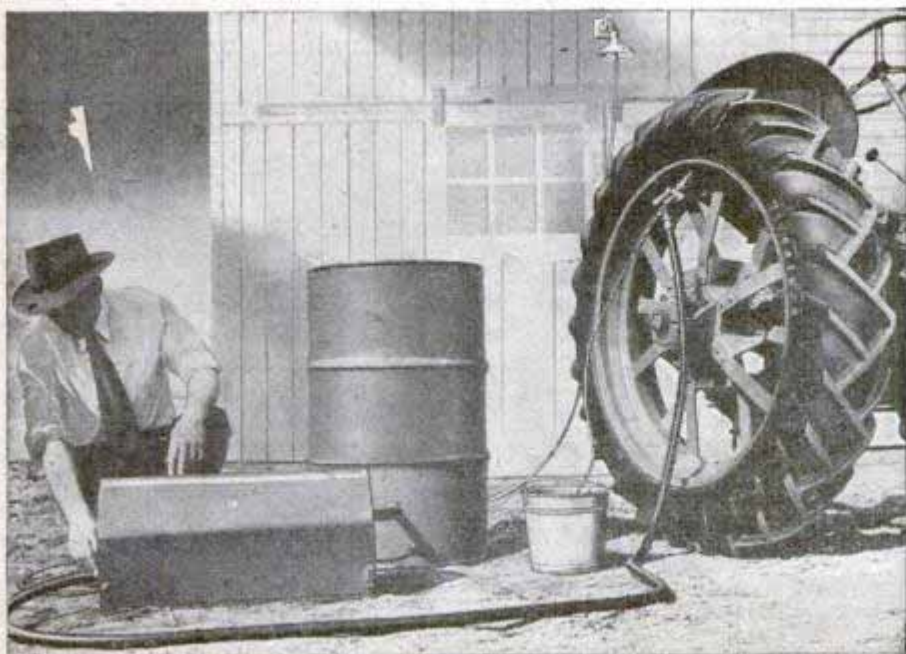


V-Tailed 4-Place Plane Has Low Flying Cost

Full rudder control without a vertical tail fin is provided by the V tail of the new low-wing four-place Beechcraft Bonanza. The tail assembly is said to reduce drag and weight and add stability. Although handled by both elevator and rudder controls, use of the rudder is unnecessary except for crosswind landings and takeoffs. The Bonanza, which costs \$7345, can be operated for 1½ cents per passenger mile when used 100 hours a month, according to the manufacturer. It is powered by a six-cylinder 165-horsepower Continental engine, less than half the horsepower previously required for the same size plane with comparable performance characteristics. Top speed is 184 miles an hour. With full load of four people of 170 pounds each plus 100 pounds of baggage, the Bonanza has a cruising range of 750 miles at 165 miles an hour. Large tires and a long



wheelbase between nose wheel and the two main wheels permit landing safely on soft or rough fields without damage. The cabin is soundproof. The interior is comfortably furnished and all protruding knobs, switches, levers and sharp corners have been eliminated. Landing speed is approximately 45 miles per hour. It is equipped with a complete set of flight instruments for night and day flying and necessary radio accessories.



Water Fills Tires Used on a Tractor

Extra weight and traction are added to tractor wheels by inflating the tires with water forced into them, in nonfreezing weather, by a special electric pump in 8½ minutes. The nozzle has a bleeder tube which allows air from the tire to escape as water is pumped in.

☐ Because of its great weight—81,120 tons—the George Washington Monument is sinking into the ground ¼₄₀ inch a year.

Bootmaker for the Stars



Wooden lasts shaped exactly like the feet of film stars guide Joe Napoli in making movie boots and shoes

IF YOU were a movie star, it's a good bet you'd know Joe Napoli. His story is another version of the classic mousetrap yarn. Only Joe didn't build better mousetraps. He built better boots, slippers, gaiters and moccasins — and the stars beat a path to his door right down Hollywood Boulevard.

Joe Napoli, the Hollywood bootmaker, was born in Sicily. At 16 he came to America with his father, who taught him the bootmaker's craft. Joe got a job working in a shoe repair shop in Hollywood.

One day, nine years later, the boss handed Joe a funny looking pair of old shoes

covered with patches. "Put on some more patches," the boss told Joe. "The more patches you put on, the better he likes it. Those are Charlie Chaplin's shoes!"

After that, Joe got to thinking about the shoes worn by movie actors and actresses. The shoes had to be comfortable. They had to look right. Most of them weren't even modern shoes; they were something out of a history book. Movie producers were fussy about having shoes right so people wouldn't write letters poking fun at a mistake. Joe thought it would be fun to work all the time on shoes for the movies.

Two-tone high lace shoe of 1900 vintage (left) is placed on a last. Right, "library" of movie stars' lasts





So he went to work for a costume supply house which did a big business with the studios. For four years he put soles and heels on "period" shoes worn in costume, or historical, pictures. Then the foreman died, jobs were shuffled, and Joe became a shoe designer for the company.

In October 1941 he decided to try boot-making on his own. He bought a shop on

Harpo Marx ordered that big black number—a combination shoe and dustpan. Boots are Gary Cooper's

Hollywood Boulevard and announced that he specialized in theatrical and movie shoes.

Two days after he opened the door, Metro-Goldwyn-Mayer asked him to make a pair of Roman sandals for Jeanette MacDonald. He measured her feet very carefully and made the sandals of fine leather.

Napoli prepares to add cork build-up to increase height in a pair of modern French oxfords for Charles Boyer





Strips of leather for movie costume shoes are trimmed carefully

Miss MacDonald liked them; so did M-G-M.

From then on, the stars "moved in" on Joe's little shop. The studios found him. He worked long hours. His wife, Carmela, helped him. He hired many shoemakers. Orders began to come for 100 period boots, or 200, or even more, for a single motion picture. He'd get a phone call at 6 p.m. for four pairs of period boots for a certain star, to be delivered next morning.

Those boots couldn't be just ordinary boots; they had to be the best boots that human skill could put together, and they had to fit the star's feet as comfortably as if the star had been wearing them for years.

Joe developed a library of data on movie stars' feet. He made wooden models of the left and right foot of many actors and actresses. If the star had a bunion, Joe allowed extra space there. If the star had a corn, Joe allowed for that. If the ends of the actor's toes turned up, Joe turned up the toes on the wooden last.

He did it by gluing strips of leather over a wooden last which came nearest to duplicating the foot. He built up a "rough" and then made fine adjustments by shaving the leather down. He started his library of foot statistics by placing each pair of lasts in a shoe box labeled with the star's name.

Row on row, the names look like Hollywood's Blue Book—Joe E. Brown, Eddie Cantor, Don Ameche, Clark Gable, Bing Crosby, Bob Hope, Fay Bainter, Binnie Barnes, Bette Davis, Loretta Young, Robert Taylor, Grace Moore, Joan Crawford, Nelson Eddy, Sonja Henie, Rita Hayworth, Paulette Goddard and many others.

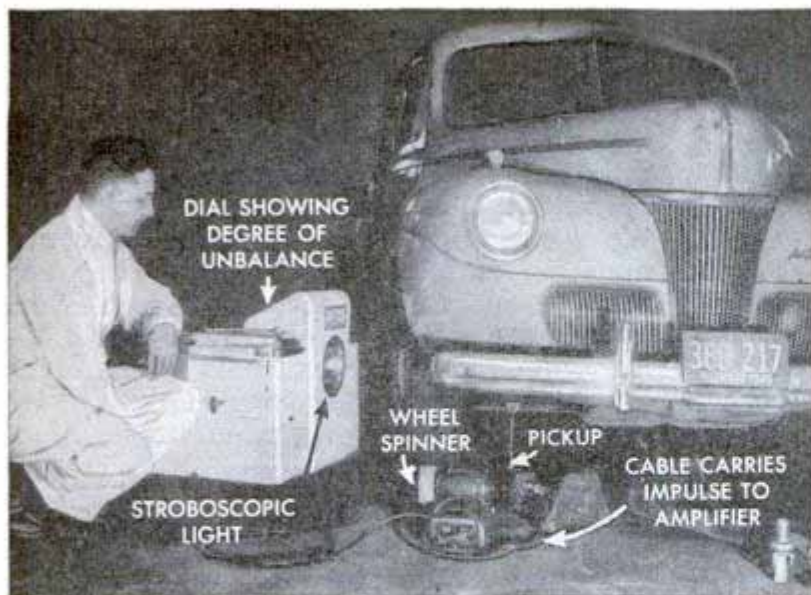
He makes period shoes for all the major studios except one, which makes its own. A week's orders may call for 20 pairs, or 200, no two pairs alike.

(Continued to page 236)

From 1000 wooden lasts Napoli selects one which nearly duplicates an actor's foot; then the last is altered to conform to the foot. Right, foot outline (with measurements noted) serves as the bootmaker's guide

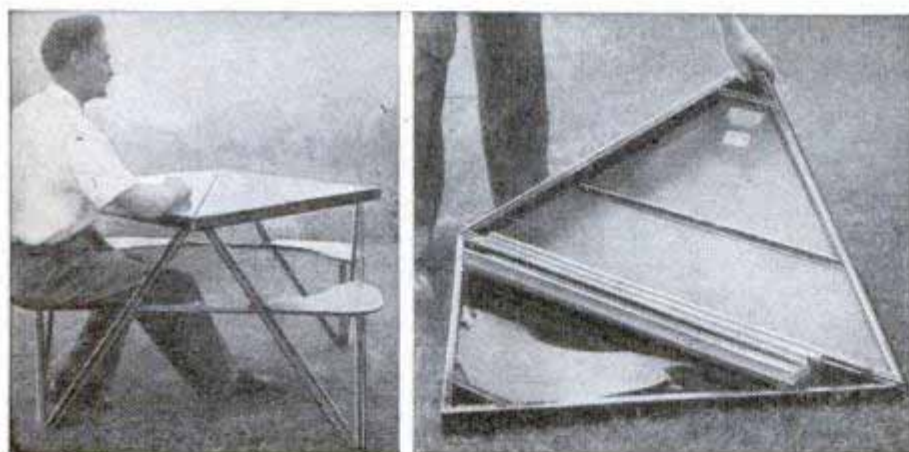


Electronic Balancer for Wheel Senses Slightest Wobble



Auto and truck wheels are checked for balance with an electronic instrument that senses vibrations as minute as two thousandths of an inch. A magnetic pickup unit transmits electrical impulses to a meter which transforms the vibrations into dial readings revealing the amount of unbal-

ance. The electronic amplifier, similar to a four-tube radio, furnishes power for a stroboscopic light which, when directed toward a spinning wheel, gives the visual effect of stopping it. This shows the exact spot at which the wheel is out of balance and where weights must be placed.

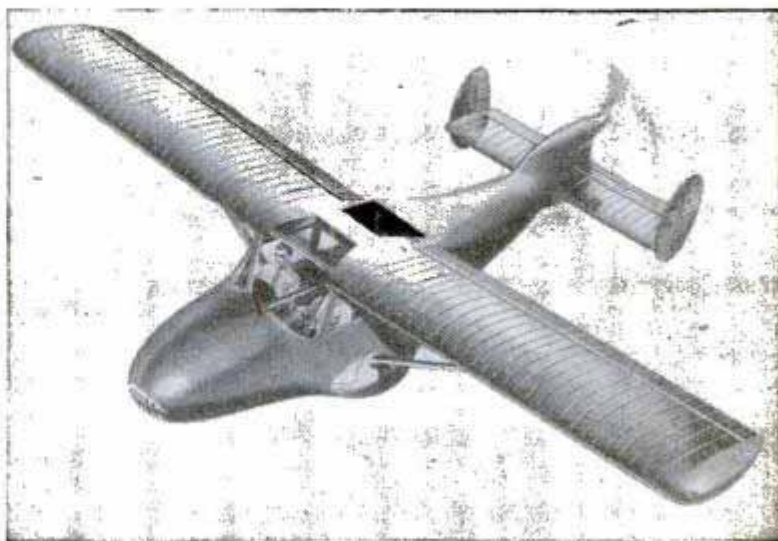


Seats Are Attached To a Folding Table

Four seats are attached to an all-metal square table which folds into a triangular package for storage in the rear compartment of an automobile. Suitable for campers and picnickers, the table is so designed that it cannot collapse or fold up when in use.

Single 'Steering Wheel' Guides Plane's Flight

All controls are coordinated into one wheel in the Waco Aristocrat, a four-place monoplane with a new-type tail propeller. The plane steers like an automobile, with turn and bank coordinated, and pulling the wheel toward the pilot sends it into a climb. There are no rudder pedals. Advantages of the tail propeller are reduced cabin noise, elimination of drag from prop wash and less danger of passengers and airport personnel being struck by the whirling blade. Equipped with a 215-horsepower Franklin aircooled engine, it can cruise 657 miles at 152 miles an hour at 5000 feet. Further



safety changes are the extra-long wheel base of its tricycle landing gear and a steerable nose wheel.

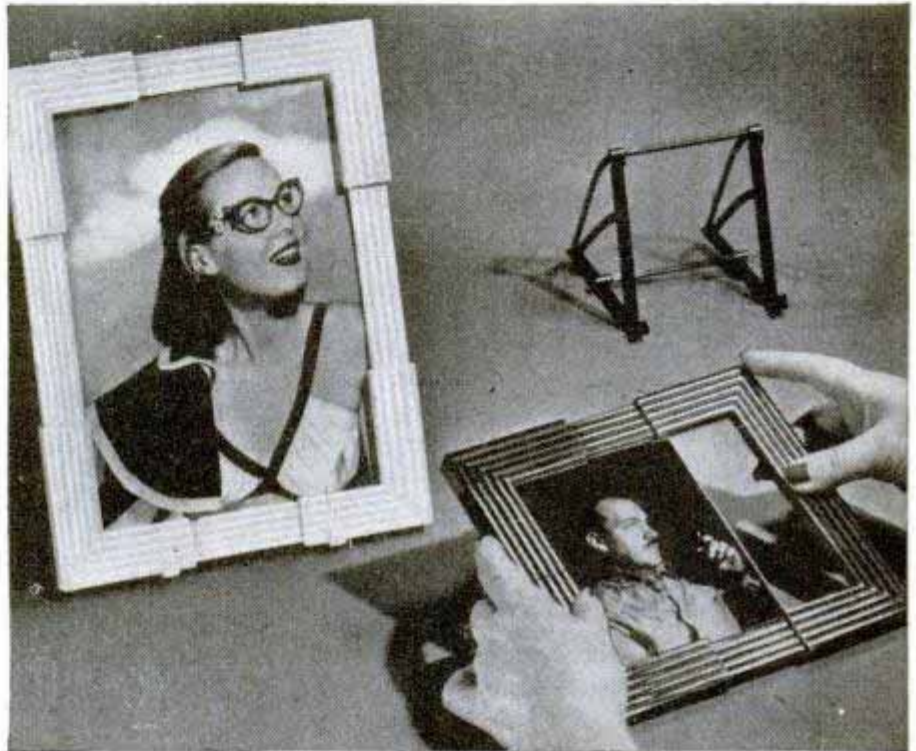


Plastic Cover of Fluorescent Tube Changes Glare to Soft Color

Plastic covers fit over fluorescent tubes to reduce glare and allow a wide range of colors. The covers permit wider use of fluorescent light for display and decorative purposes, producing soft colors that reduce eyestrain. Designed to fit a 24-inch tube, the covers slip easily into place and are nonflammable and washable. They are durable and can be used over and over. Two of the shields can be fitted over a 48-inch tube. Only a small part of the light output is lost with the covers in place. They are available in ivory, rose beige, blue, pink, maize and green.

Elastic Photo Frame Fits Most Pictures

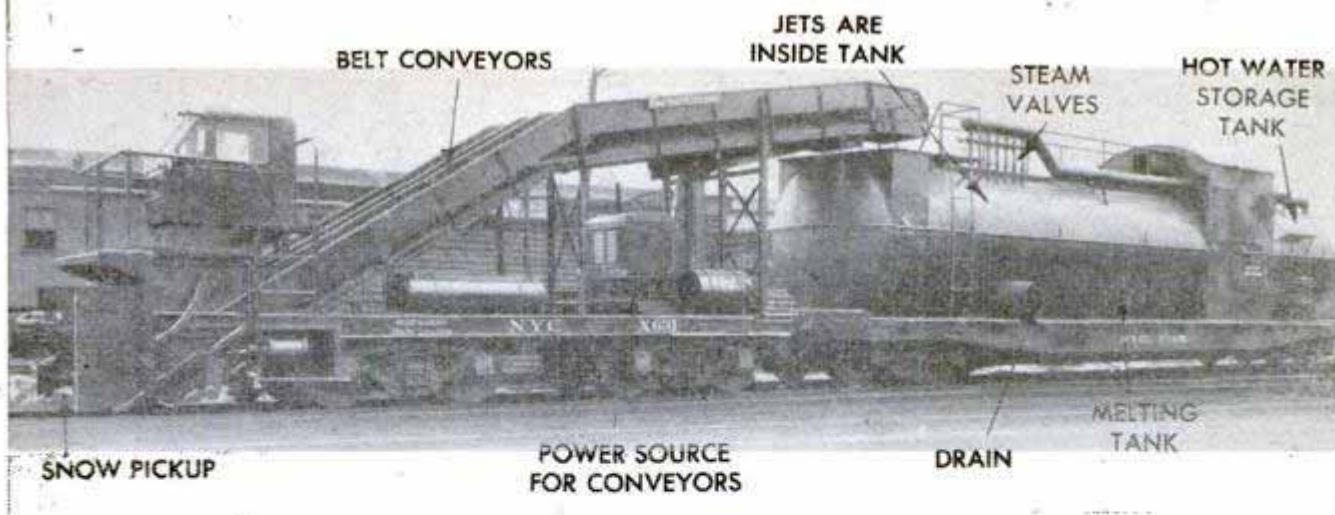
"Elastic" picture frames can be made smaller or larger by a system of springs and overlapping corners. The frames can be pulled in or pushed out to fit any size photographs from 4 by 6 to 8 by 10 inches. The plastic frames, made in several parts that slide along each other to permit exact adjustment to the picture's size, are mounted on attractive easels. They may be purchased in ivory, jade green, Chinese red or dark turquoise colors to harmonize with the other decorations of the room.



"Gunstock" Camera Support Cures Picture Blurs

Photographic buck fever is cured with a shoulder camera mount which simulates a gunstock to help the picture maker hold his camera steady. It is made of tubular aluminum and weighs only 4½ ounces. It holds the camera at eye level, free to follow rapidly moving objects. The mount is suitable for use with 8, 16 and 35-mm. movie cameras and with still cameras up to 4 by 5 negative size. The support is helpful in shooting sports action scenes.

You may wish to obtain additional information about the new products that are described each month in *Popular Mechanics*. If you want to know the name and address of the manufacturer or the distributor, just write to Bureau of Information, *Popular Mechanics*, 200 East Ontario Street, Chicago 11, Ill. Your letter will be answered promptly.



Capable of removing and melting 810 square feet of snow per minute, a giant snow removal machine on the New York Central System can clear the right of way at speeds of from two to six miles an hour. The device is in two units, a snow loader and a snow melter; it weighs 66 tons and is propelled by a powerful freight locomotive. Snow is scooped up by the loader, powered by a 52-horsepower gasoline mo-

Snow "Eater" Clears Tracks

tor, moved by two continuous belt conveyors and dumped into a melting tank of 16,000-gallon capacity. This tank contains a foot of boiling water which has been heated by steam from the locomotive. Fourteen steam jets hasten the melting and when the tank is full it is dumped in a catch basin or drain. The device was designed by the Barber-Greene Company with the cooperation of System engineers.

Motorless Observation Kite Gives "Eyes" to Submarines



In an effort to devise "eyes" for their submarines, the Germans developed a combination helicopter-kite. Weighing only 180 pounds, the motorless craft carries a pilot and is lifted into the air and kept aloft by air pressure on its three-blade rotor. It is towed by a submarine on a cable 200 to 500

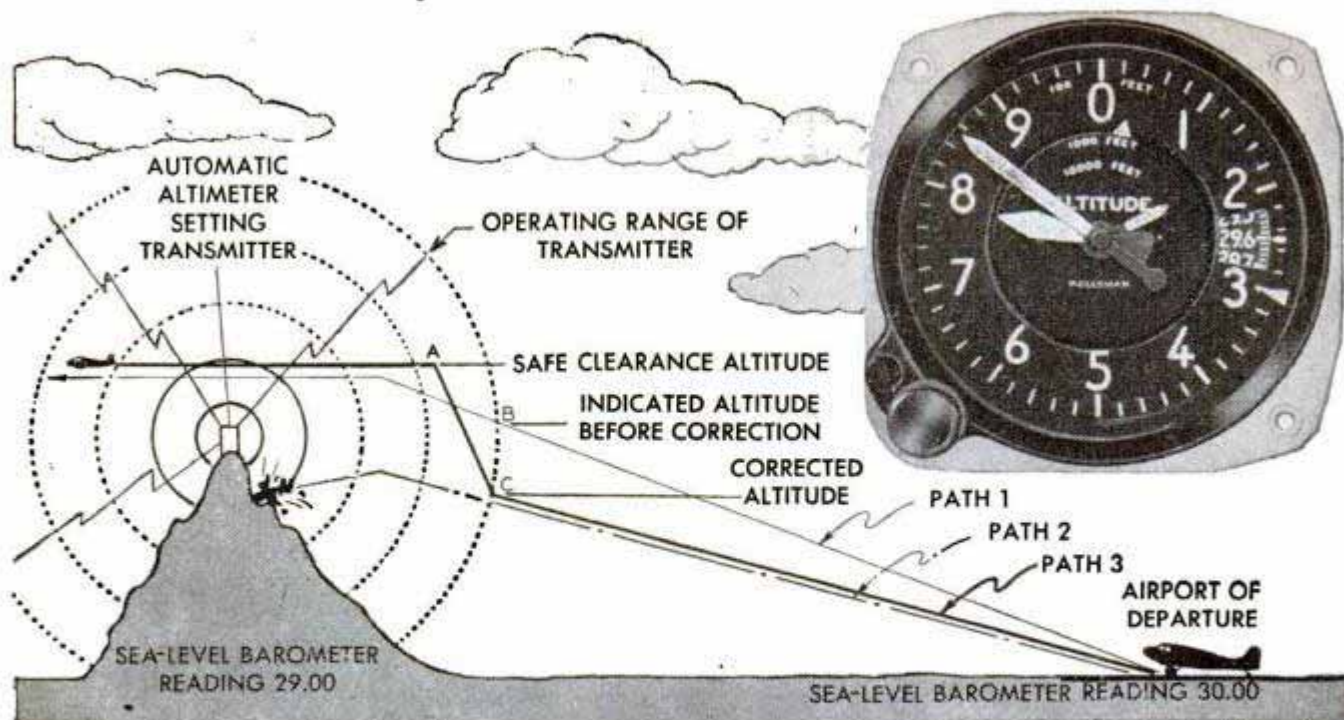
feet long. For stowage aboard a sub, it is folded into a compact package. The craft has no gear for landing on water. Descent is accomplished by releasing the rotor, causing the machine to come apart and allowing the pilot to descend by parachute. Helicopter pilots say it is easy to fly.

Nonkink Synthetic Clothesline Can Be Cleaned With Damp Cloth

Clotheslines and other lightweight cords are being made of a flexible synthetic that won't kink or twist and can be wiped clean with a damp cloth. Nineteen strands of low-stretch rayon are jacketed with a coating of Koroseal, the elastic synthetic, to pro-

duce a smooth-surface rope. The clothesline has a tensile strength of 150 to 200 pounds, is not affected by the heat and will withstand subzero weather if not abruptly kinked. Standard clothespins fit the line, which is available in 50-foot lengths.

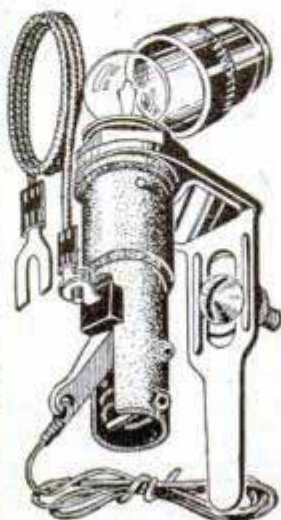
Musical Note Adjusts Plane's Altimeter to Avert Crashes



Musical notes, tuned to an exact pitch, transmitted from mountain tops by automatic radio "broadcasting" stations can adjust airplane altimeters to the correct barometric pressure and in this way help to prevent accidents. The pitch or frequency of the constant signal indicates the barometer reading at the point of transmission. Previously the information as to ground barometer reading was given to the pilot as a matter of routine in all ground-to-plane messages and the pilot adjusted his altimeter manually. But an error of one inch in barometric pressure will cause the altimeter to err by 1000 feet, in addition to which the pressure at 15,000 feet may vary considerably from that on the ground. The pilot would intend to follow Path 1, based on a sea-level barometer reading at the takeoff point of 30.00, one inch higher than

at the mountain site. Basing his calculations on the higher reading, he would actually fly Path 2 and crash into the mountain. With the new device he would follow Path 2 until coming within range of the automatic transmitter, which would correct his altimeter setting by means of a radio signal in time for him to adjust his course to Path 3, a safe clearance altitude over the mountain. The transmitters, developed by the Kollsman Instrument Division of the Square D Company, can be installed at radio range stations or independently and have a 50-mile range. They require no operational or maintenance personnel and can be powered by batteries, gasoline engines or windmills. The device may be tested by the pilot manually setting it to a false barometer reading or by transmitting to it a false reading.

Dashboard Light Flashes Red If Emergency Brake Is Not Released



Some cars and trucks are now equipped with an extra dashboard light which flashes a fiery red warning if the driver starts to drive away without first releasing his emergency brake. The light will not turn on with the ignition off, eliminating any danger of running the battery down when a vehicle is parked.

☞ Birds that swooped too near a giant radar antenna used to jam enemy search equipment during the war were stunned and cooked instantly by the powerful beam of high-frequency radar waves.

NONE OF THE KIDS in Gainesville, Texas, ever runs away to join a circus.

They have their own circus right at home, with relatives and neighbors billed as stars. Any youngster with talent has a chance to perform but he must be good, for this amateur assemblage has its own big top and can compete on even terms with professional circus groups. The Gainesville Community Circus travels thousands of miles and puts on scores of performances every season.

Watching one of the shows, you gasp when a pretty Gainesville girl makes a breath-taking "slide for life" from high in the air. You marvel at the "educated equines ridden by masterful trainers" and chuckle over the "comic capers of irresistible clowns."

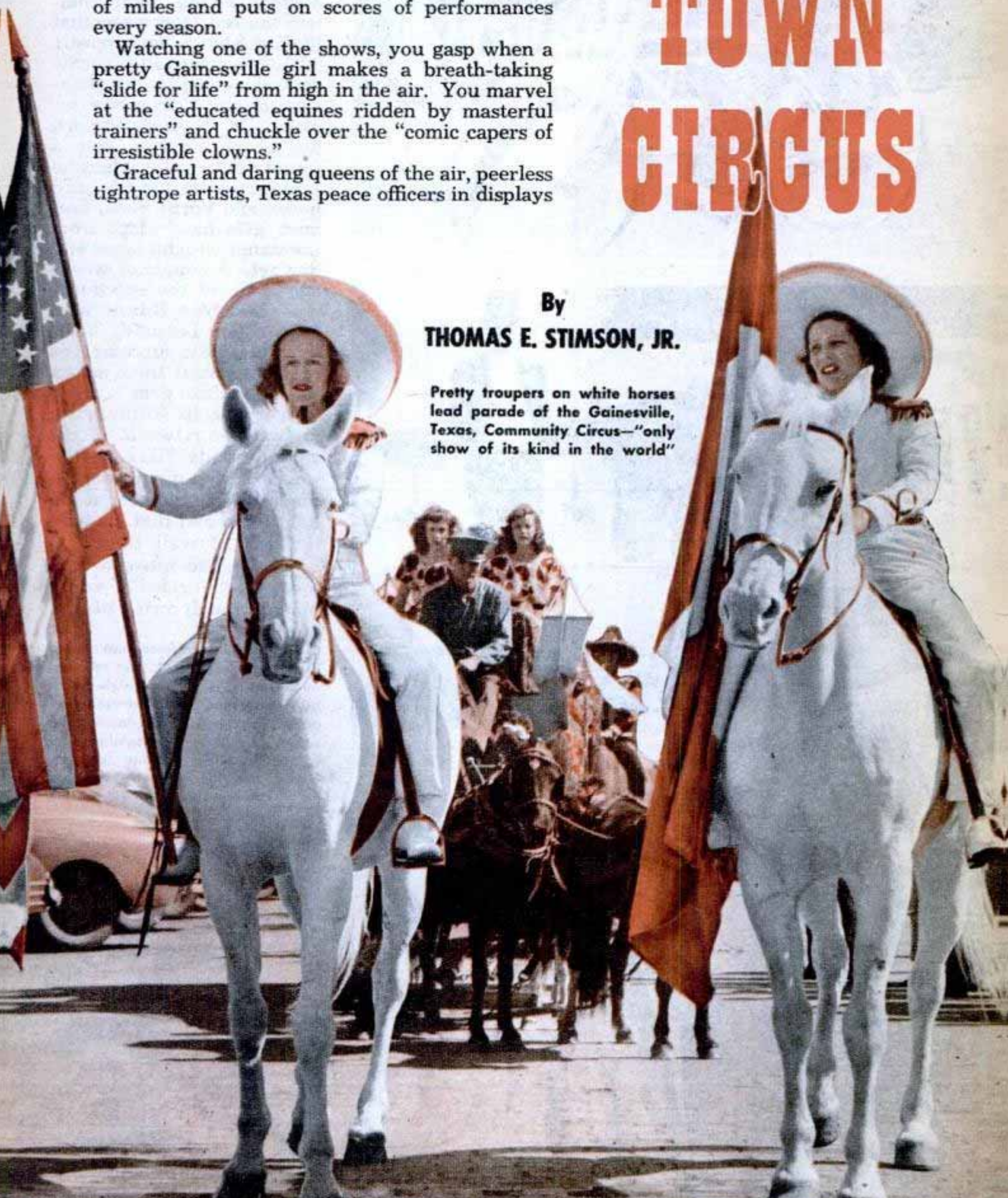
Graceful and daring queens of the air, peerless tightrope artists, Texas peace officers in displays

HOME TOWN CIRCUS

By

THOMAS E. STIMSON, JR.

Pretty troupers on white horses lead parade of the Gainesville, Texas, Community Circus—"only show of its kind in the world"

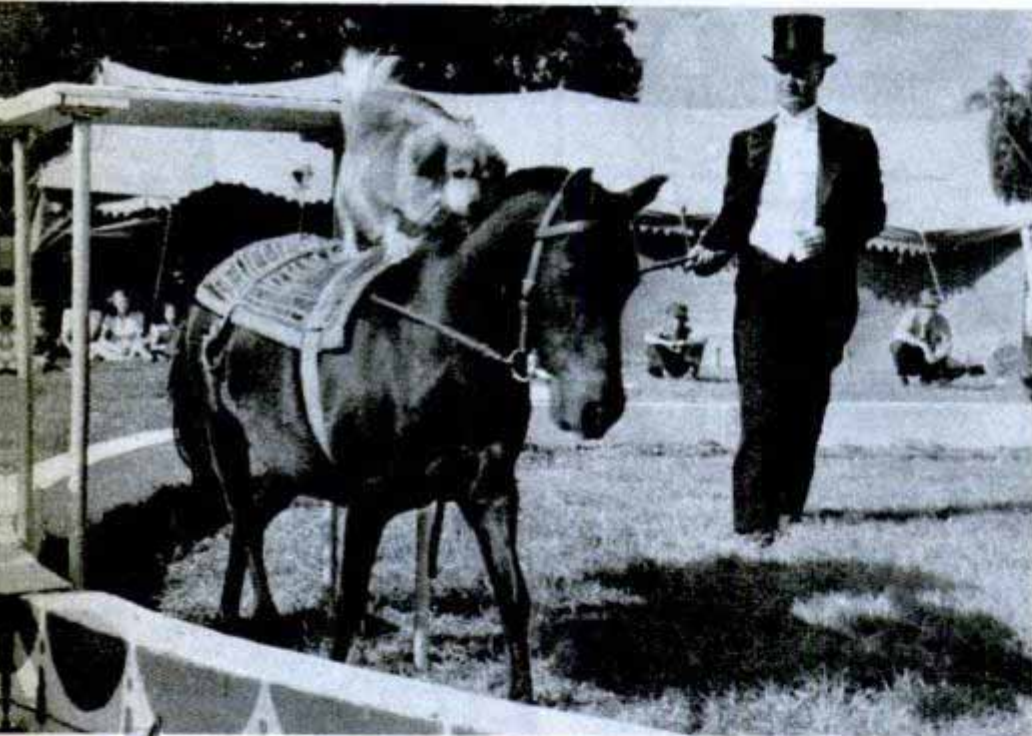




of marksmanship, and acrobats with contortionist acts—the community circus has them all.

The circus presents all the pageantry and thrills of the big time and yet home-towners in the audience recognize the slack-wire performer as Johnny Young, soda fountain worker. They know that the Roy Stamps who appears with five ponies in intricate drills is actually the manager of the Gainesville ice plant. Dr. A. A. Davenport, the chiropractor, gets a round of applause when he appears with his trained horse, and Portis Sims, fireman, gets hand claps from the stands with his horse and dog act. A couple of weeks ago some of the spectators watched Sue Roane and Mary Ellen Leonard, "feminine aerialists supreme," as they rehearsed their act in the high school gym.

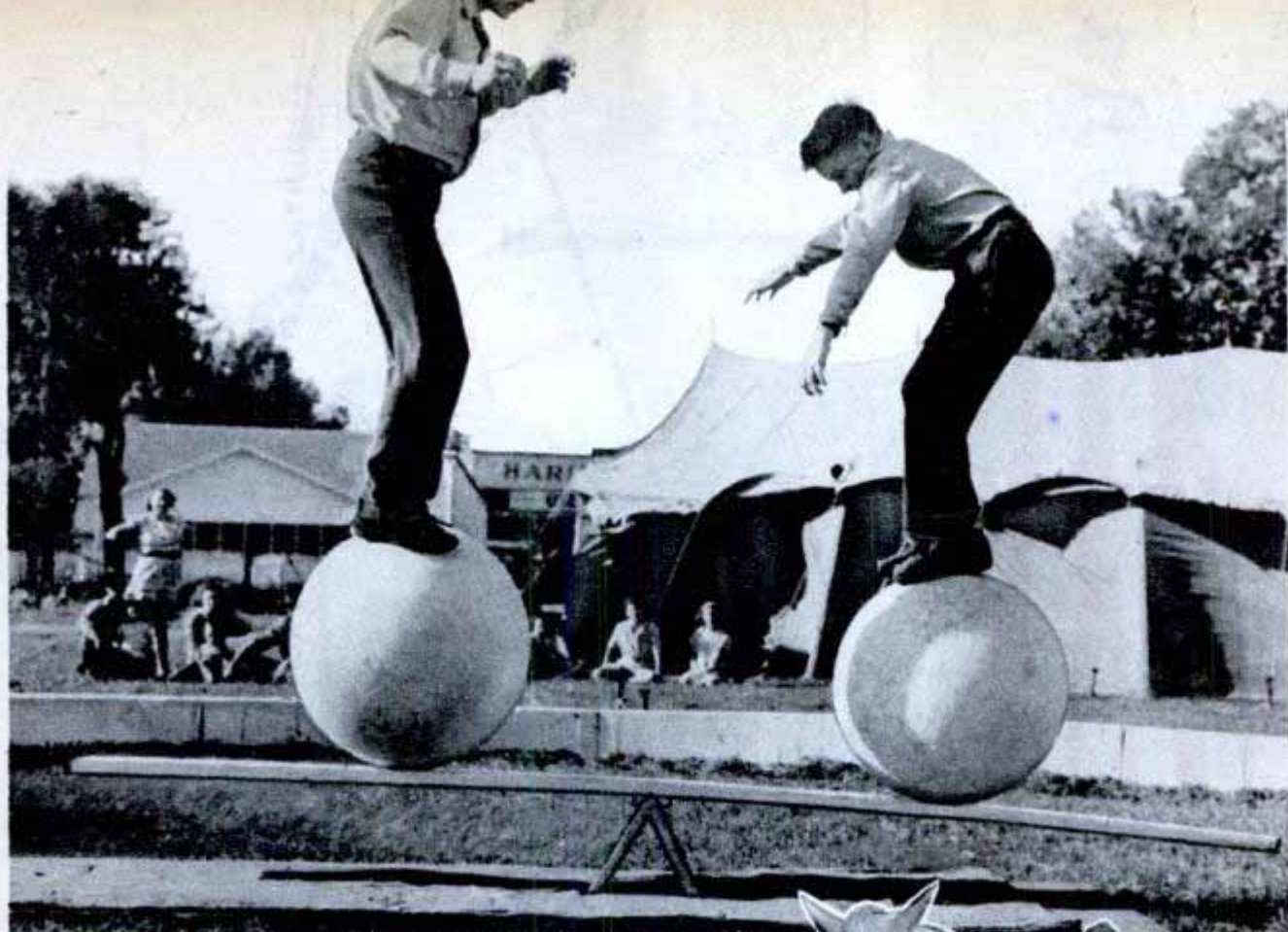
Everyone in Gainesville knows that Alex Murrell who presents "Dexter, the smallest high-diving dog in the world," is engineer at the light plant and that his wife is Gerry Murrell, the tight-rope star and intrepid performer who rides a white horse through a ring of fire.



Clown (top) is a businessman during working hours. Left, taking rehearsal seriously is Dexter, high-diving dog who jumps from platform to the pony's back. Having fun down in the corner is clown band containing some of Gainesville's leading citizens. Below, aerialist helps paint clown



POPULAR MECHANICS



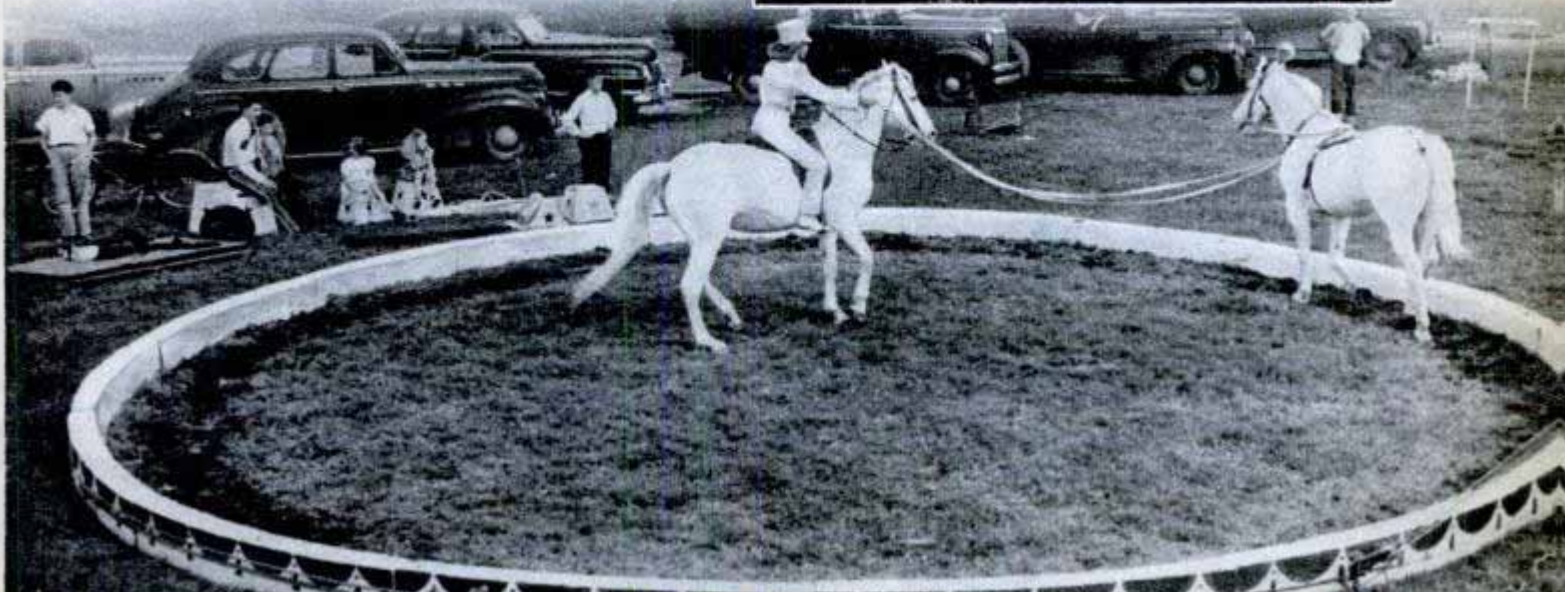
This teeter-totter act requires balancing on rolling globes

Not so easily recognized in their absurd clown costumes are J. B. Saylor, accountant, A. W. Wells, mathematics teacher, Dr. S. M. Yarbrough, physician, and Cecil Farr, automobile dealer. There are 15 clowns.

The Gainesville performers attract crowds wherever they appear and have turned down high-priced offers for professional tours. They exhibited before 11,000 spectators in College Station, 7500 in Austin, 52,000 in Fort Worth and 30,000 in Houston. In all, the circus has played to more than half a million spectators.

Some of their acts are adaptations of

Right, taking final bow just like in the big time. Gerry Murrell (below) takes time out from her housework to rehearse two white horses for feature act



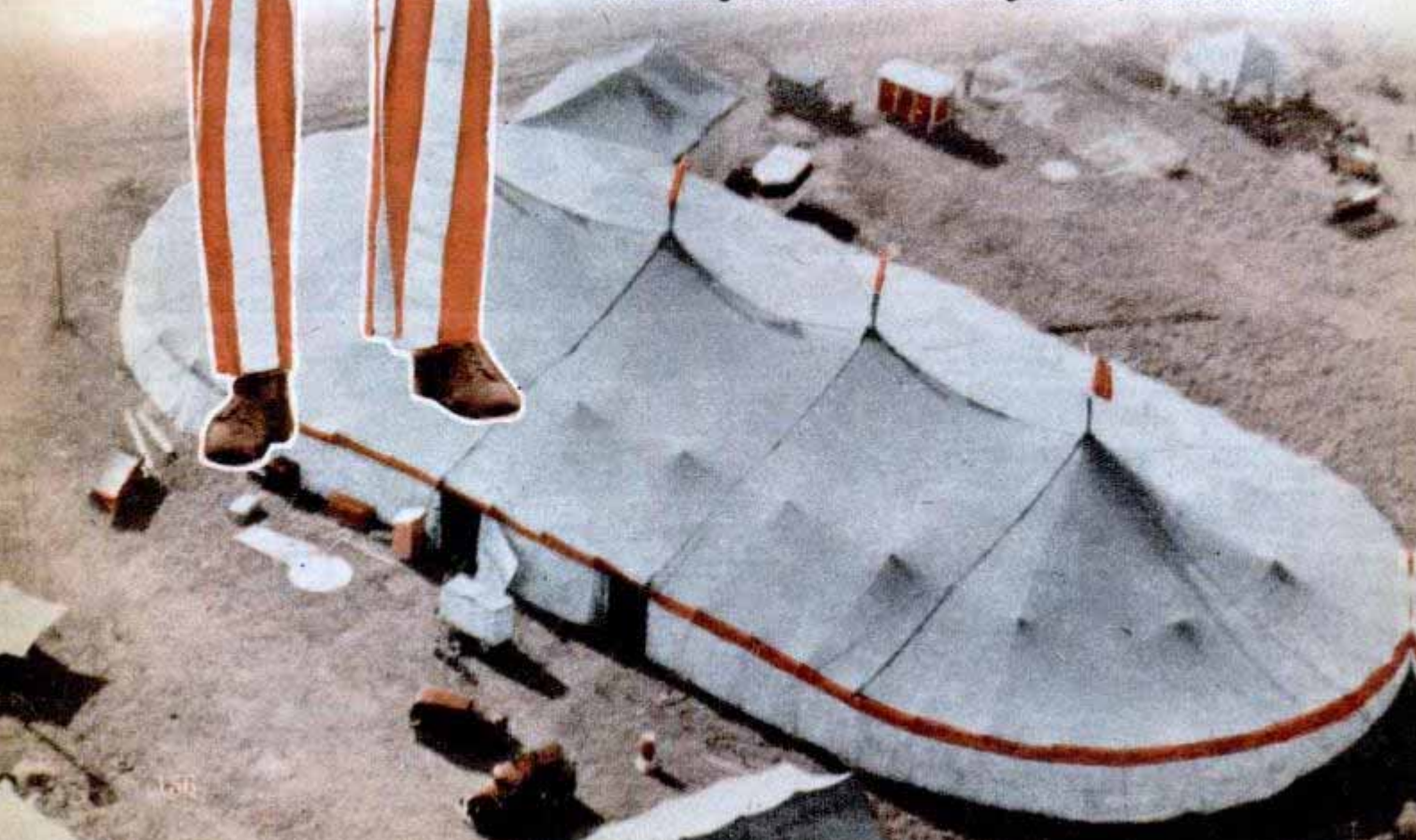


Two high school girls rehearse tricky act on double aerial ladder

standard circus routines, others are their own innovations. Any resident of Gainesville can try out for the community circus. With the proper training almost anyone can perform difficult aerial feats—so the performers say. The circus usually employs a big top expert for part of the spring training period. He advises them on new stunts, makes suggestions on properties and costumes and shows them how to polish up the acts.

This instruction is augmented by a special gym class at the Gainesville high school. Students who desire

Stilt-walking clown towers 15 feet high. Below, aerial view of tent





Aerialist rehearses for act to thrill crowd

may spend their gym periods working on aerial ladders, Spanish webs, rolling globes, Roman rings and other pieces of circus equipment. At least 25 percent of the students become good enough to participate in the circus. The best of them are selected at the annual spring tryouts.

At the tryouts, too, the officers pick the other features and the animal acts. The group has no wild animals. Horses and dogs are the most popular four-legged performers. One of the new acts last summer, for instance, was an eight-horse act performed by matched chocolate-colored equines and presented by Vern Brewer. None of the horses was even halterbroken when Brewer started to train them early last spring.

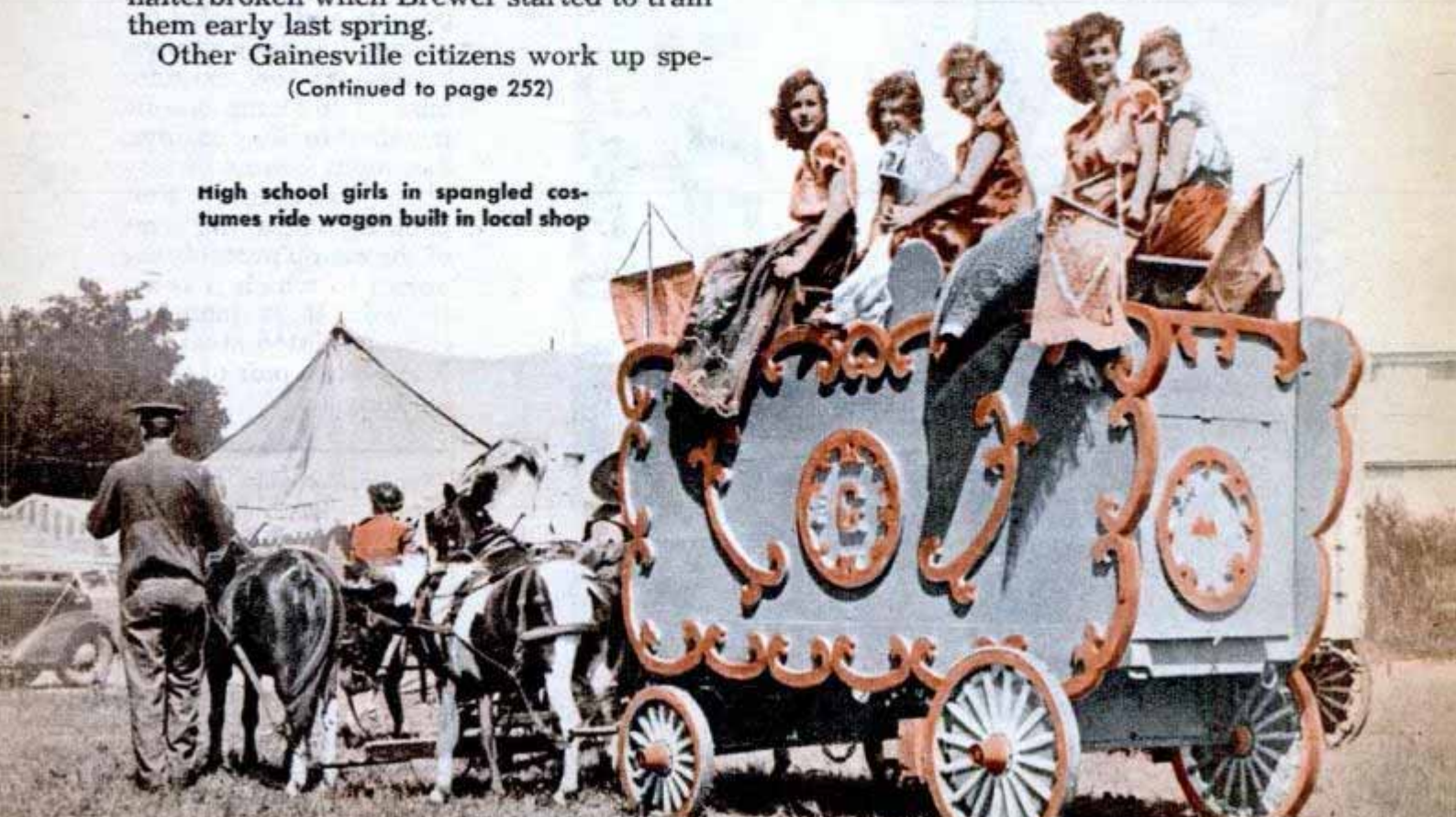
Other Gainesville citizens work up spe-

(Continued to page 252)



Amateur tightrope walker is climbing a ladder while he balances with only one arm

High school girls in spangled costumes ride wagon built in local shop



Snow Cycle Glides Down Mountain Slopes on Carved Wood Runners



Swiss mountains, slippery with ice and snow, are taken in stride by a "schnee-velo"—snow cycle—invented by a 74-year-old resident of Schwandi, Switzerland. Christian Buhlmann, whose right

leg has been paralyzed since childhood and who lost his left arm in the sawmill he operates, invented the snow cycle to help him move around the village. The runners that substitute for wheels are hand carved.



"Ice Tong" Clamps Hold Swing or Bar

Weighing only 1½ pounds, a clamp support holds up to 250 pounds and is useful for supporting baby swings, hammocks or exercise bars. The clamp can be fastened to door casings, basement beams or any sturdy structure. Felt padding within the arms of the clamp protects the object to which it is attached. It is made of chrome-plated steel and looks like a pair of shiny ice tongs.

Popular Mechanics is always ready to supply further information to readers about various products described in any issue. Just write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Illinois, for a prompt reply.

Electronic Trainer for Pilots Simulates Flight Problems

Any kind of flying condition, from the smooth "on the beam" variety to emergencies such as icing or engine failures, is duplicated in an electronic pilot trainer built by the Curtiss-Wright Corporation. Previous trainers reproduced only routine flights.

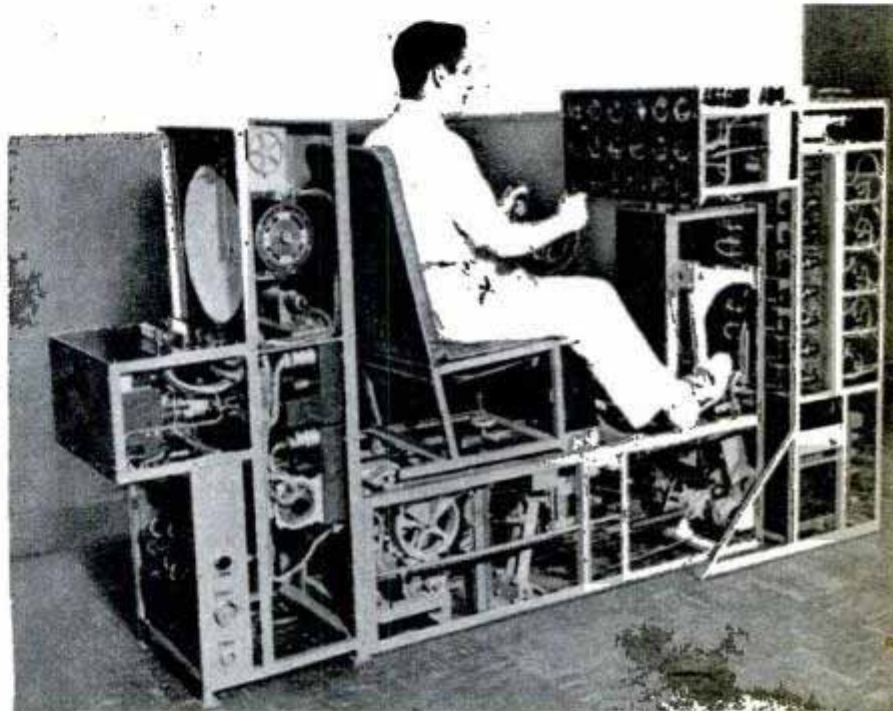
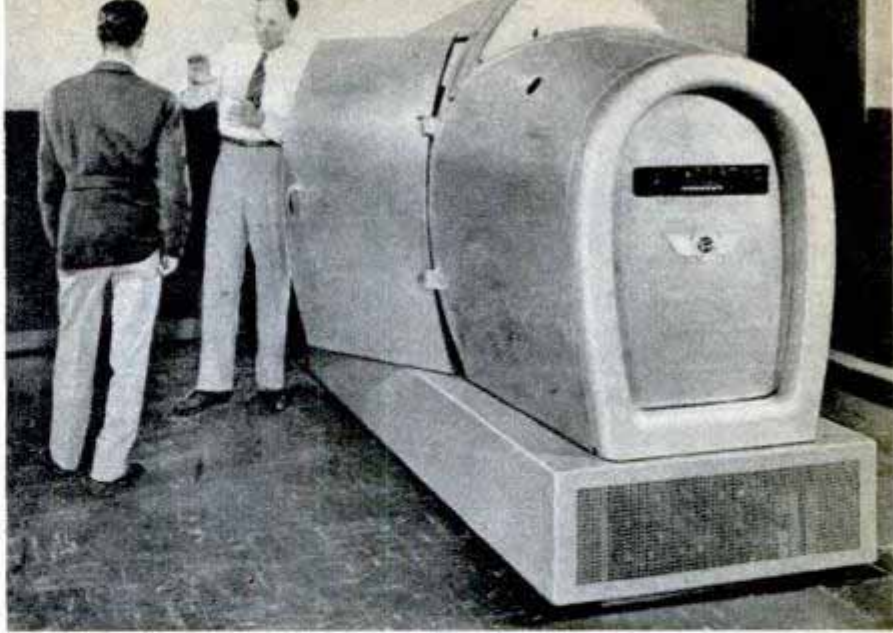
Approximately nine feet long, the trainer resembles an enclosed airplane fuselage minus wings and tail section. It has a pilot's seat, aircraft controls and lighted instrument panel. The device is made stationary so that the pilot gets no assistance in "flying by the seat of his pants" and is wholly dependent on his instruments.

An amplifier produces various engine noises such as those occurring in actual flight. Built into the tail is an instrument panel on which the instructor can create changing weather conditions.

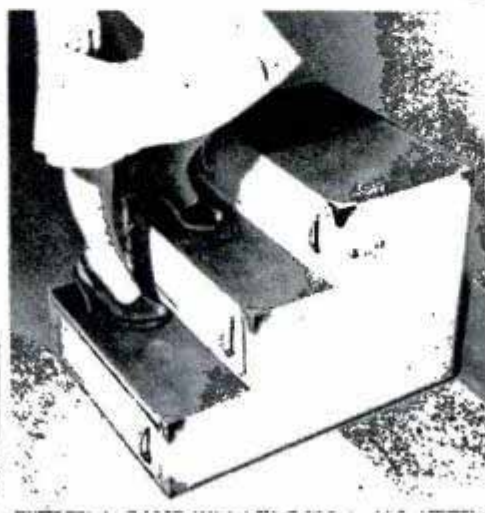
When the controls are operated, all the interacting effects of lift, drag, thrust and other factors that cause the plane to maneuver, spin or stall are developed as electrical voltages. These voltages are sent as signals to the electronic computing system of the trainer which gives the correct answers promptly as voltages or shaft rotations representing air speed, rate of turn and climb, pitch and roll. These answers are continuously translated into meter indications in the trainer's cockpit.

All of the radio signals of a navigational range and blind landing system, together with visual and audible markers, are provided. A flight path recorder permanently charts the trainee's maneuvers.

The initial model duplicates the instruments and flight characteristics of an AT-6



airplane, but they can easily be modified to any type. It is expected to be especially valuable to the armed forces and air lines in training pilots to fly new model planes. Some air lines have estimated the cost alone for such transitional training at \$20,000 a pilot.



"Step-Chest" Ladder Has Drawer Space

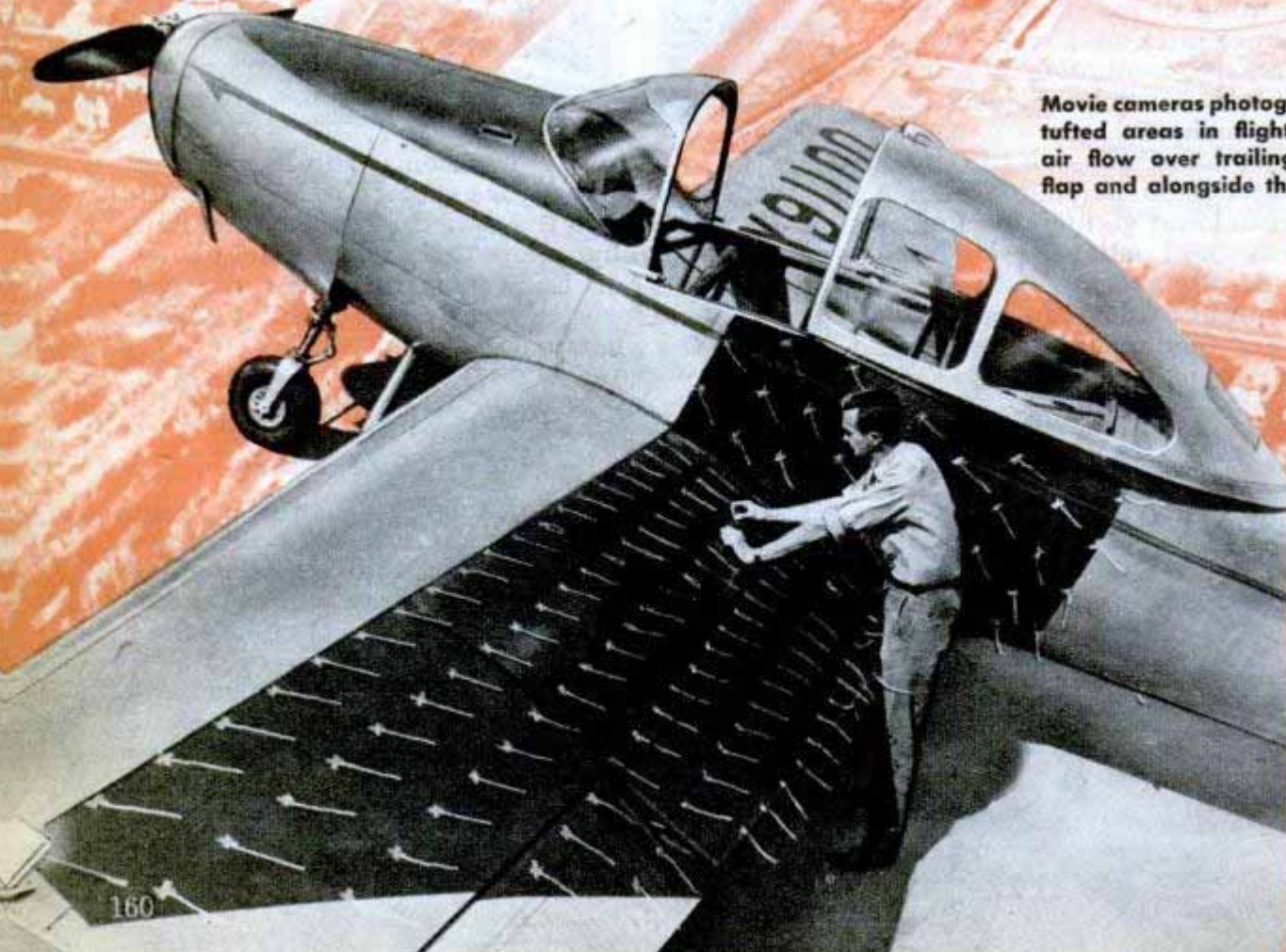
Called a "step-chest" because it combines the functions of a small stepladder and chest of drawers, an aluminum unit has three roomy drawers—one for each step. The legs are equipped with domes which make it easy to slide across floors, yet they move upward into the legs to insure steady support when a person stands on the ladder.

TESTING A NEW LIGHTWEIGHT

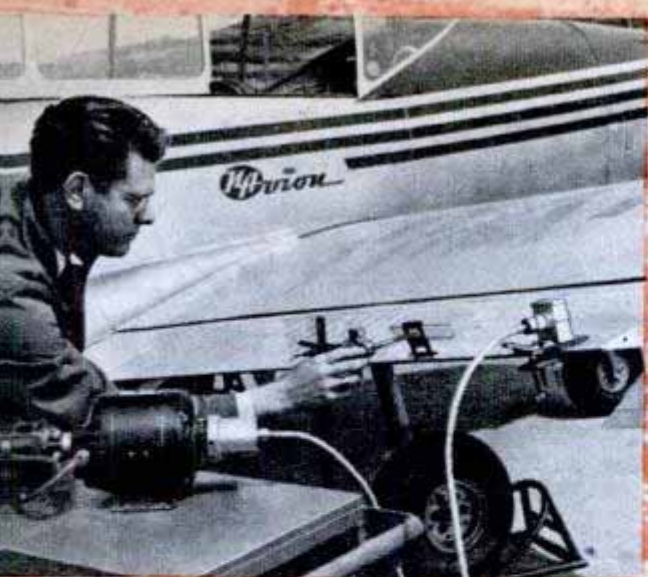


By pressing button at his left thumb pilot photographically records instrument readings that show forces acting against control surfaces

BECAUSE it's too late to call a mechanic when something goes wrong aloft, newly designed planes probably get the most thorough "going over" of any means of transportation. For this job aeronautical engineers and pilots rely on dozens of sensitive instruments, automatic recording cameras and completely equipped laboratories. The experimental craft is put through its paces by flyers trained to observe every flight characteristic. Here are some of the ways North American, for example, spent over 5000 hours in the engineering test flight department alone before producing its new four-place private plane, the Navion



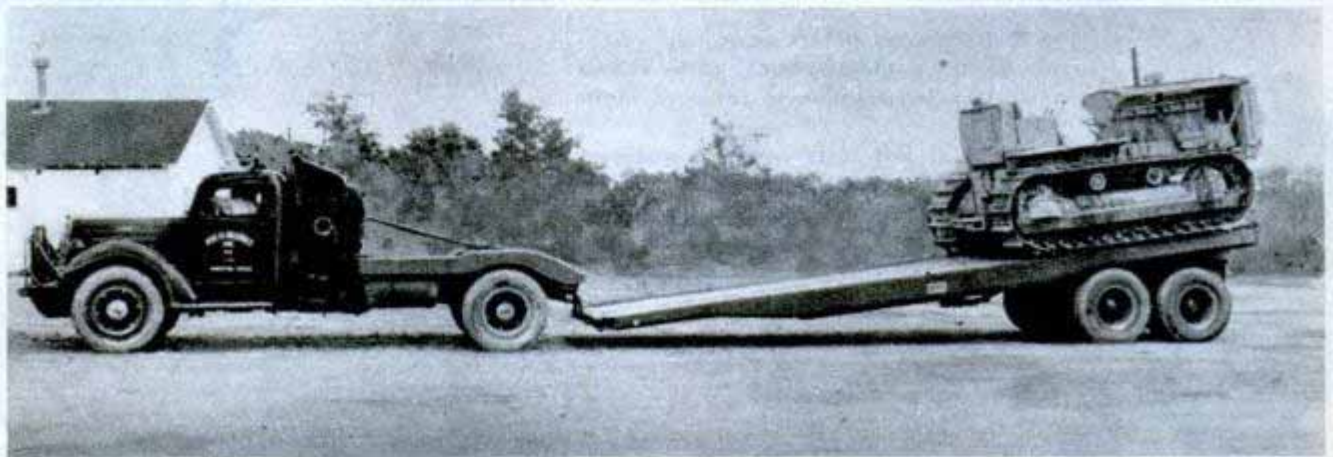
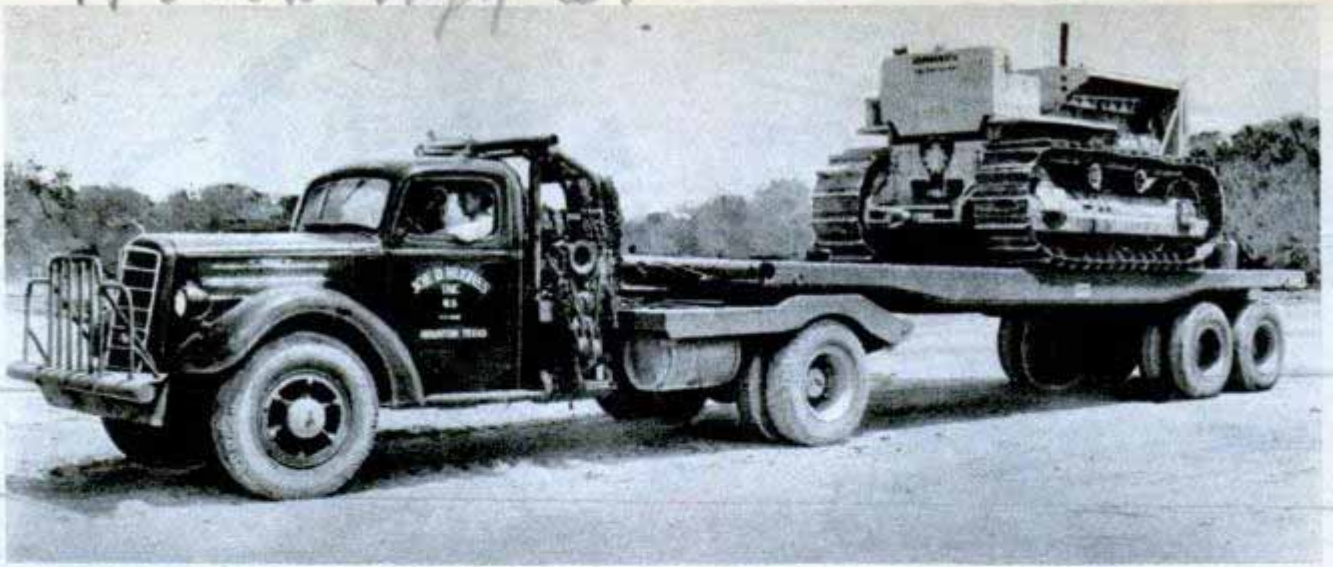
Movie cameras photograph black tufted areas in flight to study air flow over trailing edge of flap and alongside the fuselage



Flap tests (above) detect unwanted vibration. Right, angle-of-attack vane shows plane's heading relative to forward flight

Equipment at left tests wearing qualities of control cables. Bottom, removing camera recording unit after flight. To guard test pilot, tail chute at right can stop a spin





Power from a tow truck makes it easy to load or unload a trailer. To load it with a tractor or other heavy equipment, the front of the trailer is lowered to the ground. When the loading is completed, the front end is hauled by a power winch up over the rear end of the truck and onto the towing wheel plate. It was designed by Meck Trucks.

Self-Loading Truck Trailer

House Trailer Projects Above Coupling to Make Room for Double Bed

Extra space for living quarters is provided in a house trailer that extends above the coupling to utilize the space between the automobile and trailer. A large double bed is mounted in the extension. Close coupling makes the trailer easier to handle.



Helicopter With Hoist Used for Sea Rescues

Using a helicopter equipped with a power hoist, the Navy is experimenting with new sea rescue techniques. While the helicopter hovers overhead the victim hooks a line dropped from the hoist to his life jacket and is reeled up into the craft.

Cosmic Rays Tested 40 Miles From Earth

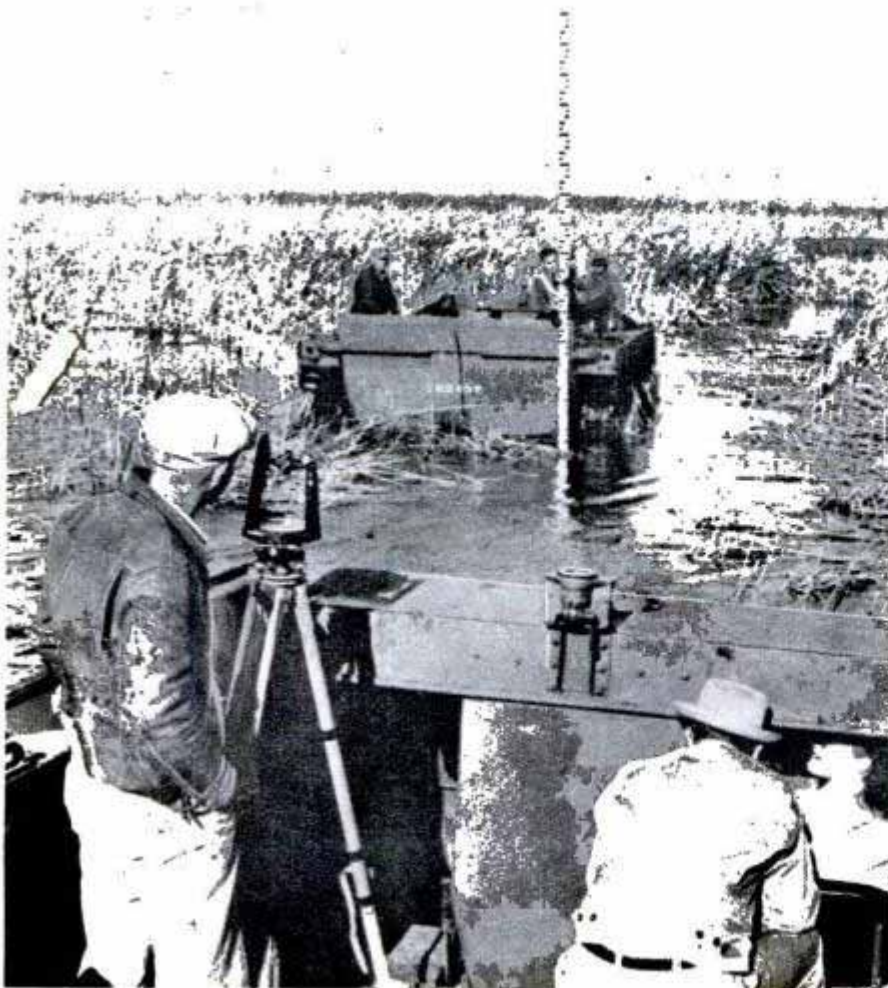
Cosmic rays 20 times more frequent, and stronger than those on earth, were found by a Nazi V-2 rocket soaring 40 miles above the desert at White Sands, New Mexico. Practically all were "hard count" rays that can penetrate six inches of lead, while scientists estimate only 70 percent of those reaching earth are in that class. Radio interference blacked out reception of much of the data.



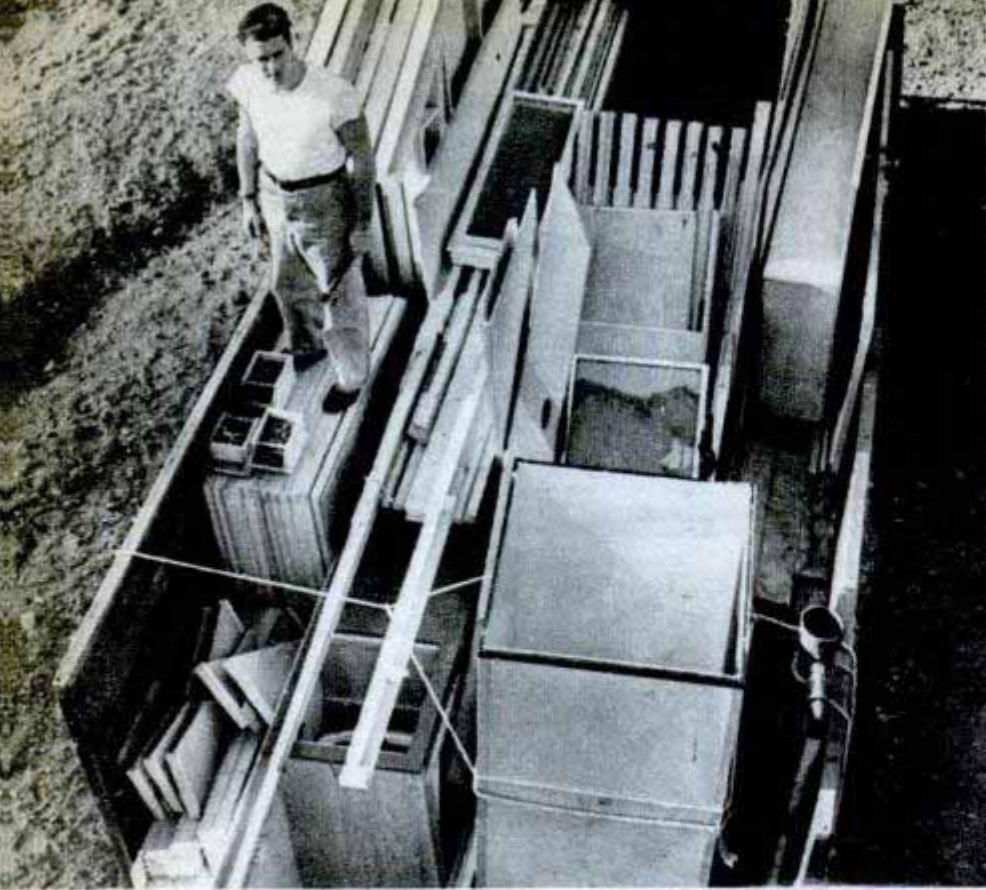
Surveyors' "Amphib" Crosses Marshland

Veterans of rough action in the southwest Pacific, Navy LVT-III amphibian tanks are now carrying Bureau of Reclamation engineers through the marshlands along the Colorado River between Needles and Topock, California, to conduct river control surveys. The armor-plated tanks plow through areas that formerly required days of trail hacking to cross. Another war development, two-way walkie-talkie radio sets, are also used.

☐ For the past 20 years the Atlantic Ocean has been rising at the rate of 1½ feet per century, according to the U. S. Coast and Geodetic Survey.



U. S. Bureau of Reclamation photo



Truck hauls knocked-down house to site in one load. Home will be ready for occupancy in about 56 hours



Door from living room leads into kitchen. Beyond kitchen extra bedroom can be seen

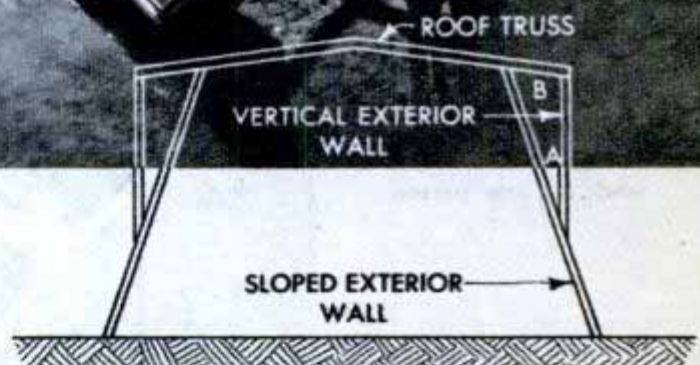
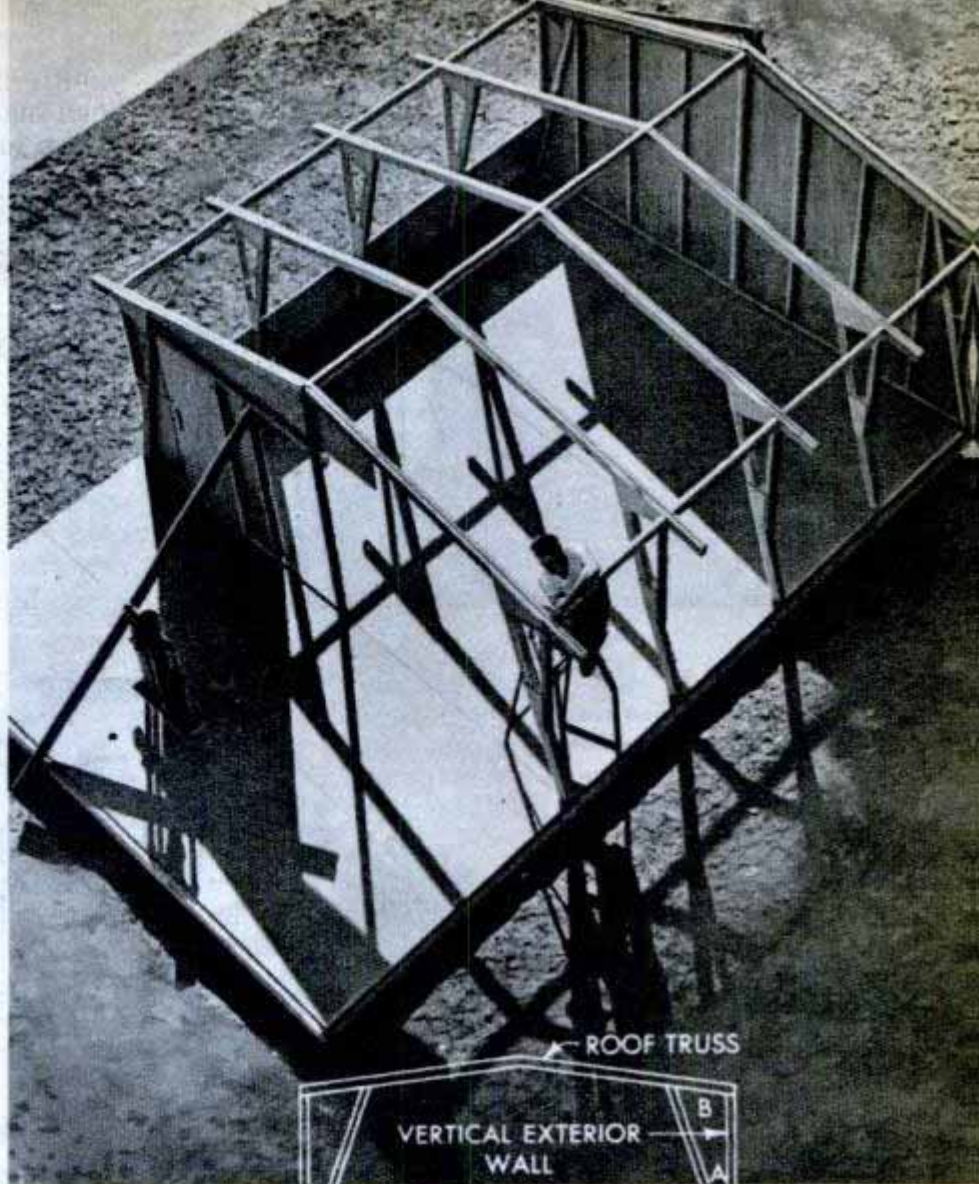
Special Delivery House

Assembled cottage makes an inexpensive mountain cabin with lots of light and air

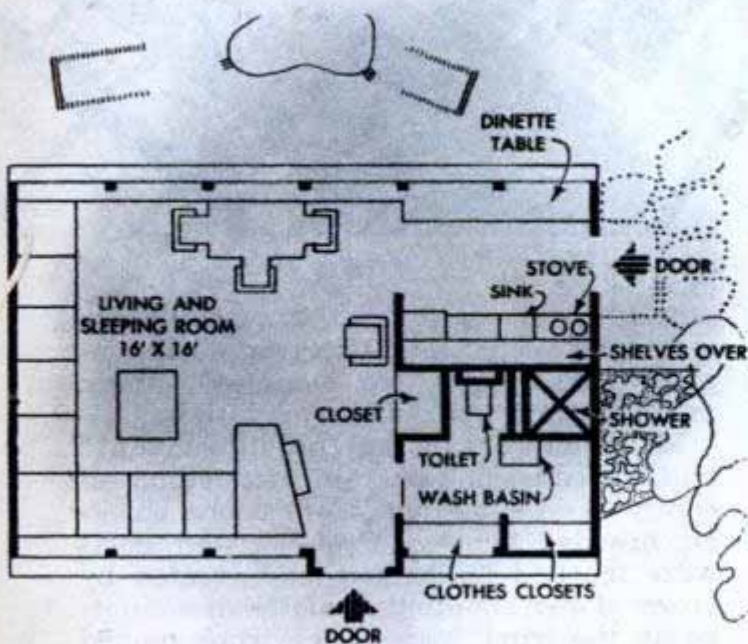




Right, with one of the end walls and part of an interior partition in place, the builder assembles the roof trusses



Roof and side wall detail shows sloping exterior walls. Plywood reinforcing gussets are fastened at A and B as in photo above



Plan shows space-saving arrangement of rooms. Front door can be placed anywhere in side wall

ONE man can erect a new "production line" cottage-type dwelling in 36 hours, wire it in 10 hours and install the prefabricated plumbing in another 10 hours.

The 16 by 24-foot home contains a combination living and sleeping room, a kitchen with a dinette, and a bath complete with stall shower. All the material used in the basic unit is delivered in one truckload to the site. Additional units may be added at either end to serve as separate bedrooms.

Priced at about one third less than conventional homes, the house has a unique "trussed modular" system of roof support that has been tested to 60,000 pounds per square foot, four times the requirements of stringent building codes. About 150 of the "packaged" houses are prefabricated per



↑
Compact kitchen has a dinette table beneath expanse of windows. Note the cupboards above stove and sink

House is completed and occupied (roof is left off so you can see → inside) after 56 hours' work by one person

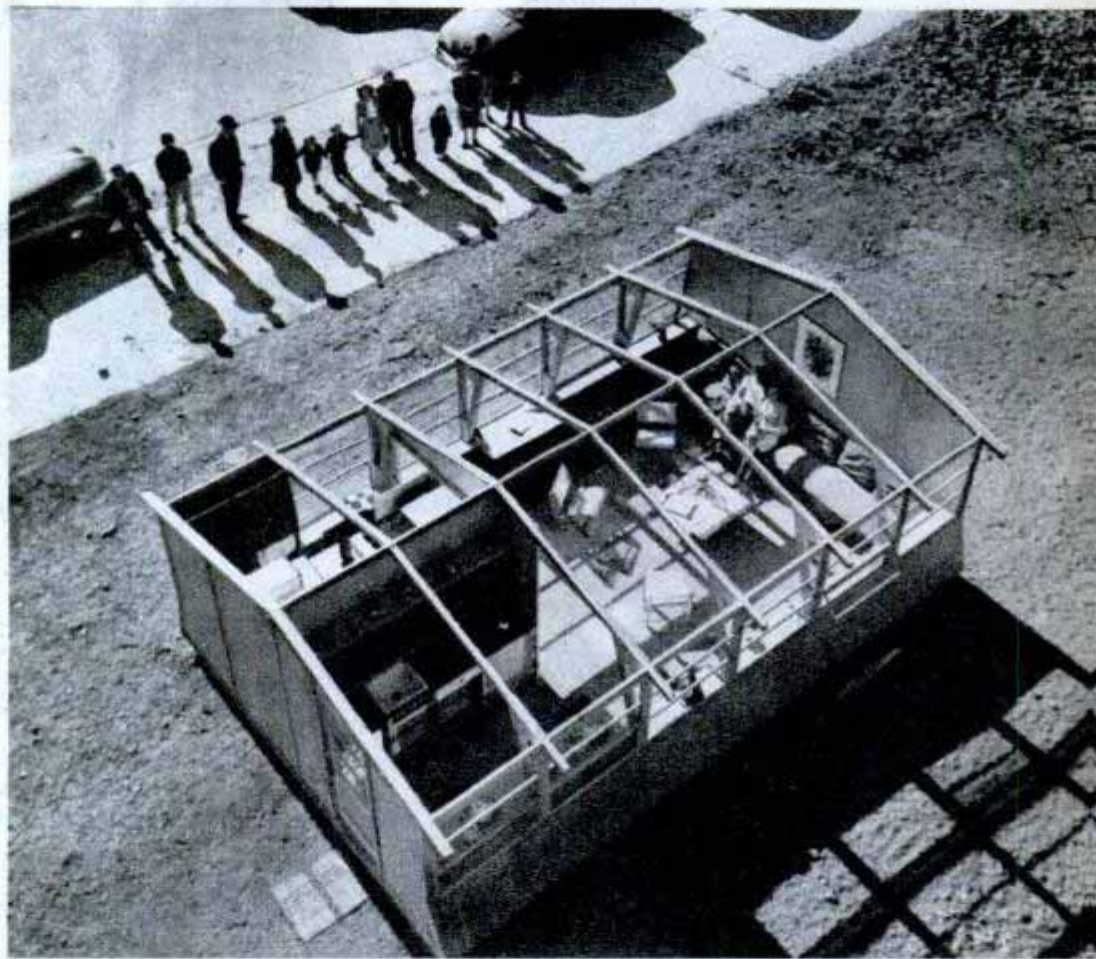
Spacious living room has row of windows on each side, storage space beneath. Note the novel roof trusses ↓



month in California and deliveries have been made to other states and Hawaii.

The long walls of the house are paneled in glass windows. The lower side walls, end walls, flooring, interior partitions and roof are built up from 4 by 8-foot weather-resistant plywood panels. Bathroom and kitchen are placed back to back for economy. Plywood panels may be used to cover window areas and doors may be placed anywhere along the side walls.

Entirely prefabricated at the mill, the parts of each house are assembled without special fitting or cutting at the site. A hammer and a pipe wrench are the only tools required. The electrical system is pre-assembled into a complete unit of wiring,



outlets and fixtures, ready for installation.

The completed buildings can be used as guest houses, beach or mountain cabins, motels and camp or classroom buildings.

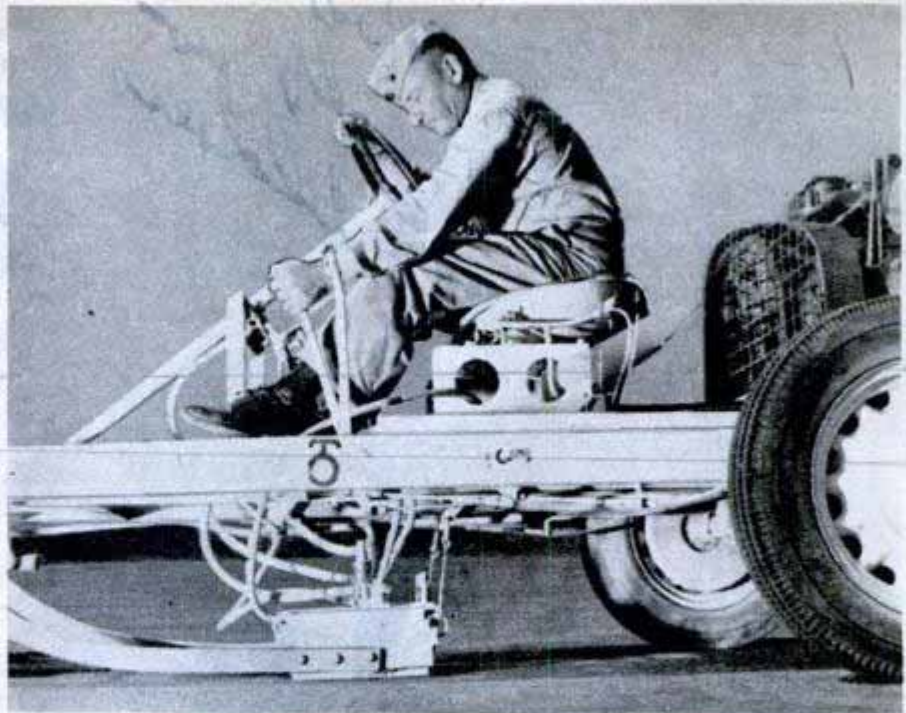
Manufacturers of the "production line" house used a somewhat similar method recently in erecting five 500-foot-long chicken brooder houses. Prefabricated parts were trucked to the site and erected by crews of men standing on platforms mounted on the truck beds. Each truck moved forward at the rate of 24 feet per hour while the men erected the sidewalls, roof trusses and roofing.

Road-Striper Does Job of 90 Men

White lines are painted on the many miles of highways at Camp Pendleton Marine Base, Oceanside, Calif., by a mechanical road-striper built of spare parts at the base machine shop. The machine paints a stripe on 30 miles of road in eight hours, a job that formerly required the work of 90 men. One man operates the machine, sighting down an extension bar to follow a guide line marked on the highway. The striper is pushed by a truck. It was developed by Lieutenant E. N. Nelson.

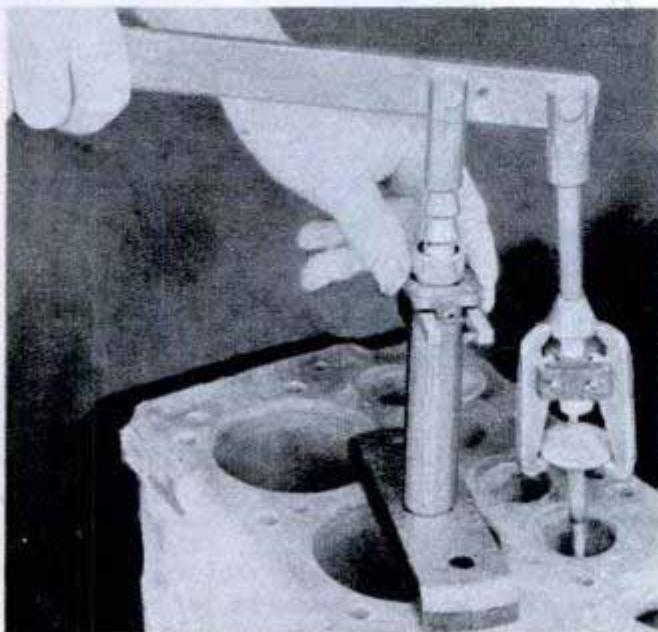
Acetylene Made From Natural Gas

Acetylene gas, used in welding and as a base for making some types of plastics, soon may be produced commercially from natural or coal gas instead of calcium carbide as at present. The process, developed by German scientists, was discovered by American investigators searching through chemical secrets of former enemies, and is said to be more efficient than American processes. The United States has large quantities of



U. S. Marine Corps photos

natural gas, a relatively small amount of which is used in production of chemicals. The process may give America another source for an important basic chemical.



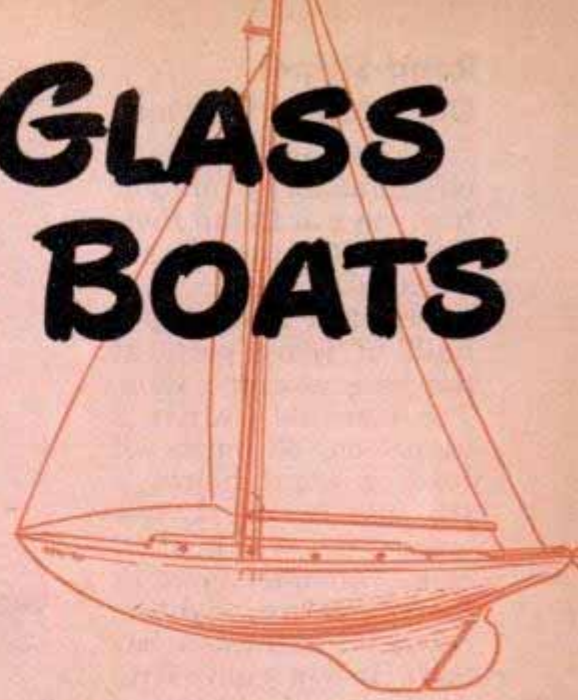
Jack Removes Valves Quickly With No Danger of Breaking

Removal of valves is accomplished easily and quickly with a jack which eliminates prying out valves, a bothersome procedure that often bends the stems. The jack has a long handle which permits the exertion of full power on the valve with no danger of breaking the guides. The position of the jack's fulcrum insures a straight pull.

Weather Stations Roll on Trucks

Mounted on Army 2½-ton trucks, mobile weather stations developed by the Signal Corps carry all the instruments necessary for meteorological observation. They were used during the war to facilitate collection of weather data in combat areas.

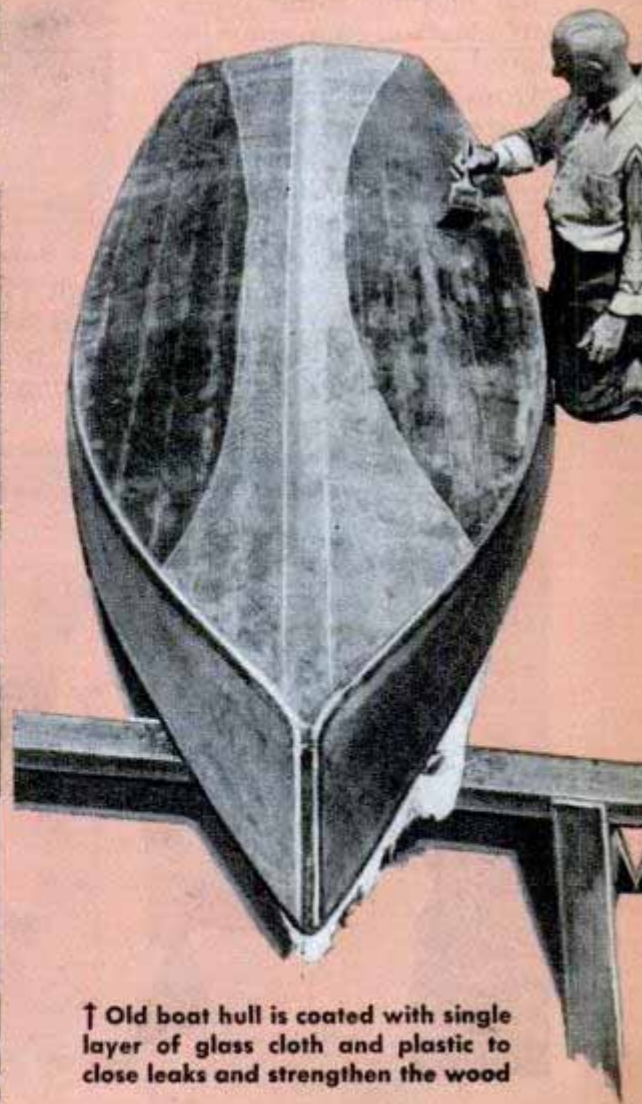
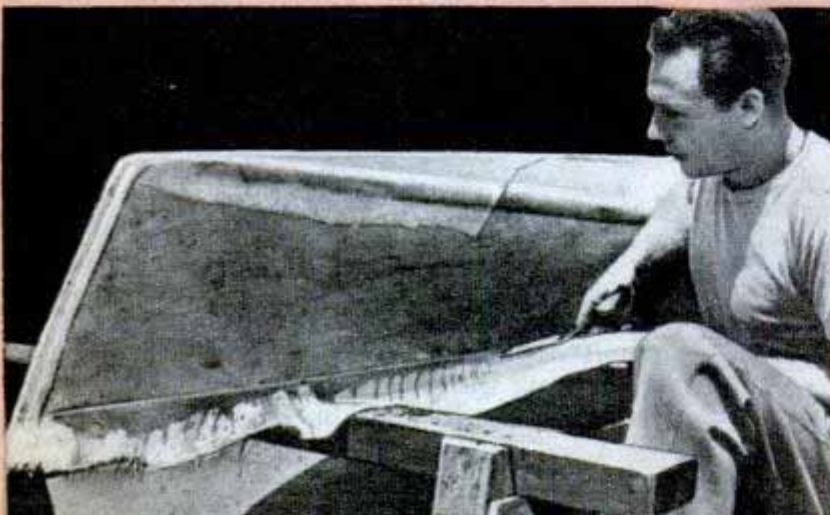
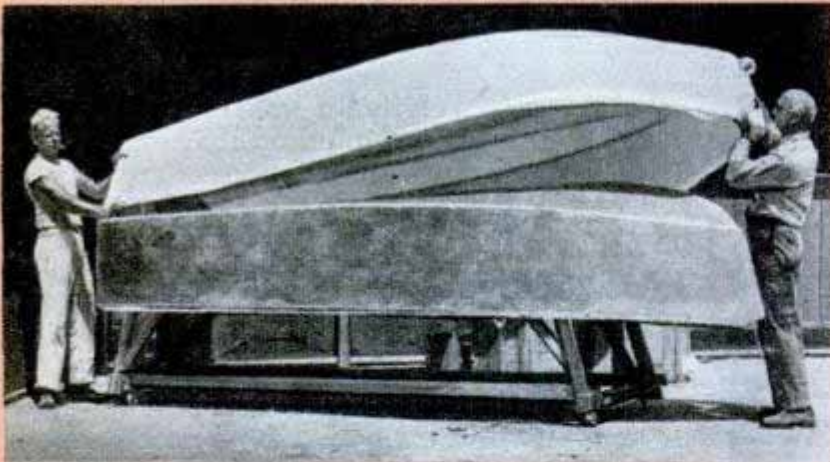
GLASS BOATS



Power boats, runabouts and sloops made by a new technique have glass hulls that are virtually unbreakable and won't open up or absorb water. The boats are built by laminating layers of glass fabric and plastic over a wooden form. The 167-pound runabouts with a tensile strength of 65,000 pounds per square inch have been run at full speed over jagged rocks without harming their hulls



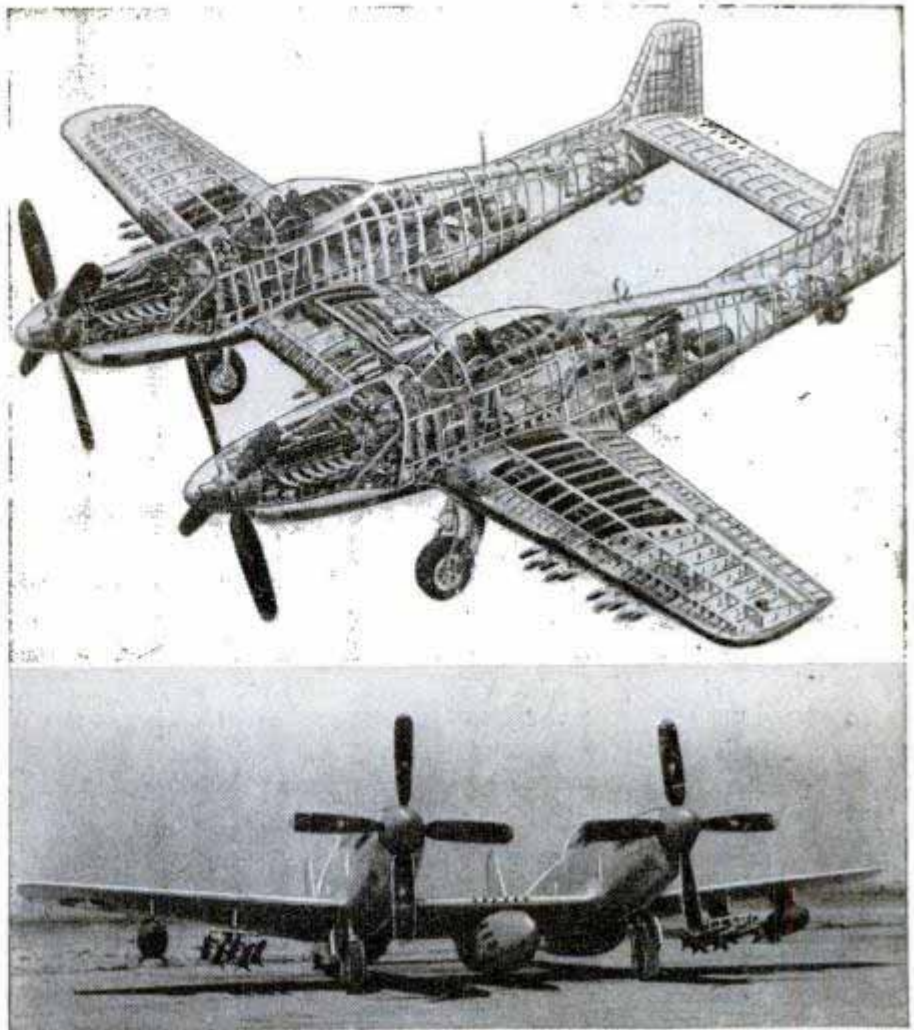
↑ Sloop patterned after this scale model will have Fiberglas sails
↓ Laminated hull is pried from the form. Bottom, excess fabric is trimmed from old wooden hull that has been given a new glass "skin"



↑ Old boat hull is coated with single layer of glass cloth and plastic to close leaks and strengthen the wood

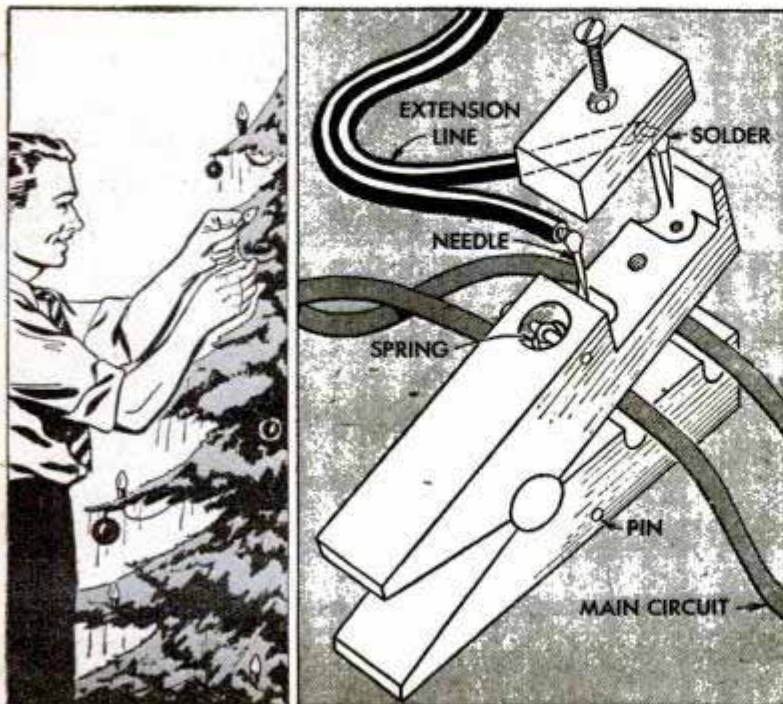
Versatile Twin-Engine Mustang Has Range of 5000 Miles

As a single-engine AAF fighter the P-51 Mustang had an outstanding war record. Now as a P-82 Twin Mustang it is considered one of the most versatile warplanes of its type ever built. Powered by two Packard-built Rolls-Royce engines developing 2300 horsepower each, the Twin Mustang approaches 500 miles per hour and can climb 7000 feet a minute. It can be used as interceptor, fighter-bomber, long-range escort, photographic reconnaissance ship, night fighter or rocket-fighter. To adapt it to varying missions, different nacelles containing guns, rockets or photographic equipment are fitted to the center wing section. When used as a fighter-bomber it packs 14 forward firing .50-caliber guns with 400 rounds for each one. Range is 1900 miles. Or it can carry two 2000-pound bombs over 1500 miles without external fuel tanks. As an escort, equipped with two 310-gallon external fuel tanks, it has a range of nearly 5000 miles at 240 miles per hour. An extra-long-range version car-



rying additional fuel has been suggested for a range of 7000 miles. As a rocket-fighter it packs 25 five-inch rockets. For reconnaissance, North American has designed a center wing nacelle to accommodate cameras.

"Clothespin" Clips Place Each Christmas Tree Light Where Needed



Christmas tree lights can be placed exactly where they are needed with a new wiring system. Each of the bulbs is on an individual extension that can be clipped to a main wire at any point. This current-carrying wire is attached to the trunk of the tree with one bulb on the end for the top branch. The individual wires are fastened to the main wire with a clip that looks like a miniature spring-action clothespin. The clip has two sharp pins that penetrate the insulation of the main wire to establish contact.

☐ Durable Nylon sheeting which can be made in any thickness in various colors has been developed by Du Pont as a substitute for leather in wallets and handbags.

Trunk-Size Oil-Burning Furnace Heats Five-Room House



Circulating fan in oil-fired furnace changes air six times per hour. Dust and dirt are kept out by filter

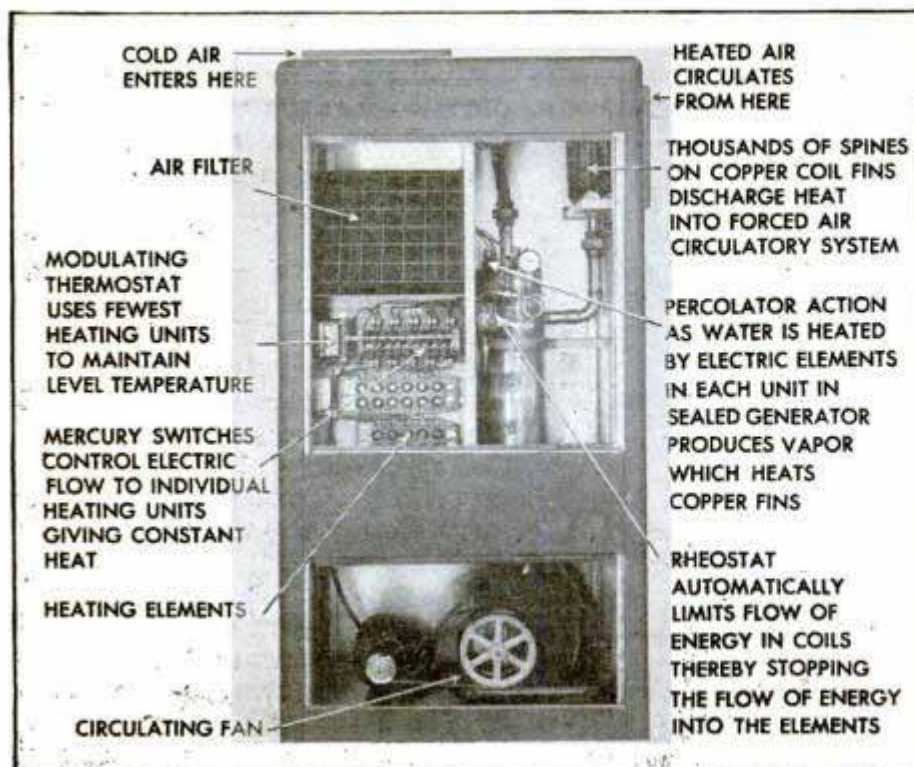
It requires only three minutes for a 187-pound oil-fired, forced warm air furnace to heat a five-room house. Measuring only 21 by 27 by 44 inches, the furnace delivers 55,000 B.T.U. A circulating fan provides six complete changes of air per hour, and a filter tray removes dirt and dust from the

air and automatically controls humidity. A larger furnace—thermostatically controlled like the smaller one—is 29 by 41 by 44 inches in size, and has double the capacity, or 110,000 B.T.U. An oil-level-control valve meters the correct amount of fuel to the burner.

"Steam Percolator" Warms Air in Electric Heating Unit for Homes

Steam generated in a sealed copper "percolator" warms the air circulated by a compact electric heating unit for the home. It is completely automatic and desired room temperatures can be selected by adjusting a wall control. Fresh air is drawn into the unit through filters. It is channeled through

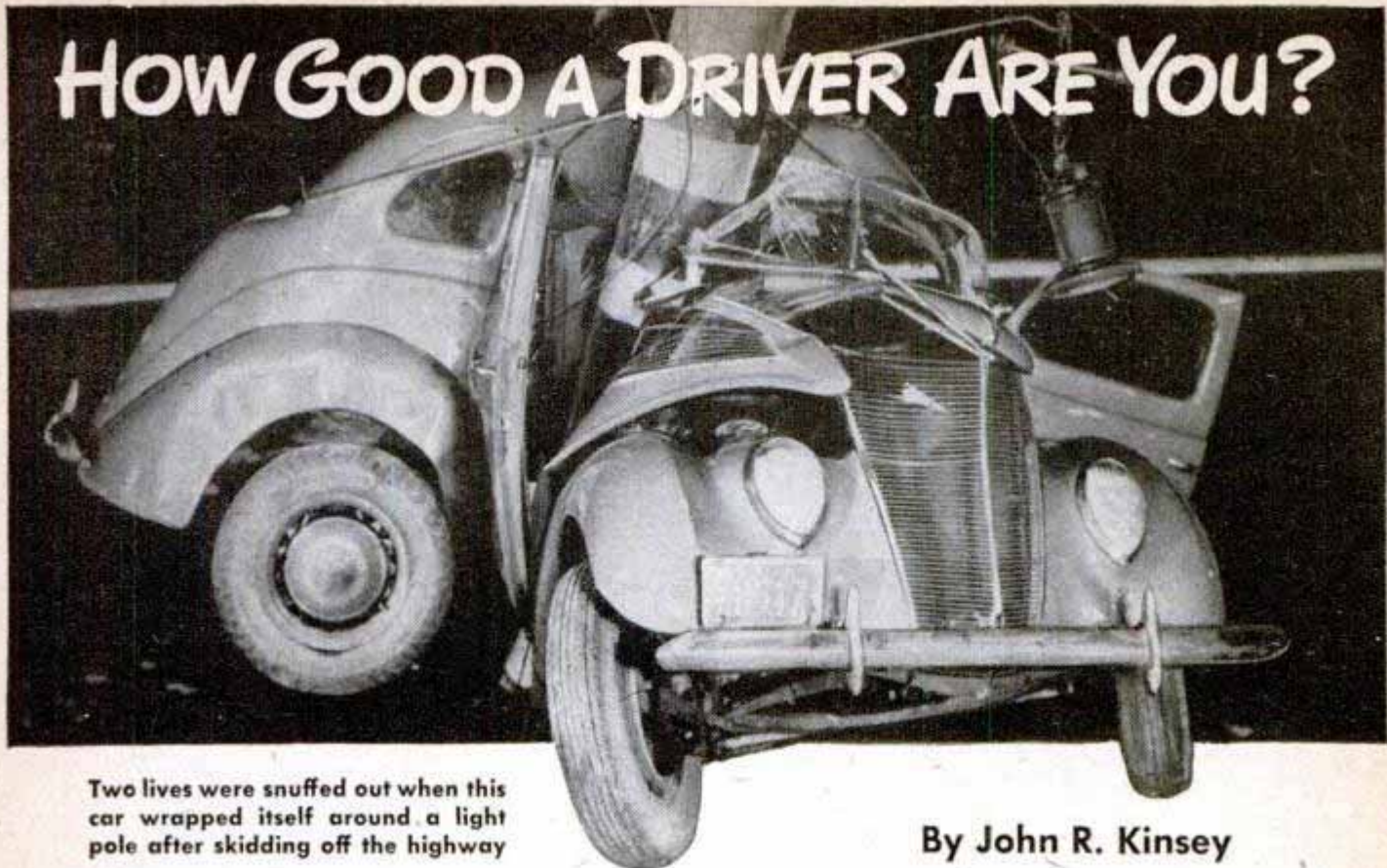
multispined copper fins which warm the air and release it into the air ducts of the house. The copper fins are heated by the "percolator" heart of the system. This consists of a copper tank containing water under reduced pressure. Low voltage immersion-type heating elements are encased in



copper tubes inside the tank. Percolating action draws water into orifices at the bottom of the tubes. In the tubes it is heated enough to change into steam vapor. The steam vapor is discharged from the top of the tubes to circulate inside the spines on the copper fins. As the steam loses its heat to the air on the outside of the fins it is condensed and returned to the tank.

☐ New tools for electronic scientists include instruments that record weights within 100,000ths of an ounce and thicknesses as minute as 100,000,000ths of an inch.

HOW GOOD A DRIVER ARE YOU?



Two lives were snuffed out when this car wrapped itself around a light pole after skidding off the highway

By John R. Kinsey

"HEY, YOU! Doncha know how to drive?"

Many an indignant automobile driver has smoldered under this familiar bit of insolence from an irate pedestrian or a hard-boiled cop.

Few drivers have ever stopped to take such a question seriously. Of course, you'll admit that the fellow in the convertible who just zipped by is a lousy driver, and that old woman in the Reo sedan ought to be home, knitting. But me? Why I'm a natural behind the wheel.

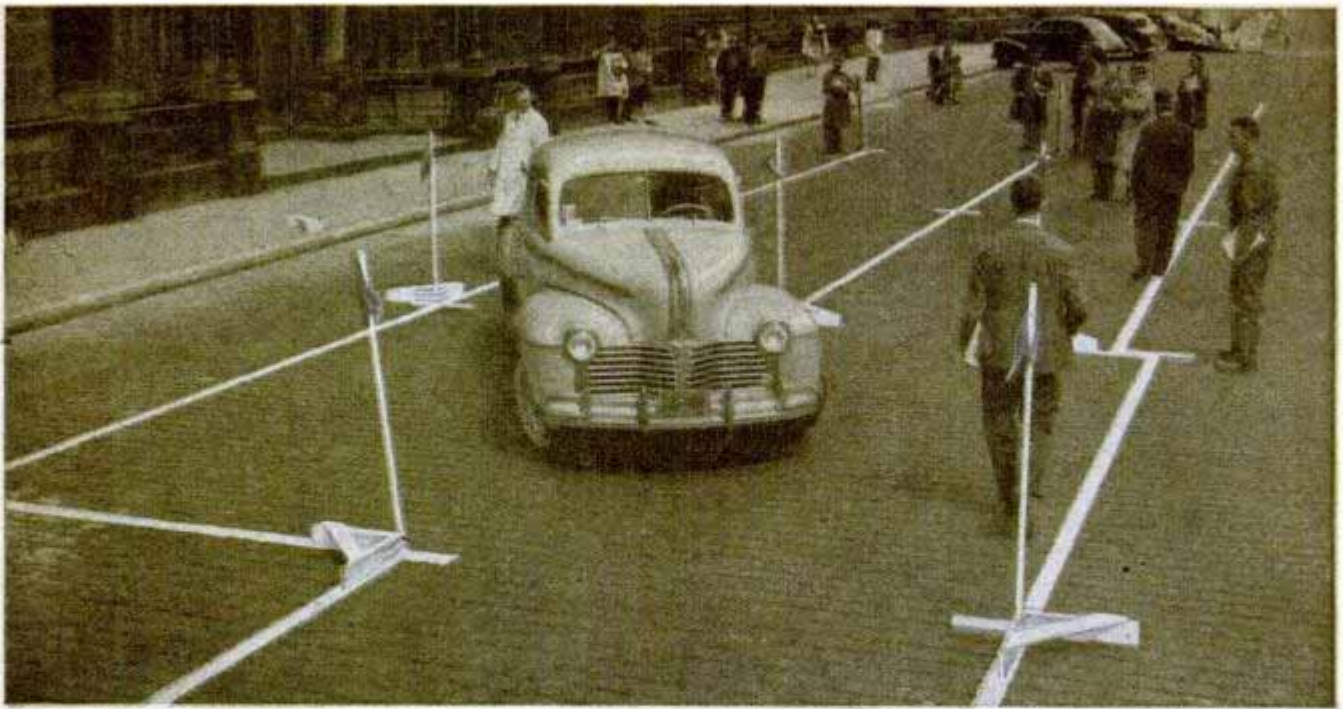
Could it possibly be that you're a bit weak on some of the essentials that make up, not necessarily an expert driver, but just an average motorist who keeps his car and himself out of crashes?

Judging by the fast-mounting auto accident toll, quite a few men and women are not fit to drive a car. Inefficient eyes, hands, feet and minds are partly responsible for the fact that probably 40,000 persons will be killed and 1,350,000 injured this year in motor vehicle accidents—an all-time high.

The average car on the road today is

ON GUARD AGAINST ACCIDENTS





White lanes dotted with posts marked the boundaries for safe driving tests conducted at Columbia University

about eight years old, and one out of three is dangerously defective mechanically. A nation-wide police traffic checkup proved this. But what about the drivers? Too many handle automobiles in such a way that the cars become lethal weapons, and state licensing laws are so variable that there is no way of tabulating the safe drivers as against the unsafe.

So serious is the climbing auto death rate that President Truman summoned the nation's top safety experts to Washington to draw up a course of action to stop the needless killing, maiming and loss of property.

In the past 10 years, 322,100 Americans have been killed in motor vehicle traffic accidents, 11,000,000 have been injured, and the damage loss exceeds 15 billion dollars.

Auto crashes are occurring at such an increased tempo, since the war's end, that collision insurance rates are up about 50

percent and liability and property damage insurance costs about 25 percent more.

One recommendation made at the President's Highway Safety Conference was that all states adopt a sound driver licensing plan which should include:

1. Adoption of minimum standards for driver examination — as recommended by the American Association of Motor Vehicle Administrators—by those states where the standards are lower. If possible, standards

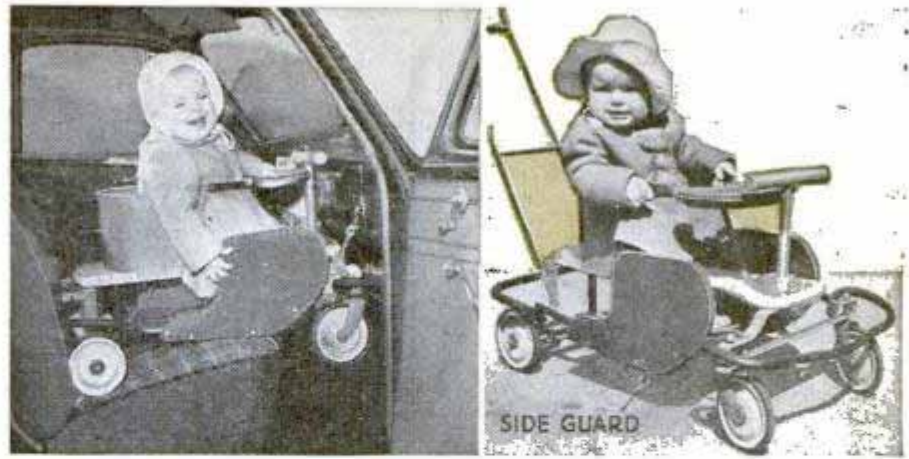
Reaction speed of motorists is tested by clocking time required to press key after red light flashes. Right, California test for driver's glare resistance



Small Child's Walker Has Plywood Side Guards

Fashioned of plywood, this walker for a small child has side guards that will keep his feet off the wheels and prevent him from dragging his shoes on the ground. The guards are cut to the general shape shown and then bolted to the frame. The walker can be carried in the car also where it will serve as a seat for the child. The back of the walker rests on the seat and the front is fastened to the instrument panel by means of snap hooks. The hook arrangement will vary with different makes and models of cars.

LeRoy Ryan, Quincy, Mass.



Carrying Case for Toothpicks Keeps Them Clean



Easily made, this carrying case will keep toothpicks clean. It's cut from light, pliable leather and holes are punched in the sides for stitching. A leather of contrasting color is used for the lacing. If desired, initials or a design can be tooled in the cover and back for decoration.

August E. Wasco, Cleveland, Ohio.

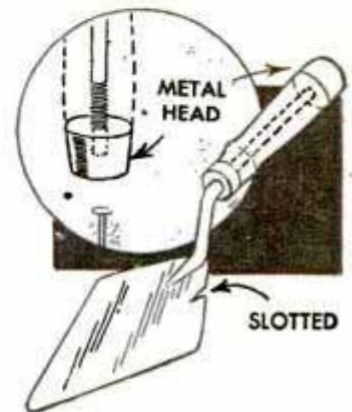
Lighter Fluid Helps Loosen Bolts

A bottle of cigarette lighter fluid kept on the workbench will be handy in loosening rusted or tight bolts and nuts, especially the small ones on electrical appliances that have been "burned on" by the heat. Usually a few drops will loosen most threads.

E. W. Moses, Jr., Blacksburg, Va.

Trowel Drives and Pulls Nails

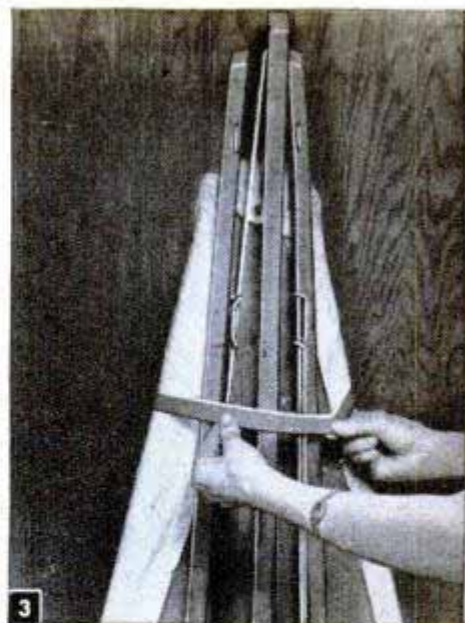
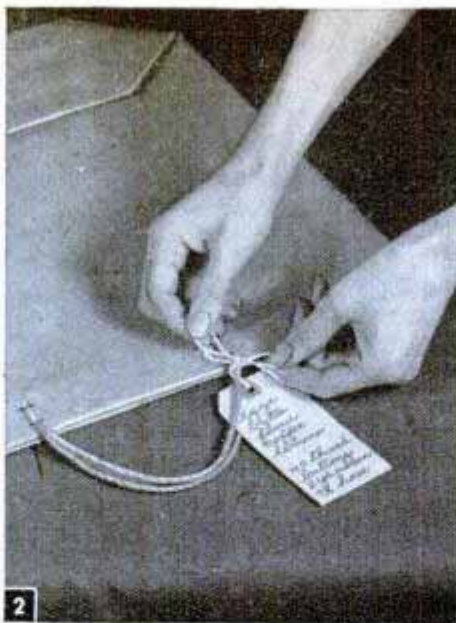
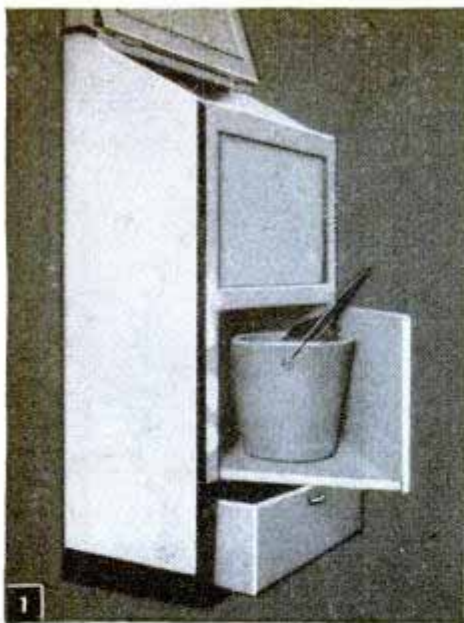
Making a three-in-one tool of his trowel, one mason fitted a metal head on the handle and slotted the heel of the trowel. The head is used to drive nails and the slot, of course, to pull them. This tool is excellent for small nails.



Old Stump Removed From Lawn With Saltpeter Solution

If it is inconvenient to chop or blast that old stump from the front lawn, try using a solution of saltpeter. Bore a series of holes in the top and sides of the stump and fill them with the solution. In a short time the wood will rot away. As much saltpeter as can be dissolved in the water should be used in order to make a saturated solution.





Solving Home Problems

1 If you have a wood or coal-burning stove, and it's necessary to store fuel in your kitchen, this bin is ideal for wood, coal and kindling

2 You won't have to waste much time hunting for a shopping list if you write it on a tag and then tie it to the handle of your shopping bag

3 Cut from an inner tube and slipped over the small end of an ironing board, a rubber band will hold the legs of the board securely

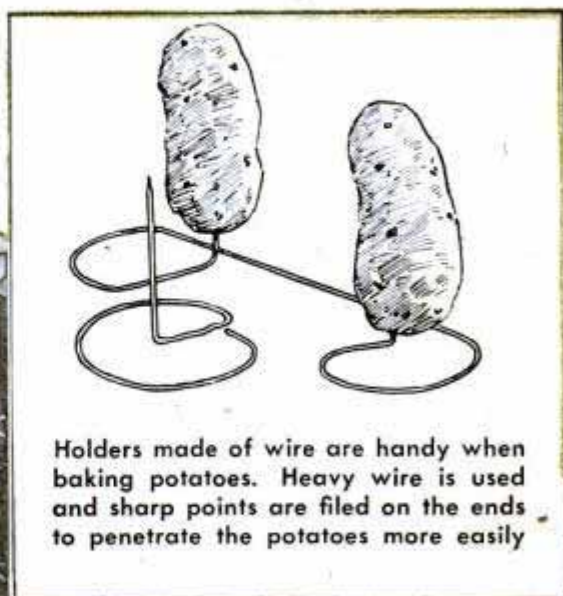
4 When new, reinforce the finger tips of rubber gloves with adhesive tape to make them last longer. Reinforcing is done on the inside

5 Toothpicks are easier to remove from a flat-bottom holder if a shallow paper cone is placed in the base of the container as indicated

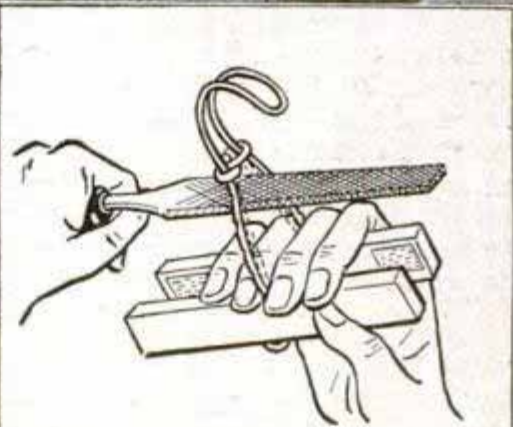
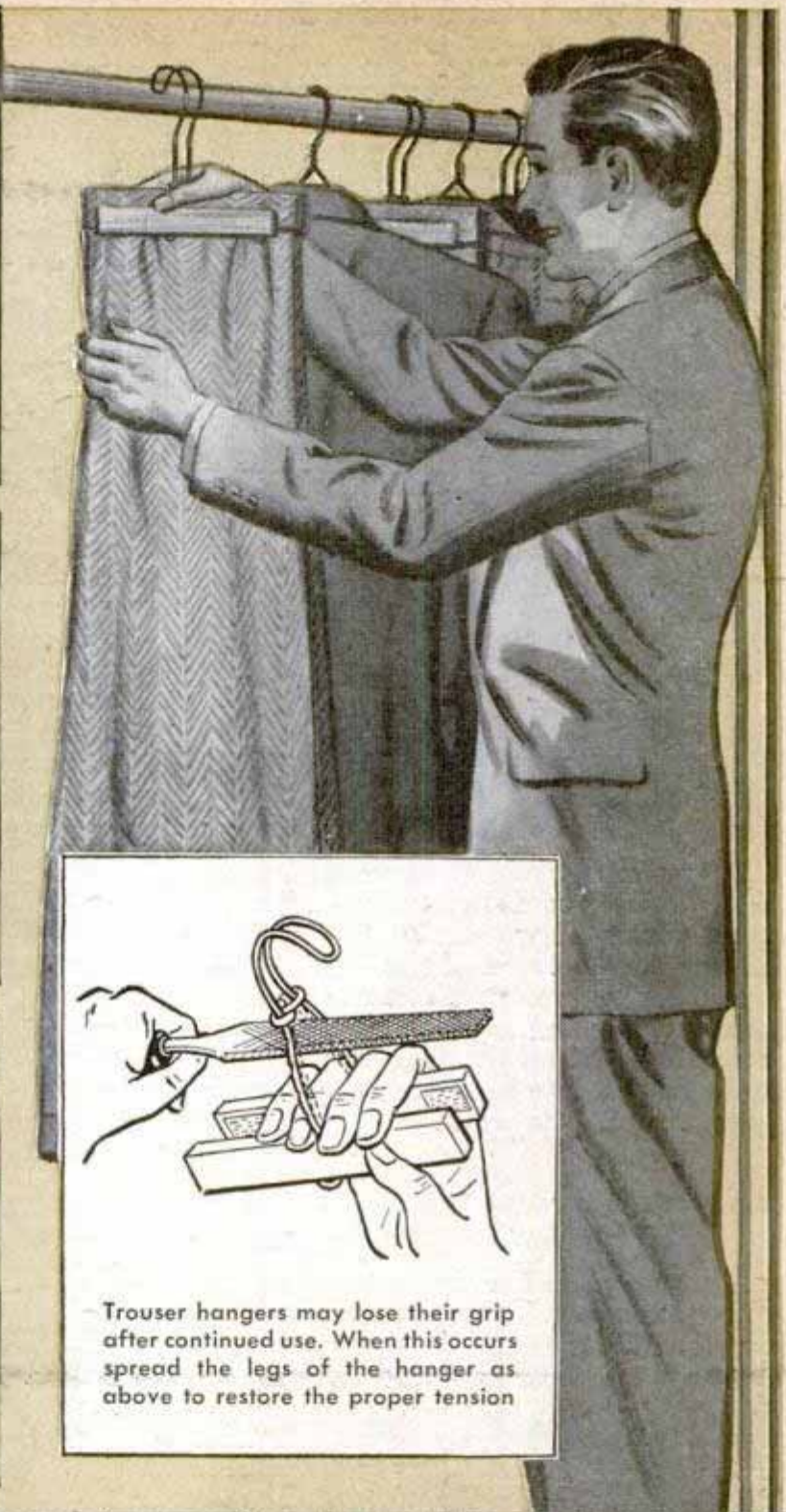
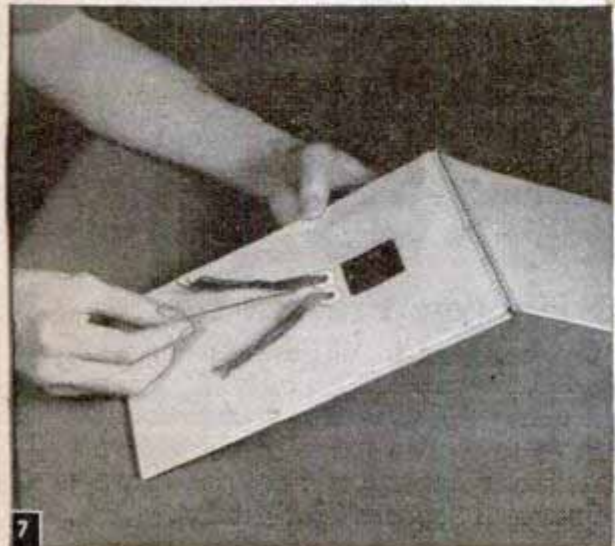
6 Where the walls of a room are finished in a light color, extension cords will harmonize if painted with white-sidewall-tire coating

7 Keep embroidery floss between notebook pages. Glue edges together, bring ends through top sheet. Put identifying label on same page

8 Long seams can be ripped easily if the material is held under the presser foot of a sewing machine. This will serve as a third hand



8 Holders made of wire are handy when baking potatoes. Heavy wire is used and sharp points are filed on the ends to penetrate the potatoes more easily



Trouser hangers may lose their grip after continued use. When this occurs spread the legs of the hanger as above to restore the proper tension

Bas-Relief Carving Simplified With Scrollsaw



Much of the painstaking work involved in carving a figure in bas-relief, such as shown in Fig. 1, can be eliminated by first sawing the work roughly in outline. In this way, the waste stock is cut away quickly, leaving the rough outline of the figure to guide you in carving. From here on it's simply a job of rounding the edges and making the necessary body cuts to give the proper contour as in Fig. 2. The final carving then is sanded as in Fig. 3. Finishing may be done in several colors of enamel or bronze paint. An antique-ivory finish looks especially well on a background of dark wood. To antique the finish, apply two coats of ivory enamel. When thoroughly dry, fill all the depressions with brown enamel, using a small brush. Then, with a soft cloth moistened with turpentine, wipe across the work as in Fig. 4. This blends the brown into the ivory and highlights the dark depressions.

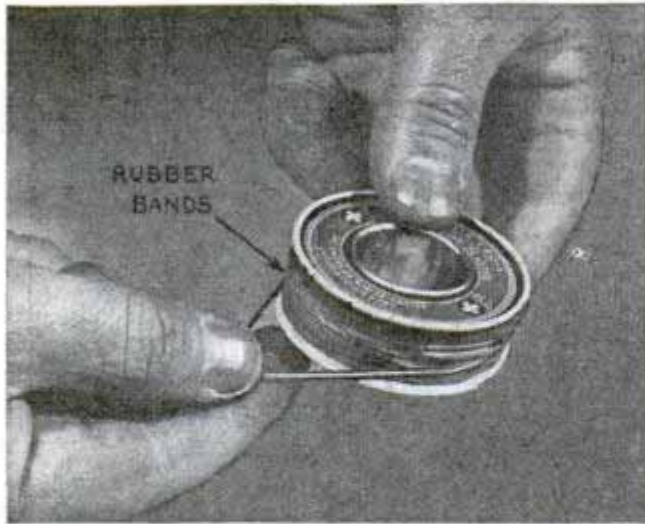
Elma Waltner, Hurley, S. Dak.

Satisfactory Method of Etching Your Name or Initials on Steel Tools

To secure satisfactory results when etching your initials on steel tools, use a solution of commercial nitric acid, one part, and muriatic acid, one part, mixed in a glass container. Mix with extreme care and wear rubber gloves to avoid acid burns. Cover exposed skin areas. Coat the metal with asphaltum and scratch the letters in after the coating is dry. Apply the acid with a cotton swab until the desired depth is obtained and remove the asphaltum with

either lacquer thinner or kerosene. Raised letters are produced by writing or printing the name and then etching around it. You can also etch your name by using a rubber stamp. First clean the metal with a dry abrasive and then prepare the "stamp pad." With a camel's-hair brush paint a thin coat of asphaltum over the surface of a piece of glass. Press the stamp on the glass to coat the letters, then press the stamp firmly on the metal. Let dry and apply the acid.

Tape Spool Stores Rubber Bands



To store rubber bands and keep them from the light until used, slip them over a spool of the kind used to dispense adhesive tape. After the cover is slipped on, it serves as a protection against the deterioration of the rubber. The container can be suspended from a convenient nail.

Kenneth Murray, Colon, Mich.

Twin Bird Bath Cut From Can

Easily and quickly constructed at low cost, this bath will accommodate two birds at a time, and it can be made in practically



any size you wish. An oil can is suitable as it has only the small triangular hole in one end and this is easily soldered shut. Cut the can lengthwise, bend the sides apart and turn over the sharp edges with a pair of pliers.

Front Hitch Helps Park Trailer

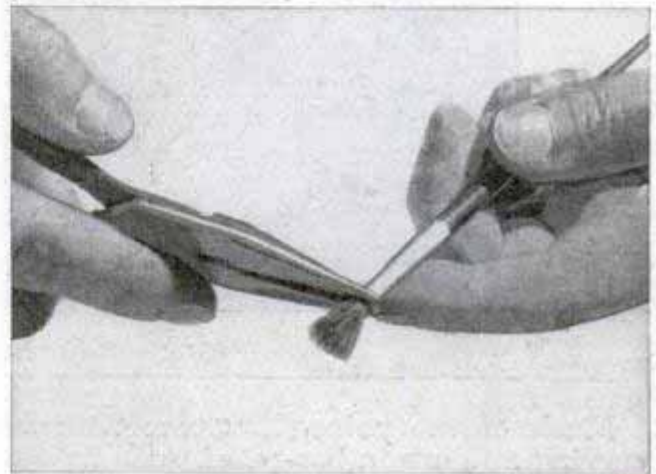
If you experience difficulty in maneuvering a trailer into tight places when backing it into a parking space, try the idea I use. Just put a hitch on the front bumper so that the trailer can be attached at this

end. Then you can either push it into place, or back the car and pull it into place. You will find it much easier to spot the trailer when you can see in the direction in which you are driving.

G. P. Shutack, Nesquehoning, Pa.

Tightening Small Brush Bristles

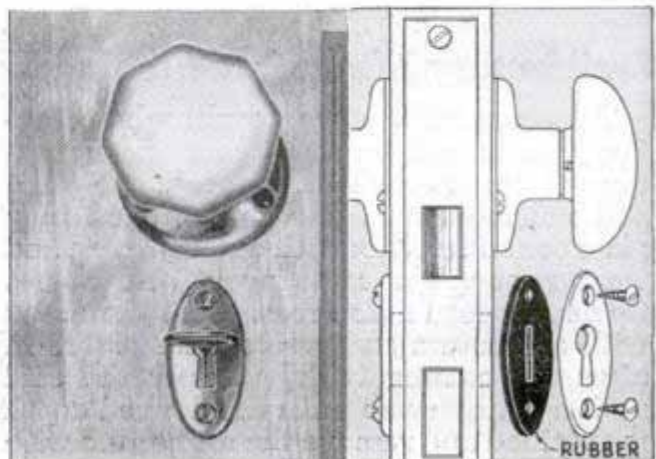
When you have need for a small artist's brush and only the inexpensive kind is available, the brush can be prepared before use so the bristles will not loosen and fall out. Using a pair of small-nose pliers, pinch the metal ferrule as tightly as possible. This will flatten the ferrule so that the bristles will be held firmly.



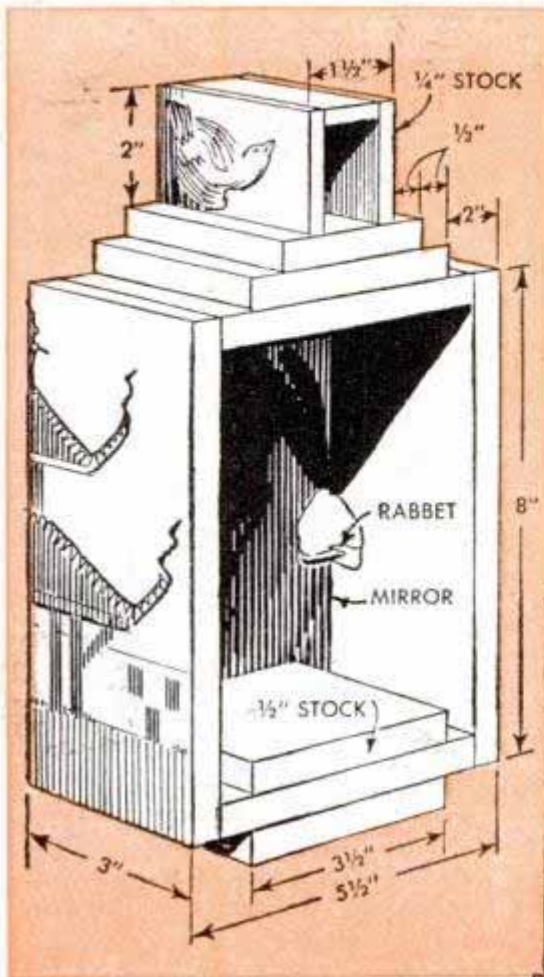
This Door Key Can't Slip Out

One neat way to prevent a key from falling out of a lock when the door is closed sharply is to put a piece of slit rubber underneath the escutcheon plate to help retain the key. Most plates are flanged around the edge, which rests against the door, so there is enough space under them for the rubber. Two holes are cut in the rubber in alignment with the screw holes on the plate. The slit in the rubber should be as long as the keyhole. An advantage of this arrangement is that it is more difficult for intruders to work the key out from the outside of the door.

H. N. Durham, Jr., New York City.



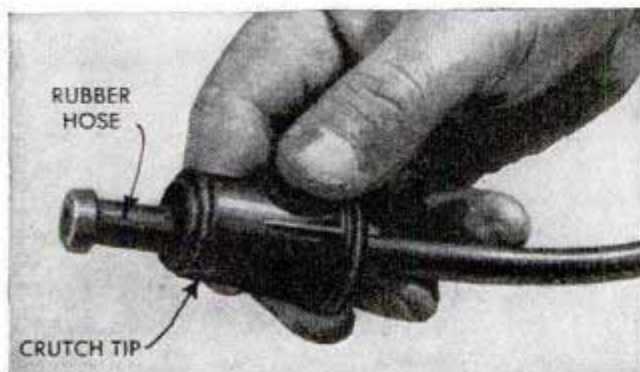
These Shadow Boxes Enhance Your Knickknacks



Adapted from an ancient Chinese design, these shadow boxes provide a dramatic means of displaying your most cherished knickknacks. The boxes are especially effective when suspended at each side of a fireplace. With the exception of the handle at the top, which is made of 1/4-in. material, the box is formed of 1/2-in. stock, preferably white oak. Since the sides are nailed to the top and bottom pieces and the nails countersunk, no joinery is necessary. This does not detract from the appearance of the box, but merely heightens its provincial quaintness. The back may be nailed in place, although you will get a better job by rabbeting it into the sides and top. The decorative pieces above and below the bottom piece will be more effective

if they are glued on, although they can be nailed, too. The handle is glued together and then assembled to the blocks on which it rests with screws driven up through the blocks. When assembled, the unit is glued in its proper place. If desired, a mirror may be glued to the inside of the back to heighten the effect.

If the wood used is a good grade, an oil finish is best. In any event, natural finish without stain is advised. Use silk cords to hang the boxes. Long tassels hanging from the suspension hook and the bottom of each box add to the appearance of the finished project.—Allan C. Carpenter, Chicago.



Rubber Hose Attached to Faucet With Crutch-Tip Connector

Usually it's a difficult matter to find a connector to attach a small hose or rubber tubing to a water faucet. A rubber crutch tip will serve this purpose very nicely. Cut a hole in the bottom of the tip for the hose, which is pushed through and folded back as shown. Then secure the hose to the tip with rubber cement and slip it over the faucet.

Puppets, says the dictionary, are small images in human form—but Martin and Olga Stevens, leading puppeteers, make them talk and act like living people. Here's how they do it

STAGE

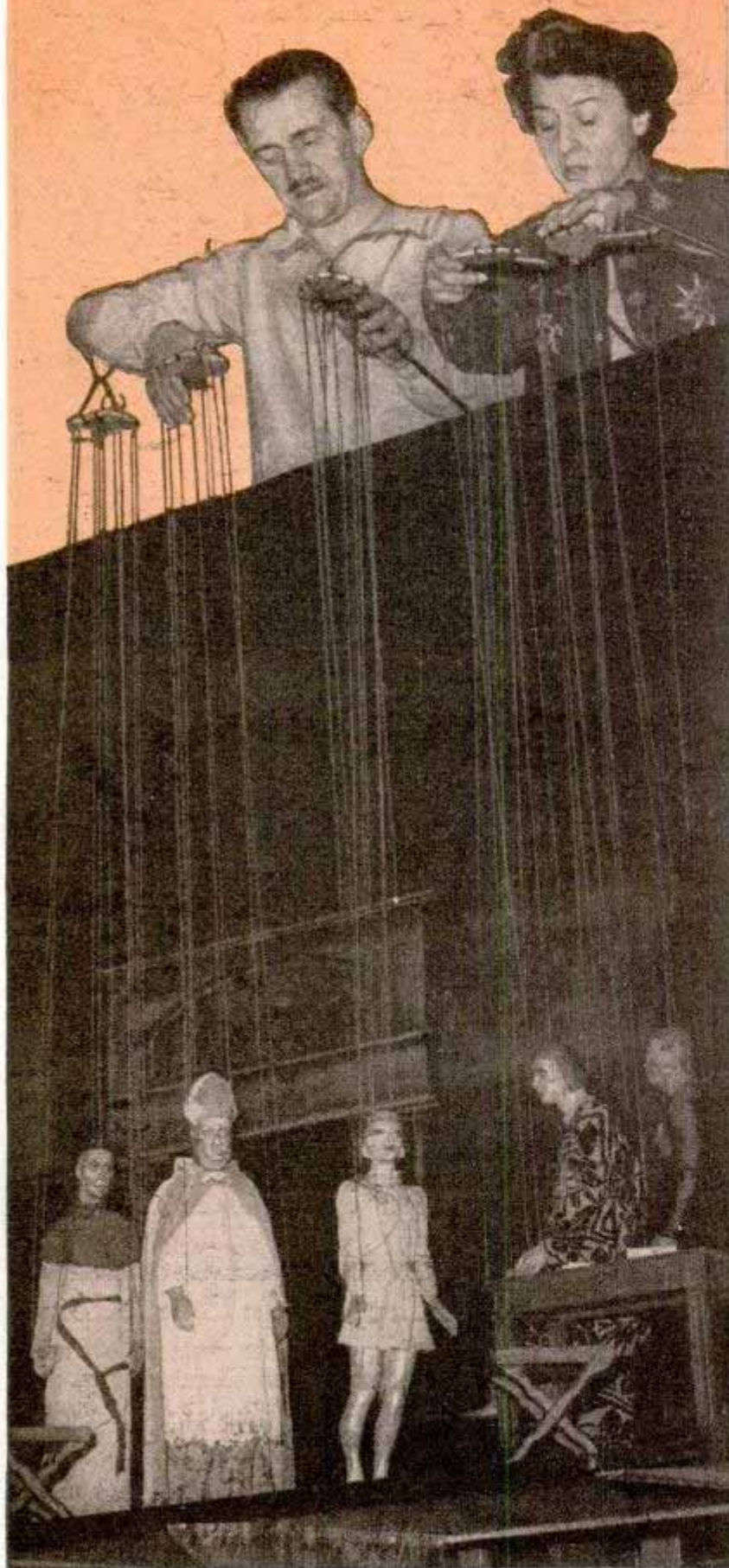


PART I

By Kenneth Murray

A MARIONETTE show, skillfully handled, is real entertainment—with all the dramatic atmosphere, costuming and dialogue of the professional stage, and the character and individuality of adult performers. In fact, so realistic are the shows put on by the Stevens Marionette Team, top-ranking puppeteers, that children have asked to be introduced to the "actors" after the performance. Except for the controlling strings which, with the small size of the stage, are the only "give-aways" of the puppeteer, marionettes can be made to go through a complete dramatic performance with an illusion so perfect that the audience is hardly aware of it. And Martin and Olga Stevens, who make their own marionettes, have revealed the reason is that the figures are copied, to a rough but close scale, directly from human models. Movements of the models are studied carefully so that the marionettes may have the same limitations, balance and dissimilarities as the prototypes.

Preparing rough blanks. In making a puppet, front and side profile sketches are first made on a 15 by 24-in. sheet of brown wrapping paper pinned to a smooth surface. General dimensions of the professional-type marionette figure can be determined from Fig. 16. Many professional puppeteers choose a model from life, using a scale of 4 in. to 1 ft. And, as already mentioned, they include all variations from the normal to give the completed figure character and individuality. Be particular in meas-



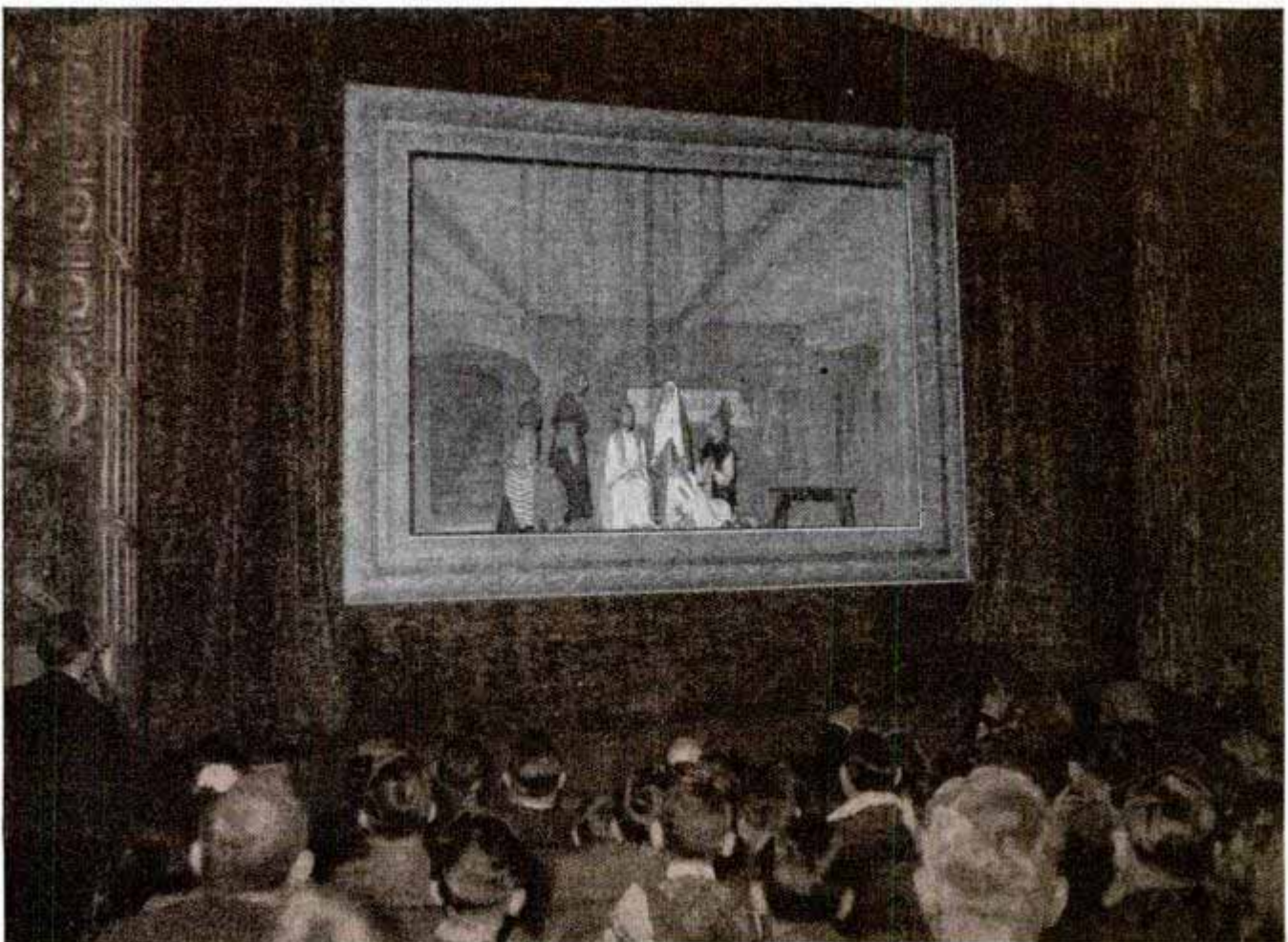
YOUR OWN SHOW with these marionettes

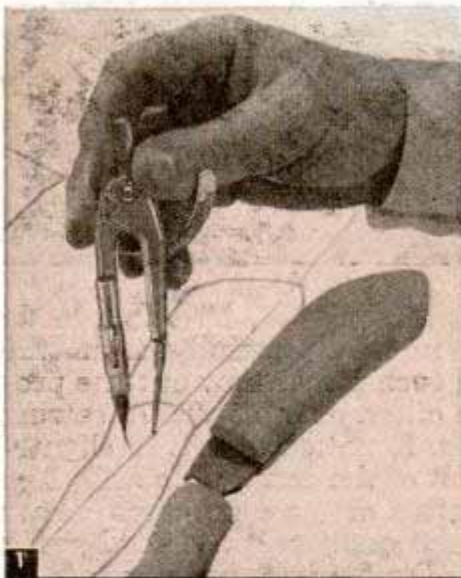
uring and locating knee and other joints so that naturalness will be built directly into the figure and will not be entirely dependent on skill in handling the controller. The location of the center line, passing through shoulder, hip and knee joints, is important because the correct position, Figs. 15 and 16, assures natural balance. If you make the figure without proper balance, special strings will be necessary for control during performances. Correctly balanced, the figures will assume characteristic poses quite naturally when merely supported by the controller strings.

Cardboard templates are next made from each view of head, torso, arms, legs, hips and feet. Carefully mark the center line on each template, Figs. 1, 2, 3 and 16. Then square up the stock from which the parts are to be cut and mark center lines on the wood as a guide in locating templates. White pine of the grade and quality commonly known as sugar pine is the best material to use, with poplar or basswood a

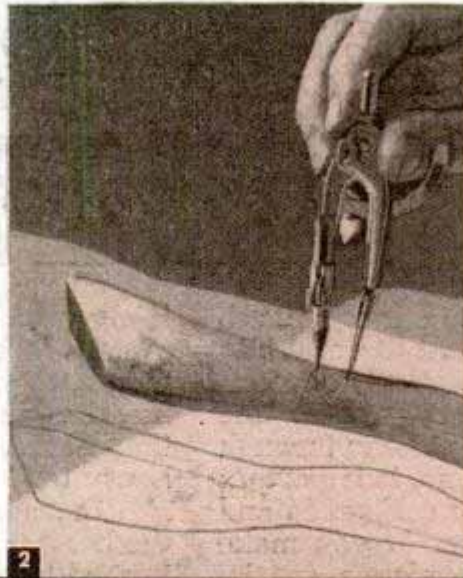
fairly good second choice. Front and side profiles are marked carefully from the templates on each piece. Saw out one profile, then the other, as in Fig. 6. In sawing the head, Fig. 9, notice that it is slightly heavy in front of the center line as in Fig. 16. This location of the center line allows the head to nod easily and without tipping inward when the figure is performing.

Hand carving. Carving the sawed blanks to the required contours may look difficult but actually it's quite simple once you get into it. With the exception of the head, the job is merely that of whittling off the sharp corners of the pieces and scraping and sanding the rounded surfaces to a smooth finish. Use regular carving tools or a sharp carving knife. Make the chipping cuts across the grain and control the tool by bracing it with the thumb of the left hand so that it cannot slip. On the head, Fig. 10, a little more patience is required to shape the features, and a photo of the model from which the profile drawings were made can





1 Lay out the knee joint with compass and make cut outside line



2 Transfer to the wood, locating circular cut carefully to assure fit



3 Trial fit of the parts comes next. Joints should work without binding



7 Toothpick holds end of cord, and notches are made to receive knots



8 Rough-carved figure with two-piece arm. One-piece arm also is used



9 Bandsawing the head to the rough shape makes carving much easier

be most helpful. Don't bother to include details that cannot be seen beyond the first row of the audience.

Joints. Various types of joints have been devised by puppeteers but the simple string-and-fiber-hinge joints are so completely satisfactory that many continue to use them. Position of strings in the hip joints is indicated in Fig. 16. Ordinary cotton chalk line is used. A notch is made in the leg to receive the knotted beginning end of the cord, which passes diagonally upward, through the lower part of the torso and back to pass out the side of the hip, Fig. 7. Round toothpicks are driven into the exit holes to secure ends of the cords and to permit later adjustment, as the legs must be of exactly the same length.

Use a compass to mark a circle equal to the diameter of the leg at the knee, Fig. 1. Draw a line across the leg immediately above the circle, and saw the leg into two parts. Slots for the hinge are cut as in Fig.

4, using a keyhole saw with a blade of the same thickness as the fiber from which the hinge pieces are cut. Holes for the hinge pins are made by using brads in a hand drill rather than hammering them into place. Note that the fiber is shaped to strike a stop pin, Fig. 17, so that the leg cannot double up in a forward position.

As the first step in forming a ball-and-socket knee joint, round off the upper end of the leg and, after wetting the ball portion so that wood putty will not adhere, shape the socket as in Fig. 5 by applying the wood putty to the adjoining part. The completed joint is shown in Figs. 3 and 12, the latter also showing finished ankle joints which are made in a similar manner but without the use of wood putty. The ankle hinge, which is self-stopping in both directions, is shown in Fig. 18. It is important to round the heels and toes so that the figure will walk in a natural manner.

Simplest way of making the shoulder



4

Slotting for the fiber hinge piece. Be sure the slot is wide enough



5

Wood putty forms the knee socket. Make an allowance for shrinkage



6

Nearly all parts of figures can be bandsawed to the rough shape



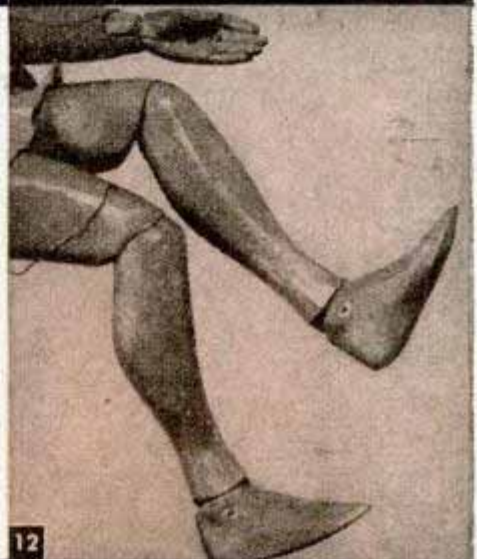
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Carving is no trick if you use a sharp blade of the right shape



11

Use a fine brush and artists' oil colors to paint on the features



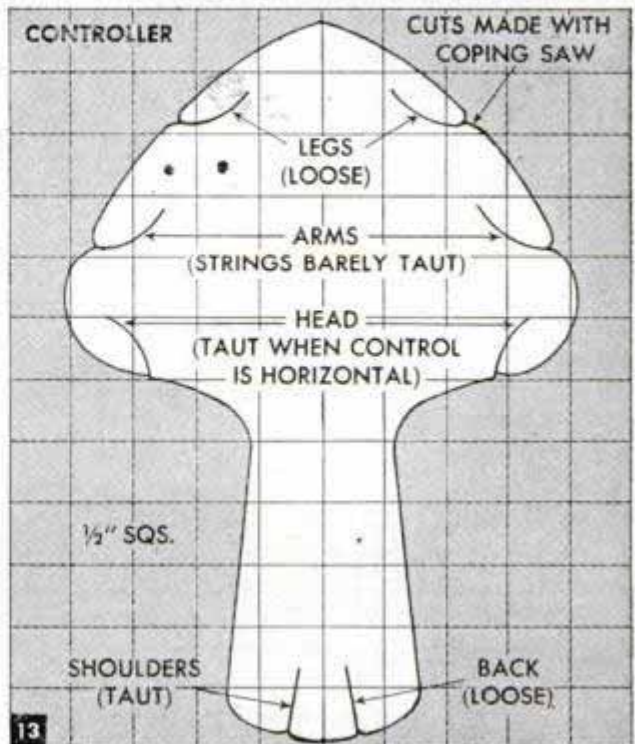
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Here are the finished leg joints. A trial fit assures free movement

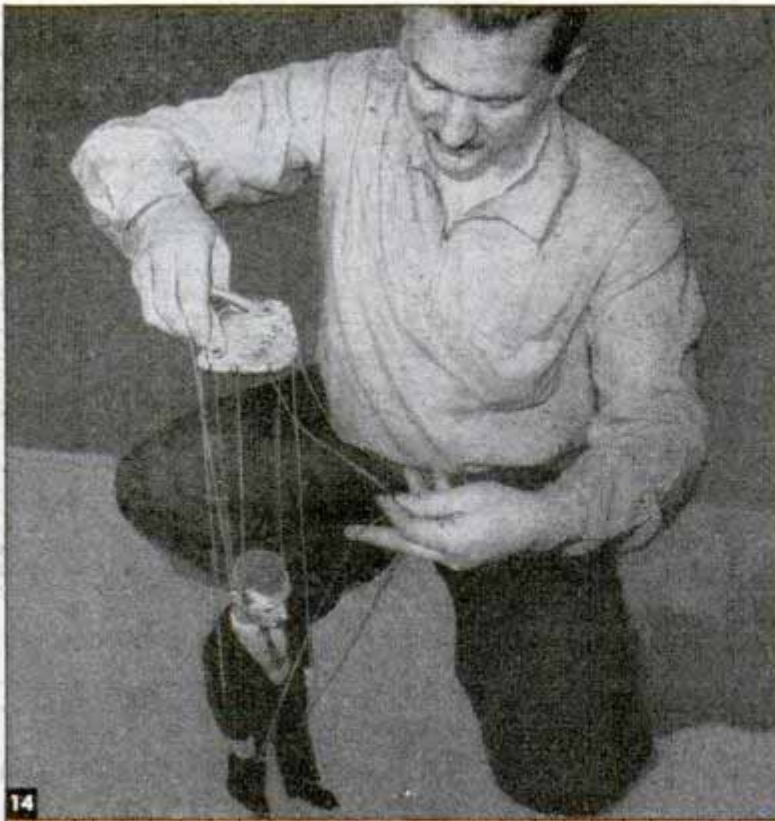
joint is with a chalk line, Fig. 8, the end of the cord being secured with a toothpick as in joining the hips. Despite its simplicity, this joint gives a perfectly natural action. It will be noticed that the elbow in Fig. 8 also is hinged. However, this requires additional control strings and is not necessary except in more detailed acts. Elbow and wrist joints may be added at any time.

Head movements. Ordinarily, puppeteers use the very practical screw-eye joint in which the neck extends into the shoulders, like a ball and socket. This simple head coupling, shown in Fig. 16, is recommended for both amateur and professional use. One of the screw eyes is wrapped with cord, in half-hitches, to eliminate operational noise. Slacking of the head-control strings permits the head to nod and turn in either direction.

Painting and clothing. Homemade wigs or ready-made doll wigs provide natural-appearing hair when the head is to be un-

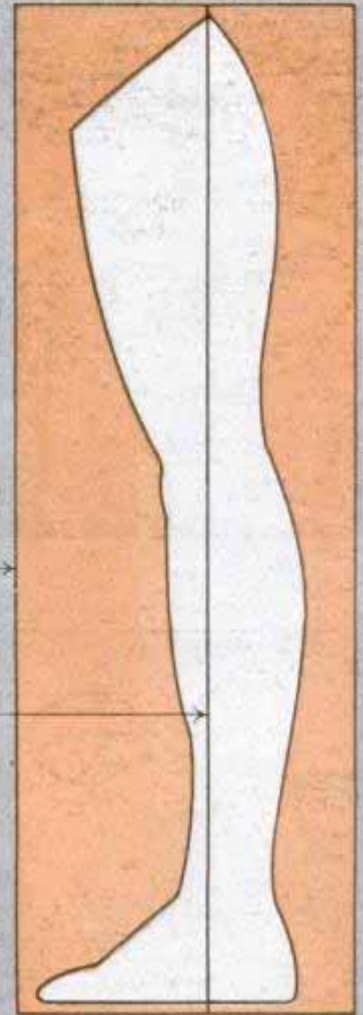


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14

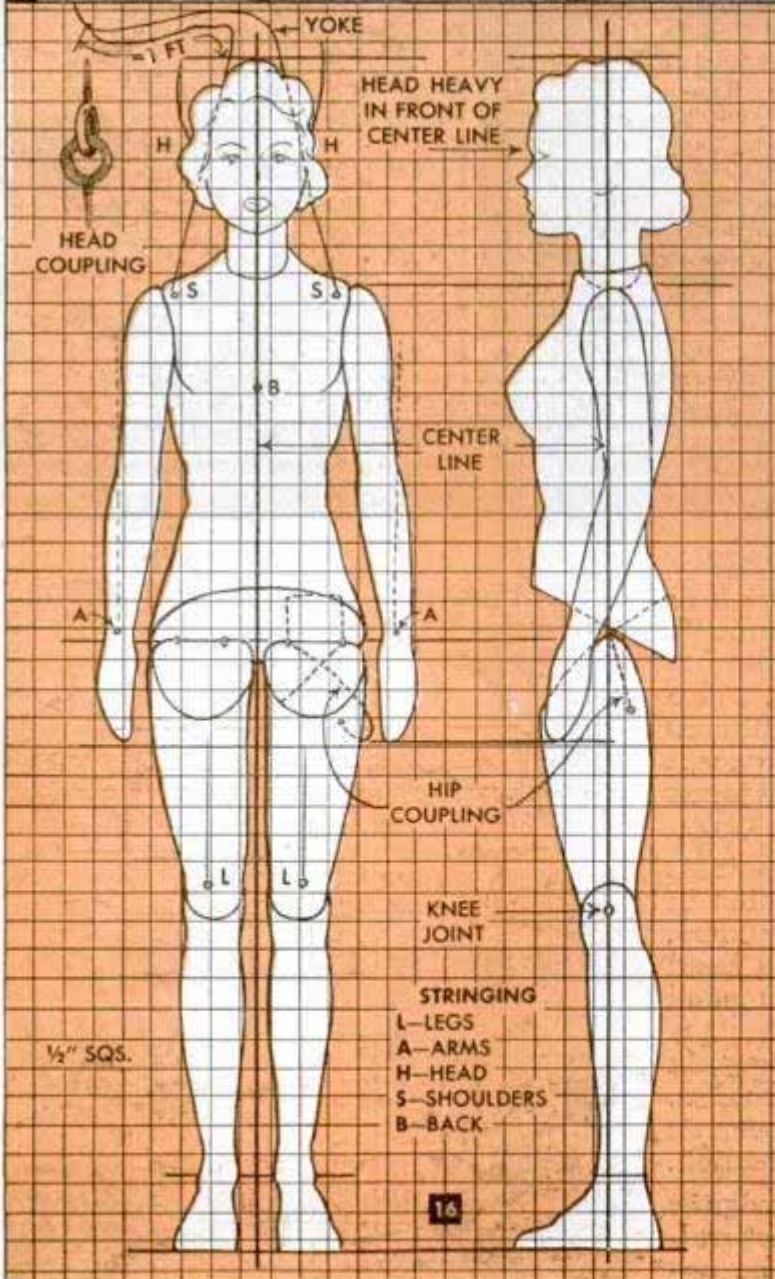
NOTE—
IN CUTTING
BLANKS OF
SIDE PRO-
FILE, DRAW
LINE DOWN
MIDDLE AND
SQUARE
WITH THE
STOCK TO
INDICATE
POSITION
OF SUPPORT-
ING JOINTS



OUTLINE OF
WOOD STOCK

CENTER
LINE

15

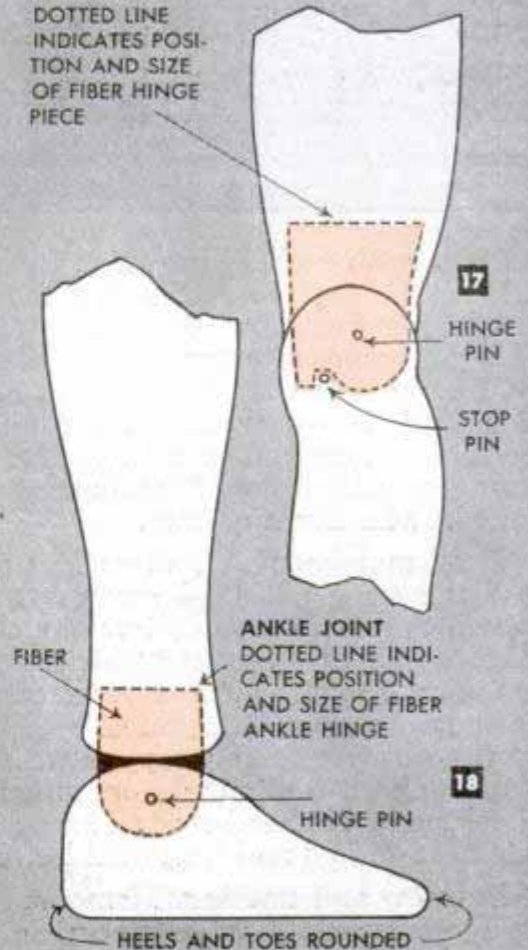


1/2" SQS.

STRINGING
L—LEGS
A—ARMS
H—HEAD
S—SHOULDERS
B—BACK

16

KNEE JOINT
DOTTED LINE
INDICATES POSI-
TION AND SIZE
OF FIBER HINGE
PIECE



17

HINGE
PIN
STOP
PIN

ANKLE JOINT
DOTTED LINE INDI-
CATES POSI-
TION AND SIZE OF
FIBER ANKLE HINGE

18

HEELS AND TOES ROUNDED

covered, but ordinarily hair simulated with paint will be adequate. Finishing of the head is done with artists' oil colors, Fig. 11, the features being painted in with a fine brush after the ground coat of flesh-colored paint has thoroughly dried. The latter also is used for the body. Characterization and personality, developed by the use of paints, is important for a professional performance. Costumes can be as simple or as elaborate as you wish, of your own design or reduced to scale from regular patterns. It is important to note that, for these small actors and actresses, clothing must be reduced in weight and texture by several times, as nothing could be more unnatural than to use cloth of standard weight which will not drape properly. As an example, to simulate the appearance of a velvet robe, use silk jersey; for a fur coat, use velvet. Clothing is attached with an adhesive or with very small tacks.

Stringing and controlling. Use fine black fishline for stringing the marionettes, attaching ends to parts of each figure with small tacks. Avoid loose string ends at the figure and replace broken strings rather than knot them together. The controller is convenient to handle and does not require separate controls as used with the customary airplane type. It is cut from 1/4-in. plywood with coping-saw cuts for the strings as in Fig. 13. Surplus string ends are wound around the handle. Use of the controller is shown in Fig. 14, with the strings shortened to include the figure in the photograph. In this illustration Mr. Stevens is demonstrating how the loose leg strings are grasped in the left hand to control walking movements. Entire support of the figure is by the shoulder strings, which form a yoke ending 1 ft. above the head with a single string connecting the yoke with the controller. To maintain natural balance, it is important that the center of the yoke be exactly above the center line of the figure. Head strings are taut when the controller is horizontal. The head turns when controller is tilted to either side and with the controller tilted forward the head nods. The back string is loose to permit it to be caught with the little finger. This causes the figure to bow naturally.

(TO BE CONTINUED)

Eggshells Clean Narrow Vases

When narrow-neck crystal vases and bottles need cleaning and a bottle brush won't do the work, break several eggshells into the bottle or vase, add a little water and shake until all film and dust disappear from the glass. After rinsing, the vase will be crystal clear.

Ruth C. Buck, Jackson, Miss.

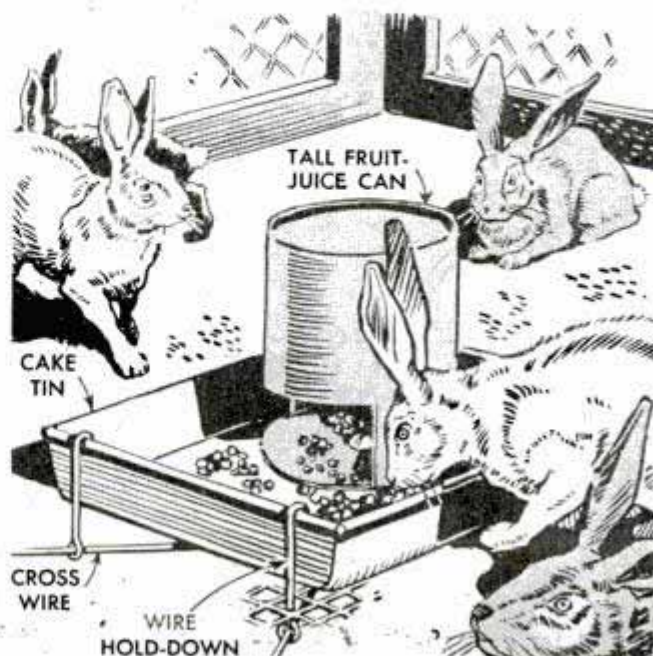
Harrow Disks Make Ice Planer To Surface Skating Pond



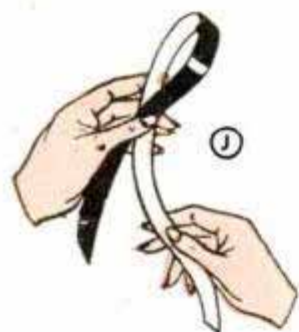
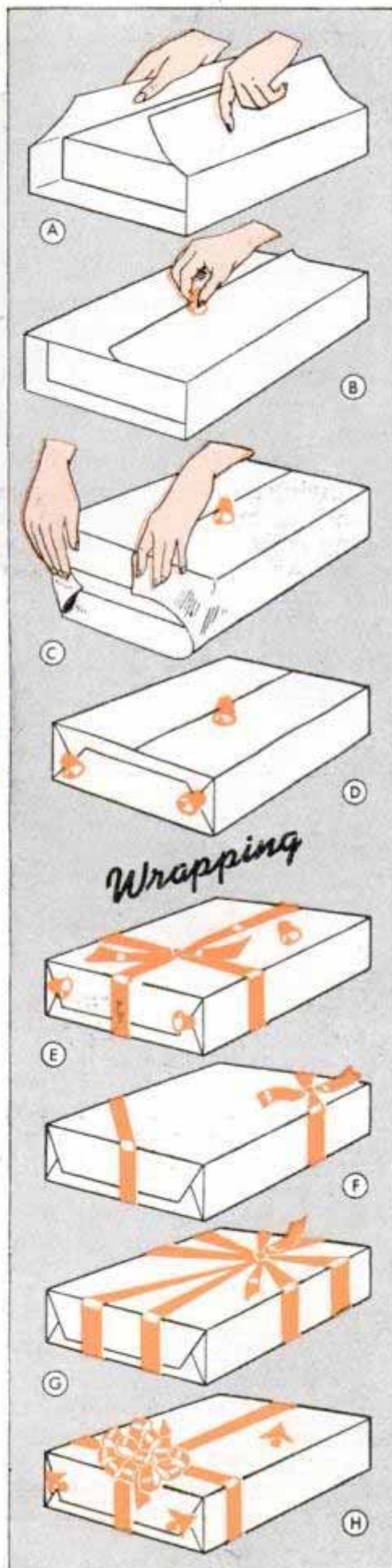
For removing skate marks or other roughness from the surface of a skating pond, one ice enthusiast found that a number of discarded harrow disks, bolted to a heavy plank, made a planer that would do the work. The device can be pulled by hand or towed behind an automobile.

Handy Self-Feeder for Rabbits

Made from a tall can and a cake tin, this self-feeder for rabbits is anchored to the hutch but can be removed for cleaning. The top of the can is cut away, and a portion of the side is removed to provide access to the food. Wire hold-downs are at each corner and cross wires are run through these.—E. Y. Wormuth, El Cajon, Calif.



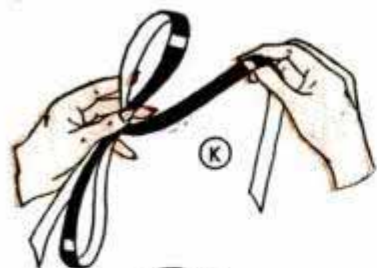
Gift Package *Glamour*



IRREGULAR LOOP



CARNATION BOW



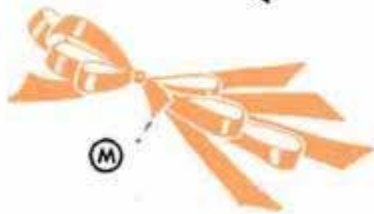
FLAT BOW



Tying Bows



FRENCH BOW



ELONGATED BOW



DAHLIA BOW

Wrapping

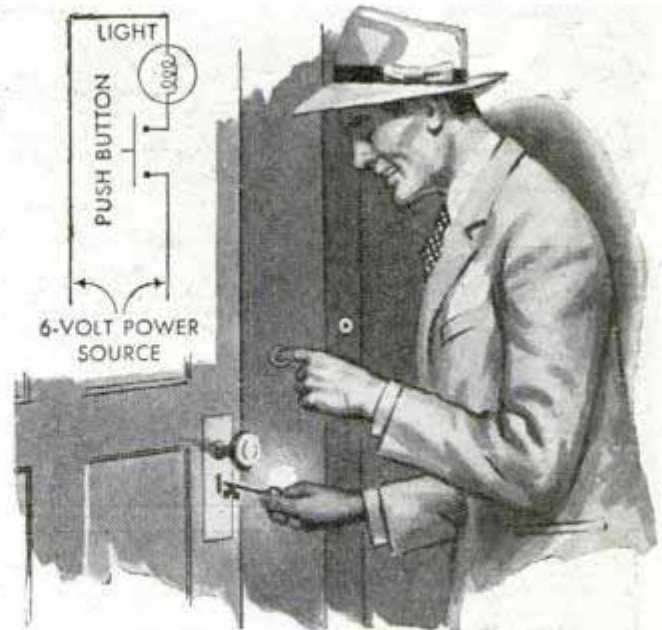
By Mildred Anderson

IT'S what's in the gift package that counts, of course, but there's no getting away from it—the wrapping leaves the first impression. Nothing takes the edge off lively anticipation quite so much as a messy, hard-to-undo package. Colorful ribbon, suitable paper in gay shades, glue, seals and a little time are all you need to turn out a neat, attractive job. The first important step is to get the paper wrapping cut to exactly the right size. Details A and B show the proper procedure. Use glue or a seal to hold the center seam, B. Glue usually is best as it makes a hidden seam which is especially effective on lined, checked or plaid papers. However, be careful not to use too much as it has a tendency to penetrate the paper. Glue or seal-fasten the flaps as at D, first making sure that the folds are neat and sharp and without wrinkles.

Details E to H inclusive suggest four package ties which are most effective on flat, rectangular boxes, although with slight variations they can be used on packages which are more nearly square. For best results, bows are made separately. The attractiveness of a bow depends on the number of loops and the way they are arranged. How to begin a loop is shown at the left in detail J, while details K, L and M outline the successive steps.

After sufficient loops have been formed for the type of bow desired, excess ribbon is cut off and the bow is laid on top of the package and tied securely. Ends of the ribbon tie need not be knotted over the bow unless the ribbon used has a tendency to slip. The irregular loop bow is easily made by varying the lengths of the loops and tying them in the center with loose ends of ribbon, which are left for this purpose. This method also can be used for an elongated bow except that the loose ends, instead of being fastened in the center, are tied nearer to one end of the group of loops. The dahlia bow consists of loops which have only slight variations in length. After the bow is tied to the package, the loops are cut diagonally to produce a petal-like effect. The French bow has loops of identical lengths, but they are placed sidewise and tied to obtain a fanlike effect. The carnation bow is composed of two separate bows with the bottom loops longer than those on top. Each unit is tied with thread before placing on the package. Besides using tricky bows like those described above, professional wrappers call further attention to packages by using ribbon that contrasts with the decorative paper wrapping and ornaments appropriate to the occasion of the gift. These are inserted in the fastening of the bow.

Light Shows Location of Keyhole When Pushbutton Is Operated



The difficulty of locating a keyhole at night is overcome by this light which directs its beam at the hole when a pushbutton is operated. A 6-volt light and receptacle from the dashboard of a car are recessed into one side of the door frame at the same height as the keyhole. Above the light a doorbell pushbutton is mounted and connected in series with the light. The power source is a transformer or batteries.

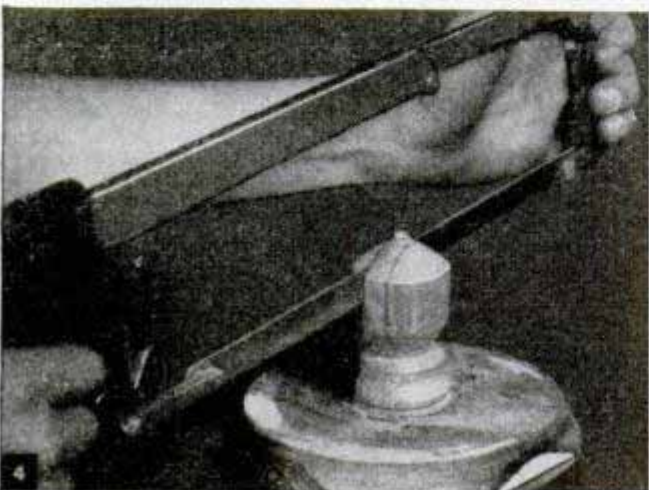
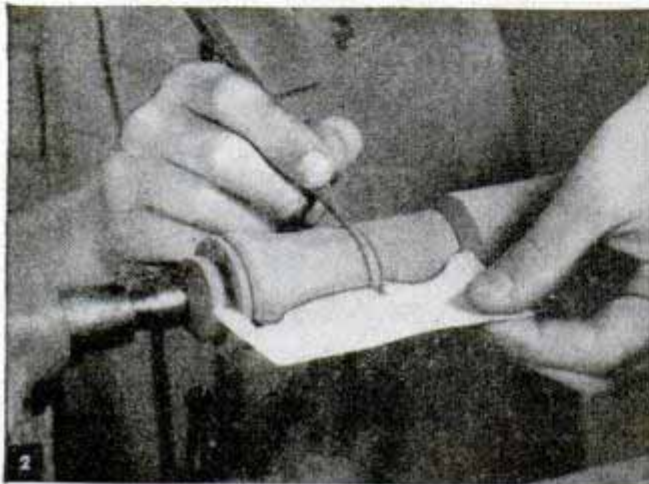
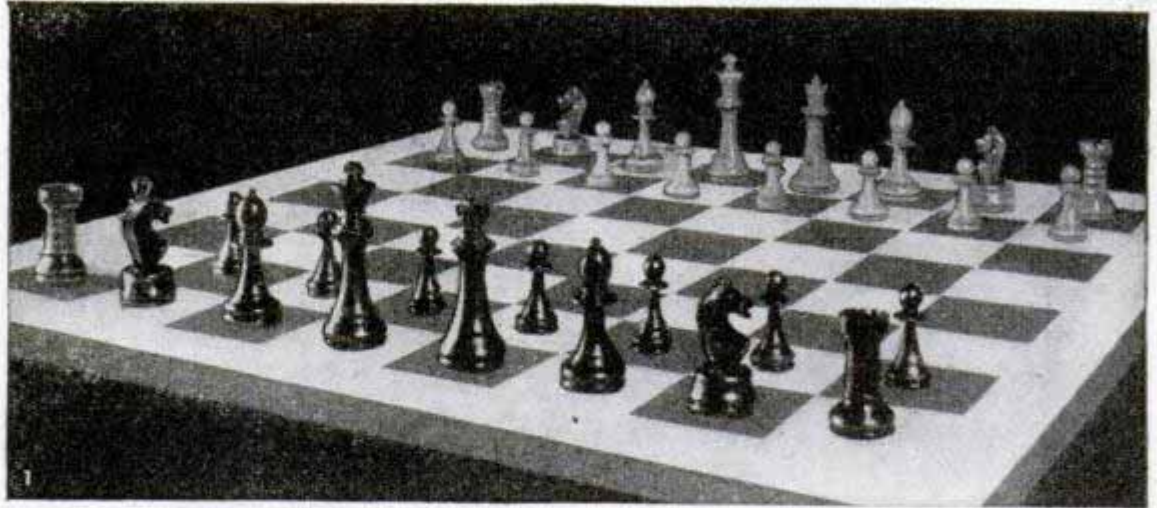
George M. Singer, Erie, Pa.

Drawer Fastened to Typewriter Holds Writing Supplies

Of help to all who use a portable typewriter, this cabinet and drawer are attached to the bottom of a typewriter case and will hold most of your supplies. The cabinet is finished flush with all sides of the case and does not mar its appearance. The drawer and cabinet are plywood.



CHESSMEN IN

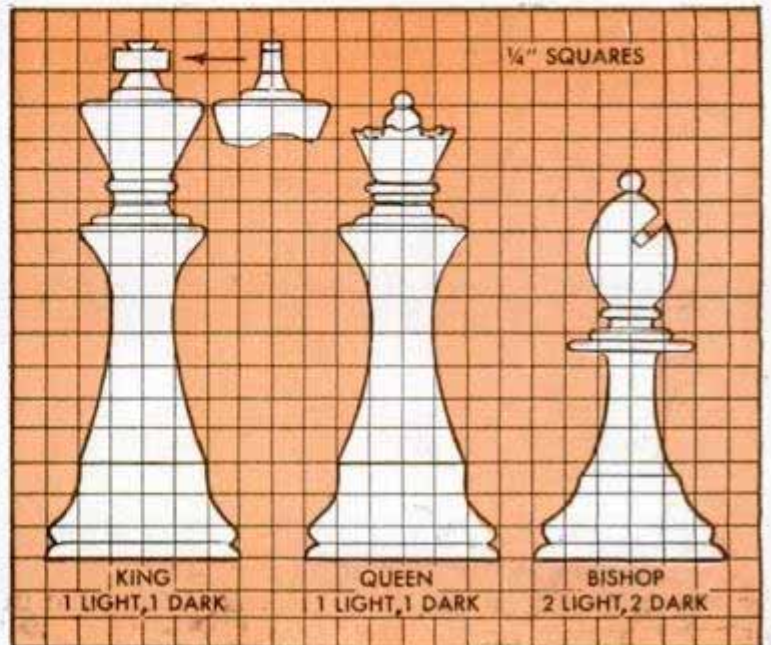


Chessmen in the Staunton pattern are familiar to all players and turning a set in the tournament size from fancy hardwood stock is wood turning at its best

By Willard Allphin

FANCY hardwoods of natural contrast are the thing for turning this set in the larger tournament size where the king is 4 in. high. Black ebony for the dark-colored men and boxwood for those that are light colored make the best combination, Fig. 1. Walnut and maple also are suitable but compared to the finer woods they are only a compromise. Careful work with sharp tools on both ebony and boxwood produces a glass-smooth surface that needs no finishing or polishing whatever.

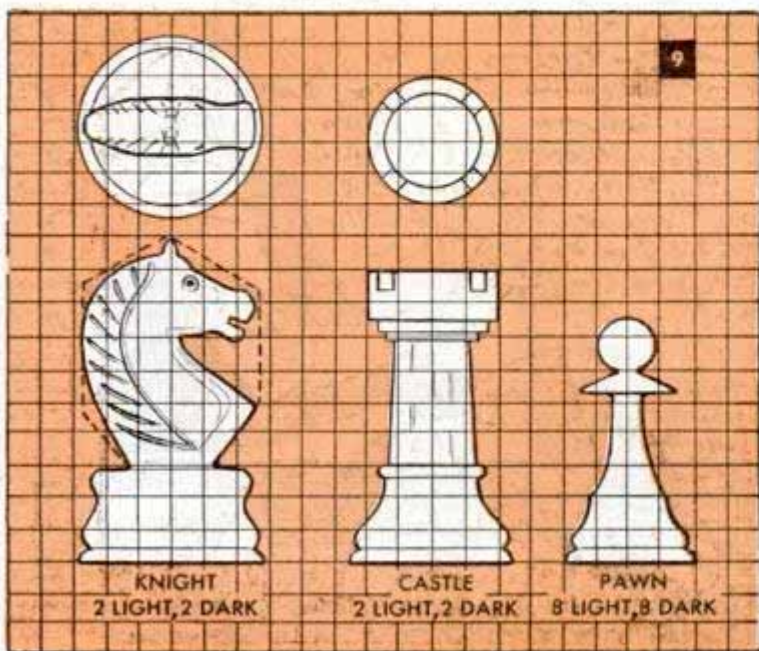
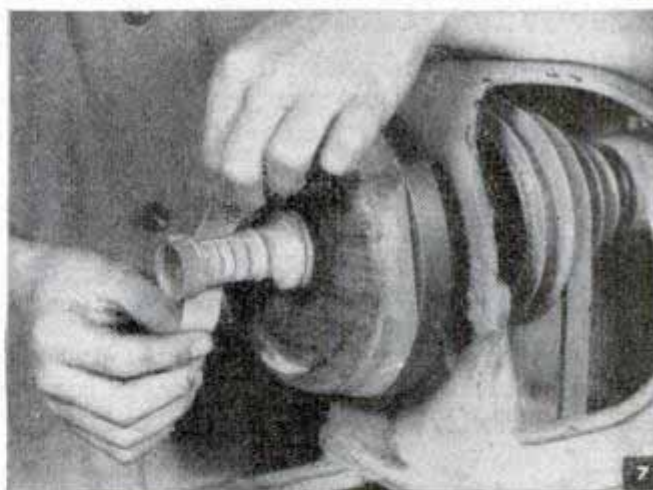
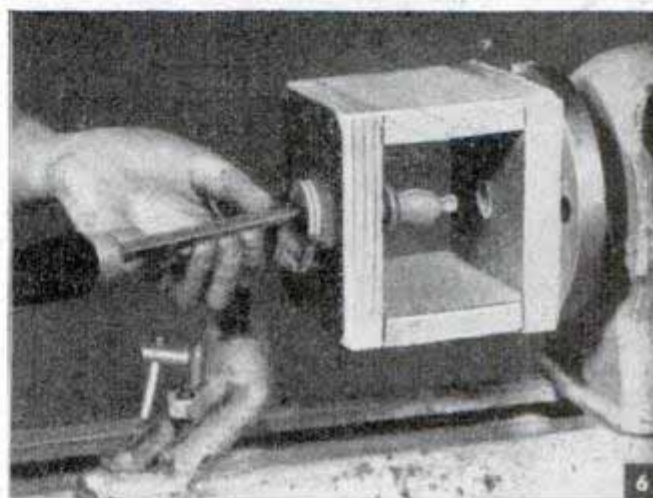
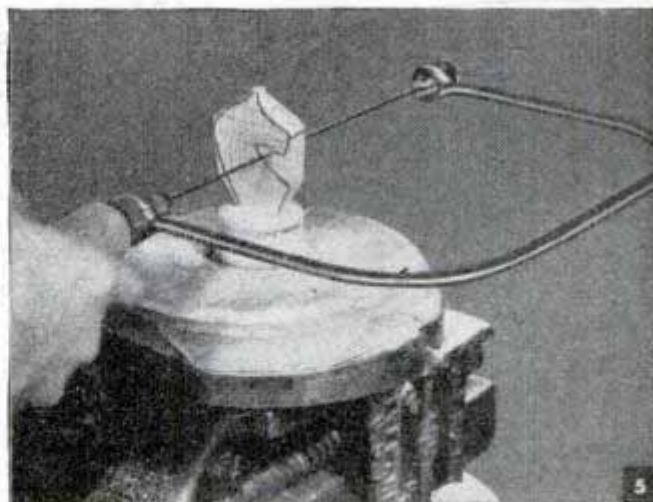
Begin by making a template from cardboard for each man, following the cross-hatched patterns in Fig. 9. You need only a half profile. Then, after turning the work



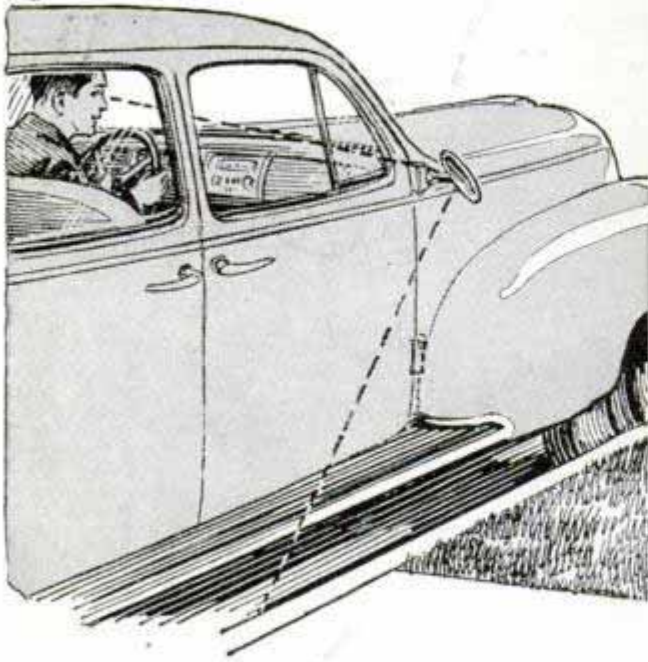
STAUNTON PATTERN

to round, use the template to lay off the exact location of shoulders, grooves and beads as in Fig. 2. After turning down the work to diameters which are near the finished dimensions, use the templates in conjunction with calipers to determine the accuracy of the profiles and diameters. If necessary you can make a screw center easily by turning an ordinary screw through a wood disk. Screw the disk to the lathe faceplate as in Fig. 3. Turn the knight to the shape shown in Fig. 4, then slot with a hacksaw—a hacksaw is best because of the fine teeth and stiff blade—and carefully cut away the waste on each side. Then, using a coping saw with a fine blade, saw the profile of the horse's head, Fig. 5. The rest is a handcarving job, but as you can see it's quite simple. Use a fine-tooth saw to slot the bishop and notice that this slot is made in two separate cuts, Fig. 9. To hollow the bases make a jig as in Fig. 6. Begin with the pawns and enlarge the hole in the jig as needed. Cut a recess in each base $\frac{1}{2}$ in. in diameter by $\frac{1}{4}$ in., fill with lead wool and wood putty to hold the "ballast," Fig. 8. Finish by gluing felt disks to the bases.

If you use any contrasting woods other than ebony and boxwood, these will need sanding and finishing as you go along. Sand as in Fig. 7. On open-grained woods such as walnut follow sanding with a filler colored to suit. Then apply a coat of sealer and finish with several coats of wax. Aside from the carving on the knight, the only other hand work is squaring the cross on the king's crown, scalloping the edges of the queen's crown, notching the rim of the castle and carving the stonework on the column of the castle.



Rear-View Mirror Aids Motorist When Parking Automobile



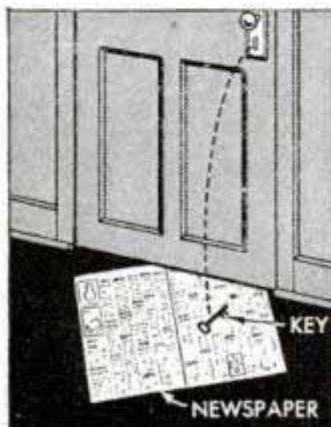
If it's difficult to avoid scraping the side-walls of your tires when parking a car, a rear-view truck mirror may be the solution to the problem. The mirror should have an arm that is long enough to extend beyond the running board so that it can be adjusted properly. Before mounting the mirror, try it in several positions to see which one is the most satisfactory.

Easy Way to Clean Plaster Objects

After a time almost all plaster objects, such as statuettes, plaques, etc., collect dust that cannot be removed with a cloth. To clean such bric-a-brac, make a thick paste of white powdered starch and hot water. Brush the paste over the plaster and allow it to dry. Then scale the starch from the object and the dirt will be removed with it. Before using this starch paste, make sure it will not mar the finish of the plaster by applying a small amount on a test area.

Wilford Leach, Williamsburg, Va.

Method of Retrieving Door Key

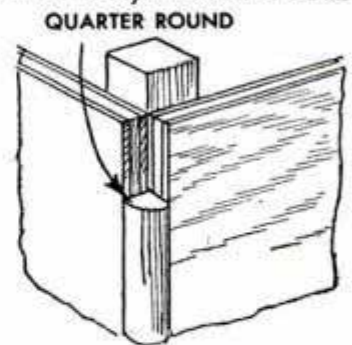


When a small child has locked himself in a room and is unable to open the door, here's a trick that may make it unnecessary for you to climb through a window and open the door from the inside. Slip a newspaper under the

door to cover as much area as possible on the floor beneath the keyhole. Gently work the key from the lock so it will fall on the paper. Then withdraw the paper and key, and you can open the door from the outside.

Round Corners for Plywood Box

When making a plywood box or other rectangular object, the corners may be rounded by assembling the plywood pieces to form a joint as indicated and then inserting a strip of quarter-round molding into the joint. Both the plywood and molding, of course, must be nailed or screwed to a corner strip.



Front-Wheel Tire Is Recapped With Blown-Out Casing

After the tread wore off the front-wheel tire on his bicycle, one boy produced a satisfactory repair by cementing a blown-out casing over it as a "recap." The blowout was repaired and the bead and part of the sidewall were cut away, detail 1. Then the inside of the recap and the outside of the other tire were cleaned with a wire brush, detail 2, to remove dirt and roughen the surfaces so they would adhere better. Rubber cement was applied to these surfaces, detail 3, and allowed to dry for about 5 minutes. Then a second coat was applied and the recap was slipped over the tire.

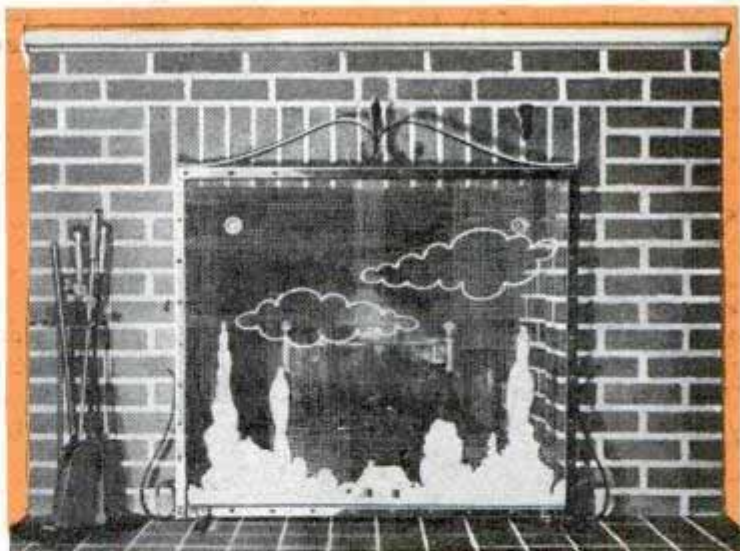
James J. Yerges, Reeseville, Wis.



Artistic SPARK SCREEN

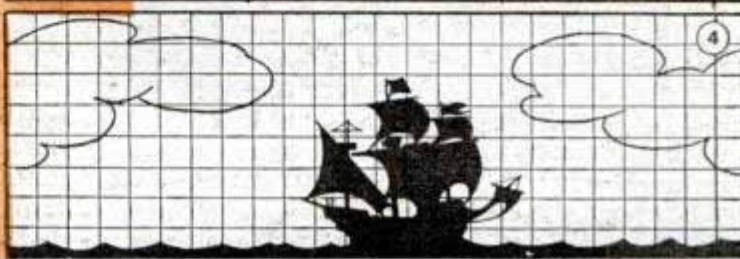
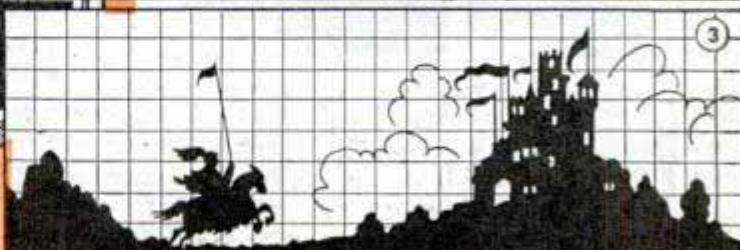
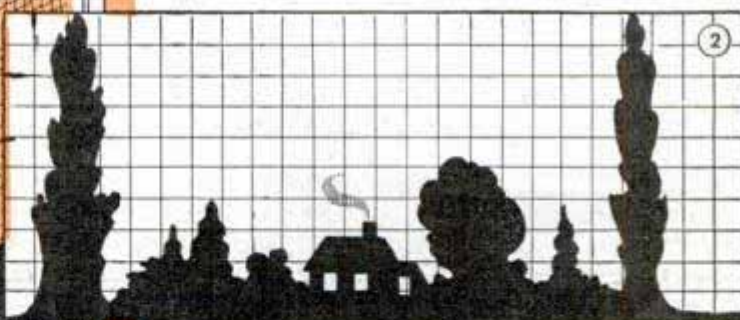
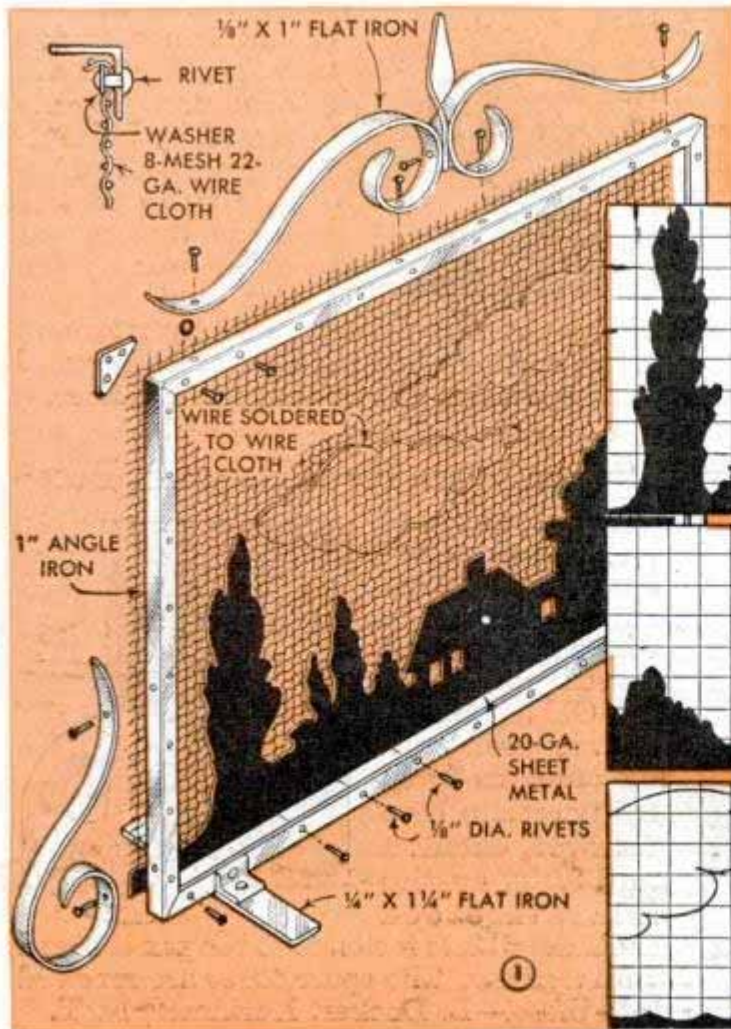
By H. Skalla

POSSESSING utility as well as being ornamental, the spark screen suggested here is presented in a variety of designs that can be adapted to almost any home. The frame is basically the same for all screens, but the scrollwork and the scenes can be altered to suit your scheme of decoration. A single length of angle iron is used to form the frame. When laying it out, allow about 1 in. on all sides to overlap the fireplace opening. Cut V-grooves in one leg of the angle at each corner to permit bending. Then reinforce each corner and the ends by riveting a triangular piece to the inside. Drill $\frac{5}{32}$ -in. holes on 4-in. centers and rivet the wire cloth to the frame, Fig. 1. The scrolls should be formed in pairs in a vise so that the halves will be symmetrical. Of course, the length of the flat iron will vary with the size of the screen, but it's a good practice to form the smaller curves first and then trim any excess length from the



other end. After the scrolls are shaped, lay them on the frame and mark the holes for drilling and riveting. All rivet heads, both for the scrolls and the screen, should be on the outside with a washer on the inside. The feet are made of flat iron reinforced with angle-iron knees.

Character is given to the screen by the silhouette decoration. In addition to the design in Fig. 1, alternate suggestions are made in Figs. 2, 3 and 4. The silhouettes are cut of light sheet metal, with the ends slipped between the frame and the screen and tacked on with solder. Clouds are outlined with wire, Fig. 1, and smoke from the house, Fig. 2, is represented by fine-mesh screen. The entire screen is painted a dull black, but if desired, touches of color can be added. Colors that are not affected by heat should be used.



Doorknobs on Garbage-Can Lid Provide Handle and Hanger

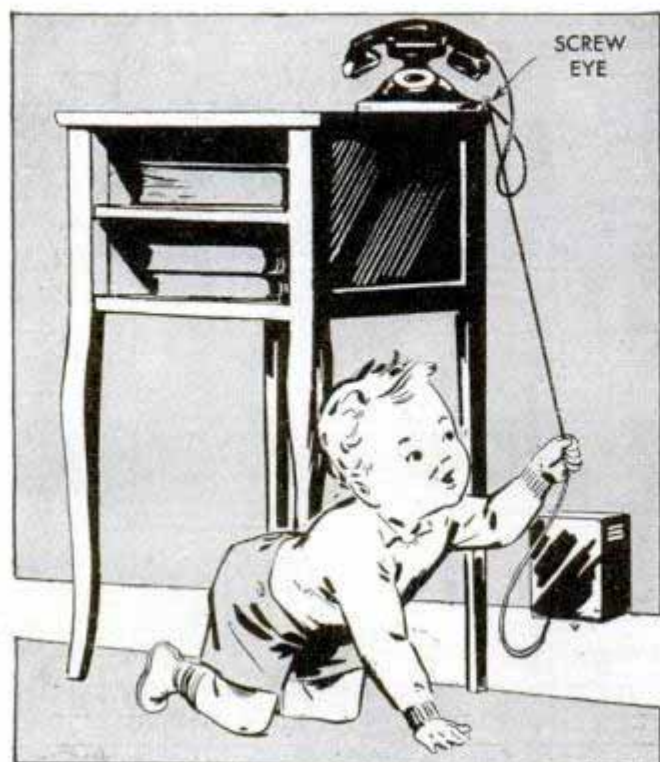


If two discarded porcelain doorknobs are attached to the lid of a garbage can in the manner illustrated, they will act both as a handle and a hanger. The knob on top is grasped to remove the lid and the knob on the underside is used to hook it over the edge. This leaves both hands free to handle the container in which the garbage is carried to the can.

Peter B. Horsley, Brandon, Man., Can.

Children Can't Pull This Phone Off Its Stand

In homes having a desk-type phone, there is always danger that small children will pull it off the stand and injure themselves or damage the instrument. This can be pre-

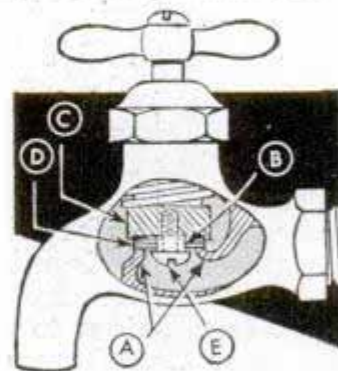


vented by fastening a screw eye on the back of the stand and running the phone cord through it. Then a child tugging on the cord could only pull the phone to the edge of the table since the screw eye would prevent further movement.

Richard C. Hare, Grafton, Mass.

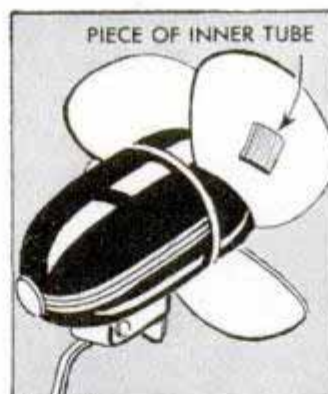
Repairing Leaky Water Faucet

After refacing the damaged seat, A, of a water faucet, one man found that he was unable to stop the leak that resulted. A composition washer, D, was selected that would fit the disk holder, C, and serve as a valve disk. This was drilled to fit a bushing, B, cut from 1/4-in. o. d. brass tubing. The assembly was fastened in the disk holder with the screw, E, and stopped the leak.



P. L. Schmidt, Kenmore, N. Y.

Balancing Rubber-Blade Fan

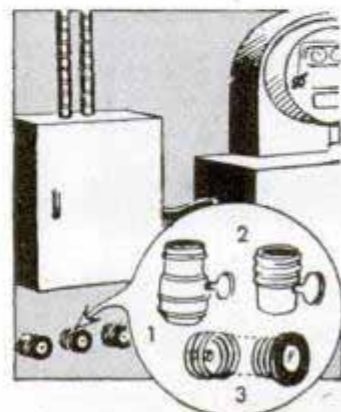


Some defrosting fans have rubber blades that may get out of balance and cause undue vibration. This condition is corrected by cementing a patch of inner tube to the blade that is out of balance. The size and location

of the patch are determined by trial and error, so the piece should not be secured until operation shows that fan balances.

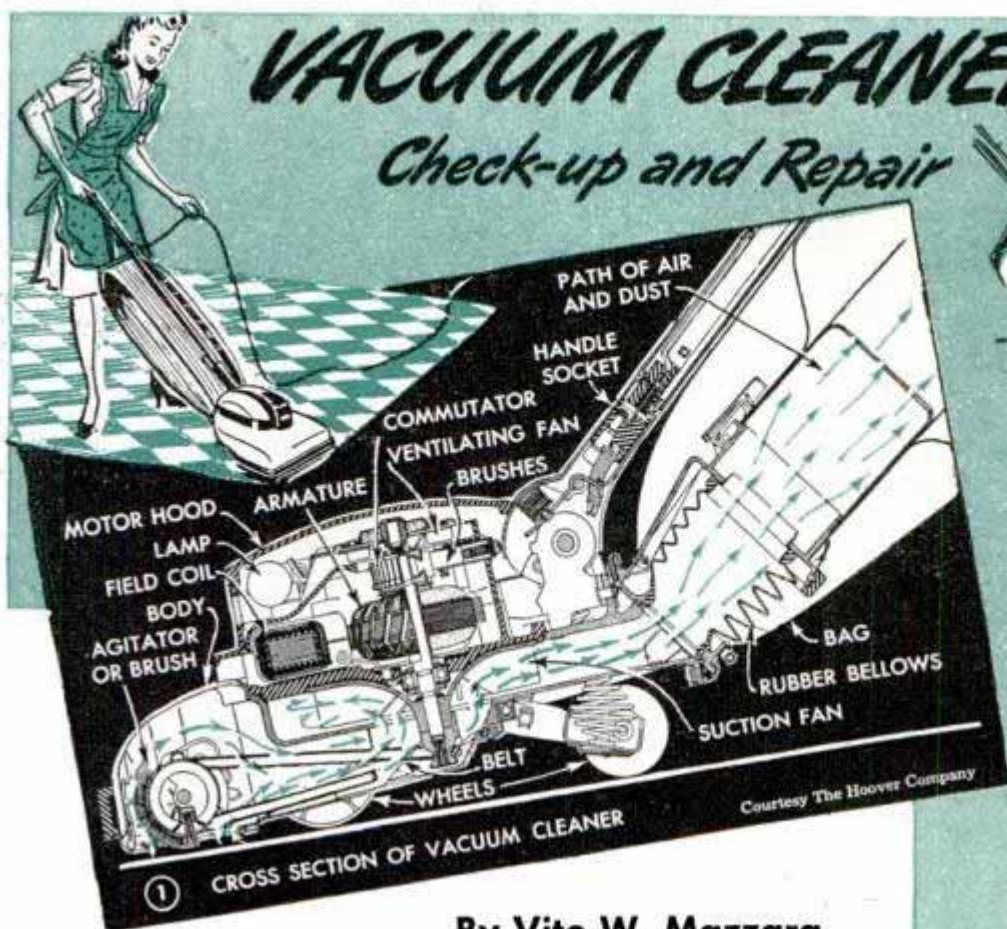
Spare Fuses Kept Beneath Box

When mounted on the panel beneath the fuse box, spare fuses are available without needless searching. Old light sockets are used with the outer shell and the porcelain base removed, details 1 and 2. Then the inner, threaded shell, detail 3, is fastened to the panel board with a screw. The spare fuses are screwed into these.—L. Decker, Herkimer, N. Y.



VACUUM CLEANER

Check-up and Repair



By Vito W. Mazzara

ALTHOUGH a vacuum cleaner is one of the most reliable mechanical devices in the home, there comes a time when it needs servicing and minor repairs—if for no other reason than to keep it in top-notch working condition. In doing its job of collecting dirt in the dust container, certain parts of the cleaner take plenty of punishment. Cut a cleaner in half, as in Fig. 1, so you can view it “in section,” as the draftsman calls it, and it looks like a complicated piece of machinery. But in reality its operation and its parts are quite simple. Essentially it consists of a centrifugal suction fan, a dust bag or container, a suction nozzle and a small electric motor which drives the fan. And that’s all, except a handle perhaps, a light to illuminate dark corners and, on certain types such as that in Fig. 1, small wheels and casters for easy maneuverability. Most cleaners of this particular type also are fitted with an agitator brush, its purpose being to loosen embedded dirt so that it can be picked up by the air stream. This brush and the dust bag or container are the two parts requiring the most frequent attention. When emptying the bag, the directions furnished by the manufacturer of the cleaner should be carefully followed, of course, but a common procedure is to hold the bag over a sheet of paper with the open end down, place your feet on the corners of the frame and shake the bag vigorously, as in Fig. 2. Turn the bag inside out occasionally and carefully brush off the accumulated film of fine dust. Never wash the bag as this will likely destroy its properties of dust retention.

The agitator brush should be removed occasionally and thoroughly cleaned. Lint, thread and string often wind so tightly on this brush that it’s impossible to untangle the mass. But you can cut through the strands with shears and remove them with a comb as in Fig. 4. Be careful not to break the bristles of the brush. Check the length of

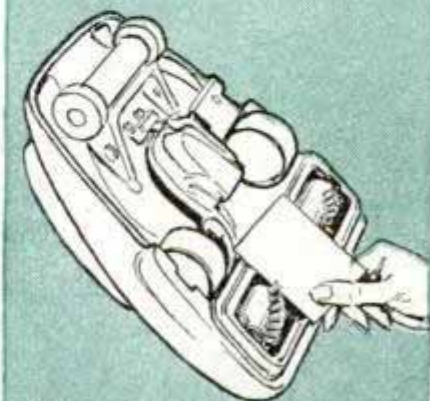
② EMPTY THE BAG AFTER EVERY CLEANING



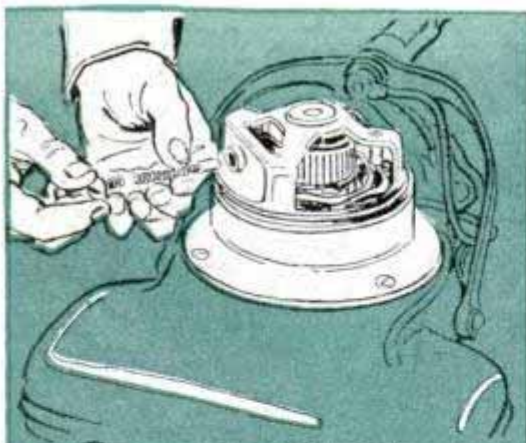
③ IF PLUG DOES NOT MAKE CONTACT, BEND PRONGS OUTWARD SLIGHTLY



④ CUT TANGLED THREAD WITH SHEARS AND REMOVE WITH COMB



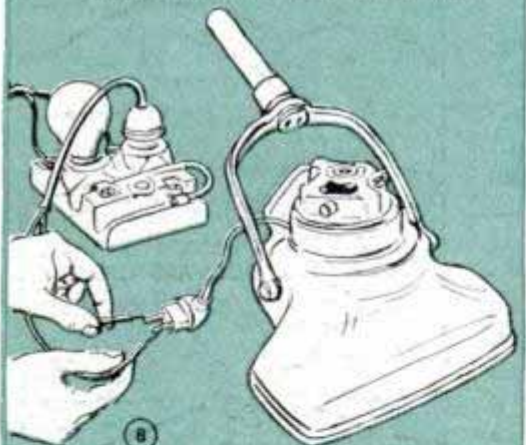
⑤ CHECK LENGTH OF BRISTLES BY LAYING CARD ACROSS NOZZLE



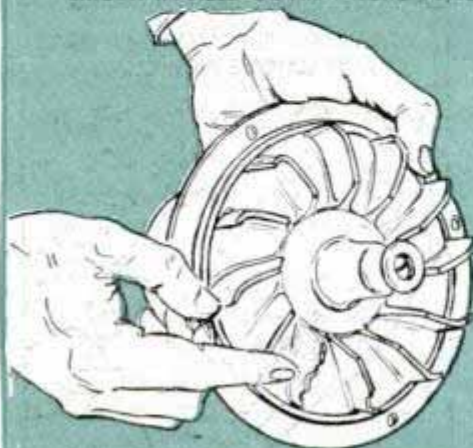
6 INSPECT MOTOR BRUSHES.
IF WORN THEY SHOULD BE RENEWED



7 EXAMINE THE COMMUTATOR AND
CLEAN WITH FINE (8-0) SANDPAPER



8 A TEST LAMP IS USED TO CHECK FOR "OPEN"
CIRCUIT IN FIELD OR ARMATURE COILS



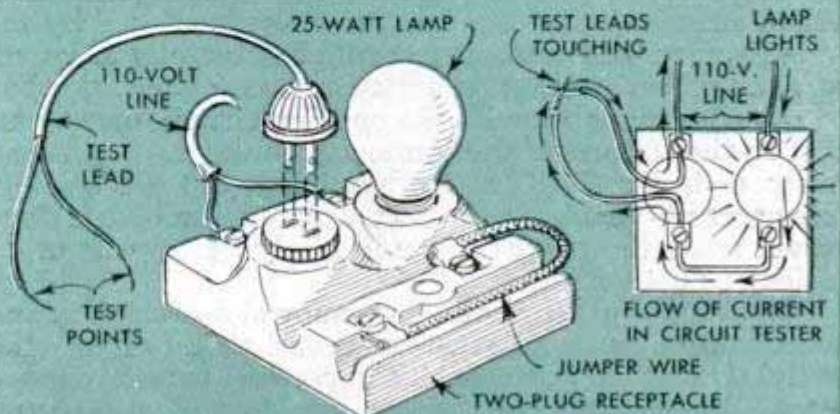
9 BROKEN FAN BLADES WILL CAUSE
VIBRATION AND WEAR ON MOTOR BEARINGS

the bristles occasionally as in Fig. 5. Also check the agitator belt tension to see that there is no slippage.

Sometimes a cleaner will start and stop at intervals when the switch is turned on, or it may simply refuse to run. When this happens the first part to examine is the plug, Fig. 3. Usually you'll find that the plug is loose in the receptacle and this means that the prongs are making only intermittent contact. The remedy is to bend the prongs outward slightly, or if the prongs are unusually loose when inserted in the receptacle it often helps to bend the ends of the prongs with pliers.

At long intervals it will be necessary to replace worn motor brushes, Fig. 6. Unscrew the brush caps and examine the brushes occasionally. Handle brushes carefully and be sure to return them to the sockets exactly as they were taken out. Don't turn the brush over. A commutator in good condition should be reasonably clean with the brush track somewhat darker in color. If the track is pitted, burned or coated, the brushes are not making proper contact. This causes arcing and results in a rough commutator surface, which of course grows worse with continued use. The remedy depends on the condition of the parts. Sometimes merely cleaning the commutator surface with fine sandpaper as in Fig. 7 will be sufficient. However, if it is rough and pitted or grooved, then, if tests show the motor otherwise in good condition, it will pay to have the commutator trued up and the mica undercut by a competent service shop. Whenever you have the cleaner apart for any reason, give the fan a thorough going over. There might be a cracked or bent blade or maybe a piece broken out as in Fig. 9. This will cause vibration which in turn greatly accelerates wear. If any of the blades are cracked or broken, a new fan is the surest remedy.

If you suspect there's need to check over the cleaner electrically, then make up the simple circuit tester detailed in Fig. 10. Begin by plugging the cleaner cord into the tester and turning the switch to the "off" position. If the lamp lights there's a short somewhere in the cleaner. Check switch cords and leads to the motor to locate it. If, on the other hand, the lamp does not light with the switch in the "off" position, snap it to the "on" position. If the lamp still does not light, there's a short somewhere along the line of the electrical circuit. Check the plug for breakage or loose wire connections, also



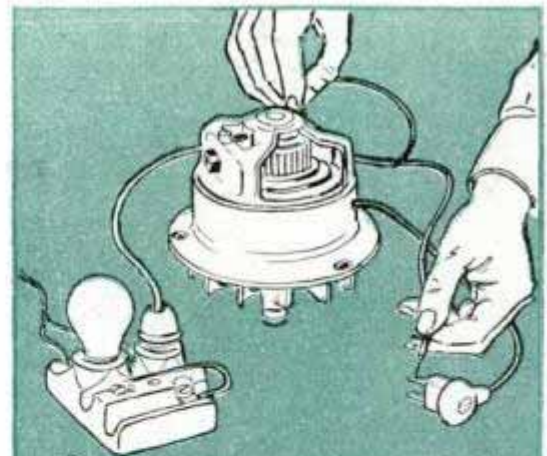
10 A SIMPLE CIRCUIT TESTER FOR CHECKING
CIRCUITS IN ANY ELECTRICAL APPLIANCE

the wires to the cleaner switch plate. Shake the cord all along its length and note if the lamp flickers at any point. If nothing happens, disconnect the cord from the motor, twist the wires together and plug the cord into the circuit tester. The lamp will light if the cord and switch are intact.

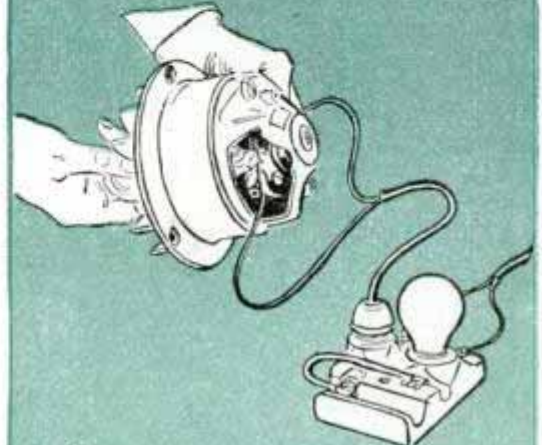
To test for open circuit in field or armature coils proceed as in Figs. 8 and 12. The lamp will light unless there is a burned or open field coil. If turning the fan slowly, Fig. 12, produces a uniform flicker of the light, everything is okay. But if the flicker is unsteady, turn slowly to find a point where the lamp goes out. Ordinarily this will indicate an opened commutator segment.

To test field coils proceed as in Fig. 14, connecting the complete set in series across the line voltage and measuring the voltage drop across each coil. A low reading indicates a short in the coil being tested. Fig. 15 shows the circuit of a universal motor, a common type in vacuum cleaners. Fig. 11 illustrates tests B and C, shown diagrammatically in Fig. 15. Although a light shows that the coil being tested is continuous, the insulation may be burned off. Test D, Figs. 12 and 15, checks coils of the rotor or armature. If the lamp does not light then test each adjacent pair of commutator segments as at E, Fig. 15. No light indicates that the coil is burned out between those two segments. The motor will not start if it should stop when a brush is in contact with the dead coil. If the test lamp lights when making the test F in Fig. 15, illustrated in Fig. 13, insulation has been scraped or burned from the armature coil, or coils, and the armature is grounded to the shaft.

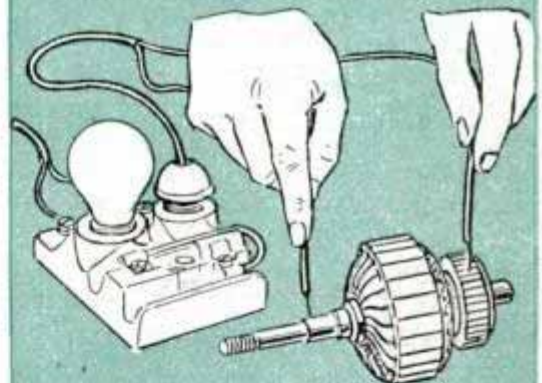
If the test lamp fails to respond when it should light, make a careful inspection of the particular circuit you are testing. Unless the motor is burned out or otherwise damaged, making replacement of the whole unit necessary, breaks usually will be found near the ends of the wires where it is easy to make a lasting repair. Generally the cord is the first offender. When you coil or uncoil it from the cord brackets on the cleaner be careful not to kink it. If you should happen to pull out a sharp kink you may break the strands of one or both the wires as well as the insulation. Other than the cord, most repairs are necessary only after a long period of hard service, unless of course the cleaner is damaged. Often it's a question of deciding which to do, repair the damaged part or renew it entirely.



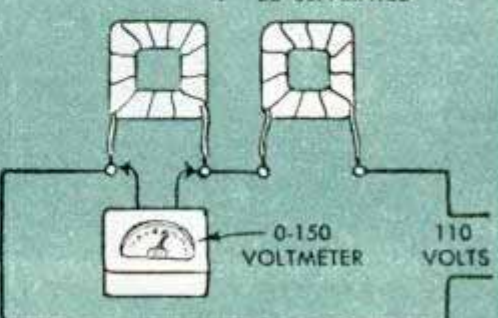
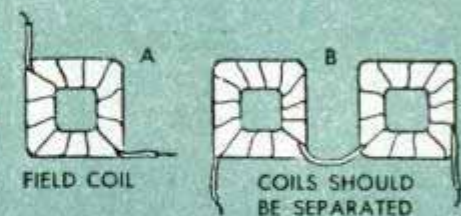
11 LIGHT SHOWS THIS FIELD COIL IS CONTINUOUS ALTHOUGH IT MAY BE SHORTED



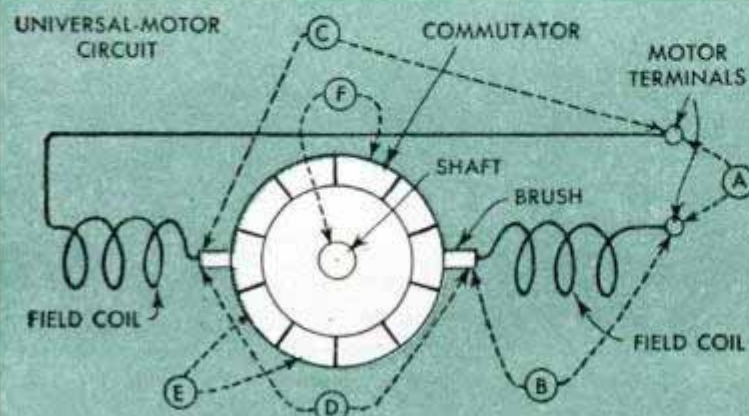
12 TURN FAN SLOWLY TO CHECK ARMATURE COILS FOR "OPEN" CIRCUIT



13 LIGHT HERE INDICATES THE ARMATURE COIL IS GROUND TO THE SHAFT



14 A LOW VOLTMETER READING INDICATES A SHORT CIRCUIT IN THE FIELD COIL



15 TEST LAMP SHOULD LIGHT AT ALL LETTERED POINTS EXCEPT (F)

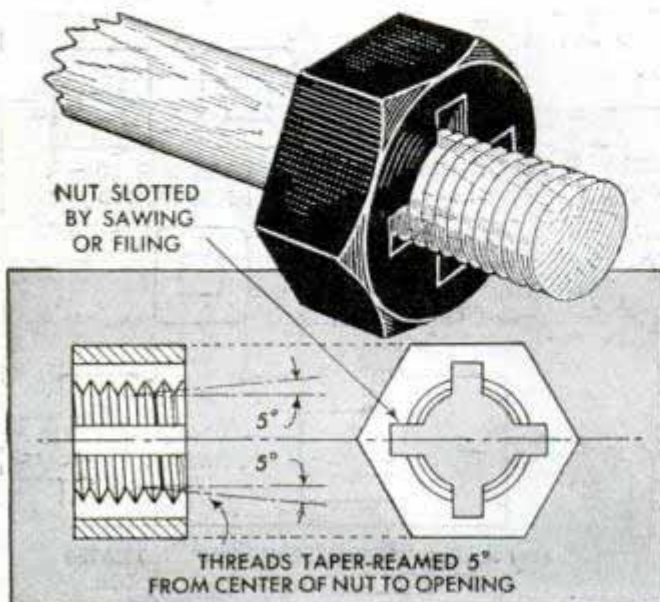
Braces Attached to Baby's Swing Will Prevent Tipping



Baby swings of the type that have a seat suspended from four cords may tip over if the infant leans forward too far. To prevent this, one housewife attached diagonal braces from the front of the seat to the rear cord where it joins the spreader. This counterbalances any forward movement.

Threading Die for Wood or Plastic Made From Steel Nut

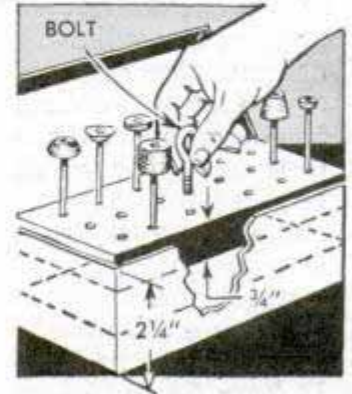
Here's a set of emergency dies you can make from ordinary steel nuts. As many sizes as are needed can be made. Slots are



cut across the threads which are taper-reamed 5 deg. from the center to the opening of the nut. In the smaller sizes, only two slots may be required. An adjustable wrench is used to turn the nuts when threading. Cutting threads in wood should be accomplished with a "rocking" back-and-forth motion.

Box Holds Grinder Accessories

If hand grinder accessories are kept in a box, they are less likely to become damaged or lost. A metal box about 2 1/4 in. high is required, length and width being determined by the number of tools you have. A block of hardwood about 3/4 in. thick is cut to fit inside the box. In this block drill holes 5/8 in. deep, spacing the holes so that the tools do not touch. An eyebolt fastened to the block will simplify lifting it out of the box.



D. E. Horn, River Forest, Ill.

Novel Designs on Flat Surfaces

It's possible to ornament most flat surfaces impervious to alcohol with an all-over design of small floral forms much like that of cut glass. Make a solution of clear gelatin, 1 part, and water, 49 parts. Filter the solution and pour the liquid over the surface you desire to embellish. Drain off any excess water and place the object where it will freeze. Once it has frozen, pour absolute alcohol over it to dissolve the water and leave a network of gelatin forming graceful designs. After the gelatin has dried, the surface is varnished.

Amusing Toy Rises From Knees

This amusing toy is made from a few matches and a walnut shell. The head of the animal is formed from any small nut; a hazelnut, for example, will serve the purpose. Holes are drilled for the head, tail and legs—the jointed members being wooden matchsticks. When drops of water are placed on the joints of the legs, the animal rises in a lifelike manner.

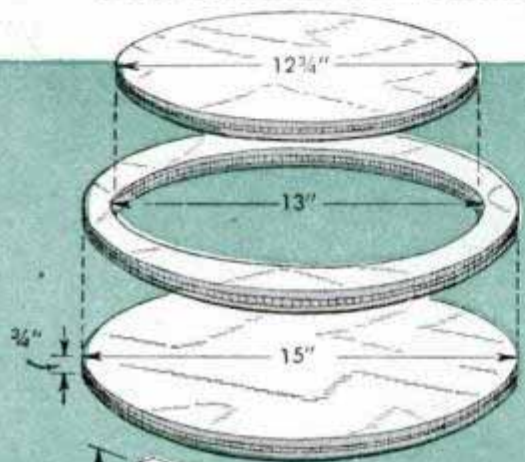


Nathan Bogoch, Winnipeg, Man., Can.

REST YOUR FEET

YOU get experience in wood turning, veneering, upholstering and finishing all in one when building this simple footstool. The base is formed of two $\frac{3}{4}$ -in. walnut boards half-lapped at the center. The top is built up of two plywood disks, the center being cut from one to provide the cushion base. Glue and screw the ring to the bottom disk, then true the edge in a lathe. Next, face the edge with straight-grained veneer, using the improvised clamp shown, and, when dry, trim off the surplus veneer flush at the top and bottom. Then veneer the top of the ring and attach to the base with screws. The slip-in cushion is padded in the manner given to fit snugly in the recessed top.

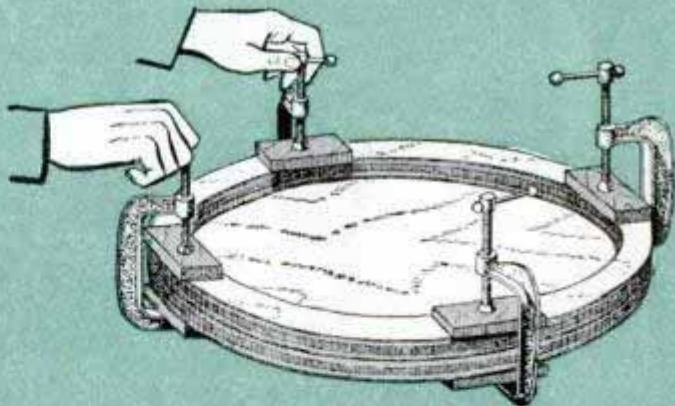
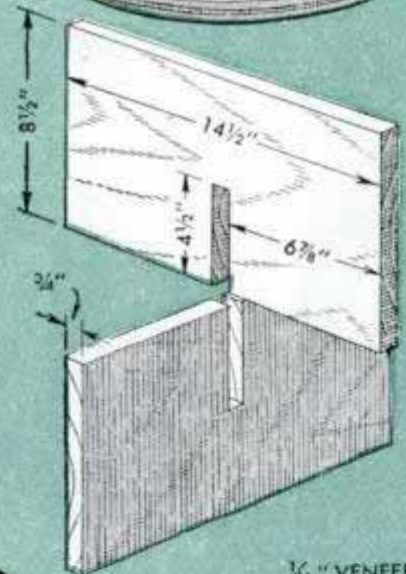
N. R. Hacken, North Sacramento, Calif.



- EXTERIOR UPHOLSTERY COVERING
- MUSLIN OR BURLAP COVERING
- WOOL OR COTTON BATTING
- MOSS OR HAIR
- PLYWOOD BASE



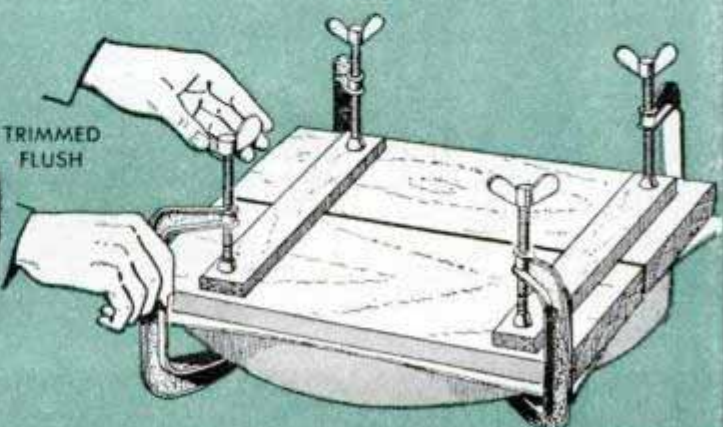
CROSS SECTION OF CUSHION



FIRST, PLYWOOD RING IS GLUED TO TOP DISK



THEN, VENEER BAND COVERS EDGE TO CONCEAL PLYS...



AFTER WHICH TOP IS VENEERED AND TRIMMED

SHOOTING

By Richard W. Emery

Photos by Ray Chapin



To keep a picture within single-column proportions, center the subject between two cardboard "masks" held as shown

TO BREAK up the grayness of solid printed matter, news editors use bright, cheerful, one-column cuts. Knowing how to make those slim, snappy pictures is a valuable aid to any photographer who wants to pay for his photo equipment. Good single-column shots can help you put over home-town newspaper publicity for your camera club, golf tournament or after-dinner speakers' club. If the small space given your picture seems



In the picture at the left it's necessary to crop one foot and part of the racket. Right, essentially the same picture but a slight shift in the camera position not only has improved modeling of the figure but both racket and foot are kept well within the single-column width you're after



Likewise, you can't pose the girl fisherman as shown above and then crop the print to single-column proportions without cutting

SINGLE-COLUMN PICTURES

Eye-catching single-column pictures find a ready market in newspapers and photo services, but you have to compete with crack photographers. Here's how it's done

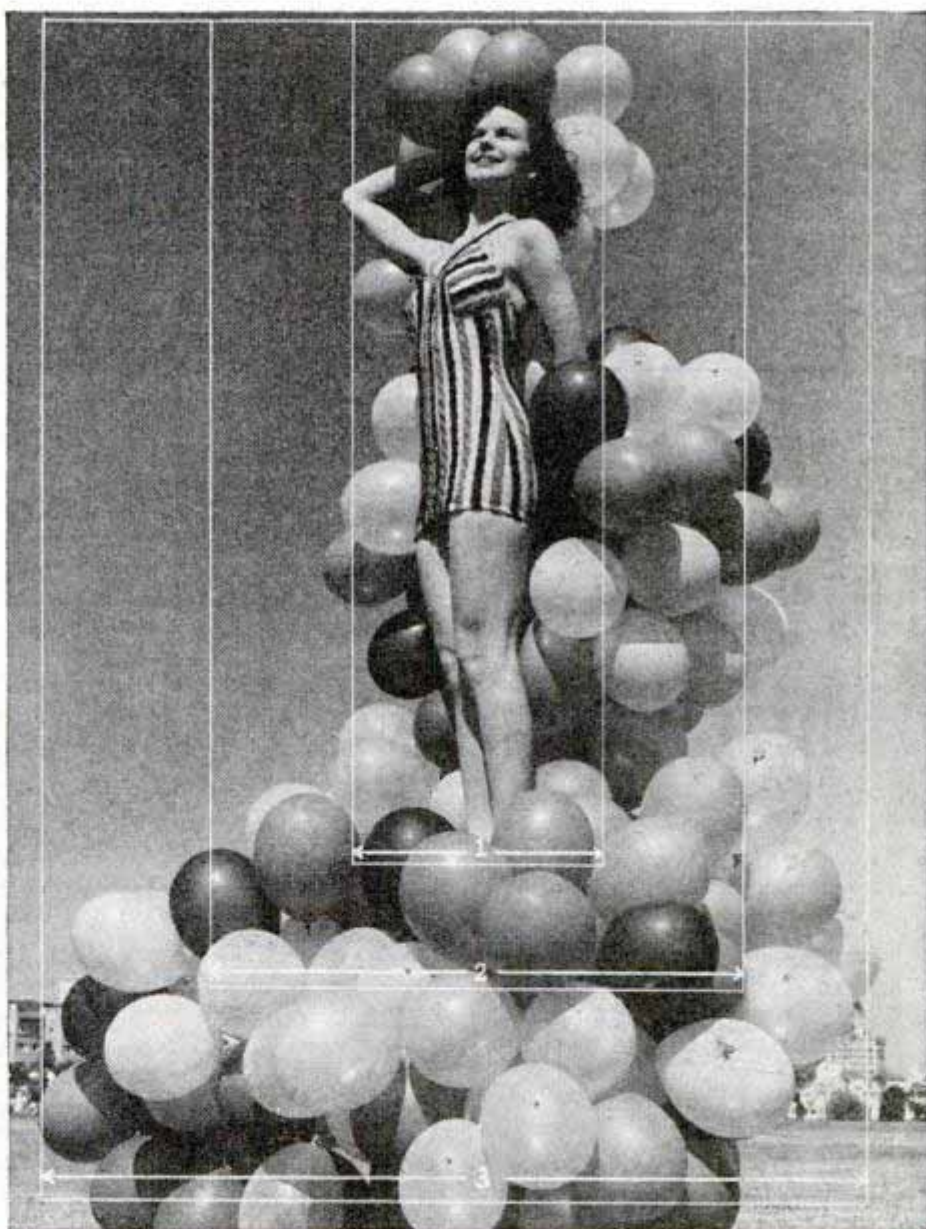
too little reward for all your work, just remember that the trim one-column picture has a high attention value. And once in a while your eye-catching narrow picture will surprise you by blossoming out in the newspaper as a two-column or even a three-column cut, maybe half a page deep. It has happened!

A good single-column shot finds a ready market in metropolitan newspapers and the various news-photo syndicates. It's handy for illustrating your own feature articles for newspapers and for news-service

markets. And every single-column picture can be made to "tell a story." It can have pictorial value in its own right. It pleases the eye. It's alive. It expresses a mood which the reader easily recognizes. It looks easy. But the job calls for imagination, careful planning and, above all, resourceful photography. Unless these narrow pictures are planned and then executed according to plan, they're almost sure to be duds with uninteresting "clothespin" lines—arms, legs and features lining up parallel with the edges of the narrow print.



off parts of the hat, boots and rod. Rather, the lady should pose as in the view you see above. She'll be happier about it and so will you



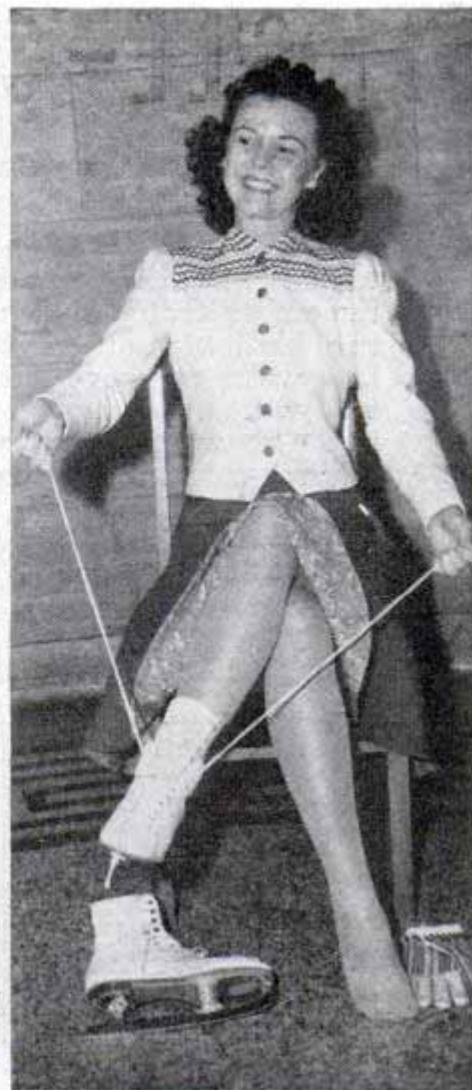
Here white lines show how you can crop the print to three possible proportions, all distinctly different pictures. News editors have used all three, and you will see at once that the pose of the figure and the placing of the props have been arranged with this thought in mind. Take your pick



The usual single-column photo of this type is merely an identification picture with no atmosphere to suggest a theme. But introduce simple props, arrange camera and subject with close attention to every detail, and in the case of an outdoor shot make the best use of sunlight. As a result you have a picture with a story, plus character and expression



Looks like a publicity shot, and of course it is, but the photographer knew his trade. Four persons and props have been posed within single-column width. The girls are standing on a stepladder, and elevating the camera at a rather steep angle reduced the depth of field to bring the whole group into sharp focus



Even persons who are somewhat camera-shy pose more naturally when you give them something to do. This occupies the attention of the subject and gives the pose the quality of action. In the shot above this thought is carried out by the simple act of lacing the skate shoes



So here comes rule one: Break up parallel lines.

One sure way to break lines is to shoot an action pose rather than a stand-still pose. Have the subject of your picture walk toward you, or perhaps do some kind of work. Or changing your camera angle may be the solution. Watch out for straight, vertical lines in the subject's clothing. Maybe you can cover them up with props—something the subject carries or works with. But remember that in your effort to avoid parallel lines, it's easy to forget about the limitations of one-column art.

And out of that you get rule two: Keep all essential parts of the picture inside single-column limits.

You'll be disappointed if you have to lop off the subject's hands or arms or ears or his pipe. The ordinary newspaper column is about 2 in. wide. A single-column cut may be anywhere

Where your camera is in relation to the subject is important. Here the photographer has found it necessary to lie almost flat on the ground to get just the angle he wants



Here the girl in the uniform of a drum majorette, the marching arrangement of the trophies and the baton make you think immediately of a parade and all the colorful fanfare which goes with it. That's what the picture is intended to do



This photo tells a story to the air-minded reader. The partial view of the plane and the pilot's uniform and helmet supply the theme. The shot is taken at a low angle. Wind action on clothing gives movement



A real action shot, this one, and an example of what you can do by skillful posing and careful timing. Just enough background is included to identify the location completely

from 4 in. to 6 or 8 in. deep with 6 in. the average. Freak pictures often require an even deeper cut—the city's new fire ladder in action, for example, or a telephone pole full length with such props as spectators around its base, a lineman and maybe a stranded tomcat on top. Within those proportions you must confine everything vital to the sense of your picture. If you let some part of the picture wander out of bounds, the column-rule will whack it off. Arms usually are the worst problem. Sometimes you can nip an elbow and then bring the hand back into the picture. If the subject is carrying anything, don't let it stick out sideways. You'll be surprised at how bulky or lengthy an object can be neatly tucked into a one-column picture, if you study camera angles and pose the subject carefully. If you have to take a picture of something that simply can't

To determine single-column width lay the print on a table and place rulers or pieces of paper on each side. Three parts length to one part width is about the right proportion





The best camera angle may require you to perch atop a high ladder and shoot down on the subject. High-angle camera positions enable you to get a number of objects in sharp focus and make all of equal size

be stuffed into one-column slimness use backgrounds to suggest oversize objects.

Rule three in one-column shooting is to use the background to round out the idea in the picture.

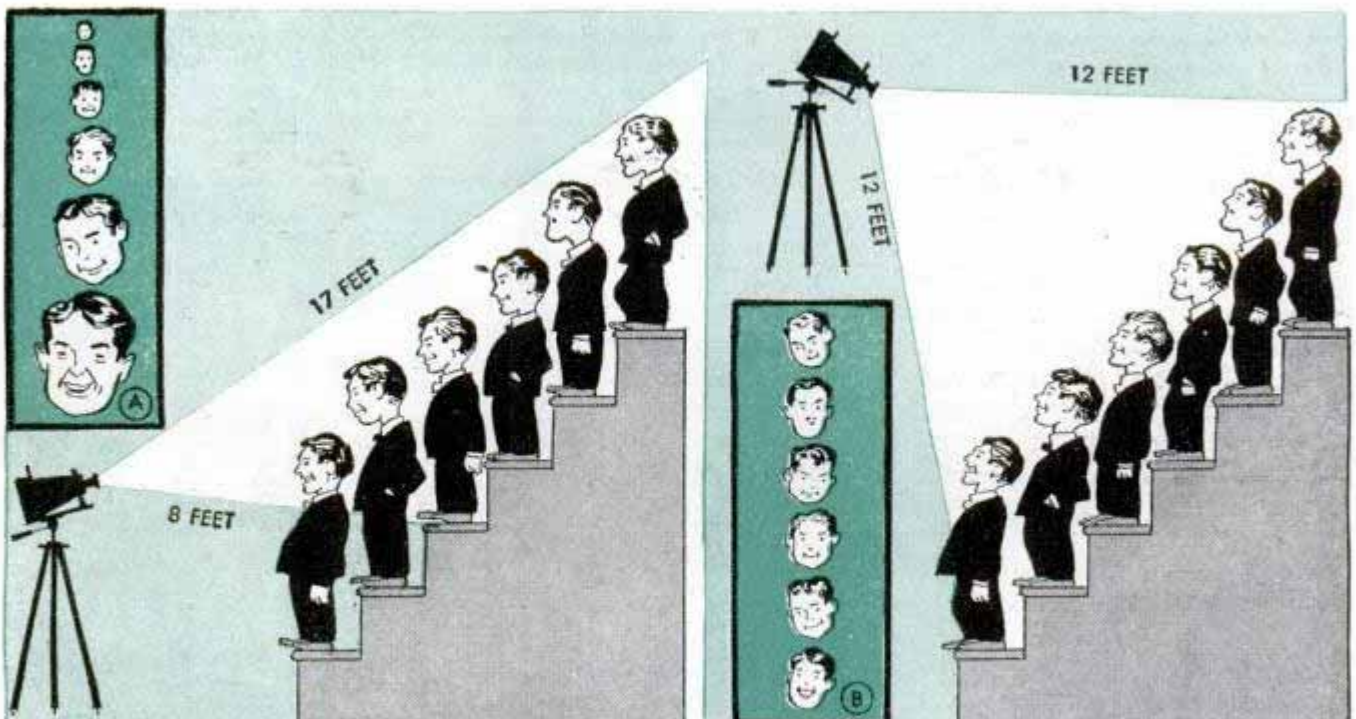
You can use only a touch of background but that always helps. You may have to fit the pieces of background jigsaw-puzzle fashion into the crook of your subject's elbow and a half-moon area behind his neck. And that may take some fancy maneuvering, but usually it's worth it.

People are the best subjects for single-column pictures. That's rule four.

The majority of newspaper pictures are pictures of people. You need concentrated subject matter and people supply just that. You can squeeze a fat man into a one-column, if you try, and a thin man is simply made to order. If your subject is one person, your problem is to pose him so that he won't look "stiff-collared" and posed, and generally uncomfortable, and at the same time keep his arms, legs, cigar, dog, shotgun, surfboard or wheelbarrow from sticking out of the imaginary boundaries.

So, you search for a camera angle. That's rule five.

Ground level may give you the best view. Eye level may be the answer. Or you may need the tallest stepladder in town, but no matter how skillfully you pack the scene into a one-column picture, you'll have a pretty dull one unless it has either action or an unusual, attractive pose.



Detail A above shows what you get when you shoot from a low angle and include objects at varying distances from the camera. Objects in the foreground often are so greatly foreshortened they appear distorted, while those farther back are difficult to bring into proper focus. Such subjects should be taken at a high angle as at B above. Here all members of the group will appear about the same size on the print

Mark down rule six: Get action, in some form.

Confining action in a single-column is like trying to get an elephant to turn a somersault in a darkroom. But it can be done, and done well. To provide some reason for the action, you use props. Give the subject something to carry, something to do.

Use props to enliven the picture. That's good enough for rule seven.

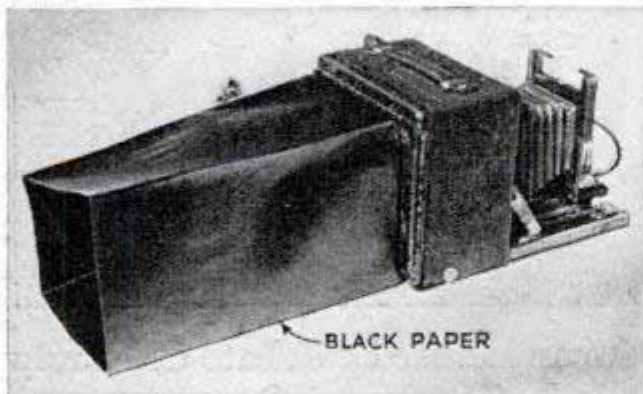
If you have more than one person in the picture, you face the job of lining them up so they will appear in the picture one above the other. Resourcefulness will give you a catchy shot. Maybe a ladder or stairway or chair can serve to raise one person. You may be able to arrange a group in vertical order on a stairway and then shoot from a high enough perch to put them all in focus. Add it up and it amounts to the same thing—you have to do some advance engineering if the picture is to have any action or prop arrangement to give it a kick.

The final rule should be obvious to all hands who try single-column illustration, but many photographers muff it—and miss the picture.

Rule eight requires that you shoot the same action several times, just to make sure.

Why? Well, try to break up parallels, tuck in some background, catch action and show interesting props all without stepping over the one-column boundary lines. Shooting several times over may give you one good negative on which everything turns up just where you hoped it would be. And in the tricky business of shooting salable single-column pictures, that's the one you're after.

Paper Extension Focusing Hood Sharpens Ground-Glass Image



When focusing on the ground glass in brilliant sunlight, reflections sometimes hinder accuracy, even though the camera has a built-in focusing hood. A large piece of black opaque paper can be folded to fit over the hood and form an extension that will minimize reflections greatly.

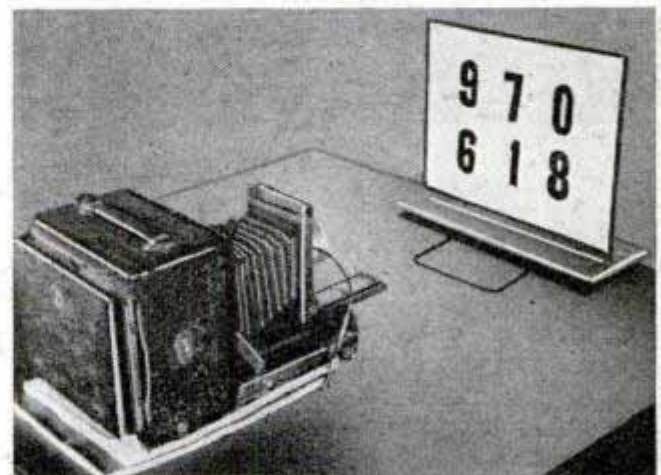
Better Use of Monotone Filter

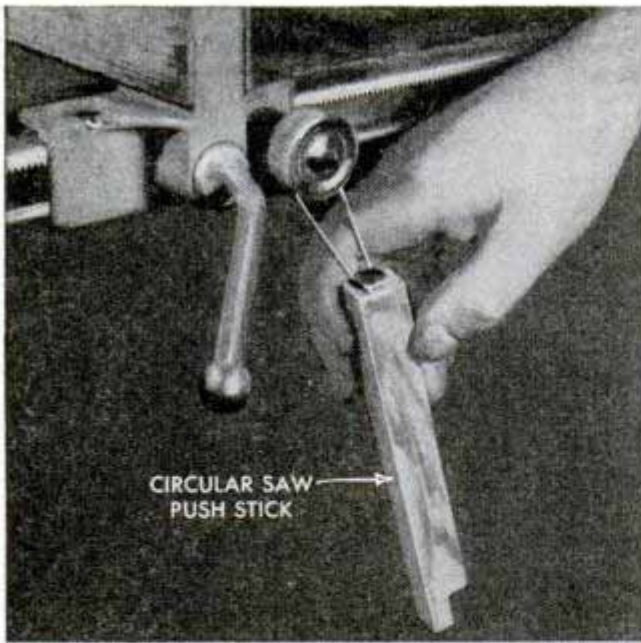


Used to view a scene before photographing it, a monotone filter can be improved if it has two densities, either of which may be used according to the strength of the light. One half of the filter may be given added density by covering it with several strips of Cellophane of the same color as the filter. After you have experimented with the unit, you will know which half to use as a viewer, depending upon the light.

Moving-Picture Title Library

A file of several sizes and types of letters and numbers for movie titles can be made by copying different kinds of lettering with a still camera. Calendars can be used to start the file. Cut out the letters of the month and the numbers. Then mount them on a sheet of white paper and copy. Enlarge to the size wanted and make contact prints for smaller titles. In this way you will build up a file of many types and styles of letters that are used to make pasteups for your moving picture titles.





Stick Attached to Fence on Saw Reminds Operator of Its Use

Many accidents would be avoided if a push stick were used whenever practical in operating a circular saw. One way to jog your memory so the push stick is not forgotten is to attach it to a loop of cord with a thumbtack and suspend it from the locking knob of the rip fence. This method has proved successful where formerly use of the stick was neglected.

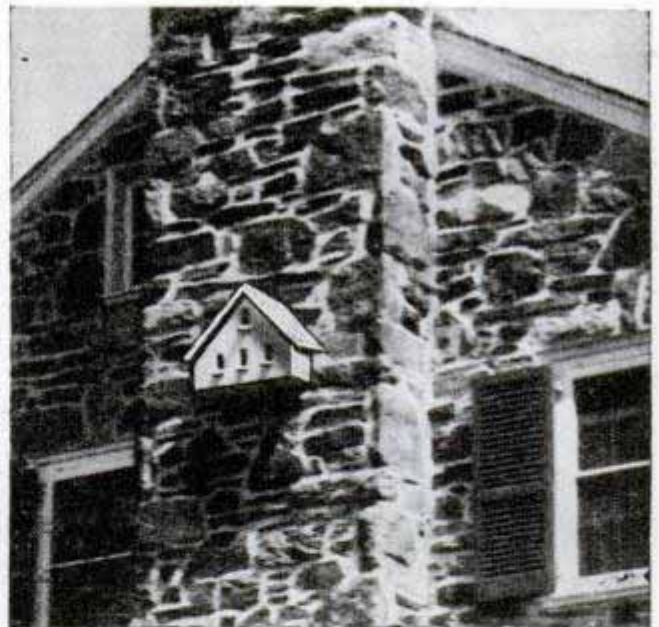
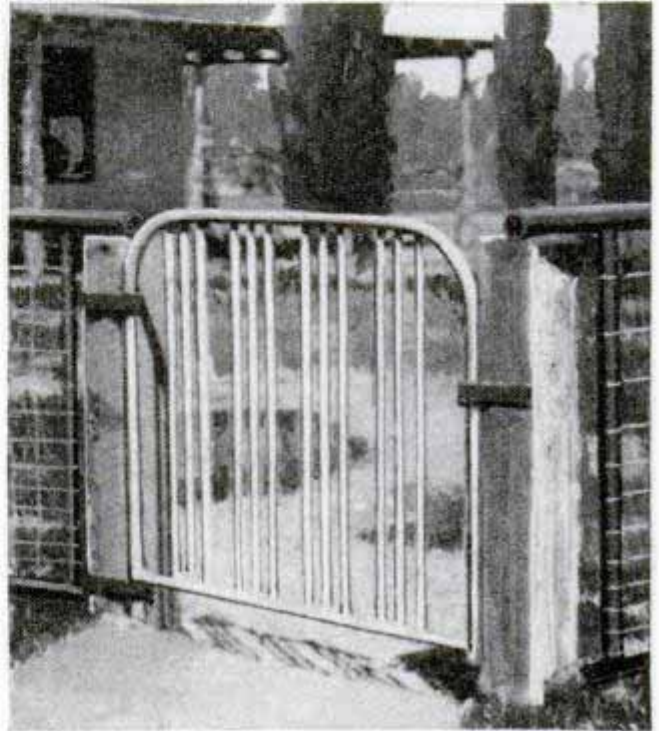
Rubber Heel Holds Small Work And Prevents Damage

Small and delicate parts often may be ruined when working on a drill press because the piece is twisted from your fingers. Such parts can be held very easily, however, if a rubber heel is placed underneath the piece to act as a drill pad. Pressure of the heel against the work prevents the latter from turning.



Sturdy Yard Gate Constructed With Part From Metal Bed

If of the right width and height, the head of a discarded metal bed will make a strong and attractive yard gate. The legs are sawed off and hinges are attached to one side with a latch on the other. Flat iron is used in the construction of the hinges and latch.—Glenn Adams, Tecopa, Calif.



Martin House Built Into Chimney Is Cast From Concrete

Made of concrete and set in place during the building of the stone chimney, this martin house is a novel decoration. Painting the house white makes it distinguishable. Because it is made of concrete, its construction is as permanent as that of the chimney.—Paul Hadley, Philadelphia, Pa.

CRAFT QUIZ



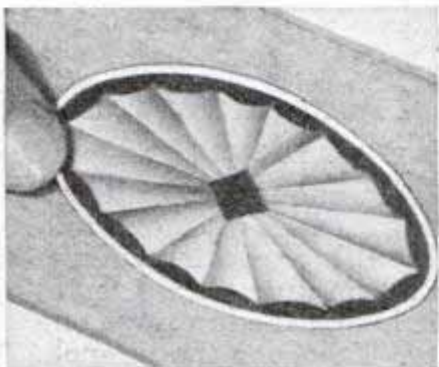
1. Plane he is using is—
 (a) Jack (c) Jointer
 (b) Block (d) Smoothing



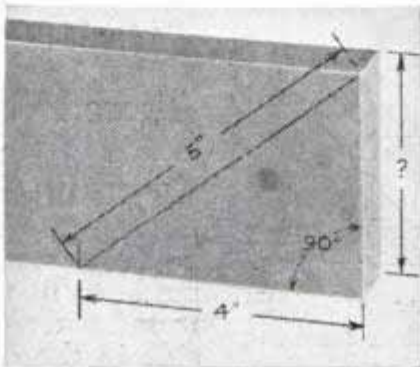
2. What is wrong here?
 (a) Kind of socket (c) Wire loop
 (b) Kind of wire (d) Screwdriver



3. These gem stones are cut—
 (a) Brilliant (c) Rose
 (b) Cabochon (d) Step



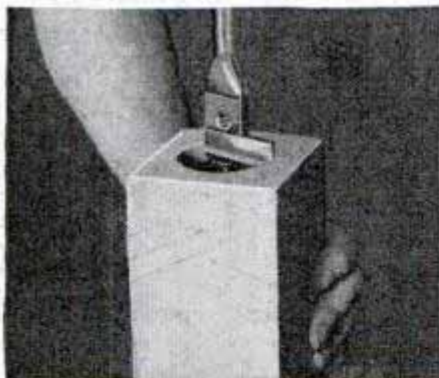
4. This inlay is a—
 (a) Sunburst (c) Anthemion
 (b) Cornflower (d) Urn



5. This board is—
 (a) 3" wide (c) 2 7/8" wide
 (b) 3 1/8" wide (d) 1" thick



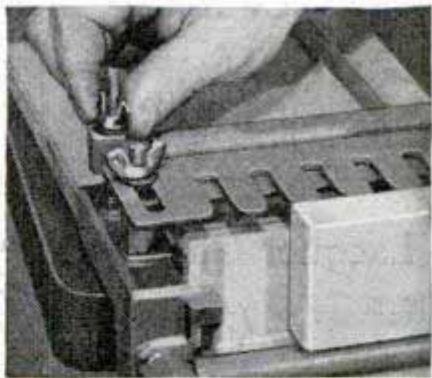
6. Best wood for boat is—
 (a) Pine (c) American mahogany
 (b) Oak (d) Philippine mahogany



7. Boring is done with—
 (a) Boring bit (c) Forstner bit
 (b) Expansive bit (d) Gimlet bit



8. This boat plank is called—
 (a) Garboard (c) Gunwale
 (b) Sheer strake (d) Shutter



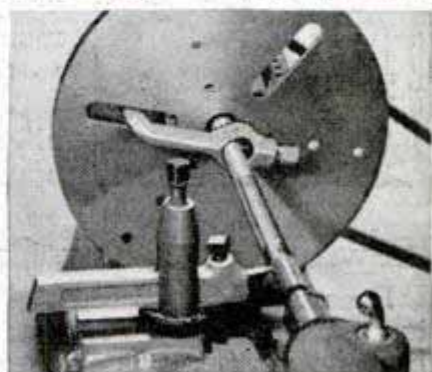
9. Getting set to do—
 (a) Dovetailing (c) Box joint
 (b) Mortising (d) Cogged joint



ANSWERS: 1—b; 2—c (loop should curl clockwise); 3—b (a rounded or plain surface, not faceted); 4—c; 5—o (from 3-4-5 rule used to test right angle); 6—c; 7—b; 8—d; 9—c; 10—c; 11—b

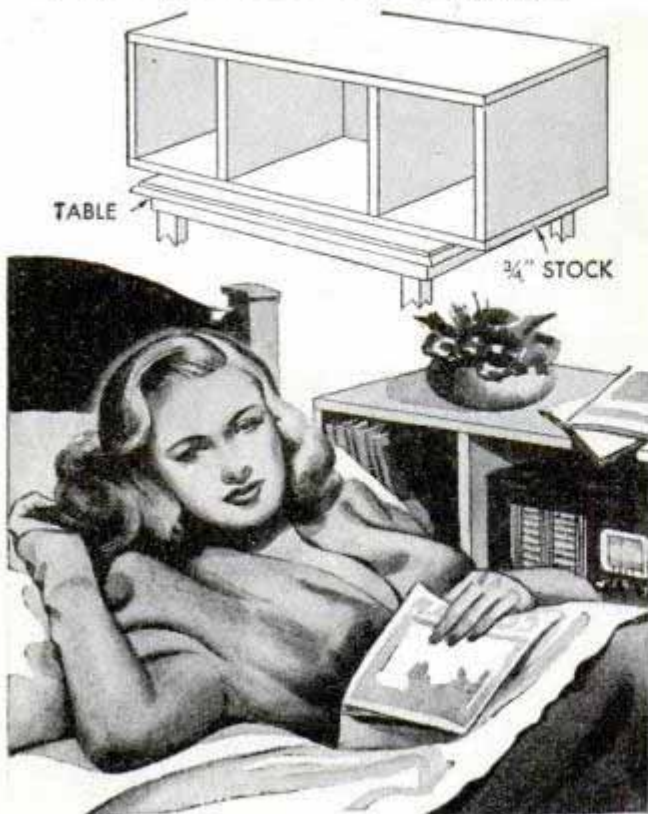


10. This metal spinning tool is—
 (a) Bead (c) Diamond
 (b) Flat (d) Point



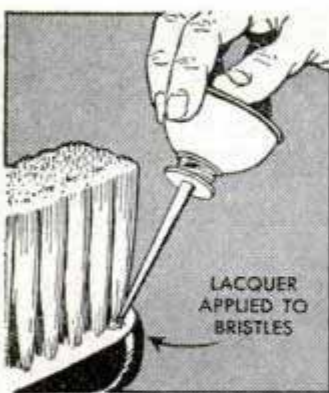
11. Work holding device is a—
 (a) Cat (c) Clamp
 (b) Dog (d) Tail

Storage Cabinet for Bed Patient Keeps Accessories Handy



A patient confined to a bed for any length of time will find this combination cabinet and storage box a great convenience. One compartment will house a small radio and the other compartments can be used for writing materials, books and records, all of which are kept in neat order and within easy reach. The cabinet also saves work for the person who keeps the room in order as it can be moved about when cleaning. It is made of $\frac{3}{4}$ -in. stock and will set on an ordinary card table.

Lacquer Glues Bristles in Brush



Lacquer is used by one craftsman to stop old brushes from shedding. The lacquer is applied at the base and serves to cement the bristles to the brush. For this purpose, an oilcan is an ideal applicator.

Sewing Patches on Canvas Tent

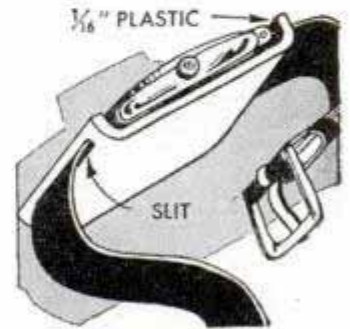
Because of the stiffness of the cloth, sewing patches on canvas tents, tarpaulins and hunting garments is often a difficult task. One woodsman found that by soaking the area to be patched and then rubbing in soap, the needle will slip through the ma-

terial easily and the possibility of breaking the needle will be lessened.

R. A. Jenkins, St. Louis, Mo.

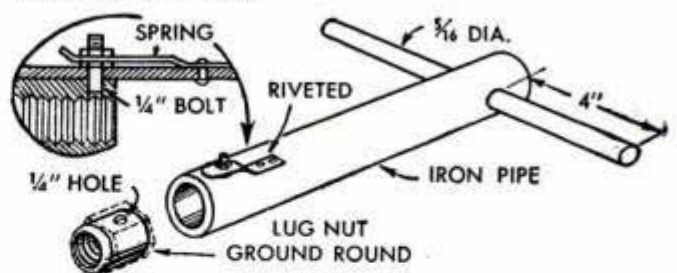
Back of Wrist Watch Protected By Plastic Shield

If you want to prevent the back of a wrist watch from corroding, try using a protective shield of plastic. The plastic is cut to fit the contour of the watch and the ends are bent and slit for the strap to pass through. After cutting and forming, the shield should be sanded. —Frank Shore, New York.



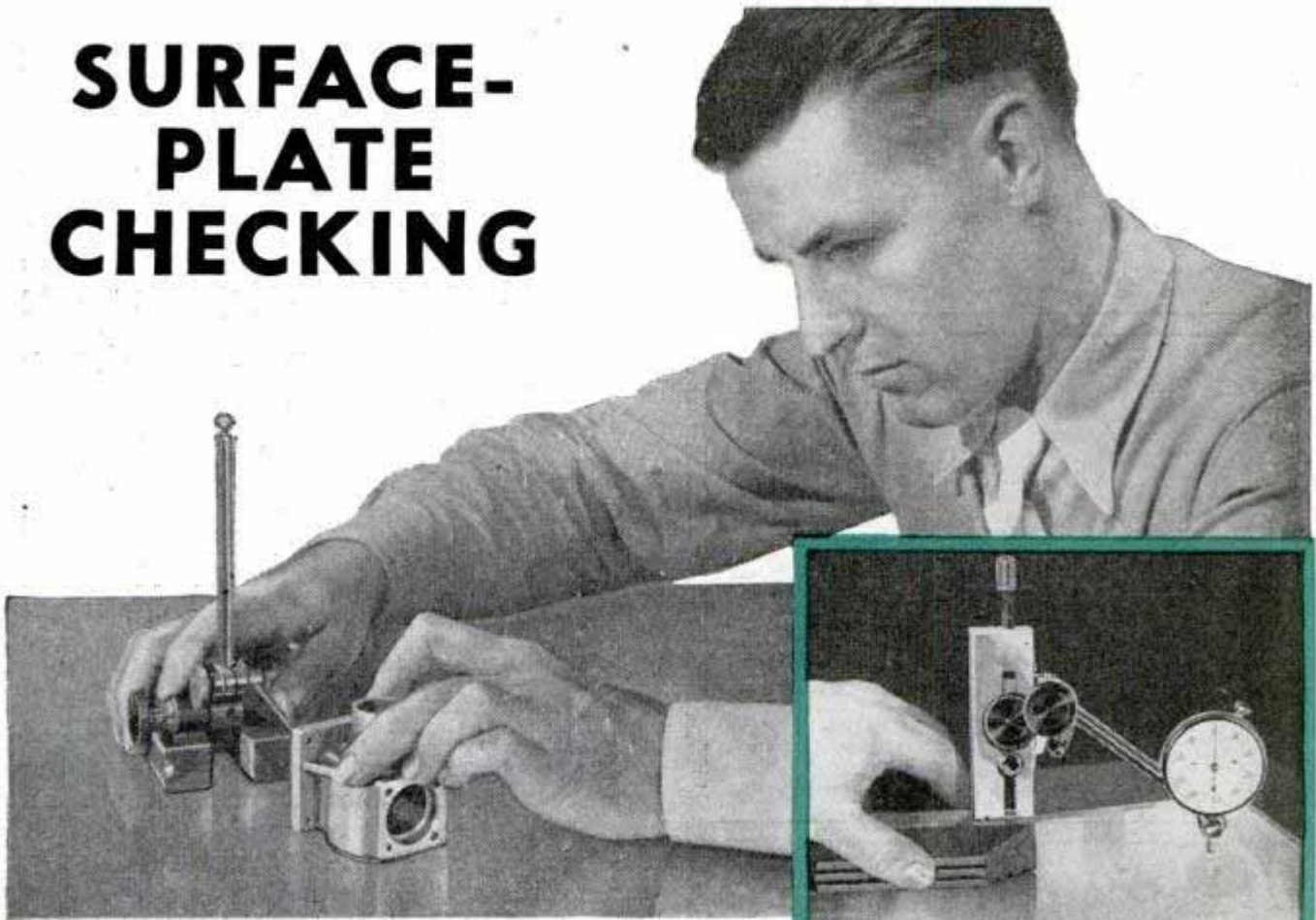
Altered Wheel Nuts and Wrench Foil Tire Thieves

To foil tire thieves, one motorist altered the lug nuts on his car wheels so they could be removed only with a special wrench made to fit them. The nuts were ground round and a $\frac{1}{4}$ -in. hole drilled through one side in the center. Then, for the wrench, he used a piece of pipe that would just slip over the nut. One end was fitted with a T-handle and the other drilled to take a short $\frac{1}{4}$ -in. bolt. The bolt, with head removed, is held in position by a spring riveted to the pipe. In use, the pipe is slipped over the nut and the bolt engaged in the hole in the nut.



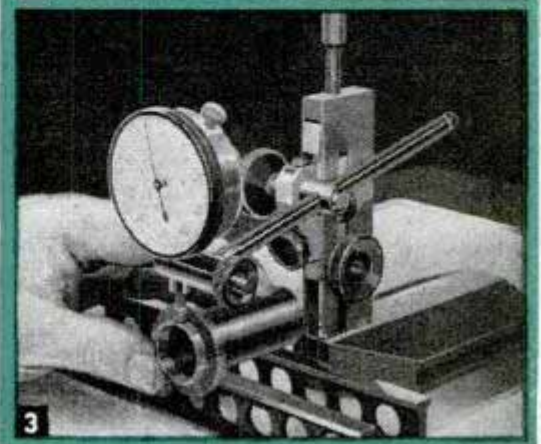
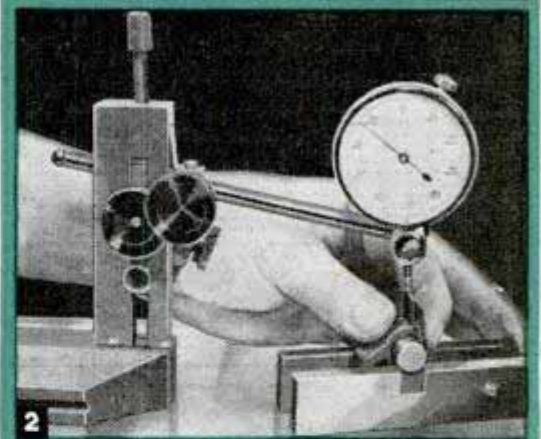
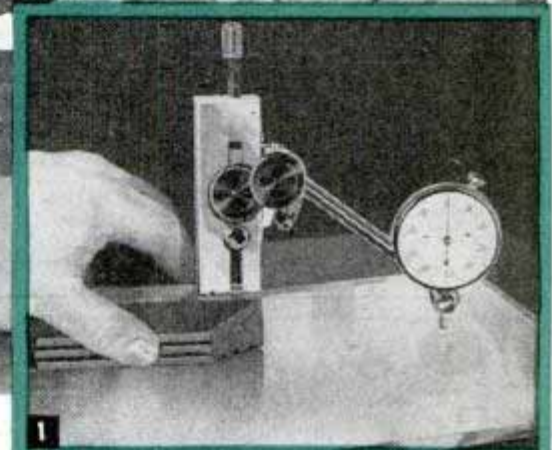


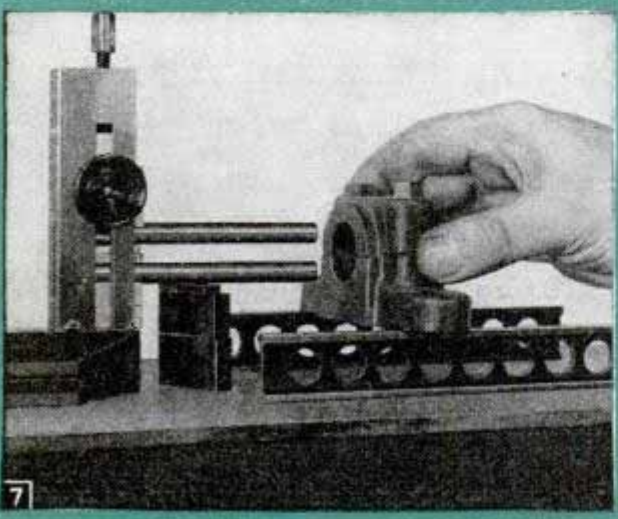
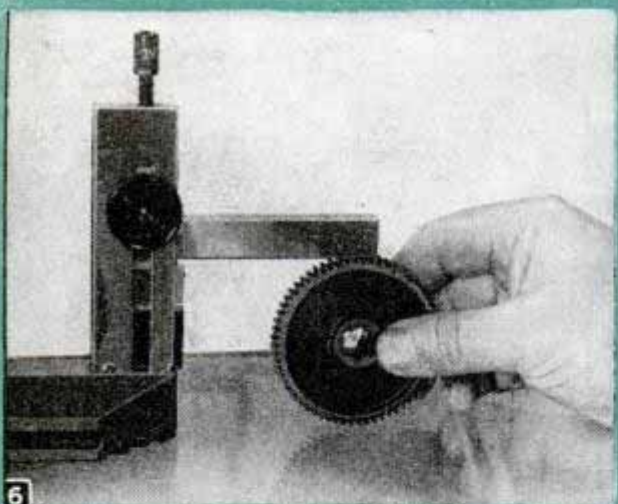
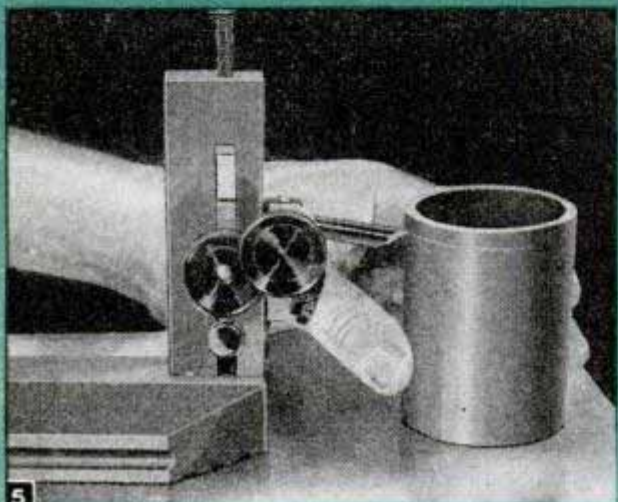
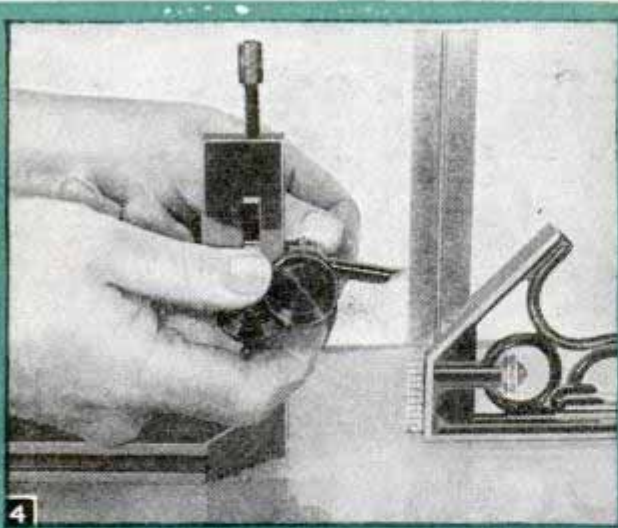
SURFACE-PLATE CHECKING



AROUND good shops a surface plate is used for close-limit inspection and layout work, and the reputation of the firm as well as the individual may depend on its accuracy. For this excellent reason every top-notch mechanic guards his surface plate with a jealous eye—there must be no dirt, no metal chips, no digs, dents or scratches and no rust anywhere on its surface if he is to do accurate work. And if the plate is to retain the fine accuracy that was built into it, it can't be used for just any rough job that comes along.

For this reason many shops handling a variety of work use a piece of heavy plate glass as a surface plate for both routine and incidental operations where the allowable error permits it. In most cases ordinary commercial plate glass provides a satisfactory and economical working surface. Glass has the one disadvantage that it will bend under a fairly heavy weight, but if care is used in placing the plate on a flat surface, the deflection caused by light to medium-weight work is not sufficient to affect ordinary measurements. The glass plate does not rust, hence there's no need to oil it after use. It is easily wiped dry with a cloth and if the surface is scratched, even quite deeply, there is no burr to hone down. When you lay the glass plate down ready for work, it is always a good idea to go over it with the dial indicator, Fig. 1, to check for deflection. Often merely relo-



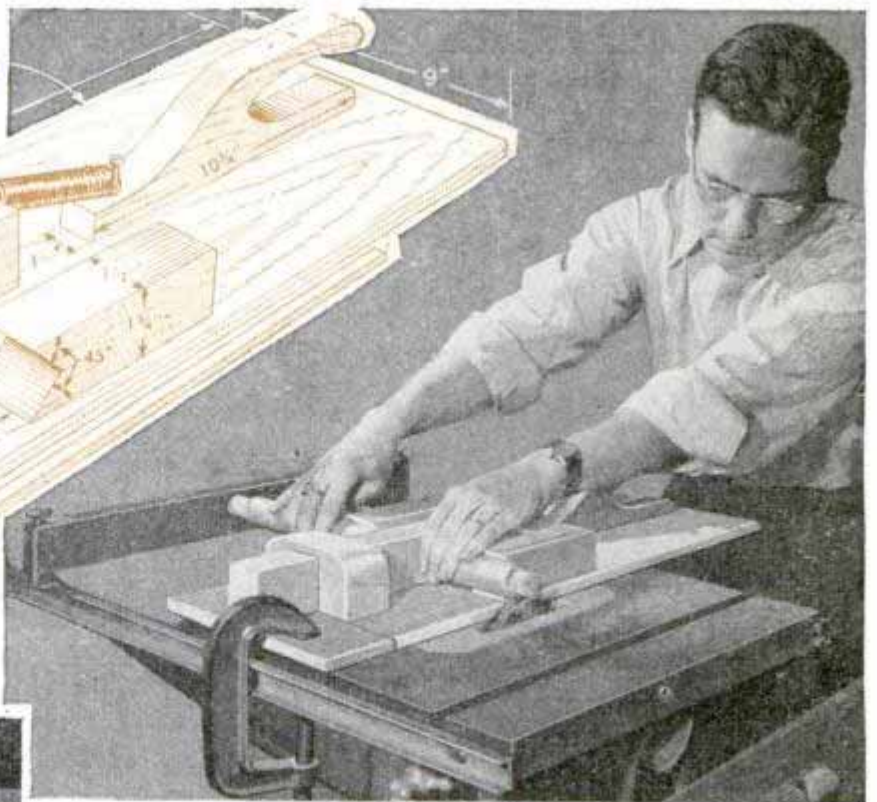
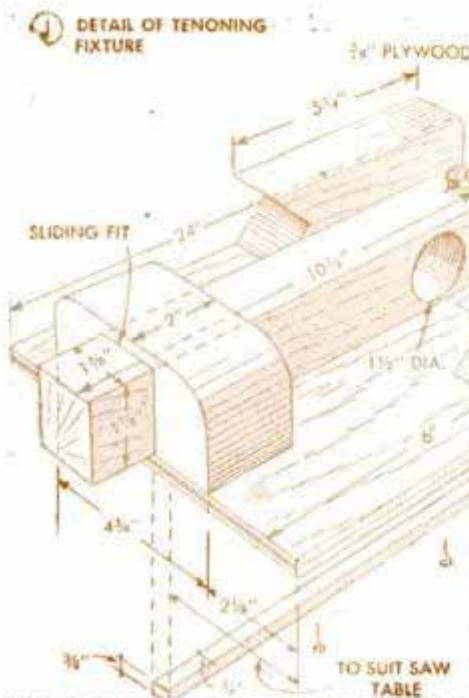


cating the glass on the bench will correct slight bends due to any unevenness of the surface on which it is resting.

Only a few examples of the many jobs which can be handled satisfactorily on a glass surface plate are given. The sharpening of shaper cutters, Fig. 2, requires a check to determine the length of each blade. Slide the cutter over a shaft resting in agate V-blocks and bring each blade to bear on the dial indicator button as shown. When inspecting shouldered or collared objects, Fig. 3, which cannot be rested on the plate, use a pair of parallels. Be sure the dust is wiped from the bottom of the parallels before using. It is good practice to have a pad of cheesecloth handy and make a habit of wiping all contacting surfaces frequently.

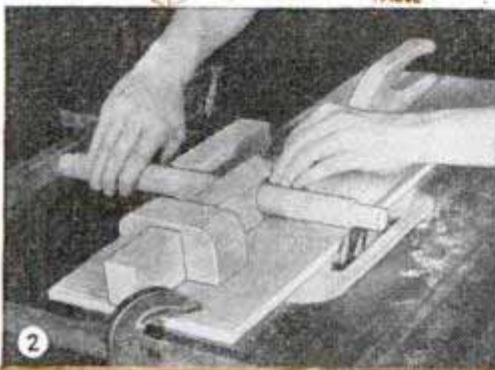
In addition to simple inspecting, the actual layout of profile and center lines is an important operation. Starting with only a known base line, all the measurements desired can be obtained as in Fig. 4 and laid down as in Fig. 5. The same base block and standard used with the dial gauge is retained. The tool is a hardened scriber point. For simple measurements it is set against a steel rule. For extreme accuracy the point is brought to bear on a stack of gauge blocks. In laying down the lines, the scriber is held still and the work rotated or pushed past, the sharp point scoring a clean and visible line, Fig. 5. For higher visibility on complex layouts purple ink is first applied to the surface to be scribed. With a scriber all guesswork is eliminated.

When inspecting a large production run make up a limit gauge, Fig. 6. It can be maximum or be minimum or both, side by side. The gear is slid under the overhanging caliper bar and over or undersize rejects are quickly caught. In Fig. 7 one pass of the pillow block will show the inspector if the bore is the correct height above the base line, if the bore is the correct diameter, and if it is bored parallel with the base line. Making the inspection fixture requires the use of gauge blocks. As the pillow block is too low to be measured while resting on the plate, the parallels are used. The height of the bore above base is added to the parallels and gauge blocks equaling the total are wrung together. A precision ground caliper bar is secured in the standard at the correct height. As the diameter of the bars is known, .350 in., the diameter of the bore is easily obtained by inserting gauge blocks between a pair of bars until the total adds up to the bore diameter. Clamped rigidly in the standard, the caliper bars project parallel with the surface plate. All the inspector has to do is lay the pillow blocks on the ways, one at a time, and slide them along.

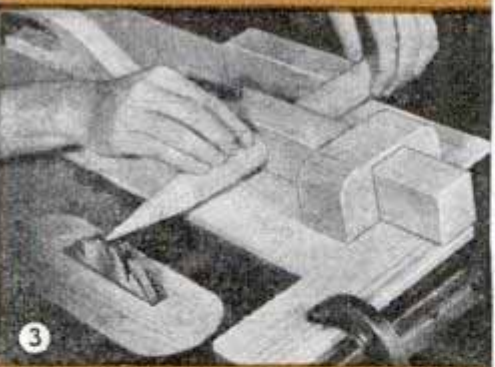


CUTTING ROUND TENONS

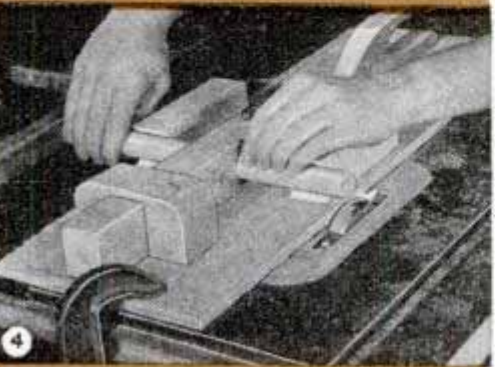
By Frank Skalla



A dado head is used for cutting straight round tenons on dowels



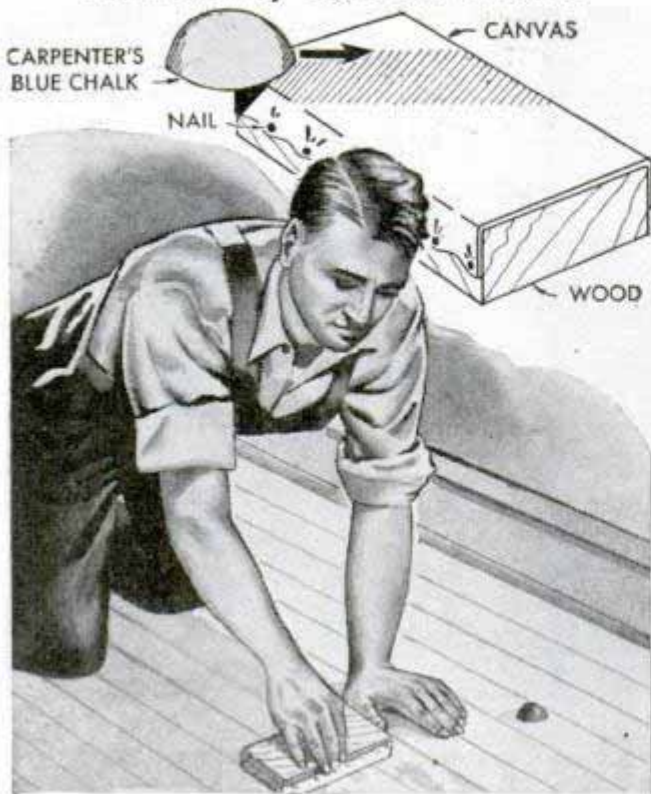
The saw table, or arbor, is tilted to point or taper ends of dowels



For rounding the ends of dowels a molding-head cutter is used

SHAPING a neat, square-shouldered tenon on ordinary flat stock can be done easily with common hand tools and of course it's only a matter of a few one-second passes on the circular saw. But shaping a round or tapered tenon on round stock without a lathe—that is something. Here's a quick, precise way to do it on a power saw. Make up a jig as in Fig. 1, using 3/8-in. plywood for the base and hardwood for the fixtures and handle. Fig. 2 shows how this jig works in making a straight tenon. The sliding member of the jig, which is spring-tensioned as shown, acts as a clamp to hold the work firmly against the V-blocks. Simply slide the work into place, locate it over the dado head, raise the latter to the proper height to give the diameter you want and slide the jig against the stop clamped to the saw table. Then turn the work one complete revolution and there you are, letter-perfect. Or maybe you need a number of stakes with one end tapered so that they can be easily driven into the ground. Tilt the saw table, or the arbor, and make the cuts in several passes. You finish up with a neatly tapered end like that shown in Fig. 3. The trick in this is in the depth setting of the head for each pass of the work. With a little care you can get a perfect taper. Then, should you wish to round the other end of the pointed stakes, you can do it quite as easily by using a molding cutter head as in Fig. 4. Select molding cutters of the proper radius and locate the work so that the squared end is over the curved section of the cutter. Turn the work one complete revolution, holding it firmly so that it does not slide to the right or left. Here again a careful depth setting determines the accuracy and neatness of the finished job.

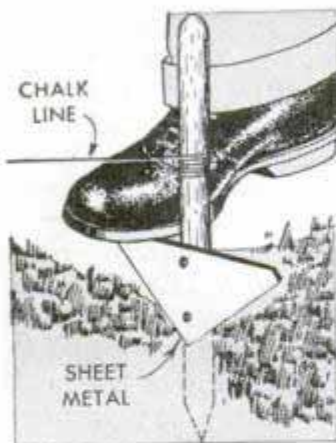
Chalked Block Marks High Spots On Newly Sanded Floors



When checking a newly sanded floor for high and low spots, one workman uses a canvas-faced block that is coated with carpenter's chalk, preferably colored. By rubbing the block over the floor, uneven areas are marked for further sanding.

Self-Anchoring Stake Driven Without Using a Mallet

To facilitate driving stakes that support a chalk line, one workman screwed a galvanized sheet-metal plate, which has a triangular shape, to each one. The stakes are pushed easily with the foot. In addition to speeding the operation, once the stakes are in the ground, they will not twist and allow the line to loosen or to become slack.



Brushes Clean Chips From Holes

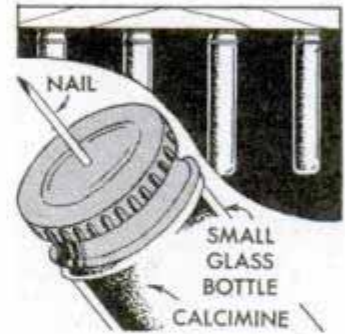
Cleaning chips from holes, particularly blind ones, is a difficult job and especially so when cutting oil has been used as it tends to make the chips stick to the walls. One way to get the chips out is to use a set of rifle and shotgun brushes of appropriate diameters. The brush is "threaded" into

the hole and then withdrawn without twisting it. These brushes are made principally of steel, brass, bronze and fiber.

F. E. Averill, Jr., Santa Ysabel, Calif.

Displaying Samples of Calcimine

One paint dealer uses small glass bottles to display colors of calcimine that he has in stock. The bottle covers are nailed to the bottom of a shelf and the bottles are screwed into the covers.

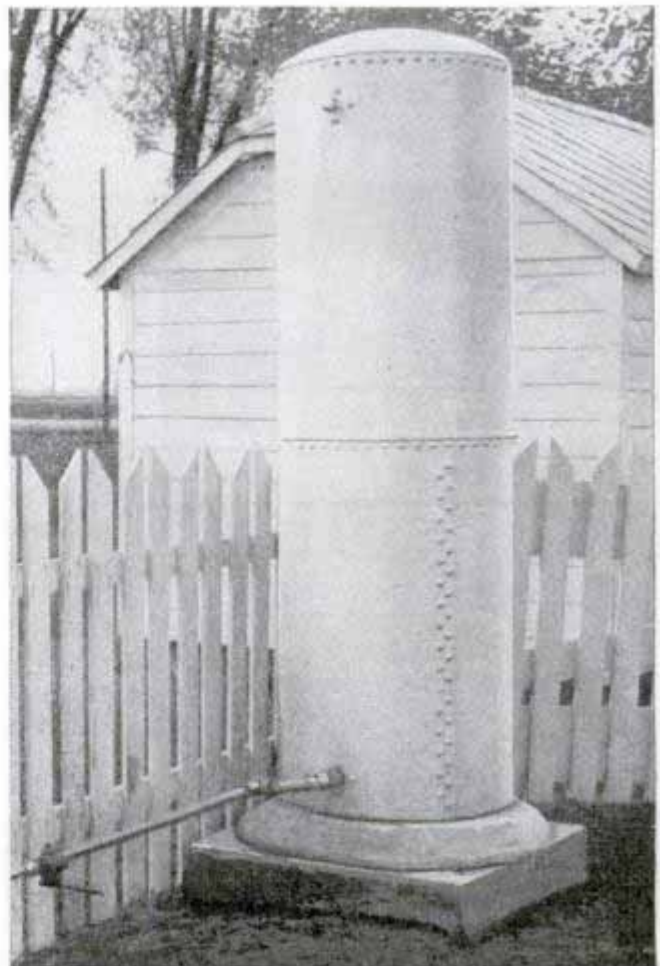


Care should be taken to locate the display at the proper height, which should be eye level.—E. J. Wiczorek, Chicago.

Boiler Contains Reserve Supply For Poultry Waterer

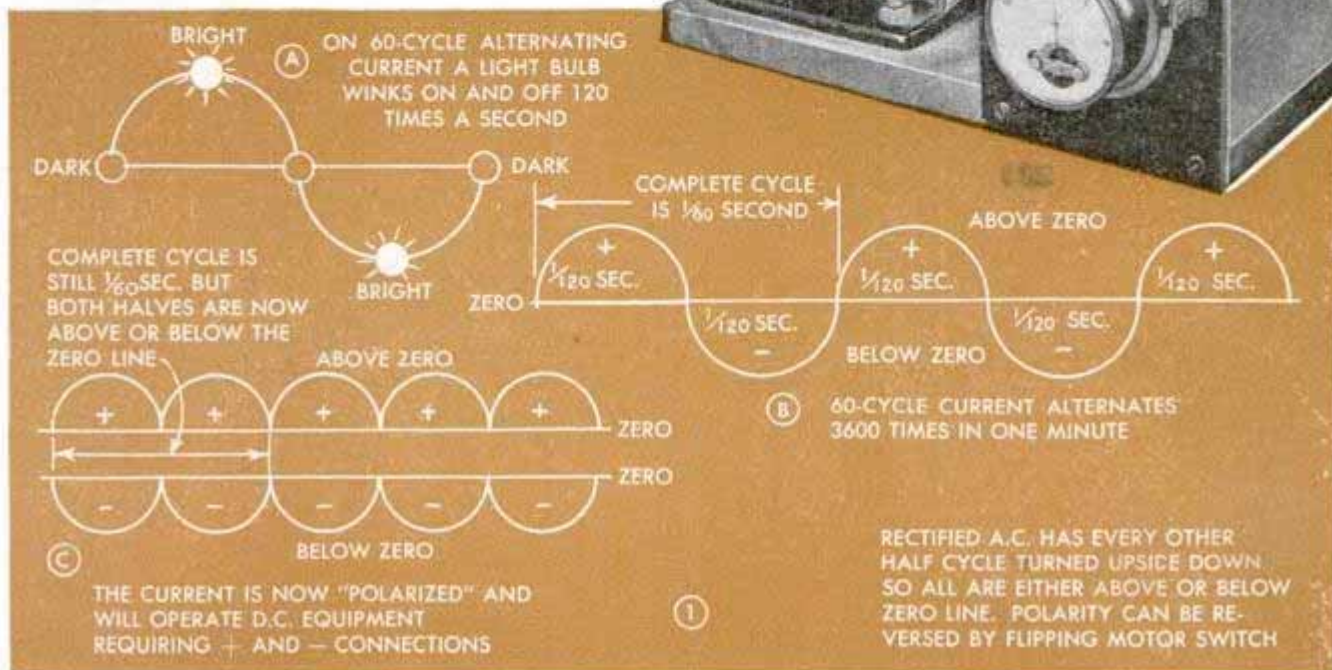
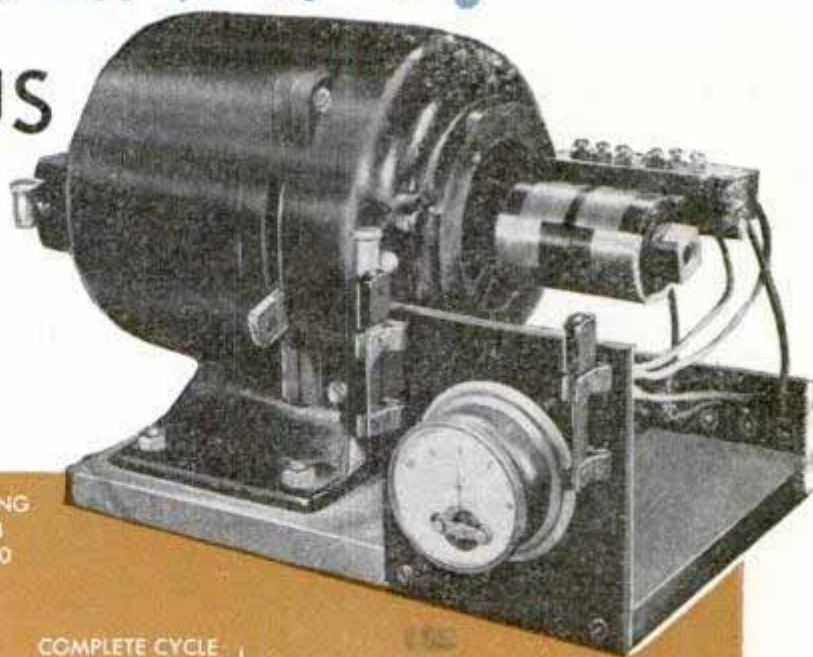
In order to provide a reserve supply of water for his poultry, one farmer mounted an unused range boiler on a concrete base and connected it to an automatic waterer in the poultry house. Although the waterer maintains the proper level as long as the openings in the tank are plugged, a valve is provided for further control of the flow.

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



SYNCHRONOUS CURRENT RECTIFIER

By Alexander Maxwell



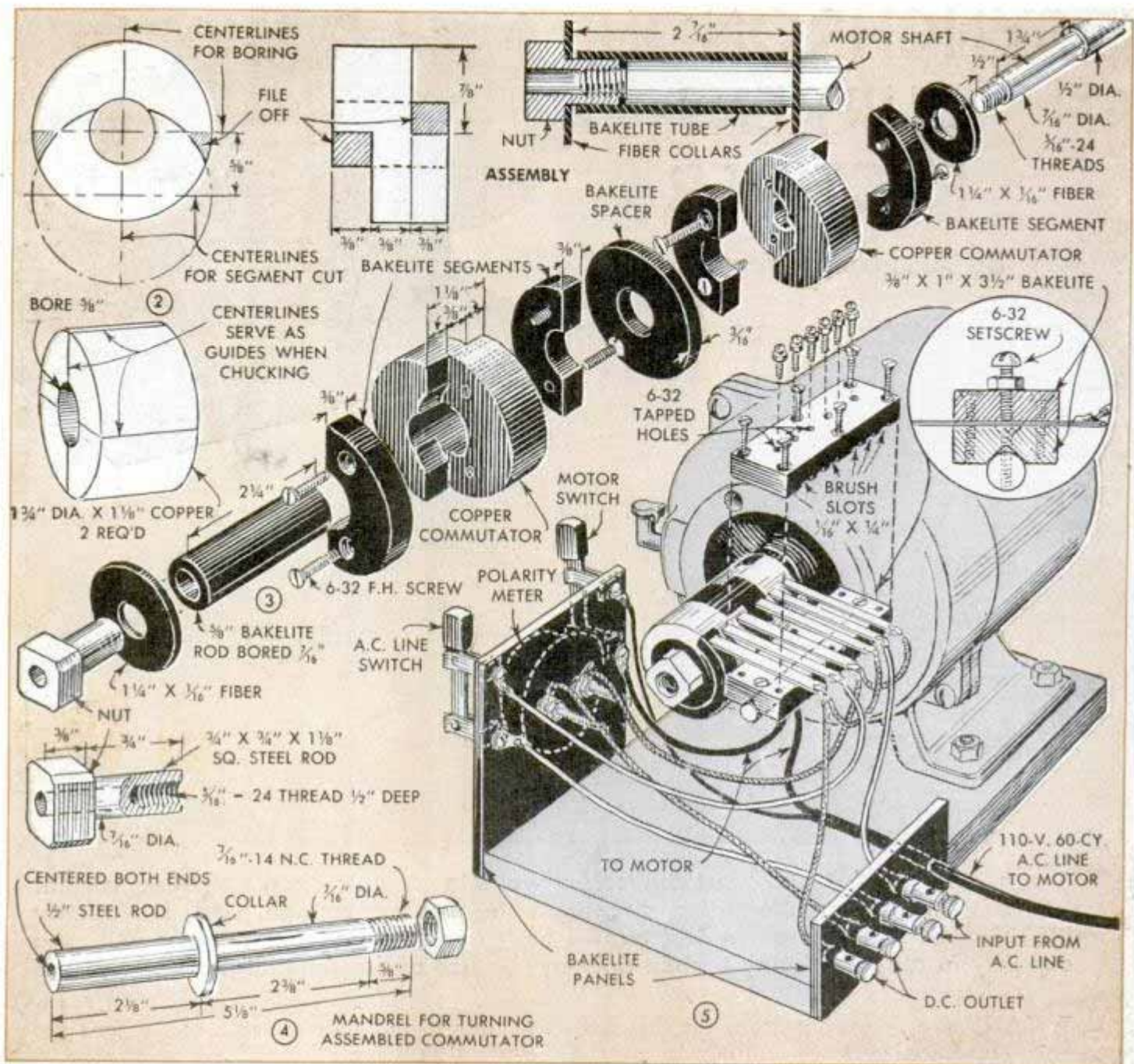
One of the simplest and most convenient ways to obtain a source of direct current is first to transform alternating current to the desired voltage, and then rectify it. This synchronous rectifier will handle high and low voltages equally well, the capacity in amperes being limited only by the size of the commutator and brushes

MANY are the applications for this synchronous rectifier, which is one of the most economical methods of rectifying electric current. Model railroaders will find that it will carry their entire system—polarized relays, block signals and permanent-magnet locomotives—delivering a reliable source of power necessary for smooth performance. It also can be used in electroplating, battery charging, operating electric-eye mechanisms, polarized relay control systems, arc lights and other electrical equipment requiring a d.c. source of current, the exception being radio.

The heart of the rectifier is a 3600-r.p.m. single-phase 60-cycle motor. It need not be powerful, for a $\frac{1}{8}$ -hp. motor will handle a commutator capable of carrying a 2-kilowatt load. The synchronous speed is necessary to agree with the frequency of the generating station. In Fig. 1, details A and B, the manner in which alternating current functions is shown. The current goes from peak voltage to zero twice during the cycle. When the current is rectified it becomes

polarized and will operate equipment requiring positive and negative connections. When the rectifier motor is rotating in exact synchronization with the power-station generator, a commutator with make-and-break switches will divide the cycles as shown in detail C of Fig. 1. Then positive current is delivered at one terminal and negative at the other. To get full efficiency, the break must come as the cycle starts. At this instant the line is dead and there will be little or no tendency to arc. Should the change come at the peak of the cycle, enough arcing might result to melt the brushes. To adjust the commutator, rotate it on the motor shaft until the point is found where arcing is at the minimum, then tighten the locknut. Use only a 6-volt power source when making this adjustment.

Since most synchronous motors are intended for direct connection to the devices they operate, they usually have long shafts and are centered so the entire armature may be placed in a lathe and the shaft turned down to specifications, Fig. 3. Bake-



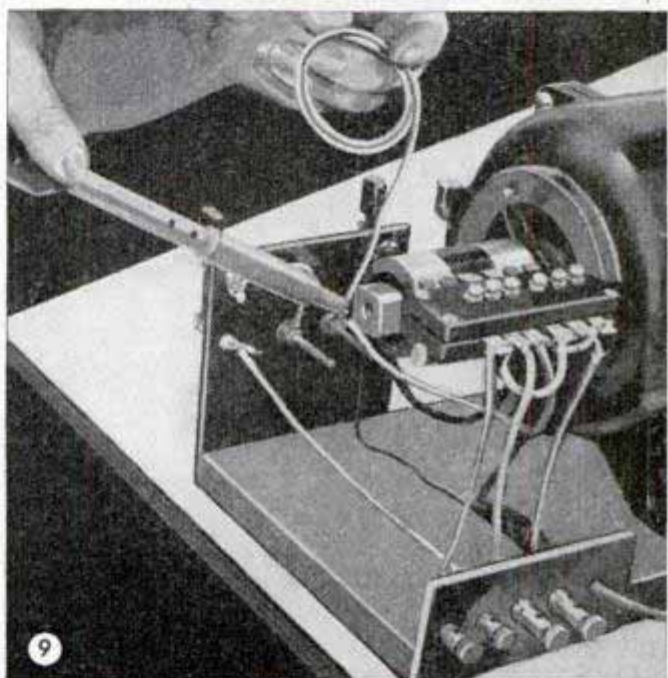
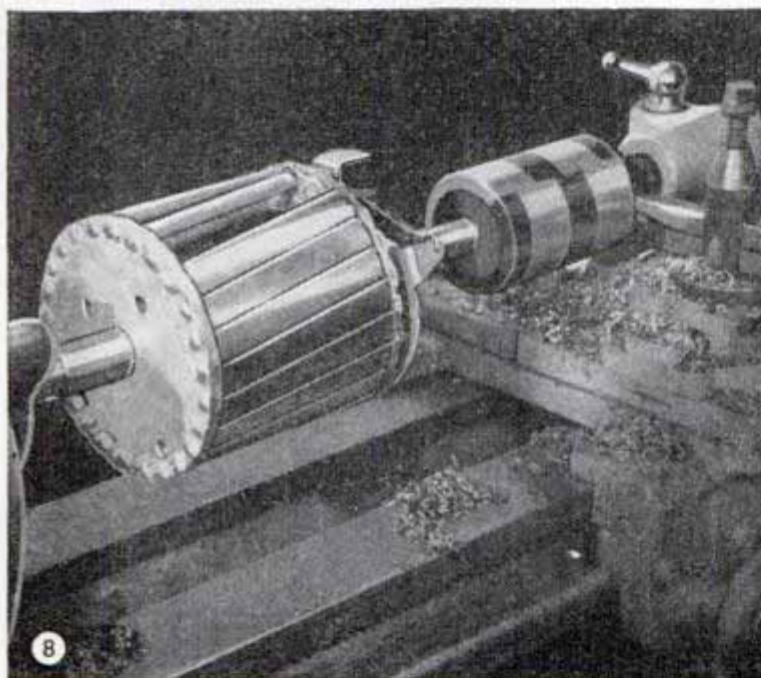
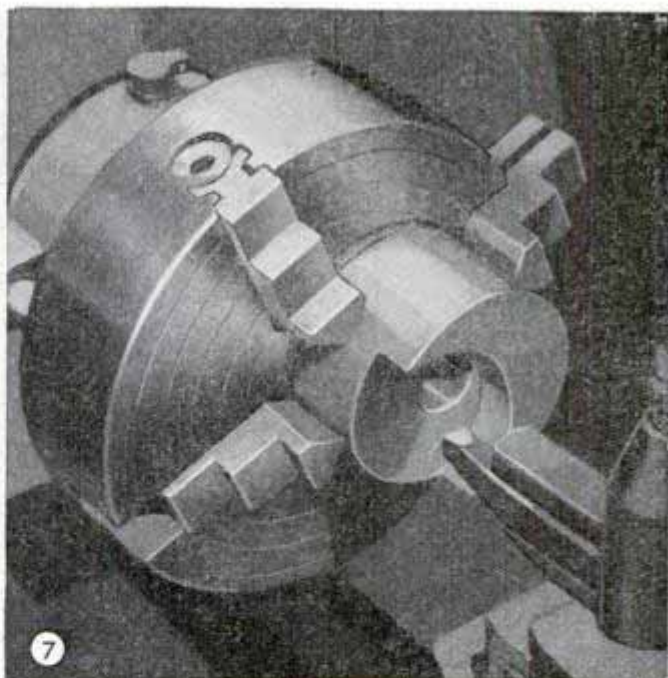
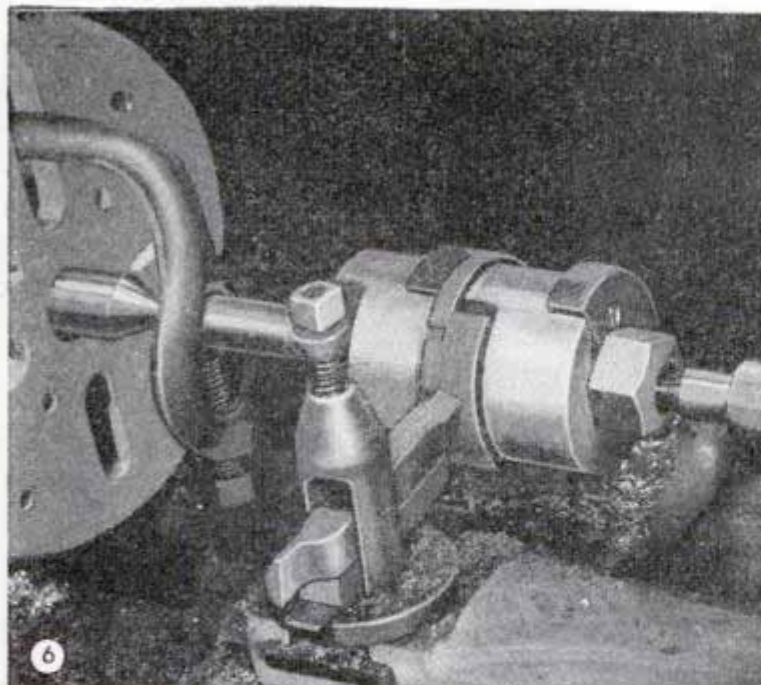
lite is used for the insulating material on the commutator, Fig. 3, which is rough cut to the dimensions given with allowances for finishing. The Bakelite tube should be made from a piece of molded rod, although it can be cut from molded sheets. Bore first, then turn to size while on the motor armature. This tube should be a snug fit.

One of the most difficult steps is building up the copper commutator segments. After boring and rough finishing, the segment is cut as indicated in Fig. 7 and the portion that is shaded is filed flat, Fig. 2. The rough-cut Bakelite segments are secured to the copper commutators with flathead machine screws, Fig. 3, and the unit is slipped over the tube. It should be an easy press fit; if it binds it will throw the commutator out of line when the locknut is tightened. This assembly is slipped on a special mandrel, Figs. 4 and 6, and turned down until all lines disappear. Then the commutator is

placed on the armature which is chucked in the lathe and a series of light finishing cuts are taken, Fig. 8. All cuts should be light, and sufficient oil should be used.

The brush assembly is supported on a bolt or rod which screws into the end bell of the motor. It will be necessary to drill and thread a hole at the proper location. Or a wooden pedestal can be screwed to the base as a support. The brushes are held between two Bakelite plates, the lower one resting on the support rod. Since the lower plate rests on the rod, a V-groove is cut down the center for a better fit. Bore mounting holes at each end of the plate, and drill and tap two similar holes in the support rod. Mount with flathead screws.

The upper plate has six shallow slots cut in it to take the brushes, Fig. 5, and it also must be drilled and tapped for the six setscrews and locknuts. Six assembly bolts are used to hold the two plates together.



The brushes are made of thin strips of phosphor-bronze spring stock built up to a thickness of $\frac{1}{16}$ in. The ends to which the wires are connected are soldered together. File the contacting end to fit the curvature of the commutator. When adjusting the brushes, remember that the pressure need be only enough to assure contact.

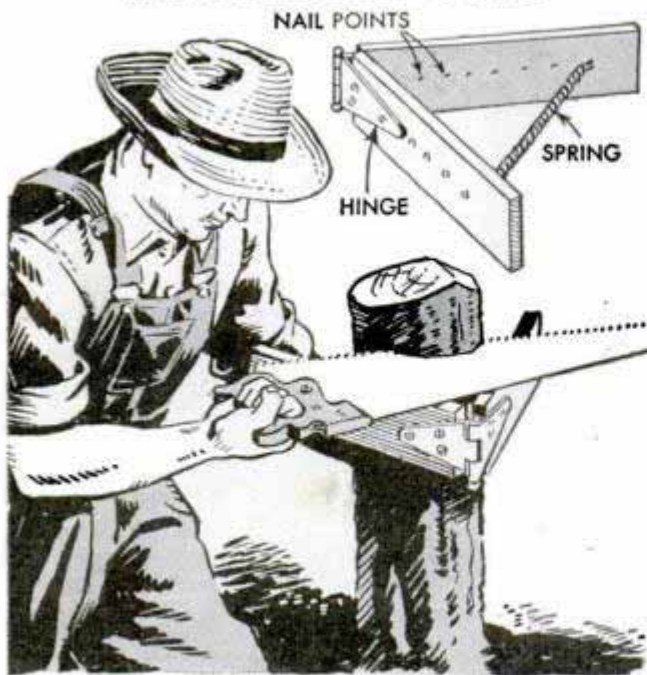
Fig. 5 shows the wiring connections and Fig. 9 shows one of the connections being made. Use stranded insulated wire heavy enough to carry the load. To secure the proper operation, the two halves of the commutator must register so the make-and-break lines are in perfect alignment. Also, to secure the correct connections, the two outside brushes should ride on the copper when the two inside brushes ride on the Bakelite and vice versa.

The polarity meter, Fig. 5, is required because a synchronous rectifier will pro-

duce positive or negative current at either d.c. outlet terminal, depending upon which half of the cycle it starts. To reverse polarity, quickly open and close the motor switch, repeating this if necessary until correct polarity is obtained. The meter is an ordinary charge-discharge ammeter of sufficient capacity to carry the load. In addition to the motor switch, there is another one which connects to the a.c. input. The terminals for this switch are connected to the line directly or through a transformer, depending upon the voltage that is desired.

When starting the unit, always turn the motor switch on first and the line switch after the motor has been operating at full speed for 10 seconds. When stopping the rectifier, always open the line switch first. Doing this avoids serious arcing. There should never be any load on the commutator when the motor is not in operation.

Tops of Fence Posts Cut Evenly With This Saw Guide



Fence posts are cut straight across when you use this guide. The two arms are held together by a strap hinge and a spring is fastened near the two ends so the guide will grip the post firmly. Nails are driven through the arms from the outside to provide additional purchase.

Balance Suspended From Pulleys Makes Weighing Easy

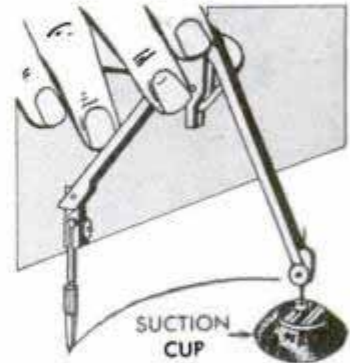
With a double pulley and bracket arrangement similar to the one illustrated, weighing a number of heavy bundles with a spring balance is made a lot easier. Instead of lifting the bundle onto the spring



balance, the latter is lowered and hooked to the object to be weighed. Then, by means of the rope, the bundle is lifted free of the ground so the weight can be read. A cleat fastened to the wall will secure the rope so the balance can be held at any convenient height.—A. H. Waychoff, Phoenix, Ariz.

Suction Cup Holds Pivot Point

When you don't want pin holes, caused by the use of a compass, to show on a drawing, a rubber suction cup can be used to hold the pivot point of the compass when drawing a circle or an arc. Should the cup have a metal stud on the top, as many of them do, drill a small hole to hold the point of the compass.



Herman Klein, Pittsburgh, Pa.

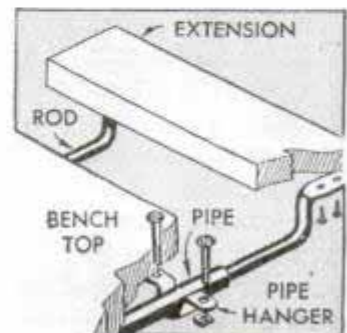
C-Clamp Brazed to Trouble Light Can Be Fastened on Joists

If a C-clamp is brazed to the cage on a trouble light, the latter can be fastened to overhead joists, beams, and exposed studding where it is undesirable to drive nails for the hook on the lamp. Only a small clamp is used.—Opie Read, Jr., Chicago.



Extension for Workshop Table

Occasionally work comes through the shop that is too long for any of the tables and, in such a case, this extension solves the problem. The top of the extension is flush with the table top and the two rods which support it slide in pipes that are fastened to the underside of the bench with pipe hangers.—Elmer Vandrey, Truman, Minn.



☐ An oilcan filled with paint can be used as a "fountain pen" to write names on sacks.



"HEAT-FORMING" PLASTICS

By Sam Brown

First plastics available to craftsmen were phenolic resins, such as Traf-ford, Catalin, Bakelite, etc. These are thermosetting—they set by heat and cannot be reshaped by bending. Recent trends in crafting have been toward the thermoplastic materials which, when heated, can be bent to almost any shape. There are various types of thermoplastics, the group most commonly available being the acrylics. Acrylics or methyl methacrylate resins are represented by such products as Plexiglas and Lucite, and are available in sheet, rod or tube form in a variety of colors

AT a temperature slightly higher than boiling water, thermo-plastic materials become almost as flexible as a sheet of rubber and can be bent or twisted by hand to almost any shape. After cooling for a few minutes, the plastic will retain its new shape. This pliability of thermoplastics permits them to be used in making many attractive articles which would be difficult or impossible to do otherwise.

Heating: The kitchen oven is an ideal heater. The tempera-ture should be held to between 220 and 300 deg. F. Many stoves are equipped with thermostatic gas control, but it's not advisable to depend on this. Best practice is to turn the gas as low as it will go, which usually will give an oven temperature of about 250 deg. The plastic sheet or strip can be placed directly on the oven grid, as shown in Fig. 1. Very small pieces can be support-ed on a sheet of asbestos paper, wood or other material. The protective masking tape is removed from the plastic before placing it in the oven. The work should be kept clean—any dirt or an undried film of water will tend to bake into the plas-tic. Heating requires 5 to 10 minutes, depending on the thick-ness of the plastic and the nature of the work.

Peg forming: One of the simplest methods of forming is to bend the heated plastic over a suitable arrangement of wood pegs, as shown in Fig. 4. Soft cotton gloves should be worn for hand comfort and also to prevent finger marking the hot plastic. The hotter the plastic is, the more pliable it will be, but it also will pick up marks more readily from any rough surface. It is good practice to wave the hot plastic sheet in the air for a sec-ond or two after removal from the oven. This will give it a



PICTURE FRAME



NIGHT LAMP



CIGARETTE HOPPER



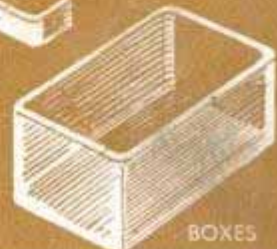
PLANT SHELF



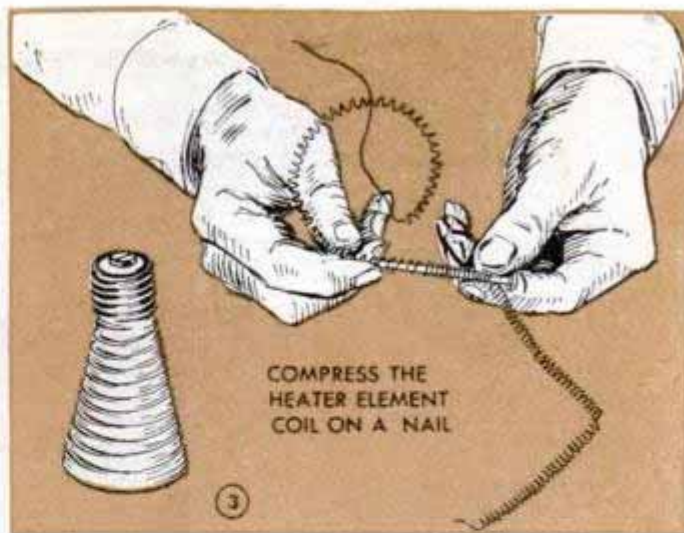
TRAY



TIE RACK

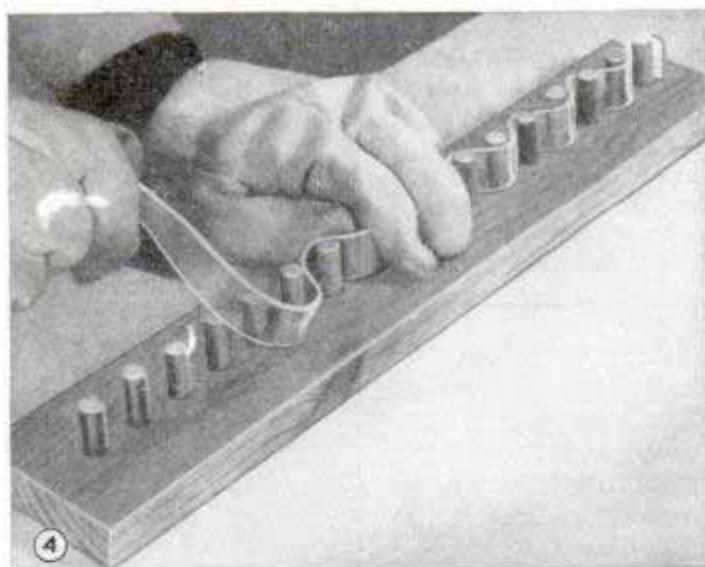


BOXES

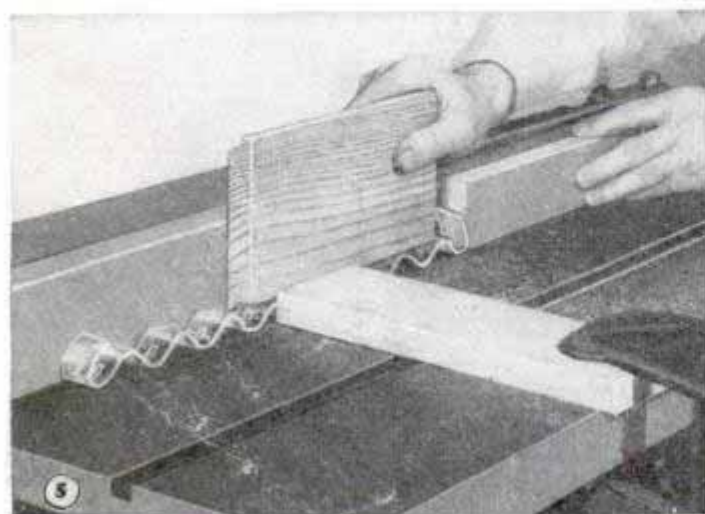


measure of surface hardness to withstand marring during handling but will not decrease its flexibility to any great extent. Whenever practical the pegs should be covered with felt or linoleum to provide smooth contact.

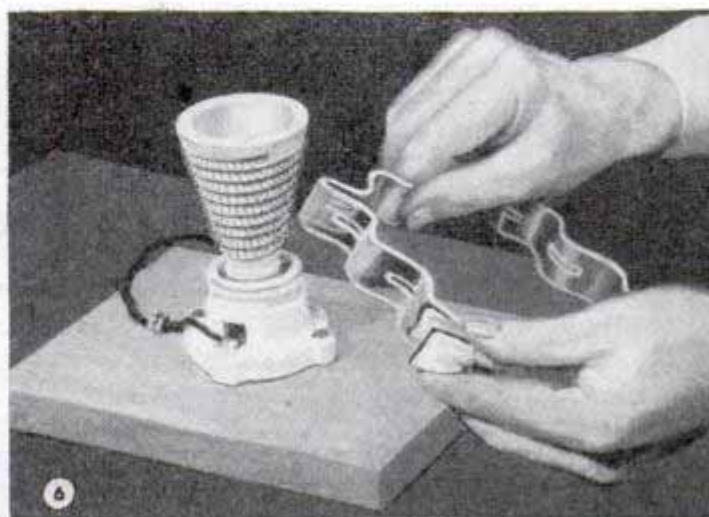
Strip heater: Some articles require heating only at certain points, the remainder of the plastic being retained in its original sheet form. For work of this kind, some type of strip heater is required. Fairly good results can be obtained with a heater element, as shown in Fig. 6. A better device, shown in Figs. 7 and 8, can be made from an asbestos shingle and a heater element. The heater element is unwound from its original core and then compressed on a nail, as shown in Fig. 3. It will be a bit long after compressing, making it necessary to jog two of the porcelain tubes through which it is fitted, as in Fig. 7. Of course, the heater could be made longer, but the one here is based on construction from a single 12 by 24-in. asbestos shingle. It is not practical to make the element shorter, as it will become too hot.



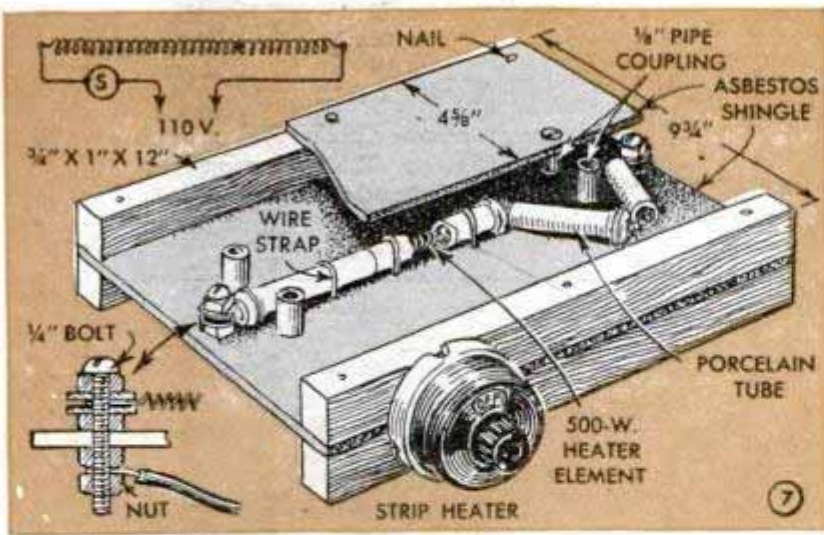
Soft cotton work gloves should be worn to protect hands and prevent finger marks when handling the hot plastic



As a safety precaution, use a hold-down and pusher blocks when machine-sawing grooves in small pieces of plastic



Localized heating for secondary bends can be provided by a heater element. Gloves need not be worn



Many projects require only corner bends. The electric spot-heating device shown above concentrates heat only where the bend is to be made, permitting sharp corners to be formed as shown at the right

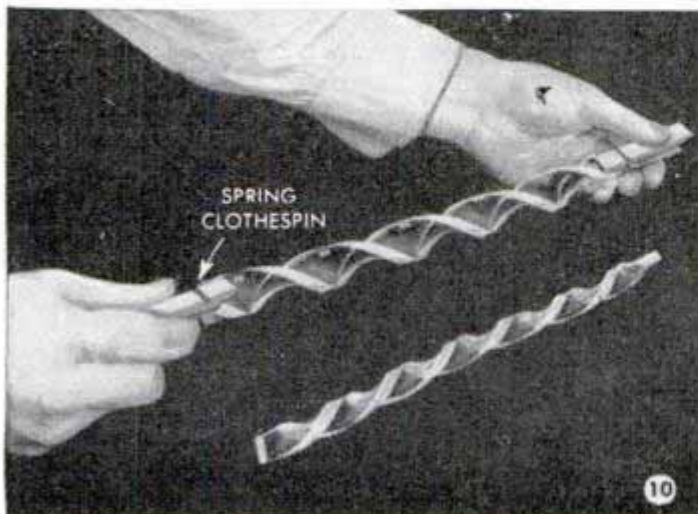
Twists: Ropelike twists are formed freehand after heating the plastic all over in an oven. A spring clothespin attached to each end facilitates bending, as shown in Fig. 10. The pins can be clipped to the plastic immediately after removal from the oven, or the clothespins can be attached before placing in the oven. In any case, the pins will mark the plastic slightly. The marks, being at the ends, can be cut off if objectionable.

Flat-strip forms: The flat-strip form is the most common jig for bending plastic strips. A typical example is the bud vase, Fig. 13, which is bent as in Fig. 12. Note that the end curve is pressed down with a cloth-padded wood block. Another example is the pin-up lamp shown in Fig. 15. The

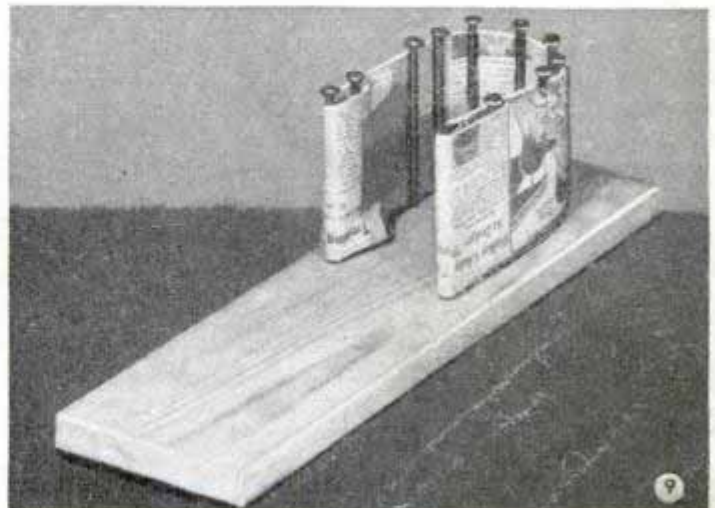


form for this, Fig. 14, has a groove to hold the starting curve and the balance of the work follows the line of the form with the final curve being held by a wood block. No pressure is required at any time in the bending of thermoplastics; the only purpose of the form is to supply the correct shape. Sanded wood forms are used.

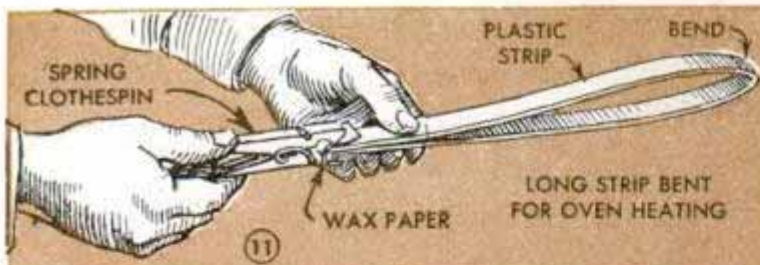
Sometimes more complicated forms are cast in plaster. Complicated jigs are not



Attractive ropelike twists are formed easily by hand after the plastic has been heated in an oven

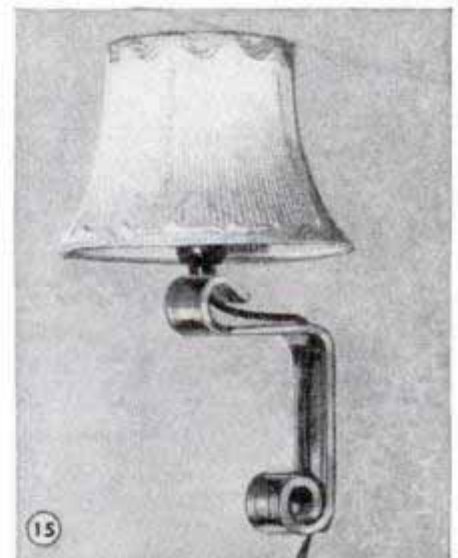
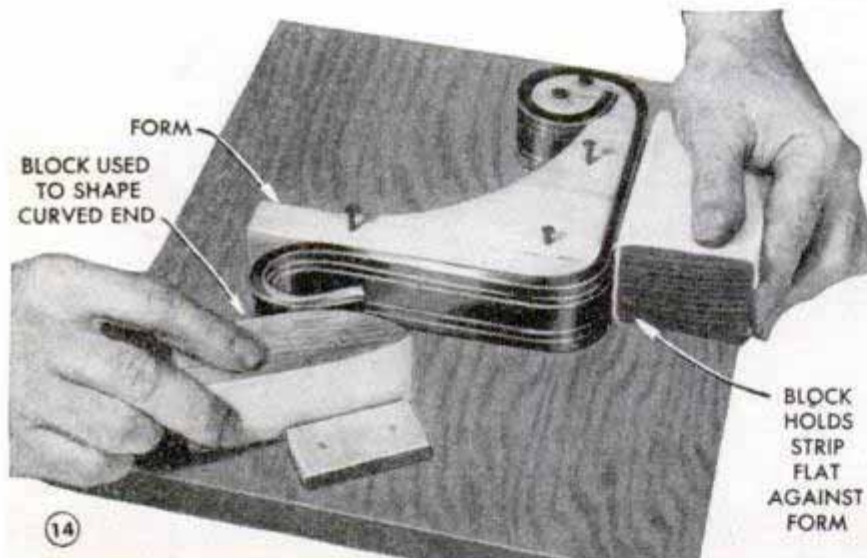
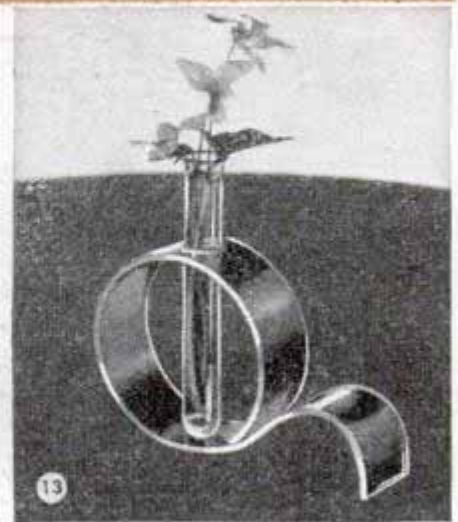
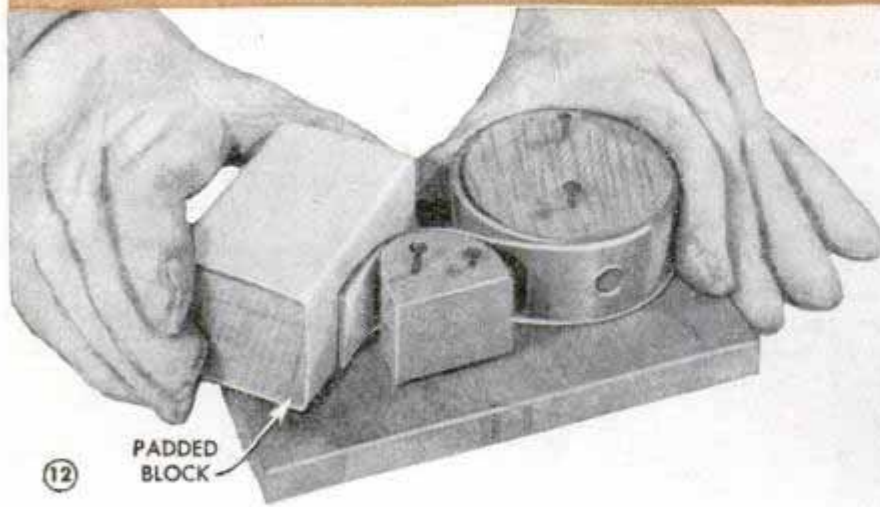


Simplified forming jigs can be made by driving nails into boards and padding them with bands of folded newspaper



Flat-Strip Forms

This is the most common and useful method of forming flat strips. The form usually is of wood, well sanded and covered with cloth

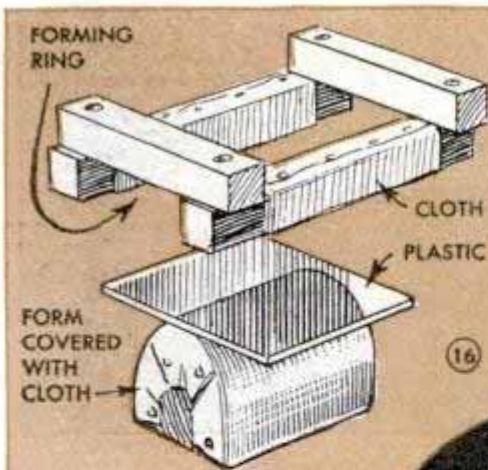


shown here but it will be apparent that certain projects requiring long strips and many bends will demand some ingenuity in making a form which will provide the proper shape and permit rapid working. In some instances, the strip required will be longer than can be accommodated in the oven. In this case, apply heat locally at the center of the strip and then clip the ends together with a spring clothespin, using waxed paper at the joint to prevent sticking, as shown in Fig. 11.

Half-cylinder form: The best method of working this much-used bend is illustrated in Figs. 16 and 18. The form should be a bit deeper than the work requires and should be covered with soft cloth, such as outing flannel. The forming ring is made to fit snugly over the combined form and plastic, as can be seen in Fig. 17. This method is particularly suited for production work.

When a single piece is being made, the form alone is sufficient, the plastic being formed by hand, as in Fig. 19, or by means of cloth-covered wood blocks which are pressed against the work. If the curve is not a complete half circle, the "sprung" method of forming, Fig. 20, is useful. All you do here is snap the hot plastic sheet in place between the retaining side pieces.

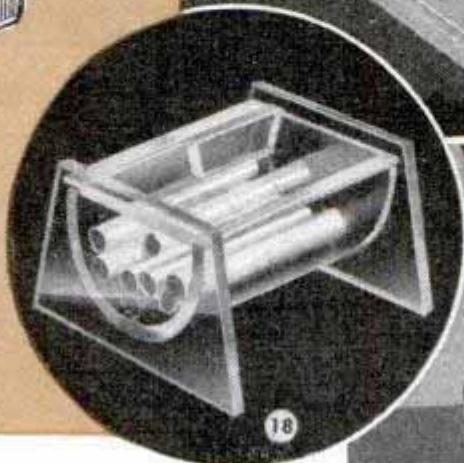
Machine operations: Bent plastics pose a problem as to whether machine operations should be done before or after bending. In some projects such as the bud vase, Fig. 13, and lamp, Fig. 15, the necessary holes can be drilled after the piece is formed. Craft workers favor this method because it permits exact placement of holes. The form itself can be used in most cases as a holding device and base block. Production workers favor doing machine work while the plastic is "in the flat." This



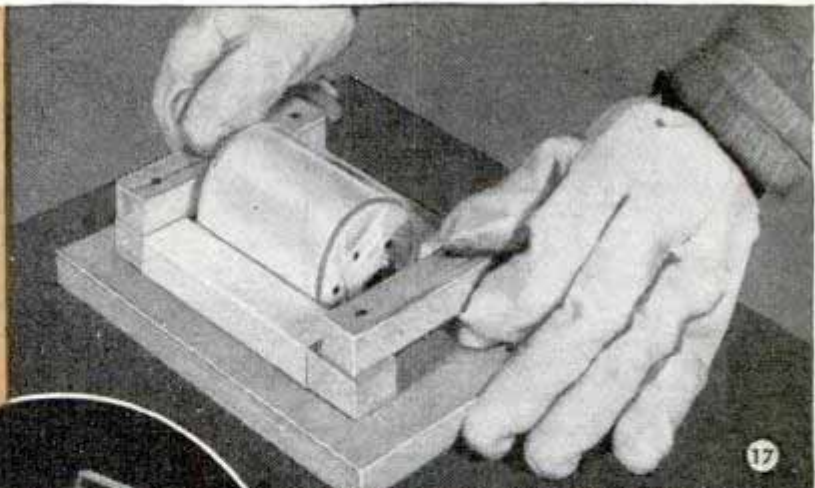
16

Half-Cylinder

This type bend is used for many projects. Cleanest method of working is with forming ring. Two other methods also are shown

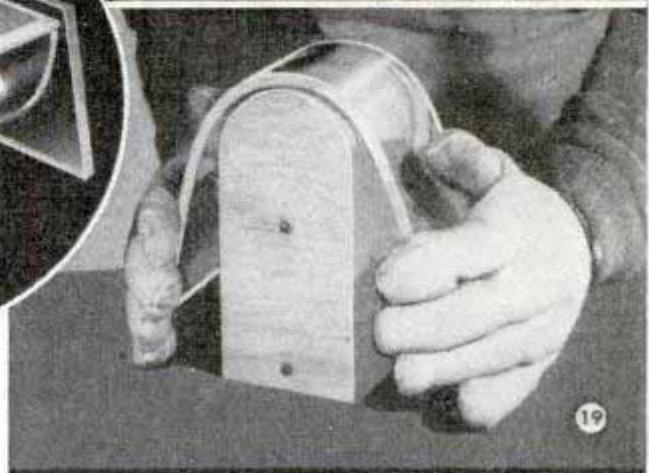


18



17

RING METHOD OF FORMING HALF CYLINDER



19

BENDING HALF CYLINDER SHAPE OVER FORM



20

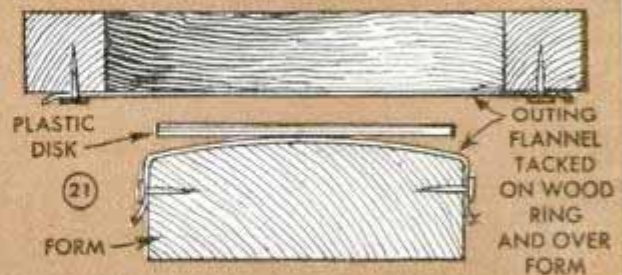
"SPRUNG" METHOD GIVES GOOD RESULTS

method demands an initial bending of the piece to determine position of machine cuts. Once the right setup has been made, the work progresses quickly and accurately on repeat work. On pieces like the picture frame, Fig. 2, there is no choice but to machine the slot for the glass after the bends have been made. However, if the full frame shape is bent, it will be difficult to make the cut. Hence, the best practical solution is to bend the piece in a continuous strip, as in Fig. 4, after which it can be slotted, Fig. 5, and finally brought to the required shape by local heating and bending, as shown in Fig. 6.

Stretch forming shallow forms: Shallow three-dimensional forms such as curved crystals for clocks are best worked with



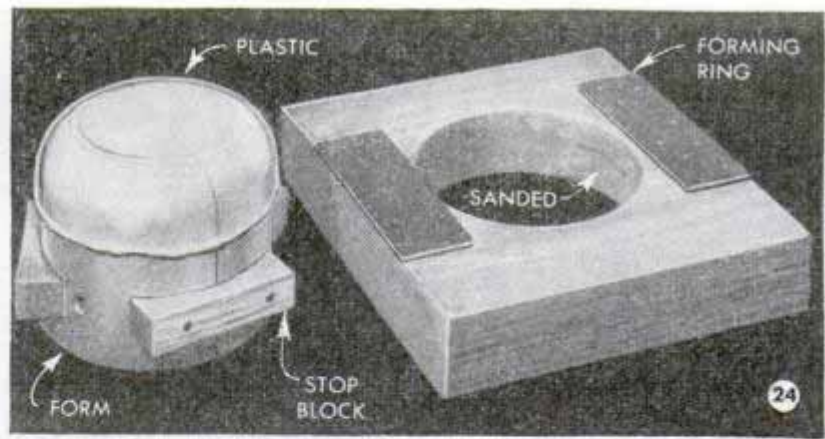
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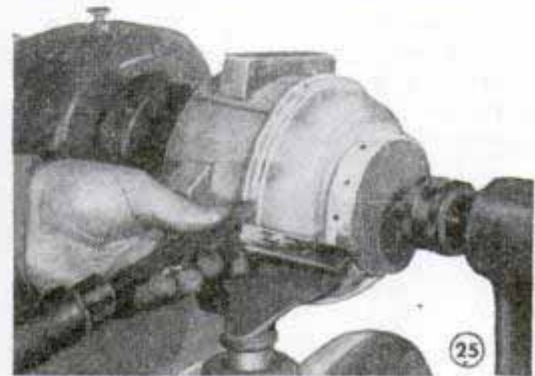
Stretch Forming

Cloth-ring method is most useful way of working and does perfect work on moderate curves. Form must be covered with cloth to prevent marring



Stretch Forming Deep Forms

A close-fitting wooden ring permits drawing to about 1½ in. in a 5-in.-diameter dish. "Wrinkled" edge is later cut off by mounting form in lathe as shown below



the cloth-ring method shown in Figs. 21 and 22. This method does perfect work and can be used for a wide variety of shallow forming. If the bend is fairly deep, the cloth should be proportionately loose.

Stretch forming deep forms: Deep stretch forming requires a more positive shaping device than can be obtained with a cloth ring. A typical setup for forming a dish is shown in Fig. 24. The form preferably should be covered with cloth or flocked, the latter consisting of shredded cloth applied to the wood over a sticky binder coating. The forming ring should be the exact shape of the widest part of the form, plus the double thickness of the plastic, and the starting edge of the forming ring should be sanded round to prevent tearing the

plastic which is heated to a temperature slightly higher than usual and then centered over the form. A single or double layer of soft cloth is placed over the disk, after which the forming ring is placed in position and pushed down to the limits of the stop blocks. Some deformity at the edges always results, but if an inch is allowed for trimming, very deep draws can be made easily by this method. Fig. 25 shows the dish being trimmed on the lathe after forming. One nice thing about bent plastics is that if you miss on the first attempt, all you have to do is replace the piece in the oven and start over again. Thermoplastics will stand repeated heating and bending without harm, and each time the work is heated it will return to its original shape.

Spring Water Piped to Covered Stock Tank Will Not Freeze Easily



Spring water is piped to this concrete stock tank, which is covered so that the water will not freeze so quickly. At the extreme left there is a small shed for hogs which keeps their waterer separate from the one used by cattle and horses. This arrangement also helps prevent the hogs from being trampled by the larger animals.

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

☛ Tooth paste will substitute for tripoli or polishing rouge on many plastic materials.

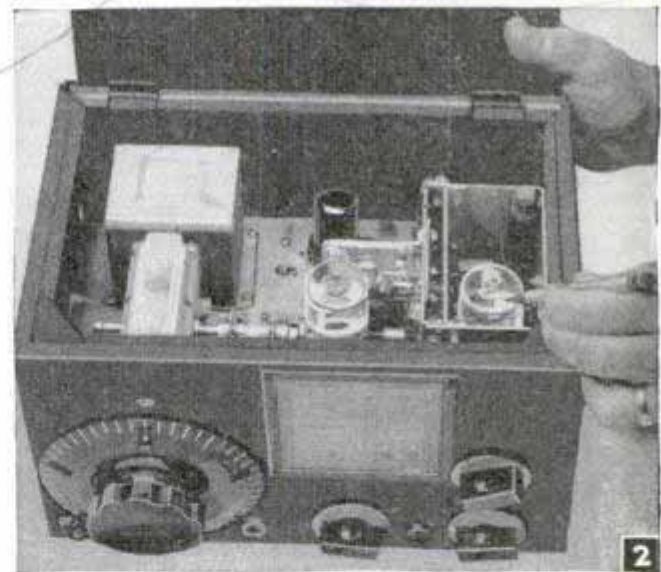


Getting Started on the VHF Bands

INCREASING activity on the very-high-frequency bands is to be expected for several good reasons. There is plenty of room on the new 6-meter band and definite evidence of good distance (DX) when skip is on. In other words, with low power on the 6 and 10-meter bands many amateurs are working surprising distances, while others with high power on the congested 75-meter phone band are having difficulty in contacting comparatively close stations through the heavy interference.

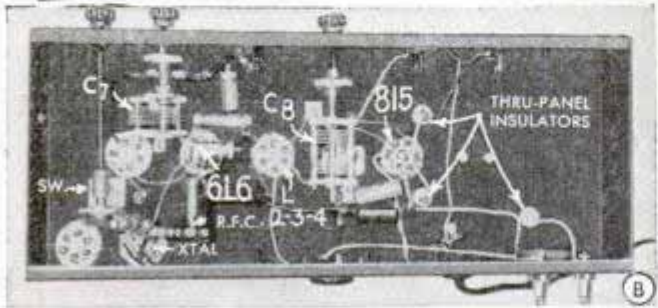
Equipment of improved design now available for the experimenter in the VHF bands includes special receivers and various types of directional antenna arrays such as the 3-element beam for the 2-meter band shown in photo 1. This consists of a director and reflector; the driven element is a folded dipole. The average gain, front to back, is claimed to be about 30 decibels. It comes complete with mast, crossarms, insulating blocks and adjustable deck flange, and may be manually rotated. This VHF beam antenna is fed with 75-ohm Amphe-nol twin-lead transmission line. The VHF receiver illustrated in photos 2 and 4 is an improved superregenerative type that covers all wave lengths from 1 to 11 meters. Especially designed for operation in these bands, it is unusually compact and suitable for either fixed or portable operation. All bands are covered with the highly efficient plug-in coils shown in photo 3; these coils are located as indicated in photo 2 and are readily accessible for interchanging. Each band is accurately calibrated on the chart, which is mounted on the panel.

A National type 5886 power supply unit and 8-in. PM dynamic speaker complete this assembly which is designed to operate from a 115-volt a.c. supply line. Batteries can be used for portable operation.



..... FIFTY-WATT TEN-METER

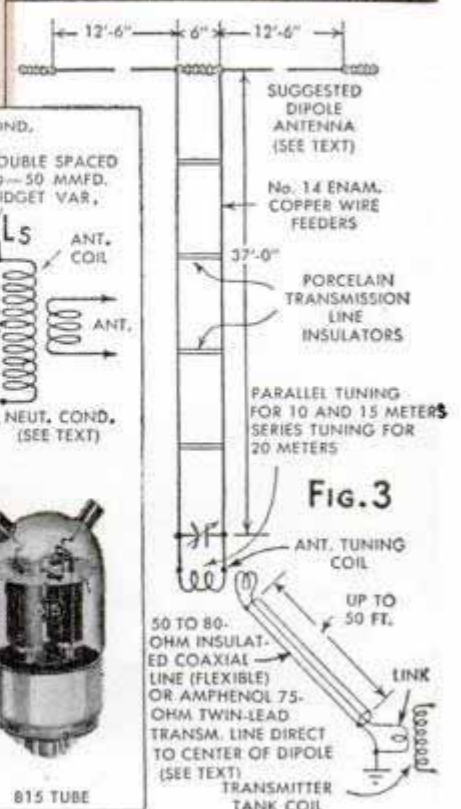
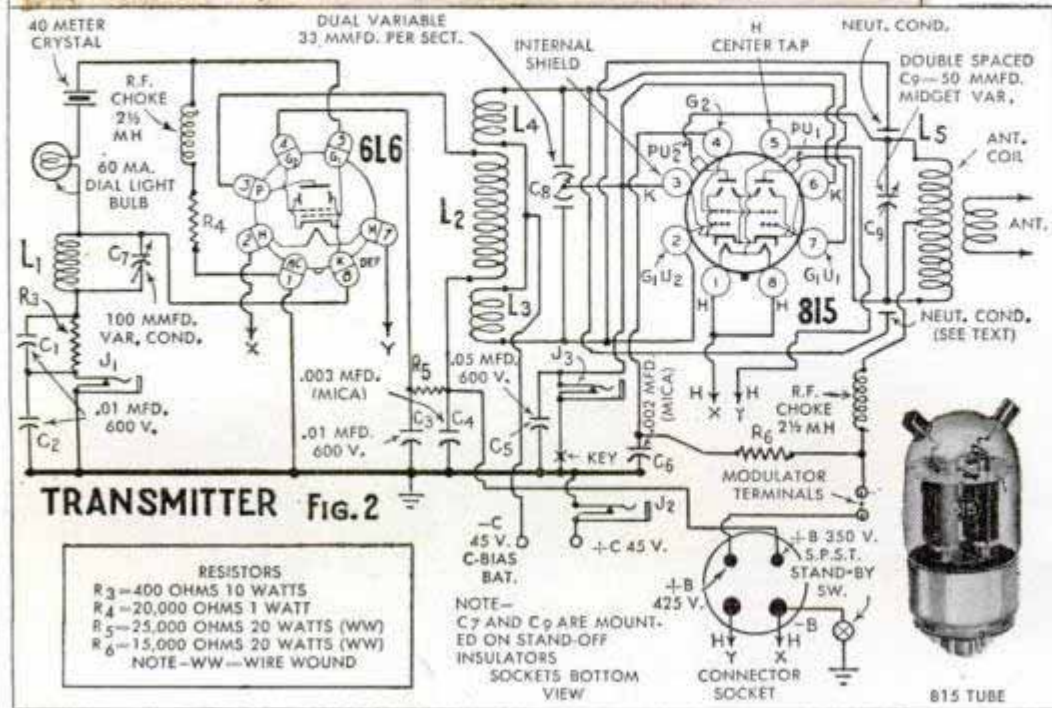
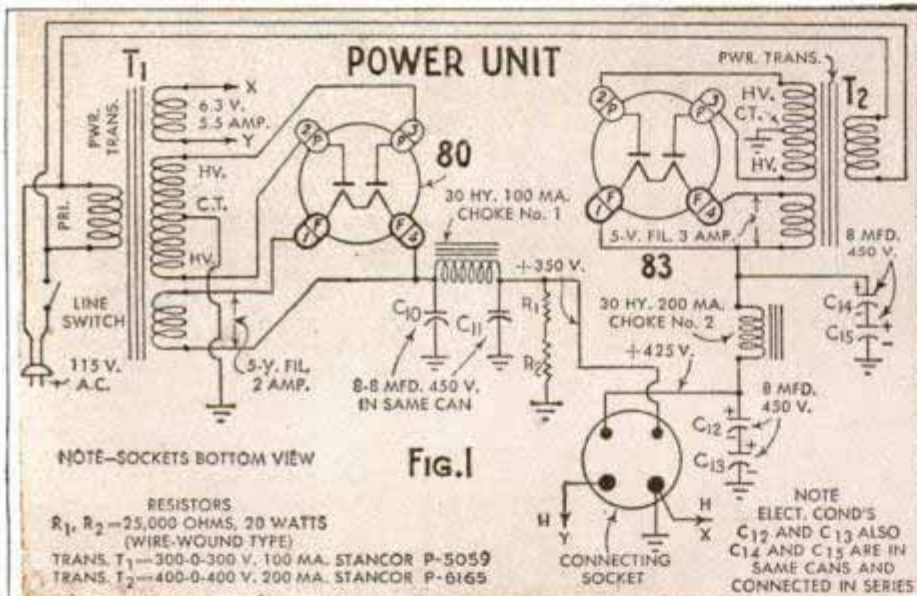
By S. A. Johnson—WØLBV



ALTHOUGH only four tubes are used in this compact 2-unit transmitter, it is capable of approximately 50 watts output on 10 meters—enough to give a transmitting range of 2000 to 4000 miles when connected to a suitable antenna. As illustrated and described, it is a complete CW transmitter that can later be converted into a 45-watt radio phone rig simply by adding a good 20 to 30-watt modulator unit.

Designed primarily for operation on 10 meters, it may also be used on the other ham bands merely by changing the coils and crystal. This not only provides a good flexible rig for the newcomer with his brand-new ham ticket, but it is also a keen performer that will please any amateur radio operator.

A schematic circuit diagram of the "twin" power unit appears in Fig. 1, and the 2-tube transmitter unit circuit diagram is given in Fig. 2. This transmitter uses a 6L6 tri-tet oscillator and the type 815 dual-beam tube as a class C amplifier; the 815 tube requires very little neutralizing even on 10 meters. The circuit is simple and employs a minimum of parts, as will be noted in photos A, B, C and E.



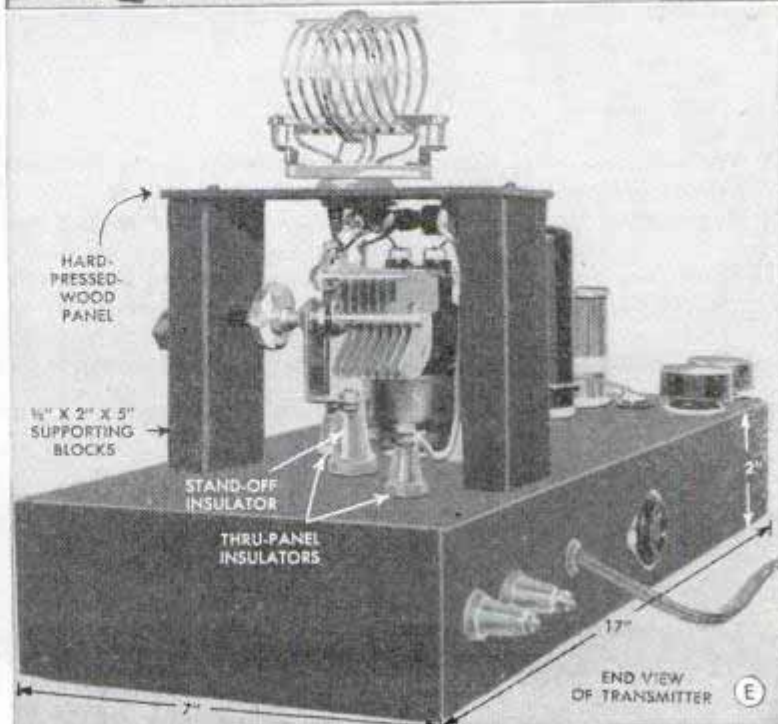
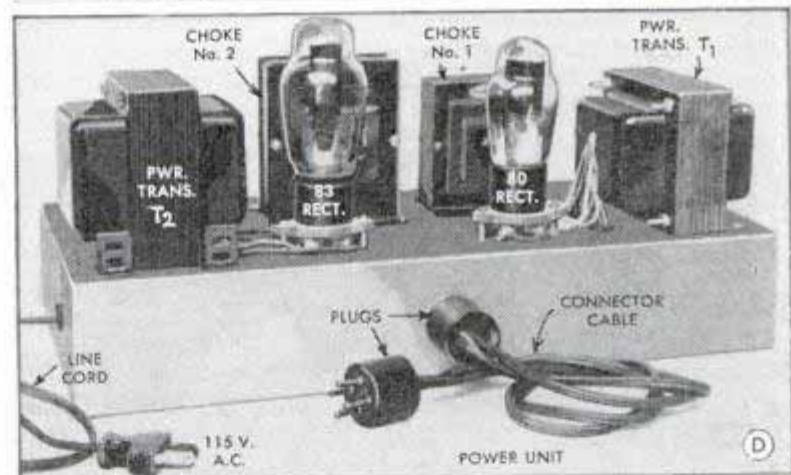
TRANSMITTER FOR BEGINNERS

The 2-tube power unit is shown in photo D.

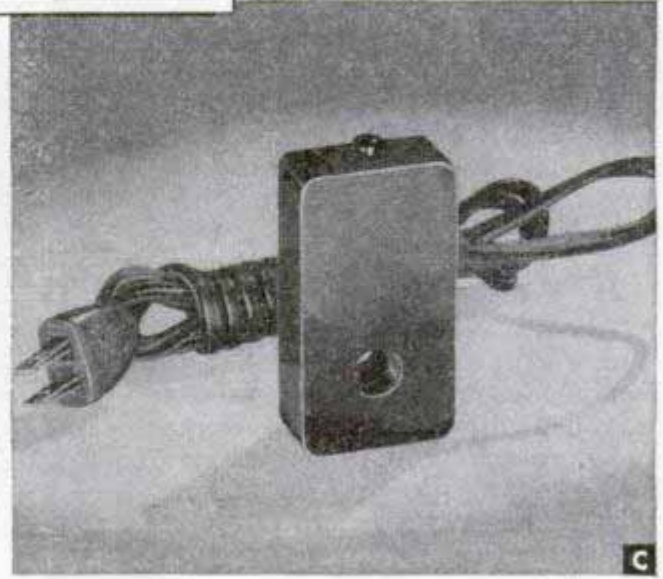
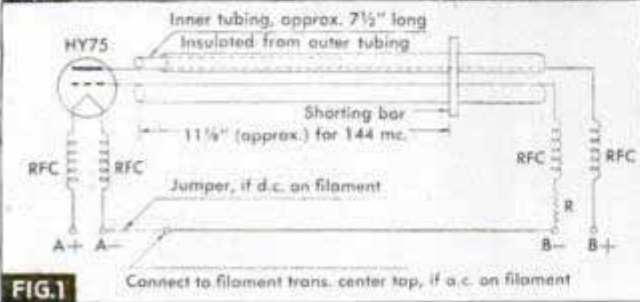
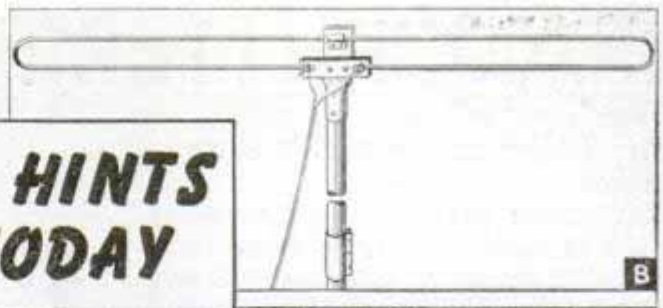
A black crackle-finish chassis base is used for the transmitter. This is a standard size chassis 2 in. high, 7 in. wide and 17 in. long; it can be used in a relay rack later if desired. A chassis base of similar size is employed for the power unit. It will be noted that insulated shaft couplings are used on variable condensers C_7 and C_8 , also on the final tank tuning condenser C_9 that is mounted between the upright wood supporting blocks on top of the chassis base. The extension shafts are short lengths of $\frac{1}{4}$ -in. Bakelite rod; the stand-by switch is an s.p.s.t. rotary type in series with the negative B lead. It is mounted on a bracket near the crystal socket, with a bushing and extension shaft brought out to a control knob at front. Coil L_1 consists of 8 turns of No. 22 d.c.c. wire close-wound on a plug-in form $1\frac{1}{4}$ in. in diameter. Coils L_2 , L_3 and L_4 are wound on a polystyrene low-loss 6-prong plug-in form $1\frac{1}{2}$ in. in diameter; coil L_2 consists of 5 turns of No. 22 d.c.c. wire spaced to occupy $\frac{1}{2}$ in. in the center of the form. Coils L_3 and L_4 consist of 3 turns of the same size wire spaced to occupy $\frac{1}{4}$ in. on the form. They are wound on each side of L_2 and are spaced $\frac{3}{16}$ in. out from it. Amphenol coil dope is used to hold all coil turns in position. Coil L_5 is a Barker-Williamson 50-watt 10-meter plug-in center-tap type with center link fitted with a standard 5-prong steatite base. This coil fits into a standard ceramic 5-prong-tube socket.

When all wiring is completed, the oscillator should be tested first. A flashlight bulb connected to a small loop of wire should glow when coupled to the combination oscillator plate coil and amplifier grid coil when the latter is tuned to 10 meters. In order to obtain maximum output from the oscillator, it may be necessary to experiment with the number of turns on coil L_1 . Although the 815 tube requires practically no

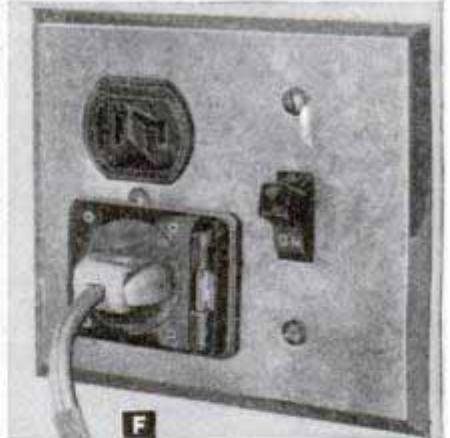
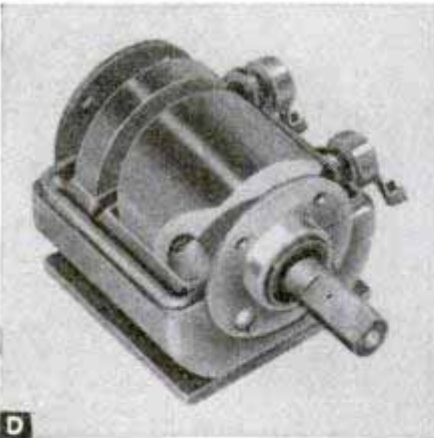
(Continued to page 248)



RADIO HINTS FOR TODAY

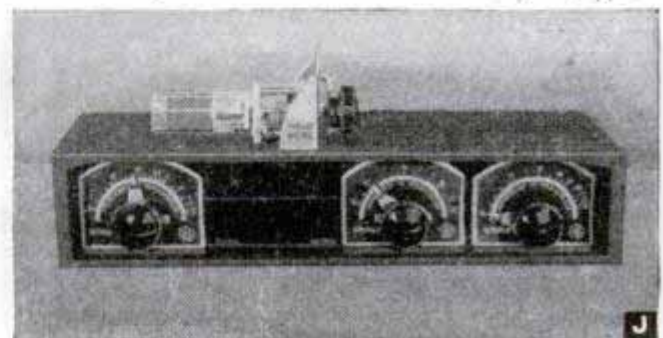


(A) Carefully engineered to make it easy to duplicate results, this efficient 1/4-meter linear oscillator is available in kit form for measurements and classroom demonstrations. It employs a type HY75 tube in the circuit shown in Fig. 1. (B) Directional folded dipole antenna for improving FM reception in areas of low signal strength. (C) Demagnetizer for small tools; they simply are passed through the hole in the field block



(D) Variable condenser claimed to eliminate acoustical feedback employs barrel-cam rotor instead of plates (E) Retractable slide mechanism permits 3-position inspection of National receiver in flush-wall installation (F) Plug-in pilot light for standard electric outlet or socket; neon light indicator shows appliance on or off

(G) Plastic stand-off insulator for 300-ohm twin-lead transmission line keeps line at fixed distance from any surface. (H) Shockproof plastic radio pliers. (J) Absorption wave meters available in many ranges. These handy frequency meters can be poked into small shield compartments, coil stages and corners to check harmonics and for similar applications, thus enabling the experimenter to find out exactly what is "going on" in the circuit



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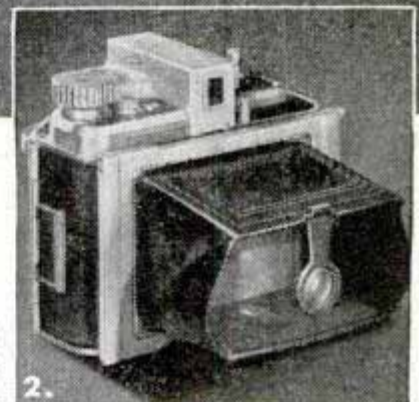
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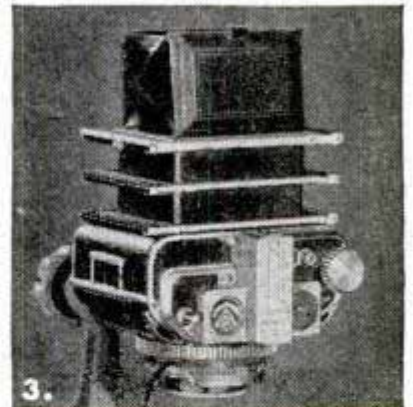
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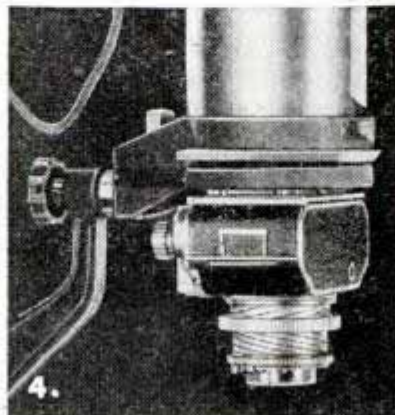
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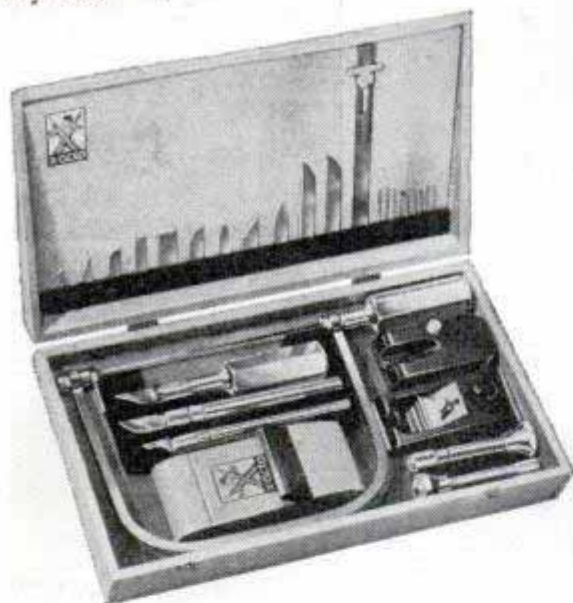
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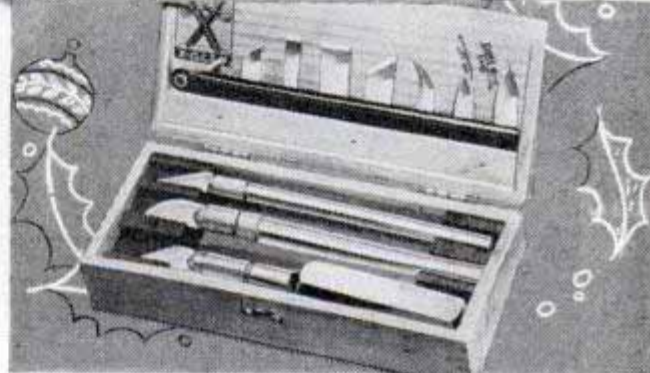
Hobby New Year

X-ACTO KNIFE AND TOOL CHESTS

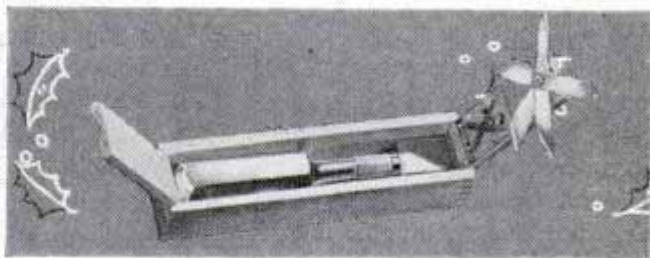
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at vital points lengthen life.
- 4 BACK GEARS ENCLOSED
IN HEADSTOCK**
with shifter rack safely and conveniently
at your finger-tips.
- 5 RUBBER CUSHIONED COUNTERSHAFT**
for smoothness and accuracy in working
area.
- 6 THREE POINT SUPPORT**
Steadies the countershaft, prevents
rocking.
- 7 ENCLOSED BELTS, GEARS, PULLEYS**
Prevents accidents. Keeps lathe clean.
- 8 AUTOMATIC BELT TENSION RELEASE**
Makes belt changing easy and safe.
- 9 PRECISION BUILT THROUGHOUT**
For tool room accuracy in your shop.

The qualities which make the Logan Lathe a successful industrial tool are equally effective in the small shop. The wide variety of operations which can be handled on one Logan Lathe is an important advantage to the small shop owner. Designed for compactness as well as for efficiency, the Logan Lathe occupies a minimum of floor or bench space. The ball bearing mounted spindle requires no adjustment from 30 to 1450 rpm and permits use of high speed carbide cutting tools. Conveniently located levers and hand wheels enable the operator to work in safety and comfort and without fatigue. Rugged construction throughout, and self lubricating bronze bearings at vital points insure lasting accuracy and low maintenance.

WRITE FOR THE LOGAN CATALOG ...complete illustrated descriptions of Logan Lathes, Shapers and Accessories. LH-9

LOGAN ENGINEERING CO., 4921 LAWRENCE AVE., CHICAGO 30, ILL

**Thread pipe
faster, with less
bother, with these
smart, handy, little**

**RIGID
RATCHET
THREADERS
Nos. 00R and 111R**

Heads snap in
either side...
can't fall out



● With one of these efficient and tough little steel-and-malleable threaders at hand, pipe from $\frac{1}{8}$ " to $\frac{1}{4}$ " is quickly perfectly threaded. Die heads with heat-treated tool-steel chasers snap in from either side, can't fall out. No special dies are needed for close-to-wall threads. Smooth internal ratchet. No. 00R, $\frac{1}{8}$ " to 1"; No. 111R, $\frac{1}{8}$ " to $\frac{1}{4}$ ". Handy, fast, durable—try one and you understand their growing popularity. Ask your Hardware Store or your Supply House.

RIGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

Bootmaker for the Stars

(Continued from page 148)

Joe learned long ago not to be surprised at strange orders. Harpo Marx wanted oversize shoes, one of which could double as a dustpan. Edgar Bergen asked for several pairs of shoes for Charlie McCarthy. Victor Mature needed caveman's footwear for "One Million B.C." Tom Tyler wanted winged shoes for "The Bat Man."

Joe turned out high lace black shoes for a monkey. He built shoes for a gorilla costume, complete with toenails, and lion's feet with claws of leather.

A studio wanted Dutch shoes which wouldn't click against a hard floor. Joe came up with shoes which looked exactly like wooden shoes, but were made of thickly padded soft yellow leather.

For hurry-up odd jobs, Joe keeps strange materials handy. At any moment he may need feathers, fur, cloth, rubber, snakeskin, alligator hide, embroidery or jewels. He uses quantities of calfskin, horsehide, sheepskin and kid.

For color movies, he must supply color-corrected shoes. To do that, he matches colors with samples supplied by studio technicians. He keeps a stock of colored leathers—almost every shade under the sun. Sometimes he must mix his own dyes.

The biggest feet in Hollywood, by Joe's measurement, are the size 13 extra-wide feet of Victor McLaglen. Cornel Wilde wears $12\frac{1}{2}$, bigger than Wallace Beery's $11\frac{1}{2}$ quadruple E.

June Haver and Lily Pons tie for having the smallest feet Joe ever fitted—size 3.

Joe's idea of a perfect rest is to spend a day at the beach where every one is barefooted. That way, he says, he's not reminded of his work.

How Good a Driver Are You?

(Continued from page 175)

The test to determine whether a person is color blind is comparatively simple. The candidate is shown disks filled with a patchwork of variously colored spots and dots, some arranged to form numbers. Asked to name the numbers, almost all persons pass this test. Color weakness occurs in one woman out of 250 and one man out of 25, but complete color blindness is very rare.

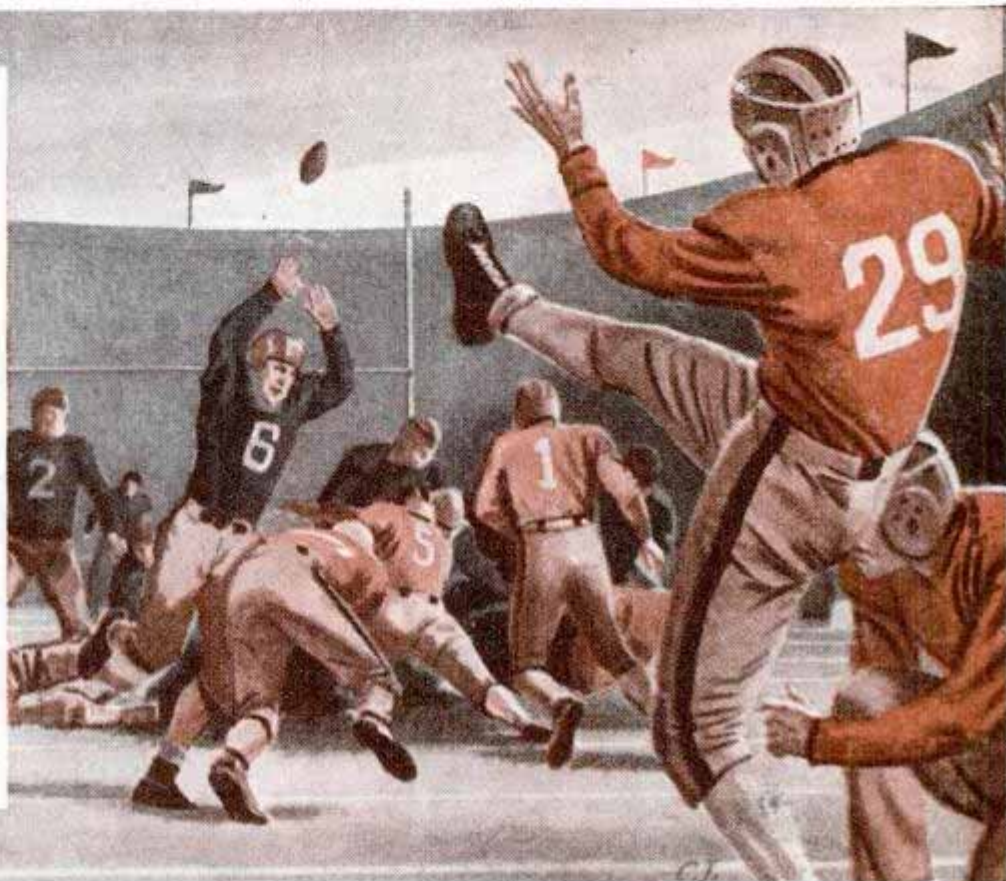
Another eye test is for peripheral vision—ability to see objects at a considerable distance to the right or left while looking straight ahead. Two examinations with a half-circle device are given and averaged. The driver should see the object at 85 or 90

(Continued to page 240)


NEW "EVEREADY" FLASHLIGHT BATTERY LASTS 93% LONGER!

Tiny cell packs
enough ENERGY to
kick 186 field goals

Like football? Like to sit breathless while the Big Team goes into kick formation for a last-minute try? Then here's news: The great new "Eveready" flashlight cell NOW has energy equal to that used in making 186 big-time field goals from the 25-yard line! Extra power makes "EVEREADY" batteries the All-American choice for brilliant, lasting, low-cost light!



THE NEW "Eveready" flashlight cell literally *blasts* darkness with a dazzling beam of powerful white light. And does it for nearly *twice* as long as famous pre-war "Eveready" batteries. Because this new cell packs *93% more energy!* Service from "Eveready" flashlight batteries is nearly *doubled*... yet you *pay no more* for this far greater value! For longer life of brighter light... get these new "Eveready" flashlight batteries!

The registered trade-mark "Eveready" distinguishes products of
NATIONAL CARBON COMPANY, INC.
30 East 42nd Street, New York 17, N. Y.
Unit of Union Carbide  and Carbon Corporation

Nearly *twice* the electric energy... almost *two times longer* life of brilliant white light than even famous pre-war "Eveready" batteries... at no extra cost. *That's* today's *high-energy* "Eveready" battery, as proved by the "Light Industrial Flashlight" test devised by the American Standards Association.

93% MORE ENERGY



High Energy MEANS
BRIGHTER LIGHT, LONGER LIFE

EVEREADY
TRADE-MARK
FLASHLIGHT BATTERIES





REWARD

Faster action, better results with a Stanley Screw Driver

You'll get the reward an earnest craftsman deserves every time you use a good Stanley Screw Driver. It's a simple tool—but in every small detail, there's a superiority that you'll note and respect and prefer every time you use it.

Stanley No. 25 Screw Driver has polished blade of alloy steel tempered the entire length. Patented bolster construction securely anchors blade in hardwood handle. Tips are accurately crossground to size. Handle is correctly fluted for good grip. You'll find every needed size and type of screw driver in the extensive Stanley line.

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City State

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"How do you know it's a good saw, Dad?"



DAD: Well, here's the main reason, son—look at this name on the blade.

SON: Say, I've seen that name before—lots of times.

DAD: Sure you have. It's one of the best-known brands on the market, and men who buy saws have confidence in it.

SON: Does a name really mean that much?

DAD: It means plenty, son. When you buy branded merchandise—tools and hardware that carry the names of reliable manufacturers—then you know you're getting high quality.

SON: But some places sell tools with no

names at all. Or names you've never heard of.

DAD: I know they do. That's why I buy all *my* tools here at Bill Parker's hardware store. Bill carries all the well-known brands you can trust—and that's the only kind I want anything to do with.

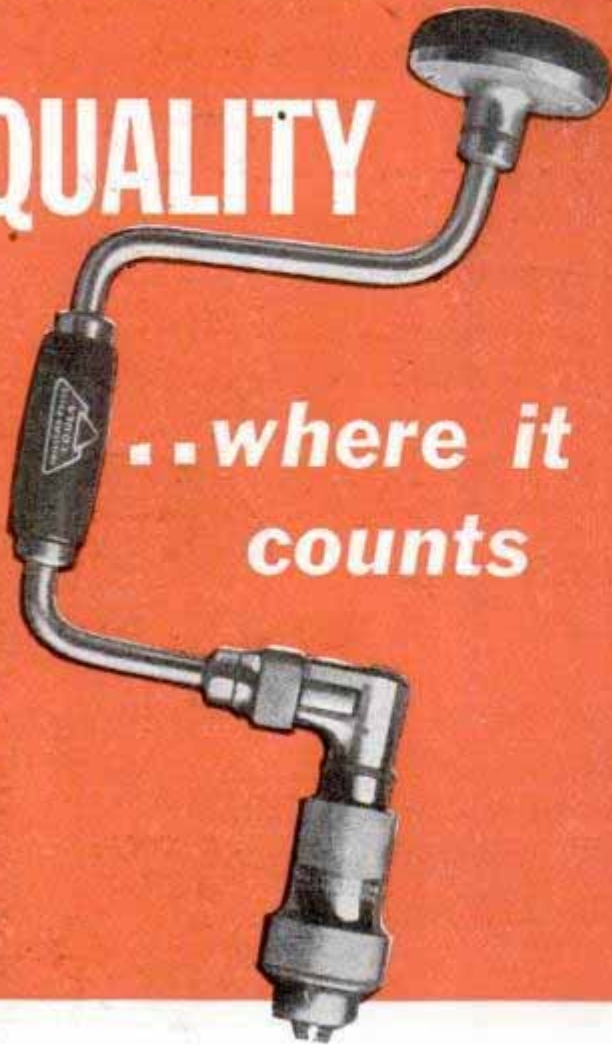
*Your **HARDWARE DEALER**
sells **QUALITY** tools and
hardware. Buy from **HIM**.*



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...where it
counts



Millers Falls Braces are best for craftsmen because these quality features count for greater ease of operation, many *more* years of trouble-free service —

- Ball bearings at every point of wear
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- Finely-finished hardwood head and handle
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The sturdy construction of **Millers Falls Braces** is recognized and preferred by professional carpenters everywhere. It can serve *you* as well. Be sure to ask for **Millers Falls Braces** when you see your hardware dealer next.

One Thing in Common — QUALITY!



MILLERS FALLS COMPANY
GREENFIELD, MASSACHUSETTS

degrees. Peripheral vision of 70 degrees or less for either eye would definitely handicap a driver.

To test whether a driver can judge distance accurately the AAF employs a string-operated device similar in principle to the depth perception tester used for aviation cadets. Good depth perception is necessary in overtaking and passing another car, turning in traffic, parking in small spaces and in judging the sizes and distances of objects ahead.

The final psycho-physical test measures the time it takes a driver to move his right foot from the accelerator to the brake pedal after a red light flashes. The average time required for a person to move his foot from the accelerator to the brake—after seeing the red light—is from $\frac{30}{100}$ to $\frac{41}{100}$ second.

Tests taken up to this point reveal a driver's deficiencies which can be compensated for, to a certain degree, by cautious driving. An important factor is that shortcomings are brought to the attention of the driver so he can exercise additional care.

In addition to these tests, the AAF puts its drivers through tough driving tests including one in which the candidate has to zigzag in and out around a line of wooden stanchions and then back the vehicle through the same course. If a fellow drives too slowly he is penalized, but if he tries to set a speed record and knocks over several posts he fails to pass the exam.

Drivers' test equipment similar to the AAF apparatus may be bought or borrowed from the American Automobile Association by truck fleet owners, schools, civic and other organizations interested in safe driving. Inquiries should be addressed to the association, Washington 6, D. C.

Like the AAF, the state of California has an effective series of drivers' tests and their effectiveness is increased by repetition. Drivers repeatedly involved in auto accidents are given the tests again.

The results are amazing. One group of 144 persons who figured in 225 traffic accidents in two years was called in and given the entire examination. During the next two years the same group was involved in only 12 accidents.



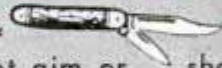









Edwin D. Fletcher, research director for the California State Division of Operators' Licenses, explained that the most significant thing about re-examination of drivers is that their limitations are called to their attention.

"The records show," he added, "that drivers immediately adapt themselves to their limitations, once these conditions become known to them. A man may learn, during

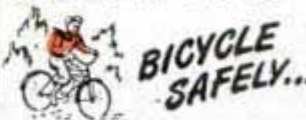
(Continued to page 244)

SHOOT SAFE BUDDY!

BOYS! SHOW THIS MESSAGE TO YOUR PARENTS!

You'll never see a real outdoorsman  aim or shoot his rifle at anything but a safe, proper target . . . he handles his firearms  with care and respect. Your Daisy  is made for fun shooting. It is not a lethal weapon but . . . like a knife,  or auto it may cause damage if handled carelessly. So do not aim or shoot at windows, street lights, song-birds,  pets, property or any other person . . . ever! Remember,  carelessness causes accidents to millions of Americans every year in cars, homes,  factories. So . . . if you are careless with your Daisy or abuse the privilege of owning one . . . your parents,  guardian  or police  have the right to take it from you . . . and  should!  Don't let this happen. Be careful. Aim and shoot safe, Buddy!

SAFETY TIPS



BICYCLE SAFELY...

Careless bicycling may cause accidental. Always ride single file. Never "hitch on" to car or truck. Follow all traffic signs, rules. Avoid ruts. Ride close to right edge of road. Use hand signals for turns, stops.

ROLLER SKATE SAFELY...

Avoid roller skating accidents by being careful. Always skate on sidewalk. Come to stop at curbs. Cross streets at corners only. Do not "hitch" on to bicyclists. Cross small cracks at right angles.



DRIVE SAFELY...

An average of more than ONE MILLION children, women, men are injured every year in traffic accidents! Think that over, Buddy! Decide now that when you are old enough to get your driver's license—and after you get it—you will remember and follow the safety driving rules you learned.

CROSS STREETS SAFELY...

Always stop at curb, look right and left to see if street is clear. Cross streets only at corners. Obey signal lights. Remember, an auto moves faster than you can run. And don't run . . . walk!

AND SHOOT SAFE BUDDY!

MEMORIZE THE SHOOTER'S SAFETY PLEDGE!
I pledge myself to PROTECT animals, property and people in my community by always aiming and shooting my Daisy safely!

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RED RYDER CARBINE

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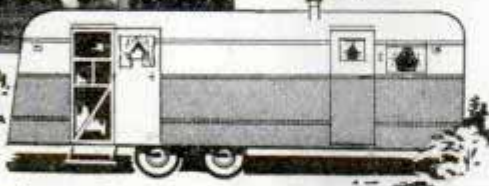
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1/8"-3/16"-1/4"-3/8" wide, 5'6" long.....\$.90 each
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Arbitrin Sweeping fluid is put into a steel reservoir in the back of the Dustless brush.

As you sweep Arbitrin filters through the tufts — surrounds particles.

The dust itself is converted into sweeping compound—cannot rise into the air.

Dustless brushes used with Arbitrin sweeping fluid are 100 times more effective in controlling dust than ordinary floor brushes used with sawdust. When used daily, Dustless brushes actually reduce bacteria, normally in the air between sweepings, as much as 97%. These facts have been proved in tests made by independent health authorities. Dustless brushes are used in thousands of stores, factories, offices, schools, and institutions. They are unconditionally guaranteed to meet your requirements. Write today for sizes, styles, and prices.

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his first test, that he reacts slowly or that he is a poor judge of distance, but often he forgets these facts in a couple of years."

California also places certain restrictions on drivers with physical handicaps. Some people suffer intensely with hay fever during the pollen season and might have spells that would cause them to lose control of their cars. They are not permitted to drive during this season. Limitations are placed on drivers with inadequate vision. The aged and the deaf must drive only in accordance with the restrictions listed on their driver's license.

As the safety experts made clear at the President's Highway Safety Conference, action along many lines is necessary to curb the mounting traffic death toll.

But one thing is certain, scientific drivers' tests—strictly enforced and repeated—will help a lot.

Harvest From the Sea

(Continued from page 143)

marine bottom deposits probably hold the secret of petroleum formation, geologists, chemists and biologists alike are interested in them.

Information on the conditions under which petroleum forms may help in locating existing oil deposits and possibly suggest ways in which organic matter may be used to produce oil under man-made conditions. For many years, oil geologists have made extensive use of oceanographic data in their quest for new fields.

Drillers as well as geologists are hopefully turning to the ocean for petroleum. Harold Ickes, until recently Secretary of the Interior, said that the continental shelf may be "our last totally unexplored great domestic source of petroleum." Already these tideland pools are being tapped by "slant drilling" from wells along the shore in California and from piers built out into the water off Texas and Louisiana.

Numerous devices have been proposed, patented or tried for harnessing the seemingly limitless power of the waves and tides. The Passamaquoddy project is an outstanding example. Such potential sources of power must not be overlooked, even though it has not been demonstrated that they can compete with power from other sources such as petroleum, coal or rivers.

Also, even though it is not economically feasible by any process yet known, sea water may some day be made fresh enough for irrigation and drinking purposes. Some promising small-scale experiments have been conducted in arid areas near the

(Continued to page 248)

New 1947 Models

GILBERT CHEMISTRY Laboratories



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HALL OF SCIENCE

The sets that bring boys fame and big awards
Spectacular new features for extra fun and thrills

More boys have won fame and big awards with Gilbert Chemistry Sets than any other kind. Because they are far more than "toy" sets. Range of chemicals and apparatus are based on real laboratory technique. Write messages in in-

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Big, three-compartment blue metal cabinet crammed with chemicals and apparatus. Puts 389 spectacular experiments at your finger tips.



WINS \$100.00 FOR CHEMICAL RESEARCH

Meet Frank Hoble of Chicago, America's No. 1 boy chemist of the year, who won a check for \$100.00 and national fame for outstanding research. The way is wide open for you to do the same. But be sure to start right—with a genuine Gilbert Chemistry Set.

ALL THESE ADVANCED FEATURES

NEW—All metal construction—rugged and easy to carry.

NEW—Each section designed as complete laboratory with trays and racks.

NEW—Tip racks for test tubes, for easier handling of test tubes.

NEW—Brown, lightproof bottles such as used for fine pharmaceuticals.

NEW—Rectangular shaped bottles and shelf spaces, holding bottles with label side out.

NEW—Postwar chemistry book, 144 pages profusely illustrated; large type, 8" x 10" page size and stay-open binding. Edited by Prof. Treat B. Johnson, distinguished Yale professor, author of hundreds of publications in the field of organic chemistry, member of the National Academy of Sciences, the National Research Council, the American Chemical Society, the American Institute of Chemists, and other scientific organizations.

\$200.00 IN CASH AWARDS

To the boy doing what, in my opinion, is the most important research in Chemistry. Microscopy or Electricity in 1947, I will award \$100.00 in cash. To the ten boys doing the next most important research, I will award \$10.00 each. Applicants must not be over 17 years old and must send me a full description of their experiments by May 1, 1947.

A. C. Gilbert

Founder of the Gilbert Hall of Science

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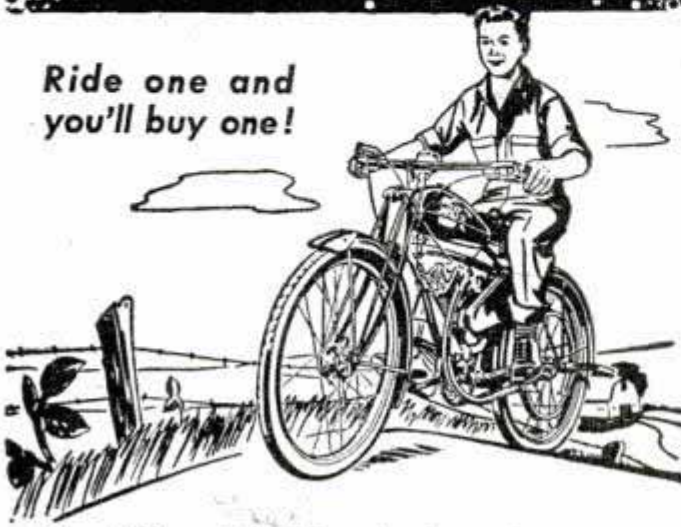
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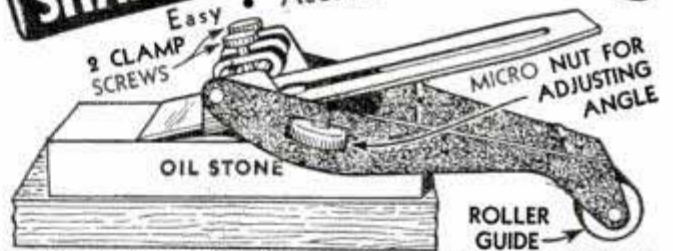


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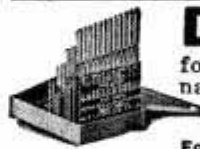
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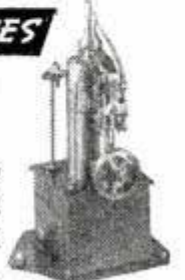
A compact container for indexing and filing twist drills. Eliminates search. Made entirely of steel in nine sizes. See your dealer or write to

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BUILD these ENGINES

GAS and STEAM NO CASTINGS! NO SPECIAL TOOLS!

All you need is a small lathe and some scrap shafting. Plans and detailed instructions for these and other high speed engines available. Illustrated literature on request. Write today.



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It is Johnson that gives you the big three of outboard motoring: 1—Reverse, with 360° Steering. 2—Dual Carburetion, which makes low trolling speed possible in a powerful motor. 3—Perfected Alternate Firing, for silken smoothness. You get them *ALL* in a Sea-Horse! Plus 24 other quality features. Plus the advantage of our famous dealer-service organization trained and equipped to keep your Sea-Horse in tip-top condition.

Write for a copy of the new Sea-Horse Handy Chart, describing all Johnson motors. And see your Johnson dealer. Look for his name under "Outboard Motors" in your classified phone book.

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JOHNSON SEA-HORSES for DEPENDability



WELD ANYTHING ANYWHERE ANYTIME

ALL PURPOSE ARC WELDER
9 Models . . . 32 Volt D.C., 110 to 440 A.C.

A complete workshop in itself! Weld, cut, braze or solder any type metal; iron, castings, aluminum, steel, bronze . . . in any gauge or weight, with equal ease. Compact, complete, sturdy as the Rockies. Formed steel and cast aluminum case, welded steel base, 4" cast wheels. Built with voltage control. Better on R.E.A. lines. No training needed. Sold throughout the world. **Unconditionally guaranteed for 2 years. Fully equipped—ready to use.**

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BOILS WATER IN 3 MINUTES



UNCONDITIONALLY GUARANTEED

Wonderful for Homes, Cabins . . . Trailers . . .
Wherever hot water is wanted QUICKLY

ELECTRIC WATER HEATER

Immersion type . . . drop it into the water . . . it heats a basin or a sinkful pronto. 110 volts AC-DC. Comes with extra long heavy duty waterproof cord. Weighs 1lb. We'll mail it C.O.D. **\$245**

Write for Big free Trailer Parts Catalog

NATIONAL TRAILER STORES
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Plus C. O. D. and postage

BRUNO SPECIAL Christmas Kit



What a gift for a man who likes good tools—two adjustable hole cutters in a colorful new box with a gay Christmas wrap! Plastic protective case keeps tools clean and blades sharp. One Bruno does the work of many fixed radius cutters—high speed steel blade makes clean, fast cuts in metal, wood, plastics. Easily sharpened. Available with square or straight shanks. **MONEY BACK GUARANTEE.** At all hardware stores or order direct Dept. PM-12.


 Beverly Hills, Calif.

ONLY \$785

Contains 2 Adjustable Hole Cutters that cut any diameter 3/8" to 2 1/2"

FOR HAPPY HOBBY DAYS!

THE FAITHFUL
HEART
OF YOUR FUEL
SYSTEM



AC

FUEL PUMPS

Pulsing steadily, hundreds of times a mile, your AC Fuel Pump is the strong, reliable heart of your fuel system. It has given you long, faithful service because of its inbuilt quality and scientific design.

You can prolong that faithful service indefinitely, if you insist upon an AC when you replace your present pump with a new or rebuilt one.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

ocean. Semipermeable pipes buried in the soil permit enough moisture to seep through and yet hold back the salt. At present, however, the cost is almost as prohibitive as that for evaporation and condensation of sea water.

The Colorado River constitutes the last important fresh water source which can be made available for southern California. Since it will be adequate for only another 100 years if the region continues to develop at the same phenomenal rate as in the last century, the day may come when California will look to the Pacific Ocean for drinking water.

Other arid areas of the world which adjoin the sea — such as the west coast of Mexico, northern Chile and Peru, the sea-coast of Arabia and Iran, and Australia's dry west coast—may some day be turned into productive farmland through the use of purified sea water.

While oceanographic research has done much to solve the mysteries of the sea, our knowledge of the ocean is woefully inadequate. Only about .1 percent of the world's scientists are engaged in oceanographic research. More is probably known about the face of the moon and the movements of distant stars than of the floor of the sea and the movement of ocean currents.

Approximately 71 percent of the earth, or 140,000,000 square miles, is covered with water. The average depth is approximately 12,500 feet while the average elevation of land above sea level is only 2300 feet. This means that if all the irregularities of the earth's surface were smoothed out, the resulting sphere would be covered with about 7500 feet of water.

The practical aspects of oceanographic research—together with the natural curiosity of man—should insure the continuation and expansion of the investigations of this last great unexplored frontier. Maybe science will even find a way to get that \$30,000,000,000,000 in gold some day!

Fifty-Watt Ten-Meter Transmitter for Beginners

(Continued from page 231)

neutralizing, some small neutralizing capacity is provided by means of short lengths of No. 14 wire mounted on feed-through insulators on each side of the tube socket and connected to tube grids 2 and 7; capacity is varied by moving the wires closer to or farther from the plates of the tube. One of these n.c. wires is clearly shown in photo C. Once the oscillator is working properly, plate voltage can be ap-

(Continued to page 252)

"Our garage could have been a mile from the house..."

Writes LLOYD A. TUPPER
Highland Park, Illinois

Minneapolis Honeywell Co.
433 E. Erie St.,
Chicago, Ill.

Attention Mr. W. Baak

Gentlemen:

Our garage could have been a mile from the house and just as much heat would have reached the rooms above it.

Auxiliary heat was always needed until your engineers got to work on the entire heating plant. Moduflow was installed together with some minor changes in the distribution system

The same plant now keeps those rooms over the garage comfortable in any kind of weather and in addition the heat is more evenly distributed throughout the entire house

Your engineers did a wonderful job.
We're all very happy.

Very sincerely,

Lloyd A. Tupper
177 Lakeside Manor Road
Highland Park, Ill.



MODUFLOW FOR APARTMENTS

NOW — "Personalized" heat control brings Moduflow to new and existing apartment buildings. It will be a "must" in modern apartments just as the mechanical refrigerator is today.



Have you a room that is "a mile from your house" so far as heat is concerned? Are your floors drafty? Have you "shiver spots" in some rooms? Are you wasting fuel?

Moduflow, the remarkable new heating system developed by Minneapolis-Honeywell, has cured such "heating headaches" in thousands of homes throughout the nation. For Moduflow is entirely different from ordinary on-and-off control systems. It furnishes heat *continuously* at whatever temperature is required to maintain comfort in any kind of weather. It does away with the drafty floors, or wasteful overheating, caused by ordinary intermittent heat supply.

Minneapolis-Honeywell Regulator Co., Minneapolis 8, Minnesota.
Canadian Plant: Toronto 12, Ontario.

Moduflow can be simply and inexpensively installed on practically any type of central automatic heating plant. You don't have to remodel or wait until you build a new home. Of course, if you are planning to build, your new home deserves the "Comfort Unlimited" that Moduflow has brought to the Tupper and to thousands of other homes. So, get the whole story of Moduflow. Just mail the coupon for the fascinating booklet, "Comfort Unlimited."

MODUFLOW

The New HONEYWELL Heating Control System



FREE!

SEND FOR THIS BOOK

Attractively illustrated, easy to read and understand; tells how MODUFLOW control can be applied to your automatic heating plant.

MINNEAPOLIS-HONEYWELL REGULATOR CO.
2756 Fourth Avenue South, Minneapolis 8, Minn.

Please send my free copy of
"Comfort Unlimited"

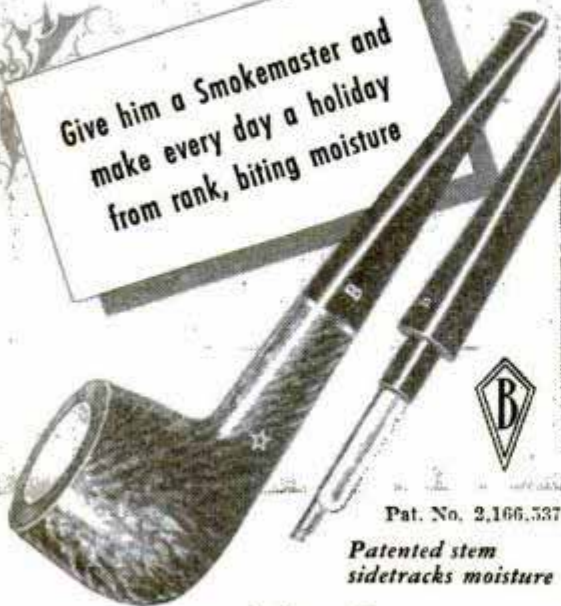
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Give him a Smokemaster and make every day a holiday from rank, biting moisture



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The exclusive Smokemaster stem sidetracks all moisture from the smoke passage as quickly as it forms . . . Prevents harsh, biting juices from contaminating the smoke.

Smoke passes through a special built-in metal tube which is slotted at the bottom. An ordinary pipe cleaner is folded and inserted into the stem just beneath the slot. As moisture condenses in the tube, it is instantly absorbed by the pipe cleaner.

At leading retailers everywhere in a full range of shapes.

Smokemaster Custom-made \$1.50

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STURDY STEEL CONSTRUCTION

Length Overall: 14"
Diameter: 1 3/4" OD
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Shaft: 1/2" or 3/8" Optional

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BALL BEARINGS . . . Ground precision type. Smooth running, vibrationless, long life. Completely shielded on exterior side.

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FINISH . . . Yes, it has "EYE APPEAL!" Body and brackets of lustrous, gray enamel. Hex nut and washers cadmium plated. Completely in harmony with any and all other fine equipment.

Now in use in thousands of workshops, machine shops, garages, hobby shops and on farms for saws, emery wheels, pulleys, buffing wheels, brushes, etc.

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10" All-Purpose Wheel



Double Radial Ball Bearings give this wheel speed plus! Puncture proof balloon—10" x 1 3/4". Heavy duty wheels — for racers, 4 wheel trucks, wagons, market carriers, golf bag carriers, scooters, garden and porch furniture, etc., etc.

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FREE with each Tester. New, Complete Practical Course in electrical appliance repairing. WRITE FOR CIRCULAR.

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SPECIAL!

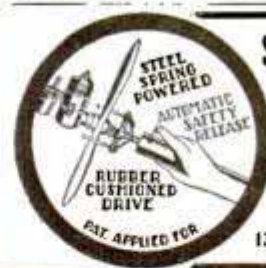
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Eye Levels (Govt. Surplus). Well constructed. Handy for \$1.00 many uses

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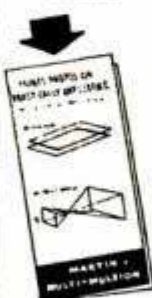


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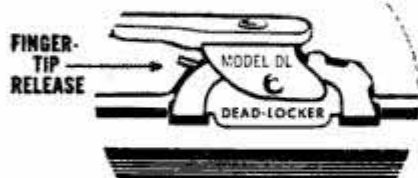


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"Dead-Locker"

WINDSHIELD WIPER
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BLADE SNAPS ON...
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CAN'T FALL OFF
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(A war-born invention—by ANCO—first)
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DON'T SHOOT YOUR GAS-PUMP MAN!

He's doing the best he can. Sure, he knows how dangerous it is for you to drive your car... in stormy weather... with your dull old windshield wipers that smear and smear. He'd gladly put on for you quickly a pair of keen new ANCO RAIN-MASTER Wiper Blades and Arms. He has them—Newest Models! But he forgets to remind you? Too busy? You can't shoot him for that!



After all, it's *your* car to protect. So *you* remind *him*. Get RAIN-MASTERS... patented features... original equipment on many makes of high grade cars and trucks... used in war—on our fighting tanks and trucks and ships and bombers too... because ANCO RAIN-MASTERS clean quicker, clean cleaner... last longer. May save you a costly smashup.

Ask for RAIN-MASTER Windshield Wiper Arms and Blades next time you buy gas.

THE ANDERSON COMPANY

Established 1918

GARY, INDIANA

plied to the amplifier section. A 0 to 200-mil meter should be plugged into jack J₃ to check cathode current. The key is cut in at X or it may be plugged in at either J₁ or J₃; the modulator terminals at the rear of the chassis are shorted, of course, when the rig is used for CW. C-bias is supplied by a 45-volt "B" battery. With the key down the transmitter should show a cathode current of about 40 ma. with the meter in jack J₃. Now when the antenna is coupled to the final tank this cathode current will rise to 175 mils. Grid current measured in jack J₂ should be 6 to 10 mils.

It will be noted that there are two sockets for crystals; one is for a spare. A simple dipole antenna using resonate feeders is detailed in Fig. 3; it is cut for 15-meter operation but will also work very well on 10 and 20 meters. Detailed student material list R-350 is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

Home Town Circus

(Continued from page 157)

cialties of their own such as juggling or stilt walking and try out for places on the program. Although some of the acts remain basically the same they all are re-vamped each season.

In a sense the community circus "just happened." Gainesville has no traditional connection with circus life. It is a town of 12,000 population, 70 miles north of Dallas, and is the trading center for adjacent agricultural and petroleum areas.

The circus got its start back in 1930 when the Gainesville Little Theater decided a burlesque circus performance might bolster its bank account. Some of the members of the theater concocted odd costumes and dressed as clowns; some assembled spangled costumes and rehearsed simple stunts in the air, while others hastily taught their pet horses and dogs a few tricks.

Spectators liked the first performance so well that extra shows were held, and the performers enjoyed themselves so much they planned a bigger and better circus for the following year. That was the beginning, and soon neighboring towns were demanding to see the Gainesville circus.

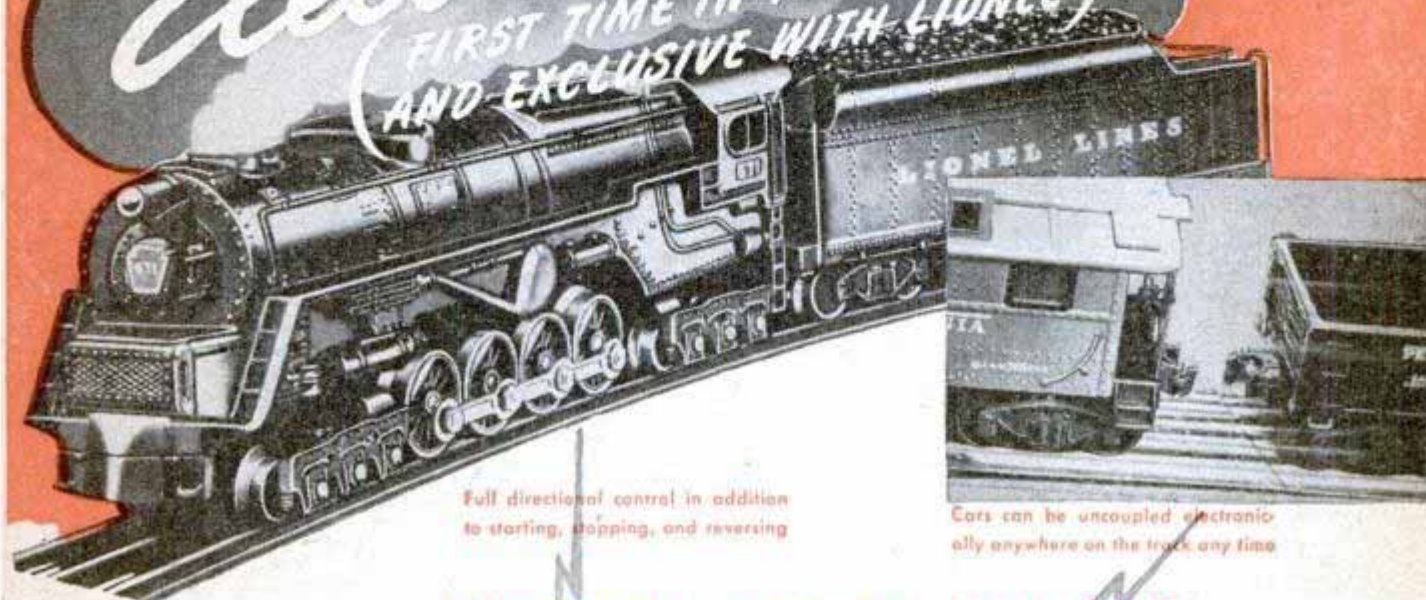
The performers decided they would continue to act as unpaid amateurs but would charge money for the show. The cash would go into the treasury and would be spent for more elaborate costumes, a fireproof tent and other paraphernalia.

Today the community circus plays from eight to ten engagements per season and

(Continued to page 256)

NOW! Lionel Electronic Control

(FIRST TIME IN THE WORLD
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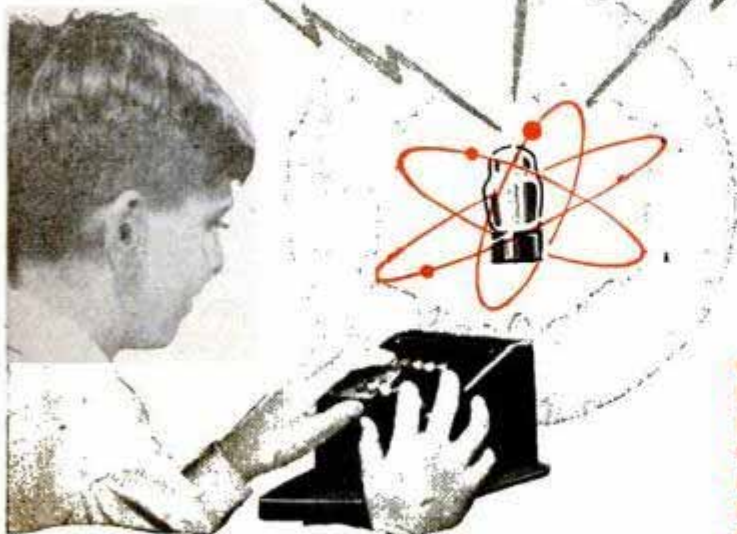
Full directional control in addition to starting, stopping, and reversing

Cars can be uncoupled electronically anywhere on the track any time

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Simple to operate — just push the selective button

With LIONEL Electronic operation every unit of the train is under constant selective control ANYWHERE on the track. Electronic Control operates this way:—sensitive receivers on each car respond to Radio Frequency waves and make the cars or locomotive perform just as you direct. (No special wiring to track necessary).



**LOCOS PUFF SMOKE
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*Send for
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and SCENERY BOOK,
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"POP PERSUADER"



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Please send me the new full color LIONEL TRAIN catalog, also the secret "Pop Persuader" and the book on Scenery Building. I enclose a DIME to cover postage and packing.




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Please don't delay! Mail today!
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Useful Tools



This popular Set will come in mighty handy

if you work on an  or a  or a  Contains 7 thin wall sockets ranging from 3/8" to 3/4" with 3/8" square drive, a Hinge Handle and Cross Bar, all in a Steel Box.

Ask your jobber or dealer for the 40-T set.

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WORCESTER, MASSACHUSETTS

Give A Practical Gift for Xmas—

UNIVERSAL GRINDER and ARBOR SET



6" high x 7" long Base 5 1/4" x 6"

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COMPLETE

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A powerful series wound motor with 6' cord and plug; 3/32 collet chuck will take all standard drills, reamers, mandrels, grinding wheels, etc., up to 3/32".

We ship to any part of the U.S.A. via Railway Express. Quantity is limited and requests are filled in the order received, so order your set at once. Send Check, Money Order, or Cash.

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Balance 4x9x4 1/2. With either Metric or Avoirdupois Weights \$600

All metal construction. Capacity 100 grams or 4 ounces. Send 10c for 36 Page Book Laboratory Supplies, Chemical & Apparatus of all descriptions.



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CENTER ROTARY CUTTER cuts holes, discs, grooves, beads, chamfers. Works in wood, plastics, soft metals. Only tool on market for decorative rotary work in all these. Maximum 5" diameter, 3" depth. 4 finest tool steel bits, one blank for special shaping. 3/8 inch shank fits hand or power tool chucks.

MODEL 101-A (illustrated) with high speed twist drill pilot, 4 bits, wrench, speed and lube chart \$3.50
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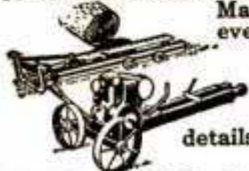
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BICYCLE LIGHT Generator

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EVEN AT A
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MAKE-A-LITE DIVISION
Chefford Master Mfg. Co., Inc., Fairfield, Ill.

turns down 30 or 40 other offers. It grossed \$25,000 in its biggest year before the war, shut down all its activities for the duration and opened again in 1946. Its present equipment weighs more than 75,000 pounds and is valued at \$15,000. This includes half a dozen ornamental parade wagons, public address system, "black light" electrical effects for some acts, seats for its three-ring big top, and a number of horses and ponies. Its latest purchase was a 53-whistle calliope for furnishing music during parades and performances.

In spite of a good income the circus officers and directors have to watch every dollar, for quite a bit of money is required to carry the organization over from season to season. Equipment must be stored each winter and the horses eat up big feed bills. Occasionally, too, a member gets hurt, though injuries are kept to a minimum by meticulous rehearsing of acts. Breaking an arm, being kicked by a horse, or spraining a back are the most common injuries, and medical bills are paid out of the treasury.

The riggings and properties used by the performers are designed and built by Alex Murrell and other members of the group, as are the seats and additional equipment. Most of the spangled costumes are put together during sewing circle sessions in the off season.

The full circus crew includes about 135 people, of whom no more than 45 are performers. The performers double up during the show so 100 different bits of entertainment can be presented. There's plenty of work for the nonperforming members. Tickets must be sold, programs and refreshments must be dispensed, and behind the scenes there are a dozen jobs before the show goes on and after it ends. The group employs a few paid hands.

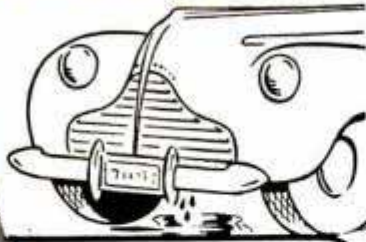
Sometimes the circus travels by rail to a distant point but most of its performances are scheduled within a 100-mile circle of Gainesville. Men, women and children drive to the scene by automobile after working hours, with just enough time before the performance for a light lunch and a quick change into costume. Out-of-town engagements are usually held under the auspices of some local organization such as a county fair or a service club. No one loses more than 10 days from work during the season, not as much time as the average person takes for a summer vacation.

The circus performers range in age from 50 years down to 7-year-old Johnny Lucas who dresses up in clown costume and with an older brother exhibits the performing mule they have trained. For several sea-

(Continued to page 260)



STOP LEAKS!

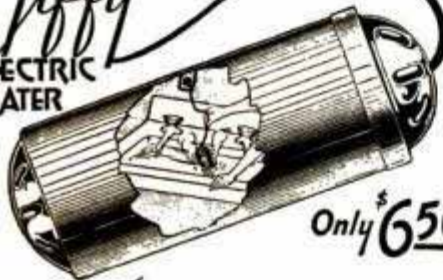


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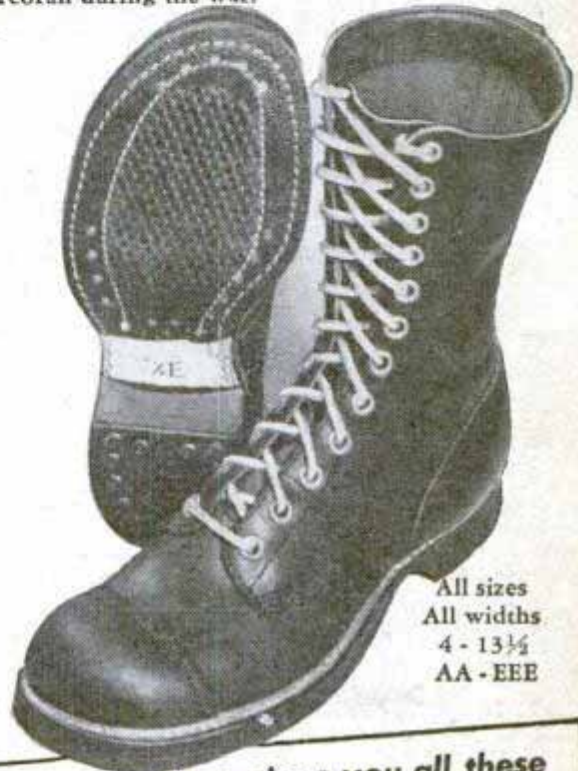


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- Middle sole is leather of outersole quality. Outside tap is rubber, sewed to middle sole in two places and nailed clear through to insole to prevent ripping off.
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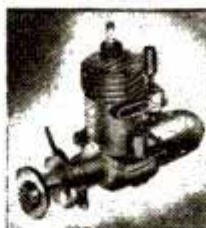
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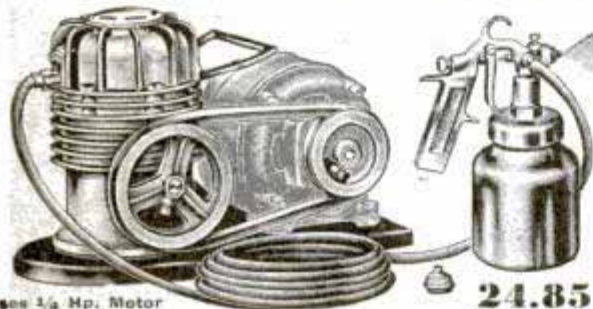
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sons the oldest clown was a county judge, age 65. Six people, including the Murrells and A. Morton Smith, newspaperman who is program director and announcer, have been with the circus since its inception.

All of the performers, old troupers and new ones, adhere to the old circus slogan: "The show must go on." Usually that means arriving at rehearsals and performances in plenty of time; occasionally it means a battle against rain, wind, hail and mud to get to the scene, set up the tents and equipment and start the show at the announced time. The circus has had its share of bad weather but has canceled shows only twice. Once the big tent was destroyed by a windstorm just before the show and no other tent large enough for the circus could be found. Another time the circus was rained out. It was impossible to drain the several inches of water that collected on the lot, and the same storm blocked the highways. Few if any spectators could be present and so the show was canceled. The following week, however, the "only show of its kind on earth" was playing to capacity crowds in a return engagement.

Inside the "Atom City"

(Continued from page 134)

University of Pennsylvania School of Medicine hopes to unravel some of the problems of diabetes by following the course of sugar containing radioactive atoms. The plan is to study a comparison of sugar and lactic acid metabolism in normal and diabetic animals. The University of Chicago will use Carbon 14 to study the processes by which plants take energy from sunlight and store it as chemical energy. The University of Minnesota plans to use tagged carbon atoms to trace the deposition of carbon compounds within the teeth and bones. The University of California will label fats with Carbon 14 and study their utilization by the liver, muscles and blood.

It is entirely possible, according to the Oak Ridge scientists, that atomic rays are capable of hastening or retarding old age. Dr. Howard J. Curtis, biologist at the Clinton Laboratories, reports that some types of radiation cause rats and mice to age rapidly and die prematurely. He predicts that this discovery will greatly aid the current scientific attack on the subject of aging.

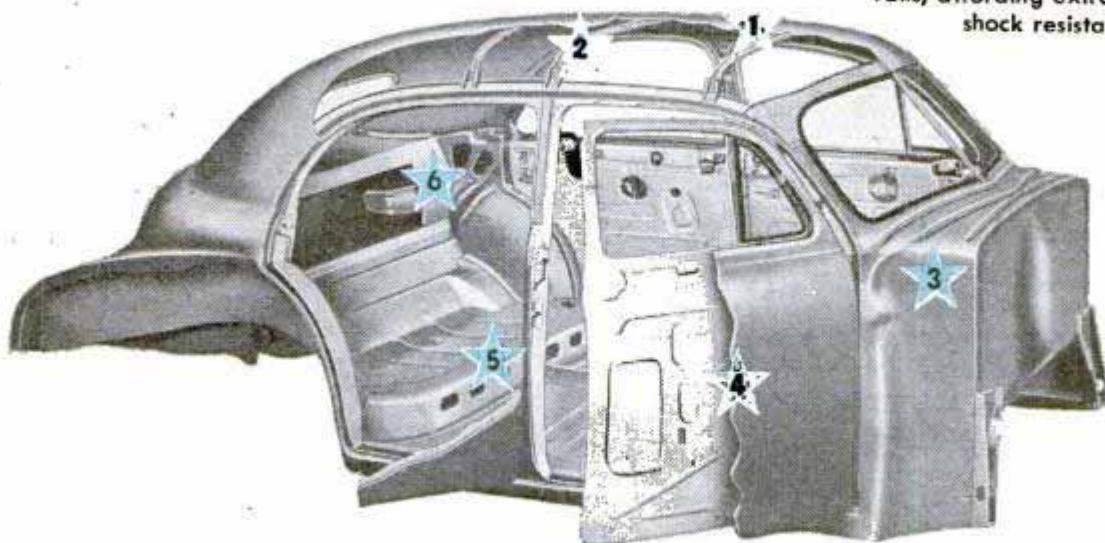
Dr. Edgar J. Murphy, formerly chief of pilot-plant operations at Oak Ridge, recently pointed out: "It may be possible to find ways of using correct dosages and proper applications of radiations to extend the period of youth."

(Continued to page 264)

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1 TURRET TOP, pioneered by Fisher Body, is formed of a single sheet of solid steel.

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3 STEEL COWL AND DASH, ruggedly braced with a triangular truss construction, provide solid support for the front door hinge pillar.

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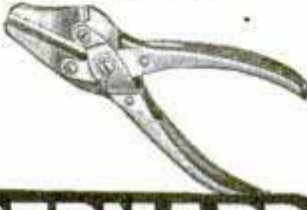
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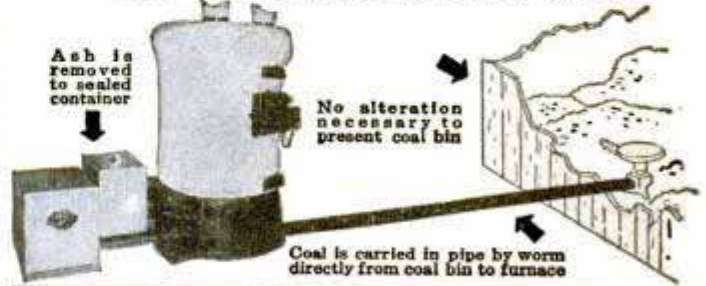
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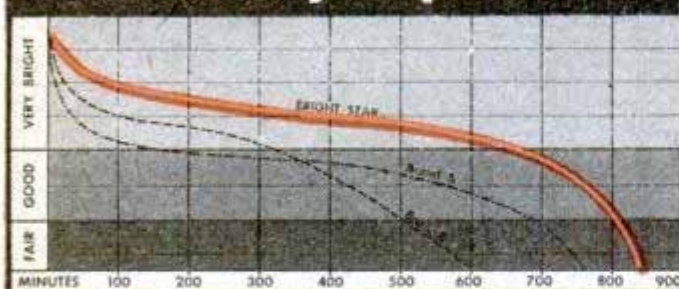
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give more
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longer

Here is your proof!



These results of vital service tests* prove that Bright Star batteries give you more *bright light* longer than the two other leading brands tested. Insist on the best—it's Bright Star by test!

*Chart based on laboratory tests conducted under government standards.

BRIGHT STAR BATTERY COMPANY, CLIFTON, NEW JERSEY

During research on the menace of radiations to workers in bomb plants, test animals were exposed to potent rays and death occurred in 10 to 30 days. If the radiation doses are large, of one type only and just below the killing level, or if they are small and repeated often over a long time, the animals die either of "old age," much sooner than normal animals, or of cancer.

Another promising research field expected to be investigated soon is radiation biochemistry. Besides their destructive chemical reactions, radiations may be able to synthesize certain organic compounds. This might be done in tomorrow's chemical laboratories on a commercial scale, according to Dr. Curtis.

Study of atomic energy no doubt will add to our heredity knowledge. By bombarding the eggs of insects with low-energy neutrons, it may be possible to produce mutations at a rate even higher than with X-rays.

Designed for Junior Engineers

(Continued from page 120)

A metal crayon kit appeals to parents. It permits selection of only one crayon at a time and it must be replaced before a second can be removed—calculated to teach neatness and color selection. Tiny electric washers will actually wash a handkerchief or dolls' clothing. Toy electric irons glow and become warm but will not burn.

Lightweight war metals are going into new model tricycles. One junior bicycle of magnesium weighs only 12½ pounds. Another manufacturer is building a tricycle with a frame of aluminum alloy so constructed that it can be converted to a high-front-wheel bicycle by removing the rear axle and one wheel. Several three-wheel models use chain drive. For the 2½ to 7-year group there is a four-wheel cycle, almost impossible to overturn. It steers with a wheel like a car and is propelled like a bicycle with a chain belt drive.

Metal construction sets are available again. With them or other build-your-own sets youngsters can make buildings, bridges, electric motors, steam engines, model airplanes, racing cars or locomotives. The educational value of these sets is enhanced by instruction books that carry practical information. With an electric motor kit, for example, there is a book of pictures, cartoons and diagrams which explain how it works and its relationship to electricity in television, X-ray and radio.

Another toy maker provides a merry-go-round or Ferris wheel along with a toy mo-

(Continued to page 268)

Boating's more fun

with
an

Evinrude "4"



From shove-off to "home again", every mile is more fun when there's an Evinrude "Four" on the stern of your boat. *More fun . . .* with four-cylinder starting ease, flexibility, responsiveness. *More fun . . .* with the thrilling surge of four-cylinder power that flows with matchless smoothness. Back of Evinrude four-cylinder models are millions of miles of fine performance, years of engineering advancement. A favorite four for small runabouts, fast family and fishing boats is the Lightfour. Weighing only 66 pounds, Lightfour develops 9.7 O.B.C. brake H.P. at 4000 R.P.M. See your Evinrude dealer — look for his name in your classified phone directory under "Outboard Motors". Catalog of complete line of 7 Evinrude models FREE. Address EVINRUDE MOTORS, 5396 N. 27th Street, Milwaukee 9, Wisconsin.

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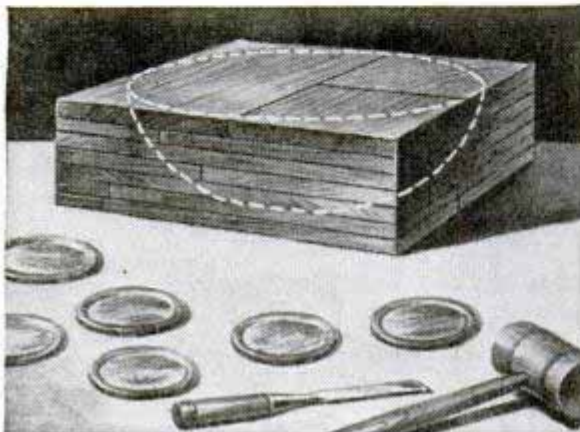
EVINRUDE

OUTBOARD MOTORS

WORKSHOP WISDOM

Laminated Salad Bowl ... Coasters

Use odd pieces of contrasting woods. Plane smooth. Spread on thin film of CASCAMITE and assemble as shown below. Clamp, and let set at 70° F. or warmer.



Stain-free CASCAMITE does not mar beauty of contrasting woods. Highly water resistant, too. Therefore, practical for salad bowls or coasters. Laminated pieces stronger than solid pieces.

Why folks prefer CASCAMITE:

Easy to mix. Just add CASCAMITE to cold water and stir.

Strong. CASCAMITE glue joints are stronger than the wood itself.

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Get CASCAMITE—and CASCO, the standard casein household repair glue, at your hardware store—in 10¢, or 25¢, and larger sizes. For outdoor and boat work, use CASCOPHEN, the new, completely waterproof resorcinol-resin glue.

WRITE FOR FREE GLUING GUIDE: Contains complete gluing directions plus helpful hints for household repairs. Address a post card to: Casein Company of America, Dept. PM-26, 350 Madison Ave., New York 17, N. Y.



CASCAMITE

Dry Powder Urea Resin Glue

PRECISION-MADE STEEL WHEELS AND COLD ROLLED STEEL AXLES

To Build your Own Wagon Cart - Toy - Carrier, etc.

Sturdy, rubber tired, precision-made pressed steel wheels with red enamel finish. Ready to use axles—threaded at both ends. Acorn nuts supplied. Order today.

WHEELS WITH SOLID RUBBER TIRES	
4" Wheels, 1/4" bearing, Steel Disc.....	\$.75
6" Wheels, 3/8" bearing, Steel Disc.....	1.00
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6" x1.50 with 3/8" Selflube Oil Bearing.....	1.75
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AXLES, COLD ROLLED STEEL	
1/4" x14" long, threaded both ends, Nickel Cap Nuts	.40
3/8" x16" long, threaded both ends, Nickel Cap Nuts	.60
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Finest Norman custom-built muffler sets—steel pack—torpedo type—heavy, perforated steel cores—chrome enamel finish—mellow, deep tone (improves with use)—designed to fit—all ways superior—double economy.

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For use on model boats, airplanes, etc., keep a supply of these free-turning brass rods on hand. Kits available for all size requirements.

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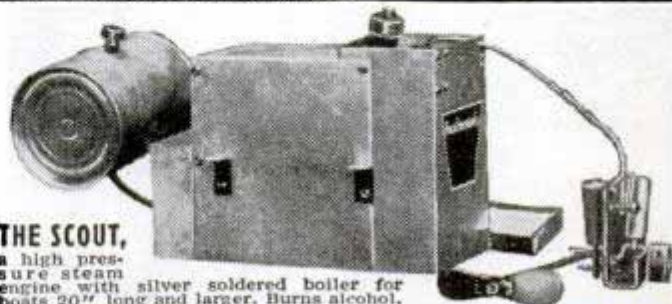
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8 1/2 inches long. Shining heavy single unbreakable casting. Free running rubber wheels. Can't rust. Trim, sleek lines. Looks like models selling up to \$12.00. Every youngster wants one.

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SEND \$2.98



THE SCOUT,

a high pressure steam engine with silver soldered boiler for boats 20" long and larger. Burns alcohol. Runs 30 min. Drives a 2 1/4" propeller. Price complete ready to run with 70-lb. safety valve and accessories as shown... \$8.95
Postage extra, shipping wt. 4 lb. Distributors and dealers write for terms.
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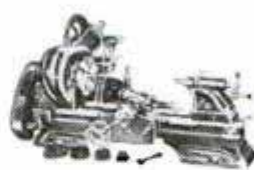
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Precision built . . . engineered for quick set-ups over a wide work range . . . the rugged, versatile Atlas miller greatly increases the scope of your shop. It handles all operations from slabbing and facing cuts to end milling, keyways, finishing, and layout work. Table travels 10" horizontally, 3½" cross, 6" vertically. Spindle speeds from 62 to 2870 RPM provide correct range for all types of work and cutters. Back geared power, complete V-belt drive, Timken bearings. Operates from 1/3 HP motor. Available now for fairly prompt delivery. See your Atlas distributor.

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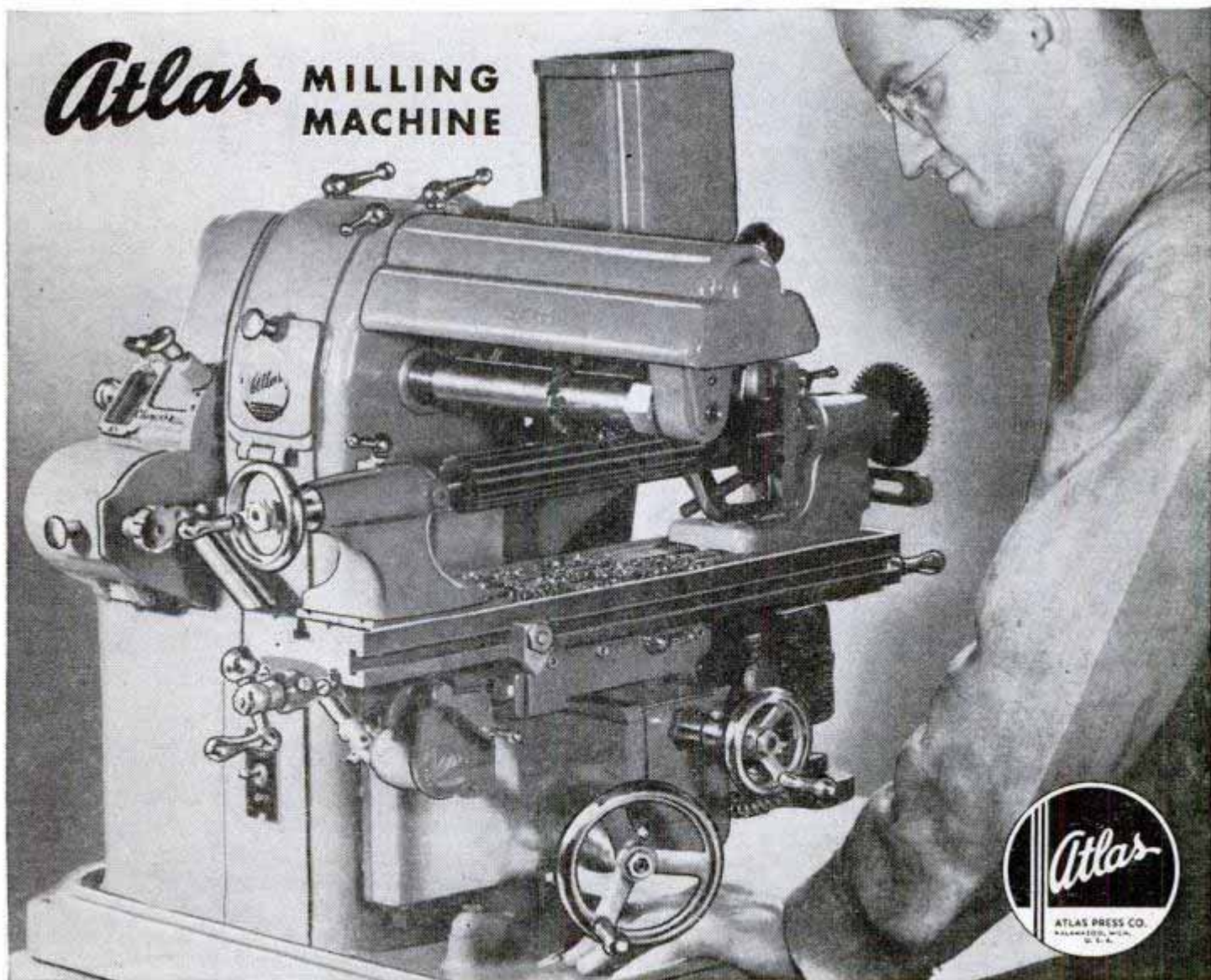


MILLING MACHINES



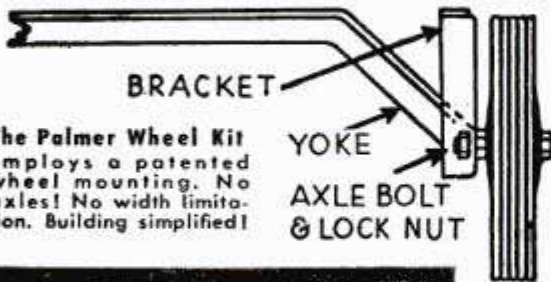
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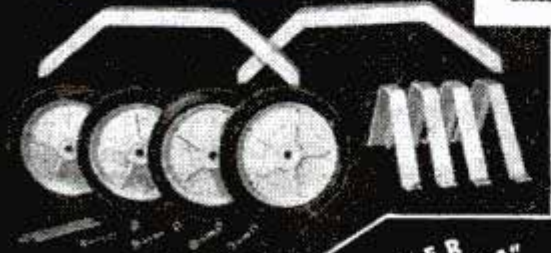


new!

PALMER WHEEL KIT eliminates "axle problems"



The Palmer Wheel Kit employs a patented wheel mounting. No axles! No width limitation. Building simplified!



The ideal Xmas gift

for ages 8 to

80! Order now while
delivery may still be
made before Xmas.

Brackets and yokes are sturdy stamped steel; attractively finished in bright red baked enamel. Axle bolts are stainless steel... rust proof! Solid molded rubber tires with 1/4" treads wear longer than other types... do not mark linoleum or polished floors! Tires cannot loosen or slip due to special mounting process. Tests have shown 8" wheel able to withstand over 1000 lbs. vertical load. Compare **QUALITY, ECONOMY, DURABILITY**, with any other wheel kit!

PALMER WHEEL KIT "B" same as "A" except wheels are small diameter (5 1/2") with 3/4" molded rubber tire. **\$5.50**

Individual Wheels

8" DIA. with 3/8" bushings. \$1.40
8" DIA. with 1/2" bushings. 1.48
5 1/2" DIA. with 3/8" bushings .94

PALMER WHEEL KIT "A" contains four 8" steel wheels with solid rubber tires. (Grooved tread 1/4" wide). Four steel mounting brackets. Two steel yokes. Axle bolts, nuts and special wrench included. **\$8.25**

NOW you can design and build *"Anything on wheels"*

- Soapbox Racer
- Tool Cart
- Display Cases
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- Wheelbarrow
- Market Carrier
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- Bike Trailer
- Toy Wagons
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- Movable Furniture
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THE PALMER MFG. CO., Dept. 1
8115 Clinton Road, Cleveland 9, Ohio

Please send me: (indicate number of sets)

- PALMER WHEEL KIT "A"
- PALMER WHEEL KIT "B"
- 8" wheels, 3/8" bushings.
- 8" wheels, 1/2" bushings.
- 5 1/2" wheels, 3/8" bushings.

Enclose check or money order—all prices F.O.B. Cleveland, O.

NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

tor. Steam engines have changed, too. One electric model has a plastic boiler that can withstand a 50-pound pressure. If the water boils out, the current automatically cuts off. It comes with a drive wheel and belt for powering models and it can be assembled with the boiler in horizontal, vertical or walking beam position.

Toy pulse-jet engines of the type that propelled the V-1 buzz bomb are available to drive racing cars and airplanes. For the first time there is a tiny Diesel-powered model plane, too.

Electronic controls have modernized familiar playthings. Cars of electric trains can be coupled or uncoupled electronically. There is an electronic doll which dances in perfect time to the rhythm from a radio, phonograph or piano. The doll is supported on a platform by a slender rod. Sound waves cause a contact to be alternately made and broken in the electronic base. This changes the voltage on the grid of a vacuum tube which in turn controls the amount of current flowing to the doll and giving motion to it.

A tiny radio, using a war-developed radar Germanium crystal, will pick up any station within 50 miles. Electric impulses govern the speed of the horses in a new horse racing game. Each player has a control button. When he presses it, an electric charge hits a steel ball which pushes the horse along a slotted track. In an electric football game it is possible to follow the play and the action of the ball carrier until he is stopped by a defensive player.

A lambskin-covered pup has magnetized jaws which grip a toy bone. Other stuffed animals glow in the dark. A pig bank squeals when a coin is inserted and there is a peg anvil which pushes one peg into hammering position when the second is hammered down.

The large juvenile population in our history will be learning from the new playthings. And if adults look closely enough, the toy makers say, they can learn a lot from toys, too.

I Rode the Turtle

(Continued from page 93)

that the "Truculent Turtle" could be leveled off at about 200 feet and a safe landing effected at the airport from which we departed. I might add that we were not called upon to test our fuel dumping system.

Our first bad weather came over Bougainville and New Guinea, but the worst was still ahead. When we hit the equatorial front, which our pilot, Commander Thomas

(Continued to page 272)

A PARROT TOO, CAN SAY...



**BUT HE DOESN'T
KNOW WHAT
HE'S TALKING
ABOUT EITHER**

 *Be Wise...
Buy "Crescent"**

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

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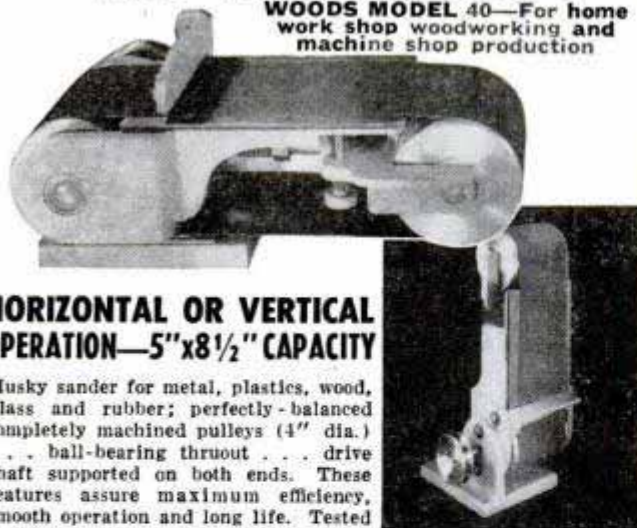
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WOODS MODEL 40—For home work shop woodworking and machine shop production



**HORIZONTAL OR VERTICAL
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Husky sander for metal, plastics, wood, glass and rubber; perfectly-balanced completely machined pulleys (4" dia.) . . . ball-bearing thruout . . . drive shaft supported on both ends. These features assure maximum efficiency, smooth operation and long life. Tested to 5000 rpm. . . . easy adjustment for horizontal or vertical operation . . . reversible platen usable on either face.

Extra belts, 5" x 6" work table, and other accessories available from stock.

Order from your dealer or shipped FOB direct from our S. Norwalk Plant

SPECIFICATIONS

Abrasive Belt 4" X 36"
Bench Space 9" X 15"
Motor Recommended 1/3 hp.
Net Weight 17 1/2 lb.
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**SANDER
COMPLETE WITH
BELT AND WORK DAM**
\$39.95

ATTENTION DEALERS!

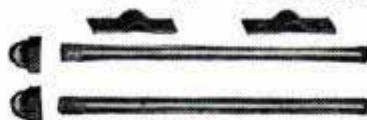
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WOODS ENGINEERING CO.
NORWALK 11, CONN.

**Ball-Bearing
—SPEED WHEEL—
Construction Sets**



Including blueprints for making



Build Your Own—

- Express Wagons** \$13.20
(Includes four 8" x 2" Tires, Wheels, Axles, etc.)
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(Includes four 10" x 1.75" Tires, Wheels, Axles, etc.)
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10% required with C.O.D.'s

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**GIANT 4 FT. PLANE
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THRILLS... FUN GALORE FOR YOUNG & OLD

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**METAL SAWING . . . SHEARING
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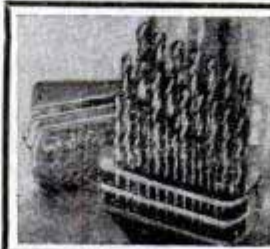
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AMAZING PATENTED PRECISION SCREW HOLDING SCREWDRIVERS

Removes, Holds, Inserts Screws in HARD-TO-GET-AT Places

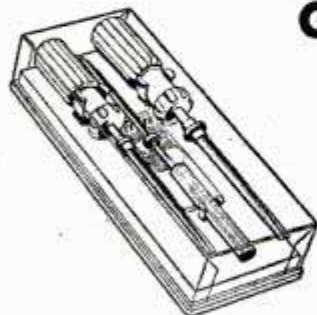
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Hardware, automotive, electrical, radio, department stores buy quantities. Attractive displays, advertising literature make fast sales. Factories, shops, garages, service stations, mechanics, electricians also large buyers!

MEN with AMPLE CAPITAL to do a real BIG business. FAST SALES, LARGE ORDERS, BIG REPEATS. No commission salesmen or agents inquiries answered. Only WHOLESALE distributors wanted.

Refundable 30 day trial offer. Immediate delivery.

We are a large, established, soundly financed company.
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3 models mounted in an attractive transparent kit —makes a wonderful gift for homes and hobbyists.

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TREMENDOUS MARKET • BIG DEMAND • SPECTACULAR

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Sharpens round shank drills from 3/32" to 1-1/16" diameter. Grinds Old Drills like new in 4 different drill point angles. Grinds Short, Medium and Long Twist Drills from 1 1/2" up to 11" long, for hand or power grinding wheels.

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Grinds your drills like factory in 25 seconds. Gives perfect center and clearance. Saves drills, time and money. No shop should be without the Super Drill Grinder. Guaranteed to do the work or money back. The Grinder that gives a rounded point!

Only \$2⁹⁵

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Before spending time and large sums of money on final development and patent, get reliable impartial advice and constructive criticism from qualified technicians on the practicability, manufacturing problems and possible sales demand of your invention. SEND POSTCARD FOR FULL INFORMATION.
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Funnier Than Ever "YOUNG" Barks!

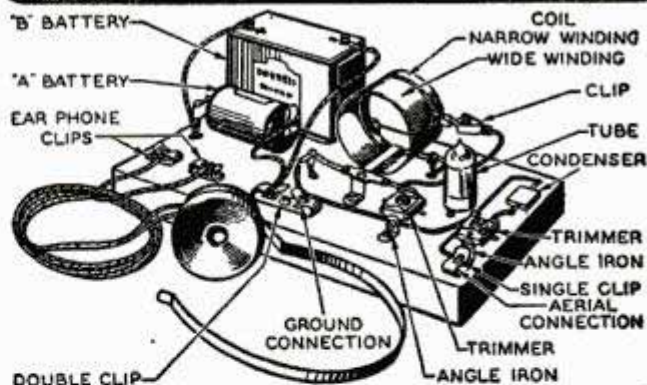
Performs all sorts of Tricks and Barks too. More fun than a circus. For grown-ups and children. Well built. Nicely finished. Give "Young" to your friends for Christmas.

Price Postpaid — \$1.00 each

GIFT CENTER Dept. B, P. O. Box 1522, Milwaukee, Wis.



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Have fun building your own Sky Prancer Midget Radio. Learn money-making radio principles. You can do it this easy, practical way.

Radio Kit comes complete with simplified, illustrated instructions for 10 educational experiments. Numbered and color-coded. No soldering, drilling or punching. Gets local, police, short wave and distant stations. Can be used as transmitter.

Complete with tube, phone and batteries, only \$7.95 postpaid. Or send \$1.00 and pay postman balance plus postage. **Order Today.**

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2 Handy Sizes Packed
in a Handsome Gift Box

BMC

**PRESSURE LOCK
WRENCH**

..actually Six Tools in One!

It will save his temper . . . improve his skill . . . greatly increase his enjoyment of puttering around the house, hobby shop, motor boat, car or plane. If he's a worker on the farm, in the shop or factory, he can't afford to be without a set.

For here is a new marvellously improved kind of wrench that is actually six tools in one—adjustable end wrench, pipe wrench, gripping tool, pliers, hand vise, locking clamp. Fits as it grips . . . and it holds . . . with more than a ton pressure, even when the hand is taken away. Can be released with the flick of a finger.

JAWS ALWAYS PARALLEL

An exclusive, patented device keeps the jaws parallel when they close. Prevents rounding of nuts, slipping and accidents . . . assures even pressure and a firm grip to the very tip of the jaws.

Nos. 7 and 9 in a gift box . . . \$5.40

No. 7—Max. jaw opening 3/4" . . . \$2.45
 No. 9—Max. jaw opening 1" . . . 2.95
 No. 11—Max. jaw opening 1 1/2" . . . 4.60
 For sale at leading hardware, auto equipment, mill supply, plumbing and electrical departments.

BMC MANUFACTURING CORP.
 Binghamton, N. Y.

Davies, called "250 miles of bottled-up turbulence," we began to worry about the plane's ability to take such a pounding with so great a load. We were afraid the fuel tanks might leak, but nothing happened.

Over the Marshall Islands, at about 8000 feet, we ran into dense clouds and heavy rain. From there to Midway the weather was foul. Through radio check with Honolulu we learned that the Seattle area, where we planned to make a landfall, was "socked in tight" and there were icing conditions, so we shifted our course to take us in just north of San Francisco. Shortly after hitting the coast of the U. S. we were bucking a headwind and about then the tachometer recording the functioning of the left engine went out of order. At first we thought the engine was out and got set to feather the propeller, but just in time noticed the engine was running all right and that it was the tachometer that was faulty. A little later, ice caused our right engine to quit for about half a minute at 12,000 feet, but it cut back in when we opened an alternate heating system (air warmed by the manifold). After we got through the soup over the coast we estimated there were a thousand pounds of ice on our wings.

I'd say we used the Sperry automatic pilot about 99 percent of our trip.

We averaged in the neighborhood of 20 hours of sleep during the trip, on the basis of two men on and two men off every four hours. We got none, though, the first night, when the plane was virtually a flying gas tank and the air was turbulent. We had hot meals, steaks and soups, prepared on an electric stove. Our rubber mattresses were comfortable and the plane was as soundproof as an air liner. None of us had to use the oxygen or the benzedrine tablets that had been stowed on board. All in all, the trip was no tougher than a hard wartime patrol, and we'd all experienced our share of those. We shaved ourselves an hour before landing.

Even our lone passenger, a nine-month-old kangaroo named Joey, seemed to fare reasonably well, though he must have been a trifle uncomfortable in his small box. A 35-pounder, he was en route to the Washington Zoo as a gift from the Australian people.

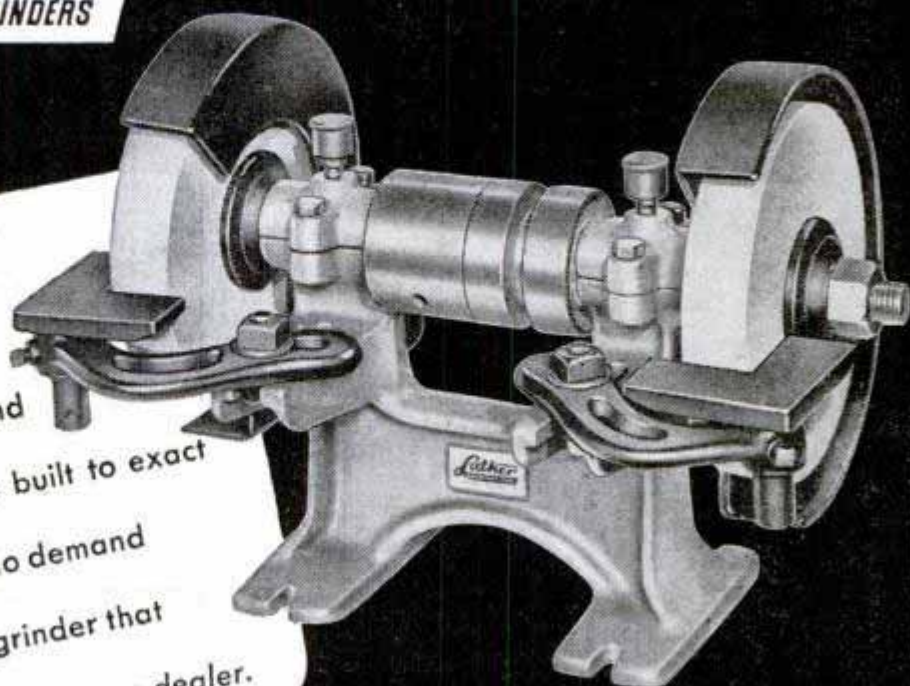
The most unusual experience of our trip occurred while flying over the mainland through heavy weather. All of a sudden the sky was lighted by an eerie glow and little fingers of flame seemed to be dancing on the windshield. For a moment, thinking the engines had caught fire, our hearts were in our throats. A moment later we

(Continued to page 276)

Luther POWER GRINDERS

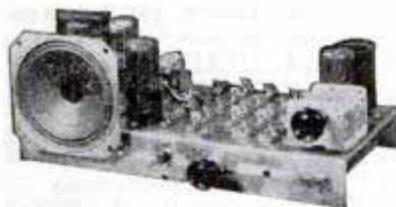
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Like all Luther Grinders, the power grinder shown here is famous for high quality and rugged construction. It is built to exact specifications for those who demand fine tools. For the Luther grinder that fits your needs, see your hardware dealer.



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This complete electronics laboratory permits the experimenter to construct 18 different useful electronics devices, including sensitive broadcast and short-wave receiver, proximity detector and multivibrator circuits patterned after radar, phonograph amplifier, intercommunication system, code practice oscillator, time delay relay, home broadcaster, relay-amplifier for photo-electric circuit, and 10 others.

Kit includes rectifier, power amplifier, double triode, powerful 4" speaker-mike, plate relay, broadcast and SW coils, tuning condenser, and generous supply of resistors, condensers, chokes, and extra wire. Components held in place by special clips—screwdriver only tool required. Complete 48-page manual with diagrams and full instructions, clearly explained for hobbyists and novices. Sent postpaid anywhere in U. S. for \$22.50, sales tax included. Pat. applied for.

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SAFE, DEPENDABLE, GUARANTEED PERFORMANCE, NON-EXPLOSIVE

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Add \$1 for 1/2 pt. fuel and all purpose solder

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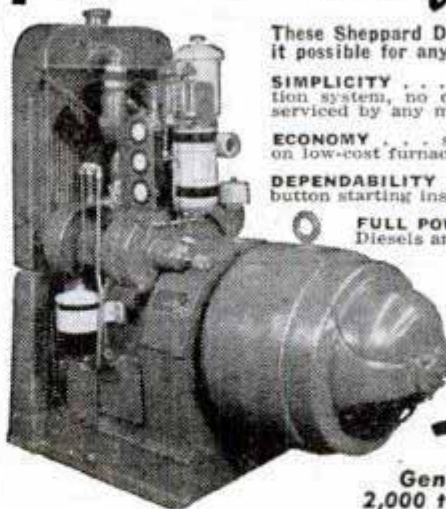
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independent of outside interference



These Sheppard Diesel features make it possible for anyone . . . anywhere.

SIMPLICITY . . . no electrical ignition system, no carburetor. Can be serviced by any mechanic.

ECONOMY . . . starts and operates on low-cost furnace oil.

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FULL POWER . . . Sheppard Diesels are rated on their actual continuous power output while operating with full equipment.

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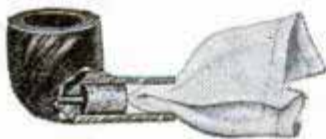
Power Units 3 3/4 to 56 H.P. • Marine Engines 3 3/4 to 62 H.P.
R. H. Sheppard Company, Inc., 48 Middle St., Hanover, Pa.

DIESEL'S THE POWER . . .

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PROVES VITAL ZONE SPOTLESS
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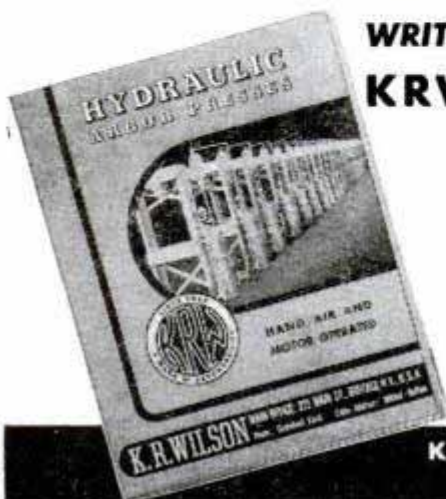
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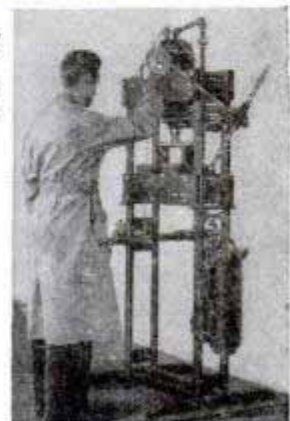
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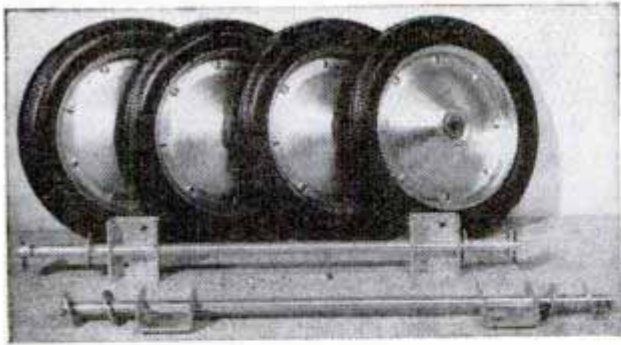
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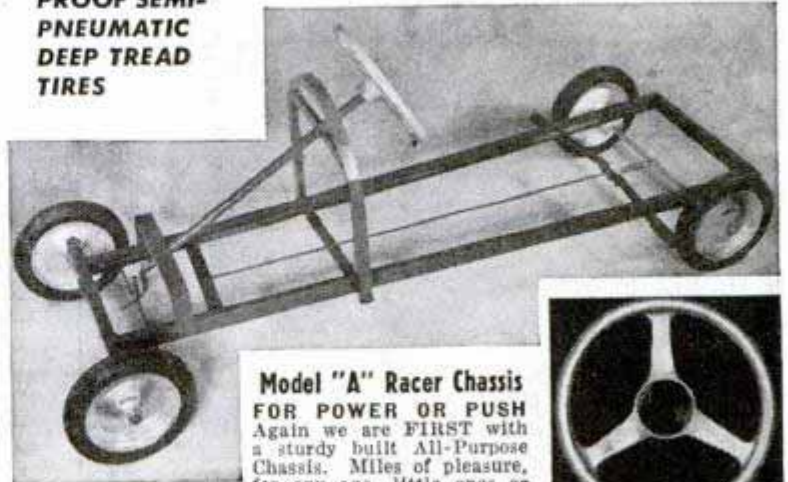
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VERSATILE SWITCH—MILLIONS IN POST WAR APPLICATIONS — Floodlight your porch when the door is opened — sounds alarm when window is opened — signals arrival of mail — controls heating of furnace — filling of water tank; these and many other services are performed by this versatile switch. Shipped with instruction sheet showing numerous illustrated uses. EXCEPTIONAL LOW \$100 post PRICE. ONLY paid
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FOR YOUR WORKSHOP!
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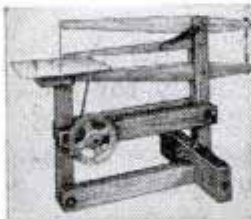
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SEND \$11.95 or \$1.00 Deposit, Balance C.O.D.

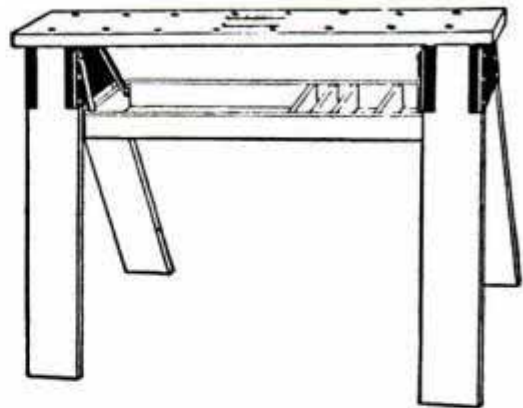
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Makes a rigid saw horse that is actually a PORTABLE HOME WORK BENCH with many uses. Has a novel SWINGING TOOL TRAY. Complete hardware and copyrighted instruction sheet for easy assembly. Lumber is not included.



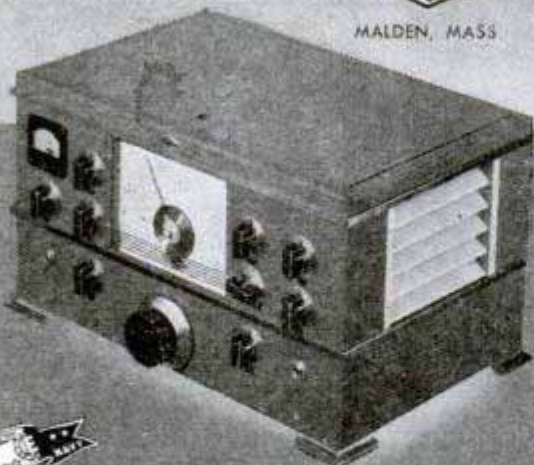
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realized what it was. The plane wasn't on fire—it was the phenomenon known as St. Elmo's fire, caused by electrical discharge from the plane into the atmosphere.

The "big jump," in my opinion, speaking collectively for the other pilots, was a successful venture. We had no definite geographical goal. We were to fly as far as the stamina of the plane, the health of the personnel and the weather would permit. From a pilot's point of view as well as from an engineering point of view, the Turtle and her sister P2Vs are good, capable airplanes which will write history in the realm of aviation achievement.

New Rivers for the West

(Continued from page 102)

Montana, Wyoming, Nebraska, North Dakota and South Dakota have projects under way for bringing water to nearly 100,000 acres. Irrigation and supplemental irrigation water for 105,000 acres in Utah are to be taken by canals from the Provo River.

In the Northwest, canal systems that are to be built soon include the hundreds of miles of channels that will distribute Columbia River water from behind Grand Coulee Dam to more than 1,000,000 dry acres in central Washington. Further development of irrigation canals from the Yakima River are under way in Washington and preparations are being made for construction of canals from behind the new Anderson Ranch Dam in Idaho.

During the past 44 years the Bureau of Reclamation has built more than 150 dams and 80 reservoirs in arid and semiarid regions in the West, providing water for the irrigation or supplemental irrigation of more than 4,000,000 acres of land. The many reclamation projects under way at the present time will provide water for another 4,000,000 acres. Much of this land will remain in private hands but in some cases public lands will be benefited and these will be opened for homesteading or for purchase at prices based on the cost of the irrigation improvements.

Work on some of the larger projects will not be completed for a number of years because of their magnitude, nor will all of the new farming land be needed immediately for food production. Nevertheless, the continuing westward shift of population shows the need in the West for the new irrigation projects.

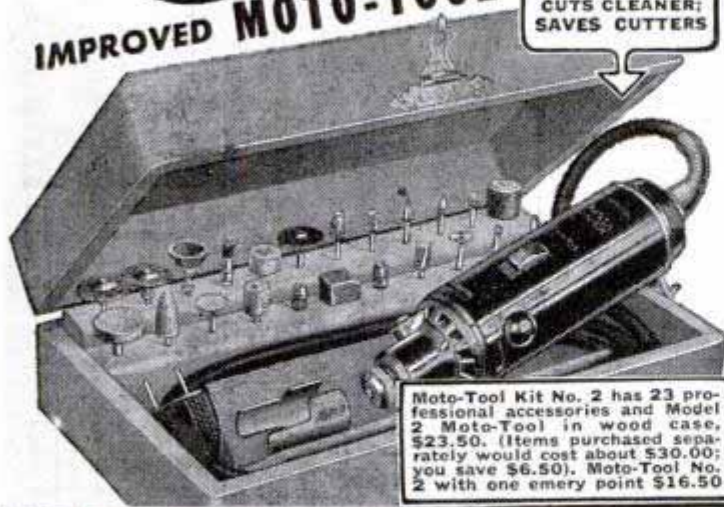
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IMPROVED MOTO-TOOL

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27,000 R.P.M.
CUTS CLEANER;
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Moto-Tool Kit No. 2 has 23 professional accessories and Model 2 Moto-Tool in wood case, \$23.50. (Items purchased separately would cost about \$30.00; you save \$6.50). Moto-Tool No. 2 with one emery point \$16.50

HERE'S A CRAFTSMAN'S GIFT THAT PACKS YEARS OF PLEASURE

Here's a gift to please a man's heart. A gleaming "powerhouse" that holds promise of endless creative hours. This "pocket-size machine shop" is a war veteran . . . used by all branches of the armed forces in far flung repair bases . . . and it helped set production records at General Electric, Westinghouse, Remington Arms, Ford and other plants. Hobby enthusiast or expert craftsman . . . first choice is Model 2 "Moto-Tool" kit, with its handsome, felt-lined, highly finished wood case . . . with rows of tools begging to be put to work. The usefulness of "Moto-Tool" for precision work is increased by two versatile attachments now available at slight additional cost (see below).



Look For These

Moto-Tool Features

- Housing has "pencil-type" finger grip
- Instant-action, wrenchless chuck
- Oil-less, sealed, trouble-proof bearings
- Patented automatic chuck lock pin
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- Weighs only 13 oz. . . . shaped to fit the hand
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- Rasping
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- Inlaying
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Free Both Hands With Moto-Tool Attachments



Moto-Tool Stand (left), made of heavy cast iron, holds Moto-Tool at any position or angle. \$4.50

Moto-Tool Shaping Table \$2.50. (Shown with stand, right). Aids accuracy in routing and grinding.



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Sturdy, compact (see dimensions). Proved in thousands of industrial installations. Case of heat treated aluminum. Gears, SAE 65 (British Gear) Bronze. Worm of case hardened steel. Timken Bearings throughout. Available in 4 different assemblies (shown below) and in these standard ratios:

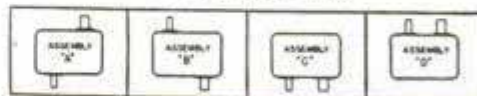
4-1	25-1	64-1	200-1
8-1	30-1	75-1	300-1
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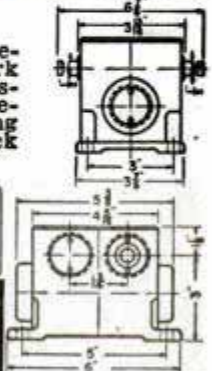
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Heavy Duty Ball Bearing Saw Arbors

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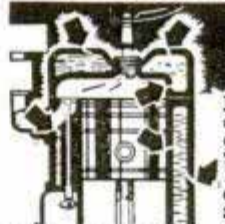
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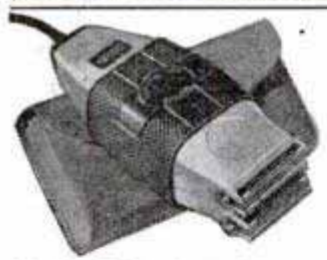
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- ♪ Current: — 110 volts, AC, 60 cycles.
- ♪ Mounted on attractive leatherette covered WOOD BASE.

♪ Dimensions: — 16½" long, 13½" wide, 9" high.

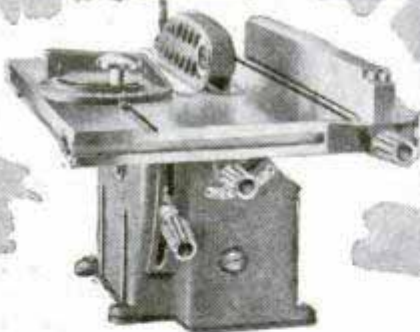
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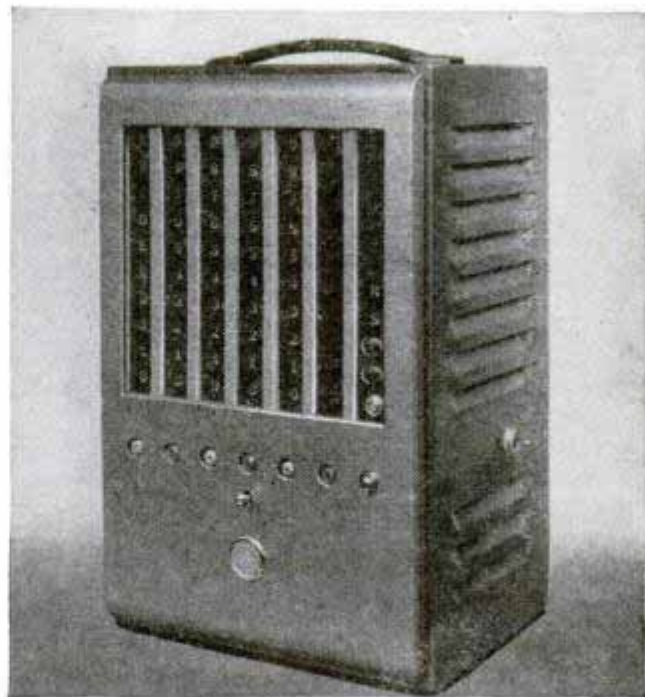
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Electronic Watch Marks Time In 1/1,000,000 Second Intervals

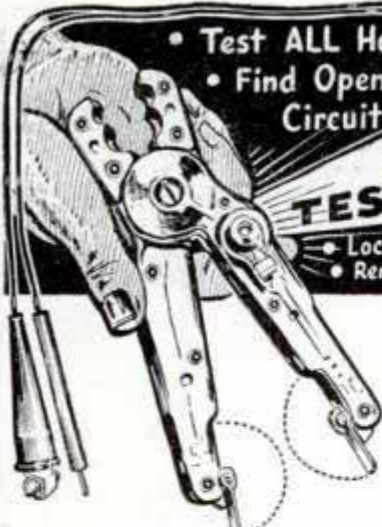
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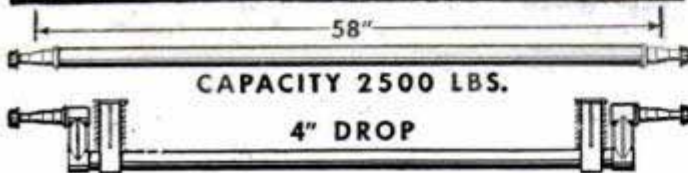
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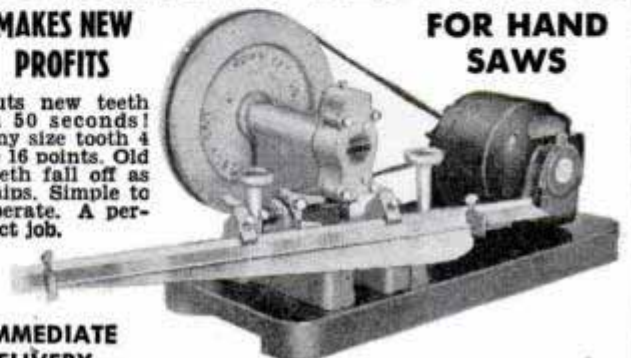
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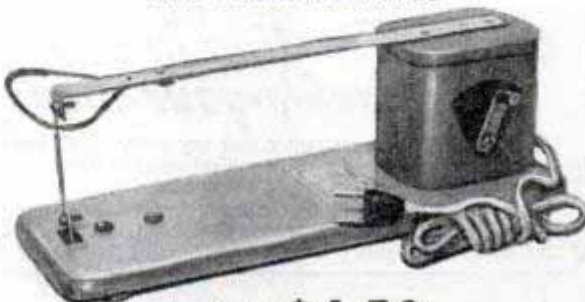
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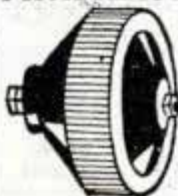
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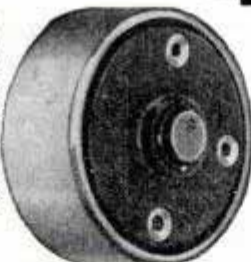
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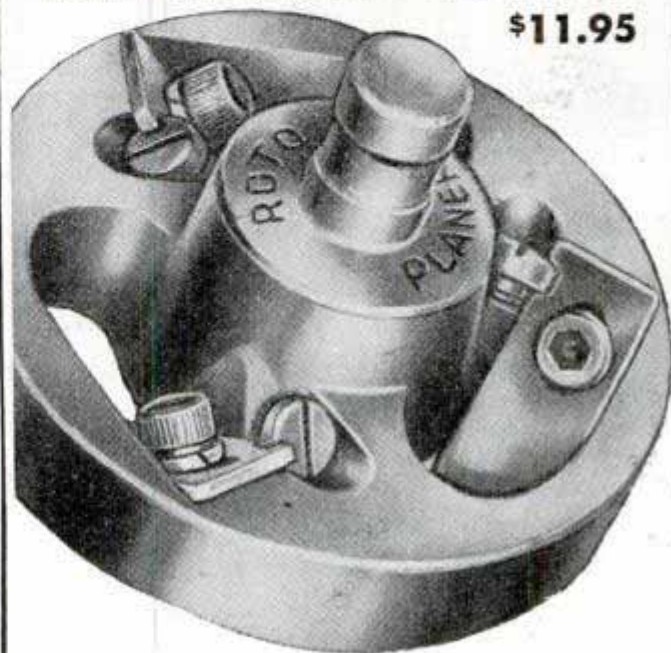


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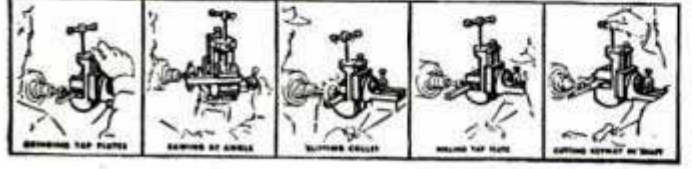
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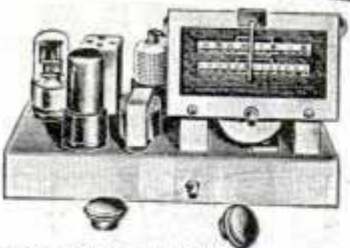
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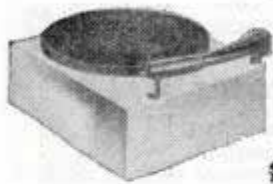
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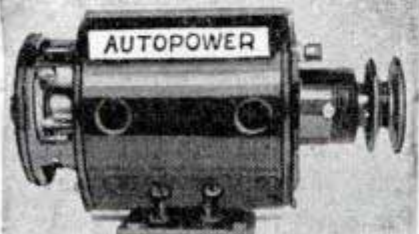
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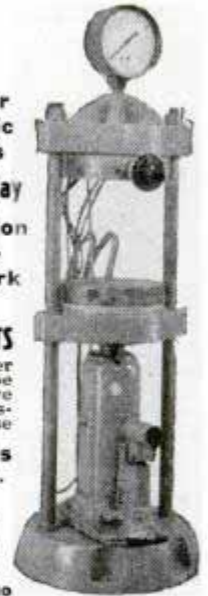
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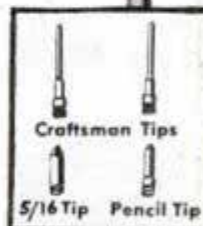
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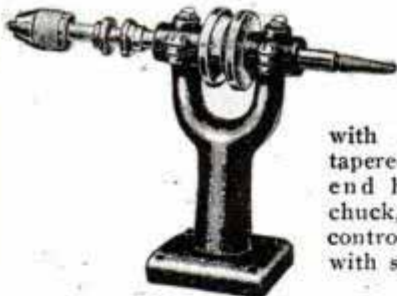
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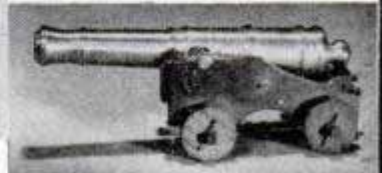


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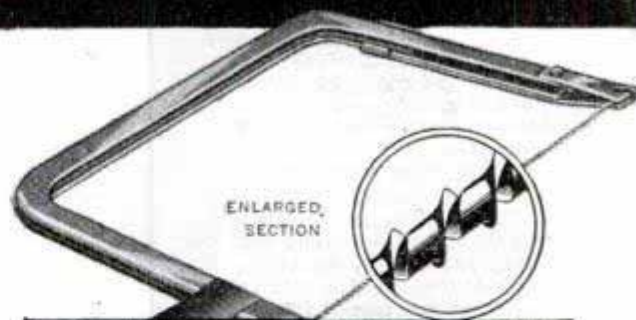
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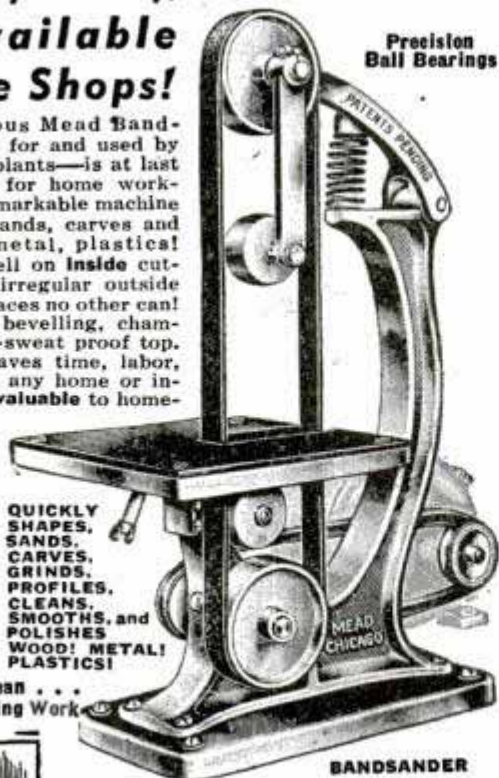
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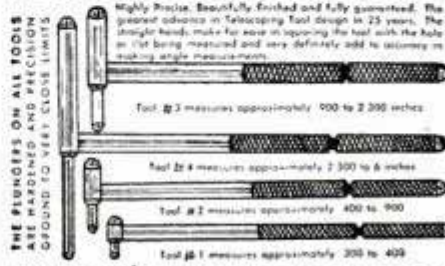
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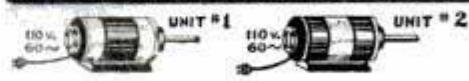
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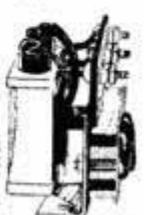


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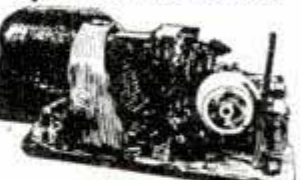


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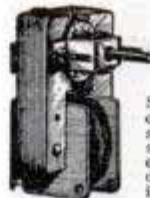
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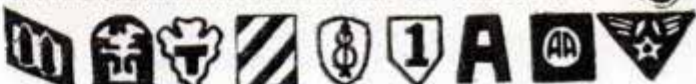
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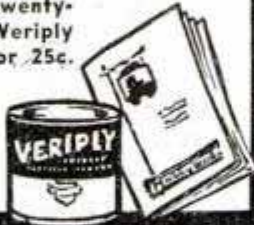
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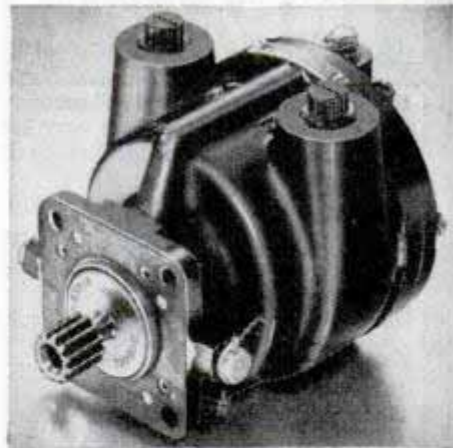
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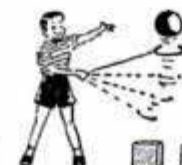
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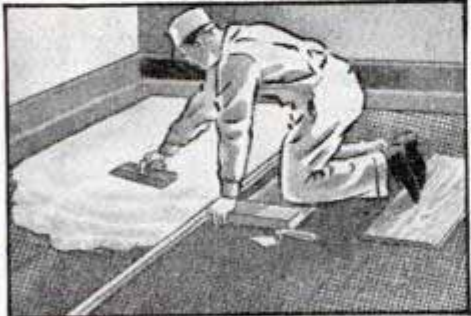
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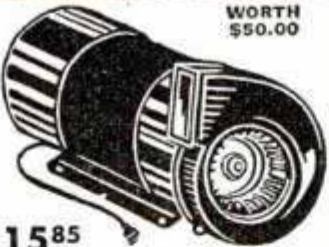
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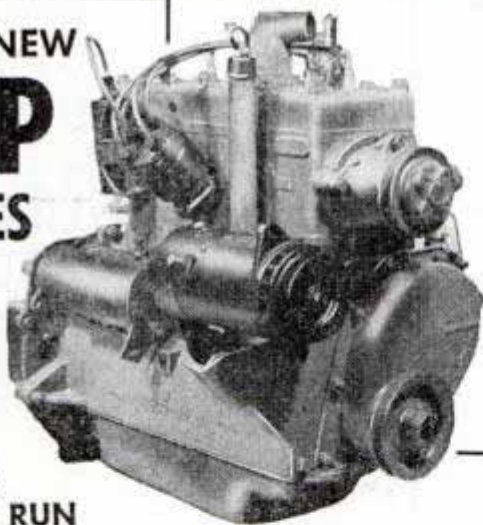
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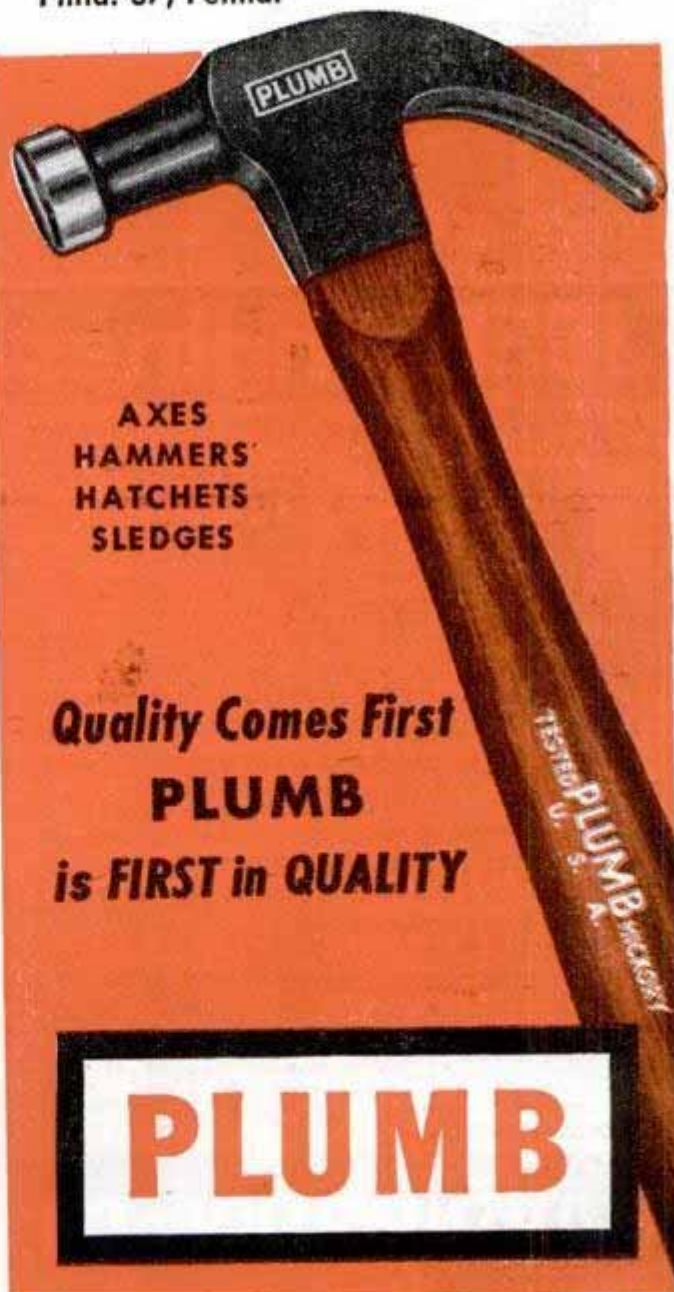
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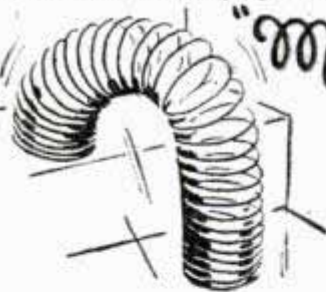
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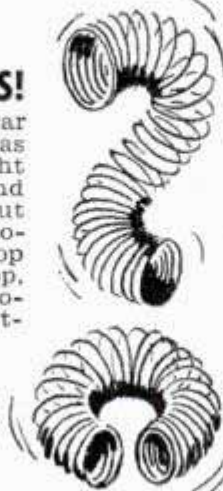
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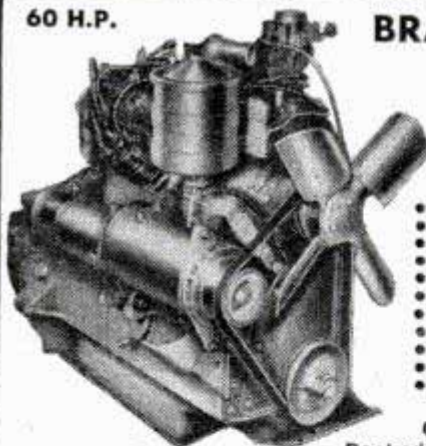
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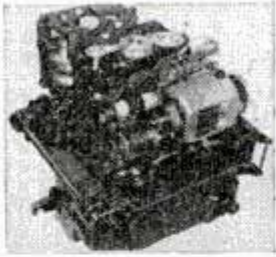
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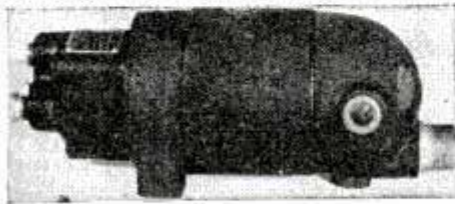
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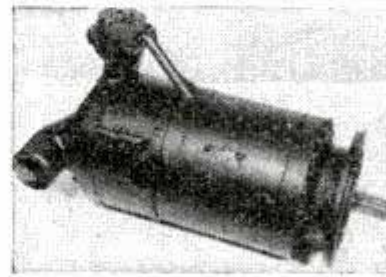
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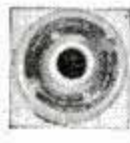
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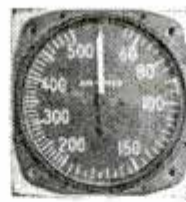
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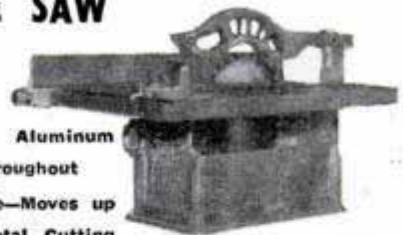
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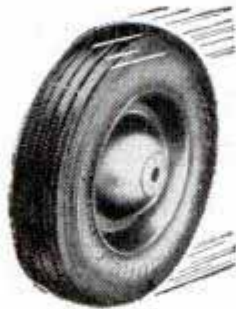
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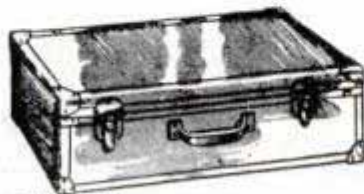
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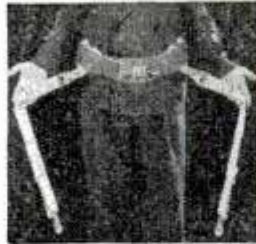
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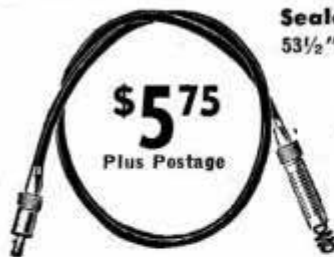
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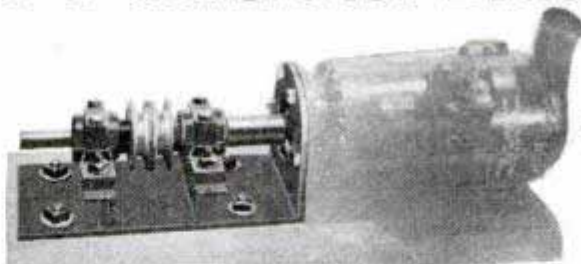
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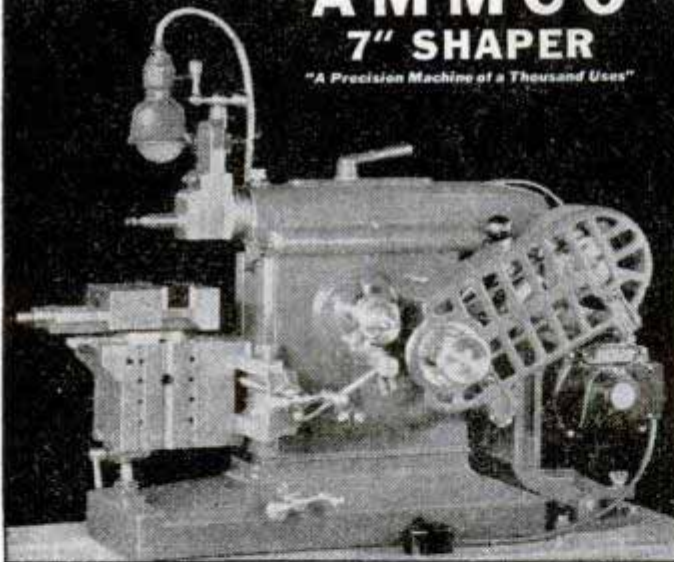


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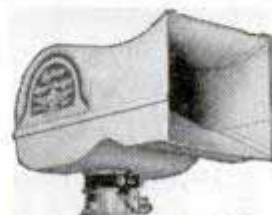
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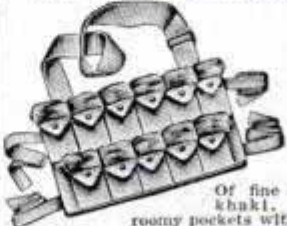
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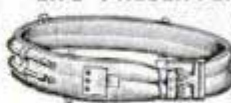
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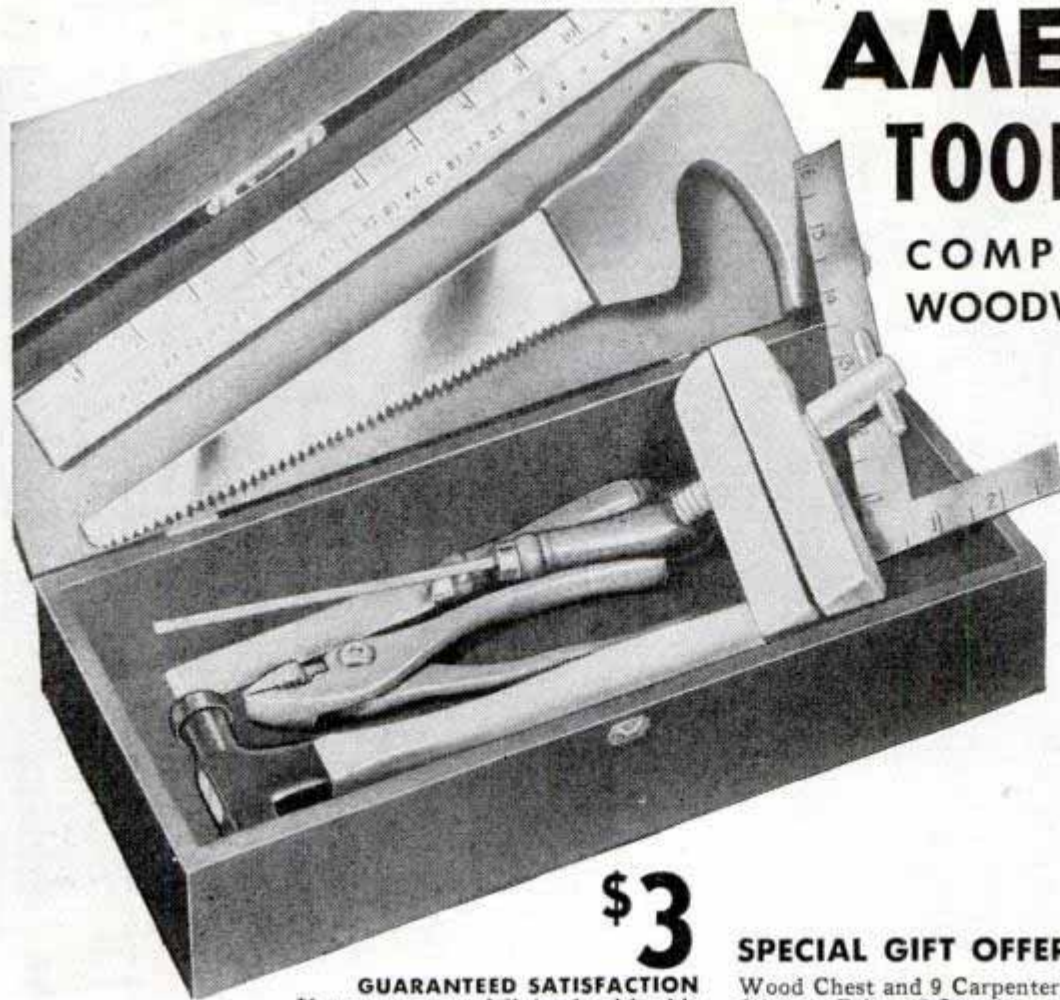
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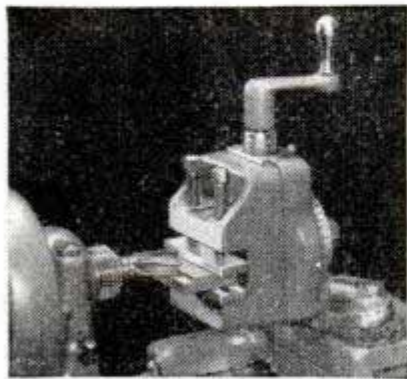
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