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PAGE 144

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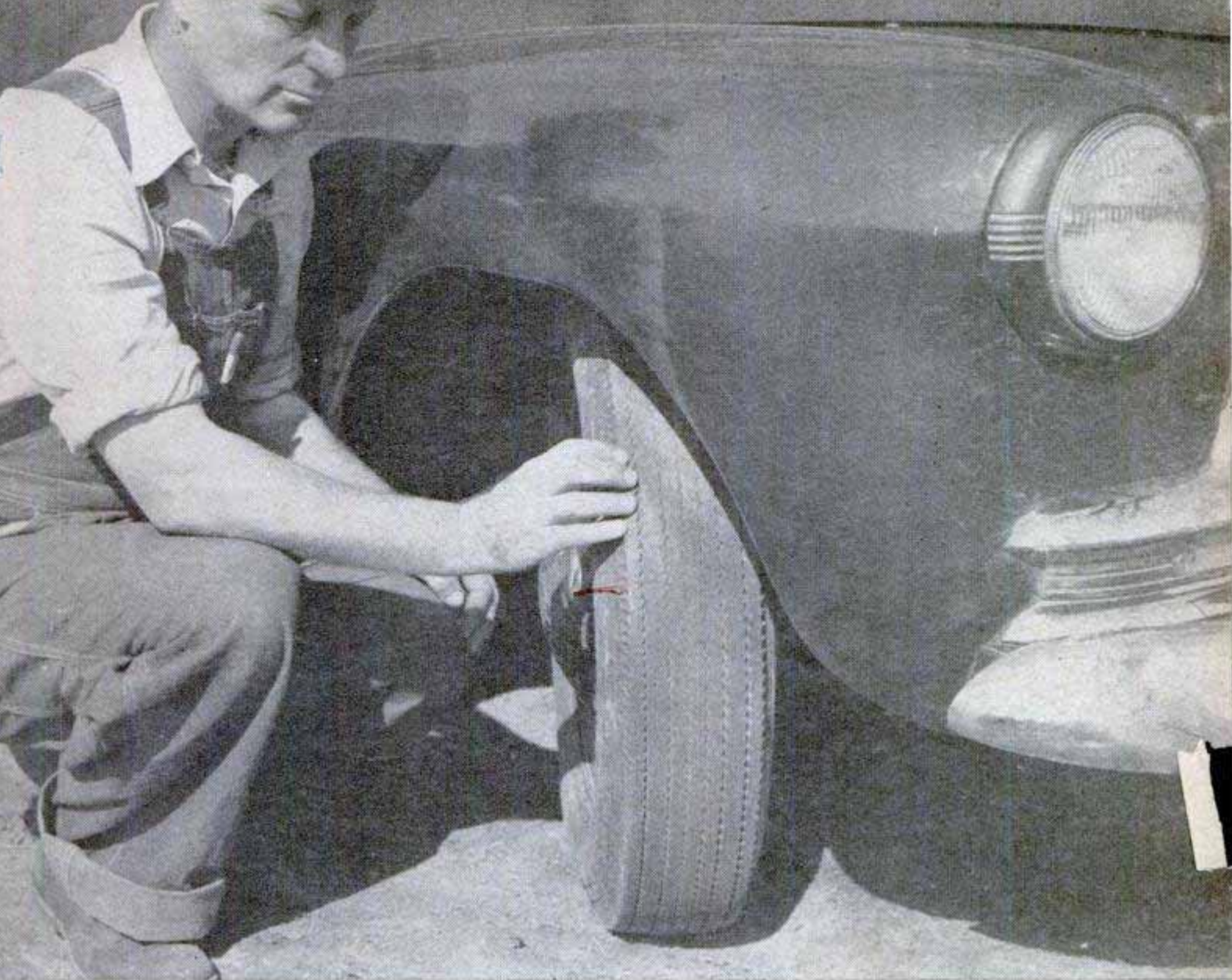


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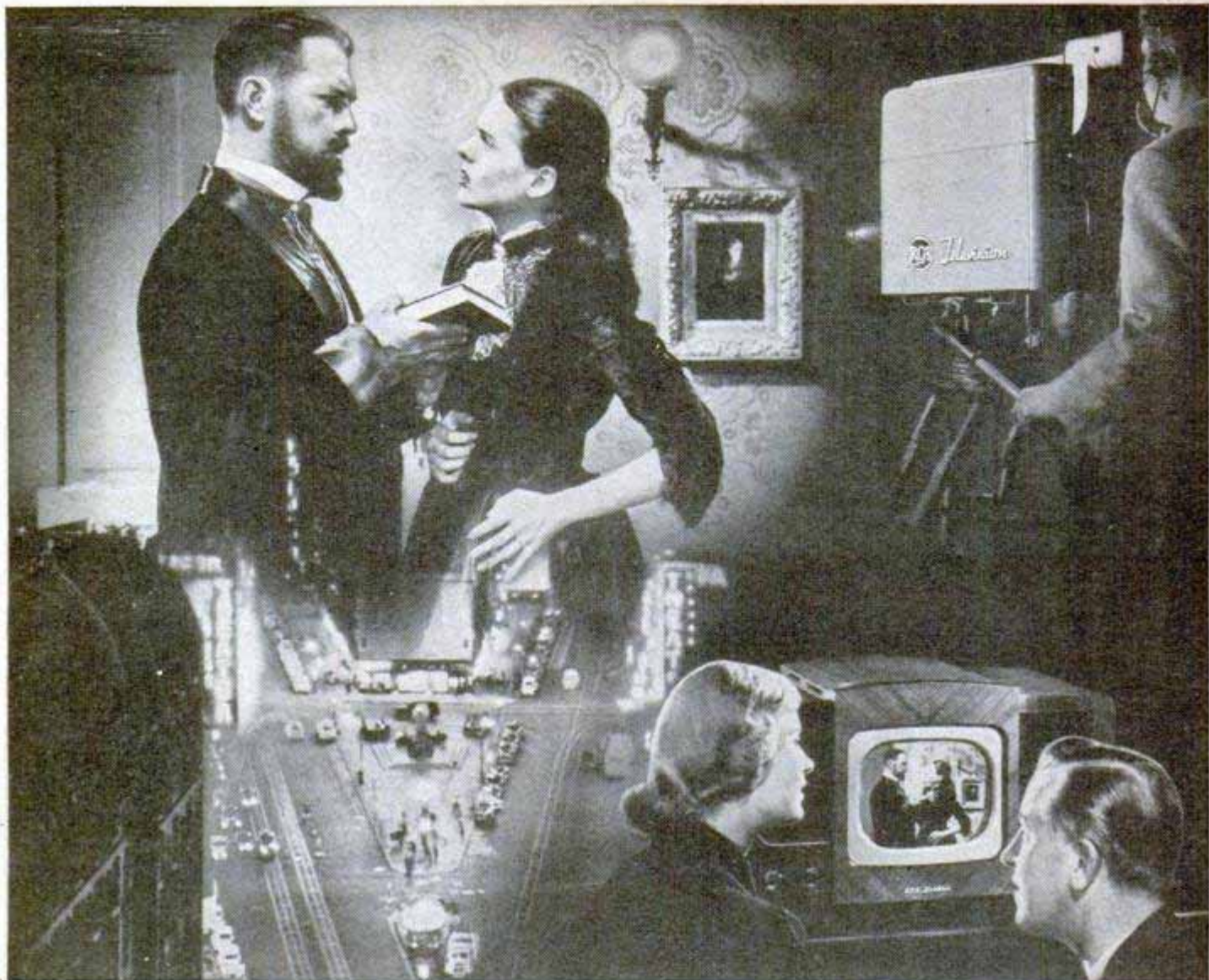
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HEADLINER of the "Three-Ring Zoo" (page 92) is the rough-and-ready St. Louis cowboy above. His talents include playing the trombone (with the cooperation of zoo mechanics). He answers to the not-so-tough name of Cookie.

NEXT MONTH an ambitious farm project is chronicled in the feature: "They Rebuilt a Farm in a Day." Another September article concerns the most vital piece of human machinery—your heart. "Mass Attack on Heart Disease" tells of an amazing experiment at the University of Minnesota. Also next month every inventor will want to rush to his workshop when he reads "Inventions Screened Here," the story of an organization on the lookout for practical ideas.

CRAFTSMEN in quest of a new hobby will be fascinated with a September feature on ceramics. It covers everything from "throwing" on the potter's wheel to construction of a home kiln and glaze firing. There's also an article on wheel-bearing care and another on making an arc welder out of a discarded transformer.

RADIO experimenters—look for the portable record changer in the September Radio section.

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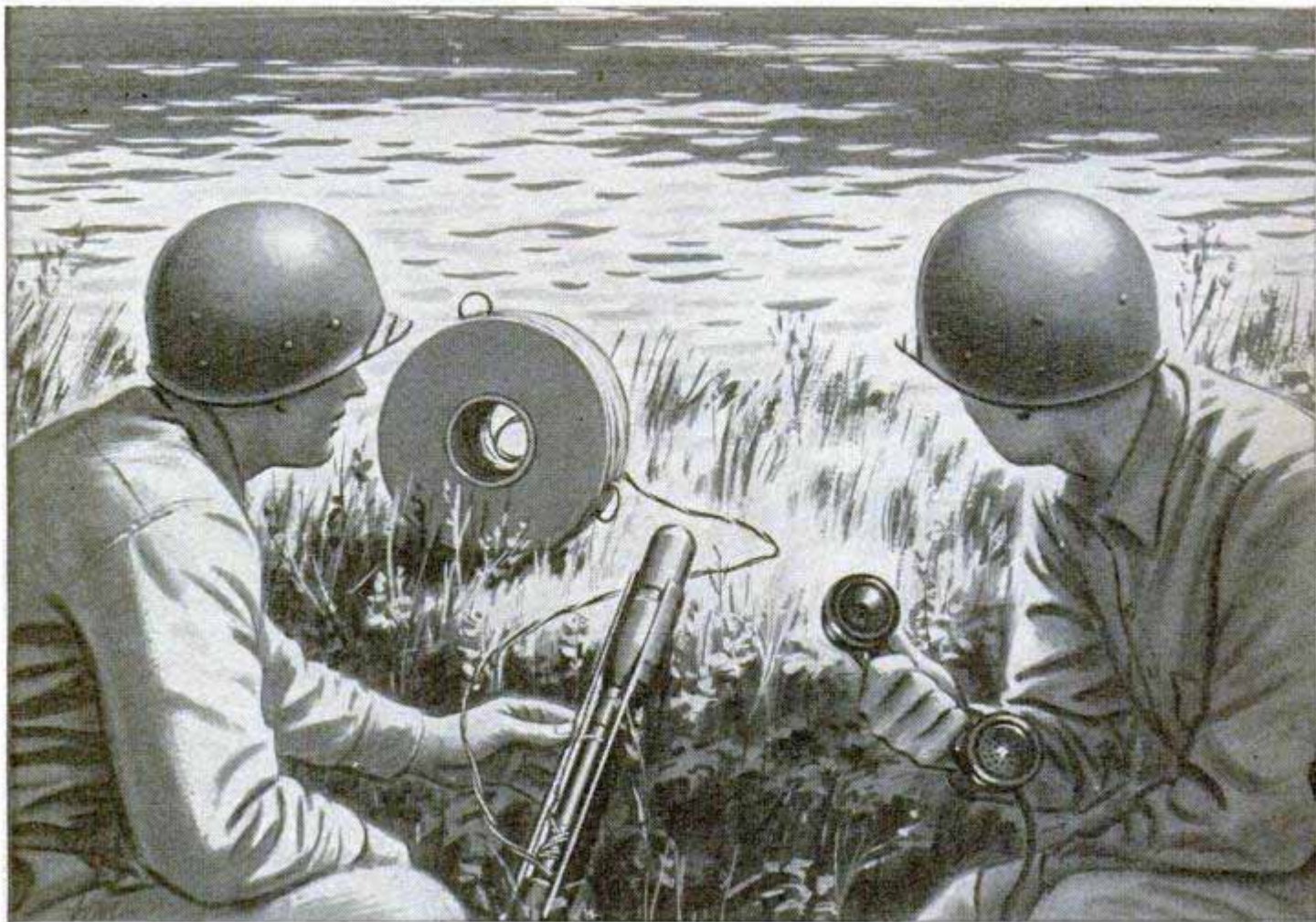
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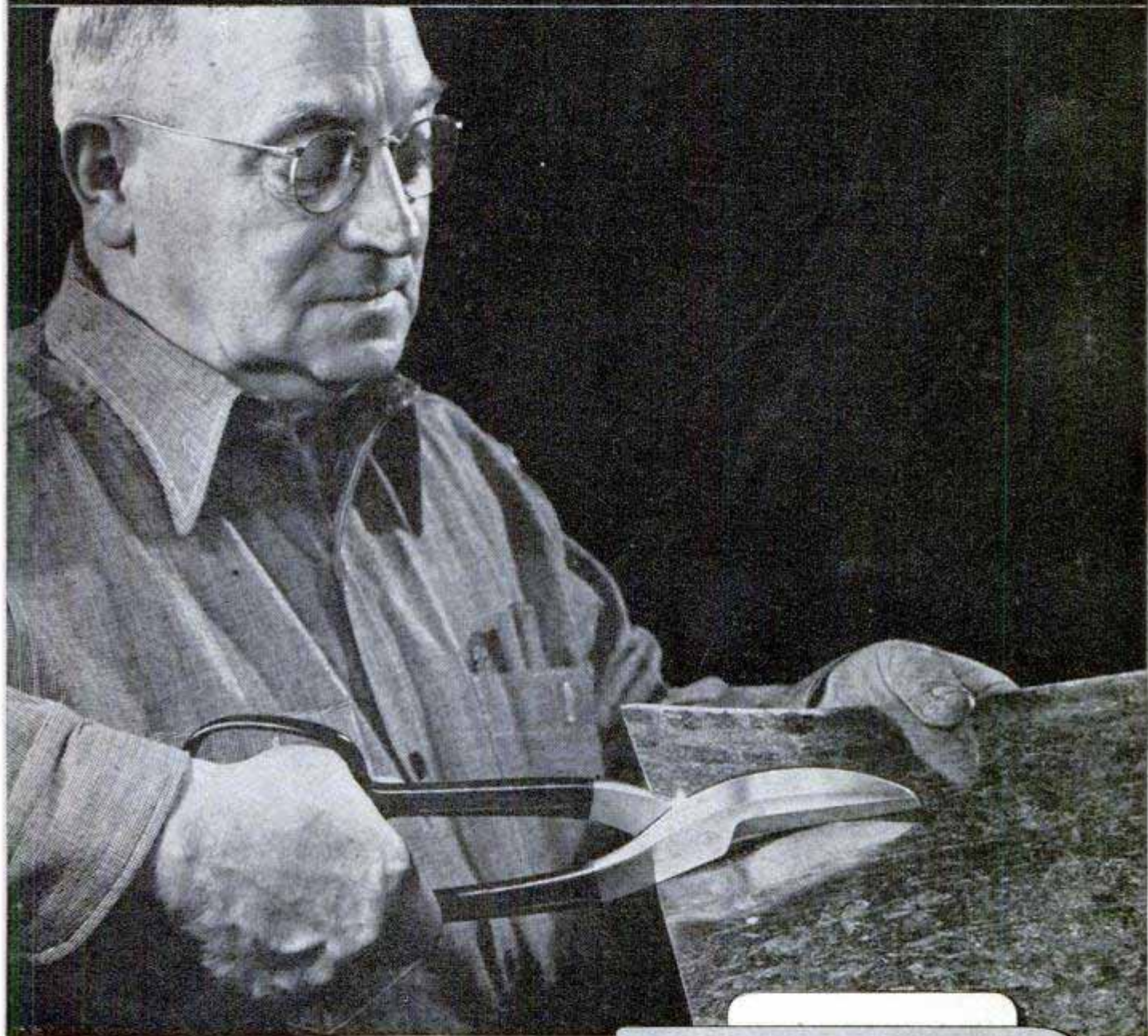
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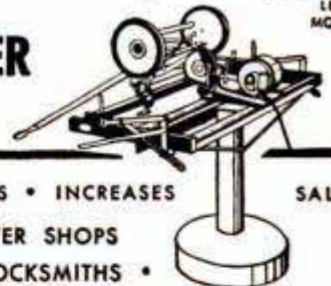
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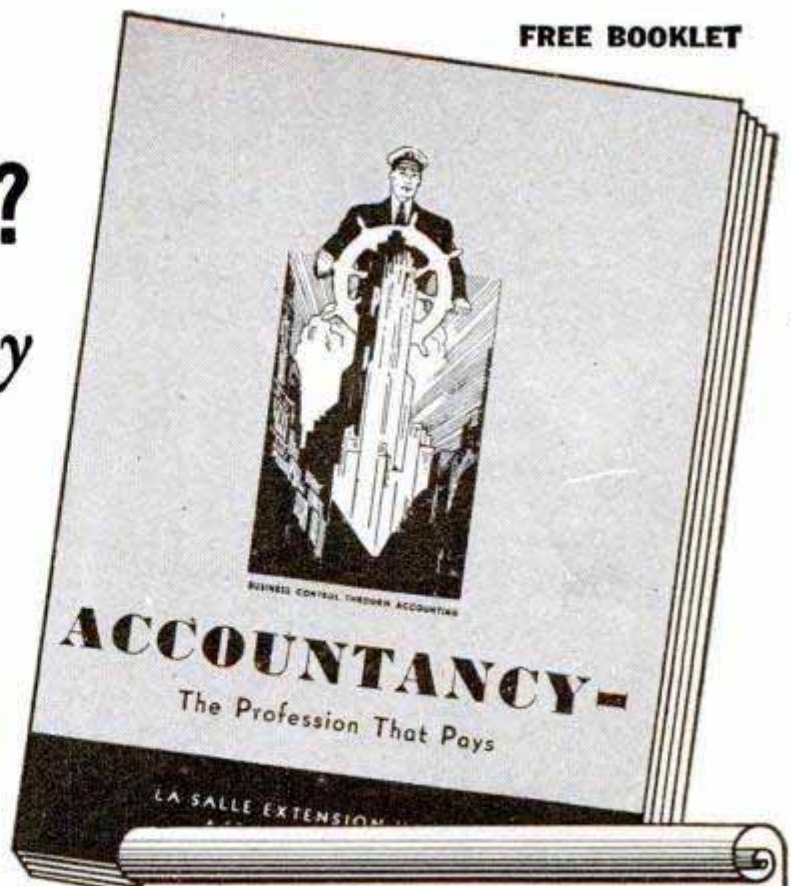
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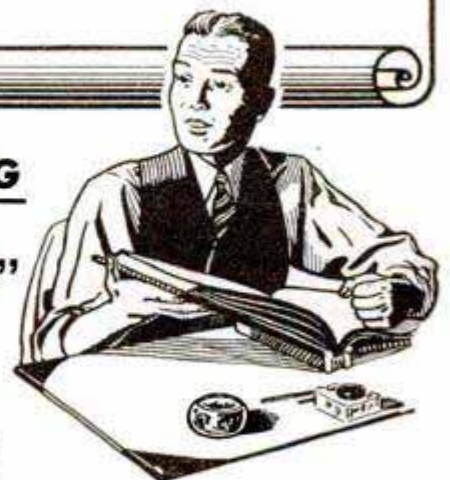
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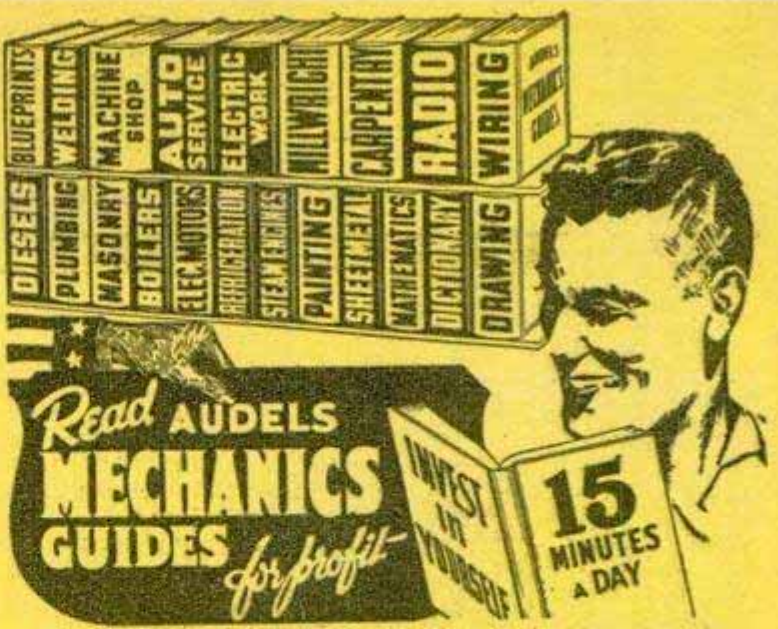
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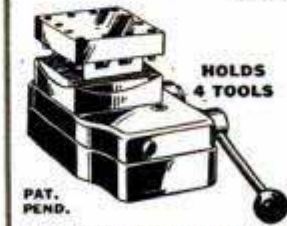
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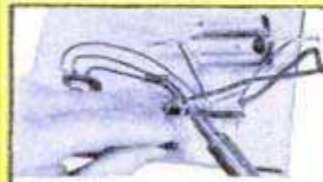
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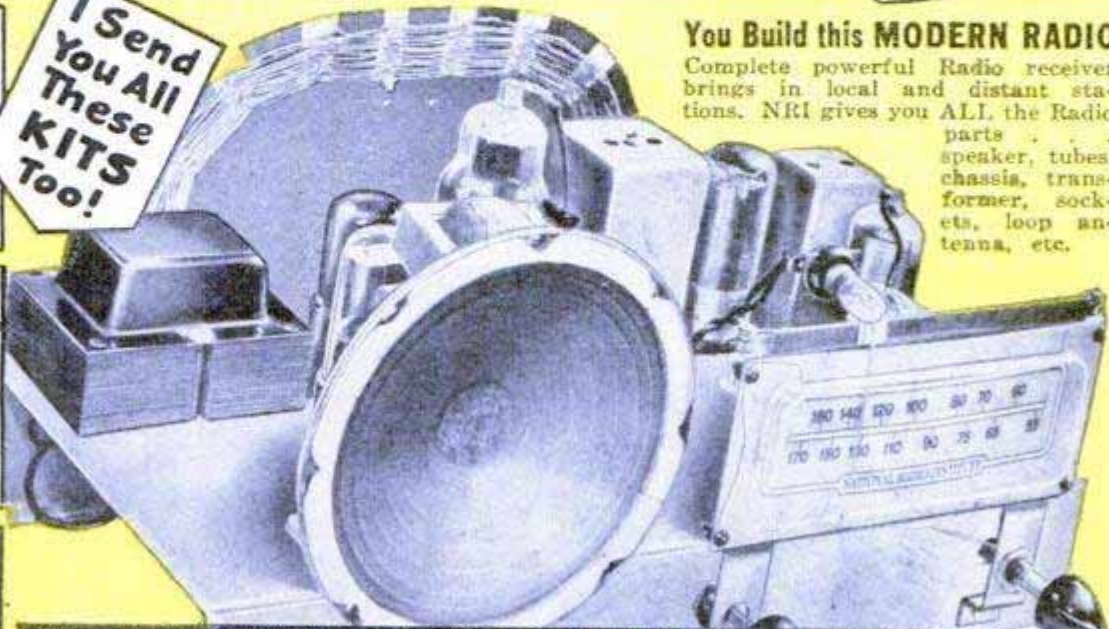


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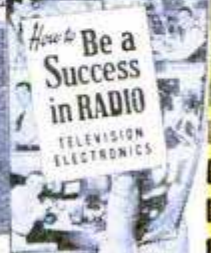
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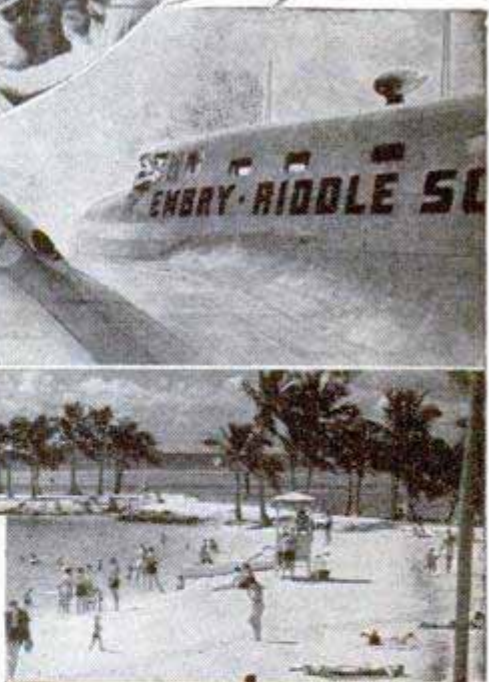
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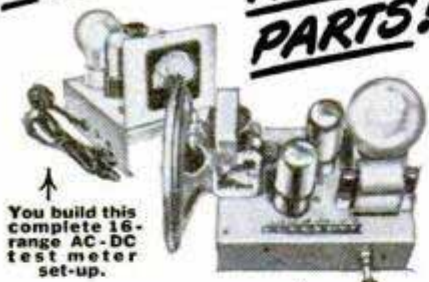
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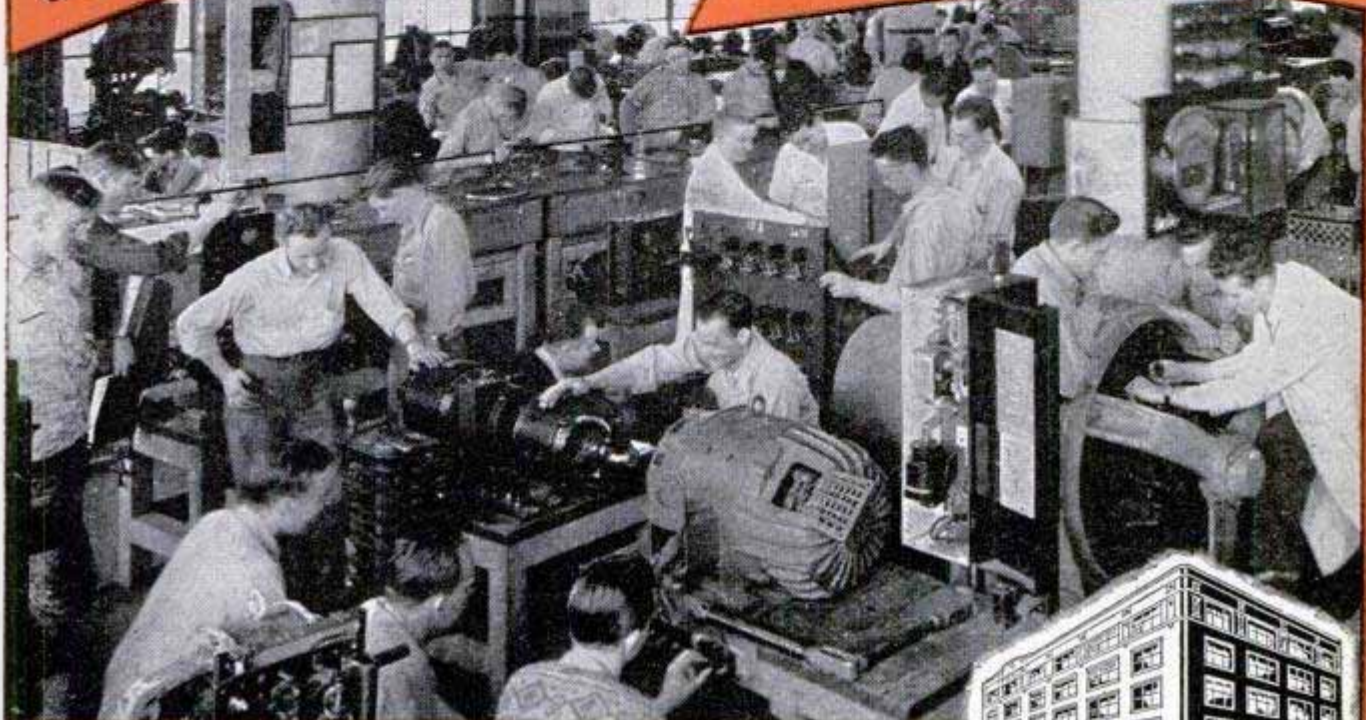
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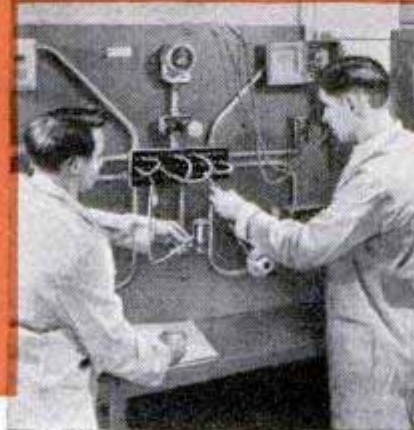
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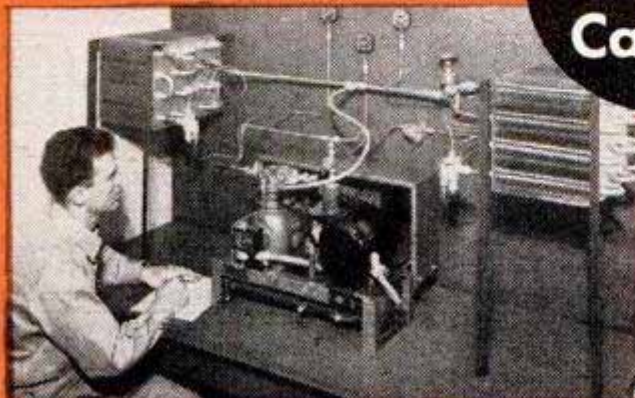


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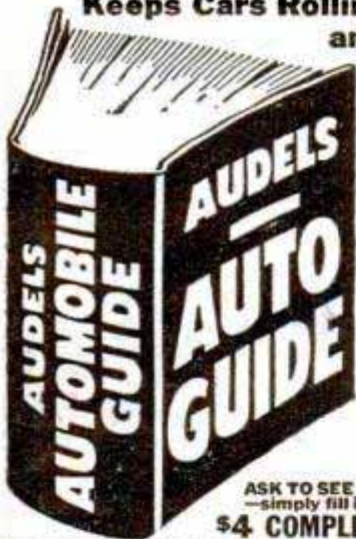
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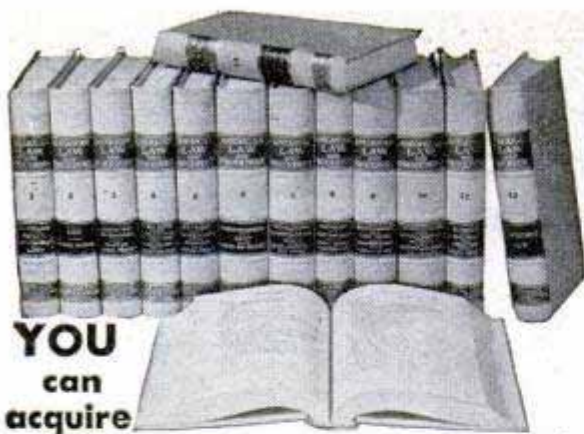
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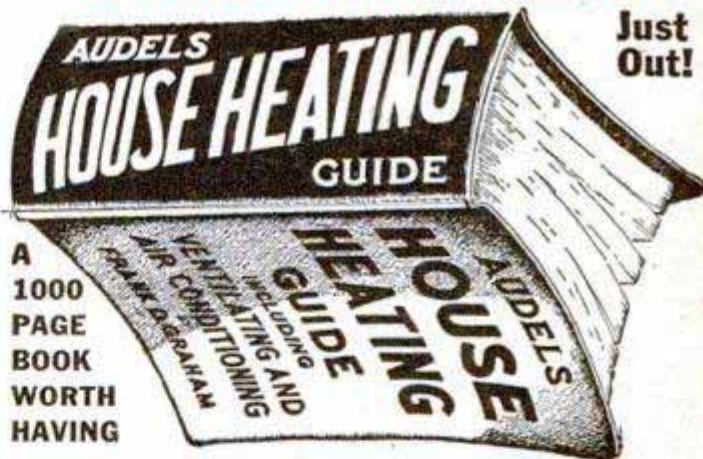
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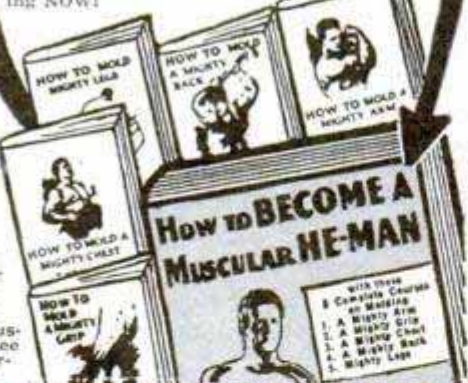
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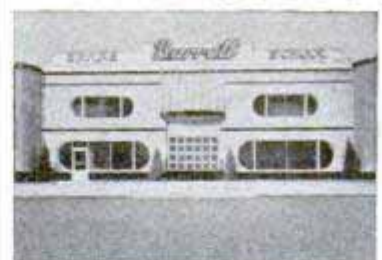
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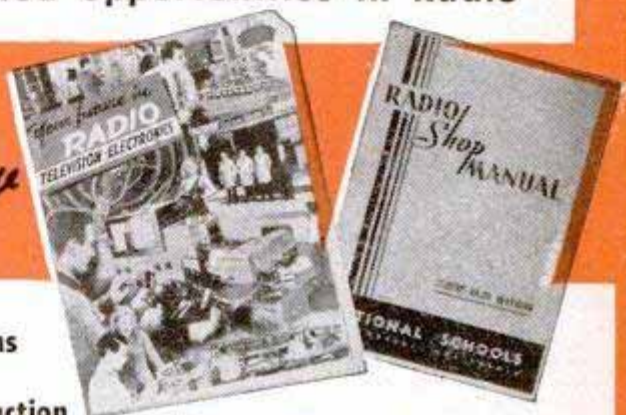
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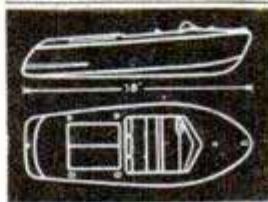
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WHOLESALE Sources 100,000 items; 60 formulas; 50 mail order success secrets; 64 page, illustrated "secret" catalogue 25c (refundable). Wilborn, 316-P Judson Rives Bldg., Los Angeles 13.

MAKE Money sharpening saws at home on electric machine. No experience necessary. Hardware dealers act as your agents to secure work. Send for free book "Independence After 40" shows complete plan for starting in spare time. Foley Mfg. Co., 47 Foley Bldg., Minneapolis 18, Minn.

"OPPORTUNITIES"—52 Page mail trade magazine, 24 wholesale sources, 3c. Wayne Burger, Baltic, Ohio.

MAKE Money by mail. Work at home. Amazing new plan tells how. Produced at great cost. Real, genuine moneymaker. Information free. Velker, 1836 Champlain Street, Toledo 11, Ohio.

RESILVER Mirrors at home. Formula 25c. Ideal Service, Park Ridge 6, Illinois.

TWO Dollars starts perfume manufacturing business. Big profits. Particulars free. Bob Celaya, Brownsville, Texas.

BE Independent, your own profitable business, home or shop, services for everyone. Complete instructions \$2.00. Packard, 2013 Chenevert, Houston, Tex.

YOU Make them. We sell them! New liquid plastic makes many items. Terrific demand! Earn minimum of \$50.00 per week at home. No experience or machinery required. We supply raw materials and instruction. Write Travaco Laboratories, P.O. Box 1883, Boston 5, Mass.

RUBBER! White liquid rubber! America's finest flexible moulding rubber! New! Extra heavy viscosity! Quick drying! Ideal for home, classroom, or industry. Only \$7.95 per gallon, \$2.95 per quart, and \$1.00 per half-pint sample. Parcel post prepaid! Plastercraft Supply Company, 3051 St. Clair Avenue, Cleveland 14, Ohio.

SPIN Angora wool. Ideal home business. Descriptive circular free. House of Angora, Springfield, Illinois.

VENDING Machines earn big money! An investment as low as \$10.50 will start you in this fascinating, profitable business that can lead you to the road of success and independence. Routes can be established and operated in either full or spare time with no experience needed. Write for full details and our free catalog illustrating our nut, candy, gum and stamp vendors; also slot machines, amusement games, etc. Parkway Machine Corporation, 623 W. North Avenue, Dept. 7, Baltimore 17, Maryland.

NO Selling, operate vendors, amazing profits, details free. Silver-King, 622 Diversey, Chicago 14, Ill.

LIKE Profits? Operate profitable mail order business. Splendid opportunities. For details write: Eugene Cottle, 249 Elm Avenue, North Sacramento, California.

PIANO Tuners are in demand making big money. Learn piano tuning at home. Write Evansville School of Piano Tuning, Dept. B, 714 S.E. Second Street, Evansville, Ind.

SPECIAL Rubber for making molds. Literature and sample free. Universal, Box 1076-A, Peoria, Ill.

POPCORN Machines, peanut roasters, caramelpcorn equipment, griddles, gasoline, bottled gas appliances. Northside Sales, Indianola, Iowa.

HOW And where to obtain capital. Small and large loans. Free particulars. Star Service, Wapakoneta, Ohio.

OWN Mirror shop. Resilver mirrors. Glass sign making. Electroplating. Supply prices. John Sprinkle, V60, Marion, Indiana.

BRONZED Baby shoe mountings and supplies. All metal bronze bookends, picture frames, ash trays, etc. Onyx ash trays, desk sets, plaques. Hardening solution, 30-amp. plating rectifiers with powerstat control, \$85.00. Geared motors for agitation \$20.00. Lead lined tanks. Write for list, Hollywood Bronze Supply, 1770 N. Vermont, Hollywood 27, Calif.

SELL Greeting cards, pictures, signs, novelties, books! Large profits! Catalog free! Elfco, 434 North Wells Street, Chicago 10.

MAKE Money making new greaseload doughnuts at home on electric machine. Wholesale to grocers, drug stores, cafes, hamburger shops. Send for free recipes and plans. M. Ray Company, 3605 South 15 Ave., Minneapolis 7, Minnesota.

MAKE Beautiful vari-colored, highly glazed concrete pottery. Amazing profits. Small capital starts. Write for samples and photographs. Ozark Enterprises, Lock Box 273, St. Charles, Mo.

MONEY For you in your own business. Many surprising opportunities. Free information. Empire, Box 1340-C, St. Louis, Mo.

RUBACREAM! Natural rubber latex! Makes molds quicker! Thicker! Free sample convinces! Castcraft Studios, 509-P Fifth Avenue, New York 17.

DO It with sea shells. Profitable easy home work. Free lesson. A. Werts, Sharp Park, California.

MAKE Liquid marble, artificial marble flooring, flexible molds, statuary, art goods, novelties. Literature free. Kemico, Park Ridge 50, Ill.

EARN \$200 Weekly installing new amazing "Styron" plastic wall tile in homes, offices. Easily applied. Tile your own kitchen, bathroom, too. Instructions, everything furnished. Literature free. U. S. Tile Co., 30 W. Washington St., Chicago 2, Ill.

GET Hundreds money making deals, business ideas, plans and manufacturing. Amazing folio free. Austin Mail Service, 5538 Lexington, Chicago, Illinois.

MAKE Money by mail, every month. Spare time business. Small capital required. Tuff, 429 Robison Ct., Pittsburgh 19, Penna.

QUICK Money. "Repairing car batteries." At home! Easy too! Batteryman, Grand Junction, Colorado.

WANTED Unused U. S. postage stamps, small discount. Advance Stamp Company, 24 East 23rd Street, New York.

MAKE And sell candy professionally, inexpensive to start, information free. Box 670, Kissimmee, Florida.

POPCORN Machines. Potato chip outfits. Long Eakins Company, 4860 Hi Street, Springfield 99, Ohio.

OPERATE Profitable mail order business. Splendid opportunity. For details write V. M. McKinley, 78 Ave. "A," Battle Creek, Mich.

READ "Advance"—The voice of mail order. Offers money-making opportunities, sources of supply, personal guidance, etc. Issued monthly. Sample copy 25c. Yearly subscription \$2.00. American Mail Trade Association, 313 East 21st Street, Suite 450, New York 10, N. Y.

\$46 FROM Square foot plywood. Jigsaw necessary. Write, Woodarts, X-38, Bridgewater, Mass.

OPERATE Profitable mail order business. Write Walter Service, 4159-A East 112th, Cleveland 5, Ohio.

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

RE-NEW Leather and leatherette—Make cloth into imitation leather with plastic discovery called Leather-New. Opportunity to make real profits taking care of sales resulting from national advertising. Write for free sample of Leather-New covered material and complete deal. 4723A Troost, Kansas City, Missouri.

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.

COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

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

LIQUID Rubber for making flexible molds. Cast novelties. Sample bottle 25c. Free literature. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

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.

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

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

137 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 220 Grand St., New York 13.

BRUSH Plating outfits connect to a battery. No tanks necessary. Good paying business at home plating autoparts, bathroom fixtures, bicycles, reflectors, silvering mirrors. No shop or experience required. Outfits furnished. Free booklet. Gunmetal Co., Ave. H, Decatur, Ill.

WOULD You pay 3%—first \$350 made? Color-illustrated book "505 Odd, Successful Enterprises" free! Some offer occasional "day off." Work home. Expect something odd! Pacific, Oceanside, Calif.

MAILING Postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordan Publishers, Box 23, Pawtucket, R. I.

CO-PUBLISH And advertise in The Central Mail Advertiser. Sample copy for stamp. Low rates. Large circulation. Bagby Printing Co., Georgetown, Ohio.

MAIL Order opportunities. Full or spare time. Hundreds of chances. No charge. Postal brings copy. Blackstone Press, Somerville, New Jersey.

MONEYMAKING OPPORTUNITIES

WANT Pleasant outdoor work in a business of your own? Good profits selling over 200 widely advertised Rawleigh home/farm necessities. Pays better than most occupations. Hundreds in business 5 to 20 years or more! Products-equipment on credit. No experience needed to start, we teach you how. Write today for full particulars. Rawleigh's, Dept. H-145-PPM, Freeport, Ill.

LEARN Air conditioning. Trained men needed. Enormous profits. Write Don Nelson, Warner Robins 2, Georgia.

MAKE Money, paint wall plaques. We furnish plaques small cost. Big demand. Marbleite, Ames Station Box 53, Omaha, Nebraska.

YOU Can co-publish impressive 64-page magazine at little cost. Get four profits; free advertising, 5,000 word details. 25c. Kimball, 31 Norway, Berlin 7, N. H.

BUILD Plastic homes. Lovable, lasting, low cost. Bays Laboratory, 327 S.E. 46, Oklahoma City 9.

START Your own business! Big money manufacturing novelties, plaques, statuary. Free catalog. Write Bing Products, 88-A8B Broad Street, Boston 10, Mass.

HELP Wanted to operate our successful mail business. Free details. Reynolds, Box 103Y, McAllisterville, Penna.

BUILD With concrete blocks: Walls, garages, houses. Professional Instructions \$1.00. "Blockmasons," 1256 Amanda, San Bernardino, Calif.

PAST Sales. Cuts food cost. Nets \$9 a case. Sell 6 daily. Exclusive terr. Jeld. Ltd., Burbank, Calif.

CASH In on brand new idea—Personalized remembrance notes. Samples free. Lincolncraft, Dept. PM, Whitestone, N.Y.

SELL Score books to 20,000,000 bowlers. 40% commission. Samples 30c. Sim's, Marysville, Washington.

EARN Up to \$520 month part or full time keeping books for small firms. Simplified system. Write Tax-Saver System, Dept. D, Ft. Worth, Texas.

MAKE Money raising bees. Wonderful spare time hobby explained in 96 page booklet "How to Succeed With Bees." Illustrated. Only \$1.00. Popular Mechanics Press, 200 East Ontario Street, Chicago 11, Illinois.

LATEST Money-making opportunities. Variety of choice. Details free. Edward Stevens, 716 West Fourth, Michigan City, Indiana.

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

HOW To make money at home spare time. P.O. Box 8357, Chicago.

UNPAINTED Plaster ornaments. Beautiful designs easily decorated with water colors or oil paints. Profit or hobby. Illustrated list free. Midwest Novelty Mfrs., 108-A Cedar Street, Anaconda, Montana.

ANALYZE Handwriting for profit! Complete outfit \$1.00. Graphologists, POB-971, Philadelphia.

CASH For you—Yes, you keep dollars. We fill orders free. You risk nothing. Write, Edwin Velker, 1836 Champlain Street, Toledo 11, Ohio.

TESTED Money making plans. Free details. James Carter, Rocky Mount, Virginia.

100 MONEYMAKING Ideas! 64 pages—\$1.00. Zampino, 2337 Bath Avenue, Brooklyn 14, N. Y.

SEA Shells. Interested in making shell jewelry, lamps, novelties. We have all supplies at wholesale. Write for price list. Sea Shells, 269 W. Flagler Street, Miami, Fla.

THOUSANDS Articles wholesale. "Supply Source Directory" 10c. Ideal Service, Park Ridge 40, Illinois.

PRIZE Contest bulletin gives various contests now operating, and valuable hints. 3¢ stamp. National Contest Bulletin, Box 2685P, Miami, Florida.

WIN Contest money. Send 25c complete instructions for writing winning answers. Winacontest, 22P Westlake Ave., Auburn, N. Y.

WIN Contest money. General Contest Magazine gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609½ East 5th, Duluth, Minn.

WOULD You pay 3%—first \$350 made? Color-illustrated book "505 Odd Successful Enterprises" free! Proven! Work at home, office. Expect something odd! Pacific, Oceanside, Calif.

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.

FORMULAS, PLANS, ETC.

21 MONEYMAKING Candy apple, popcorn formulas. Send \$1.00 m.o. We can supply equipment for starting very profitable popcorn, candy floss business at little cost. Concession Supply, Dept. A, Sta. "B," Toledo, Ohio.

PHOTOGRAPHS anywhere, three formulas \$1.00. "Photo," 2437 Hollywood Ave., Toledo, Ohio.

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

TESTED Formulas. Interesting descriptive booklet free. Pont, Box 635-PM, Terre Haute, Indiana.

OPPORTUNITIES! Catalog describing 200 helpful formula, money-making books. Airmailed throughout world for stamps. Adams Brown Company, Boston 67, Mass.

MAKE—Sell cleaners, soaps, polishes, flavors, cosmetics. Literature free. Kemico, Park Ridge 16, Illinois.

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

PLASTICS

YOUR Own business in plastics. Details free. Harco, Edgewood, Maryland.

PLEXIGLAS. Masked sheets; first quality; per square foot 1/16, 68c; .100, 80c; 1/8, 87c; 3/16, \$1.07, 1/4, \$1.26. For sheet sizes write Hub Stamping, 355 Congress, Boston, Mass.

REAL Flowers embedded in clear plastics, pins \$1.50, earrings set \$1.00. Astoria Products, 631-3rd Ave., New York City.

PLASTIC Injection machine, Plexiglas, jewelry findings, dyes, cements, tools, drills. New catalog. G. Baker Company, River Edge, New Jersey.

AGENTS Make big money selling plastic tablecloths, U. S. patented plastic aprons, magic combinations of purse and shopping bag. Also other items. Sells on sight. Samples free. Schneider Products Co., 83 Atlantic Ave., Revere, Mass.

LUCITE. Plexiglas. Masked sheets. All sizes, cost square foot (12"x12") 1/16" 90c; 1/8" \$1.16; 3/16" \$1.43; 1/4" \$1.68; 5/16" \$2.09. Include 10% postage. Almac Plastics Inc., 230 Fifth Avenue, New York 1, N. Y.

BOOK—Illustrated, fabricating, forming lucite. Simplified methods, projects. \$1.00 p.p. Ideas-B, 11379 Ventura, North Hollywood, Calif.

SUMMER Special. Prime quality masked Lucite. 3/16", 16" square \$2.45 postpaid. Free catalogue. Craft-Plastics, Somerville 1, New Jersey.

PLASTIC Materials. Cements, dyes, findings, internal carving drills. Send 10c for catalog and floral carving instructions. Locket with internally carved rose and bud 50c less findings. Art Plastics of Calif., 8125 East 14th Street, Oakland 3, Calif.

BARGAINS In plastics. Lucite, Plexiglas, Catalin. Many colors and sizes. Details free. George Plastics, 6938A George St., Chicago 34, Ill.

RENEW Leather and leatherette—Make cloth into imitation leather with plastic discovery called Leather-New. Opportunity to make real profits taking care of sales resulting from national advertising. Write for free sample of Leather-New covered material and complete deal. 4723B Troost, Kansas City, Missouri.

PLASTIC—Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2618 St. Louis Ave., St. Louis 6, Mo.

CHEMISTRY

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 10c. Dept. M-26. Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, N. Y.

LEARN Chemistry at home, from the house of Winn. Home of supplies for student chemists. New idea chemical and apparatus outfits for home experimenting. Photographic scales, semi-professional microscopes and accessories. Send 15c for retail catalogue. Established 1931. John H. Winn, 124A West 23 Street, New York 11, N. Y.

NEW Laboratory supply catalog of chemicals and apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company, 1232 N. Paulina St., Chicago 22, Illinois.

FREE Catalog: Chemistry, mineralogy, physics, biology. Tracey Laboratories, Evanston, Illinois.

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

HELP WANTED

A WORD To the wise! Ramode's imprinted cards are a most amazing offer. 50 and 25 for \$1.00, 25 for \$1.50, 25 for \$1.95. 25 beautifully boxed assortments for Christmas and everyday. Samples on approval. Ramode Greetings, 7A Hovey Ave., Cambridge 38, Mass.

BOYS Wanted. Over \$50 week! Sell name plates for front doors. Write National, 214-CC Summer, Boston, Mass.

FREE—"Amazing New Book"—"Profits From Classified Advertising." Tells how and what to advertise. Be sure to read this book before you invest one cent in advertising. Remember—it's free! Write for your copy now. F. W. Johnson, Classified Advertising Manager, 200 East Ontario Street, Chicago 11, Illinois.

AGENTS WANTED

BIG, Easy profits to 100% selling new, novel Christmas card, gift wrapping, panorama, Christmas carol assortments. Bonus. Special offers. Request free samples 50 for \$1.00. Personal, silver imprint line, name imprinted and floral stationery and feature Christmas samples on approval. New England Art Publishers, North Abington 190, Mass.

NEW Extra money plan. Make up to 100% profit; without experience; showing Christmas, Everyday Card assortments, wrappings, stationery, coasters. Unusual, attractive. Bonus. Special offers. Send for free samples 30 different name imprinted Christmas cards, 50 for \$1.00. 25 for \$1.00 and \$2.00, stationery, coasters. Christmas, Everyday assortments on approval. Thomas Terry Studios, 90 Union Ave., Westfield, Mass.

EXCLUSIVE Cutlery line. Complete table and kitchen sets. Also open stock. Butcher, paring knives, etc. Free literature. Broadway Cutlery Co., Broadway, Freehold, N. J.

SELL Dental-Stero the amazing new toothbrush holder and sterilizer with nylon toothbrush. Complete package sells for only 75c. Your cost per dozen, \$4.00; net profit on 1 dozen, \$5.00. Every home can use two to five or more. Big profits! Send \$1 today for 2 sample outfits or write for more details. Dental-Stero Company, 3906 Secor Road, Toledo 6, Ohio.

BIG Money selling cast iron and aluminum cooking utensils direct to consumer, exclusive designs. Free illustrations. Jones Machine & Foundry Co., Chattanooga 2, Tenn.

MEXICAN Feather pictures. Unusual novelty. \$1.00 (stamps) brings \$2.00 worth samples, details. Refunded if unsatisfied. Aztec Art-P, Apartado 762, Mexico City.

AGENTS Sweet smelling perfume novelties sell on sight. Gorgeous samples. Free particulars. Mission, 2328R West Pico, Los Angeles 6, Calif.

PAST Selling line beautiful Christmas and all-occasion assortments, gift wrappings, personalized stationery, matches, playing cards, coasters, napkins, guest towels. Profits to 100%. Free samples 50 for \$1.00 personal Christmas cards. Special offer. Write Senrab Co., 212 West Washington St., Syracuse, N. Y.

VARIETY-HARDWARE Salesmen—Distributors: Exclusive territory open. New cast aluminum house numbers. Huge profits. Average sale nets \$5.00. Sample display \$1.00 (returnable). Alproco Inc., 7765 14th South, Seattle, Wash.

CHRISTMAS Cards. Earn \$3.00 an hour. Take orders galore from friends. America's fastest selling 21 Christmas folder assortment. Smart, distinctive! Costs 50c. Sells \$1. A complete line. Samples on approval. No investment. Sunshine Art, Dept. PM-8, 115 Fulton St., New York 8, N. Y.

BIG Profits selling personalized rust-proof metalgram initials for autos, motorcycles, luggage, etc. Thousands waiting to buy. Unlimited opportunities. Generous samples, 3 styles (your initials) and complete details only 50c (coin). Metalgrams, 1945A-74th St., Brooklyn 4, N. Y.

CALL On friends with sensational Christmas cards in handy assortments. Sell for \$1.00. Profit up to 50c. Also popular-priced personal Christmas cards, everyday assortments, stationery, imported napkins. Samples on approval. Wallace Brown, Dept. H-4, New York 10, N. Y.

LOOK Here! Wanted—Men to start in business on our capital. Sell some 200 farm-home products. Thousands our dealers now make quick sales, big profits. For particulars write Rawleigh's, Dept. H-192A-PPM, Freeport, Ill.

BIG Money. Sell friends, others, exclusive Christmas card assortments unobtainable elsewhere. Profits to 100%. Bonus. Request free samples exclusive 50 and 25 for \$1.00 name imprinted Christmas cards with Christmas and everyday assortments on approval. Regal Greetings, Dept. PM-3, Hazel Park, Mich.

100% PROFIT. No investment—Handle quality Fotostamps. Amazing glossy photographs, gummed stamp form. Business year round. Free samples, particulars. American Foto Stamp Co., 103 East 125th St., Dept. PM 8, New York 35.

REAL Live Mexican jumping beans. 18-25c, 125-\$1.00, 500-\$3.00, 1000-\$5.00. J. J. Frank, 525 Palm, Rockford 1, Ill.

40% PROFIT. Power mowers, \$99.50. Free, sales kit. Farm Products, M-2008, Excelsior Springs, Mo.

AT Last! Something new and sensational in Christmas cards. Gorgeous satin, velour designs never before offered. Amazing value! Gets orders fast. Name-imprinted Christmas cards, 50 for \$1 up. Big profits. 30 other assortments 60c to \$1. Imprinted stationery. Samples on approval. Puro Co., 2801 Locust, Dept. 840-K, St. Louis, Mo.

\$1 STARTS You in business. Sell lined ties, 100% wool interlining. Costs you only \$7 per dozen, you make \$5.00 dozen. Send \$1.00 for special introductory offer two ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. K-26, New York 10.

SELL Ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. "7x11" cost 6c, sells 35c. Make money. 15 samples ultra-blue signs "7x11" \$1.00 postpaid. Lowy, 8 West Broadway, Dept. 399, New York City 70.

QUICK Cash. Sell friends wonder value name imprinted Christmas cards 50 for \$1.00 up to 25 for \$2.50. 43 sensational money makers. Up to 100% profit. Bonus. Special offers. Write for 9 free self-selling sample portfolios name imprinted Christmas cards and stationery. Rainbow Greeting Card Co., 38 East 1st St., Dept. 17-A, New York.

SELL Gold embossed monogram stationery. Sample free. Dunbars, Sanford, Florida.

EARN \$100 A week and more selling nationally advertised aluminumware, silverware, pressure cookers, canners and gift items. No investment required. Simply take orders, collect commissions, we do the rest. Complete sales kit free. Write Ury Co., Dept. 120, 222 4th Ave., New York 3.

AMAZING Offer—\$40 is yours for selling only 50 boxes, each containing 25 new, entirely different deluxe Christmas cards with or without name imprinted. Also 50 for \$1.00. Free samples. Other boxes on approval. Write today. It costs nothing to try. Cheerful Card Co., 383, White Plains, N. Y.

EASY Money. Sell 50 all embossed Christmas cards for \$1.00 with name imprinted. Sensational new 21 card Christmas assortment sent on approval and free samples of all name imprinted Christmas cards. Lorain Art Studios, Dept. M30, Vermilion, Ohio.

\$5.00 CASH Advance commission every sale. 38-piece "Lady Ann" silverplate table service. Guaranteed quality, value bring sales galore. Sells for only \$14.95, including tarnish-resistant chest. Bonus premiums. Write for free outfit. Dexter Silver Co., 303 Fifth Ave., Dept. PM-8, New York.

SILVER Plating liquid (NuSilver). Anyone can apply with cloth. Gives genuine gleaming silver finish. Renews silver-plated ware, articles, pieces. Silver-plates brass, copper. Distributors, salesmen, agents wanted. NuProcess Products, Aurora, Illinois.

CHRISTMAS Cards 50 for \$1.00! Other series of 25 from \$1-\$2.50. Also box assortments. Free sample albums. Commission. Bonus. Richar Greetings, 16 E. 18th, New York 3.

EARN Big money year 'round. Be a one-person-department-store. Take orders for shirts, ties, hosiery, lingerie, household linens, etc. For information, Corporate Merchandisers, Dept. PM 5, 110 West 34 Street, New York City 1.

A DRESS Yours with every 3 you order for yourself and family. Amazing new bonus plan. Everything free. Harford Frocks, Dept. R-9128, Cincinnati, Ohio.

SHINE Shoes without "polish." New invention. Lightning seller. Shoes gleam like mirror. Samples sent on trial. Kristee 125, Akron, Ohio.

BIG Bargains for big profits. Over 100 sensational wholesale values. Men's used suits \$2, pants 35c, topcoats \$1.25, overcoats \$2, shoes 20c. Experience unnecessary. Free catalog. Superior, 1250-A Jefferson, Chicago 7.

GREETING Card money-makers. Birthday. Everyday. Christmas. Catalog free. Greenport Art Company, Dept. 888P, Brooklyn 15, New York.

AMAZING New "Car-Wash"—Whirlwind seller to garages, auto owners, etc. Sell in bulk. Put it up under your own label. Profits simply astounding. Sample free. Imperial Dye & Products Co., Inc., Charlotte 1, N. C.

CHRISTMAS Cards. Earn \$5.00 with every ten 21 card \$1.00 boxes you sell. Also new plastic cards, personalized cards and stationery, note paper and wrappings. Send for samples today. Howard P. Ellis, Dept. PM-9, Pitman, N. J.

FAST Sales. Cuts food cost. Nets \$9 a case. Sell 6 daily. Exclusive terr. Jeld, Ltd., Burbank, Calif.

DUPONT Water repellent—Anyone can use, no limit to earnings. Sells \$1.00 per pint, sample \$1.00. Large profits. Cook Co., 40 Walnut St., Newark 2, N. J.

CALL On hardware dealers, garages, etc. with new 2-in-1 polishing and sanding unit. \$3.00 seller, sample \$2.00. Cook Co., 40 Walnut St., Newark 2, N. J.

POSITIVELY New. On market only short time. Hundreds of virgin territories open. Retails \$1.50. Write for details. Sample \$1.00. Farrell Company, 1377 Galbraith, Cincinnati 31, Ohio.

"SOLVEX" Cleans dirty hands quickly. Exclusive territory. Solvex, Monticello, Iowa.

UNLIMITED Commissions taking orders. Colorful pocket perfume atomizers. Prospects everywhere. Dynamic Sales, Box 2414P, Cleveland 12, Ohio.

MAKE Sensational profits! New, sell-on-sight plastic line: tablecloths, aprons, many other splendid fast-selling items, novelties. Postal brings free details, special deals. Hurry! Royalty, Box K-748, Passaic, N. J.

AGENTS—Unbelievable, until you have tried this self selling foot bath powder. 98% people need it, 50% profits. Excellent repeater. Rush name for free sample. Saari, 1916 Sheffield, Chicago 14.

MEN And women wanted. Full or part time. Women's link name bracelets. Sells on sight. Make up any name in a minute. No tools or skill required. Send \$1.00 for sample. Write for free literature. Etched Metal Plastics Co., 37 Nells Road, Milford, Conn.

TIRE Accessories. Guaranteed 10,000 mile. Tiger Grip Tire patch. Salesman-distributors. Protected territory. Economy Rubber Prod. Co., Riverdale Station, Box 552-E, Dayton 5, Ohio.

BUY Thousands of nationally advertised products direct from manufacturers. Write for "Buy Direct and Save." Consumers Ass'n., 287-A Lebanon Ave., Mt. Lebanon, Penna.

EVERY Housewife a prospect for automatic Speedi-Waxer. Send for details two big profit sales plans. Darby Corporation, Dept. 8M, 241 Centre St., New York 13, N. Y.

BIG Profits taking orders for new fast selling item. Every pipe smoker needs one. Sell direct or wholesale to cigar and gift stores. Write today for free details. B. F. Schernbeck, 5713 22½ Ave. So., Minneapolis, Minnesota.

MAKE More money in spare time handling magazine orders. Fall best selling season. Our helps build big repeat business. Wholesale catalog free. Write McGregor Magazine Agency, Dept. 12, Mount Morris, Illinois.

SELL Luxury perfumes for profits and repeats. Generous samples \$1.00 deductible first order. Edward Lawson, 10-21 Joiner Street, St. Augustine, Florida.

ACT. Sell new Xmas photo greeting folders. Big profits, we deliver, free kit. Spooner, 115 Chauncy, Boston, Mass.

REMNANTS—Amazing values. Housewives buy on sight. Good profit. Write B & M Textiles, 78 N. Main St., Paterson 2, New Jersey.

FREE Sample! Big profit opportunity with amazing Glow-in-the-Dark house numbers, switch plates, pictures, decals, religious articles. Represent large manufacturer. Madison Mills, 303 Fourth Avenue, New York 10, N. Y.

MAKE More money direct from factory. Fibre brooms, floor dusters, patented wet mops. Aluminum mop wringers. Big profits. Write Burtz Fibre Broom Co., Columbia, Penna., Dept. A.

PLASTIC Christmas cards. Exclusive new plastic, sachet, panoramic and carols Christmas assortments. Five leading 21 card \$1.00 feature assortments. Six portfolios of personal cards. All this plus America's fastest imprint service. Free samples. Elmcraft Card Co., 5930 South Western, Chicago 36, Illinois.

AGENT-Distributors. Flo-Glo plastic linoleum finishes. Acme, Box 404, Mount Vernon, N. Y.

AGENTS. Make big profits selling guaranteed Reflex spark plugs, sideline, exclusive territory. Reflex Spark Plug Co., 10902 Madison Ave., Cleveland 2, Ohio.

AMAZING Profits. \$25.00 for selling 50 \$1.00 deluxe Xmas boxes. Embossed 50 and 25 for \$1.00, name imprinted. Free samples. Ed-Brite, Dept. 12, 435 North Terrace Avenue, Mt. Vernon, New York.

\$25 YOURS For selling only fifty \$1.00 boxes, new exclusive different Christmas and all-occasion cards; also extra cash bonuses. Send for Champion Cheerio 21-card box on approval. Free samples 6 new personal groups and stationery. Write today. Dept. 27, Pen-Brush, 154 Nassau St., New York 7.

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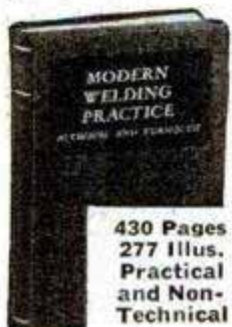


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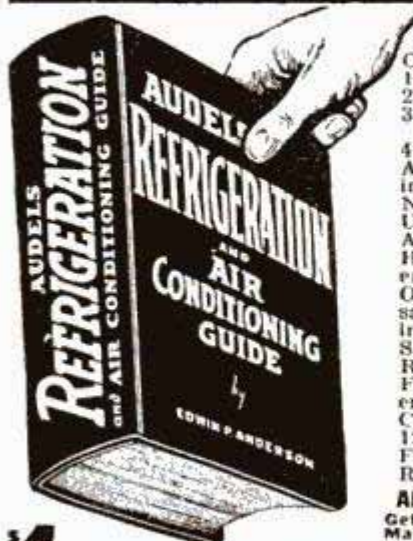
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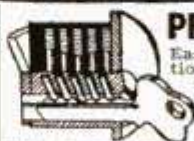
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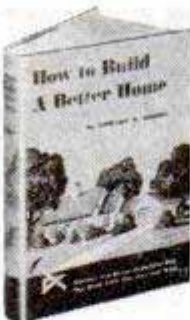
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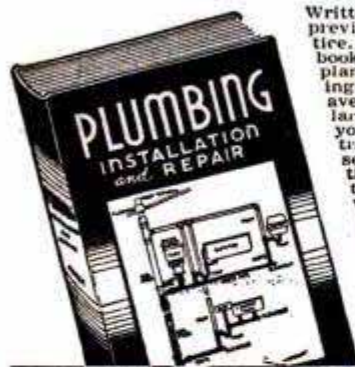
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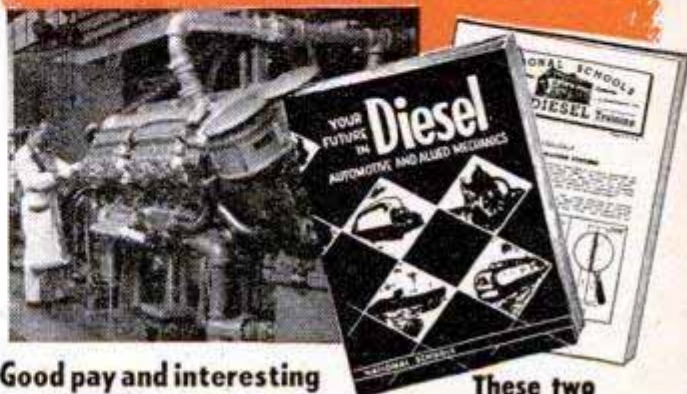
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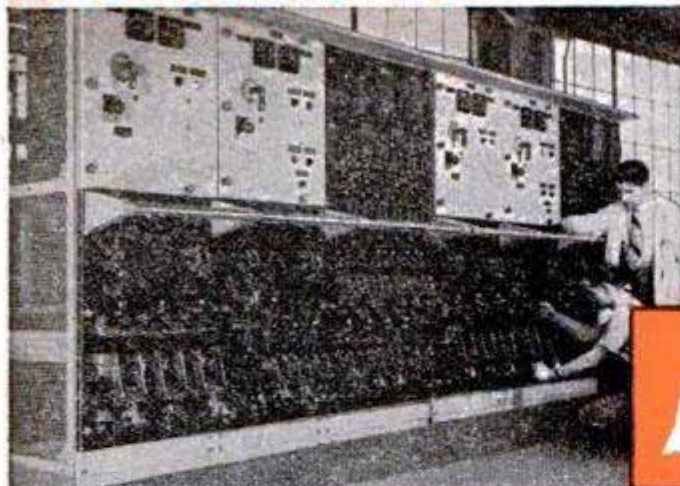
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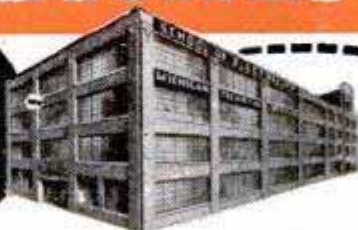
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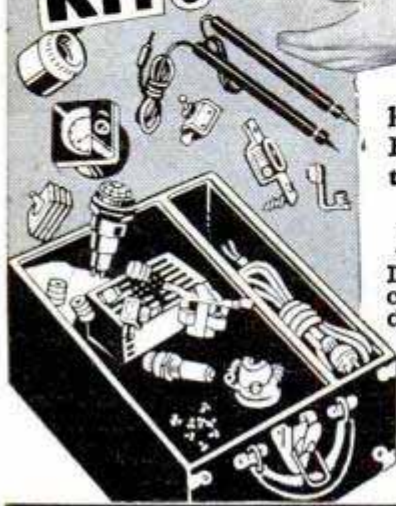
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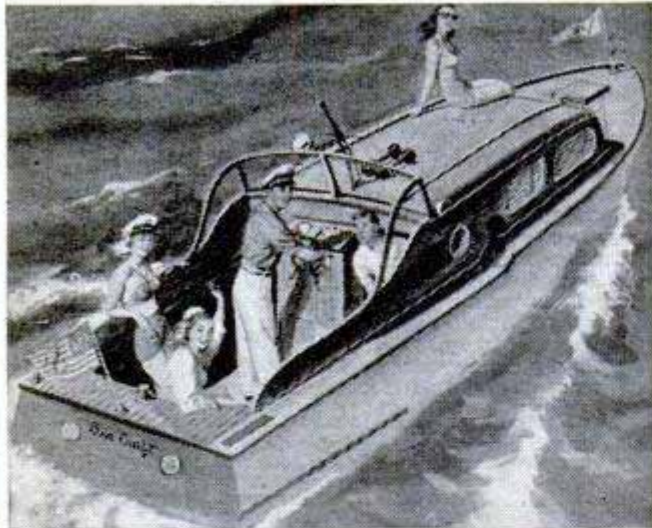
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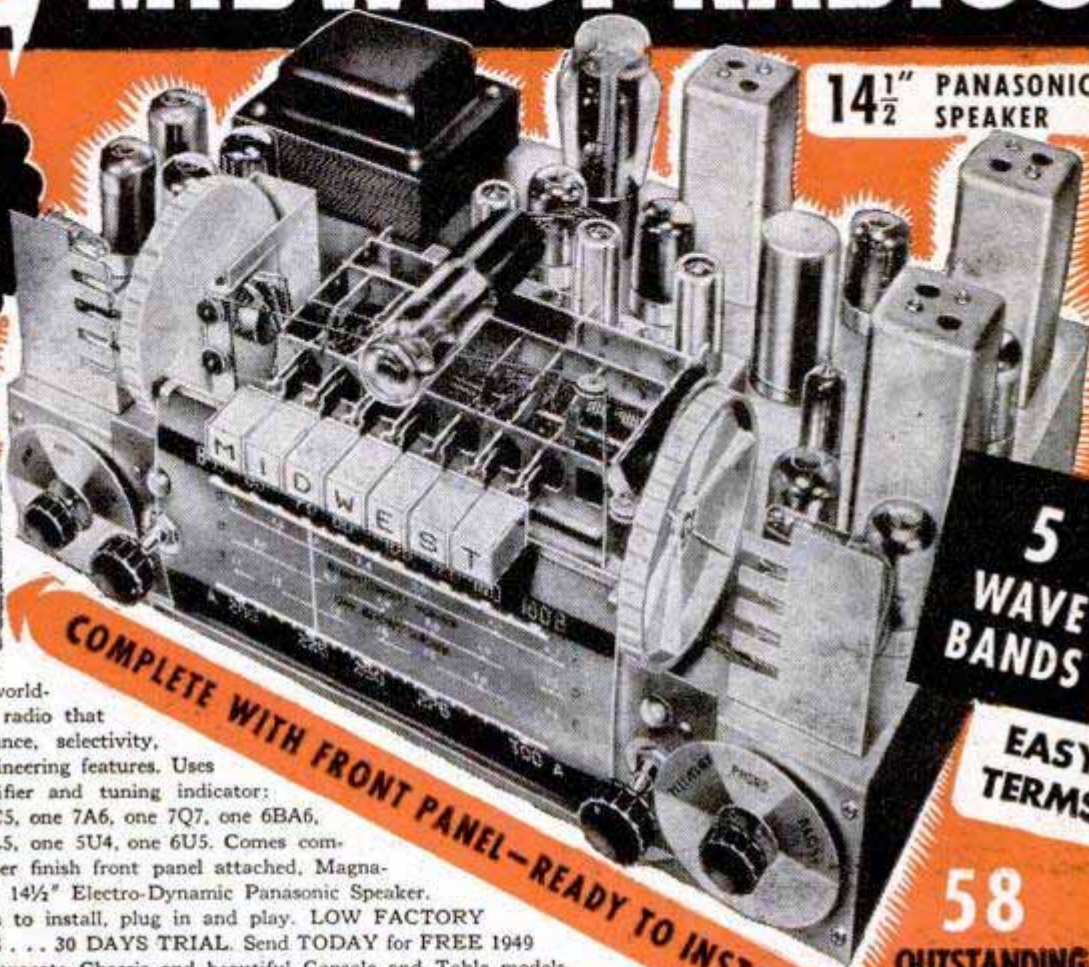
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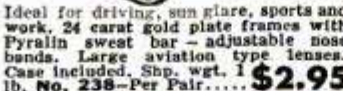
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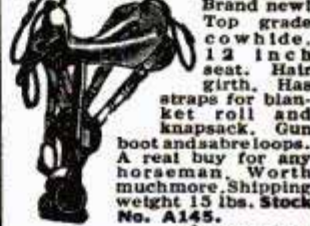
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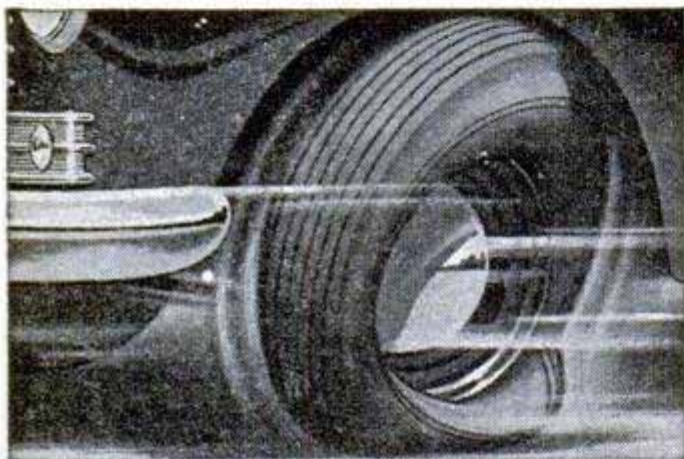
SPARKLET CARTRIDGES
May be used with above belts. In boxes of 10. Stock No. 254. Per Box..... **50c**

A blowout at 70 miles an hour but

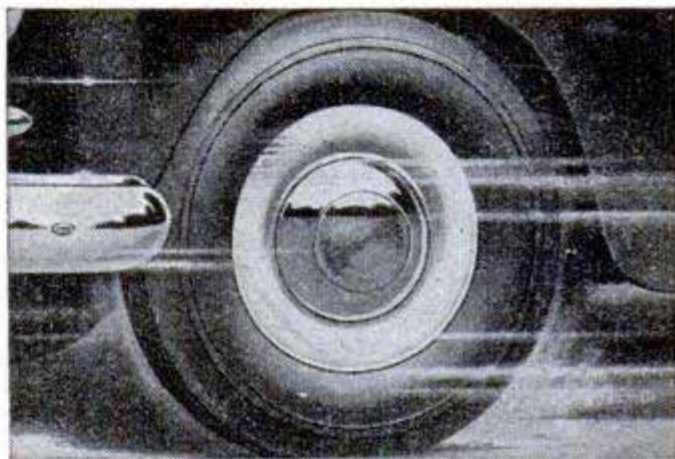
“even a child could have held the PLYMOUTH on the road”!

On a trip with his wife and two boys in a Plymouth equipped with Safety-Rim Wheels, A. L. Rives of Dallas, Texas, had a blowout while traveling at 70 miles an hour. “Believe it or not, I had no trouble whatsoever in controlling the car even at that speed,” he writes. “I am convinced that even a child could have held the Plymouth on the road without any difficulty.”

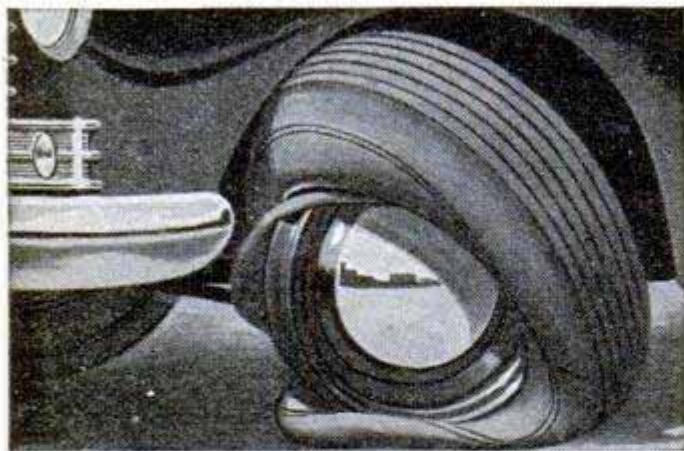
Isn't that the kind of protection you want? Then study the pictures below. Two of them show what can happen when a tire fails on a car with ordinary wheels. The others show how Plymouth avoids these dangers by providing Safety-Rim Wheels as protection. Only Plymouth has this great feature in the lowest-priced field.



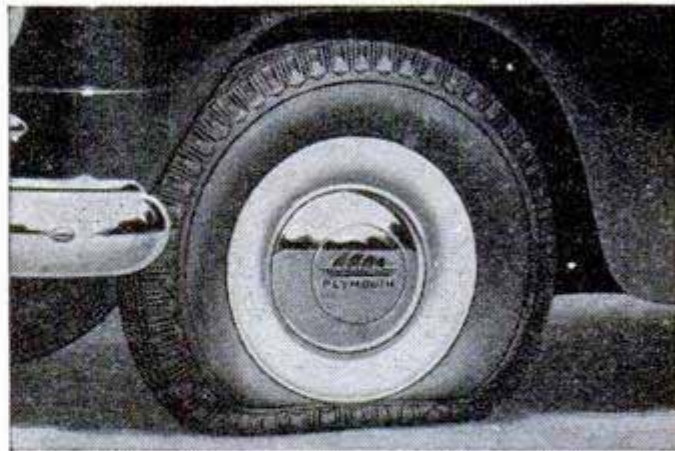
Blowout with Ordinary Rim Wheels. Here's what can happen as a tire blows out on a car with ordinary rim wheels. Such wheels depend on air pressure alone to hold the tire in place. When the air lets go, the tire pulls away from the rim . . . is likely to twist crosswise (as shown) or to jump the wheel entirely. Why take a chance on this?



Blowout with Plymouth Safety-Rim Wheels. This is how a blowout looks when you're riding on Plymouth Safety-Rim Wheels. The air lets go, but patented retaining humps are there to hold the tire straight and tight on the rim. Thus centrifugal force is able to give the effect of a certain amount of air pressure. As the car slows down, the tire goes down, and so does the danger.



Deflated Tire on Ordinary Rim Wheel. This picture clearly shows why the car with ordinary rim wheels swerved, jerked on the steering wheel, compelled its driver to fight it to a stop after the blowout. The tire has come away from the rim and is twisted. A sudden puncture or any other loss of air pressure could have had the same dangerous effect.



Deflated Tire on Plymouth Safety-Rim Wheel. See how firmly the tire stays on the Safety-Rim Wheel. Thanks to its patented retaining humps, Plymouth's stop was straight, easy and safe. Why do without this proved protection when every new Plymouth has Safety-Rim Wheels and many other safety advantages? Isn't it common sense to insist on Plymouth?

PLYMOUTH Division of CHRYSLER CORPORATION, Detroit 31, Michigan

POPULAR AUGUST 1948 MECHANICS

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 90 NO. 2

Producing 150 gallons of synthetic gasoline daily, this Standard Oil pilot plant is developing new processes for converting natural gas to gasoline

Do We Need Synthetic Oil Now?

By Dr. Gustav Egloff

Director of Research, Universal Oil Products Co.

OIL, THAT MAGIC LIQUID that does everything from lubricating tiny watches to firing massive boilers, is in the nation's headlines almost every day. Forecasts of imminent exhaustion of our oil fields frighten every user from the motorist to the railroad president.

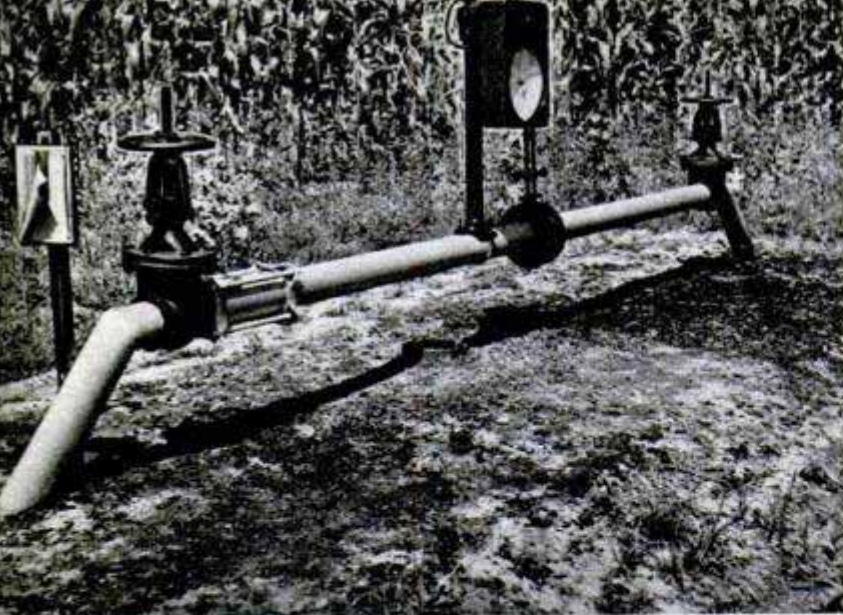
What is the story on our oil supply as it is described today by experts in the field? Are we facing an oil shortage? Should we build gigantic plants for converting our

Doctor Egloff is vice-president of the American Chemical Society, president of the Chicago Technical Societies Council and is also a member of the Industrial Committee of the Atomic Energy Commission.

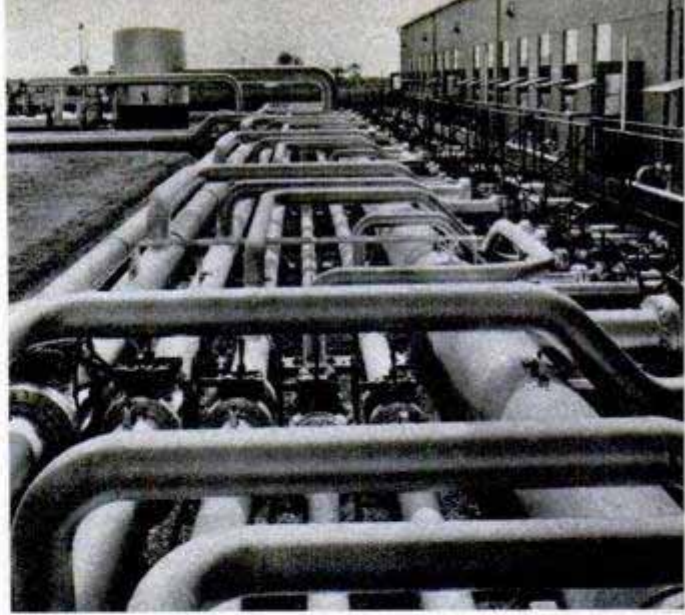
abundant coal and oil-shale deposits into synthetic oil?

These questions are not just academic. They are important to the entire economy of this oil-dependent nation.

Experts in the oil industry are accustomed to cries of shortage. Ever since the first gusher began to slacken its flow, predictions of an oil drought have been in the news. These oilmen are the people who are most directly concerned about our oil because it means dollars and cents to them—billions of dollars, in fact. Their huge investment (20 billion dollars) in wells, refineries, pipe lines, tankers and other



Standard Oil of N. J. photo



Oil & Gas Journal photo

Left, meter loop measures amount of dry gas pumped back into ground for repressuring wells to increase the yield. Right, this maze of piping is used at a natural-gasoline plant to return recompressed gas to the wells

equipment depends upon the flow of oil from the ground. If that flow stops, their investment becomes almost worthless. Strangely enough, they're not worried!

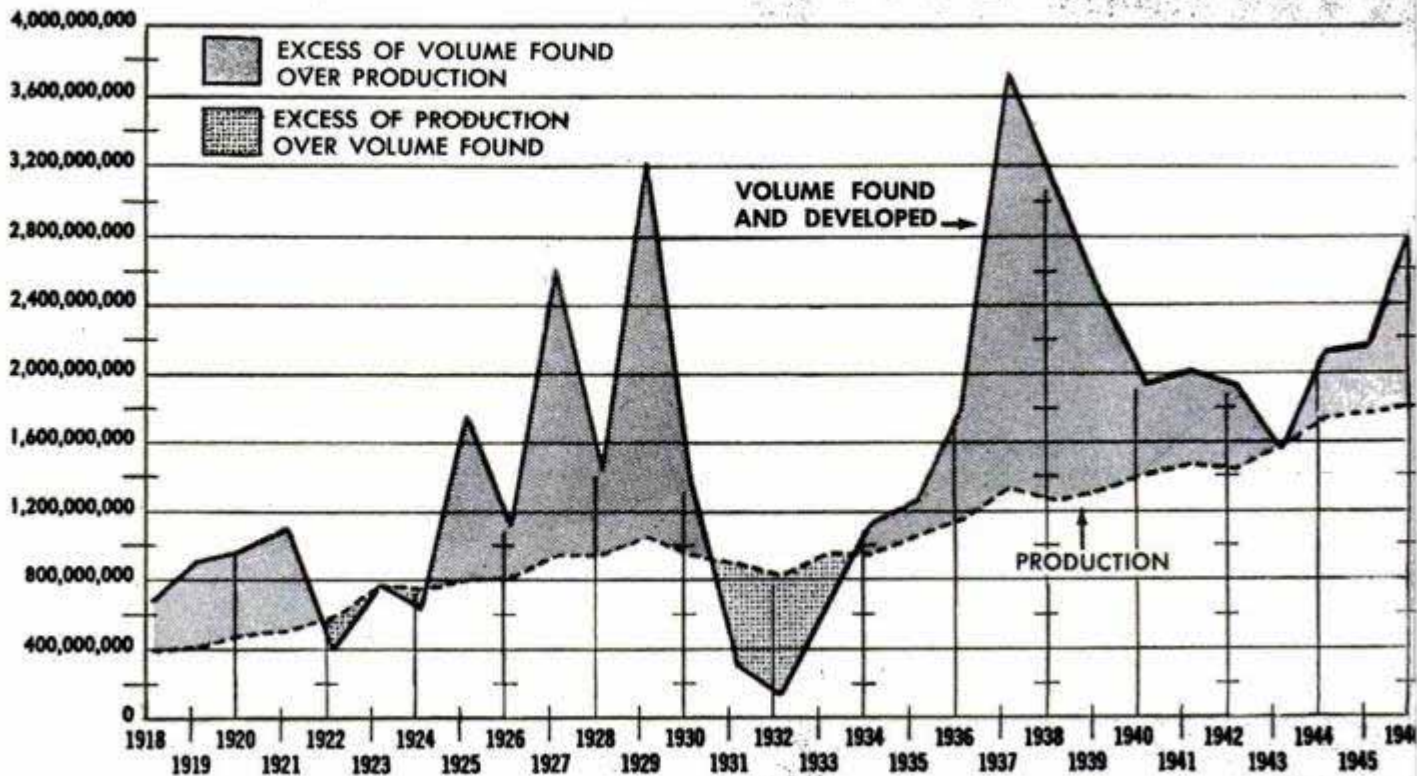
Oilmen admit that eventually we'll run out of oil. But, they say, eventually is a long way off. They are also agreed that we will probably turn to synthetic oil on a giant scale some day, but, they claim, we shouldn't jump overboard right now. There is still a lot to be learned about the complicated processes involved in economically converting coal to oil. For this reason, they believe we should continue

our research in the field. Small pilot plants should be built and operated. In these test plants the kinks can be ironed out of the complex processes so that, when we do need them, we can build and operate commercial plants efficiently. But that doesn't mean we should expect to convert to oil made from coal or shale tomorrow.

What are our present oil reserves? Definite statements about the actual number of barrels of oil in the earth are impossible to make. Just as you can't state how many trees there are in a forest until you have seen the forest, you can't guess how many

Graph shows that U. S. oil discoveries have greatly exceeded production except during depressions and war

BARRELS YEARLY



barrels of oil there are under the earth's surface until you've drilled.

However, there are facts to prove that we are not facing an immediate oil shortage. Only in years of serious depression, such as 1931-34, has there been more oil consumed in this country than there were new discoveries. Even when oil exploration was reduced because of steel shortages during the war, annual discoveries of new reserves were much greater than actual consumption in every year but one. In 1947, when oil consumption reached a new peak, we discovered 1.8 billion barrels of petroleum oils more than we actually used. At the end of that year our proved reserves were about 26 billion barrels or over twice as large as they were in 1928 and four times as large as in 1918.

Of course, there were spot oil shortages in various sections of the country last year, but these were not due to a lack of reserves. They were the result of unusually cold weather and inadequate transportation facilities. Even if we had a full-grown synthetic-oil industry we would still have had the transportation bottleneck and the resultant shortages.

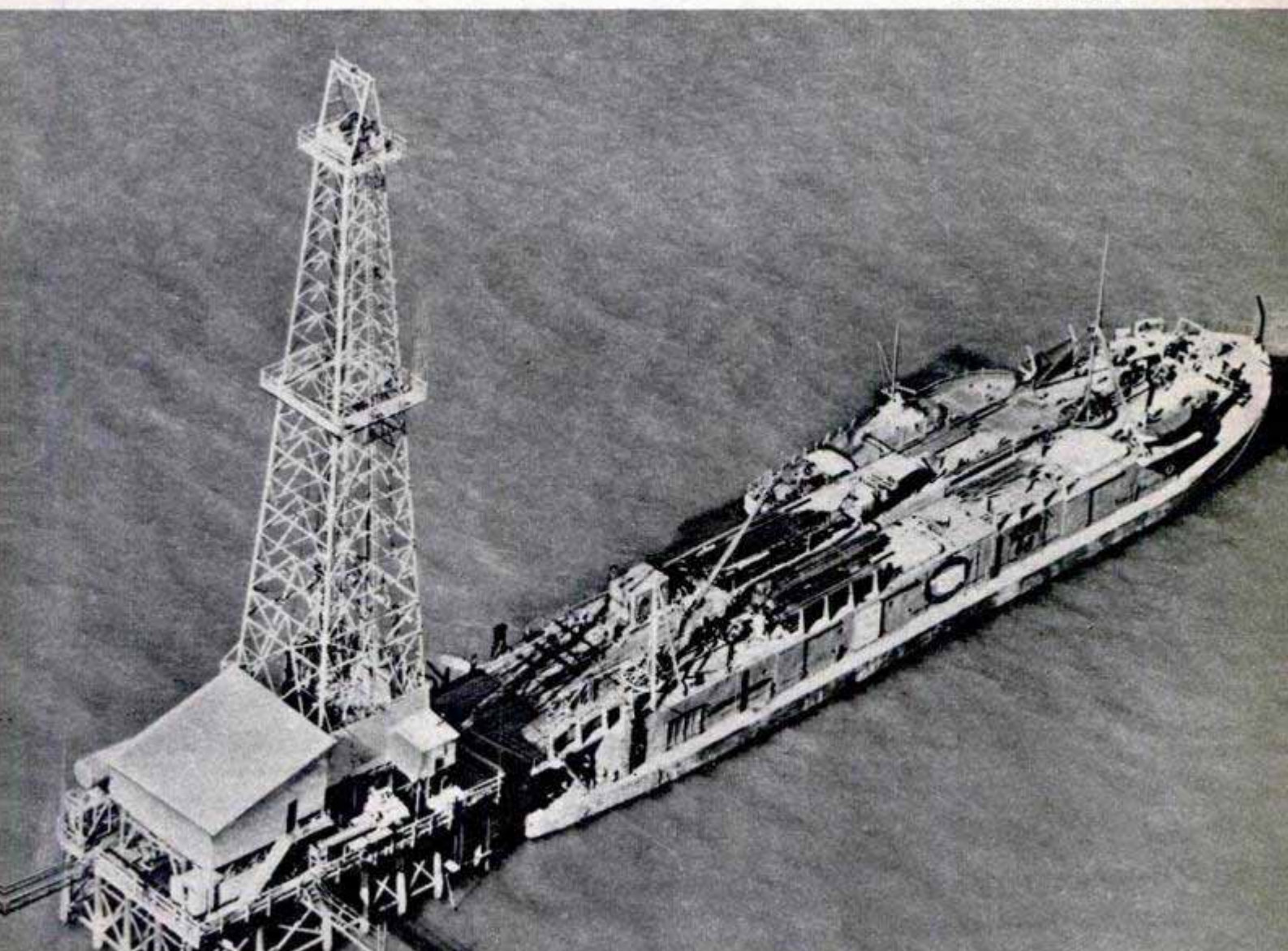
To make the oil-reserves picture even more encouraging, there are billions of

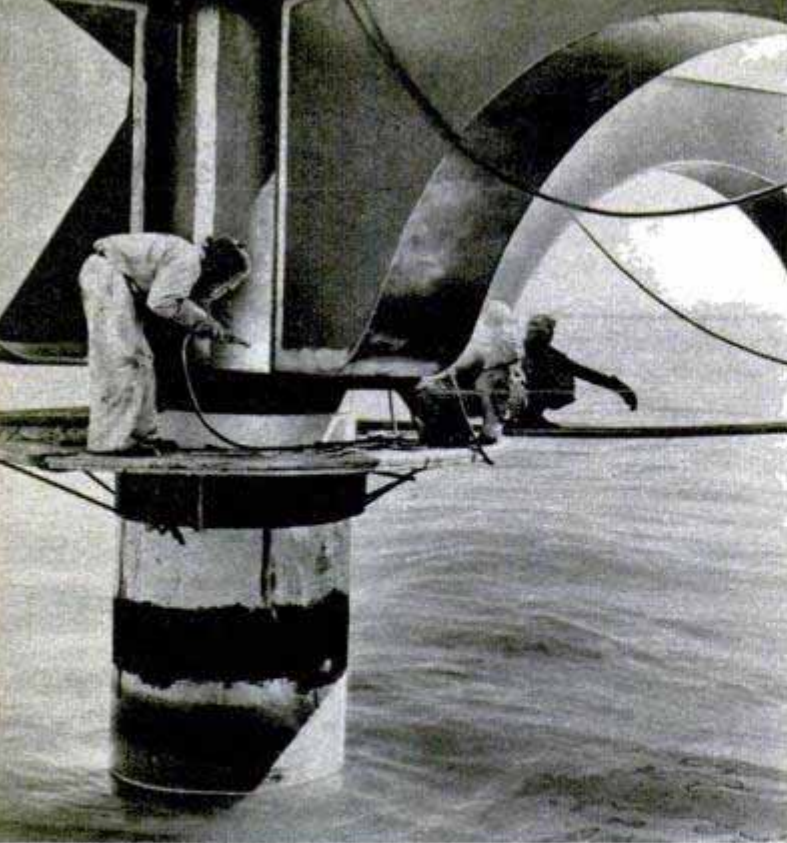


Electrode, being guided by driller, is lowered into the shaft to determine oil potential of the new well

Nine miles out in the Gulf of Mexico, drillers sink this well to tap the oil under the tideland waters

Oil & Gas Journal photo





Standard Oil of N. J. photo

Another underwater drilling project is in Venezuela at Lake Maracaibo where vast oil field is under 100 feet of water. Workers weld foundation for derrick

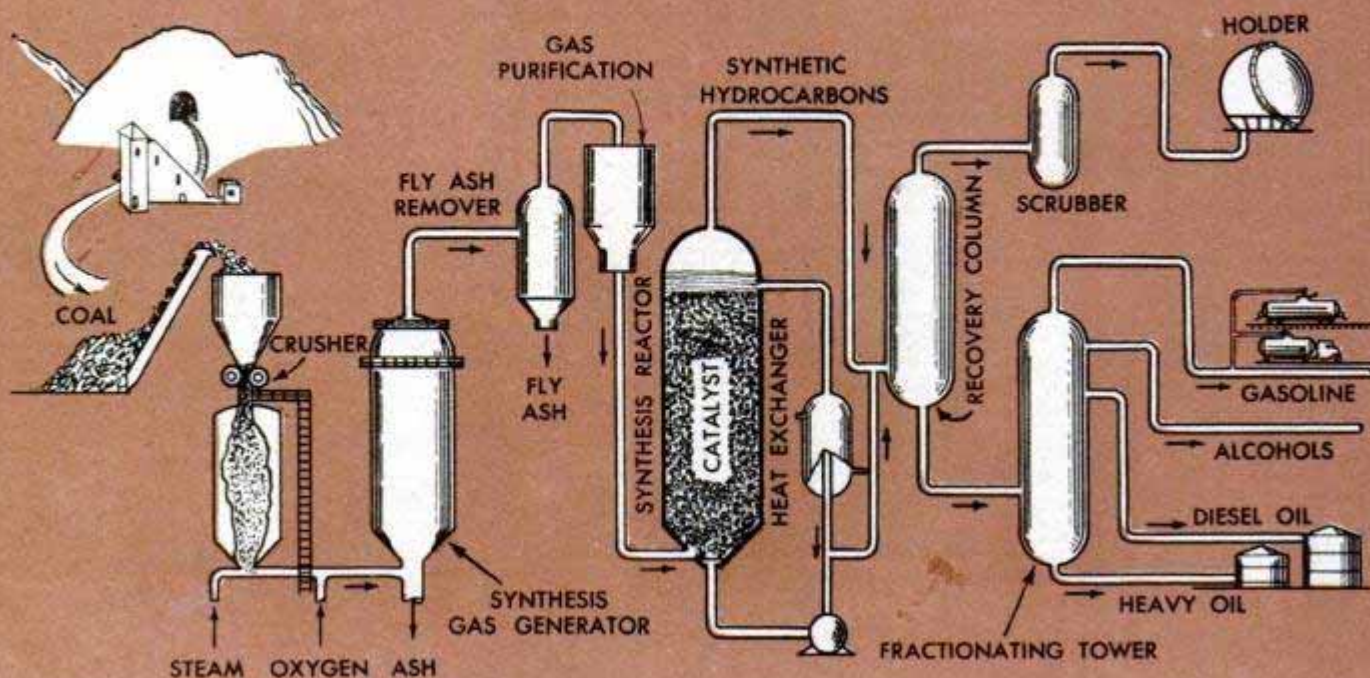
barrels of oil in the ground that can be extracted by methods other than pumping. Oilmen call such processes secondary-recovery methods. One of the biggest challenges to the oil industry is not that of finding more gushers, but the development of methods which will remove a higher percentage of oil from the ground. With the present estimate of 80 percent left underground in parts of Pennsylvania where the oil is of top quality, this challenge is a tempting one. Oil, real petro-

leum, not synthetic, can be extracted from the great quantities of oil sand still available in the areas of "exhausted" wells when necessary. Normally, an oil well is abandoned when the pumps can no longer remove oil from the ground at a rate that will show a profit. These wells "run out" not because the oil is exhausted, but because the water or gas pressure at the base of the well has dropped so low as to be incapable of driving the oil from the sand. Oil companies are using compressed air, water, gas and chemical solutions to increase the yield, but even with these methods there is still a large percentage of oil left in the ground.

There are other methods of secondary oil recovery such as the horizontal drilling technique used by Leo Ranney in the Franklin, Pa., fields. With this process it is possible to drill horizontally into the oil sands for 3000 feet or more. Thus, instead of the vertical drilling alone, there is at the bottom of a conventional shaft a series of horizontal drilled holes radiating outward like spokes on a wheel to tap oil reserves sealed in by natural barriers.

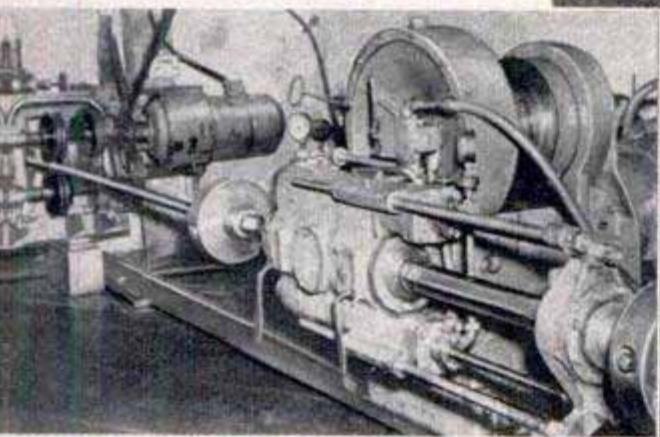
In Australia, the Ranney process is now being used at the bottom of a shaft 1200 feet deep. Radiating outward from the base of this shaft, horizontal holes, each 4000 feet long, are drilled into oil-bearing glauconite sandstone. Perforated pipe, which lines the first 100 feet of these holes,

Synthesis process for converting coal to liquid fuel is complex even as simplified for a schematic diagram
Diagram courtesy Bureau of Mines

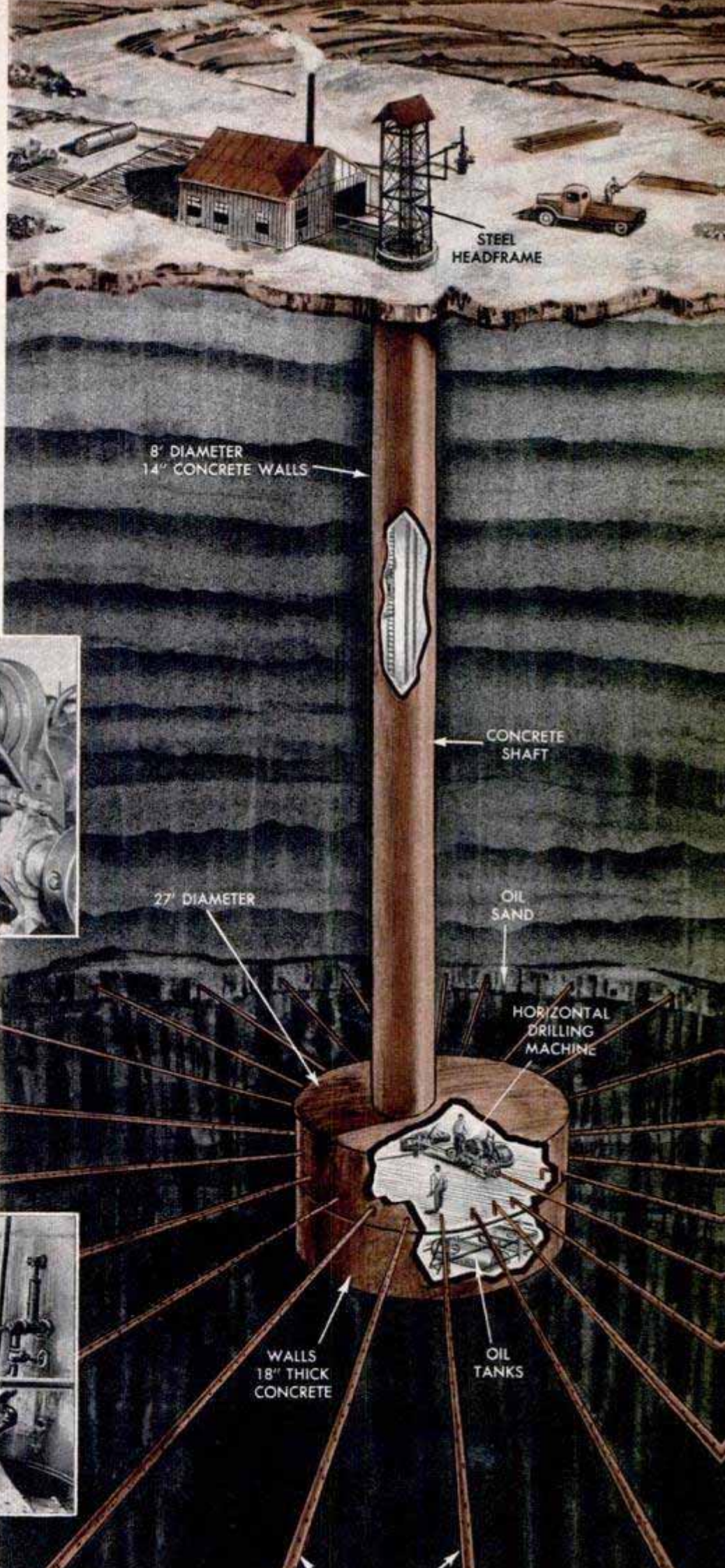
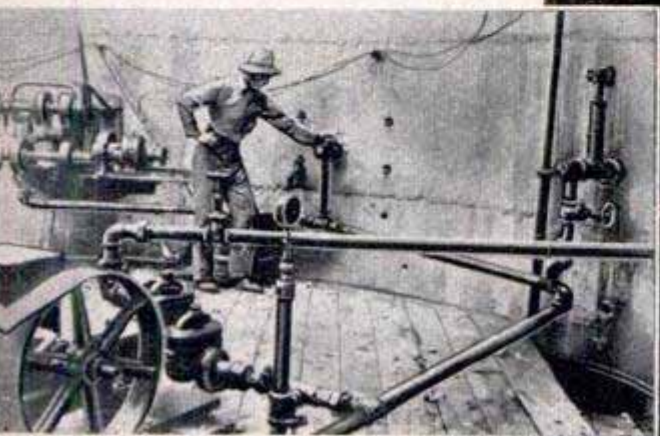


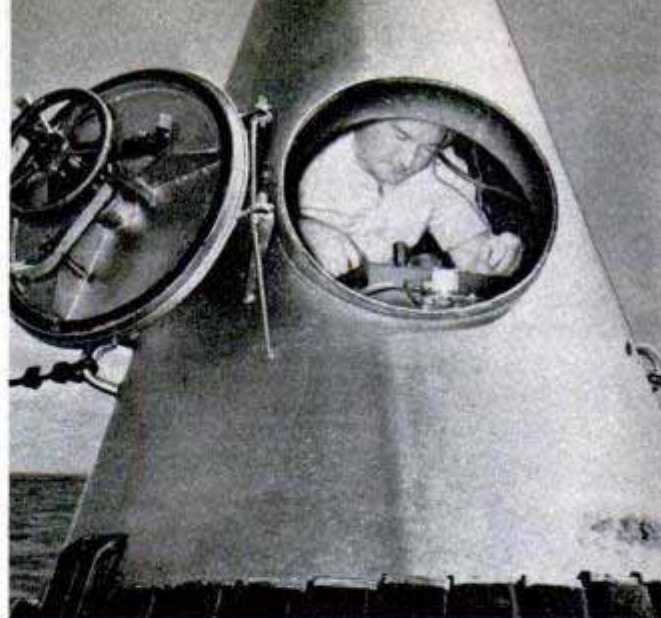
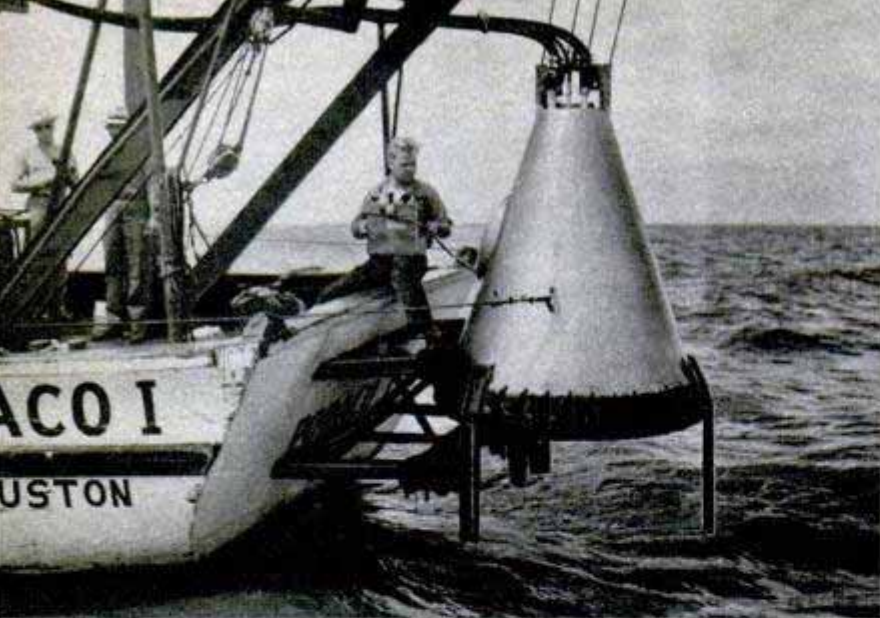
directs the oil that drains from the sand into the pit. From there it is pumped to the surface.

Several nations are today mining oil in a manner very similar to that used in mining coal. Much oil is held firmly by billions of sand particles deep underground. By sinking conventional mine shafts, it is possible to mine and haul these sands to the surface for treatment in baths of hot water and caustic soda. This solution washes the oil from the sand. The released petroleum floats to the top of the tank and is drained off for piping to the refinery. The clear white sand, now devoid of its oil, passes out from the bottom of the tank. It is possible that this



Called the Ranneywell, the horizontal oil well at right removes from the ground oil that is left by ordinary vertical wells. Work chamber at base of shaft holds a horizontal drilling machine (see photo above) that makes two horizontal drillings at once. Below, oil flows in pipes to a pump in work chamber and is forced up to surface. Shaft has an elevator to take men to and from chamber





Robert H. Ray Co. photos

Left, diving chamber is lowered to ocean floor where observer inside chamber (right) operates oil detector

sand may have by-product value and if so its sale would cut the cost of the oil.

Oil obtained from this process is not a low-grade variety. Its quality depends upon the field since it is the same grade oil as was recovered initially by drilling. Because of this, the method could be used best in fields where higher-quality oil is found, such as those in Pennsylvania.

At the Wietzer fields near Hanover, Germany, this mining process has been in use for years.

Removing these oil-laden sands is especially important because usually more oil is left in the ground than is removed by drilling and pumping. In some areas the percentage of oil remaining in the sand is as high as 90 percent. Heavy viscous oils cling most firmly to sand particles and it is this type of petroleum deposit that can be best recovered by the mining method.

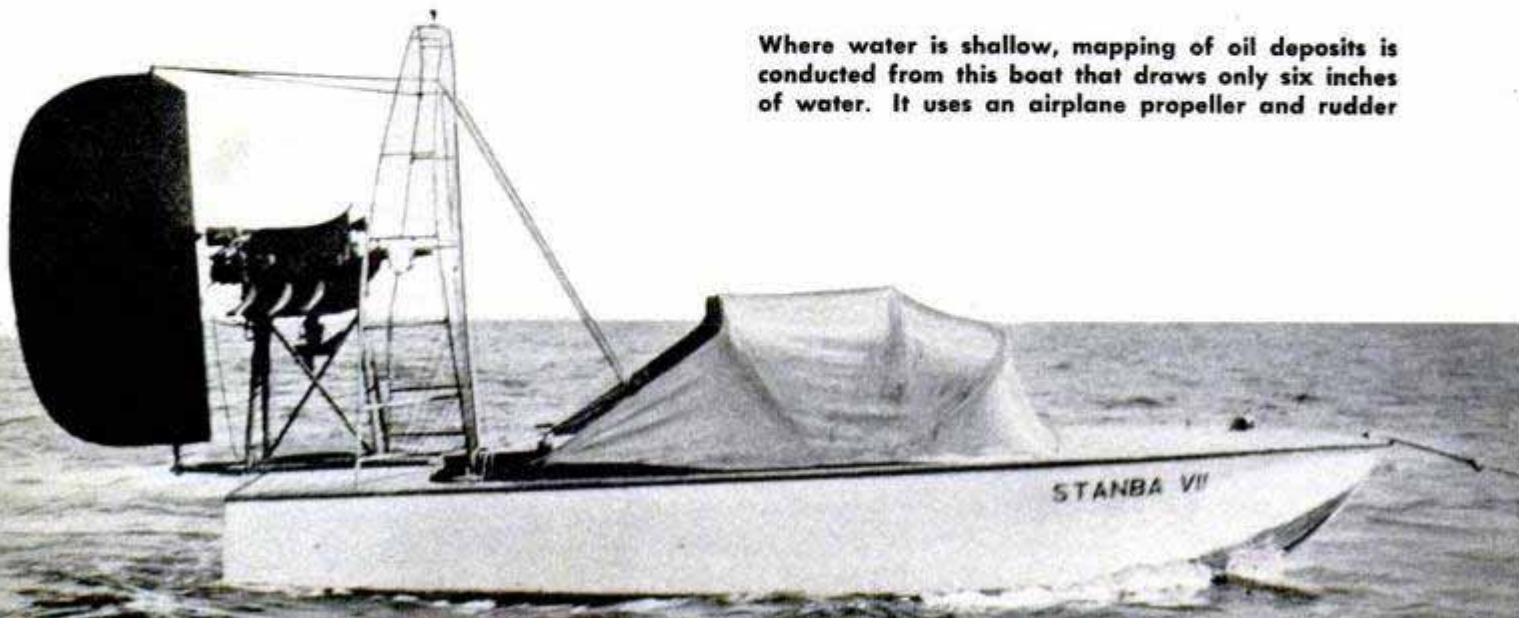
Another method of secondary oil recovery is that of draining the "exhausted" oil sands, a system being used at Pechelbronn, France. There, oil sands are drained by a series of pits and galleries very similar to those in a coal mine.

At Pechelbronn there are seven shafts currently in use and an eighth is being dug. Some of these shafts go as deep as 1200 feet into the earth. Latest reports show that the process was recovering 620 barrels of oil a day. This figure seems minute compared with our gigantic production, but the important factor is that this is oil that otherwise would have been left in the ground. If the process were used in this country, there would, no doubt, be a greater yield because our fields have much thicker layers of oil sand than those in the Pechelbronn area.

To drain the oil, a vertical shaft is sunk, and from this, horizontal shafts are dug just above the oil-sand seam. Pits are sunk in these galleries at regular intervals and extending down into the oil sand. Then by gravity flow the oil runs into the pits and pumps force it through pipes to the surface. Oil flow can be accelerated by forcing compressed air into the sand.

According to the Bureau of Mines report on the process, "after years of oil-well development and pumping have made

(Continued to page 244)



Where water is shallow, mapping of oil deposits is conducted from this boat that draws only six inches of water. It uses an airplane propeller and rudder



Double-End Collets

Lathe collets that are slotted at both ends hold two sizes of stock and provide equal gripping power and expansion throughout their length. The collets fit a chuck that has no projections to snag tools or fingers. The chuck is supplied with three double-end collets and will accommodate stock from $\frac{1}{2}$ to 2 inches in diameter. Two sizes are available—for 1-inch and $1\frac{1}{2}$ -inch arbor holes.



LEADER DISPENSER for anglers holds 100 yards of leader gut. Inside the aluminum dispenser are three reels, each with a different kind of leader. The ends project and are held by a rubber pad. Leader can be cut in a sharp notch on rim of dispenser



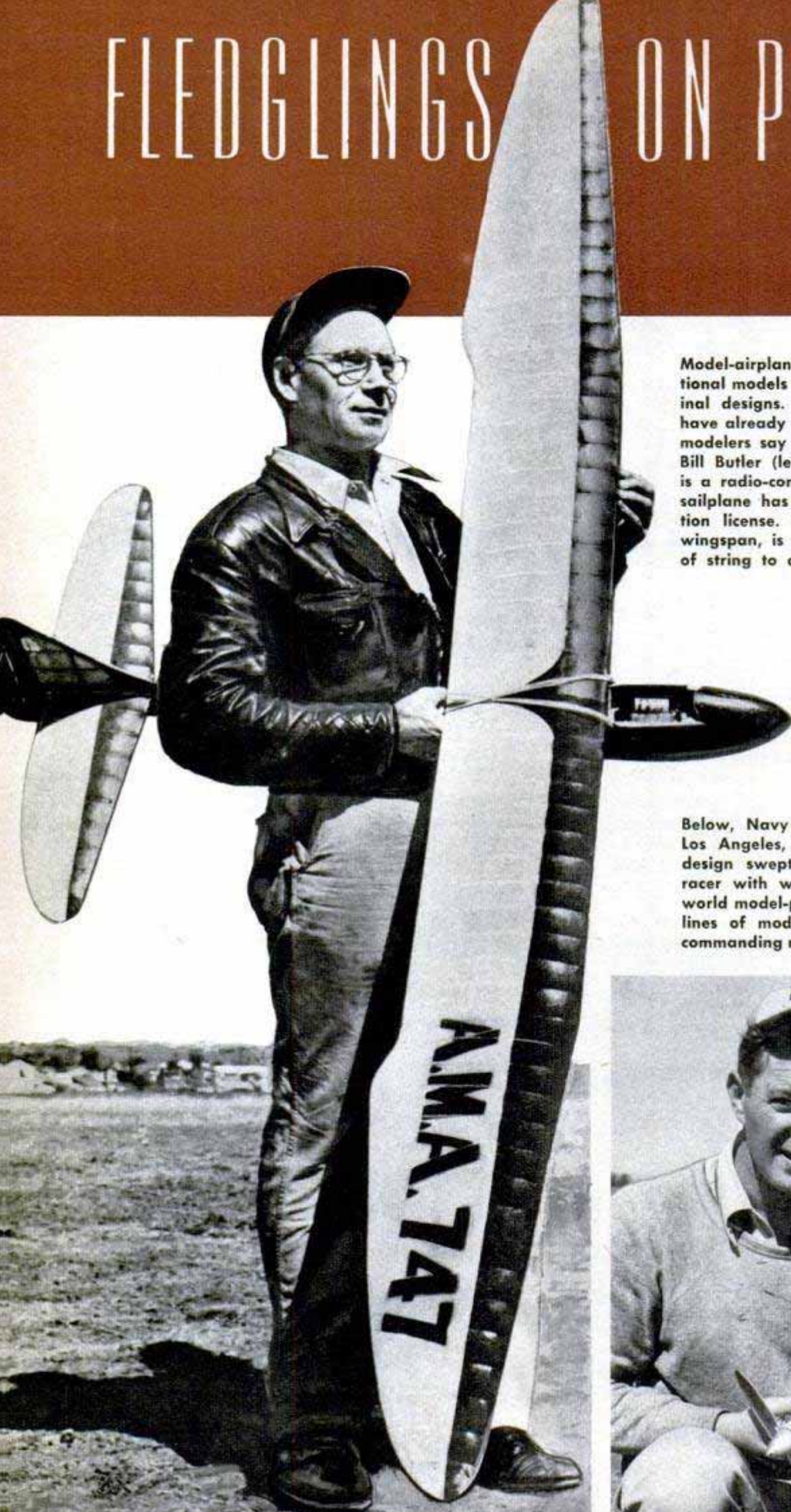
Pack Gives Hot or Cold Treatments

You have your choice of heat or cold with a combination ice pack and hot-water bottle that is small enough to be carried in the coat pocket. A liquid, sealed in a flexible Vinylite-plastic bag, congeals to a semisolid state and becomes extremely cold when placed in a refrigerator. For heat treatments, the bag is placed in boiling water for a few minutes and it absorbs heat which it holds for a long period. It folds into a case only 4 by 8 inches in size.



FLASH-BULB DYE gives clear bulbs a blue coating for use with daylight color film. Cost per bulb is a fraction of a cent. One bottle of the dye will coat 400 midget bulbs. Although blue in color, the dye is crystal clear. A dipping beaker is provided

FLEDGLINGS ON PARADE



Model-airplane racers scoff at conventional models and are turning out original designs. Tiny plywood airplanes have already exceeded 150 m.p.h. and modelers say 200 m.p.h. is their goal. Bill Butler (left) of Inglewood, Calif., is a radio-control bug. His two-pound sailplane has FCC amateur radio station license. The glider has 100-inch wingspan, is towed aloft on 100 feet of string to catch thermal air current

Below, Navy officer, Lt. Ed Baker of Los Angeles, poses with his original design sweptback wing "supersonic" racer with which he hopes to break world model-plane speed record. Clean lines of models like this set a pace commanding respect of aviation experts

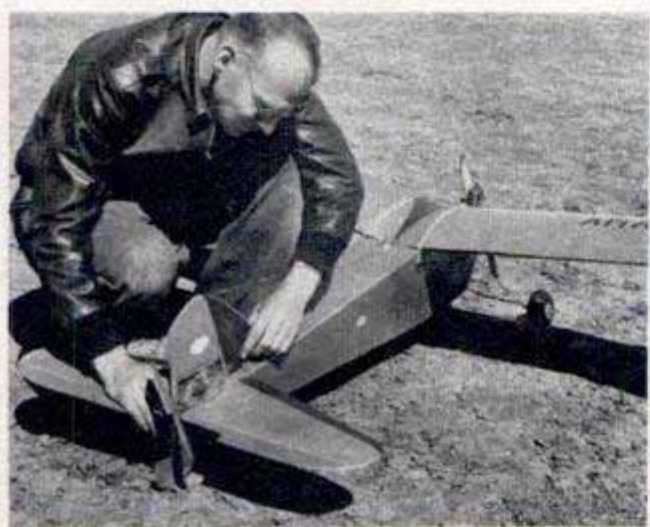




Mad Missile is what Joe Havlik, of San Diego, calls this "supersonic" Class-D racer. The engine is mounted in right wing; plane has a V-tail and no rudder



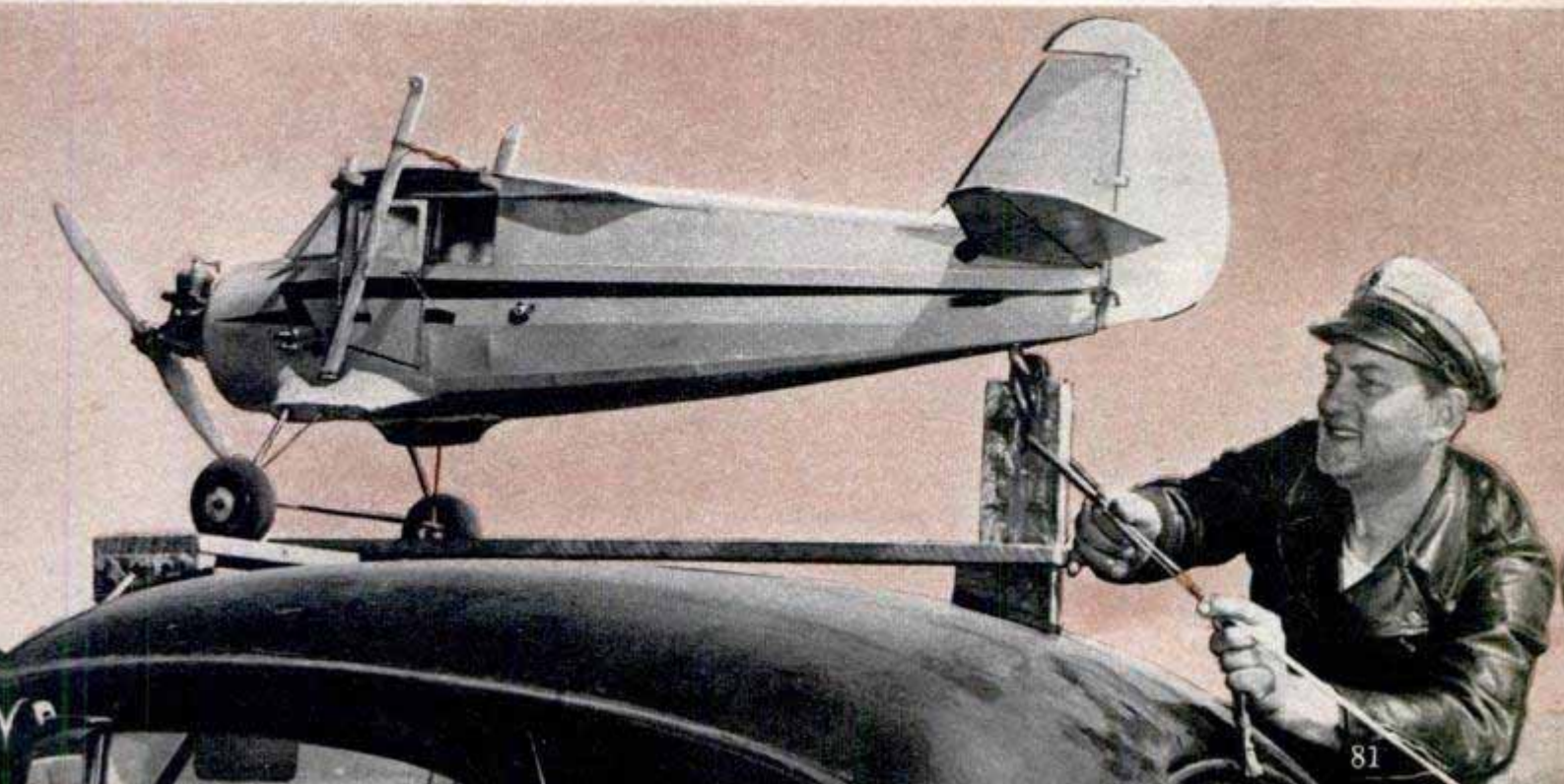
Novel one-wing half-tail "side winder" built by Glenn F. Crist of Modesta, Calif., has been officially clocked at speed of better than 150 m.p.h.

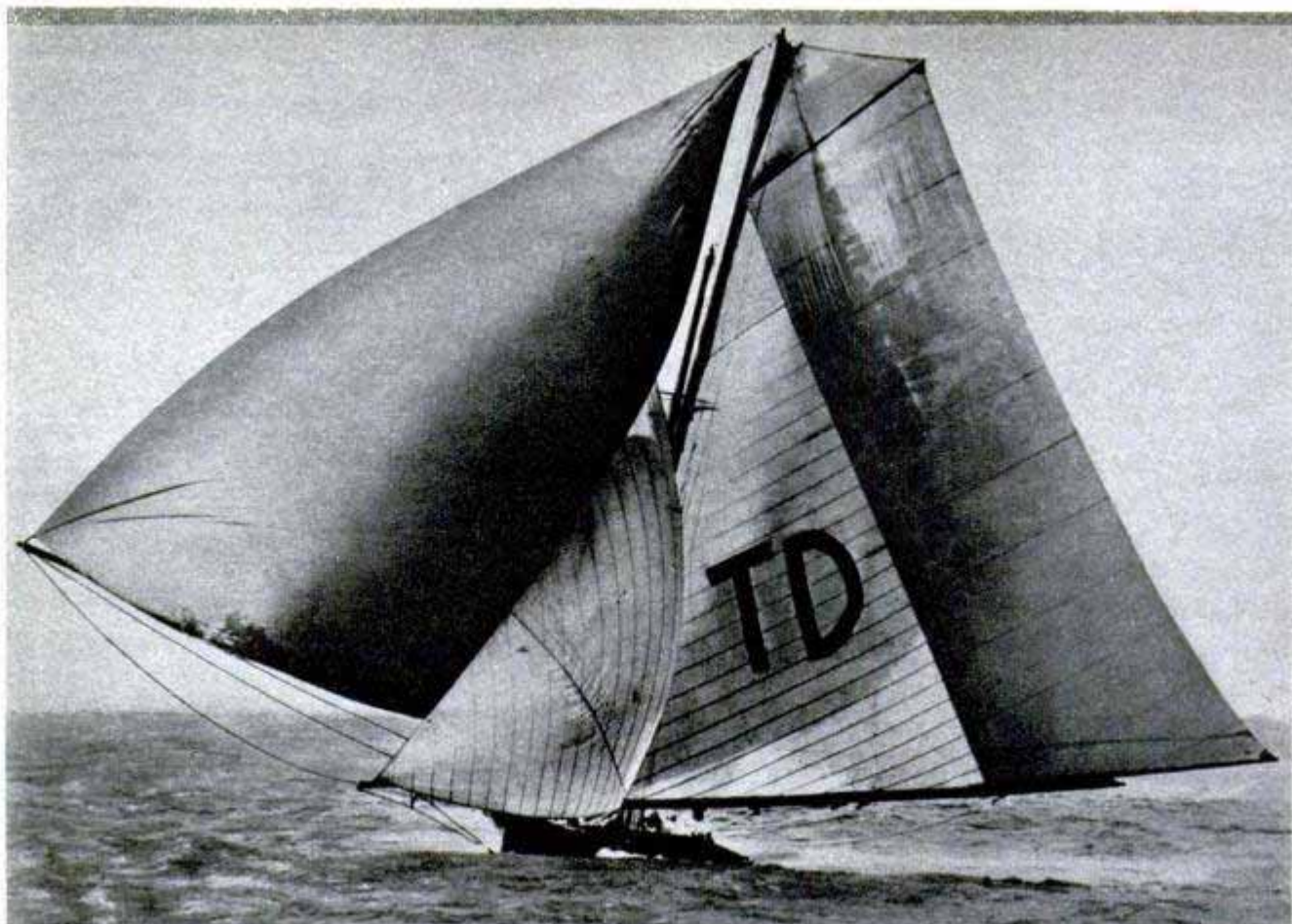


Tiny radio-control unit in this plane weighs only 1.1 ounces and provides two engine speeds in addition to controlling the rudder, elevator and the engine cutoff. It is called the Rudevator and is being inspected by Richard Schumaker, San Diego, Calif.



Ray Benskin (right) of Pomona, Calif., weighs in an original Class-C racer. He has held the world junior speed record. Below, Steve Stevens of Los Angeles holds to conventional design with his Stinson mono-plane scale model which he carries atop his auto





Sails Crowded on Mast Almost Hide Boat During Race

Spectators at the recent world's 18-foot yachting championship saw little of Top Dog, the Australian craft that captured second place. More than 2000 square feet

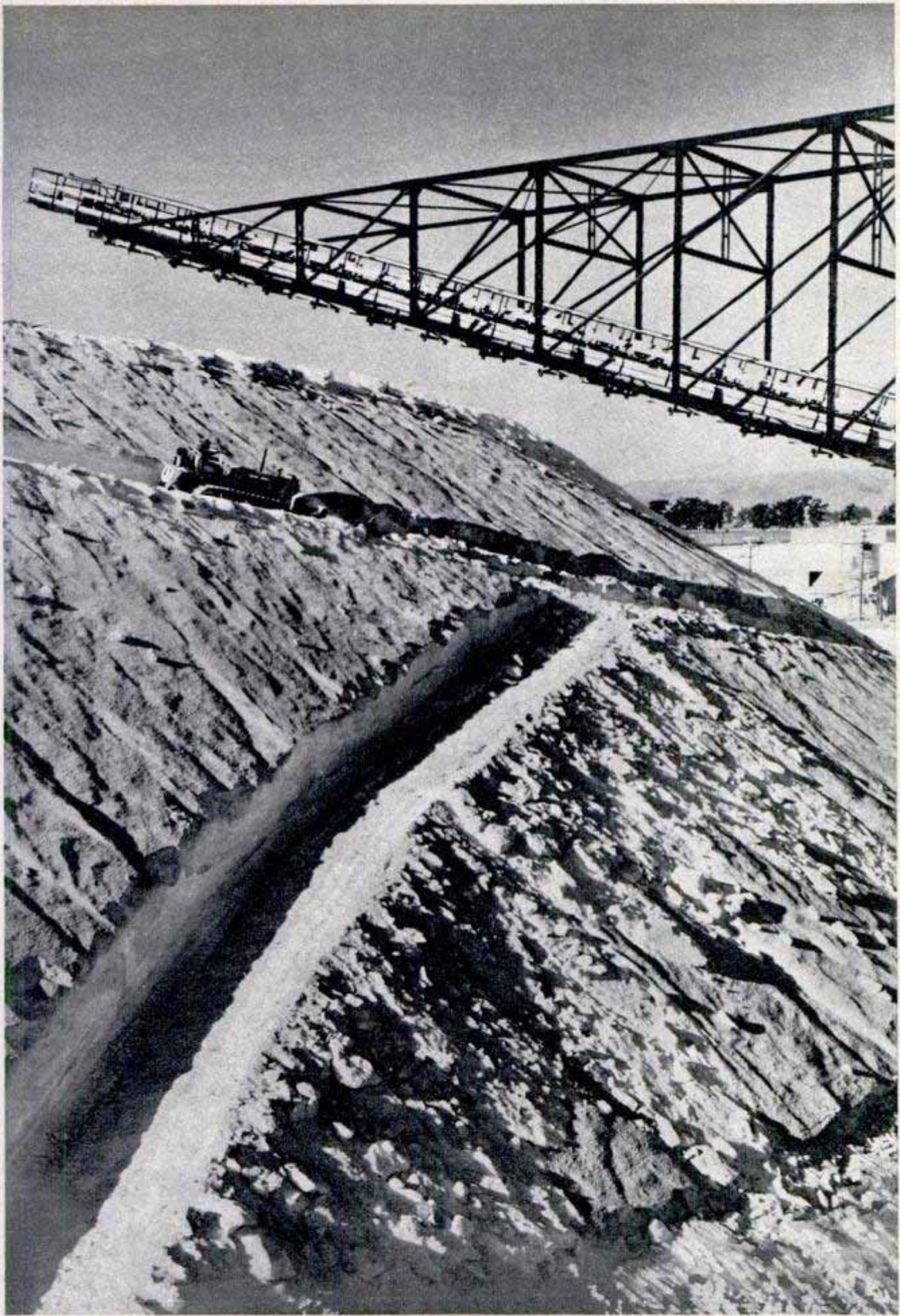
of sail which were crowded on the mast almost covered up the craft. By contrast, the yacht which finished third was rigged with about 1000 square feet of canvas.



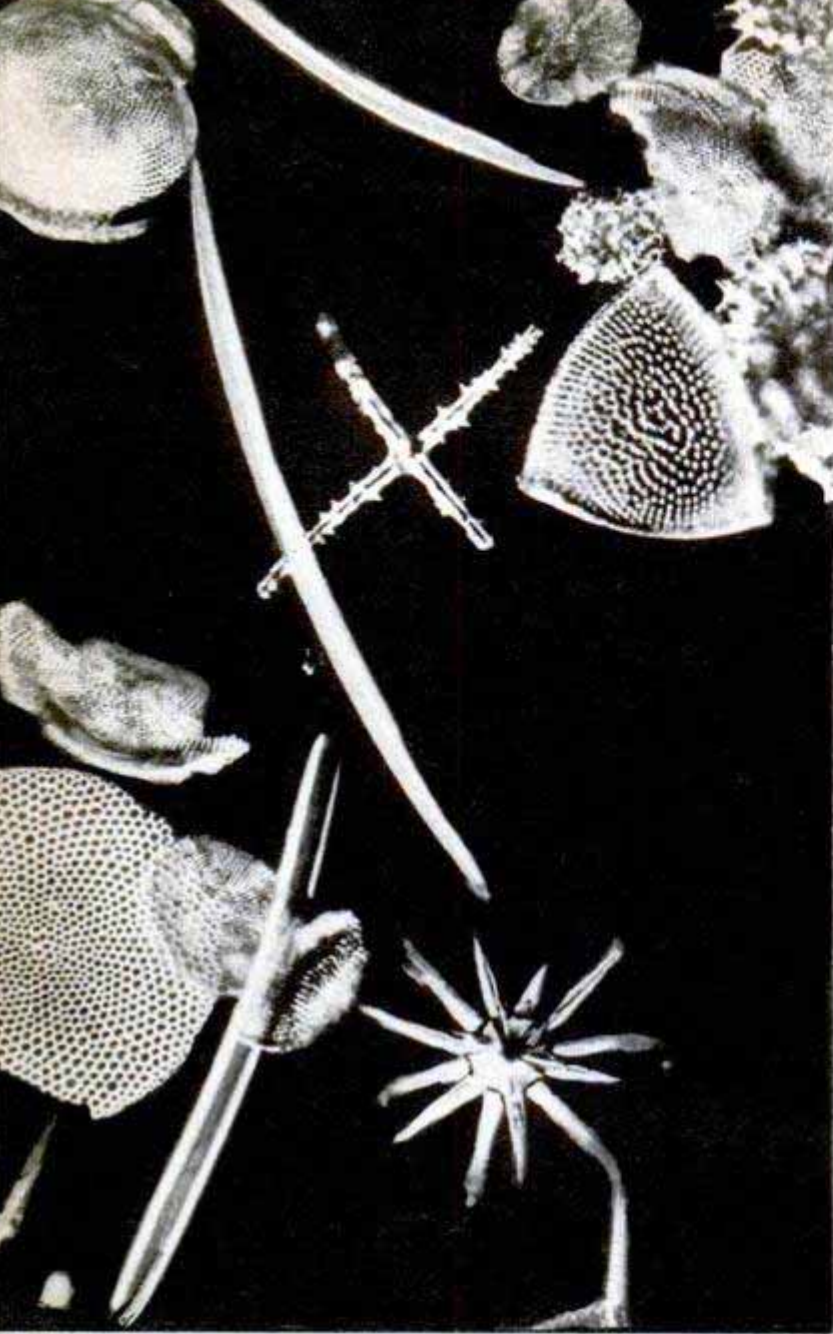
Rotary Hoe Thins Plants When Pushed Along Row

Thinning long rows of plants, a tedious job when done by hand, is a simple operation with a gardening implement that looks like a small cultivator. The offset blades of a rotary hoe, which is geared to the wheels, make 150 gaps each minute. The hoe blades dig under the soil and cut off the plants at regular intervals. These intervals can be adjusted by means of three interchangeable gears. Made in England, the machine is said to thin plants five times faster than an experienced worker.

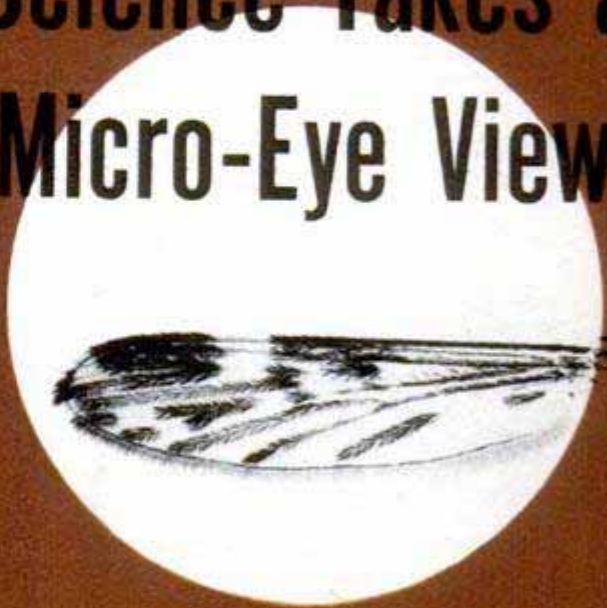
You may wish to obtain additional information about the new products described each month in *Popular Mechanics*. If you want to know the name and address of manufacturer or distributor, just write to Bureau of Information, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.



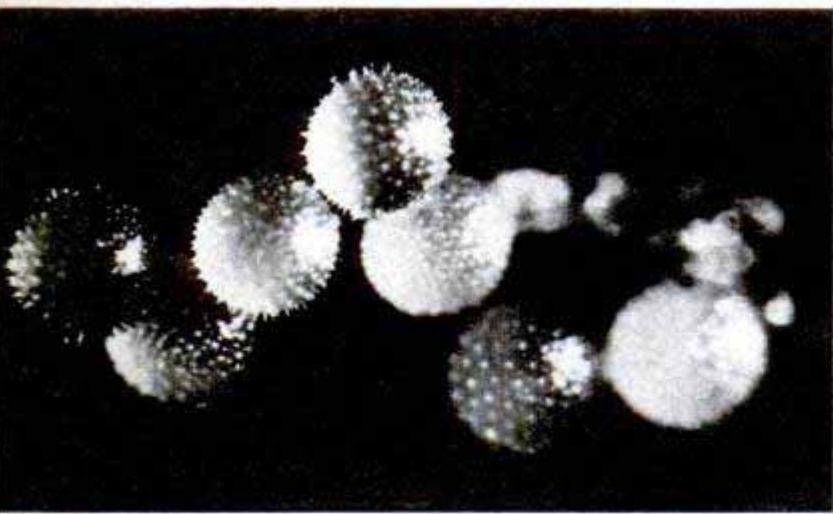
MOUNTAIN OF SALT, 700 feet high, stands near Newark, Calif., a product of solar evaporation. Salt mound, the property of the Leslie Salt Company, is growing in size as conveyor belts on the long framework carry more salt from washers to the pile. Tractors equipped with bulldozers build service roads along the side of the mountain. Salt from the huge mound is processed for commercial, agricultural and domestic uses

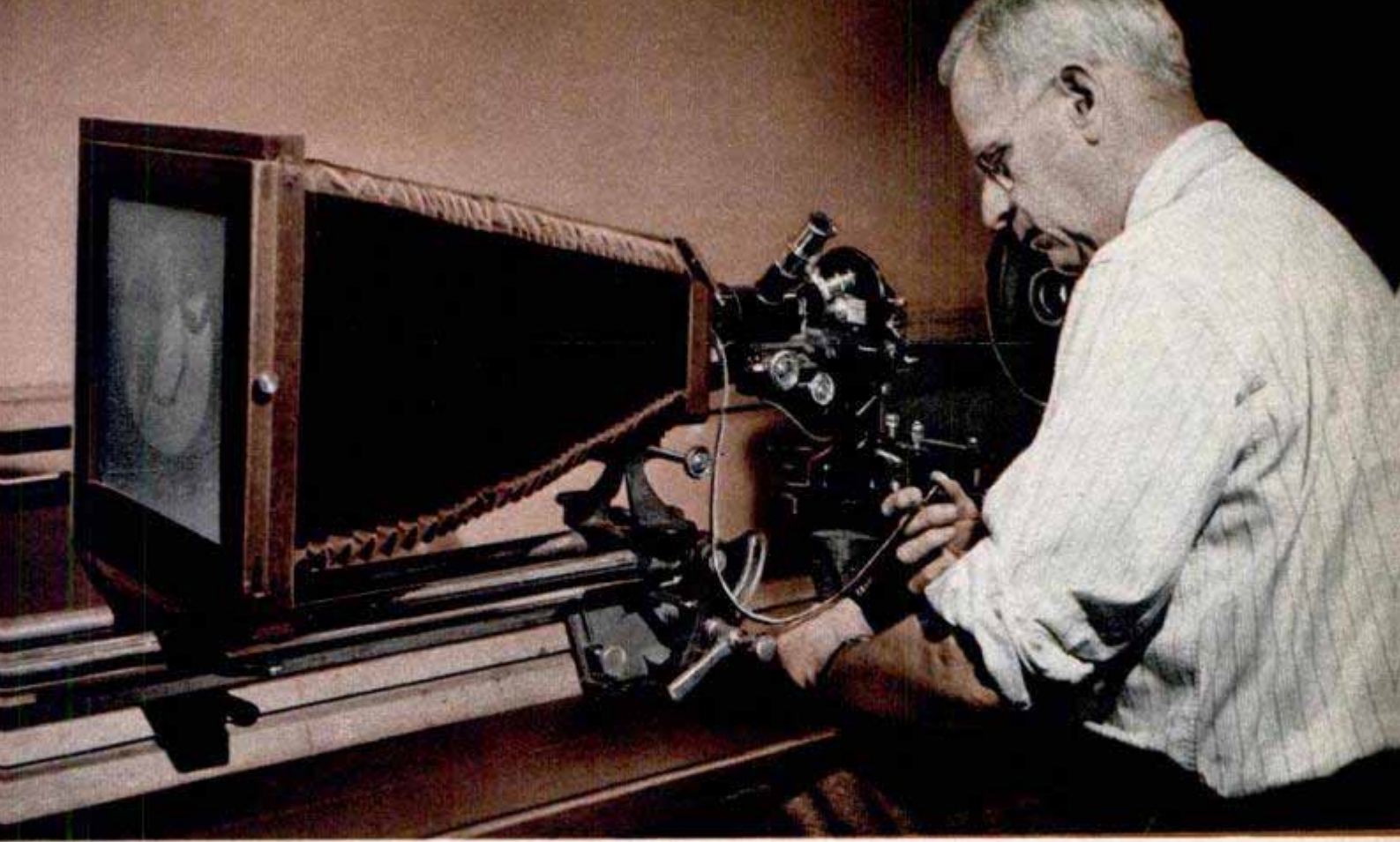


Science Takes a Micro-Eye View



On this page are five photos showing the tiny world Hollis explores and records with the aid of his camera with the microscope attachment. Above is the wing of a mosquito. Note the network that supports the tiny wing. Left, the shells of microscopic sea animals, called diatoms, make an interesting but unplanned pattern in the photo. Center left, these balls look like gooseberries; actually they are the pollen of a hollyhock blossom. Lower left, eggs of a cutworm moth are recorded by the microscope-camera. Below, a fishing net? One of Hollis' stunt photos shows silk stocking under magnification





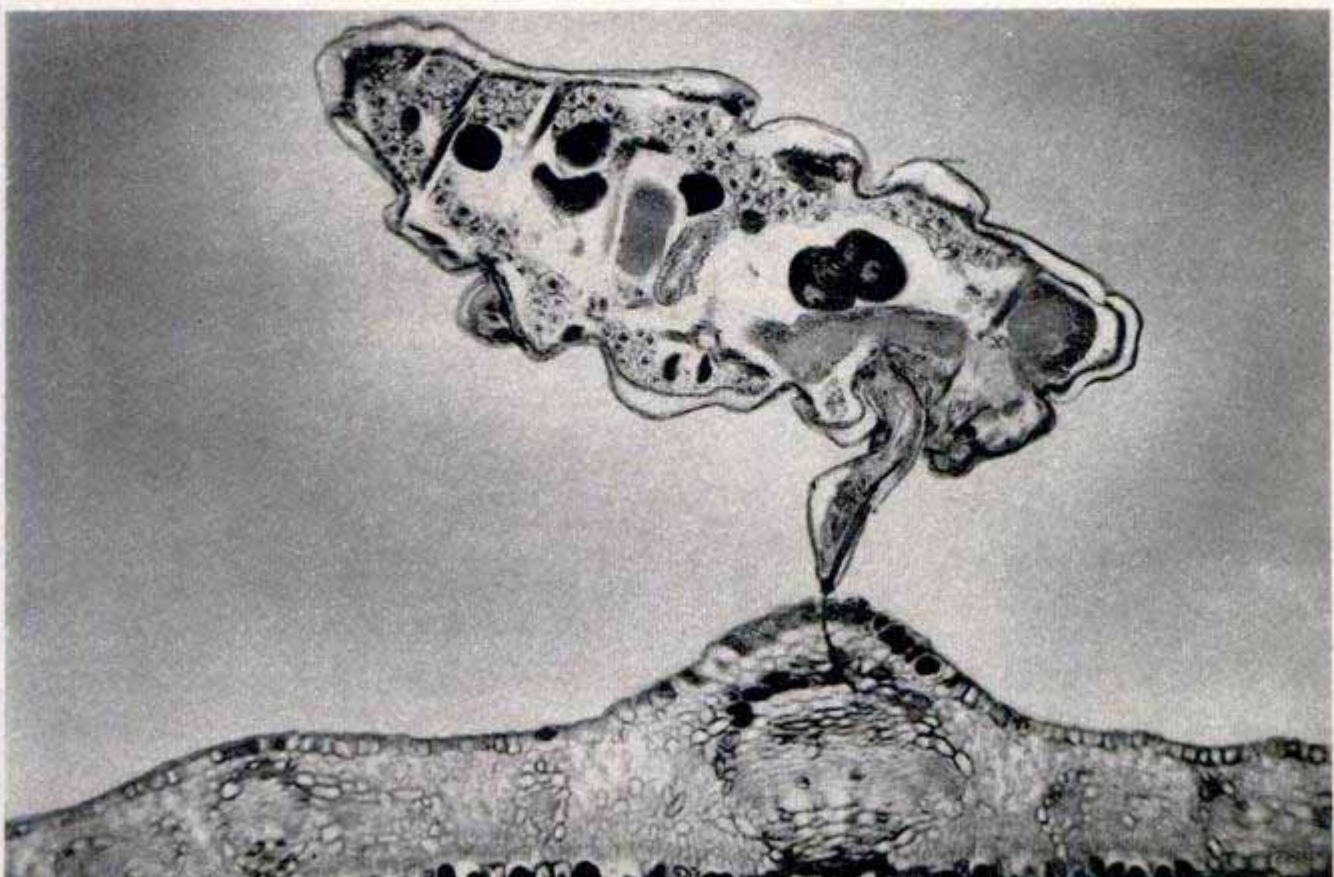
With a slide in microscope just forward of lens, Hollis prepares to snap photo. Ground glass shows the field

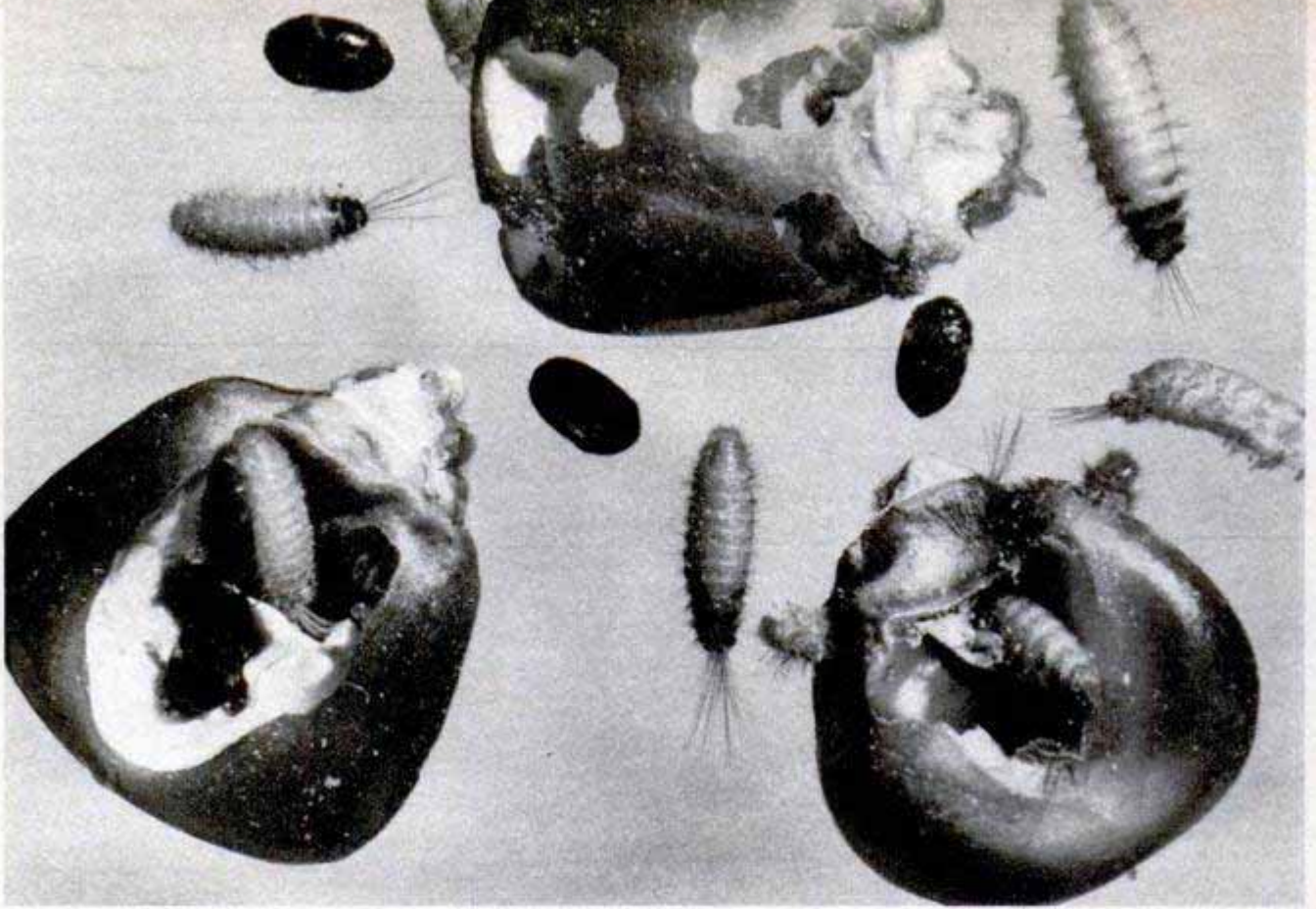
SCIENCE continually searches for better ways to record its discoveries. One technique is to photograph a world too small for the human eye to see. V. P. Hollis of the University of Minnesota pries into that world with a microscope and a camera to make photo-

By Clifford B. Hicks

graphs that are works of art as well as tools of the scientists. Hollis is director of the university's photographic laboratory. Scientists and professors consider his photographs invaluable aids in teaching students the facts about life in a suboptical world.

This photo, showing cross section of louse feeding on a leaf, won Hollis a high award in science photography



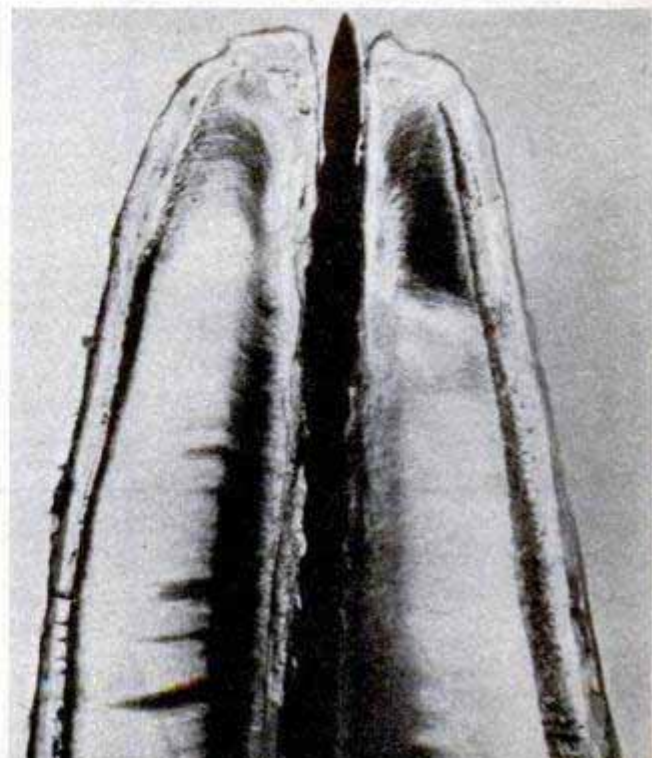
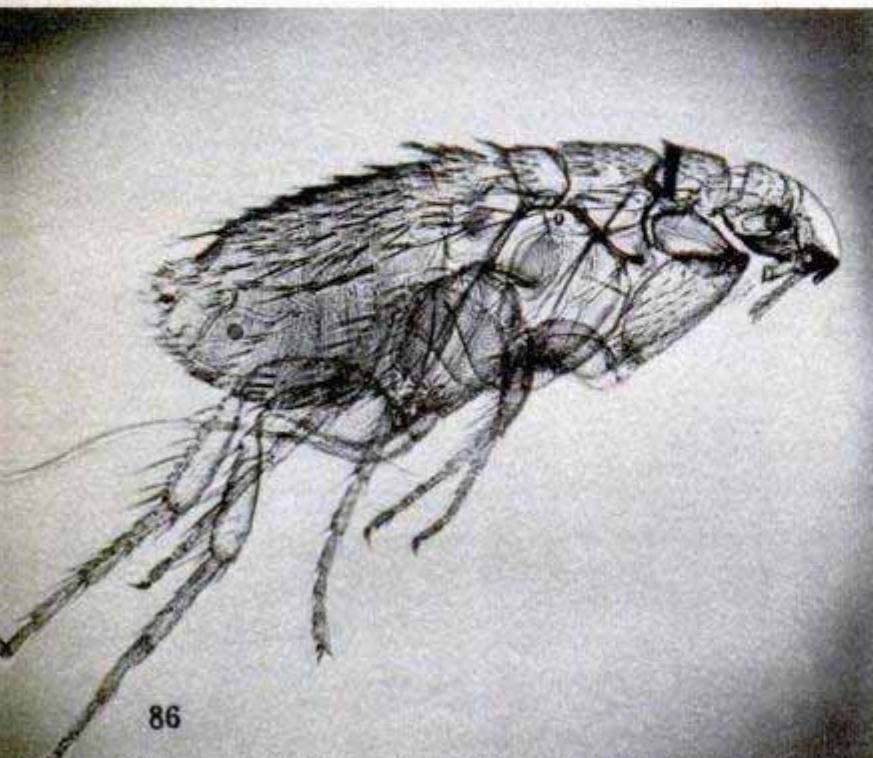


Corn, weevils and larvae were mounted on a slide and photographed with direct instead of transmitted light



Left, an untouched horsehair from the bow of a violin. Right, the same hair after resin has been applied

Left, female flea was mounted on glass slide and light from arc lamp focused through it to make exposure. Right, child's tooth was ground to extremely thin cross section for this photograph. Note the nerve channel



Students in the university's science classes can learn the behavior of minute organisms through lectures, textbooks and drawings; they can catch a glimpse of this tiny world through a microscope; but they can have no accurate record for long-term study without an actual photograph that shows the specimen in detail.

In addition, scientists engaged in research have difficulty in comparing several specimens through microscopes. Photographs of the specimens are an ideal answer to this problem.

Hollis provides those photographs through a process called photomicrography. This method is not merely the technique of taking extreme close-ups with a lens that will catch the subject in detail. Hollis has an expensive microscope connected directly to his camera. He substitutes a sheet of film for his own eye in looking through the microscope, and snaps a permanent record of the specimen mounted on the slide. He has developed his technique over a period of 17 years.

The technical name for Hollis' equipment is the Leitz UMA Photomicrographic Apparatus. The camera is mounted on tubular runners for horizontal movement. Attached to the lens is the microscope with a side telescope for locating the field. The light source, usually an arc lamp, is mounted at the opposite end of the optical bench, and the light passes through a heat-absorbing filter and stage controls before it strikes the specimen. The entire apparatus is floated on springs.

When scientists and professors at the university request Hollis to snap a permanent record of their work, he must first

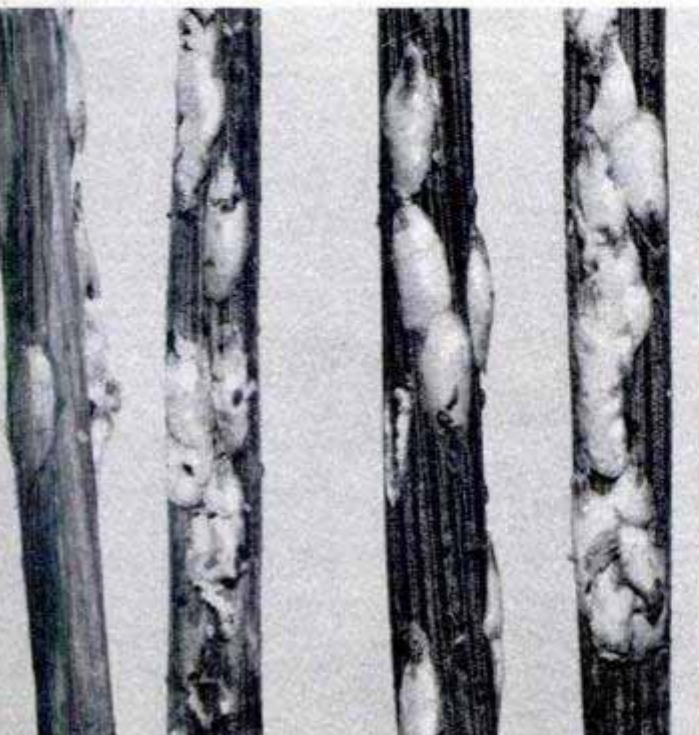
Right, when specimen is mounted in water, Hollis swings camera into a vertical position so the slide will be level. Below, photos such as this one showing infected pine needles have become tools of science

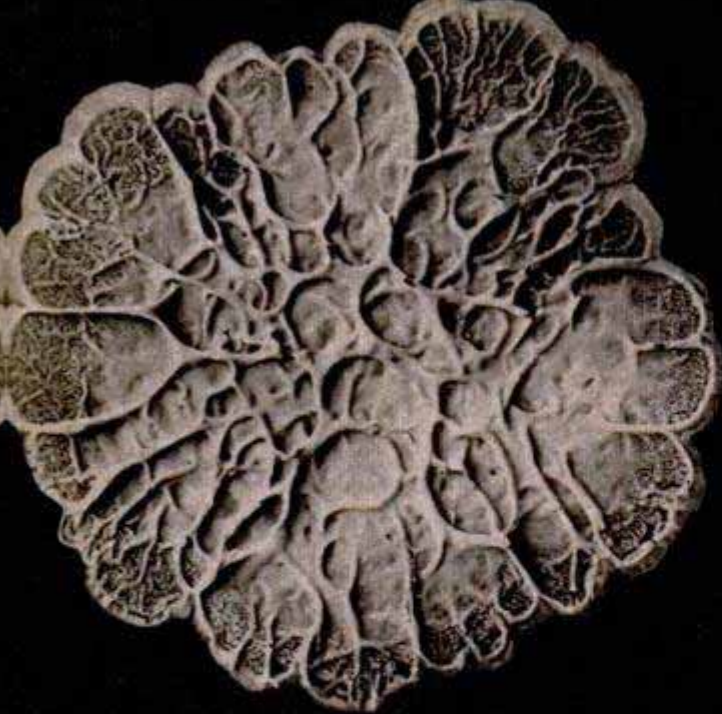
have the specimen in condition to photograph. This is an art in itself. Scientists usually do this part of the job, slicing tiny cross sections of the organisms and mounting them on glass slides. In some cases, living specimens are mounted in water.

The photographer slips the slide into the microscope, turns on the arc lamp and then squints through the microscope's telescope to locate the tiny portion he wishes to photograph. When he has found his field he turns to the ground glass on his camera, where this field is enlarged many times. Then with a fine-focus adjustment he sharpens the image until it stands out boldly on the glass, and snaps the picture.

In cases where the subject must be mounted in water, the camera and microscope can be swung into a vertical position so the hollowed-out slide stands level.

One of Hollis' unusual photos is his cross section of a plant louse feeding on a leaf. This photo won him a second award in the First International Photography in Science Salon sponsored by the Smithsonian Institution. It is an extremely thin section of the louse, sliced while the insect was feeding on the leaf. In order to make the slide, the leaf and louse were immersed in





a fixative which "froze" them in their relative positions and killed the insect. The section then was cut about eight microns (in the neighborhood of $3/10,000$ inch) thick, with the louse's beak still penetrating the leaf. This specimen was stained and mounted on a slide for the photo.

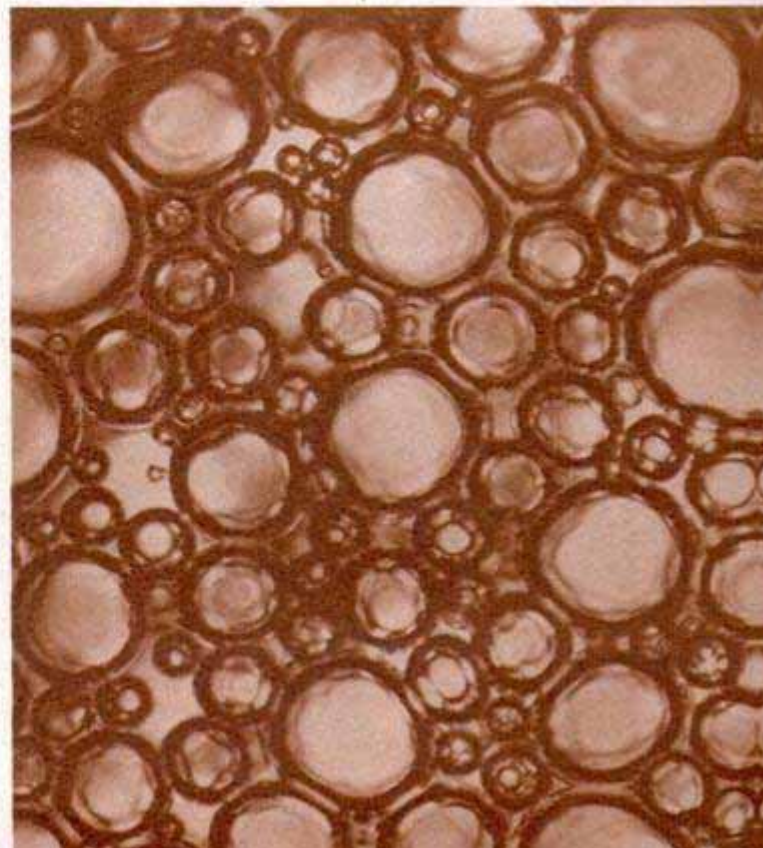
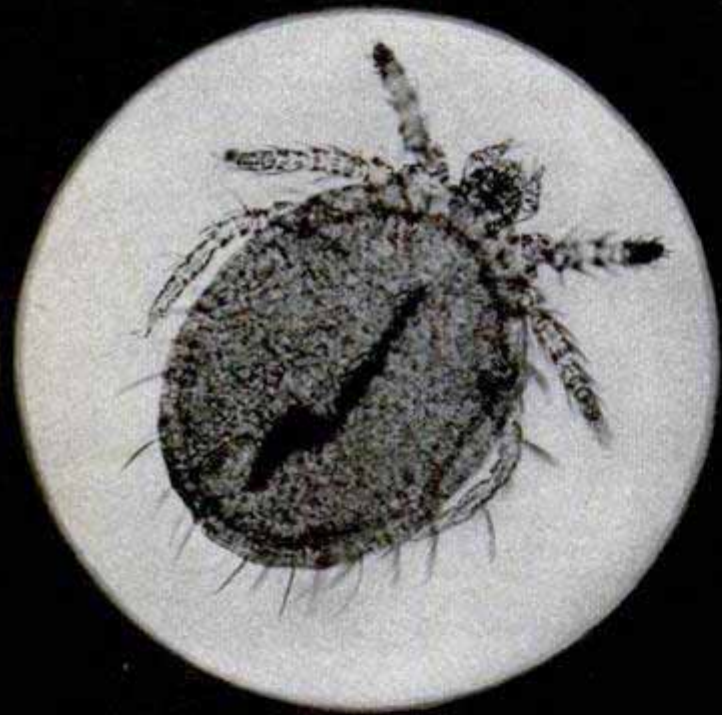
Hollis generally uses transmitted light which goes directly through the specimen to expose the film. However, on some photos, such as a beautiful design made by hollyhock pollen, he uses incident light, which falls on the subject without passing through it.

The photographer is justly proud of his photograph of a wheat kernel plainly showing the thiamin it contains. A cross section of the kernel was mounted on a glass slide and a sharp beam of ultraviolet light cast on it. Light in this band excited the fluorescence of the thiamin, so that it stands out plainly in the finished photo.

Hollis uses exposures that vary from $1/100$ second to 5 minutes, although most of his photos are made at $1/10$ or $1/25$ second. He can magnify a specimen up to 4200 diameters, but he seldom goes above 1500. Greater magnification increases size but not resolution so is of little value.

Starting with a crude setup he rigged by himself without special equipment, Hollis has developed a technique that has made his photomicrographs tools for research workers and valuable aids for students.

Panel from top to bottom shows: culture of a disease growth on cereal grasses; that troublesome mite, the chigger; exotic flower? No, just a magnified view of common clover blossom. Below, even a cook wouldn't recognize this, although it's a microscopic photo of cake batter including eggs, sugar and baking powder



Water Skis

Anyone can walk on water with six-foot shoes made of light plywood. Watertight compartments in the shoes keep the wearer afloat. Fins on the bottom bite into the water to give the "water walker" stability. Beginners use water-ski poles to keep their balance, but experienced users can move without assistance. The water shoes are similar to those developed in Venice, Italy, as reported in *Popular Mechanics*, April 1948.

Nonstop Electric Clock

Even though the power fails, a new electric clock continues to record the time without losing a second. Attached to the clock is a spring-driven unit that takes over instantly if the electric supply is cut off. Most spring-driven non-electric clocks will not start themselves if the balance wheel happens to stop on dead center. This characteristic weakness of spring-driven timepieces has been overcome in the auxiliary unit of the combination clock by magnets which keep the wheel under peak tension while the electric unit is operating. If the electricity is cut off even for an instant, the balance wheel is released and the



main spindle continues to move. The clock will operate on spring power for at least 24 hours. It is designed for recording instruments and time switches where the stoppage of the clock would result in serious complications. An automatic signal gives ample warning when winding is necessary.

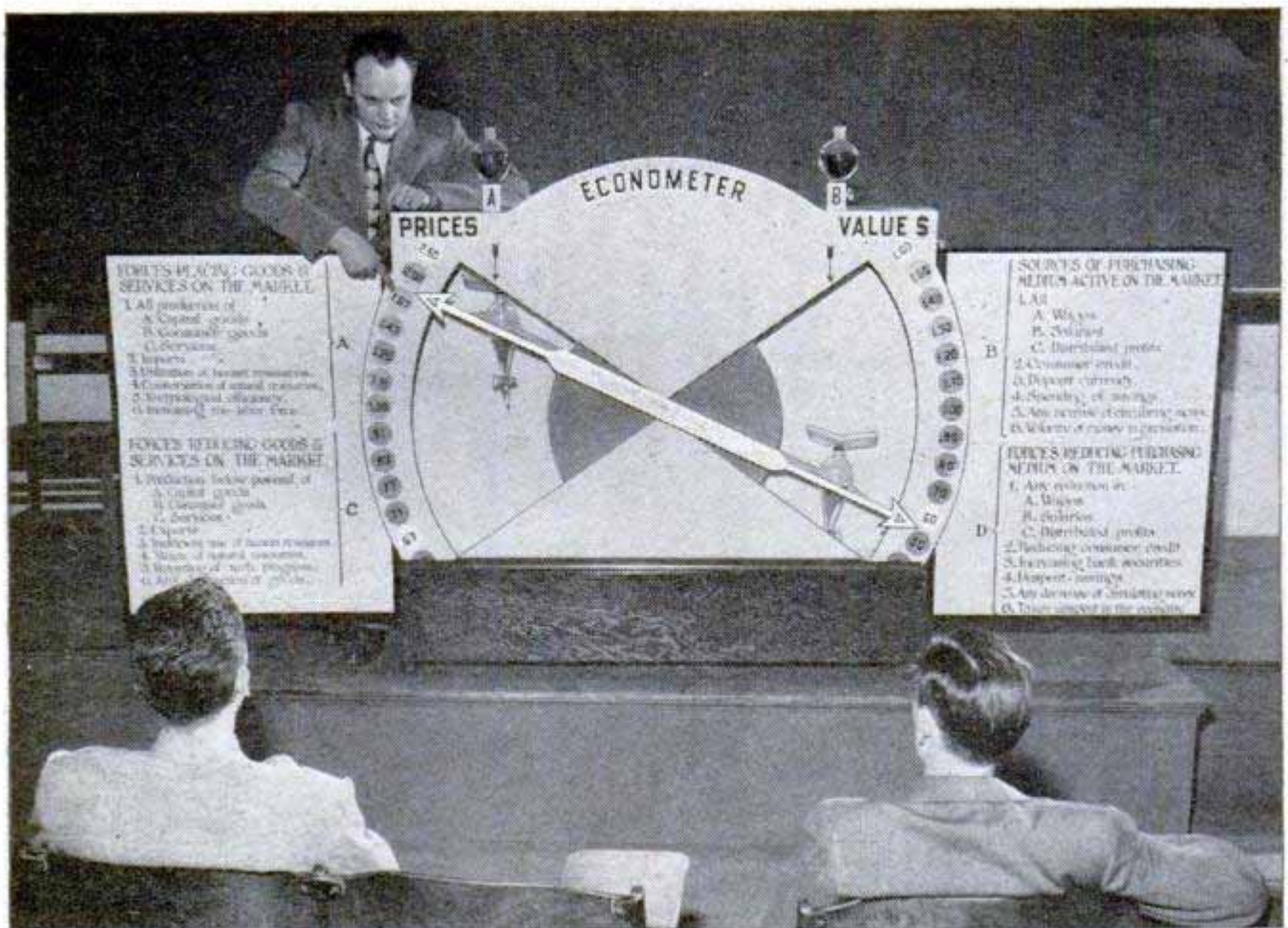


International Telephone and Telegraph Corp. photo

Two-Color Radar

Two-color radar that enables operators to distinguish between their own and enemy planes has been developed for the U. S. Air Force. It is undergoing initial tests in a 300-foot, aluminum sheathed tower at Nutley, N. J. Natural echoes and those created by a "responder" in the aircraft register on the same screen as contrastingly colored blobs of light. They are optically combined and superimposed at a spot corresponding to the plane's position. It has previously been necessary to use separate antennas and screens for the two kinds of echoes. As an aid to detection and tracking, the radar's scanning rate has been speeded, with the antenna rotating completely every second instead of every 6 to 10 seconds.

☞ Carpets made of nylon are long-wearing, mothproof and can be cleaned easily with soap and water.



Cost-of-Living Meter

What happens to prices and the value of the dollar under varying conditions is shown with an "econometer" built at the New York University College of Engineering. It consists of a two-pointed arrow several feet long and balanced on a knife edge. Above the arms of the arrow are two flasks containing red and blue liquid on which petcocks may be opened to permit the liquid to fall into beakers suspended from the arms of the arrow. Petcocks at the bottom are used to draw off the liquid. On the left side a scale representing prices is marked in units from \$.67 to \$2.50. These prices are affected by the production rate, imports, exports and other factors. On the right side a scale is marked off from \$.50 to

\$1.60 representing purchasing power measured by the real value of a dollar. The figure \$1.00 on the price side indicates the general price level of goods in 1940; 100 cents on the right scale represents the 1940 value of the dollar. As production increases (represented by red liquid dropping into the beaker) the left arrow goes down lowering prices and raising the value of the dollar on the opposite scale. As purchasing power (blue liquid) is added on the other side the value of the dollar goes down and prices go up. The econometer is constructed so that one cubic meter of liquid represents one billion dollars and today's situation of a 55-cent dollar and about \$1.90 prices is achieved by simply putting in and letting out appropriate quantities of the liquid.

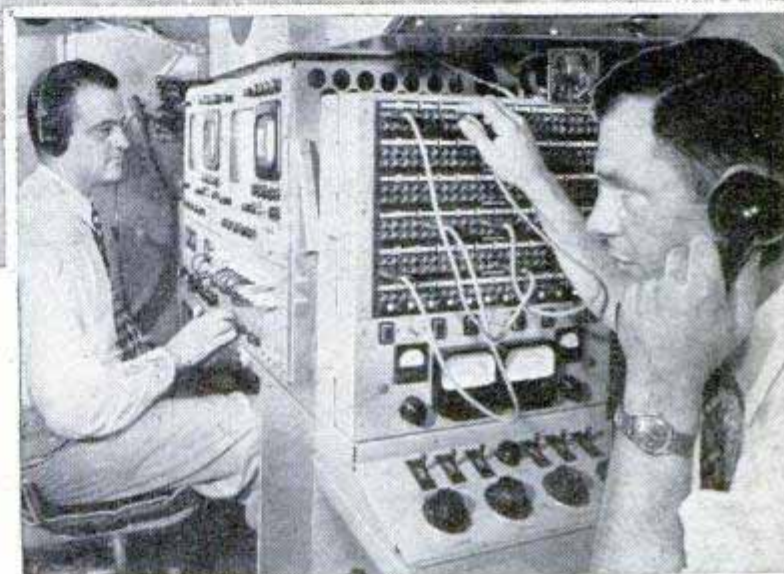
Plastic "Magnets" Are Cheaper and Lighter Than Metal Type

"Magnets" made of plastic instead of metal have been developed and show all the characteristics of permanent metal magnets. The pieces of plastic are not really magnets because their atomic structure must be changed before they will exhibit magnetic properties, so they have been named electrets. They are made by liquefying plastics of either the thermosetting or thermoplastic types and then exposing them to a strong electric field. The bonding forces that hold the atoms to-

gether are realigned in the process, and when the plastic hardens it has a positive and negative pole. The electrets are less expensive to make than cobalt-steel magnets. Being lightweight and extremely sensitive, they may be used in loudspeakers, microphones, vacuum tubes and electrical instruments.

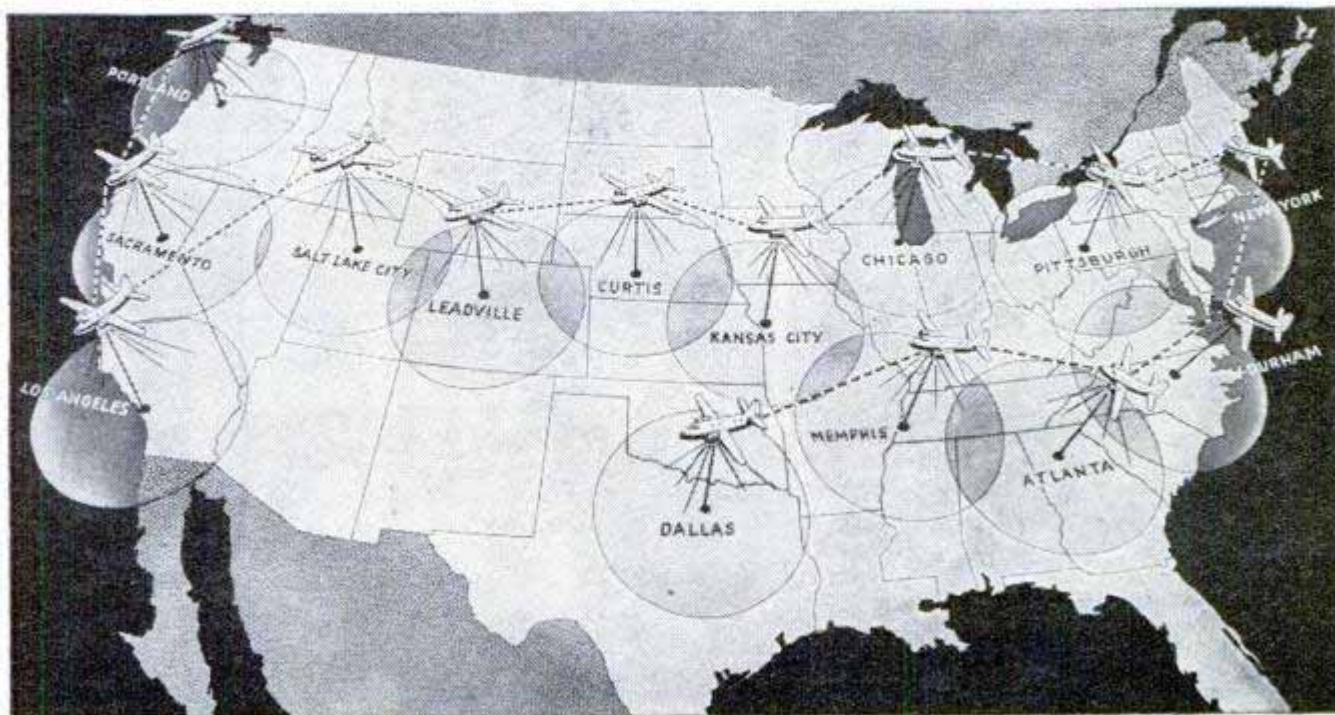
Every second of the day an average of about 16,000,000 tons of rain and snow fall on the surface of the earth.

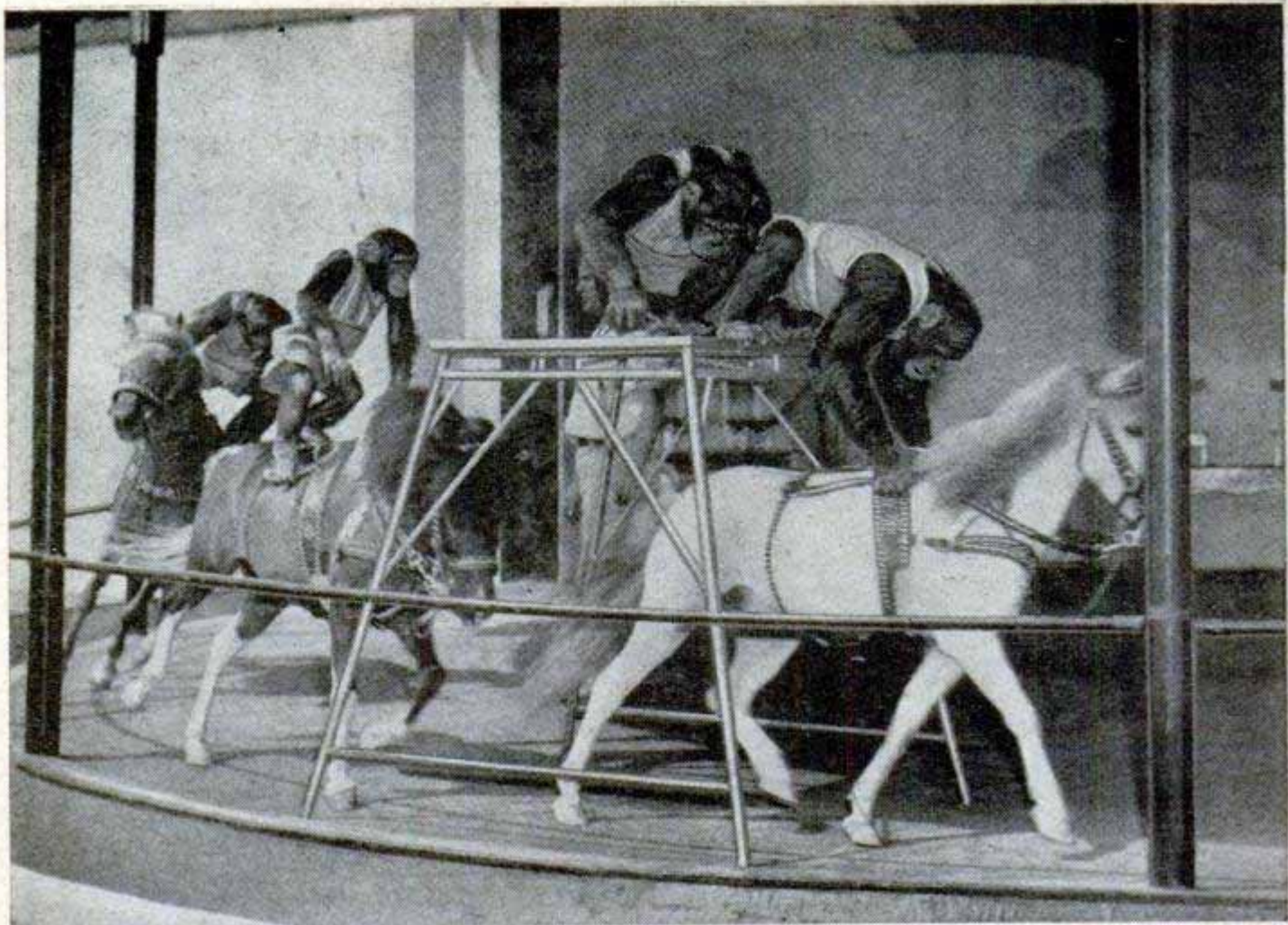
Television on Wings



Flying television stations may bring the thrills of video programs into the homes of millions who live beyond the range of metropolitan stations. In a recent test, a modified B-29 equipped with a complete receiving and transmitting station flew above Pittsburgh at 25,000 feet rebroadcasting signals from a Baltimore station over an area about 525 miles in diameter. With the relay, the Baltimore program was picked up in Zanesville, Ohio. Normally, television has a range of about 50 miles. Network plans call for the use of Martin 2-0-2s equipped for all-weather flying

The Stratovision relay plane (top) uses a tail antenna to receive the signal and a long nose antenna for rebroadcasting. Above, control panel inside plane for monitoring signals. Below, proposed network would use 14 planes as shown on map



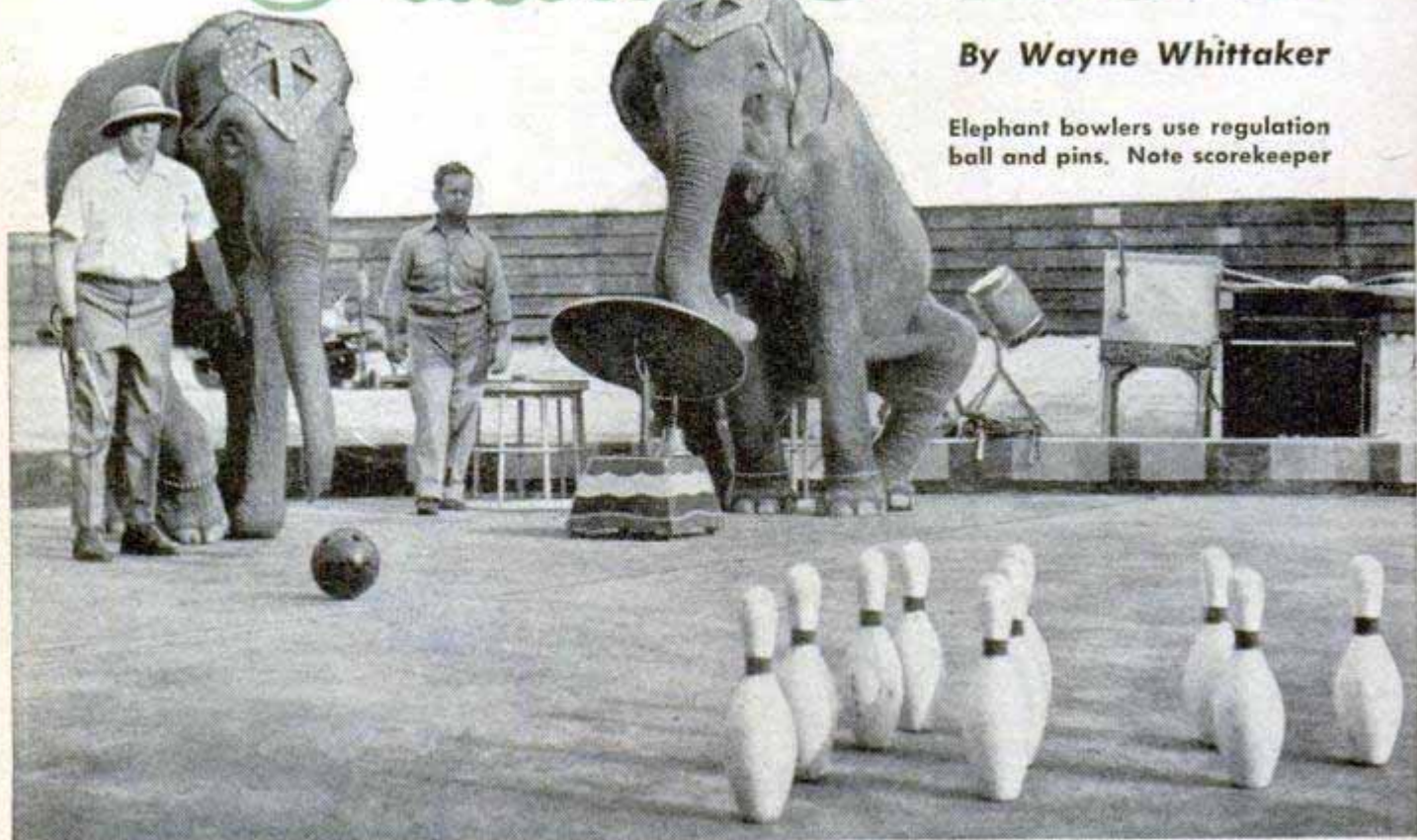


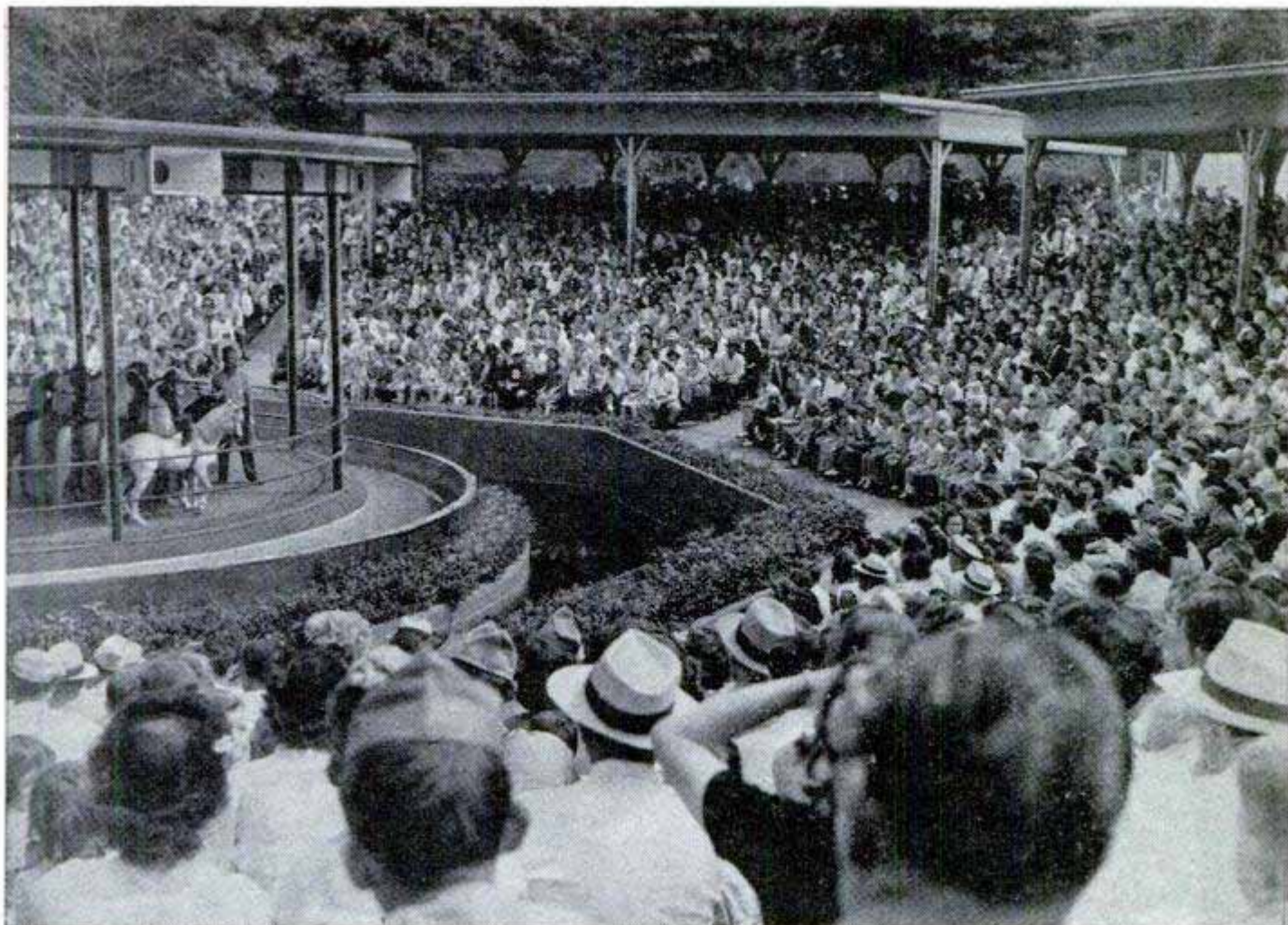
Stellar performers at the St. Louis Zoo are the chimpanzees shown here in a fast pony-riding-jumping act

BRING ZOO

By Wayne Whittaker

Elephant bowlers use regulation ball and pins. Note scorekeeper





Crowds jam grandstands of monkey theater with its open-air stage. The moat before stage is filled with water. Tunnel connects backstage to monkey house



ONE SUNDAY afternoon just 22 years ago visitors at the St. Louis Zoo witnessed a history-making event. None of them guessed it. In fact, some laughed. Even George P. Vierheller, the zoo director, would not have prophesied that here was the beginning of something that would bring the zoo world-wide renown.

All the visitors saw that Sunday in 1926 was an orangutan that rode a bike and drank water out of a bottle. The crowd of 40 or 50 was amused.

"It's a good little stunt," a friend told Mr. Vierheller, "but I doubt if it will put Ringling Brothers' circus out of business."

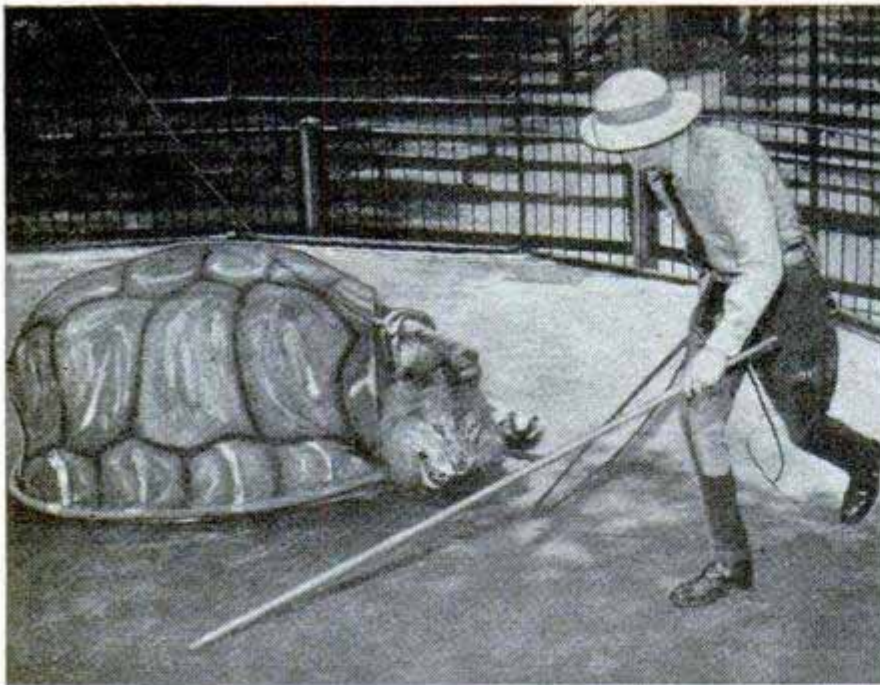
This summer nearly a million persons are beating a path to the three-ring circus at the St. Louis Zoo. One Hollywood movie director argued for an hour on the long-distance telephone in a futile attempt to get

one of the acts for a big production scene. But the show, like the zoo itself, belongs to the taxpayers of St. Louis. The zoo circus is not for sale and not a penny is charged for admission. That is only one of the amazing things about the animal acts which experts have acclaimed as three of the best in the world.

One of the acts consists of 13 lions, two tigers and two European brown bears. They perform in a huge iron cage before a permanent amphitheater seating a couple of thousand guests. The monkey act is made up of 10 chimpanzees, seven Shetland ponies and one Sicilian donkey. This show is presented on an attractive moated stage in an outdoor theater seating about 3000. The third act is composed of five Asiatic elephants. Each show lasts about half an hour and is presented twice on week days and three times on Sundays, when frequently a crowd of 30,000 attends.

Let's go to the show. Trumpets blare from loudspeakers as Jules Jacot, veteran lion trainer, steps forth. He addresses the crowd:

"Ladies and gentlemen, here at the wild-animal show we present a grand spectacle entitled 'The Crowning of the King.' You'll



Lion wearing turtle shell snaps at trainer Jules Jacot; shell (right) is made of tubing, wire mesh, papier-mache

see kings, queens and princes of the animal kingdom in this all-star cast. You'll even see Jumbo, the largest and most amazing snapping turtle in the world. We will try to show you not how tame wild animals are, but how intelligent under proper guidance."

Then Jacot, who has worked with circuses all over Europe and the U. S., pulls the trap-door rope and the first lions rush into the cage, followed by two tigers and

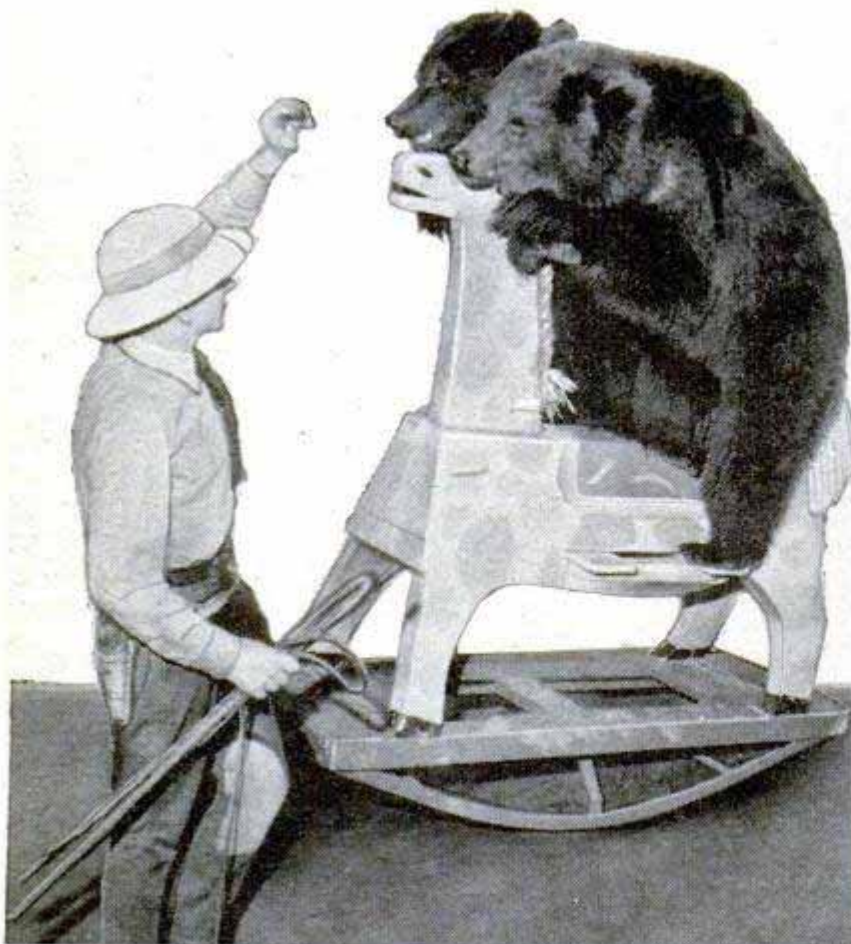
two brown bears. The bears put on a nursery scene, drinking out of bottles and riding a rocking horse. The tigers roll over at Jacot's commands. Two lions perform the difficult stunt of walking on their hind legs; a lioness stands on her forepaws; others jump through paper hoops, through Jacot's arms, and one lioness leaps on his back from her perch.

After the show gets under way Jacot begins the novelty acts. Two lions stand on pedestals facing each other. In their teeth they hold a chain of wooden wieners on which their trainer sits and swings nonchalantly.

Leo I, a four-year-old male, plays the part of the king and also the turtle. During his coronation he wears a jeweled crown with attached spectacles and a robe of simulated ermine. As he stands on his pedestal the loudspeakers play "Old King Cole" and the crowd cheers. In the turtle act, Leo crouches under a giant shell with only his head and tail sticking out and lurches around the ring roaring and snapping at Jacot.

After the show Jacot explains some of his tricks.

"Stunts that look easiest are sometimes the hardest," he says, "and some that are



Performing without muzzles or leash bears ride twin rocking horse in a nursery scene of Jacot's animal show

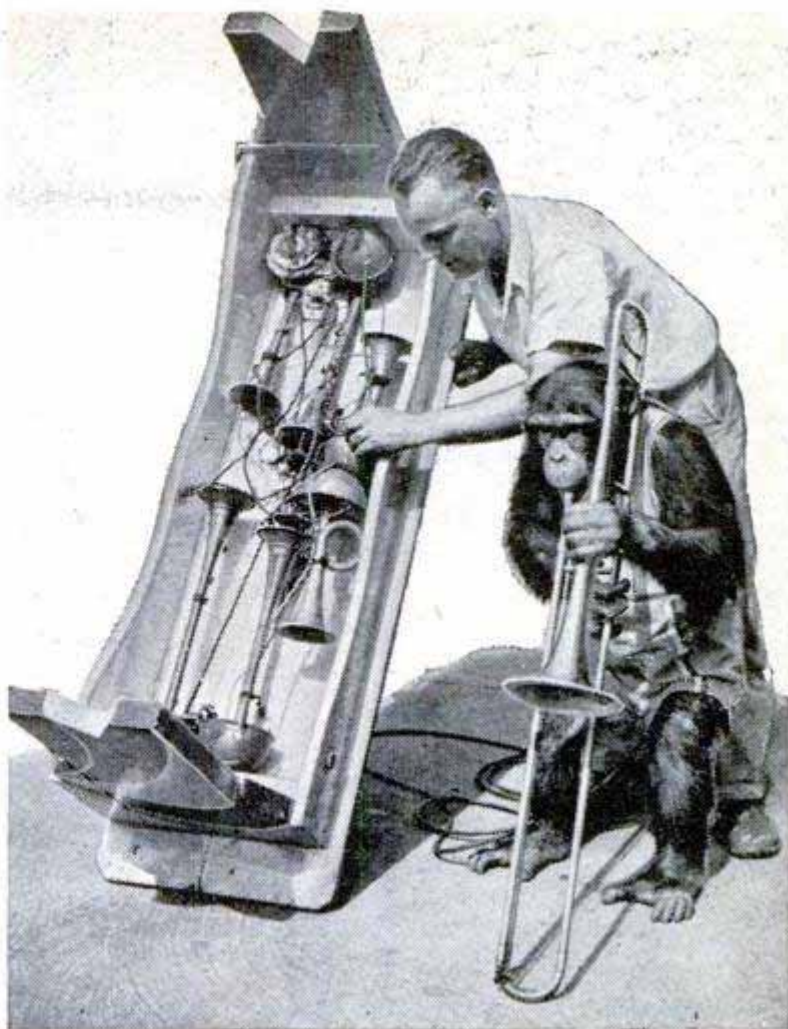
simple bring down the house. Take the bears. Did you notice I work them without muzzles or leashes? I've had my bears, Toska and Senorita, since they were cubs but I don't trust them. They are far more dangerous to work with than lions. When they growl or charge they are not fooling. Tigers are treacherous, too. The lions are great actors and most of their growling and charging is part of the show."

Although Jacot carries a revolver loaded with blank cartridges he never fires it during a show.

"The shots mean nothing to the animals when they hear them all the time," he says. "I will never fire a blank unless there is real danger."

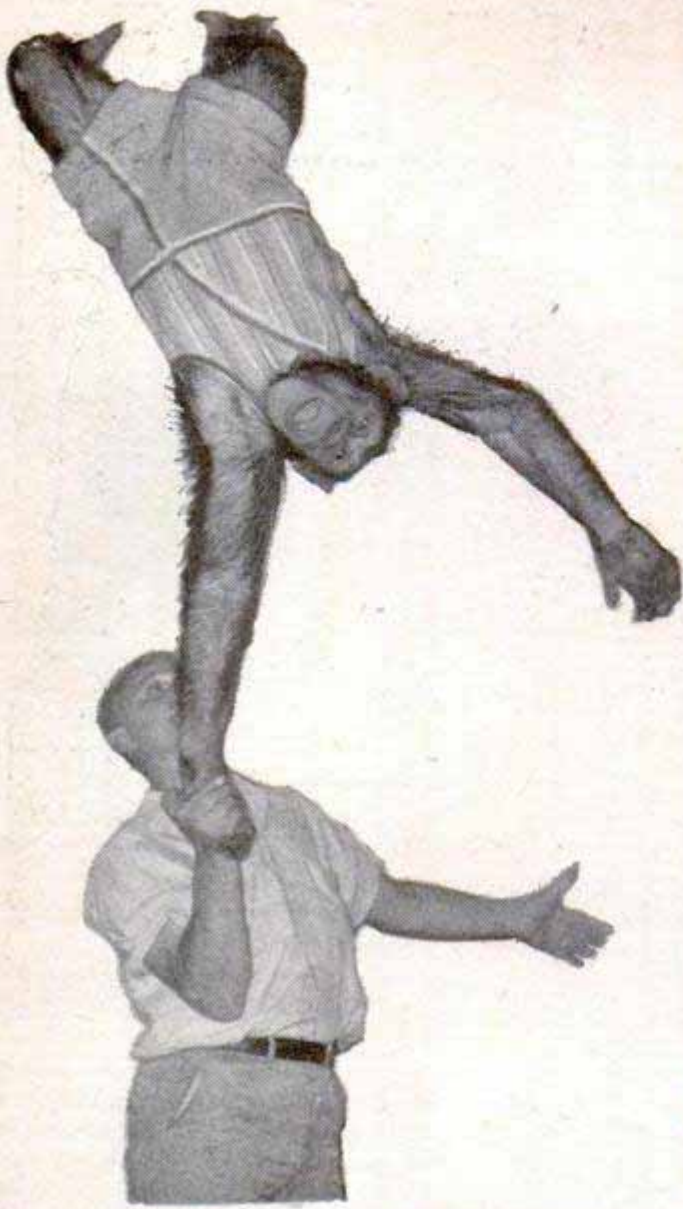
All 17 in Jacot's show are performers. In many shows, he points out, only a few lions perform and the rest are just "stool warmers." After the show closes in October he works the animals daily throughout the winter. His voice cues are given in Spanish for the practical reason that there will probably be no shouts in this language from the crowd to confuse the animals.

"I start training lions when they are two years old," he says. "Before that age they want to

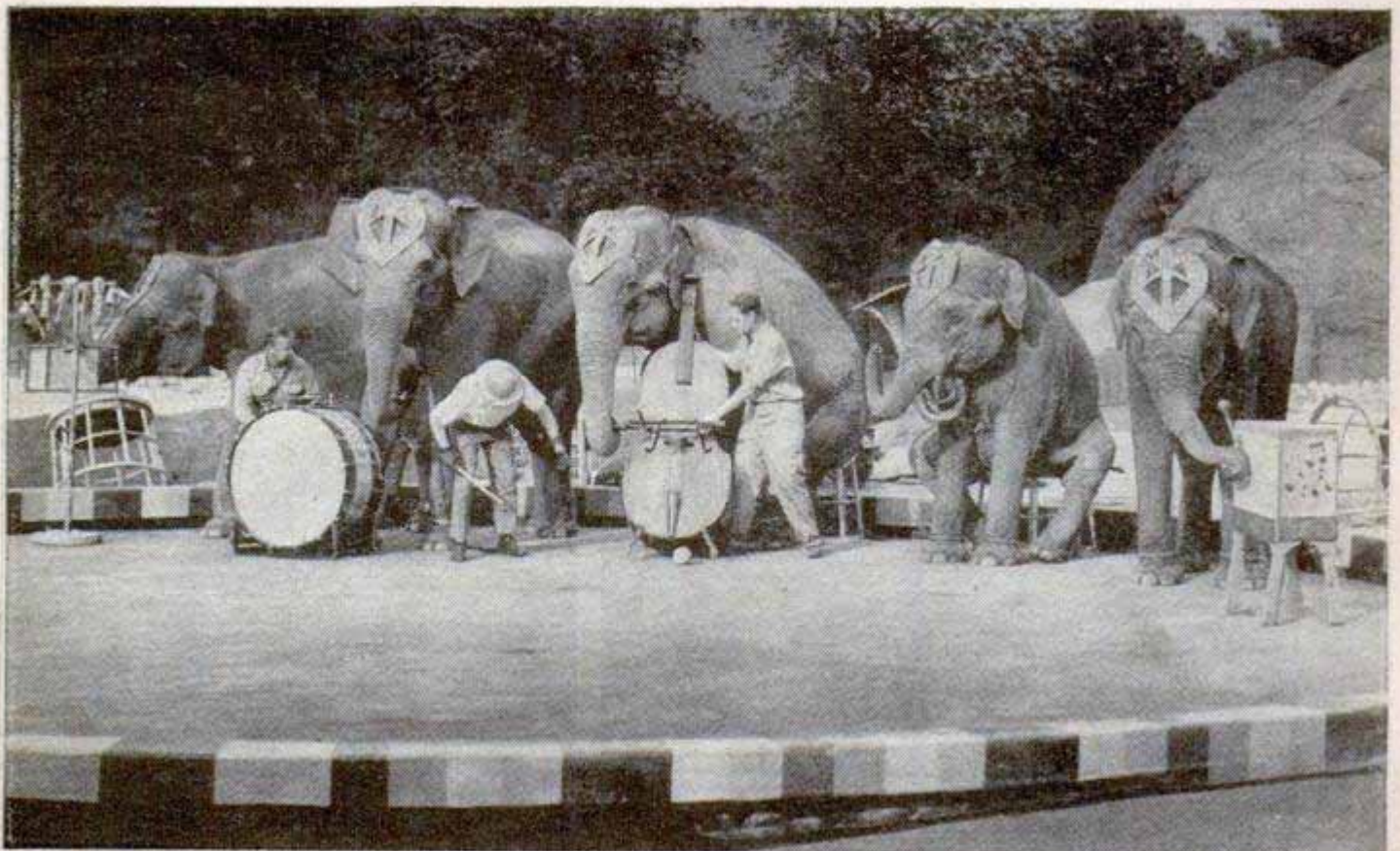


When famous chimp Cookie plays the trombone, sound comes out of three sets of automobile horns concealed under bench. They are electrically connected to slide. Below left, Tommy clowns while he plays the piano with jungle orchestra. Right, steel spectacles help hold the king's crown in place. He wears an ermine robe





Above, George P. Vierheller, director of St. Louis Zoo, coaches Cookie before bicycle act. Left, Ben Fridrich supports chimpanzee in a one-hand stand. Below, elephant orchestra; washboard is at far left

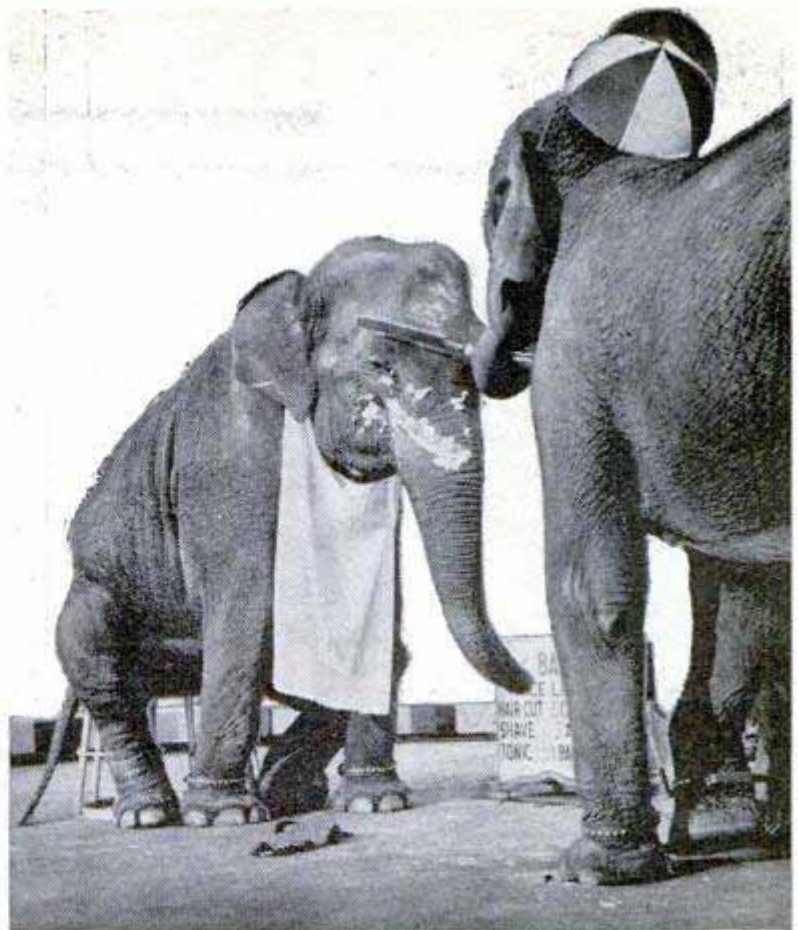


play all the time. I like to pick smart, mean lions instead of training tame ones to act wild. A well-trained mean lion is more dependable, because it's the nature of the beast to perform better when he is a little peeved.

"First I get acquainted with a young lion by moving him from cage to cage. Then I get him used to the arena. When the lion stops prowling back and forth I get in the cage with him. At first I stay close to the door and use a chair. If a lion keeps watching you and moves according to your moves you are safe. When a lion quits moving and begins to stalk, he is concentrating on you and no one can change his mind. Some late lion trainers have tried."

Jacot says lions have a touchy spot and when he finds it, he controls them by pointing his training rod in that direction. Some have it on the end of their tails, some on an ear, ribs, or on top of the tail where it joins the body. Pets lose these "touch" points and that is why he never makes a pet of any performer. It may take years to teach a lion to do a trick (such as the wiener-chain swing or turtle act) but the lion must get the idea during the first week of training. For instance, Leo refused to crawl head first into the turtle shell. Jacot finally discovered that he wanted to back into it. Since then the act has gone smoothly.

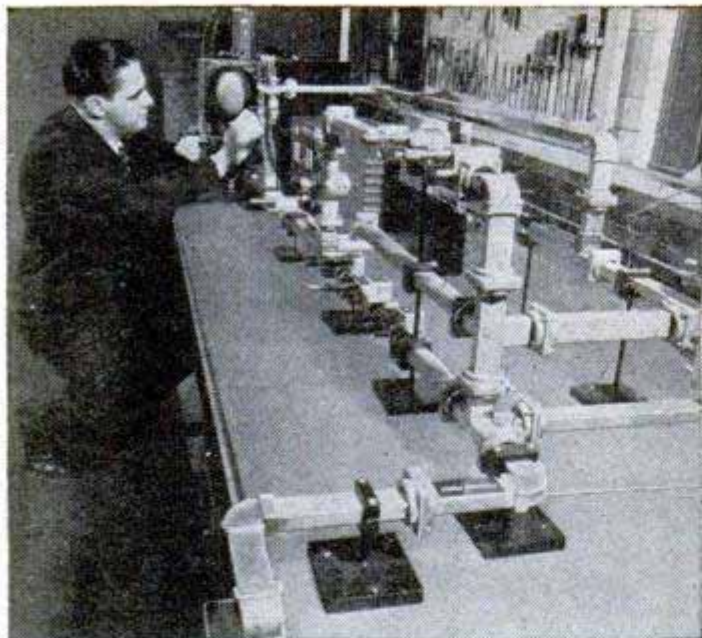
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In barber-shop scene lathering of "customer" is followed by shave with wooden razor. Bib is big sheet

Trainer Jules Jacot "relaxes" on a swing of wieners (wood) held in the mouths of two of his leading actors



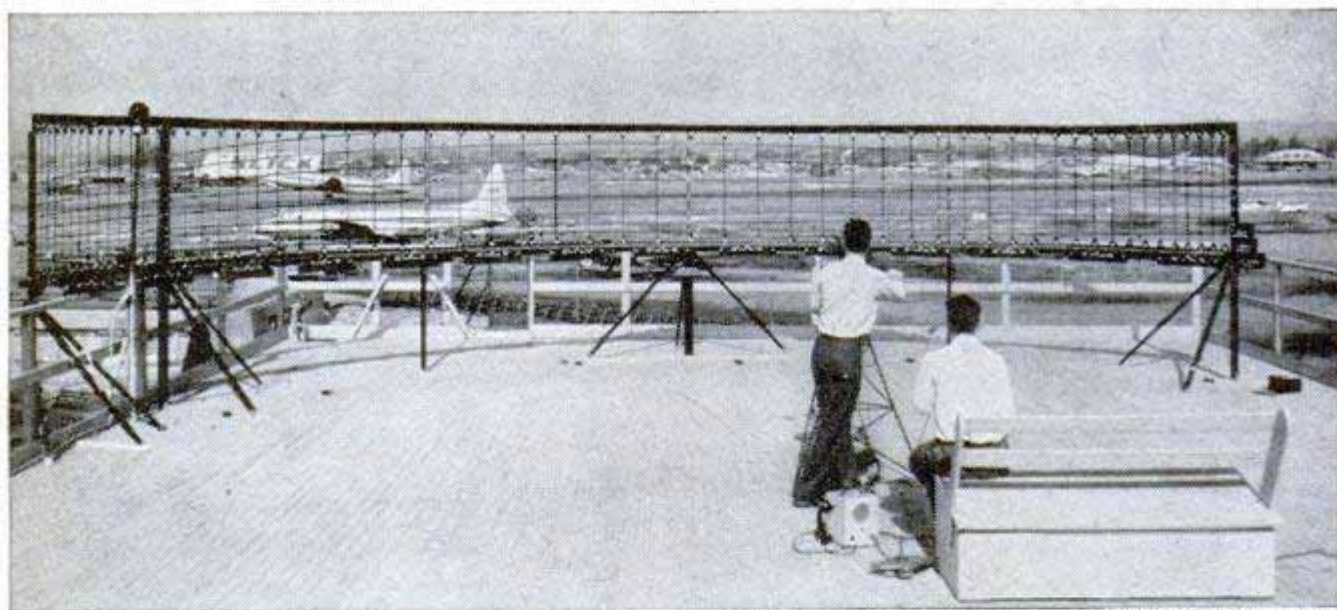


Dry "Raindrops" Aid in Experiments To Eliminate Radar's Blind Spot

Man-made "raindrops" that never fall and aren't wet are being used in experiments designed to cure the blind spot in radar sets. This blind spot occurs in sets using ultra-short waves less than $\frac{1}{2}$ inch long. When these waves strike a raindrop they sometimes bounce back to the receiver and obscure the target image on the

Above, engineer examines one of the splashless "raindrops" used in testing radar. Left, metal ducts carry the reflected waves to instruments

scope. By suspending artificial plastic raindrops in mid-air by four strings, Westinghouse scientists make their own "rainstorms" to test the reflecting capacities of various radar sets. The reflected waves bounce into a hornlike receiver and are piped through a maze of metal ducts to sensitive measuring instruments.

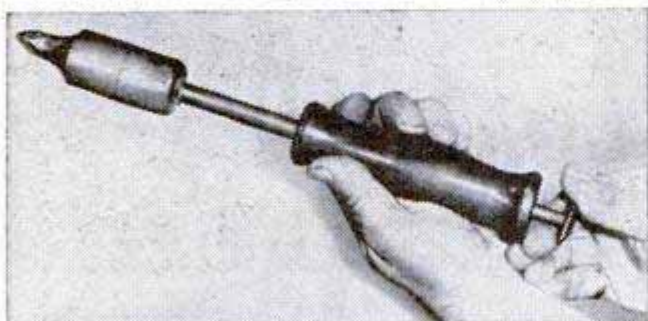


Lockheed Aircraft photo

Camera "Times" Take-Off and Landing Tests

Take-off and landing performance of all Lockheed experimental planes is photographed with a special wire grid and a motion-picture camera. The grid, nine feet high and 64 feet long, has vertical wires marking off 100-foot sections of the runway and horizontal wires indicating altitude at 25 and 50-foot intervals. Twenty feet behind it is the camera, with a telescopic lens trained on the plane 2000 feet away. A

movable tape marked in tenths of a second is pulled past the camera, in the same direction as the plane, by an electrically timed motor. The film shows the exact time and distance required for take-off and landing and where the plane would clear a 50-foot obstacle, one of the government's licensing requirements. Effects of changes in propellers, engines and flap positions can also be observed accurately.



Nonelectric Soldering Iron Heated by Chemical Action

Using no electricity or flame, a quick-heating soldering iron reaches working temperature in five seconds after a chemical cartridge in the tip is punctured. Intense heat is maintained for eight minutes. The small cartridge fits in the recessed tip and is punctured by a spring rod that runs through the handle. At peak heat it has a wattage rating equivalent to a 200-watt iron, according to the manufacturer. For jobs requiring more than eight minutes, additional cartridges are used. The iron, plus one cartridge, weighs 20 ounces.



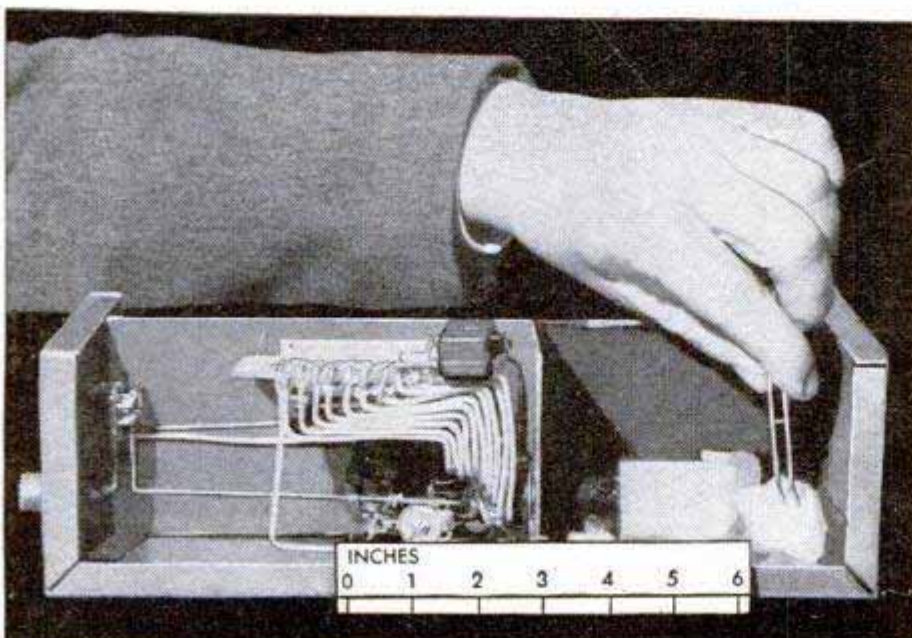
Dentist "Hitches" a Ride On Movable Stool

Seated on a padded stool that rolls smoothly around the patient's chair, a dentist can now ride with his work. The foot-control switch for the drill moves with the seat as the dentist rolls it around the chair. The seated position, being lower, also gives the dentist better visibility inside the patient's mouth.

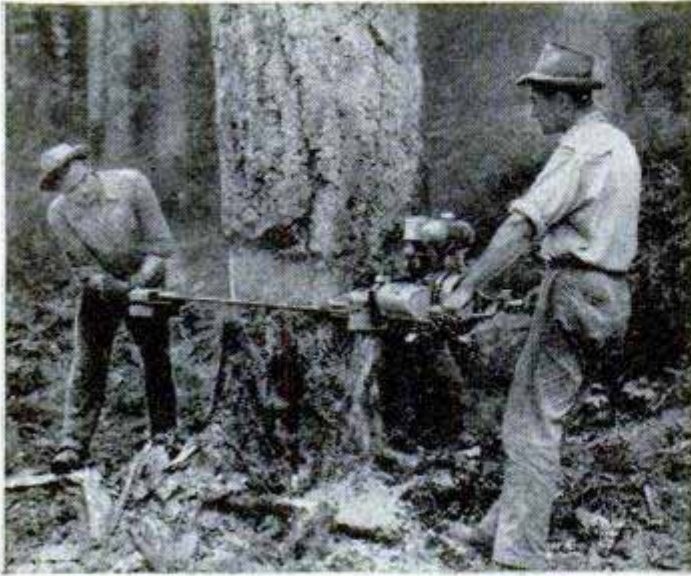
Atomic-Ray Counter Has Supersensitive Photo-Eye

Radiation is detected 30 times more efficiently with a "scintillation counter" now being tested at the University of Chicago.

It distinguishes between electrons passing through it at intervals of less than one ten-millionth of a second. Patterned after a wartime German invention, the counter is simply a box containing an extremely sensitive photoelectric tube, surrounded by Dry Ice to deaden outside interference, and a small amount of fluorescent matter. Nuclear particles admitted to the box produce bursts of light in the fluorescent matter, usually naphthalene. The light is picked up by the tube and converted into a momentary current of electricity which can be amplified and measured accurately.



As quaint narrow-gauge railroads and roaring rivers give way to Diesel trucks in hauling logs out of our thinning forests, there's a boom in road building deep in virgin timber



With portable, gasoline-driven chain saws, woodsmen can slice through 24-inch tree in a few minutes. Behind trail blazers come bulldozers, roughing out new forest roads by uprooting trees and brush, shoving rocks aside

U. S. Department of Agriculture photos



New Roads to Timberland

By Lyle F. Watts
Chief, U. S. Forest Service



PAUL BUNYAN was quite a fellow, but he'd be flabbergasted if he and Babe, the Blue Ox, were called upon to deliver to our sawmills and lumber yards as much timber as American lumbermen cut in a day. Right now wood consumption is at a high level; it is one of the critical items in our home-building program and has an ever-growing list of other uses.

That's why the U. S. Forest Service, custodian of one sixth of the nation's commercial timberland, has given high priority to construction of 2100 miles of access roads into virgin timber territory.

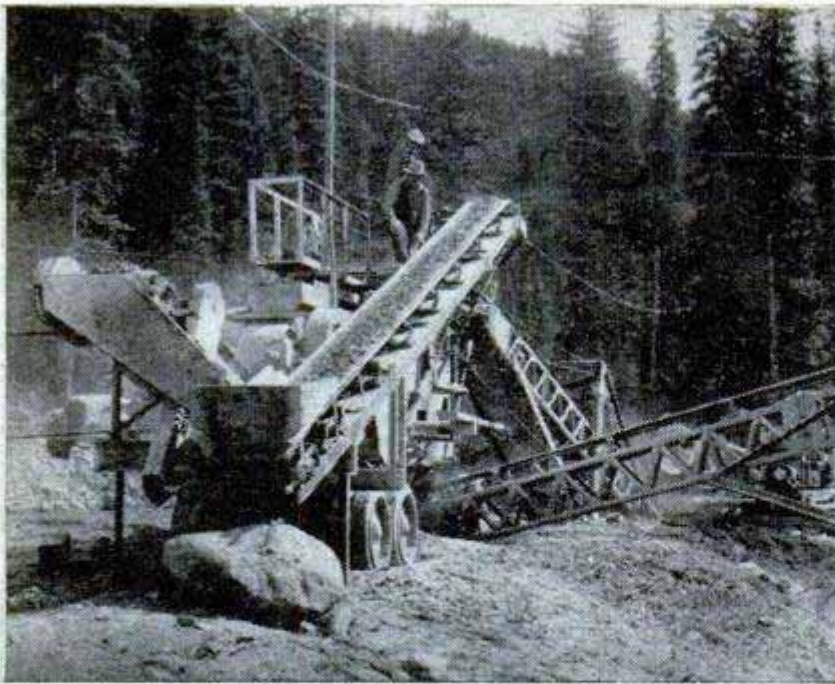
In the old days of lumbering, logs were hauled out of the woods by puffing logging railroad engines, or floated down roaring rivers. Modern methods, however, demand gravel or asphalt-surfaced roads for the huge log-carrying Diesel trucks. Access roads are a key to lumber production.

The new program of access-road construction in national forests began during World War II, when 148 mineral-access roads and 85 timber-access roads were built. Today, under an \$18,000,000 program, the Forest Service is supervising construction of additional access roads to help meet postwar lumber needs. Mileage of access roads now being built in 31 states ranges from one mile in Illinois to 190 miles in

At the head of a new access road, a trailer—modern counterpart of the old logging railroad—takes on its load of timber. Below, a midget trail truck of the U. S. Forest Service carries a party of rangers on a narrow trail not yet ready for the big trucks

U. S. Forest Service photos





Portable stone-crushing plant provides material for all-weather road

Maps indicate stands of virgin timber that have never heard the ring of a woodsman's ax. The road-building program is finally correlated in the U. S. Forest Service headquarters in Washington, D. C. Roads are carefully plotted to link up with other roads in the area, not run blindly into the woods and stop.

After the planning stage comes construction. Survey crews mark out the new road locations. They are followed by construction crews with bulldozers, jackhammers, dynamite and large power saws to clear away brush, rocks, stumps and trees. Finally, power graders smooth out the roads before crushed rock or asphalt is applied.

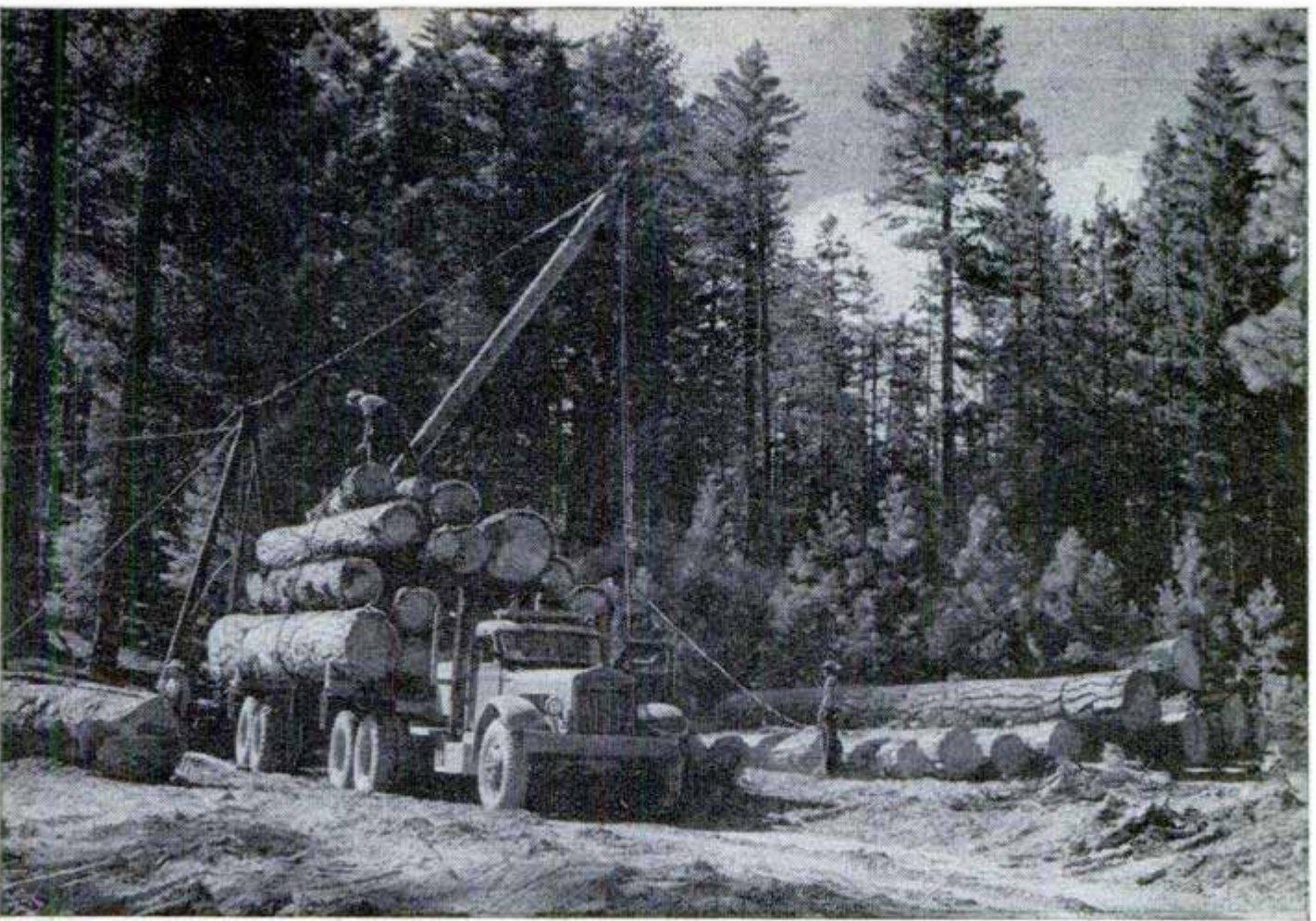
On the fringes of some forest areas opened up by access roads, portable saw-mills may be set up. In other areas where

California, 240 miles in Idaho and 257 miles in Montana. These new roads are expected to carry more than a billion board-feet of logs every year.

Planning begins with on-the-ground surveys of resources and topography.

Ranger leads a mule train packing fire-fighting equipment into a timber fire area in a Montana national forest





Mobile derricks—called "jammers" in the lumberjack's language—load freshly cut logs aboard the trucks

giant Douglas firs and Ponderosa pines grow 8 and 10 feet thick, logs are felled with gasoline-powered chain saws and trucked to larger sawmills. Normally, loads weighing 18 tons are hauled, but sometimes three monster logs weighing 70,000 pounds make a load for a big truck-trailer unit.

America's national forests include 73,000,000 acres capable of growing commercial timber crops. This publicly owned forest land has one third of the national saw-timber stand. In recent years these lands have supplied about 10 percent of the nation's yearly timber cut. With careful management, the national forests can help cushion the shock of private timber exhaustion. The first requisite for this increased cutting is the new roads, which will provide a means of reaching inaccessible virgin timber in national forests.

The long period needed to grow trees discourages many private lumbermen.

Midget truck crawls to head of new trail to service the trail tractor

Public forests, administered under long-term programs, can assume a substantial part of the country's future production of high-quality material.

"Why," it is sometimes asked, "is the U. S. Forest Service building roads into national forests? Won't that mean cutting down trees at a time when a serious timber shortage threatens?"

It is true that in 1909 the Bureau of
(Continued to page 256)



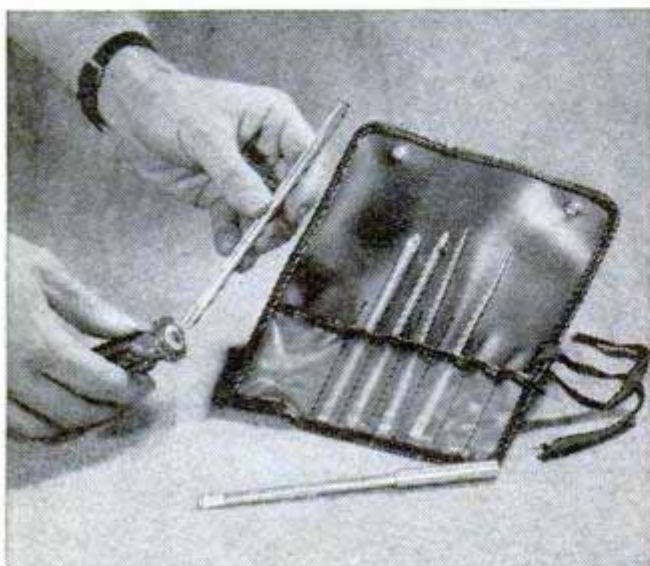
Iron-Rich Powder in Flame Enables Torch to Cut Stainless Steel



Left, hand-operated powder torch cuts stainless steel in foundry. The hilt on torch protects worker against intense heat. Right, machine cutting torch with the powder dispenser (foreground) connected to it by hoses

Stainless steel, which has defied ordinary oxyacetylene torches, now is being cut by introducing an iron-rich powder into the flame. In the new process an additional head is attached to the standard torch. A nearby hopper is connected with the head by an extra hose. When the hopper is vibrated electrically and the powder forced into the flame by a jet of air, the additional

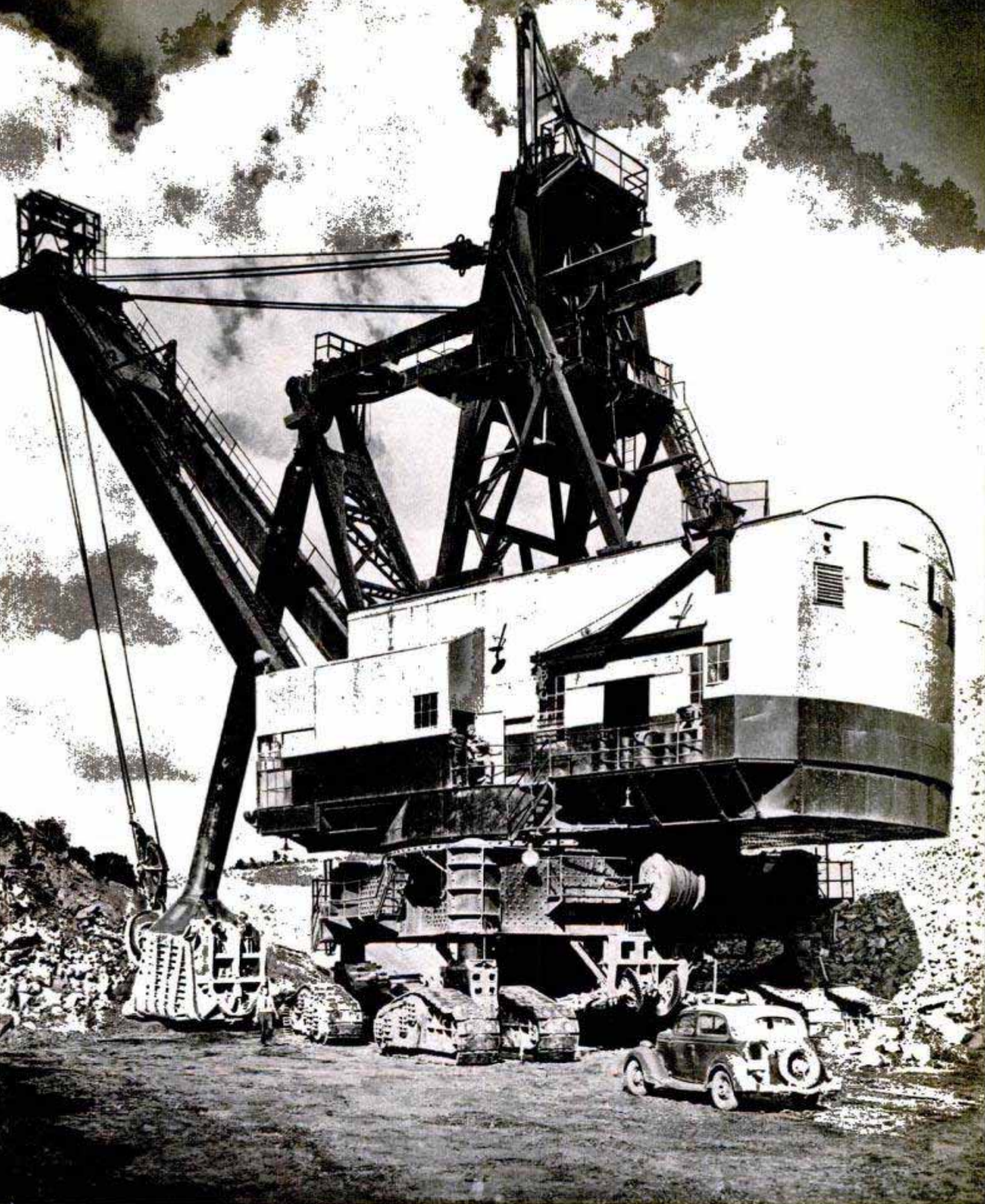
heat created by the powder, plus the fluxing and oxidizing action, keep the stainless steel in a molten state long enough to be blown out. Generally, a clean-up treatment such as chipping or grinding is necessary if the steel is to be welded. The same process is used for cleaning the sides of stainless-steel billets and for cutting steel alloys and some of the nonferrous metals.



Screwdriver Kit Has Six Tools

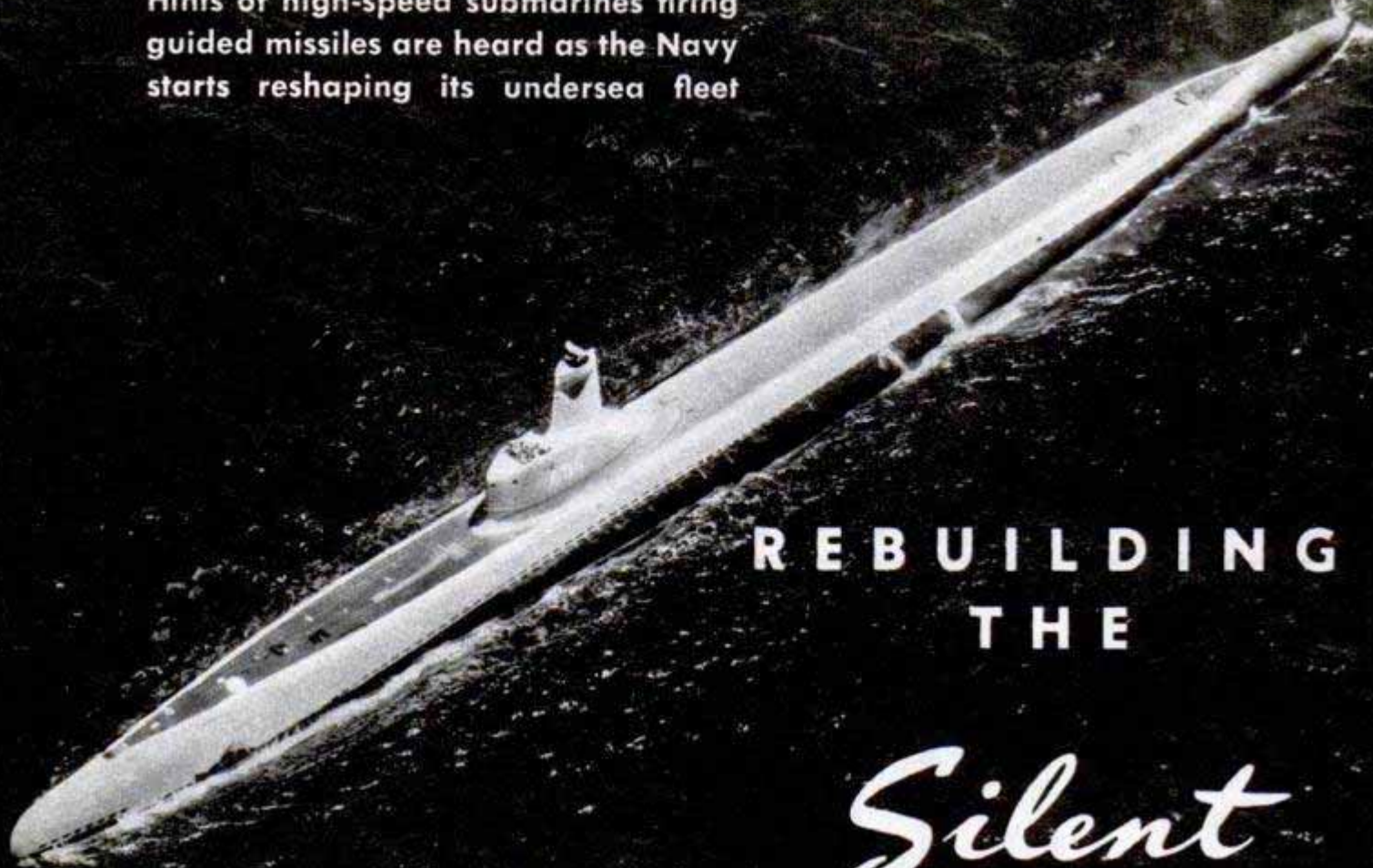
Containing the right screwdriver for almost any job, a pocket-size kit eliminates looking through the toolbox for the blade you want. The interchangeable handle is shockproof and fluted for a firm grip. Five different blades, three of them standard screwdrivers and two for use on Phillips screws, lock in the handle by strong spring action. A six-inch extension is also available for reaching hard-to-get-at places. The kit includes a seven-section leatherette tool roll fitted with tie strings.

☛Fastest bird known is the swift, some species of which fly at an estimated 200 miles an hour.



BIG BITE Enough earth to fill a room 9 by 10 by 12 feet in size can be scooped up in one bite by a giant power shovel and dipper designed for strip coal mining. The shovel can swing 40 cubic yards of earth two thirds of a city block and deposit it at a height equal to the top of a seven-story building. The boom of the shovel is 120 feet long and the total weight of the machine is 1675 tons. Operated by electricity, the shovel consumes as much power as a community of 3000 persons would use. It moves on four pairs of crawler-type tracks.

Hints of high-speed submarines firing guided missiles are heard as the Navy starts reshaping its undersea fleet



REBUILDING THE

Silent Service

Streamlined like an airplane, the rebuilt sub above may break a few underwater speed records. Cutaway of sonar unit shows the pickup tubes for detecting location and direction of travel of ships or submarines

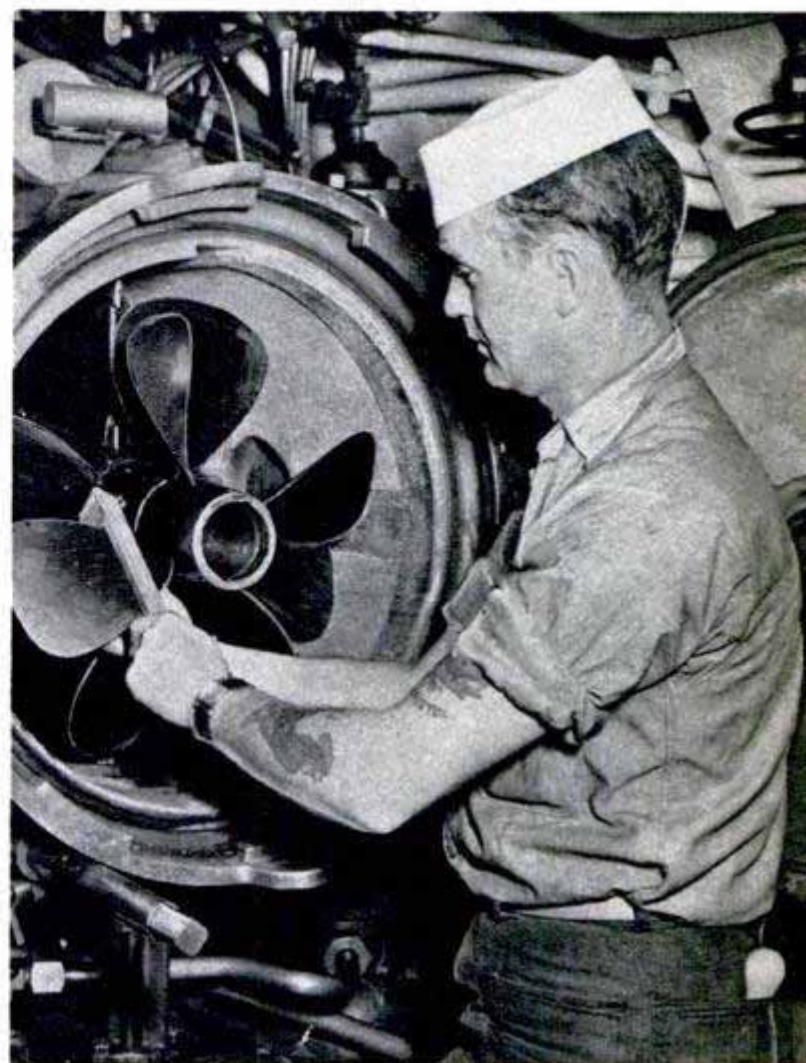
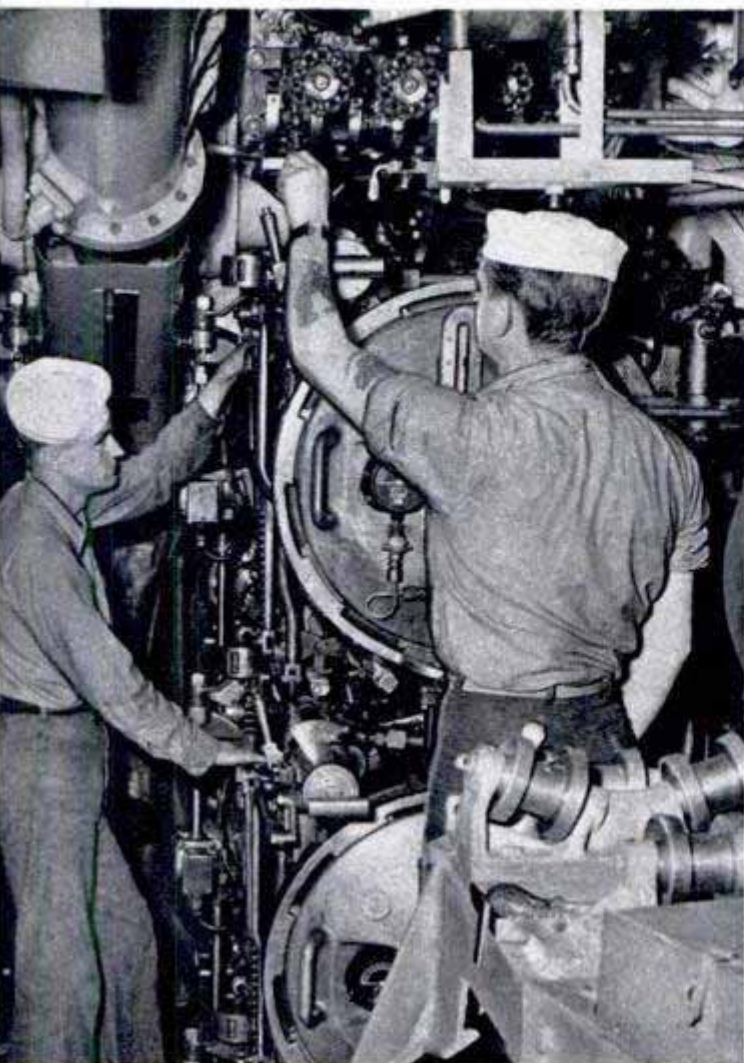


THE SUBMARINE is making its bid as the major arm of the Navy in warfare of the future.

From the California coast come reports of a new experimental undersea ship firing guided missiles, and of other high-speed submarines playing hide-and-seek with new destroyers in mock battle.

In peace as in war the submarines are the silent service, and their evolution goes on behind closed doors of Navy research offices. But at home and abroad navies are studying the enemy developments of World War II—German “breathing” U-boats that could cruise at length on Diesel engines while submerged, huge Jap subs that launched aircraft from their decks—these advances are being weighed along with our own secret improvements.

The United States kept its cake and ate it too in the last war, so far as submarine warfare was concerned. Our submarines sank hundreds of enemy ships with few losses to themselves, while the American and Allied Navies were destroying a total of 911 enemy subs. We won on both sides of the ledger, and the United States Navy is doing all it possibly can to make that



Left, firing one of sub's ten torpedo tubes. Right, removing safety stop attached to the torpedo propeller

pleasant military situation a tradition.

One of the lessons learned during the war was that undersea boats are vastly more versatile than had been supposed. Instead of confining themselves to harrying enemy war vessels and merchant ships, our submarines also served as scouts, as transports, as mine layers in enemy waters, as lifeguards for rescuing downed aircraft crews, for reconnaissance photography and, to a limited extent, for actual shore bombardment.

Since then the importance of the submarine as a major weapon has continued to increase. In a sense, various types of small and medium-sized war vessels will be able to travel under the surface as well as on top of it.

The present American fleet submarines are in excess of 300 feet long, are powered with four big Diesels, and have a surface speed of about 20 knots. At 15 knots they can cruise for 15,000 miles without refueling, more than sufficient for the standard 60-day war patrol. Their maximum underwater speed is about 10 knots which can be maintained for an hour before the batteries are drained.

Armed with one or two 5-inch deck guns

plus anti-aircraft defense, the submarine's principal weapon has been its torpedoes. There are six torpedo tubes in the nose, four in the stern. Modern electric torpedoes leave no wake, can be set so as to turn to a desired course after leaving their tubes, and can be fitted with homing devices that steer them toward their targets.

The submarines use radar equipment on the surface and employ echo ranging and other sonar listening apparatus in both the sonic and supersonic frequencies while either afloat or submerged. These spotting and tracking devices are so accurate that submarines have been able to sink their targets by radar or sonar alone without having had a visual look at the target.

Highly efficient as they proved to be, our World War II submarines already are out of date. The Germans, for instance, made new and astonishing gains in submarine engineering and concepts of operations just as the war ended and this information is now the common property of all the great powers. At the same time our own countermeasures against submarines advanced to such a point that submarines of World War II characteristics are now extremely vulnerable.



Bowplane (left) is carefully checked before start of the cruise. Right, closing exhaust valves of engines

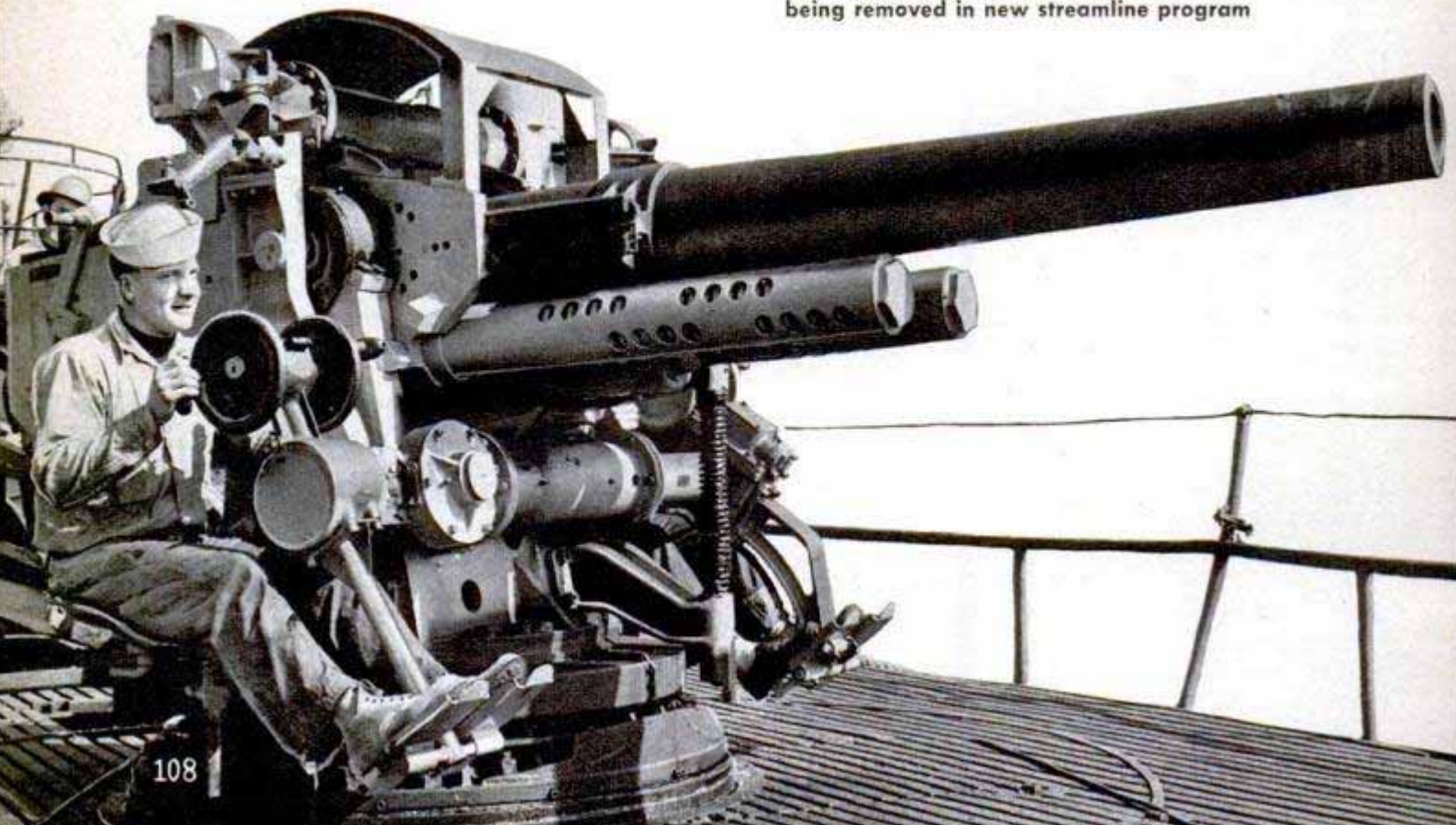
Today, the Navy's submarine experts are engaged in a hurry-up research program of testing ex-enemy developments as well as numerous ideas of our own. New submarines for which construction has been authorized will be designed to take advantage of the best of the new ideas. Existing submarines probably will be rebuilt along the same lines.

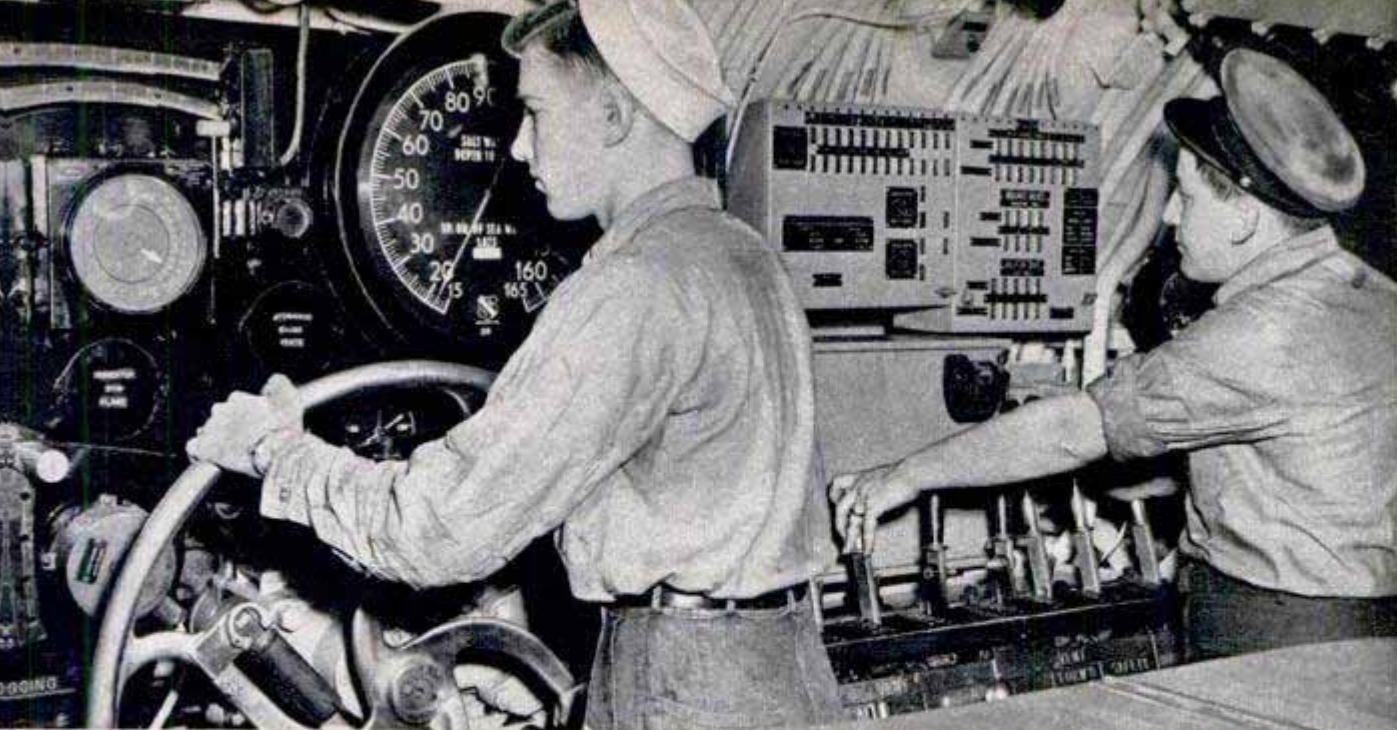
At the same time, other groups of naval experts have been given the job of working out improved antisubmarine measures so that new types of submarines can be combatted. Two hunter-killer destroyers identified by the symbol DDK are being

used as test ships. Another countermeasure is the use of sono-buoys that were developed during the war. These are automatic detector buoys that can be moored offshore or set adrift at sea. The buoys are equipped with sonar listening apparatus and a radio transmitter. Whenever the submerged sonar equipment picks up the sounds of a submarine in its vicinity these sounds automatically are broadcast from the buoy's radio, alerting radio stations either on shipboard or ashore. The position of a drifting buoy then can be fixed by using a radio compass loop.

Virtually all of the current research,

Deck guns used against small craft are being removed in new streamline program





At main diving station seaman at left mans bowplane wheel and officer operates valves to flood sub tanks

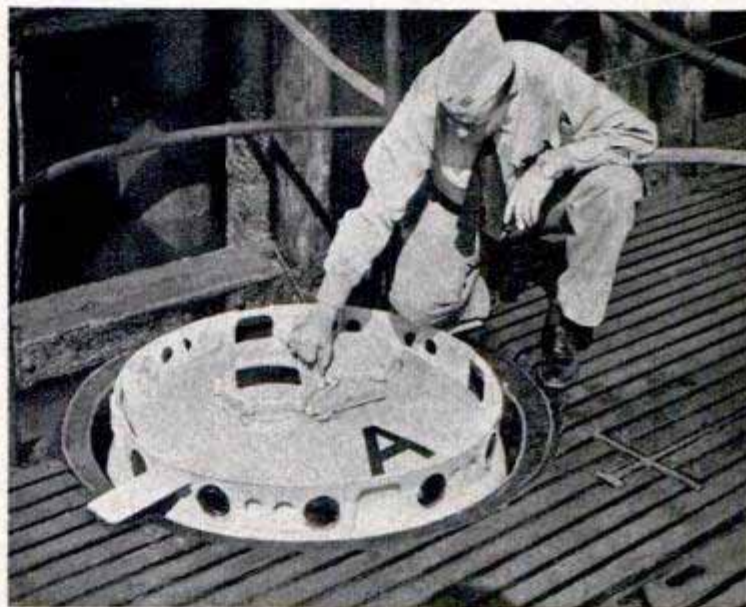
both in improving submarines and improving the countermeasures, is in the secret category. About all that the silent service will talk about is the wartime developments of the Germans and Japanese. Some of these are quite important.

The best known is the Schnorkel breathing tube, invented by the Dutch and adopted by the Germans, that allows a submarine to use its Diesels underwater. The tube is a 15-inch pipe that can be raised to the surface and opened while the submarine is at a shallow depth. The pipe draws in air for the crew and the engines and also serves as an outlet for the engine exhaust. Submerged speeds of 16 knots or better are possible with the apparatus. Submarines equipped with it have remained submerged from 40 to 70 days and have cruised for thousands of miles without resurfacing.

The top of the tube is too small for detection by radar equipment and yet it is possible to mount on it a radar scanner or a radar of the IFF type to augment the periscopes.

Parallel with working out improvements on the Schnorkel is another program intended to increase a submarine's underwater speed by improving its streamlining. The submarines Pomodon, Odax, Amberjack and Corporal, rebuilt for these tests, are now making sea cruises in which their speeds, fuel-oil consumption and other characteristics are being compared with

(Continued to page 242)

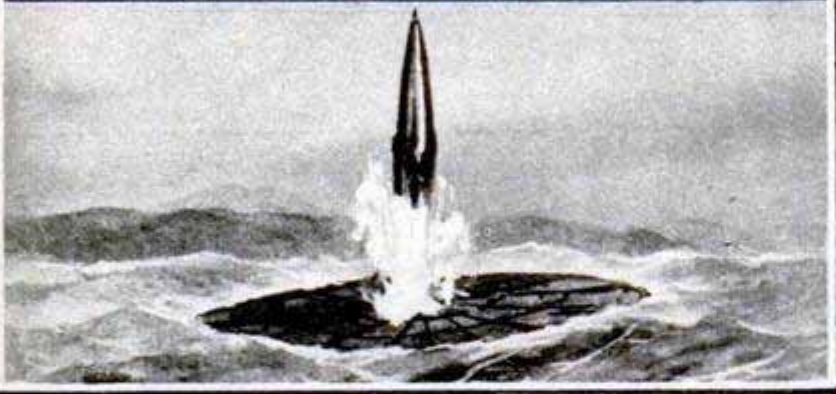


Rescue buoy (A) rises to surface if sub is sunk. It contains telephone connected to the submarine in trouble. Buoy has colored reflectors. Below, sono-buoy guarding harbor uses underwater sonar to pick up the sound of approaching sub



PREVIEW OF U-BOAT WAR?

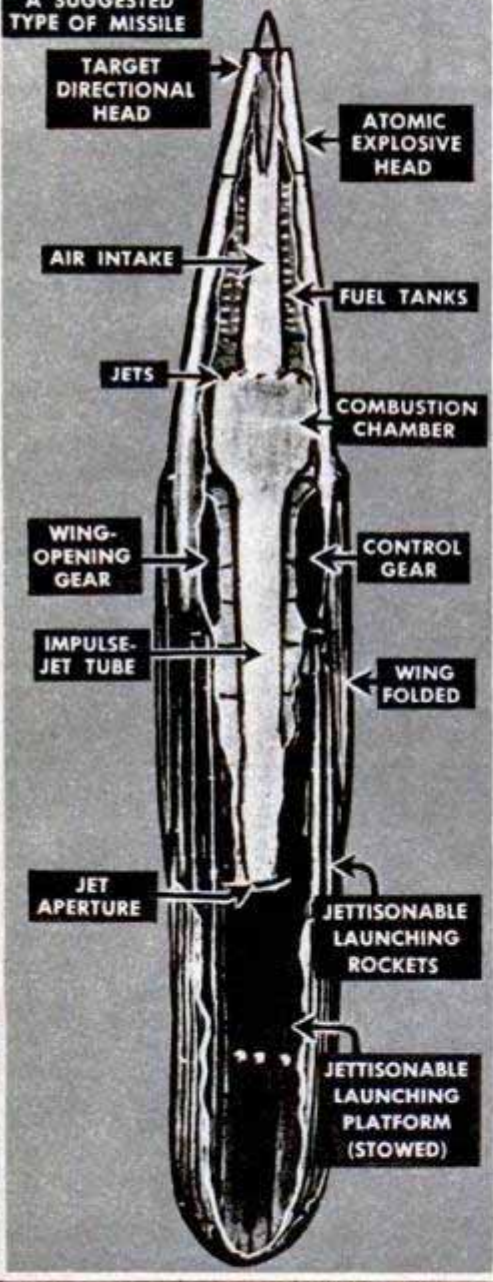
THE LAUNCHING PLATFORM OPENS AT ONCE WHEN MISSILE REACHES THE SURFACE. THE MISSILE LAUNCHES ITSELF INTO THE AIR IN THE SAME SPLIT SECOND AND THE PLATFORM IS LEFT AFLOAT BUT SINKS LATER.



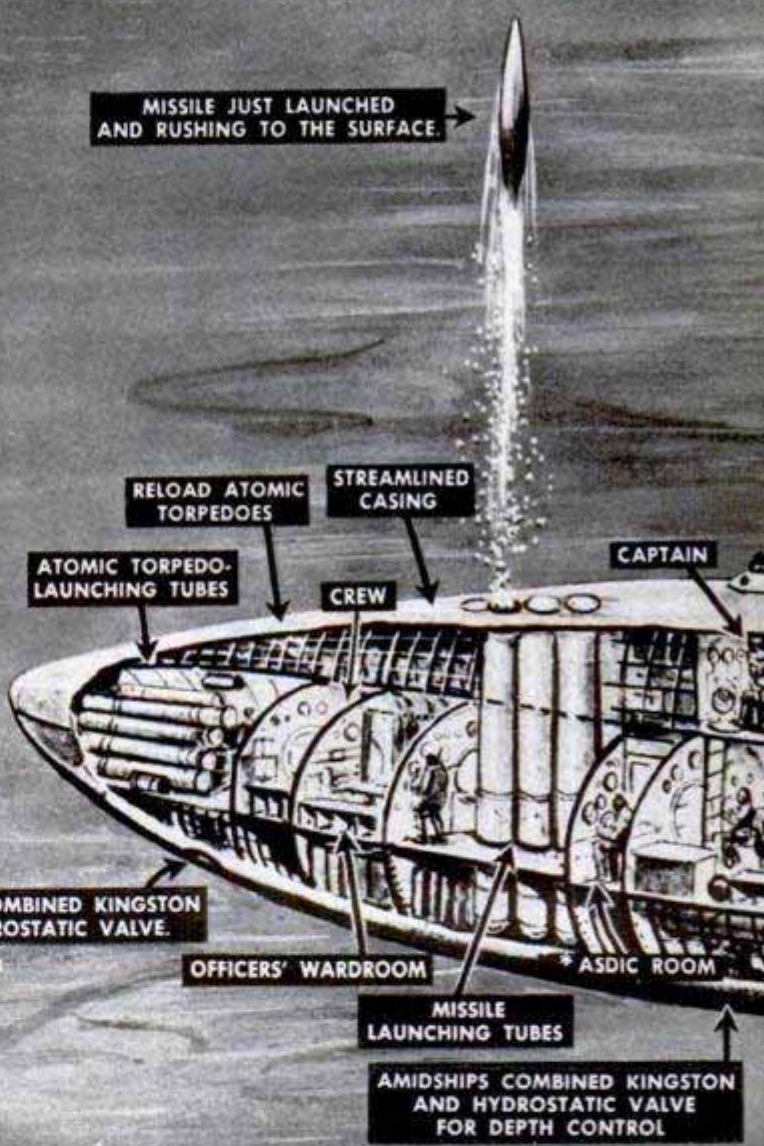
THE MISSILE, PROPELLED BY RAM-JET, COURSES TO ITS TARGET



A SUGGESTED TYPE OF MISSILE



MISSILE JUST LAUNCHED AND RUSHING TO THE SURFACE.



From England come these proposals for waging war from the deep. Submarines powered by jet engines would be equipped with tubes to launch missiles containing atomic war heads. The missile would be expelled from the tube to the surface of the water, where it instantly would release a launching platform from a compartment in the tail. The missile would rise automatically from the platform, which would be left afloat but eventually

ATOMIC MISSILES FOR SUBS

THE ROCKET-PROPELLED MISSILE CLIMBING TO OPERATIONAL HEIGHT

LAUNCHING ROCKETS JETTISONED WHEN SUFFICIENT SPEED IS ATTAINED TO OPERATE THE RAM-JET.

THE SIMPLICITY OF THE RAM-JET (OR ATHODYD) PLUS ITS BUILDUP OF POWER AS ITS SPEED INCREASES, MAKES IT AN EXCELLENT PRIMEMOVER.

RADAR FLOAT

SURFACE

THE MISSILES MAY BE OF TWO TYPES.

NO. 1. ROCKET TYPE CLIMBS TO GREAT HEIGHT, DESCRIBING AN ARC IN ITS FLIGHT TO ITS TARGET.

NO. 2. WINGED MISSILE CLIMBS TO 15,000 FT., AND PROCEEDS ON A MORE OR LESS LEVEL COURSE TO ITS DESTINATION

FOR PROTECTION, THE SUBMARINE WOULD RELY ON ITS SPEED; THE GREAT DEPTH AT WHICH IT OPERATES; AND ITS ABILITY TO REMAIN SUBMERGED FOR LONG PERIODS.

SURFACE

SUBMARINE CRUISING AT A DEPTH WHERE UNDER-WATER DISTURBANCE AND GRAVITATIONAL CHANGE POSSIBLY REDUCES THE EFFECTIVENESS OF ENEMY ASDICS*

FOR ATTACK THE SUBMARINE WOULD HAVE ITS ATOMIC TORPEDOES

(1) ATOMIC AND (2) STANDARD TYPE TORPEDOES COMPARED.

NO. 1

NO. 2

* UNDER-WATER SOUND DETECTION DEVICES

CONTROL CHAMBER

MISSILE RELOADS

ENGINE-ROOM

AFT ATOMIC-TORPEDO LAUNCHING TUBES

CREW

AFT COMBINED KINGSTON AND HYDROSTATIC VALVE

PROPULSION AND MANEUVERING JETS

would sink. When the missile is well on its course toward the target, the launching rockets would be jettisoned and wings would unfold from the side. A ram-jet engine then would propel it to the target. Subs also would be equipped with atomic torpedoes, which could be smaller in size than conventional torpedoes. Subs could cruise at high speeds and at depths where effectiveness of the enemy's sound detection would be reduced



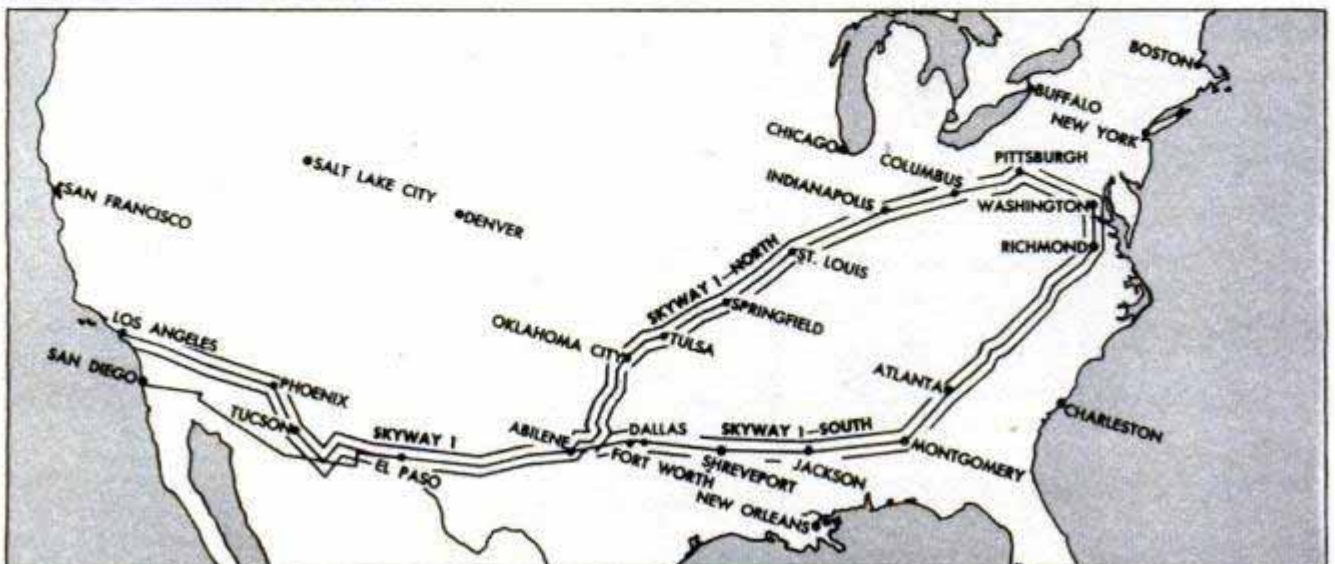
Push-a-Button Subway Map Finds Shortest Routes

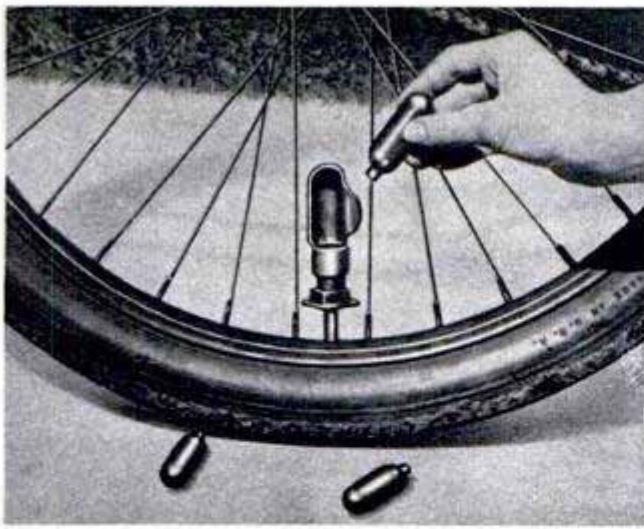
Londoners traveling the subway can press a button to find the shortest route to any station on the line. When the destination button is pushed a map lights up to show the proper route with transfer stations. Secret of the map is the neon lamps which won't glow until a certain voltage is reached. In a case where it's possible to reach a given point by two different paths, the shorter path has fewer neon lamps. Thus the voltage builds up until the shorter route glows. The route-finder, built by the Sperry Gyroscope Co., Ltd., also may be used to show passengers on ocean liners the routes between decks.

Aerial "Road Signs" Mark Path Across U.S.

Aerial "road signs" are up along the 3000-mile-long Skyway Number One for private flyers, stretching from Los Angeles to Washington, D. C. A thousand painted markers on rooftops, roads and prominent landmarks name the cities en route, with their exact latitude and longitude separated by an arrow indicating true north, and a symbol showing direction and distance to the nearest good airport. About 4000 more are needed to mark every community in a 40-mile-wide band along the route. Eastward from Abilene, Tex., the skyway takes paths north and south to Washington.

Civil Aeronautics Administration photos



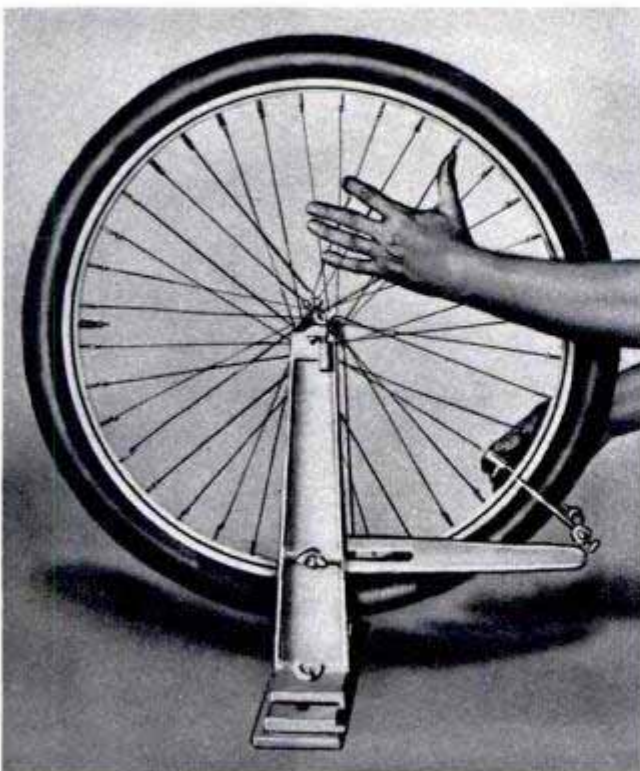


Tire "Pump" Uses Gas Cartridges

Flat bicycle tires are inflated in seconds without a pump by means of a kit that uses compressed-gas cartridges. For light-weight tires one cartridge is enough. Two cartridges inflate a completely flat balloon tire. To use the kit, you screw an adapter on the valve stem. A cartridge is placed in the holder and screwed down on the adapter, puncturing the cartridge and sending compressed gas into the tire. The kit can be carried in a tool bag or pocket.

Bicycle-Wheel Truing Stand

Adjustable for both axle width and wheel diameter, a bicycle-wheel truing stand accommodates any wheel from 6 to 30 inches in diameter. Two truing arms, mounted on an adjustable bar, detect any out-of-true portions of the wheel as it is turned. The stand is cast-aluminum.

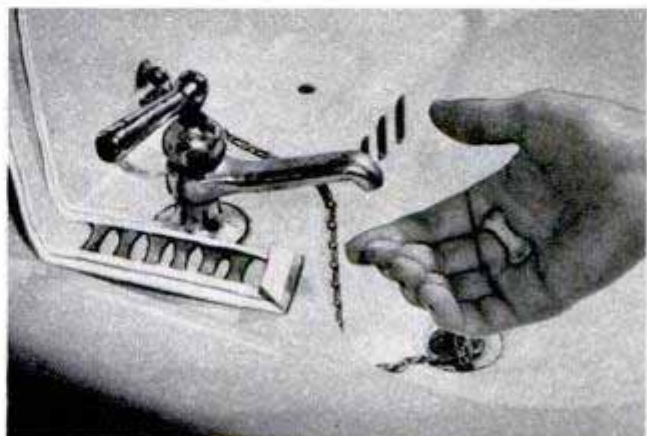


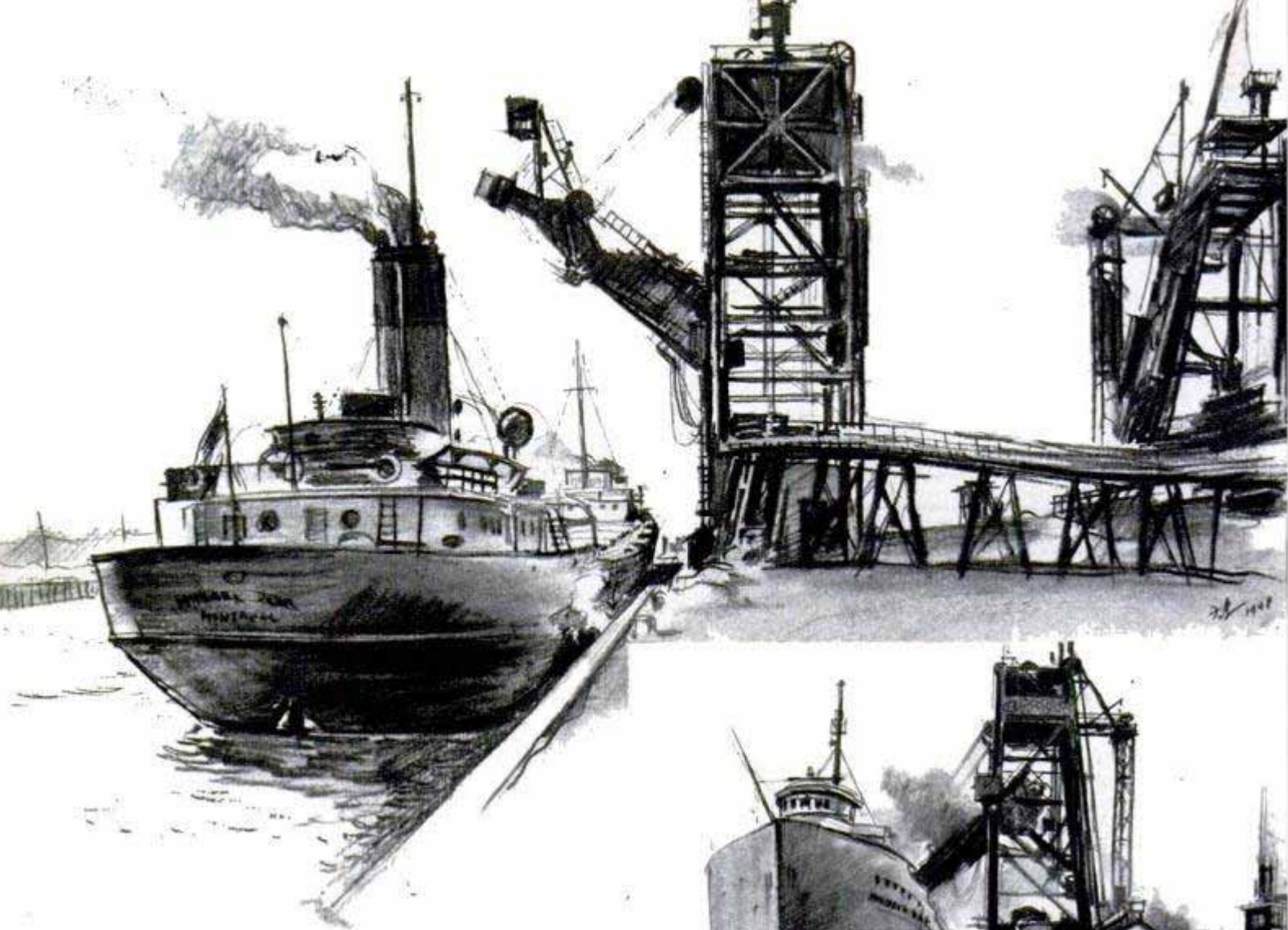
Wickets Form Movable Fence

Individual wickets installed side by side in the ground form a wire fence to protect lawns and flower beds. The wickets may be used as temporary fencing and moved about, or may be wired together to form a permanent fence. Each wicket is embedded in the ground by pushing or hammering on a shoulder that is offset in the wire. Made of steel, the wickets are 12 inches wide and 20½ inches high.

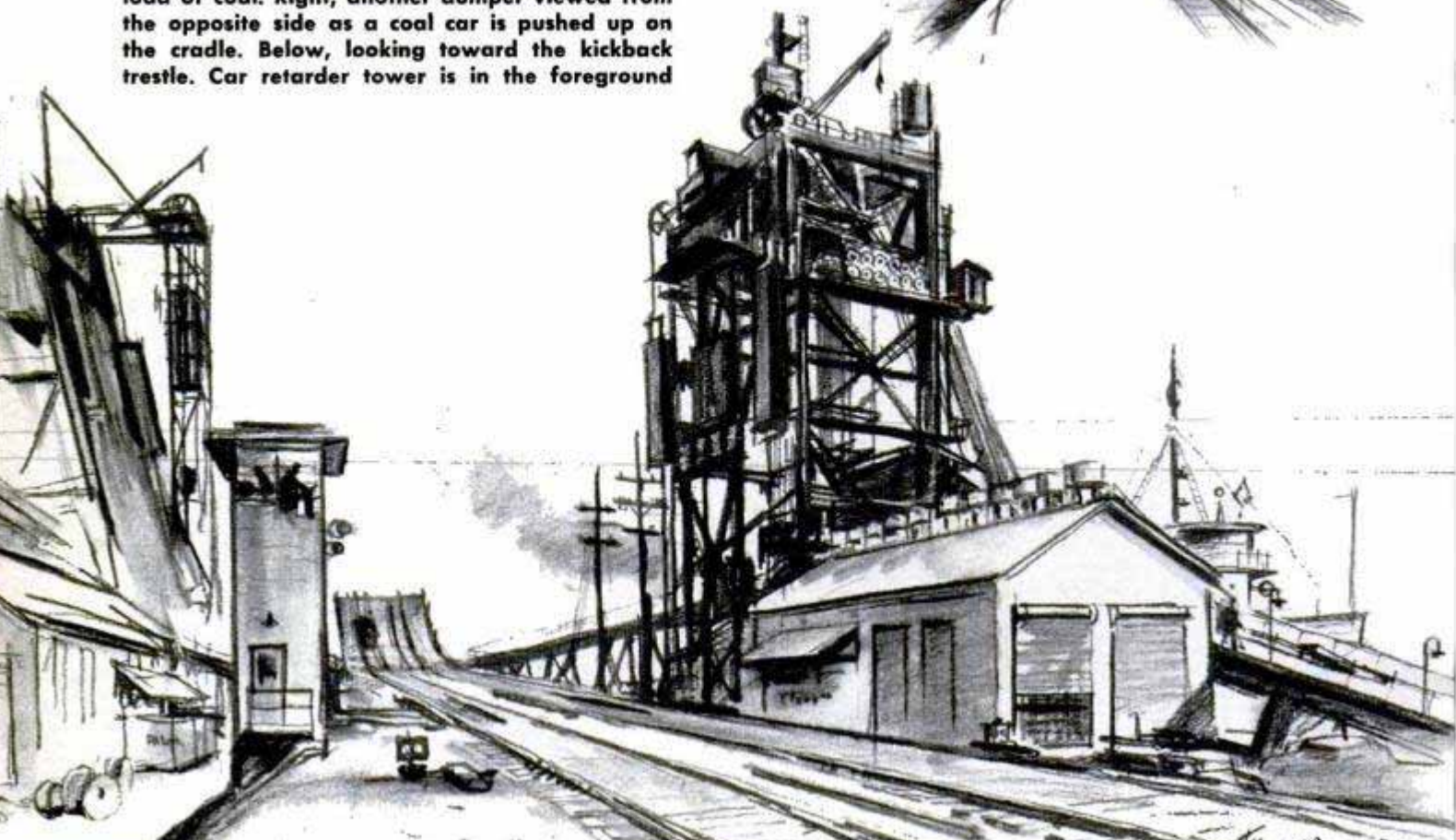
Soap-Filled Wicks Carried in Pocket

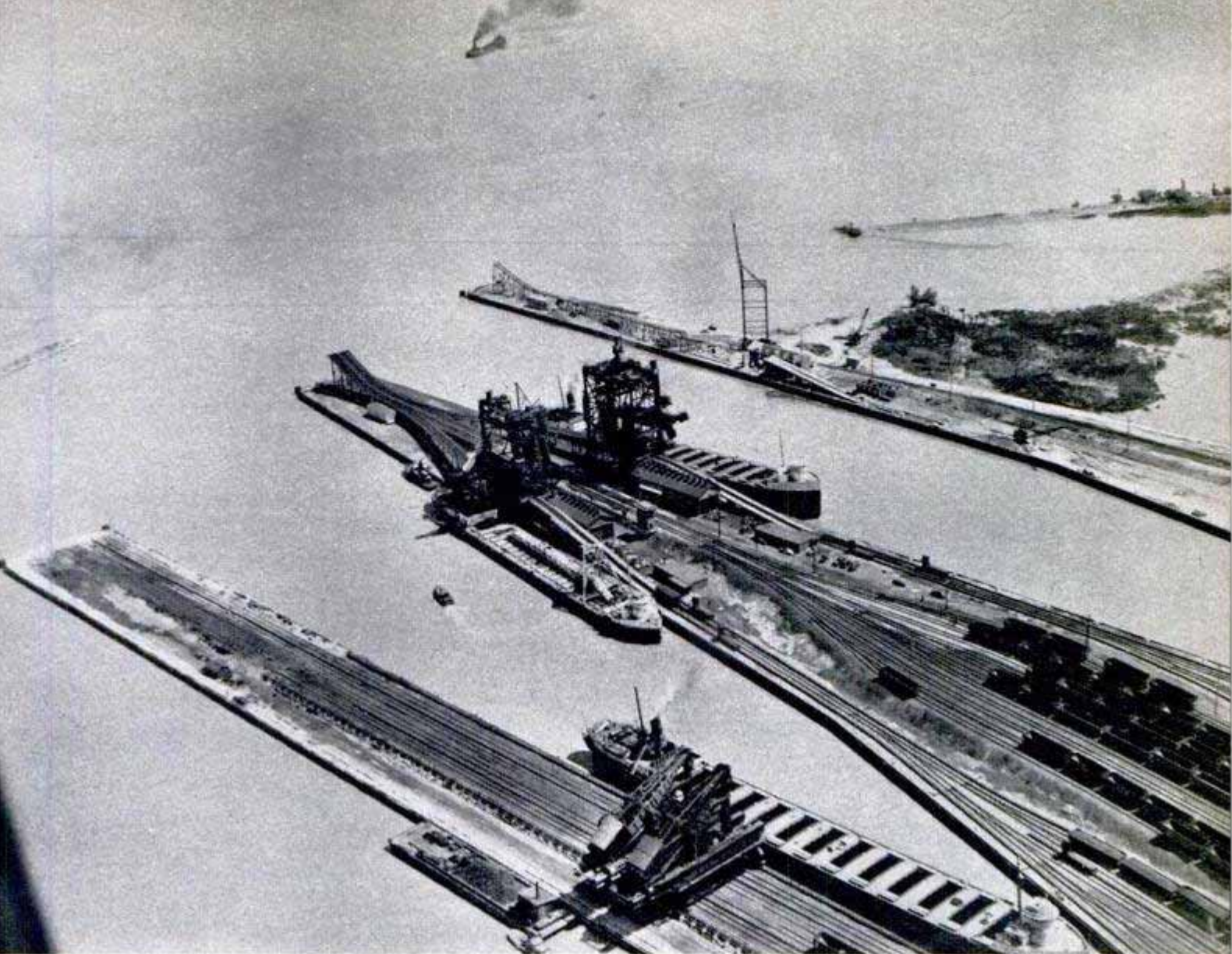
You'll always have soap handy if you carry a packet of wicks each containing enough soap for a thorough washing of the hands. The soap is covered by a fine cloth mesh. To wash your hands, you merely place one of the wicks in your palm, run some water over it and lather. The wicks are packaged in a narrow envelope for convenience in carrying.





These sketches of the coal-handling facilities at the Toledo dock were drawn by Frank Beatty, Art Director of Popular Mechanics. Above, view from the end of the pier showing a coal dumper with its chute raised as a boat moves in for a load of coal. Right, another dumper viewed from the opposite side as a coal car is pushed up on the cradle. Below, looking toward the kickback trestle. Car retarder tower is in the foreground





Air view shows ore unloaders in foreground, two coal dumpers in center. Third is going up beyond them

IRON STEVEDORES OF THE COAL DOCKS

By Arthur R. Railton

WITH ELECTRICAL MUSCLES that juggle a 100-ton carload of coal as though it were a basket of feathers, the iron stevedores along the Toledo lake front make the task of filling the cavernous holds of a coal boat look as effortless as throwing a light switch.

These untiring stevedores work at a new coal and ore-handling dock built for the New York Central and Baltimore and Ohio Railroads on the shore of Lake Erie. The dock, which began operation this spring, has a capacity of 20 million tons of coal and 4½ million tons of iron ore a year—and whether you think of those figures as shovelfuls or boatloads, they represent a heap of work!

The mechanical loaders are the middlemen between rail and water transportation. They transfer the bulky cargo so fast and so cheaply that the Great Lakes have become one of the world's busiest waterways. Long trains of cars loaded with coal from the Central States pour into Toledo night and day. To keep up with this steady stream, the dumpers, working 24 hours a day, dump cars at a rate of one a minute.



An empty coal car rolls back down the kickback trestle on its way to the yard. Huletts are at far right

Rolling back to yard, car is slowed down by retarders that grip wheels when operator moves these controls

Juggling coal cars is only part of the work done by the mechanical stevedores. Many of the boats coming in for coal bring iron ore from the Minnesota ranges. Another section of the dock unloads these floating giants at a rate of 30 tons a minute. Each of the twin buckets of the Hulett ore unloaders digs into the heavy cargo and transfers it to railroad cars in 15-ton bites.

In a few hours the ship holds are emptied and the ore, now loaded in railroad cars, is on its way to the steel mills of the Middle West. Riding high in the water, the empty boats move over to the coal dock where, in a few more hours, coal from the mines of the Central States fills the holds. With hatches battened down, the boats steam away carrying their cargo to various Great Lakes ports.

To make this smooth-running cycle continuous everything is timed as precisely as an aerial trapeze act. Coal trains roll into the yard on a strict schedule. From there, the cars are moved up to the coal dumpers which pick them up in an elevator and flip them upside down, dumping

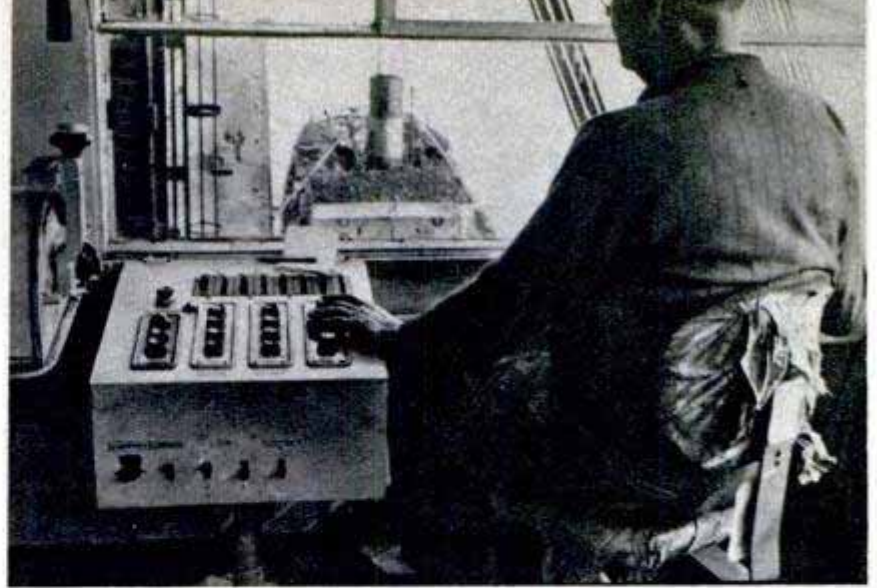


the load into the boat. Now empty, the cars roll back to the yard where they are made into trains for the return trip to the mines. Some empties are pushed over to the ore dock where they are loaded with ore by the Hulettts and hauled away to the steel mills.

It takes a lot of trackage to handle thousands of coal cars a day and there's plenty of it at the Toledo dock. It covers 212 acres and stretches back from the water more than four miles. Covering this tremendous acreage are 56 miles of tracks, enough to hold 5400 coal cars.

Dispatchers in the dumper control room signal yard crews when coal cars are needed. A small electric locomotive pushes the cars in groups of eight or ten up to the bottom of the dumper ramp. From here a tough little locomotive known as a barney takes over.

Cable operated, the barney runs on an unusual narrow-gauge system between the standard-gauge tracks. From its pit below and behind the coal car, the barney rises to the track, like an unstreamlined porpoise breaking water, and rolls forward until it is just behind the car. It automatically slows down, eases against

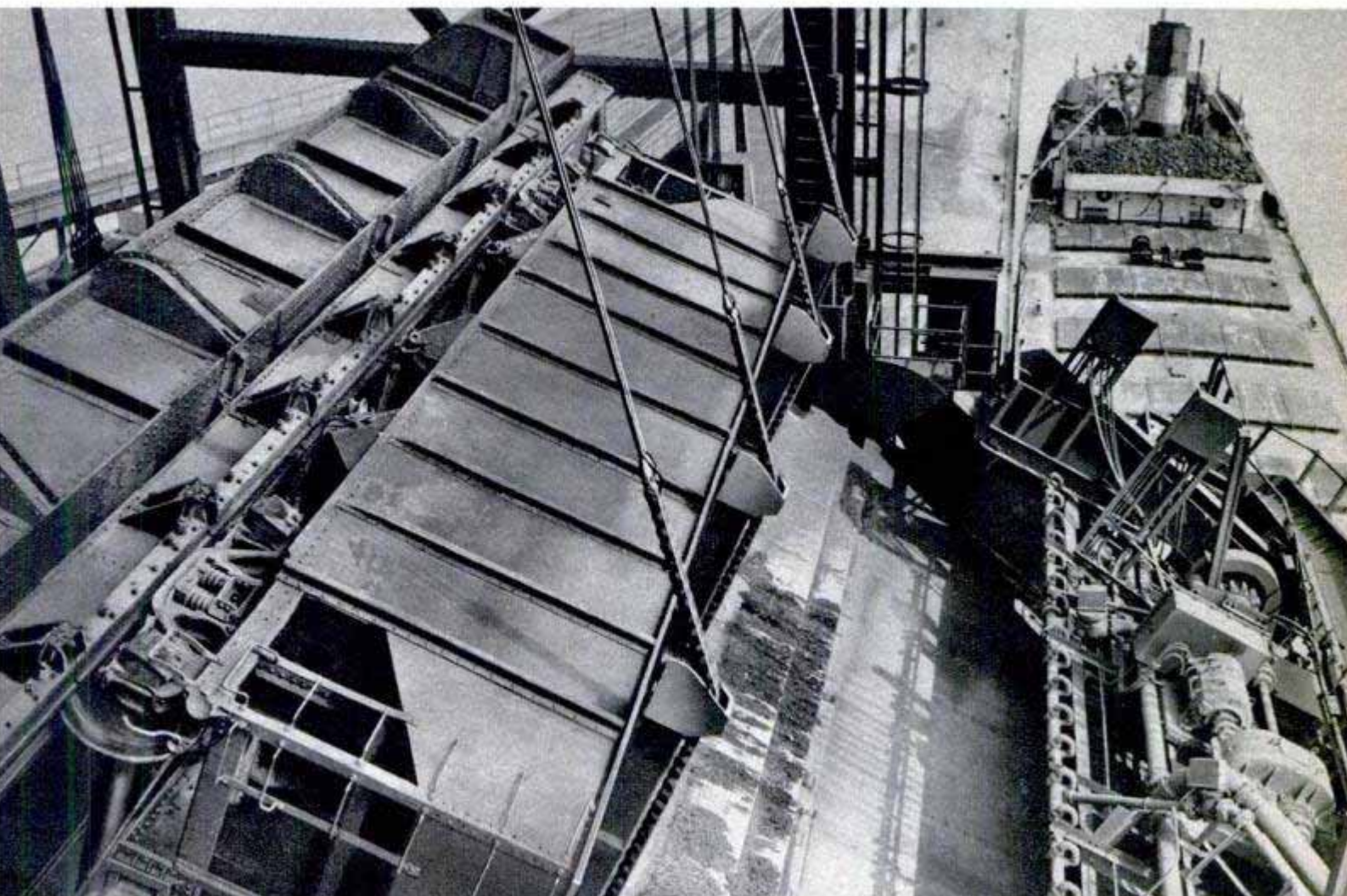


High above the ship, this operator controls the coal dumper

the coupler and pushes the load of coal up to the dumper cradle. As the barney, pushing its load of coal, arrives at the top of the ramp, its wheels are forced inward on their axles by the narrowing track. By the time the coal car is on the cradle the barney is riding an inner pair of tracks that leads back to the pit. Reversing its course, it rolls to its pit below the next car and the process starts again.

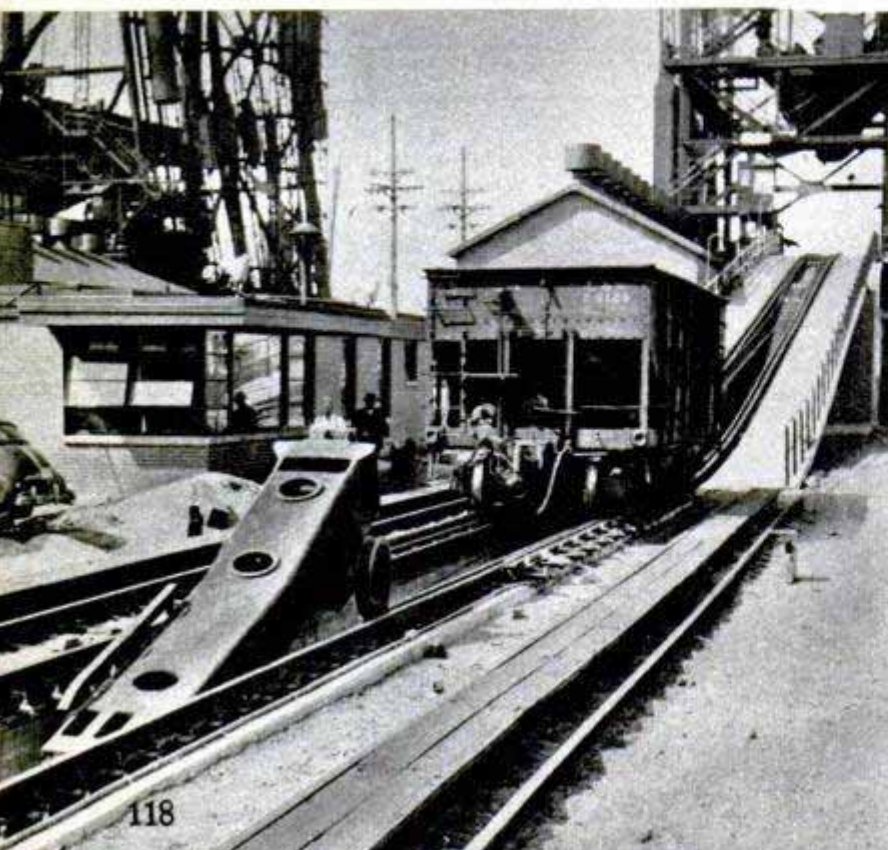
The coal car, loaded with as much as 70 tons of coal, is hoisted by the cradle until it is high above the ship tied up at the

Coal car is held firmly by clamps as it is tipped over, spilling its load of coal down the chute into ship





Carload of coal is pushed up the ramp to the dumper by pilotless barney locomotive. Below, the cable-operated barney comes up from its pit between rails to start car up the ramp



dock. Automatic clamps grab the sides of the car and it is flipped upside down, dumping the coal into a broad pan that looks like a flattened funnel.

After the dumping, the car is righted and lowered to track level. Another car, pushed up the ramp by the barney, hits the empty car knocking it off of the cradle and down a descending ramp on the opposite side of the dumper. This car then rolls up a kickback trestle from which it glides back and is automatically switched into the empty-car yard.

There are two dumpers in operation at the dock now and a third is being built. Each of these machines handles a carload a minute. That means three cars of coal can be dumped every minute, 24 hours a day.

As the empty car rolls back from the kickback trestle to the empty yard it passes a retarder system in the tracks. These retarders squeeze the wheels of the car, slowing it down. From a control tower, an operator regulates the amount of pressure exerted against the wheels to slow down the car so it won't jump the track when it hits the other empties. At the same time he must not slow it down so much that it will stop before it reaches the end of the yard. Every type of coal car—and there are many—has its own rolling characteristics and the retarder operator has to know them all.

A switchman, also in the control tower, opens and closes remote-controlled switches to sort the empty coal cars by railroads. By switching all cars bearing the name of one railroad on the same track, he speeds the job of making up trains for the trip back to the mines. He also inspects each car visually as it passes his station and when he spots a "cripple" he switches it to a sidetrack.

Adjacent to the coal dock, the ore-unloading pier juts out into the lake. On this pier, two Hulett unloaders transfer ore from the boat to railroad cars that roll under their bridgelike chassis.

These Hulett's consist of two jointed arms that dip their tremendous fists into the ship's hold, picking up 30 tons of ore a minute. At the end of each arm is a clamshell bucket controlled by an op-

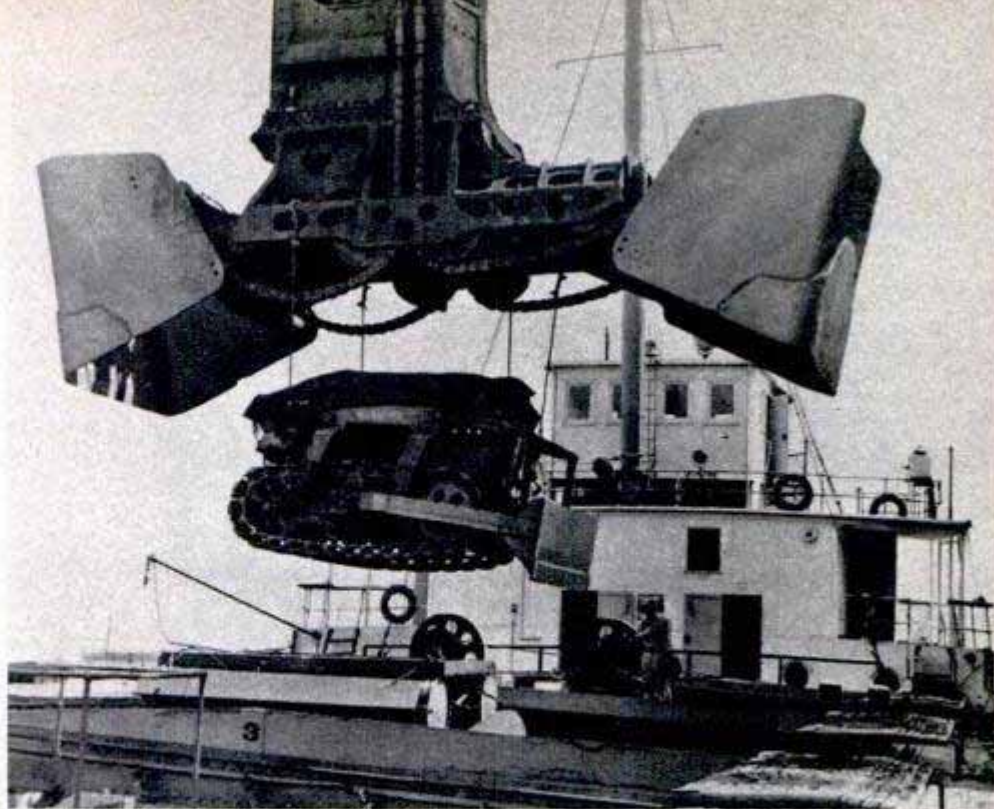
erator who rides in a cab directly above the scoop. Like a three-dimensional-elevator operator, he guides the giant arm back and forth, up and down, and from side to side.

These twin scoops pick up the ore from the hold, carry it back over the tracks and dump it into a hopper. It is weighed and then dropped into cars on the tracks below.

As the ore in the hold gets so low that the scoop can't pick up full bites, bulldozers are lowered into the boat. These powerful tractors shove the heavy ore into piles big enough for the scoops to get their teeth into. When the holds have been completely emptied, the boat is moved over to the coal dock to take on its load of coal.

A streamlined office building at the dock is the nerve center of the operation. Orders are transmitted by an intercommunication system to the machine operators and to the train yards. Ship-to-shore radio enables ship captains to get their docking instructions while approaching the port.

With the addition of these new facilities, Toledo, already the busiest bituminous-coal port in the world, is expected to forge



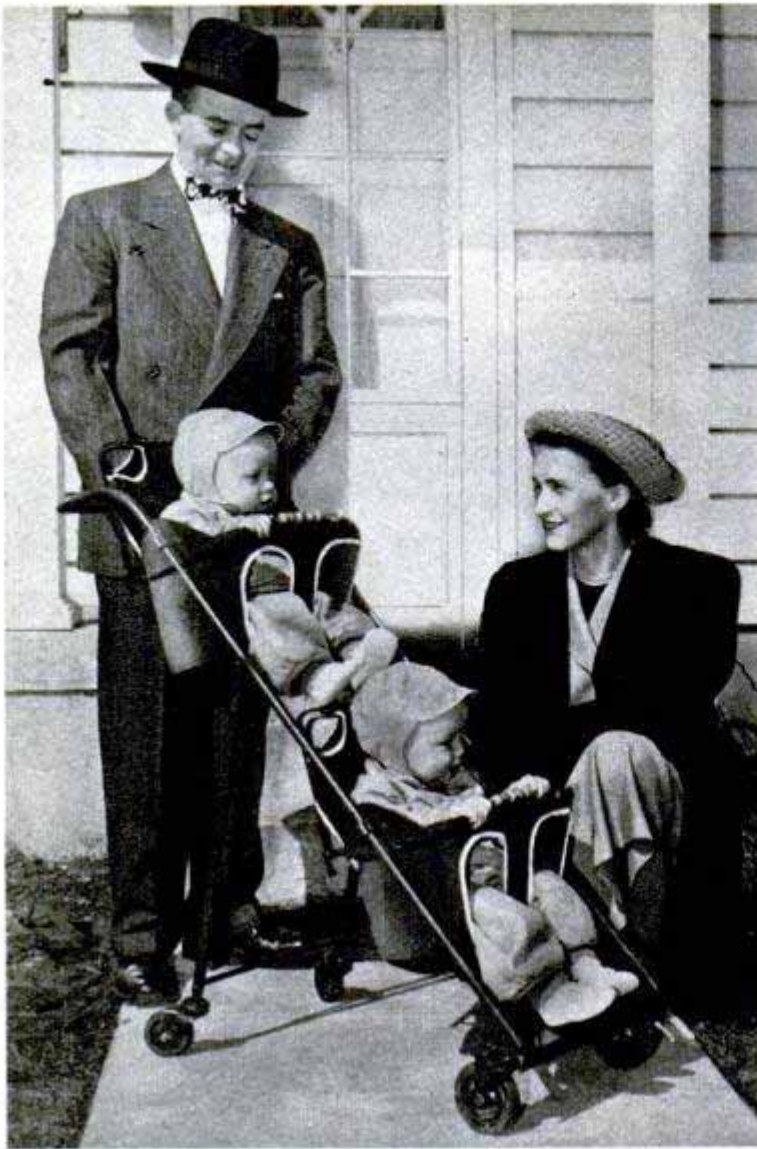
Scoop of the ore unloader lowers bulldozer into hold to scrape up ore

farther into the lead. During 1947, the Toledo area handled 23 million tons of coal and in 1948 the total should greatly exceed this figure.

But whether or not the 1948 total surpasses last year's mark, the new dock will dump a lot of coal and unload a lot of ore. It's a far cry from the old days, not too many years ago, when hundreds of coal shovelers swarmed aboard the lake boats to transfer cargo. Now the work is done by electricity and the machine operators just sit back and push buttons.

Unloading ore at a rate of 30 tons a minute, these two Hulett's can empty this huge lake boat in a few hours





Double-Decker Stroller

Realizing that travel abroad with twin year-old sons wouldn't be easy, Harris W. Jones of Springfield, Ill., built a double-decked stroller especially for the trip. Its rear wheels fold and the cart can be pushed like a wheelbarrow. Before sailing for Europe, Jones applied for a patent on the unique stroller.

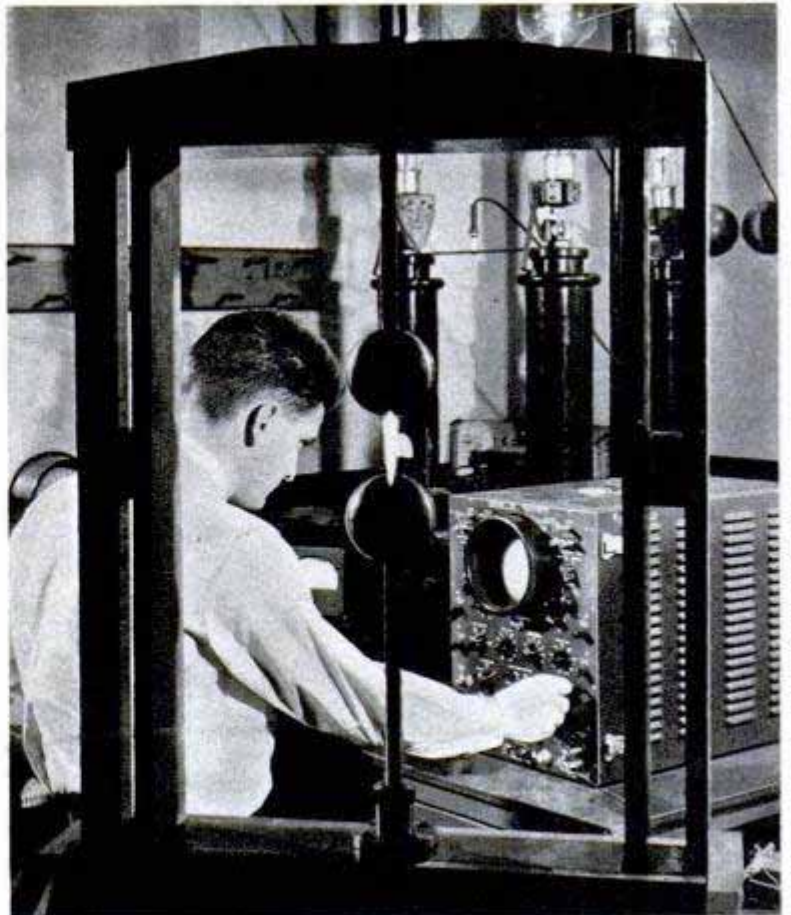
Good-by to Toothache?

Mass control of tooth decay could be possible within six years through a chemical dentifrice that would prevent the formation of corroding acids in the mouth, according to Dr. Leonard Fosdick of Northwestern University. Decay is caused by sugars and fermentable carbohydrates which are converted into acids. Research indicates that through use of certain enzyme inhibitors it may be possible to prepare a dentifrice that actually will prevent decay. If such a dentifrice were used in conjunction with the proper diet and oral hygiene, dentists could achieve mass control of tooth decay in a short time, according to Fosdick, who is one of the leaders in tooth-decay research.

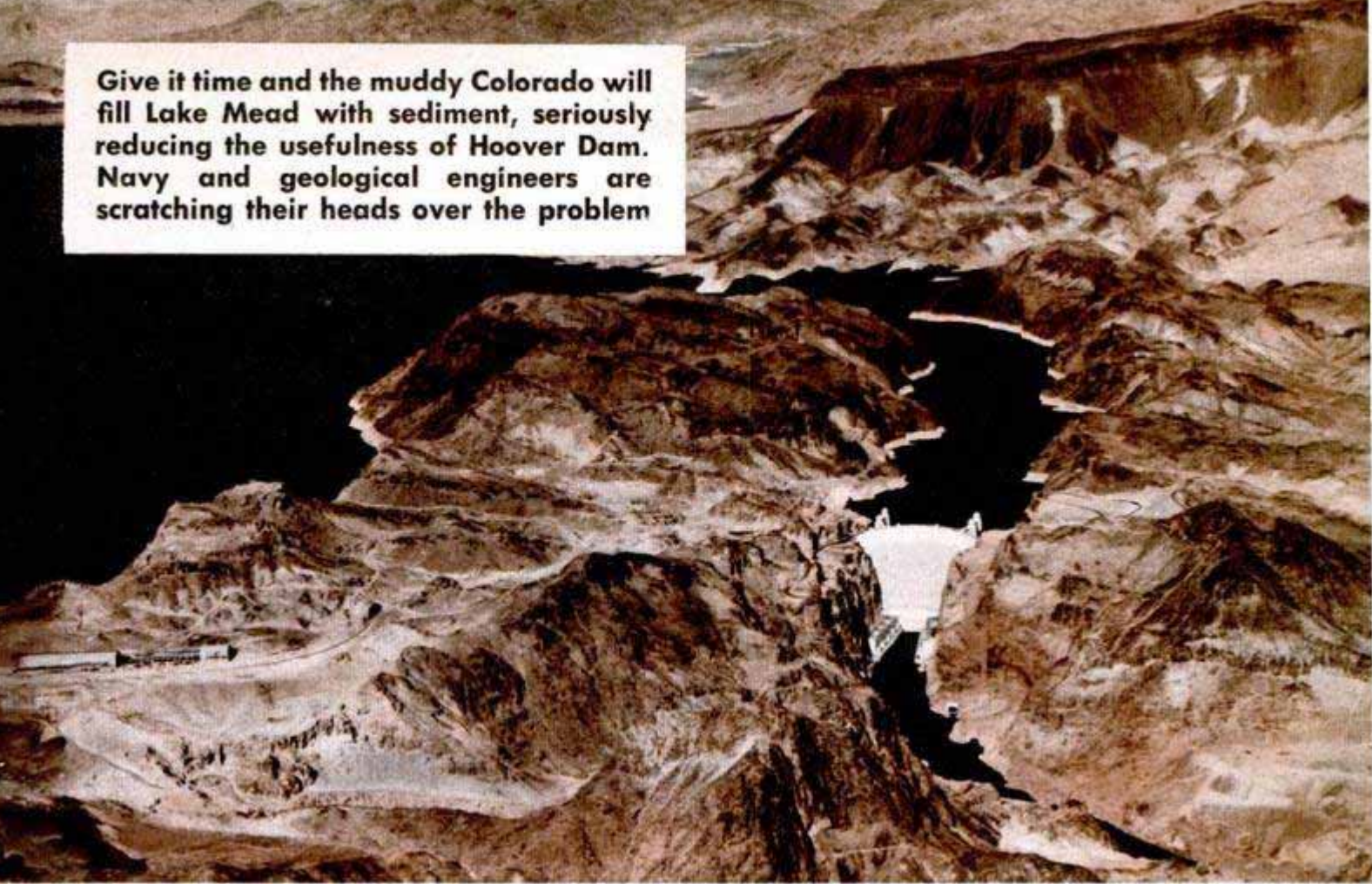
Electrical "Yardstick"

With an electrical "yardstick" scientists can measure the high voltages required in many laboratory experiments. Two spheres of the measuring device are held apart by an adjustable frame that permits the gap to be increased or decreased. Normally the air space would prevent electricity from passing in an arc from one sphere to the other. But when the voltage becomes too great the air barrier is broken down and the charge leaps across the gap. The distance between the spheres thus can be used as an accurate measure of the voltage. The instrument is used by Westinghouse scientists in developing improved electrical insulating materials.

☐ Man-made earthquakes in the form of explosions can be detected 200 miles away with small, portable seismographs developed by Carnegie Institution of Washington scientists.



Give it time and the muddy Colorado will fill Lake Mead with sediment, seriously reducing the usefulness of Hoover Dam. Navy and geological engineers are scratching their heads over the problem



HOOVER DAM CALLS THE DOCTOR

MORE THAN 400,000 tons of silt, clay and sand are being deposited in Lake Mead behind Hoover Dam every day. In the last 13 years the muddy Colorado has dropped two billion tons of sediment in the lake, reducing the capacity of the reservoir by possibly five percent. Unless some remedy is applied, the reservoir eventually will lose most of its storage value.

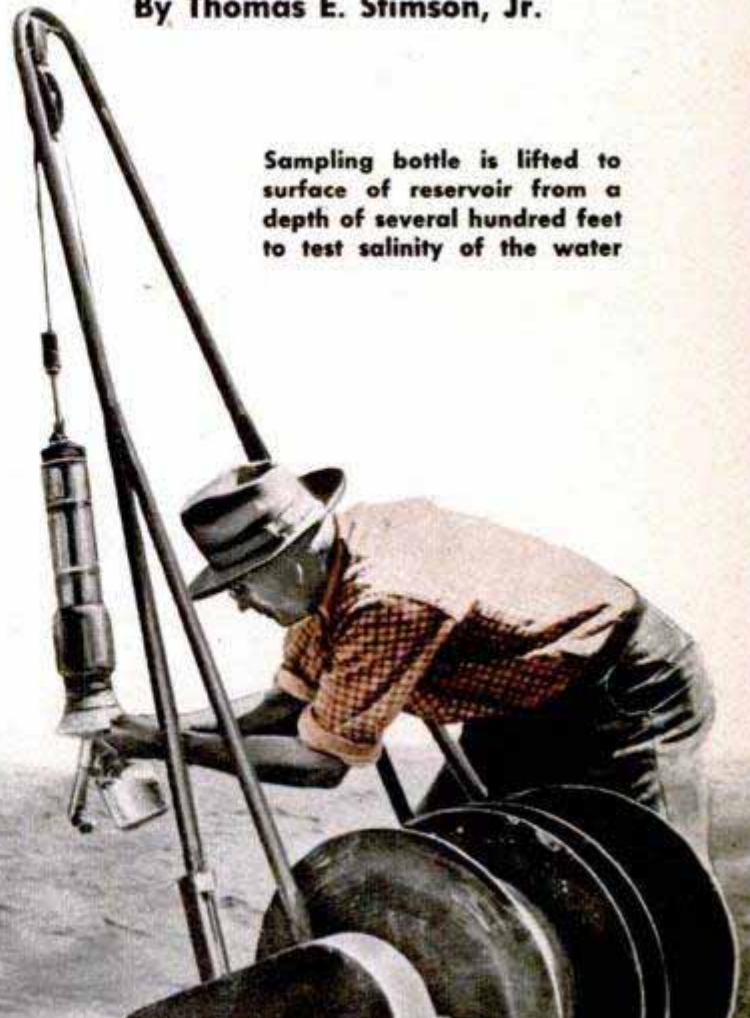
Lake Mead is a fresh-water reservoir and yet it contains several million tons of salts in solution. So vast is the lake that this quantity of mineral gives the water only nominal hardness. An oddity is the fact that the water that is discharged downstream is saltier than the water flowing into the reservoir.

The weight of the water in the huge lake imposes great strains on the earth's crust and some portions of the Lake Mead area have settled several inches. Light earthquakes due to adjustments of the earth occur frequently.

Nearly one million acre-feet of water evaporate from the surface of the lake every year. The loss amounts to more than a billion tons of precious water that could provide power for a fair-sized city as well as irrigating from 100,000 to 300,000 acres of land if the evaporation could be halted.

By Thomas E. Stimson, Jr.

Sampling bottle is lifted to surface of reservoir from a depth of several hundred feet to test salinity of the water



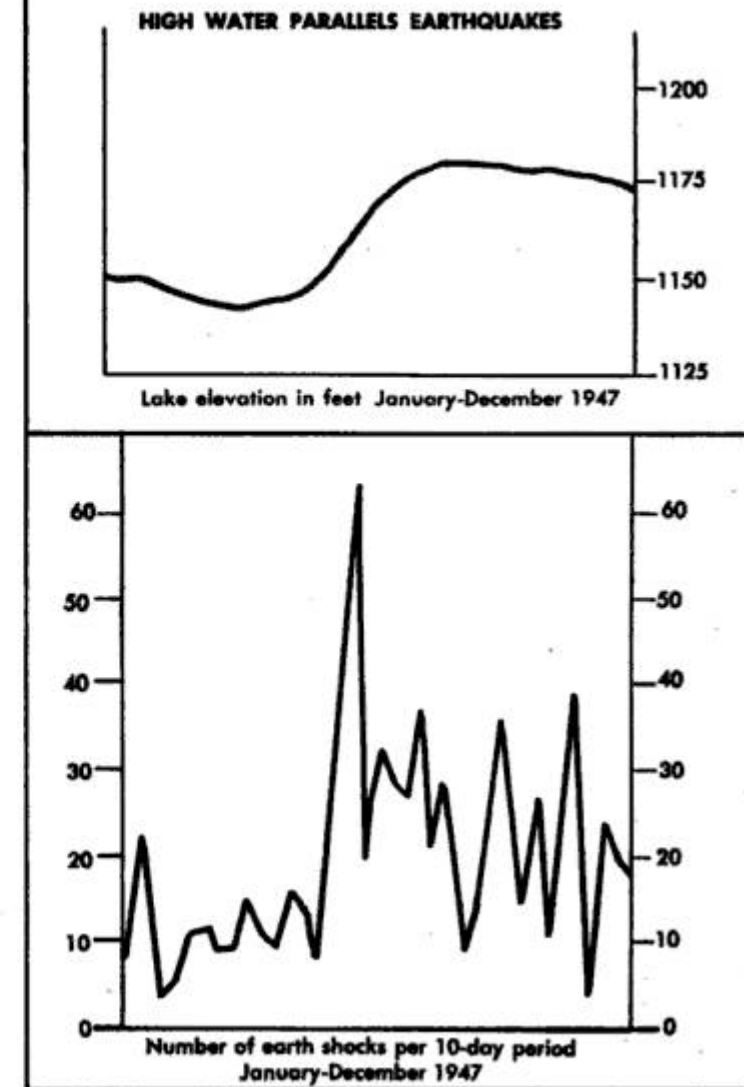


U. S. Navy photo

Navy divers on barge assist in sedimentation study on Lake Mead. Right, charts explain earth shocks near dam

These are some of the high lights from studies that are being conducted by the Office of River Control for the lower Colorado and by associated agencies. The river-control office operates that portion of the river which extends from Lees Ferry, 355 miles upstream from Hoover Dam, to the international border below Yuma, a distance of almost 700 miles.

Hoover Dam and the other structures on the river are used to create electrical energy that is distributed as far away as southern California, to provide drinking water that travels by aqueduct to Los Angeles and its neighboring cities, and to take wa-



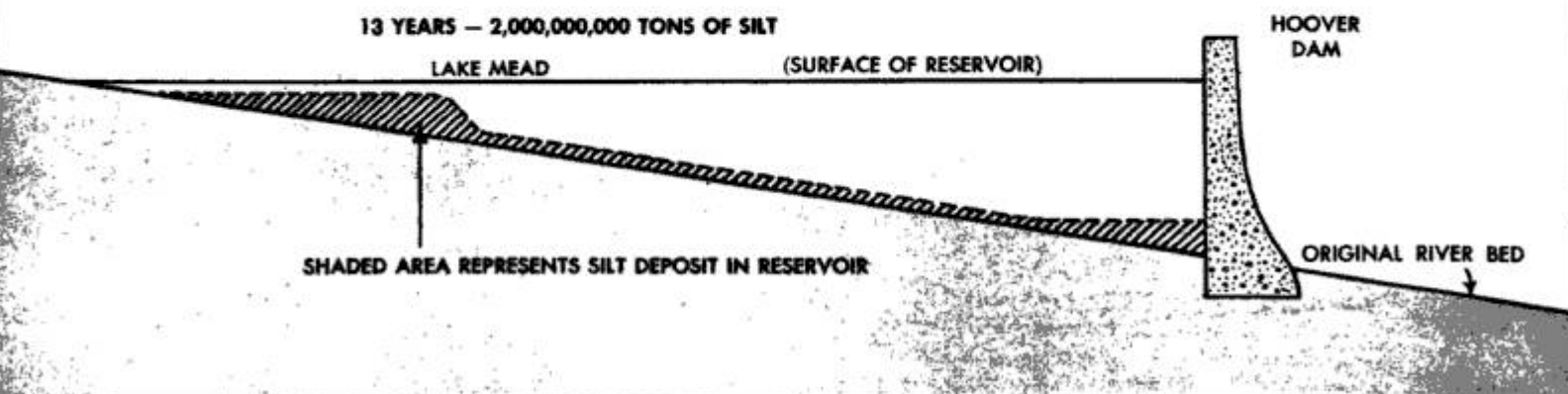
ter from the river for irrigating vast tracts in Arizona and California.

Operating the river is a complex task and one of the big problems now confronting C. P. Vetter, chief of the Office of River Control, is the silting of Lake Mead.

The water that flows into the head of the reservoir looks like brown soup; the water that is discharged through the dam is crystal clear. Vetter knows the approximate tonnage of the sediment that has accumulated, but it's hard to say what volume the sediment occupies.

To find out, the Geological Survey and the Navy are cooperating with the Bureau

Simplified sketch (not drawn to scale) shows how tons of silt are being deposited on the bottom of Lake Mead



of Reclamation and are measuring the actual depths of the water in the reservoir. These findings will be compared with the original profiles.

The Navy's survey party is using an improved type of fathometer as well as other echo devices for making precise soundings from the surface of the lake. Underwater photographs may also be made to check on the underwater contours. The Navy may employ underwater television apparatus to study the bottom as a way of finding locations from which the most revealing photographs can be made.

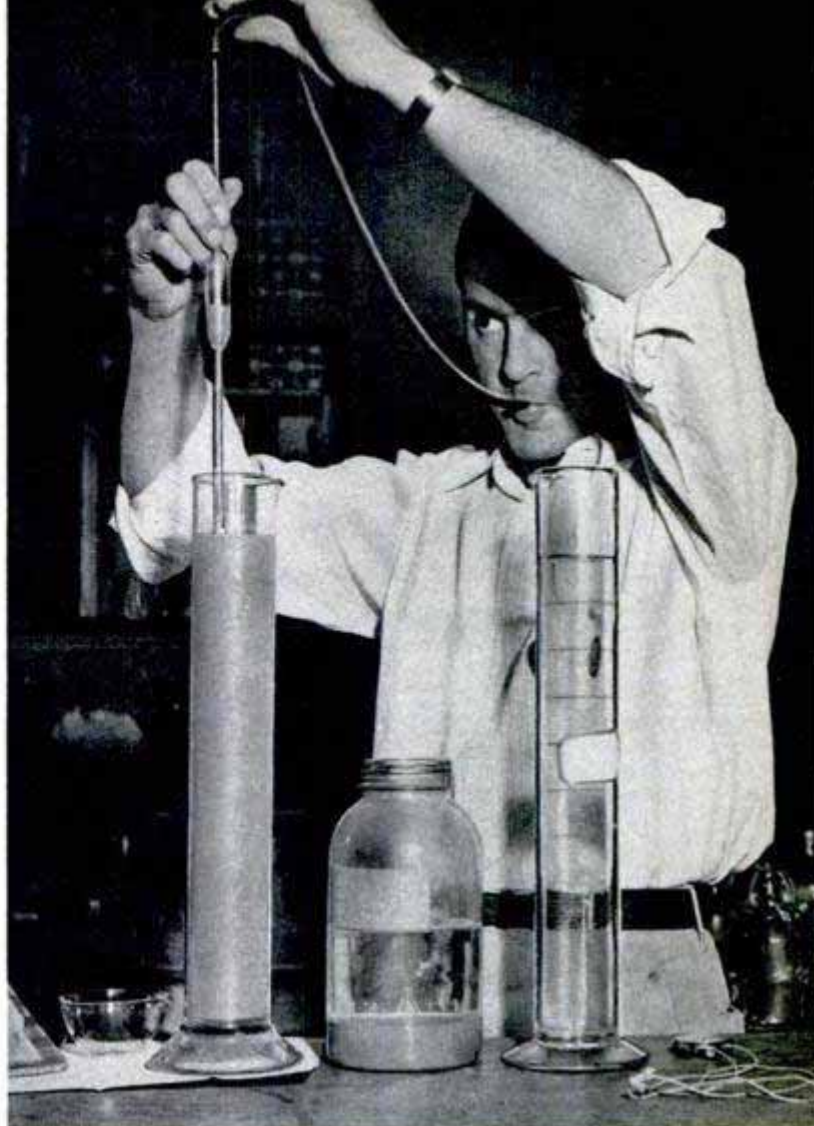
In addition to six small craft that were shipped across country to the site, the Navy has launched a 107-foot self-propelled steel pontoon barge on the lake. This is used as a platform for taking corings of the sediment deposits. Analysis will be made of the core samples to determine the degree of compaction, important in measuring the volume of the sediment. The survey will require a full year of field work and is to include the establishment of check points so that periodic measurements can be made in the future.

The sediment problem is not new. It was recognized at the time the dam was built but it was a problem that didn't need to be solved immediately. Now, at the narrow head of the reservoir, the silt is about 250 feet deep. In some portions of the main reservoir the original river bed is buried under as much as 100 feet of sediment.

Scouring out this material or by-passing the incoming sediment via diversion channels are two suggestions that have been considered and discarded because of the tremendous cost. The best solution seems to be to build another dam upstream to remove the sediment load from the water before it enters Lake Mead.

This would simply transfer the sediment problem from Lake Mead to the upper reservoir but the full plan goes further than that. Complete development of the Colorado is to involve the building of some 30 additional dams on the river and its tributaries. The river would be converted into a chain of lakes, each of which would act as a settling basin for sediment in addition to generating power, assisting in flood control, or providing irrigation water. Ultimately the fight against sediment will have to be carried even farther upstream and will consist of erosion-control measures in the areas that are contributing most of the sediment.

Colorado River water is hard and some engineers once thought that Lake Mead would slowly turn into a body of salty water too highly mineralized to drink. They reasoned that evaporation would concentrate the minerals year after year.



Beaker at left being sampled contains incoming river water full of sediment. Clear water at right is sample of water as it leaves reservoir. Below, coring tube with lead weights is dropped to measure silt deposit





Some day silt may clog intake towers behind dam which supply turbines

That fear has vanished now although evaporation plus the leaching of salts from the bed of the reservoir actually have increased the water's hardness. The average salinity of the incoming river is 575 parts per million and the average salinity of the lake itself is 650 parts per million. The discharge is even higher in mineralization and averages 680 parts per million, because the water that is discharged through the hydroelectric turbines is drawn from a depth at which the minerals are concentrated. The fact is that the salinity of the discharge waters seems to have passed its peak and to be gradually decreasing. Minerals consist mostly of calcium sulphate and calcium bicarbonate with some sodium, potassium and fluoride.

Hard as it is, the water is softer and better for agriculture than the water that irrigators used to draw from the river before Hoover Dam was built. This is because the salinity of the free river used to vary with

the season. The purest water came downstream in the great spring floods when water wasn't needed for irrigation. Salinity was highest in the summer just at the time when water was being diverted to irrigation ditches.

Today the reservoir mixes up a whole year's supply of water before it goes downstream and the average salinity remains pretty constant the year around. The Office of River Control estimates that nearly 10 million tons of salts have been kept out of irrigation ditches in the last 13 years because of the action of the reservoir.

Loss of water by evaporation from the 125,000-acre lake is tremendous. The estimate of a loss of one million acre-feet per year is computed from measurements of evaporation from floating pans of water and from pans that are placed on shore.

Water conservationists regard evaporation as pure waste even though this lost water isn't in demand today. Sometime in the future the demand for water from the river may exceed the supply and when that time

comes the water that just disappears into the air will be needed. One suggestion that may have to be tested is to coat the reservoir surface with some nonvolatile liquid such as a light oil. The thin film would prevent or reduce evaporation and would not affect the purity of the water or its value for generating electricity. Presumably the film would kill the fish life in the reservoir, at present a great tourist attraction, but eventually the need for additional water may overbalance the recreational value of the reservoir.

A moderate earthquake that rattles doors and windows is an alarming event to most people. Residents in the neighborhood of Lake Mead became accustomed to them in 1939 when 34 moderate quakes in one month indicated how the earth was adjusting itself under the weight of the newly filled reservoir.

Seismic activity in the vicinity hasn't again approached that high point but

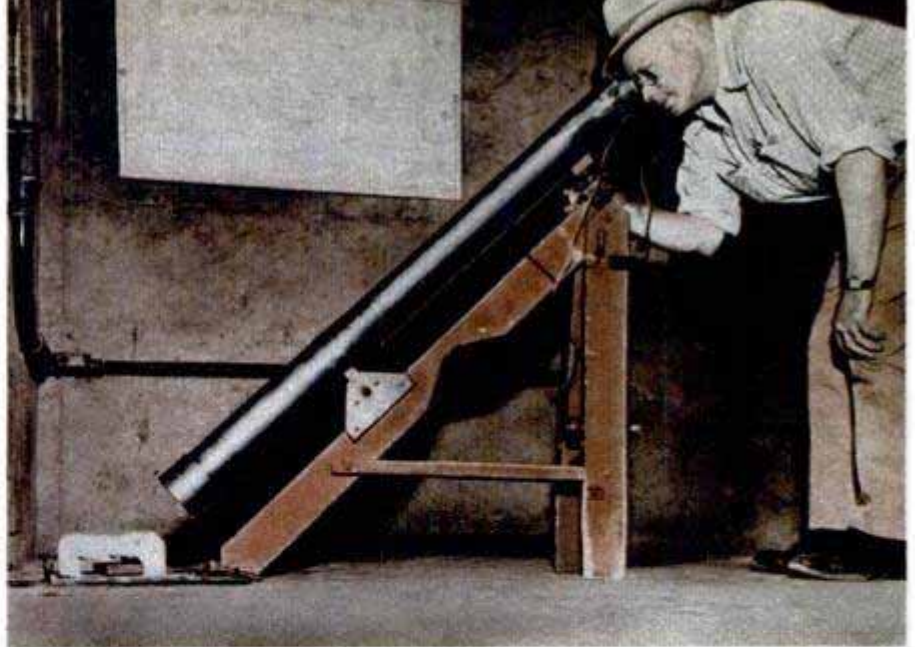
earthquakes are still occurring and probably will continue as long as the reservoir is used. A week may go by without a shock being felt, then for a time there may be one or more shocks a day. Dozens of others too weak to be noticed are recorded by seismic instruments.

This continuing activity seems to be caused by the seasonal changes in the reservoir's level. Lake Mead has a total capacity of 31 million acre-feet and the water reaches its highest elevation in late July or early August. At that time the water load may be as high as 42 billion tons, depending on the degree to which the reservoir has filled.

By late March the normal discharge of water through the turbines draws down the level of the lake by 65 feet, reducing the impounded water to about 28 billion tons. The earth moves around under this varying load.

The Coast and Geodetic Survey maintains three seismograph stations in the vicinity of the reservoir and other seismographs are installed inside the dam itself. The purpose of the installations is to check the security of the dam and to obtain background information that will be useful in planning other dams. Seismic studies at Lake Mead have confirmed the early conclusions that there are no major faults in the vicinity and that the dam is safe.

Water temperatures in a reservoir might seem unimportant but they are of more than academic interest. At Lake Mead, for instance, they help in eliminating the floating debris and other river trash that might



Tilt meter inside Hoover Dam measures slight seasonal movements of tremendous mass of concrete caused by changes in temperature

collect around the intake towers and become a problem. Logs, branches and other material that come down the river into Lake Mead collect in big rafts and remain at the upper end of the reservoir. This is because the inflowing water is cold. It flows into the lake as an undercurrent. A return flow occurs at the surface and keeps surface materials at the head of the lake.

The reservoir is a fisherman's paradise. Once that portion of the Colorado was too muddy and seasonally too warm for trout. It was always too swift for bass. Today rainbow trout are thriving in the cold, clear water below the dam and bass are multiplying in the quiet waters. A fisherman simply decides what kind of fish he wants and picks his spot accordingly. He's too content to worry about the two-billion-ton menace growing beneath this paradise.

Sounding boat used in silt survey carries sensitive fathometer and when reading is made sailors (right) take bearings on two shore markers to determine their exact location on lake. The Navy is cooperating in survey





Rotary Mower Cuts Tall Grass

Grass of any height is cut by a rotary power mower that has a single flexible blade. The blade revolves beneath the motor to cut even tall or tangled grass. The mower's frame is made of polished aluminum and the main wheels are equipped with pneumatic tires. Powered by a direct-drive vertical motor, the mower can be adjusted to three cutting heights. It is available in three models with 16, 18 and 20-inch cutting blades.



Lightweight Motorcycle

Weighing only 170 pounds, the newest entrant in the light motorcycle field is the Harley-Davidson 125, powered by a one-cylinder, two-cycle engine. It has a foot-operated three-speed gearshift and a handle-bar controlled clutch. The reinforced tubular-steel frame has a wheelbase of approximately 50 inches. For more convenient reading, the speedometer is mounted in the headlight housing. The engine is lubricated by oil mixed into the gasoline.



Garden Tool Makes Straight Rows

Straight garden rows are assured without stakes and string when a new tool is used to dig the furrows. A rod across the tool is set for the proper distance between rows. The tip of the rod then can be guided along the preceding row in digging the new furrow; or the tool can be reversed and the rod will scrape the earth to mark off the next row. After the furrow is dug and all of the seeds have been planted the tool is turned over and a corrugated roller covers the seeds with dirt. Two additional tines can be attached to the tool to convert it to a cultivator.

Tool's extension bar is guided along previous row to keep the row straight. Inset, tool is reversed and rolled over the planted row to cover the seeds

Our WHERE-TO-FIND-IT INDEX, which lists names and addresses of the manufacturers or distributors of products described in this issue, is available to readers without charge. For your copy, just write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11



Safety Photo Trimmer Protects Fingers

Instead of the usual lever-type cutting blade that may drop on the operator's fingers, a new paper cutter has two blades only an inch apart and is operated by pressing down on the base. The operator never touches the blade, but merely places the paper under a transparent guide rule, presses down on the platen and the edge is trimmed. The cutter can be operated horizontally on a table or vertically when fastened to the wall. The platen and guide rule are calibrated to assure accurate trimming. With its 11¼-inch cutting blade, the trimmer will handle all popular print sizes.

Overlay Checks Shorthand

Students can easily check their shorthand characters with the aid of a transparent sheet printed with shorthand marks. The sheet, made of Celanese Lumarith plastic, is placed over the student's characters, offering an accurate comparison of the student's letters with perfectly formed letters. The characters appear in opaque red on the sheet. Any finger smudges can be wiped off the plastic with a damp cloth.

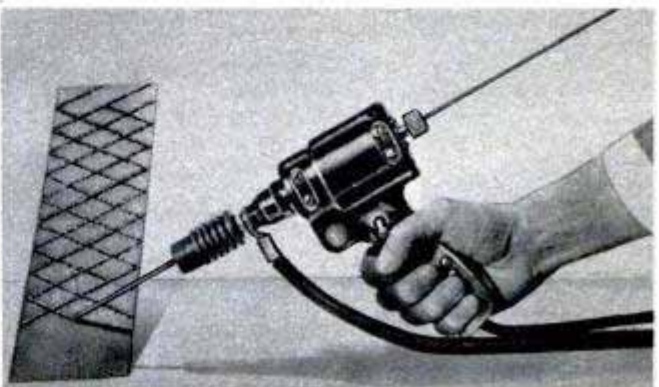


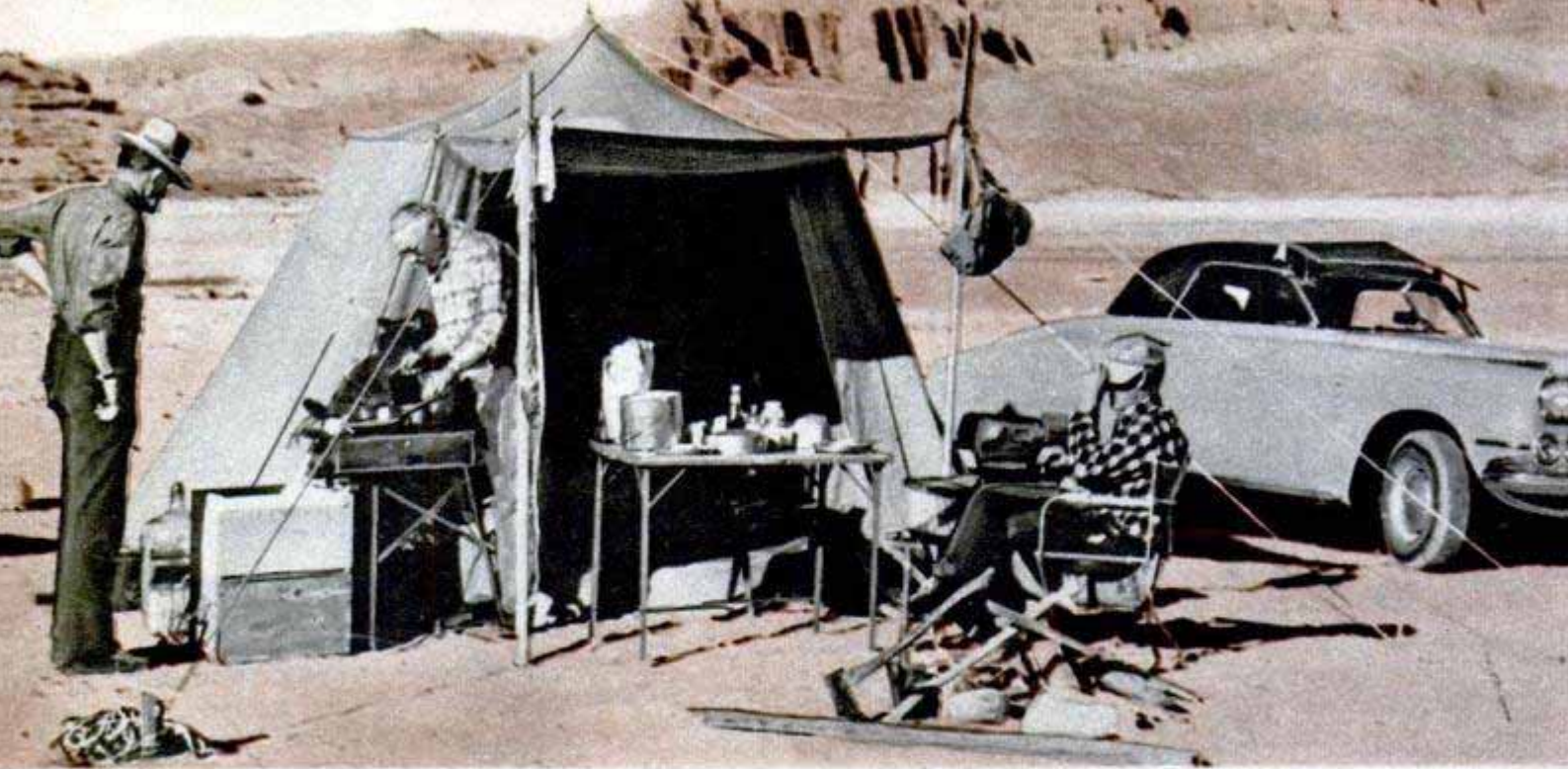
Twin Dials Measure Your Bite For Dental Work

Looking like a pair of earphones worn upside down, a new gauge for dentists measures the precise bite of patients being fitted with artificial teeth. Called a condylometer, the device has two dials that measure the movements of the condyles, those bony lumps just in front of the ears that move as the jaw is opened and closed. These measurements enable the dentist to construct better-fitting dentures.

Tool Welds Tread on Metal Floors

Iron or steel surfaces are given a nonskid tread by a vibrating hand tool that attaches to either a.c. or d.c. welding machines. The vibrating electrode holder causes intermittent arcing which melts the electrode and fuses the molten droplets to the floor. Five linear feet can be applied in a minute and no welding skill is required.





Fine for all-around camping, the umbrella tent is especially comfortable for the desert camp. There is sleeping space for several persons and it closes tightly for protection against wind and sand. The canopy provides shade during heat of day



Above, if you like to travel light, a sleeping bag with flap will keep you warm and dry even in the rain. On canoe trips, the paddles do extra duty as flap poles. Below, home is where you spread your bedroll when it has sheets and a real pillow





Inflating an air mattress is work, but it's worth it

CAMP in COMFORT

TWO ESSENTIALS for a successful camping trip are a rainproof tent and a warm, comfortable bed. Wise campers long ago learned the fallacy of imitating the hardy backwoodsman and "going light" with a meager tarpaulin for shelter, a thin blanket roll for a bed and a rock for a pillow. The summer camper goes for pleasure and health and, if he is wise, plans his outfit carefully for maximum comfort. The trick is to get real comfort without too much weight and bulk.

Adequate shelter being the major consideration, the most important item is the tent. It must be thoroughly rainproof for one driving shower can soak the bedding, ruin the food supply and wreck that long-planned trip right at the start. If you are not sure your tent will shed a hard rain, erect it in the back yard and turn a hose stream on it. If one drop of water goes through, you'd better not plan to use that tent if you want to stay dry.

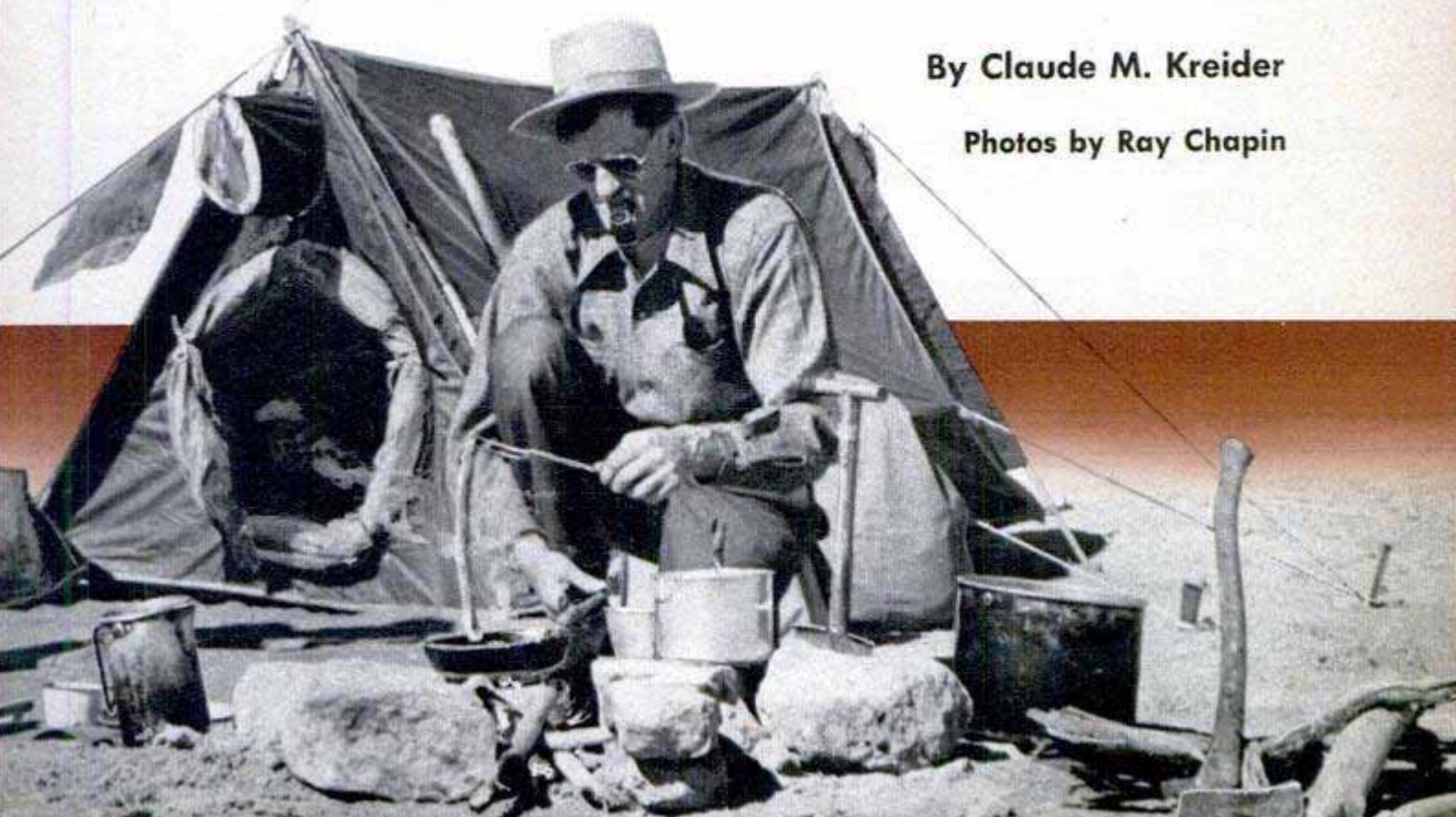
Of the many types of tents on the market, we can here consider three, each of which has certain advantages depending on your mode of transportation, whether it be by foot, auto, pack horse or canoe.

The umbrella tent: This all-purpose tent—granting that moderate weight and bulk are permissible—is almost universal for the automobile camper. It comes in sizes from about 7 by 10 feet, adequate for two persons, to a four-man size, which is 11½ to 12 feet square. The smaller size, in good, durable, 10-ounce twill, will weigh only about 25 pounds with center pole, while

Bugproof, the mountain tent has a canvas floor. Circular door fastens snugly. "Pipe" above it lets in air

By Claude M. Kreider

Photos by Ray Chapin



the larger tent may weigh 35 pounds. Made of lighter and more expensive fabrics, either tent will weigh much less, but it will be less durable. The saving in weight and bulk is not important when transportation is by automobile. Of course, all such tents have sewed-in floors.

For the mountain pack trip, where every pound of weight must be considered and the whole outfit goes on a mule's back, the smaller umbrella tent is a practical shelter that takes up no more space than a small sleeping bag. The jointed center pole is as easily carried as a fishing rod and the necessary shovel. With this tent you're sure of a dry camp when that first heavy thunderstorm pelts down. Likewise, the 11-foot tent easily pays its way on the trip when the party numbers three or four persons.

All good umbrella tents have a mosquito curtain of netting or stronger bobbinet sewed in at the top of the door flap, either to tie down along the sides or fitted with the tighter zipper fastening. This is essential, not only in mosquito country, but also to repel flies when you eat inside the tent. On warm nights with the tent flap back and net curtain tight, you sleep soundly, unbothered by flying and crawling insects. In cool weather, the flap is tied down and sufficient air is admitted

through the one or more net-covered windows of the umbrella tent.

This tent has the additional advantage of ample headroom at any point since the sides are nearly vertical. One type has a jointed center pole, with a four-arm stretcher sliding on it, each arm of which is inserted at a top corner of the tent. Many campers prefer this center pole, due to its comparatively light weight and the four stretchers are handy for hanging clothes. Another tent has four metal corner poles with sliding stretchers extending from each pole to the peak of the roof. This type provides an all-clear space inside, but is heavier and requires more time to erect.

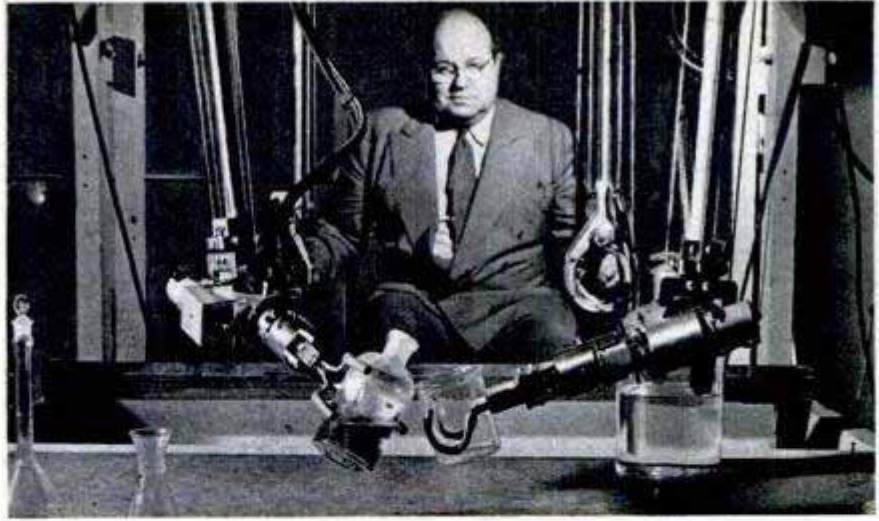
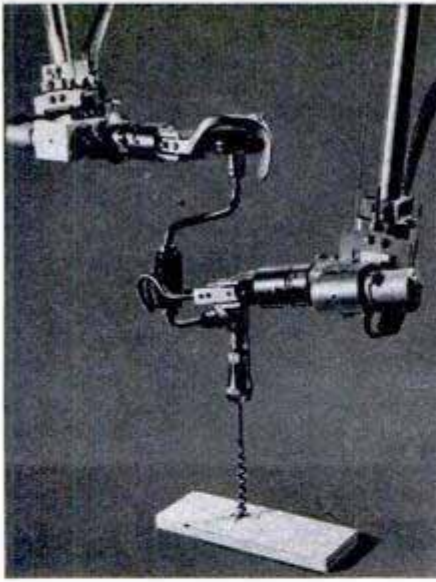
At least eight steel pegs, not less than 10 inches long, are needed for the umbrella tent. Additional protection against strong winds is provided by guying the tent peak and its four upper corners to additional pegs. Iron half-hooks welded to the projecting ends of the stretchers, make this job a quick and easy one, anchoring the tent for anything but a gale. Another advantage of this tent is the wide door flap, which may be erected as a sunshade under which to sit or dine in hot weather.

The pyramid or miner's tent: Here is perhaps the most comfortable tent for its

(Continued to page 250)

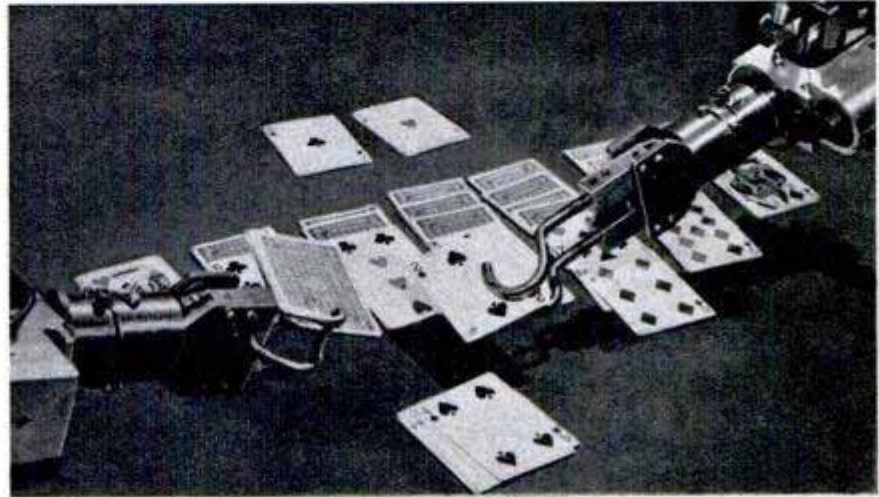
The lightweight pyramid tent sleeps three comfortably and its steep sides shed water in the heaviest rain





Mechanical Hands

Designed for use by remote control in radioactive areas, a pair of mechanical hands can do everything human hands can and more. The hands extend over a protective wall into the radiation area while the operator controls them from a safe place. Most movements are mechanical, being controlled by linkages with the handles, but wrist action is electrical. This permits the wrist to twist around completely any number of times, a feat which is particularly useful when unscrewing a nut. Interchangeable hands are used for different operations. Some are highly specialized such as one



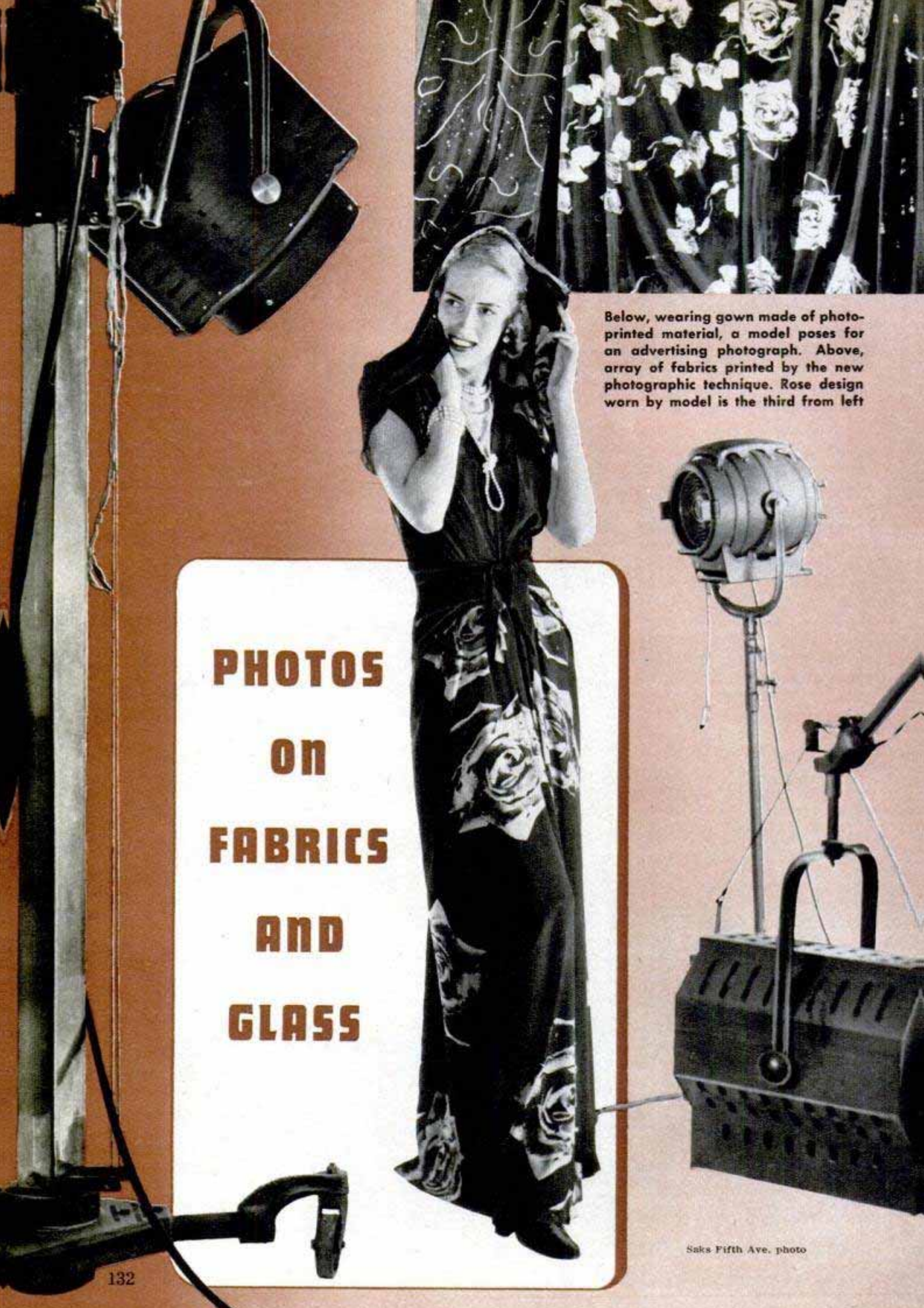
By remote control, mechanical hands do anything the operator (see upper photo) wants: pour chemicals, bore holes, or even play solitaire

hand that consists of a pair of snips instead of hooks. Control of the hands is so sensitive that a gentle squeeze can be applied to break the shell of a hard-boiled egg without damaging its contents.



Trench Digger

Foundations and shallow trenches are dug by a bucket-line machine that can be towed behind a small tractor or jeep. The machine digs a trench from one to 30 inches deep and 12 to 18 inches wide. The endless bucket line brings the dirt to the top of the machine where it is dumped onto a conveyor and moves off to the right of the trench. Powered through the take-off of the tractor or jeep, the digger has a 180-to-1 gear-reduction attachment which slows the vehicle to a "walk" of 160 feet per hour.



Below, wearing gown made of photo-printed material, a model poses for an advertising photograph. Above, array of fabrics printed by the new photographic technique. Rose design worn by model is the third from left

**PHOTOS
ON
FABRICS
AND
GLASS**

Saks Fifth Ave. photo



By Bill Reiche

PHOTOGRAPHY has come a long way since the days of the tintype, but it still has its eye on the future. Not satisfied with pictures that you merely look at, it is now making some you can wear and use.

The cameraman is invading the fields of fabrics and ceramics. You will soon be wearing photo-printed neckties and eating from photo-decorated dishes.

Fundamental techniques in the art are unchanged, but it is finding new vehicles of expression. It is beginning to free itself from the limitations of film and paper—useful as these are—and is aiming for bigger targets.

The printing of photographs on fabrics will probably be the biggest development

Chemist at light table cuts master printing film in laboratory. At rear, another chemist mixes dye for emulsion as girl proves that fabrics can be ironed

industrially and by far the most obvious insofar as the public is concerned. You will soon be seeing Sinatra's portrait on bobbysoxers' shirts, photographs of fire engines on frocks, and the photogenic Grand Canyon on sofa pillows.

While photographic fabrics will undoubtedly strike the eye most frequently, the scientific-minded will be more interested in a process for printing photographs, not on, but in glass. Pottery, metal and plywood are other substances which are or will soon be used as carriers for the modern photographer's art.

The development of photosensitive glass at the Corning Glass Works goes back to 1937, when Dr. Robert Dalton discovered

Technicians put master printing film on rollers. Goggles shield their eyes from rays of mercury-vapor lamps





Left, examining negative and photosensitive glass before inserting them in contact printing frame at right

that certain ruby glass could be permanently changed in color by ultraviolet irradiation and heat treatment. Before the war, a clear glass was made in which ruby-colored designs could be "printed."

The war interrupted the photosensitive-glass project, although photographic glass almost turned up as legal tender. The Treasury Department was interested in making coins of this material to save critical metals, but the vast quantity required in a hurry exceeded production facilities and the idea was dropped.

Prime ingredient in the photosensitizing process is the introduction into the glass of metallic particles so small that they cannot be seen under a high-powered micro-

scope. Different metals produce different colors in the finished print.

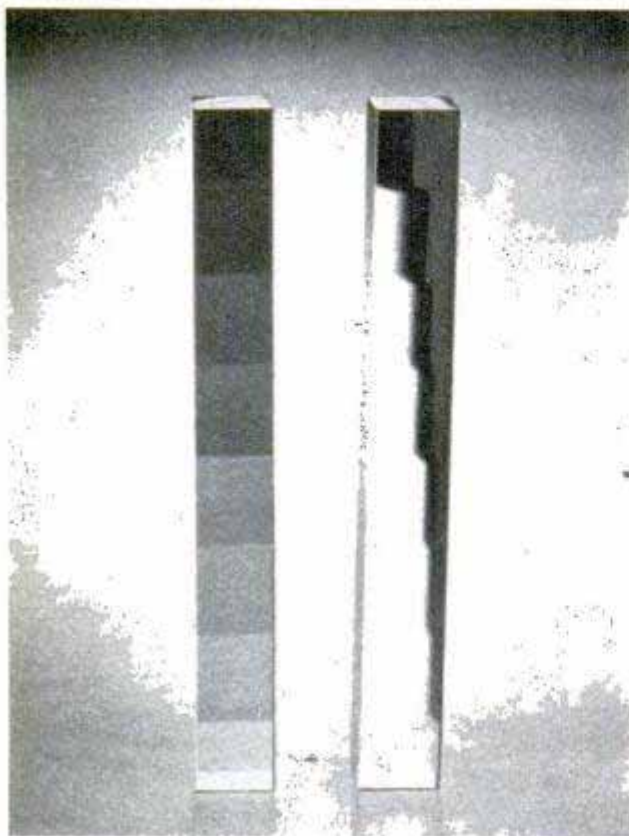
The glass is exposed to ultraviolet light through the film or glass negative—the light preferably being of high intensity and essentially parallel, but it can come from a number of sources. Sunlight, sunlamp, mercury arc or carbon arc may be used for the exposure.

The picture is produced by the precipitation of the metallic particles in the glass. These particles are so fine that the image is virtually without grain. The exposure is made with a contact printing frame and no special precautions need be taken with the glass except to shield it from potent sources of ultraviolet until it is used.

The development of the latent image is completed when the exposed glass is heated to 1000 degrees Fahrenheit in an electric furnace.

Various glasses, depending on their metal content, produce one or more color shades in the finished picture. One glass will give a blue, purple, ruby or orange image, another yellow or brown, and a third only a bright red. The color a particular glass produces is the result of the exposure time. Thus, after a period of exposure which would produce an all-purple image, part of the negative can be masked with black tape and the remainder, after continued exposure, will be ruby.

The picture is three-dimensional, in some cases the image penetrating the glass as much as two inches. Exposure time and duration of heat treatment, either separately or in combination, establish the depth of the image. The finished picture is indestructible, unless the glass is shattered; unalterable, unless again subjected



Color and depth of glass picture vary with exposure time. Seven different exposures are shown on strips



Above, exposing a photo glass to ultraviolet light. Right, the exposed glass is then heated in an oven

to 1000 degrees temperature, and ageless as far as any apparent or predictable deterioration is concerned.

The three-dimensional effect of the image is heightened by the fact that dark areas in the image penetrate deeper into the glass than the high-lighted portions.

Photosensitive glass can be worked like ordinary glass; it can be drawn, rolled, blown or pressed in the conventional manner. If extra strength is desired it may be tempered.

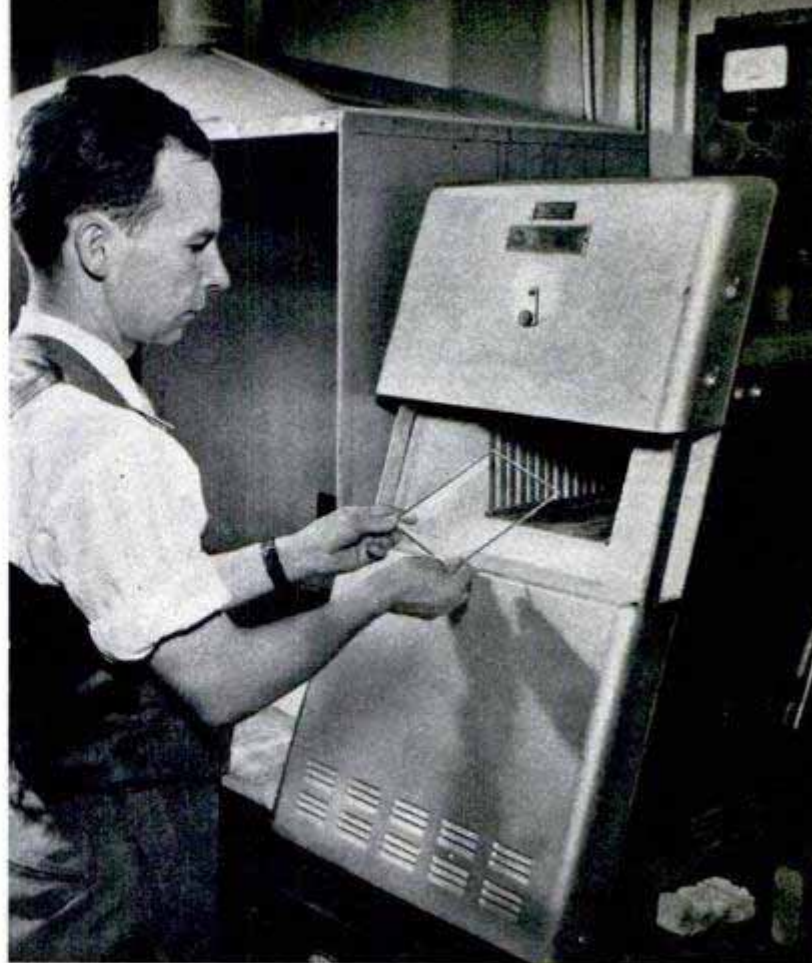
The potential uses for this material are almost unlimited, but some which suggest themselves are portraits, land and sea scapes, tableware, costume jewelry such as portraits in pins or rings, photomurals, decorative tile, church windows, advertising displays, scratch and heat-resistant instrument dials, and slides for projection.

Special lighting of the glass picture increases its general effectiveness, particularly when opalescent glass is combined with the clear variety. The opal glass, such as used in lighting fixtures, contains microscopic transparent crystals which scatter light in every direction. It can serve to some extent as a shading medium or, by directing the light on the opal glass, a self-illuminated effect is achieved.

A score of glass and research firms in many parts of the country have been licensed by Corning to use its photosensitive glass. Considerable testing is being done to discover the most economical use for the material. Incidentally, its cost is not much greater than that of ordinary glass of equivalent quality.

Photographic decoration of fabrics has been described as a step "snapping textile printing out of a hundred-year lethargy." Men in the field insist that a revolution in

(Continued to page 230)



Below, after baking, the completed photo is removed





Luxury Bus Has Snack Bar

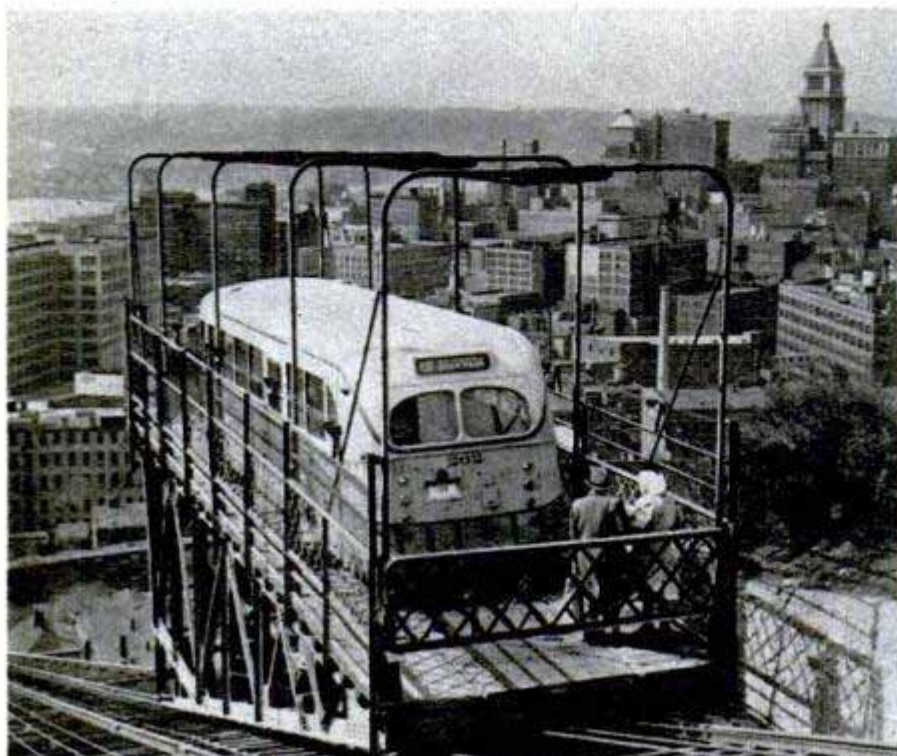
Snacks are served en route aboard new express buses operating from Chicago, New York and St. Louis. Each of the luxury buses, placed in service by the American-Burlington Buslines, has a snack bar with a stewardess in attendance where sandwiches and cold drinks are available. Other improvements include complete lavatory facilities, reclining seats, and a two-way radio telephone and complete air conditioning. The seats have individual reading lights. The buses, built on a 41-passenger chassis, seat 32 with the extra space devoted to the lavatory, snack bar and more leg room between seats. All seats on the new buses are reserved.

Electric Cart Keeps Meals Hot

During loading delays, meals for airline passengers are kept hot in dining service carts that can be hooked to portable motor generators. The mobile cart is of steel-frame construction, with aluminum skin, measuring three feet wide, five feet high and eight feet long. Inside, the hot food boxes and liquid containers have electric heating elements that are plugged in when placed in their respective compartments. The cart is wired for 24-volt d.c., the same as that in DC-6 buffets.



United Air Lines photo

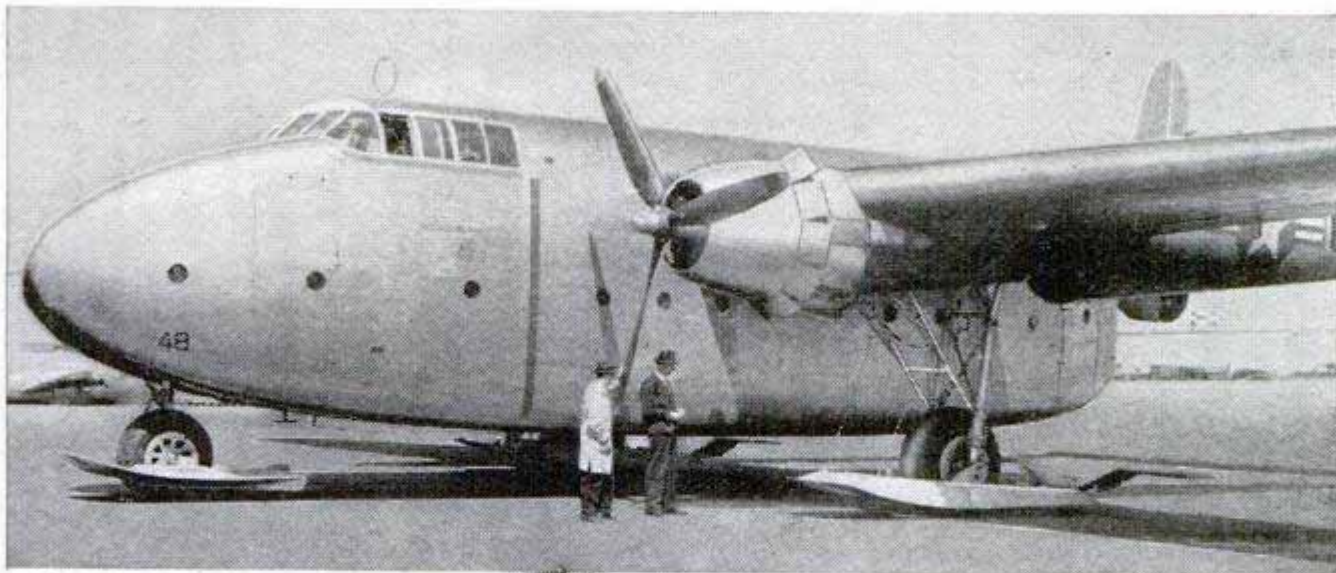


Buses Ride Trolley In Cincinnati

Buses, as well as their passengers, are getting rides now on a route in Cincinnati. They are loaded on platforms controlled by cables for trips up and down a 980-foot incline. A second set of tracks and cables makes it possible for buses to pass on the slope.

☐ About 20,000 tons of steel are used every year to make license plates for motor vehicles in the United States.

Retractable Skis for Planes Permit Landings on Snow or Concrete



U. S. Air Force photos

Right, installation features first use of ski on nose wheel. Main skis have a wing

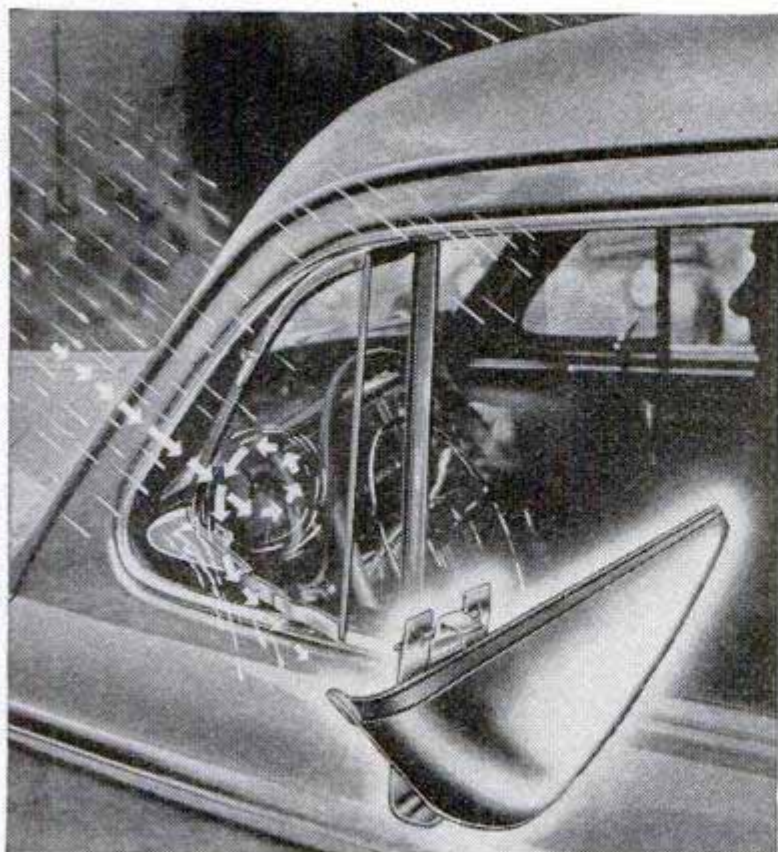
Landings on either snow or solid runways can be made with a retractable ski-wheel combination developed for U. S. Air Force C-82 cargo planes. The skis, which are raised or lowered electrically in flight in relation to the plane's wheels, are 16 feet long and four feet wide. The center portion is cut out to permit the wheel to protrude through the ski. A small wing at the tail end of the main skis holds them in place during flight, when the gear is about three fourths retracted.



Shield on Ventilator Wing Keeps Rain Out of Auto

Water can't drip inside the car when the ventilator wing is open during a rainstorm if a metal shield is attached to the bottom of the pivoting window. The device is held in place by a simple snap-on clamp. A rubber seal fits tightly against the glass to prevent leaks. The water that drips down the ventilator collects on the shield and the flow of air drives the water outside the door.

Sources of supply for the new products described in this issue are listed in the WHERE-TO-FIND-IT INDEX. For your copy of the index just write to Bureau of Information, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11. The Bureau will be glad to answer any other questions you may have on material published in *Popular Mechanics*



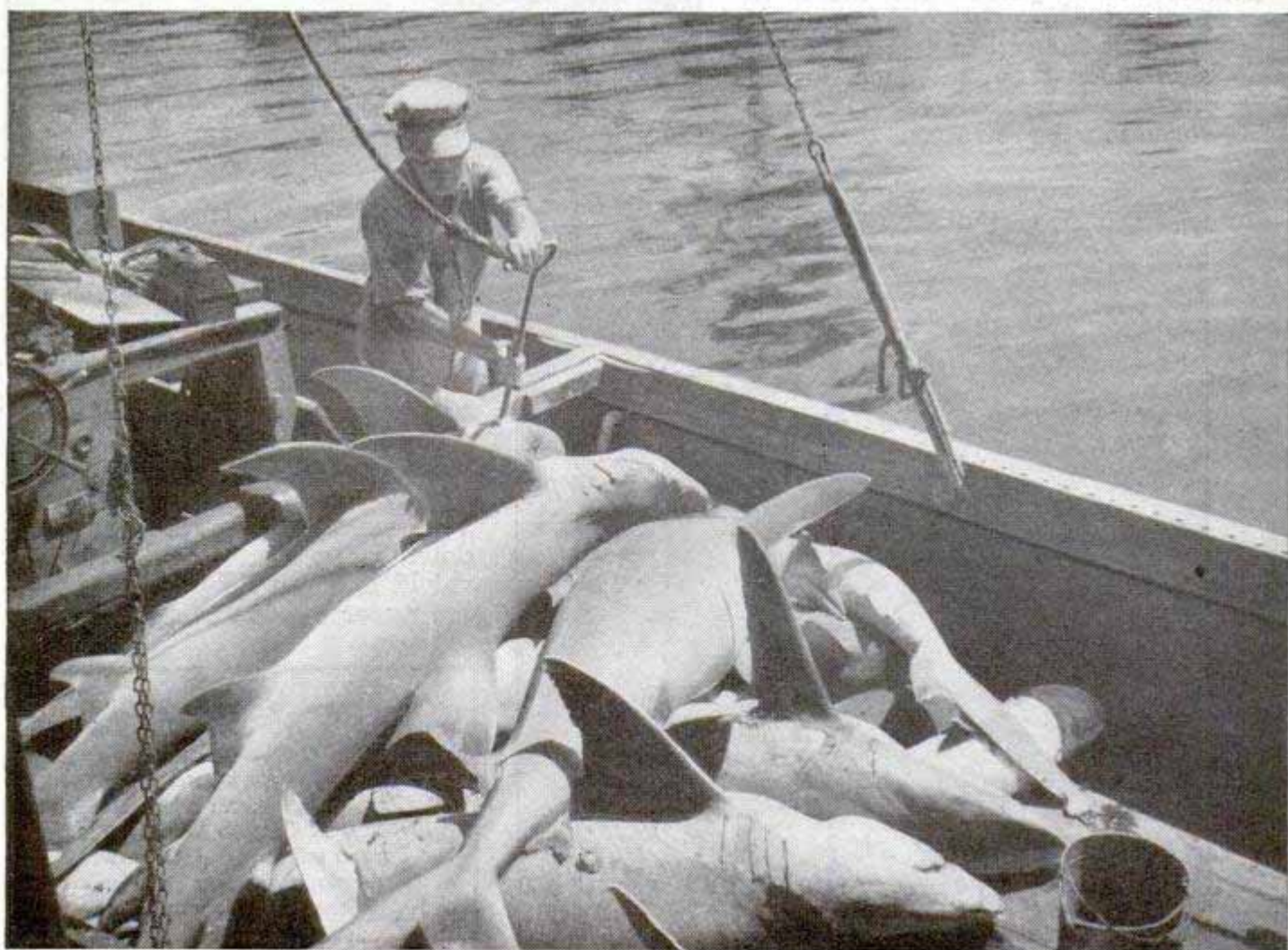


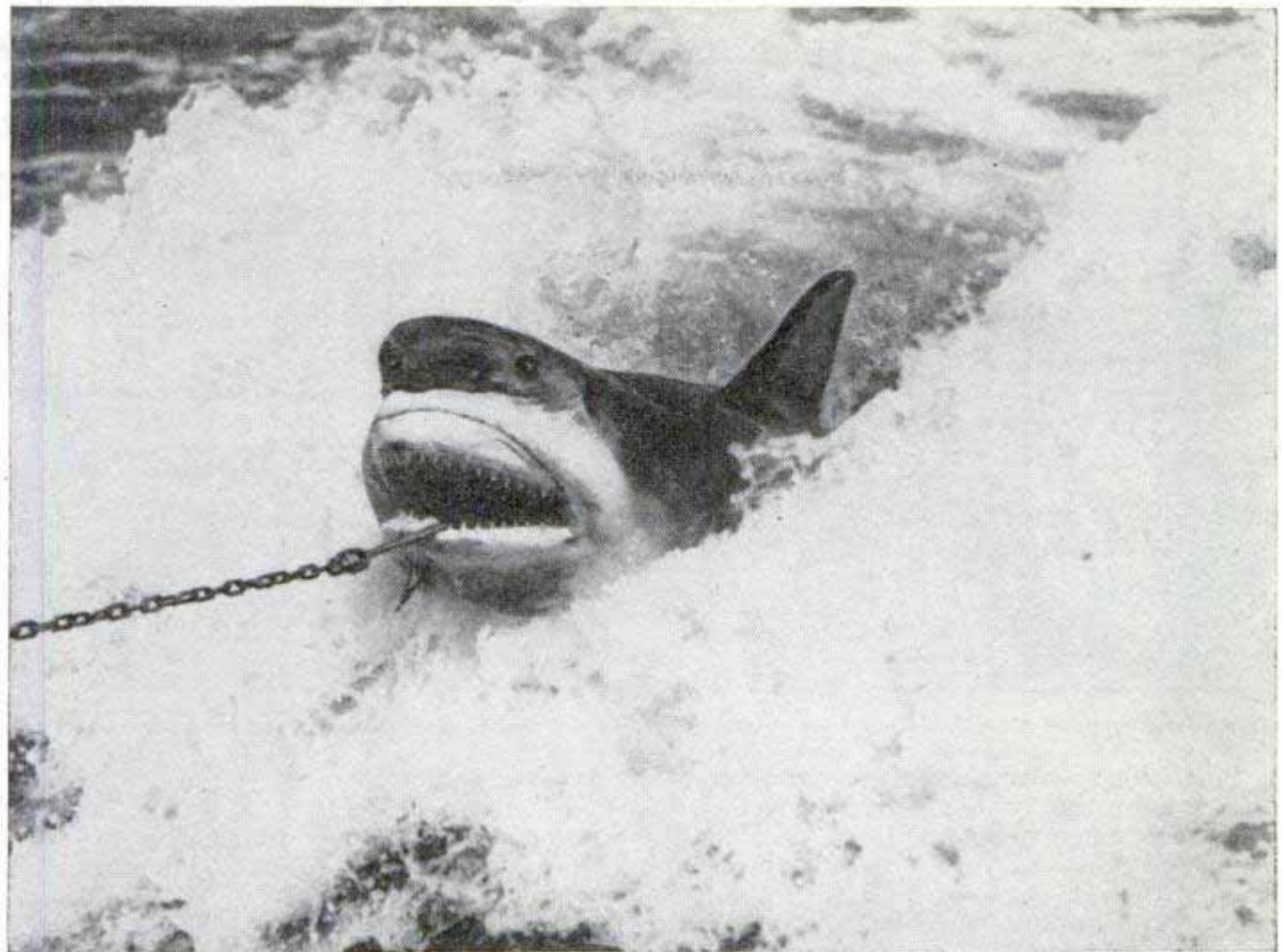
fishing for Shark

By T. T. Mosby

← After gaffing one of the undersea killers, a sharkier hauls him over the side

↓ Several tons of shark, rich in Vitamin A, are stacked aboard this vessel. Most vicious of the lot is the leopard shark





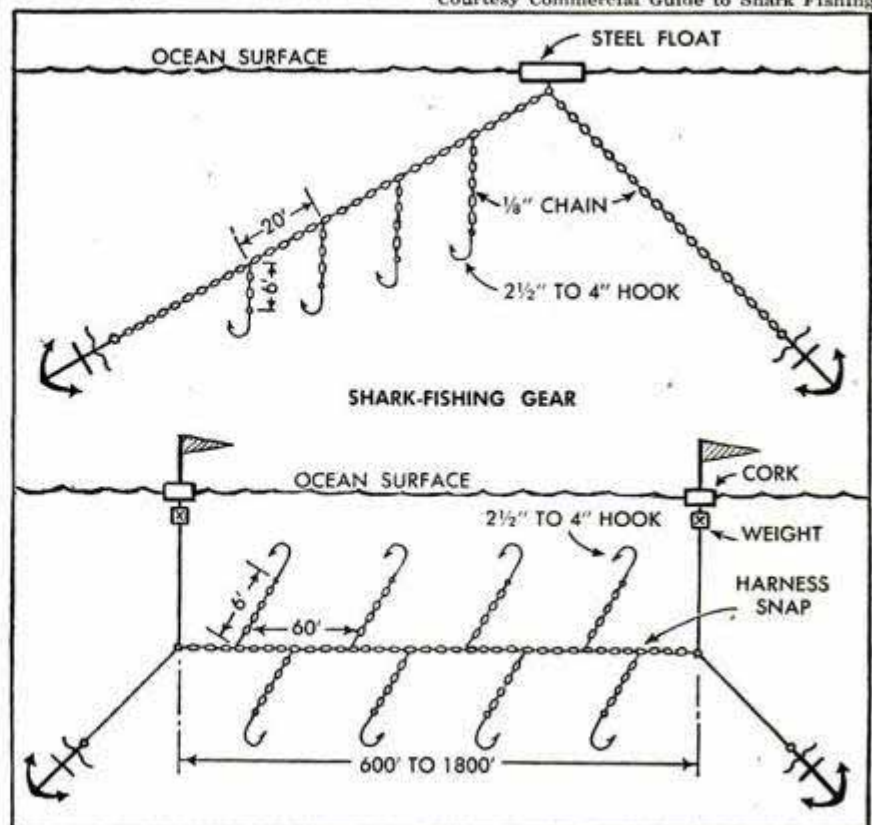
TO SHARKERS the Caribbean is a vast, rich, fishing ground. Wartime research disclosed that the shark is a valuable source of Vitamin A, so more and more fishermen are hunting this vicious undersea killer whose liver and by-products find a market all over the Western Hemisphere.

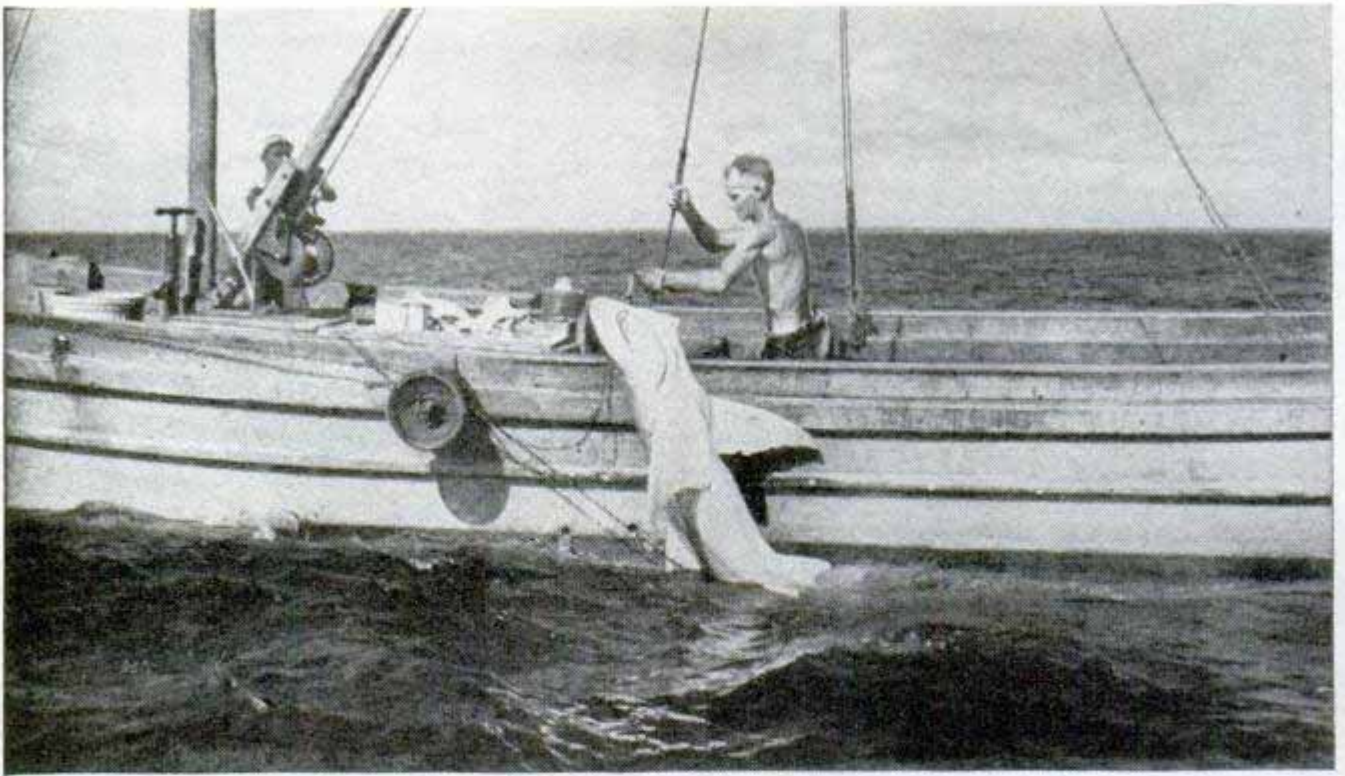
Today, every part of a shark is valuable: the liver contains Vitamin A; the fins are delicacies in Chinese restaurants; the hide can be sold to leather manufacturers; the meat is eaten all over the world; the carcass is ground into meal for poultry and livestock; even the teeth can be sold—as souvenirs. Recently, the shark's backbone has been found to contain great amounts of calcium, thus adding the dog-food market to the list of outlets.

In the past, sharks have been caught with nets. The bulk of the industry was on the Pacific Coast, where the largest catches still are made, but the Caribbean area promises to reap more valuable catches since the advent of a new shark-fishing rig which utilizes steel cable.

Note the wide mouth on this ugly fellow, pulled alongside by chain. Below, diagrams show two methods of setting chain rig. Some sharkers now use heavy cable instead of chains

Courtesy Commercial Guide to Shark Fishing





Winch hauls aboard a medium-sized killer. If still alive, he will be quieted by swatting his tender nose

Since deep-water sharks are more valuable than the shallow-water varieties, shark fishermen early saw the need for a rig which would put the giant 5-inch hooks in depths over 100 fathoms. Heavy chain lines were bulky and dangerous under certain conditions. Then a Key West shark-er developed a method which has been rewarding him with unusually large catches. This method, which consists of laying a mile of stranded steel cable strung at 30-foot intervals with 12-foot chain leaders, is also used by Thompson Enterprises, Inc., whose vessel, The Heron, is now equipped

with gear capable of bringing in the huge 14 and 15-foot monsters.

Sharkers begin their operations by filling lockers in the vessel's hold with bonita, yellowjack and barracuda for bait.

Because there are more than 40 different species of sharks in the Caribbean area, the skipper of a shark boat must use all his knowledge of fishing, plus hydrographic charts, to pick a likely spot for his hooks. Sharks vary in value according to type, habitat, season and sex.

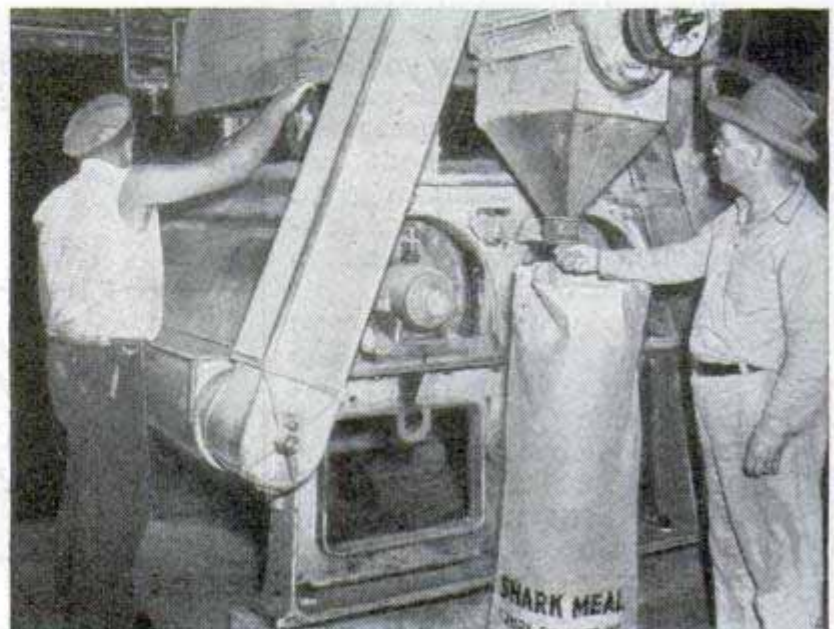
As soon as the boat reaches an offshore

(Continued to page 220)



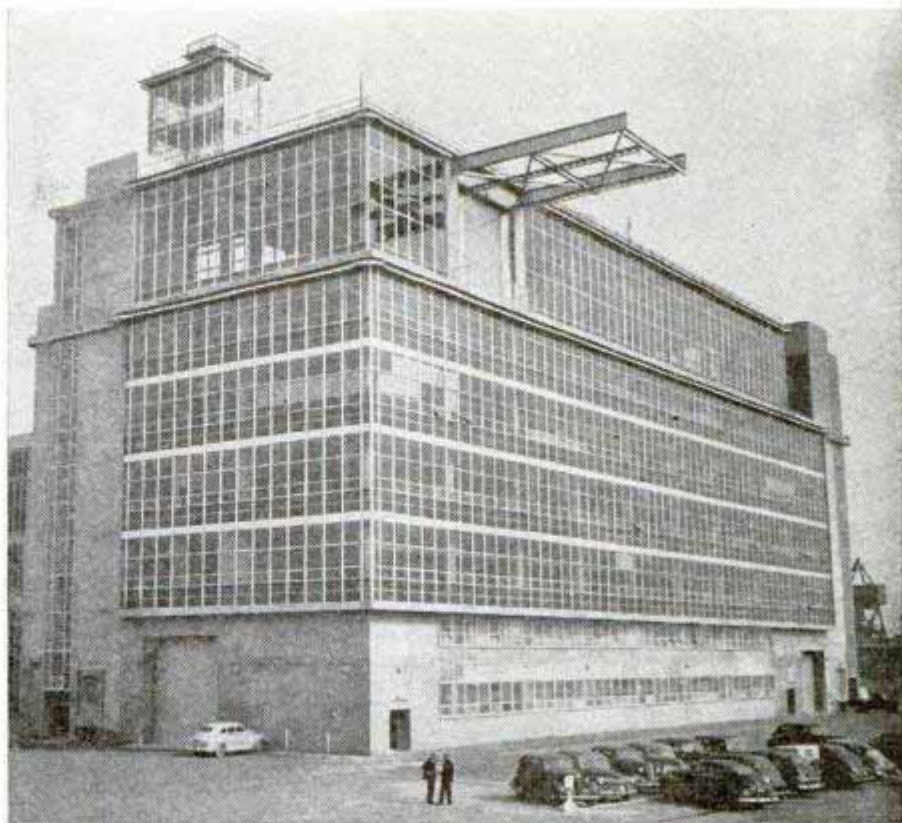
← Cutter in a processing plant slices the meat into steaks which will become prize delicacies on restaurant menus

↓ Many of the organs are ground into a meal, high in protein, which is packaged as feed for poultry and livestock

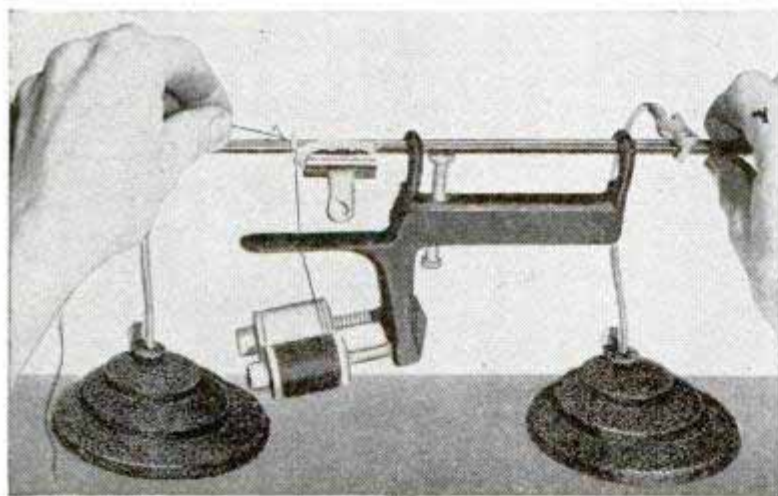


Navy Repair Shop Has Glass Walls

Everything from 16-inch battleship gun mounts to delicate optical instruments can be rebuilt in a new six-story naval repair shop whose walls are built of glass to provide even interior illumination. Heat and glare resistant, the glass covers 80 percent of the exterior walls and roof of the building, located at the San Francisco Naval Shipyard, Hunters' Point, Calif. One large work bay has a ceiling 67 feet high and is equipped with 40 and 60-ton traveling cranes for moving heavy ordnance pieces. An outside crane with a capacity of 15 tons will hoist submarine periscopes from railroad cars to the top floor where they may be set up inside a glass-enclosed tower for testing and



calibration. The building rests on wood and concrete piles driven some 45 feet into the ground and spaced 5 feet apart.



Fishing-Rod Wrapper

Wrapping a fishing rod is done in half the usual time with a semi-automatic machine that lays down any thread evenly, tightly and without bunching. It also ties the thread under automatically. The rod, supported by two uprights, is rotated by hand during the wrapping operation. If desired, two threads can be wrapped simultaneously. The machine can be used also for wrapping golf clubs and for fletching arrows.

Stray-Parts Auto Goes 130 M.P.H.

With 12 speeds forward and two in reverse, a high-powered car built by Walter Johnson, a mechanic of Akron, Ohio, zooms along the highway at 65 miles an hour in low gear. Johnson calls the car the "Mongrel 8" because it's made up of so many stray parts. In a test on the sands of Daytona Beach, Fla., Johnson cruised along at 130 miles an hour and believes the homemade auto is capable of 40 miles faster. The sleek body and fenders



are electric-welded. Johnson figures he has invested only \$200 in his creation, and has turned down an offer of \$5000 for the car.

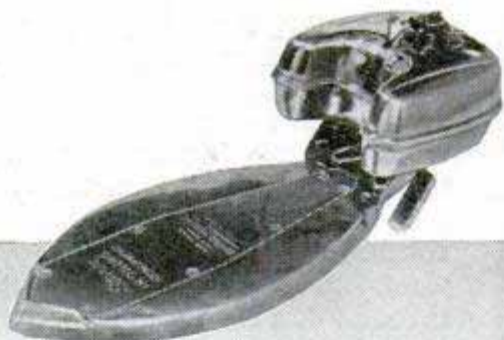


GLASS WALLS are made of two-pane units joined rigidly by an interlocking device. The panes, five times stronger than ordinary glass, fit in an aluminum frame and are used for inside or outside walls

STEAM CONVERTER consists of a tank and steam chamber. It changes "dry" electric iron to steamer

WHAT'S NEW *For Your Home*

Sources of supply for these products may be obtained from Bureau of Information, Popular Mechanics Magazine

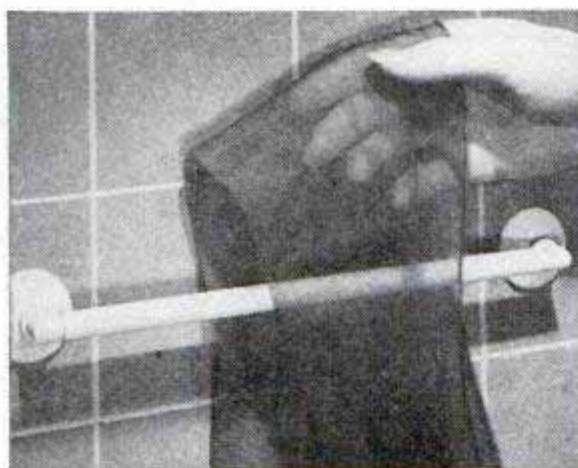


TEETHING RAIL lets the baby chew away on the crib rail without danger. The three-sided guard is formed of a smooth plastic that resists biting. It is easily slipped over the crib or playpen railing



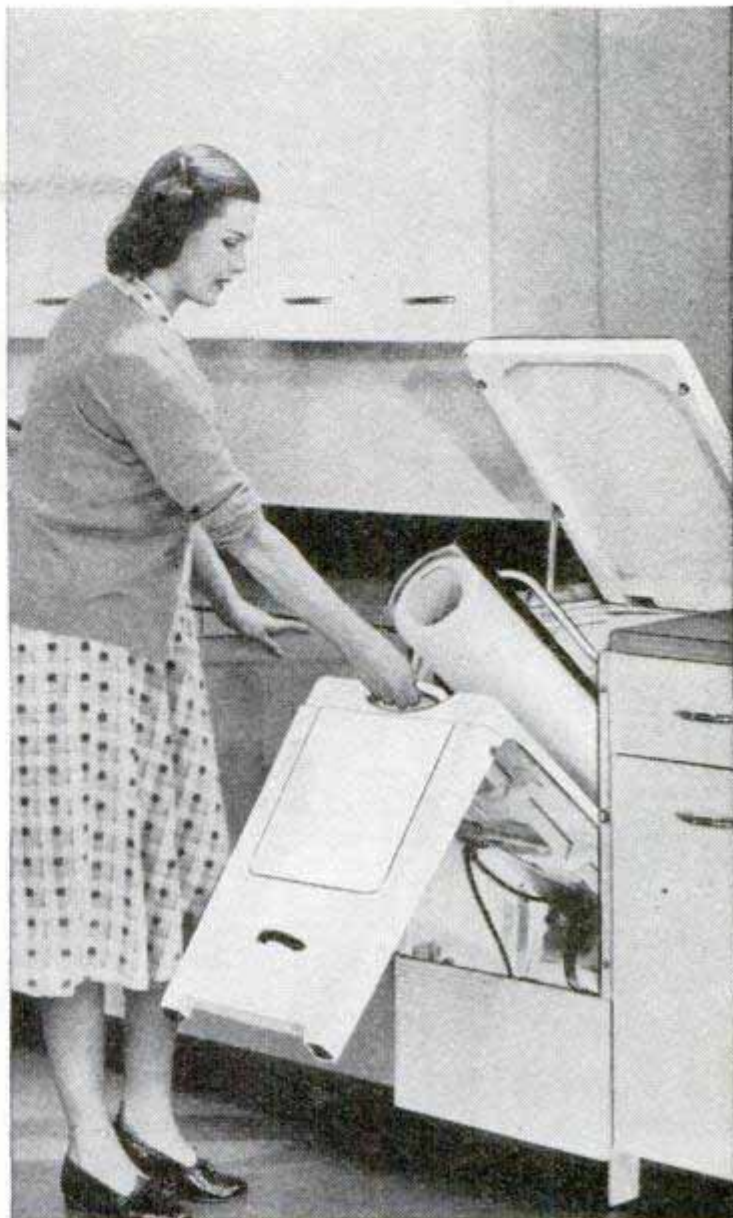
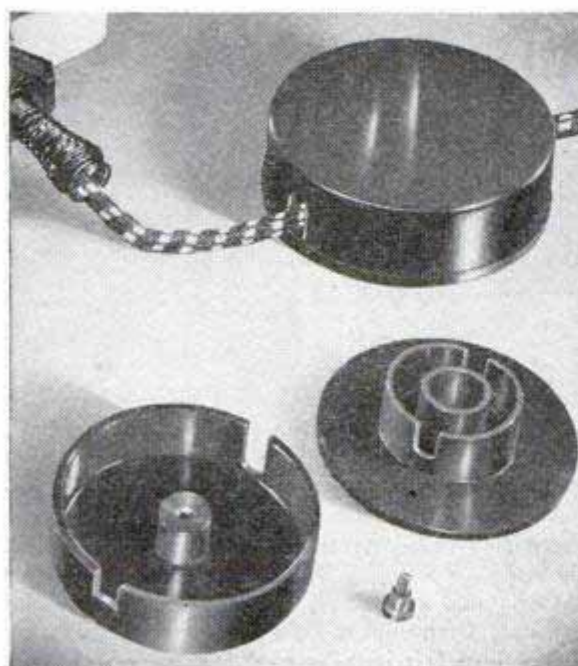


NONCLOGGING SHAKER assures free-pouring salt in damp weather. A chemical vial in shaker absorbs all moisture. When saturated, chemical turns pink and can be dried in oven



STOCKING RACK, made of snag-free Tenite plastic, is fastened to wall by suction cups

CORD REEL winds up excess wire between lamp and wall plug. It's molded of Bakelite plastic



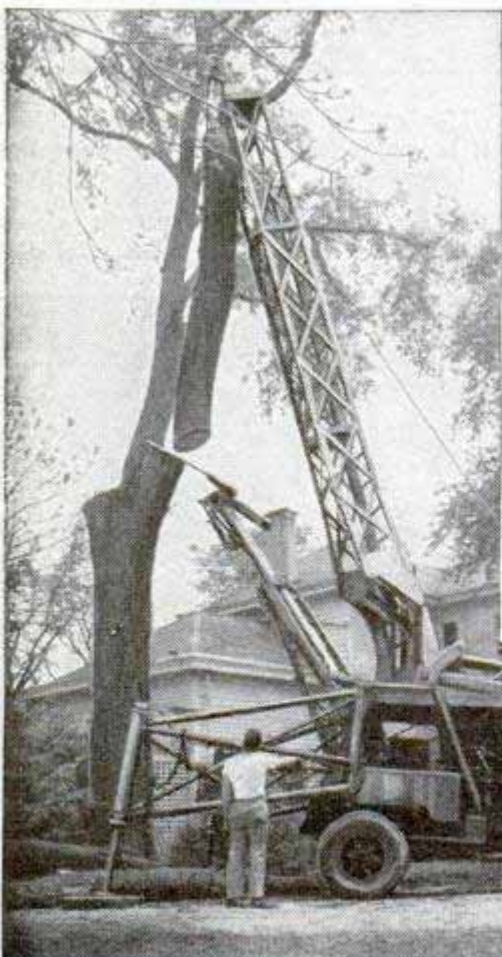
FOLDING IRONER slides out of sight in counter cabinet when not in use. It is counterbalanced for easy opening

THERMOSTATIC REGISTER for warm-air systems closes when room reaches the temperature set on the control dial



TREE CUTTERS

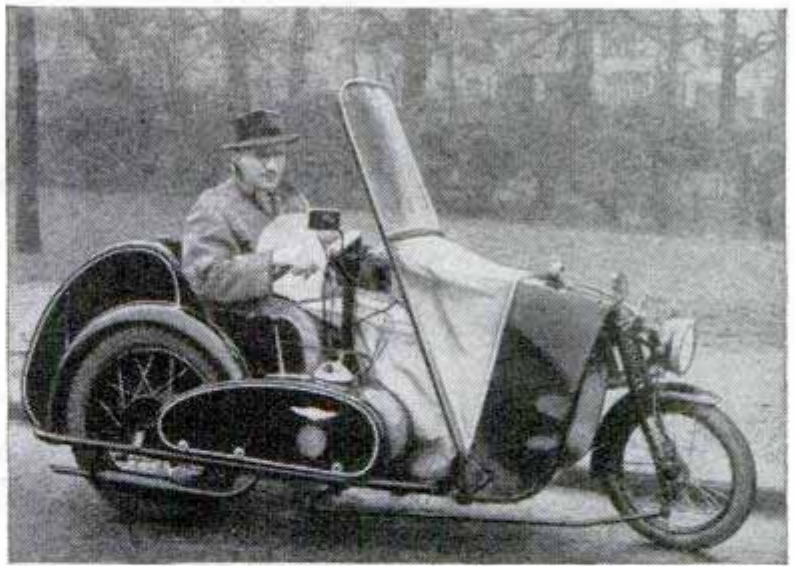
TREES are lopped off in sections and gently lowered to the ground by a hydraulic cutter which prevents damage to near-by buildings. The machine is used in Columbus, Ohio, to remove trees killed by the deadly disease called phloem necrosis. The operator wraps a steel cable on a boom around the upper part of the tree. The saw cuts through the upper branches, which are lowered by the boom. Lower sections of the tree are removed in the same way. An automobile engine operates the hydraulic pump which powers the cutter. A mechanical cutter in operation in North Carolina cuts through trees up to 40 inches in diameter, saws them into log lengths and loads them on a truck. The cutter is credited with producing 40,000 board feet of logs per day.



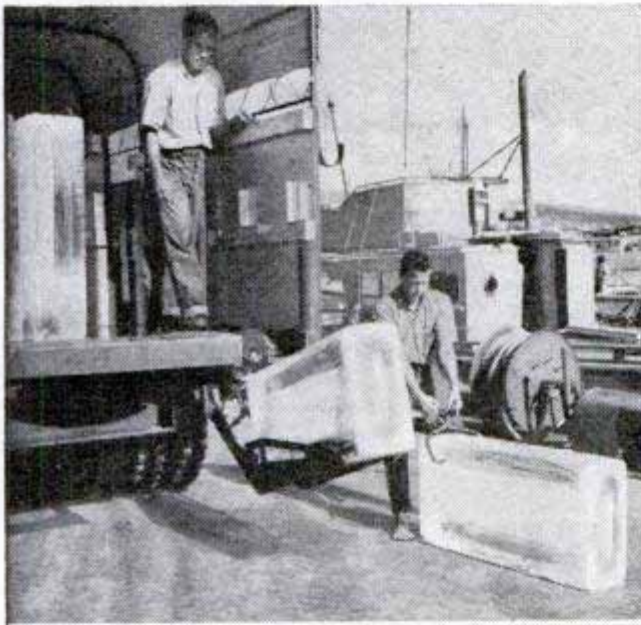
Top, operator climbs a ladder on the boom to wrap a cable around the top part of the tree. Left, saw is raised into position and cuts through one of the main branches, which is supported by the cable and boom. This section then is lowered gently to the ground to avoid damage to near-by buildings. Above, another cutter, used in forests, cuts a tree close to the ground. Then with the aid of the boom the trunk is cut into log lengths and loaded on a truck

Motorcycle for Invalids Has One-Hand Control

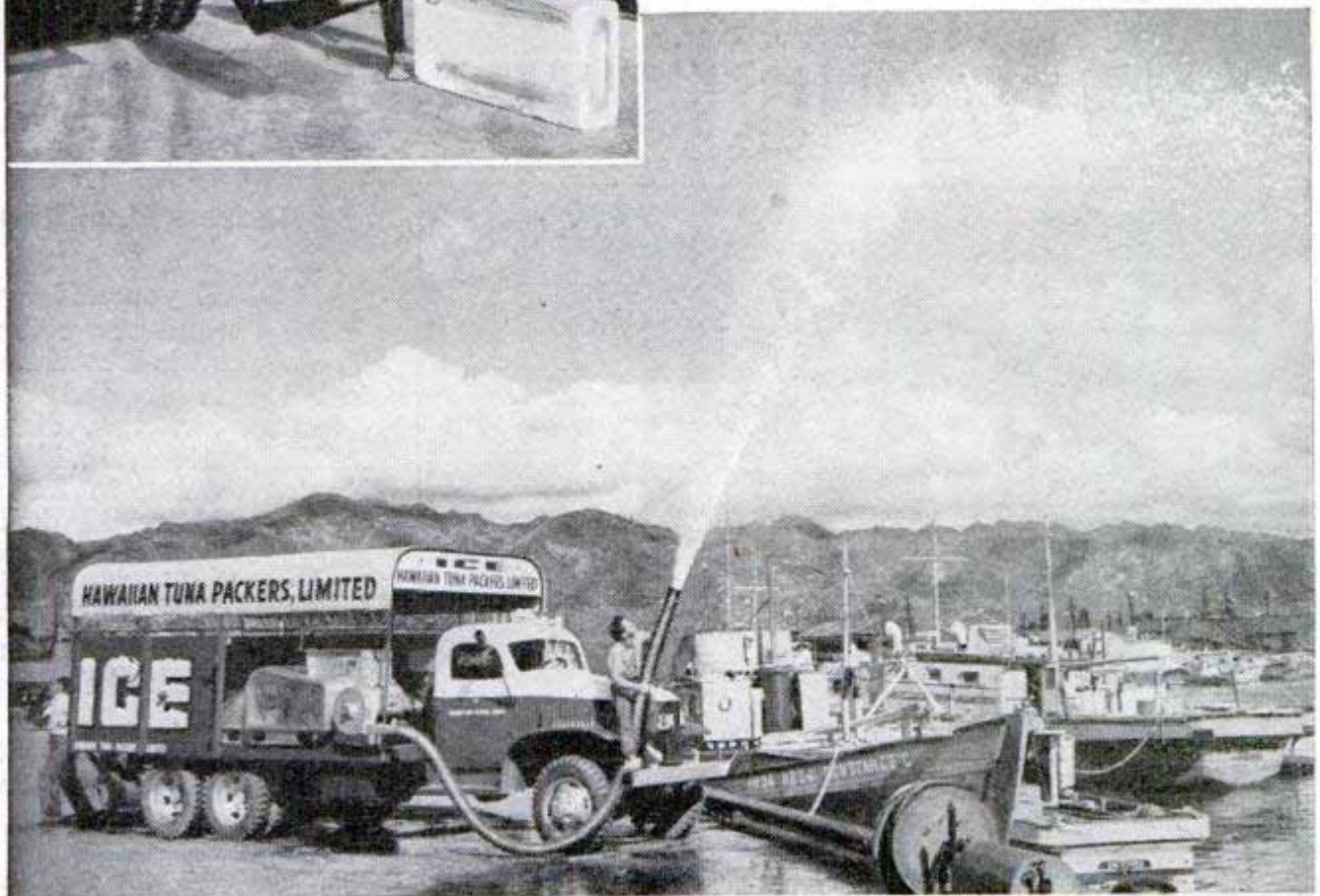
Designed for invalids, a British three-wheeled motorcycle has an ingenious control mechanism that permits driving with only one hand. Throttle, brake, clutch, gearshift and steering handle are combined in a compact control head. A gasoline engine is mounted in front of the right rear wheel and is completely enclosed except for the air-cooled cylinder head. The vehicle goes 80 miles on a gallon of gas and cruises at 30 miles an hour.



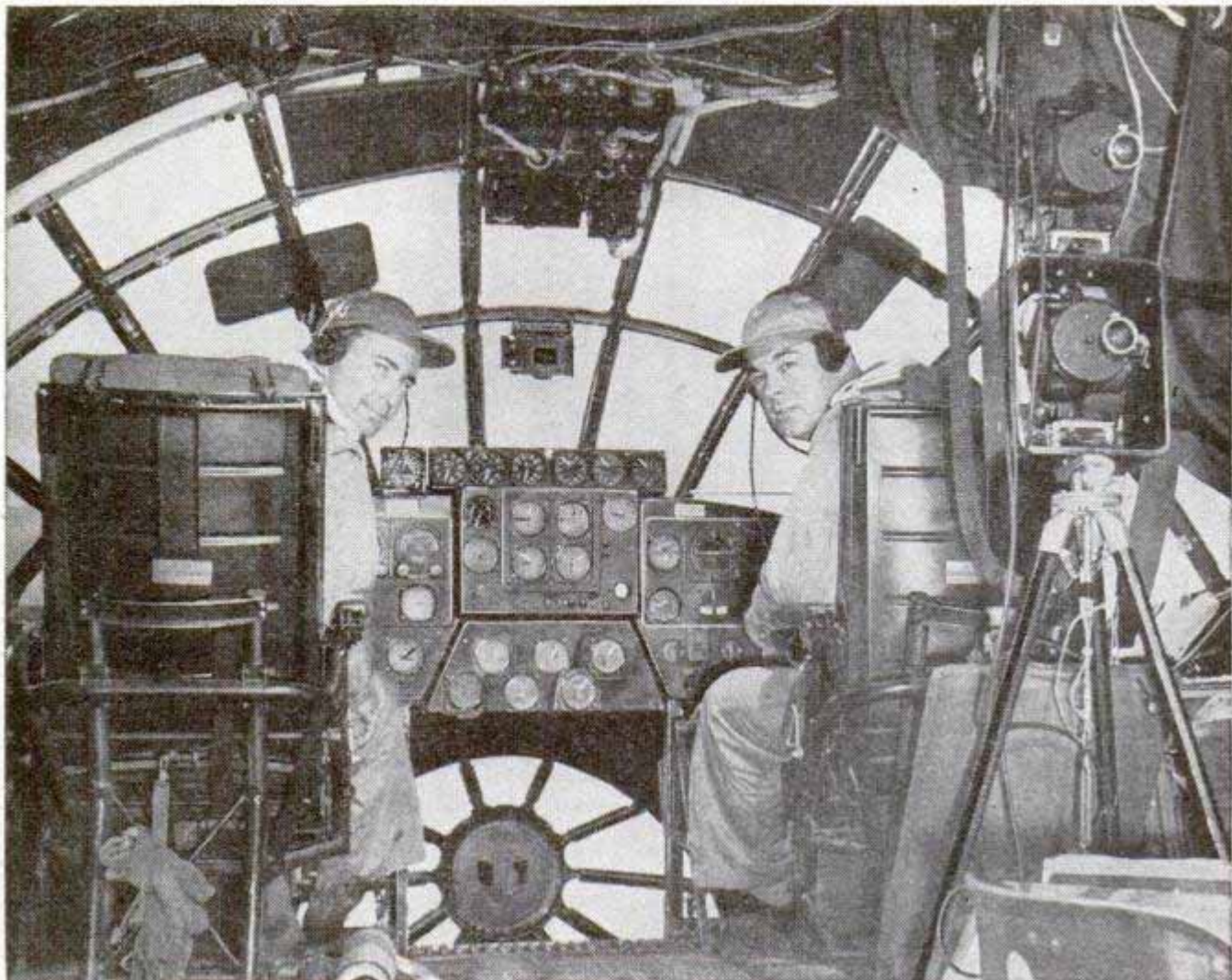
Mechanical Icedman Loads Fishing Boat in 15 Minutes



Icing a fishing boat, usually a three-hour operation, is done in 15 minutes by a combination truck and ice crusher used in Honolulu. The truck delivers 12,600 pounds of ice either in block form or as crushed ice piped into the hold. Blocks of ice weighing 300 pounds are lowered from the truck body to the ground by a hydraulic hopper. When crushed ice is needed, blocks are slid on a conveyor in the truck floor and automatically fed into the crusher. The crusher's revolving steel fingers grind 1300 pounds of ice per minute.



Crushed ice, 1300 pounds of it a minute, is forced through the pipe with enough pressure to send it into the air like a stream of water. Top, 300-pound blocks are unloaded from the truck by this hydraulic hopper



Consolidated-Vultee Aircraft photo

One of the biggest steps toward cockpit simplification is the instrument panel of the B-36, world's largest bomber

CONFUSION IN THE COCKPIT

Northrop Aircraft photo

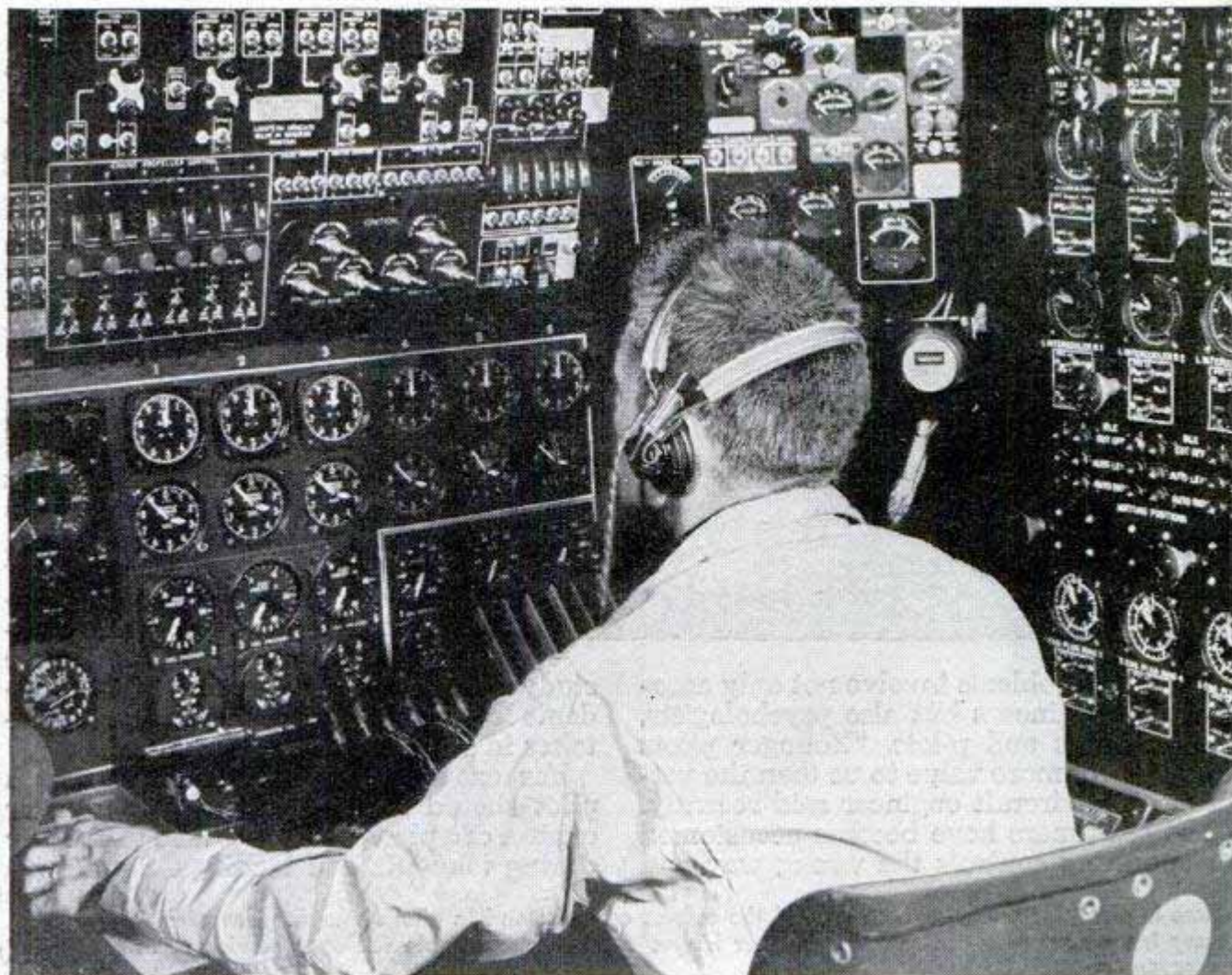


By Andrew Hamilton

IMAGINE yourself flying a brand-new plane. The cockpit is a mechanical jungle of gadgets—knobs, switches, dials, levers, buttons, handles. You're coming in for a landing. Where the devil are the flap controls? The brakes? The cutoff switch? You grab the book of instructions. But you can't make heads or tails of it....

A nightmare? Actually—no. But if it happened to you—yes.

With automatic aid, tiny stick in copilot's right hand flies a 104-ton Flying Wing. His left hand is on overhead throttles



Do you wonder if this man sees dials in his dreams? A B-36 engineer, he has to maintain a constant vigil over power output equal to that of five locomotives

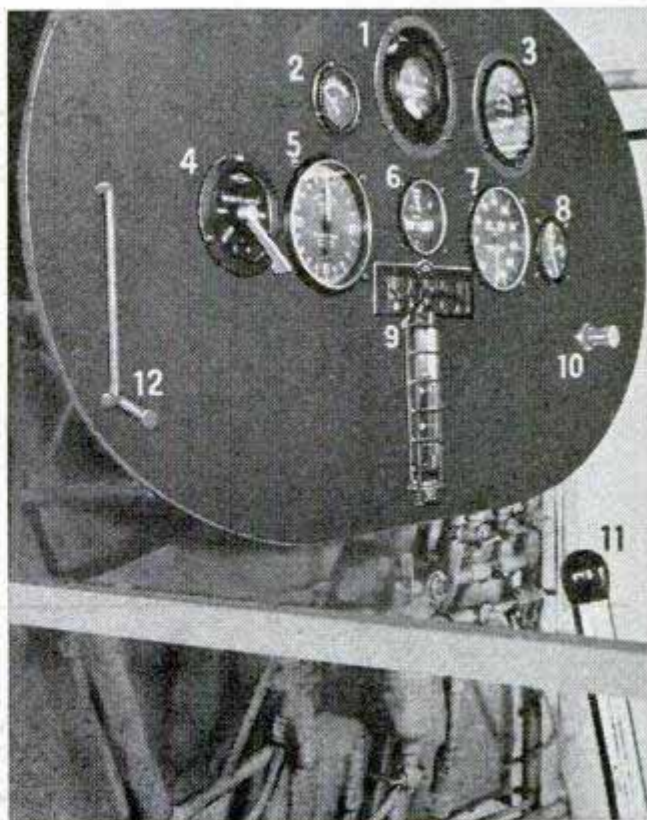
"It's happened to me," says Commander Norval R. Richardson of the research and development group of the Navy's Bureau of Aeronautics. "And I'm supposed to know cockpits!"

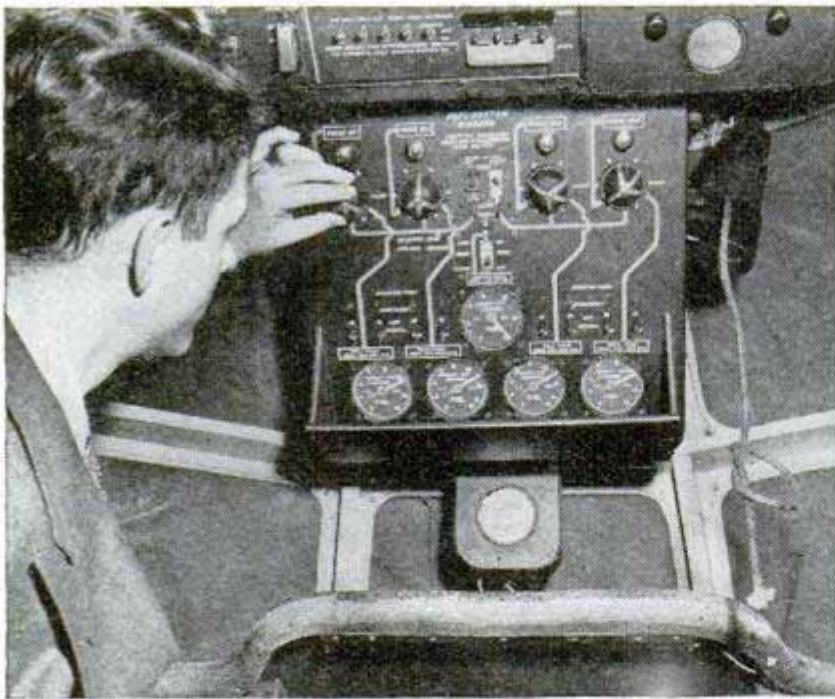
Situations such as this have spurred the Navy, the Air Force, the Civil Aeronautics Board and America's major airplane manufacturers to research on the twin problems of (1) making cockpit controls simpler and more efficient, and (2) increasing pilot comfort. Some day airplane cockpits may be as standardized as the dashboard of your automobile.

Cockpit research began during World War II when it was painfully evident that Army and Navy planes had too many controls, guns, radio sets, radars and other equipment jammed into too little space. Some 3000 to 4000 persons worked on Navy cockpits alone and they developed more than 100 mockups and remockups.

Today the work is continuing. Jet planes present a majority of the old cockpit problems—and many new ones. Some of the former instruments have been removed, some additional added. The net result is still confusing.

Lindbergh made his famous solo ocean crossing with just these instruments: (1) compass, (2) oil-pressure gauge, (3) altimeter, (4) magneto switch, (5) tachometer indicating propeller r.p.m., (6) bank-and-turn indicator, (7) air speed, (8) clock, (9) inclinometer, (10) gas pump, (11) control stick, and (12) throttle





One of the newest cockpit additions, this panel keeps flyers informed on fuel flow during transfer operations

don't like to change. A youngster can tell in a minute if a control doesn't 'feel' right."

The basic principles of cockpit design were developed by the trial-and-error method. Engineers would stumble on a basic principle without knowing it. Then they'd backslide on later cockpits before they were aware that a new principle had been discovered. What was most disconcerting was that flyers had been using badly-designed cockpits for years, which probably explains many crashes and combat losses. One Air Force

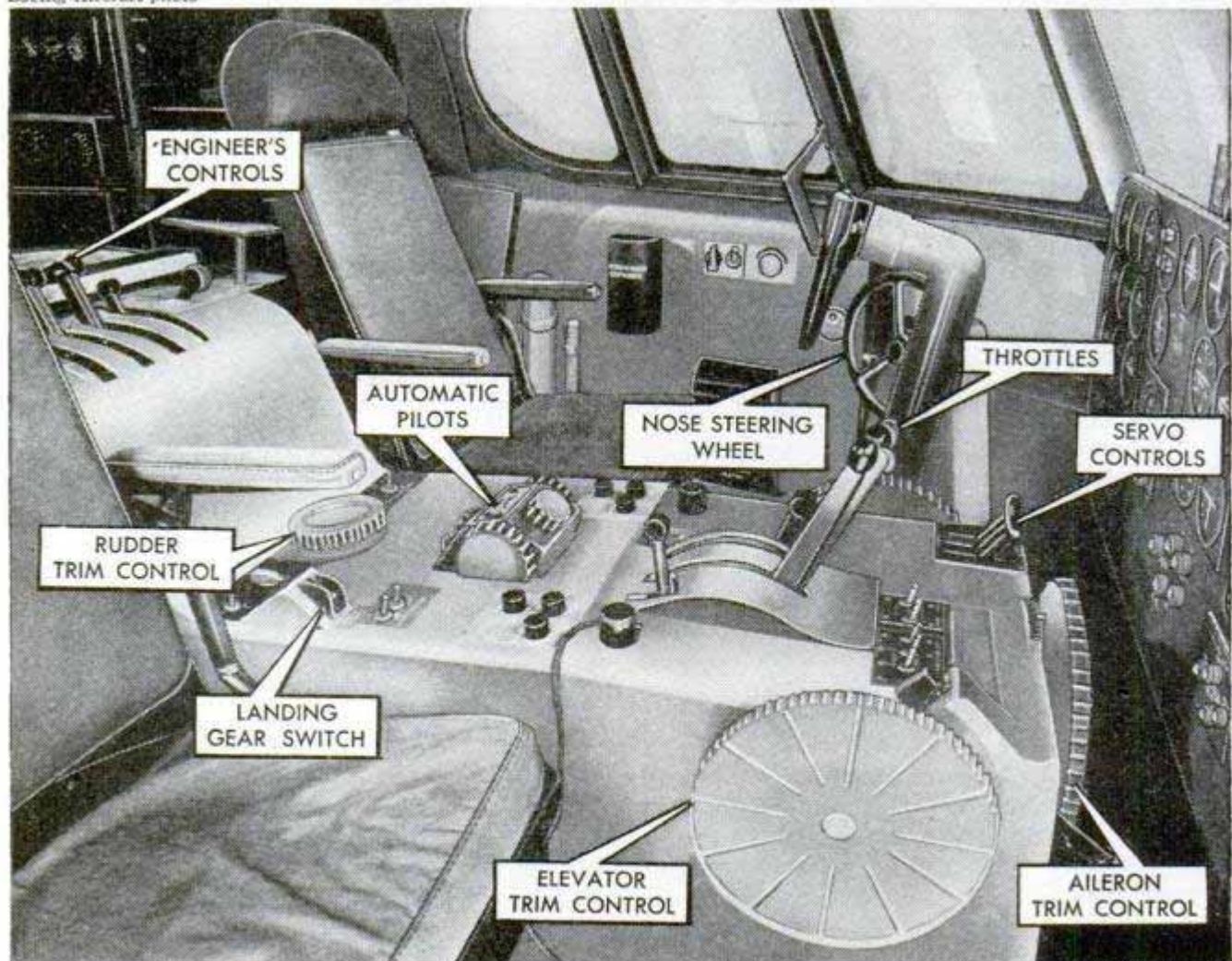
Cockpit problems involve not only aeronautical engineers but also psychologists, physiologists and pilots. "Younger pilots are often of more value to us than the veterans," an aircraft engineer said recently. "The old-timers have become accustomed to operating controls the wrong way and

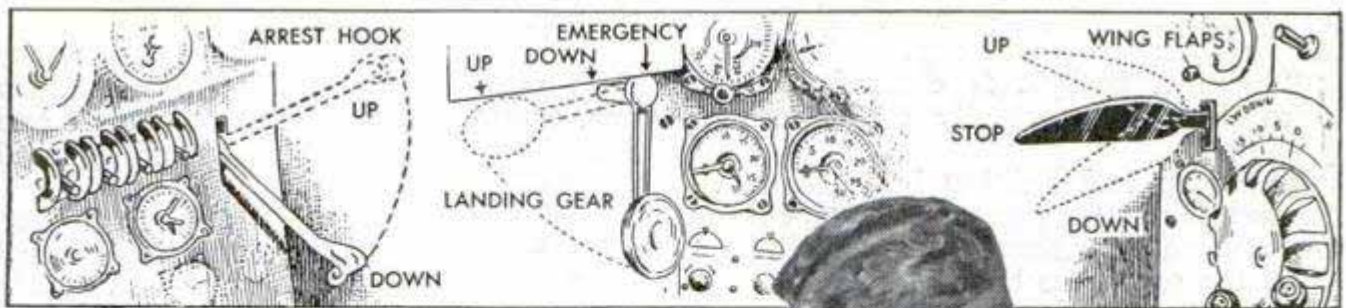
study revealed that 50 percent of the accidents laid to "pilot error" were due to mistakes in selecting the right control.

For example, engineers learned that a pilot should not be required to transfer control of a plane from one hand to another during take-offs and landings. Same with

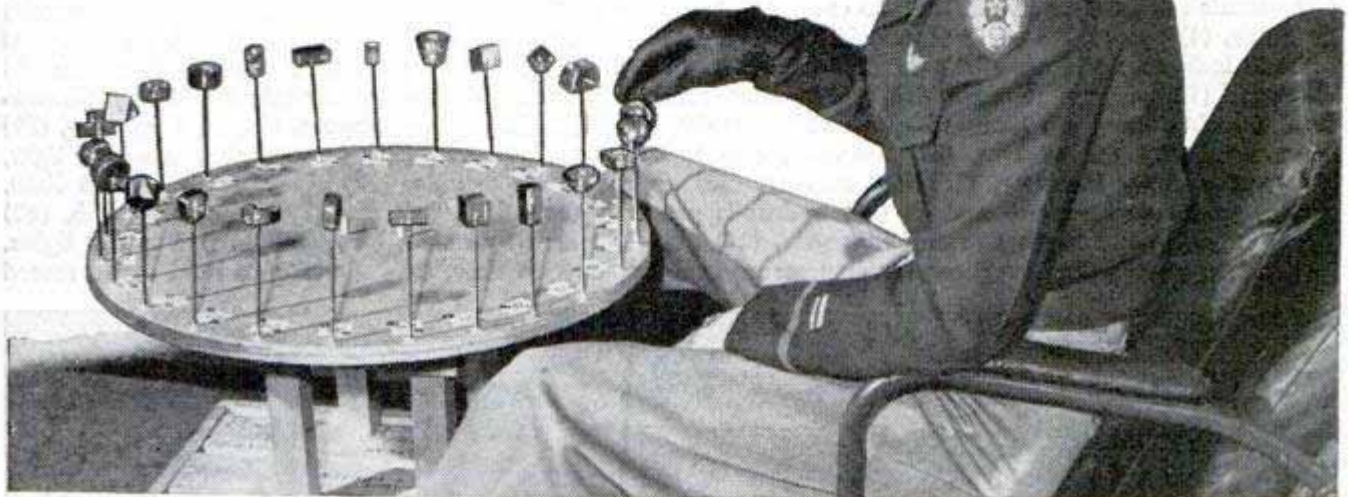
There is plenty of working room around the central control stand in pilot's compartment of a Stratocruiser. Every instrument panel in the plane either hinges out or is removable for easy servicing "in the open"

Boeing Aircraft photo





To learn which instrument-handle shapes are easiest to recognize, designers give blindfold tests to Air Force pilots. One of their principal objectives is to make levers look like the part they actuate and, as much as possible, to have them move in the same way. Sketches show how Douglas Aircraft applied the idea in designing a new carrier-based dive bomber



transfer of vision. In many planes a pilot had to wrench his eyes away from the runway and look into the cockpit to find the control he wanted. A few years ago a Navy flyer washed out a dive bomber at Roosevelt Field when he took his eyes off his landing, mistook a golf fairway for the strip and ended up in a bunker.

For many years there was no rhyme or reason for the way many important controls operated. For example, the prop control was mounted on the aft end of the power-control quadrant and moved up and down, rather than forward and backward. The mixture control was another offender. Some planes actually had the "idle" cut-off position at the forward end—just beyond the "full rich" position. In other words, if you pushed all controls forward for a take-off you would cut your fuel.

Some of the most important advances in cockpit controls have been developed by engineers at the El Segundo (Calif.) Division of Douglas Aircraft, and incorporated in the Navy's newest dive and attack bomber, the AD Series Skyraider.

Three principles were followed: (1) the control should, as much as possible, look like the part of the airplane to which it is connected, (2) the control should move in the same direction as the part, and (3)

the control should be placed as nearly as possible in a corresponding position in the cockpit to the place of the part it controls on the plane.

For example, the lever that lowers the arresting hook looks like an arresting hook. Flap controls resemble and work like landing flaps. The landing wheel lever is equipped with a small plastic tire and shock-absorber strut.

With devices like these, recognition is almost instinctive. Or, as Li'l Abner puts it—"as any fool kin plainly see." It goes further. A pilot doesn't even have to look. He can feel the control and know that it is the right one.

Older and slower aircraft gave a pilot time to perform his relatively few tasks. With the increase in instruments, and speed, it was necessary to ration a pilot's time. Power-actuated devices were substituted for manual controls; a flick of a switch held the instrument through its cycle of operation with no additional effort on the part of the pilot.

Records show that many pilots would have survived crashes if their heads had not been banged against gun sights, instrument boards and other hard objects. Engineers are still attempting to remove or recess knobs, cotter keys and levers.

Attention is being given to body clearances for head, knees and elbows.

"When a cockpit is cleaned up and streamlined, it's actually easier to fly," pilots say.

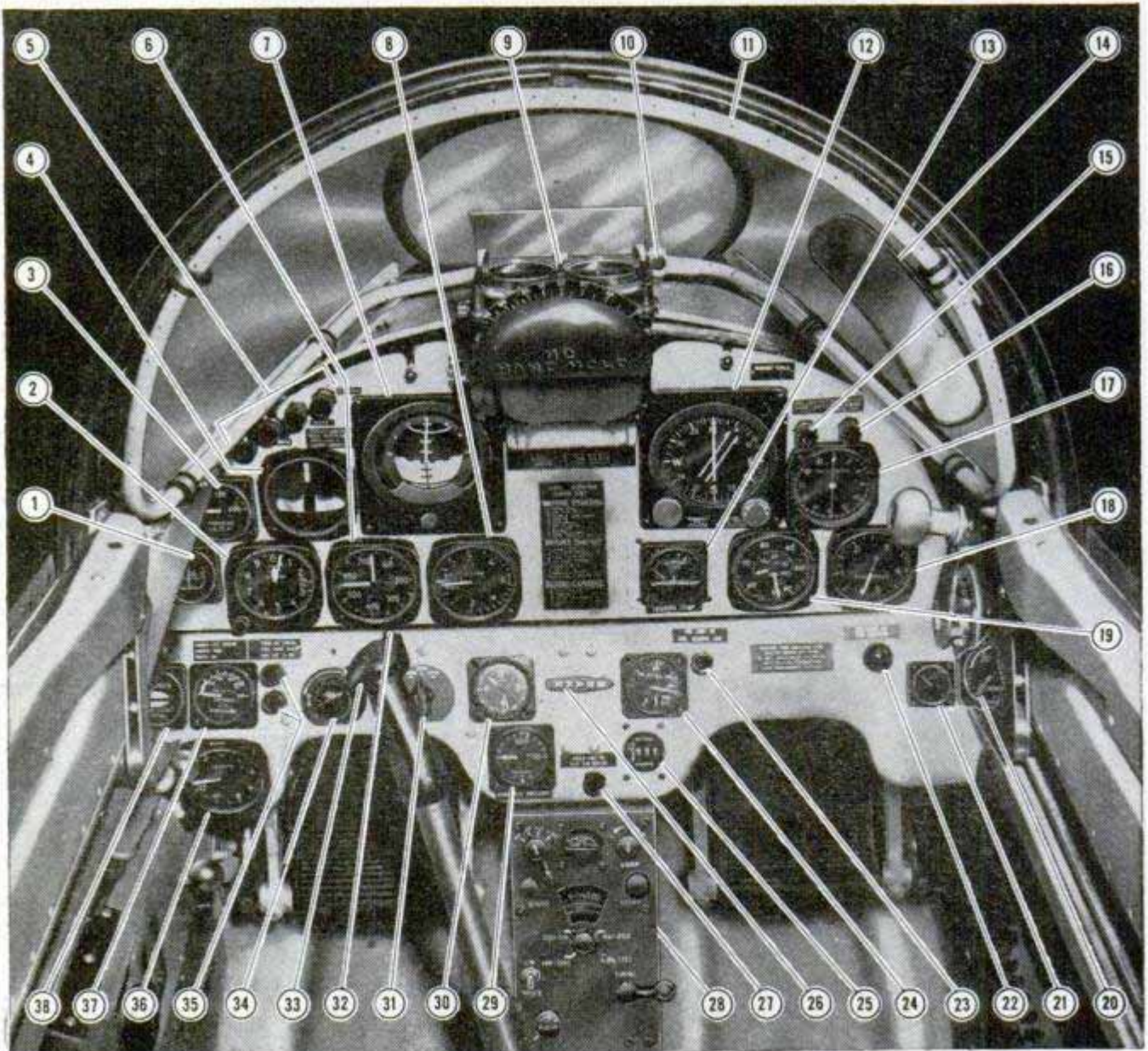
Lettering and lighting have been improved. During the war, fluorescent lighting around instruments eliminated glare. Now the engineers have gone a step farther. Indirect red lighting has increased pilots' night vision. A flyer can look from his instruments into the night sky with practically no adjustment of the pupils.

Interesting developments are being made with plug-in instruments. The base is sim-

ilar to that of a radio tube. If an altimeter should get out of whack in mid-air, the pilot merely pulls it out and plugs in a new one. Plug-in instruments are smaller and are said to produce a saving of 25 to 50 percent in panel space.

A new instrument, the Mach meter, came into being as planes moved toward the speed of sound. One of its first known uses was on the Lockheed P-38. With two hands that are operated by impact and static pressure, it is preset to warn the pilot when his plane nears its particular maximum safe speed. Beyond that, shock waves may break the craft into pieces.

One man, traveling about 10 miles a minute, has to keep himself constantly aware of the information all these instruments relay. They are, in jet P-80 cockpit, (1) standby compass, (2) altimeter, (3) fluid-injection pressure indicator, (4) turn-and-bank indicator, (5) landing-gear warning lights, (6) air-speed indicator, (7) universal altitude indicator, (8) rate-of-climb indicator, (9) gun sight, (10) windshield-defroster valve, (11) windshield defroster, (12) gyrosyn compass, (13) tail-pipe-temperature indicator, (14) rear-view mirror, (15) gyro-instrument warning light, (16) turn-and-bank-instrument warning light, (17) radio compass, (18) fuel pressure, (19) tachometer, (20) oil pressure, (21) ammeter, (22) fire-warning indicator, (23) fuel-quantity warning light, (24) fuel-quantity indicator, (25) fuel counter, (26) parking-brake handle, (27) elevator-tab neutral light, (28) radio-compass remote control, (29) hydraulic pressure, (30) clock, (31) gun-sight selector switch, (32) bomb-dropping switch, (33) control-stick grip, (34) gun-sight reticle dimmer, (35) fuel-pump warning lights, (36) accelerometer, (37) oxygen-cylinder pressure and (38) oxygen flow. This plane once held speed record



The safe maximum varies with altitude and is gauged by the ratio of true air speed to the speed of sound. For example, the Mach number reached by Maj. Marion Carl of the Marines when he set a world's speed mark of 650 miles an hour was .831, or .169 short of the speed of sound at the altitude at which he flew. Since indicated air speed decreases with altitude and the Mach number increases, the instrument is vital for safety in 600-mile-an-hour planes.

Streamlining today's high-speed planes involved juggling the position of a plane's windshield. The ideal windshield, aerodynamically, would be that parallel with the air stream. On the other hand, the ideal position from the point of view of the pilot—who wants to see where he's going and what's coming—would be perpendicular. So a compromise of about 35 degrees has been necessary.

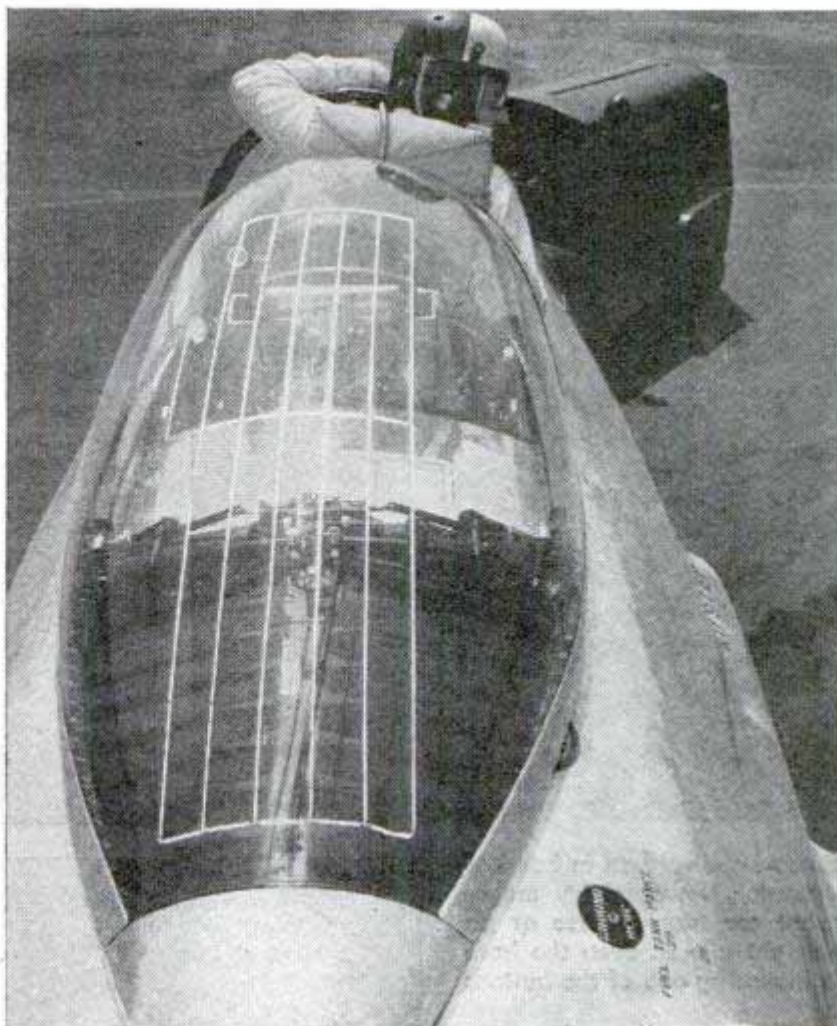
Cockpit-design studies have been made on the distance between a pilot's eye and the windshield. It has been found that an increase in this distance rapidly reduces the field of vision and aggravates interference of dirt, fog and other matter on the glass.

Another improvement being incorporated in Army and Navy experimental aircraft is a single control for adjusting both rudder pedals simultaneously. The potential hazard of unequal adjustment through individual controls has long been recognized. British, German and Japanese planes during the war used a single adjustment device, American planes did not. Now they're getting them.

Even the color scheme of cockpit interiors is receiving serious study from aircraft engineers in the interest of safety. Factors that enter into this phase of design are night vision, minimum windshield glare from reflection, adequate cockpit illumination, maintenance conditions and—in line with the trend toward more consideration for the man who has to sit in that cockpit—the psychological effect on the pilot.

For the flyer who says, "I don't care about the color scheme, just give me a comfortable seat," there is also

(Continued to page 224)



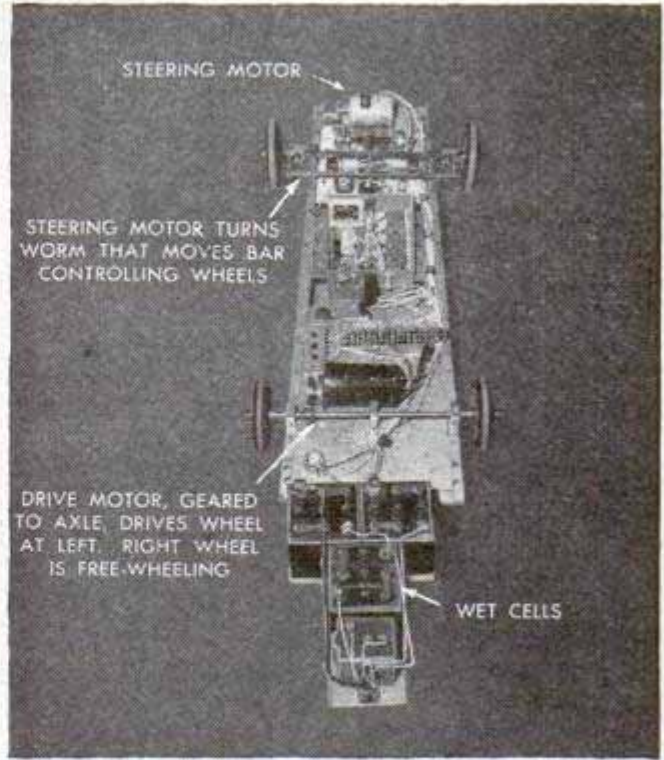
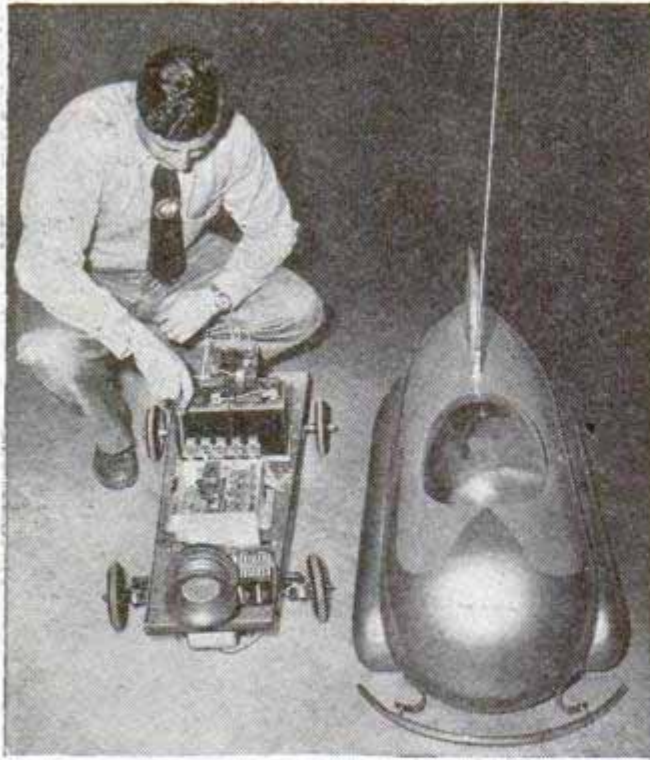
Lockheed Aircraft photos

To cut down drag, radio-antenna wires were built right into the bubble canopy of a speedy P-80

A late-comer, Mach meter (center) tells jet pilot when he nears the preset maximum safe speed

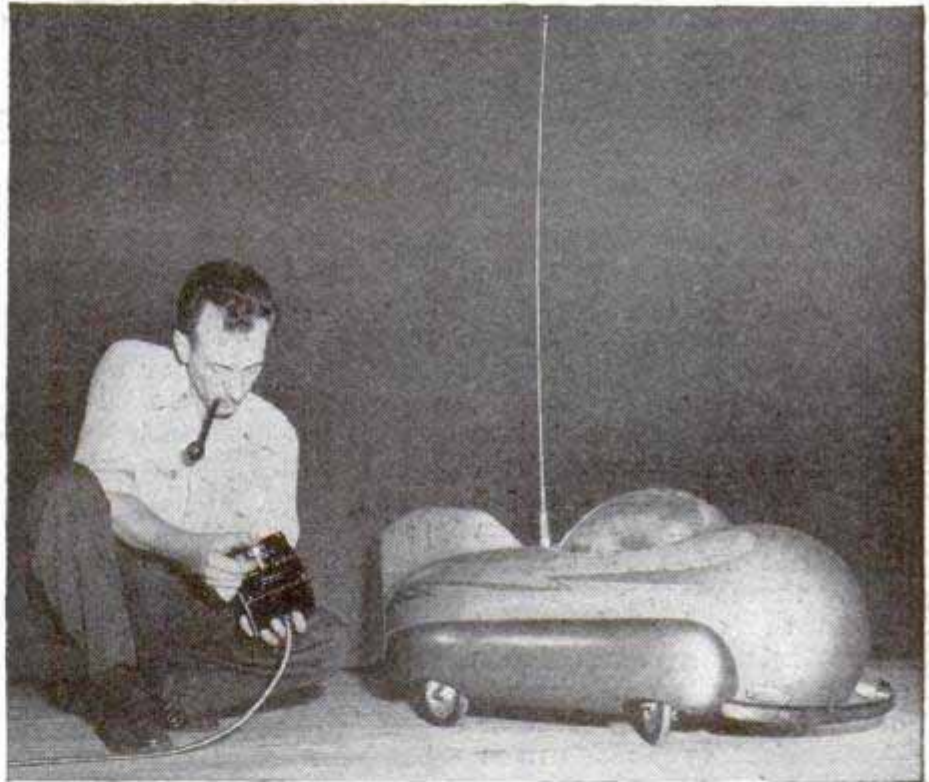


Radio-Control Box Dictates Every Move of Miniature Robot Auto



Remote-control box in hand of operator, lower right, makes robot car turn, reverse or go straight ahead. Even the horn is blown by one of the buttons

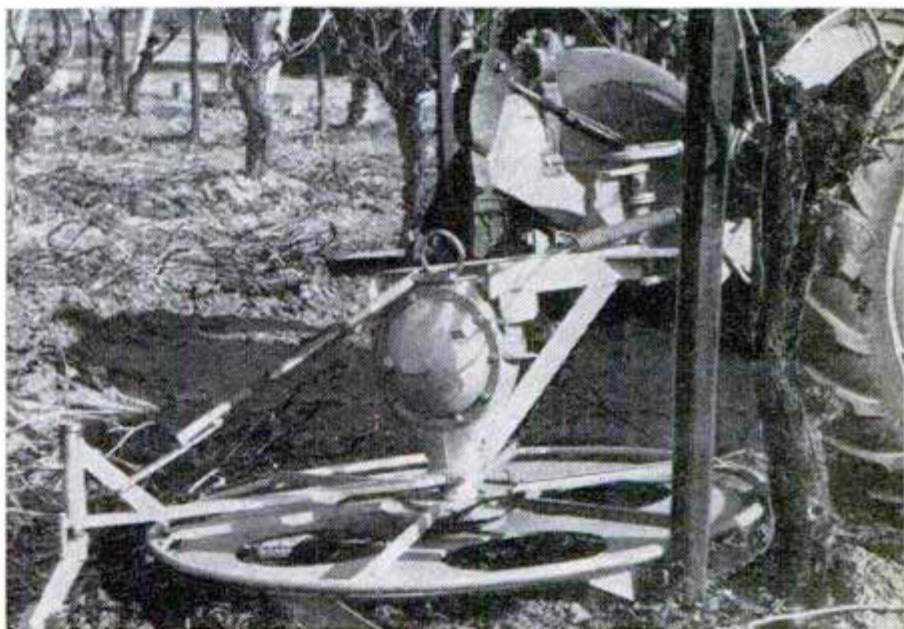
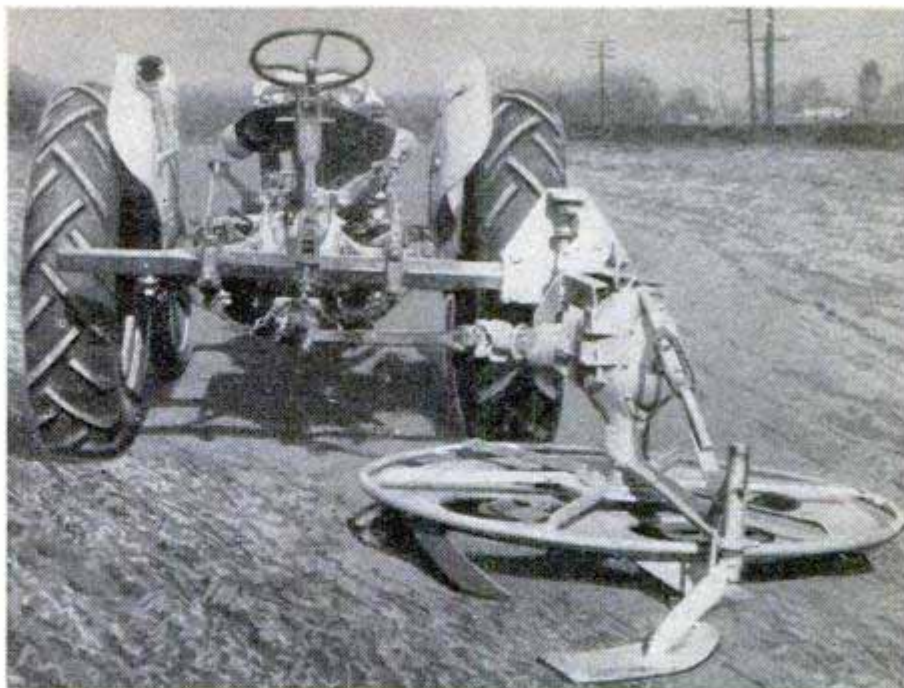
"Electron," a futuristic miniature robot automobile, sounds its horn and maneuvers like an ordinary car in response to radio directions flashed to it by its operator. The car was built by Dick Glotch, radio mechanic at Mare Island Navy Base, Calif., to demonstrate the principles of radio control. Aside from a specially built body of aluminum and Plexiglas, all the parts used are available from war-surplus materials or other general sources. The car is guided straight ahead, made to turn left or right, back up or stop, or sound its horn by means of a remote-control box attached to a small radio transmitter. Each position of the control-box switch causes the transmitter to radiate at a different frequency. The car's radio receiver has selective amplifiers each tuned to match one of the frequencies radiated by the transmitter and each is connected by relays to the electric motor that performs the desired maneuver. Wet cells supply power to the motors and horn and also serve as the radio receiver's



A-battery. It uses a one-wheel drive to avoid differential problems. The front wheels are turned in either direction by starting or reversing the motor that drives a worm gear connected to the wheels. Glotch has maneuvered his car from a distance of several hundred feet and estimates that the range of the radio control is more than a mile. He is working now on a fluid-drive model equipped with headlights that will turn on when the car is in motion and a taillight that will operate when the car is backing.

Revolving Plow "Hugs" Plantings

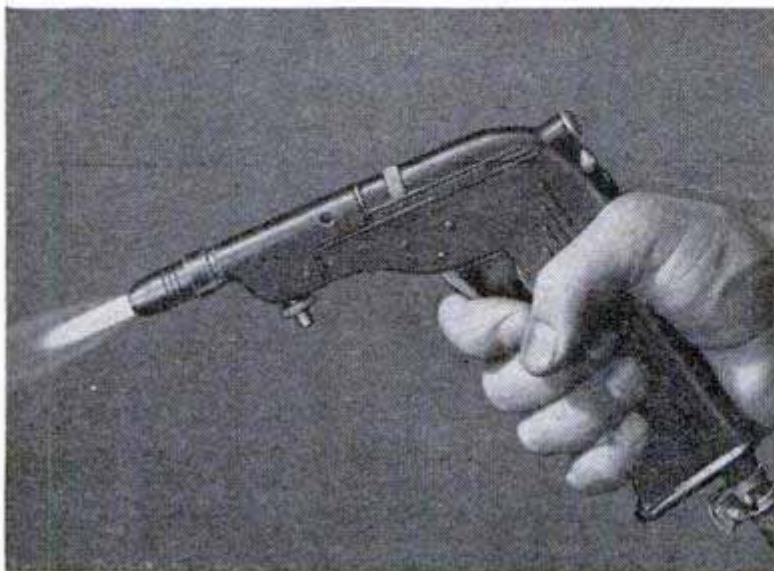
Vineyard and orchard farmers can do the work that formerly required three separate tools with a new rotary power cultivator. The tractor-pulled cultivator makes it possible for one man to plow close to trees and vines without damaging them. Ordinarily, vineyards and orchards were plowed, then cultivated with a French plow and finished with a circle harrow. The new cultivator performs all three operations at once. It consists of a revolving blade holding six small plows. A circular guard bar keeps the blade away from vines or trees. The blade is revolved by the power take-off from the tractor. It leaves a smooth mulch about three inches deep.



Synthetic Resin Aids Paper Makers

Short-fibered wood, such as poplar, beech, maple and birch, may soon provide a new source of paper, the National Bureau of Standards has announced. A synthetic resin, developed by the bureau, greatly strengthens paper made from these woods. Without this resin, such paper breaks down under the beating process used to develop good

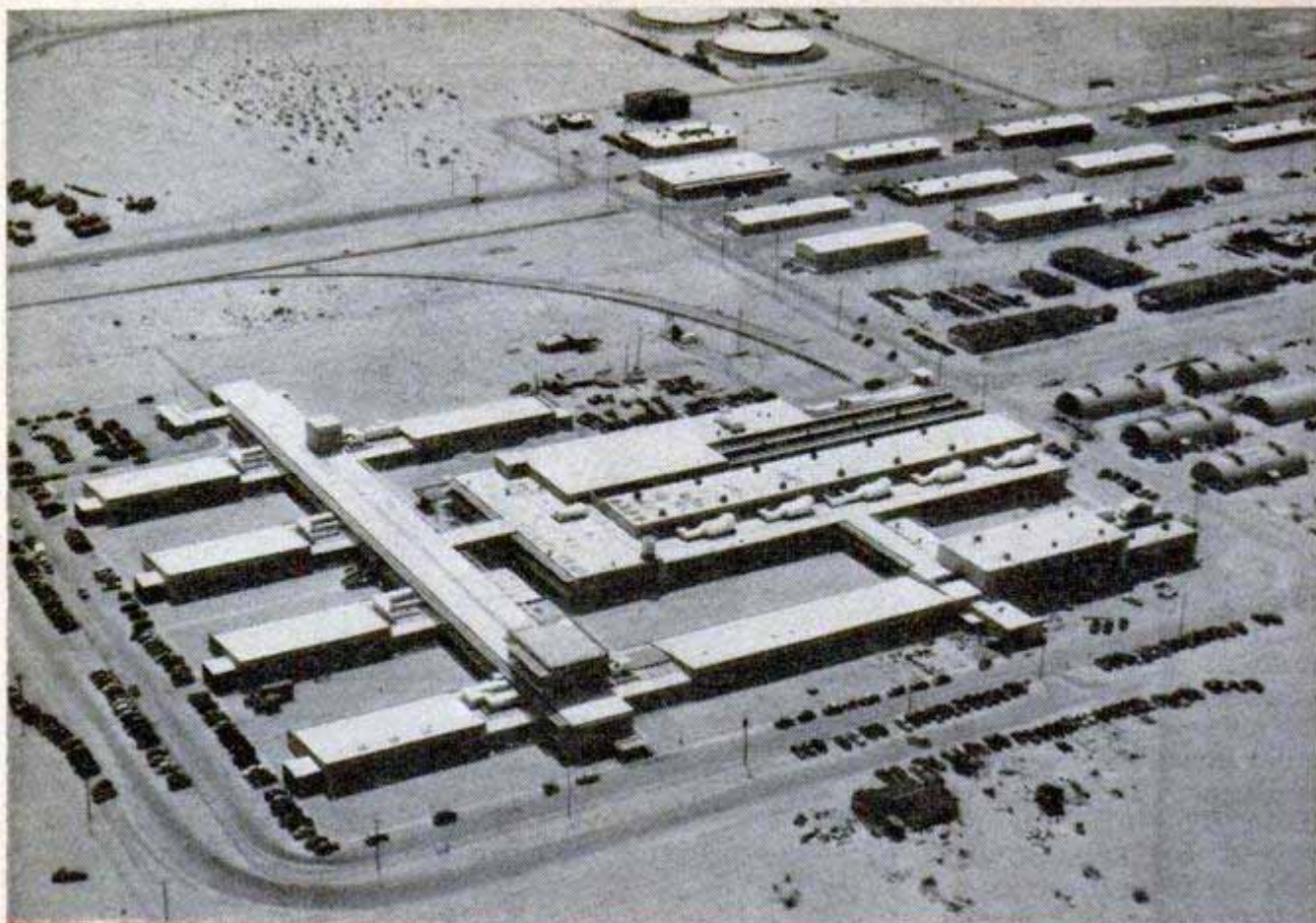
bonding. The new synthetic, melamine-formaldehyde, may increase the use of short-fibered wood, which grows abundantly in the Northeast, by 75 percent.



Automatic Acetylene Torch

Because it has an automatic lighting and extinguishing mechanism that is trigger-operated, a pistol-grip acetylene torch saves time and prevents wasting of gas. Designed for use with acetylene gas, the automatic torch weighs only 12 ounces. Its pistol grip makes it easy to operate in places difficult to reach. Interchangeable combustion tubes, nozzles and extension tips are available.

☐ Chocolate-scented ink was used in a Memphis, Tenn., newspaper to print a cake advertisement.



The huge new Michelson Laboratory, heart of the Naval Ordnance Test Station in the Mojave Desert

The Navy's Incredible Eye

Most amazing of a houseful of miracles at the missile laboratory on a California desert is a camera that blinks its eye for a hundred-millionth of a second



OUT OF the barren vastness of California's Mojave Desert has come a photographic miracle—a camera that takes a picture in a hundred-millionth of a second! Invented by Dr. A. M. Zarem of the Naval Ordnance Test Station, the camera is 25,000 times faster than any movie camera commercially available.

But this super-speed camera is only one of many miracles being produced at the Michelson Laboratory, newest addition to the station. Roughly equal in size to the state of Rhode Island, the inland naval base was created in 1943 as a rocket-testing range. It has grown until now it is one of the world's most complex research centers.

Completely self-contained, the scientific community is also one of the world's most modern cities. The heat and dry-

Internal partitions of the laboratory are movable to add flexibility to its 7½ acres of floor space

ness were given a knockout punch by twentieth-century engineering. Every building, including homes for 12,000 residents, is air conditioned.

At present, the community has 2000 permanent buildings, ranging from the sprawling Michelson Laboratory to the streamlined corner grocery. Residents include families of 3800 civilian employees and 1000 naval personnel. Civilians and service personnel combine talents in research on rocket weapons, guided missiles and aviation ordnance. The super-speed camera will be used to record rapidly moving phenomena in these fields.

Principal facility at the station is the Michelson Laboratory. Built at a cost of \$8,000,000, the laboratory has 7½ acres of floor space, all air conditioned. All air entering the building is filtered twice. Windows are sealed. Every entrance is a double-door type providing an air lock between the inside air and the desert atmosphere. Completely insulated, the building is a comfortable oasis in the desert.

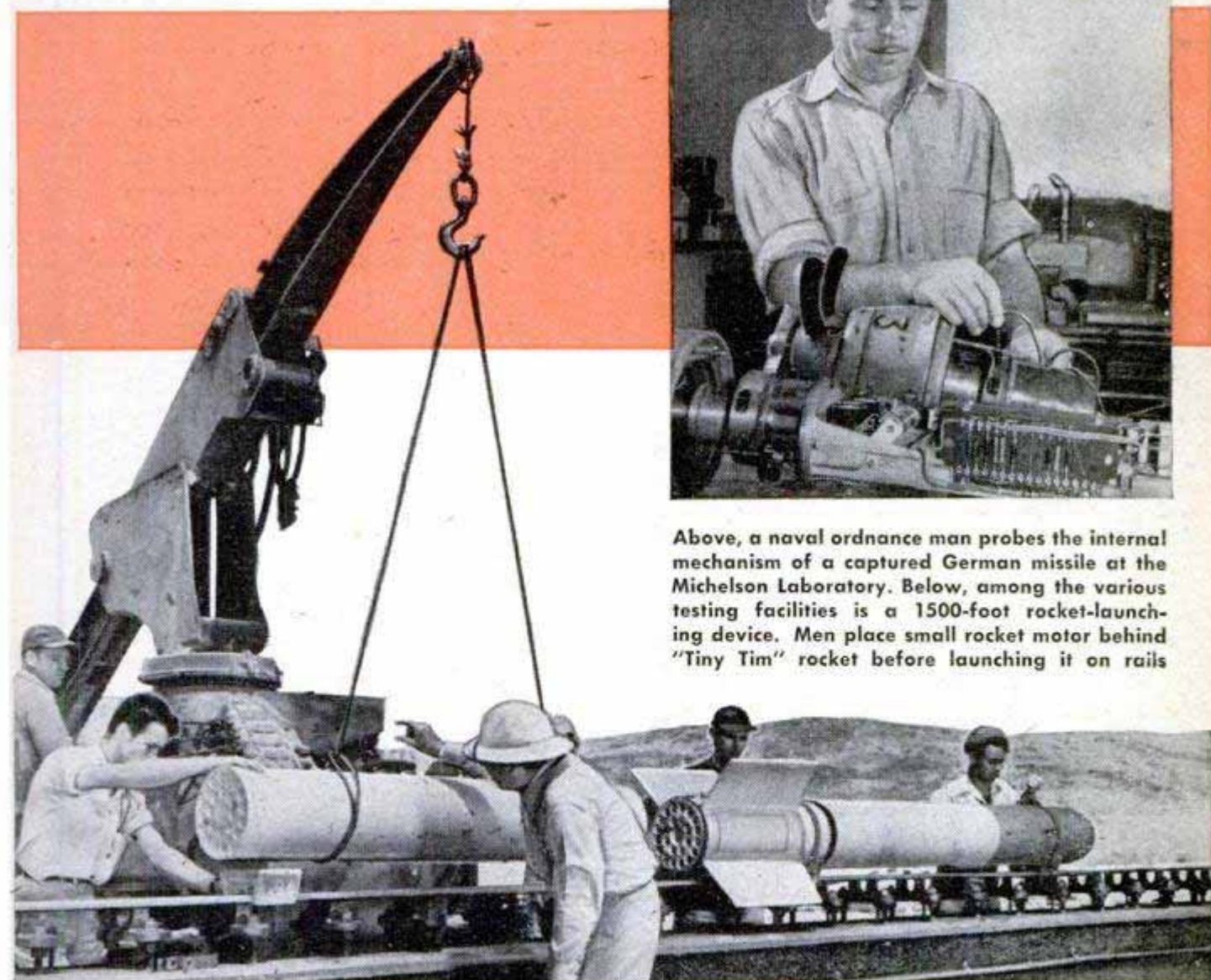
On the next two pages are details of the super-speed cameras, the Navy's new research tools.

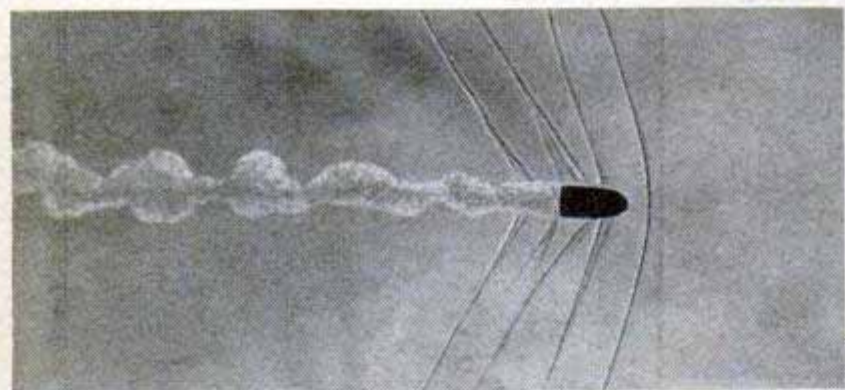
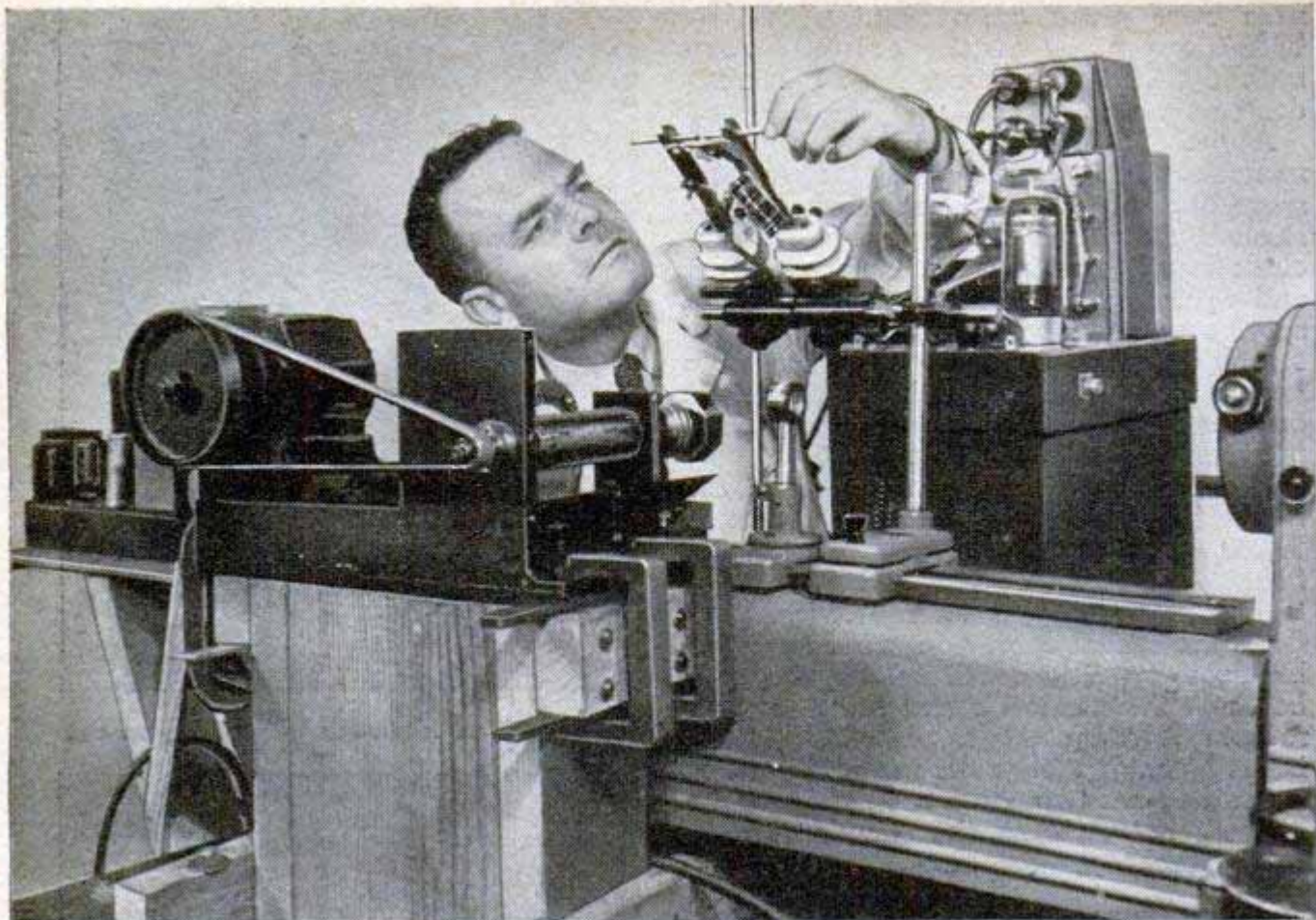


Fuse technician is protected by this nylon suit



Above, a naval ordnance man probes the internal mechanism of a captured German missile at the Michelson Laboratory. Below, among the various testing facilities is a 1500-foot rocket-launching device. Men place small rocket motor behind "Tiny Tim" rocket before launching it on rails

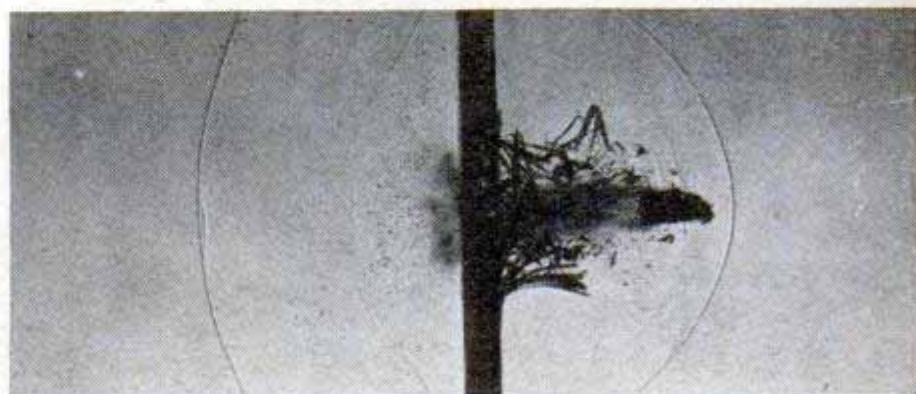
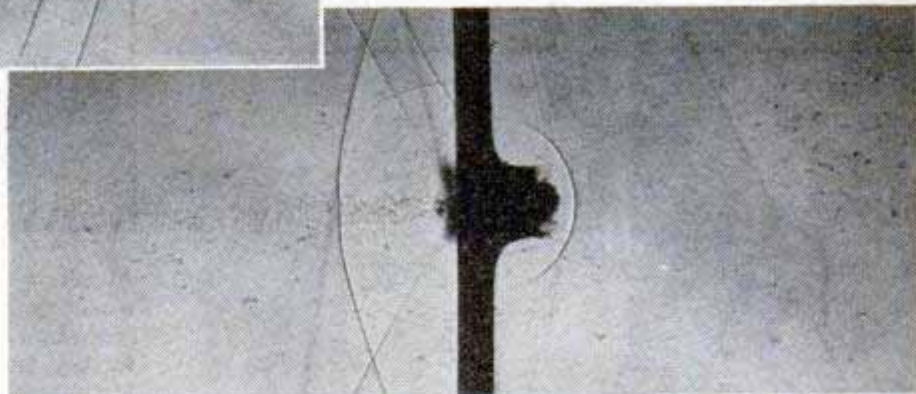


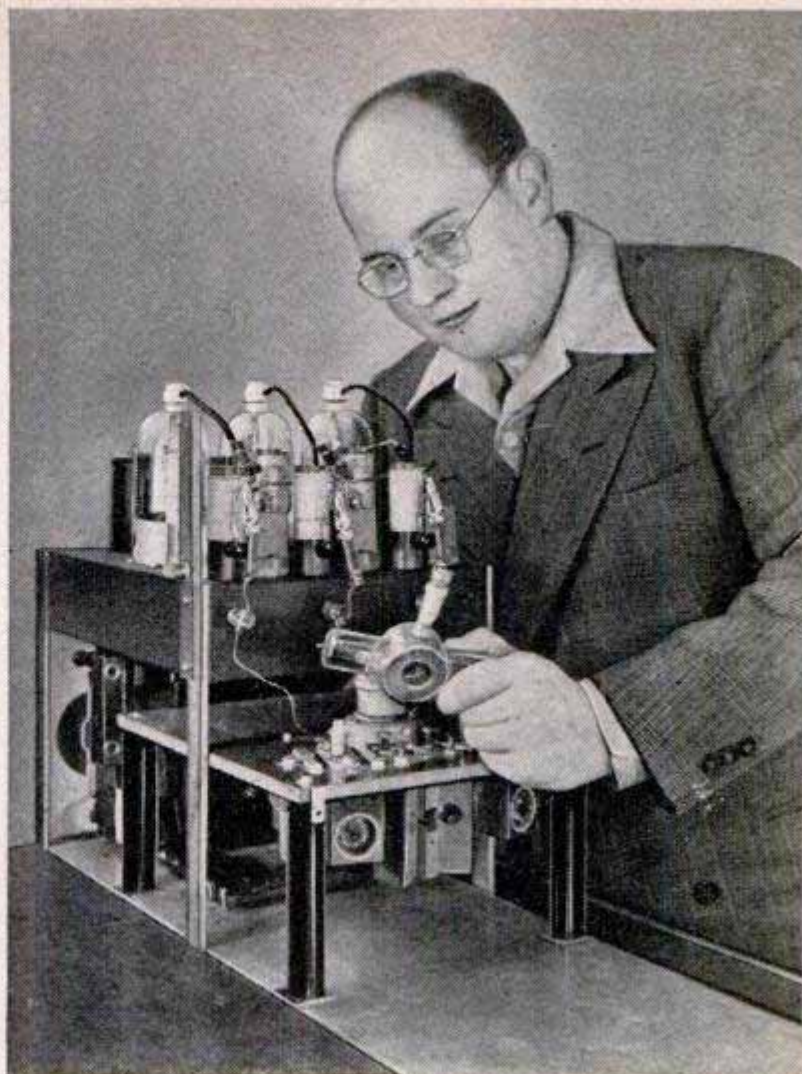
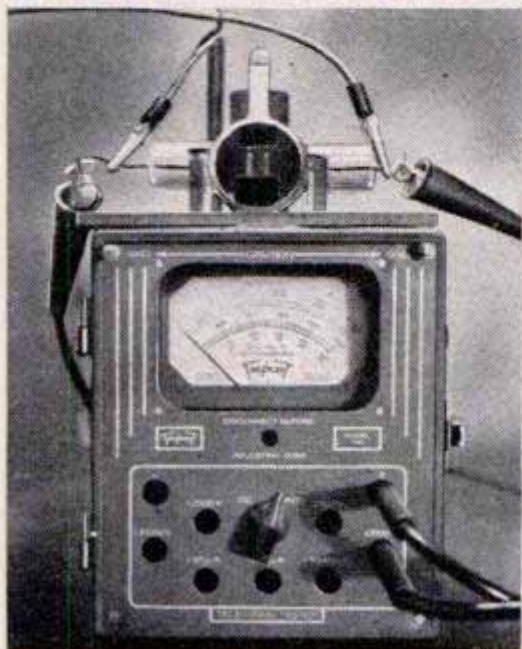
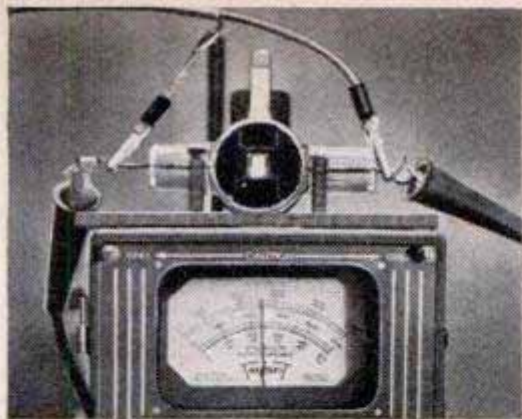


Above, another high-speed photographic device, the spark shadowgraph, took this picture of a high-power .22 rifle bullet traveling faster than the speed of sound. Black lines are shock waves. Note air turbulence behind the bullet

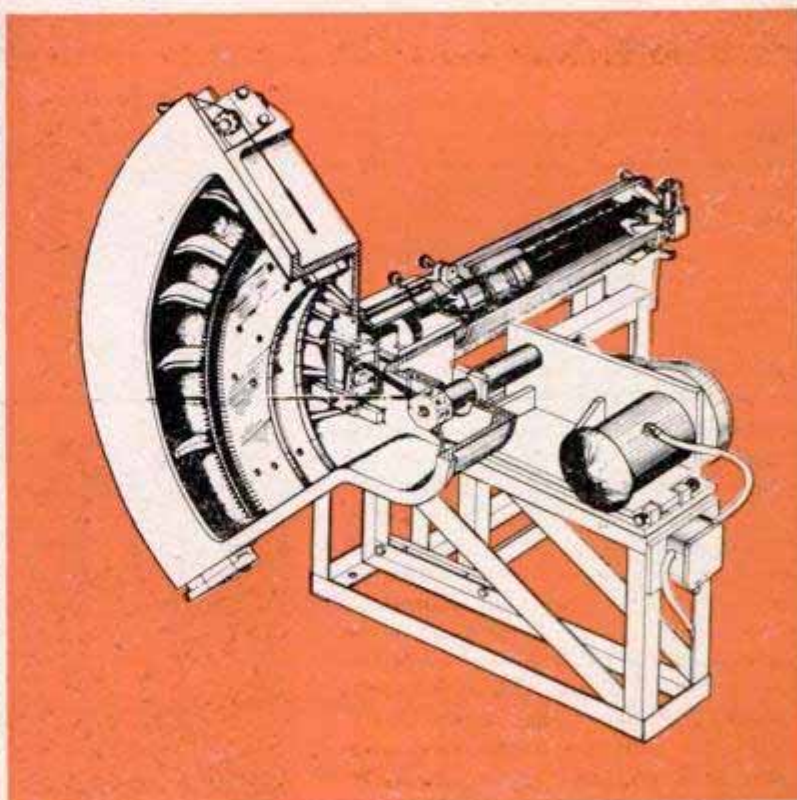
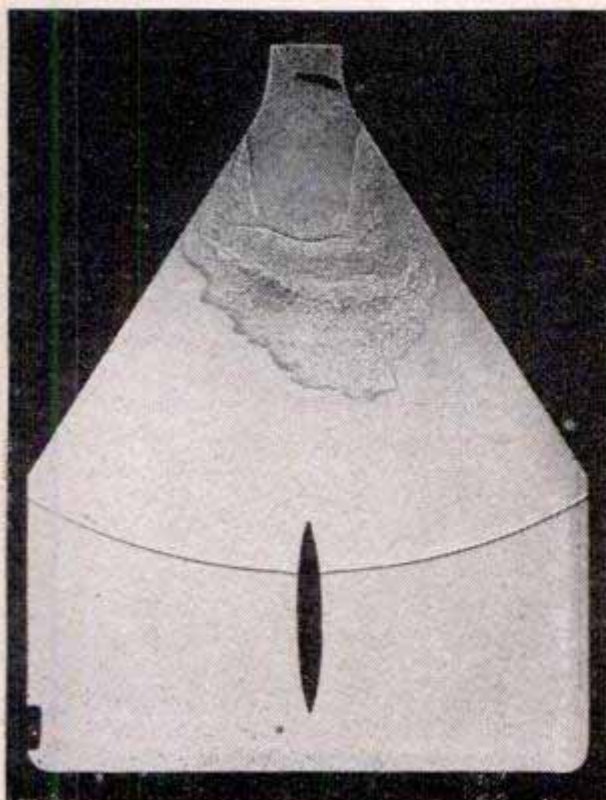
Right, these two pictures, also made by spark shadowgraph, show how a bullet crashes through a thin plywood sheet. Notice the unusual location of the shock waves. The wave that preceded the bullet in the free-flight view (above) has bounced off the wood and moved to the rear. It has a small rupture in the center that was caused by the bullet as it passed through it on its way into the wood. A new wave has formed ahead of the nose as it breaks through the other side. In the lower picture, the advance shock wave once again is clearly defined as the bullet emerges and resumes its flight in air

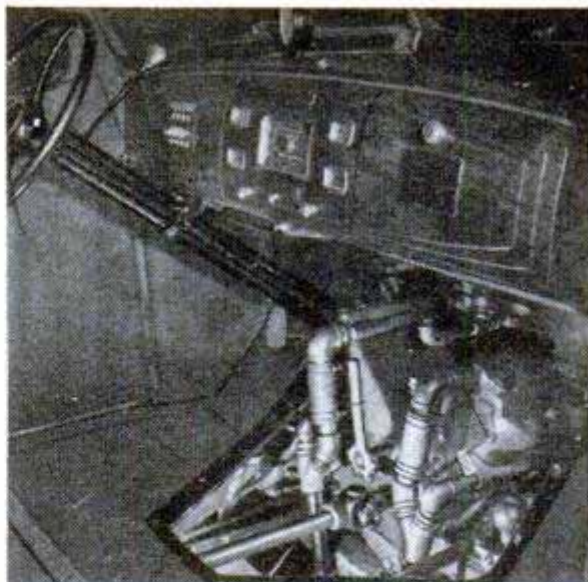
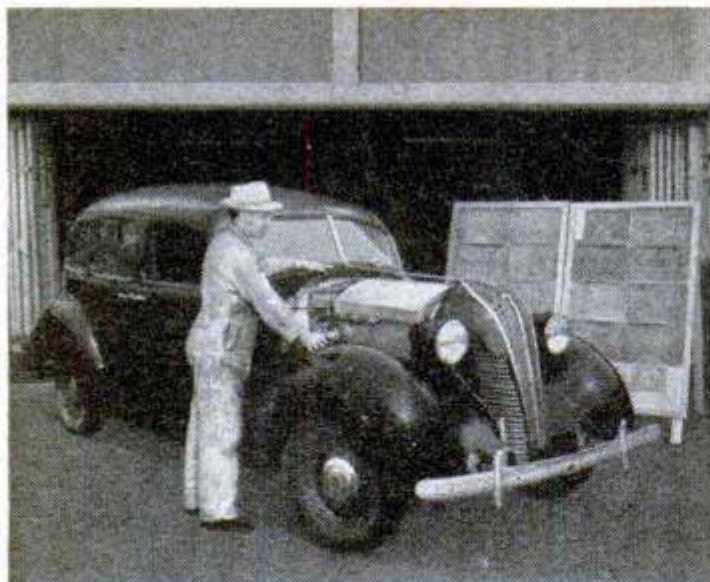
Above, called a "time microscope," a spectrograph records photographically the spectrum of an electric spark to show, within a millionth of a second, the stages of the discharge. Scientist adjusts spark gap. The octagonal mirror below electrodes revolves rapidly throwing image on spectrograph (right) where the continuous series is filmed





Above, the Zarem camera that snaps a picture in a hundred-millionth of a second is demonstrated by its inventor, Dr. A. M. Zarem. He is holding the Kerr-cell, which acts as an electric shutter. Action of the cell is shown at left. In lower picture, the cell, on top of voltage meter, is closed. When 5000 volts are introduced in upper view the cell opens permitting light to show through in dark circle. Below left, when stationary streamlined object is hit by air under high pressure, a curved shock wave is formed. Right, the RC-4, another fast camera, has 76 lenses arranged in arc. Spinning 8-sided mirror throws image into lenses

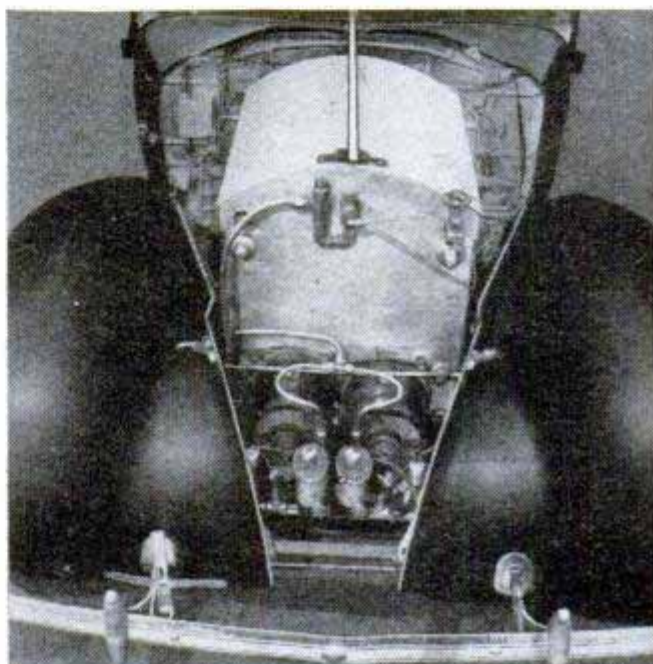




Steam Engine Burning Fuel Oil Installed in Standard Car

Steam power, used in the early automotive days, has been installed in a modern car by James H. Lawler of Huntington Park, Calif. He built the steam engine on a conventional chassis and burns stove oil as fuel. The motor has four cylinders, $3\frac{3}{16}$ -inch bore, with full power at low speed. Lawler says the same type of steam engine can be used to power boats and stationary installations. He plans to supply the unit complete or in parts so mechanics can build their own steam-powered cars.

Top, the steam generator fits beneath the hood of a standard car. Top right, engine is located beneath the dashboard. Right, with the grille off, the simple burner, steam generator and controls can be seen. Steam engine also can be installed on boats



Versatile Jimmy Gets Fire Fighters Through Locked Doors



Designed for opening locked doors quickly, a combination tool officially adopted by the New York Fire Department may replace the fire ax as the fireman's traditional favorite. Even heavy metal doors can be jimmed open from the hinged side with this tool. The claws and prong permit attack from almost every angle.

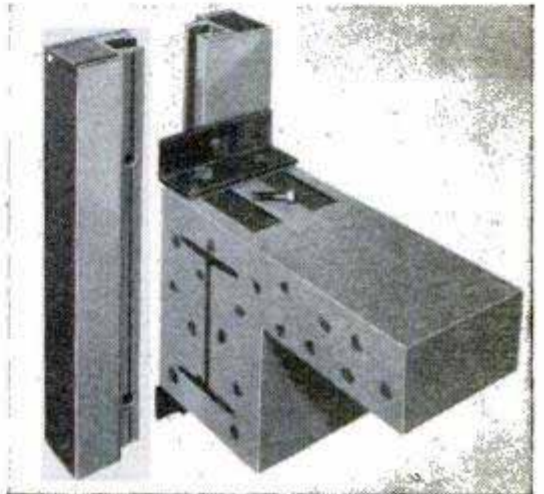
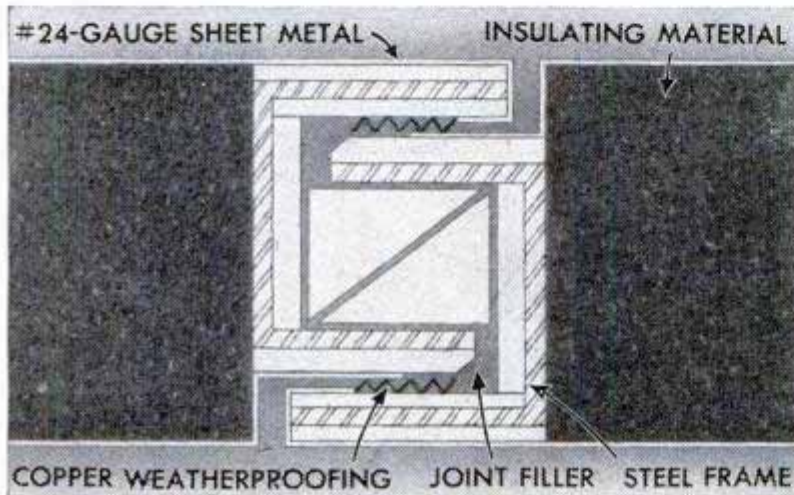
Releasing tons of pig iron and steel scrap for construction uses, magnetite ore is being used as ship ballast after being mixed with cement and cast into blocks.

Bolt-On Wall Panels Cut Costs

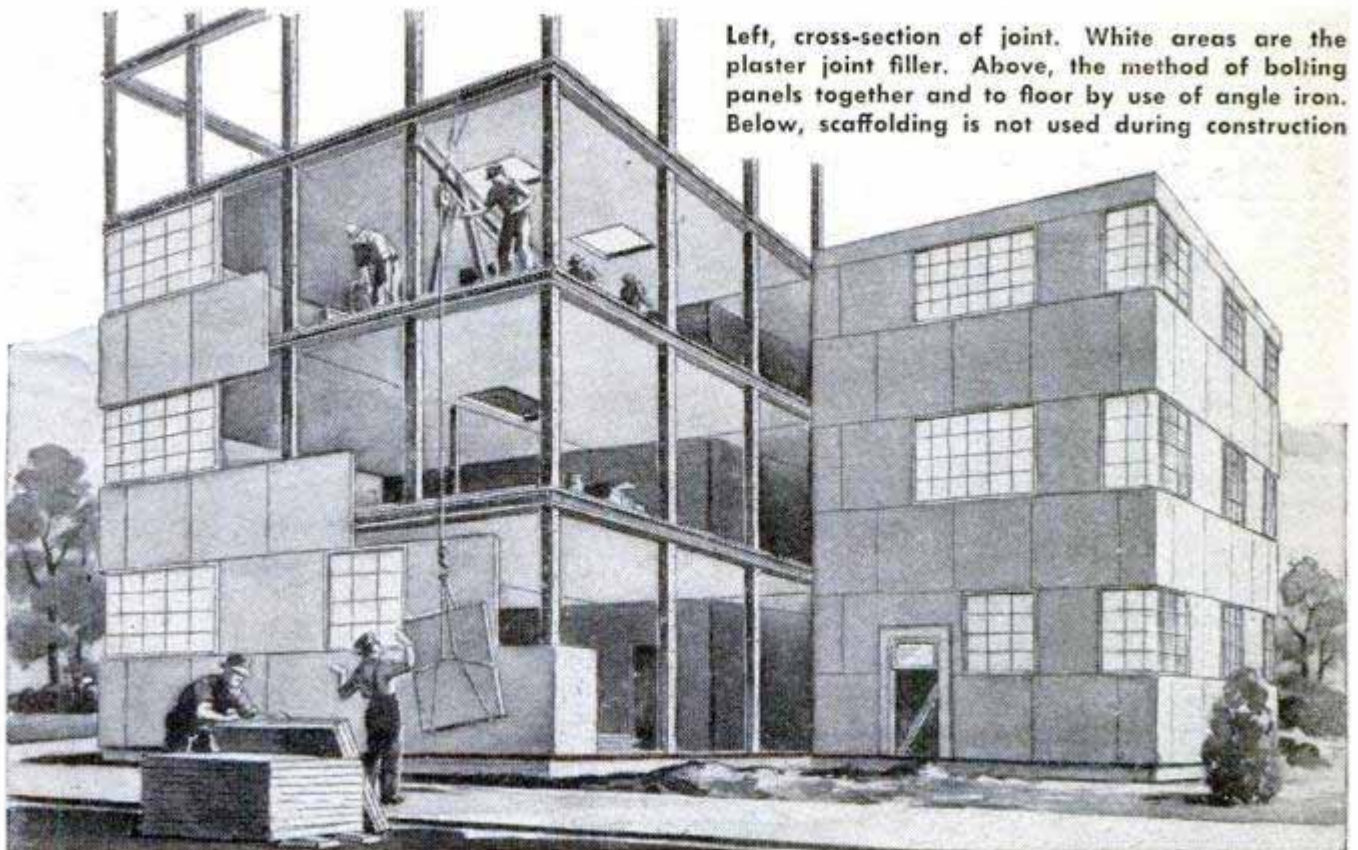
Construction costs of multistory buildings may be greatly reduced by a wall panel that bolts to the framework without the use of scaffolding. The panels are about four feet square and either three or four inches thick. Weighing only $\frac{1}{20}$ as much as a masonry wall, the panels are made of insulating material covered with stainless steel on the exterior and lacquered steel on the interior. Individual panels are connected by a weatherproof, fireproof joint on all four sides and are bolted together and to the girders at each floor. Insulating quality of the four-inch panel equals that of a 12-inch masonry wall. Lightweight, the wall reduces strain on the foundation and its narrowness increases usable floor space. It can be produced for about half the cost of brick or masonry walls and maintenance costs are low due to metal facings.

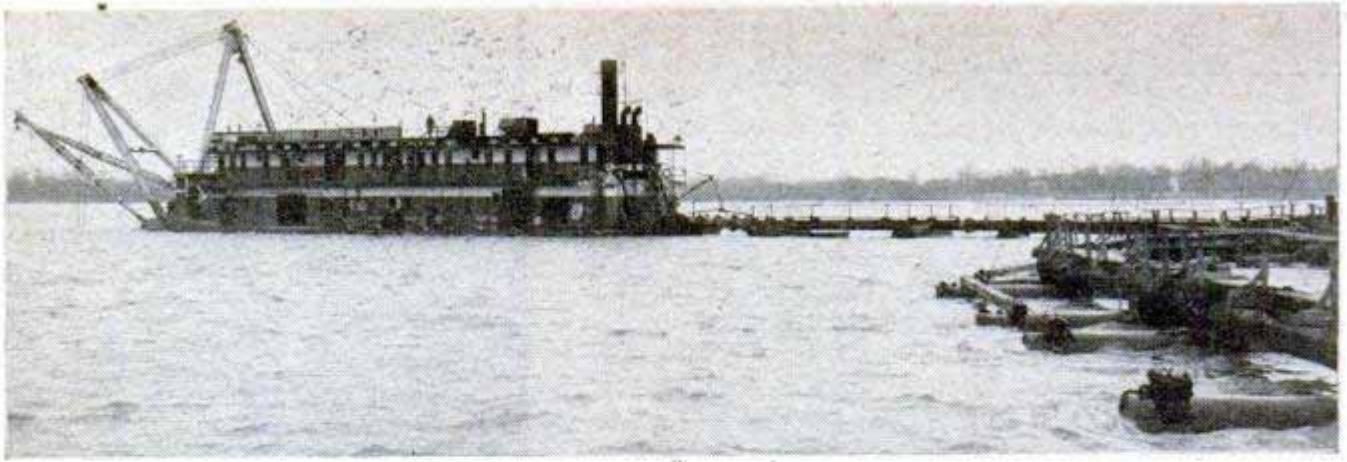


Fireproof plaster seals joint. Note BX channel in baseboard →



Left, cross-section of joint. White areas are the plaster joint filler. Above, the method of bolting panels together and to floor by use of angle iron. Below, scaffolding is not used during construction





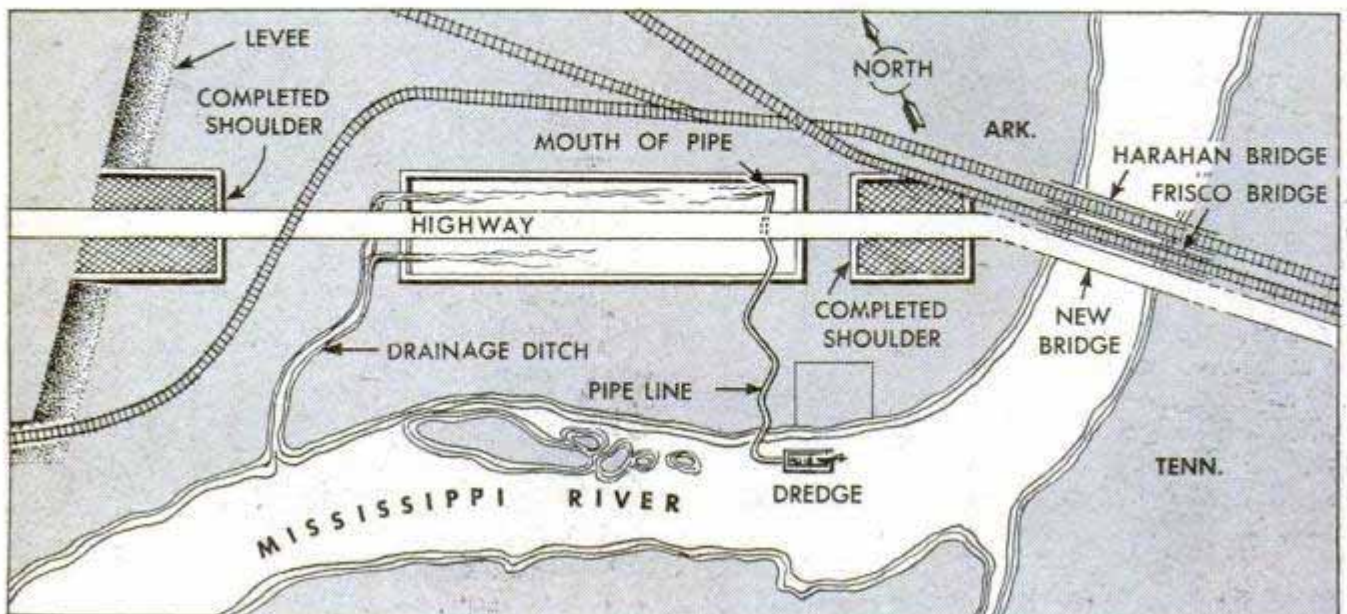
Reversing normal erosion, this dredge sucks silt from river bed to form shoulders for highway. Pipe that carries silt floats in foreground. Below, pipe snakes across fields carrying its load of silt-laden water

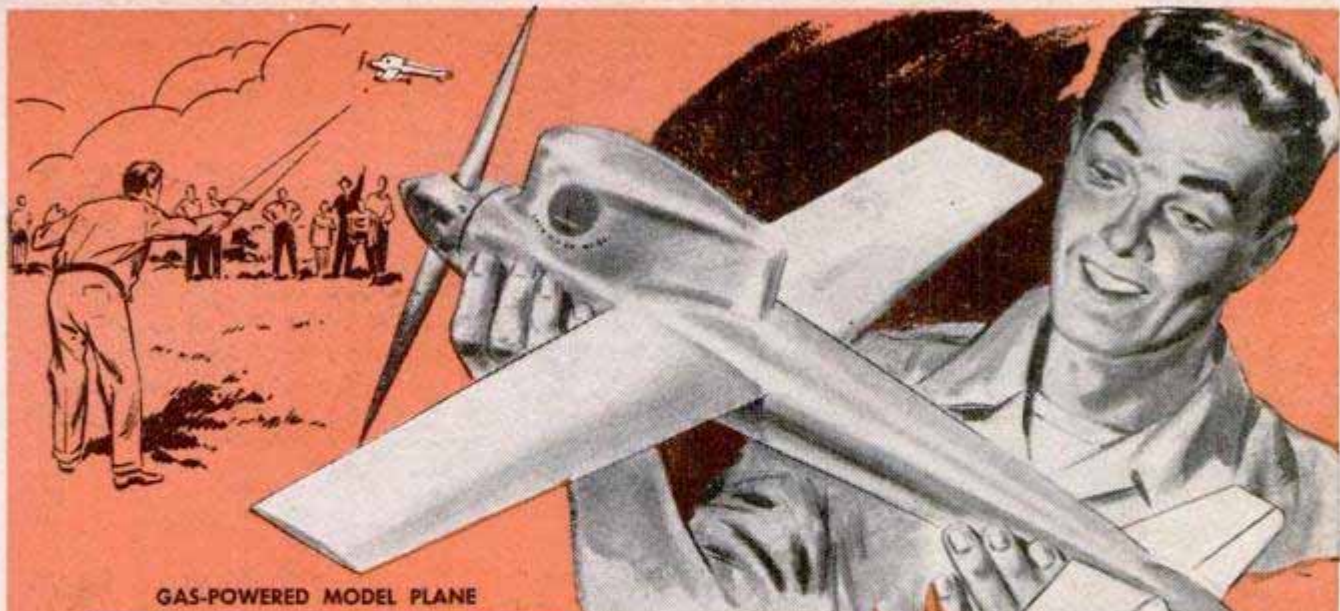


Above, about 850 cubic yards of silt an hour gush from end of pipe. Below, locations of dredge, pipe, shoulders and drainage ditch are shown on the map

SILT RETURNS TO THE LAND

Motorists driving on the approach to a new bridge over the Mississippi River at Memphis will soon be riding along 1,480,000 cubic yards of silt sucked up from the bottom of Old Man River. Silt, which is topsoil washed into the river by the erosive action of rains and streams, is usually considered utter waste. By dredging the silt from the river and using it, engineers are recovering some of this huge loss. Because earth slides have damaged previous roadbeds over the lowland between the levee and the river, highway engineers are using the silt to form wide protecting shoulders along the approach. The screw-type blade of a powerful river dredge sucks an average of 850 cubic yards of silt an hour from the river bed and forces it through more than a mile of 25-inch pipe to the project. Water that carries the suspended silt along the pipe drains back to the river in a long ditch after the silt has settled to the bottom. The roadway is 35 feet higher than the surrounding land.





GAS-POWERED MODEL PLANE

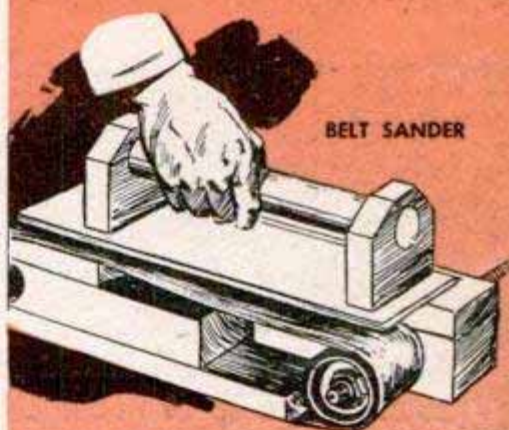
The CRAFTSMAN

★ Nearly every model-plane "pilot" in the country knows about the record hung up last year by the "Gold Rush of '47"—an official 134.91 miles per hour! Beginning on page 170 the designer of this record-holding plane gives step-by-step instructions for building a duplicate of it.

★ Photographers—both picture snappers and professionals—have spent a lot of time dreaming about those action shots they could have gotten with a high-speed flash unit. On page 191 a practical photographer-electrician tells how to assemble a battery-operated speed light and how to use it with ordinary cameras having synchronized shutters.

★ The feature woodworking project is an unusual coffee table. The top is shaped from a solid slice of wood cut diagonally from a log of native cherry. See page 162 for plans and detailed instructions.

★ Shop feature for the month, page 197, describes the construction of one of the simplest portable belt sanders we've seen. It's made from small pieces of hardwood and uses regular sanding belts. A flexible shaft drives it at standard motor speed.



BELT SANDER

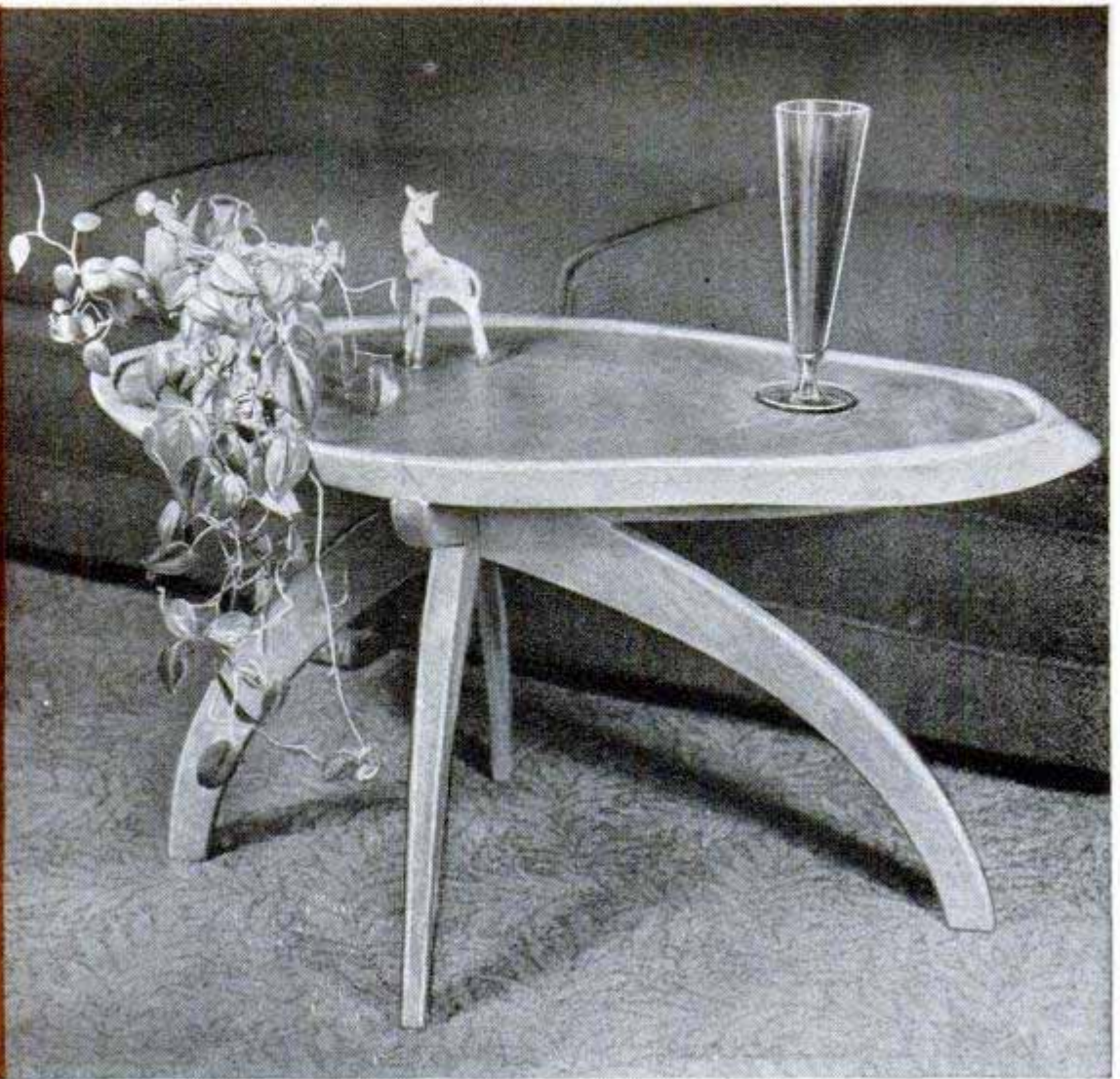


COFFEE TABLE



BATTERY FLASH UNIT

COFFEE TABLE



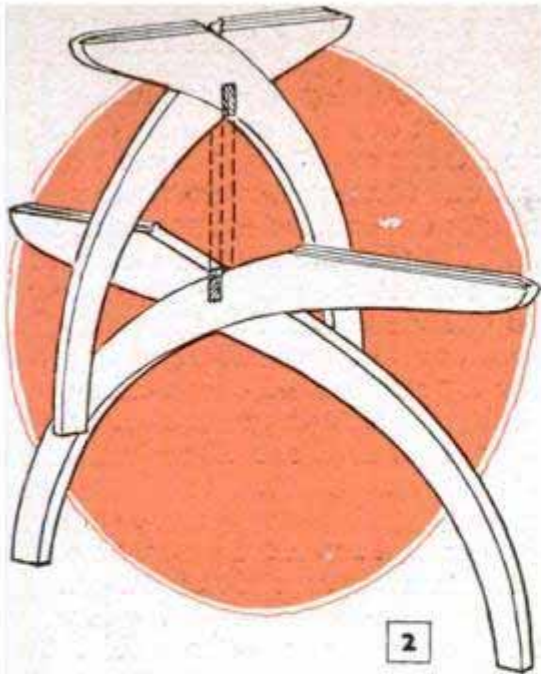
Diagonal slice from hardwood log produces beautiful grain effect to give this graceful coffee table a distinctive and exclusive touch. Legs are half-lapped and interlock

By W. J. LaFleur

IF IT'S the unusual you crave in occasional furniture, this coffee table should really intrigue you. Its novel construction calls for a top sliced diagonally from a log. Cut in this manner, the top assumes the natural contour of the log and the grain is enhanced by the annual-growth rings which take on a beautiful pattern.

The original table top was cut from an 18-in. cherry log, 4 ft. long. The log should be fairly round, thoroughly seasoned and the bark should be removed. To mark the log for cutting, make a wooden frame from stock $1\frac{3}{8}$ in. wide, measuring 18 by $29\frac{1}{8}$ in., inside measurement. The frame is placed over the log as in Fig. 3 and is tacked temporarily in place. Then a pencil is run around both sides of the frame to mark the log and the space between the lines is chalked. Fig. 1 shows how the log can be supported at an angle with a ladder and braced for sawing. Work carefully with a crosscut saw and try to make both cuts parallel. The saw will produce a rough surface which must be planed flat on the side selected for the underside of the top. Then $\frac{3}{16}$ -in. grooves are run on



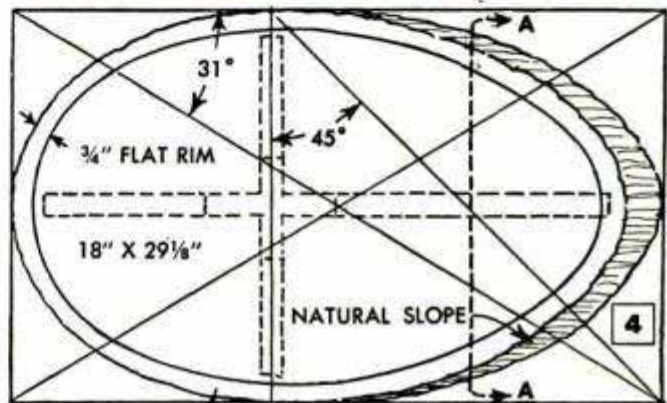


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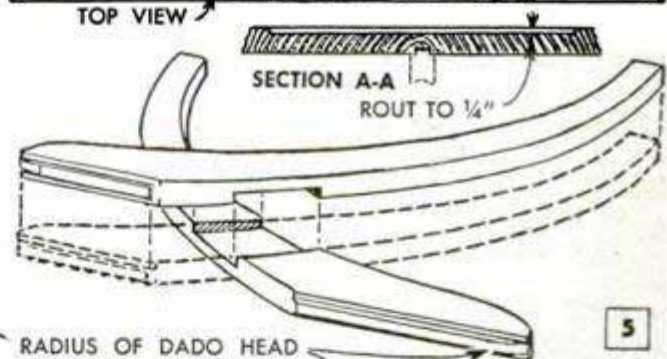


3

the underside for the leg tenons, locating them according to Fig. 4. Each groove can be cut on a bench saw by cutting a wooden strip to slide in one of the saw-table grooves and tacking it to the underside of the work parallel with the line of cut. A $\frac{3}{4}$ -in. rim is marked around the top surface and the area inside the rim is routed $\frac{1}{4}$ in. deep. This can be done with a router bit in a drill press, or with a portable router. After sanding smooth, a sealer should be applied to both sides of the top to seal the end grain and to retard checking. Fig. 6 details the leg patterns. Although the point of half lap is indicated by dotted lines, it is best to determine this by placing one corresponding leg on top of the other, as in Fig. 5, and marking directly. The assembled pairs of legs are notched to fit together as in Fig. 2 and then the top is glued to the leg tenons.

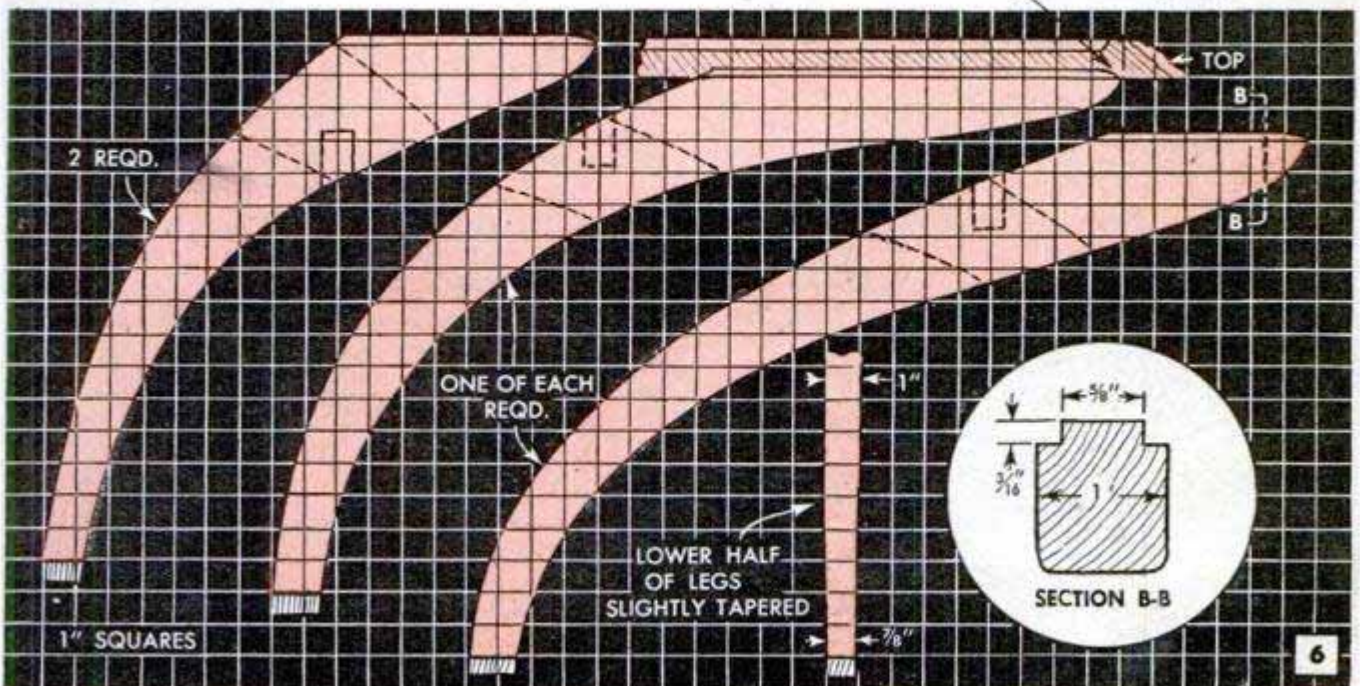


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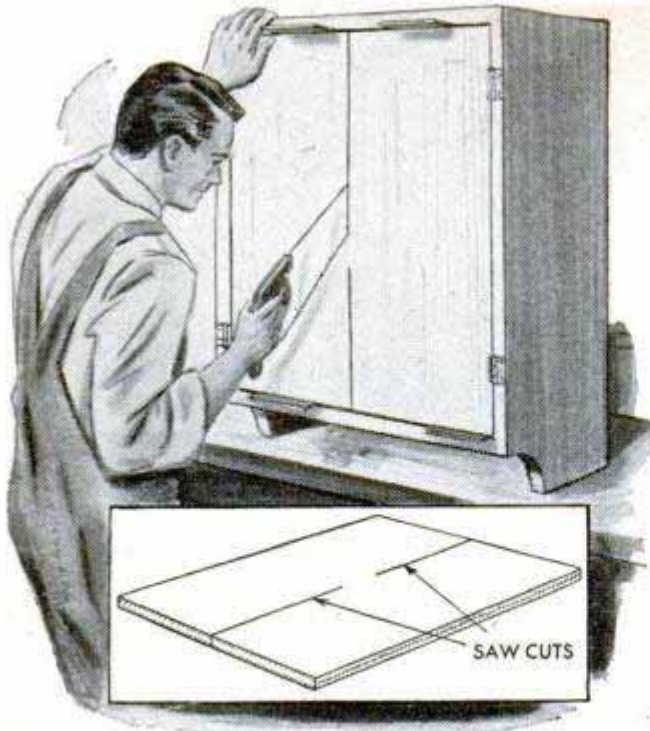
5

RADIUS OF DADO HEAD



6

Matched Cabinet Doors Hung as One Simplifies Fitting and Hinging

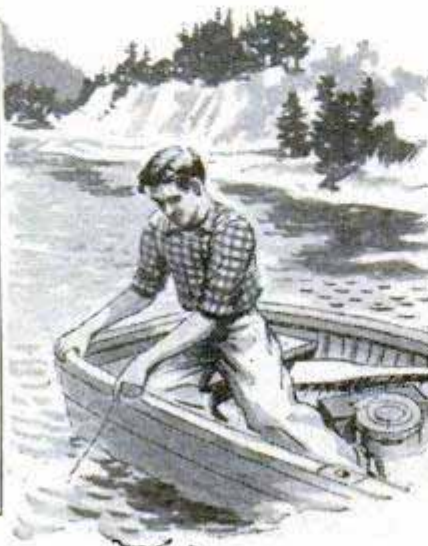


When fitting overlapping or flush-type matched cabinet doors, I save a lot of time by hanging them as a single door. To do this, I first cut the plywood to fit the entire opening, allowing for clearance at top and bottom. If the doors are to overlap the opening, I rabbet the inside edges and round the outside edges. Next, I partially form individual doors by sawing part way in from the top and bottom edges, as shown in the detail, stopping the cuts about 3 in. apart. If fixed shelves are already in the cabinet, the uncut portion of the panel should come at a point between the shelves so that they do not interfere with completing the cut later. Unless a narrow-gauge blade is used, a fine-tooth handsaw is preferred to a power saw to obtain a close-fitting joint between the doors. Next, I fasten the offset part of all four hinges to the rear side of the panel and complete hinging it to the cabinet after shimming it snugly in the opening with cardboard. Finally, I saw through the uncut part to make two separate doors and sand the edges.

Herbert Fey, New Braunfels, Tex.

Chugging Catches Walleyes

Walleyes lie in wait for minnows near the bottom of the water and chugging with this combination of natural and artificial bait usually results in a good catch. To assemble a chugging lure, first take a heavy sinker—one large enough to carry the line to the bottom—and scrape it bright. After tying the sinker to the end of the line, attach two small strips of cloth at the upper end of the sinker, one white and the other red. Then fasten a single or treble hook to the lower ring of the sinker. The hook is baited with a minnow, frog, worms or pork rind. To chug, allow the boat to drift while raising and lowering the bait slowly so that it touches the bottom about every two feet. Sometimes varying the movements, slow to fast, gives good results.—R. A. Jenkins, St. Louis, Mo.

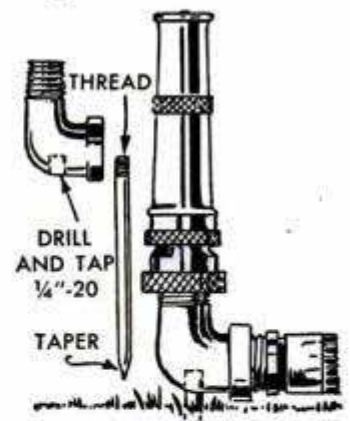


Mending Kit for Fishing Trips

For on-the-spot repairs when fishing, carry a bicycle-tube patching kit in your pocket or tackle box. This can be used to mend leaks or snags in your hip boots, waders or any other rubber footwear.

Improved Lawn Sprinkler

This convenient attachment will enable your garden hose to do double duty as a fountain-type lawn sprinkler. It is made from a $\frac{3}{4}$ -in. street elbow and a $\frac{1}{4}$ -in. metal rod, which serves as a spike. A brass rod and a galvanized elbow are best as they will not rust. After pointing and threading the rod, drill and tap the elbow as indicated. Then turn the rod into the elbow tightly to insure a leakproof fit. Screw the elbow on the garden hose and attach the nozzle as shown. To use, adjust the nozzle for a fine spray and force the spike into the ground.



☞ To keep important papers together in your desk, use a spring clothespin as a paper clip.

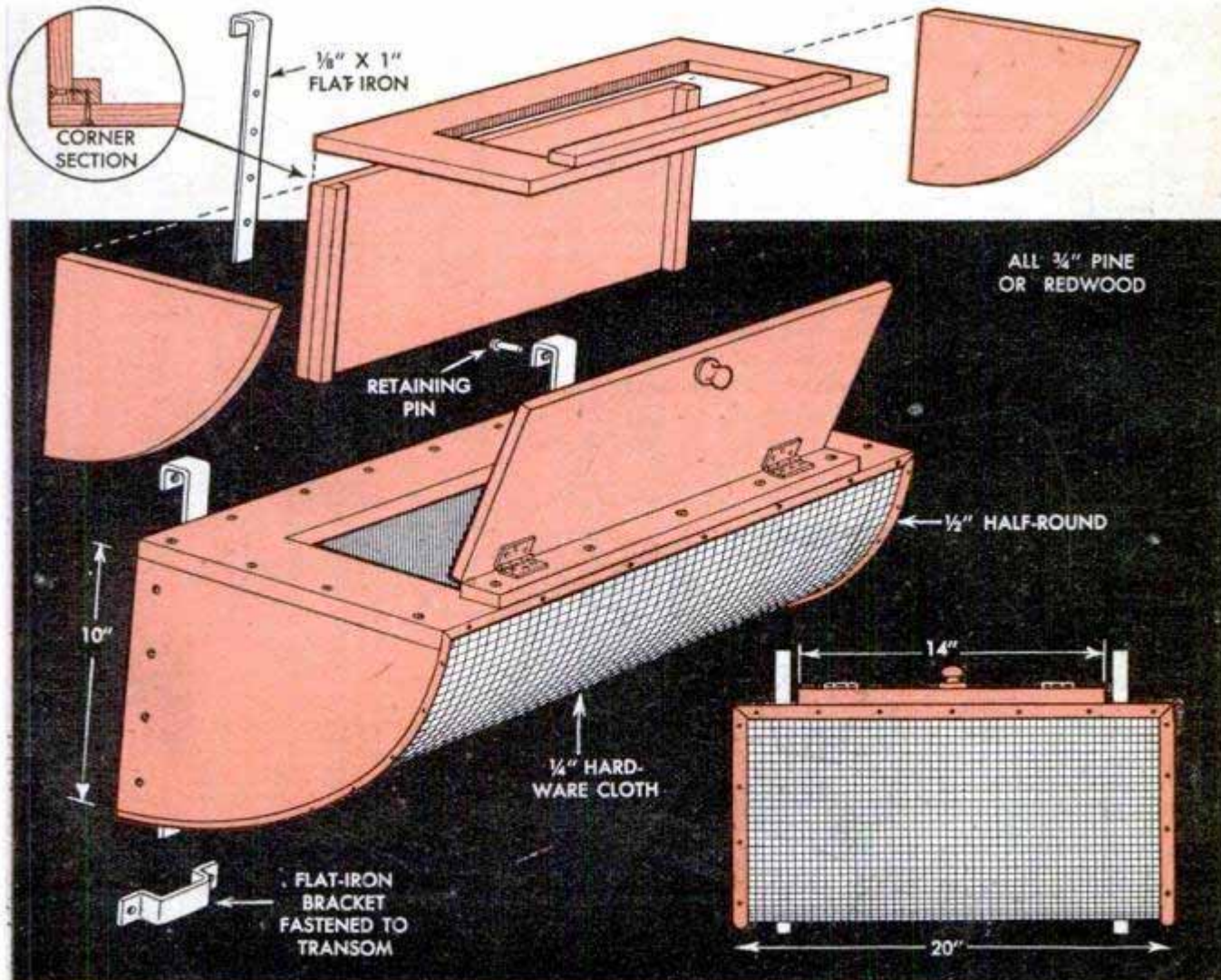
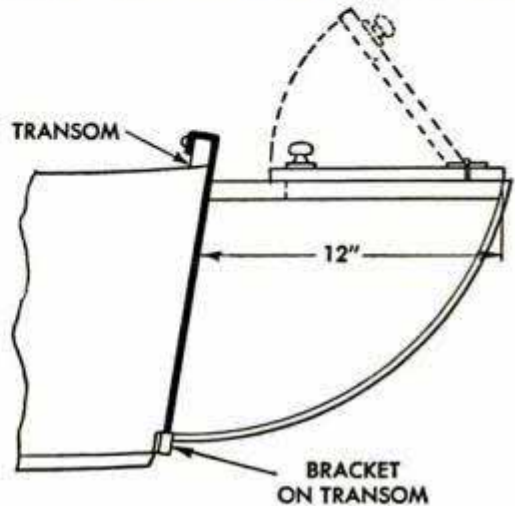
BRING 'EM

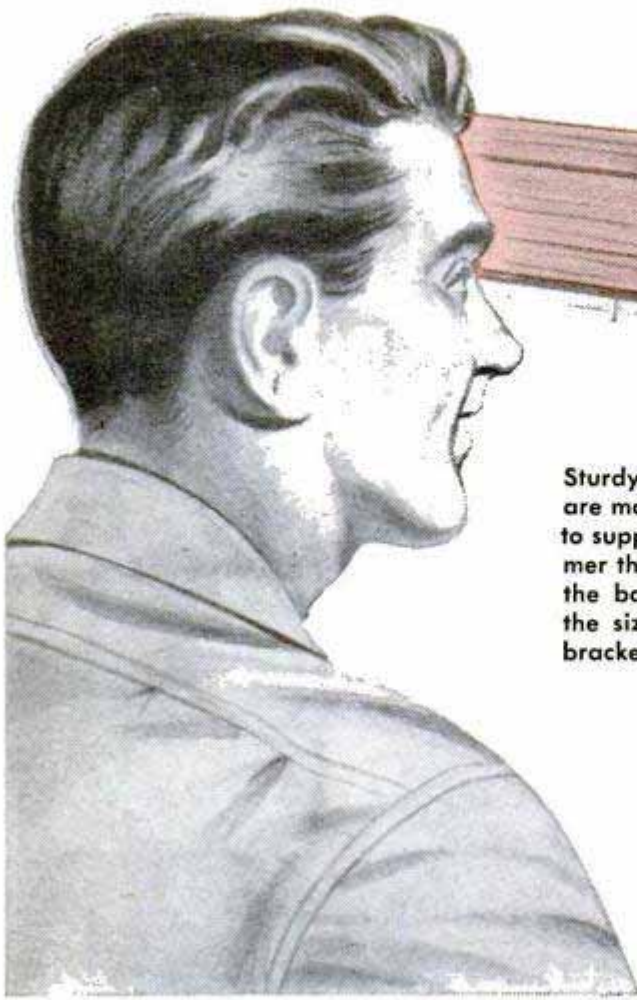
BACK ALIVE

By Hi Sibley

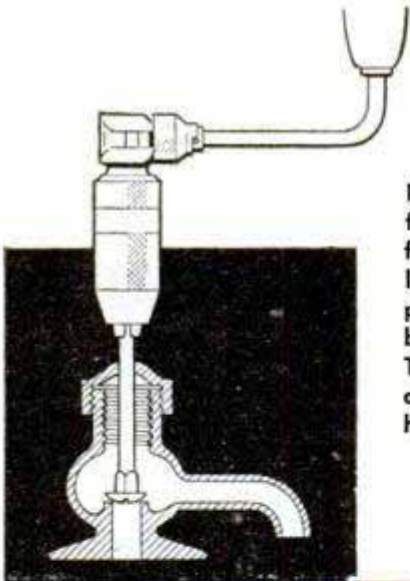
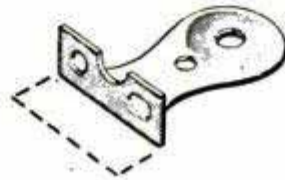


Designed to hook over the transom of a rowboat, this convenient live box rides partially submerged to assure the fish you catch a constant supply of fresh water. Being located at the rear of the boat, the box will not impose any appreciable drag when rowing. Construction details show how it is assembled. Redwood is the most durable wood to use, although pine will do. The rounded side of the box is covered with hardware cloth and trimmed with molding. Flat-iron brackets, which hook over the transom at the top, fit in sockets at the bottom and are anchored with retaining pins. Note that the cover is made large enough to overlap the opening on all three sides.



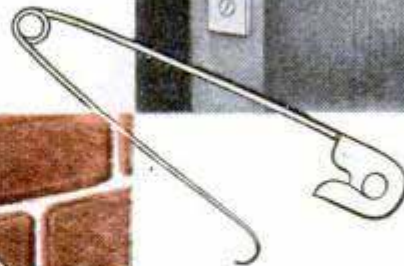
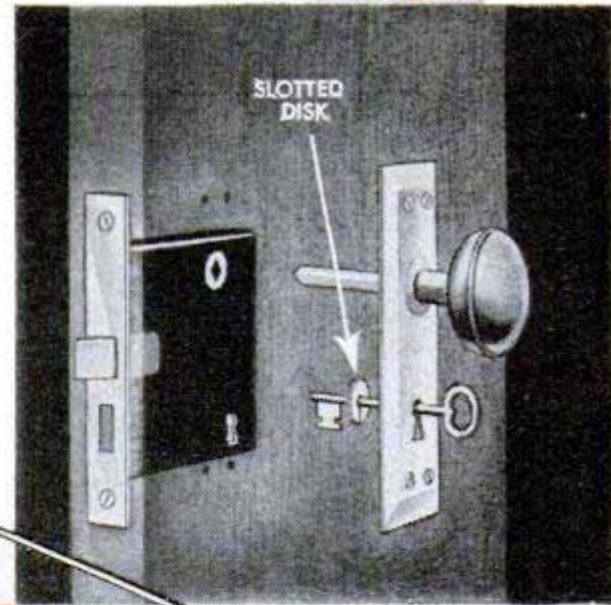


Sturdy hangers to hold a heavy picture are made from discarded brackets used to support a window-shade roller. Hammer them flat and screw one or more to the back of the frame, depending on the size of the picture, then bend the bracket outward to slip over the nail

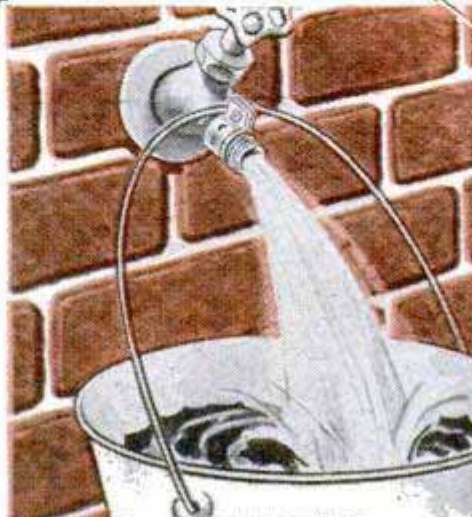


Above, if a faucet continues to leak after installing a new bib washer, you can save the cost of a valve-seat reamer by using a carriage bolt in an auger brace. Saw a slot in the bolt head so that in rotating the bolt it will ream smooth any irregularity in the valve seat. Do not apply much pressure—just enough to remove the burr. Use the largest size bolt that the faucet will admit

Right, to prevent a door key from being pushed out of a lock from the outside, remove inside lock plate, insert key through plate and place a slotted cardboard disk over the key shank. The disk will not interfere with operation of the lock and yet holds the key securely in lock

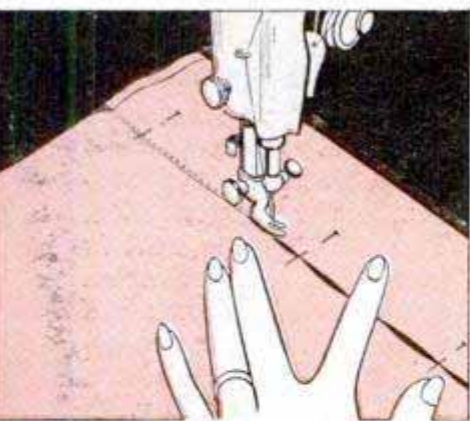


Above, knots in shoe laces difficult to untie with the fingers can be loosened readily with hook point of a safety pin



Left, a pail won't slip off a sill faucet when filling it if a hose clamp is fastened to the faucet and used as a hook for the bail. This is especially handy when carrying water as one pail can be filled while the other is emptied

HOME PROBLEMS



Left, if you use pins instead of thread to save time when basting, place the pins crosswise rather than lengthwise. Then you can stitch right over them with the machine and remove them later. If the needle does strike a pin, it will glance off and not be damaged or broken



Above, the next time you leave a note for the milkman, try this stunt to keep it from falling in the bottle or blowing away. Let one corner of the note project from the bottle and anchor it with a discarded milk-bottle cap

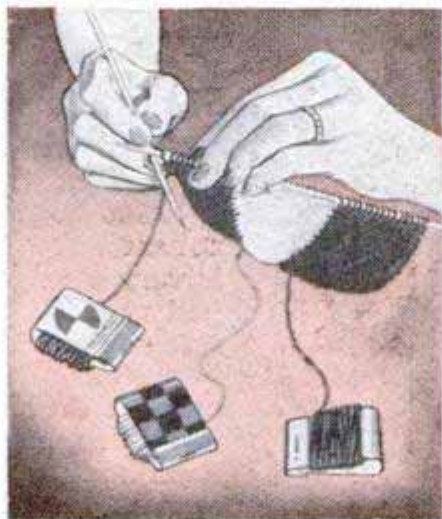


Right, when ironing large and long pieces, such as tablecloths, and they tend to dry out rapidly, pin a turkish towel to ironing-board pad to form an envelope. Place item in towel and pull it out as you iron. Towel will keep it nicely dampened

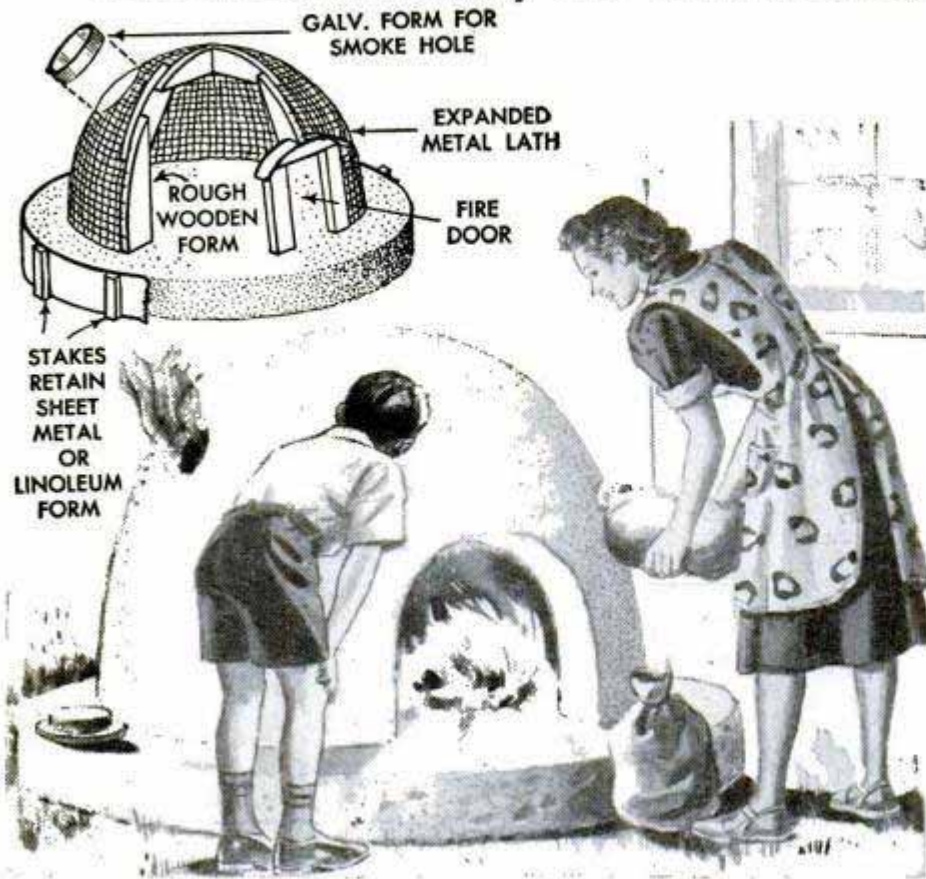
Lint on a suit or dress can be removed quickly by stroking garment with a "delinter" made by wrapping adhesive tape, sticky side out, on toothbrush holder

When knitting with several different colors of yarn, empty match books make excellent nonslip bobbins for holding the yarn. The flap of the book prevents yarn from unwinding

Save the scraps left over when upholstering a chair and keep them handy for patching holes and tears. Place them in an envelope and tack it to the underside of the chair



Novel Igloo Incinerator of Troweled Concrete Combines Both Utility and Attractiveness

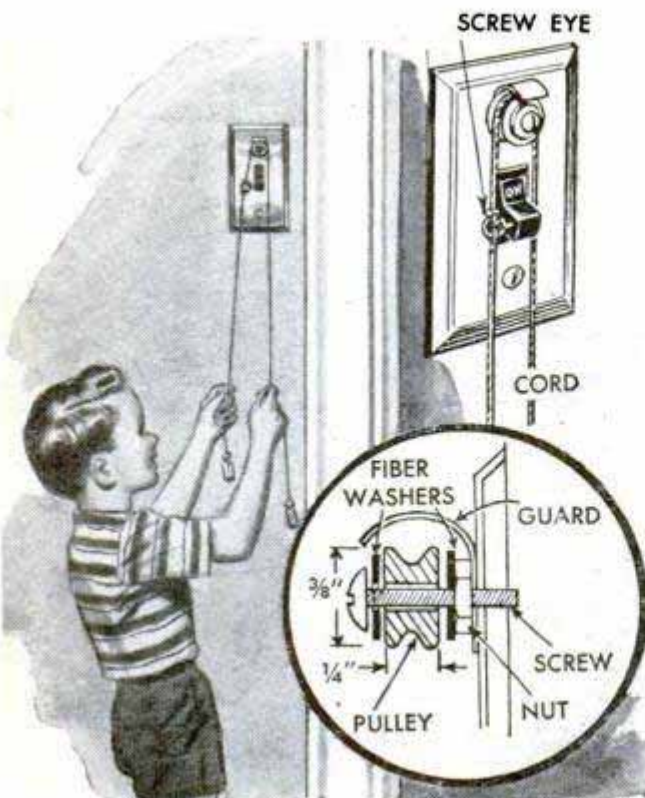


Wish you could burn rubbish in the back yard without having an old oil drum or other eyesore cluttering up the place? Then, here's just the thing for you—an attractive concrete incinerator that will do the job and always present a neat appearance. The base of the unit is poured in a sheet-metal or linoleum form. A wooden form for the igloo is made as shown, and this is covered with expanded metal lath, except over the fire-door and smoke-hole openings. Galvanized iron is used for the smoke-hole form and also to support the concrete over the fire-door frame. Then, cement is troweled over the lath to a 4-in. thickness. The wooden forms may be burned away later.

Pull Cord Attached to Toggle Switch Permits Operation by Small Children

If a young voice exclaiming, "Daddy, please turn on the light for me," frequently interrupts your browsing through the evening paper, you'll like this idea of W. Wild of St. Louis, Mo. He attached a pull cord to the toggle wall switch so the chil-

dren could turn on the lights by themselves. To do this, the top screw of the switch plate is replaced with a wooden pulley, as shown in the detail. Note the sheet-metal guard that keeps the cord from jumping off the pulley. Next, a small screw eye is turned into the side of the toggle switch. One piece of colored cord is looped over the pulley and tied to the upper part of the screw eye. Then, a shorter length of cord is tied to the lower part of the screw eye, and tassels are fastened to the dangling ends of the cord. This arrangement does not interfere with the normal operation of the switch, and the children soon learn to pull the cord to turn the lights on or off.

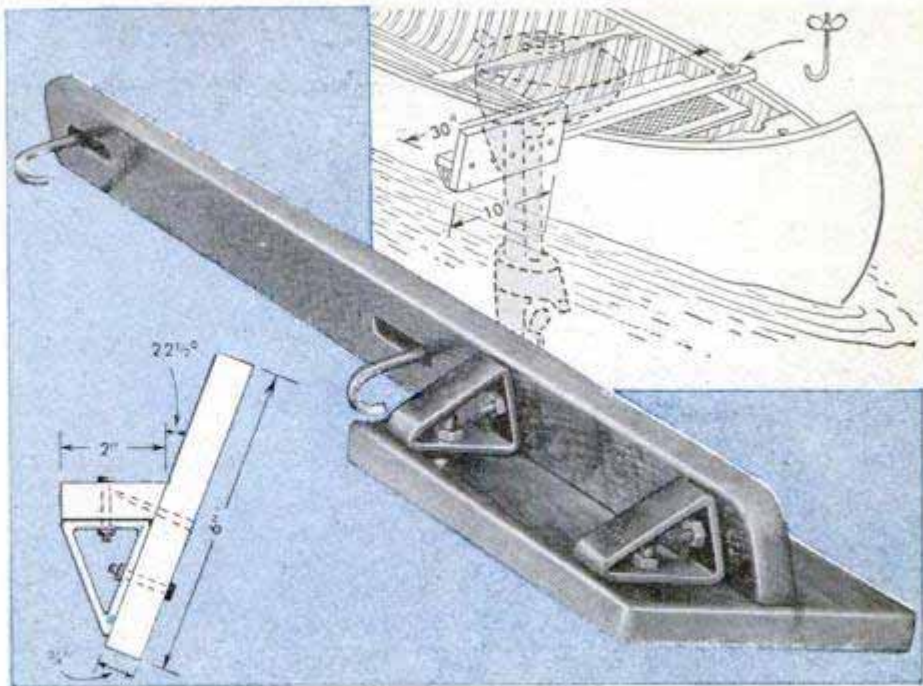


Substitute for Bucktail Flies

For those who prefer to tie their own trout flies and bass bugs, woodchuck (ground-hog) tail hair will serve as an excellent substitute for bucktail hair. This is very similar to bucktail hair and works just as well. To tan woodchuck tails, first remove the tail bone and tack the tail, flesh side out, in a cool, dry place. Then rub salt into the flesh side of the tail. When the tail is dry, pack it in a glass jar along with naphtha flakes or cedar shavings to protect against possible damage by moths.

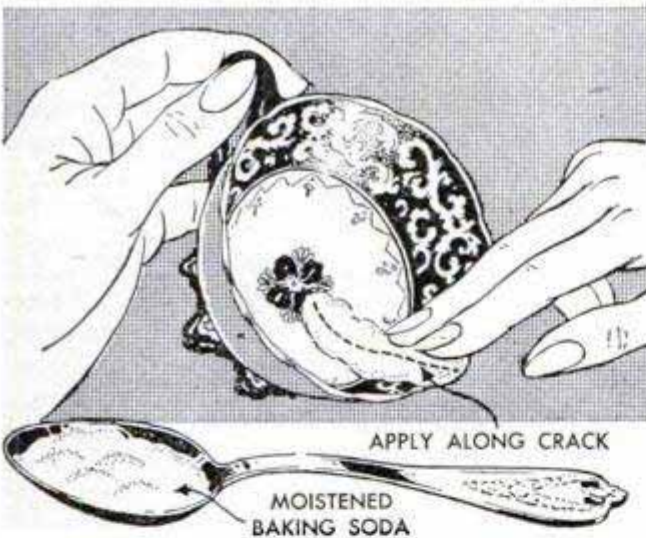
Attached and removed with a few turns of two wing nuts, this mounting bracket permits a light-weight outboard motor to be operated at maximum efficiency on almost any canoe. As the motor is held well out to one side of the canoe, full benefit of steering, tilting and reversing features is attained. The unit is constructed entirely of $\frac{3}{4}$ -in. oak. The crosspiece is 2 in. wide and long enough to project about 1 in. over one side of the canoe and 10 in. over the other. The motor mount is a 6 by 10-in. piece of wood, screwed to the crosspiece at an angle and braced by two triangular flat-iron brackets bolted in place. The crosspiece is slotted to take two hooks which are tightened with wing nuts so that the bracket is held securely to the gun-

Canoe "Sidemount" for Light Outboard Motor Permits Full Tilting and Steering Control



wales. The hooks can be made by cutting the heads from long bolts and bending the unthreaded portion to shape. A coat of marine varnish will preserve the wood.

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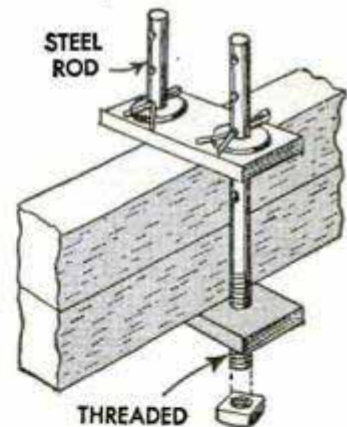
Baking Soda Removes Stains On Rare China

Those who take pride in their collection of rare china will welcome this handy tip for removing tea and coffee stains from hairline cracks. First, apply ordinary baking soda, slightly moistened, to the area that is stained. Let stand for about one hour and wipe off. If one application does not remove the stain completely, repeat the treatment.

☐ While beating ingredients in a bowl with one hand and adding material with the other, the bowl can be prevented from slipping by placing it on a folded towel.

Improved Woodworkers' Clamp Assembled From Scrap Parts

An inexpensive bar clamp can be improvised from two lengths of iron rod, two pieces of flat iron, two nuts, two washers and a couple of cotter pins. Thread one end of each of the rods to take a nut and drill a series of holes along

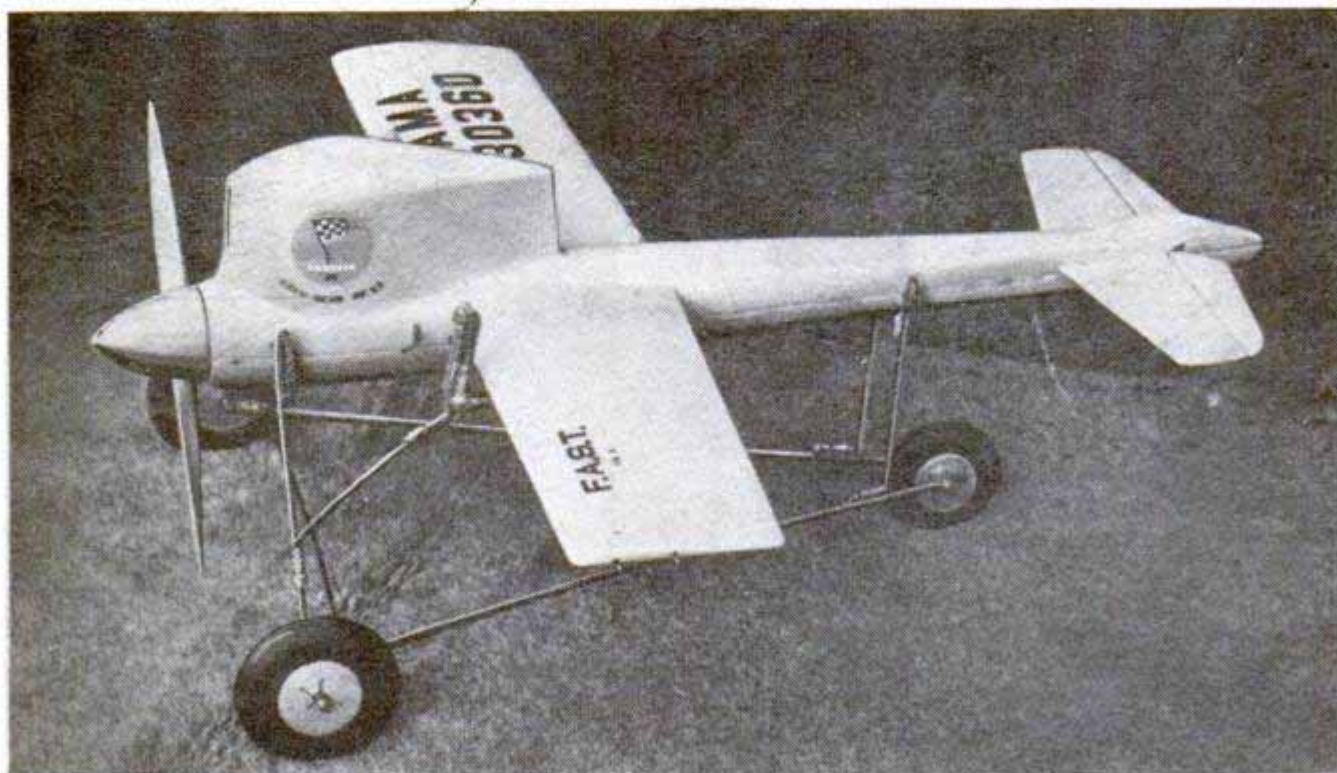


each rod to permit inserting cotter pins. Then drill two holes in each of the flat-iron pieces to fit over the rods. In use, the top piece of flat iron is held in place by washers and cotter pins, and the lower piece is tightened with the nuts. The length of the rods, the number and spacing of the holes determine the over-all width of work the clamp will handle. Make the thread length equal to the distance between the cotter-pin holes.

Al Ferguson, Hollywood, Calif.

☐ When painting a house in regions of intense summer heat, use a light color of paint. This will tend to make the house cooler, as light colors absorb less heat.

Build "GOLD RUSH OF '47" the A.M.A. Open Class B record holder



IN RESPONSE to many requests, *Popular Mechanics* presents the plans on how to build the famed model speed plane "Gold Rush of '47"—the A.M.A. Open Class B record holder which blazed across the contest fields of last year at a speed of 134.91 m.p.h. Its construction is so very simple that its record is all the more impressive.

Fuselage: Begin by selecting two pieces of clear white pine to be used as the top and bottom halves. Cut to the rough dimensions with allowance at each end for waste and face off one side of each piece. Then glue the faced sides together with a sheet of thin paper between so they can be easily separated later. Carefully locate center points on the joint. Mount in the lathe, rough-turn, and mark off stations at sections A-A to G-G inclusive, Fig. 2. Then, using a cutoff tool and calipers, cut the fuselage down to size at each station. Remove the waste to depth between the stations, and finish with fine sandpaper. Finally, face off the nose of the fuselage square. Remove from the lathe and cut off the waste at the ends by hand. From a point roughly halfway between sections D-D and E-E, plane a flat on each side of the fuselage to section G-G. Then separate the piece into the original halves by running a knife blade along the joint, and sand the joining faces to remove the glue and paper.

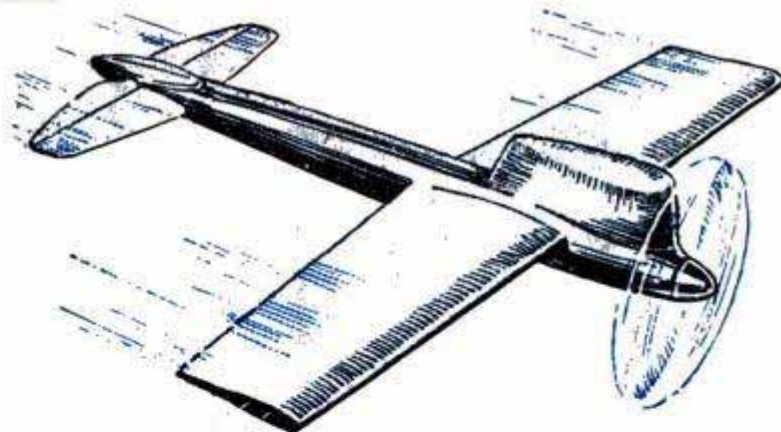
By Keith Storey

Pencil a center line on the flat face of each half of the fuselage and carefully check the dimensions with the plans. See Fig. 2, sections A-A to G-G inclusive. Pick the straightest-grained piece for the bottom half of the fuselage as it will bear the load. Now, draw in all lines indicating wall thickness and location of engine bearers. Back of the engine well, hollow the bottom half to a uniform wall thickness of $\frac{1}{8}$ in. The engine section gets a different process. The original ship was powered by a McCoy 49 engine and dimensions are given for this particular power plant. As the width at the base of the engine mounting lugs is $1\frac{1}{2}$ in., measure $\frac{3}{4}$ in. on each side of the center line and draw lines parallel with the center line from the rear of the engine well to the nose of the ship. The area between these lines is recessed to a depth of $\frac{1}{16}$ in. at the rear and slowly tapered up in depth to conform to the shape of the fuselage at the nose. Wall thickness from a point directly under the engine to the forward end of the fuselage should be at least $\frac{1}{4}$ in. Hollow the top half to a uniform $\frac{1}{8}$ -in. wall thickness and finish the two halves smoothly on the inside with sandpaper so that the bulkheads will fit snugly.

Next, make the magnesium crutch, Fig. 2, by first scribing the layout lines on the magnesium sheet. Saw out the openings

in the center but do not finish-file the outside until the crutch has been mounted in the fuselage. Cut away the bottom half of the fuselage to receive the crutch in a smooth, snug fit. Then drill and tap mounting holes as shown in Fig. 2. After mounting the crutch, file the outside edges flush with the wood. Next, attach the $\frac{1}{16}$ -in. magnesium landing skid to the underside of the bottom half as in Fig. 2, running the tie bolts through both the crutch and skid in a trial fit. Then, remove the crutch and skid from the shell and fit the wooden bulkheads.

The $\frac{1}{4}$ -in.-wide magnesium brace at the nose can be formed from a straight strip of magnesi-



um or, cut a ring from a piece of tubing and split it in half. Drill and tap the brace for a screw which comes up through the forward end of the skid. This brace is mounted on the crutch by means of two 2-56 machine screws. Nut plates, section B-B, Fig. 2, are cut from $\frac{1}{8}$ -in. duralumin and are drilled and tapped to fit the engine mounting bolts. Use 3-48 machine screws for attaching the plates to bottom of the crutch.

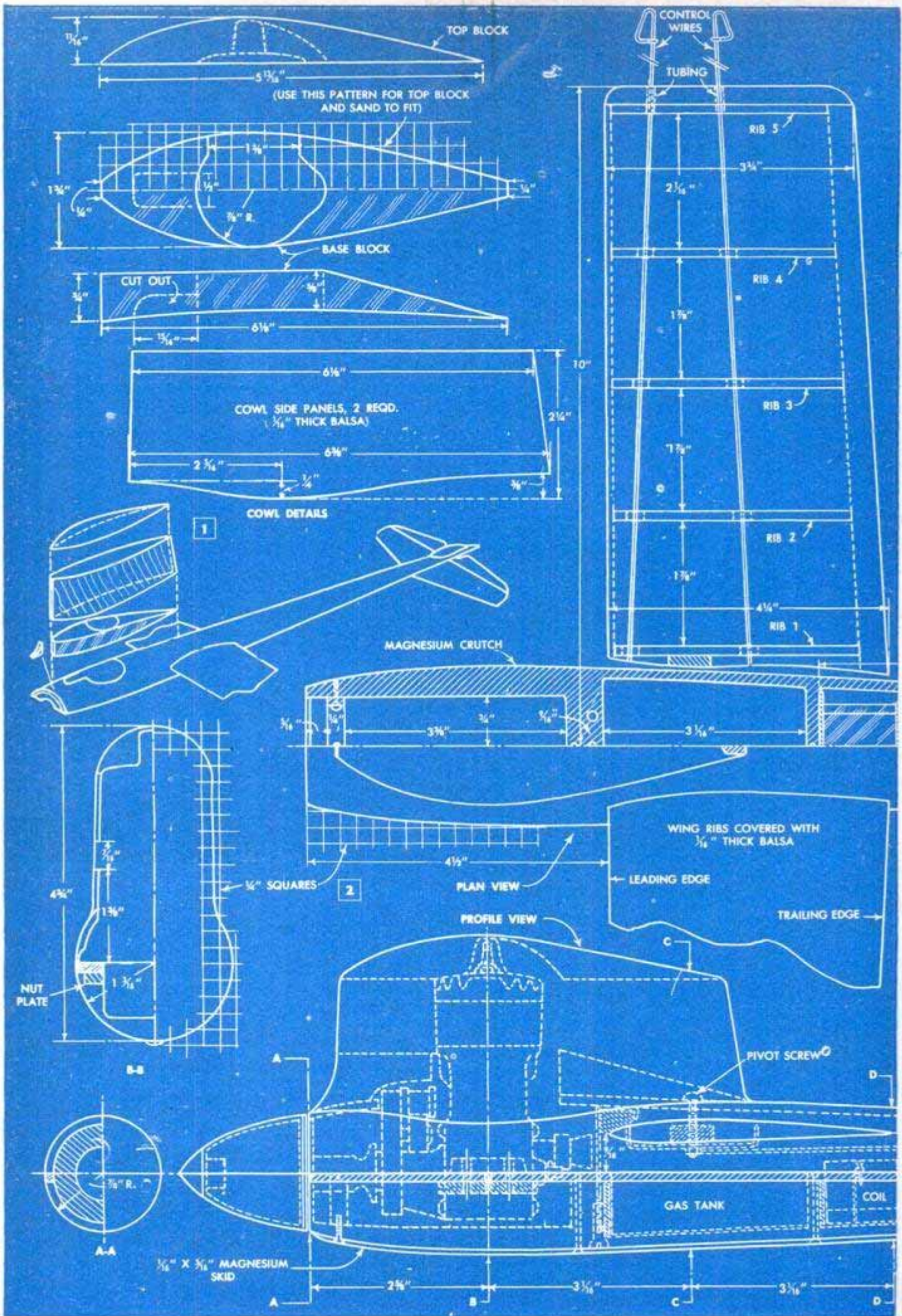
Wing: The wing, Figs. 2 and 3, is made in one piece. Location of the ribs, Fig. 3, and the half spar are indicated on the bottom sheet of $\frac{1}{16}$ -in. balsa wood by drawing the outline directly on the wood. Then cement the ribs in place. Now, install the maple half spar shown in Fig. 4. This forms a rigid support on which the control plate, Figs. 4 and 6, is mounted. Drill a No. 10 hole in the half spar and wing bottom to aid the installation of the control plate later, and cut curved slots for the control-plate tabs.

RECORD LOG "GOLD RUSH OF '47"*

No. of Flights	Place	Date	Position	MPH	
4	Anaheim, Calif.	April 1947	2nd	118.21	NS
2	Colton, Calif.	May 1947	1st	124.14	NS
2	L.A.A.M.	May 1947	1st	124.18	†
2	Bellflower, Calif.	May 1947	1st	124.78	†
3	A'moda, Calif.	July 1947	1st	120.65	NS
2	Western Open	June 1947	2nd	119.70	S
1	Long Beach, Ca'if.	July 1947	1st	124.78	S
2	International (Plymouth) Detroit		2nd	119.25	S
1	1947 Nationals		1st	125.25	
1	Joliet, Illinois		1st	128.50	NS
3	East-West (St. Louis)		1st	128.88	†
1	Anaheim, Calif.		1st	129.56	NS
1	Long Beach, Record Trials		Record	134.91	†

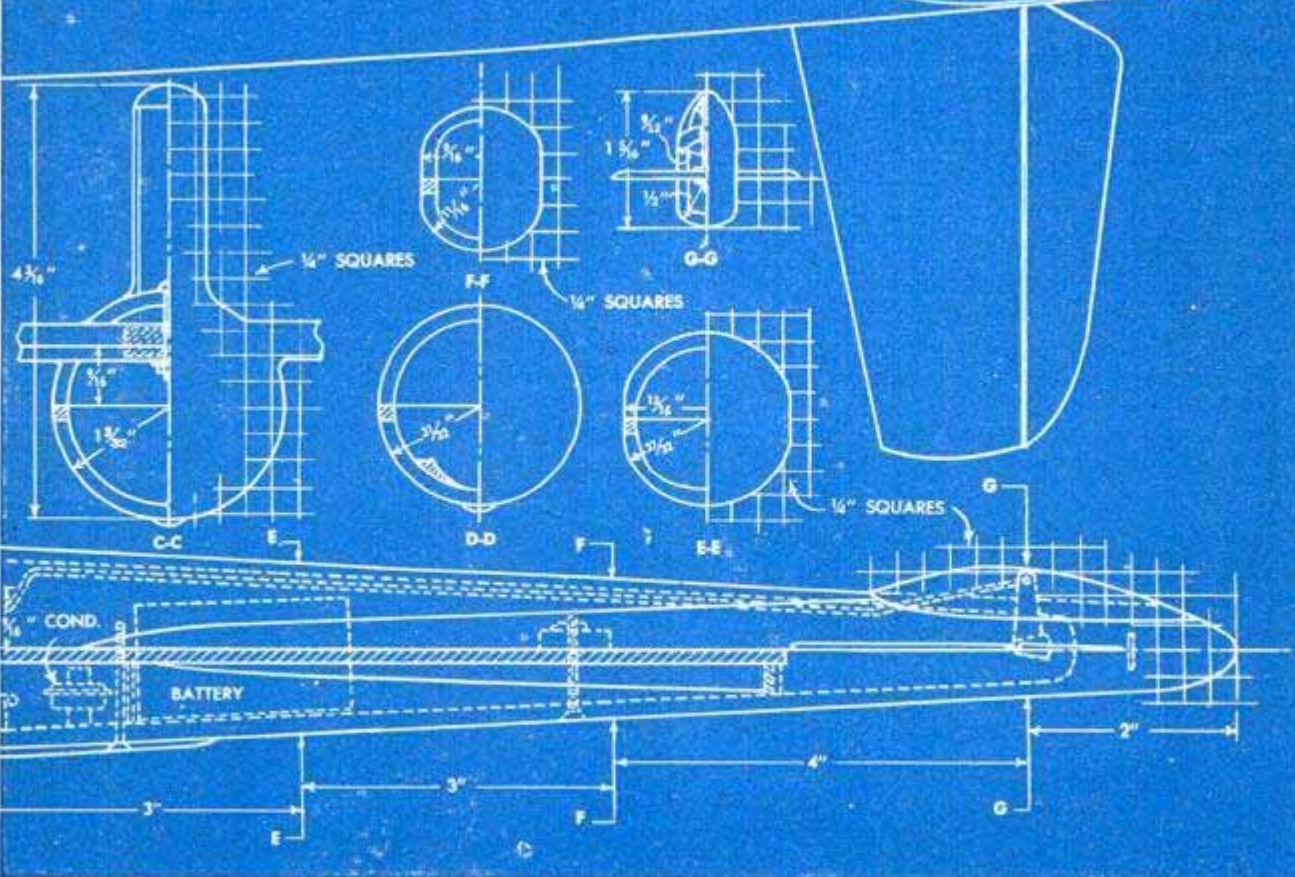
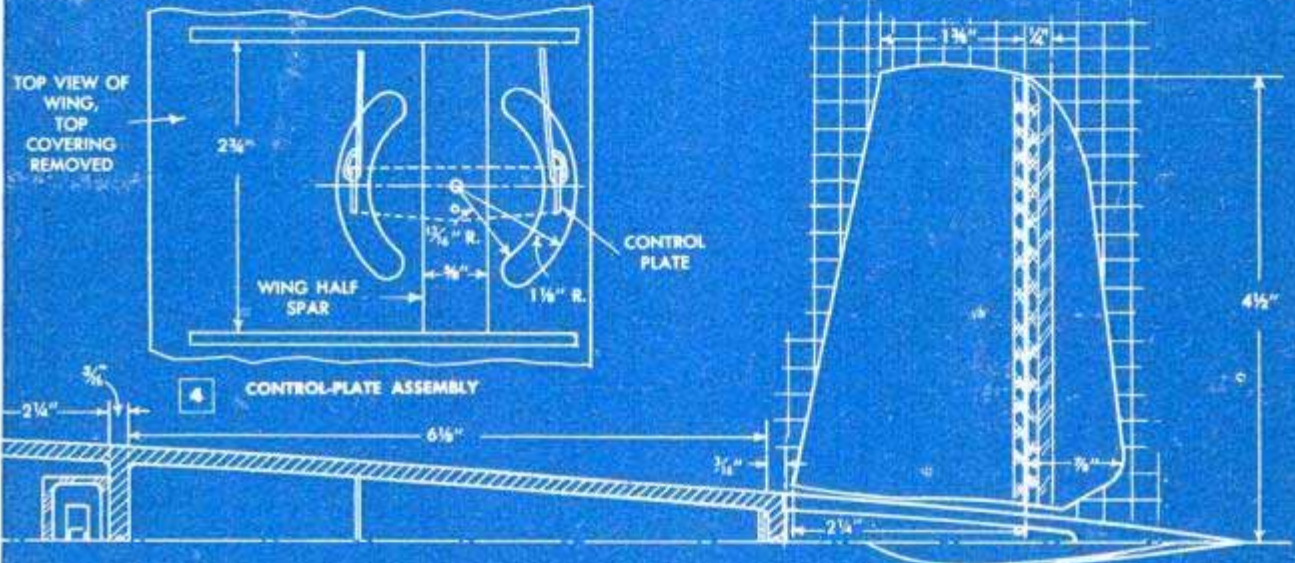
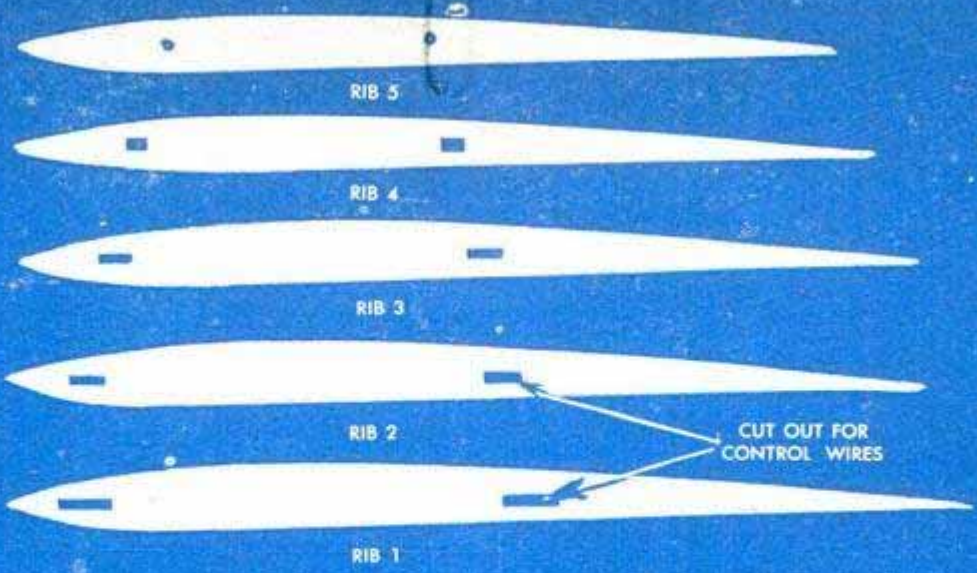
† A.M.A. Sanctioned meet — new record.

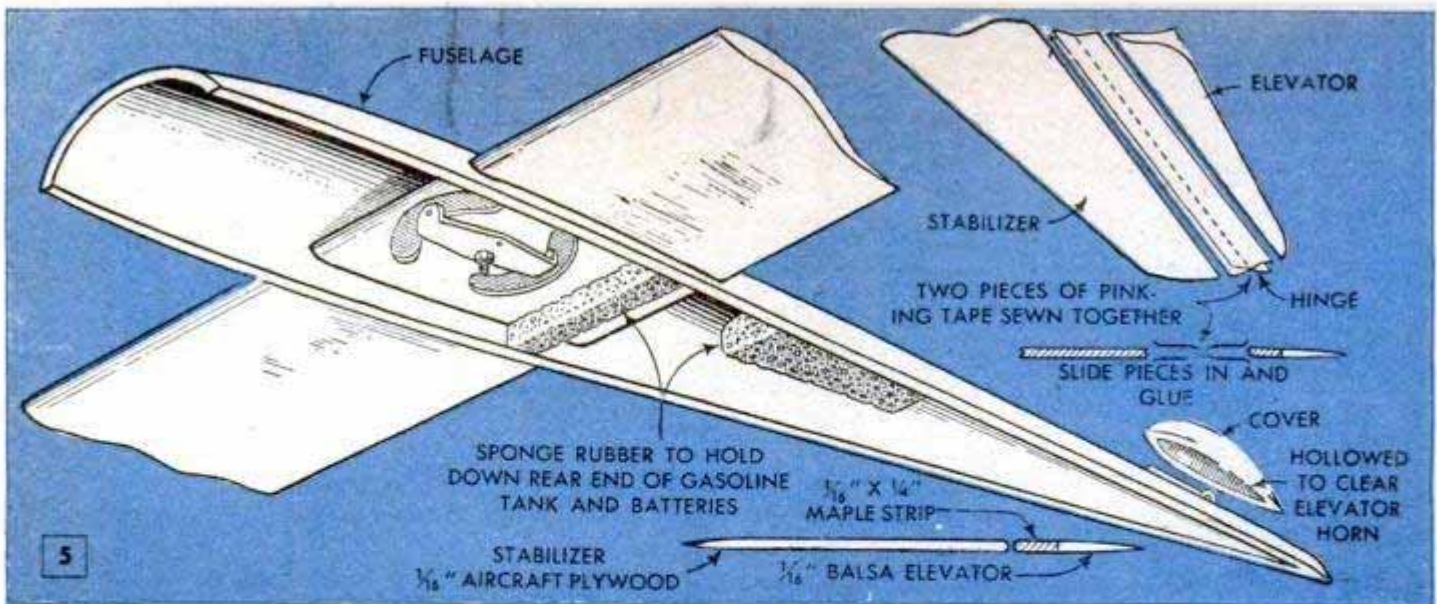
* The 1948 A.M.A. rules now place this airplane and motor in class C, for motors of .30 to .50-cubic-inch displacement. S = Sanctioned. NS = Not Sanctioned.



3

WING RIBS
(FULL SIZE)





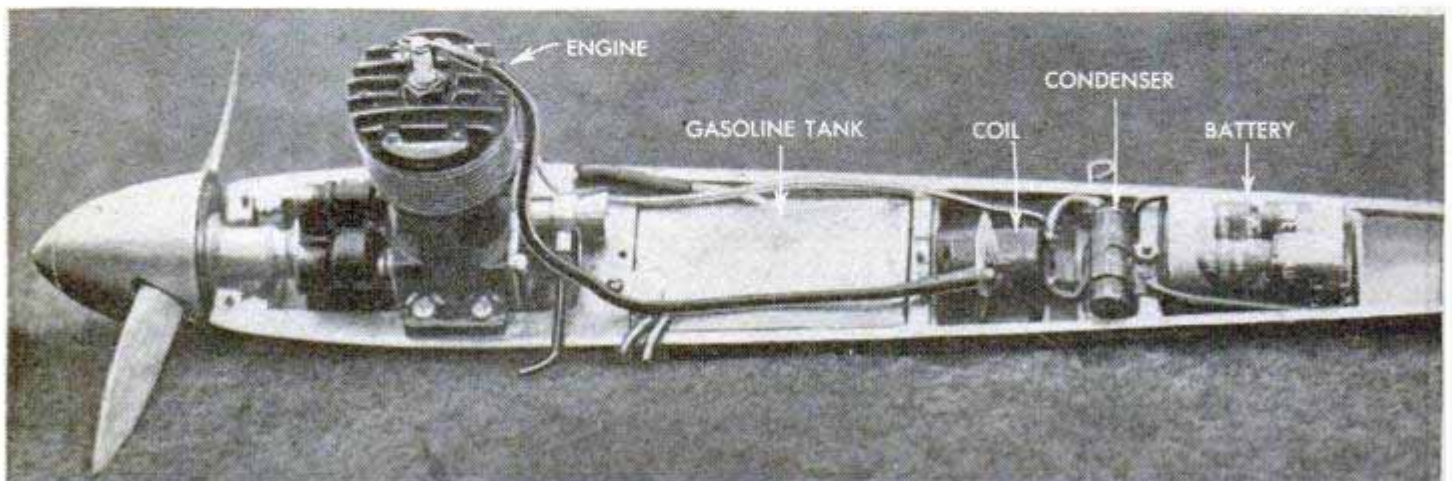
Then glue the top skin over the ribs. Wing tips are made from scrap balsa and merely close the opening at the outer ends of the wing. Two $\frac{1}{2}$ -in. pieces of $\frac{1}{16}$ -in. o.d. aluminum tubing are installed for control-wire guides. See the plan view, Fig. 2. Control wires can be installed in either the right or left wing.

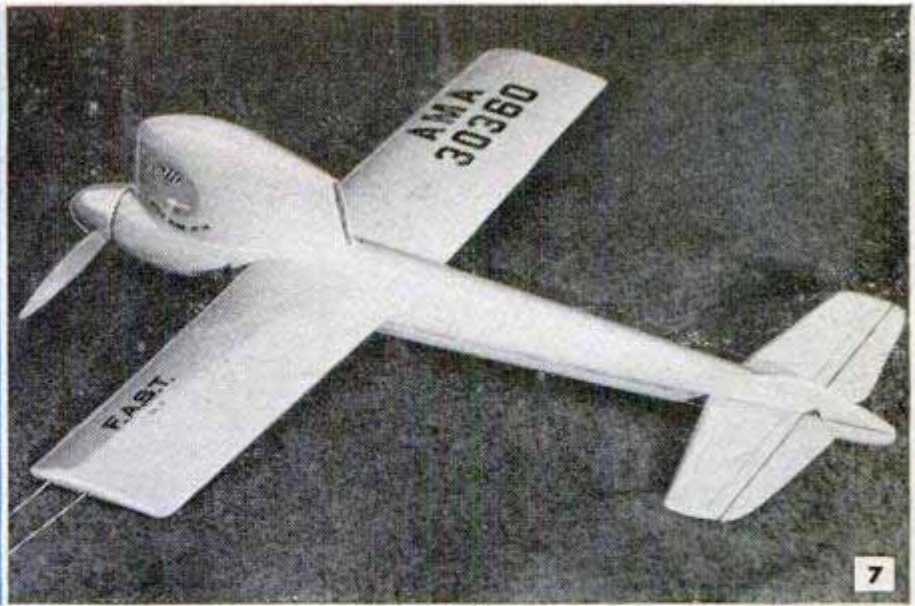
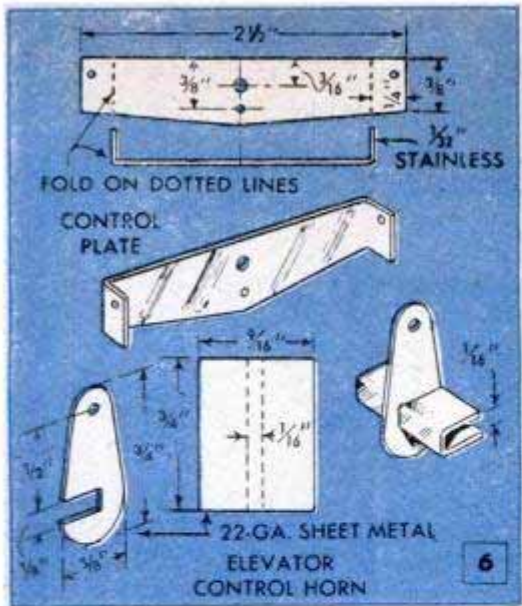
Cover the wing with silk to give an extremely smooth contour, and coat the wing surface with a sealer. To install the wing, measure $\frac{9}{16}$ in. up from the fuselage center line to the leading and trailing edges of the wing center section, Fig. 2, making sure that the 0-deg. incidence is accurate. The leading edge of the wing should be $4\frac{1}{2}$ in. from the nose. Draw the approximate rib profile on each side and cut out with a sharp knife or coping saw. Try the wing and trim the opening to fit. After the wing is correctly located and cemented in place, continue the hole in the bottom of the wing and half spar through the top of the fuselage. Then, make the control plate, Fig. 6, and install on the bottom surface of the wing as in Figs. 4 and 5, inserting the bolt through the top of the fuselage and locking it in place with a staple made from $\frac{1}{32}$ -in. wire. The prongs of the staple are

forced into the top of the fuselage on each side of the bolt head, and the straight section enters the slot in the head to prevent the bolt from turning. Finally, make the block and fitting to hold the bicycle-spoke tie-down which anchors the leading edge of the wing. In the profile view, Fig. 2, these parts are shown in section just forward of the fuel tank and leading edge of the center section of the wing.

Tail section: The stabilizer is made of $\frac{1}{16}$ -in. mahogany or aircraft plywood and the elevator is balsa, edged with a maple strip, Fig. 5. The elevator hinge is made from two pieces of aircraft linen, $\frac{1}{2}$ in. wide and 9 in. long, sewn together down the center of the cloth. Glue the hinge in place before making and installing the control horn and cover, Figs. 5 and 6. At this time, install the piano-wire control cable between the control plate and elevator horn, bending the wire to fit.

Engine cowling: A carefully made cowl, Figs. 1, 2 and 7, gives efficient engine cooling which results in a smoother-running engine. First, mount the base block on the fuselage and then cement the sides in place, holding them in position with pins. Make sure the top block is correctly re-

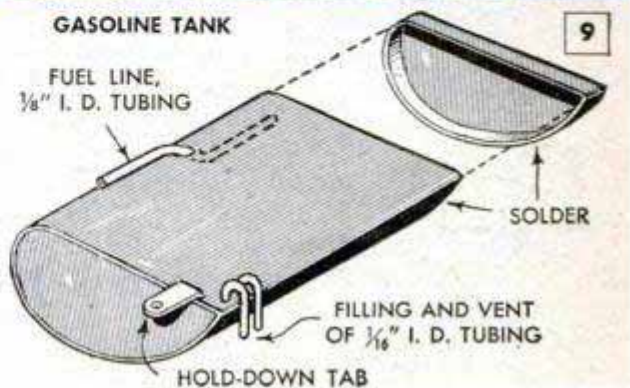
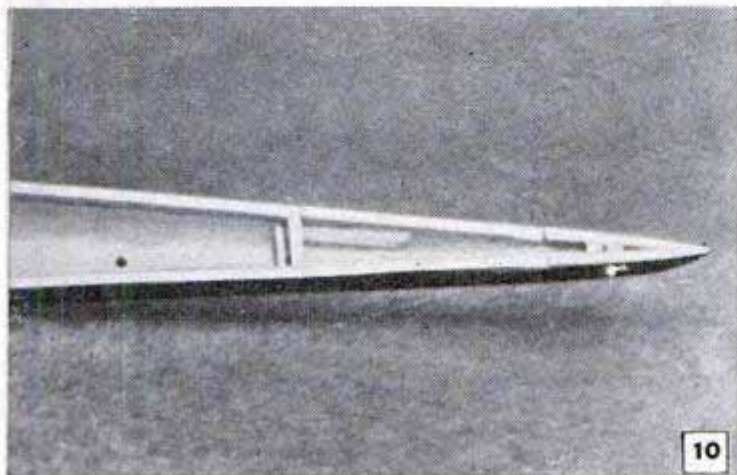
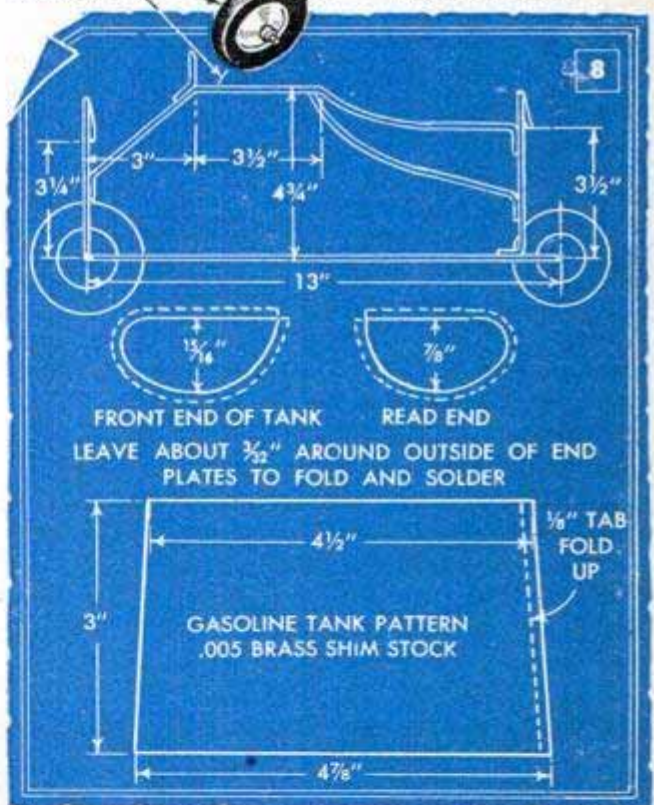
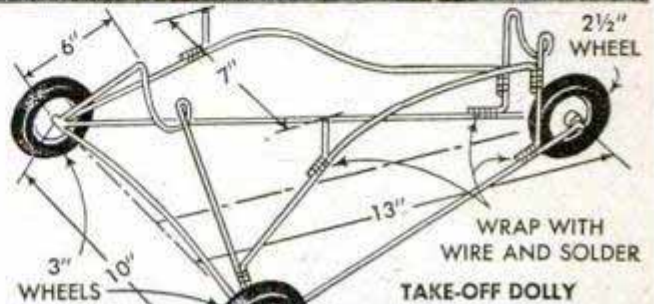




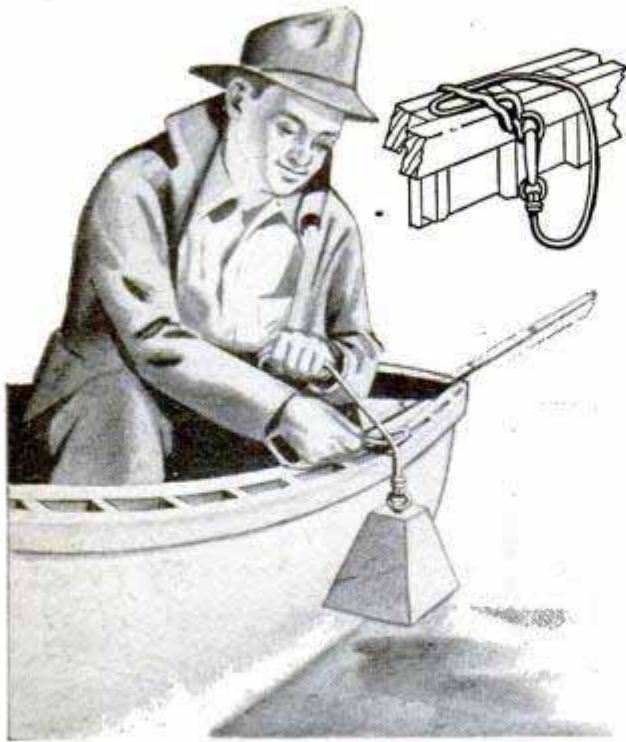
cessed for the cylinder-head fins and spark plug or glow plug, and also that it is grooved for the high-tension wire or glow-plug lead. Place the engine in the bottom shell and mount the top half of the fuselage to determine height of the top block. Allow the block to rest on the head and cement it in place on the side panels. Where the cowl meets the fuselage, fill in to a smooth contour with wood putty. Sand all over and cover the cowl with silk. Next, make the fuel tank, Figs. 8 and 9, and test for leaks. Then install the engine and all accessories in the lower half of the fuselage as in Fig. 10. The take-off dolly, Fig. 8, is easily made, the important thing being to adjust the wheels so that it rolls straight when pushed.

Finish: All surfaces should be filled and sprayed with synthetic enamel.

Flying: Use a 3-1 methanol and castor-oil mixture. If using spark ignition, setting on the point gap should be .003 in. maximum. Start with a 9-in.-dia. 10-in.-pitch prop, true the pitch to approximately 10 1/2 in. and make an accurate airfoil shape for the blades. With the plane at rest, the engine should turn 14,500 r.p.m. minimum.



Anchor Held in Raised Position On Outside of Boat



Wet, muddy anchors may be kept on the outside of a small boat by belaying them in the manner shown. Insert an eyebolt through the gunwale of the boat and attach the anchor rope with a snap hook. To hold the anchor in the raised position, loop the rope under the eye of the bolt, bring it up to the top of the gunwale and then under the portion of rope holding the anchor. The weight of the anchor will keep the rope from slipping. Drop the anchor by pulling on the dangling loop of rope.

Lee W. Panney, Ionia, Mich.

Filing Home-Workshop Publications



Colored cellulose tape attached to the backs of home-workshop magazines provides an excellent means of keeping them in order on the bookshelf. After arranging the issues in order as to month and year, fasten a strip of colored tape diagonally across their backs and then cut the tape between each magazine. When you wish to return a magazine to its proper position on the shelf, merely insert it between the other publications so that the diagonal line appears unbroken. By using different colors of tape and reversing the direction of the diagonals, it's easy to have

a systematic and orderly reference library. Use of transparent tape will permit wording to show through.

Henry Zave, Chicago.

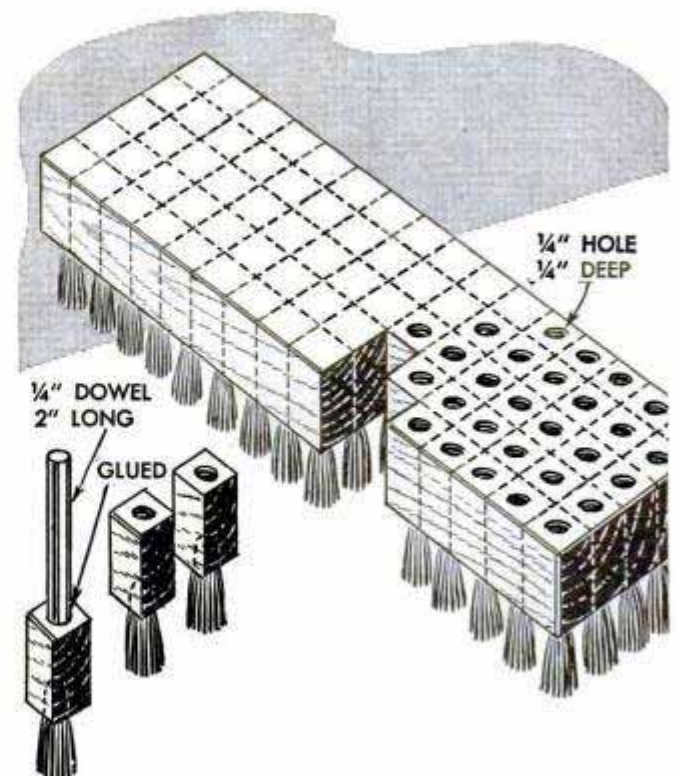
Ruler Markings Renewed With Rubber-Stamp Pad

If the graduated markings on a wooden ruler have become worn with use and are difficult to read, try drawing them back and forth across a rubber-stamp pad. After doing this, wipe the ruler lightly with a cloth. The ink will remain only in the calibrations making them clearly visible. Repeat the operation if needed.



Discardable Glue Brushes Cut From Scrubbing Brush

Here is a way one home craftsman produces small glue brushes in quantity, and at a cost so slight that he can discard them after each gluing job. He bought a fine-bristled scrubbing brush having a rectangular wooden back, and marked the back of the brush as shown by the dotted lines, centering one of the tufts in each square. Then he drilled a $\frac{1}{4}$ -in.-dia. hole, $\frac{1}{4}$ in. deep, directly over each tuft, and after sawing the squares apart along the lines, glued a 2-in. length of $\frac{1}{4}$ -in. dowel in each of the holes to serve as a handle.

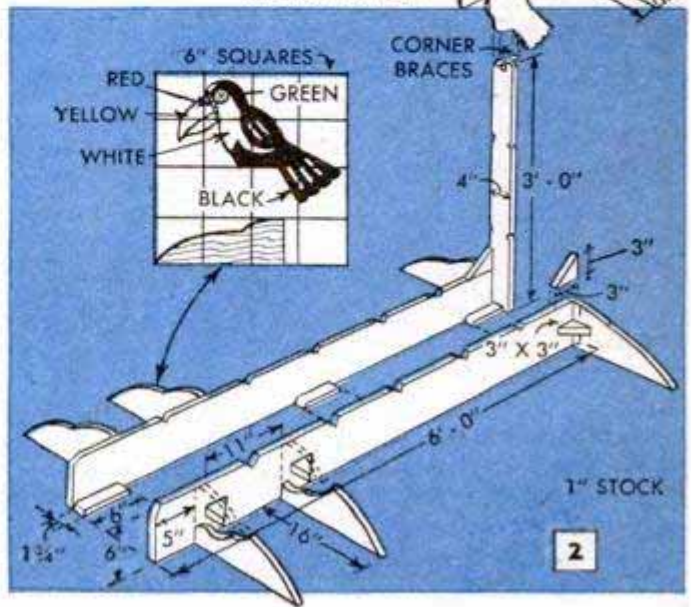
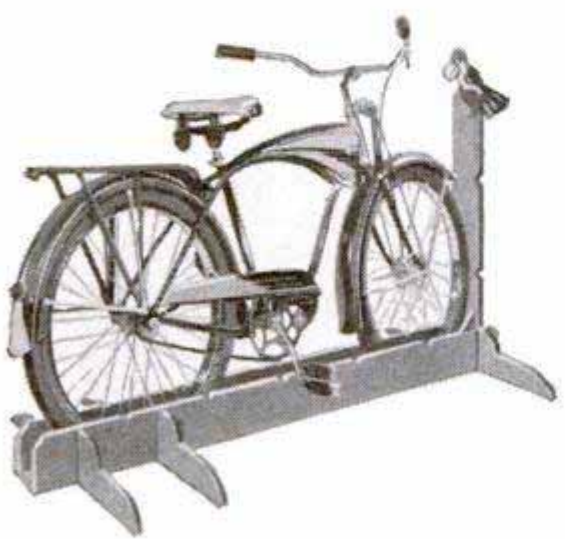
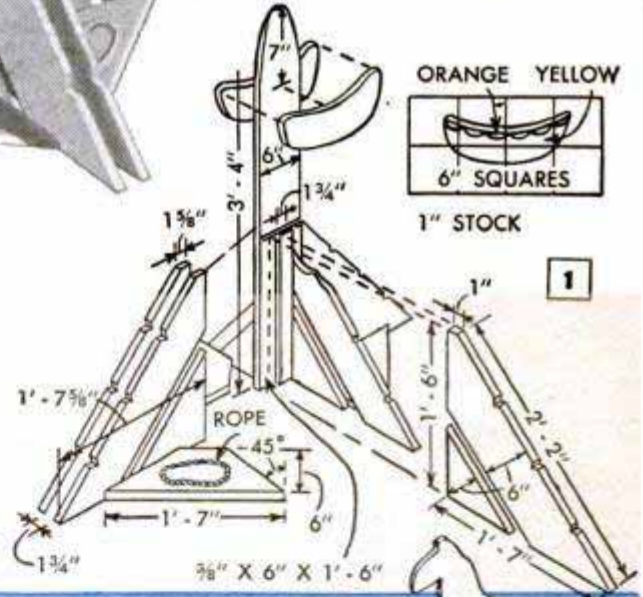


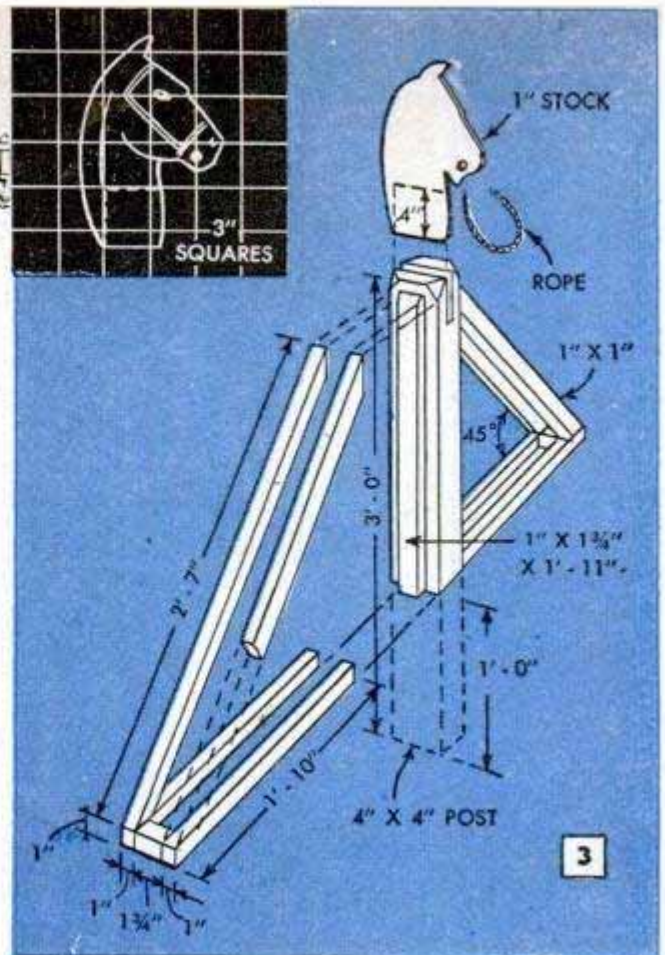
Hitching Posts for Bikes



By
Roberta L. Fairall

THESE colorful bike racks are designed to take care of bicycle-parking problems anywhere. Two are portable, while the third unit is designed for permanent installation. Pine, in the natural finish, combined with harmonizing colored decorations gives the pieces an attractive individuality in design. The unit detailed in Fig. 1, provides four stalls, or racks, placed at right angles about a center post. The upper end of the post is rounded and a curved cross-piece attached to each side represents





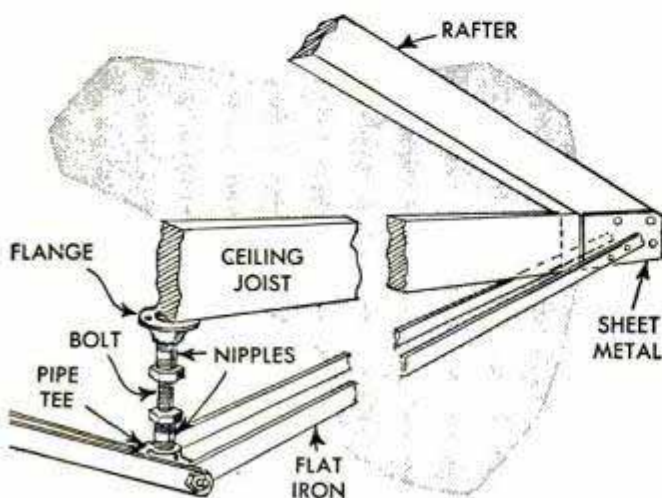
the wide brim of a sombrero, which is a feature of the design as are the V-notches regularly spaced along the top edges of sloping members. The rope decoration on the mitered spacers, Fig. 1, can be omitted without detracting from the appearance.

Another portable rack designed especially for the individual bike is pictured and detailed in Fig. 2. Its construction is similar to the first rack and the finish is the same except for variations in the enamel colors on the jigsawed bird that mounts guard at the head of the rack. Top edges of the long horizontal members, and also the head board, are V-notched at regular

intervals in the same manner as are the sloping members of the four-place rack in Fig. 1. Bandsawed feet are attached to the horizontal members to hold the rack firmly in the upright position.

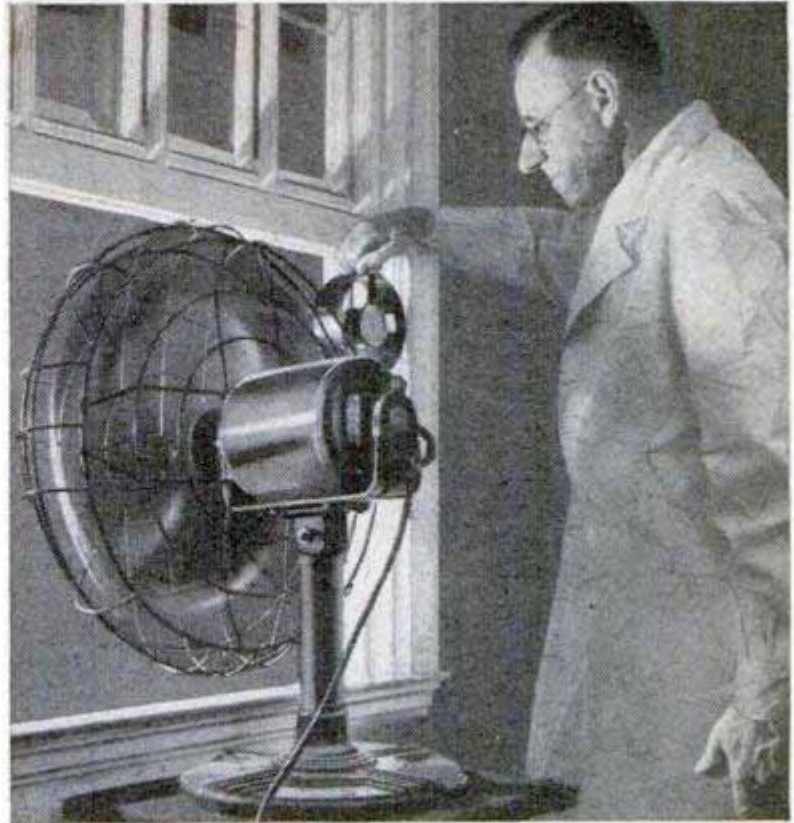
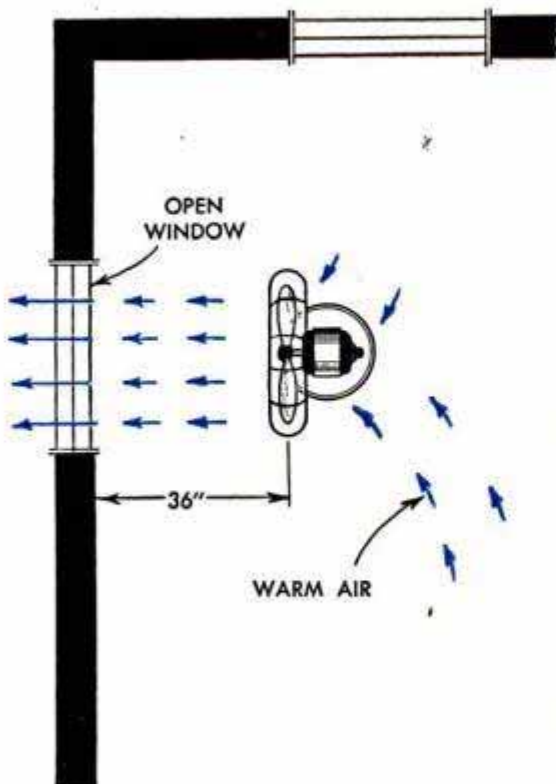
The permanent rack, Fig. 3, can be made to accommodate either one, two, three or four bikes as required. Set the center post in concrete and slot the top end for a horse's head which is sawed to profile from the cross-hatched detail in Fig. 3. Then add as many racks as desired, following the assembly plan in Fig. 3. Paint the head brown, bridle white, and the balance of the rack a contrasting color.

Adjustable Truss for Garage Ceiling Joist Prevents Buckling Walls



The walls of a hip or gable-roofed garage or small barn can be kept from buckling by installing one or more ceiling joists and fastening this flat-iron truss under each joist. Also, with these trusses in place the space between the joists and rafters may be used for storage without danger of sagging the joists and bulging the side walls inward. The truss consists of four lengths of flat iron, two of which are bolted to the joist and rafter at each plate. These points are reinforced with pieces of sheet metal. At the center of the rafter, the flat-iron strips are bolted to a tension adjustment which is assembled from pipe fittings and a bolt with double nuts, as shown.

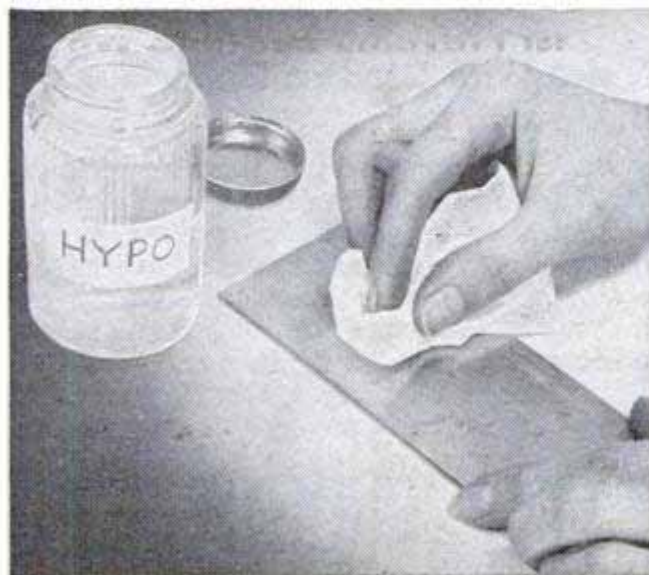
Reversing Fan Position Accelerates Cooling



Experiments conducted by Westinghouse Electric Corp. have shown that the cooling power of an electric fan can be increased as much as 75 percent on a sweltering night. This is done by setting the fan in front of an open window to blow air out the window. In one typical test, a nonoscillating, 16-in. portable fan, placed to blow air into a room, reduced room temperature only eight degrees, from 84 to 76, in two hours' time. But when the same fan was turned around, the temperature in the room was lowered from 86 to 72 degrees in the same period of time, a drop of 14 degrees. The distance the fan is placed back from the window should be about 1½ times the width of the opening. Thus, if the open-

ing is 2 ft. wide, the fan should be placed 3 ft. from the window.

This increase in efficiency is explained as being the result of an air stream set up by the fan. As the air stream rushes to the window, it draws with it additional air from the room. This causes greater amounts of cool air to enter through other open windows to replace the warm air exhausted from the room. As warm air will concentrate in the path leading to the fan, it is not advisable to place the fan in the room you are trying to cool. The windows through which the warm air will be expelled and the cool air drawn in should be carefully selected to take advantage of natural air movement through the room.



Bringing Out Scribe Lines on Metal With Discarded Hypo Solution

When working with copper, brass or bronze and it is difficult to see the scribed layout, try polishing the metal and swabbing it with photographic hypo solution. The hypo will deposit a thin white film on the metal when dry, bringing out the scribed lines clearly when the hypo is wiped from the surface.

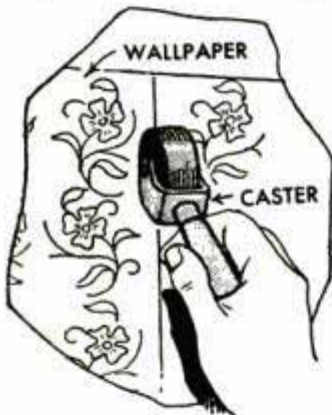
☐ The tendency of furnace pipes to rust in a damp basement during summer months can be avoided to some extent by burning papers in the firebox ten or twelve times throughout the season. This replaces the moist air in the pipes with dry air.

Rolled Paper Soaked in Paraffin Kindles Outdoor Fire in Light Rain



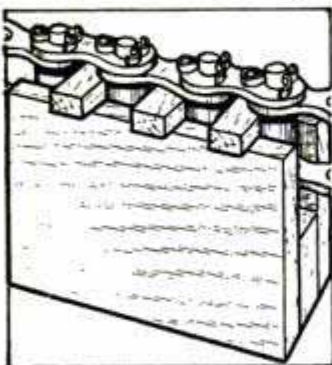
Did you ever find yourself badly in need of a fire when miles away from the nearest shelter, and discover that although the matches were dry, there was no dry wood available? At times, such a situation could have serious consequences, and for this reason, it's an excellent idea to carry several fire rolls on every hunting or fishing trip. These fire rolls are easy to make and their cost is negligible. Just fold a few sheets of newspaper four times and roll them up tightly. Fasten the rolled paper with pieces of light wire spaced an inch or two apart along its length. After cutting the paper into 3-in. rolls, soak it in paraffin melted in a double boiler. Then, remove the rolls from the paraffin and allow them to harden. Place a couple of these rolls in your hunting-coat pocket or tackle box, and when you need a fire in a hurry, pile small twigs and larger branches over one of the rolls and light it. The resulting hot flame, which burns for 5 minutes or more, will ignite the twigs easily. The twigs will dry and ignite the branches, giving you a good fire even in a moderate rain. If the twigs are very wet, use two fire rolls.

Improvised Wallpaper Seam Roller



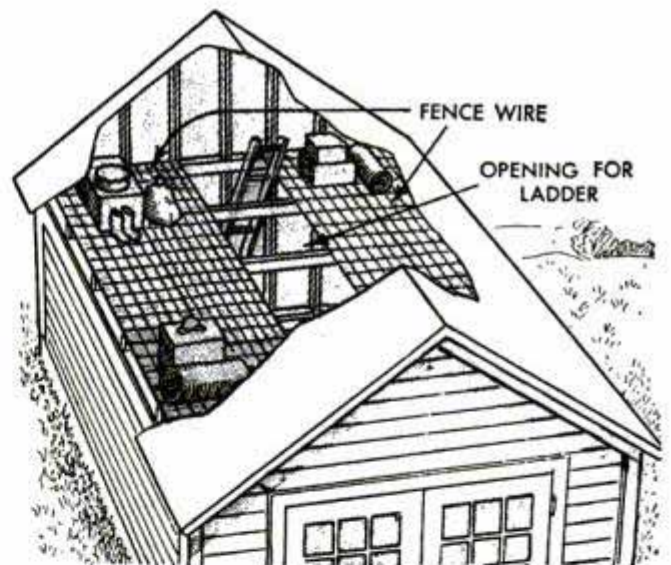
When wallpapering a room and a seam roller is not available, an ordinary castor makes an excellent tool for this purpose. The castor is easier to manipulate if fitted with a handle taken from an old file or other tool.

Removal of Roller-Chain Pins Simplified by Repair Block



The pins of bicycle and motorcycle roller chains are removed easily without straining the links or rollers if the chain is mounted in a repair block made of hardwood scraps. The block consists of two

side pieces fastened to a center piece, allowing enough room below the chain for the pins to be driven out. Small wooden spacer blocks are slipped between the rollers to hold the chain in position. All of the blocks must be the same thickness in order to keep the rollers and links parallel.



Fence Wire Used as Floor In Garage Attic

Besides being cheaper than wood flooring, I found that wire fencing made an excellent floor for the attic over my garage as it not only prevented dust and dirt from collecting, but also afforded a view from below of the items stored. I left the center unfloored for access by ladder.

George W. Horres, Charleston, S. C.

☐ Place a baked potato in a breadbox to keep the bread from drying out. Also, wash and air the box once a week to keep the bread from having a musty taste.

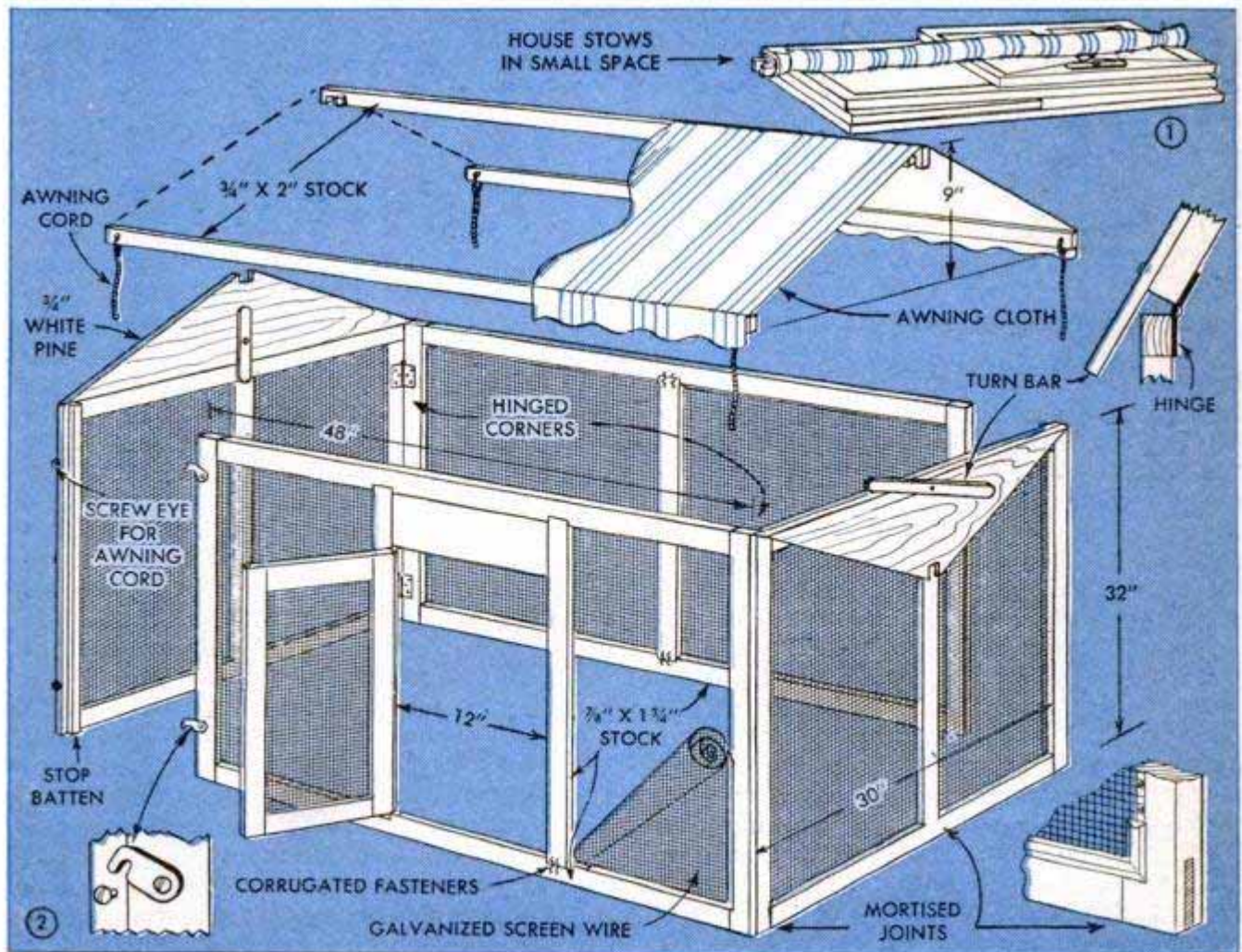


Parents will feel at ease when baby is safely playing in the yard or on the beach in this screened playpen, which can be folded flat for carrying

PORTABLE "SCREENED PORCH" FOR BABY

This screened playpen consists of only three units which fold into a compact bundle, Fig. 1. The side and end walls are hinged to form two separable units, which are joined at diagonal corners with flat sheet-metal hooks that lock over round-headed screws as in Fig. 2. Frames for the

walls are constructed with mortise-and-tenon corner joints and covered with 14-mesh wire screen. The gable ends, made from pine, are hinged on the outside and wooden turn buttons on the inside hold them erect when the pen is set up. A notched ridgepole supports the awning.





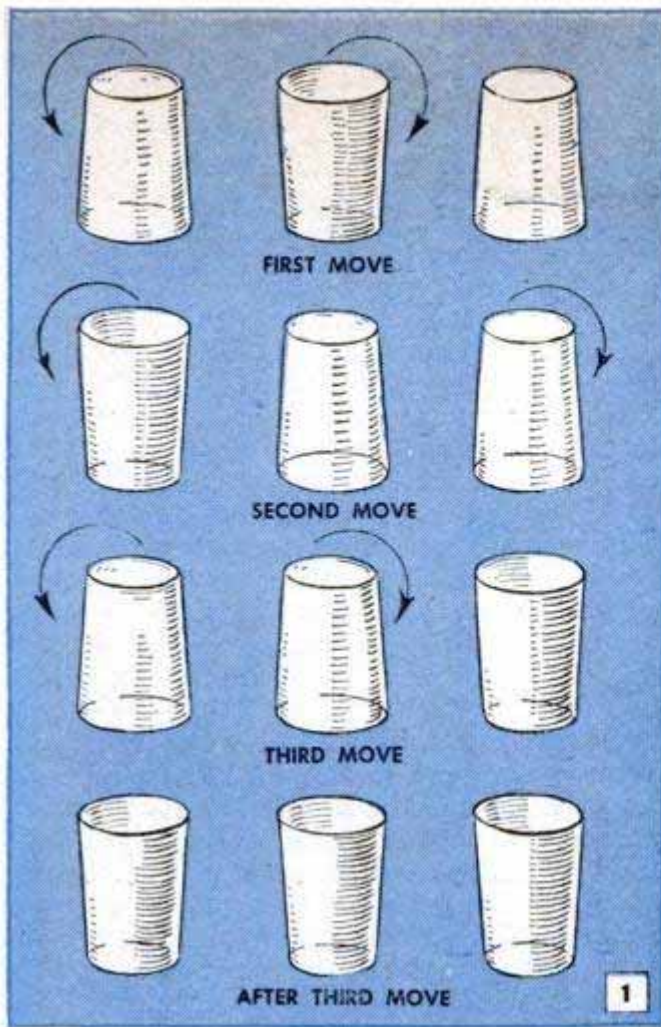
PARTY MAGIC

By Bill Turner

WE AREN'T going to show you how to pull a rabbit from a hat as Johnny Jones, professional magician, is doing above, but some of the following tricks are just as mystifying and can be executed expertly with very little practice and concentration. No special apparatus or stage props are needed, as all the stunts are performed with common articles that are always handy. Some of the tricks are real posers and, if skillfully done, will prove just as baffling to your audience as some involved stunts which require special magic equipment.

As a good example, try this stunt, a favorite of Joe Berg, inventor of tricks. It's done with three empty glass tumblers which are placed in a row on a table. Then, asking the spectators to watch carefully, take a glass in each hand and quickly give them both an end-over-end half-turn, Fig. 1. This movement is repeated twice, always turning two glasses at once. Finally, all the glasses are mouth up. Now turn the center

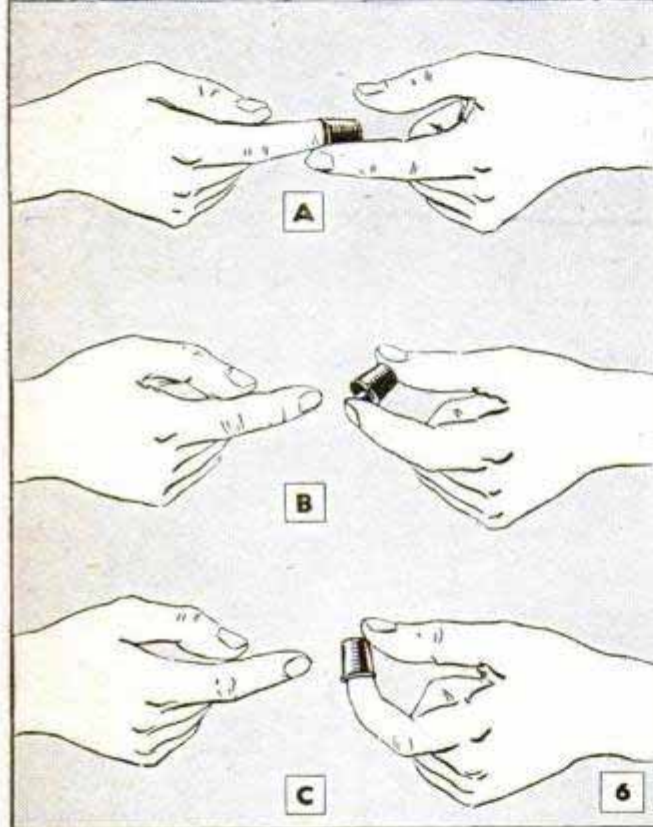
glass mouth down and challenge a spectator to try it. But try as he will, the spectator cannot bring the three glasses mouth up by turning two at a time. Here's where you take over, rearranging the tumblers and successfully repeating the performance in a few quick moves. After reading the simple secret below, practice a few minutes and try this trick at the next party. You'll have everybody in the place turning tumblers and scratching his head, wondering how it's done. The idea is to start with the end glasses mouth down and the center one mouth up, but when the spectator is invited to try, the two end glasses are placed mouth up and the center one mouth down. The trick derives its mystery from something besides a mere secret. Its success depends to a large extent on a slick presentation, Fig. 2, and also on skill in deception. This is achieved by planning the talk and action to focus attention on the routine, which keeps the audience watching for an extra turn or some other secret



manipulation that will reveal the trick.

By this time, the guests will be asking for more. So borrow a man's handkerchief and proceed to push a small object right through the cloth without leaving a hole in it. First, place the handkerchief over your left hand, doubled loosely into a fist, and poke a pocket into the center of the handkerchief with the right forefinger. At the same time, the right middle finger is secretly extended. Then the left fingers are opened slightly so that the right middle finger can enter the left fist, carrying a fold of cloth with it to form an opening that is unknown to the spectators. Fig. 3 shows this with the fingers slightly opened and Fig. 4 shows how it appears with the fingers closed. Now pick up a pencil, cigarette, or other small object, and place it in the secret opening, holding it in place with the left fingers. To the audience, it appears that the object has been placed in the pocket. Then say a few words of magic, release the grip of the left fingers, and the object drops through the opening in the handkerchief to the floor. But to the attentive spectators, it appears to pass through the solid center of the hankerchief.

Another trick that calls for quick sleight of hand is shown in Figs. 5 and 6. The sequence of this thimble trick begins with the thimble on the forefinger of the right



hand. Point this finger to the left and touch the thimble to the end of the left forefinger. Draw the hands apart, rather quickly. Then repeat the action and this time the thimble appears to jump, quite magically, to the left finger tip, Fig. 6, B and C. The deception depends upon easy, swift manipulation of the thimble plus control of the attention of the audience—a technique professional magicians call “misdirection.” The last three fingers of each hand are folded loosely into the palms, while the thumbs are held parallel with the first fingers and are kept out of sight of the audience. As the fingers touch, the tip of the left thumb is near the thimble. The first time the fingers are pulled apart nothing happens except that you follow the thimble on the right finger with your eyes. This serves to misdirect the attention of the

spectators and is an important part of the deception. Now, moving a little slower than before, touch the fingers again, as in Fig. 6, A. Slide the inside of the left forefinger tip against the thimble and secretly seize the thimble between the left thumb and left finger tip, pulling it off the right finger. Bending the left forefinger slightly, push forward on the thimble with the left thumb, and it will flip onto the left finger quite easily. But be sure to follow the right finger with the eyes just as before, Fig. 5. Thus the spectators' attention is directed to the finger and they never see the flipping motion which transfers the thimble. This one will require practice.

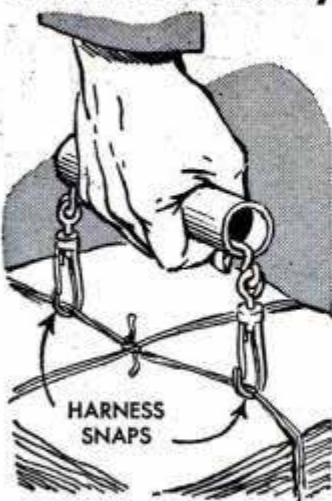
Here are three more party tricks which have not been illustrated because they are so very easy to follow. For the first one, obtain a number of spools of colored thread and select six or eight of these of sharply contrasting colors. With these you can perform a puzzling feat of divination. While your back is turned, have a spectator select one of the spools. Next, have him place this spool in your hands, which are held behind your back, and put the other spools in his pocket. Then, apparently by sense of touch alone, you name the color of the spool you hold. Here's the way the trick is worked. When the spectator has put the spool in your hands, turn to face the audience. Quickly and unobtrusively break off a short length of thread from the spool, wad it up, and insert it under the nail of the middle finger of your right hand. In the meantime, distract the attention of the audience by talking about the strange powers of divination. Even ask the spectator to help by concentrating on the color he selected. While talking, bring the right hand out from behind your back and point a finger at the spectators in a natural gesture. This provides an opportunity to glimpse the color of the thread under the fingernail. Do this very subtly, bringing the hand in line with the eyes so it does not attract the attention of those who are watching every move.

Most tricks should never be repeated, but here's one to perform at the dinner table that becomes more baffling with repetition. If there is a dish of olives, select four of them with the right hand, palming one and dropping three on the table in front of you. Hold the concealed olive in the crook of the second and third fingers, keeping the hand in a natural, relaxed position with its back toward the audience. Then pick up one of the three olives from the table, taking it between the right thumb and forefinger. Place it in the palm of the left hand and close the left fingers over it. Do this quickly but openly so that everyone sees just what is done. Then pick

up another olive and put this second olive into the left palm in the same way as the first. At the same time, secretly drop the palmed olive into the left hand and immediately close the fingers. Then pick up the third olive, saying that you will put it into your pocket. Go through the motions of putting it in the right-hand coat pocket, but palm the olive instead. Then, as the final gesture, open the left hand and drop the three olives on the table, saying that the one placed in the pocket has mysteriously joined the others. As the fourth olive remains palmed in the right hand, you are ready to repeat the trick. Most audiences will give up trying to guess and ask how it's done.

Finally, here's a number puzzler which is rare in that it does not appear to depend upon trick figuring as such stunts usually do. To the audience, there seems to be no possible explanation for the feat of prophecy which the magician accomplishes. Write a number, as explained later, on a piece of paper. Then fold the paper and hand it to a spectator for safekeeping. No one but you knows what is written. Now look over the audience and purposely ask a stranger to write certain figures in a column. These are the number of years he has been married, the year of his birth, his age, and the year he was married. The spectator is asked to add the column of figures and read the total. It will be found that this total and the figure written on the paper are exactly the same. It works this way. The total of the stranger's age in years, birth year, number of years married, and the year he was married is certain to equal twice the figure of the current year. In other words, if the year is 1948, the figure 3896 would be the prophecy.

Handle for Heavy Bundles



of the wire are bent hook-shaped. Then, an ordinary harness snap is fastened to each hook. To carry a bundle, just clip the harness snaps to the binding.

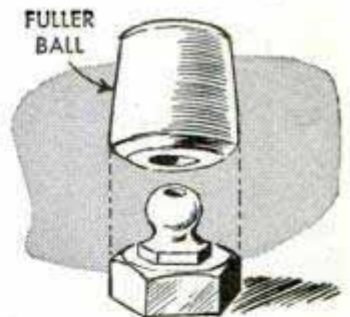
Length of Dog's Tether Adjusted With Tent-Rope Tightener



In order to protect his plants and shrubs, one man frequently finds it necessary to vary the length of his dog's tether when the animal is staked in different parts of the yard. To adjust the tether, he uses a tent-rope tightener made from a short length of dowel by drilling a hole through it near each end.

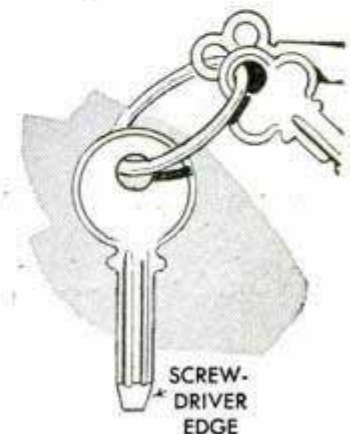
Fuller Ball Covers Grease Fitting

The grease fittings on a car or piece of machinery are protected from damage and kept free of dirt if they are covered with ordinary fuller balls. This type of washer fits snugly over the tip of the fitting and is easily removed for greasing. One end of the ball should be plugged to prevent dirt from entering.



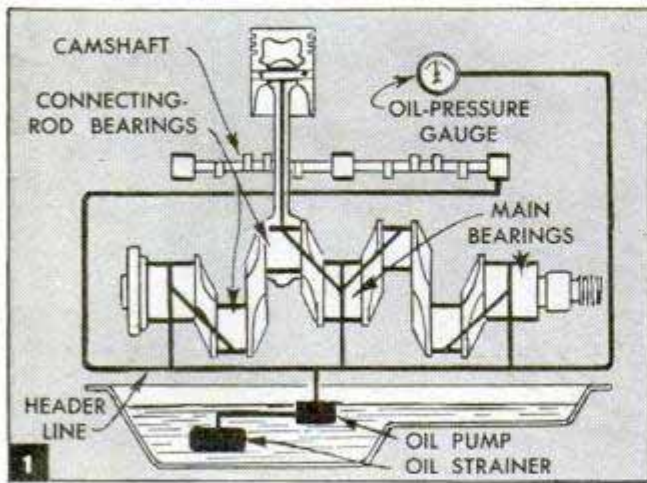
Screwdriver From Key Blank

A useful pocket screwdriver can be made by grinding or filing a screwdriver edge on a steel key blank. If the screwdriver is carried on a ring or in a holder with the rest of the keys, it will always be handy when needed.

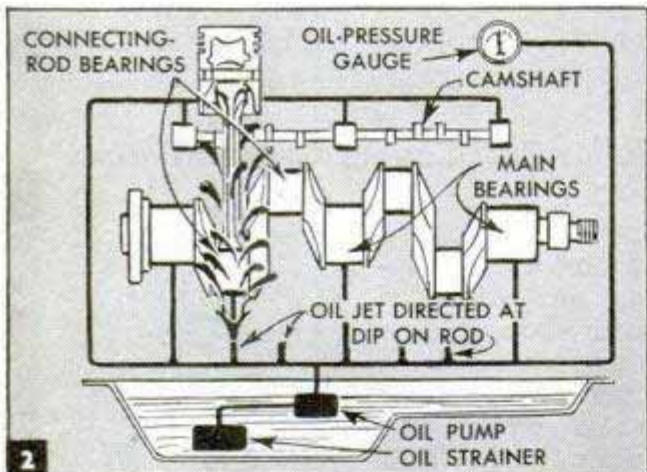


LUBRICATING YOUR AUTO

Good lubrication of the auto engine means more than just adding a quart of new oil occasionally. Like all other common servicing operations, it calls for scheduled attention to important details



In a full-pressure oil system, oil is pumped directly to the crankshaft and connecting-rod bearings; also to the camshaft and piston rings. In engines with overhead valves, oil is pumped to rocker-arm shaft



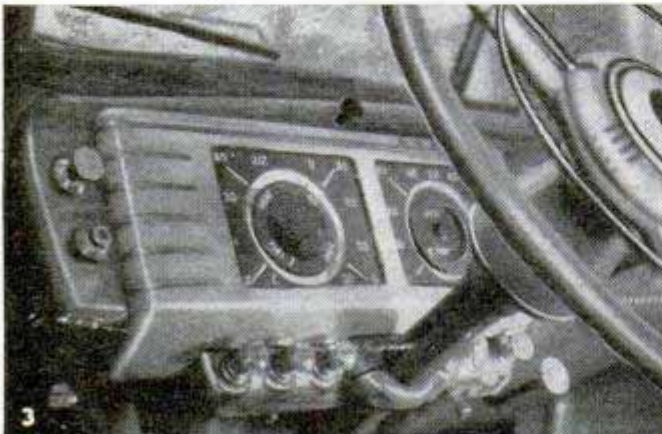
Diagrams courtesy Clawson & Bals, Inc.

In a modified splash system, oil is pumped to the main bearings and the camshaft bearings. Connecting-rod bearings are lubricated by a splash from oil dips located on the lower ends of the connecting rods

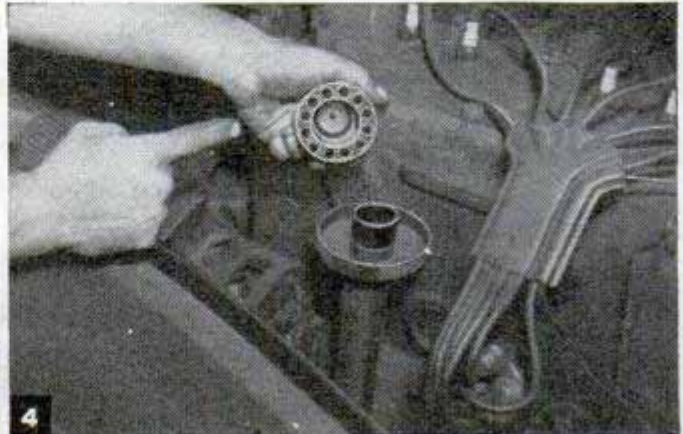
ALTHOUGH good engine lubrication represents only a small percentage of the average yearly cost of operating a car, there is more to it than merely adding a quart of oil now and then. Oil in the crankcase gradually becomes contaminated with certain acids and mildly abrasive particles. Just how rapidly the oil becomes contaminated to a point where it is injurious to the engine and should be replaced, depends much on the driver—length of trips, choking, etc.—and on atmospheric conditions. In some cases it may be possible to drive as much as two or three thousand miles without changing oil, while in other cases it may be advisable to change at 500 miles or less.

For example, in a car that is driven only a mile or two at a time in winter, such as on shopping trips, moisture condenses inside the crankcase each time the motor cools, some of it reaching the oil. Combustion gases passing the pistons mix with the moisture and form a mild sulphuric acid, which pits the bearings, pistons and cylinder walls.

An oil filter does not remove moisture, acid or gasoline. It will remove most solid contaminating and abrasive agents, such as dust, metal and rust particles from the engine, gummy residues from leaded fuels, etc. However, even with an oil filter and a carburetor air cleaner, the oil should be changed at regular intervals, length of the intervals being determined by the operating habits of the driver, distances the car is driven regularly, season of the year and condition of the roads on which the car is operated most of the time.



When driving, glance at the dash gauges to see that oil-pressure and temperature readings are normal

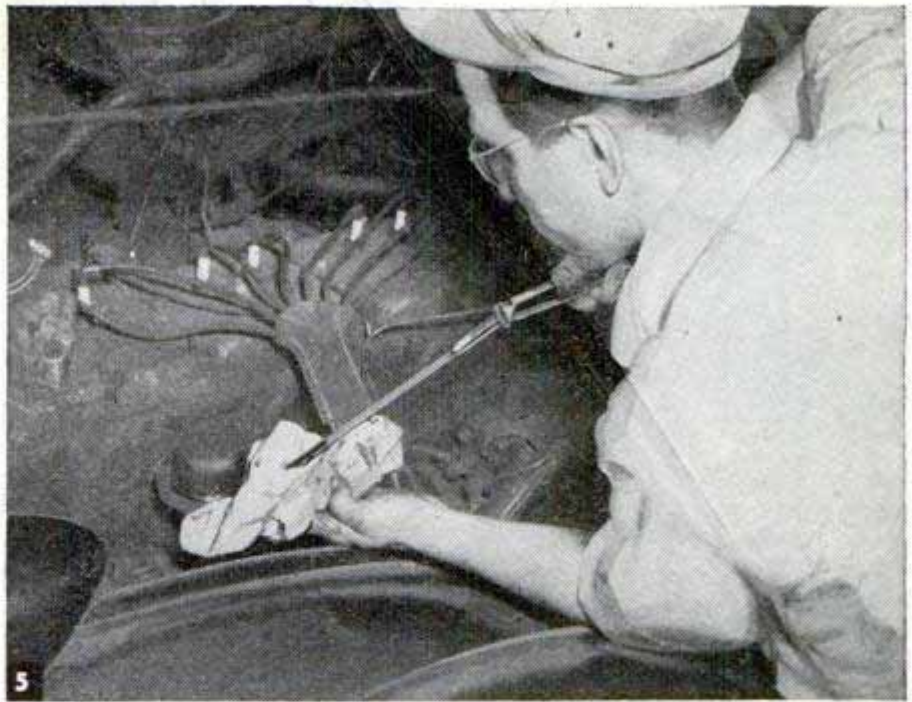


Wash breather cap in gasoline at regular intervals. Then coat the element with a heavy motor oil

ENGINE

By Phil Ruskin

Check the oil level frequently and refill. When checking the oil level after a long drive, wait for the oil to drain back into the oil pan to get the true reading. If the oil appears discolored or if there are indications of water, drain, flush and refill with new lubricant

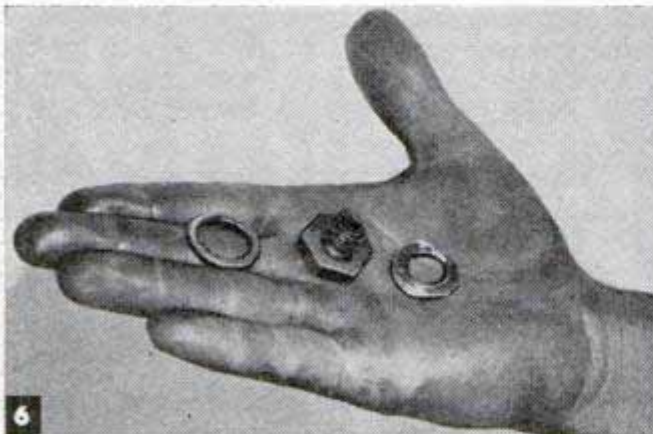


One method often suggested for determining oil-change periods is to test the oil for contamination, especially acid content, at regular intervals over a period of time, and from this data work out an oil-changing schedule for both winter and summer.

A lubricating oil has to perform several separate jobs in protecting the engine from excessive wear. It must lubricate moving parts and reduce friction to a minimum, Figs. 1 and 2. The oil also acts as a coolant in carrying off heat from the cylinders and the bearings. In addition, it seals engine compression by providing an oil film between the pistons and the cylinder walls. Some oils also act as cleansing agents by removing dirt and carbon from the working parts of the motor.

Always use a high-quality motor oil of the correct viscosity for the particular engine, selecting it according to the type of operation and season of the year. Oils are now available for various kinds of operating conditions. Usually these are designated as regular, premium and heavy-duty

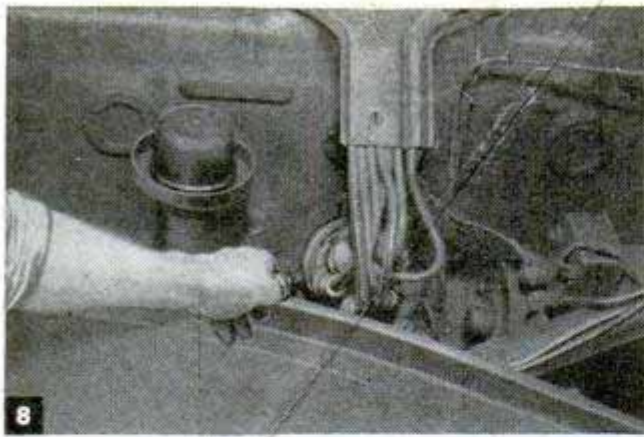
grades. The regular-type motor oil is satisfactory for average use in a passenger car. However, regular grades do not ordinarily contain oxidation inhibitors (additives) which aid in preventing sudden breakdown of the oil under exceptionally severe operating conditions. For constant hot-running conditions, such as mountain travel and long runs in summer heat, where motor oil tends to break down rapidly, a premium-type oil should be used. This contains a chemical (additive) which resists breakdown of the oil by oxidation, thus preventing undue sludge formation and bearing corrosion. Heavy-duty motor oils contain not only additives, but also detergent agents which cleanse the engine parts of solid deposits and tend to keep sludge dissolved in the oil. Generally, this special grade is required only for trucks and other heavy-duty engines, but it can be used in passenger-car engines subjected to severe operating conditions. When using these special oils for the first time, the crankcase should be drained after 300



A leaky drain plug may cause complete loss of oil from the crankcase, resulting in a damaged engine



Use a light oil for the generator, starter and other units having oil cups, but do not overlubricate



Lubricate distributor shaft with high-temperature grease. Take care not to get dirt in the grease fitting

to 500 miles, as the first filling will rapidly collect crankcase waste and sludge. It is not advisable to mix different kinds of premium lubricating oils.

For best results, engine operating temperatures should never be lower than 140 deg. or more than 180 deg. F., and preferably should be between 160 and 180 deg. F. The proper operating temperature is important as it affects the efficiency of the lubricating system. Clean the cooling system regularly of rust and other loose deposits by a thorough back flushing. A loose fan belt may cause overheating and overloading of the cooling system. If the engine runs too cool in cold weather, cover a portion of the radiator. When starting a cold engine, remember that most engine wear takes place during the warming-up period, especially if the engine is raced idle or put under load immediately after starting. When temperatures are below 70 deg., it is good driving practice to allow the engine to warm up before driving the car. After stopping, oil drains rapidly from the working parts when the engine is warm and because of this the bearing surfaces will be relatively dry when the engine is started again. These bearing and sliding surfaces run dry until oil from the pump reaches them. The small quantity of oil left on the bearing surfaces will not stand up under heavy loads or high speeds. Be sure that the automatic choke is working properly as a rich fuel mixture causes dilution of the crankcase oil.

Poor crankcase ventilation, especially in a cold-running engine, will cause extra condensation of water in the crankcase. Short runs in cold weather aggravate this condition. Check and clean the crankcase ventilator openings, Fig. 4, at regular intervals. Wash the filler cap in gasoline and then reoil. An efficient oil filter is helpful in maintaining a clean oil supply, provided the filter element is replaced regularly. However, a filter does not eliminate the need for a regular oil drain; it simply per-

mits the extension of time between drainings. Always renew the filter element when changing to a premium grade of oil. An oil that looks clean may contain too much acid and fine abrasives for safe lubrication. Only a complete draining, flushing and oil renewal will provide adequate protection.

As the cost of a complete oil change is small compared to the yearly bill for gasoline, repairs, storage, etc., it pays to drain and flush the engine oiling system at least twice a year—spring and fall. Without an efficient filter, draining should be done more often. Because some oil remains trapped in the oiling system when draining, flush the crankcase at each draining. Use a flushing oil, which has the properties of a light lubricant, to eliminate any danger of the bearings running dry during the flushing process. Always drain the oil when hot and be sure the drain plug is replaced tightly. See that the plug gasket, Fig. 6, is in good condition. Check the oil level, Fig. 5, after the engine has run awhile. Remember that the filter takes about a quart. When checking the oil level, allow time for the oil to drain back to the crankcase to get an accurate reading. In both new and reconditioned engines, a light-grade lubricating oil should be added to the gasoline for upper-cylinder lubrication. Too heavy an oil may foul the plugs and cause extra deposits of carbon and gum around the valves, pistons, etc.

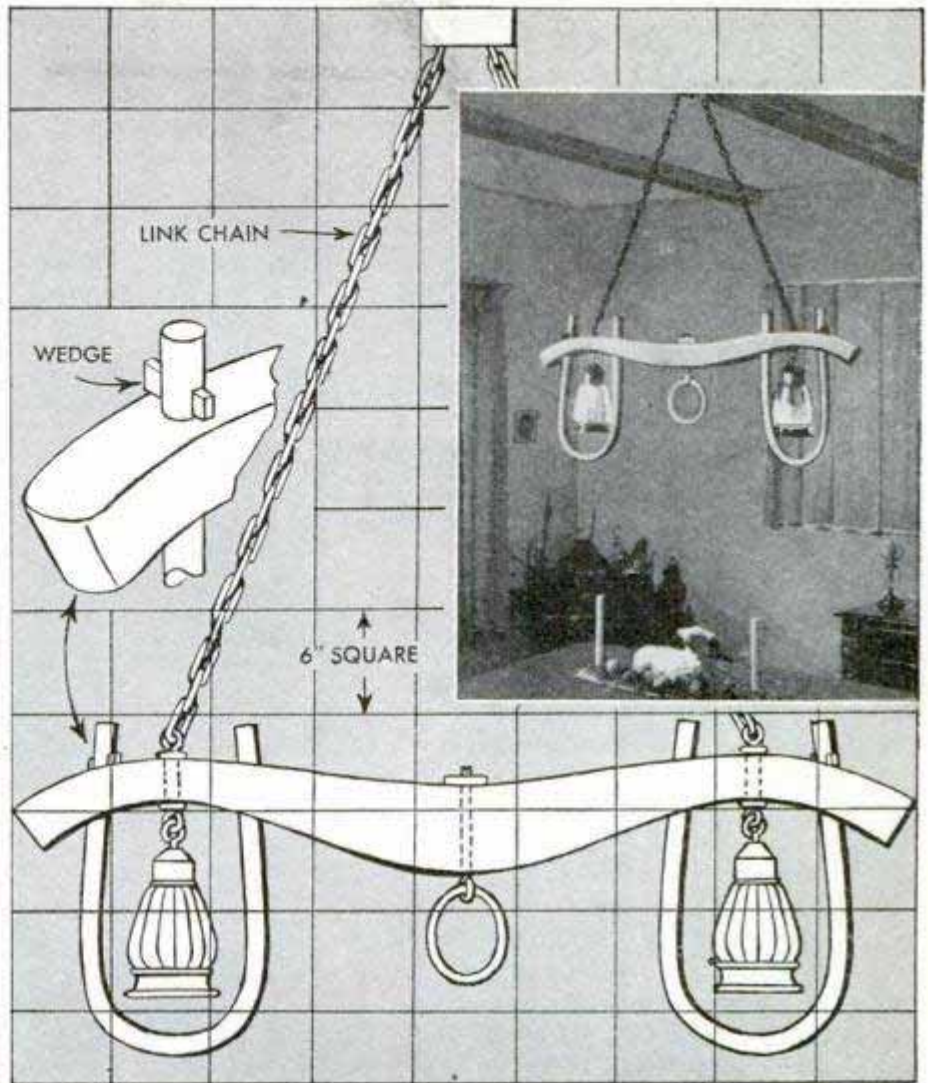
Generator and starting-motor bearings, Fig. 7, if provided with oil cups, require a few drops of light motor oil at regular intervals. Clean the cups before oiling to prevent dirt getting into the bearings. Do not overlubricate. Use a high-temperature grease in the distributor-shaft grease cup, Fig. 8, and put a few drops of oil on the felt pad under the rotor. A light smear of grease on the rotating cam face will save wear in the breaker assembly. Water-pump lubrication varies, and some have bearings that do not require lubrication. Use a medium oil in the water-pump oil cups and a special water-pump grease in the grease cups. This grease will resist heat and the dissolving action of water. As with all moving parts, do not overlubricate the water pump.

The fans on some engines require separate lubrication. Use a small amount of chassis lubricant for fans having pressure-type fittings, and a motor oil for those having sump-type lubrication.

☞ If your car won't start due to the ignition system being wet, try sprinkling carbon tetrachloride over the distributor, coil and spark plugs. This usually will permit the motor to be started immediately.

Suspended from the ceiling of a studio living room or informal dining room, this unusual fixture conveys a feeling of pioneer days to your cabin or ranch-type home. It's especially appropriate if western-style architecture and furnishings prevail in the room. The yoke can be bandsawed from a 2 or 3-in.-thick piece of wood, preferably oak, to the size indicated in the squared pattern. The bows may be bent by steaming them and clamping in shape, and they are fastened to the yoke by means of wedges, as shown. Hickory, if available, is excellent wood for the bows. The fixture is held to the ceiling with two lengths of chain which are attached to eyes in the yoke. Although these parts on the original were taken from an old lighting fixture, threaded brass tubing and eyes can be purchased for this purpose. The yoke is drilled to take the tubing and the eyes for the chain and light are turned on each end of this. Then, a lantern-type light, which is attached to the lower eye, is wired through the tubing and along the chain to

Oxen-Yoke Ceiling Fixture for Dining Room Imparts Pioneer Atmosphere to Ranch Home



the ceiling outlet. Finally, a large iron ring is bolted through the center of the yoke.
Wm. H. Freeman, Baldwin, N. Y.



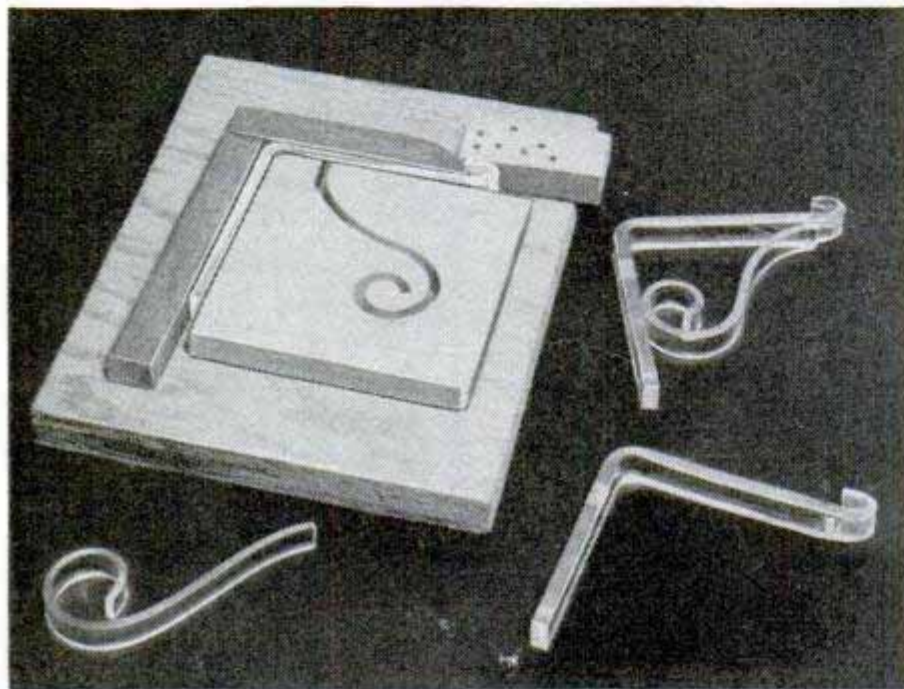
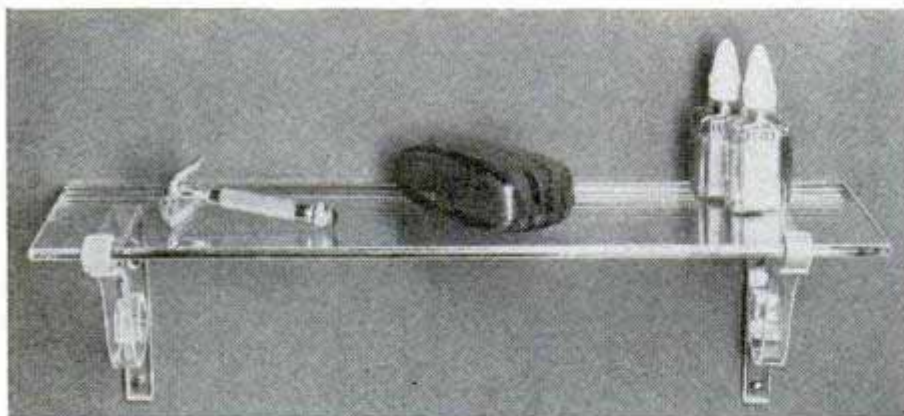
Handy Rack Holds Baby's Blankets On End Panel of Crib

If fear of smothering the baby prevents you from hanging blankets, towels, etc. over the side of the crib, you can still keep these items handy by hanging them on this little rack which is screwed to the end panel of the crib. The brackets may be cut from scrap wood and a length of dowel will serve as a bar. After the rack is painted to match the crib, it is attached to the end panel with roundheaded screws.

Patching Small Holes in Walls

The small hole that remains in a wall after a gas or water pipe has been removed is easily patched if a cork is used to back up the plaster. The cork is trimmed to size and pressed in the hole flush with the lath. The edge of the plaster should be undercut.

Shelf Brackets Are Mass-Produced in Plastic With This Simple Four-Piece Wooden Mold



Crystal-clear or brilliantly colored plastic provides distinctive brackets for glass shelves. If Lucite, Plexiglas or other heat-forming plastic is used, it's easy to bend brackets of a variety of interesting designs in a simple wooden mold. The mold is made by nailing two strips of wood to a plywood base to form a right angle, as shown. Then, a square piece of plywood is jigsawed for the scroll and the edges of this same piece are used to form the angle part of the bracket against the wooden strips. The hook to retain the shelf at the end of the angle piece is bent over a dowel and held in place with a small wooden block. For the brackets pictured, $\frac{1}{4}$ by $\frac{1}{2}$ -in. plastic was used for the angle piece, and $\frac{1}{8}$ by $\frac{1}{2}$ -in. material for the scroll. The parts of each bracket are cemented together or held with ornamental drivescrews, and the vertical leg is drilled to take wood screws for attaching the unit to a wall.

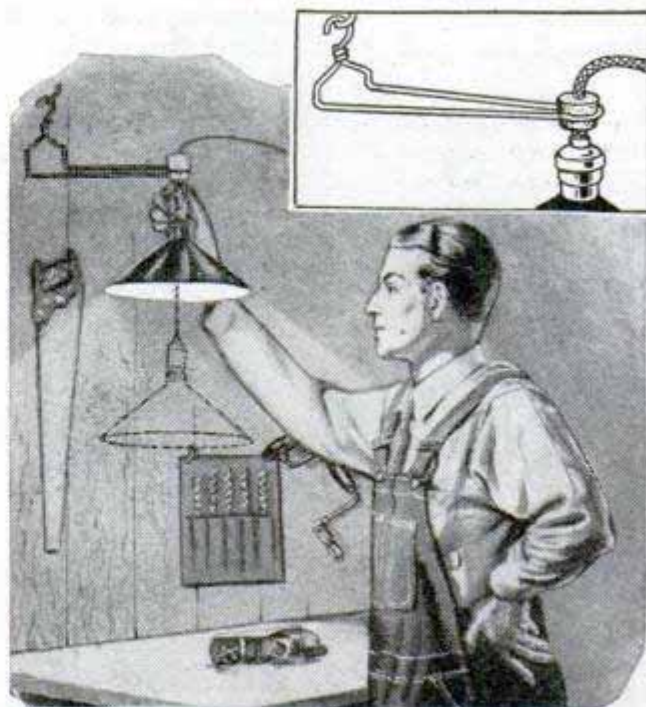
Extension Lamp for Workbench Supported by Coat Hanger

Suspended by a bracket bent from a coat hanger, an ordinary drop-cord lamp will provide ample light at any point on your workbench top. A cork, which has been drilled slightly smaller than the drop cord and grooved around the side, is slipped over the cord. Then, a wire coat hanger is bent around the cork, as shown, and is hung from a nail or hook driven into the wall above the bench. Several nails or hooks placed at intervals along the wall permit the light to be moved as needed. The light is adjusted to the desired height by pulling the cord through the cork.

Minimizing Stains on Dresser Tops

The finish on the tops of dressers, night stands, etc. is protected if a sheet of wax paper is placed under the scarf. Spilled cosmetics, medicines and other liquids will not soak through the paper.

Mrs. John Braun, Brooklyn, N. Y.

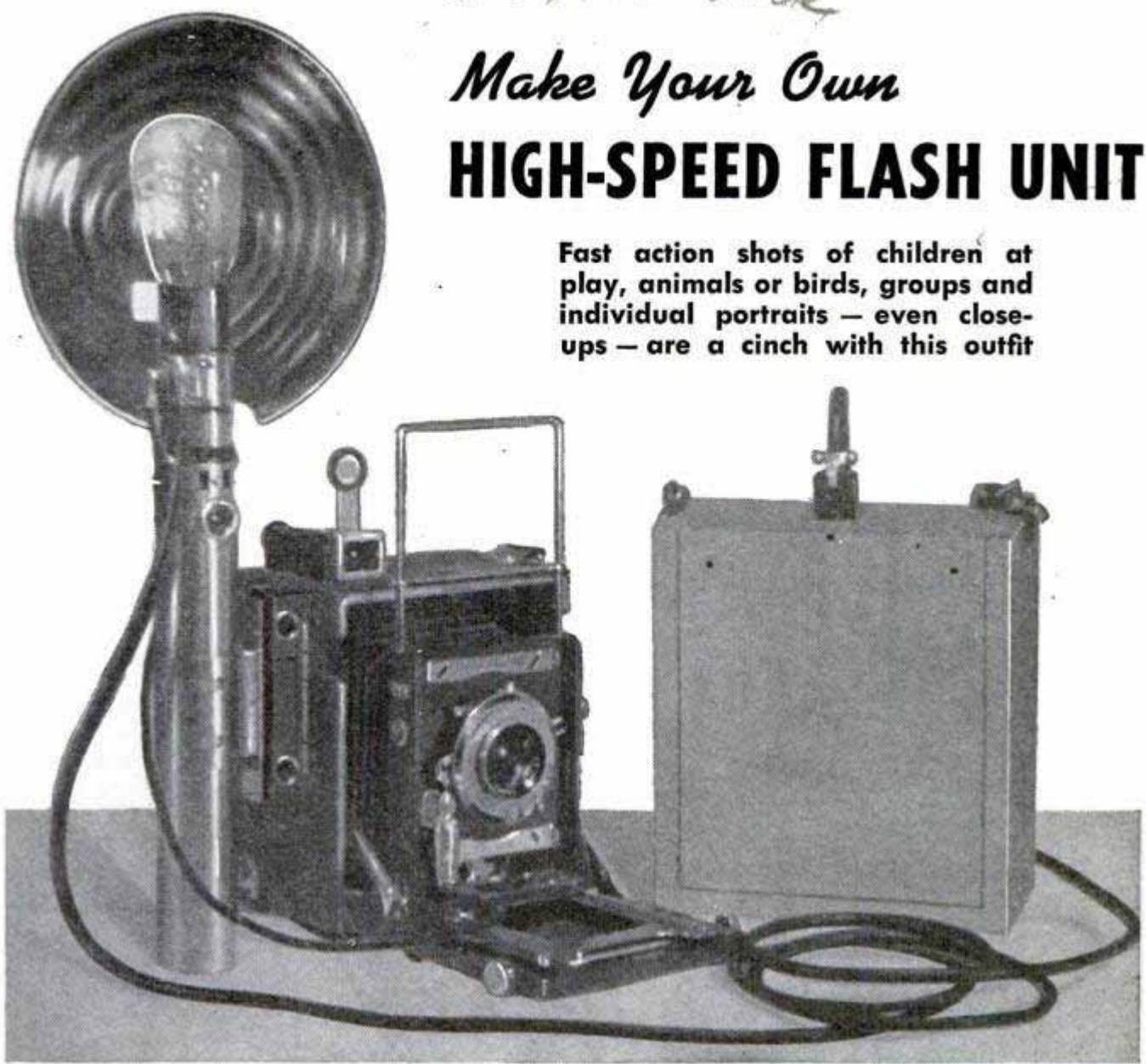


Stored linen is less likely to turn yellow if it is wrapped in black, opaque paper and kept in a cool place.

Make Your Own

HIGH-SPEED FLASH UNIT

Fast action shots of children at play, animals or birds, groups and individual portraits — even close-ups — are a cinch with this outfit

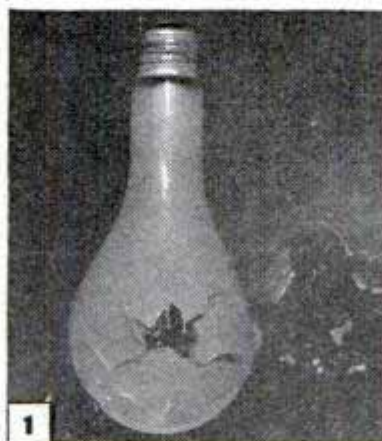


BE CAREFUL

Although the electrical circuit in this unit is not dangerous if handled correctly, you must keep in mind that the power output is 2000 volts, which, if passed through your body under certain conditions, might prove fatal. When testing the unit, stand on a dry, nonconductive surface. Before touching any parts of the circuit inside the case, switch off the power supply and "short" the terminals of the condenser to discharge it, using a screwdriver having an insulated handle. In operation, unless picture exposures are made within a few seconds of each other, always remember to turn off the switch and then flash the bulb, after taking each picture, to discharge the energy remaining in the condenser. Keep wiring and cables in good order

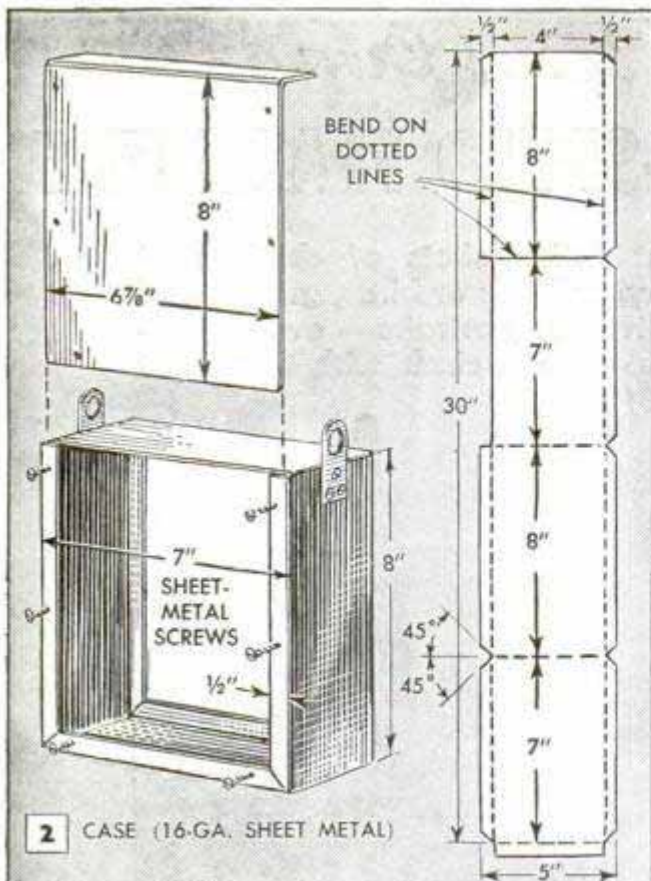
By Cecil Koyama

THOUSANDS of photo flashes of brilliant sunlight quality and positive uniformity at a fraction of a cent per flash—that's what you get in this battery-operated, high-speed flash unit. The speed shot, Fig. 1, of a light bulb being shattered by a rifle bullet is a good example of what can be done in high-speed flash photography. Synchronization of the speed light to the

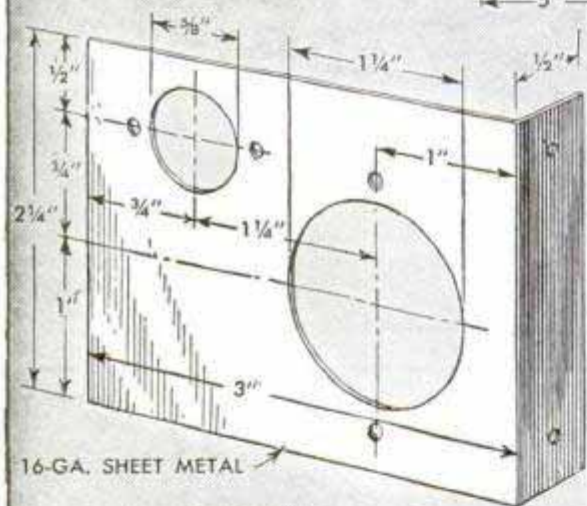


High-speed shot of a lamp bulb being shattered by rifle bullet

shutter of the camera is simple because the total duration of the flash is only $\frac{1}{15,000}$ second. This makes a high-speed camera unnecessary; excellent photographs can be taken with any low-priced camera equipped with a solenoid or used with the open-shut method of exposure. Being battery-operated, the unit can be used anywhere. Completely assembled it weighs less than 10 lbs., and is adaptable to your present flash gun (with

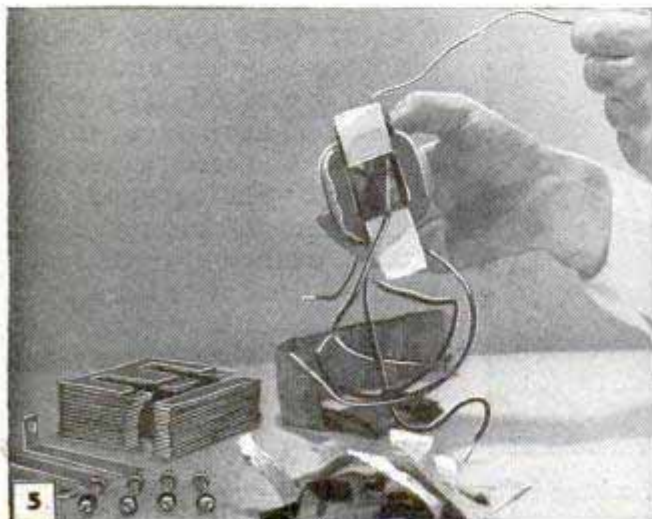


2 CASE (16-GA. SHEET METAL)

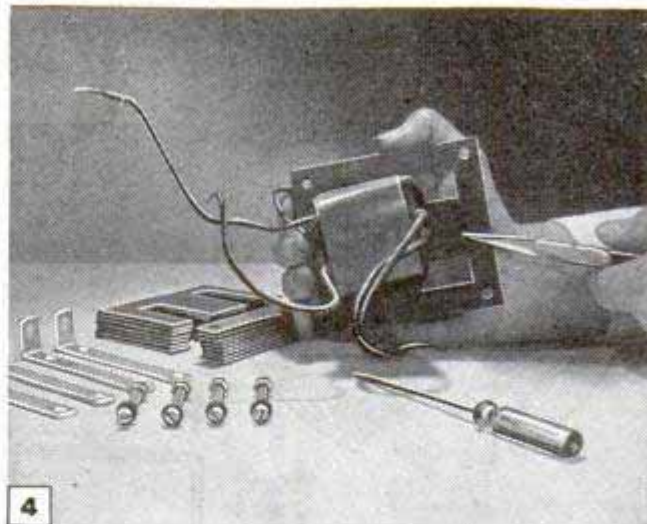


3 BRACKET FOR RECTIFIER TUBE AND VIBRATOR SOCKETS

Next, the filament winding is removed from the coil. It is necessary to work carefully to avoid damage



5



4

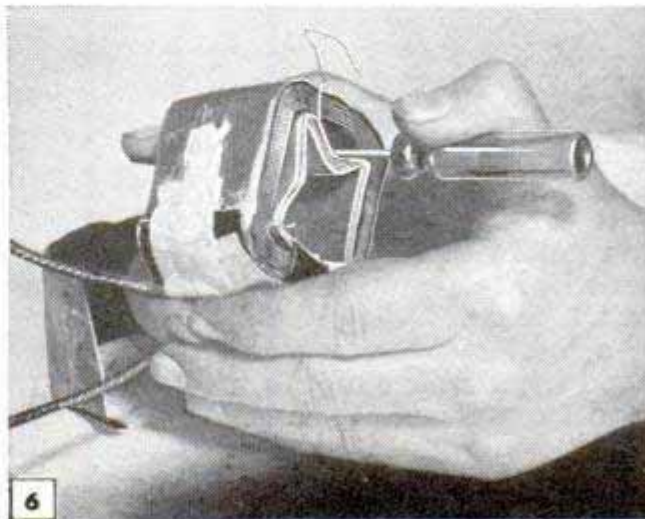
To prepare the transformer for rewinding first remove the bolts and brackets and also the iron core

batteries) without disturbing synchronization or hindering normal operation in any way. A high-voltage switch or relay is used in its circuit, making it impossible to come in contact with the 2000 volts in normal operation. All electrical units are housed in a metal case which assures further safety to the operator because it makes a perfect electrical shield. The condenser charges quickly enough to allow a maximum of a flash every four seconds, which is faster than a series of shots normally can be taken under average conditions.

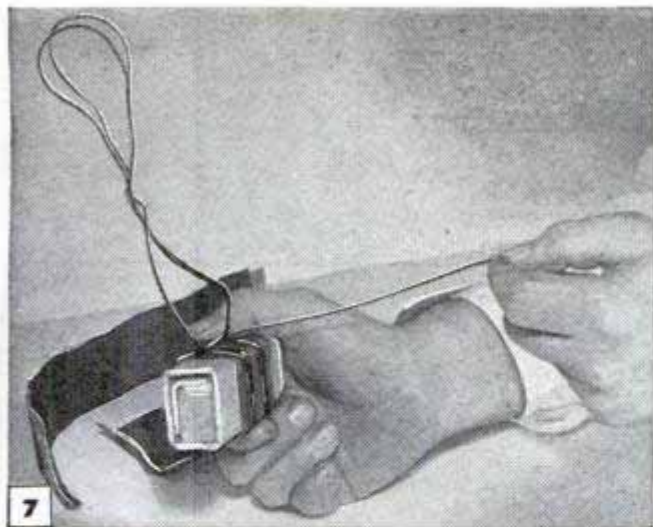
Fully charged batteries will give about 100 flashes of the single high-speed glow lamp. In operation, a high-voltage condenser stores energy. When ready to utilize this stored energy, the capacitor (condenser) is discharged through the flash bulb, giving off an intense blue-white light. The relay acts as a magnetic switch while the rheostat and the output transformer are used solely in the synchronization of any between-the-lens shutter.

Rewinding the transformer: A standard a.c. transformer is rewound for this unit.

Loosen the primary winding by carefully working a screwdriver between primary and secondary windings



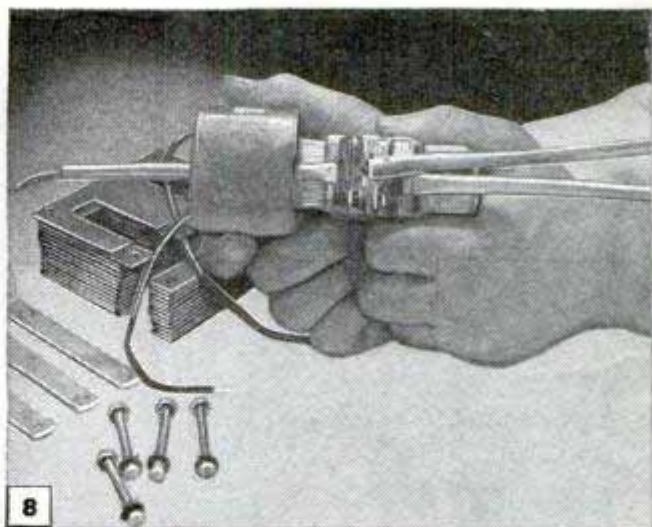
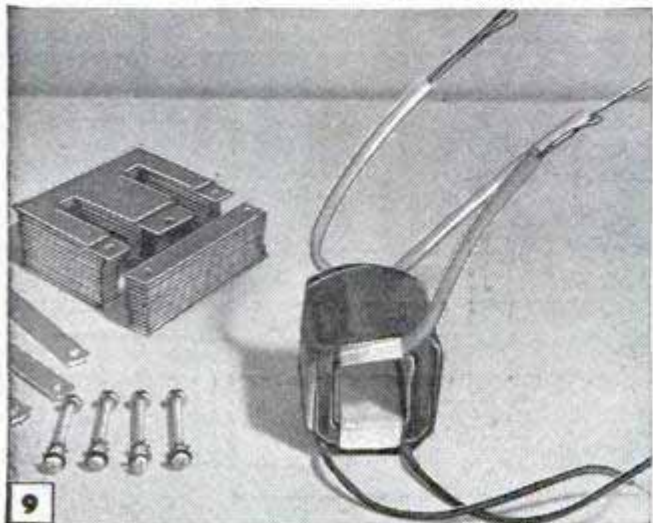
6



7
 Rewinding new primary coil. Note the looped tap. Wooden form is inserted in cardboard form of coil

It has a 2½-volt filament winding which is unnecessary when using a cold-cathode rectifier tube. (The CK 1013 tube is used to minimize current consumption from the battery.) Remove bolts and mounting brackets, then remove the iron core from the transformer, Fig. 4. Take off the outer insulating material and carefully lift aside the high-voltage leads. Unwind the filament winding from the coil, Fig. 5, being careful not to damage the high-voltage secondary winding. After this is done, the high-voltage leads are replaced in their original position and taped down. The next step, Fig. 6, shows how to remove the primary winding of the transformer by carefully inserting a very small screwdriver all the way through between primary and secondary windings. Press the primary inward, and repeat this on all four sides of the coil until the primary is free and may be removed. The primary is mounted on a square cardboard form, which may be removed in the same manner. After the form has been removed, it is carefully bent back into shape and a wooden block is

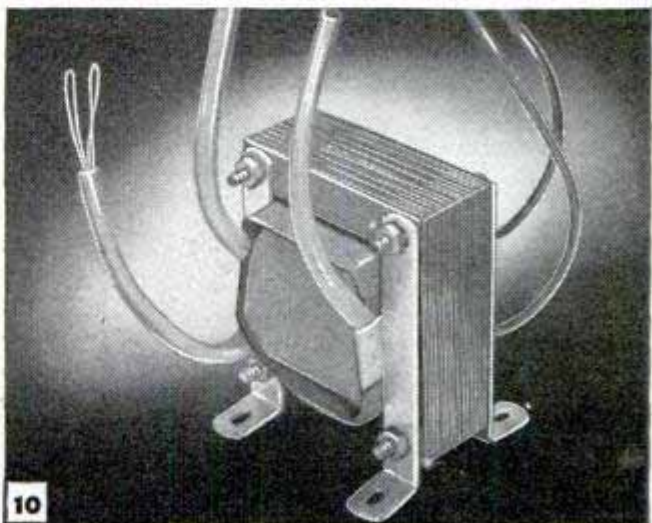
Completed coil with the new primary winding in place ready for assembly into the core and brackets

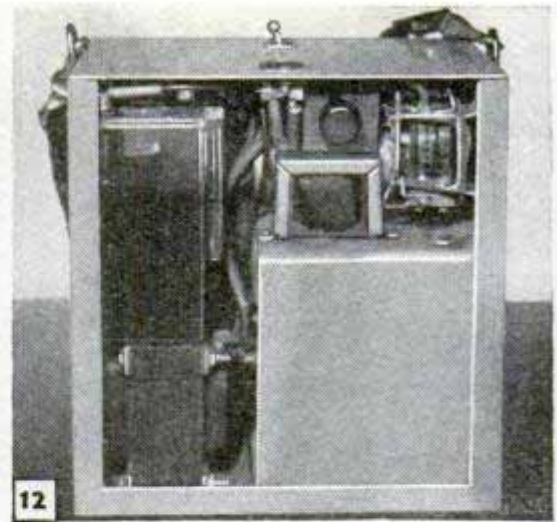
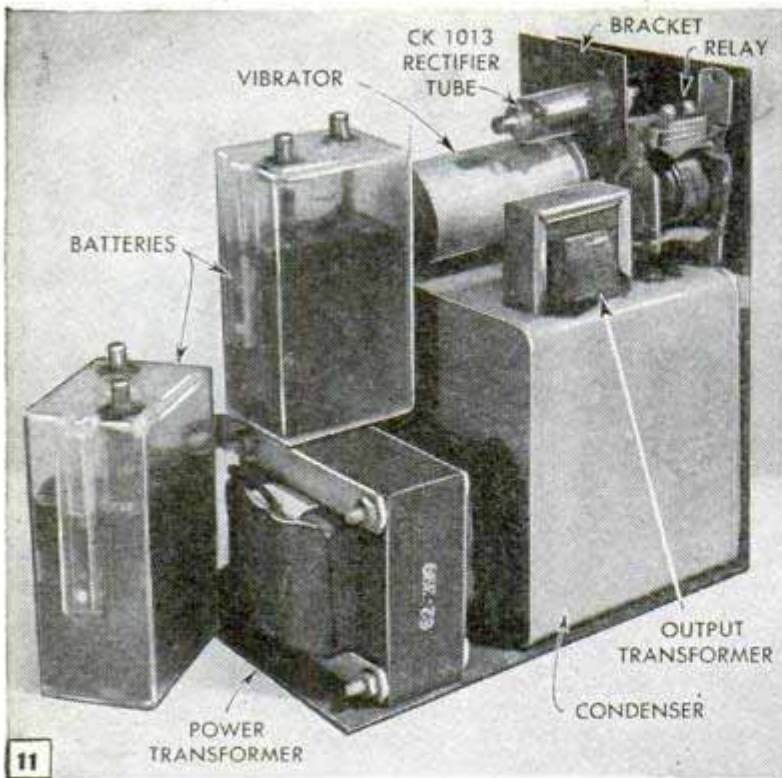


8
 New primary is inserted in the original secondary winding. Leads are insulated and all parts taped

then cut so that it will fit tightly into the paper form. This is done to prevent the form from losing its shape while the primary is rewound. Before rewinding, wind one layer of cellulose tape around the coil form. The primary is wound with two strands of No. 20 enameled copper wire wound parallel with each other in order to have the equivalent of a larger size wire but to minimize the thickness of the primary winding. When starting to wind, leave about 6 in. of wire projecting to serve as primary leads. Wind four turns, leave a large loop and twist this as in Fig. 7 for a center tap, then wind four more turns. Bend the center lead down, laying it parallel with the other two leads. Slip lengths of varnished cambric tubing over each of the three leads of the primary. Another layer of tape is then applied over the coil. Insert the primary, with its leads coming out the sides, back into the secondary winding, Fig. 8. Finally, remove the wooden form and wrap all original insulating material around the transformer coil. Now, replace the transformer core, Fig. 9, and

The new transformer assembled with the original core and brackets ready to be installed in the unit





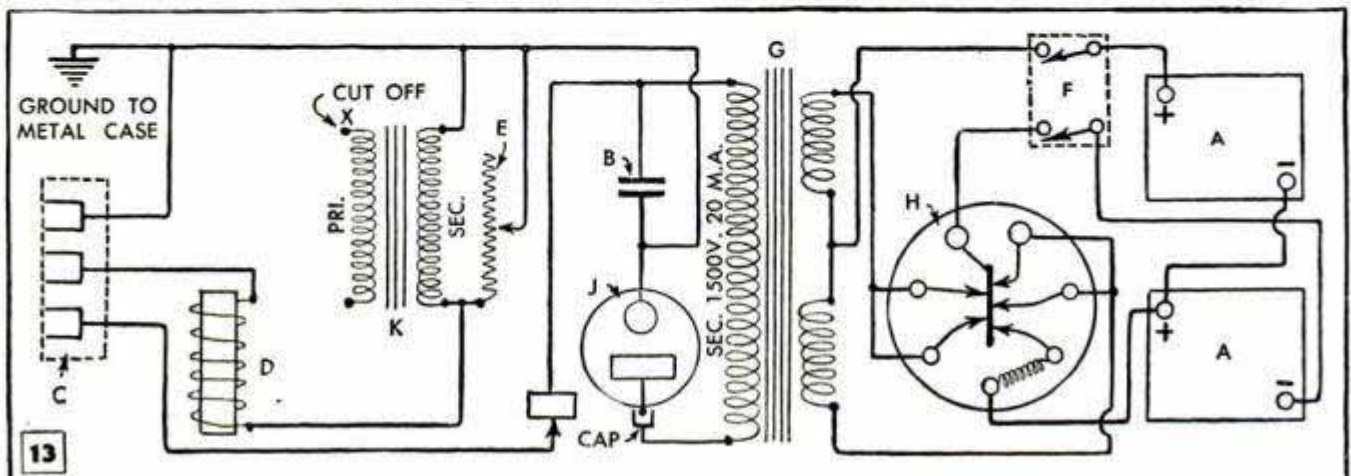
At the left, the electrical parts are shown partly assembled on the chassis, and above, completely assembled in the box. Note the placement of the special batteries

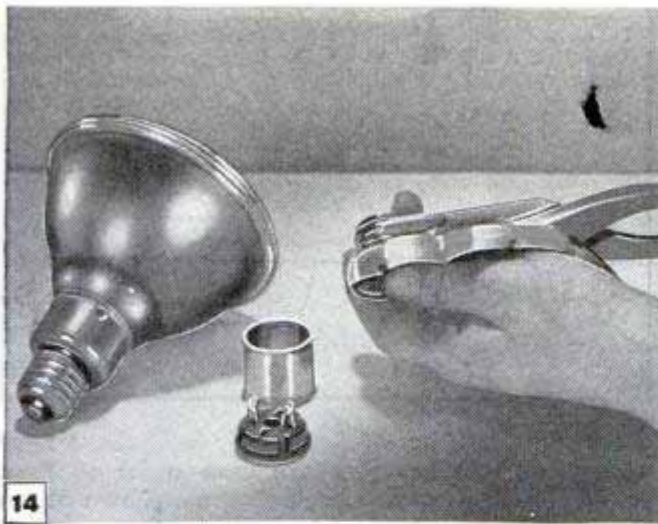
The table below Fig. 11 lists electrical parts required. Key letters correspond to those shown on the wiring diagram, Fig. 13

- A—WILLARD RECHARGEABLE PHOTOFLASH BATTERY (Type ER-6-2B, supplies 2 volts for 6 amp.-hours. 2 reqd.)
 - B—HKG T PHOTOFLASH CAPACITOR (Type 1A00, 15 mfd., 2000 volt d.c.)
 - C—HOWARD B. JONES, 4-CONTACT, POLARIZED PLUG AND SOCKET (Plug, Type P-304-CCT. Socket, Type S-304-AB)
 - D—POTTER AND BRUMFIELD MEDIUM-DUTY POWER RELAY (Model No. MR1D, Type S.P.S.T., Normally open, 8 amps.)
 - E—6-OHM RHEOSTAT
 - F—D.P.S.T. TOGGLE SWITCH
 - G—HIGH-VOLTAGE, PHOTOFLASH TRANSFORMER (Allied Radio Corp., Type 62-399)
 - H—MALLORY VIBRATOR (Type T 4000, 2 volt)
 - J—RAYTHEON RECTIFIER TUBE (Type CK 1013/5517)
 - K—KNIGHT UNIVERSAL RADIO OUTPUT TRANSFORMER (Type 62-021, 8 watts, primary impedances 4000 to 14,000 ohms)
- NOT SHOWN
- JOHNSON MINIATURE-SERIES TUBE SOCKET (7-pin steatite socket for rectifier tube (J))
 - SUB-PANEL, WAFER-TYPE SOCKET (7 prongs for vibrator (H))
 - AMGLO ELECTRONIC PHOTOFLASH LAMP (Type 51Q4X, 20-30 mfd., Max. volts 2000, 40-60 watt-sec.)

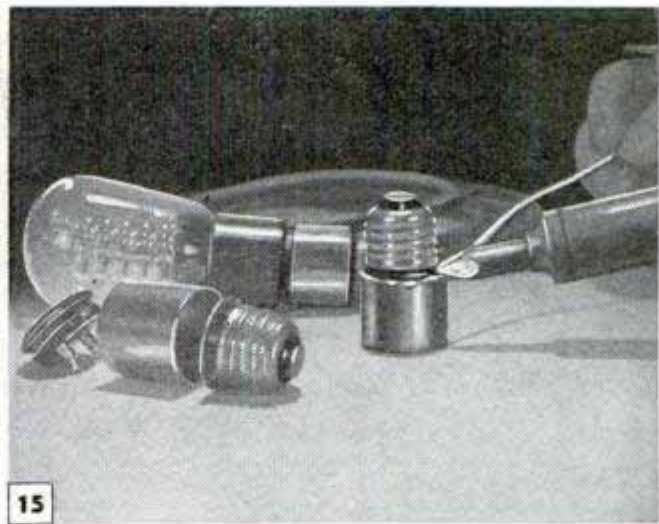
reassemble with bolts and brackets as in Fig. 10.

Assembly: Before assembling, have at hand all parts listed in Fig. 11. Note that in the box below Fig. 11, letters A, B, C, and so on, serve as key letters to locate the parts in the wiring diagram, Fig. 13. Actual layout of parts in the case is not important. It is only necessary to arrange them to occupy a minimum of space so as to leave ample room for the wiring. Build the case, Fig. 2, first, as it serves as a chassis on which all parts are mounted. Capacitors vary somewhat in size so make sure the case is large enough. To facilitate mounting of parts, the sides of the case are attached with metal screws so that they can be screwed in place after the electrical units are assembled inside. Since the capacitor is oil-impregnated, and no holes may be drilled in the housing or container, spot solder it into position. Fasten the high-voltage transformer to the case with mounting brackets, using 6-32 bolts and





14 The upper flange of the heat-bulb socket is cut off so that a length of brass tubing will fit over it

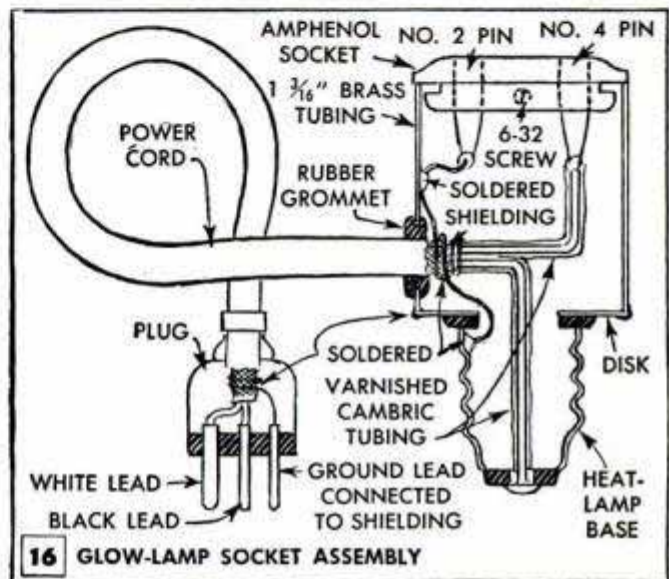


15 The length of brass tubing is then soldered to the heat-bulb socket. Also see the detail below, Fig. 16

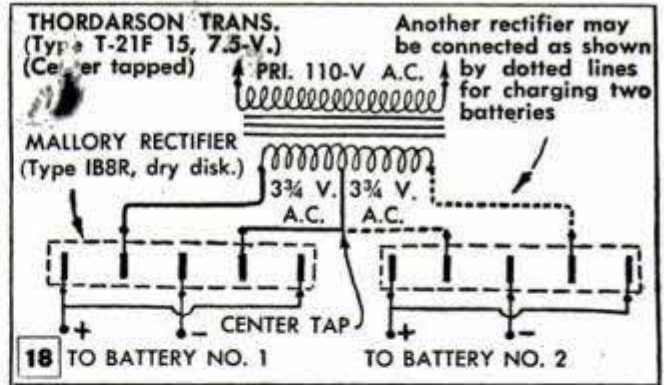
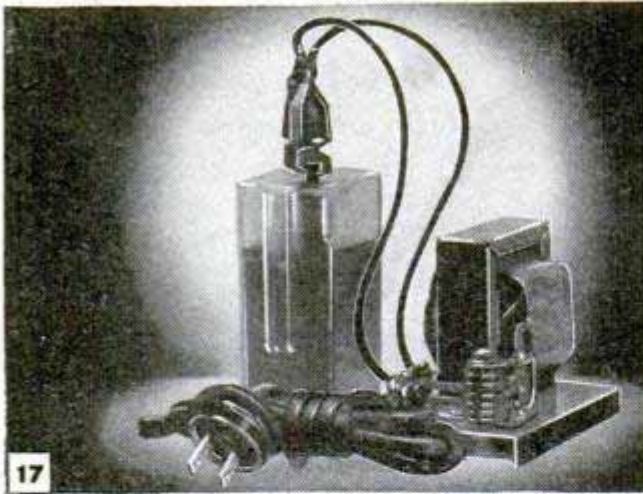
nuts. Make the L-shaped bracket of 16-ga. sheet metal as detailed in Fig. 3. Cut two holes, one to mount a miniature-series 7-pin tube socket which holds the CK 1013 rectifier tube, and the second, a larger hole, for the 7-prong wafer socket for the vibrator. After the socket has been mounted on the bracket, bolt the bracket to the case as in Fig. 12. Before mounting the relay, solder 6-in. leads on all the terminals. Mount the relay as in Fig. 12, using 6-32 bolts and nuts. The primary leads of the output transformer are cut short for they are unnecessary to the circuit. Then solder the transformer to the capacitor. Fasten the 6-ohm rheostat, the Howard B. Jones plug and the switch to the top of the case.

Wiring: The wiring is simple if the circuit diagram in Fig. 13 is carefully followed. All wiring in the power-supply unit should be done with a good grade of high-voltage radio test-prod-lead wire. The leads are further insulated by covering the wire with varnished cambric tubing to prevent any possibilities of leakage which would reduce the maximum output voltage. When connecting the secondary of the output transformer, use terminals No. 1 and its highest number to get maximum inductance of the winding. In order to transform d.c. current, it is necessary to use an interrupter. This vibrator, or interrupter, is the synchronous-type 7-prong, 2-volt vibrator commonly used in portable radios with rechargeable batteries. The contacts of the vibrators should be paralleled to give maximum current efficiency. It is wired as shown in the diagram, Fig. 13.

Socket assembly: The glow-lamp socket assembly is made up as in Figs. 14, 15 and 16. First, get a piece of chrome-plated tubing, $1\frac{3}{16}$ in. in diameter and 1 in. long, and also a screw base from a heat lamp with an oversize flange, Fig. 14. Break the glass in the base by wrapping the base with cloth



and striking lightly with a hammer. Remove the glass with pliers. Trim off the upright flange, leaving a disk or shoulder $1\frac{3}{16}$ in. in diameter, Fig. 16, so that the screw base will fit snugly inside the tubing. The socket is then soldered into one end of the tubing, Fig. 15. Drill a $\frac{3}{8}$ -in. hole near the bottom of the tubing for the power cord to the glow lamp and synchronizer, Fig. 16. Insert a rubber grommet in the hole and feed the cable through this hole. Solder the outer shielding of the cable to the inside of the tubing. A short length of wire is then soldered, one end to the outer edge of the screw base and the other end to the tubing, to make the ground connection. The black lead of the cable is carefully skinned, covered with the cambric tubing, and then soldered to the center contact of the screw base, Fig. 16. Remove the No. 1 and No. 3 terminals of the 4-prong tube socket. The white lead of the cable is covered with insulation and soldered to the No. 4 pin of the socket. Then push varnished cambric tubing over the No. 4 pin, leaving no exposed socket connection. Solder a short length of wire to the No. 2 pin.



Above and left, an efficient, easily built charger for the speed-light batteries can save a lot of time. Wire according to the circuit diagram shown above

The other end is soldered to the tubing to make an electrical ground, Fig. 16. Fit the socket into the end of the brass tubing. Drill and tap two 6-32 threads, one opposite the No. 1 and the other opposite the No. 3 terminals. Fasten the 4-prong socket to the brass tubing by inserting short screws in the tapped holes. Make sure the screws are short so that they do not project through the prong holes of the 4-prong socket. Solder a male plug to one end of the power cord, Fig. 16. Do all the assembling and wiring before connecting the batteries into the circuit, which should be the last operation before testing. Many electricians keep one hand in a trouser pocket and use only one hand when testing or otherwise working inside the box after connecting the batteries. This helps avoid a possible shock by accidentally getting both hands in a position that would provide a path from one hand to the other for the high-voltage current.

Adjustment and operation: The unit is easily synchronized with the camera shutter without changing the adjustment of the solenoid tripper. The output transformer is used in conjunction with the rheostat in order to increase or decrease the time of the flash. By varying the rheostat, one may synchronize the speed light with the shutter by holding the light unit and reflector as closely as possible to the open back of the camera. A piece of thin paper is placed over the front element of the wide-open lens, with the shutter set at its fastest speed. Now press the button of the gun. You will probably see a "Y" or other odd-shaped light figure on the paper. Turn the rheostat to the left and try another flash. Repeat until you see a clear round spot of light the full diameter of the lens. If the rheostat is turned completely to the left and you still do not see the round spot of light, increase the distance of the contacts on the relay and repeat the test. (Caution: When working on the relay, be careful. Make sure the capacitor has been

shorted several times, before attempting any adjustment.) When the round spot is showing through the lens, the flash is perfectly synchronized with the shutter. Permanently set the control in this position. Make your own tests to determine the correct exposures, as various reflectors differ in their light-concentration and light-reflection qualities.

Battery charger: An efficient charger for the speed-light batteries is pictured and detailed in Figs. 17 and 18. Use a Thordarson (T-21F15, 7.5-volt) center-tapped transformer for the power source, and a small copper-oxide (dry-disk type) rectifier, Mallory (type IB8R, full-wave). Any make of transformer with a 110-volt primary, and with a 7.5-volt secondary center tapped (current rating, 2 amps.) may be used. The center tap on the secondary winding is very important because the oxide rectifier is only connected across one half the secondary winding. Another oxide rectifier may be connected, if desired, to the other half of the filament winding to charge two batteries at once instead of only one at a time, Fig. 18.

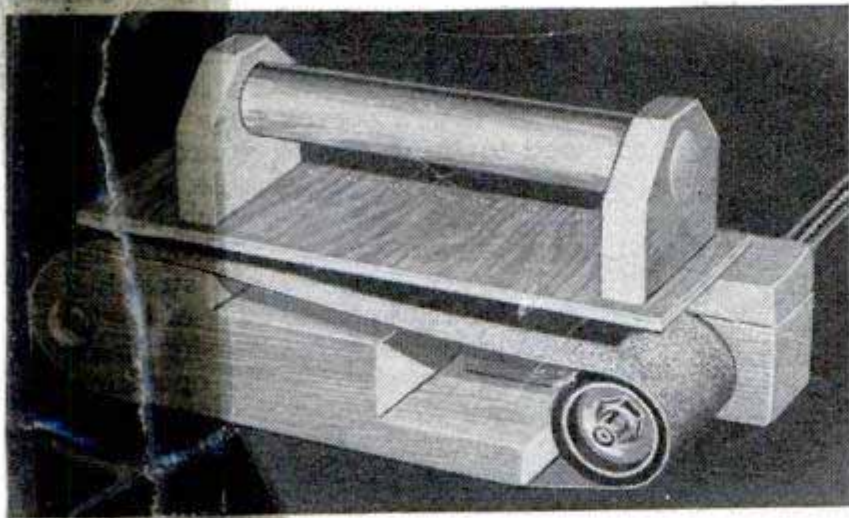
Clothespin Handles on Reflectors Prevent Burned Fingers

After burning my fingers in adjusting hot photo-flood reflectors, I clamped a couple of wooden clothespins to the rim of the reflector as shown. These provided cool handles which I could grasp to tilt the



Besides serving as handles, the clothespins also can be used to hold a diffusing cloth over the reflector.

R. F. Donovan, Jersey City, N. J.



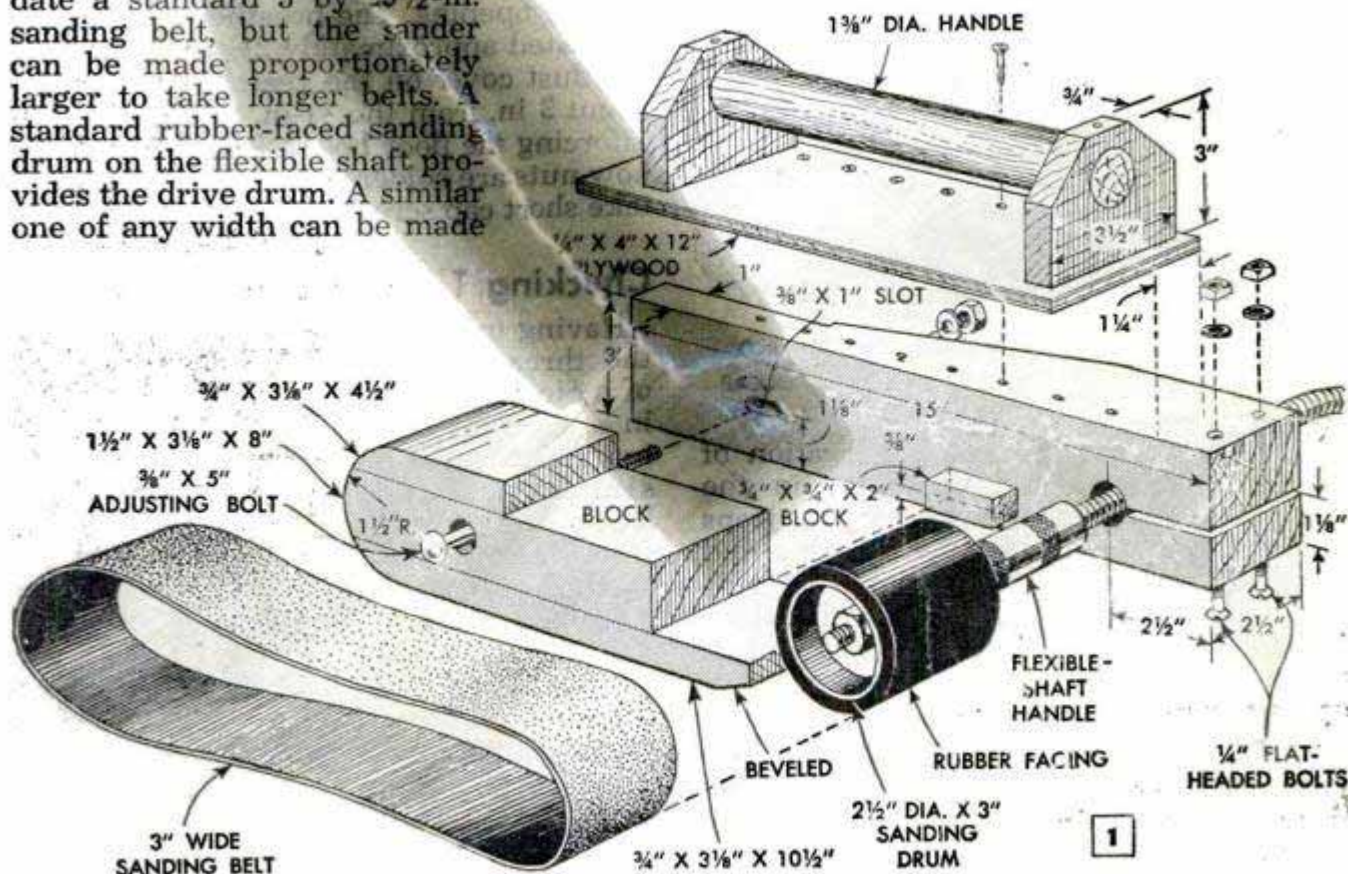
BELT SANDER

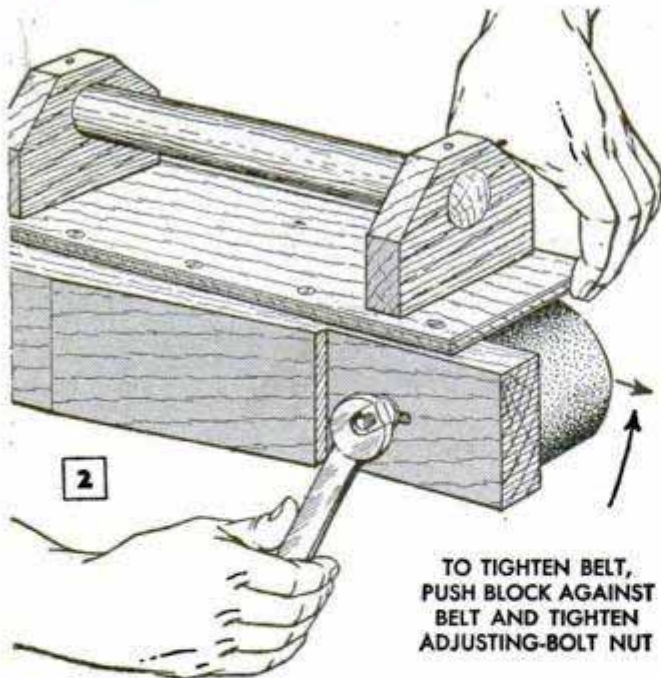
By A. B. Carper

I NEEDED a belt sander, but couldn't justify the expense of a self-contained unit, so I made one, which is electrically driven through a flexible shaft. It works efficiently and, being made entirely from scraps of hardwood, costs only the price of a 3-in. sanding belt and a few bolts.

The pull-apart drawing, Fig. 1, shows the assembly of the sander and dimensions all the parts. The dimensions given accommodate a standard 3 by 29½-in. sanding belt, but the sander can be made proportionately larger to take longer belts. A standard rubber-faced sanding drum on the flexible shaft provides the drive drum. A similar one of any width can be made

by placing a number of solid-rubber disks between two metal washers or on a threaded shaft and clamping them together with a nut. Then, the drum is trued while rotating by holding coarse sandpaper or a grinding wheel against the rubber. The block used for the frame is clamped to the handle of the flexible shaft by means of a slotted hole, which is bored exactly at right angles to the inner face of the frame. Two





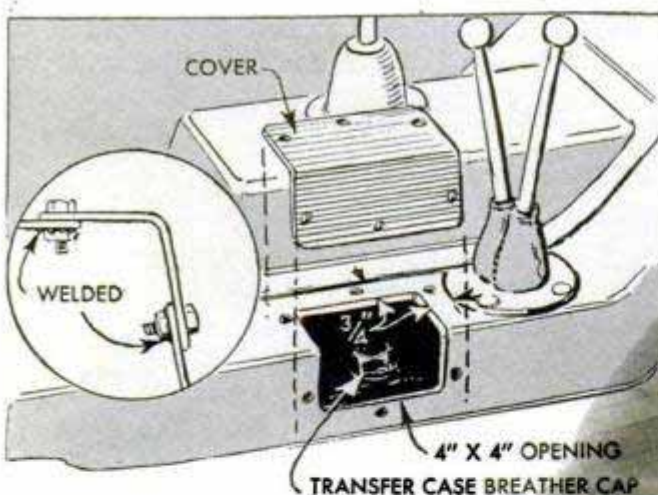
TO TIGHTEN BELT, PUSH BLOCK AGAINST BELT AND TIGHTEN ADJUSTING-BOLT NUT

flat-headed stove bolts take up on the slotted hole and clamp the shaft rigidly. The opposite end of the frame is slotted to take an adjusting bolt on which the tension assembly pivots. The latter consists of three separate blocks, although it can be a single block. It is movable back and forth in the slot to permit proper belt tension. When mounted, the belt surface of the tension assembly is $\frac{3}{8}$ in. below the frame. The as-

sembly is held at a horizontal level by a small stop block screwed to the frame. This block permits the assembly to pivot when the sander is lifted but keeps the bottom or shoe of the assembly level with the face of the sanding drum. A plywood guard keeps the hand from coming in contact with the belt. This overhangs the frame to cover the belt and is attached with screws. Two blocks, bored to take a length of curtain pole which serves as a handle, are screwed to the plywood guard before attaching the latter to the frame. A nail driven through the handle at each end pins it in the holes in the blocks. Proper tension is maintained as the belt stretches by loosening the nut on the back of the frame, Fig. 2, and pushing the tension assembly forward in the slot. Avoid operating the sander with the belt too tight. Excessive friction produced by the belt passing over the wooden tension assembly will only tend to wear the belt prematurely. Waxing the bottom and the rounded end of the assembly will help to reduce friction.

The flexible shaft should rotate counterclockwise at about 1750 r.p.m. A $\frac{1}{4}$ -hp. motor will furnish ample power. In using the sander, apply very little pressure and keep it moving. If a stand is made to hold the sander in an upside-down position, it can be used as a bench sander.

Floor-Board Opening on Jeep Gives Easy Access to Breather Cap

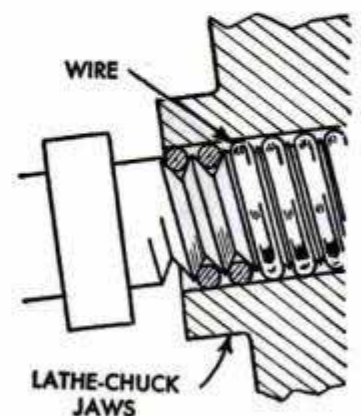


Because of the inaccessible location of the breather cap and ventilator in the transmission, owners of war-surplus jeeps are apt to neglect cleaning the caps and plugged ventilator holes regularly. This results in leaking oil seals and rusted transfer cases. To get at the cap requires reaching up under the floor boards in a space above the transfer case barely large enough for the hand and removing a cotter key from the reverse side of the breather cap. However, a simple solution to the problem was discovered during the war.

An opening is cut in the metal floor board directly over the breather cap so that it can be reached by removing a plate covering the opening. The breather cap usually is located approximately $2\frac{1}{2}$ in. back from the dust cover on the gearshift levers and about 3 in. from the $\frac{1}{4}$ -in. raised plate reinforcing the floor board. The detail shows how nuts are soldered to the floor board to take short cap screws which hold the plate.

Chucking Threaded Work

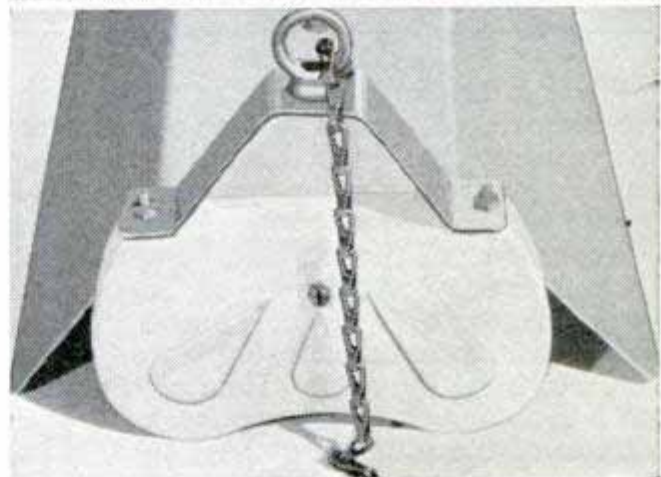
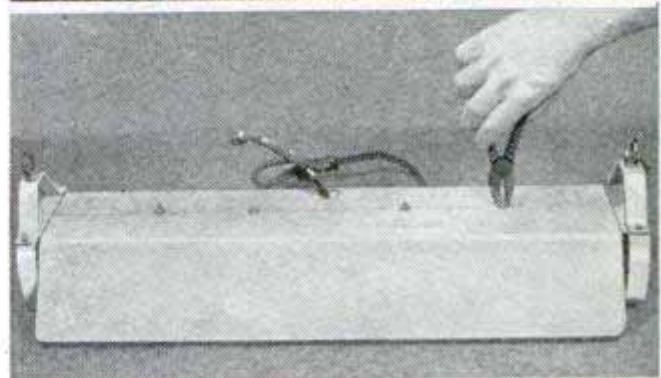
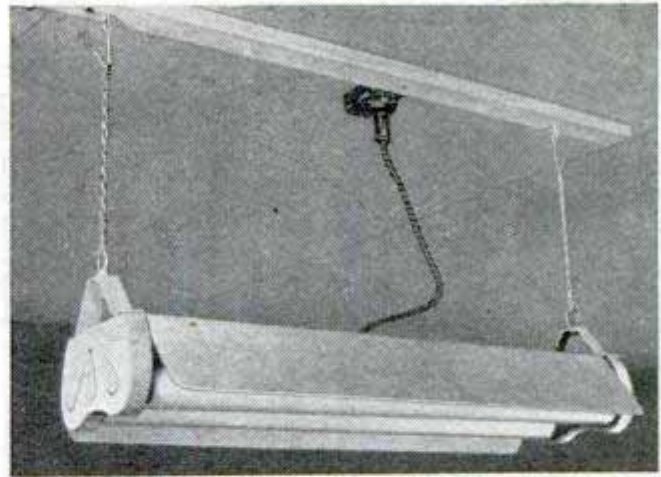
Having to chuck the threaded end of a piece of work in a lathe for facing, I discovered a simple way to keep the thread from being damaged. I wrapped a piece of wire around the thread so that the chuck jaws would bear against the wire.



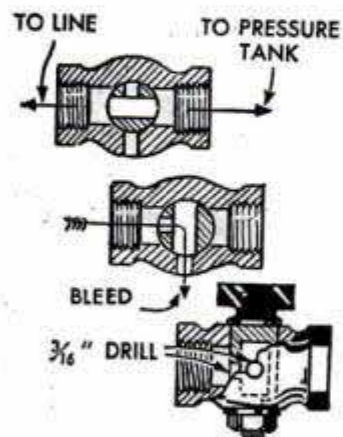
The wire should be heavy enough to keep the jaws from injuring the top of the thread.—Shiro Fujihira, Seattle, Wash.

Fluorescent Ceiling Fixture Converted to Hanging Workshop Light

Wanting a good fluorescent light for his workshop, but hesitating to buy one because of the expense, D. J. Bachner of Jackson Heights, N. Y. converted an ordinary twin-tube ceiling fixture into an excellent workbench and drawing-board light. In addition, the light can be raised to the ceiling to furnish illumination for the entire shop. He first made a sheet-metal reflector to fit over the fixture. This is bent in a U-shape and a hole is cut in it to provide for the lamp cord. Then the reflector is drilled for four small bolts centered and spaced along its length, and the underside of the sheet metal is painted white to afford a good reflecting surface. The overhanging sides of the reflector are bent to come just below the bottom of the fluorescent tubes in order to direct the light downward. When the reflector is finished, the mounting flange is removed from the fixture which is drilled to coincide with the holes in the reflector. Next, a suspension bracket for each end of the fixture is bent from heavy-gauge sheet metal, as shown in the lower photo, and fitted with an eyebolt at the top. Holes are drilled through the legs of the brackets and the end plates of the fixture, and the brackets are bolted to the end plates. After the brackets are in place, the reflector is bolted to the fixture. The fixture is attached to the ceiling by means of screen hooks and lengths of lightweight chain, a method that permits the light to be adjusted to almost any height. As his fixture was of the plug-in type, Mr. Bachner fastened a surface-mounted receptacle to the ceiling near the light. However, if a direct-wired fixture is used, it may be connected to a junction box in the ceiling. A wall switch will be found most convenient.



Bleeder Valve for Pneumatic Tools Improved From Gas Shutoff Cock



of the threaded openings and make a hole in the side of the cylinder at right angles to the original hole. Then, drill another hole through one side of the valve casting

When a two-way air valve is needed to bleed equipment before disconnecting it from an air-pressure tank, one can be made in a jiffy by altering a gas shutoff cock as shown. With the cock in the closed position, insert a drill through one

to coincide with the original hole in the cylinder. Use a drill with a diameter approximately one half the width of the valve opening. This will retain ample surface on either side of the holes and prevent air leakage. Thus, a $\frac{3}{16}$ -in. drill would be used for a valve with a $\frac{3}{8}$ -in. opening. An extension handle fastened to the top of the valve facilitates operation.

H. W. Billard, Hempstead, N. Y.

Repairing Rust Holes in Car Bodies

Small rust holes in car bodies can be repaired by plugging them with steel wool, applying flux and soldering. They then can be filed, sanded and painted with metal primer. After the primer has dried, a finish coat of the desired color is applied.

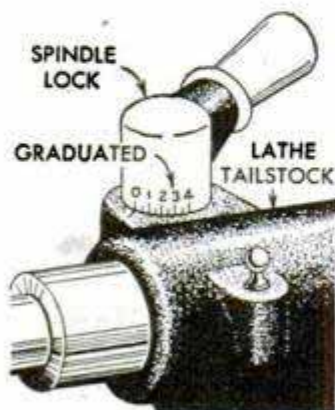
Altered Pressure-Type Oilcan Meters Insecticide



To permit regulating the amount of corn-worm oil applied to each ear of sweet corn in my garden, I devised a metering applicator from a pump-type oilcan. I soldered a U-shaped metal bracket under the thumb lever of the can and bored a small hole in the top of the bracket. Then, a nut was soldered over the hole and a machine screw was inserted as a stop. By adjusting the height of the screw, I am able to control the amount of oil applied with each stroke of the plunger.

Clinton R. Hull, Costa Mesa, Calif.

Scale on Locking Lever of Tailstock Permits Critical Clamping Pressure



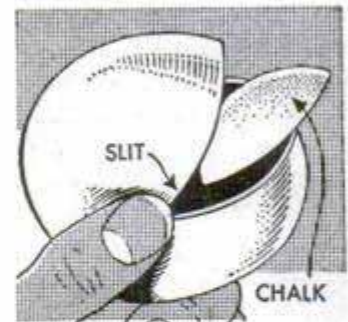
Noticing that varying degrees of spindle tightness affected the centering of work when locking a lathe tailstock spindle, I decided to calibrate the locking lever. This was found especially helpful when releasing the tail center for

lubricating and again engaging it, as I merely had to note the scale reading beforehand and reset the locking lever ac-

ordingly. An index mark is made on the tailstock casting to aid in setting the lever.
Earl R. Goddard, Denver, Colo.

Holder for Carpenter's Chalk Provided by Rubber Ball

A cake of carpenter's chalk will not rub off on everything when kept in a toolbox or carried in an apron pocket if it is placed in a hollow rubber ball. A slit is made in the ball and by pressing the sides of the ball, the slit will open wide for inserting or removing the chalk.—G. E. Hendrickson, Argyle, Wis.

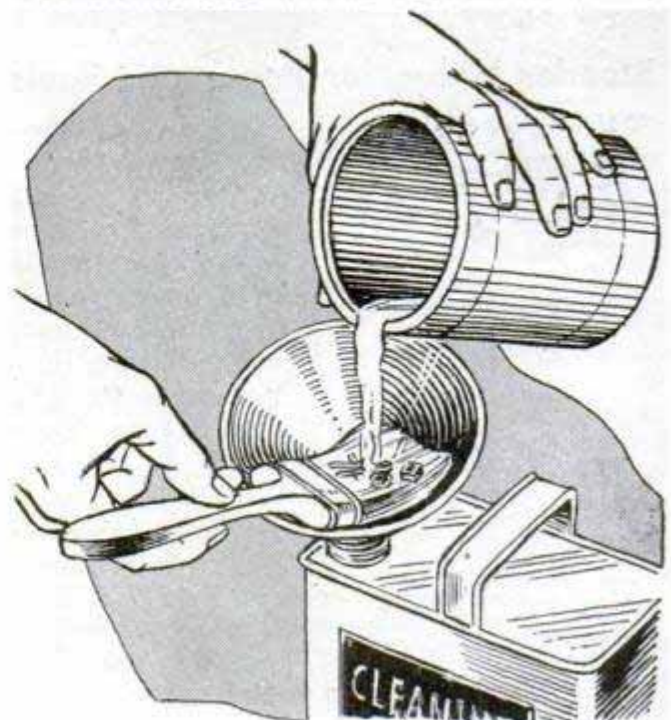


Slapper Aids Driving Animals

Fastened to an old paintbrush handle, a length of inner tube makes an ideal slapper for driving cattle, pigs and other animals. The rubber tube, of course, does not injure the animals.

Paintbrush Strains Cleaning Fluid Used to Wash Small Parts

After using a commercial cleaner or gasoline to wash small parts, much of the residue may be removed from the fluid by straining it through the bristles of a paintbrush. Just place the brush over the funnel spout when the liquid is poured back into the container. Small washers, cotter pins and other parts that may have been overlooked also will be recovered.

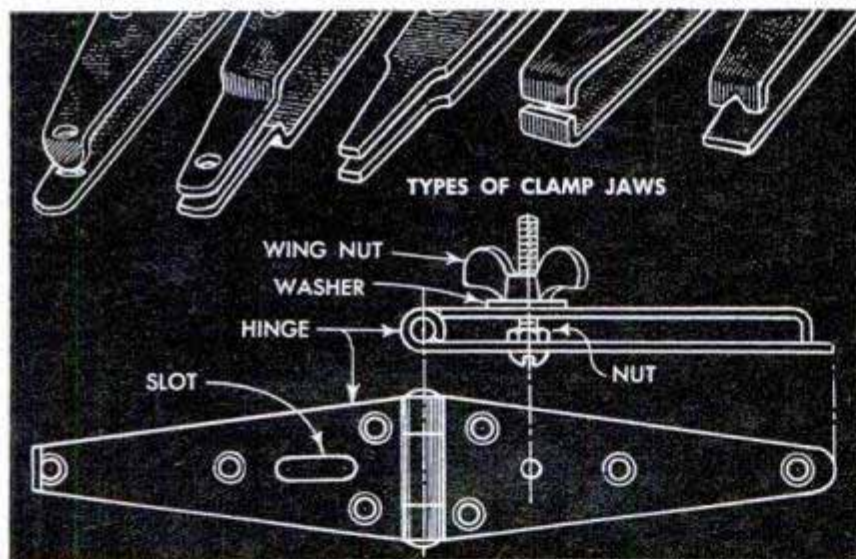
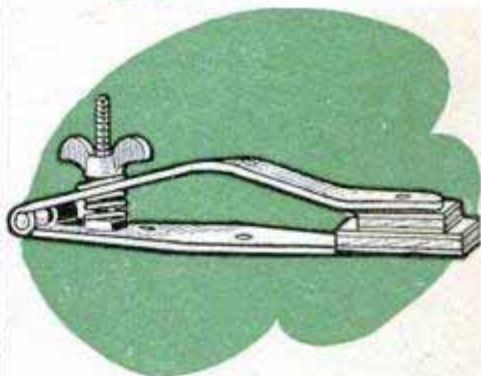
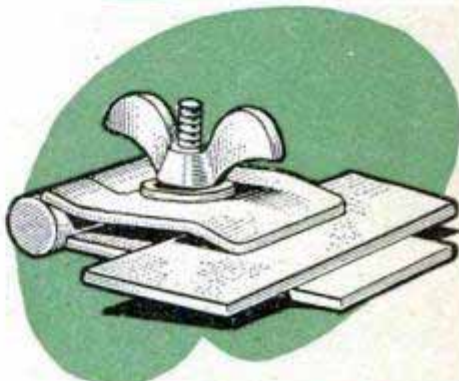
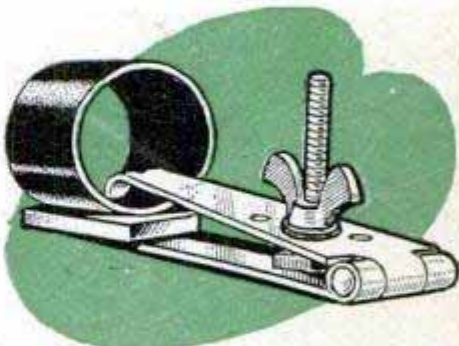
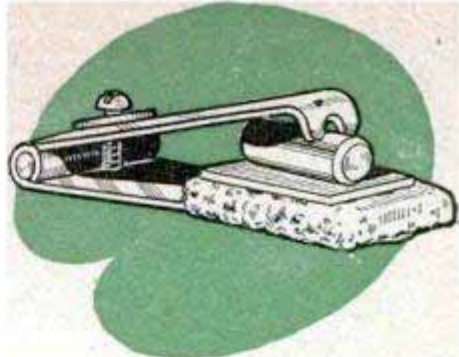


SMALL CLAMPS from HINGES

Hinges need not serve only as hinges. They can be put to work as efficient clamps. Ideal for holding small work in position for soldering and light brazing, they are especially useful where the nature of the work requires a clamp having narrow jaws and a deep throat. Modelmakers will find these clamps just the thing for holding odd-shaped work, as the ends of the jaws can be bent and shaped to fit the exact contour of the parts to be glued or soldered. The four examples show various applications of hinges for clamping small work.

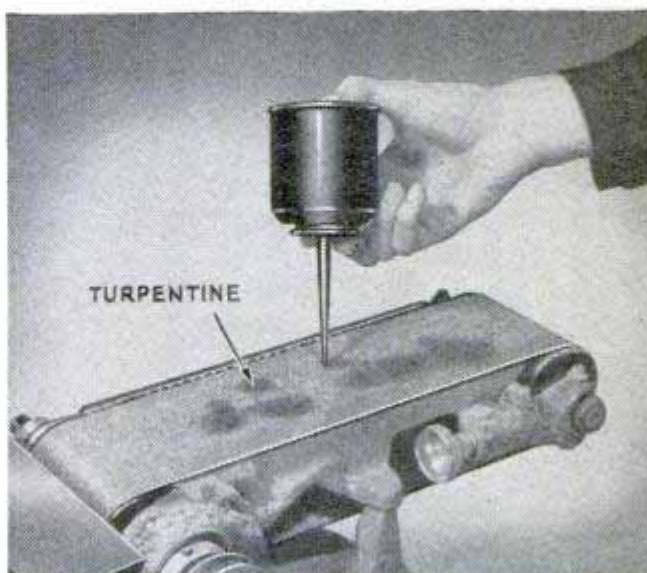
Strap hinges make the best clamps. The drawing below shows a typical clamp and also a few of the many different types of jaws that can be formed. A wing nut, washer and stove bolt provide clamping pressure. The bolt is placed in a hole drilled in the hinge leaf and the head is backed with a nut. A slot formed in the other leaf engages the end of the bolt and permits opening the clamp jaws. The amount the jaws can be opened is determined by the length of the slot. A small coil spring placed over the bolt between the leaves of the hinge will provide a clamp with self-opening jaws. When a clamp is used to hold parts to be brazed, the parts should be clamped to an asbestos pad.

Edward J. Thatcher, Woodstock, N. Y.



Turpentine Softens Glaze On Sanding Belts

When a sanding belt or disk becomes glazed to the point where it no longer will cut, don't throw it away. You can get further use from it merely by removing the glaze with turpentine. First, soften the glazed areas with the turpentine and then remove the deposits with a wire scratch brush, being careful not to rub too hard so as to wear away the abrasive. An oilcan makes a handy applicator and container for the turpentine. Fast evaporation of turpentine permits the belt to be used almost immediately. Caution: Do not turn on the sander to speed the removal of the glaze, as sparks might ignite the turpentine.





If you can see traces of a white line on the tool edge when held up to a light, the tool is dull and requires sharpening



UTILITY FILE



SCYTHESTONE



KNIFE SHARPENERS

1



COMBINATION BENCH STONE



GOUGE SLIP



ROUND-EDGE SLIP



AUGER BIT STONE



SOFT ARKANSAS POCKET STONE



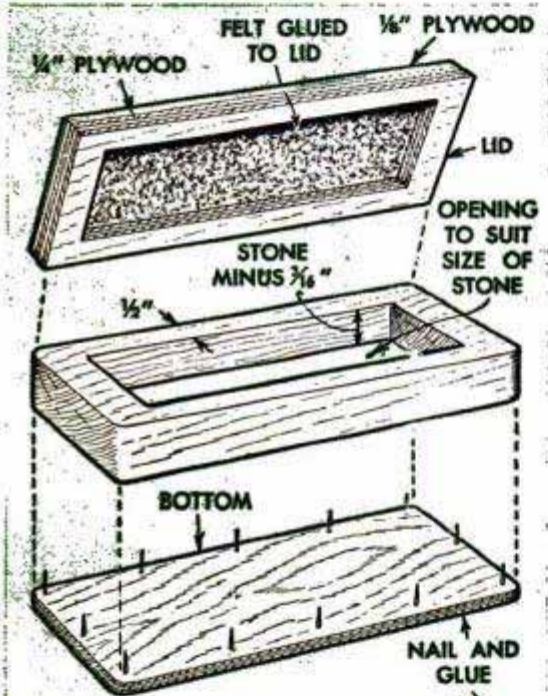
STICKS

HONE TOOLS

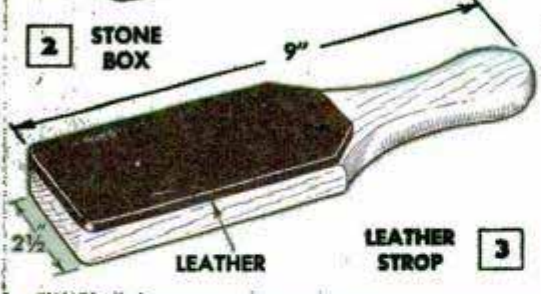
By Sam Brown

UNLESS there are nicks in the cutting edge, it's not necessary to grind a tool each time to sharpen it. Once ground, any tool can be kept razor sharp for many hours of use by frequent, light honing. The right stone to use in honing depends upon the type of tool and its purpose. Grass and bread knives cut best if honed on a coarse stone, while most other tools require honing on a medium or fine stone to prevent the edge from tearing the work and to hold up under cutting pressure.

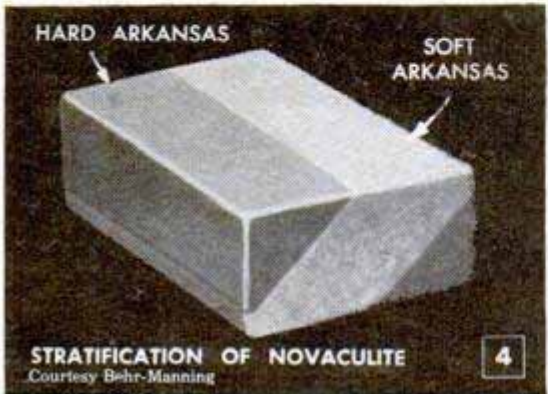
Artificial abrasives, aluminum oxide and silicon carbide, are gradually replacing natural or mined stones for honing tools. Aluminum oxide is of the same physical structure as natural corundum and is often called "India." In this country, Arkansas is about the only natural oilstone



2 STONE BOX



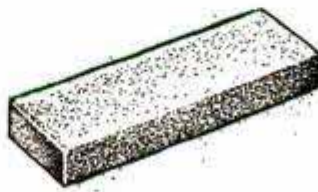
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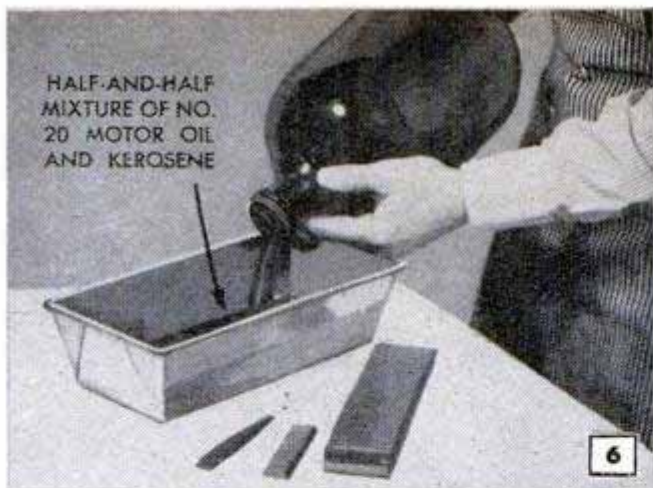
5 NATURAL STONES

HARD ARKANSAS—finest grit of all natural stones. Excellent for all delicate cutting edges



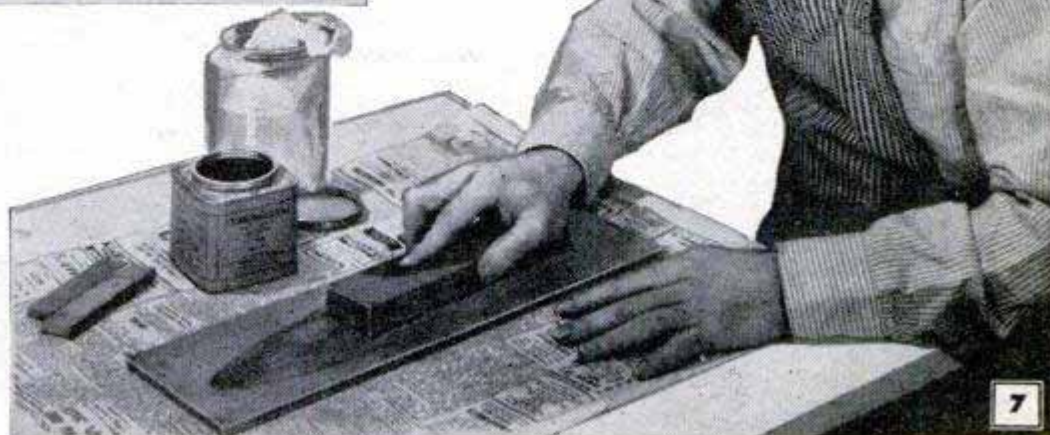
SOFT ARKANSAS—softer and more porous than hard Arkansas but cuts considerably faster

LILY-WHITE WASHITA—a soft but fast-cutting stone with good bite. Best for carpenters



Above, new stone should be soaked in oil before using and then always used with oil to prevent wearing unevenly

Right, if continued use produces hollow in the stone, rub the stone on smooth glass, using silicon carbide and water



WITH THE RIGHT STONE

of commercial importance. This stone is mineral novaculite, and is largely composed of silica. The stratification of novaculite, Fig. 4, runs from hard Arkansas to soft and then grades off to the still softer and more porous lily-white Washita, Fig. 5. First-grade Washita is the same as lily-white, but is not graded for color.

The bench oilstone: The conventional combination coarse-fine oilstone is widely used in sharpening most straightedge tools in the home shop, although Fig. 1 shows several other shapes which are recommended for honing special tools. The combination oilstone usually consists of either aluminum oxide or silicon carbide. Artificial stones are graded coarse, medium and fine—150, 240 or 320 abrasive grains per inch. Natural stones are not graded by grit

size, but by the variety of stone itself. Hard Arkansas, for example, is of both hard and fine texture, whereas soft Arkansas is soft and coarse. The soft stones cut faster but produce a coarse edge. Certain species of fine sandstone, such as Queer Creek and Hindustan, possess this feature to a marked degree and are used extensively for sharpening scythes and other tools requiring a coarse edge.

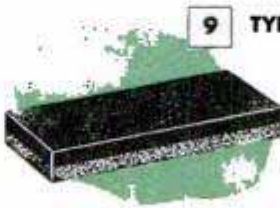
The bench oilstone should be kept in a box such as shown in Fig. 2. If the stone has not been preoiled, it should be soaked overnight in a mixture of oil, 1 part, and kerosene, 1 part, Fig. 6. In use, the stone should be worn down uniformly to prevent the formation of a hollow. However, should the stone become hollowed, it should be rubbed flat on a piece of glass, Fig. 7, using



SILICON CARBIDE
Hardest abrasive made. Cuts fast with light pressure, but breaks down under a heavy pressure



ALUMINUM OXIDE
Physically the same as natural corundum, hence often called "India." It is fast-cutting oilstone

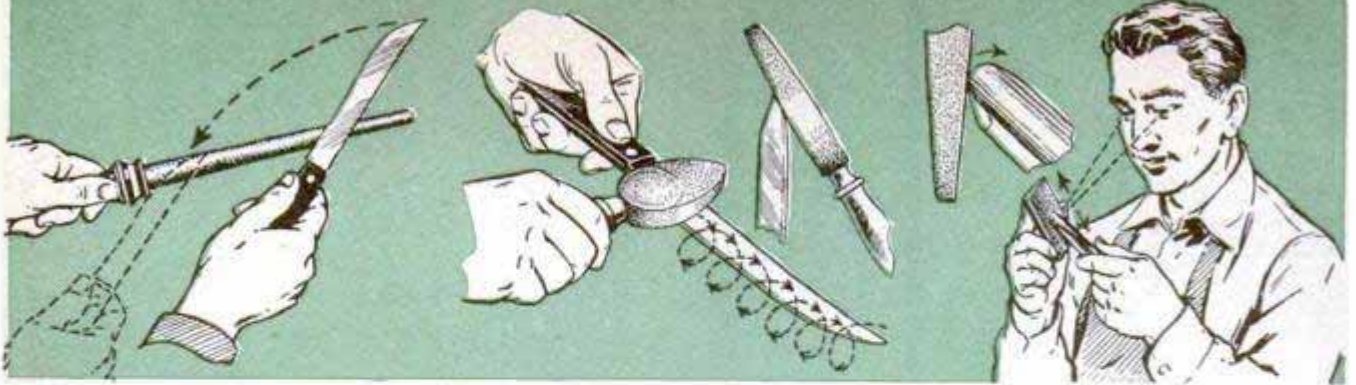


COARSE-FINE
All oilstones can be obtained in a combination of two stones. Coarse-fine is most widely used



MEDIUM
The standard grits in artificial oilstones are: coarse, medium and fine. Combination type is best

Tips on Sharpening a Variety of Tools



KNIFE (first method)

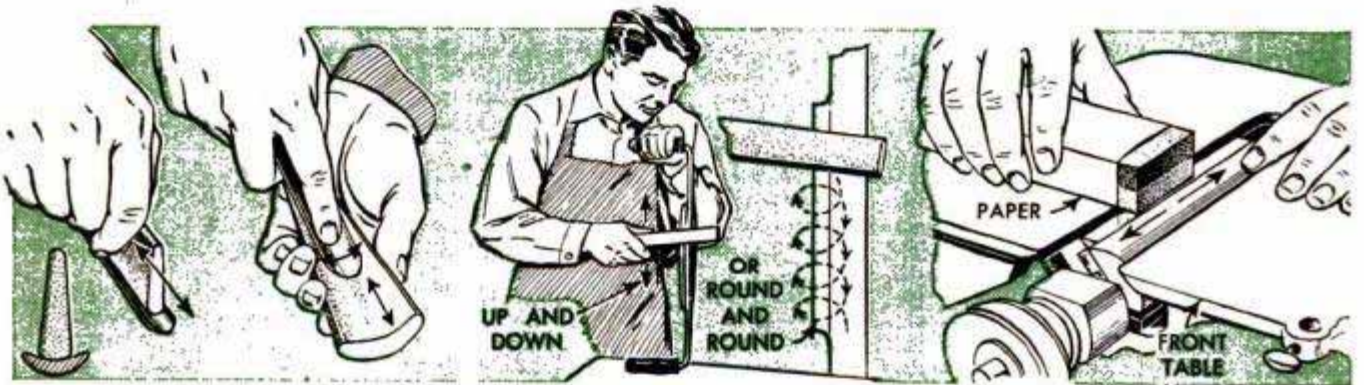
This type of sharpener is coarse-fine, cuts fast with little pressure and requires no oil. Start the initial stroke as shown, pulling the knife down smartly from heel to tip. Repeat on other side

KNIFE (second method)

Stone is fine-grit silicon carbide, excellent for sharpening stainless steel. Honing is done dry or with water lubricant. Use little circular strokes, as indicated, working stone on one side, then on other

GOUGE

Use flat side of round-edge slip or surface of bench stone. Apply oil, then hold gouge steady and move stone up and down, at same time slowly rotating gouge. Clear view of bevel is had at all times



GOUGE (continued)

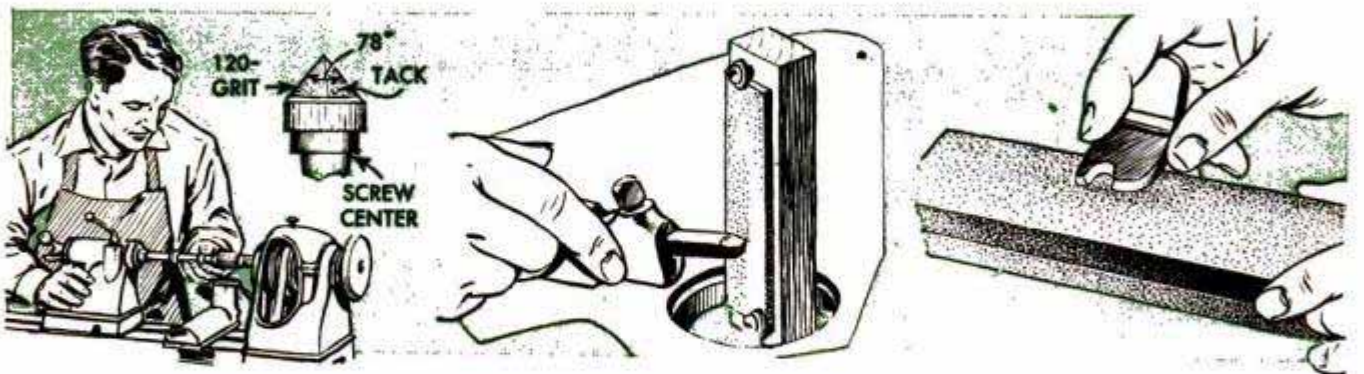
Wire edge from previous operation is removed by honing with round-edge. Use oil, hold stone flat on tool. Hollow stone is used to hone gouge having outside bevel to help keep proper bevel

DRAWKNIFE

Use a scythestone or a flat stone of coarse grit. Stroke up or down or round and round. Watch bevel by sighting and use stone dry or wet. Same technique is used to sharpen blade of scythe or sickle

JOINTER

Hone jointer knives by wrapping bench stone in paper to prevent marking table. Wedge pulley to hold cutterhead steady. Use oil and hone lightly. Use coarse side of stone first if blades are dull



MORTISING CHISEL

If you are unable to obtain a stone of the correct cone shape for sharpening a mortising chisel, turn a wooden cone and cover it with silicon-carbide paper. Apply oil and run lathe at slow speed

LATHE TOOL BITS

Although having blunt edges, lathe bits will stand up much longer if honed to a medium or fine edge. If tool is carbide tipped, use silicon-carbide stone. Mount stone in chuck of jigsaw

SHAPER CUTTERS

Use coarse, then fine side of bench stone. Hone only on flat side of cutter. Give bevel a light paring stroke with sharpening stick to remove wire edge. Molding cutters are honed the same

10 STEPS IN SHARPENING A CHISEL



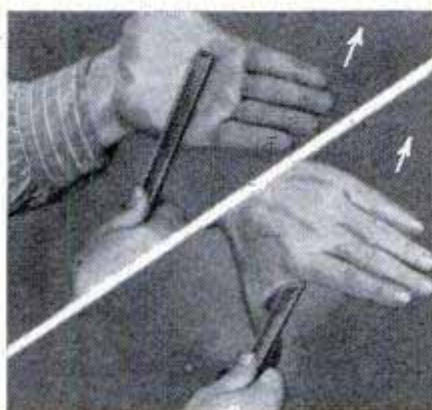
1. Chisel has been newly ground on 60-grit wheel, so honing starts on coarse side of stone. Apply a few drops of light oil beforehand



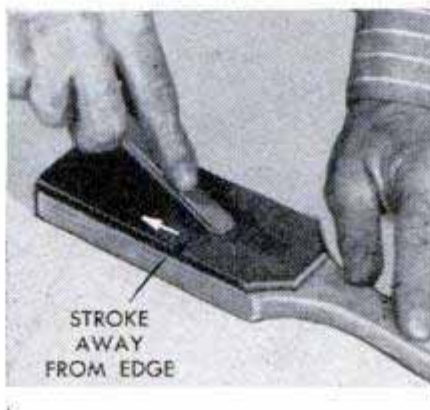
2. Hold chisel with heel slightly above stone, as shown in the side view. Stroke chisel back and forth using medium pressure



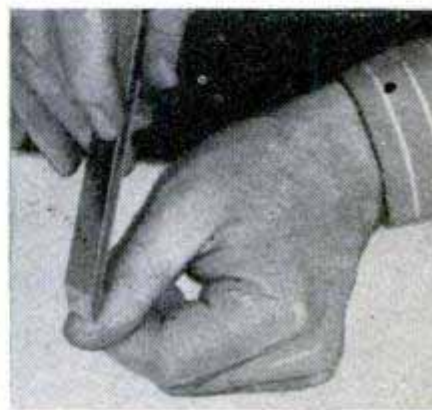
3. Alternate operations 2 and 3 until edge shows sharp with minimum of burr or wire edge. Repeat same steps on fine side of stone



4. To remove final burr or wire edge, hone the chisel on palm of hand, stroking away from edge. This bends and breaks wire edge



5. Velvety smoothness, provided previous steps have been done properly, is obtained by stropping chisel on smooth piece of leather



6. Test on your thumbnail — if chisel is sharp, it will bite in; if not, it will slide off. Make this test also at end of step 3

80-grit silicon-carbide grains and water as a lubricant. Silica sand also can be used to dress a hollowed stone.

Using the oilstone: There are no stroking rules in honing other than the obvious one of having the tool in contact with the stone at the proper angle. It is advisable, however, to hone against the edge of the tool whenever possible to hold burring to a minimum. Always use oil but avoid charging the stone with anything heavy or gummy. A kerosene-and-oil mixture is excellent. Being fairly thin, the mixture floats away any metal particles and prevents them from becoming embedded in the stone. It also permits smooth stroking and reduces friction. After a stone has been used, it should be wiped dry with a clean cloth. Never let oil containing metal par-

ticles dry on it, as this will form a glaze.

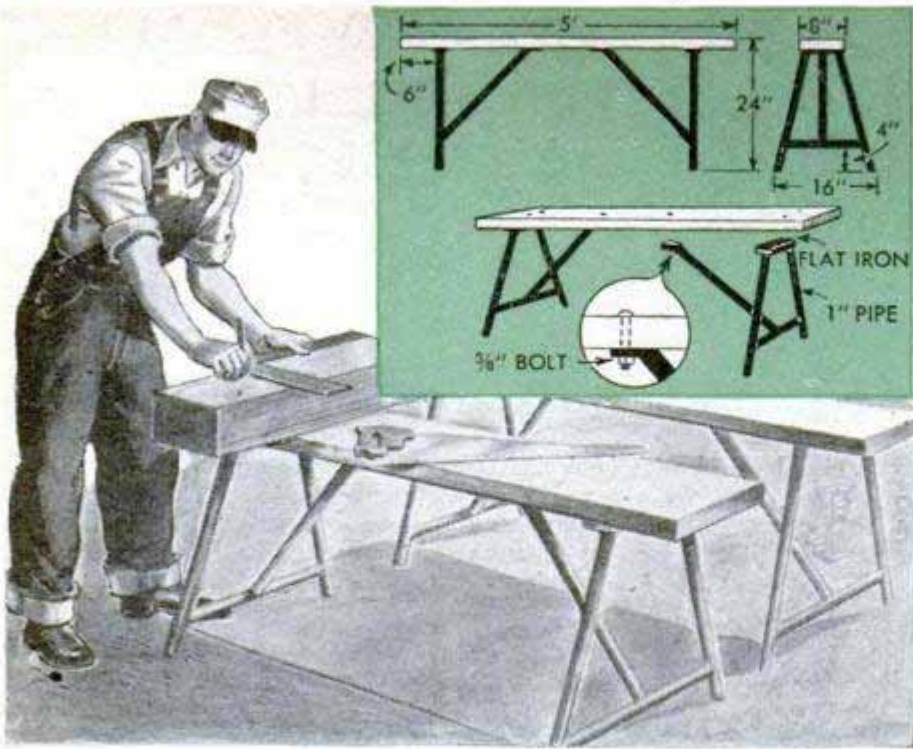
Kinds of edges: When magnified, any edge will show as a series of sharp "mountain peaks," and the relative size of the peaks classes the edge as coarse, medium or fine. When a chisel is ground on a 60-grit wheel, the edge may be sharp but it is very coarse. Honing on the coarse side of an oilstone gives an ordinary coarse edge, which then can be brought to any degree of fineness by honing on the fine side.

Honing suggestions: The photos in Fig. 10 show the general procedure in honing a chisel and the steps also apply equally as well to plane irons and similar tools. To construct a strop, Fig. 3, glue the leather to a wooden block with the hair side up. Hints on the opposite page cover honing operations for a variety of tools.

Household Lye Distinguishes Aluminum Stock From Similar Metals

When you wish to determine if a piece of metal actually is aluminum or another type of metal with a similar appearance, try this easy test. First make a 40-percent solution of household lye in water, being sure to use a glass container. Then, file or cut a few chips from the stock

in question and drop them into the solution. If the chips produce a vigorous reaction and disappear in a few seconds, the metal is aluminum. When using this solution, be careful not to get it on your hands or clothing. Also, flush the drain thoroughly after disposing of the solution.



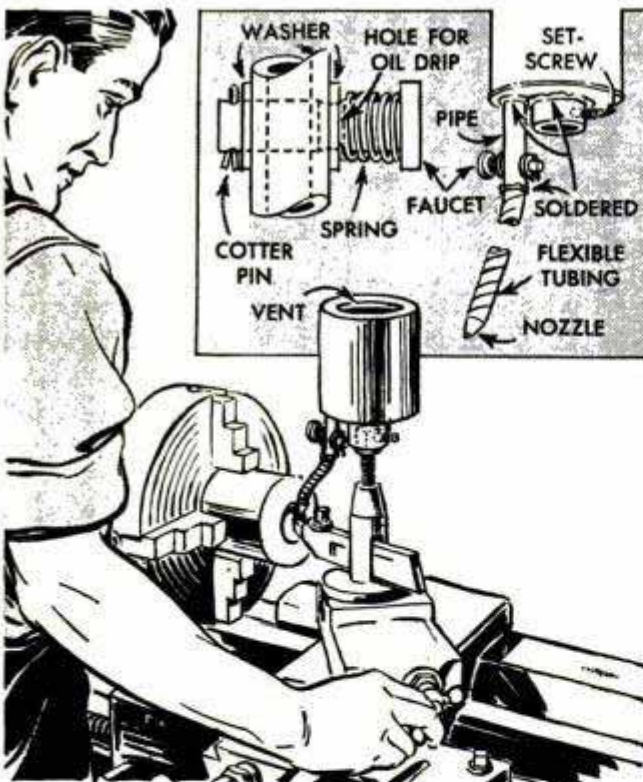
Sawhorse Benches Have Pipe Legs

A pair of sturdy sawhorse benches, made to the dimensions given in the detail, will be invaluable around the shop by providing a rigid working surface even when the heaviest tools are employed. Each set of legs is made by welding together lengths of 1-in. pipe and a piece of flat iron. Bolt holes are drilled through the flattened end of the diagonal brace and also through the flat iron to permit fastening the legs to a plank.

Gravity Coolant Dispenser on Tool Post Rides With the Carriage

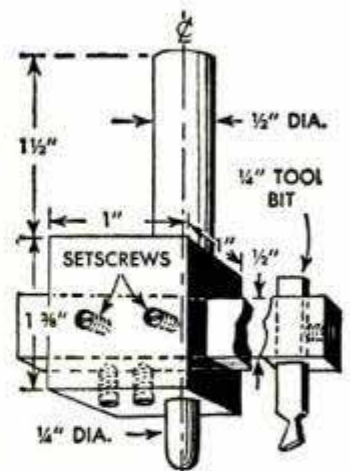
For a small lathe not equipped with a coolant system, this handy cutting-oil dispenser makes it easy to keep the tool bit well lubricated at all times. Being mounted on the tool post it rides with the carriage, out of the way, and has a flexible metal

to the bottom of a tin can having a press-type lid. Then a small hole is made in the bottom of the can and a length of tubing, in which the faucet is installed, is soldered over the hole. The flexible metal hose is soldered to the end of the tubing. Note that the drip hole in the faucet must be located at a point where the spring will keep it on the outside of the tube when the faucet is in the "off" position. It is important, too, that the bolt of the faucet be the same size as the inside diameter of the tube.



Counterbalanced Hole Cutter Uses Lathe Tool Bit

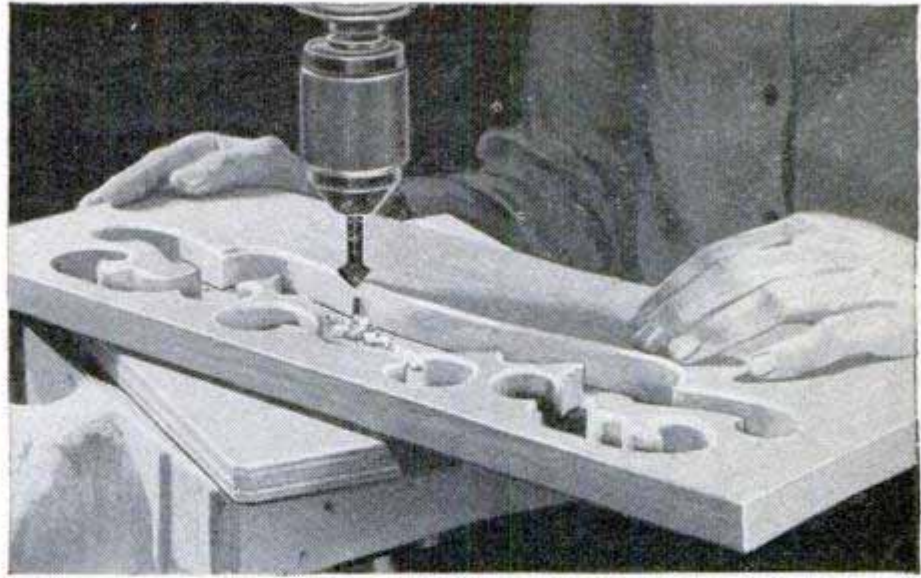
Designed to compensate for the overhang of the extended tool-bit holder, this hole cutter is balanced to rotate with little or no vibration. The shank and head of the cutter are machined in one piece, the shank and the pilot on the end being off-



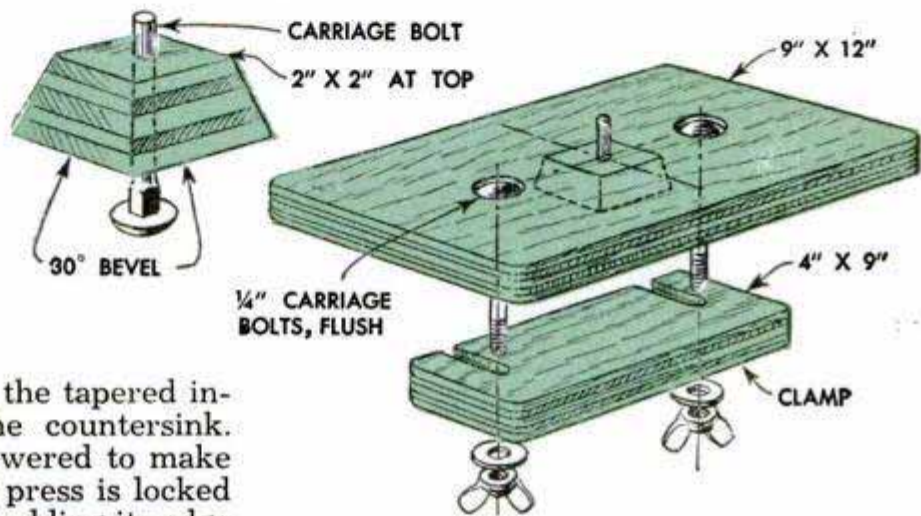
set in the square head. A 1/2-in. hole is drilled through the head and squared with a file to take a 3-in. or longer arm. Another square hole is formed in the end of the arm for a 1/4-in. lathe tool bit. Setscrews are used to lock both the arm and bit in place. Note the shape of the cutting edge.

hose which directs the oil to the very tip of the cutting tool. A simple faucet controls the flow of oil. The details show how the dispenser is made. A section of pipe having an inside diameter which will fit over the square head of the tool-post clamping bolt is tapped for a setscrew and soldered

Jig for Scroll Chamfering and Pattern Routing



By using this jig as a guide, it's easy to chamfer the edges of a scroll-sawed cutout on a drill press with a rose-head countersink. The jig is made as shown and clamped to the drill-press table. The countersink, with the squared end cut off, is chucked in the drill press and the guide pin in the tapered insert is centered under the countersink. After the countersink is lowered to make the desired bevel, the drill press is locked and the work is guided by holding its edge against the pin. Standard $\frac{5}{16}$ -in. shaper cutters can be used instead of the countersink by mounting on a shaft and offsetting the guide pin to suit the depth of cut. The jig can be adapted for pattern routing by fashioning several wooden inserts and equipping each with a pin of a different size to correspond with the diameters of the routers that will be used. A template

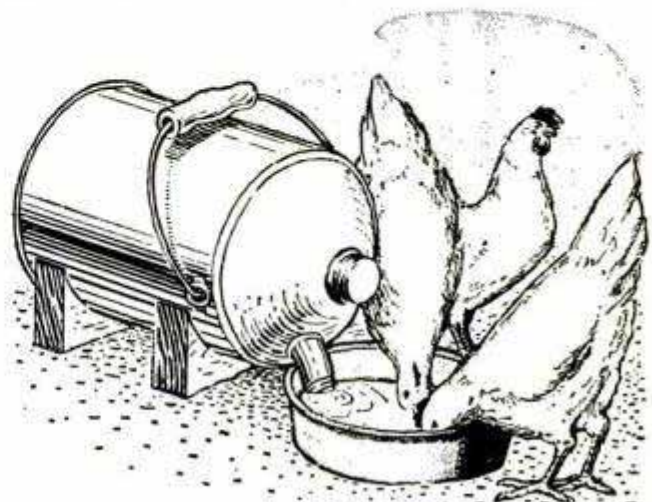


is prepared by sawing or routing a master pattern in a block of wood, and then tacking to the underside of the work. The pin is centered exactly under the router, and the work is guided by placing the master pattern over the pin. In this way, any number of identical pieces can be routed without further adjustment of the jig.

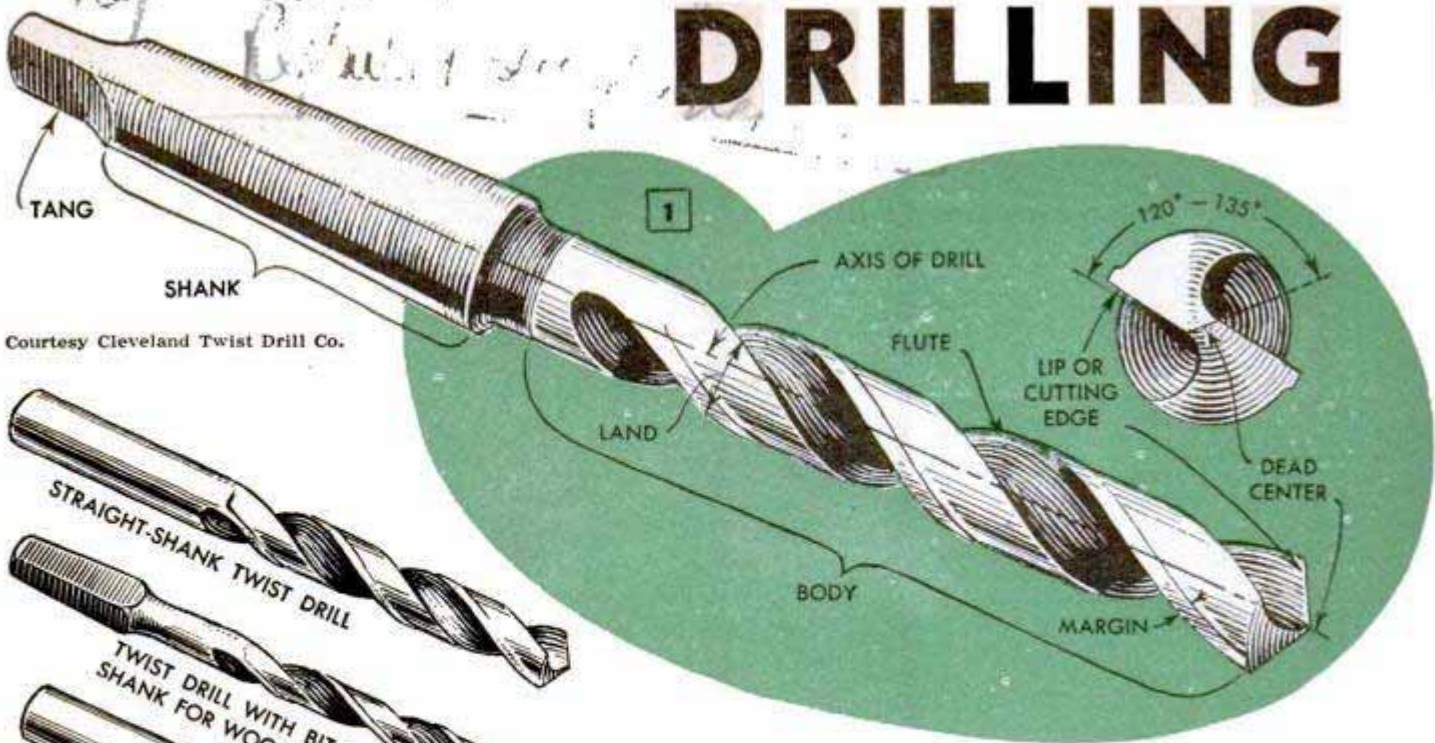
E. M. Love, Palmdale, Calif.

Poultry Watering Fountain Is Improvised From Five-Gallon Oilcan

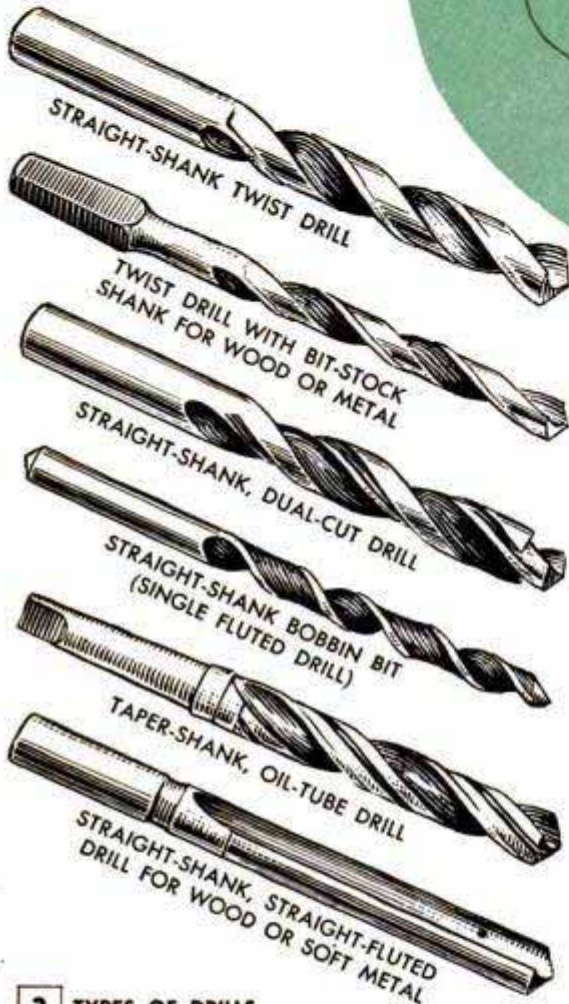
When small flocks of chickens or turkeys are moved to a temporary range where there are no facilities for supplying water, an automatic watering fountain can be quickly improvised from a 5-gal. fuel-oil can. The can is laid on its side and the spout is inserted to the fullest possible depth in a drinking pan. Water from the can will flow into the drinking pan and maintain a constant level, providing the filler cap of the oilcan is screwed tight to prevent the seepage of air into the can. Depending on the length of the spout, the can may be held off the ground with blocks or propped so it will not roll.



DRILLING



Courtesy Cleveland Twist Drill Co.







2 TYPES OF DRILLS

By Thomas Trail

ALTHOUGH the actual operation of drilling metal or wood is one of the simplest shop procedures, skill and "know how" are required to keep the drills sharp, to know the correct speed and lubricant to use and the right drill for the job at hand. The principal parts of a drill are shown in Fig. 1. The dead center should be on the exact center of the drill axis and the cutting edges must be equal both in length and in angle. The margin is a narrow, raised rib with a cutting edge being the full diameter of the drill. In operation, the rib accurately sizes the hole and reduces friction. The shank is the end of the drill that is held by a drill-press chuck or a taper socket. The drill shown has a tapered shank with a tang on the end which engages a slot in the small end of the tapered socket to give a positive drive. Drills also are made with a straight

3 CAUSES AND CURES FOR COMMON DRILL TROUBLES

 <p>BREAKING OF CUTTING EDGES AT CORNERS</p> <p>CAUSE</p> <ol style="list-style-type: none"> 1—Too much lip clearance 2—Material has hard spots, sand inclusions or scale 3—Drill running too fast 4—Wrong cutting compound or lubricant 5—Feed too rapid <p>CURE</p> <ol style="list-style-type: none"> 1—Regrind and reduce lip clearance to between 12 and 15 degrees 2—Reduce speed 3—Reduce speed 4—Use proper lubricant or compound 5—Reduce feed 	 <p>OVERSIZED HOLE</p> <p>CAUSE</p> <ol style="list-style-type: none"> 1—Length and angle of lips not equal <p>CURE</p> <ol style="list-style-type: none"> 1—Regrind drill and equalize lip angles and lip lengths 	 <p>BROKEN TANG</p> <p>CAUSE</p> <ol style="list-style-type: none"> 1—Poor fit of tang in socket caused by nicks, burrs, dirt or wear 2—Mutilated tang <p>CURE</p> <ol style="list-style-type: none"> 1—Ream old socket or replace with new one. Cleaning sockets before use lengthens their life 2—Dress or replace 	 <p>CHIP FORM CHANGES</p> <p>CAUSE</p> <ol style="list-style-type: none"> 1—Lubricant not reaching proper location <p>CURE</p> <ol style="list-style-type: none"> 1—Drill chipped, dulled or damaged—Inspect and regrind 2—Remove drill and check lubricant
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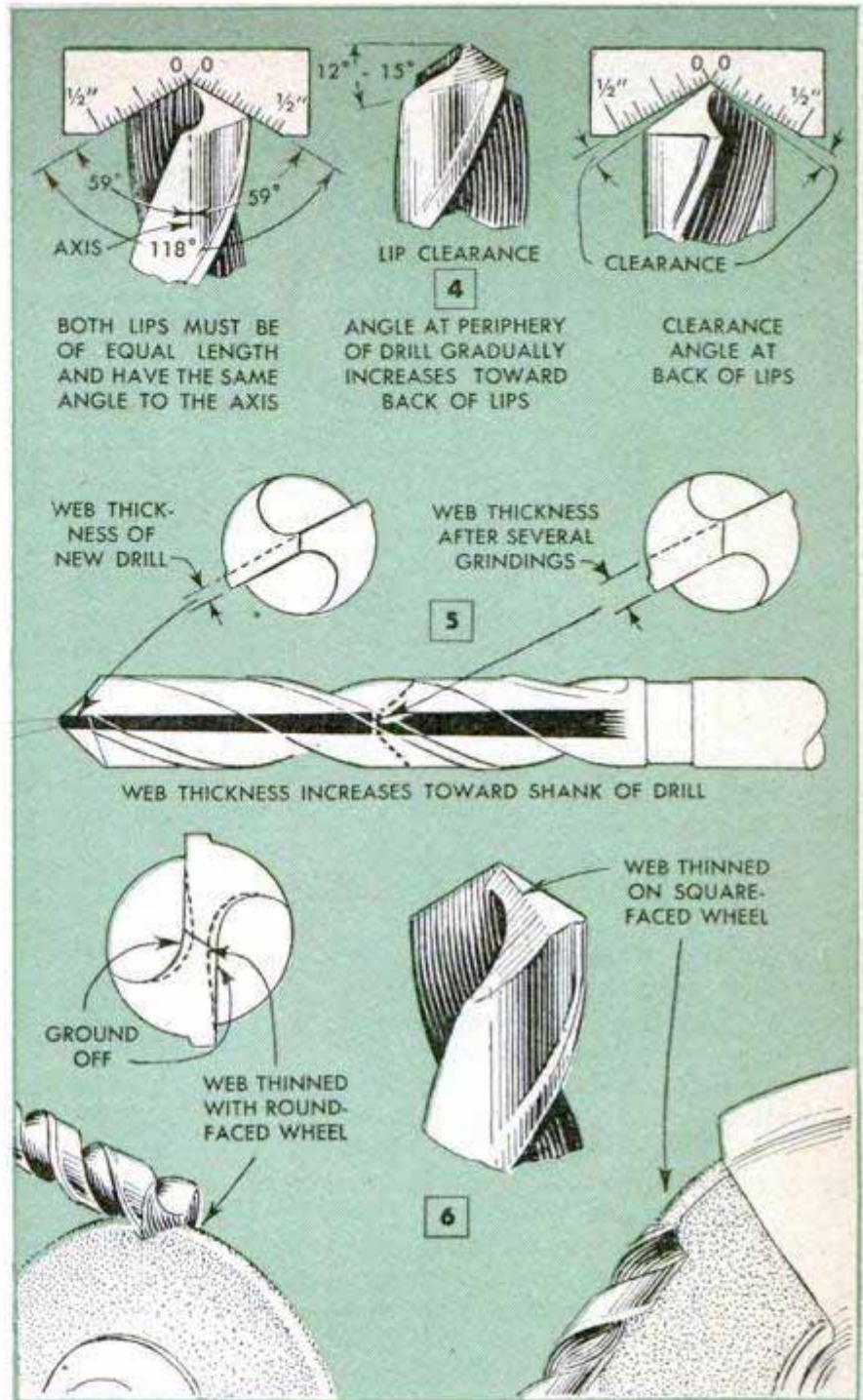
DATA

shank and a bit-stock shank, as in Fig. 2. The diameter of a drill decreases slightly from the cutting point in order to prevent binding in the drilled hole. Sizes are designated in four classifications. Number drills range from No. 80 to No. 1 (.0135 in. to .228 in.); letter drills from A to Z (.234 in. to .413 in.); fractional drills rise from $\frac{1}{64}$ in. upward by 64ths, and metric drills are listed from .5 mm. to 10 mm. by .1 mm., larger than 10 mm. by .5 mm.

Normally, the cutting edges of a new drill gradually wear away with use and require sharpening. A dull drill will not cut properly and may be damaged by excessive heat generated by friction at the cutting point. Drills should be sharpened on a medium-grit grinding wheel. To prevent a drill from overheating and losing its temper while grinding, it should be dipped frequently in water while being sharpened. Cold water should not be used for this purpose, however, as it may cause cracking or distortion of the drill bit.

Most drilling trouble is due to faulty grinding of the cutting-edge clearance and angle. The two cutting edges of a drill must be made equal both in length and angle, and the angle must be such as to produce best results in the material to be drilled, Figs. 3 and 4. For average drilling, an angle of 59 deg. at the cutting edges has been found most satisfactory and new drills are ground to this angle unless made for special purposes. A drill gauge, Fig. 4, is used to check the angle of the cutting edge when grinding.

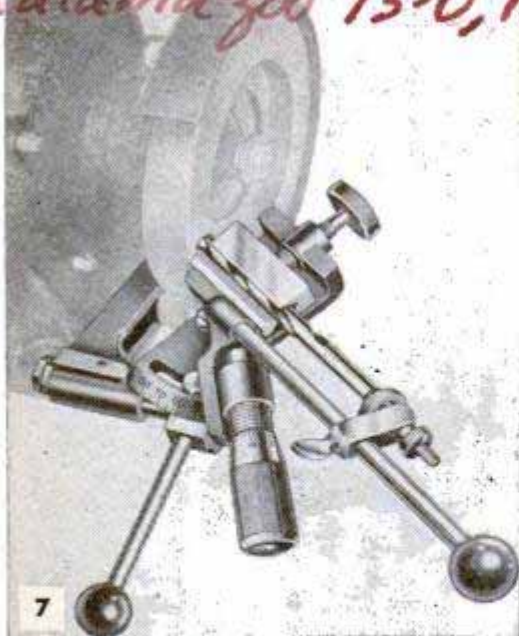
If either the lengths or angles of the cutting edges are ground unequally, the drill will drift and form an oversize, stepped hole. This will happen even though lip clearance is correct for the angle at which each lip is ground. The clearance, as shown in the center and right-hand details in Fig. 4, allows the drill to penetrate the material being drilled. For average work the clearance angle back of the cutting edges



should be between 8 and 12 deg., but it is sometimes increased to 15 deg. where heavy feeds are taken in soft materials. When cutting-edge clearances have been ground uniformly to the proper angle, the angle subtended by the dead-center line and each cutting edge should be at least 120 deg., and not more than 135 deg., as shown in Fig. 1. Excessive clearance will weaken the cutting edges and cause them to break down. Insufficient clearance will prevent the drill from properly penetrating the material and may result in splitting the drill. After grinding, the drill point should be checked carefully to assure accuracy of the cutting-edge lengths and angles, the clearance angles and the location of the dead center.

Although with practice the mechanic can do an accurate job of drill grinding

2073 W. Pitcher St.
Kalamazoo 13-D, Mich

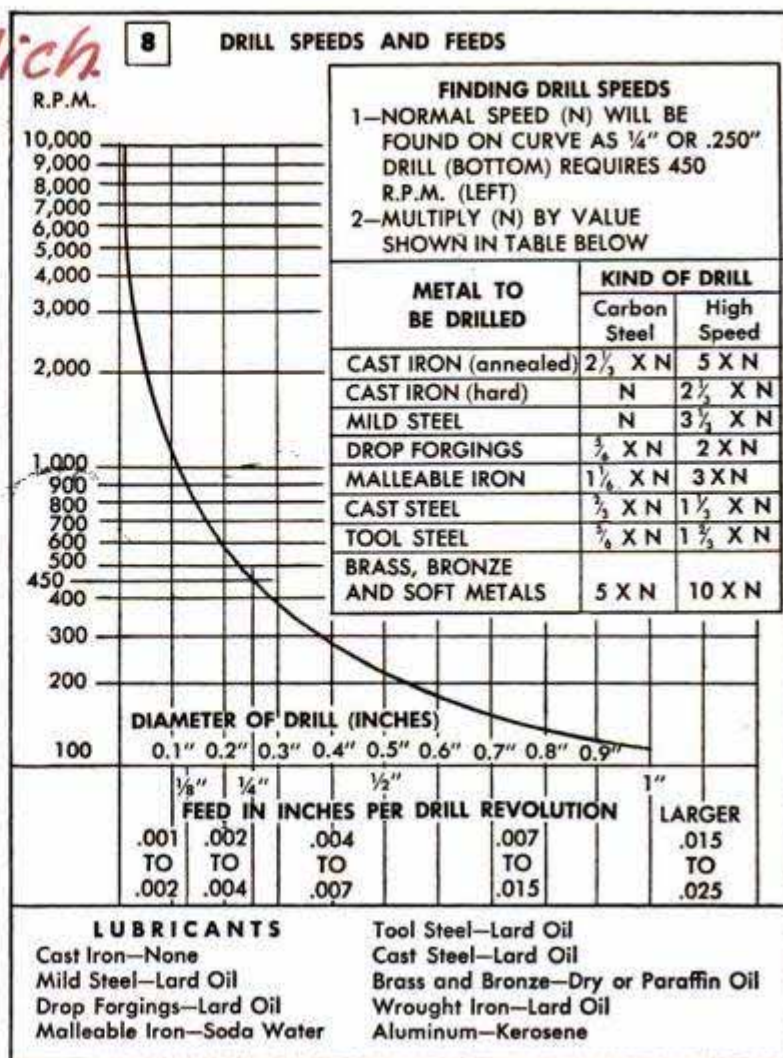


Atlas Press Co. photo

by hand, use of an automatic grinding attachment, Fig. 7, is recommended. This will produce an accurately ground drill point and will save excess grinding.

When drilling hard material it is sometimes desirable to use a heavy feed pressure. To prevent the drill from chipping, a narrow flat is ground on the leading side of each cutting edge. Care must be taken not to give the edge a negative rake, however, as this would cause heating and possible breakage. This type of drill point also is used when drilling soft materials, such as brass, where a normal point may tend to dig in. Note from Fig. 5 that the web increases in thickness from the cutting point to the shank to give the drill greater rigidity. As a result, the web becomes thicker at the point after a number of sharpenings and must be thinned by grinding to maintain ease of penetration of the drill point. Fig. 6 shows two methods of reducing the thickness of the web at the point. The best way is to use a round-faced grinding wheel, the radius of the wheel face being less than that of the flutes. Another method is to grind a bevel on the trailing edge of the heel as in the upper right-hand detail of Fig. 6, using a square-faced wheel. Except for cast iron, which is drilled dry, most metals require use of a lubricant for best results. Lubricant serves a threefold purpose. It dissipates heat rapidly, lubricates the drill at the cutting edges and aids in the formation of uniform chips. This results in smooth, clean work with a minimum of wear on the drill.

The chart, Fig. 8, makes it easy to figure proper drill speeds and feeds in all common drilling operations. It also lists the correct



lubricants used on various types of metals.

Work to be drilled should be clamped securely to the drill-press table and the drill should be held firmly by the chuck or taper socket. When using taper-shank drills, see that the shank and the inside of the socket are smooth and free from grit, and that the drill tang is not damaged. Use a block of wood to drive the drill shank tightly in the socket. In removing the drill from the socket, place a piece of wood under the drill point to prevent it from striking the drill-press table or the work, and use a drift of the correct size to drive out the drill. When drills are used at the bench, keep them in a metal stand especially made for the purpose. Drills not in use should never be stored loose in a drawer or chest or together with other tools as they are likely to become nicked or otherwise damaged. Stored drills should be oiled to prevent rusting.

Testing Gear Compound for Grit

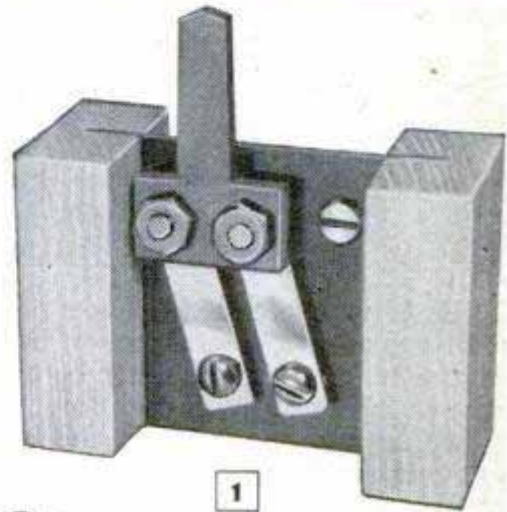
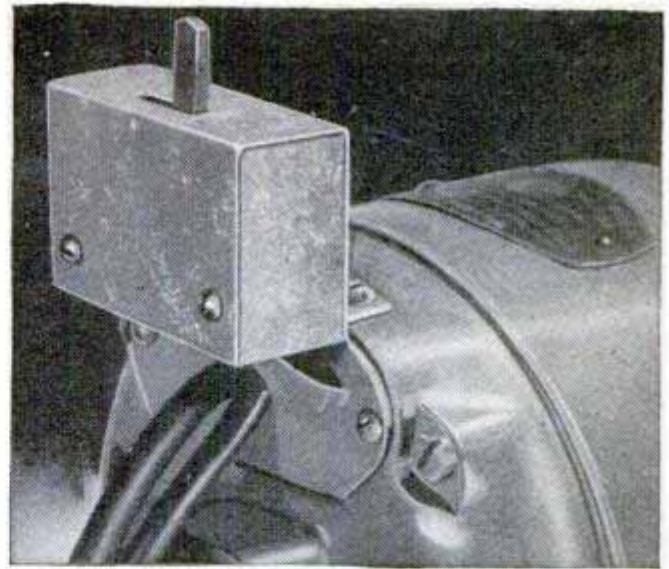
Whether or not gear grease contains grit can be determined by placing a small amount of the grease between two clean pieces of glass. These are rubbed together until a thin film of grease remains and then held up to the light. Any foreign particles will be apparent.

MOTOR DIRECTIONAL "SWITCH"

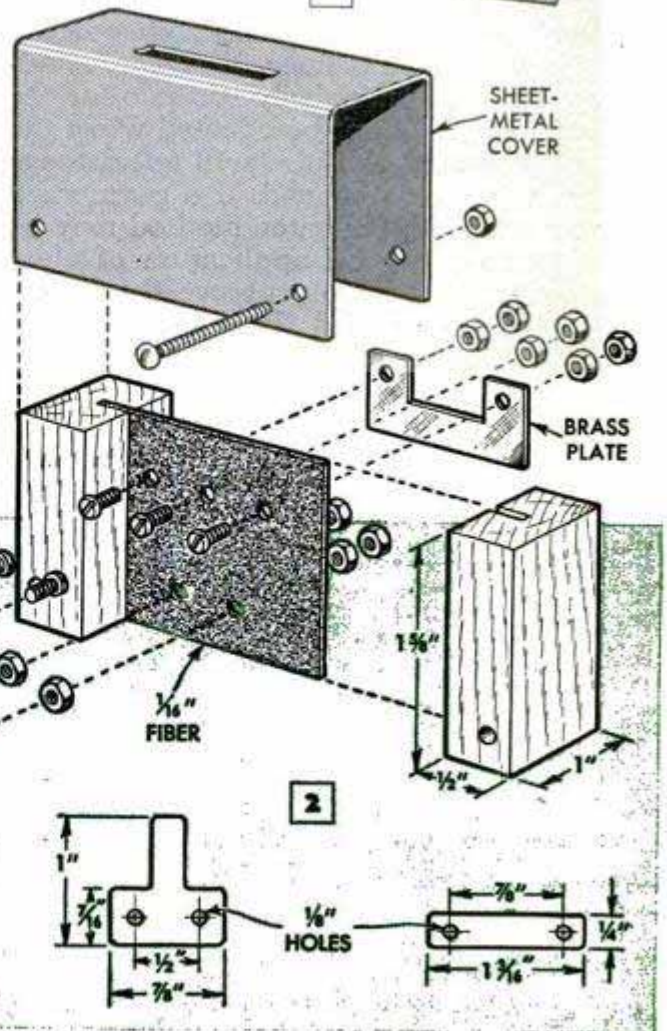
This inexpensive motor directional "switch" differs from the commercial reversing type in that it is used in conjunction with the motor switch. This feature eliminates the possibility of accidentally starting the machine in the wrong rotation. While a directional switch generally is used in operating a shaper or a metal lathe, such a switch also can be adapted for use where a countershaft or a motor is used to drive two machines placed on opposite sides of the drive pulley. This obviates need for crossing the belt.

If the motor is of the split-phase or capacitor type, reversing rotation ordinarily is done by transposing the position of the two starting-coil leads. But when the motor is equipped with this directional switch, the direction of rotation is reversed by just moving a lever. Fig. 1 shows what the switch looks like with the cover removed and Fig. 2 shows the parts and how they go together. To install it on a motor, remove the motor cover plate and disconnect the two starting-coil leads, leaving the motor-switch leads connected. Next, short lengths of wire, connected to the motor terminals, are brought through holes in the cover plate for connection to terminals on the directional switch. The directional switch is connected to the starting-coil leads according to the wiring diagram in Fig. 3 and then mounted on the motor with an angle bracket. Remember that in using this switch, the motor should come to a complete stop before changing the direction of rotation. Positive contact must be maintained to prevent arcing.

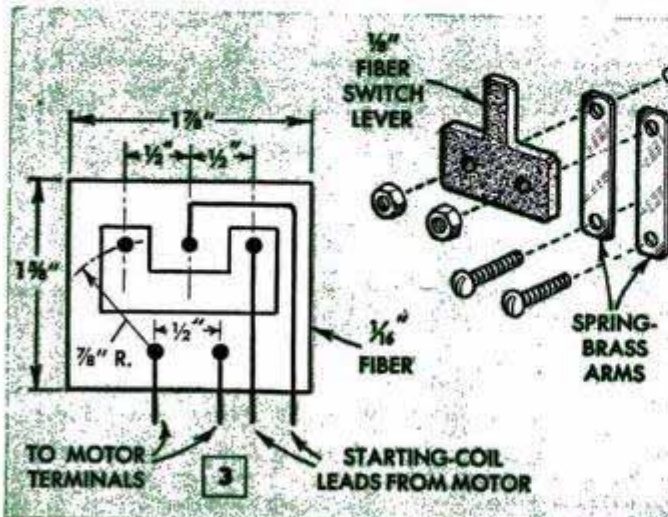
Henry Hanscom, Elmhurst, Ill.



1



2



3

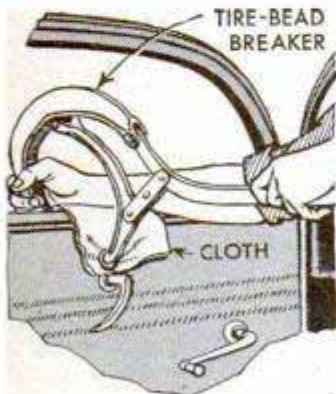
Schedule Board Ruled With Tape Permits Easy Arrangement



SCHEDULE BOARD							
MACH.	SUN.	MON.	TUE.	WED.	THUR.	FRI.	SAT.
LATHE		JONES		JONES			
PLANER	SMITH				SMITH		
SHAPER			BROWN				
				BROWN		WOODS	

In plants where ruled schedule boards must be rearranged from time to time, the arrangement of the lines may be changed and the board used again in a few minutes if it is ruled with tape. When the lines are to be rearranged, the tape is stripped off and replaced with new tape in the position desired. This, of course, is much quicker than repainting the lines. Waterproof adhesive tape is particularly suitable for the purpose as it will not be affected when the board is washed and also will not damage the board when removed. If a permanent board is needed, the same method may be used followed by an application of clear lacquer or varnish to preserve the whiteness of the tape and the surface of the board.—Neal Houlahan, Glenshaw, Pa.

Tire-Bead Breaker Helps Remove Inside Car-Door Handles



When removing inside door handles from some of the older model cars it is often difficult to keep the collar depressed while knocking out the pin which holds the handle. This was my problem until I thought of using a

tire-bead breaker to apply pressure. I padded the body and upholstery to protect them and placed the tool so it would apply

pressure to the trim pad above the handle. This made it easy to drive the pin out.

Russell L. Card, Tweed, Ont., Can.

Creosote Treatment of Fence Posts

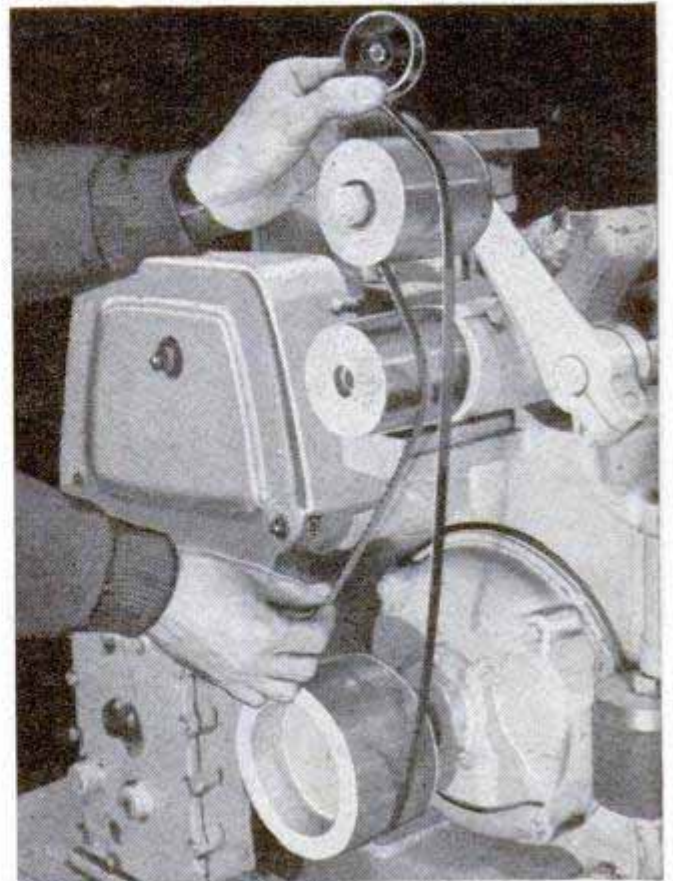
Here's a way to creosote wooden fence posts if pressure treatment, which requires special equipment to apply the preservative, isn't available. All you need are two oil drums, creosote and some used crankcase oil. Prepare a mixture of creosote, 4 parts, and crankcase oil, 1 part. Fill each drum with enough solution to cover the posts to a height of 2½ ft. Prop up one drum and build a fire beneath it; then stand the posts on end in this container and heat for about three hours, keeping the creosote solution just under the boiling point. At the end of this period, remove the posts and plunge them into the unheated mixture in the other drum. Deep penetration of the creosote will result.

Van Allen Bradley, Jr., Chicago.

Determining Machine-Belt Sizes With Flexible Steel Tape

The easiest and most accurate way to determine the length of a belt required for a certain machine is to measure the distance directly, wherever possible. Common practice is to use a string for measuring, but you'll find that a flexible steel tape is much better as it will not stretch and yet will easily bend around the pulleys.

Richard Hanscom, Elmhurst, Ill.

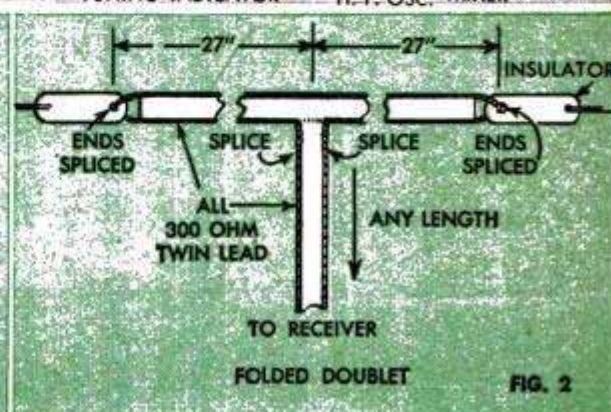
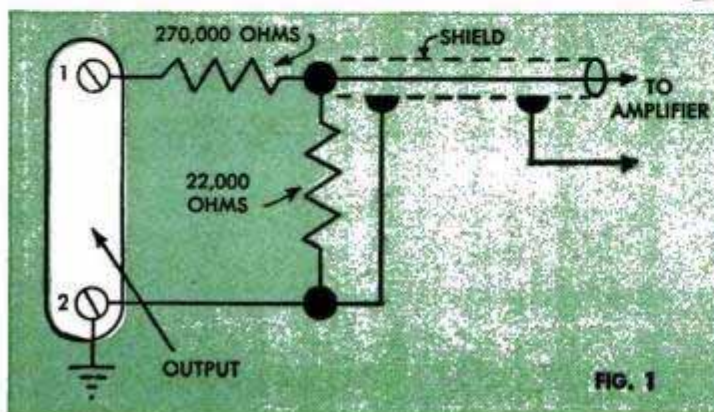
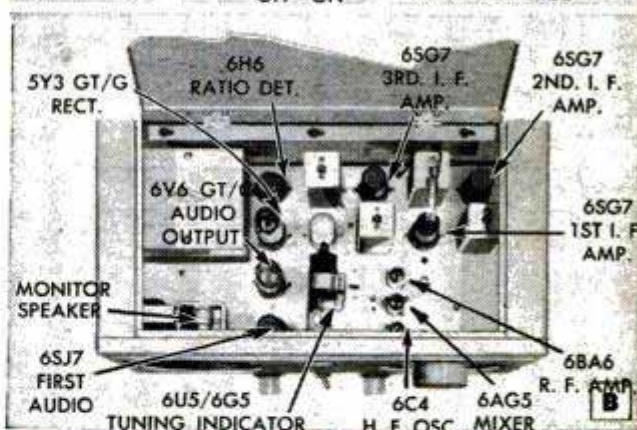
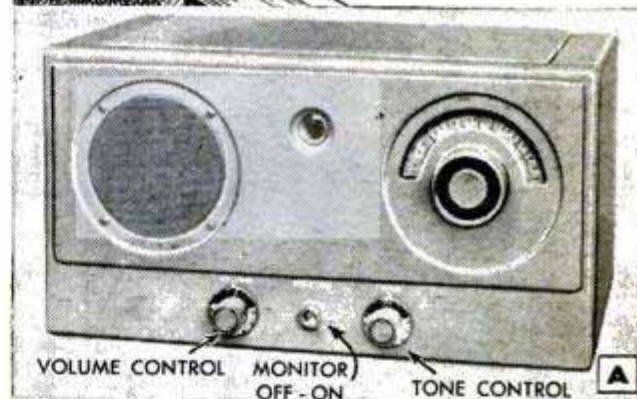
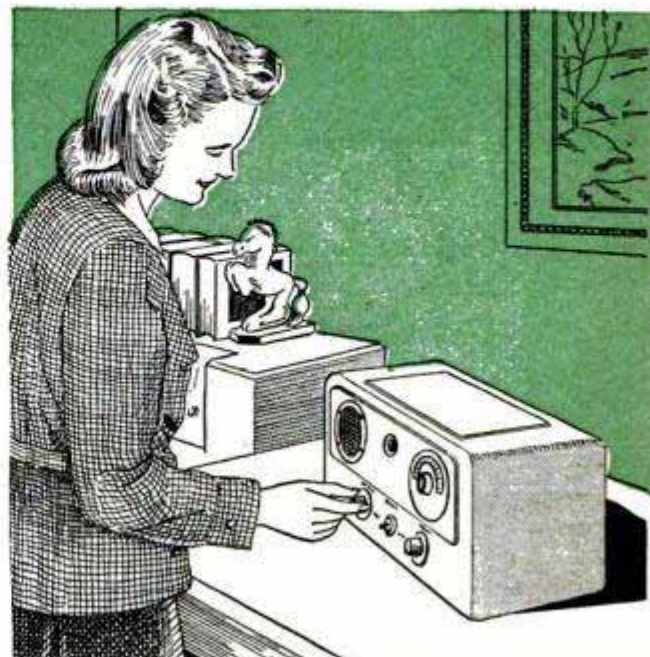




UNIVERSAL FM RECEIVER-TUNER

ALTHOUGH this FM unit is a complete receiver in itself, it is primarily designed to serve as the nucleus of a high-fidelity installation for the reception and reproduction of FM broadcast entertainment. It may be used alone or in conjunction with a public-address system or with any standard broadcast or short-wave receiver. The built-in monitor speaker can be switched on and off as desired. With any external amplifier-loudspeaker system capable of amplifying and audibly reproducing the full output, the high sensitivity and fidelity capabilities of this FM unit are fully realized. Most large standard broadcast receivers have suitable audio-amplifier stages.

Nine tubes, plus a rectifier and tuning indicator, are employed in a superheterodyne circuit with ratio-type FM detector. The frequency range is 87 to 109 megacycles and the dial is calibrated in both megacycles and channels. Volume and tone controls are operative both in the unit and external audio systems. Photo A shows a front view of the cabinet. The weight is 24 pounds. Photo B identifies the various tubes and their location. When using this National FM unit with an external amplifier, the interconnection is made with a low-loss shielded cable that should not exceed 10 ft. in length, and preferably shorter. If a longer connecting cable is necessary, the voltage-divider network, Fig. 1, is used across the output terminals to compensate for the resulting loss of high-frequency tones due to the longer cable. A suitable FM folded-doublet antenna made from Amphenol 300-ohm twin lead is detailed in Fig. 2. As this type of antenna is quite directional, maximum results are obtained when the receiving antenna is parallel with the transmitting antenna.

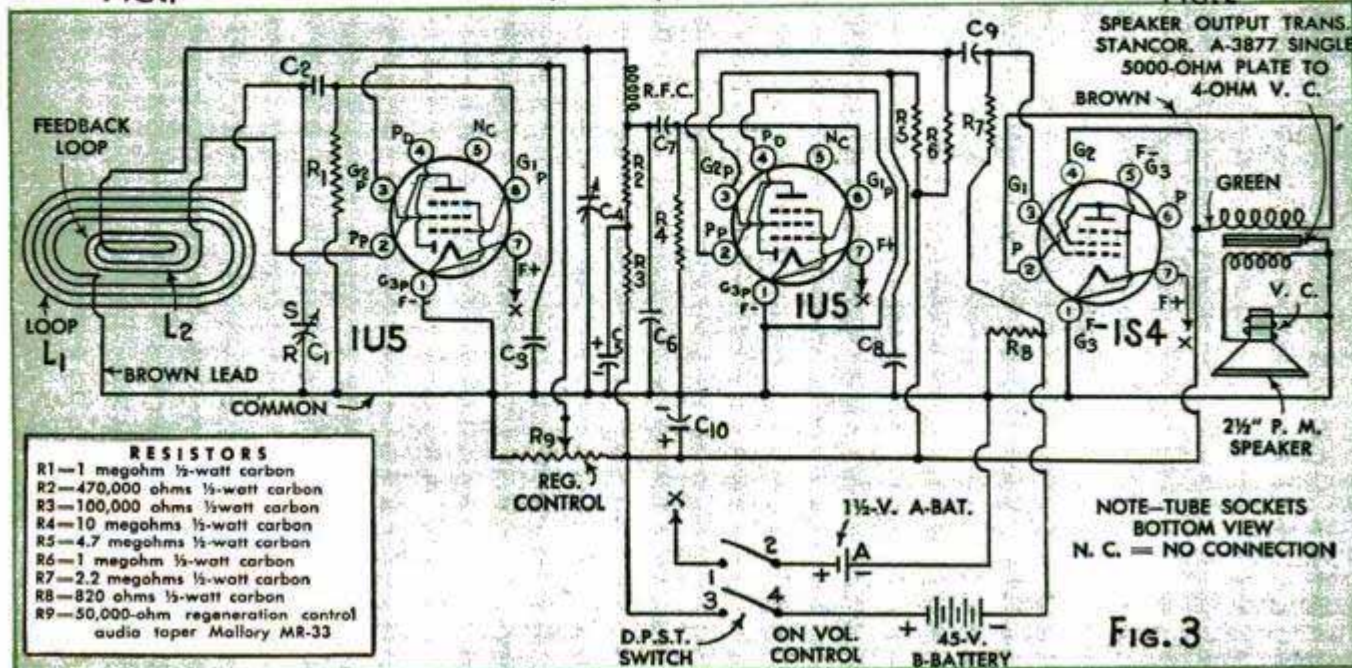
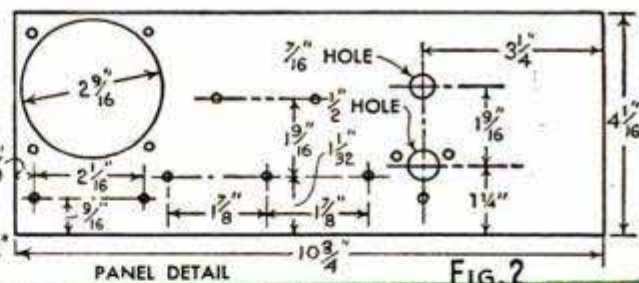
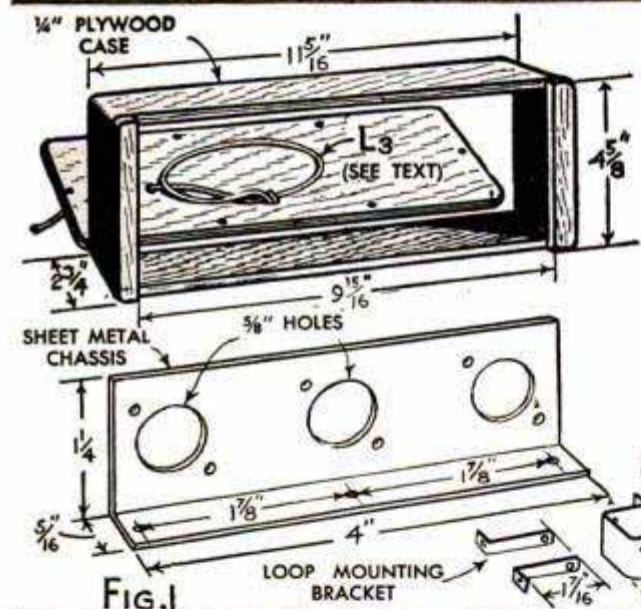
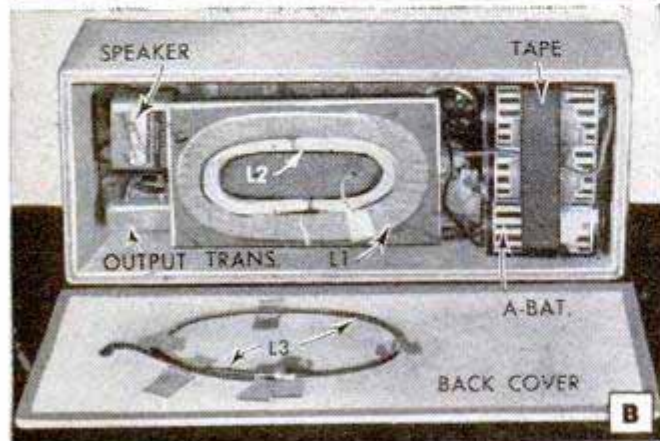
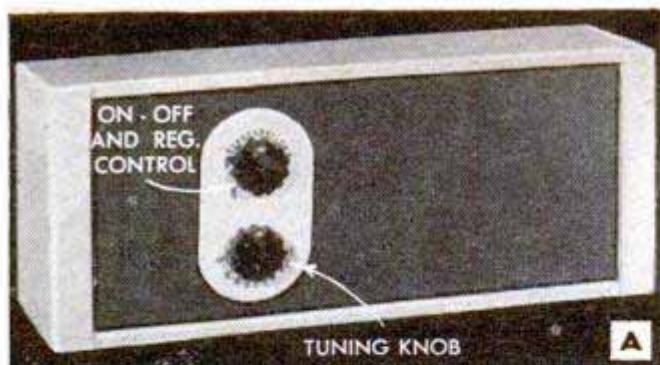


THREE-TUBE POCKET SET

By L. M. Dezettel

THIS three-tube walkie-talkie-type portable receiver is designed for speaker reception of local broadcasting stations and is ideal to take to the ball game or on hikes. The entire broadcast band is covered by a single tuning condenser. Construction is simple in spite of the limited space and the fact that the set employs a 3-tube circuit complete with batteries and speaker.

Construction should begin with the chassis and panel detailed in Figs. 1 and 2. Make a careful study of photos A, B, C, D and E. This panel may be made of either thin plywood or 1/8-in. hard-pressed wood. The speaker should be shock-mounted as detailed in Fig. 5, and covered to protect it during assembly. The chassis and brackets are made of 1/16-in. sheet aluminum. Wiring should begin with the filament circuit, followed with the speaker and the output transformer. A good common-ground connection is carried throughout the set, as indicated in Fig. 4. Miniature electrolytic filter condenser C5 should be carefully mounted so that its outer shell does not touch connections on the tube sockets. The metal shell in the center of each tube socket acts as a shield and may be used for a common-ground tie point.

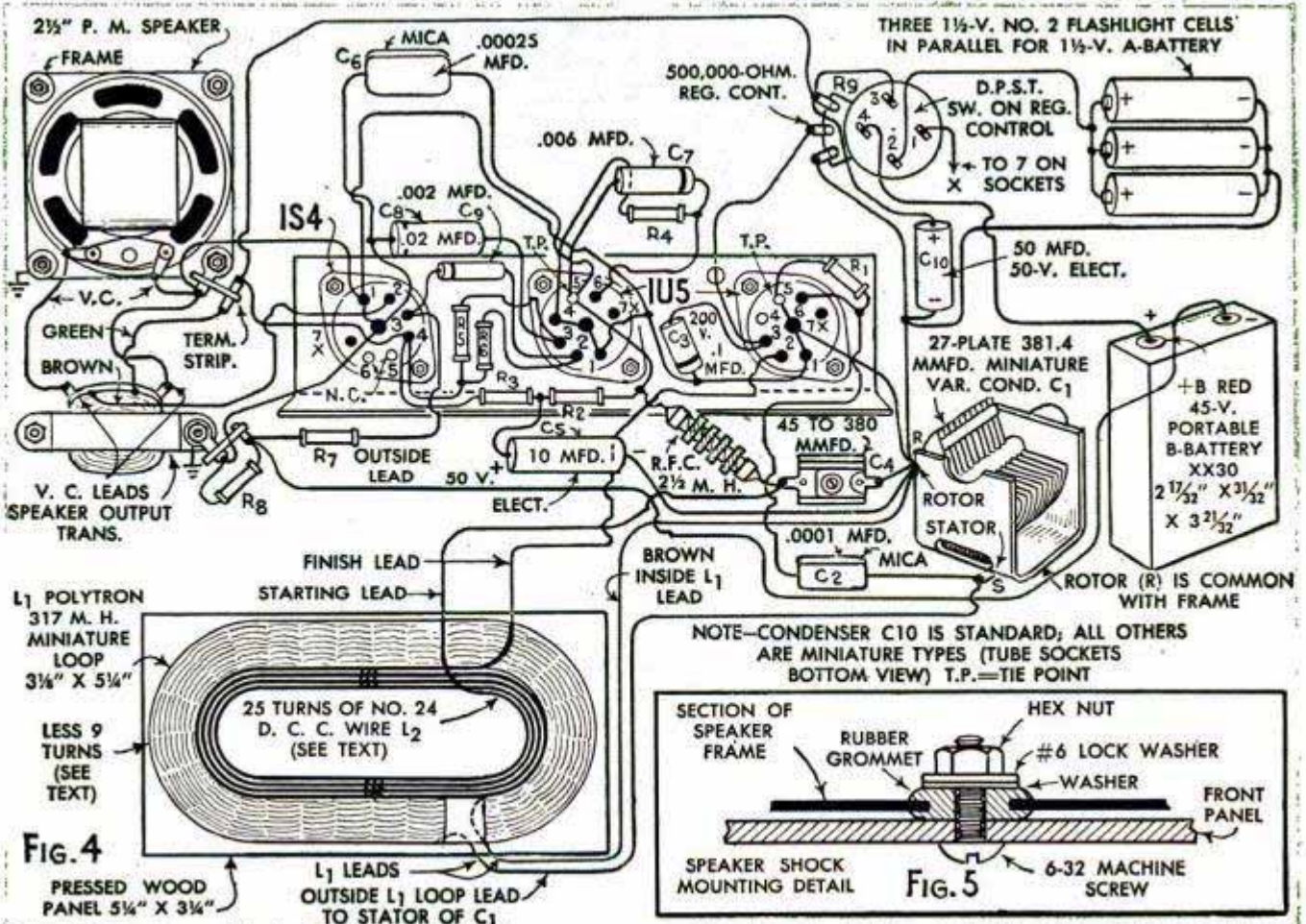
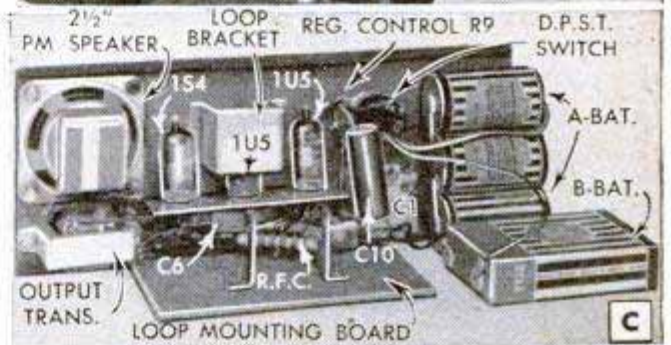


HAS BUILT-IN LOUDSPEAKER

Before installing the loop antenna, check the set to be sure that all wiring up to this point is correct. A hum should be heard in the speaker when the No. 6 pin of the second 1U5 tube is touched with a short piece of wire.

The finished loop L1 is about 2¾ in. wide and 5 in. long. Loop L2 is random-wound with No. 24 d.c.c. wire on a 2½-in.-dia. form. A small can was used for the purpose. The coil is then removed and tied with thread in several places. This coil is next formed until it has the same shape as the inside of coil L1. Duco cement is applied to one side of L2, and the coil is mounted in the center of coil L1. A weight is then placed on top of the loop to insure a flat assembly. The combination loop is finally cemented to the small panel. Before making the circuit connections to L1 and L2, examine the schematic circuit diagram, Fig. 3, to make sure that the coils are connected with the same direction of winding. Now turn the set on, with variable condenser C1 fully opened. The regeneration control is now slowly rotated until a squeal is heard in the speaker. If no squeal is heard, reverse the two wires connected to feedback coil L2. To receive stations, adjust the tuning-condenser C1 and back off

(Continued to page 218)



TELEVISION RECEIVER HAS SIMPLIFIED CONTROLS



A

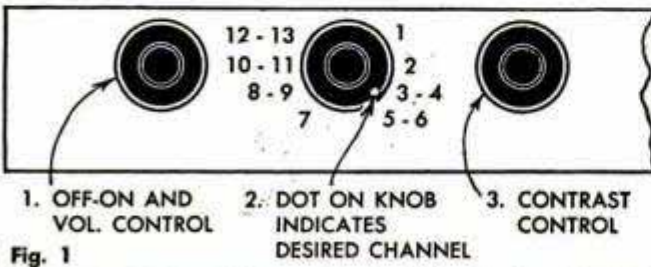
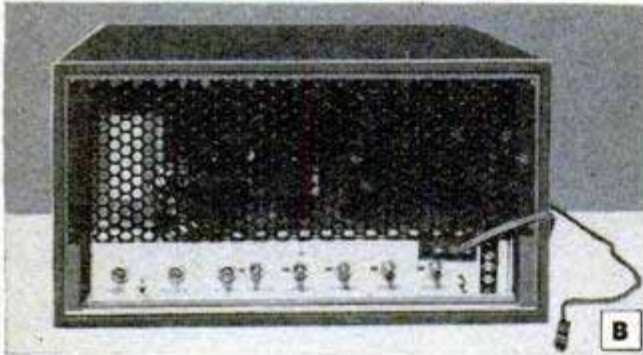


Fig. 1



B

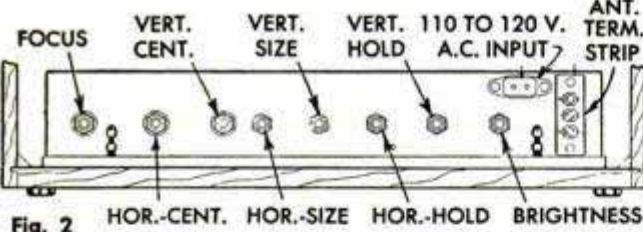


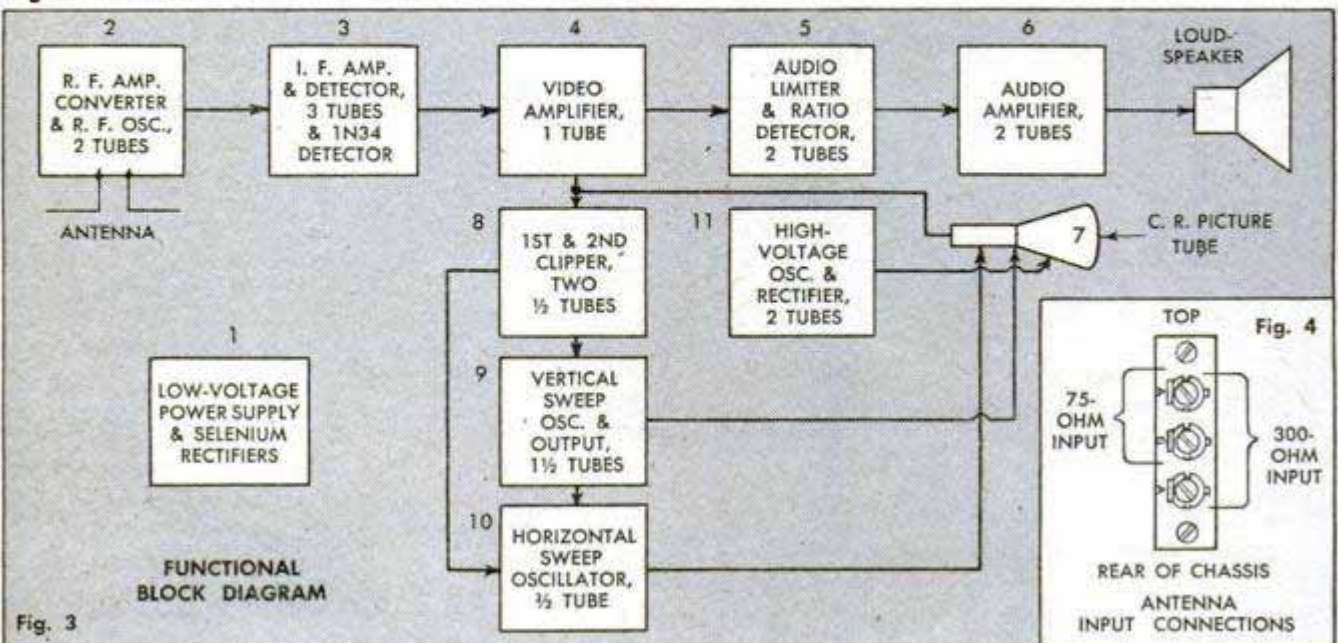
Fig. 2

ONLY three controls on the front panel are necessary for complete operation of this comparatively low-cost table-model television receiver. These controls are clearly shown in photo A and are detailed in Fig. 1. The 8-position tuning knob is adjustable to any 8 of the 13 channels available for television broadcasting in any locality and the set is pretuned for the reception of the 8 stations.

The picture size of this direct-view receiver is 4½ by 6 in., or approximately 26 square inches; the cabinet is 9¼ in. high, 16¾ in. deep and 16¾ in. wide. This compact unit weighs only 26½ pounds and may be easily carried about the house to provide television entertainment in any room desired where antenna leads are available. Owing to its light weight and compact size, special stands or tables are unnecessary.

Designed for use on 115-volt 60-cycle a.c., this Motorola model features a safety interlock which disconnects the power cord from the chassis whenever the protective metal back cover, shown in photo B, is removed from the cabinet. The service adjustment controls in Fig. 2 are adjusted at the factory so that none other than the front-panel operating instructions need be followed in putting the receiver in operation. However, to provide for any misadjustment of the rear-panel controls due to handling, simple instructions are supplied for adjusting these insulated

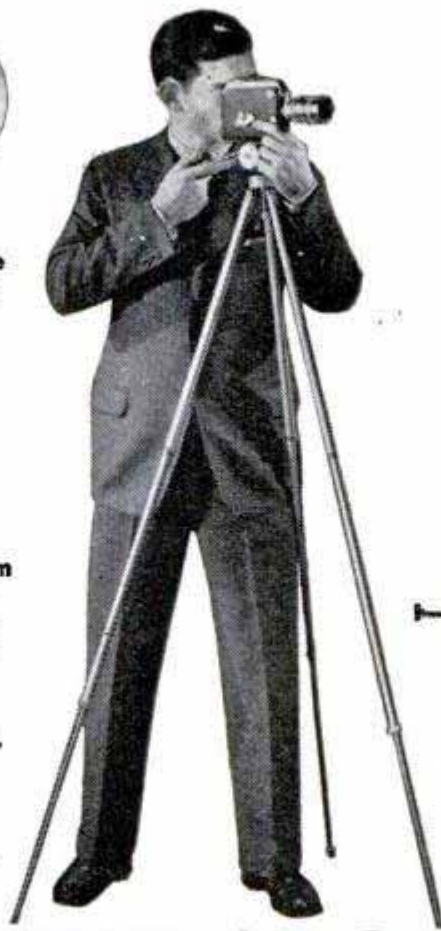
(Continued to page 218)





KODAK TURN-TILT TRIPOD HEAD—permits fast aiming with still and movie cameras. Has multiple-disk felt friction clutches for smooth, easy panning.

KODAK EYE-LEVEL TRIPOD (right) sturdily built to last for years . . . designed for fast set-up. Adjusts from 2 to 5 feet in height. A simple twist locks legs at any extension. Weighs only 2 pounds—folded, it measures 22½ inches. Spur points of the legs give firm surface grip—removable rubber tips included for indoor work.



KODAK TABLE TOP TRIPOD—makes table-top photography real fun. Elevates camera to convenient level. 8½-inch rubber-tipped legs are detachable for compact carrying.



KODAK METAL CABLE RELEASES—eliminate danger of jarring camera when tripping shutter. 7-inch and 12-inch sizes to fit practically any camera.

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KODAPOD—substitutes for tripod out-of-doors. Toothed jaws bite into tree, fence, or any other wooden support. The tilt is controlled by thumb screw.

KODAK OPTIPOD (left)—its handy felt-lined clamp grips shelf, table, window ledge. Ball-and-socket head holds camera in any desired position.



KODAK TILT-A-POD—on your tripod it permits tilting either movie or still camera. Quick-locking screw prevents slipping after adjustment.

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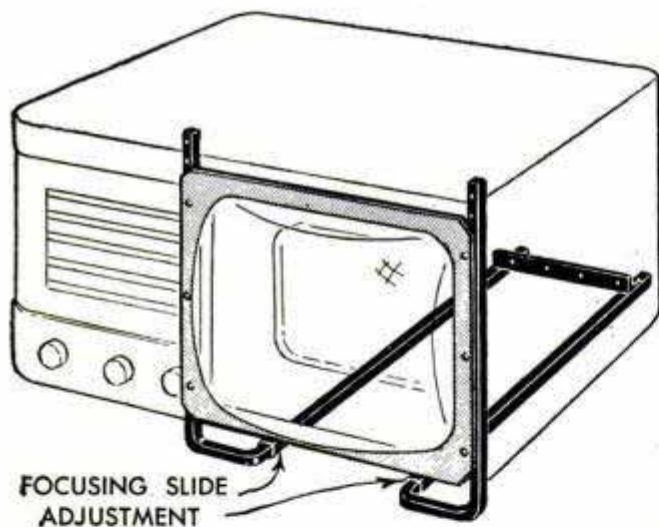
Television Receiver

(Continued from page 216)

emergency controls. The efficient audio system employs a 6½-in. permanent-magnet speaker and operates on an intercarrier sound system which eliminates the necessity for vernier tuning. This also does away with the need for automatic frequency control and makes it possible to tune in weak signals for best picture reception and still maintain good audio reception. Additional features include high usable sensitivity, automatic brightness stabilizer and automatic volume control. The chassis is completely shielded against oscillator radiation and all wired connections are pre-tested for resistance to humidity.

The 11-unit block diagram given in Fig. 3 illustrates the operation of the receiver which has 15 tubes, 2 rectifiers, a germanium crystal detector and a 7-in. cathode-ray picture tube. Antenna input connections for either a 300-ohm balanced line or for matching to a 75-ohm shielded lead-in, are made as indicated in the detailed sketch, Fig. 4.

Television Magnifying Lens



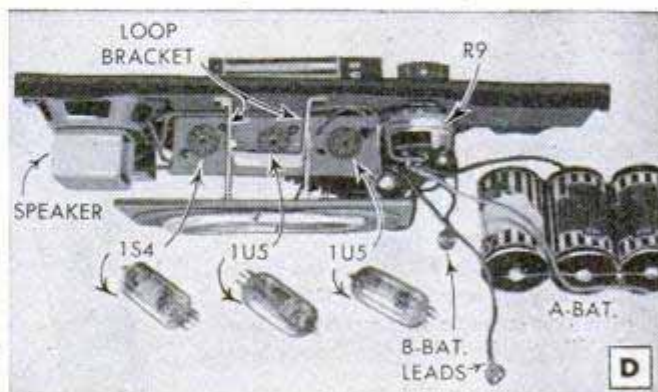
MAGNIFYING-LENS ASSEMBLY

Made of crystal-clear or blue Lucite, this magnifying lens is claimed to enlarge television screens from 2 to 4 times, and also to eliminate glare and eyestrain. Available in sizes for use with television sets having either 7, 10 or 12-in. screens, this Vue-Scope lens is filled with a liquid which has the same index of refraction as its plastic shell. Surfaces are maintained at rigid micrometer standards and micro-polished like the finest optical instruments. The lens assembly is made with a 2-way adjustable bracket as illustrated. This permits raising or lowering and also provides for focusing adjustment.

Three-Tube Pocket Set Has Built-in Loudspeaker

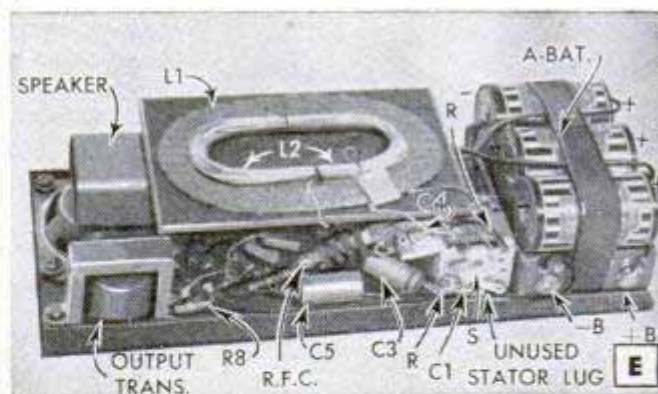
(Continued from page 215)

the regeneration control very slowly until a station comes in clear and loud. Turns should now be removed, one or two at a time, from the outside of the antenna loop L1 until the stations at both ends of the broadcast band can be received. Nine turns were necessary for the original model.



Next, tune C1 to the lowest-frequency station and adjust the regeneration control for maximum volume and clarity. Padder condenser C4 is then adjusted until it is just possible to hear the squeal when the tuning condenser is slightly off the station. The set is now ready for the case. A piece of thin cardboard must be placed between the front panel and the metal brown-flocked grille screen. This screen covers the entire front panel and must be trimmed to give a tight fit when it is in place. The dial is cut from heavy drawing paper and is cemented to the grille screen.

The case was finished in a cream color with matching knobs. L3 is a single-turn



capacity coupling loop for use if an external antenna is desired. It is made with No. 20 insulated hookup wire and is mounted on the inside of the back cover, photo B. If the set is microphonic, wrap a piece of paper around the first 1U5 tube, or use a rubber band. Detailed student material list R-369 is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

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Fishing for Shark

(Continued from page 140)

spot that is calculated to be a "good hole for sharks" the gargantuan fishing line is let out. The bait is cut into chunks about the size of a man's hand. As the cable pays out a crewman snaps on the baited leaders. These leaders swivel on an ordinary harness snap.

Many methods of laying the line are in use. Some skippers suspend their lines from buoys with anchors at each end. Others prefer to lay the line on the bottom with an anchor on one end and the boat riding on the other. Above an irregular coral bottom, set lines must be suspended high enough to clear the jagged edges of rock which would foul a line.

After about eight hours, the line is drawn up. One man takes position on the bow to signal the winch hand whenever a shark appears. Another man stands by the bollard block to unsnap the leaders. The skipper always operates the engine throttle, backing down whenever necessary to keep the line taut. If a large shark manages to get some slack in the line near the surface, the leader usually parts.

Whenever a shark breaks the surface, the winch is stopped, the leader un-snapped, and the shark towed aft to be gaffed and hoisted aboard by the power boom. This is the ticklish moment in shark fishing. Many times the shark is still alive and thrashes the water into foam. In such cases the crewmen swat the shark's snout—his tenderest spot.

The catch is dumped into a cockpit just forward of the wheelhouse to await butchering, which is done at sea if time permits. Those sharkers who have port facilities for processing the entire shark take their catch to the factory dock for butchering.

Shark livers must be segregated as to type and sex before being sent to the processing plant, for potency varies according to these classifications. This means that when butchering is done at sea the skipper must be able to identify each shark—not an easy matter. Telltale features are shape of head and snout, position of fins and characteristics of teeth. For example, the tiger shark has seven rows of razor-sharp teeth with serrated edges.

Putting hooks on the floor of the Caribbean is asking for trouble. Sharks are not the only monsters that lurk in the 300 and 400-fathom depths. Thompson Enterprises, Inc., reported that one boat recently caught a shark too large to be hoisted aboard. It had to be towed. Boats have brought up giant moray eels and even larger snake eels.

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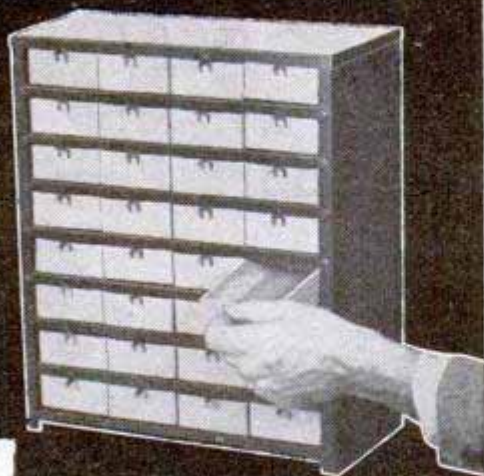
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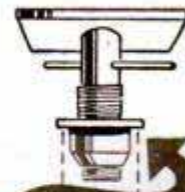
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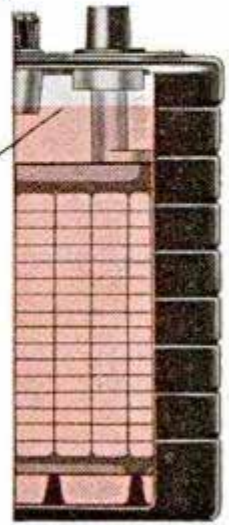
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only 3 times a year**



ORDINARY BATTERY



BOTH BATTERIES FULL



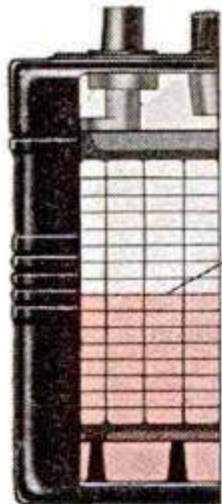
STA-FUL BATTERY

HERE'S WHAT HAPPENS INSIDE AN ORDINARY BATTERY

This battery is now full. Small liquid reserve gives battery plates little protection against damage and loss of power if evaporation lowers liquid level.

HERE'S WHAT HAPPENS INSIDE AUTO-LITE "STA-FUL"

The new "Sta-ful" feature has 3 times the liquid reserve of ordinary batteries. Gives its plates added protection. Helps it last longer too!

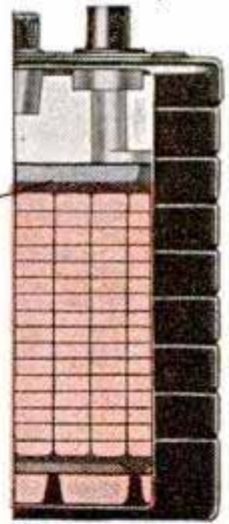


ORDINARY BATTERY



ADVANCED STATE OF EVAPORATION

Equal Liquid Loss From Both Batteries

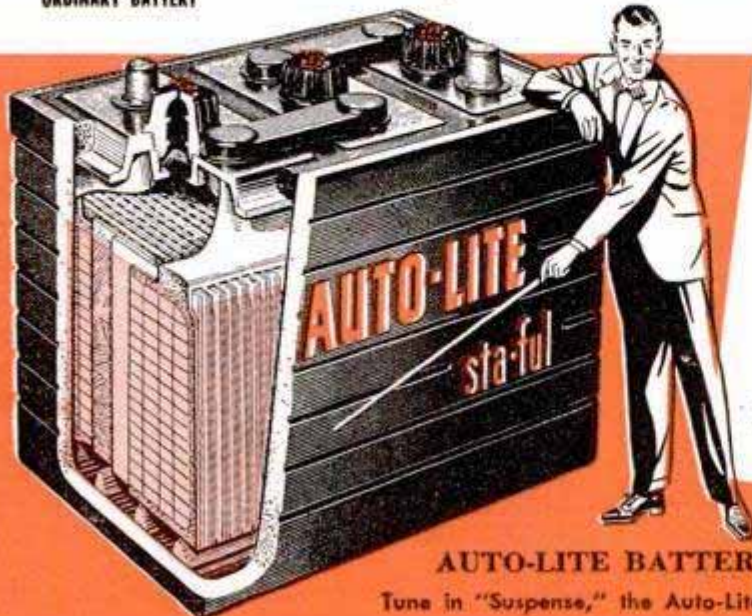


STA-FUL BATTERY

Plates at the left are now exposed and inactive because of the small liquid reserve provided in ORDINARY battery.

The "Sta-ful" Battery plates are still kept fully covered and protected because of the 3 times greater liquid reserve.

**In normal car use*



Why the "Sta-ful" Design Is Possible
Fibre-glass mats help to keep the power-producing material from shedding—add to battery life. This makes possible the "Sta-ful" construction with its smaller sediment well which permits room for a liquid reservoir with over 3 times the usual capacity at the top of the battery. Make your next battery an Auto-Lite "Sta-ful."

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Quick solutions to countless woodworking problems. Just set dial: convert linear feet to board feet; compare characteristics and workability of various woods. Also shows bit



sizes; nail specifications; tool sharpening hints; etc. Heavily varnished cardboard, 6" diameter. Send 10c to Greenlee Tool Co., 2108 Columbia Avenue, Rockford, Illinois, U. S. A.

Confusion in the Cockpit

(Continued from page 151)

encouraging work going on. Several aircraft companies, including Boeing and North American, have been improving this part of the plane.

For example, North American's P-82 is equipped with a pulsating seat to reduce pilot fatigue on long flights. The cushion has a multiple-celled rubber bladder, sandwiched between two layers of foam rubber. Air pressure is reduced and increased alternately inside the cells of the bladder—thus giving the pilot relief from compression fatigue or the "double feature feeling."

The breathtaking speeds of jet planes have posed new problems for the cockpit engineers. At low speeds it was a relatively simple matter for a pilot to bail out. At high speeds, the problem becomes complicated. He may be thrown against some part of the plane and be knocked cold, injured or killed.

Ejection seats were developed, first by the Germans, then by the British and the U. S. Army and Navy. Two of the first planes to use the "break away" seat were Lockheed's P-80 and Douglas' Skystreak.

The installation of such seats brings new worries to the cockpit engineers. Adequate clearance must be provided for the pilot and his seat when he is thrown clear. At the same time, the functional cockpit arrangement of controls must be maintained.

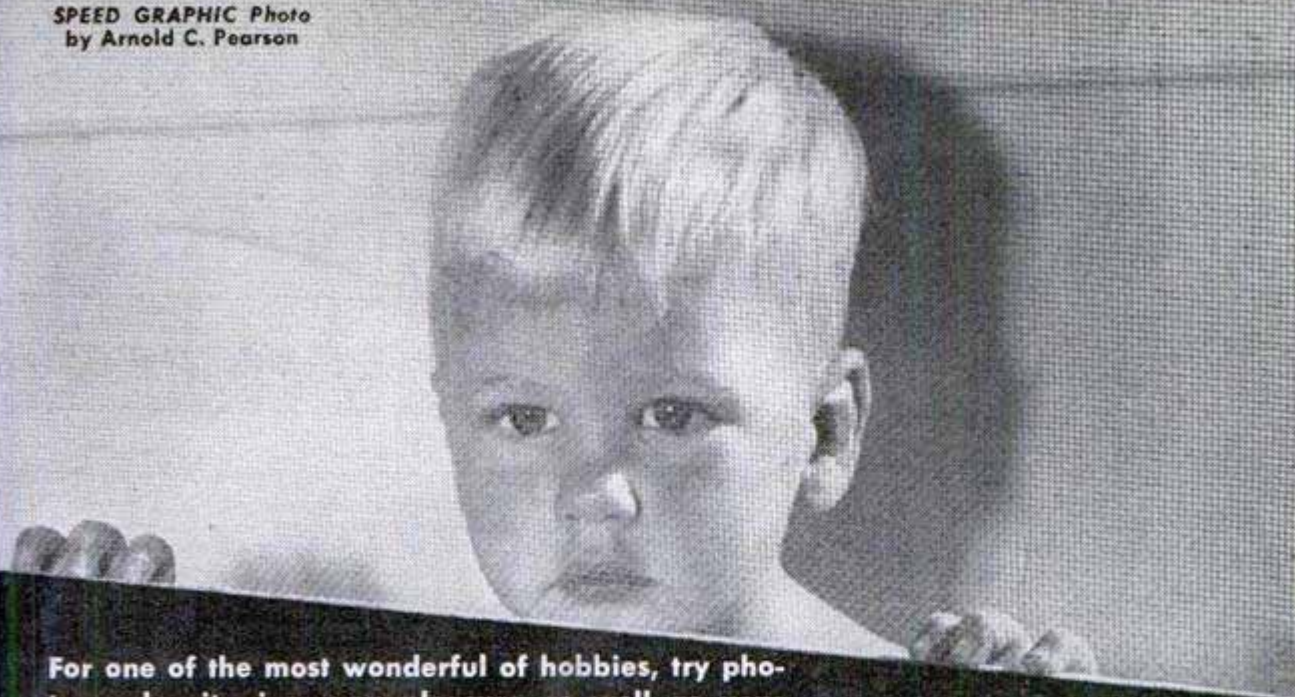
The next step, say engineers, will be the ejection of the entire cockpit. Planes soon will be flying at supersonic speeds in the stratosphere. If thrown out at such dizzy speeds, pilots would be torn apart or die from lack of oxygen. If that didn't finish them off, they might freeze to death before they reached earth.

The obvious answer is an ejection cockpit. Then the pilot could voluntarily or—if he had passed out—be automatically thrown free in his pressurized cockpit. When his fall had slowed and he reached a predetermined altitude, his parachute would open and let him down. His pressurized cockpit might serve as a life raft on the ocean or as a protected home in arctic or desert country. It would be equipped with oars, sail, radio, food, water and snowshoes.

Ejection cockpits are still pretty much in the study-and-discussion stage. Engineers hold their heads and say that this new trend means that they'll have to start from scratch and redesign the pilot's compartment all over again.

(Continued to page 230)

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by Arnold C. Pearson



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Build this Famous C. & N. W. "PIONEER" TRAIN MODEL

All parts ready-shaped for easy assembly. Length 9". Accurate, realistic 1/4" scale model kit of Chicago & North Western's historic "Pioneer" locomotive (1848) to be seen at Railroad Exposition in Chicago this Fall. Ideal to decorate home or office, display on mantel, desk, or in collector's group. Kit complete.....69c

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Choice of experts in every art and craft field. A blade for every purpose—quickly interchangeable. Singly and in sets, 50¢ to \$50.00. (Slightly higher in Canada.)

Buy where you see this sign—
At hobby, hardware, gift and dept. stores.

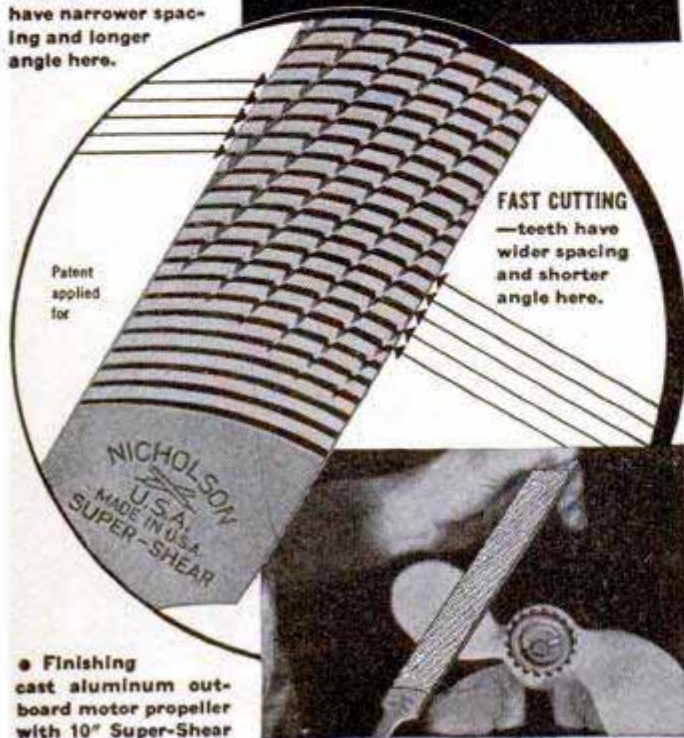
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... a new principle in a precision file for the industrial or amateur craftsman

SMOOTHING—teeth have narrower spacing and longer angle here.



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● Finishing cast aluminum out-board motor propeller with 10" Super-Shear

A development by Nicholson, the Super-Shear is a curved tooth file that *smooths as it roughs*. Practically two files in one! Its extremely sharp teeth are *milled* in an arc that is off-center in relation to the axis of the file. Thus, when used with the usual overlapping right-to-left stroke, the Super-Shear "smooths out its tracks as it goes." Longitudinal serrations help to keep the file clear of chips; to overcome "chatter" and the tendency to run off the work.

Use Nicholson Super-Shear Files on the flat or convex surface of aluminum, brass, babbitt, bronze, copper, magnesium, cast iron, annealed tool steel; on plastics, hard rubber and hardwood.

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As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.

Gutter Downspouts Open at the Joint

Q—Two of the downspouts on my house are opening at the joints. On one downspout the joint has started to open just above the point where the downspout enters the drain tile. On the other the opening is about a foot below the elbow at the gutter. What causes this and is there any way to repair the parts? They are still in good condition except for the joints.

J.M.—Toronto, Ont., Can.

A—Usually this trouble is caused by a collection of leaves or other trash which only partially clogs the downspout but is sufficient to catch and hold snow and slush. When the temperature falls, this freezes and forces the folded joint open. Ordinarily, downspouts in this condition can be repaired satisfactorily without dismantling by simply wrapping one turn of wire around the pipe at the point where the joint has started to open. Pull the wire tight and twist with pliers. Then wrap another length of wire an inch or so nearer the center of the open joint and again twist tight. By proceeding in this fashion for the length of the open joint, you can force it together as good as new in most cases.

Refinishing Breakfast Set

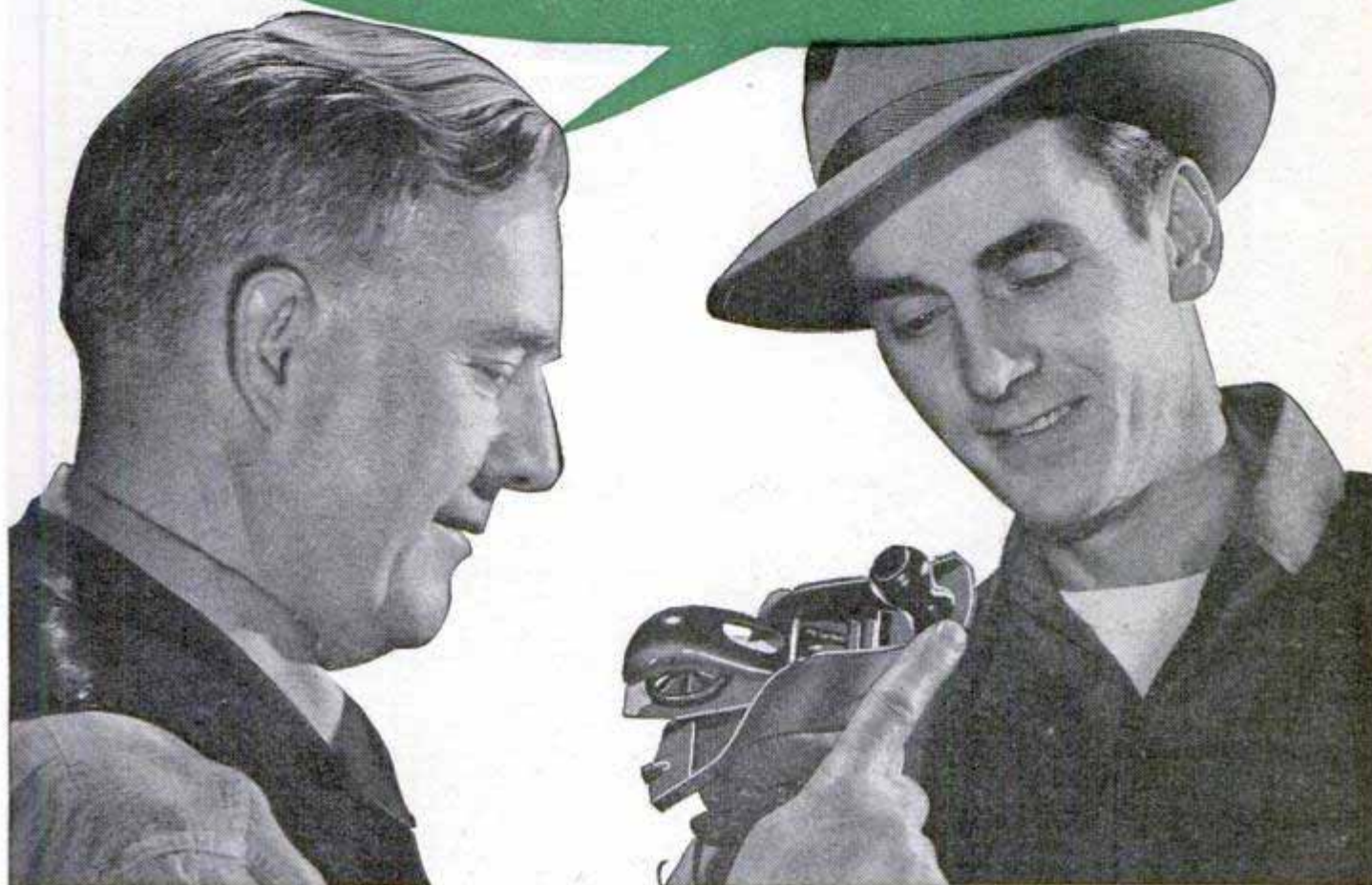
Q—I have a light-colored maple breakfast set which needs refinishing. The top especially, is badly marred and scratched. I want to refinish the set in the same color as the original. What is the proper procedure? E.R.—San Francisco, Calif.



A—Judging from your description, the original finish of the set was what is known as blonde maple. If, as you say, the set is rather badly marred and scratched, the best procedure is to remove the old finish with a prepared remover. This done, sand thoroughly and then apply a commercial wood bleach, carefully following the directions on the container. After bleaching, any digs or gouges too deep to be removed by sanding should be filled with stick shellac of a color to match the bleached wood. Sand the fills smooth after the shellac has set. Then finish with one coat of white shellac followed by one or two coats of a good furniture varnish. Sand between coats with fine paper and rub down the final coat to a satiny-smooth surface.

(Continued to page 228)

"That brand name means plenty, Mister"



JONES: Sure it does—to you hardware dealers. Tools with advertised names get you higher prices. But how about me? I want the most I can get for my money.

DEALER: Well, sir, let me ask you this. Do you think you get more for your money when you buy unknown tools at bargain counter prices?

JONES: Not necessarily. But I know this much—you can't change a poor tool into a good one just by putting a well-known name on it.

DEALER: Of course not. But don't forget that when a reliable manufacturer puts his advertised brand name on a tool—or

any other piece of hardware—it's got to be good.

JONES: How do you figure that?

DEALER: The manufacturer has a reputation to protect. Thousands of men *believe* in that brand name . . . *depend* on it . . . and he can't afford to let them down. It's the same way with me and my hardware store. I've got to keep *my* reputation for quality merchandise or I couldn't even stay in business.

Your **HARDWARE DEALER** sells **QUALITY tools**
and hardware... Buy from HIM



POPULAR MECHANICS

PERFORMANCE GOES UP IN SMOKE . . .

"IT'S NOT A FIRE, BILL . . ."

IT'S A CAR THAT NEEDS

FEDERAL-MOGUL ENGINE BEARINGS"



WORN CONNECTING ROD BEARINGS CAUSE OIL PUMPING, STEAL POWER

Smoke behind your car means worn connecting rod bearings up front in the engine. They let excess oil reach combustion chambers. It carbon-fouls pistons, rings, valves, spark plugs—means sluggish, costly operation. To restore power, pep and economy, replace with Federal-Mogul Oil-Control Bearings—ask your mechanic!

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Replace in Sets with Genuine

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Oil-Control Bearings
in your car



Removing Oil-Burner Soot From Siding

Q—The siding on my house is stained in spots with a dark, oily stain which I suppose is soot from the oil burner. How can I remove this grime so it will not discolor new paint?
M.M.—Hartford, Conn.

A—Dark, greasy dust from an oil burner that settles on the siding usually can be removed quite easily with an ordinary paint cleaner. If the old paint is chalking uniformly this may not be necessary, as a brisk brushing may remove the loose particles of paint pigment and take the grime along with them. Incidentally, it would be a good idea to have the burner checked, as a correctly adjusted oil burner should not produce the troublesome soot deposit you describe.

Attaching Wooden Strips to Concrete

Q—I'm planning a recreation room in my basement and want to use knotty pine on the wall at one end of the room. My problem is how to fasten the pine boards to the wall, which is concrete. Can you help me?
F.M.—Manchester, N.H.

A—First you will have to attach furring strips to the wall to get a nailing base, and to provide space back of the boards for circulation of air. If the wall is the common height of 6½ or 7 ft. from the basement floor to the bottom of the joists, you will need at least three horizontal strips spaced evenly, the first strip placed about 8 in. above the floor. These strips are attached to the concrete wall with lead or fiber screw anchors. To install the anchors, first drill holes to the required depth with a star drill of the correct size. Tap the anchors in place in the holes with light blows of a hammer so as not to upset the ends. Then simply drive ordinary wood screws through the furring strips into the screw anchors just as you would drive the screws into wood.

Refinishing Wall Registers

Q—The wall registers in my home need cleaning and refinishing. I prefer not to paint them. How can I refinish the registers myself so they will look like new?
M.A.—Des Moines, Iowa.

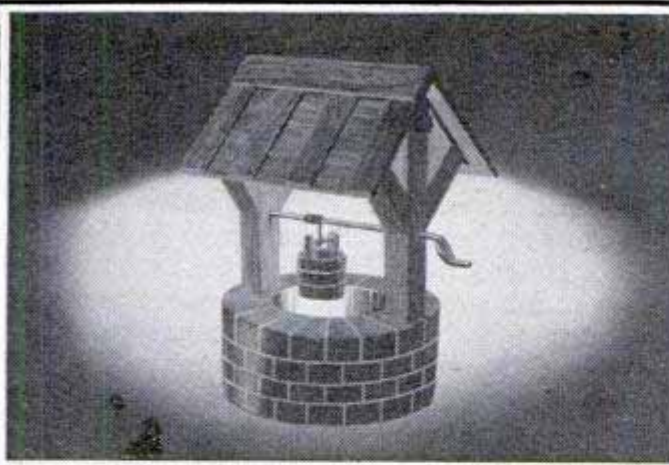
A—Go over all the metal surfaces lightly with fine steel wool, 00 size or finer, to remove the discoloration and grime. Then clean thoroughly with a soft cloth dipped in lacquer thinner. Have the windows open and avoid inhaling the fumes of the thinner. Finally, finish with one coat of clear lacquer applied with a fine-bristle brush. Do not get lacquer on the painted wall as it will soften oil paint.



Stained Exterior Doors Turn White

Q—Two doors in my home are stained. Recently, both of them have turned white, the color ranging from gray to white on the inside of the door. What is this, and how do I restore the finish?
J.G.—Minneapolis, Minn.

A—Excess moisture commonly causes bleaching of the varnish finish you describe. It is probable that the doors "sweat," that is, high humidity in the house causes moisture from the air to condense on the interior surfaces of the doors. Usually, the only remedy is to remove the old finish entirely, but first try rubbing the doors lightly with camphorated oil. In some cases, this treatment will restore the finish to its original color. To avoid further trouble, reduce the humidity in the house during the winter months.



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Prone-position cockpits—where the pilot lies on his stomach—have been built on an experimental basis over a period of several years, mainly with an eye to high-speed research. To date, engineers have no fixed opinion as to the desirability of such a radical departure. "They solve some problems and create others," says Al Mayo, a Douglas engineer. "We feel that we must know much more about the limitations of the human body under high negative and positive G forces before we know whether prone cockpits are necessary or desirable."

Most of the work on redesigning cockpits has been done on small single-seat military planes. But many of the improvements are being installed on bombers and large transports. Lockheed, Martin, Boeing, Douglas, Consolidated and others are working on problems of greater visibility, increased pilot comfort and decreased noise levels.

The Boeing Stratocruiser, for example, has new-type windows that are electrically heated and made of nonshatterable "bird proof" glass. Consolidated's B-36 bomber is equipped with a simplified, easy-to-read, instrument panel. The latest Martin Mars flying boat groups pilots, flight engineer, navigator and radioman on a compact, efficient flight deck.

Col. Philip B. Klein, chief of the fighter branch of aircraft projects at Wright Field Air Materiel Command, in a pessimistic mood, recently said: "The time is not far distant when we will have to admit God never intended that we should move as fast as the contrivances we put together might carry us."

But until such limitations are reached, cockpit engineers will be plugging away to make flying safer by providing easier and more efficient controls. If clothes make the man, cockpits make the pilot!

Photos on Fabrics and Glass

(Continued from page 135)

the textile-printing industry is at hand. They point out that New York City's largest industry prints 1,500,000,000 yards of fabric a year using methods which are from 100 to 5000 years old.

The leading process for photographic printing of fabrics is Photone, operated by the Ross-Smith Corporation of New York, using a process developed by the General Aniline & Film Corporation. A. M. Ross-Smith states that since the beginning of history there have been only two types of fabric printing: hand blocking, its origins lost in antiquity, which developed mechan-

(Continued to page 232)

SCREW DRIVER TIPS

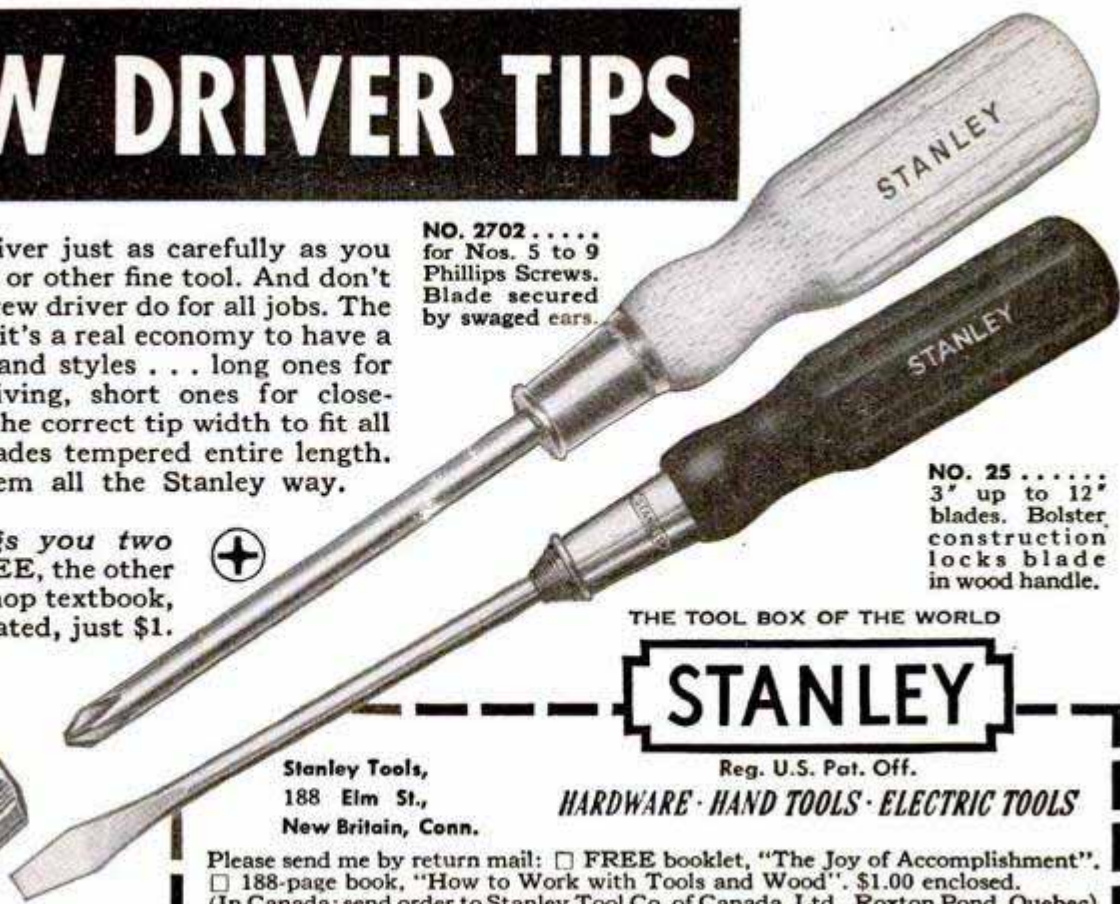
Choose a screw driver just as carefully as you pick a plane, chisel or other fine tool. And don't try to make one screw driver do for all jobs. The best costs so little, it's a real economy to have a full range of sizes and styles . . . long ones for more powerful driving, short ones for close-quarter work and the correct tip width to fit all sizes of screws. Blades tempered entire length. Stanley makes them all the Stanley way.

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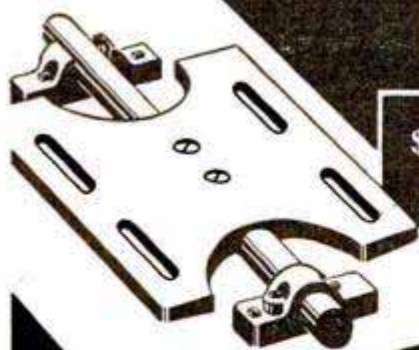
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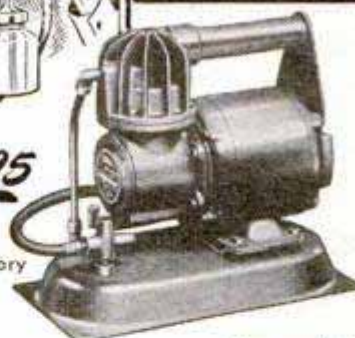
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ically into silk-screen printing; and roller printing, which is a hundred years old and has improved only to the extent that its equipment has been made more efficient.

The problem of recording photographs on fabric had been the concern of scientists for 60 years when Ross-Smith walked into the laboratory at General Aniline and asked the head chemist to sensitize his handkerchief and put Lana Turner's picture on it. The chemist used an old method, never before successful. However, the result was so good that the company went to work on the process and perfected it.

The method used in the Photone process is simple. The material to be printed is sensitized and run over rollers which hold the film negatives. The printing is done by contact with a high-wattage mercury-vapor lamp inside the roller. In successive straight-line steps it is developed, fixed and finished.

A number of problems had to be solved before the process could be called a success: Light-sensitive dyes had to be found that would stand up under daily usage; sensitizers and fixatives which would not damage the fabric fibers had to be discovered, and unevenness in development had to be overcome.

Details of the process are being kept secret at present, because many changes have been made in the technique since patents were issued.

The photographic image, as it appears on the fabric, can embrace any or all of 32 tones and may be in red, blue, brown or black. With the development of a color-separation method and the necessary printing equipment, four-color reproduction will be possible—probably within the next two years.

The process can be used on a wide range of fabrics, being effective on rough monk's cloth as well as ultrasoft satin. Even velvets and pile fabrics, such as used in automobiles, previously thought unprintable, produce a good image.

Women's clothes surely will be the first big market, beginning with the luxury lines. But the list of possibilities seems endless. Scarves, neckties, tablecloths, draperies, lingerie, bathing suits, pajamas and sport shirts are a few other uses that come to mind.

Printing pictures on ceramics is a problem under study at the Onondaga (N. Y.) Pottery Company. This involves working with a porous surface—unglazed pottery—but it is believed that the technique resembles the Corning process in that the latent color is brought out by heat.

(Continued to page 242)

The '49 Ford

"THE CAR OF THE YEAR"

Designed to set entirely new standards of comfort, performance, economy and beauty in its field, the '49 Ford represents a complete break with the past. Here is a car that is completely new, inside and out. A car that is the triumphant result of thousands upon thousands of man-hours spent in research, design and testing . . . of millions of dollars invested in new facilities, machines and equipment to do the job. From the clean, low lines of its fresh styling to the smallest detail, inside and out, the '49 Ford is truly "the car of the year."

High on the list of important changes is new riding comfort with new independent front wheel suspension, parallel rear springs and

Hotchkiss drive. Of equal importance to many are the new engines—100-hp. V-8 and 95-hp. Six, which offer greater economy, improved service accessibility and other features which will mean smoother operation and longer engine life.

The complete line of '49 Fords includes two series: the Custom and the Ford. There are five body styles in the Custom Series—Tudor Sedan, Fordor Sedan, Club Coupe, Convertible Club Coupe, and Station Wagon. In the Ford Series are four models—Tudor Sedan, Fordor Sedan, Club Coupe and Business Coupe. A range of ten body colors is also offered, although all colors will not be available on all models.



Advertisement

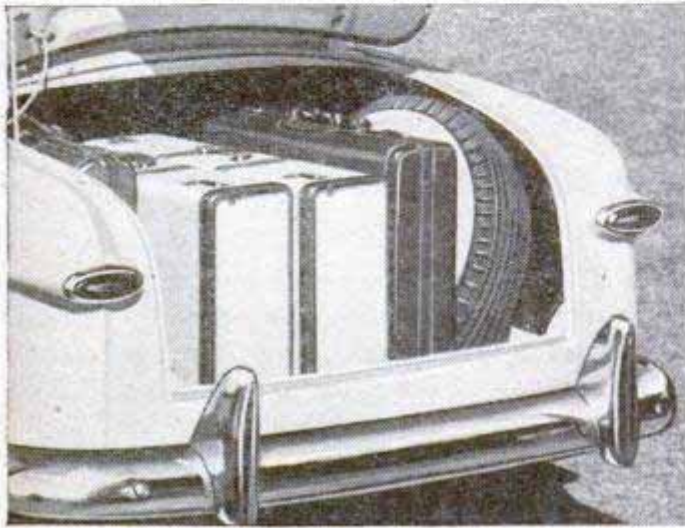
Body Styling. Regardless of body style or series, at first glance the most impressive feature of the '49 Ford is the complete departure from previous exterior design. The body has been made full width, with rear fenders integral with the rear quarter panels. Front fenders are more massive and have higher crowns, giving an almost unbroken line from side to side across the hood. The clean, smoothly-flowing horizontal lines of the body are evidence of the careful attention paid to this design detail. Wind noise and air resistance are reduced and, of course, usable space within the body is greatly increased by the full width design. In the process of achieving

the rear portion of body and provides exceptionally solid footings for the full-arch roof rails.

Insulation. Bodies are effectively insulated against heat and noise, a variety of methods being used. Roof, floor and deck-lid panels are lined with a special waffleboard-type insulation. Sprayed-on sound-deadening materials are used for door panels, quarter panels and wheel housings. In addition, the dash is insulated by the use of heavy fabric material.

All structural members in the new Ford bodies are carefully cleaned, treated with a rust inhibitor and painted. This treatment is applied even to the inside surfaces of such large box-section members as the center pillars, in which special openings are provided for the purpose.

"Lounge Car" Interiors of the Ford "Forty-Niner" show every bit as much change as the exterior body lines. Most important advancement is the great increase effected in usable space. This has been accomplished, in part, by moving the engine 5 inches forward. Extending the body sides outward to the full width of the car likewise results in substantially increased seat widths, particularly at the hip and shoulder levels. Front seats are 57" wide, an increase of

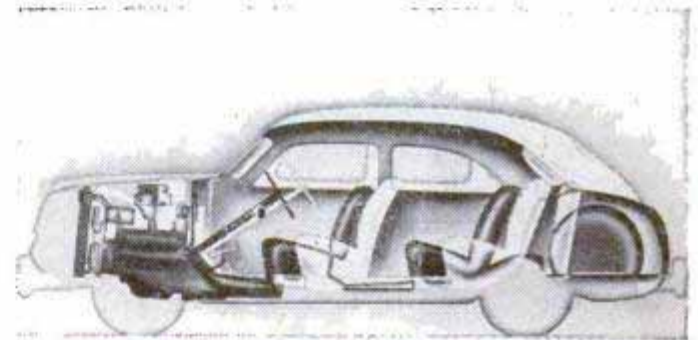


Up to 57% more luggage space.

this smoothness of design a number of the dirt and moisture collecting seams found in conventional designs are eliminated.

Stainless steel moldings extending horizontally backwards along the sides of the body, do double duty as protective rub-rails. Extra-heavy "Fender Guard" bumpers curl around the sides of the fenders for added protection. On all models the trunk capacity has been markedly increased. Usable trunk volume is 28.5 cubic feet in coupes; sedans have 19 cubic feet, an increase of 57%. The trunk lid is externally hinged and provided with an ornamental handle incorporating the license plate lamp, and license plate holder.

Body construction is likewise completely new, affording greater strength and safety with reduced weight. The combined body and frame structure is actually 59% more rigid. It is of the all-steel, all-welded type, incorporating material and design features that reflect over 21 years of research into the problems of combining maximum strength with minimum weight. The body is bolted firmly to the frame at 22 points, with special shims provided for insulation. Front pillar posts have a narrow cross-section to improve visibility. Another interesting innovation is that the rear wheel housings are completely separated from exterior sheet metal and welded to the rear floor pan. This increases stiffness at

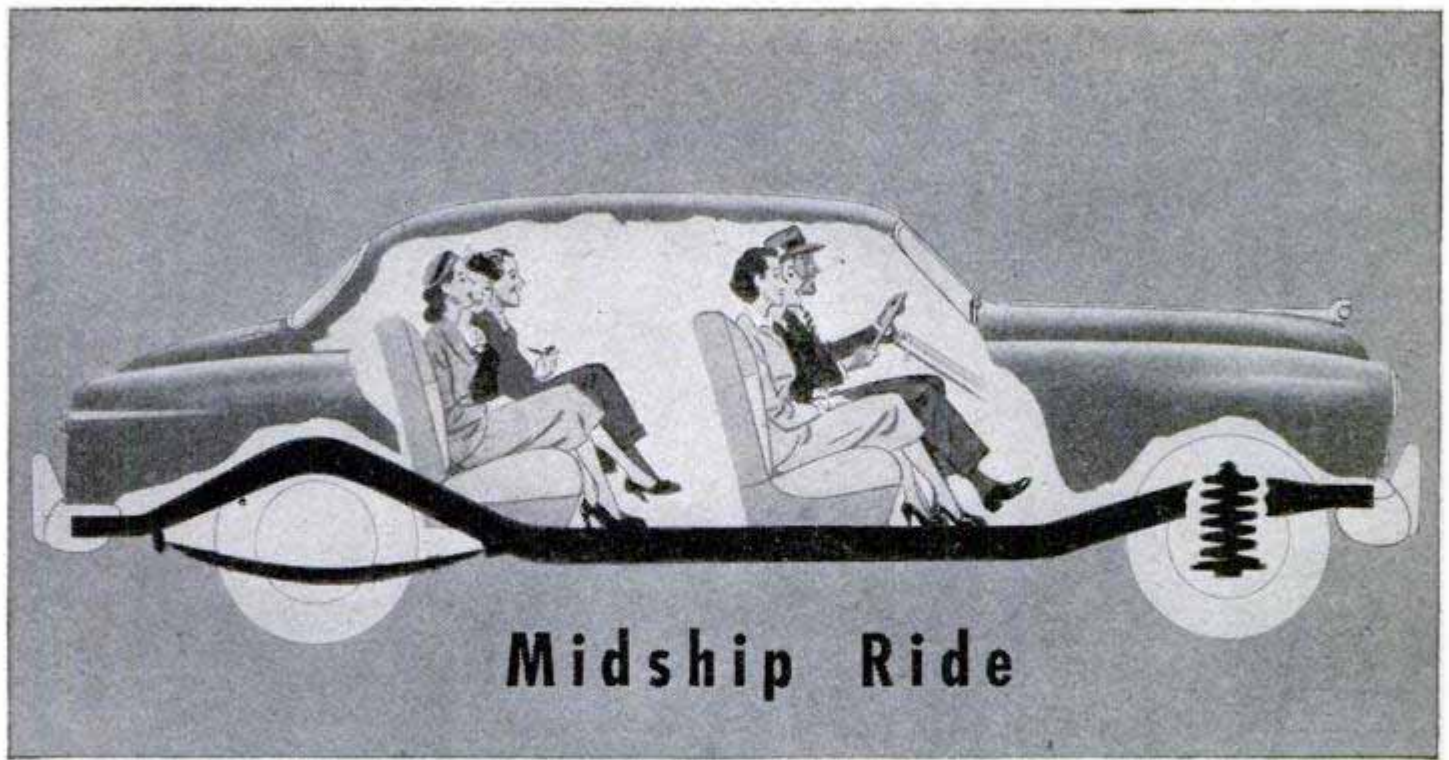


White outline—'48 Ford; gray outline—'49 Ford.

6.5", while rear seats now measure 60", or $7\frac{3}{4}$ " more than before. 56" shoulder room has been provided in the front seat and 55" in the rear seat of sedans, enabling three large people to occupy each seat with complete comfort.

Added riding comfort is obtained by scientifically positioning seats well forward between the wheels, resulting in a smooth, soft "Mid Ship" ride. Also new for Ford this year is the seat construction employed — lightweight tubular frame containing a unique "zig-zag" spring base and short, soft-acting coil springs.

Visibility. Another important achievement in body design has been accomplished by Ford engineers in substantially increasing the window area of the new models, while at the same time lowering the overall height of the body over 3". The greater visibility provided for both driver and passengers alike is an important contribution to greater safety of operation, as well as adding to comfort and pleasure. The total vision area in the popular Tudor model, for example,



has been increased from 2612 square inches to 2916 square inches. The extra-wide and extra-deep V-type windshield gives over 20% more vision area than before.

Instrument Panel. In keeping with the high quality and luxury feeling of the new Ford interiors, the instrument panel has been completely restyled to combine beauty and utility. Oil pressure gauge, fuel gauge and battery charging and engine temperature indicators have been grouped in a single cluster around the rim of the 100 mph. speedometer directly in front of the driver. The speedometer face also contains the headlight beam indicator light, and provision for turn signal indicators. A completely non-glare lighting system is employed to illuminate the gauges and speedometer. Based on the "black light" system developed during the war for illumination of aircraft control panels, the Ford system uses a light that approximates ultra-violet and is invisible to the human eye. Instrument figures, graduations and pointers are coated with a substance that emits a clear glow when acted upon by the "black light" rays, thus becoming easily readable in the dark with no distracting bright light or reflections.

Custom models have a clock in the center of the instrument panel and locking glove compartment at the far right. Provision is made for the installation of a radio below the clock, with speaker grille located at the top of the panel next to the windshield. Tests show that this high-level speaker placement gives greatly improved acoustical reception for all passengers.

Controls. The popular dash-mounted starter button has been retained. The windshield wiper

control has been placed within easy reach on the instrument panel, along with a three-position light switch, three-position ignition switch and lock, choke control, and on the Custom models, an automatic cigar lighter. An ash tray is also provided in the panel. Operating controls and their placement follow standard practice, a two-spoke steering wheel being used to provide unobstructed vision of the gauges and speedometer cluster. A T-handle pull-type parking brake control is used in place of the pistol-grip type.

Two upholstery choices will be available in the Custom series—blue-gray tweed broadcloth and a gray-green striped mohair. In the Ford series, green striped broadcloth or green and red striped mohair is offered. Both series may be had tailored in tan leather, at extra cost. The convertible model comes in either red leather combined with beige bedford cord, tan leather with beige bedford cord, or green leather with green bedford cord, depending on the exterior body color selected. Station Wagons have genuine leather upholstery on driver's seat and vinyl is used on passenger seats.

Door controls have been extensively modified to give greater ease of operation and safety. Outside door handles operate by pulling outward. Inside door handles pull up to open, thus eliminating the possibility of accidentally opening a door by leaning on the handle. Also, possibility of snagging clothing is minimized by placing open ends of handles towards front of car. Door lock inside controls are push buttons which return to open position whenever the door is opened or closed. It is thus impossible to lock the keys in the car. Ignition key operates

exterior door locks located in both front doors. Either right or left door may be opened with the key, regardless of which one was locked from the outside originally.

Appointments. Ford models are provided with a variety of interior appointments, including arm rests at each side of both front and rear seats in sedans and club coupes, an ash tray in both front and rear compartments, coat hooks, interior light and sun visor. The Custom models are equipped in even greater detail, with extra quality upholstery and floor mats, cigar lighter, robe and assist cords, clock, dual sliding-type sun visors, two ash trays in rear compartment and two interior lights.



Instruments are grouped directly in front of driver, and "black lighted".

A Living Room on Wheels—that's the overall impression created by Ford's new combination of increased visibility, greater usable interior roominess, extra-wide seats and smartly styled materials and fittings. This comparison is further heightened by Ford's new ventilating system, which admits fresh air through screened openings next to the radiator and discharges the air into the car body just above the toe boards. Each inlet is individually controlled by knobs on the steering column bracket. The forward movement of the car produces a ram effect in the air intake, delivering fresh air under pressure. This pressurized ventilation permits vent windows to be opened slightly even in rainy weather to maintain air circulation.

The three-way "Magic Air" heating system (available at extra cost) is designed to operate in conjunction with this new ventilating system. A two-speed blower takes air from the right-hand air intake and passes it through a heating coil. The warmed air then enters the car body through an outlet that extends across the dash above the toe board. A three-way valve permits operation of the system as either (1) a fresh-air heater with forced circulation for cold weather or quick warm-up; (2) a fresh-air heater without blower for milder weather; (3) with intake closed, as a recirculating heater for quick heating in very cold weather or to keep out obnoxious fumes in heavy traffic.

A thermostatically-controlled valve regulates flow of hot water through the heating coil to

maintain nearly constant temperature inside the car regardless of outside temperature. Thermostat is set by a push-pull knob on dash. All the way out permits maximum flow through the coil, and all the way in shuts off flow completely, permitting blower to be used in hot weather for forced circulation of fresh, low-humidity air.

Defroster operates in conjunction with heater. A push-pull knob on dash regulates dampers inside the heating coil box, directing warm air to the windshield. When defroster knob is pulled out to its "full out" position, full discharge from the powerful blower flows through the defroster ducts to remove heavy ice from windshield quickly on the coldest day.

Two New Engines: For the "car of the year" Ford provides a choice of two engines—a new V-8 and a new Six. The following are the basic engine specifications:

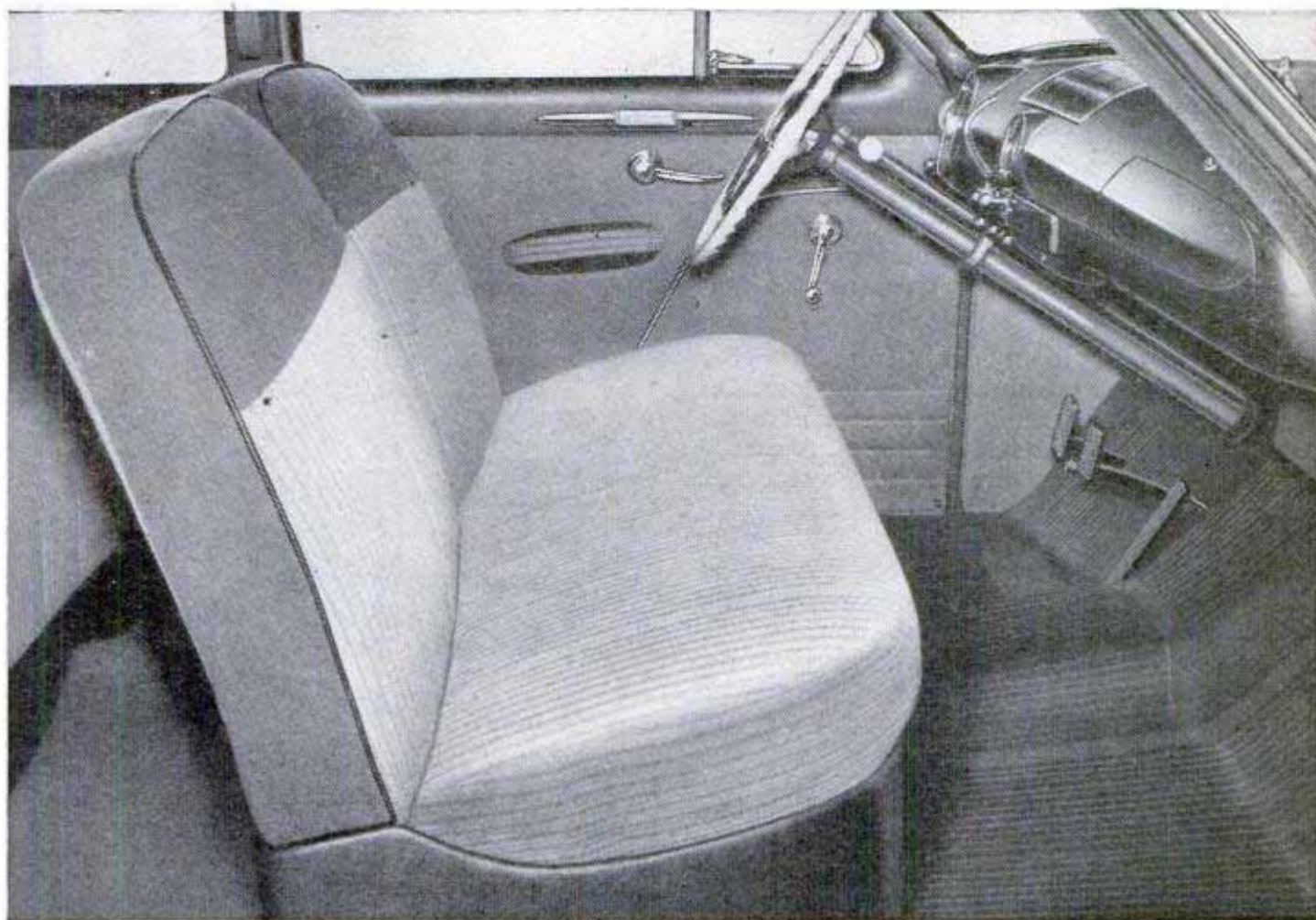
	SIX	V-8
Type	L-head.....	L-head, 90° "V"
Displacement, cu. in.	225.9.....	239.4
Bore x Stroke, in.....	3.3 x 4.4....	3-3/16 x 3-3/4
Max. brake hp. @ rpm. .95 @ 3300 .100 @ 3600		
SAE-AMA hp.....	26.1.....	32.5
Compression ratio.....	6.8 to 1.....	6.8 to 1

Both V-8 and Six cylinder engines incorporate many radical changes in design and construction which decrease power losses, increase engine efficiency, provide exceptional accessibility for servicing and assure longer engine life. The major changes incorporated in both engines include: a new "Equa-Flo" cooling system with balanced type thermostat and pressure type radiator cap; greatly improved lubrication system; new combustion chamber contours; redesigned intake manifold; unique vacuum differential spark advance regulation; new single breaker-type distributor mounted for easy accessibility; more effective crankcase ventilation; timing mark on pulley or damper at front of engine and a carefully engineered 3-point rubber mounting system.

The new V-8 engine has an off-center location of oil passage in each crank pin, providing a "sludge pocket" designed to trap foreign matter carried over from main bearings. Individual steel-backed precision-type bearings are locked in the end of each connecting rod replacing the single floating type formerly used for each pair

of rods. V-8 valves are precision set and periodic adjustment is not required. Valves are straight stemmed and guides are one-piece type for better heat transfer and more effective lubrication. Heat and wear resistant valve seat inserts are used at both intake and exhaust valves.

completely new body design with greatly reduced air resistance; (2) the new cooling system which permits higher engine operating temperature with consequent decrease in heat loss to coolant and a decrease in internal friction resulting from higher lubricant temperature; (3) improved



Seats are "sofa wide" and trimly upholstered in modern fabrics.

The Ford 6-cylinder engine block has been increased in height and connecting rods have been made longer with consequent decrease in side-wall thrust. Larger main and connecting rod bearings are provided. Cylinder walls are lubricated by pressure spray from a drilled hole in lower end of each connecting rod. An extra-quiet rotor type oil pump is gear driven from center of camshaft. Another innovation is provision for installing a base-mounted oil filter (at extra cost) connected directly to the engine lubrication system by drilled holes, thus eliminating all external oil lines. Valve mechanism on the Six is completely new with high-lift cams, pressed-in valve guides, and self-locking, adjustable tappets. Either the modern viscous type or the efficient new rubber type vibration damper is bolted to front end of crankshaft.

Savings in gasoline mileage of up to 10% have been achieved. The major factors responsible for this increased economy are: (1) the

manifolding with more even distribution to each cylinder; (4) new combustion chamber contours permitting high (6.8 to 1) compression without detonation even when using non-premium fuels.

Lubricating oil is forced under full pressure to camshaft, crankshaft, main and connecting rod lower bearings through passages in engine block, in both V-8 and Six. On the V-8, timing and distributor drive gears are lubricated by an intermittent pressure spray while cylinder walls, pistons, pins, valve mechanism and oil pump drive gears are lubricated by throw off from the bearings. Cylinder walls, pistons, and pins on the Six receive oil under pressure from a drilled hole in lower end of each connecting rod while timing gears, distributor and oil pump drive gears are lubricated by throw off from bearings.

The new "Equa-Flo" cooling system gives an equal flow of coolant throughout every part of the system. The high-capacity water pumps

(two on V-8, one on Six) force all coolant directly to rear of block, thence up into head and back to radiator. Turbulence is high as a result of the high velocity, improving heat transfer. Uniform temperatures are maintained with no possibility of hot spots. No special provision is required for valve seat cooling. A pressure-type radiator cap is used on the flat tube and fin-type radiator, permitting a maximum pressure of about 4½ pounds in the cooling system with a correspondingly higher, more efficient coolant temperature. Loss of coolant is practically eliminated by use of the pressure type cap. New balanced type thermostats, which are not affected by water pressure, are used on both engines for quick warm-up and a recirculating by-pass at each pump assures uniform temperatures during warm-up period.

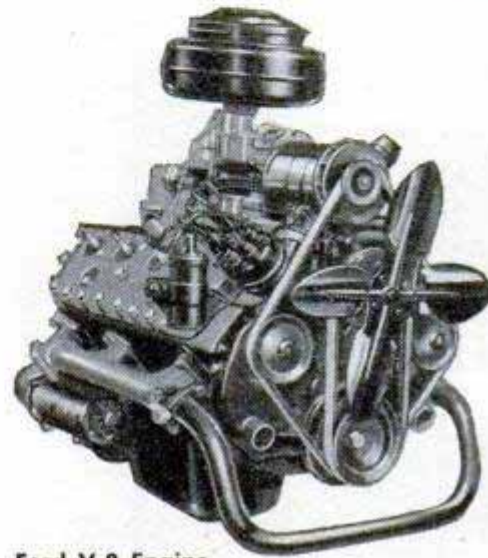
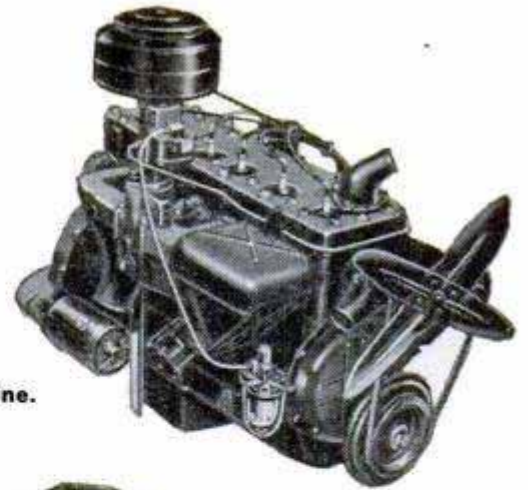
Fuel pump on both engines operates at higher pressure, reducing possibility of vapor lock. On the V-8, pump is in center and at rear of block away from the hot exhaust manifolds. A special shield is provided on the Six to protect fuel pump from heat given off by manifold.

The generator is rated at 30 amperes at 7 volts and is air cooled. A three-way regulator maintains constant voltage, limits current output and prevents battery discharge through the generator. Ignition wiring is provided with heavy synthetic sheathing that is highly resistant to moisture, oil and ozone.

Economical Service. The new Ford engines are designed for quick, economical inspection and service. Engine accessories are positioned well above the center plane of the engine where they can be reached easily. The distributor is near the top of engine, and ignition wires are held in place by rubber grommets. A timing mark is provided at front of engine where it can be seen clearly. For quick, easy servicing of bearings, oil pump intake screen, etc., oil

SIX

Ford Six Engine.

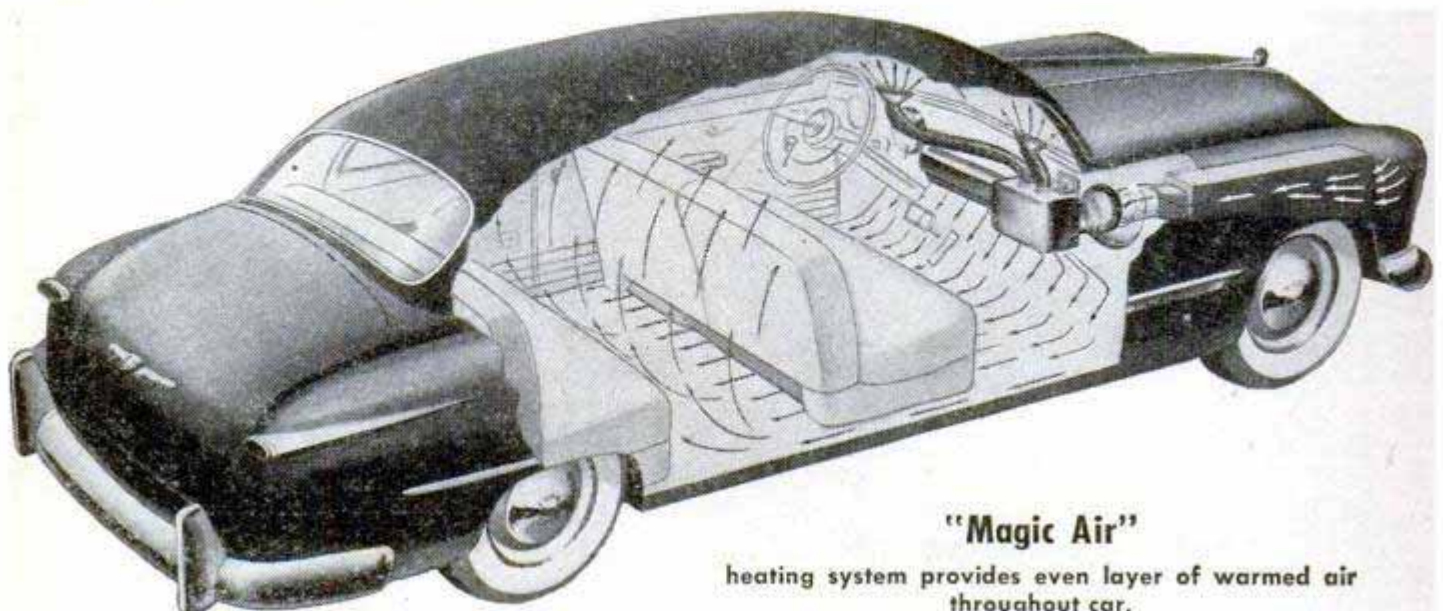


V-8

Ford V-8 Engine.

pan removal has been made as simple as possible on both engines. This careful and thorough attention to engine design, permitting easy maintenance, will be an important '49 Ford feature for both owners and mechanics.

Road lighting is provided by sealed beam headlights which can be readily adjusted both horizontally and vertically. Twin parking lamps are located in the radiator grille and dual combination tail- and stop-lights blend into the rear contour of the car. Provision is made for install-



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ing directional signal indicators in the parking and taillights. The license plate is illuminated by a light in the trunk lid handle.

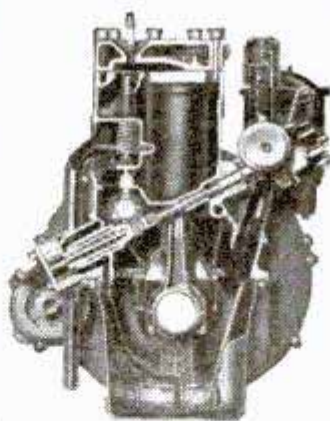
New Suspension. Of great interest to automobile enthusiasts is the fact that, with the introduction of the "Forty-Niner," the transverse spring suspension that has long been almost a Ford trade-mark has been done away with. The new Fords for '49 have a completely new suspension system, using "Para-Flex" rear springs and "Hydra-Coil" front springs. Both elements of the system have been carefully engineered to work in complete harmony with each other, for a balanced, cushioned ride.

The "Para-Flex" rear springs are, as the name implies, semi-elliptic leaf springs mounted parallel to the frame. Impregnated inserts between tips of spring leaves, together with concentrated pressure-type rubber bushings at shackles and brackets, make lubrication unnecessary. Rear shock absorbers are hydraulic double-acting aircraft type.

The "Hydra-Coil" front springs have double-acting hydraulic aircraft-type shock absorbers mounted inside them. This method permits the shock absorbers to be readily removed and replaced, without even jacking up the wheels, and the springs protect them from flying stones, etc.

Swinging link independent front wheel suspension is employed to permit either wheel to move up or down without effect on the other. A new, one-piece, rubber-mounted stabilizing bar across the front assists in controlling side sway of the car on curves and turns.

Frame. Serving as the backbone of these new Fords is a completely new double-drop frame, with big box-section side rails 4 inches deep and $3\frac{3}{4}$ inches wide. Two heavy gauge channel sections are welded together at their flanges to form the box-section, which extends from front suspension cross member to center of kick-up at rear axle. Weld is continuous throughout the box-section. Five cross members are used, with an exceptionally large box-section front



The new Ford Six engine develops 95 h.p.

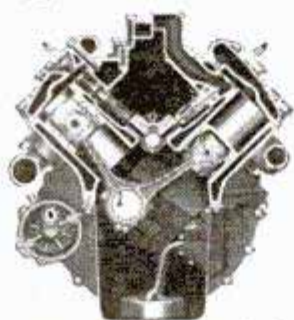
suspension member. Frames for the Convertible and Station Wagon models are further reinforced to compensate for the inherent loss of body rigidity in the former and the normally heavier loads to be expected in the latter.

Another chassis change for '49 is the adoption of Hotchkiss drive in place of the former torque tube and radius rod system. In this new system all driving and braking forces are transmitted through the rear springs, giving smoother, more comfortable starts and stops, and reducing unsprung weight.

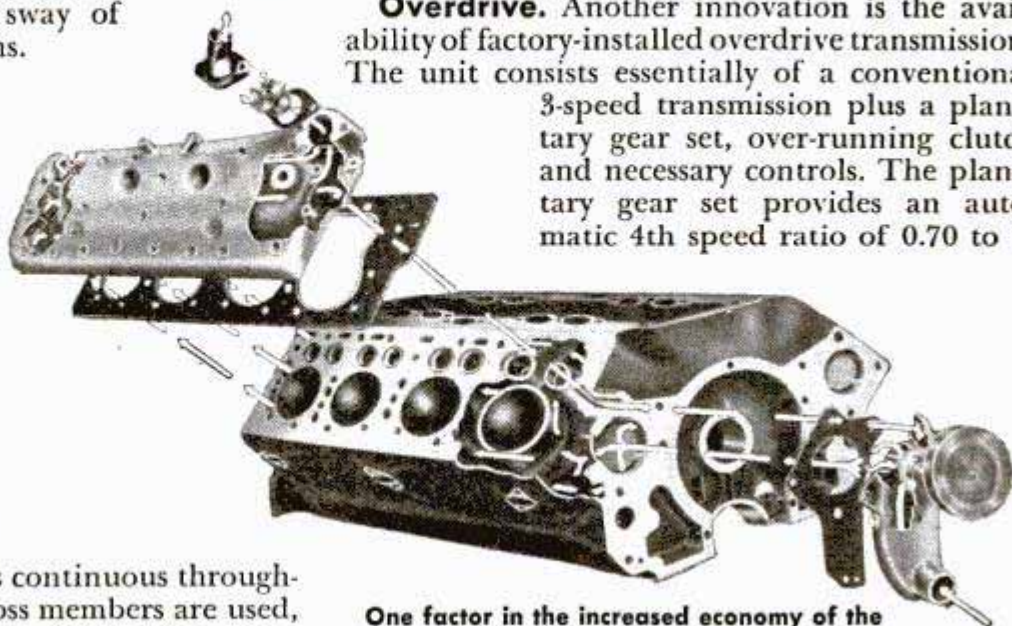
Axle Ratios. A further development is the use of a new semi-floating rear axle, with hypoid ring gear and pinion carried in an extra-strong, light-weight banjo housing. Hypoid design, together with the forward location of the rear seat, practically eliminates drive line tunnel in rear compartment floor. Single row, ball type wheel bearings are permanently lubricated. Rear axle ratio, standard, is 3.73 to 1; with overdrive, 4.10 to 1. An optional ratio of 4.10 to 1 is designed for use in the mountains. The heavier Station Wagon model has a 3.91 to 1 axle ratio as standard and 4.27 to 1 with overdrive.

The transmission of the '49 Ford is of conventional 3-speed type, with shift lever mounted on the steering column. Quiet, long-life helical gears are used in all speeds. Transmission ratios are as follows: 1st, 2.819; 2nd, 1.604; 3rd, direct; reverse, 3.625.

Overdrive. Another innovation is the availability of factory-installed overdrive transmission. The unit consists essentially of a conventional 3-speed transmission plus a planetary gear set, over-running clutch and necessary controls. The planetary gear set provides an automatic 4th speed ratio of 0.70 to 1.



Cross section view of the new 100 h.p. Ford V-8 engine.



One factor in the increased economy of the '49 Ford is the "Equa-Flow" cooling system.

Shift into overdrive gear is made at any time after car reaches a speed of about 27 mph. by simply releasing accelerator pedal for an instant. Car remains in overdrive until speed drops below about 21 mph. at which speed the drive reverts to regular 3rd gear. Driver may shift from overdrive back to 3rd gear at any time by depressing accelerator past wide open throttle position. This operates a "kick-down" switch that permits transmission to shift back to regular 3rd speed automatically, to provide for faster acceleration in passing other vehicles or for better hill-climbing ability.

The rear axle ratio on cars equipped with the new overdrive is 4.10 to 1, in place of standard 3.73 to 1. With overdrive in operation,



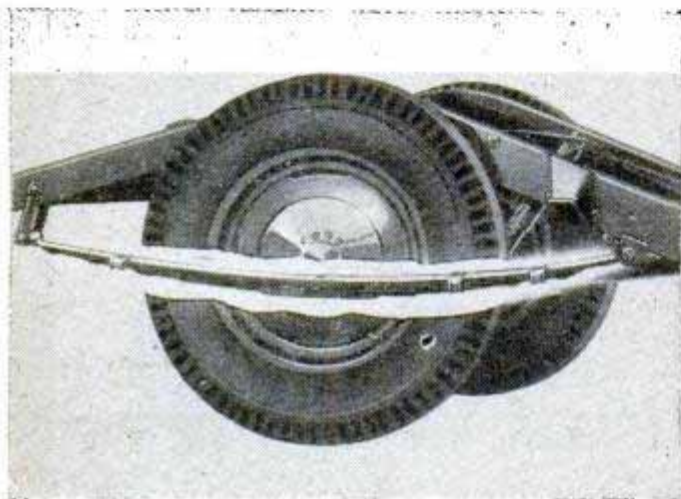
Hydraulic brakes are "King-Size", operate with easy feather-light pedal pressure.

engine speed is 23% lower than in a car with standard axle and no overdrive. The result is smoother, quieter operation, longer engine life and a marked increase in fuel economy. The 4.10 to 1 axle provides exceptional performance for acceleration and hill climbing.

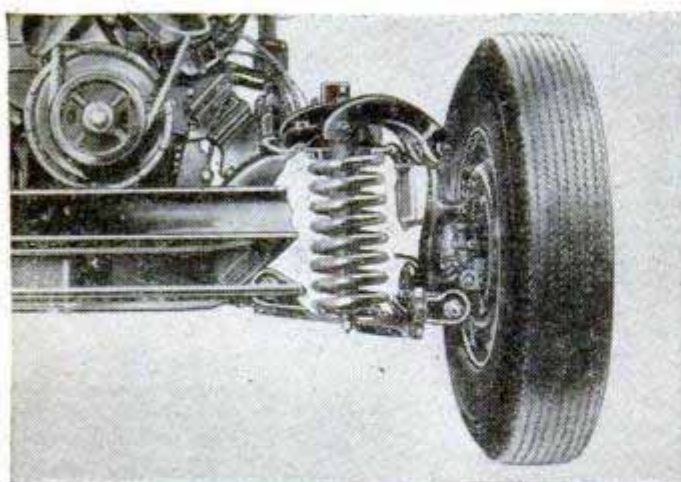
New "King-Size" hydraulic brakes with "Magic Action" touch have been developed for both series. These utilize the energy of the car's momentum to aid in applying the

brakes, thus decreasing the pedal pressure required for a given deceleration rate as much as 35%. Brake area of 177 square inches is an indication of the ample margin of safety provided for a car of this size and weight.

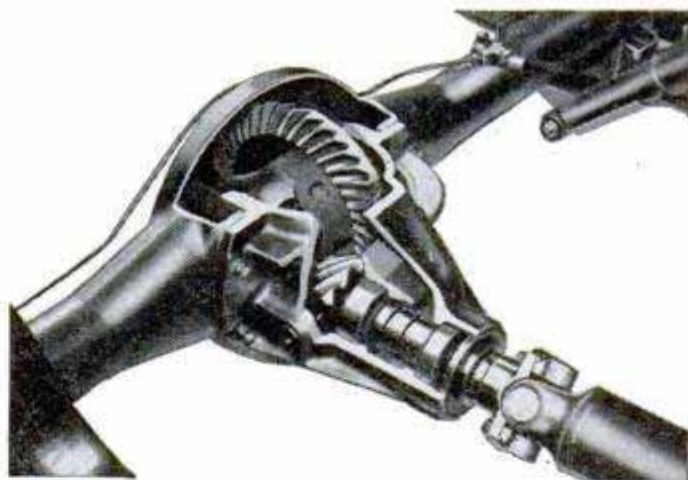
Tires. On all models except the Station Wagon 6.00 x 16 4-ply tires on wheels with 4½-inch rims are standard equipment and the new super balloon 6.70 x 15 4-ply tires on 5-inch rim wheels are available at slight extra cost. Station Wagons are equipped with 7.10 x 16 6-ply super balloon-type tires on 5-inch rim wheels as standard equipment.



"Para-Flex" Rear Springs are made extra long, extra strong for smoother riding.



New "Hydra-Coil" Front Springs use soft-acting coils for the spring suspension.



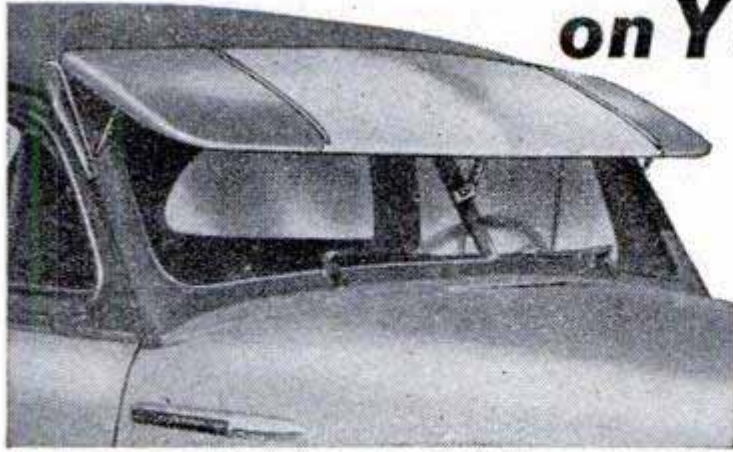
Cut-away view of new Ford axle and differential showing hypoid design.

From road to roof, from bumper to bumper, Ford for '49 makes good the promise of being the one and only *new* car in its field. And to drive one is to *know* that here is "the car of the year" —the '49 Ford.

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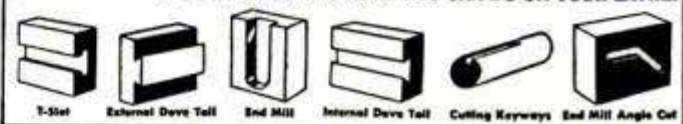
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What these new developments will do to the fabric and pottery industries is still uncertain. As for you, the consumer, don't be surprised if you find a photograph of yourself decorating your napkin when you sit down at the dinner table some day in the near future.

Rebuilding the Silent Service

(Continued from page 109)

those of unimproved submarines. The streamlining program includes removal of deck guns and other topside appurtenances, reducing the size and smoothing out the contours of the superstructure, and reshaping the bow. Improved breathing tubes are installed on 11 submarines.

Two other wartime undersea vessels have been classified as radar picket submarines for development of radar scouting techniques both for normal ocean climates and under arctic conditions. Undoubtedly part of the research program is to develop ways of raising radar equipment to the surface from a submerged vessel to follow movements of surface ships.

Still another submarine is being used for underwater-transport research. Both the Americans and Japanese put submarines to this use during the war and the idea was so valuable that methods of carrying large cargoes or groups of men underwater are being investigated.

More than usual secrecy surrounds an experimental submarine that is designated by the symbol SSG and is classed as a guided-missile submarine for studies in that field. The Germans had visions of rockets that could be launched from a submerged ship and that would travel up through the water, emerge into the air, and

(Continued to page 244)

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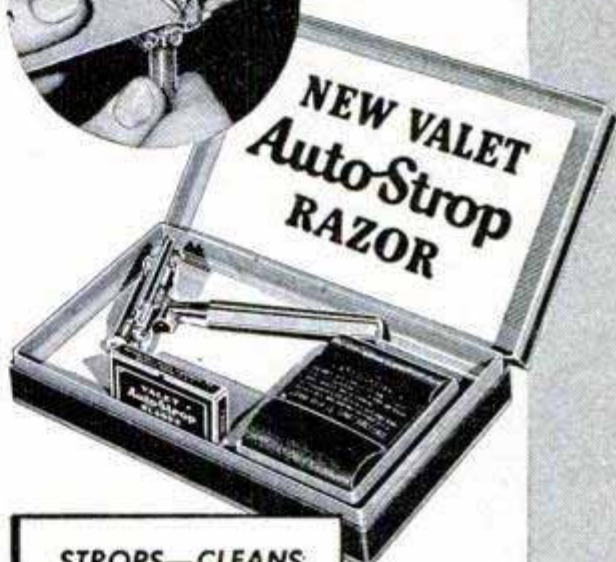
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continue on to a target. This ideal weapon seems hardly practical as yet but serious efforts are being made to work out techniques for launching medium-sized missiles from decks of surfaced submarines.

Methods for stowing large cargoes of missiles on a sub are suggested by other studies being made in adapting the submarine to aircraft-carrier duties. The Japanese had subs that carried four small aircraft in cylindrical hangars on deck. Launched by catapult, each plane had a 1500-pound bomb load. Range was limited and the plane was not recovered, being crash-landed alongside the submarine so that the pilot could be picked up. Presumably the present flat deck of a submarine can be housed over to provide space for shore-bombardment rockets, guided missiles, or piloted or pilotless aircraft.

New systems of underwater propulsion are an intriguing subject and some people predict that the first installation of an atomic power plant for vehicular use will be in a submarine. Presumably the energy would be used to create steam for operating ordinary turbines. The sub would be capable of operating almost indefinitely underwater at speeds that are attained now only on the surface. Underwater endurance, in fact, would be limited only by the oxygen, food, and health requirements.

At the end of the war the Germans had designed an undersea boat that could do 25 knots, submerged, using as a power plant a special gas turbine that burned kerosene or fuel oil plus hydrogen peroxide. The hydrogen peroxide provided the oxygen needed for combustion. The idea never got into production, for one reason because a tremendous tonnage of hydrogen peroxide would be needed.

Pending the time when atomic power plants are actually built and put to use, the search is still going on for efficient fuels that require no air for combustion.

Do We Need Synthetic Oil Now?

(Continued from page 78)

the project no longer remunerative, petroleum has been recovered by mining and drainage to an additional 40 percent of the original sand content where only 20 percent had been obtained from wells on the surface." In other words, where originally 80 percent of the oil was left in the ground after pumping was discontinued, the mining and draining method recovered twice as much as had been produced by drilling. So, instead of 80 percent being left underground, now there is only 40 percent.

(Continued to page 246)

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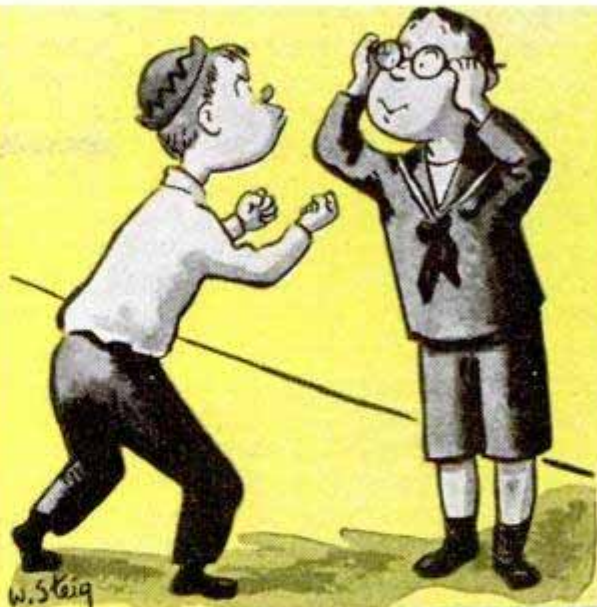
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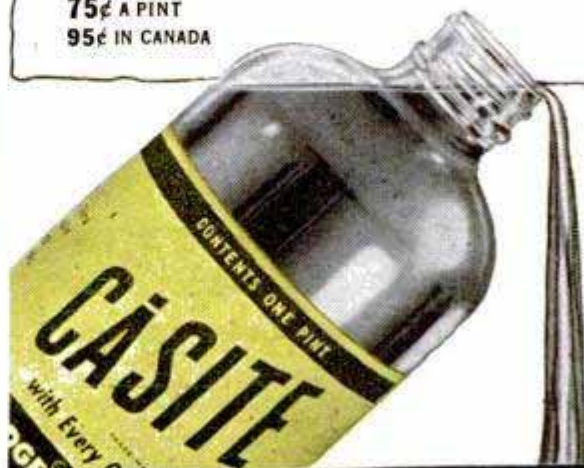


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The same process is being used successfully in the Higashiyama fields of Japan. These fields produced 156,710 barrels of crude in the first six years from a series of drainage galleries and crosscuts that divide the sand into rectangular blocks.

In the United States the same technique could be expected to produce better yields per cut especially in areas where the residual content of reservoir sand is much greater than in Japan.

According to recent estimates the capital investment required to set up synthetic-oil plants capable of producing 2 million barrels a day—the target set by governmental advocates of the program—would range anywhere from 20 to over 30 billion dollars. These figures, for plant construction alone, are greater than the total amount invested in our entire petroleum industry. And this industry is now producing, refining and transporting 5½ million barrels of oil daily, or almost three times the hoped-for production from coal and shale.

Not only would the synthetic program require huge amounts of money, it would also require more coal than it is possible to mine today without vast expenditures for equipment and manpower in the mines. Nor does the estimated figure include the

cost of transporting the raw materials and synthetic oil. It doesn't include the cost of housing for the employees required to run the complex plants built in out-of-the-way places. Complete new cities would have to be built around the plant sites.

The government has set aside 60 million dollars for research in the development of commercial synthetic-oil plants, and oil and coal companies are also spending many millions. This is proper procedure. By such investigations we can get the knowledge needed to design, construct and operate commercial plants economically. It is premature to build large plants until we have such knowledge.

One phase of the synthetic-oil program that is commercially practical today is the one using natural gas as the basic material. Two such plants are being built, each of which will produce 7000 barrels of gasoline and Diesel oil a day. In addition, each plant will produce daily about 400,000 pounds of chemicals such as alcohols and fatty acids. The synthetic oil from these plants will be competitive with crude products at today's prices whereas the proposed coal and shale synthetics could not compete on the market if produced by processes we know of at this time.

The synthetic-oil processes as planned

(Continued to page 248)

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First Time
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This is not a Rheostat, but a highly engineered, scientific wartime development, designed for controlling any desired amount of heat from 1% to 100% of the unit connected.

Controls 4-11 Amp., 240V. Circuits or 4-22 Amp. 115V. circuits, 60 cycle, A.C. Hot Plates, Elec. Irons, Soldering Pots, Ovens, Glue Pots, etc. Also Controls any other electric device where intermittent service is desired, such as signs, conveyors, pumps, fans, motors, stop and go signs, signal systems, Electric ranges, water heaters, etc.

Designed to sell for \$32.50. Mass production makes it possible to offer this ingenious electric device for only Fully guaranteed, easy to install, comes complete ready for use.

\$14.60

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KIRKLAND, ILLINOIS



SAVE TIME, WORK, MONEY!

SHAW "DU-ALL"

and "PEPPY PAL" TRACTORS

These rugged walking or riding tractors are ideal for farm, truck garden, orchard, poultry farm. Operate on a few cents an hour. A child can handle them.

DO DOZENS OF JOBS Both riding and walking tractors quickly and easily plow, cultivate, harrow, disk, bulldoze, spray, haul, grind, saw wood, etc. **LOW FACTORY PRICES** Buy direct or through your dealer. Year's guarantee!

RIDING TRACTORS 4 models from 5 to 12 1/2 H.P., 58 in. wheelbase, 36 to 52 in. wide, 24 in. plant clearance. Hand or electric starter. Walking Tractors 1 1/2 to 3 H.P.

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MFG. CO.**

SEE IT! TRY IT!

"Lincwelder"
180 AC
Accessories
as shown,
\$19.00



PRICE

\$150

FREIGHT
PREPAID

NEW LOWEST-PRICED WELDER

for World's Easiest Welding

For Repairing, Hardfacing Building Equipment

Easy to weld. Arc striking is now automatic. The instant the electrode touches the work, "Lincwelder's" exclusive "Arc Booster" blasts the end of the electrode with an extra burst of welding current to start the arc. Eliminates electrode sticking and bothersome scratching formerly needed to get the arc started.

Ideal for rural power lines and for use on farms. Draws less than 37 amps. when welding at 180 amps. Approved by power companies and REA. Safe to operate. Open circuit voltage never exceeds 52 volts.

Lowest priced welder. Has many high quality features found only in Lincoln industrial welders . . . yet sells for only \$150 . . . lowest cost of any welder of its capacity.

Full details in Bul. 370. See your local Lincoln Welder or write The Lincoln Electric Company, Dept. 333, Cleveland 1, O.

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This Husky Drill Tops 'em All!

From the first time you pull its trigger switch and feel its surge of power, this Home-Utility 1/4" Drill will click with you! You'll use it to turn out better work at top speed—drilling holes; driving attachments for sanding, grinding and buffing—in everything from building furniture to repairing appliances. It's a *real tool*, with ample motor, husky housings, full-size gears and bearings. You can count on its top-notch performance because it's well-built by BLACK & DECKER, world's leading maker of quality electric tools for 37 years. And at only \$18.95, it's a buy that's too good to pass up. Order your 1/4" Drill and other Home-Utility Tools from your hardware, electrical or implement dealer.

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in ceramics

AC's new *patented* aluminum oxide insulator material is another "first" in the manufacture of spark plug ceramic insulators. As early as World War I, AC developed the *first practical ceramic aircraft spark plug*, for Liberty engines. It was perfected and ready for World War II—and its ceramic aluminum oxide insulator material was used in spark plugs exclusively by American war planes.

Now you can have that same patented aluminum oxide insulator material in AC Spark Plugs especially designed for your car, truck or tractor engine—plugs that can take terrific punishment—plugs whose wider Heat Range adapts them to a wider range of engine temperatures. For easier starting—better idling—steadier firing under heavy load, buy AC's. They give you *utmost reliability*.

= Al_2O_3

AC
SPARK PLUGS

today will produce largely internal-combustion-engine and heating oils. These oils are not true petroleum. Oil from shale is equivalent to a low-grade crude oil. Lubricating oil can be produced from natural-gas synthetic products by the use of expensive secondary processes.

The best way for this country to assure itself of petroleum is to increase exploration for new fields, to develop new ways to increase oil recovery, to develop the vast oil deposits of the continental shelf and to explore the possibilities of new methods of secondary recovery.

In the U. S. tideland oil fields alone, which are those beneath the coastal waters, there are now an estimated 100 billion barrels of crude oil or roughly 50 years' supply at the present rate of consumption. In addition, we have in the United States proved reserves totaling another 13 years' supply. Together these reserves assure us 63 years' supply of oil at the current rate of use. Then, in addition, there are billions of barrels of oil in the proved reserves of South America which are available to us. These reserves do not include the vast oil fields of the Near East.

These proved reserves do not include new quantities of oil still to be discovered in the United States. Every year we find new reserves and there is no reason to assume that we won't find more next year and for years to come. Extensive deep-drilling programs are in progress to test the possibilities of oil production at levels below 15,000 feet underground.

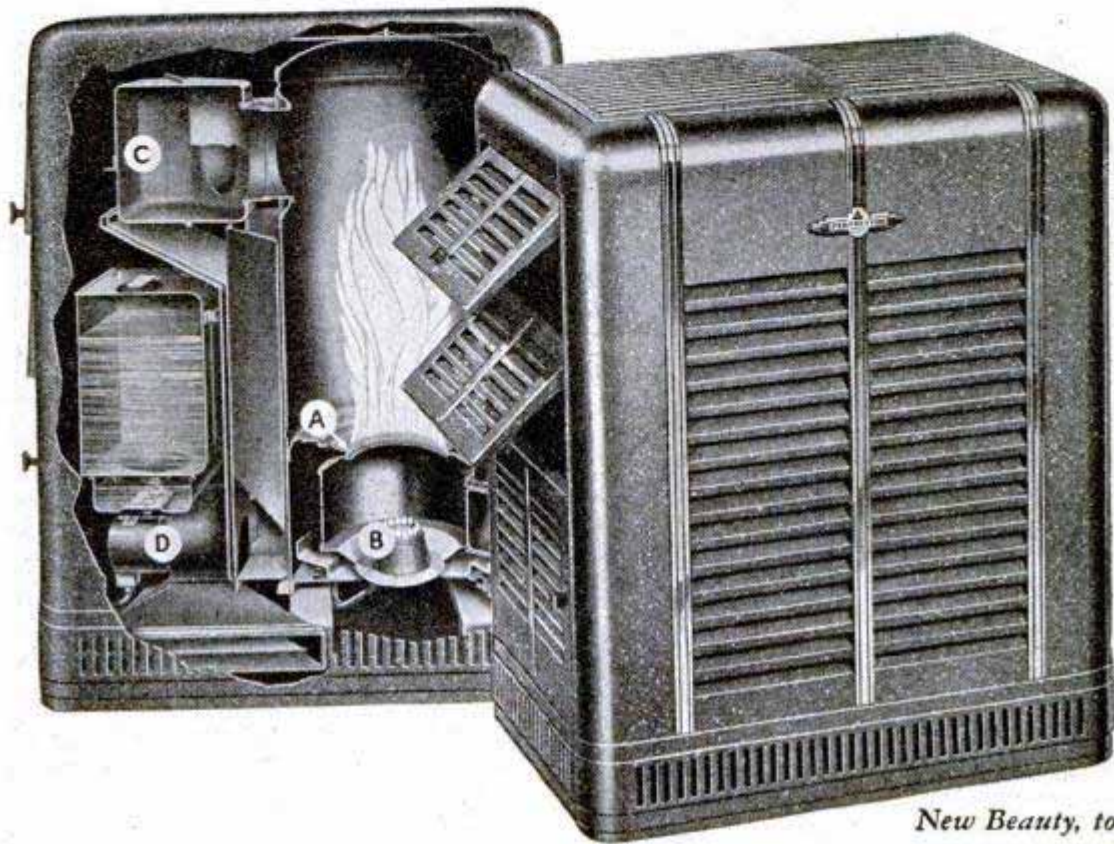
There are other facts that brighten the future of oil. Many power plants and steam engines began burning oil instead of coal when residual fuel oil, left after the refining process, was sold at extremely low prices. The oil industry at that time was selling this oil at a price below its cost from the crude.

Today, the industry can process this residual fuel oil by hydrogenation so that it is converted to more gasoline and higher-valued products by volume than the original amount used. For every 100 gallons of residual oil processed, over 105 gallons of gasoline can be produced. In 1947, for example, the production of residual fuel oil was 448 million barrels. If processed into gasoline, this would have provided more than 460 million barrels or more than 55 percent of our total gasoline production for 1947.

If all this residual oil were refined—and it is not the same oil you burn in your furnace at home, that is a distillate product, not residual oil—we would have a

(Continued to page 250)

Practical
Science + experience = **PERFECTION**
Oil Burning HOME HEATER



New Beauty, too.

NEW "Multi-Heat" burner (A) balances heat output to actual needs. SAVES FUEL.

NEW midget pilot (B) burns for hours on a cup of oil. SAVES FUEL.

NEW heat extractor (C) between fire-chamber and flue, collects heat that would otherwise go up the chimney.

NEW "Floor-Flo" circulating blower (D) (not just a fan) puts heat where it's needed. SAVES FUEL.

AUTOMATIC CONTROLS, of course. Combined with multiple stages of heat, plus *real pilot*, they assure most comfort with least oil in cold or mild weather. SAVES FUEL.

Designed and proved in Perfection's own Research Center, most complete in the industry. Backed by Perfection's 60 years' experience in making oil-burning equipment for the home.

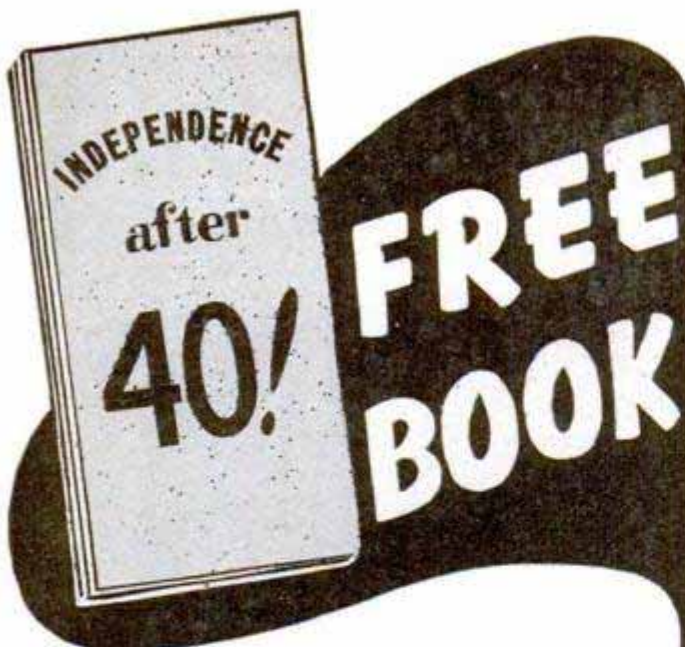
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Do you dream of independence and freedom from money worries for yourself and your family? The best way to become independent is to have a business of your own. This FREE book "INDEPENDENCE AFTER 40" shows you a proven, practical, profitable way to start in spare time, with a necessary service in every community—sharpening saws with a Foley Automatic Saw Filer.

Start your own Business with SMALL CAPITAL

Here is a steady, repeat CASH business you can start in your basement or garage, with a modest investment and no overhead expense or stock of goods to carry. Machine saw filing pays up to \$2 or \$3 an hour — it is easily possible to make \$20 to \$30 a week or more in spare time. There are thousands of saws in every community to keep sharp. This business is a money-maker in both large and small towns.

"INDEPENDENCE AFTER 40" shows you how to get plenty of saws to file without canvassing, and after you get a start how you can develop into a general repair shop business also sharpening lawn mowers, skates, scissors, making keys, repairing vacuum cleaners, etc. Other men have made themselves independent—you can too! The way to do it is all planned out for you in this practical book—send for your free copy today!



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greater supply of gasoline than could be sold on the present market.

Fuel oil should not be used for firing large power plants. The logical fuel for such use is coal and as residual oil prices increase because of its higher value as gasoline, such users may have to change back to coal. When this happens, enough oil will be available for processing so that we will have more than enough motor fuel. The supply of this residual oil is tremendous since about 25 percent of the crude oil run becomes residual oil.

Converting coal into synthetic oil results in a loss of 60 percent of its original heating capacity with present methods of synthesis. These processes require heat to produce the end products leaving only 40 percent of the total BTUs of the original coal in the synthetic oil.

Research in the coal-burning field will develop more efficient use of the tremendous power of coal. Burning powdered coal in gas turbines is an example of such progress. To convert coal into oil and then have only 40 percent of its value left is not the economical way to use our resources.

What about the use of atomic energy as a means of providing heat for power plants instead of burning oil? This is a definite development of the future and it promises to provide, in 25 years or so, enough energy to alleviate some of our fuel problems.

This, then, is what the experts in the oil industry say about the synthetic-oil program. We should continue our research in the field, but it is too soon to consider investing billions of dollars in something that is still not adequately investigated. We should make sure we have the right answers to economical production before we go ahead with plans for commercial plants. We have time for careful study—there's enough oil in the ground for at least another 100 years.

Camp in Comfort

(Continued from page 130)

small weight and bulk. One that has a sewed-in floor, 8 feet square, will sleep three men comfortably and provide space for their duffle. The tall, peaked roof provides headroom and sheds heavy rains very well. In the usual waterproof material, this tent will weigh, with a three-joint center pole and four corner poles, only about 20 pounds. Made with heavy, unbleached muslin, thoroughly waterproofed, a lighter model weighs only 15 pounds. Ideal for the "go light" automobile camper, the pyramid tent is also one of the

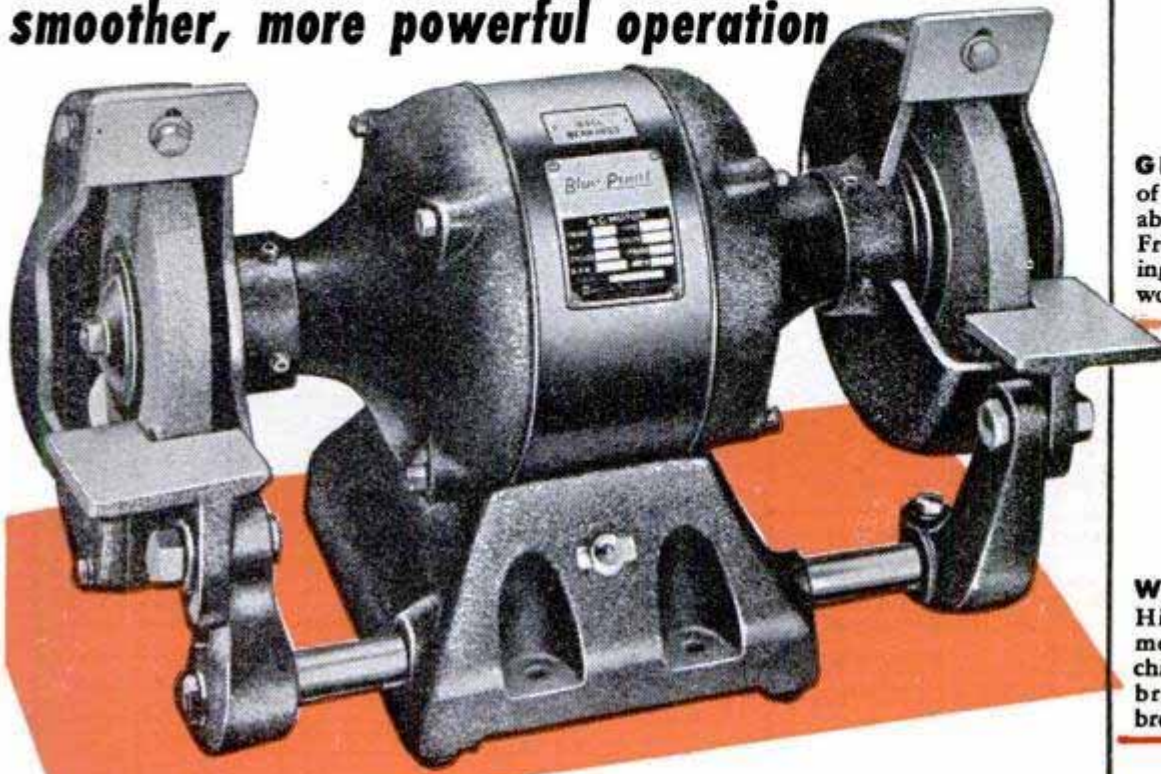
(Continued to page 252)

Snap-on

Bench Grinders

With the famous **Blue-Point** Trade Mark

... have the construction features that guarantee smoother, more powerful operation



GRINDING WHEELS
of natural aluminous oxide abrasive . . . fully vitrified. From 60 grit for fine grinding to 24 grit for heavy work.



WIRE WHEEL BRUSHES
High quality wire and metal, bound to prevent chips flying loose. Crimped bristles cannot bend or break.



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Quickly trues, cleans grinding wheels. Protective hood over cutters. Includes extra set of easily inserted cutter wheels.



EYE SHIELDS
Thick safety glass for clear vision, protection. Sturdy aluminum frame. Easily attached to grinder.

LARGE WHEEL GUARDS: Allow use of special shape grinding wheels or wire brushes. Guards fitted with chip breakers.

BELL TYPE CONSTRUCTION: Provides full clearance so that long straight pieces may be ground across the face of the machine.

STURDY TOOL RESTS: Adjustable for any type of work with ample take-up for wheel wear.

CAPACITOR START MOTOR: Uses low starting current . . . actually less than 15 amps. is consumed.

VOLTAGE: Standard models of the 1/3 H.P. and 1/2 H.P. grinder require 110 Volts, 50/60 cycle AC current. Standard 1 H.P. grinder takes 220 Volts, 50 or 60 cycle AC current.

COMPLETELY ENCLOSED MOTOR: Super powered, precision balanced motors enclosed to prevent dirt, grit, etc. from entering.

BALL BEARING CONSTRUCTION: Oversize grease sealed ball bearings used throughout, assure smooth, motor operation.

LARGE RUGGED BASE: Rubber feet provides solid mounting free from vibration. Recessed bolt openings for permanent mounting.

INDUCTION RUN MOTOR: Develops less heat in the windings — more desirable for continuous operation.

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GROBAN'S SURPLUS BARGAINS!

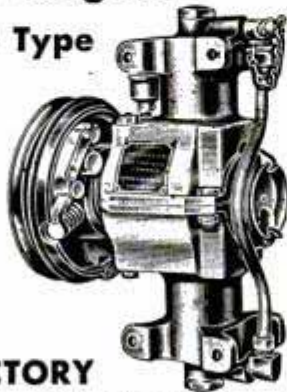
WESTINGHOUSE AIR COMPRESSOR

**BRAND NEW
War Surplus Bargain**

2-Cylinder Piston Type

Ideal for:

- Paint Spraying
- Industrial Uses
- Tire Inflating
- Spraying Insecticide
- Operating Air Tools



For the:

HOME... FARM... FACTORY

Designed for automotive truck or tractor mounting. Can be run off fan belt or power takeoff. Comes with automatic clutch. Can be installed for use on: farm trucks, jeeps, tractors, tire or garage service trucks, contractor or road building machinery, pneumatic devices, etc. Has 2 inch bore - 1 1/2 inch stroke.

Can be operated with 1/2 H.P. or more electric motor or equivalent portable gas engine.

Light weight, compact and versatile unit... delivers "oil free air" ... simple in operation; requires minimum of maintenance; operates under all climatic conditions; suggested operating pressure 75 P.S.I.; equally efficient operation in either direction of rotation; approx. displacement 3.27 CFM at 600 RPM, 6.54 CFM displacement at 1200 RPM; Overall dimensions: width 9", height 11 3/4", depth 6 5/8"; approx. wt. 23 lbs.

**A REAL BUY...
worth many times
this price**

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REGO REGULATORS OXYGEN - MODEL 1601

INLET 967

BRAND NEW

UNDERWRITERS APPROVED

**For the Workshop - Home -
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Designed for precision, gas pressures; meet the heavy demands of cutting and welding in shops, ship and scrap yards, mills, etc. REGO REGULATORS deliver an ample supply of gases at constant, even pressures.

Manufactured by Bastian-Blessing Company. This highly dependable accurate instrument is modern in design—diaphragms are 2 3/4" in diameter; two brass gauges are each 2 1/2" in diameter; 0-400 P.S.I. and 0-3000 P.S.I. Ship, wt. 7 lbs.

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CHICAGO

1/2 H.P. - A.C.

ELECTRIC MOTOR

(Capacitor Type) BRAND NEW

For the Farm, Home, Factory, Workshop

Here Are a Few of Many Uses:

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| Pumps | Air Compressors |
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3/4" Keyed Shaft; 115-230 Volt; 60 cycle; 1725 R.P.M. Single phase - alternating current; capacitor start - induction Run—Resilient Mount and Motor Protector—Reversible Rotation—High Starting Torque—Magnetic Starting Switch. Cooler Operation—Dynamic Balance—Compact Design. A Great Value at.....

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GROBAN SUPPLY CO.

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best for the mountain pack-animal trip. For the boat or canoe camper, the center pole may be dispensed with and the peak of the tent roped to the limb of a tree. The four small corner poles, likewise, are not essential and only a small amount of space at head height will be lost due to the tent not being stretched tightly.

Two men can erect this tent in about three minutes by first pegging out the corners, then stretching the peak, either by the pole or by a rope fastened to a limb. The four corner poles may then be used or not, as desired. With its sewed-in floor and a mosquito curtain to roll down over the wedge-shaped door, this little tent is adaptable for hot or cold nights. It will withstand a wind of gale force when guyed from the center pole to four additional pegs set well out from the tent corners.

The Army mountain tent: Lightest of all, this tent is perfect for the canoe or back-pack trip, where bulk cannot be great and every pound must pay its way. Made of extremely light and strong waterproof fabric, it is warm and snug for cold nights and equally comfortable when the nights are warm. A circular door fastens snugly and air is provided through tunnel-shaped windows at front and back. A strong bobbinet curtain is insectproof and may be tied back when not in use.

Weighing only a few pounds and with a bulk of not much more than two rolled blankets, this little tent will sleep two men in snug fashion or has space for one sleeper and all his duffle. Available in many war-surplus stores at a fraction of its original cost, the tent comes complete with jointed poles, rope and steel pegs. The poles are erected shear-fashion, front and rear, to eliminate the center-pole problem. The back-packer in a woods country may not bother carrying poles and pegs and instead cut his own in the forest. A strong, sewed-in floor completes this little shelter which is one of the most comfortable and weatherproof small tents that has ever been designed.

The sleeping bag: The one-time popular folding cot, with its bulky bedroll, has been largely replaced by the modern sleeping bag equipped with an air mattress. This is the ideal combination for outdoor sleeping. The air mattress, a perfect insulator against cold and dampness, is inflated in a few minutes with a small pump or by blowing into it. Its weight and bulk are little more than that of a spare blanket.

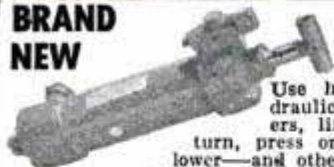
Most sleeping bags have a pocket for the air mattress. Thus it becomes an integral

(Continued to page 254)

GROBAN'S SURPLUS BARGAINS!

BRAND NEW

AIR OR OIL HYDRAULICS



Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks — push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship.

1. Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1 1/2" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Vickers Pump). A \$55.00 value. **\$12.95** postpaid
2. Double action, 2 3/4" bore, 8" stroke. (Will lift 4400 lbs. in one second with Vickers Pump). Will withstand 1500 P.S.I. against wall. A \$65.00 value, available now at. **\$14.50** postpaid
3. Double action, 3" bore, 12" stroke. All steel hydraulic cylinder, will lift up to 12,000 lbs. (7000 lbs. in 3 seconds with Vickers Pump). A \$78.00 value. Wt. 12 lbs. **\$19.50** postpaid



Brand New HYDRAULIC CONTROL VALVES

Outlets are standard 1/8" pipe thread and inlet takes standard 1/4" copper tubing fitting.

1. Four-way control valve for use with double action hydraulic cylinder, may be used with 1500 p.s.i. hydraulic system to open and close hydraulic cylinders. Brand new. Shp. **\$7.95** postpaid
2. Four-way control valve for use with two hydraulic double action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Brand New. Shp. Wt. 6 lbs. A \$60.00 Value. **\$10.95** postpaid
3. Same as valve item 2, except that unit is designed for three double action cylinders. Brand New. Shp. Wt. 8 lbs. A \$72.00 value. **\$12.95** postpaid
4. A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand New. Shp. Wt. 8 lbs. A \$75.00 value. **\$14.95** postpaid



VICKERS MF6 HYDRAULIC PUMP OR MOTOR

Compact, powerful, rated 1,000 P.S.I., .507 cu. in. per revolution, 8 gal. per min. at 3750 r.p.m. Change rotation by reversing flow. Delivers up to 6 H.P. BRAND NEW. Wt. 4 1/2 lbs., \$60.00 value for **\$14.95** Postpaid

VACUUM-AIR HYDRAULIC GENERAL PURPOSE PUMP

Original Cost

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Use them for

SPRAYING MACHINES

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HYDRAULIC SYSTEMS

MANURE LOADERS

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Worth Many Times This Low Sale Price

• Originally cost \$45.00. May be used as air or fluid pump—for pressure or vacuum. Standard 3/4 inch pipe thread with interchangeable ports. Will pump 7 1/2 gal. SAE 30 oil per minute at 300 RPM. Builds air pressure of 30 lbs. per sq. in. at 1000 RPM. Vacuum will draw 26 inches of mercury at 1750 RPM. Develops up to 120 lbs. per sq. inch of hydraulic pressure, which in conjunction with a 3 inch hydraulic cylinder will lift 840 lbs. minimum. Runs forward or reverse. Self aligning shaft. Die cast aluminum housing 6x4x4 inches. Has stainless alloy steel vanes and impeller. Made by Bendix-Avis, Corp. Spline terminal for direct drive—readily replaced with a pulley. Recommend a 1/4 H.P. or stronger electric motor. Rated capacity 1500 RPM with high overload factor. Special price for quantity users. Complete illustrated engineering report and instruction booklet FREE with every pump. Send check or money order today! Postpaid in U.S.A. **\$9.95**

BRAND NEW ALL-PURPOSE WATER PUMP

Ready for use on any pumping need

Use it for: **DRAINING BASEMENTS**

HOME WATER SYSTEMS

FIRE PROTECTION

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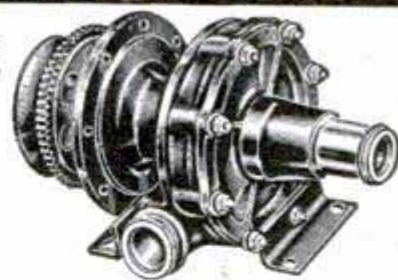
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Complete with pulley and mounting brackets, ready for use.



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An extraordinary value for all types of intermittent or continuous pumping in the home . . . farm . . . factory. Built to exact specifications of Packard Motor Car Co. for use in Rolls-Royce Merlin Aircraft Engines. May be run with electric motor, gas engine or power take-off on tractor. Delivers up to 25 gallons a minute with 1/4 H.P. motor; 80 gal. a min. with one H.P. motor. Will deliver up to 44 ft. head or 25 ft. suction. Use 1" outlet hose; 1" or 1 1/2" inlet hose (recommended).

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Has cast aluminum housing, accurately machined 5" bronze impeller; 3 1/2" V belt pulley and mounting brackets. Shaft rotates on ball bearing; has grease gun fitting.

Original cost approx. \$88.00. Shipping weight 10 lbs. A REAL BUY. Satisfaction guaranteed. Mail orders filled promptly.

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VICKERS HEAVY DUTY HYDRAULIC PUMP

BRAND NEW



For tractors, bull-dozers, construction machinery, lift trucks, industrial applications, etc. Delivers 18 gal. per minute at 1000 P.S.I. at 1200 R.P.M. using 10 H.P. Has 1 1/2" intake; 1 1/4" outlet; threaded and keyed 3/4" shaft for direct or pulley drive. Wt. 40 lbs. Dimensions: 5 3/4" diameter, 7 1/2" high. Original value \$148.00. NOW **\$39.50**

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BRAND NEW

5/16" letters, 2 1/2" length, can be used hot or cold—ideal for stamping or burning lettering on leather, wood, plastic and soft metals such as aluminum, lead, copper, brass, etc. Complete alphabet, numbers and punctuation. Available in veneer fitted case. Excellent for marking, identifying and stamping. Worth many times this unsurpassed price of **\$6.95**

Prepaid in U.S.



CLUTCH with UNIVERSAL JOINT

BRAND NEW



Formerly used on Amphibious Jeeps. Has 5 inch ball bearing pulley. Used on garden tractors, midget cars, lawn mowers, etc.

Can be used for power take-off with winch and hoist. ONLY **\$4.95**

Worth a lot more!

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with Sickle Bar
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Garden-All

LAWN and GARDEN TRACTOR



SICKLE BAR
32 or 36" cut

LAWN MOWER
26 or 30" cut

Write
for Folder

DUMP TRAILER
holds
1000
lbs.



Ride while you cut your grass! It's easier! You can do it with either the Garden-All 2½ h. p. or 3 h. p. tractor. Simply remove the body from the Garden-All Dump Trailer, install the Sulky Seat, and you're ready. To use the trailer just put the body back on. Attachment is quick and simple. You will find many uses for the trailer. It has a 22 x 42 x 12-inch bed with sliding end-gate and exclusive dumping feature; 8-gauge all-steel welded, reinforced construction; 4-ply, 4:00 x 8 tires mounted on roller bearings; foot controlled brakes. Garden-All supplies a tool for every lawn and gardening need for every season. See them all before buying any power equipment.

GARDEN-ALL TRACTOR, INC.

Dept. P, 100 W. UNION STREET, LIBERTY, INDIANA

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• Your hardware store has a fine display of Billings wrenches from which to choose the right wrench for your jobs.

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WRENCHES

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The Billings & Spencer Company, Hartford 1, Conn.

part of the bag with only the corner containing the valve being exposed for inflation and deflation. The best models are zippered down one side and across the foot so they can be opened wide for arranging bedding which may be used for extra warmth. The warmest and lightest type of sleeping bag is padded with down, closely quilted, inside a sateen or cotton cover. It weighs only a few pounds, but is amply warm for the coldest weather and is ideal for the back-packing outdoorsman.

The somewhat heavier and less expensive bags are padded with either kapok or wool, well quilted, and blankets are added when more warmth is necessary. The ordinary-size bag, about 30 inches wide, will take a wool blanket nicely when it is folded the long way. One or two such blankets, plus an inside washable cotton blanket, will insure warm, comfortable sleeping in temperatures well below freezing.

Many campers dislike the close confinement of a small sleeping bag, and for them there is an extra-wide bag, measuring from 36 to 40 inches across. In this, the extra blankets are used full width, the edges tucked in on each side. For real sleeping comfort the wise camper uses a pair of narrow sheets inside the bag and a pillow slip on a feather pillow. Then, tucked in his sleeping bag on an air mattress, inflated just enough so he will sink into it without touching the ground, he enjoys the restful slumber which contributes so much in pleasure and health to outdoor living.

All good sleeping bags have waterproof covers and a long flap, which folds down over the opening. This protects the bedding from dust in transportation and may be stretched out as a shelter for the head, when the bag is used in the open. The canoe traveler and the back-packer, who dispense with a tent entirely, may thus sleep comfortably even in bad weather.

When you plan that camping trip, remember these two essentials: A waterproof shelter and a soft, warm bed. The success of your trip—and often your health—depends on these two items.

Carburetor Ice Detector for Planes

Pilots of private planes can tell exactly when ice begins to form in the carburetor with an ice detector hooked to the engine. A neon light on the instrument panel flashes to warn the pilot to turn on his pre-heater and thus avoid the danger of the engine choking and a crash landing. The instrument is installed in the fuel induction system where the dangerous types of ice form. It is powered by electricity from one of the spark-plug leads.

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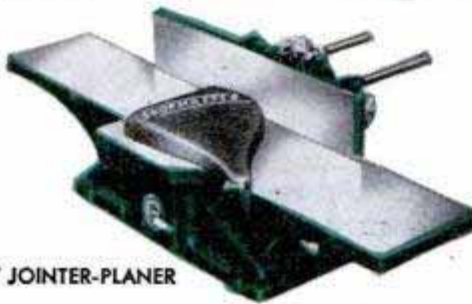
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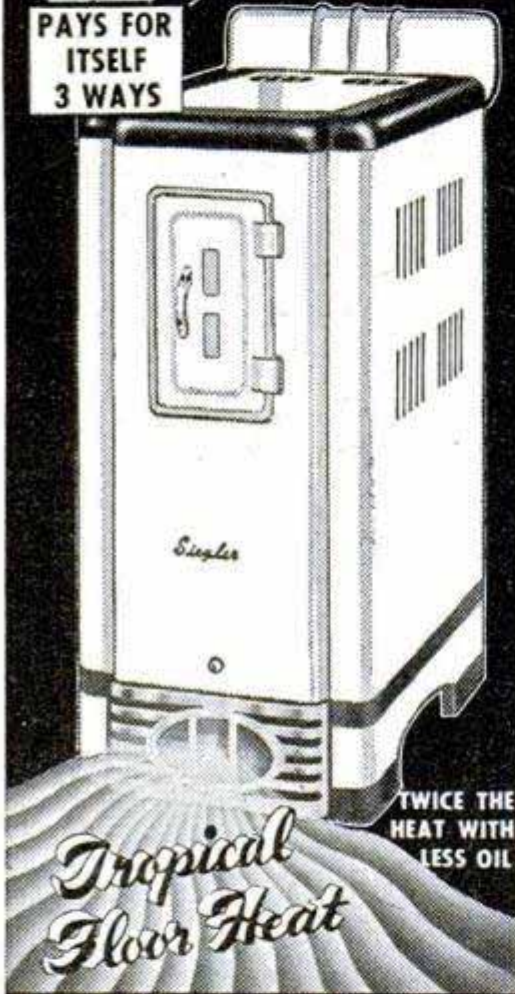
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New Roads to Timberland

(Continued from page 103)

Corporations estimated the total stand of saw timber in the United States at 2,826,000,000,000 board-feet. During 1945-46 the Forest Service estimated that only 1,601,000,000,000 board-feet remained. This would indicate that in 36 years this nation's wood pile has been reduced by 44 percent. The important thing, however, is that depletion has been largely from private lands. National-forest timber has held its own or even increased a little. Where private timberlands are giving out, many communities and industries become more and more dependent upon national-forest timber. The Forest Service, therefore, has the double task of providing as much timber as can be safely cut now, and managing the timber resources wisely so more timber will keep growing for future generations.

Unlike such resources as coal, iron and oil, timber if properly managed can replenish itself and produce a continuing harvest. Uncle Sam, the nation's largest timber farmer, has found it necessary to build roads not only to harvest trees but to (1) fight forest fires, (2) replant burned-over areas and thin out young growth, (3) combat insect pests and disease, (4) improve grazing facilities, and (5) provide recreational areas.

The new timber-access roads will be part of a planned national-forest road network of 138,167 miles, of which 53,438 are now of satisfactory standard, 46,976 miles of unsatisfactory standard, and 37,753 miles merely in the blueprint stage.

In addition to roads, the Forest Service is building or maintaining 165,145 miles of trails. Last year the Forest Service fought nearly 10,000 fires within national-forest boundaries, which burned over 175,000 acres and did \$1,000,000 damage. And even though the new techniques of aerial fire fighting hold much promise, roads and trails are still indispensable in fighting fires. In some areas, it is necessary for fire fighters to travel 10 to 35 miles on foot over mountainous terrain to reach fires.

New roads also are often a boon to reforestation crews. Up to the beginning of World War II, some 1,150,000 acres of deforested land in national forests had been replanted. But some 2,200,000 acres still must be planted to bring the land back to productivity and another 1,000,000 acres are so understocked that fill-in planting is needed. Today, the Forest Service is bringing its system of nurseries back into

(Continued to page 258)

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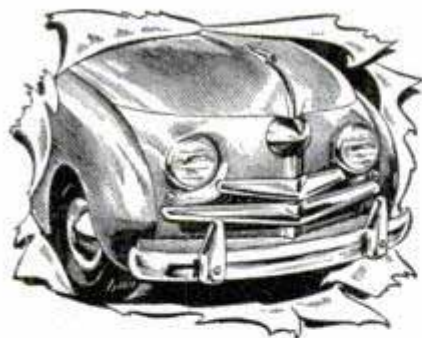
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production and has as a goal completion of planting on these lands in 15 years.

Modern forestry does not depend entirely upon the natural growth, but upon scientific speed-up methods. Cleanings in young stands can favor desired species. Thinnings can provide the best spacing and increase the growth rate of individual trees 50 to 100 percent. Pruning of pole-sized timber can result in growth of knot-free wood at a younger age than would naturally occur. At a cost of \$12 to \$15 per acre, pruning in young conifers may increase the value of timber by \$100 or more per acre.

Science also has developed methods of combating some destructive forest insects and diseases—the white-pine blister rust and the pine bark beetle, for example. Access roads will help this front-line combat, as it will aid the Forest Service in management of national forests where in a year more than 1,300,000 cattle and horses and nearly 4,000,000 sheep and goats graze. Present ranges must be maintained in good condition and other ranges that have deteriorated from droughts and over-grazing built up.

Finally, as host to some 18,000,000 Americans who annually visit national forests, the Forest Service hopes that new roads may expand recreational opportunities.

Yet there will always be roadless areas in the national forests. More than 70 areas, totaling some 13,000,000 acres have been designated as wilderness areas, to be maintained permanently in their primitive status. In these wild areas, accessible only by trail or water, those who wish really to "rough it" or see nature free of artificial influences, will never be bothered by the sound of motor cars.

Forest Service engineers have developed several items of equipment especially adapted to road and trail building and other work. Among the newest is a "trail beetle," a tiny crawler tractor weighing only 1900 pounds. Another is a "trail mule," a three-wheeled, motor-driven, freight-carrying cart to negotiate steep mountain trails. In contrast is the new giant "tomcat" logging tractor, combining tractor and logging arch in one compact unit for snaking out and yarding big logs.

To sum up: the 2100 miles of access roads now under construction not only will provide timber for postwar construction, but will be a part of the transportation network by which the Forest Service can protect and manage the timber resources of the future. How Paul Bunyan would rejoice to be there with Babe, the Blue Ox, helping build those new roads!

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Three-Ring Zoo

(Continued from page 97)

The turtle shell (made of airplane tubing, wire mesh and molded green papier-mache) is only one of scores of circus properties concocted by the zoo staff. The chimpanzee show requires specially built tricycles, bicycles and unicycles including an old-fashioned high wheeler and a bicycle-built-for-two.

Other chimpanzee properties include stilts of various sizes, harness and saddles for the ponies, bizarre instruments for the jungle orchestra, acrobatic equipment and 42 costumes. These costumes, made by Mrs. Henry Pennypacker, wife of the assistant director, have zippers in hard-to-reach places. The trainers, Ben Fridrich and Mike Kostial, keep a watchful eye on stage to prevent the chimps from unzipping each other and turning the Chimpanzee Circus Review into a strip-tease act.

"Chimps are like people," says Fridrich. "Some have talent and brains and some don't. Take Cookie; he is nine years old and we've had him in the show since he was three. I think he understands everything we say to him." He turned toward Cookie, sitting on his chair on stage. "Hey, Cookie! Make a face." Cookie complied by rolling his lower lip away down and screwing up his nose. "When Cookie was three he could turn a key in a lock and thread a needle. He does back somersaults on the ponies, rides bikes and plays in the orchestra."

The chimpanzee actors range from small four-year-old Nero, who steals many a scene, to Rastus, nine, oldest and toughest, who retires this year. When male chimps reach maturity (about the age of 10) they sometimes become savage and unmanageable and the trainers take no chances. Swanty, one of the brightest, has to wear a muzzle because of his mischievous nature. He not only nips his fellow actors with his sharp teeth but sometimes breaks up an act which he thinks is getting too big a hand. Occasionally, when seven or eight of the group are riding the ponies he will leap at them and knock them all off.

Among the hits of the chimpanzee review are the pony-riding stunts. One of the most difficult is the "table catch," performed by seven ponies, one donkey and nine chimpanzees—one more chimpanzee than there are mounts. As they ride up to a table at the front of the ring each monkey, in turn, leaps on the table top. As he does so the chimp already standing on the table leaps on the first chimp's horse as it comes out from under the table. Then the

(Continued to page 262)



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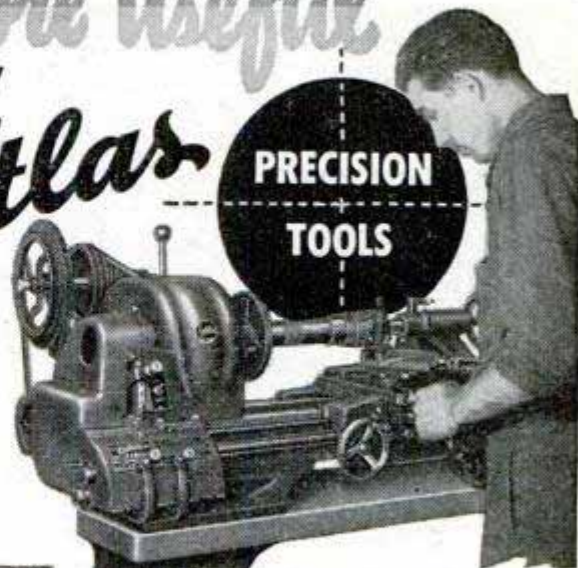
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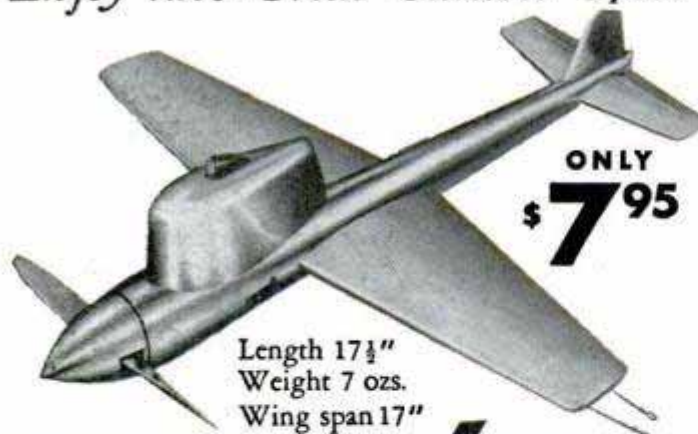
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first chimp goes over the table to catch the horse of the rider just behind him. The action is so fast there seems to be a continuous stream of chimps pouring over the table and a moving circle of ponies underneath. Another popular riding act is a Wild West solo by Cookie mounted on rearing White Lightning.

The bicycle acts include a Gay Nineties revue. The most difficult act is unicycle riding performed by Cookie and Tommy. Unicycle training starts by the trainer holding both cycle and chimpanzee as he moves them around the stage. Then a rope is used with the chimp gripping the rope and holding on while the trainer pulls him around. This rope is gradually lengthened until the trainer can stand in the center of the stage as the chimpanzee rides around. Finally, he performs without the rope. Only four chimps have mastered this show-stopping stunt.

The chimpanzee orchestra consists of a piano, snare drum, bass drum, trombone, tom-tom and xylophone. Cookie, the trombone player, is the star. He puts his mouth in place and works the slide up and down producing a weird assortment of honks synchronized with his actions. The slide is electrically connected with three sets of automobile horns concealed under a bench. Tommy obviously enjoys his piano act and makes faces as he thumps the keys. Most of the chimpanzee stars have understudies. Eight new actors are being trained to replace the aging stars.

Changing of actors does not worry Floyd Smith, the elephant trainer. His stars, Clara Belle, 15 years old; Marian, 14; Vi, 13; Lady, 7; and Honey, 6, need no understudies. Clara Belle, leader of the herd, has been performing for 11 years.

"The hardest trick to teach an elephant is to lie down on its side," says Smith. "The reason is because this king of beasts (king in my opinion) fears nothing when on his feet. When an elephant lies down it's at the mercy of other animals because it takes him so long to get up. At first I have to use a block and tackle to throw them—doesn't hurt—while I give the command 'down' and pull down on them with the bull hook. They soon get the idea because elephants are smart."

His elephants are so smart, Smith reports, that they craftily test out every new helper he hires. As the new man walks by, Clara Belle casually slaps him with one of her big ears. If she is allowed to get by with it, the next time the man passes near she "accidentally" whacks him with her trunk, looking very innocent. If this passes

(Continued to page 264)

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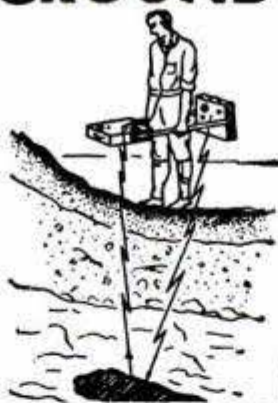
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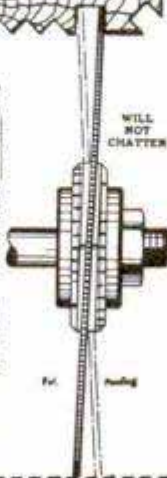


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without reprimand the next time she may knock the man down and tramp him to death. Elephant trainers and handlers must impress their charges at all times with who is boss. Once this lesson is learned the elephant is docile unless frightened.

Smith tried to teach Marian to lie on her side without using the block and tackle. He kept her in a kneeling position for some time urging her to lie down. She refused. When he allowed her to get up she acted as if she had gone mad. Her eyes were wild and her ears stood out straight. A berserk elephant is something no trainer likes to think about. Smith believes Marian's feet went to sleep that day and the strange sensation made her frantic. She calmed down in about the time it would take circulation to return to her feet.

The elephant stunts include a shaving scene in a barber shop with a huge wooden razor and a pail of soapsuds for props, a Spanish dance, a baseball game with one elephant pitching a ball while another swings a bat with her trunk. A bowling game is performed with a regulation two-finger ball. Marian, who rolls out the ball with a flourish of her trunk, always gets at least two pins. During this act Vi serves as pin boy and Clara Belle sits back on a stool and keeps score on a huge board.

Smith watches his animals for special talents. This resulted in a new act this year called "The Crooner." He had noticed that Marian "chirped" at him every time he came near her stall. He encouraged her to make odd bawling noises, bellows and chirps. Now, in a nightclub scene, Marian wears a big bow tie and "croons" while another elephant "plays" a piano—all to appropriate music from the loudspeakers. Another solo is a hula dance performed by Clara Belle in grass skirts.

Featured in the elephant orchestra are a bass viol, hand organ, bass drum, washboard and tuba. The latter has a duck call inserted in the mouthpiece and is actually blown by the elephant. In the hilarious finale an imitation skunk is pulled out of the tuba, the viol lays an egg and the organ collapses. Marian, the drummer, was taught to press the bass-drum pedal by working with an old bedspring.

In a solo act, Vi counts by beating on a gong. The audience calls out numbers up to 10 and with no apparent cue from Smith she hits the gong the right number of times. How this act is performed remains one of Smith's secrets.

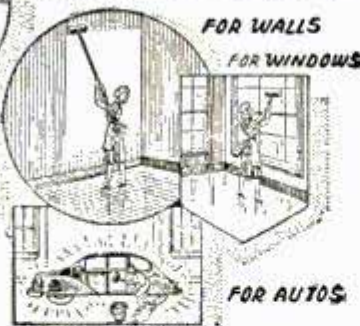
No one chides Director Vierheller these days about trying to compete with Ringling Brothers. There's a good reason. Ringlings haven't visited St. Louis for several years.



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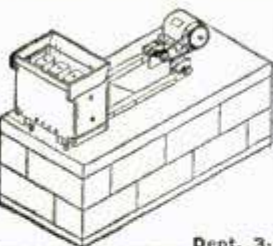
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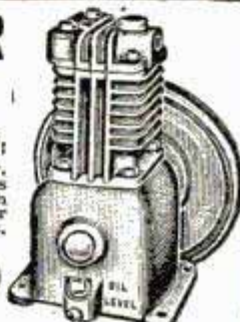
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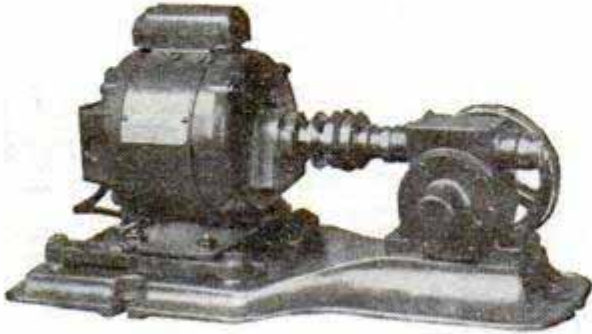
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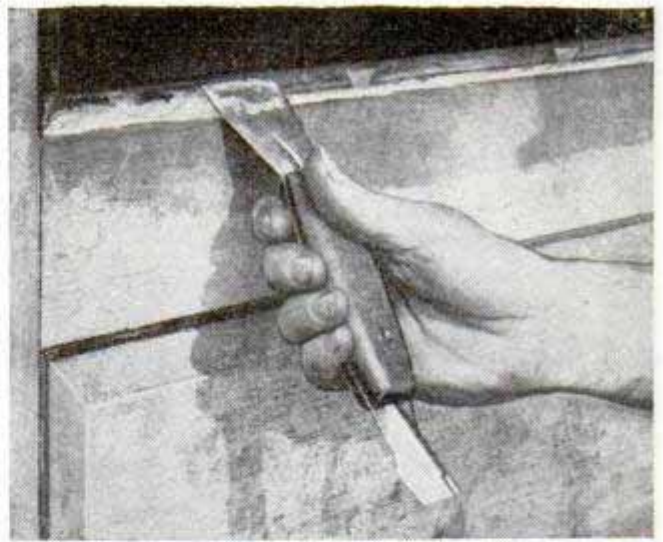
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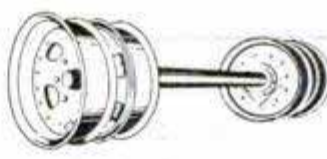
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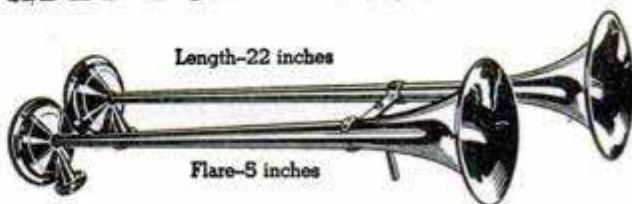
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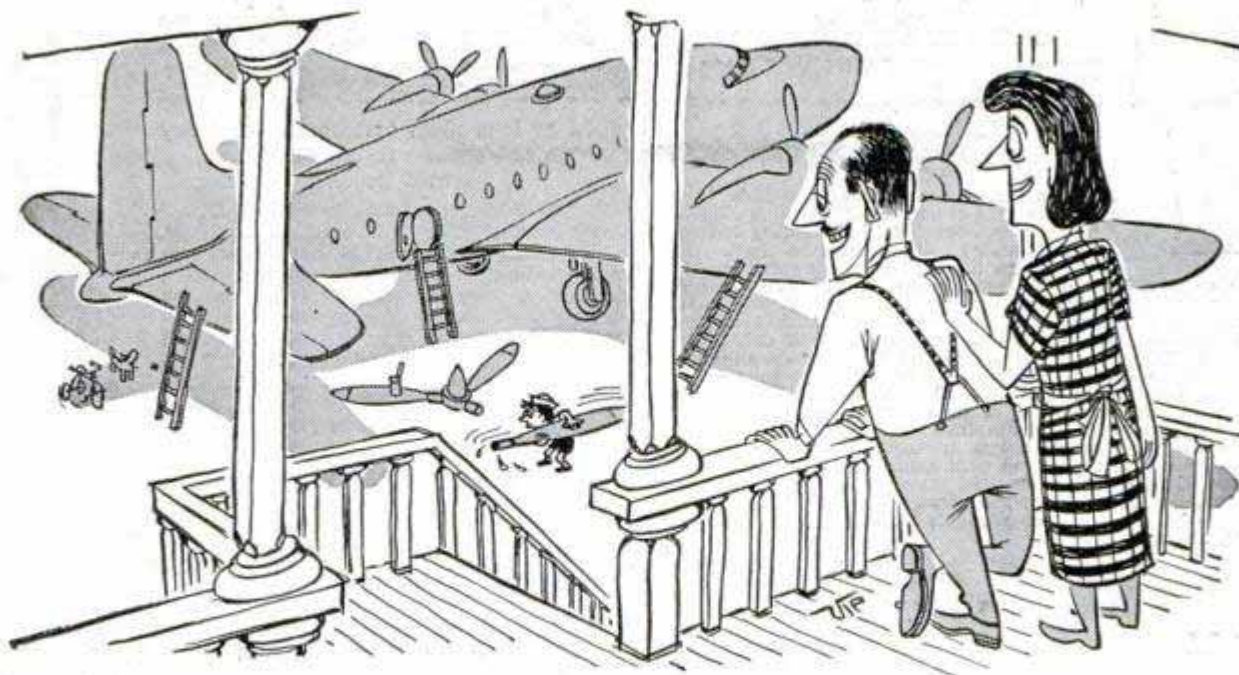
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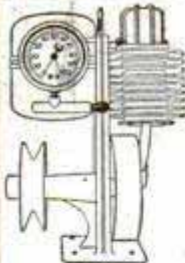
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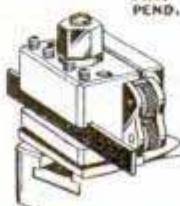
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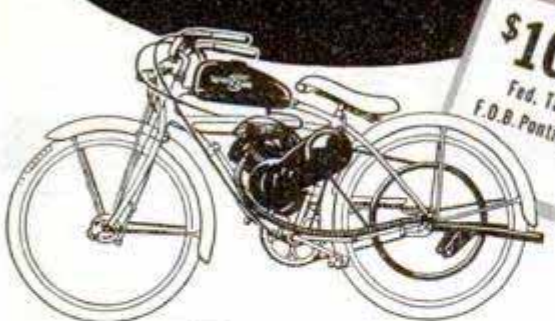
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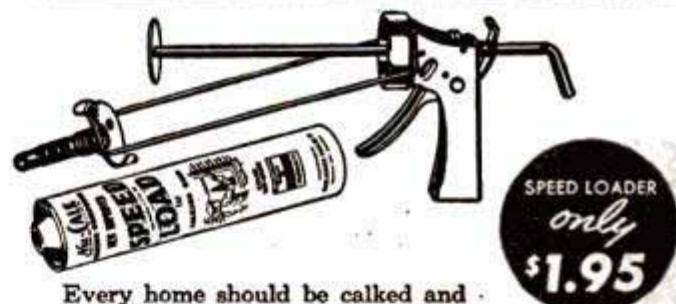
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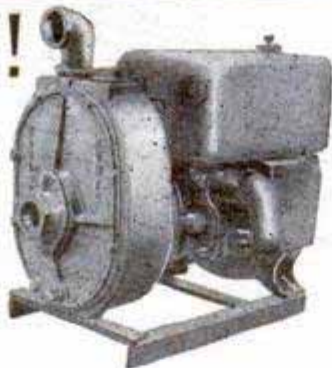
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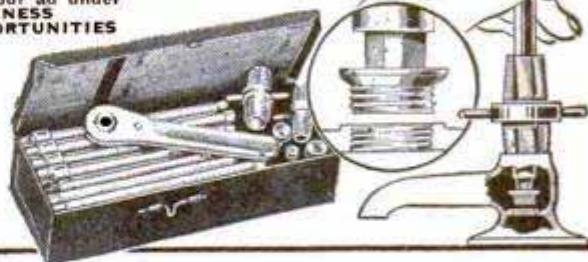
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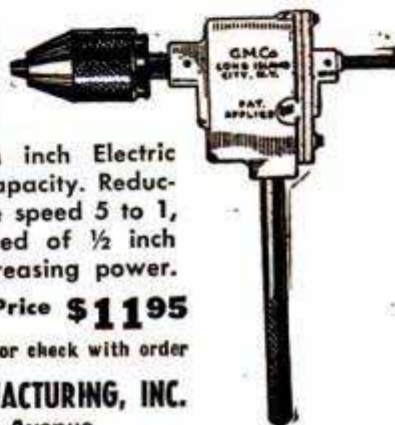
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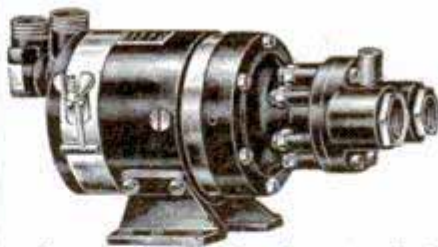
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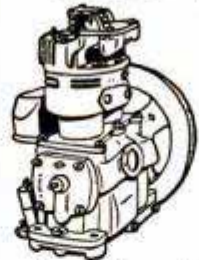


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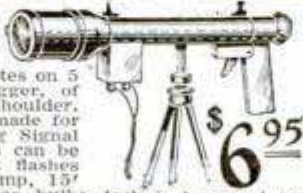
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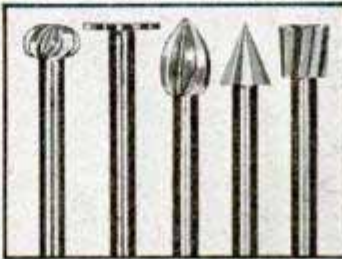
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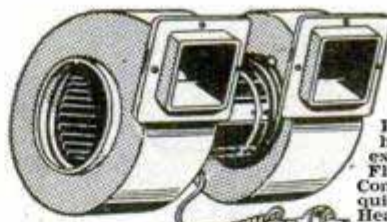
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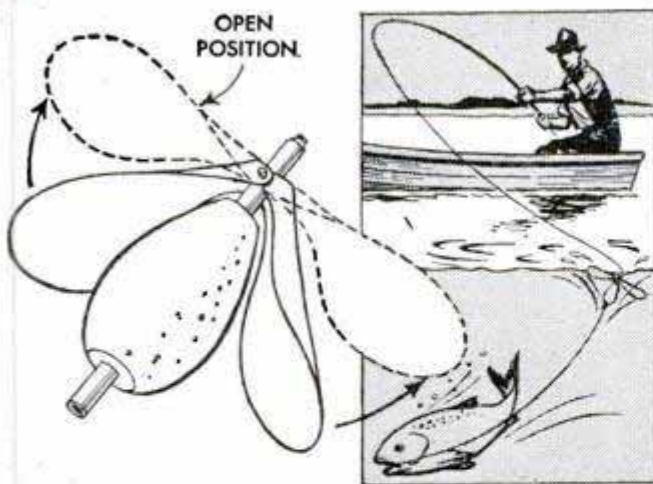
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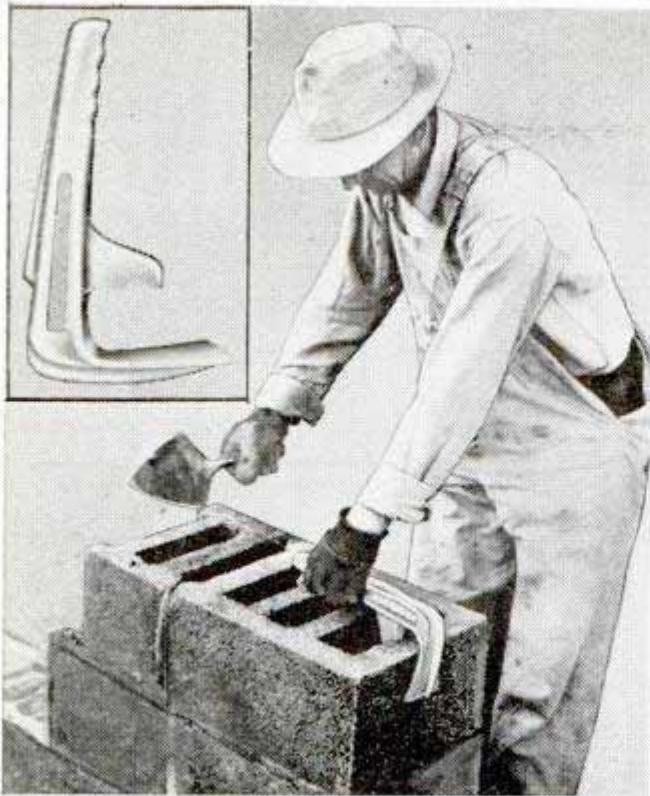
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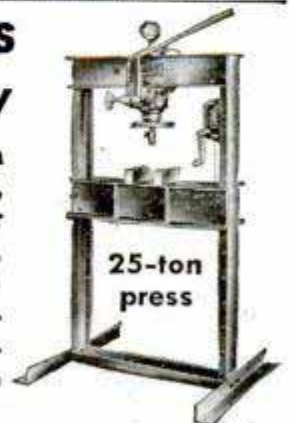
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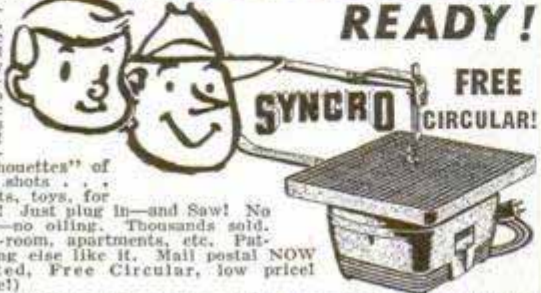
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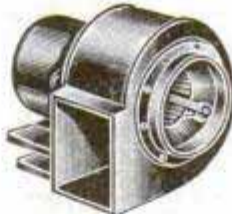
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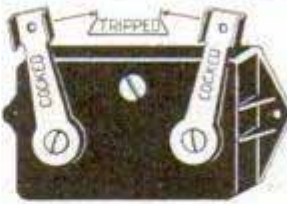


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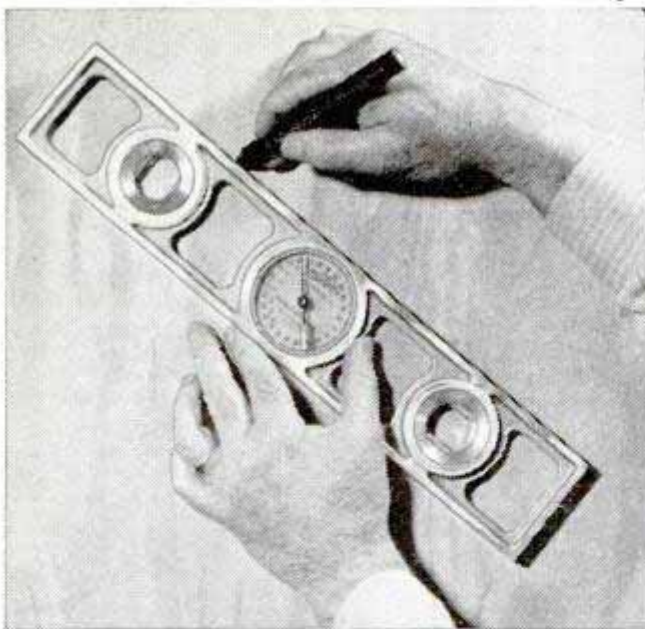
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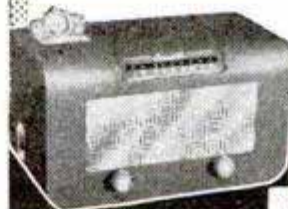
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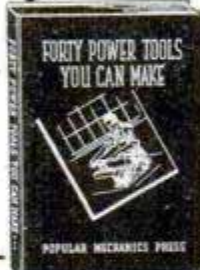
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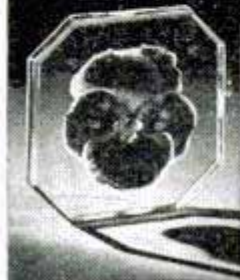
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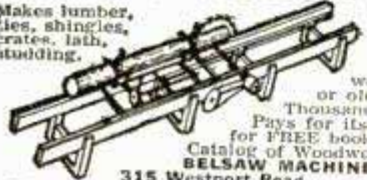


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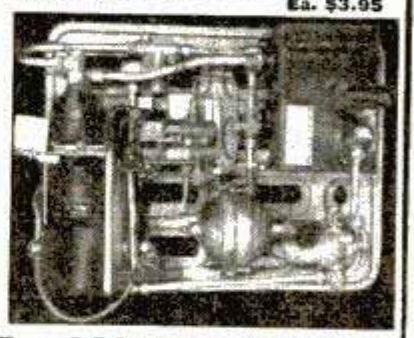
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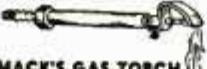
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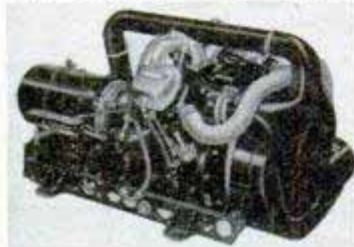
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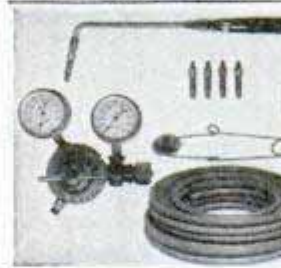
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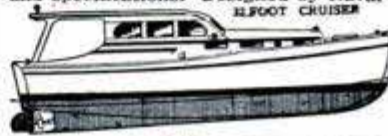


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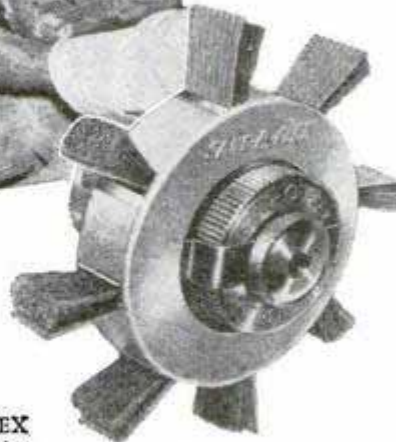
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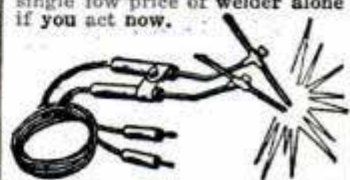
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Will pump 7 1/2 gals. oil at 300 R. P. M. Builds air pressure 20 lbs. per sq. in. at 1000 R.P.M.
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Perfect portable air tank to carry air to cut or trailer. Ideal for painting, cooking, spraying, ocean buoy, underwater fishing or diving.
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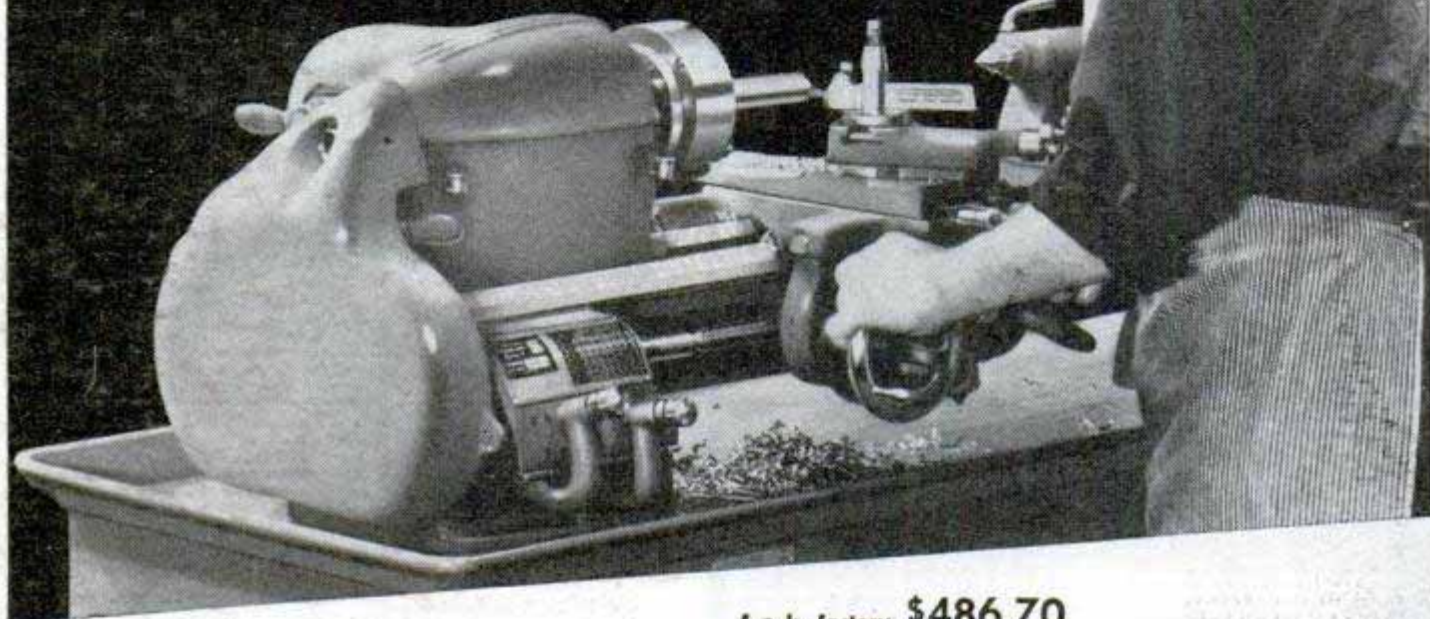
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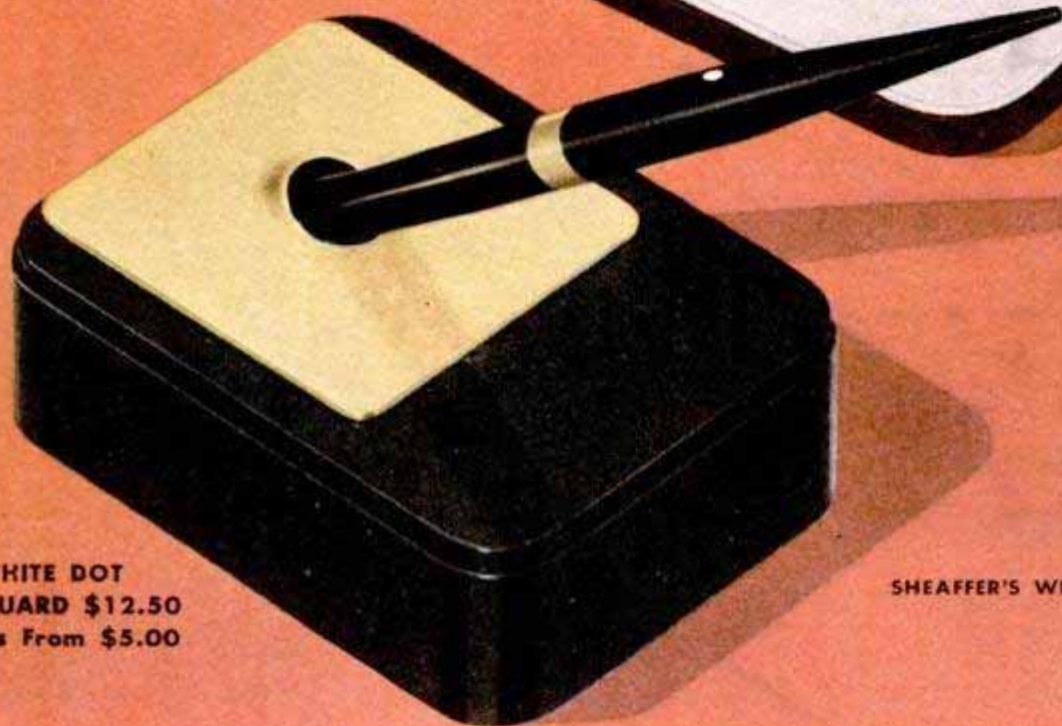
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