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POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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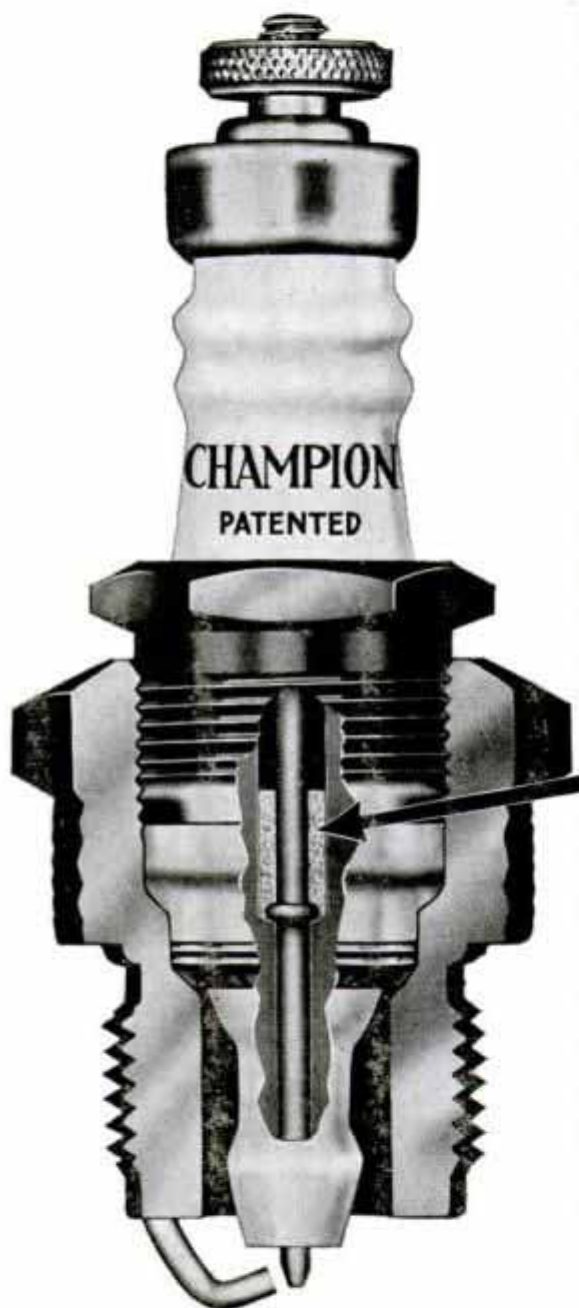
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**KING
OF THE
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SEALING SPARK PLUGS AGAINST LEAKAGE



Because every reader of Popular Mechanics has a far better than average understanding of the function and importance of spark plugs, some of the more recent structural developments in Champion Spark Plugs should prove interesting.

Until very recently all spark plugs, including Champions, used a wet cement to seal the center electrode in the bore of the insulator. Baked, this cement showed a minimum of compression leakage when new—but, as the miles piled up, heat, chemical reaction and mechanical shock all tended to break down the best available cements.

Constant, painstaking research developed better and better cements, but none remained gas-tight until Champion developed a new *dry* cement, appropriately named Sillment. Obviously a gas-tight spark plug will perform better with no tendency to overheat or pre-ignite.

Sillment, a patented feature of Champion construction, is a dry cement. A very small quantity packed around the center electrode anchors it permanently in place—see illustration—and forms an absolutely gas-tight seal. This raises the efficiency of Champions far beyond that of any other spark plug. This and other patented and exclusive features help Champions to make every engine a better performing engine—proved and re-proved in every major race victory throughout the world in the last twelve years.

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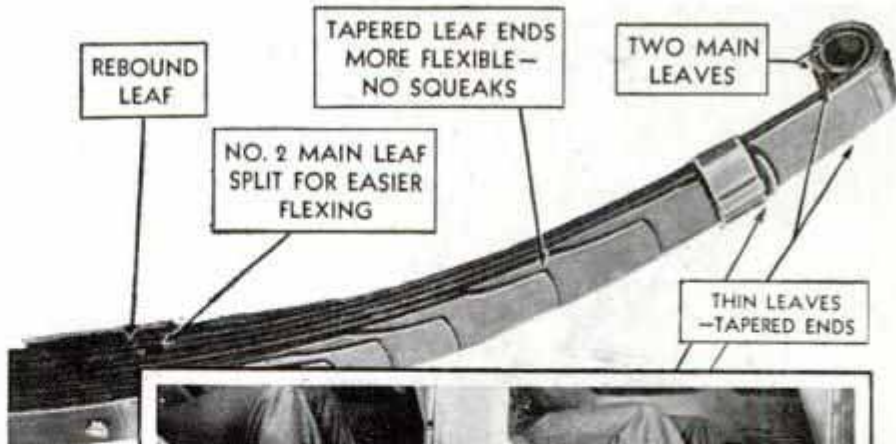
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April, 1936

Vol. 65, No. 4

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Steel of the Future

MAN progressed from bronze to iron and from iron to steel. Today sees the dawn of a bright new era of steel alloys. There are almost as many kinds of alloys today as there are uses for iron and steel products. Your automobile, for instance, contains about forty different kinds of iron, steel and steel alloys, and those in your car may be unlike the iron and steel products employed for thousands of other purposes. Steel, the master servant of mankind, promises to play an even more important part in the future of civilization than it has in the past. Watch next month for the story of steel alloys, illustrated with eight pages of Coloroto pictures.

Next Month

YOU can see America today for \$100. In the May issue U. S. Senator Robert R. Reynolds of North Carolina tells you how to do it. In thirty days he visited hundreds of historical spots from the Atlantic to the Pacific and from Canada to Mexico—and made the trip at a total cost of \$100 per person for travel expense.

Undersea Adventure

OFF the coast of Mexico under nine fathoms of water lies a chest of gold which went down with a boat in 1868. A party of motion picture technicians, headed by Capt. John D. Craig, set out to find it and to make an undersea movie of its recovery. One day a diver went down on an exploring expedition. He never came back. Weeks later a roll of film found in one of the undersea cameras revealed, like a message from the beyond, the fate of the diver. Read Capt. Craig's thrilling story next month.

The Age of Power

THE United States, with one-sixteenth of the world's population, today does as much useful work as the other fifteen-sixteenths of the world's people. America's claim as chief worker is due to an abundance of power, and the advance of the power age makes an absorbing article. Read it in the May issue.

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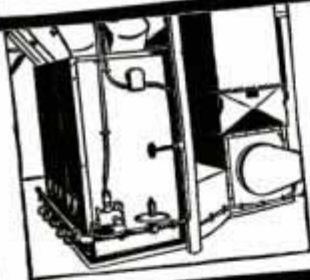
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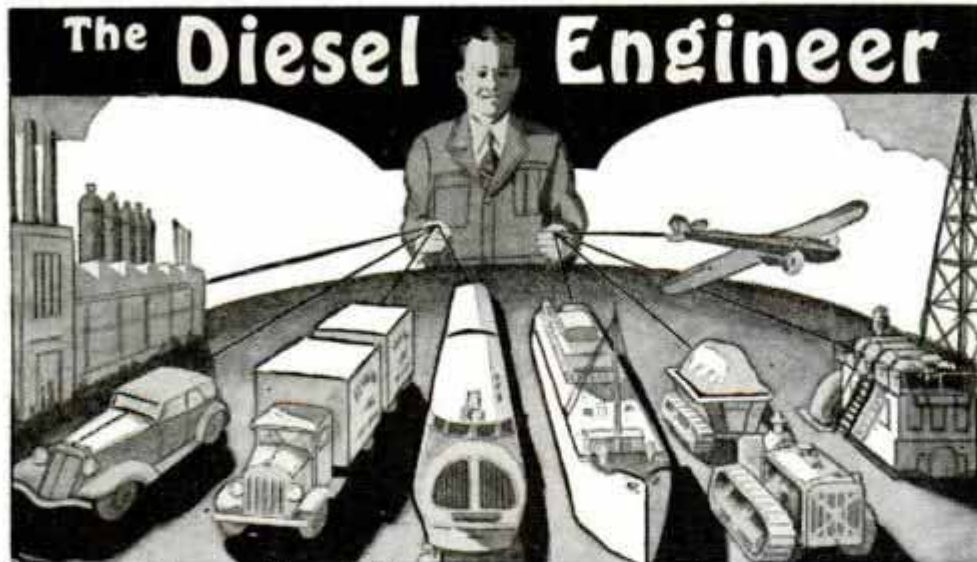
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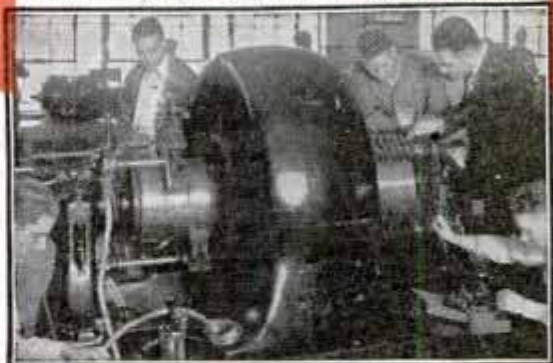
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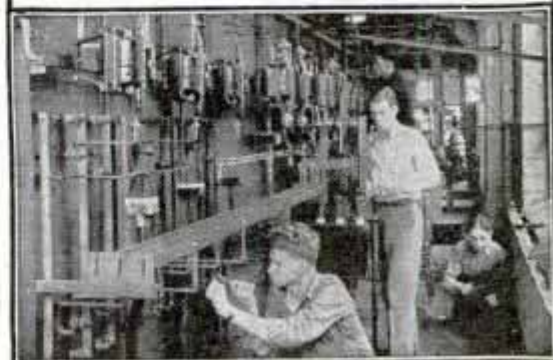
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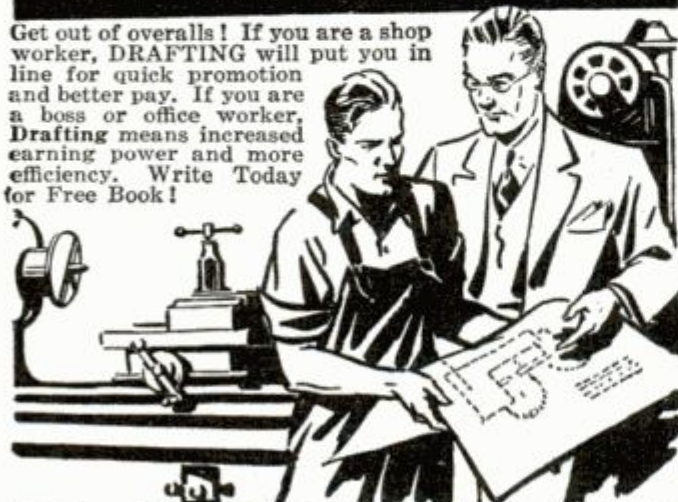
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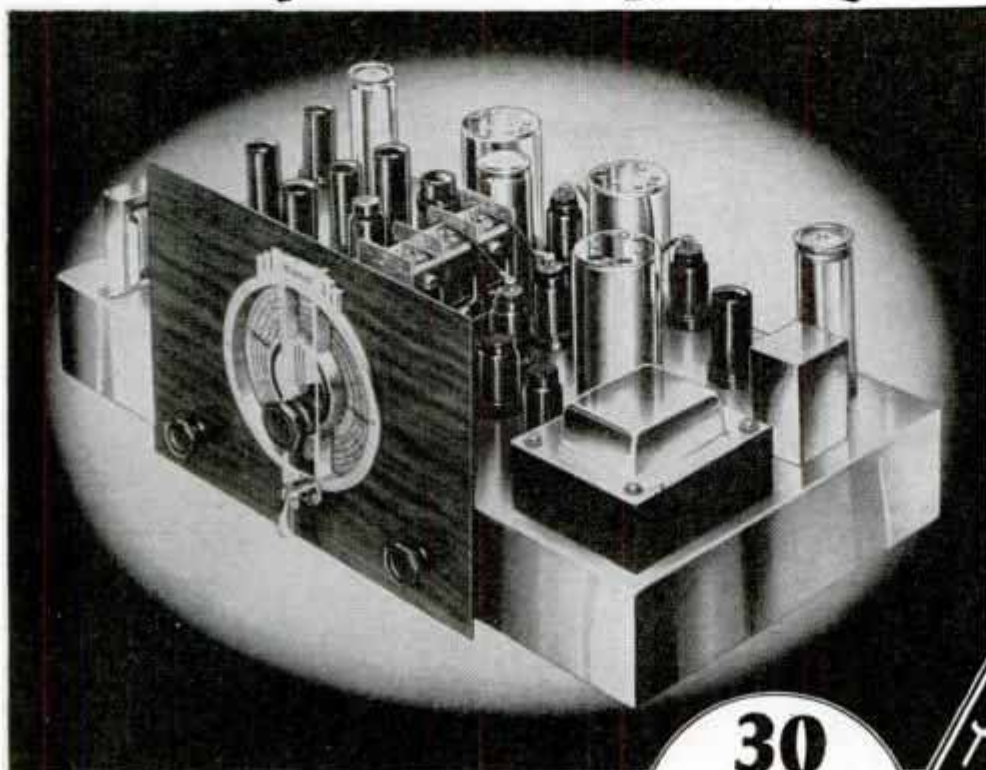


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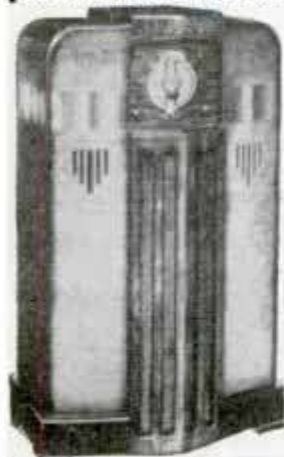
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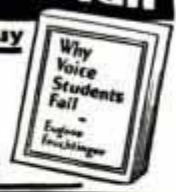
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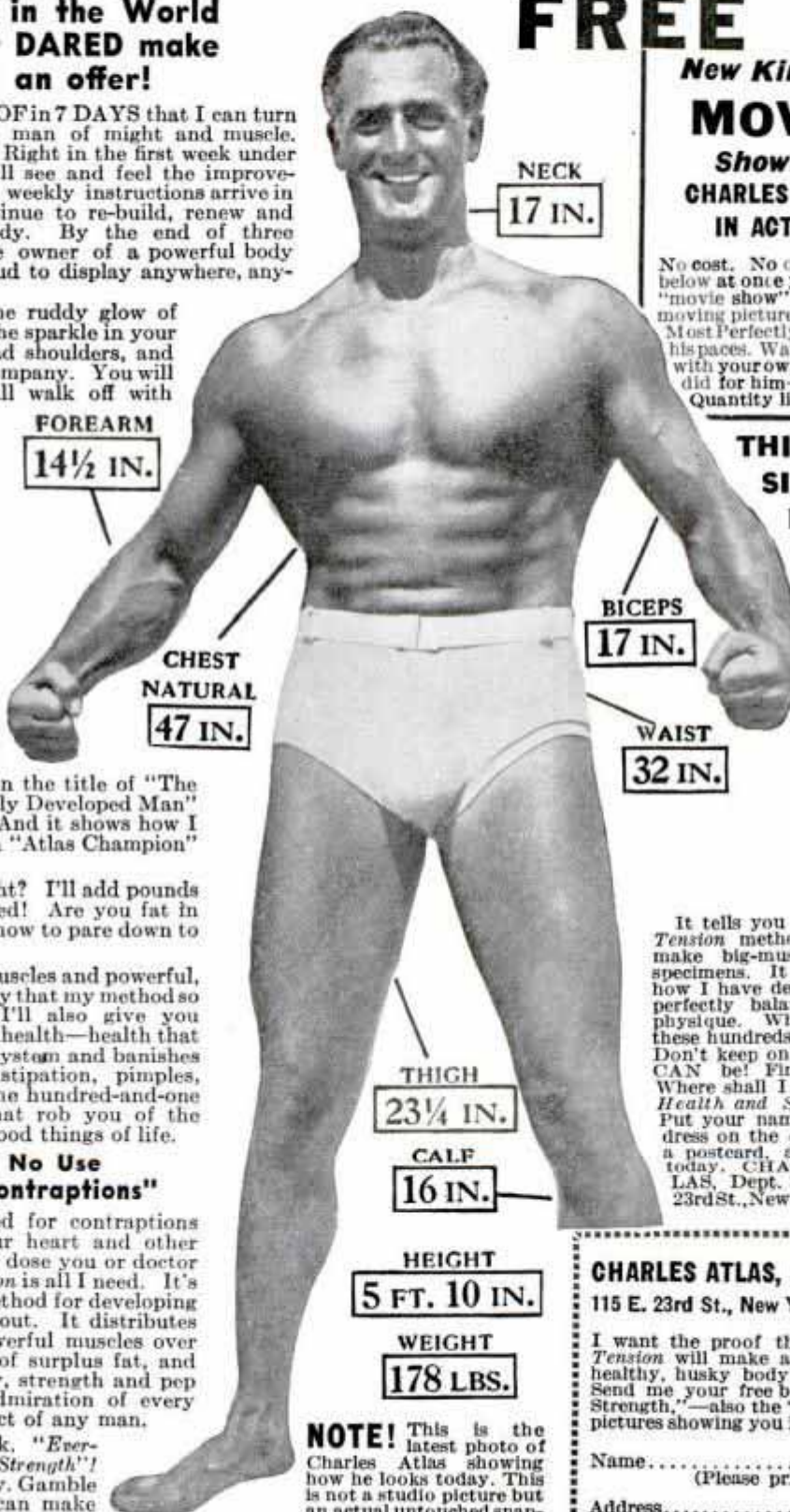
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HEIGHT
5 FT. 10 IN.

WEIGHT
178 LBS.

THIGH
23 1/4 IN.

CALF
16 IN.

BICEPS
17 IN.

WAIST
32 IN.

CHEST
NATURAL
47 IN.

FOREARM
14 1/2 IN.

NECK
17 IN.

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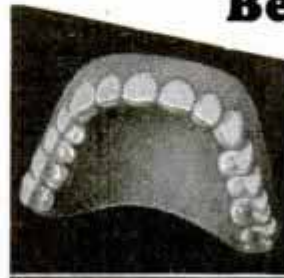


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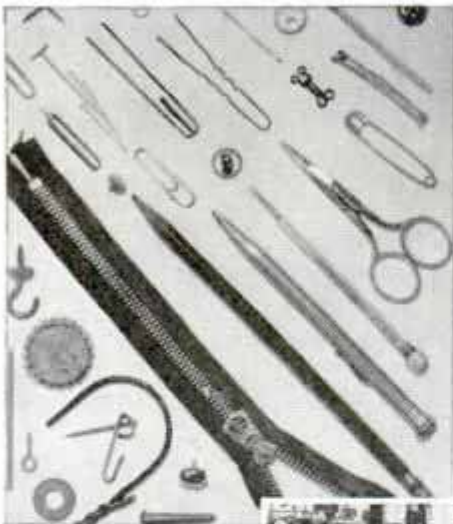
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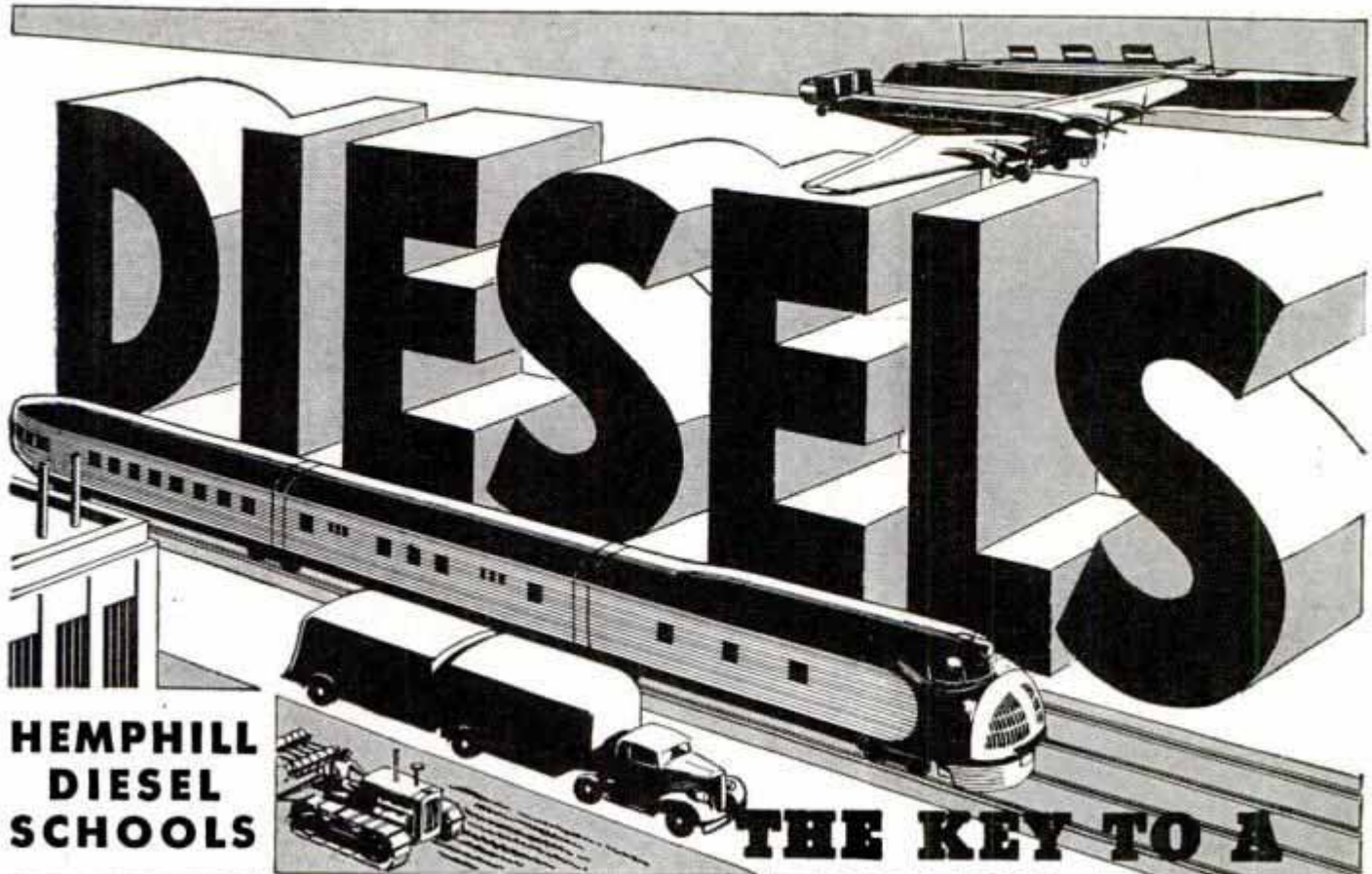
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I MAKE \$200.00 Monthly from small sideline mail order business. Particulars free. Grinstead, Edwardsville, Illinois.

LIQUID Marble—Anyone can make! Colorful, glazed! Moulded, brushed, sprayed. Rubberlastic moulds. Composition flooring. Big money making these! Particulars free. Marbleizing Service, Edwardsville, Illinois.

FREE Plans, books, circulars. Make thousands of dollars selling by mail. Home. Spare time. Mail Order Institute, 193-H Tompkins Ave., Brooklyn, N. Y.

STEADY Cash income resilvering mirrors; replating fixtures, tableware. Easy factory methods. Experience unnecessary. Make outfits. O'Cluster, HP-224 Highland, Detroit, Michigan.

LATEST Money making ideas. Eastern Service, 902 Walnut Avenue, Baltimore, Maryland.

"SCHEMER Magazine," Alliance, Ohio, prints schemes, ideas, business starters, formulas—big winners: \$10,000 to \$50,000 reported. 38th year: \$1.00. Trial special: Six months only 30c.

FREE Plans, books, circulars. Make thousands of dollars selling by mail. Home. Spare time. Mail Order Institute, 193-G Tompkins Ave., Brooklyn, N. Y.

POPCORN, Crispette, caramels, potato chip, salted nut machines. Long Eakins, 1960 High St., Springfield, Ohio.

FREE Booklet describes 107 plans for making \$20-\$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

GET Lots of mail. Money making offers, etc. Your name in 10,000 directories, 25c. Roscoe, 4627 Glenshade, Cincinnati.

START Little business anywhere. Everything furnished. No canvassing. Maywood, PM-923 Broadway, New York.

ARTIFICIAL Marble sanitary flooring, instructions covering wood or cement flooring 1/2 inch thick, fireproof, all colors, low cost, ornamental casting, concrete, plaster, papier-mache, garden furniture, statuary, flexible molds, particulars free. Chris. Mahler, Elmont, N. Y.

I WANT To send you proof of the wonderful pulling power of Popular Mechanics Magazine's classified pages. What's your proposition? Write me today. F. W. Johnson, Manager, Classified Advertising, 200 E. Ontario St., Chicago, Ill.

MAIL Order business is your opportunity. Many began small, now earn thousands yearly. No personal contact. Boundless opportunities. Have had over 30 years experience; will help you succeed. Send 25c for valuable booklets, none free. B. Breniser, 257 South 21st, Philadelphia.

SELL By mail. Books, novelties. Bargains! Big profits. Particulars free. B. Eifco, 525 S. Dearborn, Chicago.

MONEYMAKING OPPORTUNITIES

MILLIONS Jobless! Make money, like we do, supplying them satisfying, job-getting information (got man 76 openings). Keep dollars you receive; we fill your orders free. Stamp brings details. Co-Operative Service, 77 Swan, Buffalo.

PLUMB Shops on wheels. Master plumber guides you. Tells all. Not a school. Immediate profits. Small capital. Man or woman. Particulars free. One Trip Plumber, 615 Cherry, Jackson, Miss.

SELLING Out—Moneymaking books at less than cost. List for stamp. Merritt Co., Box 51, East Orange, N. J.

MAKE More money gilding picture frames. Easy factory method. Personal instruction, materials, formulas, \$7.50. American School of Gilding, Santa Fe, New Mexico.

EARN Extra money. Details 10c. Stephen Loebi, 1508 Larrabee, Chicago.

MAKE \$10 Daily. Three formulas for 20c. Box 5, Cornishville, Ky.

ROMANO Pays the world's highest prices for old coins, paper money, encased stamps. Important! Notice our full page advertisement on page 29A.

RECOVERY Of used lubricating oil. Produce high grade motor oil from crankcase drainings. Details and samples, \$1.00. George Woods, 210 - 5th Avenue, Suite 1102, New York City.

IMPRINT Circular pulling 36% cash orders. Absolutely new. Nothing for you to buy or sell. Keep money received and send us the names. 25c (coin) brings sample and full details. Imprint Service, Smithboro, N. Y.

EARN Money at home. Big profits. Plans 25c coin. Owens Service, Millport, N. Y.

SPARE Time work. Large profits. Plan 10c. Save-a-Home Association, Antrim, Penna.

\$50.00 A WEEK With car and camera— big profits with your inexpensive camera. Described on page 62 in new Photographic Almanac and Bargain Book of cameras and supplies. Write for free copy. Central Camera Co., 230 So. Wabash, Dept. 5354, Chicago.

MAILORDER Digest publishes local and mailorder plans, schemes, formulas, opportunities. \$1. Trial six months 25c. Metro, 126 Cannons, Louisville, Ky.

RECEIVE Big mails, magazines, samples. Your name in 5,000 directories, 10c, including directory. National, Box 335-WS, Saginaw, Michigan.

BUSINESS By mail. All profit. No scheme. Postal brings details. Hampton, Beechwood, Rochester, N. Y.

FIVE Profit-plans. Complete, authentic. \$1 bill. Kayrob, Canisteo, N. Y.

MAKE Useful articles from klinkers found in ordinary ashes. Real moneymaking opportunity. Complete instructions 50c. Adolph Ringl, 12524 Moran Ave., Detroit, Michigan.

NEW \$3 Letter printer! Fourfold profits using, demonstrating. Mailmarts, PMF-2, Cincinnati.

SCHEMER—Giant dime getter—Sample plan and instruction 25c coin. Fast motion. Box 175, Station C, Montreal, Canada.

"PRIVATE Brands" magazine. Money with your own products. Formulas, methods, each issue. Sample free. Myers Publications, Troy 3, N. Y.

EARN Extra money, addressing, mailing circulars. Details. Stamp appreciated. Buda Service, P. O. Box 74, Brooklyn, N. Y.

FREE Booklet describes 107 plans for making \$20-\$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

TO Win success you must do something different; particulars free. Publishers Sales Company, Box A-67, Nelson, Georgia.

BIG Money at home plating auto parts, reflectors, mirrors, chandeliers; by new method; experience unnecessary. Outfits furnished. Gunmetal Co., Ave. N, Decatur, Ill.

FORMULAS, PLANS, ETC.

MAKE Your own brushless shaving cream. All materials and directions to make two quarts of the finest cream for only \$1.00. Almont Chemical Co., 1622 Larchmont, Lakewood, Ohio.

FORMULAS. All kinds. Guaranteed. Catalog, "Special Offer Free." Kemico, 32, Park Ridge, Ill.

3,000 FORMULAS, Facts, processes, trade secrets in Dr. Brown's Book of Formulas— 380 pages. Price, postpaid \$1.00. Ogilvie Publishing Co., 57 Rose Street, Dept. 25, New York.

EXTRAORDINARY—Wealth using formulas. Large catalogue free. Brown's Formula, 212 East Waters, Tampa, Florida.

500 MONEYMAKING Formulas 25c. Descriptive literature free. Harvey Teeple, Decatur, Indiana.

AMAZING Paint and varnish remover. No scraping. Just rub. Inexpensive, non-injurious. Formula 25c. Becker 22F Hale Avenue, Brooklyn, N. Y.

FORMULAS—List free. Andco Laboratories, 225 - 7th St., Rockford, Ill.

A FREE Sample copy of Income Increaser Magazine given with each order for 500 money making formulas and trade secrets. Bucknam, 177 State Street, Boston, Mass.

SAMPLE Formula and list, dime and stamp. Kayrob, Canisteo, N. Y.

NEWEST Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson, Chemist, BD-4702 No. Racine, Chicago.

ANY Formula 50c, three \$1.00. Cole Laboratories, Bryant Pond, Maine.

2,342 FORMULAS For making adhesives, weed killers, ant destroyers, enamels, face powders, vanishing creams, lotions, rust removers, waterproofing compounds, gold plating, floor waxes, soaps, polishes, etc. Explains how to mix ingredients, clarify liquids, grind materials, where to buy supplies. Start a business of your own. This 300-page book, \$2.00. Franklin Publishing Company, 800 North Clark Street, Dept. 2401, Chicago.

TRISODIUM Phosphate—White powder. Wonderful formula solvent, quickly dissolves dirt, grease, paint. 25c gets sample, supply sources, useful formulas. Waldo, Box 266, Dallas, Texas.

SUCCEED With your products. Formulas, processes, analytical service. Information free. B. Thaxly Co., Washington, D. C.

FOR Any complete, guaranteed formula, send \$1.00. McGillicuddy Laboratories, Box 1093, Seattle.

CHEMICAL Analysis. Practical formulas. Consultation. Write. Associated Chemists, Indianapolis, Indiana.

PROVEN, Tested, successful formulas. Ritter, 1713 Powers Street, Cincinnati, Ohio.

FORMULAS—Guaranteed paint and varnish remover. \$1.00. Baic, 1150 Leonard Ave., St. Louis, Mo.

TESTED Formulas—Largest, most complete line. Catalog free. Grinstead Laboratory, Edwardsville, Illinois.

FORMULAS—Latest money makers. Literature free. Belfort, 4012 N. Keeler, Chicago.

FORMULAS—Tried, tested, proven. Real money makers! Average cost only 4c per formula! Write for interesting information. Best-Formulas-of-the-Month Club, Mayo, Florida.

CHEMISTRY

NEW Big catalog! Chemical sets, microscope outfits, laboratory apparatus, biological supplies, chemicals. Approved by experimental laboratories. Send 10c now (refundable) and get special 30 day offer. Winn, 124W West 23rd St., New York.

HANDBOOK For chemical experimenters, for students and amateur chemists, revised, illustrated, 50c. Chemical catalogue, 5c. Booklist free. Reading Scientific Company, Reading, Pa.

SPECTROSCOPE And book of 120 experiments, \$2.50. Kutting Sons, Campbell, Calif.

25 CHEMICALS With experiments, 50c. Kayare Chemicals, 5522P Ft. Hamilton Parkway, Brooklyn, N. Y.

LEARN Chemistry—Complete courses, \$15. Easy payments! Details free. College, 4931-N Hamlin, Chicago.

ECONOMICAL Chemistry supplies. Catalogue 5c. Damon Chemical Company, D176, Alliance, Ohio.

FREE Chemistry catalogs. Supplies at 5c! Equip complete laboratory. Send 3c postage. Kennik Corporation, 135P Johnson Street, Brooklyn, New York.

CHEMICAL Analysis and industrial problems. Estimates free. Esco Laboratories, 2206 Lyncast, Detroit, Michigan.

CHEMICALS, Laboratory glassware and apparatus. Catalog CP. Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N. Y.

HELP WANTED

FASTEST Selling style-sensation in years! Beautiful "Scottie" handbag, endorsed and praised by Sally Ellers, famous screen star. Genuine plaskin. Calfskin trim. Chrome initial. 3 roomy compartments. Exclusive patented side-opening gusset—"Talon" zipper locked. Free key-case. Low wholesale price. Free sample offer. "Scottie" Bag, 605 Washington, Dept. B-205, Chicago.

BIG Advance cash profits selling men's quality hats, made-to-measure, rain-proof caps. Bargain prices. Your own hats, caps free of extra charge. Outfit free. Taylor Hats, Dept. B-22, Cincinnati, Ohio.

GO Into wholesale business without investment. Call on stores with biggest line self-selling counter displays: Aspirin, razor blades, handkerchiefs, breathlets, household cement, 79 different items. Up to 125% profit for you. Experience unnecessary. Write for catalog and plans. Procopax, Dept. 36-XD, 1956 S. Troy, Chicago.

USE \$500? Raise canaries for us. Guaranteed market. Free particulars. Crimmins, 3741-G 60th, Woodside, New York.

MRS. M. M. earned \$538 in her cellar (sworn statement) raising patented giant mushrooms for United (estab. 1908). Exceptional! Yes, but your cellar, shed, barn may be suitable to bring moderate income all winter. Book, sample free. United, 3848-A-229 Lincoln Avenue, Chicago.

SAVE 30% To 50% on groceries and household necessities besides making up to \$32.50 a week. Automobiles given to producers. Details free. Albert Mills, 2762 Monmouth, Cincinnati, Ohio.

CASH Paid for butterflies, insects. See Sinclair Display Advertisement on page 12A.

MONEY In mushrooms! Grow them now, in cellar or shed. Exclusive new process. Bigger, better, quicker crops. We buy. Book free—write today! American Mushroom Industries, Dept. 606, Toronto, Ont.

AGENTS WANTED

AMAZING Money maker! Ladies' genuine Steerhide leather handbag. Half regular price. Big commissions. Lifetime quality. New, exclusive, features. Two zipper compartments. 22 karat gold engraved name and initials. Free coin purse, mirror, key case. Gift sensation. Sells on sight. Free sample offer. Halvorsen, 605 Washington, Dept. K-6, Chicago.

FULL Letter-size stencil duplicator; only \$3.00! Prints letterheads, menus, advertising etc., black or several colors. Complete with ink, stencil, etc. Big demand offices, stores, churches, schools, restaurants, etc. Big profits. Write quick for free samples work and details. Rocket Duplicator, Dept. Z-871, Cincinnati.

WHOLESALE Catalog free, 500 best sellers. Paty Co., 1167 Broadway, Somerville, Mass.

MAKE 212% Profit! Metalfix—amazing new "metallic liquid" instantly, permanently repairs metal, wood, glass, leather, etc., without heat, acid or tools. Holds forever! Free sample. Write, Metalfix, Dept. Z-313, Cincinnati.

MEXICAN Feather pictures. Unusual novelty. No competition. 25c (stamps) brings \$1.00 worth sample and details. Refunded if unsatisfied. Mexican Art, Apartado 1593, Mexico City.

AGENTS Coining money everywhere. Free samples. "Window Lettering," 2410 Maple, Los Angeles, Calif.

100% PROFIT In the "Self Starting Cigar Lighter." No flint or friction. What makes it light? No wind can blow it out. Retail 35c. Costs \$2.00 per dozen. Sample and sales plan 25c. New Method Company, Desk PM-40, New Method Bldg., Bradford, Pa.

DOUBLE-EYED Self-threading needle packages, size 3/9. Blind people thread them, invaluable for failing sight, necessary for good sight. Five samples 25c. Twenty packages, dollar bill, 100 packages \$5.00. Particulars. Wm. Oglesby, Vandalia, Ill.

AGENTS—Sell our Luminous Crucifix (it shines in the dark) for handsome profits. Hannan Co., 2620 South Parkway, Chicago.

\$2.00 HOURLY With new, scientific cream that mends all cloth easily, quickly, invisibly, without needle and thread. Stands laundering. Free sample. Sewnomore, Z-744, Cincinnati, O.

AGENTS—Make \$72.00 from \$9.00 investment. Every home, store, factory a prospect. Write today. Quick Bandages, 801 N. Sangamon, Chicago.

CASH Income daily silvering mirrors at home. Plating autoparts, tableware, etc. Combination outfit. Write Sprinkle, Plater, 128, Marion, Indiana.

HAWAIIAN Novelties: Good profit for sincere workers. Send fifty cents coin for dollar samples, information. Box 2273A, Honolulu, Hawaii.

COIN Money selling colored people. Give away free pictures of Joe Louis with hair preparation. Valmor, 2241-NM Indiana Ave., Chicago.

HANDS Up! But don't worry! "Mystery" trouser belt with secret pocket defies thieves, conceals and protects money. No betraying zipper. Looks like any fine, lined leather belt. Men eager to own it. Startling demonstration sells it. Costly genuine Dirigold buckle included. Remarkable profits. Free sample offer. "Mystery" Belt, 605 W. Washington, Dept. P-90, Chicago.

FREE! Descriptions, 450 newest money making opportunities. Metromails, P-4, Cincinnati.

450% PROFIT In new automatic gas lighter. No flint or flame. Lights gas instantly. Retail 25c. Costs you \$1.00 a dozen or 15 dozen for \$8.00 postpaid. Sample 10c. New Method Co., Box PMG-40, Bradford, Pa.

\$6.85 HOURLY! Amazing No-Flat fixes punctures without patching; makes tires puncture proof! Instantly—permanently seals holes made by nails, etc. Big seller. Free sample offer. No-Flat, Dept. Z-172, Cincinnati, Ohio.

MAKE 100% Profit. Write for particulars. Mailing Bureau, Lawndale, Calif.

SELL Stores, factory fresh gum. Big profits. Sample outfit 50c. American Chewing, Mount Pleasant and Fourth, Newark, N. J.

REPLATE Brass, copper, etc., with my silverplater. 4 oz. 50c. Agents wanted. Dixon, 912 W. 48, Kansas City, Mo.

\$6.00 HOURLY. Amazing Karnu refinishes auto like new without rubbing, polishing, waxing or painting. Wipes on with cloth. Lasts 8 to 12 months. Free sample. Karnu, Dept. Z-8, Cincinnati, Ohio.

EVERYBODY Needs food! I'll give you a wonderful chance to make \$9.50 a day supplying nationally known products on weekly route. Complete outfit sent on trial without money risk. Albert Mills, 2768 Monmouth, Cincinnati, Ohio.

MAKE And sell your own products. Employ agents yourself. We supply formulas and full instructions for making toilet preparations, perfume, flavoring extracts, soap, household specialties. Valuable booklet free. National Scientific Laboratories, 1950W Broad, Richmond, Va.

CASH Paid for butterflies, insects. See Sinclair Display Advertisement on page 12A.

PROFIT With new products. Make, sell, repeat. Guaranteed formulas, special prices, leads. Biggest catalog free. Gibson, Chemist, RD-4702 No. Racine, Chicago.

EXCLUSIVE Distributor: Trial order \$1.00. Your profit \$2.00. Money back if misrepresented. Bur-Lite Special, Hudson, Ohio.

SELL Men's ties, razor blades, etc., big money for you. Heil Premium Co., M-5, Gaylord, Minn.

AGENTS—Good profit item, outfit \$1.00. Happy, Box PM598, Cincinnati.

MAKE Big money with our sterling silver initialed photo rings. Send for proposition. Gibson Photo Jewelry, 837 McDonald Ave., Brooklyn, N. Y.

SELL, Made to measure raincoats. Outfit free. Goodyear Rainwear, 126 West 22nd, New York.

SUCCEED With your products. Formulas, processes, analytical service. Information free. B. Thaxly Co., Washington, D. C.

500% PROFIT! Gold and colored sign letters for windows, offices, trucks, signs, Monograms. Easily applied. Neonite, Akron, Ohio.

FREE Sample new photo novelties, 300% profit. Novel-Ad Company, 3327 North Ave., Chicago.

SEND Hose size for samples and chance to earn \$20 weekly. Show sensational guaranteed hosiery. Guaranteed against holes or replaced free. Dignified, pleasant work. Wilknit Hosiery, Desk 37-D, Greenfield, Ohio.

NEW Type genuine bristle bath mitt. Highly efficient, economical. Every person is prospect. Substantial profits. Ker-lee Company, Arlington Heights, Illinois.

\$3.00 HOURLY! Amazing automobile ornament. Produces revolving colored light. Propell-O-Lite Company, Mt. Washington, Ohio.

SALESMEN, Crew managers, agents. Big profits. Write for catalogue. Dandy Mfg. Co., 6 Bleecker Street, New York, N. Y.

DISTRIBUTORS—Sell table model radios. Trutone Radio Co., 1700 South Ogden, Los Angeles.

PERMANENT Income selling auto seat covers, sun glasses. Write, Rice 135-15 27th, Laurelton, N. Y.

STOP Squealing—Start crowing!! Drive out to country or "movies"—afternoons, work mornings—home! Unusual "plan"! National Folio, (Metro-sta), Los Angeles.

AGENTS—Crew managers—Wagon men. New 25c item—write at once. Sells to everyone. World Specialties, Inc., A-900 West VanBuren, Chicago.

MEN Or women. Big profits. Quick sales. Repeat orders. Saves customers money. No opposition. Make \$5 and up daily. Master Supply Co., Randolph, Vt.

BIG Money in tire patches. Sell New auto tire patch to service stations, garages, etc. Tiger-Grip patches guaranteed 10,000 miles. \$75 weekly for salesmen or distributors. Protected territory. Write Economy Rubber Co., 794 Burkhardt, Dayton, Ohio.

EARN Up to \$100 weekly underselling stores. Fast selling necessities. We furnish stock. Write today for catalog-agency offer. National Products, 119, Berwyn, Ill.

BRONZE Signs, nameplates, memorial tablets, letters, bulletin boards, railings, metal specialties. Always a ready market. Easily sold. Big profits. Write for full particulars and new catalog. Newman, 671 West Fourth Street, Cincinnati, Ohio.

Sell Perfumed starch direct to consumer. New delightful household product. Rapid seller. Big repeater. Fine profits. No investment. Send quick for free sample and liberal terms. Hoyt Bros., 104 Shipman St., Newark, N. J.

MAGIC Gas increases mileage 25-50%. Used by bus companies. Harmless, guaranteed. Approved by automotive engineers. Amazing sales records. Free radio advertising. Agent's name on cans. Particulars, proof free. P-46 Magic Gas Building, Alexandria, Ont., Canada.

MAKE Good money taking orders: shirts, ties, underwear, dresses, hosiery, raincoats, pants, uniforms. Sales kit free! Nimrod Company, Department 8, 4922-28 Lincoln Avenue, Chicago.

WANTED—Direct purchasing agents. No experience or money required. Write Purchasing Manager, 174 N. Halsted, Chicago.

BIGGEST And quickest sales are made in brushes. Write for proposition. Wire-Grip Sanitary Brush Corporation, 220 Southern Boulevard, New York.

AUTO Radio—World's cheapest. Entirely new. Write J-20th Century Co., Kansas City, Mo.

AGENTS: Smash go prices! Santos coffee 12c lb. 4 oz. vanilla 8½c, razor blades 10 for 8½c, 100 sticks chewing gum 12c. 150 other bargains. Experience unnecessary. Write Carnation Co., PO, St. Louis, Mo.

AGENTS Mosco corn and callous remover will build you a steady repeat business. Send today for pocket-size trial outfits. The Moss Company, 64 Searle Bldg., Rochester, N. Y.

GOLD Reflecting letters for store windows. Easily applied. Large sizes, penny each, free samples! Atlas Sign Works, 7941 Halsted, Chicago.

100 PROFITABLE Mail order and local business plans. A. Pruitt, Elburn, Ill.

AGENTS—Opportunity to make money; book containing 107 successful business plans; home or office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

PROFITABLE Home business. Legitimate. No canvassing. Maywood Publishers, P-923 Broadway, New York.

GENUINE Gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-B North Clark, Chicago.

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

BIG Money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.45. Ten orders daily easy. Write for particulars and free sample. American Monogram Company, Dept. 40, East Orange, N. J.

MAN In each town to plate auto parts, reflectors, bathroom fixtures, refinish beds, mirrors, chandeliers; by new method. No capital or experience required. Simple plan of manufacturing at home starts you in big money-making business. Outfit furnished. Free particulars and proofs. Gun Metal Co., Ave. H, Decatur, Ill.

NEW Cleaner! Washes clothes quickly. Cleans everything. Premium deals. Free sample. Bestco, 5007 Irving Park, Chicago.

BIG Money applying gold initials on automobiles. Easiest thing today. No experience needed. Free samples. "Ralco," 1084 Washington, Boston, Mass.

SELL Townsend postcards, big demand, large dollar assortment starts you. Chariton Associates, Chicago, Ill.

JUST Published—New 1936 edition Popular Mechanics Book Catalog. "A Billion Ideas." Thousands of books on practical subjects. 3c stamp to cover postage brings you this valuable catalog. Popular Mechanics Press, 200 E. Ontario St., Chicago.

HIGH-GRADE SALESMEN

MEN! Here's good paying work with a large shoe company. Good pay every day. No experience needed. Complete sales outfit sent free. Write Consolidated Shoe System, Dept. K13, Chippewa Falls, Wisconsin.

ATTENTION Salesmen! If you want to step into a dignified, sure money-making plan that's sweeping the country, line up quick with our sensational business stimulator deal for every retail store. No premiums. Positive money-back guarantee to increase sales 10% to 30% for grocery, drug, cigar stores, meat markets, beauty parlors, service stations, etc. Sells on sight. Repeats like sixty. Up to \$15.00 cash in your pocket daily. Experience unnecessary. Start making fast money immediately. Just send your name and address—post card will do—for complete free outfit. Federal Trade Builders, K-176 Adams, Chicago.

EARN Big pay every day in advance. Sell complete line printed business necessities, advertising book matches, gummed labels, advertising novelties, sensational business stimulators and complete line process engraved-like combinations for professional trade. New low prices. New plan. Experience unnecessary. Large 1936 outfit free! Northwestern, SX-625 Jackson, Chicago.

GIVE Away free 1936 short wave and home radios, also full electric automobile radios with our unique "Punch Sales Card Plan." 2 sales daily pays \$203.88 weekly profits. Write for our free starting offers. DeLuxe Mfg. Co., Dept. 253, 173 W. Madison, Chicago.

SALESMEN—Something new; sells on sight; unlimited prospects; sales repeat; exclusive territory; liberal commission. Chemical Specialties Co., Milwaukee.

MEN Wanted by world wide industry. Write today for particulars about few good old Rawleigh routes that have paid well for years. Established, profitable business. Over 200 farm and home necessities. Industry and reliability main qualifications. Man with auto preferred. Give age, experience, references. Rawleigh's, Dept. D-N-PPM, Freeport, Ill.

CAN You fill a business position? Information mailed promptly. County or state rights. Executive and sales ability necessary. Excellent opportunity. 150% profit. Art Service, Bremer Arcade B, St. Paul, Minn.

TODAY'S Fastest selling item. No competition. Sells on sight. Only individual toothbrush sterilizer manufactured. Exclusive territory for live wire salespeople. Send \$1.00 for \$1.60 samples and details. 100% profit. Steral Sales Company, Lorain, Ohio.

NEW Presto wind proof cigar lighter packed six chromium on 1000 hole punch board. Sells to dealer at \$8.00. It's a knock-out. You collect \$2.00 as your commission. We ship C.O.D. \$6.00. Get particulars. New Method Co., Box PMP-40, Bradford, Pa.

BE Independent. Own your business; experience unnecessary, selling \$10,000 accidental death, \$50 accident; \$25 sick weekly benefits—\$10.00 yearly. Other amounts proportionate. Guaranteed steady renewal income. \$726,415.63 securities deposited. Universal Policy, 716-A Lefcourt Bldg., Newark, New Jersey.

MAKE Big money steady. High grade coveralls, shopcoats, pants, shirts, raincoats. Advertising on back. Fast sellers. Free outfit. Strong Mfg. Co., 2330 W. 22nd St., Dept. N-11, Chicago.

BIG Money makers: Large line work uniforms, raincoats, pants, shirts, etc. Advertising embroidered. Low prices. Every business, individual prospect. Free outfit. Dove Garment Co., 1733 Milwaukee Ave., Dept. 115, Chicago.

STRANGE Ironing cord. Saves electricity. Abolishes scorching and kinking. For telephones also. 150% profit. Sales guaranteed. Big free offer. Neverknot, Dept. 4-A, 4503 Ravenswood, Chicago.

SELL Process raised letter printing \$3.95 thousand. Free cut service. Worth \$6.00. Commission \$1.00 advanced. Experience unnecessary. United, F-8 South Dearborn, Chicago.

MANUFACTURER Wants local man—Represent line fine shirts with new Tru-benized starchless collars. Ties, underwear, hose also. Exceptional values. Maker to wearer. Large earnings daily; cash bonuses regularly. No investment. Expensive outfit free. Write Dept. PM4, Quaker, Broadway at 31st, New York.

SALESMEN—Here's your chance to contract exclusive selling rights the "Charm" wrench, your state. General Wrench Concern, 251 Kearny, San Francisco.

MAN—Sideline, full time, handle regular store route 10c counter card merchandise. 100% profit! Fast repeater! No competition! Nationally, locally advertised. Details free or sent 25c for \$2.80 value. NoDoz Awakeners, PM-4, Sacramento, California.

AMERICA'S Fastest selling garment line. Pants \$1.39 to \$4.95. Raincoats \$2.95 to \$4.95. Broadcloth and polo shirts. Uniforms with free lettering. Smashing low prices, biggest commissions, cash bonuses, free garments to producers. Write now for free selling outfit. Dunlap Pants Co., Dept. C-1, Cincinnati, Ohio.

MAN—Handle regular store route. Place nationally advertised 5c-10c counter card mds. New aspirin deal—6 tablets 5c. 85 other fast sellers. 100% profit. No investment. Samples free. World's Products Co., Dept. 4810, Spencer, Ind.

CALIFORNIA'S Sensation—New true fruit product; only 15c package makes five glasses home type jelly in five minutes without use of fruit juices. Should make \$10,000 first year. Minute Foods, Ltd., 257 Werdin Place, Los Angeles, Calif., Dept. 608.

CORRESPONDENCE School salesman—Experienced, energetic man can earn good income. Leads furnished. Liberal commission. Several territories available. Must have car. Write, giving experience and references. E. S. Smith, Federal Schools, Inc., Minneapolis, Minn.

SELL Retailers; world's best dime value. Southern Products, Enid, Okla.

SALESMEN: Sell complete line book matches, labels, carbonized sales books, pricing sets, business stationery. Wonderful sideline. Free deals. Comm. daily. Free sales portfolio. Lionel, Dept. JA, 312 So. Hamilton, Chicago.

SELL "Do-All" Combination Electric Hammer and Drill to contractors, industries, installers. Wodack Corp., 4627 Huron St., Chicago.

MAKE More money taking orders; shirts, ties, underwear, dresses, hosiery, raincoats, pants, uniforms. Sales kit free! Nimrod Company, Department 65, 4922-28 Lincoln Avenue, Chicago.

SOMETHING New in fire extinguishers—Red Comet Automatics. Proved in west five years. Exclusive territory. Low price opens pocketbooks. Write, Red Comet, 404 Comet Building, Littleton, Colorado.

DO You want a good selling item, needed in almost all homes? Either as a principal or a side line. Write Tift, Tift Road, Route 1, Dover, N. H.

MAKE Big money—Commissions advanced, sell Popular Mechanics work shoes—complete line of dress shoes—outfit free. Dura-Tex Shoe Co., 80, Brockton, Mass.

SALESMEN: Sell advertising novelties, calendars, fans, thermometers, etc., for nationally known firm. Liberal commissions. Stanwood Hillson Corp., 21 Station St., Brookline, Mass.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Foyer cleared \$4920 in three months. Write, F. E. Armstrong, President, Dept. PM, Mobile, Ala.

SALESMEN—New deal guarantees stores \$10 for one. Two \$15 sales net you \$20 daily. Sayers, 2801-123 Sheffield, Chicago.

FREE Booklet describes 107 plans for making \$20-\$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

BRAND New grab-bag deal. Going big everywhere—big profits—swift sales—fast repeats. No restrictions. All dealers buy. Act! K&S, 4373 Ravenswood, Chicago.

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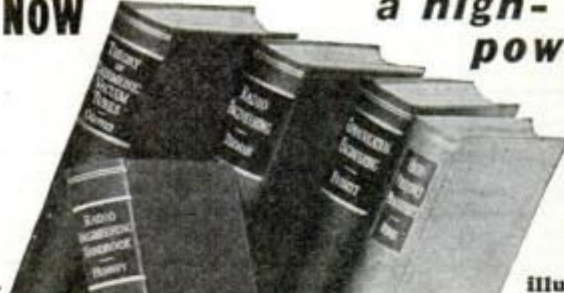
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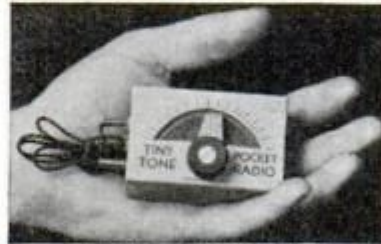
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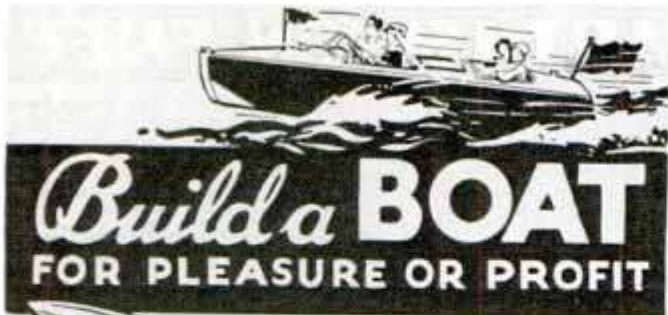
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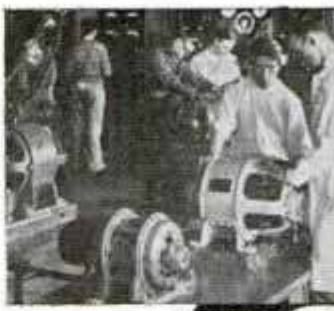
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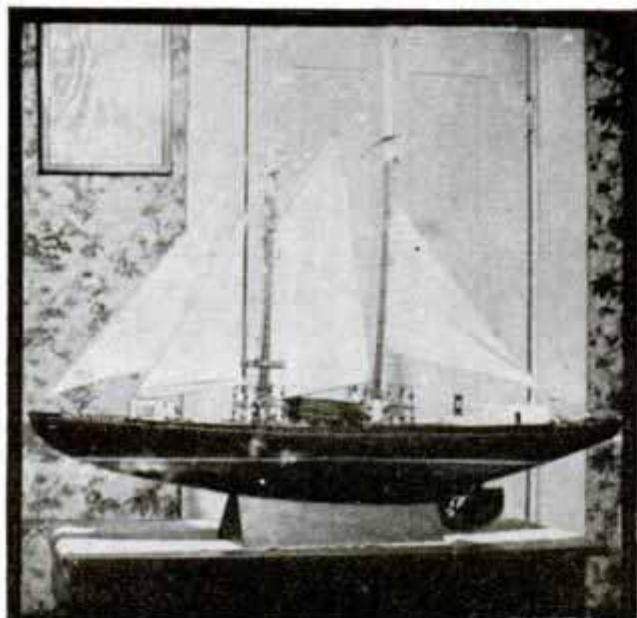
MAIL BAG

(Continued from page 34A)

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- 1341 Unusual Menus
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- 1351 How to Get Ahead
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- 1361 Who Killed Jesus?
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- 1710 Magic of Numbers
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- 1723 Career of Al Capone
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- 1726 How to Think
- 1728 Care of the Teeth
- 1729 Technocracy Explained
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- 1745 Story of Cancer
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- 1748 Scientific Crime Detection
- 1749 How to Play Backgammon
- 1751 Methods of Criminals
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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 65

APRIL, 1936

No. 4

F168

see March 1936 - 412

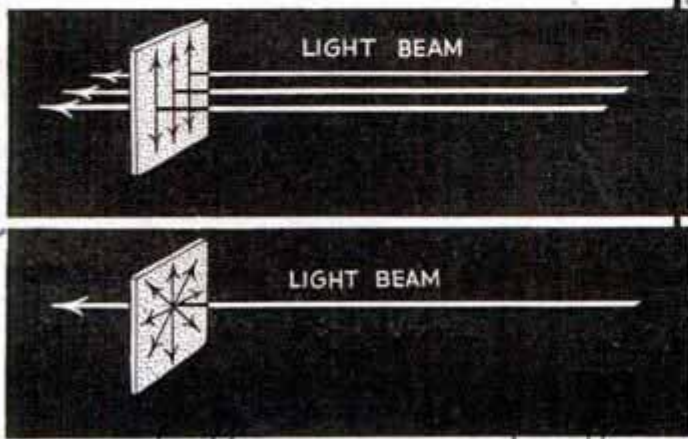
One-Way GLASS Stops GLARE

SOUGHT ever since the invention of the automobile, glareless headlights have at last been shown in actual operation in a demonstration of a unique glass which polarizes light and is known as Polaroid.

A pair of blinding headlights was set up at each end of the demonstration room. When these were viewed through a Polaroid windshield, these brilliant lights seemed almost out, although objects between the two sets of lights were brilliantly illuminated.

Polaroid looks like clear, colorless glass

Below, Polaroid glass, top picture, "combs out" tangled light waves so they occur in one plane or parallel planes, but ordinary glass, at bottom, does not have this effect



Top, how Polaroid windshield cuts glare of Polaroid headlight. Below, how two pieces of glass, whose polarizing planes are at right angles to each other, can be made opaque

(d no Edward Land)

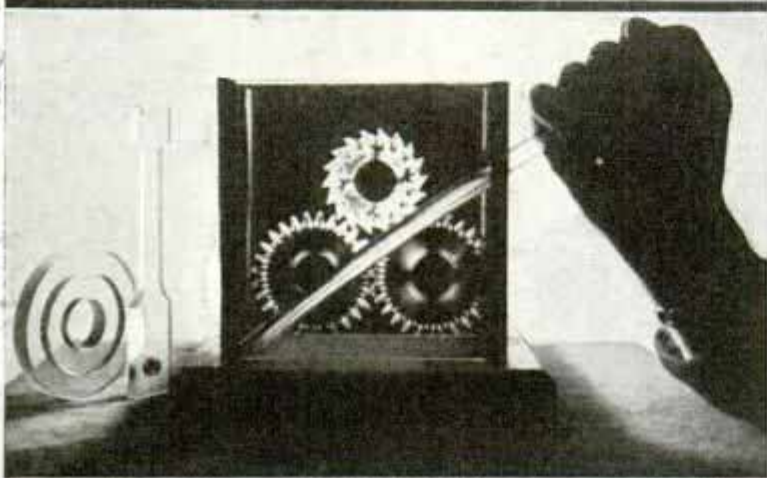
The Polaroid Corp. 285 Columbus Ave
730 Main St. Cambridge, Mass. Boston Mass

Boston Mass

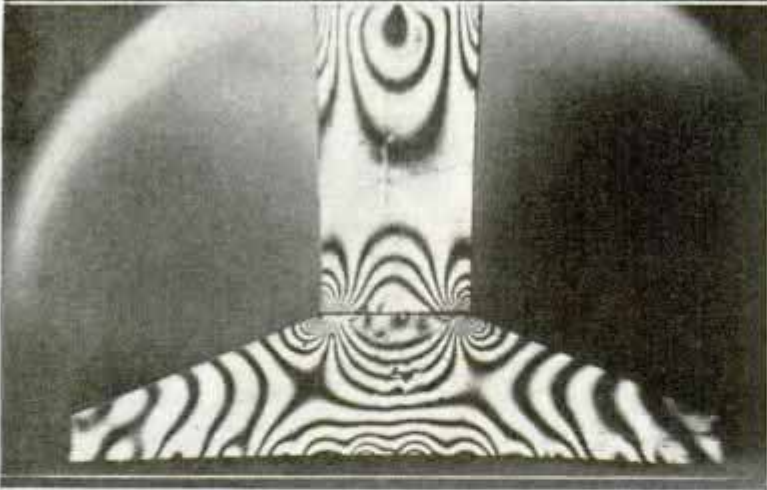
Land. Wheelwright Laboratories
168 Hartmouth St.



Besides removing the glare from automobile headlights, this glass makes lifelike three-dimensional movies available for commercial projection, gives beauty specialists and photographers a new penetrating light for viewing the skin, provides engineers with a powerful means of spotting defects in the design of new bridges, aircraft, and other structures long before they are built, and gives science a new tool for prying out secrets in many branches of knowledge.



About ten years ago a boy in his teens, Edwin H. Land, was attracted to the astonishing properties of polarized light. It gave interesting optical effects, which had been observed for many years before his time. But industry and the public could not use polarized light until some practical, cheap, and simple method for producing it could be found.



Land went to Harvard, but his pet idea bothered him so much that he finally took a leave of absence and induced one of his teachers, George W. Wheelwright, to join him. After years of secret work, he developed "Polaroid glass" which is really not a glass but innumerable artificial crystals suspended in a cellulose matrix a few thousandths of an inch in thickness. These ultra-microscopic crystals really make a sheet of glass act like a single large mineral crystal.

Top, using polarized light to see below the outer skin. Center, using polarized light to reveal internal stress and strain in machine parts. Bottom, Polaroid analysis of stress and strain in spread footing used in building construction

Now to explain the theory of polarization, Land was forced to abandon the old theory that light

and light that has passed through Polaroid looks like ordinary light. The light rays, however, are actually combed out or polarized so that all the vibrations of the rays occur in one plane. Thus light can now be controlled on a scale which has never been known before.

waves travel in longitudinal lines, like sound waves. According to Land, light waves move longitudinally in the direction of the beam, but the "elements of the wave" move at right angles. Light, therefore, may be said to consist of transverse waves. For instance, light from the sun

File 118
 Edwin H. Land
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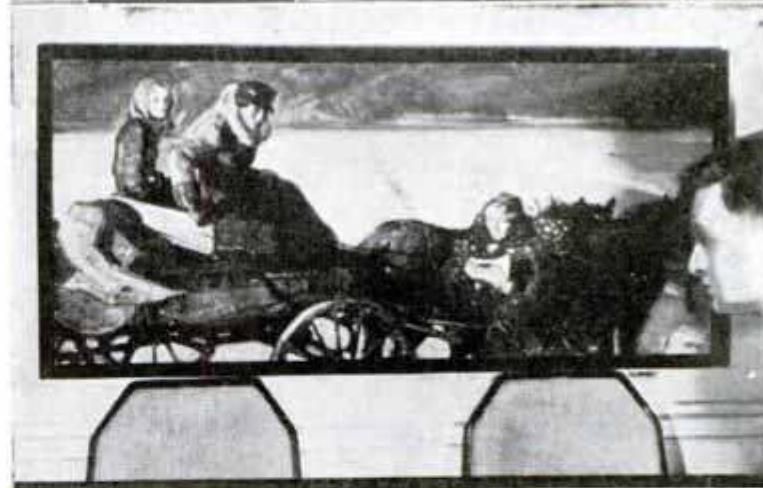
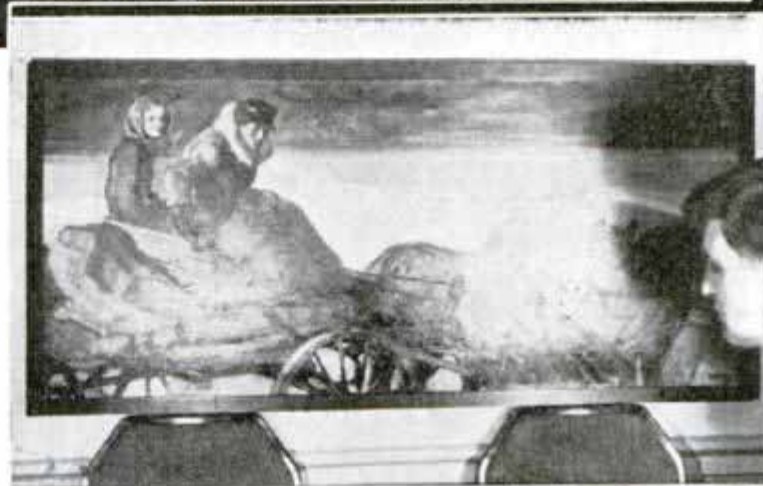
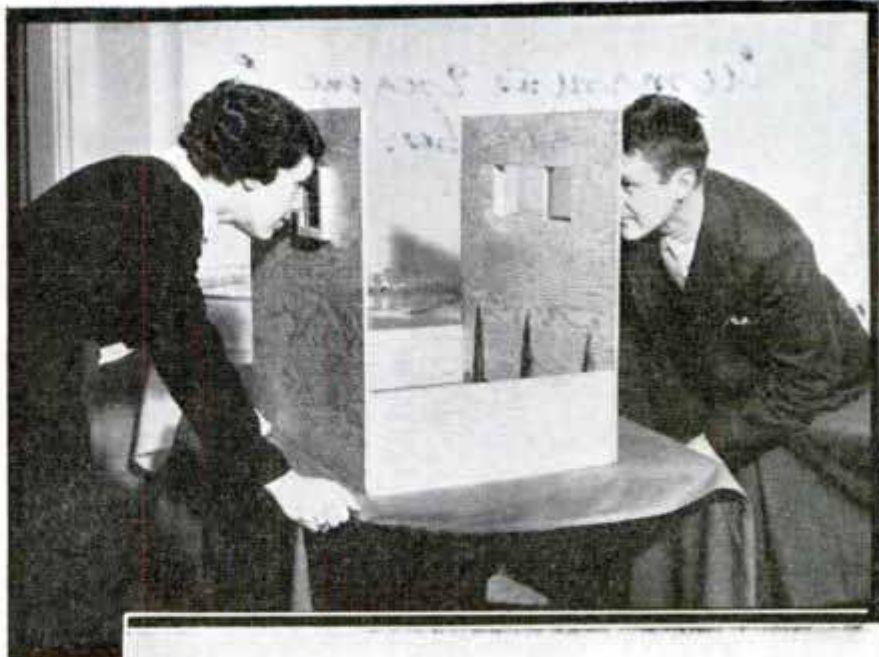
vibrates in all possible planes at right angles to the direction of the beam. Such light is unpolarized, or "tangled."

The new Polaroid glass contains a thousand billion crystals per square inch. These crystals lie parallel and in one direction, so that when ordinary light waves pass through Polaroid they are "combed" out and untangled. Polarized light means that wave motions are in one plane, or in parallel planes.

If properly placed, two sheets of Polaroid glass can be made opaque to the eye. This opens a possibility that Polaroid might be used in apartment house courtyards. You would be able to see outside your own window, but you could not see through your neighbor's window, because the two glass sheets cancel each other. The disadvantage, however, is that Polaroid cuts down illumination; and, besides, your neighbor can see through your glass merely by opening his own window.

Another possible use of Polaroid is in theatrical and building illumination. If you project polarized light from behind a screen of transparent or semi-transparent substance, like Cellophane, you refract the light on this colorless substance and obtain a veritable fairyland of colors in soft, pleasing shades. By rotating your light source, these colors can be made to change continuously through the whole color spectrum. A mobile color system like this will find many applications in stage presentations, in colored-movie photography, and in building illumination.

For seeing pictures without glare, it is proposed to use Polaroid illumination in museums. In this way, the difficulty of standing off and seeing an oil painting from the right angle is overcome at once.



Top, one-way glass permits you to see out your window, but not through one across the way. Below, picture in center was taken in natural lighting, and one at bottom by Polaroid lighting. Note the absence of glare in lower one

Polaroid lighting makes a canvas glareless from all angles, and it affords great assistance to photographers, as well as to lovers of fine art.

A Polaroid screen erected between two people enables one to see beneath the

(Continued to page 154A)

This is a photograph of a Polaroid screen. The screen is made of two sheets of Polaroid glass. The top sheet is transparent, and the bottom sheet is opaque. The screen is used to view a picture in a museum. The picture is an oil painting of a scene with people and a horse-drawn carriage. The top photograph shows the picture as seen through the screen in natural lighting, with glare. The bottom photograph shows the picture as seen through the screen with Polaroid lighting, which is glare-free.

*Com. John R. West, Jr.
Asst. & Vice President
Cummings Engine Co.
Columbus, Ind.*

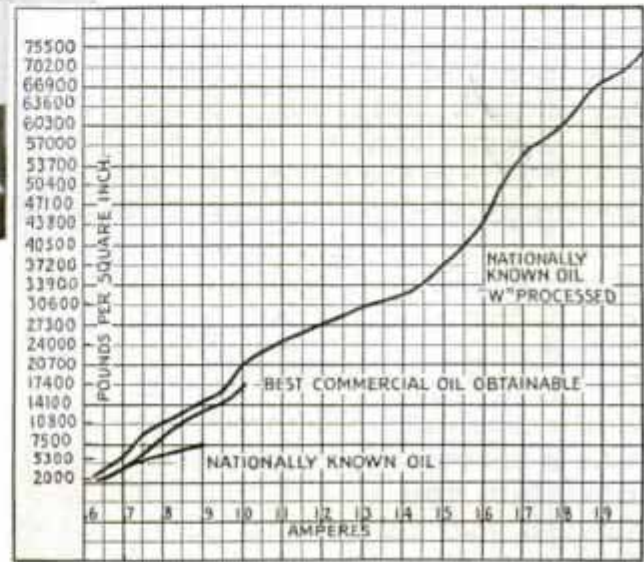
Lubricant Clings to Metal and Reduces Wear

*Shaw, Pres. E. C. Co.
Railway & Machine Works
Cincinnati, Ohio*



Left, one of the tests in which electronic lubricant was found highly efficient. Below, graph shows result of the tests, with the processed oil withstanding several times the load limit of untreated lubricants

Development of a process which causes lubricants to adhere to metal surfaces when they are warm, when a scraping, wiping or washing action is present or when heavy pressure is applied has been announced. This adherence is directly contrary to the action of untreated lubricants. The process is said to introduce an electronic action, meaning that a lubricant so treated contains a number of infinitely small electronic particles, each carrying an electrical charge having an affinity for metallic surfaces and therefore is attracted and firmly bound to the surface to which the lubricant is applied. Use of processed lubricants, the developers claim, will result in greatly increased life and efficiency in the machine and a corresponding reduction in cost of operation and maintenance. It is considered probable that the new lubricants will make possible more economic design of all forms of machinery requiring lubrication because the size of bearings and journals in many instances may be reduced appreciably. The process does not change conventional properties of the lubricants, save to improve high and low temperature characteristics. One instance where treated oil would prove invaluable is in the automobile engine. Started in winter, the engine receives little, if any, lubrication until the oil warms up. The treated oil, in contrast, would remain on the metal surfaces, even after standing for long periods, and lubrication would begin the moment a single part of the motor moved.



Test Plane Noses over Safely with Protective Cradle

To enable test pilots at Wright Field, Dayton, O., to nose over an army plane deliberately in trial flights, air corps officials use a special cradle of metal tubing to protect the front of the ship. When the tail of the plane is tilted up, it somersaults smoothly on its cradle. The army flyers are testing new cabin designs required by increasing speed of combat planes. One cabin has an adjustable seat which lets



Metal "cage" around nose of plane allows pilot to somersault on field in testing new cabin designs

*Com. Charles J. Bauer,
Dayton, Ohio*

pilots raise or lower themselves eight inches, thus allowing a lower cabin and cleaner streamlining. The pilot is protected by sponge rubber padding, and a heavy beam overhead reinforces the cabin.

F138 *Chideanapolis* Pass-Around Electric Lighter Has Glowing Tip

\$ 1.00



Handy for lighting cigarette, pipe or cigar, the latest electric lighter is flameless. It consists of two parts, the base to which an electric cord is attached for plugging into alternating or direct current sockets and the pass-around tip which is heated by pressing it into the base. The tip holds heat long enough to light several cigarettes.

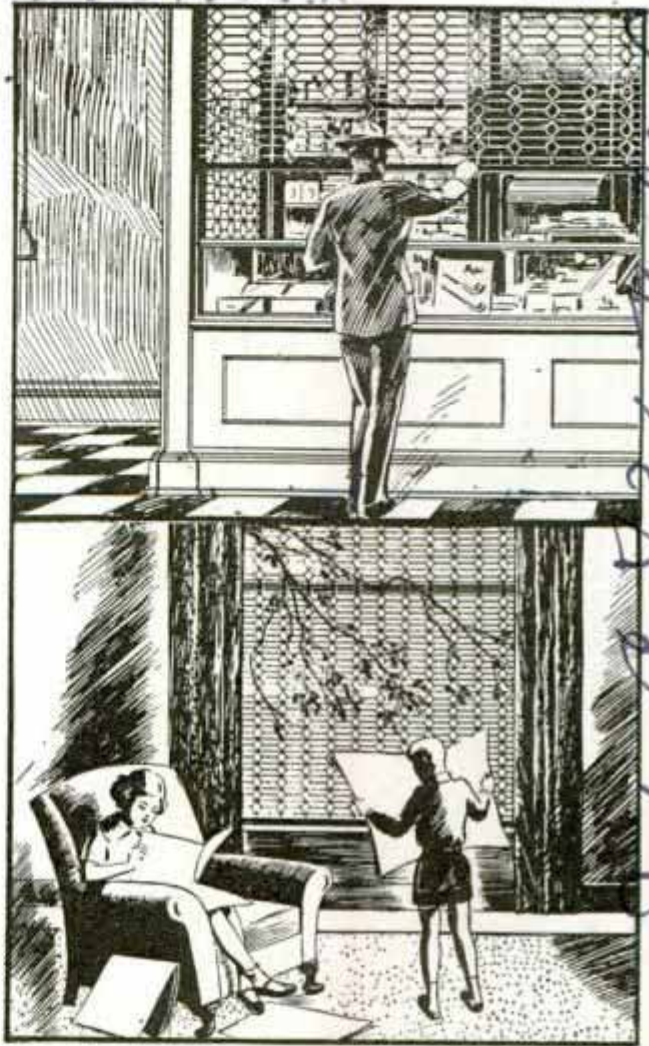
Smoke Bomb Fired above Fog Shows Planes Way to Port

Fog, the dread of aviators, is gradually being beaten. At Croydon airdrome in England a signaling mortar has been installed to throw smoke projectiles up through the mantle of fog whenever airplanes approach. The bomb is fired 1,000 feet high, where it explodes and shows incoming pilots the location of the field.



Firing smoke bomb from mortar at Croydon airdrome as signal to pilots flying above fog blanket

Rolling Metal Grille Guards Windows and Doors



Top, rolling down grille to protect cigarstand. Bottom, grille in window of home

Protection against trespasser, burglar and kidnaper, a metal grille for window, door or passageway is available. When not in use, it coils on a roller above the lintel, out of the way and unnoticed. It can be lowered quickly and locked. In operation, the grille travels in steel guides on either side of the opening. Manual or automatic operation is possible. If desired, the grille can be connected for use with an electric motor and push button or a photoelectric cell or a sensitive mat. It is made of steel, stainless steel, bronze, or aluminum, its round metal bars being joined by pressed links of octagonal shape. For schools, nurseries, store entrances, gateways, residences, elevator shafts, vaults, compartments and the like, the grille provides a safe barrier without sacrifice of air, light or vision.

*Cooley Electric Furnace Co
1411 E. 20th St. Indianapolis*

*Kinnear Mfg Co 126 Field Ave
Columbus Ohio*

2142

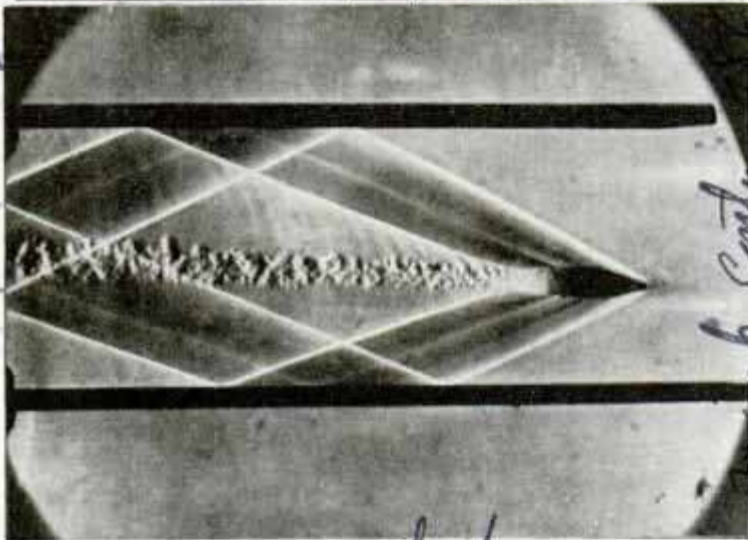
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Photographs of Sound Waves

Show Their Path of Travel

New York City



Top, photographs of sound waves produced by two spark gaps. Below, waves emanating from a bullet

Many of the theories concerning the action of sound waves have been confirmed by the eye of the camera. Photographs of sound waves in motion are obtained by a very technical process known as streak photography which was discovered more than seventy years ago by the eminent physicist, Toepler. However, it has been in recent years only that the method has been applied practically in the realm of acoustics, ballistics, flow-physics and heating technique. One picture shows the waves produced by a bullet traveling between two parallel plates. Parting from the nose of the projectile are sound waves and from the rear are tail waves, all reflecting against the plate walls like light

rays against a mirror. The stippled effect behind the bullet is produced by waves from the wake, the vacuum. The other photograph shows sound waves produced by two spark gaps. These waves are similar to those produced by a pebble dropped into quiet water and can be seen to be spreading evenly and virtually independently of each other.

Certificate of Brake Test Made Automatically by Small Recorder

Certificates showing the condition of the brakes are stamped by an automatic tester each time the car is brought to a stop in state and city tests. Weighing only fourteen pounds, the device makes two readings, one on the certificate inserted in the machine, and the other on a scale on top. The test is made with the machine clamped on the left running board. While the car may be running at any speed from five to thirty miles per hour when the brake is applied, the pointer and the certificate will record the stopping distance exactly as if the car had been traveling twenty miles an hour. The stamping on the certificate cannot be erased or altered. The tester may be used inside the car in inclement weather, provided it is held firmly on the floor while the test is being made.



Removing brake certificate from machine

Bendix Products Corp. Bendix Drive

Vertical handwritten notes on the left margin.

Vertical handwritten notes in the center margin.

Vertical handwritten notes on the right margin.

Germany Arms Mosquito Fleet of Speedboats

Abeking and Rasmussen



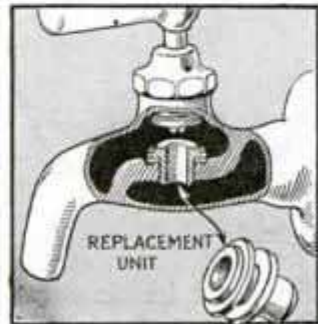
Top, one of Germany's "pocket battleships," a tiny cruiser with twin 550-horsepower gasoline motors. Left, another of the "mosquito fleet," secretly armed, doing forty miles an hour

for the German navy in yards at Lemwerder, with a top speed of forty miles an hour. Its armament is a navy secret. These tiny, amazingly fast war boats can be formidable in attack against larger battleships and transports, and their mobility helps protect them.

"Pocket battleships" are taking the place of the great dreadnaughts of Germany's wartime fleet, and a veritable "mosquito fleet" of tiny armed ships is understood to be growing in German shipyards. These torpedo boats, sloops, cutters and even midget cruisers are too small to be governed by treaty restrictions yet are well protected by steel armor, powered by gasoline engines and reputedly strongly armed, representing the best of modern navy engineering in "pocket" size. A German shipbuilder produced for Finland recently a dwarf protected cruiser with two 550-horsepower gasoline motors capable of twenty-five miles an hour. One of the boats illustrated is a speed cruiser built

F140.
Worn Faucet Seat Replaced by Unit Easily Installed

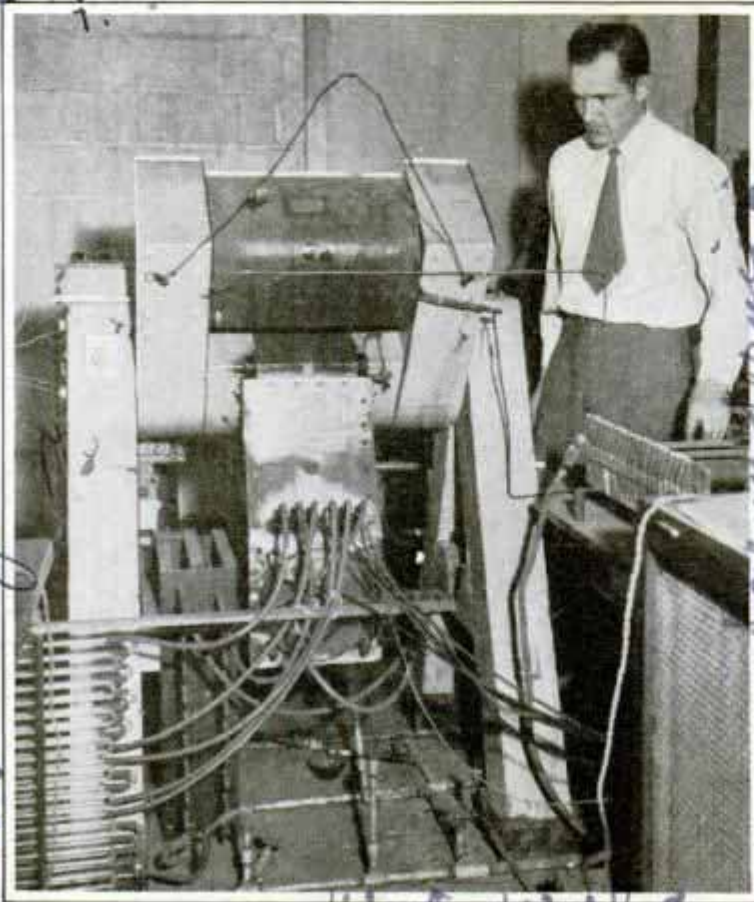
Home owners can repair worn faucet seats by replacing them with a new unit at less expense than installing a new faucet. The unit is inserted in the throat of the old seat with a lead pencil, presenting a new seat to the valve stem washer. A lead washer against the worn seat makes the joint watertight.



*Pink Specialty Co
1891 E 10th St*

Chicago and Boston

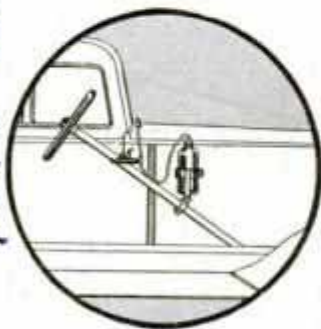
Earth's Lightest Solids Made by Separating Atomic Twins



Splitting up twin atoms is the business of this apparatus in a Swarthmore, Pa., scientific research laboratory

In the Bartold Research Laboratory at Swarthmore, Pa., scientists are experimenting with an electric machine which produces the world's lightest solids. The feat is achieved by a newly developed "detector" which separates twin atoms.

F149 Spray Gun to Clean Windshield Is Operated from Dashboard



Windshields can be kept clean in any weather—frosty days, muddy days, dusty days—by installing a spray cleaner that is operated by hand from the dashboard. The cleaning fluid, supplied with the unit, is mounted in its container on the steering post beneath the hood, and the pressure

gun on the instrument panel sends a stream from the nozzle at the base of the windshield. This cuts the grime, frost, mud, and insects from the glass and lets the wiper clean it efficiently.

F174 Pile Driver Is Operated by Explosion Cylinder

Instead of dropping a weight from a high tower, the latest pile driver in Germany has an explosion cylinder that bombards the pile with a heavy piston. When the piston rises to the top, expanding gases drive it down with great force. It weighs 1,100 pounds, and the recoil from each explosion lifts it two feet. Two men can operate the pile driver.

Carving Swordfish Blades Is Seaside Hobby

Joseph Agna of Provincetown, Mass., makes a hobby of transforming the "blades" of swordfish into ornaments. He scrapes and polishes the sword, paints designs on it and uses carved wooden figures for handles. One of his swords, decorated with a sketch of navy vessels, was sent to the White House as a gift to President Roosevelt.



This ornamental sword, polished, painted, carved and given a wooden handle, was once a real swordfish

Ant. J. C. Johnson,
6 Prucille Alden

Weston Products, Inc.
1016 Baltimore Ave.
Kansas City, Mo.

Erstingen, am Neckar
Germany

W. C. Johnson

Provincetown, Mass.

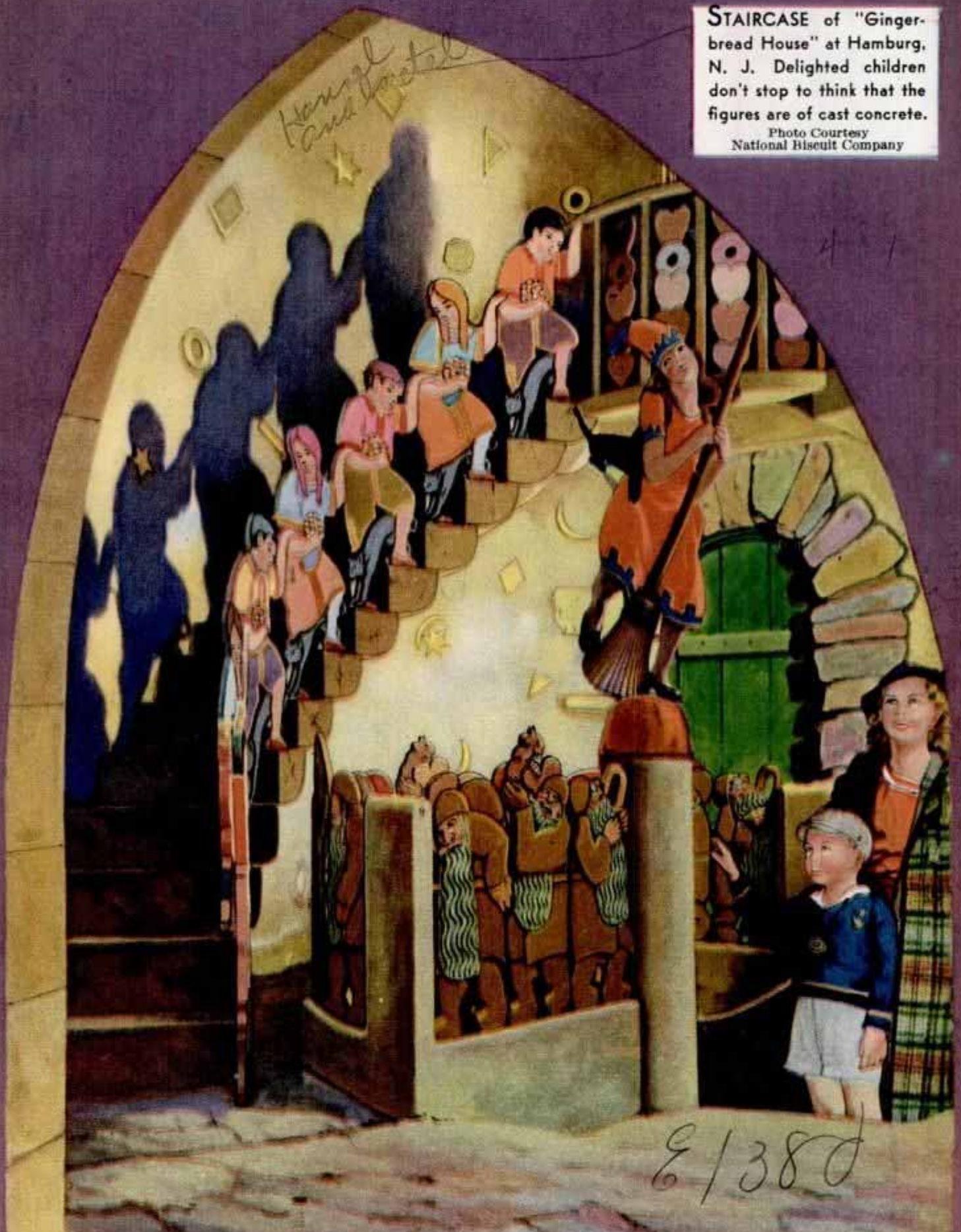
Provincetown, Mass.

Road.

From the RAINBOW to CONCRETE

489

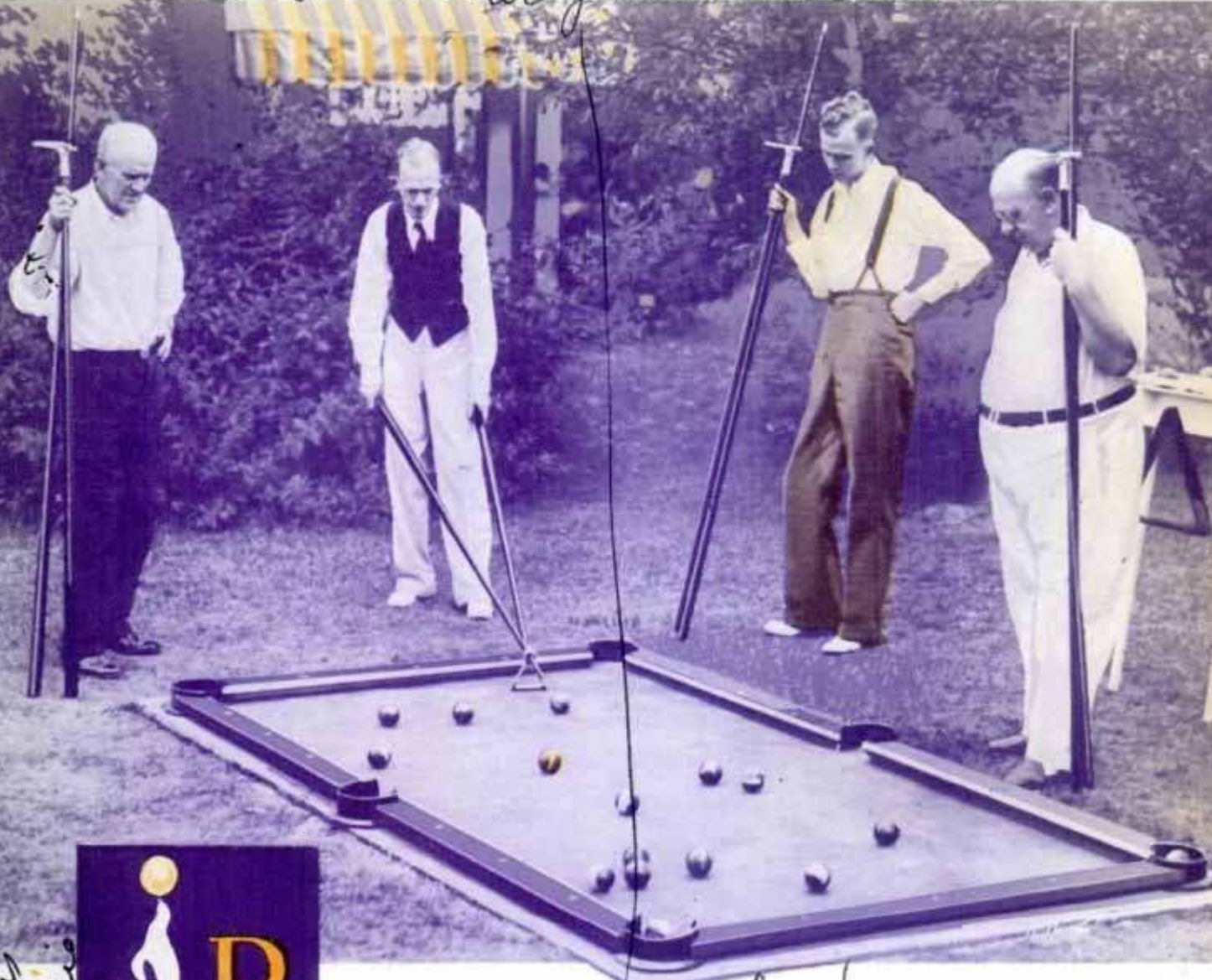
STAIRCASE of "Gingerbread House" at Hamburg, N. J. Delighted children don't stop to think that the figures are of cast concrete. Photo Courtesy National Biscuit Company



*Hamburg
Candy Hotel*

6/380

67000 *made of concrete*



490

No dealer known



From Columbus Citizens Columbus Ohio
Carl. H. O. Hayes, 124-9th St. Wheeling, W. Va.

PICTURE Wall street paved in glittering gold, Fifth avenue paved in rich crimson or the streets of Wash-

ington with traffic lanes of red, white and blue!

These are possibilities as a result of current studies and developments in concrete. For colored concrete aggregates, in the latter stage of development, will produce concrete with the brilliance of precious stones, and in many colors. New Orleans suggests colored streets as a way to give personality to a city. The gay spirit of Mardi Gras has been permanently cast in old Canal street by paving with terrazzo, a popular and effective decorative treatment used primarily for building lobbies and corridors.

Such streets set a new tempo for build-

BILLIARDS, like bowling, has been made an outdoor game by concrete as evidenced by this happy scene.

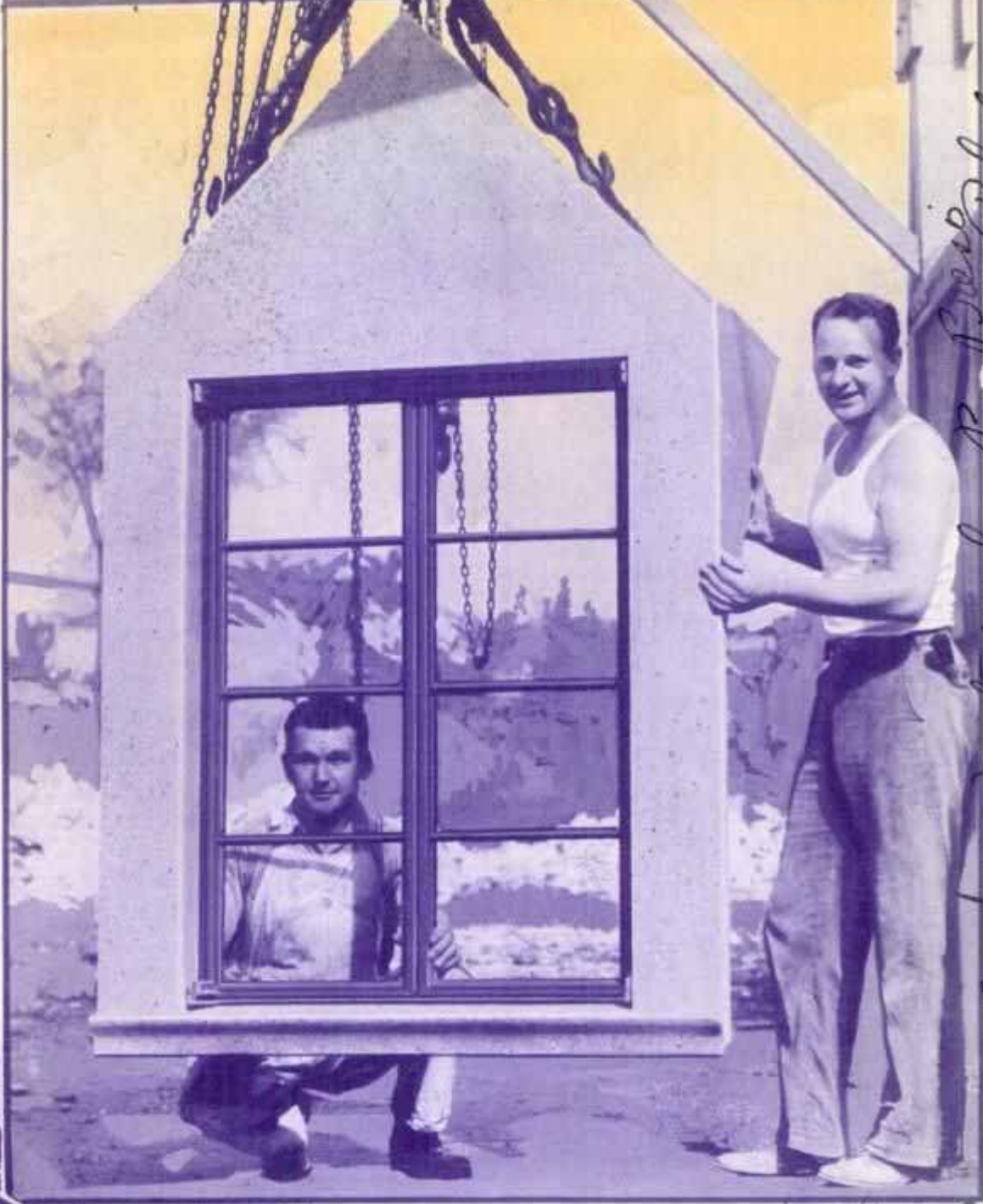
ings, and as streets vie with nature in a riot of color, buildings may be expected that will rival the rainbow in a harmony of hues. A sample can be seen in Philadelphia where the magic stone, concrete, in a colorful and pleasing blue tone, houses another infant prodigy—radio. In California is another development in the new building era. Here is a type of construction well adapted to the art of painting with light, so dramatically portrayed at a Century of Progress.

California architects have developed a new concrete architecture, putting concrete to work as a self-sufficient structural material, needing no superficial decoration, and requiring no preservative coatings. In its natural tone it is admirably suited to serve as the canvas,

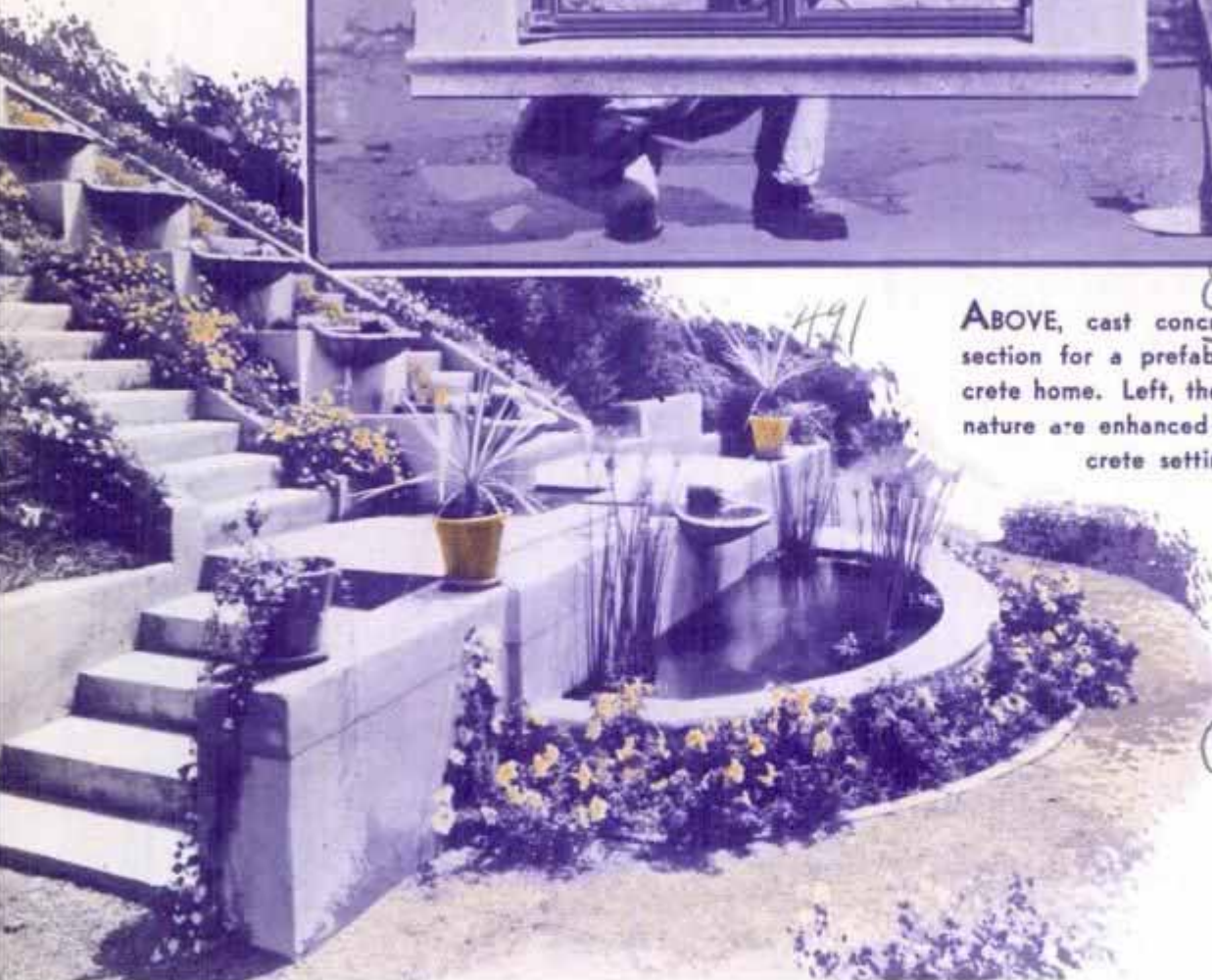
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81380

491



Earley Process Corp. National Precast Bldg. Washington D.C.



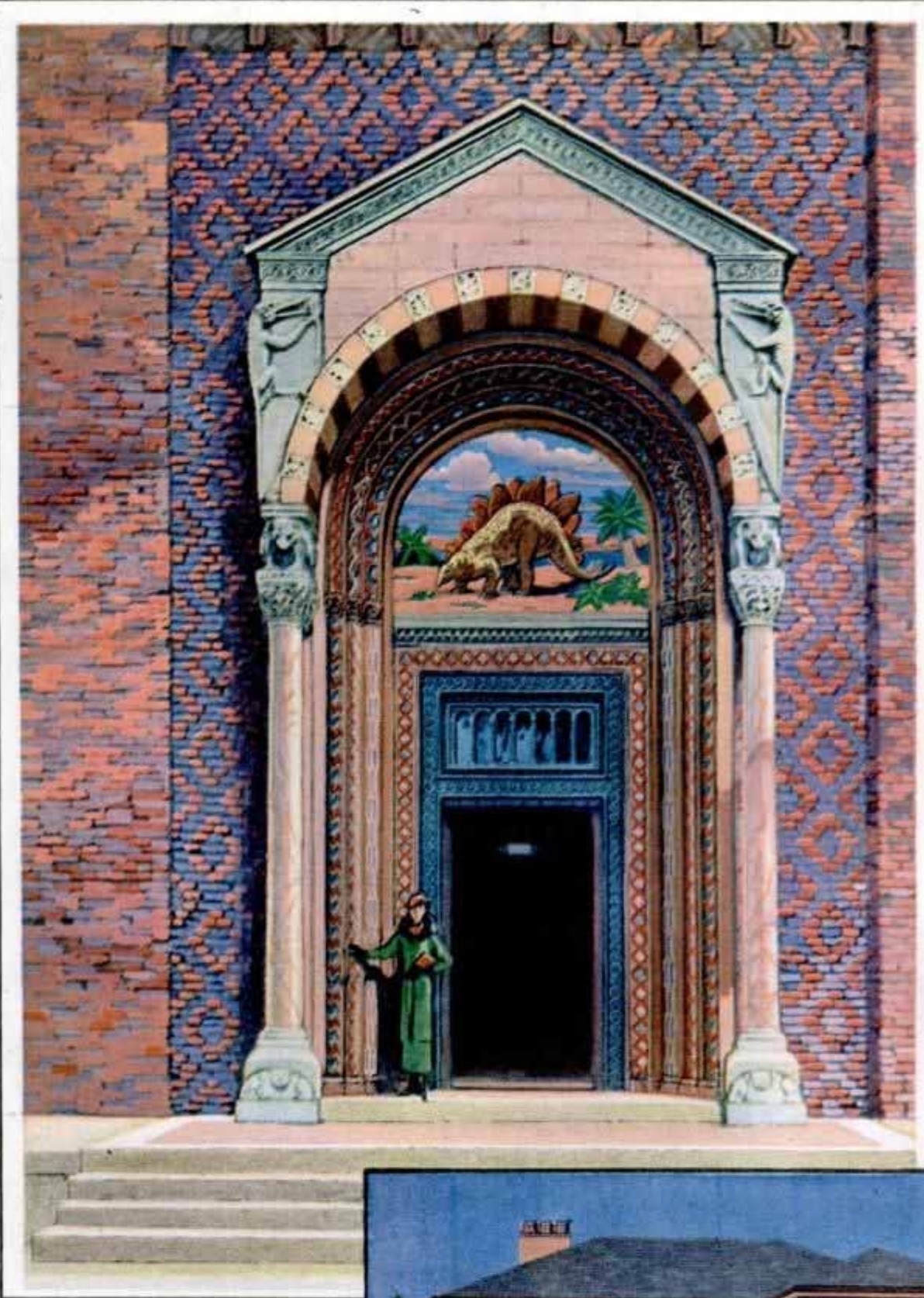
Earley
ABOVE, cast concrete window section for a prefabricated concrete home. Left, the beauties of nature are enhanced by this concrete setting.

*at
 391
 Carolwood
 Street,
 Los Angeles*

Earley Process Corp.

81380

492



492

ENTRANCE to the reptile house of the Washington, D. C., zoo. The intricate geometric patterns of the reptile's back are reproduced in the concrete columns. Right, distinction and individuality can be incorporated in the precast concrete house.

Carley



THIS entrance illustrates a modern interpretation of mosaics in colorful concrete by John J. Earley.

493

while the artist, with light, paints a symphony of color on it. Or go to the Temple of Light, near Chicago, on the shore of Lake Michigan, there to see the tough, rugged sinews of concrete, jeweled with crystal-like fragments of quartz, so delicately molded that they give the appearance of a piece of fine lace. Then go to Washington, where the mechanics of prefabrication have been applied to a cottage to make it "fit for a king." Conservatively trimmed in colorful concrete mosaics, the house combines dignity with substantial warmth. These are among the spectacular ways in which



Specifications from
Portland Cement Co
33 W. Grand, Chicago



494

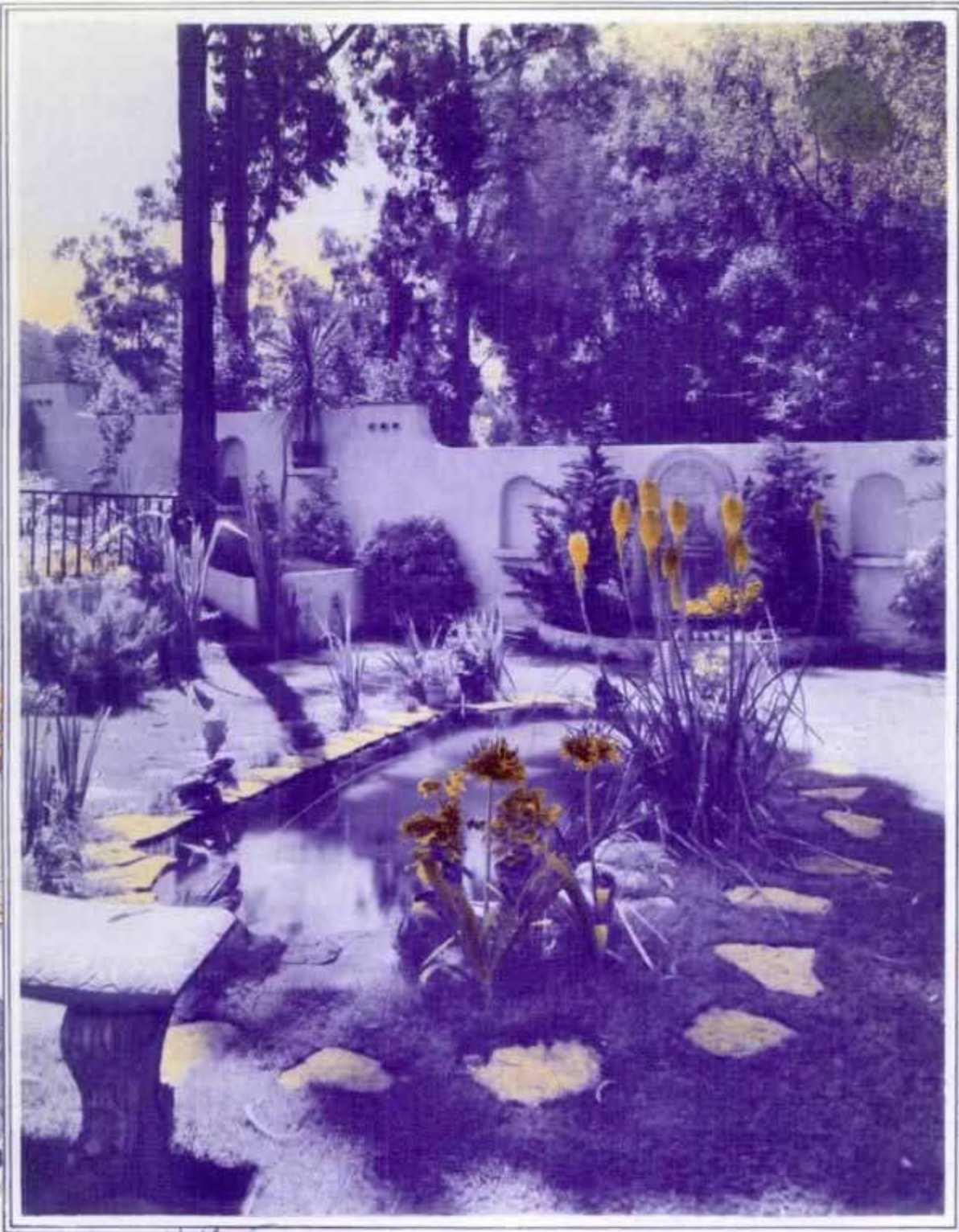
concrete may influence the daily life of tomorrow.

Cities today dump wastes in our rivers. Gone is nature's automatic control system against flood, drought, erosion, and filth-bred disease. Overburdened with man-made waste, streams are no longer refreshing or self-cleansing. Fish die, streams are condemned for water supply and for recreation. Slowly the water table has dropped. Floods and drought come and the soil, enriched through the centuries, is washed away. Science at last has gone to work replacing nature's prodigious automatic control system. River beds must be enlarged, head water areas turned into vast reservoirs by a series of dams, immense treatment plants built to convert poisonous sewage into harmless effluent before discharge into streams, floods brought under control and countless would-be land and soil destroying rivulets blocked. Less spectacular but more vital, concrete has been regimented for the big job ahead: that of replacing nature's automatic water-control system.

Picture a system of roads, singing with 100,000,000 spinning wheels of the highway—the locale of the world's



TOP, outdoor concrete ping-pong tables in public parks have brought this popular game many new enthusiasts. Below, one of the points of greatest interest in the horticultural exhibit at the Century of Progress was this "Old Mill Garden" with its concrete pool and flagstone paths.



495
ASSURING privacy, the concrete fence also adds to the charm of this garden with its interesting pool and ornamental garden furniture.

greatest human slaughter. Overwhelmed by demands for good roads for a rapidly multiplying multitude of cars, road builders fail to anticipate an accelerated speed of travel. Needing roads designed for modern cars, a motor era cries for safety. Engineers now are planning safe roads, re-aligned to eliminate dangerous curves; rigid, true and even driving surfaces; wider roads, where traffic requires; separated traffic lanes to prevent head-on collisions; grade separations at

busy street intersections; non-skid pavement surfaces; elevated highways; pedestrian underpasses; highway sidewalks; bicycle paths; wide culverts and bridges, without dangerous columns and abutments; express roads free of slow-moving traffic. Concrete again fits into the picture.

Today we face a new era in personal comfort with air conditioning the year around, drafts eliminated, bedrooms and basements, and rooms between, all main-

61380.

Marshall Field Tearoom
7th floor.



496

SKILL, imagination and a sense of the artistic have been combined to produce this beautiful and colorful cement slayte, another of the hundreds of possible new uses for cement.

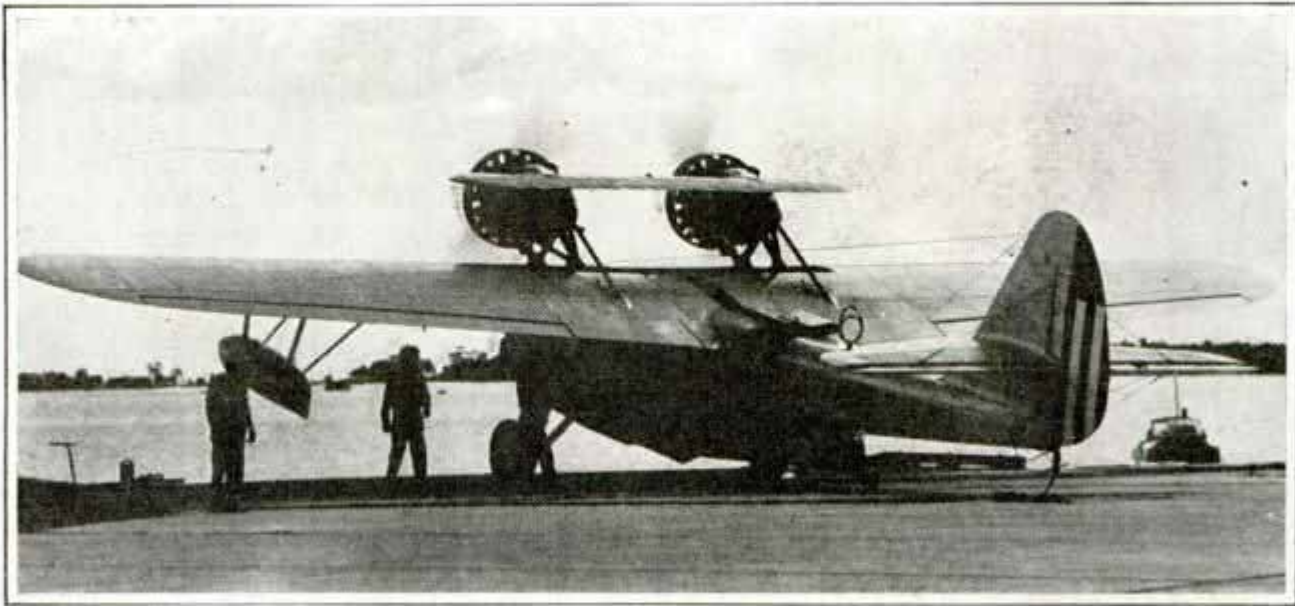
tained at livable temperatures, and nerve-racking echoes and re-echoes gone. A nation to be rehoused to new standards offers another field for the magic stone.

Major disasters still reap their toll. Earthquakes, fire, hurricanes, tornadoes and disease which thrives in dirt all are to be conquered. Homes, apartments, schools, churches, industrial and commercial buildings all can be made safe, and concrete can do part of the job.

Industry, seeking striking dress and modern style with which to
(Continued to page 130A)

F129 Mr. Anthony V. Pragasen
Box 496, Biloxi, Miss.

Coast Guards Grow Wings to Save Life at Sea



Twin-motored rescue and patrol plane of the U. S. coast guard air station at Biloxi, Miss., warming up its engines on the ramp preparatory to a flight over waters of the Gulf of Mexico

Far out at sea a sailor is stricken with severe illness. A coast guard plane, "eye of the fleet," roars out over the ocean to rush him to a hospital ashore. A sudden squall menaces fishing smacks and small boats. Again the coast guard flyers race through the sky to give warning, survey the situation and coordinate rescue work by land and sea. More than 5,000 lives are saved and \$50,000,000 in floating property preserved every year by the coast guard. Founded in 1790, the service has made steady progress in lifesaving, prevention of smuggling, protecting customs, patrol-

ling the ice fields and international borders. The "air" arm, youngest branch of the coast guard, has rapidly expanded in importance during the last fifteen months as an aid to the cutters and shore stations. There are about fifty planes in the service now—all amphibions or seaplanes except those on border patrol. Coast guard aviation stations and air detachment units are located at Salem and Gloucester, Mass., Cape May, N. J., Miami and St. Petersburg, Fla., Biloxi, Miss., San Antonio, Tex., San Diego, Calif., Port Angeles, Wash., and Buffalo, N. Y.

Designs Are Etched on Glass by Winter's "Sand-Blast"

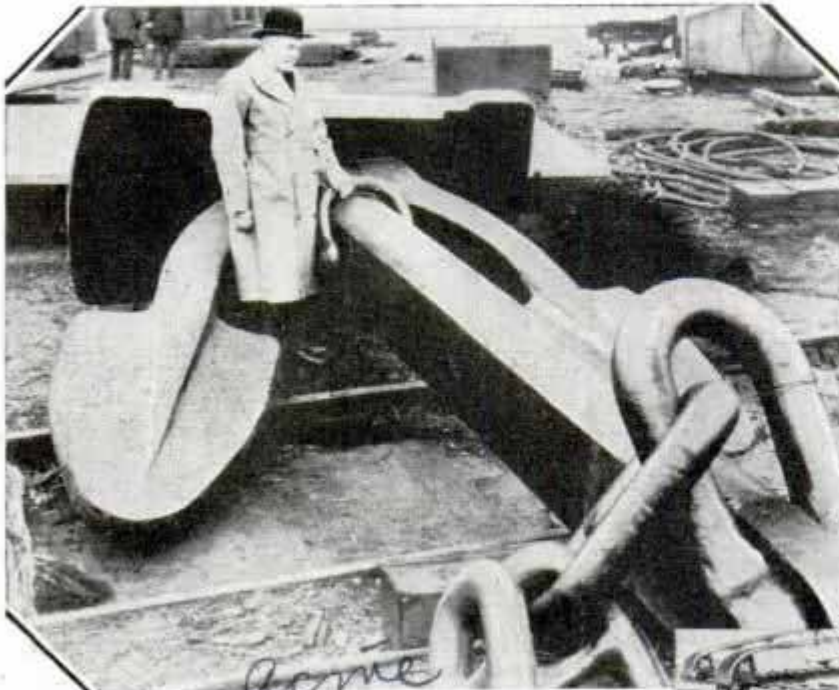
Etching on glass with nature's own "sand-blast" is a favorite winter pastime of Cape Cod residents and the coast guardsmen who patrol the windswept ocean beach. Stencils are cut from paper and pasted on window glass or bottles, which are then left exposed on the shore. The fierce winter winds whip millions of grains of sand against the glass, quickly producing the effect of frosted glass. When the paper pattern is removed, the clean-cut design stands out against the sand-blasted glass. Cape Cod residents thus etch designs of boats, anchors, lighthouses and bits of "local color" for their front door panes.



F126
Cent. J. C. Johnson, 6 Priscilla
Biloxi Road, Provincetown

F96
7/9/36

Massive Anchors and Chains on Superliner



Three sixteen-ton anchors and 150 tons of anchor chains have been installed on the superliner "Queen Mary," for her maiden voyage from England to the United States. Two of the anchors will be in regular use, the third ready for an emergency. Each link of the massive chain is two feet long and weighs about 225 pounds. The liner is being fitted out at Glasgow, Scotland, to enter the Cunard White Star fleet.

Top, giant anchor ready for superliner. Bottom, massive chains for the anchors



Robot Pianist Upsets Theory That Touch Controls Tone

Contrary to the theory of eminent musicians, the tone produced by striking a given key on a piano is the same no matter in what manner the key is struck. Ignace Paderewski is the notable exception among pianists who cling to the idea that the way the key is struck influences tone. Proof that the old theory is false was supplied recently by Prof. Charles Weyl of the University of Pennsylvania in a demonstration in which he used a giant model of a grand piano containing one key, one hammer and one string. With it, Professor Weyl showed that after striking the key the musician had no more control over the tone than a marksman has over a bullet after he has pressed the trigger of the gun. A mechanical pianist demonstrated gradations of tone so small that no ear could detect them, yet they were visible on an oscillograph.

Philadelphia

When the first railroad trains stopped at Chillicothe, O., conductors called out "Twenty minutes for quinine" and passengers at this "quinine stop" were given medicine to prevent spread of malaria prevalent in the region.

Radio Brake Stops Automobile at Grade Crossing

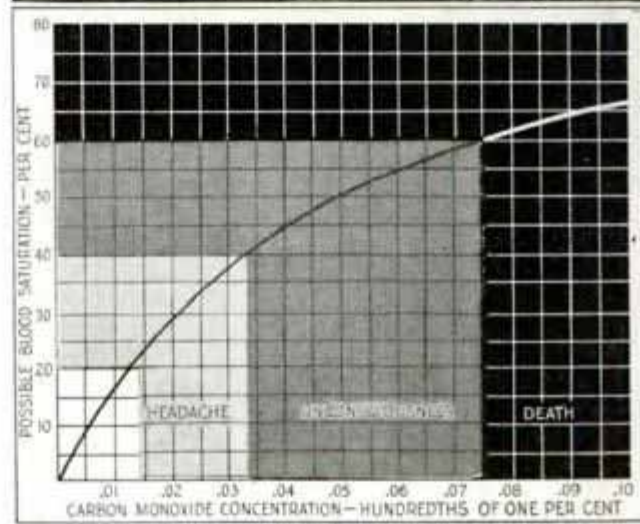
Radio may some day prevent grade crossing accidents. A patent was issued recently for a "radio brake" intended to stop cars automatically at grade crossings if a train is approaching. The crossing would be equipped with two radio sig-

Science Service
1/31/36

F136
 School of Electrical Eng.
 from Railway Eng.
 1/18/36 P. 154H

Dr. Jerome H. ... 23 W. 17th St. New York City

Gas Detector Shows Amount of Carbon Monoxide in Auto

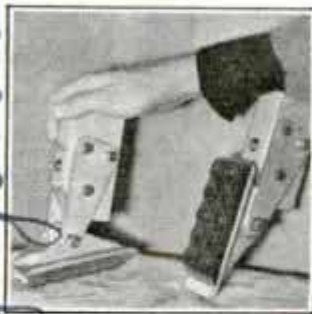


Continuous carbon monoxide detector installed in car and chart showing carbon monoxide concentrations which will cause headache, unconsciousness and death

nalling stations emitting waves of a predetermined frequency down the road in each direction, the sending range being limited to about 500 feet. An approaching train throws a switch putting the stations on the air. An auto equipped with the radio brake carries a receiver tuned to the grade crossing signals which are picked up and converted into electrical energy. Amplified, the energy operates a relay which flashes a warning light on the dash. If the driver does not stop, a delayed relay goes into action and shuts off the motor. At the same time a small electric motor motivates an "artificial foot" which steps on the brakes and brings the car to a stop. The brakes stay locked until the driver releases them by stepping on the foot pedal.

511-9th St. Cashesville, Mo. Alton Safety Ladders Co.

Metal-Rubber Feet for Ladder Prevent Slipping



Ladders which are equipped with a new type of foot are prevented from sliding on smooth floors, ice or in dirt and cinders. The foot consists of a metal shoe with a rubber suction-cup base. It swings through a quarter turn to permit use on floors and back for use in dirt or cinders. It may be adapted to the legs of any ladder.

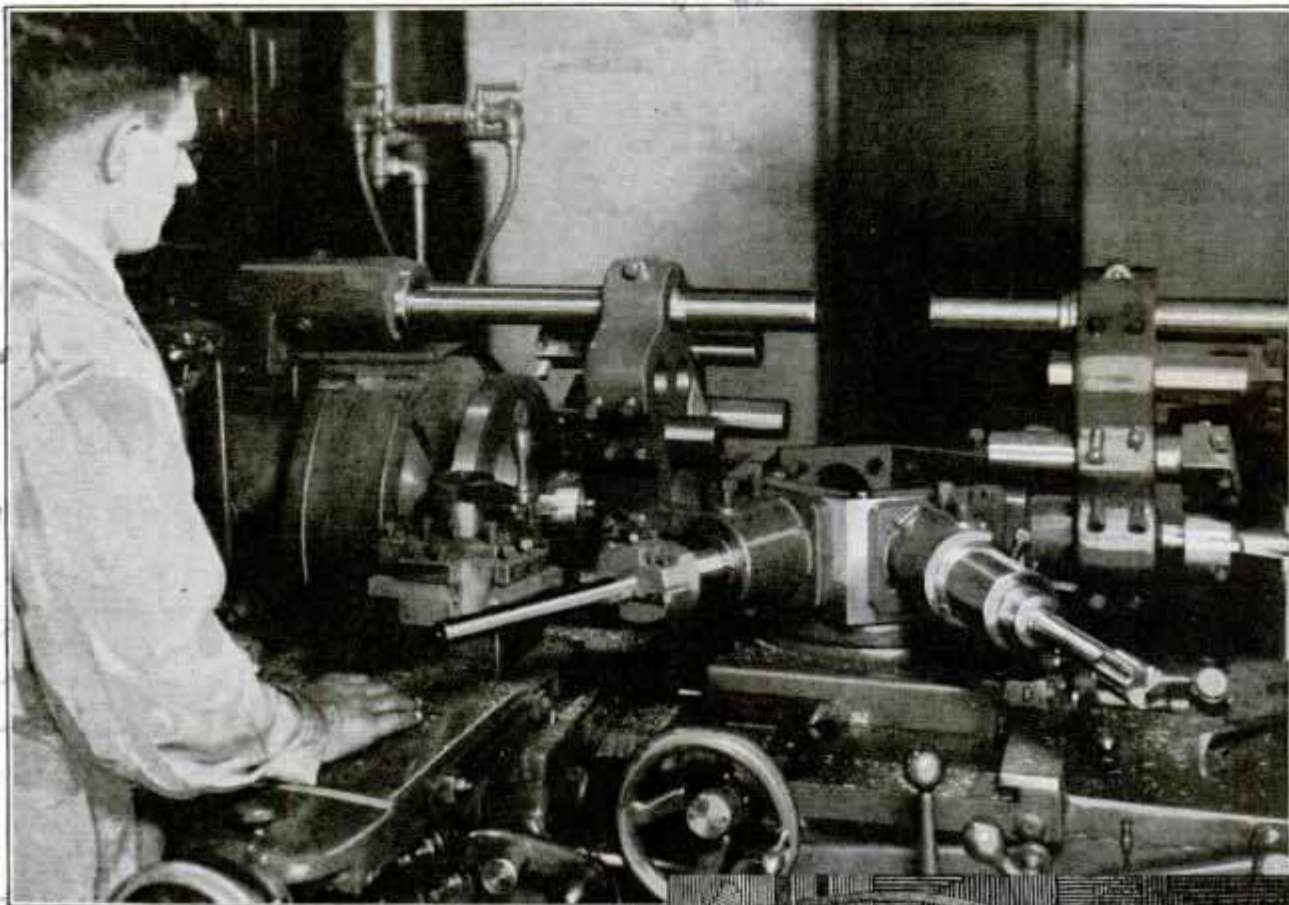
Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

When installed in any closed car or truck cab, a continuous carbon-monoxide detector warns of the presence of this deadly gas. Very minute amounts of the gas lower physical and mental efficiency. The detector has a motor-driven pump which draws a continuous sample of air into the instrument. An adjustable flow meter maintains a constant flow of air and a dehydrating canister removes moisture from the sample, while a cell containing a catalyst oxidizes to carbon dioxide any carbon monoxide present. Heat liberated by this oxidation is directly proportional to the amount of carbon monoxide and is measured by thermocouples in series with the indicating meter. The meter is calibrated to read directly in percentage of carbon monoxide. The same unit can be used for testing the air beneath a man-hole cover or wherever the presence of this odorless, tasteless and non-irritating gas may be suspected.

Safety appliance by Squaddish, Shonkers and Meade, Pittsburgh, Pa. Mine

61434

Who are the WORLD'S FIVE



By J. A. Keyes

FIVE men and five machines remade the world. Who and what are they? One thinks of Whitney, Edison, Ford, Bell and Morse. Of the cotton gin, electric light, automobile, telephone and telegraph. But these were not the men or the machines, with one exception. Eli Whitney, alone, of these men can be mentioned as one of the greatest in the history of invention.

Why exclude the others? By what right can they be placed below four other persons? The answer makes a fascinating and dramatic tale. Imagine a history of chemistry and medicine without mention of Pasteur. Yet that, in fact, is what has been done with the history of the mechanical world since the beginning of the industrial revolution. The men who shaped the productive destiny of civilization from the middle of the eighteenth century up to the present, have been accorded no place in its history.

What is the explanation for the silence

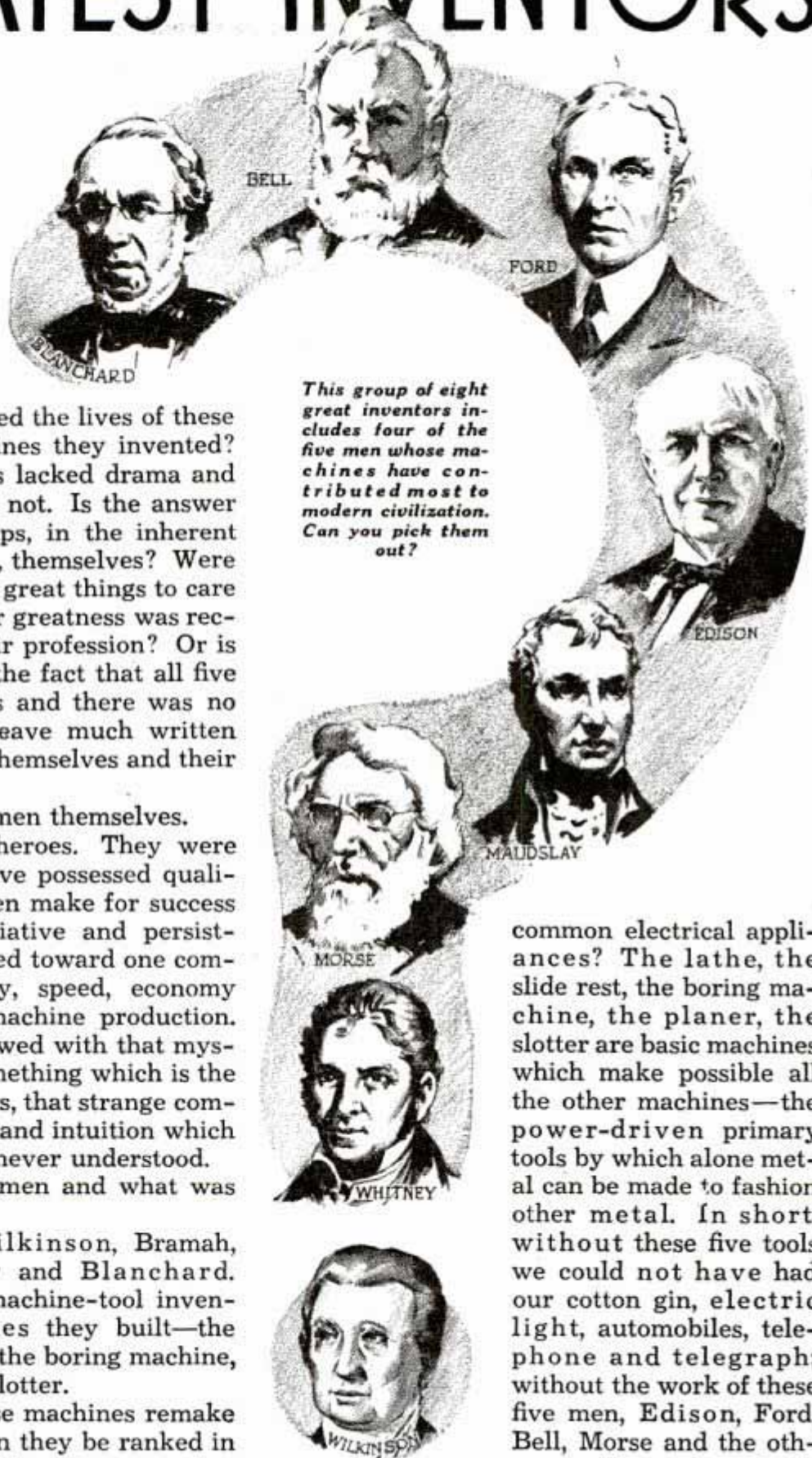


Modern turret lathe, and interior of early machine shop from wood cut by Jean George Van Vliet. A comparison shows advance in shop equipment

with a history of U.S.P. 117 of a machine shop - wood

Cont. Miss Jacqueline Abbot Keyes
The Patent Engraving Association, 23, 24, e

GREATEST INVENTORS



This group of eight great inventors includes four of the five men whose machines have contributed most to modern civilization. Can you pick them out?

which has surrounded the lives of these men and the machines they invented? Is it that their lives lacked drama and interest? Certainly not. Is the answer to be found, perhaps, in the inherent modesty of the men, themselves? Were they too busy doing great things to care whether or not their greatness was recognized outside their profession? Or is the explanation in the fact that all five died in the harness and there was no time for them to leave much written matter concerning themselves and their work?

Let's turn to the men themselves.

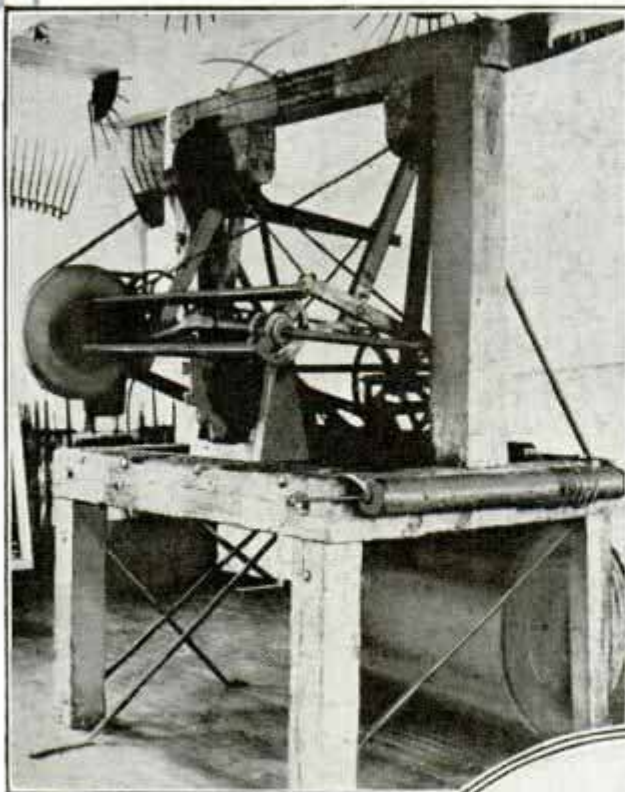
They were not heroes. They were workers. Yet, all five possessed qualities which most often make for success—self-reliance, initiative and persistency. All five worked toward one common goal—accuracy, speed, economy and efficiency in machine production. And each was endowed with that mysterious, burning something which is the heritage of inventors, that strange compound of reasoning and intuition which psychologists have never understood.

Who were these men and what was their work?

Their names—Wilkinson, Bramah, Maudslay, Whitney and Blanchard. Their profession—machine-tool invention. The machines they built—the lathe, the slide rest, the boring machine, the planer and the slotter.

But, how did these machines remake the world? How can they be ranked in importance before the steam engine, telephone, telegraph, reaper, thresher, automobile, airplane, radio and even

common electrical appliances? The lathe, the slide rest, the boring machine, the planer, the slotter are basic machines which make possible all the other machines—the power-driven primary tools by which alone metal can be made to fashion other metal. In short, without these five tools we could not have had our cotton gin, electric light, automobiles, telephone and telegraph; without the work of these five men, Edison, Ford, Bell, Morse and the others could not have built their epoch-making wonders. Think what that



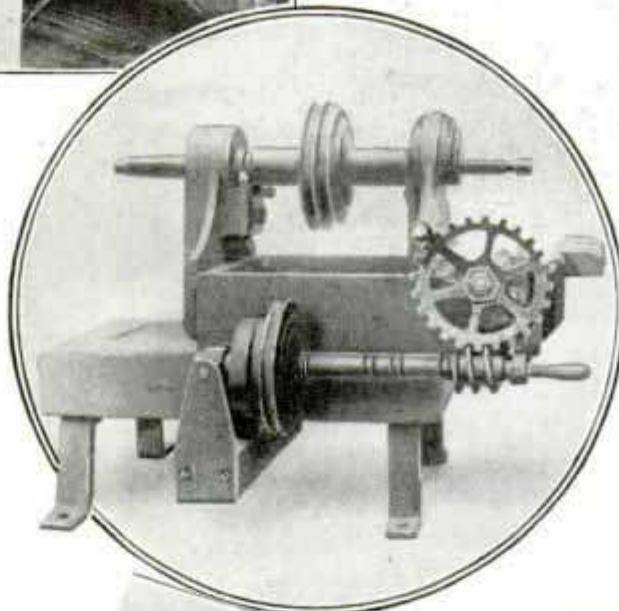
were no tools to carry out the ideas. It was not until 1764, goaded by the urgent demands of Cornish miners for a steam-operated pump to rid their mines of floods of water, that Watt once more took up the idea. By 1765 he built a model of his steam engine. But when Watt came to build a full-size engine, all his skill and the skill of the workmen around him was not sufficient to bore a cylinder six inches in diameter and two feet long. For the lack of a tool which could accomplish this simple machine operation the world was denied the steam engine for ten more years.

It is ironic that history has so little to say of the man who finally made the steam engine possible. His name was John Wilkinson. He was a machinist who, hearing of Watt's unsuccessful steam engine, started working on an idea of his own for making

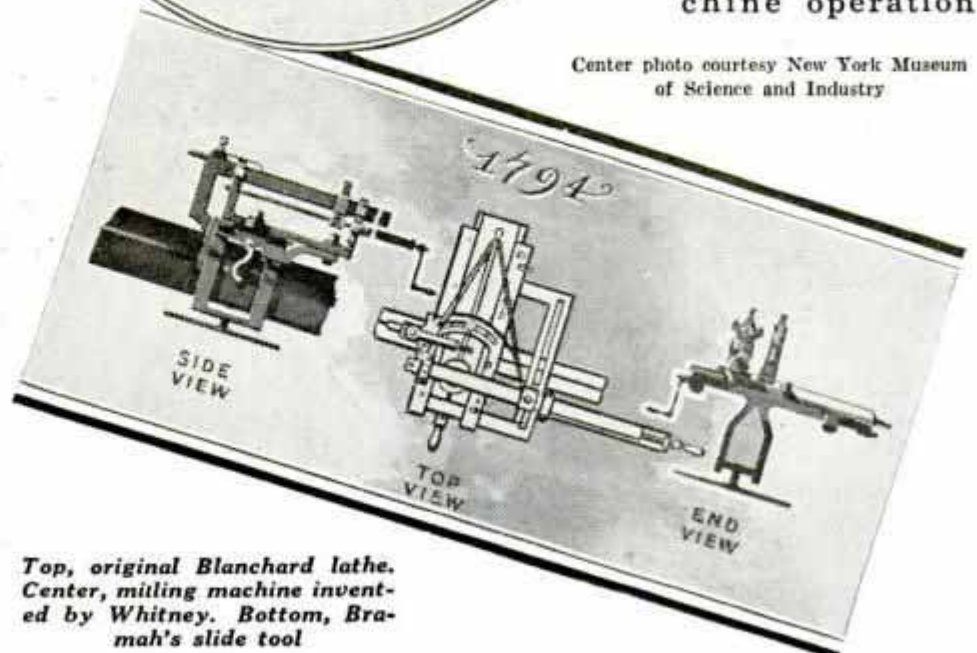
heavier the boring bar of the device then used for boring wooden drums, and of running it clear through the cylinder with a fixed support at the outboard end. Thus, the first principles of the modern, industrial-age boring machine were put into practice. Through that seemingly simple machine operation

means. Our whole civilization as we know it today has resulted from the quiet perseverance, the untiring labor of these men who worked for results and not for glory. It is probably safe to assume there are not more than a few thousand adults in this country who could tell you anything concerning four of them.

A graphic instance of the dependence of inventors upon machine tools lies in the story of Watt and his steam engine. In 1759, John Robinson, a friend of Watt's, suggested a steam engine might be applied to the moving of wheel carriages. The plans and theories were sound but there



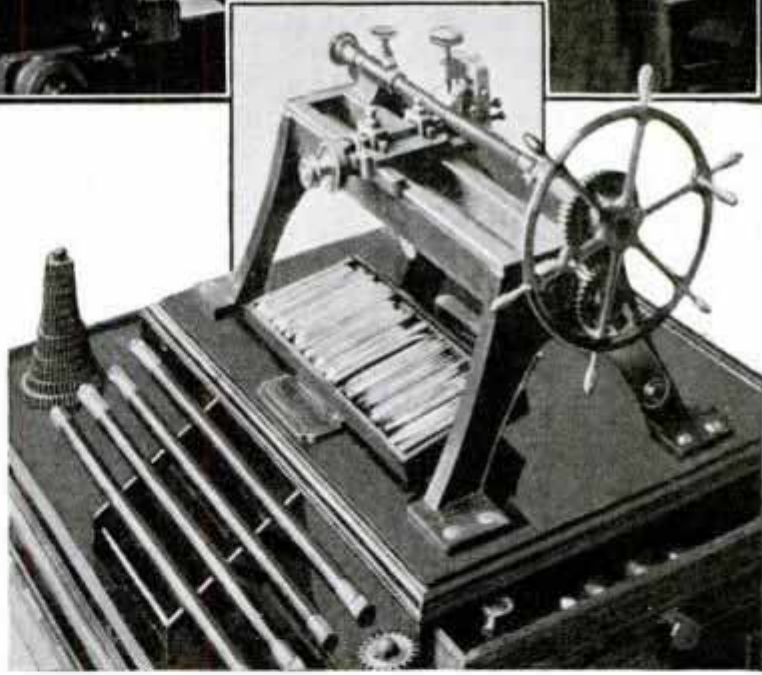
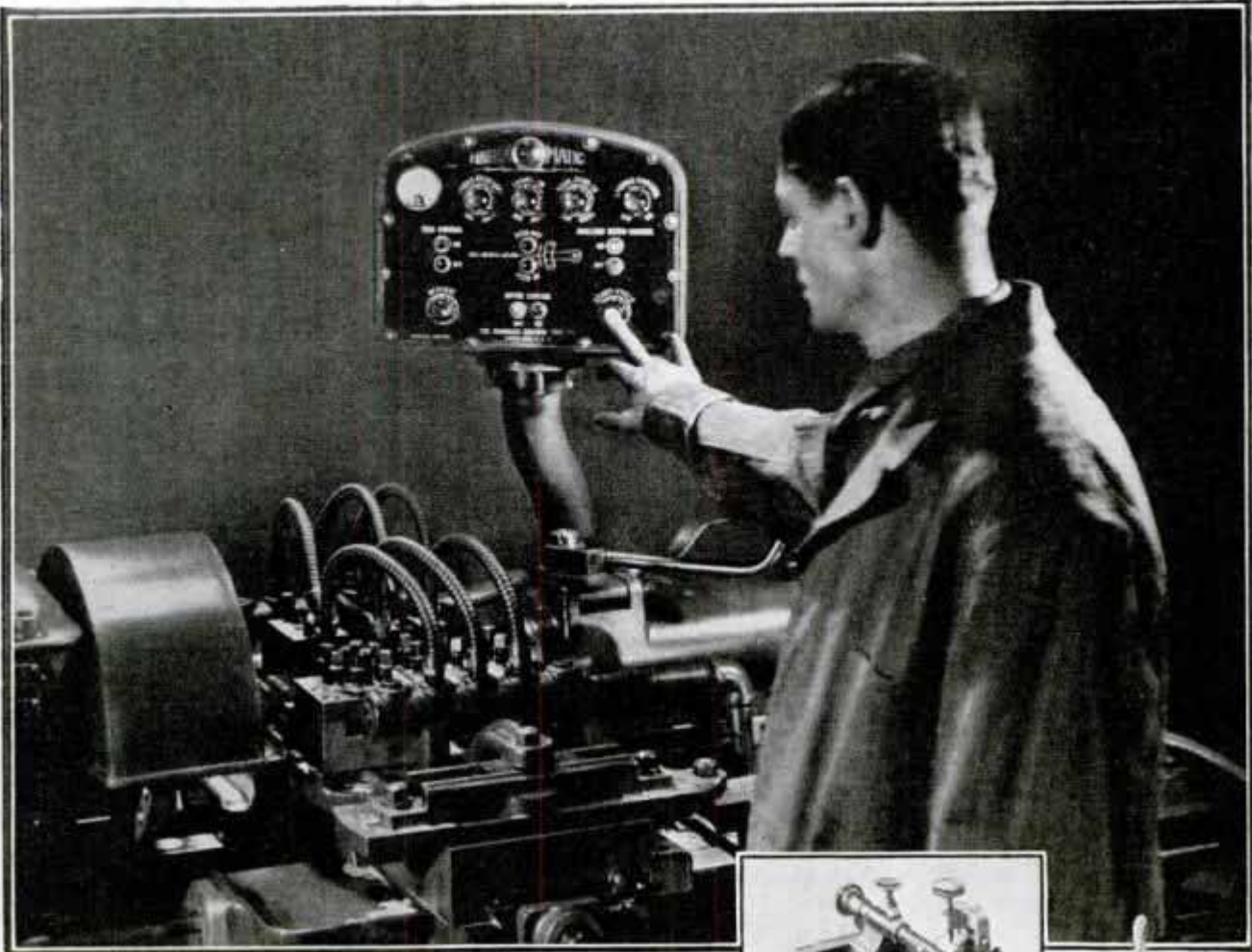
Center photo courtesy New York Museum of Science and Industry



Top, original Blanchard lathe. Center, milling machine invented by Whitney. Bottom, Brahma's slide tool

8 1434

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Watt's fame became everywhere established, the Cornish mines were pumped free of water, the economic history of Britain was changed and a whole new series of machine operations was started. In spite of these facts, one finds little material dealing with the life of John Wilkinson, "father of the iron trade." But we know he was a man of extraordinary character and energy and perseverance. But what exactly is a boring machine—that device which made the steam engine possible and made so many other mechanical marvels feasible? In simple words it is a vertical or horizontal machine for boring holes in metal held fast by a locking device.

Top, lathe with slide rest and full electrical control. Below, Maudslay's cutting lathe

As great as was Wilkinson's influence on machine-tool design, Joseph Bramah exerted an even greater influence. Born in 1748 on a Yorkshire farm, he moved to London in early life to work as a machinist. London was besieged with petty thieves and Bramah turned his attention to build-

ing a lock which could not be picked. He worked on the invention for years until he finally manufactured a lock which for sixty-seven years was regarded as unpickable. Later he developed a hydraulic press. Because of his reputation the Bank of England commissioned him to build a machine for printing the date lines on

(Continued to page 124A)

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20 Church St. New York
navigated, Conn

Solfia Is Played by Hand and Pumped by Lung

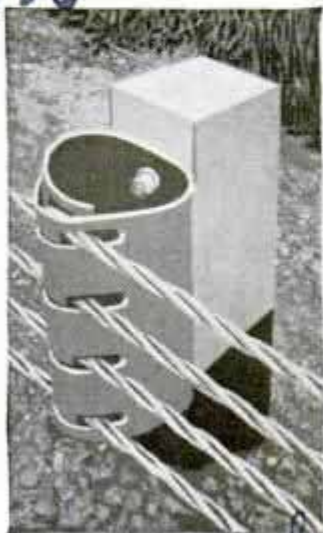


This table-top instrument was named the "solfia" by its inventor, a German orchestra conductor

Youngest child in the family of wind instruments is the "solfia." Something like a baby organ, it has a miniature piano keyboard a little more than an octave long, but its music depends on air. The player can either blow through a rubber tube or use a bellows. The solfia was designed by Hans Kaulbersch, as a low-priced musical instrument for the home.

Berlin, Germany

Highway Guard Rail Made Safe by Resilient Cable Bracket



Resilient brackets of strip steel are the latest type of shock-absorbing support for roadside guard rails. Nearly circular in form, they have overlapping ends and are slotted for the cables of the fence. Held in the slots by an oval pin, the cables can slide

The Iron Age 12/19/35 P. 33.

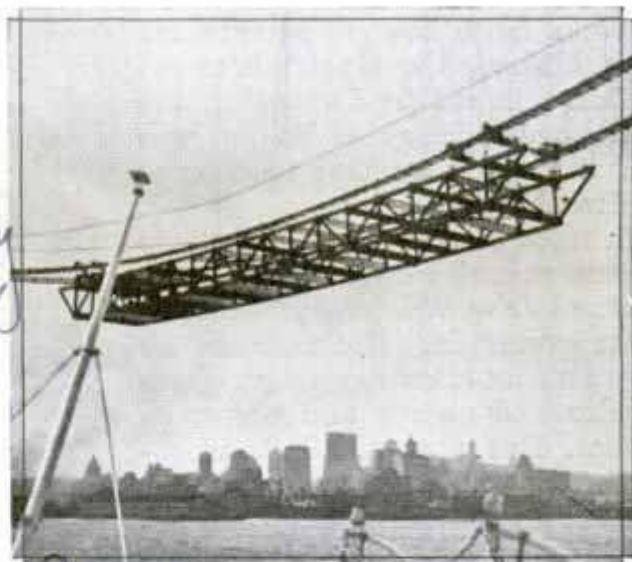
A message of steel & wire
208 2 ha talks

freely in either direction at the post connections and the shape of the bracket makes it act as a buffer when the guard is struck by an automobile.

Diving Helmet Used by Coach of Swimming Team

Underwater observation of swimmers has been adopted by Robert J. Kiphuth, coach of the Yale teams and of the American Olympic team, and he wears a diving helmet on the job. Coach Kiphuth says that this is the best way to get a true image of the swimmer, since refraction, waves and bubbles tend to distort the image when the swimmer is viewed from above the surface. The diving helmet makes it possible to watch each swimmer. The diving outfit consists of weighted vest, helmet and ropes, the last for safety purposes because Coach Kiphuth cannot swim a stroke, in spite of having developed champion swimmers.

Steel Ropes Lift Bridge Span into Place High above Bay



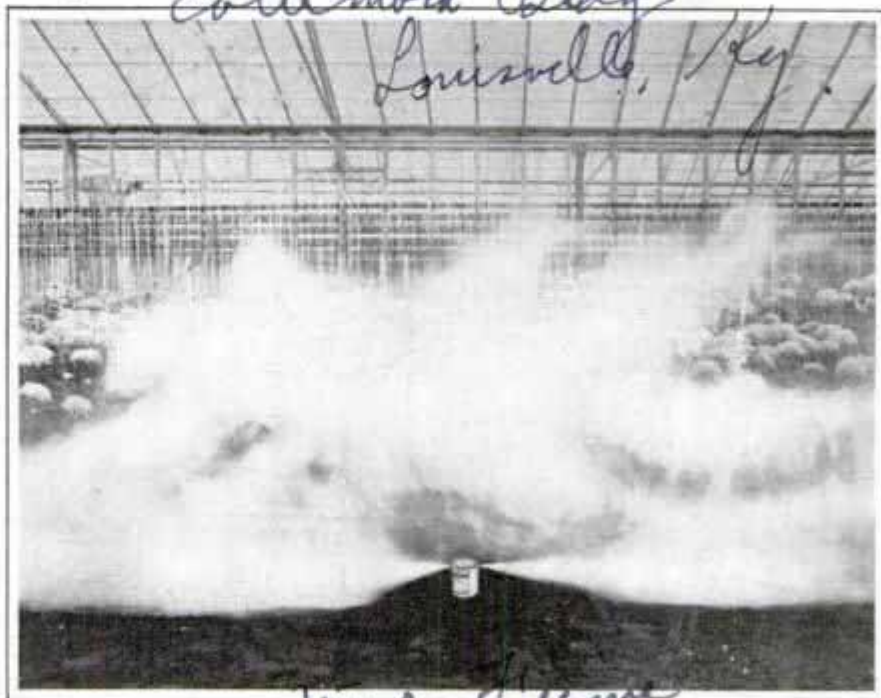
Midway between towers of San Francisco Bay bridge the skeleton of a 540-foot span is hung

Far above San Francisco bay hangs a 540-foot center span of the great suspension bridge that is to make Oakland and San Francisco closer neighbors. In nine sections, this skeleton was lifted into place in the middle of the suspension cables by steel hoisting ropes, and now is supported by the vertical cables looped over the two

new Patent

Canned Fumigant Set Afire

FL7 Floods Greenhouse Quickly



Nicotine fumes, forced out at high pressure when the powdered fumigant in the can is lighted, quickly spread through the greenhouse

By generating pressure in a can of fumigating powder, a greenhouse can be quickly and thoroughly flooded with nicotine spray to kill insect pests. Heretofore burned in open piles, nicotine powder is now available in hermetically sealed cans with two "eyelets" on opposite sides of the top which are punched open when ready for use. A lighted "sparkler" is then inserted in one opening and the powder quickly ignites, forcing out fumes under increasing pressure as it burns. The speed of distribution enhances toxicity of the fumigant. A pound can is effective for 25,000 to 30,000 cubic feet.

Two Signals on One Frequency F72 Solve Radio Problem

Transmission of both voice and radio range signals on the same frequency is being tested as the latest aid to commercial aviation. The two sets of signals are received simultaneously in an airplane, directional signals operating a needle pointer on the instrument panel and the voice signals being received in headphones. The development solves the problem of interruption of directional beacon signals and weather reports when both were sent on the same frequency.

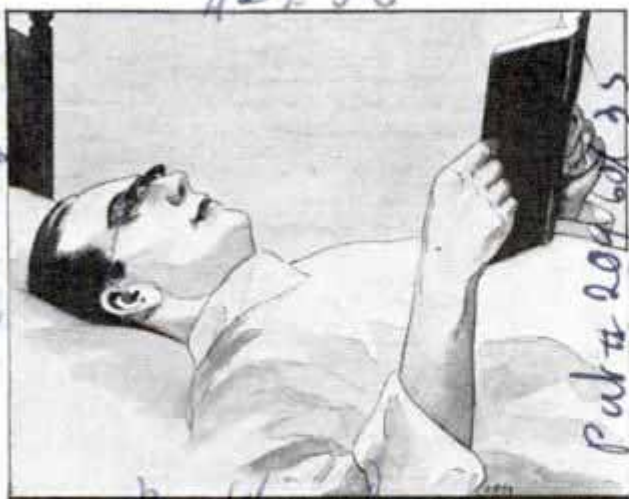
main suspension cables. The upper horizontal beam marks the level of the top deck of the four and one-half mile bridge, and the bottom deck will be at the level of the lower beam.

F110

Prism Glasses Help Bedfast Reader by Reflecting Book

Recumbent spectacles have been designed to make reading in bed more comfortable and less tiring. Specially devised prisms reflect the light clearly, without inversion or coloring of the image, so that the reader may hold his book in a comfortable position on the chest and direct his eyes straight upward in the normal and least fatiguing way. The spectacles are especially valuable to patients forced to lie in bed for some time. They may be worn over other spectacles.

#2750



These spectacles reflect book held at right angles to the eye and make reading in bed less fatiguing

Alvies Col & Co. 105 N. Wabash. Chicago

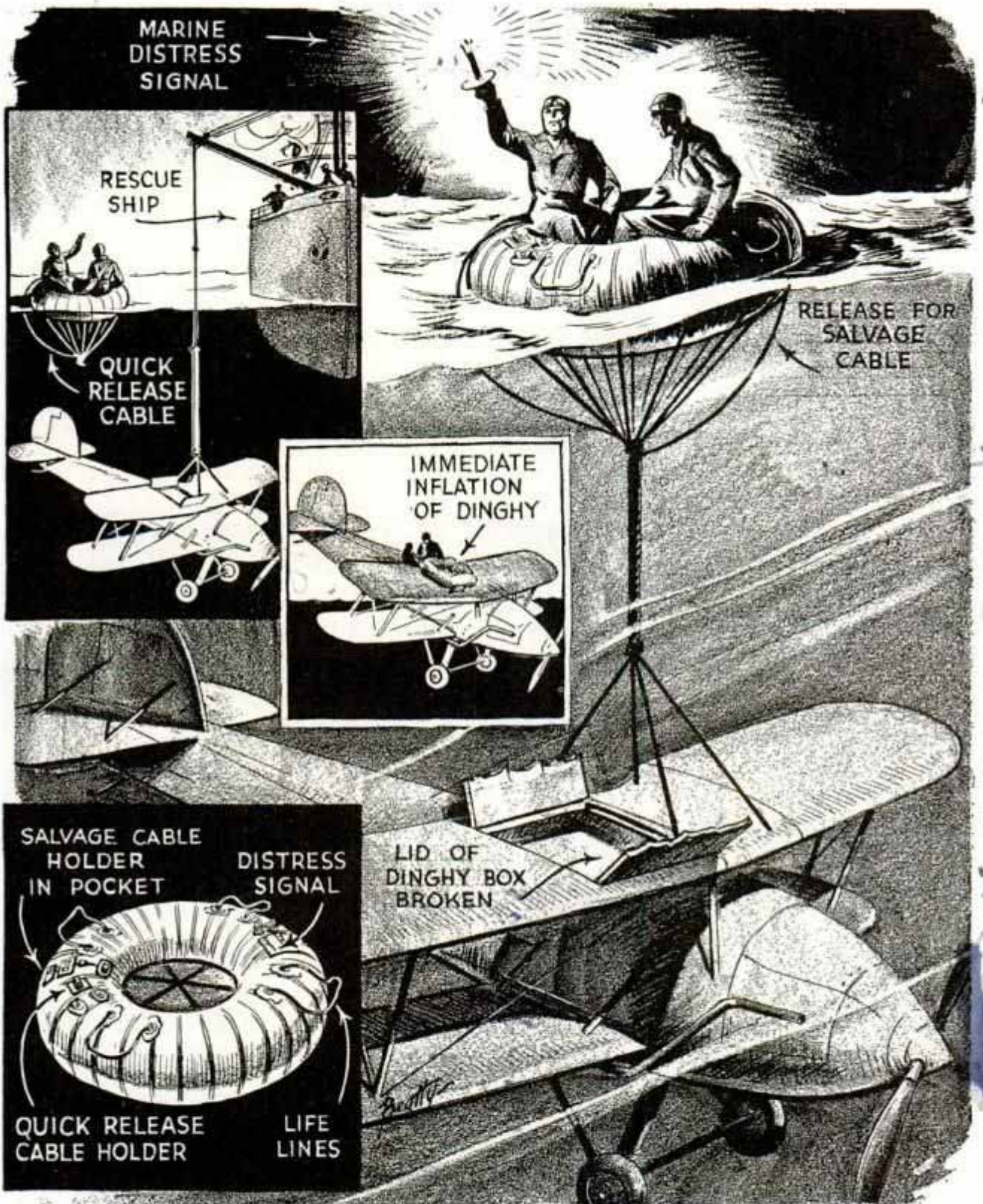
Pat # 2,046,735

Recumbent

Science Service

1/19/36

Doughnut Boat on Plane Saves Flyer in Sea



Self-inflating "doughnut" boat of rubberized fabric which keeps flyer afloat if plane comes down in water and also supports the plane so it can be salvaged

Successful tests have been made in England recently with flotation gear for airplanes intended to save the flyer in case his ship is forced into the sea and also to serve as a buoyant support for the plane

so it can be salvaged. Various types of gear have been tried, one consisting of atmospheric bags placed within the fuselage, air being stored in them at atmospheric pressure. There are also buoyant inflat-

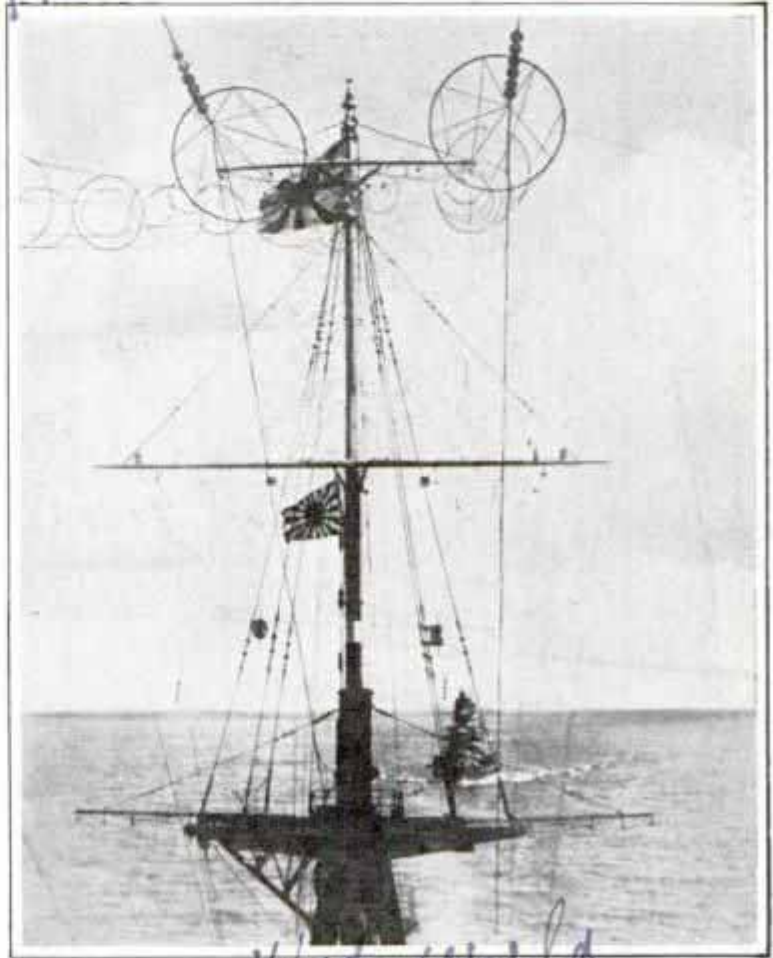
Youngman dinghy
R. S. Youngman Esq. Hayes
46 Fairey Aviation Co Ltd. Middlesbrough

From Illustrated London News 12/28/1905-Pl 117

Copyrighted by R. S. Youngman Esq. Hayes

able bags which may be filled in an emergency with carbon-dioxide gas released from a cylinder by automatic or manual means. The third type is known as the Youngman dinghy and is a big doughnut of rubberized fabric with a "floor" in the center. The deflated tube is stored in a compartment in the top of the wing together with a cylinder of carbon-dioxide gas and cables which link it to the plane. The dinghy may be inflated manually or by actuators which release the gas when the ship is slightly submerged, causing the dinghy to burst open the lid of its compartment and escape. The passengers enter the dinghy which supports their weight and the weight of the submerged plane. If a ship is near, the cable leading from the dinghy to the plane can be attached to the ship's derrick and a release cable can be operated to cut the dinghy adrift, allowing flyers and plane to be saved separately.

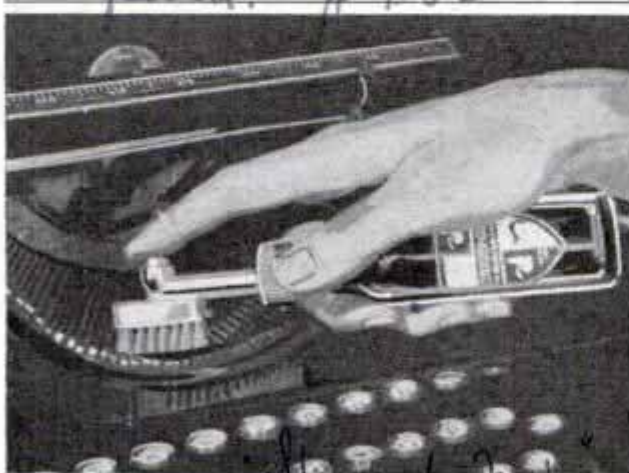
7105 Warship's 'Voice' and 'Ears'
Aid Maneuvers Far at Sea



Wide World
Looking through elaborate antenna arrangement high above deck of battleship during maneuvers of the Japanese fleet

755
Fountain Brush Cleans Typewriter with Liquid

Cleaning typewriters, rubber stamps and adding machines is made easy with the aid of a fountain brush which releases a liquid cleaner when a valve button on the back of the brush is pressed. The bottle containing the cleaner forms the handle for the brush.



Speed. mo.
Fountain brush for typewriter which releases liquid cleaner when valve is pressed

How a modern fighting ship can perform intricate battle maneuvers at night, in murky weather or behind a dense smoke screen without the use of signal lights or flags may be a puzzle to the landlubber. But the answer is simple. High above the glistening decks of the ship is an elaborate arrangement of wires, the very latest type of radio antenna, which is a clue to the puzzle. By means of these wires, the ship "speaks" or "listens" as the radio operator transmits or receives orders. Navigating these big ships blindly is made easy by use of radio, and modern navigating instruments. Japanese dreadnaughts, recently engaged in maneuvers in the Pacific, are equipped with the newest radio apparatus.

One-thousandth of an ounce of thyroxin, a mysterious chemical substance in the body, separates every normal human being from imbecility or death.

Quyet. O. Myg Co
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61550

DIVING



Capt. John D. Craig and an undersea camera of his own design which he uses among the sea killers. Below, nurse shark with remora or sucker fish

Photo at left courtesy Paramount Productions, Inc.

HE'S engaged in the most dangerous and thrilling business in the world!

Captain John D. Craig is the man whom the big movie producers usually call upon when they want such exciting jungle or submarine scenes as—

A hungry and wounded tiger charging....

An octopus on the bottom of the ocean seizing prey with its deadly tentacles....

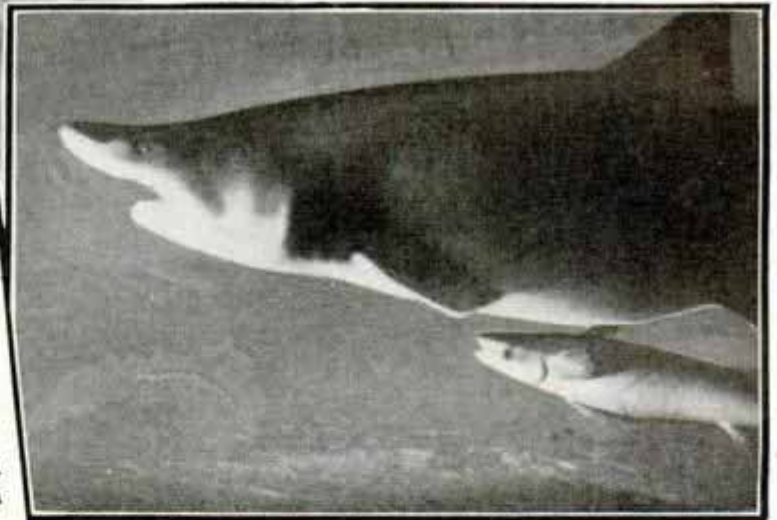
A man-eating shark rushing a diver....

Killers of the jungle in furious action.

Only thirty-one, an expert deep-sea diver, inventor of the submarine camera, authority on big game hunting and fishing, he has led his camera crews into more than thirty-nine different countries and to the depths of the Atlantic and Pacific oceans.

By Capt. John D. Craig

WHAT a thrill my first dive was! I think I was most impressed by the utter silence of that strange undersea world. It's so quiet down there it almost hurts. All the weird and unusual undersea denizens crowded around to greet me. They were not afraid but seemed to as-



sume I was just another poor fish like themselves.

Crouching in the dark corners of rocky ledges ugly crabs and lobsters peered out at me. The light was dim and of a greenish hue. A silvery cloud of minnows floated by overhead, bending to and fro to the swell of the sea. A six-foot marrow, or jewfish, loomed out of the distance and cruised around me with the effortless ease of a floating dirigible. He goggle-eyed me and departed into the grey haze. I was elated, scared and breathless all at once.

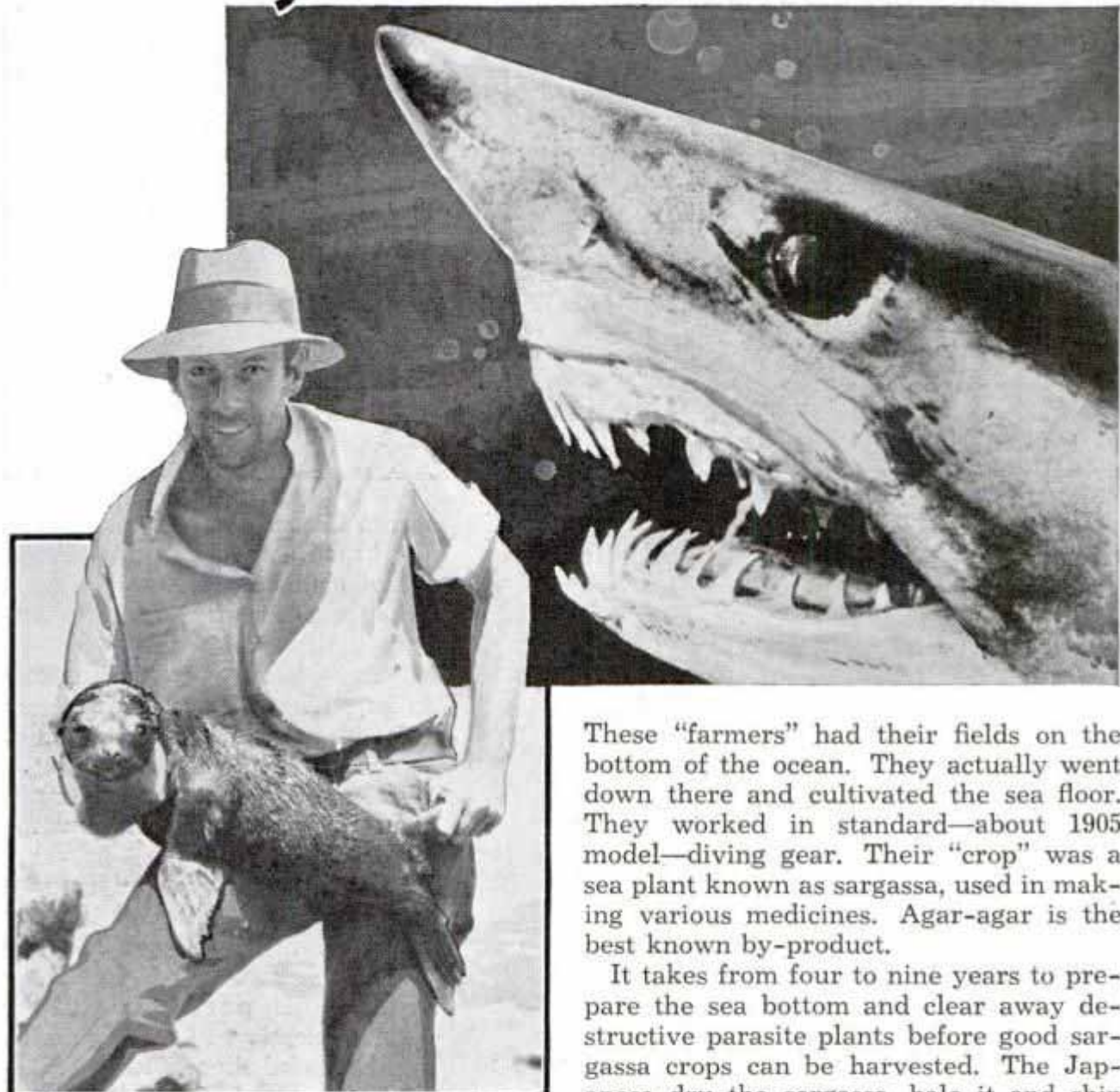
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Among SEA KILLERS



Head and jaws of a blue fin shark and, below, Capt. Craig and a baby seal he captured

Somehow I managed to follow my instructions sufficiently to survive that first dive, and immediately I became a devotee.

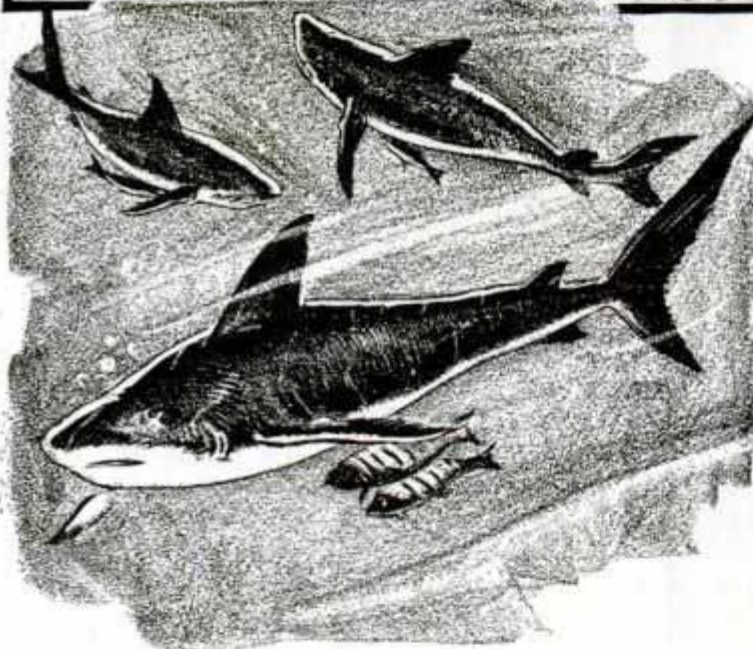
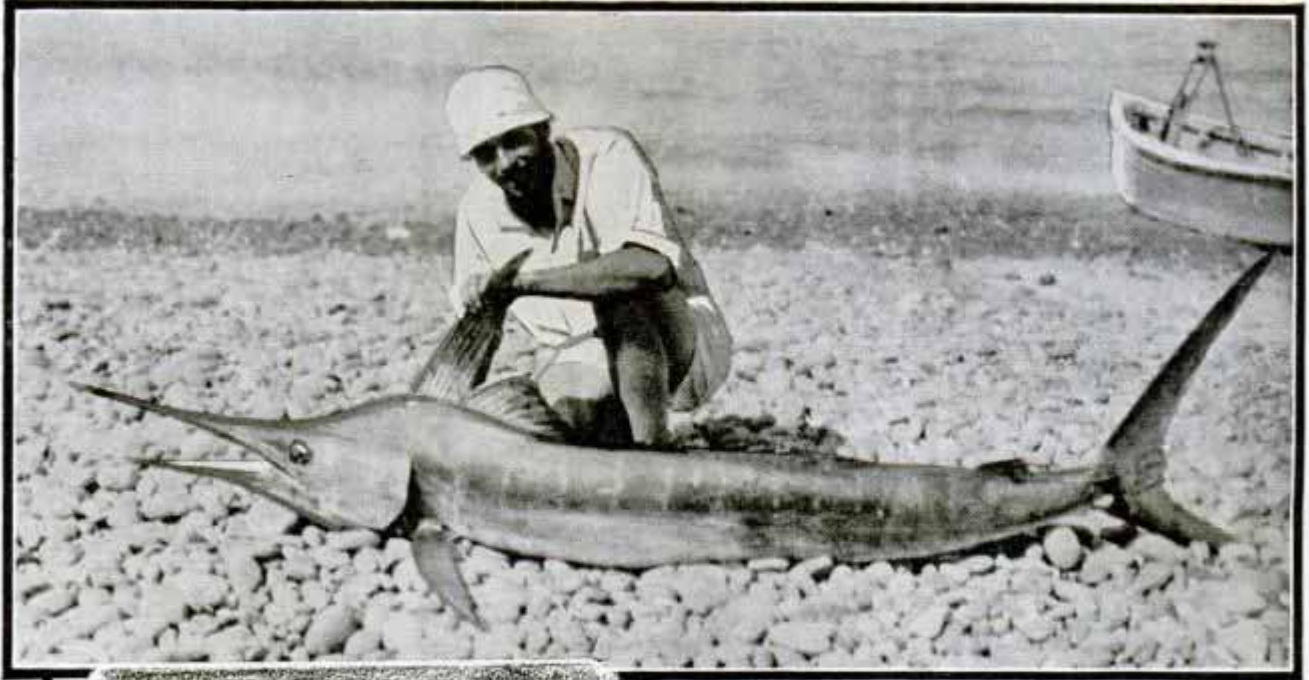
I have dived hundreds of times since. Every dive brings new thrills. I can honestly say I have learned something new from every dip.

My first dive was made in tropical waters off the lower coast of Mexico. Japanese divers were my instructors. The gear I used was such an out-of-date contraption I still wonder there wasn't an accident. The Japs are "sargassa farmers."

These "farmers" had their fields on the bottom of the ocean. They actually went down there and cultivated the sea floor. They worked in standard—about 1905 model—diving gear. Their "crop" was a sea plant known as sargassa, used in making various medicines. Agar-agar is the best known by-product.

It takes from four to nine years to prepare the sea bottom and clear away destructive parasite plants before good sargassa crops can be harvested. The Japanese dry the sargassa, bale it and ship the lot to Japan. Once under cultivation the crops grow constantly and a good diver can gather between \$80 and \$350 worth of sargassa per day. They deserve it for they take terrible chances.

It was a tough school in which to learn the hazardous game of deep-sea diving, but the Japs were good instructors and I acquired many tricks of the game that have been lifesavers on several occasions. I first learned to dive because I wanted to know whether it would be practical to shoot undersea a certain picture we were preparing in Hollywood, or do it in a tank as the studio wished. We made it underseas. I have shot several undersea pic-



The author and a striped marlin swordfish. Below, blue fin shark, a man-eater, and pilot fish

tures since. There is something about that weird underwater world that gets under one's skin.

Four of the boys in my crew are now expert deep-sea divers. We still thrill at the thought of our first dives with that antiquated gear. The last time I passed Cedros island I counted twenty-two graves in that little Japanese cemetery. There were only nine when we first learned to dive there. They still use the same old gear. I have since learned they lost most of their casualties when the boys got fouled in the kelp beds and the tenders broke the lines trying to pull them out. Manta rays, those huge bat fish, also fre-

quent Cedros waters and probably broke some lines. No, diving is not a healthy game. We do it because the public demands authentic pictures.

I have been asked a hundred times, "What do you do when you meet an octopus on the bottom of the ocean?" I stand perfectly still, tuck my hands under my arms, hold my breath and then hope for the best.

"Don't move when an octopus takes hold of you," they told me repeatedly. "It will get excited and attack if you struggle. But if you remain perfectly still the chances are it will merely touch you here and there with a tentacle just to satisfy its curiosity and

will then move away." Those warnings saved me dozens of times from a horrible death in the arms of octopuses that measured from fifteen to eighteen feet. There are octopuses much larger, but I hope never to meet them. An octopus with tentacles eight or nine feet long is tremendously powerful and a most formidable antagonist should it become aroused. Those big fellows can devour an average human, stripping the body of all flesh and blood in from fifteen to twenty-five minutes.

Octopuses usually frequent dark and rocky places on the ocean bottom, and the larger ones are found in colder waters. The female lays 40,000 to 50,000 eggs near

the mouth of some cave in subterranean reefs, where she remains during the fifty-day hatching period. She is very temperamental and will strike out in anger at any intruder so the undersea denizens give her a wide berth. When hatched, the baby octopodes are about the size of a garden pea. They have very short legs and cannot move about without swimming. Usually they rise immediately to the warmer sunlit surfaces where birds and fish devour them by the thousands. If this were not the case the sea would be literally swarming with octopuses. The few survivors seek homes in the shallows near rocky shores. Their first food consists of minute animalcules floating in the water.

As they grow stronger they seek deeper waters. Within a year they have grown to be four to five feet in breadth and feed on shell fish, perch or bass. When moving about they walk on their eight arms or swim backward by expelling water through a locomotor tube just under the head. A large octopus can dart about in this manner with surprising speed. Each tentacle is armed with from 160 to 240 vacuum cups which can exert a pressure of from one-fourth to nineteen pounds per square inch. When attacking their prey, they retain a firm hold on the bottom with three or four tentacles and grapple their adversary with the others.

The principal weapon of the octopus is its parrot-like beak concealed in the very center of that many-armed hood. With that beak a large octopus could easily rip open a deep-sea diving suit. The most practical defense against such a foe is a nitric gun, a type of plunger pistol loaded with glass-enclosed cartridges of nitric acid. When this is discharged in the water near an octopus the creature inhales it and is killed instantly. This gun is a recent development. We were not armed with them when shooting pictures off Mexico.

The Japanese divers there, however, did give us a hint that worked. An octopus is baffled if it cannot find firm "ground" for its suckers. Without a solid foundation it cannot exert that vacuum pressure, and when it realizes this it departs. We found by wearing a coverall made from porous burlap over our diving dress, the octopus could not seize us.

(Continued to page 138A)

789
Cymbal Maker Uses Secrets
Three Centuries Old



One corner of foundry where cymbals are tempered carefully to obtain tone purity

When the cymbal maker, Avedis Zildjian, makes a set of the shining metal disks for the modern orchestra, he uses a tempering process which has been a family secret for more than three centuries. The cymbals are produced at the Zildjian foundry in Massachusetts for many prominent orchestra and band leaders.

E 1597
High-Priced Gold Spurs Mining
for Billion-a-Year Output

Increased buying power of gold is sending the output higher and Dr. Adolph Knopf of Yale University predicts the world production will exceed \$1,000,000,000 a year within a short time. This output, Dr. Knopf says, will establish an equilibrium between production and the present purchasing power of gold. Better methods in mining and metallurgy and improved transportation facilities are expected to accelerate mine operations and production. Such inaccessible regions as the two million square miles of pre-Cambrian rocks north of the Great Lakes may be developed by means of the airplane.

Professor of Psychology
University of Pennsylvania

Journey's

6.6
**Exact Models of Royalty
 Save Trips to the Tailor**



© Planet News, Ltd.

Attaching hair to heads of models. Note the life-like appearance of the completed head on the table

Kings and queens are saved the trouble of frequent fittings at the tailors' and dressmakers' by an artist who prepares papier-mache models of royalty. Provision is made for loss or gain in weight by layers which can be added to, or removed from, the model. Each model is made from exact specifications of linings prepared by the tailor after taking measurements. Among those for whom the artist, J. A. Gems of Kensington, England, has made models are King Edward, King George, Queen Mary and members of royal families of other nations. Hospitals, fire brigades, and the police also make use of the models, which are constructed of a substance almost as soft as human flesh.

783
**Music Changes Color Lighting
 on Liner "Queen Mary"**

Color tones of illumination in the main ballroom and veranda grill of the superliner, "Queen Mary," now under construction, are controlled automatically by a microphone in front of the orchestra platform. The lighting is changed by the pitch of the notes played or sung, a high note producing color lighting of utmost brilliancy. The ceiling of the grill will be divided into three large bays, each having

its own indirect color-change lighting. A balustrade surrounding the main portion of the grill and slightly raised above the dance floor level, is formed of silver bronze and glass panels which are sandblasted and etched. It is illuminated by the color-change lights through the bottom of the glass which catches all the relief of the etching. By means of reflectors, this light also is thrown horizontally across the dance floor, illuminating the feet of the dancers. The "Queen Mary" is scheduled to sail May 27 on her maiden voyage to the United States.

Skis on Auto's Front Wheels

7144
Aid Steering in Snow

To make steering easier in snow, an English entrant in the Monte Carlo trials attached skis to the front wheels of his automobile. In soft snow, the front wheels sink so deep that steering becomes difficult and the driver tires rapidly from fighting the wheel. The skis slide smoothly over the snow and the weight of the car helps to prevent the front end from skidding on turns.

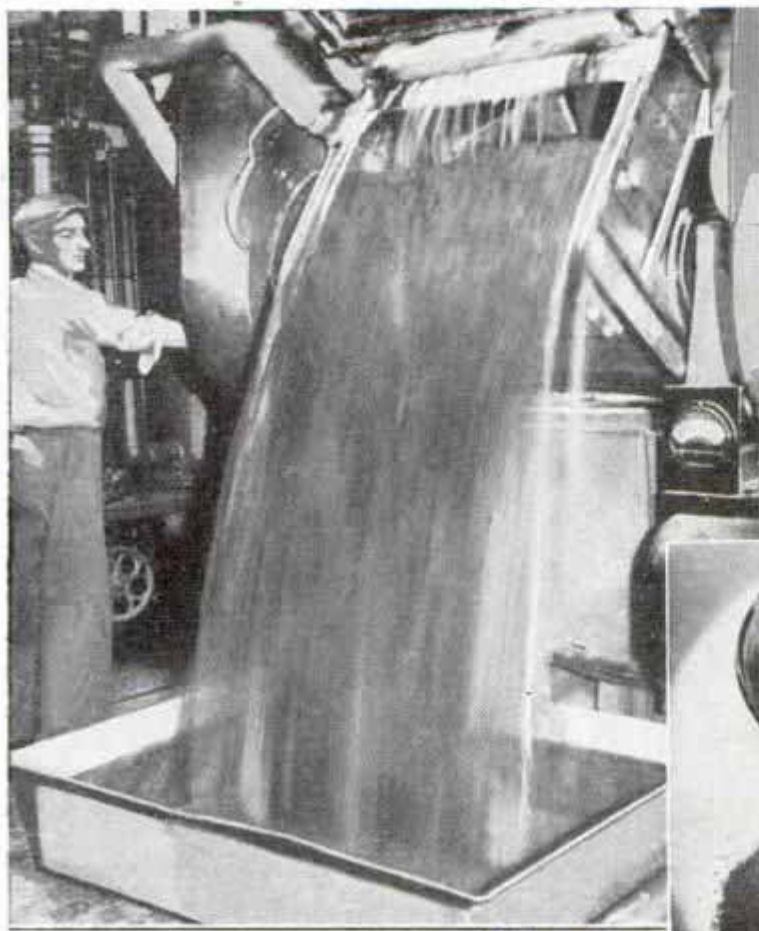


7144
 Runner attached to front wheel of car, ready for start of Monte Carlo trials

Cunard White Star Line

F90

Soy Bean "Soup" Is Pressed into Auto Parts



There are fifteen pounds of soy bean "soup" in your Ford automobile. Once merely an important item in the diet of the Chinese, the soy bean has grown into a major element in modern manufacturing, particularly of lacquers and molded parts for automobiles. The acreage devoted to raising soy beans in this country has advanced rapidly to 5,000,000 in 1935. Bean soup consists of fibers rolled and crushed to a fine powder, which is then pressed to the ap-



Strange Things About the Air Revealed by Research

Some of the strange things about the air, which the ancients considered an imponderable substance, have been revealed by scientists after years of research. Dr. L. H. Koller of the General Electric company has found that the air in an average room weighs about 169 pounds, that a cubic foot of air weighs slightly more than a letter requiring three cents postage, that the air you breathe during a day weighs more than the food you eat in the same time and that air is made up of more than a dozen gases, including nitrogen, seventy-eight per cent, oxygen twenty-one per cent and all other constituents, one per cent. In the one-per-cent group are carbon dioxide, water vapor, hydrogen, helium, neon, argon, krypton and xenon, with traces of radon, the gas produced when radium disintegrates. Dr. Koller points out that industry extracts argon which is employed to fill incandescent light bulbs and neon, now used extensively in advertising signs.



© Ewing Galloway
Soy bean "soup" and some automobile parts, including distributor terminal plates, fabricated from it

proximate shape of the article and finally treated in a hydraulic press. Among the automobile parts made from soy beans are distributor terminal plates, dashboard instrument cases and ornaments.

☐ Tides at Tahiti follow the sun instead of the moon, high at noon and midnight.

Science Service 1/19/36

Schenectady NY

S. M. ...
1936

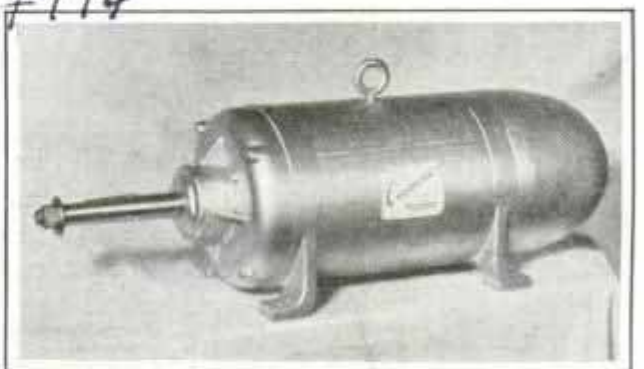
Plane Spans U. S. at Four Miles per Minute



Two views of the slim, racy monoplane in which Howard Hughes set a new coast-to-coast speed record
Northrop Airplane C
 an hour. The plane, a Northrop Gamma, with constant speed propeller, carried 700 gallons of fuel and had 100 to spare at the finish. The radial motor develops 925 horsepower at sea-level and a supercharger maintains high power at high altitudes.

but
 Hurling through the sky from Burbank, Calif., to Newark, N. J., at better than four miles a minute, without a stop, brings fame to Howard Hughes—movie producer and speed pilot—as the new holder of the transcontinental flight record. Trying out new type Wright engine in his low-wing, slender monoplane he lifted the ship off the west coast airport shortly after noon, picked a lane 18,000 feet high and in nine hours, twenty-seven minutes and ten seconds set the wheels down on the Newark runway. His record beat that of Col. Roscoe Turner by more than a half hour. Hughes already held a record for land planes of above 352 miles an hour, set on a three-kilometer course. He averaged nearly 260 miles an hour for the 2,450-mile transcontinental jump and covered the Indianapolis-Columbus sector at 295 miles

Anglo-wood, Calif
Power from Wind Generator Is Limited at High Speeds



Driven by a wind wheel connected directly to the shaft, a direct-current gener-

Another plane - special 1,000 hp. racing monoplane (says reader)

295 miles per hour

ator built entirely of aluminum except for the field and armature is now on the market. The coils are so wound that regardless of the speed above 400 revolutions per minute, only one kilowatt is developed. It will close the cutout on a thirty-two volt plant at 175 revolutions per minute, charges five amperes at 200 revolutions and develops one kilowatt at 400 revolutions. Wind resistance is minimized by streamlining. The generator is available in various power capacities.

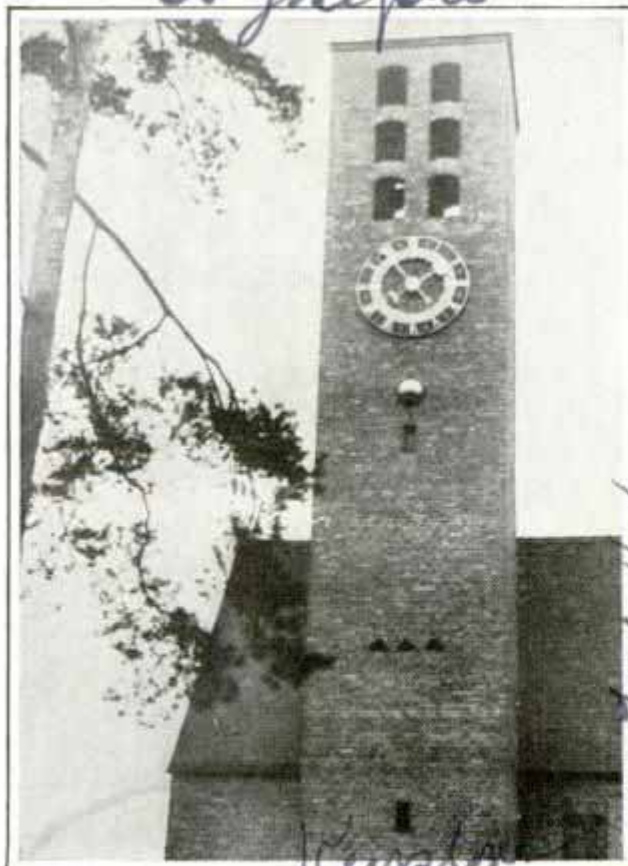
Milk Kept Fresh for Months by Steam-Vacuum Capping



Capping machine as it applied metal sealer to bottles for keeping milk fresh over long periods

Lighted Moon Clock Shows Next Phase

Which phase the moon will assume on the following night is shown by an unusual clock installed recently on a church steeple in a Berlin suburb. The clock is a large lighted globe with shaded sections to indicate the proper phase for any time during the month. Above it is a larger clock for telling time.



White spot below clock is moon indicator

Cabbage That Doesn't Smell Is Developed for Market

Odorless cabbages will be ready for your table soon. Six years' work at Cornell University went into the production of a variety of cabbage without a smell, and at last, after careful pollenization with tweezers for many generations of cabbage plants the odor was eliminated by hereditary selection. The chosen seed are being guarded against contamination and within two years it is expected enough of the odorless plants will be grown to go on the market commercially.

at Siemenstadt Chicago, Ill. 11/15/26 Prof. C. H. Meyer, Ithaca, N.Y.

Auto 408... Chicago... White Cap Co... 1812 N. Central Ave... Chicago

E 1432

1239 Appleton St.
Long Beach, Calif

MORE GARDEN

Thrift Garden Community



are also "non-poison" cucumbers, with the objectionable flavor removed. These can be eaten, skin and all, like an apple. The bush pumpkin, as the name implies, grows upward as a bush, with the pumpkins forming in the center.

In his "gritless" spinach the characteristic harsh flavor is removed. The entire plant, including stalk and leaves, is fiberless, tender and edible. Where winters are mild it can be grown the year round. There is also the



MAN is only beginning to solve the mysteries of plant life. We grow on acres what could be grown in square feet of ground through processes of selection, and sturdier stock could be developed to withstand many of nature's onslaughts. The time is coming when, in his back yard, the amateur gardener will be able to grow, the year round, sufficient produce to feed his family.

"The trend to individual, Lilliputian gardens is inevitable," says Major Harry L. Bateson, plant wizard of Long Beach, Calif., who has developed vegetable and flower species which have earned him wide recognition.

Achievements of Major Bateson include a "dwarf bush corn" comprising multiple stocks growing from a single root, with as many as twenty ears maturing at once. Maximum height is about three feet. There

Rare type of tuberous-rooted, hot-house begonia, and dwarf corn developed by crossbreeding. Several ears mature at once

8 1432

in LESS SPACE



Bed of zinnias developed in thirty years from blossoms the size of a dime, brought by Major Bateson from Mexico

cabbage-cauliflower which develops as a cabbage, then continues growing until the head has turned to cauliflower.

"Plant 'wizardry' is a process of development and not creation, involving a constant search for throw-backs," says Bateson. "Nature creates black-sheep, misfits, plants with hereditary ailments—or super-plants—all from otherwise normal families. We select the strong, or the individualists, and blend them with the hardiest or most unusual, in the families we know."

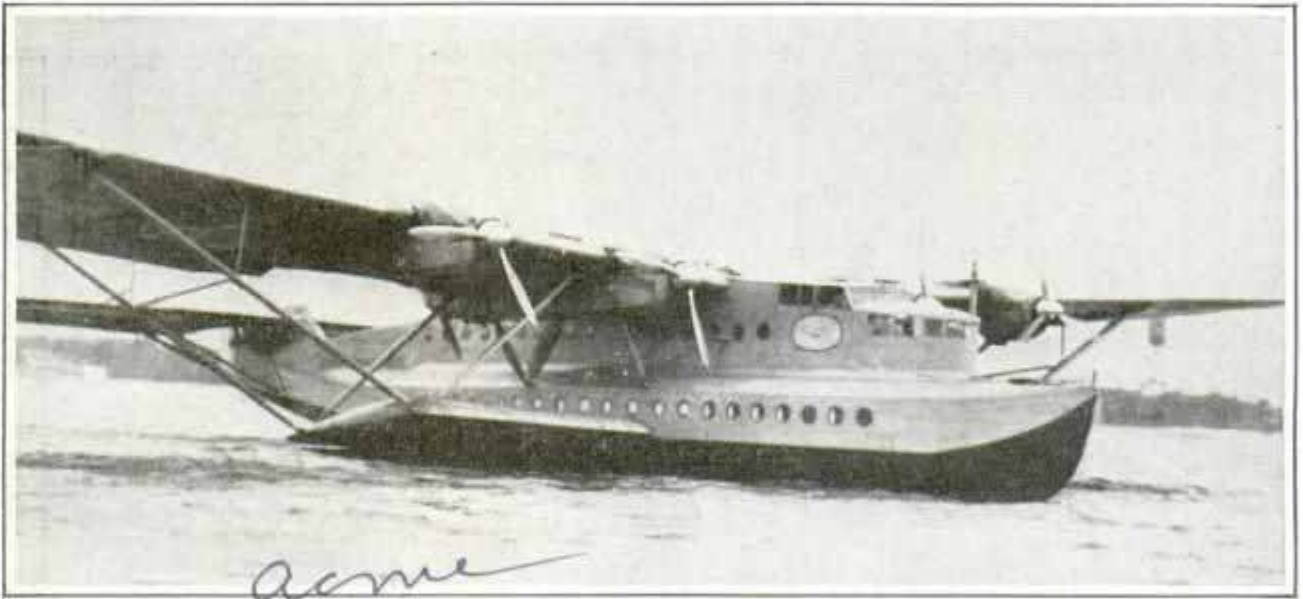
Why, for instance, should onions have an odor unlike lilies of which the onion is really the parent? The first step was to find two onions of the same species which were virtually taintless, mate them, and in succession take seeds from the mildest of the offspring. The result of thirty-five

years of effort is a partly odorless onion about ninety per cent developed; that is, ninety odorless out of every 100.

Likewise, acid in tomatoes—an unessential. In certain types of tomatoes Bateson found almost no acidity. Again it was a process of selection and breeding. He also found tomatoes could be grown in clusters and that it was unnecessary to grow fruit with the high water content. The result is an acidless tomato, scarcely larger in circumference than a quarter, and which contains food equal to the ordinary type.

"Nature did so much that man has unwittingly been taking it easy," says Major Bateson. "For instance, she gave us the bee. And for thousands of years the bee has been 'half-doing' work in pollenization that we ought to have done scientifically."

Four Motors Drive Big Seaplane over Ocean



French flying boat is shown on Pensacola (Fla.) bay where it landed after crossing the Atlantic from Paris. Not long after this photo was made, the plane was damaged when a sudden squall ~~met it~~

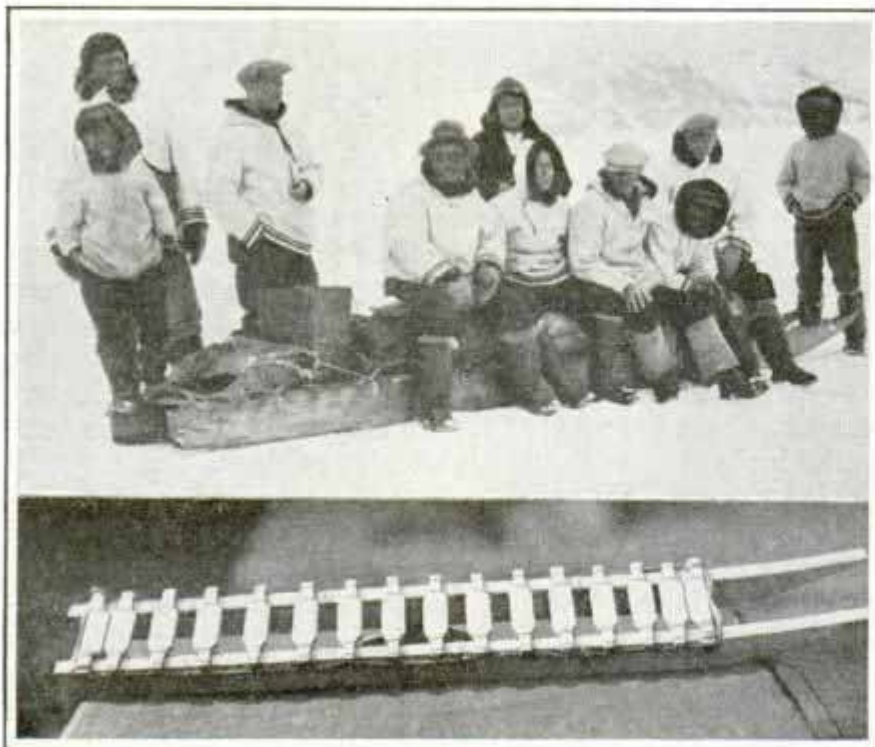
Marking the 300th year of French rule in the western hemisphere, a giant flying boat recently completed an air voyage from Paris to Pensacola, Fla., by way of Dakar, Senegal, Natal, Brazil and Mar-

tinique, in the French West Indies. ~~Four~~ motors drove the seaplane across the sea to a triumphant landing on Pensacola bay. The craft is one of the largest in the French air fleet.

Eskimo Sledges Are Lashed with Thongs of Walrus Skin

Eskimos scorn nails in lashing together the runners of their sledges. Sleds built

with nails would be likely to break in the rough going along hummocky shore ice.



Cross-boards are lashed to runners with walrus strips instead of nails

Instead they lash the transversal boards, which form the top, to the runners with tough thongs made from strips of walrus skin. The small cross-boards, laid every two or three inches along the top of the runners, are grooved so that the walrus strips will not slip off. Holes are drilled for the thongs near the top of the runners. When the sledge is driven over irregular, rough blocks of ice these thongs give enough to absorb the shock and save the sledge from breaking apart. The line running along the edge of the runners affords a way of lashing baggage to the

L. de Vaiseaux Paris.

F99
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dis

Com. Eses H. Valiquette
293 Esuques, Canada

Service
1/15/36

sledge. Repairs along the trail are more easily effected with thongs than with nails.

F121
Foot Circulation Improved by Roughened Cylinders

"Fingerprints" of Auto Tires Help to Trace Criminals

Modern counterpart of the pioneer woodsmen who tracked their quarry by footprints in mud or snow are the federal "G" men, who trail criminals sometimes by the "fingerprints" of their automobile tires. In a file at Washington are 1,800 different tire patterns. When a criminal's car leaves its tire marks on paved highway or mud road, law enforcement officers photograph the marks or make plastic molds of them, compare the patterns with their files, and not only determine the make of tire but from its markings identify the car as it appears elsewhere.

F117
Weights Hung on Model Cable Test Strength of Bridge

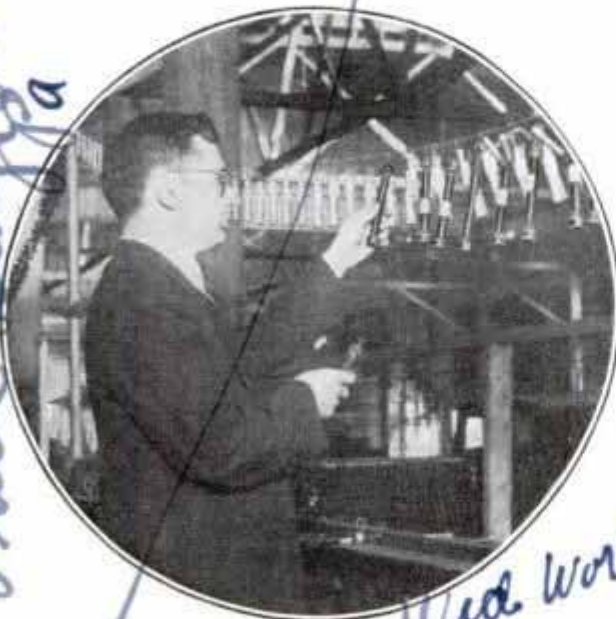
As the San Francisco-Oakland bay bridge is being erected, engineers are constantly checking for stresses and strains by hanging weights on a single strand of cable representing the cables of the real bridge. White weights are hung on the "line" to represent the actual weight of the cable in miniature; the black cylinders designate road sections in place, and as the road is completed the effect on the cables is watched by adding black weights.



Trying out the blood stimulator invented to relieve tired feeling in the feet

Rubbing the soles of the feet on the roughened surfaces of a cylindrical device introduced recently on the west coast will speed up the blood circulation. The circulator has a wartlike surface on each of its two cylinders or spindles and the feet are rubbed back and forth to stimulate the flow of blood. The treatment is said to relieve fatigue for persons who stand for long periods and for those subject to cold feet, the result of poor circulation.

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.



Hanging black cylinders on model cable to represent weight of road sections on bridge

Frank Blyskal

Wild World

Fred J. Decombe, 3527 Dege-man, Av. Oakland Calif.

H. W. Trolsch, American Bridge Co.

61544

Capek M & More
Chicago Fire Department
Chicago, Ill.

Mystery FIRES



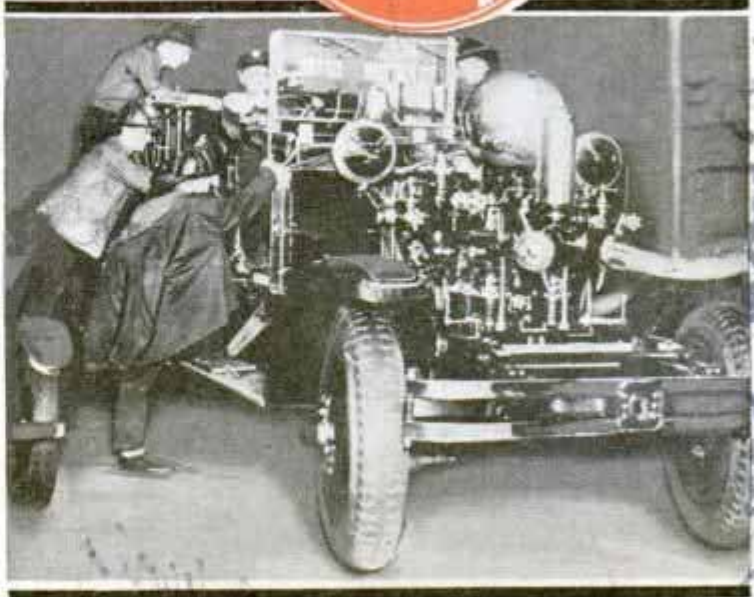
self-heating of combustible materials to the point where they burst aflame—costs this country perhaps \$50,000,000 a year in fire losses; and static electricity—that spark at your fingertips after you glide across the parlor rug—is lurking everywhere as the unseen torch that may start a holocaust.

A series of fires in an eastern shoe factory puzzled officials of the plant one winter. Always, the flames broke out at the same point, and always the same girl employe was at the worktable, passing shoe soles between rollers where rubber cement was applied



YOU don't need a can of gasoline and a box of matches to burn the house down. You can do it with a goldfish bowl, a carpet sweeper, a sack of sugar or an insect spray. An umbrella handle or an electric-light bulb may set the house afire, or you may discover you're a human spark plug yourself.

If you smoke a cigarette in bed, toss a can of kerosene on the kitchen stove or let the youngsters play with matches you can only blame yourself for adding to the total of 10,000 deaths caused every year by fire. But how can you help it if the blaze was self-started? Spontaneous ignition—



In training at a firemen's school, these fighters will be ready for duty when the sun shines through a goldfish bowl and starts a blaze or the drapery is set aflame by a cigarette

Chicago Fire Department

Chicago Fire Department

Engine no. 11. Last run
from 10 E. Austin. # 1544

and HOW they START



to the leather. Suddenly and mysteriously the rubber cement would burst into a blaze. Obviously the girl was not guilty of arson; in fact, on one occasion she was severely burned. During her absence a substitute worked regularly at the same post, yet no fire occurred. Then, fifteen minutes after the girl returned to duty, another fire started. Physical examination demonstrated that her skin was so dry that static electricity was continually building up a strong charge in her body and clothing, and sparks from her fingertips would ignite the rubber cement. She was a human spark plug. Maybe it's fun to "shock" your friends with a static spark from your finger, but if conditions are just right you may blow up the house.

A painter was burned to death when a spark, either static or from an electrical appliance, touched off the inflammable vapor rising from his varnish remover. Even



Old and new in fire fighting equipment—horse-drawn fire engine starting for blaze, and a modern water tower in action

Hire at masonry
and Son of Boston



Firemen wearing oxygen masks and helmets insulated against electricity rescue victim overcome by smoke. Battery of floodlights at right guides squads at night fires

an insect spray can be an agent of flaming death. A housewife was spraying crannies with a liquid insecticide when a spark caught it, the home burned down and she was trapped in it. There is enough friction in the flow of a liquid to generate a dangerous charge of static, and merely pouring gasoline from one metal container into another might cause an explosion if care is not taken to keep the two containers in contact to disperse the static. That is why filling-station attendants keep the fuel hose, made of non-ferrous metal, touching the car as they fill your automobile tank, and gasoline tank wagons drag a chain to ground the static developed by the fluid. One of the simplest methods of starting a blaze you can't stop is to use gasoline, naphtha or similar highly volatile substance to clean a suit or gown.

Gasoline vapor is dangerous farther than you can smell it. Light a cigarette in the next room and the flame will follow

that odor of gasoline to its source. A tiny pilot light in the kitchen may touch it off. But if that doesn't happen, just rub the cloth a couple of times and it will generate—particularly if it is silk—enough static for a spark that will ignite your cleaning fluid with a murderous flare. Static electricity in a cloth type dust-collector once caused a dust explosion that wrecked part of a factory and seriously injured six men.

But for subtle ways of starting fires, consider spontaneous combustion. Com-

monest victim of the self-starting blaze is the hay barn. Hay, stored away too green, has a way of heating up in damp spots to the point where a breath of air fans it into flame. Spontaneous ignition destroys hay worth \$20,000,000 each year, and one-tenth of the entire harvested hay crop of the United States, worth \$1,300,000,000, is destroyed by spontaneous heat that chars without quite reaching the blazing point. All this loss despite the fact that farmers have recognized this heating process for two thousand years or more.

Floods in Vermont were followed by an epidemic of barn fires. As soon as the water receded, haymows began to heat. One barn standing in five feet of water caught fire two days after the flood crest passed and burned to the water line. Four hundred barns burned in three years in the province of Ontario and half of them were due to spontaneous combustion.

You reflect, comfortably, that this does

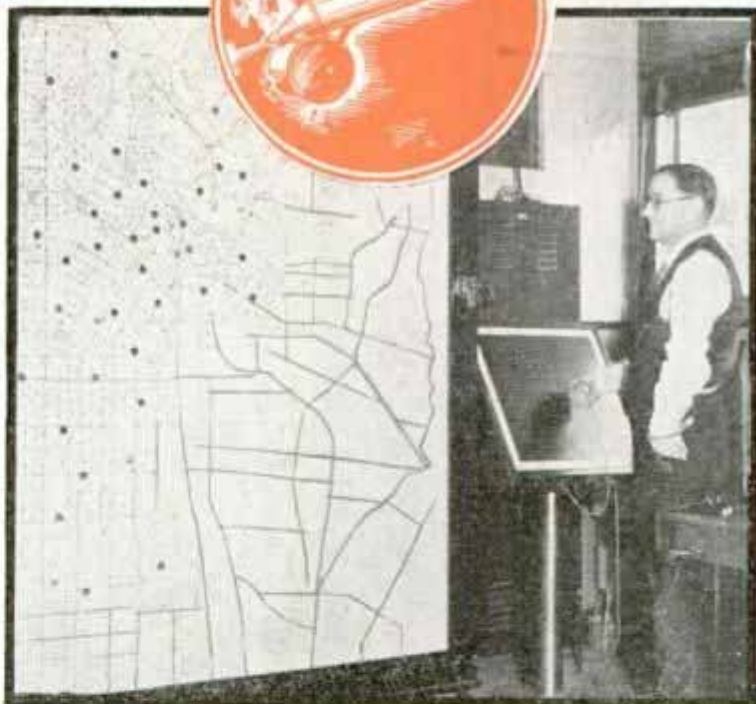
Cal. Lanker at, Bagman

NJ 6/15/44



not concern you for there is no hay stored in your home. How about that pair of greasy overalls hanging in your closet or those rags you used to wipe the paint brushes, then tossed in a burlap rubbish bag? Anything bearing a trace of vegetable oil, which oxidizes and creates heat, is a fire menace. Linseed oil is a notorious incendiary. What about your carpet sweeper? Minute particles of floor wax and other combustibles mingle in the dust collector of one carpet sweeper under just the right conditions to heat up and set the house afire.

Several fires have started spontaneously in jute bags of sugar. Disastrous theater and hospital fires have been traced to spontaneous ignition of cellulose-nitrate motion-picture or X-ray film, which decomposes at a temperature of 300 degrees Fahrenheit and ignites easily even in a low air supply, giving off noxious gases. Certain cleaning compounds, silk stored away in improper conditions, and sawdust heaps are breeders of flame. Wood that has been alternately wet and dried absorbs a heavy



Top, fireboats at waterfront conflagration. Below, operator plugs switchboard and light on map shows location of fire

supply of oxygen and ignites readily, even at low temperatures. You're courting fire if you pack your steam lines with sawdust.

Modern fire departments date back only to about 1865, when cities of America and Europe assumed the duty of protecting the homes. The Roman, Crassus, added to

(Continued to page 148A)

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Shockproof Compass Built for 'Queen Mary'

4/22
786



Stitching compass points on silk. Right, finishing shockproof pedestal for "Queen Mary's" compass

Christopher Columbus relied on it still the vital element in steering ocean vessels. The "Queen Mary's" compass has the coach-spring form of suspension fitted into the pedestal. The compass card is poised on a pivot whose base is fixed on a mattress suspension to absorb shocks.



Emb. Thomas M. Johnson
417 W. 118th St. N.Y.C.

Expert needlewomen at Glasgow, Scotland, have an important part in building the magnetic compass, one of the largest in the world, which will guide the liner "Queen Mary" across the Atlantic on her maiden trip. These women stitch in bright colors, with finest silk, the points of the compass which must stand out in bold relief and with unerring accuracy on the compass card. Despite the modern inventions of the gyroscopic compass, "metal mike" and submarine echo-sounder, the old-fashioned magnetic compass that

'Hitching Posts' for Clipper Ships Are Old Boat Anchors

F102



Modern air liners will be "hitched" to these old anchors which were discarded after long service on ocean-going boats

Rusty anchors of old ships, bought at scrap iron prices, are to be put to modern use at the island bases in the Pacific where ocean air liners will stop for refueling and servicing. They will anchor the buoys to which the clipper ships will be moored while making the regular service stops on the transpacific air route.

Pan American Airways

Best Gasoline Will Win War of Future, Says Scientist

F129
Dr. Merrell R. Fenske of Pennsylvania State College says that the next war will be won by the nation having the best gasoline. The load which a bombing plane can carry and the range of a pursuit plane depend upon the weight of gasoline they

State College Pa

must transport, Dr. Fenske says, and if the efficiency of gasoline could be improved so a gallon of fuel would give more miles of flight than at present, then the bombing plane could carry a greater load and the pursuit plane would have a greater cruising range. The efficiency of the modern gasoline engine depends on the compression ratio. However, as the compression ratio is increased to get efficiency, "knocking" appears unless the octane rating of the fuel is increased. The government last year ordered 1,000,000 gallons of gasoline for army and navy planes with an octane rating of ninety-two. Automobile gasoline has an octane rating between seventy and eighty.

F68
Three-Pound Portable Radio Transmits Voice Two Miles

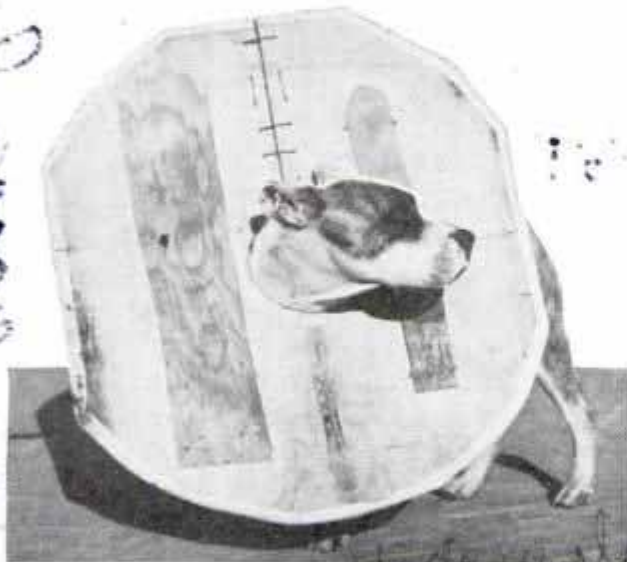


Mouthpiece doubles as receiver for this tiny two-way radio set. Battery and all, compactly boxed, weigh only three pounds

In a small box conveniently equipped with shoulder straps, a Staten Island inventor has built a radio transmitter and receiver capable of carrying the voice and receiving for a distance of two miles. Completely equipped, with power supply self-contained, the outfit weighs just three pounds. It operates on a frequency of sixty megacycles. A single-unit mouthpiece and receiver is used.

F104
Three-Foot Collar for Fido Protects His Sore Tail

When your dog has a sore tail, tie up his neck. That's part of the treatment at an animal hospital in California where dogs with sore tails wear collars consisting of light plywood disks three feet in diameter. The collar helps heal Fido's tail because it prevents Fido from biting it.



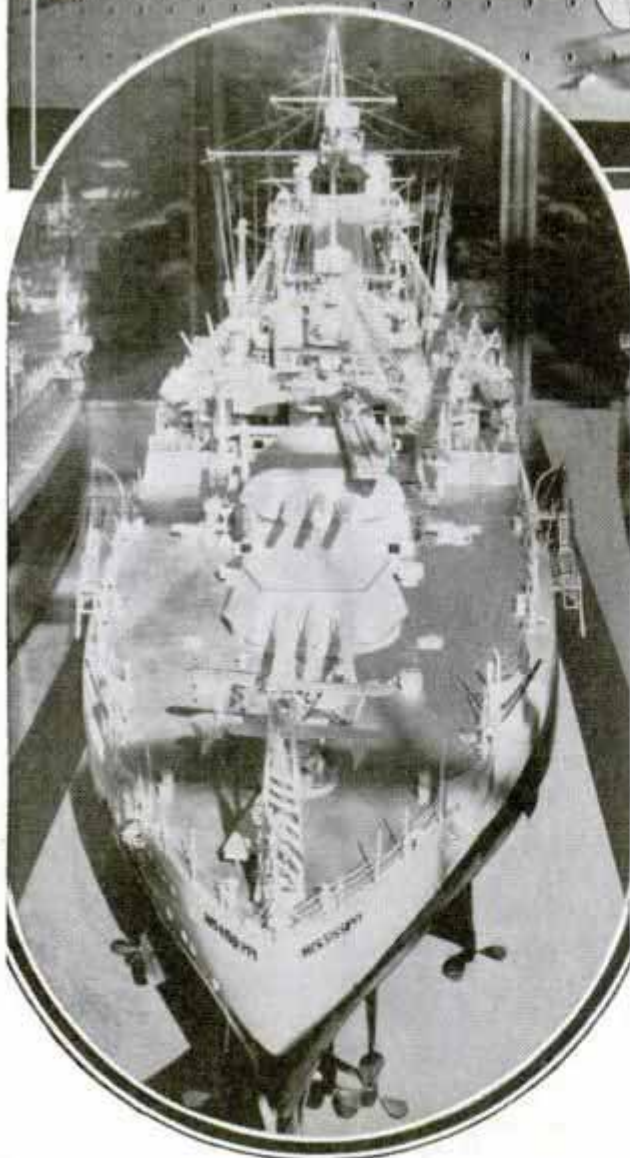
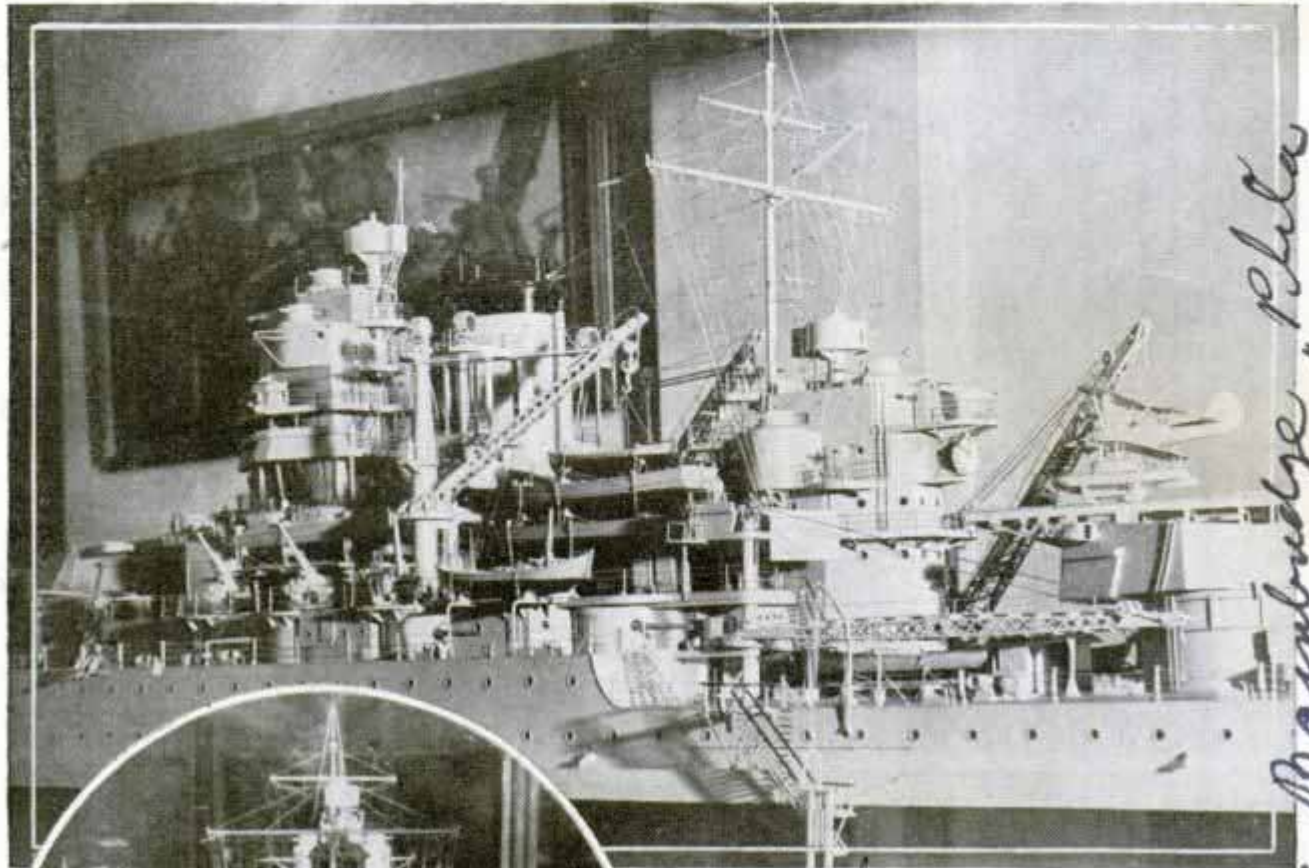
Here is collar Fido wears to help speed up healing treatment of his tail

F53
Plant Grows Bigger If "Stuffed" with Carbon Dioxide

Plants can be made to grow bigger and produce a larger seed yield by "stuffing" them with carbon dioxide, the atmospheric gas they use as initial raw material in food-making. This is the finding of Dr. Earl S. Johnston of the Smithsonian Institution after a series of laboratory experiments in which he grew wheat plants in open-topped glass enclosures, maintaining the carbon-dioxide content of the air at four times the usual percentage. The plants produced more stalk and larger and more numerous heads than did similar ones in adjoining containers where only ordinary air was used. As yet the results have no practical application because the cost of raising the carbon-dioxide content of the air under field conditions is greater than the worth of the increased yield.

*Charles Alessandro
 156 Bryant Ave.
 June 14/36
 Washington, D.C.*

'Mississippi' Is Navy's Only Battleship Model



Stern and side views of navy's model of the U.S.S. "Mississippi," with seaplanes on deck catapults

Only model of a great modern battleship in the navy's possession is that of the U.S.S. "Mississippi," now on exhibit at Washington. It was built by F. B. Craven of LaPorte, Ind., at a cost of \$3,975 and is true to every detail of the dreadnaught itself. Even toy seaplanes are shown mounted on catapults on the afterdeck. One other model owned by the navy is of a cruiser, the U.S.S. "Houston."

One-Station Radio Receiver F57 Assures an Audience

One of the simplest radio sets recently developed is a one-station outfit. It is tuned by the manufacturer to a certain wave length, the volume is fixed, and the only adjustment is the switch that turns it on and off. Such an outfit is quite inexpensive to build. By placing these sets in stores and places where people gather, the radio station to which it is tuned can assure itself a large audience. The one station set can also be connected with a clock that turns the radio on automatically during a certain advertiser's program.

*Ivan Creneef. %
H.A. Bartholomay*

Islohe
© Harris and Ewing
American and Cambridge, Phila

120
526
526

81507

Q20 Cairo St Washington Station
Pittsburgh Pa

MASTERPIECES in Wax

By J. A. Hogle, Jr.

"MEXICO, the land of contrasts," is also the home of unusual art—the application of odd materials to native handicrafts.

Dolls and animal figures are made from cornhusk and bits of wood, Mexican landscapes, street scenes and native life are portrayed in clever mosaics of colored broomstraws or "popote," and reproductions of native life formed in statues of wax!

The wax statues portray, in miniature, the everyday life of the natives, women making tortillas, pottery makers, basket weavers, fruit and produce vendors and bullfighters in their elaborate costumes. Interesting figures are those of the charros and the china poblanas, the colorfully costumed Mexican cowboy and cowgirl mounted on beautiful horses in various colors and lifelike postures. The saddle, stirrups and



trappings of these statues are complete to the smallest detail as are the costumes of the riders

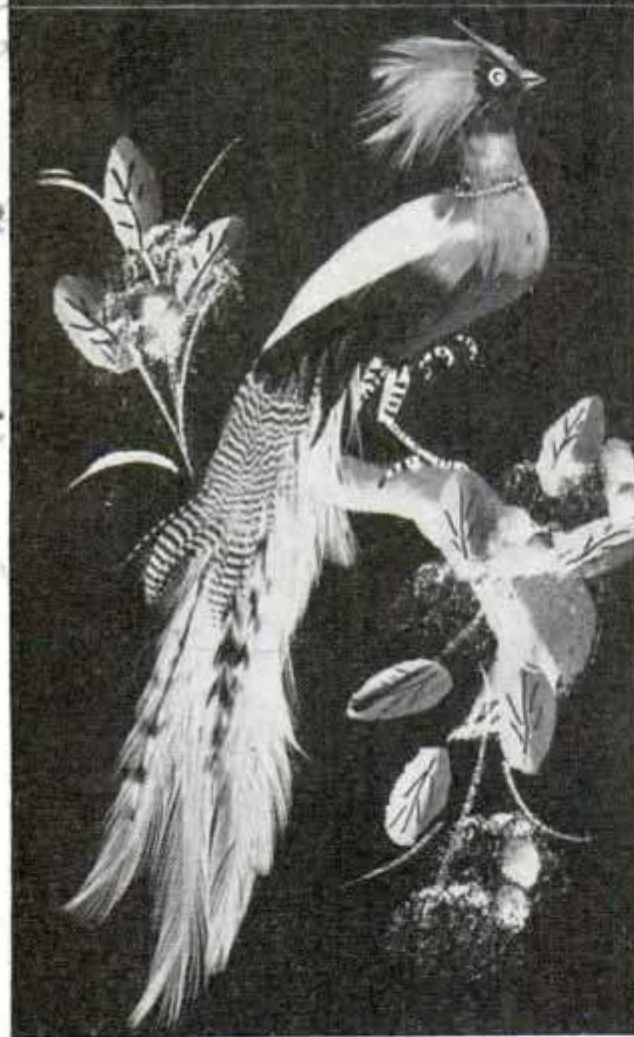
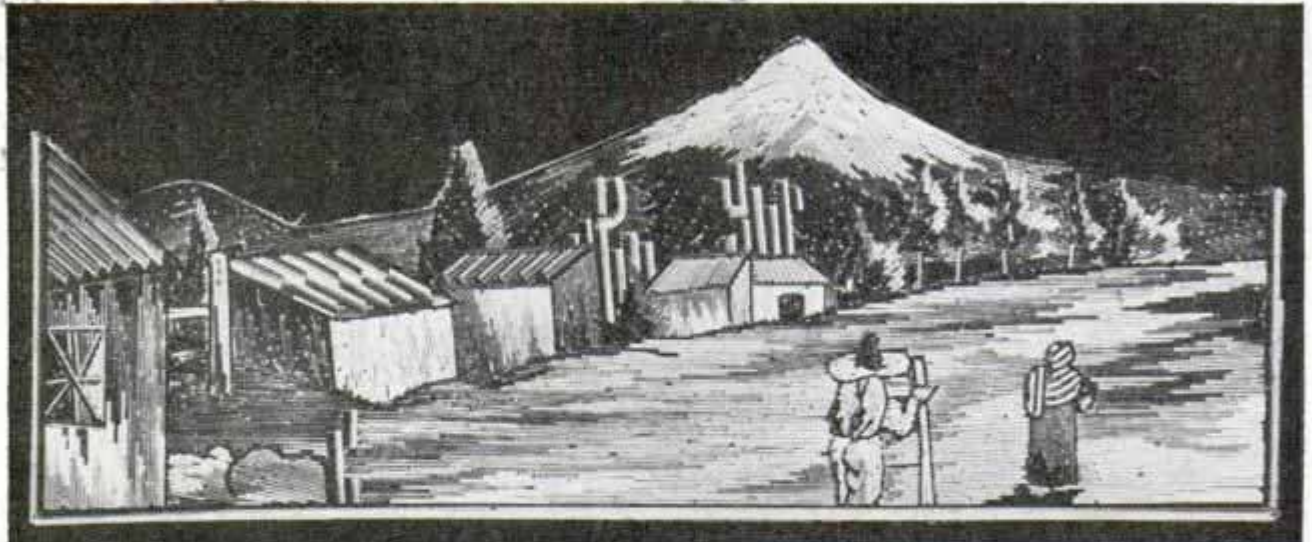
Luis and Ramon Hidalgo, Mexico's wax sculptors, are descendants of Joaquin Hidalgo, famous wax sculptor, who brought the art to Mexico from Italy and Spain in 1777. It has been handed down through seven generations.

Ramon employs molds in making some of his reproductions and incorporates bits of other materials such as cloth, leather and tinfoil, but Luis Hidalgo, famous throughout the continent for his reproductions in caricature of famous personages uses nothing but his fingers to shape the wax. He not only has inherited the secrets of his ancestors but has worked out many new methods in the coloring and preparation of the wax,



Luis Hidalgo, one of two brothers famed as Mexican wax sculptors. Center, dancing girl done in wax by Hidalgo. Bottom, wax grouping complete to smallest details

Wax Sculptor
Mexico City, D. F.
Filomena Mate
ni. 17



Top, picture made of hundreds of colored broomstraws. Below, Mexican feather composition

one of the most important improvements being a wax that will withstand a high temperature.

The broomstraw artists are mostly girls and young women whose ancestors, in many cases, were Aztec Indians famed for making feather mosaics. The adobe hut of the native serves both as home and studio.

Here, with a tray of colored broomstraws or popote and a pair of tweezers, they glue broomstraws of various lengths and colors on cardboard to form landscapes and portraits that resemble oil paintings in shading and perspective. The broomstraws used for picture making are grown near the volcanoes, Popocatepetl and Ixtacihuatl some distance from Mexico City. Nature not only supplies the material for this unusual art but has surrounded the artists with a panorama of wondrous beauty. This scenery forms the background in most of their pictures. Church towers, street scenes and neighbors at work are favorite subjects.

Popote pictures range from the size of a postage stamp to about eight by ten inches or larger. Some compositions require thousands of tiny lengths of straws and a week or more is needed to complete some of the more elaborate pictures which sell for from \$5.00 to \$7.00. Most curio stores in Mexico City will have your favorite Mexican snapshot copied in broomstraws for a nominal sum. Wooden fruit bowls and serving trays inlaid with popote pictures, as well as jewel and powder boxes, also can be purchased. Most popote pictures are sold unframed but they are also available with frames decorated with inlays of the same material. Picture making with broomstraws apparently is not one of the old Aztec arts but dates back to about 1850.

Feather mosaics of multi-colored birds formed on cardboard of various sizes, when framed, make a handsome wall decoration for the home. Greeting cards dec-

MEXICAN Feather pictures. Unusual
 Novelty. No competition. 25c (stamps)
 Rings \$1.00 worth sample and details. Re-
 turned if unsatisfied. Mexican Art, Apar-
 tado 1593, Mexico City.

orated with feather mosaics and further enhanced with hand-painted flowers offer a change from the usual. Score cards for bridge parties are another item obtainable with feather-picture decorations.

Feather mosaics date back to the days before the conquest when artisans were expert in the creation of real works of art with the feathers of tropical birds. These birds, mostly of the parrot family, furnished gorgeous feathers of every hue and texture. The downy feathers of the hummingbird were also used in profusion in the creation of draperies and wall decorations and feathers were pasted on fine cotton web and made into dresses for members of the wealthy families. Aztec nobles and high officers of the various military orders wore coats of feather work over their quilted armor. These coats worn with plumed helmets gave them a picturesque appearance and banners, embroidered in gold and feather work and decorated with gayly colored plumes, added splendor to military assemblages. History records that when Cortez and his followers first visited Montezuma at his palace, they passed through rooms, the walls of which were hung with gorgeous draperies of feather work wrought in imitation of birds, insects and flowers.

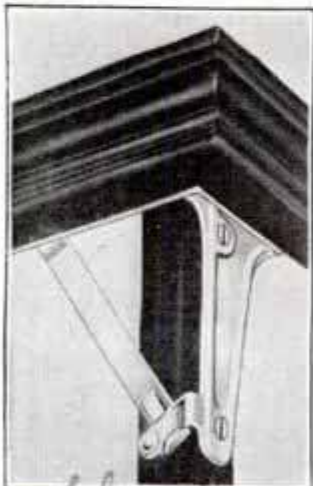
61591
Cableway Drops Freight Car to Rails below Boulder Dam



Loaded freight car swings out over canyon on cableway and drops 800 feet to rails leading to Boulder Dam power plant

Eight hundred feet down into Black Canyon swings a steel cableway carrying tons of freight to the powerhouse and construction crews of Boulder Dam. Loaded steel box cars are run aboard the platform of the cableway, rolled out over the gorge and then dropped gently to the railroad track leading to the Nevada powerhouse at the base. The cableway is capable of lifting 150-ton loads.

F29
Brace for Legs of Card Table Is Locked in Position



Foolproof leg braces for the card table are handy in repairing and strengthening these and other pieces of collapsible furniture. The braces lock in position when the legs are opened, but lay flat and out of the way when they are folded.

Homing Pigeons Carry "S O S" from Fishermen to Shore F58

Long Island fishermen are taking on homing pigeons as their partners. Two pigeons ride along as passengers in every fishing boat that puts out from Freeport, L. I. From the fishing grounds, the first bird is released with a message to shore advising other fishermen of their location and their luck with the catch. A second pigeon is kept as an emergency "ship-to-shore" messenger, to carry an "S O S" message in a capsule in case of trouble.

The Stanley Works
 195

Carl George H. Eckhardt
 2017

61459

The NEXT WAR



U. S. army searchlights throwing 100-mile beam. In front of lights are sound detectors which pick up whir of airplane propeller and enable the soldiers to turn beam on "enemy" aircraft

Hartford
Conn.

By Hiram Percy Maxim
(Noted Inventor, Author and Engineer)

Recd
Feb. 17, 1936

PART IV

IN THE next great war men will battle in a new medium—the ether. Tremendous strides have been made since the last great war in exploring this strange and little understood domain.

Originally, in our efforts to account for the transmission of light across space, we had difficulty understanding how light waves could be propagated unless there were some medium which would carry waves. We understood sound waves in air and knew they were propagated in the air. We understood water waves because we could see them propagated. But when it came to light waves, coming across millions of

miles of empty space, we were stumped. To propagate a light wave it seemed something were needed that could be waved.

Empty space being without a wave-carrying medium, we decided to imagine one. We imagined an all pervading something so finely divided that it passed through everything without friction. It was supposed to be perfectly elastic and jellylike. Such things as suns, planets and moons could travel through it at high velocities without resistance. Light, as well as all other forms of radiation, set it vibrating or oscillating. These vibrations oscillated sidewise instead of forward and

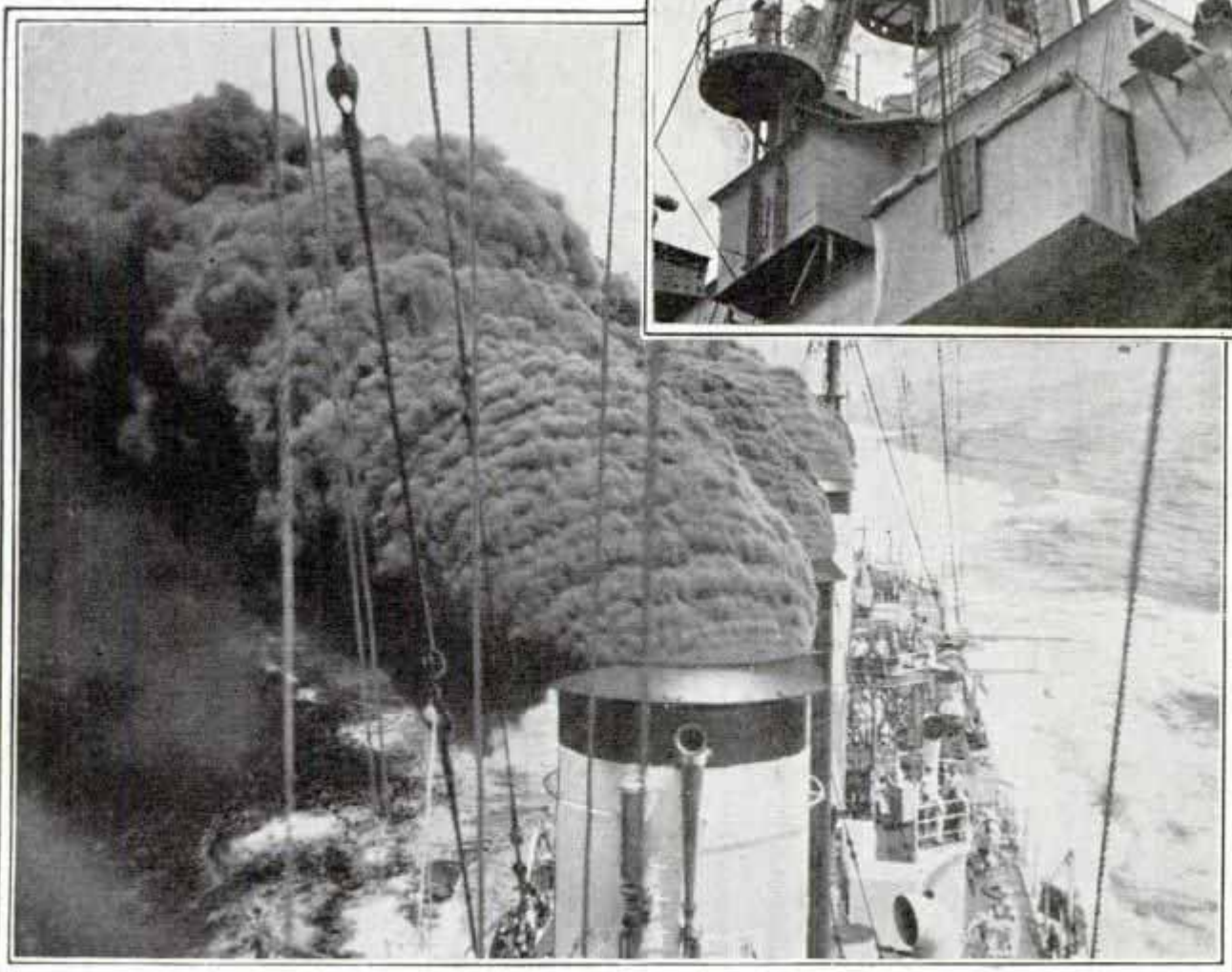
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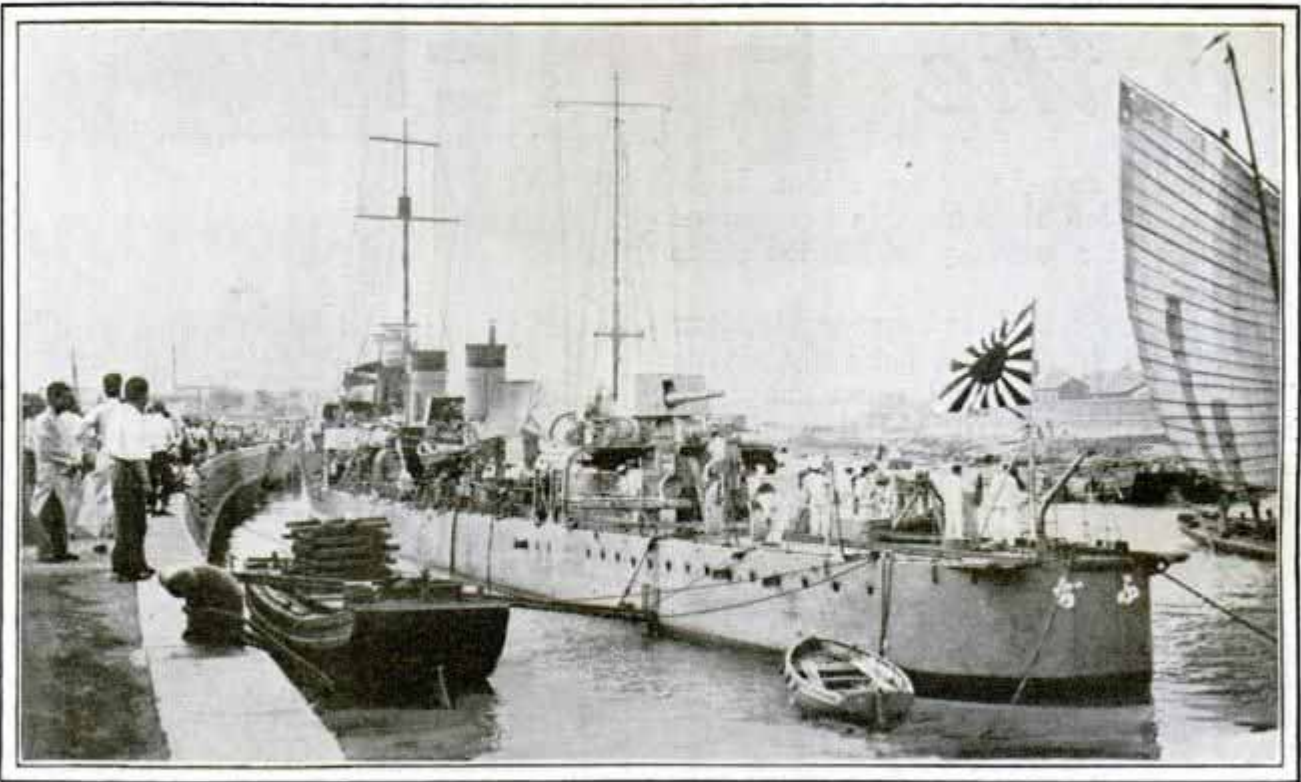
in the ETHER

backward as sound waves oscillate. Light waves traveled through this mysterious substance at a velocity of 186,000 miles per second.

This theory called for large applications of faith. A frictionless, perfectly elastic jelly, that permitted all these things to happen, taxed credibility. But something had to be provided to account for what was known to happen. Pending the offering of a better theory, it was accepted by the scientific world and the assumed substance was given the name ether. Then Dr. Albert Einstein came along. He suggested we cease trying to imagine an all pervading mechanistic medium, and instead, urged us to regard the propagation of radiation as an abstract mathematical concept, such for example as the "propaga-



Top, unusual view of mainmast of U.S.S. "Pensacola." Bottom, cruiser "Cincinnati" pouring out dense smoke screen to hide activities of airplane carrying ship, "Lexington," in Pacific maneuvers



tion" of solar noon around the earth at the equator.

The equator is an abstraction, but solar noon is propagated all the way around it every day. Einstein further playfully suggested that each of us imagine our own ether, and so have what suited us individually as best accounting for the propagation of radiation. Here we have the existing state of affairs regarding the ether, the greatest myth of science.

There is only one ether. All our radio communication, friendly and enemy, must be conducted in it. In the next great war there will be armies of millions of men. Maneuvering these vast numbers will de-

mand thousands of radio transmitters and receivers.

There will be naval fleets each numbering hundreds of ships. To maneuver and fight them effectively will require more hundreds of radio sets. There will be thousands of airplanes, most of them transmitting scouting reports and receiving orders. There will be at least 100 submarines which will need frequent communication with their headquarters. There will be hundreds of non-combatant ships accompanying the fleets, furnishing transport, material, supplies, hospitalization and equipment. They will require radio communication.



Top of page, Japanese destroyer, "Tsuta," anchored at Tientsin, China, at one point in crisis between the two nations. Bottom, German torpedo boat bucking high seas during maneuvers in North Sea



Above, cavalry officer in U. S. army mechanized unit receiving orders by radio as he prepares his steel steed for action



Top, right, camouflaged Vickers instrument which controls fire of anti-aircraft guns. Bottom, signal corps company of U. S. Army sets up communications equipment during war games



Troops mounted on horses and automobiles camouflaged with foliage are shown being moved at midnight during the annual grand maneuvers of the Japanese army at Kagoshima

Imagine thousands of steam whistles tooting, fire-alarm bells clanging, traffic sirens screaming, automobile horns hooting, and radio loud-speakers blaring. While you, in the midst of it all, try to make out what is being said by one of the fainter loud-speakers. And yet, in the next world war, radio sets must successfully pick out and make intelligible what each wave is saying.

This can only be done by tuning, or rejecting all except the one wave desired. The ether, a tumult of different waves emitted by thousands of transmitters, is like the confusion water is in when a large number of boats are passing to and fro. To pick out one particular small set of waves, and reject every other, seems an utter impossibility. Fortunately we cannot see the confusion of waves in the ether as we can on water or we would quail at the job of picking out a particular one. But it can be done.

By immersing a wire in this confusion of ether waves, we find the wire will pick up that series of waves which is "in step" with the particular "step" natural to the wire. If the natural step, or period of elec-

trical oscillation, of the wire is 30,000,000 per second, only that many waves per second will excite the wire. Any other number will leave it "cold."

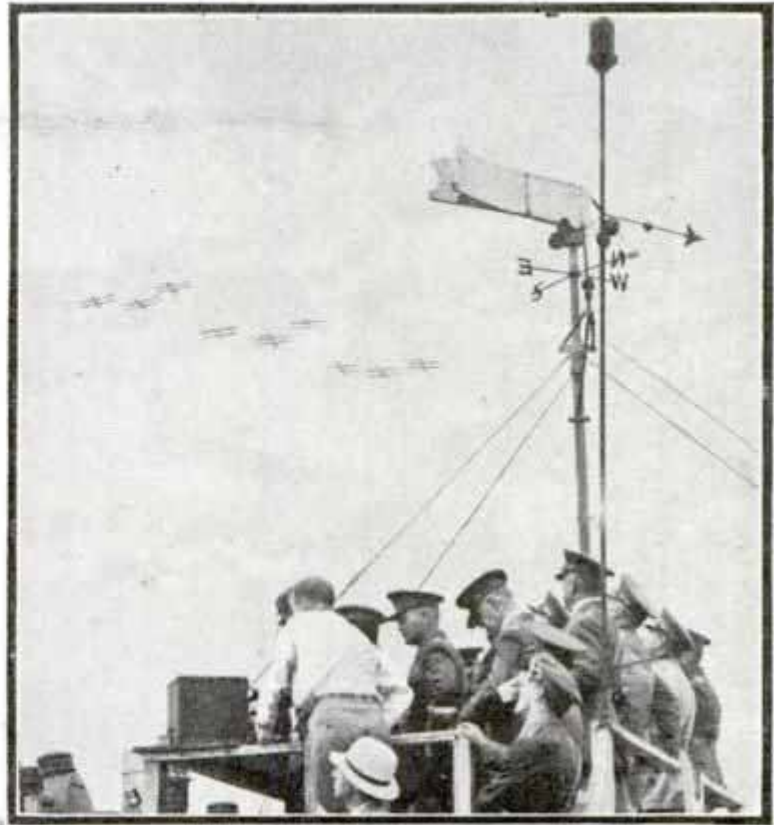
If some one station is transmitting at this particular frequency, its signals will be heard, and all other frequencies will be rejected. However, if more than one station is transmitting at this exact frequency, all will be heard, and an unintelligible jumble will result. This is why, when several transmitters are sending out waves, each transmitter must have a wave length, or frequency of its own.

Several armies, with several millions of men in each, scattered over a front a hundred or more miles long, divided up into many separate mobile units, call for the extreme in coordination. The next great war probably will see the most far-reaching system of coordination ever attempted, because more men and speedier equipment will be involved than ever before. Without radio communication the difficulties would be insurmountable.

To conduct the communications of several allied armies, not to consider enemy armies, requires the use of a large number

of different frequencies. There are available waves from one meter to 30,000 meters for both radiotelegraph and radiotelephone. The distance from crest to crest of a one-meter wave is one meter, or about thirty-three inches. The distance from crest to crest of a 30,000-meter wave is 30,000 meters, or a little over eighteen miles.

These waves radiate from a transmitting antenna at the velocity of light. In the case of one-meter waves, a "punch" is delivered to the ether frequently enough for the resulting wave of ether to move out just one meter by the time the second punch is administered. Since the waves move out at 186,000 miles per second, the "punches" must come pretty frequently. If we wait even



Top, directing air fleet from ground by using radio. Bottom, Berlin street cleaners in gas masks after realistic air "raid" on the city

one second between punches, wave No. 1 would have reached a point 186,000 miles away before No. 2 started. The distance between waves then would be 186,000 miles instead of thirty-three inches. To deliver a new punch by the time the wave from the preceding punch has traveled outward only thirty-three inches, requires that punches follow each other at a frequency of 300,000,000 per second. If the

wave length is 30,000 meters, the frequency of the punches must be 10,000 per second.

During the world war we did not know how to administer 300,000,000 punches per second. The best we could do was about 1,500,000. The difficulty was keeping the number of punches per second exactly at one steady rate. Today, thanks to crystal control, we can hold our punches steadily



Top, camouflaged heavy field gun in action during Japanese maneuvers. Bottom, Japanese soldiers wearing fish nets to which may be attached branches, twigs and grass for camouflage in the field

enough at 30,000,000 per second to give reliable communication. This is ten-meter wave lengths.

Below ten meters new troubles arise. Roughly speaking, physical objects, such as mountains, become opaque, as is the case with visible light waves. To ether waves of ten meters or longer, mountains, buildings and similar objects are transparent. To waves below ten meters they are opaque. Reliable communication on these ultra-short waves is therefore limited to "line of vision."

Visible light waves are ether waves, like radio waves. The only difference is that there are more of them per second. The lowest ether wave frequency our eyes can detect is thirty-seven and one-half million

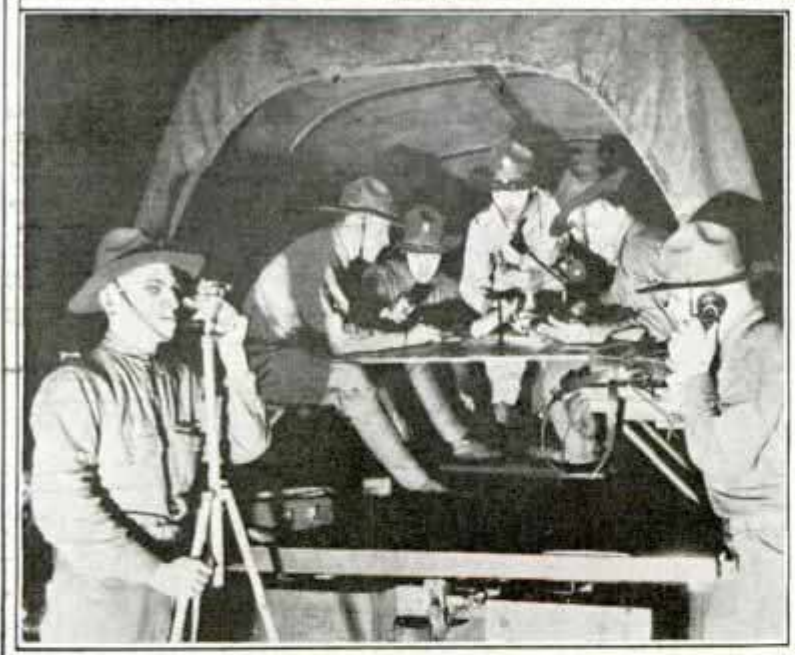
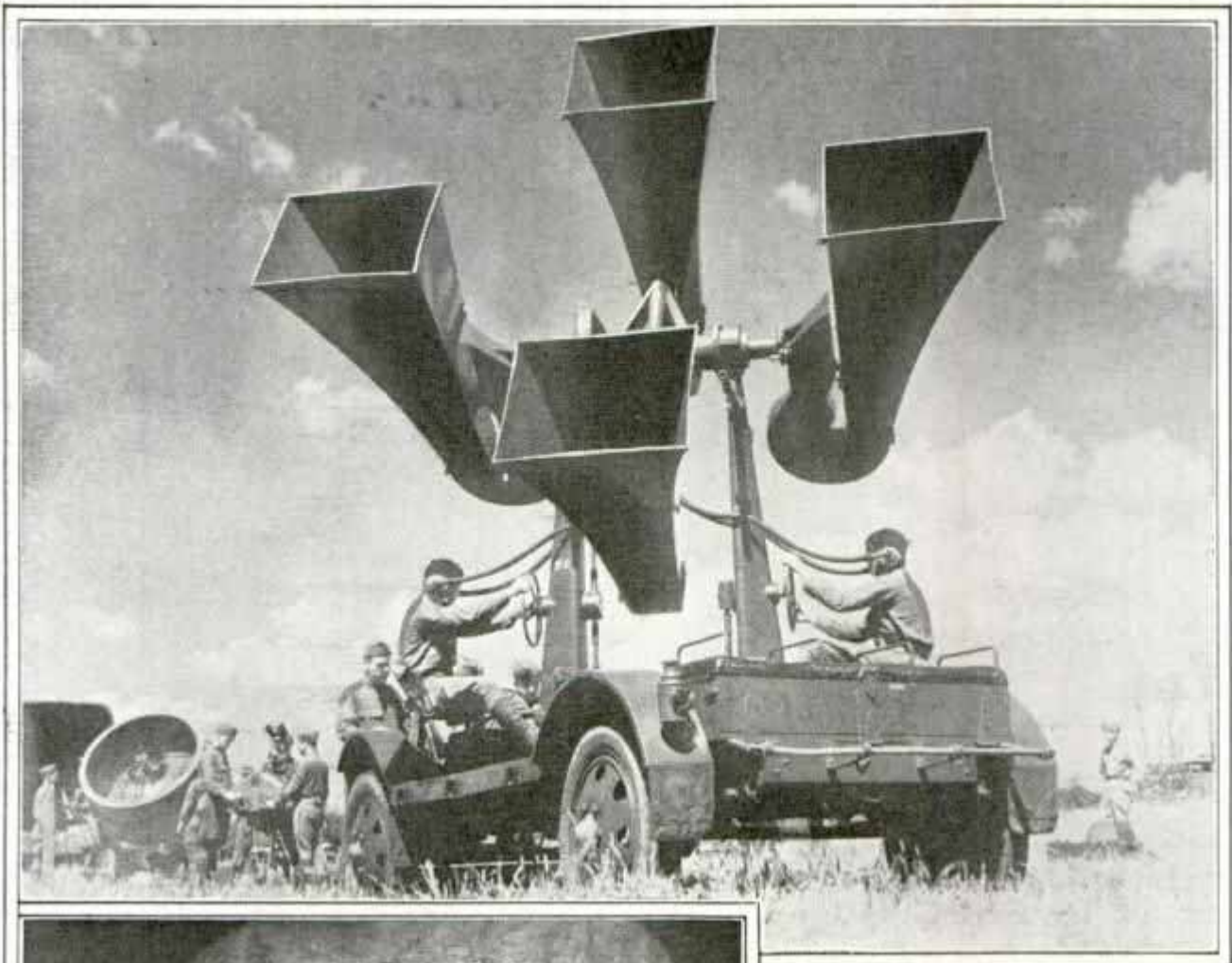
million per second. This is the darkest visible red. The highest frequency our eyes can detect is 150 million million per second. This is the faintest shade of violet. The vast space between the slowest of visible light and the fastest of radio waves indicates the extent of this unexplored realm.

In practice, the number of communication "channels" is limited. One might think there are enough different wave lengths between ten meters and 30,000 to accommodate all the armies, navies, and air forces of both belligerents. Unfortunately, there must be a generous separation between different wave lengths if they are not to overlap each other and cause interference. Also, the long wave lengths require bulky antenna systems for the transmitters, which would not be sufficiently mobile to be suitable in warfare. The result is that where a large number of communication channels must be provided, crowding is un-

avoidable. This crowding brings into existence an entirely new form of warfare.

Nothing is more helpful to an army than to break down an enemy's communications. Then his coordination automatically breaks down, far-flung units become separated, team play ceases, supplies fail and cooperation ends. Chaos and defeat follow. This may be brought about by "jamming," or sending out a hodgepodge of powerful waves on all frequencies. If every wave length were involved, and if plenty of power were used, every receiving set would be smothered. Signals could not be read, and confusion and delay would ensue.

Whether the leading nations have devised jamming and anti-jamming apparatus is unknown. Obviously any such



Top, U. S. army's huge "ears," sound locators tuned to pick up noise of "enemy" aircraft or motor equipment. At night, the detectors are synchronized with powerful searchlights which reveal the source of the sound. Bottom, mobile command position in truck during mimic war between opposing forces of U. S. army

preparations would be kept secret. But it will be difficult to jam an enemy's radio communications without jamming one's own; to avoid jamming one's own calls for some entirely new inventions and devel-

opments not generally known at this time.

Whatever would avert jamming one's own communications would also enable the other side to protect their communications. An inkling of these means would be all that is necessary for the secret to be worked out successfully. Before war actually breaks out it is extremely difficult for one nation to keep new developments in war equipment from other nations. Military attaches at the various legations, and secret intelligence operators manage to get hold of nearly every new thing. After war breaks out, however, it is different.

Another new form of warfare in the ether probably will be the use of secret radio by spies. In the world war ultra-short wave radio was not available. Spies were

(Continued to page 150A)

Ten-Car "Zephyrs" in Thousand-Mile Race



Chicago

The original "Zephyr" that started streamline styles for the Burlington railroad is a baby by contrast with its big brothers, the ten-car "Denver Zephyrs" drawn by twin Diesel power cars, soon to start a nightly 1,000-mile race between Denver and Chicago



Ten-car twin streamline trains, "big brothers" of the Zephyr twins already speeding daily on three other middle western routes of the Burlington railroad, will start a nightly race against time next summer over the plains between Denver and Chicago. Dual Diesel-electric power units will streak over the 1,039 miles on a sixteen-hour schedule, hauling stainless steel cars accommodating 200 passengers and luggage. Included in the equipment are four sleepers, two coaches, diner, club and observation cars. These "Denver Zephyrs" will better present schedules by about ten hours, averaging around sixty-five miles an hour on the long overnight run. With several stops to make en route, the trains must cruise at ninety miles an hour. The Burlington's first "Zephyr" operates daily between Lincoln, Omaha and Kansas City; the original "twins" make daily round trips between Chicago and St. Paul-Minneapolis, and the "Mark Twain" serves Mississippi river communities between St. Louis and Burlington, Ia. The right of way along the Republican river valley in Nebraska was re-engineered last year, removing the last obstacle to sustained high speeds over the Chicago-Denver line.

Pipes Seven Feet Deep Located by Magnetic Detector

Deep laid pipes whose exact location has been forgotten for years can be charted with great accuracy by a magnetic detector recently developed by the General Electric company. In emergency searches it has located pipes laid for forty years, some of them seven feet deep and as much as 100 feet away from the supposed line. The detector is an extremely sensitive surveying compass with adjustable bar magnet to minimize effects of the earth's magnetic field. Attached and turning with the compass box are two radial fins acting as magnetic antennas, increasing the sensitivity. If the pipe is non-magnetic, electric current is established in it by wires to the nearest hydrants. By setting up the detector at one side of the pipe line, making proper adjustments and plotting a curve showing changes in current indication as the detector is moved across the pipe line,

Pipes
Glass frying pans and other cooking utensils which can be exposed to the direct heat of the flame now are being produced.

*Corning Glass Works
Corning, NY*

*Schenectady
NY*

Chicago. Carcasey mandels.

the pipe can be located directly below the peak of the curve. To determine exact depth of the pipe, the detector is moved to a point under a return wire from the pipe; the wire is then suspended over the detector at a height equaling the peak current indicated in the curve plotted during the search. The distance between wire and compass box then equals the depth of the pipe below the box.

Four-Mile-a-Minute Transport Plane Carries Ten Passengers



Twin-engine transport plane developed in Germany. It carries ten passengers and makes a speed of 250 miles per hour

F12

Midget Automobile Built of Junk Runs Cheaply

Constructed of junk parts, a miniature automobile built by a Californian without plans or blueprints will run five hours on one and one-half quarts of gasoline. It has four forward and one reverse gear and attains a speed of thirty-five miles per hour. Parts from two discarded washing machines and a twenty-year-old motorcycle, together with scrap materials gathered at junk yards, were used. Excepting a drill press and a hack saw, only ordinary tools were used by the designer. The car operates by belt drive. A "kick" starter under the hood starts the two-cycle engine.



This little car was built without plans. Note the attention to detail, even to miniature headlamps and bumpers

Germany recently launched what that country claims is the fastest transport passenger plane ever built. The twin-engine "Heinkel" ship, carrying ten passengers and a crew of two, is said to be able to maintain a speed of 250 miles per hour.

F84

Burning Coal Mines to Get Gas Is Tested for Economy

In Siberia and north Caucasia, the Soviet Republic, coal mines are being burned underground for their gas content. Many years ago, this economical way of using coal deposits of the lower grades was suggested by Sir William Ramsay, British chemist, and the Russian engineers are making a practical test of the theory. Already, it has been found that labor spent on the coal gas is only one-tenth to one-sixth of that needed in mining the coal. Also, it is possible to obtain gas from very narrow sheets of buried coal. The process calls for an air shaft to supply oxygen and exhaust outlets for drawing out the gas.

C. Lancaster
 478 E. 60th St. Long Beach
 Service Service
 11/4/36

F 36

How TO WIN the



By **CHARLES F. KETTERING**

*Vice President in Charge of Research,
General Motors Corporation*

(As told to John M. Bonbright)

WHEN I was at the age of these young Americans who compete in the annual All-American Soap Box Derby, boys were not given the opportunity to coast down a hill straight into a college course. I'm sorry, too—because I believe that the United States would be a better country today, if more of those who are now grown men had learned in their boyhood the things that the young boys of today are learning in their striving to build worthy soap box racers and to drive them to victory. I believe every Soap Box Derby entrant who carefully follows the rules, who designs and builds his own car, who studies how to get the best performance out of his car, and who conducts himself in every race in a sportsmanlike



Top, two young builders assembling a derby car. Bottom, some of the major awards in the All-American Soap Box Derby. Note framed certificate marked "First Prize" which entitles winner to four-year college scholarship

F36

SOAP BOX DERBY

Derby technical committee checking up on dimensions of old No. 7, original soap box car, before formulating the rules for the 1936 races



Charles F. Kettering

Vice president and director of General Motors Corporation and general director of General Motors Research laboratories; born on an Ohio farm in 1876; educated in country district school, normal school and Ohio State University; entered business as telephone installation manager; development engineer and then director of inventions department, National Cash Register company. Organized, with associates, the Dayton Engineering Laboratories company to manufacture Kettering inventions, including automobile self-starter and lighting and ignition systems; commissioned by General Motors to set up and direct research work; since 1925, "Boss" Kettering has been in charge of large staff of scientific workers inventing and testing automotive and other devices for General Motors.

own initiative, inventiveness and ingenuity in designing and putting together a car of his own conception than to start off with a set of blueprints and specifications to be followed blindly.

My opinion is that the thing most essential to building a good Soap Box car is brains—and that includes ingenuity and resourcefulness and, especially, what is known as common sense.

Any boy can build a four-wheel coaster that can be steered—and that is all required of a Soap Box car, subject to rules regulating safety, size, and weight. But everything depends on the boy's original plan for the car, and on his careful workmanship.

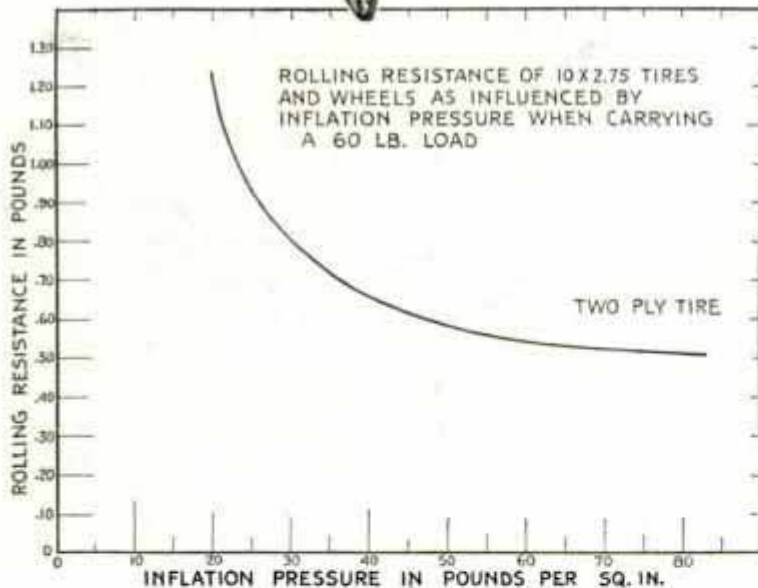
If I had had the chance to compete in these races when I was a boy, I would have proceeded just as I have always done in carrying out other projects—in developing the self starter, for example. The first thing is to learn what a Soap Box car must be and what it must not be. That infor-

manner, is a better boy after the race—win or lose—and will grow to be a better citizen by applying the lessons of the contest to his everyday life.

I won't attempt to tell how to build a winning derby car because I believe it is of far greater benefit to a boy to use his



Illustrating different designs used by 1935 entrants. Bottom chart shows effect inflation pressure has on rolling resistance of small pneumatic tire under sixty-pound load, the tests being made by the B. F. Goodrich company



mation will be set forth in the 1936 rules. The next step is to consider advantages and disadvantages of different possible types of car—judged by cost, materials available, ease of construction, and performance. Rough sketches should be made and criticized and revised before any work is done. Consideration must be given the materials to be used. Will they make a strong chassis? Will they keep the car inside the weight limit?

the correct alinement. The wheels may toe out or toe in, imperceptibly, but enough to slow down the car. What do I do? First, I make a series of test runs on a grade, either timing myself or seeing how far the car will coast each time. Then I make the same tests over again—but first turn the front axle around. If the wheels toed out slightly before, now they toe in—and the car will run better because the road resistance will tend to offset the toe-in.

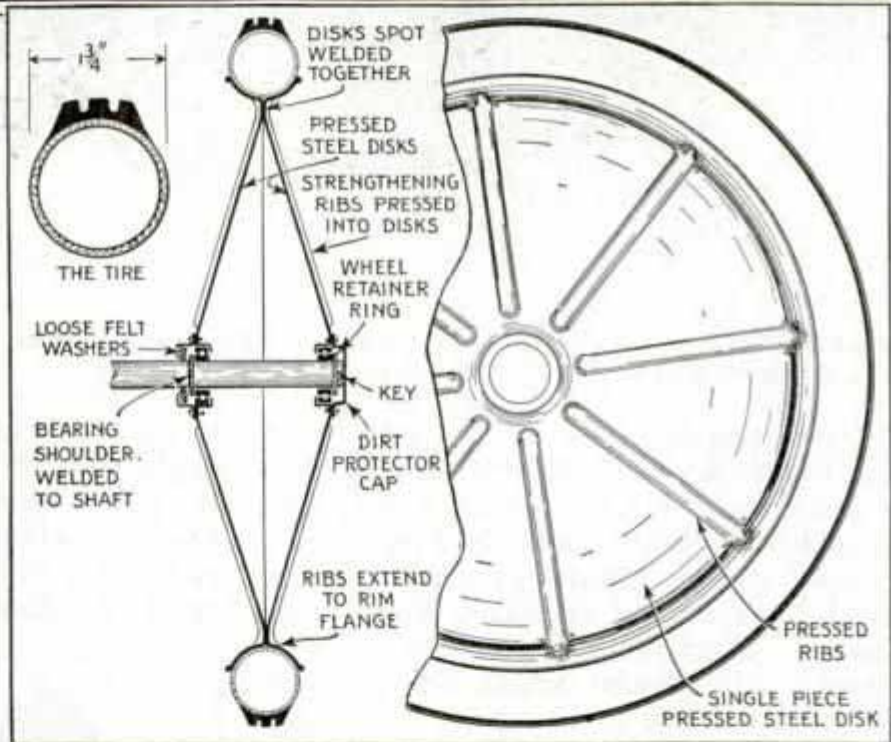
Only when I had finally put a car together would my real work of trying to make it a winner actually commence. That's where the value of the proving ground comes in.

Suppose my car is designed with the simplest steering gear—a movable front axle, pivoted in the middle, with a wheel at each end. I know much depends on having both wheels alined to follow exactly parallel courses. I also know that on my first try I may not have succeeded in attaining



There probably is nothing I can suggest about building Soap Box cars that thousands of boys have not already realized for themselves. These contestants are smart! At the Akron finals last August, they were just as keen as the men you find in race crews at Indianapolis on Memorial Day. It was hot—very hot—that day, on the long brick-paved hill. As a set of four cars was waiting on the starting ramp, a small driver suddenly produced a can of talcum from his pocket, and liberally powdered the treads of his rubber tires. He had noted that the tar, squeezed up between the brick, and broiling hot, was soft and sticky. It would cling to his tires, and slow him down. But he knew the tar couldn't stick to his tires so long as they were covered with talcum.

You see, we engineers don't have to tell boys like these youngsters how to build soap box cars. Rather, I think it might be a good thing for automobile engineers to go to Akron next summer and, perhaps, pick up some pointers from the boys.



Sketch by courtesy the B. F. Goodrich Company

Top, crowd around 1935 winner, Maurice Bale, shown talking into microphone. Bottom, suggested construction of wheel and tire for the derby car

By PHILIP R. TARR

Physical Research Laboratory,
The B. F. Goodrich Co.

The advantages of the ribbed racing tread such as was used on the winning car in the 1935 Soap Box Derby have been known for some time. For straightaway racing purposes this type of tread has the least rolling resistance of the many tread designs available. Under the conditions of

(Continued to page 120A)

From The Beecher. Jan 17 1936

Full Air Lines to Girdle Globe

on Seventeen-Day Schedule

Corp. & Hartford, Conn



Black lines represent present air routes; heavy dotted lines are routes to be operated soon. Lighter dotted line marks Post-Gatty route

Seventeen days around the world by air lines on regular schedule! Only two gaps remain to be bridged before this dream becomes a reality. British, French and Dutch aviation companies soon will extend lines linking Bangkok, Siam, with Manila. Then, with the inauguration of regular air service across the Atlantic from New York to Europe probably by 1937, you can chart a 24,000-mile air voyage around the globe and reach home in seventeen days. Magellan's flagship, the "Trinidad," was first to circumnavigate the earth in 1522, taking 1,083 days to do it. Sir Francis Drake sailed around thirty-one days faster. Railroads and automobiles slashed time and distance. In 1931 Wiley Post and Harold Gatty first flew around the top of the world in less than nine days. And while the "China Clipper" of Pan-American Airways was pioneering the new skyway from Alameda bay to Honolulu, Midway and Wake islands, Guam and Manila, repre-

sentatives of Pan-American and the British Imperial Airways were arranging joint transatlantic service to weld the last link. From New York you will fly by way of Montreal and Harbor Grace to Cobh and London, or via Bermuda, the Azores, Lisbon and Marseilles. From Europe you will board a plane for the Mediterranean, Baghdad, India and Siam. Air France extends to Saigon, soon will reach Manila; Dutch and British lines fly from Bangkok to Singapore and Java, and will extend to Manila, where, you will board a "Clipper" for San Francisco.

F107 Polo-Golf Game Is Played in Back Yard

Combined features of polo and golf appear in a new back-yard game introduced recently in Miami, Fla. The game is played with a stick that resembles both the polo mallet and the golf driver. Putting the ball into the hole is the "goal," and it requires a sharp eye and good judgment of distance, just as in golf.



Odd sticks and ball used in game which combines features of polo and golf

Johnny Revolta and ...

E 1485

Re-Making the WORLD



Scene from Warner Brothers' "Captain Blood." The fight between two ships in this movie occurred on an indoor sound stage, the special effects department creating the scene

IT'S the boast of Hollywood that there is no spot on earth that the movies haven't reproduced to order, for one picture or another. They re-make the world—mountains, jungles, deserts, rivers, sunshine, moonbeams, fog, sandstorms, lightning, volcanoes, rain or snow—the special effects department will make any of them to order.

To the special effects crew, moving a naval battle, a snowstorm or Manhattan's skyline indoors is just a part of the day's work. And this moving of all outdoors onto a sound stage is not the result of "process shots," miniatures or trick photography. It is down-to-earth physical and mechanical accomplishment, on good concrete and steel foundations.

The shots are not obtained by photographing through painted glass, but by the sweat of thousands of carpenters, structural steel workers, electricians, mechanics and specialists of all kinds, and by the

brains and skill of artists, designers, engineers, chemists and special effects experts.

Warner Brothers has just completed a "crafts building," nearly all glass, that will be used to house specialists in resourcefulness and originality.

It is their job to find a way to do the impossible things that must be done when the movies re-make the world to order. From their desks, laboratories and experimental vaults go the plans that the workers in the foundry, the woodworking departments, the mills, the plaster and marble plant, the electrical department, the machine shops, the model works, the art gallery, the scenic and wardrobe departments must follow to accomplish the amazing results required.

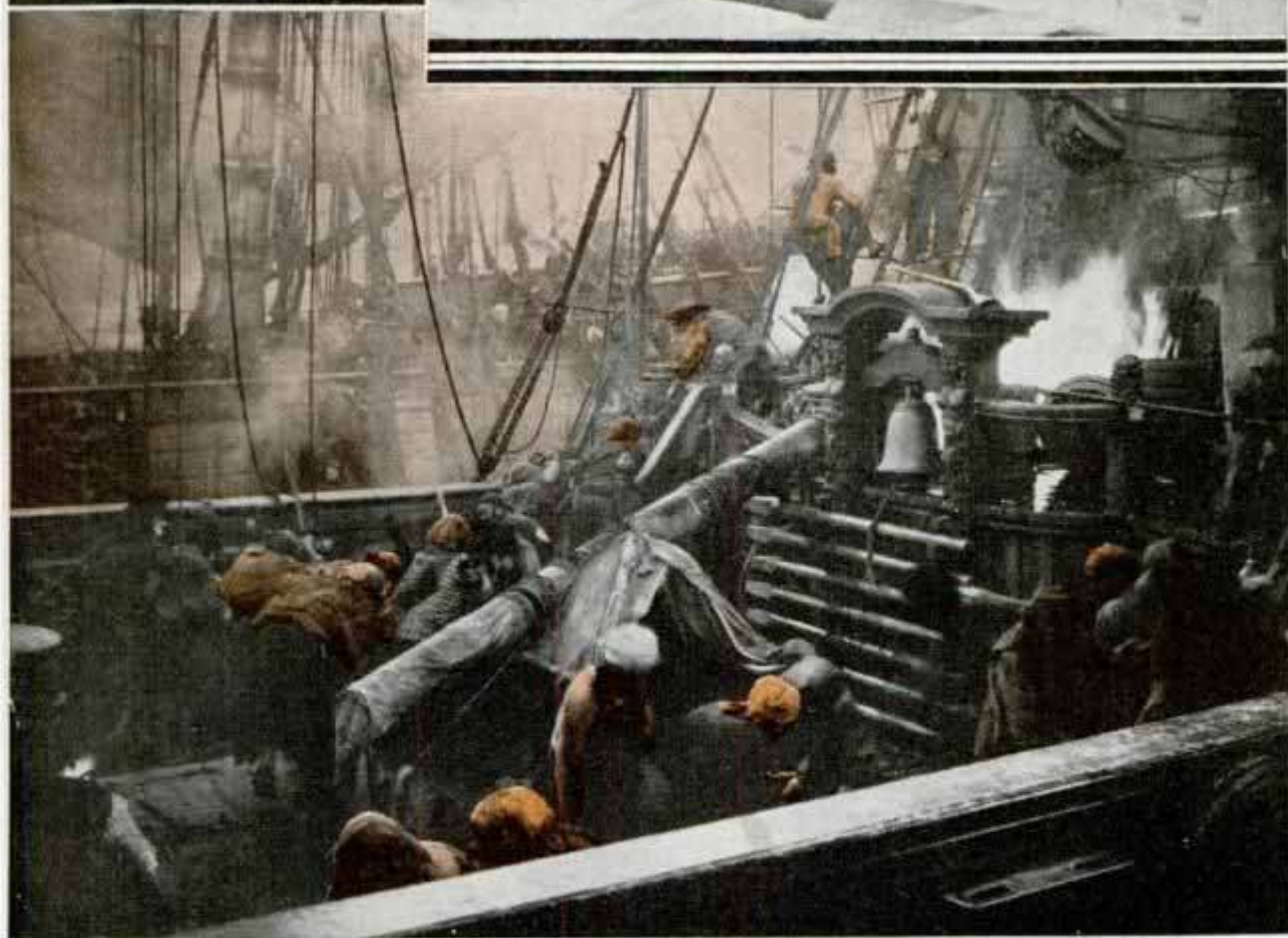
Process shots are all right in their place, and miniature sets will pass for long shots or quick shots, but when a script calls for thirty husky pirates to swing, on rope's end, from one ship to the other, and drop,

Capt. William F. French 6939 Camrose Pl. L.A. Hollywood Calif.

6/1485

for the MOVIES

cutlass in mouth, among the enemy, no model or miniature maker can do the job. It takes structural steel workers, carpenters and mechanics. So when it was decided that "Captain Blood" should be made on the home lot, in the studio's sound stages, instead of going on location, a big problem was passed on to Warners' miracle worker, Anton Grot. Carrying the title of art director, he is really the big brother of the man in overalls, and



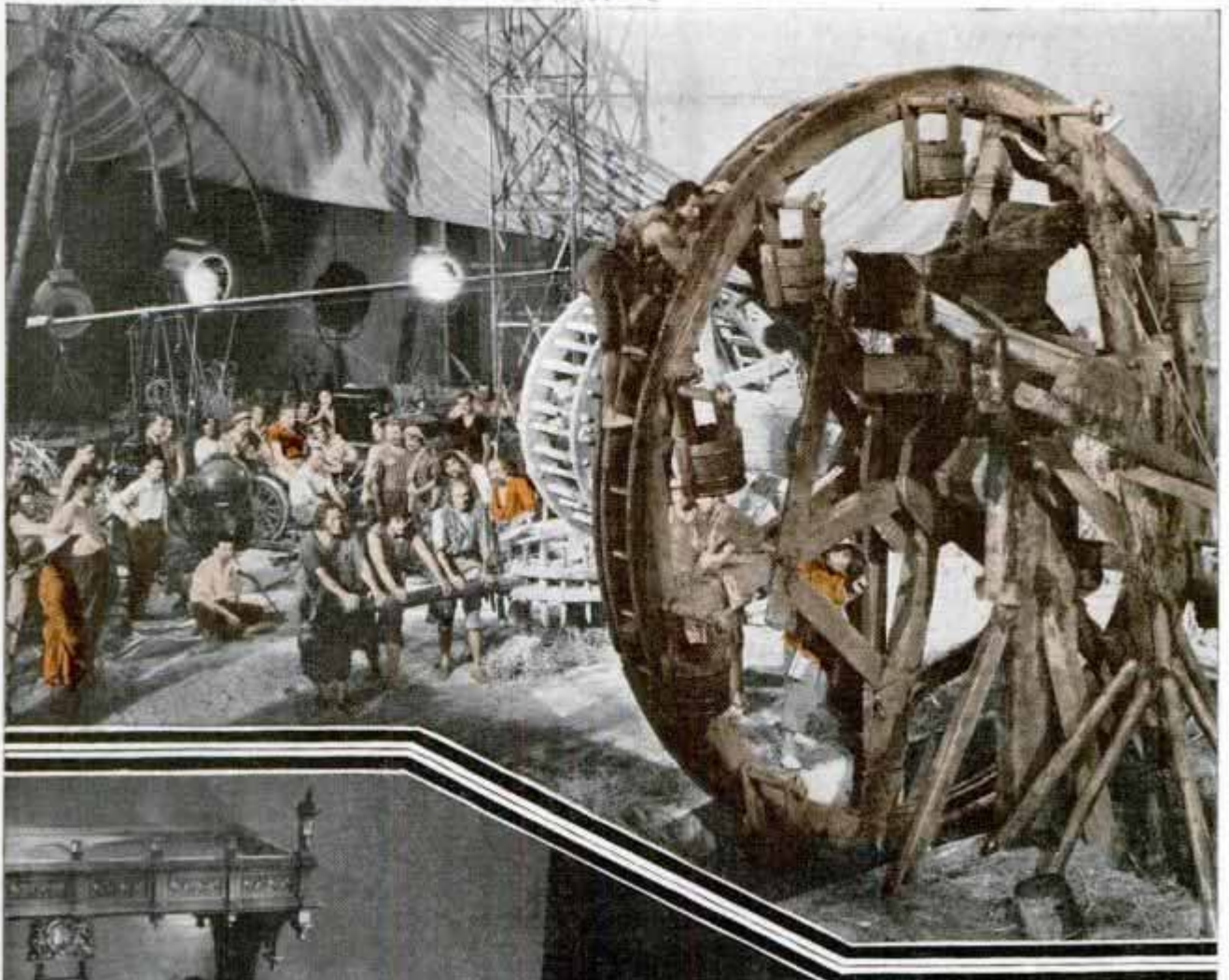
Studio officials looking over sketches of indoor sets prior to the making of "Captain Blood," and the fight between the two pirate ships which was staged indoors

6/14/86

Paul Royal



Two views of a sea-coast town built on a back lot in Hollywood for a recent production. The boats rest in real water which fills the concrete basin



- Water wheel constructed on indoor stage for one picture and a court scene built for another production

photograph like ships at sea?" the studio executives asked Grot.

"We can build anything," was the reply.

"But they must be authentic reproductions," warned the executives, "true in detail as to boat construction, deck structures, carvings, riggings and gun mountings."

"They'll be authentic," was Grot's assurance. "We'll make your sea shots so natural you'll get seasick."

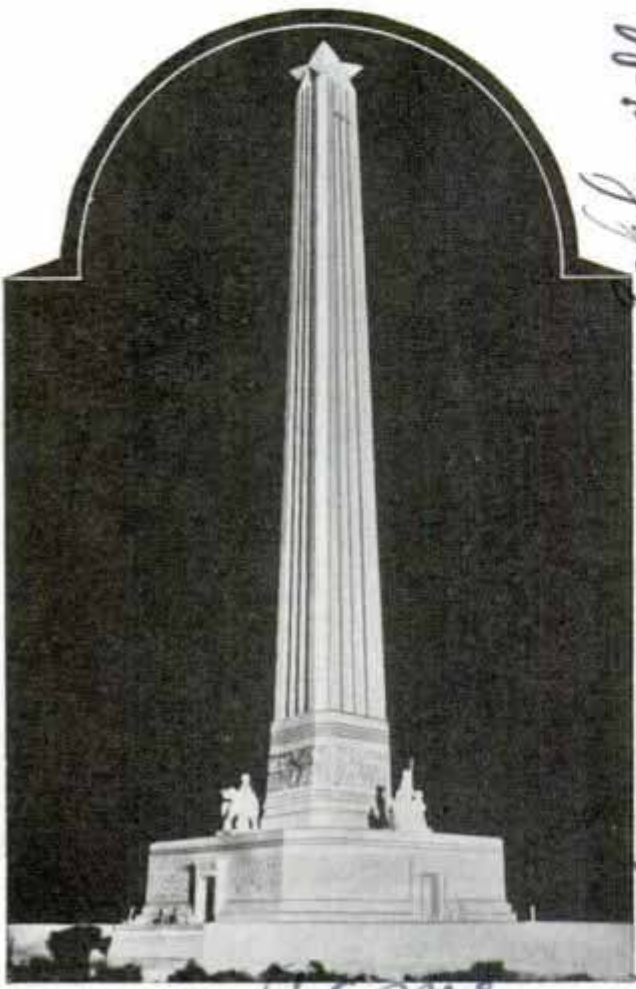
upon his shoulders falls the job of solving any problem the production department happens to meet. And staging a sea battle between Captain Blood's pirate ship and the French man-of-war on a sound stage was a problem.

"Can you build two vessels that will let us use four hundred extras, and that will

Grot burned midnight oil figuring a way to bring two battling ships under full sail across a billowing sea and ram them together to permit a bloody battle to be fought over their sides and in their rigging—and do it inside a sound stage. Grot works from pictures and gradually his

(Continued to page 144A)

Lofty Texas Memorial Shaft to Have Fast Elevators



Elevators will take sightseers to the top of this shaft planned as Texas memorial

Towering 550 feet, the giant memorial shaft to be erected on the San Jacinto battlefield near Houston, Tex., will have fast elevators to carry sightseers to the observation level near the top. The base of the shaft will house relics of the battle in which the Texans under Gen. Sam Houston won their independence from Mexico. The memorial is a part of the plans drawn for the celebration of the Texas centennial.

Radio Announces Street Name in Trolley, Bus and Auto

Controlled radio is used in a system for announcing street names and historical information in street cars, busses and autos passing near by. Two types of transmitters have been developed, one announcing from film and the other from a phonograph record. The transmitters are

placed upon poles and operated on power regulated to cover a radius of only one-half a city block. Directional antennas on the vehicles are set to pick up the weak stations as they approach them, and the street cars have receivers tuned to pick up only these stations. As the vehicle approaches the corner, the receiver picks up the signal and from a loud-speaker announces the street. These weak stations also are suggested as a means of fog warning. Operators of a ship or plane hearing one of the limited power stations would realize that the craft was too close to shore or ground.

F69 Man-Made Wind Saves Fruit from Damage by Frost

Standing guard like a sentinel over a vast citrus fruit orchard in Whittier, Calif., is a wind-maker with a sixteen-foot propeller ready to thrust back any invasion of frost. In freezing weather it has actually prevented damage to trees. The



When frost threatens his oranges, this orchardist turns on his fan and blows the freezing air away

American and Baird & Phila

Lehmann

Ivan Cremel, J.A. Bartholomay, Inc American and Baird & Phila

made machine see also for

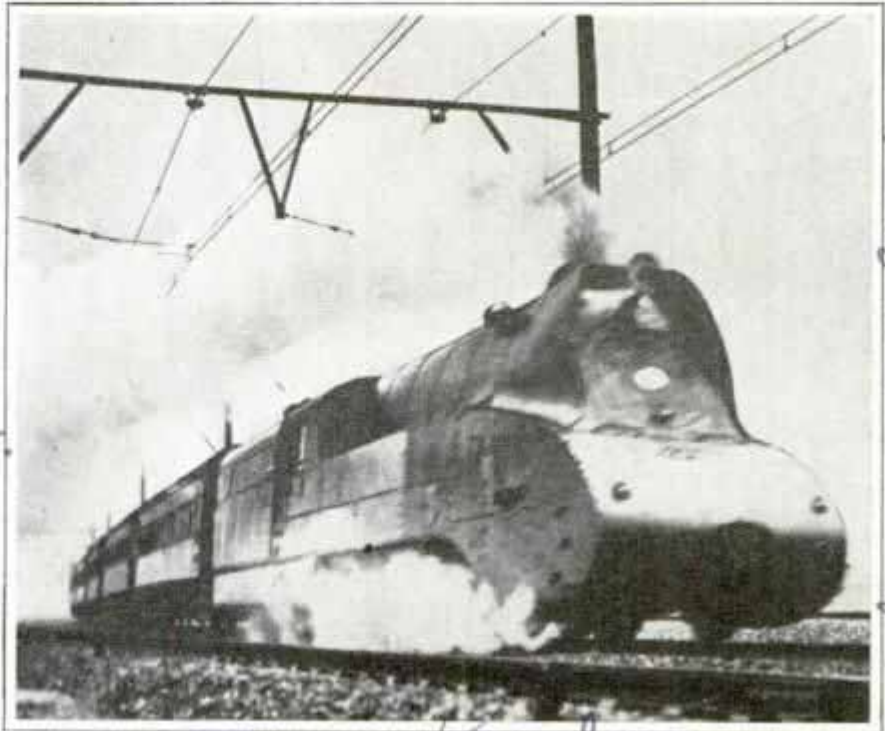
Whittier, Calif

Ivan Cremel, J.A. Bartholomay, Inc

Owned by J. E. Powersmith

blades, whirling at 950 revolutions per minute, draw down warm air and keep it circulating in the grove, for frost does not form if the air is kept in motion. The propeller and its motor are mounted on a rotating base atop a forty-six foot steel tower. It guards a forty-acre citrus grove. A special study of its effectiveness is being made with instruments installed at four stations in the orchard by the U. S. weather bureau.

F101
**Fast Express Train in Japan
 Hauled by Streamline Engine**



Streamline
 Japan's most advanced streamline locomotive, built in government shops, hauling the speediest express train from Osaka to Nagoya

F65
**Whale's Big Molars
 Replaced in Jaw
 for Exhibit**

When a cameraman visited the grounds of the California Pacific International exposition at San Diego shortly before its reopening, he found one man replacing the molars in the jaw of a sperm whale. The whale is one of the wonders in the Palace of Natural History. Thirty-six giant teeth were set in the whale's jaw, just as they were when the big mammal was taken far at sea.

Japan is going in for streamline designing in its modern engines. Hauling the fast express train between Osaka and Nagoya is a steam locomotive streamlined to reduce air resistance. It was built in government railway shops recently.

F77
**Pouring Spout for Metal Can
 Prevents Spilling**

Liquids can be poured from tin-can containers without spilling by using a spout attachment shaped like a U-pipe with sharp ends. The ends cut through the top of the container and the contents of the can pass through a



spout when the can is tilted. The spout is hinged so it can be folded against the U-tube when not in use, thus sealing the contents if all the liquid is not emptied at once.



The photographer caught the "dentist" at work on huge teeth of whale in exposition building

Tommy's 158 Washington D.C. Peckham, N.Y. Tomlin

and make

Science Service
1/11/36

F49

Race Horses Require Shoes of Special Design and Weight



Dr. Hutslar with a collection of horseshoes he has designed for racing, saddle and harness horses

Shoes must be "tailored to measure" for race horses, and it takes considerable skill to shape up shoes of the exact weight and design for the fast-stepping horses of the turf. Dr. Charles F. Hutslar, a clergyman of Pomona, Calif., made a specialty of shoeing race horses, and has collected examples of the many types of shoes worn on the track. They must correct any weakness of the horse's leg or foot and must meet weight requirements within a fraction of an ounce.

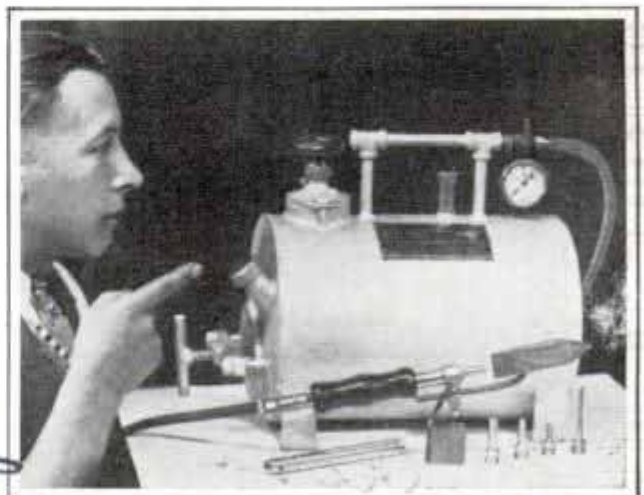
Tiny Fire Bomb, Not Gas, Held Real Peril in Next War

That the two-pound incendiary bomb of thermite will be the real peril in the next war is the opinion of Prof. J. Enrique Zanetti of Columbia University's chemistry department. In discussing what might

happen to a large city in an air attack, Prof. Zanetti says: "The small size of these bombs may appear almost ridiculous, particularly after considering the tons of gas required to produce lethal concentrations. The small incendiary bomb is particularly fitted to airplane raiding. It does not have to be aimed and a single two-ton bomber could carry nearly 2,000 of them. Granting that only one in 100 makes a hit, that single bomber will start twenty fires within a few minutes of each other. What simultaneous fires would mean in a city like New York may be understood by considering that the Cunard pier fire in 1932 summoned one-fifth the entire fire-fighting apparatus in the city." The thermite bomb is a mixture of iron oxide and powdered aluminum, or magnesium, which is stable if protected from moist air. But if heated to a high temperature at some point, it reacts violently.

Soldering Unit Makes Its Own Gas Supply

Housed in one compact unit, an economical soldering outfit produces its own gas supply from carbide and water. One charge of carbide will do four hours of continuous work and it is claimed the cost of operation per day for ordinary soldering, light brazing or torch work is



Soldering outfit which generates its own gas supply from a charge of carbide and water

39 Lincoln Ave.
2270
2270
2270

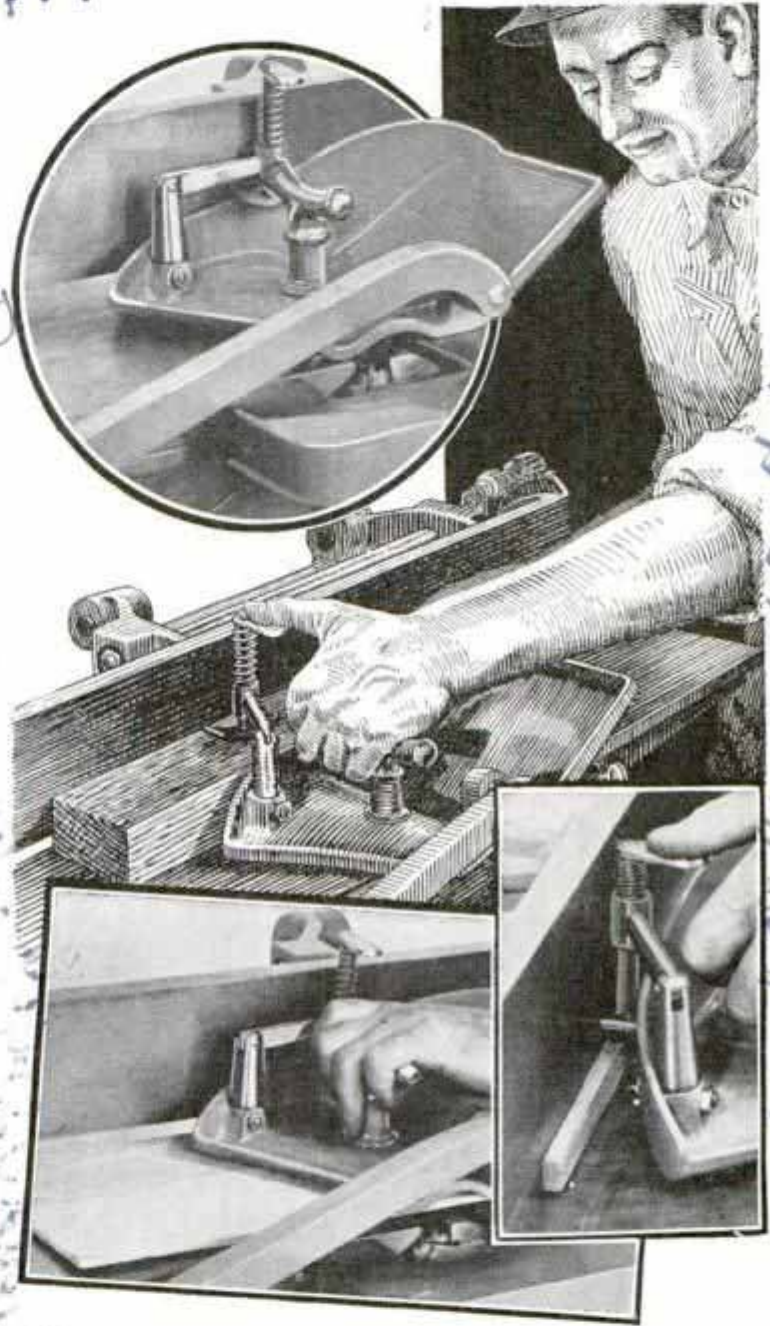
F52

Chemistry Dept.

Reiner + Campbell
Cno. 242 Lafayette

**Jointer with Improved Guard
Makes Planing Safer**

F17



Several views of jointer in use. Note guard which also is used to apply pressure for planing properly

Equipped with a new guard which permits ribbon-thin planing in complete safety, a power jointer for large or small industrial plants is on the market. The guard is so designed that work can be fed under it while the operator's left hand, resting on the guard, applies the necessary amount of pressure. This permits planing wood down to a ribbon. Also, thin, narrow strips may be planed to practically nothing by feeding the strip between the fence and the curved inner edge of the guard. The jointer enables the operator to produce very accurate work.

only ten or twelve cents. No pre-heating or pumping is necessary and the iron is hot after one or two minutes. The heat can be regulated for light or heavy work and the torch is equipped with a needle regulation and fresh-air feed device which is automatic in operation. The torch also can be used for melting or burning off solder or paint. The outfit is windproof and produces no dust, smoke or sparks.

8154

**Airplanes Help Develop
New Flower Varieties**

Airplanes that chase summer back and forth between the hemispheres are stepping up the work of horticulturists in developing new flowers to double-quick time. Instead of the old, tedious process of waiting for spring to plant new seed varieties, the scientists send the seeds by plane as soon as they mature to some spot in the world where the season is right for the new crop. One plane acted as the "stork" for a giant nasturtium with sixty petals, first nasturtium to receive a patent in the United States. Three years ago a double yellow nasturtium was found in Mexico, with eight to ten petals instead of the usual five. David Burpee began in June, 1933, on his California farm to cross this Mexican nasturtium with various colors of the single variety. It required 50,000 pollinations by hand, the seeds being flown to Mr. Burpee's greenhouses near Philadelphia as fast as they developed. Second generation seeds were grown there, and in November were flown to Florida, Puerto Rico and Buenos Aires, planted, and the next generation of seeds flown back to Philadelphia and California, chasing spring. One seed finally developed into the super-double nasturtium with sixty petals, which is sterile but can be grown from seeds by using the proper treatment.

W.A. Burpee Co., 18th St. and Hunting Park Ave Philadelphia

44-28-95.6-845.00

81392

Cont. Thomas G. Stinson,

10555 Holman Ave

Los Angeles
Calif

KING of the



9. 8. 20. 25



4. The opening of the race

Official signaling start of race and, left, measuring completed racing block

nings on cold, hard figuring. Luck has very little to do with it. Dangerous as their work appears, they take few unnecessary chances.

Among those who race for the purse instead of the roar of the crowd is Chet Gardner, known as "king of the money drivers" because of his consistent wins. In the last five years Gardner has grossed better than \$25,000. Gardner owns his own car and pulls it on a trailer behind his sedan from track to track. In the last four years he has competed in more than 500 races on sixty tracks and, except for a dozen times when he failed to finish, he has nearly always placed among the winners.

THERE are hundreds of professional racing drivers but you can count on your fingers and toes the men who make money at the game. Yet driving with death at the radiator can be made a paying business.

Big time drivers like Kelly Petillo, Louie Meyer, and Wilbur Shaw base their win-

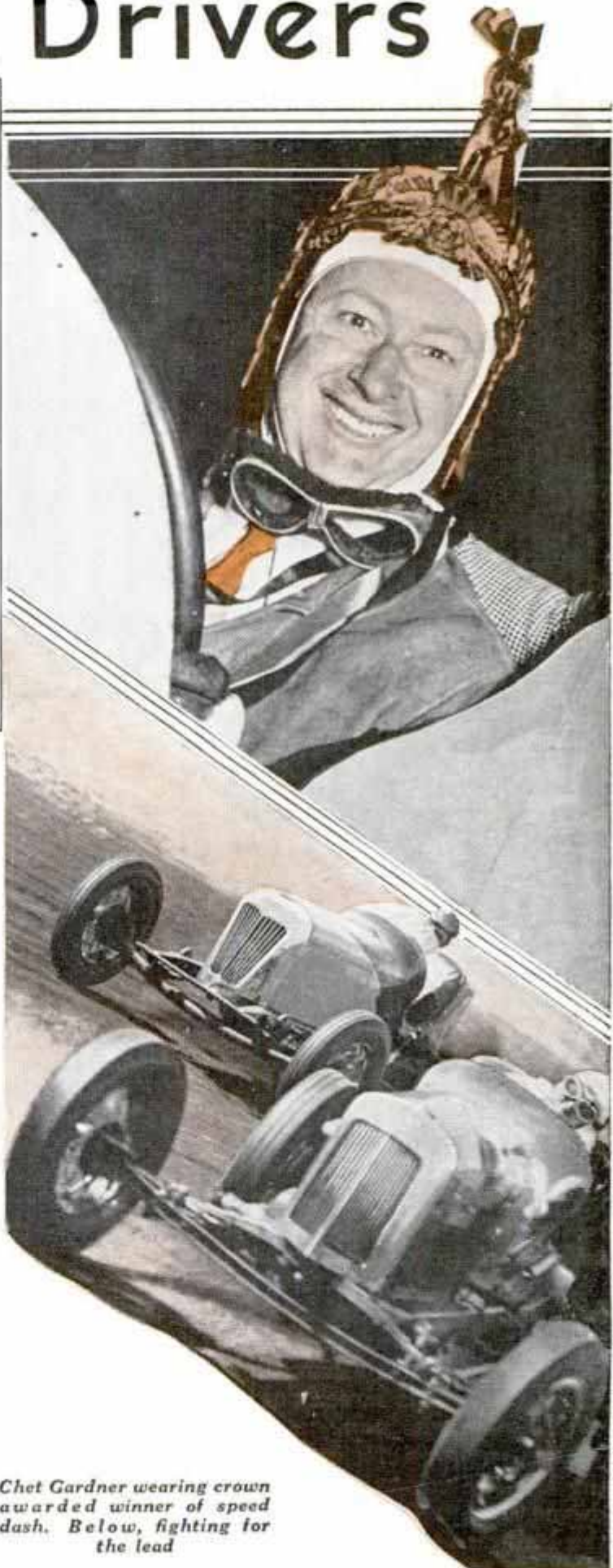
Rex Mays, the young Californian who led the last Indianapolis race until forced out with a broken spring shackle, has netted \$12,000 in less than three years and averages better than \$100 a week the year round. Since he doesn't own his car and drives merely for the driver's split, Mays earns his owner something like \$10,000 a

225 E. Garfield
Los Angeles, Calif

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E1392

MONEY Drivers

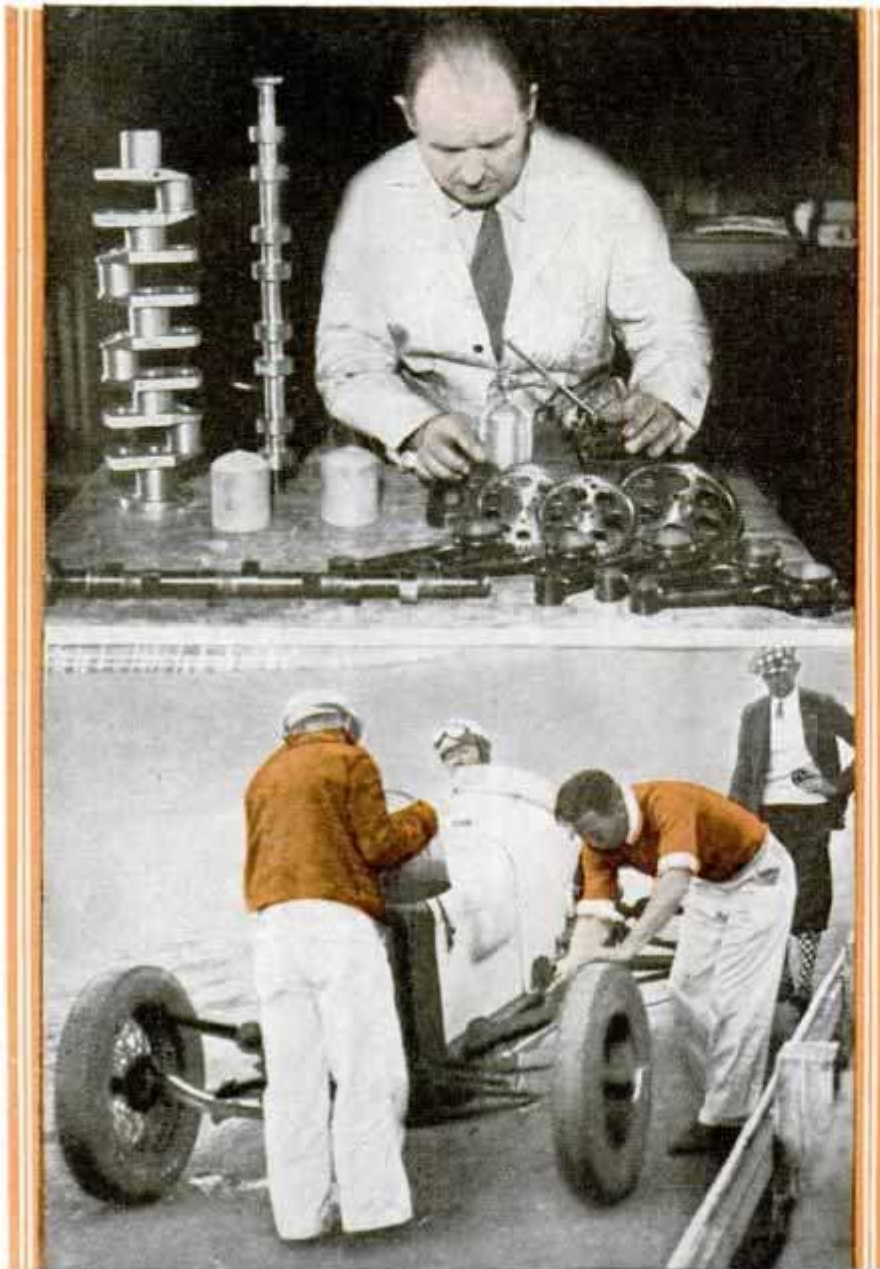


year. What are the secrets for earning a living on the track? First, says Gardner, is strong, sturdy equipment. "If you can't finish a race there's no need to lead it," is his motto.

The terrific hammering on dirt tracks has shaken apart many a prospective winner and in nearly every race three or four cars develop mechanical trouble and fail to finish. A part that costs only a few cents is more important than the engine if it breaks down under the strain.

But often a car finishes race after race without trouble, then everything seems to go wrong at once. In one 200-mile race the favorite had gone only a few laps when a new tire blew out. After a pit stop he started out again. Then the steering gear froze. That took ten precious minutes to fix. Next the cap vibrated away from the cowl oil tank and the driver was sprayed with oil. Finally, coming out of the last turn, his clutch broke. The man behind

Chet Gardner wearing crown awarded winner of speed dash. Below, fighting for the lead



Measuring the top of a machined piston, and pit crew at work on a racer during a stop when every second counts

cars to string out, then pass them one by one. Fighting for the lead in the middle of traffic is always dangerous. If the leader should spin, every car behind would crash into him. And there's no way of telling what a blowout will do. I've had a front tire go flat and hardly hurt the steering qualities at all. Other times a blowout turns a car over. A driver should never push his car past the point where he has good control, just as with highway driving.

"Sometimes an experienced driver will hang back on purpose. Near the end of a race the leader may blow a tire or make a pit stop to change a wheel. Then a smart driver who has been slowing down on the turns to save his rubber can work his way to the front and hold it. Wrecks are always expensive and careful drivers usually think it wisest to take third or fourth place money at a safe speed than chance a wreck."

Gardner has never been in a serious wreck and in

him took seventh place and \$750 in prize money.

Gardner figures he "lost" a \$900 purse because he trusted his axles too long. He had installed new heavy axles early in the season and failed to inspect them periodically. Then one of them snapped in the middle of a race. The best way to hunt for trouble is to wash the parts in gasoline and tap them with a hammer. If a crack has started, oil is forced out of it and the weak spot can be seen.

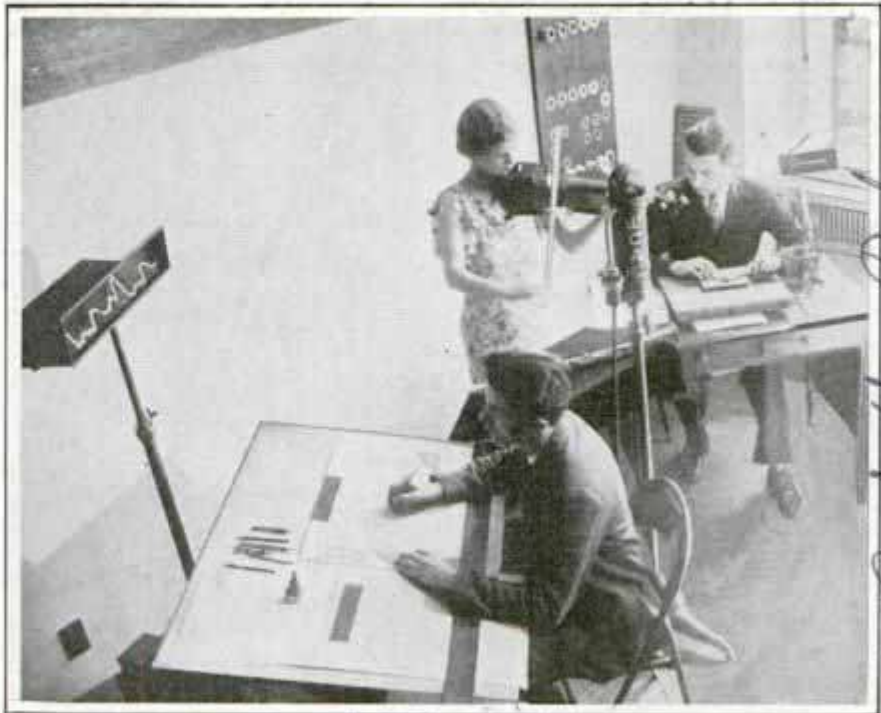
"The best position in a race is usually the lead," Gardner says. "If the car and driver are good enough it's best to take the lead on the first turn before the field is at top speed. If that fails, wait for the

only one in which another car was involved. His worst injury was a broken collar bone received at the beginning of a 200-mile race. Loaded down with gasoline, his car spun on the first turn in front of a field of thirteen cars. All missed him and he hit the fence. He barely escaped a part in a spectacular crash when he made a pit stop at Altoona in 1929. A few seconds after Gardner stopped, a car went into a spin on a steeply banked turn. Ray Keech swerved out of the way of the spinning car and struck the outside iron railing, backed with heavy timbers, which bounced Keech's car back on the course. Along came another car that rammed

(Continued to page 128A)

Wave Pattern Helps Musician Improve Tone

Perfect patterns of music waves, patterns which can be seen, are helping the musician to attain higher quality of tone. An accurate visual record of any vocal or instrumental number is obtained by using the oscillograph, which traces the exact wave pattern of any sound on a glass plate. As the oscillograph operates, strips of cardboard on a frame are used to mark off and cut out the sound pattern as the waves appear on the glass plate. A draftsman marks down the pattern and workmen make cutouts of it. Projectors and other equipment are employed in



Sound waves from violin appear on oscillograph at left. From these, patterns are made for the musician to follow in practice

making from the first pattern a music-wave record which is perfect for that voice or instrument, harmonics and other wave shapes being added. Then the musician places the perfect pattern beside the oscillograph and practices to make the pattern of his voice or instrument exactly like the perfect record. When the two patterns are identical, the musician's rendition may be said to be perfect. Thus, the musician de-

pends not upon the human ear, which varies in every individual, but upon science. There are many sounds that the human ear cannot hear. Leopold Stokowski, orchestra leader, is devoting much time to research in an attempt to bring to the ear of all the hidden "overtones." Ivan Eremeeff, research engineer, has been working with Mr. Stokowski in an effort to solve the problem.

Cockpit Enclosure Converts Plane to Year-Round Use

Conversion of the open plane to a year-round ship is achieved by attaching a



Enclosure is shown in place around cockpit, making this plane an all-weather craft. Vision is not obstructed

cockpit cover. One flyer constructed and equipped his plane with an enclosure which cost slightly more than \$10.00. The conversion was made without changing the primary structure of the ship. There are no welded joints and the increase in weight is less than eight pounds. Doors of the enclosure are hinged at the top to facilitate emergency parachute jumps. Flying characteristics of the plane are unchanged, save for a slight increase in top speed. Installation of the cover is simple. Occupants of the cabin may converse freely without annoyance from the roar of the engine.

Carl Eckhardt

760
 Station WC A D. Philadelphia
 Builder Fred Golly Aircraft Golly
 447 N. Alabama
 Indianapolis Ind.

Carl Fred Golly 447 N. Alabama
 (also builder) Indianapolis Ind.

Capt. G. W. Percival
England.

Harry Brock
1228 Harrison
Beaumont, Tex

Plane Fits into Garage

F51 When Wings Are Folded



Demonstrating how hinged wings can be folded to permit housing the plane in ordinary garage. The ship cruises at 150 miles per hour

Rated at a top speed of 170 miles per hour, a new four-seater monoplane manufactured in England is housed in a small garage when its wings are folded. The craft cruises at 150 miles per hour while fully loaded. Its flying range is 630 miles. The plane is another product of the movement to popularize flying for the family, which makes it necessary for the ship to be easy to fly, reasonably safe and small enough to be housed in a small space while not in use. A number of small, low-priced planes are being tested for the same purpose in the United States.

Gasoline Made of Waste Gases Is Almost "Perfect"

Reversing the process of "cracking" to produce automobile fuel has resulted in production of gasoline which is rated at ninety to 100 octane, or almost "perfect" in antiknock value. This new process, called polymerization, consists of building up light gases and liquids which gasify easily at ordinary temperatures by the application of high pressure and heat. This means that refinery waste gases, which are a by-product of the cracking of heavy oils to make gasoline, can be converted into high-

tion from cracking operations is about 300 million cubic feet annually from which might be produced one billion gallons of gasoline by polymerization. This would be about five per cent of the total motor fuel output for the United States for one year.

F48 Wheelbarrow Adapted to Snow by Attaching Runner



Fastening runner rigidly to the wheel converts wheelbarrow for year-round use

With a single runner attached to its wheel to facilitate operation on the snow,

Write Harry Brock
1228 Harrison

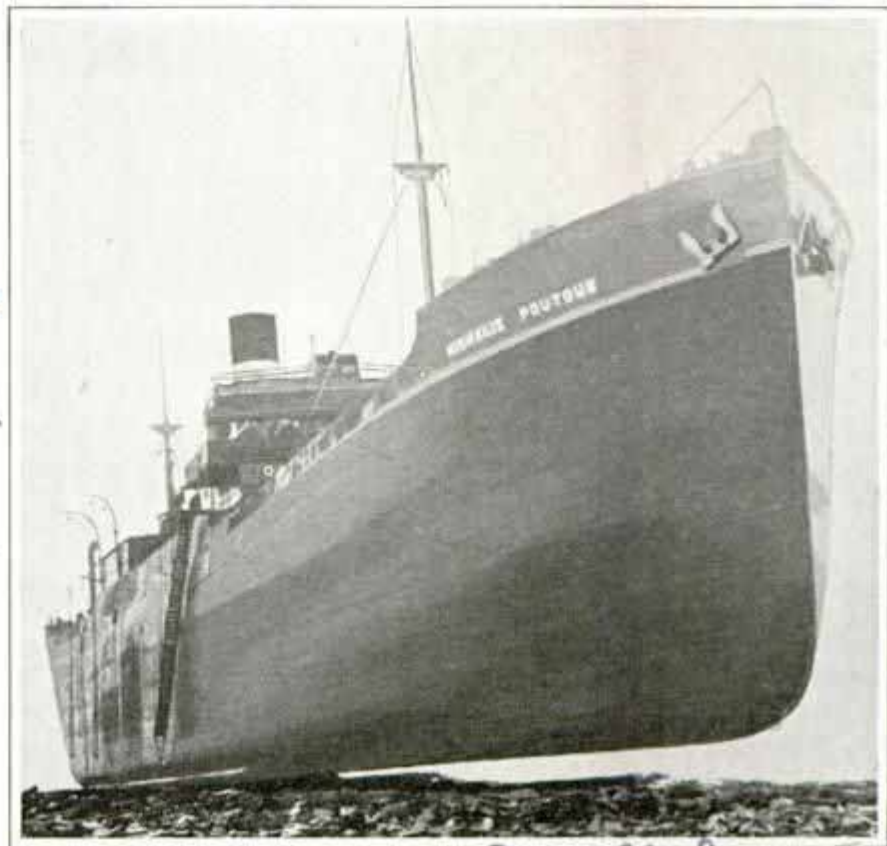
1228 Harrison
Beaumont, Tex

Ed Longway,
Asford Maine

F 42

a wheelbarrow is used the year round by a resident of Maine. From early fall to late spring, a period in which Maine is subject to considerable snowfall, the wheelbarrow is used as a sort of sleigh or sled. It slides easily over the snow on its runner, making it possible to carry large loads.

Ship Beached in Dense Fog Stands Like Balanced Rock



High and dry on an English beach, erect as though propped in a dry dock, stands the steamer "Michalis Poutous" where she grounded in fog

acme

Inner Tube Boat Rides the Waves at the Beach

Riding the ocean waves is an exciting water sport which is made even more thrilling by using a "boat" without a bottom or sides. The craft is made of inflated inner tubes attached to a cypress framework with canvas strips. The forward section of the boat also is of canvas and the craft stays afloat even when encountering big waves.

F 56



Wave-riding boat made of inner tubes attached to cypress framework with canvas strips

Run aground at Lilstock, in the Bristol channel during a soupy fog, the Greek steamer "Michalis Poutous" stands high and dry on the beach like a balanced rock. Her crew of twenty-nine was rescued by lifeboats from neighboring English ports.

Tape Kills Moths in Clothing by Emitting Vapor

Moths can be destroyed in clothing by using a new gas tape which emits an insecticide vapor. The tape comes in clean, non-adhesive rolls which can be cut into convenient pieces to be inserted in sleeves, trouser legs and other parts of garments. Vapor given off by the tape does not stain or injure furs or clothing. No heating is required and there is no lingering odor. Applied in tape form, the active insecticide is spread out for rapid evaporation. Materials to be protected are wrapped tightly to prevent the gas from escaping before eggs and larvae have been destroyed.

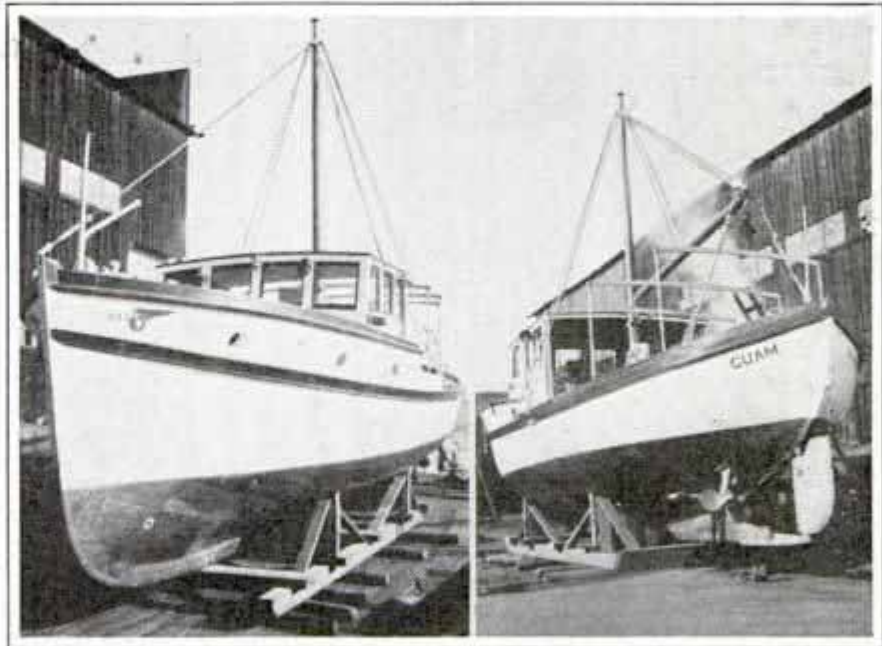
Emb Barbara Rese The March Route 1, Box 655, Housley, Iowa

Edelman Co 6249 St. Lawrence Ave Chicago

Made by Mr. O.A. Tuftnell Galveston

Crash Boats Aid Air Liners in Trouble at Sea

One task of Pan-American Airways in maintaining its transpacific route is to keep sufficient supplies of fuel, oil, water and food at the Midway, Wake and Guam island bases. Important links in this supply service are four tow boats or "crash boats." These are thirty-eight foot, twin-screw tugs which transport supplies from freighters anchored off shore and also go to the aid of an airliner at sea in case of trouble. These tugs resemble the old type double-end whaling boats. They are powered with two gasoline motors of sixty horsepower each, have a speed of eleven miles an hour and a cruising radius of 1,100 miles. Living accommodations for four persons are provided below decks. Radio compasses like those aboard the air liners are part of



Crash boats which will go to aid of transpacific air liners in trouble at sea and will also serve as tow boats at island bases

the equipment, and the boats are so designed that they can pass under the wings of an air liner at sea to service or replace a disabled motor. The boats often make trips between supply ships and shore with barges carrying loads of sixteen tons.

Photos Given Color Tones by Secret Chemical Process



Dr. Arthur Rodzinski examining photograph of Moroccan scene which he has printed in color tones by his own secret formula

Printing photographs in color tones is the latest accomplishment of Arthur Rodzinski, conductor of the Cleveland symphony orchestra and an enthusiastic amateur photographer. He has developed an original process for enhancing prints with color tones, and is keeping his chemical formula secret while continuing experiments to perfect the method. In the illustration Dr. Rodzinski is examining a Moroccan scene he photographed last year. The building is printed in a tan hue, and the columns are milky white.

☞ Cacao or cocoa beans were the monetary unit of the Aztecs and Mayans of Central America at the time of the Spanish conquest and were also used as a beverage, but only the wealthy could afford to drink their "money."

Cleveland, Ohio

Smithsonian Report 1934

8/26/49

Cont. Walter & Burling
1032 Florida Ave

SHOOTING

Arson, Ohio



phers and photography, and will sponsor candid-camera nights at local theaters.

The idea of admitting photographers to theaters and other places and letting them shoot to their heart's content is spreading, and it's great fun for the camera owner, for there is a fascination about stage photography difficult to find in other branches of the hobby.

The making of pictures in the theater, radio studio and wherever else there is fairly good artificial illumination is within the reach of amateur photographers, thanks largely to new high-speed films. Not many years ago a camera equipped with an f:4.5 lens—that is, one whose focus is 4.5 times as great as the maximum diameter of

THE photographer who likes to snap pictures of stage shows and other difficult subjects has had a break. Not long ago the girls of Earl Carroll's "Sketch Book Revue" performed before a New York audience composed mostly of 400 amateur cameramen, and thereby inaugurated a new deal for people who make pictures for fun.

Little cameras, big cameras, cameras equipped with super-speed lenses, and others with ordinary lenses snapped in the orchestra and from the boxes. Other theaters have taken up the idea, and have announced special performances or morning rehearsals for photographers. Radio station WHN of New York City has started a series of broadcasts featuring photogra-



Interesting bits of action on the stage and before the microphone caught by the candid camera. Some theaters give special performances for photographers

*Cameras
Super I format
Centar. Carl Zeiss Co
E 1267
485.5th
An. New York.*

in the DARK

the lens opening—represented the ultimate in speed equipment, and was correspondingly high-priced.

Today, a great many amateur cameras having f:4.5 lenses are in use. Their cost is not great and with such a lens it is possible to obtain very good pictures of stage action. Of course, there is a limit to what can be done. Whereas, the miniature camera having an f:1.5 lens, which is nine times as fast as the 4.5, can shoot pictures of a dancer at one two-hundredth of a second, the f:4.5 lens owner would have to wait for less violent action,



*Central Camera Co
230 S. Wabash
Chicago*



Camera enthusiast preparing to make a shot of a radio broadcast, and soloist snapped by candid cameraman

which he could snap at one-twentieth of a second.

For theater and similar photography under artificial light conditions, fast panchromatic film, sensitive to all colors, is used almost without exception. During the past few years the speed of film has

been increasing gradually, so a given camera lens today is, in effect, several times as fast as the same lens a few years ago. High-speed panchromatic film is available today for roll-film and film-pack cameras and those using thirty-five millimeter motion-picture film can be loaded with a new material whose speed is considerably greater than that of any other film. Rumors have it that even higher speeds are in the offing.

So, as far as film materials go, the amateur photographer, regardless of the camera, can get printable results from the average stage show. It is entirely possible for a skillful photographer to obtain a successful picture with an ordinary box camera. He would, of course, have to wait

until action is temporarily suspended. This waiting for the psychological moment is one of the tricks the theater photographer must learn. Almost any action has moments when the performers are relatively at a standstill. By learning to anticipate such moments, shots can be made at rela-



Photographers "shooting" a radio broadcast. Below, waiting for the psychological moment

tively slow shutter speeds. Another trick is to snap the shutter as the performer moves toward or away from the camera.

The front row of the orchestra usually is a good location for the photographer. So are boxes near the stage, and front balcony seats. Better see the show once before attempting to make pictures and pick the best location for photographing. If the camera shutter is noisy, wait until the orchestra is doing its best, or build a sound-proof case for the camera, leaving only the

lens, shutter and film controls projecting through. Stout cloth padded with a layer of cotton or other sound-absorbing material can be used.

Many failures in theater photography result from camera movement. Often the shutter speed, because of light conditions, is not great enough to overcome muscle quiver and other body movement. If possible, rest the camera against some solid object such as a balcony railing; or use a tripod. Or hold your breath and try to keep from quivering when you snap the shutter. Experienced photographers can hold miniature cameras steady while making one-half-second exposures, but it is safer to support the camera against something solid.

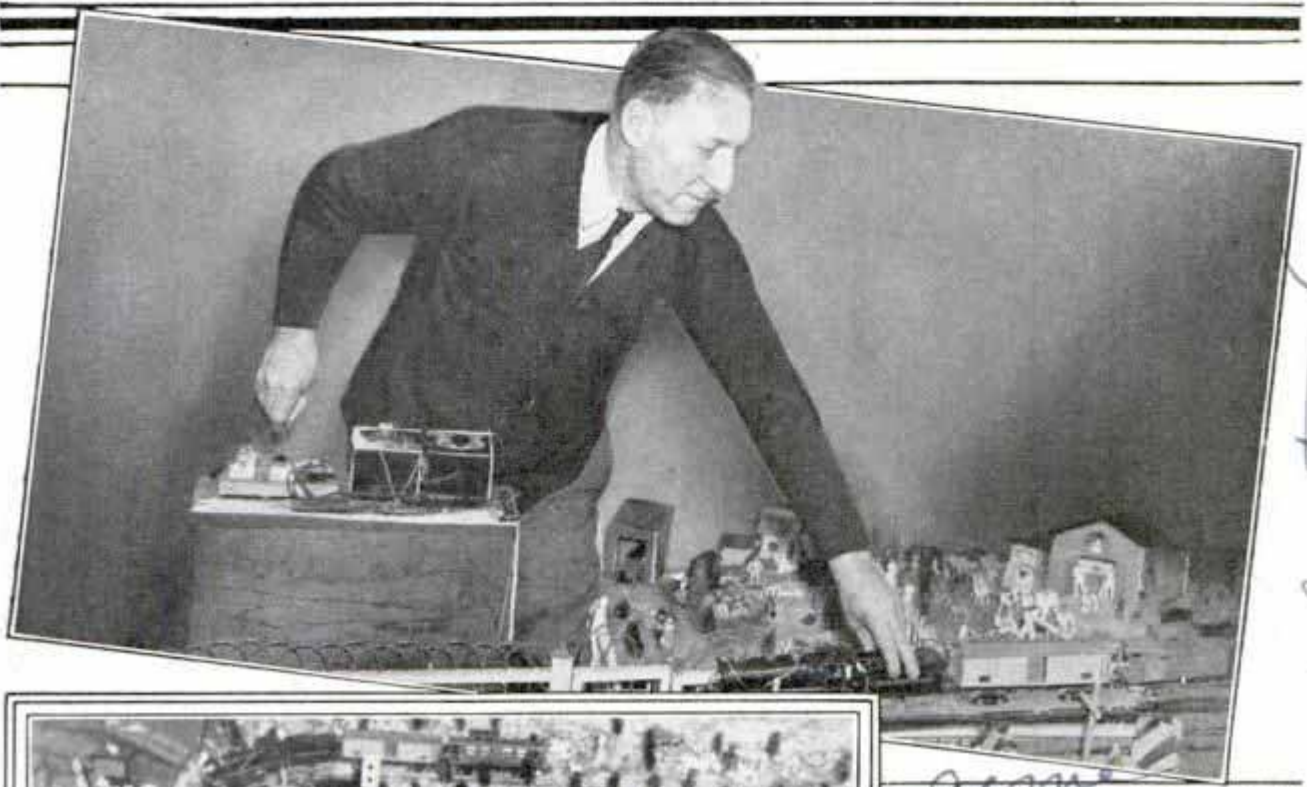
The average theater stage is well enough lighted to permit pictures to be made with available films and camera equipment, without resorting to various tricks that boost the film speed. However, the rabid photographer cannot resist prefogging film, bathing it in ammonia, or otherwise trying to make it faster.

Prefogging is making a preliminary exposure in a way that will fog the film slightly. This can be done by letting a very weak light fall on it before it is loaded.

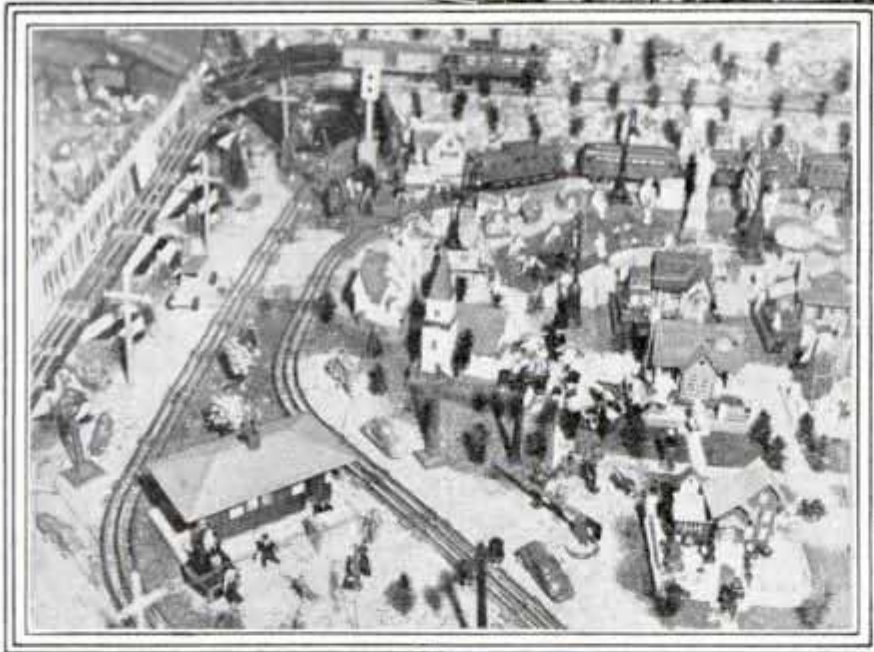
(Continued to page 116A)

F1

Switch Controls Homemade Miniature City



1032 Leates Ave. N.Y. Brooklyn.



Top, William Woodring at switches which control operation of miniature city designed and constructed by him in his Brooklyn home. Note the small electric train and tiny figures on midget farm beside the track. Trains roll, bells jingle and chimes of the Wedding March issue from a little church when the current is applied by throwing a switch

Above, one part of the miniature city, showing the little railroad station, three sets of tracks and a passenger train and a freight rounding the curve at top of photo. Also shown are the church and several houses. Bottom, close-up of the residential section, showing the fine attention to detail in construction of the houses. Midget automobiles and tiny figures on the sidewalk enhance the appearance of realism, so skillfully has the artist introduced the illusion of motion



1032 Leates Ave. N.Y. Brooklyn.

Super-Liner Planned for Fast Ocean Service



Artist's rendition of great liner to be constructed for Atlantic service. Note that decks are enclosed and that there are no portholes. The ship will be supplied with conditioned air by latest equipment

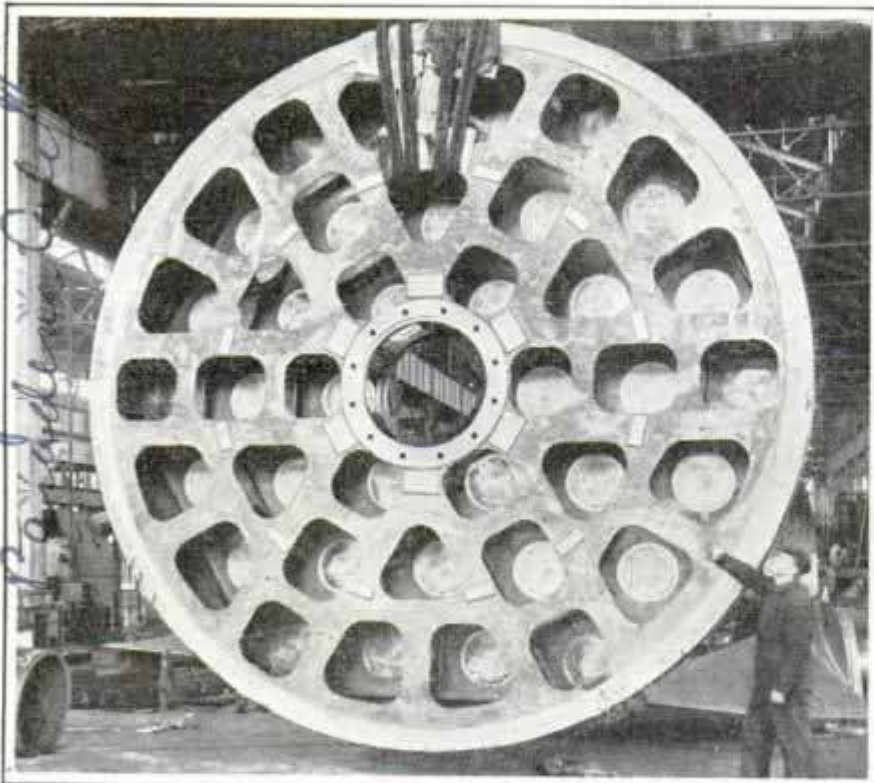
One of the two government-built superliners planned for the north Atlantic service is depicted by the artist as a radical departure from accepted ship design. The entire liner will be sealed and air-conditioned, with no open decks and no port-

holes. Far different from anything afloat, it will have a speed of forty-two knots and a passenger capacity of 7,000. Advanced streamlining is a feature of the ship. One-way fares to Europe of \$60 are included in the plans for the new service.

Grinder with Human Touch to Polish Eye for Telescope

Operating with an almost human touch, a giant grinder will both grind and polish the 200-inch mirror for the world's largest

telescope now being erected in California. A 25,000-pound mirror cell and grinding table rests in the center of a thirty-foot



Mirror cell which will be used in grinding the "eye" for giant California telescope. Five motions give apparatus a "human touch"

high structural framework which supports the mechanism. Made of steel plate with welded construction, this table is 208 inches in diameter, and when the pan for catching the abrasive material is bolted to the face, the over-all diameter exceeds 240 inches. The table is actuated by an electric motor with a worm gear drive. On the top and protected by a two-inch layer of sponge rubber will rest the mirror. The grinding of the mirror involves five distinct motions: first, a counter-clockwise rotation of the table; second, a counter-clockwise motion of the grinding tool, mounted on a carriage; third, a

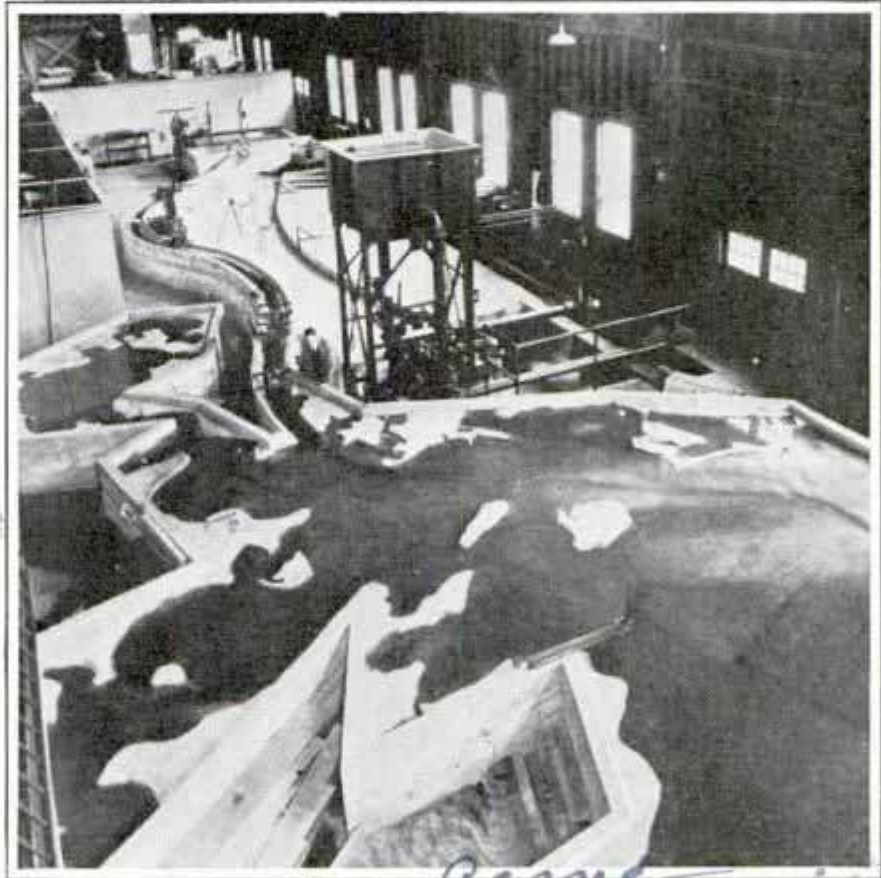
Baldwin Southwark Corp
Ed. Rustine

Created by scientists of California Institute of Technology

Wild World

Model of Cape Cod Canal Aids Study of Channel

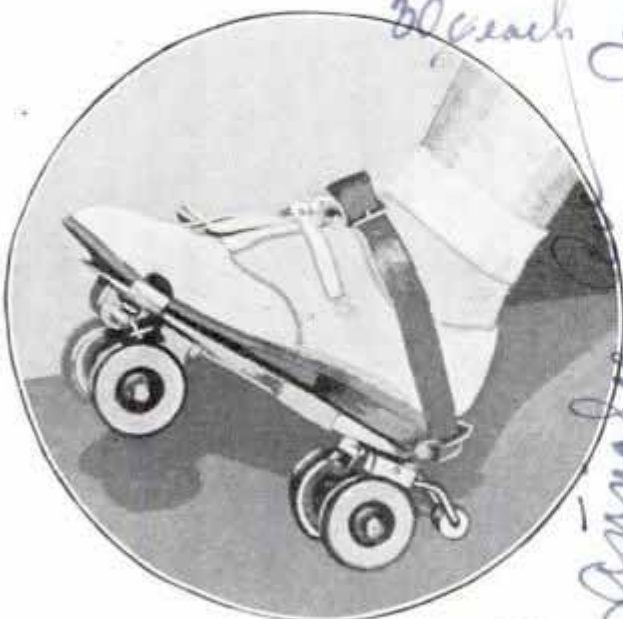
bridge upon which the tool carriage is mounted travels back and forth; fourth, a motion of the carriage holding the grinding tool at right angles to the bridge, but guided by it, and, fifth, a quadrant rocks and tilts the table for purposes of test and inspection. These movements will give the mirror a concavity that will be smoothed and corrected to parabolic shape with a pitch-covered polishing tool and jeweler's rouge. The first grinding tool, a convex metal dish of the same diameter as the mirror, will be faced with glass blocks two inches square.



Large model of proposed Cape Cod canal. Note size of man at left center in comparison with the model, the length of which is 115 feet

Safety Brake Stops Roller Skates Instantly

Five-wheel roller skates are the latest innovation. The fifth wheel is a tiny aluminum roller at the back which applies brake-blocks to the rear wheels when the foot tilts backward. The brake prevents falls and gives skaters instant control in avoiding collisions.



Kick your heel back and the aluminum roller sets brakes on the rear wheels of your skate

Built on a scale of nine feet to the mile, a model of the Cape Cod canal is helping scientists study the effects that tidal currents will have when the waterway is enlarged to a width of 700 feet and a depth of forty feet. The model is 115 feet long, including its approaches. As constructed in Massachusetts Institute of Technology, the model presents Cape Cod bay as a rectangular body of water, with Buzzards bay and its many islands and indentations in the foreground. The channel of the old canal winds across the far side of the bay, while Hog Island channel leads out from the old channel and crosses the middle of the bay, marking the route of the deeper and wider channel under construction. Along the course of the canal proper are instruments for measuring and registering the rise and fall of the miniature tides.

☐ Ducks whose gizzards yielded gold nuggets gave prospectors the clue to pay-dirt deposits in the Ural mountains.

Mass. Cambridge

*The Roller Skates Science Service
Brake Co 1620
12/20/25*

Ship Flies Five Miles a Minute Five Miles Up

Fl.



Engineered for cruising in the sub-stratosphere—around the 26,000-foot level—this twin-motored monoplane is expected to set a five-mile-a-minute pace

New York is scarcely twelve hours from Paris in such a speed plane as the "Crusader," designed by Thomas M. Shelton and exhibited recently at Miami, Fla. It was built to cruise at five miles a minute at an altitude of 26,000 feet. The ship is a low-wing cabin monoplane powered by twin engines, and with twin tail units that stretch far back of the tail wheel.

Two-Pound Piston and Rod Unit Develops More Power

Made of lightweight aluminum alloy, a new piston and connecting rod is available for high-compression Diesel and racing engines. The unit produces more revolutions per minute, due to the short length of the rod, and compression can be carried as high as twenty to one, according to the makers. An air gap gives the proper degree of cooling to cylinder walls. The assembly operates with a two-point bearing on the cylinder wall. No ledges are formed and the edges do not wear off the rings. Connecting rods can be removed from the engine without taking off the cylinder head. The complete unit for a Chevrolet motor weighs only two pounds. Use of babbitt for bearings is omitted, since tests show the alloy develops a smooth glaze and stands up as well.



Meter Tells Your Glove Size by Measuring Hand

Retail glove counters are being equipped with a "meter" which accurately measures your hand and shows on a dial what size glove you should wear. The hand is inserted through a metal strap on the instrument and the middle finger presses forward a movable button so far as stops between the fingers permit. The glove clerk then tightens an adjustment knob which fits the metal strap firmly around the hand. Thus both finger length and hand width are registered on the dial.



Meter that registers glove size on dial

Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

by Prof. A. C. Davis

Cornell Univ. - Ithaca N.Y.

Designed for Leates Int'l. Club
Johnston N.Y.

70 American Eagle Co
Elephant Building
Hessner Co

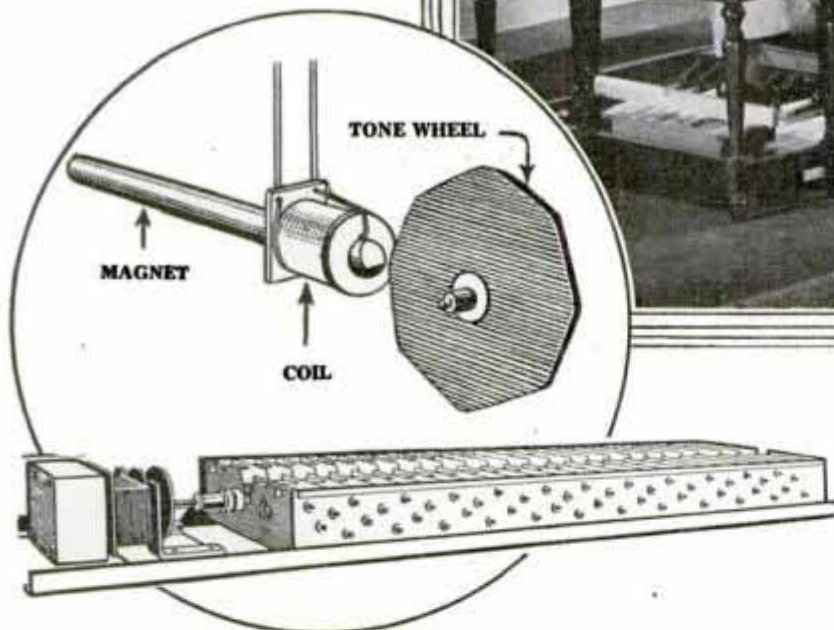
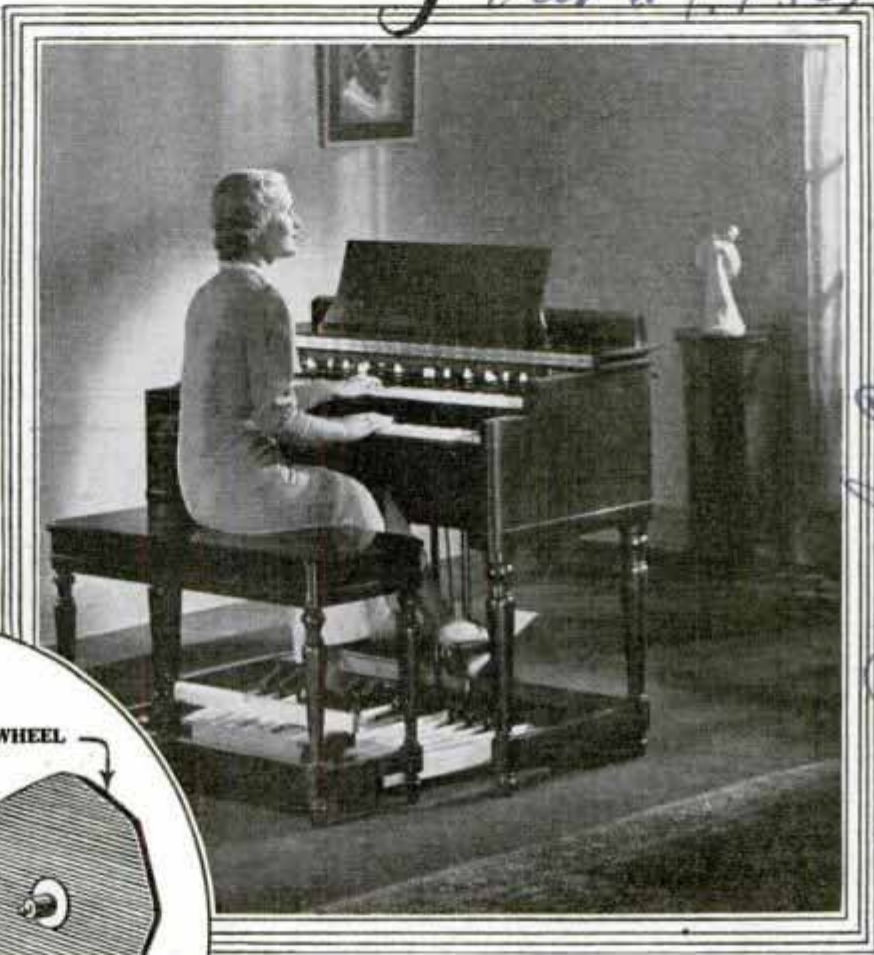
Acme
R & R Mfg Co
E 1504
Box 546
Anderson

8/14/28 Export handled by
New York office of
50 W. 59th

Electric PIPELESS ORGAN has MILLIONS of TONES

Pat. # 1,756,950

SMALLER than a piano, a midget in comparison with the vast pipe organs of traditional style, yet capable of 253 million different tones is the electric organ invented by Laurens Hammond of Chicago. Pipeless, it can match in volume of sound the greatest pipe organs. Without reeds or trumpets, it can simulate an infinite variety of musical instruments. Its mainte-



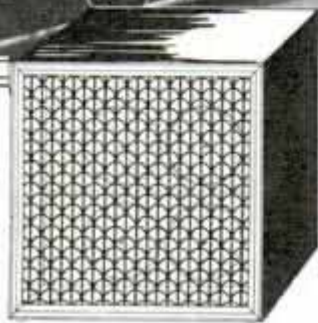
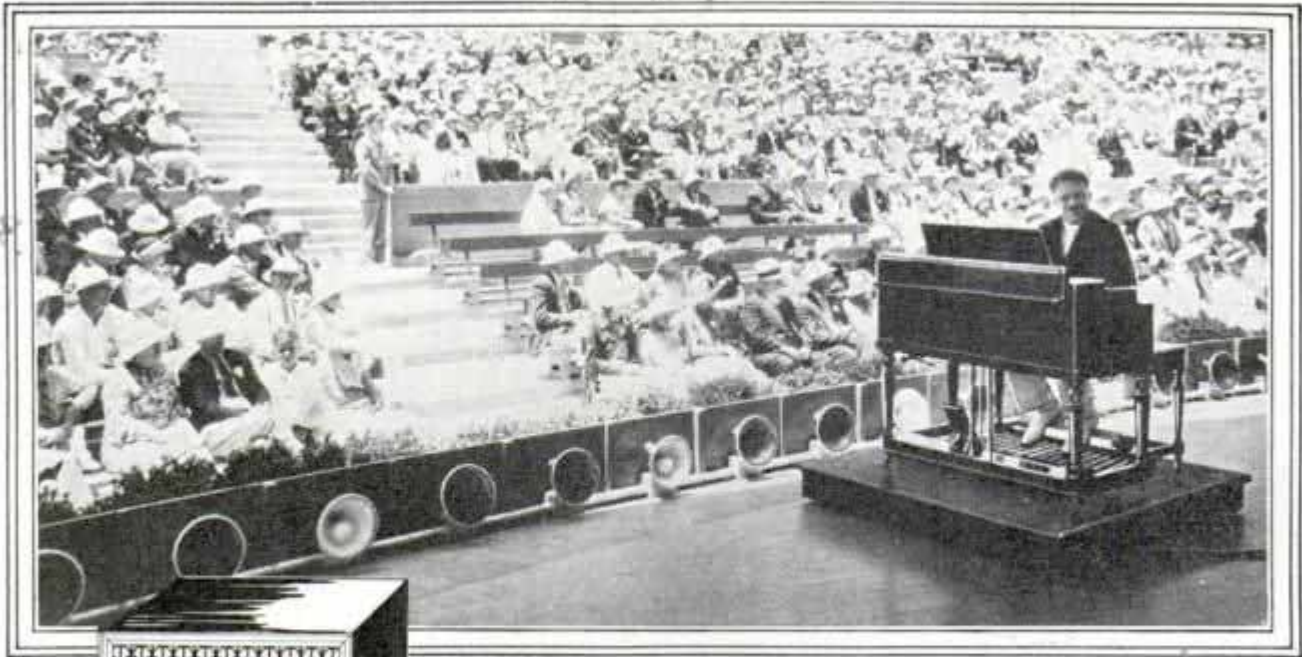
This compact pipeless organ, plugged in on house electric circuit, has 253 million tone combinations available. At left are magnet and tone wheel, ninety-one of which, arranged in box below, are driven by synchronous motor

nance cost is that of a radio, standard radio tubes being used not to produce sound but to amplify tones. The synchronous motor which drives the tone generator consumes only ten watts from the house electric circuit; the amplifier requires about 180 watts. Beyond the keyboard, this organ for home, theater or outdoor arena bears virtually no resemblance to musical instruments of the past. Sound is produced, varied, swelled and modified electrically. Heart of the Hammond organ is the tone wheel. It is a metallic disk

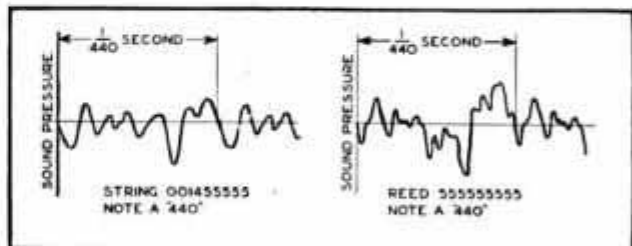
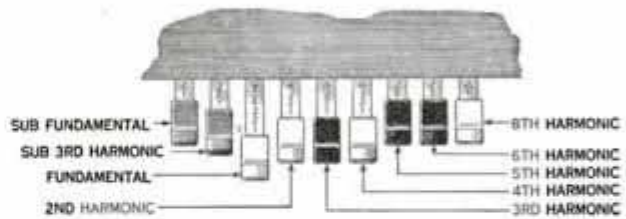
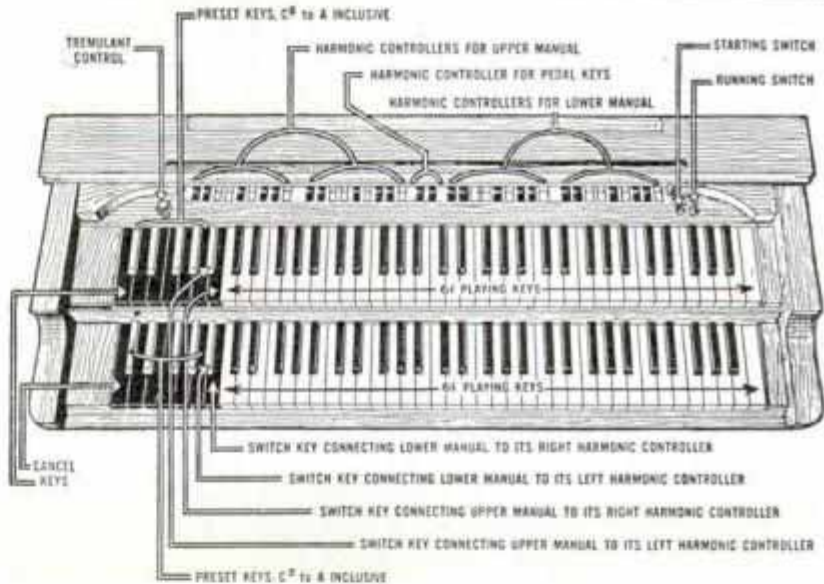
about the size of a silver dollar, rotating on a constant-speed shaft driven by the synchronous motor. Adjacent to it is a permanent magnet about one end of which a coil is wound. The tone wheel has a number of humps or high spots placed equidistant around its periphery, and as it rotates these high spots vary the field of the magnet and thus induce a tiny current in the coil. When the disk rotates at such speed that 440 high spots pass the magnet each second, a minute alternating current of a frequency of 440 is generated in the

The Hammond Clock Co Chicago
2915 N Western Ave

8 147 8
570



coil and its circuit. Heard over the headphone, this frequency is the standard "A" pitch of 440 vibrations per second. Disks with more or fewer high spots produce other pitches, and in the organ there are ninety-one graduated disks driven by the same synchronous motor and producing ninety-one notes. Thus synchronized by alternating current, the organ can never be out of tune. There are two keyboards. Above them is a row of drawbars controlling the harmonics, and it is these which give the infinite variety of tone color. Each drawbar can be set at nine different positions numbered from zero to eight, the position determining the presence and intensity of the harmonic associated with that control bar. There are four harmonic control groups, two for each keyboard, and pre-set keys to the left of the keyboards permit the player to set up certain tone combinations before starting to play. Besides the eighteen pre-set keys which correspond to the piston buttons on the pipe organ console, the organist can manipulate the harmonic controls independently into millions of different rela-



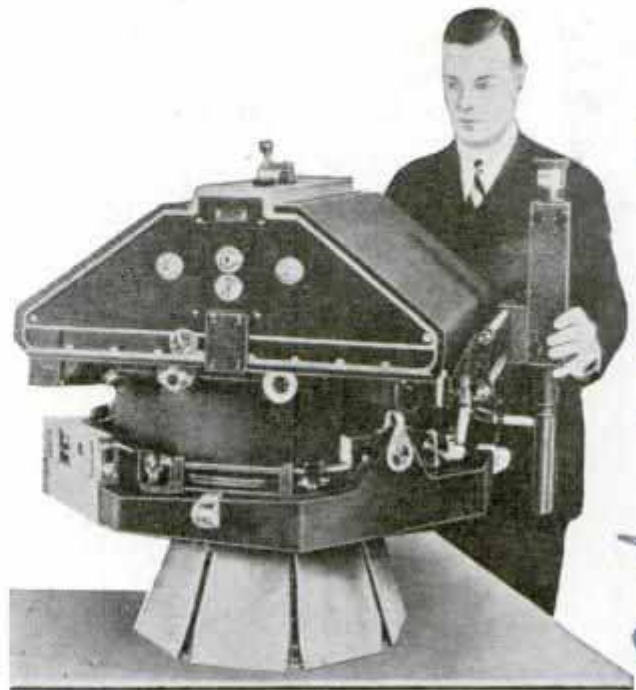
To amplify electric organ for outdoor theater, extra power cabinets are added. Drawings, from top to bottom, show power cabinet; double manual keyboard; a tone mixture set up on one of the harmonic controls, and graphs of the wave patterns of string and reed, pitch "A"

2/498

F3

tive positions each producing a different tone color. Certain pre-set keys are arranged to produce qualities of the flute, diapason, string and reed families. As the organist presses a playing key, current of the proper frequency flows to the drawbar of the harmonic controller, whose position determines intensity of the frequency. Thence the various frequencies are mixed and flow as a complex electrical wave to a preamplifier in the console and then to the vacuum tube amplifiers in the separate power cabinet, where the current is translated by speakers into musical sound. A small knob above the keyboards operates the tremulant; a foot-pedal controls the swell. Besides the five-octave manual keyboards there is a pedal clavier of two octaves. The organ is unaffected by temperature or humidity. The electric contacts are composed of a platinum-iridium alloy. The keys are of plastics, mounted permanently on aluminum shanks.

Nine-Lens Aerial Camera Films 600 Square Miles



Stainless steel mirrors arranged octagonally at base throw image on vertical lenses of aerial camera

With one simultaneous click of the shutters, nine lenses of the latest aerial camera photograph an area of 600 square miles from an altitude of 30,000 feet. The lenses are mounted vertically, eight of them focused upon the image reflected by eight stainless steel mirrors, and spaced equidistantly around the single center lens. These mirrors, of astronomical type and an innovation in aerial cameras, are nine and one-half by five inches and $\frac{5}{16}$ inch thick, supported on an octagonal steel cone. All nine images from the lenses are projected on a single film with a negative size twenty-three inches square, the entire 200-foot load of film weighing twenty-five pounds and capable of 100 exposures. A telescopic view finder is equipped with drift indicator and an automatic control assuring proper overlap of the nine vertical pictures for mapping purposes, the camera having been built by Fairchild Aerial Camera corporation for the U. S. Coast and Geodetic survey. Camera and accessories together weigh 636 pounds. Its shutters are operated automatically by an electric motor of $\frac{1}{200}$ horsepower, and once in operation the cameraman needs only keep it level with two spirit levels. A suction pump keeps the film flat.

61575

Twenty-Four Hour Globe Clock Shows Time in Every Zone

Not only the time but the date in each of the twenty-four time zones of the world is shown on a globe clock invented by Edward R. Fowler of New York City. It is electrically lighted and includes second and minute hands as well as the hours around the world.



This is the mechanism of the globe clock which tells time for all of the hour zones around the earth

Wide World

Fairchild Aerial Camera Corp. 62-10 Woodside Ave. Long Island, N.Y. Woodside

'Quake' on Shaking Table Aids in Study of Effects



White outline in foreground is shadowgraph of quake. Tank on table is shaken as equipment converts shadowgraph lines into motion

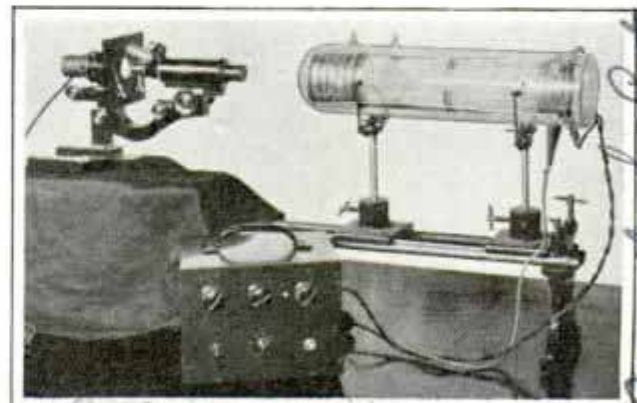
Designed for studying the destructive effects of earthquakes on buildings and other structures, a new type of shaking table duplicates in the laboratory the various temblor motions directly from seismograph records. An electric eye follows the wavy outline of a shadowgraph of an actual earthquake, such as that at Long Beach, Calif., in 1933, a pencil of light being the only connection between the shadowgraph and the shaking table. In one test a scale model of an elevated water tank was erected on the table. Driving mechanism includes an oil-actuated piston which moves the table under the control of a very sensitive, quick-acting valve that

transmits to the piston every detail of the earthquake waves as they are seen on the shadowgraph by the electric eye. The machine makes it possible to determine just what might have happened to a full-sized water tank in the Long Beach temblor.

Magic Tube Sends Movie Through Dark Glass

Motion pictures can be projected through black glass and microscopic organisms seen with invisible light by means of an electron tube being demonstrated by the Radio Corporation of America. The tube converts light rays into electrons. With the ordinary light beam of a movie projector focused on the tube, electrons speed through the tube and reproduce the pictures on a screen. When a dark glass interrupts the light beam, the motion pictures continue as if by magic, for the tube is functioning on infrared rays, known as "black light." In the electron image tube, pictures

are focused electrostatically by means of a potentiometer. The tube may also prove



Microscope set up for study of cell tissues by infrared light of electron image tube

Designed by Arthur C. Riggs, Research
Laboratory in Seismology, in consultation

Int. Sec. Cambridge Mass. U.S. Pat. 2,112,112

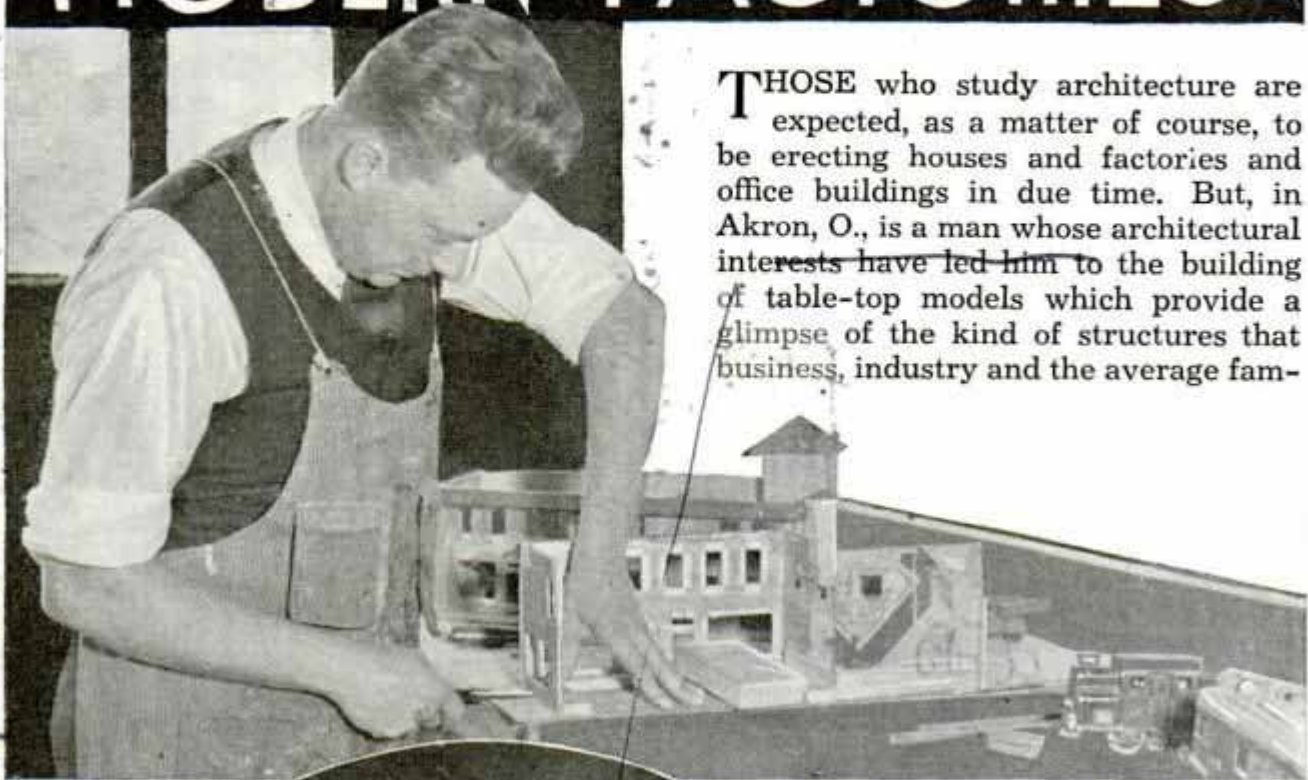
Mass. Institute of
Technology
RCA Bldg. 30
Rockefeller Plaza

New York City

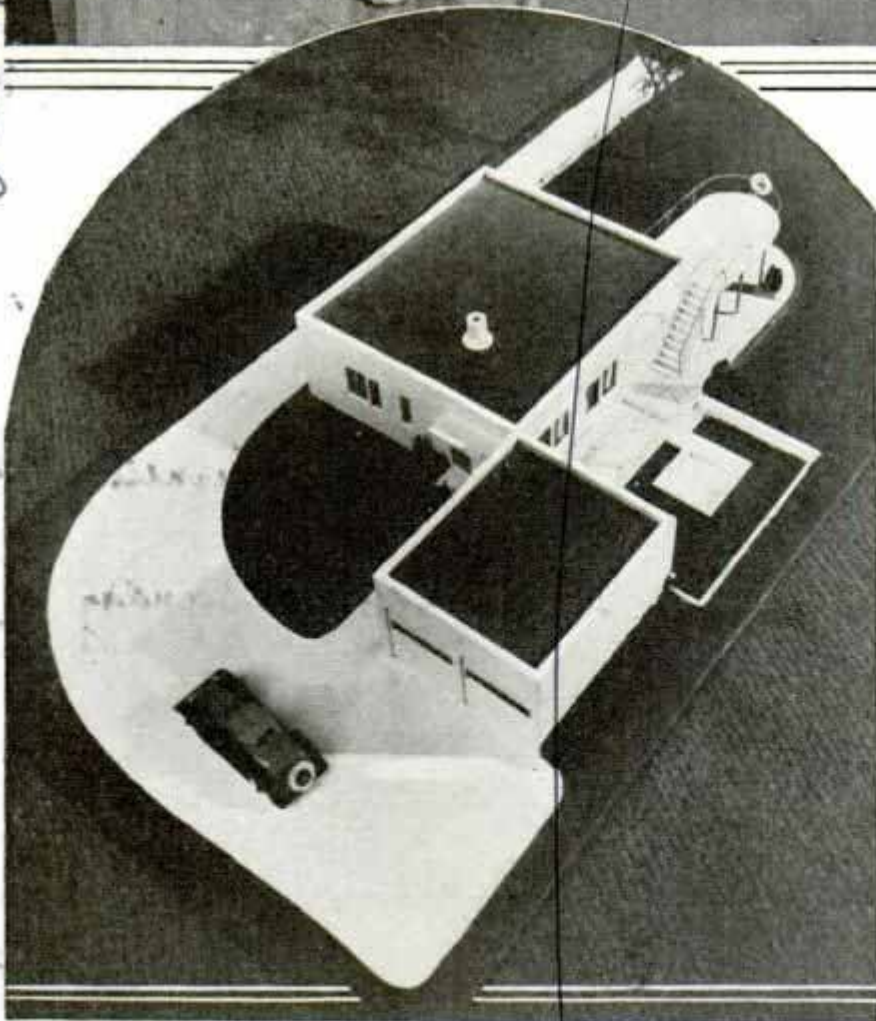
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Emr. Walter G. Barton
1032 Florida Ave
Akron, Ohio

MODERN FACTORIES



THOSE who study architecture are expected, as a matter of course, to be erecting houses and factories and office buildings in due time. But, in Akron, O., is a man whose architectural interests have led him to the building of table-top models which provide a glimpse of the kind of structures that business, industry and the average fam-



ily will occupy in years to come.

Robert Wise has found a business in making cardboard factories, surrounded by rubber-sponge hedges and poplar trees made from dried goldenrod plants. For many years he had been interested in models. He liked to build miniature replicas of various kinds of things. He studied architecture—then went to work for a company that deals in financial securities. After 1929 it became increasingly difficult to find people who wanted to buy securities and Wise found himself with a lot of time on his hands. He spent much of it painting in oils, and making and reading about models.

About two years ago, a friend who admired

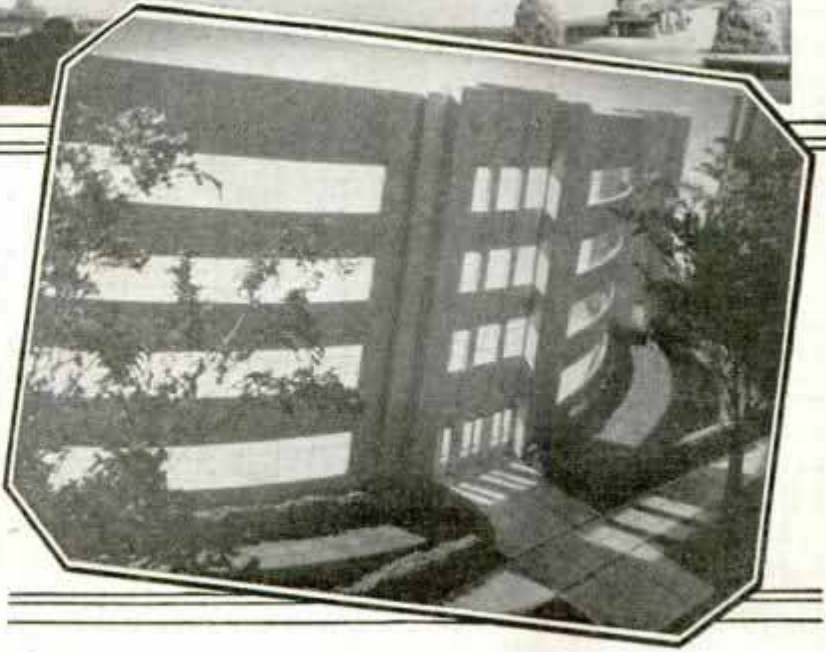
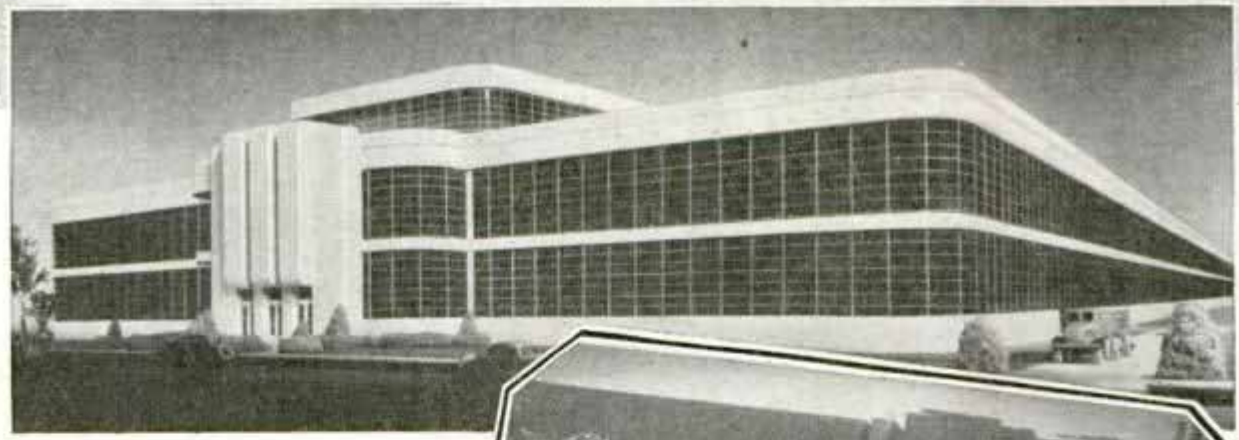
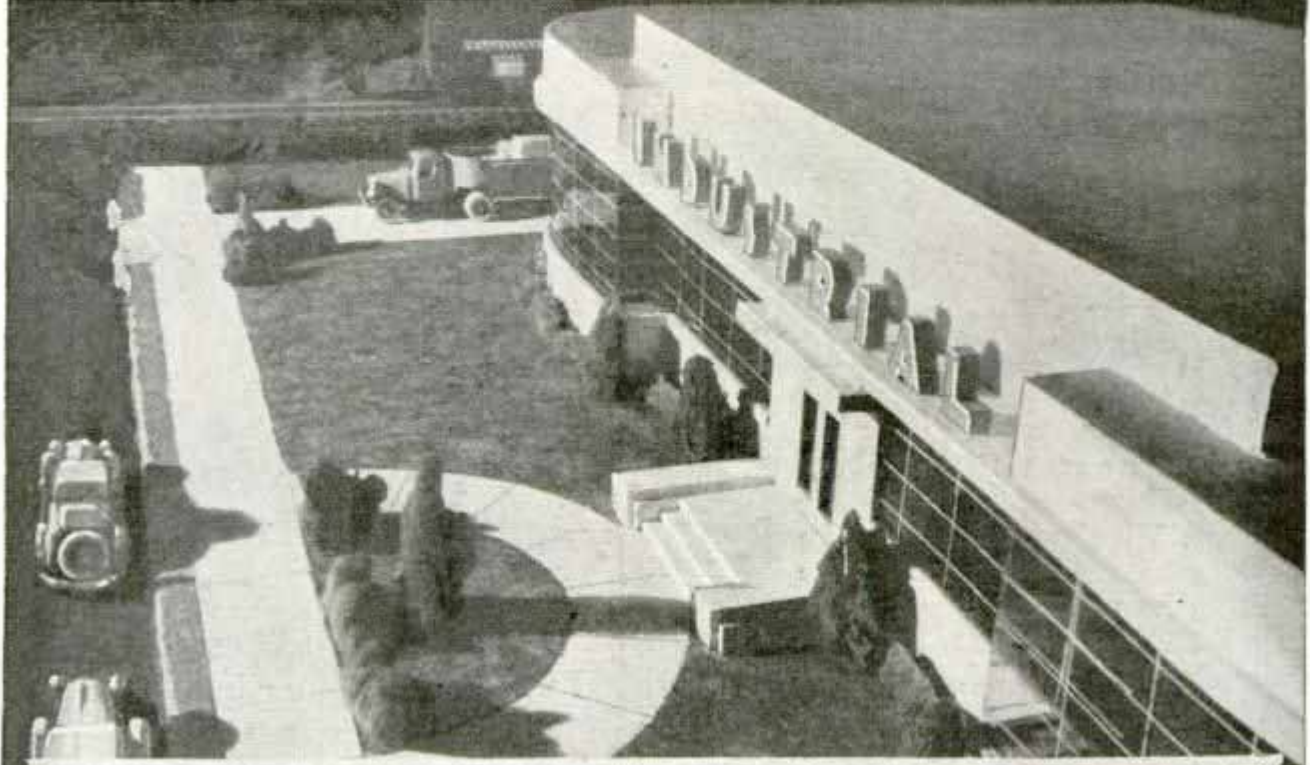
Robert Wise working on model of tourist hotel, and his model of a modern residence from which a full-scale house was built. Such models often save costly alterations later

Robert O. Wise, 203 Overwood Road, Akron, Ohio

203 Overwood Road

E 1268 W

Built on TABLE TOP



Wise's model work suggested he visit a Cleveland company that specializes in fabricating factory buildings, power houses, gasoline stations and other industrial structures. That company, the friend explained, sometimes hires people to make models. Wise went to Cleveland and met a man who was "tearing his hair" because he was expected to have a photograph of a factory building ready in two days and the building hadn't been erected yet. A model

Top, factory model complete even to landscaping. Center, model constructed to give impression of great depth. Bottom, factory model illuminated to show appearance at night



Left, model of a bus terminal. Mr. Wise had to construct the miniature busses because none of the scale necessary was available on the market

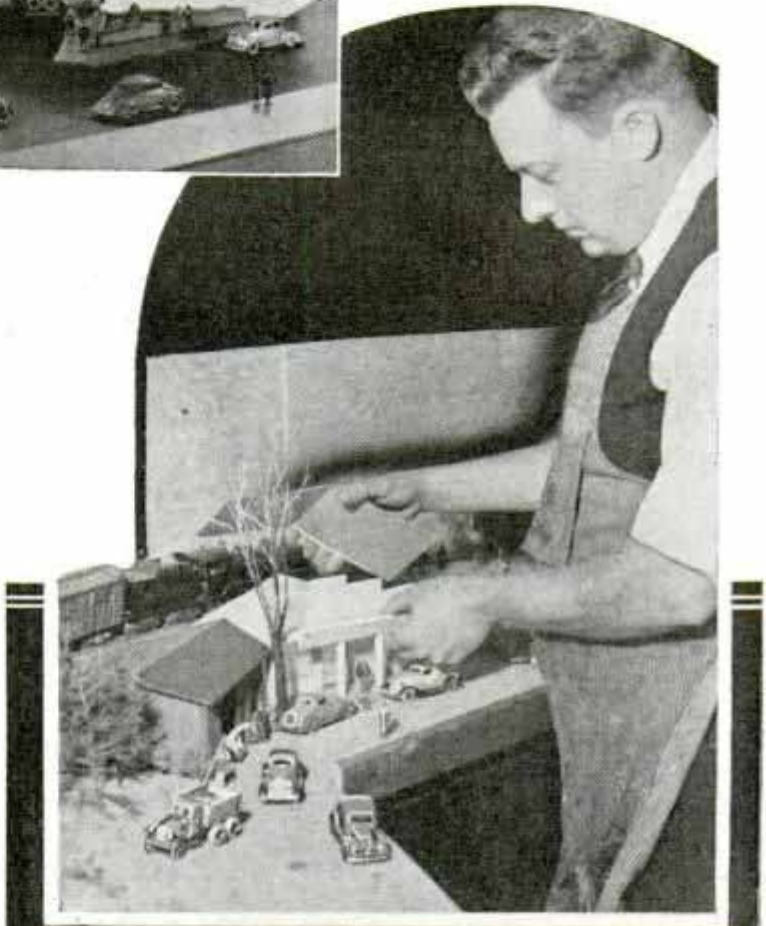
had been suggested but the photographer knew nothing about model making.

When Wise explained that he could read blueprints and make models, he was put to work. In less than a day, the model was completed. The photographer made a picture and at the appointed time the desired print was delivered. That was the incident that transformed Wise's pastime into a paying business. Since then, he has built dozens of model factories, most of them for use in making photographs for advertising and publicity work.

He makes his factories from a good grade of cardboard, glue, bits of composition roofing and whatever other materials are suitable and convenient. Most of the buildings are painted to resemble enameled steel, the material of which similar full-size structures are built. Sometimes Wise works from blueprints, reducing them to the desired scale. At other times, he is given merely a rough sketch and works out his own details. In all this, his architectural training has proved invaluable as have his artistic abilities—knowledge of pigments and paint materials.

The cardboard buildings are put together so they are strong enough to withstand considerable handling, for they frequently are sent to various parts of the country for

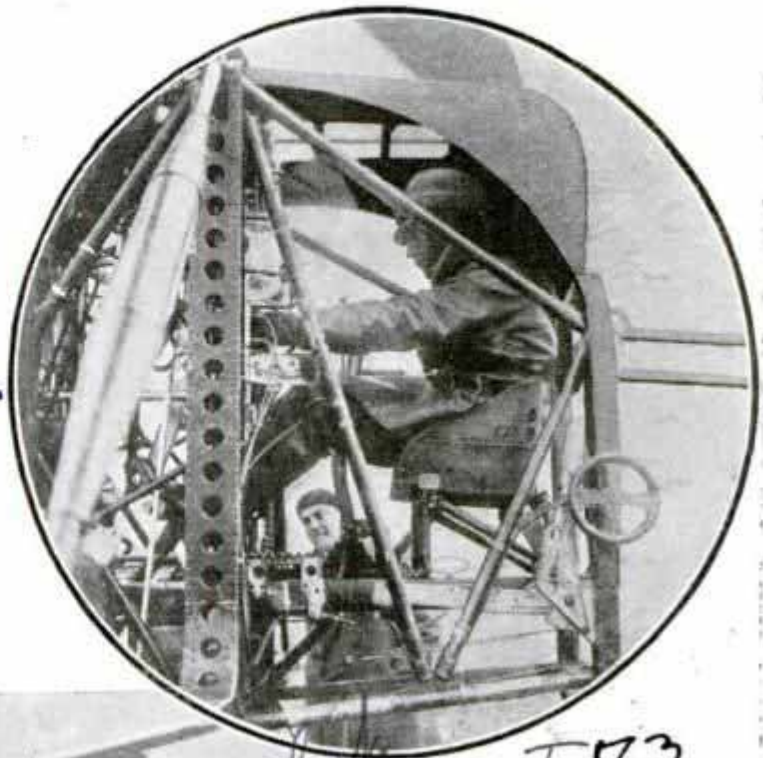
(Continued to page 132A)



Above, part of a model southwestern town. Bottom, electric power station as visualized in cardboard to show builders appearance of structure before it was built

Twin "Windmill" Blades Fly Wingless Ship

Great whirling "windmill" propellers are mounted tandem over the pilot's head on a wingless airship undergoing tests in France. One of the horizontal blades sustains the ship in flight and the other propels it forward. Besides the traditional three-point landing gear the gyro has a small wheel under the nose. Pilot Maurice Claisse gave the ship extensive tests, successfully demonstrating its ability to lift off the ground and remain in the air. Its wide-set wheels are joined to the body by steel framework.



Two views of the wingless French aircraft. Observe the intricate mechanism surrounding the pilot's seat



F73
Air Springs Replace Metal Leaves for Automobiles

Air springs consisting of bellows have been tested successfully in automobiles, replacing the ordinary metal leaves heretofore used. The air springs are described by R. W. Brown of the Firestone Tire and Rubber company as resembling two hot-water bottles placed

one on top of the other. Through tubing they connect with an air reservoir and the bellows and reservoir are filled with air to a predetermined pressure. Road shocks cause the air to pass back and forth between bellows and reservoir. Tests have indicated the rubberized fabric material in the air springs will stand 8,000,000 two-inch deformations under twenty-five per cent overload. Body roll on curves is eliminated by using a small pendulum device hung inside the air spring. This controls a valve mechanism and by valve action the air pressure on the outside springs is maintained at a higher level than on the springs toward the inside of the curve.

F54
Flat Chest Linked to Mind in Intelligence Tests

If your chest is flat, you probably are more intelligent than that fellow with the deep chest. From studies of several thousand adults and school children, Dr. S. A. Weisman of the University of Minnesota concludes that flat-chested persons not only average more intelligent than the full-chested, but are taller and heavier. In earlier surveys Dr. Weisman found that, contrary to popular belief, flat chests are not an evidence of tuberculosis, but that deep-chested individuals are more prone to the disease.

Scene Service
 10/10/36

Minneapolis

men

Scene Service

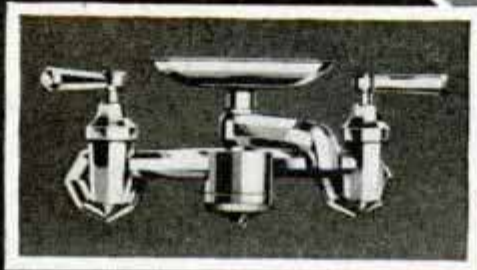
1/13/36

at meeting of
 S. A. G.
 Akron Ohio.
 see May 1936 69.3

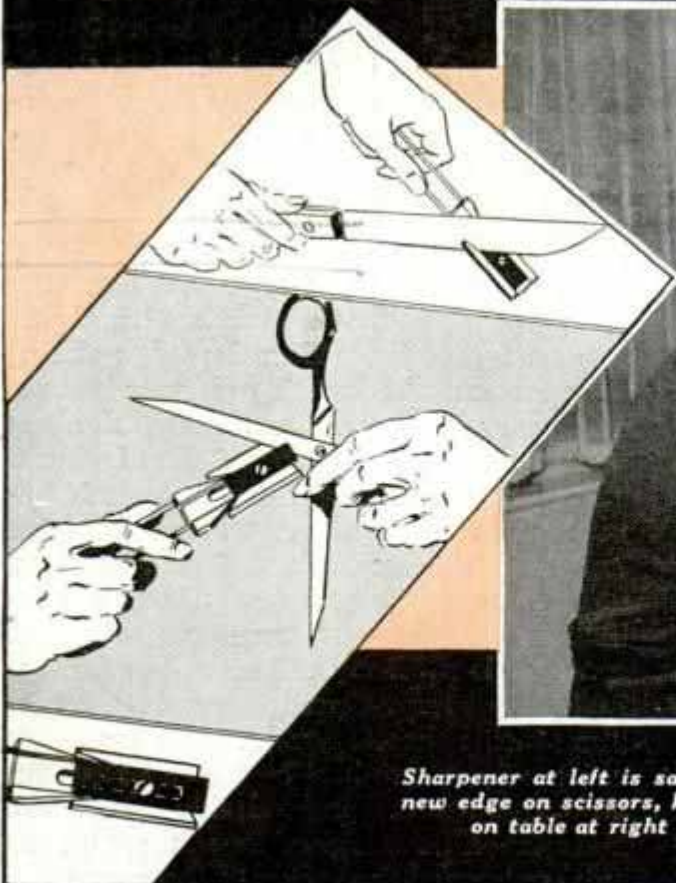
New Conveniences YOUR



Bridge lamp, above, has horizontal tube bulb extending over table without interfering with players. Porous stone encased in water faucet at right filters out germs and foreign particles

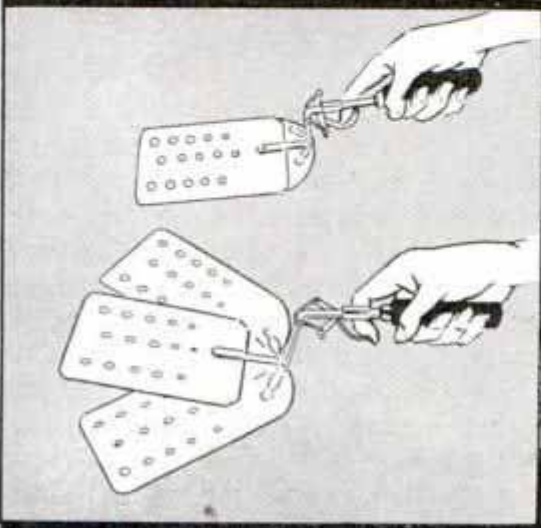


At each end of the day-enport, above, are convenient shelves and compartments for books, beverage set and radio

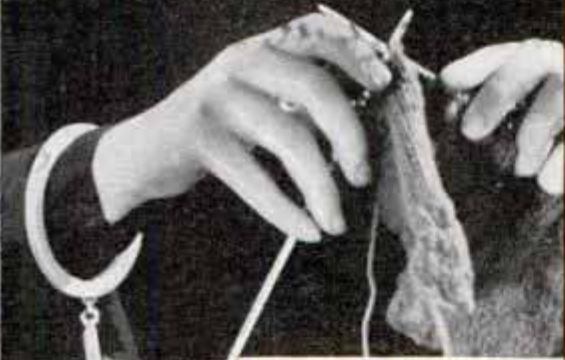


Sharpener at left is safe and can be adjusted for putting new edge on scissors, knife, or skates. Pocket-sized meter on table at right tells how much light you need

for . . . HOME



Adjustable flapjack flipper, above, can be slipped under steak and spread into three-bladed lifter by pulling trigger

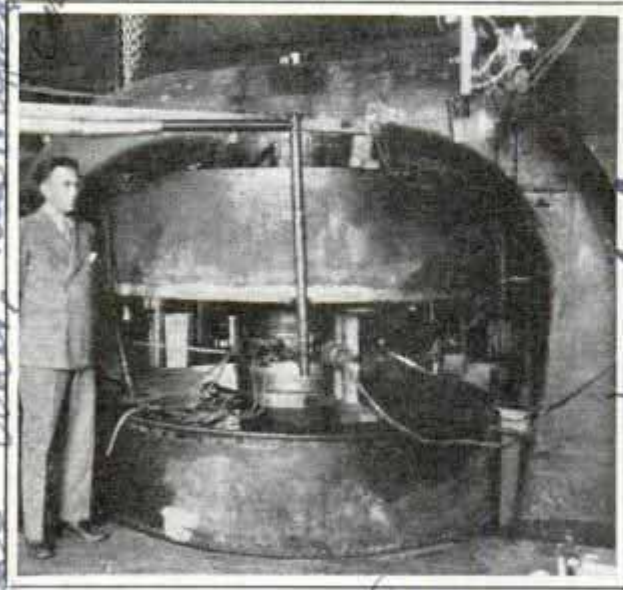


Left, decorative bracelet has detachable pendant holding ball of yarn for knitting. At right, time control dial for household washing machine tells proper water temperature and time for washing various fabrics, and switches power off automatically



Adjustable quilting frame can be tilted or turned upside down and the quilt may be stretched tight or loosened by winding the two rollers

Six-Million Volt Atom Smasher Creates New Elements



This eighty-five ton "cyclotron" creates new radioactive elements by smashing atoms

Artificially radioactive elements, hitherto unknown, are being created by the "cyclotron," giant atom-splitting machine at the University of California, whose power has been stepped up to 6,000,000 volts or more. A score of elements have been transmuted into other elements, some well known but others not previously recognized on the earth. The radioactive substances give off emanations for a few days, or only minutes, whereas radium is active for thousands of years. The cyclotron weighs eighty-five tons, and permits discharge of more than 100,000 billion fragments of double-weight hydrogen atoms per second. One of the research fields in which the cyclotron will be used is the development of the neutron ray, far higher in energy and penetrating power than the X-ray.

Two Time Zones for Nation Proposed Instead of Four

Radio, airplanes, telephone and telegraph lines have so annihilated time that the suggestion is being made that the United States be divided into two time zones instead of four. The present eastern, central, Rocky Mountain and Pacific standard time zones were adopted in 1883 to end the confusion of "sun time" in every city. Railroad time schedules were a

coordinating influence then. Now Bernrose Boyd of the University of Iowa proposes one time zone east of the Rockies and another for the west. The east would adopt what is now central standard time, and the west would be three hours later.

Language-Teaching Machine Plays Charted Records

Learning foreign languages, music and correct speech is made easier by a machine with controls by which words or sentences or musical passages selected from a printed lesson chart may be produced in sound. Lesson chart and the record are correlated so that any word or sentence can be selected and repeated automatically as many times as desired. The machine is a phonograph-radio combination, with the controls for playing the instrument at any point on the record. Charting the disks can be done at home or in the class room. The machine may be



Printed passages may be played and repeated at will by setting indicator of this machine

adapted to any textbook by making recordings and preparing charts. Called "translaphone," the instrument operates on alternating or direct current and uses any standard phonograph disk.

We Beg Your Pardon

William Priess is the sole inventor of the television scanner described in the February issue of Popular Mechanics Magazine. Dr. Lee De Forest, who was mentioned as co-developer of the scanner, asks that full credit be given Mr. Priess. Popular Mechanics is glad to make this correction.

Designed by Dr. C. Lawrence, U. of California
Improved by Dr. Reginald Crooksey Berkeley
Yale Univ. New Haven Conn.

Iowa City, Iowa.

F40

translaphone 597.6
W. Voachel
Chicago 6906 Ottawa

F6

Science Service
12/2/35



*Adapters
for using*

ALL-METAL TUBES..

£ 36 98

IF YOUR receiver has a tube listed below in the first column you can substitute the corresponding metal tube indicated in the second column in a few seconds by means of a suitable adapter. Although the new metal tubes require an entirely different type of socket, these adapters are designed to solve the problem in a very simple manner. The base of each adapter has the same number of prongs as the glass tube which is to be replaced; the standard octal socket for the all-metal tube is built into the top of the adapter.

There are no changes required in the set, simply place the new metal tube in the adapter, as shown in the upper photo, and insert it in the socket previously occupied by the old-type tube.

Besides modernizing the receiver, these adapters in r.f. circuits permit greater stability and better selectivity due mainly to the reduced interelement capacitances of the metal tubes and the greater effectiveness of the steel shell shield. The adapters entirely eliminate the tube shields used at present. No ground connections of any kind



are necessary, as this is effected within each adapter.

When using the 6A8, 6B6, 6J7 or 6K7 metal tubes which have the new miniature caps, it is necessary to use a small metal clip on the top of the tube so that the larger grid clip, used on the old tube, will fit. These

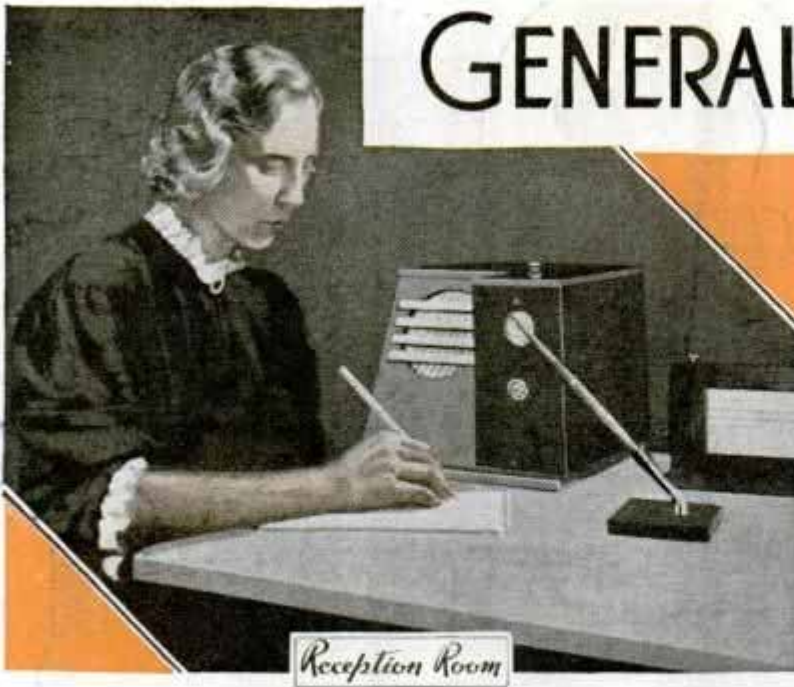
adapters not only provide the set owner, and experimenter, with a simple means of improving their receivers, but they are

also useful to the service man who wishes to bring his tube tester up to date. They may be used to check the metal and octal-based tubes of various makes, in the tube checking sockets that are indicated for the tubes in the first column. Each adapter is color coded for easy identification.

Old Tube Replaced	New Metal Tube Used	Base of Adapter
80	5Z4	4 prongs
76	6F5	5 prongs
75 triode	6F5	6 prongs
37 or 76	6C5	5 prongs
41 or 42	6D5	6 prongs
77 or 6C6	6J7	6 prongs
78 or 6D6	6K7	6 prongs
41 or 42	6F6	6 prongs
75 or 85	6B6	6 prongs
6F7	6P7	Small 7
6A6	6N7	Large 7
6A7	6A8	Small 7

*Alden Products Co.
715 Center Brookton*

GENERAL PURPOSE



By M. N. BEITMAN

AN INTER-ROOM communication system saves time, patience and shoe leather; you merely push a button to talk, and release it to listen to a person in another room. It may be used between the front and rear rooms, or the first and second floors of a home. It is also suitable for inter-office communication; paging and

calling; between store and stockroom; house and garage; sickroom and nursing quarters, and many other useful applications that will suggest themselves to the builder.

The system to be described is very compact and may be transferred easily from one location, and application, to another. To place it in operation it is only necessary to plug the line cord of each unit into the nearest a.c. 110-volt wall socket, turn on the switch and advance the volume control about

half-way on. The 4-wire connecting cable may be any length up to 200 feet.

Two identical units are required. They are housed in neat cabinets made of plywood, the dimensions of which are given in the sketch. Holes are cut in the front of each cabinet for mounting the 5-in. speakers, lapel-type single-button microphones and pilot lights. The larger holes are backed with gold cloth and any type of speaker grill may be used; however, the four narrow wood strips shown answer the purpose. The original cabinets were finished in dull black and the strips were given a coat of gilt lacquer.

Schematic circuit diagram, Fig. 1, is exactly like the one used for the No. 2 unit except that the color-coded cable connections are reversed for the type-38 tube and speaker in the No. 2 unit just as indicated

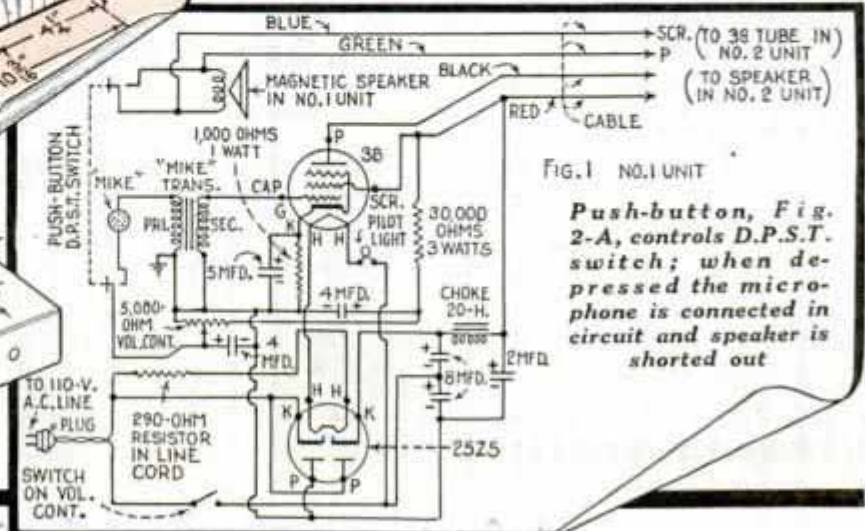
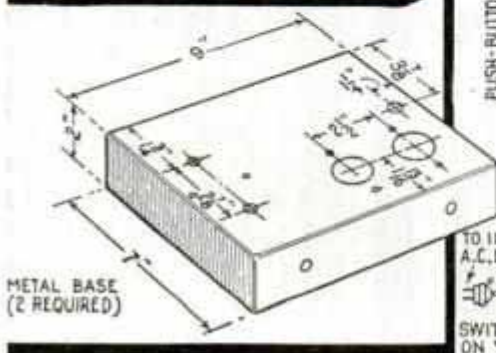
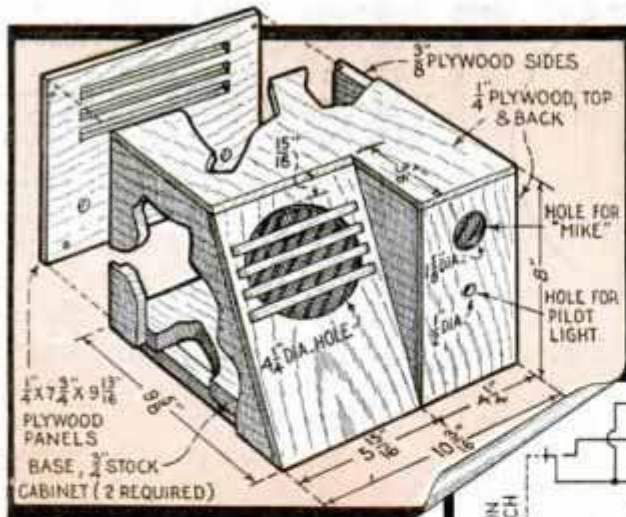
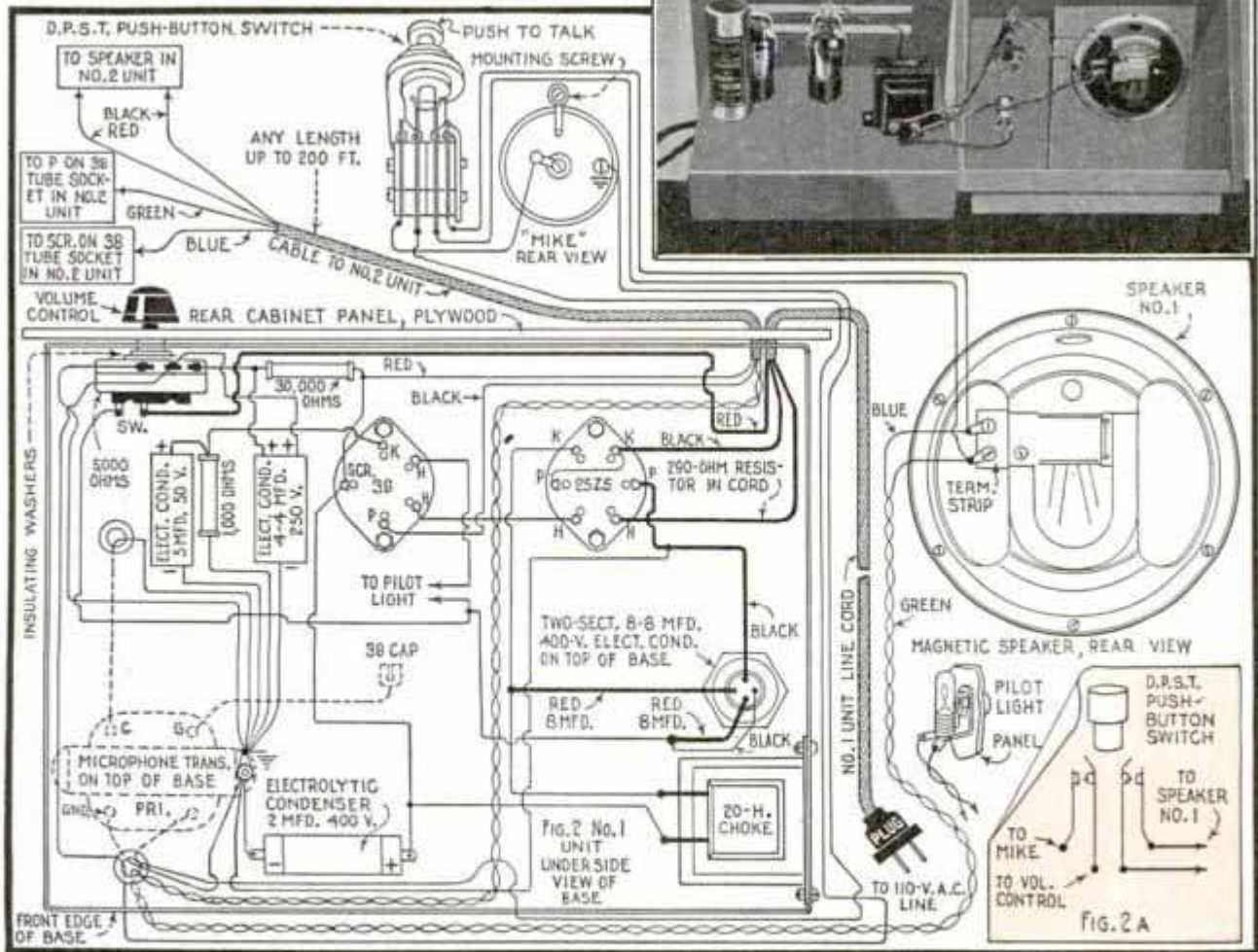
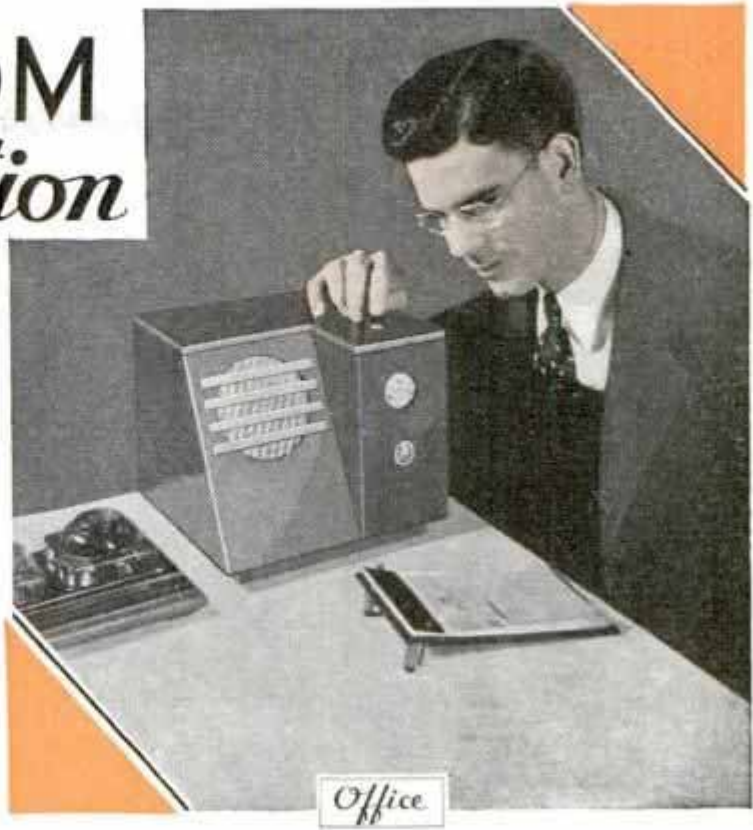


FIG. 1 NO. 1 UNIT
Push-button, Fig. 2-A, controls D.P.S.T. switch; when depressed the microphone is connected in circuit and speaker is shorted out

INTER-ROOM Communication System

in the simplified wiring diagram, Fig. 2. It will be noted that the circuit consists of a type-38 single-stage audio amplifier, the power supply for which is derived from a 25Z5 rectifier tube in a voltage-doubler circuit. These tubes and their associated parts are mounted on the metal bases detailed at the left of Fig. 1. The filament of the 38 tube is connected in series with the pilot light and the filament of the 25Z5 rectifier. All of these require .3 of an ampere. The line voltage is

(Continued to page 136A)



Simple Amateur Radiophone for 160 Meters

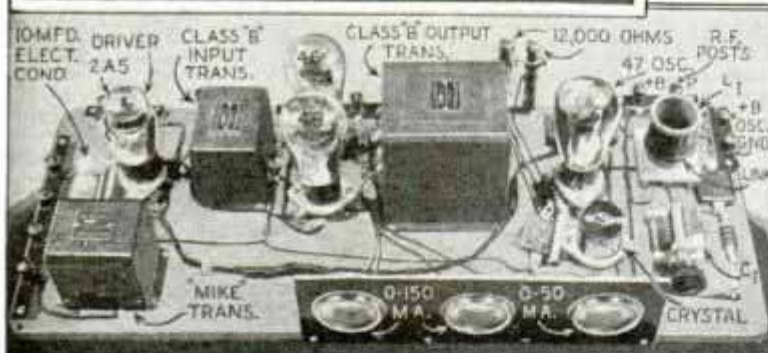


ally some real DX of 1,000 miles or more can be worked with moderate power on this popular band.

The baseboards, for the units shown in the photos, are $\frac{1}{2}$ by 9 by 24 in., cut from a standard 18 by 24-in drawing board. They were given a coat of orange shellac and mounted on rubber-headed tacks. All wiring is above the baseboards.

A type-47 tube is used for the crystal oscillator, the schematic diagram of which is given in Fig. 1. This section is mounted on one end of the board shown in the upper photo, and the rest of the board is reserved for the modulator and speech-amplifier equipment. The coil socket for L_1 is mounted directly behind the 21-plate midget tuning condenser C_1 ; this socket is a National 6-prong coil socket, and L_1 is a National No. 65 plug-in coil of the same type as used in the "SW-3" short-wave receiver. There are no changes

in the coil whatever. A link coil consisting of two turns of insulated wire is placed around the bottom of this coil, loose enough so that the coil may be removed from its socket without disturb-

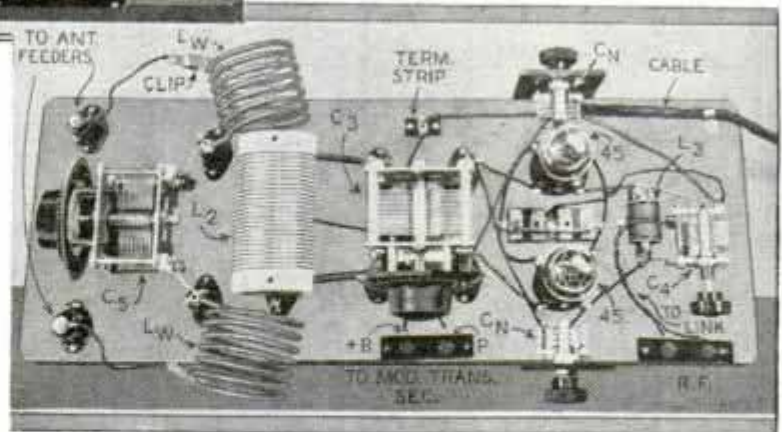


Left, crystal oscillator, class-B modulator and speech amplifier; the R.F. amplifier unit is shown below

By **CALVIN F. HADLOCK**

BEGINNERS in radiotelephone operation will find this bread-board layout easy to build, inexpensive and up to date in every detail. It is crystal controlled, employs Class B modulation, push-pull r.f. amplifier and has a built-in speech amplifier for a carbon microphone.

Since the 75 and 20-meter amateur radiotelephone bands are limited to those who hold a license for unlimited radiotelephone operation, the logical band for the inexperienced beginner is 160 meters. This phone band lies between 1,800 and 2,000 kilocycles. Consistent communication up to 100 or 200 miles and occasion-

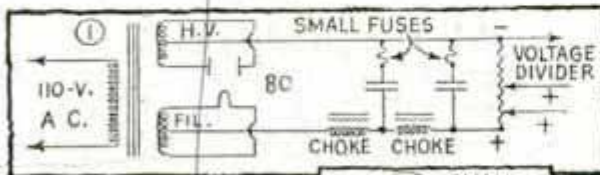


ing the link. The ends of the link coil are twisted together and brought out to the two binding posts directly behind the coil socket. These posts are so located that when this unit is placed in front of the r.f. amplifier, they will be directly opposite the r.f. input posts shown at lower right

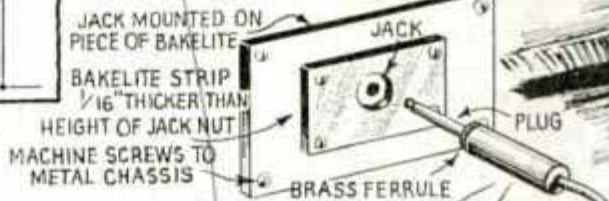
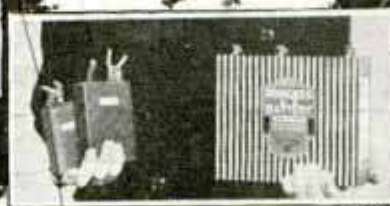
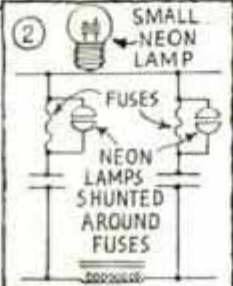
(Continued to page 118A)

PRACTICAL RADIO SUGGESTIONS

Right, section of old drain pipe fastened to base of antenna mast conceals counterweight which keeps antenna supporting rope taut



Neon lamps indicate filter condenser failure in power pack. Fig. 1 shows safety fuses; Fig. 2, lamps which light when condensers fail. Photo at right reveals size of new portable batteries compared with standard B-battery



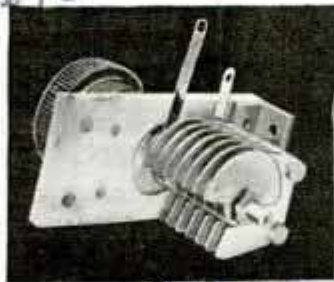
Above, Bakelite strip prevents shock from jack; brass ferrule on plug enters hole in cover strip. Left, Isolantite socket for metal tubes



Right, collodion applied to first few turns and permitted to dry before coil winding is resumed helps hold turns in place. Left, flexible metal tube for shielding auto-lighting and ignition wires



Below, interchangeable transformer and resistance-coupled plug-in audio stages for experimental short-wave receivers



Above, "ultra-midget" tuning condenser for ultra high-frequency receivers and transmitters designed to work in the bands below 10 meters



COUNTERWEIGHT SLIDES UP AND DOWN

SMALL TIN CANS OR SECTION OF PIPE MAY BE USED TO HOLD WEIGHTS

WOOD PLUG
PIPE FILLED WITH SAND
DRAIN PIPE
STRAP IRON

Consolidated Wire Corp. Teoma and Harrison Chicago

All-Wave Super Has Metal Tubes and Iron-Core I.F. Transformers

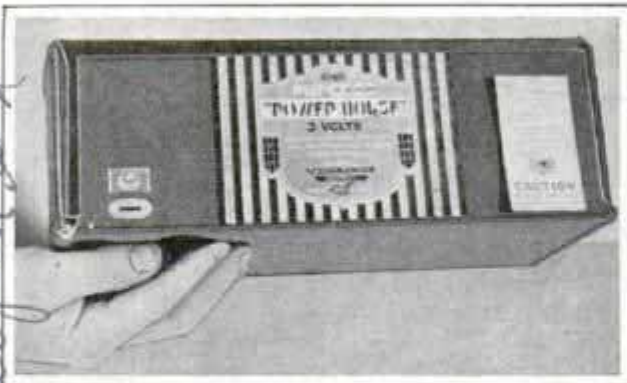


Five-band superheterodyne with vernier band-spread dial, built-in speaker and nine metal tubes

Nine metal tubes are used in this self-contained all-wave super which employs iron-core i.f. transformers to obtain high selectivity. It tunes from 7.4 to 550 meters, has crystal filter and other features of special interest to amateurs and short-wave listeners. Tested in Popular Mechanics radio laboratory, the results were highly satisfactory on all bands.

A-Battery Unit Has Long Life

Designed for use with 2-volt battery-operated receivers, this compact 3-volt

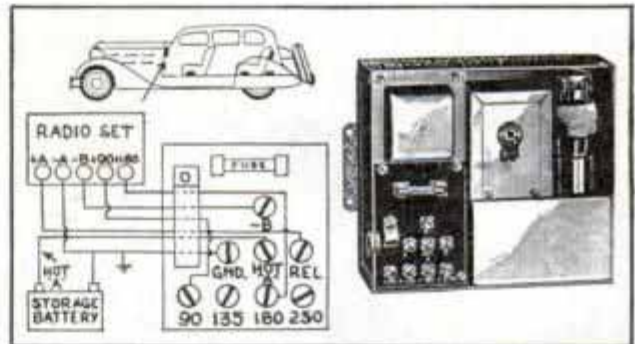


Heavy-duty dry A-battery for 2-volt sets

A-battery unit is claimed to deliver 400 hours service based on a 1/2-ampere discharge three to eight hours per day using an end point voltage of 1.8 volts per 3.0-volt battery. At this rate the operating cost is less than 1 cent per hour. It is necessary to use a resistor with the battery to step down the voltage to the required 2 volts. A suitable tapped resistor is available for receivers without a built-in voltage regulator.

Tapped B-Power for Mobile Sets

The well-known principle employed for many years, of utilizing the direct current from a storage battery converted to pulsating current by a vibrating interrupter and obtaining high a.c. voltages through a transformer, has now been adapted to mobile radio by adding a rectifier tube and suitable filter. The device illustrated



B-power supply and suggested hook-up diagram

produces a smooth, quiet B-power supply for operating radio receivers in autos, motorboats and aircraft. It is claimed to be free from annoying hum and r.f. disturbances, the output being completely filtered, eliminating interference and feedback. The vibrator case is suspended between vibration-absorbing sponge rubber in a larger case for additional shielding.

Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; material lists are available without charge on receipt of postage.

NEXT MONTH—How to Build Your Own 2-Volt Portable Battery Receiver. An exceptionally good 4-tube super for picnics, beach, country home or wherever power lines are not available. Other features include—A Dual Power Unit for Amateur Radiophones, also, an Electron-Ray Tuning Tube Adapter for Your Set.

The Hallcrafters Inc. 3001 Southport Ave. Chicago
62-90
62-3574
Bugas Battery Co. 1000 W. 1st St. Chicago
General Transformer Co. Chicago

B P 9 36



The CRAFTSMAN

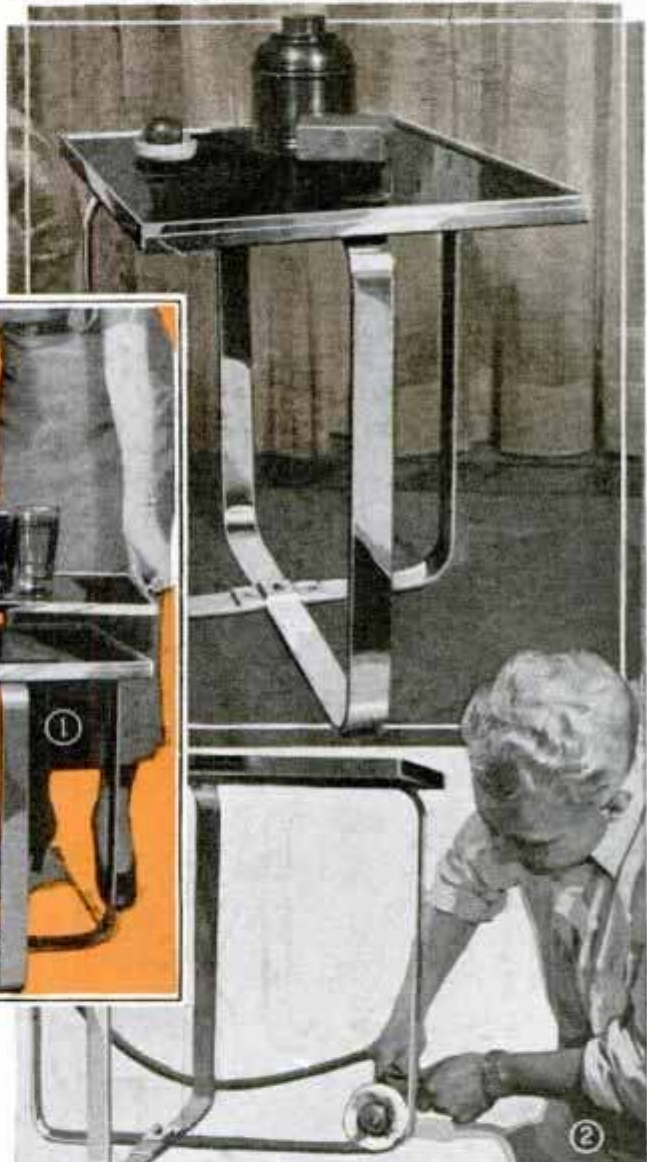
The Latest in

METAL FURNITURE

By Walter T. Warde

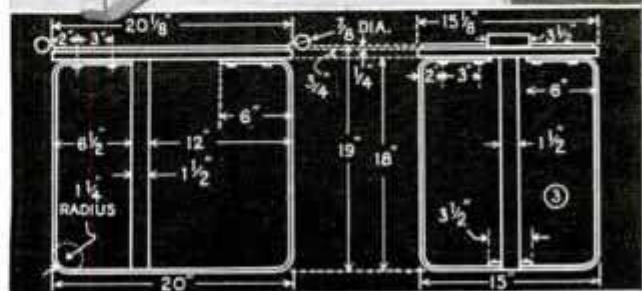
PART IV—COFFEE TABLE AND TRAY of Simplified Design

POLISHED Bakelite or other suitable material of similar appearance and gleamingly bright aluminum, combine to make this modern coffee table, with its removable tray, Fig. 1, appealing to everybody. Besides being quite "at home" with other furniture that is not of the decided period type, it is in perfect harmony with the new classic style, and especially with the club type of furniture so popular at present. The approximate cost of the materials used is four dollars, and the simplicity of design makes it an easy piece to build.

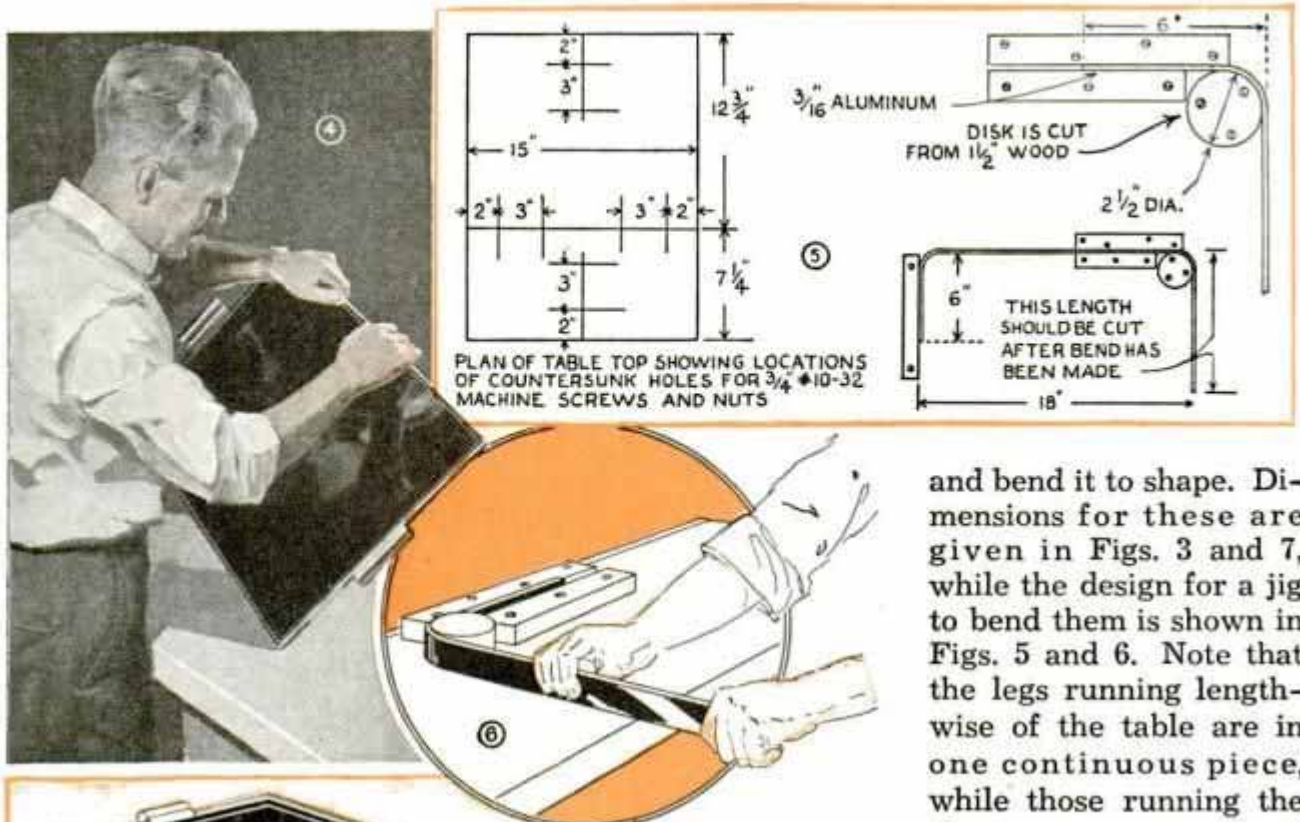


First, the wood and Bakelite for the table top and tray are cut to size and holes are drilled to hold the legs as indicated in the left-hand detail of Fig. 5. Next, cut $\frac{3}{4}$ by $\frac{1}{2}$ -in. angle aluminum and miter the ends so that the short side of the angle forms the support for the table top. Repeat this operation for the tray, using $\frac{1}{2}$ by $\frac{1}{2}$ -in. angle aluminum. Then fit the larger angle to the table top and screw it to the wood from the underside.

Next, cut the flat aluminum for the legs



Felt glued to the bottom of the tray will prevent any possibility of marring the polished Bakelite top

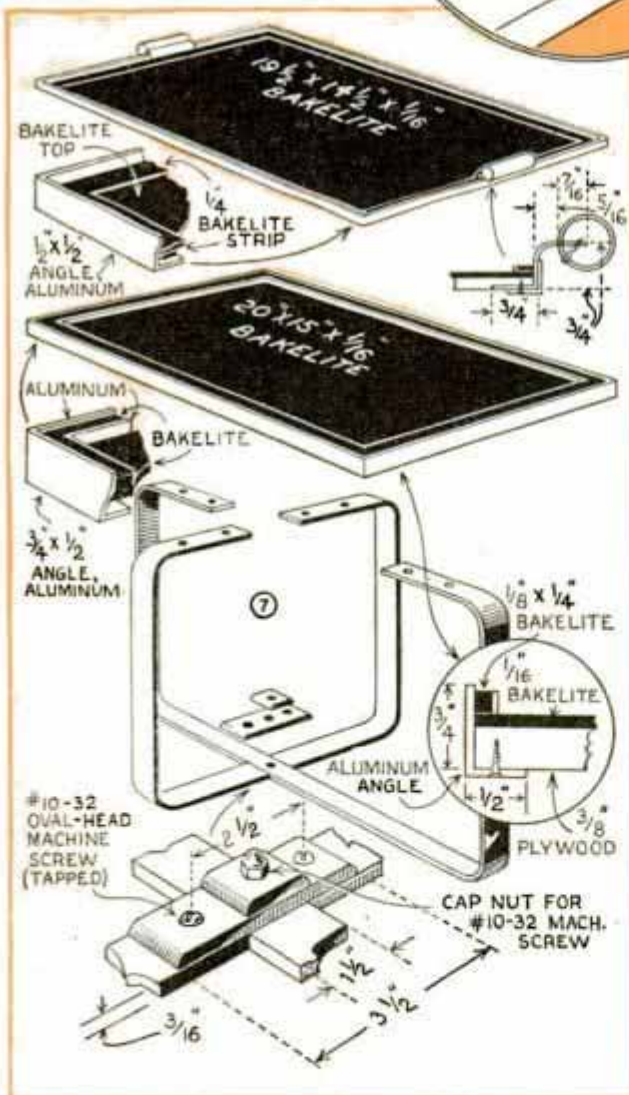


and bend it to shape. Dimensions for these are given in Figs. 3 and 7, while the design for a jig to bend them is shown in Figs. 5 and 6. Note that the legs running lengthwise of the table are in one continuous piece, while those running the short way are composed

of two separate pieces, which are joined by short pieces placed over the long section. Join the assembly with three machine screws, tapping the holes for the outer two and providing the center one with a cap nut.

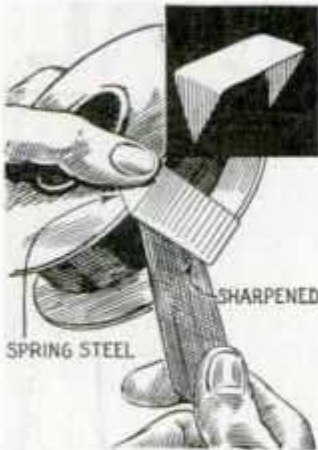
Next, complete the table top. Glue the large piece of Bakelite to the wood top, Fig. 4, cement 1/4-in. mitered strips of the same material in place to form the tray well and complete the table top by gluing the thin aluminum facing strips to the sides of the well. The tray is of similar construction except that the aluminum facing strips for the shallow well are eliminated. Note in the cross-sectional view of the tray that the wood and Bakelite are recessed to accommodate the handle brackets, which are 3 by 4-in. pieces of sheet aluminum. The handles are 3 1/2-in. lengths of 7/8-in. tubing plugged with hardwood dowels and slit lengthwise along one side to take the brackets, the latter being fastened to the handles with screws driven in from the underside. Gluing 7/8-in. aluminum disks to the ends of the handles completes them.

To finish the table, file down all projecting metal parts in the top and tray, go over the entire assembly with fine steel wool and then buff the job. A buffing wheel on a flexible shaft, Fig. 2, is ideal.



In bending the flat-aluminum legs, make your measurements carefully, using a 68-in. length for the long leg and two 31-in. lengths for the short ones

Tape Cutter Fits on Spool



Bent to a wide U-shape and sharpened on one edge, a narrow piece of spring steel makes a good cutter for adhesive tape. The cutter should fit tightly over the edges of the tape spool, yet loose enough so that it can be moved. In

use, the cutter is held with the fingers of one hand while the tape is pulled against the sharp edge with the other.

Kitchen Utensils in Cabinet Hung on Sliding Arm

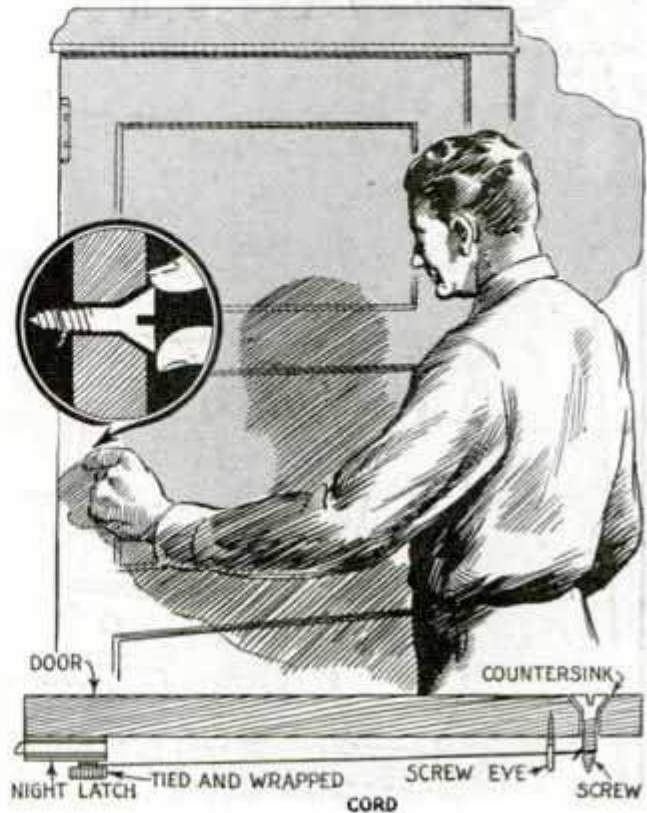
Sliding between two rabbeted strips, this bar for hanging saucepans and other kitchen utensils makes it easy to get them out of deep cupboards. You can use 1/2 by 7/8-in. stock and the length is determined by the depth of the cupboard. Screw hooks are driven into the underside of the arm



With this sliding arm on your cabinet you can reach utensils without getting down on your knees

and a small handle, which may be a short wood screw or a small pot-lid handle, is provided at the outer end.

Keyless Lock Foils Intruders Trying to Enter Door

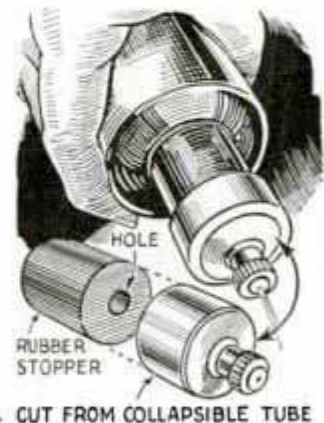


Fit the dummy screw carefully so that it can be pulled out with the fingernails

By simply pulling on a dummy screw located in the stile of this door, the lock or night latch is turned. The screw, which slips easily into a countersunk hole, is fastened to a cord. This in turn is wrapped several times around the shank of the lock handle so that the latter is turned when the cord is pulled.

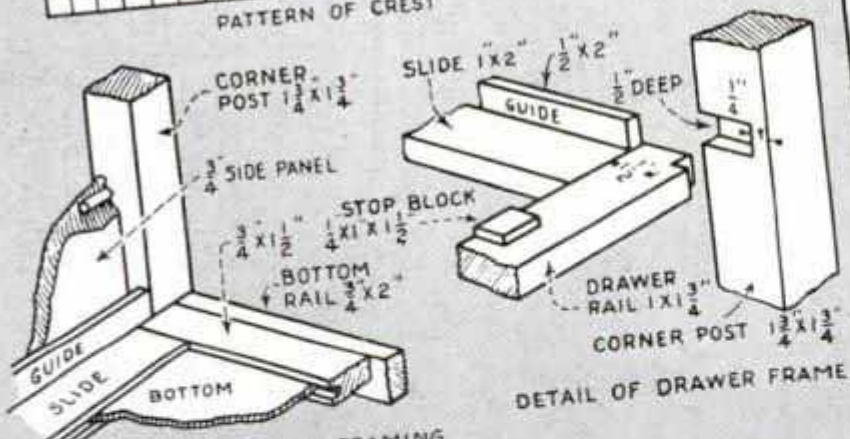
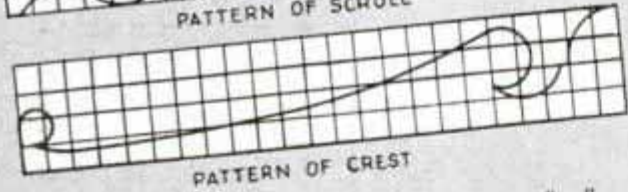
Squirt Bottle Quickly Improvised

If you need a squirt bottle and none is at hand, one can be made quickly from a bottle and a collapsible tube. Cut off the top of the tube as shown and then drill a small hole lengthwise through the center of the bottle



stopper, preferably a rubber one. Slip the end of the tube top snugly over the stopper and the job is done.

CUPBOARD *in Knotty Pine*



SHEET NO. 1
MECHANICS MAGAZINE

Substantial in construction and pleasing in authentic colonial style, this quaint kitchen cupboard is small and compact, and provides ample space to store your linen and silverware. Knotty pine can be used, as this was the prevailing colonial custom, but other wood can be substituted if you desire. Any craftsman can build the entire piece, with the exception of the legs, by means of a few hand tools

933

Hand Shield on Tinner's Shears Made from Auto Tire



PIECE OF AUTO TIRE

Cut the shield from a tire having thin walls and it will not interfere with the shear action

To protect the hands against sharp edges of the work when cutting large pieces of sheet metal with a pair of tinner's shears, slip a piece of light auto tire over the shears as shown. Make a slot in the piece of tire to take the shears, cutting it large enough to allow free movement of the shear blades.

Eraser Slipped over Pencil Point When Used Constantly



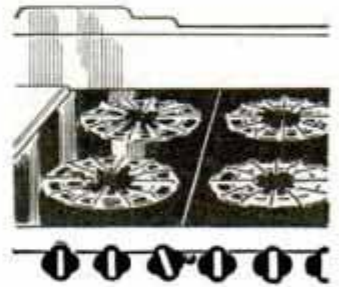
There are many cases where figures are read off hurriedly to clerks as for instance in election offices or where inventory is being taken, and every second counts. When mistakes in copying are made, there is hardly time to turn the pencil around, and, to avoid such waste of time, one clerk mounted an eraser on the lead end of his pencil, holding it in place with a spring-steel ring just tight enough to allow a slid-

ing movement. Attached in this way, the eraser does not interfere with writing, yet when a mistake is made, the thumb deftly pushes the eraser out for use, and just as quickly pushes it back again.

White lines painted vertically on round handles of gas-stove cocks will enable you to tell at a glance whether they are open or closed. Or, you can use narrow strips of adhesive tape instead of paint. When applying the paint or tape, be sure the cocks are shut off tightly.

Lines on Stove-Cock Handles Show When Gas Is Off

White lines painted vertically on round handles of gas-stove cocks will enable you to tell at a glance whether they are open or closed. Or, you can use narrow strips of adhesive tape instead of paint. When applying the paint or tape, be sure the cocks are shut off tightly.



Wire Prevents Snow Slides from Steep Roofs



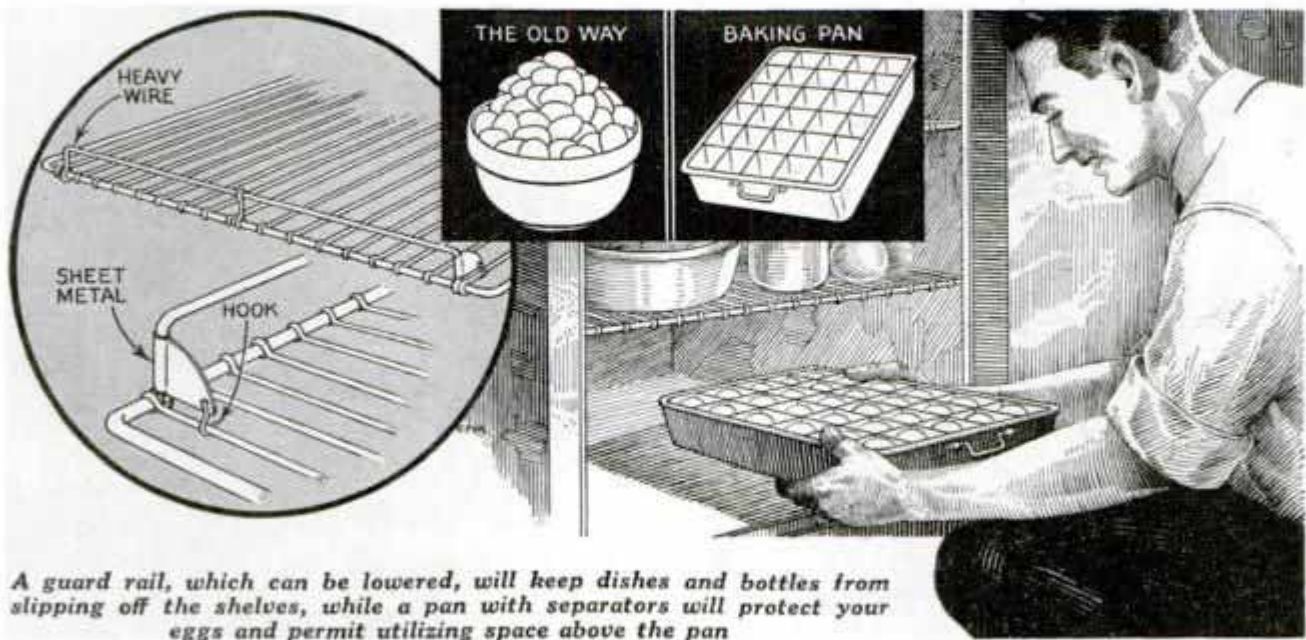
Where a high dormer or porch with a steep roof overhangs a sidewalk, there is a possibility that melting snow may fall and injure someone. An occurrence of this kind led one home owner to stretch poultry wire across the lower portion of the roof, as shown, to hold the snow. The wire is fastened to the edge of the roof with screw hooks.

Testing Seeds in Raw Potatoes

For making a germination test of a small number of seeds punch holes in one half of a raw potato and insert one seed in each hole. Then place the potato in a shallow pan partly filled with water and set it in a moderately warm place until the seeds sprout.



Protecting Contents of Crowded Refrigerator



If your refrigerator shelves are so crowded that dishes near the edge occasionally slip off or are inadvertently knocked off when removing some larger items from the back, a simple wire guard rail, which may be swung out of the way when necessary, will save both dishes and food. The rail is bent from heavy wire as shown in the circular detail, and is pivoted to the edge of the shelf by means of eyes formed in the ends of the wire. Pieces of

sheet metal folded around the ends of the wire and fitted with hooks hold the rail vertically. Another idea is to store your eggs in a flat pan, using egg-carton separators, which beats the usual practice of keeping eggs heaped in a pan or bowl. Besides providing a safer place to keep the eggs, the use of a pan gives more orderly arrangement and often makes it possible to utilize the space above the pan if a cover is provided to support other objects.

Floral Carvings Are Imitated with Seeds and Pine Cones

If you are an admirer of floral carvings but are not adept at this work, you can make good imitations in the form of over-



Cone scales simulate the flower petals while the stamens and pistils are formed with the seeds

lays by simply building up the designs with hard seeds of plants and the scales of pine cones. For deep designs, use large cones similar to those of western yellow pine. Cones of white-pine trees have thinner scales, which are best for shallow designs, while those of spruce, fir, hemlock and larches are used for small decorations. First trace the design to be copied on the work, and then fill in the pattern, using the scales to simulate petals of flowers and the seeds for the stamens and pistils, attaching each one with a drop of glue. As soon as the glue has dried, apply two coats of shellac or clear varnish. If you prefer bright colors, paint the scales and seeds before applying them.

☐ Vegetables that grow underground will cook better when covered; those that grow above the ground cook best uncovered.

SLOOP - *Fast Trim and Able!*

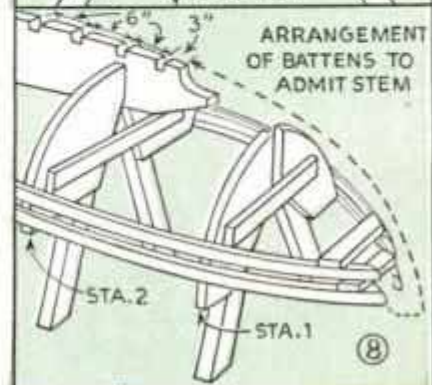
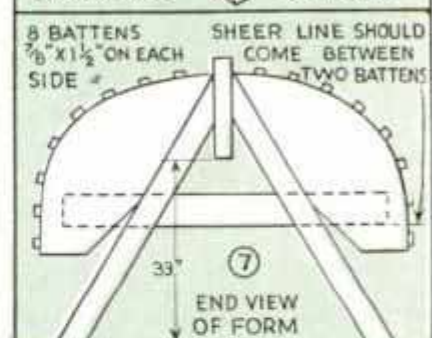
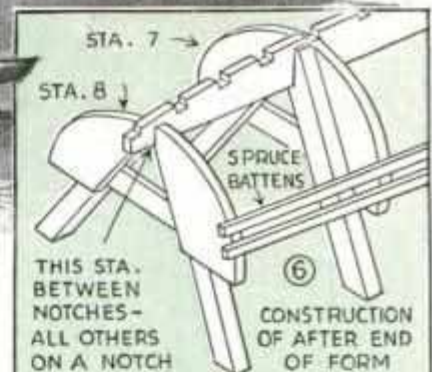


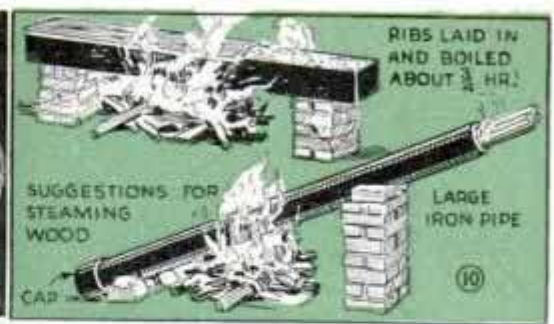
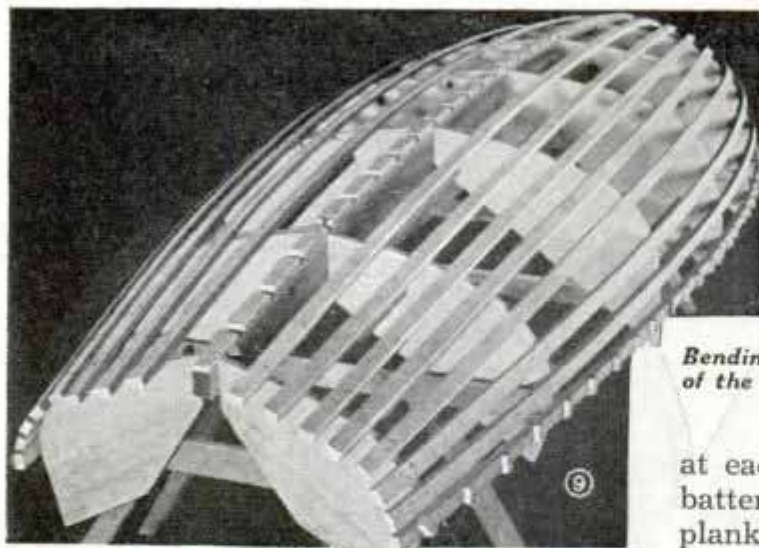
Designed and built by Charles H. McAlary of Newport Beach, Calif., this sloop recently won a cup in a free-for-all race on Lake Arrowhead in the same state. With an over-all length of 21 ft. and a beam of 5 ft. 11 in., this speedy little craft is especially designed for quick maneuvering in difficult waters

Part I—Hull Form, Keel and Ribs

EXCEPTIONALLY fast in light winds and a staunch performer in heavy weather, "Arrowhead" is especially designed for conditions found on the smaller inland lakes, though she's at home on either salt or fresh water. With a length of 21 ft., Fig. 20, and a beam of 5 ft. 11 in. she makes a splendid family boat with room for eight or ten passengers. The hull, moreover, is a particularly suitable type for the amateur boat builder because it is built over a form. With the form right, you can't go wrong on the hull.

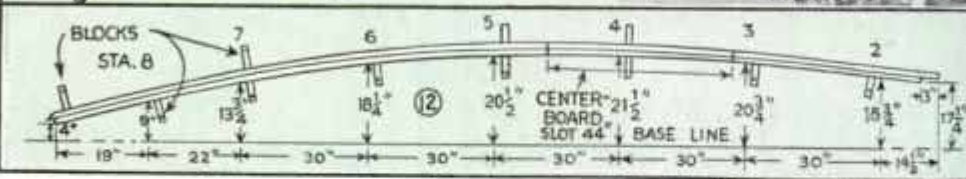
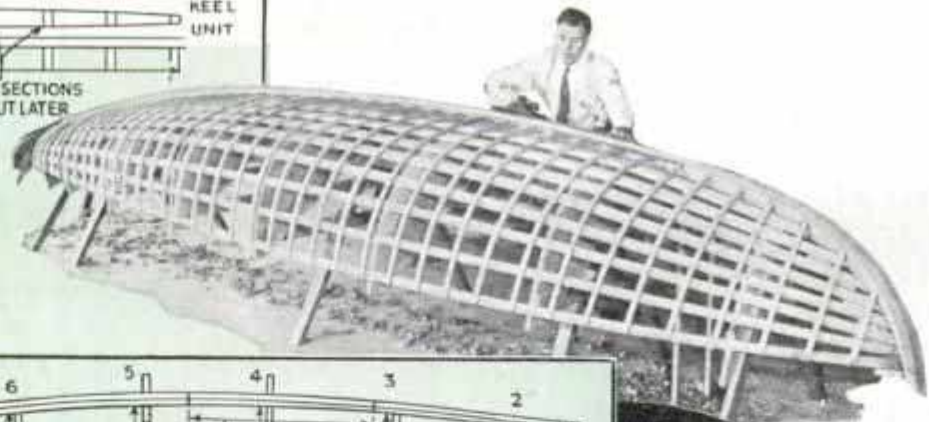
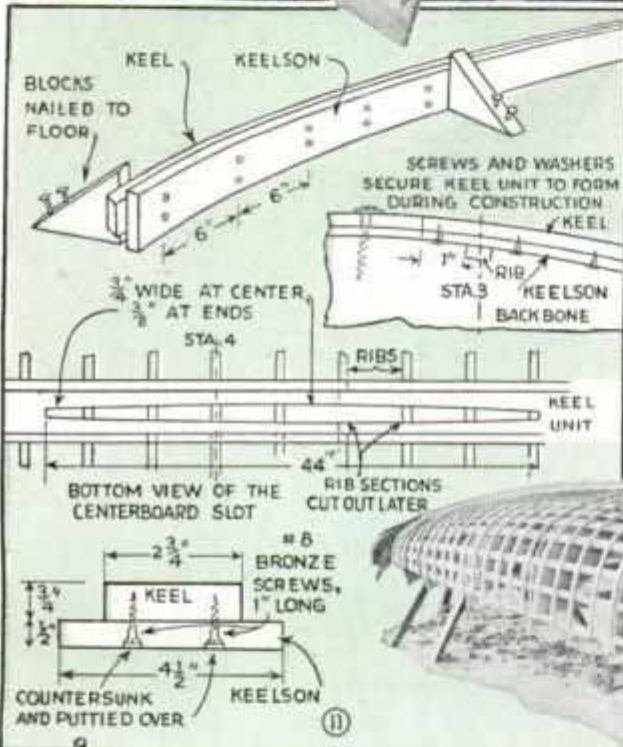
First of all, get large sheets of clean, smooth wrapping paper, pasting enough sheets together to lay out the plans full size as in Figs. 1 and 5. After the plans are drawn, tack the sheet to the floor near your work space so that it will be handy to refer to as you go along. The backbone of the form, Fig. 2, is cut from a piece made up of two 2 by 8-in. planks, cleated together as shown. This is sawed to the curve of the keel and notched every





Bending the oak ribs is not difficult if you use either of the methods above. At the left you see the form ready for ribs and keel

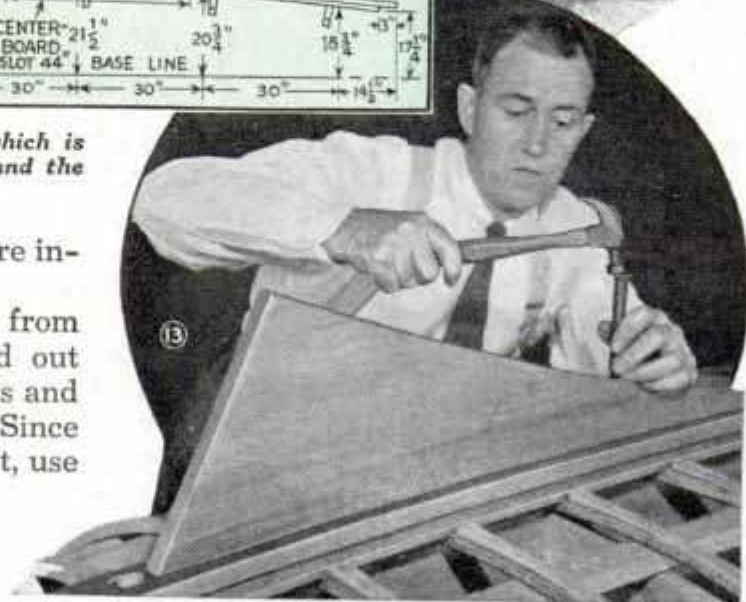
at each station to cover the thickness of battens on the form, the ribs and the planking itself. Erect the backbone on slanting supports so that the lower edge is exactly parallel with the floor and 33 in. above it. Use five pairs of legs for this purpose, at stations Nos. 1, 2, 4, 7 and 8, and nail on the pairs of form molds at the stations designated, in the manner shown in Figs. 2, 6, 7 and 8. Note that the form molds join the backbone just at the bottom of the notches, and station No. 8 only is between two notches, Figs. 2 and 6. This form does not extend aft as far as the

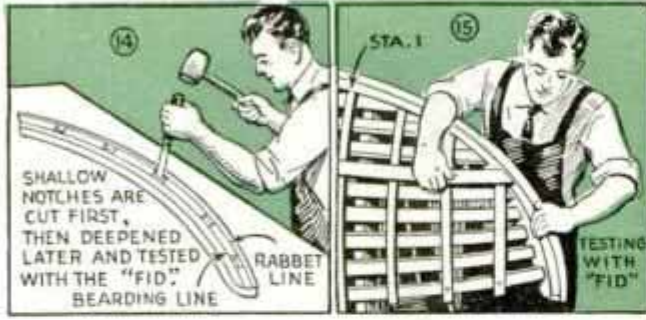


Actual construction begins with the keel, which is made up of two members, the keel proper and the keelson. Both parts are selected oak

6 in. to receive the bent ribs, which are installed later in construction.

Next cut the station molds in pairs from the full-size profiles you have laid out from Fig. 3. These are made in pairs and can be cut from any 1-in. material. Since they do not become a part of the boat, use cheap lumber. Note from the squared diagram that the dimensions to the outside of the planking are determined by adding $2\frac{1}{16}$ in.

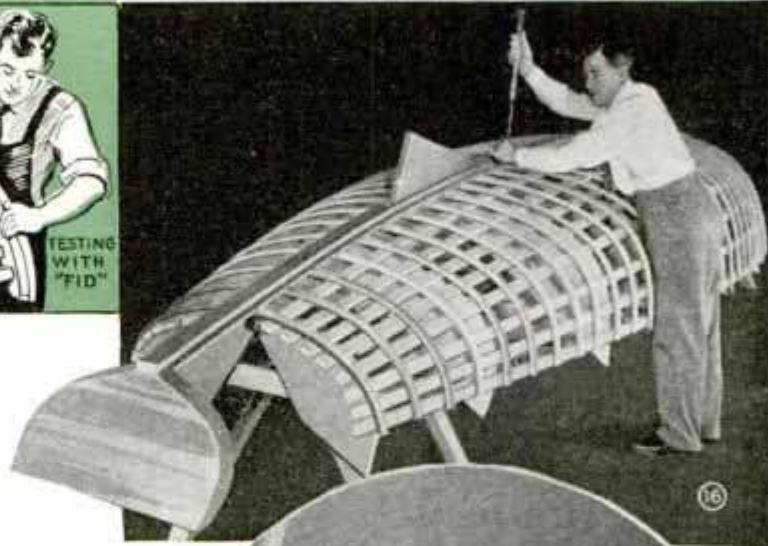




stern, the reason for which will be explained later. Pine battens, $\frac{7}{8}$ by $1\frac{1}{2}$ in., are now nailed to the station molds. There are eight of these to a side, equally spaced, as in Fig. 9.

Here is an important point: Before nailing on the battens, mark the sheer line on the form molds. This you get by measuring the distance from the floor as in Fig. 2. Space the two bottom battens so that the line comes between them. The forward ends of the battens do not meet at the stem, as a space must be left here to admit the stem piece, as in Figs. 8 and 15. Also station No. 1 has a gap for the same purpose.

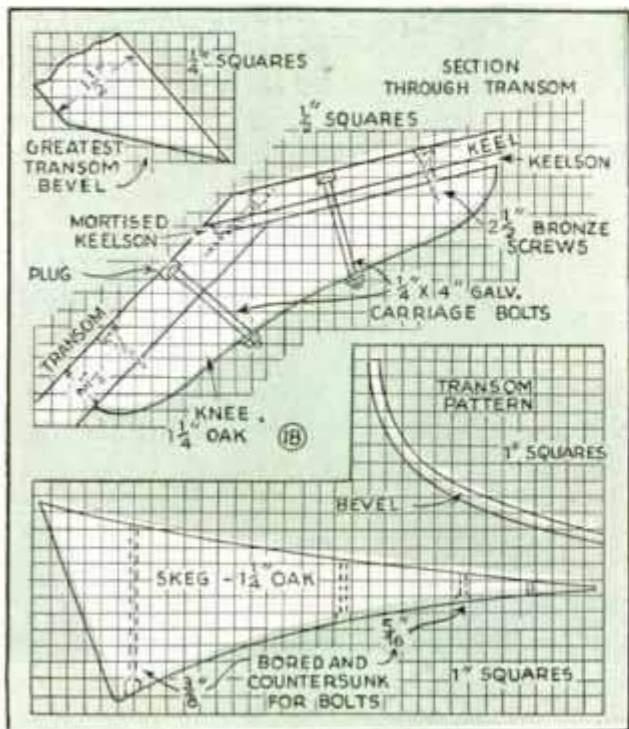
The keel is built up of two members, the true keel and the keelson, as in Fig. 11. Both parts should be oak, bent to the same curve as in Fig. 2, with the full dimensions given in Figs. 11 and 12. Each of the pieces is 18 ft. long, and they must be screwed together in the bent position. To do this, nail blocks to the floor and fit the

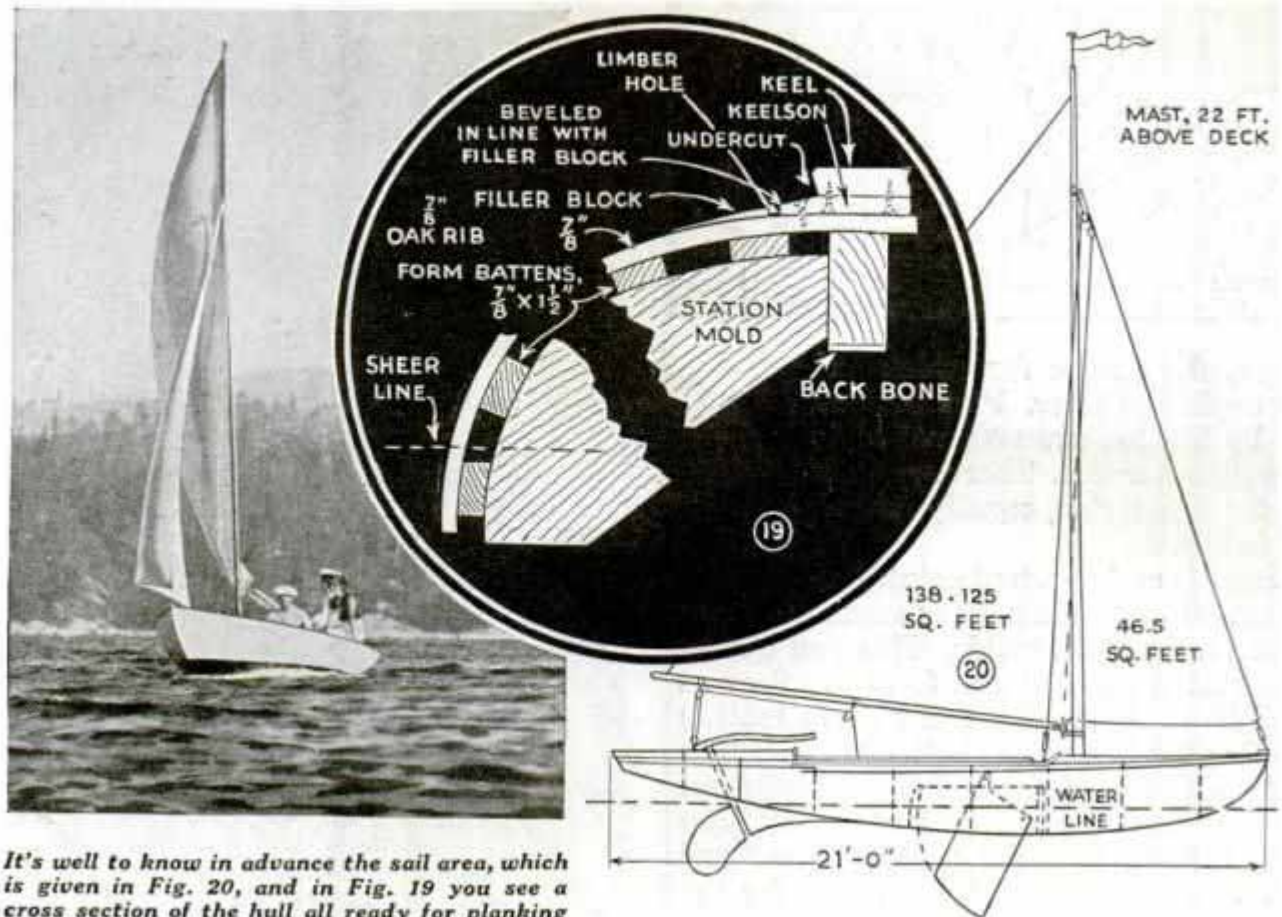


Here's the way you progress with the hull. Above you see the keel, ribs and transom in place and the stem being fitted. Below in Fig. 17 is a very important detail. The bevel of the keelson must coincide with the slope of the filler block so that you get an even bearing for the plank

pieces as in Fig. 11. The screws are set in a double row, 6 in. apart, and should be spaced to come between the ribs. The slot for the centerboard must be cut before putting the keel unit on the form. Location and dimensions are given in Fig. 11. Note that the slot is wider in the center than at the ends.

Installation of the ribs comes first. The ribs are $\frac{5}{8}$ by $\frac{7}{8}$ -in. oak, in 9-ft. lengths. They must be steamed for at least half an hour. Two suggestions for boiling or steaming are given in Fig. 10. The ribs are placed directly in the water, and when removed are bent over the form as soon as cool enough to handle. Lay one in a notch in the backbone to locate it, then bring down the ends and clamp and nail to the lowest batten. With the ribs in place, you install the keel unit with screws and washers through the centerboard slot to hold it in position while the screws through the keelson into the ribs are being driven. That





It's well to know in advance the sail area, which is given in Fig. 20, and in Fig. 19 you see a cross section of the hull all ready for planking

portion of the keelson extending beyond the keel, Figs. 17 and 19, is now beveled so that, when a plank is laid over it and the filler block, it will lie flat. This should be done very accurately.

The stem is cut from a piece of oak $2\frac{3}{4}$ by 12 in. by 5 ft., as laid out in Fig. 4. Between the rabbet and bearding lines is the long groove or rabbet into which the planking fits. The best way to make this groove accurately is to notch at intervals with a chisel, as in Fig. 14, testing for depth with a "fid" as in Fig. 15. This is merely a strip 1 in. wide and long enough to reach back to station No. 1. The fid will also serve as a guide in beveling the portion between the rabbet and the face. Secure the keel to the stem with four $\frac{5}{16}$ -in. bronze bolts and drill a $\frac{3}{8}$ -in. hole in the joint where indicated for the "stopwater," Fig. 4, a white-pine dowel, which will swell and close this joint tightly.

Philippine mahogany makes a durable transom, the latter being cut from a piece 14 by 30 in. by $1\frac{1}{2}$ in. thick. This gives a wide bearing for planking as well as the keel. You find the transom pattern in Fig. 18. It should be sawed to the greatest bevel, thus leaving enough stock to work

down later. Bear in mind that the pattern in Fig. 18 will not coincide with the projection of the transom in Fig. 3 as the latter is set at an angle of nearly 45 degrees.

The transom is mortised for the keelson, but not the keel, as shown in Fig. 18. An oak knee is bolted to the keel and transom and is further secured by braces down to the floor, as in Figs. 16 and 18.

Fig. 18 gives the pattern for the skeg, which is secured to the keel with two galvanized carriage bolts and two screws as in Figs. 13 and 16. The after edge of the skeg gives the angle of the rudder post, and serves as a guide in boring the $1\frac{3}{16}$ -in. hole for the rudder post tube, Fig. 21.

Now each of the ribs must be "faired off," so that the first plank on each side of the keel will be flat. The best way to do this is with a long batten laid over the ribs the full length of the hull. The batten should be of thin stock so that when clamped at the ends it will take the curve of the hull easily. From this you can determine the amount of waste to be taken off each rib. Use a sharp draw-shave or a block plane and begin at the keel and work outward, moving the batten as you go along. The essential thing is to make

sure that the batten bears equally on each rib. This means that at stations fore and aft you will have to bevel the ribs considerably and the degree of the bevel will vary somewhat from the keel to the sheer line. Each individual rib is faired off so that the batten bears its full width. Should any of the ribs be left with the batten touching only one corner, an imperfect joint between the rib and the plank will result. A condition of strain will exist which is likely to either split the plank or pull the screws through it. You should be particular with those ribs between the stem and station No. 3, for it is here that the greatest curve comes in the planking. The bevel on the transom should be faired back from the keel only the width of the first two or three planks as there is a point in connection with this bevel that will be covered in the second installment.

MATERIAL LIST

LUMBER FOR FORM

Backbone—2 pieces 2 by 8 in. by 16 ft. 1 in. Pine.

Station molds—5 pieces 1 by 14 in. by 12 ft. Pine.

Battens—16 pieces $\frac{3}{8}$ by $1\frac{1}{2}$ in. by 19 ft. Spruce.

Miscellaneous lumber for cleats, legs, etc.

LUMBER FOR HULL FRAME

Stem—1 piece 3 by 12 in. by 5 ft. Oak.
(Skeg and transom knee cut from waste)

Transom—1 piece $1\frac{1}{2}$ by 14 by 30 in. Mahogany.

Keel—1 piece $\frac{3}{4}$ by $2\frac{3}{4}$ in. by 18 ft. Oak.

Keelson—1 piece $\frac{1}{2}$ by $4\frac{1}{2}$ in. by 18 ft. Oak.

Ribs—36 pieces $\frac{5}{8}$ by $\frac{7}{8}$ in. by 9 ft. Oak.

FASTENINGS

6 doz. No. 8 bronze screws, 1 in. long, Keelson to keel.

6 doz. No. 7 bronze screws, $\frac{3}{4}$ in. long, Keelson to ribs.

2 only No. 9 bronze screws, $2\frac{1}{2}$ in. long, Keel to transom.

2 only No. 9 bronze screws, 2 in. long, Knee to transom and keel.

2 only No. 9 bronze screws, 2 in. long, Skeg to keel.

2 only carriage bolts (galv.) $\frac{1}{4}$ by 4 in., Transom knee.

1 only carriage bolt (galv.) $\frac{1}{4}$ by 5 in., Skeg to keel.

1 only carriage bolt (galv.) $\frac{3}{8}$ by 12 in., Skeg to keel.

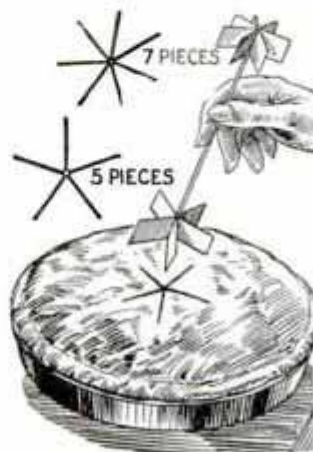
5 only carriage bolts (bronze) $\frac{1}{4}$ by 4 in., Stem to keel unit.



About the last thing you do before planking is to bore the hole for the rudder post as in Fig. 21. The after end of the skeg is used as a guide

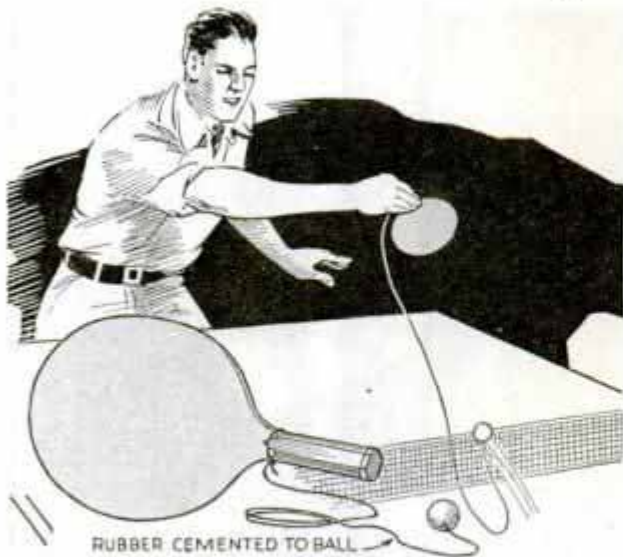
Pie Marker Assures Equal Pieces

Assembled from wire and tin, this marker takes the guesswork out of cutting pies, and assures that all pieces will be the same size. To get the tin pieces spaced evenly on the wire, scribe a circle on a piece of paper and lay off the circumference in the



required number of divisions with a pair of dividers. Then, using the paper as a pattern, hold the wire vertically in the center of the circle and solder the tin markers in place, using fairly heavy tin so that the markers will hold their shape.

Practicing Table Tennis Alone with Aid of Rubber String



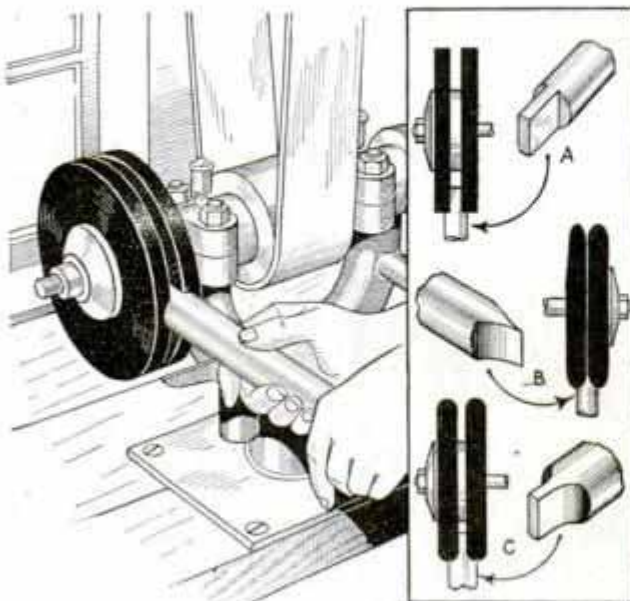
RUBBER CEMENTED TO BALL

Rubber string tied to paddle and cemented to ball returns latter when driven across table

If you need a little practice in table tennis, here is the way to get it alone without having to run all over the game room after the ball. Simply cement one end of a long rubber string to the ball and tie the other end to the handle of your paddle. Then you can drive the ball across the table and return it with the string.

Spaced Abrasive Wheels Grind Points on Steel Rods

By placing two abrasive wheels side by side on a grinder shaft and spacing them with a large washer, ends of rods can be



A few of the shapes you can grind on rods with a couple of spaced abrasive wheels

pointed, beveled or shouldered. Besides the operations A, B and C shown in the detail, many others will suggest themselves once the wheels are put into use. For pointing and beveling, round-faced wheels are used, while most shouldering work will require flat-faced wheels. A tool rest must be used to support the rods, and care must be taken to hold them true, to keep the work from binding between the wheels, which might break one of them and injure the operator.

Tool for "Setting Out" Plants Made from Tin Can

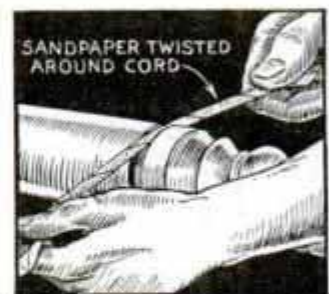


Time and labor can be saved when transplanting vegetables, flowers and small shrubs by using this tool to make the holes in the ground. It is merely a tin can having both ends removed and a U-shaped piece of flat iron riveted to the upper end for

a handle. The lower edge of the can should be sharpened with a file so that it can be pushed into the ground easily.

Sandpaper on Cord Smooths Irregular Lathe Turnings

For sanding irregular surfaces of a lathe turning, twist a narrow strip of sandpaper in a spiral around a length of stout cord. This provides a flexible, abrasive surface

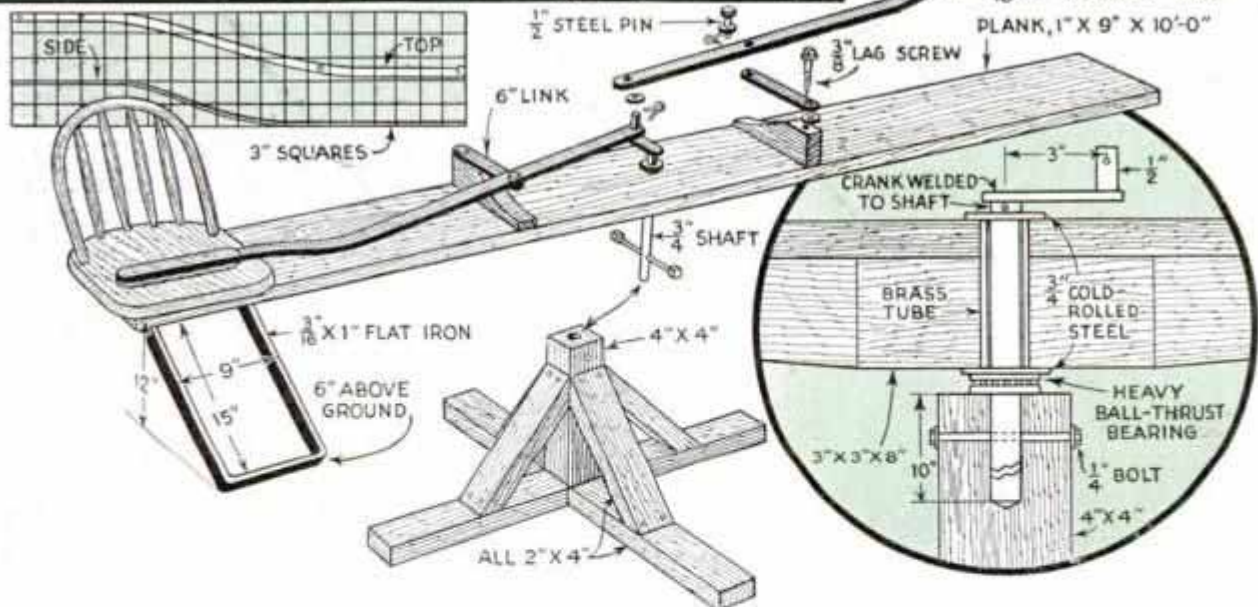
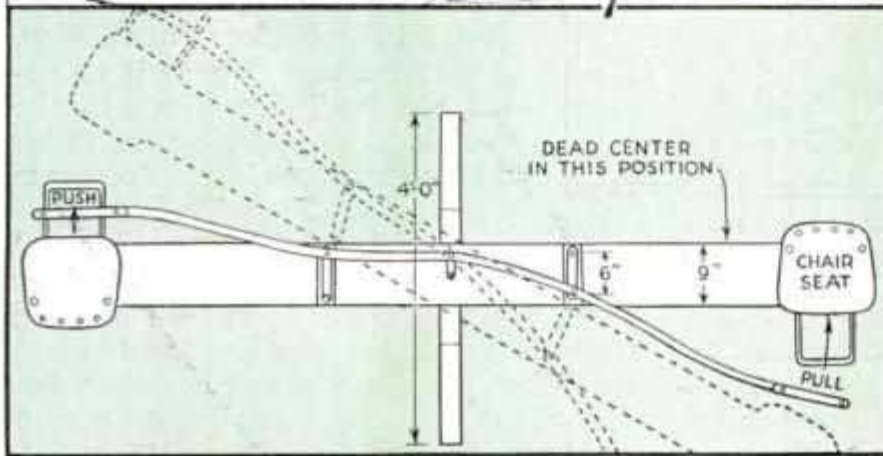
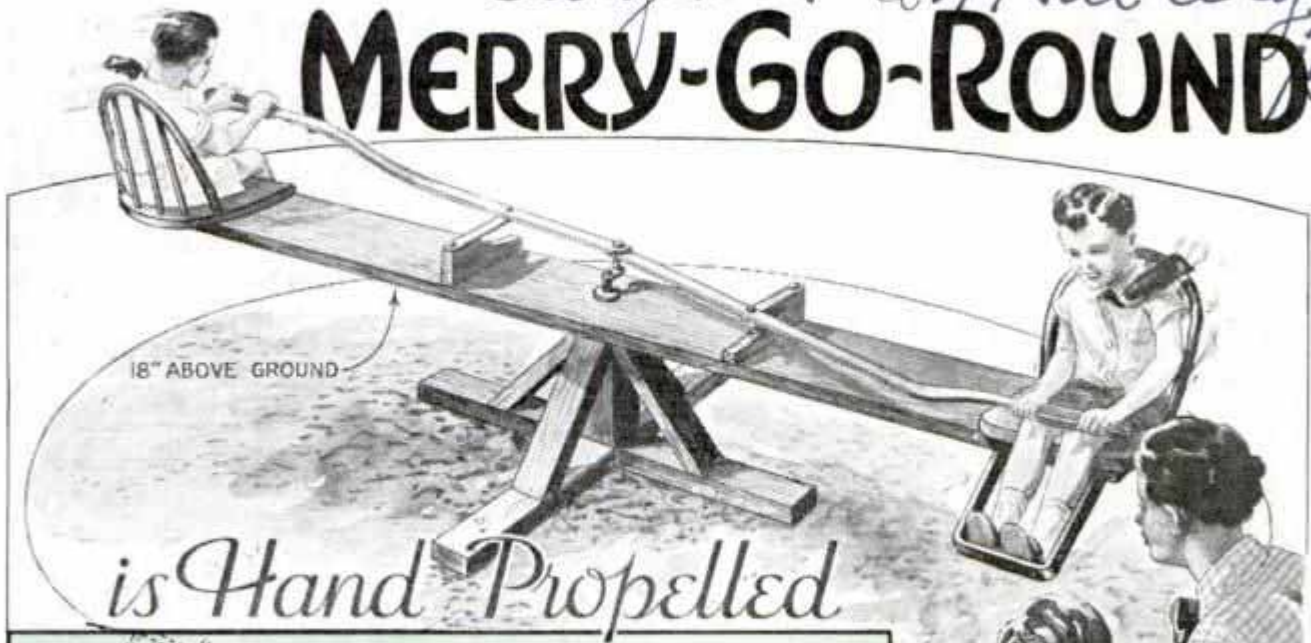


that gets into narrow grooves. The ends of the sandpaper strip may be held on the cord with the fingers or they can be attached with short pieces of adhesive tape.

Paint stains are removed easily from the hands if they are rubbed with vaseline before starting the paint job.

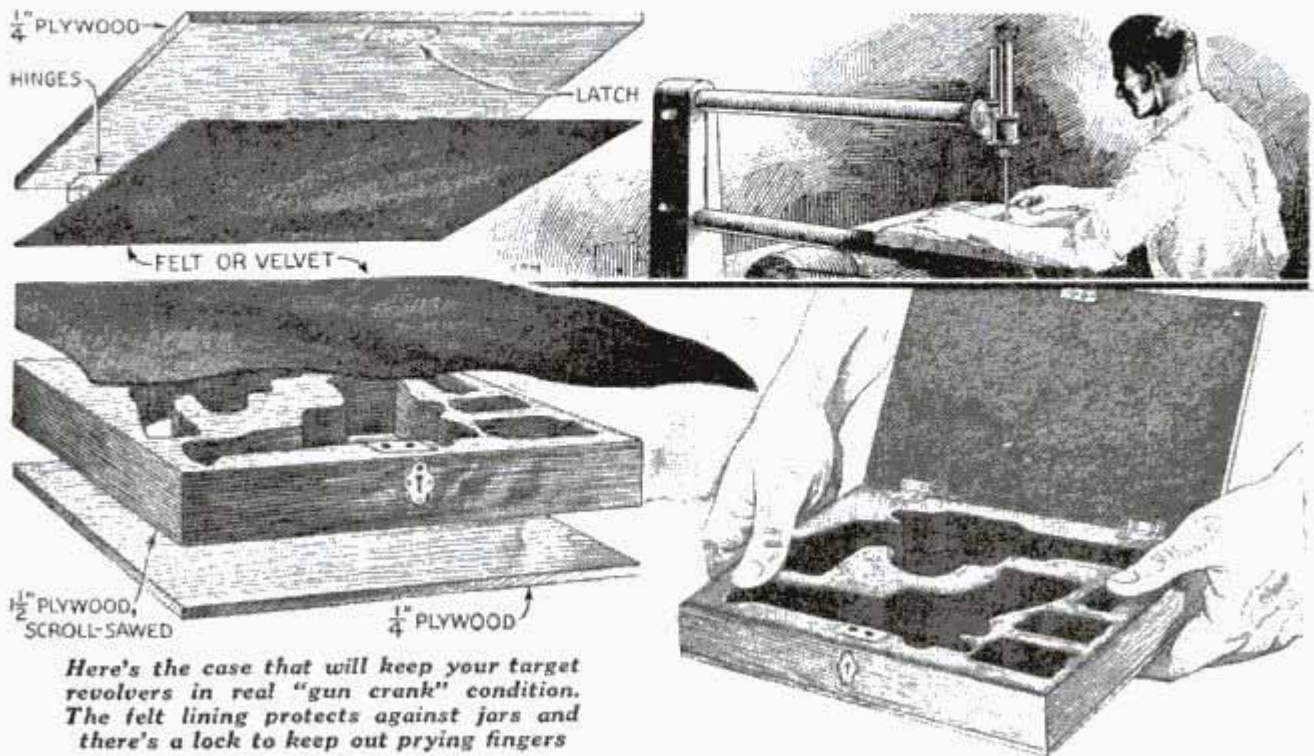
Hand propelled for playgrounds
 Clayton & Co., Hill City, Kansas

MERRY-GO-ROUND



Operated something like a railroad hand car, this merry-go-round not only offers beneficial exercise, but it is inexpensive and is easy on shoes. It consists of a well-braced standard, a strong plank and two seats. A steel shaft, pinned rigidly to the standard, passes through a bushed hole in the center of the plank, and a crank, having a 3-in. throw, is welded to the upper end. Or, a longer shaft can be used and a crank bent on the end. Friction between the plank and the standard is reduced to a minimum with a ball thrust bearing. For the seats, old chairs are used, the leg assemblies having been removed. U-shaped footrests of flat iron are bolted under the seats to project downward at an angle. Push handles or bars, with which the merry-go-round is driven, are lengths of heavy flat iron to which wood handgrips are riveted. A 6-in. link connects each handle to a block screwed to the plank, and permits lateral movement of the bars

Pet Hand Guns Carried in Felt-Lined Case



Here's the case that will keep your target revolvers in real "gun crank" condition. The felt lining protects against jars and there's a lock to keep out prying fingers

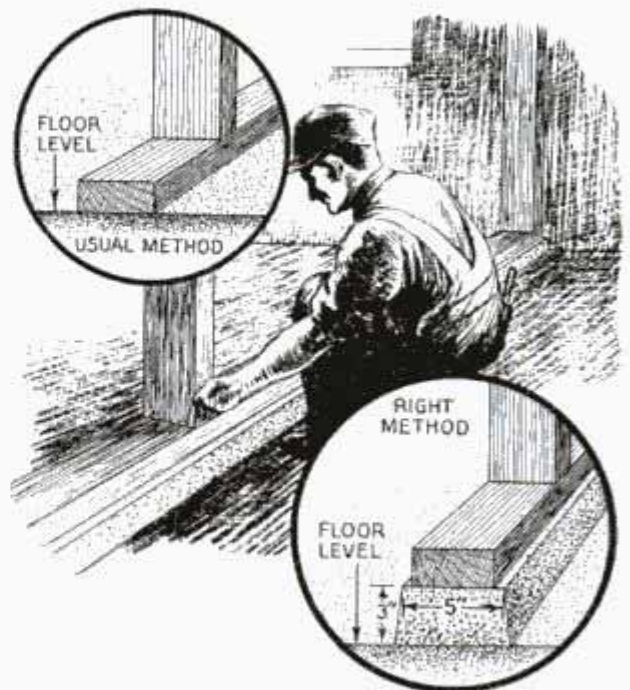
Jigsawed from plywood and lined with felt, this neat case provides safe storage for valuable hand guns, with space for cartridges and accessories. The weapons are laid on a piece of 1½-in. plywood and the outlines carefully marked with a pencil. Then the outlines are cut through with

the jig saw. A bottom piece of ¼-in. plywood is fastened with screws and glue, and a top of the same material is hinged as shown. Upholsterer's felt is then glued to the top and to the inside edges and bottom of the case. If desired, you can fit a cylinder lock as shown.

Concrete Footing Raises Basement Partitions Off Floors

Instead of laying the wood sill of basement partitions for coal bins, fruit cellars and laundry rooms directly on the floors, permitting moisture to be absorbed into the wood readily, which rots it in a few years, why not take a little more time and make the job a permanent one by putting in concrete footings to raise the sills above the floor? Such footings not only protect the wood from moisture, which accumulates by condensation on most basement floors during summer, but also shield the wood when washing the floor. If you want to go a step further in protection, impregnate the plates and ends of the studs with creosote and use coated nails to join them.

☐ When making enlargements on thin photo paper, best results are obtained by laying the latter on a sheet of black paper to prevent reflection of the image through the back.



Permanency of your basement partitions more than offsets the slight extra cost of the concrete footings

Home Comforts in this FAMILY TRAILER



Part 3

Interior Furnishings and Painting

ONE glance at the cutaway view above and you have the whole story of the interior furnishings. There's your kitchen, dining and living room, and two bedrooms with clothes-closet space. When you stop along the road for the night, there's nothing to unpack, no ropes or awnings to bother with. Simply uncouple the trailer from the car and park it in any convenient place. One person handles it easily, even when fully loaded.

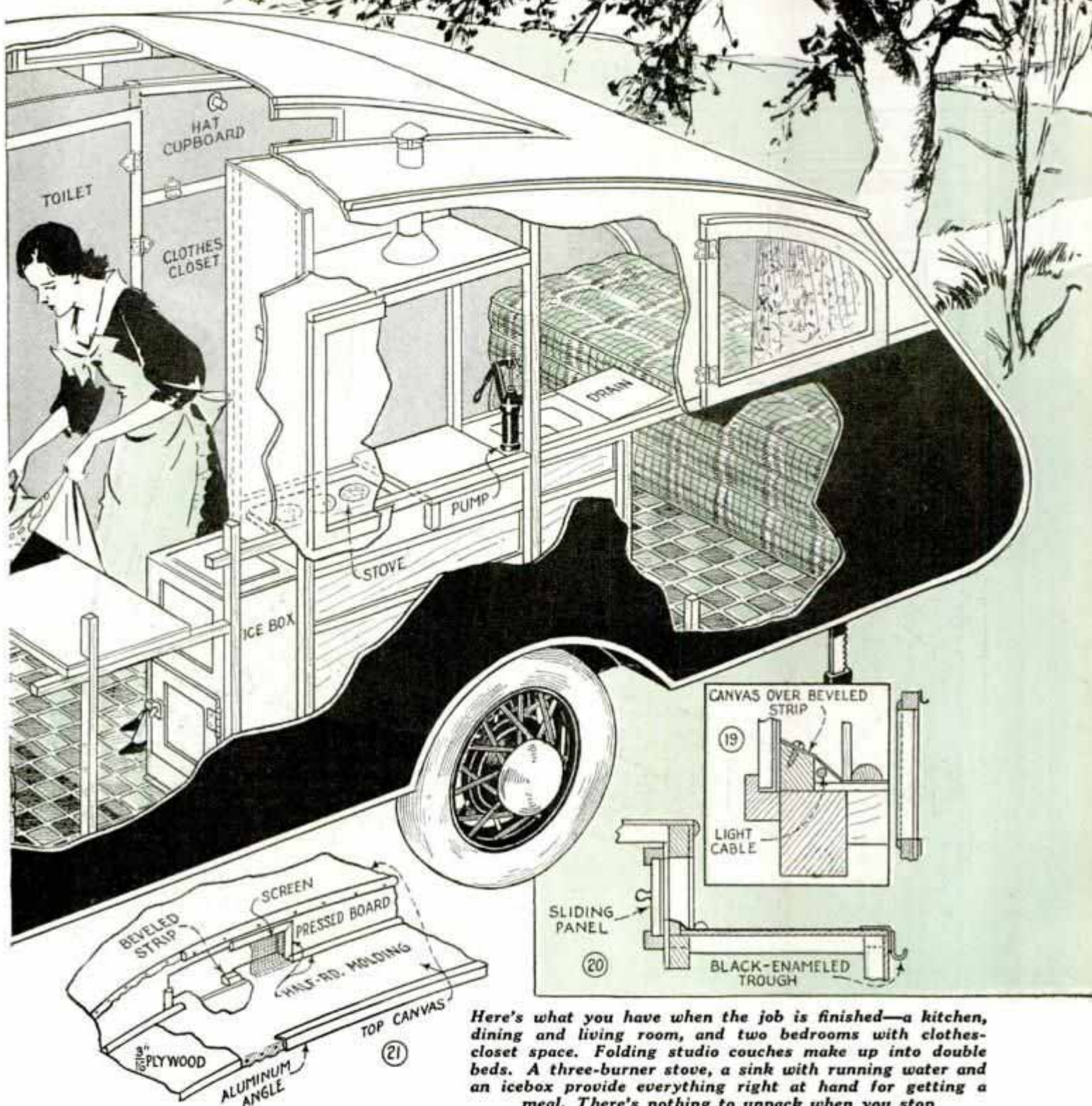
Now to finish the job. Remaining exterior details are application of the roof of auto-top canvas and, if you have so decided, a fabric covering of the body. In putting on the latter, you apply the lower half of the wall covering first, then lap the upper half over it, using copper tacks. A strip of auto-fabric binding is tacked over the seam. Fig. 24 gives you the distribution of the material, and the sectional views, Figs. 19 and 20, and the detail in Fig. 21 show what to do when finishing up



Selected as being representative of the type trailer many of our readers have desired to see published in Popular Mechanics, this trailer, of which this article is the third and last installment, was designed and built by Mr. C. Hart Collins. We are indebted to him for his kind cooperation in going through the entire construction in detail so that complete information, based on the actual work, could be supplied to our readers

the top at the outer edge and around the ventilator openings in the sides of the raised center section. Bindings of light aluminum angle are used to finish all corners of the body as in Fig. 18. Where the top canvas overlaps the sides it's a good idea to apply a light coating of marine glue under the seam. Aluminum gutters around the edges of the top finish this part of the job.

Window sash are made of white pine, rabbeted as illustrated in Fig. 23, the cor-



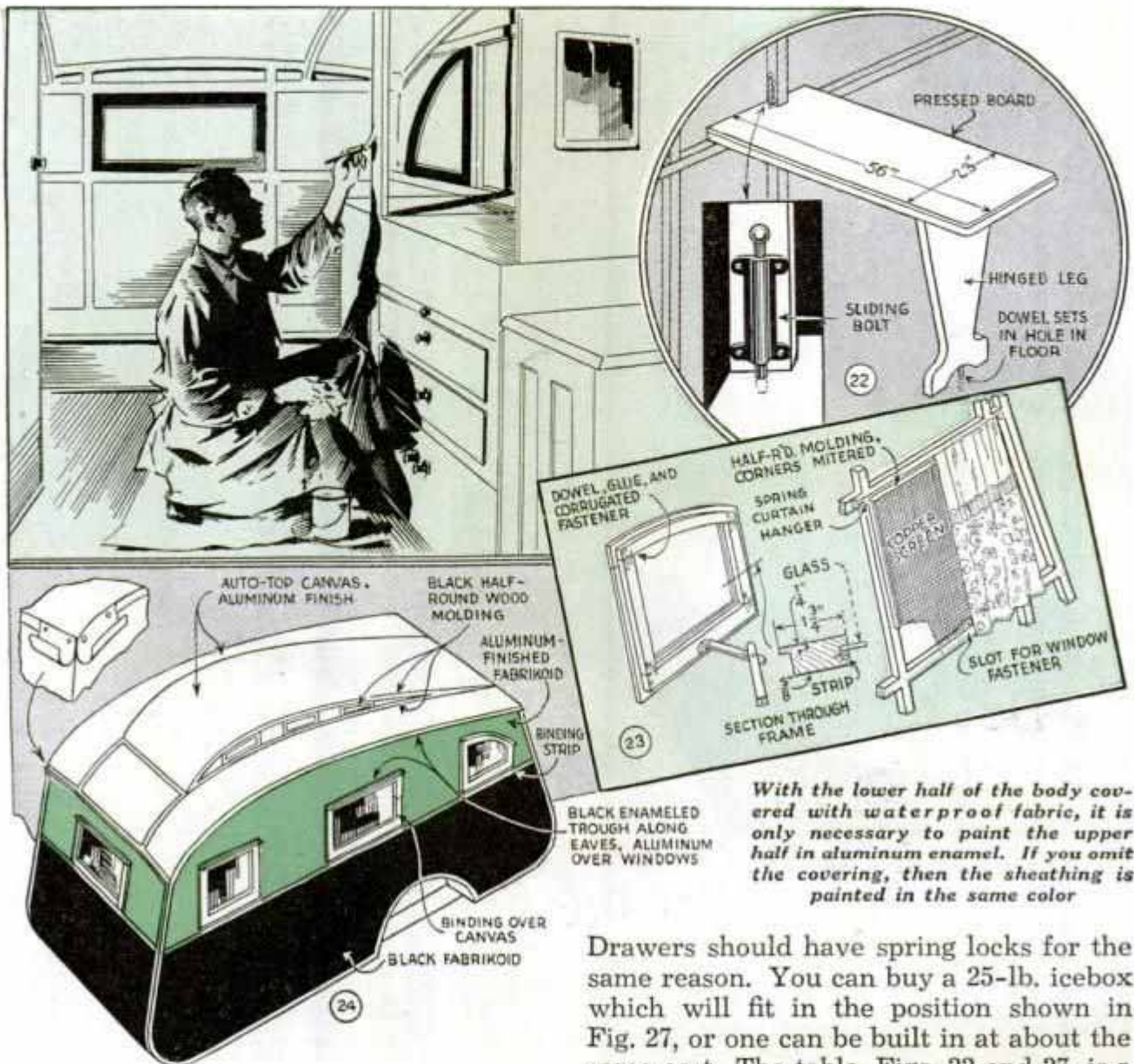
Here's what you have when the job is finished—a kitchen, dining and living room, and two bedrooms with clothes-closet space. Folding studio couches make up into double beds. A three-burner stove, a sink with running water and an icebox provide everything right at hand for getting a meal. There's nothing to unpack when you stop

ners joined with casein glue, dowels and corrugated fasteners. The same figure shows how the copper screen is tacked to the inside of the window frame. All windows swing outward on offset hinges as in Figs. 17 and 18. Jointed brackets hold the windows in any position. After you finish the exterior of the body you can permanently install the A-frame and coupling and also the tail and clearance lights.

When you go inside, the first job is painting. An undercoater and two applications of eggshell enamel in ivory or cream should take care of this. Remember that you can easily make a double-walled

job by sheathing the interior walls and ceiling with pressed board or plywood. Now's the time to do this if you desire. The interior walls and ceiling painted, the next job is the floor. A linoleum covering, cemented down, adds to the attractiveness of the interior and is easier to clean.

Now over to Figs. 25, 27 and 28 for the views and plan of the stove, cupboard and sink. Fig. 25 shows a space-saving arrangement of the drainboard. The latter slides down over the sink when not in use, and the swinging arm which supports it when open folds back against the cabinet. The drain pipe from the sink is led down

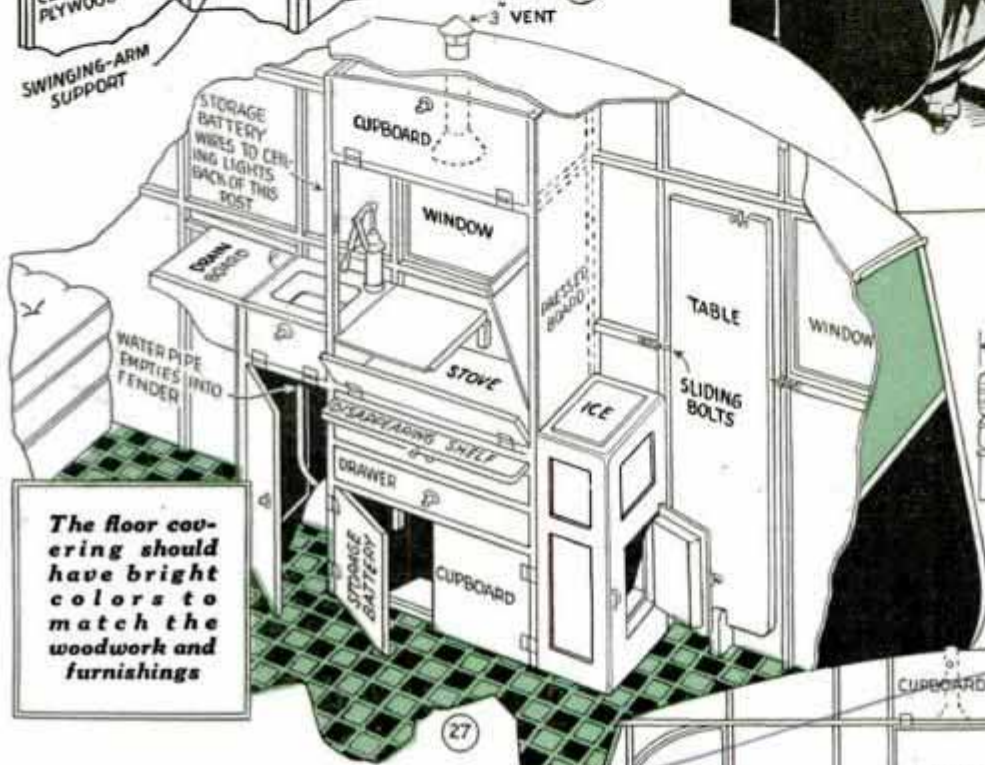
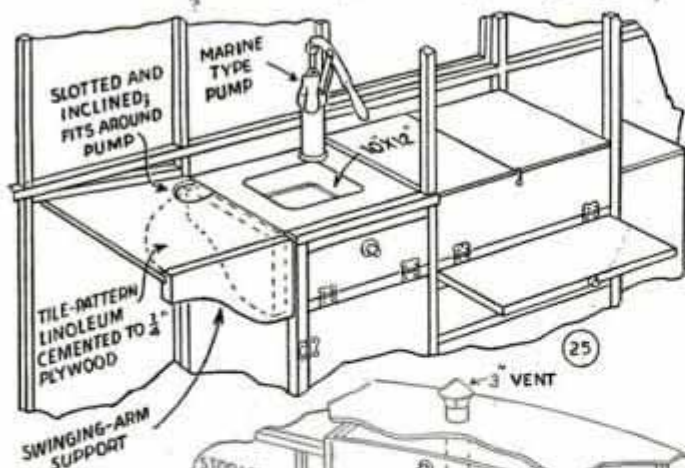


With the lower half of the body covered with waterproof fabric, it is only necessary to paint the upper half in aluminum enamel. If you omit the covering, then the sheathing is painted in the same color

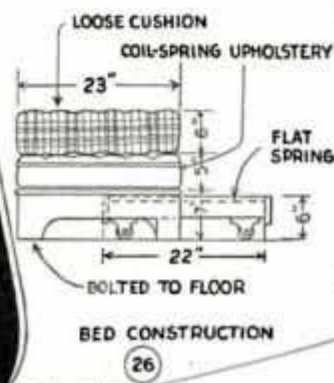
through the fender, the end being bent so that the water does not strike the road wheel. The cabinet which houses the cook stove is fitted with two drawers, a sliding shelf, and a cupboard which houses the storage battery with additional room for large utensils. There is more cupboard space above the stove. A 3-in. vent, made as in Fig. 27, passes through this cupboard and the roof to carry off cooking fumes. In the main the framing for this cabinet can be the same material as the body frame, $1\frac{1}{4}$ by $1\frac{1}{4}$ -in. spruce. For panels you can use pressed board or plywood. Doors, drawer fronts, and the sliding shelf are best cut from $\frac{3}{4}$ -in. fir plywood. Fig. 28, with a plan and elevation, shows you where to place the cabinet on the wall. Doors should have positive catches so that they do not swing open on the road.

Drawers should have spring locks for the same reason. You can buy a 25-lb. icebox which will fit in the position shown in Fig. 27, or one can be built in at about the same cost. The table, Figs. 22 and 27, is a simple folding affair made of either plywood or pressed board, painted of course, and is shown open in Fig. 22 and folded against the wall in Fig. 27. Ordinary sliding door bolts are used to hold the table in either position.

Installation of the clothes closet and the chemical toilet as in Figs. 29 and 30 just about completes the job. The elevation, Fig. 29, will give you the size and position of these closets. For material you can use either plywood or pressed board. It will save time to cut the doors from $\frac{3}{4}$ -in. fir plywood for then there is no frame to make. Notice that there is a flap hinged to the clothes-closet door. This flap hooks to the corner of the stove cabinet, the arrangement forming a partition. All doors should have spring catches to hold them closed. The chemical toilet is vented to the roof through the clothes closet as in



The floor covering should have bright colors to match the woodwork and furnishings

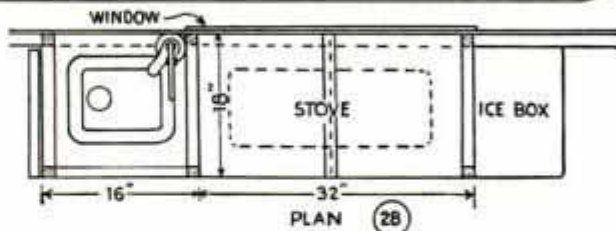


Above you have the "kitchen" equipment, a stove, sink, icebox and cabinet and also the dining table. At the right is a plan and elevation showing where to build in the cabinet. The lower cupboard houses the storage battery which furnishes current for the lights



Fig. 29. There is a folding writing desk hinged to the back of the clothes closet under a mirror.

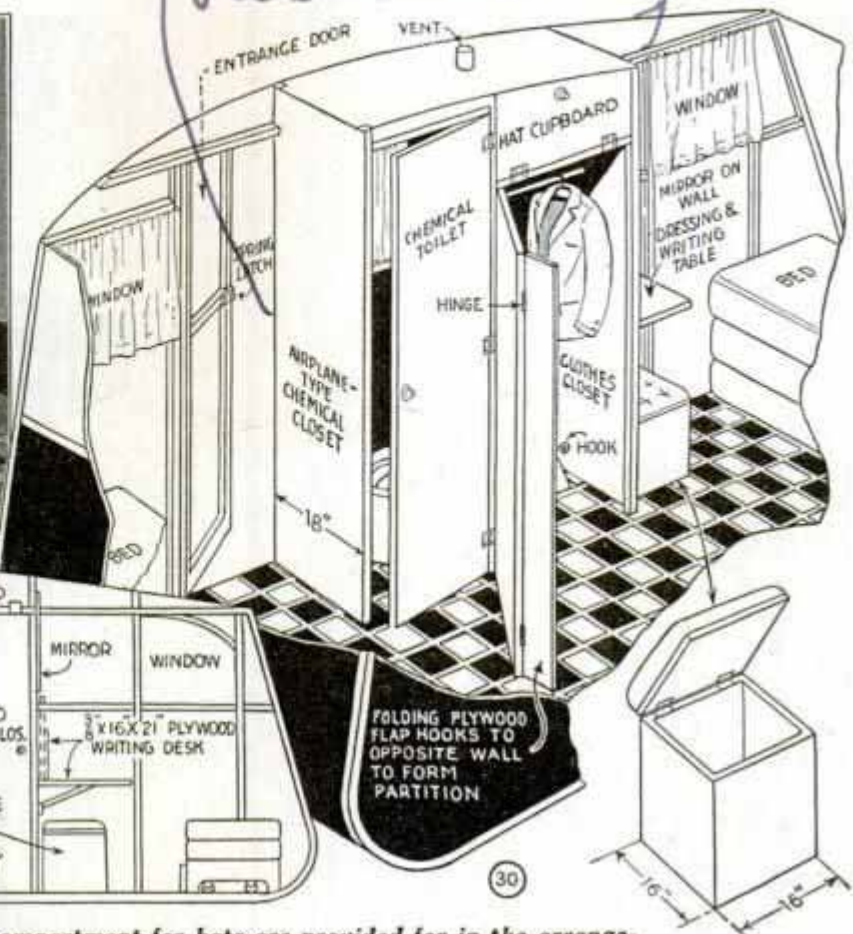
A stool, which is really a box with a hinged top, does duty both as a chair and added storage space. The top may be upholstered as indicated. The beds are two studio couches, the end dimensions being approximately those shown in Fig. 26. Both can be made up into double beds. When folded there is space in a lower compartment for the bedding. You will save time by buying these ready made, as they are inexpensive. Fasten each to the floor with bolts or screws. Now you come to painting the cabinets, and, if you want a first-class job, give the walls one more



coat. If the doors have been cut from 3/4-in. plywood, as is recommended, it will be necessary to fill the edges of the plywood. A paste wood filler worked into the end grain on all the exposed parts will build up a smooth surface for the paint. Work it into the open grain with a cloth or your fingers, rub off the excess and allow the filler to dry. Then sand the edges lightly with fine sandpaper to level the filler and

Trailer refrigerator and lighting. Water, cold heaters...

*Ultra Summary by
Paradene Calif*

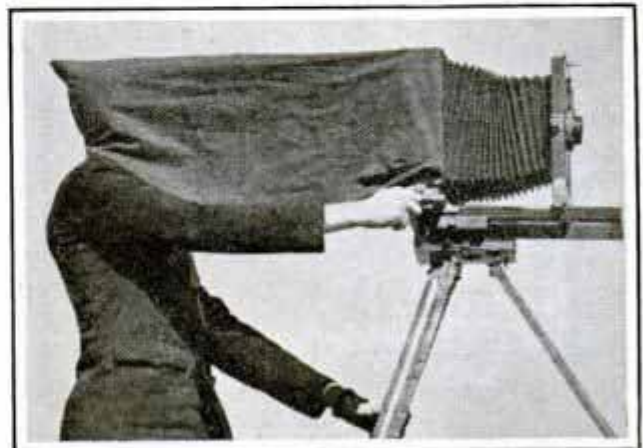


Generous clothes-closet space and a compartment for hats are provided for in the arrangement shown above. There's also a mirror and a folding writing table. A flap on the clothes-closet door hooks to the stove cabinet and partitions the interior into two rooms

smooth up sharp corners. The trick in painting cabinets of this sort is in covering all corners, edges, and the smaller surfaces first, then finish off with the large areas. In this way you can brush out the paint to a uniform coating much more effectively. To produce a smooth, even final coat, it is necessary to be just as particular with the primer as you are with succeeding applications. Another trick is keeping the paint thinned to an easy brushing consistency to avoid a too heavy application which cannot be brushed out to a thin film. This applies also to the exterior paint job. You should be particular with such details as the sliding ventilator panels and the windows. The panels, Figs. 20 and 21, are best removed while you are painting the slides, and the sash should be left open until the paint is thoroughly dry. In this way you will avoid sticking and possible breakage. The same thing is true of the closet and cupboard doors and also the drawers. Now with the painting done, all that remains is to fit and hinge the entrance door and provide a spring lock, and there you are.

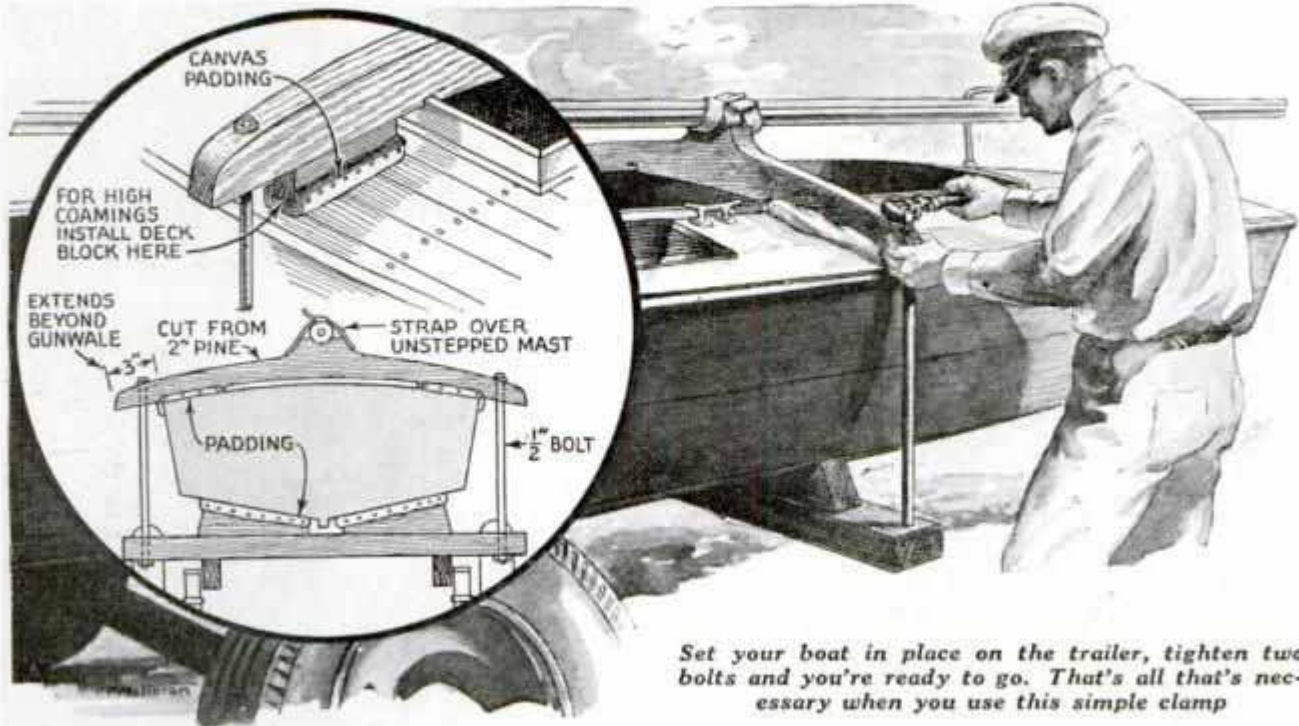
Focusing Cloth Like a Hood Is Useful on Windy Days

Here is a quick solution to the problem of keeping your camera focusing cloth in position on windy days. Fold the cloth in the middle and sew it about half way down one end to form a hood. The other end is fastened to the camera. In use, the hood is slipped over your head, leaving both hands free to adjust the tripod and focus the camera.



Camera focusing cloth with one end sewed to form a hood is easy to keep in place

Padded Clamp Locks Boat Rigidly on Trailer



Set your boat in place on the trailer, tighten two bolts and you're ready to go. That's all that's necessary when you use this simple clamp

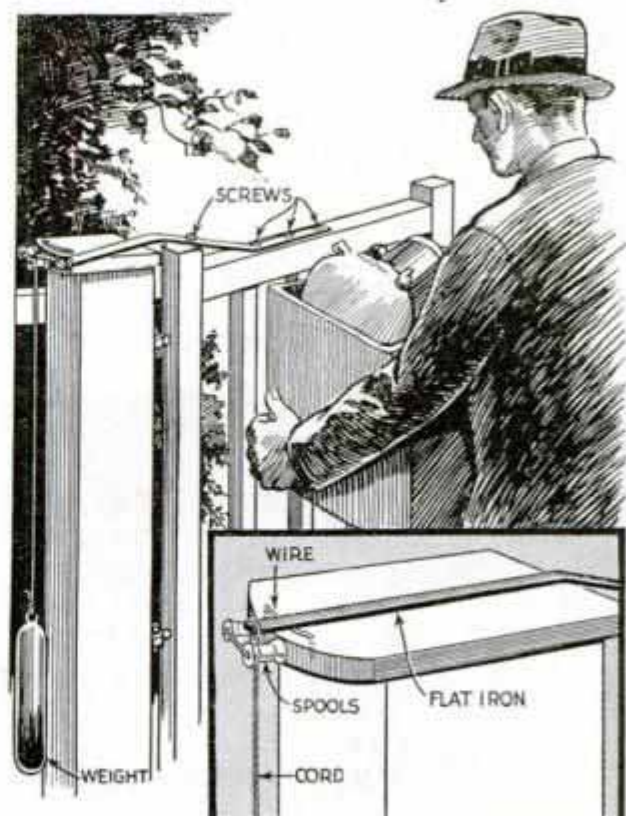
This padded clamp takes care of many difficulties you are apt to encounter when transporting a boat on a trailer. Once it is locked in place the boat cannot shift or slide about to cause chafing or possible damage to the bottom or deck. For craft

over 12 ft. in length, two clamps should be provided, one across the bow and the other just aft of midships. The top bracket is cut to conform to the contour of the deck, being padded at the bearing points. For high coamings provide additional blocking.

Springless Gate Closer Is Operated by Suspended Weight

Requiring no locks or latches, this gate closer is always ready to do its job as there are no springs to stretch out of shape or moving parts of metal to rust and bind. A weight suspended from a heavy flat-iron arm with a cord or light rope does the trick. Two wood spools serve as rollers over which the cord travels as the arm swings to one side when the gate is opened. The spools rotate freely on a U-shaped rod, the ends of which are driven tightly into holes in the gate post. Besides strengthening the outer ends of the spools, the rod serves as a guide to keep the cord between them. If it is necessary to use a heavy weight, a short piece of hard wire or iron rod should be driven into the post top near the end of the arm as shown, to keep it from scraping on the wood.

☐ Hotbeds should be built and filled very early in the season; a long time before the cold, spring weather has disappeared.



Wheeled Ash Can Easy to Move About the Basement



Instead of carrying a heavy ash can to the alley, fit it with rollers and push it

Screwed to the corners of a square piece of plywood, four rollers of the type shown provide a wheeled base on which heavy ash cans can be moved about with ease. The plywood base is attached to the bottom of the can with long, slender bolts, using washers under the bolt heads to prevent them from pulling through the bottom of the can. If you are in the habit of keeping the can in a damp place for any length of time, the plywood should be painted, impregnated with melted paraffin or given two or three applications of oil.

Mitten Blotter Saves Time

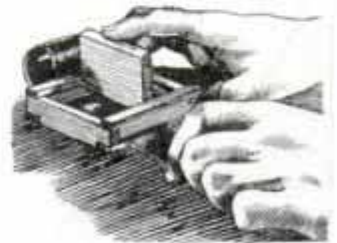


If you have considerable writing to do which requires constant blotting, such as writing signatures, making entries in books, etc., this mitten blotter will save time. The blotter is made by gluing several thicknesses of

blotting paper to a mitten, gluing the first sheet solidly to the palm of the mitten and only tacking the other sheets to the first one at the corners with a drop of glue. When one sheet is soiled it is removed to expose the next one.

Photo Printing Frame Is Altered to Take "Vest-Pocket" Films

When making contact prints from a roll of "vest-pocket" negatives, the roll can be handled easily if the bottom of a regular printing frame is slotted to take the film as shown. The slots should come flush with the glass, and their sides and edges should be sanded smooth. In use, the film is slipped through the slots and a piece of printing paper is placed over the negative, after which the back is swung into place and the exposure is made in the usual way. While a black-paper mask can be used to obtain a border on the print, this is usually dispensed with, the print being trimmed after the picture has been dried and is ready for mounting.



Wood Vases Have Glass Linings

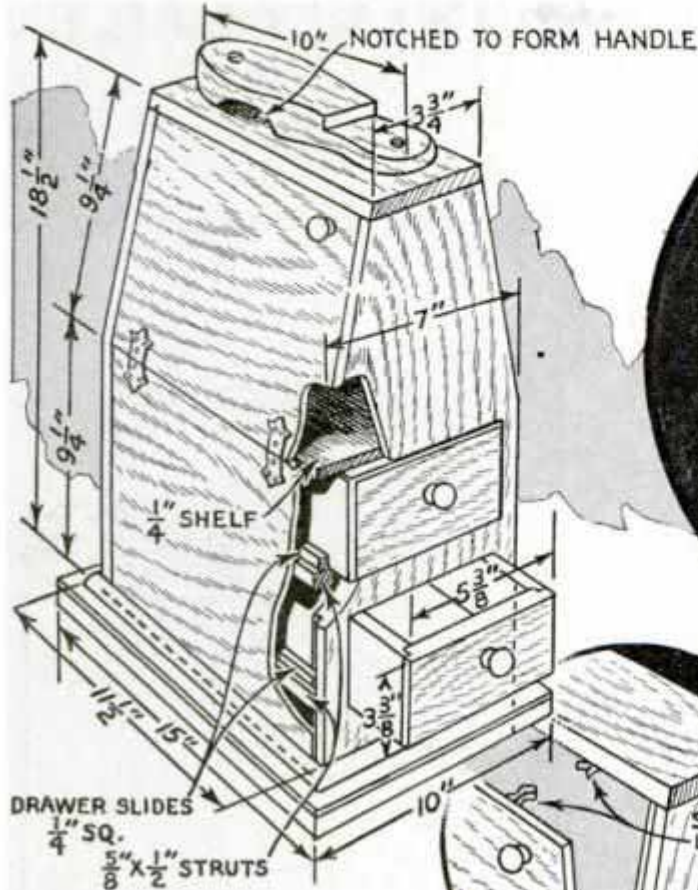


You can use your ornamental wood vases to hold cut flowers in water if glass test tubes are first slipped into the vases. As the tubes can be obtained in various sizes, you will have no trouble in selecting some to suit your

particular needs, taking care, of course, to get them short enough so that they do not project above the tops of the vases.

☐ A paper plate glued to the bottom of a paint can, when doing touch-up jobs, prevents paint from dripping on the floor and provides a place to lay the brush.

Shoe-Shining Stand Stores Brush and Polish



This tidy shoe-shine stand keeps black and tan polishing equipment in separate drawers and has compartment for rags



with a hinged side and snap lock for polishing cloths. The shoe rest, which is screwed to the top of the stand, is notched to serve as a handle to carry the stand. The base and ends are 1-in. stock, the sides 1/4-in. stock, and the top 5/8-in. stock. Note that the finger

Why not help to keep the home tidy by providing a convenient shoe-shine stand, where polishing materials are neatly stored and always ready for use? This one has two drawers for storing brushes, polishes and cleaners as well as a compartment

knob for opening the cloth compartment is placed to one side so that it will not interfere with hand motion when shining the shoes. The stand takes little space in a closet or other storing place.—Charles Brothers Anthony, Kalamazoo, Mich.

Miter-Box Clamp Grips Work to Relieve Strain on Hand

When mitering, I find this clamp helpful to hold work rigidly in the miter box. The clamp is a lag screw with the threaded end cut off square and a pin driven through a hole in the head to serve as a handle. A piece of scrap wood between the end of the screw and the work prevents marring the latter when the screw is tightened against it.—D. W. Prince, Quincy, Mass.

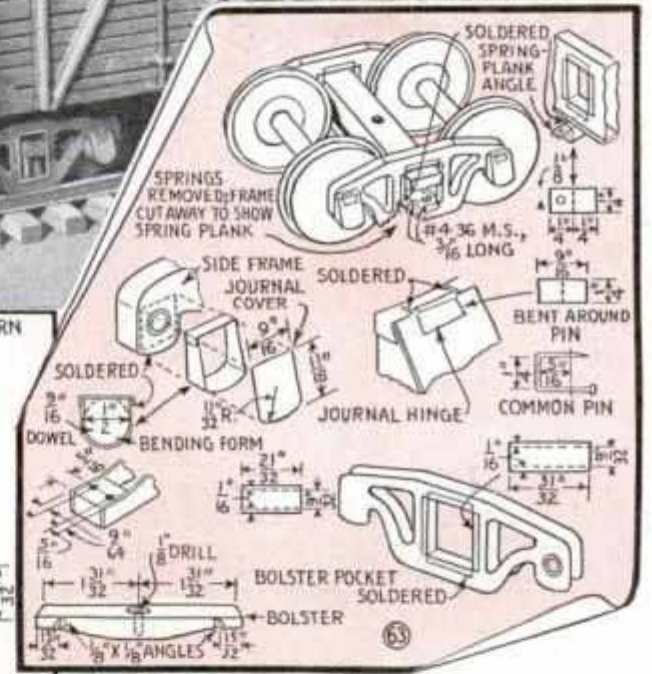
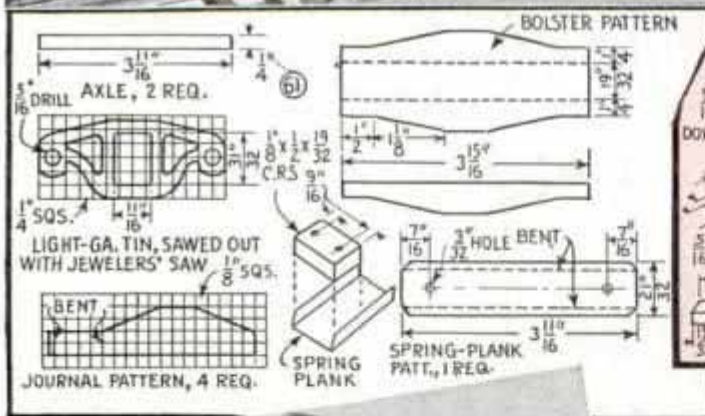
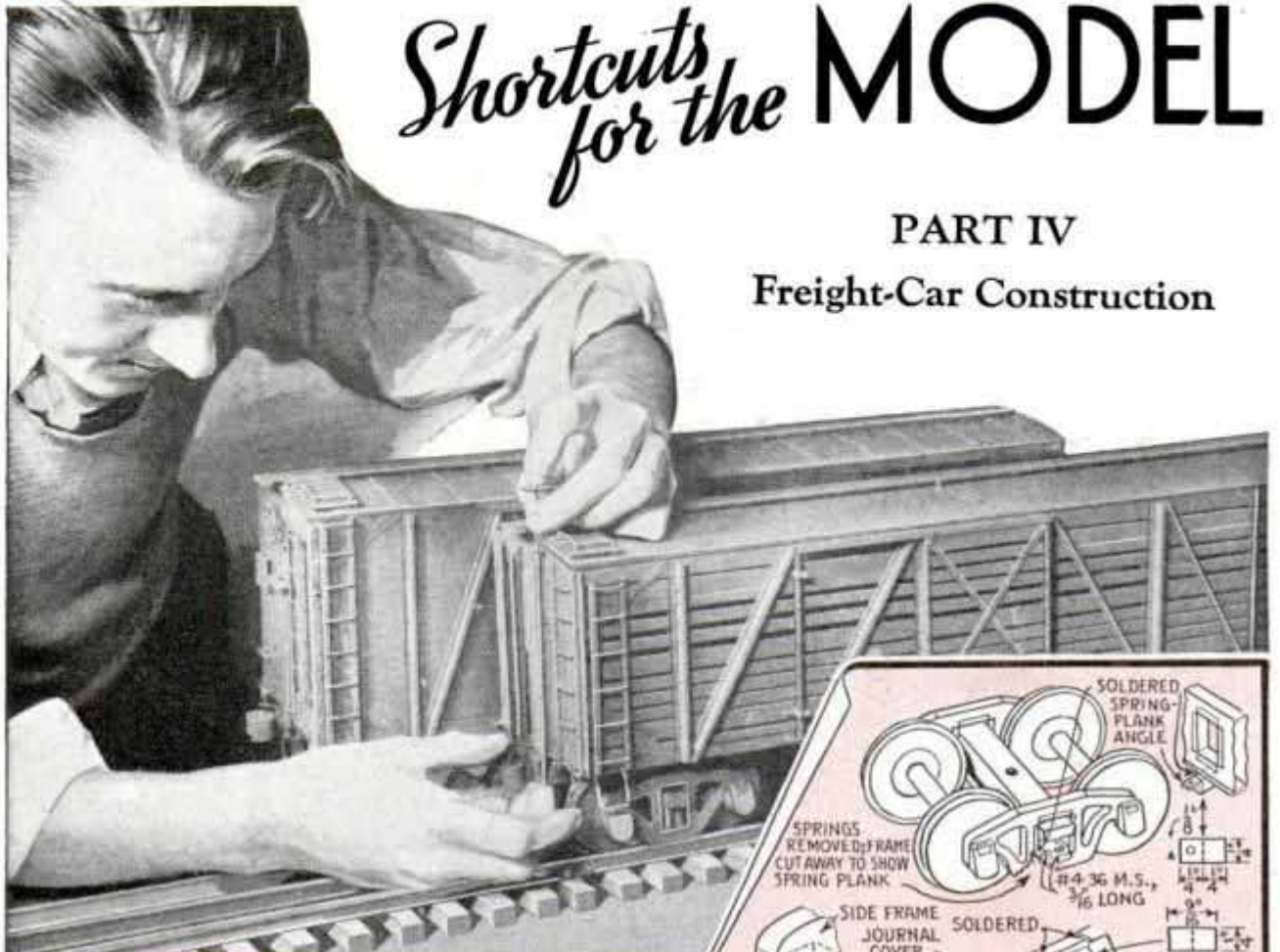
☐Holes and indentations in linoleums are repaired easily by filling them with a mixture of finely chopped cork and liquid glue, which is smoothed carefully and given two coats of clear varnish when dry.



Shortcuts for the MODEL

PART IV

Freight-Car Construction

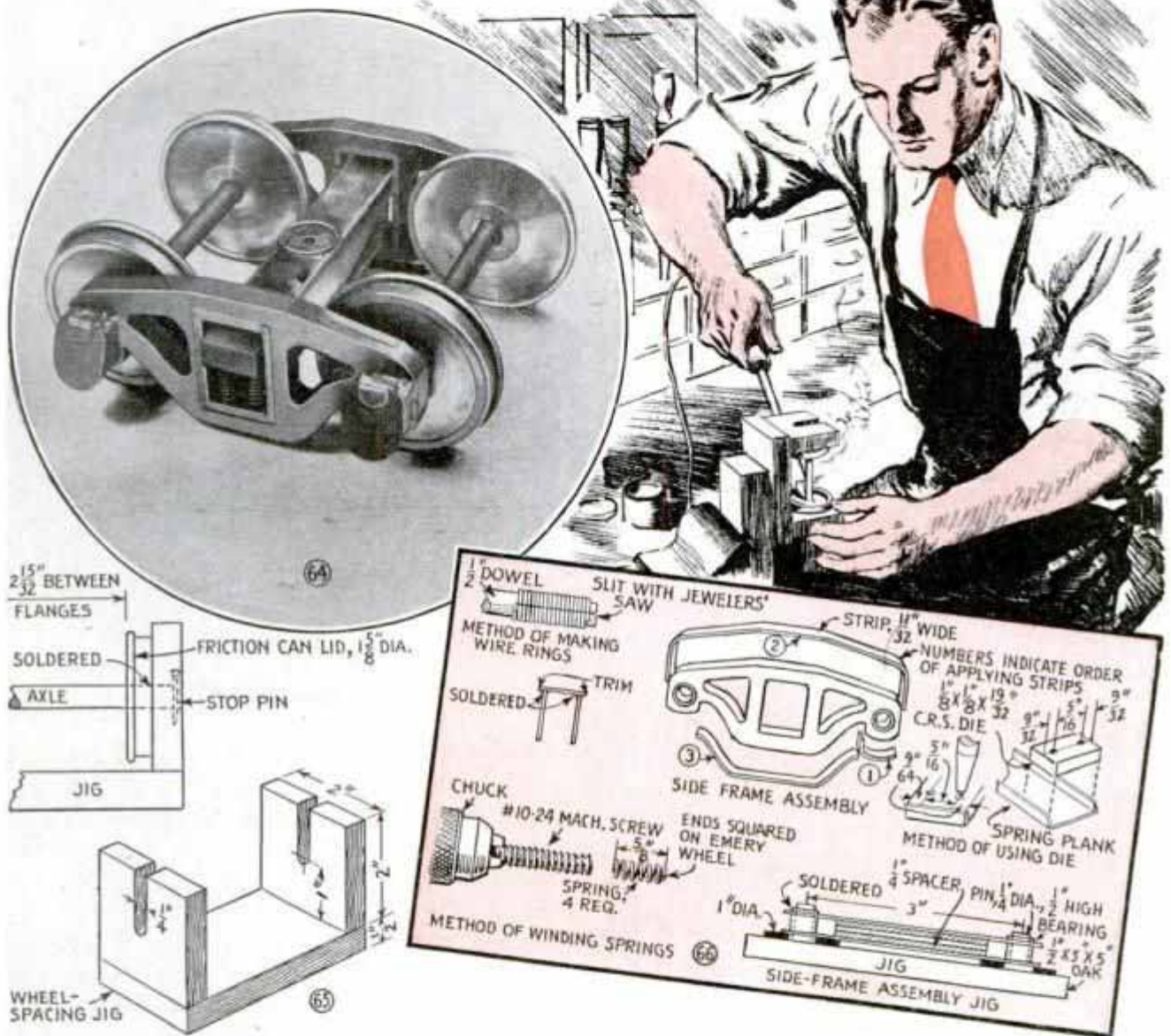


metal for the frame. Fig. 64 shows you the result. Information on wheel construction will be found in a previous issue of Popular Mechanics. Figs. 61, 62, 63 and 66 show the details on the truck frame. All parts are shown in 1/2-in. scale, but this is easily reduced to 1/4-in., the smaller size permitting use of essentially the same methods. The truck frames can be made of sheet brass instead of tin, or, if your blueprints call for 1/4-in. scale, then the use of solid brass will save time as you can make the side frame in one piece.

WHEN you build the cars for your model railway system you can use essentially the same materials as were used in the construction of the locomotive. Figs 61 to 66 inclusive show the assembly of a freight-car truck using friction can lids for wheels and odds and ends of sheet

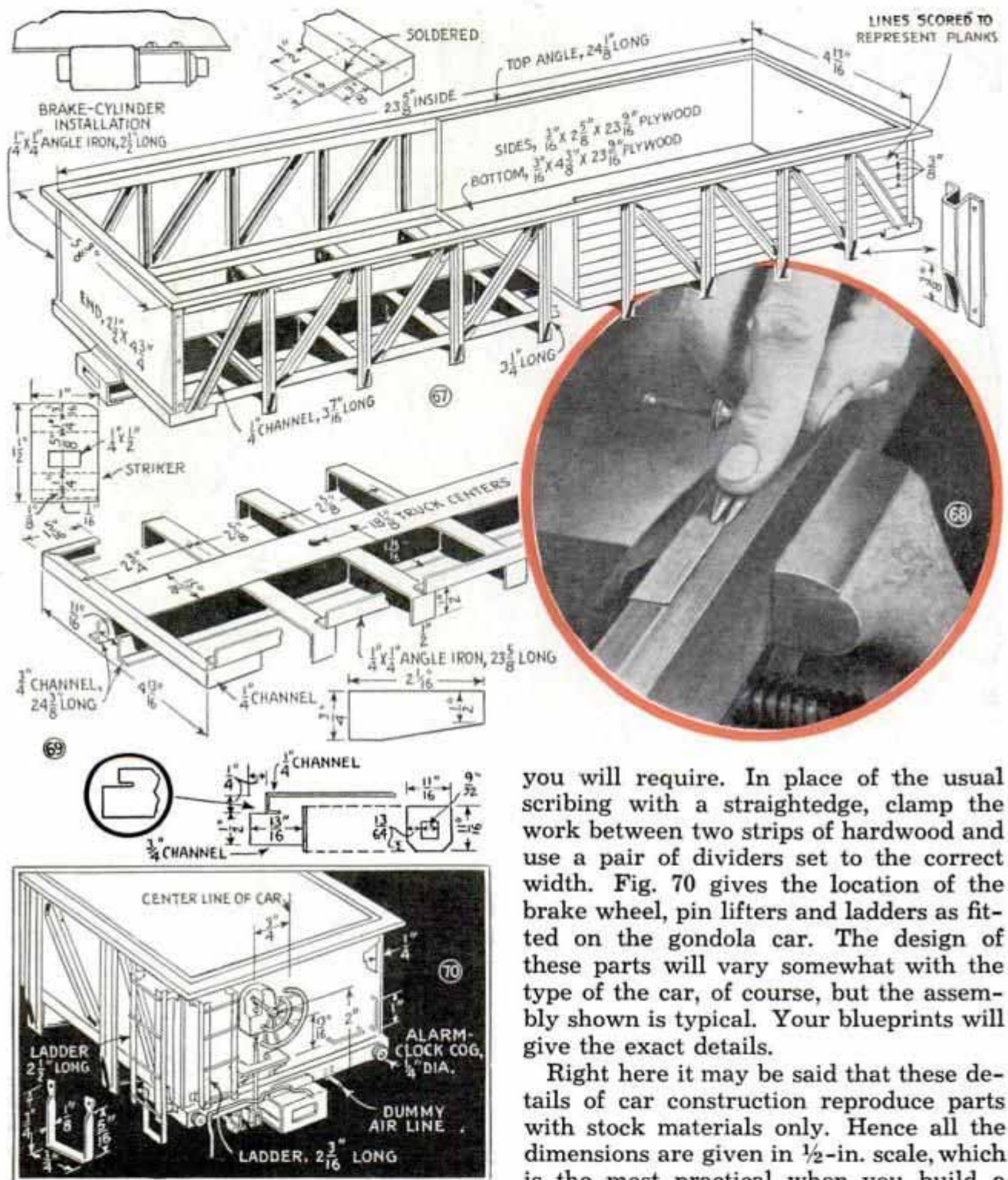
You start the job by cutting parts to the pattern sizes shown in Fig. 61 and assemble the side frames on a jig as in Fig. 66. Use your drill press to wind the bolster

RAILWAY BUILDER



springs. Then assemble the wheels on the axles with a jig made as in Fig. 65, soldering the wheels in place as in the illustration at the upper right. The journals are simply dummies bent to shape on a hardwood former as in Fig. 62 and soldered to the frame. The cover is hinged as in Fig. 63. Note especially that a number of the parts must be duplicated. To do this quickly stack the sheet metal in the same number of thicknesses as there are parts required, and lay off the pattern on the top sheet. Then clamp the sheets together and saw through the whole thing. This will give you duplicate parts in one operation. Drilling for the bushings can be done in the same way.

The car frames come next. These differ, of course, with the type of car you are building, but Fig. 69 shows a typical car-frame construction. It is a built-up affair made entirely of stock sizes of sheet metal, channels and flats, and designed for a gondola body as in Fig. 67. With exception of the bottom and sides which are of plywood, scored to simulate planking, the gondola frame is purely a sheet-metal job. Note that when assembled the uprights are joined directly to the underframe, making a single unit. Before you attempt to assemble a job like this take time to clean thoroughly all parts to be joined, and once you have the parts clean, avoid handling them wherever possible. This



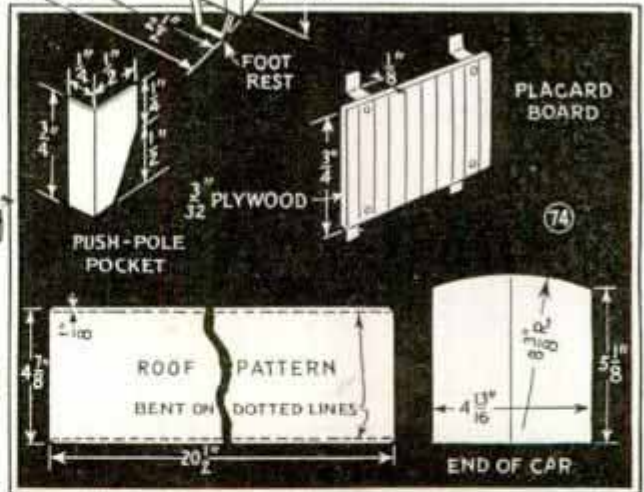
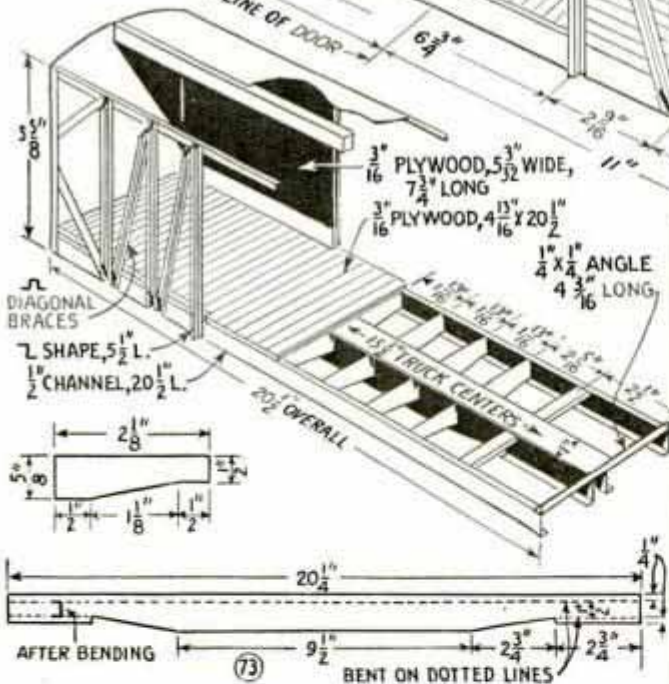
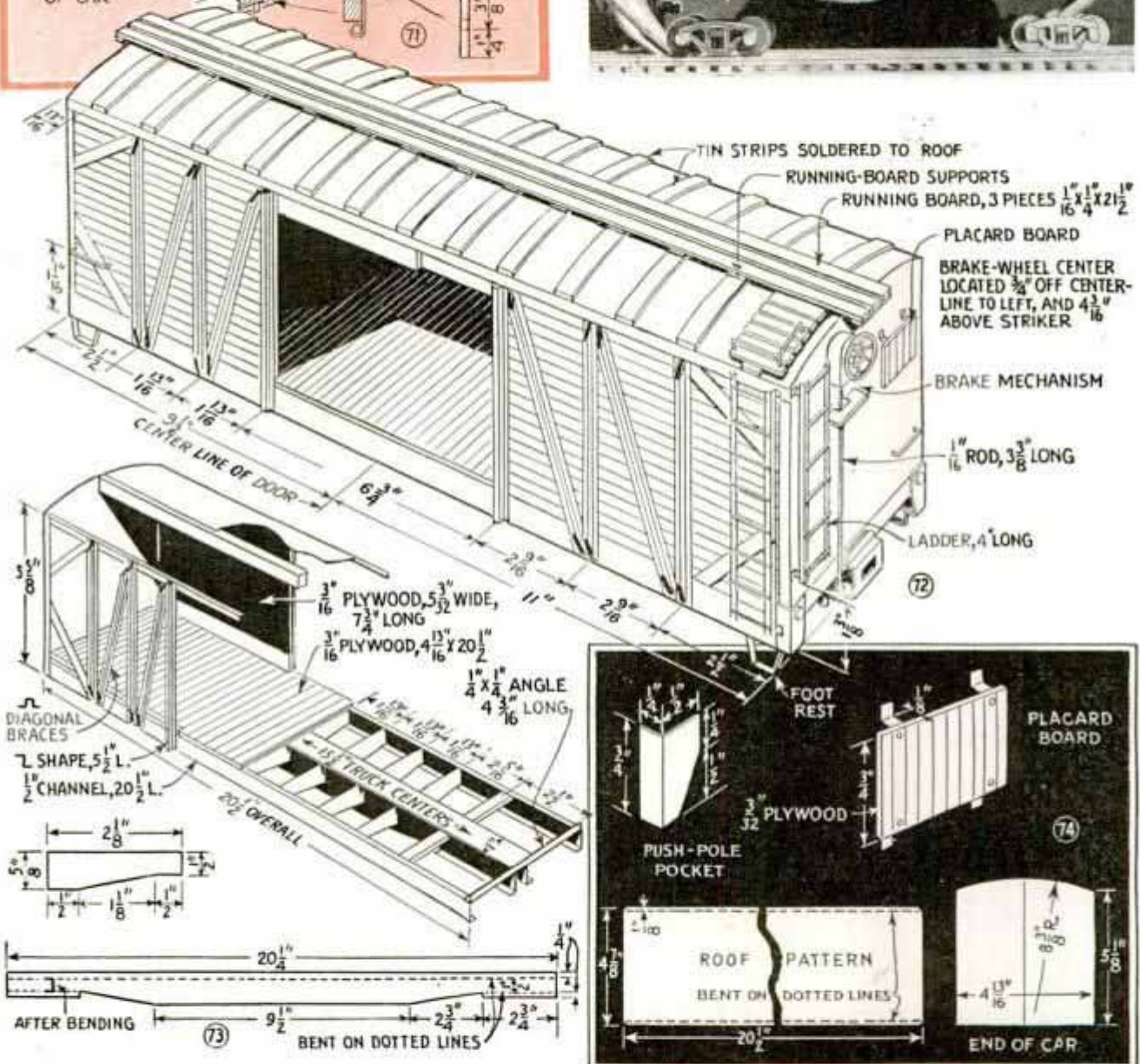
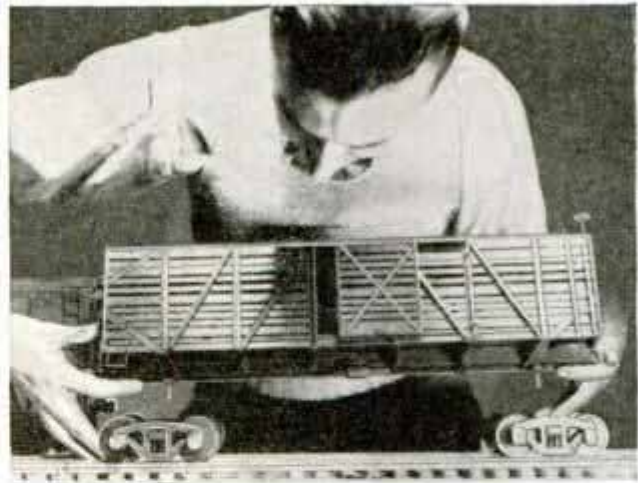
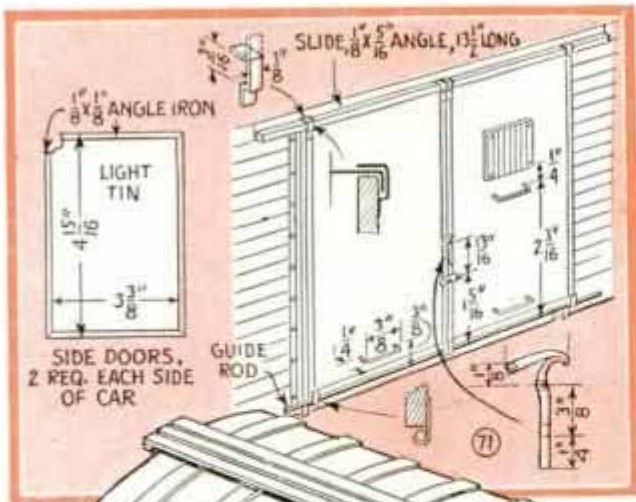
precaution will save trouble in soldering. Spring clothespins make the handiest clamps for the assembly work, for with these it is a simple trick to hold the parts in position for soldering.

Some gondola and car frames will call for rivet impressions in the metal parts. These you can make with the impression die described in a previous issue of *Popular Mechanics*. Fig. 68 shows a simple trick in laying off the exact width of the angles

you will require. In place of the usual scribing with a straightedge, clamp the work between two strips of hardwood and use a pair of dividers set to the correct width. Fig. 70 gives the location of the brake wheel, pin lifters and ladders as fitted on the gondola car. The design of these parts will vary somewhat with the type of the car, of course, but the assembly shown is typical. Your blueprints will give the exact details.

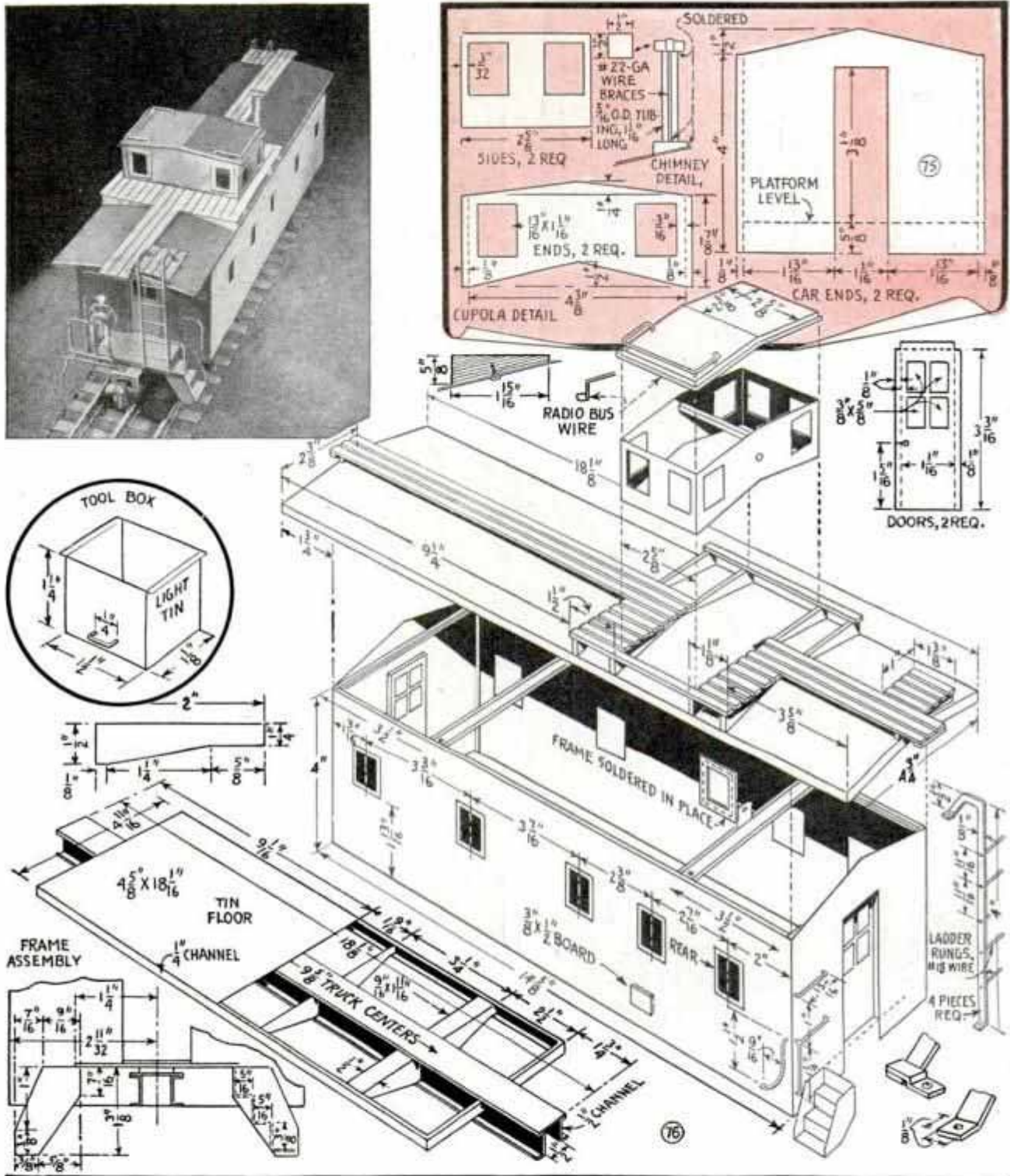
Right here it may be said that these details of car construction reproduce parts with stock materials only. Hence all the dimensions are given in $\frac{1}{2}$ -in. scale, which is the most practical when you build a scale reproduction of any particular prototype. When the scale is reduced to $\frac{1}{4}$ in., you can often save time and effort by omitting certain small details and purchasing some of the parts ready made.

Beginning with Fig. 71 and continuing to Fig. 74 you have the essentials of box-car construction. You will see at once that in general assembly of frame and body the car shown is practically a duplicate of the gondola. Fig. 72 shows the body of the car mounted on the underframe and ready



for the trucks. Fig. 73 details the setup of the frame, the assembly being very nearly the same as the gondola frame in Fig. 69. The sides and top of the body are of plywood, scored to simulate the planking, while the top and ends are of sheet metal, as are the sliding doors shown in Fig. 71. The brake wheel, pin lifters and ladders are the same as those in Fig. 70 except

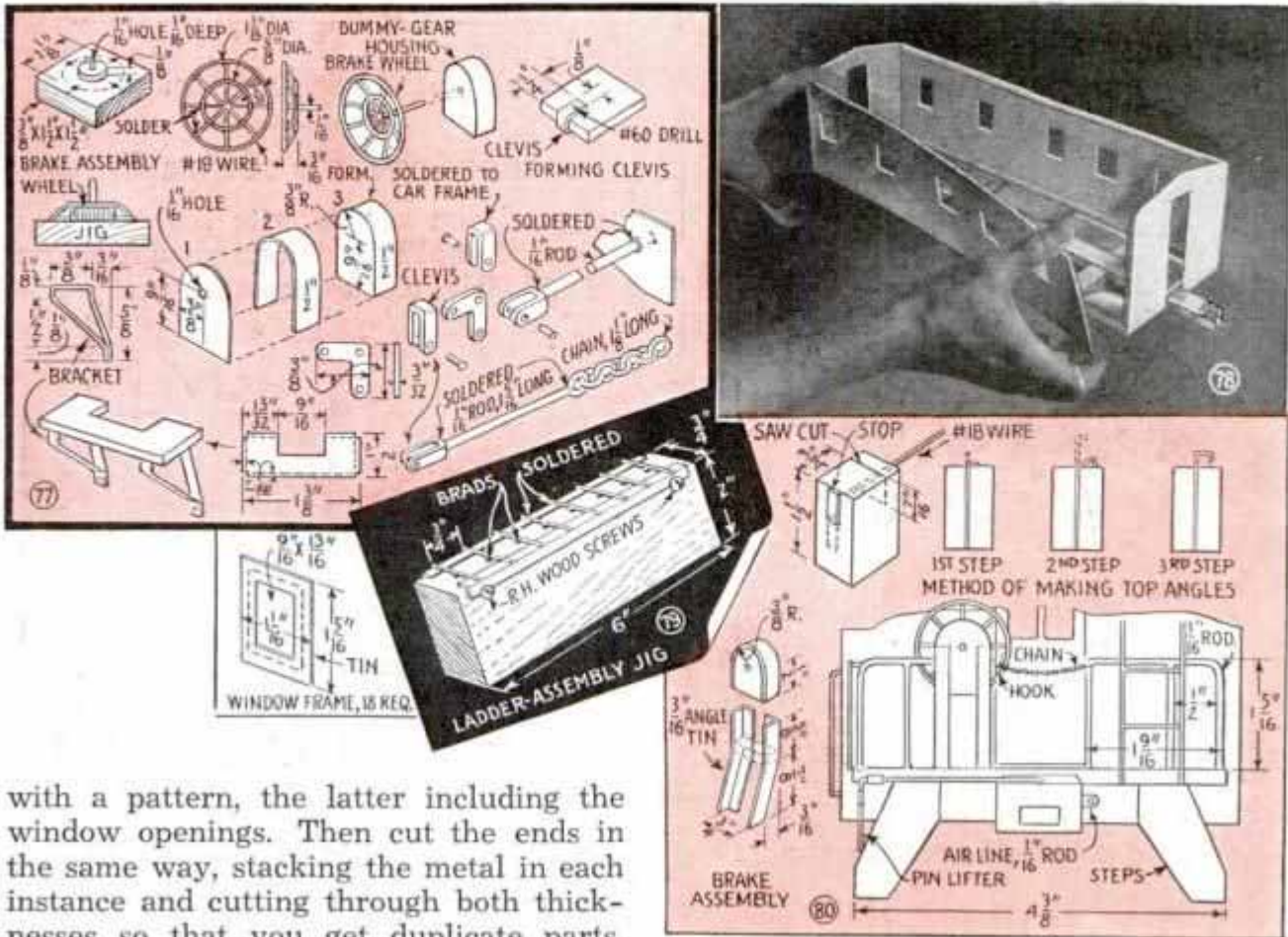
that the ladders and brake rod are longer. Note that this particular car is of the automobile type and that all dimensioned parts are in 1/2-in. scale. The same is true of the gondola. In building a complete train there will be some variations in frame design to suit the type of car. For example, the tank-car frame will differ from either the gondola or flat car in that it



omits all cross bearers save those directly over the truck bolsters. Likewise the frame for the refrigerator car will show some variation from the stock or box car, though the frames for the latter two cars are generally the same.

Now the caboose. This is a somewhat more elaborate affair as shown in the details beginning with Fig. 75. It is constructed entirely of sheet metal except the roof boards which are of thin wood. Note from Fig. 76 that the frame is the same

construction as that of the box and gondola cars except that the central beam extends beyond the cross bearers at each end. Fig. 76 also shows the body assembly with all parts dimensioned in $\frac{1}{2}$ -in. scale. The job begins with the frame, which as shown is made up of sheet metal as is the boxcar frame. If you wish to make up this same frame in $\frac{1}{4}$ -in. scale you can save time by using solid brass, cutting this to the sizes and shapes required. With the frame made up you next cut out the sides



with a pattern, the latter including the window openings. Then cut the ends in the same way, stacking the metal in each instance and cutting through both thicknesses so that you get duplicate parts. Assemble sides and ends as in Fig. 78, clean the joints at the corners and smooth the edges with a file ready for the top. The latter is one piece of sheet metal, there being no opening cut for the cupola. The windowpanes are squares of transparent celluloid fastened over the openings with celluloid cement. Parts for the cupola are shown in Fig. 75 and it is assembled in the same way as the body of the caboose. The balance of the details in Figs. 75 and 76 complete the main structure, which is then soldered to the underframe.

Now for some general details which apply to all car types and the caboose. Fig. 77 shows the manner of making up the brake-wheel assembly for the cars while a further detail on the brake-wheel assembly for the caboose is shown in Fig. 80. In Fig. 79 you have a handy hardwood jig for making the ladders, and in Fig. 80 a jig which makes easy work of cutting ladder rungs to exact length. Fig. 80 also details simple hardwood jigs for making up angles from flat sheets. The method of making up windows and frames, like those on the caboose, is shown in Fig. 79.

The paint job on the cars should reproduce as nearly as possible the colors of

the prototype. Wherever you have wood to paint, such as on the cattle and box cars and the wooden gondola, make sure that you have a smooth surface before paint is applied. On the larger areas you can use fine sandpaper, but in close quarters a small bunch of fine steel wool pressed into the end of a short length of tubing is much better. Clean all the soldered joints with steel wool and round over sharp metal corners with a file. Where possible, it's best to disassemble parts for painting. A flat iron paint gives the best appearance on all metal parts of the cars. Use an oil paint on the wood. Carefully applied, one coat of the flat paint will be sufficient on metal, but the wood should have at least two coats, a primer and a finish coat. The one important thing in painting a model is to keep the paint solution thinned so that it brushes easily without any tendency to drag under the small brushes. Get in the close corners and over the small areas first, leaving the larger surfaces till the last. Watch that the paint film doesn't sag. Keep the excess picked up with vertical strokes of the brush.

(To be continued)

Hand Mirror Supported on Table in Altered Coat Hanger



This holder leaves both hands free when shaving or dressing in front of a small mirror

When you find it difficult to keep a hand mirror propped up vertically on a table, just bend a wire coat hanger to serve as a support. The wire of the hanger is soft and is easily bent with a pair of pliers, altering the design shown to suit your particular mirror.

Glass 'Feeding Pen' in Aquarium Floats on Surface

By using this floating pen, you not only effect a saving in food by keeping it confined, but you prevent small particles from adhering to the sides of the aquarium where they decay, contaminating the water and providing a breeding place for parasites. The pen is made from a 1-ft. length of glass tubing, which is sealed at the ends and bent to the shape shown.

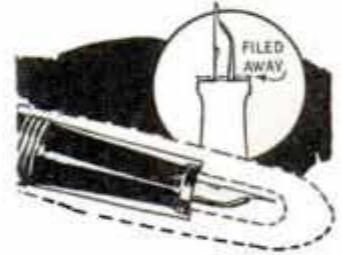


To seal the tubing, heat the glass about 1 in. from each end, slowly drawing it out

as it softens. After this, heat the tubing at the proper spots and bend it to shape.—K. F. Keith, St. Petersburg, Fla.

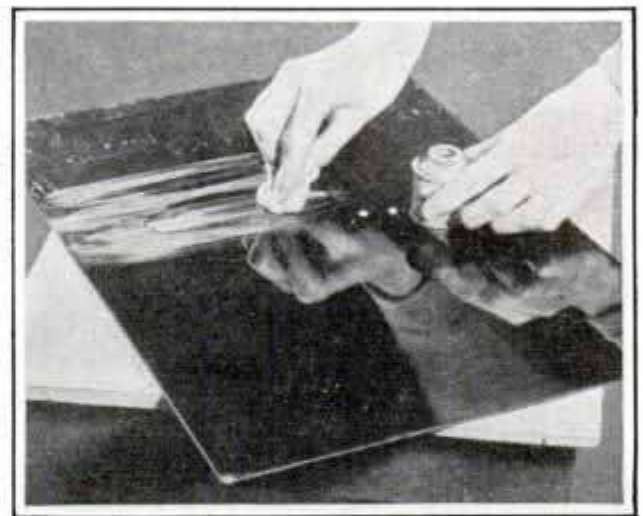
Renewing Grip of Pen Cap

Threads on my favorite fountain pen wore down until the pen dropped from the cap and allowed ink to spot my vest pocket. To remedy this trouble I filed off the end of the pen so it would go a trifle farther into the cap before striking the shoulder. This permits the threads to get a firm grip and now the cap holds as well as ever.—H. E. Benson, Denver, Colo.



Ferrotypes Plates Are Polished to Remove Scratches

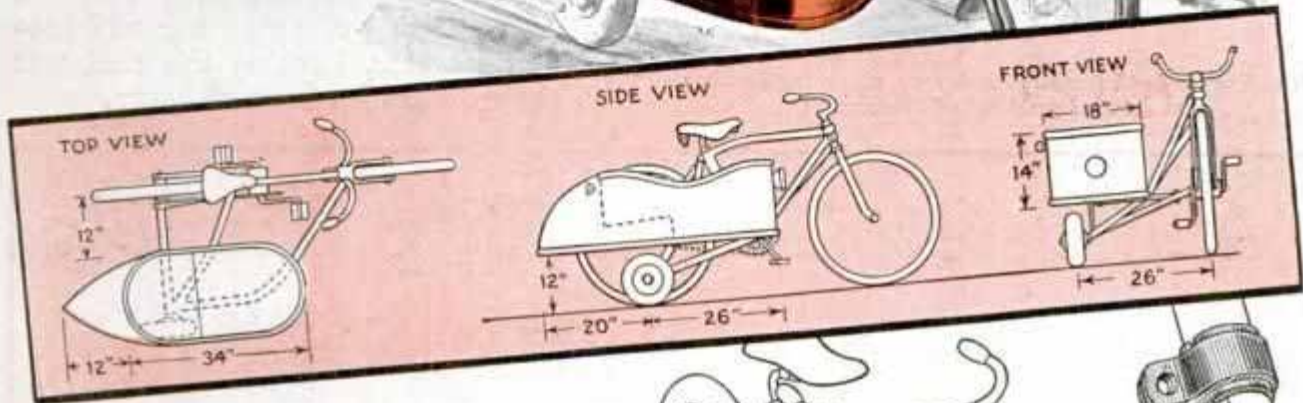
Scatched surfaces of enameled ferrotypes plates can be restored to practically a new condition by means of an automobile polish which is slightly abrasive, such as is used for removing traffic grime from lacquered surfaces. Directions supplied with the polish should be followed. Generally, these recommend rubbing the surface with straight back-and-forth movements, followed by polishing to a high



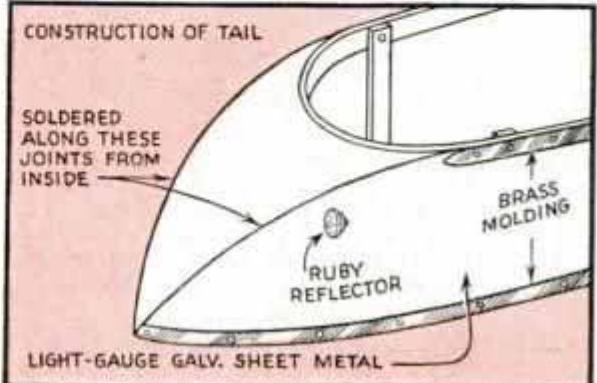
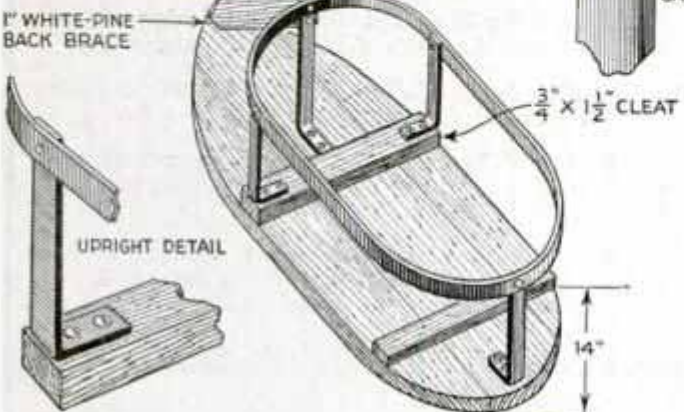
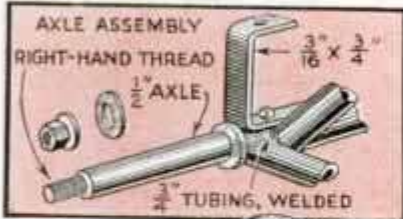
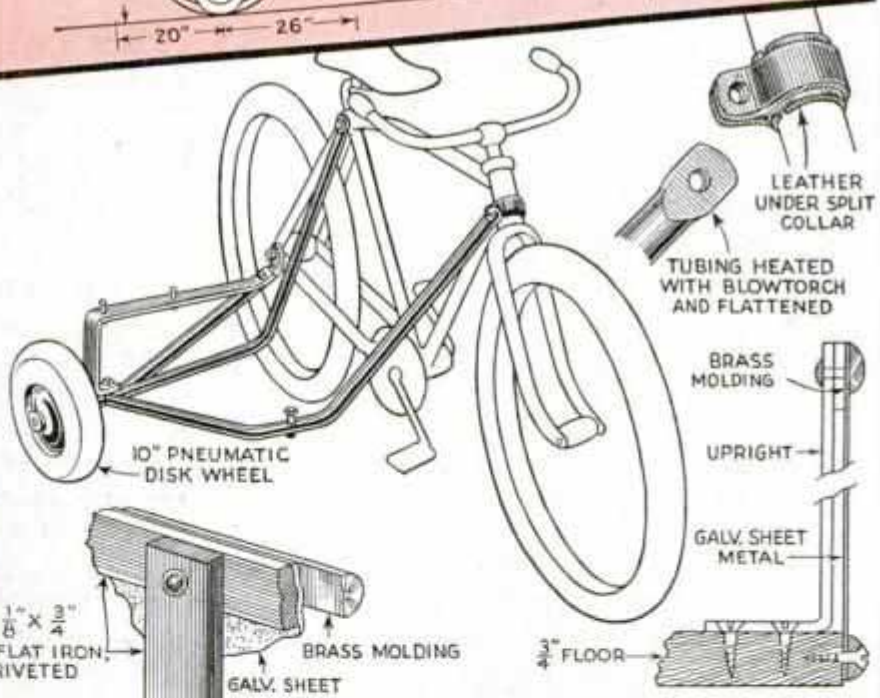
Rubbing enameled ferrotypes plate with auto polish removes fine scratches in the surface

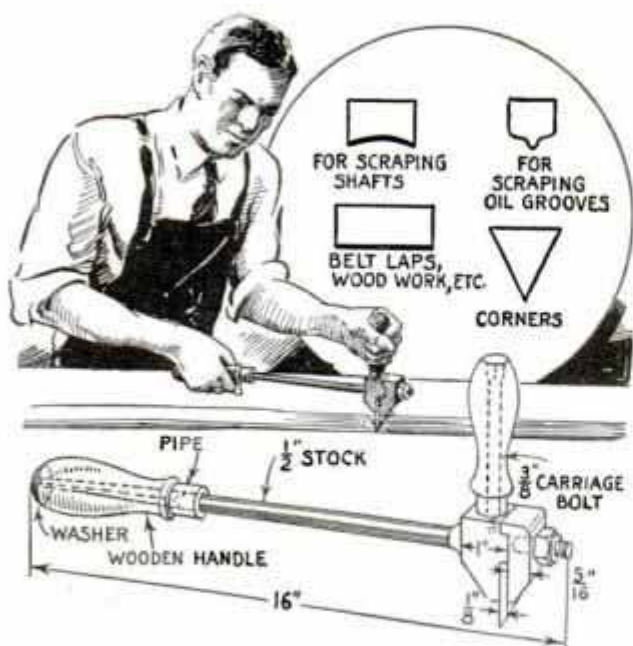
gloss with a soft cloth. After the surface scratches have been removed, a thin coating of wax should be applied to the plates before using them.

Bicycle Sidecar



Your friends will enjoy a ride in this sidecar, and it's just the thing for delivering parcels, newspapers, etc. The tubing is heated with a blowtorch to facilitate bending, and the welding is a simple job for the neighborhood garageman.





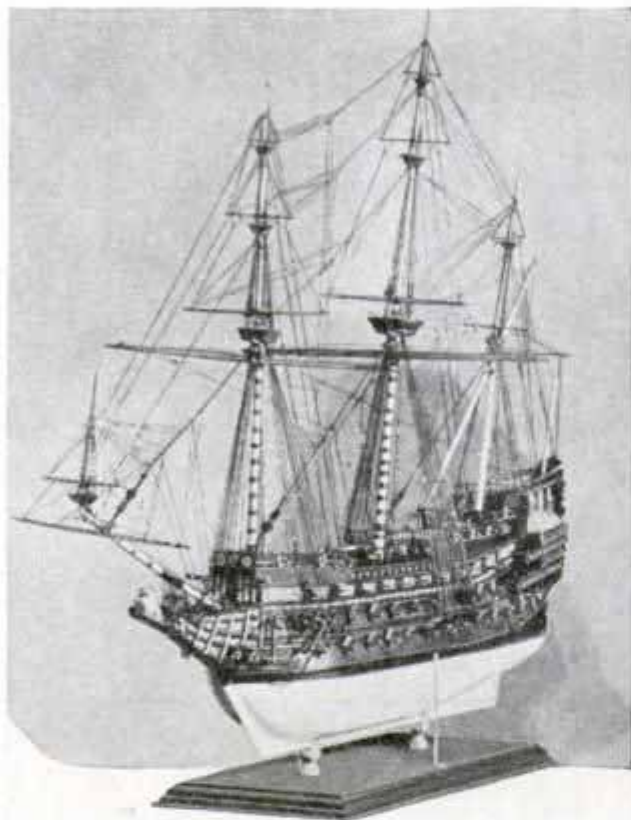
Handles for both hands permit free, sweeping strokes and careful guiding of the scraper

Scraper Has Removable Blades for Variety of Work

For almost any scraping job from belt laps to oil grooves, whether the surfaces to be scraped are convex, concave, or are grooved, you will find this scraper, which has adjustable jaws to hold cutters of various shapes and sizes, a handy addition to your workshop. The cutters are best ground from tool steel such as old planer knives, wood scrapers, etc. For heavy work, the jaws should be casehardened.

When rubber-finished raincoats become hard, it is claimed that flexibility can be restored often by brushing them with a solution consisting of equal parts of ammonia and water, keeping the coat wet with the solution for several hours.

A Masterpiece in Ship Models



Hundreds of plans for many other projects are listed in our 80-pp. booklet "What to Make" which will be sent for 12c postpaid. Also contains information on workbench construction, tools you need, how to file saws, make wood joints, spin metal, get correct measurements, etc.

Do you want a model of one of the most outstanding warships in history? If so, build the "Sovereign of the Seas." Complete information on the construction of this ornately decorated, and highly picturesque model, 34 in. long and 26 in. high over all, is given in our blueprints 828 to 835 incl., priced at \$1.50 per set. Descriptive text in bound book, \$1.00 additional.

OTHER WORTH-WHILE MODELS

"Flying Cloud" Clipper Ship—709-714A: No collection is complete without a clipper. Complete with full-size lift templates—\$1.25.

"Half Moon"—717-718A: Model of boat used by Dutch Seaman, Henry Hudson—\$1.00.

"Mayflower"—887: Midget replica of ship which anchored at Plymouth Rock—25c.

"Savannah"—889: First steam-driven boat to cross the Atlantic. 14-in. model—25c.

Viking Ship Model—888: Used by Norsemen in early explorations. 14-in. hull—25c.

"Santa Maria"—759: Simplified design of Columbus' flagship. About 18 in. long—25c.

"U.S.S. Pensacola"—863 and 864: Midget design of 10,000-ton treaty cruiser—50c.

Prairie Schooner—728: Model is quaint reminder of covered-wagon days. Wagon without top, 8 3/4 in. long—25c.

Model Colonial Cannon—735: Perfect 10-in. miniature of guns used during days of 1776. Turned brass and wood—25c.

Blueprint Department, Popular Mechanics Magazine, 200 E. Ontario St., Chicago

60 Power Tools

Flaregon - Luxex Abrasives Corp. 63 Wall St. New York



SHOP NOTES

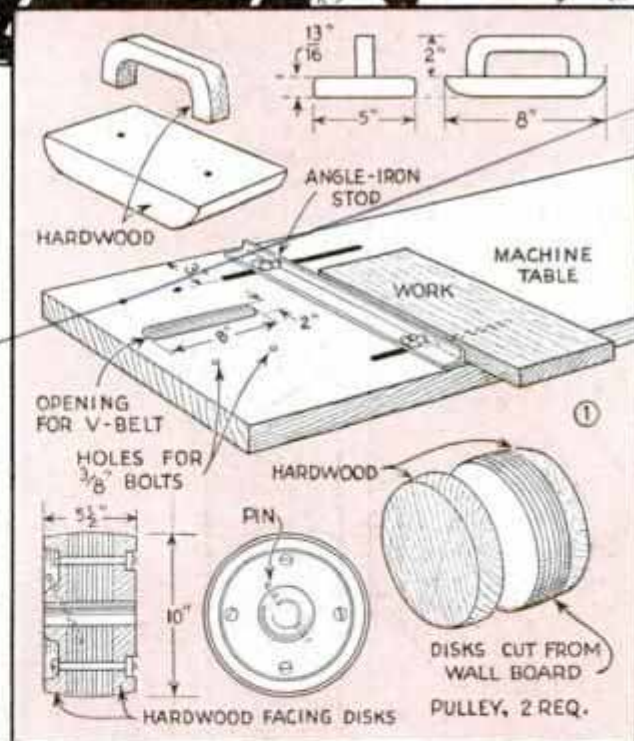
Flexible-Belt

SANDER

Makes Finishing Easy

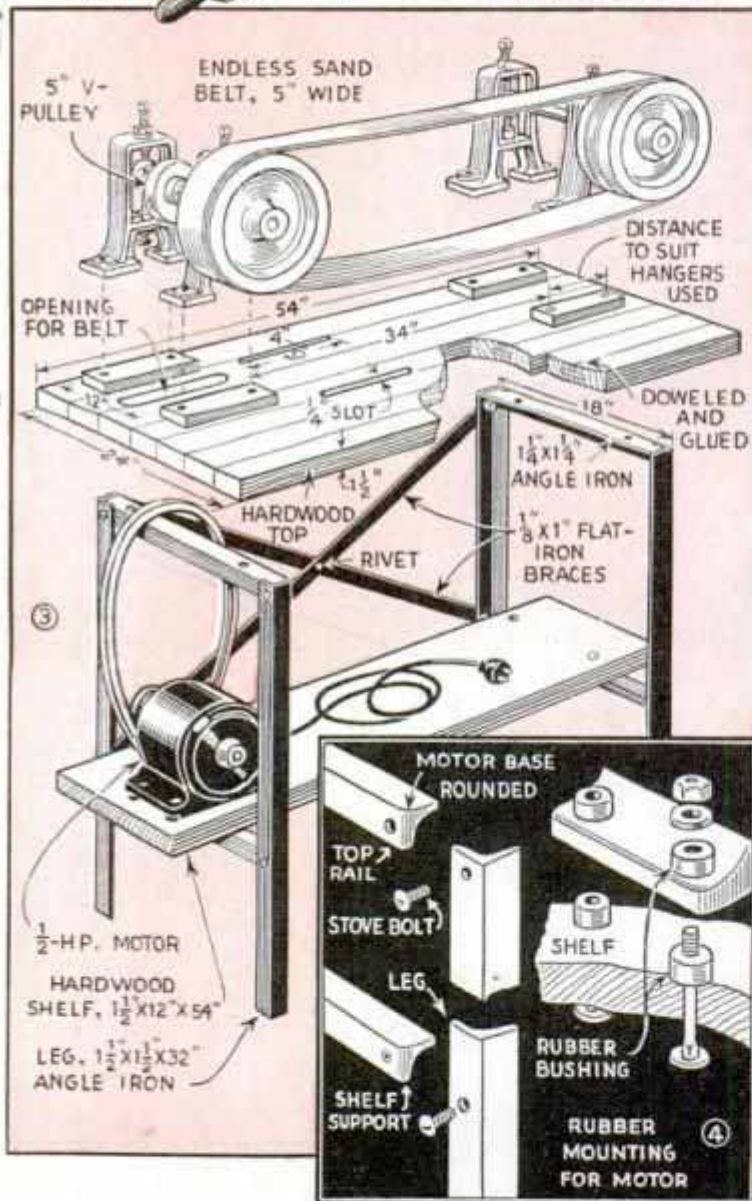
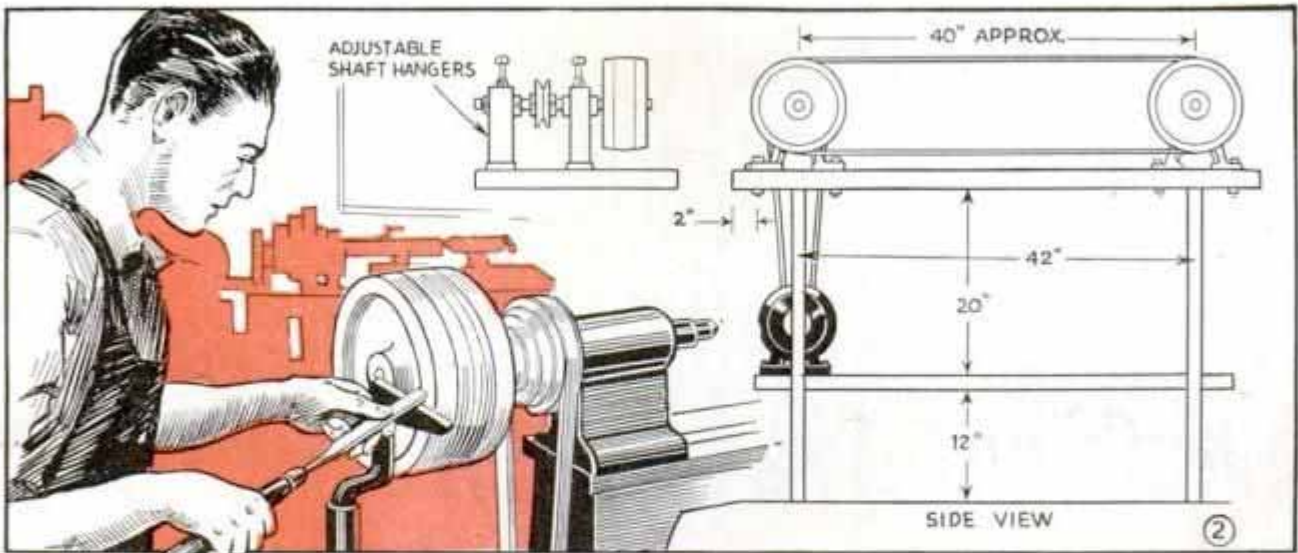
BUILT of odds and ends easy to get most anywhere, this belt sander will handle practically all sanding operations on flat work of the average size. The design permits a delicate control over the cutting action of the belt and you can see what you're doing, as the work is in full view.

Although you can use any wood or iron pulleys to carry the abrasive belt, Fig. 1 shows how you can make much better pulleys for the purpose right in your own shop. The center section of each pulley is made up of twelve disks of 1/4-in. wall board glued together with casein glue. Then on each side of the center section glue a 1 1/2-in. disk of hardwood, such as birch or maple. After turning, four equally spaced holes are bored through the web of each pulley. These take small stove bolts as in Fig. 1. Now center a hole through the hub of the pulley to take the shaft. The method of keying the pulley to the 3/4-in. shaft is also shown. Combining Figs. 1 and 4 inclusive, you have the story of how the sander is assembled. To carry the pulleys you mount four self-aligning



Delicate finish work on small parts, cutting glued-up panels down to uniform thickness, producing a fine finish on veneered panels—all these operations are easy when you have this belt sander. Materials that you do not have at hand to build it are easy to get most anywhere. The lower details show how to make pulleys out of wall board and hardwood with a friction surface that will prevent slippage of the sanding belt

15091
 mmm
 mmm
 mmm



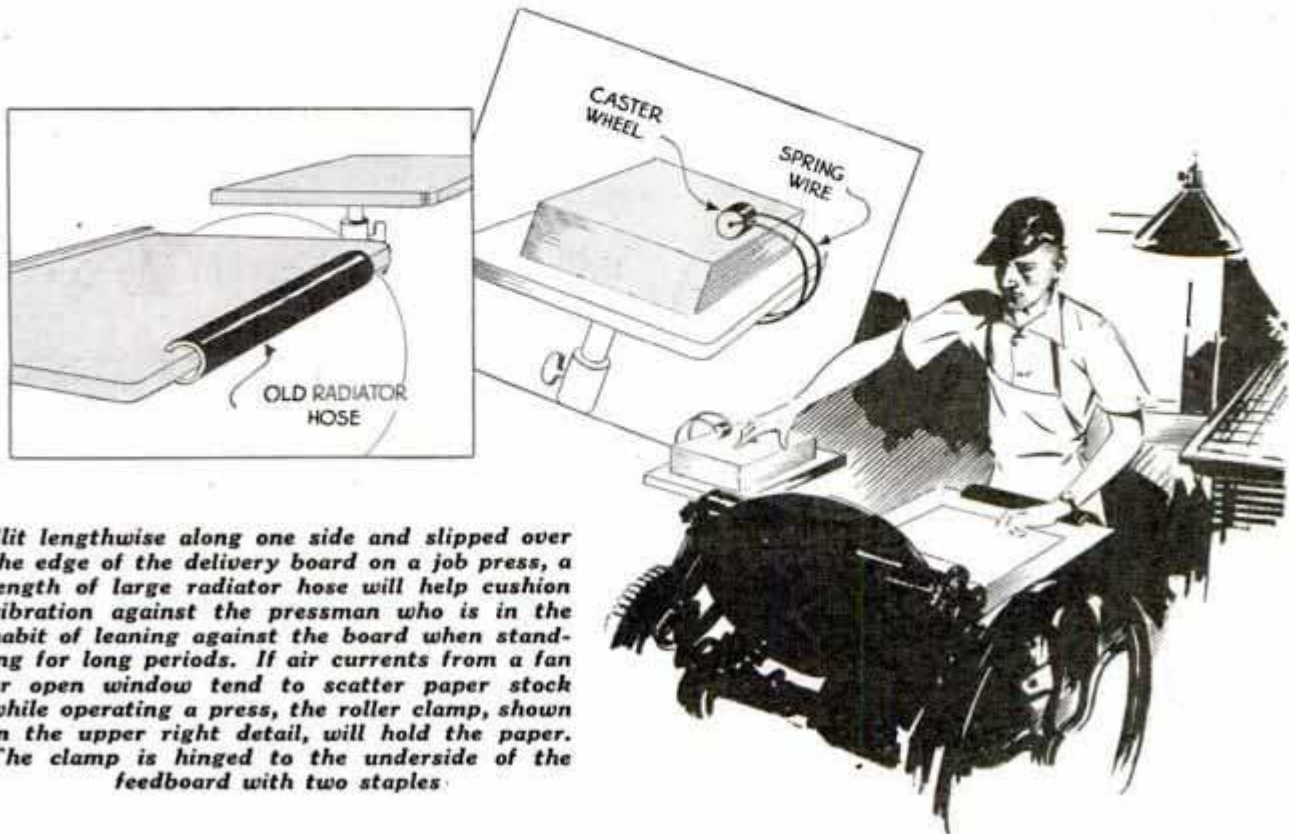
shaft hangers on a hardwood table top, the latter slotted for the V-belt to the motor, and also for the angle-iron stop against which the work is placed. This assembly is mounted on an angle-iron stand made as in Fig. 3, with a hardwood shelf underneath on which the motor is mounted. Fig. 4 gives the details on bolting the iron stand together and also shows how you can mount the motor on rubber bushings to lessen vibration. Use a rubber V-belt to drive. Speed of the pulleys carrying the sand belt should not exceed 1,000 r.p.m. Two small bolts with wing nuts provide the necessary adjustment. The rubbing block is made of hardwood as in Fig. 1, with the ends curved upward and the bottom sanded smooth so that it does not damage the belt.

The important thing in using a sander of this type is to keep the work moving in a slow back-and-forth motion across the table while you press the sand belt into contact with the surface. Only a light pressure is needed to insure a fine finish. Suitable endless belts in various grades are available in the length and width required.

Any sturdy table will do for mounting this sander. It can be bolted to an open bench, or an angle-iron stand like that shown above. A 1/2-hp. motor supplies ample power for any ordinary work. The table can be made larger than that shown, if you wish to increase the capacity of the sander.

☐ A putty that insulates against both heat and electricity can be made by pulverizing sheet asbestos and mixing it to a dough with water glass.

Two Ideas That Help Ease the Pressman's Job



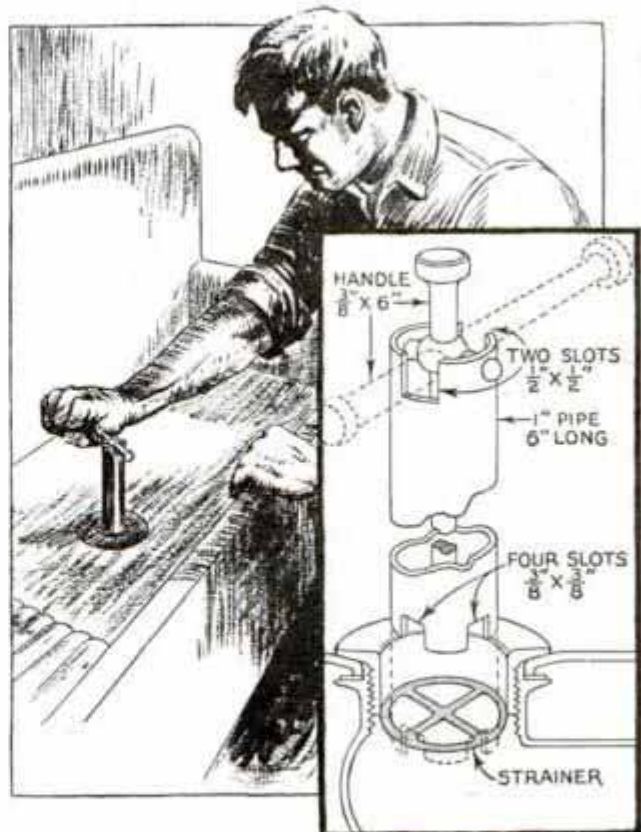
Slit lengthwise along one side and slipped over the edge of the delivery board on a job press, a length of large radiator hose will help cushion vibration against the pressman who is in the habit of leaning against the board when standing for long periods. If air currents from a fan or open window tend to scatter paper stock while operating a press, the roller clamp, shown in the upper right detail, will hold the paper. The clamp is hinged to the underside of the feedboard with two staples.

Wrench for Removing Sink Strainers Has Folding Handle

Here is a wrench that will remove tight sink strainers in a jiffy. Made from a short piece of scrap pipe, it costs nothing, and takes little space in your tool kit. Four equally spaced slots in the lower end of the pipe straddle the strainer arms, and two larger slots in the upper end take the handle. This is a bolt or rod, with the ends enlarged, which slides through a pivot, the latter being an old faucet handle with the hole reamed and the ends shouldered to fit holes drilled in the pipe. To insert the pivot, it will be necessary to slot one of the holes and then solder the piece, thus removed, in place after installing the pivot.

Bridle Bit Sheathed in Winter

During winter when a cold bridle bit is likely to injure a horse's mouth by sticking to its lips, I wrap the bit with rubber. Tire patching, when wrapped spirally around the bit, will last all winter, and will not come off if the ends are overlapped and cemented.—John Halvorson, Regan, N. Dak.



If you make up one of these wrenches and carry it in your tool kit, you are prepared to remove any tight sink strainer without difficulty

Sickle Section on Pitchfork Cuts Sheaf Strings



Cutting strings on sheaves of grain to feed livestock is a simple job with this cutter

When small grains are fed to livestock in the sheaf, a section from a mowing-machine or binder sickle riveted to a pitchfork will save time and labor in cutting the sheaf strings. Slipping the outside tine, which carries the section, under the string as shown, severs it with one stroke, after which the grain is spread for feeding.

Clerk's Crayon Always at Hand on Rubber Finger Tip



slipped over the index finger. The user can address packages and check them in

Reducing waste motion to a minimum, this crayon attachment for the finger is a time-saver for shipping clerks. A crayon is inserted into a hole made in the solid end of a rubber crutch tip, which is then

or out without removing the attachment from the finger, thus saving time in picking up or laying down the crayon while handling boxes and packages.

Micrometer Attachment Checks Tapered Work

Machinists who have difficulty in accurately measuring the taper per inch of a tapered piece with a scale and micrometer will find this attachment for the latter handy to determine when the work has been advanced exactly 1 in. over the micrometer anvil. The attachment is a piece of flat steel $\frac{3}{8}$ in. thick, having a shoulder at each end, and a hole reamed to fit



snugly over the micrometer anvil. The center of the hole is $\frac{1}{4}$ in. from one shoulder and $1\frac{1}{4}$ in. from the other one. The attachment can be any size provided one shoulder is 1 in. farther from the hole than the one on the opposite side.

Bread Knife Has Pistol Grip to Ease Wrist Strain

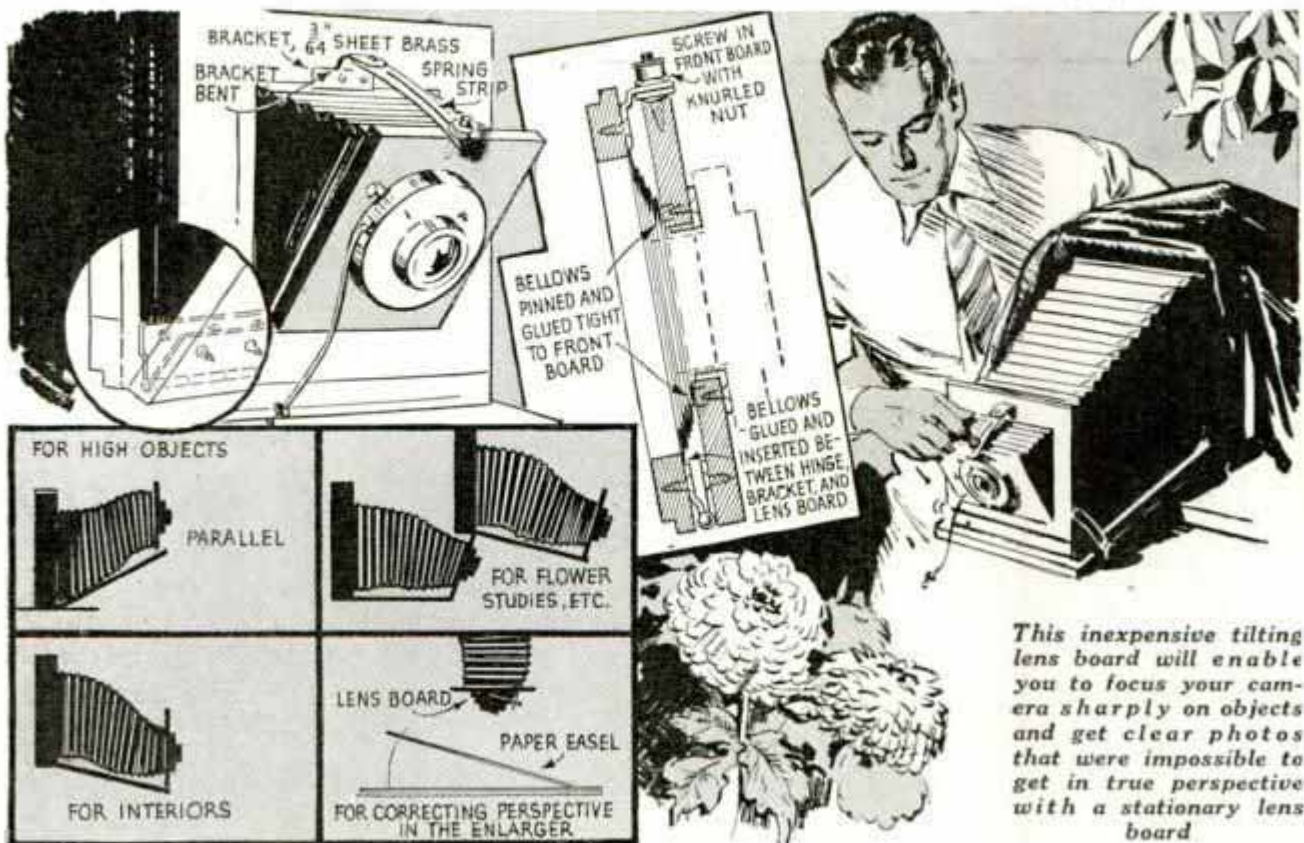
In restaurants and other places where many loaves of bread must be sliced, a detachable saw handle screwed to the



Keyhole-saw handle is attached by reaming rivet holes in knife blade to take bolts of handle

bread knife will make the task less tiresome. The handle permits the operator's wrist to assume a natural position, thus offering an easy cutting stroke with plenty of grip and free action.

Tilting Lens Board Broadens Your Photo Field

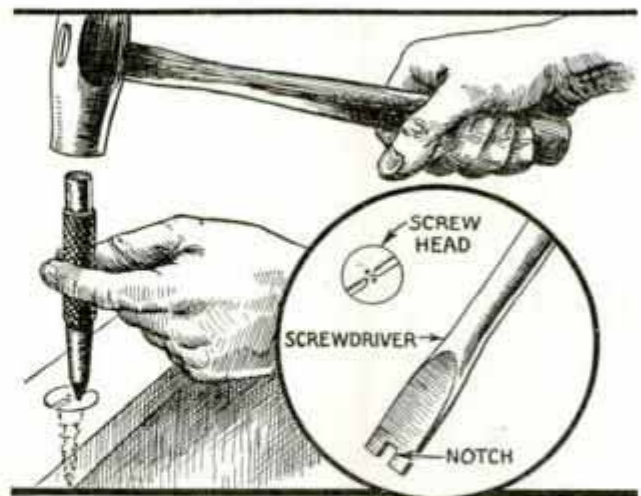


This inexpensive tilting lens board will enable you to focus your camera sharply on objects and get clear photos that were impossible to get in true perspective with a stationary lens board.

By fitting any camera having a ground glass with this simple tilting lens board at a cost of less than two dollars, you can convert it into a camera that greatly increases the possibilities of your photographic work. With such a camera, you can take portraits from a high or low level, bringing the body or shoulders into focus without stopping down the diaphragm. Using the camera for view work, you can photograph high architectural objects, or you can go to the other extreme and get flower beds and hundreds of other views not possible without a tilting lens. In addition to this, you can use a tilting lens on your enlarger, making it possible to correct faulty perspective of old negatives. To make the tilting board, the camera lens assembly is removed and is mounted on a wood block. The opening in the camera lens board is then enlarged to take a short bellows, which you can get from an old hand camera. The bellows is glued over the enlarged opening and to the back of the tilting board, which is then hinged in place. Care must be taken to get a light-tight job. A bracket and a flexible arm of spring brass hold the adjustment of the tilting board.

Removal of Locks Prevented by Altering Screw Heads

To prevent locks and other objects attached with screws from being removed, bead over the center portion of the screw slots with a punch as shown, so that a



Center portion of screw slot beaded over requiring special screwdriver to remove it

regular screwdriver cannot be inserted. For driving such screws, you can notch the end of a screwdriver to straddle the filled portion of the screw slot.

Adjustable Shelf on Ladder Holds Workman's Tools



Time lost in going up and down a ladder after tools is saved with this tool shelf

Painters, carpenters and others who often have to work on a ladder will find this tool shelf a time saver. It is quickly attached to two adjacent rungs on the ladder to hold tools conveniently at any height. Two flat-iron props, forked at the lower ends, straddle one rung, and support the front side of the shelf, while two hooks driven into rear edge of the shelf fit over the other rung.

Oilcan Has Washer on Spout to Lift Spring Caps

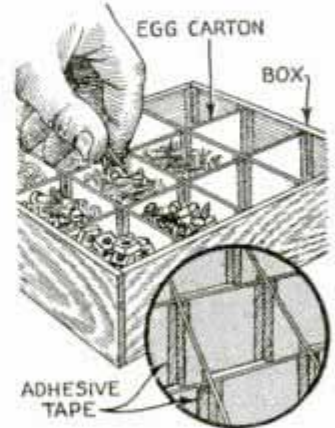


When a dust-proof oiler is used in a hard-to-reach position on a piece of machinery, a small washer soldered to the oilcan spout will solve the problem of lifting the spring cap. A small copper washer from a harness rivet is

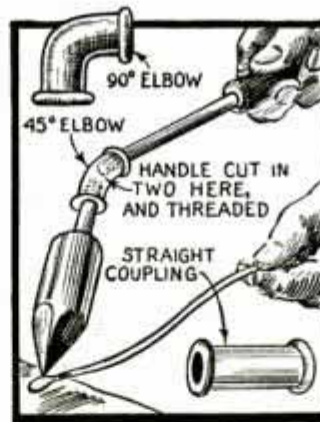
just about the right size for this purpose.—Roscoe Osborn, Vermilion, S. Dak.

Small-Parts Kit Improvised from Egg-Case Separator

With a few strips of adhesive tape, the average egg-case separator can be set inside a box and made rigid enough to hold small parts such as screws, nails, nuts, etc., properly separated and easily accessible. Besides reinforcing the corners, the tape is used to hold the lower part of the separator firmly on the bottom of the box.



Usefulness of Soldering Iron Increased with Elbows



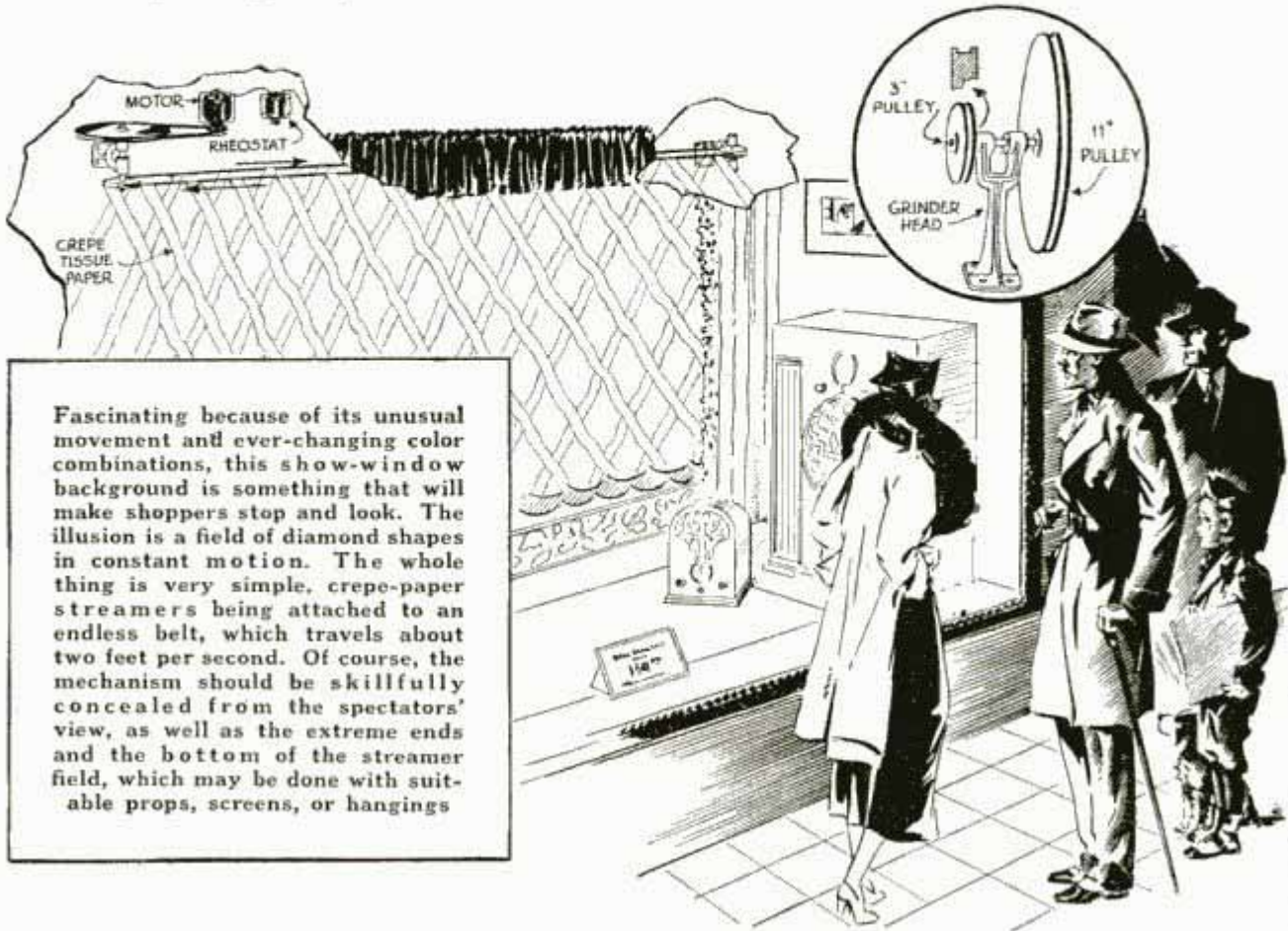
By simply sawing a soldering-iron handle in two and threading the severed ends, you can connect them with 45 or 90° pipe elbows to hold the end of the iron at different angles. When a straight-handled iron is needed, re-

move the elbow and screw on a pipe coupling.—W. C. Wilhite, Edelstein, Ill.

Getting Clear Detail in Photos of Light and Dark Objects

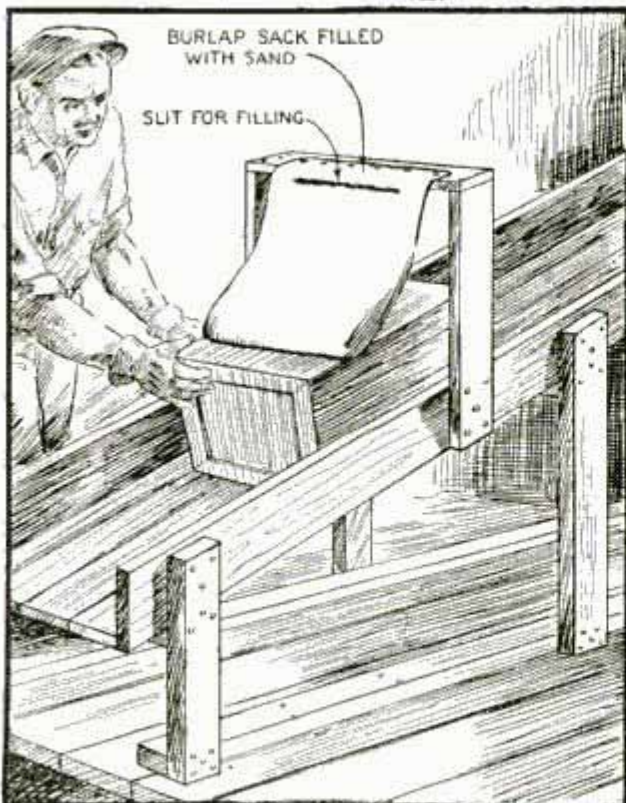
When photographing a picture which has a very light subject in the foreground and a very dark subject in the background, I find it best to use the longer exposure time necessary for the dark subject, and then develop the film only about two-thirds the normal developing time. This enables me to bring out the detail of both the light and dark objects.—Wayne G. Gross, Tilden, Nebr.

Store Display Has Ever-Changing Background



Fascinating because of its unusual movement and ever-changing color combinations, this show-window background is something that will make shoppers stop and look. The illusion is a field of diamond shapes in constant motion. The whole thing is very simple, crepe-paper streamers being attached to an endless belt, which travels about two feet per second. Of course, the mechanism should be skillfully concealed from the spectators' view, as well as the extreme ends and the bottom of the streamer field, which may be done with suitable props, screens, or hangings

Sandbag Brake Checks Speed of Boxes Coming Down Chute



Speed of boxes sliding down chute greatly retarded by sudden impact against sandbag at lower end

In a factory where boxes of merchandise are sent down a chute to the loading platform, this brake is used at the lower end of the chute to slow down the movement of the boxes. The brake is merely a sack filled with sand and suspended above the chute as shown. A slit near the top allows sand to be added or removed to get the necessary resistance.

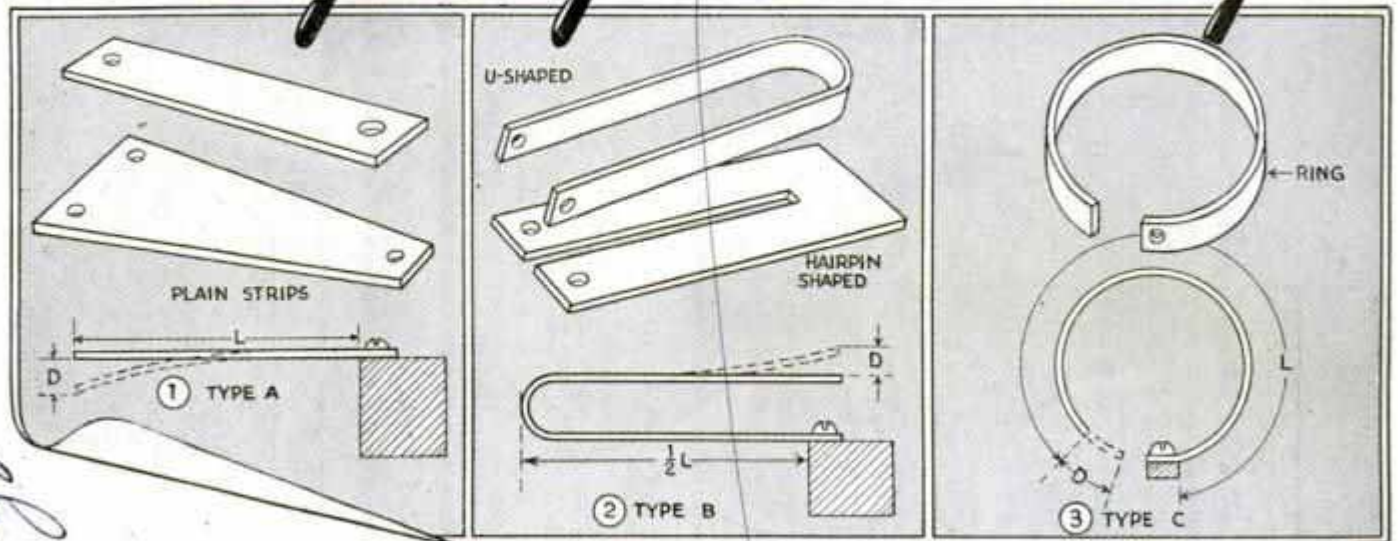
Dense Smudge in Orchards by Burning Tires

Owners of small orchards may protect their trees from frosts at little cost by following the method of a California orchardist. Without any expense for smudge pots or crude oil, this man collects a supply of discarded auto tires, distributing them in his orchard. When danger of frost comes, he pours a little gasoline on each tire and ignites it. The tires burn readily, sending off heat and dense clouds of smoke. —Oscar H. Roesner, Live Oak, Calif.

W. M. Chace & Co
 4743 W. Lake. Chicago
 also - 1600 Reed Ave. Detroit Mich.

Designing and Building

Shop notes say Technical Service Bureau 2680 N Clark Chicago

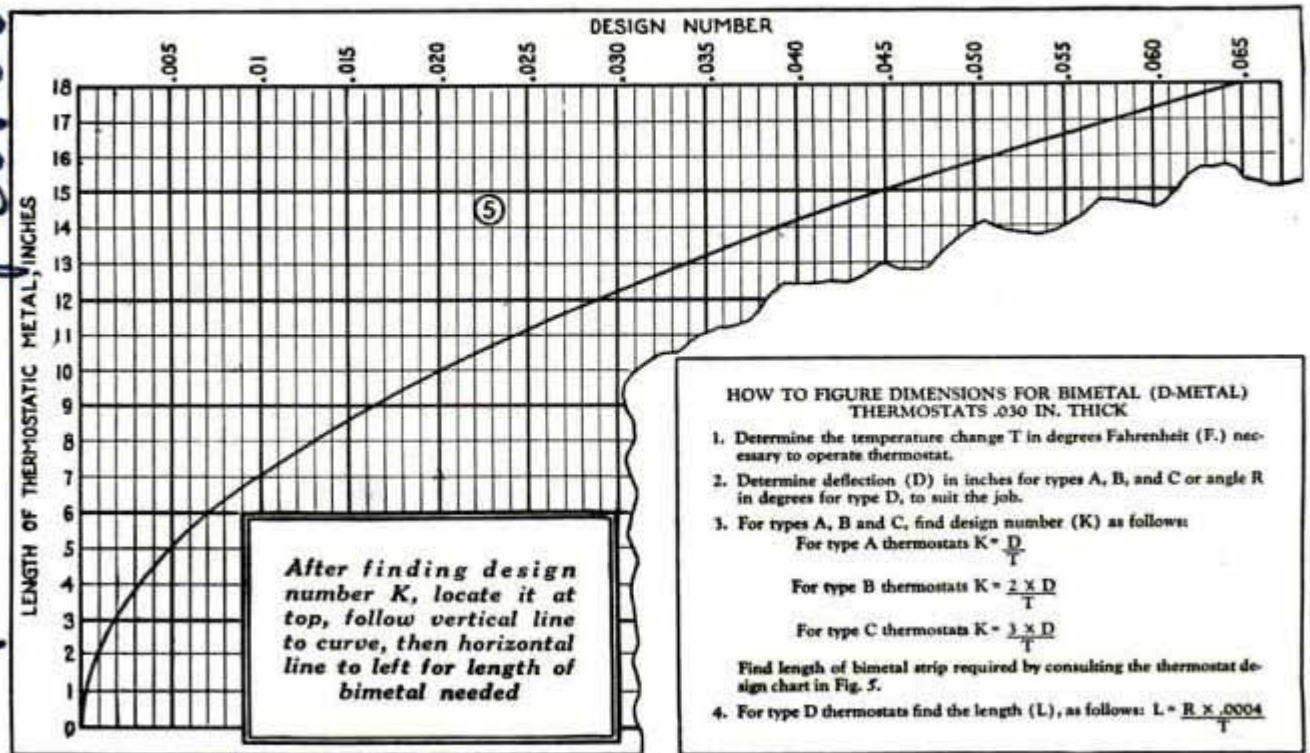


Straight strip thermostats, type A, are used where a temperature difference of 5° F. or more is allowable, as in electric irons, toasters, tire vulcanizers, water heaters, etc. U-shaped and hairpin thermostats, type B, are for sensitive units where vibration of the element must be reduced or where space limitations prevent use of strip thermostats. Ring thermostats, type C, are used for constricted spaces

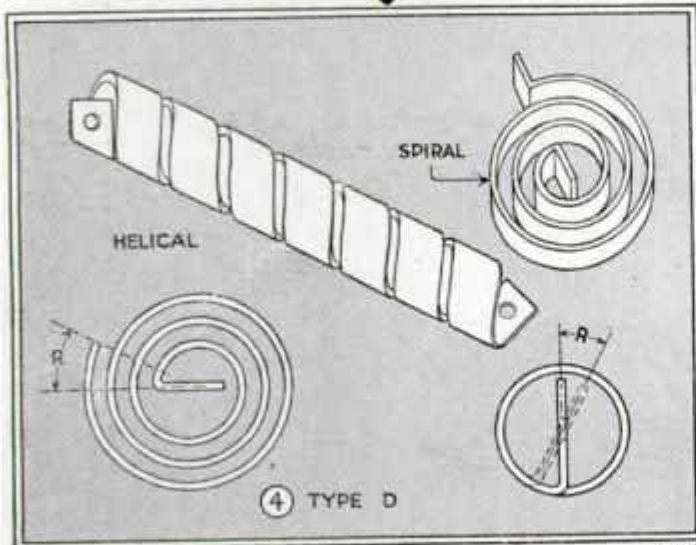
By C. A. CROWLEY

AS A METHOD of automatically controlling temperature, bimetal thermostats are used in hundreds of practical, everyday applications from flatirons to air-conditioning units. Constructing thermostats for almost any job is purely a matter of design and careful workmanship in assembling as each thermostat must be

figured for its own particular application. Therefore, to convey as much usable information as possible, this article will show how to design various types of thermostats from .030-in. bimetal, giving the principles of construction and arrangement, without involving complicated technical details or mathematical calculations.



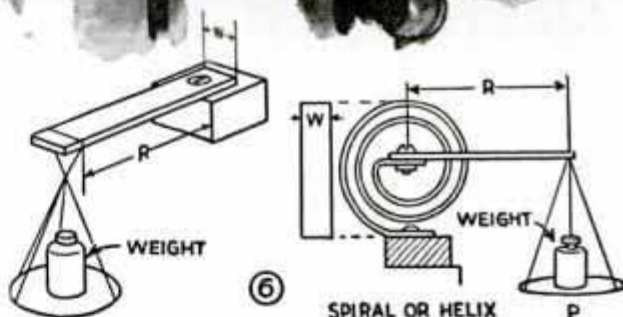
THERMOSTATS



Helical and spiral thermostats, type D, are capable of producing a large movement within relatively small temperature variations—especially suitable where rotary motion is desired

How a Thermostat Works: Thermostatic bimetal consists of two sheets of metal fused together—one having a high rate of expansion when heated and the other a very low rate. This bimetal has the property of bending when heated, always away from the metal which has the large expansion rate. When in doubt as to the expanding side, heat the strip with a match and note the bending. A standard grade of bimetal known as D-metal .030 in. thick, and having an active working range of from -50 to 800° F., can be purchased in sheets and strips at low cost. The metal will stand $1,200^{\circ}$ F. without injury; however, it is only sensitive up to 800° F.

Fig. 1 shows a plain strip type of thermostat, which is used to open and close electric circuits when several degrees of temperature can be allowed. As an illustration, the unit may be used when a heater must be turned on at, say 70° F. and off at 75° F. Subtracting 70° from 75° gives 5° as the temperature difference which must operate the bimetal element. In all cases where temperature difference, called T in the formulas, is used, the difference between the high and low value of temperature is to be used. Of course, straight strips can be used when the temperature difference is more than 5° with



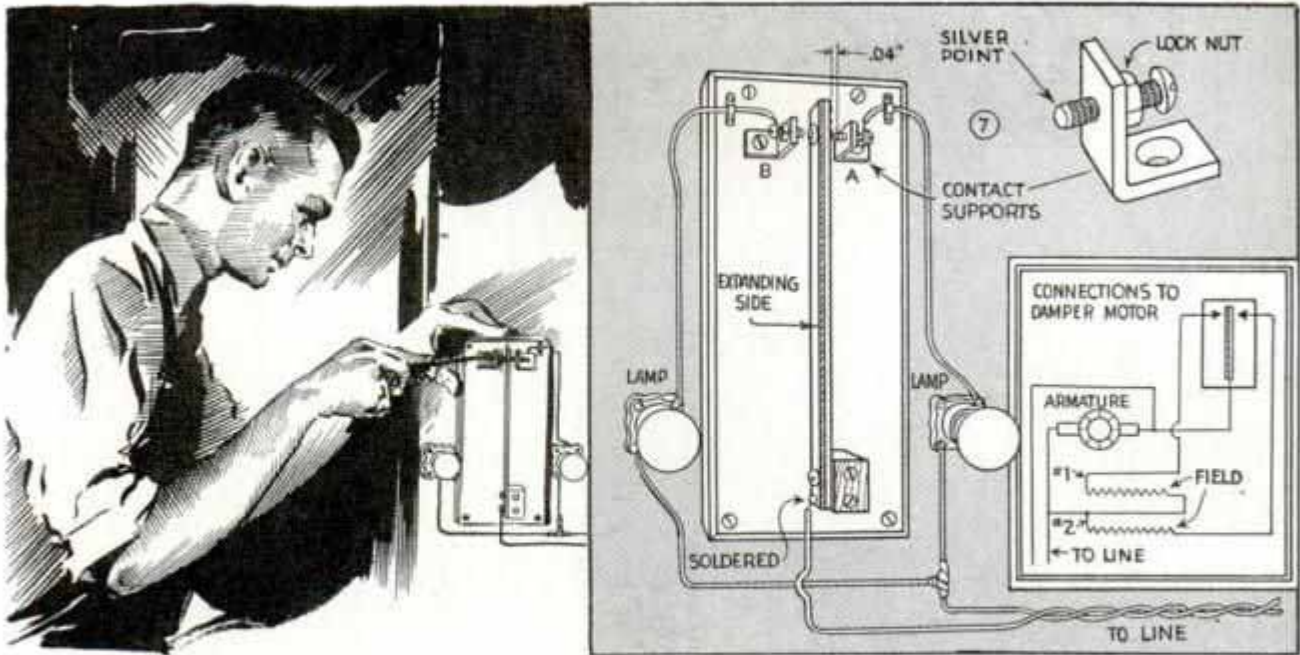
$$\text{PULL IN LBS.} = \frac{W \times S}{6 \times R} \quad \left| \quad \text{WIDTH OF STRIP REQUIRED} = \frac{6 \times R \times \text{PULL REQ. IN LBS.}}{S}$$

(SEE TABLE BELOW FOR VALUE OF S)

USE PROPER VALUE OF S TO SUIT HIGHEST TEMPERATURE OF THERMOSTAT			
TEMPERATURE	S	TEMPERATURE	S
150° F.	27.0	700° F.	13.5
300° F.	22.5	900° F.	9.0
500° F.	18.0	1200° F.	2.7

Pull of any thermostat in pounds can be calculated readily by following this simple method

even more efficient results. For operation on a smaller temperature difference a spiral or helical unit should be used. Straight strip thermostats are used to control the heat of electric irons, toasters, waffle irons, tire vulcanizers, water heaters, ovens, room thermostats and aquarium thermostats. Fig. 2 shows the U-type and "hair-pin" type of thermostats. The latter is made by cutting a slot into a flat strip of



One of the most popular applications of the thermostat is for controlling furnace dampers. This drawing shows the connections for testing the thermostat while the insert shows how to modify a 6-volt motor to serve for damper control. Silver contacts, which minimize arcing, are provided on the movable end of the thermostat and on the adjustable screws A and B

bimetal. The movement of the U-shaped section of metal is indicated as bending upward, which means that the brass or expanding metal is on the inside of the U. If the U-shape were bent in the opposite way so that the brass would be on the outside, the U would tend to close when heated. This form of element is used for sensitive units where a straight strip would be in the way or when it is desirable to reduce vibration in the element. The movement of the U-shaped element is one-half that of a straight element of the same total length; however, the pull or force which it exerts is twice as much provided the width of the strip is the same in both cases. U-shaped elements are used in some water-heater thermostats, damper controls, gas-stove safety pilots, chicken brooders and incubators, and fire alarms. Fig. 3 shows a ring type of thermostat. The element is bent in such a manner that the brass is on the outside of the ring. The movement produced by the ring unit is one-third as much as is produced by a straight strip of equal length. This form can be used to advantage when space is at a premium. It is used in some air-conditioning thermostats and for purposes where small size is important. Fig. 4 shows methods of forming thermostats which will produce large movement with a minimum of temperature change. The helical

and spiral forms are used when rotary motion is to be produced by heat. In designing a thermostat it is first of all necessary to decide upon the type of unit which is to be built. This is determined by considering the movement required of the unit as already explained. To explain the use of the design charts, we will work out a complete design for a straight strip thermostat.

Designing Straight Strip Thermostats: We will first work out all of the details required to build a furnace-control thermostat such as is shown in Fig. 7. When the temperature becomes too high the thermostat must close the furnace damper by operating a damper motor, and vice versa. Special damper motors may be used or a 6-volt, a.c. or d.c. motor may be modified by winding two fields in place of one and connecting them as shown in the detail of Fig. 7.

To find the length of the bimetal strip needed, first assume values for the movement of the element required to make and break the electrical circuits. A movement of .04 in. will be satisfactory in most cases. The thermostat should turn on the heat when the temperature drops to, let us say 68° F. and turn it off at 76° F. Subtracting 68 from 76 gives us 8° as the temperature difference, which must cause the thermostat to move .04 in. Consulting the

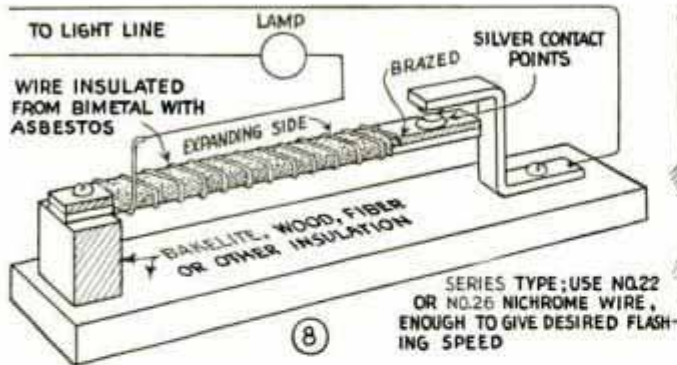
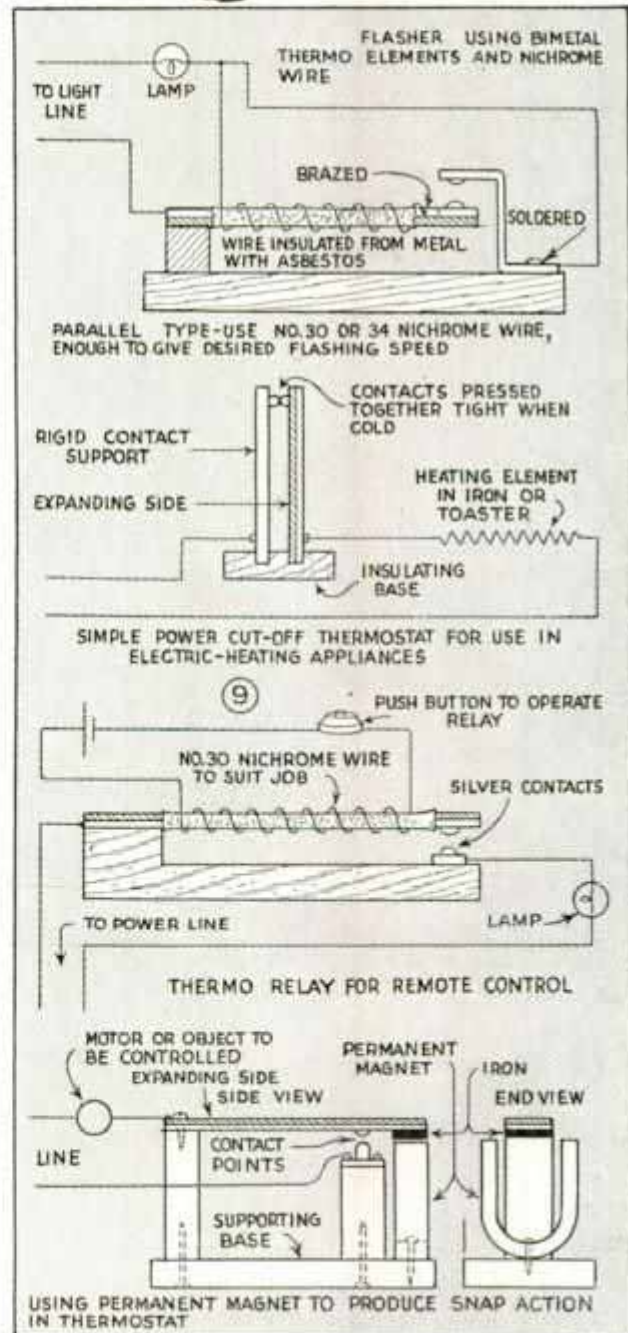


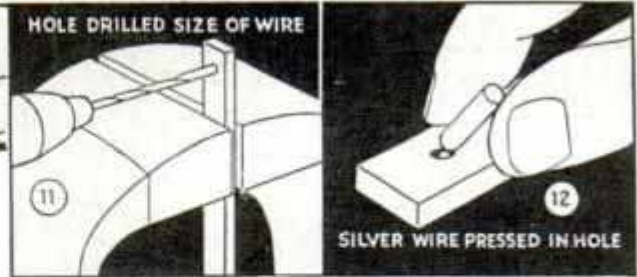
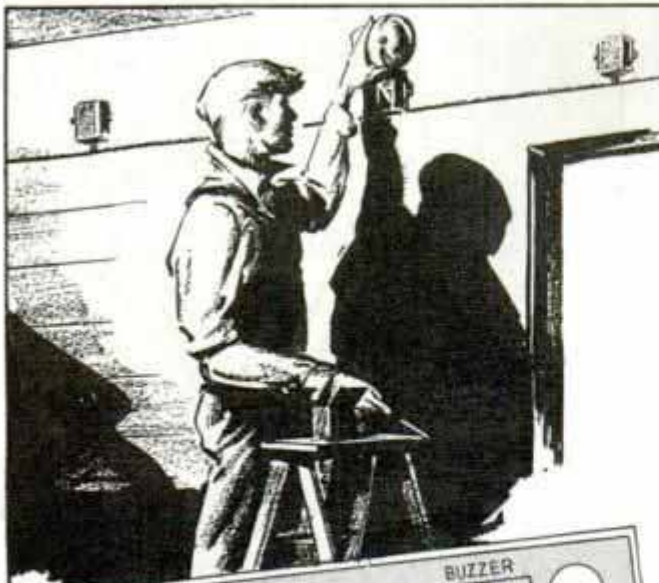
Fig. 8 and the upper detail of Fig. 9 show two types of flashers using bimetal thermo elements and Nichrome wire. The second diagram of Fig. 9 illustrates how to make a simple power cut-off thermostat for electric-heating appliances while the third detail gives a thermo relay for remote control, and the last one an application of a permanent magnet to produce snap action in a thermostat



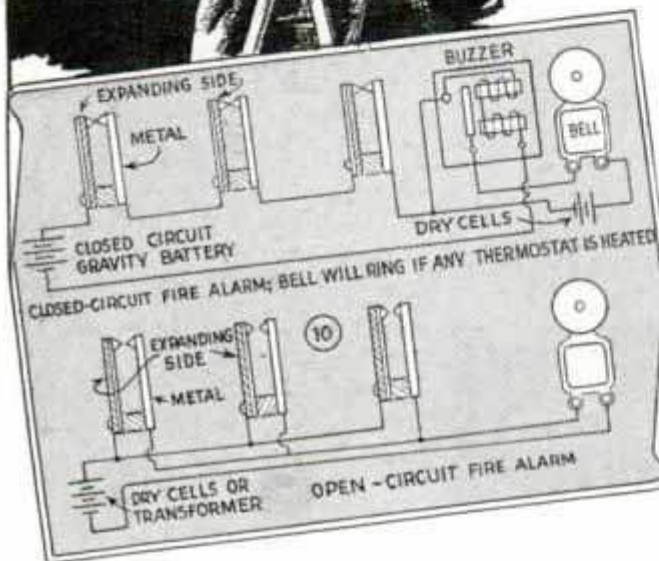
formula, Fig. 5, we find that the design number for a thermostat to do this job is calculated by dividing D (the distance which the metal must move) by T (the temperature change which must cause this movement). Thus, dividing .04 by 8, we get .005 as the design number. Next, we will turn to the chart, Fig. 5, and find this number, .005, at the top of the chart. Following the .005 line up to the curve and then the coinciding horizontal line to the left, we find that the thermostat should be 5 in. long, that is the distance from the point at which contact is made to the point of mounting. It will be necessary to use a strip somewhat longer so as to have enough metal for mounting the unit on a wood or insulating base and for the riveting of contacts.

A thermostat of this type will not need to carry an appreciable load; therefore, it will be unnecessary to calculate the pull. We can simply use good design judgment and make the strip $\frac{1}{2}$ in. wide and depend upon it to work satisfactorily. If the strip were 10 in. long it should be about $\frac{3}{4}$ in. wide to produce ample rigidity. Accordingly, we can cut a strip of D-metal $\frac{1}{2}$ in. wide and 6 in. long. The method of mounting the strip can be worked out to suit any particular case. The important thing is that the strip be mounted rigidly upon a base and that the fixed contact points be rigidly fixed so that they cannot vibrate or move. After the thermo element has been set up as shown and connected to light bulbs for test purposes, as in Fig. 7, the contact points should be so adjusted that the element will close on A when the





Figs. 11 to 14 picture the steps of fitting a silver pin in a strip of thermostatic metal to provide good mechanical and electrical contact



Here are two fire-alarm circuits in which use is made of thermostatic metal at the contacts. In the closed-circuit type, an interruption of current causes the bell to ring, while in the open-circuit type the making of a contact produces the same result

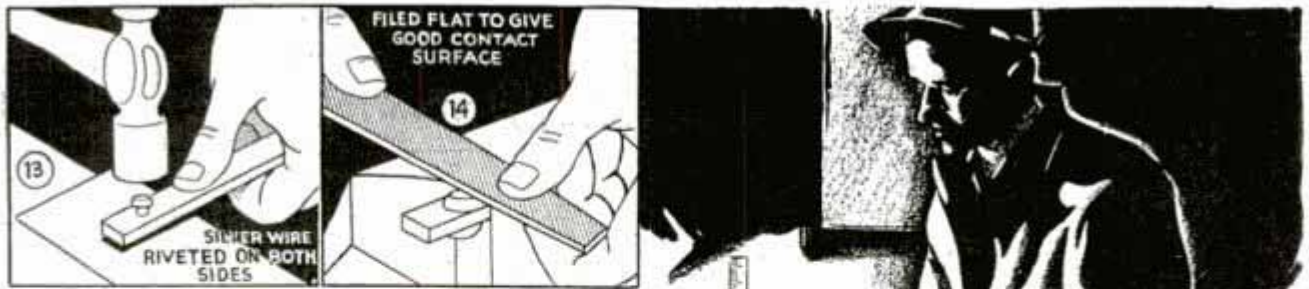
temperature is 76° F. It should then be allowed to cool and the contact point at B should be adjusted so that it closes on the other side when the temperature reaches 68° F. In some cases, thermostatic elements do not work very accurately when first made and may possibly require aging, by alternately heating and cooling 25 or 30 times. After this treatment, the units will usually work accurately. Heating and cooling are effected by placing the unit in an oven to heat and removing it to cool. If it is necessary to figure the pull of a strip unit refer to Fig. 6 for the formula.

Designing U-Shaped Thermostats: U-shaped thermostats give just half the movement that would be produced by a straight thermostat using the same total length of metal. Their ability to move a load is twice as great. To illustrate the

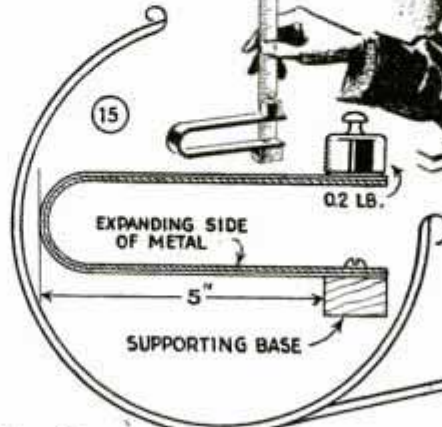
methods used in designing U-shaped thermostats, let us assume that we wish to build a thermostat like the one shown in Fig. 15. The thermostat is to be designed in such a manner that the U will bend upwards to lift a weight of .2 lb. .1 in. The weight may be a spring or other load which the unit must move when heated. Let us also assume that we want this weight to be lifted this distance when the temperature changes from 80° F. to 90° F. Subtracting 80 from 90 gives us 10° as the temperature change. Referring to the formula for U-shaped thermostats, Fig. 5, the design number is found by multiplying the distance to be moved by 2 and then dividing this result by the temperature change. Performing this, we get 2 times .1 or .2 in. Dividing .2 by 10 we get .02

as our design number. Referring to the design chart, Fig. 5, we find that the total length of metal required will be 10 in. Next, we will figure the width of metal required. Referring to Fig. 6, we find that the width of strip needed equals 6 times R times the pull, divided by S, a value which will be found in the table. R is the bending length, which must support or lift the weight. Referring to Fig. 15, we see that the weight is to be applied at one end of the U; therefore R will be 5 in. Multiplying R or 5 times 6 times .2 lb., we get 6. If the thermostat is to be operated at a temperature of 300° F., the table in Fig. 6 tells us that S or the number we must divide into 6 to get the width of strip required is 22.5. Dividing 6 by 22.5 we get .266 in. as the minimum width of strip which can be used to give the desired pull. To make the width in even numbers we can cut it to $\frac{5}{16}$ or $\frac{1}{2}$ in. and be safe.

Ring-Type, Spiral and Helical Thermostats: Ring-type thermostats are designed by following the formula in Fig. 5. The



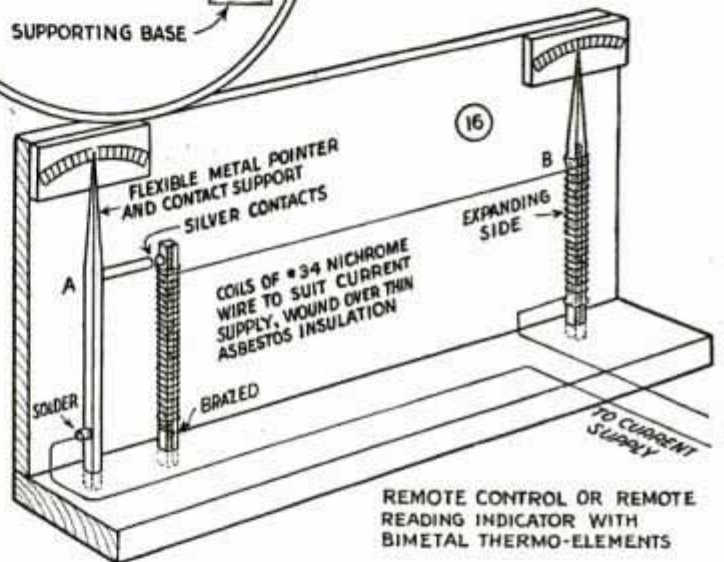
The method shown in Fig. 15 is used to measure the movement of a U-shaped thermostat under a weight equivalent to the load it is to move. When this is done the thermostat must be brought from minimum to maximum temperature as in actual operation condition—usually by means of a resistance-wire winding illustrated in other diagrams. The principle involved in making a remote-control or remote-reading indicator with bimetal thermo elements, is shown in Fig. 16



design number for this type of unit is found by multiplying the distance through which the end of the ring must move by three and dividing the answer by the temperature difference which must cause the movement. The length corresponding to this design number can be found in the chart. The pull which the ring-type thermostat will deliver will be found by the methods explained under U-shaped thermo units.

Spiral and helical thermostats are used when a small change in temperature must cause rotary motion. See Fig. 4. With any given length of thermo metal wound in either spiral or helical form, the amount of angular movement will be exactly the same. To find the length of metal needed for these thermostats first determine the number of degrees of movement shown as R in Fig. 4. A protractor will be found convenient. The length of metal required is found by multiplying the number of degrees of rotary motion by .0004 and dividing this answer by the temperature difference.

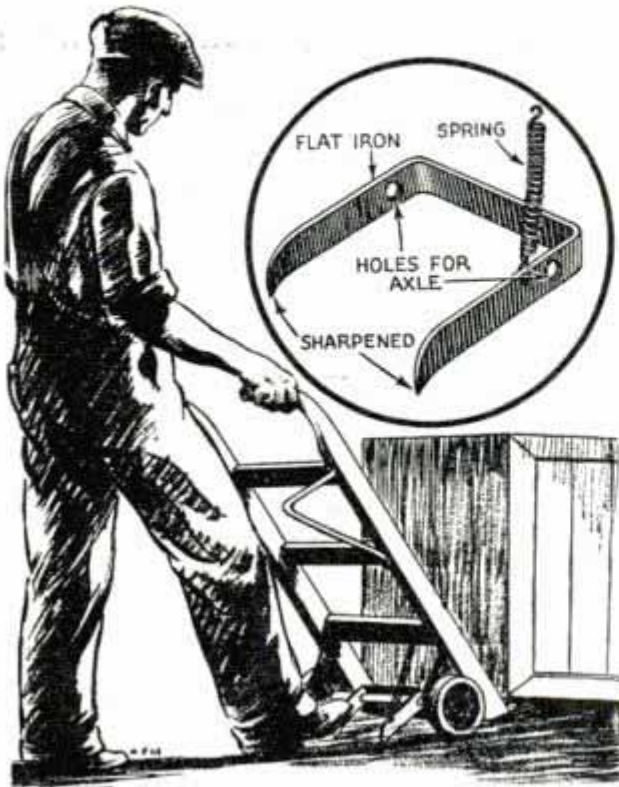
Electrical Contacts: Thermostats should be fitted with contact points which will carry electricity without arcing. These may be purchased ready made or you can make them from silver wire. Figs. 11 to 14 show a method of using silver wire for contacts. Silver wire in various sizes is available from any jeweler.



Special Types of Thermostats: Figs. 8, 9, 10 and 16 show a number of uses for thermostats. In all cases the length and width of metal required may be figured as explained. Nichrome wire is used to wind heating coils for many thermostats. The bimetal element should be covered with thin asbestos paper and the wire wound over this to prevent short-circuiting. Thermostat coils connected in series like the one in Fig. 8 should be wound with No. 22 or No. 26 Nichrome wire. For heavy loads use No. 22 wire. The amount of wire used is best determined by experimenting until the proper speed of operation is produced. Thermo units connected like the upper one of Fig. 9 should be wound with a heating coil of either No. 30 or 34 Nichrome wire. In this case the exact length will depend upon the voltage and speed of operation required and is best determined by experiment.

*Riverside Metal Co
New York City*

Brake Holds Hand Truck Steady to Load Heavy Crates



Brake bites into floor and prevents wheels from rolling back when load is tipped onto truck

Bent as shown and pointed at the ends, a length of flat iron will make a good brake on a hand truck which is used for moving heavy crates and boxes, as it can be pressed down against the floor when the beak of the truck is forced under the load. A coil spring pulls up the brake when not in use. If the spring is unhooked and the brake is allowed to drag, it is useful when pushing heavy loads up an inclined platform or gangplank as it prevents the truck from slipping back.

Slotted Gripper on Printing Press Is Removed Quickly

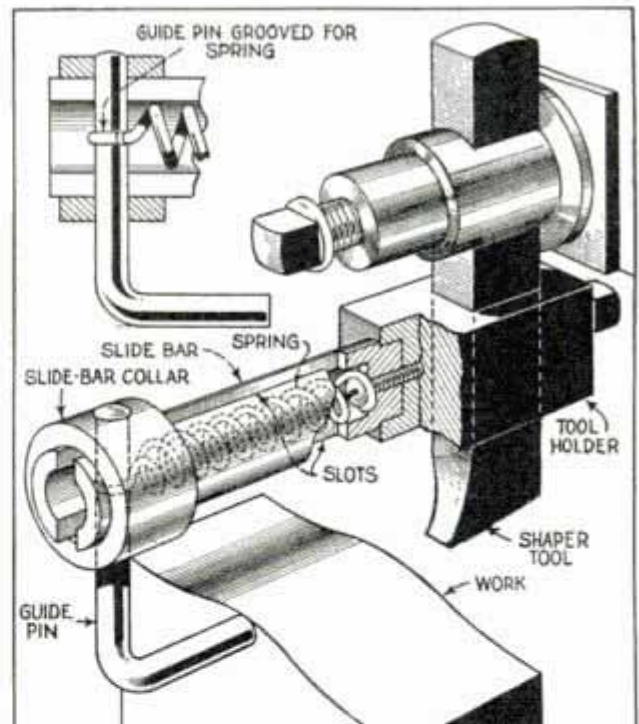


On printing presses having grippers of the type shown, which slip over square bolts on the gripper bar, much time can be saved when removing the grippers from the bar if one of their ends is slot-

ted. This permits the grippers to be removed or put on by loosening the nuts, making it unnecessary to entirely unscrew them.—T. R. Rice, Walla Walla, Wash.

Tool Guide for Profile Shaping

Particularly useful when shaping irregular work, this tool guide does not move in relation to the backward and forward motion of the tool, therefore the position of the tool with regard to the layoff lines can be seen at all times. The guide consists of a tool collar, slotted slide bar and an extension spring. The collar slips over the end of the bar and carries a guide pin, which is attached to one end of the spring and works in the slot. The other end of the spring is held under the head of a large machine screw, which attaches the slide bar to a tool holder. This is clamped to the shaper tool with a set screw. In use, the assembly is adjusted up or down on the shaper tool until the latter just

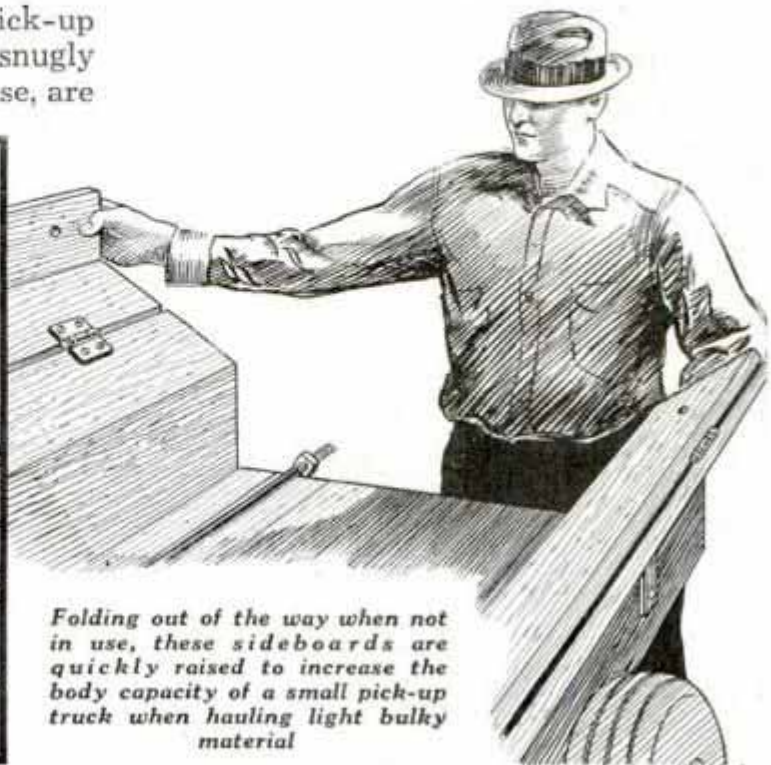
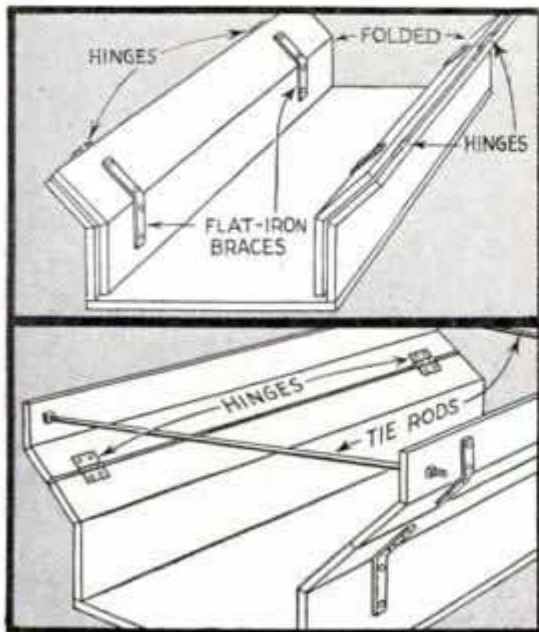


Pointer remains stationary against side of work, making it easy to follow the guide line

clears the guide pin. Then the table and tool post of the machine are moved in the usual way, but no notice is taken of the position of the shaper tool, the operator's attention being directed solely to the guide pin by which the tool adjustment is gauged.

Folding Sideboards on Truck for Bulky Loads

Hinged to the flared sides of a pick-up truck, these sideboards, which fold snugly inside the truck body when not in use, are



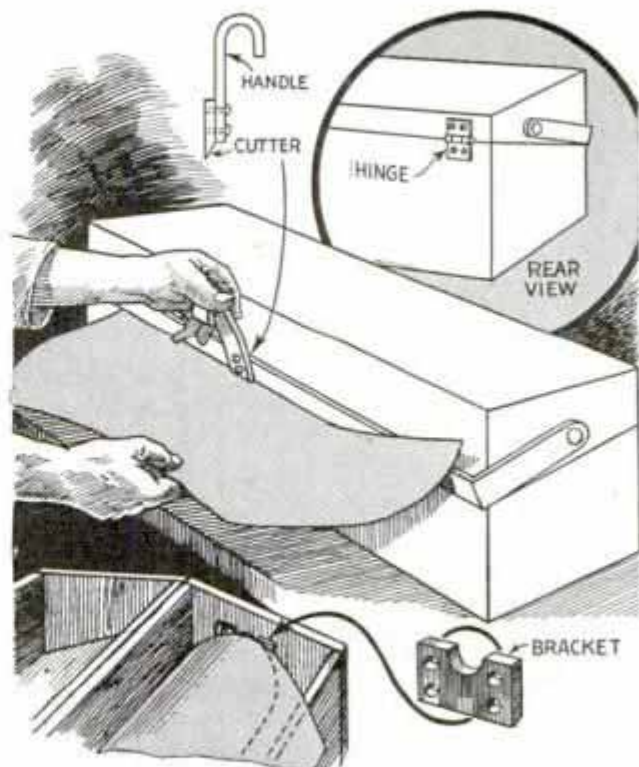
Folding out of the way when not in use, these sideboards are quickly raised to increase the body capacity of a small pick-up truck when hauling light bulky material

quickly brought into service for hauling light, bulky loads. Each sideboard consists of two pieces of hardwood joined at an angle with flat-iron braces, the angle being the same as that of the body side members. For a neat job, the abutting edges

should be beveled. The built-up sideboards are then hinged to the sides of the body with heavy butt hinges. Two $\frac{3}{8}$ -in. iron tie rods threaded at each end and provided with double nuts, support the sideboards when open.

No Waste of Blueprint Paper with This Box and Cutter

Any amount of blueprint paper can be drawn from this box and cut off squarely and to exact length required without waste of paper or loss of time, while the roll is always kept in the dark. Both the lid and top of the box are cut off at corresponding angles as shown, and the lid is hinged at the back. For a cutter, a piece of flat iron bent at right angles, as indicated, is pivoted to the ends of the lid so that the lower edge will strike the side about $\frac{1}{4}$ in. below the bottom of the lid. The cutter is ground to a sharp edge. With this arrangement the paper always projects from the box about $\frac{1}{4}$ in., so that it can be pulled out easily. The roll of paper, of course, is swung between two brackets screwed to the ends of the box on the inside.



☛ Rubbed against aluminum, a pine stick leaves a black mark when the metal is heated to proper annealing temperature.

Oil Cans Used for Containers Have Pipe Finger Grips



Pieces of pipe slit along one side and hammered over edges of cans, serve as finger grips

When discarded oil cans are used around a shop or farm as containers, short pieces of $\frac{3}{4}$ -in. pipe fitted over opposite edges of the cans make good finger grips to carry them. The pipes are slit lengthwise along one side with a hack saw, after which they are slipped in place and hammered to close the slits tightly against the metal.

Rubber Stamps Cleaned Easily with a Bottle Brush



When cleaning rubber stamps apply the cleaning fluid with a small bottle or percolator brush, rubbing the bristles back and forth across the letters. The bristles of these brushes are so soft that they will not mar the rubber, yet stiff enough to reach into the recesses of even a small stamp.

Durable Crucibles for Casting

Recommended by a silversmith who for many years used it in making his own crucibles, the following fireproof composition is inexpensive and no parting oil is

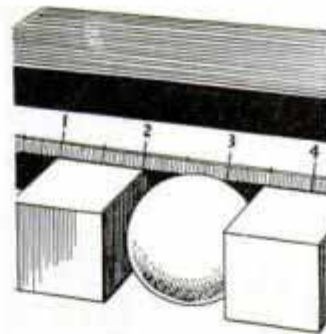
needed between the mold and casting. To make the composition, mix portland cement, 10 parts, plaster of paris, 4 parts, fire clay, 3 parts, and asbestos powder, 1 part, with enough water to make a thick mass. For an extremely hard casting, bake the mixture in a hot oven.

Burring End of Screwdriver Gives It Grip

If a screwdriver has a tendency to twist out of the slot in a screw head, give the end of the blade a few taps with a hammer to burr it slightly. The sharp edges of the burr will bite into the sides of the screw slot.



Measuring Diameter of Balls

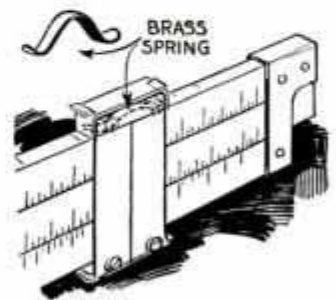


It's very simple to find the diameter of a ball or other spherical object, by placing it between two blocks and measuring across the top of them with a scale. If very accurate measurements are necessary, the blocks should be absolutely square.

Brass Spring on Slide Rule to Avoid Rust Spots

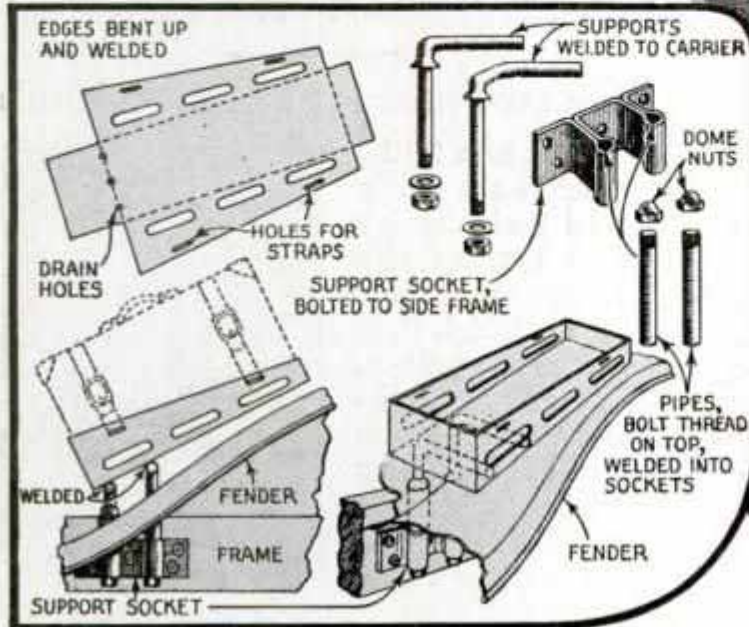
To eliminate spots and streaks on the edge of a slide rule that are caused by rust from the steel spring on the indicator, remove the spring and replace it with one of spring brass.

As a further protection, clean the brass thoroughly and dip it in clear metal lacquer to help avoid corrosion.



This Sheet-Metal Luggage Rack Is Removable

Slipped into place quickly, this luggage rack is located over the front fender where it cannot mar the car finish and will not interfere with opening the door. It is



Here's a carrier for that extra suitcase. There's nothing to rattle and no part of carrier or luggage can touch the car finish

mounted on a bracket bolted to the car frame under the front fender. The sheet-metal carrier is held about an inch above the fender by a pair of iron brackets welded to the bottom. These are L-shaped, flanged to fit into sockets welded to the

bracket, and the lower ends are threaded for nuts and lock washers. Upper ends of the pipe sockets are threaded for chrome-plated dome nuts. The carrier is made of $\frac{3}{16}$ -in. sheet iron, cut to the pattern shown, slotted, and then welded at the corners.

Fenders Shielded Against Flying Stones on Gravel Roads



Motorists who drive on graveled roads often find that their fenders are dented by small stones thrown against them by the tires. These dents not only mar the appearance of the car but are starting points for rust. To avoid this trouble, some owners cement strips of composition roofing to the undersides of the fenders. To do this, rubber cement is used, two coats being applied to both the fenders and strips, allowing the first coat to dry before applying the next. When the last coat is dry, the roofing strips, which should be about 6 in. wide, are pressed firmly in place.—C. E. Packer, Chicago.

☛ For cementing abrasive paper to sanding disks, melt together tallow, 3 oz., and rosin, 1 oz., casting the mixture into sticks, which are then held against the rotating disk until it is well coated.

Snowdrift Against Garage Doors Pulled Away on Carpet



It takes only a moment to clear away a heavy blanket of snow so that garage doors will open freely

Physicians and others who must have their autos ready for instant use, need not spend valuable minutes in shoveling the snow away from the garage doors if a burlap carpet is left spread upon the driveway. The burlap should be hemmed at the ends for insertion of stout poles to which pull ropes are attached for rolling back the carpet. If a thin layer of sand is sprinkled over the driveway before the carpet is spread, there will be no danger of the burlap freezing to the concrete, and it may be left in place all winter.

Emergency Pump Diaphragm Improvised from Celluloid



If the diaphragm in a fuel pump breaks on the road, an emergency repair to get to a garage can be made from a piece of photo film. When this happened to my car, I

removed the diaphragm and used it as a pattern to cut the film, after which both

pieces were put in the pump. Then the pump casting was replaced and holes were punched in the film, the repair being completed by bolting the assembly together. After driving the car 25 miles to a garage, the improvised diaphragm was still "going strong."—J. R. Flaherty, Springfield Gardens, Long Island, N. Y.

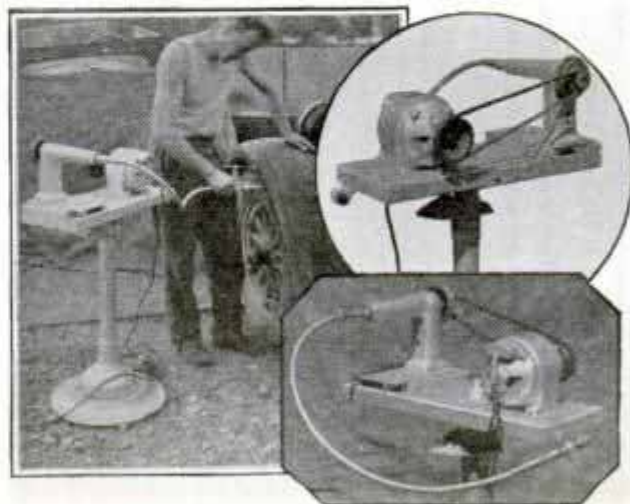
Center-Punching Name on Tools

You can initial your tools neatly and quickly by first typing the letters on a slip of paper, which then serves as a pattern in center-punching the letters on the tools, using rubber cement to stick the paper in place. Punch uniformly at close intervals over each typewritten letter. This will go through the paper into the steel, giving a neat and legible impression.



Portable Drill for Small Shop Has Flexible Shaft

Improvised from scrap parts, this electric drill was made by a mechanic for use in various parts of the shop as well as for making minor repairs to cars at the curb. The drill consists of an electric motor, sewing-machine head and a flexible shaft, which are mounted on a short plank. This

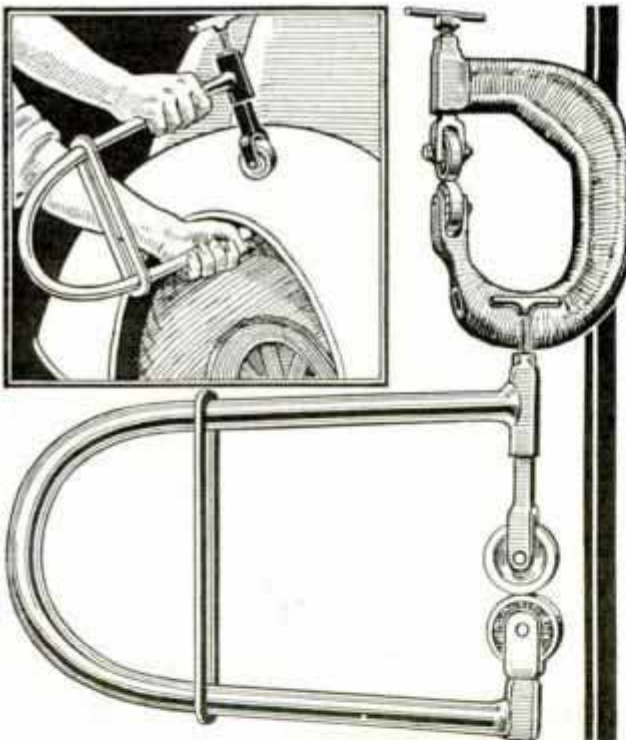


Base of the drill is any piece of metal heavy enough to keep the unit from upsetting

pivots on a standard, which is one half of an old rear-axle assembly, the plank being drilled to slip over the projecting end of the axle where it is held with the axle nut. Both the sewing-machine head and the motor are fitted with step pulleys, the flexible shaft being fastened to the outer end of the sewing-machine shaft.—Edward Lindberg, Sherman, N. Y.

Tools for Rolling Out Fenders Made from Old Bearings

Any mechanic can make a set of tools to roll out crumpled fenders by using old ball bearings, which are fastened to C-frames. These may be any size needed and are made of heavy iron or tubing as shown. One bearing is held in a forked piece welded to the lower end of the frame, while a second bearing is mounted on a square, forked pin, which moves in a socket welded to the upper end of the

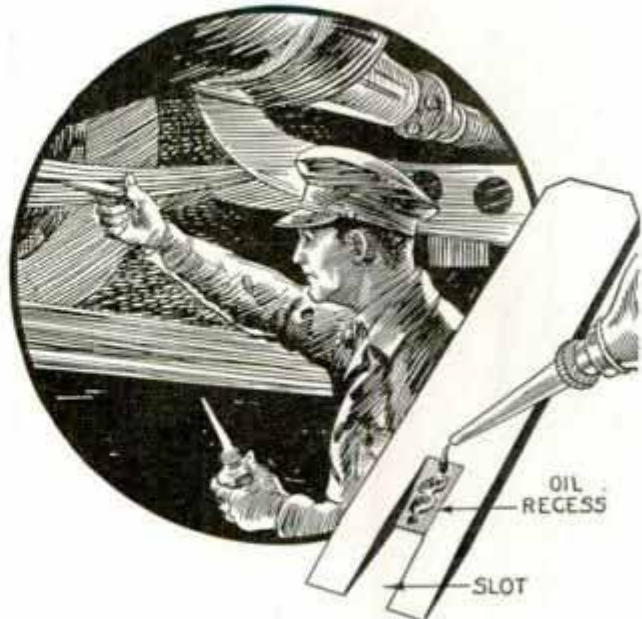


Upper bearing assemblies move in square sleeves and are adjusted with thumbscrews

frame. A large thumbscrew at the top of the socket regulates the adjustment. On tools having a large throat, a sliding brace of square iron rod helps to hold the adjustment.—Jos. C. Coyle, Phoenix, Ariz.

☞ Film cement, when applied sparingly, can be used as an adhesive for Cellophane.

Lubricating Wedge for Springs Gets Oil Between Leaves

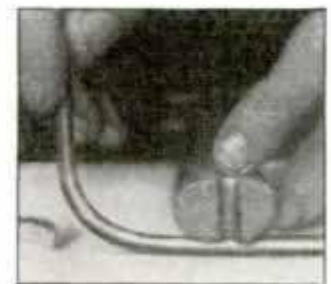


Slot in wedge is beveled at rear end to carry oil between the spring leaves

To lubricate auto springs with the assurance that the oil will be well distributed between the leaves, use a leaf spreader similar to the one shown, which has a slot in one end to allow the oil to flow to all parts of the leaves. The spreader is simply a piece of steel ground to a wedge shape at one end and then slotted, the rear end of the slot being beveled to carry the oil from the can spout in between the spring leaves.—Lester P. Young, Culver, Ind.

Copper Tubing Bent at Angles by Grooved Hammer Handle

If you have occasion to make sharp bends in small size copper or brass tubing, away from the bench where tools for such jobs are kept, a simple



dodge in bending without kinks is to make use of a hammer handle in which a groove has been cut as shown. The combined action of pressing the handle firmly against the inside radius of the tubing, which fits in the groove, and gradually bending the tubing, does the trick. In this way, the tubing is slightly flattened which facilitates making the bend.

Ham Is Supported Vertically for Easy Slicing



You'll be surprised how uniformly a ham can be sliced when it is supported rigidly

In restaurants, lunchrooms and other places where many hams are used, the job of slicing can be simplified greatly by supporting them rigidly in a vertical position on the shank end. A good support for this purpose is made by driving a large spike through the center of a piece sawed from the end of a large plank. If the shank end of the ham bone is sawed off to expose the marrow, the spike can be inserted into this as shown.

Metal Drilling Chips Removed by Compressed Air

When it is difficult to remove drill chips, once they get inside of work such as tanks, manifolds, crankcases, etc., you can prevent the entrance of such chips by building up the internal pressure with a connection to the compressed-air line. Of course, the interior must be airtight, all holes being plugged, and the pressure should be about 1 lb. per sq. in. When the drill breaks through the wall, chips are blown outward.

The Next Issue

IDEAS IN DESIGNING YOUR SOAP BOX RACER

Chock full of suggestions that will help you in designing your own car for the biggest American race. First of a series of articles showing advantages and disadvantages of various types of frames, brakes, steering mechanism, etc. Tells how to assemble the parts rigidly and neatly, using either wood or steel.

PHOTO ENLARGER FOR FIVE DOLLARS

Six lamps assure uniform illumination of the entire negative area in this enlarger, which is constructed from scrap parts and utilizes your camera lens.

VANITY MIRROR OF MODERN DESIGN

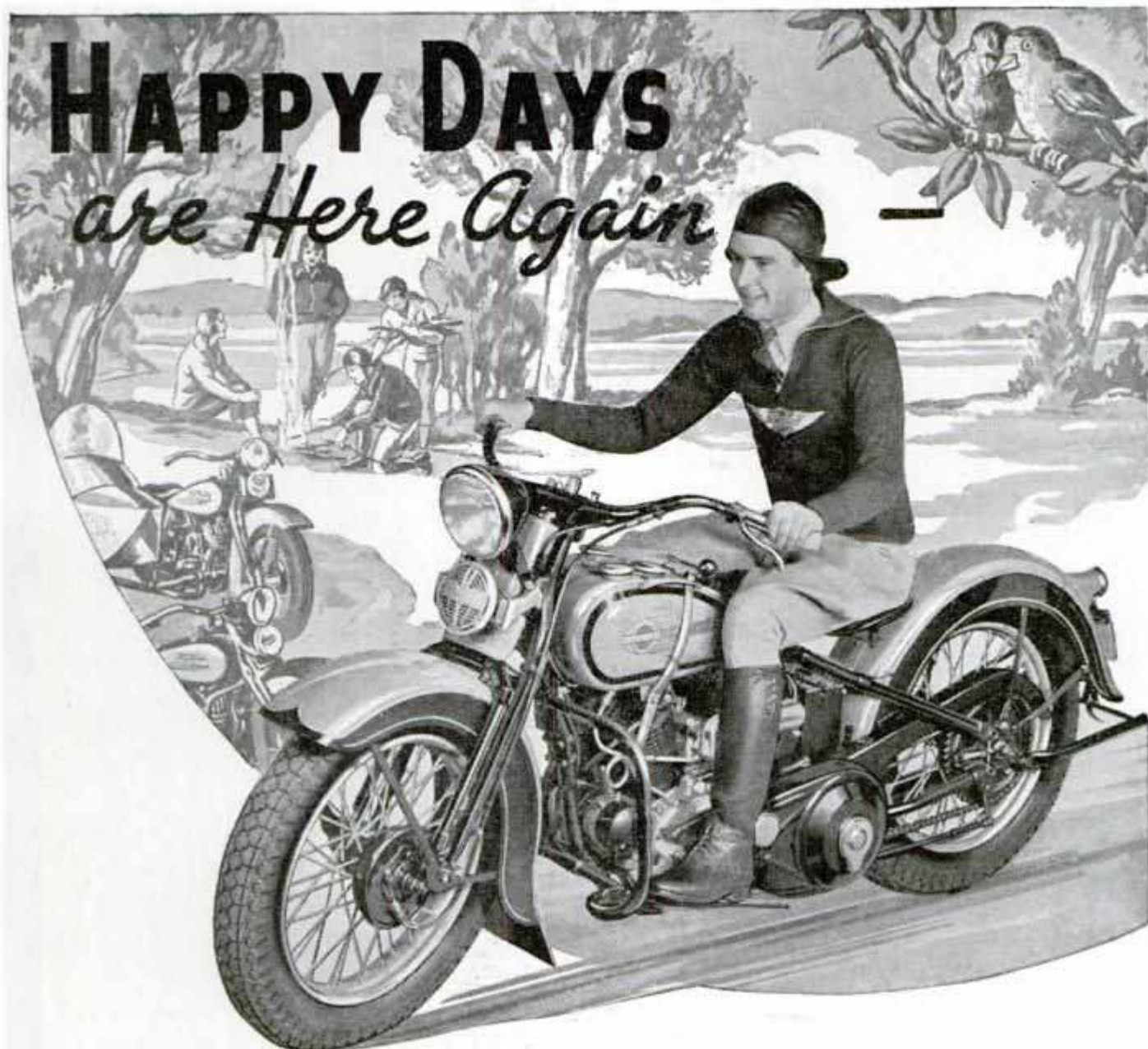
Combining mahogany and brass tubing in a simplified construction that produces a smart effect in table mirrors. For use on a vanity or hallway table.

ELECTROPLATING WITH ALLOYS

Thoroughly describes every step of this interesting process so you can successfully plate with brass, bronze and cadmium-silver alloys on a small scale.

UTILITY SEWING CABINET

Consisting merely of a box mounted on two turned legs, this sewing cabinet is fitted with sliding trays to keep sewing accessories neatly at hand.



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"GET A LIFT WITH A



THE TOWERS OF MANHATTAN from a new angle—New York's new Triborough Bridge, which is rapidly being completed. In the foreground: Howard Hougland, McClintic-Marshall engineer, wearing the picturesque engineers' "hard hat," a necessary protection on big jobs. "An engineer's life," he says, "calls for physical fitness and energy. When my pep is at low ebb, there's nothing like a Camel, for a Camel chases away all signs of tiredness. I always get a 'lift' with a Camel. I have preferred Camels for years because of their good taste and mildness. They never irritate my throat. That's one way you can tell Camels are made from more expensive tobaccos."



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LISTEN TO THIS BUSINESS GIRL. Eve Miller, New York department-store executive: "I smoke Camels because I appreciate mildness and delicacy of flavor. I found, in addition, that Camels give me a 'lift' whenever my energy is low."



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WINTER SPORTS TAKE ENERGY TOO. But to enjoy the fun you have to be fit. "And that's why I prefer Camels," says Margaret Lynam. "I know that athletes approve of Camels, as they do not disturb their wind. And that goes for me too."



Shooting in the Dark

(Continued from page 564)

Another way is to load the camera, extend the lens to "infinity" position, place a sheet of opaque white paper over the lens, point the camera at the sky or an electric lamp, and snap the shutter at a fairly high speed, such as one one-hundredth of a second, with the lens wide open. The best shutter speed can be found by trial. After pre-fogging, reset the shutter but do not wind the film ahead until after the picture is taken. Some cameras with automatic film feed will not permit this method to be used.

By subjecting the film to ammonia fumes, or bathing it in an ammonia solution and then drying in dust-free air, it also is possible to increase the original speed. It is, however, difficult to determine just how much the speed was boosted, and how long the film will remain in its hypersensitized state. Generally it is best to use the film within a few hours, or at least before a day has passed. Hypersensitized film kept in a refrigerator will retain its speed for several days or a week or more. Some kinds of film, when kept for more than two or three days in a refrigerator, are affected by moisture so that, after development, the back coating resembles ground glass.

There are supporters of both the ammonia fuming and wetting methods. The former put the unexposed film into a light-tight box or an empty developing tank, then release ammonia fumes which act on the film emulsion. Pieces of blotting paper soaked in strong ammonia and placed in the bottom of the tank are convenient. The fuming continues for several minutes, the best time being determined by trial.

For bathing in an ammonia solution, mix four parts of twenty-eight per cent ammonia with 100 parts of water. Bathe the film in this for about one minute at fifty degrees Fahrenheit. Then dry the film rapidly, with the aid of a fan if one is available, in a room or box where photographic chemicals or dust will not lodge on the emulsion. Film already hypersensitized can be purchased from some manufacturers.

Hypersensitized films and plates generally show chemical fog when developed

but this usually is not objectionable. In time, if the ammonia-treated film is not used, the hypersensitizing effects will wear off, and the film will return to its former speed. If you are planning to purchase a camera or lens for use where speed is important, the following table gives relative lens speeds. The table is arranged so that lenses are compared with a standard f:4.5 anastigmat.

Maximum lens aperture	Relative speed in relation to f:4.5 (approximate)
f:8	0.32
f:6.3	0.51
f:4.5	1.00
f:3.5	1.7
f:2.8	2.6
f:2.5	3.3
f:2	5.06
f:1.5	9
f:1	20.25
f:0.85	28.2

Thus, the table shows that an f:2.8 lens is about 2.6 times as fast as an f:4.5 and an f:1.5 is nine times as fast. At the present time, the 1.5 is about the fastest lens available to amateurs. It is used generally with miniature cameras employing motion-picture film. For all-around use, with an advanced type camera, an f:2 lens is preferred by many photographers.

To compare lens speeds, square the "f" values, and divide one by the other. Thus, 4.5 squared is 20.25, and 1.5 squared is 2.25. Dividing, we find an f:1.5 lens is nine times as fast as an f:4.5, or, conversely, an f:4.5 is eleven per cent as fast as an f:1.5.

The developing and printing of theater and similar pictures are essentially no different than for any other type of photography. Some care, however, may have to be taken to avoid excessive contrast, because in theater lighting the lighted areas usually are very bright, and the shadow areas very dark. A soft-working developer may be desirable, and the print generally will look best on a paper not too contrasty.

☐ Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

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—that may win you \$350⁰⁰

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\$2500 for Night Pictures

89 CASH AWARDS every month during January, February, March, 1936

2 awards of \$100 each
3 awards of \$50 each
4 awards of \$25 each
10 awards of \$10 each
20 awards of \$5 each
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\$250 GRAND AWARD

A \$250 Grand Award will be given to one of the six winners of the \$100 award; hence the grand award winner receives \$350 for a single picture.

RULES

1 Any number of pictures made on or after January 1, 1936, may be entered. Entries must be post-marked not later than midnight of February 15, March 15, and April 15—the three closing dates. Contests are open to any amateur in the United States and

Canada (except employees of Eastman Kodak Company and those engaged in the manufacture or sale of photo supplies).

2 Prizes will be awarded *only* for pictures made at night, either indoors or outdoors, by artificial light. Winners will be chosen solely on subject interest and appeal, not on technical excellence. The decision of the judges shall be final.

3 Each prize-winning picture, with negative and sole rights for advertising, publication, and exhibition in any manner, shall become the property of the Eastman Kodak Company. If winning picture is of a person or persons, their (or, if under 21, the parent's) written consent to use the picture must be furnished before prize can be awarded.

4 Each print must bear, on the back, your name, address, make of camera, kind of film, and lights. No prints can be returned. Be sure to keep the negatives.

Mail prints only to Prize Contest Office, Eastman Kodak Company, Rochester, N. Y.

FREE—a booklet, all about Night Pictures

Write for your copy of this booklet, or get it from your dealer, today. It gives complete information about Night Pictures . . . what film to use . . . how to set your camera . . . where to place the lights . . . suggests subjects. Eastman Kodak Co., Rochester, N. Y.



Winning Combination for Pictures at Night

KODAK "SS" FILM . . . the ultra-fast film with the lightning stripe on the box. MAZDA PHOTOFLOOD LAMPS . . . give brilliant light, last for many pictures, cost 25¢. SIX-16 KODAK (f.6.3) . . . will make instantaneous 1/25 second snapshots indoors, at night, when used with Kodak "SS" Film and two or three Mazda Photoflood bulbs. For 2½ x 4¼-inch pictures—\$20.

Accept nothing but the film in the familiar yellow box.



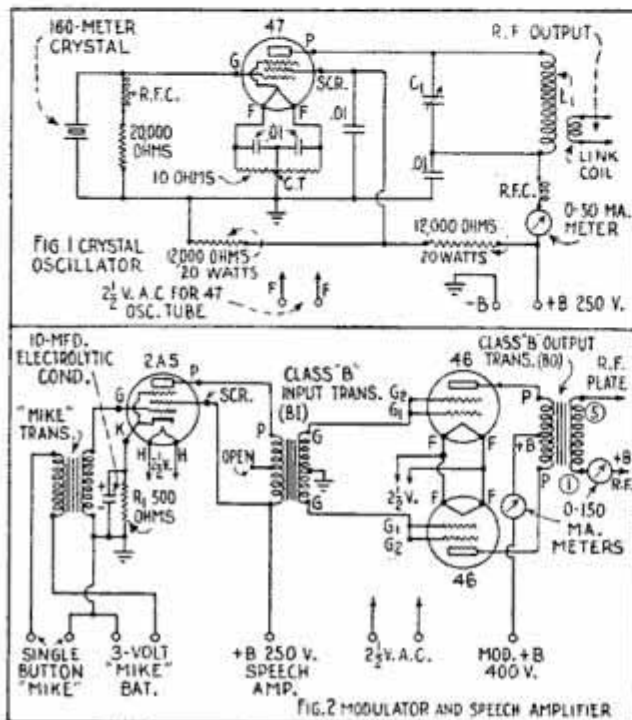
When writing to advertisers please mention Popular Mechanics

Simple Amateur Radiophone for 160 Meters

(Continued from page 584)

on the r.f. unit. Later, a twisted pair of wires will be connected between these two sets of binding posts. The sockets for the oscillator tube and crystal are located at the left of the coil and tuning condenser.

Two type-46 tubes in push-pull are

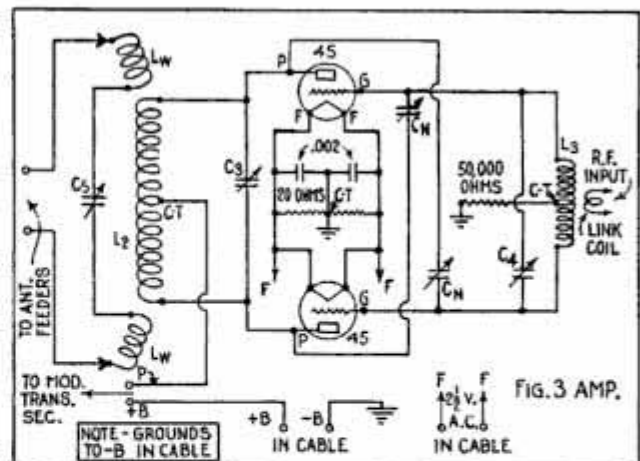


employed in the Class-B modulator; the grids of these tubes are tied together and no grid bias is required. The output, with 400 volts on the plates, is about 20 watts which is enough to modulate an input to the r.f. amplifier of between 40 and 50 watts 100 per cent.

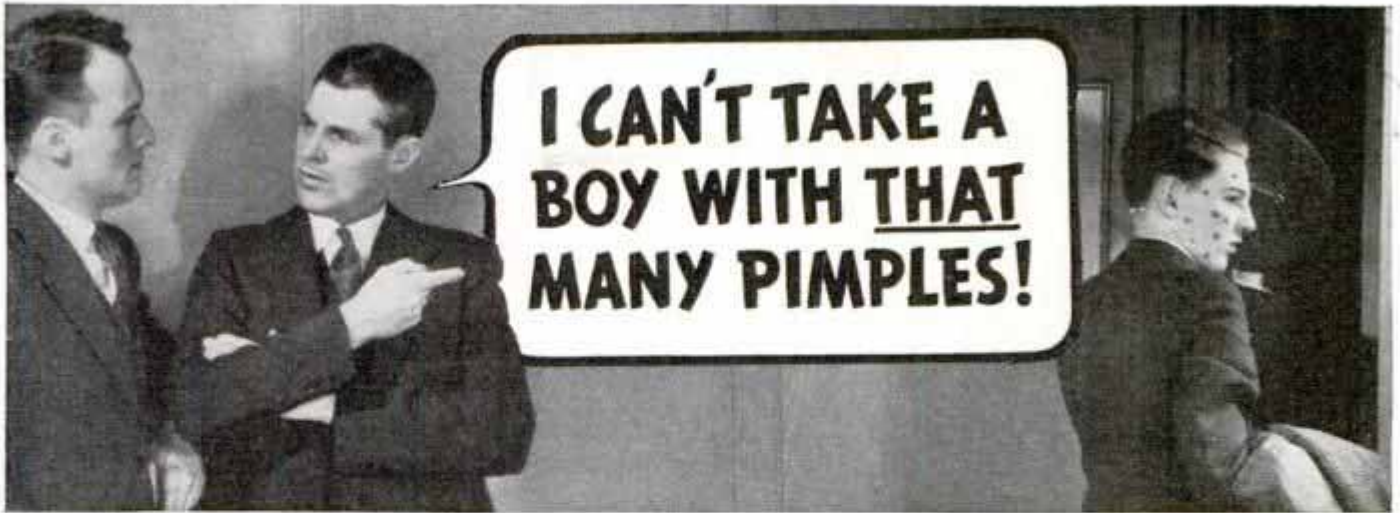
The type-2A5 driver tube in the speech amplifier is self-biased and provides ample microphone pick-up for a good single-button carbon microphone. The 7 1/4-in. Bakelite terminal strip on the extreme left of the baseboard is for the "mike" and its 3-volt battery as indicated in Fig. 2. A similar strip is mounted behind the 46 tubes for positive "B" r.f. and plate r.f. posts to the Class-B output transformer secondary, also a post for modulator positive "B" 400 volts, and one for positive "B" 250 volts speech amplifier. A 2-in. strip with two posts is mounted behind the Class-B input transformer for the 2 1/2-volt filament supply to the 46 modulator tubes, and a similar strip behind the 2A5 tube is for a separate 2 1/2-volt filament supply to the 47 oscillator and 2A5 driver tubes. The

three d.c. milliammeters are mounted on a Bakelite panel 3/16 by 4 by 11 in. Two binding posts for the oscillator plate positive "B" 250 volts, and negative "B," are on the extreme right end of the baseboard.

Construction of the r.f. amplifier unit is quite simple; condensers C_3 and C_5 , also coils L_2 and LW , are supported on small porcelain stand-off insulators. Two 7-plate midget condensers (C_2) "CN," are used to neutralize the type-45 tubes. The center-tapped grid coil L_3 , consists of 72 close-wound turns of No. 32 s.s.c. magnet wire wound on a form 1 in. in diameter. Condenser C_4 , placed across L_3 , is a 75-mmfd. midget type. The link coil is a single turn of insulated wire around the center of L_3 , the twisted ends being brought out to an r.f. binding-post strip. L_2 consists of 26 turns of No. 14 enameled-copper wire wound on a threaded National-type XR-10 coil form; wing coils "LW" consist of 7 or more turns of 1/8-in. copper tubing wound on a coil form of the same diameter as L_2 . Condenser C_3 is a National-type EMC 500 mmfd. and C_5 is the same type 350 mmfd. All power leads are cabled to this unit; positive B is 400 volts. Owing to limited space, the neutralizing and tuning data will be included with the priced list of materials which can be ob-



tained upon application from Popular Mechanics radio department without charge. Standard list prices are given on the original parts subject to the usual dealers' discount to amateurs; no other material list is authorized. A simple dual power unit, designed for this 160-meter radiophone, will appear in the May issue.



... But Jack gets a tip— AND a JOB!



Don't let Adolescent Pimples make YOU lose out

After the beginning of adolescence—from about 13 to 25, or even longer—important glands develop and final growth takes place. This causes disturbances throughout the body. The skin gets oversensitive. Waste poisons in the blood irritate this sen-

sitive skin. Pimples appear. Fleischmann's Yeast helps to correct adolescent pimples. It clears these skin irritants out of the blood. Then, pimples go! Eat 3 cakes a day, before meals—plain, or in a little water—until your skin is clear.



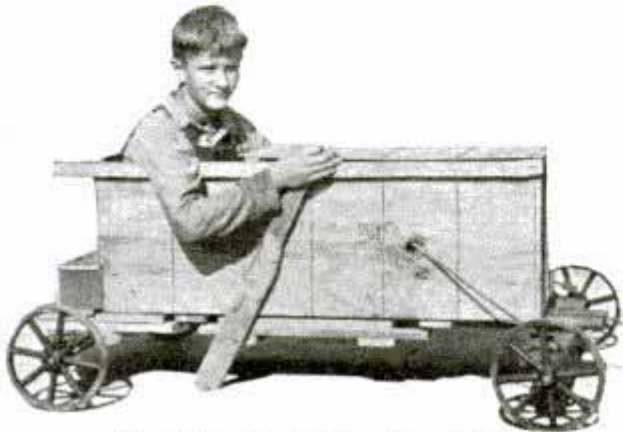
—clears the skin
by clearing skin irritants out of the blood

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F 36 How to Win the Soap Box Derby

(Continued from page 543)

straightaway racing so-called "road grip" is of minor importance compared to the reduction of rolling resistance. This fact practically prohibits the use of soft tires having a large area of road contact with its attendant high friction. The frictional resistance caused by large areas of road contact is illustrated in the case of the bicycle, which, as we all know, requires



Typical entry in Soap Box Derby

more motive effort to ride when the tires are underinflated.

The outstanding features of the tires on Maurice Bale's car (winner in 1935) probably had considerable influence on his consistent winnings. The tires were pneumatics of single-ply construction and were fitted with soft rubber inner tubes. The walls of the tubes were of quarter-inch thickness. The tire casing was also made of soft red rubber. Tests made during development of the tires indicated that they could withstand pressures of eighty-five pounds per square inch, but they were inflated to only forty-five pounds per square inch for racing purposes after tests showed that the car slowed down with lower inflation pressures, and rode hard and handled with difficulty at higher pressures.

The tire tread design comprised two grooves and the rib between these grooves formed the main supporting member. Under normal loaded conditions the width of this central rib when in contact with the road was only seven thirty-seconds of an inch. The two outside ribs were tapered to their respective sidewalls and took up the load progressively as it increased.

In reference to wheel diameter it should be borne in mind that, given two wheels

with bearings exactly alike, the larger wheel has greater leverage over the friction in its bearings than a smaller wheel. Moreover, because of its lesser curvature the tire on the larger wheel will not be deflected so much by a bump of given size. Since energy is used up in deflecting the tires, any means for reducing this action will be of advantage in increasing speed. Bearing friction must also be minimized if the highest possible speeds are to be attained.

My observations during last year's races led me to believe that the slightest wheel misalignment may be a defeating factor. The wheels should be in absolute alignment in relation to each other, and their plane should be parallel to their path of travel and at right angles to the surface upon which they run. In this case the solid front axle is advisable because it automatically aligns the wheels laterally. If this type of axle is used it is then necessary only to be sure that the front and rear axles are parallel and that their centers are on the common center line of the car in order to complete alignment of the entire chassis.

Wheel rigidity is also desirable; that is, the wheels should be more resistant to side thrust than ordinary bicycle wheels which are designed for use where the distribution of weight is in a direction parallel to and near their plane.

Another problem concerns the type of wheel to use. It is well known that the disk wheel has less wind resistance to forward motion than the spoked types, although this advantage may be negligible at the low speeds at which the racers move. The 1935 winning entry was equipped with cast-aluminum disk wheels. The over-all diameter of the wheels and tires was seventeen and one-half inches. They were very rigid laterally.

The ideal wheel and tire assembly would consist of light weight but extremely strong wheels, with widely spaced bearings adequately protected from dirt. The tires should be of small cross section having ribbed racing treads and thin sidewalls capable of supporting inflation pressures up to fifty pounds per square inch.

(Continued to page 122A)

HALF & HALF MAKES ONE SWELL SMOKE!



No Bite!



No Bite!



Still no Bite!

Meet your pipe half-way. Pack it with Half & Half. Cool as Big Ben's: "Come on, Fellow; scam!" Sweet as recalling: "It's Sunday . . . hurrah!" Fragrant, full-bodied tobacco that won't bite the tongue—in a tin that won't bite the fingers. Made by our exclusive modern process including patent No. 1,770,920. Smells good. Makes your pipe welcome anywhere. Tastes good. Your password to pleasure!

Not a bit of bite in the tobacco or the Telescope Tin, which gets smaller and smaller as you use-up the tobacco. No bitten fingers as you reach for a load, even the last one.

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HALF AND HALF

The Safe Pipe-Tobacco

FOR PIPE OR CIGARETTE

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F 76

(Continued from page 120A)

The problem of the proper tire inflation pressure for obtaining the least possible rolling resistance is a difficult one. By all means, accurately timed test runs should be made with several different pressures.

Practical designs and suggestions for building Soap Box Derby cars will be presented next month in the first of three articles by an experienced craftsman

F94

Colder Weather Is Predicted for Next Four Years

Colder winters and cooler summers are predicted for the eastern United States during the next four years. H. H. Clayton, Massachusetts meteorologist, who points out that this forecast does not mean that every season during the period will average colder than normal, bases his prediction largely on a study of correlation between past weather and sunspots. The critical cycle, in his opinion, is thirty-three years, comprising three of the normal eleven-year sunspot periods. He says that when the spots are few the weather averages warm and when the spots are numerous the weather averages cold. Spots are becoming more numerous now. The meteorologist expects a warm, dry period during the years 1944 to 1949.

Science Service
1/15/36

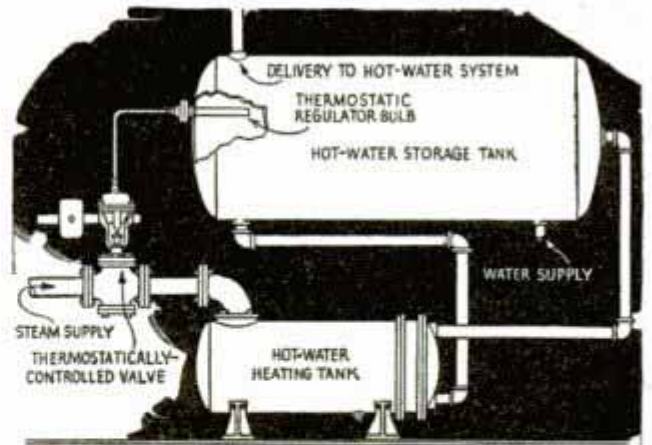
Milky Way's Strange Signals Sent by Charged Dust

That the mysterious radio signals received from the Milky Way are transmitted by electrically charged dust particles is the explanation advanced by Dr. Robert Langer of California Institute of Technology. Interstellar dust that has become charged, Dr. Langer says, is converted into a tiny radio transmitter which sends out a wave when disturbed. The surprising thing is that the dust particle, to send out a wave like those received by Dr. Karl G. Jansky of the Bell Telephone laboratories, must be only one ten-thousandths of an inch across. That is just the size of the particle known to exist in interstellar space. And the amount and character of energy received in the Jansky research are just about what would be expected from known interstellar conditions.

8/15/34
Pasadena, Calif.

Science Service
12/19/35

Water Supply Heated with Steam

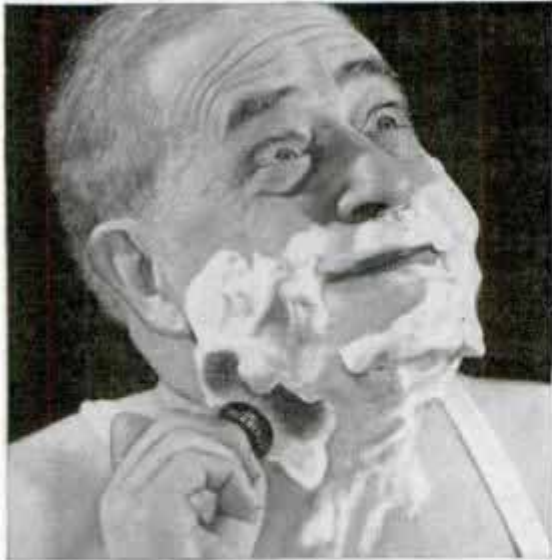


Steam Supply Must Be Delivered at a Pressure Greater Than That in the Water Mains

Here is an exceptionally simple arrangement for a self-regulating system to supply hot water. Two tanks are used; the upper one or storage tank has a thermostatic regulator bulb. This maintains the desired temperature in the tank by operating a control valve, which admits steam into the water heating tank. Thus, when the temperature of the water drops slightly, the regulator bulb causes the control valve to open and admit steam into the heating tank. The hot water in this tank then circulates upward into the storage tank, heating the water there to the point where the bulb shuts off the steam supply through the control valve.—W. F. Schaphorst, M. E., Newark, N. J.

Heating Armature of Generator to Test in Growler

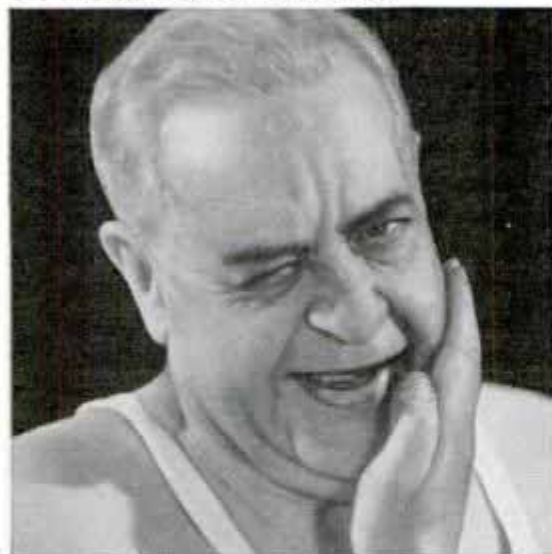
When the armature of an auto generator that is known to be faulty, is placed for test on a growler, and no amount of testing will indicate anything wrong, the trouble may be due to a difference in temperature; the armature, while running, is heated and a short circuit or ground may develop when the wires are expanded as a result of this heat. When placed in the growler, the armature cools and the wires contract. To test such a generator, connect it to a storage battery and run it as a motor, applying pressure to the armature shaft to reduce the speed. When the generator is heated, quickly remove the armature and test in the growler. This method of heating is safer than that of placing the armature in an oven.—W. C. Wilhite, Edelstein, Ill.



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2 *Smooths the skin; prepares it for easy, scuffless shaving.*



3 *Cools your face; prevents burn and after-shave irritation.*

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To put more comfort into your daily shave, we put three special ingredients into Ingram's Shaving Cream. This is how they help you—

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More than a million shavers like Ingram's because it feels grand on the face. On any skin. Because it treats all whiskers alike—softens them, takes out the pull, makes them meet the razor meekly. And like it even more because it is economical. Ingram's is *concentrated*. Three months of cool shaves in every tube or jar.

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8 1434 Who Are the Five Greatest Inventors?

(Continued from page 503)

bank notes. Bramah completed the invention in a month. He subsequently brought it to greater perfection, the figures in numerical succession being changed by the action of the machine itself. This invention is still in regular use by banks.

It was during the period when Bramah was manufacturing locks that he discovered the quality of workmanship available was not good enough to produce the kind of locks he wished and that a series of new machine tools had to be devised if locks were to be made in the quantities and quality he demanded. So he called upon Henry Maudslay, then only eighteen years old. One might dub Maudslay a Benvenuto Cellini in overalls for his delicacy of touch was unsurpassed.

The work of Bramah and Maudslay together laid the whole foundation for the standard metal cutting tools of today. Their greatest contribution was the slide rest, a tool which actually revolutionized machine production. Yet, in theory it is so simple as to sound almost absurd—it did nothing more than reverse a process used up to that time. With the invention of the slide rest it became possible to bring the cutting tool up to the metal to be cut instead of bringing metal against the tool. Why was this so important? Merely because the slide rest gave rigid support for the cutting tool, holding it firmly and allowing small, delicate cuts of measured depth by moving the entire slide rest toward the rotating work. Naturally this increased accuracy and efficiency a hundredfold, making the slide rest far reaching in its effect on industry.

Along with the invention of the slide rest came new devices for other parts of the metal cutting lathe and the beginning of the planer and slotter. The lathe is perhaps the best known of all machine tools. Every school boy who has taken a manual-training course has used one. The lathe in principle is nothing more complicated than a turning machine which, holding the metal to be cut, revolves it on a horizontal plane, permitting the cutting tool to be pressed against it while in motion. And the planer? A power-driven machine, similar to a carpenter's plane, which removes metal from flat surfaces.

The slotter, as the name implies, is a machine for cutting grooves and slots in metal.

Here, perhaps, is the answer to our original query. An explanation for the silence surrounding these machines and their inventors may lie in their very simplicity. They have been judged as "ends" in themselves instead of as means to further and greater ends, and have appeared to the layman simple, dull, homely "tools" and nothing more. We are apt to forget that through them and through them alone our whole system of mass production became possible. They are the cornerstones upon which rest the whole structure of our present mode of living. In the middle of the eighteenth century the machine-tool banner came across the ocean from England to America and for the last fifty years this country has led all others in machine-tool design and production.

Eli Whitney is the best known of any single figure in machine-tool history, although the world knows him as the inventor of the cotton gin. Yet his influence was twofold. He produced machine tools used in the textile industries and in the manufacture of firearms and he also opened up a vast new industry which called for new tools.

He was born on a farm in Massachusetts in 1765. From his boyhood he showed mechanical talent and at fifteen, during the Revolution when nails were in great demand, he began making them with the aid of such rudimentary tools as he could contrive. It was not until some time after his graduation from Yale that Whitney had his first inspiration concerning the cotton gin. In the course of an afternoon tea party, some friends remarked it was too bad someone could not devise a means by which green cotton could be separated from its seed. At that time separating one pound of the staple from the seed was a day's work for a woman.

This idea fired Whitney's imagination and he set to work. He made his first model in two weeks' time. Unfortunately, a friend showed the model to visitors and the invention was stolen and copied so

(Continued to page 126A)

DON'T GAMBLE!



GOLDEN PLY BLOW-OUT PROTECTION FOUND ONLY IN SILVERTOWNS!

Onlooker: "That was a mean blow-out you had, Mister. Is your daughter all right?"

Father: "She'll be O.K.—but I'll never gamble on tires again."

Do you realize that, unless you're protected, the chances are better than even you'll have a blow-out some day?

At speeds of 40 — 50 — 60 miles an hour, tires get blistering hot *inside*. Rubber and fabric pull apart. A blister forms and grows bigger until—sooner or later—BANG! A blow-out!

That's why the invention of

the Golden Ply makes the new Goodrich Silvertown a real *life-saving* tire. It resists internal heat. It keeps rubber and fabric from separating. It keeps blisters from forming. Thus you're protected against these treacherous high-speed blow-outs.

Silvertowns also have a "windshield-wiper action" tread that gives you maximum protection against dangerous "tail-spin" skids. They'll give you months of extra mileage, too. Yet Silvertowns cost no more than other standard tires. See your Goodrich dealer. Remember, it's better to be *safe* than sorry.

HEAT CAUSES BLOW-OUTS.
PREVENT THOSE
BLOW-OUTS WITH THIS
HEAT-RESISTING
GOLDEN PLY



FREE! Join the Silvertown Safety League. Sign the Safe Driving Pledge and your Goodrich dealer will get for you absolutely free a tail-light emblem with red crystal reflector. No obligation to buy.



The new **Goodrich SAFETY Silvertown**
With Life-Saver Golden Ply Blow-Out Protection

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IT MADE MY OLD
PEN WORK LIKE NEW.



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No matter what kind of pen you use—a Parker or any other—get a bottle of Parker Quink and your pen will start instantly—every time. The Parker Pen Co., spent \$68,000 to create Quink to guard the famous Parker Pens from ordinary pen-clogging inks.

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Quink makes all pens—steel pens and fountain pens—work like a charm. Not a watery ink—but rich and full-bodied, with a brilliancy of color that will make your writing distinctive.

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BEATS
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Very fast utility model

6/14/24
(Continued from page 124A)
that before Whitney could protect himself there were so many machines similar to his own that the government would not grant him the patent. In the end, of course, he won his law suit and was given his rightful due.

What the majority of people do not know is that had Whitney depended on the cotton gin for financial return he would have died a pauper. His law suits cost him more than the gin ever netted him. It was because of his poverty that he turned to the manufacture of firearms. This led, inevitably, to his delving deep into the matter of machine tools and spending much time and energy on them. It was through his work in manufacturing firearms and inventing the tools to make them, that the system of interchangeable manufacture was instituted.

By making possible the production of more than one complete machine or mechanism, the corresponding parts of which are so nearly alike that any part may be fitted into any of the other parts, automobiles, airplanes, firearms and all other mechanically fashioned devices may be turned out a hundred or a thousand at a time—and this "mass production" naturally lowers prices and puts "luxuries" within the range of all. Surely Whitney, not as the inventor of the cotton gin, but as the father of the system of interchangeable manufacture, deserves to be rated as one of the five men who remade the world.

And what of Thomas Blanchard? He is the most picturesque figure in our mechanical history. Born in 1788, he was the fifth of six sons. As a boy he stuttered badly and was considered by some to be half-foolish. He had no interest in farming and little more in study, spending most of his time whittling shingles, making windmills and miniature water wheels. His first invention was an apple-paring machine. At eighteen he went to work for an elder brother who made tacks. It was while working at this plant that he got the idea for making a machine that would cut and head tacks in one operation. For six years he worked at this, expending everything he earned on materials. Finally his hard labors were well repaid. He built a successful machine which he sold for \$5,000.

Blanchard next turned to the manufac-

ture of muskets for the government. It was a suggestion of his for the addition of a new motion to the lathe that would permit turning the cylindrical part and the flat and oval end of a musket barrel in the same operation that interested the government to such an extent that he was sent for by the Springfield armory. While workmen gathered to witness his new operation, one exclaimed, "Well, John, he has spoiled your job." Still another said, "He can't spoil mine, for he can't turn a gunstock." Blanchard, overhearing the remark answered, "I am not so sure of that, but I will think of it a while." On his way home, the whole principle for turning irregular forms came to him. In a short time he had built a wooden model. His amazement was almost as great as that of all the others who saw it, for indeed it turned a miniature gunstock with perfect accuracy. In 1825 Blanchard began work on a model of a steam road wagon, and by 1830 he had his own boats running on the Allegheny and other tributaries of the Ohio.

These men cared nothing for glory, or posterity's fame, but their work, in spite of their modesty, will live always. They laid a foundation upon which rest all the mechanical inventions which we already know and, necessarily, all those which are yet to come. It is significant that there have been no new machine tools invented since 1850, but only perfections of old designs, so solid was the work of these five unsung men.

Let us not forget hereafter when we lift a telephone receiver or receive a telegraphed message from California sent a half hour before; when we clean our rugs and wash our dishes with machines; when we motor south in the winter or fly west, the five men, Wilkinson, Bramah, Maudslay, Whitney and Blanchard and their five machines, the lathe, the slide rest, the boring machine, the planer and the slotter, for these five men and these five machines remade the world!

☐ Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information is kept on file and will be furnished by our Bureau of Information upon request, accompanied by stamped, self-addressed envelope.



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King of the Money Drivers

(Continued from page 556)

Keech broadside and threw him back into the fence.

The second collision with the fence tore the outer rail from the structure and 600 feet of the loosened rail sagged and stretched into U-shape across the track. Then the cars piled into the death curve one after another. The first struck Keech again, demolishing his car and catapulting him through the air. The second and third, skating on the boards at 120 miles an hour, plowed into the loosened rail hanging above the track. The lower parts of the front ends of these cars were sheared from the bodies but the impact flattened the rail down so the rest of the cars zig-zagged their way through the wrecks.

Cliff Bergere once won a race going backward. Nearly a hundred yards from the finish line his car spun when it hit a spot of oil and Bergere skidded backward down the track past the finish line in time to receive the checkered flag. But Frank James won a race when his car was upside down and going backward. He was hit by another car entering the straight-away. One of the most spectacular finishes occurred at Ascot track in Los Angeles when Orville Brummier, who was lapping the field, began the last dash for the finish flag. Another car spun in front of him, clipping both front wheels from his axles. Brummier, temporarily stunned, sat unconscious while the car plowed forward, his foot still holding the throttle down. The drive from the rear wheels and the impetus of his speed carried the wrecked car across the finish line to win the \$1,200 first prize.

Often the most thrilling part of a race is the fight between the first and second drivers as they go around the course barely a foot or so apart. Lap after lap, the second car hangs on grimly, waiting for a chance to get by. On the short tracks the stretches are not long enough to permit safe passing at high speed because of the chance of spinning on the next turn. The rules call for the leader to give room to a faster car but the officials can't always tell if one car is purposely driving wide to prevent another car from passing.

"The best way," says Mays, "is to chase your rival right down the stretch and then

shut off before he does. You go into the curve a little slower but you have better control, so you can step on the gas long before he does. Accelerating the engine at the right point gives you a chance to ride right past him coming out of the turn."

You can break into racing on the small tracks for a few hundred dollars if you assemble your own car. The best equipment available costs from \$4,000 to \$5,000 of which \$2,000 goes for a four-cylinder engine. The rest buys the chassis and a one-man body. Repairs come high on racing cars and a broken connecting rod may do damage costing \$600 to repair by springing the crankshaft, wrecking the pistons and valves, and tearing holes through the block and crankcase. Connecting rods cost \$45 each and new crankshafts cost \$225. Such parts are machined out of solid billets of steel to minimize chances of breaking.

Most drivers doubt whether Kelly Peltillo's record of 106 miles per hour at Indianapolis last year will be beaten in 1936. Fuel for the 500-mile grind will be limited to 37½ gallons, so cars that finish must average better than thirteen miles to the gallon. That means slower, more consistent driving, although drivers who hope to place among the winners expect to hit 140 miles per hour on the straight portions. More effective streamlining may be one way to increased economy although many drivers like the braking effect of the present bodies. Fred Offenhauser, builder of the engines that won first and second places last year, is experimenting with a new kind of economical fuel injection system that may replace the present carburetors on some cars. Instead of allowing the fuel mixture to be sucked into the combustion chambers, the injection system would meter portions of gasoline and air equally to each cylinder. This might permit a driver to save gasoline without greatly impairing speed. Most cars also will have compression ratios of twelve to one or better, twice as much as on the average pleasure car.

Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

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to build
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There is just a few days difference between these oils

IF YOU FOUND me putting this black, tarry substance in your crankcase, you'd never come here again.

And yet, unless it's protected by a good oil filter, this fine oil you are getting from us will be just as black and dirty and unsatisfactory in a very few days of driving.

You can't keep dirt and grit and hard carbon and metal particles out of your crankcase. But a good oil filter takes them out of the oil stream as it circulates through the lubrication system. Keeps them from forming a destructive sludge that grinds away at valves and cylinder walls and bearings. And if the maker of your car thought enough of his engine to give it Purolator protection, it is certainly up to you to keep it in service.

That is simple and inexpensive. After about 8000 miles of driving, your Purolator is so full of this sludge that it holds no more. Ask your garage man to renew it... with another *Genuine* Purolator. He'll do it in a very few minutes. Check on these statements for yourself. Use your measuring rod from time to time and you'll find that oil protected by a **GENUINE** Purolator retains its color after many thousands of miles of use. Motor Improvements, Inc., 365 Frelinghuysen Ave., Newark, New Jersey.

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THE NEW 1/4-INCH JUNIOR DRILL is a sturdy, practical tool which speeds up a thousand and one jobs around the shop, garage or home. Drives twist drills for drilling up to 1/4-inch holes in steel; wood augers up

to 1/2-inch. Also drives wheels for light grinding, wire-brushing, etc. Large easy-grip handle; sliding thumb switch; powerful Universal motor. Price only \$19.50.

THE NEW 1/2-INCH JUNIOR (not illustrated) drills up to 1/2-inch holes in metal; up to 1 1/4 inches in wood; only \$35.

NEW 7-INCH LIGHT DUTY SANDER. Saves hours of slow, laborious hand work with sandpaper, emery, etc. Ideal for cleaning and smoothing wood or metal, removing paint, rust and scale, cleaning joints, smoothing welds, etc. Flexible pad fits flat or curved surfaces. Only \$48.00.

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From the Rainbow to Concrete

(Continued from Coloroto Section)

adorn the commonplace, finds in concrete appeal, style and adaptability—for clocks, for ash trays, for bookends, for cocktail bars or for modern furniture. And in the world of recreation there has been started a gigantic construction program of swimming and wading pools, tennis courts, bicycle paths and field houses.

Here are major jobs for a coming generation. Here are jobs that will require careful analysis and calculations if they are completed with economy. Engineering is ready to meet the challenge.

Beauty with colored concrete is still far from the ultimate, but many fundamental problems are solved and substantial economies in cost of colored aggregates are anticipated in the near future.

The use of architectural concrete has effected lower cost of construction, due to the elimination of veneers and improved construction methods. But more important is the current announcement of new structural design principles with concrete. Custom has applied the same basic principles of design to concrete as to older unit types of construction. Long recognized, but not understood, principles which utilize the natural advantage of continuous action between units of concrete construction now promise amazing reductions in safe structural elements. From lightweight concrete, high-strength concrete, earth-strength concrete and vibration will come other economies.

For the less spectacular job of replacing nature's water-control system, engineering has further contributions. River beds must be enlarged, paved with concrete to stop migratory habits. More economical concretes for dams, obtained by accurate gradation of aggregates, are designed.

For roads, engineers can now use traffic counts to learn what traffic needs require and design each type of surface to meet structural and impact demands placed upon it. They have economic bridge designs to eliminate dangerous pillars and abutments; know safe curvature and super-elevation for today's needs, and know how to build rigid surfaces that stay true.

As America moves forward, we face tremendous tasks that defy; that challenge. Concrete, the magic stone, is ready to do its part in meeting the challenge.

Light-Diffusing Disk for Enlarger Has Variable Densities



Any degree of light diffusion needed is selected by simply rotating the disk to the proper screen

Made from a 6-in. disk of clear celluloid, this photo-enlarger attachment permits quick selection of a light-diffusing screen for the job at hand. By rotating the disk, any degree of diffusion can be had, or part of the exposure can be made at sharp focus and then the light diffused for the remainder of the exposure. Six circles are scribed on the disk, after which one is cut out to provide an opening for accurate focusing and sharp enlargements. The remaining circles are cross-lined into squares, these being $\frac{1}{4}$ in., $\frac{3}{16}$ in., $\frac{1}{8}$ in., and $\frac{1}{16}$ in. respectively. The area of the disk not covered by the circles should be painted an opaque color as an aid in properly centering the various screens over the lens of the enlarger. The disk is fastened to the enlarger with a brass rod drilled and tapped at one end to take a $\frac{3}{16}$ -in. screw, which passes through the center of the disk. The other end of the rod is threaded to fit one of the screw holes on the lens board.

Ⓢ Strips of adhesive tape serve nicely to bind blocks of note paper; the sheets pull away as easily as if regular binding glue had been used.

Translucid Supply Co. Inc.

He Stumbled over a MAN-EATER in the Dark



Soldier of Fortune lives to tell the story of a jungle combat between man and beast.

"It was a black, moonless tropic night," writes Gardner K. Hussey, "but I trudged along the familiar jungle path in the dark with assurance. It was the path from my timekeeper's shack to the house where I slept. Without warning I stumbled and fell headlong. There was a hissing noise followed by a sharp click. I scrambled to my feet and reached for the Eveready Flashlight in my belt . . .

Within three feet of me was a huge thrashing *alligator*, his jaws snapping like castanets.

"If my light had failed at that moment, if it were not for the *fresh* strong Eveready Batteries in my flashlight, they would probably have found some of me on that path next morning. I might even have lived...but not with all my arms and legs.

"Nearby was a boiler-room. I made for it and with the aid of a slice-bar finally finished that ghastly survivor of the prehistoric beasts.

"I think there are perhaps two morals to this story:

"First, I owe life and limb to fresh Eveready Batteries, that gave me light when I had to have it. Second, if I had been using my flashlight on that trail, I would have entirely avoided the fright of my life. No one needs to tell me now that unexpected perils lurk in familiar paths."

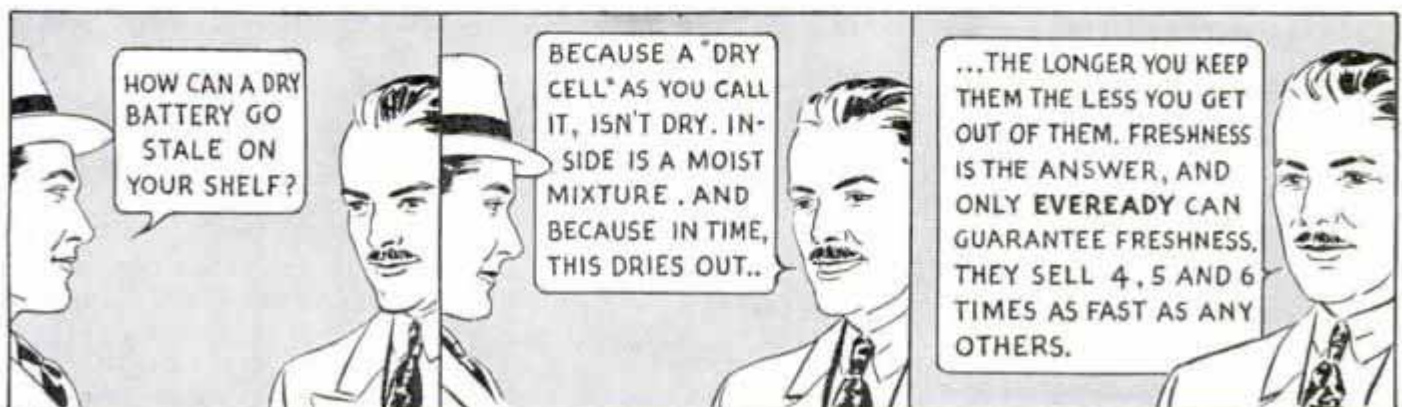


**EVEREADY
BATTERIES
ARE FRESH
BATTERIES**



Once more the DATE-LINE is a LIFE-LINE

NATIONAL CARBON COMPANY, INC.
30 East 42nd Street, New York, N. Y.



When writing to advertisers please mention Popular Mechanics



Joe Cook and one of his elaborate "inventions" in the musical comedy "Fine and Dandy"

How to cure Whisker Trouble

by Joe Cook

Comedian of Radio, Stage and Screen

I BELIEVE I was teathed on a camshaft. Maybe that's why machinery is my dish. But the machinery I saw in the Gillette factory puts anything I've ever seen way behind the eight ball.

For instance, they start out with a coil of the finest steel, and put it through more tests than a guy trying to get his first driver's license. Metallurgists "X-Ray" the steel, pop it into a furnace and burn it—take pictures of it enlarged hundreds of times. Say—there isn't a hidden flaw that can get by.

Of course the big Five-Star feature is the battery of grinding and sharpening machines which put so fine an edge on each blade that you can't even see 'em. What's more I accidentally dropped one of these blades and my guide informed me that the blade would not pass inspection. I made him prove it. We placed the blade in a magazine containing 1000 blades. We alone knew the location of the blade.

The blades were then handed to an inspector who ran her eagle eye along the mass of blades and instantly picked out the one I had dropped! That shows you how perfect a blade has to be to get by Gillette inspection.

All I can say is—that if every whisker-troubled human could only take a trip, like I did, through the Gillette plant, nothing but a Gillette edge would ever touch his face. Yes sir—I'm keen for Gillette blades—and vice versa.

Here are the facts about razor blades. Why let anyone deprive you of shaving comfort by selling you a substitute! Ask for Gillette Blades and be sure to get them.

GILLETTE SAFETY RAZOR COMPANY, BOSTON, MASS.

Modern Factories Built on Table

(Continued from page 576)

exhibition. Yet there must be no internal braces because the models must be capable of being photographed from any angle, and to give various effects. "Night" pictures of the buildings are made by placing lamps inside them, and this would cause braces to cast unnatural shadows.

The chief reason for building models of factories before they are erected is to enable the photographer to obtain pictures showing exactly how the projected buildings will look. Sometimes, after a factory is built, it cannot be photographed because of other buildings or obstructions, and a model must be made. One company has constructed shipping boxes, so each model can be sent to branch offices and elsewhere for display purposes.

Wise's model work usually is of a rush nature. He usually finds the time allotted is only a few days. However, he does his work so accurately that he seldom has to make alterations. He has worked as long as twenty hours a day for a week straight, in order to complete a job on time. One series of ten modernistic factory and power-house buildings required, on an average, thirty-five hours of labor each. Wise does all of the work himself for he never has found anyone he thinks would be successful as an assistant.

The reducing of full-size dimensions to usable values has presented some unusual problems. When the building is to be displayed or photographed with miniature automobiles surrounding it, the scale must be in proportion to the cars. Wise obtains the automobiles first, and makes the building a proportionate size. Frequently, factory units are shown with railway sidings and trains near them. The scale in such cases is seventeen-sixty-fourths inch to one foot, that being the scale of the standard O-gauge model railway equipment. Wise has built a number of scale model cars and locomotives for use with his building models.

In addition to creating factory buildings modernized as far as outside detail is concerned, Wise is turning his attention to factory interiors. He is planning a series of models showing how modern planning can transform the machine shop or other manufacturing department, and make it more efficient as well as attractive. This

work will include the making of model machinery, lighting equipment and workmen. An executive can peer inside such miniature replicas and see just how his plant would look if brought up to date.

One of his most unusual jobs, and one that took a month of steady work, was to construct a set of fifty world's fair buildings for use as table decorations at a national sorority banquet. On this job he worked entirely from photographs. He has built, for a manufacturing company, models of passenger busses. One order called for a bus model that could be opened up to show the motor and other vital parts. The installing of a complete model motor would have been costly and time-consuming, so Wise obtained several photographs of a real bus motor, cut out parts of them, arranged the pieces in proper order, and produced a strikingly realistic model.

Wise has made models of residences. Here, he believes, is one of the most promising fields for accurate scale models. More and more prospective home builders are realizing that money spent for a detailed model is a highly profitable investment.

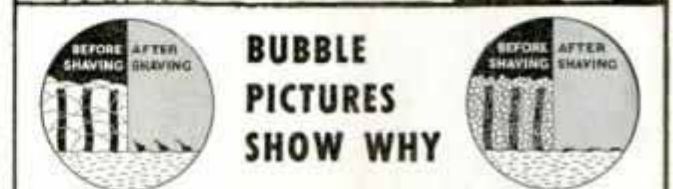
"About ninety per cent of the people who start out to build a house can't read the blueprints," Wise declared. "Most of them think they can, no doubt; but usually only an experienced builder or architect can visualize exactly how a house or part of a house will look, merely by studying the blueprints.

"The owner and his wife studied the plans for a home for more than six months, then finally decided to have a scale model built. Not five minutes after I had delivered it, the woman discovered the kitchen windows were not as she wanted them. It was easy to change the plans, but it would have been costly to make the same changes if the actual house had been built."

Models of residences, as well as other buildings, can range from a relatively simple set-up that shows only the exterior details, to elaborate take-down affairs that reveal every minute interior detail. The cost may run from a nominal amount to a sum as great as the cost of the real building.

Wise estimates that the cost of building a satisfactory model of a house in the \$10,000 class will average about \$100. This includes landscaping of the grounds. Then, the owner can get an accurate conception

(Continued to page 134A)



MOST LATHERS are made of bubbles too big to get to the base of the beard! Air pockets keep the soap film from reaching the whiskers. So the beard is only half-wilted.

COLGATE RAPID-SHAVE CREAM makes tiny bubbles that get clear down to the skin-line. Its rich soap film soaks your beard soft at the base. Makes your shaves last longer.

NEXT DAY 8 A. M.



5 P. M. SAME DAY



COLGATE "SKIN-LINE" SHAVES
LAST HOURS LONGER



YOU NEED THIS FREE HOME REPAIR BOOKLET

Contains diagrams and simple instructions for emergency and routine repairs that every home and auto owner can and should make himself. Revised



edition, greatly enlarged and completely rewritten. Get a copy for your workshop.

Be thrifty—do your own work—and keep the money otherwise paid to plumbers, repair men and for new parts.

With Smooth-On No. 1, you can stop leaks at joints, seams and cracks in pipes, boilers, heating systems, tanks, pails, auto radiators, water jackets and crank cases, tighten loose parts, reset stripped screws, bolts and nuts, and make dozens of other equally practical repairs—all at almost no cost, and in emergencies without the delay of waiting for outside help.

Smooth-On No. 1 is applied without heat or special tools, hardens into metallic iron and holds permanently under any pressure and on any metal, masonry, wood and tile. Leading power and industrial plants have used it for 35 years, and with this new booklet as a guide, you can make equally successful applications.

When you know where and how to apply Smooth-On No. 1, you will make constant savings. Be prepared. Ask us for the booklet and buy Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. can from your hardware store.



Do it with SMOOTH-ON

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574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name.....
Address.....
4-36.....

Call 1268

(Continued from page 133A)

of how it will look from any outside viewpoint; and by removing the roof, can study the exact arrangement of the interior. In nearly every case the owner finds something he wants changed—something that, had the change been delayed until the full-size house was partly or wholly completed, would have cost much more than the money spent for a model.

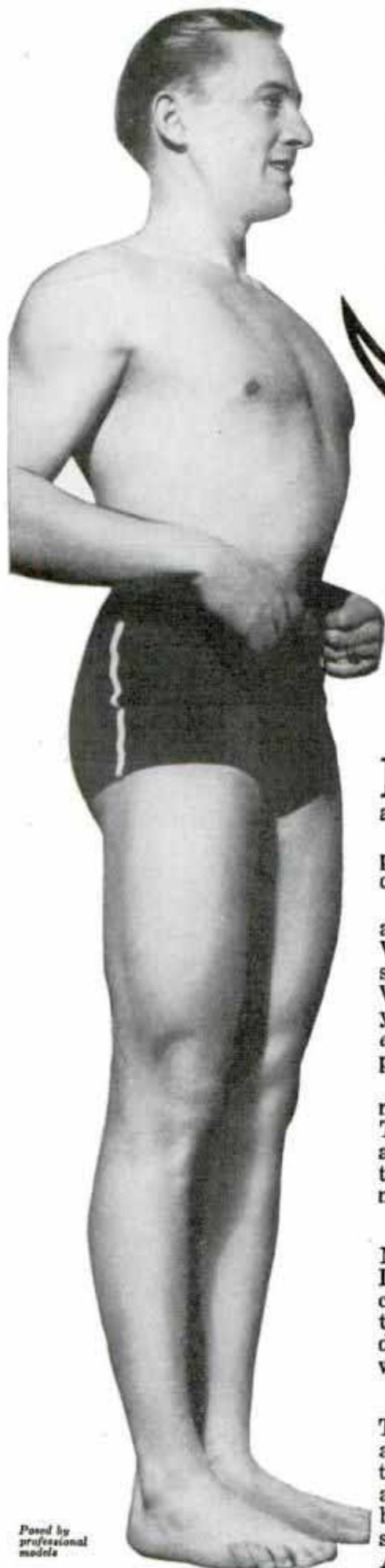
In landscaping his buildings, Wise must turn botanist. He has discovered a striking similarity between many common weeds and the trees and shrubs usually planted about buildings. So he hires youngsters to collect weeds for him. These he dries, trims and colors and he has strikingly realistic "model" plants. Goldenrod, dried and properly painted, makes excellent elm trees. Very realistic sagebrush can be made from dried Queen Anne's lace picked when it is going to seed. Care must be exercised to have the plants on the same scale as the buildings they surround.

In building models, Wise uses power tools such as drill presses, scroll saws and lathes. However, much of the actual work is done with knives and files. He assembles his factory models in Cleveland if they are to be photographed and used there. He also does considerable work at Akron, in a workshop that occupies part of his garage. Now he is designing a portable shop that can be carried in an automobile trunk. This will include a power lathe and scroll saw.

F70 Ready-Made Hotels Are Shipped to Ocean Bases of Air Line

Two prefabricated hotels, shipped complete from walls and fixtures to shower baths and ash trays, are being assembled on Midway and Wake islands in the Pacific for the convenience of transoceanic passengers and crews of Pan-American Airways. Each hotel comprises forty-five rooms. Designed for the tropical climate of the south Pacific, the hotels are of frame construction, two wings jutting out from a circular lobby, with wide verandas. Each room has a shower bath, and hot water is furnished by a solar heating system. Beds, coat hangers, cashiers' cages, inter-room telephones all were included when the ready-made hotels were shipped from San Francisco.

Chicago Tribune 1/15/36



**I CAN'T GET OVER
HOW SKINNY YOU
WERE A FEW
WEEKS AGO**

**NOW I KNOW THERE IS
NO EXCUSE FOR BEING
SKINNY**

Amazing Gains in Weight with New "7-Power" Ale Yeast Discovery

EVEN if you never could gain an ounce before, remember thousands of skinny men and women have put on solid, naturally attractive flesh this new, easy way — *in just a few weeks!*

Not only has this new discovery brought normal, good-looking pounds to hosts of thin people, but also naturally clear skin, freedom from indigestion and constipation, new pep.

Scientists recently discovered that thousands of people are thin and rundown for the single reason that they do not get enough Vitamin B and iron in their daily food. Now the richest known source of this marvelous body-building, digestion-strengthening Vitamin B is ale yeast. By a new process the finest imported ale yeast is now concentrated 7 times, making it *7 times more powerful*. Then it is combined with 3 kinds of blood-building iron in pleasant little tablets known as Ironized Yeast tablets.

If you, too, need these vital elements to build you up, get these new "7-power" Ironized Yeast tablets from your druggist today. Then, day after day as you take them, watch flat chest develop and skinny limbs round out to natural attractiveness. Constipation and indigestion from the same cause vanish, skin clears to normal beauty—you're an entirely new person.

Try it—guaranteed

No matter how skinny and rundown you may be, try these new Ironized Yeast tablets just a short time, and note the marvelous change. See if they don't build you up in just a few weeks, as they have thousands of other men and women. If you're not delighted with the benefits of the very first package, your money will be instantly and gladly refunded.

Special FREE offer!

To start you building up your health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results guaranteed with the very first package—or money refunded. At all druggists. Ironized Yeast Co., Inc., Dept. 534, Atlanta, Ga.

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professional
models

BUILD IT YOURSELF

with **MUSSELMAN**

10" x 2 3/4" DOENUT CORDS



Build your own midget autos, coasting derby racers, coaster wagons, scooters, bicycle trailers, wheelbarrows, etc., with 10" x 2 3/4" MUSSELMAN DOENUT CORDS mounted on ball bearing cadmium plated steel disc wheels. Their performance has amazed tire people everywhere. The inventor is the same A. J. Musselman who developed the air wheel for airplanes used the world around. Tire requires only 12 to 15 lbs. of air to carry loads up to 200 lbs. per wheel. They take bigger loads with about half the effort. When you watch them float over road bumps, you see why they are winners in coasting contests. No wonder they are revolutionizing the tire industry. They even coast farther than any other tire built regardless of price. You can now build any of these vehicles in a few evenings spare time.

U. S. Patent No. 2015459.



Simply send 25c for detailed working blue prints of any vehicle shown, except Derby Racer, and

Ask for **FREE Catalog**

Every derby racer or midget auto equipped with MUSSELMAN DOENUT tires and wheels has an advantage. Do not handicap yourself because others will have them. Get this coasting derby building set that includes these MUSSELMAN DOENUT tires—the fastest tires ever built. And the same fast ball bearing disc wheels, too. Don't gamble on inferior tires and wheels if you are out to win.

WIN ANY COASTING RACE



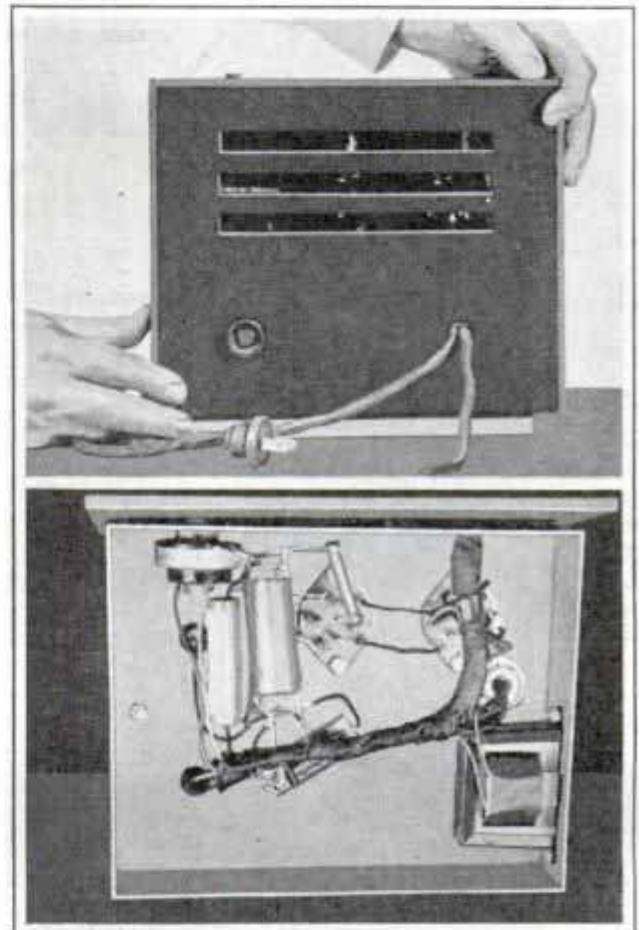
Our detailed working blue prints show you how to build your chassis with good self-equalizing brakes and a steady, safe steering control, and they cost but fifty cents. So you can see for yourself, the amazing performance of the MUSSELMAN DOENUT tire and wheel, we will send you your FIRST wheel with tire (one only) at a special price of \$2.00 prepaid anywhere in the U. S. (Canada \$2.50). If you are not delighted, return it for full refund. Send 50c for detailed working blue prints of Derby Racer and Midget Auto Chassis combined and ask for FREE catalog.

MUSSELMAN PRODUCTS COMPANY
6247-D St. Clair Ave. Cleveland, Ohio

Inter-Room Speaking System

(Continued from page 583)

reduced by means of the resistor which is built into the 110-volt line cord. Direct-current voltage supplied by the voltage-doubling circuit is about twice the a.c. line value at the low-current drain of the amplifier tube. Suitable electrolytic condensers and a small choke are used for



Above, rear view, showing combination a.c. switch and volume control. Below, underside view of base

this purpose and for filtering. Microphone current is also supplied from the same source. An original priced parts list and further information, can be obtained upon application to Popular Mechanics radio department, without charge.

Each speaker is operated from the amplifier located in the opposite cabinet. Since each speaker requires two wires to connect it to its respective amplifier, the 4-wire cable can be connected permanently or a 4-prong connector-plug and socket may be inserted at any convenient point in the cable. An enlarged blueprint of the layout and wiring diagrams is available if desired. Construction is quite simple and all parts are standard.

3000 FAST SELLERS AT ROCK BOTTOM WHOLESALE PRICES. MAKE BIG MONEY



Opera and Field Glass

No. V17. Pocket size opera and field glass, with fine quality lenses, which clearly magnify objects. Useful for all sport events and nature study. Sells for 50c.
Sample 27c Dozen \$2.45



Reducing Card Trick

No. J300. With these trick cards—you can make the cards appear to reduce in size—simply and easily. Fun too. Sells for 10c.
Sample 3c Dozen 18c

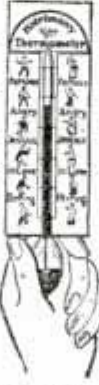


Jokes—Novelties

500 most popular numbers are shown in our catalog—All at wholesale prices.

Matrimonial Thermometer

No. J464. A new novelty. When bulb is placed in the hand, it registers like a regular thermometer up to various degrees marked on card, such as, In Love, Jealousy, Angry, etc. Sells for 10c.
Sample 6c Dozen 65c



Every purchaser gets something. Each package bears a number. Purchaser pulls off one of the "tabs" in front of cabinet at 10c each. There is a number on back of tab—this same number appears on the package in the back of the cabinet and identifies the package to be given for the number pulled. It's exciting—creates suspense. Drug and variety stores, filling stations, amusement places, etc.; are a few of the many prospects. This is something new, novel, different. An opportunity for you to make as high as \$10 to \$25 a day. Write for particulars today. (Shipped by express or freight only.)



BRINGS IN \$13 COSTS YOU \$6.90

Shaving Deal

No. D73 consists of, 10 Double Edge blades, 1 tube of Shaving Cream, 1 Styptic Pencil and 1 Genuine Goodrich Hone, all wrapped together with cellophane. Sells for 50c.
Sample deal 20c Dozen \$2.28



Cigarette Lighter

No. M243. Octagon shaped lighter. Convenient to carry in hand bag or pocket. Efficient, dependable and easily serviced. Sells for 15c.
Sample 6c Dozen 42c

Guaranteed 3 Years

No. V296. Watch. Smart looking and an accurate timekeeper. Has a non-breakable crystal and a non-tarnishing case. Size—suitable for ladies or men. Fitted with a metal or leather wrist band. Money back if not pleased. Selling price \$3.45.
Sample \$1.79



Two Color Pencil



No. R270. Operates as if by magic. A few turns of the cap to the right and a black lead appears; a few turns of the cap to the left and a red lead appears. Movement is dependable. Barrel and cap are finished in black; attached clip and band in silver like metal. Sells for 25c.
Sample 15c Dozen \$1.45



JUMBO SIZE.

LATEST IN FOUNTAIN PENS

No. R30. IT'S NOVEL AND USEFUL. Jumbo size—sells on sight. Holds about 20 times more ink than ordinary fountain pen. One filling will last for weeks. Fitted with a smooth writing 14-Kit gold plated point. Length 5 1/4 inches, Diameter 1 inch. Selling price \$1.50.
Sample 69c Dozen \$7.92

A NEW DEAL THAT CLICKS WITH A BANG

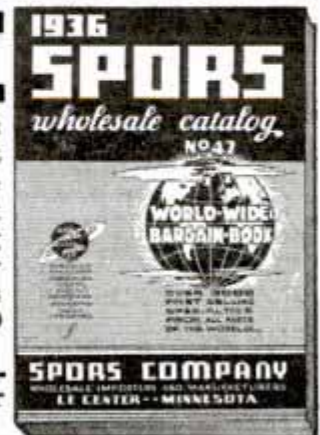


No. D143 Easy Sales—Nationally advertised products. Consists of 6 Wm. A. Rogers tea spoons; 1 box of Wm. A. Woodbury face powder and perfume; 1 lipstick in metal case; 1 rouge compact. Each set in a gift box. Offer the toiletries for 99c and give the spoons free—POSSESSES SALES APPEAL.
Looks Like a \$4 Value. Wild Fire Seller.

SAMPLE 49c DOZ. 48c EACH DEAL GR. 46c EACH DEAL

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I have found something —just what we've been looking for. A single application of Lucky Tiger Vegetable Oil Hair Dressing tames your dry and wild hair right now... and mother says it has 'em all beat as it does the job in a jiffy. A small bottle has lots of mileage and it's not gummy or sticky, in fact

Lucky Tiger HAIR DRESSING Doubles Your Looks

Yes sir—I know, I have tried it. It not only doubles your good looks but also gets rid of dandruff and scalp irritations, all in one operation... and costs so little at druggists and barbers you can afford to be groomed all the time... and that pleases mother still more and a lot of other folks... or you can just send the makers a dime to pay packing and postage and they will send you a week's supply.

LUCKY TIGER MFG. CO.
Dept. 216 Kansas City, Mo.



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Cards, stationery, circulars, tags, labels, advertising, etc. Save money. **Print for Others, Big Profits!**; easy rules sent. Will do popular Raised Printing like Engraving. Presses \$11 up, power \$149. Send for free catalog and all details. **THE KELSEY COMPANY, C-37, Meriden, Conn.**

DOUBLE Vacation FUN with



FOLD-FLAT BOAT

PAIR OARS GIVEN

WOODEN! SAFE! PORTABLE! READY IN 1 MINUTE!



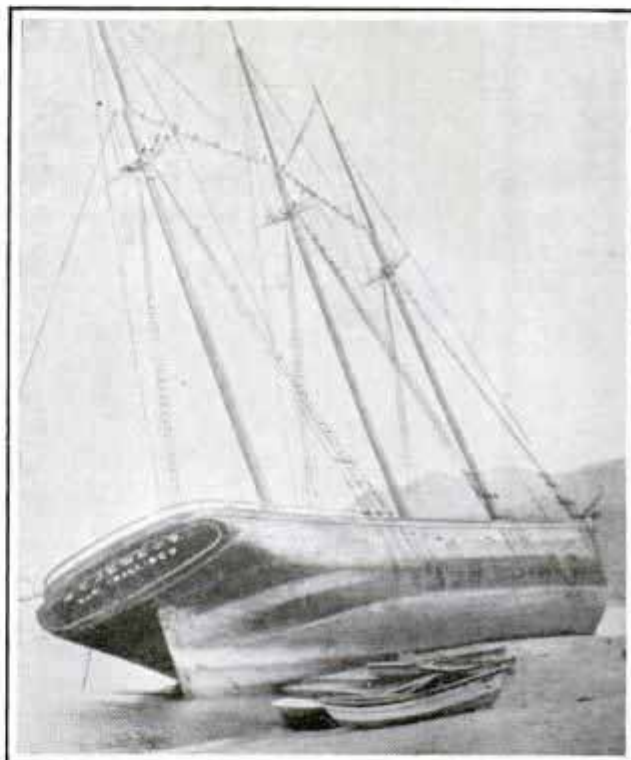
With each boat — if you hurry! Marvelous new non-sinkable Fold-Flat sets up, takes down in one minute! Sidel Uses any outboard motor or oars. Carries 4. Folds flat into small space. Rides running-board, roof, STRONG. Light, Fool-proof! Priced low. Comes ready to use! Doubles vacation pleasure. Rush 10c for big, illustrated circular, low price FREE OARS Offer!

MEAD GLIDERS, 15 S. Market St., Dept. FB-4, CHICAGO

Diving Among Sea Killers

(Continued from page 511)

Usually octopuses are very timid and retiring. When first they take hold of a diver it is out of curiosity. If there is an accident it is because the diver makes some false move. We carry knives, but it is a mistake to attempt to cut an octopus for it will then attack. Divers fear them most because of their ability to hold the diver on the bottom. For divers cannot stay down as long as they wish. There is



Wreck of the sailing ship, "Jewett." The dots in the rigging are buzzards

a charted safety period allowed for each foot of depth. Staying over this "safety time" entails longer decompression time when the diver must hang suspended in the water until the nitrogen gas gets out of his system so he will not suffer from bends.

The bends are nothing more than internal pressure built up inside the body by nitrogen. The air you breathe under normal conditions consists of about twenty per cent oxygen and eighty per cent nitrogen. You exhale practically all the nitrogen. Under pressure, like in a diving suit, much of this nitrogen condenses in a liquid form in the diver's lungs and enters his blood stream. It is particularly deposited in the fatty tissue, in the liquid

(Continued to page 140A)



OLD MOTHER HUBBARD HAS FILLED HER BARE CUPBOARD WITH ONIONS AND STEAKS AND CHEESES; HER STOMACH FEELS GRAND SINCE SHE KEEPS TUMS ON HAND...

Can You Finish This Jingle?

\$250 IN CASH

And 100 Other Valuable Prizes for Best Last Lines



NO ALKALIES FOR ACID INDIGESTION

MILLIONS have found they do not need to drench their stomachs with strong, caustic alkalies. Physicians have said this habit often brings further acid indigestion. So much more safe and sensible to simply carry a roll of Tums in your pocket. Munch 3 or 4 after meals—or whenever troubled by heartburn, gas, sour stomach. Try them when you feel the effects of last night's party, or when you smoke too much. Tums contain a wonderful antacid which neutralizes acid in the stomach, but never over-alkalizes stomach or blood. As pleasant to eat as candy and only 10c at any drug store.



A Valuable Prize For Everyone Who Enters

Can you write a last line to this jingle? It's easy! It's fun! And your "last line" may win one of the 158 valuable prizes! 1st prize—\$100.00; 2nd prize—\$50.00; 3rd prize—\$25.00; five prizes of \$5.00 each; fifty prizes of \$1.00 each; 50 Eversharp pencils; 50 hunting knives. Every entrant will receive a worth while gift besides. Get your information about TUMS from the advertisement at the left, then read the simple rules.

— SIMPLE RULES —

Write your "last line" in dotted line, tear out whole advertisement, and mail with your name and address to the address given below. If you submit more than one entry, simply write your additional "last line" on a plain sheet of paper. But EACH "last line" submitted *must* be accompanied by the wrapper from a 10c roll of TUMS which you can secure at any drug store.

Elaborateness will not be considered. Only skill with which "last line" is completed, and neatness will count. Every entry will be individually considered and acknowledged with a worth while free gift. No entries *will be returned*. Judges will be chosen by officials of the A. H. Lewis Co. In event of tie, duplicate prizes will be awarded. All entries must be post-marked not later than midnight of May 31st, 1936. Prize-winners will be notified as soon as awards are made.

Address your entries to Contest Department, Room 15-A, The A. H. Lewis Co., 4th and Spruce Streets, St. Louis, Missouri.

BUILD YOUR OWN

Slow Speed Wind Charger

from old auto generator. We show you how. Make money building for others. Light your buildings and play radio. Dime (coin) brings complete plans and catalog, with 20 other generator changes. Satisfaction guaranteed or dime refunded.

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1447 W. Lake St. Minneapolis, Minnesota



FREE Lights



NEW AUTOMATIC ADDER, \$4.75

Makes adding easy. It's accurate, quick, durable and easily operated. Capacity 8 columns. Saves time, brain work and errors. 85,000 pleased owners. Fully guaranteed. Price \$4.75 delivered. Agents wanted.

J. H. BASSETT & CO., Dept. 4, 1458 Hollywood Ave., Chicago, Ill.

TURN SCRAP INTO MONEY

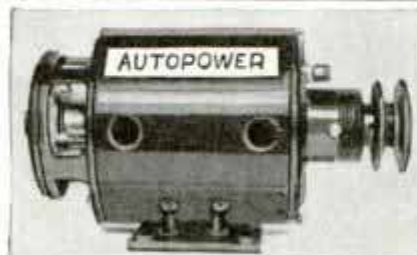
From practically every country in the world come thousands of letters of appreciation for "AUTOPOWER," the remarkable book which has solved their electrical problems. AUTOPOWER can also tell you how to turn scrap into money. It shows you how easily auto generators are converted into a. c. and d. c. generators and motors with voltage from 2 to 1000 volts, for POWER, LIGHT, WELDING, RADIO, SOUND SYSTEM; and, in fact, for whatever practical application you desire.

A SPECIAL FEATURE: A 1/2 H. P., 110-VOLT, A. C. MOTOR FOR CONSTANT DUTY No previous experience or special tools are needed. You, too, can cash in on this knowledge the same as thousands of others have done. This book is so plainly written that all you have to do is to follow the simple instructions. Many of the changes can be made for as little as \$1.00. The generators can be driven by wind, water, the fan belt of an auto, or by any prime mover. Special instructions for direct propeller driven generators. **\$500.00 IN PRIZES given to the readers of "AUTOPOWER."** Full particulars with each book. Send for this book today while the price is still only \$1.00 postpaid.

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Engine or Motor driven for every farm or home use

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INTERNATIONAL MODELS CO.

1787 Broadway General Motors Bldg. New York

(Continued from page 138A)

8/5/50
joints and along the spine. It retains its liquid form because it is under pressure. If you should bring the diver suddenly to the surface that liquid nitrogen, now that the pressure is removed, returns again to a gaseous form. It causes bubbles in the blood, in the joints and along the nerves beside the spine. The pressure is terrific and the pain excruciating. Blood vessels will burst and should one burst in the brain death is instantaneous.

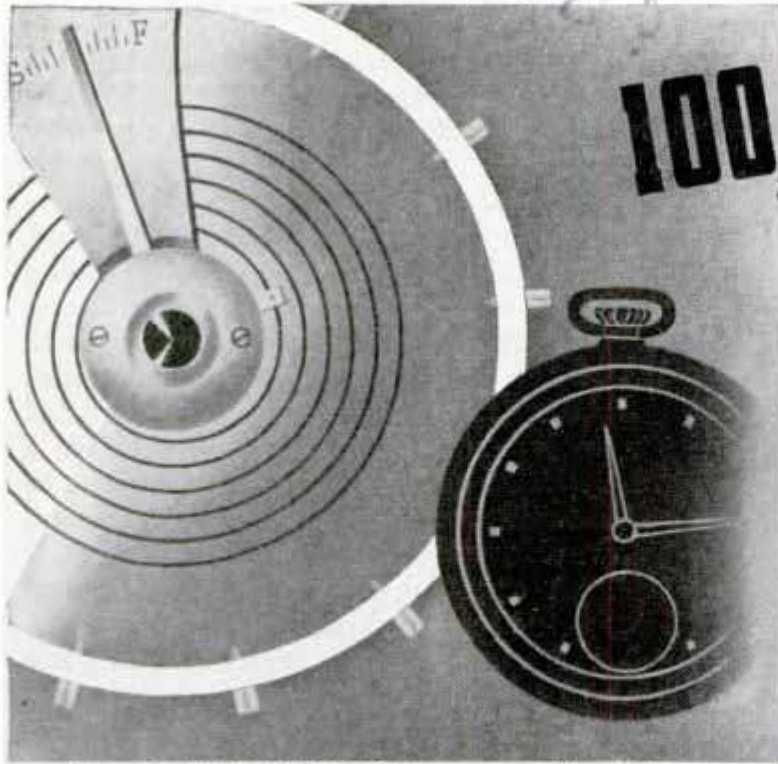
By decompressing the diver, holding him at easy stages for periods of time during his ascent, you give his lungs a chance to gather what gaseous nitrogen has developed and exhale it. Eventually all the nitrogen will be returned to the lungs by the circulation of the blood and exhaled. At such a time the diver can come out of water and will have no ill effects.

We study the habits of the creatures with which we must work. We first understand the causes that create certain dangers, then we use our own intelligence to avoid them. During four years of diving neither I nor any of my boys have ever suffered from bends but we have been scared at times when we were fouled on the bottom and visualized hours and hours of "over time." But we always came out all right. I once fell off a wreck under 110 feet of water, jammed my lines and spent a wicked half hour. I was a little seasick but a proper decompression and a few whiffs of good sea air cured it.

The most thrilling diving experiences are those that come so unexpectedly that things happen and are over before one has a chance to recognize the danger. Octopuses, being temperamental, sometimes provide such incidents. I have had only one battle with an octopus, and that occurred through my own fault. Apparently I didn't stand still quite long enough. That error nearly cost me my life, and as a reminder of it I have the tentacle which took hold of me with a deadly grip preserved in a large bottle. It measures just eight feet so I know the octopus must have spanned at least sixteen feet.

The incident occurred off the lower coast of Mexico. We were looking for a place to film some submarine shots. We found bottom at fifty feet and I went down to have a look, hoping we might find some pic-

(Continued to page 142A)



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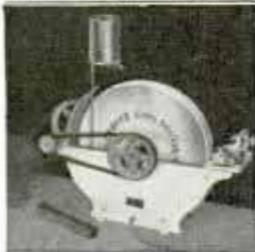
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(Continued from page 140A)

6-15-50
turesque wreck that would add "color." I found a deep, black hole in the rocky bottom, and decided to explore it. Cautiously I descended into the hole, which was about twenty feet deep and forty feet in diameter. As I neared the bottom I found secure footing on a shelf of rock. Standing on this ledge I peered downward and spotted two large octopuses. They seemed to swarm over the entire bottom of that hole. My first impulse was to get out of there but I suppressed it temporarily. I decided the safest thing I could do was to stand still and make sure whether I had been discovered.

That question was quickly answered when the larger of the two octopuses extended a tentacle and began touching my leg. I remained motionless, scared stiff, with my arms folded so my bare hands were hidden in my armpits. Fortunately the monster did not attempt to wrap its tentacle around my legs and yank me off that ledge.

After a long minute or two the octopus moved away to join its mate, while I hooked the toes of my lead shoes under some rocks and inflated my dress preparing for a quick ascent. When I let go and started for the surface, I realized it was a dangerous move. Apparently the devil fish hadn't satisfied its curiosity, for before I could get out of reach it whipped out a long arm and fastened on my ankle. Luckily it must have been walking on loose gravel for it was jerked from the bottom as I shot upward.

Ordinarily, with no anchor, an octopus would let go. But this one didn't. By the time I reached the surface it was swarming all over me and to release me from those crushing tentacles my attendants had to hack off several with axes.

Before we left we spotted several caverns in which we knew lived very large octopuses. We are returning there this spring and you can bet we will have nitric guns, burlap coveralls, and any other gear that will help us make the one big scene we have always hoped for and never attained—the authentic battle between a giant octopus and a big shark. It will probably turn out to be an awful headache for us, but just the same it will be a swell battle scene. Anybody want to come along to referee?

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Re-Making the World for the Movies

(Continued from page 549)

imaginings began to take the form of little sketches and the scratching of figures on estimate sheets. The first job would be for the foundry, the structural steel workers and the machine shops. Giant cradles must be constructed to carry the full-size ships. Tracks and wheels must be designed to support them as they approach each other.

Blueprints were made from rough drawings. Then wash drawings of the ships began to appear on Grot's office walls. Artists from the research department were digging through libraries, copying carefully the designs and carvings for the woodwork. Marine experts were at work on reproductions of riggings and armaments. The town was scoured for proper period rifles, cutlasses, cannon and pistols. The armory itself was making what could not be bought. Already 700 workers were busy carrying out Grot's sketchings.

A great sound stage was set aside for the battle sequence, and soon trucks were bringing structural steel, motors and machinery. One hundred carpenters moved in and with them fifty iron workers. Thirty workers from "special effects" appeared, followed by two score scenery artists. Giant drops, suspended by great cables and operated by motors were painted into sky and horizon backgrounds. When these drops moved up and down an illusion of the boats being rocked by waves would result. Instead of rocking the boats, they would rock the background. The steel tracks were laid and the machinery installed in the boat cradles. They were tested, and the partly built boats were majestically drawn together. Meanwhile Grot's pen and brush continued to fly and drawings of old-time sea towns, South Sea islands, ship interiors and island prisons were finding their way from his studio to the drafting department.

On a back lot, part of another ship was being built in a concrete basin which soon would be filled with water. Along the edge of this basin was built the physical reproduction of Grot's drawings of old Port Royal. Everything built was a counterpart of one of Grot's drawings. Some of them were of peculiar shape, for the models are often designed not architecturally, but for stage effect, for illusion. Thus the model

of a ship's cabin seems to work into a funnel effect toward the back. This cabin may be only ten feet deep, but it will give the illusion of much greater depth.

After six weeks, 400 extras crowd the decks of the two ships, garbed in the torn rags of pirate and oldtime sailor. On a platform high above the action, cameras grind as the ships move slowly toward each other and pirates prepare for action. But the real stars of this scene are not on the set. They are over in the machine shops, the foundry, the electrical and property departments, wrestling with that sandstorm for another picture.

The production department finds there are advantages great enough in stage shooting to justify almost any expense to stay off location. And some of the items of bringing the outdoors inside are staggering. Consider a \$75,000 waterfall set in Warners' "Footlight Parade" wherein a giant hydraulic jack lifts ninety-six girls mounted on revolving platforms from which a myriad of real fountains play. This jack was built in the studio's own shops, used for one picture, then dismantled, and its parts put back into stock. It took 300 men, working four shifts, or twenty-four hours a day, seventy-five to the shift, five weeks to build this set.

The reason studios spend a fortune on a single set is that better pictures can be made in the stages than on location. Better lighting is available and better sound almost certain. A location trip to Hawaii to make certain sequences for "Flirtation Walk" was abandoned when the technical department agreed to build a Hawaiian beauty spot including an ocean, an island, fishing boats, a swimming pool, huge rocks with ferns and a trickling stream, a waterfall and mountains with palm trees. It had to be constructed so 100 players could blend into the background.

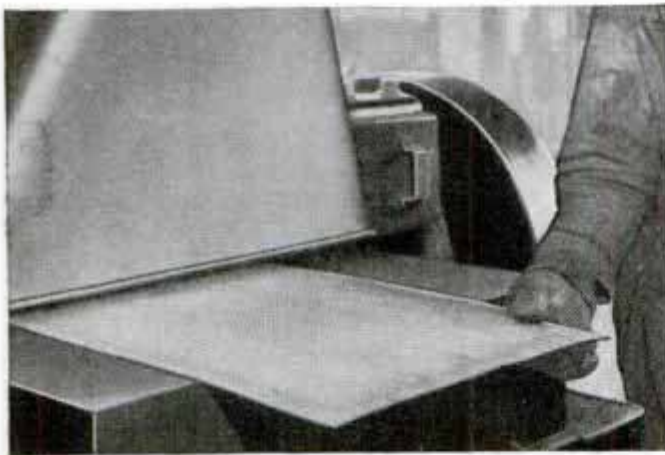
After drawings and blueprints were made, an exact scale model was built. This model was reproduced in plaster paris with every contour of the ground, the winding stream, the rocks, the water and the boats included. The model was then cut into strips and the strips built to set size sections. These sections, some thirty

(Continued to page 146A)

FORD GASKETS ARE BUILT TO WITHSTAND HIGH PRESSURE— UNDER FIRE

THE development of the modern high-compression engine brought many new problems. Higher compression meant greater power and increased economy from smaller engines. But it also meant greater loads on various engine parts.

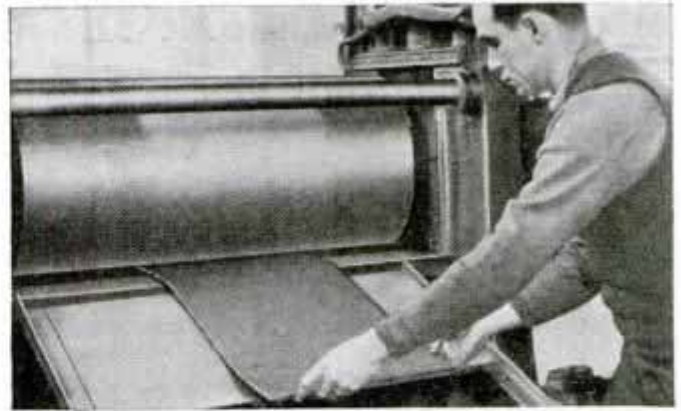
Many parts which served their purpose well in ordinary engines could not stand the added strain. New materials and new methods of manufacture were needed to meet the more severe requirements.



Forming the tongues in the steel core used in Ford V-8 gasket.

Take gaskets, for example. Each explosion in a Ford V-8 engine exerts pressure of about 600 pounds per square inch. That pressure must be held in by the cylinder-head gasket. And at the same time the gasket is exposed to the flame from burning gases with temperatures as high as 3000 degrees.

To meet these conditions required the development of an improved cylinder-head gasket. It has a steel core between two asbestos sheets which are mechanically and permanently bonded to it. The asbestos is so treated that water, oil or gasoline will not affect it. A steel edging around combustion chamber openings adds

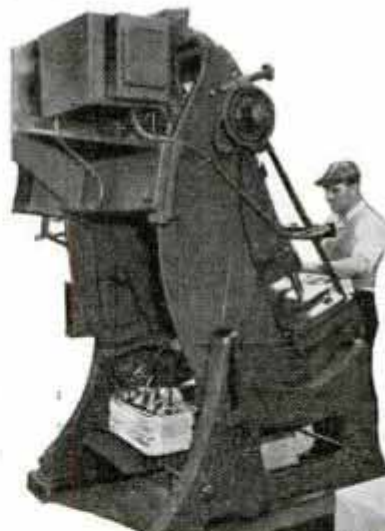


These rolls bend the tongues over to hold asbestos to steel core.

further strength and protection against blowing out. This type gasket is best for aluminum cylinder heads because it prevents the electrolytic action which causes gasket corrosion.

Regardless of where it serves or what it does, the most suitable and most economical part for a Ford is one which meets Ford requirements. When replacement parts are needed, insistence upon Genuine Ford Parts will help to maintain the high performance which was built into your Ford car or truck at the factory.

FORD MOTOR COMPANY



One of the punch presses in gasket department at the Ford Rouge Plant.



Partially completed Model A gasket showing how flange is curled over asbestos liner.



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File 86

(Continued from page 144A)

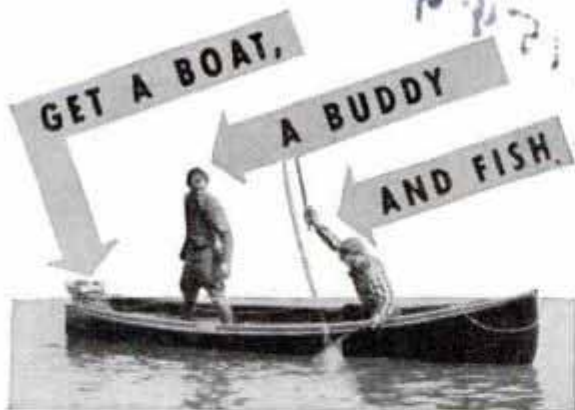
feet high, were built of steel and lumber and reinforced with concrete. They were piped for plumbing, wired for electricity and built to withstand heavy traffic. The finished set cost only about \$13,000.

One sequence in "The Midsummer Night's Dream" called for magic cascades and falls, for deer peeping out from among trees, for frog men coming up from the waters, for a shooting star that falls and explodes a dancing fairy onto the green-sward, for a ballet winding out of sight in the heavens on a moonbeam, and a shaft of moonlight that "pours on the ground like molten silver" and shapes itself into a dancing fairy. That moonbeam, a winding stairway of light for the fairy dance, weighed seven tons and carried the weight of ninety dancing girls.

Because of such mechanical requirements, the men and women most in demand in pictures are not stars or featured players, but electricians, structural steel workers, carpenters, designers, draftsmen, women for the wardrobe and sewing departments and artists for the make-up departments. The man in overalls and the woman in the apron have five times the chance to win steady employment as has the extra girl, dancer or bit player.

But let us look in on that crew wrestling with the sandstorm. Inside a sound stage they built what looked like an enormous tent, made of three partitions of canvas. Inside the third tent, so to speak, was the desert, with sand shoe-top deep. Great papier-mache stones rose from the stage and blended with other stones painted on large wooden cutouts, which in turn blended with the painted background. When they finished, everybody donned masks and the director gave a signal. There was a humming, then a droning. Little eddies of sand swirled up. The humming increased. Then it came, a series of blasts and a rush of sand. Half swept from their feet, half blinded in spite of masks, the crew rushed out, satisfied.

Outside the tents they had built a long wooden box or funnel running from inside the canvas to a mounted platform. Up there a load of fine sand was slowly poured into an enormous hopper. Just below a wind fan whirled the fine sand through the canvas-lined box to pour out into the set as a furious desert storm.



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81544 Mystery Fires

(Continued from page 523)

his wealth by owning and operating one of the world's first fire departments. He organized his private battalion, attended all fires in Rome, and as flames licked through a building he would offer the owner a very low bid for the property. If his bid was accepted, his fire fighters would go to work to save the structure. If refused, they stood by and watched it burn while Crassus constantly lowered his bid. Thus he became a great property owner and Rome's wealthiest citizen. The invention of hand syringes about 1637 and the flexible hose in 1672 marked the beginnings of modern fire equipment and the passing of the leather-bucket stage. Insurance companies banded together to form fire squads. As late as 1832 the insurance company firemen idly let the parliament buildings in London burn because they were not insured. After that, an aroused public demanded and got municipal fire protection.

If you don't care to watch the firemen wet down the ashes of what was your home, follow these "don'ts."

Don't wrap cloth or paper around a lighted electric bulb to shade it; you can start a fire in a few minutes that way.

Don't leave broken glass in a rubbish pile or barrel too near the house; fragments of glass reflectors tossed in a barrel set it afire by focusing the sun's rays.

Don't light a cigar near your automobile—it isn't always gasoline that flares up. One motorist drove his car into the garage when the radiator froze, blanketed the front, took off the radiator cap and let the motor run. There was not enough alcohol to prevent freezing, but enough to flash and burn the garage when he lit a cigar.

Don't put a penny in to substitute for a burned fuse in the house lighting circuit unless you want to start a fire in an unexpected place.

Don't use hot bricks to warm up the bed; a woman burned to death that way.

Don't leave the goldfish sunning themselves where the sun might focus through the bowl and ignite curtains or rug.

Don't stow your umbrella behind a radiator or against a chimney wall. A motor bus was destroyed when an umbrella handle of combustible material caught fire from a heater.

Beware the self-starting blaze!

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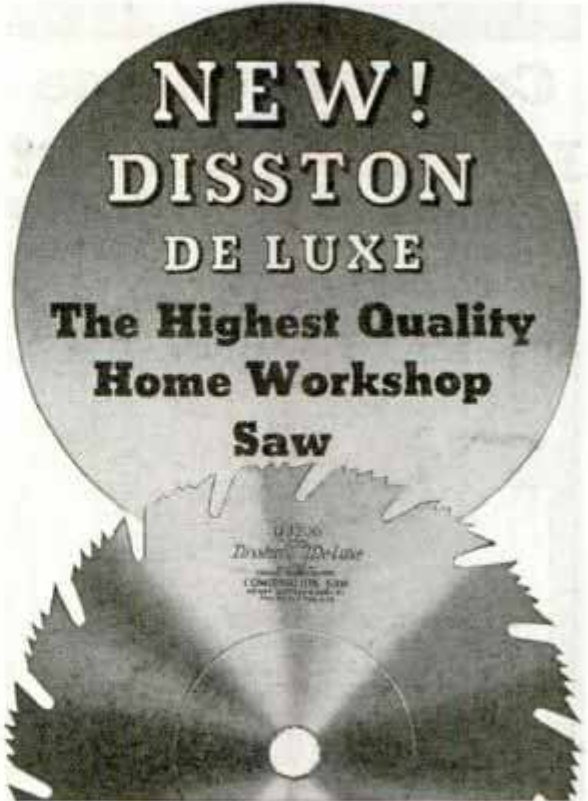
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Three models: "Sinking", "Floating", "Jointed". New "Shore-Minnow" Finishes (X-Ray effect). Also all other standard finishes and colors. Catalog with Bait Chart and "How to Catch More Fish." **FREE!** Send today.

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Now your dealer has (or will get for you) Disston De Luxe Home Workshop Circular Saws. These saws are made to the same standards and carry the same guarantee as those used by the large lumber mills throughout the world.

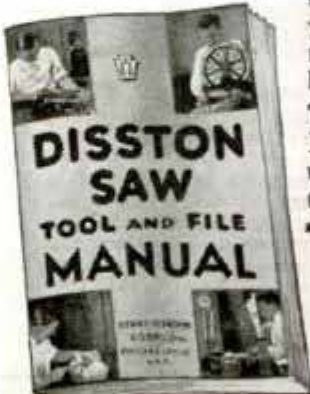
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KOHLER CO., Dept. PM-1, Kohler, Wisconsin
Send copy of "Kohler Electric Plants" to:

Name.....

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The Next War in the Ether

(Continued from page 537)

61549
compelled to carry their information by hand and undergo the great risk of crossing the lines. Today, ultra-short wave radio makes it possible to set up a radio transmitter in a bedroom closet, or in a trunk, or under the seat of a traveling automobile. Messages could be sent out at prearranged hours and if several listening stations were provided, messages would stand a good chance of getting through.

The location of such a spy transmitter, if it were fixed in one location for any length of time, could be determined by radio direction finders. Time, however, is required to trace down such locations. If several transmitters at different locations were used, and especially if they were mounted in moving automobiles, and if each station sent out a few signals at a time, the problem for the spy hunters would be very difficult. Whether radio spies are being provided for the next great war can only be guessed at. The advantages over the old system would lead one to guess in the affirmative.

Radio eavesdropping was practiced in the world war to a small extent. It is said that the British gained information just before the battle of Jutland that was invaluable. In the next great war radio eavesdropping probably will be extremely highly organized. With the exquisitely sensitive receivers developed in recent years, nearly everything said by one side will be picked up by the other. We may count upon large numbers of operators scattered over considerable areas, equipped with automatic recorders, making a business of copying everything. Expert decipherers of code would work with them.

The ether in the next great war will be an active battleground. The nation best able to command the ether will possess an enormous advantage. Beyond the ether, is a field still more complex. This is the field of so-called rays. They are not strictly ether waves, although they obey certain laws that waves obey. They also possess properties that suggest infinitely small bullets of energy projected at velocities approaching that of light.

Before the Italian-Ethiopian war started, press reports stated Marconi had de-

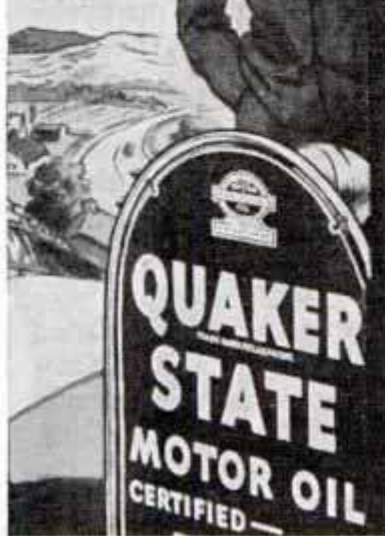
(Continued to page 152A)



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(Continued from page 150A)

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Expels all 3 kinds of Worms
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PULVEX *Combination WORM CAPSULES*

developed a ray which would short-circuit all electric ignition in explosion engines, bring down airplanes and put out of use all tanks, tractors, trucks and other equipment operated by gasoline engines.

This is just what would happen were a powerful enough radiation employed. Doubt as to the accuracy of the reports was manifested by scientists because no way is known to generate such powerful radiation. However, the fact that the reports were started indicates that someone, somewhere, is giving thought to this problem. It has been suggested that Marconi may be conducting experiments inspired by experience with the quartz crystals used in radio to hold wave frequency steady. Quartz is a transparent rock. It has a fixed rate at which it will oscillate, depending upon its thickness and the plane in which it was cut.

When placed between two metal plates connected to the oscillating circuit of a radio transmitter, the crystal actually swells and shrinks a tiny amount. This swelling and shrinking occur every oscillation. They therefore occur hundreds of thousands or millions of times per second, according to the frequency. Unconfined, one of these "trembling" crystals will travel all over the plate on which it rests. Touched, it "burns" the skin, although there is no heat. At the lower radio frequencies, it does not burn seriously, but to the touch it is the "slipperiest thing on earth," as one experimenter described it.

In experimenting with quartz crystals one sooner or later applies a bit more power than the crystal can stand. Then the crystal flies into dust and fragments so fine that some of it remains suspended in the air like fog.

Can it be that Marconi, thoroughly familiar with the behavior of crystals in radio, has discovered a way to excite super-oscillations at a distance, thereby creating disruptive and "burning" effects on a large scale? Or is he attempting by radio to induce super-sonic oscillations at a distance, and thereby create a lethal super-sonic vibration, such as has been used in the laboratory to sterilize liquids and kill fish?

These possibilities, added to what already has been pointed out, indicate the next-great war will be wholly different and far more destructive than the world war.

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Sani-Flush **Safe NOT CAUSTIC**
KEEPS RADIATORS CLEAN

DOUBLE YOUR PROFITS with Modern Service Equipment!

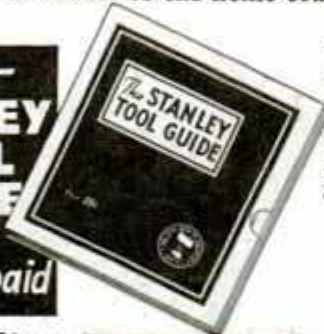
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F168 One-Way Glass Stops Glare

(Continued from page 483)

outer skin of the other. Thus Polaroid glass becomes a valuable tool for beauty operators and skin specialists. By seeing beneath the outer layer of skin, the expert can tell the nature of the underlying tissue. Simply by rotating the Polaroid glass to the proper position, you make it possible to see the ordinary top skin of the person sitting opposite.

There is no doubt that Polaroid can cut out the glare from automobile headlights, but it does this at some sacrifice of a driver's visibility, since this glass is not quite as clear as glass commonly used. To make it really effective on the road, it would be necessary that all cars be equipped with Polaroid glass in both windshields and headlights. Then headlights could be stepped up a bit to compensate for the loss of transparency in the glass, which has been estimated at about twenty-five per cent.

These and other uses are made possible by the invention which a young lad dreamed about ten years ago. He set out to break one of nature's monopolies and he did it.

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F214

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Science & Time 2/19/36

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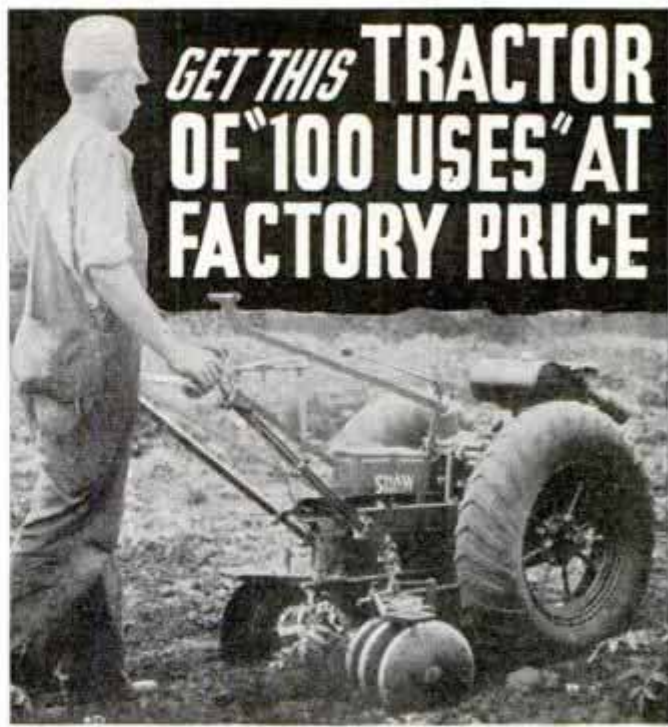
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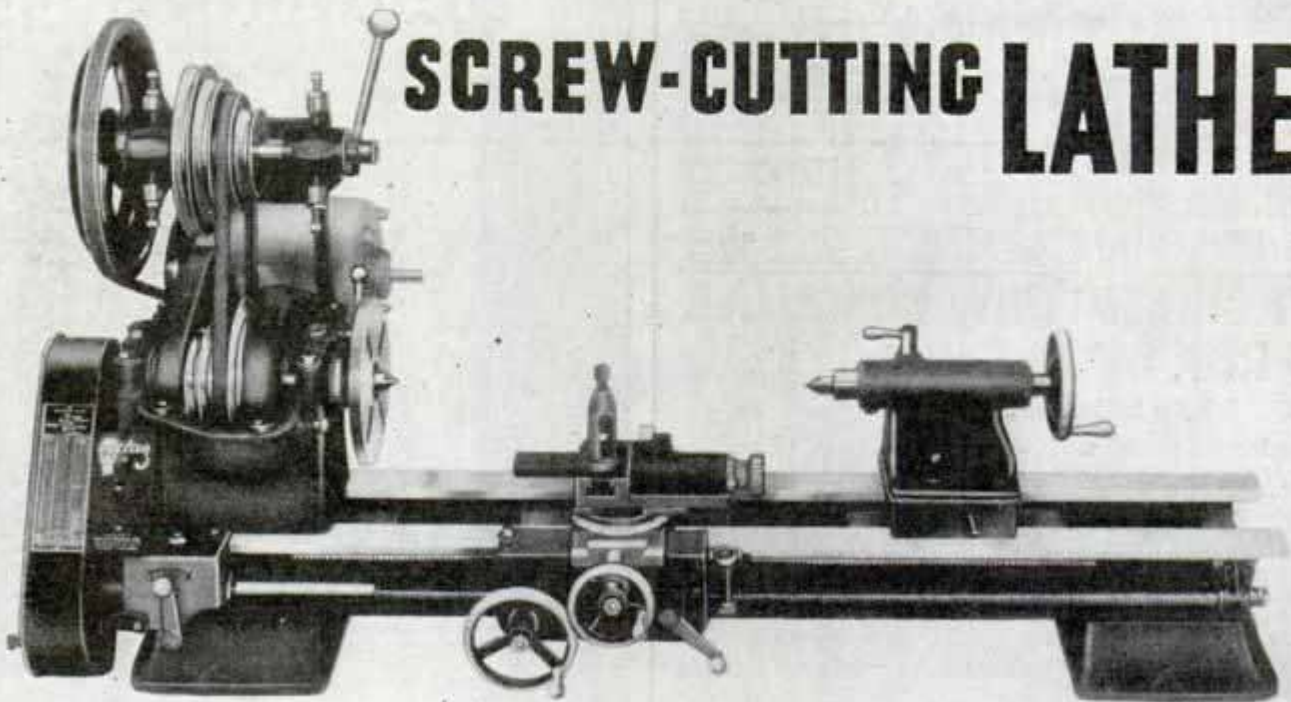
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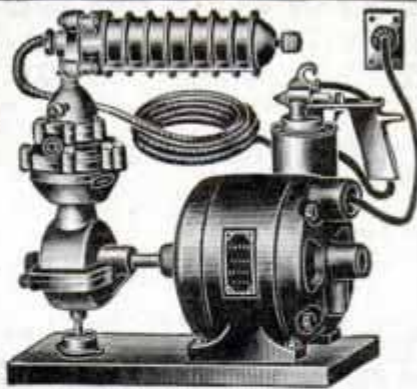
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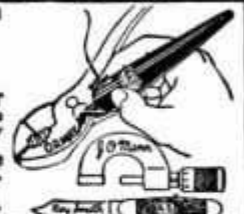


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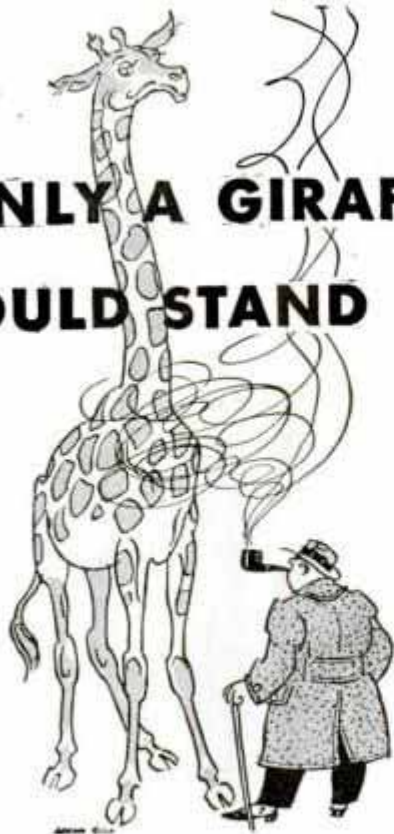
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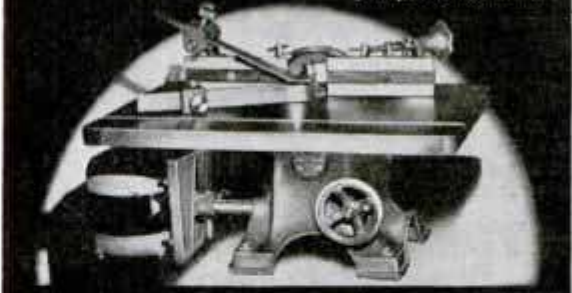
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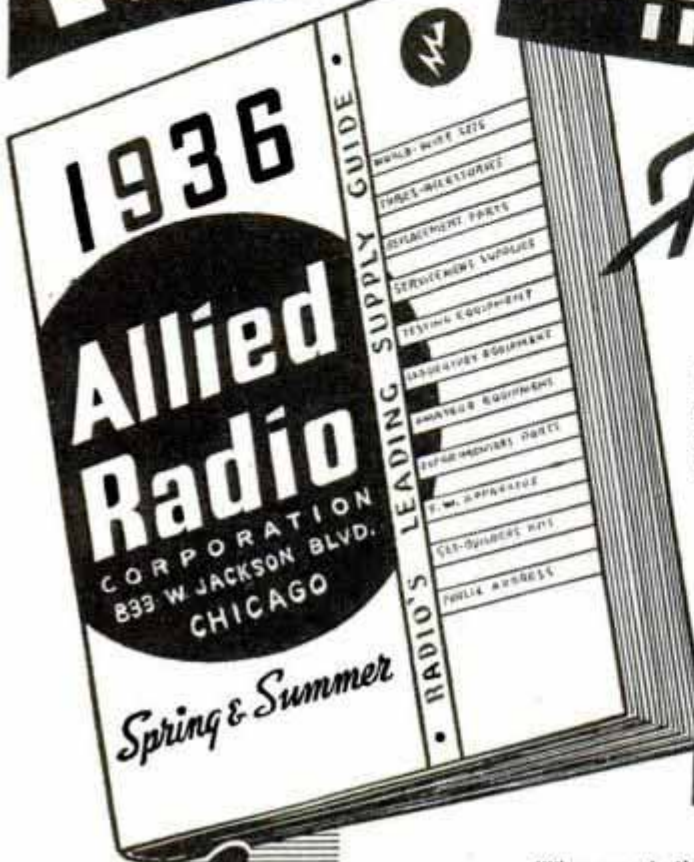
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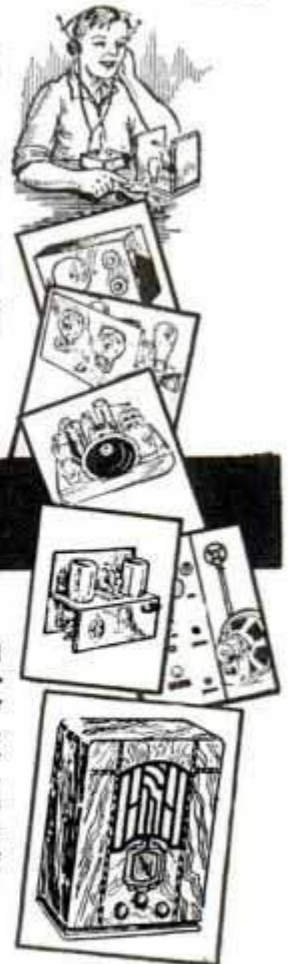
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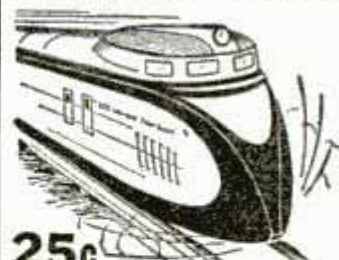
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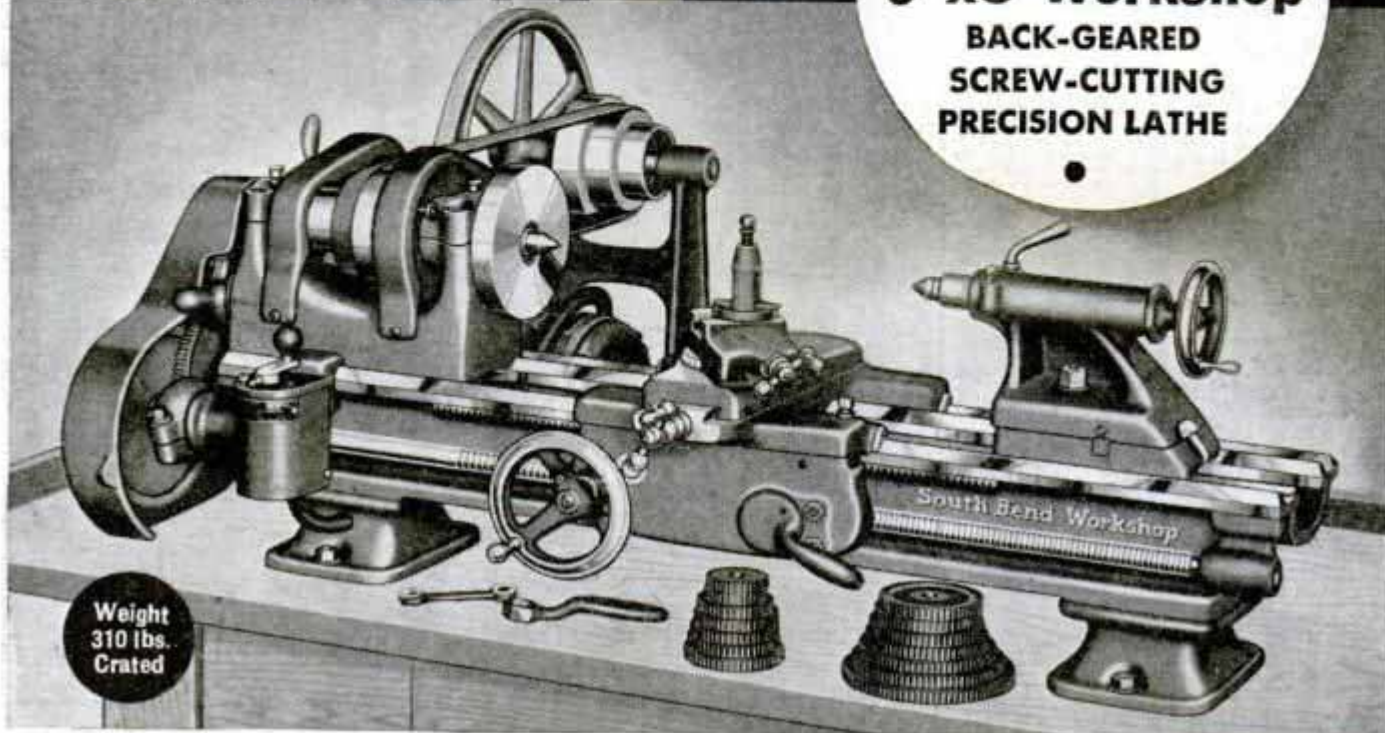
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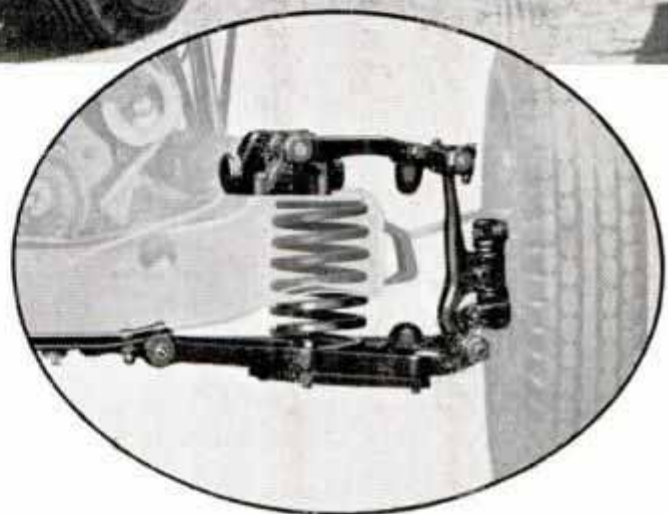
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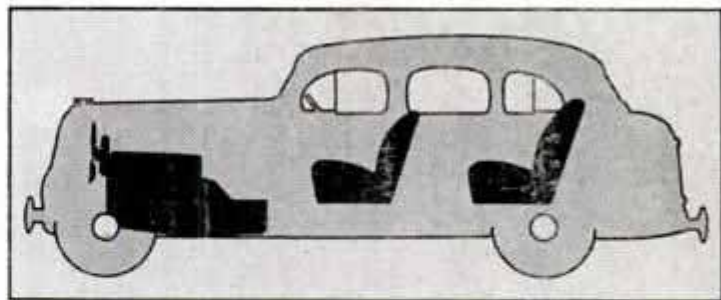
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