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POPULAR MECHANICS

MAGAZINE



WE EXPLAIN SO YOU CAN UNDERSTAND IT

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SEE PAGE 54

OUTWITTING THE AIR RAIDERS

PROEM

● Here is the Famous 3049 Heavy Duty Grinder—universally acclaimed by users everywhere as the most powerful, speediest and smoothest running Grinder for all types of work. With the new accessories listed below a new field is opened to Model Makers and Craftsmen—makes wood turning, drilling, routing, shaping, carving and many other operations easy to accomplish. Better results are obtained faster and easier.

\$14⁹⁵



For the most thoughtful and exciting Christmas of them all a **DURO HAND GRINDER AND ACCESSORIES**
 AMERICA'S FINEST—MOST DISTINGUISHED HAND GRINDER



\$6⁴⁵
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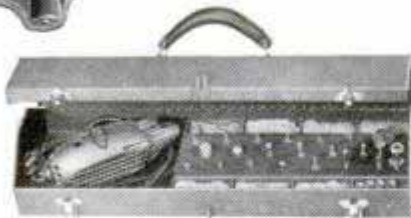
Drilling, routing, veining, shaping and many other operations are made easy by the matchless combination of the Famous Heavy Duty Grinder and this Drill Press. Its practical design and extra large capacity makes it an ideal tool for the Model Maker or Craftsman.

The Lathe pictured below, using the Heavy Duty Grinder has plenty of power to do real work—In fact you'll be amazed to see how you can take full size cuts without stalling it. It's ideal for all types of Model Making. An unlimited variety of parts such as masts, spokes, wheels, pulleys, etc., can be turned to size with speed and precision. The high speed provides smooth finished cuts on wood or plastics.



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\$21⁹⁵
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The *Streamline* Grinder is ideal for free hand use. The abundance of power developed makes heavy cuts easy, its high speed insures a smooth finish at all times. It is light in weight—only 12 ounces—compact and fits the hand perfectly. It is the ideal tool for fine engraving and other work that must be done in a confined space.



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Make this his most Memorable Christmas—Give a Duro Grinder
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Popular Mechanics Magazine

H. H. WINDSOR, Founder

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

January, 1940

Vol. 73, No. 1

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Super-Senses of Science

YOU'VE heard the human eye called the most perfect optical instrument. It is pretty good; but, like your other senses, human sight hasn't improved much in 25,000 years. Meanwhile science has developed super-senses. A "roughness meter" can measure the thickness of a fingerprint. A sonic device hears a submarine fifty miles away. The unseen, odorless vapor rising from a bowl of mercury is made visible to the human eye as a shadow on a fluorescent screen, yet that mercury could go on evaporating for ten years without detectable loss in weight! Read about these super-senses in the February issue.

Winning Races in the Pits

BLACK oil dripping from his shoes, a driver hops out of his smoking car at the pit. The crew mops up the cockpit, tightens an oil-line connection and he's off again, while another \$20,000 racer is out of the 500-mile Indianapolis classic because of a faulty ten-cent valve lock. The Coloroto section next month shows you how races sometimes are won in the pits.

Next Month

OUT of California rolls a train-load of lettuce and peas for New Hampshire. When it reaches New York the market has changed, and the load turns back to Indiana. Prices vary again and it is split into carloads for Georgia, carloads for New Hampshire. Meanwhile some crew has blown in cold ice instead of warm ice, and part of the shipment is frostbitten. But you must have your salad out of season, and how you get it is told next month in "America's Dinner Rides the Rails."

Radio Goes to War

SAFE in your livingroom you may some night hear the whine of fighting planes, the rattle of machine guns and the boom of heavy arms at the war front. Mobile radio transmitters are already there, waiting for the moment to broadcast battle as they were waiting in London and Berlin, Warsaw and Paris to bring you the first word of war's outbreak. In the February issue, pictures and story reveal to you how radio is covering the war.

Anyone Can Fly

FLYING your own plane is no longer "over your head." You can buy a safe-flying "flivver" plane for \$1,000, paying a third down, and that includes a course in piloting that will lead you to a license. And it's a fact today that it costs less to fly and maintain a light plane than a medium-priced automobile over the same distance. If you're skeptical, read the figures in next month's issue.

GET THIS



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Prepare for a *New Motoring thrill*.. when you drive with the

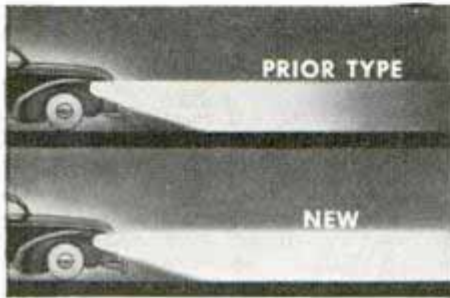
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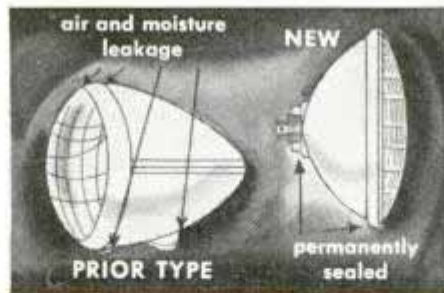
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SUCCESS—

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IF you are normal, you want the comforts and luxuries which are the by-products of success—a home of your own—a new car—the leisure to read—the means to travel.

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Note, please, that the coupon names different lines of training and that it will bring you full particulars of the training which appeals to you, together with a 48-page booklet discussing the opportunity and requirements of that field—all without obligation.

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IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described, in order to avoid possible liability for patent infringement.

what will you be doing



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Name.....Age.....Address.....

City.....State.....Present Position.....

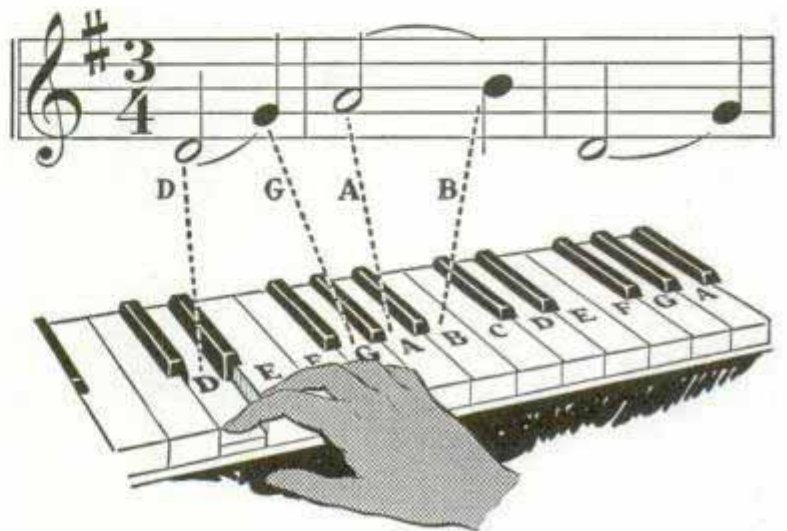
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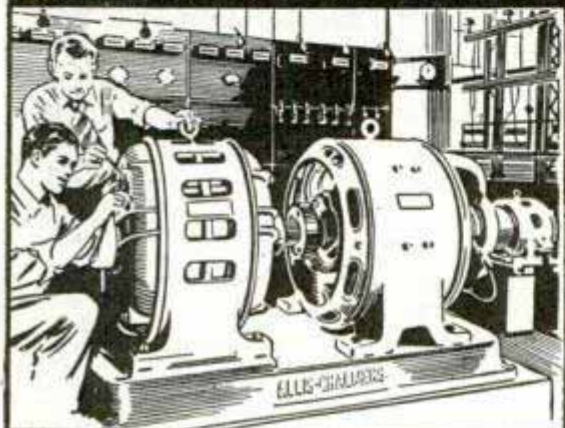
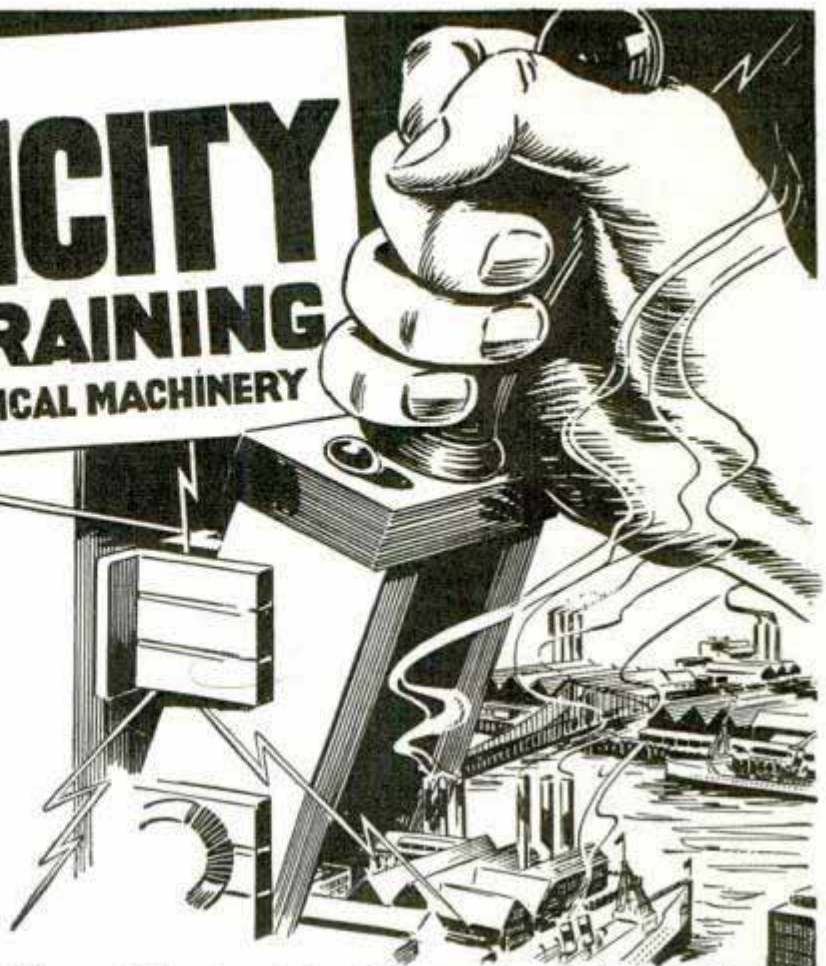
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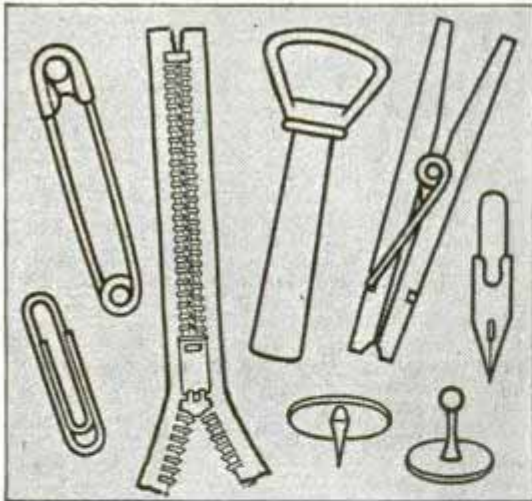
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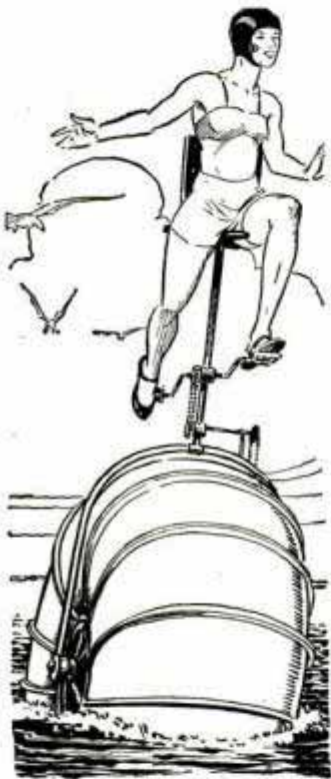
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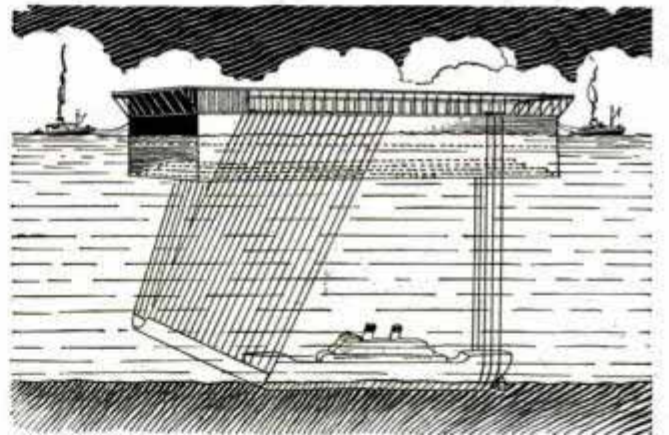
INVENTIONS

S¹⁰⁴⁵OMETHING new for the water-sports fan is offered in a patent covering a unicycle. The odd craft consists of a circular tubular wheel, resembling a large automobile tire, a seat mounted above the wheel, a weight forming a keel attached beneath the wheel and a pedal-and-gear arrangement by which the rider may rotate the wheel, causing the unicycle to move through the water. The inventor probably visualized races between riders on unicycles as feature events on water-carnival programs.



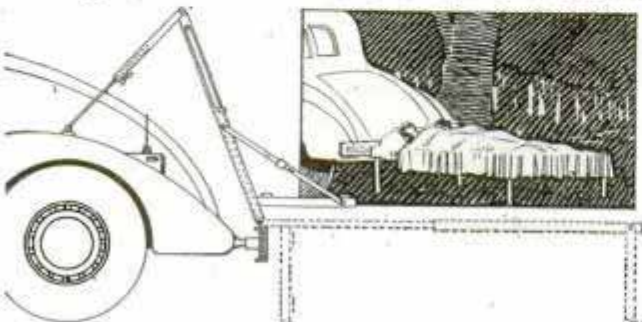
the travelers stop for the night, it may be swung into horizontal position, with legs supporting it at the rear. Mattress and bedding may then be placed on the frame.

IMPROVED means of salvaging sunken ships is the objective of a newly patented device. It comprises a pontoon ship having a well located at one end, a scoop adapted to be positioned under one end of



the sunken ship and cables supporting the scoop from the well. Other cables would be attached at the other end of the craft lying on bottom, to facilitate lifting it.

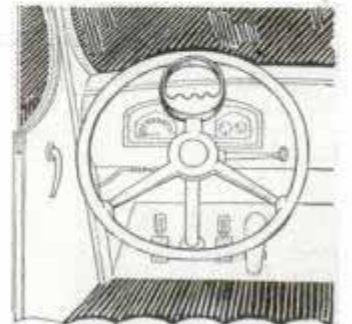
FOR the convenience of the tourist, a handy sleeping arrangement to be attached to the automobile is proposed in a new patent. It consists of an extensible



and collapsible bed frame mounted in connection with, and supported by, the rear fenders and rear bumper. While the car is under way, it is in folded position, but when

AS AN aid to the driver, a rotatable grip for the auto steering wheel has been patented recently.

The grip is intended for inclusion in the steering wheel at manufacture. It has an opening into which the hand fits, with indentations for the driver's fingers. The grip has a counterweighted gripping side to give the driver better control in turning the wheel.



(Continued to page 26A)



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| <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Welding, Electric and Gas | |
| <input type="checkbox"/> Cotton Manufacturing | | |
| <input type="checkbox"/> Diesel Engines | | |
| <input type="checkbox"/> Electrical Engineering | | |
| <input type="checkbox"/> Electric Lighting | | |
| <input type="checkbox"/> Foundry Practice | | |
| <input type="checkbox"/> Fruit Growing | | |
| <input type="checkbox"/> Heating | | |
| <input type="checkbox"/> Heat Treatment of Metals | | |
| <input type="checkbox"/> Highway Engineering | | |
| <input type="checkbox"/> Locomotive Engineer | | |
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| <input type="checkbox"/> Management of Inventions | | |

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| <input type="checkbox"/> Cartooning | <input type="checkbox"/> Civil Service | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> College | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Lettering Show Cards |
| <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Commercial | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> Foremanship | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Secretarial |
| <input type="checkbox"/> French | <input type="checkbox"/> Domestic Science Courses | <input type="checkbox"/> Service Station Salemen's |
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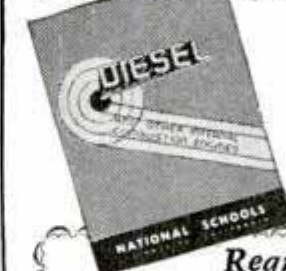
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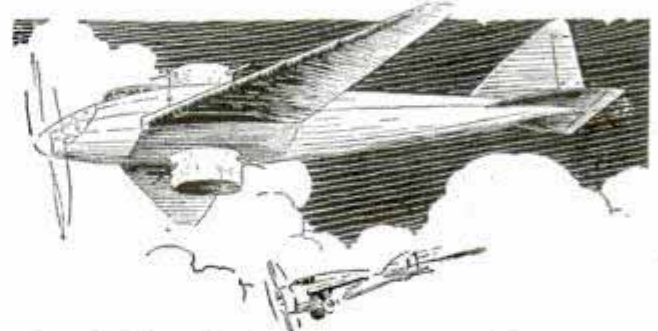
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POPULAR INVENTIONS

21045 (Continued from page 22A)

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other below. These turrets may be moved into and out of the fuselage, in an up and down simultaneous movement, at the will of the plane's crew, to combat an enemy aircraft attacking from virtually any angle.

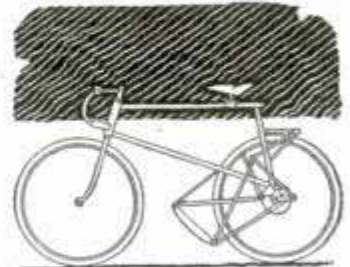
ADAPTABLE to many uses, a knapsack spray device has been patented. It is designed to be carried on the back, in knapsack fashion and consists of a tank, a nozzle, a flexible tube connecting tank and nozzle and a holder for the nozzle. The



sprayer might be employed in orchards for combating insects and molds, or in forests for extinguishing small fires.

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(Continued to page 32A)

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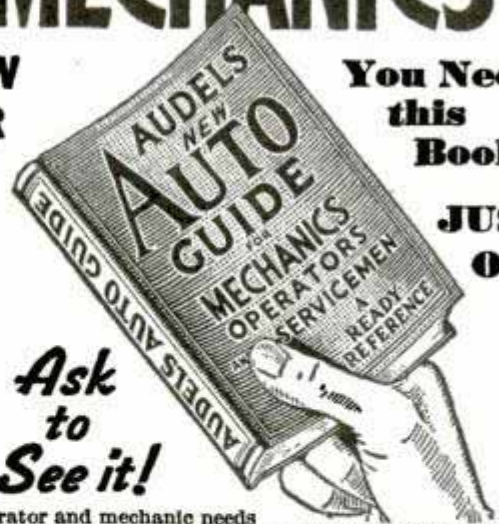
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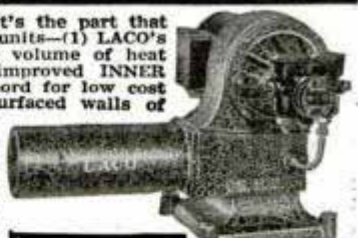
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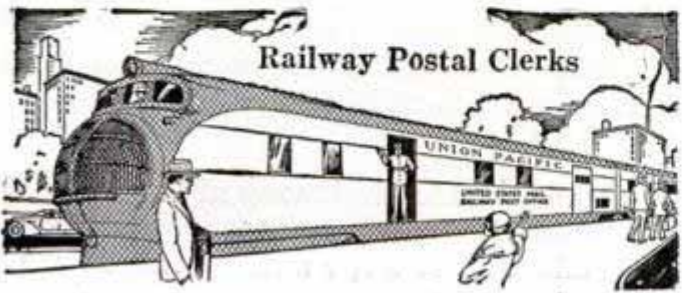


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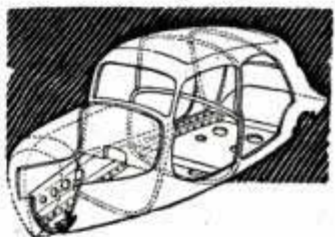
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POPULAR INVENTIONS

(Continued from page 26A)

GREATER safety for the professional window cleaner, or the housewife who does the work herself, is the objective of a guard patented recently. It comprises a pair of bars adjustably connected together, to which side bars are hinged, and means for connecting the free ends of the side bars on opposite sides of a window opening. The window cleaner works within the protective area formed by the bars. When not in use, the guard folds for carrying or storage.



PPOINTING the way to stronger construction of the automobile is a combined body and chassis patented recently. Body side panels extend continuously from the front-wheel suspension to the rear wheels. Together with inner angular cross-section side sills, the panels form with the body side panels a closed box section with combined body and chassis sill structures adapted to carry the motor, flooring and seats. Faster construction and assembly would be two advantages of the new method.



WHEN air pressure drops in the automobile tire, a newly patented gauge on the instrument panel would warn the driver. One part is so mounted in relation to the axle as to be responsive to the tilting of the axle caused by the unbalanced condition of opposite tires. As soon as this unbalanced condition is detected, an impulse is sent to an indicator on the dash.

Due to the fact that many of the devices described in this department are still in the patent office stage and are not on the market, Popular Mechanics Magazine cannot undertake to supply further information regarding them.



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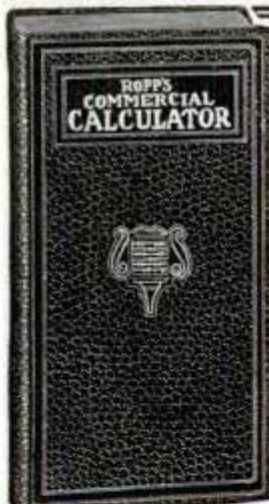
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PHOTOGRAPHIC Enlargements from pictures or negatives: $5'' \times 7''$ 25c (5 for \$1); $8'' \times 10''$ 39c (3 for \$1); $11'' \times 14''$ (2 for \$1) cash or C.O.D. Photo Art Service, 505-PM Fifth Avenue, New York City.

SIXTEEN Sparkling lifetime prints and 2 beautiful 5x7 Hollywood enlargements with roll developed—25c. Trial, 20 Lifetime prints 25c; 100—\$1.00. Prompt—careful. Lifetone Studios, F-39, Des Moines, Iowa.

SENSATIONAL Offer. Five 5x7 enlargements 29c. Cardinal Photos, Summit, N. J.

IDEAL Photos. Professional work only 25c per roll of 8 and free enlargement. Photographic greeting cards and calendars. Details free. Ideal Photos, Box 2255, Paterson, N. J.

35MM. Special. Developed and enlarged to $3\frac{1}{4} \times 4\frac{1}{2}$. Extra glossy prints \$1.30. Any 6 or 8 roll 25c. Free enlargement coupons. All work guaranteed. Kelso, Box 549-B10, Inglewood, California.

SPECIALIZING 35mm. Rolls fine grain developed, 36 enlargements, $3\frac{1}{2} \times 5$ \$1.00. Cartridge reloaded 35c. Photoshop, Linton, Ind.

BEAUTIFUL Photographic Christmas cards, 75c dozen. Send 10c and negative for sample. Hench Studios, Harrisburg, Penna.

QUALITY Since 1889—one day service. Roll developed, 2 Brilliantone prints each negative 25c. 8x10 enlargement coupon, 16 reprints 25c. 20 Photographic Christmas Cards from your negative \$1.00; 50—\$2.00. Willard Studios, Box 3535-A, Cleveland, Ohio.

EIGHT Silvertone gloss enlargements or eight prints and two enlargements, 25c. Mayfair, Box 261-K, Toledo, Ohio.

ROLL Developed, 8 prints all enlarged to double size, 25c. 16—50c. Enlarged reprints 4c. Artcraft Studios, Box 3582-A, Cleveland, Ohio.

ENLARGEMENT From each picture on your roll 25c. Lifelike enlargements bringing out the best in your pictures. High quality, fast service, low price, an unbeatable combination. Cut Rate Photos, Dept. B-4, Janesville, Wisconsin.

PROFESSIONAL. Overnight service. Developed, printed, 2 enlargements, 25c. Fotoservice, 1942 Marlow, Toledo, Ohio.

TWO Prints from each picture on your roll 25c. Your pictures will speak volumes when finished by our expert craftsmen. One day service. Nineteen years experience. Lens Photos, Dept. J-4, Janesville, Wisconsin.

ROLL Developed 8 prints and two enlargements 25c. Beautiful photographic Christmas cards or calendars from your negatives, 4 for 25c; 17, \$1.00, envelopes included. Young Photo Service, 405-G, Albany, N. Y.

BETTER Photo finishing. Eight exposure rolls developed and printed 25c. Moore Studios, Alstead, New Hampshire.

EMBOSSED Christmas cards, including envelopes, from your own negative 60c dozen. Minimum 4 for 25c. Film Capitol Service, Box 504, Rochester, New York.

ROLL Developed, 16 guaranteed prints, 25c. Smart Photo, Winona, Minnesota.

ROLLS Developed, two prints each and two free enlargement coupons, 25c; reprints, 2c each; 100 or more, 1c. Summers' Studio, Unionville, Mo.

THREE Prints each good negative in roll 25c. Reprints 3c. Fred D. Eastman, Bode, Iowa.

16 PRINTS With roll 25c. 16 reprints 25c. Rex Photo, Ogden, Utah.

ONE $6\frac{1}{2} \times 8\frac{1}{2}$ Wide border embossed enlargement or one 5x7 hand colored enlargement with each roll developed and 8 prints 25c. 36 exposure roll developed and 36 $3\frac{1}{4} \times 4\frac{1}{2}$ enlargements \$1.35. 18 exposure roll 75c. Vidor, 321-P Hennepin, Minneapolis, Minn.

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TWO Glossy enlargements, 1 colored with roll 25c. Arbor Service, 10, Joliet, Ill.

CANDID Special, 35mm. rolls enlarged to $3\frac{1}{4} \times 4\frac{1}{2}$, \$1.00. 18mm. rolls 60c. $3\frac{1}{4} \times 4\frac{1}{2}$ reprints 3c. Brown Photo Company, 1910-61 Emerson, Minneapolis, Minn.

FOR The discriminating amateur—Rolls developed 2 prints each, 25c. Reprints 3c. Superior workmanship. Same day service. Paramount Co., 327 E. 92nd St., New York.

ENLARGE Your own photos. Make money doing work for others. Build your own enlarger. 4 complete plans 50c. Popular Mechanics Press, Dept. 939, 200 E. Ontario St., Chicago.

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SELL Best pics to 2500 publication market. Inquire Tynan Pic Sales, Rhinebeck, N. Y.

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CAMERAS Films, paper 25% to 35% discount. Paramount Photo Division, 327 East 92nd St., New York.

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8MM.-16MM. Varieties. Arts. Home Movies, Box 82, Cincinnati, Ohio.

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35MM. Bargains—Westerns, comedies. Jersey Films, 2075 Richland, Lakewood, Ohio.

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SONG Poems wanted. Work guaranteed. Publishing, Great Eastern, "D27," Thomaston, Maine.

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WE Help start you in business, furnishing outfits and instruction, operating "Specialty Candy Factory" home. Men, women, opportunity to earn good steady income, all or spare time. (Our 31st year). Booklet free. W. Hillyer Ragsdale, Inc., Drawer 4, East Orange, N. J.

\$30 WEEKLY. Grow mushrooms. Cellar, shed. We buy 35c lb. Mr. B. made \$270 spare time. World's largest company of its kind. 40 page book free. Mushrooms, Dept. 701, 2019 Second, Seattle, Wash.

WANTED—Factory representatives for complete Turkish bath outfit for home use. Light, streamlined, compact. Retail \$9.95. Write today for our proven sales plan. Perspir-ator Mfg. Co., First and Utah, Toledo, Ohio.

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 booklet, none free. B. Breniser, 257 S. 21st, Philadelphia.

COLOR Concrete with chemicals. Stucco-Rock. Cement artistry. Benches. Washings. Spin concrete pottery. Miniature castles, waterfalls. Coldglaze, water-paints, marbling. Sample 10c. Hollywood CementCraft, 8527 Wonderland, Hollywood, California.

LEARN Account collecting. Good income; quick results. Interesting folder free. National Collectors Association, Newark, Ohio.

EARN Extra money at home. Increase your income at home by new, simple Wentworth Tempera Color method. We instruct you and supply you with work. Write today for free booklet. Wentworth Pictorial Co., Ltd., Dept. 3, Hamilton, Ont.

100 PROFITABLE Mail order and local plans. Gilbert Supply, 1107 Broadway, New York.

MAKE Money by mail, the way we do. Free information. Maywood, P-1107 Broadway, New York.

MANUFACTURE From Phospholene. Cleaning fluid 1c gallon; bleach 2c gallon; hand soap 2c pound; and ten fast sellers. Sample 25c. Details free. Western, 401 Climax Bldg., Cleveland, O.

ADVERTISERS! 1,600,000 Mail order circulation. Inch advertisement, \$15.40. "Get results." 20 newspapers, 18 words, \$6.50. Diener-Dorskind, 1474P Broadway, New York.

SUCCEED With your products. Make-sell. Formulas. Accurate analyses. Catalog free. B. Thaxly Company, Washington, D. C.

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.

SELL By mail. Books, novelties. Bargains! Big profits! Particulars free. E. Elfco, 438 N. Wells, Chicago.

CHARTERS: Delaware; best, cheapest; free forms. Colonial Charter Co., Wilmington, Del.

WHERE To buy at lowest wholesale prices. Information free. Yorena, Box P-312, Bayonne, N. J.

WANT More business! 2c daily opens individual New York branch office. Co-operative Mail Service, 126 Lexington Ave., New York.

START Now. Make money by mail. Easily. Details only dime. Stan, 7 Meadow St., Bayonne, N. J.

LIVEWIRES—Operate "Commercial Reporter Plan." New. Startling. Dollars daily. Thorne's, 214 W. Trail, Jackson, Mich.

OPERATE Legitimate amusement machines. Investment required. Box 1591, Rockford, Illinois.

MONEYMAKING OPPORTUNITIES

SWEETHEART Syrup. Sensational. It's a honey. Complete directions fifty cents. Hurry. Hassell, Colton Plant, Arkansas.

YOU'LL Like resilvering mirrors, auto-parts, reflectors, making chipped glass signs. Write Sprinkle, Plater, 287, Marion, Indiana.

"MONEYMAKING Ideas" publishes practical plans how to make money today. Local or mailorder. You've never read anything like it. Sample, dime. Earl Gearhart, Fresno, California.

WORLD'S Only self-tying necktie. 1,000 patterns. Sales guaranteed. Sample 50c. One-In-Hand Tie Co., Clinton, Iowa., Dept. F.

AMAZING Opportunity. Learn to make beauty clay, women's foremost beauty aid, after shaving lotion for men. Instructions and both formulas only \$1.00. Formula Laboratory, P.O. Box 720, Texarkana, Texas.

KEY Check stamping outfits. Emblem key checks, key rings. Catalog free. Sample name and address 25c. Social security plate name number 15c. Kemp & Company, 463-P East 178th St., New York.

RAISE Rabbits. We pay to \$7.00 for young. Catalogues 10c. Rabbitries, Bowling Green, N. Y.

MILLION Articles. Buy wholesale. Valuable directory 10c. Ideal Service, DR-1, Park Ridge, Ill.

START Big paying mailorder business at home. Particulars free. Wilson Sales Service, 504 E. Wilson St., Milwaukee, Wis.

MONEYMAKING Ideas magazine—Sample copy 10c. Kenneth Parish, East Syracuse, New York.

REALIZE 97c Profit on each dollar order. No canvassing, peddling, or personal contact. Send stamp for details. J. A. Luczak, 3451 Lemoyne, Chicago.

NEW! Money making secrets. get's the orders. Details free! Samples 10c. Modern Specials, Box 6346-M, Pittsburgh, Penna.

BE Independent. Sell by mail. buy wholesale. Wetzel, Valhalla, N. Y.

INVENTIVE Minded can become independent. Explanation free! Higbee, Cantil, Calif.

READ Our war and oil ad under Business Opportunities. it's worth answering. Royal Keystone Enterprise, Berryville, Ark.

"SALES Success Stimulator"—36 packed pages point prosperity path—10c. Advertisers' Assistants, West Liberty, Kentucky.

START Mailorder business. Send 25c for big folio "How to Sell by Mail" by expert. Benty, 1741 Melrose, Chicago.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, OS-1142 Sunnyside, Chicago.

EARN Extra money writing for publication. Simple method. Demand inexhaustible. Details free. Glen Donaghey, 17 Groton, Lowell, Mass.

SELL By mail. \$1.00 starts you. Complete layout. Particulars on request. Wade, 1023 Oak, San Francisco.

NEW Work for men and women. Excellent fee basis makes good income all or part time. Easily learned by anyone who can type and is neat. Complete instructions 25c. Free circular. E. O. Pendleton, 433 S. Milton, Whittier, Calif.

\$3.00 FOR 2 Hours work operating portable disk sharpener. Easily built. Small investment. Instructions 50c. Harvey Pickett, Garden City, Iowa.

AFTERNOONS Free! DeHol reported \$2,000 month (exceptional, fulltime). Work home. No canvassing! Expect surprise! National-T, Bx1240, San Bernardino, California.

BOOKKEEPERS: Make more money with tested, modern bookkeeping service. Inexpensive, simple. Bobertz, 3701 East Hancock, Detroit.

START 1940 Right! Using guaranteed Certified Formulas for "Sure Successes." Miller, Chemist, Tampa, Florida.

FREE Details. Home mail order business. Unique plans. Campbell's, 3231 North Dupont, Minneapolis, Minnesota.

"OPERATE" — (Specialty) sandwich stand! (Exceptional opportunity.) Davis, Bx1484, Clarksburg, West Virginia.

BIG Mail—Homework opportunities. 10c. Haussler, Station D, Cincinnati, Ohio.

MAIL Dealers! Whirlwind profits and steady repeat business selling new "Carbosome" folio. Send for circular or \$1 for folio and wholesale information. Giff's, Aberdeen, South Dakota.

WANT Money? Wonderful plan; it works; no investment. Write P.O. Box 1928, Hollywood, California.

MAKE Beautiful vases, jars, urns of synthetic pottery with my molds for few cents. Big profits. Write Morrow, 19 North "G" Street, Pensacola, Florida.

CASH. Mailing opportunity folders. Sample 3c. Bernard Hinkle, Joplin, Mo.

CASH Paid for insects. See Sinclair display advertisement on page 139A.

MONEY Making opportunities. Our magazines brim full. 25c. Drew, 710-5th, Devils Lake, N. Dak.

STEADY Income copying—selling names. Sample list with instructions 25c. Hausler, Box Six, Sta. D., Cincinnati, Ohio.

START Own telephone repair service in your farm community. Good money maker. We furnish instructions, material at low prices. Ideal sideline—Radio, electric, hardware stores. Inquire about county agency. Farm Telephone, Dept. A, Rogers Park Station, Chicago.

BE A professional scrapbooker. Big fees. Unlimited opportunities. Can be done at home. No competition. No capital needed. Write to Scrapbookers Guild, 59 Park Place, New York, N. Y.

MONEY By mail, new mailorder opportunities free. Harvey Teeple, Decatur, Indiana.

AMATEUR Cartoonists, earn cash at home. copying and duplicating cartoons for advertisers. Ad-Service, Argyle, Wis.

BE Funny, make money. Learn gag writing. Stamp brings information. Don Ullsh Studios, B-443 Wrightwood, Chicago.

BETTER Yourself. Present position—new job—or your own business. Advance, prosper, succeed. Startling free details. Write, Manager, VR Mfg. Company, Detroit Lakes, Minnesota.

MOULDS. Guaranteed, for casting toy soldiers, Indians, trappers, warships, sinker moulds, 244 kinds. Send 5c for illustrated catalogue. Henry C. Schiercke, 645 Spencer, Ghent, N. Y.

RAISE Earthworms for profit. Information free, stamp appreciated. Bureau Zoological Research, 106A Broadway, Peoria, Ill.

WHOLESALE Sources. 500,000 articles. Free directory. Maywoode, 1107 Broadway, New York.

INCREASE Your income, free literature. Ace Publisher, 60C, Maspeth, N. Y.

SMALL Business of Your Own. 1000 tried and proven methods. \$1.00. Popular Mechanics, 200 E. Ontario St., Chicago.

FORMULAS, PLANS, ETC.

BARBECUEING Pays big profits. Sauce formulas, instructions \$1.00. Lois Raines, Box 96, Salem, Ill.

3 GOOD Formulas with instructions for making gold, silver, gun-metal mirrors, \$10.00. Don't buy cheap formulas. Nashville Mirror Plating Co., 427 Broad, Nashville, Tenn.

FORMULAS—All kinds. Real money-makers. Lowest prices. Catalog free. Clover Formulary, 108-P1, Niles Center, Ill.

MOTOR Oil 2c gallon. Reclaim used oil. Formula 25c. George, 285 Queen, Germantown, Philadelphia, Penna.

FORMULAS: — "Chemist Approved." None better. Lowest prices. Catalog free. Kemico, 12-A, Park Ridge, Ill.

50 SINGLE-INGREDIENT Formulas requiring no manufacturing! Catalog free. A. Kinford, Wayne, Penna.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

FREE Formula catalog. Anything analyzed \$10.00. Western Chemical, Salem, Oregon.

START 1940 Right! Using guaranteed Certified Formulas for "Sure Successes." Miller, Chemist, Tampa, Florida.

HUNDRED Money-making formulas \$1.00. Box M, Saint Edward, Nebraska.

10,000 PROFITABLE Formulas, processes, recipes. Make most anything. 900 page book \$1.50 postpaid or C.O.D. (Foreign \$1.85). Catalog 3c. Adams-Brown Company, Chestnut Hill, Massachusetts.

FORMULAS: 15 Proven moneymaking formulas \$1.00. (Not stock-formula catalogue stuff), real unusual offers. List free. Marvel Laboratories, 6629 No. Maplewood, Chicago.

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

THAXLY Formulas for perfect products. Accurate analyses. Catalog free. B. Thaxly Company, Washington, D. C.

FORMULAS. Latest money makers. Literature free. Belfort, 4042 N. Keeler, Chicago.

ELITE Formulas and plans; make and sell your own products. Descriptive booklet free. Elite Co., 214 Grand St., New York.

CHEMISTRY

FREE Catalog. Chemistry, mineralogy, biology, microscopes, telescopes. Tracey Laboratories, Evanston, Illinois.

FREE: 40 Page catalog of chemical and laboratory supplies for amateur chemists. Wollensak microscopes and supplies, scientific books at big discount. JE-1 Winn, 124 West 23 Street, N. Y. C.

CHEMISTRY Course at bargain. Particulars, A. Shapereau, 620 E. 8th St., Brooklyn, N. Y.

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

GROW Plants indoors in water. Chemicals and directions 25c coin. Monroe Laboratory, Box 271, Rochester, N. Y.

CHEMICALS, Laboratory, glassware, apparatus. Send 3c for catalog CP1. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, N. Y.

CHEMICALS In 5c quantities. Catalog 5c. Fleischer's Laboratories, Everett, Mass.

SPECTROSCOPE For quick chemical analysis \$2.50. Kutting Sons, Campbell, California.

FREE Chemistry catalog. Supplies at 5c! Equip complete laboratory. Send 3c for postage. Kemkit Scientific Corp., 397P Bridge St., Brooklyn, N. Y.

HELP WANTED

EARN Cash at home! M. M. earned \$267.00, three weeks raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. Materials furnished. Starting crop guaranteed. We buy all crops. Book free. United, 3848 Lincoln Ave., Dept. 66, Chicago.

EVERY Employed person your customer! Rare opportunity for clerks, factory, mill or office workers to earn extra money! 50% commission selling social-security, life-time plates and cases. Send 10c with your social security number. Wm. Hament, 665 W. Lexington Street, Baltimore, Md.

SALARIED Positions—\$2500 yearly and up. Let us find one for you. Write for valuable information. Executive's Promotion Service, (16), Washington, D. C.

\$30 WEEKLY. Grow mushrooms. Cellar, shed. We buy 35c lb. Mr. B. made \$270 spare time. World's largest company of its kind. 40 page book free. Mushroom, Dept. 701, 2019 Second, Seattle, Wash.

AGENTS WANTED

YOUR Hose free with outfit. Make up to \$32.50 in a week taking orders for amazing new hosiery. Replacement guaranteed against holes, snags, runs. Rush name, hose size. Wilknit, Desk AA-37, Greenfield, Ohio.

STRANGE Ironing cord! Abolishes kinks, snarls. Prevents scorching. Saves time. Saves work. Saves electricity. 100% profit. Exclusive territory. Big offer free. Neverknot, Dept. 1-A, 4525 Ravenswood, Chicago.

STEADY Profits: New improved wax furniture polish. Private brands; your name. P. O. Box 247, Newport, R. I.

AGENTS: Smash go prices! Santos coffee 12c lb. 4-oz. vanilla 8 1/2c. Razor blades 10 for 8 1/2c. 100 sticks chewing gum 12c. 150 other bargains. Premiums. Experience unnecessary. Carnation Company, P. O. St. Louis, Mo.

CAR-OWNERS To put up our signs. Fine offer for anyone traveling. (Not for kids.) Get details. Atlas Sign Works, 7941 Halsted, Chicago.

TWO Way flashlight. Brilliant spotlight ahead—closeby illumination as well. May Mfg. Co., C-2, 724 Sacramento, Pasadena, Calif.

POLMET Polishing cloth removes tarnish from metals without the use of liquid, paste or powder. Agents say it sells like "hot cakes." Retail 25c. Sample free. Gale & Co., Inc., 15 Edinboro St., Boston, Mass.

AT Home, your own manufacturing business, making popular \$1 novelties. Cost you 3c to 15c. Everything supplied. Write So-Lo Works, Dept. C-842, Cincinnati, Ohio.

BEAUTIFUL Christmas signs selling fast. Beauty and tailor window signs 14x22, slogans 7x11. Free list. E. Z. Display Signs, 4614 Montana, Chicago.

MAKE And sell your own products. No machinery needed. Amazing profits. Guaranteed "Chemist Approved" formulas. Catalog free. Kemico, 10-A, Park Ridge, Ill.

500% PROFIT With new perfected (1940) quick-action, no flint, automatic gas lighter. Retail 25c. Sample 10c. New Method Co., Box PMH-84, Bradford, Penna.

100% PROFIT. Selling new ZZ Salve. Needed by everyone. For muscular aches, pains, sprains, rheumatism, etc. Send 50c for sample jar. Desk 213, ZZ Products, 5948 N. Paulina, Chicago.

SILK-TEX—Sells in every home. 100% profit. Sample 10c. Bunn, 218 S. 40th St., Philadelphia, Penna.

10c BOOKLET, "How to shave wisely," fast seller, direct and through stores. Tremendous discounts. Sample 10c (refundable). Razor Research, 130 Water, New York.

MAKE 125% On new motor accessory. Agents write Magic Co., 417 S. Spring, Sioux Falls, S. Dak.

MEXICAN Curios sell on sight. Large profits. Free particulars. Samples 10c stamps. Marquez-PR, Apartado 1176, Mexico City.

BUSINESS Proposition resilvering mirrors, autopaarts, reflectors, making chipped glass signs. Write Sprinkle, Plater, 128, Marion, Indiana.

COMBINATION Iridium tipped pen and pencil for few minutes spare time. Veltex Co., M-1, Birmingham, Ala.

SELL Magic lines. Samples 10c. Willits Service, South Milford, Ind.

AGENTS, Easy money. Instruction for making instant penetrating oil. Best on the market. 300% profit. Steady repeater. Instruction for making and selling only \$1.00. W. A. Farnsworth, 801 W. Main St., Bellevue, Ohio.

100% PROFIT In new perfected 1940 quick action self-starting cigar lighter. No flint or friction. No wind can blow it out. Retail 25c. Costs you \$1.75 dozen. Sample and can fluid 25c. New Method Company, Box PM-85, Bradford, Penna.

GOOD Paying business silvering mirrors, plating autopaarts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. N, Decatur, Ill.

NOVEL Kitchen article. Multiple repeat sales. No competition. 100% profit. Details, sample 25c. Cache Co., Box 728, San Diego, Calif.

POLISHING Cloth for all metals, wood, glass. Repeater. Regent Products Co., 19 West Jackson Blvd., Chicago, Illinois.

READ Our war and oil ad under Business Opportunities, it's worth answering. Royal Keystone Enterprise, Berryville, Ark.

MEXICAN Glass novelties, sample dime. Deluxe Creations, Box 944, Laredo, Texas.

SURE Winner, big sales. Elkin electric shaver. Guaranteed. Clean close shave. Retail 3.00. Wholesale \$12.00 doz. Sample postpaid \$1.50. National Supply, Fosston, Minn.

COLLECT 50c From each person wearing eye glasses selling our anti fog. Prevents glasses from sweating and fogging in cold weather. Jobbers wanted. Gold mine for pitchmen. Sample 50c. Queen City Chemical Co., 724 W. Trade St., Charlotte, N. C.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

ACCELERATE Your automobile with either foot. Eliminates right foot fatigue. Easily attached. Fits all cars. W & S Manufacturing Co., Dept. A, 4929 N. Kedvale Ave., Chicago.

WANTED! Agents to sell nationally guaranteed, popular priced, domestic electric refrigerators, direct to consumer. Commissions up to 50%. Gennett & Sons, Manufacturers, Richmond, Indiana.

MAKE Over 1100% profit. Save buyers one half. New home and office necessity. Quick repeats. Start now. Send 25c for sales outfit, samples retailing for \$1.10. Money back if dissatisfied. Tab Products, 2154-A Walton, Chicago.

NEW—Different—Gas station "Service Signals." Knipp Specialty, Long Beach, Calif.

REPEATING Profits selling our aluminum polish in every home. Royal Supply Co., Fairhaven, Mass.

BRAND New, super power auto product. Millions waiting. Harmless—guaranteed. Possibilities unlimited. Thermo-Exolene, Peoria, Ill.

SENSATIONAL Device cuts, trims own hair. Also manufacturing formulas. Plaza Laboratories, AX 1561 North Clark, Chicago.

FAST Selling ladder specialty, liberal commissions, extra profit for installation. P. O. Box 349, Oak Park, Ill.

NEW Furniture polish and cleaner, 230% profit. Have 25 salespeople in Chicago selling nothing else, house to house. All year repeat business. Your name and address on labels. Exclusive territory. Lynbury, Dept. K, 2601 Armitage, Chicago.

PROFITS—Made quickly introducing marvelous new All-Lead pencils. Lightning 10c retailer. "Always a writing point." Outlast wood pencils 25 to 1. Sell individuals, also attention-getting counter cards. Quick repeats build permanent business. Windsor, 41-A Cortlandt St., New York.

BRAND New item for agents, salesmen. Just out. Sells on sight. Every man needs 3 to 12. Rush name for money-making offer. Remark Mfg. Co., Dept. 8, Butler, Ind.

CELLAR-DRY. Waterproofs wet cellars on inside. New guaranteed chemical treatment. Big easy profits. Staminite Corp., Dept. 60, New Haven, Conn.

FAST Selling perfume novelties. Big profits. Vassar, 332-P Washington, Hoboken, New Jersey.

GRAB This amazing product. Proven by three years actual use. Seals punctures automatically. Run ice-picks into tires without losing air. Auto and truck owners amazed and delighted. Whirlwind seller. Salesmen can make \$100.00 per week. Distributors \$1,500.00 per month. Write immediately. Air-Seal Distributors, Inc., 8053 Beverly Blvd., Los Angeles, Calif.

NEW—Cap and handle makes pitcher out of milk bottle. Premium and home use. Sample 25c. Kapsit Co., Winona, Minn.

MYSTERY Invention, carried in pocket, keeps hands, feet, ears, body warm on coldest days. Lasts years. Everybody buys—workmen, housewives, schoolboys, farmers, others. Low prices—big profits. Write quick. Kumfy Warmer, Dept. A-2301, Cincinnati, Ohio.

SELL Artistic oil painted personal portraits. Portraiture, 2637 Evergreen, Chicago.

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

AGENTS—Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

DANDY Seller. Good profits. Details free. Societe Cent Quarante, Valley City, N. Dak.

NEW 10c Seller. Costs 1c. Western, 432 Climax Bldg., Cleveland, Ohio.

SELL Fascinating Jitterpups and carded merchandise. Dixie Supply, Rosslyn, Va.

DRESSES 10c. Hats 40c. Shoes 50c. Many other bargains—Used merchandise. Free catalog. Send name on postcard. Fairmount, 160PM, Monroe Street, New York.

AGENTS Make big profits on food products, bargain deals. Low wholesale prices. Rush name for trial outfit offer. Ho-Ro-Co, 2810-T Dodier, St. Louis, Mo.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1105-1107 Broadway, New York.

SUCCEED With your products. Make-sell. Formulas. Accurate analyses. Catalog free. B. Thaxly Company, Washington, D. C.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for short order decalcomania name plates. "Ralco," 1305 Washington, Boston, Mass.

BIG Money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 40, Dunellen, New Jersey.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 1107-P Broadway, New York.

REVOLUTIONARY Window cleaning tool. Good Housekeeping approval. Only ten \$2.25 sales daily to housewives, factories, schools, stores will make you \$350.00 monthly. Carter Products Corp., 900 Front Ave., Cleveland, Ohio.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, 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 Degraw St., Brooklyn, N. Y.

HIGH-GRADE SALESMEN

CLEAR Up to \$10 daily. Offer deluxe family Bible—\$1.95. Experts say worth \$5. Average \$1 profit. Size, 8 $\frac{3}{4}$ by 11 $\frac{3}{4}$. Every home, church a prospect. Amazing value makes fast sales. Westcraft, Dept. 213, Racine, Wis.

ADVERTISING Book matches—Sell union label book matches. Fastest selling line in America. Large sales producing kit, sample matches, complete cut catalog, eight color combinations make selling easy. Commission in advance. Superior Match Co., 7530 Greenwood, Dept. M-1, Chicago.

A REAL Future for you with Red Comet Automatic Fire Extinguishers. Low price. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Building, Littleton, Colorado.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Farrell cleared over \$1,000.00 monthly. Write F. E. Armstrong, President, Dept. PM, Mobile, Ala.

BIG Commissions—Selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

LOCAL Agents wanted to earn bonus suits and demonstrate to friends. Up to \$12 in a day easy. Experience unnecessary. Valuable demonstrating equipment, actual samples absolutely free. H. J. Graves, 1300 Harrison, Dept. B-817, Chicago.

MAGIC Clothes brush. Revolutionary invention. "Erases" dirt like magic. Saves drycleaning. Sensational seller. Samples sent on trial. Rush name. Kristee 114, Akron, Ohio.

SALESMEN: America's finest sideline. 40% commission daily. 725 fast selling repeat items. Every business uses and must buy. No investment now or ever. Sales portfolio free. Willens, 2130 Gladys, Dept. RF, Chicago.

OPENING For several good men, absolutely new trade stimulator; sells all dealers; good commission; good territory. Master Fine Arts Studio, Chattanooga, Tenn.

SELL Complete line business necessities—over 1000 items. 50% savings to every merchant. Experience unnecessary. Samples free. Commissions advanced. Northwestern, 625-RP Jackson, Chicago.

YOU Can beat competition yet make up to 40% comm. plus cash bonus. Biggest line restaurant checks, etc. Book matches, salesbooks, standardized printing for all businesses. Popular prices. Outfit free. Nationwide, 160-MB N. Wells, Chicago.

3 SALES Make \$9.00 daily. Inexpensive business stimulator. New idea. Selling prospectus 25c. Grasco, Alton, Illinois.

SELL Printing at cut prices. 500 book matches \$1.50; 2,000 business cards \$1.50; 1,000 envelopes or statements, etc. \$1.75; 25 printed sales books \$1.50; 1,000 process embossed cards \$1.50; 2,000 two-color labels, free holder \$1.50; 2,500 printed handbills \$1.75. One-third comm. Free outfit. Bargain Prtg. Co., 189-F W. Madison, Chicago.

DON'T Be a job hunter—Start your own business on our capital. No hard times; no lay-offs; always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary. Wonderful opportunity to own pleasant, dignified, profitable business backed by world-wide industry. Write Rawleigh's, Dept. AU-PPM, Freeport, Ill.

SELL A complete line of specialties. Alvin Swanson, Oelwein, Iowa.

ADVERTISING Book matches—World's largest "direct selling" book match factory offers advance cash earnings calling on every type of business. Experience unnecessary; full, part time. Low prices for high quality; quick deliveries, help you get orders. Good repeat profits. Free kit, instructions. Match Corp. of America, 3433 West 48th Pl., Dept. E-1, Chicago.

\$3,000 PROFIT In six months by Poster. Over \$6,000 in one year by Felton. Over \$30.00 daily for 90 days by D. F. P. All selling our special tool set to garages. Exclusive territory. Mesco, Beaver City, Neb.

CLEVER New auto accessory. Motorists buy on sight. Inalco, 823 Plymouth Bldg., Minneapolis, Minn.

EXCELLENT Sparetime profits! Taking subscriptions—2500 magazines. Pines, Dept. 131, 583 Monroe, Brooklyn, N. Y.

MAN Wanted—Trustworthy, steady worker. Manufacturer established 50 years will finance responsible man with complete stock of guaranteed food, farm and household necessities—you pay when sold. Mighty attractive proposition. Be your own boss. Pleasant outdoor work. Experience not necessary. No slack seasons or layoffs. Products well advertised on popular radio stations including WLW, Cincinnati, WSM, Nashville, WHO, Des Moines, and others—a big help to success. Write for no investment offer. McConnon and Company, Room MA 66, Winona, Minn.

DRESSES 10c. Hats 40c. Shoes 50c. Many other bargains—used merchandise. Free catalogue. Send name on postcard. Fairmount, 162PM Monroe Street, New York.

BLADES. Finest quality. Factory prices, postpaid. Ace Blades, Buffalo, N. Y.

EXCELLENT Opportunity selling our complete line of brushes, largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

EDUCATIONAL AND INSTRUCTION

YOU, Too, can have your own profitable, lifetime business. Operate a collection-credit bureau. Capital unnecessary. Free literature. Cole Associates, Syracuse, N. Y.

STEADY Job—good pay. Be an expert meat cutter. Sound, essential business. People must eat. Demand for trained meat cutters greater now than ever before. Intensive, short course, actual practice makes you a fully qualified, experienced, union meat cutter (union card guaranteed—furnished free) on completion of course in six weeks. Job help. Pay after graduation. Write for details. We have no salesmen. National School of Meat Cutting, Dept. U-3, Toledo, Ohio.

AIR Conditioning—Electric refrigeration. Rapid growth creates big demand for trained men. Earn up to \$35-\$50 weekly. Write for free facts. Utilities Engineering Institute, 404 North Wells, Dept. 101, Chicago.

"UNCLE Sam" jobs. Many 1940 appointments expected. Start \$105-\$175 month. Prepare for next examinations. Common education usually sufficient. Particulars—list positions, free. Write today. Franklin Institute, Dept. W3, Rochester, N. Y.

INVENTIVE Minded can become independent. Explanation free! F. Higbee, Cantil, Calif.

WATCH Repairing is steady profitable work. Experts always in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Co., A-2001 Manhattan Building, Chicago.

AMAZE With extraordinary memory! Make learning easy! Remember names-dates-facts-ideas with incredible ease. "Super Memory" course tells how. Complete 7 lessons \$3.00. Details free. Info Co., Box 1122, Chicago.

READ Our war and oil ad under Business Opportunities, it's worth answering. Royal Keystone Enterprise, Berryville, Ark.

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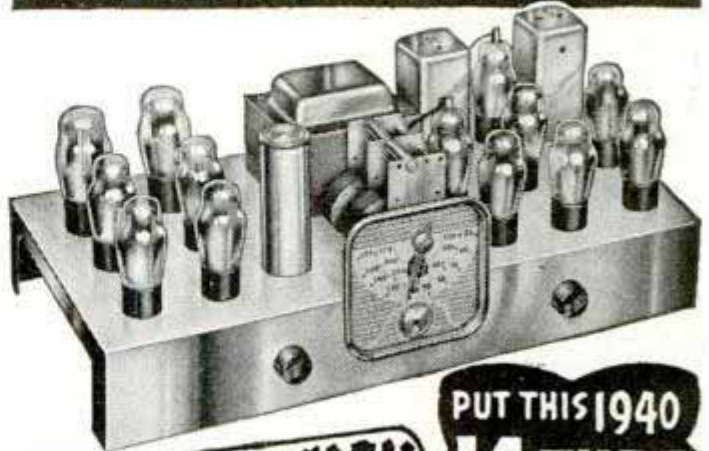
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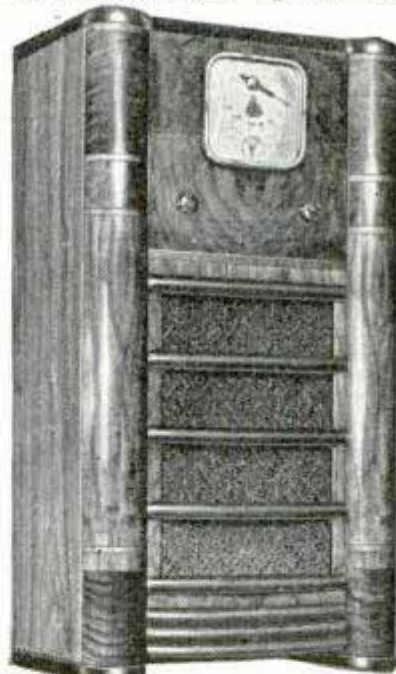
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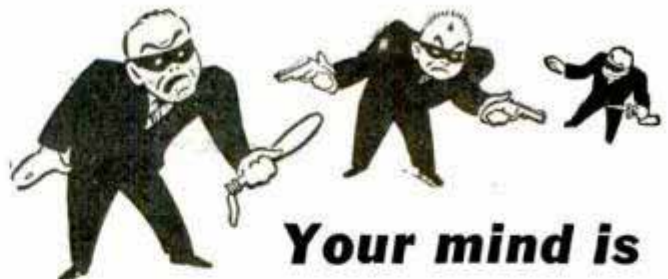
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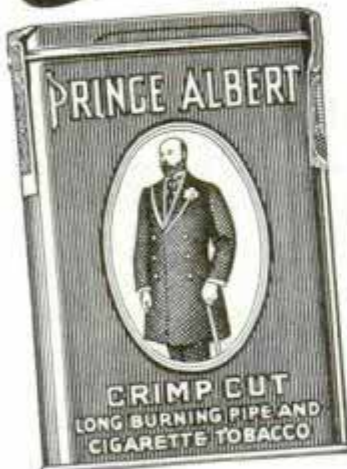
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Vol. 73

JANUARY, 1940

No. 1

ARMY *ON* WHEELS



PART I

By R. Ernest Dupuy
Major, U. S. Field Artillery

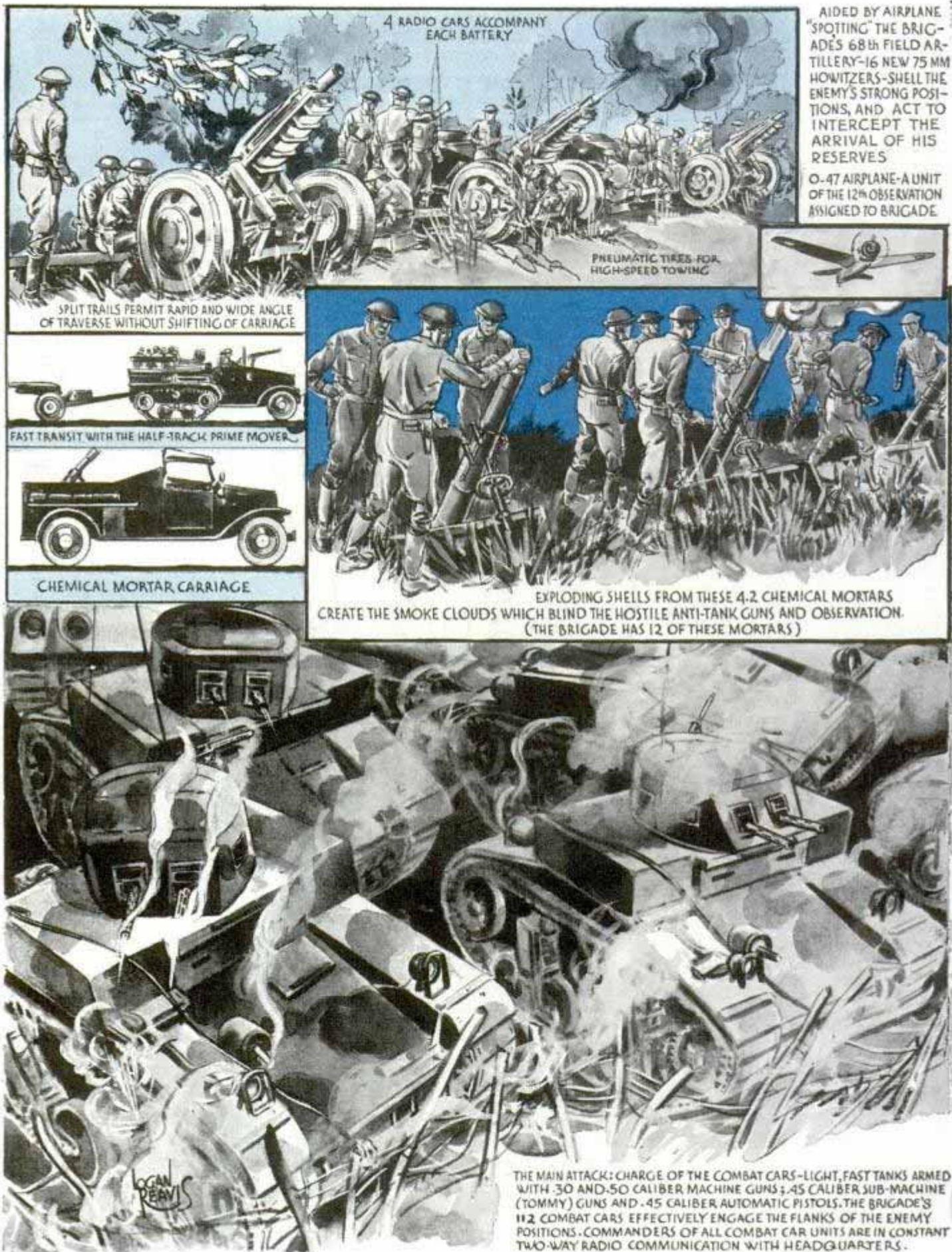
West Point 24
TANKS on the ground, planes in the sky, pig boats under water; radio direction finders, mechanical fire-control computers, automatic rifles—it's a machine age in war as in peace.

Many of us are inclined to make the rash conclusion that war today is entirely an affair of machines—with robots taking the place of flesh and blood. Nothing could be farther from the truth. War is



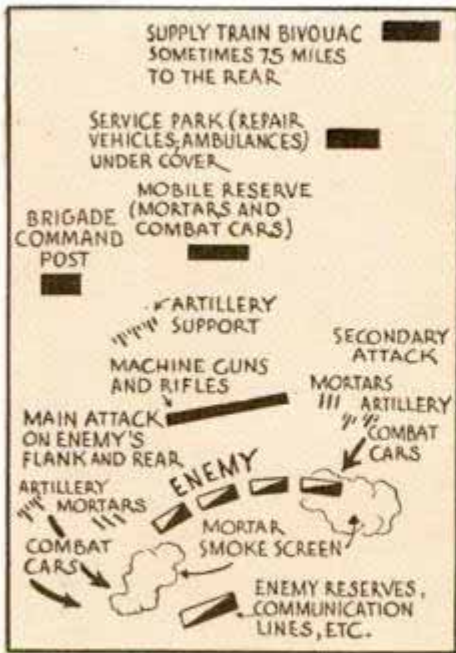
Courtesy U. S. Army Signal Corps

New 75-mm. howitzer and, below, a light tank leaping off the ground in demonstration of its cross-country capabilities

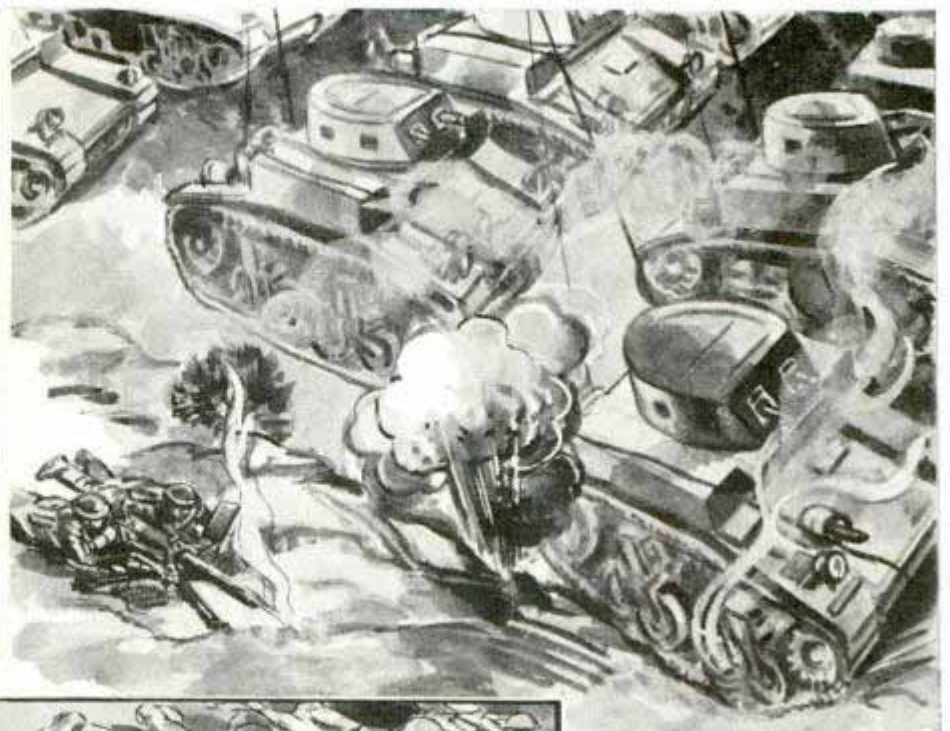


Mechanized forces which were unleashed against Poland have their counterpart in the Seventh Cavalry Brigade of the U. S. Army. Its equipment includes speedy, heavily armed and armored reconnaissance cars and tough "hell buggies"—combat cars. Drawings show how the brigade would use its equipment in battle

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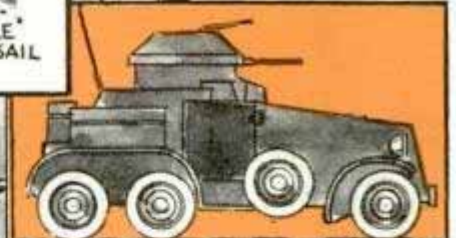
A TYPICAL ATTACK DEPLOYMENT



RAKING THE ENEMY WITH DIS-
MOUNTED MACHINE GUN FIRE,
WHILE THE COMBAT CARS ASSAIL
HIS FLANKS AND REAR.

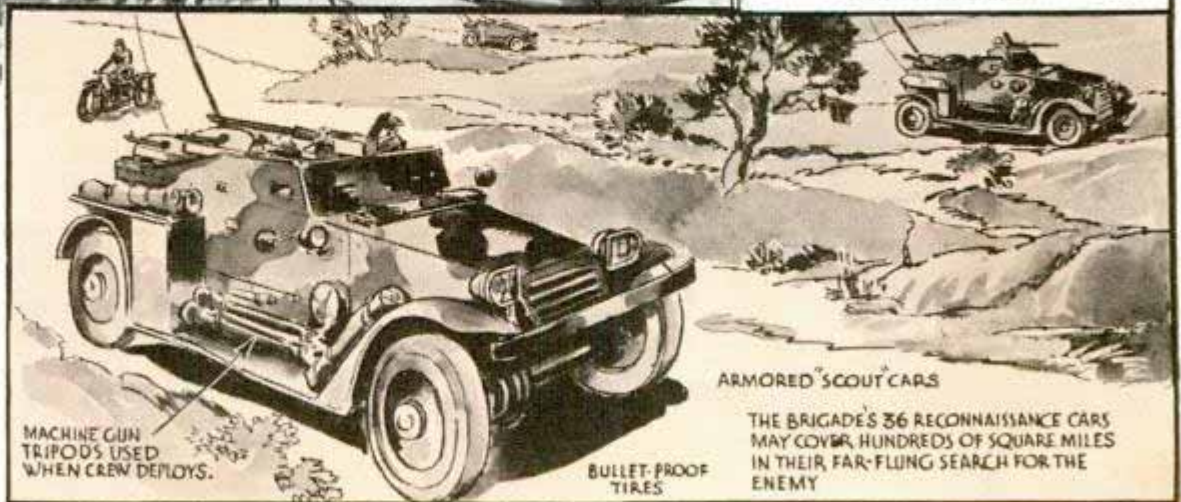


PROTECTION OF FLANKS
OF THE MACHINE GUN-
NERS AND ARTILLERY-
MEN WITH THE GARAND
SEMI-AUTOMATIC RIFLES



ARMORED CAR

LONG BEFORE THE MAIN
ATTACK THE ENEMY MUST
BE FOUND. THIS RECONNAIS-
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AIRPLANES, ARMORED
CARS AND SCOUT CARS
ASSISTED BY MOTOR-
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LATTER ARE ALSO EXTEN-
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MESSAGES. TWO-WAY
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MACHINE GUN
TRIPODS USED
WHEN CREW DEPLOYS.

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THE BRIGADE'S 36 RECONNAISSANCE CARS
MAY COVER HUNDREDS OF SQUARE MILES
IN THEIR FAR-FLUNG SEARCH FOR THE
ENEMY

Additional drawings of the manner of attack employed by the Seventh Cavalry Brigade, which comprises a total of 650 vehicles and 2,280 officers and men. On this, and the page opposite, the vehicles are shown in close formation, but in a real battle they would attack in open ranks manner, reducing chances of damage from enemy fire



Courtesy U. S. Army Signal Corps



waged by men; men drive machines. Mars is simply utilizing the latest in mechanical developments as he has since the first caveman found that by rushing on his opponent, stick or stone in hand, he could do better than by walking slowly at him, barehanded.

That first caveman didn't know it but he was utilizing the basic elements of mechanics—force and motion. Ever since that time men have taken advantage of mechanical contrivances on land and sea.

Invention of the wheel was the first step toward the earliest form of tank, the chariot. The sling, the bow, the arbalest, the ballistae hurling great rocks, later gunpowder, ushering in firearms—all of these things are machines, some invented for use in war, others adapted to it from pacific uses.

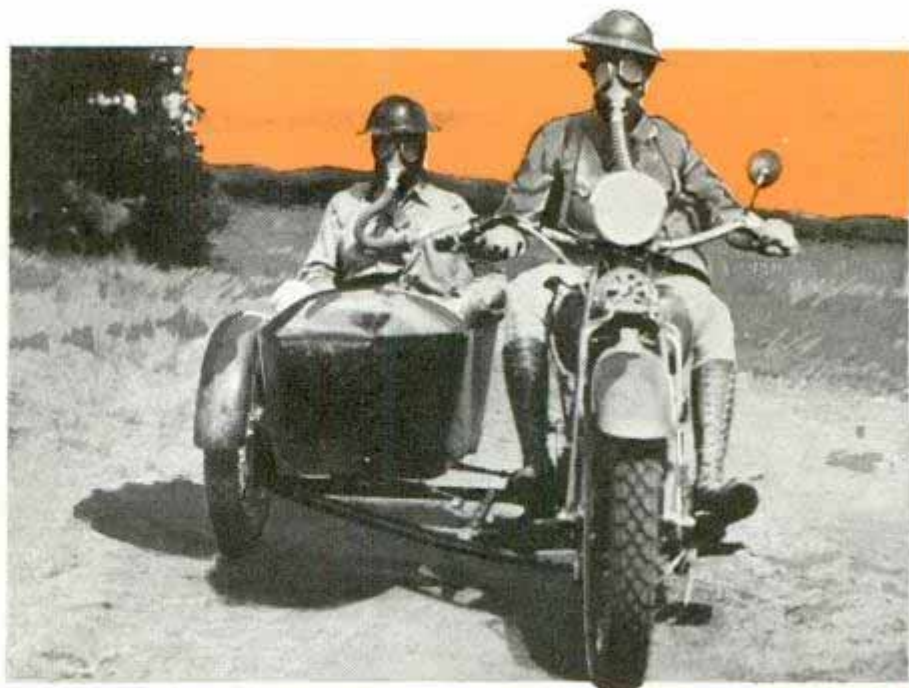
And for each new invention in offensive, each improvement in the art of war, man in turn invented something to defend himself against it, from the shield of hide to the armor plate, from the

Top, rifleman ready to attack when smoke screen becomes effective, and, right, mechanized cavalry combat car. Center, new and old in army supply transport. At left is the supply truck of today, at right the escort wagon of World War days. Bottom, tanks operating in sham battle

simple shelter of a tree or hammock to the Maginot line and the Westwall.

Fire and movement, striking power and mobility are the aids mankind has been seeking since that first caveman's rock-implemented rush. The two things are diametrically opposed. The Roman short sword stopped the Greek phalanx, the British longbow the armored knights of France. The machine gun's stutter sounded the knell of cavalry's earth-shaking charge. Armor and armor-piercing projectiles have vied with one another since before the invention of steel. And now the perfection of the motor vehicle has brought into being the mechanized forces—troops that fight from moving vehicles, differing from the hide-armored, scythe-armed, arrow-shooting chariots of ancient history only in degree of human invention.

The fight between fire power and mobility has always brought about a compromise, for the fast-



Type	Weight (tons)	Crew	Max. speed m.p.h.	Combat speed m.p.h.	Traction	Armament	Armor (thickness in inches)
Creeper	1/4-1/2	1	6-12	1-5	Track	1 machine gun	.25-.50 (front only)
Tankette	2-4	2	20-35	8-15	Track	1 machine gun or 1 cannon	.25-.63
Light tank	5-9	2-4	15-45	10-20	Track	1-3 machine guns or 1 cannon and 2 machine guns	.35-1.33
Medium tank	10-20	4-6	15-35	8-20	Track	1-2 cannon and 1-3 machine guns	.50-1.4
Amphibious	3.3-11.0	2-3	6-10 water 25-36 land	8-20	Propeller and track	1-3 guns	.35-.59
Half-track armored car	4-8	3-4	25-30	10-15	Wheels front, track in rear	1 cannon and 1-2 machine guns	.25-.50
Light armored car	4-8	3-4	35-60	25-40 on roads	2 or 4 wheel drive	1 cannon or 1 heavy machine gun and 2-3 light machine guns	.20-.35

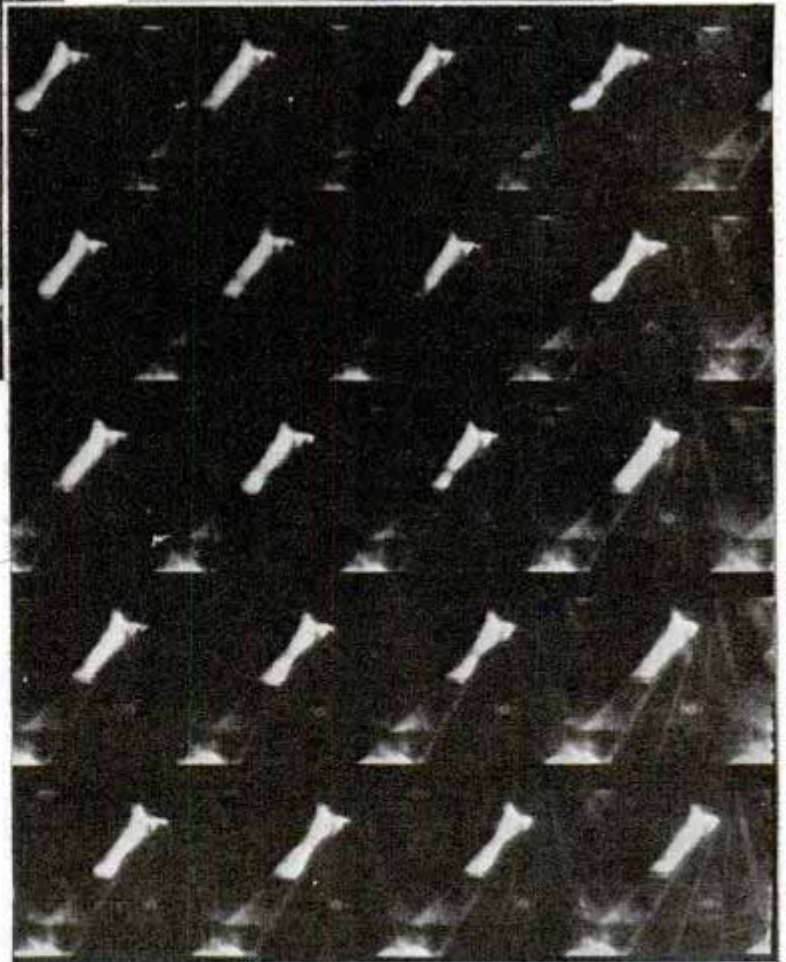
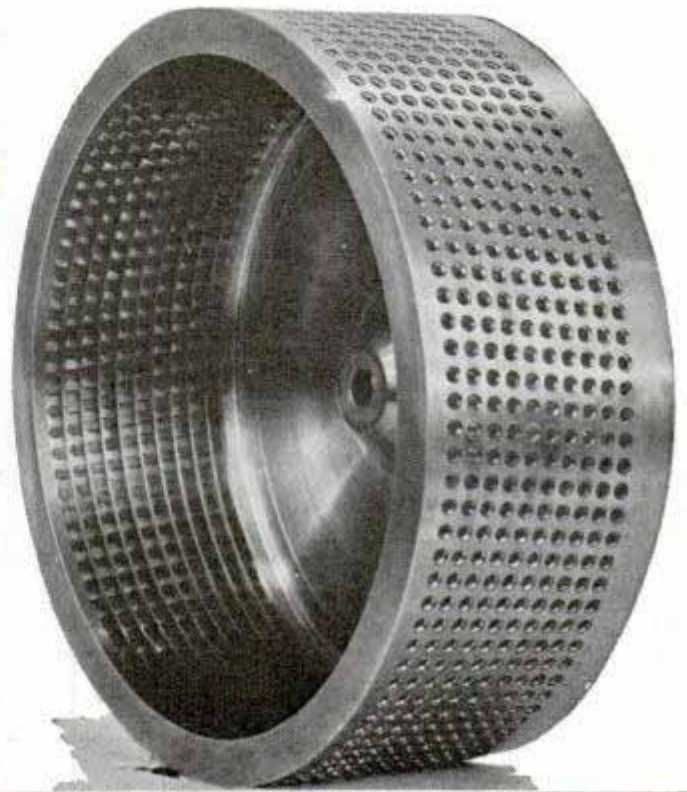
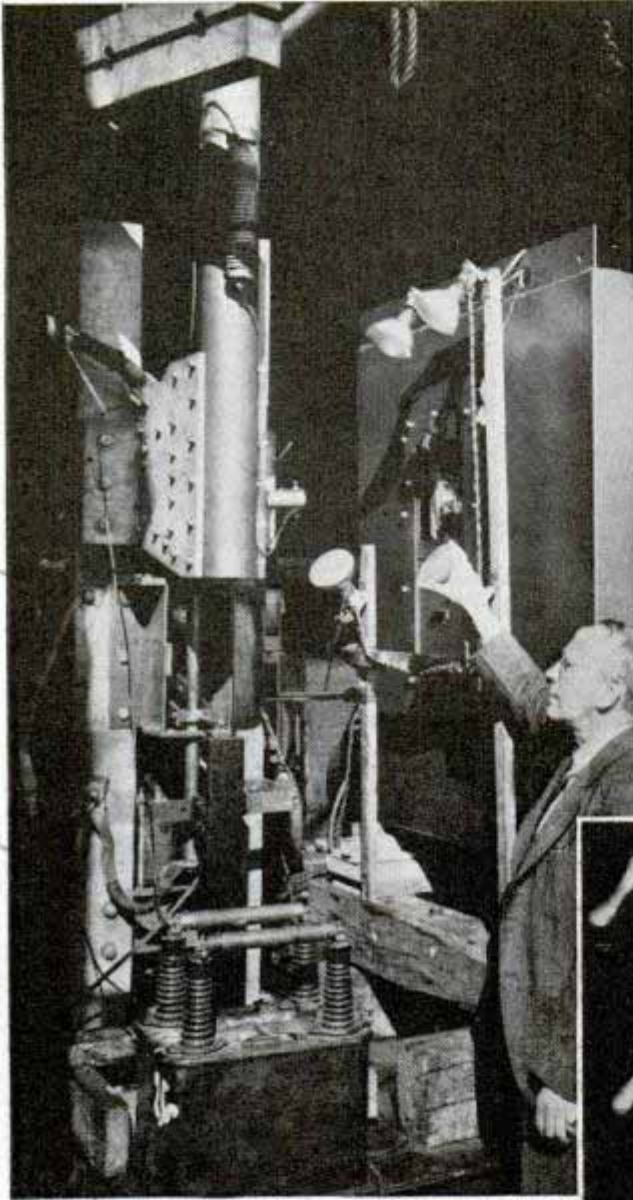


Top, reconnaissance motorcycle entering gassed area. Center, types of tanks and cars in use, with essential operating data. Bottom, tank attempting to break through a barricade

er the movement, the less protection can be carried. Conversely, the heavier the protection, the more massive the weapon, the less the speed. In our own Civil War railroads were prime factors for mobility; so too in the Austro-Prussian war of 1866. By the time of the World War, fire power—the long range punch of artil-

(Continued to page 146A)

1,000 Lenses Take 120,000 Pictures a Second



Pictures at the rate of 120,000 per second are made with a camera having 1,000 pinhole "eyes." Engineers of General Electric company devised the camera to help them study the behavior of arcs in circuit breakers and other electrical apparatus. Instead of glass lenses, the camera has 1,000 holes one-hundredth of an inch in diameter. Glass lenses, it was found, caused distortion in the pictures due to inter-reflection from the brilliant light of 5,000 to 50,000 ampere arcs, which is equal to the brilliancy of forty million watts in photo-flood lamps. The film, measuring four and one-half by forty inches, is placed around

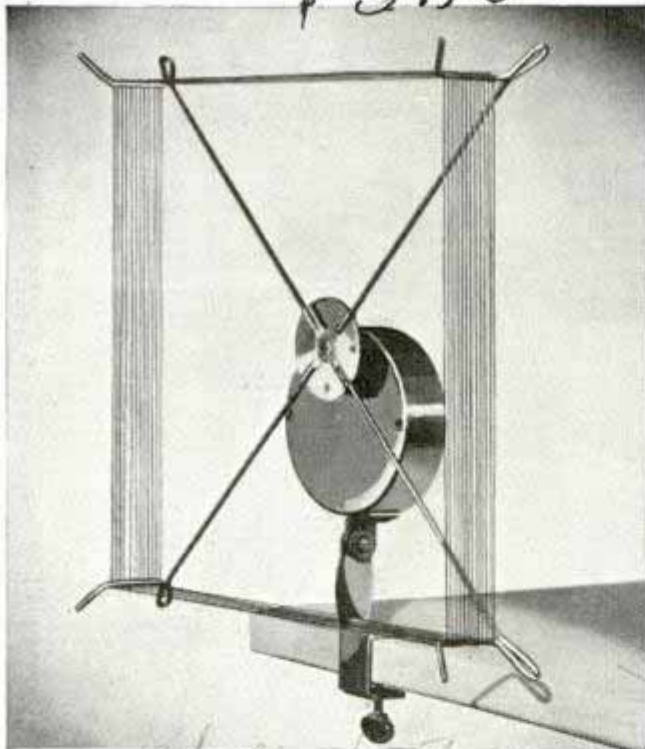
Top, left, adjusting lights before camera is put into operation; right, drum perforated with a thousand pinholes that serve as lenses. Bottom, action of arc recorded on film studied by engineers to learn more about electricity's behavior

W. K. Rankin, Philadelphia Works

the inside of a metal drum encircled by ten rows of holes. These are so arranged that no two holes are exactly opposite each other and only one of them comes into photographic position at a time. A one-half horsepower motor turns the drum at 7,200 revolutions a minute, thereby permitting each of the pinhole openings to be exposed as fast as one-one-hundred-twenty-thousandths of a second. The drum rotates within a cylinder fourteen inches in diameter, and as each of the 1,000 pinholes passes a slot extending the width of the film, a picture is taken. Pictures are about one-third of an inch square.

1208
**Reel for Drying Fishing Line
 Is Wound Automatically**

\$ 3.50



Wald speaking good
 Drying reel automatically winds fishline from casting rod and is reset for use when line is removed

With a self-winding reel on which to wind his fishline, a fisherman can dry the wet casting line quickly with little effort. A clamp with swivel mounting secures the winder to any vertical or horizontal surface. Hook the line on any of the wire spokes and press the button, and the reel automatically winds the wet line from your reel onto itself. In a few minutes the line is dry and can be rewound on the casting reel—and this automatically resets the drier for the next winding. The unit will handle 100 yards of silk casting line.

Chicago
 Eclipse Mfg. Co.

**Radio Time Is Regulated
 by Two-Way Clock**

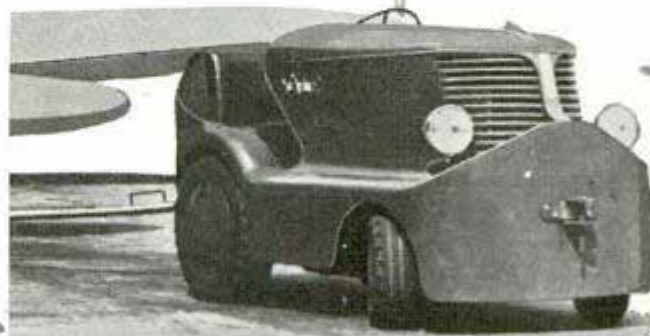


I am trying national
to indicate C. Ballman
 Clock with two dials runs forward and backward to help in timing radio programs to the second

Split-second timing of radio programs is made easy by using an electrical clock that tells at a glance how long the program has been on the air and how much time is left. Actually it is two clocks in one. The dial of one moves clockwise to indicate elapsed time, and the other counter-clockwise to show the time remaining.

1143
**Streamline Tractor for Airport
 Has Six-Cylinder Engine**

Pennsylvania at Detroit
 Airport tractors have gone streamline to keep up with the design of modern airplanes. Their job is to haul the giant air liners about the hangars and air field. The new model is powered with a six-cylinder automobile engine. *Plymouth*



Larry Foto
 Airport tractor for hauling airplanes around hangars is streamlined for movement in close quarters

4531 Jacomy, Philo
 Yale & Towne Co.

18618
maly
15555 Holman Ave
Pasadena
Pasadena

FLYING

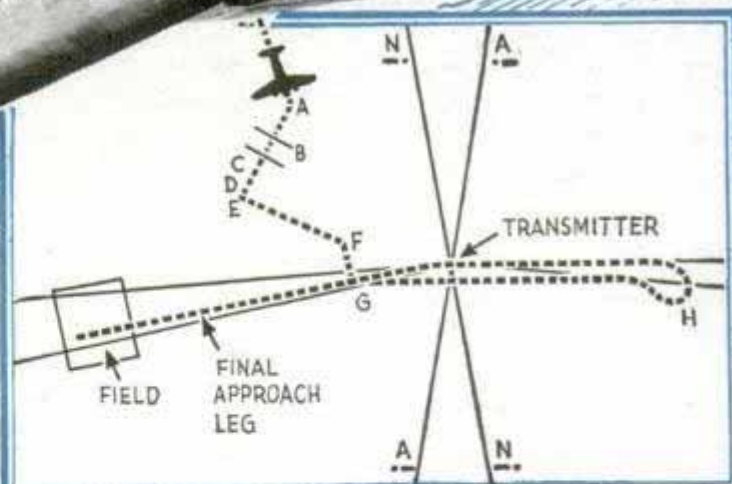


to learn his location. He had to stay in the dark, find the direction of the airport by instruments, and fly directly to it without one peek at the scenery. He was somewhere within a 40,000-square-mile area that had the field as its center, but it took only a couple of minutes for

Area above: Publishing Director
United Air Lines
Pasadena

FOR more than an hour Capt. C. R. Bowman had been flying blind at the controls of the "Mainliner." Canvas curtains were fastened securely around his side of the cockpit. He had flown off the field by instruments alone and since then he had banked the plane in turns, stalled it with and without power, and performed other maneuvers that the voice in his earphones dictated. By now he was completely lost. "Okay, Dick, let's go home."

Sitting in the co-pilot's seat, Assistant Flight Superintendent Bob Bergesen of United Air Lines' southern division gave Bowman his final order over the interphone. That didn't mean Bowman could unsnap his curtains and look over the side



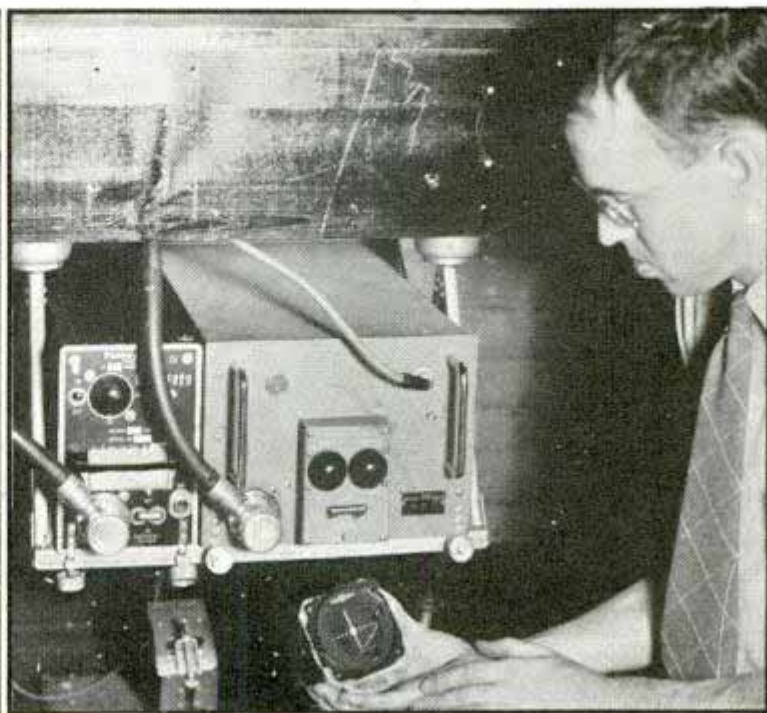
- A. Loop turned on, plane starts turn.
 - B. Null signal from station comes over loop.
 - C. Continues straight until signal returns.
 - D. Loop rotated for second null to indicate side station is on.
 - E. Loop rotated to "homing" position and plane turned to receive null on nose.
 - F. Heading of plane changed 45 degrees to intercept nearest leg.
 - G. Plane turns toward range station and flies across it to opposite leg.
 - H. Pilot makes 180-degree turn and flies back over range station, descending as he flies along final approach leg.
- Location procedure takes about three minutes at any reasonable distance from range station

Circle, pilot is curtained off while test flight is under way. Center, DC-5, sixteen-passenger transport. Below, how pilot finds airport while flying blind

"UNDER *the* HOOD"

C 0 5 1
0 1 5 1

United
H. W. DeWesse
Civil Service Commission

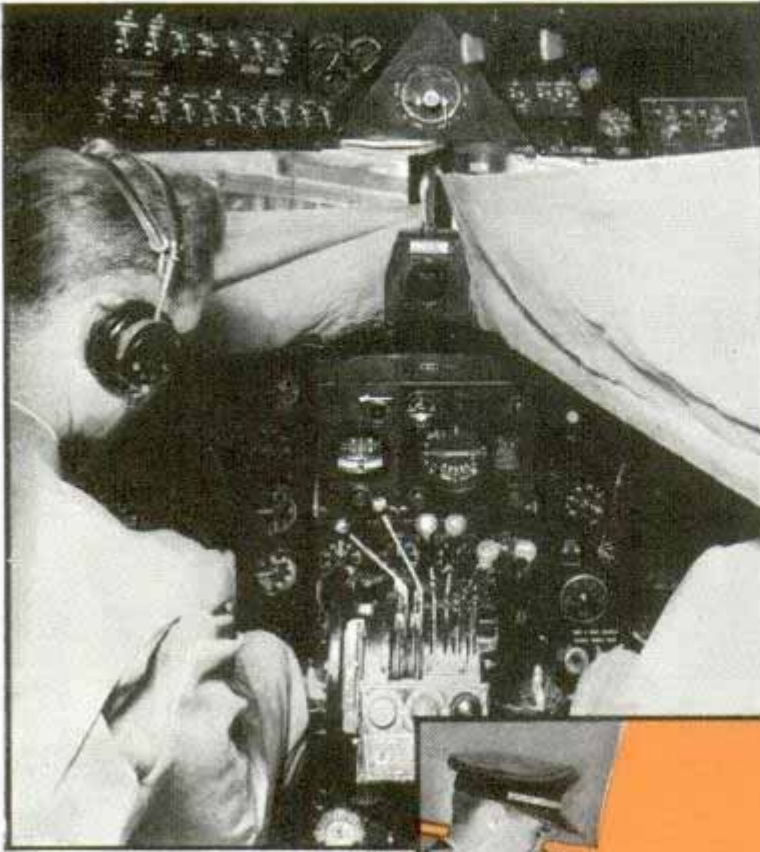


Left, Bennie Howard demonstrating throttles in DC-4. Right, instrument, in demonstrator's hand, has cross pointers which pilot follows in making landing. Below, special antenna, atop fuselage, makes possible uniform reception of radio signals required in making instrument landing

him to locate himself. Making sure that the directional radio loop was pointed fore and aft, he switched its circuit to his headphones and began a slow turn. When the repeated dots and dashes faded out he straightened his course. A few more adjustments to the loop showed him the direction to the nearest radio beam from the range station and he steered toward it. By now he had enough data to enable him to determine his exact geographical position.

All through the test Bowman had been flying by manual control. The image of his plane on the





artificial horizon told him his position in the air and the altimeter gave him his height. The air speed, compass, rate of climb, and the bank and turn instruments supplemented the others. After he flew to the radio range station he was required to turn to the final approach beam that led to the field and descend along it until he reached a certain minimum altitude over the airport.

Every six months Captain Bowman and every other pilot in charge of an air liner must pass that test. The check pilot who gives the examination sits in the clear and can take charge of the airplane if other aircraft approach. Blind or instrument flying is common today when weather obscures landmarks, and the check flights that pilots make include combinations of

circumstances more severe than they would encounter on their regular runs. Aside from their tests the pilots spend considerable time "under the hood" to increase their proficiency.

United pilots are already practicing blind landings in anticipation of the time when they will land regularly with passengers in zero-zero weather, just as they practiced instrument flying for a long period before they carried passengers through heavy weather. R. T. Freng, flight director of United, has made more than 1,000 blind landings, each time guiding his plane directly to the field and putting it down gently on a 100-foot wide runway without seeing the ground.

Details of the instrument landing system, worked out by the Civil Aeronautics Authority at its Indianapolis experiment center, include a sharply defined directional radio beam that guides the plane to the runway



Top, how pilot's compartment is curtained off. Center, examining cartridge that contains reel on which trailing wire is unwound to diminish static. Bottom, nose of DC-4 opened to expose radio compass loop

8957

21213

and a "radio glide path" radiation from a separate transmitter that creates radio waves that gradually incline upward in a dishlike pattern from the field. As a forerunner to absolute blind landings pilots will be using this system this spring to assist them in making landings in limited visibility.

On the Douglas DC-4 transports that United has ordered for service in 1941, blind landings will be facilitated by the nose wheel of the aircraft's tricycle landing system. Landing this plane is already partly automatic. The job of steering it can be handed over to the automatic pilot, which also takes care of the ailerons, and all the human pilot has to do is control his rate of descent. The nose wheel forestalls any possibility of ground looping with the rudder control set.

Control surfaces are so large that booster controls are provided to help the pilot handle the plane. These planes will have sealed pressure cabins and two-stage engine superchargers so that passengers can be carried in comfort as high as 20,000 feet for greater speed on long flights. In the cockpits will be ground-to-plane radio teletypewriters to take down weather reports as they are broadcast, relieving the crew of the jobs of copying the signals. Terrain indicators that use a radio echo to measure the distance to the ground will be another new cockpit instrument. Another device will turn on a warning light to show the proximity of another airplane.

More and more, aviation is developing radio into one of its most useful servants. If a United pilot finds that static is so heavy that messages are not coming through he simply pushes a button and the interference falls away to a whisper. The button operates a reel in the tail cone, releasing a short trailing wire that discharges most of the static behind the ship.

(Continued to page 145A)

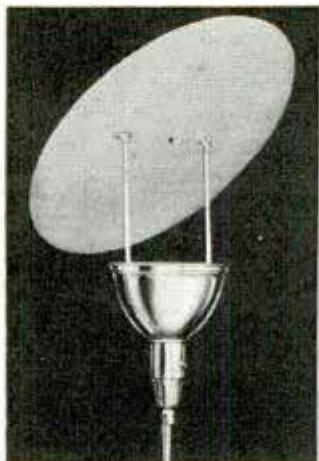
"Hoopcycle" Carries Rider and Motor in Rear Wheel



Motor and seat for rider are mounted inside hooplike wheel which is steered by handlebars attached to small front wheel

Fifty miles an hour and 250 miles on a gallon of gasoline are claimed for a motor-operated "flying wheel." Driven by a small gasoline engine mounted inside it, the hoop also circles the driver's seat. Steering is accomplished with handlebars attached to a small wheel at the front. The inventor, an automobile mechanic of Glendale, Calif., spent four years developing his idea.

Tilting Reflector Above Torch Lamp Softens Light for Portraiture

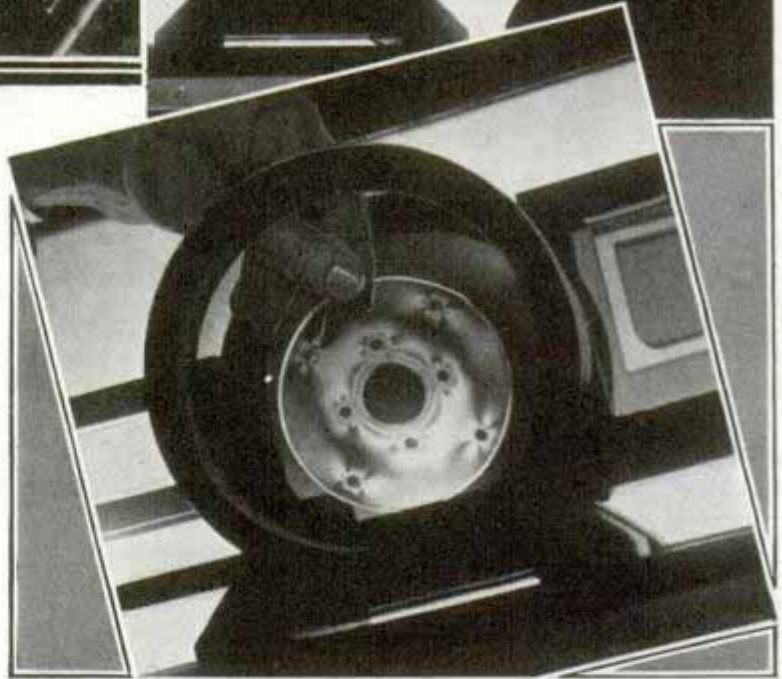


Softly glowing light, especially desirable for use in portraiture, is shed by a photographer's lamp now available. Indirect lighting is achieved by a flat-surfaced tilting reflector mounted above the standard of a torch type lamp. This can be adjusted to any angle so the light will be cast wherever desired. Remove the reflector, and the unit serves as a floor lamp.

The Halderson Co.

L. T. New York
 J. H. Chicago
 C. E. L. T. New York
 L. T. New York

"Frozen" Model Reveals All Points of Stress



Top, left, placing Bakelite test piece in polariscope; right, pattern reveals stresses in crane hook, and, below, in disk

Machine parts that must withstand heavy strains are made safer through a testing process developed by a research engineer of the Westinghouse laboratories. A transparent Bakelite model of the part to be tested is placed in an electric oven and subjected to a load such as the full-size part must endure, then the heat is turned on. For an hour the test piece "cooks" at about 240 degrees Fahrenheit, reducing the Bakelite to an elastic condition in which deformation of the piece results, due to the stresses which are exerted on it. The load is left on as temperature is lowered, thus "freezing" the deformation when the material returns to the solid state. To the unaided eye the sample appears unchanged after its heat and load treatment. Here is where polarized light comes in. The investigator cuts a slice through the model and places it in a polariscope, resembling a giant magic lantern. Polarized light,

which vibrates in only one plane instead of scattering like ordinary light, is passed through the Bakelite slice. As these light rays come out they are captured by an analyzer and form a picture of the stress lines in the model. By studying these lines, the engineer sees where the greatest stresses will occur in the part he is designing.

Two-Way Facsimile Unit for Planes Offers Rapid Communication

Two-way facsimile communication is possible for airplanes, automobiles and small boats with a transmitter weighing only twenty-five pounds. With the light-

weight unit in an army plane, the pilot can fly over enemy lines, mark information on a prepared map, then place it in the scanner and immediately send it to every bat-

Mr. Zublas. Petenyi
 G. Bell...
 1039

Service Bureau
 Ad: 24
 1251

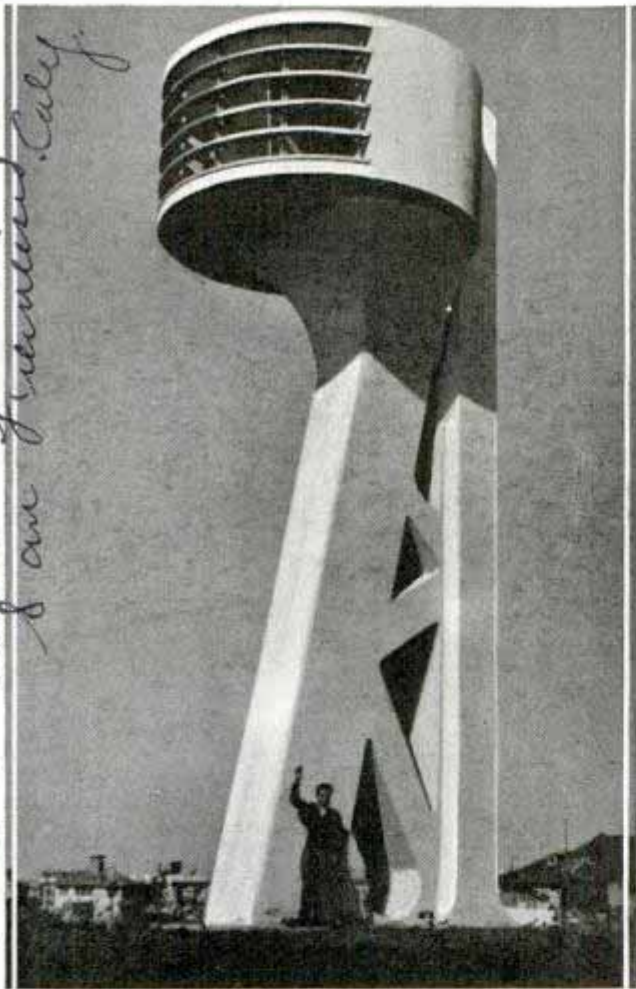
Finch Telephone Laboratories
 27 111 57 41

Demmer... of W. Va. is French.

tery which can reach the objective by gunfire. Complete secrecy is obtained by using any of the present "scrambled" radio methods which can be decoded only in pre-arranged facsimile receivers. Jamming of the air with distorting signals on the same wave length has little effect on facsimile transmission, since this results merely in graying the background but does not obliterate the intelligence which is superimposed upon it. In peacetime, airplanes and ships could use the facsimile system to exchange weather maps and other information with ground stations.

J 1152

Giant Streamline Loud Speakers Broadcast Music in Park



One of two streamline loud speakers erected in San Francisco to broadcast music and announcements

Two giant loud speakers facing each other from opposite ends of a park in San Francisco, Calif., add a touch of modern design to the surroundings with their streamline construction. The towering public-address units broadcast music and announcements to holiday throngs.

Arch. Herb L. Trumbull 1831 Polk St. San Francisco, Calif.

J 1207
Stop Signal Worn on Sleeve of Driving Jacket



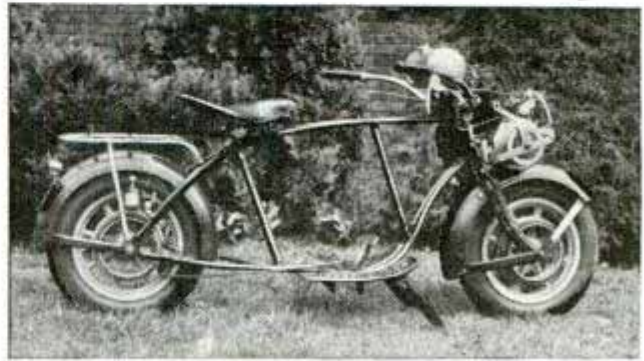
at auto show
Driving jacket with word "stop" outlined in bright reflectors makes hand signal easier to see at night

One of the latest fads for motorists is a driving jacket with the word "stop" outlined in brilliant red reflectors on its left sleeve. It adds safety to hand signaling since drivers coming from behind can see the outstretched arm more easily when their lights shine on the red reflectors.

J 1164

Motorcycle with Fluid Drive Starts without Jerk

Using an oil or fluid drive, instead of gears, for transmitting power from engine to wheel, a motorcycle is started smoothly without jerking. New in design, the vehicle carries either a one or a two-cylinder engine on the front fork. Standard straight-side pneumatic tires and drop center rims are used.



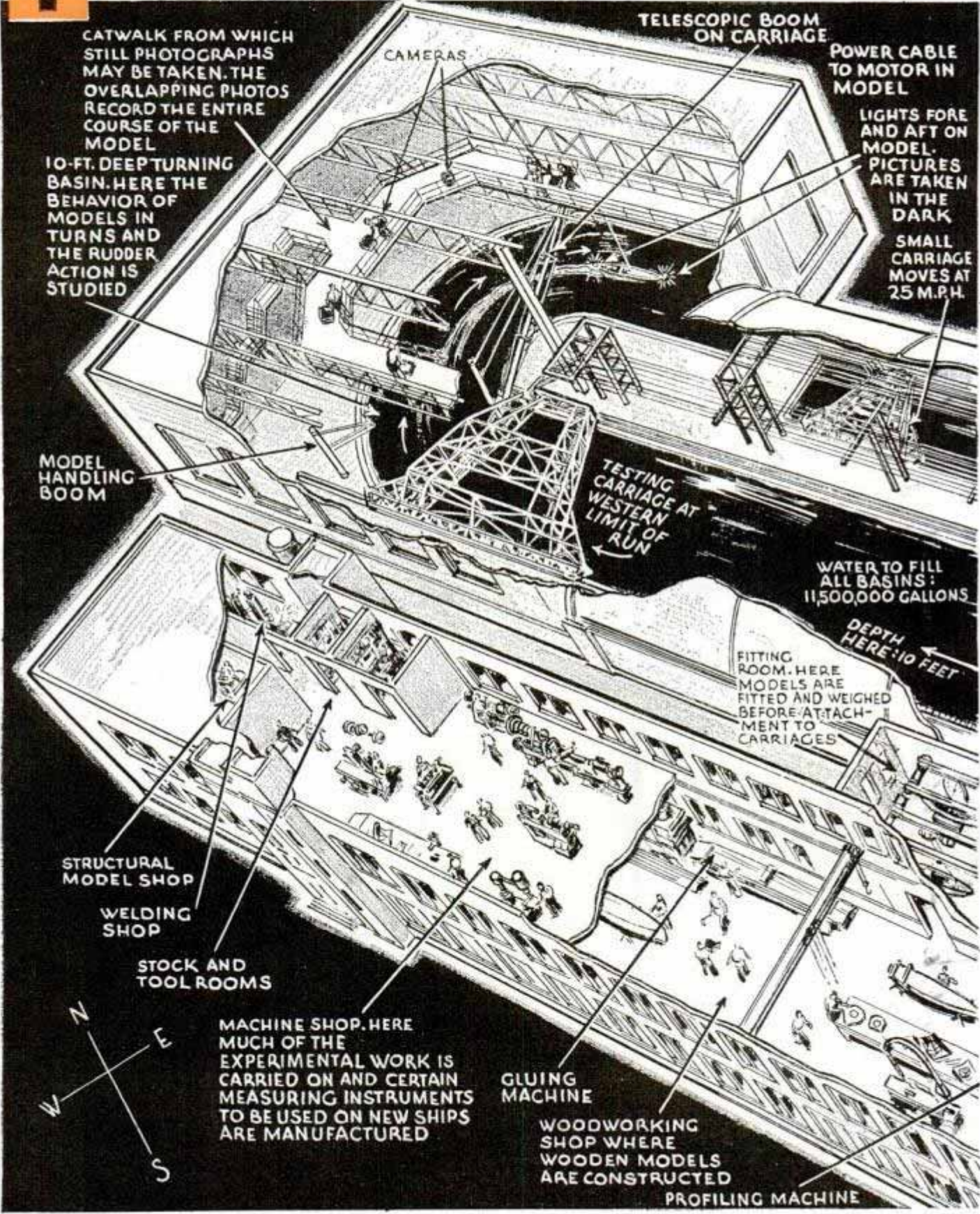
No jerking is noticed when this motorcycle starts because gears have been replaced by fluid drive

Chas. E. Miller Corp.

American Brass & Steel Co. 450. 4th Ave. New York Products Co.

1065 Cnr. 2. U. Cleaves
145 W. 46 th. New York

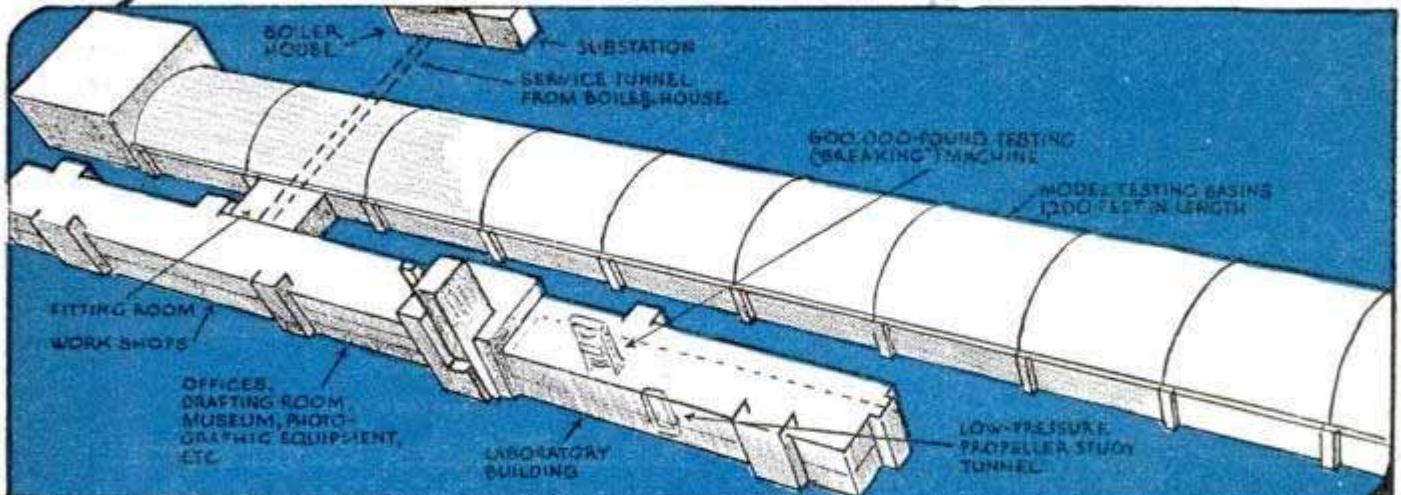
TESTING *the* WARSHIPS



Shown here is the \$3,500,000 basin being built by the navy at Carderock, Md., for testing seaworthiness of scale models of America's future battleships, torpedo boats, other naval craft and merchant ships. Self-propelled models with lights mounted fore and aft will be photographed to show up defects in maneuverability. More than 250 persons will be employed at the basin

David W. Taylor model basin

of TOMORROW

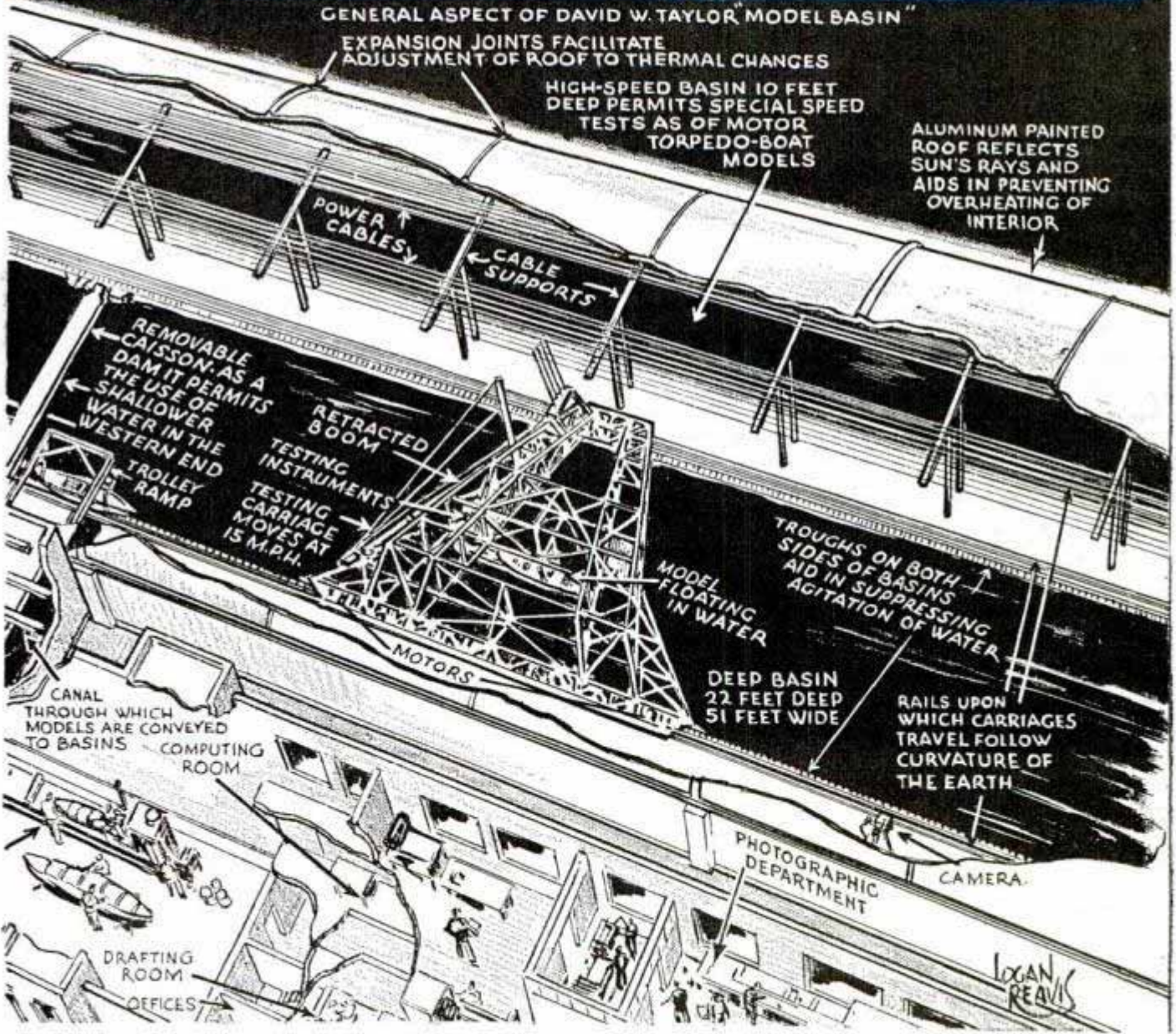


GENERAL ASPECT OF DAVID W. TAYLOR "MODEL BASIN"

EXPANSION JOINTS FACILITATE ADJUSTMENT OF ROOF TO THERMAL CHANGES

HIGH-SPEED BASIN 10 FEET DEEP PERMITS SPECIAL SPEED TESTS AS OF MOTOR TORPEDO-BOAT MODELS

ALUMINUM PAINTED ROOF REFLECTS SUN'S RAYS AND AIDS IN PREVENTING OVERHEATING OF INTERIOR

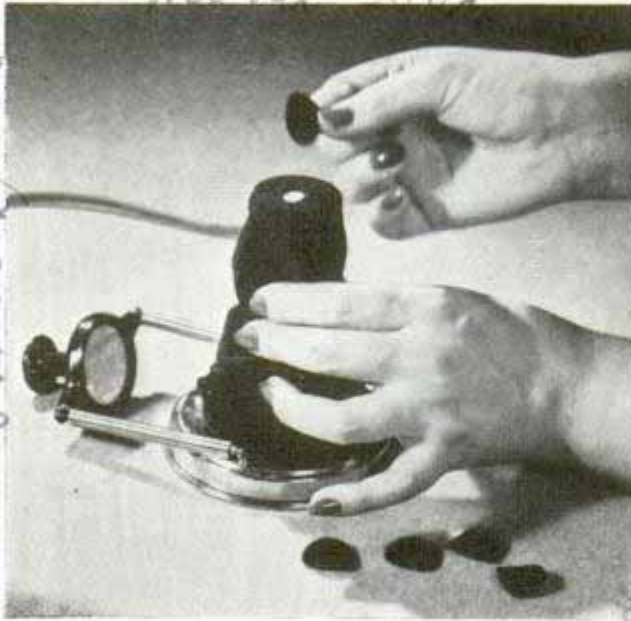


Because extreme precision is essential for tests in the 1,200-foot basin, it is air conditioned and draftless, heavily insulated and the temperature is maintained between sixty and seventy degrees. The rails on which the towing carriages ride are even adjusted to the earth's curvature. The tests are recorded on delicate instruments and wave patterns are photographed

2-118-0
16

Socks Are Mended by Patch "Vulcanized" over Hole

Lewis & Cinger
45th and West 40th Ave
Cleveland



Small patch held in hand is "vulcanized" over hole in stocking by special heating device

Socks can be mended without darning by a process similar to that of vulcanizing patches on auto inner tubes. A patch is placed over the hole and then a heating device is applied. This results in a finished mend without any lumpiness like that which sometimes appears in darning.

Built by Preston Tucker
Tucker Infy. Co. of Flint, Mich.

Four-Gun Anti-Aircraft Tank Fires 5,220 Shots a Minute

Intended as a defensive arm against low-flying aircraft on ground-strafting missions, an arc-welded combat car is equipped with three machine guns and a cannon. The automatic cannon fires at the rate of



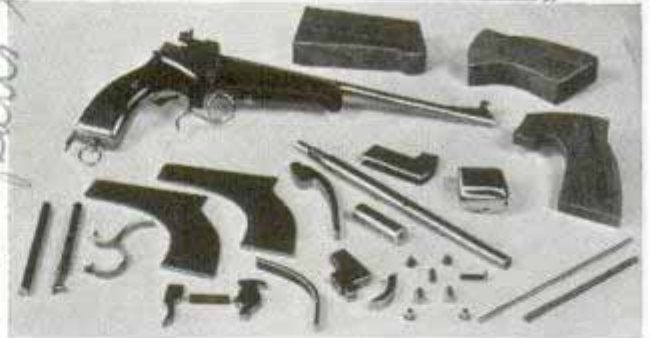
High-speed bulletproof auto with rotating turret on top is designed to combat low-flying airplanes

Simon Electric Co
12818 Coll Road
Cleveland Ohio

120 shots per minute and three thirty-caliber machine guns fire 5,100 shots, making a total of 5,220 shots a minute. With a motor of 200 horsepower, 114 miles an hour is possible. Designed by an American builder, the tank is arc welded of bulletproof armor plate to eliminate rivets. The welds themselves are bulletproof. The turret rotates freely to give complete firing range, and glass two and one-half inches thick gives full visibility. Mounted on bulletproof tires, the new mobile unit has little difficulty traveling through mud, sand and broken ground.

Kit for Building Target Pistol Requires Only Hand Tools

parts list 7 B. P. 2-00
1/264 \$15.00



Top, designer sights target pistol; below, complete homemade pistol and parts from which it is made

Sportsmen who want to build a target pistol in the home workshop can follow blueprints worked out by a Wisconsin man, using hand tools for all except the turning of the barrel, which requires a lathe or grinder. This shop hobbyist has shot down toy balloons a quarter mile distant with his homemade pistol. It is a .22-caliber weapon with twelve and one-quarter inch barrel. A pistol that might cost \$100 and more in a gunshop may be built at home for about fifteen dollars. The complete kit of parts is available in roughed-out form or ready for assembly.

The Selmer-West Co
12818 Coll Road
Cleveland Ohio



Wall Disney Productions 2719
Hyperion Ave. Hollywood Calif.
New York - 1270 Sixth Ave.

COLOR-SHOOTING in FAIRYLAND



Building the story of "Pinocchio" for the colorful motion-picture version of the fairy tale, members of story crew study sketches for a proposed sequence



© Walt Disney Prod.

Noise-makers shaking buckshot in rubber balloons to produce sound effects for Monstro, the whale. Left, animator checks his own expression in mirror in drawing wondering expression on J. Worthington Foulfellow

all, he's only a color cartoon having a furious time in a three-by-five-foot pool. And that he got his start as a model with synthetic ribs which could breathe if the stunt man was there to pump his lungs full.

Fairyland is back in Hollywood again. Even before "Snow White and the Seven Dwarfs" had rung up new box-office records, Walt Disney and his staff were sitting up nights reading fairy tales and thinking up ways

of bringing them to life in livelier and more colorful vein than ever. Several technical problems were solved before "Snow White" went on the road, but it was too late for changes and the lessons learned then will benefit fairyland's second full-length Technicolor production, "Pinocchio."



ACROSS the screen you'll watch a whale of terrifying size swim lazily, his powerful muscles undulating in blue-black waves along his back.

When he goes into a fit of rage and lashes up mountainous seas with that gargantuan tail you'll forget that, after

X 907 19

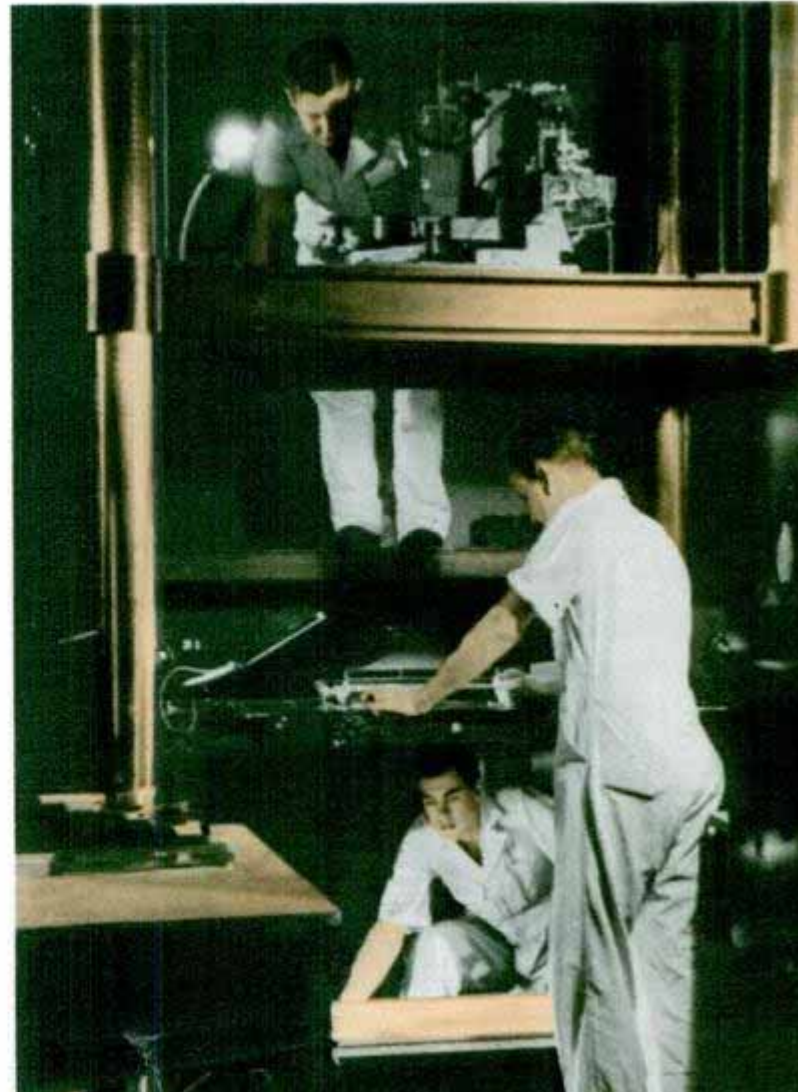


© Walt Disney Prod.

Music for the picture is produced by composer (left, above) who checks score with air of Movieola at right. Sound effects man splashing paddle in soapy water (right). Disney multiplane camera which makes possible new techniques in motion pictures

Dimensional models of not only characters but various properties in the picture were created for the animators to use in making up the cartoons of which the motion picture is composed. These models were regular little figurines designed, sculptured and cast in the studio's character model department, and painted in the same colors in which they were to appear on the screen. These models enabled the animator to obtain a more concrete idea of what the characters would look like from every angle.

In connection with the creation of the character of Pinocchio himself, actual puppets were created by the model department for the use of the animators responsible for the live marionette hero of the famous story. These animators took lessons from the fellow worker who created the puppet. A well-known puppeteer before joining the studio, he showed them how to make Pinocchio go through all





© Walt Disney Prod.

2909

26



Colors for "Pinocchio" came from paint laboratory in which more than 200 new types and shades have been produced since the making of "Snow White." This brings the total number of colors and shades up to more than 2,000

Checking up on recording equipment on sound stages must be frequent in order that music, sound and dialogue be as nearly perfect as possible. The technician is shown checking board responsible for one complete sound stage set-up in the Disney studio

21 2709

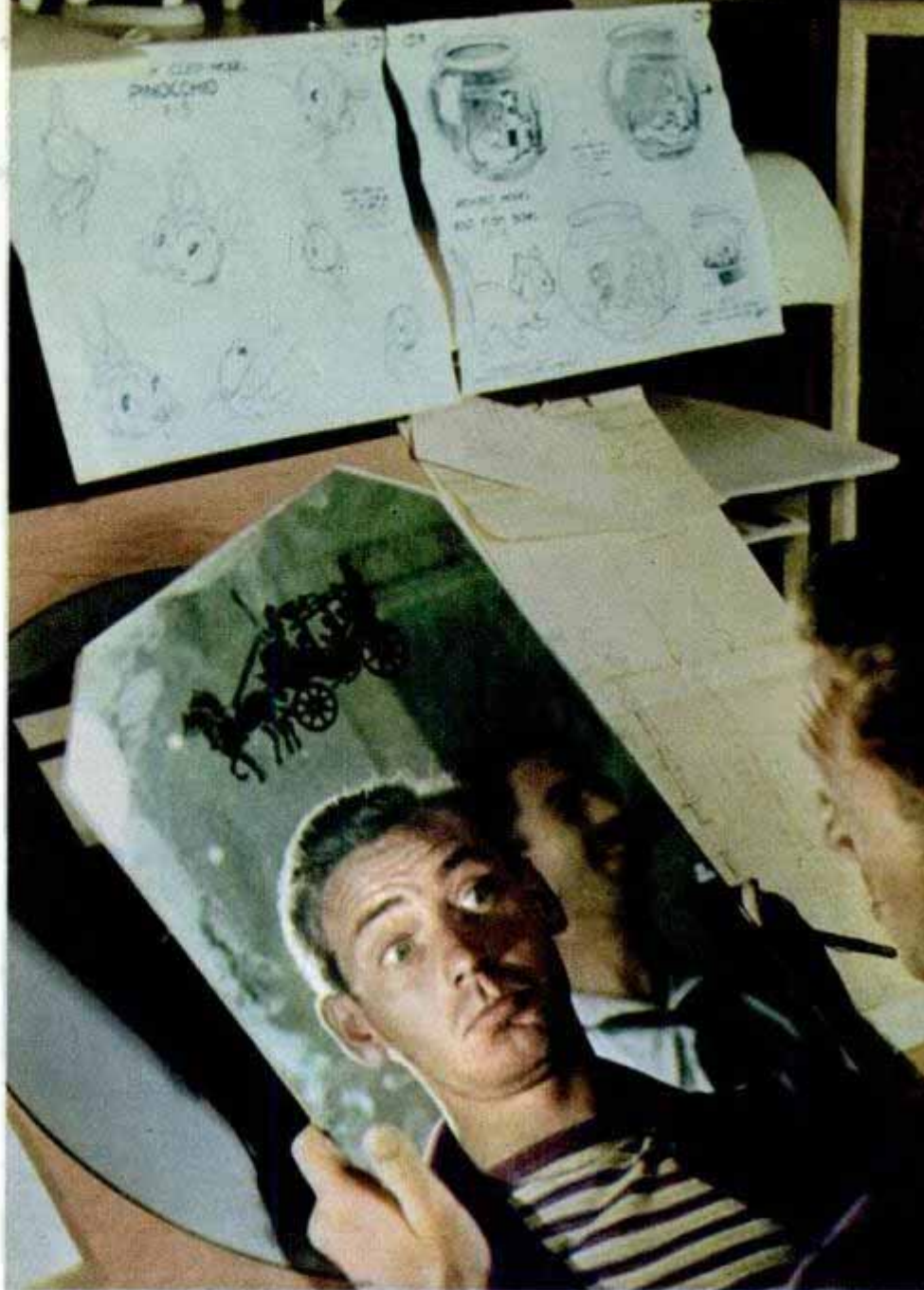
sorts of antics. This was necessary because although, in the story, the puppet is alive, he is still wooden, and therefore cannot move as a real boy would move.

Other properties which helped the animators included a little stagecoach perfect in every respect, even to the tiny lamps which were lighted by means of hidden batteries; and the wagons used by Stromboli, the puppet master in the picture. Motion pictures were shot of all these vehicles as they were trundled over miniature roads—bumps and all. These movies were used by the animators for study and inspirational aids. For the illusion of weight, the little coach and wagons were weighted with pieces of lead. The bumps in the "road" were made of sponge. This combination gave the exact appearance of heavy vehicles, while the miniature springs rocked them from side to side in a realistic way as they hit the sponge bumps.

In the story of "Pinocchio," the puppet is created by an old woodcarver named Geppetto, whose quaint old house is overflowing with toys, musical gadgets, clocks, pipes and furniture to delight the hearts of young and old. Many of the objects drawn for this animated production had their actual inspiration in counterparts which came out of the character model department.

One clock shows a mother with a small boy turned over her knee. One of his hands is caught in a jam pot. As the clock strikes, she spansks him and he cries.

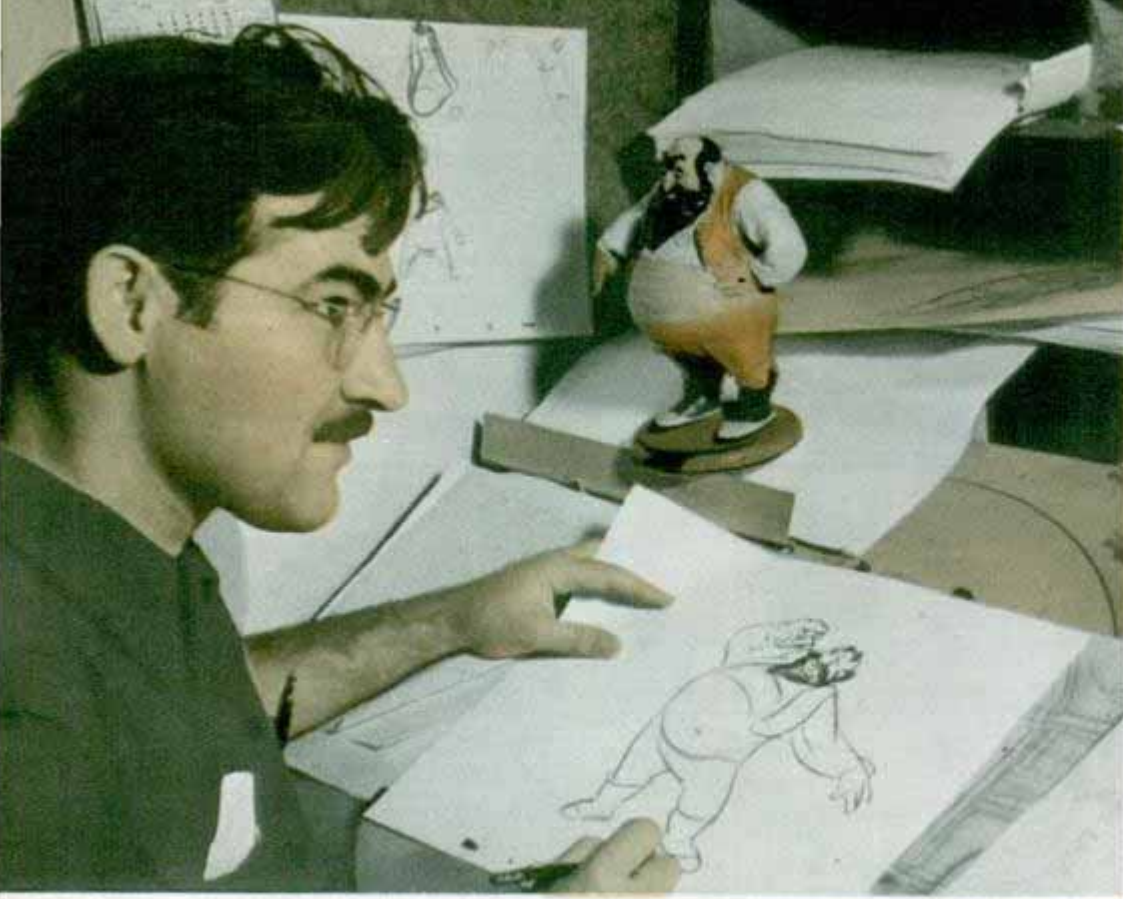
Those who saw "Snow White" marveled at the



© Walt Disney Prod.

Making faces at himself, the animator attempts to catch coy expression to pin on Cleo, the goldfish. Below, cutter synchronizing a scene from the fairy tale, seeing that picture, dialogue and sound are all "on the nose"





27

Models helped animators produce sketches for the movie. Bottom of page, sound men hard at work producing various weird effects that were found necessary at some stages in "Pinocchio." Note the devices employed by the sound men

© Walt Disney Prod.

2909 realism of the shadows, the highlights on jewels, and on shiny objects, the mists, the dusts, and the water. All such inanimate but highly important things are the responsibility of the special animation effects department. In "Pinocchio," for the first time in the field of animation, audiences will see the warm glow of a lighted match against a man's face as he lights his pipe. They will see underwater effects that look for all the world like super-special marine photography. They will see the Blue Fairy step from a dazzling brilliance of light. They will see that three-story whale rippling under the water. Animation-effects men spent months around the Pacific ocean in all kinds of weather, photographing and sketching the sea in all of its moods. They also studied the exotic and colorful under-water gardens which can be seen plainly from glass-bottomed boats off Catalina Island.

The creation of Monstro the whale lay rather equally between the regular

character animators, the effects animators, and the layout men. For months they experimented with some way to fix up Monstro so that his big bulk took on depth, perspective and highlighting. The whale was first drawn in pencil on regular animation paper. Then the drawing was traced to a special type of colored paper and the highlights rendered in chalks. From this point, the drawing went through a tracing-dyeing-photographing process on a newly developed type of sensitive film. In this way, subtleties of highlights and perspective were obtained, as well as nuances and shades of coloring impossible with regu-



2909

23

lar paints. Whale models created within the studio also helped the animators and layout men with their project. A miniature whale skeleton some five feet long was made, which the artists could twist and turn at will. The model department fashioned a rib cage and lungs which could be pumped to simulate actual breathing. Clay models were made and painted in oil so that the artists could study probable highlights and light changes on Monstro's skin.

The layout men discovered the illusion of great size could only be carried out by paying minute attention to perspective. They drew



© Walt Disney Prod.



Pinocchio being given final touches in inking and painting department (top). Overhead shot of crew on stage for combined sound effects and organ recording (center). Working model clock employed as a prop to produce a novel, humorous touch in the movie



© Walt Disney Prod.



Melding the movie (top) by using control board for dialing music, dialogue and sound up and down, as desired. Below, Walt Disney holding Pinocchio, the puppet hero of the picture, on his knee

2909
 him to approximate the scale of a three-story building. Wherever possible, the whale filled up most of the camera field. Although the largest capacity of sound ever put on film was recorded for sequences when Monstro churns up the sea in a fit of rage, the water effects were made in a tank with the relatively small dimensions of three feet by four feet by five feet. Swishing ordinary water around in this tank didn't do at all, because the sound coming over the play-back machine didn't give the effect of several tons of blubber thrashing in an ocean. The desired "heavy" tone was accomplished after one of the ingenious members of the sound effects crew suggested that they play with soapy water. Several boxes of soap powder were poured into the tank at one time, and as the suds mounted toward the ceiling of the recording room, the crew, garbed in swimming trunks, attacked the water with stirring rods and similar instruments.

When Monstro reached his peak of activity, the entire range of sound frequency was employed which, of course, meant a delicate balancing of the frequencies. The fullest amplification of sound was obtained on one occasion by stretching a screen across a framework. Above the screen was

(Continued to page 128A)

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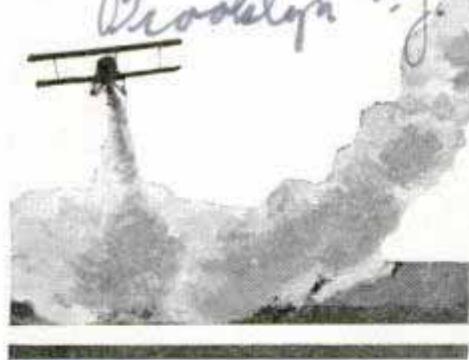
Floyd Bennett Airport
Brooklyn N.Y.

Sky Writers Play Tick-Tack-Toe with Smoke

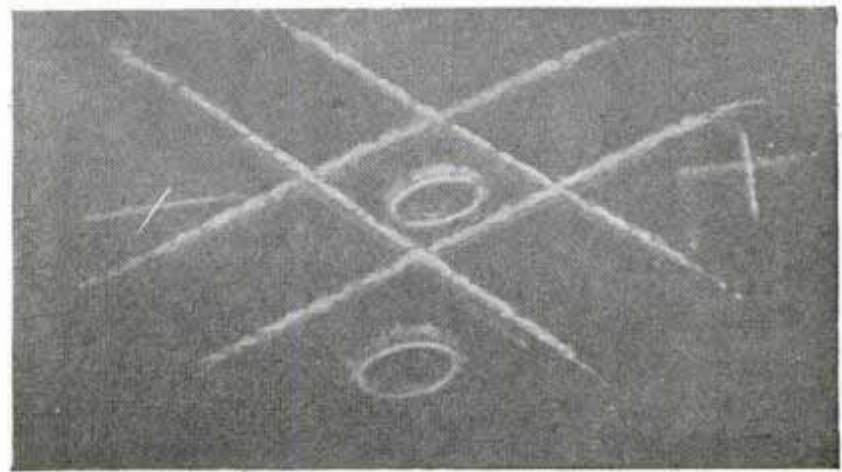
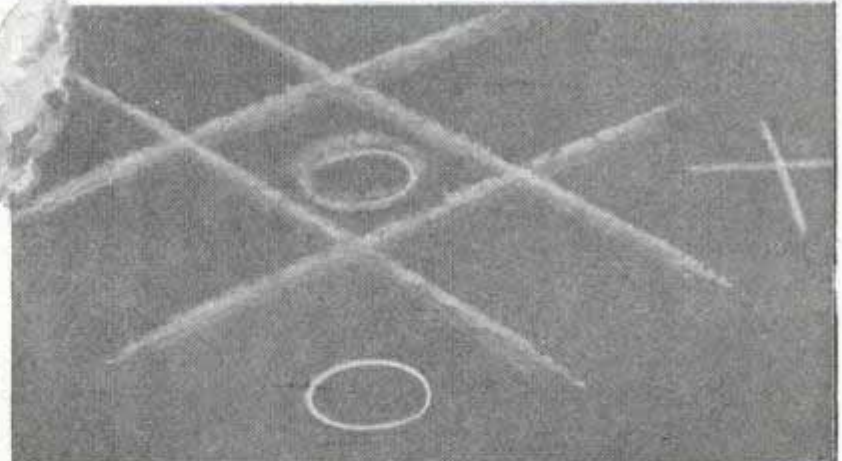
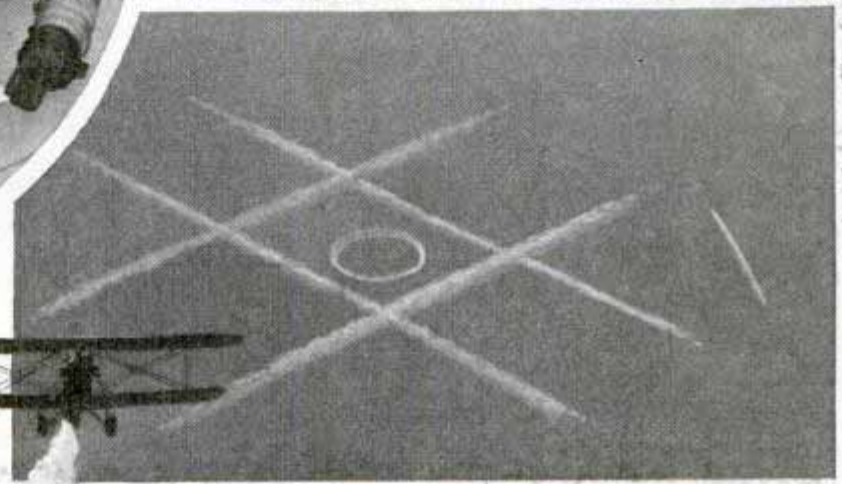
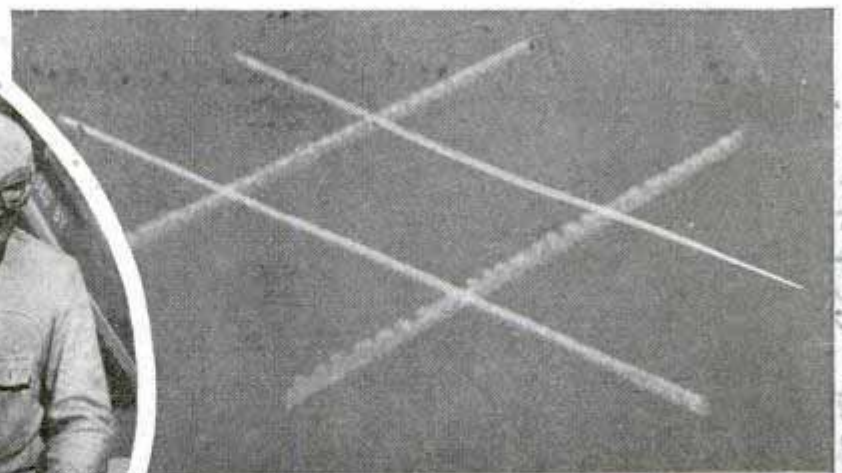


Hangar # 6,

Andy Stinis and Dave de Blasio, sky-writing pilots (above), were getting nowhere with tick-tack-toe in idle hours on the ground at Floyd Bennett airport so they decided to go "upstairs" and try their luck. Below, taking off for the biggest game ever played

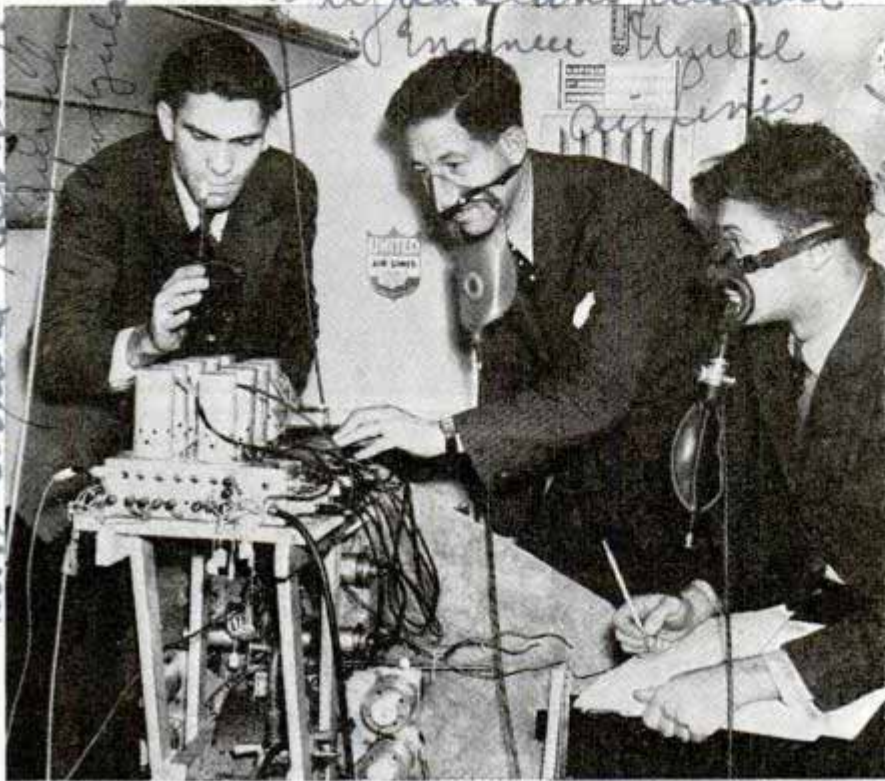


Brooklyn N.Y.



Using planes for pencils and the blue sky for a scribbling pad the two pilots fight a tick-tack-toe duel. It's not as simple as it looks, for the flier can't see the "board" without climbing above or dropping below it, they must work fast before smoke falls apart, and each line must be 100 feet or more above the last, lest propeller blast disperse previous smoke lines. In bottom scene Dave, apparently confused by twisting maneuvers at high altitude, has just put his "X" in the wrong corner and Andy has only to write another "O" to complete the diagonal and win. During the game the framework drifted twenty miles from starting point

Cosmic Rays Filmed in Plane 28,900 Feet above the Earth



Wearing oxygen masks in rare atmosphere at 28,900 feet, scientists photograph cosmic-ray tracks in Wilson cloud chamber installed in plane.

Five and one-half miles above Chicago, a twin-engined United Air Liner took three scientists on a cosmic-ray hunt the other day. They not only captured the tracks of the cosmic rays on photographic film but established an altitude record of 28,900 feet for transport planes of that type. Outside, the temperature was thirty degrees below zero. Inside, crew and researchers wore oxygen masks. At intervals they operated the photographic equipment, and found a cosmic-ray count at 28,900 feet, ten times that at sea level. The apparatus used was the glass-walled Wilson cloud chamber, which produces an artificial cloud in expanding air. The cosmic ray shooting through the air smashes molecules into ions, which, in the artificial cloud, form nuclei for droplets of moisture that mark the track of the rays, which can be filmed under brilliant lights.

World's Weather Getting Hotter, Widespread Records Show

The world is becoming a warmer place in which to live, according to records for the last twenty years gathered from many parts of the globe. An official of the U. S. weather bureau cites the records at Portland, Ore., where seventeen years in the

last twenty have been warmer than usual. During the same period Washington, D. C., had seventeen years of warmer-than-normal weather, and nineteen of the last twenty years in Cape-town, South Africa, have been warmer than normal.

Hard-Rubber Toe for Football Shoe Helps Kicker

Football wars may be won henceforth by armor-plated toes. Too often for the comfort of coaches the extra point after touchdown has been the difference between defeat and victory. In autumn practice sessions Coach George Munger of the University of Pennsylvania found his kickers could boot the ball between the goal posts ninety-eight per cent of the time, but when they traded the heavy shoes of practice for the light, fast shoe of game time they weren't so expert. The remedy was found in a hard-rubber toe with a blunt, corrugated face. It is tossed out to the kicker from the bench just before the play.

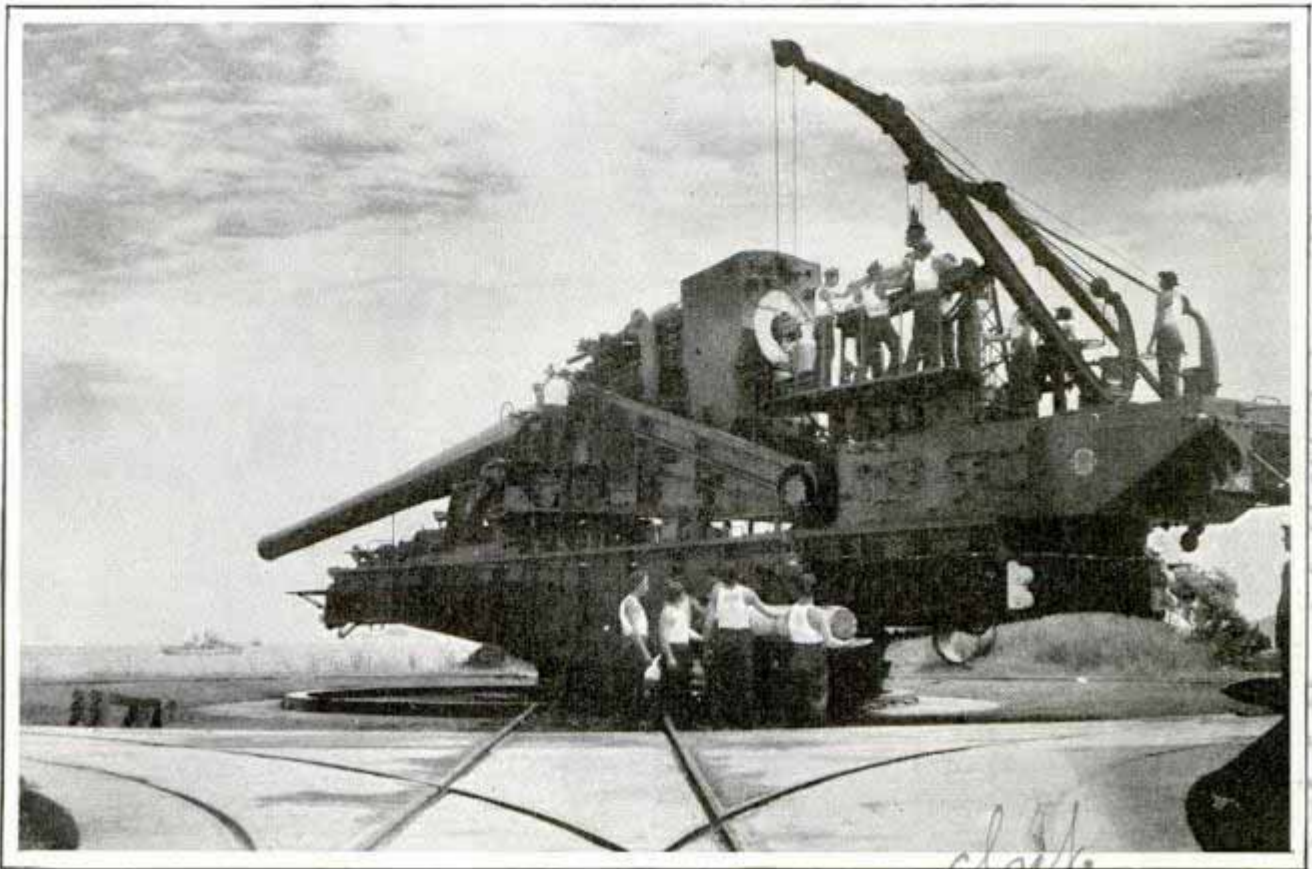


Football player fitting hard-rubber toe over shoe before attempting field goal. Notice the blunt face

Reference: Prof. Arthur H. Compton, United States of Chicago
Science Service 11/3/39
Walter Dean Research Engineer Chicago
Pratt and Whitney
Science Service 25. United States of Chicago
Mr. Barbara / 10/25/39
Manual from
29
Washingt. D.C.

21148

Fourteen-Inch Guns Guard Panama Canal



One of the fourteen-inch guns shown in loading position at Panama canal. Shells that can be hurled thirty miles in any direction are loaded by derrick mounted on gun carriage

Looking out over the Pacific ocean to threaten any possible invader, fourteen-inch guns stand guard at the Panama canal, vital lifeline of the United States.

Capable of hurling projectiles thirty miles, the giant rifles can be aimed in any direction. Shells are loaded by a derrick mounted on the rear of the gun carriage.

Self-Cooled Air Conditioner Equals 100 Tons of Ice Daily

Borrowing an idea from the household refrigerator, Westinghouse engineers have built a compact air-conditioning compressor unit with a cooling capacity equal to the melting of 100 tons of ice in twenty-four hours. Like that of the home electric refrigerator, the new "V-16" compressor is hermetically sealed. It has a water-cooled condenser, and is much more compact than earlier models because the refrigerant gas is used to cool the compressor motor as well as the air.



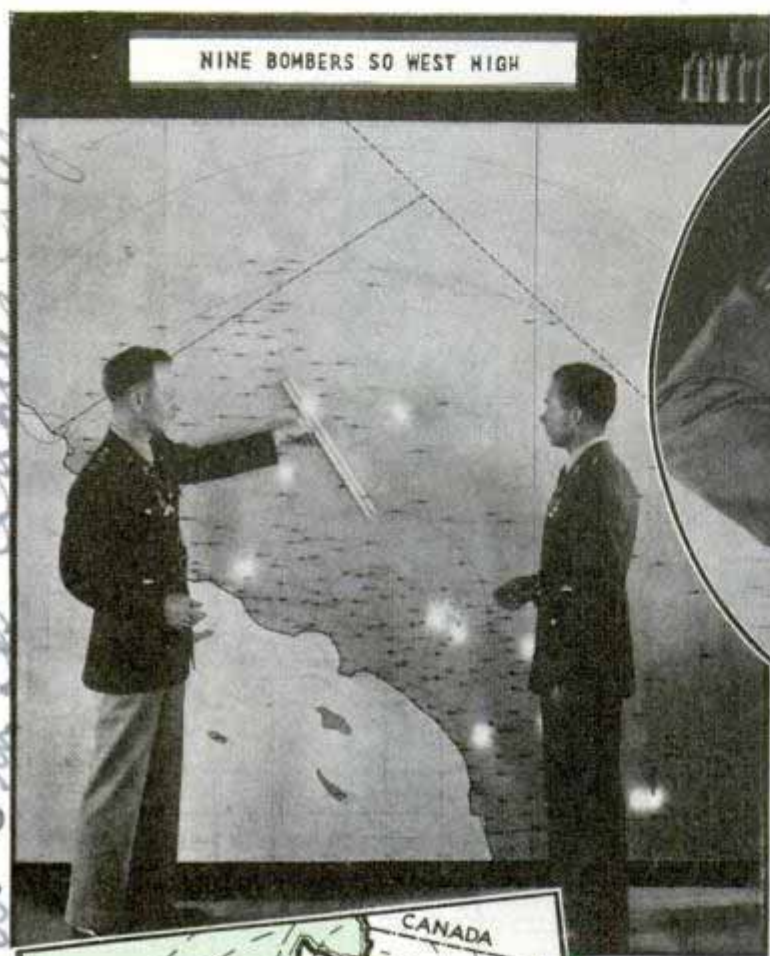
Compressor of air-conditioning unit is cooled by its own refrigerant gas

Mr. Norman E. Stinson, Jr.
10555 Halman Ave
Los Angeles, Calif.



OUTWITTING

Air Raid Warning Service - Frank Eley, Sautera,
California Edison Co. 601 W. 5th St. Los Angeles, Calif.



Left, map with light circuits to show locations reporting enemy planes. Note translucent screen overhead. Right, plotting course of planes from observers' reports. Below, map shows four message centers to which reports of enemy planes are phoned or radioed



A FLIGHT of planes representing enemy aircraft had been ordered to attack an unknown target in southern California and the defending forces had mobilized to track down the planes.

At the nerve center of the defense network in Alhambra groups of army officers and civil technicians were watching the operation of their latest idea, the new aircraft warning service. From the long telephone table a bell jingled six times and an operator lifted his receiver. "Message center, go ahead," he said.

"Flash flash 5 Ventura 215 seen Ventura 9 large bomber multiple motor monoplane southeast high 10:58 that's all."

Nine enemy bombers headed southeast had been spotted high above Ventura by a civilian observer. Checking the words on a chart in front of him, the message clerk passed the sheet to an army officer who had the job of plotting the course of the flight. On a large map at one end of the big room a red light that marked the loca-

Major Lesaslie Chan-
Capt. A. A. Hopkins,
Sheriff's Office

2898

the AIR RAIDERS

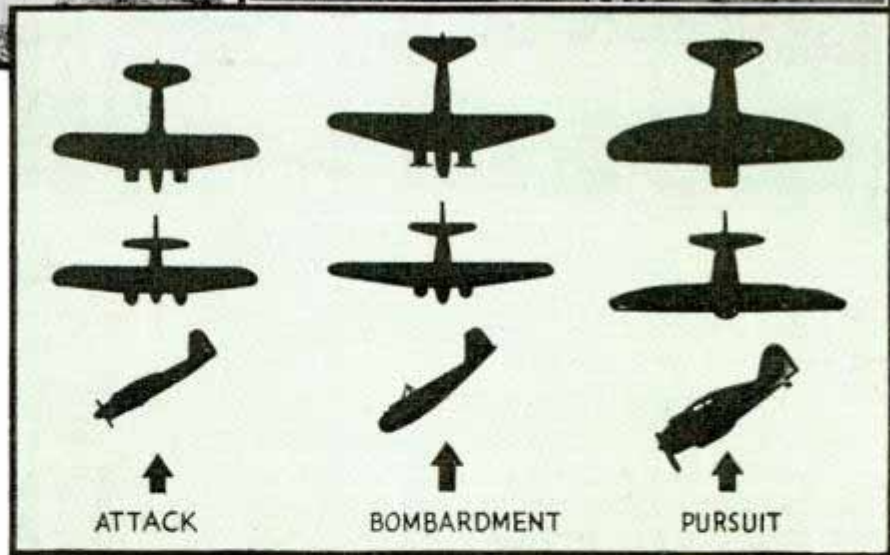
508 N. Loma St. Los Angeles



tion of the report flashed on and details of the message appeared on a moving tape on a translucent screen overhead.

By now other dispatches were coming in over the battery of phones. Teletype machines were chattering and operators at the radio posts were taking down other messages. On the big map another red light showed the latest location of the planes and the path along which they had passed was marked by bulbs that glowed more dimly.

Looking at the map and the charts in front of him, the plotting officer made his decision. "Probable objectives are Douglas airplane factory and the oil refineries at the harbor. Warn Santa Monica to ex-



Left, camouflaged anti-aircraft gun ready for enemy bombers. Right, watching cathode-ray tube that shows visual sound track of planes passing over robot listening post far away in mountains. Below, profile charts of military aircraft are issued to civilian observers to facilitate identification of planes

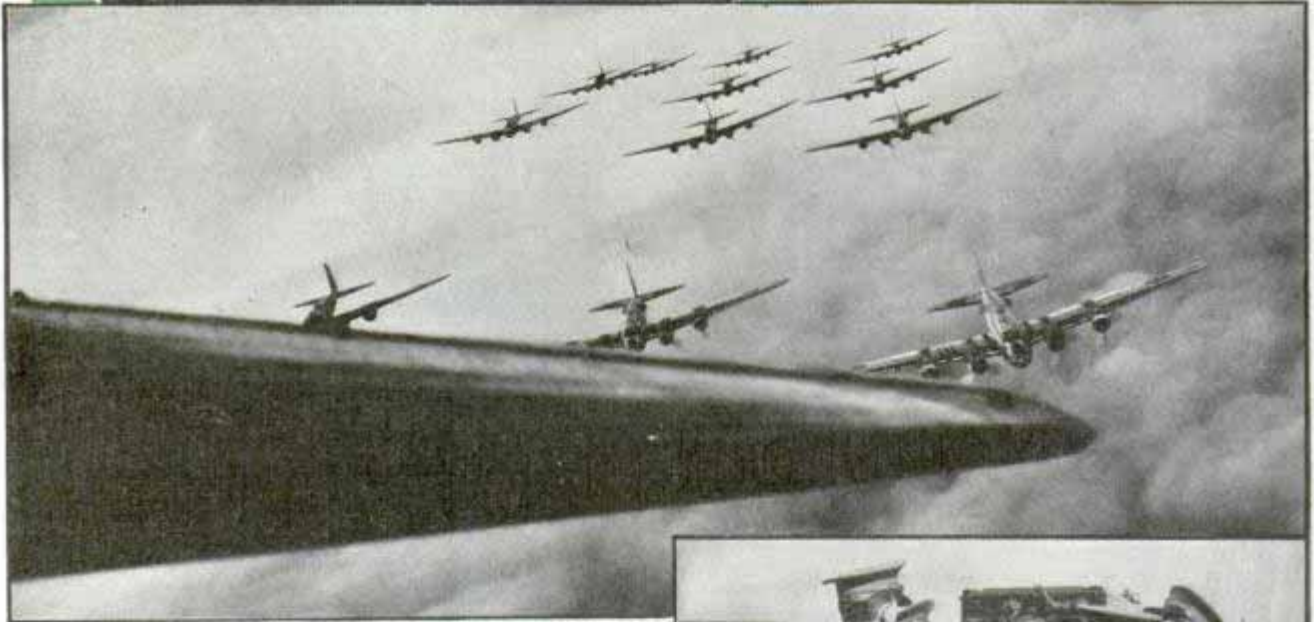
pect hostile aircraft at 11:15," he ordered. The defending squadrons at adjacent airports had already been warned by radio and now special air-raid signals were transmitted to civil authorities over the civil advisory circuits. In each town involved authorities were "alerted" for pos-

March Field Calif. B Battery



the sound of the invading planes as they passed overhead and transmitted it along a 66,000-volt power line as carrier current to the message center. The cathode tube gave a visual sound track of the flying planes, permitting detection and identification of the type at long distance. Ultimately the robot listening post may be improved to report the altitude, direction of flight and even the number of planes that it "hears."

For three days last summer the Pacific coast frontier was



sible fire suppression, rescue of trapped civilians and evacuation.

At a table beside the map a sergeant was watching a cathode-ray tube. Suddenly the glowing line on the face of the tube began to waver. "Formation passing over robot listening post number one," the sergeant reported and at the same time the room was filled with the sharp roar of airplane motors from a loud speaker below the tube.

The huge mechanical ears that the army uses to detect distant airplanes require from eight to ten men to operate and in the recent California tests an untended robot ear was tried out for the first time. Guarding a lonely mountain pass more than 100 miles away, the ear picked up



Circle, control board with switches by which lights showing position of enemy raiders can be flashed on map. Center, army bombers in test raid. Bottom, army men group around mechanical device that figures angle at which anti-aircraft gun should be fired

in a state of military preparedness. General Air Corps maneuvers gave the aircraft warning service a chance to prove its efficiency. Message centers at Seattle, Portland, San Francisco and Alhambra easily kept track of the flights from the reports flashed in by hundreds of special civilian observers who used a vast network of communication lines. On an average two minutes elapsed from the time an observer first saw the planes until he contacted the message center.

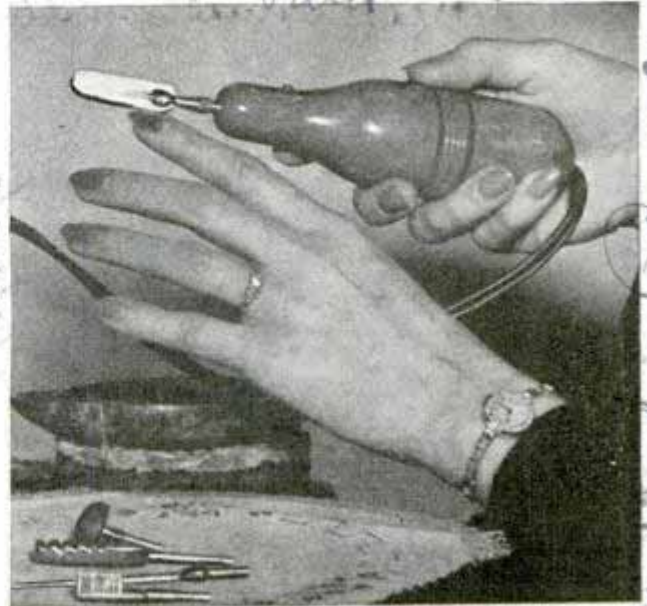
The warning service was developed in conferences between army authorities and officials of the Southern California Edison company after it was realized that in an emergency valuable time might be lost in creating a network to report the presence of enemy airplanes. The present organization consists of trained men in the employ of public utilities and other agencies, and is ready for instant operation at any time without diverting men from their usual duties or commandeering public channels of communication.

In the southern California test area a territory as large as New England is protected by men at 245 reporting stations. For the last three summers, the first two times in secret, drills were held to test the observers in speed and accuracy. Nucleus of the warning system is the Edison company's 6,500 miles of private telephone lines and 17,000 miles of light and power lines that crisscross the area and extend far into the mountains. Interconnected with these are the communication circuits of other utilities. Telegraph company line-men, station agents of the major railways, mountain lookouts of the forest service, lighthouse keepers along the coast, and navy observation stations on offshore islands all link together to form a voice, teletype, and radio network around Los Angeles that would be extremely difficult to penetrate without detection.

As organized, the warning service is merely an organization to warn the army and the population of incipient attack. At the message center are the facilities for throwing switches for a blackout as protection against night air raids although authorities are undecided about the value of a blackout in a highly electrified community. A general power cut-off would result

(Continued to page 151A)

21244.
**Electric Manicure Set
 Is a Fast Worker**



In addition to manicuring, this electric tool has been used by a jeweler for cleaning and polishing

Brush, nail file, emery bar and massager are combined in an "electric manicurist" invented by an Idaho man. Working somewhat on the principle of the electric shaver, it is four and one-half inches long and one and one-half in diameter, and besides its manicuring duties has been put to work by a jeweler cleaning rings and watches, and polishing and sanding surfaces.

1237
**Deadly Mines Washed in by Sea
 Are Set Off by Coast Guard**

Mines laid in the sea by Europe's belligerent nations frequently drift to Dutch beaches, where they are a deadly menace if not destroyed. It is one of the wartime duties of Holland's coast guard to watch the shores and shallows for these spheres and blow them up.



Smoke in right background marks explosion of one mine, while another, at left, awaits its turn

27059

Robot Sells Air-Mail Stamp, Stationery and Map

Address: Louise Campbell



Using air-mail machine which does practically everything except write the letter

Complete materials for an air-mail letter are delivered by a machine invented recently. Stamp, stationery and air-mail map are turned out by the robot for the price of the present air-mail stamp. The machine also contains an electrically operated motion-picture reel which depicts various phases of aviation news.

Preservative for Rubber Latex Solves Storage Problem

Rubber latex, which is subject to rapid decomposition, now can be kept in good condition during transportation and storage by means of a chemical preservative, consisting of sodium pentachlorophenate with a small amount of ammonia added. Lack of such a preservative has been a serious problem to both importers and exporters of latex, since eighty per cent of the world's supply is produced in British Malaya and Netherlands East Indies and

must be shipped thousands of miles. In 1937, 100,000,000 pounds of liquid latex were shipped into the United States. This development makes it possible to maintain a reserve of the highly perishable material for use in the event of interruption of the supply by warfare on the seas.

Rotary Planer for Drill Press Finishes Wood Surface

Wood surfaces can be planed to a smooth finish on the drill press with a rotary planer. It is a die cast disk with three high-speed tool-steel cutting knives, and fits into the chuck of any powered woodworking drill press. Any size plank that can be moved on the drill-press table can be handled and the tool will plane a plank two feet by eight inches in twenty-five to thirty seconds. Blades are adjusted with feeler gauges so they extend .002 below the center face of cutter body, and it is recommended that the drill-press depth gauge be set to take a cut one-thirty-second of an inch or lighter. A patented set-screw arrangement holds the cutting blades securely so it is impossible for them to get out of adjustment while in operation.



Planing piece of wood in drill press. Inset shows new tool with its three cutters held by set screws

I and F. James Roberts Hollywood, Cal. Box 1596

same as Berry tool Co. Architects Ology Kerkhof

2291 Scott St Detroit, Mich

Monsanto Chemical Co. St. Louis Mo

X-Ray Camera Photographs a Beating Heart

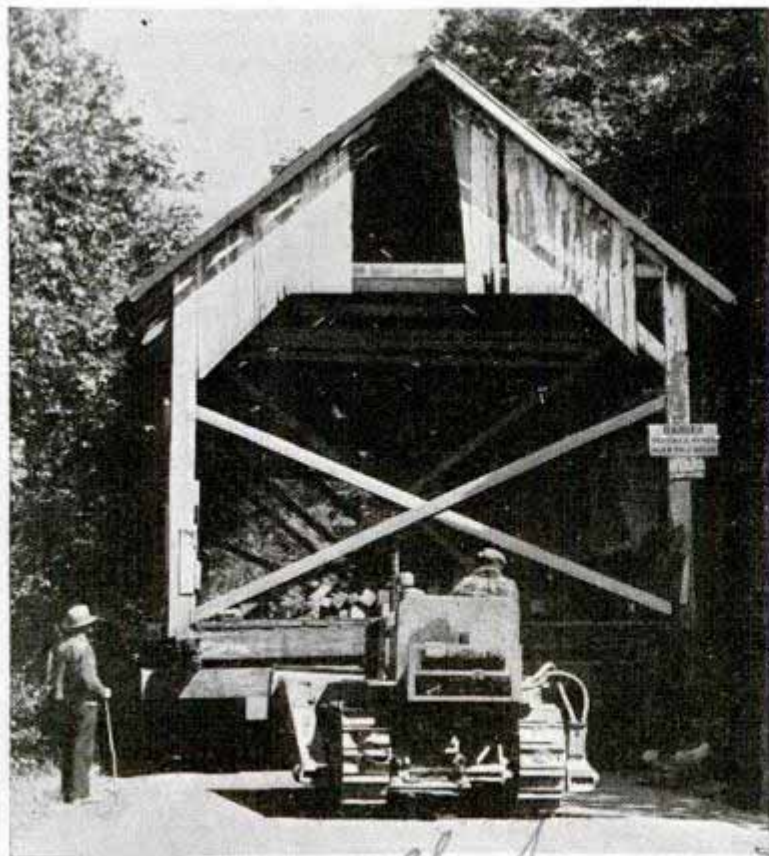
Stereoscopic photographs of a beating heart and of lungs in the process of breathing are taken with a giant automatic X-ray camera, developed by Westinghouse engineers. Controlled by a double-trigger electric "gun," the robot releases charges of 100,000 volts of electricity, stopping action to one-sixtieth of a second, with perfect safety to the subject. Pressing the larger trigger raises the voltage to the point at which it is set for operation and operates five relays to make the apparatus ready for taking X-ray pictures. The smaller trigger starts another series of four electric relays, which in turn cause the film to be exposed and then quickly adjusts the apparatus to the



Automatic X-ray camera releases charges of 100,000 volts of electricity when trigger is pressed to make split-second pictures of beating heart

proper angle of view for the second part of the stereoscopic picture. When this action is completed the circuit automatically resets itself for another pair of pictures.

Covered Bridge Moved by Tractor to Its New Location



Tractor hauling old covered bridge through park to new location in order to preserve its rustic beauty for posterity

Sentiment forestalled the destruction of an old covered bridge in the west when its removal became necessary to make way for a modern bridge. As a result of protests by citizens, the historic structure was towed by tractor to a near-by park where it will spend its days in retirement spanning a small creek.

Doctor Finds Length of Life Depends on Shape of Body

How long you'll live depends somewhat on the shape of your body, two scientists found after a study of body shapes. Early deaths from heart and kidney ailments were indicated by large abdominal girths and chests that were unusually large or small. Cancer was more prevalent in men overweight or underweight, and in diabetic persons the weight and girths were larger than average.

J. W. Long Island City

Technician

Samuelin may hospital

Chauncey Cook

Dr. Ray Palmer
Director Pres. Hospital

21091

10/29/39

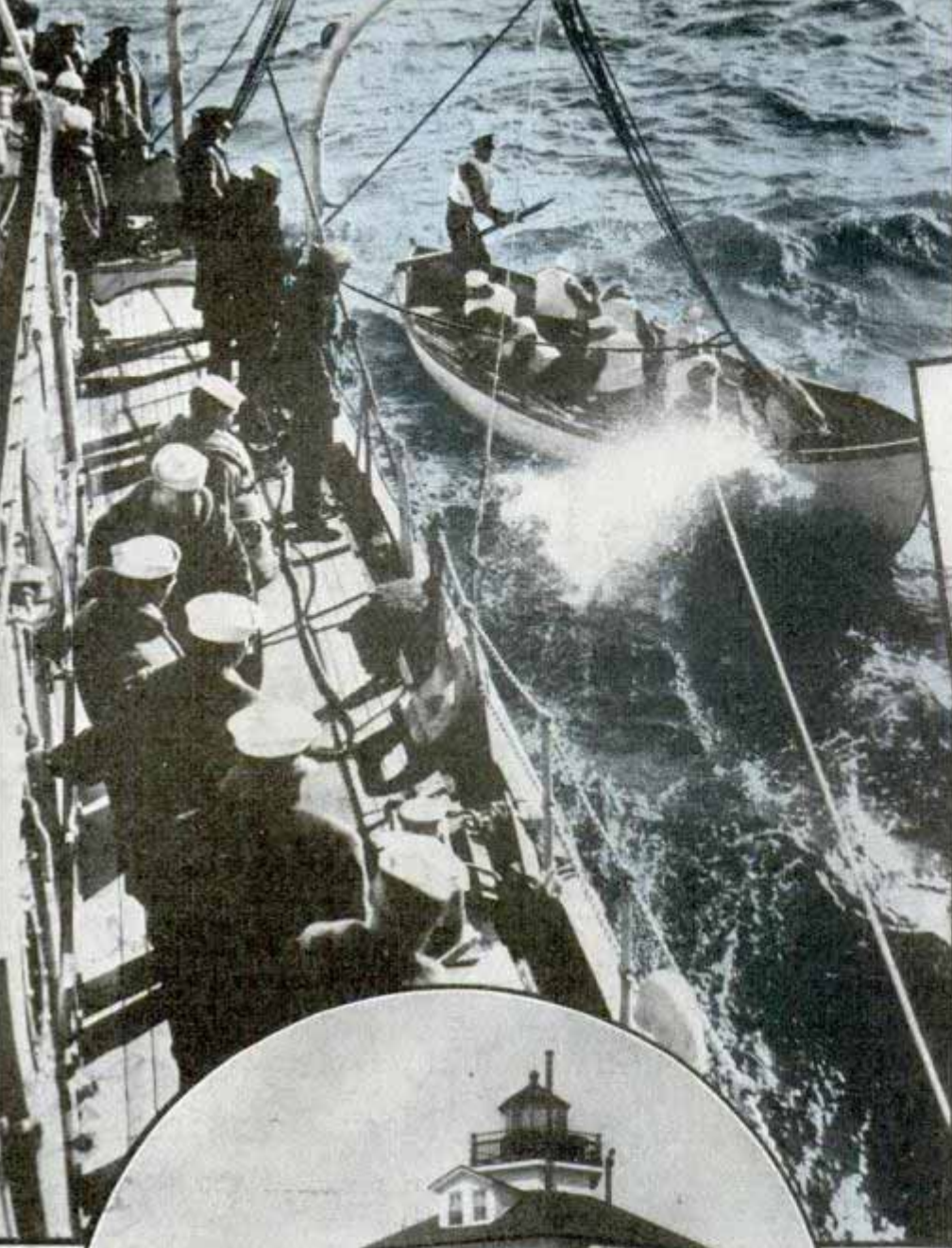
1241

Raymond

club

Allen Canyon, at

BLIND



Left, boat drill on the high seas; above, checking an ocean liner's position with the bearing repeater. In the circle below is the Drum Point lighthouse on the shore of Chesapeake Bay



WINTER surrounds a liner off Nantucket. Winter and fog. There's something eerie about the cold gray wall of vapor that swirls about the bridge, blotting out the bow, condensing in opaque droplets on the windows of the wheelhouse. Through a cleared circle made by

the revolving wiper, the watch officer peers ahead anxiously. The captain paces the open bridge wing, staring intently into that gossamer wall—seeing nothing.

A jet of steam spouts from a pipe on the forward funnel as the deep-throated whistle blares its fog warning in ghostly, minute-spaced wails. Fog at sea! A thousand passengers, twenty million dollars worth of ship and cargo, in one's charge; and a high-speed schedule to be maintained. And here we are making a landfall, approaching a busy harbor after two days of dead-reckoning navigation, unable to check position by sun and stars.

Blind man's buff, with the ship's captain "It," with a thousand souls forfeit to Davy Jones should the game be lost. Do we exaggerate the peril? Hardly! There have

Com. Herbert V. Webb,
4322 Second Road, North
Arlington, Va.

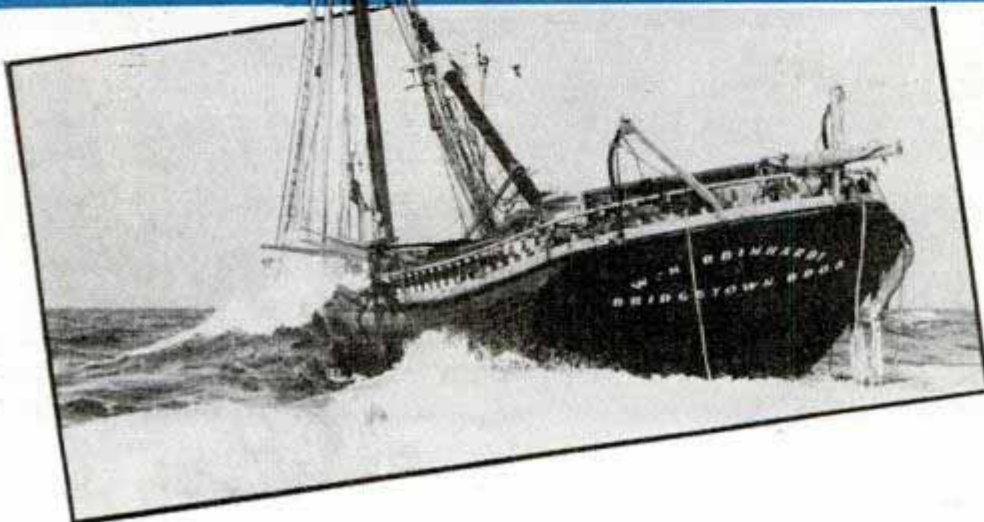
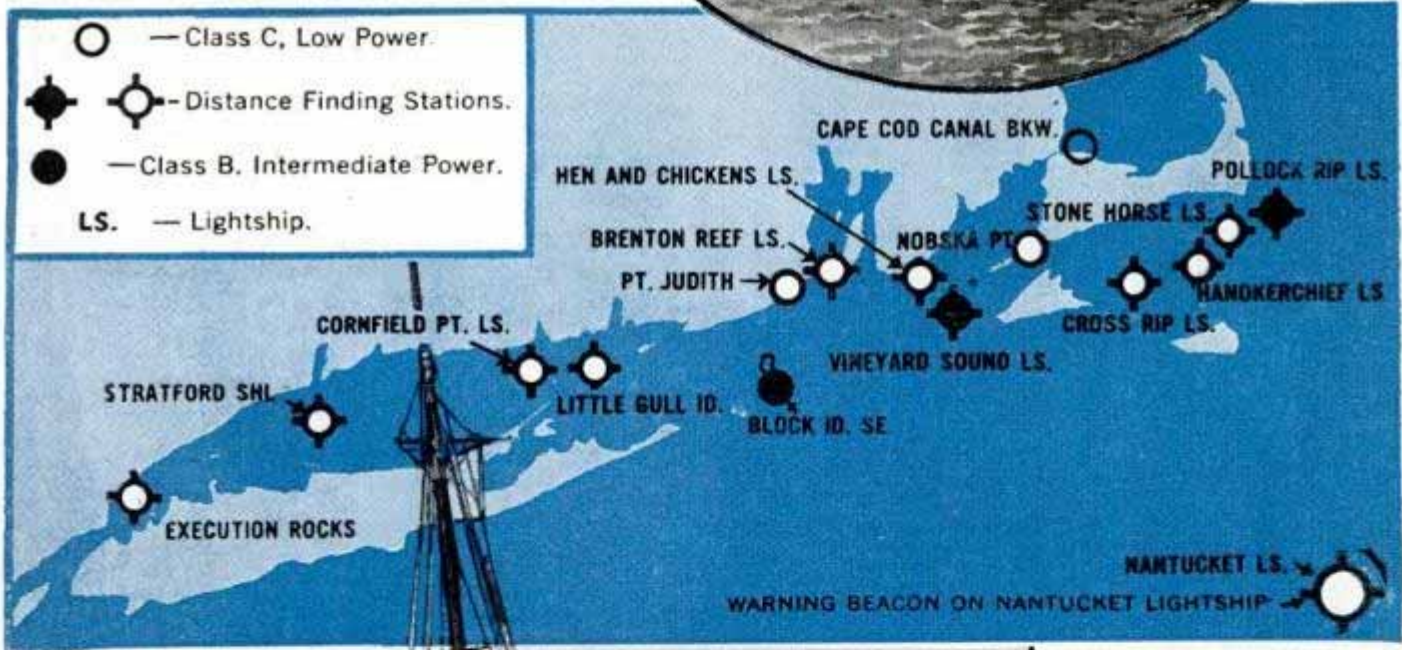
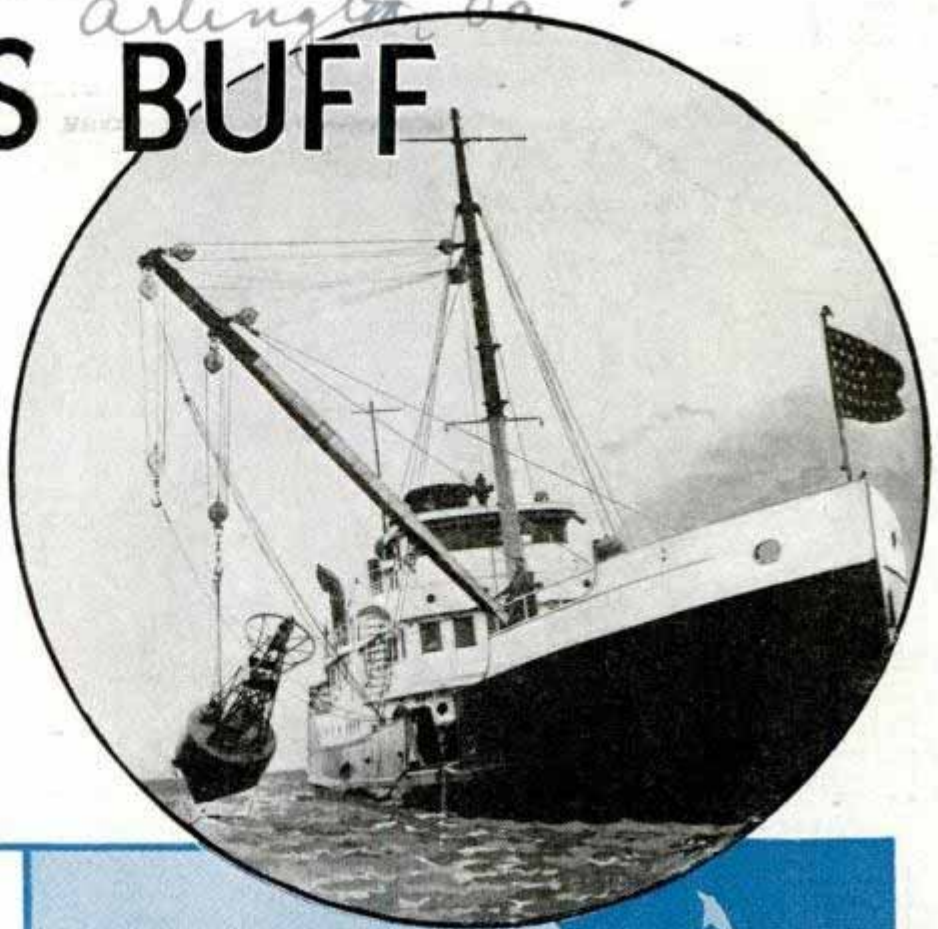
2994

MAN'S BUFF

been nearly 40,000 collisions and groundings due to fog since the World War. There have been more than 40,000 lives lost. Fog still is the greatest natural peril at sea.

Dead reckoning places our position 200 miles east of Cape Cod; but without a sextant shot for two days, that's merely an intelligent guess, what with wind and current knocking holes into the best of calculations.

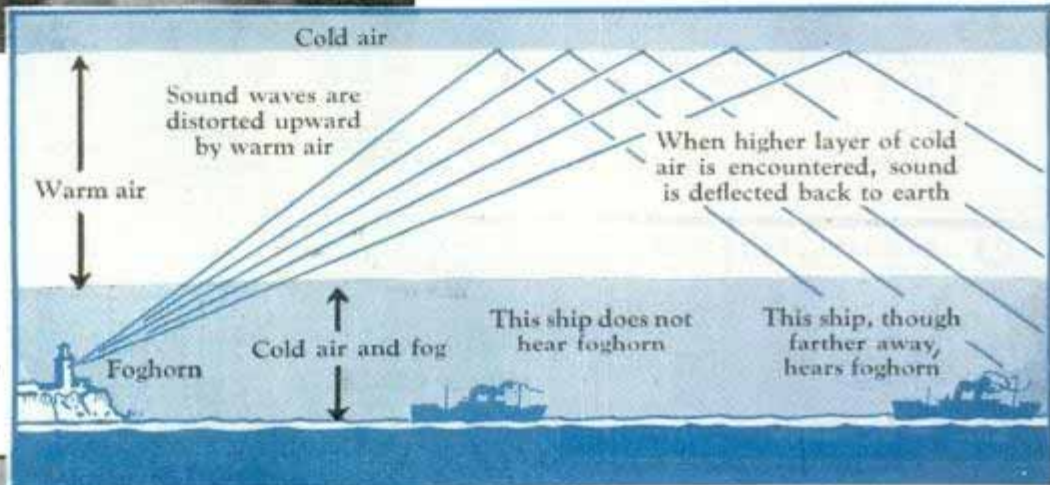
Sparks crackle in the



At top, a U. S. lightship tender on the Great Lakes places a lighted bell buoy in position. The map in center shows the position of lighthouses and lightships between Cape Cod and Long Island, with the famed Nantucket lightship in lower right corner. Bottom, breakers pound the "W. N. Reinhardt" to pieces after its crew has been brought ashore safely by breeches buoy with aid of Coast Guard



Top, placing acetylene gas tank in lighted whistle buoy; as buoy rises on wave, air is drawn in at whistle; as it sinks, rising water compresses air and forces it out through whistle. Diagram shows how air currents affect foghorns. Below, Coast Guard lifeboat in surf, and Ambrose lightship at New York harbor entrance



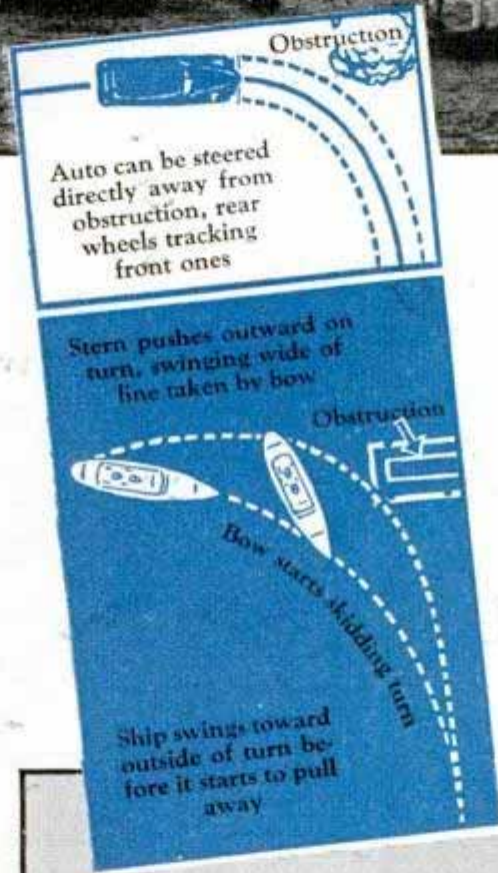
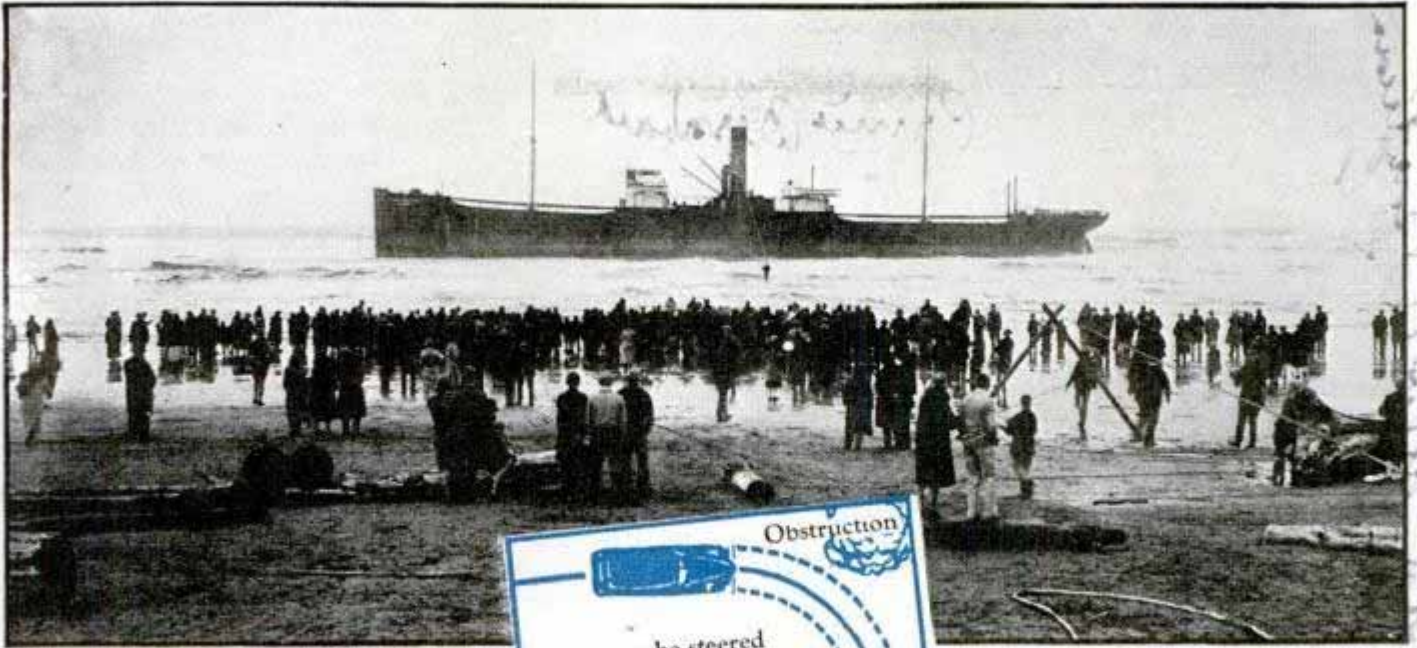
radio shack, as the captain requests bearings from the U. S. Navy. The naval radio stations along shore get into communication, and each takes a radio-compass bearing on the ship, phoning the results to the central station. Rays are drawn on a chart from each of these stations at the obtained bearings, and the ship is informed of the latitude and longitude at which these rays cross.

But these bearings show your captain to be nearly fifty miles off his plotted course, and he has no confidence in the report. He knows

how fallible is the radio compass, depending on the far from perfect human ear. For the radio compass gives no direct reading. The operator must swing a loop antenna over a compass card, until the signal fades out. Noting this bearing, he swings the loop in the opposite direction, marking the next fade-out point. The bearing is the difference between the two fade-out readings. An error of two or three degrees is normal on such readings, ten degrees is not unusual. At 200 miles, a ten-degree error will cause a mistake in fix of thirty-four miles.

In the captain's mind, he is still playing blind man's buff, still doesn't know where he is. So he uses his own equipment to get radio-beacon bearings from the nearest lightships and lighthouses maintained by the Coast Guard.

2994



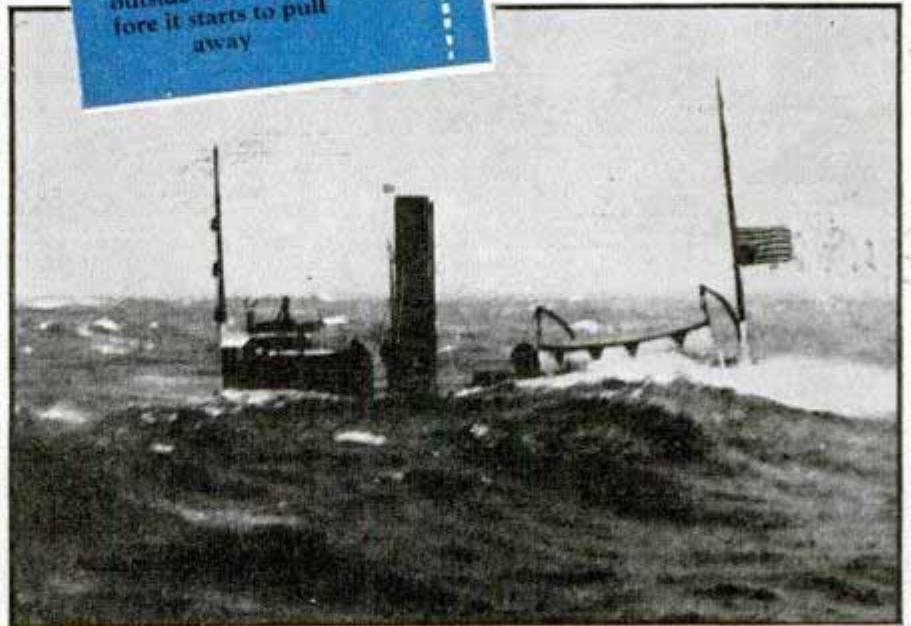
The radio beacons broadcast dot and dash signals. The ship picks these up with its own loop antenna, mounted over a gyrocompass repeater, and the captain plots his own position by cross bearings. This system is subject to the same errors as the navy's; but at least the navigator knows any errors will be his own.

Until a few years ago it was the practice of ships approaching New York from Europe to steer directly on the radio beacon of Nantucket lightship. But in 1934 the S.S. "Washington" headed too accurately for that beacon and ran down the lightship in the fog; carrying away part of her superstructure. A few weeks later the "Olympic" cut the lightship squarely in two as it loomed suddenly out of the fog. Seven of the lightship's crew perished. The Nantucket was soon replaced, equipped with an auxiliary beacon to sound a warble note on the same frequency as a warning

that ships were approaching too close.

Practically all lightships, and many lighthouses, are equipped with the standard distance-finding device—a foghorn synchronized with the last note of the radio beacon. The transmission of radio waves being practically instantaneous, while the speed of sound through air is comparatively slow,

(Continued to page 138A)



Top, breeches buoy saves crew of steamer beached in fog. Diagram shows difficulty of ship avoiding collision as stern swings wide. Tug flying distress flag, bottom, was assisted into New York harbor by Coast Guards

Diamond rd 2

Watertight Diesel Tractor Speeds Lifeboat Launching

Princ Bernhard



Watertight tractor, top, speeds launching of lifeboat by hauling it into water on track-type trailer as shown in lower picture

Made completely watertight by sealing it with special metal coverings, a Diesel tractor operates in water as long as the level is below the air intake and exhaust pipes, which extend upward. Rubber hose keeps sea water out of the steering clutch and main clutch levers, and no water can enter the drive or transmission housings. The tractor is used by the coast guard of the Netherlands for speedy launching of lifeboats.

National Park Visitors Increase by a Quarter Million

Visitors to the twenty-five national parks numbered 6,804,216 persons during the season ending last September, an increase of nearly a quarter of a million, or three and one-half per cent, over 1938. Popular also were the sixty-three national monuments where travel increased from 2,313,630 in 1938 to 2,566,452 in 1939. A decrease in the number of visitors to national military parks and cemeteries was shown, due

to the seventy-fifth anniversary celebration at Gettysburg national military park and cemetery in 1938, skyrocketing the figure there to 1,554,234 compared with 608,125 in 1939. The grand total of visitors to all units of the federal park system during 1939 was 15,454,367, a drop of 779,321 from the 1938 total—16,233,688.

Overshoes Fit in 'Capsule' in Handle of Umbrella

There's protection from top to toe in an umbrella that has been nicknamed the "umbrubber" because it carries a pair of rubbers, ready for a rainy day. They are made of special lightweight material and pack away in twin containers of plastic that form the handle of the umbrella.



At the first sign of rain you merely twist the lid of the umbrella handle and out come the overshoes

Halstead and Gravenstein

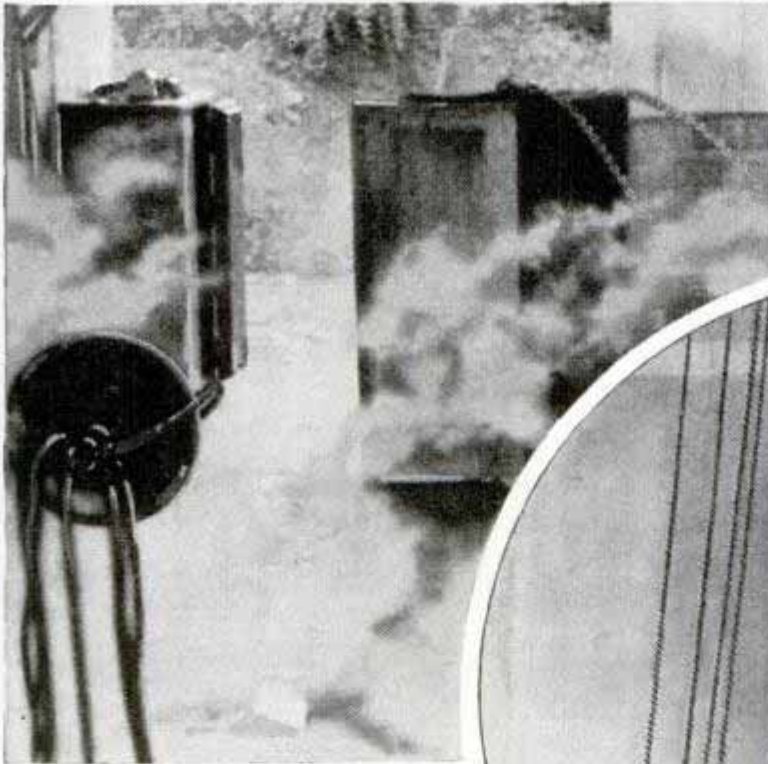
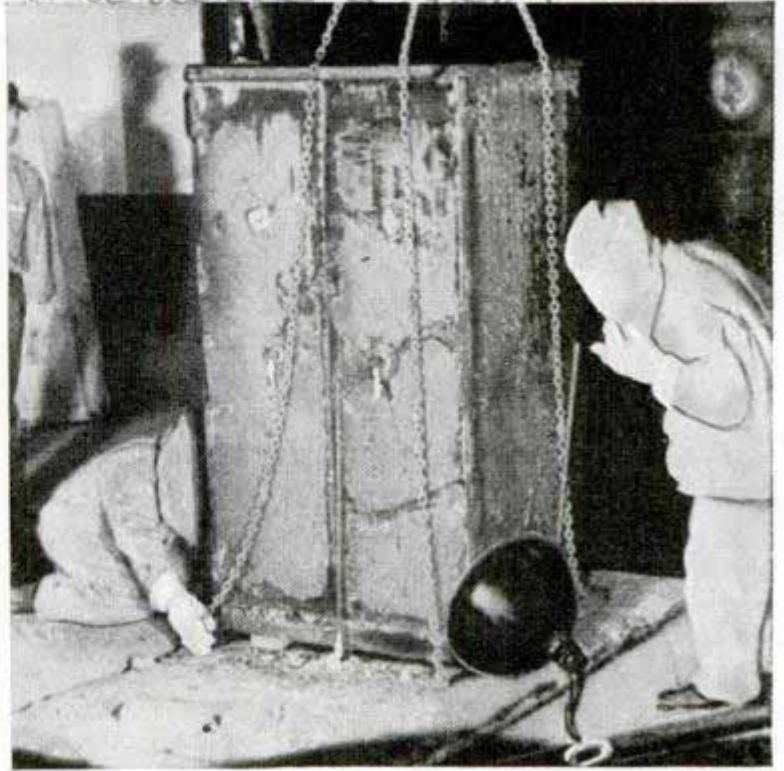
Handwritten notes:
- Top left: *Mr. Sondrian, managing director, Regmatul line van Nieuw, Longden*
- Top right: *Deveke & Co. Technische Bureau de Ruyterkade 113 Amsterdam - Centrum, Holland*
- Middle left: *National Park Service, Dept. of Interior, Washington, D.C.*
- Middle right: *Calypso tractor*
- Bottom right: *56th, New York*

210888. safe Cabinet des.

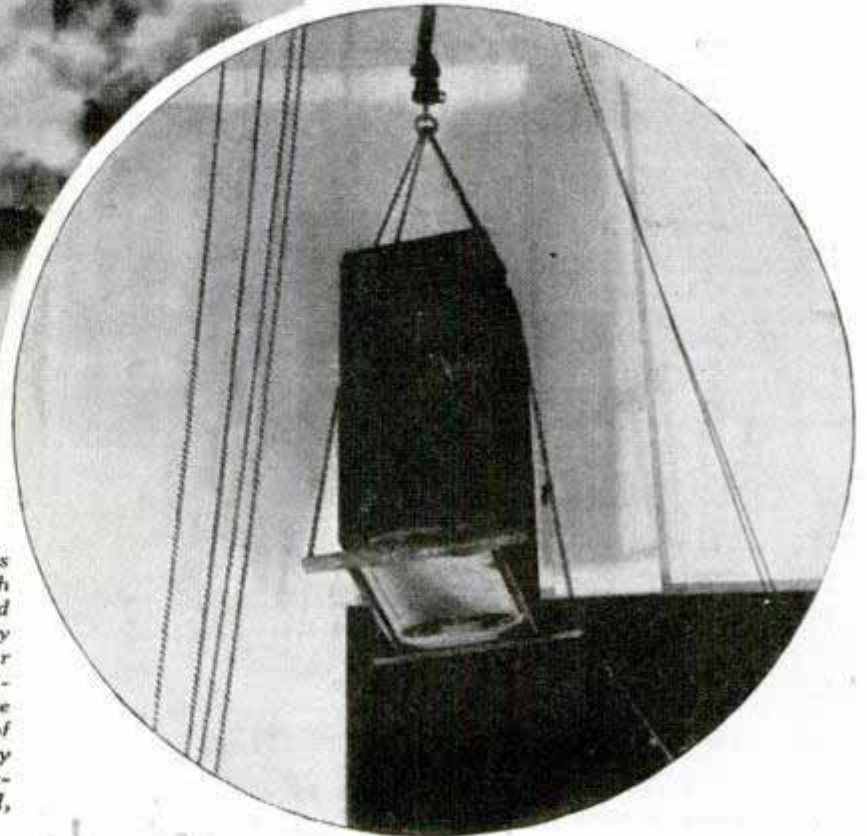
Remington - Rand Inc.

Fiery-Furnace Test Proves Safe Can 'Take It'

marretto il bed



Above, left, rolling a big steel safe into gas furnace for flame test. Right, asbestos-clad men attach chains for drop test after safe has been tortured with heat for one hour. Below, the safe is hoisted for its thirty-foot plunge, the laboratory equivalent of a three-story fall in a burning building. Left, dust flies as it crashes down on a solid concrete block

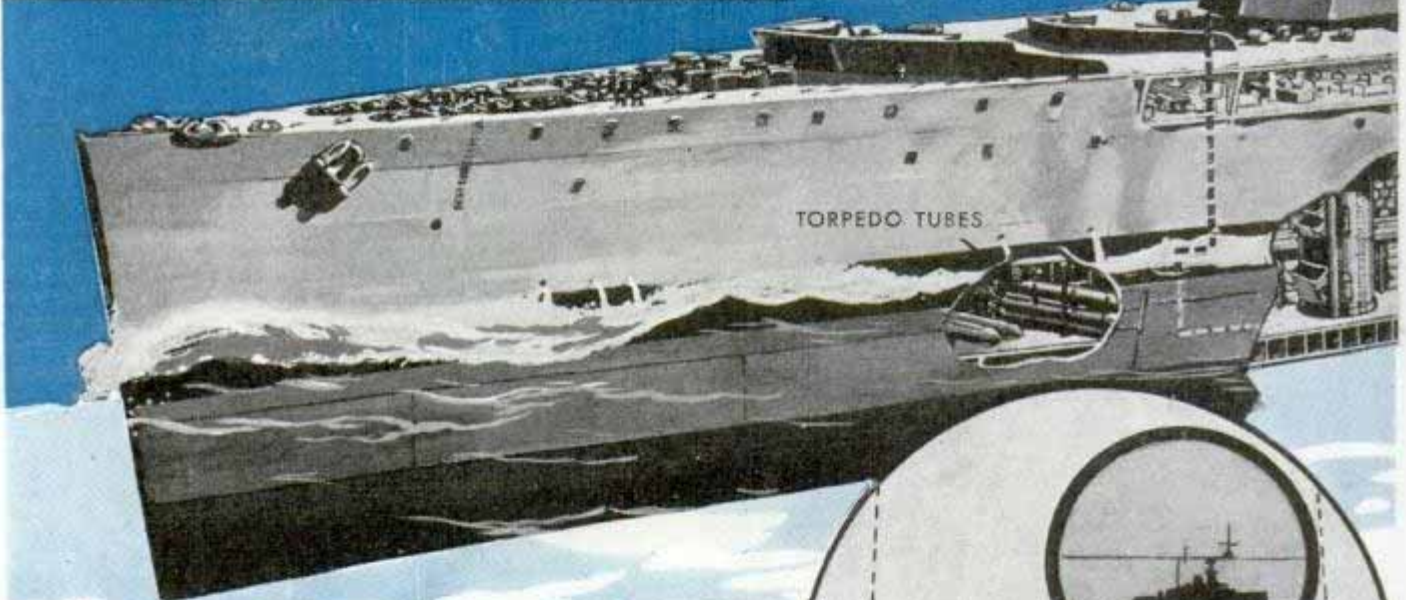
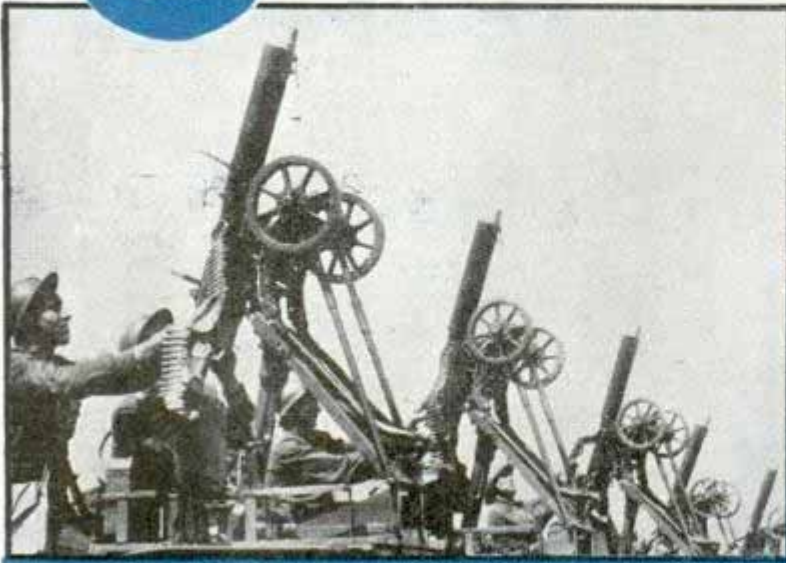


Before a safe manufacturer calls his steel box "fireproof" he puts it through a terrific ordeal. The safe is rolled into a furnace, sealed with fire clay and subjected to roaring gas flames for an hour. Redhot, it is rolled out, allowed to drop thirty feet to a concrete block, then given another hour of 1,700-degree heat. Chilled suddenly with water, it is broken open. If papers inside have not been scorched, the safe has passed its test

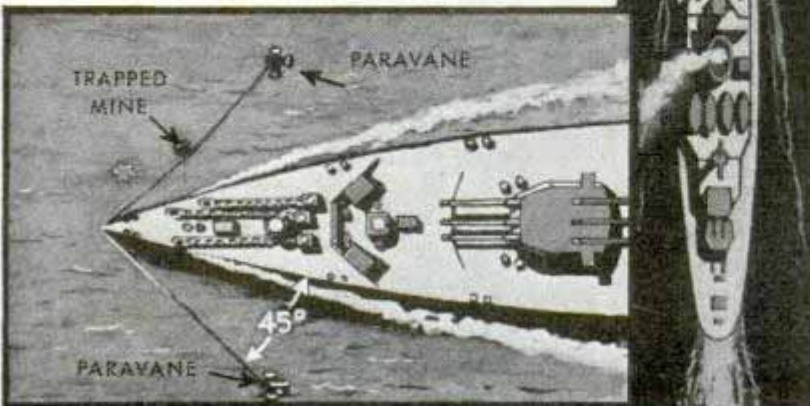
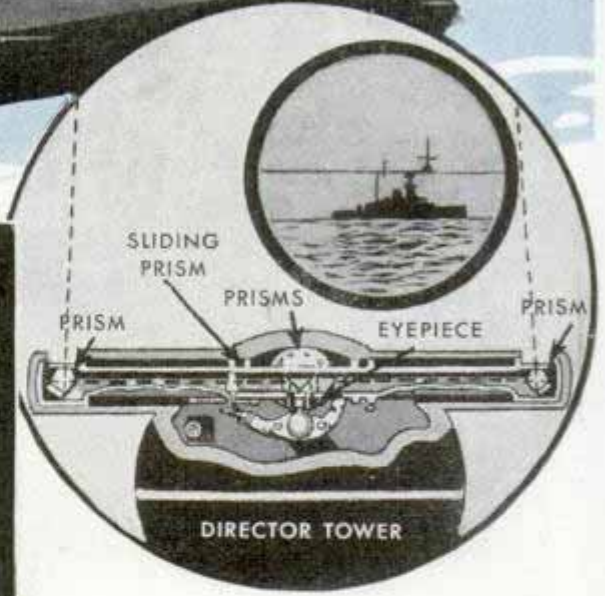
21053

Soviet aircraft battery

The MECHANICS of



Mighty engines of warfare have been unveiled by nations involved in the new European conflict, as well as by countries that may be drawn into the struggle. Many, many anti-aircraft batteries, such as the one pictured at top of page, are found in Soviet Russia's red army



Bottom, left, how ship employs paravanes to avoid striking mines. Center, actual size of battleship as seen from bombing plane at 6,000 feet. Circle, above, diagram of range finder, with inset view of what it sees. When the two images coincide, the range is mathematically calculated with help of sliding prism

Chris

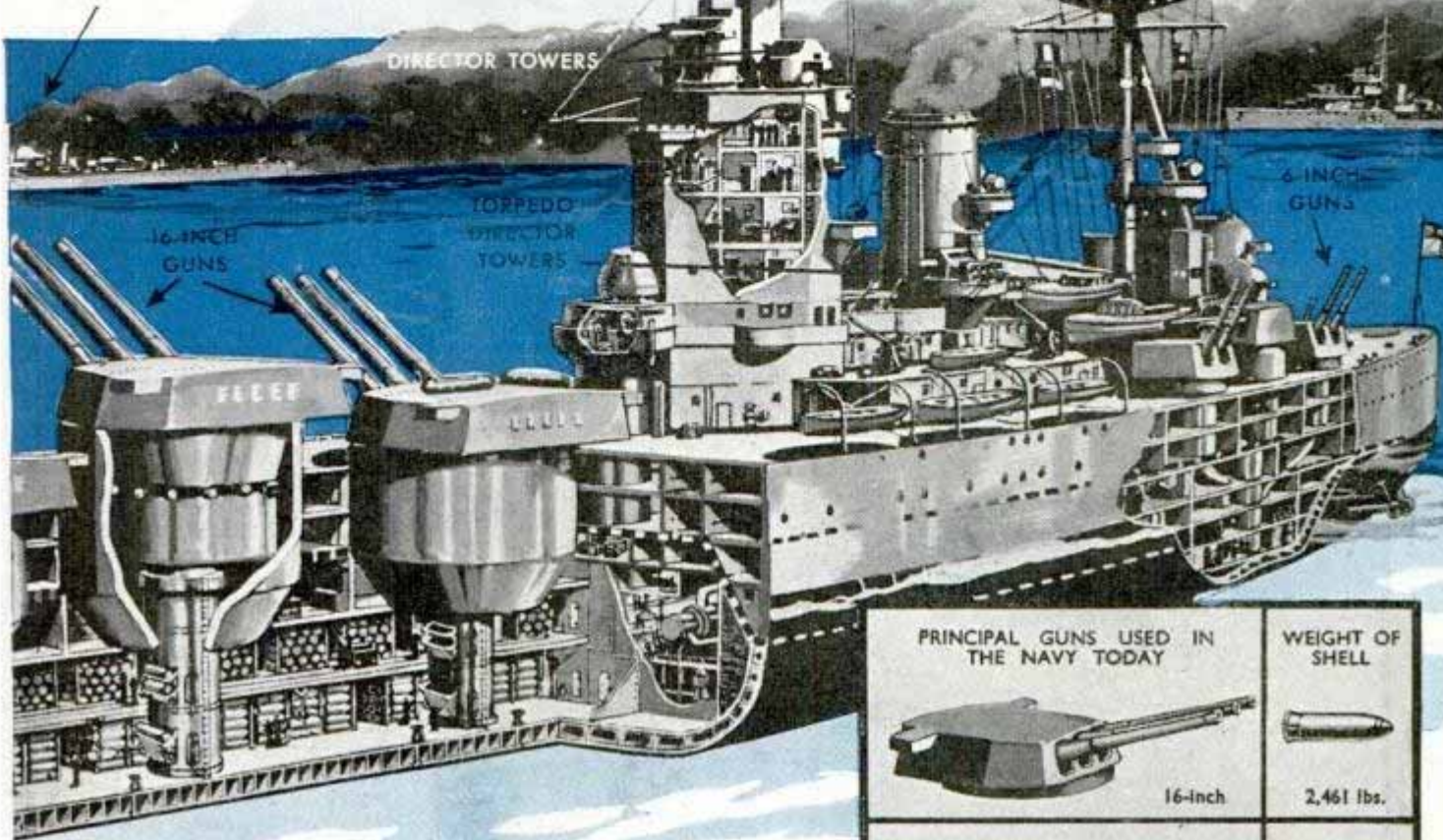
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MODERN WARFARE

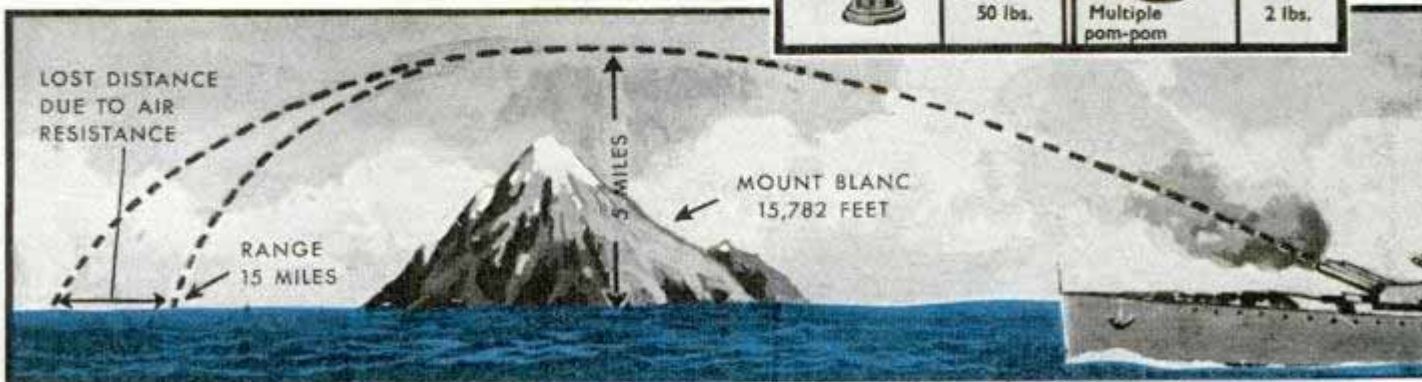
DESTROYERS LAYING PROTECTIVE SMOKE SCREEN

FIRE CONTROL TOP



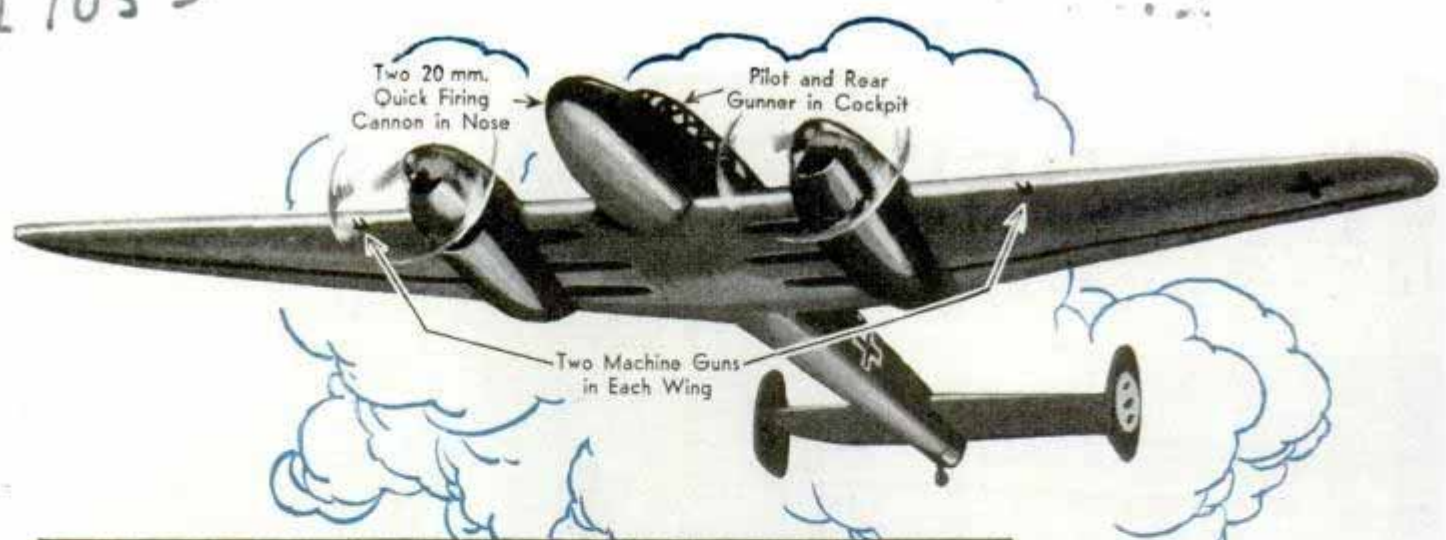
How a mighty British battleship goes into action is shown on this and the page opposite. Decks are cleared and sixteen-inch guns firing, while destroyer lays protective smoke screen. Right, naval weapons and weight of shells. Bottom of page, range and trajectory of modern sixteen-inch naval gun and shell. The shell has a muzzle velocity of 1,800 miles an hour and a rate of fire of one round a minute. The sixteen-inch gun is the largest believed practical for warships to mount, under present methods of construction

PRINCIPAL GUNS USED IN THE NAVY TODAY		WEIGHT OF SHELL	
	16-inch		2,461 lbs.
	15-inch		1,920 lbs.
	8-inch		256 lbs.
	6-inch		100 lbs.
	4.7 A.A.		50 lbs.
	Multiple pom-pom		2 lbs.

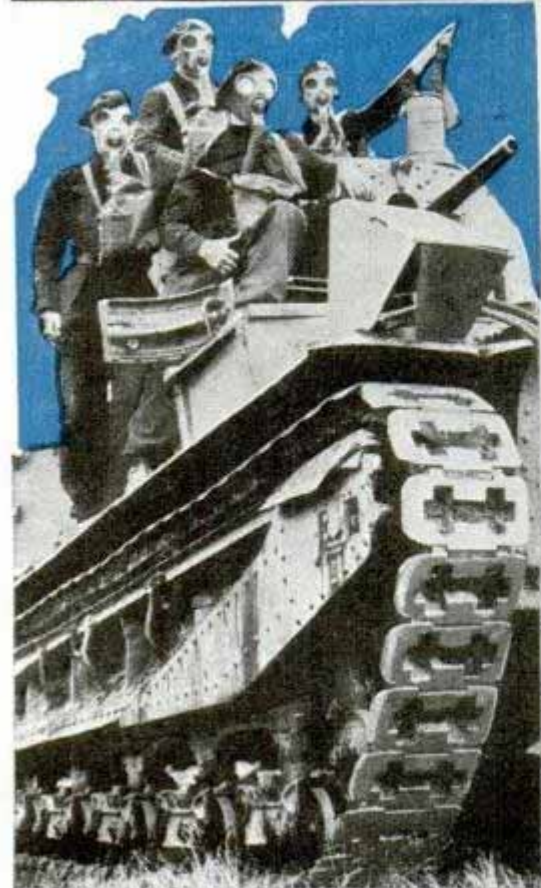


Club

21053



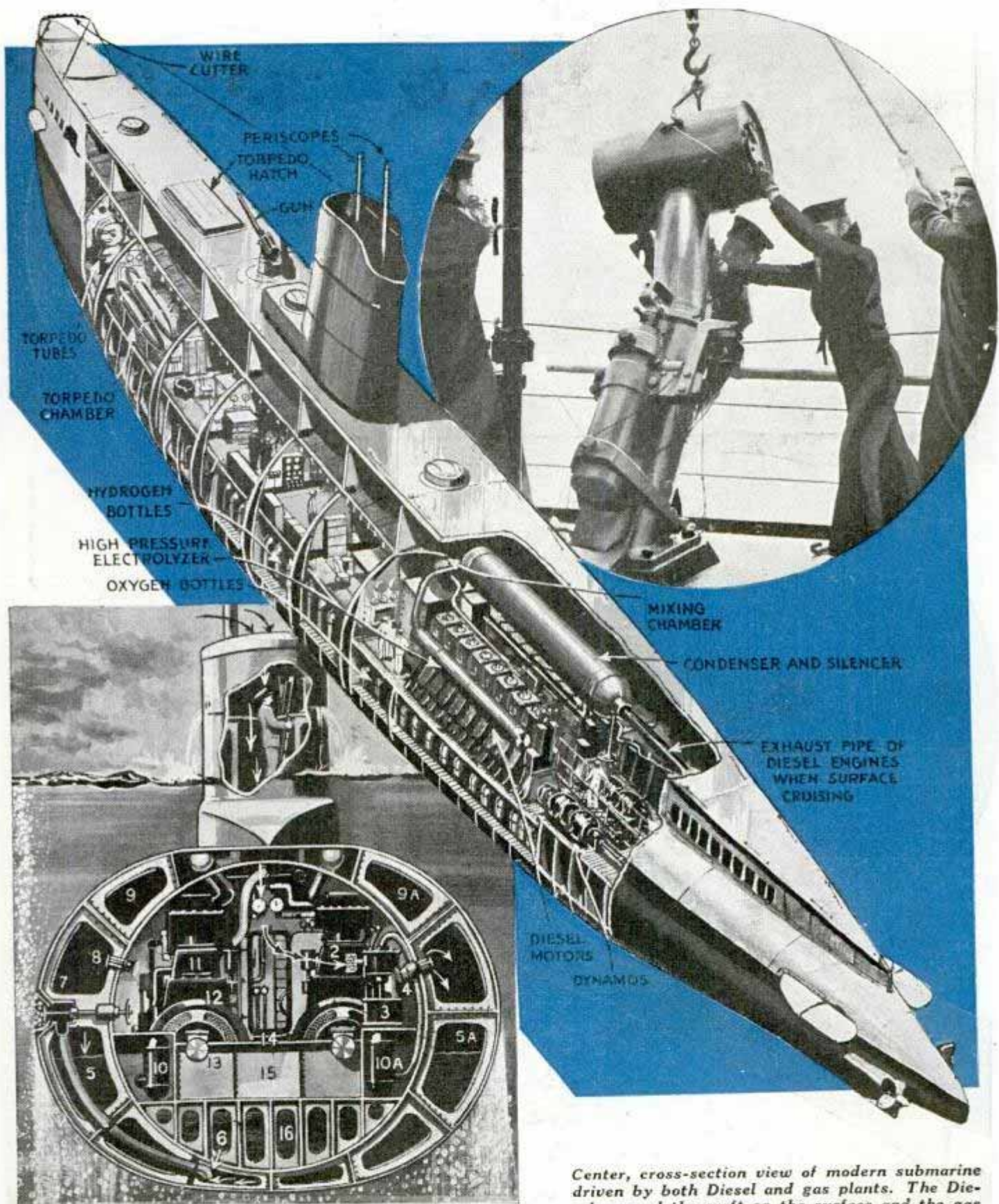
Top, drawing of long-range combat plane reported as designed to escort German raiding bombers. Its purpose is to fight off small pursuit ships. Speed is around 380 miles per hour and the range about 1,200 miles, with two 1,160-horsepower engines delivering the power. Left, British airmen, dressed in heavy uniforms and carrying machine guns of latest type. Bottom of page, left, British soldiers, wearing gas masks, atop a modern war tank



Bottom, center, massive air-raid shelter, built to protect 2,000 people, on Germany's western frontier. Right, German torpedo boat with two tubes for discharging deadly loads at enemy shipping. The torpedo boats operate from a "mother ship"



club

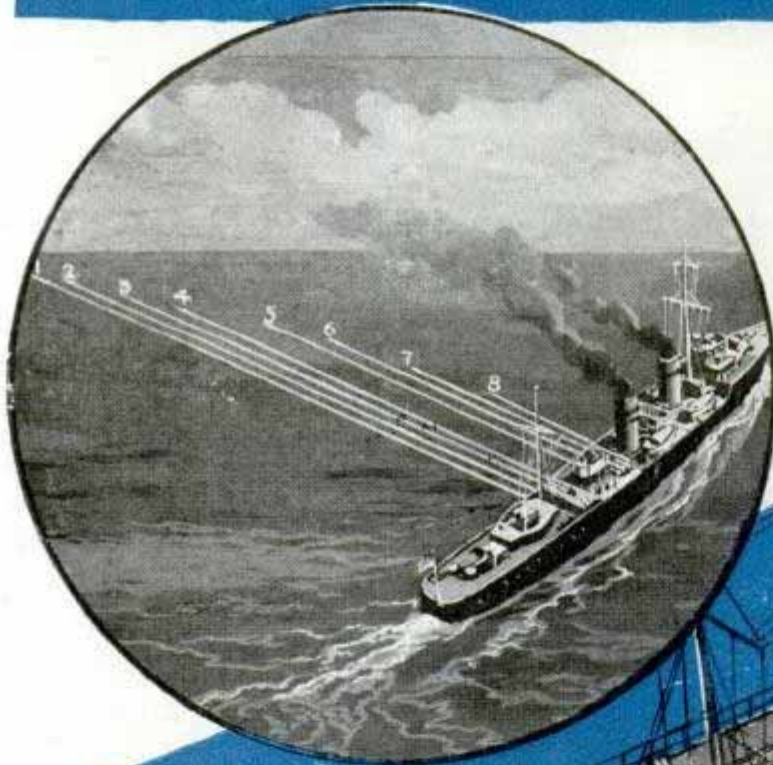
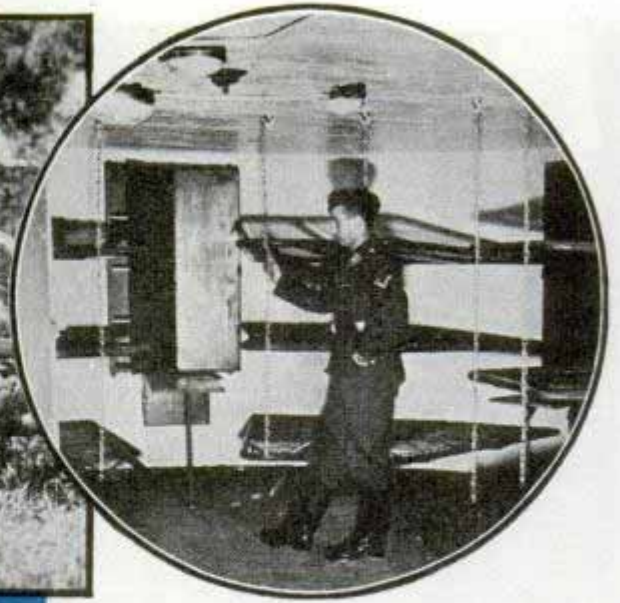


- This sketch shows how a modern submarine returns to the surface:
1. The submarine breaking the surface with the conning tower hatch opened to admit pumping outside air.
 2. Air inlet.
 3. Air pump forcing air into the tanks without using compressed air bottles.
 4. Three-way blowing valve.
 5. 5A. Air forcing water out of external ballast tanks.
 6. Water tail-pipe.
 7. Flooding valve open for ejecting water.
 8. Air vent valve to relieve pressure in tanks when emptied.
 - 9, 9A. Special anti-rolling tanks.
 - 10, 10A. Compressed air bottles. Used only for blowing the tanks sufficiently to raise conning tower above the water.
 11. Diesel engines.
 12. Main electric motors. Used also for driving auxiliary motors for pumps.
 13. Propeller shaft.
 14. Watertight door (open).
 15. Battery tank.
 16. Internal ballast tanks used for maintaining positive buoyancy.

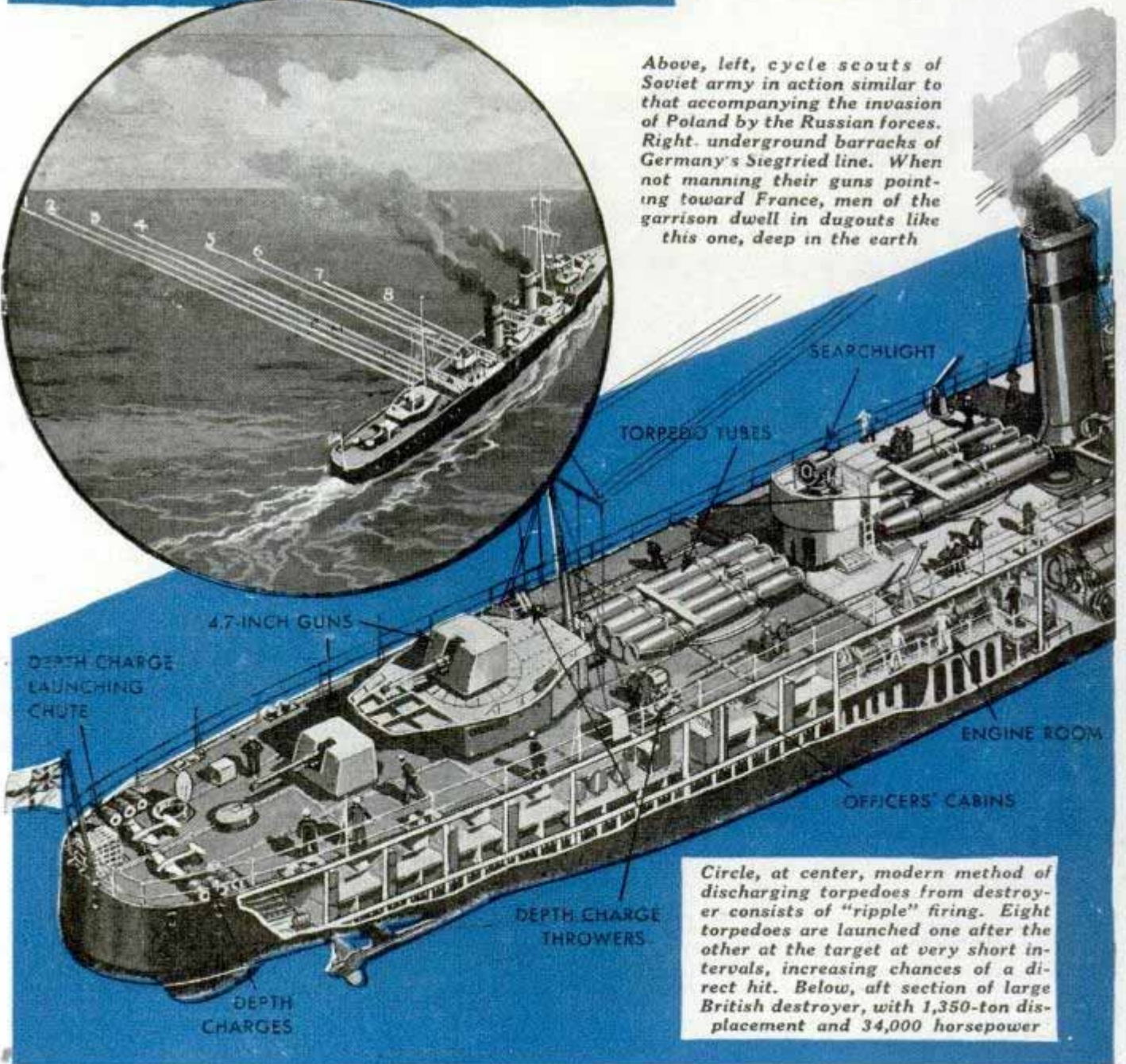
Center, cross-section view of modern submarine driven by both Diesel and gas plants. The Diesels propel the craft on the surface and the gas engines when it is submerged, eliminating peril of batteries ordinarily used for underwater cruising. Bottom, how a submarine rises to the surface. Circle, top of page, members of British ship's crew heaving a depth charge over the side. The charge automatically explodes from the pressure of water at a certain depth—the depth at which an enemy submarine may be riding according to calculations

Handwritten signature: H. S. Pittern 43

2-105-37



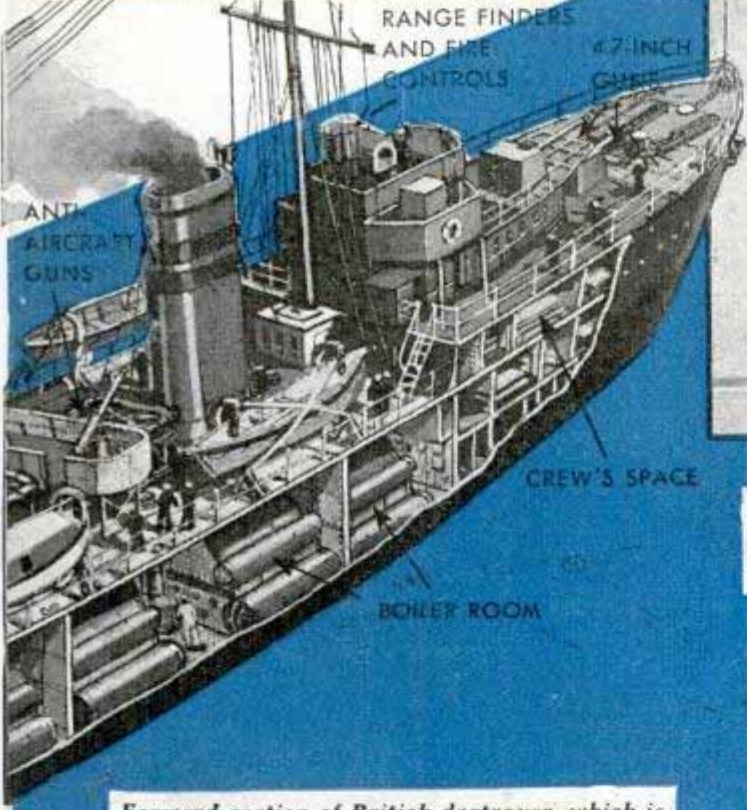
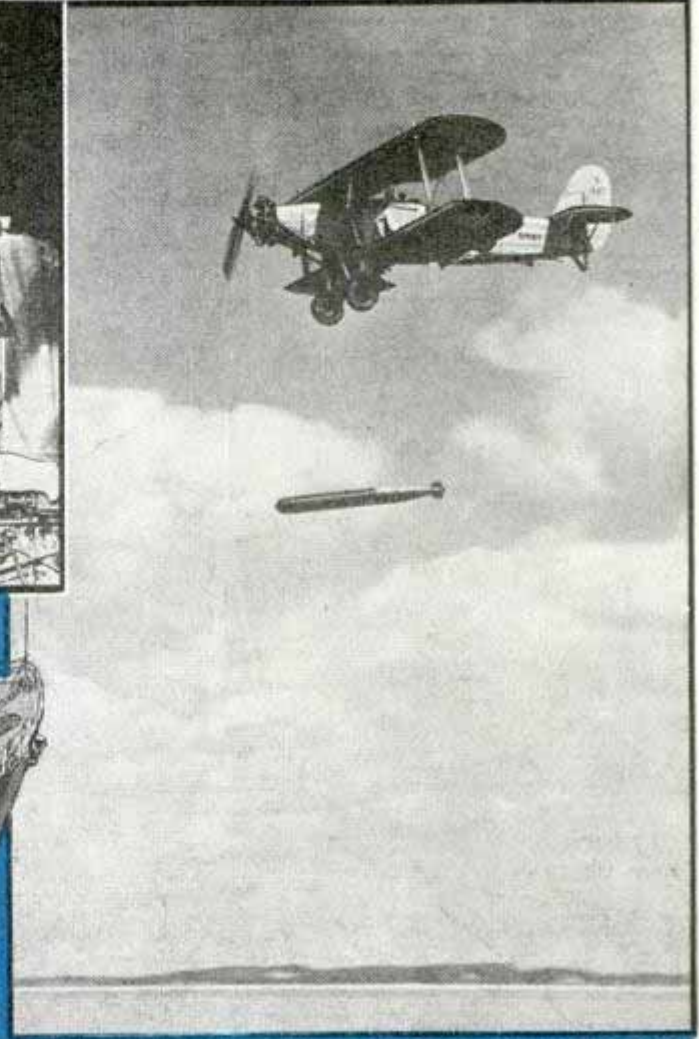
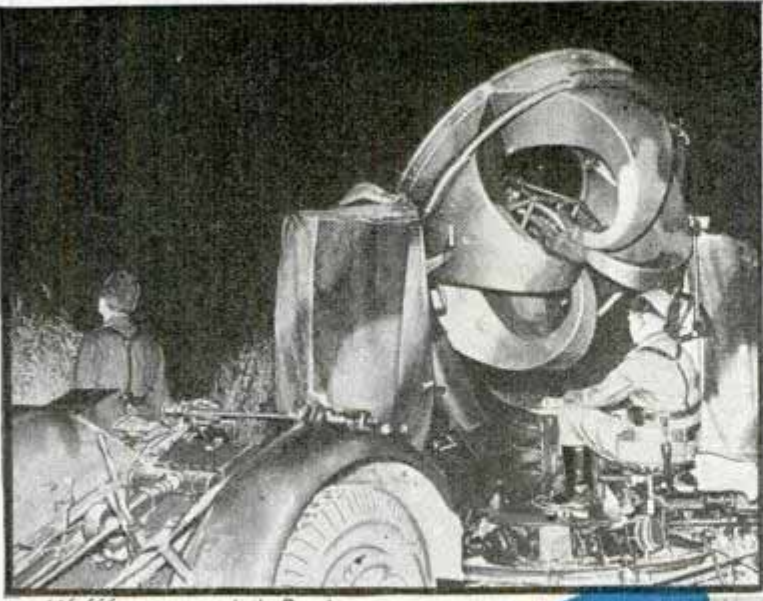
Above, left, cycle scouts of Soviet army in action similar to that accompanying the invasion of Poland by the Russian forces. Right, underground barracks of Germany's Siegfried line. When not manning their guns pointing toward France, men of the garrison dwell in dugouts like this one, deep in the earth



Circle, at center, modern method of discharging torpedoes from destroyer consists of "ripple" firing. Eight torpedoes are launched one after the other at the target at very short intervals, increasing chances of a direct hit. Below, aft section of large British destroyer, with 1,350-ton displacement and 34,000 horsepower

Jan 1940
2-105-37
clw

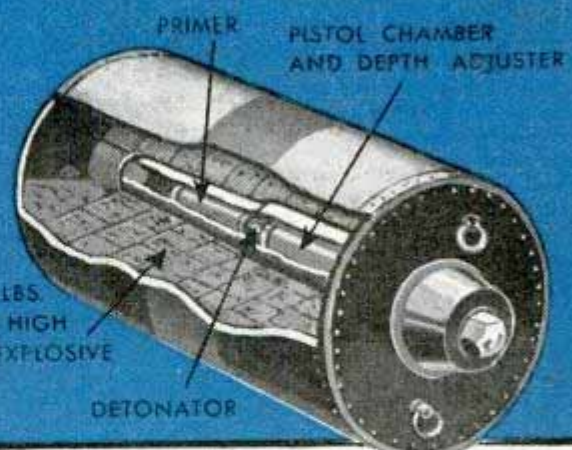
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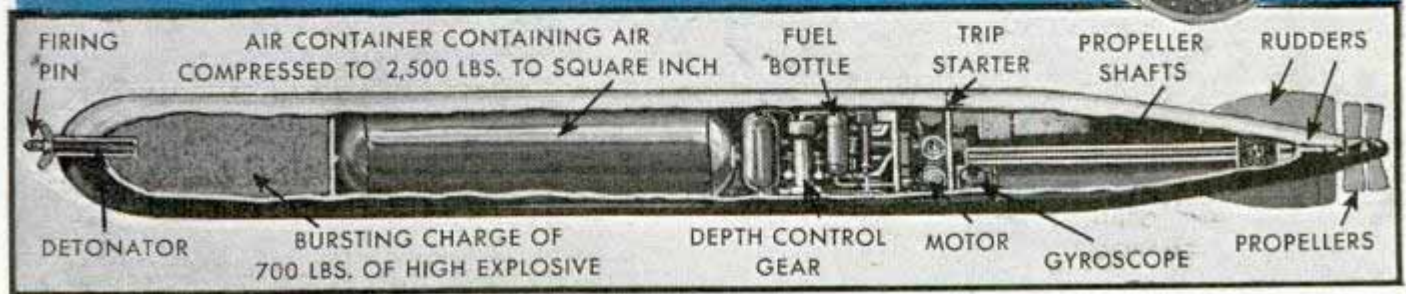
RANGE FINDERS AND FIRE CONTROLS
 #7-INCH GUN
 CREW'S SPACE
 BOILER ROOM

Top, left, latest type of German searchlight used on the western front in anti-aircraft defense work. Right, British plane releasing a torpedo powerful enough to sink a battleship, if properly placed

Forward section of British destroyer, which is equipped not only with torpedoes and 4.7-inch guns, but also carries powerful depth charges, such as that shown at right in cutaway drawing. The destroyer straddles a submarine in the water beneath it and releases depth charges dead astern and also about forty yards to starboard and port. Bottom of page, section of a deadly twenty-one inch torpedo



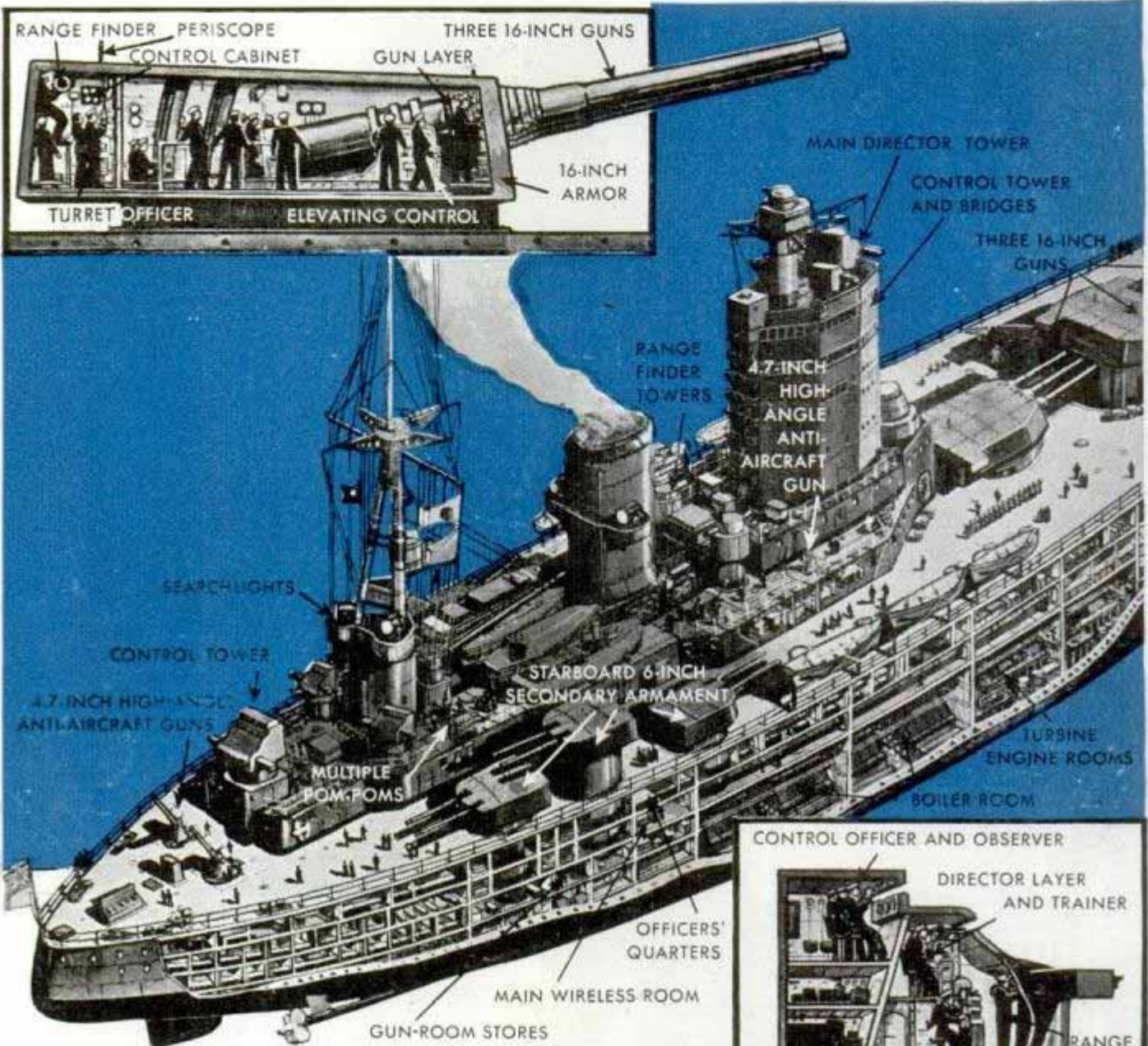
PRIMER
 PISTOL CHAMBER AND DEPTH ADJUSTER
 300 LBS. OF HIGH EXPLOSIVE
 DETONATOR



FIRING PIN
 AIR CONTAINER CONTAINING AIR COMPRESSED TO 2,500 LBS. TO SQUARE INCH
 FUEL BOTTLE
 TRIP STARTER
 PROPELLER SHAFTS
 RUDDERS
 DETONATOR
 BURSTING CHARGE OF 700 LBS. OF HIGH EXPLOSIVE
 DEPTH CONTROL GEAR
 MOTOR
 GYROSCOPE
 PROPELLERS

alw.

9.70.53

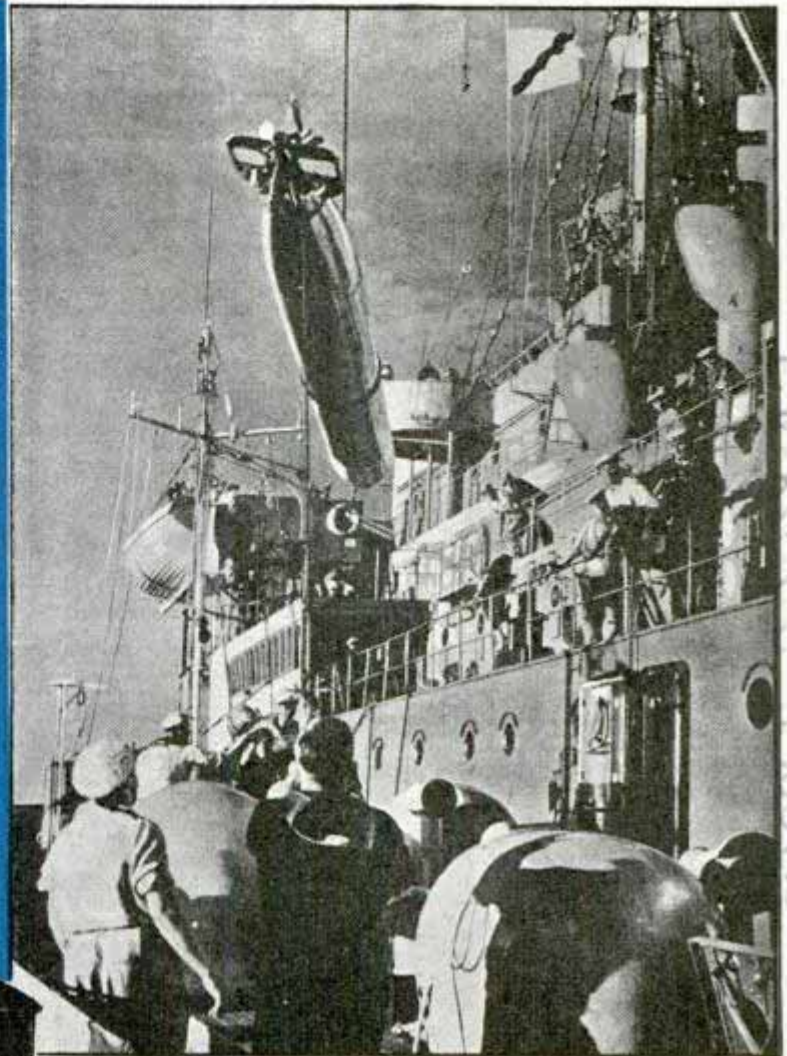
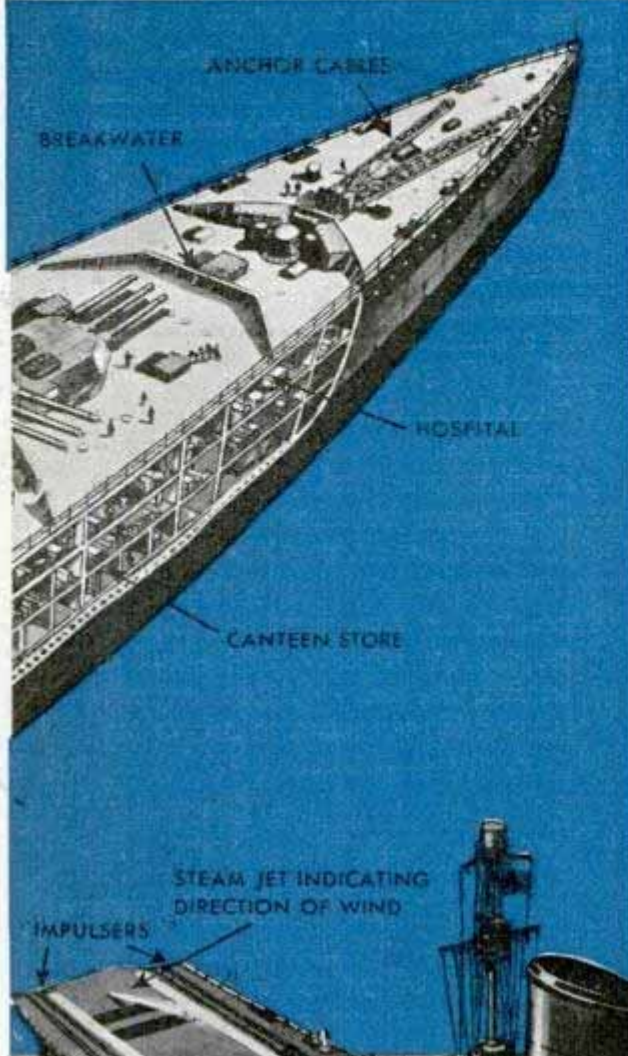


Aft on mighty British floating fortress, showing offensive and defensive weapons and equipment. Displacement is approximately 34,000 tons and the vessel carries nine sixteen-inch guns. Top of page, turret and guns on the battleship. Right, main control tower. Bottom of page, left, British soldier firing new anti-tank rifle which discharges high-velocity bullets that easily penetrate steel plating on tanks, disabling them. Ordinary rifle bullets have no effect on tanks. Right, German air squadron taking on load of bombs. Note bomb in foreground, ready to be placed in the racks

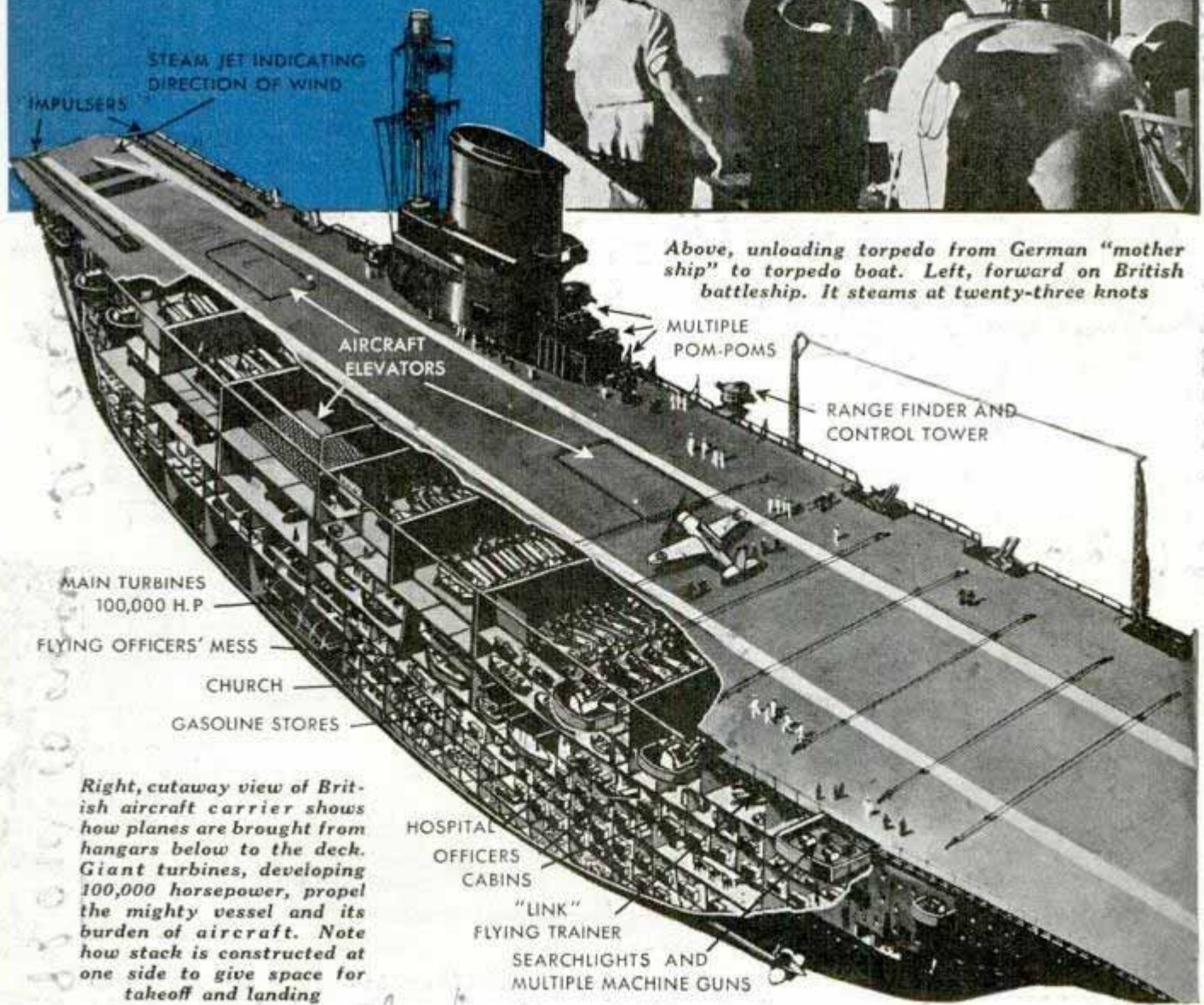


clad

2 1053



Above, unloading torpedo from German "mother ship" to torpedo boat. Left, forward on British battleship. It steams at twenty-three knots



Right, cutaway view of British aircraft carrier shows how planes are brought from hangars below to the deck. Giant turbines, developing 100,000 horsepower, propel the mighty vessel and its burden of aircraft. Note how stack is constructed at one side to give space for takeoff and landing

abnd

21138.

"Bouncing" Iron Ball Dashes Gambling Machines to Bits



Giant iron ball is lifted high above doomed slot machines by electric magnet whence it descends to smash them to bits

Slot machines are threatened by a new kind of ball game introduced by Los Angeles police in their drive against gambling devices. Confiscated machines are piled up and a huge iron ball is raised high above them by an electric magnet. Then the current is cut off and the ball descends with devastating effect.

Lustrous Stainless Steel Like Precious Metal

Stainless steel with a surface as lustrous as gold, silver or platinum, has been produced by processes discovered at Massachusetts Institute of Technology. This was one of the results of research to make steel resistant to all known sorts of corrosion, and was achieved by adding to the chemical bath a little titanium tetrachloride, the metal that produces smoke for warfare. Steel is ren-

dered corrosion resistant in salt water, it was found, if stainless steels are exposed to air for some hours, or if they receive treatment by an oxidizing solution directly after the pickling operation. Salt-water corrosion is cut down more than eighty per cent by adding minute amounts of silver, resulting also in a great improvement of the rolling and machining properties of the metal. For cold-rolling, a thin film of silver is electroplated on the steel. This prevents rollers from marring the surface and the silver alloys with the steel to make a corrosion-resistant surface. These discoveries tend to remove the handicap in the use of a stainless steel on naval vessels where it is subjected to sea water.

Display Rack on Wheels Rolls Tires In and Out

To save himself the time and effort consumed in carrying tires in and out of his store every day for display purposes, one dealer designed a rolling rack mounted on pneumatic tires for ease in handling. On this movable stand he displays about forty used tires and it can be wheeled quickly to any part of the lot where the stock may be shown to best advantage.



Rackful of tires on wheels can be moved in and out of shop easily or placed to best display advantage on outdoor lot

Developed by: Herbert H. Biggs, John C. Wolff, Robert S. Williams, Eugene L. Stange and Robert S. Williams

General Tire

Quaker Co., Akron, Ohio

20 W. 10 Ave. St. Ann, Mo.

Same Service

Used by P. S. Norris + Son Inc.

'Air Traffic Cop' in Tower Guides Air Liners

Built on filled-in land at a cost of more than \$53,000,000, the new North Beach air terminal in New York is located within a twenty-minute cab ride from the Grand Central area. On the roof of the administration building is a booth for the "traffic cop of the air" who controls airplane traffic, and from there emanate the radio directional beam signals which guide the giant transports to the field. There are four runways ranging from 3,532 to 6,000 feet long, and space is provided for fifteen big transport planes to be loaded or unloaded at a time. Accommodations also are offered



Tower from which "traffic cop of the air" gives "stop and go" signals to pilots of transport planes using new airport at New York

East river. They will be hauled from the water by special cars running on tracks which extend under water onto the ramp across a service field and into the hangar.

Merry-Go-Round Baby Scooter Anchored to Safety Zone

Restricted to movement within a five-foot circle, a baby's exerciser and walking-trainer permits the toddler to ride forward or backward in merry-go-round fashion

without danger of injuring himself. It is anchored by a pivoted rod to a weight resting on a non-slip rubber base. A safety-belt around the baby's waist slides up and down, permitting him to stand up or sit down comfortably.

Non-tip scooter anchored to weight is confined within circle where baby may learn to walk in safety. Belt that fastens about him permits sitting or standing in comfort

\$ 5-95



'Leaded' Steel Saves Time in Machining Metal

Adding small amounts of lead to batches of steel is the latest trick of industry to turn this metal into a product that can be cut faster on lathes and milling machines, thus bringing lower production costs. In mass-production operations this also results in less wear in cutting tools and dies, and fewer breakdowns. Recent tests made by metallurgists show that the tensile strength of "leaded" steel remains virtually the same as steel not so treated.

Loring in Court. Resister key

Shis and Loughlin... 155

2 1176
JWA

2 1130

same since 10/19/34

2 1235

Frimble Maryland
134
Robbins and
Casper

21001 Mr. James McQueeny

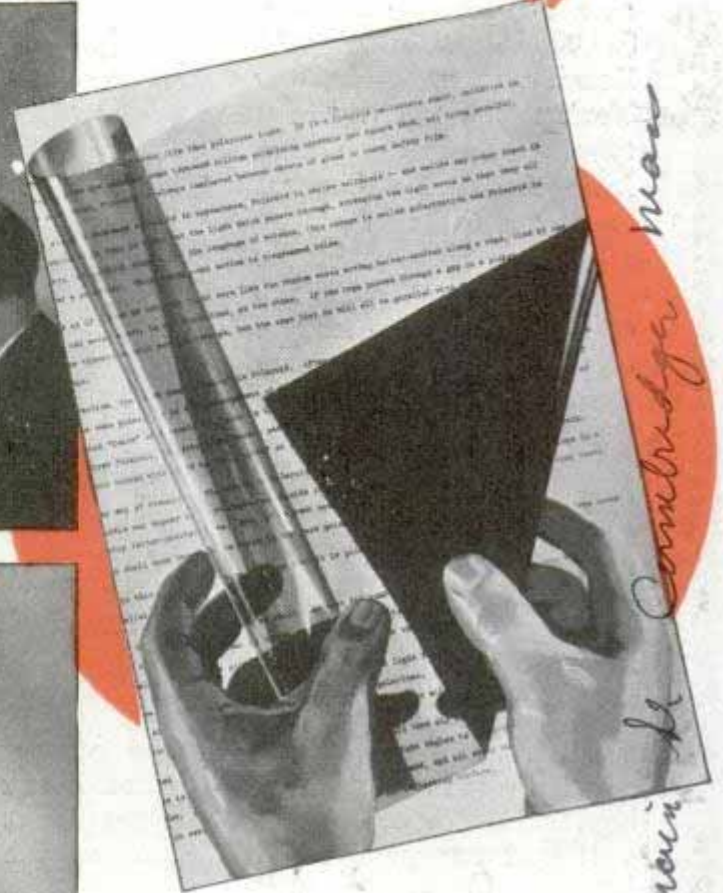
9 E 45th Kansas City Mo

The WONDERS of

City of Los Angeles' observation car



Top to bottom, view is too bright so passenger turns knob to sight comfort level and then to cut off view entirely. Polaroid is the secret. Right, you can see through several thicknesses of Polaroid if optical "slots" are parallel, but not when slots are crossed, as in fold at right



By James McQueeny

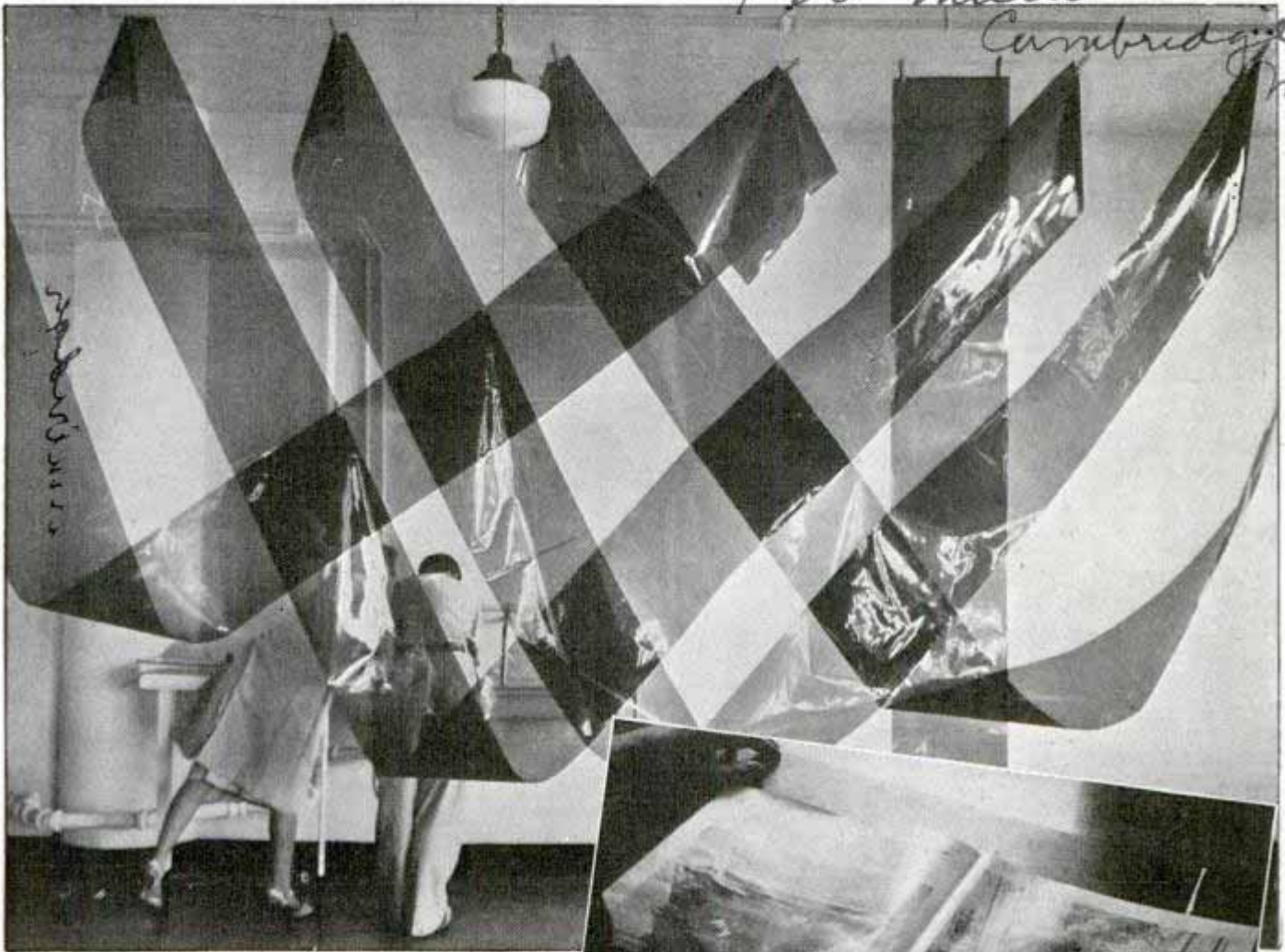
BYPASSING light through what is known as a polarizer, its vibrations can be combed and rearranged so they'll vibrate in planes parallel to each other, instead of at right angles and, generally, in every direction.

The material performing this amazing operation is a thin, transparent film—Polaroid light control material. Because of it, polarized light, once merely a scientific oddity, gives promise of doing for applied optics what the vacuum tube did in applied electricity. Many careers are being mapped out for it. Non-glare reading lamps and anti-glare sun glasses are sales leaders in their fields. By placing a bottle between two sheets of the Polaroid material, a glass manufacturer can tell if it's been correctly annealed to prevent internal strain; heat content

man Cambridge Polaroid Corp. 420 main St

Polaroid Corp
285 Columbus Ave - 2/100/
Boston Mass
730 Main St
Cambridge
Mass

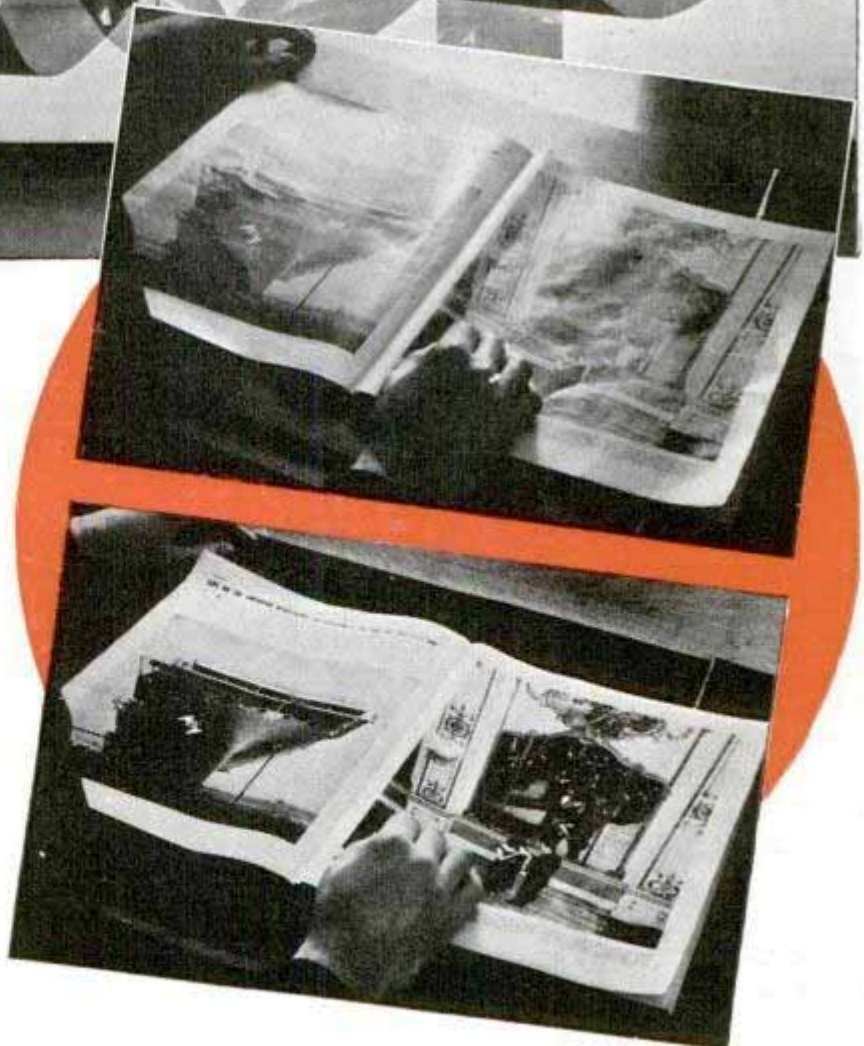
POLAROID GLASS

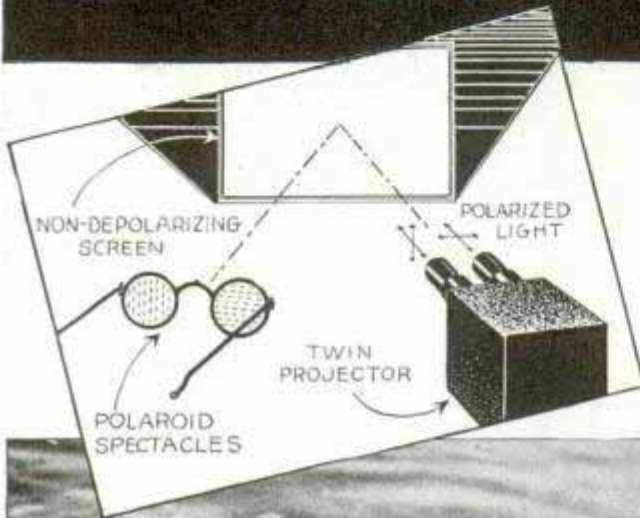
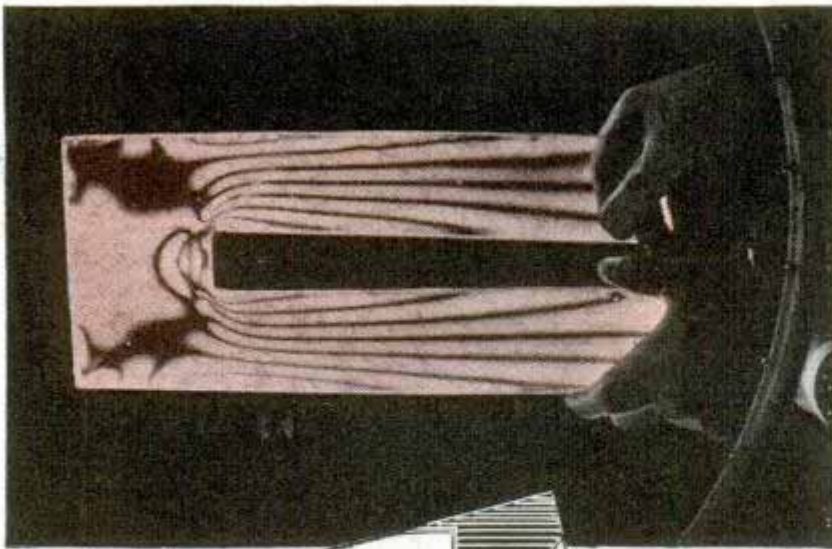


Polaroid strips (top) are transparent unless two are crossed at right angles. Right, comparative views showing how Polaroid sheet eliminates reflected glare on magazine pages.

of coal samples may be measured in a similar fashion and so can the wearability of cotton fabrics.

The jeweler has made the versatile substance his ally in the detection of clever imitation jewels. An engineer can determine in advance how efficiently the members he's designing will carry their actual service loads. He makes a transparent Bakelite or celluloid model of the part, places it between Polaroid disks in an optical system;





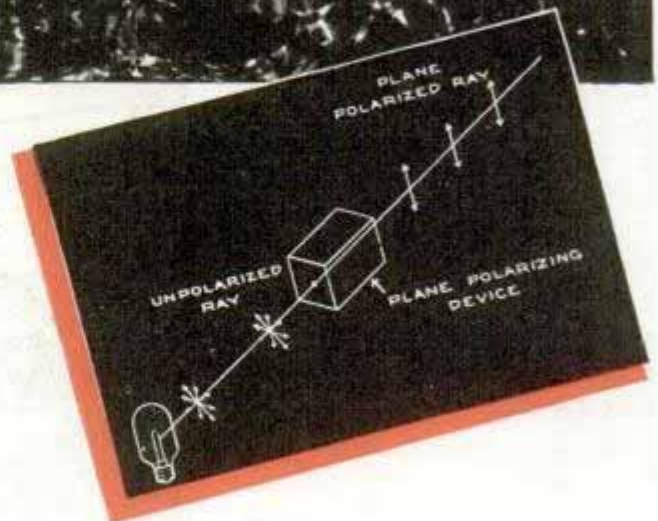
applies forces to the model corresponding to actual service conditions. Strains appear as a map of light and dark bands in the specimen, and from this he can calculate strain at every point in the model, and in turn, predict the behavior of the full-size metal parts in service.

Insurance doctors use it in probing cases of those who claim loss of vision from accidents. Marksmen find it eases eyestrain when applied to gun sights, and the long lights in architectural offices now are being covered with it to take the glare from drafting tables.

A partial solution to the highway death toll, at least the number caused by glaring

headlights, is furnished by Polaroid glass. After two years of intensive testing, automotive engineers predict the windshield in front of the driver, and headlight glasses on all new cars, will be of the new material with installations being made available for cars already in use.

Significant uses for Polaroid glass in photography are many. Through it scientists are photographing the sun to study the structure of the sun's corona. Glare from glass or water ceases to be a problem to the photographer whose camera is equipped with a filter of this material and by means of a small device containing two pieces of the wonder film, one over the other, home-movie makers find they can turn out "fades" between shots that have a professional touch. Recent works of Charles S.



Polaroid sheets reveal strain (top) on transparent model under pressure. Below, principle of Polaroid three-dimensional pictures. Center, how water looks to fisherman before and after putting on Polaroid glasses. Note the fish. Bottom, how polarization affects light rays

Foster, famed microphotographer, have convinced amateur and professional researchers that Polaroid glass is the open-sesame to hitherto inaccessible explorations.

With a thickness of only three-thousandths of an inch, a piece of this flexible cellulosic sheet might be mistaken for Cellophane. For protection, it's always sandwiched between sheets of glass or safety film. Embedded in a square inch of it are some thousand billion sub-microscopic crystals, each having polarizing properties yet all lying parallel so they perform as a single crystal. Their effect is to absorb vibrations along one of their axes. There's no perceptible change in light that is passed through the crystal-studded matrix but it can be called upon to do scores of tasks ordinary light can't. The behavior of the altered light may be studied best with a second Polaroid sheet. Many of the applications involve the use of two sheets.

Polarization isn't new. Scientists have known and understood the principle for years. The big difficulty has been in finding an economical, convenient means of getting the job done. Polaroid material accomplishes in a more practicable fashion what a Nicol prism or what other cumbersome, expensive polarizers do. Then too, it's not limited in aperture or field of view, and is easy to adjust in an optical system.

Place a piece of Cellophane between two polarizing sheets and there appears, as if by magic, a combination of striking, yet harmonious colors. These are created by the withdrawal of certain spectral components of white light by the interference of light vibrations occurring at the second sheet. Consequently, display signs now are fashioned by cutting or stamping Cellophane into the designs wanted. Layers of Cellophane are then added until the

(Continued to page 130A)

Family Rides "Pedalmobile" When State Bans Gasoline



Write World
Family of five turned to this foot-powered vehicle for transportation when Italy limited use of gasoline to emergencies

Milare
Many innovations in bicycles have been produced in Italy as a result of rigid conservation of gasoline. One of the latest vehicles carries a family of five, four of whom do the pedaling.

1127 Army Automobile for Roughest Road Can Climb Steep Slopes

Having proved its ability in the war in Spain, an army car that can travel over the worst roads has been adopted by the German army. Chain driven, the vehicle climbs slopes of forty-five degrees and on level ground can attain a seventy-mile-an-hour speed. Tires have special tread to grip muddy ground, and the body is set up high to give clearance in passing over ridges.



Acme
Sturdy auto of German army travels rough terrain, climbs forty-five degree incline, and attains seventy-mile speed

*Built by Krupp.
Second Parliament firm*

Self-Launching Boat Runs on Beach to Load

Shipper and navigator

Jack Benson, Oceanide, Ore.



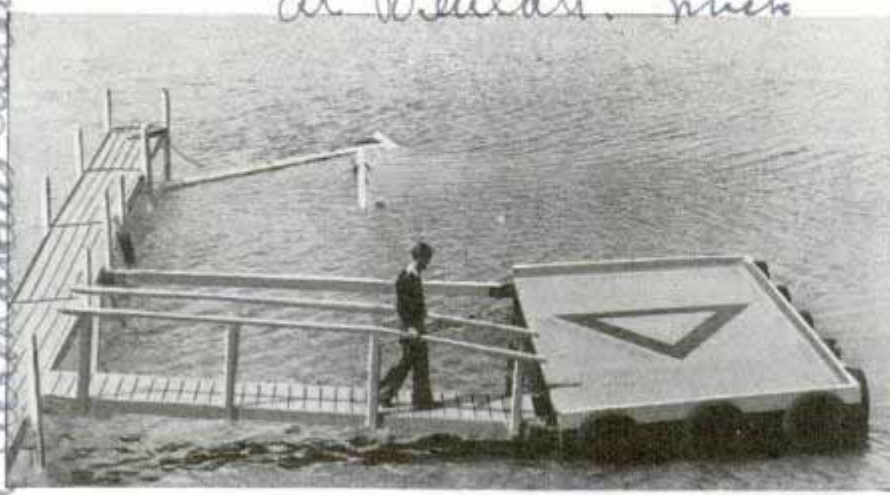
Boat equipped with wheels can go ashore where there is a sloping beach to pick up load of passengers and then launch itself again into deep water for a round-trip pleasure ride

Three wheels mounted on a pleasure boat give the craft amphibian characteristics. On a sloping beach she can ride out of the water to take a load of sixteen passengers, drive them over the surf to deep water for a boat trip and return them to the beach. No dock or pier is needed. Powered by a 110-horsepower engine, on

land the ship is driven by two front wheels, and by a paddle at the rear while in shallow water. Twin propellers give the boat a speed of about eight miles an hour in deep water. A rubber-tired wheel at the stern is encased in the rudder so the same controls may be used in steering the boat whether it is on land or at sea.

Seaplane Bases Dot the Map with Ports for Private Flier

at Beulah, Mich



To facilitate and encourage use of private seaplanes, floating bases like this are being established on lakes and rivers throughout U. S.

It won't be long before you can fly your private seaplane from Norfolk to Long Beach and find a convenient floating base at safe intervals across the country. Seaplane flying by private owners, lagging behind land planes at the start, is now fast-growing and the government is building a network of bases at strategic points on rivers and lakes throughout the

*Ref: Harry Bartholomew, Oceanide, Oregon
Chief, Airport System, Washington
and Director, Aullon*

states. Every town or city with adjoining water has a potential port with little initial cost or maintenance expense. The standard float consists of a twenty by twenty-two foot lumber floor with oil-drum floats anchored in the water and connected with shore by catwalk piers. Several of these units can be combined if larger mooring is necessary.

21140
Lightweight Air-Brush Motor Combined with Compressor

Combined in one unit, an electric motor and compressor weighing only twelve pounds produce pressure to operate an air brush for either home or professional jobs of painting with enamel, lacquer and other materials. The air gun, furnished with

about \$10.00



Lightweight motor and compressor combined in one unit operates air brush handy for shop or home use

a glass liquid container, is readily adapted for use in refinishing furniture, which is tedious when performed with a brush. Easily carried by its handle, the unit is mounted on a firm base and includes a receptacle for the gun. Ten feet of connecting hose and an electric cord are supplied, and the motor operates on 110 volts a.c. or d.c. The sprayer is also useful for spreading insecticides.

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

Crosswalk Is Painted White to Reduce Accidents

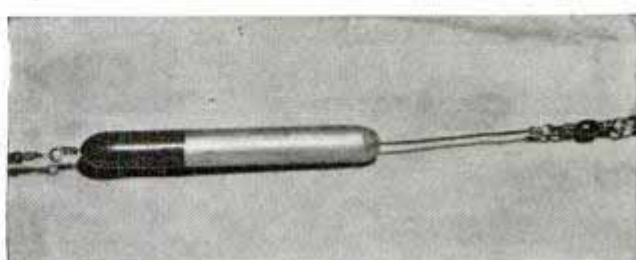


Wide strip of white to mark crosswalk over highway silhouettes pedestrians so motorist can see them

Pedestrians crossing a street are seen quicker by motorists if the crosswalk is painted white, according to one test at a dangerous intersection. The strip is visible to drivers from a great distance and persons walking on it are silhouetted against the bright background.

91217
"Shock Absorber" Helps Angler Land Big Fish on Light Pole

Deep-sea fishermen along the California coast are using a "shock absorber" to take big fish with a light pole. It is an ordinary wooden jig with a strong spring inside it that can stand fifty pounds pressure, taking the initial shock off the line.



Strong spring in wooden jig withstands fifty-pound shock, so big fish can be caught with light pole

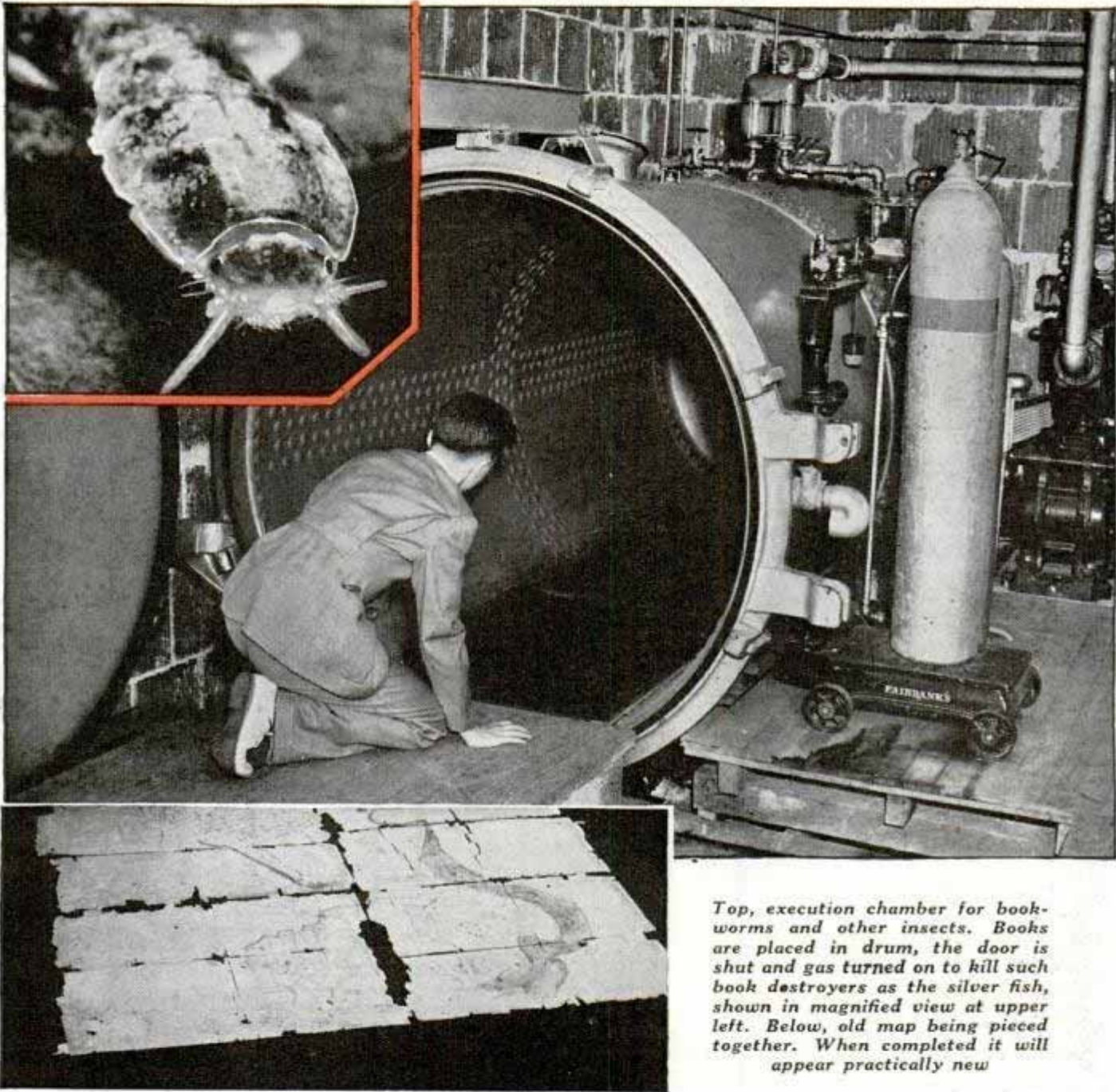
Jegging Joe

Comb. Sam. Bramfaha
1941 Newlee Sh. Monterey, Calif.

4278 91st St. Los Angeles, Calif.

2 102 0. Cont. R. Cle. W. H. Miller
4547 S. Serrano Ave.
Los Angeles

LIFESAVERS for OLD



Top, execution chamber for book-worms and other insects. Books are placed in drum, the door is shut and gas turned on to kill such book destroyers as the silver fish, shown in magnified view at upper left. Below, old map being pieced together. When completed it will appear practically new

RESTORING old, worn manuscripts to good condition, kicking out book-worms and seeing that no more get in is a job for a scientific laboratory whose staff has been especially trained. One of the finest manuscript repair laboratories is at the Huntington Library at San Marino, Calif., which houses some of the world's most valuable books and manuscripts.

All newly received books and manuscripts are first "gassed." This is done in a gigantic steel drum, the poisonous gas be-

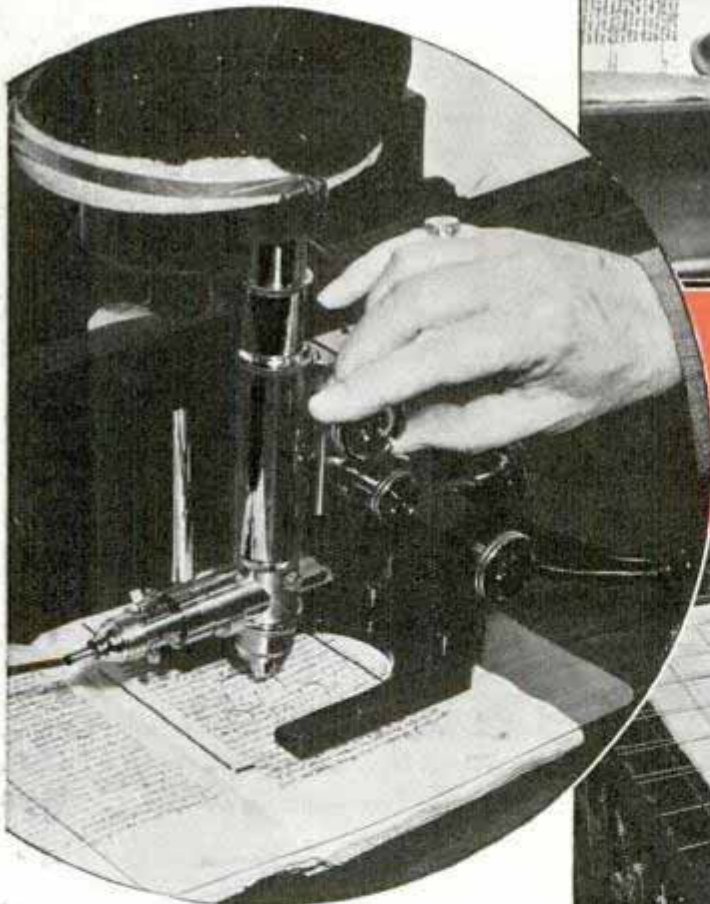
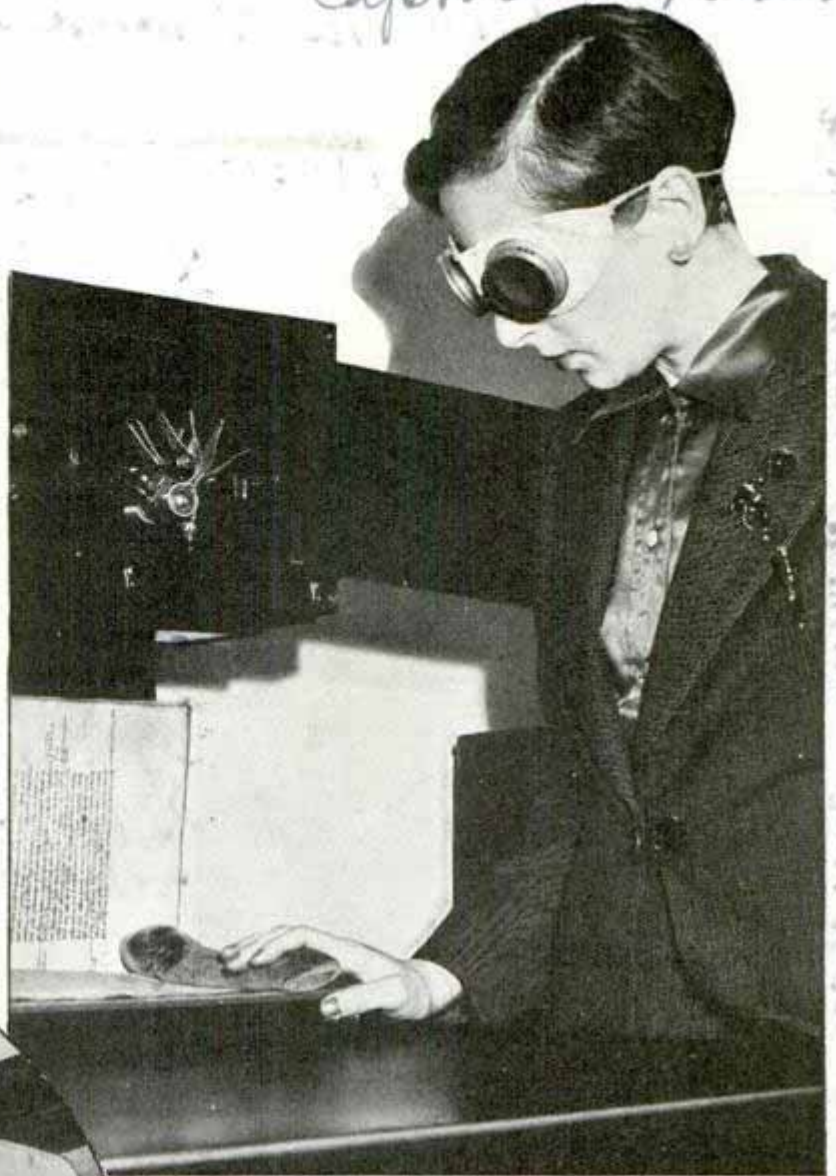
ing pumped in under high pressure to insure its penetrating into the eggs of worms or other destroying pests. From the gas chamber, the manuscripts go to the repair laboratory. Those which are wrinkled or creased are flattened with the aid of a controlled-humidity stretching table. Weighted lines are clamped to all sides of a manuscript, thereby applying an even pressure. During this process, the manuscript is kept damp by a special humidifying process which prevents moisture from actually

27020
Capt. R. B. Hazelden

BOOKS

touching the manuscript, as this would cause the ink to run. Desks with neon-illuminated glass tops, giant presses able to exert a pressure of many tons, special map-piecing tables, binders, all form part of the equipment by which trained workers transform a faded, torn, and crinkled piece of vellum into a page which looks almost as new as it did centuries ago when it was written; a page from which the bookworms have been banished by a gas attack.

(Continued to page 144A)



Top, old manuscript under ultraviolet light. Circle, robot being used to analyze shade of ink used in old manuscript. Right, "stretching table" which applies uniform pressure to edges of manuscript aids in restoration of creased pages

I. M. Mr. John C. Keill

5118 N. Broad St., Phila.

Near-Blind Can See Better with Telescopic Glasses

see Circ. 194d 525



Telescopic mounting for spectacle lenses helps near-blind to see well enough to perform normal work

Near-blind persons are helped to see for normal work with telescopic glasses. Held together by rods a little more than an inch long, two lenses instead of only one are used for each eye. They are said to permit more normal perspective than thick lenses.

Airplane Tires Used as Springs Cause Truck to Float on Air

"Doughnut" airplane tires act as a pneumatic cushion in a system designed to replace mechanical springs on trucks and pleasure cars. In a truck installation, four of these small balloon tires were placed on each side to keep the truck, loaded or empty, floating on air, with the result that spinning of rear wheels on dry surfaces



Four airplane tires on each side cushion truck load on air, improving traction and reducing tire wear

was eliminated and the inventor estimated road wear on tires would be reduced as much as twenty-five per cent.

Soil-Testing Kit for Gardeners Helps Prescribe for Plants

Before planting seeds or bulbs or nursery stock you can determine the suitability of the soil for those particular plants, or its deficiency in nitrogen, potash or phosphorus, by using a simple soil-testing kit. Anyone can make the tests without previous knowledge of earth chemistry, and can change the degree of acidity or alkalinity as desired by adding the right amount of aluminum sulphate or ground limestone. A pamphlet of directions shows the acid or alkaline preferences of common flowers and vegetables. Other tests will show what fertilizer is needed.

Artificial Lung Worn Like Vest Leaves Arms and Legs Free



Small size artificial lung, leaving arms and legs free, has "window" to permit observation of chest

Permitting arms and legs of a patient to remain free for any necessary treatment, an emergency lung developed by General Tire and Rubber company covers only the chest of infantile paralysis victims whose chest walls have been rendered useless for breathing. Sealed at the edge by a pneumatic rubber ring, the "lung" exhausts air between itself and the patient's body.

Transistor Body Co. employed at 43rd Avenue of Pennsylvania Philadelphia

9117 3

Judby's deal Gesting Substation South Suburb. Mass. 555 Huntington Ave. Boston Collins, 555

Sold by Warren &

A recent Wright Co. Wilmington, Del.
 POPULAR MECHANICS
 21213.

thereby expanding his chest and inducing breathing at a normal rate. Doctors or nurses can observe the action through the transparent material. The electric pump, operated by a quarter-horsepower motor, is provided with a lever which also permits the "lung" to be operated by hand. Its low cost, as compared with the larger "iron lung," makes it available for the smallest hospitals as well as for ambulances.

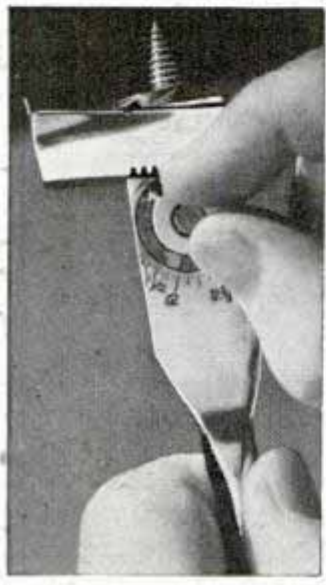
Twin-Unit Electric Cooker Fits on a Table Top



You can cook dinner right on the table in trailer, cottage or camp with this two-burner electric stove

When there is no room for a full-size stove, a table-top electric cooker solves the problem. There is a tiny range available with either one or twin burners, which are individually controlled for low, medium or high temperatures. The top of the cooker is made of stainless steel, making it easy to keep clean. The small unit is especially suited for installation in kitchenette apartments, camp cottages or trailers.

Bit to Drill Holes of Various Sizes Is Set by "Dialing"



You can drill holes of various sizes by "dialing" an expansive bit now on the market. Available in two sizes—five-eighths to one and three-fourths inches, and seven-eighths to three inches—the micrometer bits are claimed to be accurate within one-thousandth of an inch. A set screw

prevents any slipping of the adjustment, and a gauge on the back of the dial shows depth of the hole during the drilling.

'Painting' Made of Beans and Corn Shows Pilgrim Scene

Dried beans and corn supplied all the color needed for painting an unusual "picture" of "Pilgrim Exiles" which was exhibited at a state fair in Connecticut. Thousands of beans in their natural shades provided a variety of colors, and corn was used to give an added touch of yellow and white.



Artist used only colored beans and corn in "painting" this Pilgrim picture which was exhibited at Connecticut state fair

made by William Cook

Samson's Limited Cookery Range 1700

*Original Service
Oct. 26
American Chemical Society*

Buoys Mark Lanes in Sea Cleared by Mine Sweeper



dist.
Sailor holding string of marker buoys of type laid by mine sweeper to guide vessels through mine-infested waters

When a lane in the ocean has been swept clear of death-dealing mines, it is indicated by marker buoys, so vessels may follow the safe course. British mine sweepers, working in coveys, use paravanes to cut the cable holding hidden mines in position, in order to clear areas for ocean shipping.

Robot Chemist Analyzes Solution and Draws Graph of Results

Complex chemical substances can be analyzed today by a robot that works faster and more accurately than any trained human chemist. The only help it needs is an assistant to "feed" it chemical solutions. It reduces to an automatic, mechanical process the electrometric titration method

now commonly followed by hand, the chemist adding small amounts of reagents to a solution and watching the voltage as the solution's current flows. The robot chemist does this by itself, adding reagents and recording the voltage on a graph after each "dose" of reagent. Not only is human labor saved but the element of human error is eliminated and the recorded graph of the chemical substance can be depended upon.

Floodlight Attached to Camera Can Follow Action

Action pictures indoors are captured more easily when light and camera are teamed up to follow the action. A photoflood gun that is attached to the camera makes this possible. The camera is mounted on an arm between two floodlight reflectors, so that aiming the camera aims also the lights, and the photographer needs no extra hands. There is also a single-lamp gun carrying still or movie camera on its arm.



Making indoor movies with photoflood lights attached to camera so that lights can follow the action

How Chemical Co. Midland

1258

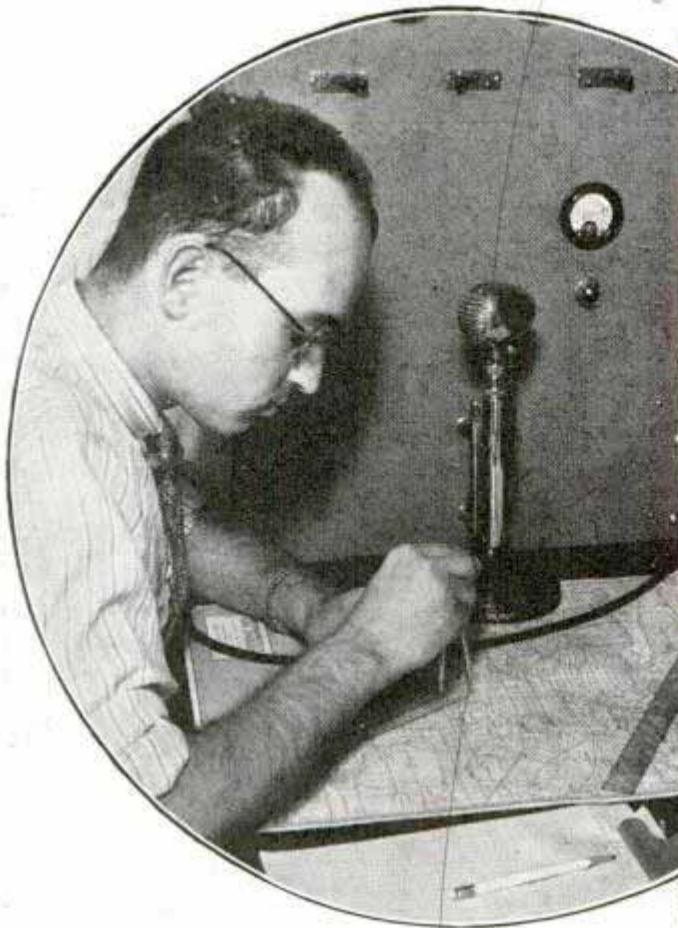
275 up

1206

Portland, Ore. 1925 N.E. Smith

91021.

C. W. Elston, Hall of Justice, Los Angeles, Calif.



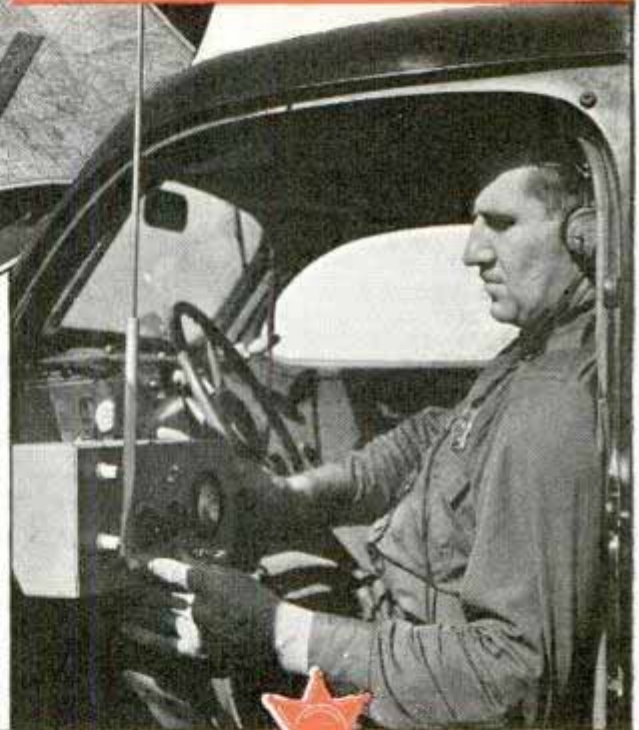
TRAPPING the RADIO SPIES

Scouting through the short waves with his high-frequency receiver, a radio deputy in the sheriff's office of Los Angeles county suddenly ran onto a message that didn't make sense. He copied it down. It was in code, and there was no signature.

It was just the sort of message he was seeking, and during the next few weeks a constant watch was kept on that frequency. Other messages were recorded. Decoded, they helped bring about the arrest of a group of spies who were stealing naval secrets and selling them abroad.

During a flood in southern California a couple of years ago the existence of an illegal short-wave radio station that had been in communication with a foreign capital was disclosed when the operator, in fear of the rising waters, broadcast an SOS that brought deputy sheriffs to his rescue.

Spies are busy in the United States today and they have turned to short-wave radio as a means of communication that is fast and fairly safe and secret. A direc-



Top, tracing short-wave signals on map by triangulating bearings from several patrol cars. Center, field intensity meter helps find station by measuring strength of signals. Below, deputy sheriff hunting transmitting antenna, with car pointed in direction of strongest signals

Capt. Thomas E. Stevenson, Jr. 10555 Wilman Ave Los Angeles 61

2 10 21



Top, talking on directional beam over parabolic antenna. Right, rotating beam antenna on sheriff's station finds direction of other transmitters. Bottom, mobile transmitter and power supply

tional antenna hidden in an attic and a transmitter that can be carried in a suitcase are all the equipment that a foreign agent needs. He can cross an ocean and a continent with no more power than is needed to light an electric bulb.

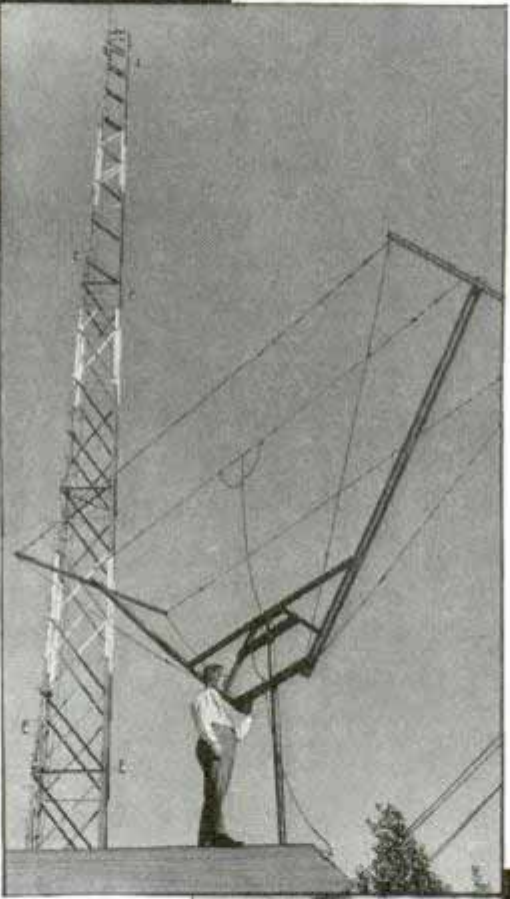
It is estimated that there are several thousand unlicensed short-wave radio transmitting stations in the United States. Most of these are amateur "bootleg" stations operated in the five or two-and-a-half meter bands by enthusiasts who haven't bothered to apply for federal licenses or can't pass the required tests. Having no call letters, a bootleg operator frequently uses the signature of a bona fide amateur station and it is through this deception that he is apt to be caught. Other bootleg stations are used for such illegal activities as

the broadcasting of horse-race results from tracks when such announcements are forbidden to gamblers. A tiny mobile set hidden in an automobile at the race track is all that is required.

One of the advantages of radio in espionage is that with directional transmitting aerials, dot and dash messages or conversation can be made almost completely secret. By turning his antenna in the right direction a spy can communicate with a foreign nation, yet other stations a few miles behind or to one side of the transmitter can't pick up the signals. Automobiles containing powerful transmitters can

broadcast while driving at high speed although in such cases the message radiates in all directions, because a large directional antenna can't be mounted on a car. Using a portable apparatus that he can carry under one arm, a spy can talk from a cliff to a ship at sea, employing an ultra-high frequency beam only a few centimeters in wave length that confines the radio waves like the beam of a searchlight. Only a receiver in the direct path of the beam can pick the signals up.

So grave are the possibilities that many law-enforcement bodies have been co-operating



with army and navy intelligence units, standing watch over short-wave channels and working out methods of apprehending illegal operators. In Los Angeles county, Lieut. Charles W. Ellison, in charge of the communications department of the sheriff's office, at the orders of Sheriff Eugene W. Biscailuz, is training his staff in counter-espionage work and in tracking down illegal stations. Standard police radio equipment instead of special direction-finding sets serve the purpose.

"Surprising as it seems," says Lieut. Ellison, "a patrol car equipped with a two-way radio and a fish-pole antenna is a perfect direction-finder. Radio reception



Radio car finds direction of short-wave station by rotating on grease rack, top. Center, recording high-speed signals, to be played back slowly for decoding. Bottom, tiny beam transmitter sends signals twenty to thirty miles

is usually best when the car is pointed directly toward or directly away from the transmitting station. If we are trying to find the location of an unknown station the car's radio is tuned to it and the driver then turns the car until the signals come in strongest. At that point the car is in a direct line with the transmitter, although there is no immediate way to tell whether the station is in front or in back of the car. The next step is to drive in the general

(Continued to page 122A)

2 1115.

Gas Bag on Roof of Auto Holds Fuel for the Car



Coal gas, taking the place of gasoline as auto fuel, is carried in large bags on top of cars in London

Rationing of gasoline in England has brought back the gas-bag car, familiar in London and other British cities during the world war. Coal gas used in place of gasoline is stored in a bag on top of the car and piped to the engine through a hose.

2 1167

"War Tape" on Paris Windows Introduces New Art

Forced to plaster their plate-glass windows with paper tape to keep them from



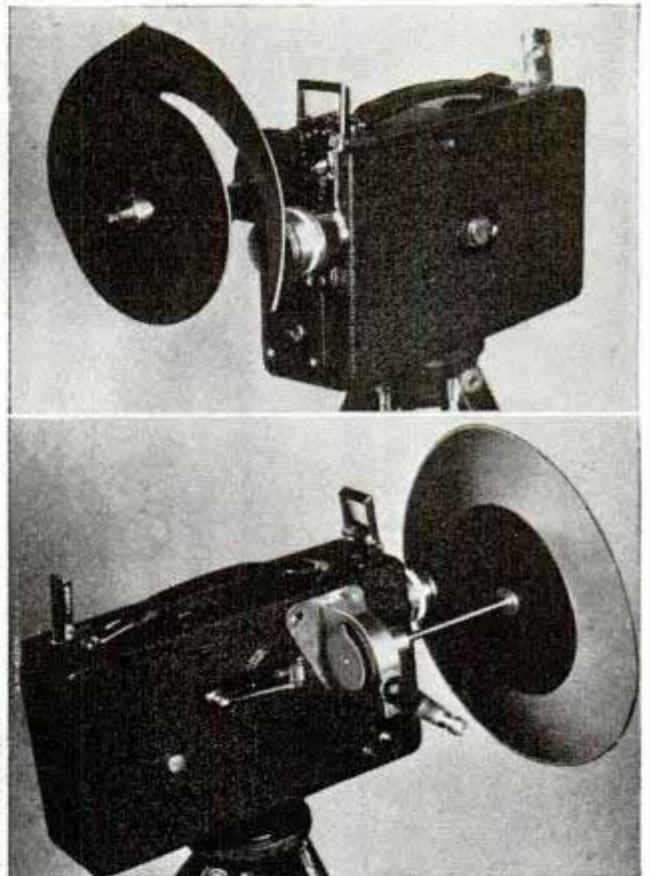
Dress shop in Paris with its plate-glass windows protected by tape arranged in decorative design

shattering under bombardment, Paris merchants have created a new kind of advertising art. By arranging the strips in attractive designs to represent the kind of merchandise carried, shopkeepers create effects which sometimes enhance the appearance of their establishments.

2 1216.

"Wipeoff" Disks for Movies Produce Trick Effects

Amateur moviemakers can produce professional effects with inexpensive disk attachments just made available. There is a celluloid "fadeout" disk that ranges gradually from opaque to transparent, and a



"Wipeoff" and "fadeout" disks attached to movie camera rotate when a button is pressed

"wipeoff" disk that wipes the scene from left to right or vice versa. The equipment is mounted on the camera with a detachable frame counter and back crank. Pressing a button automatically turns the disk while the camera is operated normally.

Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

21129

Wesper Aircraft Corp, Pa.
Luck Haren, Pa.

Plane Light Changed by Man in Automobile

Perched precariously in a speeding automobile, a ground crew member changed the port running light of a seaplane seeking to establish an endurance mark. Soaring dangerously low to complete the hazardous maneuver, the pilots managed to guide the craft within reach of the car traveling fifty miles an hour.

Mechanic stretches to reach airplane wing light that needed changing, as pilots lowered their ship flying at speed of car racing fifty miles an hour across sands.



Jack London, Jr.

Wes Aircraft Corp, Pa.
Luck Haren, Pa.

Floating Conveyor Hose on Sea Pumps Cargo to Tanker



Seagoing tankers are filled in record time with the aid of a hose light enough to float on the surface of the water, yet strong enough to withstand high pumping pressures. Using such a hose, 1,000 feet long, 3,000,000 gallons of cargo were loaded into a ship, ready to sail, in eighteen hours.

Hose lying snakelike on surface of water loads cargo from shore into tanker in record time

F. Goodrich Co.

London Cars Wear Slotted Masks on Headlights as Raid Protection

Automobiles driven in London must wear hoods over their headlights at all times as a precaution against air raids. The mask emits diffused light downward through three horizontal slits, and is placed on all lamps. Permanent installation is ordered to supersede the former temporary screening methods.



Fitting three-slot hood over automobile headlight

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

21148

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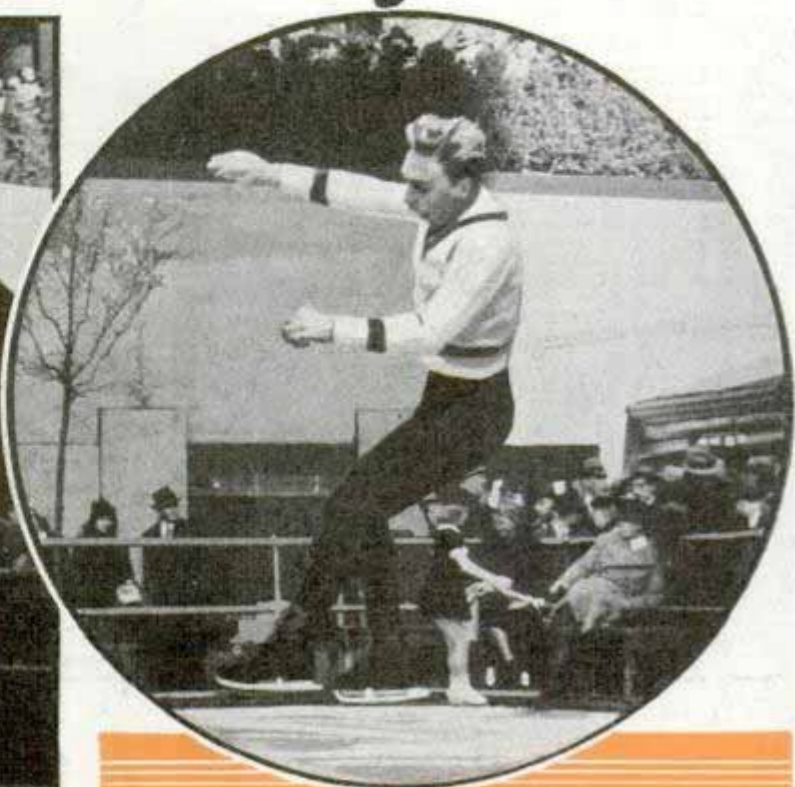
Cont. Wallace D. Morris

5902. Magnolia Ave

Chicago



TRICKS of the



Eric and McChug
By Lewis A. Elkin

(Senior Instructor, Chicago Figure Skating Club)

244 E. Pearson St. Chicago

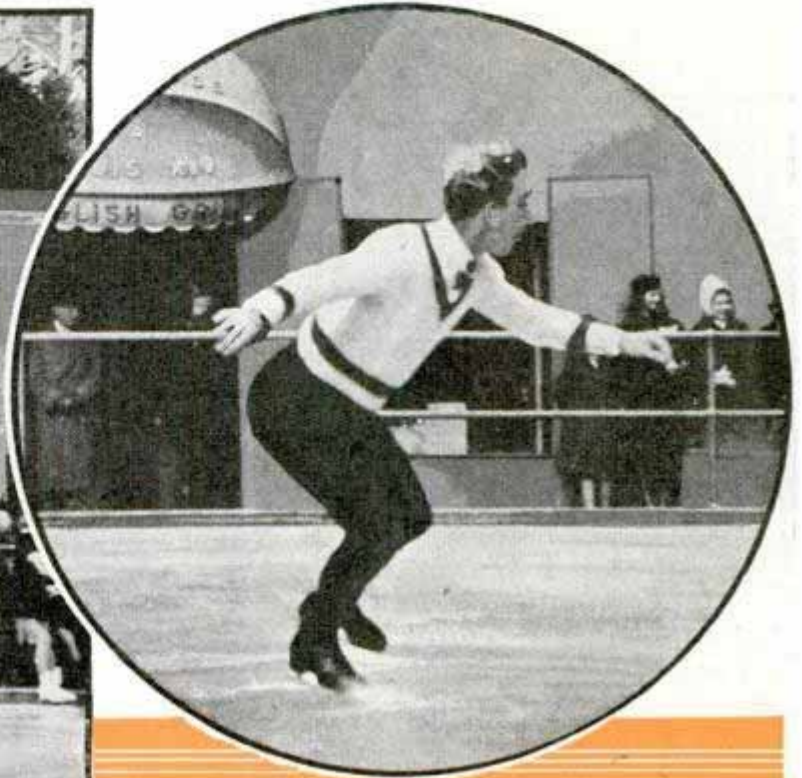
OUT on the ice you see a skater cutting graceful and intricate figures. It looks simply perfect—and perfectly simple—but there is more to “big league” ice skating than greets the eye. Top-flight skaters, with memories of years of assiduous training, practice, and many unpremeditated bumps on the ice, are fully aware of what it takes to become a champion.

No matter whether a person becomes an expert figure skater, or merely acquires enough ability to skate simply and pleasurably, a few fundamental rules of procedure govern in all cases, and at all times. First, remember that in order to move along on the ice, and to acquire speed, skating must be done on the edge of the skate blade. With that essential habit acquired, the next thing to learn and remem-

Ollie Haupt, Jr., one of America's outstanding figure skaters starts Axel Paulsen jump (top, left). Circle, Haupt in air, using his arms to help him twirl. Bottom, Audrey Peppe starting forward-outside spiral

J. 10 48

FIGURE SKATERS



Top, Haupt nearing end of Paulsen jump and then landing. (Photos courtesy St. Louis Post-Dispatch.) Bottom row, Miss Peppe, member of U. S. Olympic team, continuing and completing forward outside spiral (Photos courtesy Sun Valley, Idaho.)

ber is to lean to one side. This latter becomes instinctive, almost, when the edge of the blade is used. Skating on the blade edge, and leaning, tend to make the skater progress in curves, rather than in a straight line. Simple curves, when worked up, become the beautiful figures that form much

of the repertoire of the champion skater.

A skate blade is identified in four sections, or edges, the forward outside edge, the forward inside edge, the back outside edge, and the back inside edge. The figure skater employs all these edges, and he who hopes to become proficient should be-



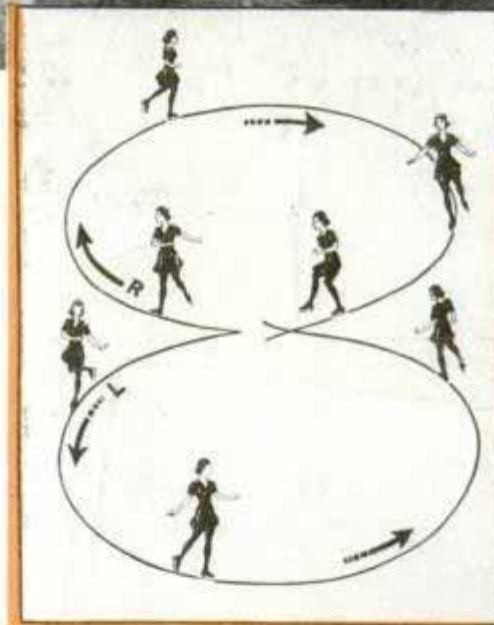
gin by acquiring stability and balance on the four edges. The problem that besets the beginner is that of keeping in motion on one foot, while the other foot is preparing to shove him along. Fear of falling prompts him to put both feet down together. But you can't skate that way.

Do it this way: start with the outside edge of either foot. The body is leaned to the side of that starting foot, known as the skating foot, but is kept otherwise erect, with the skating knee well bent. The free leg, and the arm on that side, go naturally to the rear as you make your first stroke. And remember that you skate on the edge of the blade by leaning the whole body—not by turning the ankle. After pushing off, you are apt to begin to lose your balance. To offset this, come down on your free foot, so that it becomes the skating foot, and shove off with what was the skating foot, but which now becomes the free foot. This is the basis of all skating. In a short time—only a few minutes for some—foot follows foot to the ice in instinctive rhythm, the distance covered in each stroke is longer, the

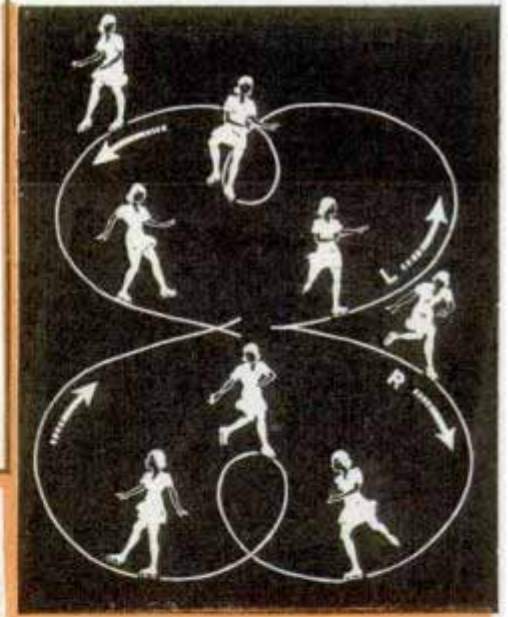
speed greater, the balance more sure, and you begin to get the pleasure of skating.

This is ideal form for the skater: the body erect, the arm on the skating side in front of the body, with the forearm and hand parallel to the ice as nearly as possible. The other arm and shoulder blade should be held well back—not rigidly, but gracefully. Hands should be below the waist, controlled but relaxed, the palms downward.

The same basic principles apply to skating backward as to skating



Top, Miss Peppe in midst of splits jump. Center, how forward outside eight is executed. Right path followed on a loop, forward outside. (R and L indicate right and left foot)

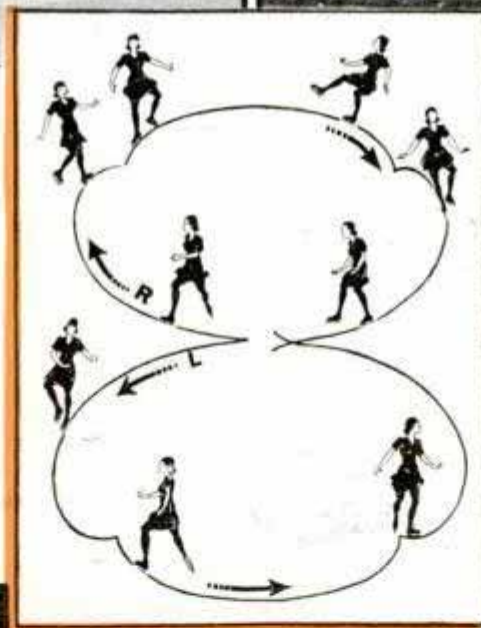
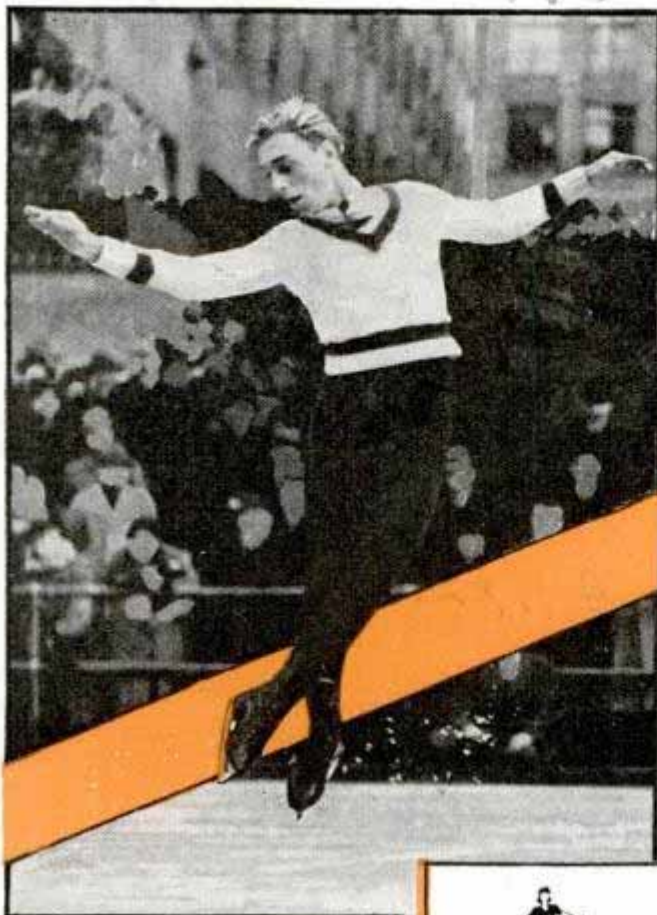


forward. Only the direction of propulsion is reversed. Plain skating, both backward and forward, is a necessary foundation before the skater can begin to learn the figures that make up what might be termed "specialty" skating, but which is the thing that marks those who advance to the enviable status of "champions."

Professional or "champion" ice skating is arduous, too. Karl Schafer, who held the championship for men in Europe from 1929 to 1937, has been quoted as losing as much as two pounds in weight during a five-minute exhibition.

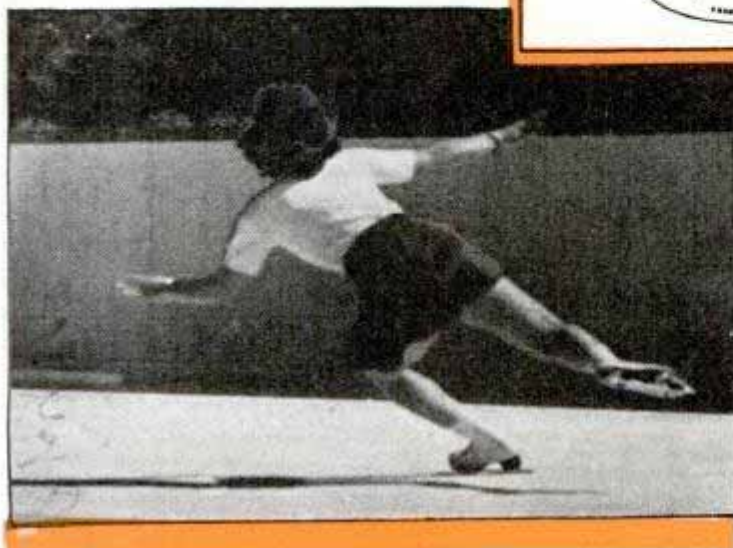
Once a skater reaches top form—cham-

27048



pionship form, so to speak—he or she cannot expect to stay at or near the top on less than two hours of practice a day. It is not uncommon for a topnotcher to practice a full hour on one figure that he is trying to perfect. So, for school figures and free skating a two-hour average every day must be on the cards.

Top, left, Haupt, skating backward, performs mazaruka jump. Right, perfect form in the stag jump by Haupt. (Photos courtesy St. Louis Post-Dispatch.) Center, diagram of the forward outside double three, R and L indicating right and left foot. Bottom, Miss Peppe concluding Axel Paulsen in graceful swing (Photo courtesy Sun Valley, Idaho.)



Near the head of the list of qualities with which the competent skater must be endowed is the gift of co-ordination—co-ordination of mind and muscle, of arms

and legs, of the body as a whole. If you want to test your own co-ordinative endowments, try this: let both your arms hang beside your body. Then rotate one of them in one direction, in the same plane as it was when hanging loose, at the same time rotating the other arm in the opposite direction. If you can do that, your co-ordinative ability is good.

Like any other active sport, skating calls for good stomach muscles. Those who eventually attain better than average abil-

(Continued to page 118A)

2/16/35. Mr. Donald Willey c/o P. Over State Co
 10130 Jackson St. Louisville, Ky

Rail Crossing Gate Swings to Release Trapped Auto

despite outside temperatures that run as high as 120 degrees by installing an auto cooler that uses Dry-Ice to lower the interior temperature. One patented container, filled with twelve pounds of Dry-Ice, is installed in a window opening, the glass window being rolled up to hold the unit in place. Outside air entering a small port in the container passes over the Dry-Ice and is delivered into the car at a temperature of about fifty degrees, resulting in a general drop of as much as thirty degrees. On some desert routes motorists may rent a filled container which may be refilled along the way, and then turn it in at a station at the end of the crossing.



Pushing railroad gate to prove it really will swing to release trapped motorists as sign indicates

Motorists who find themselves trapped on railroad tracks inside gates recently installed at Louisville, Ky., can push their way through, since the arms can be swung outward. A pressure of twenty-five pounds will open the gate. Bells and lights go into action five or six seconds before descent of the gate arms, giving traffic time to halt, but if a car is trapped, the driver can get it off the track by nosing it against the gate.

9/11/32. —————
Speech Is Timed to the Second by Radio Readometer

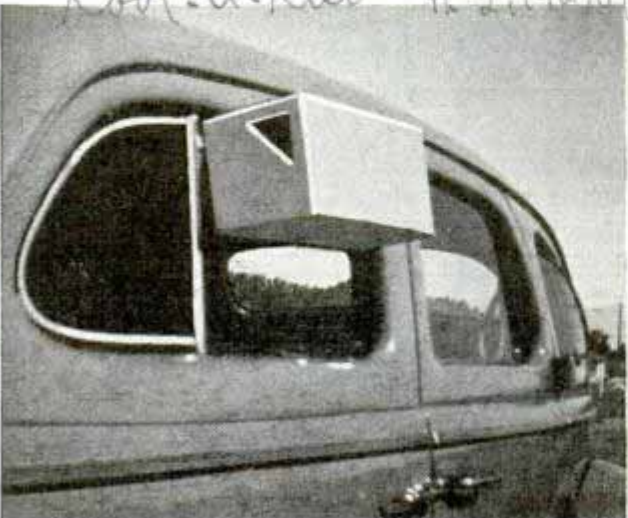


Manuscript or music is rolled through Readometer at proper speed so radio program will end on the second

9/10/34 —————
"Dry-Ice" Automobile Air Cooler for Hot-Desert Driving

Tourists who drive over the hot deserts of the western states remain comfortable

Kool-A-Kar # 2,142,895



Carton of Dry-Ice mounted in automobile window picks up and cools hot outside air before it enters car

In radio broadcasting, where programs literally are scheduled to the second, it is a major problem to regulate speeches, announcements, dramatizations or orchestration so they will fit the exact allotted time. This is being accomplished uniformly by using a Readometer which feeds the matter to be broadcast across the face of the machine at the correct speed. It con-

Cole's Readometer Co
 308 W. Washington

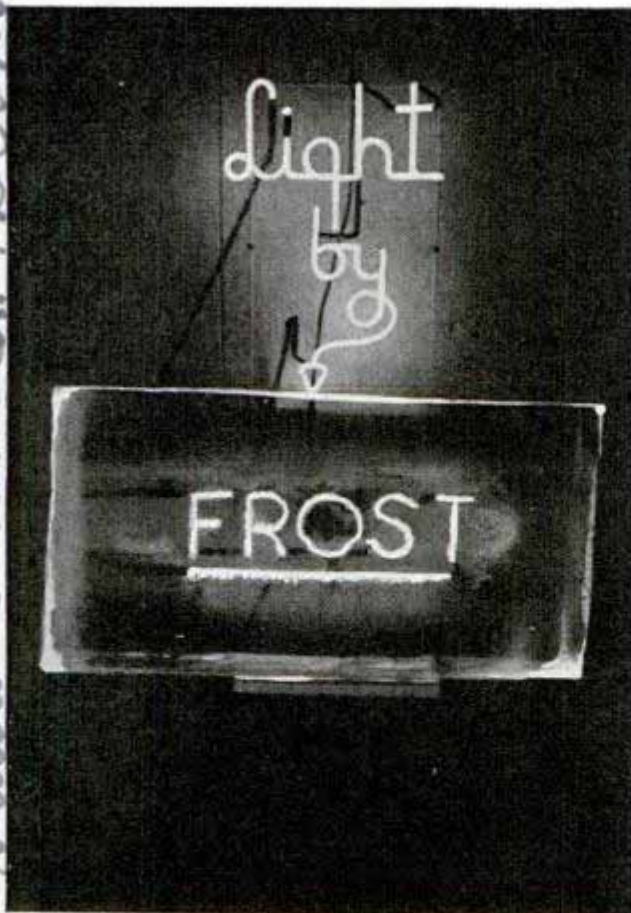
motor of air-dc (C.) Las Vegas Nevada
 412 S. main (N.)

C. Sprague

sists of two rollers to which the manuscript or music is attached, and as the paper rolls along a pointer helps the speaker keep his eye on the line of print, where a light is provided for ease of reading. With this instrument, a speaker can make use of his full paid-for broadcasting time without exceeding it, and it also eliminates the need for a "fill-in" between programs.

21125
"Cool" Light Glows Inside Ice without Melting It

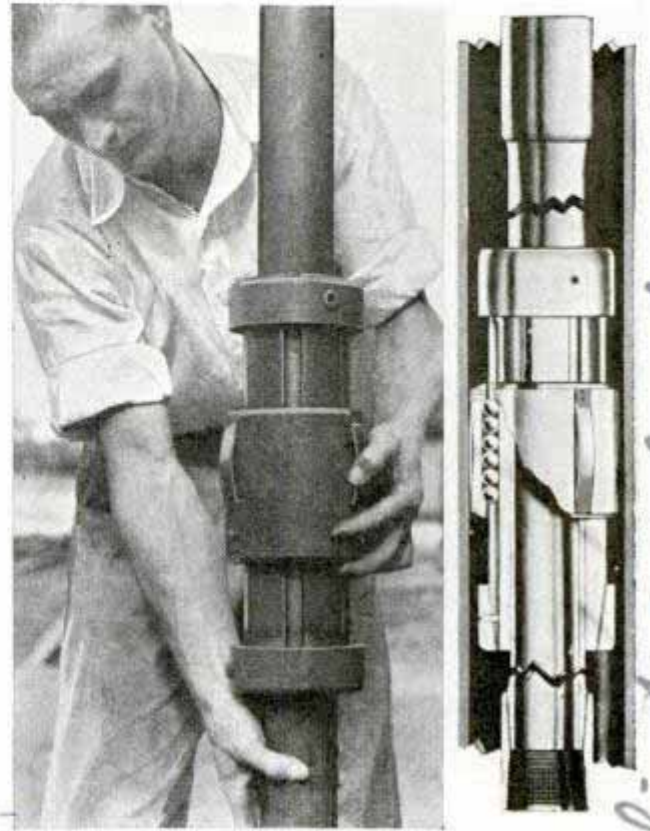
To demonstrate the "coolness" of a newly developed fluorescent light, a sign was frozen solidly in a cake of ice and burned continuously without causing it to melt. The light was designed for use in freezing rooms of a modern cold-storage plant, where a temperature of thirty degrees below zero prevents efficient operation of ordinary fluorescent lamps, and incandescent lamps would create too much heat. Solution of the problem was found in the development of this special fluorescent-tube light, and extensive tests under frigid conditions proved its success.



Fluorescent sign frozen in cake of ice proves its lack of heat and its efficiency for use in cold rooms

Clifford Seriman

21154
Ball Bearings for Oil Well Save Casing and Tubing



Left, oil-well connection. Right, cross-section showing location of ball bearings

In pumping wells, especially those more than 5,000 feet deep, a breathing action causes the inner string of pipe, or tubing, to rub against the well casing. A new device with ball bearings allows several inches of vertical movement in the well without appreciable friction, thus retarding wear on casing and tubing collars.

21223
Electric Eye Sees Death Approach in Time to Prevent It

Warning of the approach of death is given by a photoelectric eye, designed at Ford hospital in Detroit, Mich., which reacts to changing color of the skin and blood of a patient. It will be used in surgical operations where anesthetics or sedatives have been administered, as its signal allows time to give life-saving oxygen. Blood grows darker, due to loss of oxygen, upon the approach of death, and this is what actuates the photocell. A strong light is placed behind the ear, and the electric eye picks up rays passing through, thus detecting changes in the blood color.

Chicago Tribune
10/20/39

to Aurora News Co. 4 S. Archer St. Aurora, Ill.

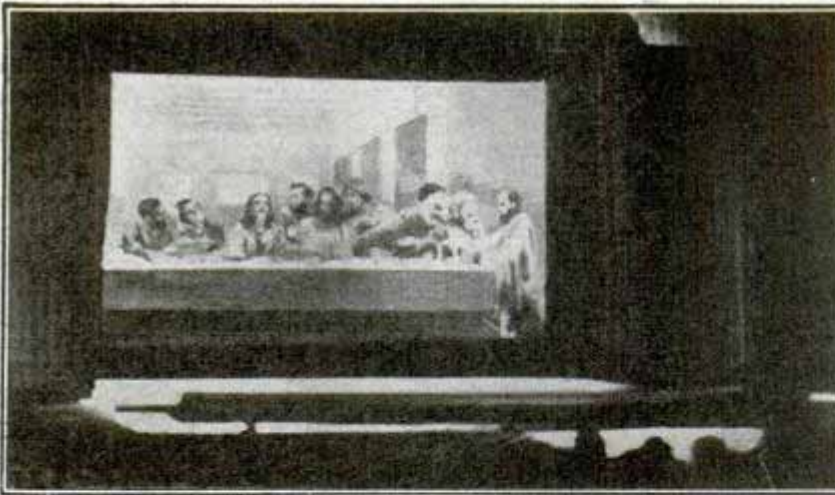
21154
21125
21223
Wetzel Tubing Co. - Des Moines, Ia.

2973

Cont. Co. with Muller
457 S. Serrano Ave.
Los Angeles Calif



“PAINTING” LIVE



Top, left, Roy M. Ropp adjusting gilt globe for "The Races of Man" presentation. Right, cotton glued to pitcher and bowl looks like milk. Bottom, left, "The Last Supper" reproduction. Right, glassware glued to tablecloth to prevent sliding on tilted table in "The Last Supper"

BEFORE the audience appears one of the world's masterpieces of painting, every line and color just as a great artist created it. Only the painting is life sized, and the characters are actually living.

For a minute and a half the picture remains visible, then vanishes. A few moments pass, and another world-renowned work of art appears. Next comes a piece of famous sculpture. Then other paintings.

Finally da Vinci's immortal "Last Supper" is spread before the audience, its power, reality, and unbelievable feeling of "depth" bringing an awestruck whispering from the crowd.

Painting with people sounds a little like a miracle—until you see it done. And even then, you have to shake yourself to make sure you haven't dreamed that the great masterpieces of the world's finest painters

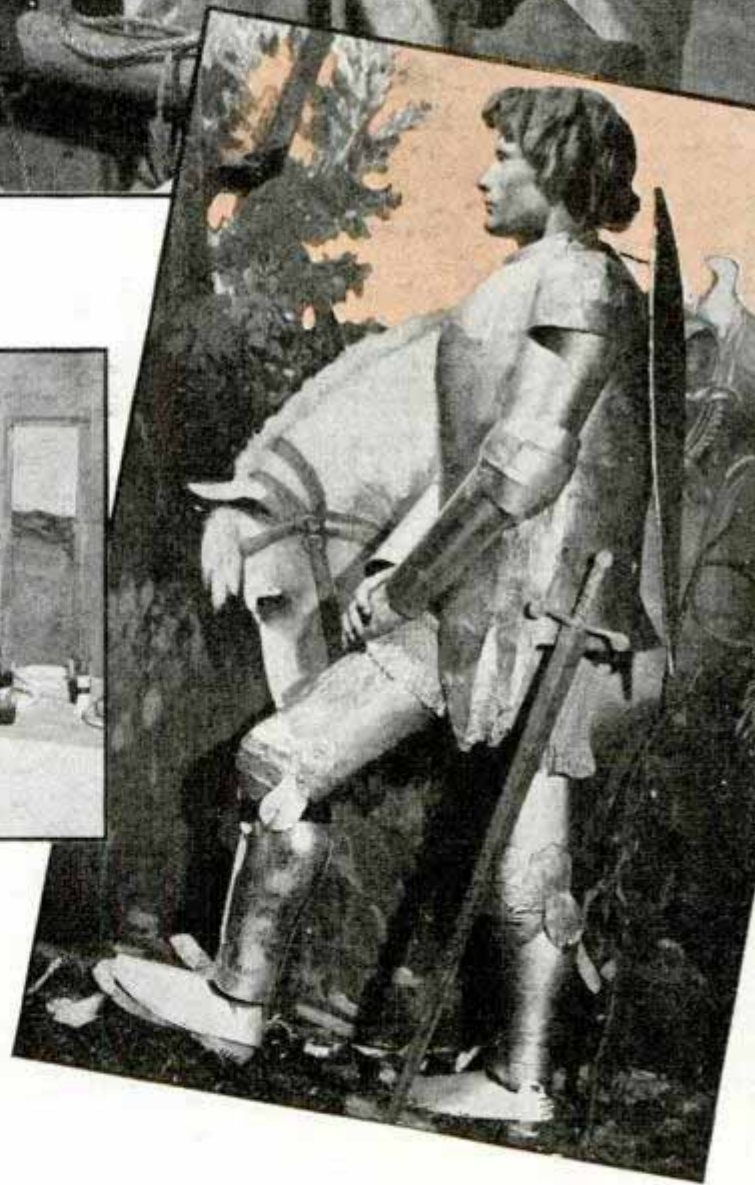
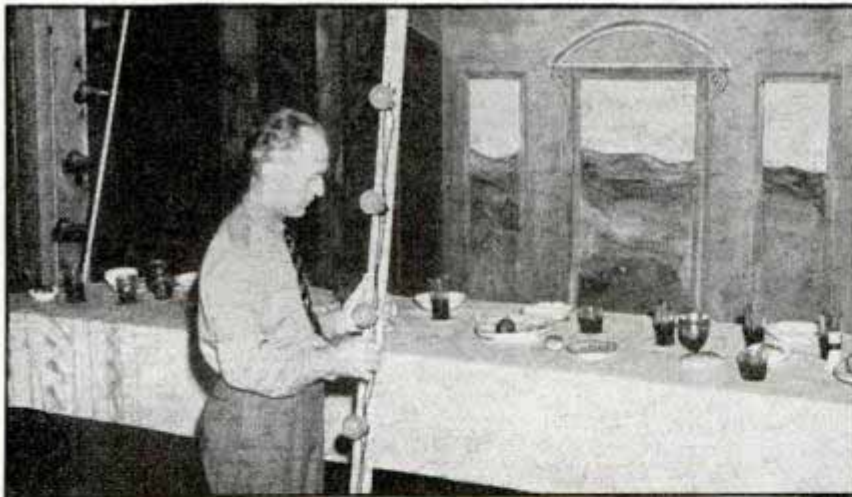
Laguna Beach, Calif. ...

The ...

9993



PICTURES



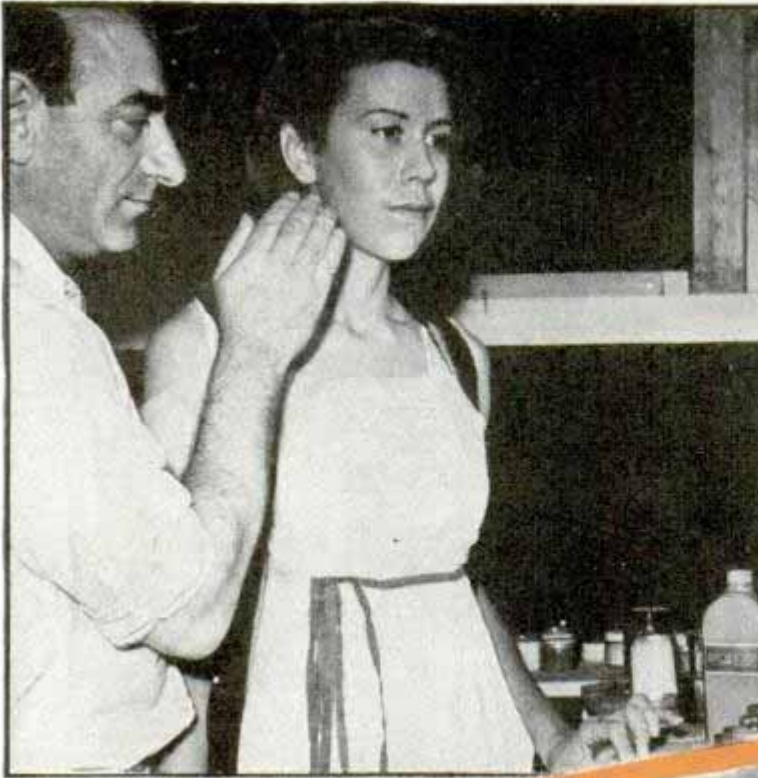
haven't walked right out of their frames.

Behind this seeming magic is the artistry and mechanical ingenuity of Roy M. Ropp of Laguna Beach, Calif., whose living masterpieces form part of the annual Festival of the Arts which is held in that city.

For six months before the annual festival, Ropp culls through copies of hundreds of the world's great paintings, selecting those which are best suited for reproduction in his unique manner. This year he chose forty-four paintings and started the seemingly impossible task of solving the

Top, living models presenting Renouf's "A Helping Hand." Below, left, preparing setting for "The Last Supper." Right, reproduction of Watt's immortal painting, "Sir Galahad." The model is living, the horse is painted on background

2973



men understood the situation. But when they realized what it was all about, they agreed to become statuary for a night.

In the vast majority of cases the models are secured from citizens of Laguna and near-by towns. Often, it is the magic of makeup and costuming which turns the trick. The highly masculine character of Velasquez' "Alessandro del Borro" was played by a woman, certain features of whose face had suggested to Ropp that she might play the part. Makeup and costume did the rest.

One of the most difficult mechanical as well as artistic prob-

mechanical and artistic problems and finding the proper models.

Noticing a resemblance between the face of a local garage owner and that in Frans Hals' most famous work, Ropp obtained his consent to play "The Laughing Cavalier." A Laguna octogenarian plays Whistler's "Mother." Ropp was once unable to find three physically perfect men to play parts in one of the pieces of statuary which are displayed on the same program with the paintings. The statuary in question, Malvina Hoffman's "The Races of Man," was to be given with the aid of a specially modeled golden globe of the world, and a revolving pedestal. He was about to cancel this number, when he saw three young men walking along the street. They were the exact type he wanted. It took quite a bit of explaining before the young



Top, the magic of makeup is important in recreating masterpieces. Center, living reproduction of Whistler's painting of his mother has a striking resemblance to the original. Bottom, reproduction of a piece of sculpture with a living model during Pageant of the Masters

2973

2117

6012

lems is to properly blend the living models and constructed sets with the painted background. Correctly judging where the set should end and the background begin is important in securing the feeling of "depth."

For instance, in Watt's famous painting, "Sir Galahad," a knight in shining armor stands beside the head of his horse, while in the background are massive oak trees. In reproducing this picture only the knight and a narrow strip of leaf-strewn ground are real, the trees and the horse being skillfully painted on a backdrop. The armor is made from papier-mache.

In Renouf's "A Helping Hand," a large part of an old rowboat was used in the foreground, the rear of the boat being so skillfully blended into the painted background that only a few feet away it was impossible to tell where the two joined.

In one picture it was necessary to show milk being poured from a pitcher into a bowl. The scene was to be held for ninety seconds, but a pitcher of the relative size painted by the artist wouldn't hold enough milk to pour that long. After days of experimentation, it was discovered that a strip of ordinary cotton glued to the pitcher at one end and the bowl at the other created the desired effect perfectly.

Such pictures as "Birth of the Flag" by Henry Mosler, which shows Betsy Ross and her daughters sewing on the first Old Glory, require elaborate costumes and makeup. The costumes are made by members of the association presenting the living pictures. Many of the characters must wear wigs. As no standard wigs will give the specific effects intended by the great artists, it is necessary to create a special wig for each character. The wig for the "Blue Boy," adapted from a theatrical wig, is so perfect that even when

(Continued to page 141A)

Braille Globe for the Blind Helps Follow War Events

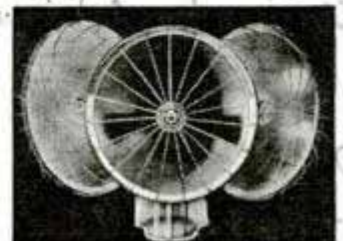


Globe with pins outlining sea coasts and boundaries of countries enables blind to trace them in following events of war

Blind people can keep posted on the progress of events in Europe with the aid of a Braille globe designed for that purpose. Boundaries of the various countries are read by following with the fingertips a line of pins projecting above the map.

Motor-Oscillated Electric Disk Heater Distributes Warmth in Room

Quick, even distribution of heat from the common disk-type electric heater is accomplished by an oscillating heater introduced recently. A quiet-running motor turns the heater alternately right and left.

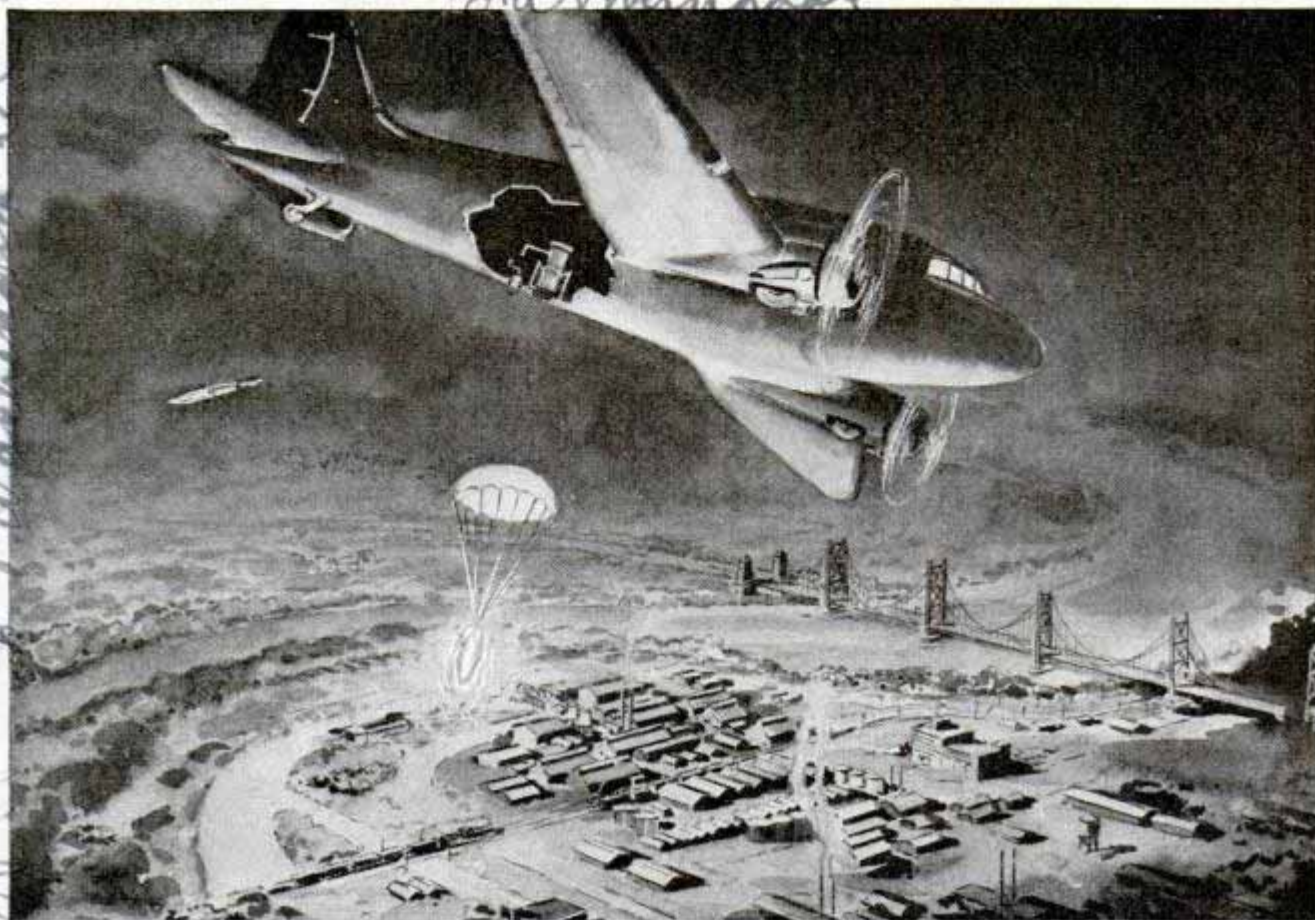


J.A. Smith Mfg Co NY
Price \$11.95

Marysville
1-1-41

Braille, distributor of America
N. Vermont, 1-1-41

Flash Bomb Lights City for Air Cameraman



Flashlight bomb suspended by a parachute, at top, illumines terrain below and its light automatically releases shutter of camera shown mounted in cutaway portion of plane



Photos U. S. Army Air Corps Lower photos show San Diego and an airport photographed at night, and army's aerial flash-bomb equipment

Automatic flash bombs that set off an automatic camera shutter make aerial photography at night as simple as in broad daylight. After twelve years of experiments the U. S. Army Air Corps has developed a bomb that is dropped by parachute, exploding when the parachute opens

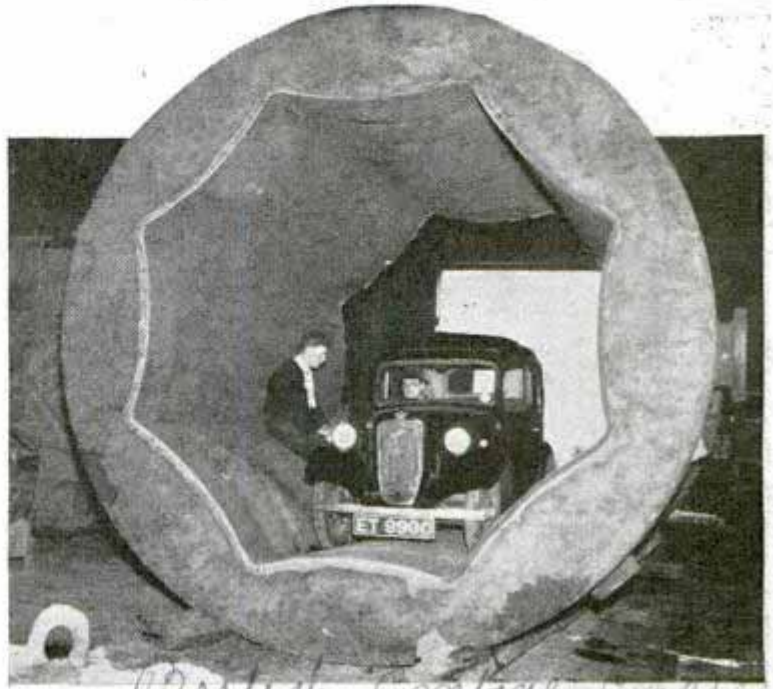
at a safe distance from the airplane. The bomb floods the terrain below with a brilliant light, sufficient to bring out in sharp detail the ground within view of the camera with an exposure of one twenty-fifth second at f3.5. The shutter is automatically tripped when the light reaches a photo-

War Dept. Office Chief of Army Corps

Illustrated London News 8/19/39

electric cell in the camera. Besides its value to military photography, the flash bomb can be used for aerial pictures of shipwrecks and accidents at night, or to illuminate a target for artillery or for aerial observation flights.

295/
**Giant 170-Ton Iron Casting
Big Enough to House Auto**



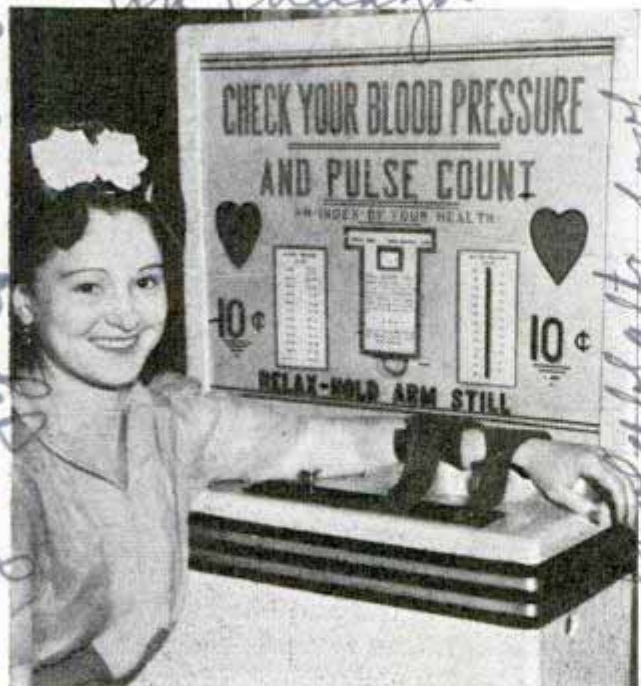
Automobile was driven into casting with plenty of clearance to demonstrate enormous size of 170-ton piece of molded iron

One of the largest castings ever produced in England was recently completed at the English Steel Corporation, Vickers Works, Sheffield. Into its production went 170 tons of molten iron. An automobile was driven through the mold easily in demonstration of its unusual size.

212/4
Surgical Tool Has an 'Eye' to Light Way into Wound

Surgery has a new tool that "sees" its own way into a wound where life is in danger and use of the knife might be fatal. It is the peritoneoscope, a slender instrument with a telescope and electric lamp at its end, and forceps that can clamp off a bleeding artery or pluck out a fragment of bullet or shell. It can be thrust into the tiny opening made by a bullet without enlarging the surface wound. It can be inserted through a needle-size opening through the skin and tissues to drain an internal abscess or sample a bit of tissue suspected of cancer. Surgeons hope that many an abdominal operation can be avoided by using the new instrument.

2113/
Robot "Doctor" Shows Pulse Count and Blood Pressure



Blood pressure and pulse count are measured by a coin-in-the-slot machine, known as the robot "doctor." The "patient" places his arm in position on the machine and an attendant helps him strap it in place. Then a dime is inserted and the doctor automatically conducts a test and reports its findings.

2115/
Dripless Flowerpot Reservoir Prevents Souring of Soil

Soil will not sour in a flowerpot that has a reservoir into which moisture drains. A perforated disk above the reservoir retains the soil, but roots extend through to absorb water as needed.



Vending machine that sells information about your blood pressure and pulse count for ten cents

Dally mfg Co 2640 Belmont Avenue Chicago Ill. 16

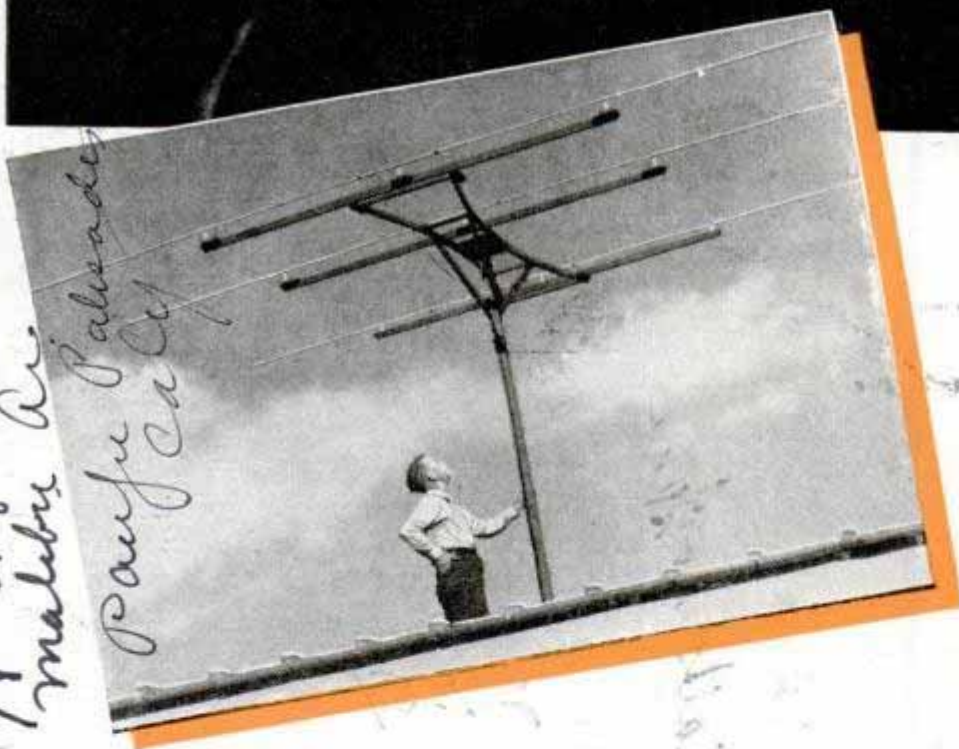
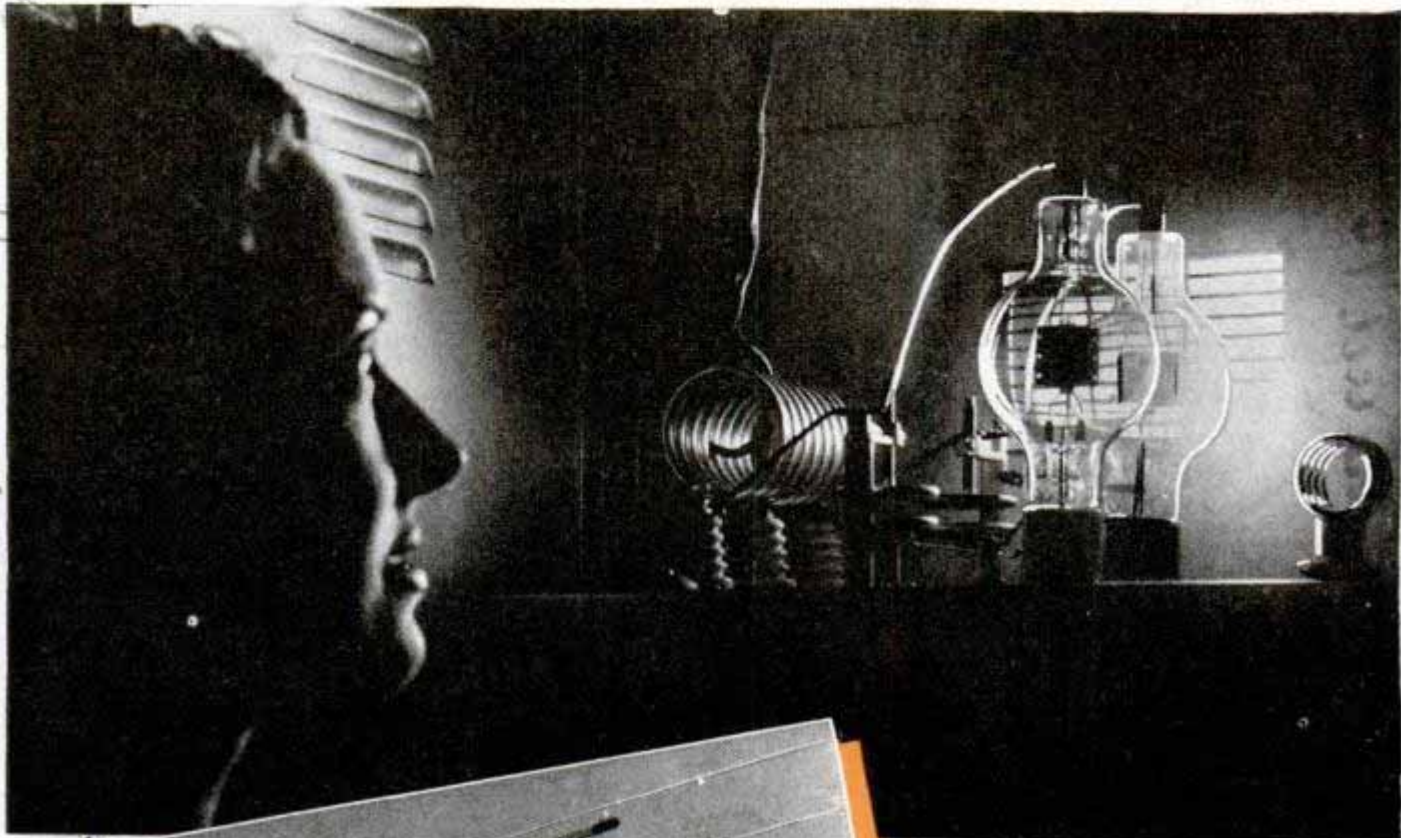
Write Roy C. Burns

George Korb, Inc. Inc. 207 Pennsylvania

2997

W. U. Smith
Harvard Blvd
Los Angeles, Calif

"HAMS" CIRCLE GLOBE



Final amplifying stage of one-kilowatt transmitter built by amateur and (left) rotary beam antenna for ten-meter transmitter

to the recent perfection of the three-element rotary-beam antenna that acts as a reflector and directs nearly all transmitted waves in one direction. It delivers a signal improvement in the desired direction amounting to 100 times more than was possible with earlier types

FIFTEEN years ago not even five times the power of today's biggest broadcast station was enough to insure daytime radio communication across the continent, but today an amateur with a five-watt set can talk coast to coast. His transmitter consumes no more power than a Christmas-tree bulb. With a twenty-five-watt transmitter he can reach friends in any part of the world when conditions are good. This tremendous gain in efficiency is due in part

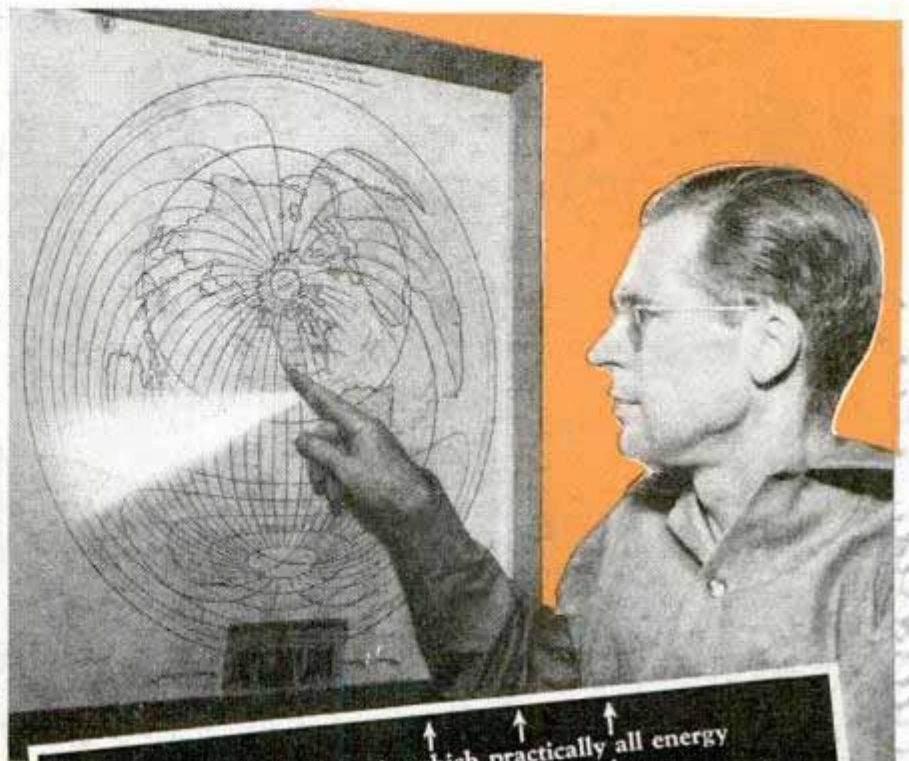
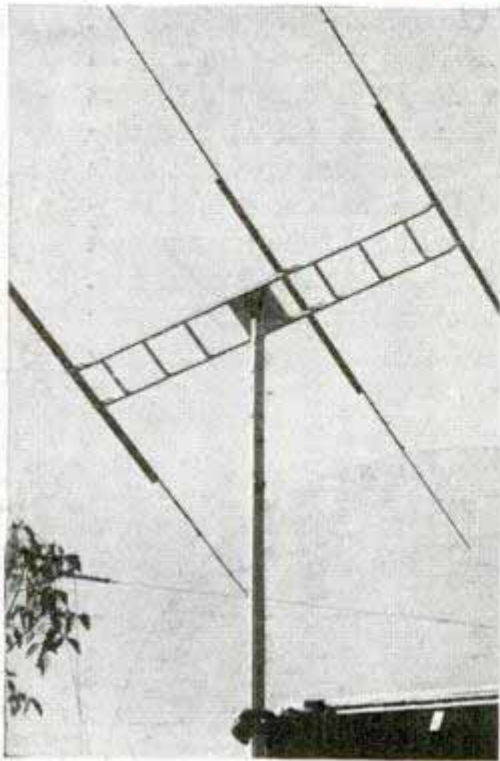
of aeriels. Very little energy radiates away in undesired directions. It likewise increases ability to pick up distant signals when used as a receiving antenna. The beam aerial consists of three parallel metal rods, usually of dural or stainless-steel tubing, the lengths and spacings of which must conform to a formula worked out by J. N. A. Hawkins of W6AAR from theoretical research performed by George Brown. The antenna is supported horizontally in

Cont. Thomas E. Stinson, Jr.
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Malibu, Calif
10518
Pacific Palisades
Pacific Calif

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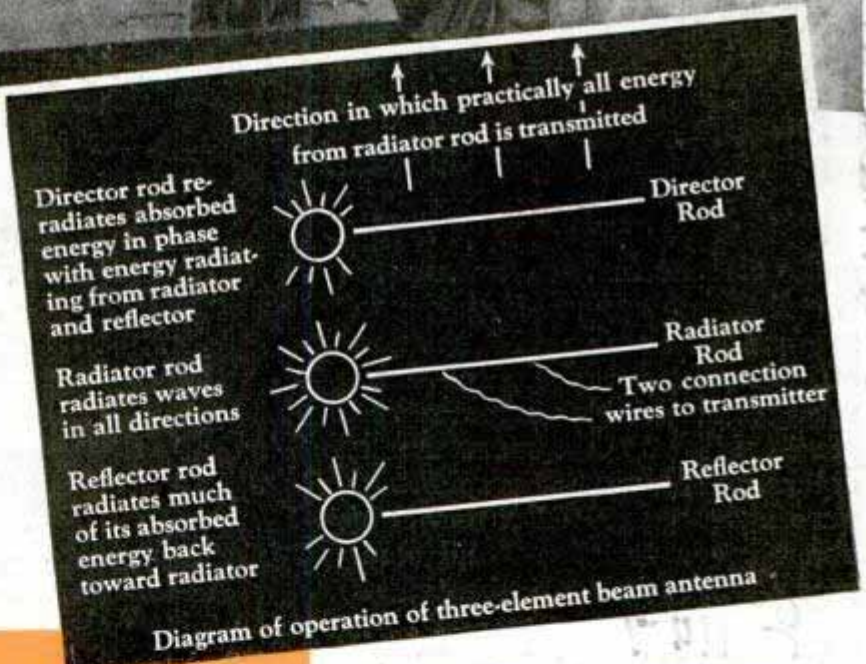
J. 997.

with "RIFLE" ANTENNA

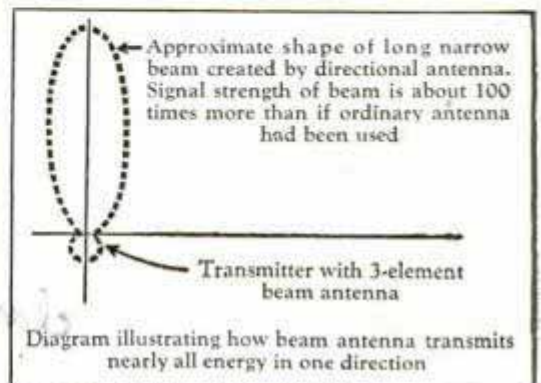


the air. The central rod is a radiator, the rear element is a reflector, and the front element is a director. The reflector absorbs and re-radiates back signals broadcast from the radiator, the time delay that occurs permitting the re-radiated power to reinforce signals then being broadcast from the radiator rod. The direc-

(Continued to page 126A)



Top, left, ladder is antenna framework. Right, light behind map shows direction antenna is pointing. Center, how antenna works. Bottom, amateur at "mike," and diagram of how antenna transmits energy



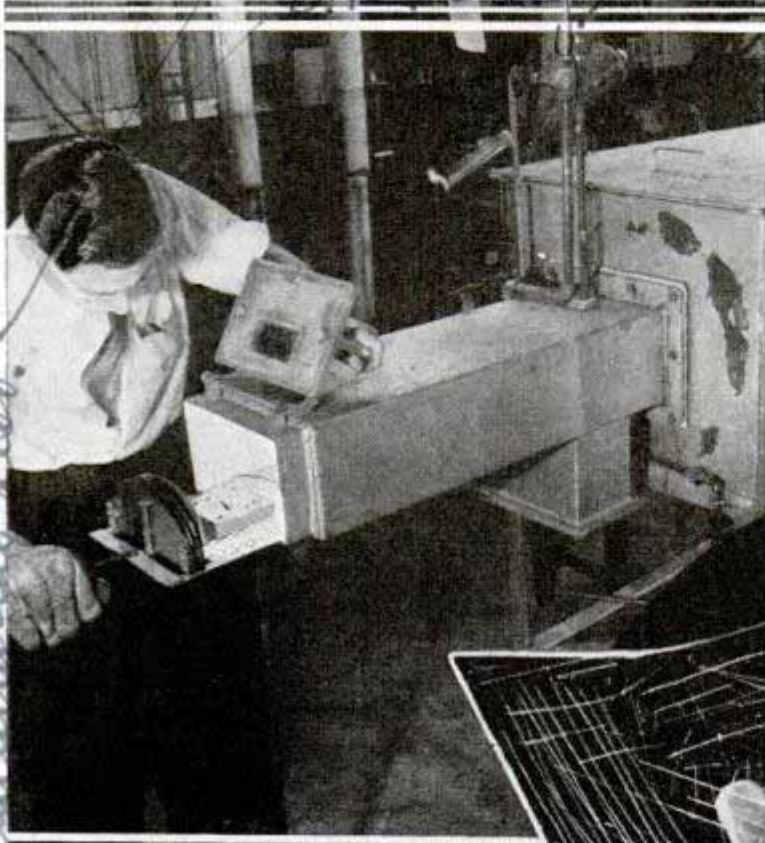
and Howard C. Scott
res. mech metallurgist.

1124.

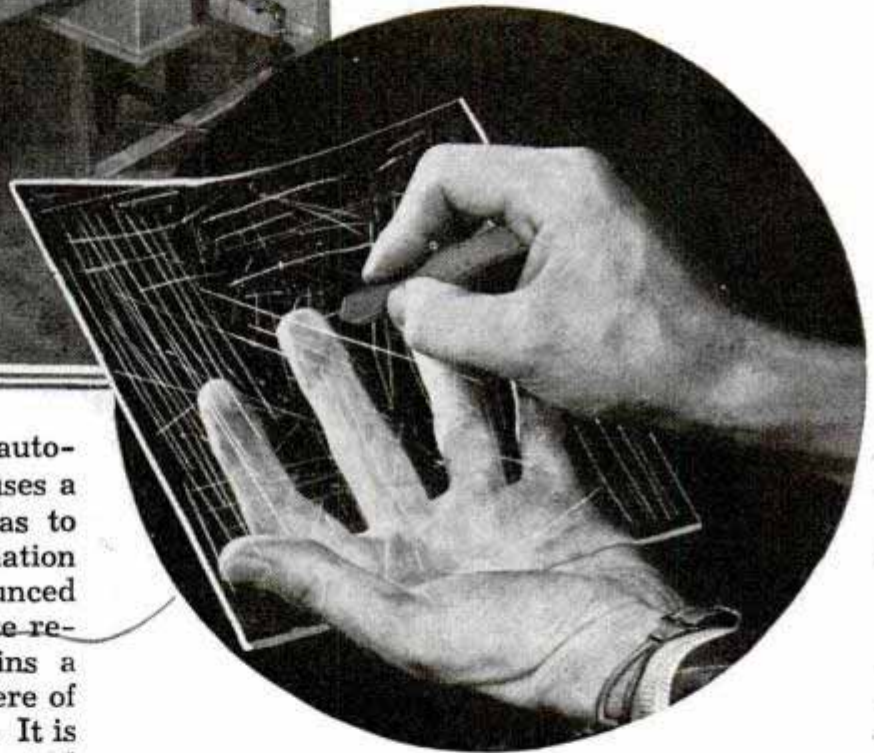
Steel Made Diamond-Hard in 'Blanket' of Gas

J. P. Esray, research engineer

Mr. A. A. Bates
Chemical
and metallurgical lab.



high as 2,000 degrees Fahrenheit before it cools in an air-cooled tunnel. There is no quenching in oil or water, which would distort or mar the metal. Steel pieces approach diamond hardness in their finished form with a bright surface and without the expense and delay of additional machining. Delicate steel springs retain their brilliant finish despite the intense heat treatment.

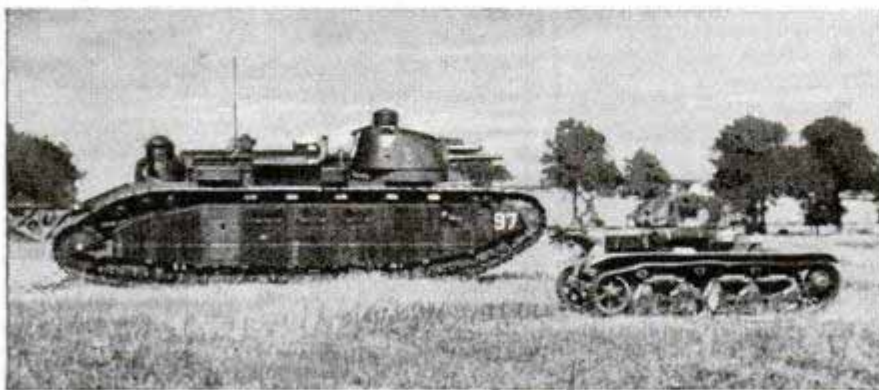


Steel is hardened in an automatic electric furnace that uses a "blanket" of oxygen-free gas to prevent distortion and formation of scale. The furnace, announced recently by the Westinghouse research laboratories, maintains a delicately balanced atmosphere of pure hydrogen and nitrogen. It is about seven feet long, and steel passing through it is heated as

Above, removing steel die from furnace. Right, steel so nearly approaches hardness of diamond it can scratch glass

1147

Ninety-Two-Ton French Tank Is New Monster in War



One of the French army's most powerful weapons is a huge tank weighing ninety-two tons. Its gigantic proportions dwarf the "baby" tank weighing twelve tons.

Photo, News of the Day
"Baby" tank weighing twelve tons is dwarfed by ninety-two-ton monster. Both are used by the French army

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

*Write to Hazel Dell, North
709 Thiel St N.E.
Fort Dodge, Iowa
said name of inventor not given*

Plates Attached to Grader Speed Road Work

Highway maintenance may be speeded by a set of four portable toothed plates that can be attached to the blade of a road grader in ten or fifteen minutes. The plates are adapted to two types of teeth, one for loosening gravel on rough road, the other for removing ice from slippery highways. Use of the equipment is said to speed up road maintenance and reduce the costs.



Inspecting special toothed blades attached to road machine. Two types are used, one for loosening gravel, the other for removing ice

Old Locomotive Hauled on a Truck to Railroad Station

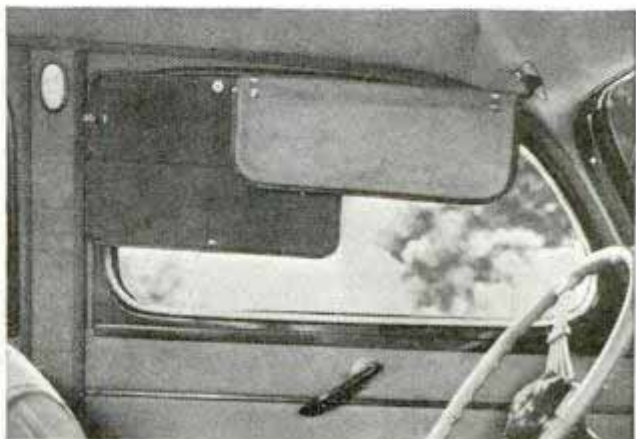


When the Southern Pacific railroad wanted to place the old locomotive "C. P. Huntington" in front of the station in Sacramento to help celebrate the city's centennial, it called upon a moving specialist. The once proud giant was hauled to the spot on motor trucks and there unloaded. In its better days of service the 43,500-pound engine, built in 1843, operated between Sacramento and Promontory Point, Utah.

Here is how historic locomotive was loaded on truck and hauled to station where it took part in celebrating centennial

Extension Shield on Automobile Sun Visor Cuts Glare to a Minimum

Your sun visor can be increased in area to provide greater protection against the sun and wind while driving by adding to it a shield that may be extended and unfolded when needed. It is attached to the visor by means of snap fasteners, and since it weighs but eight ounces the burden will not cause the bracket to sag. When not in use the extension shield slides behind the regular visor.



Shield extending to left of regular automobile visor is attached with snap fasteners

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

21145.
21133
Send to: Essential Store - Rubber Co. Akron, Ohio
Des Moines, Calif.

*Serafin Sales Co.
123 E 7th St*

2995 cont. smile (Schneidmayer)
108-9-E. 66th St. N.Y.
New York City



COLLEGE for SEALS



One of Capt. Spiller's seal

Left, seal applauding. It's a trick that has to be taught. Right, ready for graduation. Below, difficult "one-hand" stand by an educated seal

"GIVE the average seal a 'college degree' and he'll be worth a great deal more than he would be as an expensive fur coat, besides which he'll pay for his education for many years to come."

So says Mark Huling, president of Seal College, who, at Kingston, New York, is scientifically educating seals to become versatile performers, musicians, acrobats and comedians. The demand for educated seals during the past few years has increased to such proportions that after a year's training under Huling's supervision, a seal worth from \$100 to \$200 when caught, has a value of from \$3,000 to \$4,000 when it graduates. Especially talented seals have been worth \$5,000.

Seal College, a large wooden structure, contains many scientific devices, some of which are worthy of a school for human beings. There is a large swimming pool, for example. Lined with concrete, fed with a constantly

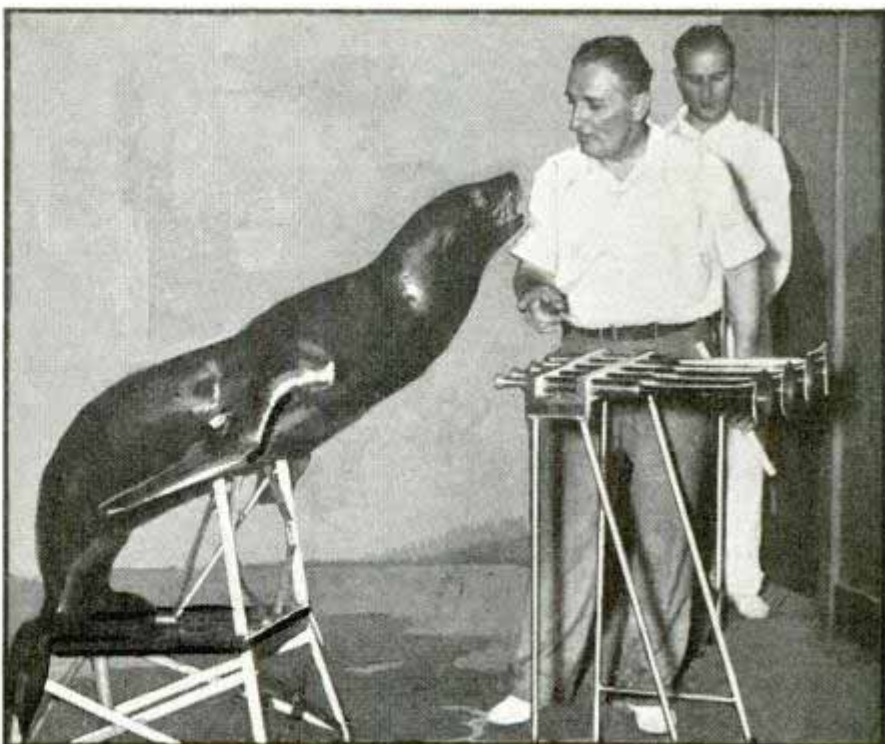
2995.



flowing stream of fresh water and equipped with springboards, it has replaced the old-time bathtub and small tank which trainers previously used. Near by is a miniature stadium capable of seating about 200 people so that the pupil, during the course of his training, becomes accustomed to spectators who invariably collect when he performs. The seal "dormitories" are of concrete, and spotless.

Huling's pupils, which are mostly caught in the Pacific near Catalina Island, are of the type known as California sea lions. They have long supple necks, lithe bodies and a considerable amount of nervous energy which makes them among the best fitted for performers. Sometimes they are temperamental, too. In their native haunts they are accustomed to feeding themselves on live fish, so

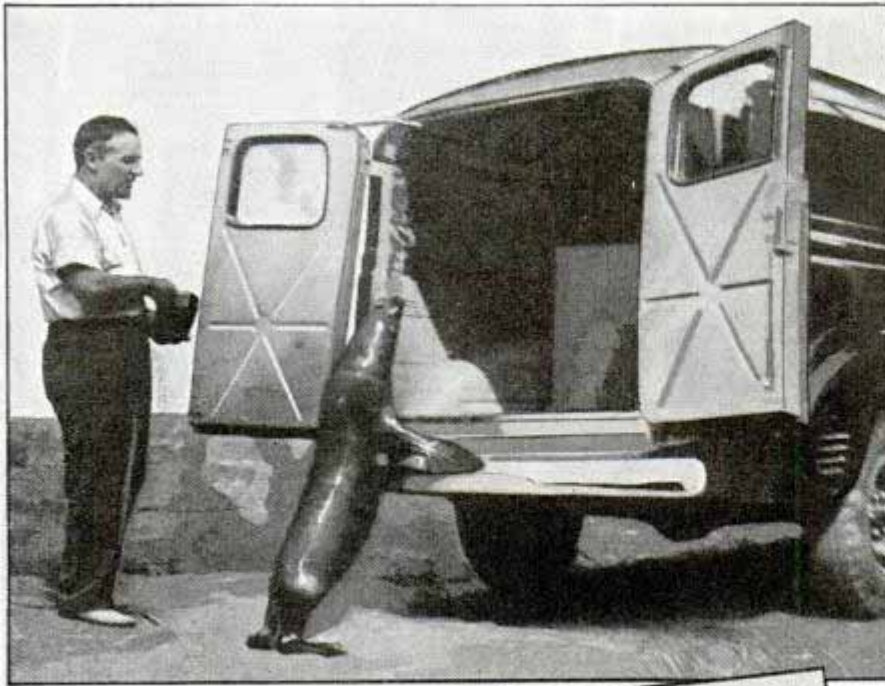
Left, seal ready for a comedy turn, for which it has a natural flair. Right, this big fellow didn't go to college but he learned to jump for a fish dinner. Below teaching one of the pupils to play a tune on the horns. The trick is teaching the sequence in which each horn is to be blown



Al Huling

Capt. Dolana Pebois

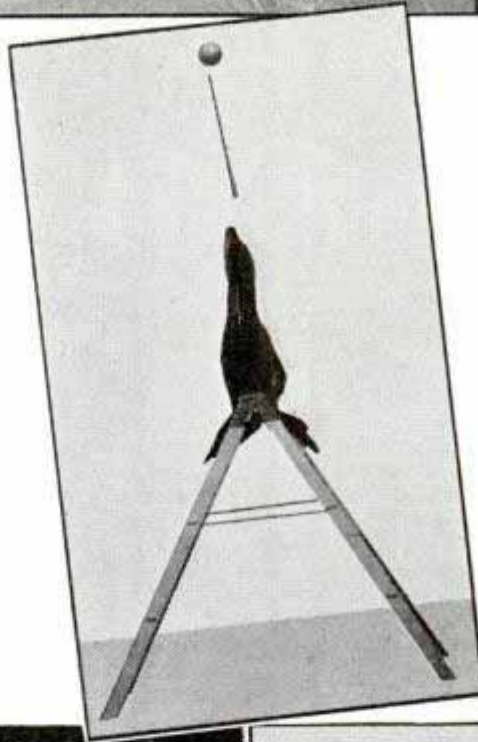
2995



some of those shipped to Seal College go on a hunger strike for several days after they arrive, refusing to be fed by Huling or his assistants.

Each student gets from eight to ten pounds of fish a day. He also gets a snack before and after he goes through each stunt and will not perform otherwise.

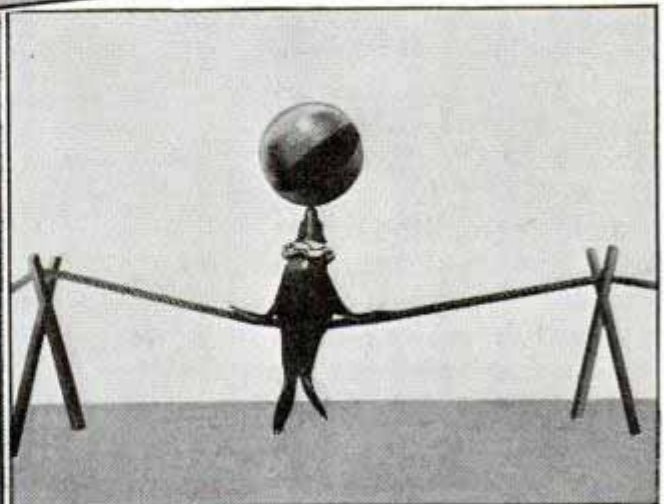
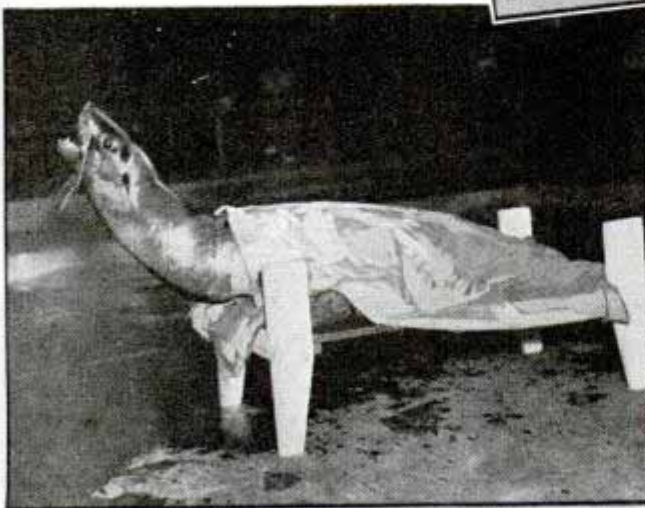
"A seal gets just about one half hour of instruction every day," says Huling. "He learns readily and what he learns he



never forgets. An intelligent seal may remember from fifteen to twenty tricks and after he has become used to the routine of the college he can learn them at an average of about one a week.

"The first thing we teach a pupil is to take things in his mouth. Then comes balancing. After that comes clapping. This last looks like a natural gesture and a great many people think that it is, but it really must be taught, which isn't as simple as one might think. After a seal has learned these rudimentary tricks, he is ready for more complicated ones and may specialize in one of the several courses given."

Thirty years ago, according to Frank Wirth, one of America's foremost bookers of animal acts, the seal became popular as a novelty act and its popularity has persisted. In order to continue to be a "novelty" however, the seal has had to add considerably to its repertoire. As a result, even old troupers are sent back



Top, seal graduate leaving "college" in specially equipped car. Center, doing a difficult balancing act. Bottom. left, seal in a "bedroom" scene. Right, doing combination balancing and acrobatic act

to school every once in a while for a post-graduate course. Since a seal lives as long as a human being, in some cases even longer, some of the performers that got by with simple tricks three decades ago are still taking courses occasionally with various trainers to brush up on their routines.

One of the most popular branches of study at Seal College is music and Huling and his assistants can teach a pupil to play the chorus of a song on the horns by blowing them.

"Some people think that a seal is actually musical and can distinguish the various notes," he says. "This is not so. The student is taught to remember the sequence by which he must blow, not the notes themselves. Incidentally there are two ways of blowing, by the mouth and the nose. Inasmuch as a seal puts his mouth around a horn when he blows by the former method, for fast choruses we teach him merely to exhale through his nose as this is much swifter.

"Sometimes one of my pupils will show temperament. Noise does not seem to affect them, except the sound of clapping, which they realize is applause and which they continually seek. Colors in motion do affect them occasionally and I have known a pupil to slip up in his routine when a woman in a brightly colored dress took her seat and distracted his attention after a performance had started."

One odd example of temperament in Huling's recollection was that exhibited by Alf, a seal which had graduated with honors. Alf had an extensive repertoire of tricks and went through every one of them faultlessly during rehearsals. When there was an actual performance, however, for some reason or other he cut a simple balancing stunt out of his routine. One night he played in a theater in which the first row of seats was so far back from the stage that he couldn't see the audience in the darkened house. Thinking he was at a rehearsal, he went through his entire repertoire without a flaw. When the lights went up, he saw the audience and heard their applause, then seemed to realize his mistake. Never thereafter did he cut out a trick during his performance.

Advanced students at Seal College sometimes specialize in difficult balancing tricks

(Continued to page 142A)

Portable Talking Projector Tells Sales Story



Tiny talking projector tells sales story in word and picture for prospect in his own office

To present a complete sales story, there is now available a talking projector which can be taken right into the prospect's office. Slide films are shown on the screen and a reproducer does the talking. Electrically operated, the unit is light in weight and easily carried in a compact case.

Gas Masks to Protect Dogs Fit All Sizes and Breeds

Dogs have not been overlooked in war-torn Europe. The French society for the protection of animals is providing gas masks to fit all sizes and breeds of dogs so the pets may be protected against possible gas attacks from enemy airplanes.



Dog wearing gas mask as protection against possible gas attacks from enemy airplanes in France

21135
 Clyde A. May, Chief Engineer of Seal
 Sales Engineers, Chicago
 N. Michigan Ave. Chicago
 5410
 J. 1137
 Paris, France.

Dr. Samuel S. Meyer
58 E Washington
Chicago

Model Homes Rotate on Shelf Offering 'Paint Prescriptions'



Home owners select model house most nearly resembling their own, choose most appealing paint combination and obtain prescription for the paint

Cleveland Color Center

More than a thousand color combinations for the home are suggested in a display of 400 miniature houses mounted on revolving tables in a paint manufacturer's "color clinic." The home owner can look over model houses resembling his own, visualize the decorative effects of various combinations of colors on both the exteriors and the interiors, and then obtain "prescriptions" for the paints preferred.

923 Included

Diseased Eyes Are 'Spot-Welded' to Restore Sight

Increasingly good results have been reported in restoring sight by a kind of electrical "spot-welding" where a detached retina is threatening blindness. The retina depends for its nourishment on tissue called the chorioid, and when, through in-

jury or disease, it becomes detached from the chorioid, it cannot function properly. If not treated, the retina may eventually peel off the chorioid, and blindness results. Eyesight is being saved for better than one out of three patients by applying tiny needles carrying an electric current to the chorioid, without puncturing it. The electric cauterization produces an adhesive inflammation between the chorioid and the retina, causing the retina to become reattached.

Handcuffs on Belt Prevent Attack on Officer

Prisoners handcuffed in the usual way sometimes have used the shackles as a bludgeon in a two-handed smash to subdue the officer and escape. It was to prevent such misuse of handcuffs that a detective invented a belt to which they are fastened. The belt is locked about the captive's waist, making it impossible for him to swing his hands.



Handcuffs fastened to belt around prisoner's waist prevent use of shackles in assailing officer

Detective Emmett El Kersas Cincinnati

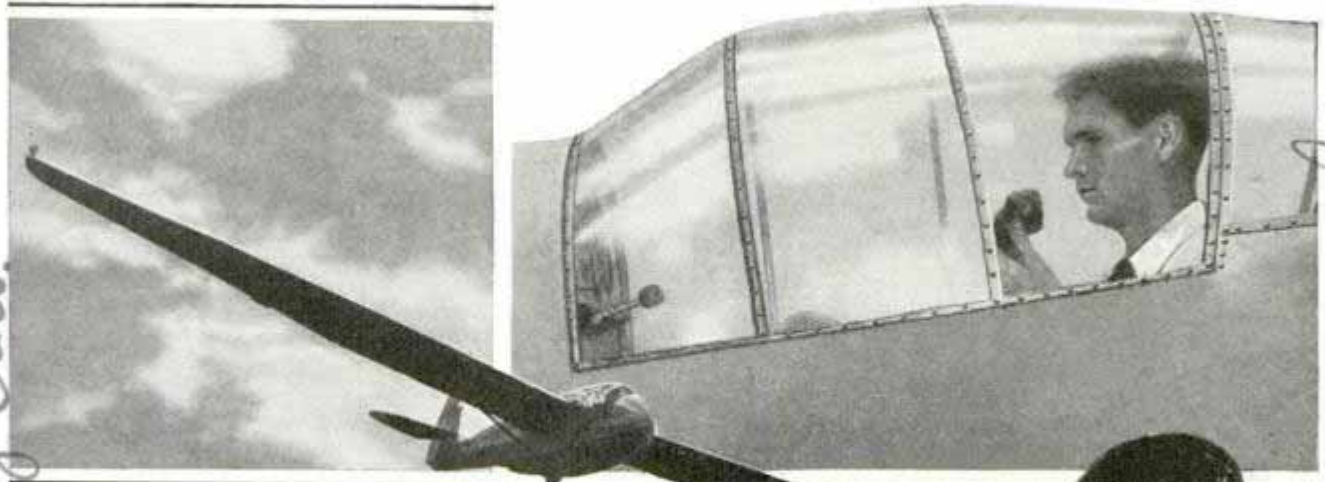
The Bladden Co., 107 S. Lodi St., Cleveland, Ohio

Service Service ad. 12

Reported by American Police & Surgeons

27106 Page designed by -
Schweitzer Bros.
Brookshill, N.J.

Glider's Two-Way Radio Guides Crew in Car



Two-way radio enables a ground crew to track down the metal two-seater sailplane owned by one gliding club. The sailplane, on endurance flights, may travel several hundred miles from starting point and a special lightweight radio working on five-meter wave length guides the crew following in an auto also equipped with the two-way radio. Above, sailplane in the air and pilot giving instructions on radio to crew on ground



Above, testing radio before the sailplane takes off. Left, circle, operator in auto receives pilot's message giving location of sailplane. Below, ground crew arrives at point where the aircraft has landed and the pilot approaches the car. The radio is also valuable for instruction purposes on local flights, such as warning beginner pilots of obstacles in their path. The two-way radio weighs twelve pounds, including batteries



Jack Brookhart, winner
State Glider

and Soaring Club

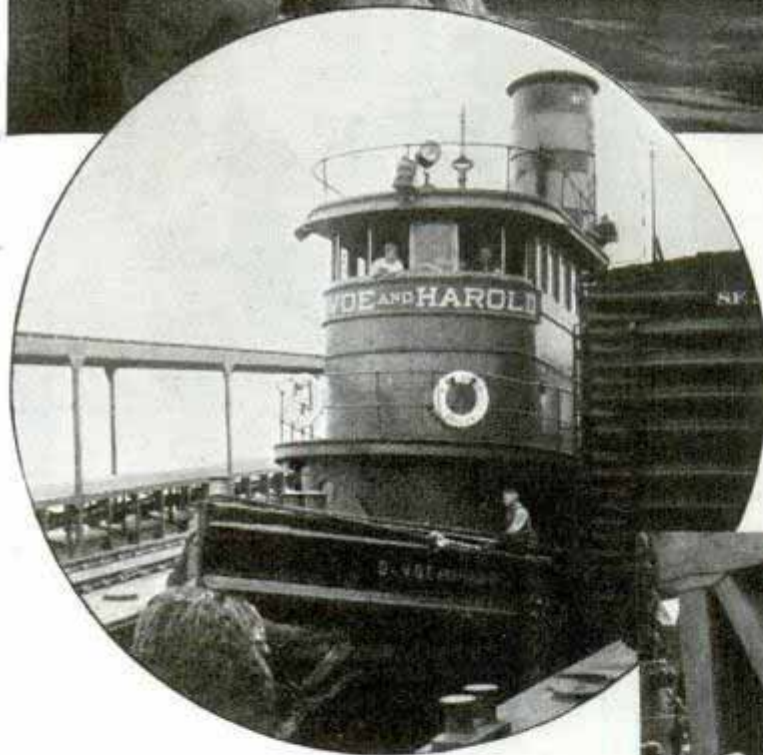
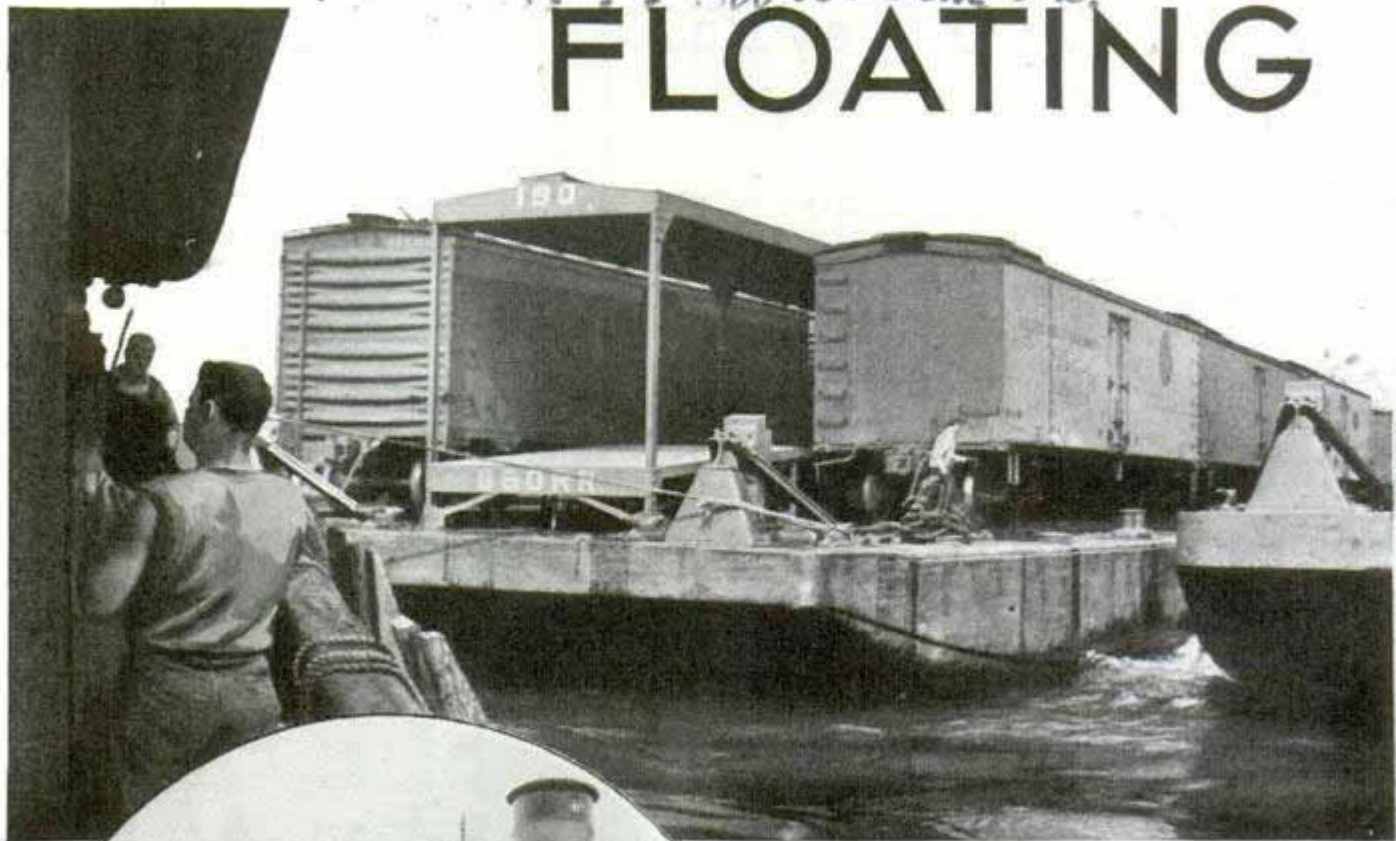
Asst. Chief

Radio - Transceiver Sabogalones

and Soaring Club
Chamberlain

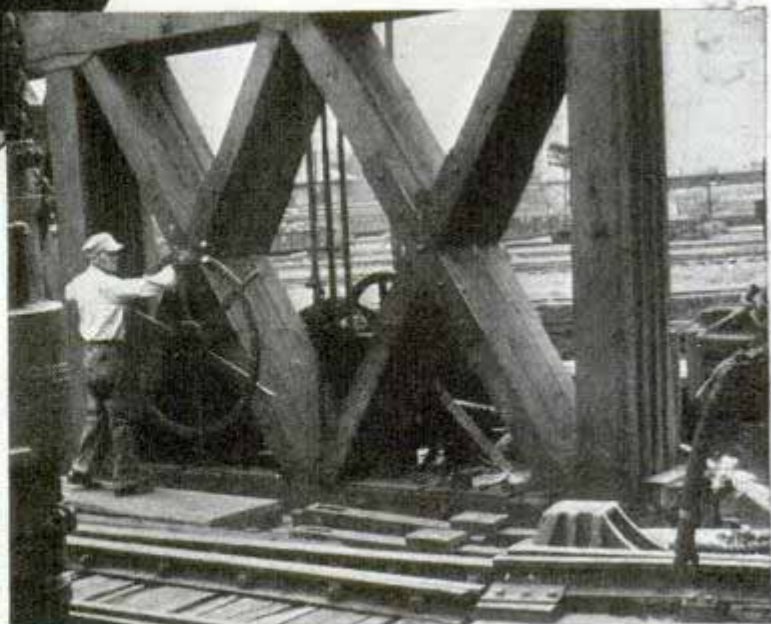
G-928. Conk. Under max well.
20 Sherman Ave
Giverson d 27

FLOATING



North river, over from Staten Island and points on down the Jersey shore, all bound for Manhattan. The cars are on long, narrow boats, from twelve to twenty cars to a boat. Between each pair of boats is a tug. With the expert ease of long experience, the tug gently lays the boat alongside the

WHEN New York's business day is over, hundreds of motor trucks come snorting out of the side streets and form long lines, each leading to a wharf on the water front. Each driver knows exactly where he belongs. Laborers by the thousand wheel hand trucks out of storage rooms and stand waiting. Soon, beyond the usual harbor activity, comes a wave of something greater, more extensive, and finally dim shapes moving across the water assume the outlines of boxcars—freight cars, coming down the Hudson, across the

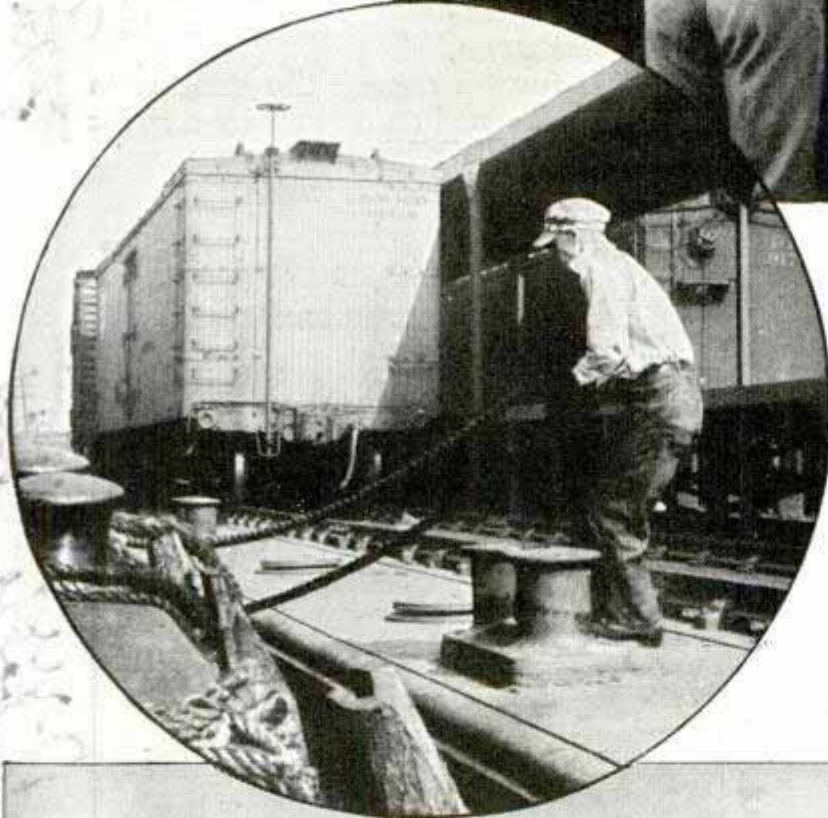
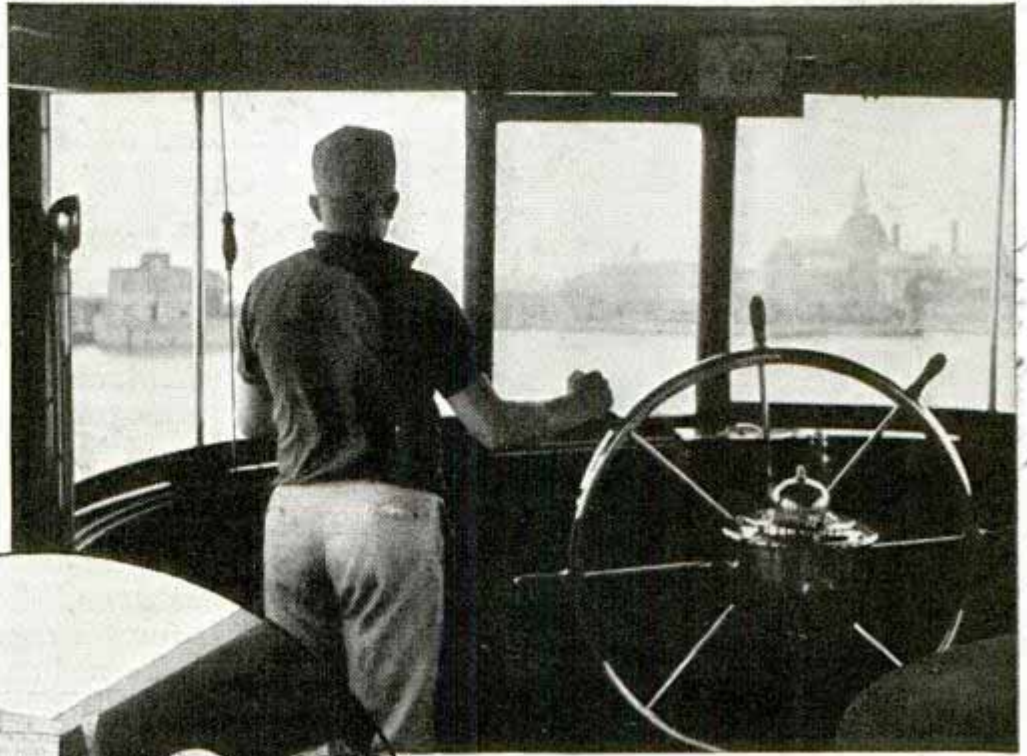


Top, snaking car float out of line without disturbing those next to it. Circle, tug's pilot house is high enough to overlook tops of cars. Bottom, lining up tracks on bridge and car float

2928

FREIGHT YARDS

Right, captain in pilot house has a clear view of all operations. He does his own steering. Circle, casting off the towing bridle. Bottom, the first job each morning is to round up and return all car floats emptied of their freight during the night. The car-float system solves the problem of how to get freight cars into New York without having extensive freight yards, which are out of the question because of lack of space



wharf, slides out of the middle and nudges the other craft alongside the first. Hardly has the first tug retired before another arrives. The boats, or car floats, as they are called, fit together like tiles in a floor. The seagoing freight yard has arrived—and it is the answer to New York's problem of lack of space on the island for the vast freight yards that would be required to serve the city.

(Continued to page 124A)



*I. W. Watson Arnola
Northville, N. Y.*

21099
**Electric Photoprint Drier
Circulates Warm Air**



Speeds
Your photographic prints would not face danger of scorching in this drier that circulates warmed air

Photographic prints are dried within fifteen minutes without danger of scorching or burning in a drier that circulates warmed air. Even if prints are allowed to remain in the chamber over night they will suffer no ill effects from overheating.

21097
**Multiple-Broom Snow Sweeper
Clears Skating Rink**

Snow is swept off a skating rink at Northville, N. Y., with a homemade clean-

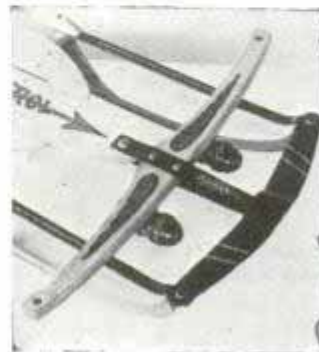


Chemical Culture Company
Pushed forward by hand, sled sweeper brushes snow to one side with its twelve brooms on endless chain

er that is pushed by hand over the ice like a sled. A two-cycle engine rotates an endless chain of stout brushes which throw snow sidewise as they travel across the ice at the lower level, and then are sent back over the top for another sweep.

21100
**Colored Safety Lights on Sled
Guard Children at Night**

Red and green running lights are installed on some sleds as a protection for children who go coasting on streets used by automobile traffic. Besides warning drivers of the presence of children, the lights furnish enough illumination to see ahead. Turned on and off by a slight twist of the lens, the lamps are mounted on brackets and have plastic lenses.



21119
**"Wick" in Soilless Flowerpot
Lifts Chemicals to Roots**



Pointing to capillary feeder that "lifts" chemicals to soilless flowerpot. Complete assembly at right

Amateur water-culture experimenters sometimes find that mineral solutions of their chemical gardens get out of balance and the plants may wither and die. Now a

*Ernest W. Breading
Montebello, Calif.*

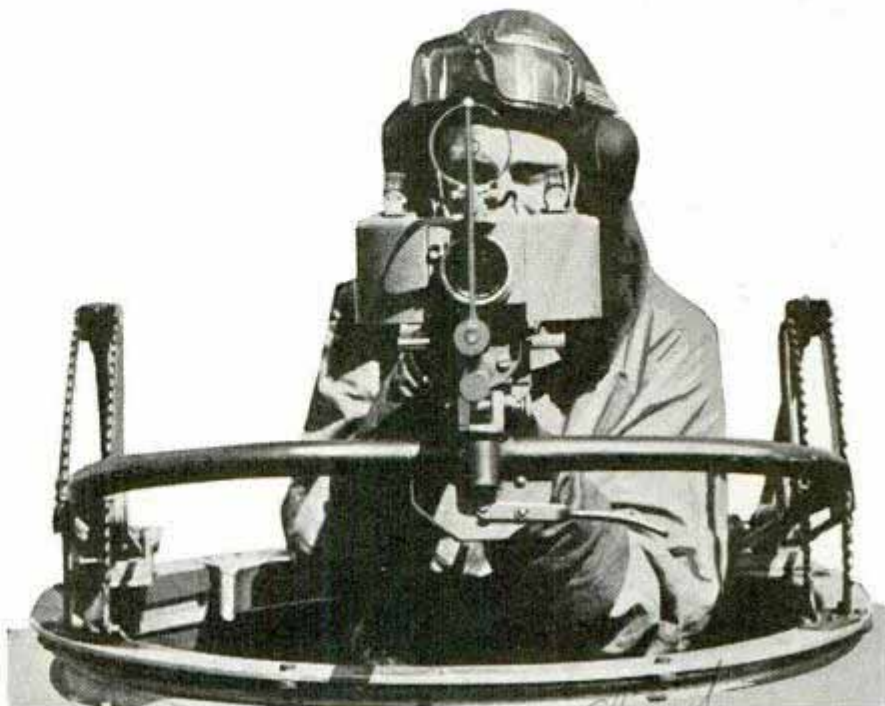
*General Electric Corp.
2125 Spanght Circle
Chicago*

*S. J. Allen & Helen
Greenwood Phil.*

*Ernest W. Breading
Montebello, Calif.*

"foolproof" flowerpot is available which automatically regulates the amount of chemicals fed to a plant's roots by a capillary feeder working on the principle of a kerosene lampwick. The pot is divided into two compartments, the lower half containing the minerals in solution and the upper half holding the roots of the plant in pure silica gravel or other inert material. Between these two separate compartments is the capillary feeder which carries the solution from the storage tank to the roots, making the process self-regulating. The chemical garden requires refilling only at intervals of from ten days to six weeks, and plants do not need to be repotted like the old-style dirt pots to allow for root expansion. The pots are made in various sizes and shapes, like window boxes, urns, and hanging baskets.

Camera "Gun" Trains Fliers without Wasting Ammunition



Marksman on British bomber practicing with camera "gun" that saves ammunition by shooting pictures of target instead of using bullets

Aerial gunners of the British air force test their marksmanship with a camera gun instead of bullets. When the pupil fires the gun, he merely clicks the shutter to record a picture of the target. This supplies instructors with information of the pupil's ability, and conserves ammunition.

'Trailer' Run by Its Own Motor Is an Overnight Sleeper

Built in the form of a trailer, a motorized "club car" has sleeping accommodations

comparable to a train drawing room for four persons and a separate room for the driver. It is intended primarily for long-distance non-stop transportation, and not simply for overnight stops, since one person can drive while the other rests. Tanks carry fuel for a 400-mile trip. With an interior headroom of six feet, the car is equipped with table and seats, washroom and toilet facilities. The driver's cab seats four people easily. Shorter than many motor cars, the vehicle is about the width of a small size trailer. It is light in weight and easy to handle on the road. The car has a top speed of seventy-five miles an hour and can cruise at fifty-five or sixty.



Motorized "trailer" for long non-stop runs has sleeping quarters for four, and permits one to drive while the other rests

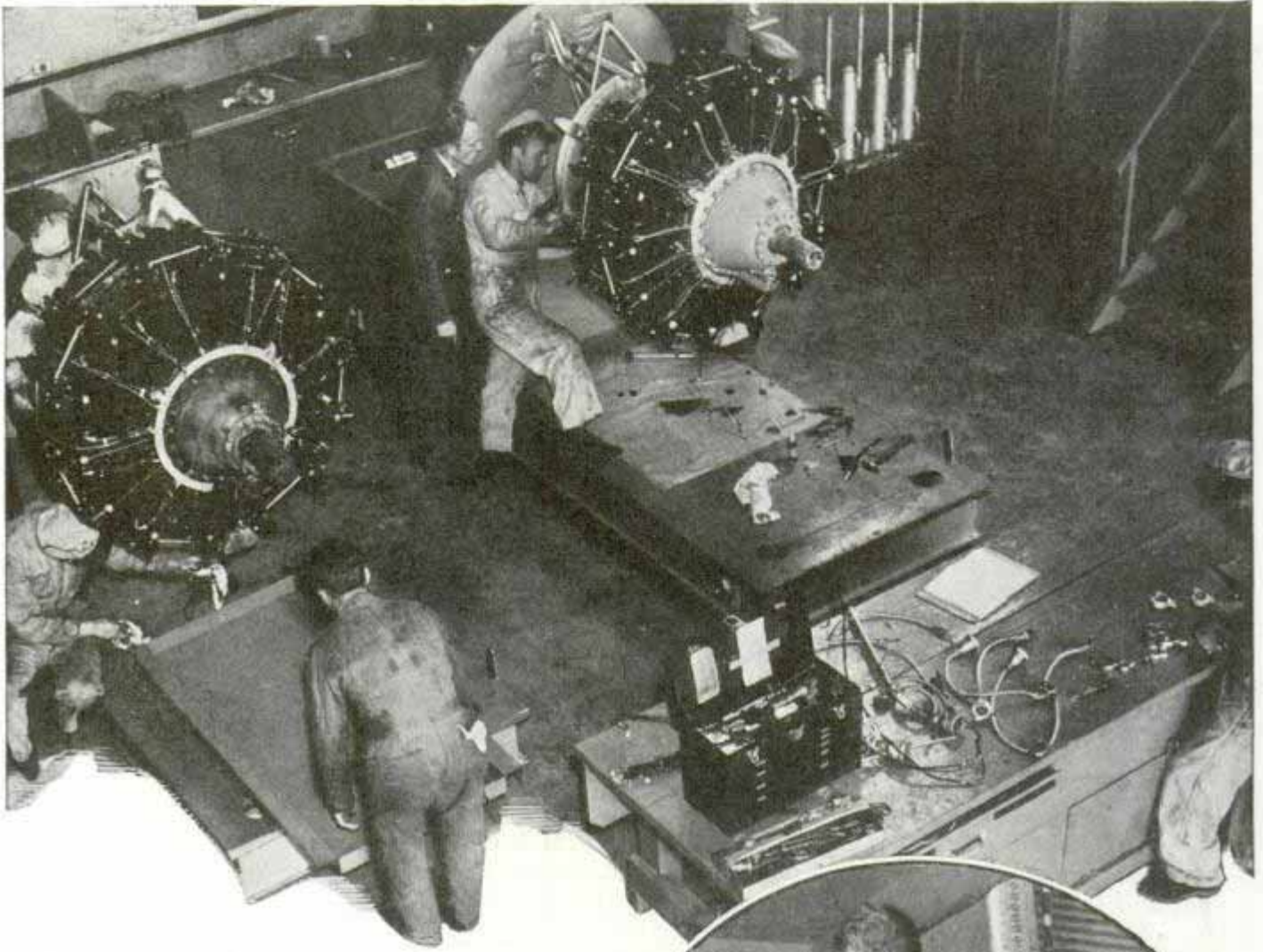
Wi
li:
Ea
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Club Car steering and drive mech.
Search rear engine
Stout Engineering Laboratories, Inc.
2124 S. Telegraph Road

J. 8 45

Com. Tom White 0508 48,
Alameda, Calif

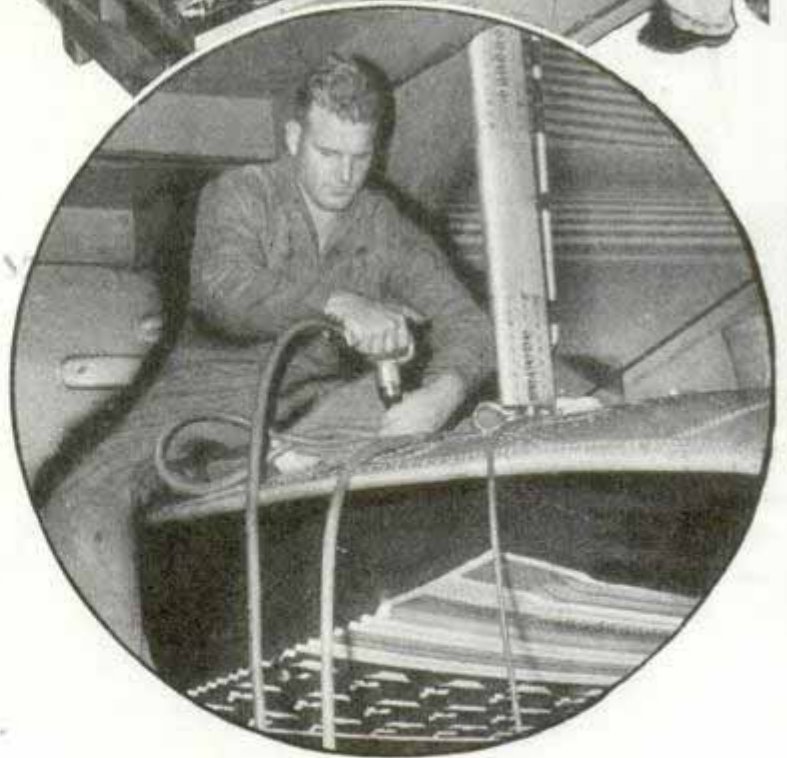
KEEPING *the*



WITH passengers and mail aboard, the new giant Clipper pokes her nose out of her Treasure Island base, taxis into San Francisco bay, and heads west. Then with a mighty roar, her four engines lift the forty-one-ton ship clear of the water, out through the Golden Gate and off for Hong Kong. Her first stop is Honolulu, 2,410 miles away, the longest scheduled hop in commercial, transoceanic flying.

Back of this departure lies a routine of checks and counterchecks, tests and retests that lays bare all but the unpredictable in flight failure—the mechanical as it relates to engine performance, the structural as it concerns the huge, seventy-four-passenger ship itself and the scientific from the angle of intricate flight and navigation instruments.

This rigid system of checking and testing is all the more important be-



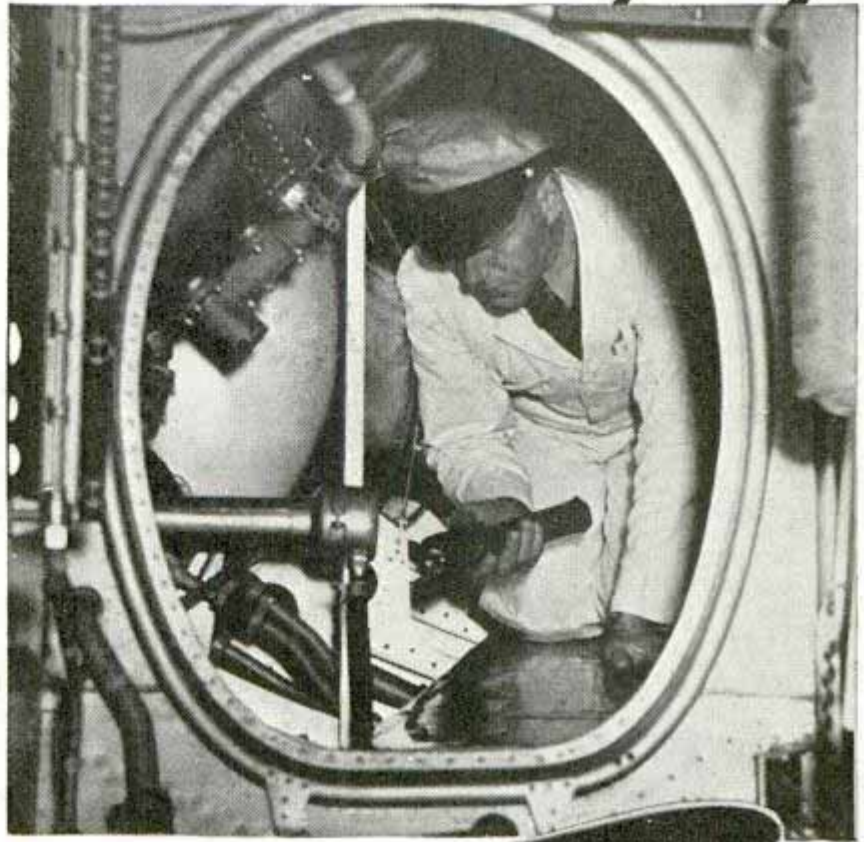
Taking down engines (top) for shipment to rebuilding plant. Circle, mechanic riveting reinforcement in place on Clipper's hydro-stabilizer, which is subject to great shock in landing on water.

Brownsville Texas

SEA BIRDS *Flying*

cause, being seaplanes, the clippers have no emergency landing fields every hundred miles or so, on which to "sit down"; therefore, they must be right in every respect, especially before taking off on a hop equal to one-tenth of the circumference of the globe.

The Treasure Island home of the clippers is one of the world's finest air marine terminals. It is here the monster planes come roaring in from the Orient, discharge mail and passengers, then submit to the all-revealing checks and tests. Every maintenance operation is carried on here, except for complete motor rebuilding. The first step is getting the



Engineer in position to work on engine in flight (top) and Clipper being brought to land on cradle similar to that of a marine railway (bottom). This is first step in the maintenance routine

Clipper out of water. This is done by maneuvering the ship over a submerged cradle running up an inclined track to the land level, similar to the marine railway at a shipbuilding plant. The clipper rests on a wheeled framework on the level deck

of the cradle; and as powerful electric motors bring the elevator and its forty-one-ton load even with the shore, the ship rolls off in tow of a tractor and is parked in the hangar, ready for inspection. This is done following every round trip to China.



building record of every engine is kept as carefully as the case history of a hospital patient. And just to make doubly sure that no ship is afflicted with complete failure of a power unit for more than one hop, spare engines and skilled mechanics are stationed at Honolulu, Midway, Wake and Guam.

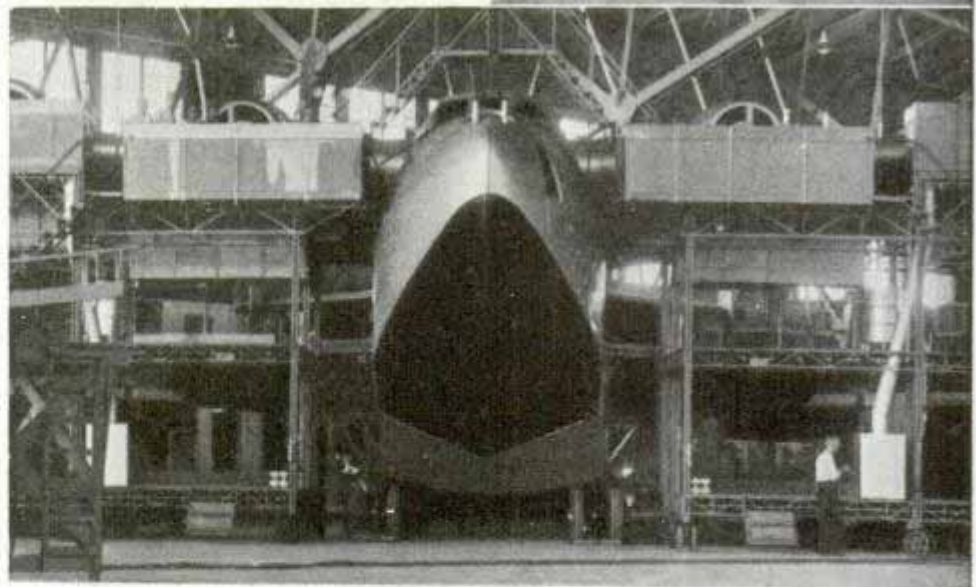
One of the major divisions of clipper maintenance work is carried on in the accessory overhaul shop, where many of

(Continued to page 114A)

Left, inspecting water rudder. Below, testing bubble sextant; wheeling lofty platforms into place for servicing, and Clipper just leaving the water

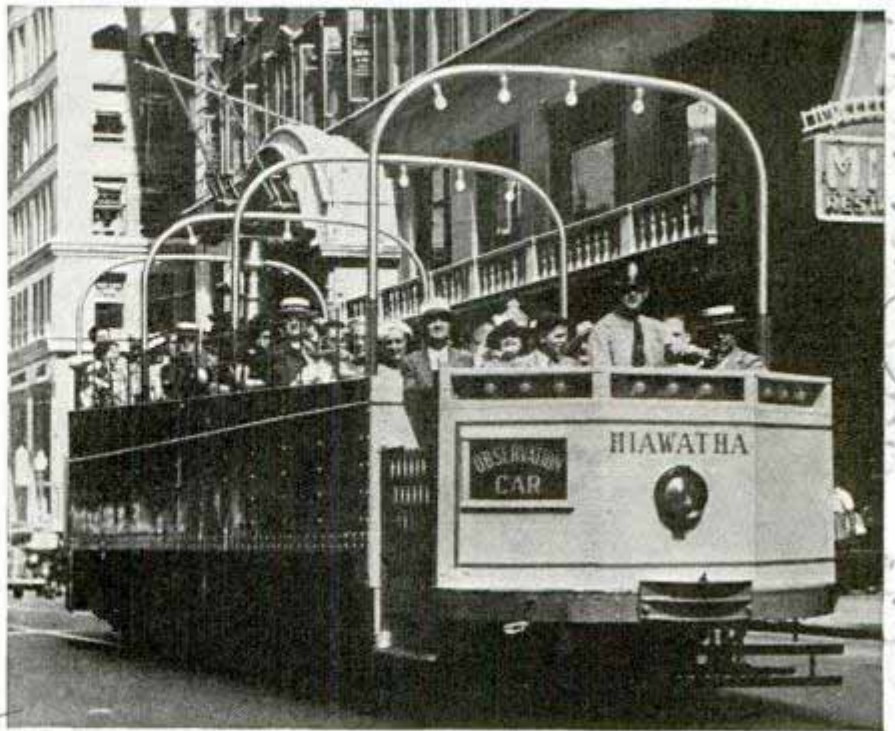


Out of the hands of the captain and crew, the ship is taken over by a drove of highly skilled technicians, each assigned a definite job. First, out come two alternate engines, No. 1 and No. 3; upon return from her next round trip, Nos. 2 and 4 will come out. The two engines removed are shipped to the Brownsville, Tex., engine rebuilding depot, for complete overhaul; this means that after two round trips the entire power plant has been rebuilt. Each engine bears the shop number, the number denoting its position when mounted—whether No. 1, 2, 3, or 4—and its serial number which is given to all clipper engines throughout the entire system. A maintenance, repair and re-



Open-Air Sightseeing Car Popular for Parties

Unexpected was the popularity of a fresh-air streetcar and a bus, with their roofs and upper sides removed, which have been introduced in Cincinnati, O. These vehicles are now in demand for observation trips and special parties. The car floor slopes upward toward the rear and no windshield is needed, for the car travels at a leisurely pace. Colored lights decorate the car.



Roofless observation streetcars, festooned in colored lights, are enjoyed by sightseers and can be chartered by excursion parties

Electric Eye Draws Molten Glass from a Fiery Furnace



One stage in the production of optical glass involves "cooking" it at an exact, controlled temperature, and to insure its removal from the annealing oven at the right instant a photocell has been installed on the handling machine, which rolls back and forth on special heat-resisting tires. The crucible, weighing two tons, is carried by tongs at the end of a nine-foot arm.

Truck controlled by "electric eye" rolls back from fiery furnace at exact instant two-ton crucible of optical glass must be withdrawn

Three-in-One Trowel for Garden Pulls Weeds and Furrows the Soil

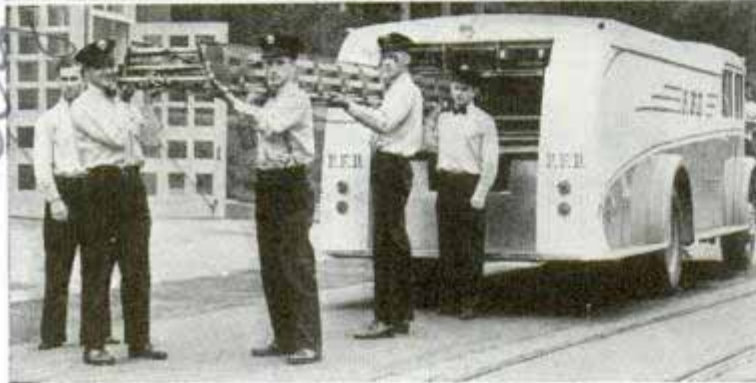
All the tasks in planting a home garden can be performed with a trowel that includes several unusual features. At the point there is a V-shaped slot for pulling weeds and cutting roots. Two claws on each side make furrows for seeds. Then, for measuring the exact depth when planting, the surface of the tool is calibrated.



M. Johnson, 1232-16th St. Santa Ana, California

Truck made by Wentworth and driven 123 N. E Oregon Portland Ore

Fire Truck Goes Streamline with Inclosed Body and Cab



Above, the streamline fire truck. Below, firemen removing ladders through rear door of the inclosed body

Gone is the red fire engine, with firemen clinging to its sides. The latest fire truck is painted white, its crew rides in a cab up front and the ladders and other equipment are housed in the inclosed body. A life net is carried in the top. Powered by a "pancake" motor installed beneath the floor, the truck has a 250-gallon booster pump and a 200-gallon water tank. Equipment is removed through a wide door at the rear of the body.

Community Workshop Rents to Craftsmen

Craftsmen who want to follow their hobby but lack room and tools at home can rent the space and equipment in a community workshop in San Francisco. It is a commercial "build-it-yourself" establishment equipped to enable anyone to build a wide variety of things from toys and tiny plane

models to full-size boats and automobile trailers. Both power and hand tools are maintained and builders can do their own welding, painting, drafting and designing. Although not operated as a school, the shop offers an extensive library, in addition to expert advice from master mechanics and the mutual exchange of ideas with fellow craftsmen. Down the middle of the work floor are power-driven bandsaws, rip saws, jointers, drills and lathes, while smaller tools are obtained from the tool-room. Rental fees are based on the amount of space and type of tools used, size of the project, and space needed for materials.

Flying Merry-Go-Round Is Driven by Propeller

Children of one man in England enjoy riding on a homemade flying "gondola" built for them in their own back yard. The gondola is suspended from a boom attached to a central post and it is driven by a twenty-three inch wooden propeller mounted as on an airplane, a one-horsepower engine supplying the power.



Homemade flying merry-go-round, erected in back yard, is driven like an airplane by a one-horsepower engine

Commissioner G. Earl Riley Portland Ore

City

San Francisco

England

Public Workshop... Maurice Chats

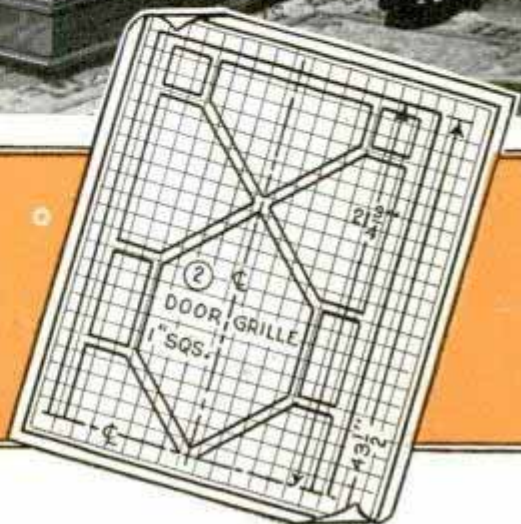
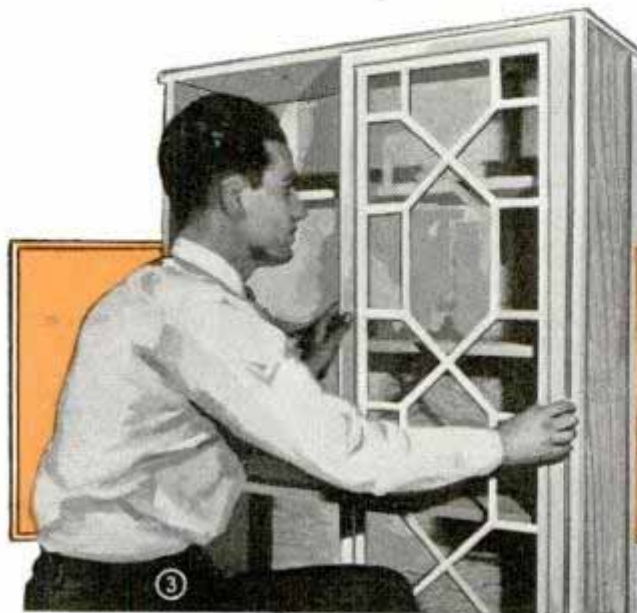


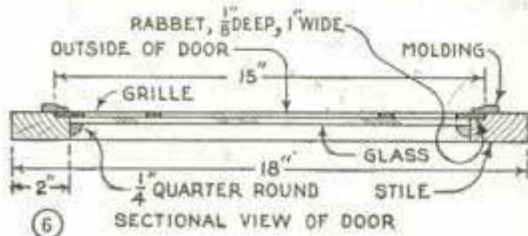
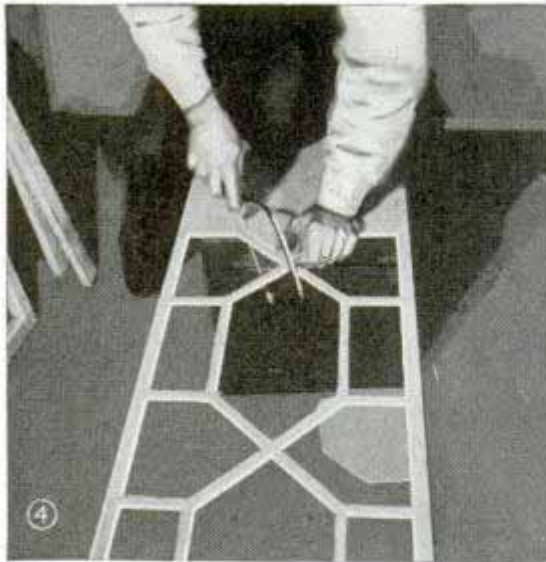
The CRAFTSMAN

Attractive GRILLE-DOOR CASE protects books from dust

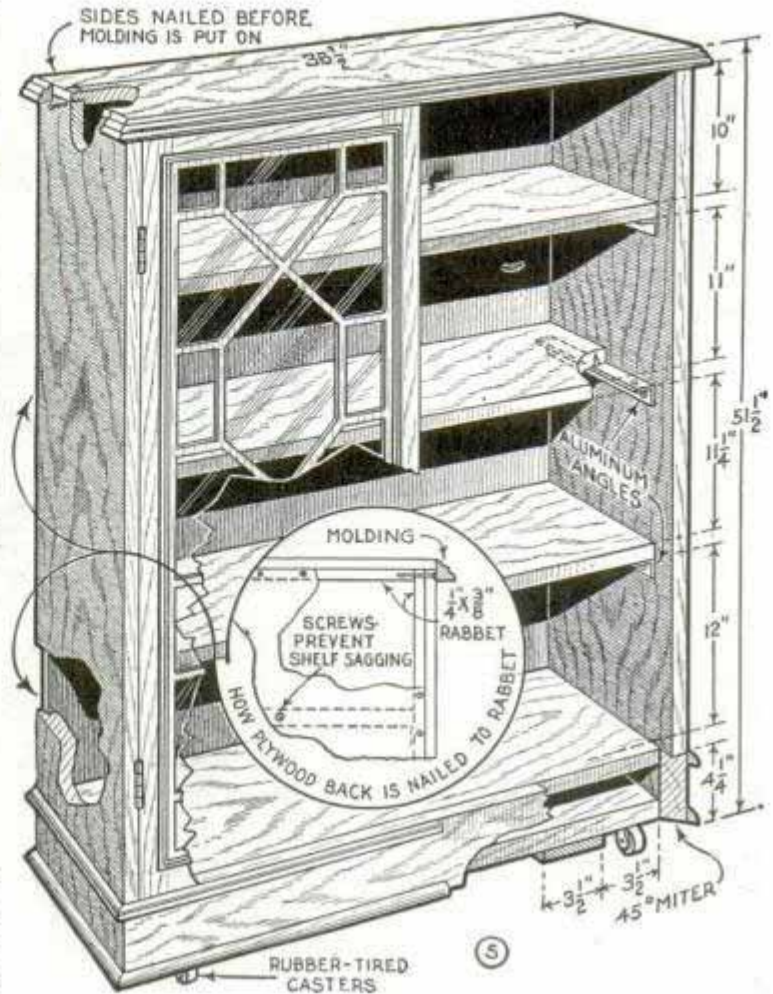
By GEORGE E. BASICH

USING a few hand tools, a bit of ordinary craftsmanship and inexpensive materials, this attractive 95-volume bookcase with grilled doors, may be built for the living room, den or study. As you see from Fig. 1 it makes a neat job when finished. Seasoned white pine is used in its construction. This wood finishes nicely with walnut stain and oil-rubbed varnish. Select the best pieces of stock for use on the outside of the case. Less choice material with checks and discolorations may be used for shelving. To begin with, cut two sides 50 $\frac{3}{4}$ in. long and the bottom shelf 35 in. long from $\frac{3}{4}$ -in. stock. The latter should be about $\frac{1}{4}$ in. narrower than the sides as this will save the trouble of rabbeting it later, since the plywood backing





can extend down the full $\frac{3}{4}$ in. The top, since it overlaps the sides, is $1\frac{1}{2}$ in. longer than the bottom shelf. Rabbits are cut on each end, $\frac{3}{4}$ in. wide and $\frac{1}{2}$ in. deep. The sides fit into this rabbet and the joint is covered with a stock molding as you see in Fig. 5. On the back edges of the top and the sides, cut a rabbet $\frac{1}{4}$ in. deep and $\frac{1}{2}$ in. wide for the plywood back. Assemble the four pieces with finishing nails. The bottom shelf is placed $3\frac{3}{4}$ in. from the bottom ends of the sides. The front apron is mitered to the sides below the bottom shelf as you see in Fig. 5. With the apron in position, put on the plywood backing, nailing it every 3 in. with box nails. Then screw the four rubber-tired casters in place. Aluminum angle stock with $\frac{5}{8}$ -in. legs is used to support the shelves. Drill three holes into the leg of each 10-in. piece and fasten to the sides with small screws. Cut the shelves from $\frac{3}{4}$ -in. stock and fasten with screws driven up from the underside through the angles. Each shelf is braced against sagging in the center by screws driven through the plywood back. Put on the molding as indicated in Fig. 5. Use brads, sink with a nail set, and fill the holes with plastic wood. Sand and stain the wood with walnut oil stain, and wipe with cheesecloth to the desired shade. Apply a mixture of shellac,



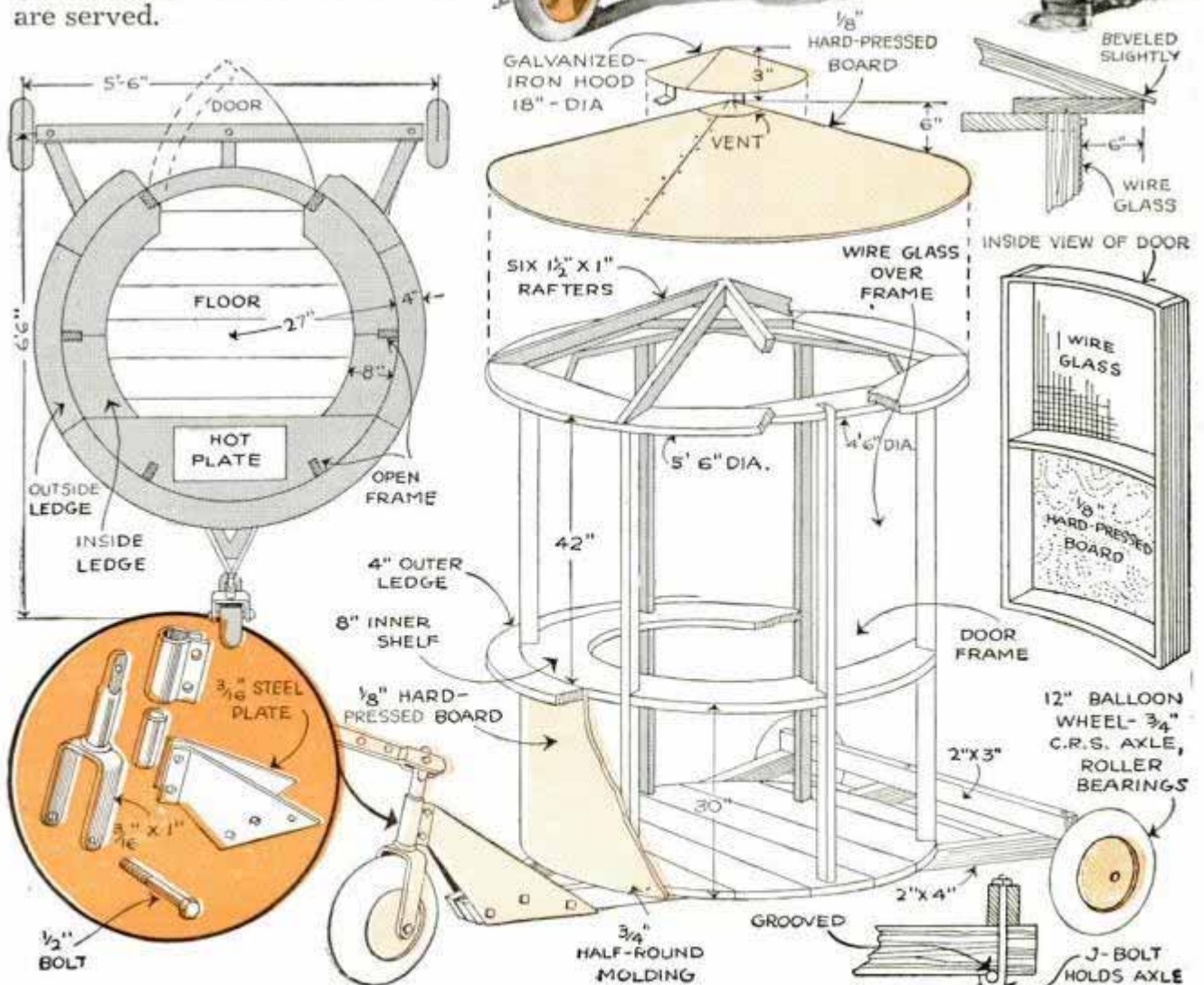
one part, and alcohol, one part, to prevent the stain from coloring the varnish. Two coats of varnish are sufficient, the final coat being rubbed with oil and pumice. This gives a smooth, non-glossy finish.

Fig. 6 shows a cross-sectional view of the door. Joints are plain butt, fastened with dowels and glue. The width given makes allowance for trimming to fit after assembly. Cut four pieces 47 in. long for the vertical stiles and four top and bottom pieces $17\frac{5}{8}$ in. long. The rabbet for the grille is $\frac{1}{8}$ in. deep and 1 in. wide. Lay out the design for the grille from Fig. 2 and start cutting at the top with an ordinary coping saw as in Fig. 4. The joint between the grille and the door is covered with molding. Fit the doors as in Fig. 3 and put on the hinges. To prevent the doors from swinging inward too far, place two small blocks at the top and bottom. On the inside of the left door, fit an elbow catch. The lock and escutcheon plate go on the other door. After fitting, remove the doors and cut the quarter round which holds the glass. Then take off all hardware and finish the doors as you did the case.

Wheeled "SNACK SHACK"

rolls to profit spots

STATIONED at any spot where refreshments can be sold, this gay-colored booth will pay you dividends. Balloon-type pneumatic wheels equipped with roller bearings and sturdy axles are used. Framing is covered at the bottom and roof with hard-pressed board. From the counter to the roof the covering is wire-glass to offer weather protection without shutting off the light. There is a door at the rear and two of the front frames are fitted with removable or hinged sash through which customers are served.



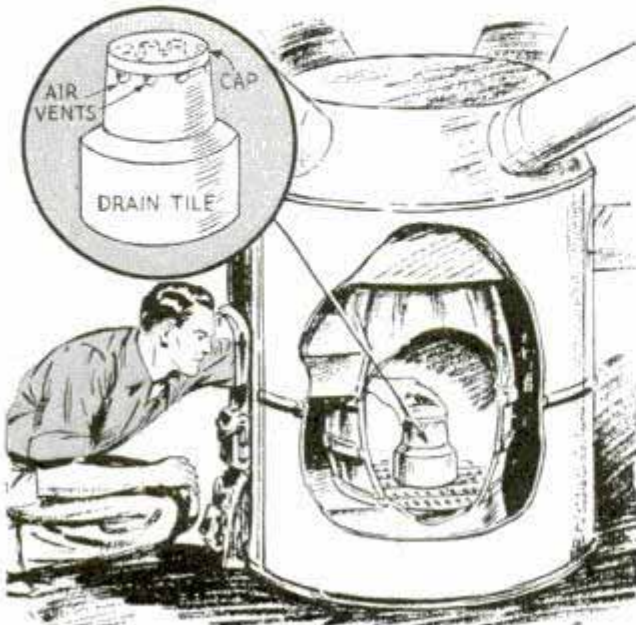
Two Men Can Roll Logs Easily on Rubber Tires



Two old tires mounted on clincher rims having valves in the inner tubes that do not project beyond the rims will save work when moving heavy logs. The ends of the log are inserted through the tires as indicated. By gripping the tops of the tires, the workmen can keep a more upright position and the log rolls easily.

Tile in Center of Furnace Grates Improves Fuel Combustion

One home owner claims that he gets better combustion of fuel in a hand-fired furnace if a section of ceramic tile is set on

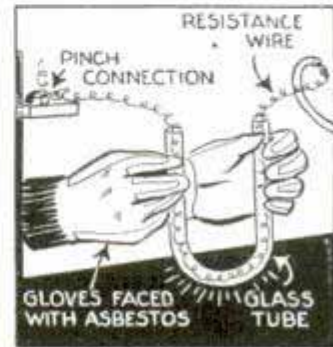


the grates as indicated. Fuel is piled up around the tile, which brings air up through the center and disperses it into the fuel through vents filed in the upper edge of the tile. A ceramic cap prevents fuel from falling inside the tile.

—M. B. Birge, Hinsdale, Ill.

Glass Tubing Bent by Heating with Resistance Wire

Having a number of glass tubes to bend to a U-shape, one craftsman used resistance wire, such as the element from an electric heater. The wire was threaded through the tube, connect-

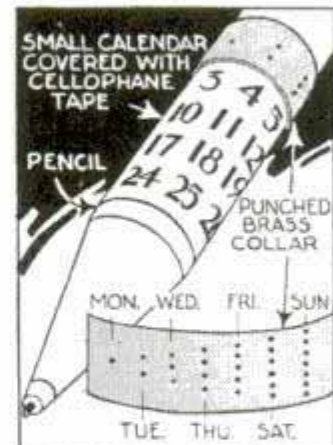


ed to the current, and the glass bent slowly as soon as it was hot enough. Gloves faced with asbestos were worn so that the tubing could be bent in the hands.

Calendar on Pencil Saves Time

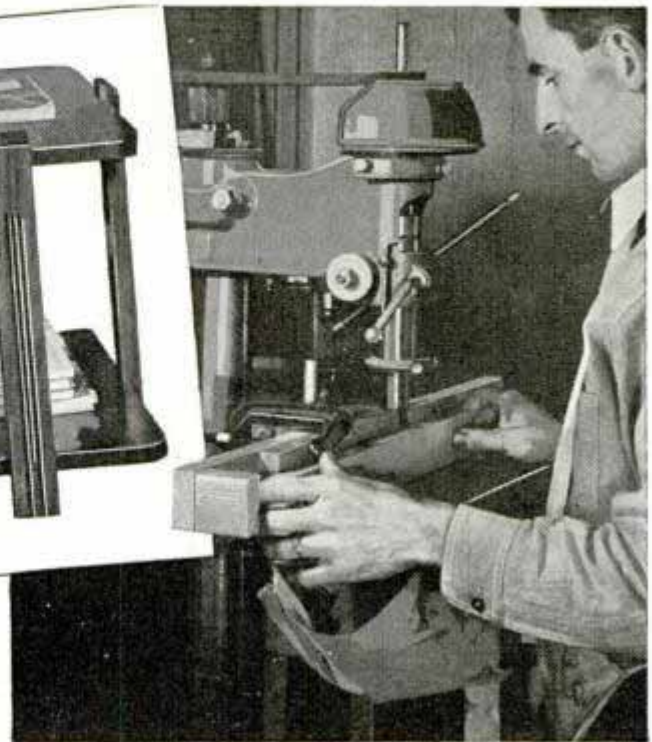
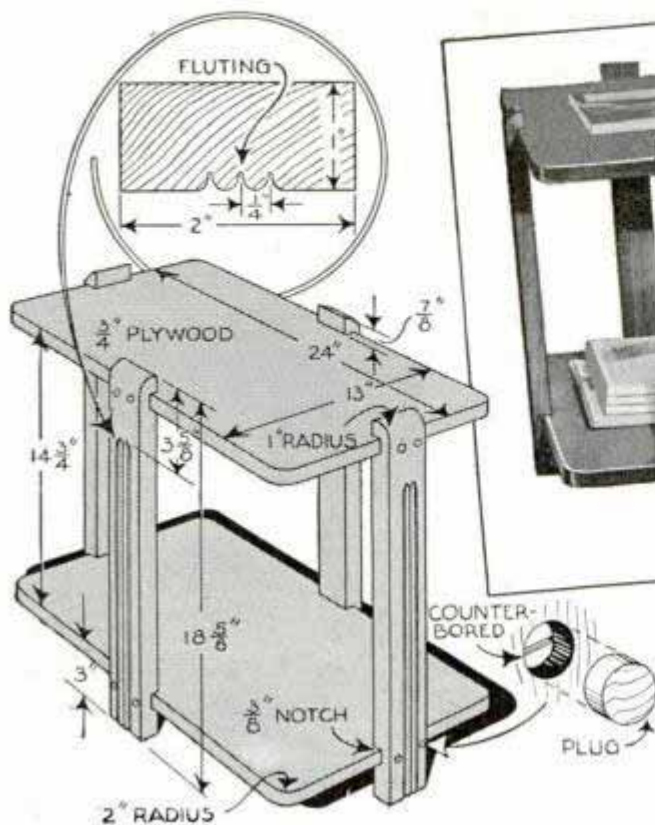
You can have a perpetual calendar right on your automatic pencil where it is always at hand. Just attach a small calendar sheet to the pencil with rubber cement and cover it with transparent adhesive tape to protect the paper.

Then make a small brass band to fit snugly on the pencil and indent it as indicated to represent the days of the week. At the first day of each month, move the band so that the day of the week corresponds to the day of the month, and the rest of the figures will represent the correct calendar reading for that particular month.



Triangular pieces of thin felt cemented to the underside of oilcloth where it contacts the table corners will help to prevent it from cracking.

Sturdy Construction in This Six-Piece Stand



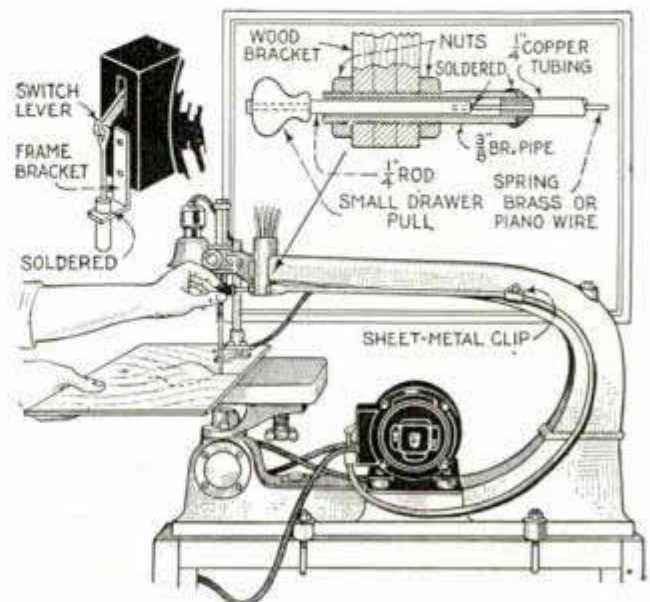
Just six pieces of walnut or whatever wood you desire—that's all the material required for this modern magazine stand. Four $\frac{3}{4}$ by 2-in. strips, stop-beaded on the outer faces and grooved to take the shelves, serve as legs. Beading is done with a beading cutter on the drill press as shown. Shelves can be $\frac{3}{4}$ -in. plywood or the solid stock. If you use the latter you will have to dowel and glue together several narrow

strips to build up a single piece of the required width. Either way the assembly of the stand is the same. First see that the shelves are exactly the same size, then counterbore the legs for small screws. Spread glue in the grooves, center the legs on the length and width of the shelves and screw them in place. Plug the screw holes with matching wood plugs. Finish a walnut stand with filler, shellac and wax. Close-grained woods can be enameled or stained and varnished, as desired.

Motor-Switch Control on Scroll Saw Located Above Table

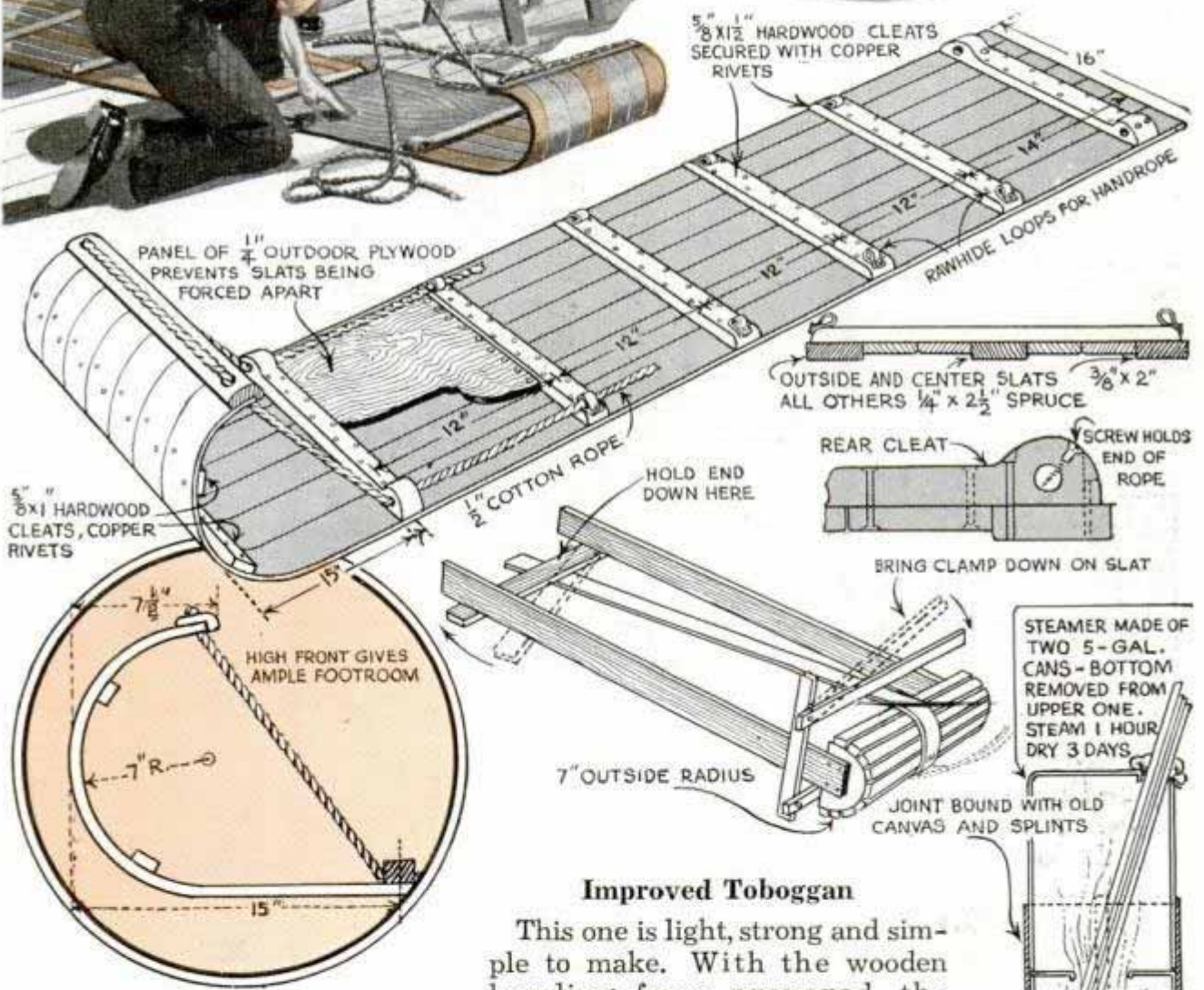
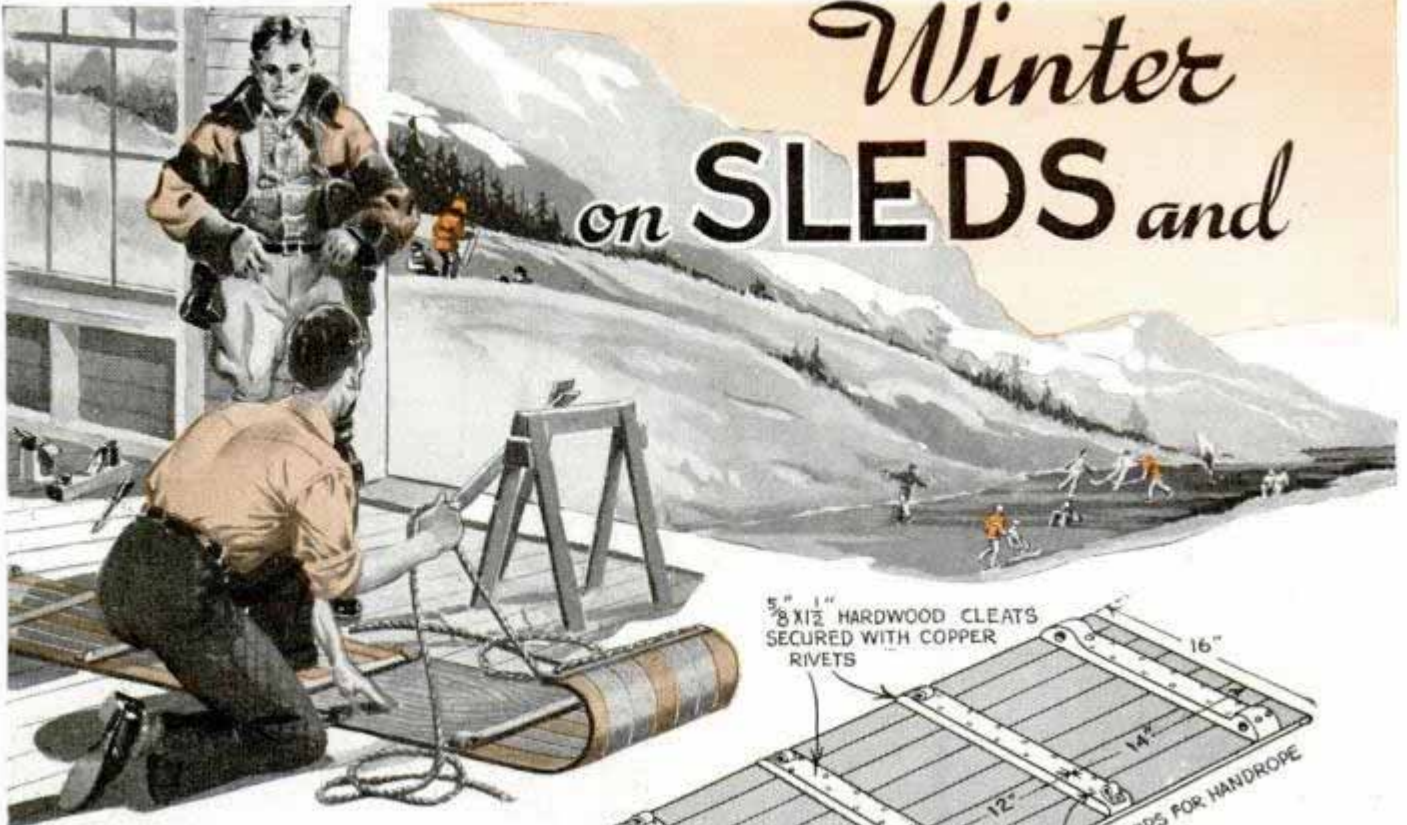
As the nature of work done on a scroll saw requires that it be stopped and started frequently, this switch control, which is located above the table within easy reach, is handy. The control is a length of piano wire run through a piece of copper tubing and connected to the switch lever. A hardwood bracket supports the control on the arm of the saw. If desired, a number of holes can be bored in the top of the bracket and it will also serve as a container for saw blades.

—Dick Cole, Los Angeles, Calif.



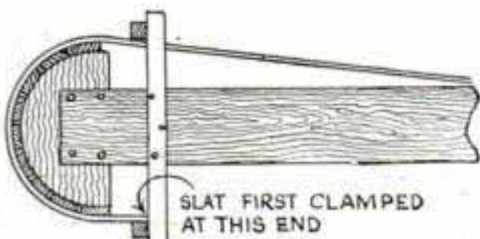
☞ Glass baking dishes that have become brown can be cleaned by soaking them in a strong solution of borax and water.

Winter on SLEDS and



Improved Toboggan

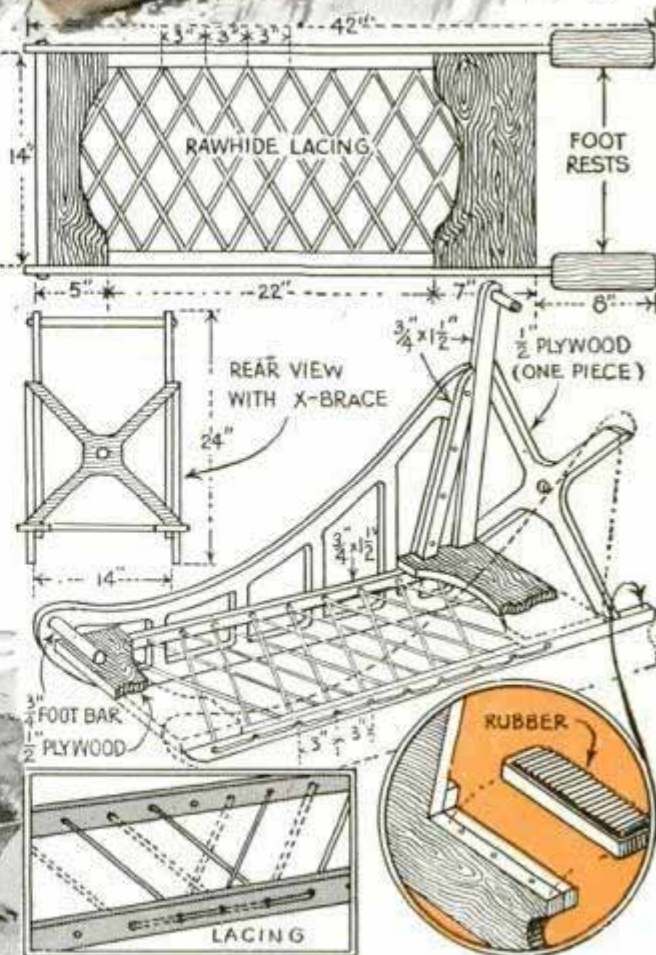
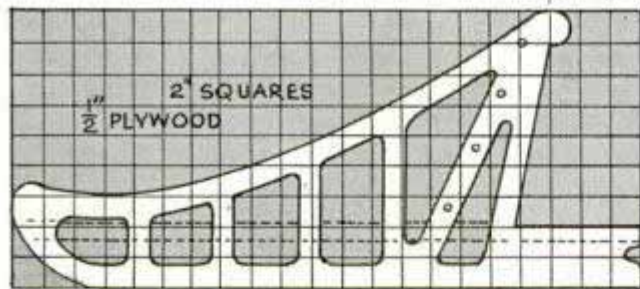
This one is light, strong and simple to make. With the wooden bending form prepared, the steamed slats will all be curved uniformly. The center and outside slats are thicker than the others, which helps to keep the toboggan on its course. In order that these thicker slats can be bent the same as the others the forward ends are planed down to 1/4 in. for a dis-

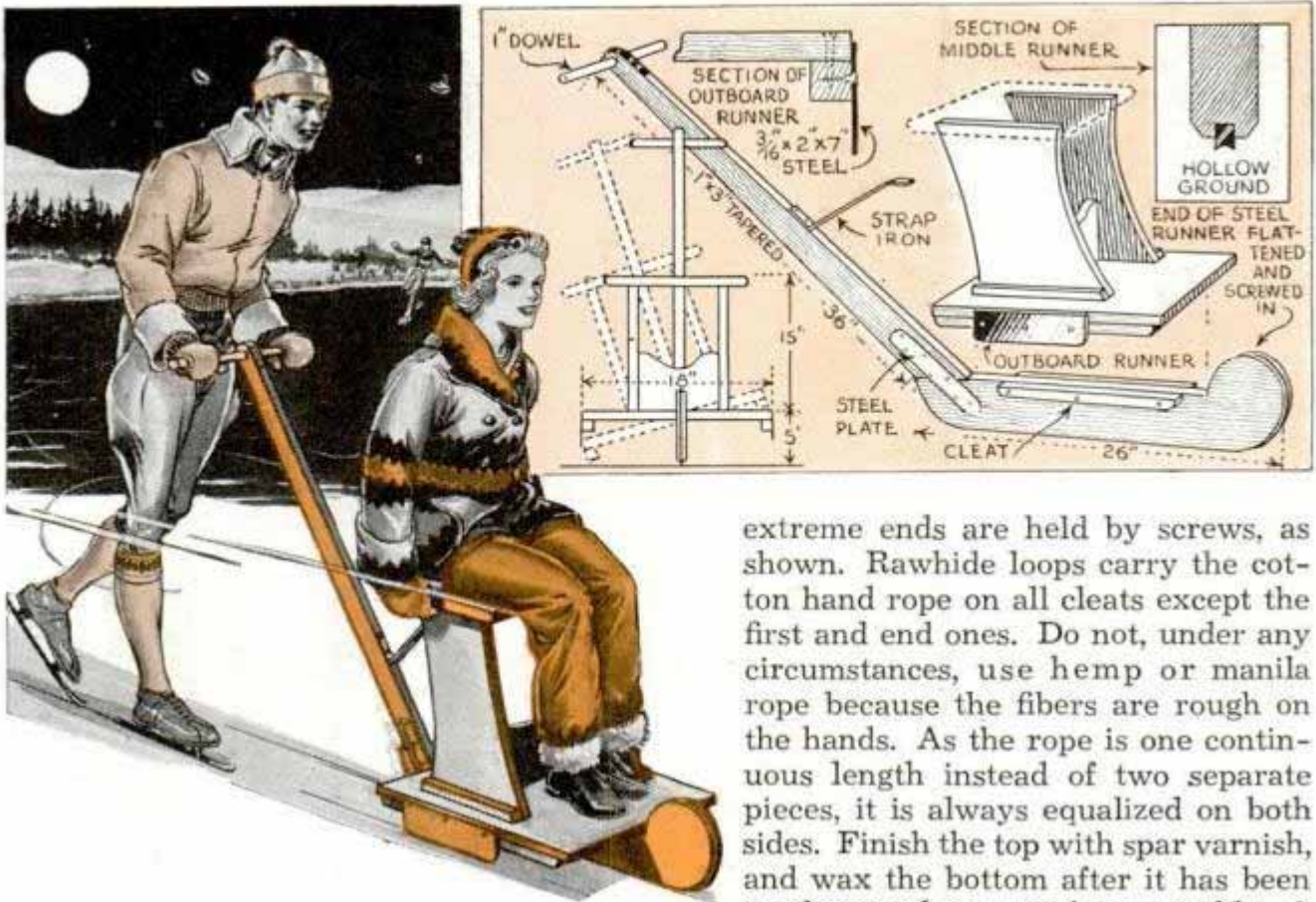


Thrills SLIDES



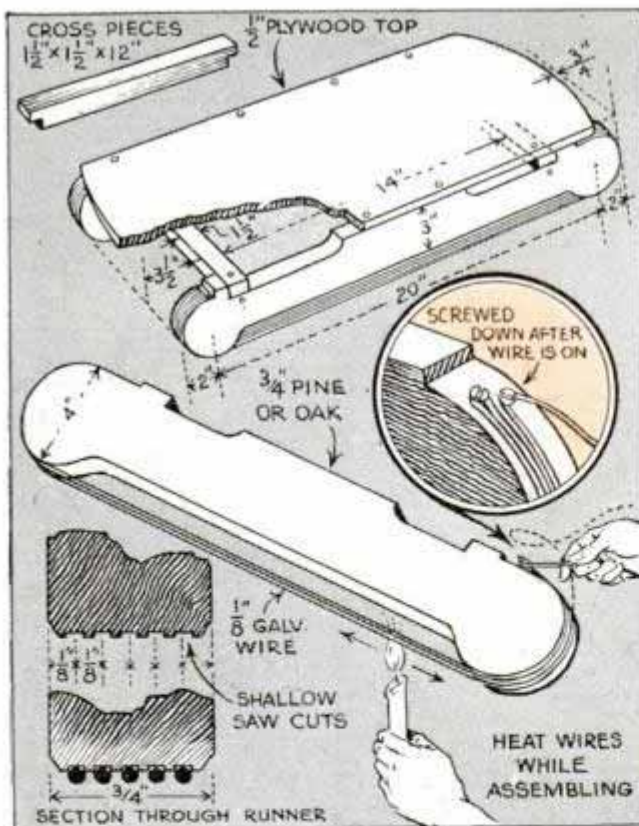
tance of 24 in. Then the thickness gradually increases along the next 12 in. of length. All cleats are fastened with copper rivets, the heads being countersunk flush on the bottom. This is much better than screws, which have a tendency to loosen soon. A rectangular panel of plywood is riveted down between the two forward cleats. This forestalls the trouble of having the toboggan knocked askew by the occasional experience of bumping



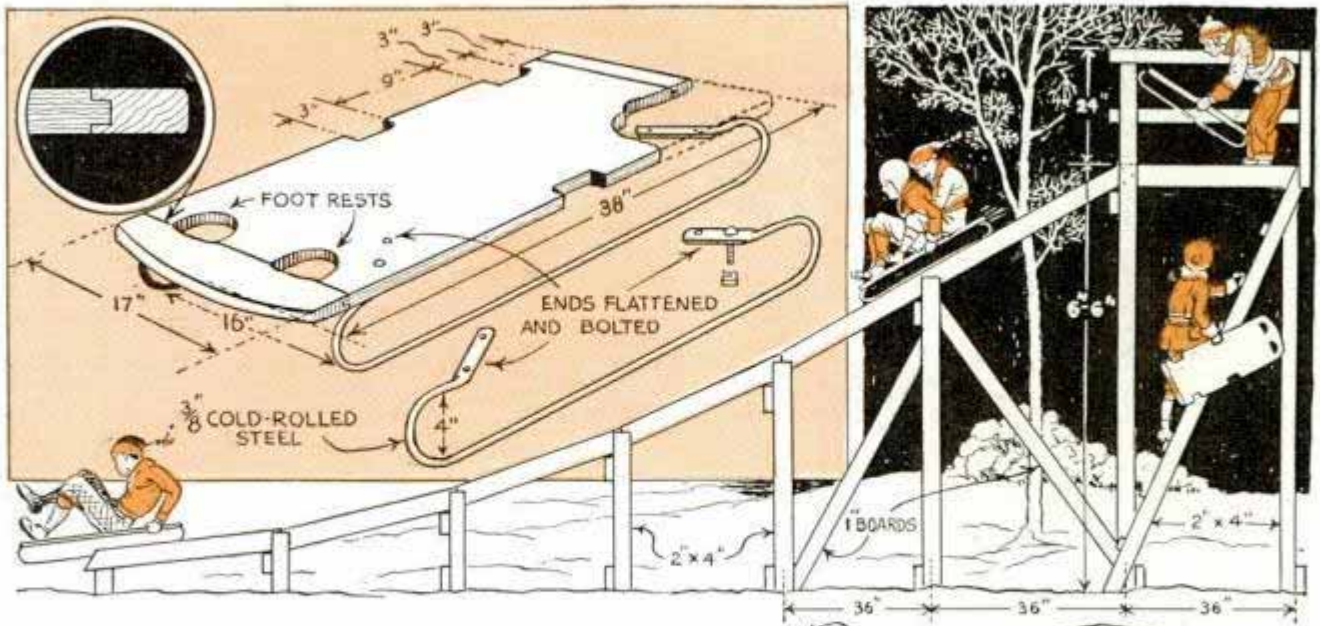


extreme ends are held by screws, as shown. Rawhide loops carry the cotton hand rope on all cleats except the first and end ones. Do not, under any circumstances, use hemp or manila rope because the fibers are rough on the hands. As the rope is one continuous length instead of two separate pieces, it is always equalized on both sides. Finish the top with spar varnish, and wax the bottom after it has been sandpapered as smooth as possible. A pleasing effect is obtained by staining alternate slats mahogany or walnut.

Eskimo Sledge: The design of the little sledge shown on the second page of this article was adapted from a real eskimo komatik and has been so modified that construction is not only very simple, but light and exceptionally strong. The sides are scroll-sawed from 1/2-in. waterproof plywood, with inner frame pieces to support the rawhide lacing and the handle bar. On a plywood panel 18 by 42 in. lay out the side frame as shown in the squared detail, and saw two identical pieces. Then install the reinforcing frame members. The two former are drilled 1/4 in. for the rawhide lacing at 3-in. intervals. Join the two sides with the plywood gussets at the ends and the X-brace, after which the wooden handle bar and foot bar are installed. Use brass screws where required, and apply casein waterproof glue to all joints. Footrests are screwed to the projections of the runners and rubber runningboard matting is cemented on. Flat iron is secured to the runners with countersunk screws, and bent around the ends. Lace the rawhide thongs tightly in the manner indicated, on bed and back, and when in use, cover with blanket or pad.



into a tree stump or some other unplanned obstacle. Casein glue should be used under all cleats. Before installing the hand rope, stretch it by attaching to the garage rafters with a weight through a pulley. The

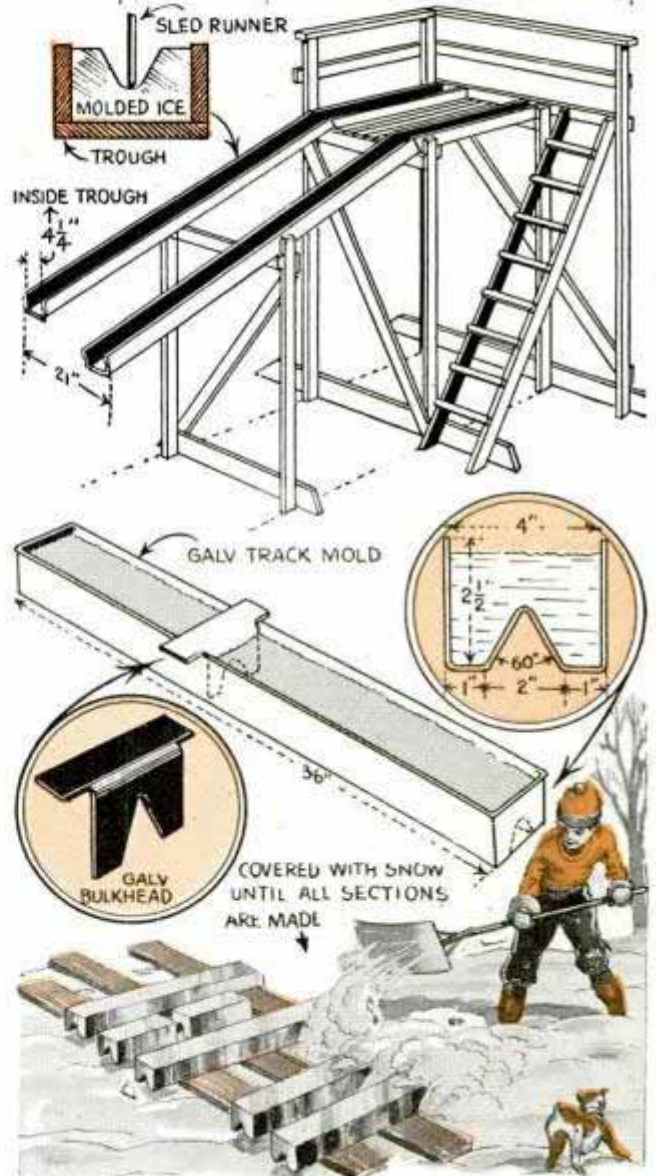


While the original Eskimo komatik of driftwood and bone is unpainted, a child will appreciate a lively color. A dog can be humanely hitched to this sledge when a boy helps push behind, and the latter can have his ride when going down inclines.

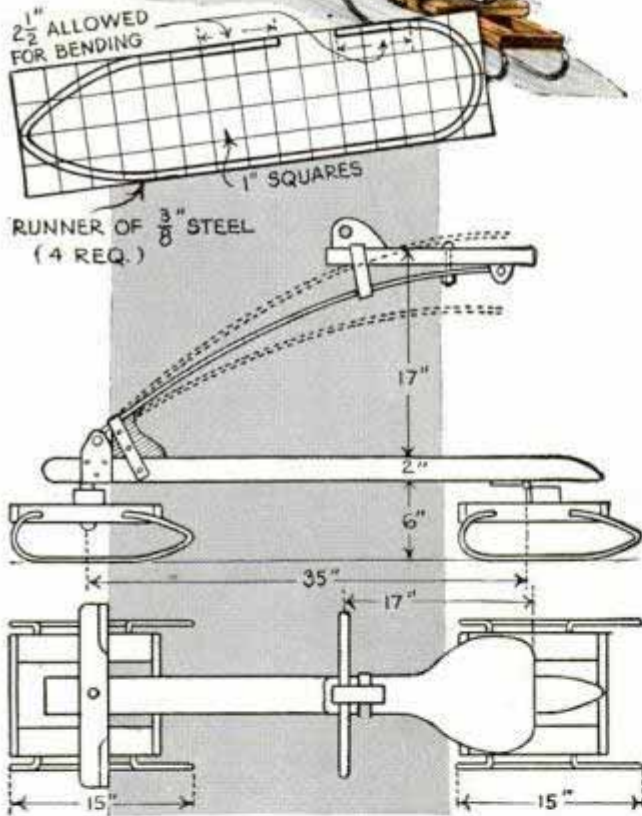
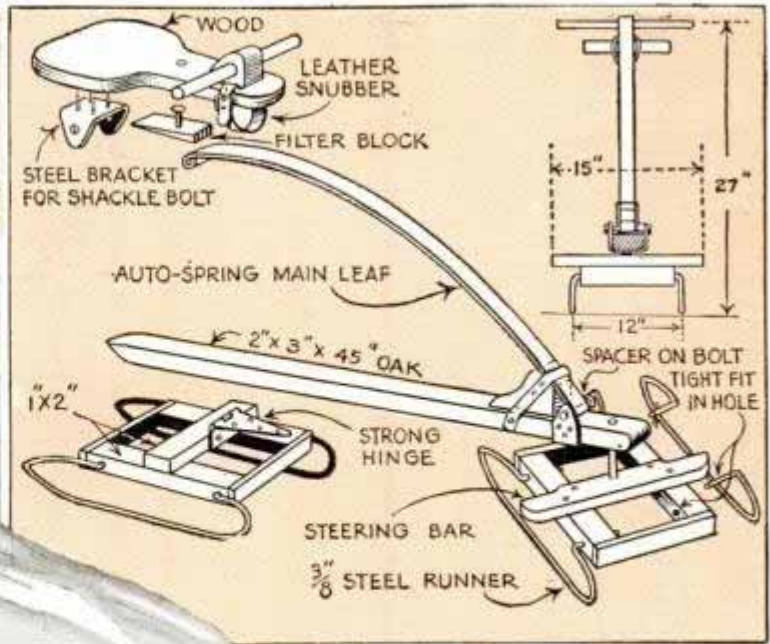
Scandinavian Ski-Jack: The tricky little ice sled on which the rider has a seat requires no practice to balance after it is once under way, and a minimum of effort is required to push it because the single runner is narrow and hollow-ground. Short outboard runners prevent capsizing in an emergency but do not interfere on the straightaway when it is riding on the middle runner. It literally "turns on a dime" because the sled can be tilted up on its heel by bearing down on the handle. Ordinary pine is used. Assemble with galvanized screws and casein waterproof glue. Note that the square-section main runner, which is cold-rolled steel, lays in a groove half its depth. The ends of the runner are flattened and screwed to the wood.

Wire Runners on Sleds: Sleds used on hard-packed snow or on ice can be provided with multi-strand wire runners. In order to stretch the wire taut, it is heated while being fitted to the runner. The runners have circular ends the edges of which are notched with circular saw cuts 1/8 in. between centers. Into these notches the wire lies when drawn up and brought around the screw heads at the ends.

Ice Tracks on Back-Yard Slides: Minimum friction enables riders to get up considerable speed and a long ride, if ice tracks are provided on a slide the frame-



work of which is wood. The tracks are frozen in galvanized troughs, and old lumber from a wrecking yard will do for the structure, using 2 by 4-in. uprights, 1-in.



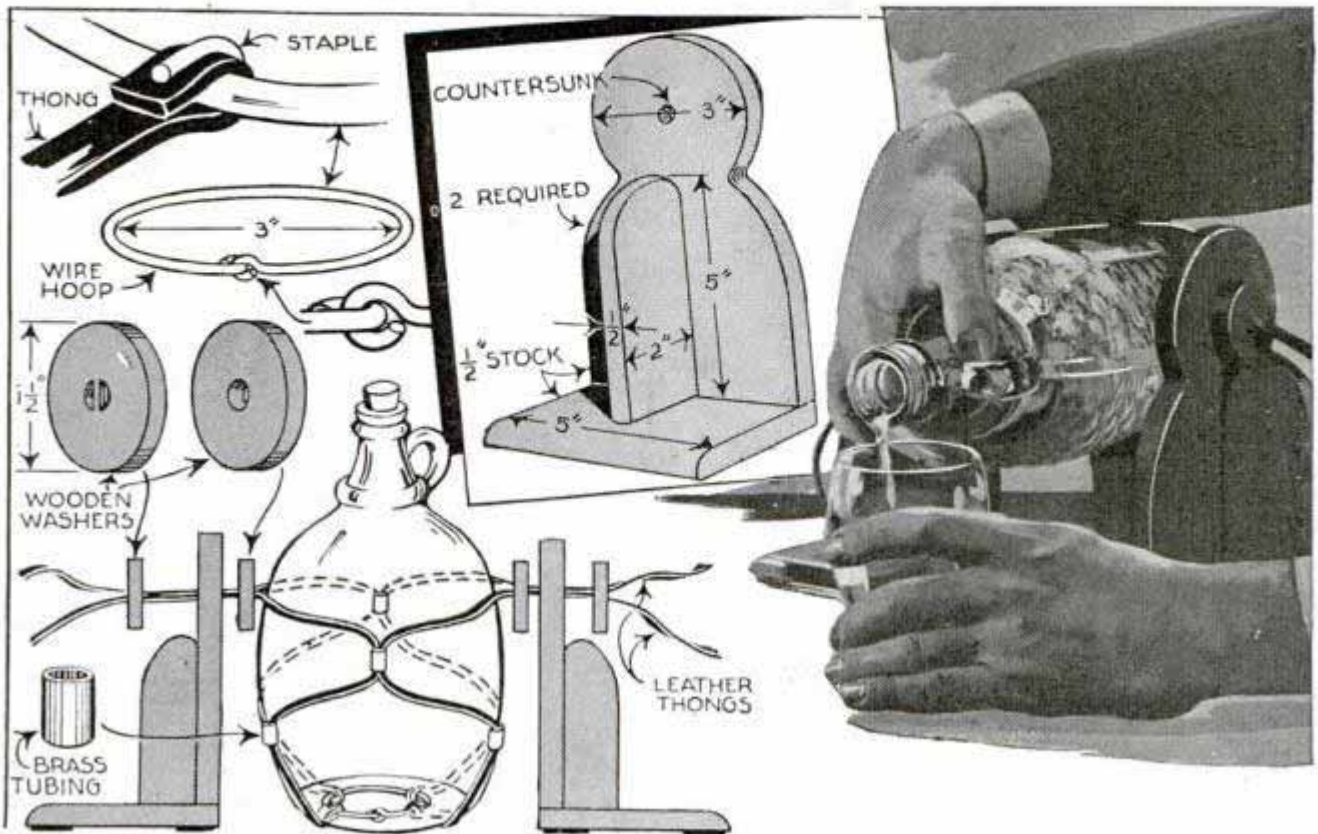
stock for diagonal braces and the troughs in which the ice tracks are laid. For molds, make one or more galvanized sheet-iron troughs to the dimensions shown. A local tinsmith can bend them to this shape easier and cheaper than you can do it yourself.

With four troughs in sub-zero weather, sufficient rails can be made in a few nights. When one is removed from the mold by pouring hot water over the bottom, lay it face down on old boards and cover with snow, in a shaded spot, until enough rails

are made to complete the job. Beginning at the bottom, lay the rails in the wooden troughs, end to end toward the top. Should they have a tendency to slide in thawing weather, nail a small cleat to the trough at each joint. In daytime cover them over with burlap and they will last through considerable mild weather. If an extra cold night comes after they are laid, turn a fine spray from the hose over them. Sleds for this slide are made wider than standard size to give ample stability and also a low center of gravity. Runners are bent from steel rod and permit a certain amount of side movement to accommodate themselves to inequalities in width of the track. Notches are made for handholds.

Galloping "Jockey Bob": On the single-passenger bobsled very little effort will start the "saddle" in a galloping motion. Having acquired a main leaf of an auto spring and about 10 ft. of $\frac{3}{8}$ -in. steel rod, the remaining material can be found among odds and ends. Bend the runners, after heating in a forge or with a blowtorch, as in the squared diagram, and insert the ends in holes in the sled frames. They should be driven to a tight fit and as a further precaution, cotter pins should be driven through holes in the ends. A strong hinge permits rocking motion in the rear sled, and several washers on the kingpin permit a certain amount of latitude forward. A good grip is supplied by the short, wooden handle bar, and a leather snubber prevents the seat from rearing backward. Steering is done with the feet.

Adjustable Cradle to Handle Heavy Bottles



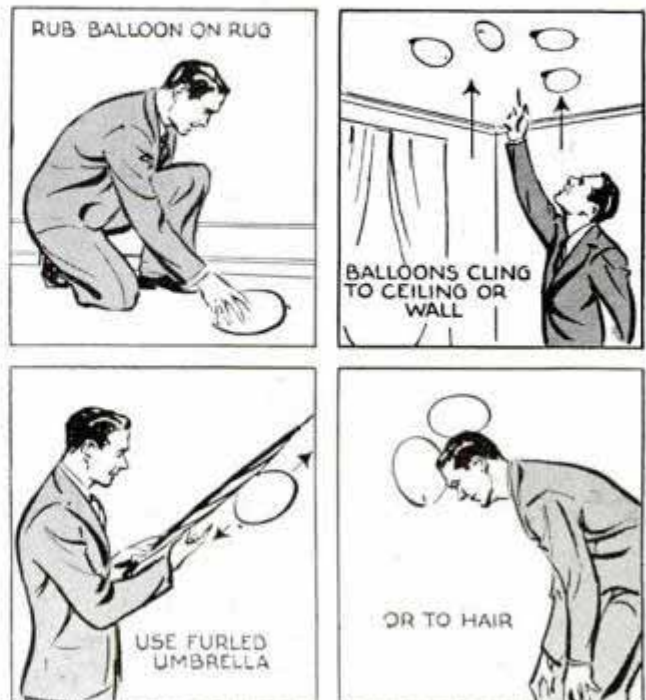
This ornamental cradle permits easy pouring from large bottles, especially when they are on shelves, making it unnecessary to lift them down. It is also useful on a dining table for handling water carafes. Made of $\frac{1}{2}$ -in. wood, the cradle may be

finished with stain, paint or varnish. One long rawhide thong, such as a shoelace, and four $\frac{1}{2}$ -in. sections of brass tubing are used to make the bottle sling, which may be adjusted in a moment by tightening or loosening the thongs.

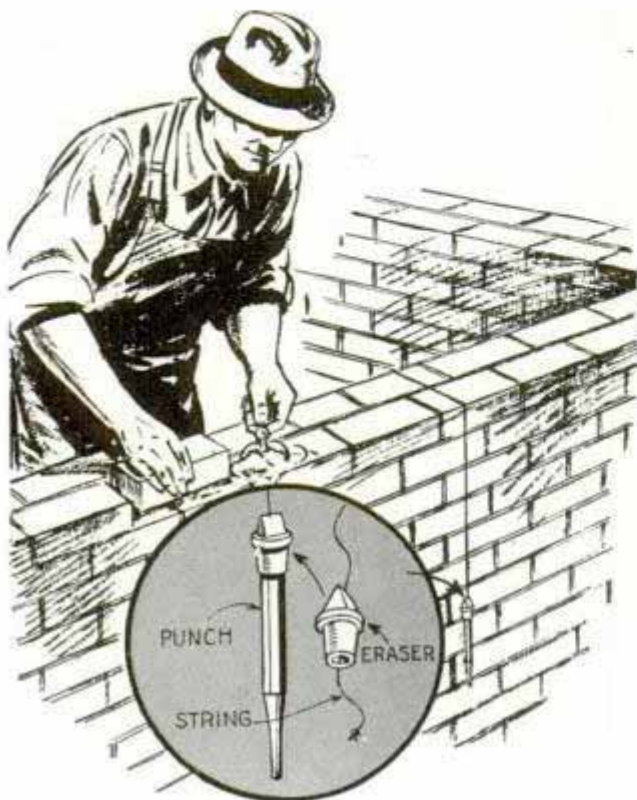
Tricks with "Charged" Toy Balloons That Defy Gravity

Toy balloons that dive for the ceiling, cling to your hair, move up and down an umbrella and do many other things contrary to gravity will amaze your friends who are not familiar with the laws of static electricity. Rub an inflated balloon briskly on a rug. Then toss it gently near the ceiling. It will make a sudden spurt for the ceiling and cling there. Or, prove that a balloon will defy gravity by moving along a cotton umbrella at will. Toss two balloons into the air, walk under them and as they cling to your hair prove you are a master juggler. The balloons will not take a strong static charge in humid air. The best time is a dry fall or winter day.

☛ When washing painted woodwork with soap and water, a tablespoonful of baking soda sprinkled into the water will help.



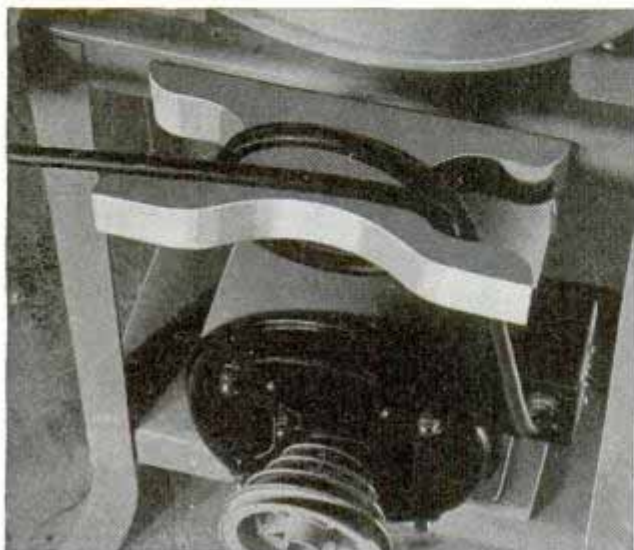
Pencil Eraser and Prick Punch Make Plumb Bob



An emergency plumb bob that will give practical and dependable service may be made from a slip-on pencil eraser and a prick punch. A stout line is knotted and threaded through the eraser, which is then fitted over the end of the punch.

Motor Cord Wound on Reel to Keep It Off Floor

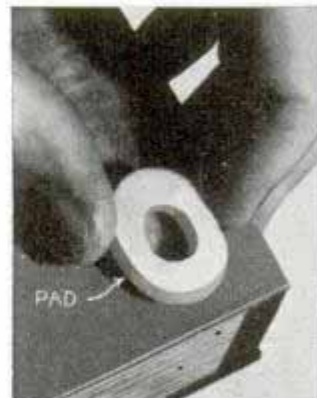
When shop machines are located near an electrical outlet, the excess motor cord can be wound on this reel or cleat to keep it off



the floor. Made of wood, the reel may be fastened in any position on the machine where it does not interfere with work.

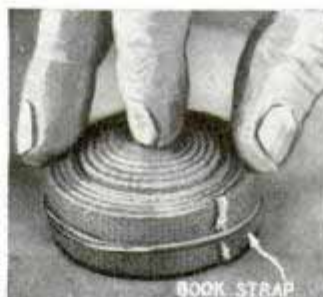
Non-Scratch Feet for Boxes

Book ends, small boxes or pieces of bric-a-brac that are placed on polished tables can be kept from scratching the surfaces by sticking pieces of felt to their bottoms. Felt corn plasters of the type shown are handy for this, and come in several sizes. Just moisten the pads and stick them in place.



—Daniel Reynolds, Pontiac, Mich.

Coiled Strap Is Good Polisher



You will find that a coiled web book strap is better than a cloth when using cleaning and polishing compounds. Snap a rubber band around the strap to keep it coiled, and dish the center by pushing the coils down slightly. This provides a small well to hold the powder on the surface of the work.

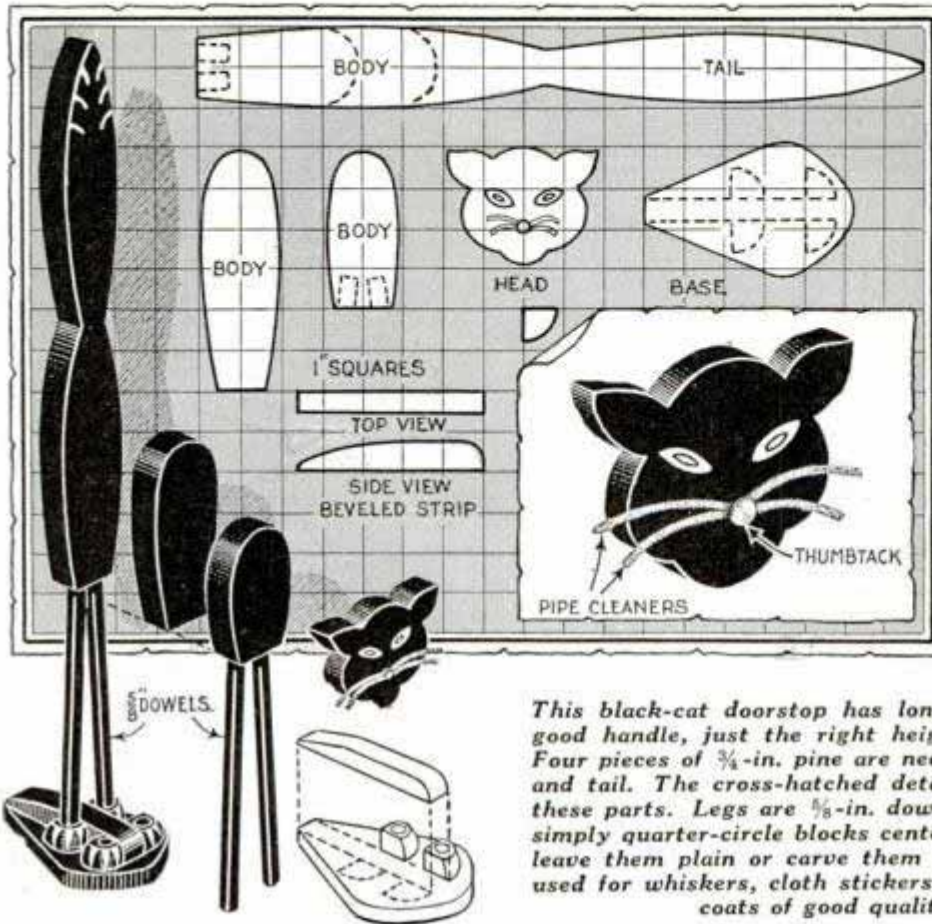
Typewriter Oiled with Dropper

Instead of using a small oil can to lubricate your typewriter, try a medicine dropper. You can reach all of the bearings easily and oil will not drop on the machine, which often happens when you turn up a can to do the job.—E. T. Robinson, Broadacre, O.



☛ If showcard color rubs off when dry, mix a small amount of glue or mucilage with it.

"Cat" Doorstop Reached Without Stooping

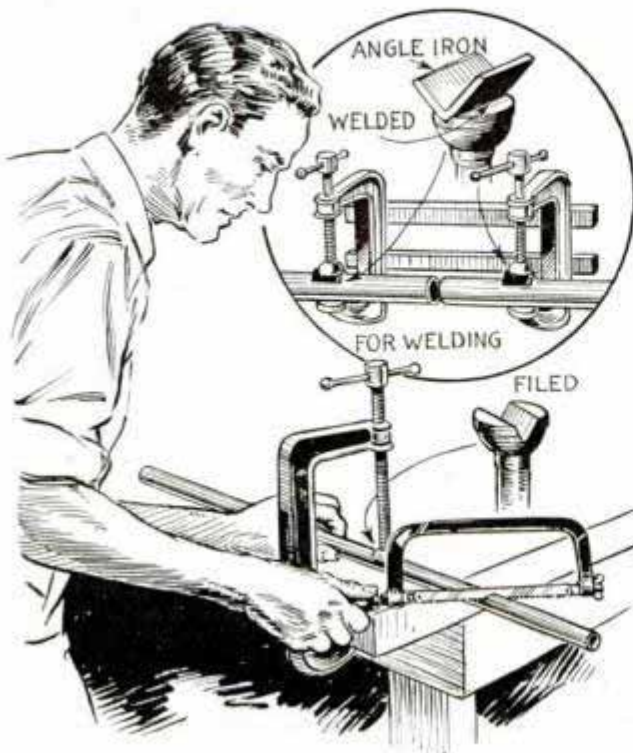


This black-cat doorstop has long legs and its tail provides a good handle, just the right height to reach without stooping. Four pieces of $\frac{3}{4}$ -in. pine are needed for the body and the head and tail. The cross-hatched detail gives the size and shape of these parts. Legs are $\frac{1}{8}$ -in. dowels, 9 in. long, and the feet are simply quarter-circle blocks center-drilled for the legs. You can leave them plain or carve them if you wish. Pipe cleaners are used for whiskers, cloth stickers for the eyes. Finish with two coats of good quality flat black paint.

Notch Is Filed in Jaw of C-Clamp to Hold Rod or Pipe

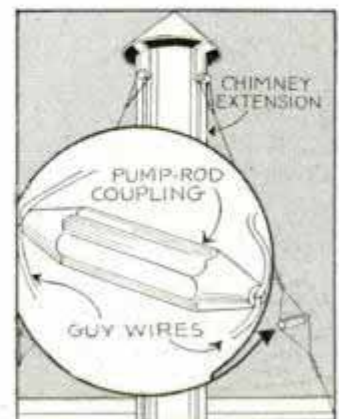
It is easy to adapt an ordinary C-clamp for holding pipe or rods. On a small clamp, just file or grind a V-shaped notch in one

jaw. A piece of angle iron welded onto the jaw of a large clamp takes the place of the notch. A convenient jig to hold pipe while welding it can be made by welding two clamps to lengths of bar or channel iron.

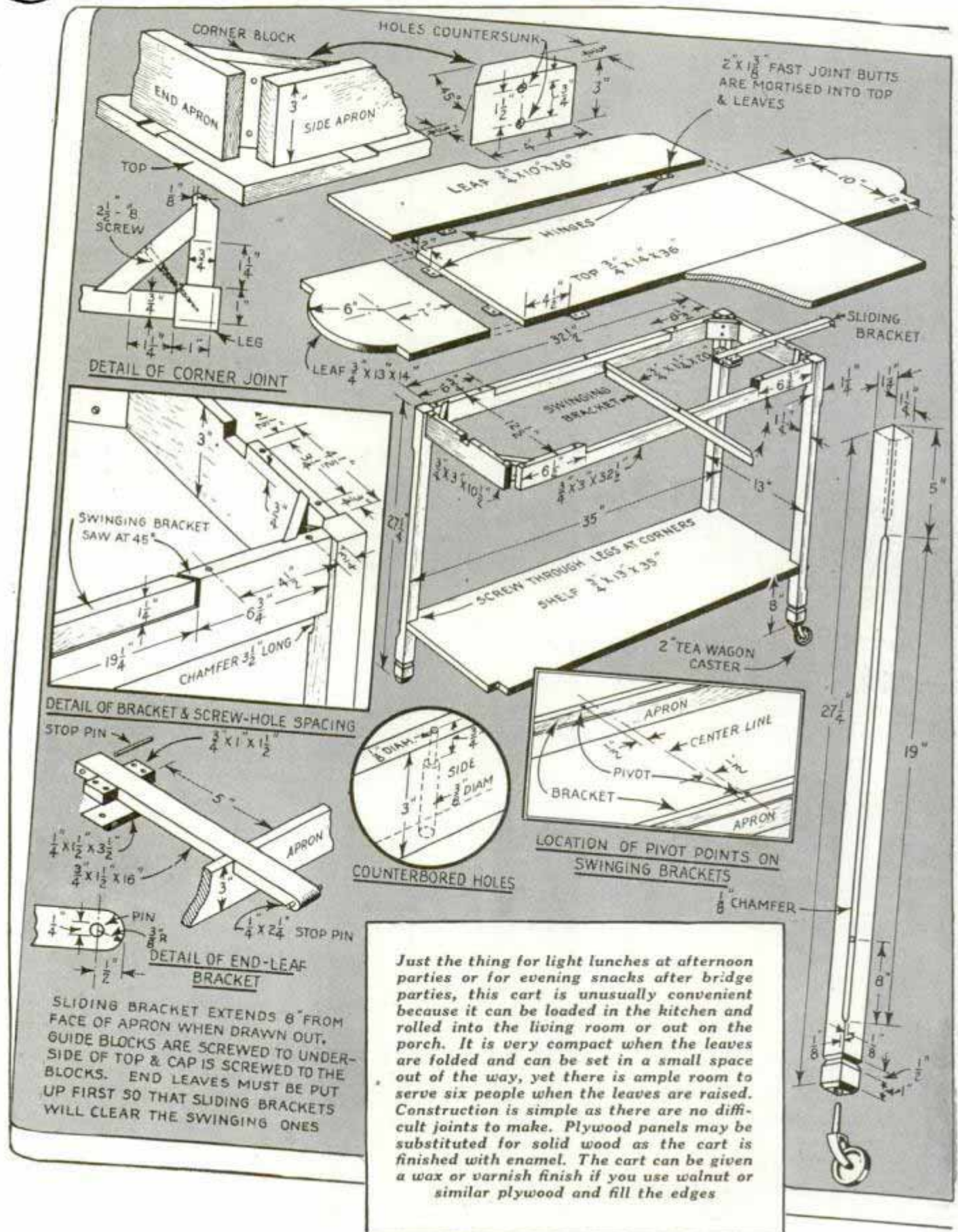


Rod-Coupling Weights Stop Hum of Chimney Guy Wires

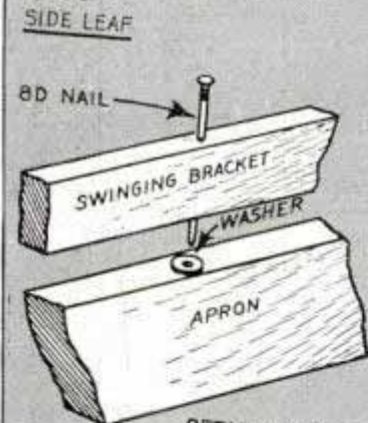
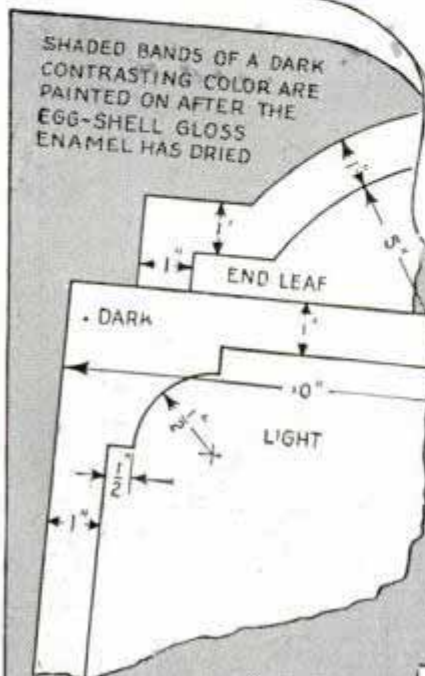
When a customer complained that long guy wires on the pipe extension of a chimney made a constant humming in a high wind, one tinsmith overcame the trouble by inserting weights of pump-rod couplings at the points indicated. These tended to break harmony of the vibrations and stopped the noise.



Swedish SUPPER CART



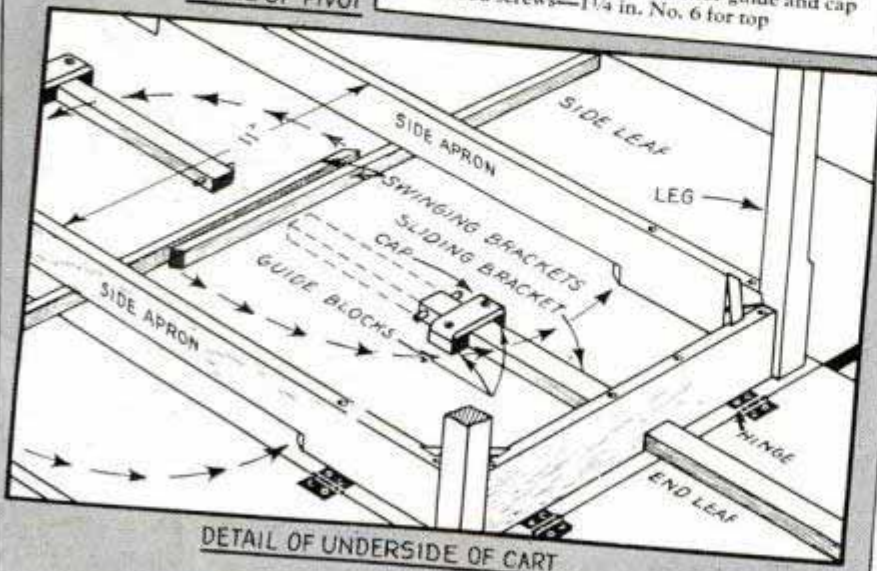
has four drop leaves



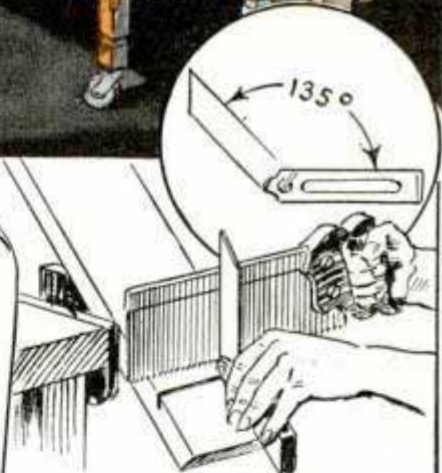
DETAIL OF PIVOT

MATERIAL LIST (Birch or Gum)

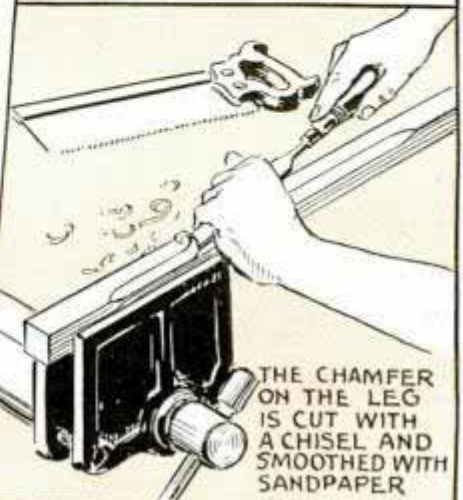
- 4 Pcs. 1 1/4 x 1 1/4 x 27 1/4 in. for legs
- 1 Pc. 3/4 x 14 x 36 in. for top
- 2 Pcs. 3/4 x 10 x 36 in. for side leaves
- 2 Pcs. 3/4 x 13 x 14 in. for end leaves
- 2 Pcs. 3/4 x 3 x 32 1/2 in. for side aprons
- 2 Pcs. 3/4 x 3 x 10 1/2 in. for end aprons
- 1 Pc. 3/4 x 13 x 35 in. for shelf
- 4 Pcs. 3/4 x 3 x 4 in. for corner blocks
- 2 Pcs. 3/4 x 1 1/4 x 20 in. for swinging brackets
- 2 Pcs. 3/4 x 1 1/2 x 16 in. for sliding brackets
- 4 Pcs. 3/4 x 1 x 1 1/2 in. for guide blocks
- 2 Pcs. 1/4 x 1 1/2 x 3 1/2 in. for caps
- 4 2-in. Tea wagon casters. (Rubber tired)
- 8 Wood screws—2 1/2 in. No. 8 for corner blocks
- 4 Wood screws—2 in. No. 8 for shelf
- 12 Wood screws—7/8 in. No. 6 for guide and cap
- 16 Wood screws—1 1/4 in. No. 6 for top



DETAIL OF UNDERSIDE OF CART



DADOS FOR CORNER BLOCKS ARE SAWED, THEN CHISELED TO DEPTH



THE CHAMFER ON THE LEG IS CUT WITH A CHISEL AND SMOOTHED WITH SANDPAPER

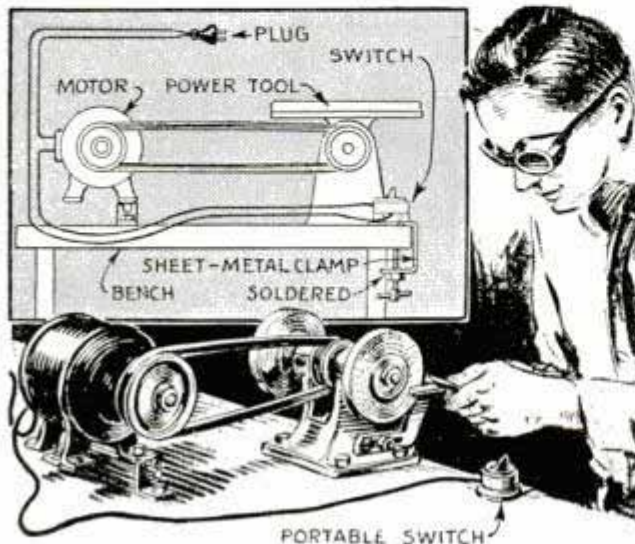
Cardboard Under Thumbtacks Makes Them Easy to Remove



Slip small pieces of cardboard underneath thumbtacks and you can remove them by pulling up on the cardboard instead of pulling them with your fingernails which are likely to break. Cardboard pieces 1 in. square are about the right size.
—Robert Bowers, Springfield, Ohio.

Motor Used on Several Machines Controlled by Portable Switch

Owners of home workshops who have only one motor and move it along the bench to operate different machines, will find this portable switch handy. It can be moved from machine to machine and

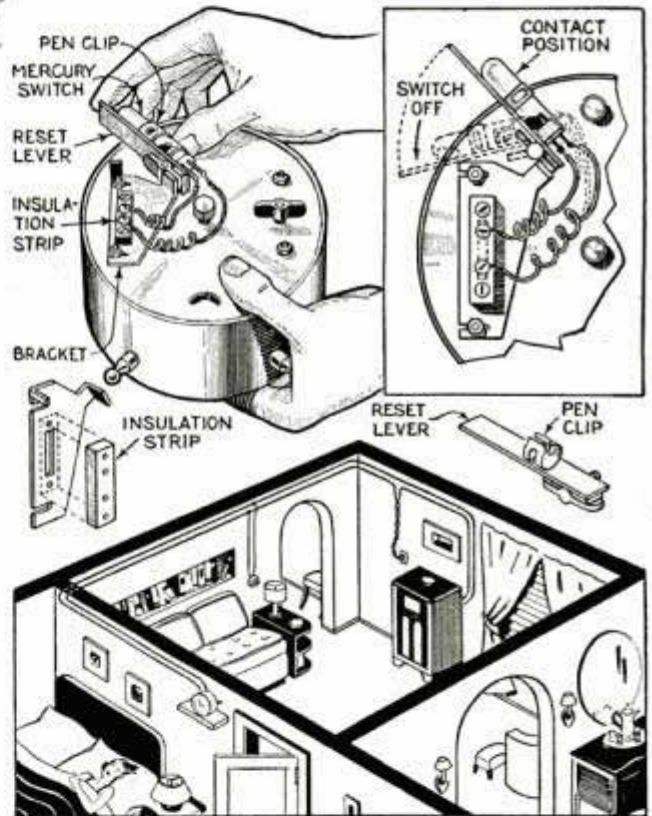


clamped to the bench top to give instant control over the motor. The switch is mounted on a C-clamp shaped from heavy sheet metal, the screw of the clamp being a bolt driven through a nut soldered to the lower end of the clamp.

—Jack La Londe, Portland, Ore.

Time Switch Operates Appliances in Your Home

Here is a simple time switch that anyone can make to turn on a radio, toaster, electric iron or coffee percolator at a given time. All you need is an alarm clock and a mercury switch. If desired, the latter can be made from a small phial. This is attached to a strip of heavy brass, which is



in turn soldered to the alarm winding key after the latter has been removed. In use, the alarm is wound just enough to tip the switch, after which further winding is unnecessary as resetting the switch by pulling down the arm winds the alarm. A stop pin must be soldered to the back of the clock to check movement of the arm after the switch has been tipped. The switch can be used to turn off an appliance by simply reversing the position so that the mercury flows away from the electrodes when the alarm tips the switch.

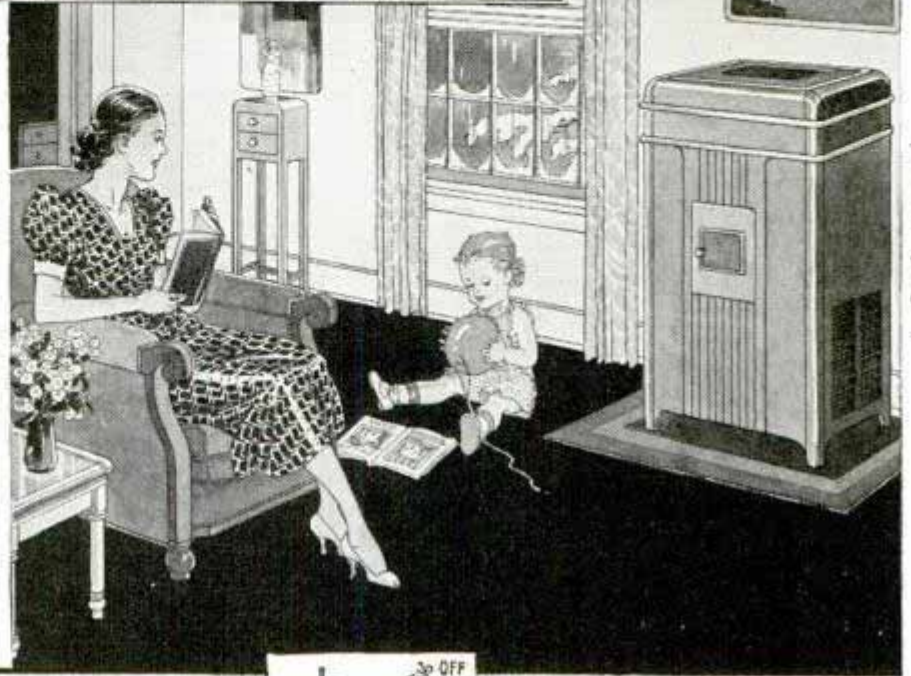
Basement tanks supply FUEL OIL TO HEATER

An electrically driven pump automatically maintains the oil level in the heater tank

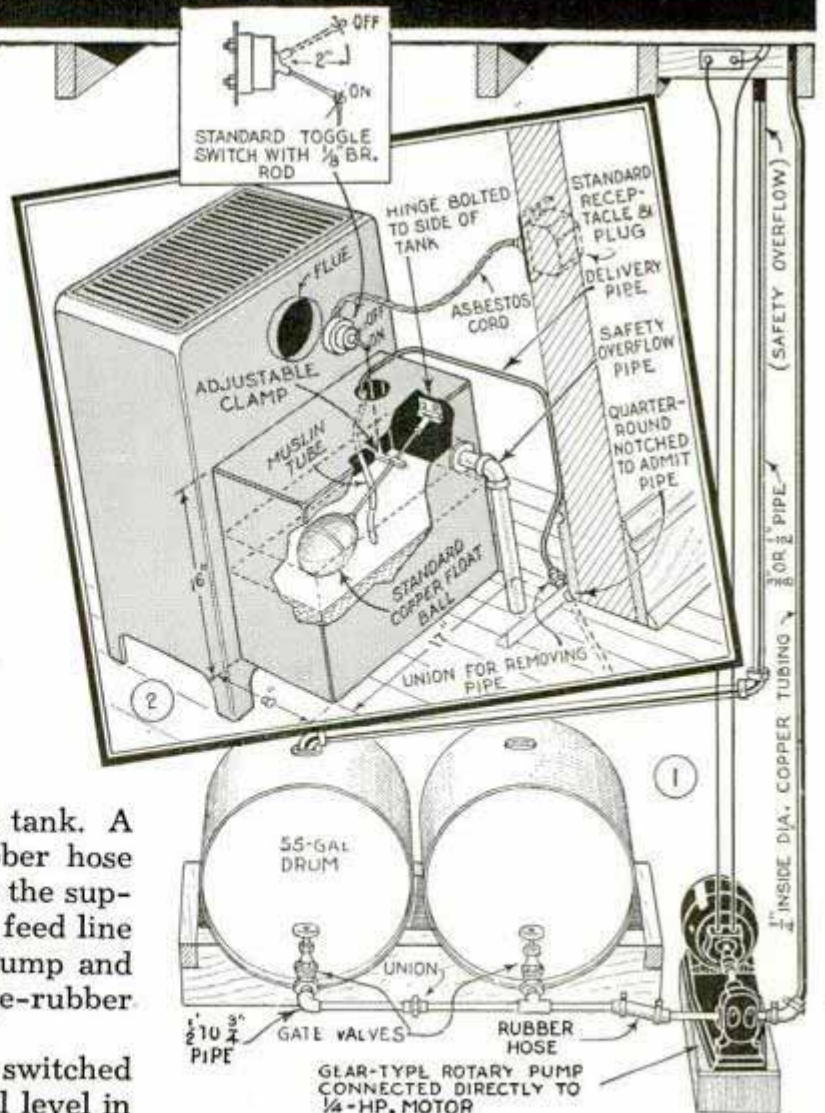
WITH this automatic method of keeping the oil tank on a stove constantly supplied, there's little chance of the tank running dry. Also there's no danger of the tank overflowing in the event the float might develop a leak or the switch would fail, as an overflow line of greater diameter than the supply line is provided to carry oil back to the tank or tanks in the basement. A gear-type pump is used and it is run by a $\frac{1}{8}$ or $\frac{1}{4}$ -hp. electric motor. In the reservoir on the stove, a float operates a toggle-type electric switch, which in turn controls the motor and hence the oil supply. The whole arrangement is clearly shown in Figs. 1 and 2.

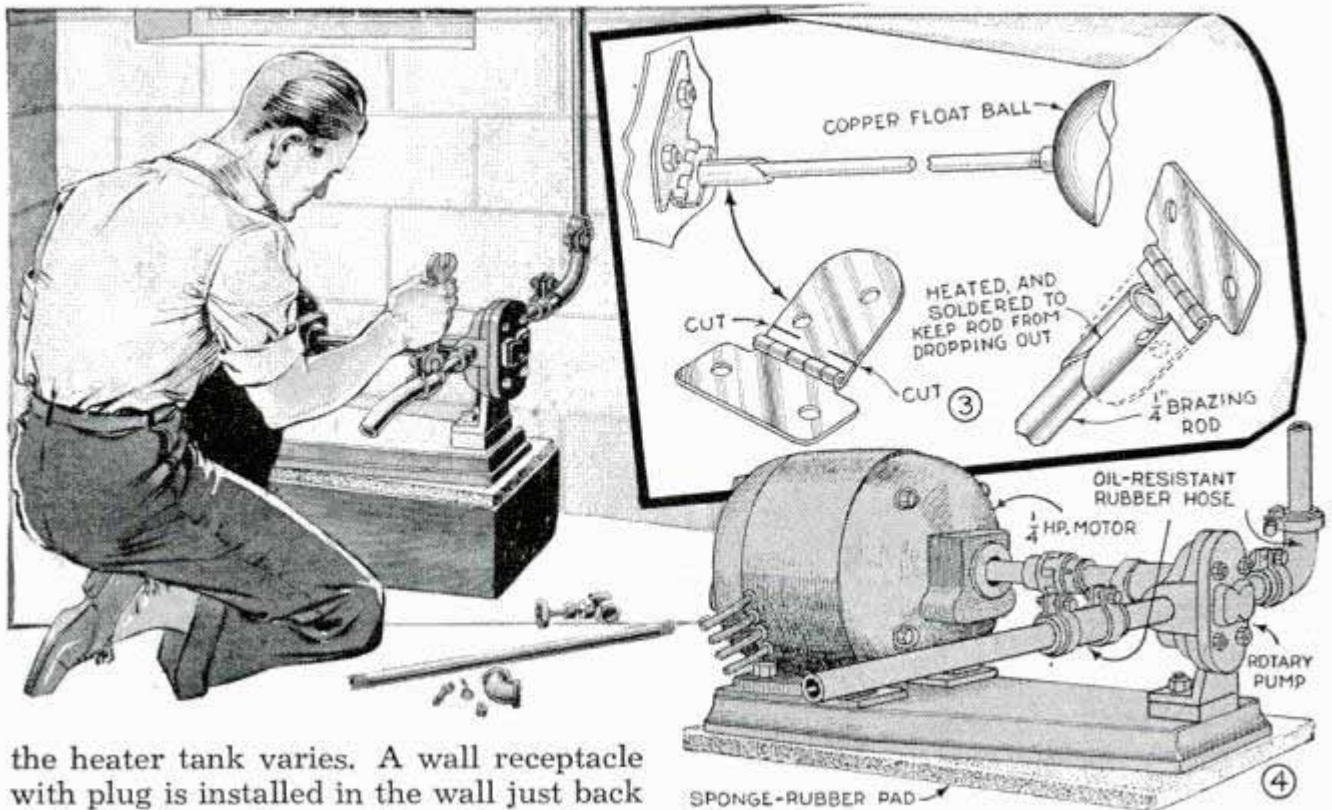
The discharge line from the pump to the heater tank is made of copper tubing as this is easily bent to pass through the floor and through a notch cut in the quarter round as in Fig. 2. A short length of muslin rolled to form a tube is attached to the end of the feed line as shown. This prevents splashing of the fuel oil as it is pumped into the tank. A short length of oil-resistant rubber hose is inserted in the intake line from the supply tanks to the pump and in the feed line to the heater. In addition, the pump and motor are mounted on a sponge-rubber pad to prevent noise.

Fig. 2 shows how the motor is switched off and on automatically as the oil level in



Woburn Electrical Supply Co.





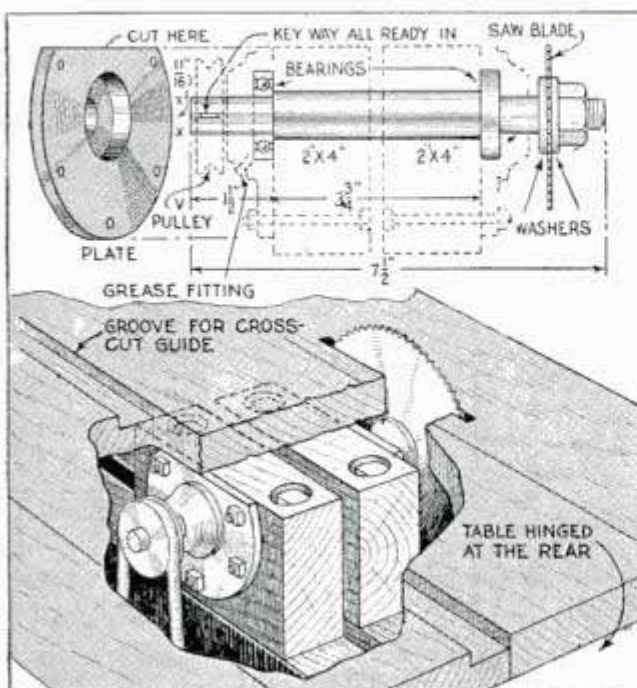
the heater tank varies. A wall receptacle with plug is installed in the wall just back of the heater and connections through armored cable are made to the current supply and the motor. A double-pole toggle switch is mounted securely on the back of the heater and the switch handle is extended with a short length of $\frac{1}{8}$ -in. brass rod as shown. The switch so fitted is

linked to an ordinary copper float ball as in Fig. 2. The float is hinged to one end of the heater tank as indicated in Figs. 2 and 3, taking care that the hinge works freely. An asbestos cord and plug leads from the switch to the wall receptacle.

Saw Mandrel Made Inexpensively from Generator Parts

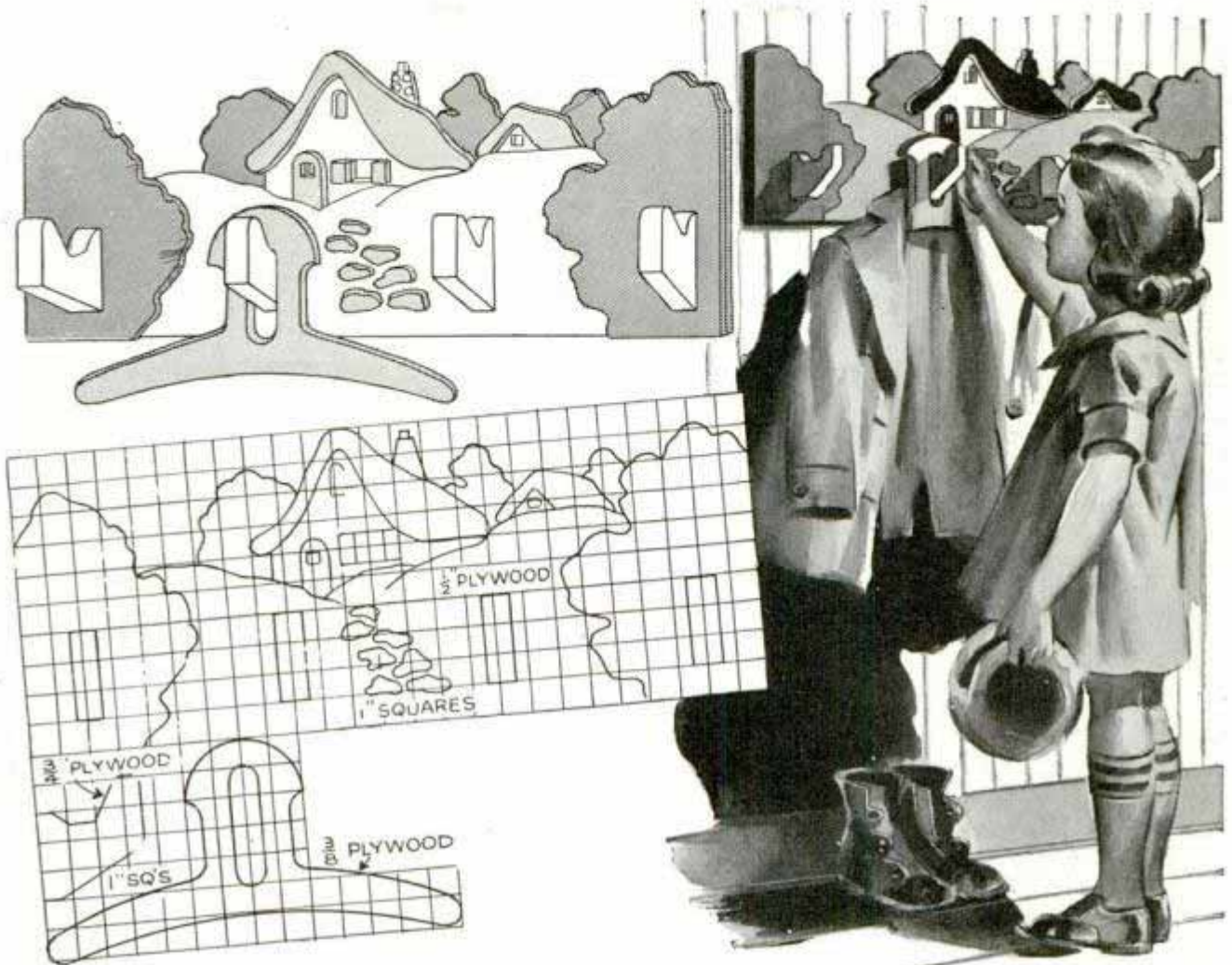
A ball-bearing mandrel for a homemade circular saw can be assembled at little cost by using the armature shaft from an old-

car generator. The pulley end of the shaft and end plate of the generator housing can be used without alteration. The other end of the shaft will have to be turned down to take the saw blade and to fit the bearing in the end plate of another generator. If both ends of the shaft extend through the plates, you can use them by simply turning down the shaft so that the bearing can be moved in to allow for the saw. In assembling the mandrel, the plates are bolted to blocks on the underside of the saw table as indicated, being sure that the plates are in perfect alinement to avoid binding.



☛ If you have an idea that might be used for a short article in these pages, send it to the Homecraft Editor. Inclose a snapshot or drawing and give all the necessary information in as few words as possible. To be accepted, material must be of general interest and different from any we have published previously.

This Child's Clothes Rack Invites Neatness



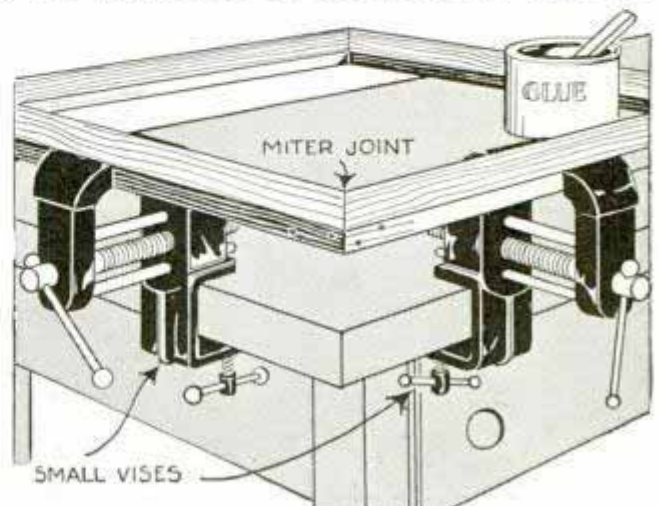
Hung within easy reach in the children's room or in the hall, this brightly colored clothes rack keeps tiny wraps in order and always ready for use. To make it, you cut the main part of the rack from $\frac{1}{2}$ -in. plywood. This includes the whole outline as you see it above except the tree overlays at

the ends. The latter and the flagstone overlays at the center are cut from $\frac{1}{4}$ -in. plywood and glued in place. Hooks for the hangers are simply notched blocks of $\frac{3}{4}$ -in. stock fastened with screws driven through from the back. Finish with enamel in cream, orange and green.

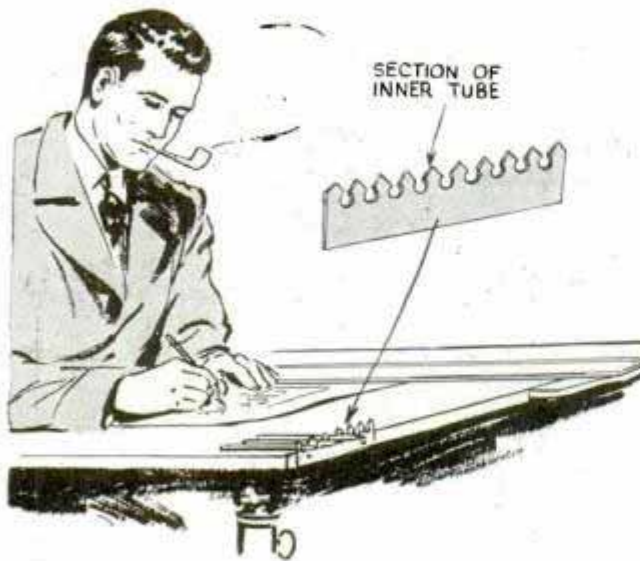
Bench Vises Serve as Clamps to Assemble Mitered Work

For holding mitered work while assembling it, two dime-store bench vises of the clamp-on type are just the thing. One is clamped to the side of a bench and the other at the end as indicated. Due to play in the vise clamps, they can be twisted to one side slightly and clamped in the proper position to hold work cut to form hexagon, octagon and other shapes.

☛ Flies and small insects that often infest house plants can usually be destroyed by spraying the plant with a suds made of washing soap.



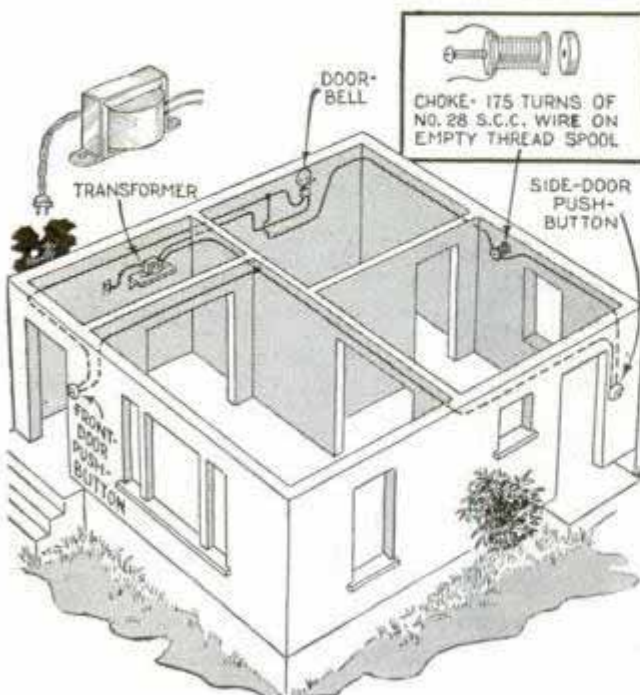
Inner-Tube Holder Keeps Pencils on Drawing Board



Simple and practical, this pencil holder for a drawing board is made from a strip of inner tube. It is cut as indicated and is tacked to the upper edge of the board. Pencils are held against accidental dislodgment, but are removed easily.

Choke Coil Changes Tone of Bell for Use with Two Doors

By simply installing a small choke coil in the circuit to one push button, you can use one doorbell for both the front and back doors of your home. The electrical resistance provided by the coil causes the bell to ring softly when the back-door



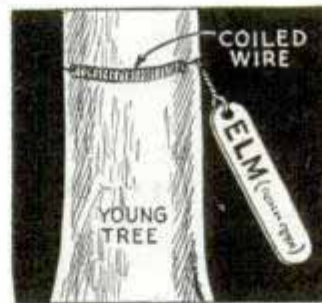
push button is closed, while the absence of any resistance in the circuit to the other push button allows the bell to ring loudly. The coil is made by winding No. 28 single-cotton-covered wire on an empty thread spool. The number of turns will vary according to the output of the transformer. One home owner used a 14-volt radio transformer and found that 175 turns of wire on the choke gave the tone desired.

Electric Light Aids in Soldering

When soldering a leak in a pail or other container, time can be saved if you place an electric light under the pail. Light will show the leak so a quick soldering job can be done. —H. Arrall, Newburyport, Mass.



Label Wire Around Tree Coiled to Protect Bark

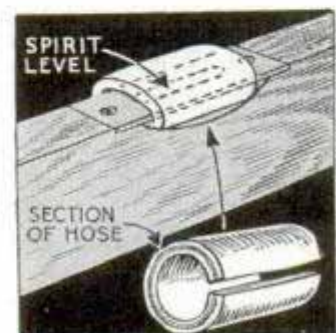


If you leave the labels on shrubs and small trees when transplanting them, coil the label wires as shown. This allows the wire to stretch as the growing tree or plant increases in diameter so that the bark will not be injured.

—A. S. Wurz, Jr., Rockyford, Alta., Can.

Rubber Hose Shields Level Glass in Tool Chest

If a carpenter's level is stored with other tools, slit a short piece of garden hose and slip it over the glass to protect it against breakage. A piece of $\frac{3}{4}$ -in. hose is just the right size.

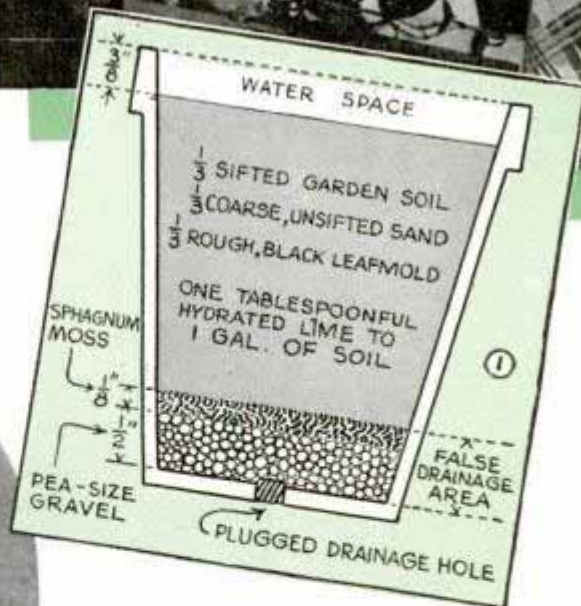


Healthy HOUSE PLANTS

Secrets of success with succulents

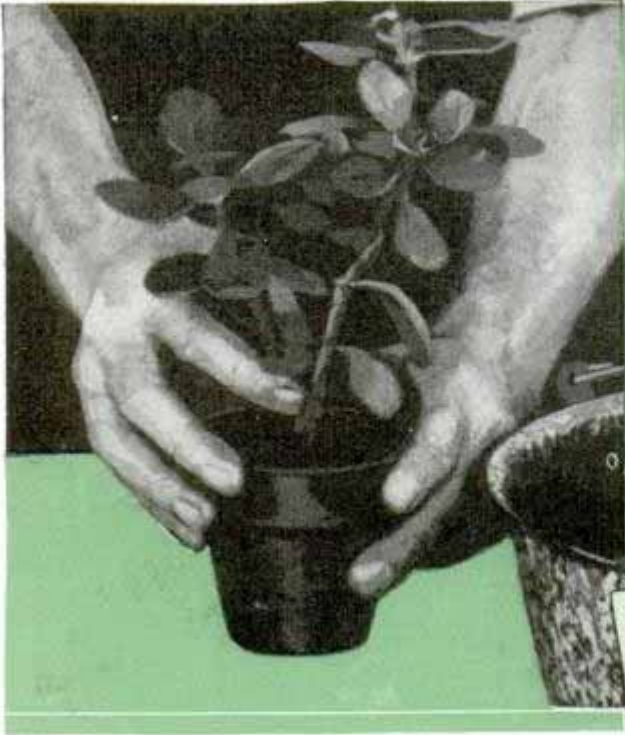
By Robert Clarence Stahler

ALL-SEASON window gardens of succulents, those hardy slow-growing plants native to the hot, arid regions of the world, lend to your living room the charm of colorful foliage the year 'round. Properly cared for, they thrive in the warm and comparatively dry atmosphere of heated rooms where other seasonal plants sometimes wither and die. Caring for them is the very simplest procedure; just a small pot partly filled with gritty soil, and an occasional watering. True succulents should not be confused with the ordinary varieties of cactus plants. Succulents are generally classified in groups and all exhibit a striking variety of foliage, both in oddity of form and in brilliance of coloring. The aloe group alone can furnish more than enough specimens to complete a window garden. However, for the sake of variety try to collect a few plants from other groups such as Echeveria, Euphorbia, hart's-tongue,



Crassula, Kalanchoe, ice plants, Sansevieria. True succulents thrive best in a soil of the composition shown in Fig. 1, but will do very well in a mixture of half garden soil (sifted) and unscreened coarse sand, with the lime content the same as in Fig. 1. Don't use manures or fertilizers in your soil mixture, and avoid a clay soil.

When potting, have the soil damp, but not

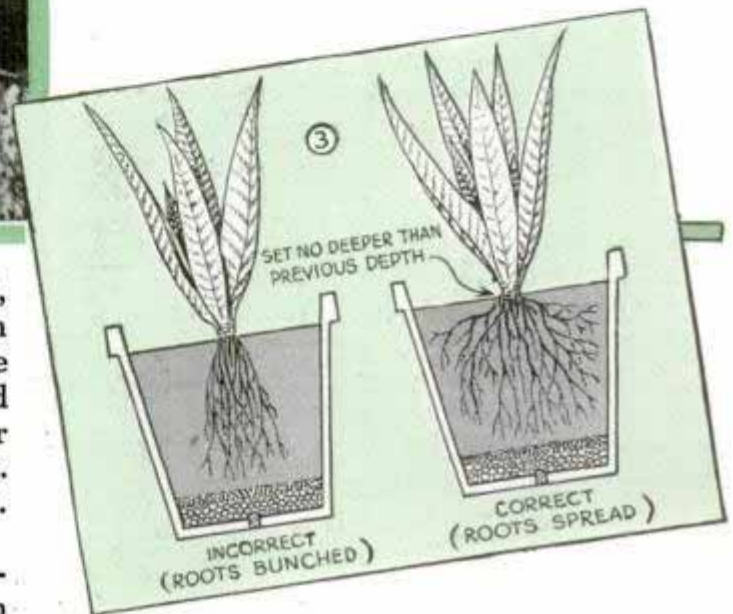


wet. Large pots will not do; 2, 2½, 3, and 3½-in. pots are the rule, with an occasional 4-in. size for very large specimens. Plug the drainage holes and follow the drainage details and water space given in Fig. 1. This is important. Rot is the chief enemy of succulents. They cannot abide a wet, boggy soil.

After providing the required drainage, potting procedure is as shown in Figs. 1, 2, and 3. Thumb the soil down somewhat firmly as in Fig. 2, but avoid packing it too hard. Loose soil in pots brings about a boggy condition. After potting, fill water spaces one-third full. Most succulents thrive without repotting or without new soil for about two years. They may be repotted at any time except when in bloom. Late fall and winter is the dormant season, though some plants may continue to grow. Do not attempt to force these resting plants into active growth by over-watering. To do so is to invite rot. Give the soil of the resting plants a slight dampening—water space one-third full—every week or ten days. Fill water spaces of growing plants every ten days or two weeks. No hard and fast rule for watering can be laid down. Size of pots, room temperature and humidity all have a bearing on the intervals of watering. Soil in glazed or decorated pots will remain damp for several days, whereas soil in common clay pots will evaporate its moisture through the pot walls in about 24 hours. This does

not mean you should apply water every day, for succulents can absorb water from soil that appears bone dry. Should a plant droop, or, as succulents are more likely to do, shrink slightly, water thoroughly.

In late February dormant plants will begin to wake up. From now on do not allow the soil to dry out, but at the same time do not overwater. Remember that while the top soil seems dry, that at lower levels may be sufficiently damp. Choose, if possible, the morning of a sunny day for the watering routine, and always use water at

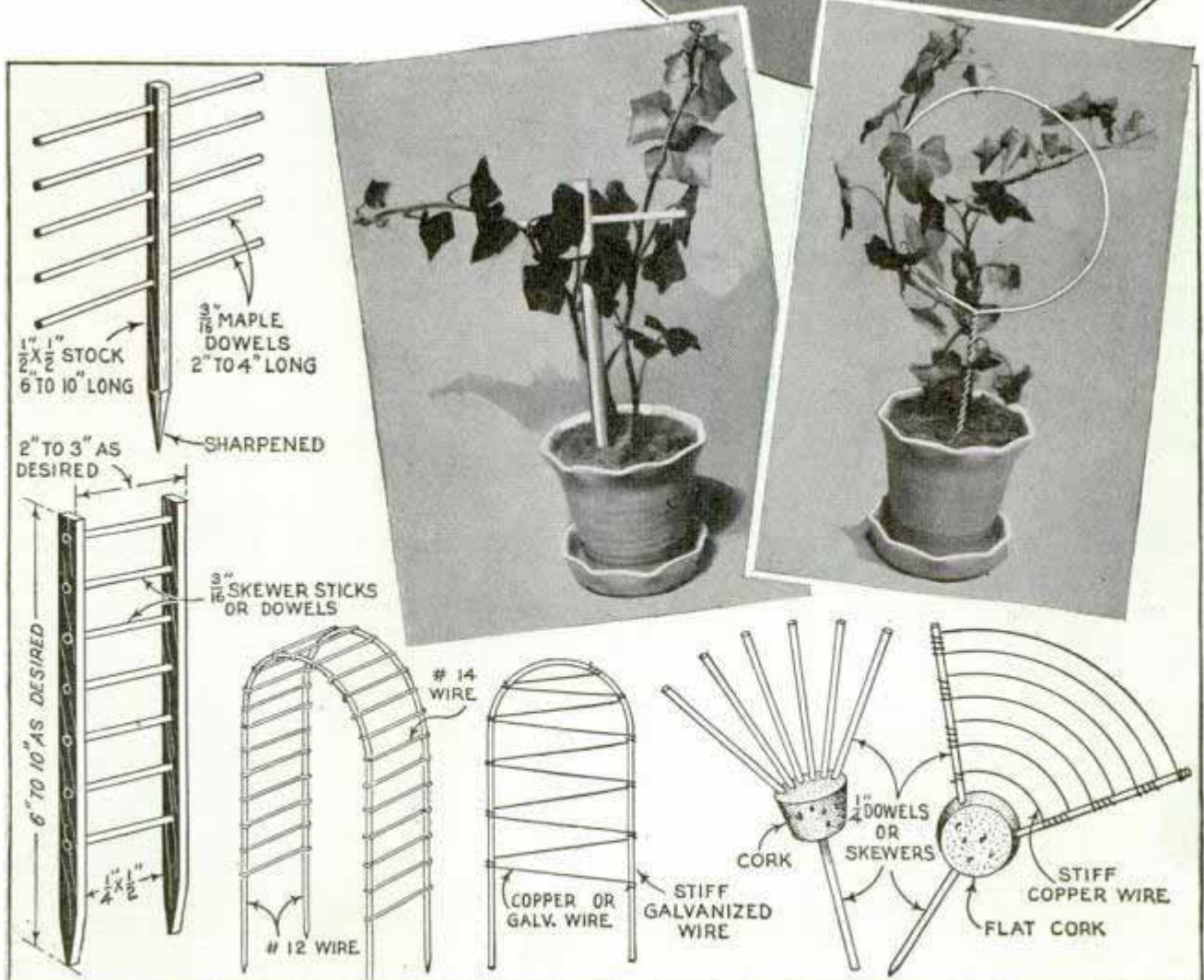


about living-room temperature. Avoid locating your plants over a hot-air register or radiator. They tolerate a wide range of humidity, but like all indoor plants dislike drafts, cannot stand freezing temperatures. A window in a cooler part of the home would, of course, be their choice, but is not essential; succulents thrive in temperatures higher than living-room average. If you locate your garden in an east window, a curtain is unnecessary. A south window radiates too much heat during early fall and spring, but such a location is ideal if a curtain of fine mesh hangs between the window and the plants. Although succulents occasionally send forth beautiful blooms, their charm lies in their foliage. Keep it clean. Once a month carry the plants to the bathtub and wash them carefully with mild warm soapsuds. Go over the stems and leaves, using the fingers or a small sponge instead of a rag. After washing a plant, spray off with lukewarm water.

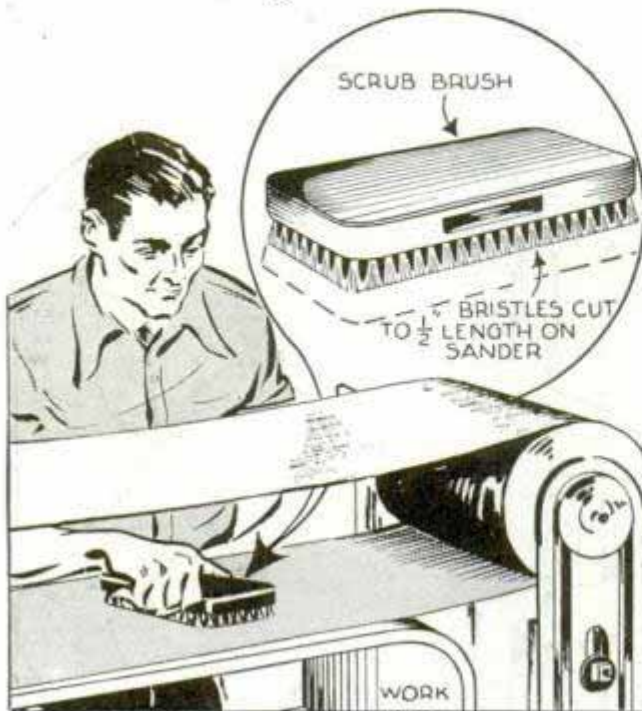
X750 Tom-Thumb TRELLISES

improve indoor gardens.

THESE tiny trellises add the atmosphere of an outdoor garden to groups of potted plants kept indoors during the winter months. Wire, a few large corks, small dowels or skewers and several strips of pine are all the materials you need to make up the ones shown below. In any case they should not be too large but should be kept in proportion to the size of the pots and plants. Although trellises usually look best painted white, other colors or combinations may be used.

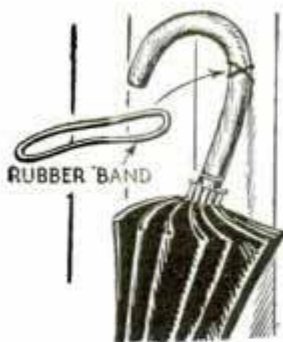


Scrub Brush Is Handy Stroker for Long Belt Sander



Easy handling and minimum wear on a sanding belt are the features of this simple stroker, which is nothing more than a scrub brush. The bristles are cut to a length of $\frac{1}{2}$ in. by holding them against the abrasive side of the moving belt.

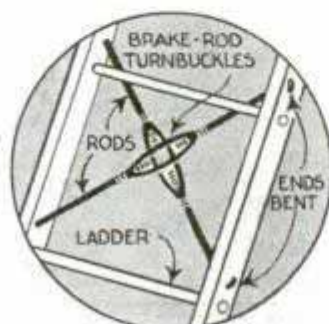
Rubber Around Umbrella Handle Prevents Slipping



The tendency of umbrellas to fall when leaned against smooth surfaces may be overcome by twisting a rubber band around the handle. Friction will tend to hold the umbrella in place.

Old Brake Rods Truss Ladder

Having a long ladder in which the rungs loosened so that it tended to sway sideways, I trussed it with lengths of brake rods and turnbuckles as shown.

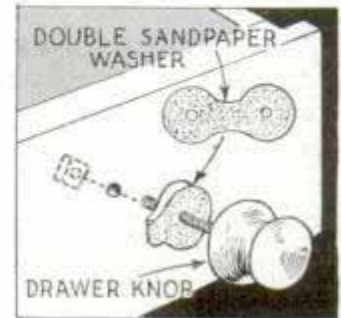


The ends of the rods were run through holes drilled in the ladder sides and bent over to keep them from pulling out. Then the turnbuckles were tightened.

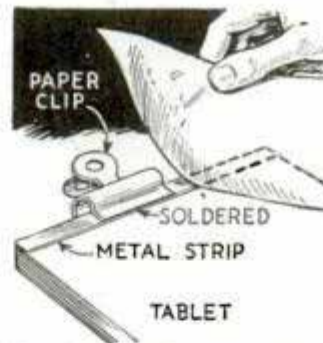
—A. H. Waychoff, Phoenix, Ariz.

Sandpaper Washers Keep Knobs Tight on Drawers

To prevent wooden knobs of cupboards or dresser drawers from loosening, cut twin washers from medium sandpaper as indicated, fold them in the center and slip them over the knob bolt or screw. When the knob is tightened against the washers, the abrasive surface will hold it securely.



Scratch-Pad Binder Holds Sheets and Permits Easy Tearing

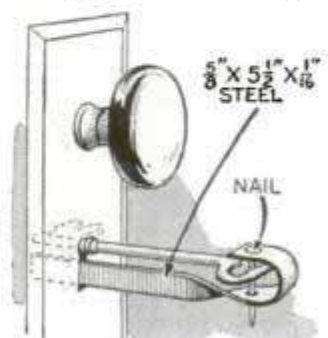


If you have some odd pieces of stationery on hand and would like to make them into a scratch pad, a strip of metal soldered to one jaw of a spring paper clip makes a good binder. This not only provides a means of holding the pages together, but the metal strip serves as an excellent tearing surface.

This not only provides a means of holding the pages together, but the metal strip serves as an excellent tearing surface.

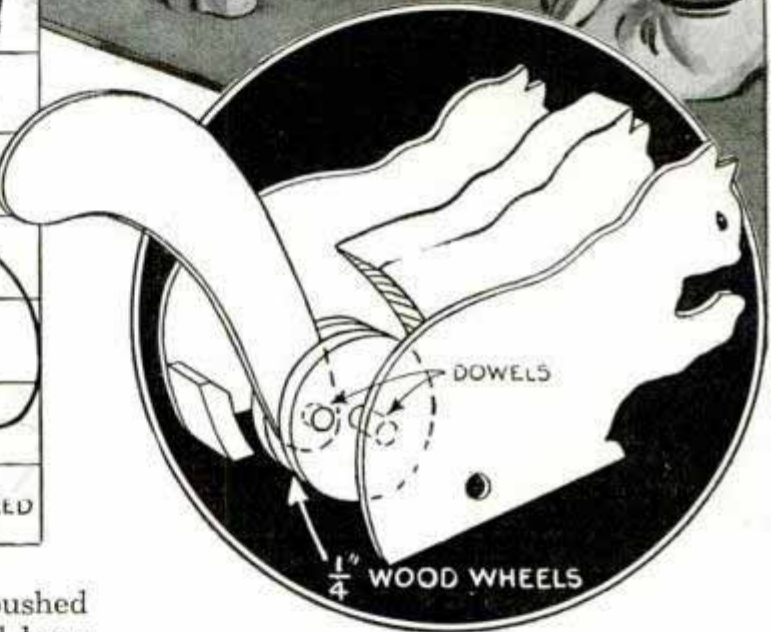
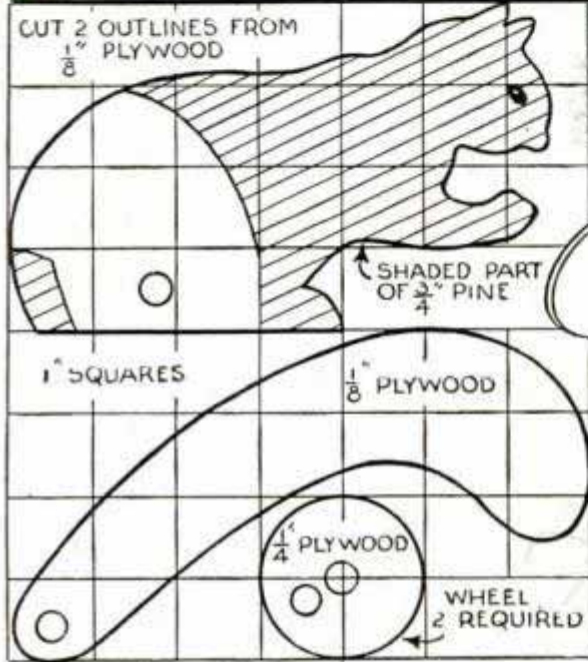
Key Held in Lock by Metal Strip

Of the many methods of preventing a key from being pushed out of a lock so that a skeleton key can be inserted to enter from outside, the method shown is one of the most effective. A strip of thin steel is bent to a U-shape at one end, given a half twist and inserted into the lock as indicated.



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Animated Squirrel Toy Performs Realistically

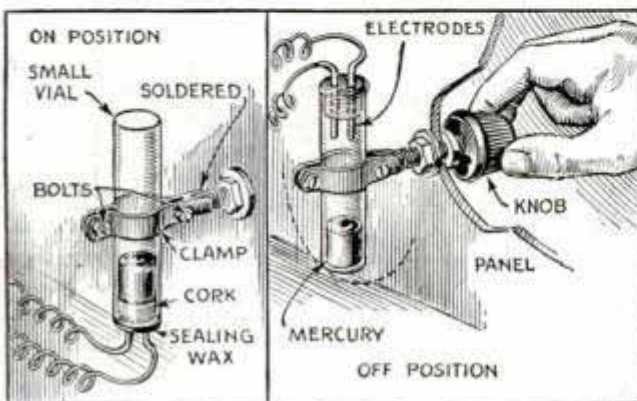


Merrily flipping its tail as it is pushed over the floor, this squirrel toy will be a prized possession of your small child. The two sides are cut from thin wood and are glued to a spacing block shaped and cut out, as indicated in the squared detail, to accommodate the tail-actuating mechanism. This consists of two wooden wheels

or disks having the tail piece pivoted slightly off center between them. Short dowels glued into the centers of the wheels project through holes in the side pieces to serve as an axle.

—Hazel F. Showalter, Davenport, Nebr.

Rotary Mercury Switch for the Experimenter's Workbench

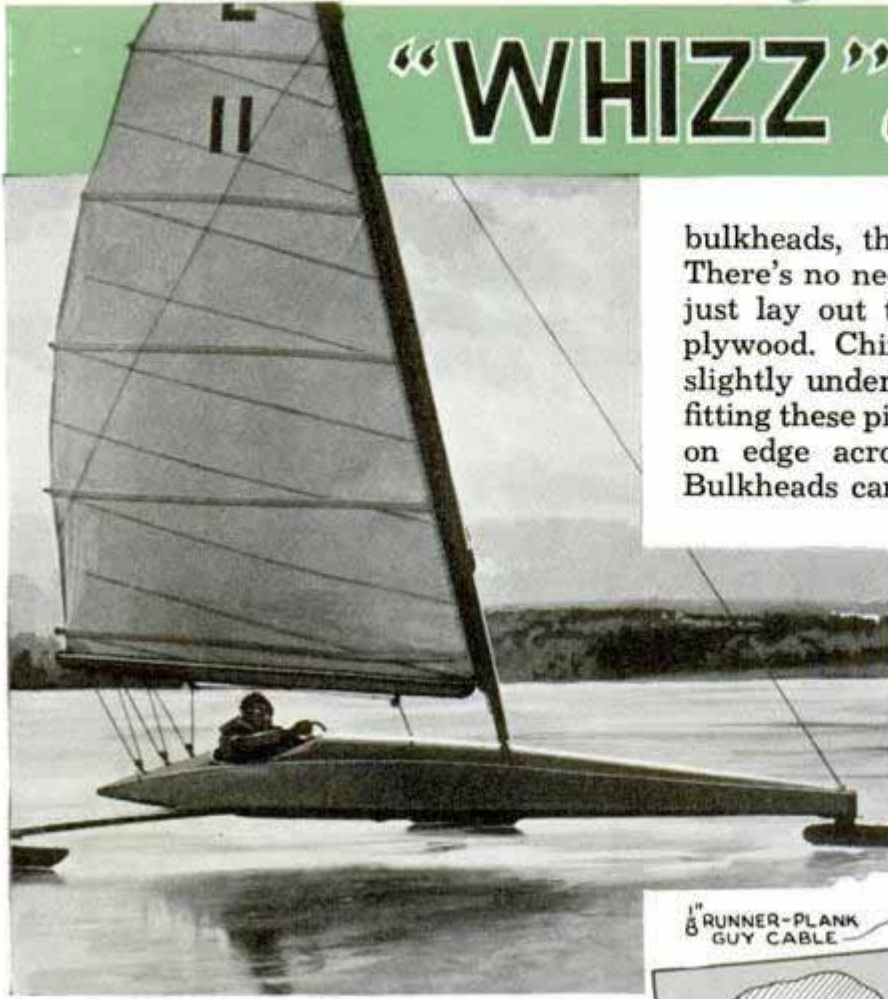


An electric switch of the rotary type that is suitable for use on currents up to 110 volts can be made from a small glass vial as indicated. The switch must be connected with flexible lead wires so that it can be turned easily.

—Neil H. McKay, Jr., Fontana, Calif.

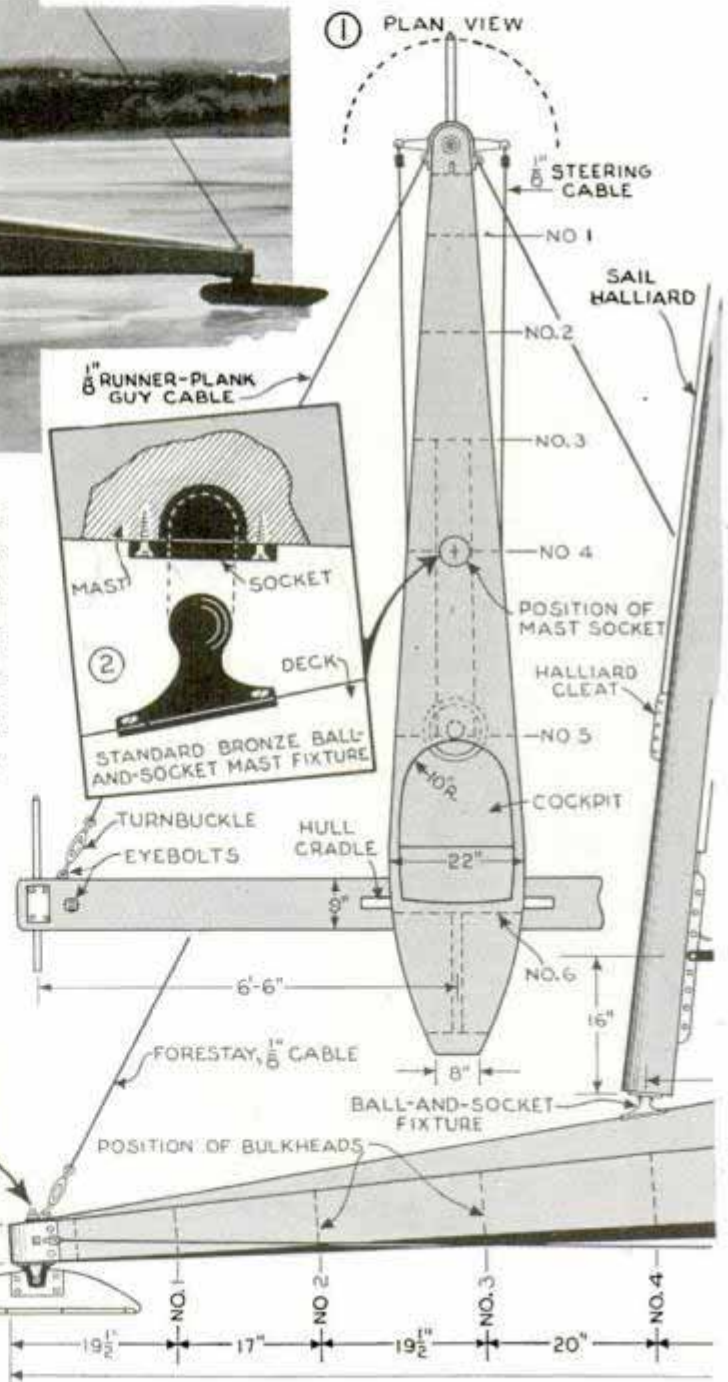
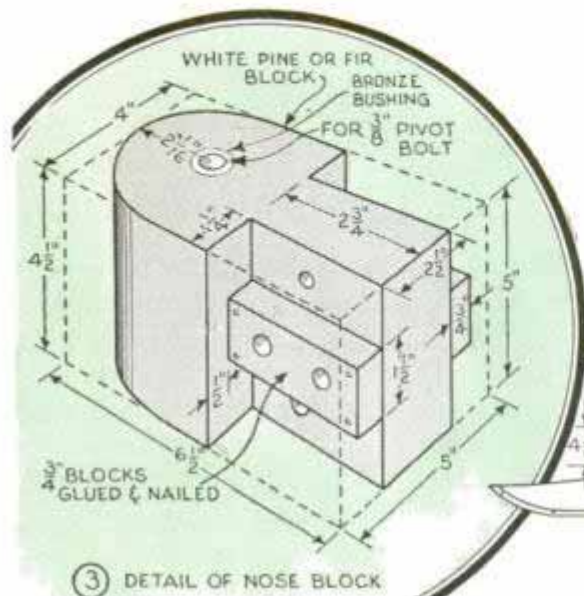
Ⓞ Much time will be saved if you put cheese, that is to be grated, through the food chopper, using a fine cutter.

"WHIZZ" a Fast

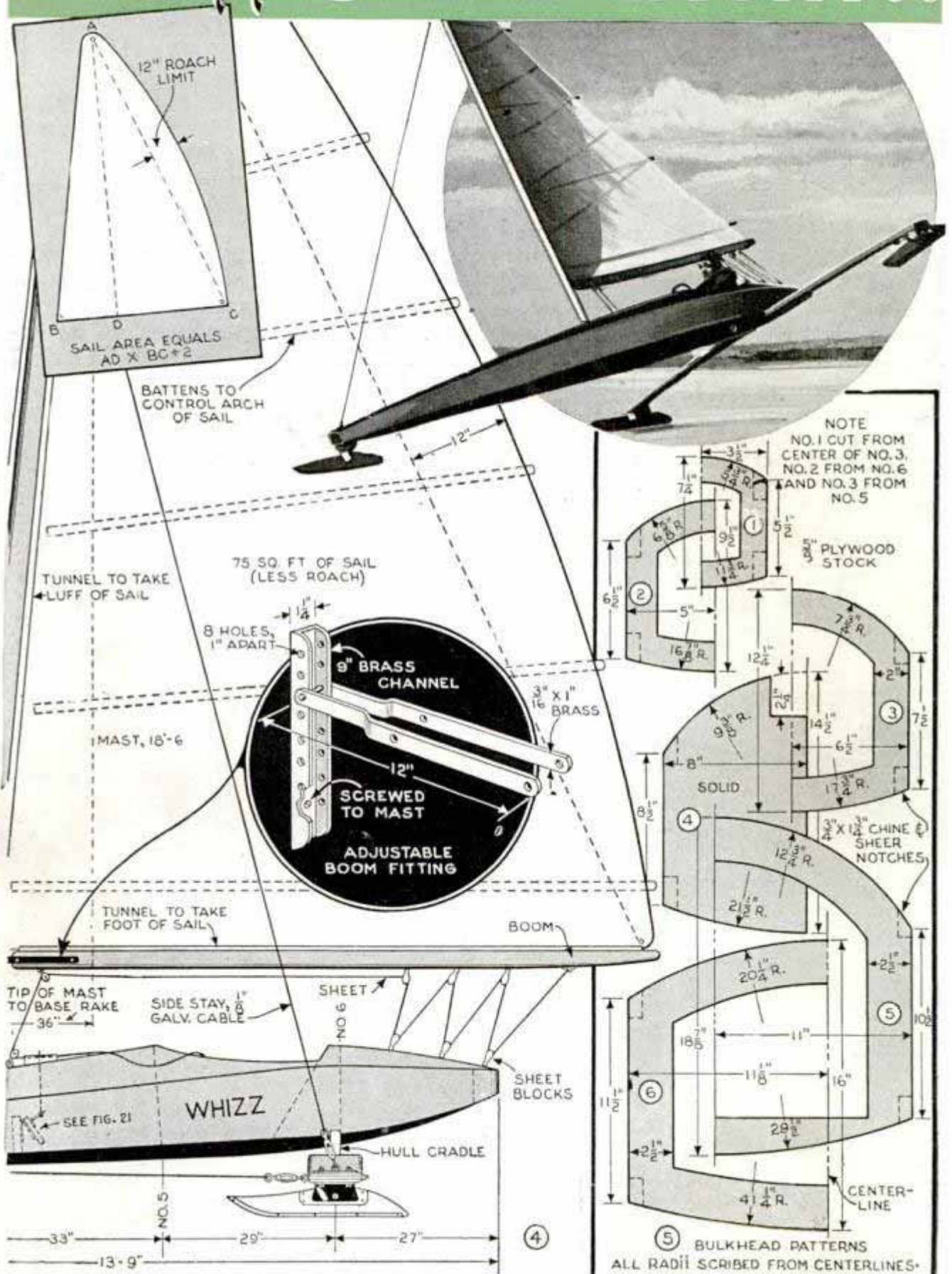


bulkheads, the smaller ones are made. There's no need to make paper patterns—just lay out the outlines directly on the plywood. Chine and sheer notches are cut slightly undersize and finished later when fitting these pieces. Place a 2 by 4-in. plank on edge across a couple of sawhorses. Bulkheads can be fastened temporarily to

IN BUILDING this ice yacht, you start by carefully going over the drawings to get acquainted with all constructional details. The six bulkheads, dimensioned in Fig. 5, are cut out of a $\frac{5}{8}$ by 24 by 72-in. panel of fir plywood. Centers of all bulkheads except No. 4 are cut out and from the cutout stock of the larger



Class-E ICE YACHT..



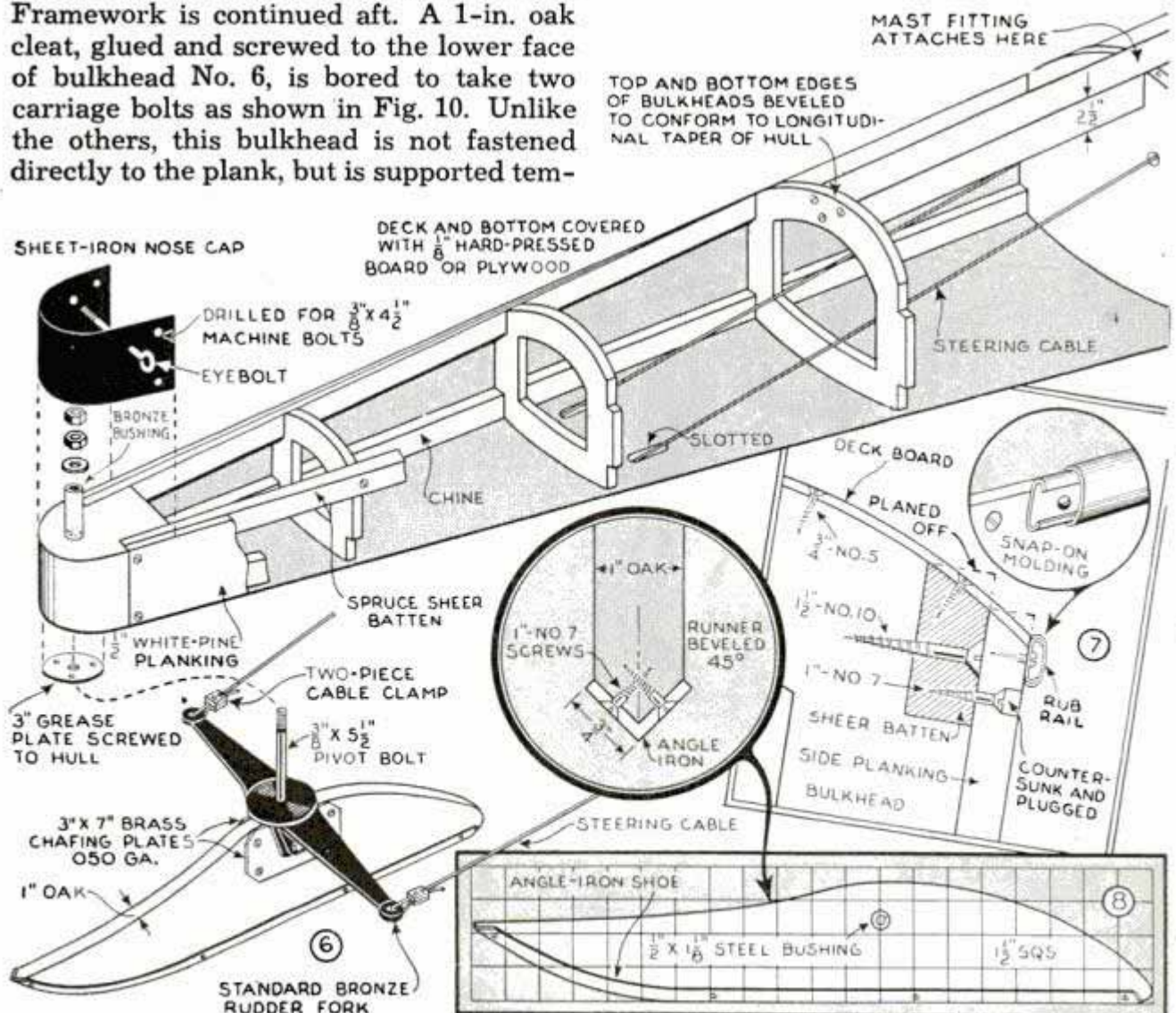
this plank while assembling the hull framework. Center-to-center spacing of the bulkheads is given in the side view, Fig. 4. Begin assembling by fastening the nose block, Fig. 3, to the plank with a lag screw inserted through the pivot hole. Then toenail bulkhead No. 5 to the plank in its correct location, after which a light straightedge is laid across the top of both nose block and bulkhead to determine the bevel to which the outer edges of the bulkhead should be cut in order to conform to the longitudinal taper of the hull.

After locating and beveling the intervening bulkheads, the chine and sheer battens of $\frac{3}{4}$ by $1\frac{3}{4}$ -in. spruce are fitted, casein-glued and screwed in the nose-block rabbets and bulkhead notches, using No. 10, $1\frac{1}{2}$ -in. f.h. brass or galvanized screws. Allow the sheer and chine pieces to extend all the way back. Next, the oak mast support is glued and screwed in place. The top edge of this piece is crowned slightly to conform to deck contour. Framework is continued aft. A 1-in. oak cleat, glued and screwed to the lower face of bulkhead No. 6, is bored to take two carriage bolts as shown in Fig. 10. Unlike the others, this bulkhead is not fastened directly to the plank, but is supported tem-

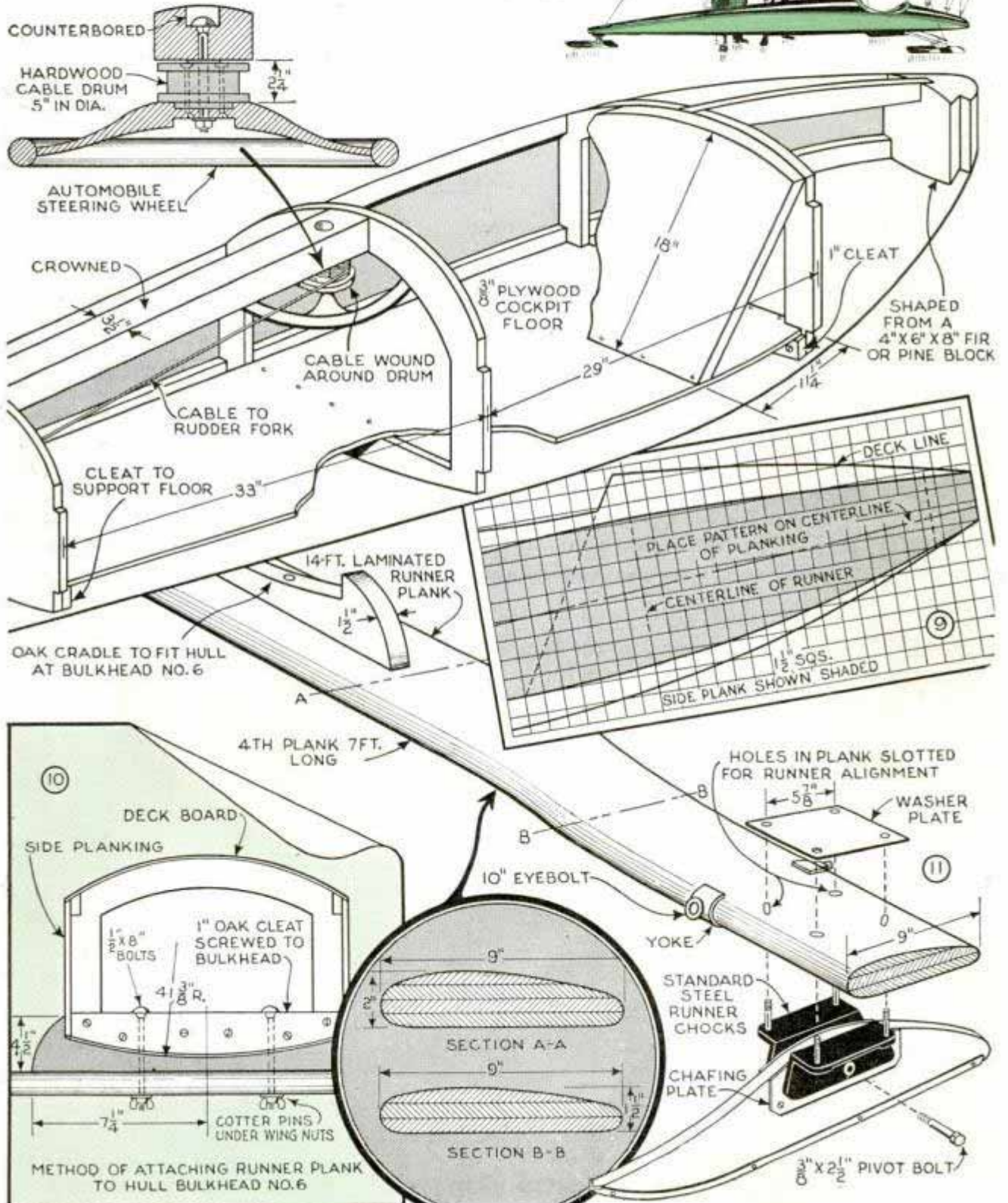
porarily about $1\frac{1}{2}$ in. above the top edge of the plank to maintain the sweep of the hull. The natural curve of the battens when fastened at this point will bring the bulkhead in true position. After fastening the tail block in place, a $\frac{3}{4}$ -in. center brace is fitted between the bulkhead and tail block.

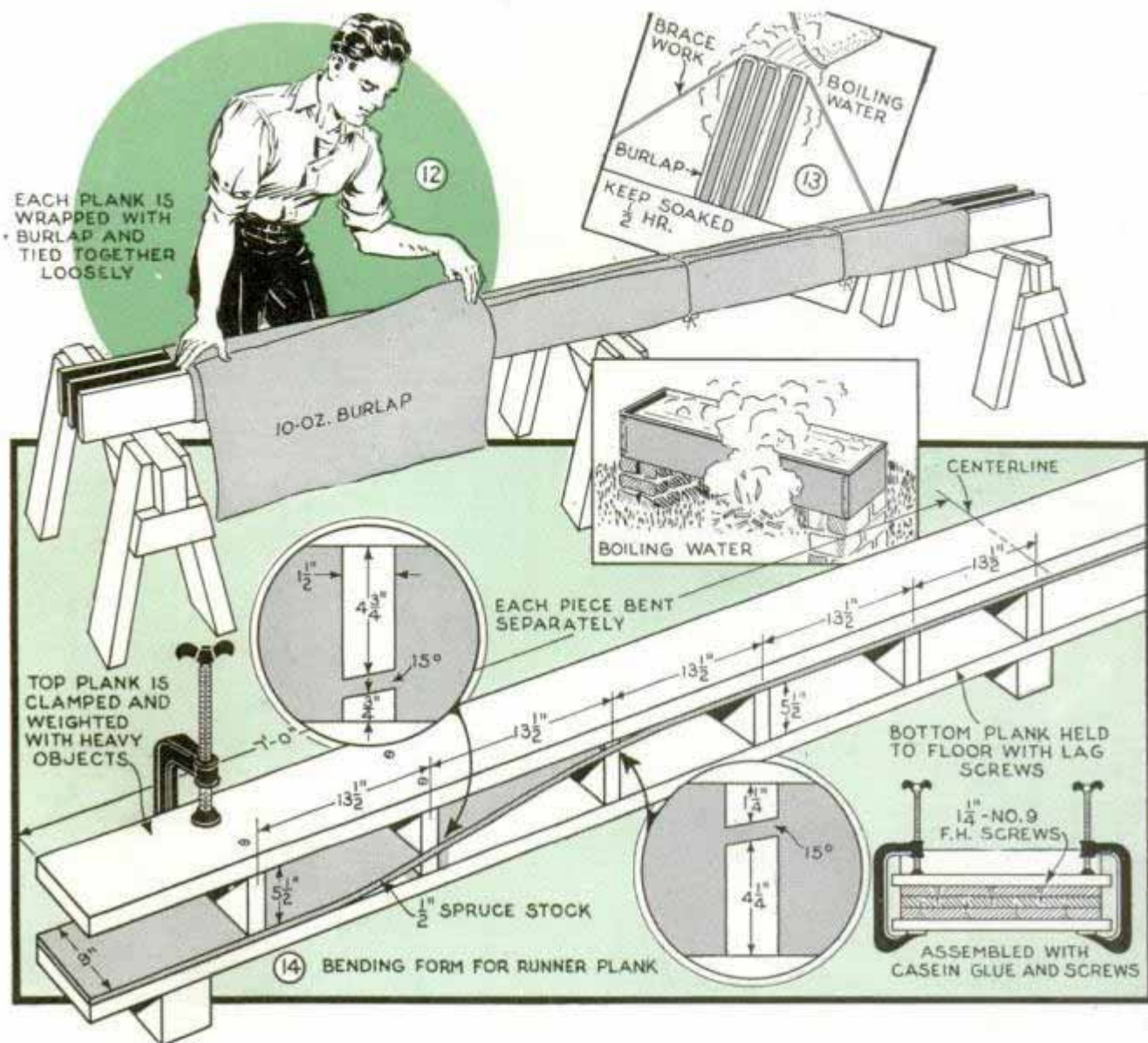
Now for the side planking: The shaded portion of the pattern in Fig. 9 represents the shape of the side planking 39 in. from the tail of the hull, the lines being straight from this point forward. The centerline of your paper pattern, which is made accordingly, is laid directly over a centerline struck on the planking and the curved outlines traced off. After the planking is cut to shape, first, temporarily fasten it in place to the battens for a test fit before permanently fastening with casein glue and No. 7 1-in. brass screws, spaced about 4 in. apart. The batten edges should come about flush with the planking.

Before the deck and bottom covering are



applied, the edges of battens and planking must be planed off so that they will be flush and on the same angle as the bulkheads. See Fig. 7. Also, the cockpit floor and back are fitted. And, don't forget the bolts in the cleat on bulkhead No. 6, nor the counterbored hole for the steering-wheel pivot bolt. Paper patterns of the deck and bottom to guide in cutting the hard-pressed board can be made by laying



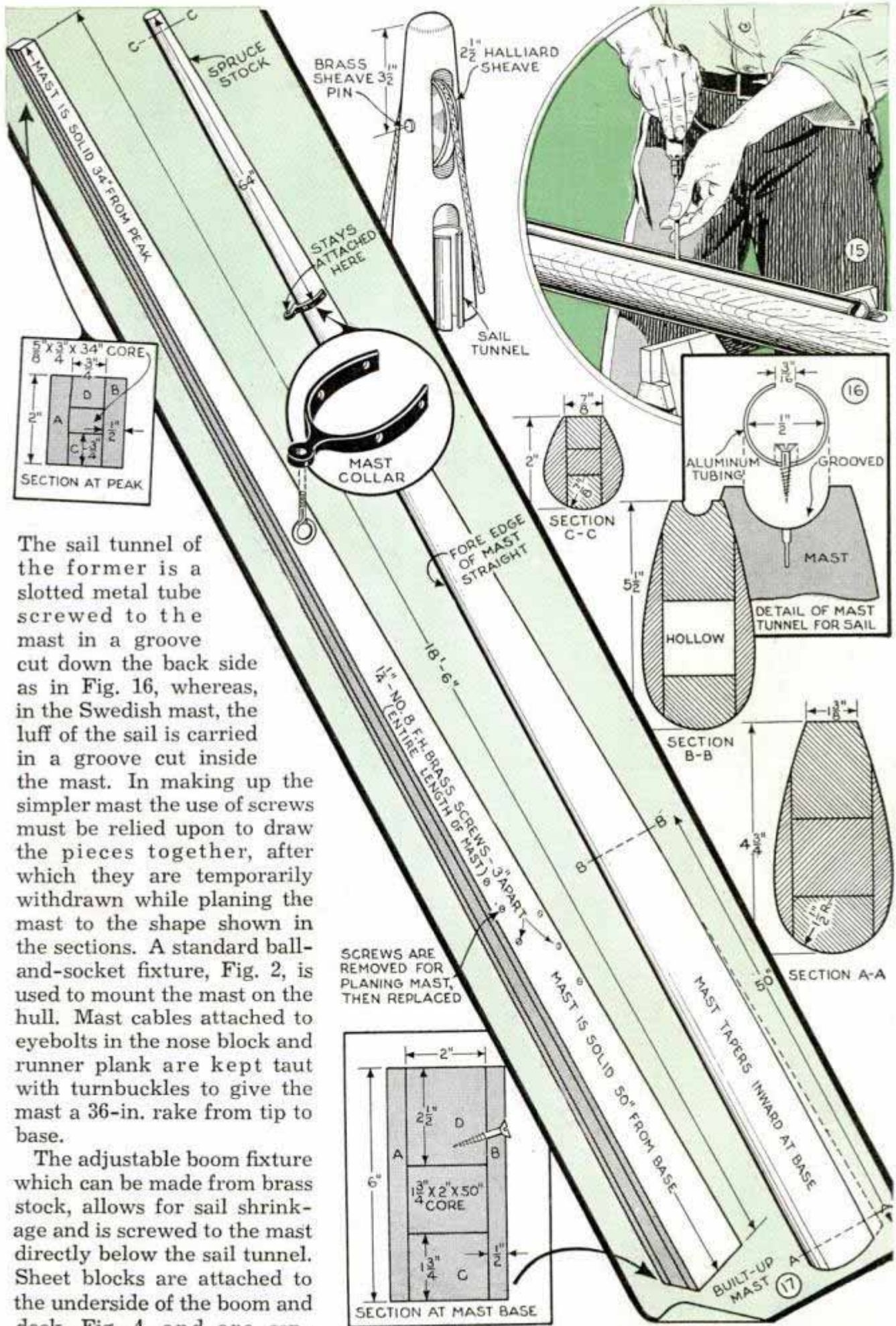


large sheets of heavy wrapping paper over the framework, fastening it here and there with thumbtacks. Use No. 5, 3/4-in. brass screws spaced 3 in. apart for fastening the covering. After trimming the edges flush with the side planking, a 1/2-in. standard rub-rail molding is attached over the joint.

The runner plank, Fig. 11, comes next. It is built up from four pieces of 1/2-in. spruce to give spring action. Figs. 12, 13 and 14 show how the pieces are wrapped loosely with burlap and steamed before being clamped separately in a wooden form until thoroughly dry. When each piece has been bent, the three upper planks are glued, clamped and screwed solidly together with No. 8, 1 1/4-in. brass screws, after which a fourth auxiliary plank, 7 ft. long, is screwed to the bottom side at the center. The complete assembly is then shaped as shown in the sectional detail of Fig. 11. For ease in transportation the run-

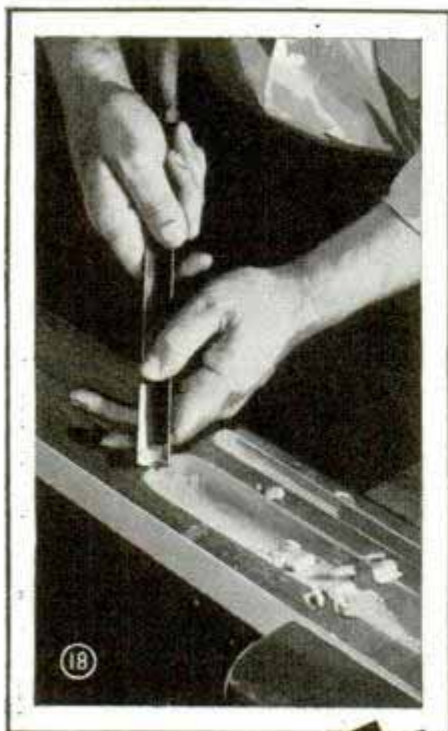
ner plank is made quickly detachable from the hull by means of an oak cradle cut and bored to receive the two projecting bolts at bulkhead No. 6, as in Fig. 10. Cotter pins through the bolts prevent the wing nuts from working off. The runners, cut and shaped from 1-in. oak as in Fig. 8, are pivoted in standard runner chocks, shown in Figs. 6 and 11. The bronze rudder fork, Fig. 6, bears on a 3-in. grease plate screwed to the bottom of the hull. Rear runner chocks are bolted to the runner plank in slotted holes to permit runner alignment. The 1/8-in. galvanized side stays stretched from eyebolts fitted through the edge of the runner plank and nose block are fastened with small cable clamps and drawn taut with turnbuckles, as in Fig. 1.

Choice of two types of mast and boom construction is given in Figs. 15 to 20 inclusive. The one in Fig. 17 is simpler than the Swedish type of mast shown in Fig. 19.

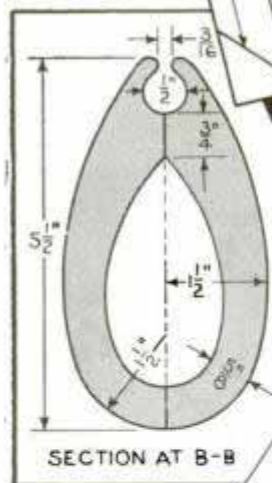
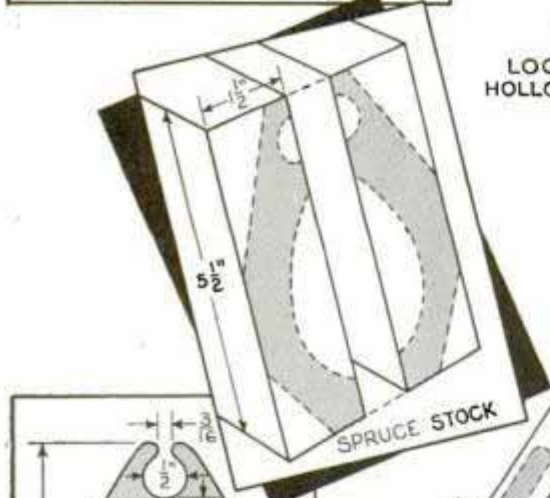


The sail tunnel of the former is a slotted metal tube screwed to the mast in a groove cut down the back side as in Fig. 16, whereas, in the Swedish mast, the luff of the sail is carried in a groove cut inside the mast. In making up the simpler mast the use of screws must be relied upon to draw the pieces together, after which they are temporarily withdrawn while planing the mast to the shape shown in the sections. A standard ball-and-socket fixture, Fig. 2, is used to mount the mast on the hull. Mast cables attached to eyebolts in the nose block and runner plank are kept taut with turnbuckles to give the mast a 36-in. rake from tip to base.

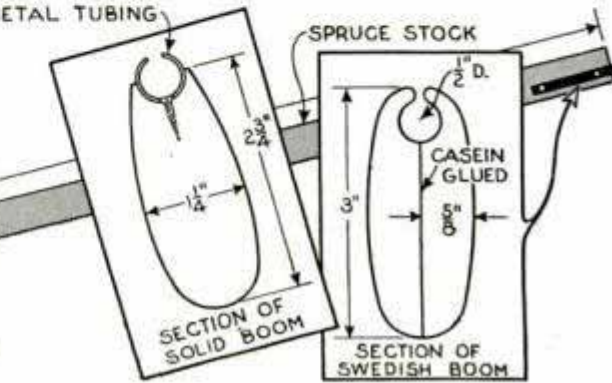
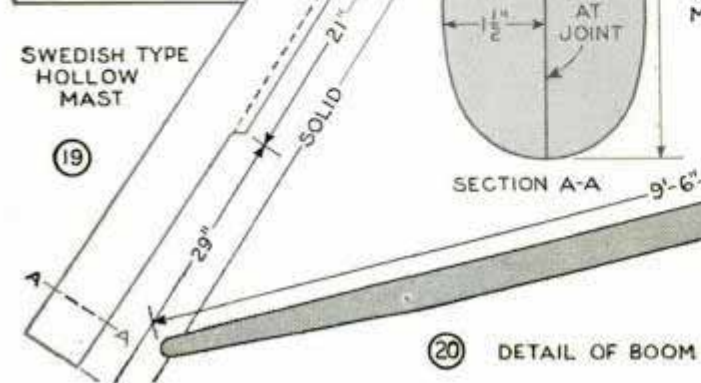
The adjustable boom fixture which can be made from brass stock, allows for sail shrinkage and is screwed to the mast directly below the sail tunnel. Sheet blocks are attached to the underside of the boom and deck, Fig. 4, and are con-



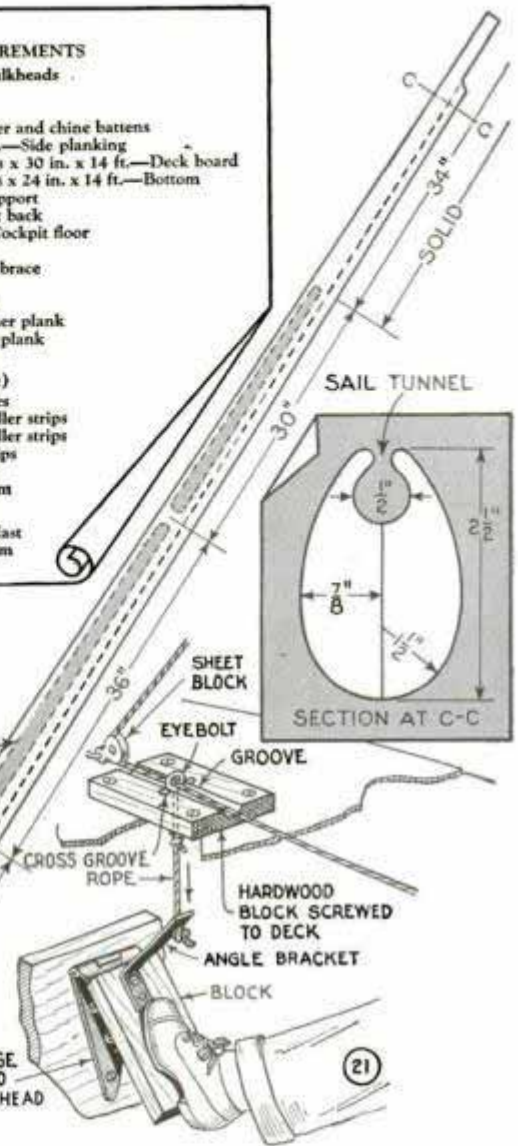
- LUMBER REQUIREMENTS**
- 1 pc. Fir plywood 5/8 x 24 x 72 in.—Bulkheads
 - 1 pc. Fir 5 x 5 x 7 in.—Nose block
 - 1 pc. Fir 4 x 6 x 8 in.—End block
 - 4 pcs. Spruce 3/4 x 1 3/4 in. x 14 ft.—Sheer and chine battens
 - 2 pcs. White pine 1/2 x 11 3/4 in. x 14 ft.—Side planking
 - 1 pc. Hard-pressed board or plywood 1/8 x 30 in. x 14 ft.—Deck board
 - 1 pc. Hard-pressed board or plywood 1/8 x 24 in. x 14 ft.—Bottom
 - 1 pc. Oak 2 1/2 x 3 1/2 x 36 in.—Mast support
 - 1 pc. Fir plywood 5/8 x 20 x 24 in.—Seat back
 - 1 pc. Fir plywood 3/8 x 24 in. x 6 ft.—Cockpit floor
 - 1 pc. Oak 1 x 3 x 40 in.—Floor cleats
 - 1 pc. White pine 3/4 x 3 x 30 in.—Deck brace
 - 1 pc. Oak 1 x 5 x 16 in.—Hull cradle
 - 1 pc. Oak 2 1/2 x 6 x 6 in.—Cable drum
 - 3 pcs. Spruce 1/2 x 9 in. x 14 ft.—Runner plank
 - 1 pc. Spruce 1/2 x 9 in. x 7 ft.—Runner plank
 - 1 pc. Oak 1 x 6 in. x 8 ft.—Runners
- Mast and Boom (built-up type)**
- 2 pcs. Spruce 1/2 x 6 in. x 18 1/2 ft.—Sides
 - 2 pcs. Spruce 2 x 2 1/2 in. x 18 1/2 ft.—Filler strips
 - 2 pcs. Spruce 1 3/4 x 2 in. x 18 1/2 ft.—Filler strips
 - 1 pc. Spruce 1 3/4 x 2 x 50 in.—Core strips
 - 1 pc. Spruce 1 x 1 x 36 in.—Core strips
 - 1 pc. Spruce 1 1/4 x 3 in. x 9 1/2 ft.—Boom
- Mast and Boom (Swedish type)**
- 2 pcs. Spruce 1 1/2 x 6 in. x 18 1/2 ft.—Mast
 - 2 pcs. Spruce 3/4 x 3 in. x 9 1/2 ft.—Boom



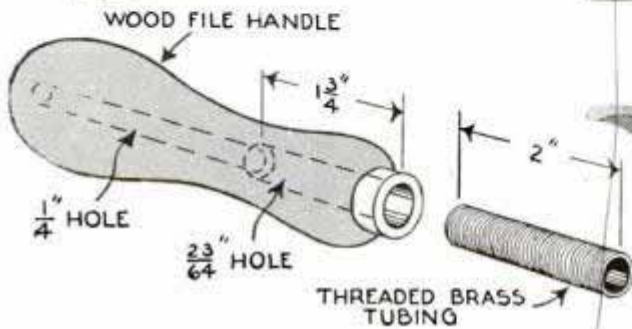
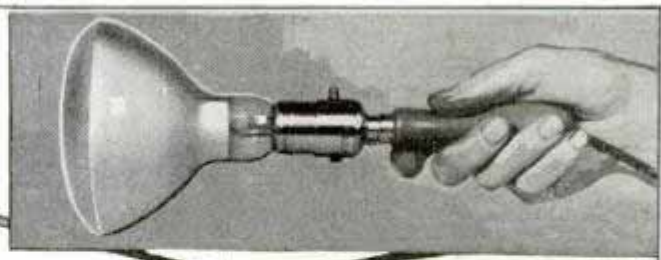
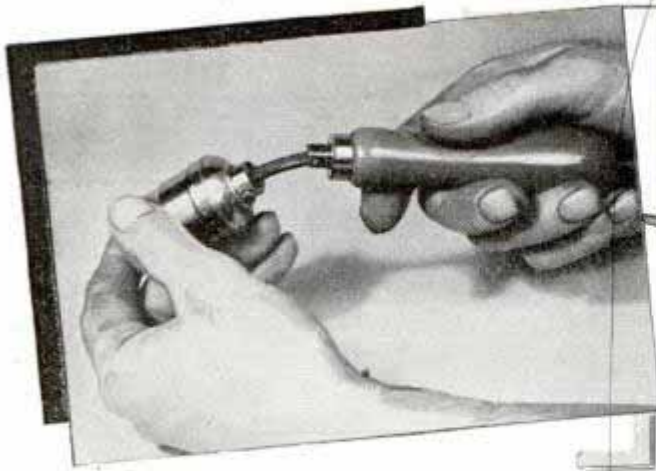
LOCATIONS OF HOLLOWED SECTIONS



trolled by a pedal, Fig. 21, which eliminates holding the sheet continuously by hand. It is recommended that the sail be purchased from a dealer. The steering cables are fastened to the cross-piece on the front runner with cable clamps, and a turnbuckle should be installed at a convenient point so that the cable can be kept taut without the necessity of removing the cable clamps.



Cool Handle on "Mushroom" Photo Lamp

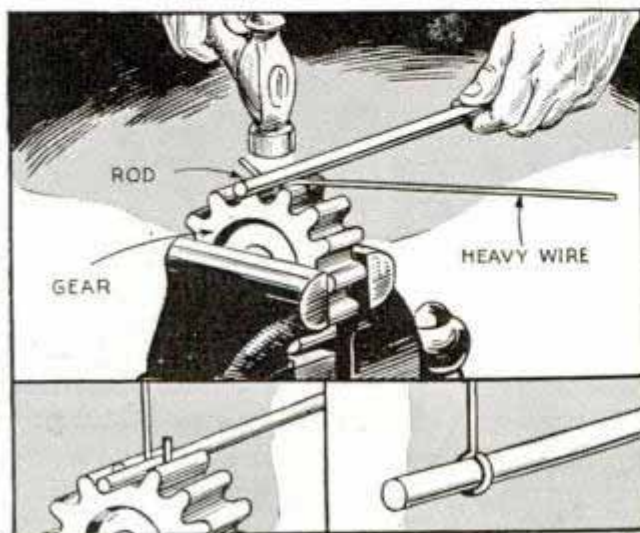


Photoflood lamps of the new R-2 type, in which the reflector and lamp are combined, cannot be held comfortably by the socket due to the heat. A cool holder on the socket can be provided by using a wooden file handle. A hole is drilled lengthwise through the center to take a threaded brass tube or a $\frac{1}{4}$ -in. pipe nipple, which can be purchased at a dime or hardware store. Turn the nipple into the

file handle to project about $\frac{1}{4}$ in. Then screw a push-switch socket onto the nipple, assemble the socket and connect a cord and plug through the handle.

Eyes Formed on Rods and Wire with Aid of an Old Gear

When you want to form an eye on a small rod or a piece of heavy wire, use an



old gear clamped in a vise as a former. To shape the eye, lay the work across two teeth of the gear and force it down between them with an iron rod and a hammer as shown. This shapes part of the eye, which is completed by bending the projecting end of the work around the rod as in the lower left-hand detail. You can make chain links and do similar work in the same way. If you pick up several old gears having the teeth spaced differently, you can form eyes of various diameters.

☞ You will find that rectangular-shaped doilies provide a much wider space on your dining table for silver and glasses than the round or oval ones.

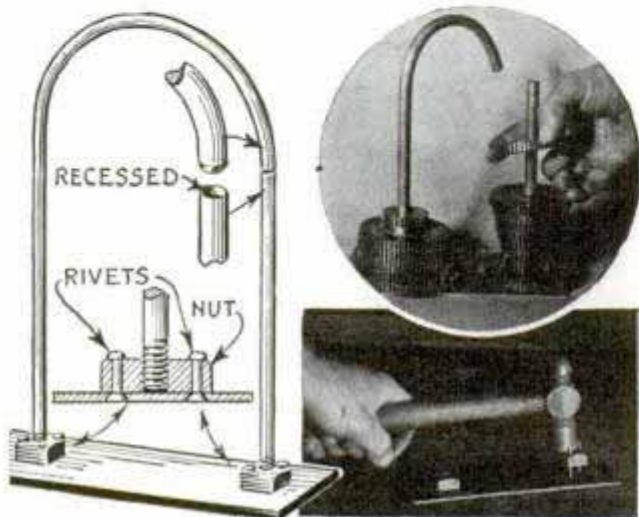
Safety Pin Keeps Thread Spool Close at Hand



When sewing large work such as quilts, a blanket pin is just the thing for keeping a spool of thread at hand. The pin is run through the spool and fastened to the work. This allows the spool to turn as thread is unwound, yet keeps the spool from rolling off on the floor.

Improved Lathe Gear Holder

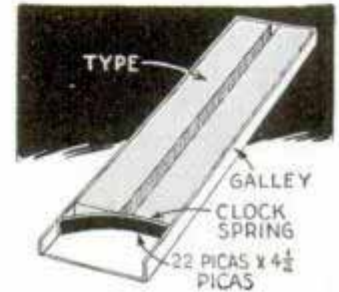
Assembled from a piece of heavy sheet metal and a couple of bolts, this lathe gear holder will do away with the inconvenience of replacing the gears on a single spike, or serve as a space saver for the



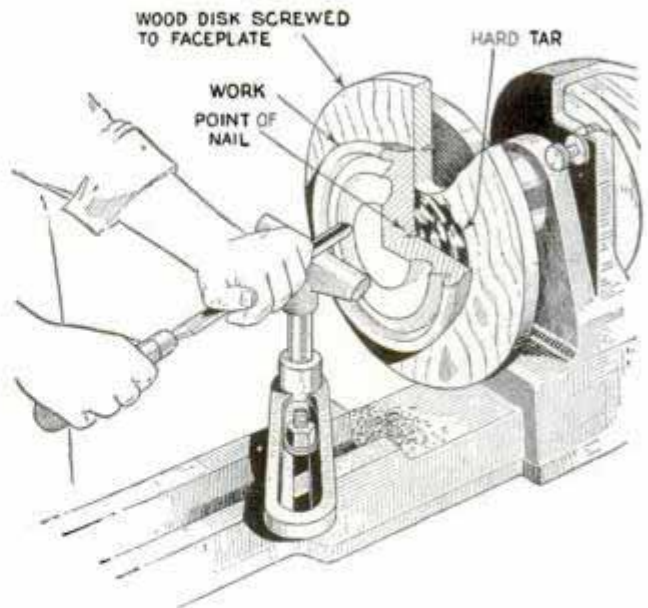
machinist who keeps his lathe gears on separate pegs. Two threaded nuts are riveted to a metal base, the dimensions of which vary according to the size and number of gears for which the holder is intended. One upright member is a headless bolt long enough to hold all of the gears and the other is a longer bolt bent into an arc as shown. The end of the short bolt is recessed and the long bolt is rounded to fit into it. In using the holder, you move the gears from side to side until the desired gear is reached, then swing the handle over and remove it.

Spring Locks Type in Galley

To keep type in position in a galley, one printer uses a length of clock spring. This is sprung into place so that the edges bear tightly against the galley sides. The spring is especially useful for locking the type in position for taking galley proofs and for storing.



Tar Holds Work on Faceplate to Turn Rosettes



Stock for turning thin decorative pieces can be held on a lathe faceplate with tar. First screw a disk to the faceplate and put a point in the center for centering the work to be turned, making a small indentation

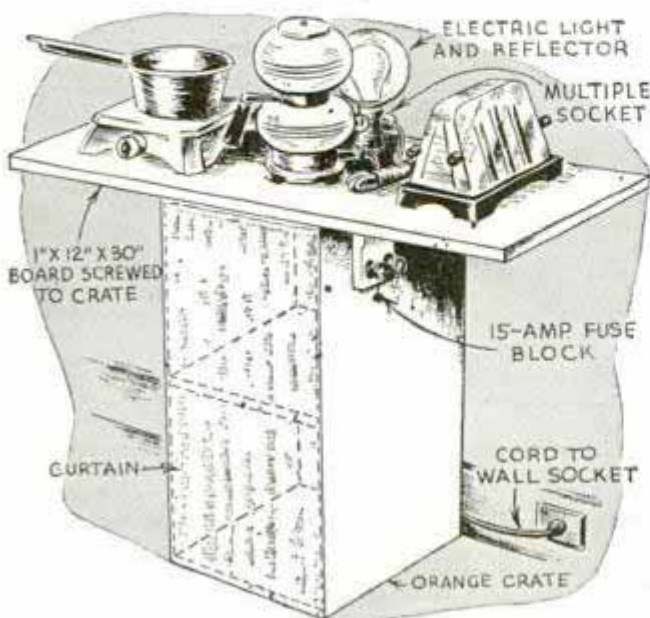
in the back of the work to take the point. Then start the lathe and hold a piece of hard tar against the disk. Heat caused by friction will soon soften the tar so that some adheres to the disk. Hold the work against the faceplate with the lathe still rotating for a few seconds and then let it go and it will stick tightly to the disk. After the turning has been done, the work can be separated from the disk with a chisel, which is tapped lightly with a hammer.

—L. Malecki, Chicago.

Portable "Kitchen" Made from Orange Crate

Living in a rooming house where there were no facilities for cooking, one girl made herself a portable "kitchenette" from nothing more than an empty orange crate and a wide board. The board was screwed to one end of the crate to serve as a table top on which were set an electric hot plate, toaster, coffee percolator, etc. An electric cord for plugging into a wall outlet was run through a fuse box on the side of the crate to a multiple outlet box on the table top for plugging the various accessories. Painting the top and covering the crate with cloth, with a curtain in front, completed the job. Dishes and silverware were stored on the shelves of the orange crate.

—H. Small, Kansas City, Mo.



Ash Tray Clamped to Lamp Always at Hand When Reading



Regardless of how a room is decorated, one or more bridge or reading lamps are usually located near a comfortable chair or davenport, which is the ideal location for an ash tray. The one shown was turned from walnut, to take a glass tray, and clamped to the lamp standard by means of a wood bracket. After filling the pores of the wood with paste filler, apply two coats of good varnish, then rub down with oil and pumice.

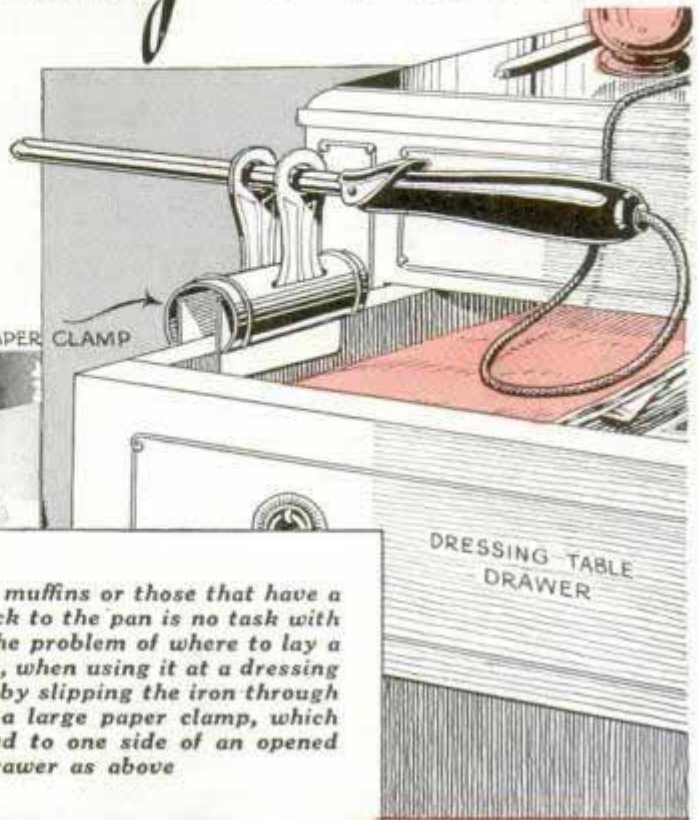
Silencing Noisy Sink Drain

Sink drains that are noisy because of a long fall from the strainer to the water in the trap can be silenced by inserting a twisted strip of sheet aluminum into the drain as shown. The strip keeps the water from splashing in the trap and can be removed easily for cleaning.

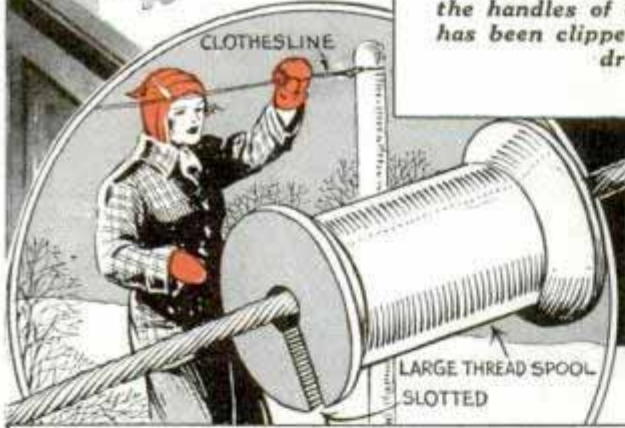


☐ If your linoleum is soiled badly, a little kerosene added to the wash water loosens the dirt, and makes washing easier.

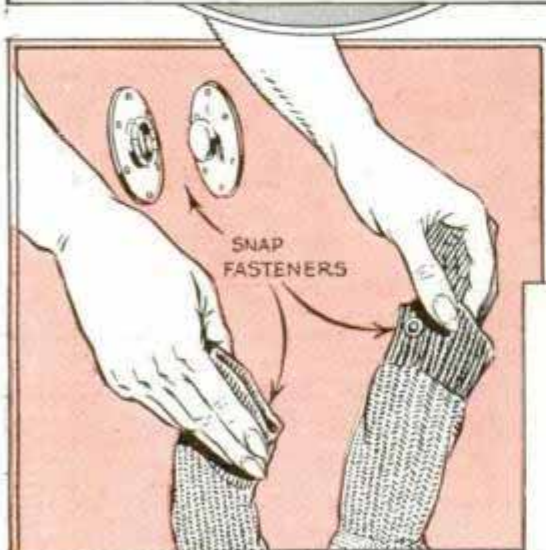
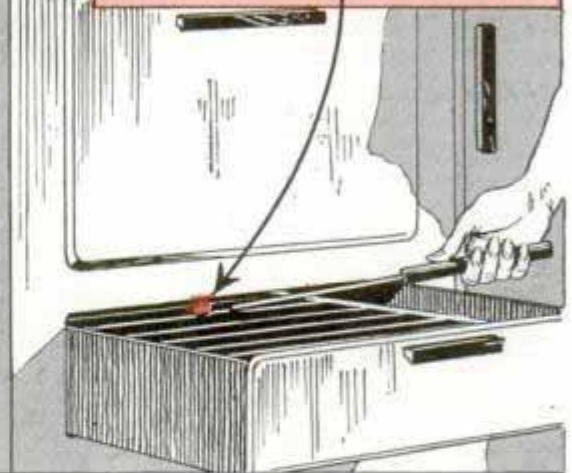
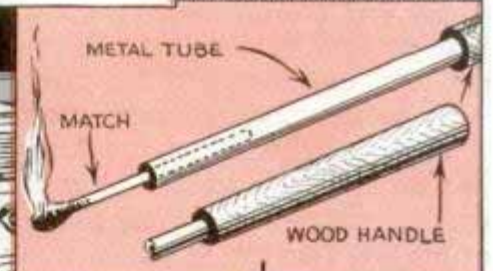
Solving HOME



Removal of hot muffins or those that have a tendency to stick to the pan is no task with these tongs. The problem of where to lay a hot curling iron, when using it at a dressing table, is solved by slipping the iron through the handles of a large paper clamp, which has been clipped to one side of an opened drawer as above

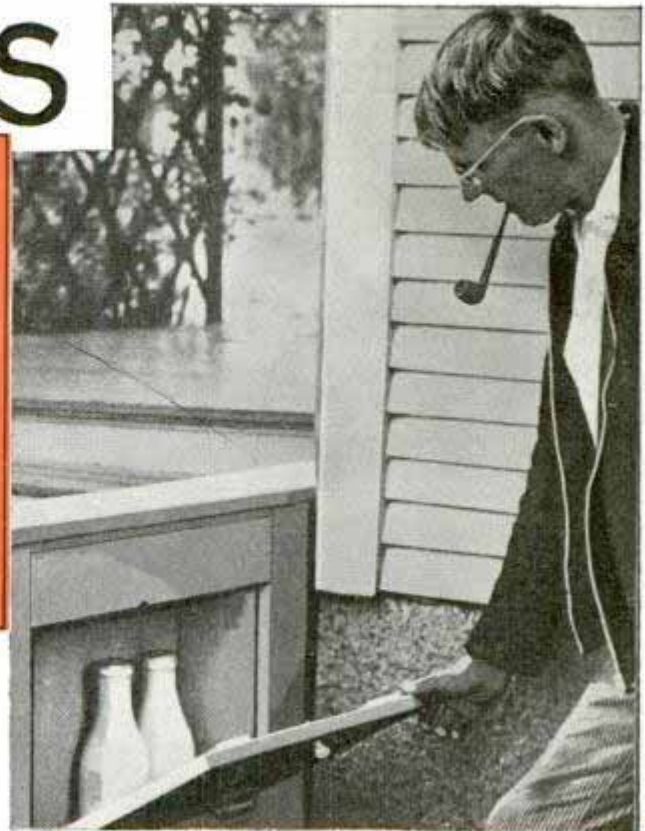
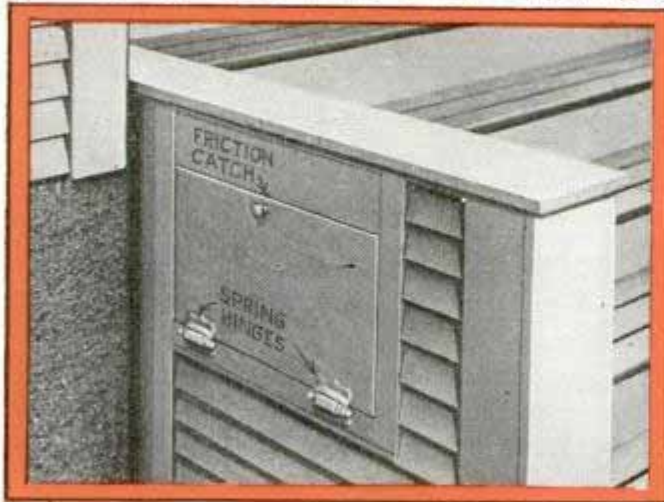


Cleaning ice from an outdoor wire clothesline in winter is easy if you use an empty thread spool slotted as above

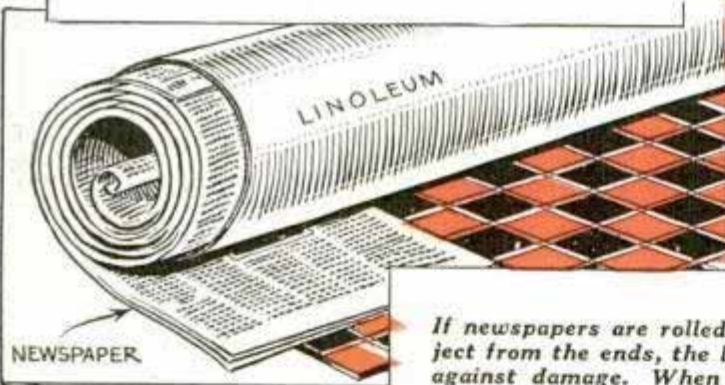


To keep children's stockings in pairs while washing and drying them, use snap fasteners. Sew half of a fastener to one stocking of each pair as at the left. This saves time in sorting after they have been laundered. A small metal tube to take a match snugly in one end, and a wood grip in the other end, is handy for lighting an oven of a gas stove. The tube keeps your fingers away from the flame

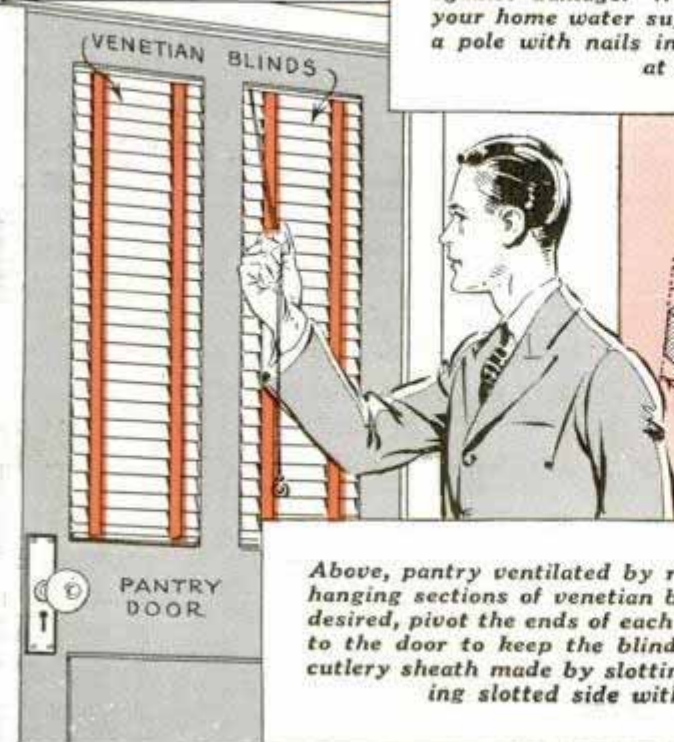
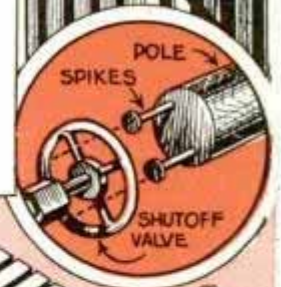
PROBLEMS



There is no worry about cats and dogs getting at your milk in the morning if you have a cabinet built into the porch steps as above. A door pivoted over the cabinet opening with spring hinges and fitted with a friction catch prevents the milkman from leaving it open

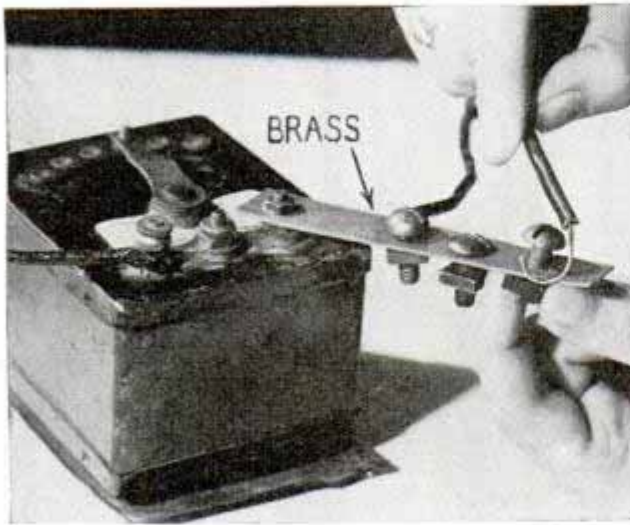


If newspapers are rolled with linoleum to project from the ends, the latter will be protected against damage. When the shut-off valve to your home water supply is hard to get at, use a pole with nails in the end to operate it as at the right



Above, pantry ventilated by removing door panels and hanging sections of venetian blinds in the openings. If desired, pivot the ends of each lower slat of the sections to the door to keep the blinds from swinging. Right, cutlery sheath made by slotting wood block and covering slotted side with thin plywood

Extra Binding Posts on Terminal of Small Transformer

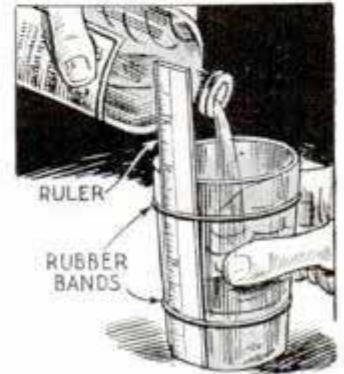


In experimental work where it is sometimes necessary to attach several wires to one binding post of a small transformer or

battery, drill several holes in a strip of brass and fasten it to the terminal. This will enable you to attach the wires individually with small bolts in the holes of the strip so that they can be connected or removed as desired without disturbing the others.—W. Dennis, Riverside, N. J.

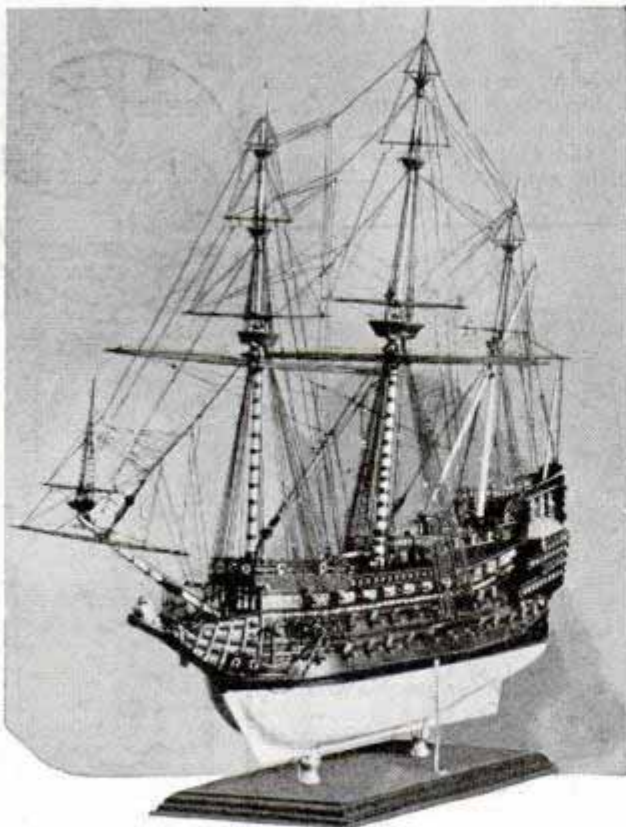
Pocket Rule and Glass Tumbler Provide Emergency Graduate

A graduate for emergencies, especially for measuring comparative quantities of liquids, may be made by fastening a pocket ruler to the side of a glass tumbler with two rubber bands.



A Masterpiece in Ship Models

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. Descriptive data in book form \$1.25 extra.

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"Sea Bee"—905 to 968: 32 in. speed boat for circular race courses. Powered by midget gas engine—\$1.00.

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.

Any six of these blueprints (not projects) will be sent postpaid upon receipt of \$1.00

Blueprint Department, Popular Mechanics Magazine, 200 E. Ontario St., Chicago



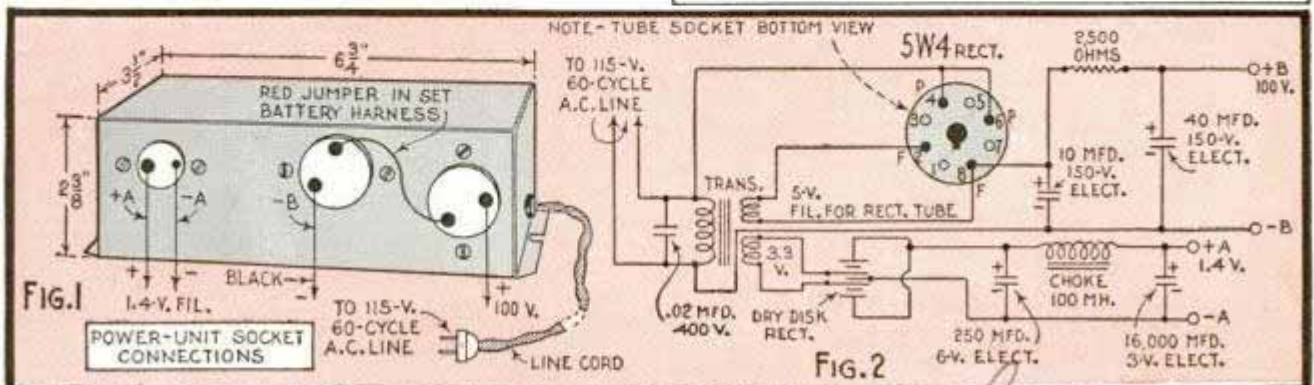
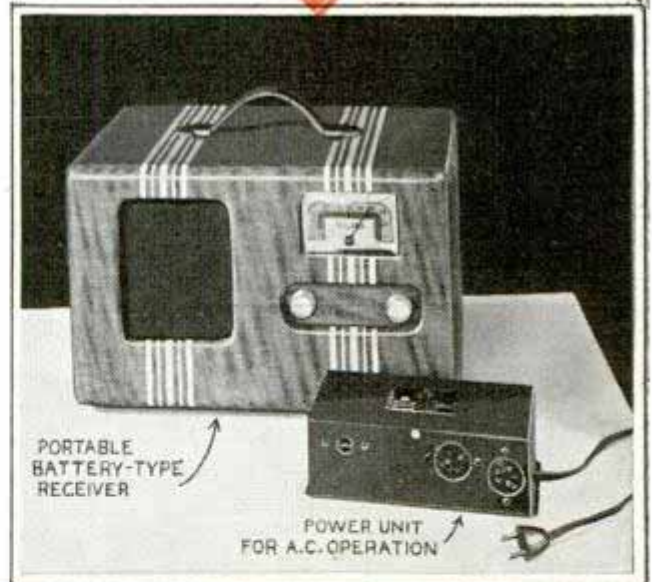
Radio

"A" and "B" ELIMINATOR for Portable Sets

IT IS no longer necessary to put away your portable battery-operated vacation receiver when winter comes. At home or in a.c. power locations, you can remove the dry batteries, substitute this inexpensive "A" and "B" eliminator, and operate the set at a negligible cost.

This compact battery eliminator is suitable for use with any standard portable set which employs 1.4-volt tubes. Operating from the 115-volt 60-cycle a.c. power source, it supplies the required filament and B-voltage for the circuits, providing at all times the same hum-free performance as obtained with new dry batteries.

Assembly and circuit details are given in Figs. 1 and 2; the parts are available in kit form from radio supply houses. When assembled in the metal container, there is nothing to adjust, merely attach the regular set battery plugs and insert the line plug in your electric-light socket. Operating cost is estimated at about eight cents per month, if used for three hours each day. Improved transformer, hum-filtered dry-disk rectifier and high-capacity electrolytic filter condensers make this efficient compact lightweight unit possible.



*Electro Product Laboratory 135
549 W. Randolph Street*

Do not use. Costs obsolescent.

How to Build an Inexpensive

By Harry A. Fore

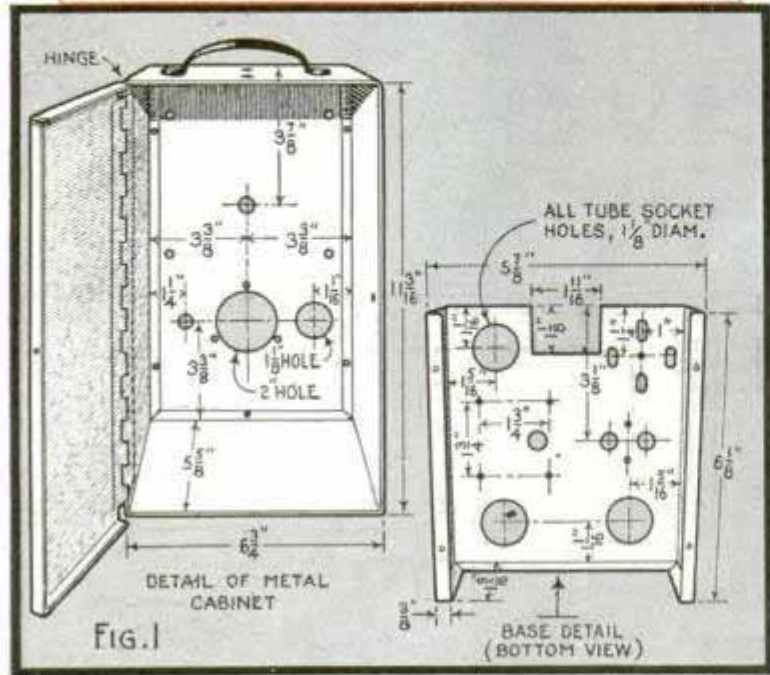
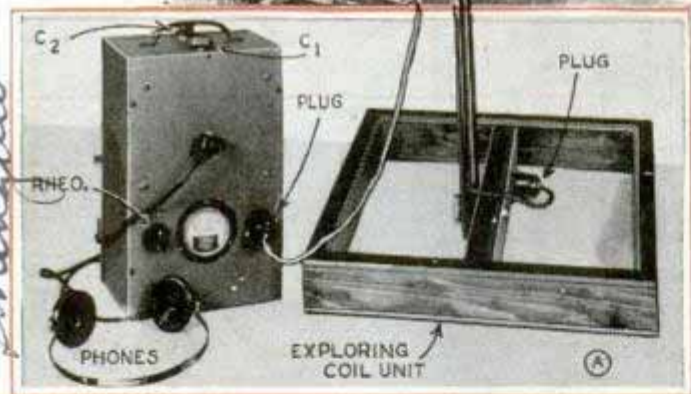
FOR many years treasure-finder enthusiasts have tried to make use of beat-frequency circuits for detecting small metal objects. Theoretically the idea is fine. In actual practice, however, such instruments have not proved entirely satisfactory because the body, or hand, of the operator, and surrounding vegetation, produce such tremendous changes in capacitance that any effect due to changes in the inductance caused by metal objects within the field, is completely masked.

The "Chilson"-type metal-detecting device to be described enjoys all the theoretical advantages of the beat-frequency instrument without any of the disadvantages caused by extraneous capacity effects, and is adjustable to zero beat. This highly efficient little instrument was designed for locating buried metallic objects; it is also suitable for exploring masonry and walls for hidden metal objects, and tracing out pipes. It employs only a single loop unit connected to a metal box containing the instrument. The circuit is easily adjusted for zero signal, or near-zero signal, and metal brought into the field of the loop sets up a sort of "clucking" sound in the headphones. When correctly adjusted, this clucking noise will be heard when a large sheet of any metal is brought within 5 ft. of the exploring coil unit. If a good adjusting job has been done the signal will change from zero beat to a slow clucking sound when a 3-in. square piece of sheet metal is brought within 12 in. of the loop. A coin as small as a dime, when held within a few inches of the center of the loop, will cause the signal to appear.

Although the metal instrument cabinet and drilled base are available, construction details are given



Commercial instruments made by Proddak Co 1031 Broadway Los Angeles



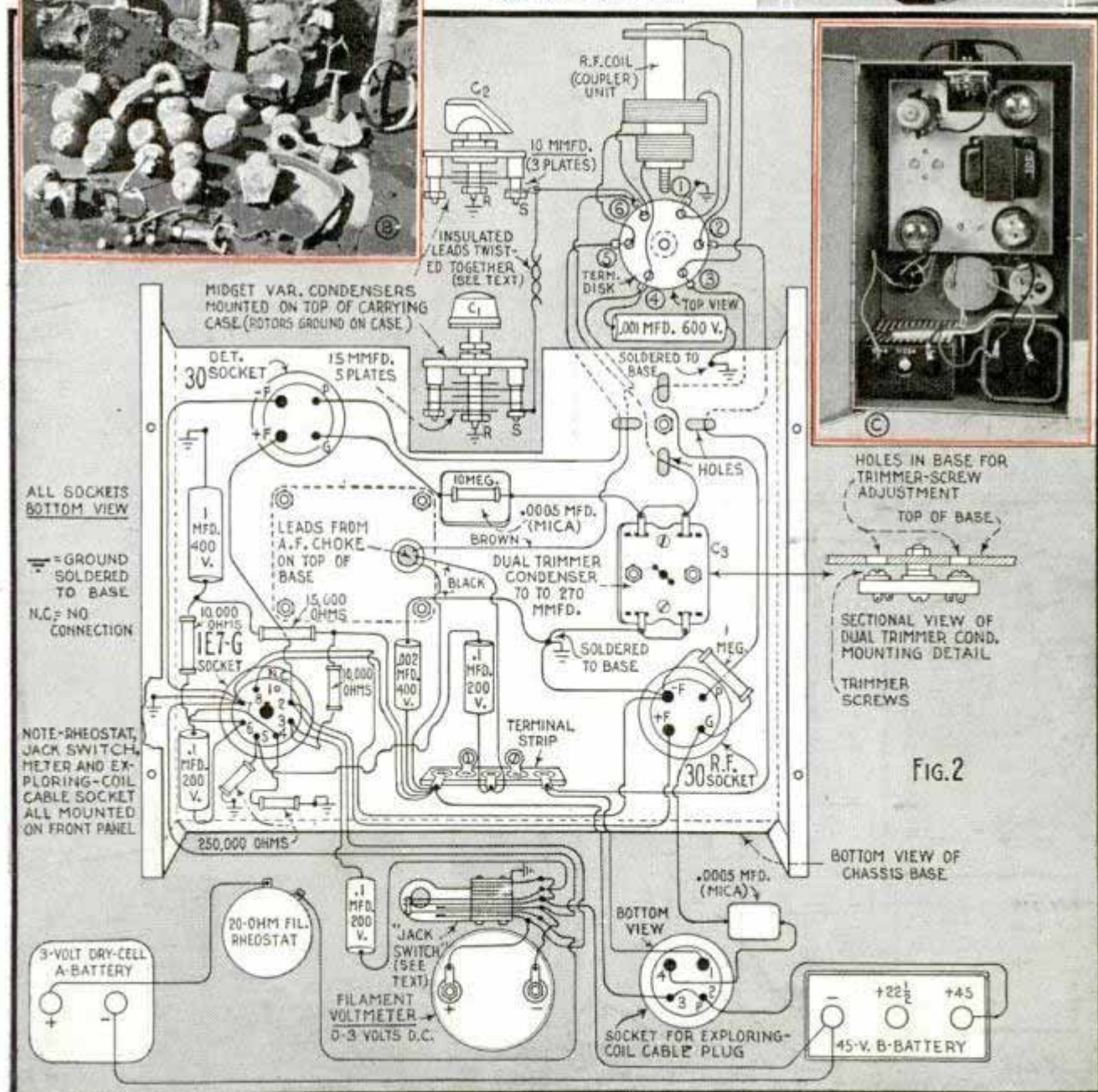
similar

TREASURE FINDER

in Fig. 1 for those who wish to make their own. The simplified wiring diagram, Fig. 2, shows all connections under the base and includes all leads running up to the parts mounted on top of the base and those mounted on the back of the front panel and top of cabinet. All parts are standard except three special foundation units, namely, the r.f. coupling coil, complete exploring coil unit and a.f. choke. Although these three parts are special, they only cost the builder about \$15.75, and the manufacturer has made them available either direct, or through several large mail-order radio-parts houses. The double filament circuit-control phone jack is a "Yaxley" type. A good

(Continued to page 133A)

Left, old cannon balls and other relics recovered at Fort Ticonderoga, N. Y., with this type of instrument



Welden Hgg. Van Buren Chesay

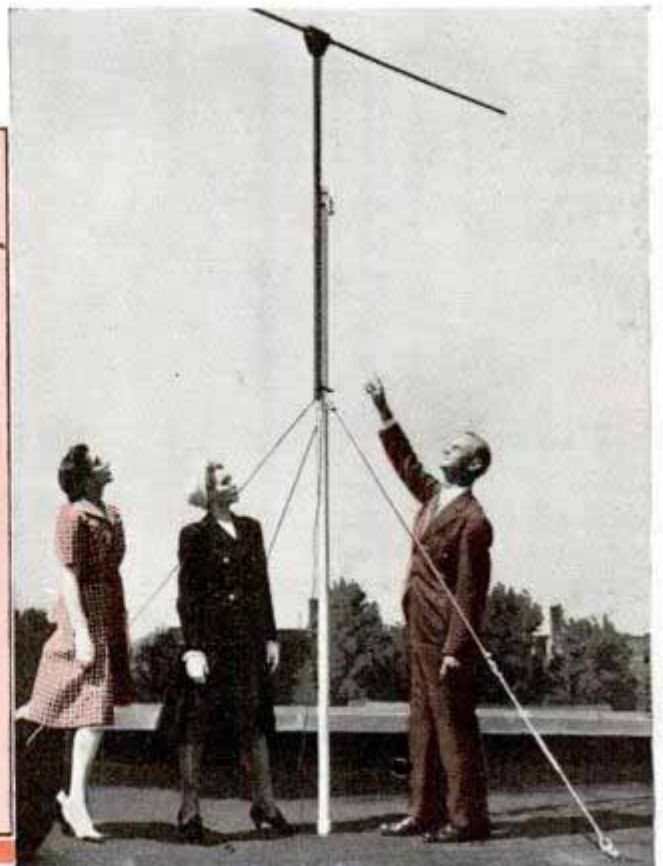
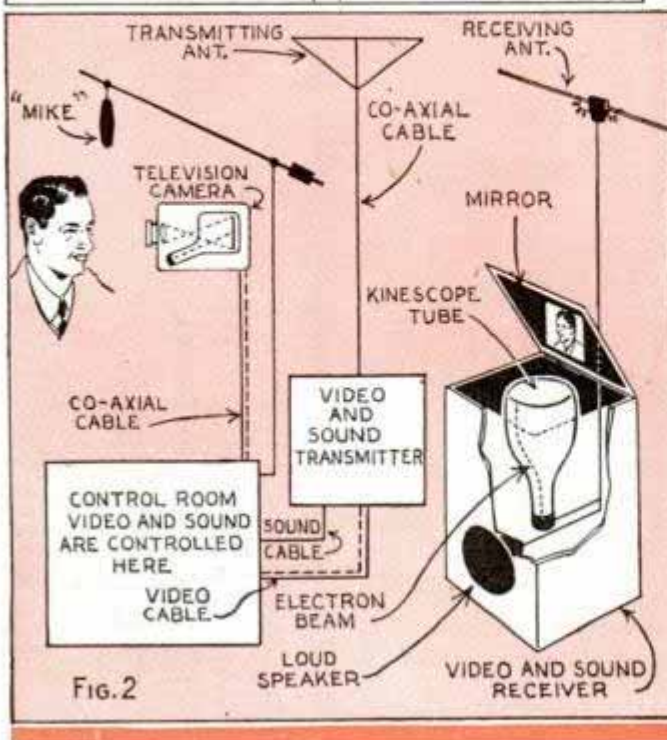
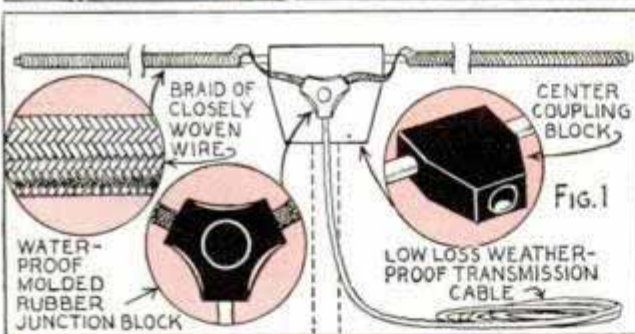
Improved Di-Pole Television Antenna System



BECAUSE of the wide range of television frequencies and the low intensity of the signals, your television antenna must be more efficient than those used for ordinary broadcast and short-wave reception.

Recent tests indicate that stronger "video" (sight) and sound signal pickup is possible by means of an easily installed antenna system specially designed for television requirements. Instead of using metal rods to form a di-pole, or "curtain-rod," type of antenna commonly used for television reception, this antenna consists of two 64-in. weatherproofed wooden rods each covered with a shield of finely woven enameled-copper braid. Leads from these pickup areas are permanently connected with a low-loss transmission line as indicated in Fig. 1; the complete installation is shown in the photo below.

A reflector antenna of similar type, erected directly behind and parallel to the braided di-pole, greatly increases the signal strength and, when properly placed prevents multiple images. Servicemen use a simple portable telephone between set and antenna locations to determine best position for the di-pole and reflector. Fig. 2 shows the operating principle of television.



Ward Products Corp
Ward Bldg
Cleveland Ohio

Electronic Laboratories
Chas. 17 2nd Ave. New York 11
Cincinnati Ohio

Practical RADIO SUGGESTIONS

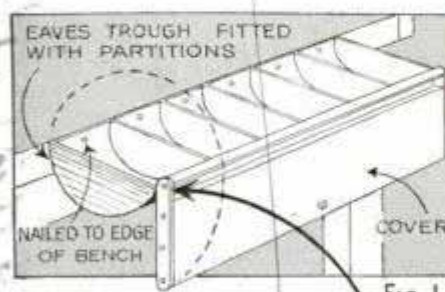
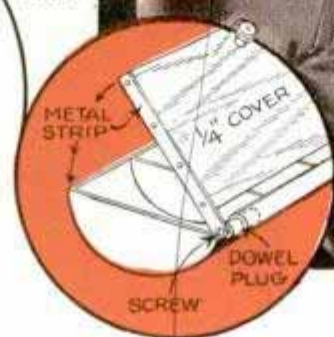


FIG. 1
This handy bin for screws, nuts and small radio parts is made from a short length of 3 1/2-in. eaves trough divided into a number of separate compartments by fitting and soldering semi-circular pieces of tin as illustrated in Fig. 1. Fastened to the end of the workbench, the contents are quickly accessible. The cover is optional



Sketch Fig. (A) shows an easily installed "pneumatic" telescoping auto antenna which is independent of ignition and vacuum systems. It is raised or lowered by means of the pneumatic dash control; (B), portable high-voltage vibrator power-supply unit of heavy-duty design operates either on storage-battery or 110 volts a.c.

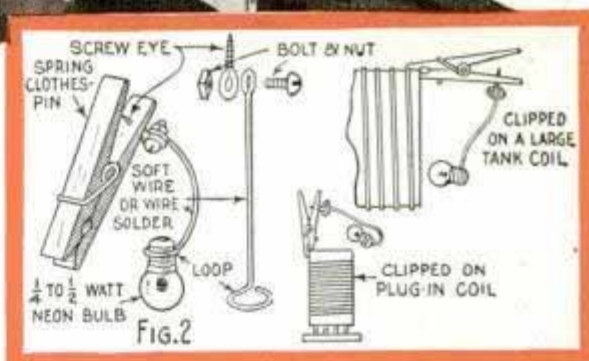
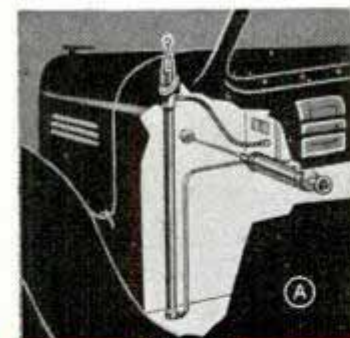
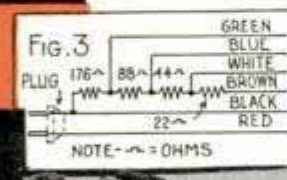
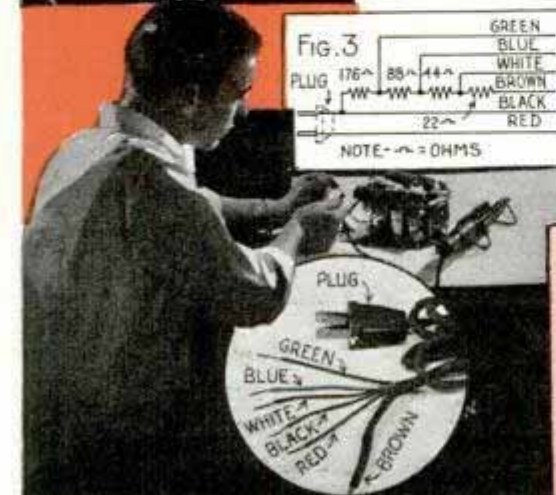
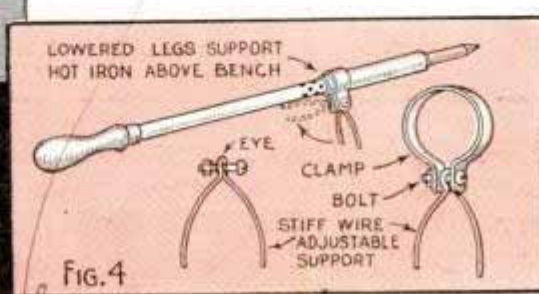


Fig. 2, spring clothespin and a short piece of flexible wire make a handy adjustable clip for holding a small neon bulb in any desired position to check resonance in amateur tank circuits. Fig. 3, and photo at lower left, show a universal line cord that enables experimenters and servicemen to add or change tubes in a.c.-d.c. sets by merely changing the line-cord resistor connection. This single cord may be used as a service replacement for all a.c.-d.c. receivers specifying line-cord resistors



Plug-in relays of the type shown in photo (C) permit the use of low-powered tubes such as type-30 or 71-A to control heavy-duty loads in photo-cell-operated devices; a simple solution for the "hot-iron" problem is detailed in Fig. 4



Sigma Instrument Co
Palmetto, Mass
139

Fourteen-Inch Television Tube for Home Receivers



This giant cathode-ray tube is now probably operating in a television receiver located in some home in or near New York City. The photo shows the tube receiving its Bakelite base with the various connections which this skillful laboratory worker is soldering to respective contact members. Rounded sides add strength to bulb.

Tiny Dual-Purpose Receiver

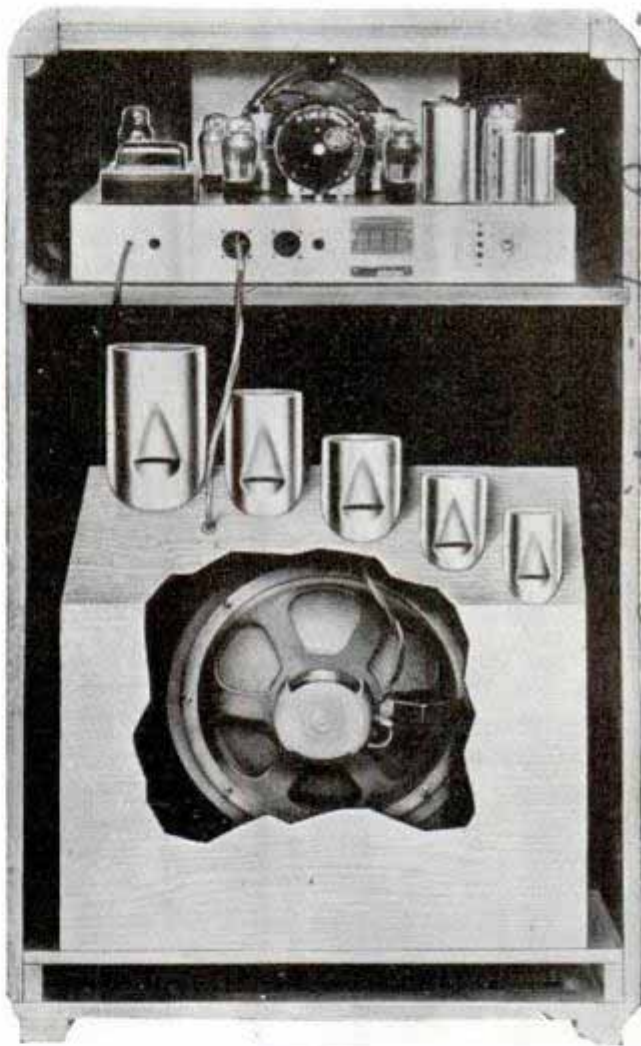


With the radio switch turned off, this combination unit appears to be, and actually is, an electric clock with its entire dial or face looking like the lower half of

the dial as seen in the photo; black ring blocks out the dial readings.

Modern Set Fits Old Consoles

Now you can modernize your old radio by installing this up-to-date receiver which is designed to fit into most types of consoles. It includes an "organ-fonic" tone filter of resonating pipes, organ-key tone control and built-in antenna.



Blueprints covering radio construction articles in this and past issues are available for 25 cents each. Original material lists, with names of manufacturers and dealers, can be obtained from our Radio Department upon receipt of postage.

NEXT MONTH—How to Build a Two-Band Flashlight-Battery Receiver. This new model of one of our most popular low-cost sets for beginners covers broadcast programs and a short-wave band. Also **Home-Recorder Assembly for Amateurs.** Practical suggestions for making and playing your own records at home.

Majestic Radios and Television Corp. 2600 W. 50th St. Chicago, Ill.

Midwest Radio Corp. 909 Broadway, Cincinnati, Ohio



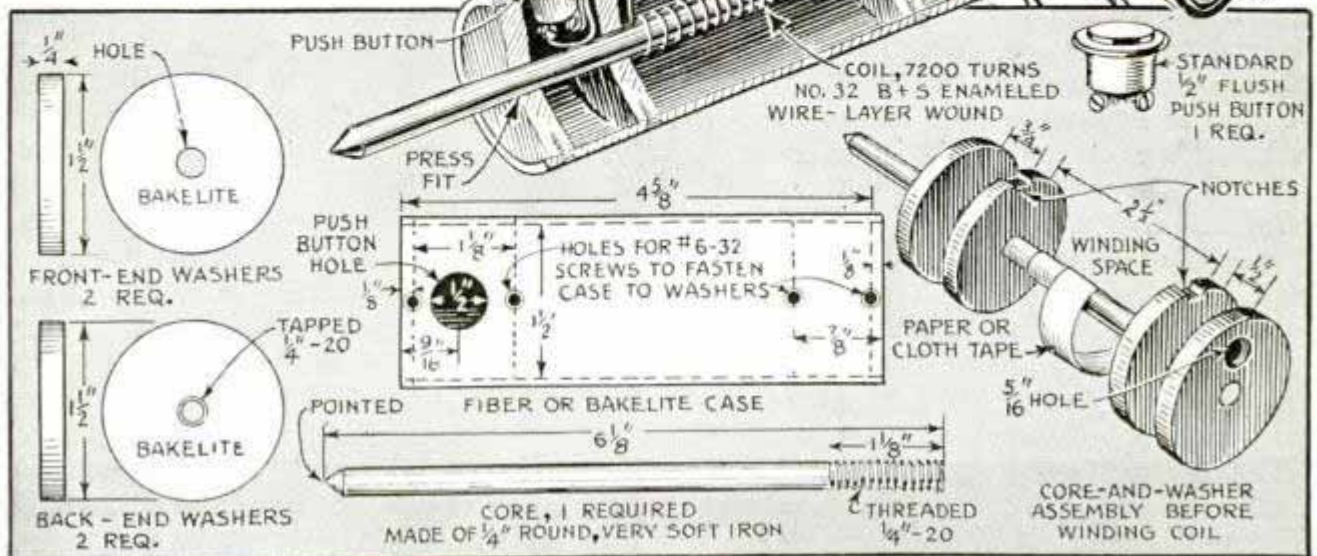
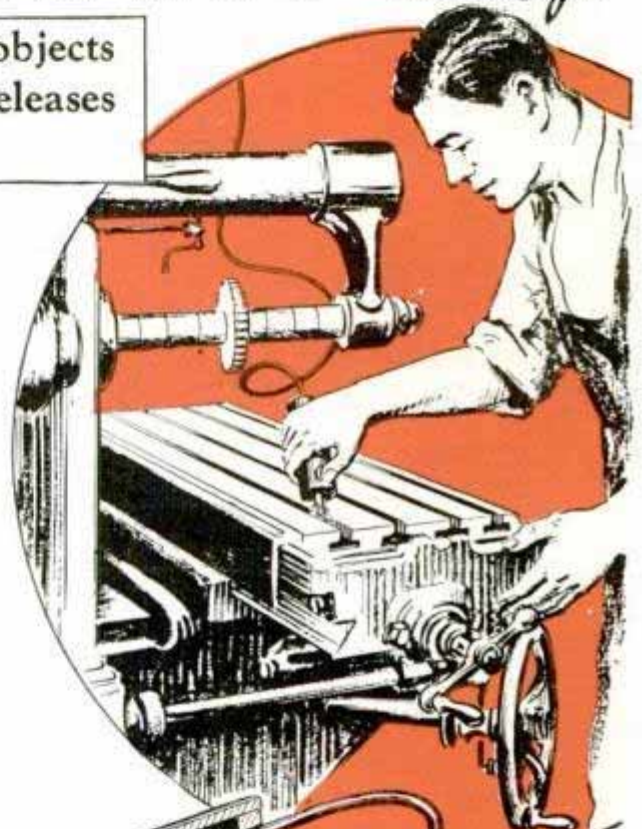
SHOP NOTES

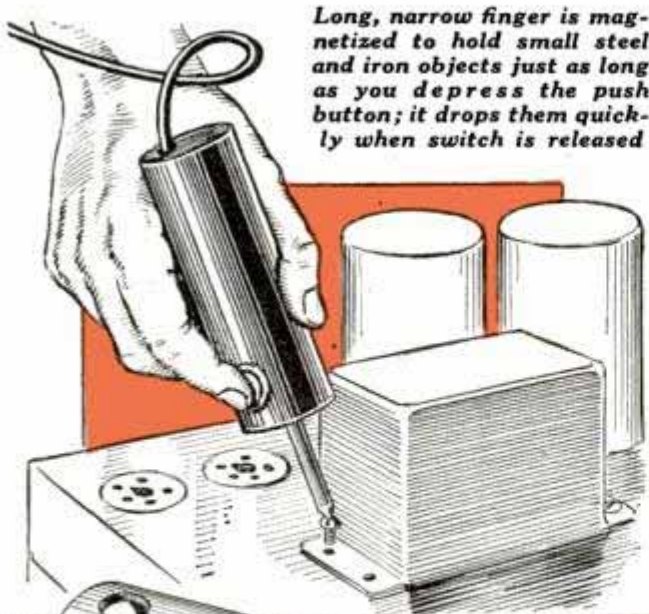
"ELECTRIC HAND" *in the shop*

Easy-to-make electromagnet picks objects from hard-to-reach places and releases them on the bench

PICKING up small steel brads and screws, cleaning steel turnings from hard-to-reach places inside a lathe bed and compound rest, and setting tiny steel screws in difficult assemblies—these are jobs easily done with this little electromagnet which operates on 110 to 125-volt, 60-cycle alternating current. An ordinary horseshoe-type permanent magnet cannot reach some of these places and it will not release the things it picks up.

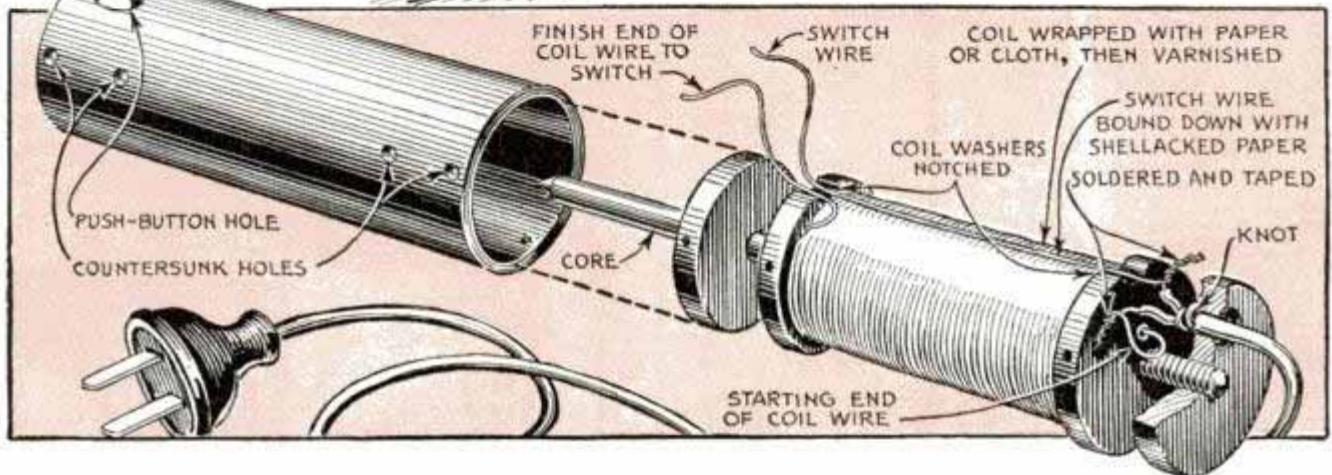
The assembly diagram below illustrates construction. One winding in the center represents the coil which, of course, is much larger and more compact than is shown. The core of the magnet is a piece of $\frac{1}{4}$ -in. round soft iron rod, $6\frac{1}{8}$ in. long. If a $\frac{1}{4}$ -in. bolt of sufficient length can be found, it will serve the purpose by cutting off the head. One





Long, narrow finger is magnetized to hold small steel and iron objects just as long as you depress the push button; it drops them quickly when switch is released

a 1-ft. length of the wire through the hole in the back coil washer and fasten it temporarily. Chuck the core in the lathe or in a hand drill, and proceed to wind the coil, keeping the turns tight and close together. Coat each layer thinly with insulating varnish before going further. As the winding progresses, the layers will become more and more uneven. This can be corrected from time to time by covering the coil with a layer of thin paper. When the coil is completed, cut the wire leaving a length of 1 ft. to extend for connections. Cover the coil with several layers of paper, which you wrap tightly, varnishing between each layer. Lay the switch wire on the coil, set



end of the rod is sharpened to a point while the other end is threaded as indicated in the drawing. Four Bakelite washers are cut from an old radio panel which is $\frac{1}{4}$ in. thick. To make them, drill a $\frac{3}{16}$ -in. hole in four pieces, slip them on a threaded bolt, drawing nuts tightly against them to lock them in place. Then mount the assembly in a lathe and turn the pieces down to size. The two washers for the front end are reamed to $\frac{1}{4}$ in., while the two for the other end are tapped to turn on the thread. Be sure to notch the edge of the washers and drill lead-in holes near the centers for the coil wires before assembling on the core. The rear washer has a $\frac{5}{16}$ -in. hole in it to admit the supply cord. Coat the core with insulating varnish and a layer of thin paper or cloth, tightly wound. After this is dry, push the front washers into place and screw on the rear ones. Adjust the space between the coil washers to $2\frac{1}{2}$ in.

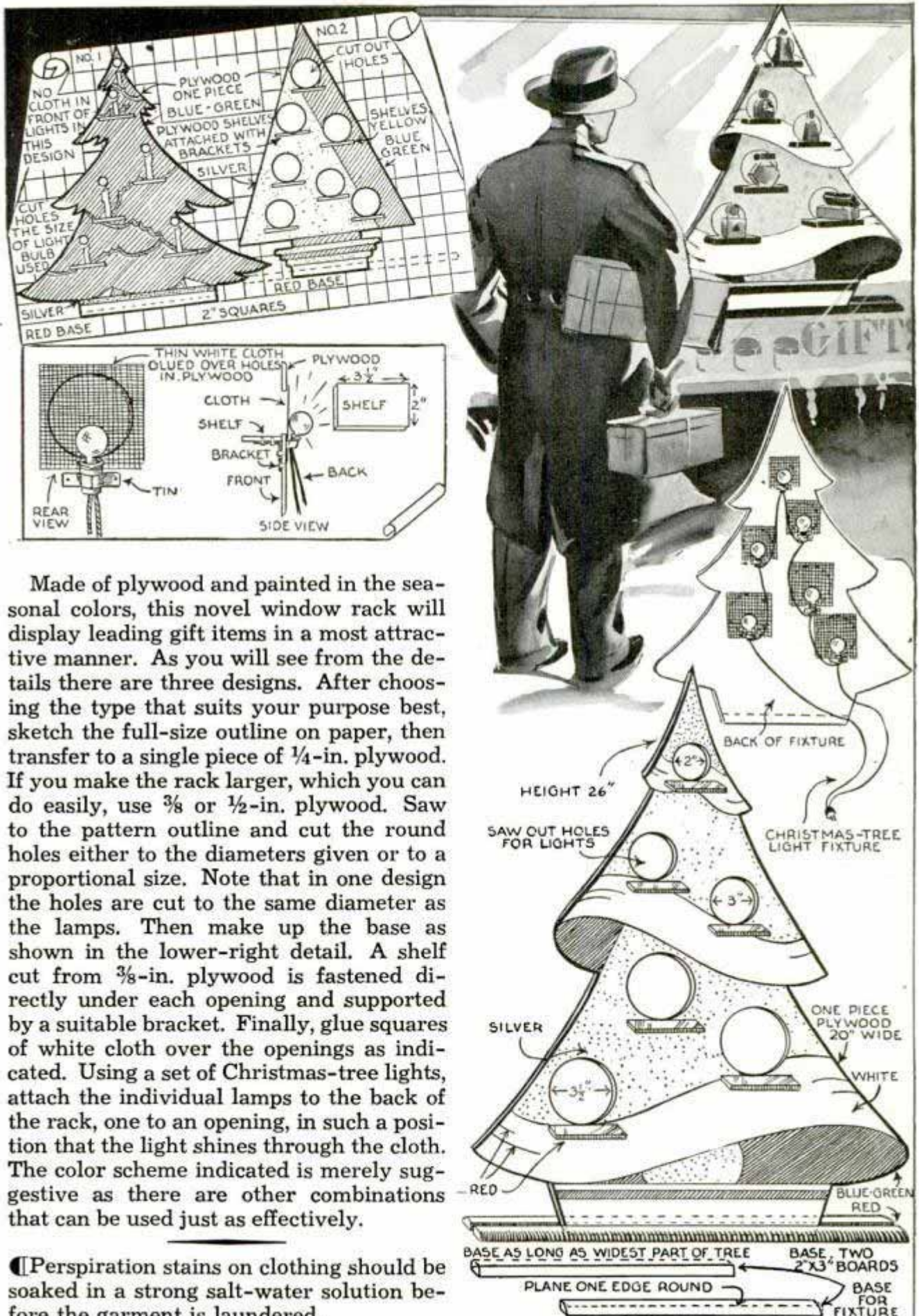
The magnet winding consists of 7,200 turns of No. 32 B & S enamel-coated copper magnet wire, wound in layers. Draw

it in the washer notches and bind it down with tape or another layer of paper.

The case is a Bakelite or fiber tube $1\frac{1}{2}$ in. inside diameter and $4\frac{3}{4}$ in. long. Holes are drilled in it as shown. Drill the push-button hole and then drill and countersink the fastening screw holes.

To assemble the magnet in the case, pull the cord through the hole in the rear washer, knot it on the inside and solder one of the wires to one of the wires from the magnet. Cover the connection with tape, and with silk thread bind securely to the core. Then the other lead wire is similarly soldered to the switch wire and well taped and tied. You can now slip the case on from the front end and pull the front wire through the switch hole. Using the fastening drill holes in the case as guides, drill and tap holes in the washers for No. 6-32 screws to fasten the case in place. Connect the switch to the front wires. Carefully insulate the two connections. A little piece of asbestos bound in place with thread will do this quite well.

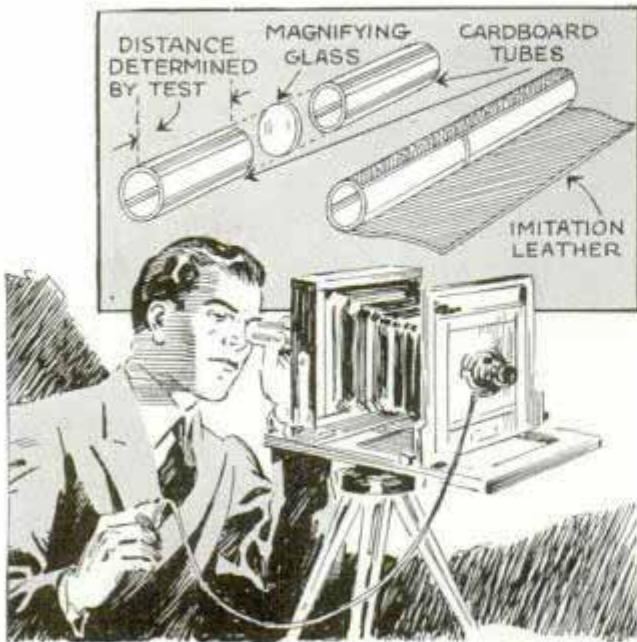
Christmas-Tree Display to Attract Shoppers



Made of plywood and painted in the seasonal colors, this novel window rack will display leading gift items in a most attractive manner. As you will see from the details there are three designs. After choosing the type that suits your purpose best, sketch the full-size outline on paper, then transfer to a single piece of $\frac{1}{4}$ -in. plywood. If you make the rack larger, which you can do easily, use $\frac{3}{8}$ or $\frac{1}{2}$ -in. plywood. Saw to the pattern outline and cut the round holes either to the diameters given or to a proportional size. Note that in one design the holes are cut to the same diameter as the lamps. Then make up the base as shown in the lower-right detail. A shelf cut from $\frac{3}{8}$ -in. plywood is fastened directly under each opening and supported by a suitable bracket. Finally, glue squares of white cloth over the openings as indicated. Using a set of Christmas-tree lights, attach the individual lamps to the back of the rack, one to an opening, in such a position that the light shines through the cloth. The color scheme indicated is merely suggestive as there are other combinations that can be used just as effectively.

Ⓛ Perspiration stains on clothing should be soaked in a strong salt-water solution before the garment is laundered.

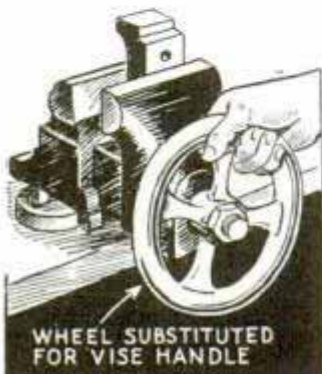
Substitute for Focusing Cloth in the Photo Studio



This focusing tube is easier to handle than a cloth and it magnifies the image on the ground glass so that focusing is done quickly and accurately. To assemble the tube, two fiber or cardboard tubes are placed end to end with a small magnifying glass between them, after which they are rolled on a piece of imitation leather or similar material that has been coated with glue. The leather holds the parts together to form a tube with the glass near the center. The variable factor in the dimensions of the tube is the length from the ground glass to the magnifying glass. To determine this distance, hold the glass at a point where the image on the ground glass will be in sharp focus. Then cut one of the tubes to this length. The other tube does not matter as it merely keeps out light.

—Joseph Raszinski, Chicago.

Wheel Operates Vise Quickly

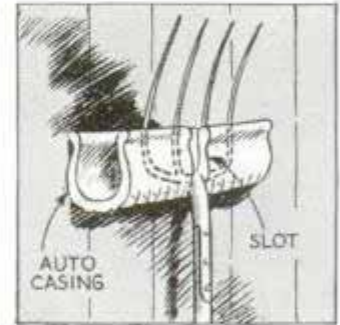


At an assembly bench where the worker has to use a bench vise, time can be saved by replacing the vise handle with a large wheel. This permits the vise to be opened or closed much more

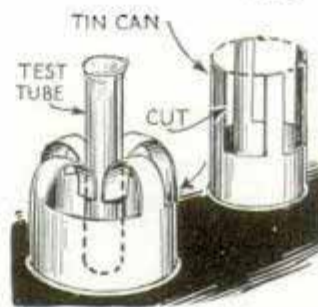
rapidly. If the wheel is fairly large, the worker will be able to apply sufficient leverage for most work of this type.

Pitchfork and Shovel Racks from Auto Casing

One farmer cuts sections from an old auto casing and nails them up to hold forks, shovels, garden rakes, etc. Two or three nails through the back side and a slot cut in the front as shown, is all that is required to make these handy holders.



Holder Supports Test Tubes



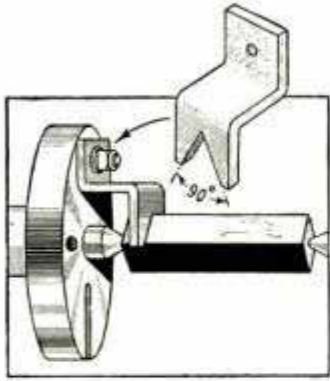
When you want to set down a filled test tube, a holder made from a tin can, as indicated, will support it and help to prevent accidental spilling of the contents.

Binder Wheel Fitted with Legs Provides Farm Forge

With an old binder bull wheel for a start, it is easy to make a good forge. The wheel is supported on flat-iron legs, and the spokes are imbedded in concrete, which is covered with fire clay if this is available. The hub of the wheel is left open and becomes an inlet for the air blast, which can be furnished by a blower either hand or power driven.



Dog for Turning Square Stock



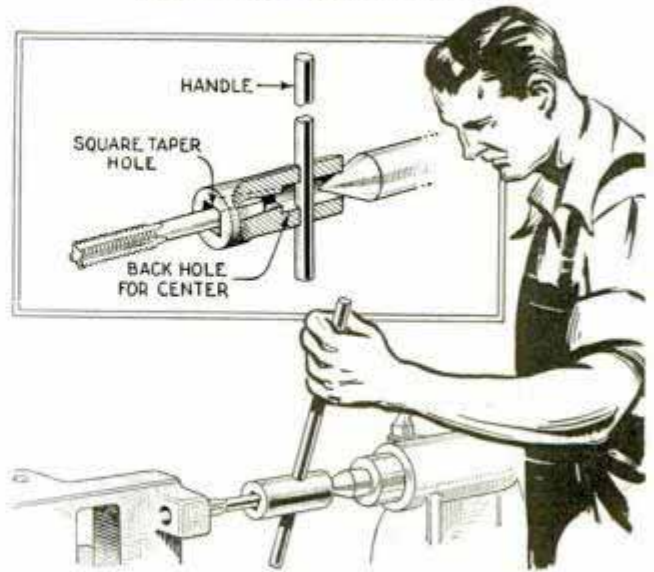
This is a simple lathe dog that can be used to turn various sizes of square stock, making it unnecessary to change dogs each time the stock is changed. The dog is a piece of heavy flat iron bent as indicated, and a V-notch cut in the end to straddle one edge of the work. The other end of the dog bolts to the faceplate.

Rigid Support for Mailbox

With the increased use of large mailboxes on rural routes so that parcels may be inclosed during bad weather, a more substantial type of support is usually needed. The one shown in the photo has proved successful and consists of two old auto-tire rims riveted to four pipe legs, which are bent as indicated and set firmly in the ground. If desired, the entire assembly can be set on the ground so that it can be moved to one side when the road maintainer comes along.



Small Hand Taps Used in Lathe with Special Wrench

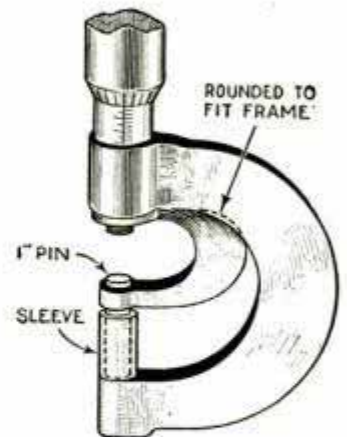


Here is a wrench that enables you to use small hand taps in a lathe and keep them in alignment. As shown, it is a piece of round steel with a tapered square hole in one end to take the squared ends of the taps, and a round hole in the other end to take the lathe tailstock center. The tapered square hole permits the wrench to be used on taps of various sizes without making adjustments.

Adapting Large Micrometer to Small Work

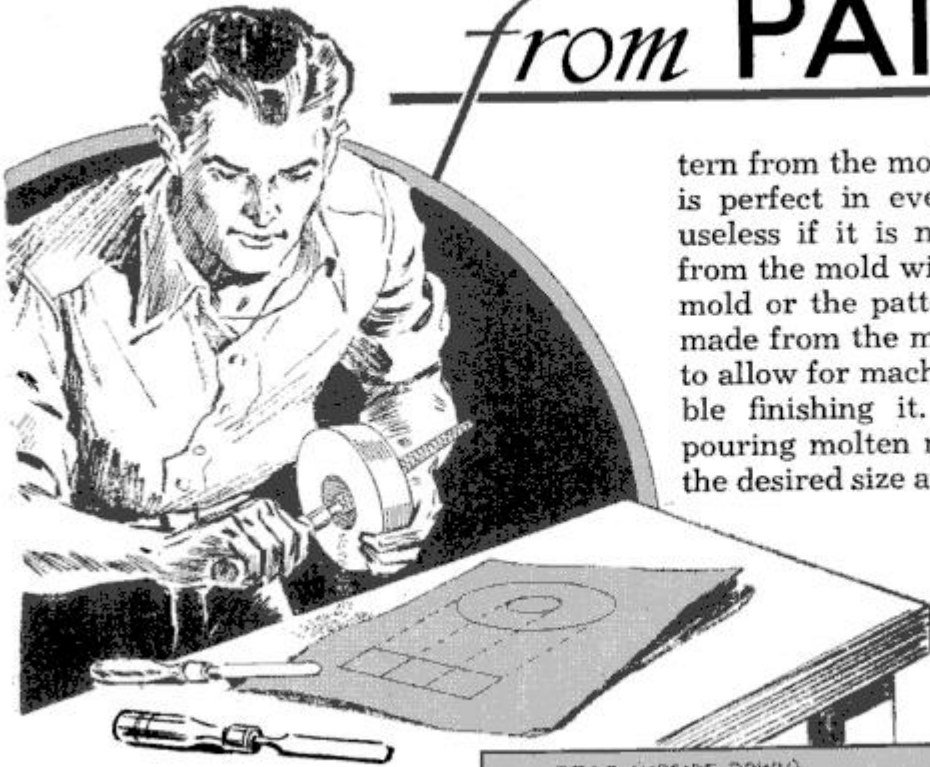
Having a 2-in. micrometer, which was used only occasionally, one shop owner

fitted it with a 1-in. adapter for smaller work. A piece of steel was cut to the shape shown, and rounded on the back edge to fit the mike frame. The piece was then drilled and reamed at the upper end to fit the mike spindle, and at the lower end to take



a pin, a sleeve being made to fit tightly on the pin. To use the adapter, the spindle is withdrawn to clear the frame, and the adapter slipped in place. When the spindle is brought down and the sleeve is pushed over the anvil, the adapter is locked securely in place.

from **PATTERN**

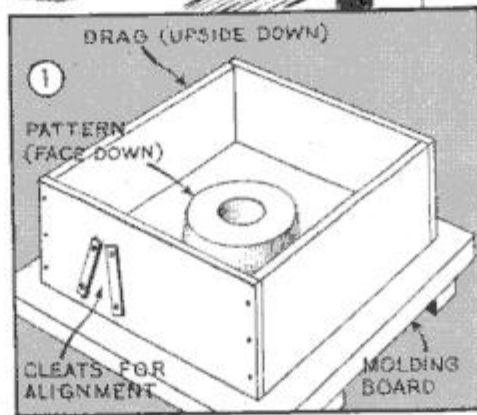


tern from the molder's viewpoint, one that is perfect in every other respect is still useless if it is not possible to remove it from the mold without breaking either the mold or the pattern. If the rough casting made from the mold has insufficient metal to allow for machining you will have trouble finishing it. Castings are made by pouring molten metal into a sand mold of the desired size and shape, Fig. 4. The sand

is retained in a box open at the top and bottom which is called the "flask." The latter is made in two sections, the lower of which is called the "drag" and the upper the "cope." These are fitted with guides and cleats or dowels to permit accurate realignment of the two sections. The first steps required in making a mold from a one-piece pattern are shown in Figs. 1

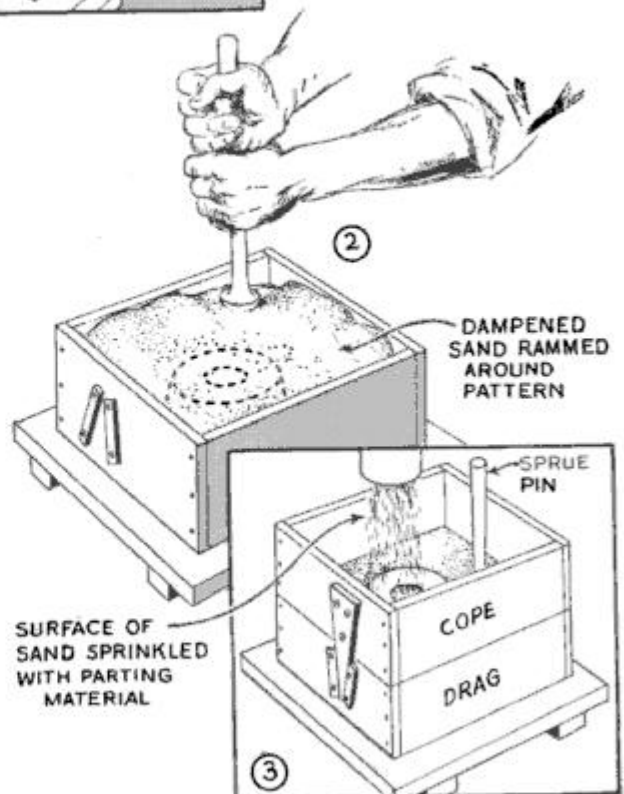
PART I

Tells how castings are made in the foundry in sand molds—how to make your own patterns—what woods to use—where to use fillets—how to make draft and shrinkage allowances with 'shrink' rule



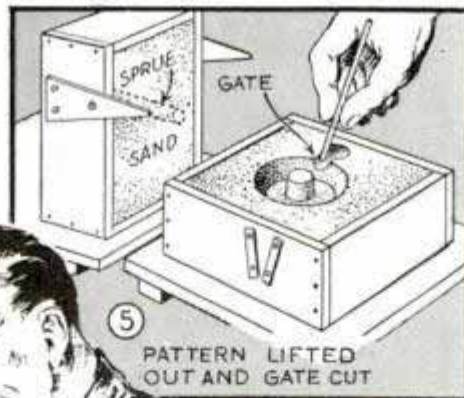
HOW often have you attempted to make up some metal part of stock materials and finally found that a casting would be much better for the purpose? Then, why not make a pattern and have a casting made from it that will be just what you want? Unless the casting required is complicated in detail or unusual in shape, the pattern needed will be a very simple affair. There's no need for fancy woods or elaborate equipment. Just a piece or two of pine and a few hand tools will serve the purpose where only one or two castings are to be made from the same pattern. However, it is necessary that the latter be laid out and constructed very carefully, for any errors in the pattern will be reproduced in the casting.

The pattern for a casting is simply a form or device from which a mold can be made that will produce a casting of the desired shape and size. Looking at the pat-



to CASTING

to 3. First the pattern is laid face down on the molding board, with the drag inverted around it. The sand, properly dampened, is rammed around the pattern until the drag is filled to the top and struck off level with a straight edge. The drag is then turned right side up on the bottom board and the surface is sprinkled with a parting material to prevent sticking. At the same time the second half of the pattern, if it is in two pieces, is set in place. The cope is set on the drag, a sprue pin is placed to form a pouring hole in the cope, and the latter is rammed with sand. It is then lifted off and the pattern is removed from both halves of the mold. After a pouring hole and gate for the metal are cut in the sand as in Fig. 5, the cope is replaced as in Fig. 6. This, in brief, is the common procedure. The pattern is invariably larger than the finished casting, and in all cases it is necessary that it be made with tapered sides, or "draft" as it is commonly called. This provision on the pattern makes it easy to remove from the mold without breaking up the print as in Fig. 7. Fig. 8 shows the same pattern constructed with the proper draft. The amount of draft that must

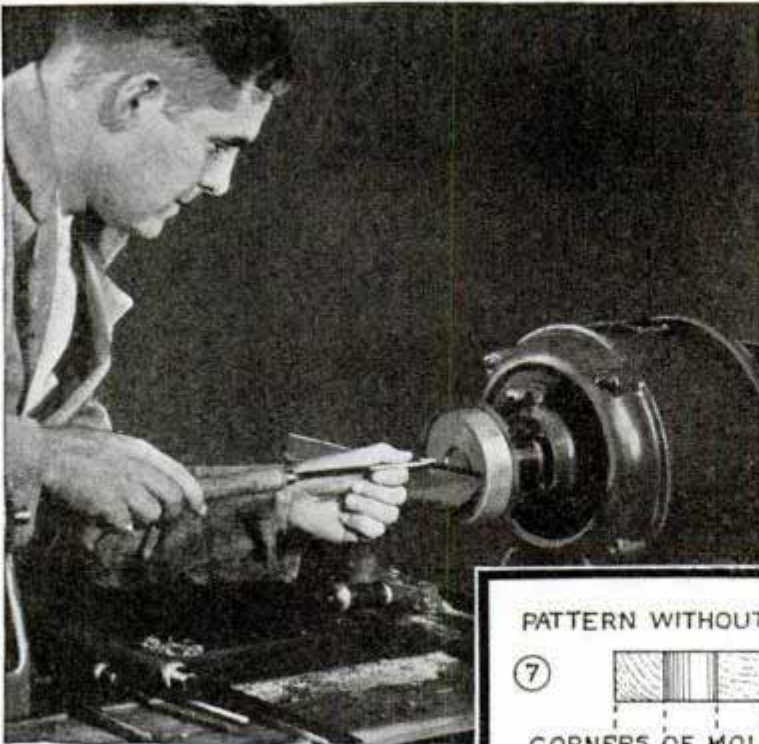


COPE REPLACED ON DRAG,—READY FOR POURING



be provided depends on the type of the mold and the location. Where possible, the pattern is made with the draft all running in one direction from the parting line, as at A in Fig. 9. In this case, and for the outside of the pattern, the amount of draft is generally $\frac{1}{8}$ in. to the foot, as in Fig. 10. Note also in this illustration that on the side of a casting, where a hollow pattern is used, considerably greater draft is required. Generally a draft of $\frac{1}{16}$ in. to the inch is specified. If the opening is less than 1 in. in diameter, draft of $\frac{1}{8}$ in. to the inch must be allowed. Where this amount of draft cannot be tolerated on an inside surface, it is necessary to use a solid pattern and form the hole with a core. This will be explained in the second article of this series.

Another important provision with regard to draft applies to those cases where a pattern cannot be made in one piece, but is made in two pieces with

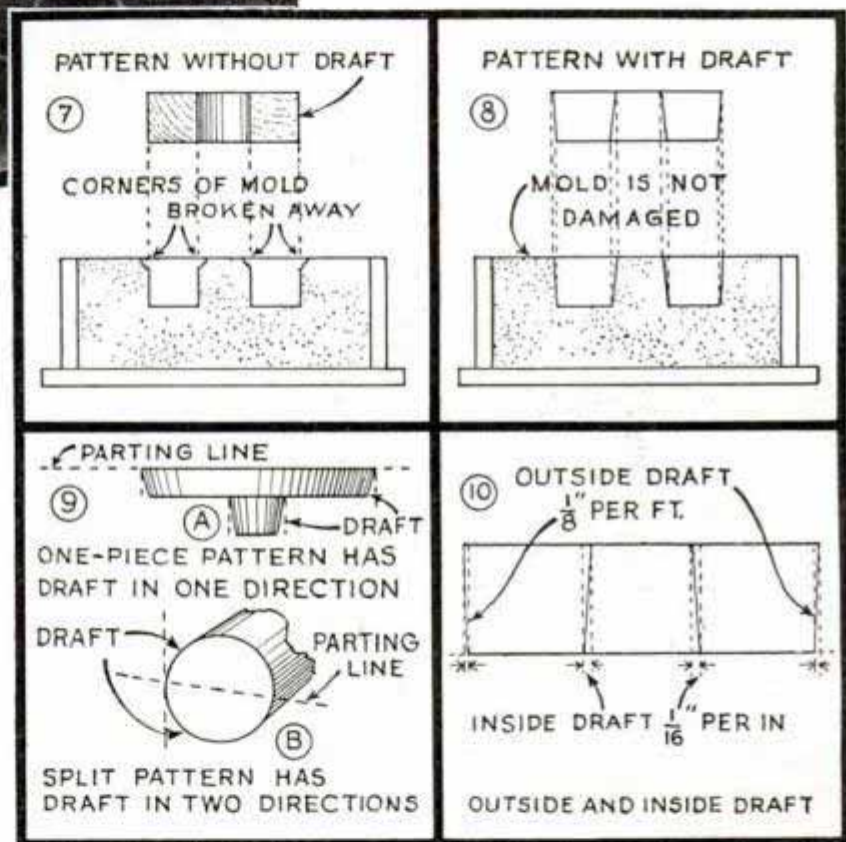


draft running in both directions from the parting surface, as shown in Fig. 9, B. Here it is necessary to double the draft on the section of the pattern that extends into the cope or upper section of the mold. This provision is made to assure easy parting of the pattern from the mold when the cope is lifted off the drag and the pattern is removed.

The second important characteristic that affects the pattern size is shrinkage. All castings shrink after solidification, the amount of shrinkage depending on the metal from which they are made. It is, therefore, necessary to make the pattern and mold somewhat larger so that the casting will shrink to the desired dimensions. Table I gives the approximate shrinkage for various common metals. To get this shrinkage accurately you simply lay out the pattern with a shrink rule instead of an ordinary rule. A shrink rule has each foot increased by $\frac{1}{8}$ in., if for iron, and by $\frac{3}{16}$ in., if for brass, and all subdivisions elongated proportionately. This saves the time necessary to calculate the shrinkage allowance on each dimension.

A third allowance which must frequently

be made is that for finish. The surface of a casting is naturally rough and somewhat irregular, and if two castings must be fitted together accurately, or if extreme accuracy is necessary for any other reason, the surface will have to be machined down to the finished size. Generally an allowance of $\frac{1}{16}$ in. is made for each finished surface on small castings, although for larger castings in which irregularities may be greater, a larger allowance for finish is needed. One more thing and you're ready to lay



out the pattern. Wherever wood parts of a pattern join at right angles a fillet is necessary, Figs. 12, 13, and 14. Triangular leather fillets are obtainable ready-made in a variety of sizes and are easy to apply with glue. On small patterns such as those used for model parts, beeswax is usually better. It is simply pressed into place then worked to a true radius with a spherical-ended tool as in Fig. 14. The tool must be heated slightly at intervals.

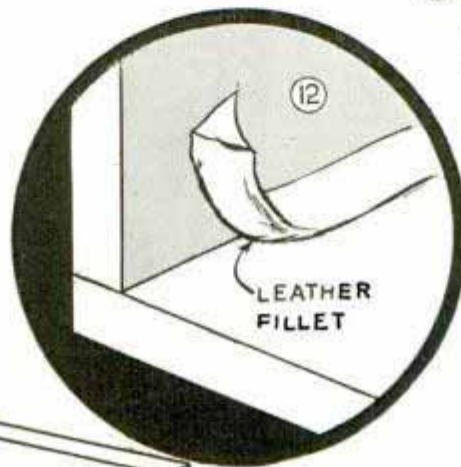
The best way to lay out the pattern is to make a mechanical drawing of the part to be made as in Fig. 15. Locate the surfaces to be finished and use the symbol "f" to

denote them on the drawing. This will help in remembering to make the proper finish allowances. Patternmaking woods should be well dried and seasoned. Redwood is sometimes used, also cherry, mahogany, or maple when the pattern will be subject to repeated use. For ordinary work, clear white pine will do very well. Where gluing is necessary use a hide glue applied hot, as in Fig. 11. If possible the layout should be made directly on the wood that is to be used for the pattern. The pattern should be planned in advance so that, if possible, the draft is all in one direction from the parting line. With this



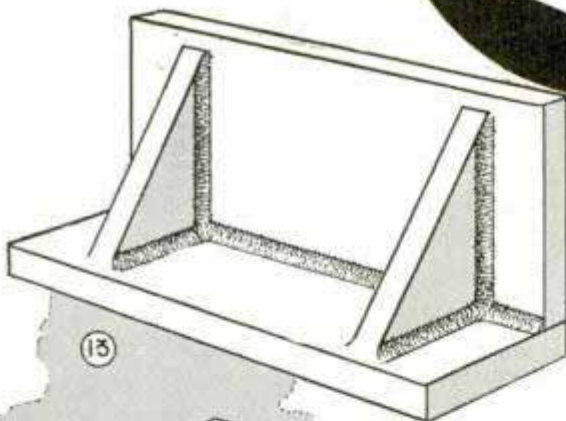
TABLE I
Approximate Shrinkage of Castings

Cast iron1/8 in.
Brass3/16 in.
Aluminum1/4 in.
Zinc5/16 in.
Copper3/16 in.
Lead5/16 in.
Malleable iron1/8 in.
Steel1/4 in.

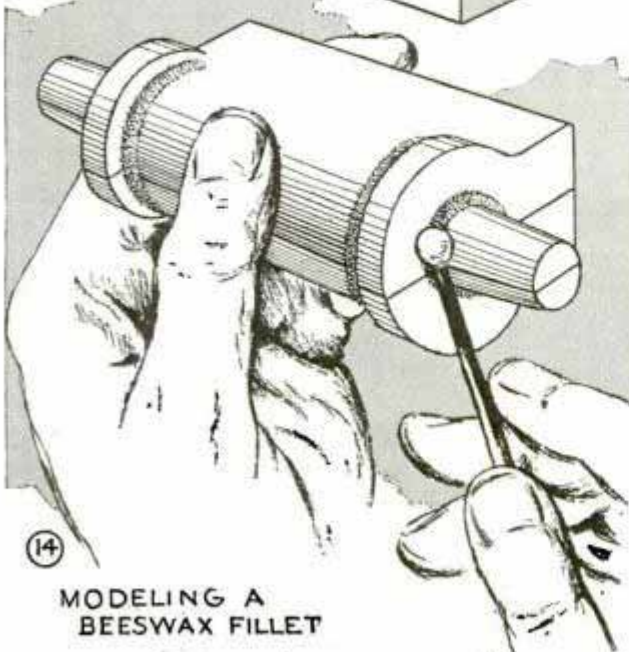


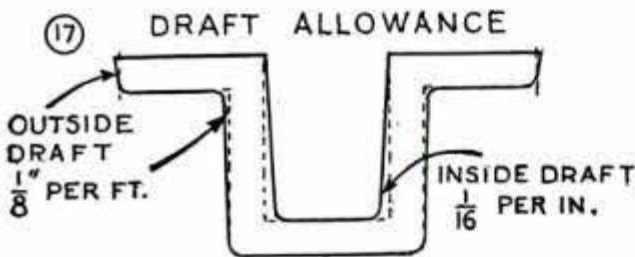
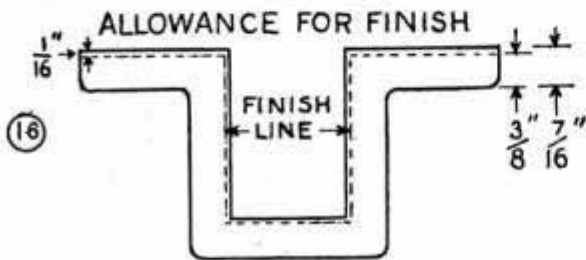
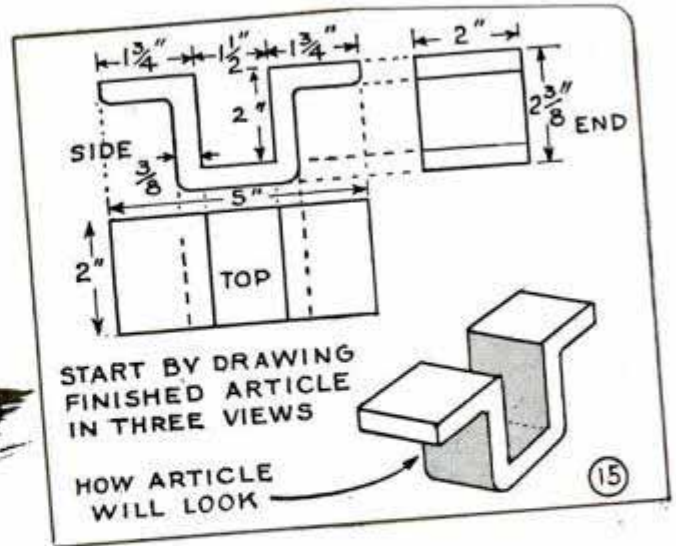
in mind, the layout is made, using a shrink rule for all dimensions and marking all lines with a sharp knife. It is best to start all measurements from the center line of the pattern, rather than from an edge; and to lay out any holes first before

laying out edges. The steps in laying out a pattern for a simple bracket are shown in Figs. 16, 17, and 18.

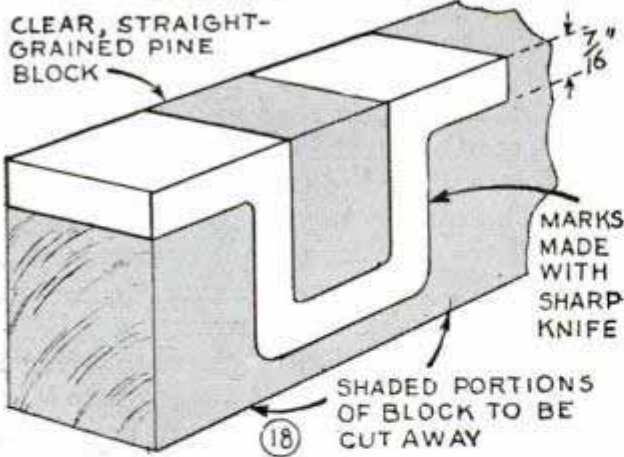


When the layout is completed, the excess wood can be removed by sawing and the pattern finished with chisels and gouges. Cylindrical or other round sections, of course, may be turned in a lathe. The work should be finished to exact size very carefully. The quality of the finish, especially on small wood patterns, is very important. All surfaces of the wood which come in contact with the sand must be glass-smooth before applying shellac. Where hand tools are used to cut away waste it is necessary to use care when you approach the finish dimensions or you may cut too deep and spoil the pattern. It is essential that surfaces worked down with edge tools be left as smooth as possible so that sanding will be reduced to the minimum. Slight cavities or shallow cuts made inadvertently under the finish dimensions can be filled with woodturner's cement or wood putty. Have your tools razor-sharp so that you can cut with or across the grain without





LAYOUT ON WOOD MADE WITH AID OF SHRINK RULE



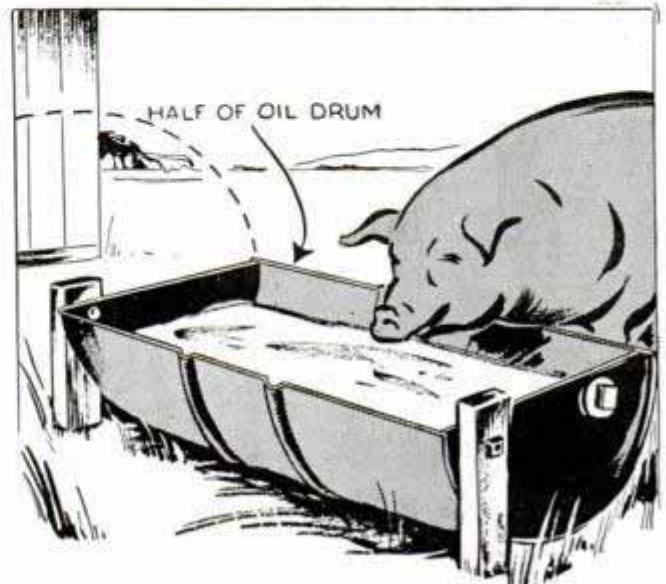
raising deep splinters. Sometimes a fine rasp is better than a chisel or gouge on the cross grain. The disadvantage of the rasp for general work is that it raises the fibers of the wood and leaves a rather rough surface which requires considerable sanding to smooth up. Lathe-turned patterns can be finished ready for shellacking with a minimum of hand work, of course. Some-

times small patterns are simply sanded and then dipped in melted paraffin to finish. Although not approved practice, this method frequently serves very well. In any case when the carving is finished, the pattern is sanded carefully with No. 0 or finer sandpaper and, as is the common practice, given two or three coats of orange shellac to protect it from moisture.

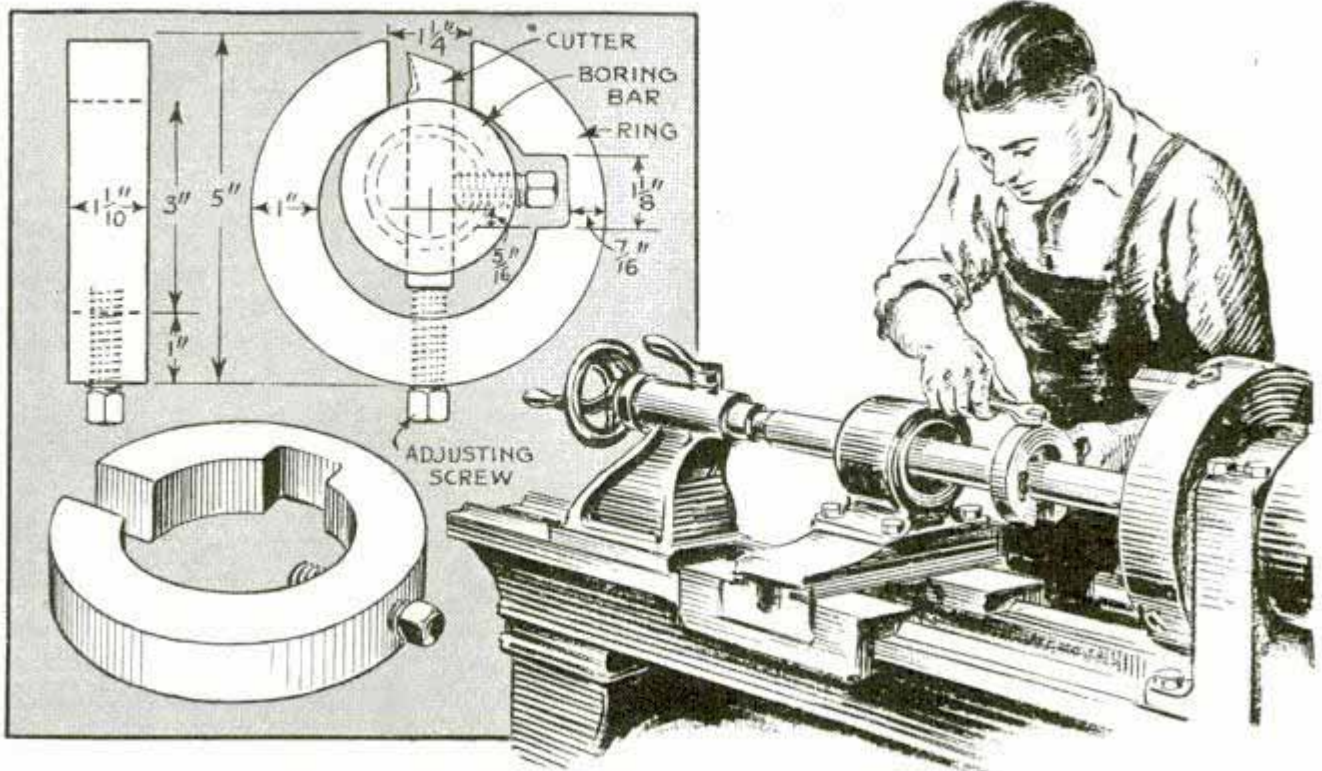
(To be continued)

Hog Trough from Oil Drum

Here is a hog trough that is cheap, can be emptied and cleaned easily, and that will not burst if liquids freeze in it. Made from half an oil drum, it is pivoted at the corners between stakes driven firmly into the ground. In this position, it is easy to overturn for emptying. After cutting the drum in half, it is a good idea to bend the edges over or round them with a file to avoid injuring the hogs.



Jig Sets Boring-Bar Fly Cutter to Close Limits



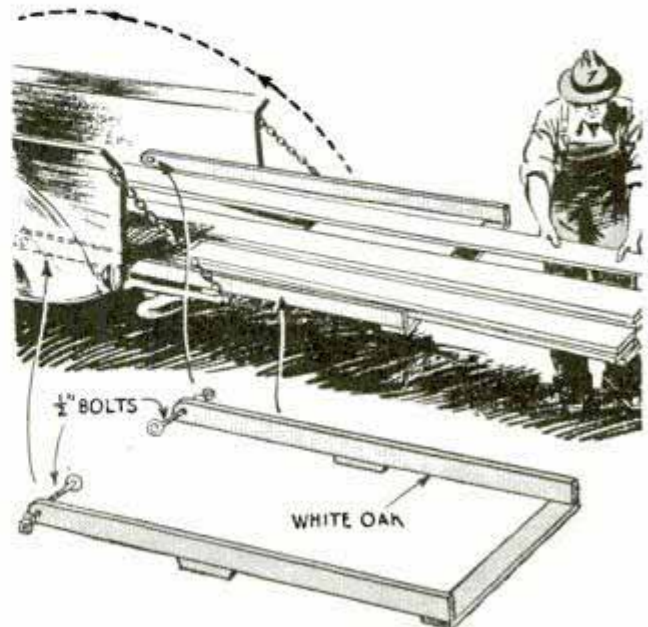
On jobs of boring either small or large-diameter holes to close limits with a boring bar when it is difficult to set the tool out for the finish cuts, especially where the cutter must be moved only a few thousandths, you'll save time by using this simple tool-setting jig. Whatever the size of your boring bar the general dimensions of the jig should be proportional to those given above. Turn and bore the ring from mild

steel and slot and groove it to provide space for slipping it over the cutter and the head of the set screw holding the cutter in place. In this position, the adjusting screw of the jig bears against one end of the cutter as shown. This makes it easy to move the tool to exactly the finish dimension required by simply turning down the adjusting screw with a wrench.

—W. P. Davies, Topeka, Kans.

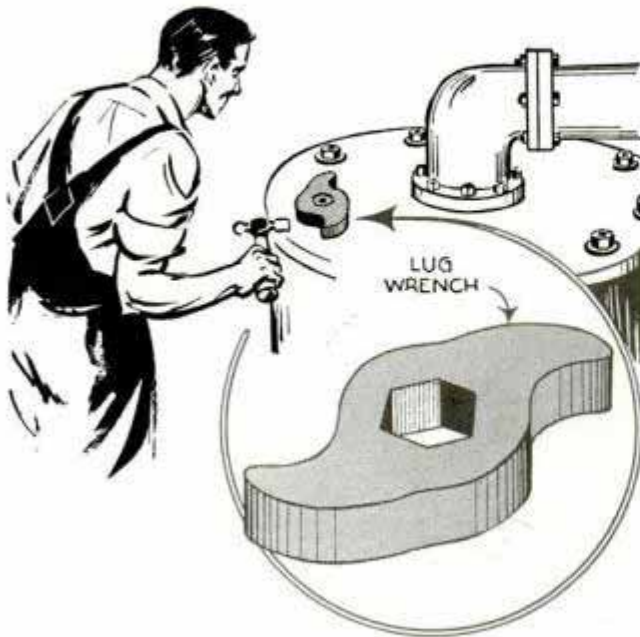
Folding Rack Lengthens Pickup Truck to Haul Lumber

One lumber dealer reduced delivery costs on small orders by using this rack on a pickup truck, making it unnecessary to drive his large trucks for less than ½-ton loads. The rack will accommodate boards up to 18 ft., and will enable the truck to handle a load of over 600 ft. of lumber averaging 14 ft. in length. As shown, the rack is pivoted to the truck body and gives it an over-all length of 11 ft. When the truck is not used for hauling lumber, the rack is folded inside the body out of the way.—P. Walker, Wautoma, Wis.



☐ When you clean tinware, rub it with a wadded piece of moistened newspaper and washing soda and then polish it with a dry piece of the paper.

Lug Wrench to Remove Nuts with a Hammer

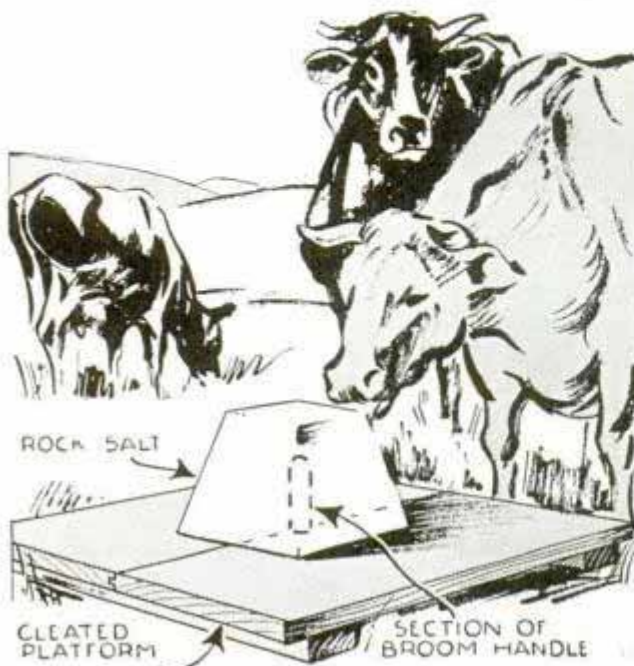


Having many large nuts to remove, I use this lug-type wrench and strike it with a hammer to loosen them. I find that the impact of the hammer on the lug is often more effective in loosening a tight nut than the leverage of a wrench. After the nut has been loosened, it can be turned off rapidly by rotating the lug with the hand.

—Chas. H. Willey, Penacook, N. H.

Block of Salt Kept on Platform by Projecting Peg

Cattle can be kept from pushing rock salt off a platform, which is provided to

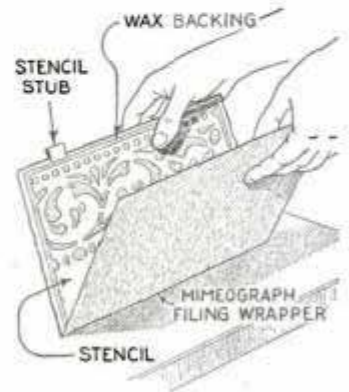


keep it off the ground, by slipping the salt over a peg projecting from the platform. An old auger will serve for making a hole in the salt to take the peg.

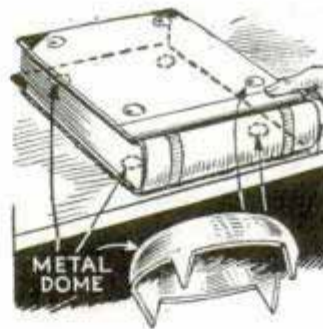
Waxed-Paper File Stops Drying of Mimeograph Stencil

I have kept mimeograph stencils for many months in filing wrappers lined with waxed paper like the one shown, without them drying out. The paper is fastened to the wrapper with staples or glue at the corners, and an index tab is attached to one edge.

—W. F. Horan, Plainfield, N. J.



Metal Domes on Large Ledgers Make Handling Easy

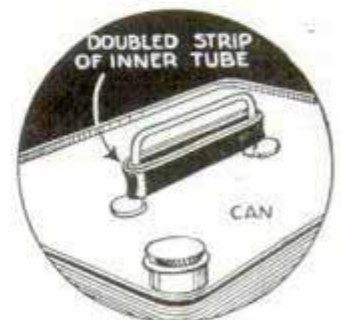


Heavy ledgers that are hard to slide on and off shelves can be handled easier if metal domes or furniture glides are fastened near each corner of the covers. The domes

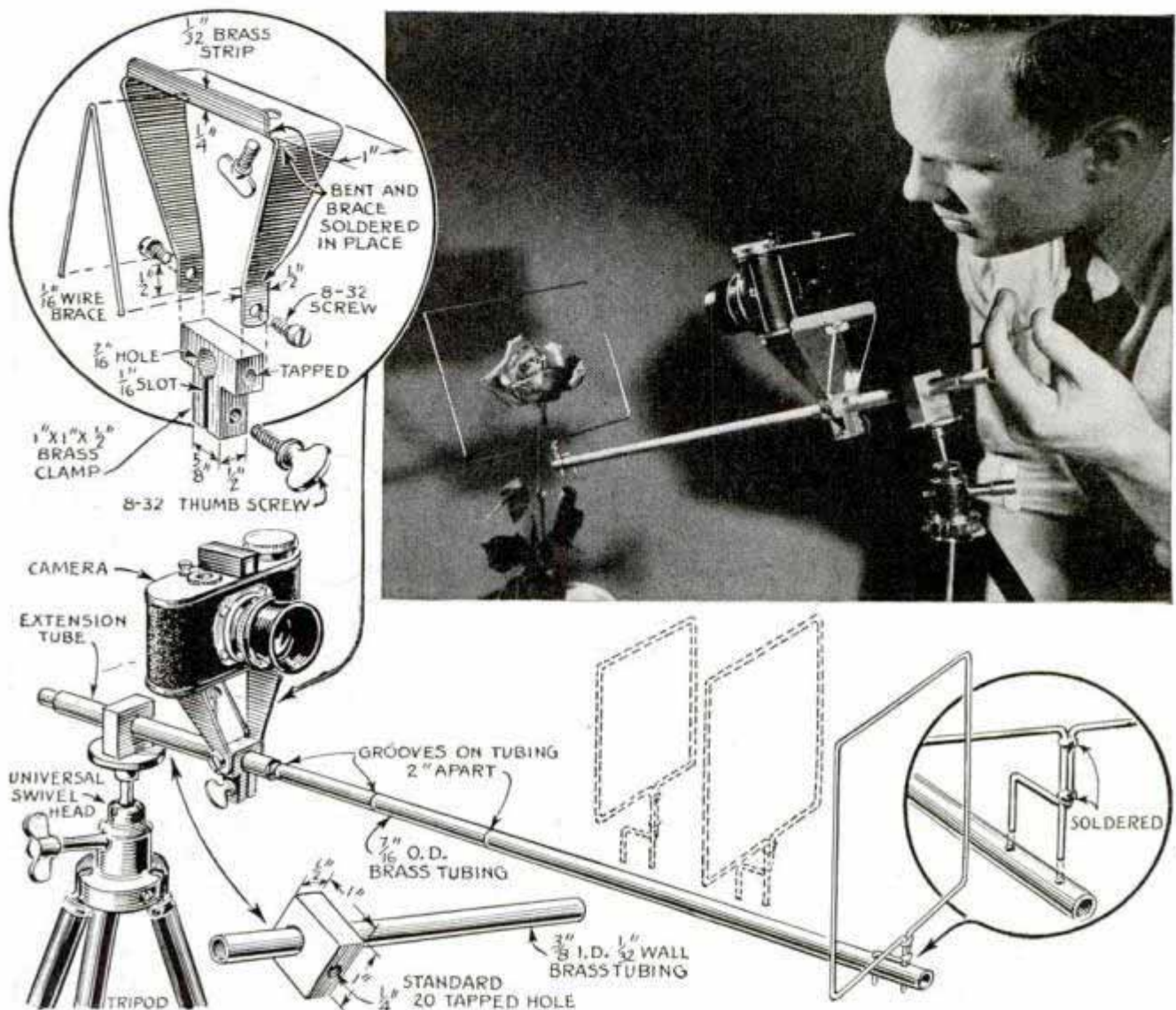
provide only four small points of contact on the shelf, thus reducing friction so that the ledger can be moved easily.

Rubber Band Holds Can Handle Upright for Grasping

A Wisconsin beekeeper who found it annoying to pull up the wire handles on cans of honey when moving them about, avoided the trouble by snapping rubber bands around the handles. These support the handles, but allow the cans to be stacked.



Mini-Camera Focuser Aids Taking Close-Ups

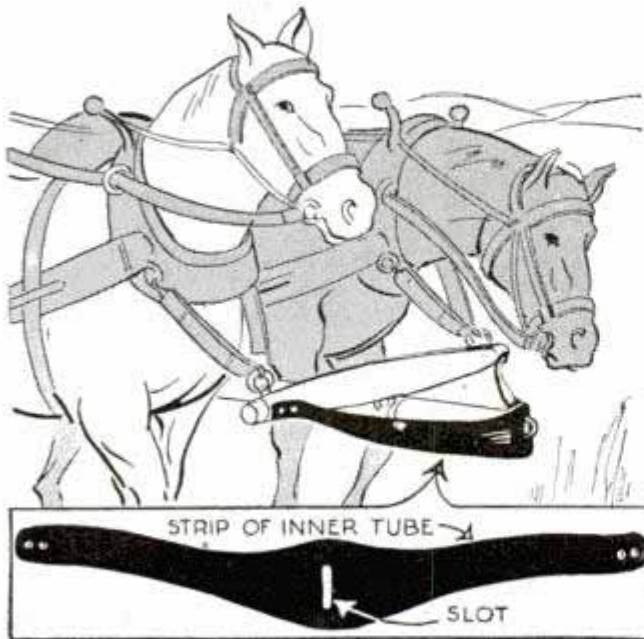


When photographing small objects with a miniature camera fitted with a supplementary copying or portrait lens, you can save yourself the time of taking measurements under 3 ft. for exact focusing by using this quick-acting focusing frame which attaches to the universal head of any tripod. The telescoping tube you see in the details carries both the camera and the wire focusing frames. The latter are for the purpose of framing the subject and centering it at a given distance from the lens. Grooves turned or filed on the extension tube give these distances for each of the three frames. However, as the accessory lens has a definite focal length it is necessary to determine this accurately beforehand. Place the camera on a table, set the lens at minimum distance and attach the supplementary lens. Then open the back of the camera and insert a piece

of ground glass in place of the film. With the shutter set on "time" and a small object in front of the lens, move the camera back and forth until the image focuses sharply on the ground glass. Then measure and record the distance. By re-setting the distance scale on the camera you can vary the number of inches between the lens and the object when the latter is in sharp focus. This will give you the distance settings for the three frames. Sizes of the frames will also vary. Each one should be sufficiently large so that no part of it is included in the field of the lens, otherwise it will appear in the picture.

☞ To clean hairbrushes without loosening the bristles, wash them in luke-warm soapsuds to which a few drops of common household ammonia have been added; then place them in an open window to dry.

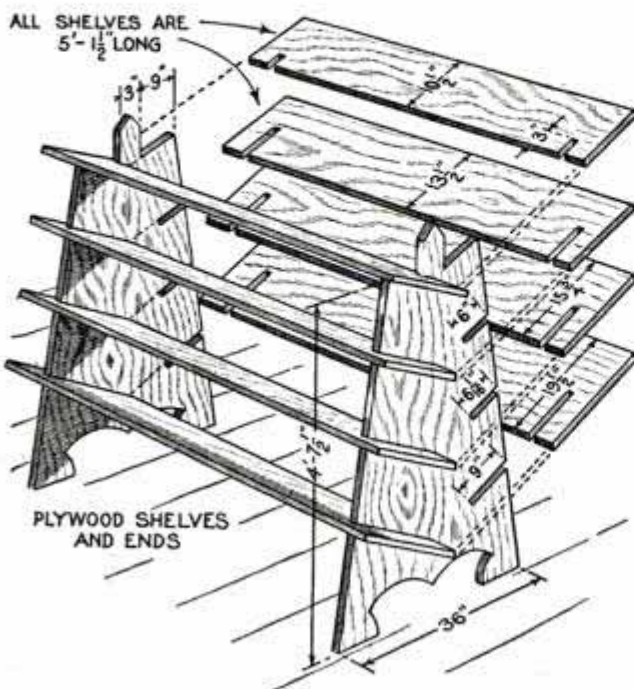
Shield over Implement Tongue Keeps Reins from Tangling



Reins are likely to get under the end of an implement tongue when horses lower their heads unless a shield is provided to avoid this trouble. Such a shield is made easily by stretching a strip of inner tube over the end of the tongue and nailing the ends to the neckyoke as indicated.

Simple Rack Displays Groceries and Vegetables

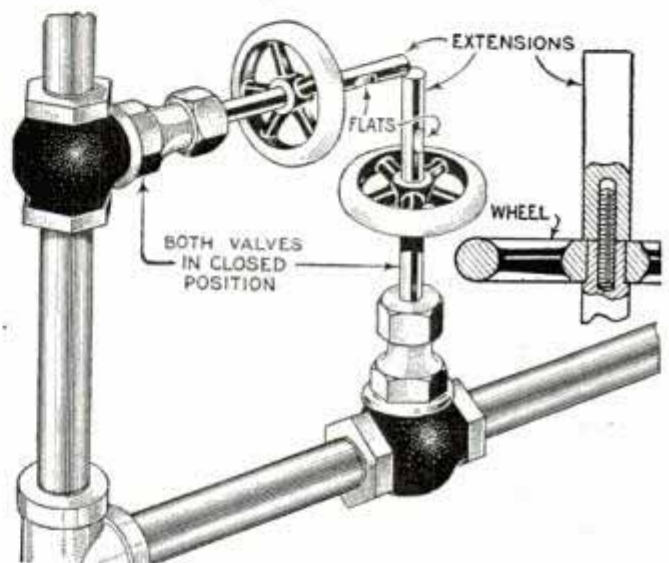
Made entirely of inexpensive plywood, this rack is just the thing to display groceries and fresh vegetables in a store. It



can be made any size desired by varying the dimensions given, and will be found especially useful in self-service stores. Or, it can be made smaller for home use.

Extension Stops on Two Valves Prevent Using Both at Once

In a factory where it was necessary to make certain that two valves could not be opened together, and that one would be closed before the other was opened to avoid incorrect mixtures in a tank, the simple arrangement shown in the drawing was found effective. The nuts on the valve



stems were removed and two extension pieces screwed on, which just cleared each other when the valves were closed. Then, when one of the valves was opened, it was impossible to open the other one as the extension piece was in the way.

Attached Rubber Bands Save Time in Handling Blueprints

By permanently attaching rubber bands to blueprints, a contractor saved time because the bands could not be misplaced when a print was unrolled. Strips of adhesive tape held the bands in place.



☐ Aluminum muffin pans provide good trays for starting seedlings.

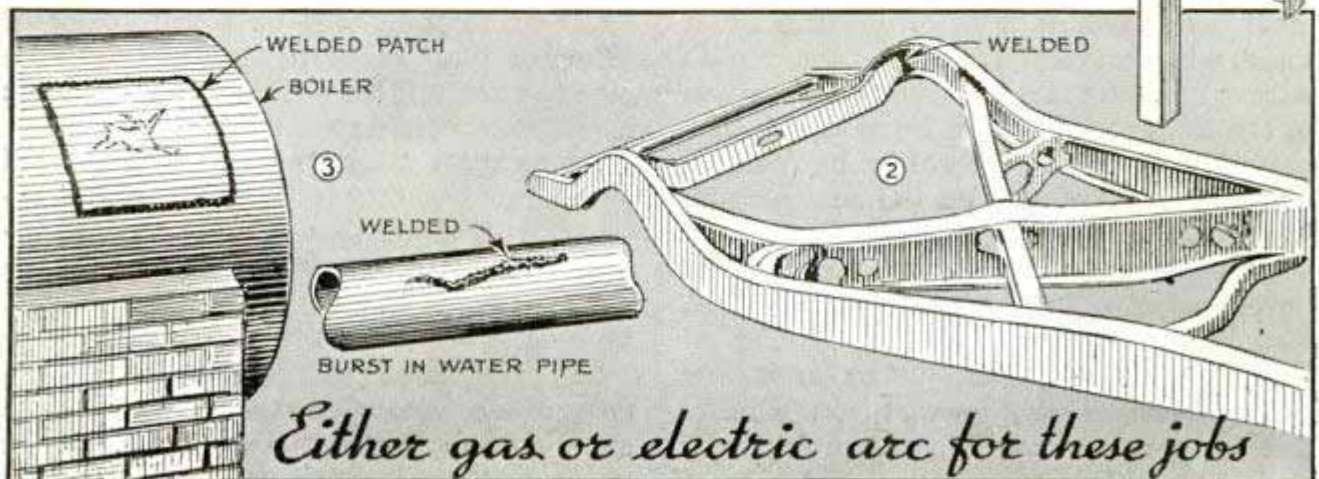
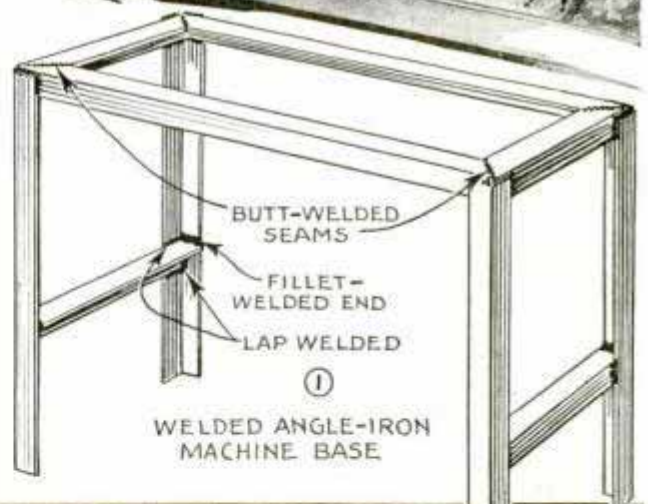
The RIGHT WELD

in the right place

WHEN to use the electric arc and oxy-acetylene flame for welding need not be a puzzling problem. Just remember that the arc is faster and enables you to minimize distortion, while the gas flame can be varied to control hardness of the weld. In many cases, however, either method produces results that are quite similar, thus making the choice a matter of convenience. Ordinary assembly work and repair jobs on wrought iron and mild steel, Figs. 1, 2 and 3, permit the use of either method. On other jobs, the form or thickness of the pieces at the point of weld, the kind of metal and the results desired often make one method better than the other.

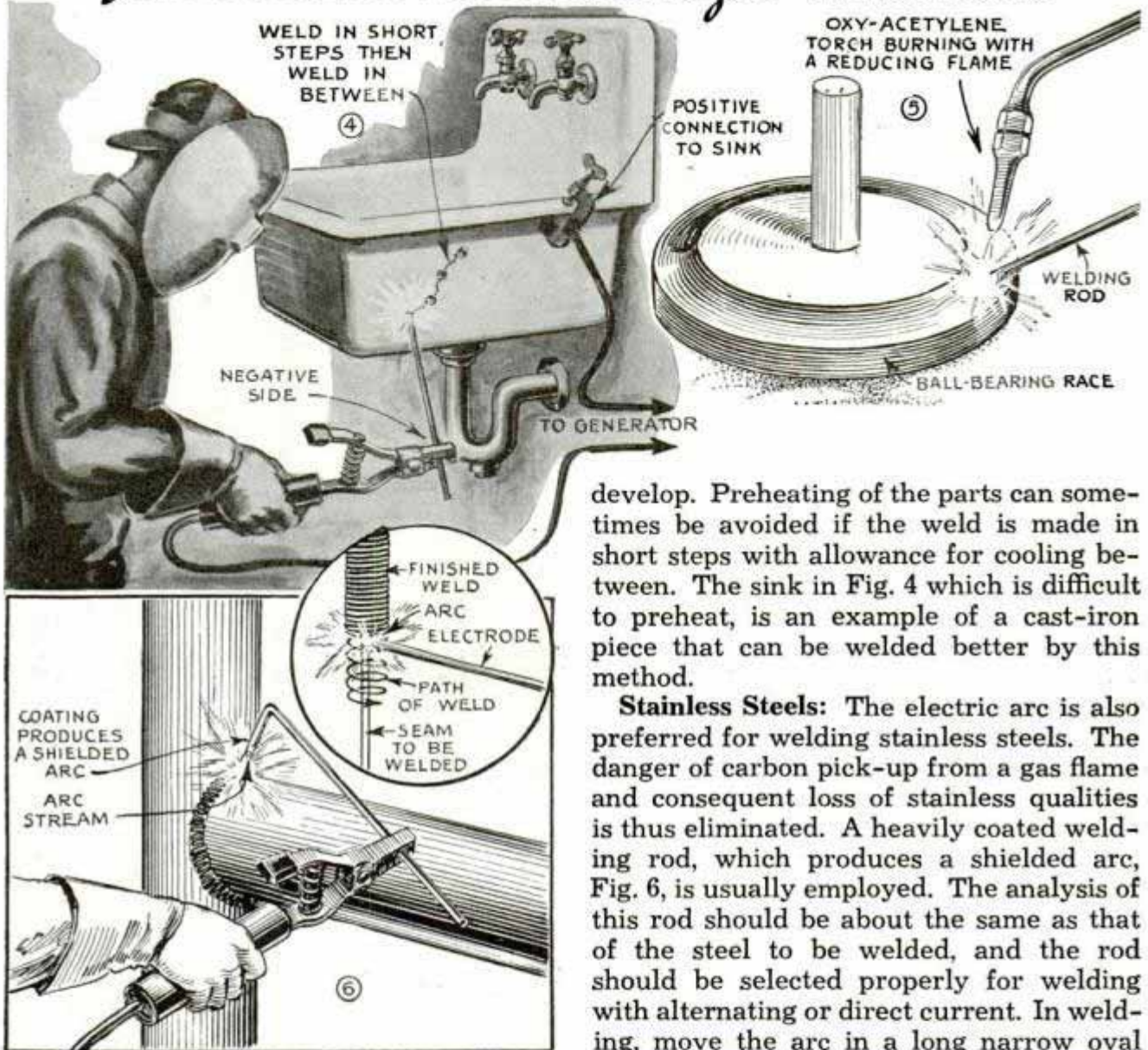
Special Shapes: In welding special shapes where distortion or warping must be kept at a minimum the electric arc is better as the weld can be finished before the surrounding metal has been heated excessively. For example, in building up a broken gear tooth, Fig. 7, speed is necessary to minimize distortion. The tooth is built up as rapidly as possible with the electric arc, after which the finished weld is machined or otherwise finished.

Hardness of Steel Welds: With the oxy-acetylene torch, a reducing flame—one with an excess of acetylene gas—can be used to control hardness of the weld. In this case, some of the excess gas is broken



Either gas or electric arc for these jobs

The electric arc minimizes distortion



down into carbon, which passes into the molten iron of the weld. This metal then becomes high-carbon steel and will be much harder and more brittle when it is cold, which is desirable in welding hard steel, as shown in Fig. 5. On the other hand, when an oxidizing flame or one with excess oxygen is used, some of the carbon in the weld metal will be burned out. The resulting weld will be softer but with a larger amount of slag on the surface, and will have a tendency to be pitted and coarse-grained. With reasonable care, however, jobs like the automobile fender, Fig. 8, can be welded successfully.

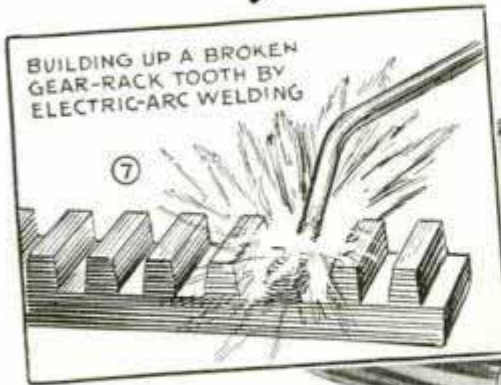
Cast Iron: The faster electric arc is better than gas welding on cast iron. Cracks due to uneven expansion of the cast iron and the weld metal are not so likely to

develop. Preheating of the parts can sometimes be avoided if the weld is made in short steps with allowance for cooling between. The sink in Fig. 4 which is difficult to preheat, is an example of a cast-iron piece that can be welded better by this method.

Stainless Steels: The electric arc is also preferred for welding stainless steels. The danger of carbon pick-up from a gas flame and consequent loss of stainless qualities is thus eliminated. A heavily coated welding rod, which produces a shielded arc, Fig. 6, is usually employed. The analysis of this rod should be about the same as that of the steel to be welded, and the rod should be selected properly for welding with alternating or direct current. In welding, move the arc in a long narrow oval along the seam to keep the metal molten long for gas bubbles to escape. Stainless steel expands greatly upon heating and the strains produced around a welded joint in this metal are considerable. If the piece is annealed after welding to remove these strains, the joint will be much stronger. When a direct-current arc is used, the electrode should be positive and the work negative, reversing the usual procedure.

Aluminum: This metal can be welded satisfactorily either by gas or by the electric-arc method. Gas welding on aluminum is more convenient, however, as the metal has a very low electrical resistance. In nearly all cases, preheating of aluminum parts before welding is essential when using the oxyacetylene torch, as the metal expands and contracts greatly with heat changes. Care should be taken not to pre-

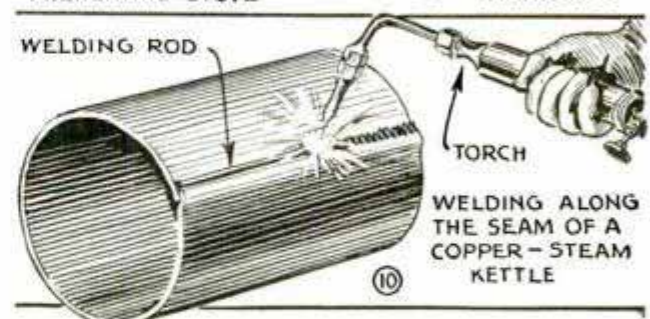
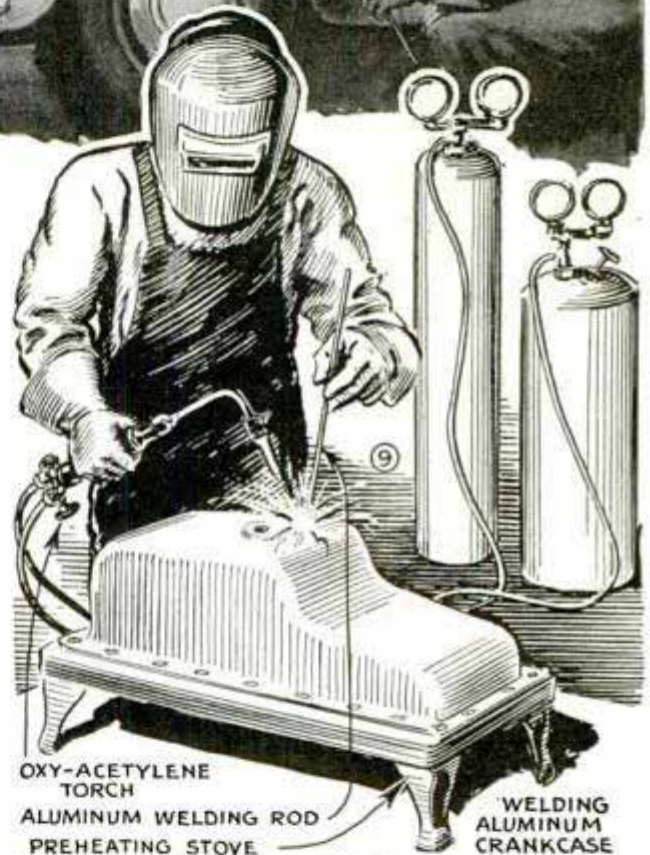
Gas welding controls hardness



heat over 800° F. as aluminum becomes very weak at temperatures above this point.

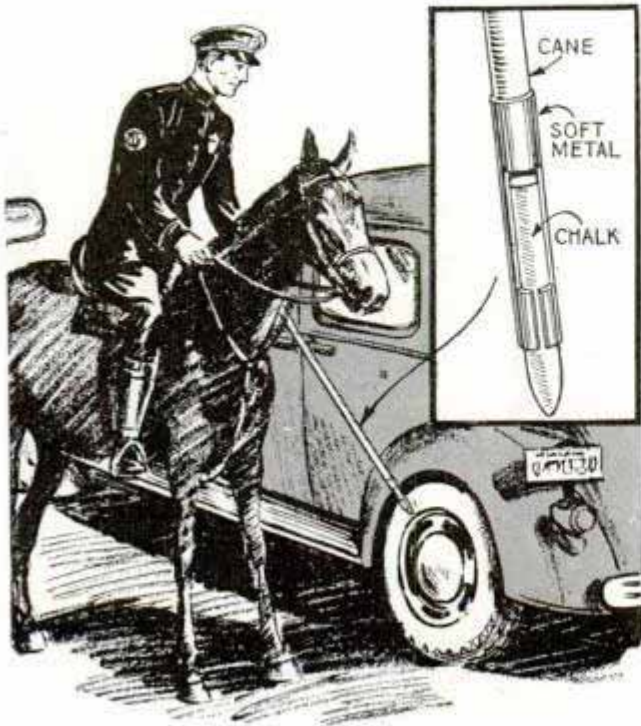
There are several methods that can be used for preheating aluminum to be welded. An open forge may be the only means available, or perhaps a gas burner is handy. The latter method is convenient when welding a cracked aluminum crankcase, which, as shown in Fig. 9, has been placed over both burners. As the determination of exact temperature of a casting may be impossible with apparatus available, you can tell approximately the correct welding temperature by simply touching a stick of ordinary solder to the metal at the welding location. Just as soon as the solder melts when it contacts the aluminum, the piece is hot enough to commence welding. Aluminum and its alloys have a sharp melting point and collapse readily into a very fluid pool around the torch flame. This may cause difficulty in welding as the molten pool can become deep enough to blow through and run off while the rod is still solid. Technique in handling the torch and rod will help, but the use of welding rods of the same alloy as the metal to be welded—cast rod for cast aluminum, duralumin for duralumin, etc.—will tend to eliminate this difficulty.

Copper, Bronze, and Brass: Since the electrical resistance of this class of metals is very low, gas welding is again slightly more satisfactory than welding with the electric arc. Results are the same, however, by either method, when the work is done correctly. Copper, bronze, and brass do not expand excessively when heated but the molten metal is very fluid. This



makes for faster fusion and often the welding can be done by simply laying a piece of welding rod along the joint or seam and flowing it in place with the torch, Fig. 10. Copper and its alloys conduct heat readily, and it is often difficult to keep the weld hot enough. Preheating the pieces will save gas and allow the welding to proceed faster.

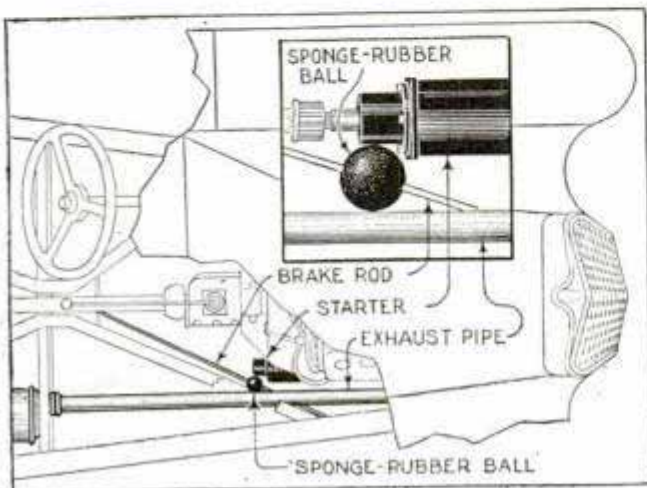
Mounted Policeman Marks Cars without Dismounting



By using chalk on a long handle, a mounted policeman can mark the parking time on car tires without getting off his horse. The handle, which may be an ordinary wood cane, has a short metal tube fitted on the end to take the chalk, one side of the tube being cut out as indicated so that the chalk can be moved down as the end wears off.

Silencing Noisy Brake Rod

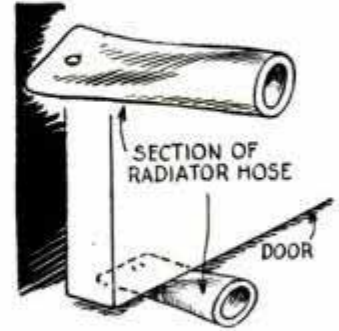
Noise caused by a brake rod vibrating against the starter and exhaust pipe on my car was silenced with a sponge-rubber ball. A hole was made in the ball with an ice pick so that it could be slipped over



the rod, locating the ball in a position to contact the starter housing when the rod vibrated.—Woody Harmon, Fairbanks, Ind.

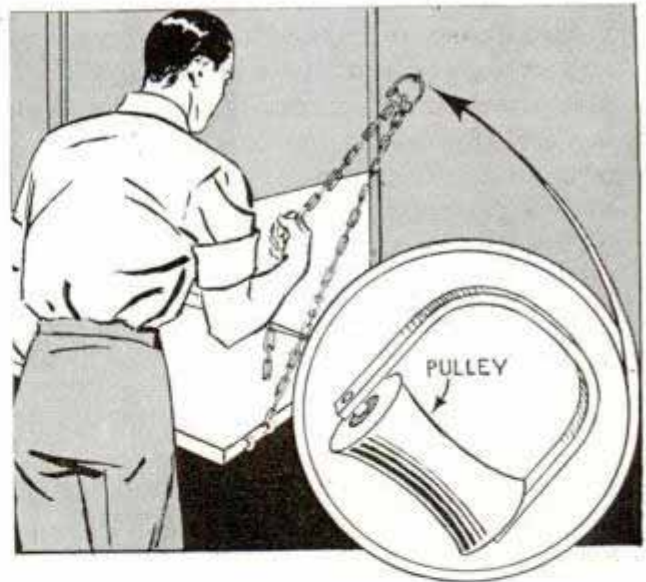
Flexible Garage Doorstop from Radiator Hose

In a public garage, where doorstops were lost or thrown about so that they were not at hand when needed, one mechanic made a supply of them from discarded pieces of radiator hose. Each piece was flattened and riveted at one end to make an elastic wedge.



Truck Tailboard Chain on Pulley Easy to Operate

Instead of running the chain that holds the tailboard through the usual screw eye or over a hook, use a pulley of the type



shown. This makes it easy to pull up the chain as the board is raised, and the chain end can be fastened in the usual manner.

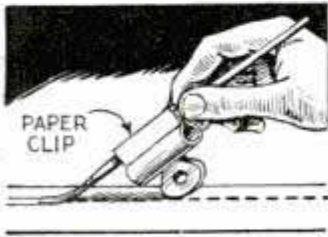
Uses for Soap on Your Car

Besides cleaning your hands, there are several uses for soap around your car. Soft soap or shaving cream applied to the edges of vacuum cups on coat hangers, ash

trays, etc., will make them stick tightly. Maybe there is a squeak around the windshield or other part of the car that is caused by two metal parts rubbing slightly. Shaving cream worked between the contacting surfaces will stop the noise. If it is coming from the floor of the car, an application of yellow laundry soap will silence it.

—C. E. Packer, Chicago.

Paper Clip Provides Guide for Striping Brush

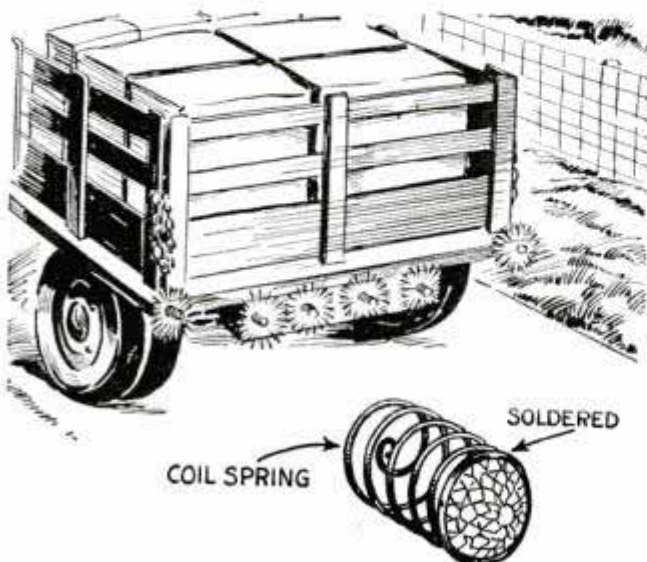


Having an occasional job to touch up with paint where a fender or part of a body had been repaired, one mechanic found that a paper clip

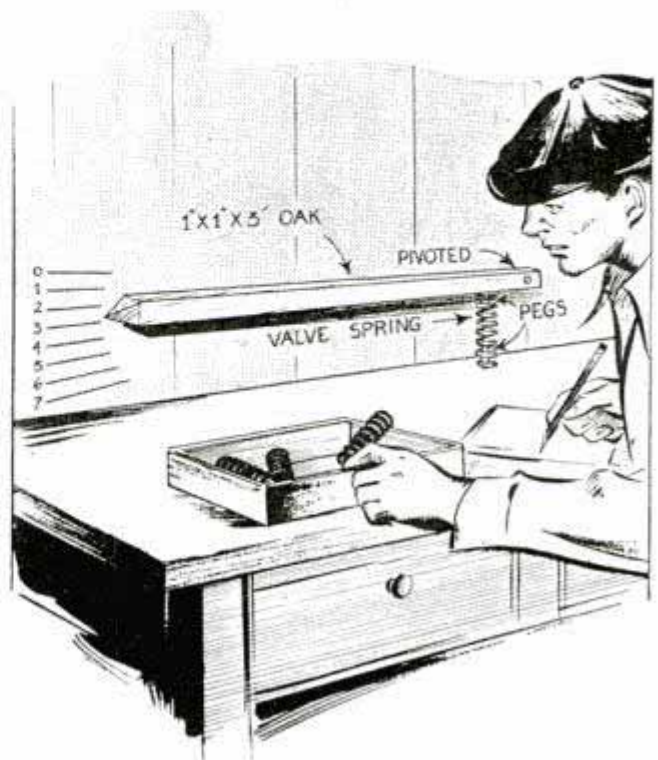
of the type shown provided a good guide for his striping brush. The jaws of the clip are clamped over the brush, which is then adjusted to any angle desired.

Jiggling Reflectors Get Attention of Motorist Behind Truck

Red glass reflectors soldered to small coil springs, which are fastened to the rear of a truck body, will vibrate and tend to attract the attention of an approaching motorist quicker than those that are attached rigidly to the body. The wire from which the springs are made should be of a small diameter so that the weight of the reflectors will cause them to flex at the slightest movement of the truck.



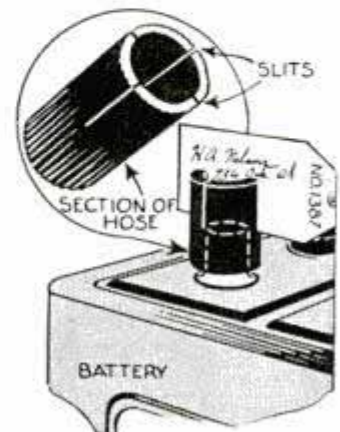
Pointer Tests Valve Springs by Comparison



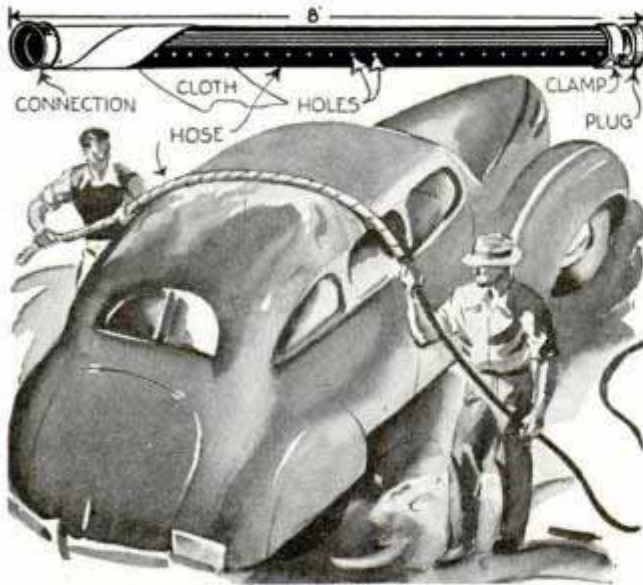
To test the strength of valve springs in approximate comparison with that of a new one, an auto repairman pivoted an oak pointer to the wall over his workbench. A peg in the underside of the pointer and one in the bench top support the spring upright for the test, which is made by allowing the weight of the pointer to compress the spring. The zero mark of the scale at the end of the pointer was determined by using a new valve spring, and the remaining marks were made to indicate comparative loss of strength of old springs.

Acidproof Battery-Tag Holders

Short pieces of garden hose, with one end slit as indicated, provide good tag holders for customers' cards on batteries in a charging room. Ordinary size hose fits snugly over most battery posts and the card may be inserted securely in a slot where it will be conspicuous and the number read easily.



Perforated Hose Washes Car Tops

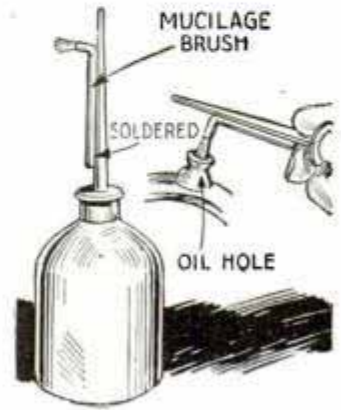


Late-model cars that have no running boards give car washers a problem because

there is no place to stand to reach the top. To overcome this trouble, one washer uses a length of garden hose, which has small holes punched in it about 1 in. apart to emit water. The hose is plugged at one end and is wrapped with soft cloth.

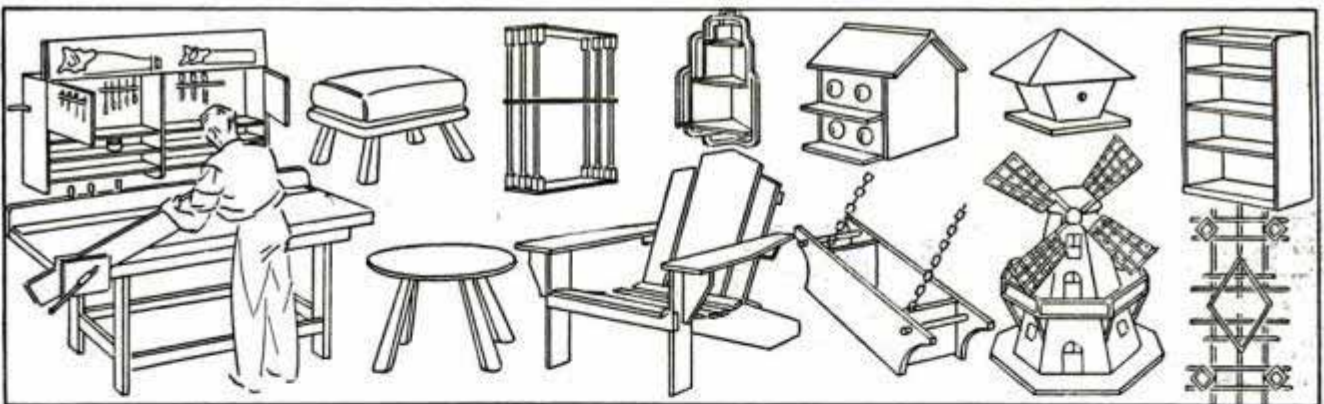
Brush Cleans Oil Holes

To clean out oil holes so lubricant may be applied freely, solder a bent mucilage brush on the oil-can spout. The bristles of the brush may be manipulated to clean a hole before the oil is applied.



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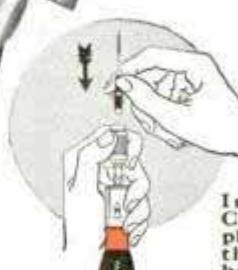
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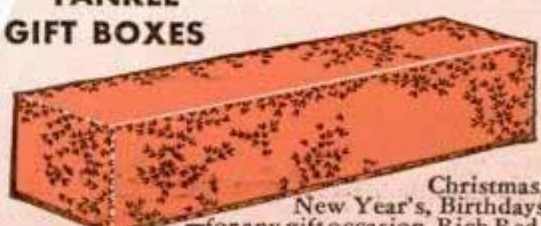
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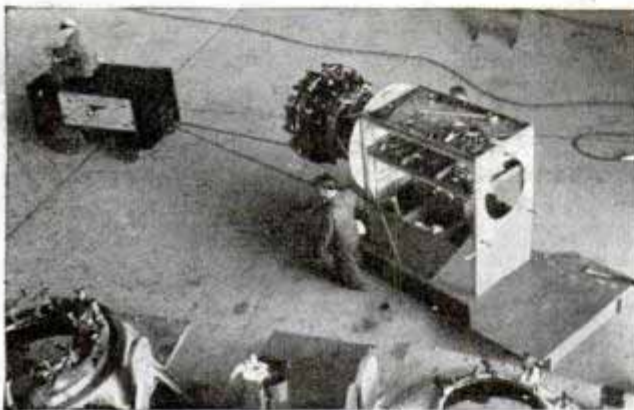


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Keeping the Sea Birds Flying

(Continued from page 94)

the units making up the nerve center of the craft are inspected and serviced, such as generators, magnetos, starters, spark plugs, propeller governors, gasoline meters, five different kinds of pumps and countless other accessories. New equipment, too, is examined and subjected to rigid tests. Of equal importance is the maintenance of the giant, three-blade propellers. An entire shop is given over to the care of this equipment, which is a highly mechanized unit. Each propeller is completely dismantled after every trip, the blades removed and the mechanism overhauled, cleaned, checked and lubricated. Known as variable-pitch propellers, their



Moving one of the 1,500-horsepower engines, of which the Clipper is driven by four

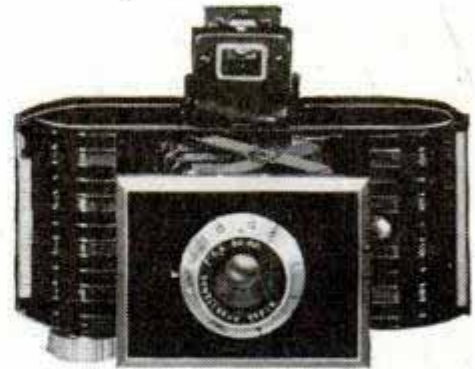
blades are pitched so the angle of attack may be changed in flight. On taking off, the pitch is reduced to develop more power; for straightaway flying, the angle is increased for better efficiency.

As the over-all length of the new Clipper is 109 feet, this means that some of the control cables are close to 100 feet long, which calls for more time and greater care in checking and inspecting the controls of these big ships than any others yet built. Control cables for the ailerons, rudders, wing flaps and elevators are gone over and tested for a service far more demanding than that required of a land plane whose average length of hop is approximately 1,000 miles.

Even the body, or fuselage, is checked, such as port covers and soundproofing panels, which are inspected, cleaned and repaired if necessary. The sea wings, or hydro-stabilizers—short, stubby, under-

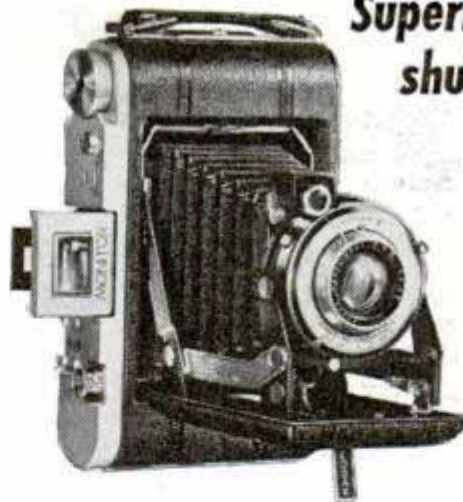
(Continued to page 116A)

1 What \$14 camera gives me KODACHROME transparencies?



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2 What camera recently announced is equipped with that great new Supermatic shutter?



KODAK MONITOR SIX-20 (f/4.5 Special). The Supermatic is Eastman's new high-precision between-the-lens shutter, that is unsurpassed anywhere in accuracy. 9 speeds to 1/400 second. Other features: Kodak Anastigmat Special f/4.5 lens, new-type body shutter release, double-exposure prevention, automatic film stop. Price, \$42.50.

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3 What great miniature is a sensational value at its present price?



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5 What movie camera is justly known as the "economy movie maker"?



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4 What 35 mm. miniature offers high precision at modest cost?

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GREATEST VALUES IN YEARS

(Continued from page 114A)

wings—come off regularly, every third round trip, for inspection and painting. These wings are built to absorb much of the shock of landing; also, they stand a terrific beating when taking off in a strong cross-wind, and when lying alongside a dock or pontoon, which sometimes results in sprung plates or pulled rivets.

The maintenance of instruments for both flying and navigation requires the services of sixteen highly specialized workers. Each class of instrument has its own shop. For flying, there are the air-speed indicator, the tachometer for counting engine revolutions, the bank-and-turn indicator and the artificial horizon. Perhaps the instru-



Giant propeller on test stand for checking after its mechanism has been serviced thoroughly

ment calling for the greatest care and precision on the part of the inspector is the automatic pilot. This maintains not only directional flight, but altitude as well, such as ironing out bumps. Among the navigation instruments are the compass, drift indicator, chronometers, radio direction finders, and the sextant. And every scientific instrument, for both flying and navigating, is removed, overhauled and checked after every round trip to the Orient.

Complete maintenance work at Treasure Island is divided between 125 scientific and mechanical experts; and after each one has finished and inspected his own work, the general inspector goes over the whole ship for a recheck of every detail. The net result is summed up in the test flight. For example, consider a ship that arrived on Tuesday and is scheduled to depart next Wednesday, eight days later. On the fol-

lowing Tuesday all shop work is completed; the ship is fueled and oiled, but before launching there is an engine "run-up"; that is, engines are run for two hours, part of the time at full throttle, part at low speed.

While this is going on, the compass is being compensated, as when the captain of a steamer adjusts his compass by swinging his vessel. Once more in the water, the crew and captain go aboard for a four-hour "cruise to nowhere," the men taking the time for routine drills, such as making emergency landings and abandoning ship exactly as if passengers were aboard.

The purpose of this four-hour shake-down cruise is to make sure everything is in order for the flight to Hong Kong. But if any performance detail is in doubt, if the skipper doesn't like the sound of that No. 4 engine, the detail is attended to overnight. With everything in perfect order, the ship is moored and stands by ready to take aboard her passengers the following day.

But just suppose something does go wrong with an engine or its fuel or oil line, while in mid-flight. Immediately the engine is cut off, while the engineer crawls out through the wing to make repairs. If necessary, a four-engine ship can fly indefinitely on three power units; even on two it will maintain level flight.

Energy in Handful of Uranium Could Drive an Ocean Liner

There is enough atomic energy in eight pounds of uranium to drive a great liner like the "Queen Mary" across the Atlantic ocean. Of course, it won't happen very soon, for the neutron bombardment that releases atomic energy is turned loose only in laboratory cyclotrons. Experimentally, thirteen grams of metallic uranium were exposed to neutrons and the temperature rise was measured. It was found that each uranium atom split liberated 175,000,000 electron volts of energy; splitting 155 billion uranium atoms would warm a gram of water one degree centigrade; a little more than a half pound of uranium would boil 386,000 tons of ice water. And so it was computed that the energy in eight pounds of uranium would equal that of the 6,300 tons of fuel oil carried in the "Queen Mary's" bunkers.

Mr. Malcolm C. Henderson Princeton

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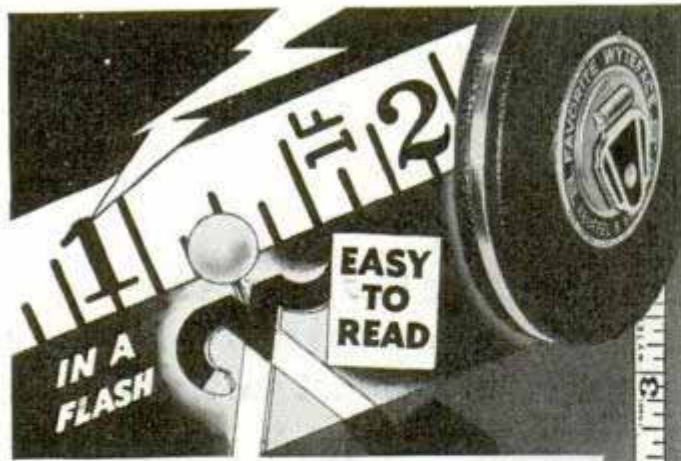
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Tricks of the Figure Skaters

(Continued from page 69)

ity usually start at a tender age, too. The child who takes first steps in figure skating between the ages of four and six has a distinct advantage over those who start later. Not only is he a proficient skater by the time others are just taking it up, but he also, if properly instructed, has nothing to unlearn—no bad self-taught skating habits that must be replaced with the proper routine, and only done by painstaking practice.

Consider for a moment the insecure footing of a skater. It is only a thin blade of steel in contact with a sheet of ice, and there hardly could be a more slippery combination. It is obvious, then, that exhibition skaters do wonders, under those circumstances, and their accomplishments are proof of real skill and agility. A skilled skater, leaping from one foot, can do a double Salchow or a double back loop jump, both of which are two complete turns in the air, and land properly on one foot. Most skating jumps are made from but one foot.

There is no average length of time required for a novice to acquire skill on the ice. The requisite asset above all others is natural ability—in other words, muscular control and that matter of co-ordination spoken of above. The soundness of instruction weighs heavily, coupled with which is the matter of an adequate amount of the proper instruction. Then comes practice, and more practice. From personal experience I know what it is to put in from five to seven hours a day at it, part of the time being devoted to rope-skipping, limbering up and stretching exercises, manipulations by a masseuse, and general conditioning exercises.

Skating being the thing of grace, rhythm and motion that it is, lots of things can be and are done on skates. To pass the tests and earn the medals of the United States Figure Skating Association, the seeker of ice laurels must skate various "school" figures, beginning with circles, and running through threes, change of edges, double threes, loops, brackets, counters, rockers, one-foot eights, three-change-three, double-three-change-double-three, loop-change-loop and bracket-change-bracket. All figures are done commencing on either

right or left foot, forward and backward.

If the seeker of medals can do all these figures in a series of seven tests, to the satisfaction of judges duly qualified by the U. S. F. S. A., the aspirant crosses his fingers, makes sure his rabbit's foot is in his pocket, and heads into the eighth or championship test. Here, if he can execute, commencing on alternate feet for each figure, the backward three-change-three, backward and forward double-three-change-double-three, backward and forward loop-change-loop, and backward and forward bracket-change-bracket, again to the satisfaction of the judges, he has won approximately half the U. S. F. S. A. gold or "champion" medal. The possessor of a gold "champion" medal is not a champion, in the ordinary sense of the word. The medal simply means that he has attained a definite high degree of skating ability.

With his gold medal partly won, as above, the skater wins it in its entirety by giving an exhibition of "free" skating, doing spirals, dance steps, jumps, spins, spread-eagles, and other maneuvers alive with a dash of sparkle and whatever inventive skill he may give to them. It's nice work if you can do it—and do it fast. Men are required, in passing this final test, to do five minutes of continuous free skating; women, four minutes.

Of the free-skating specialties, the jumps deserve the most prominence, because of their innate difficulty. I would rate the various jumps as follows, beginning with the least difficult: 1. Three or waltz jump; 2. Salchow jump; 3. Back loop jump; 4. Splits jump; 5. Lutz jump, and, 6. Axel Paulsen jump. There are minor variations of these jumps that are given different names, but they are only slight departures from the basic forms.

Oddly enough, the three-jump, the least difficult of them all, usually wins the greatest applause from non-skating audiences, when properly done, due to the height attained by the skater in the air in executing it. The three or waltz jump consists of jumping off with one foot, making a half turn in the air, and landing on the other foot. The true skater always skates on one or the other of the edges of the blades of his skates, thus gaining maneuverability, or, in other words, control, due to the knifelike pressure of the skate edge against

(Continued to page 120A)

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(Continued from page 118A)

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the ice. Also, this makes for more graceful patterns that he may cut as he weaves and glides.

To do the Salchow jump, the skater takes off from the inside back edge of one skate. Then he does a complete revolution in the air, landing on the outside back edge of the other skate.

The back loop jump is like the Salchow, but a bit more difficult. Here the skater takes off and lands on the same foot.

With the Lutz jump things begin to get difficult in earnest. The jump is done from a strong outside back edge, by simultaneously putting the toe of the free foot in the ice and using it as a lever to assist in counter-rotation, the jumper landing on the back outside edge of the foot used originally as a lever. Thus when he lands he has done a full turn in the air, and comes down facing in the same direction as that in which he started.

Then comes the Axel Paulsen, one and a half turns in the air. You take off from one foot, landing, one and a half turns later, on the other foot. Still greater skill is demanded by the double Salchow and double loop, performed the same as the Salchow and back loop, but each adding an extra revolution in the air. It is easy to read, but don't be misled.

Spins are something else. There are one-foot spins, two-foot spins, sit-spins, change-foot spins and cross-foot spins, done on either edge of the skate or the toe of the skate. All call for practice, and the novice soon learns that as he draws his arms in toward his body he calls into play one of the factors of motion, known as centripetal force. This force builds up the speed of his spin.

Ice skating is a supreme sport, and he who gains proficiency at it gets keen personal enjoyment out of it. In this respect it is perhaps more so than is the case in some other athletic activities, such as baseball and football, where the spectator reaps the most pleasure from the exhibition.

Our Bureau of Information keeps on file the names and addresses of makers of, and dealers in, all devices described in the pages of Popular Mechanics Magazine. We are glad to furnish this information to our readers upon request, accompanied by stamped, self-addressed envelope.

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"Have just made \$40.00 for 7 hours' work with my Deterger cleaning wrestling pads for high school athletic department. The coach said that this was the only method of doing a satisfactory job."

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"My profits with the Deterger have been more than satisfactory. One job paid \$18.00 for 7 hours' work, another \$28.00 for 8 hours and my customers report 'Looks like new', 'Just wonderful', etc."

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Every machine is made in our own factory and we fully guarantee the quality of materials and workmanship, we also help you get started and make it possible for you to earn a lot of money. The entire outfit comes to you ready to use.

Easy Terms

The price is very reasonable and a down payment brings everything to you complete. The balance you can pay just a few dollars monthly. From the very day you receive the machine you should be able to start making money.

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EASY TO HOLD—EASY TO USE

Here's new skill, new ease for home craftsmen! **FOREDOM TOOLS** afford complete freedom of operation—definitely controlled power at your finger tips. You can work in hard-to-reach places with professional precision. See illustration. Motor suspends from swinging wall bracket. You hold pencil-size, lightweight hand-piece which can be grasped close to its end for easy control. Accessories interchange almost instantly. Hundreds of uses: grinding, polishing, drilling, milling, engraving, sharpening, slotting, stone-cutting, rust-removing, sawing, carving, cleaning, sanding, scratch-brushing, etc., etc. Since 1922 **FOREDOM TOOLS** have been quality-tested and proven by thousands of expert craftsmen the world over. Here's what you get: 1. High grade universal motor (operating on both AC and DC). 2. Flexible shaft assembly. 3. Hand-piece as described. 4. 50-piece accessory set. 5. Swinging wall bracket—complete portable workshop for only **\$14.95**

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\$9.245
*and up

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21021
Trapping the Radio Spies

(Continued from page 63)

direction indicated, tune in on the signals again, and measure their intensity with a field-strength meter in comparison with their intensity at the original location. If the signals are stronger the car is on the right track. If they are weaker, the car turns back in the opposite direction.

"Another method is to spot patrol cars at locations miles apart. Each driver takes the direction toward which his car is



Portable receiver for short-wave beam messages; antenna rod is adjusted for different wave lengths

pointed when the signals are strongest and these directions are triangulated on a map, the point at which the lines converge indicating the location of the transmitter.

"But locating a subversive radio station isn't always as simple as that. A spy station could confine its transmissions to periods so short there isn't time for the cars to swing in a circle to measure the signal strength. We have an answer to that. If we can anticipate the time at which a message is to be sent we can place cars on hydraulic grease racks at gasoline stations in different parts of the county. Raised on a pivot, a car can be swung rapidly while the radio operator finds the direction in

2-10-21
 which the signals sound loudest. Plotting the directions reported by the different cars supplies the answer."

Trapping radio spies is not a major function of the sheriff's communication department in peacetime and such methods have been used mainly to find amateur stations that are infringing on the sheriff's wave length and interfering with official messages.

"Few people appreciate the extent to which foreign nations have been using radio to learn conditions and important military information about this country," remarks an official in another branch of radio surveillance. "An amateur short-wave operator in the United States may, in conversing with an amateur abroad, unwittingly pass on information that the foreign amateur immediately turns over to his government. A foreign vessel offshore, taking advantage of the anonymity of radio may disguise itself with the call letters of an innocent amateur station and converse with amateurs here on the chance of learning something important. Amateur operators are warned to be on guard. These suggestions may seem far fetched, but the actual facts are otherwise."

This kind of radio espionage has been made to work the other way. Trusted amateur operators in this country, properly coached, have deliberately passed on misinformation to foreign amateurs who seemed to have a more than natural curiosity about some subjects. With Europe at war and amateur radio activity in the belligerent countries ended there is not so much prying over the ether waves, although it is not impossible that some amateur stations in warring nations may occasionally assume the call letters of amateurs in neutral countries to carry on conversations with amateurs here.

If the United States should become involved in war all amateur radio transmission, as in the last war, would be forbidden. In such a case some or all of the 50,000 American amateurs may be asked to spend all available time guarding the short wave lengths so that illegal messages may be detected. Attached to Lieut. Ellison's department in Los Angeles county is a small band of advanced amateur operators, chosen for patriotism, ability and availability, on call for work that would include such listening duties in time of emergency.

for SAFETY'S SAKE "PUT A NoRoL ON YOUR CAR"



Avoid
Accidental Roll Back ...

NoRoL

HOLDS CAR on UP-HILL STOPS

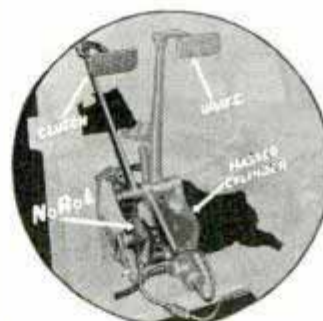
--leaves right foot free for accelerator

Don't be a brake pedal jockey! Put a NoRoL on your car and get away from a lot of leg fatigue as well as excessive wear and tear on clutch and drive mechanism.

NoRoL gives you a "third foot"—doing brake duty against back-roll on inclines, while right foot is left free for accelerator duty. Eliminates fatigue and frazzled nerves when you are driving in congested traffic on hilly roads and streets . . . Does away with chance of back-roll on up-hill start . . . Prevents unnecessary wear on clutch facings . . . Also lessens chances for clashing of transmission gears.

Easily installed . . . Built to last . . . Does not interfere with operation of brake pedal, clutch pedal or accelerator.

HERE'S HOW IT WORKS



[Illustration shows a NoRoL installation . . . Actually is out of sight. Does not alter appearance of car.]

When stopping on any incline, no matter how steep, you simply apply the brake and disengage the clutch in the usual manner. An automatic check retains the hydraulic pressure in the braking system which was developed when brakes were applied. This hydraulic pressure holds the brakes applied as long as the clutch pedal is held depressed, enabling the driver to take his foot off the brake pedal and use it for accelerator duty . . . Thus making it unnecessary to keep his right foot on the brake pedal while the car is stopped. It's like having a "third foot."

When ordering a new car, specify that it come complete with a NoRoL. Available for new models of—

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Also available for many 1936, 1937, 1938 and 1939 makes of cars and trucks having hydraulic brakes.

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Send FREE BOOKLET and details on NoRoL.

NAME _____

ADDRESS _____ CITY _____

STATE _____ MAKE AND MODEL OF MY CAR IS _____

2.928

Floating Freight Yards

(Continued from page 89)

Hardly have the car floats been moored till the seals are broken, car doors swung open and gangplanks hooked over the sills. Men start heaving the crates of fruit and vegetables onto hand trucks. These are promptly wheeled to the platform where the motor vehicles are backed. As one truck departs, another slides into its place. As the crew unloads the first row of cars onto hand trucks another group unloads the outer row onto the platform which runs down the center of the float. With the first row of cars empty, the doors are opened and the truckers go on through, and speedily whisk away the stacks of crates and baskets which are still being piled out of the cars. The air is heavy with the smell of melting ice, celery, tomatoes and oranges.

As soon as the cars on one float have been unloaded, the tug returns and snakes that float out of the line, and shoves a loaded one into its place. The wharf is almost a quarter mile long and a number of tugs are busy at once, all moving, but never seeming to get in each other's way. On their stacks are familiar symbols, Erie, B. & O., New Haven, C. N. J., and others. These tugs all belong to railroads and are in reality floating switch engines.

Along New York's water front are 157 miles of wharf. The activity is being repeated at intervals around the entire island. It is not uncommon for a single wharf to handle 250 cars between ten at night and seven in the morning, unloading them, distributing the merchandise to the waiting trucks, and having it all hauled away, the refuse swept up and the pavement washed by nine o'clock.

The newer car floats are made of welded steel and are streamline. Rectangular in shape, the underwater structure offers minimum drag, and they can be handled in close quarters as easily as an automobile in a parking lot. There are two distinct types, the terminal float, which runs up to a dock for the cars to be unloaded, and the transfer float which runs from one railroad to another. The cars are taken off bodily by a switch engine and hauled by rail to their destination. The terminal float has only two tracks, and is often roofed over; the transfer float is longer, heavier and has

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Send today for FREE Sample and amazing profit details and bona fide reports of big steady earnings! Also, 3-way proven sure money-making plan. Get started at once on this permanent, profitable business. No competition. Simply mail name on penny post card—NOW! Be the exclusive Warner Nu-Way Electroplater in your community.

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Most powerful made for anywhere near the money. Closes to one foot in length. Multiple lens system. 30 mm. objective lens. 5 sections. Directions included for using as a compound 4 lens microscope. American made. Prompt shipment guaranteed. We pay the postage. Only \$2.19. Catalog of Microscopes, Binoculars, Telescopes FREE on request. **BROWNSCOPE CO., Dept. 41, 5 W. 27th St., New York, N. Y.**

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Quick relief from itching of eczema, rashes and other externally caused skin troubles

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2928

three tracks and no roof. These floats are all sufficiently stable and seaworthy to withstand a long trip in rough water, and they ride much easier than many passenger vessels.

Of the 700 tugs operating in New York harbor, one-fourth of them belong to the railroads.

Getting the cars onto the floats is serious business. High and low tide often makes a six-foot difference in water level. Light and heavy loads make a difference in float level. A complex structure, known as a bridge, is used. It is a hinged section of track, which may be raised and lowered to match the deck of the incoming float. When the float is in position, it is securely moored by hawsers, and gigantic drawbolts are slid into sockets, like dowel pins, joining float and bridge into a single rigid unit. Then as the float rises and falls, the hinged bridge moves with it. On the larger floats a hydraulic jack must be used to level the float so the drawbolts can be inserted. Locomotives never roll on the bridges or floats. The switch engine always pushes a string of cars ahead of it, and stays well back on the solid earth.

In the month of October alone, one railroad, with its five tugs, moved 4,959 loaded cars from the Jersey City yards to Manhattan unloading terminals. The total for all of the roads for one year falls just a few cars short of a million. With this staggering volume, one would think it sufficient, yet it is but part of the railroads water borne traffic. There is the ship to rail business, the rail to barge coal handling, the movement of bulk and less than carload lots between terminals and warehouses, and the special delivery and emergency dispatch of rush orders and scheduled business. It is a complicated business structure and calls for many pieces of special equipment, such as special delivery boats to carry last minute deliveries to out-bound steamers, refrigerated and heated floating warehouses to house perishable commodities in summer and winter while they are being transferred from ship to rail, or from one terminal to another.

Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

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Also planes, soldering irons, hand drills and tool chests.

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Prices slightly higher West of Missouri River

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The biggest need in most home workshops is more good clamps—clamps for gluing, holding, drawing-up and for setting-up work. They are the extra hands for the 1-man shop. Don't spoil or delay work for want of clamps. From over 40 types of clamps we have selected these as the first for homecraft use.

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PONY Miniatures 9 types 1" to 2 1/2" cap. Not torn but fine tools with 100 uses.

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GHQ MOTORS, 40B East 21 St., New York, N. Y.

2997

"Hams" Circle Globe

(Continued from page 79)

tor rod likewise absorbs radiation and re-radiates the power in phase to boost the strength of the radio waves traveling in its direction. As many as five elements instead of the usual three may be used to collect the power broadcast from the radiator and direct it as a powerful beam in one direction.

The Hawkins' formula for the radiator rod is: length in feet equals 477 divided by the station frequency in megacycles; reflector: length in feet equals 492 divided by the frequency in megacycles; director: length in feet is 458 divided by the frequency in megacycles. For a station transmitting on 28.8 megacycles, in the ten-meter band, the radiator is sixteen feet six and one-half inches long, the reflector is seventeen feet one inch long, and the director is fifteen feet eleven inches long. Spacing between the radiator and reflector is ten per cent of a wave length, or forty-one inches for 28.8 megacycles, and the distance between the radiator and the director is fifteen per cent of a megacycle or sixty-one and one-half inches for 28.8 megacycle transmission.

With an aerial calculated from this formula amateurs on the east coast are able to communicate with Japan, using twenty-five watts or more, and amateurs on the west coast can reach across the continent and the Atlantic to work voice stations in Europe and Africa. Scientific measurements of "radio echoes" indicate that signals from many small stations actually travel all the way around the world.

In order to be able to rotate their aerials in any direction amateurs use special antenna supports. The aerial rods are usually mounted on a lightweight wooden framework strong enough to withstand high winds. The whole structure is revolved by means of an electric drive, a satisfactory combination consisting of an electric washing-machine motor attached by means of a V-belt to a gear box that in turn is connected to a worm and wheel drive such as may be obtained from the steering mechanism of a 1932 Chevrolet automobile. The electric drive is operated by remote control from the transmitting panel. Such an antenna may be built for twenty dollars and up or at a minimum cost of fifty dollars if an electric drive is used.

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... Now in my OWN Business.

Would you, too, like to own a business where you could take in \$200 your first week as did L. A. Eagles in Madison, Wisconsin?

We want a reputable, honest man in each county. This man need not have any special experience or more than ordinary ability, but he must be honest and courteous.

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The rug-washer finishes rugs like new on the customer's floor. Anyone can run it. Electricity does the work. A quick, thorough and highly-efficient method that restores the natural beauty of floor coverings.

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Address.....
City..... State.....

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C. J. White says: "\$100 business in six days—never a complaint." That is the nicest part of this business—every customer is more than satisfied. Stains and blotches disappear and vivid colorings and freshness in faded floor coverings come back.

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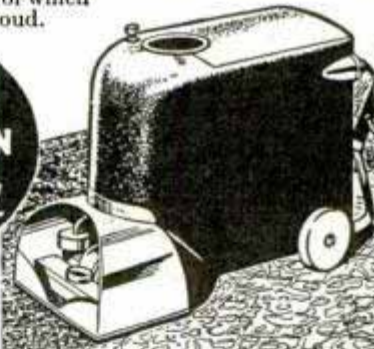
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Calculator Machine Company, (Mfrs.), Dept. 101, P. O. Box 1118, Chicago, Illinois

Color-Shooting in Fairyland

(Continued from Coloroto Section)

placed a phonographic pickup, which was connected to the screen by a small piece of wire. By pounding on the screen with drumsticks, the vibration was transmitted into the phonographic pickup and then amplified and reproduced through a large horn, at which point it was picked up by the microphone.

While the sound effects department was at work, the musicians were working on the background score for the production. The first rough music tracks were recorded by piano, to give an idea of the type and theme of music for various sequences. After all sequence changes were made, the score was recorded by organ and Novachord. Because there were so many places in the picture where strange, comic or eerie sounds of music were required, the music department frequently called in small orchestral groups and used them for experimenting in arrangements. After the desired result was worked out, the full recording orchestra was called in. Among the scenes which called for more than "every-day" music were those in connection with the whale, the sounds of musical toys and music boxes, and the theme music surrounding the "Blue Fairy."

Cameras considered the last word when "Snow White" was filmed have been improved or replaced by new types. Among the most important is a type of universal camera crane, a development whereby instead of using a vertical method of shooting, as on the original Disney multiplane camera, the camera dollies into a scene or away from it, on the same principle as motion-picture photography in a live-action studio. The backgrounds which can be used on this camera are twice as big as those which could fit in the original multiplane setup.

Dirt, dust and lint, long the bugaboo of the inking, painting and camera departments were vanquished by having the employes of these departments wear lint-proof smocks and coveralls while working. In the camera department two innovations were set in: one is an electronic method of cleansing the celluloids of all foreign matter. The other is a device whereby anyone entering the camera rooms is treated to specially routed air blasts guaranteed to remove all dust and lint from clothes.

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This latest model Delta 11" Drill Press is almost a complete workshop in one tool. It will, of course, perform all metal drilling usually required around your home shop, taking drills up to $17/32$ " in diameter. It takes all standard wood bits up to $1/2$ " shanks and can be used for drilling holes up to 2" in diameter with multi-spur bits. With the addition of special Delta attachments it can be used efficiently: for making square end mortises from $1/4$ " to $1/2$ " width and of any length—for numerous routing operations—for shaping—for sanding both curved and straight work—and for many jobs of surface grinding. No wonder this quality tool offered at a surprisingly low price is being used and endorsed in thousands of home shops and small industrial plants all over the country!

Many Special Delta Features on this 11" Drill Press

Here is the only 11" drill press made with both the Self-Aligning Drive and a Free Floating Spindle—a combination that assures years of accurate service. Has numerous other quality features including precision construction, Tilting Table with locating pin, Graduated Quill and Adjustable Pointer for depth boring and drilling, Stop Rod and nuts for repetition drilling and self-sealed ball bearings requiring no lubrication for their entire life. For full details, send for latest Delta catalog.



\$25.95
(less motor)

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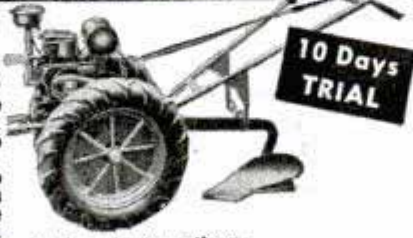


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The Wonders of Polaroid Glass

(Continued from page 53)

desired colors are attained. A turn of one of the Polaroid disks and the color scheme can be made to change smoothly to the complementary color arrangement, four times during each rotation. In fact, with a more complex mechanical setup, endlessly changing color schemes become possible.

The first full-scale mural, eighteen feet wide and thirty-six feet high, was built for a motor-car manufacturer to show the car of the future glowing in ever-changing, subtly-blended colors—colors seen only in a butterfly's wings, a sea shell, and in a film of oil on water. The mural operates only at night. No colors are used, the entire effect being produced from revolving disks of Polaroid film.

Several months ago, the motion-picture industry was startled by a colored film Loucks and Norling made for the Plymouth company in which the illusions of depth and roundness are preserved by substituting two-eyed vision for one-eyed vision. In principle, at least, this approach to stereoscopy is a familiar one. Most of our impressions of distance and of space, optical experts say, arise from the fact we see simultaneously with two eyes. The view seen by one eye is always slightly different from that seen by the other. Through life-long experience, our brains are trained to interpret the differences between the two views in terms of space and distance.

The camera, therefore, used in making stereoscopic colored pictures looks upon a scene just as a pair of human eyes would. Two pictures are shot simultaneously, eye distance apart, by means of an attachment affixed to the camera. The two views are then recorded side by side on a single film. When shown, the two views are projected on the same screen, one over the other, by means of a similar device which reverses the taking technique. Each image is polarized by projection through Polaroid disks. The disks are set in such a way that the right-eye image reaches the screen polarized horizontally while the left-eye image reaches the screen polarized vertically.

Supplied with spectacles having special Polaroid lenses, set at corresponding angles, the spectator sees one image with the left eye, the other with the right; each eye

21001
 45 W. 55th Street
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 sees one picture and one picture only. That's all there is to the procedure—the left eye sees what the left eye would see if it were present at the scene of the action, the right eye sees what it would see. The brain converts these impressions into a feeling of depth and true realism.

One of the most popular applications of the single Polaroid sheet is in dealing with glare. If you look at a non-metallic surface, your eye gathers two kinds of light—the diffuse light with which it sees color and detail and the mirrorlike reflection of the light source—glare. This specular reflection, as it is called, is largely, sometimes wholly, made up of vibrations that are parallel with the reflecting surface—therefore, highly polarized. The diffuse light on the other hand is substantially unpolarized. Thus, by looking at the surface through Polaroid material, the glare virtually can be removed without greatly changing the relative brightness of the diffuse light. Ordinary sun glasses, on the other hand, reduce the intensity of diffuse light and unwanted glare equally but the Polaroid ones can discriminate between them, absorbing the reflected light, transmitting the other.

The eyestraining glare of the desk top or the word-obscuring dazzle of the slick magazine page can be precluded by Polaroid. The light reflected from these surfaces is polarized horizontally, making it impossible for these vertical ribbons of light to deflect off the horizontal desk top or printed page in the form of glare.

Light filters made of this material do for the camera what Polaroid glasses do for the eye. The polarizing material, cemented between optical plates, and mounted in a lightweight metal cell, fits in front of the camera lens. One type Pola-screen is suitable for photography both in Kodachrome and black and white. With such an attachment, a photographer making a shot of, say, a store window can subdue oblique reflections. If he takes particular pains in selecting his camera angle, reflections virtually can be eliminated. Or, in shooting a picture in a direction at right angles to the sun, faces, buildings, trees, and other objects can be made to stand out against a blue sky by using one of the special filters to darken the latter. Copy and reproduction work can be improved appreciably by Polaroid attachments on lens and lights.

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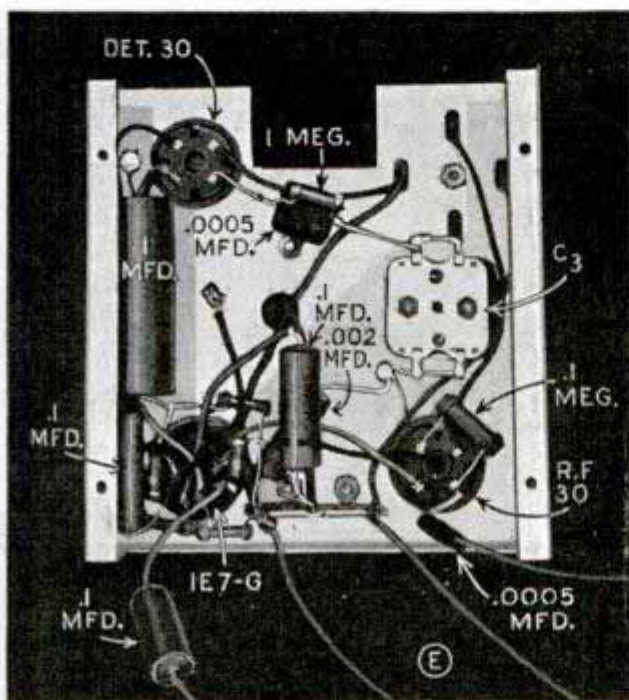
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Inexpensive Treasure Finder

(Continued from page 137)

pair of 4,000-ohm headphones should be used for maximum results.

When wiring the instrument, refer to photos A, B, C, D and E, as these all show actual views of the various stages of construction; the schematic circuit diagram appears in Fig. 3. Avoid loose connections, and use insulating sleeves of "spaghetti" tubing freely throughout the circuit wiring to prevent the possibility of accidental shorts. Make all soldered connections



carefully, with rosin-core solder. The battery leads should have a definite color code. A detailed list of materials can be obtained from Popular Mechanics radio department without charge.

Handle the r.f. coil unit carefully so that the two fixed coils are not moved from their established positions; be particularly careful to avoid injury to the delicate leads connecting the movable middle coil. Note the separate twisted insulated hookup leads loosely coupling the variable condensers C₁ and C₂. For a better coupling it is suggested that these leads terminate in single interlocked loops, rather than being merely twisted together.

After assembly, install batteries, insert tubes and plug in the headphones. Adjust rheostat to show exactly 2 volts on the voltmeter. Set C₁ and C₂ so that the plates are about half way in. Carefully move the

(Continued to page 135A)

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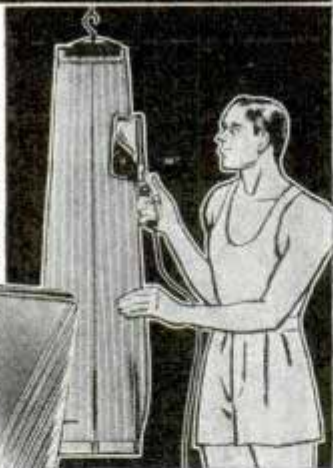
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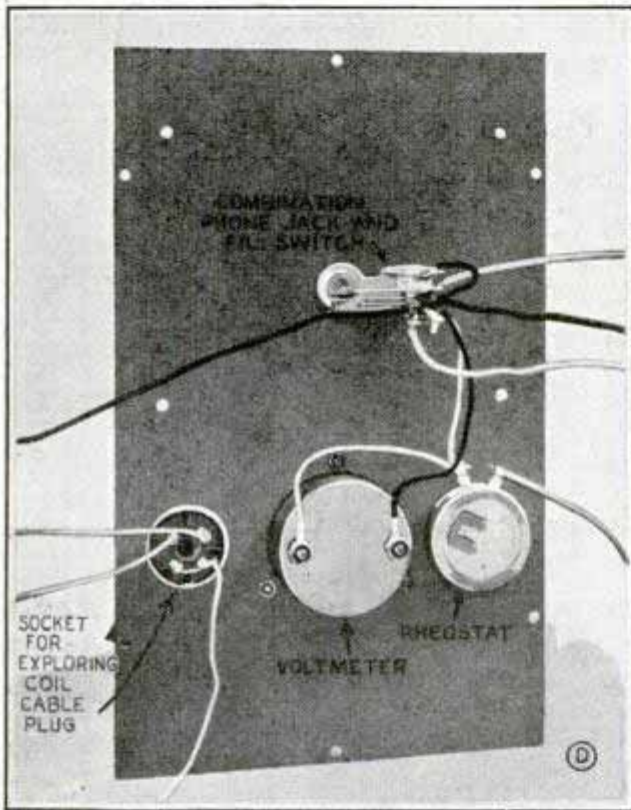
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(Continued from page 133A)

adjustable middle coil on the r.f. unit to about mid-position. Plug in the loop-unit cable and set the loop edgewise on a table, at least 6 ft. away from all metallic objects. A strong oscillatory tone should now be heard in the headphones.

The next step is to adjust the dual trimmer C₃ by means of a long insulated screwdriver inserted through the holes in the top of the base, and reconcile this adjustment with the correct placing of the adjustable middle coil previously referred to. Adjust



the trimmer screws one way or the other until the signal tone drops to zero frequency. Tighten this trimmer slightly more to bring the low-frequency signal tone again into action. When the movable coil has been placed correctly by trial, it will be found possible to control the audible clucking note through a satisfactory range of from zero to several hundred cycles per second by a slight adjustment of the vernier control C₁; make this adjustment with the cover of the cabinet closed. Note that when adjusting the middle coil, a rather violent oscillation is heard when the fingers are placed on the coils; this is normal.

If C₃ and the movable coil have been adjusted correctly, you can now set the instrument for zero, or near zero, signal and make the test with metals previously re-

(Continued to page 136A)

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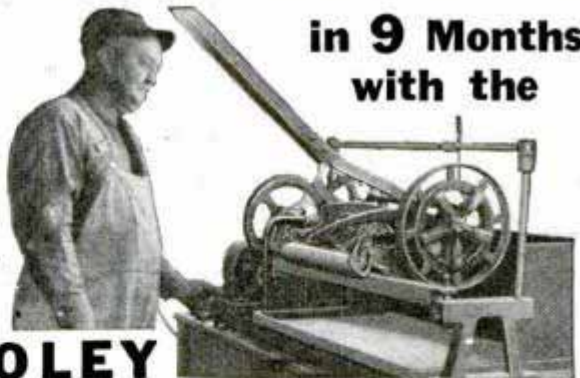
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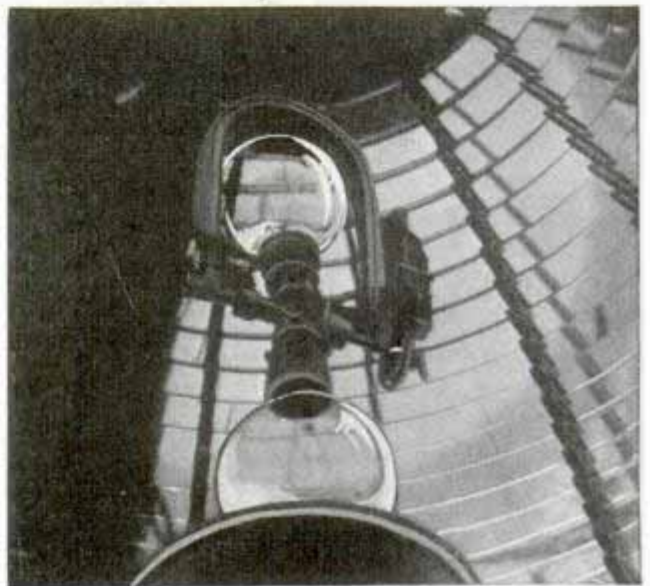
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2994 Blind Man's Buff

(Continued from page 37)

the distance from ship to radio beacon may be computed by measuring the time interval between radio and aural signals. Dividing the seconds of interval by five gives roughly the distance in miles.

The trouble is that frequently the fog-horn is not heard, even by the best of ears. For the very difference in air temperature that causes fog also distorts sound waves upward. These same waves may be deflected later back to earth by a higher layer of cold air, so that a ship five miles from a



Lens of the Cape Henry lighthouse on the Virginia coast, guarding the entrance of Chesapeake Bay

lighthouse might hear the fog signal, while a vessel a mile away might miss it.

Sound waves are subject to other disturbances. The edge of a fog bank, intervening between ship and source of sound, deflects waves that strike it at an obtuse angle. Wind always distorts sound waves, confusing the direction of the source. The reason is that sound waves spread in a circle, like ripples from a stone dropped into a pond. Wind distorts this circle into an ellipse. Since the apparent source of sound is at right angles to the front of the wave, a listener may mistake the source by as much as seventy degrees.

To overcome the idiosyncrasies of sound through air, several lightships transmit submarine distance-finding signals. The Fire Island and Ambrose lightships transmit with an underwater bell; the Nantucket has a submarine oscillator. Such signals are not subject to distortion, and their

2994
 speed is uniform at 4,800 feet a second. However, it takes a costly installation in the ship's hull to receive such signals; few except the most modern liners carry it. The "Olympic" did, but it did not prevent her running down the Nantucket.

Having felt her way along by radio and sound to Ambrose lightship at the entrance to New York harbor, our captain picks up the Sandy Hook pilot, who guides ships through the narrow channels of our busiest port. And the channels are narrow. The broad expanse of water you see from the Staten Island ferry is a delusion, for most of it is less than ten feet deep. Even Ambrose Channel is but forty feet deep—and a thousand yards wide. The pilot must keep the ship within this channel, must avoid other ships, and the countless ferries, tugs, and lighters in the harbor.

To follow the channel in fog, he must feel his way by compass and watch the buoys anchored along the channel boundaries, half a mile apart. Each may be identified by a number on the side, by the individual flashing interval for its light, and by its distinctive bell or gong, trumpet or whistle—all sounded by wave action. A deep-toned bell or whistle can be heard for miles, yet the ear has trouble ascertaining its direction even when close at hand. A shrill, high-pitched tone has excellent directional qualities, but can be heard a very short distance.

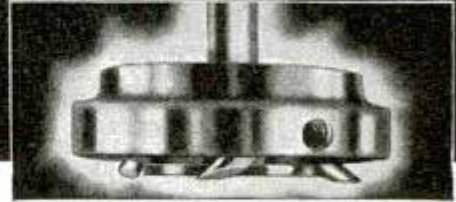
Navigation and piloting in fog must be done entirely blind, except for the few unobscured yards permitted by the fog. And this short visual distance is not enough, for a ship must proceed at a reasonable rate of speed to remain manageable. Except for ferries, tugs, and a few other vessels with an extremely high ratio of power to size, a ship cannot maintain steerage-way and be stopped in less than four or five times its own length. Neither can a large ship be maneuvered quickly to avoid collision. It will continue on its original course for a considerable period after the rudder has turned it in the new direction, skidding or drifting on the turn. Then too, a ship cannot turn directly away from danger, as can an auto, or other vehicle with front steering. In making a right turn, a ship's rudder actually pushes the stern to the left, instead of tracking the bow in the new direction. You can illustrate this prin-

(Continued to page 140A)

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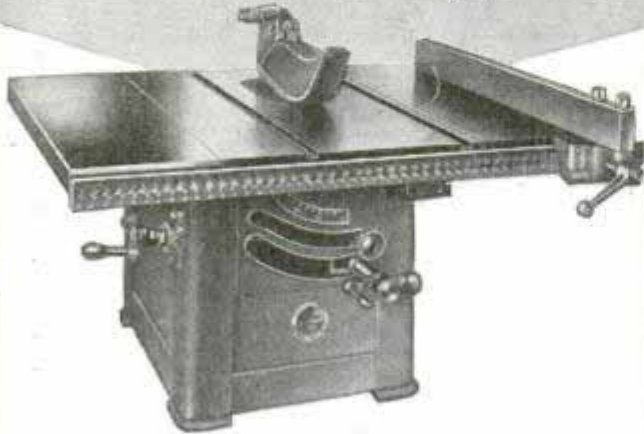
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(Continued from page 138A)

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ciple with your own car. If parked alongside another car, you can turn your wheels and move forward directly away from it. But if you cut your wheels to back away, the front end of your car (now the rear) will move toward the other car before you start to move away from it.

With sound so unreliable, with ships so hard to manage in the visual distance permitted by fog, some method needs be found to increase that visual distance. Science has long been at work on the problem, but with little success. Sodium vapor and neon lamps have been tried, but they increase visibility in fog by a few feet only. Dr. W. J. Humphreys of the U. S. Weather Bureau says 300 feet of dense fog so refracts visual rays that the direction of their source becomes indistinguishable.

He suggests the shorter waves, heat waves invisible to the human eye but easily detected by a visually recording thermocouple. Such a receiver would pick up rays from a heating element in lighthouses and buoys; engines of another ship would emit more than enough heat rays to stimulate the thermocouple. Such equipment, already perfected in the laboratory, awaits commercial exploitation. Efforts to disperse fog have met with failure, though successful in the laboratory. Electrical induction, for instance, will dissipate fog within a few feet of the charged wire. It is manifestly impossible to string a network of highly charged wires over a harbor. Electrified sand, dust, or water, sprayed from an airplane, will cut a swath through fog; but the fog will close in again immediately unless enormous quantities are sprayed—a ton a minute per acre. Fog particles will condense and fall as rain when the temperature becomes low enough; or will evaporate with enough heat. It would take a ton of coal a minute per acre to furnish enough heat to evaporate a fog, if distributed evenly.

"Yes," Dr. Humphreys declares, "we know how to dissipate fog—in the laboratory. I know how to carry a stone too, yet I wouldn't attempt to walk off with the Washington monument. It's one thing to know how to do something; quite something else to figure out a practical means of doing it."

Meanwhile, the game of blind man's buff goes grimly on.

9973
 "Painting" Live Pictures

(Continued from page 75)

seen close up it still appears to duplicate exactly the hair on the figure in Gainsborough's masterpiece.

Of all the living masterpieces, da Vinci's "Last Supper" is the most startling. The original, now faded and blurred, is on the wall of a chapel in Milan. But Ropp's living reproduction has all the drama and brilliance which must have characterized the painting at the moment when da Vinci's brush finished its work. In recreating this painting it was found that the audience was unable to see the top of the table behind which the apostles sit. So Ropp slant-



Girl making wig for Gainsborough's "Blue Boy" is guided by copy of the famous painting

ed the table toward the audience. So cleverly was the illusion created that the table looks flat—yet all of its top is clearly visible. But with a slanted table, the cups, plates, bread and fish, which da Vinci painted, would slide off. Ropp solved this problem by gluing all the plates and cups, even the bread and fish, onto the tablecloth.

So the Pageant of the Masters goes on, accomplishing with artistry and ingenuity the seemingly impossible task of displaying great paintings and pieces of sculpture that, in all reality, live.

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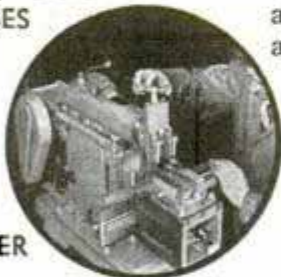
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2995 College for Seals

(Continued from page 85)

or in comedy, the latter being in particular demand these days. Huling points out that the balancing tricks are much more difficult than those demanded of performers of former years. One of the hardest is to balance a glass of water and roll over without spilling it. Another is to roll a small ball back and forth on a grooved stick.

As for comedy, complete little routines of the vaudeville sketch type are being taught in this course. "Seals are real comedians," says Huling, "and their droll appearance gives them a natural advantage as far as getting laughs are concerned. Right now I am teaching one pupil to say his prayers, get into bed and pull up the covers, then 'wake up' and start scratching himself with a flipper. After he has mastered this, I will teach him to go through some antics in a bathtub. Then the two stunts will be combined in one routine and the student will be able to give a thoroughly ludicrous imitation of a person taking a bath and going to bed. Tricks such as these, burlesquing actions of human beings, have a sound theatrical psychology and are sure fire with audiences.

"Curiously enough when a pupil has thoroughly mastered a difficult trick, he must be taught to 'unmaster' it a bit. Veteran showmen know that a stunt will be more appreciated by an audience if it is made to appear very hard. A proficient student will go through a really difficult trick so fast that it seems easy to the casual onlooker. And so he must be taught showmanship, and the knack of doing things more slowly."

When one of the students leaves Seal College, he does so in his own specially equipped car, designed by Mr. Huling. The car contains a miniature tank of fresh water and is spacious enough for the seal to exercise in while en route, instead of being confined in a small cage as formerly.

"The seal car is but one of the many scientific improvements which we have added recently," said Mr. Huling. "As the need for new apparatus and equipment develops we will originate it along scientific lines. Any animal with a value that can be increased as greatly in a year's time as the seal's certainly warrants the best and I believe that Seal College is a long step in this direction."

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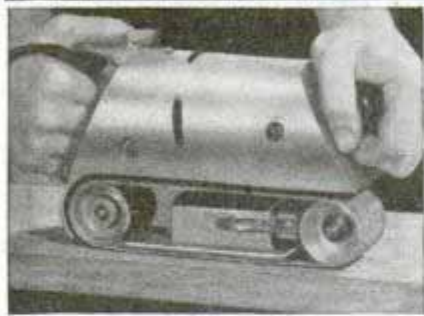
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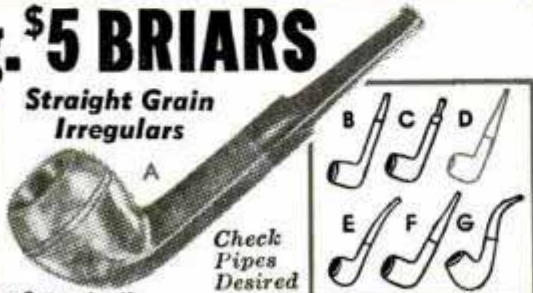
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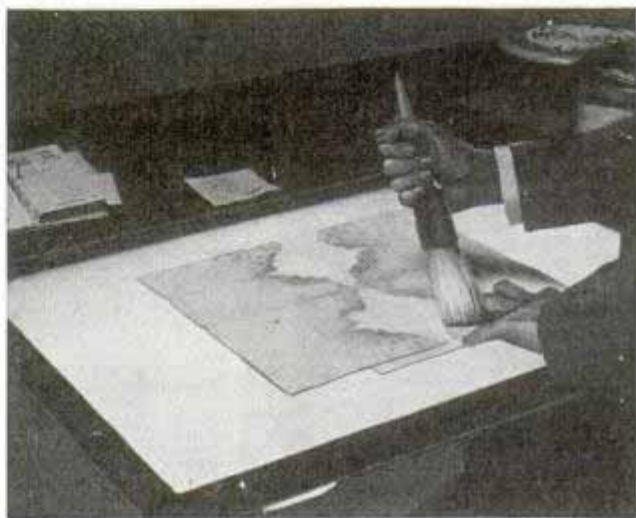
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21020
Lifesavers for Old Books

(Continued from page 57)

Mysteries surrounding old manuscripts are solved with the aid of a color-distinguishing robot which automatically analyzes the color of ink used in old documents. Combining an electric eye, a microscope, filters, radio amplification, and a current recorder, the mechanism was designed by Captain R. B. Haselden.

His color-distinguishing robot was designed to aid the human eye in analyzing the color of small opaque objects such as pen strokes. The writing to be analyzed is



Glass table top, illuminated from beneath, aids in the patching of manuscript fragments

placed under a microscope. At the eyepiece of the microscope is a photoelectric cell. Before reaching this cell the light passes through a color filter. Color filters are provided which cover the entire range of the spectrum. The light which passes through the filter and reaches the cell sets up an electric current which is amplified by radio tubes, and finally recorded on a meter. By noting the difference in the strength of the electric current when different colored filters are used, the exact shade of the ink can be determined with far greater accuracy than could be done by the human eye. By using ultraviolet light, a complete manuscript may be found written under the one being examined. As the lambskin or "vellum" used by ancient authors was often scarce, they made a practice of washing the writing off a discarded document and using the vellum again. Although the original writing is invisible under any normal illumination, ultraviolet light makes it clearly visible.

295 J
Flying "Under the Hood"

(Continued from page 11)

Because of radio a pilot no longer needs to watch the ground to keep track of his position. Airway marker beacons of several kinds tell him of his progress along an airway and if he desires he can take intersecting bearings on several radio stations with his rotatable loop. With such bearings he can fix his position instantly. The directional loop is one of the most valuable instruments on the plane and pilots practice with it constantly. One recent innovation is an automatic direction finder that consists of two loops that revolve at con-



Big DC-4 warming up for night flight. A smaller ship of same type will be used in transport service

stant speed, the mean of their readings being transferred to a dial that shows the bearing of a particular ground station no matter in what direction the airplane is turned.

Valuable as the radio beams along the airways are now they are to become even more dependable shortly when new ultra high-frequency transmitters are installed. The purpose of the new installations is to eliminate static and multiple and bent courses, delivering clear reliable signals to aircraft under all conditions. Present radio range stations transmit four beams, one in each quadrant, and the plan is to replace each of these with two short-wave transmitters that emit two beams each. The idea is to avoid the congestion of four-way traffic at one point. In the future each leg of a radio range station is to be identified by a special signal that shows its direction from the transmitter. Another proposal is that the present ground control radio stations at major airports be equipped with re-broadcast equipment so that pilots of incoming air liners can talk with one another to arrange their order of approach.



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21221 Army on Wheels

(Continued from page 5)

lery, the deadly hail of the machine-gun bullet—combined to halt mobility. Then came the tank, as compromise, for it combined to a certain degree mobility and fire power or striking power. Today an improved tank, with increased mobility as well as increased fire power, is in the field. And already its Nemesis has appeared—the anti-tank gun.

Last September, Poland was eliminated as a combatant because the German invasion disrupted the entire economic structure of the nation; destruction of Polish armed forces was of secondary importance and a logical conclusion once the industrial heart of the nation was penetrated. This was accomplished by use of mechanized forces which, being mobile, dashed ahead at top speed, and, having fire power or punch, brushed aside local resistance. Foot troops, infantry, able to hold the terrain dominated by the mechanized thrust, followed fast. And foot troops, armed men on the ground, are the decisive factors in war.

Perhaps the most brief, the most illuminative word-painting of what this all means is the homely language of General Nathan Bedford Forrest, of the Confederate Army, who expressed all the principles of war in this remark—"Git thar fustest with the mostest men."

This can be done in two ways—by using transportation to get troops onto the field of battle, when they must then dismount and fight on the ground, or by using the vehicles not only for transport, but as actual fighting platforms. Today we call the first motorization the second mechanization. The words do not mean the same thing. The basis for mechanization is of course the cross-country vehicle, which by one of several ingenious devices, most of them adaptations of the so-called Caterpillar tread, or endless-chain track, can cover ground which an ordinary wheeled vehicle cannot cross.

Mechanization began with the World War tank, a cumbersome armored tractor which lumbered across country at the pace of walking infantrymen, protecting them in its advance, crushing machine-gun nests, knocking down barriers, crossing ditches and trenches. Today tanks, both light and medium, which can in theory make forty miles an hour or more, are still

(Continued to page 148A)

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21221

(Continued from page 146A)

the basic vehicles of mechanized forces. We say "in theory" because in fact a vehicle of this type crossing rough terrain is limited more by the human element than by its traction. One must remember that in action the driver, completely enclosed, has most limited vision. How fast would you drive your auto, on the road, if your only observation was through narrow eye-slits? Multiply this by the obstacle-dodging necessity of cross-country driving, and you will realize that only under most exceptional circumstances, on smooth ground, could extreme speed be kept up.

The heavy tank or "land battleship," is a special weapon for special circumstances, such as a break-through on a stabilized front, and has been discarded by some nations. Armor used on tanks covers only the vital parts, and is not all-round, hence tanks are more vulnerable on top and bottom. Again we see the conflict between the two opposed factors of mobility and fire power. It might be possible to build a tank which would be impervious to anything but heavy artillery projectiles; when you do this, however, you instantly slow up its speed out of all proportion. A nearly motionless tank cannot carry out its mission.

Light, medium and heavy tanks have two uses—accompanying, that is, moving with their infantry and assisting its forward movement; and leading, that is, to charge and clear the way for infantry.

Tanks have certain basic limitations: their noise, which can be heard a mile or more away, and which, inside the vehicle is terrific, limiting communications and preventing the crew from locating anti-tank guns by ear; poor vision of crews; distinctive appearance; ineffectiveness of their fire at any but the most limited ranges, because of poor vision and eccentricity of motion; limitations of ammunition supply; terrific strain on the crews, and sensitivity to terrain. Deep mud and sand, and stump land are serious obstacles. Steep-sided ditches, felled trees, pits—like elephant traps—in roads and artificial obstacles like concrete pyramids, will break up tank attacks.

Most tanks can cross ditches five to six and one-half feet in width and can ford streams up to three feet in depth if the bottom be firm. Mines, portable affairs which weigh about five pounds, detonated by contact, can be sown in fields which

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Q 1221

might be perfect avenues of approach. Heavy woods are tank obstacles, but sparse woods may work to their advantage as tanks can push over trees up to six inches in diameter, and scattered trees may provide cover for them to creep up within charging distance.

But of all anti-tank weapons artillery is the most to be feared. To understand this we must visualize the penetrative power of projectiles in armor plate. The following approximate tabulation may help:

Weapon	Caliber (inches)	Rate of fire in combat rds. per min.	Penetration (inches) at 100 yards distance
Rifle	.30	10	.35
Automatic Rifle	.30	40	.35
Light Machine gun	.30	250	.35
Heavy Machine gun	.50	100-150	.80
20 mm. Anti-tank Rifle	.79	10	1.25
37 mm. Cannon	1.45	10-20	1.30
47 mm. Cannon	1.85	10-20	2.00
75 mm. Cannon	3.00	6	Direct hit probably fatal to any tank

The figures given above are based on a direct hit with ninety-degree angle of incidence, that is, with the bullet meeting the armor plate squarely. However, one must remember that absolute destruction of the tank is not the essential object of anti-tank fire. The shot that knocks off a tread or otherwise cripples the progression of the vehicle is sufficient.

To assume that the tank is not a dangerous weapon, however, is erroneous. The tank is a highly dangerous and highly important weapon, since it provides for the attacker an increase of mobility and an additional striking power crushing through defensive works which would otherwise hold up the infantry. It is an essential member of the combat team.

Insofar as the infantry are concerned, the tank, used either as an accompanying weapon or as the spearhead of an attack, must be considered by both attack and defense. Its use as either or both depends upon national doctrine, terrain and tactical situation. Some countries, for instance Germany and Russia, contend that the hammer-blow, in advance of the infantry, is the true role of the tank. Others, among them France, hold that tanks should move side by side with the foot troops.

(Concluded next month)

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minnows, eels, mink, muskrat, with our folding galvanized Steel Wire Traps. **Walton's Automatic Hooks** are so constructed that when a fish gives the slightest pull on the bait the upper hook reaches down and gets a hold that holds him. 3 for 50c. Write for descriptive catalog of Traps, Hooks, Lures, and other specialties. **Walton Supply Co., 3567 Junata Ave., St. Louis, Mo.**

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Outwitting the Air Raiders

(Continued from page 31)

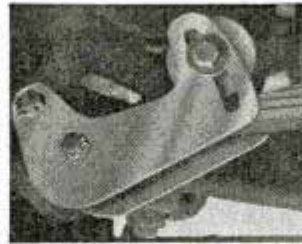
in serious stoppage in steel mills, petroleum refineries and airplane factories.

The idea of the aircraft warning service is an outgrowth of an older plan intended to organize emergency assistance in time of stress. Unknown to most of the inhabitants, a major disaster plan has been prepared for Los Angeles city and county and for a number of other cities and counties in the west. In case of any such major catastrophe as a devastating earthquake, an uncontrollable pestilence, or a destructive air raid, a behind-the-scenes rescue and rehabilitation organization will immediately begin to function.

The plan coordinates into a large efficient organization much of the public and private resources of the area. The American Red Cross, fraternal organizations, law-enforcement bodies and fire departments, ex-service men and other groups, all have been furnished with stand-by orders as to what each member should do. The efficiency of such a plan depends on its details and the emergency council of Los Angeles county has tried to foresee every possible contingency. Golf courses, parks, race tracks and other open areas adjacent to dense population centers are listed as possible refugee camps, the availability of uncontaminated water and the furnishing of medical supplies to the refugee centers has been studied, and the location of food supplies has been noted.

Chests of maps have been prepared, available only in time of a major disaster, that show all public utility lines and pipes in the area and the location of all key valves and switches that might be needed for shutting down or furnishing electricity, water, and gas. Members of the emergency organization have written instructions as to the location of supplies of motor fuel, lubricating oil and construction equipment. Arrangements have been made for drafting airplanes and boats. The larger fleets of taxicabs, automobiles and trucks are listed. Portable emergency illumination and public-address systems would be furnished by motion-picture studios. Armored cars would be available from bank-messenger concerns. Alternative methods of communication have been prepared in case the ordinary systems should fail.

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SWAY-CHEK is especially appreciated when driving in high winds, along crowned roads, around sharp curves and with heavy loads. With this advanced accessory on your FORD, MERCURY or LINCOLN-ZEPHYR you will enjoy an added sense of stability, handling ease and safety.

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Cap. . . . 1/4" steel
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FREE TRIAL: Try the Drill Champion in your shop. We ship C.O.D.; you pay \$19.95 on del. Keep tool 10 days; if not satisfied return it. Your money refunded at once.

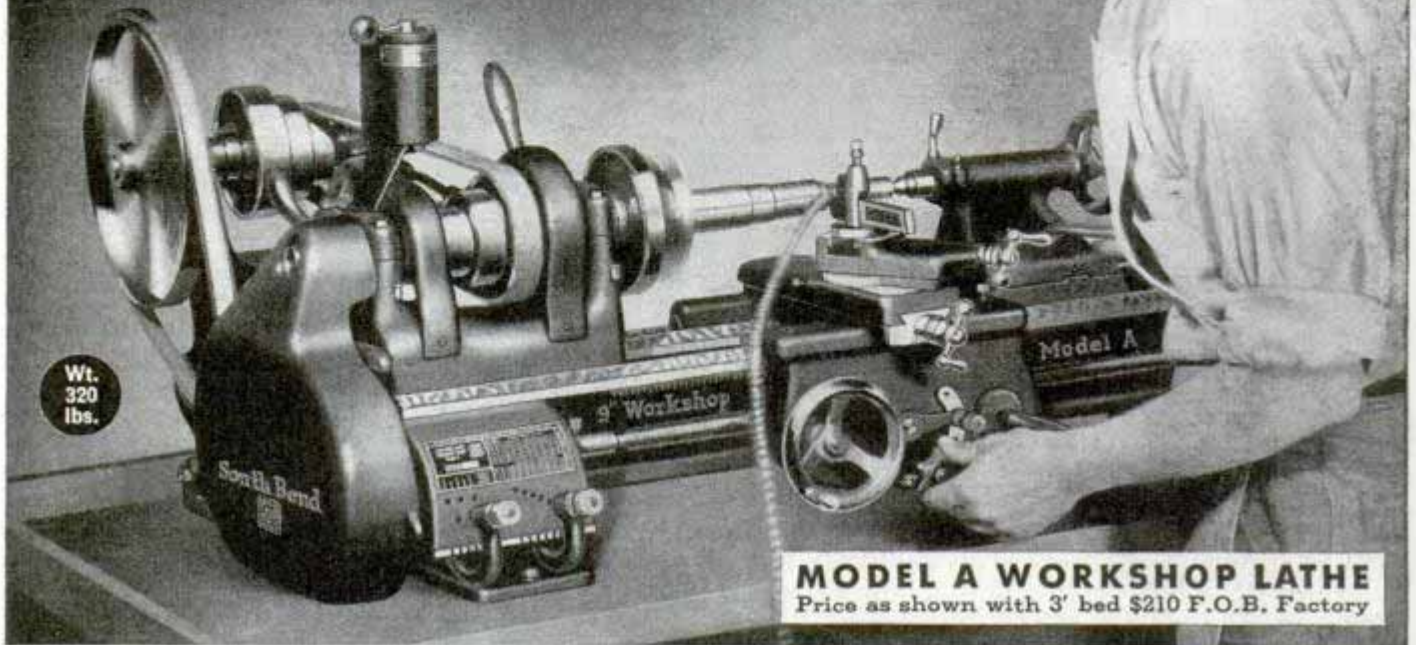
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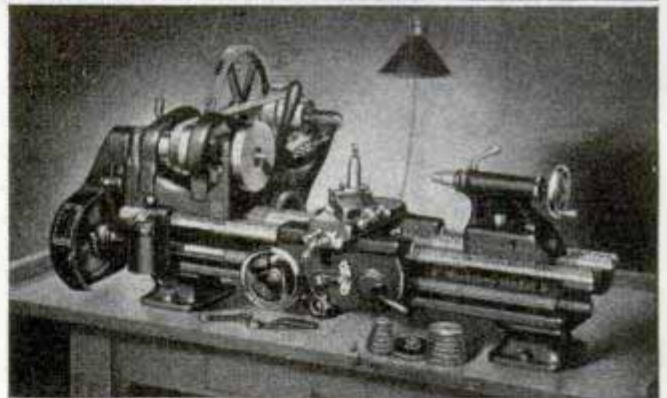
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Please Send Catalog No. 50 Free.

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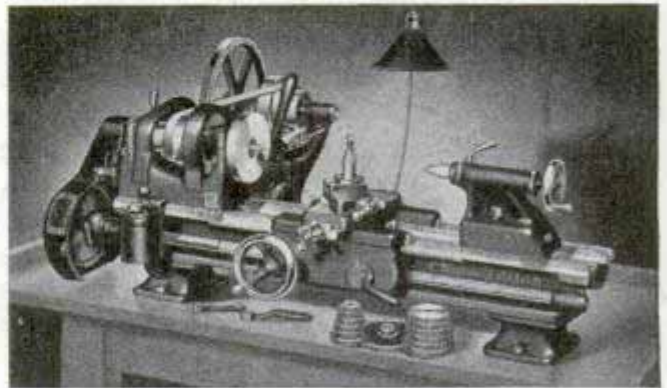
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