

JUNGLE EXPLORING BY TRAILER

By Commander Attilio Gatti

POPULAR MECHANICS



MAGAZINE

WRITTEN BY

REG. TRADE MARK GREAT BRITAIN No. 40432

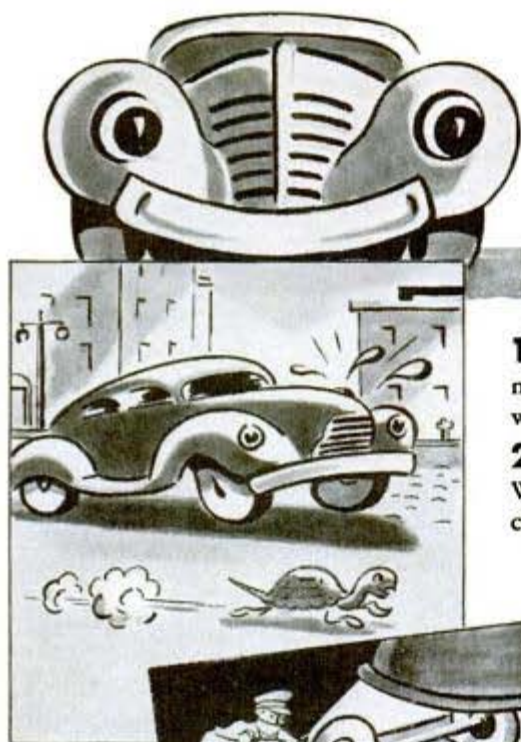
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JUNE
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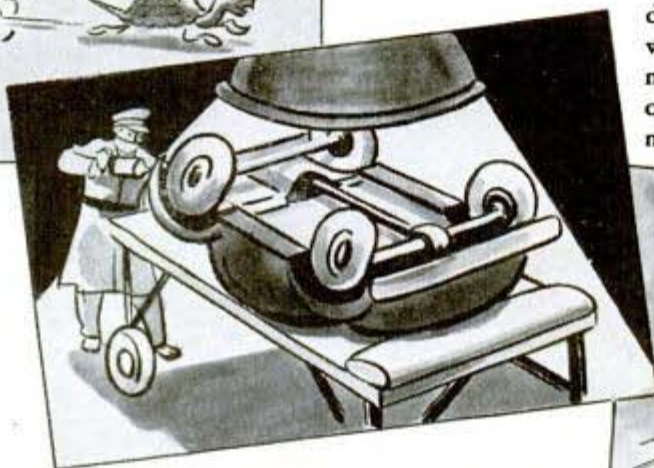
"Did I ever tell you about my operation?"



1. Boy, oh boy! Was the first day of that vacation trip a nightmare! I was sluggish. No pep. Seemed as if the road was uphill all the way . . . and into the wind!

2. That night they operated! Took me to a Packard Re-Wiring station, where a Certified Re-Wiring mechanic checked my electrical system from A to Z.

3. The next day . . . Wow! What a difference! New Packard spark plug wires and a few electrical adjustments made me feel like a new car. And other Packard replacements saved me from costly *major* repairs later on.



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When you pile into your car and head for vacation country, it's a satisfying feeling to know that new Packard spark plug wires are delivering full power . . . to know that no corroded, undersize cables or dirty connections anywhere in the electrical system are going to cause trouble on your trip.

A Packard Certified Re-Wiring check-up not only traces down defective cables and connections, but also uncovers "bottlenecks" in the electrical units . . . battery, starting motor, generator, distributor or voltage regulator. It takes only a short time, and it will prevent breakdowns and more serious electrical repairs later on. If your regular service station dealer does not provide Packard Certified Re-Wiring Service, have him get in touch with his Packard jobber. Packard Electric Division, General Motors Corporation, Warren, Ohio.



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Fluid Drive is the first new motor car feature in years that does something really big for the driver!

You never quite get over the wonder of gears that are shifted for you . . . of power applied through oil, so smoothly that you can't make it jerk or buck!

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You put on the brakes for a traffic light . . .



BE MODERN—with *Fluid Drive*
and *Vacumatic Transmission*—

but you stay in high gear position! You glide away again when the light changes . . . but all you've done is to step on the gas! In all normal driving, you drive this way . . . and you realize what a relief *Fluid Driving* brings.

Try *Fluid Drive* with *Vacumatic* transmission at your Chrysler dealer's. It's standard equipment on most Chrysler models this year and only a few dollars extra on the lowest-price Chryslers.

A phone call to your Chrysler dealer will bring a Chrysler to your door!



FOR SAFETY!

Chrysler's Safety Clutch is like a lifeboat on a ship. You will use it very seldom, but you're mighty glad to have it when you need it. A very valuable safeguard for parking . . . for maneuvering your car in close quarters or dangerous places!

★ Tune in on Major Bowes, Columbia Network, Every Thursday, 9 to 10 P. M., E. D. S. T.

Buy Chrysler!

JUNE, 1941

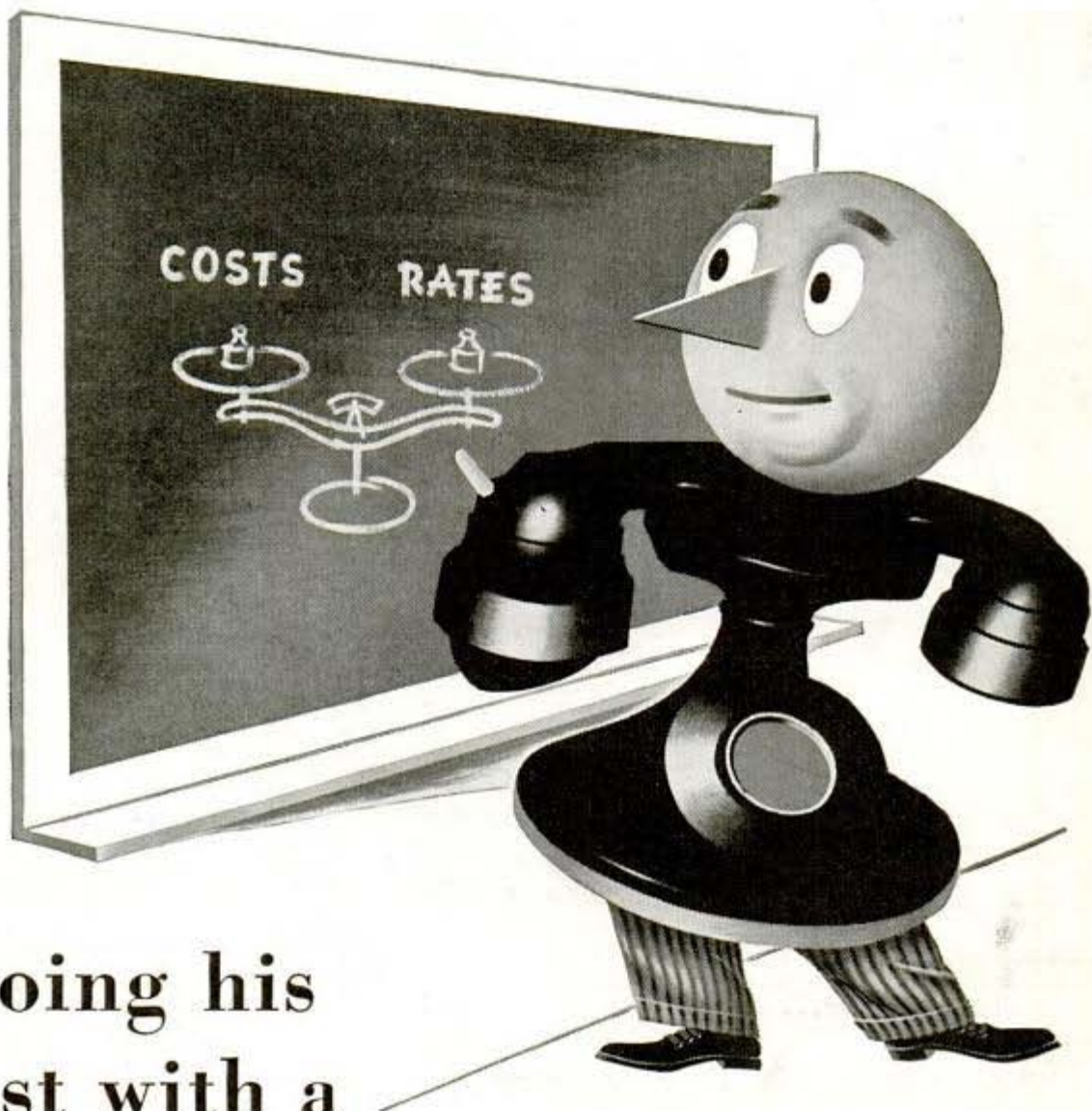
This One



NTQB-ZGU-NPJ7

1A

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Doing his best with a tough job

The hardest job of the Bell System is to give you more and better telephone service and yet keep rates low. It isn't easy to keep those two things in balance. Increasing costs and taxes make it difficult.

But there is no end to trying. There is never any letting up in the search for a better, more economical way. All along the line, the Bell System believes in economy in business housekeeping. That is part of its obligation to the public.

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Listen to "The Telephone Hour" every Monday (N. B. C. Red Network, 8 P. M., Eastern Daylight Saving Time)

Popular Mechanics Magazine

H. H. WINDSOR, Founder

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

June, 1941

Vol. 75, No. 6

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New Sinews of War

SIXTEEN-INCH chromium steel shells shot from Uncle Sam's coast defense guns will pierce sixteen-inch armor of a target 30 miles at sea, sink any battleship afloat. Far more than in 1917, when stainless steel was new, steel alloys today are the sinews of war. Tank gears are of steel that will bend, not break, under strain. Critical parts of warplanes are of stainless steel that resists wear and corrosion. The Coloroto section in July reveals the revolution that has come to the steel maker's art since the 'twenties.

Carrying the Torch for Industry

THOSE hard-working industrial twins, welding and flame cutting, were born during the world war but nobody paid much attention. Now look where they've gone! A July feature tells of the all-welded battleship, the welded locomotive boiler, flame-hardened steel, and of flame-cutting the teeth of a bridge.

Next Month

MILES in the sky you bail out and plunge earthward. Air rushes past you at a couple of hundred miles an hour, yet strangely enough you can breathe, you're not dizzy, your eyes don't smart. You do get a bang when the parachute finally opens, but you are hanging up there safe enough. Parachutes are pretty reliable lifesavers, you'll agree on reading "Jump Out, the Air Is Fine," a July feature. It reports that 85 percent of R.A.F. pilots shot down have been saved by their 'chutes.

Any Idle Horses?

SOME of the horsepower under your hood is eating up gasoline but doing no work. You paid about \$10 for every horse in your new automobile, but you've let some of them retire to pasture. There are some things you can do about it. A garage equipped with a chassis dynamometer can diagnose your car ailments. An article next month offers a score of valuable tips on tuning your car to the altitude, the work and the grade of gasoline to which it's accustomed.

Saboteurs, Halt!

TRY barging into the Douglas Aircraft plant along with the 18,000 employes who come and go every day. You can't do it. Douglas, like many another vital industrial plant, is on guard against the spy and saboteur. An article in July tells how America's defense factories are protected with infrared fences, camouflaged roofs and unbeatable secret devices.

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"Going to the '500' this year, Jim?"

1. I'm a bear for punishment, I guess. Plan all year to see the "500" auto race at Indianapolis and then miss it twice in a row!

2. Both times, car trouble. First a bearing burn-out, then sticky valves. I spent my holidays in the garage while the boys were at the speed-way!

3. "Do you use Pyroil?" Ed asks one day. "Nope," I said. "Have often intended to, but never did." "Well," he says, "Plenty of the '500' race drivers do. Why don't you climb aboard?"

4. So, am I finally wised! I've been using Pyroil a year now without one smell of grief. And does this baby purr: . . . Am I going to the "500" this year? I'll see you there, boys, when that starting bomb goes boom!

WILBUR SHAW, winner of last year's Indianapolis "500," used Pyroil in his fuel, throughout the running of the race.

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SELECT YOUR OWN TIME PAYMENT PLAN AND SAVE MONEY, TOO!

Buying a new car is big business for any family—and you want to make sure you're getting real value for every dollar you spend. That goes for financing as well! So —before you buy—why not take a few minutes to figure the cost yourself!

Just send the coupon below for the GMAC Figuring Chart that gives you the whole car financing story in dollars and cents... shows exactly what you get for what you pay. You can figure easily just what the

cost will be to you—based on the amount of time you want and the amount you wish to pay each month.

Notice the low-cost financing and the broad insurance protection for your car included in the General Motors Instalment Plan. Then, compare all the various finance plans and what they offer! See for yourself just where and how you can save!

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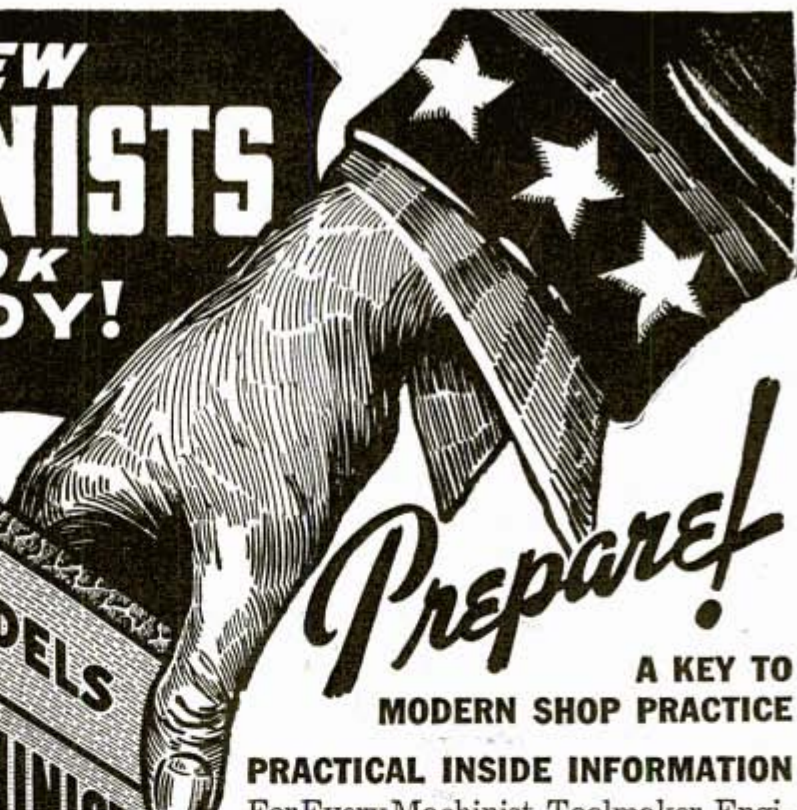
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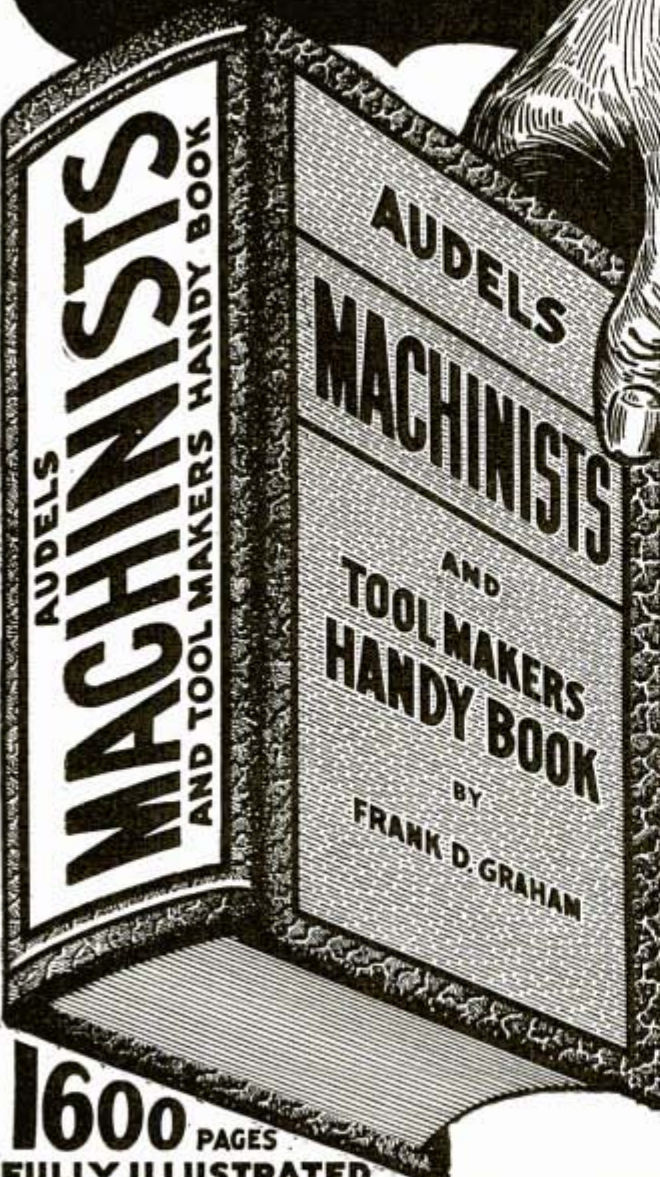
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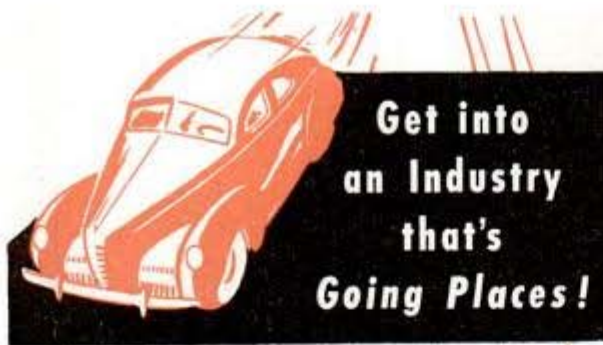
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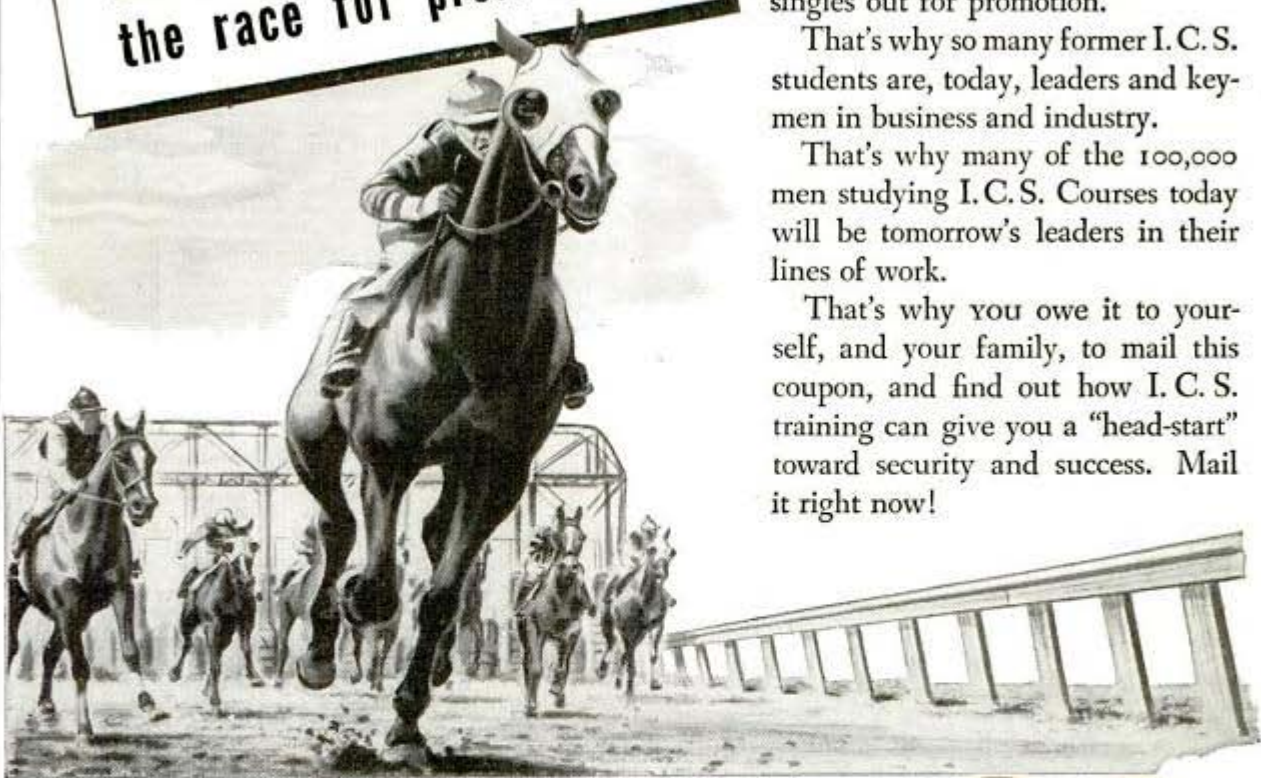
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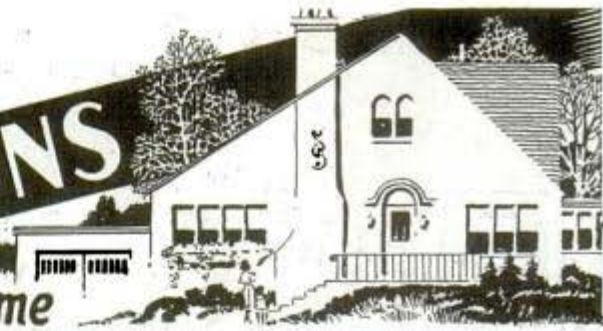
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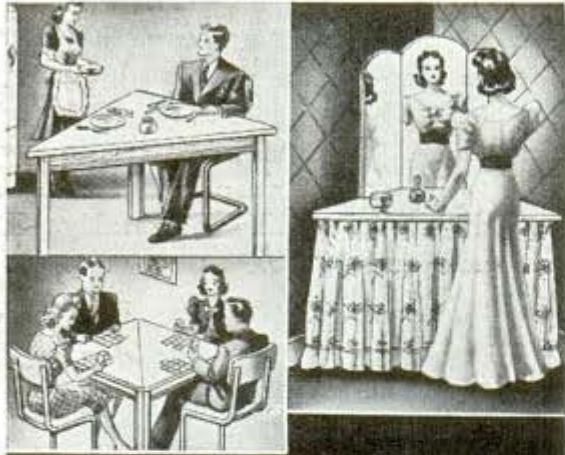
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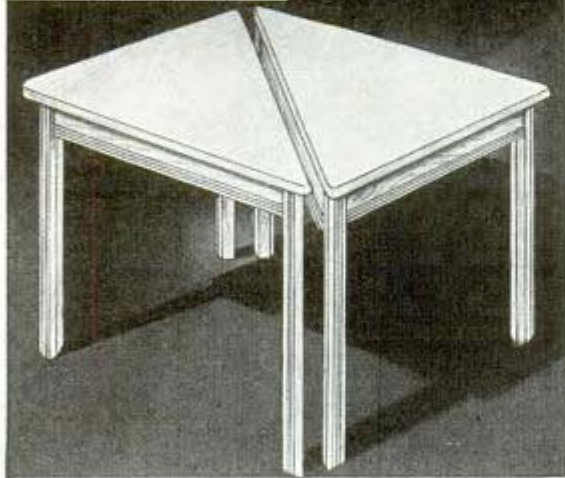
For Your Home



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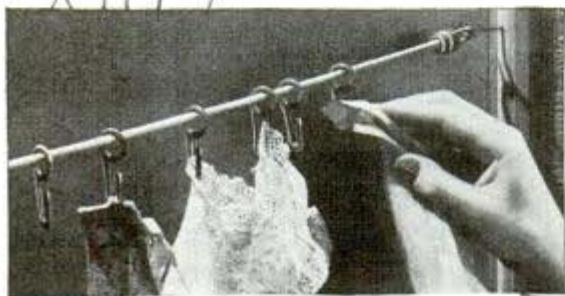


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WHERE-TO-BUY-IT INDEX OF POPULAR INVENTIONS
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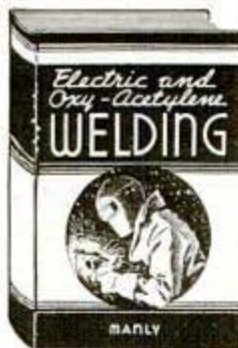
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CAMERAS And supplies. Free illustrated catalog listing everything photographic—still and movie cameras, films, lenses—at tremendous savings. Hundreds of bargains, new and used. All guaranteed. We take your old camera or equipment in trade. Write now for your free copy of our newest money-saving bargain book—just out! Limited edition. Hurry! Central Camera Co., (Photographic Headquarters since 1899), 230 S. Wabash, Dept. F-16Z, Chicago, Ill.

MAKE Money in photography. Learn quickly at home. Easy plan. Previous experience unnecessary. Common school education sufficient. Booklet and requirements free. American School of Photography, 1315 Michigan, Dept. 3431, Chicago.

HAVE You a camera? Send ten cents for recent number of our big magazine, showing how to make better pictures and earn money. American Photography, 116 Camera House, Boston, Mass.

ENLARGER \$1.59. Enlarges eight times size of small negatives. Fully guaranteed. Paramount Sales Company, 89 Dudley Street, Boston, Mass.

CAMERA Repairing. Bellows made to order, shutters repaired. Bellows made to fit all standard cameras! United Camera Co., Inc., A-1515 Belmont, Chicago.

PHOTO FINISHING

FREE—Get acquainted offer. We'll make two custom quality snapshot prints from your favorite film negatives. Just mail this ad. and two negatives. Free prints, mailers, new 1941 price lists sent by return mail. Ray's Photo Service, Dept. 1-CA, LaCrosse, Wisconsin. Quality work since 1920.

BIGGEST \$1.00 Value in 35mm. finishing today. 36 exposure fine grain vapo-rated 3½x4½ enlargements: deckled, embossed margin and date. Eighteen exposures 75c; sixteen exposure splits 55c. Free mailers. 8 exposure rolls in beautiful, deckled contact finish with free handy album 25c. Mailbag Film Service, Box 5440A, Chicago.

QUALITY Developing—Prompt service. Roll developed, two prints each negative, free enlargement coupon. 25c. Postcard brings mailer. Petry Studios, 3310-P W. 65th St., Chicago.

SPEED Service pictures mailed same day received. Sixteen deckled-edge prints from roll 25c. One colored or two plain enlargements plus 8 deckled-edge Velox prints only 25c. Tops Photo, 1201-05 Orden Avenue, New York City.

125 PERMANENT Golden-Tint prints on paper, cloth, wood, etc., from any snapshot negative. No darkroom necessary. Beautiful results. Complete easy instructions and phototex fluid sent postpaid for 25c coin. Phototex Co., 59 E. Van Buren, Chicago.

TECHNIFINISH — 35MM. 36 exposure rolls fine grain developed and beautifully enlarged to 3"x4" glossy prints. 85c. Cartridge reloaded with Eastman Plus X, 30c. Satisfaction guaranteed. Write for free mailing bags, information, and sample print. Technifinish Laboratory, 641-645 Brown St., Rochester, N. Y.

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WORLD'S Fair snapshots, foreign pavilions, industrial exhibits, amusement area, beautiful showgirls, stage revues. 15 different \$1.00. Forman, 882 Lorimer Brooklyn, N. Y.

FREE 3 Professional 5x7 enlargements, 2 sets of guaranteed prints, and your film developed—all for 25c. original order only Reprints, 16 for 25c. Aro Studios, Dept. 12, Des Moines, Iowa.

100 GENUINE Kodaks given free Roll developed, two sets prints, plus free cellophane pocket album, 25c. Same-day service. Pho-T-Pho, Box 24-P6, Highland Park, Mich.

MONEY-BACK Guarantee! Your choice 8 Velox prints, two 5x7 double weight enlargements or 16 prints, 25c coin. Write for free mailers. Please U Film Service, 107-A, LaCrosse, Wis.

5x7 ENLARGEMENTS 10c. Three for 25c. Wineholt Photo, Woodbine, Penna.

VELOX Deckle-edge prints. Roll developed, 16 prints and one professional enlargement 25c; 100 reprints \$1.50. Same-day service. Superior Finishers, Dept. K, Monroe, Wis.

ROLL Developed, eight Velox prints, two portrait enlargements 25c. Christensen Studios, 729 Pacific, Waukegan, Illinois.

ROLL Developed with choice—8 prints, 2 enlargements 25c, 16 prints 25c, 8 oversize prints 25c. May's Photo, Box 870-AL, LaCrosse, Wis.

ROLL Film developed and printed 19c. mail only, many other offers. VanVranken, Winona, Minnesota.

FREE! Eight chromium finish enlargements with every roll developed, 25c. Same day service. Giant Fotos, Box 632, Lincoln, Nebr., Dept. PM.

"SUPERFINE"—35mm. 36 Exposure rolls developed, chemically hardened and glossy enlarged with "Exposurequalizer" to 3½x5. Cartridges respooled 35c. "Our laboratory head pioneered 35mm. photography." Superfine Laboratories, 57 Halsey St., Newark, N. J.

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8x10 SILK Finish enlargement—20c. Send negative. Irving Studio, 4006A Irving Park, Chicago.

35MM. Rolls developed 36 big 3½x5 enlargements \$1.00. Cartridge reload 35c. 16 enlargements from 127, 120, 50c. Camerashop, Linton, Ind.

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EXTRA Reprints, tinted, or two untinted enlargements with roll developed and printed 25c coin, reprints 2c. Merit, 3609 45 Avenue South, Minneapolis, Minn.

CUSTOM Developing and printing at mail order prices. Panel packet prints. Send for price and premium folder and sample print. Syncrosnap Process, Box 137B, Utica, N. Y.

ROLLS Developed—8 prints, free enlargement and valuable premium 25c. Blood, Bristol, Vermont.

SIXTEEN Prints from each roll developed or eight prints and two enlargements, 25c. Prompt and dependable. Globe Photo Service, La Crosse, Wisconsin.

PHOTO Mill service. Your choice for only 25c coin: roll developed and printed plain or deckle edge plus (1) two 5x7 enlargements or (2) one tinted 5x7 enlargement, or (3) one 8x10 enlargement, or (4) eight extra prints or (5) jumbo size prints instead of regular. Reprints 3c each. Highest quality workmanship and materials. Photo Mill, Box 629-12, Minneapolis, Minn.

ROLL Developed and 8 sparkling glossy Velox prints 25c. Extra prints 3c. Other specialties. Artline Photo, Box 507, Altona, Penna.

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IMMEDIATE Service! Pictures returned same day order is received. Sixteen guaranteed deckle-edge prints from roll, 25c. One colored or two plain enlargements plus 8 deckle-edge Velox prints only 25c. Special! Coupon for 8x10 enlargement given with each 25c order. Any 36 exposure 35mm. film fine-grain developed Vaporate treated and each good negative enlarged to 3x4 on deckle-edge Velox paper, only \$1.00! Reloads: 36 exposure, 50c; 18 exposure, 35c. 3x4 deckle-edge reprints, 4c each. 24 hour service. Details, sample and mailers free on request. American Studios, Box 51, LaCrosse, Wis.

ROLL Developed 16 prints, or 8 prints 2 enlargements, or 8 4x8 enlargements, 25c. Credit for unprintable negatives. Reprints 2c, 100—\$1.00. Include this ad for free surprise. Peerless Studio, Great-Northern Bldg., Chicago.

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ROLL Developed—16 glossy prints, 25c. 35mm. developed and one 3x4 enlargement of each—36 exposure \$1.00. 18 exposure 60c. Modern equipment. Careful processing. Irving Studio, 4006A Irving Park, Chicago.

ROLL Developed: Choice: Eight beautiful double size prints, 16 regular prints or 8 prints 1 enlargement, 25c. 35mm. rolls enlarged 3½x4½ \$1.00. Burton Studios, 443M Roscoe, N. Y.

PHOTOGRAPHY For pleasure and profit. Prepare at home. Common school education sufficient. Write for information and requirements. American School of Photography, 1315 Michigan, Dept. 3452, Chicago.

ROLL Developed, Two 5x7 and 8 prints, 25c. Reprints 2c. Photolab, 1806-CA Wabash, Chicago.

IDEAL Photos beautifully finished wide border deckle edge, 25c roll of 8 and free enlargement. Ideal Photos, Box 2253, Paterson, N. J.

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ROLL Developed and your choice; 8 enlargements or 8 prints and two enlargements or 16 prints 25c. Premium coupons and Snapshot Magazine included free. Young Photo Service, 405-L, Albany, N. Y.

8 ENLARGEMENTS And film developed, 116 size or smaller, 25c coin; enlarged prints 3c each; special offer: enclose advertisement and negative for hand-colored enlargement free with order 25c or more. Enlarge Photo, Box 791, Dept. PM, Boston, Mass.

ROLL Developed, 16 guaranteed prints, 25c, reprints 2c. Photolab, 1806-C Wabash, Chicago.

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8 ENLARGED Prints (nearly postcard size) or 16 regular size prints from your roll or negatives 25c. Willard Studios, Dept. 47, Cleveland, Ohio.

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FREE Trial—16 sparkling Lifetime prints, three lovely Hollywood enlargements, and free Leathertone frame with roll—25c. 20 reprints 25c; 100—\$1.00. Overnight service. Lifetone Studios, L-39, Des Moines, Iowa.

PROMPT Service! Rolls developed, two Velox prints each negative 25c. Hench Studios, Harrisburg, Penna.

TRY Us. Roll developed, two prints each negative 25c. Reprints 2c. Royal Photo Finishers, Maywood, Ill.

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R.C.A. 16mm. Sound projector, latest model in original cartons. List, \$300.00; sacrifice, \$225.00. Bromfield, Evelyn Road, Waban, Mass.

WORLD Travelogues, used, like new, 16mm. 100 foot subjects \$1.75. half reel subjects \$3.25. Write for list. Some 8mm. Parth Films, Mt. Pocono, Penna.

SILENT 35mm. Films! Projectors! Cheap! Demsey, 1223 Berkley, Youngstown, Ohio.

FASCINATING Hollywood productions. Sample scene dime. Erwine's Laboratories, Allentown, Penna.

16MM. Kodachrome reduced onto 8mm. Kodachrome. Parth Laboratories, Mt. Pocono, Penna.

GENERA Films for all movie cameras. Save 50%. Two "The End" trailers, 10c. (Size?) Bargain circulars free. Promaders, Davenport, Iowa.

8MM-16MM. Films. Free catalogue (with sample film 10c). Parkway Exchange, 961 Eastern Parkway, Brooklyn, N. Y.

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TRIAL Offer—100' 16mm., processing included \$1.50. 25' double 8mm. 75c. Cine-lab, 479-A Quincy Street, Brooklyn, N. Y.

THRILLING. New film subjects. Mercury 1157 N. McCadden, Hollywood, Calif.

16MM. Film, projectors, cameras. Zenith, 308 W. 44th Street, New York.

LOOK! Nationally advertised movie cameras, projectors, films, accessories. Payments low as \$2.50 monthly. Send stamp for literature and close out bargains. Don Elder's, Dept. 26, 739 Boylston Street, Boston, Mass.

GUARANTEED 8mm., 16mm., 24-hour reversal, processing. Eso-S, 3945 Central, Kansas City, Missouri.

FREE 16mm., 8mm. bargain lists. Home Movies, Box 216, Easton, Penna.

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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.

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BRILLIANT Music to your song poem, \$1.00. Professionals, Sausalito, Calif.

SONG Poems—lyrics wanted by nationally known musical arranger. Publication guaranteed if accepted. Send yours for offer. Charles Flesher, Box 1990-B, Hollywood, California.

SONGWRITERS—Melody composed to your poems \$1.00. Frank Jugan, Jr., Signal, Ohio.

WE Buy songs; song-poems. Best offer. Free advice. Liberty Music Publishers, San Francisco.

SONGS, Poems published. Royalty basis. Unlimited opportunities. Free advice. Dept. M, Radio Music Company, 6912 Hollywood Blvd., Hollywood.

FREE Booklet "Getting Ahead in Songwriting." Song Service, 43-C Park Place, Brooklyn, N. Y.

SONGWRITERS: Send poem for our plan and free rhyming dictionary. Richard Brothers, 24 Woods Building, Chicago.

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PUBLISHERS Need new songs. Poems wanted. Five Star Music Masters, 687 Beacon Building, Boston.

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DUO-FLEX Reeds for clarinets, and saxophones eliminate your reed troubles. Write for circular. Duo-Flex Reeds, 1204 1st Ave., Evansville, Ind.

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WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

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SMALL Capital starts "route" coin-operated peanut, gum and amusement machines. Particulars free. Robbins Co., 1141P DeKalb Ave., Brooklyn, N. Y.

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MAIL Order business course shows you how to make money, spare or fulltime. Teaches professional mail order technique—no penny-catching schemes. Free details. Nelson Company, 500 Sherman, Detroit 404-P, Chicago.

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RAISE Chickens in attic, spare room or basement. Enormous profits. Details free. Oshkosh Homecrafters, Oshkosh, Wisconsin.

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OWN A cash business? No selling. Operate "Silver King" vendors, \$3.95 up. Free instructions. Automatic, 2422-A Fullerton, Chicago.

MAKE More money selling Red Comet Fire Control Products. Write today for free facts. Red Comet, 766 Comet Building, Littleton, Colorado.

MAKE Color-glazed concrete pottery, statuary, gravestones, tiles, walls, floors, basement waterproofing. Booklet, color-plates 10c. National Potteries, Minneapolis, Minnesota.

MAKE Genuine rubber molds. Details free. June, 101-B Beech, Holyoke, Mass.

ELITE Collection of business plans, contains 127 tested plans and scores of formulas. Start own business; home, office. Particulars free. Elite Co., 214 Grand St., New York.

MAIL Order business is your opportunity. Many begin small now earn thousands yearly. No personal contacts, boundless selection. Have over 40 years experience, will help you succeed. 25c brings 2 valuable booklets. None free. B. Breniser, 257 S. 21st, Philadelphia.

BE Your own boss. Amazing profits. Nassau Co., Winston-Salem, N. C.

WE Successfully sell inventions, patented and unpatented. Write us, if you have a practical, useful idea for sale. Chartered Institute of American Inventors, Dept. 4-C, Washington, D. C.

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

FOOLPROOF Rubber, mold making, plaster casting, tremendous market, large profits, 24 page instructive catalogue free. Plastic Arts, 711 Neely, Muncie, Indiana.

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

OPERATE Mail order business at home. Details dime. Maples, 3418 South Marshfield, Chicago, Illinois.

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

127 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 214 Grand St., New York.

HOW And where to obtain capital fully explained, free particulars. Star Service, Wapakoneta, Ohio.

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

HOUSE Plan books—Latest titles—Bargain catalog free. Popular Mechanics, 633 St. Clair, Chicago.

MONEYMAKING OPPORTUNITIES

EARN Money at home! Thousands do! "Home Worker Magazine" tells how. Sample 25c. Sizemore, Box 7, 4917 North Kostner, Chicago.

SELL By mail! Make sparetime pay with profitable home mailorder business. Constructive literature explains amazing opportunities! Write Jay, 1123 East 61st, Chicago.

YOU'LL Like resilvering mirrors, tableware, making chipped glass nameplates, signs. Write Sprinkle, Plater, 287, Marion, Indiana.

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

FREE—Magazine, opportunities, circulars. Lincoln Supply, Box 32, Irwin, Penna.

LATEST Money-making opportunities! Offers, plans, sample plan 10c. Malow Press, 3048 East 82, Cleveland, Ohio.

BOOKKEEPERS Make money operating new idea bookkeeping service. Ralph Lee, Vicksburg, Michigan.

EARN Money with your typewriter addressing envelopes, circulars, typing. Information 10c; none free. Ace-PML, Box 1123, Birmingham, Ala.

EARN Money anywhere. Call names of strangers, tell them what they're thinking about. Baffling stage acts explained. Barrels of fun. Professional course mind reading, etc. \$1. E. J. Gallagher, Camp Taylor, Grandview, Wisconsin.

MAKE Statuary, flooring, etc. Imitation marble formula 25c. Ideal Service, 11-G, Park Ridge, Ill.

MAIL Order secrets. New book teaches how to earn money by mail. Postpaid 25c. Cheerio Service, Box 157-Z, Brooklyn, N. Y.

HERE Is your opportunity! 15 sources of income. Elsmor, Box 26, Flushing, N. Y.

MONEYMAKING Mailorder opportunities, free! Postal. Schroeder, 803 Wisconsin, Peoria, Illinois.

CONVERT Old lawn mowers into electric cutters. Drawings 25 cents. Wheeler Merchantile, St. Petersburg, Fla.

\$25,000 RICHER Working \$-getters published in Schemer Magazine, Alliance, Ohio. Year, \$1.00. Two samples and premium 25c.

CASH For butterflies, insects. See Sinclair display advertisement page 16A.

BIG Mails, catalogs, propositions. Send dime. Service Press, Box 167, Waukesha, Wis.

4 WONDERFUL Opportunities. Details dime, deductible from order. Clement, 1743 Arthur, Rochester, N. Y.

FORMULAS For any known preparation including cosmetics, beverages, insecticides, germicides, cleaners, etc., only \$1.00 each. Satisfaction guaranteed. Key Chemical Company, 1317 VanBuren, Chicago.

SELL Anything for cash. "I Want to Buy" tells you where. Copy 10c. Reliable, Box 107, LaGrange, Ill.

TWENTY Dollars daily reclaiming lube. Boisset, Box 483-A, New Orleans, La.

FREE. Big opportunity offers to make money. Wetz-l, Valhalla, N. Y.

AMATEURS Make \$30 weekly with the new National Cartoon Originator. Free trial. National Artists Bureau, 801 North Marsalis, Dallas, Texas.

WILL You give us 5% first \$600 you make? Afternoons free! Work home, \$1,000 month reported (exceptional—full-time). Expect surprise. National, Box 1240, San Bernardino, Calif.

WHY Work for others? Have others work for you. Splendid profits received. Details 10c (coin). Dave Bertelson, Antelope, Montana.

CASH In on your spare time. Read "Progressive Mail Trade" magazine. You get everything—"money-making" ideas, plans, schemes, tips and inspirational articles—opportunities for men in most every walk of life. Sample copy 10c. Langlev, Pub., 631 Roscoe St., Chicago.

PASTEST Growing mail order business of today. Enormous demand. Details free. Charles Schroeder, 56 West Washington, Chicago, Illinois.

AMATEUR Cartoonists, earn big profits, duplicating comical advertising cartoons. Comic-Ads, Arkville, Wisconsin.

MAKE Money easily, pleasantly with roadside stand. Write Fame-\$-System, Lathrop, Calif.

MOULDS. Guaranteed. For casting toy soldiers, Indians, trappers, warships, sinker moulds, 244 kinds. Send 5c for illustrated catalogue. Send \$1.00 for large sample mould. Henry C. Schiercke, 645 Spencer, Ghent, N. Y.

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

182 THINGS You can easily make for fun or profit. 50c. Popular Mechanics Press, Room C-40, 200 E. Ontario, Chicago.

FORMULAS, PLANS, ETC.

AUTHENTIC Formulary. Instructions and supply sources for easily making 10,000 profitable products. Complete book—924 pages, \$1.50 postpaid or C.O.D. (Foreign \$1.85). Catalog 3c. Adams Brown Company, Chestnut Hill, Massachusetts.

FORMULAS: 3 Varnish, 5 wood stains, 25c. Russell, Box 1028, Cedar Rapids, Iowa.

MAKE Fast selling products. "Chemist Approved Formulas." Catalog free. Kemico, 12-P, Park Ridge, Illinois.

SALTED Peanuts in the shell. Formula by originator, 25c. SP Co., Penn Yan, N. Y.

FORMULA Guaranteed to kill ringworm, athlete's foot, 25c. Agnes Luzader, Winnfield, Louisiana.

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

ICELESS Ice! Colder! Cleaner! Cheaper! Instructions 25c. Duffy, Covington, Ky.

SINGLE-INGREDIENT Formulas! No manufacturing! A. Kinford, Fort Lauderdale, Florida.

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

FORMULAS—Latest, best, Analysis. Literature free. Belfort, Engineering Building, Chicago.

STATE Licensed chemist, 25 years experience, formerly in employ of the British government. Will furnish high grade formulas, processes and trade secrets. Ask for lists. Dr. W. L. Cummings, 230 Gordon Ave., Syracuse, N. Y.

NEW Money making formulas book tells how to go into business for yourself. Send for free details. Popular Mechanics, 200 E. Ontario, Chicago.

CHEMISTRY

FREE! Catalog chemicals, laboratory supplies for students, new idea chemical-kits, apparatus-outfits. Scientific books at discounts, telescopes, microscopes, biological needs, photographic chemicals, scales. Write Winn Mfg., Dept. JE6, 124 W. 23 St., New York.

GIANT Crystals. Grow them! Embryonic crystal and directions 10c. Kimberling, Minden, Nebraska.

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

HANDBOOK For Chemical Experimenters, hundreds of experiments, illustrated, 50c. Experiment booklet 15c. Free catalog. Reading Scientific Company, Reading, Penna.

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

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

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

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

HELP WANTED

AMAZING Offer! I'll send you absolutely free big assortment of actual, full size foods, household products worth \$5.00, and show you how to earn money in spare time, without experience. Zanol, 2283 Monmouth, Cincinnati, Ohio.

STEADY Work. good pay. Reliable man wanted to call on farmers. No experience or capital required. Pleasant work. Home every night. Big money every day. Wonderful new proposition. Particulars free. Write Mcness Co., Dept. 516, Freeport, Illinois.

LOCAL Agents wanted to wear and demonstrate suits to friends. No canvassers. Partial payment plan. Up to \$12 in a day. Experience unnecessary. Valuable demonstrating equipment, actual samples free. Stonefield, 1300 Harrison, Dept. T-817, Chicago.

PERMANENT Representative wanted for Hoover uniforms to call on restaurants, hotels, beauty parlors, doctors, nurses, others. Excellent income. Leads furnished. Equipment free. Hoover, Dept. TK-10C, 251 W. 19th, New York.

GROCERIES Free! Just agree to show friends, neighbors, others and I'll give you \$5.00 assortment foods, groceries, etc., free. Amazingly simple way to make good money. Send no money—just name and address. Zanol, 2283 Monmouth, Cincinnati, Ohio.

AGENTS WANTED

CONVINCING Facts about two sales and profit producing leaders—LaRene, the new and different shampoo, and Eazer, the cleaner without equal. Business and profits from these leaders are eye openers. Get particulars today. Eazer Company, Lebanon, Penna.

STARTLING Profits selling "Orange Concentrate," delicious natural orange drink. Sells like wildfire. Roadstands, resorts, camps, hospitals, hotels, homes, farmers big buyers. Sample free to hustlers. Eldorado Fruit Juice Co., 3359 Clifton Ave., Chicago.

AGENTS (Champion belts), suspenders, for all who wear. Samples 25c. Institute, 664 W. Baltimore St., Baltimore, Md.

AGENTS \$1.00 Starts you in business. Sell ties 100% profit. Send \$1.00 for complete line of ties (value \$2.00). Free catalogue. Radio City Neckwear, 112 West 50th (M-5), New York, N. Y.

FLASHY Electric razor (lifetime guarantee, \$15.00 appearance, performance) punchcard deals. Cost \$1.25 dozen lots, sells dealers \$2.50, takes in \$5.00. Sample \$1.89 prepaid. Moran, Box 177-p, Lockport, New York.

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

SELL Nylon hosiery and give fine silk hose for half price in combination order. Guaranteed against holes, snags, and runs or replaced free. Hose for your own personal use given with large outfit. Rush name and hose size today. Wilknit, Desk BF-37, Greenfield, Ohio.

ELGIN and Waltham wrist and pocket watches, reconditioned like new, from \$2.95. Write for catalog, Dearborn Watch Co., 5 So. Wabash, Chicago.

START Small—Grow fast. Our dealer agents make good profits. No investment needed. Open regular paint store later. Write Manager, Dept. I-1, Box 325, Evansville, Indiana.

AGENTS—Organizations. Sell world's wonder cleaning crystal compound. Sample free. Chas. Seiders Laboratory, Pottsville, Penna.

STORAGE Battery clamps. Clamp remover combined, guaranteed, 20 cts, postpaid in U. S. Agents wanted. Waters Terminal Company, Atlantic, Iowa.

GLASS Cleaner—costs 3c, sells \$1.00. Sample free. Western, Lehi, Utah.

WOMEN Agents. Free details about a mighty pleasant and profitable opportunity. Michel, 52 Congress St., Jersey City, N. J.

MILLION Articles. Buy wholesale. Valuable directory 10c. Ideal Service, D-6, Park Ridge, Ill.

300% PROFIT Selling revolutionary foot comfort, longer wear, tieless shoelaces. Sample pair 10c. Mercer, 307-G East 105, New York.

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

ELGINS; Walthams; wrist watches, \$3.25. Free wholesale catalog. Louis Perloff, 729 Walnut Street, Philadelphia, Pa.

FREE Water and our concentrates make 72 products. We supply labels, bottles. Enormous profits. Qualco, E-20030 Russell, Detroit.

MIDDLE Aged salesmen. Sell Killroach. 100% profit. Protected territory. Sample 10c. Buskett, Joplin, Mo.

YOU'LL Like resilvering mirrors, tableware, making chipped glass nameplates, signs. Write Sprinkle, Plater, 128, Marion, Indiana.

CALLING All health food salesmen. Min-A-Rex — Marvelous revolutionary health-yielding mineral product—wants agents. Write Min-A-Rex, 6024 Mission St., San Francisco.

ROMANTIC South American beverage. Delicious. Patented. Territorial exclusivity. Liberal samples postpaid, 200 cups 95c, 2000 \$5.95, 4000 \$9.95. USA certified checks. Mate Triunfo, Ltd., Visconde Nacar 1501, Curitiba, Brazil.

SALES People wanted. We credit you. Dobbs Drug Co., New Orleans, La.

NOVELTY Ash tray, sample 10c. W. Kolanko, 5305 Winona St., Chicago.

EARN \$10-\$15 Daily applying beautiful silver and goldlike sign letters. Cost 1c. Free samples. Modernistic Signs, B-3000 Lincoln, Chicago.

NEW York office under your own name, \$1.00 monthly, \$7.50 yearly. Co-operative Offices, 128 Lexington Avenue, New York.

NEW Sensational no leak toilet tank valve. Sells on sight. Big commission. Get territory and become independent. Every house a prospect. The Elhar Manufacturing Company, So. Glens Falls, N. Y.

800 FACTORIES Offer you newest fastest sellers. Amazing selection, marvelous values, bigger profits than ever. Get all through New Agents' Buying Guide. Sent for only \$1 cash; or write for particulars. Glass Publishing Co., Ellwood City, Penna.

"GOD Bless America" pin. Patriotic specialties. Big demand. Rush dime (coin) for sample and plan. Coleman's, Smithboro, N. Y.

PERFUME Sells like wild to women, clubs, churches, schools. Dalzene quality, 50c size \$3.00 dozen. Tucker Chemical, 212 West 136, New York City.

\$50 WEEKLY At home. Make cosmetics, flavors, etc. Employ agents yourself. Albert Wilcox, Nicholls, Ga.

SELL "Out clocks" for dentists and physicians or any business. Quick seller. Sample 25c. New England Card Co., 378 Highland Ave., West Somerville, Mass.

AMAZING Calculator, accurately adds, subtracts, multiplies, divides. Simple to operate. Sells for only \$7.50. Profit 33% to 40%. Every office desk, store, factory, home, prospects. Write for details. Foreign inquiries welcomed. Lightning Calculator Co., Dept. 18, Grand Rapids, Mich.

SELL Individualized belts, buckles. Over thousand emblems to choose. Fast money maker. Repeat business. Write today special outfit offer. Hook-Fast Specialties, Box 1425, Providence, Rhode Island.

"SWANKY-SERVERS" Easy to sell. Circulars and details free. The Oster-Bauer Shop, Rockford, Illinois.

AGENTS, Pitchmen, amazing new 10 cent seller. Make \$4.00 to \$8.00 daily. Lovely, 1734B Washington, St. Louis, Mo.

WILL You give us 5% first \$600 you make? Afternoons free! Work home, \$1,000 month reported (exceptional—full-time). Expect surprise. National, Box 1240-R, San Bernardino, Calif.

FREE "Service Signal" demonstrator. Post card brings details. Knipp, Long Beach, California.

BIG Money taking orders: shirts, ties, hosiery, underwear, pants, jackets, sweaters, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

FREE Brush offer with new toilet bowl cleaner. Sell 35c to \$1.00. Skasol Corp., 4217 Race Course, St. Louis.

"FREE!" Mexican curios, novelties, 100% profit! Marquezp, Apartado 1176, Mexico City.

WINDOW Sign letters, Penny each. Large sizes. New styles. Absolutely beautiful. Free samples. Atlas, 7941 Halsted, Chicago.

GOOD Sideline for printing and advertising salesmen. Decalomania name plates in small quantities. Great demand. Also make money applying initials on automobiles. Free samples. "Ralco," 727 Atlantic Ave., Boston, Mass.

WE Pack products under your label. Cleaners, food products, etc. Big profits, low prices. Samples free. Bestco, 5007 Irving Park, Chicago.

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.

EARN Money in your spare time taking subscriptions to Popular Mechanics. Unlimited possibilities, every family a prospect. Easy to sell. Bonus paid in addition to liberal commission. Send postcard for further details today. Circulation Dept., Popular Mechanics Magazine, 200 E. Ontario St., 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.

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

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

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

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

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

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.

HIGH-GRADE SALESMEN

ADVERTISING Book matches. America's largest manufacturer of union lab-1 book matches. Fast selling line. Large sales producing kit. Sample matches. Complete cut catalog. 13 color combinations makes selling easy. Commission in advance. Superior Match Company, 7530 Greenwood, Dept. M-6, Chicago.

MAKE Big money! Demonstrate automatic electric hot dog cooker. Sells on sight. Eating places, taverns, drug stores wild about it. Write for big profit deal. Wienie Chef, 2301 W. Hubbard, Dept. E-18, Chicago.

REVOLUTIONARY New invention. Thousands prospects everywhere. Men earning high as \$100.00-\$150.00 week. Placed on free trial. Sells itself. Orders financed by factory. Protected territory available. Free demonstrator offer. Salesmanager, 2440 Lincoln Ave., Dept. R-1716, Chicago.

NOVEL Office necessity. Sells on sight. Exceptional merit. Sure fire repeat business. Big profit. Address: Rush, 231-B, West Water, Syracuse, N. Y.

SELL Sensational new book match line. Low prices. big cash commissions daily. Also salesbooks, gummed tape, business cards, stationery, etc. Free outfit. Write today. Regal Match, 2134 Van Buren, Dept. 46, Chicago.

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

EVERY Business buys items we manufacture. Write Dept. PM5, P.O. Box 1315, Oklahoma City.

PRINTING Salesman wanted, free outfit. Route 3, Box 834, Miami, Florida.

EVERY Business must buy. Printing, advertising specialties, book matches, etc. Take orders for the pioneer line—1000 necessity items at 50% price saving. Free deals, 40% advanced commission, bonus. Experience unnecessary. Outfit free. David Lionel Press, 312 So. Hamilton, Dept. 76, Chicago.

CALENDARS—Beautiful complete line, all sizes, including jumbos, samples free. Start now, be the first in the field. Fleming Calendar Company, 6539 Cottage Grove, Chicago.

ADVERTISING Book matches offer liberal earnings—full, spare time. Experience unnecessary. Factory direct. Low prices for fine quality, quick deliveries, help get orders; faster repeats. All business firms prospects. Free outfit, instructions. American Match & Printing Co., Dept. 66, 4822 South Trumbull Ave., Chicago.

"RED Hot" patriotic seller—Cash in on hottest specialty out—"Sells on sight" to every kind of business. Retail \$3.95, your profit \$1.50. Ten second demonstration makes 10 to 20 orders day, possible. Experience unnecessary. Full, part time. Free sample offer, Riley, 1105 Lawrence, Dept. PM-6, Chicago.

METALIZED Baby shoes, other keepsakes. Big profits. No investment. Artco, 5309a Wabada, St. Louis.

SCROLLWAY Malls sell larger calendars. Information, sample 10c. Scrollway, 1440 Broadway, Oakland, California.

SENSATIONAL Polish. Send 50c for sales kit. Products, 5319 Glenwood, Chicago.

SELL Bargains! Novelties, paper specialties, greeting cards! Big profits! Catalog free! Elfco, B-438 North Wells, Chicago.

400% PROFIT Selling Glo-Brite signs to stores, restaurants, taverns. J. A. Baxter, Cambridge, Ohio.

MAKE More money selling Red Comet Fire Control Products. Write today for free facts. Red Comet, 704 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.

BLADES—Big profits. Best 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

WELDING—Electric arc. Learn profitable trade quickly through actual practice. Individual welder instruction at bare cost of materials. Full particulars free. Valuable welding lessons book 50c. Hobart Welding School, Box M-611, Troy Ohio.

NEW Opportunities in air conditioning, electric refrigeration and auto body-fender including metal work, welding, painting. Many trained men earn up to \$35-\$50 weekly. Start preparing now. Get free facts. Utilities Engineering Institute, 1314 Belden, Dept. 116, Chicago.

TRADE Magazines. Current samples—trade, technical, class. Books on advertising, printing, engraving, etc. Discounts. Lists free. Commercial Engraving Publishing Company, 34-R North Ritter Avenue, Indianapolis, Indiana.

LEARN Auto-finance, personal-loans—Inexpensive course. Nebraska Finance Co., Lincoln, Nebraska.

MY New way—Blue way mathematics, illustrated. Analyzes, dramatizes, visualizes mathematics, \$1 prepaid. C. E. Blue, Teacher, Rosemead, California.

DEVELOPING Personality: decorating the home; scrapbook keeping instruction: 25c each. National Education Bureau, 814 Mass. Ave. N. E., Washington, D. C.

LEARN Watchmaking. Material instructions for start and wholesale supply catalog, all \$1.00. Refund not satisfactory. Stewart's, 721 Olive, St. Louis, Mo.

WATCH Repairing is steady profitable work. Experts usually 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., 500 Sherman, Dept. F-2001, Chicago.

U. S. Government jobs, 105-\$175 month. Men-women. Prepare now at home for examinations. Full particulars—list positions, free. Write today. Franklin Institute, Dept. T3, Rochester, N. Y.

MEN Wanted—Big pay—Learn welding. Free booklet No. 3 tells all. State age. International Trades Institute, 741-45 W. 70th, Chicago.

HOME Study for degree. Psychology, Metaphysics, Philosophy, Bible. Free information. College of Universal Truth, 20-B East Jackson, Chicago.

LOCKSMITH Course. Lock picking, etc. \$1.00 prepaid. Locksmith, Canadian, Tex.

LEARN A good trade now. Big demand for welders and mechanics. Complete practical courses in arc and acetylene welding, auto and aviation mechanics, body and fender bumping, spray painting, metal finishing, etc. Low rates. Pay after graduation plan. Write today for big illustrated catalog. Michigan Trade School, 3754 Woodward, Detroit, Mich.

AUDITING Lessons by C.P.A. New method. Quick. Simple. Cheap. Information free. Public Accounting School, P.O. Box 1534, Memphis, Tenn.

CLINICAL Laboratory technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 494-E, Elkhart, Indiana.

LEARN Big pay trades in a few weeks. Decorating, paperhanging, graining, marbling, sign and pictorial painting. Catalog free. Chicago Painting School, 102 West Lake Street, Chicago.

LEARN Auto mechanics, body, repairing, welding electricity, refrigeration. Diesel. Stevinson's, 2008A Main, Kansas City, Mo.

LEARN Telegraphy! Opportunities now available to beginners due to new railroad retirement act. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

PLAYS, STORIES, MANUSCRIPTS

STORIES. Novels, articles—competently revised, typewritten for editorial consideration. Welton Tinney, Winnsboro, Tex.

PUBLISHERS Want stories! Details free. Hursh, Box P1013, Harrisburg, Penna.

STORIES. Books, poems wanted for publication. Many eager markets. Author will help you sell. Manuscripts marketed, revised, typed. Christopher Carr, 3636A Chestnut, Philadelphia, Penna.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

ILLUSTRATED Method now makes drawing easy. Amazingly simplified. Most practical method possible to conceive. Big earnings. Complete method \$1, or send 3c stamp for eye-opening particulars. Leon (Commercial Artist), Box 253, Los Angeles, Calif.

POSTERS. Signs and pictures, quickly and easily made with Clear-Opticon. Catalog free. Sign Publishing Co., 2325 Cass, St. Louis, Mo.

TRIAL Cartoon lesson, 10c. Hartman Studios, 2438 W., Lincoln, Nebr.

SEND For free details Migs Course in Cartooning, Box 893, Springfield, Mass.

PEN And ink drawings. Let us draw your advertising and catalogue illustrations, from photos, copies or objects. Best work and fair prices. Heraldic Studios, 1914P Oakdale Avenue, Chicago, Ill.

FREE—Big list of helpful books. Popular Mechanics Press, 200 E. Ontario St., Chicago.

MAKE \$30 Weekly with the new National Cartoon Originator. Free trial. National Artists, 801 North Marsalis, Dallas, Tex.

AMATEUR Cartoonists, earn big profits, duplicating comical advertising cartoons. Komic-Ads, Arroyo, Wisconsin.

AMATEUR Letterers, cartoonists—Use inexpensive process for quantity production. R. Dordal, Karlstad, Minn.

CARTOONING Course—30 illustrated lessons, over 500 sketches, drawing paper, pens and pencils. \$1.00 complete postpaid. Montes Studio, Box 985, Pasadena, Calif.

DRAW Beautiful girls. Earn big money. New anatomy-nude guide trains anyone to draw free hand perfectly. 30 gorgeous nude poses. Send \$1 for complete training including individual criticism. Ray Rogers, 607-3 Arbuckle Bldg., Brooklyn, N. Y.

YOUR Ad in this space will bring amazing results. I'll prove it to you. Write at once for interesting information. F. W. Johnson, Room 300, 200 East Ontario St., Chicago.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

MAIL-ORDER Or agent ad reaching 1,000,000 families throughout United States \$14.00 inch. Newspaper, magazine, mailing-list, rate-book, free. Chicago Advertising Agency, 20-PM West Jackson, Chicago.

SAMPLE Five column inches display advertising in 25 newspapers for \$15. Footprints, Fountain Green, Illinois.

GUARANTEED Resultful mailorder letters, circulars, folders, campaigns, planned, written. Moderate charges. Investigate! Finkel Adservice, 36-P Kenilworth, Brooklyn, N. Y.

ADVERTISE—24 Word in 71 newspapers \$2.04. Classified and display ads placed in all publications. Lowest rates. Complete direct mail campaigns. Outline proposition for free suggestions. Kirkpatrick Advertising, 540 North Michigan, Chicago.

ADVERTISE: 24 Words, 149 newspapers \$6.50. Lists free. Advertising Bureau, 4515-C Cottage Grove, Chicago.

ADVERTISING Placed all magazines, newspapers U.S.A., Canada, Mexico, Central-South-America, West-Indies. Lowest rates. Free service. 54 page catalog free. Baker Advertising Agency, A-189 West Madison, Chicago. Established 29 years.

LEARN Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 1315 Michigan Avenue, Dept. 3431, Chicago.

FREE—New Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, Merchandise Mart, Chicago.

BUSINESS SERVICE

DELAWARE Corporations organized; represented; serviced; reasonable. Corporation Counselors, Wilmington, Del.

YOUR Mail received and re-mailed, showing Washington, D. C. postmark. Hawkins Mail Service, 968-A Fourteenth.

\$6.65 YEARLY Establishes permanent mail address. Co-operative Mail Service, 126 Lexington Avenue, New York.

POPULAR MECHANICS

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

INCREASE Business now. "Excelsior" Rotary Stencil Printer reprints thousands everything you typewrite, hand-write, draw or trace. Colors. \$19.75 to \$44. Terms. Illustrated literature free to business or professional men. Pittsburgh Typewriter Supply, Department K-2, Pittsburgh, Penna.

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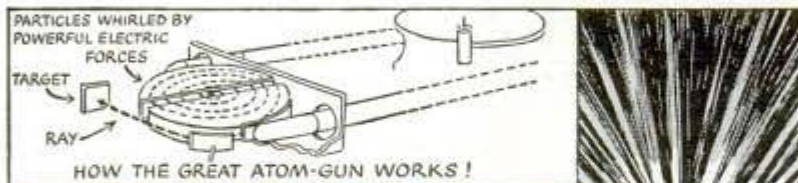
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Say you saw it in Popular Mechanics!

WONDERS OF AMERICA

Smashing the Invisible!



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86 DEGREES COOLER

THAN THE AVERAGE OF THE 30 OTHER OF THE LARGEST-SELLING BRANDS TESTED — COOLEST OF ALL!

PRINCE ALBERT HAS BROUGHT MODERN PROGRESS CLOSE TO THE LIFE OF EVERY PIPE-SMOKER. PA'S MILDNESS, MELLOWNESS, AND GOOD TASTE ARE NOW WITHIN EVERY SMOKER'S REACH

WE ROLL-YOUR-OWNERS REGARD PA. THAT WAY, TOO — PRINCE ALBERT SPINS SO FAST, SO EASY, SO SMOOTH, AND FIRM! NO, THERE'S NO OTHER TOBACCO LIKE PA. FOR REAL SMOKING JOY!



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Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 75

JUNE, 1941

No. 6

AMERICA'S "SEA" OF OIL

2340
By W. R. Boyd, Jr.

Executive Vice President,
American Petroleum Institute

50 W. 50th
EVERY 20 minutes the American petroleum industry produces as much gasoline as a European air fleet consumes in a whole day of wartime flying, so no one need worry about whether our oil supply is sufficient for all defense purposes.

Actual daily consumption by an air fleet remains a military secret, but might be estimated at 2,500,000 gallons. In contrast our petroleum industry distributes to consumers around 180,000,000 gallons of gasoline daily.

How much gasoline may be consumed by the great mechanized army and the mighty fleet which Uncle Sam is building is comparatively unimportant so far as our oil supply is concerned. No military machine in the world, and none presently contemplated, can have even the capacity for consuming as much gasoline as do the 30,000,000 motor vehicles



Photo courtesy Standard Oil of Indiana

Here the "fishtail" is going down, which means the driller is working fast in a soft formation. This is one step in drilling an oil well

JUNE, 1941

1



Photo courtesy Socony-Vacuum Oil Co.

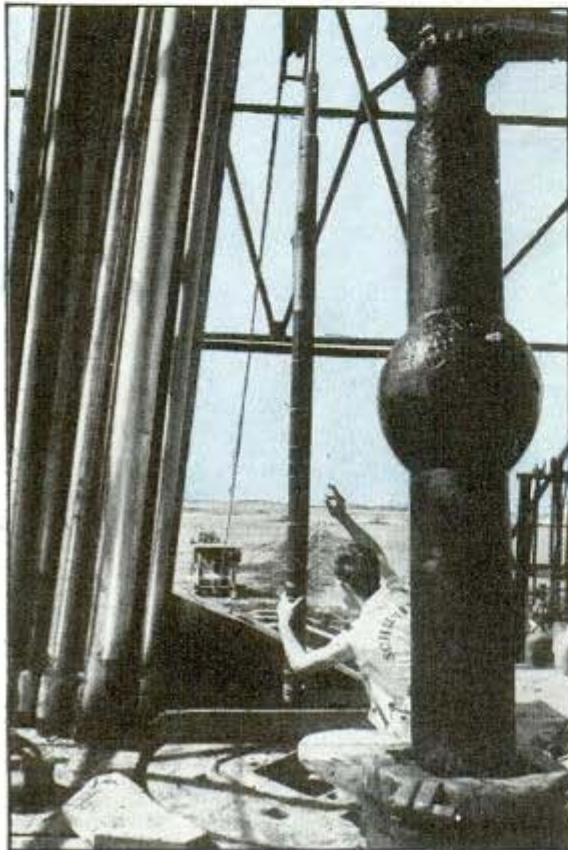
Studying extreme pressure lubricants such as are used in auto hypoid gears
Below, oil is detected in earth when it blocks flow of electricity from this device to truck



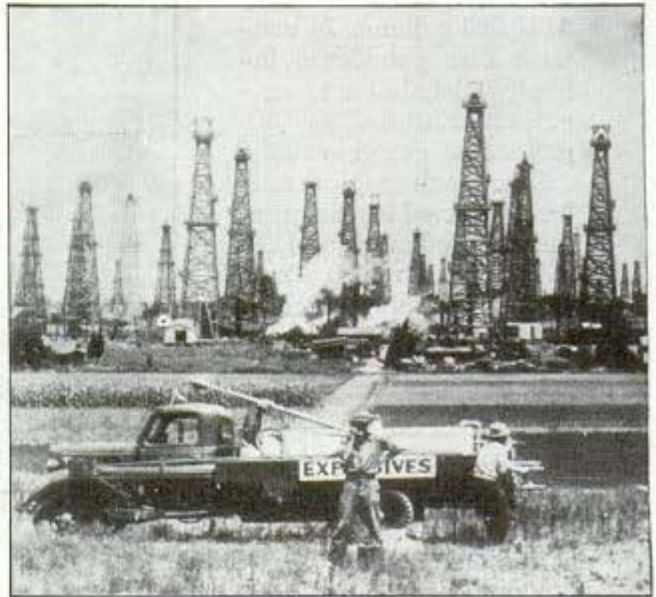
Engineers in American Airlines plane checking on test of new fuel for commercial and warplanes

and the thousands of airplanes, motor boats, tractors, stationary engines, and other consuming agencies in this country in peacetime operations.

Folks who worry about this country's oil supply underestimate the size, productive capacity and the ability of the petroleum industry, which is accustomed to meeting changing, as well as suddenly expanding needs. For instance, from 2,000,000 to 4,000,000 new-model automom-



Below, with background of old-fashioned, crowded oil field, engineers set off charge whose vibrations bounce off deep-laid layers of earth's crust. Instruments record the vibrations and help determine whether rock structure capable of bearing oil exists at point tested

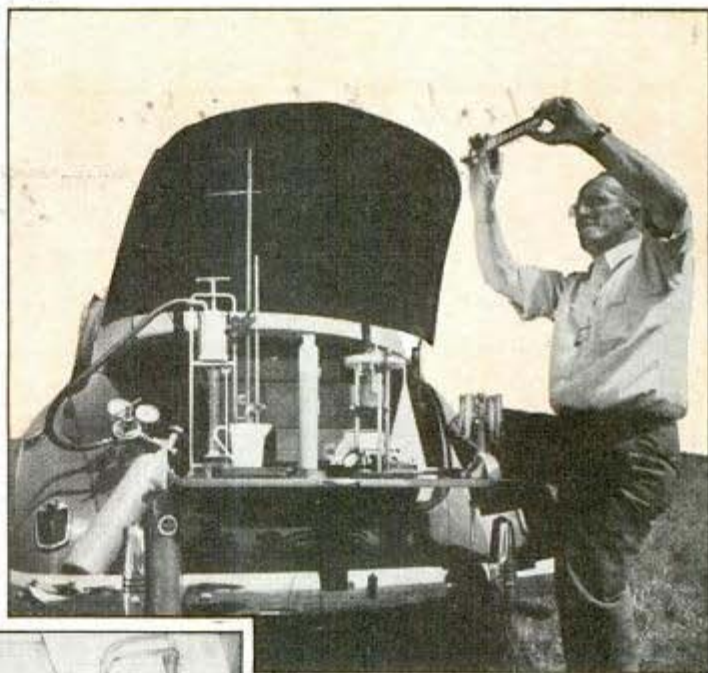


1340

biles have been taking to American highways every year for more than a decade, in fact, for about two decades. Those new machines, with their changed requirements for fuel and lubricants, came along, but the older cars kept traveling, too.

Meeting the fuel requirements of these 2,000,000 to 4,000,000 new cars alone meant that the industry had to produce from 1,400,000,000 to 2,800,000,000 gallons of additional gasoline each year. Meeting lubrication requirements meant the additional production of from 100,000,000 to 200,000,000 gallons of lubricating oil. No army in the world has 2,000,000 motor vehicles, and possibly none ever will have so many. Even if military demands grow far beyond present estimates, the supply still would be adequate. For years the petroleum industry has been producing far more than could be consumed. Present gasoline consumption of the United States is approximately 24,000,000,000 gallons per year. That gasoline comes from crude oil

(Continued to page 192)



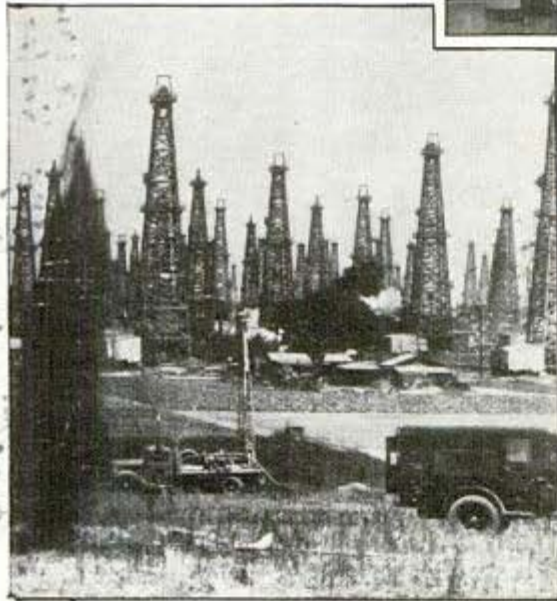
Laboratory on wheels is used to analyze drilling mud for signs of oil



Left, model of apparatus developed by Standard Oil of New Jersey to speed up cracking of petroleum

Below, the photographer catches an unusual view of a gas absorption plant

Photo courtesy Standard Oil of Indiana



2310.

Test Tubes 14 Feet High Sort Atoms by Weight

Hubert E. Janis, Jr.



Inside the tall glass tube is another containing a gaseous element whose atoms are to be sorted

Light and heavy atoms of the same element are separated according to their weight in a towering pair of test tubes at the General Electric research laboratory. The apparatus consists of two glass tubes 14 feet long, one inside the other, and a gold wire extending from top to bottom in the inner tube. This inside tube contains the gaseous element to be separated, and is kept at fixed temperature by passing

Schenectady, N.Y.

*The Testing Apparatus
Co. 1330 S. Grand
Los Angeles*

Auto-Wheel Tester Shows Faults On a Single Meter

Attached to the front wheel of an automobile while it is in motion, an automatic tester indicates whether the wheel is rolling true, and in addition shows camber, caster, kingpin inclination, toe-in and toe-out-turns. All this is given on a simple meter that can be read without knowledge of steering geometry. Other hidden defects, such as shifted axles and bent frames, are also detected by the instrument.



2348

Protective Plate in Baseball Cap Guards Against Head Injury

Players on the Brooklyn National League baseball team are wearing caps equipped with protective plates to guard them from head injuries that wild throws might inflict. The caps have side pockets in which the guard plates are inserted.



Slipped into the side pockets of the cap, the protective plates prevent injury from accidental blow

Died Johannesburg

*Mr. Phaul
Pleuve Reese
John Josephens Harbater*

*dnos. POPULAR MECHANICS
Mrs. M. L. Bennett and
Philip Handy*

✓ L364

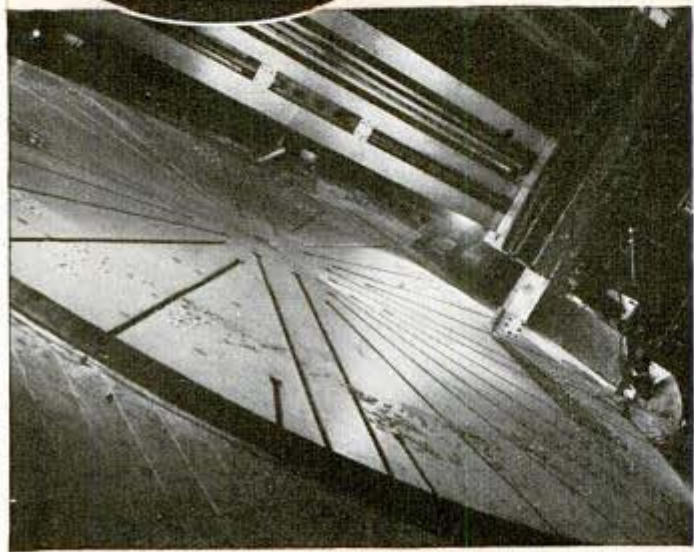
The SYMPHONY of INDUSTRY



Rhythm of machines, clash of steel and humming of motors play a symphony of industry as America's factories turn to defense. Above, like an organ console are De-ion arc extinguishers, which perform job formerly done by fuses



Left, Westinghouse pneumatic tube system, in which messages speed through tubes that, in this photo, resemble pipes of an organ



Above, 30-foot table of boring mill, resembling phonograph turntable, at Westinghouse plant. Right, "cymbals" are metal plates built into electric motors to keep out dirt



JUNE, 1941

Electric Mfg Co.
East Pittsburgh, Pa.

L298.

Large Patrol Bomber for Navy Tested in Flight



Initial flight tests were made recently of a new long range four-engine patrol bomber said to be one of the largest and most powerful in the navy service. Built by Consolidated Aircraft Corp., San Diego, Calif., the huge ships, known as PB2Y-2, will take their place in the fleet as sister ships to hundreds of twin-engine Consolidated patrol bombers of the PB1Y classification.

Four-engine long-range patrol bomber is one of the largest and most powerful airplanes in service of the navy

L281

Army Sled Driven by Propeller Mounts Machine Gun

Similar to those used by the Russian army in their final assaults against the Finns, aerosleds have been operated during winter maneuvers by U. S. Army units at Fort Brady, Mich. Powered by gasoline, the propeller-driven sled is equipped with a machine gun and is manned by troops equipped with skis, snowshoes and other winter paraphernalia.



Getting ready for warfare in snow, troops at Fort Brady practice with this aerosled

702 no military Police

Wide World
South Ste. more

Boone

Six-Foot Coil of Pipe Cleaner Is Unrolled and Clipped Off as Needed



Smoker pulls pipe cleaner from reel and cuts it off

Holding a six-foot coil of pipe cleaner, a vest-pocket container is equipped with a small push clipper which "bites" off the cleaner at the length wanted. Refills may be inserted by unscrewing a flat plate on the side. Pipe smokers find that one filling lasts a long time. For long-stem pipes, an extra-long cleaner can be snipped off.

Two billion cubic feet of wood are produced annually on farm woodlands in the United States.

POPULAR MECHANICS

My Service 12/20/40
John. F. Preston, Chief Forester, Soil Conservation Service

Slurrite Products, Inc. 1029-d Wabash

L347 Siffert & Moore Mfg. Co.
Sheerfield, Ill.

Roller Skates Easily Converted for Use on Ice

\$12.50 with roller skate attachment \$10.50.



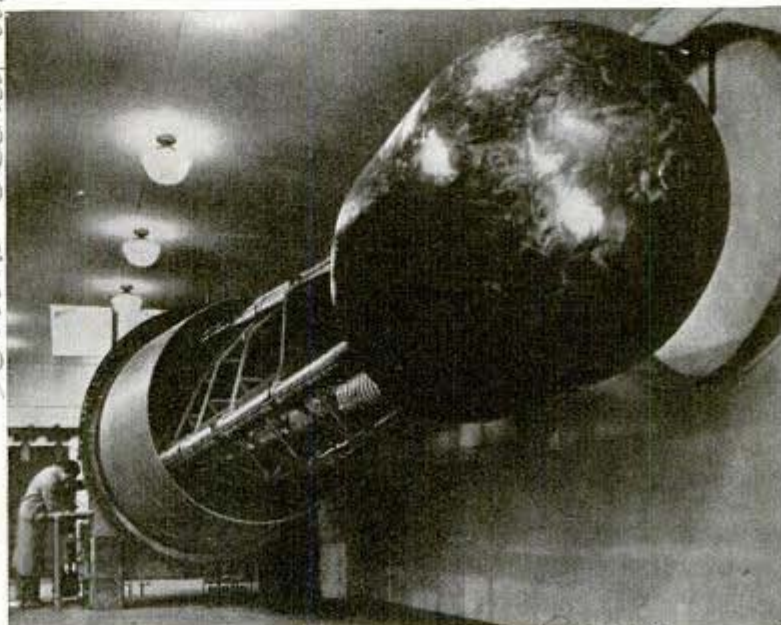
Two views show how blades may be attached in place of rollers so the skates may be used on ice

Both ice skating and roller skating may be enjoyed with convertible skates now on the market. As rollers they have three wheels in line and a rear brake, which make rolling easy, quiet and smooth. To

change the skates for use on ice, the wheels are removed and a blade having three steel supports fastened in their place on each shoe. The ice-skating attachment comes in hockey style blade.

Twenty-Ton Atom Smasher Generates 8,000,000 Volts

Power as high as 8,000,000 volts will be generated by a gigantic atom smasher, weighing 20 tons, which has been completed at Notre Dame University. This immense energy will be used in experiments with the disintegration of the nuclei of atoms by bombarding them with high-speed electrons, and in production of radioactive metals. Making available the most penetrating X-rays ever produced, the machine also will aid scientists at the university conducting fundamental research in the field of artificial radioactivity.



Atom-smashing monster hurls electrons with force of 8,000,000 volts in making metals radioactive and splitting nuclei of material structure

L 208

The MOST POWERFUL

By Roderick M. Grant



Through louvres on roof of locomotive, above, heat from electric brake is dissipated

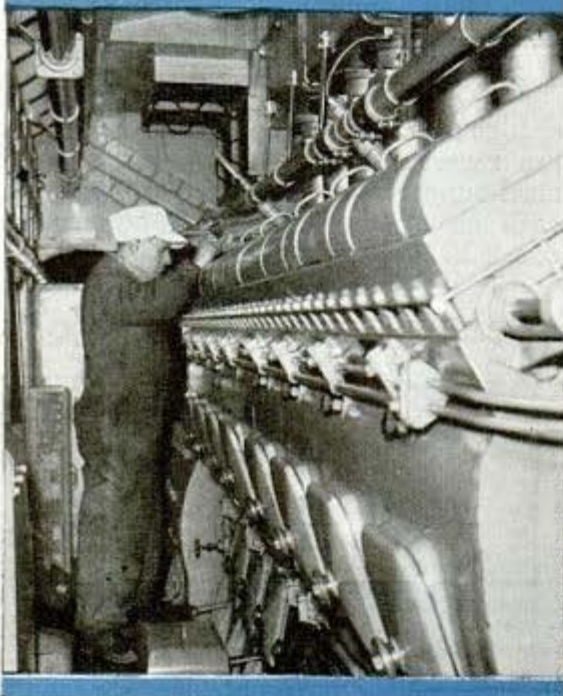
OVER the caboose, three-quarters of a mile down the track, a lantern waves.

"High ball!"

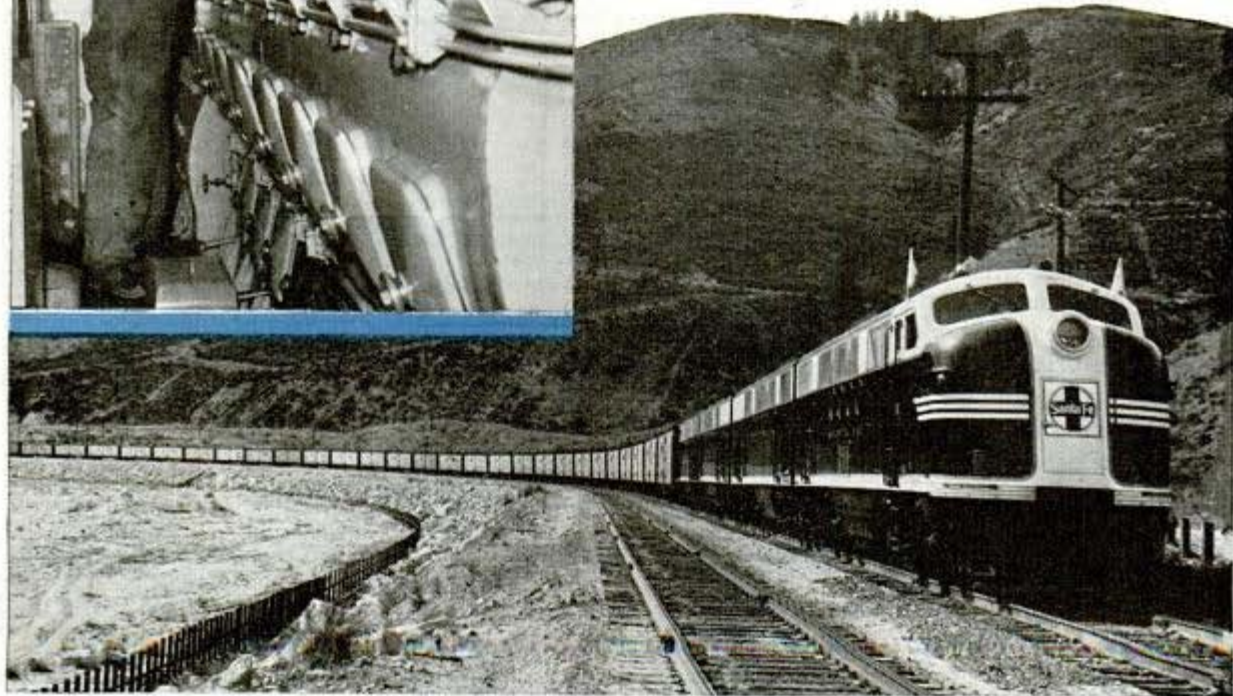
Two blasts issue from the powerful horn. The engineer throws the control lever into position one, advances the throttle and the idle hum of the Diesels amplifies into a businesslike throb. Gently, easily the 68-car freight glides forward, heading up for the Arizona Divide—one of the toughest grades on the line.

"Never saw any steam engine get up here with a load like this," remarks the fireman up in the cab. "We'd need at least one helper engine, maybe two."

But the big Diesel-electric streamliner doesn't call for help. The Santa Fe's No. 100, first main-line freight locomotive of its breed, the most powerful Diesel on wheels, is on trial for its life. The price tag was \$450,000, more than a thousand dollars



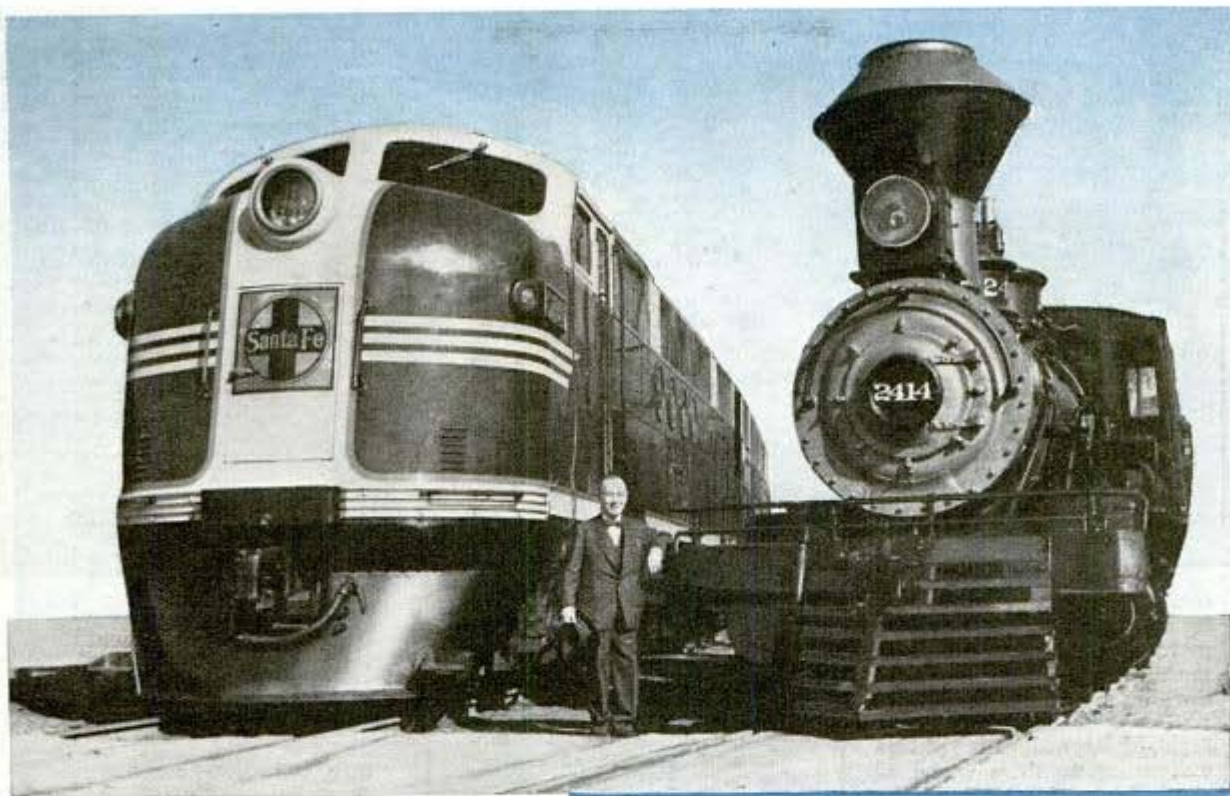
Left, the maintainer inspects a neatly packaged 16-cylinder engine. Below, the Diesel pulls up the steep grade to Cajon Pass on its first eastbound trip



*Built by Electro-Motive Corp.
La Grange, Ill.*

DIESEL on WHEELS

L 208



a ton, and it had better be worth it. For back of the steam engine lies a century of performance; the country grew up with the iron horse, and old railroaders cling to it in sentiment as much as in respect for the power of those thrusting pistons. The Diesel locomotive—grandchild of the automobile and child of the submarine—is an infant. If it meets the test of heavy freight service, the railroads are headed into a new era.

In the dynamometer car just back of the locomotive a bell jingles. An observer up in the cab is calling the engineer of tests.

"Throttle in position three," comes the word from the head end, and the test man jots the information on the locomotive's "diary" as he watches the needle jump around to 110,000 pounds on the drawbar dial, indicating the engine's pull on the coupler as it drags 3,150 tons of freight into action. The diary is a moving sheet of paper, geared to the car wheels

No. 2414, oldest engine on the Santa Fe, has one-tenth the tractive power of the big Diesel. Built in 1880, the old timer was retired in 1939 after nearly 60 years service. Below, at the controls of the Diesel freighter





Mechanical pens in dynamometer car (above) log the Diesel's performance on its maiden trip; the dial shows the pull on the drawbar in thousands of pounds

Right, high-speed motion picture camera shows drive wheel of steam locomotive clear of the rail, pounding it; Diesel-electric drive wheels hold the rail

Below, engine maintainer regulating shutters which control air intake for cooling radiators



Above, the engine control pedestal in the streamliner's cab. Dial at top guides the engineer in advancing or retarding traction motors

and traveling across a desk at a speed proportional to the train's; on it a crew of engineers and a battery of mechanical pens record every change of pace, every shift of throttle, every milepost and every variation

in drag on the coupler as No. 100 purrs up the mountain grade. A mechanical integrator writes continually the foot-pounds of energy expended in hauling the train across the continent. For this is the baptismal trip of the Santa Fe's 5,400-horsepower giant, and a jury of railroad engineers is waiting to be shown.

Over the plains of Texas from Canadian to Amarillo the train raced in two hours and a half, sprinting over a mile a minute on the level, taking a six-tenths percent grade—one percent is 52.8 feet rise in a mile—at 34 miles an hour. No stops en route. The man at the throttle grinned.

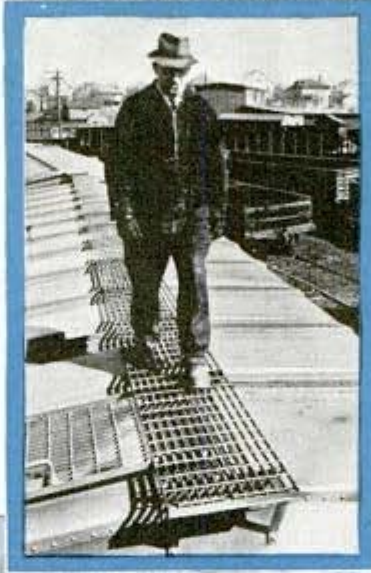
"Used to make this run in seven or eight hours with a double steam locomotive," he said. "And we stopped for water about every 25 miles on the upgrades."

For a long time the people of America had almost forgotten there were railroads. Then, seven years ago, a Diesel-electric streamliner flashed across their vision at 100 miles an hour. Today they are riding from coast to coast by Diesel, at nearly a mile a minute all the way. Freight has been speeding up, too, but of this the public is scarcely aware. The average freight locomotive is nearly 50 percent more powerful than 20 years ago, and freight train speeds from terminal to terminal are 63 percent faster.

Again, as in passenger service, it is the Diesel-electric streamline freighter that is likely to revolutionize railroading. No. 100 gave a hint of what is to come when, on its debut trip from Kansas City to Los Angeles over the Santa Fe, it trimmed a full day from the steam schedule without attempting a record. Running time was 55 hours, an average of 32.5 miles an hour with a top speed of 65.

Inside and out, it looks very much like its sensational brother,

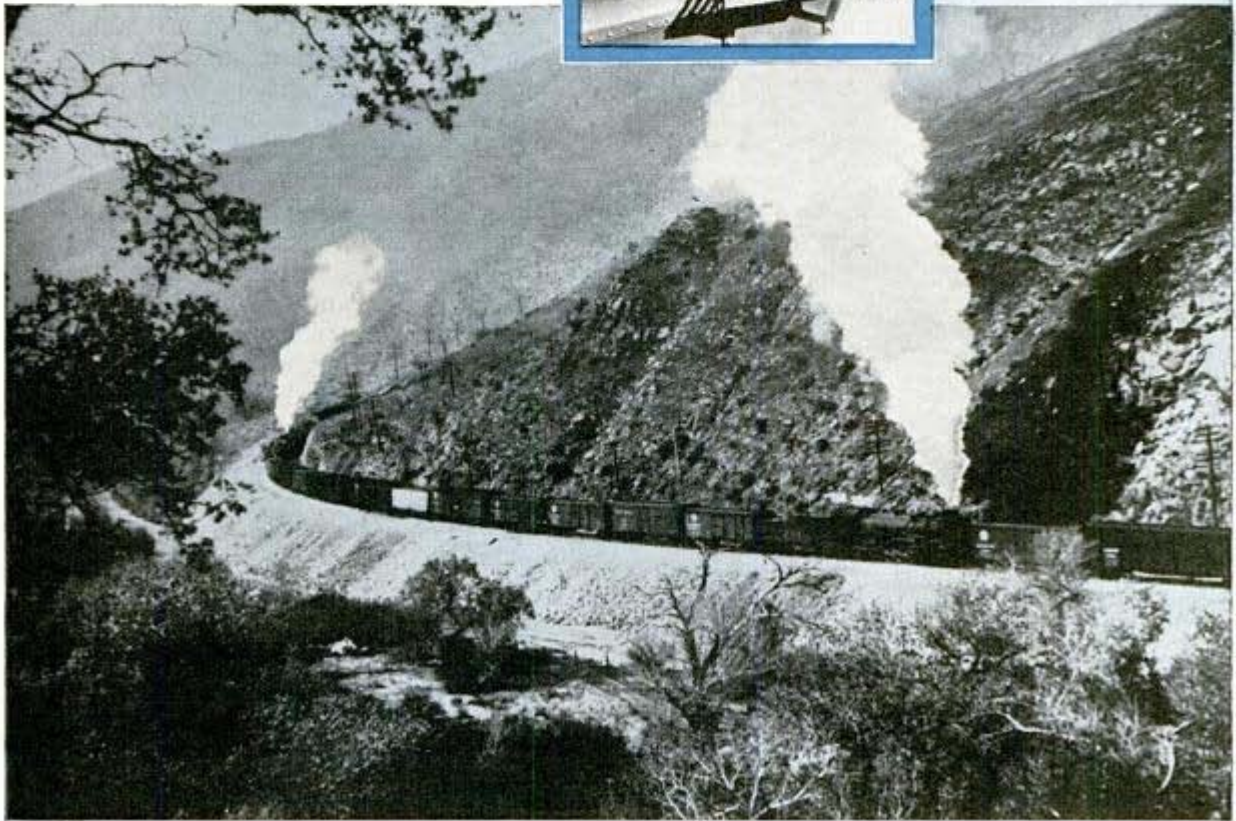
(Continued to page 199)



Windshield wiper and horn rope are silhouetted against cab window; the engineer's view is like that from your car seat

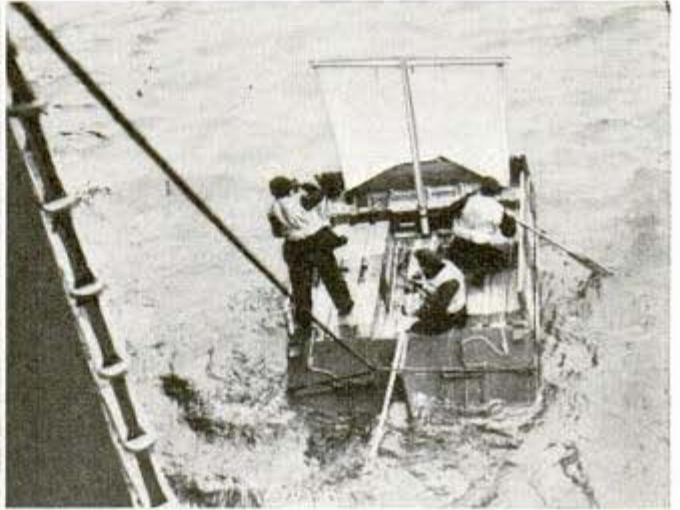
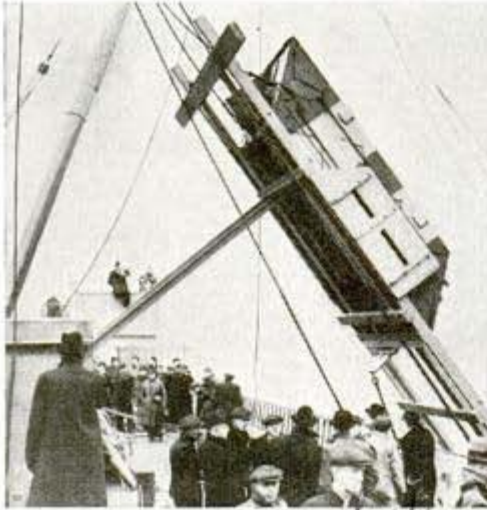
New steel freight cars (left) have open-mesh steel running boards and brake steps for safety

Two extra engines at middle and rear help a Santa Fe steam freighter climb a steep grade the Diesel can take unaided



L307

Life Raft for Wartime Launched by Catapult



Life raft, left, being catapulted into sea. Right, it is designed to float safely with either side up

To save the lives of her merchant seamen who may be shipwrecked by enemy action, Britain has introduced a new raft that may be launched with either side up. If the ship is struck by a torpedo, an auto-

matic launching device catapults the raft into the sea. Invented by R. S. Chipchase, head of a firm in South Shields, England, the life raft carries a sail, oars and a stock of food, water and other provisions.

L286

Unexploded Bombs Hauled Safely in Special Police Truck

Probably the first vehicle of its kind in the United States, an automobile has been designed for the Milwaukee, Wis., police department to be used in transporting unexploded bombs which saboteurs or spies

might "plant" in factories producing defense materials. Its body is a heavy steel "hopper," weighing 3,300 pounds, and so shaped that the force of an accidental blast would be directed upward through the open top. The bottom, three feet square, is made of five layers of half-inch boiler plate, while the beveled sides consist of two layers of plate with a 2½-inch oak plank between them. Heavy boiler plate reinforces the driver's cab, and a rear window of 1½-inch bullet-proof glass protects the driver from flying fragments. In practice tests, explosions have forced the hopper about four inches down on its special springs, but have done no damage to the machine itself.

by J. J. Kluckesky, Chief of Police



If bomb being transported in this truck explodes accidentally, its force will travel upward with little chance of doing harm

L370

Cartridge in Garden Hose Feeds Plant Vitamin

Much labor in applying vitamin B₁ to lawns and gardens is saved by the development of a vitamin cartridge that distributes automatically when the garden hose is

Engineering
Walterburg
Sells & Plant Co.

Essofact 30 for \$1.00

L 292

used. The usual method of application involves mixing the vitamin in a container and spreading it by means of a sprinkling can. This is eliminated by the vitamin cartridge, since it is only necessary to insert it in any standard nozzle, screw the nozzle onto the garden hose, and sprinkle with a fine spray. One cartridge is sufficient for an average size lawn and garden, and it costs only a dollar to keep them "vita-mized" an entire season. Adding vitamin B₁ to the soil frequently results in larger blooms, hardier plants and a better lawn.

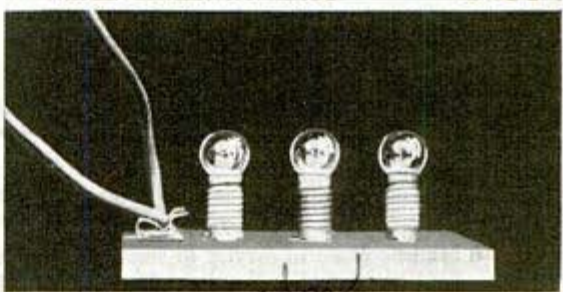
Sun Rays Make Electricity To Light Three Bulbs



L 294

Shredded Foil in Photoflash Increases Light Output

Giving a light output double that of the familiar Synchro-Press Lamp No. 21, and two-thirds that of the huge No. 75 foil-filled lamp, a new powerful photoflash lamp has been designed especially for obtaining good color pictures, as well as making flash pictures at greater distances. Designated as G-E Photoflash Lamp No. 50, the bulb is rated at 100,000 to 120,000 lumen-seconds of light output, coming to its peak in .03 second. That so much light can be generated from a bulb having an over-all length of 5 3/8 inches, is due to the shredded foil with which it is filled.



Electrical hookup, top and center, uses sun's rays to generate current that will light lamps, bottom



Another step toward the goal of harnessing the sun's power to produce heat and light has been achieved in an invention by O. H. Mohr, of Oakland, Calif., which utilizes rays from the sun to generate sufficient electric power to light three electric lamps. The device consists of a lead-free glass bulb, enclosing a cluster of wires, thermocouples and other electric apparatus. Alternate heating and cooling of this assembly generates electricity in small amounts.

Foil is finely shredded in this new photoflash lamp in order to produce a light of greater intensity

□ A new calcimine "overcoater" paint can be applied over old calcimined surfaces without washing, shellacking or sizing.

JUNE, 1941

*Essential Electric Co.
Vela Park
Cleveland, Ohio*

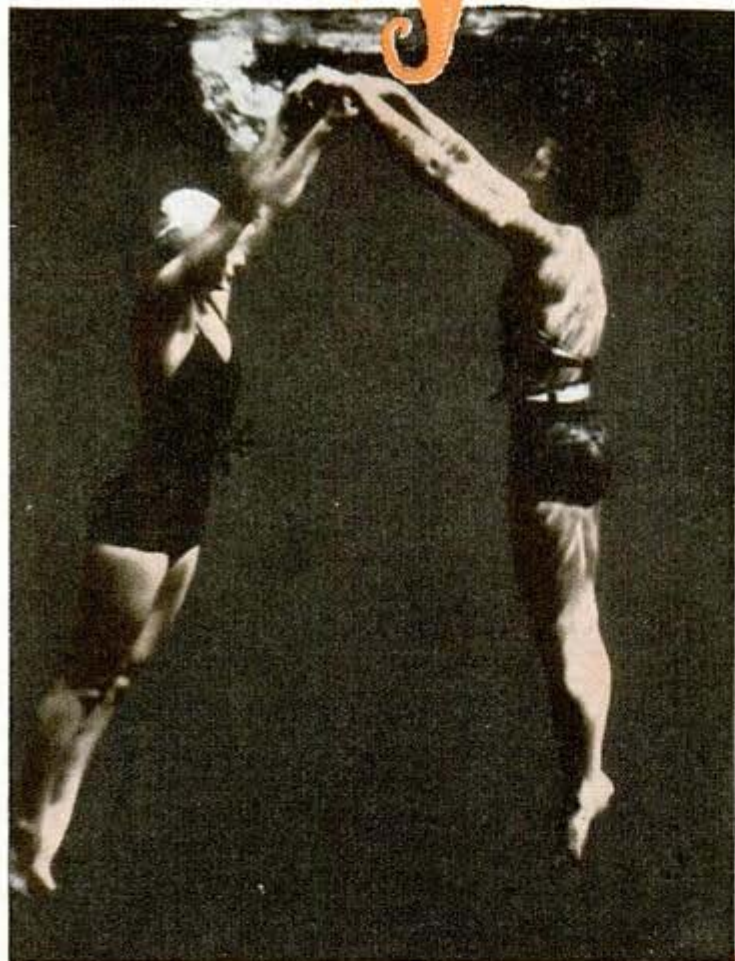
*Paint. Paint
Products Co.
99 d 6 st.*

Brooklyn, N.Y.

K1358



WONDERS of



Two swimmers form a bridge through which "mermaids" will dive. In the movies the scene is a masterpiece of grace and timing

Below, firing a stove in undersea schoolroom, Dry Ice is used to give a realistic effect in movies of smoke pouring from chimney



Above, photographer descends into steel tank for an underwater "take"

DOWN on the ocean's bottom a school for mermaids is in session. Each damsel sits at her desk, taking down with pencil and paper the lecture of the "teacher," who illustrates the lesson with chalk on a blackboard.

Now one of the fair students raises her hand. "I'm cold, sir," she complains. "Would you mind firing up the stove a bit?" Teacher pokes around in the stove, and a cloud of smoke pours up the chimney.

This scene from a recent underwater movie is realism to the nth degree. The players look so natural and comfortable you'd insist they were in their subsurface classroom 15 minutes or more.

Just how is such movie magic achieved? How long must the actors remain below at a stretch? Best qualified to answer these questions is Newton Perry, who for 12 years at Silver Springs, Fla., in waters so crystal clear you can see the bottom 70 feet below, has been acting, directing and writing scripts for underwater films. Perry has made about 15 feature films



Newton Perry

See in Land Reel. Spotlight more

*X1358 Comb. Randolph Roberts 4630
New Hampshire Ave N.W. N.W.
aprk 2, Washington, DC*

UNDER-WATER MOVIES

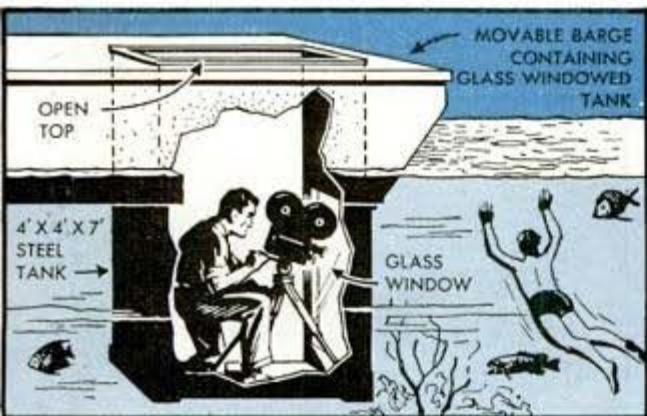


and a score or more of news-reel shorts.
 * How are underwater movies filmed?
 The photographer goes down in a steel tank four feet square and seven feet deep. One section is glass and the top is open. The cameraman can shoot as deep as 20 feet, or tilt his camera to film the surface. Usually no special lighting is required, for the shots are made in sunlight.

(Continued to page 190)

Enjoying soft drinks at a submarine soda bar; stage "props" are weighted down to keep them in position

Glass-bottomed range finder (below) is used to watch rehearsal of underwater high-jinks before filming



This sketch shows the cameraman crouched in his floating tank, shooting movies through glass window

✓ **Air-Raid Shelter Used in Home Serves as Table in Daytime**



Heavy steel table affords good air-raid protection for the folks at home

Strong enough to bear the shock should two stories of brick and masonry tumble on it, a new shelter for protection in homes against bombs of air raiders has been developed in England. Designed for use as a table in the daytime and a shelter at night, it is a box 6½ by 4 feet, fashioned of steel, and having side walls of steel netting to prevent injury from flying glass and debris. The combination shelter and table is large enough to accommodate two adults and two small children.

High-Speed Midget Flash Bulb Hits Peak in 1/200 Second



Synchronizing the flash bulb and camera shutter is simplified by a new lamp that reaches its peak of flash in 1/200 second. It is revolutionary in its construction, for this midget has no aluminum leaf or

wire to produce its flash. Instead, it has a small amount of chemical paste applied to the ends of the lead-in wires in an atmosphere of oxygen. Its quick flash makes

possible the use of rather simple synchronizers to take pictures by the open-flash method, but it can also be used for high shutter speeds. The new bulb, called the "SM," is the same size as the Number 5 and has a single-contact bayonet base. It is said to be especially good for closeup pictures.

Baby Buggy Cradle Has Two Rockers Folding Upward

Equipped with a pair of hinged rockers, a baby buggy can be changed into a cradle whenever desired. To afford maximum benefit from the sun, the body is completely open. Rockers are of heavy gauge tempered wire. Foot pressure lowers them, raising the buggy off its wheels.

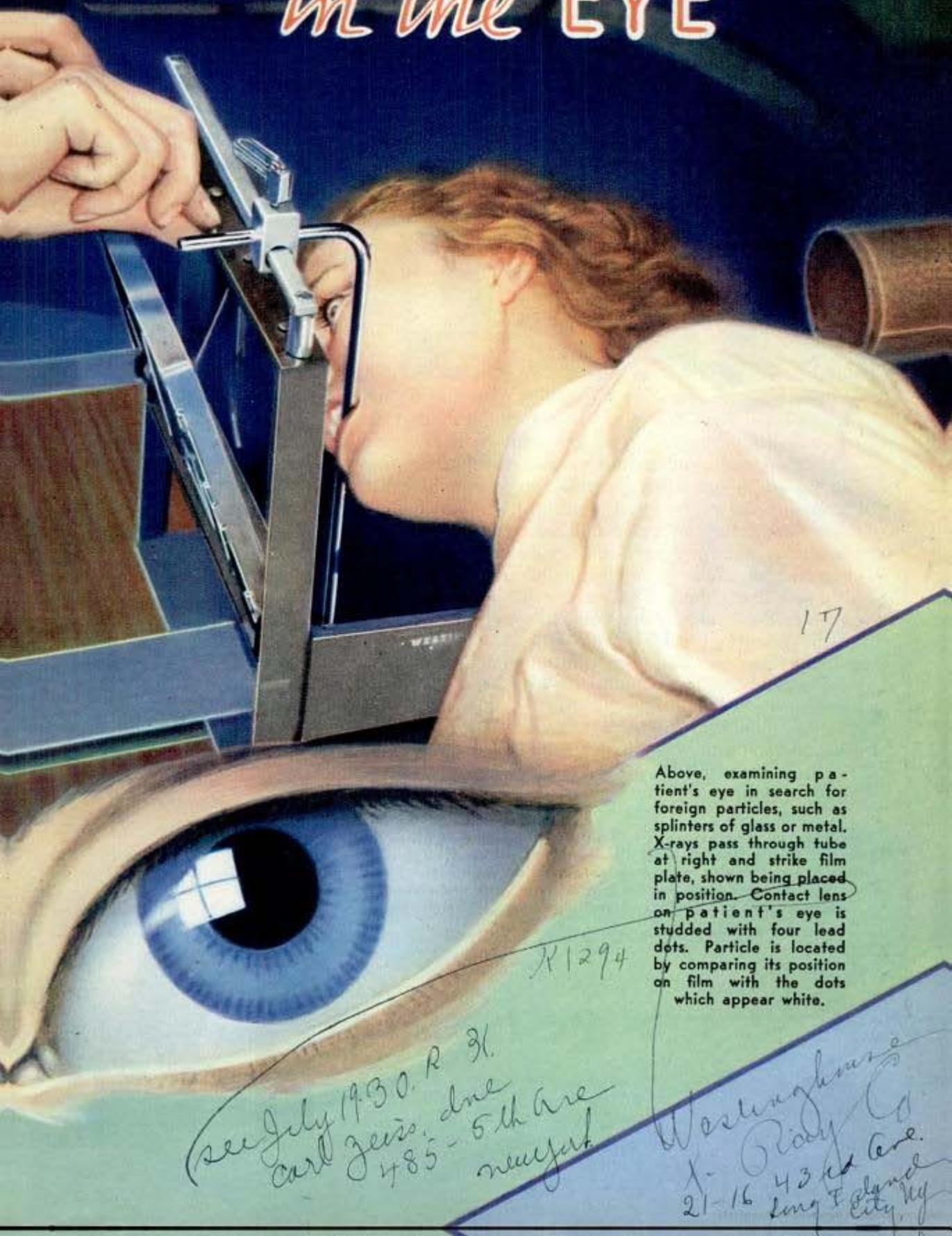


Rockers are lowered to use baby carriage as cradle

*General Electric
1614 Park
Cleveland
Ohio*

*L 218
L 187
L 328
Stally wood
Calif.
Charles W. 1000, 82-10 Midpath*

SCIENCE LOOKS YOU *in the EYE*



17

Above, examining patient's eye in search for foreign particles, such as splinters of glass or metal. X-rays pass through tube at right and strike film plate, shown being placed in position. Contact lens on patient's eye is studded with four lead dots. Particle is located by comparing its position on film with the dots which appear white.

X1294

(see July 1930. R. 31.
Carl Zeiss, Inc
485 - 5th Ave
New York)

Worthington
X. Brady Co
21-16 43rd Ave.
Long Island City, N.Y.



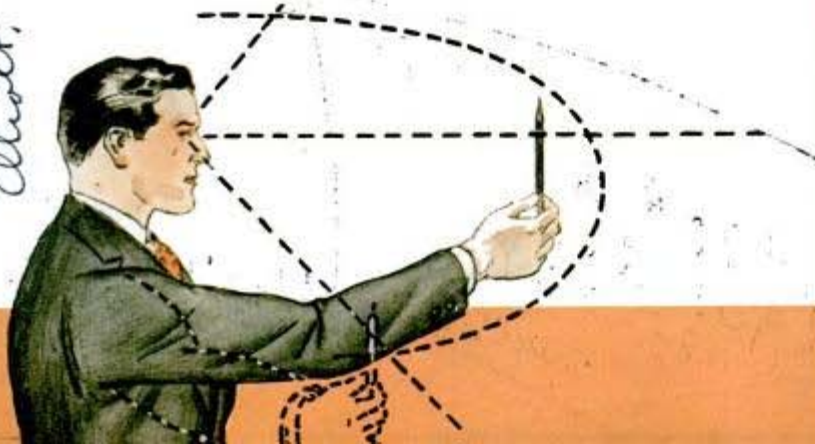
Above, narrow lines show what person afflicted with tunnel vision sees, while dotted lines show what person with normal vision can see. Tunnel vision often causes crashes.

YOU are doing something right now that nature never intended you should do and if your descendants keep it up, which is quite probable, at some distant period the human face may be equipped with a single, large eye, perhaps staring out like a locomotive headlight. Or one big eye which functions and one small one which does not.

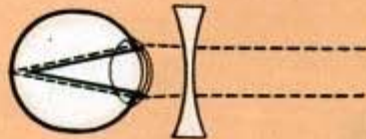
Reading, watching movies, playing bridge and concentrating on close, difficult industrial and commercial tasks are things that nature did not take into consideration when your binocular-type of paired eyes were worked out by evolution. Nor did she expect that the human race would stay awake after dark, dancing, riding around in autos, going to parties and window-shopping.

These modern, sixteen-hour-a-day eyestraining tasks and pleasures were not contemplated for the primitive, teamed-up human eyes and something was bound to happen. What is happening, according to

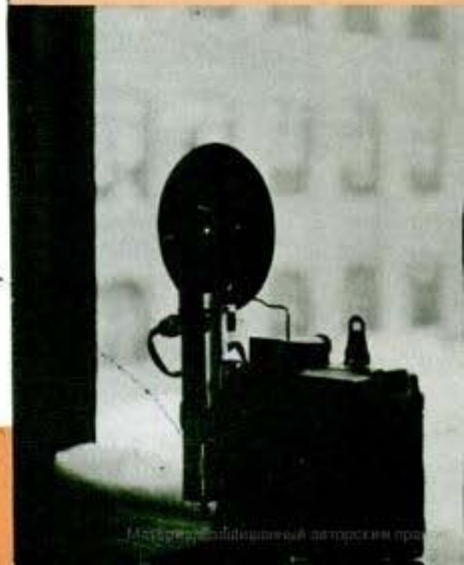
Below, test for tunnel vision is to hold pencil at arm's length to the side and a little forward. Look ahead, then move pencil all the way across line of vision to same angle on other side while keeping eyes forward. If you cannot see the pencil throughout the movement your side vision is faulty and you should consult an oculist.



How to correct near-sighted eye revealed in test at bottom of page



Below, place object on window sill. Stand back a few feet. If object clear and object across street look blurred, you are near-sighted. Concave lenses are prescribed.



Capt. Allen Warren
 Elliott, 343
 33rd Street
 New York City

K1294

Suite 3157
International by Irene
Lesieur 19

the research experts of the Better Vision Institute of New York City, is that civilized man is rapidly becoming a one-eyed creature in the sense that he uses only one of the two eyes which he possesses.

“Optical scientists are engaged in a vital struggle today,” says M. J. Julian, president of the institute. “They are fighting to keep mankind two-eyed. Just as there is scientific evidence indicating man once had a third eye in the top of his head — perhaps to keep vigil from monstrous flying enemies — there is a school of thought which favors the theory that we may evolve into a one-eyed species. Nature usually first subordinates and eventually eliminates the neglected human organ.

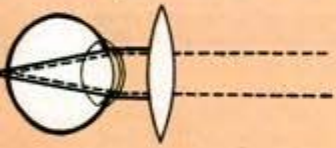
“And a glance in the mirror will give you evidence that nature does make major changes in our eyes. The pulpy mass in the corner nearest the nose is the

Overhead



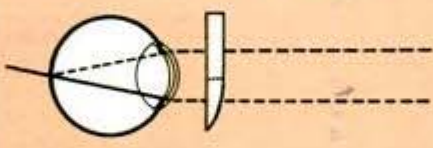
Above, reading skill is tested on eye-movement camera which produces developed film eight minutes after test. Film reflects actual behavior of eyes while reading. Called the ophthalmograph, it was developed by American Optical Company to assist educators and eyemen in diagnosing defective reading habits which are a major cause of school failures.

How to correct far-sighted eye revealed in test at bottom.



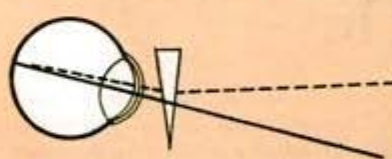
Below, if distant object is clear, but near object blurred, you are far-sighted. Glasses with convex lenses are prescribed to correct this defect in your vision.

How to correct astigmatic eye revealed in test at bottom.



Below, if both near and far objects look blurred and distorted, you are handicapped with astigmatism and should wear glasses with cylindrical lenses.

How to correct double vision revealed in test at bottom.



Below, if both objects appear with two blurred and overlapping images, you have double vision and should wear glasses with prismatic lenses.

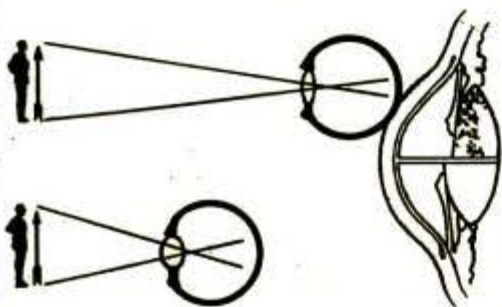




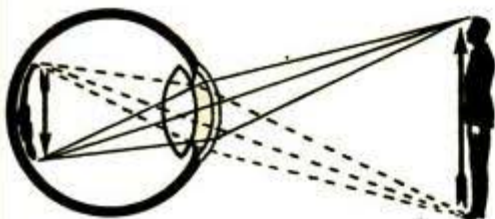
Photo courtesy of Polaroid Corp.

Here's what happens when you take two Polaroid disks and place one over the other with their invisible "optical slots" crossed. This helps to explain the basic principle on which the polarizing lenses operate in blocking glare, as they would if installed in windshield and headlamps of autos. Note blacked-out segment.

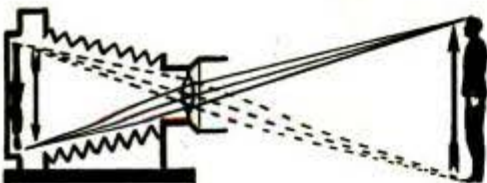
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In comparing the human eye with the camera, note above that flexible lens of eye keeps eye in focus. It becomes flatter for far vision and rounder for near (see upper and lower drawings, respectively).



Note, in drawings above and below, that eye, like the camera, "takes pictures" upside down. In the eye, light rays fall on the retina—and picture is flashed to brain, giving impression we call "seeing."



730 Main St. Cambridge, Mass.

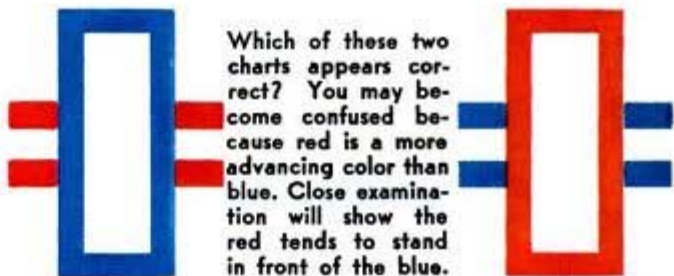
Above, many people regard the color of the eyes as indicative of certain characteristics in the human makeup. Black eyes are believed to show wit and ambition for power; brown to indicate affection and sincerity; hazel to go with a happy and active nature; blue to denote the optimist and dreamer; gray to mark wisdom and perseverance, and green eyes generally are associated with talent and a shrewd mind. How do your eyes seem to carry out this theory?

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Cold Charts - Emergo Optical Co. Cambridge, Mass.

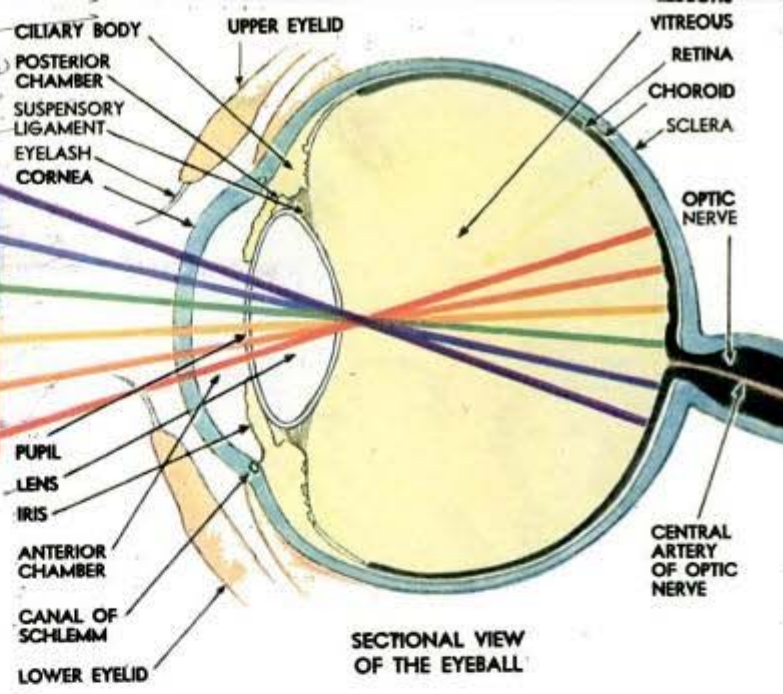


Your eye is likely to play tricks on you in color perception. For instance, gaze steadily at the center of the flag above and keep looking at it for at least thirty seconds. These colors will saturate your eye. Then quickly focus your attention on a plain piece of paper or blank wall. Keep staring for a few moments—and the flag gradually will appear in its normal colors. If you fail on the first attempt, try it again, experimenting with the distance you hold the page from your eyes.



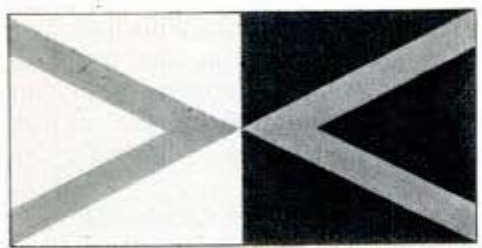
Which of these two charts appears correct? You may become confused because red is a more advancing color than blue. Close examination will show the red tends to stand in front of the blue.

*Write to: Better Vision Institute
3157 International Bldg
Rockefeller Center
New York*



This diagram shows essential parts of the eye, as well as demonstrates perception of color. Your eye contains some 130,000,000 nerves, called "rods," which are sensitive only to black and white, and some 7,000,000 nerves, called "cones," which give the sensation of color. One scientist estimates that the human eye can see 100,000,000 different colors.

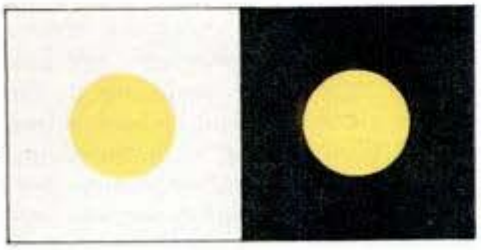
21 K1294



You see colors (diagram above) in daylight because then the pupil opening of your eye is small, confining light entering it to the cones — color-sensitive nerves—which are located in the center of the eye.

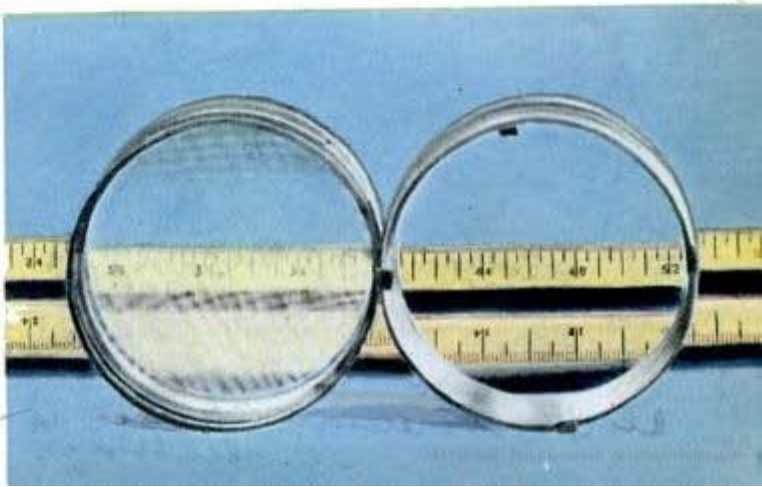


Above, both gray arrows are the same in this chart. Yet one looks lighter and one darker. Below, the two yellow circles are identical. Yet the one on black seems to be far brighter than the one on white. No man-made instrument is so sensitive to form, motion and detail and to the countless variations of color shades and tones as your eye.



Above, close left eye, look at black circle on chart and bring picture slowly toward you. At a certain point the cross at right will disappear. Left, cross vanishes if you repeat with right eye closed, showing the eye has blind spots.

Right, by applying a transparent film of vaporized salt, generally a fluoride, about four-millionths of an inch thick, light beams are made to penetrate rather than reflect from the surface of a lens. Treated lens is shown at right, giving clear view of the ruler, and the untreated lens at left, reflecting the light beams and giving a blurred image of the ruler.



*Bausch & Lomb
Optical Corp
Rochester, N.Y.*

K1294

Newton, Mass



Pat and Pat Taylor, Mount
Dale Junior College

shrunk remains of a third eyelid, scientists believe."

"Civilized eye"—a phrase used to describe the breakdown caused by modern man when he brought outdoor eyes indoors and put them to work at tasks for which they were not fitted—is growing so prevalent in the United States that even optical scientists were surprised at the first reports from a survey started on behalf of the institute and not yet completed.

It turned up the fact that eighty-one per cent of the city folks questioned had their eyes examined at some time in their life, indicating their sight was troubling them. Another startling, new figure uncovered was that fifty-nine and nine-tenths per cent of all urban adults in this country now wear glasses. By such surveys and laboratory research these scientists who look you in the eye are finding out a lot of interesting things concerning your sight and are doing a lot of important things to correct rapidly increasing defects.

For example, just as one of your feet is usually larger than the other and one of your hands is usually stronger and more useful than the other—so that you are said to be right-handed or left-handed—these research men say you are also born right-eyed or left-eyed, which means one eye dominates the other.

This works out satisfactorily while we are very young. But when modern life begins to put its heavy strain on the eye-team, the weak member gradually collapses under the pace set by the stronger eye and as a result, without realizing it, the last few generations have been doing most of their seeing with the dominant eye. This situation, unless corrected, leads to many serious eye conditions and, some of these experts believe, will eventually cause mankind to become one-eyed, in theory or in fact.

While everyone knows that eyestrain will result in headache, they have found also that it is responsible for such apparently unrelated troubles as indigestion, St. Vitus's dance and shingles. And, because the body's nerves are hooked with the

American Optical Co
Southbridge
Mass

Above, this huge pair of glasses, made for exhibition purposes to illustrate a new style, is large enough to fit a giant sixty feet tall. More than half of the adults living in cities in the United States wear glasses. Eyestrain has been found to result not only in headaches, but in such troubles as indigestion, St. Vitus's dance and shingles. The eyes provide definite clues to the state of your general health.



Corp 730 Main St
Cambridge
Mass

Polaroid day glasses have control button permitting wearer to regulate amount of light passing through the lenses. Left, the glasses "wide open" and, right, "closed" to block out blinding glare.

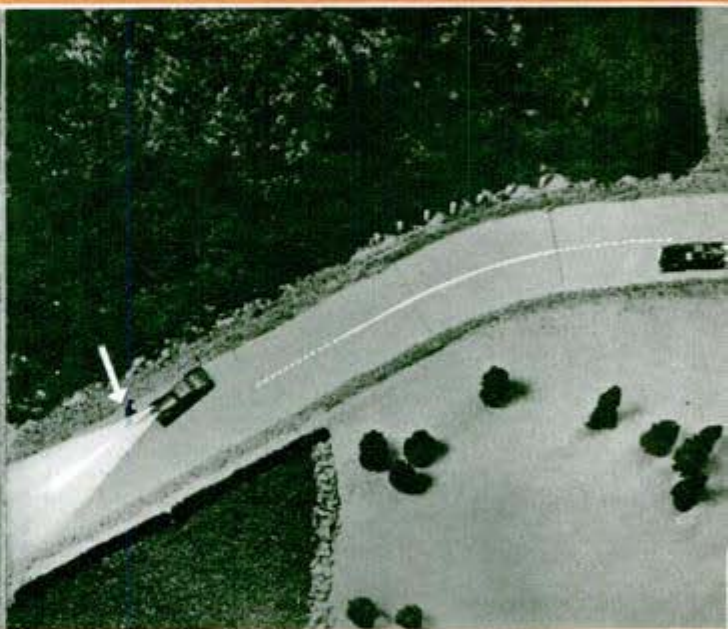
Dist: American Optical Co
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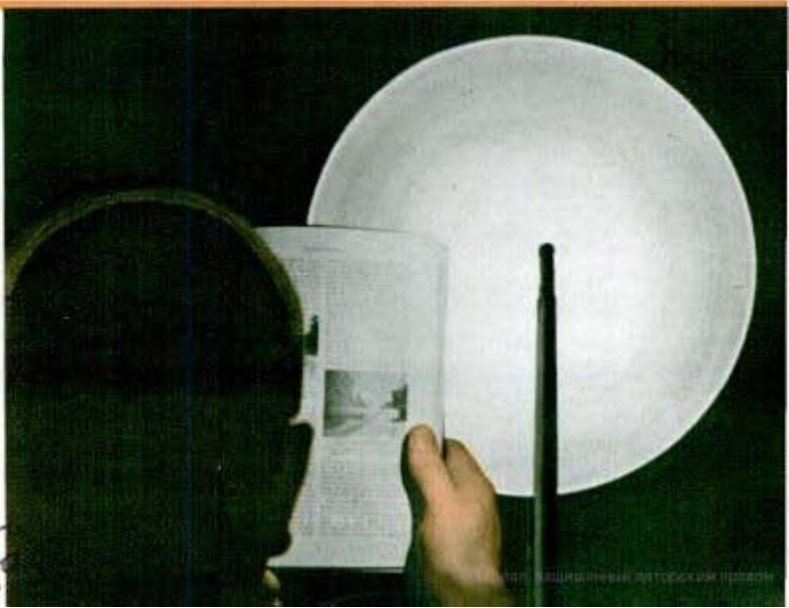
K1294

spinal cord, and thus the brain, eye trouble causes false symptoms of stomach ulcers, gallstones, lumbago, sciatica and rheumatism. On the other hand your eyes provide definite clues to the state of your general health. That's one reason why the newly improved ophthalmoscope is such an important eye-examining instrument. This device projects a beam of light into the eye and permits an examination of the eye's retina and background—the only part of the body where arteries, arterioles, veins and capillaries with the blood circulating in them may be viewed in their natural living state. With the aid of the ophthalmoscope, symptoms of eye, brain, blood and systemic dis-

27



Top, taking test of reading ability. Center, left, driver of car at right is blinded by glare of other car's headlamps and situation is dangerous for cars and pedestrian, indicated by arrow. Center, right, although the cars have met and passed, the same driver may be so badly afflicted with night blindness that he may not recover vision in time to avoid striking the pedestrian. If you've had this experience—slow recovery of vision at night after a strong glare, you'd better have your vision checked by an expert. Bottom, peanut bulb on tip of rod emits one foot-candle of light, about as much as Abraham Lincoln read by in his youth. This demonstration was staged in General Electric's laboratory.



American Mutual Liability Insurance Co. Boston, Mass.

K1294

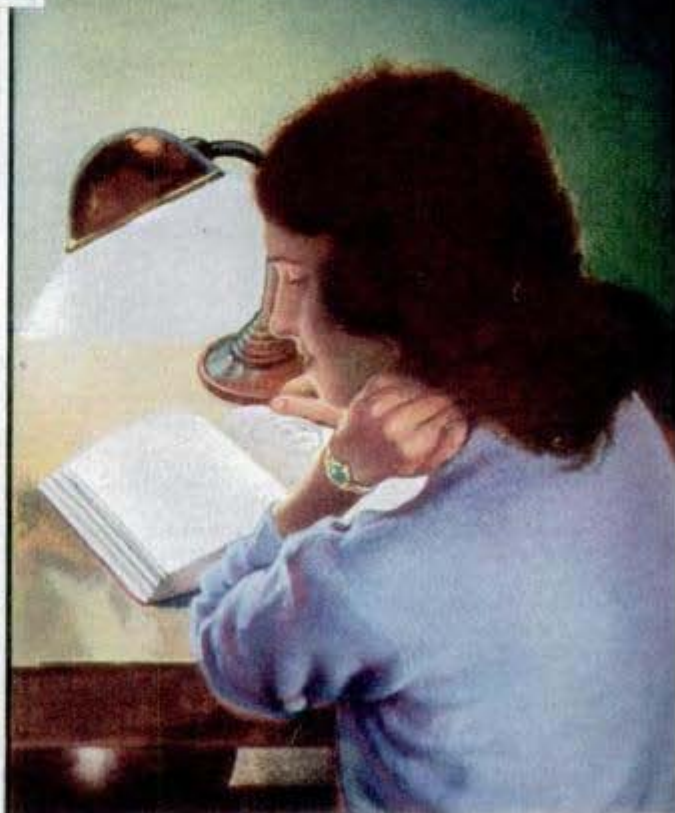


eases can be observed in the eye's background. Recently this diagnostic instrument was improved by the addition of Polaroid, the glare-control material, which eliminates the reflections that formerly handicapped doctors when looking you in the eye.

Your eyes each have over 130,000,000 nerve endings and six muscles so they may be turned in any direction or converged or diverged. These muscles perform a tremendous amount of work in the course of a day. More than 100,000 eye muscular movements are made by the average good reader in a single half-hour's perusal of non-technical material. Those of a poor reader may run as high as 300,000.

If eye-coordination is below par, the attempt of the eyes to focus on an object, and the brain to fuse the
(Continued to page 176)

Left, Polaroid eyetogs, especially for skiing, block out about ninety-nine per cent of ultra-violet rays and reduce glare from snow.



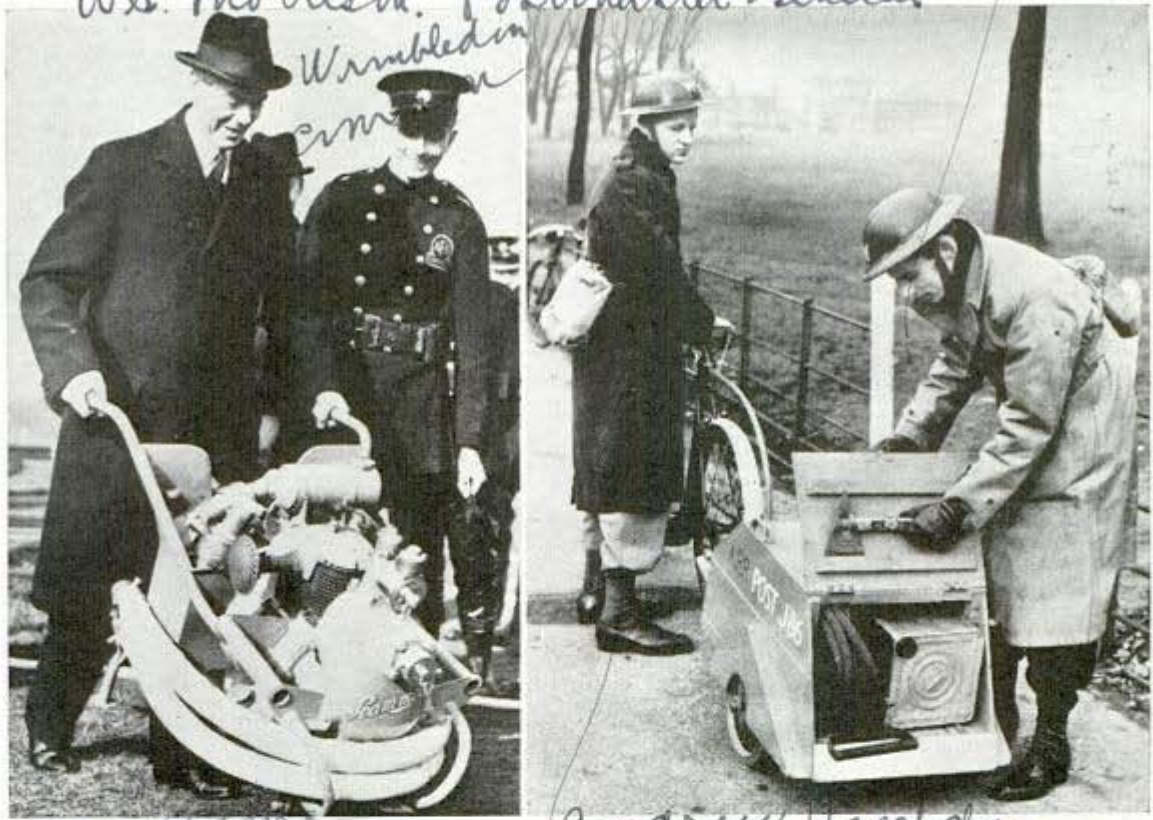
Demonstrating how Polaroid light reduces glare in reading. Left, note that type in book is visible, even in this reduced photo. Right, the page, under ordinary light, is just a white blur.

£2341

James Bradford

Portable Pumps Help Quench Air-Raid Fires

W.S. Morrison, Postmaster General



Wimbledon

Andrew Haselden

At left is engine and water pump mounted on special wheelbarrow that may be moved easily to strategic spot. Bicycle trailer, right, carries stirrup pump, first aid kit, and fire fighting apparatus

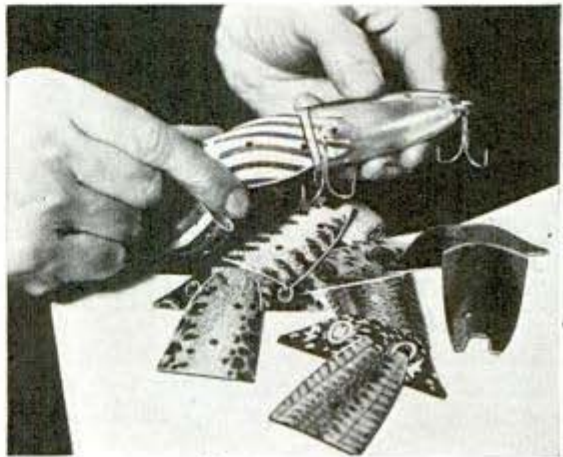
Two types of easily portable pumps are being used in London to help minimize damage wrought by incendiary bombs. One, built by two 18-year-old boys, consists of a bicycle trailer that carries a stirrup pump, four gallons of water and a first

aid outfit. The boys are messengers for air raid wardens and their work inspired them to construct the apparatus so they might be ready for action at all times. Another recent development is an engine-operated fire hose pump mounted on a wheelbarrow.

£283

Colored Fishing Lure in Shell May Be Changed Easily

Made in two parts, a transparent fishing lure can be changed in color by unscrewing and inserting a different colored piece. There is no limit as to possibilities of color combinations and as many inserts as desired may be carried. The lure consists of an unbreakable "glass house" equipped with hooks, the two sections being held together by screw threads. Inserts are specially treated paper pieces shaped to fit snugly within the lure and ranging in color from greens to bright oranges, with stripes of various hues simulating the scintillating colors of fish.



Any color insert that suits the whim of fisherman may be slipped into transparent lure as shown above

Nearly one-half of the 92 known elements are used in the building of automobiles.

JUNE, 1941

25

Illinois Auto Club
3401 Michigan Chicago

The best 2nd floor merchandise mark Chicago

L 3-27

Bomb-Resistant House Set Up in 23 Minutes

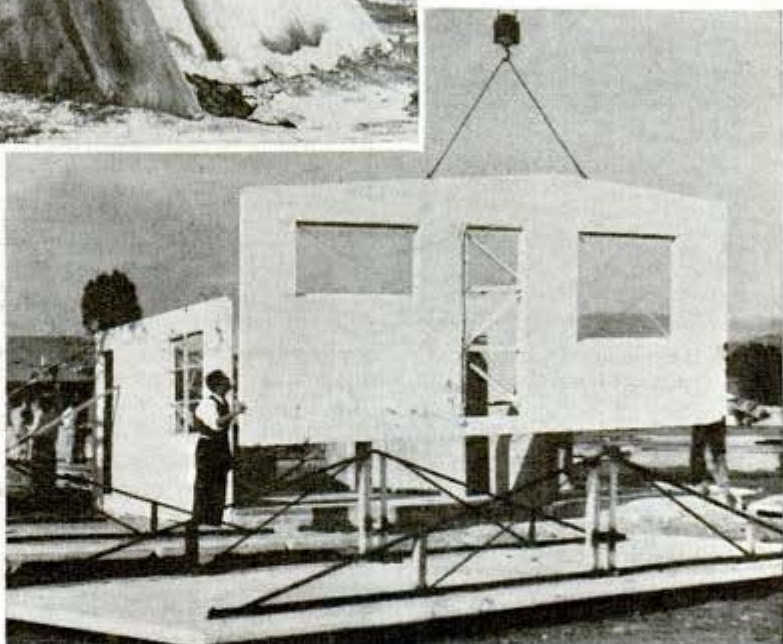
Thermo-Crete James
108 46 Ventura Blvd
Los Angeles
Calif



Intended as a backyard shelter, the "tepee" at left is of three-inch reinforced concrete and would protect against anything but a direct bomb hit

Below, a crane lifts one of the precast concrete walls of the semi-bomb-proof three-room house, which was erected in less than a half hour

In a recent demonstration of precast concrete houses and backyard "tepee" bomb shelters, the walls, partitions and roof of a three-room house were erected in just 23 minutes. Semi-bombproof, in that its walls would stop all but the heaviest flying fragments, the house was designed for quick construction for defense industry workers. The walls, floors and roof panels are precast in forms flat on the ground, and are made of an aggregate which is 60 percent pumice. Only half as heavy as ordinary concrete, it is said to be more resilient to shock. The cost of the precast house is about half that of typical frame construction. After pouring, the panels are allowed to dry for two days, then are lifted into place on the building site with a truck



crane. Welders join the corners and partitions. The small shelter demonstrated with the precast house is of three-inch reinforced concrete and is intended to be buried in the backyard. Impervious to damage except by direct hit, such a shelter for six persons would cost around \$60, plus excavation and charcoal filters if gas defense is required.

Use of Wrong Hand in Writing Is Not Cause of Stuttering

Despite the theory that stuttering is a result of teaching a left-handed child to use the right hand, a test of 1,600 students at Syracuse University indicated there is no basis for that explanation. In that group were 77 students who had changed their

writing hand, yet only one of these stuttered. The old theory has been based on the finding that one side of the brain is dominant, and it was supposed that teaching a person to write with the wrong hand would force the weaker side of the brain

Syracuse NY

2234

to take the initiative and thus disturb the whole nervous system. Prof. Harry J. Helmsman of the Syracuse School of Speech says there are about 1,300,000 stutterers in the United States, that the habit is most likely to develop at 11 years of age, and that three times as many boys stutter as girls.

Soldiers Working As Linemen Learn Trade for Civil Life



These soldiers, swinging on wires, learn trade while serving Uncle Sam.

Many men will emerge from Uncle Sam's army well versed in useful trades about which they knew nothing when they entered. In stringing up communications lines, for instance, uniformed soldiers learn the fine points of how to erect poles and climb them to hook up the wires.

Liquid Rubber Coat On Pulley Stops Belt Slippage

Applied easily with a brush to the face of any pulley, whether flat or V-type, a coating of rubber-base liquid is claimed to prevent the belt from

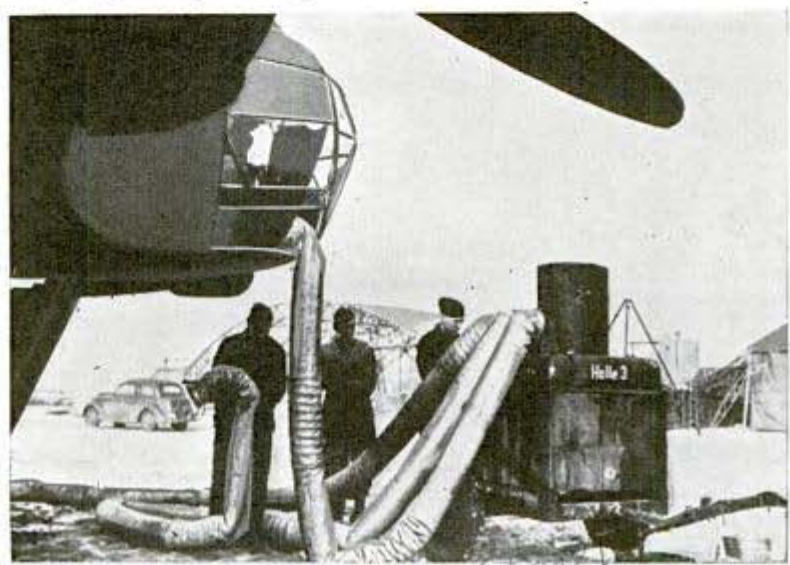


slipping. The liquid is so compounded that it sticks to the pulley's face regardless of the pull exerted upon it. It takes only a few minutes to apply, and if put on at the end of a working day, the pulleys are ready for use the next morning. Tests are said to show that the covering increases the efficiency of belt drives as much as 50 percent.

The fireboxes of some of the steam locomotives now in service on the United States railroads would hold an automobile with room to spare.

Hot-Air Unit Warms Up Bomber's Engines

To conserve gasoline and oil that would be consumed in warming up the engines of a bombing plane before the take-off, the Germans have been using a portable heater. This unit delivers hot air through flexible ducts to the engines. The saving in aviation fuel and lubricating oil is considerable, especially during the cold winter weather.



German airport workers warm up engines of bomber with portable heater

Handy Rubber Coat

Vertical Co. Pulley Co. 253.

no data

K 1404

SECRET FUELS for



Pouring sample of blended fuel in knock engine to test its detonation qualities before using in racing car



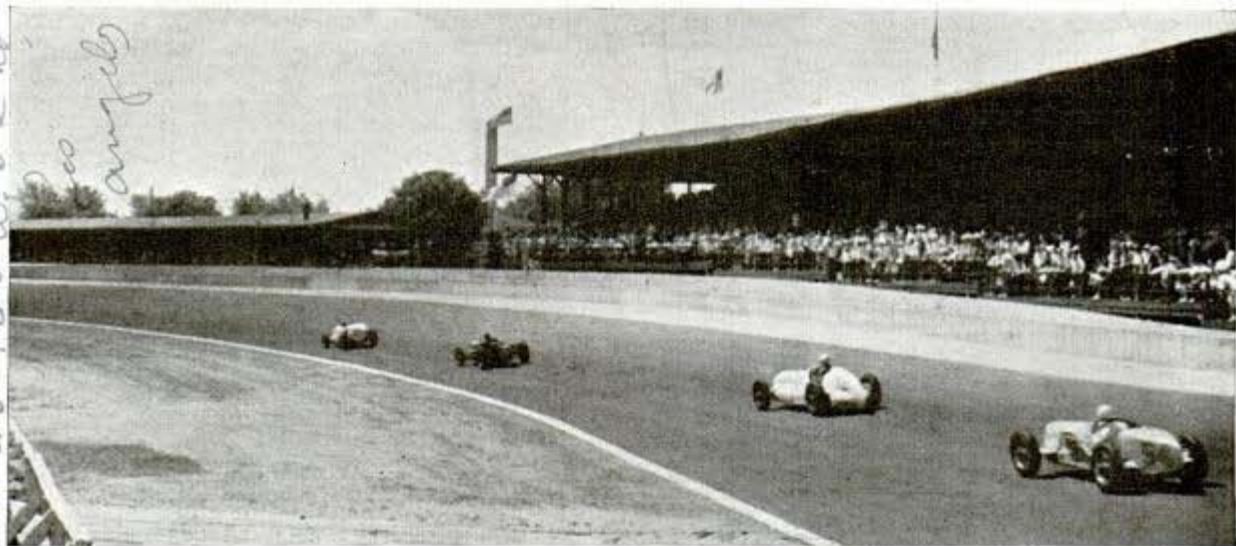
Fred Offenhauser finishing the two blocks of new V-8 supercharged engine to be used in this year's race. Below, view of Indianapolis Speedway with racing cars passing stands at high speed

STUFF that is poured into the gasoline tanks will boost speeds at the 500-mile Indianapolis race on Memorial Day. More than anything else it will decide the winner of America's racing classic.

Two years ago the emphasis was on mechanical perfection. Last year driving skill was paramount. This year, with practically the same cars and drivers in the starting line-up, the fastest fuels are being sought by the racing teams. Secret blends and mixtures by the score are being tested in laboratories and on trial runs.

Gasoline is about the best fuel there is, yet few of the drivers will use it this year; alcohol is one of the poorest fuels and yet all of the supercharged engines as well as many of the unsupercharged motors will be powered with it. Chances are that a "cocktail mixture" will beat straight leaded gasoline to the finish line.

Gasoline's only fault is that in a high-compression, high-speed engine of high specific output it causes high engine heat, preventing the engine from delivering all the power

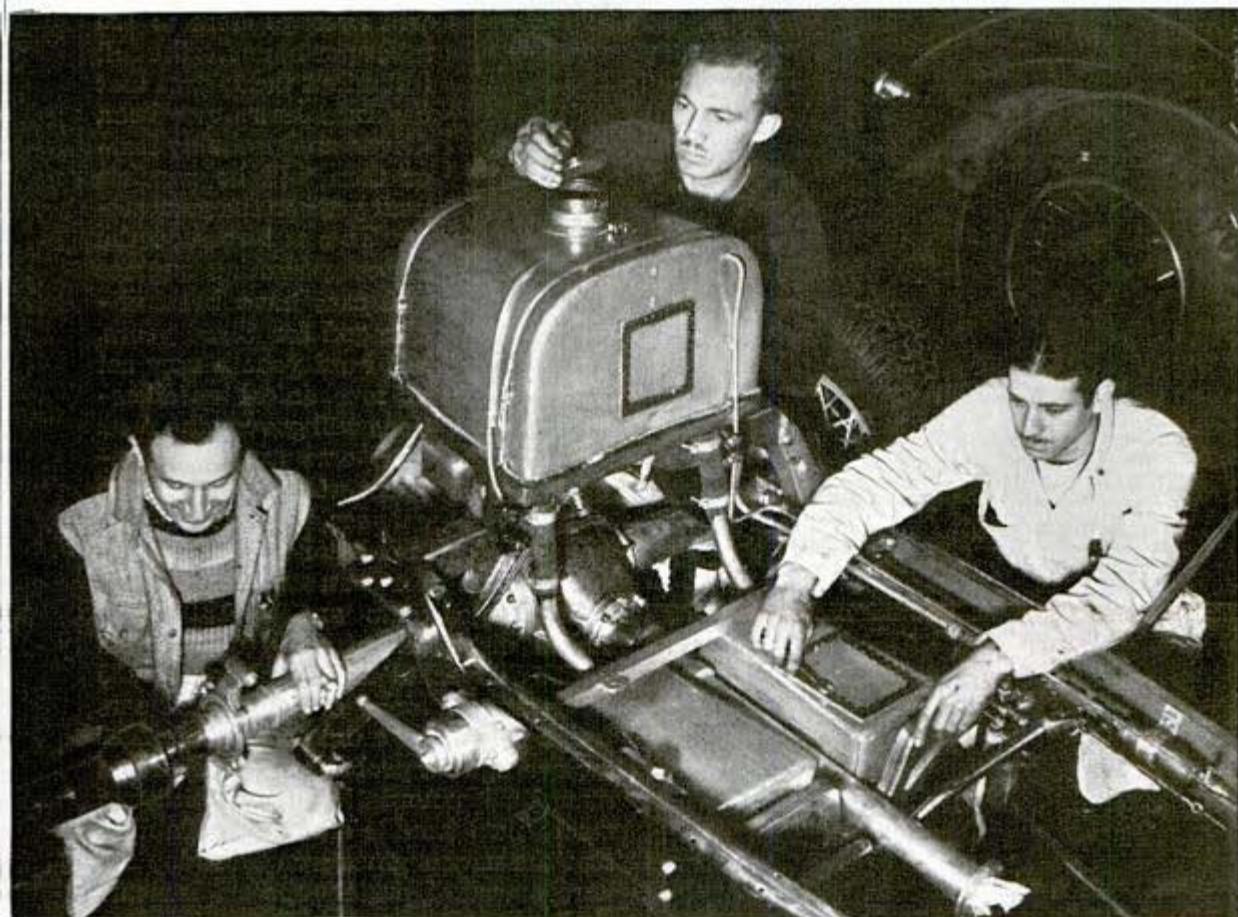


Offenhauser Engineering Co. Thomas E. Stinson, Jr. 3872
Franklin Ave. Indianapolis

Handwritten note on the right margin.

R 1484

the KINGS of SPEED

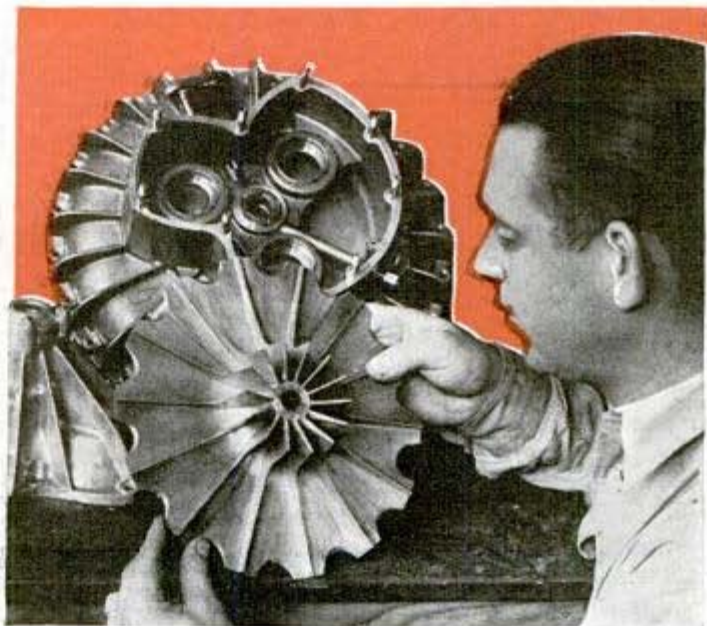


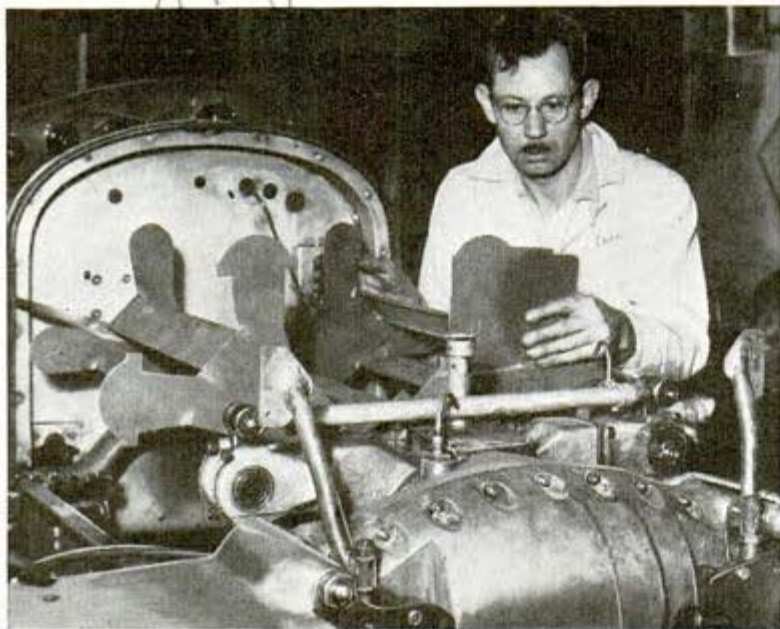
that it otherwise might. On the other hand, alcohol keeps engine temperatures lower, inhibits detonation, and is not as finicky in the carburetor. But alcohol has neither the punch nor flexibility of gasoline, it delivers only a fraction of the mileage, it won't start at such low temperatures, and it sometimes condenses in the intake manifold, giving a lean mixture and balky performance.

In spite of all these objections a few drivers will use methyl alcohol at half a dollar a gallon, while others who have magnesium castings in their superchargers will have to use grain alcohol, far more expensive, because methyl attacks the magnesium parts. But most drivers are hunting for a perfect speed blend that combines

Mechanic at right is shown installing additional fuel tanks around the drive shaft of one of the speedsters

Below, rotor blade and other parts of a supercharger like those used in the cars at Indianapolis





Placing "mockup" of engine in chassis so body can be finished by time engine is ready



View of special brake that has only two moving parts, reducing chance of failure

the good qualities of both alcohol and gasoline. The two fuels can't be used as a simple mixture because each tends to separate from the other. Benzol or acetone is added to keep them mixed. One standard racing mixture is made up of almost 80 percent methyl alcohol, 10 percent gasoline, 10 percent benzol, and a small amount of castor oil. In most cases the secret mixtures that are being tested are variations of this basic formula.

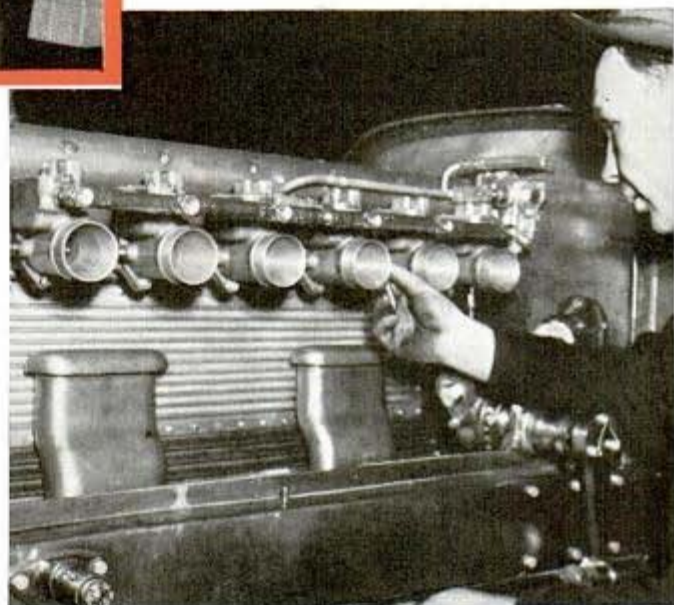
With fast fuels, and barring

wrecks or weather that would slow down the race, most of the drivers believe that the winner will average close to 120 miles per hour for the full 500 miles, the fastest that the race has ever been driven and probably faster than will be possible next year or the year after. This is because the rules governing engines and cars have been unchanged for three years, but next year a new set of mechanical specifications will govern the race. New cars and new engines will be built. The chances are that the new

rules will call for smaller engines and lighter cars. For instance, the present supercharged cars are of 181 cubic inches displacement or less and this limit is expected to be reduced to 135 cubic inches. Many of the present cars weigh more than a ton each and in 1942 the average car probably will weigh less than 1,500 pounds. The possibility of mechanical trouble and the probability that the new engines won't develop the horsepower of present motors indicate slower speeds next year than this.

Due to the forthcoming changes, only one or two new engines have been built

Below, closeup of six carburetors on racing engine. Each cylinder has a carburetor



Muller... from wheel stems Special

X1484 *Offenhauser Engineering Co.*
 1935 W. 62nd, Los Angeles

for this spring's race. One of these, built by Fred Offenhauser for Bud Winfield, is a supercharged V-8 motor of 180 cubic inches displacement, burning an alcohol mixture, that will be mounted in a specially built front-drive Ford chassis that was raced at Indianapolis four years ago. Ralph Hepburn will drive it and it is expected to be one of the fastest cars on the track. Another new car this year will be entered by Ed Walsh of Detroit, having a coil spring front-end suspension and powered with a four-cylinder unsupercharged engine. Only one of the three radical four-wheel-drive rear-engined "Man from Mars" cars designed by Harry Miller is left and this car is being changed around with the engine in front.

One improvement that will help deliver higher sustained track speeds is the new Winfield anti-tilt carburetor with which a number of the cars will be equipped. In this new design, the centrifugal force of a fast turn doesn't drain fuel away from the carburetor and starve the engine, hence the driver can always reach for full power with his throttle foot in coming out of a turn.

The standard racing wheel until now has been 18 inches in diameter, and this year the size has been increased to 20 inches with a corresponding increase in tire size. In the past the wheels were made of steel. This year they will be of duralumin construction and each wheel and tire will weigh 14 pounds less. The larger diameter with its slower outside speed will deliver better traction and wear on the tires will be decreased.

Giving only half the mileage that gasoline does, the alcohol mixtures being used this year will mean more pit stops than in the past and the drivers will have to change some of their driving habits as well. For instance, the supercharged straight eight that Rex Mays drove to second place on 100-octane gasoline last year, making one pit stop, will make two stops for alcohol fuel this year, in spite of a larger fuel tank that holds 53 gallons.

Does the swing to new fuels on the track mean that alcohol-type fuels would be better than gasoline for stock cars? Not for a long time to come, the racing engineers declare. Gasoline costs less than half as much, goes twice as far, doesn't absorb water from the air, and is more efficient in many respects.

JUNE, 1941

Portable Platform on Pole Holds Workman Safely



This sturdy platform may be placed at any height

Quickly fastened to any large pole or similar upright made of wood, steel or concrete, a lightweight platform provides a safe place for the workman to stand. The board is sturdy, each unit being tested to support loads over 750 pounds before shipping. Actual breakdown is claimed to be in excess of 1,700 pounds.

Flower Glows Within Light Bulb In Decorative Flowerpot

Nested in a small decorative flowerpot, an electric bulb incloses a flower that lights up in beautiful colors when plugged in. Crystalline stones placed about the bulb give it a gardenlike appearance. The light may be used as a night lamp, since the glow is not bright enough to disturb the sleeper. It is claimed the bulb is capable of burning 2,000 hours.



Steinmetz & Keilly
 14th floor Merchandise
 mail Chicago

James O. Kearney Corp.
 4206 Clayville Ave.
 4206
 4206
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L 415.

Latest Streamline Auto Is Wider Than It Is High



Above, full view of new Packard "Clipper." Right, closeup of front end. Note how radiator grille has been narrowed



Detroit News

Breaking from the traditional body lines that distinguish its other models, the Packard Motor Car Company is introducing a streamline model that is a foot wider than it is high. Viewed from the front, the car displays the Packard radiator lines only in miniature, with the radiator grille section quite narrow. The front fenders are high and wide with no depression between the crown of the fender and the bonnet side. Running boards, concealed by the skirted doors, are arranged to permit the front fenders to "fade" into the doors, merging with the body at a point about midway of the front door. Unusual roominess is one feature, with the front compartment measuring 58¾ inches at shoulder level, ample for three persons. Extra comfort is said to result from the use of a fifth shock absorber which functions to "dampen out" any lateral movement between the rear axle and the frame. This new model, called the Clipper, is powered by a 125-horsepower, eight-cylinder engine. One mechanical innovation of interest is the extension built into the transmission, permitting a shortening of the propeller shaft. This is said to result in quiet operation and in a

reduction in the tendency of the shaft to "whip" at high speeds. The Clipper's gasoline tank is equipped with an alarm whistle which permits full-force filling of the tank as long as the whistle sounds. When the whistle stops the tank is full. A custom styling touch is found on the rear deck where the Packard signature is carried in chrome script.

L 306

Breathing Restored By Tilting Patient On Stretcher

Mounted on a wheeled cart that permits tilting, a multi-purpose stretcher adopted by the British Army can be used as an operating table or for artificial respiration. By tilting the patient up and down the stretcher induces breathing similar to the function of an "iron lung."



Stretcher on tilting cart rocks patient to restore breathing

L351

Camera Snaps Black Leopard's Circus Leap

Trainer Alfred Cuel



Here is a spectacular bit of frozen motion—a black leopard caught by the camera midway on its long jump

Fans of the "big top" are getting their 1941 thrills from the performance of a black leopard. One of its stunts in the cage is a long, flying leap between two tall ped-

estals. A cameraman visiting the training quarters of the circus in Florida recently caught the big animal in air midway between the pedestals as it made the jump.

Clunging Bros. Barnum & Bailey

Sarasota

Steel Claw Lifts Fire Bombs From Inaccessible Places

London fire fighters have been equipped with a new tool for defense against the incendiary bomb. It is a steel claw mounted on a long wooden handle. Kept readily available to the fire watchers on the city's roofs, it is used to grip bombs that have fallen into inaccessible spots and lift them out before the fire has gained headway.

WHERE TO BUY IT

Readers who wish more information about commercially available products described in Popular Mechanics Magazine may now write directly to the manufacturer or distributor of the item. Just note the page on which the article is described, then turn to the "Where-to-Buy-It" index starting on page 4-A in the front of the book. If the product is on the market, the name and address of the seller appear under the indexed item. To get quick action—Say You Saw It in Popular Mechanics.

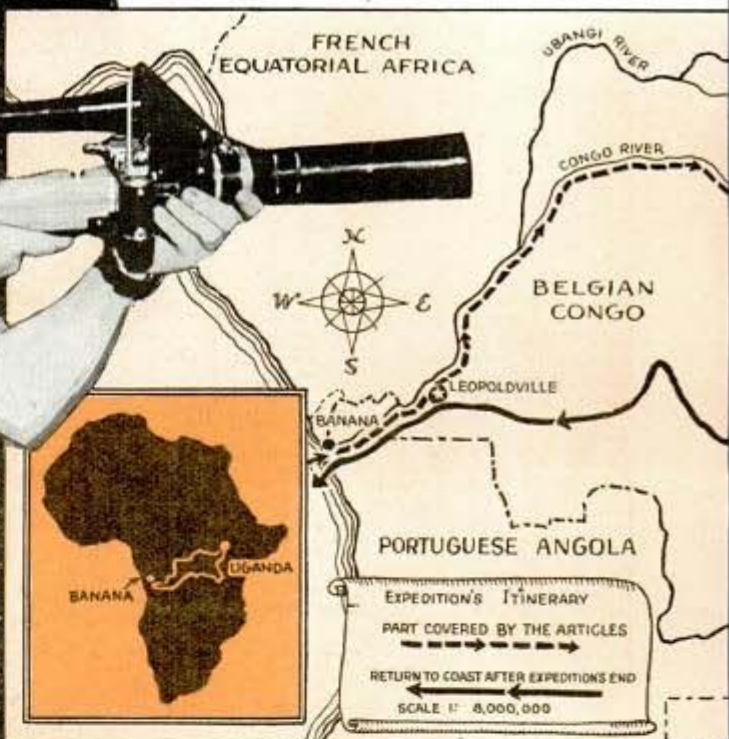


*British
Cmpts
P. H. ...*

Fireman shows how the claw grips incendiary bombs



Commander Gatti sights his telephoto "camera gun" on big game in Belgian Congo. The map traces his Tenth Expedition into the heart of the continent



1428 TRAILER BLAZING *through*



The transformer steps up the charge in this single wire encircling the camp to 4,500 volts as a discouragement to wild animals prowling around at night

Part I

By Commander Attilio Gatti

9 & 30th of November
 Editor's Note—Three times decorated for bravery in the trenches, on horseback and in the air during the World War, Commander Attilio Gatti emerged with a light wound and influenza, for which he took "the cure" of daily burial in the hot Sahara sands. Under the spell of Africa he planned the first of his adventurous expeditions. Author of "Great Mother Forest" and other books, fellow of numerous scientific societies, Commander Gatti is credited with many scientific discoveries among the beasts and flora of the jungle. Mrs. Gatti, an American, accompanied him on the Tenth African Expedition of which he writes in the three-part story beginning here.

IT'S A LONG way from the steaming Congo jungle that John Rowlands Stanley opened up to the Congo into which we plunged, 50 years later, to retrace his perilous journey.

Africa has not changed so much. It is we who have changed, and our safari equipment. Stanley sailed from New York on a precarious little vessel on an expedition in behalf of Leopold II, King of the Belgians. We sailed on a luxury liner, my wife and I and four American companions. Instead of months of navigating down the Atlantic coast to the slave-trading post of Banana

K 1428.

3:41



Designed by Count Alexis de Sakhnoffsky
July 1938 94

the AFRICAN JUNGLES



Antenna for the expedition's short-wave radio station extends from tree left standing in middle of camp (top); the tree also has a platform for movie shooting. Below is a herd of hippos

there was a five-day flight to a modern African town of flower-covered homes.

From there, the 1,700 infernal days it took Stanley to push up the Congo river to the head of navigation telescoped for us into 12 days of lazy relaxation on a paddle boat that once plied the Mississippi.

Our trek into the equatorial jungle began where Stanley stopped, halted by the impassable Stanley Falls. Instead of poisoned arrows, we were met at Stanleyville by welcoming cries of natives, jubilant at

the prospect of earning a few francs by unloading our seven vehicles and 15 tons of supplies.

Air-conditioned, electrified "jungle yachts," comfortable steel trailers housing our expedition and its radio station, photographic laboratory and workshop, were to carry us into a wilderness impenetrable a half century ago.

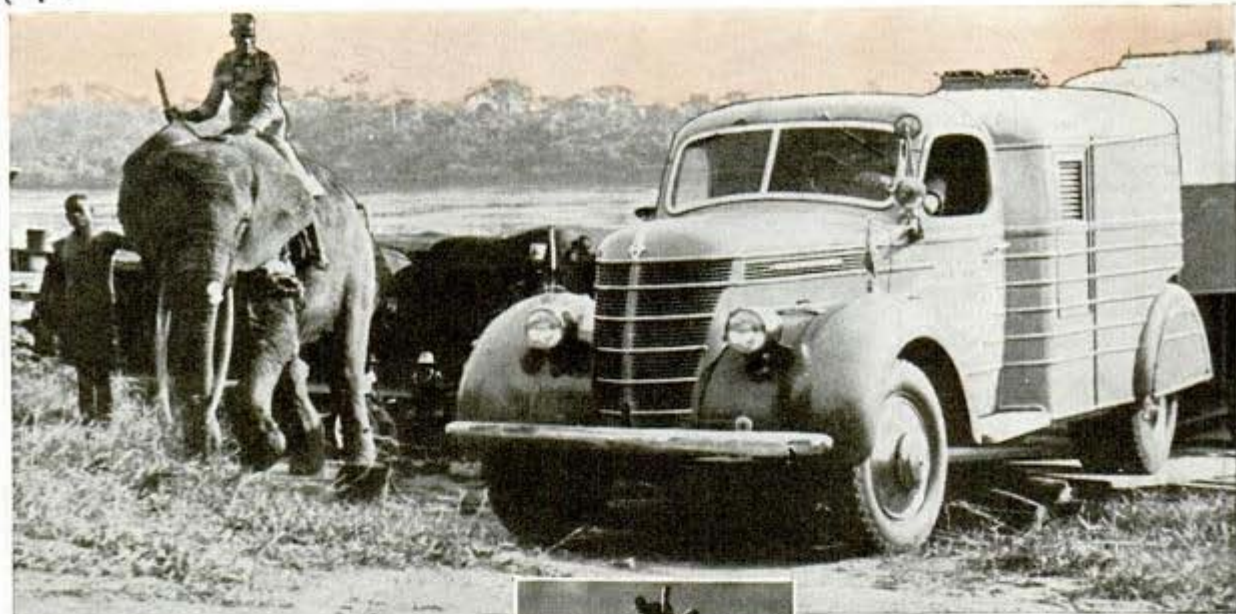
Before the dark curtain of Africa drops on us, come join the party in fancy. The Tenth Gatti African Expedition needs one

JUNE, 1941

International 35
Harvester Co. 180 N.
Michigan Chicago

Waves D. 20 D. 2.
D. 15.

R7428



Above, elephants help bring the trucks and trailers ashore over a plank bridge at Stanleyville

more member. Adventures, thrills, danger will be your lot, along with unique landscapes, pestiferous insects, the scorching equatorial sun and tropical hurricanes. And don't forget, plenty of work. We must shoot educational movies, capture weird animals; investigate ancient secret societies like the Baboon-Men; learn about the Mangbettus who deform their heads like pears; the copper-colored pygmies who barely reach your belt buckle; Giant Watussi princes who look down on you from eight feet of

At right, installing the radio antenna. Below, one of the comforts of home in the heart of Africa—an electric shaver is plugged into a convenient 110-volt outlet



height and with graceful ease jump a couple of feet higher than your head.

Now Stanleyville is just beyond the bend. See the native jumping into the river? There are crocodiles around, but he goes in all the same to bring ashore the boat's cable. Those elephants on the bank came from Gangalana-Bodio, where the African elephant, thought undomesticable for centuries, is captured, tamed, trained to serve man.

So, let's go. Or in Kingwana, the only language that can carry us through central Africa, we'll say "Funga safari!"

The river is low, the bank is high. The boat cannot approach shore, the trailers are 44 feet long overall, weighing nine tons each. With poles and planks we build a sort of gangplank. Then hopefully, we call for the elephants. But they don't take kindly to our monsters of stainless steel. The cornaks shout, push,



bang right and left with their crooked sticks, but instead of advancing the pachyderms go into reverse. Well, we'll turn them around and see if going in reverse doesn't bring them to the right spot. Chains are hooked to the dolly of the first trailer; an order is given, wheels thunder over the bridge. The elephants, scared by the din, spring ahead at such a pace that the trailer is on the verge of overturning, nearly smashing against a palm tree.

Better thank the elephants and proceed with the slower, safer system of letting the engines manage the climb.

Think how Stanley would shudder at the

Right, tuning in station OQ5-ZZ for a chat with the outside world and the news from the United States



**Above, one of the Jungle Yachts is jockeyed over precarious planking to a river ferry rigged of native dugouts
Below, inside the air-conditioned trailer the operator jots down a message from a radio "ham" back in America**

sight of these half-civilized natives in sporty hats and violent-colored shirts, descendants of the warriors who in 1883 fought him a few miles from here, near the Falls where the Lualaba river becomes the mighty Congo. But now that we are out of town, ready to put up our first camp, he would surely feel at home here at the village of his old friends the Wagenias.

Stanley's little fort today is the capital of Congo's largest province, but nothing has touched the Wagenias. True, they no longer devote themselves to killing white men, but otherwise life is much



K1428



Above, the explorers relax in camp for a snack and a siesta. At the left is a glimpse of one of the trailer lavatories



Below, Wagenias set fish traps, huge funnels of reeds hung from skyscrapers of poles at the Falls of the Lualaba



the same as in 1883. They still dress their innumerable children with fresh air; their girls with colored beads; themselves with a square foot of bark, and a preposterous straw hat and necklace of leopard fangs for grand occasions.

Pleasant rascals at times, first-class banditti at others, they run the best racket of the river. Stretched across the falls they keep skyscrapers of poles insecurely planted between gigantic rocks and connected over the deafening tumult of foam by other poles. From these heights, every evening and morning, they drop huge reed traps, which they retrieve so abundantly filled that for 100 miles the river remains almost fishless, and the populations downstream would practically starve were they not to come and

buy fish from the Wagenias. Buy it, of course, at the Wagenias' price. Plenty of catch? A fish goes for a spear point or a couple of leopard teeth. The season is bad? The same fish costs 10 spear points or 20 leopard teeth.

A swell racket. But glance at those skeleton skyscrapers; think what it takes to reach them and get away safely every morning and evening of a man's life!

Look at that 60-foot

K 1428

L 108

canoe, at the frenzied efforts of its 80 paddlers; how it is grabbed by the current, swept away, spinning dizzily. Watch the head man, standing in marvelous equilibrium on the prow, direct its maneuvers. The craft has abruptly stopped just where he pointed, a few feet from treacherous rocks. Now it is catapulting in another direction, seems to fly through the air, is overturning.

Watch how the canoe is steadied, arrested by the brake of 80 paddles, how the last momentum is spent to reach the rocks, to touch them gently. Four men jump with a rope to anchor the canoe; a shout of victory thanks the river's god, the crew swarms up the poles, polished by billions of tons of raging water to the smoothness of white marble.

The aerial fishermen race to the highest poles, hang by their feet, disappear under the foam, make a human chain that swings over a precipice until it reaches the other side of the gap left by a log snatched away by the river, and bridges it so that others can pass over and make a hasty repair.

Huge funnels of reeds are laboriously raised, emptied of their bulging contents, lowered again. Each fisherman, as his ancestors have done for hundreds of years, slits open fish after fish, devouring a part to give his own body the fish's swiftness.

On the return from the falls a small error often capsizes the craft. One moment it is flying down the current, the next it has vanished. Black points bob up here and there, are carried away in a flash. From the shore, women shout and laugh, knowing that tonight or tomorrow the crew will turn up, the canoe on their shoulders, paddle in one hand, string of fish in the other, legs tired from a long walk.

Northward we resume our journey, soon to face the problem hanging over us since the Governor swore that never would the 65 pontoons take the enormous weight of our trailers across a river. The pontoons, sent ahead, are rough contraptions of planks fastened to the tops of native canoes. In designing our Jungle Yachts I had kept them in mind. I had moved forward the rear wheels, carefully calculated distribution of weight and braking problems. But if the Governor is right and I am wrong, we may have to leave our Jungle Yachts behind, or maybe lose one in a river. Fifteen thousand dollars worth of trailer, ir-

(Continued to page 164)

JUNE, 1941

Three-in-One Lamp Adjusts For Table, Wall or Bed



Three lamps, all of same design, may be used on a bed, as at left, on wall, center, or as table lamp

Any of three purposes may be served by an adjustable lamp that will stand on a table, or hang on the wall or a bed. Rubber-covered clamps housed in the base are opened to hang it on the head of the bed; on the wall it may be hooked to a nail or screw, or it will stand upright on its base upon a desk or table. A universal joint permits the base to be manipulated to suit each of the three positions. The lamp has a three-way incandescent fixture.

Pilot Light of Flash-Bulb Tester Shows Condition of Bulb

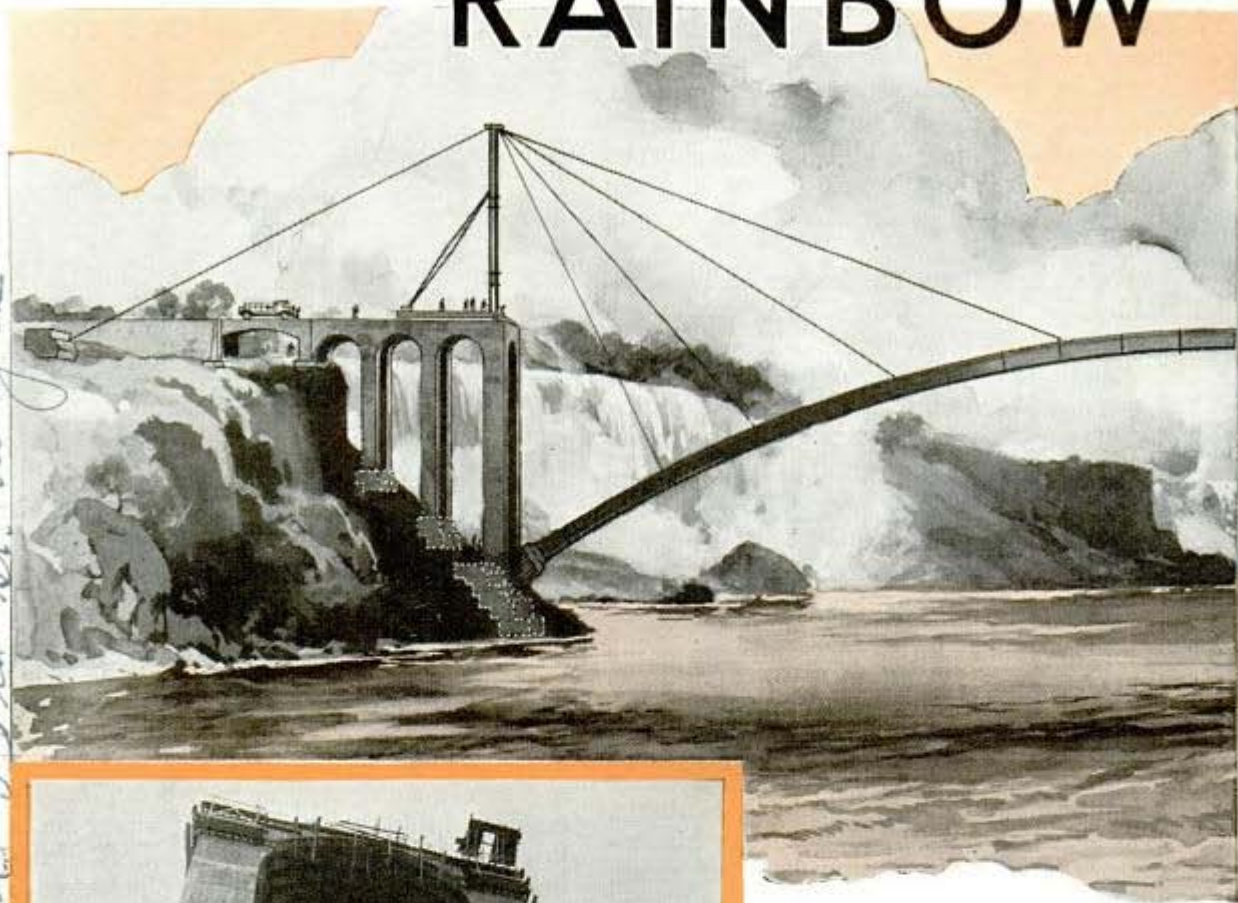
Photographers' flash bulbs can be tested without firing them by means of a simple battery-operated test unit. If the flash bulb is in good working condition, a pilot light on the tester flashes when contact is made. Floodlight and projection lamps can be tested in the same way.



Burke & James Inc. 39
223 W. Madison
Chicago

The Burroughs Co. 225-5th Ave. New York City

RAINBOW



DARING bridge workers—perched precariously at skyscraper height on slender steel, far above the swiftest flowing natural river on the face of the globe—are constructing the world's longest hingeless arch by an engineering method which makes the span itself a mechanical phenomenon.

They are building a rainbow of steel, pushing girder sections one by one from the rocky cliffs on both sides of a gorge 200 feet deep, toward the day not far off when the two sections will halt about 11 inches from each other. Then a tiny keystone section will be dropped in. Not much wider than the length of a loaf

Sketch, at top on this and the page opposite, shows method of construction of Rainbow Bridge. Left, abutment on American side of bridge. Steel is swung out from both sides

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of STEEL

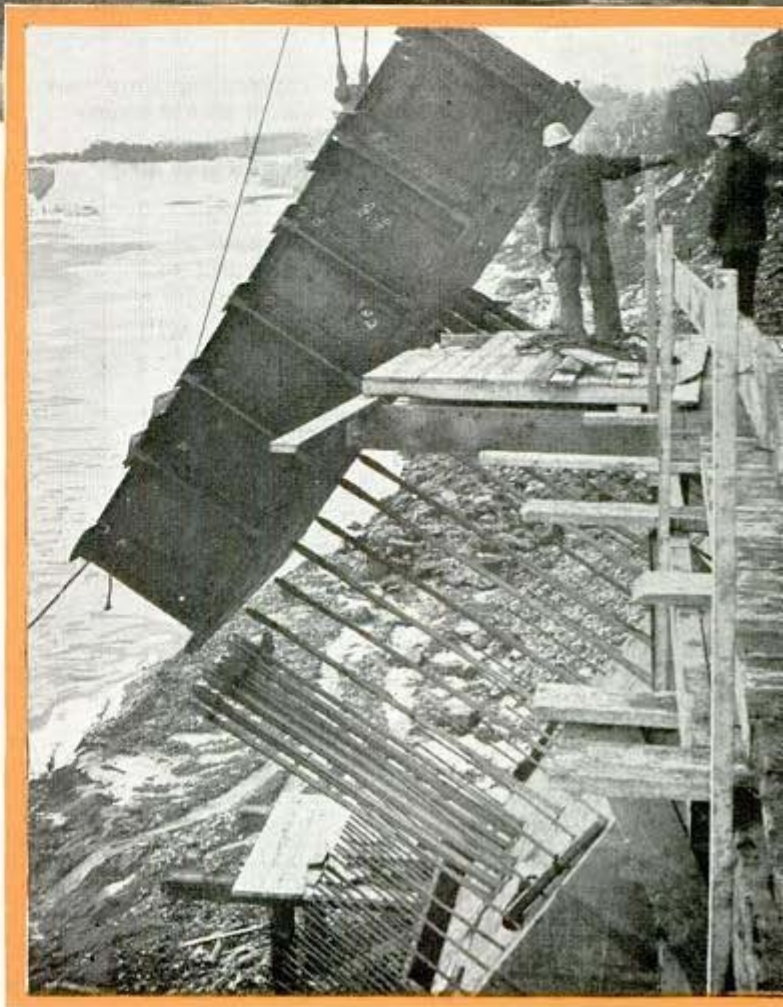


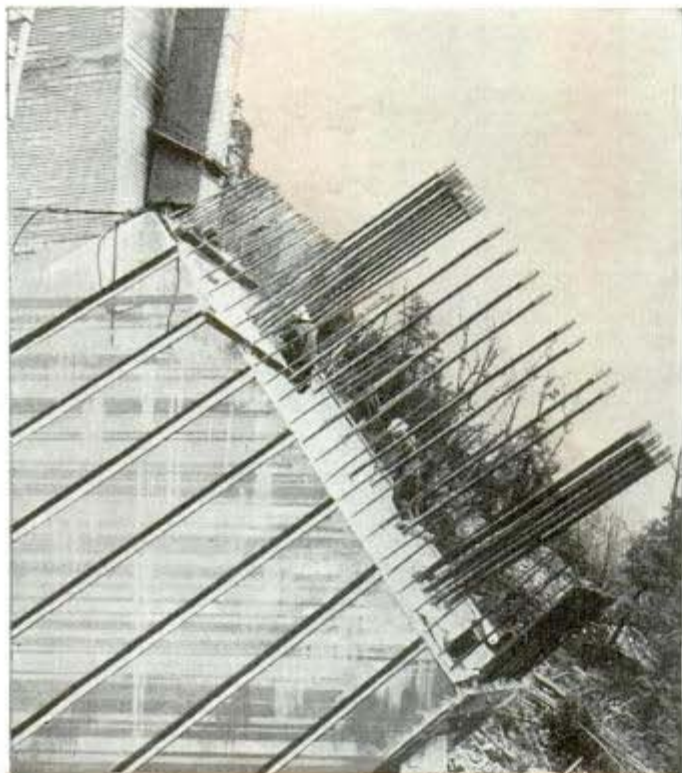
of bread, this little section will support 11,000,000 pounds of concrete and curved steel 950 feet long. And it will do the husky job alone, for there will be no suspension cables above or piers below this modern crossing when it is completed.

Then Rainbow Bridge, spanning the Niagara River 2,000 feet below famous Niagara Falls, and linking the United States and Canada, will be an accomplished fact.

Past here, in the 36-mile-long Niagara River, pour the waters of the four Great Lakes. Imprisoned between stone walls, the current races toward Lake Ontario. At the falls, the stream takes a drop of 167 feet, boiling with terrific force toward the mouth of the river. Thirteen times this liquid maelstrom aided by winds in the gorge has forced

Right, steel grillage reaching the anchor bolts on abutment. It weighs 60 tons. First sections of the arch were fastened to the grillage before being swung out over river





Above, preparing concrete surface of masonry on Canadian abutment and anchor bolts for the grillage

Right, unusual view of the construction. Note worker clinging high up on derrick, on way to scaffold

reconstruction or major repairs to bridges at this point.

As each piece of steel is swung out and riveted in place, it is supported by a fanlike series of steel ropes which will remain until the keystone section takes up its incredible burden of weight.

Four columns, 130 feet tall and linked in pairs, have been built on abutments, two on each side of the river to support the cable. Bracing the towers themselves, corresponding clusters of steel ropes extend back 200 feet from both towers where they are anchored into a pair of "deadmen," one for each pair of towers. These are concrete anchors, weighing 600 tons apiece and firmly imbedded in solid rock.

When the keystone section temporarily completing the arch has been replaced by the permanent keystone section, to be carefully machined with an accuracy measured in hundredths of an inch, the supporting cables will be unhooked, the towers will be razed and the bridge will appear during the month

of September in all of its glory, a trim, eye-arresting arch consisting of two ribs of steel 12 feet deep, anchored in concrete abutments, joined by lateral steel cross-pieces and supporting vertical pillars which in turn help form a base for the roadway—and that's all.

As a structural object it will be as sleek as a leaping greyhound and as clean as the wind that whistles through the gorge cut in the rock by the tumbling rapids from nearby Niagara Falls, named by the Iroquois Indians from the phrase "Thunderer of Water," which indicated their terror of the falling and boiling stream.

Modern-day engineers were not terrified by the problem of building Rainbow Bridge, but they knew they had a puzzle which needed a novel approach. The site had been used for a bridge since 1868, when a suspension bridge of wood was erected only to be destroyed by the wind. In 1888 the tower and deck were replaced with steel construction. On Jan-



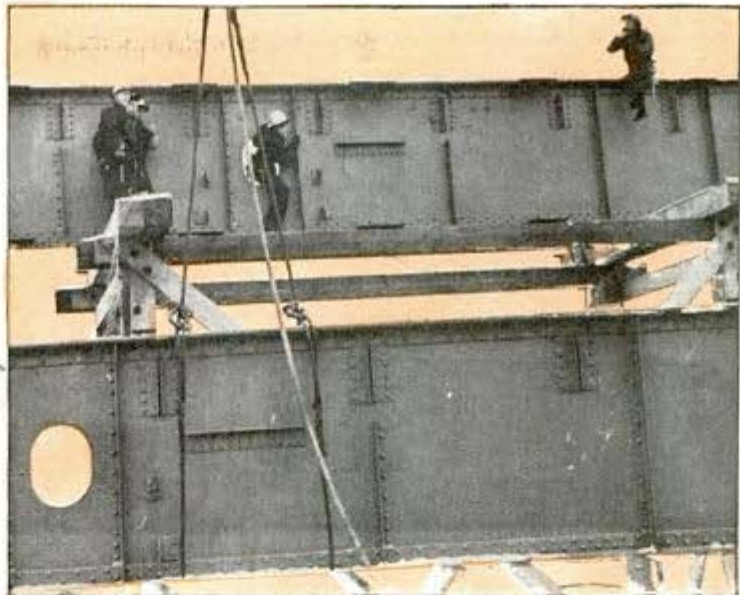
22,247

uary 10, 1889, the entire deck was carried away by a wind storm. The structure was hurriedly rebuilt, but its inadequacy and dangerous character soon led to a decision to construct an arch span. This was begun in 1895 under the name, The Falls View Bridge. The structure was a two-ribbed steel arch 840 feet long, the longest in the world, and hundreds of thousands of visitors enjoyed the close view of the falls from its deck. But it was destroyed January 27, 1938 when the worst ice jam in the known history of the Niagara River battered away foundations of the structure which had become known to millions as Honeymoon Bridge.

Then it was decided that the new bridge would be in the shape of a rainbow—an arch. An appropriation of \$4,000,000, not a large one as present-day bridges go, was all that was available for the job. The erection of any kind of piers in the stream, flowing at 25 to 30 miles an hour and a volume of about 6,000,000,000 pounds of water a minute, even temporary piers for construction purposes, would have washed out the sum in a hurry. Also, part of the construction period was likely to fall within the interval in which the gorge was choked with ice. This invited another disaster from an ice jam during the building of the bridge, if not after.

So engineers began building the novel and graceful rainbow of steel, using the unusual construction methods that soon will result in completion of the bridge.

Each of the main arch abutment piers is



Putting finishing touches on tieback towers atop Canadian abutment

located about 50 feet back from the water's edge and about 50 feet above the surface of the water. The main span is thus over 100 feet longer than the former Falls View Bridge, and the piers are considerably higher above the water. The abutment piers and the approach spans rest on solid rock which forms the sides of the Niagara Gorge so that the bridge does not have contact with the river.

The main arch span, of the hingeless ribbed type, will have two steel box girder ribs spaced 56 feet apart. Steel spandrel columns will rest on the arch ribs and will carry the steel floor girders and concrete deck of the roadway above. The two ribs will be rigidly braced together with steel members to resist forces set up by the wind or by live loads on the structure.

In order to provide for these tie-backs, the Bethlehem Steel Company, the fabricators and builders of the arch span, first

(Continued to page 162)



Sketch showing how the bridge will appear when it is finished. Note rainbow shape

Eastman Kodak Co. Rochester, N.Y.

Range Finder for Close-Ups Focuses Less Than Foot

\$450.00 \$40.00



Close range and view finder may be focused down to distance of 10½ inches when special lens is used

Among six accessory items available for Eastman's new 35mm. Kodak Ektra is a close range-and-view finder. The instrument is intended for use with the 50mm. Kodak Ektar f:1.9 lens at distances from 3½ feet down to 1½ feet, and, with the addition of the Kodak Portra 3-plus supplementary lens, down to 10½ inches. In the latter instance, an internal mask is slid into place. It also includes a single eyepiece, automatic parallax correction, and a vernier scale for distances shorter than 1½ feet. A high-low angle finder, fitting into the universal accessory bracket on top of the Ektra, permits the camera to be used conveniently from waist-level, as well as overhead, when attached to tripod or other firm support. Then there is a right-angle finder that aids in obtaining unposed shots as well as shots in cramped quarters where it is inconvenient to face the subject. Critical focusing on close-up subjects is provided by a special ground glass focusing back equipped with a self-erecting magnifier and a mirror which can be set at a 45-degree angle for reflex-type focusing. A fifth accessory is the flash synchronizer that attaches to the top of the camera, while the tripper unit is simply screwed into the cable release opening. No

\$15.00
\$10.00
\$25.
17.50

\$1.25

other adjustment is required, yet it synchronizes for speeds up to 1/500 second. It has a quick-ejection socket that accommodates No. 30 or No. 31 Photoflash lamps. Finally, a tripod clearance head is offered which raises the camera a short distance above the tripod head, allowing the hinged cover of the magazine back to be opened for loading and unloading, or another magazine back to be substituted, without removing the camera from the tripod.

Lamps Sterilize Medicine Bottles By Killing Air-Borne Germs

Lamps emitting germ-killing ultraviolet rays have been put to work sterilizing medicine bottles at the Brockway Glass Company plant, removing danger of impure air reaching prescription bottles from the time they enter the annealing ovens until they are capped. This new health defense is made possible through development by Westinghouse of a new lamp having a slender rod-shaped tube. Still another lamp of this general type carries the health protection into drug stores where the bottles are used in filling doctors' prescriptions. In this case the lamp is so mounted that its rays shine directly on the mixture to prevent air-borne bacteria from entering the medicine or the bottle.

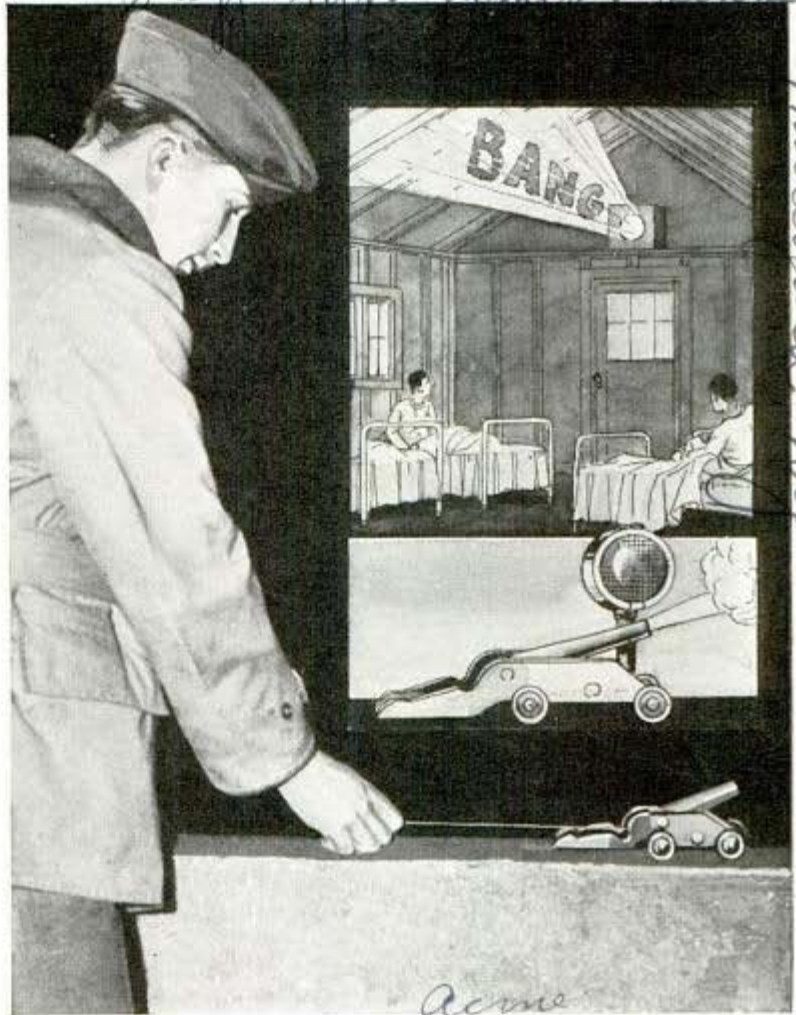


Druggist filling prescription under protection of lamp emitting ultraviolet rays that kill bacteria

✓ \$ 300.

Toy Cannon Amplified to Roar Like Big Gun

Given a considerable boost by an amplifier, the crack of a toy cannon becomes a loud "boom" when the traditional morning or evening salute is fired by the gunner of 102nd Observation Squadron attached to the 27th Division at Fort McClelland, Ala. The six-inch-long barrel is loaded with a black powder charge and the miniature gun placed close to the microphone of the public address system. The report issuing from the loud speakers is said to be as loud as the roar of a full-size cannon.



Gunner firing toy cannon. Inset, upper right corner, shows how miniature gun, firing alongside microphone, has its "bark" amplified over system of loud speakers which may be distributed within barracks and outdoors

simulat - ball board equipment Co. 306
 Cherry Phila

Dart Baseball Uses Target to Score Hits, Runs and Outs



Scorekeeper indicates balls and strikes on "batter" as dart is tossed at target. Tense situations in dart baseball often rival real game

Many of the exciting situations of a real ball game are provided by dart baseball, introduced at Kansas City, Mo. Each player in his turn "at bat" throws darts at a target which is marked in circles to determine whether the pitch results in a foul ball, strike, hit, error, or home run. During play, three outs retire a side. Each team has a scorekeeper at the board.

☐ An average of 2,388,000 motor vehicles have been scrapped each year for the last ten years.

JUNE, 1941

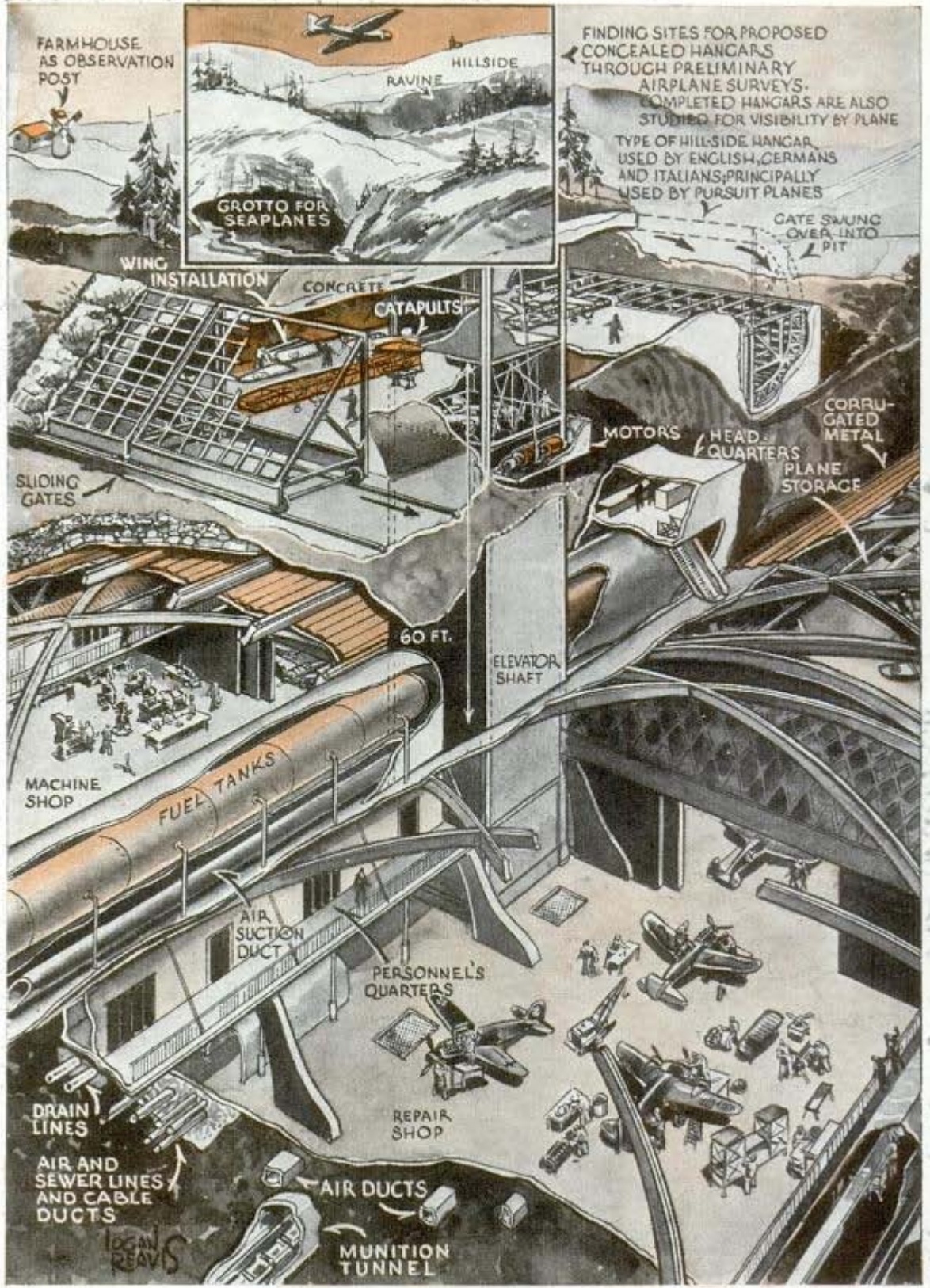
Equipment Co.
306 Cherry Phila

Auto Regis Acme 45

Logan U. Cleavis, 145 W. 45th New York City

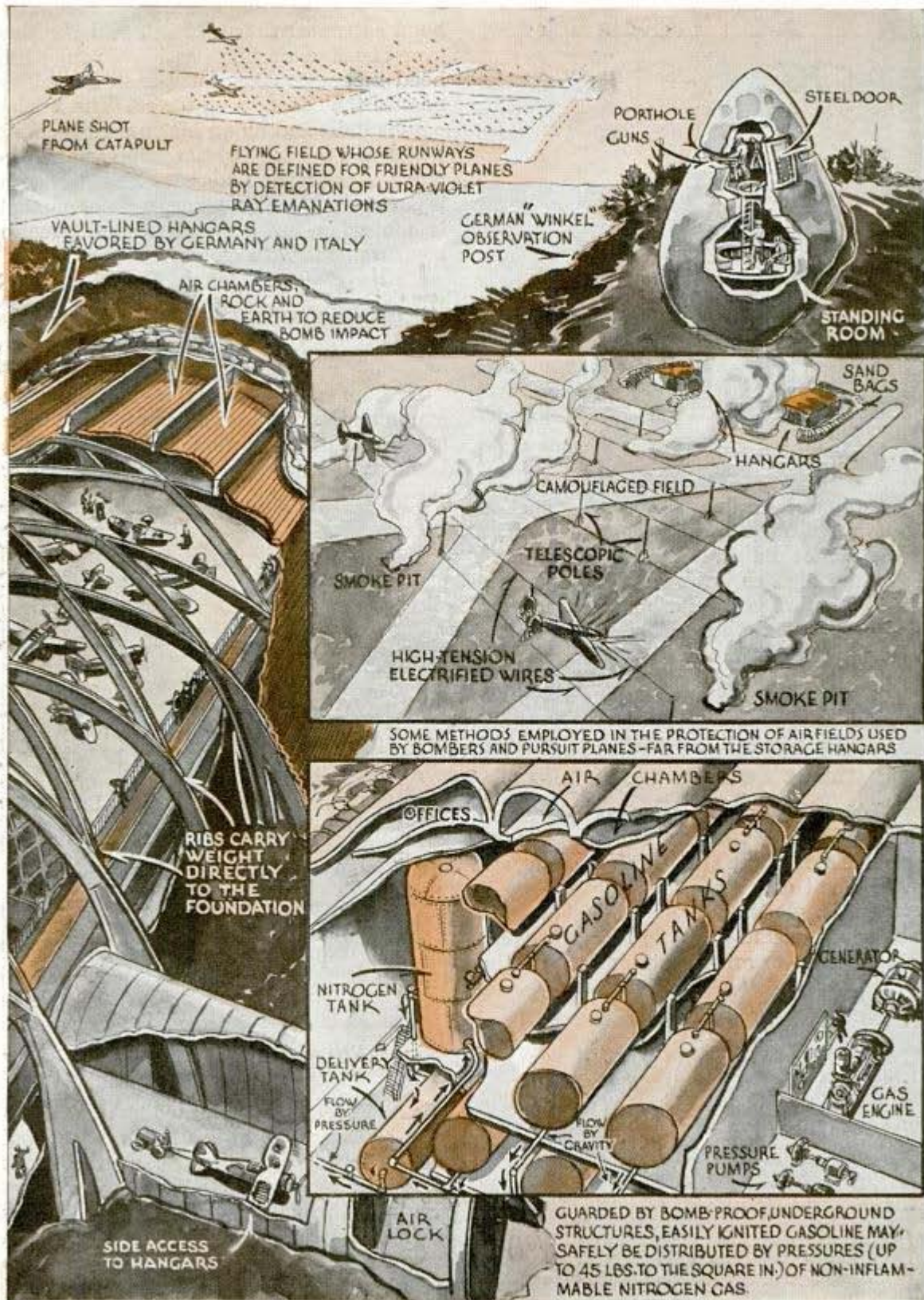
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Warplanes Hide in Vaults Deep Under Hill



Deep down in the wooded hillsides of Germany, Italy and Britain are vast hangars where warplanes can be stored and repaired, safe from observation and bombs. These drawings were made from actual designs of an American engineer, C. G. Flebus, who was engaged by the axis governments on the subterranean vaults. Disappearing gates hide exits from which catapults shoot planes

Pressure Tanks Feed Fuel to Buried Hangar



Landing fields for the bombers and fighters are well camouflaged and guarded from enemy planes by telescoping poles and high-tension wires as well as concealed gun nests. Near the bombproof vaults and the seaside grottos where seaplanes hide are huge underground storage tanks from which gasoline is fed into the hangars by the force of compressed, noninflammable nitrogen gas.

L312 Walbridge & Co
706 Oakwood W
Cavertina
Ched

Rubber Jacket Grips Dish And Keeps Food Warm



The big rubber suction cup forming the base of the baby's dish holds it firmly on the tray

Firmly anchored by a big rubber suction cup, a child's three-compartment china dish cannot be overturned or knocked from the high chair. The dish has a lacquered rubber jacket for hot water to keep the food warm. The rubber acts as an insulator, keeping the dish warm and protecting the baby from too much heat.

Gauge Tests Thickness of Steel Without Touching Both Sides

With a magnetic gauge just developed in the General Electric laboratories, the thickness of sheet steel can be measured even when only one side of the sheet is accessible. It is accurate to 1/1,000-inch. The seven-pound portable indicating unit is connected to an electric outlet and the



Measuring the thickness of a sheet of steel, with the magnetic cylindrical gauge head held on the sheet

cylindrical gauge head containing an Alnico magnet is held against the sheet to be measured. The magnetic field of the gauge head saturates the material, and the degree of magnetic flux passing through the head magnetic circuit depends on thickness of the sheet being tested. The thickness is indicated by an instrument reading which is a measure of the increased reluctance of the magnetic circuit. This system is particularly useful where a sheet of steel is too wide for convenient and precise measurement with calipers.

L146. "Submarine" Powered by Hand Propels Bather in Water

Bathers who do not know how to swim can push themselves through the water on a one-man "submarine" which operates beneath the surface, yet keeps the user



Swimmer kept afloat in water by wearing "submarine" propels self along surface by turning hand crank

afloat. The device, invented by J. D. Barlow, of Dallas, Tex., has a hand-operated bicycle-pedal arrangement at the front that delivers power to a small propeller at the back through a series of gears. Loops over the swimmer's shoulders serve as a harness and have floats on top that help maintain balance in the water.

See index, page 4-A, to find where to buy articles described in this magazine. Say you saw it in Popular Mechanics.

L 158 Cont. Bay. Trenchers. 221 W. Liberty Cincinnati

Hinged Seat Tilts When Aerial Ladder Rises

Tillerman's seat at rear of long fire truck, right, tilts to one side in order to make way for the huge aerial ladder

Below, going up! Operation is automatic, fireman manipulating levers instead of turning crank as on older trucks



Fire Dept
 One man operating the controls can raise the giant aerial ladder of a modern fire truck recently put into service at Cincinnati, O., to combat fires in tall buildings. A special feature is the action of the tillerman's seat, which turns over on its side to allow the ladder to rise from its inclined position. So smooth and quiet is the operation that scarcely a sound is perceptible as the ladder begins its skyward journey. By similar procedure it is lowered and put back in its berth. A turntable permits the towering ladder to be rotated in any direction, and so sturdy is the all-steel framework that any number of firemen may use the ladder at one time.

Variable Speed Control Pulley Expands and Contracts

Speed of belt-driven tools can be varied continuously by a control pulley with only two moving parts, cones with interlocking fingers floating freely on a single axle. Pulleys are used in pairs between the power unit belt and the working unit belt. Moving a lever forces these intermediate pulleys closer to or farther from the power unit, thus decreasing or increasing pressure on the power belt, which in turn forces the interlocking fingers either closer together or farther apart. This, of course, varies the diameter of the pulley and, hence, the speed of the tool.



Lever is moved back and forth to change speed

JUNE, 1941

M. H. Collins 270 South 49 St. San Bernardino Calif

DESTRUCTION IS



Top, bridge wrecked by French demolition crew as Germans advanced. Four to six men can demolish a big bridge in a few minutes

TEARING down enemy fortifications, bridges, barbed wire and the like, in the quickest possible time is the job of the "explosion squad," daredevil fighting unit of the Army. Literally, destruction is their business. Picked men from Engineer regiments, their task in peacetime is to test newest demolition equipment, while in wartime they will not hesitate to gamble with death.

In an advance into a hostile region they must be among the first troops on the job, for they pave the way for the artillery and cavalry; in a retreat they must be the last to leave since they must destroy bridges, railroads, roads and armaments to handicap the enemy advance.

At Fort Belvoir and other experimental stations, the demolition soldiers, with the aid of revolutionary equipment especially designed for



Left, making ready demolition equipment for a test with a scout car

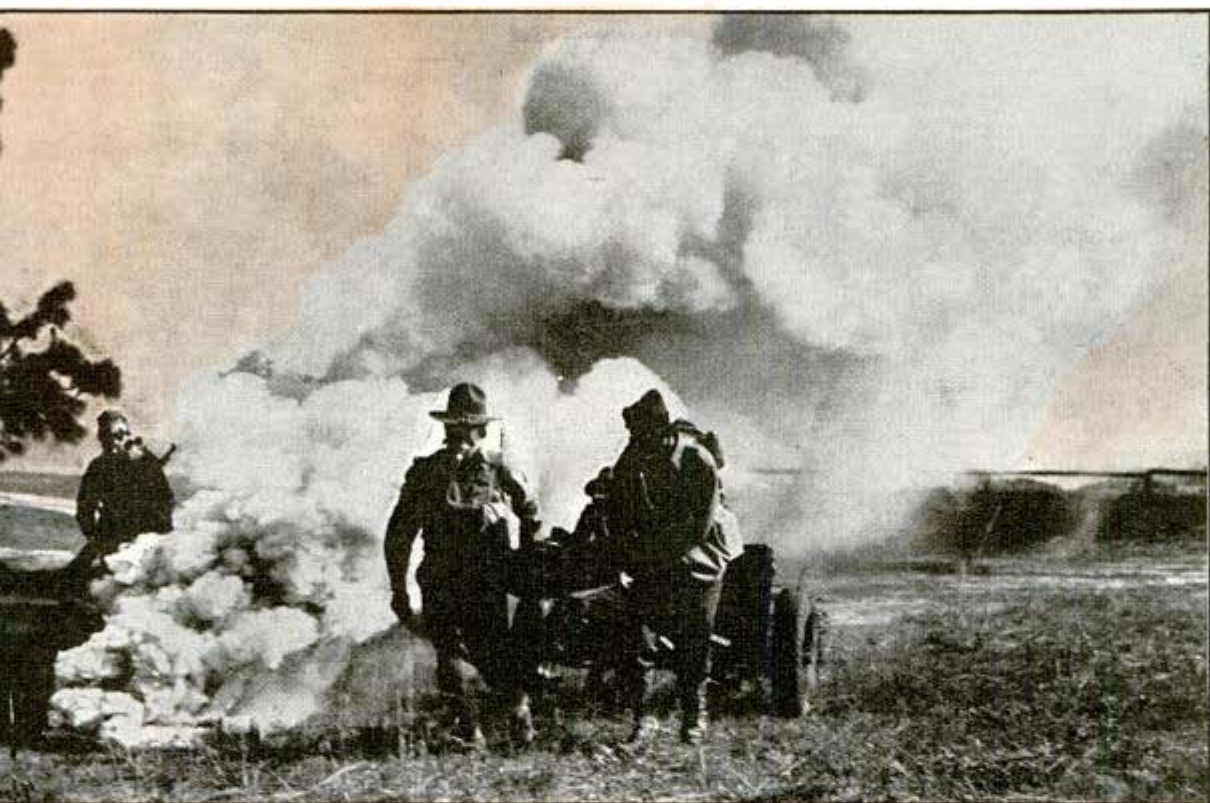
Below, preparing to plant mortars in the standard position for firing



7630 New Hampshire
 329
 Washington DC
 Capt. Randall J. Roberts
 And H. W. Ap...

L. 329.

THEIR BUSINESS



"Explosion squad" in gas masks hauls anti-tank gun through smoke screen
Below, a new use for compressed-air drills—destroying an "enemy" bridge

them by the ordnance department and chemical warfare service, are developing techniques that are expected to outdo anything the Germans have accomplished.

Speed, surprise and violent action are the keynotes of the explosion squad, composed of four to six men hand-picked from each regular combat Engineer unit of twelve. They are armed with rifles and machine guns and equipped with special tools and all manner of grenades, explosives and gases.

Assuming the demolition specialists are called upon to aid in assaulting an enemy stronghold, here's the procedure: First the air corps and heavy artillery bombard the area, crippling major





Above, the air drill starts a crater in road to slow the enemy advance. Below, a battery of gas cylinders; placing these screens is an important duty of the "explosion squad"



A striking example of what a land mine can do to a tank is shown below. During the invasion this French tank was retreating across the bridge when it struck the hidden mine



fortifications. Now the explosion squad makes its assault: smoke screens cutting off enemy observation; flame throwers burning the hostile positions; hand grenades and thermit bombs detonating in and around each enemy position; infantry units in readiness to repel counterattacks and to consolidate gains; and finally, demolition troops placing explosives against turrets, doors, hinges and other sensitive parts of the enemy "works." In other words, this new Army "blitz-unit" is charged with disrupting the entire plan of hostile defense or attack.

Bridges that are not to be used during the advance of our

troops will be charged with explosives, ready for instant demolition. Roads not scheduled to be ridden over by our attacking forces will be prepared for defense by mining, by road blocks of large trees, by earth barricades or concrete blocks.

Precisely timed military teamwork is needed in blocking the enemy's mechanized vehicles. While the demolition engineers are equipped to build the road blocks to halt the enemy, it is the mission of the heavy weapons of the infantry and artillery to destroy the vehicles once they are halted. Wheeled cars must in general stick to the roads. Tread vehi-

L329

cles can only make speed off the roads when the terrain is favorable. Armored cars of both kinds are hard to hit with sufficiently heavy guns when traveling 40 to 50 miles an hour. Therefore it is the job of the explosion squad to halt mechanized forces so they can be destroyed by heavy fire of our infantry and artillery.

In this work the "land mine" is helpful. A charge of 10 pounds of high explosive in a mine is sufficient to smash any wheel or tread vehicle which will detonate it. Small and easily and quickly handled, it can be buried in open spaces or hidden by underbrush. When a vehicle passes over this type of mine, it explodes immediately.

Military experts believe a sufficiently large supply of land mines, adequately covered by anti-tank weapons, will go far toward preventing spectacular advances such as German mechanized units achieved in Holland, Belgium and France.

Not only do the members of the explosion squad destroy, but they rebuild and repair. Roads and bridges blocked or demolished by the enemy must be made ready for our troop advances. Without the demolition engineers, any dash of our armed vehicles to the front, or on sweeps around the enemy flanks, would be difficult or impossible. Other vital jobs are: penetrating barbed wire; helping consolidate territory gained; extending routes of communication into captured territory; and supplying the usual engineer material, notably pure drinking water and sanitation facilities to troops on the march.

In the case of railroads, demolitions are especially effective. An enormous amount of track can be demolished in a few minutes by explosion crews of four to six men.

War Department scientists are now performing countless tests with incendiaries, which are directed primarily against buildings and equipment and in major assaults on fortifications. White phosphorus, primarily a smoke producer, with the property of igniting spontaneously and burning vigorously when exposed to air, is one of the best incendiary materials. When scattered from overhead by grenades and trench mortar bombs, the phosphorus rains down in flaming particles which stick to clothing and cannot be easily brushed off or quenched. Phosphorus always causes a demoralizing effect far beyond the actual casualties it produces.

(Continued to page 162)

L238

Gas Mask for Hard-to-Fit Drapes Over Shoulders



Announced by Ministry of Security

Instead of the regulation gas mask, persons hard to fit wear this helmet draped over the shoulders

Special respirators for those who cannot be fitted to ordinary gas masks are being issued in Britain. There are persons who, because of unusual facial contours, deep hollows or wrinkles, or because of injuries or allergies, cannot wear the regulation mask. The new type is a helmet that covers the entire head and shoulders.

L326 Meter Indicates Light Needed For Various Types of Work

How much light is adequate for various types of work without inducing eye strain is indicated by a simple light meter that is inexpensive and accurate. At the top of the meter is a dial giving a direct reading of the light strength. Below it, corresponding numbers show whether the light is satisfactory for a range of work from rough housework to that involving prolonged, close use of the eyes.

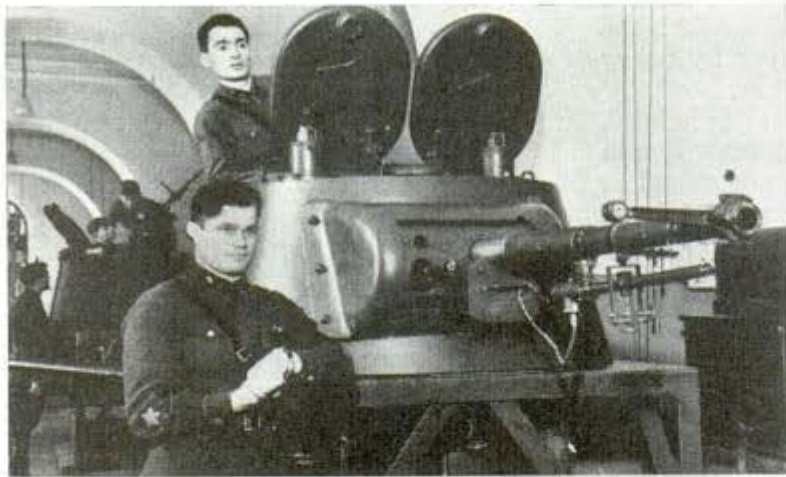
Lightmaster \$1.95



John A. English 53
23 Newell Ave.
Dorchester, Mass.

L233

Russian Tanks Play War With Aid of Stage Scenery



As tank gunner, top, fires at targets, another student checks results with his watch. Bottom, stage wings used for landscaping indoor range

Tank gunners of the Russian army practice shooting from turrets mounted on "stilts" on an indoor artillery range at the Stalin Military Academy of Moscow. To simulate a real battlefield, the target range is landscaped with wings like those used in stage settings. Student marksmen fire at targets and tiny objects placed in the background. Other students check the results.

Health of Tree Estimated Quickly With Sensitive Voltmeter

Using a simple but very sensitive voltmeter, tree surgeons can determine whether a tree is healthy in somewhat the same way that a doctor can examine a human with the aid of a stethoscope. The process is based on a discovery, made by Thaddeus Parr of the U. S. Department of Agriculture, that there is a difference in electrical

potential between the top and root of a tree. In spring, during the fastest growing time, the gradient is from top to root. Later, the direction is reversed. In a tree seriously injured or otherwise in bad health, however, the reaction is abnormal, being either weaker than in a sound tree or reversed in direction. The instrument is portable and may be carried into the woods for field diagnoses by foresters and entomologists.

Lure's Rubber Tail Wiggles in Water To Attract Fish

If it is lifelike action that the big fish go for, a rubber-tailed lure now on the market gives promise of hooking them. With its flexible tail simulating the wiggle of a small fish when being retrieved, the plastic lure, which is available in 14 different color combinations, is more than big game fish such as bass, pike and muskies can resist, according to the manufacturer. The rubber tail is interchangeable, spinners are mounted in the fins, and treble hooks are there to make sure that the catch does not get away.



Flexible rubber tail wiggles as the lure is retrieved

Service Source 3/5/41

L255
Lure's Rubber Tail Wiggles in Water To Attract Fish
The rubber tail is interchangeable, spinners are mounted in the fins, and treble hooks are there to make sure that the catch does not get away.

4126 Wg. L Tail

L 309 Cont. E Newman Everlade,
 6 Roman Terrace, Roxbury
 Regular practice with this rescue gear prepares the Junior Coast Patrol for a real emergency
 Regina da Souza

Junior Patrol Trains With the Coast Guards



Lines made fast, above, a "shipwreck victim" is hauled to safety in breeches buoy. Regular practice with this rescue gear prepares the Junior Coast Patrol for a real emergency

They target the mast of the drill pole (above), 300 feet distant, the boys are shown how to fire the Lyle gun (below). They load it with two ounces of powder, insert the 18-pound projectile and fire it by lighting a fuse. When they succeed in hitting the target, lines of the breeches buoy are made fast to the pole for a practice rescue



Photos from WPA



Launching the 26-foot surf boat, above, for a lesson in rescue work and handling oars, is one of the enjoyable "classwork" assignments of 30 boys who have organized a Junior Coast Patrol unit at Provincetown, Mass. First studying coast guard work in theory, they later spend weekends at Race Point station participating in drills and routine work of the Coast Guard. They learn rope splicing, seamanship, codes, weather and semaphore signals, and navigation. In emergency they stand ready to help the Guards

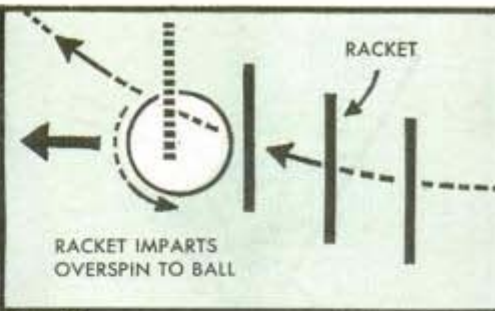
Race Point

manuel benrique

X 146

TENNIS TIPS

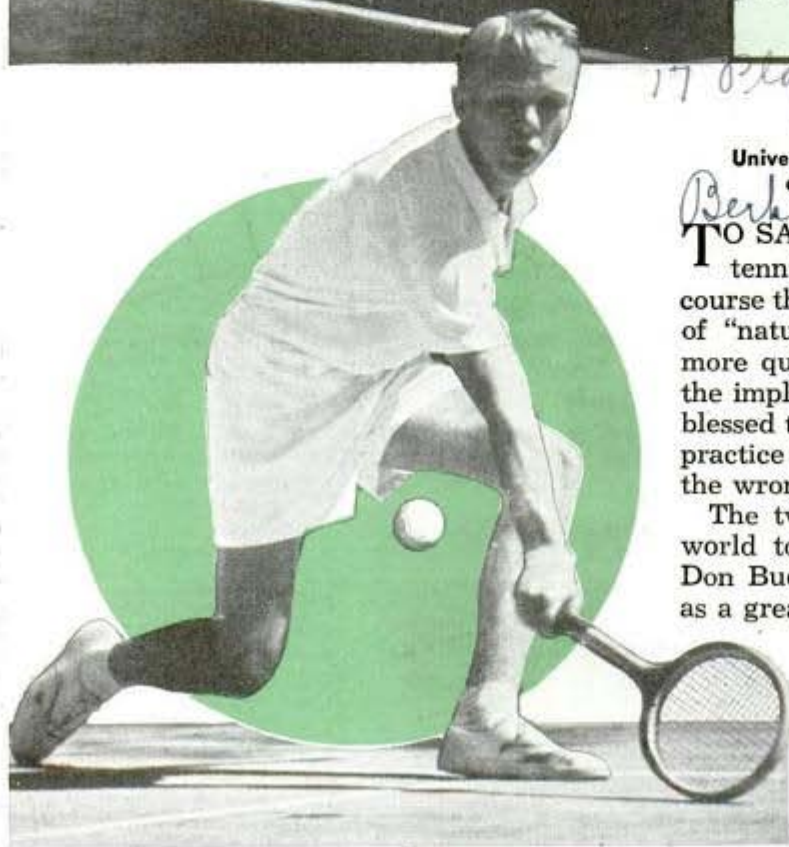
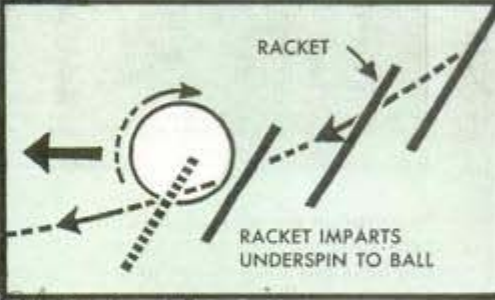
Any inf. on this Super Secret.



Diagrams above and below show path and angle of racket for overspin or underspin stroke

Left, Don Budge starts an approach shot perfectly balanced, left arm relaxed confidently

Below at left, reaching for a backhand shot near the ground



17 Plaza Drive,

By **TOM STOW**

University of California Tennis Coach and Teacher of Don Budge

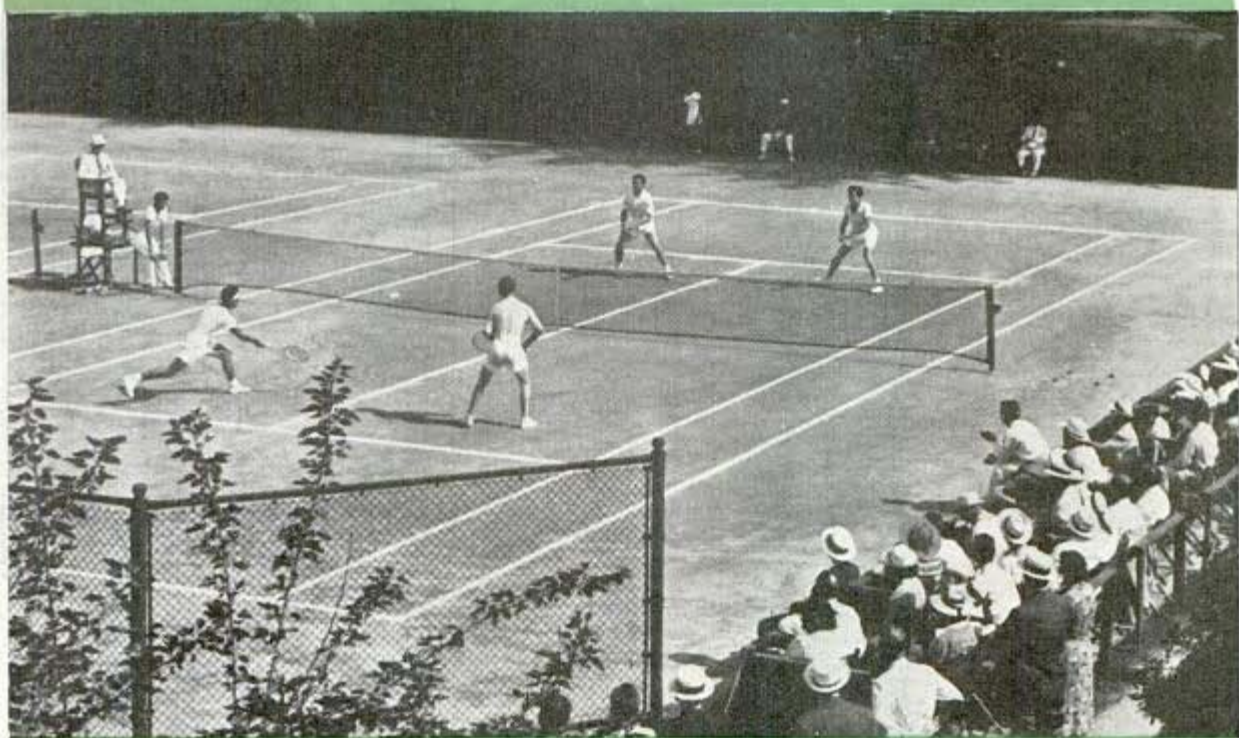
Berkeley, Calif.

TO SAY that anyone is a "natural tennis player" is nonsense. Of course there are players who because of "natural athletic ability" learn more quickly than the average; but the implication that any person is so blessed that he can be a star without practice or effort will always rub me the wrong way.

The two greatest players in the world today are Alice Marble and Don Budge. I well remember Alice as a great "natural" player seven or eight years ago, yet it took five years of constant practice before she hit a winning streak. I worked with Don Budge four solid years. He came to me as a great "natural" play-

... .. K 7.4-62

from a CHAMPION MAKER



Above, Frank Parker smacks a forehand in fast action at close quarters during doubles play in a National Clay Court Tournament

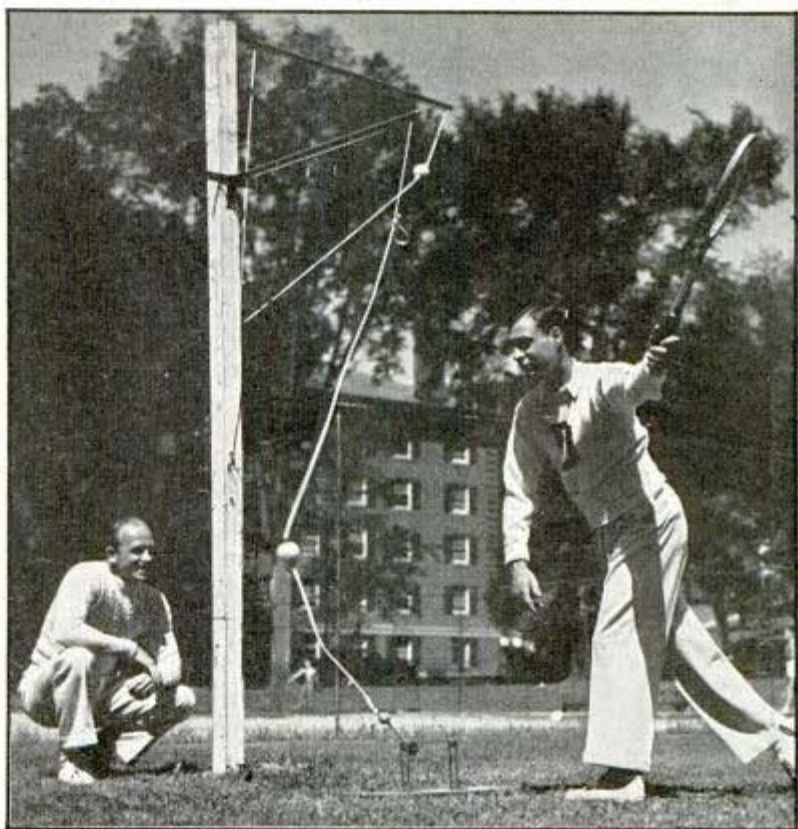
er. They told me he was destined to be champion. He did become champion, and probably the greatest player of all time, but only after four years working, changing, practicing strokes and footwork and every phase of the game.

So whether you're a beginner or an average player who wants to improve, understand that skill is not inherited but acquired by concentration, determination, and study. If you're willing to put in the effort, come along and I'll see what I can tell you to help develop your game.

To start at the begin-

Right, Coach "Red" Hoehn of Dartmouth watches a left-handed star practice backhand with the Stow Stroke Developer. Notice upper ball for service and overhead practice

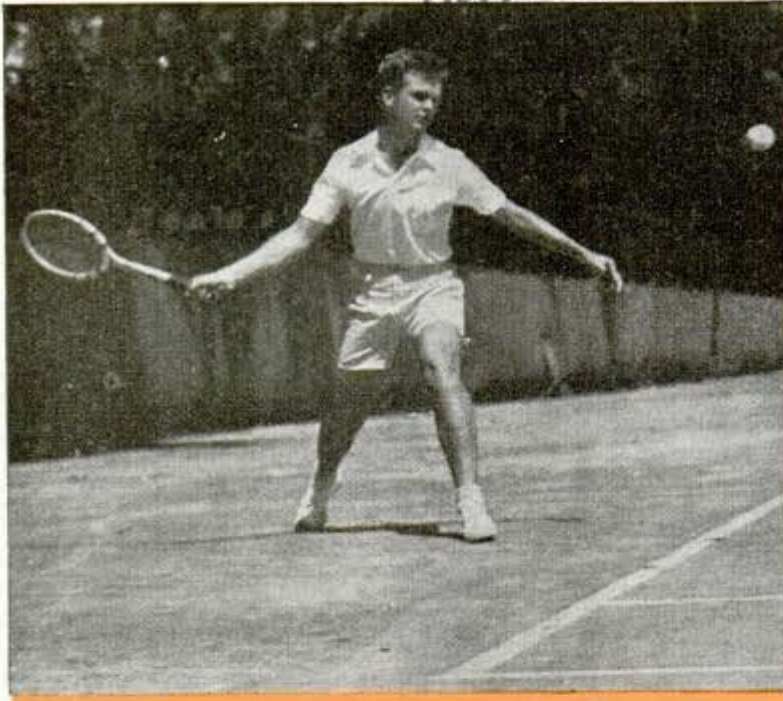
Bouchard Photo



Sam D. Nov. 1940 Team Captain

Fred Chewnie, Santa Monica

K
1462



In good position behind the baseline, the player at left, above, has racket well back to hit a hard forehand drive. Right, practicing the forehand, weight on right foot, left foot ready to step in for the shot



Elwood Cooke's arm swings straight up in a smooth, accurate toss for serve

ning, pick out a racket with a medium balance and a $4\frac{5}{8}$ or $4\frac{3}{4}$ handle, weighing $13\frac{1}{2}$ to $14\frac{1}{2}$ ounces; slightly smaller if you're a girl. The main thing is to get one that feels right. Next, check on your physical condition. Tennis is hard and fast. Play hard, stop when you are tired; you'll learn faster and get more fun that way.

Now for the grips. The Eastern forehand is probably best for you: stand your racket on edge with the cross strings perpendicular to the ground and shake hands with it, the heel of your hand touching the leather button, the fingers around the handle. For the backhand, turn your hand at least a quarter turn to the left and put your thumb up the back of the handle.

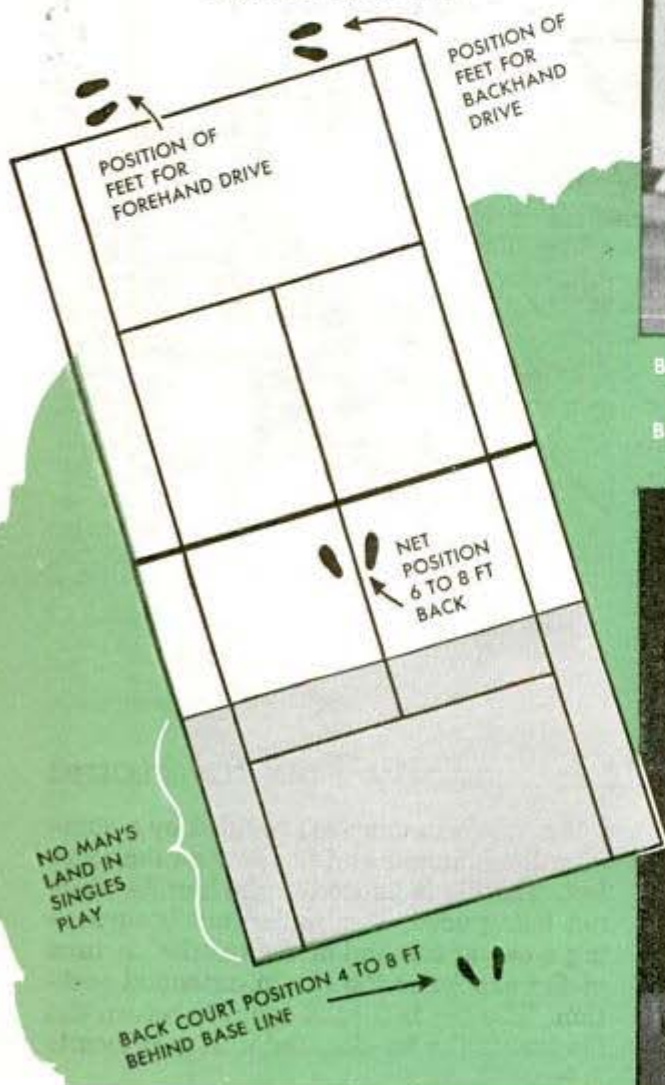
Before you try the strokes, let's get the theory of the spins clearly. Since a ball curves the way it spins, an over-spin or top-spin will cause the ball to curve down and jump faster as it hits the ground. This shot can be made by turning the face of the racket up and over the ball with the wrist, or by coming up on the ball with firm wrist. The latter is the correct method, for you can retain control and accuracy, and the body is more easily timed with the shot. To under-cut, hit down at the ball with the racket beveled back; this shot tends to travel straight and bounce slower. Although an under-cut or sliced backhand is used by many top-ranking players, my advice is to eliminate undercuts until over-spun shots are mastered. Don McNeill, national amateur champion, in trying to overcome an under-cut shot uses his wrist too much in

over-spinning. In so doing he has obtained the "feel" of how to drive the shot, but does not have maximum control. When he corrects this, which he is apt to do this year, the tennis world may be treated to another Budge.

The ultimate shot most ranking players try for is the flat drive, hitting straight with the face of the racket flat against the ball. It carries more speed, but should not be used until confidence and control have been gained for the over-spun shot.

Really the most important fundamental is—keep your eye on the ball. The court and the net won't move; don't watch them. Don't watch your opponent, either. Face the net squarely, weight evenly distributed on the balls of your feet, racket in front and supported by your left hand. In the back court, stay four to eight feet behind the base line, in the center. In playing net, take a center position six to eight

(Continued to page 178)



Both feet off the ground (above), a player sends back a fast one in a national tournament
Below, weight on left foot, player is ready to step forward on right for backhand stroke



L252

at Fort Benning, Ga

Soldier Grinds Out Power for Portable Radio

Private H. S. Hendrick

Portable hand-powered generators are used in the field by army scouts to operate portable radio transmitters and receivers. While one soldier cranks away steadily at the generator to supply the current, others handle the radio apparatus.

Portable radio equipment carried by troops on scouting expedition, left, is set up in the field

Hand-cranked generator, below, supplies the current and saves carrying much heavier batteries



U. S. Can Expect as Many Indians In 1980 as in 1492

No longer a "vanishing race," American Indians are now multiplying so rapidly that in forty years their number should reach the total estimated to have been living here at the time Columbus landed. The number of Indians in the United States is expected to reach 700,000 in 1980, perhaps even 750,000. The total is about 360,000 today. Anthropologists believe there were 700,000 to 800,000 Indians in this country when Columbus landed in 1492.

Washington, D.C.

Hammer With File in Handle Is a Handy Tool for Home



File pulled out from hammer handle is ready for use. Cap at end is turned when you want to push it back

Two tools in one are provided by a combination hammer and file now on the market. The file is housed in the handle while not being used; it is pulled out by grasping a cap at the end of the handle. A turn of the cap locks the file in extended position. The cap is turned again to return the file inside the handle, and a snap prevents it from coming out accidentally.

Ref: Mr Frank Longner
Director of Population Studies
American Museum of Natural History

Private A. E. Criswell

Source: Service Magazine

244

De Soto Motor Cars
6000 Wyoming
Detroit, Mich.

Sedan Is Easily Converted Into an Ambulance

No tools are required to change a specially designed De Soto seven-passenger sedan into an ambulance. When the right-hand doors are opened and the center post is swung up on its hinge, a full-length hospital cot can be loaded into the car easily. The post is held up during the transition by a stainless-steel arm that hooks onto an inconspicuous roof bracket. The seats, of course, are removable.



All that is necessary to change this sedan into an ambulance is to open the doors wide, swing the center post and hook it to the roof bracket, then remove the seats. No tools are required

223

Pick-Up Baler Ties Hay in Slices That Pull Apart Easily

Baled hay is produced in slices by a new pick-up baler that cuts and presses the hay into separate layers so it falls apart like sliced bread when the wires are cut. This saves tearing the hay from the bale,

which is of conventional size and weight, and thus eliminates waste when it is used. Mounted on rubber tires, the lightweight machine operates as fast as eight miles an hour in baling hay or straw left in the field by grain combines, and bales up to five tons an hour. Operating efficiency is increased by continuous feeding into the baler and elimination of the need for wooden divider blocks, the bales being separated automatically and measured accurately into equal lengths. Fuel consumption of the baler engine is about one quart per ton.



Baler picks up hay left in field and packs it into bundles made up like slices of bread so it may be pulled apart easily when the wire is cut

JUNE, 1941

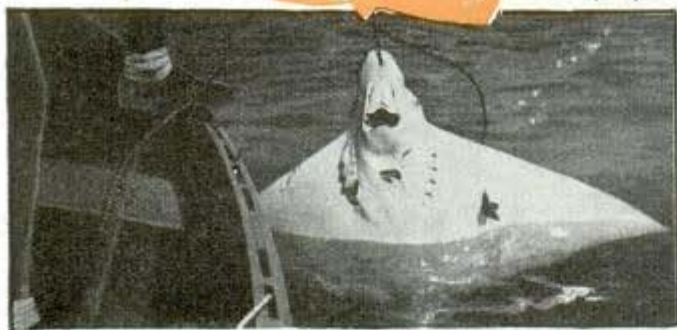
J. I. Case Co
Racine, Wis

Two new 6,000-horsepower Diesel-electric locomotives built to haul Union Pacific streamliners have automatic water sprays to cool the wheels while brakes are applied.

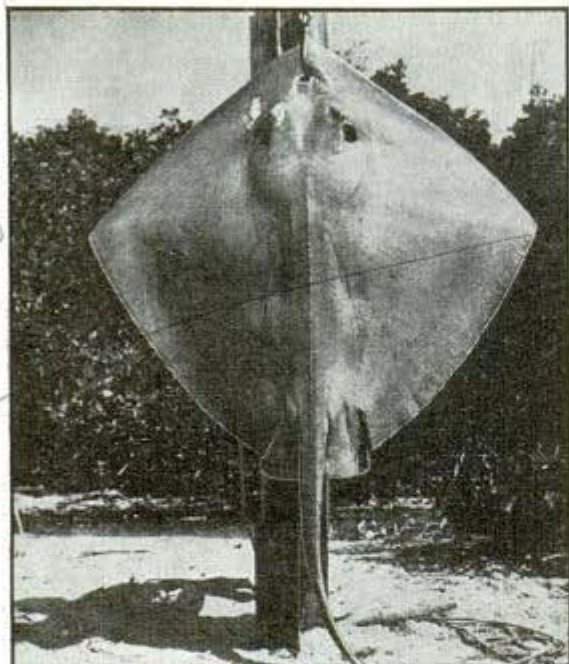
Ranking Ag. 61
3/15/41 P-494

N 13 4' 3. Cont. Harold M. Farhas
601 E. Lafayette St. Tampa, Fla.

WHIPPING



Leopard ray with gig in its head. This shows white underside



500-pound gray whip ray caught by the Bowens



FIGHTING to escape the biting teeth of a gig, the great leopard whip ray thrashed the sea madly. Its batlike flippers smashed and pounded the water and its long, horny tail lashed from side to side in a deadly arc.

Suddenly it plunged. The gig pole jerked loose and floated on the surface, but the teeth clung. As the ray streaked through the water, it dragged behind 30 feet of

sash cord and a sealed gallon "spotting" can. Where the ray darted, the can jerked, with the hunters following in an open, shallow-draft boat, bumped along by a high speed nine and one-half horsepower outboard motor.

Poised on the deck of the boat, Dr. Carroll Bowen watched through Polaroid glasses which cut the water's glare, his eyes following the moving can. At his waist was a steel fish knife and in one hand was a harpoon. With it he would hurl the death blow. Signaling his brother, Paul, at the motor controls, Dr. Bowen jiggled his harpoon up and down, pointing his weapon in the direction of the darting ray. Paul stepped the boat up from 6 to 12 miles per hour, then to 17. After a mile and a half of perilous straightaways and breath-taking hairpin turns, which almost tossed Dr. Bowen from the boat more than once, the chase reached an abrupt end.

Finding its refuge barred, the ray sought deeper waters, sank to the bottom and blew up sand to muddy the sea and obscure the vision of the hunters.

Dr. Bowen signaled again and Paul reduced the speed until he had the motor little more than idling. The doctor with his harpoon poised, peered down, ready for the strike. Then, under its camouflage the ray streaked off at a right angle. Spinning the boat around, Paul raced after the ray again, speeding up this time to 25 miles per hour. So fast was the

Left, upper side of leopard ray. Note four-inch spine being examined by Dr. Bowen. The ray can inflict a very painful wound by striking the hunters with the spines

10 Dept. of Health
St. Landevidale, Fla.

K1043

THE WHIP RAY

ray that the "spotting" can was submerged for 100 yards in the mad dash.

Suddenly the can stopped moving. The Bowens feared the gig had torn loose and the ray was gone. Paul edged the boat up and stopped the motor. Below, scarcely nine feet off, they spied the huge ray on the bottom and the doctor promptly hurled the harpoon into the head of the monster. Infuriated it shot to the surface and leaped into the air, whipping its tail and smashing with its flippers. Again and again it hurled itself from the sea and crashed back. Finally, after an hour's battle, Dr. Bowen guessed the ray's strength was spent. He and Paul grabbed the gig and harpoon lines and drew the creature close to the boat. As they did the ray sprang and lashed his whip around Dr. Bowen's body, shaking him to his knees. But the ray was too far gone to injure the doctor.

Making sure the monster was dead, they dragged it into the boat. Back at the docks a block and tackle were employed to hoist the ray. It weighed 500 pounds.

Whipping the whip ray is Florida's newest thrill sport. Few have tried it in the past. More will attempt it from now on. Along with Guy Fielden and Ted Gan-yard of Coral Gables, Dr. Bowen and Paul think it offers more ad-venture than sailfish, marlin or tarpon fishing. The sport is fast, daring and risky. Good nerves, steady eyes and a sure aim are essentials. Perfect teamwork be-tween hunter and pilot and split-second timing are requisites.

Rays are broad, diamond-shaped and have small, vicious eyes set close together. The leap-

(Continued to page 175)

Right, hauling a relatively small ray into the boat. Note the ray's resemblance to a bat. The manta ray found in the Florida keys sometimes weighs 3,500 pounds



Dr. Bowen with gig in bow of boat; his brother operates motor

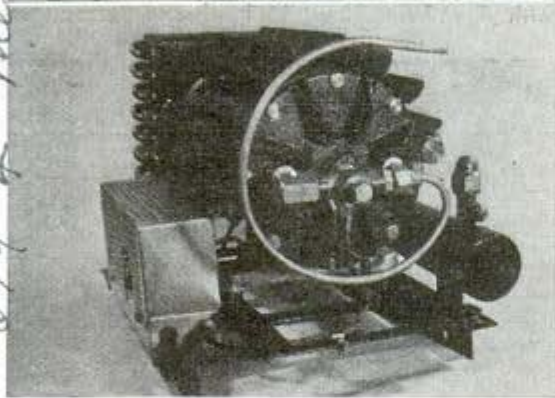


Bowens pulling ray to boat. Large rays can drag boat for miles



243

Radio Tubes Rule Current In Low-Cost Refrigerator



Top, piston assembly of 500-watt tube-operated refrigerator; below, 250-watt domestic refrigerator unit

An electro-magnetic pump replaces the ordinary rotary motor and pump mechanism in a refrigeration system just developed. The unit is lightweight, quiet, and may be marketed at a 33 percent reduction under present prices. Radio tubes control the current. The pump consists of two opposed compression chambers and a central double-headed piston. Each chamber is alternately polarized by utilizing the characteristics of alternating current, the effect being to drive the piston back and forth between the chambers. The pump is capable of 3,600 strokes per minute, and freezing speed can be varied at will.

2311

Three-Inch Glass on Warplanes Stops Fifty-Caliber Bullets

Tests of safety glass three inches thick, designed for protection of pilots and gunners in warplanes, prove it will stop even

Scene Service
Mar 4.

Ref. H. J. Alter
Army Ordnance,

the heavy bullets of .50-caliber machine guns fired at right angles from 100 yards away. Two-inch glass of the same type will stop bullets of the ordinary rifle-caliber machine guns. The heaviest bullet shatters and powders the glass at the point of impact but fails to penetrate it. Since windshields and turrets on airplanes are always streamlined and present a sloping front to the enemy bullet, thinner glass than that tested nearly always would offer sufficient protection.

2155

Adjustable Sprinkler Limits Water Within Area Desired

Finger-tip control for both the distance and amount of water is provided by an automatic lawn sprinkler now on the market. By turning a plastic button located on the sprinkler head, the position of the nozzle arms may be adjusted to cover any area from 5 to 50 feet in diameter, and the openings in the arms may be changed to govern the quantity of spray. Whether set for large or small circles, the spray is always broken up by revolving arms to provide a rainlike shower.

Stain King \$4.75



Top, dial control permits sprayer to be set for any diameter up to 50 feet. Bottom, sprayer in action

Dr. J. J. von Elderen Los Angeles
619 4 Mesa Ave

Washington, D.C.
5648 8495 West of Denver
Chicago, Illinois
P. O. Box 11000
Broadway
Central Ave

2305 Pumpo-Maxim motor Co. middleboro Mass

Motorcycle Pump Pours a Torrent on Flames



Motorcycle pumper at left, equipped with a V-8 engine, feeds 500 gallons of water per minute into hose lines. At right, Boston fire fighters man a line of nozzles in a test of small trailer and motorcycle pumps

Borrowing an idea from the "smoke eaters" of London, who fight incendiary flames with small mobile pumping units strategically distributed throughout the city, the Boston fire department recently demonstrated several portable pumps capable of pouring a torrent of water. One of them was a motorcycle unit carrying hose lines and using an eight-cylinder engine to deliver 500 gallons of water per minute. Others were pumps of larger

capacity mounted on trailers or small trucks. In one test, three pumps drove 2,572 gallons per minute through fourteen hose lines. In London similar small units, which can be hauled by any automobile or taxicab in emergency, proved able to rush fire-fighting equipment to the scene of a fire in a few minutes, going around bomb craters or traffic jams that would stop large trucks. Boston has ordered four 600-gallon auxiliary pumps for emergency use.

Plastic Helmets for 'Chutists Top Off Latest Uniforms



Members of the crack new 501st Parachute Battalion training at Fort Benning, Ga., have been equipped with new uniforms, plastic helmets, and shoes with inner soles of sponge rubber to absorb the shock of landing. The suits are in one piece, made from snagproof olive drab material, and are liberally furnished with pockets sealed with slide fasteners.

New York led the states in passenger automobiles registered in 1940 with 2,392,008, California following with 2,374,507.

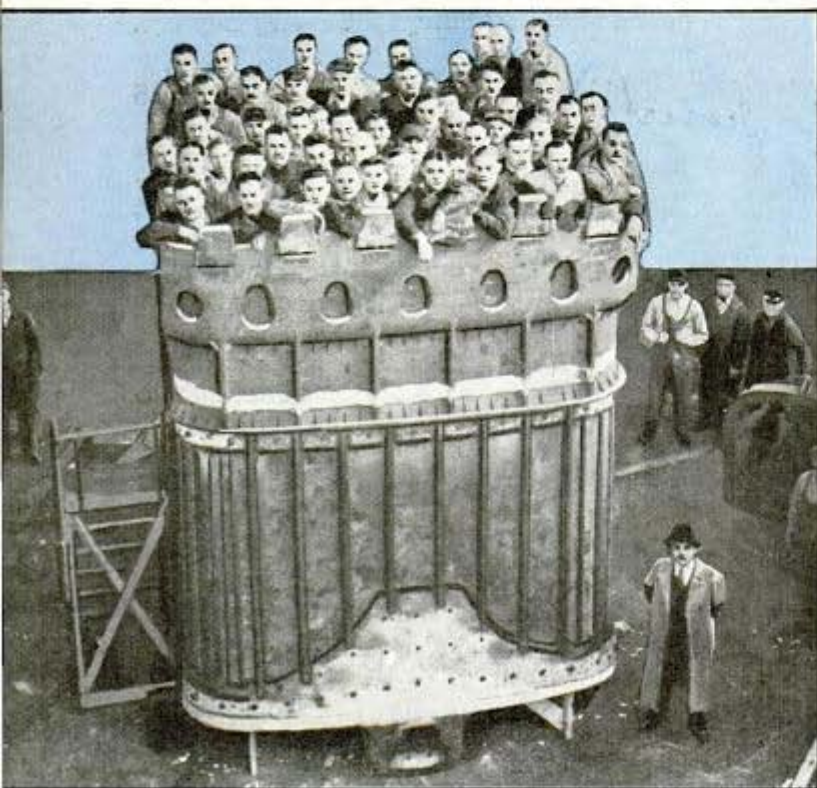
Here are Uncle Sam's own parachutists, clothed in new type uniforms

Automotive Industries 65
3/1/41 P. 215

MAN'S



R 1453
South Melbourne, Wis
Above, thirty-three cubic-yard Bucyrus-Erie stripper operating in an Indiana surface coal mine. Below, 52 men standing in heavy duty stripping dipper demonstrate size of the huge machine



EVER since the first member of the human race attained sufficient intelligence to realize he could dig faster with a clamshell than he could with his fingers, mankind has been striving to increase the strength of the comparatively feeble arms and legs with which nature endowed the species.

For example, Leonardo da Vinci in 1514 sketched a practical machine for underwater excavation and wrote detailed instructions for its operation. It was so mechanically ingenious that when someone placed da Vinci's plans for an excavator, together with sketches and models of some of his other neglected inventions on display in New York City recently, thousands of people were surprised that machines they had known to be so new were based on ideas they had never suspected to be so old.

But it was not until 1837 that

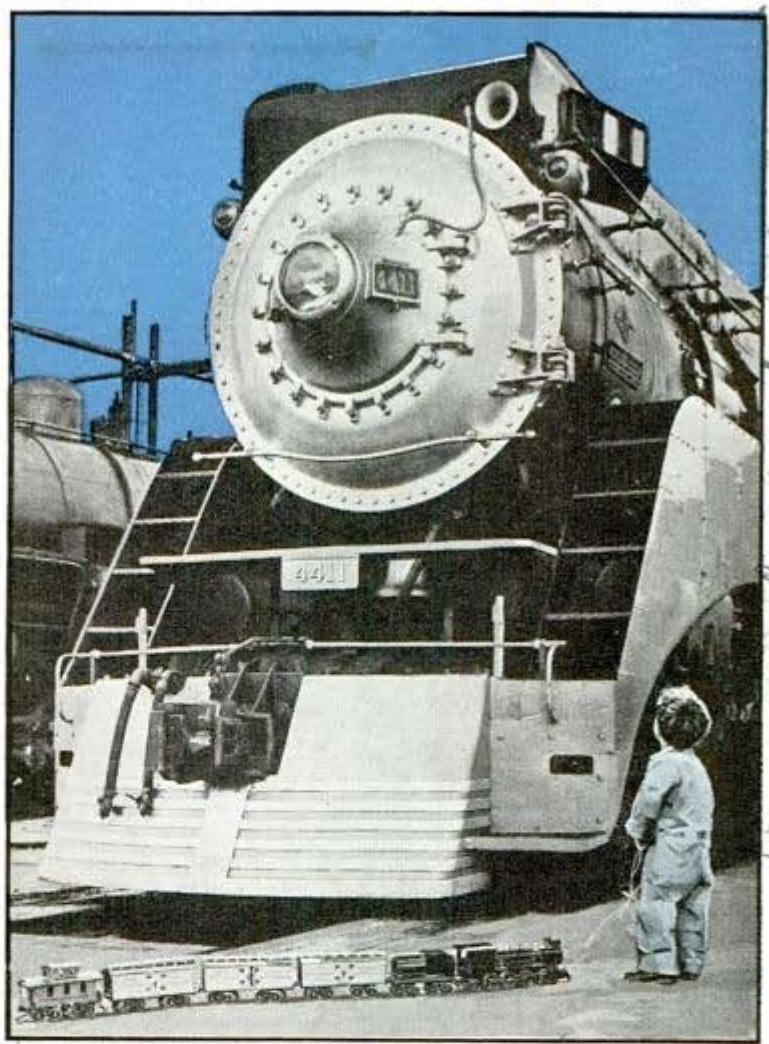
K145 3

ROBOTS of METAL

Anyone thought of constructing a mechanical excavator, which is nothing more than a robot arm operating a robot hand. Patented in America in 1839, it attracted a lot of attention with its clumsy central mast of iron supporting a crane which lifted a bucket after it had been filled by a series of jerks from chains controlled through temperamental clutches and powered by a wheezy steam engine.

Then in 1880 an improved machine was invented. This

Below, man standing beside 1,023,000-pound steam drop hammer used in airplane manufacture



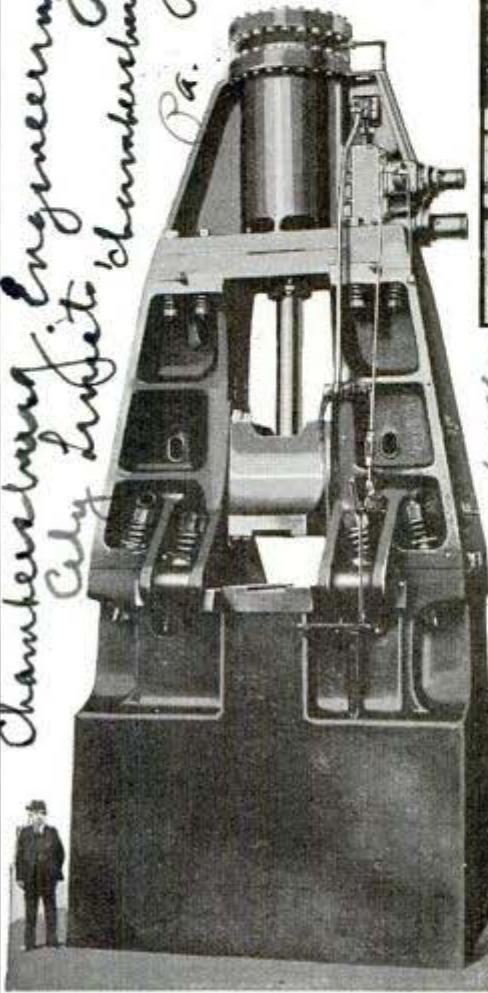
Above, child drags toy up for comparison with one of man's robots, a Southern Pacific locomotive

was the railroad type shovel which dips and lifts very much like the one now used to excavate for basements and foundations. The dragline, which digs with a bucket drawn toward the machine, soon followed, and machine-age man continued to free himself from the limitations of his arms and legs at a breath-taking pace, devising thousands of labor-saving mechanisms and immediately making them bigger and better. When he could make them no better, he kept on making them bigger.

Today, because of the demand for tool steel and machine specialists in national defense production, it seems unlikely that for some years, at least, anyone will attempt to produce larger digging machines than those recently put to work in the surface coal mines and quarries of the United States.

The huge dippers of these excavators, used to strip soil from seams of coal or rock, scoop as much

Chambersburg Engineering Co. City of Chambersburg Pa.



Donald Lyano. Son of ...

of ...

...

Built by Chambersburg Engineering Co.

R 1453

American Insh. & Steved Co
Robert and Walter St Paul



more than 110 feet, dump 75 feet in the air and dig at a height of more than 95 feet.

So perfectly are they balanced that if one or two of the four caterpillar traction units settles in soft soil, a unique mercury control system causes four huge hydraulic jacks to level the 2,500,000-pound machine instantly. And one little man seated at electric controls as simple as those on your automobile operates the giant robot shovel, so large that the dipper alone will accommodate 52 men, standing comfortably close.

Nor will the 250-foot arm-like booms of the newest type dragline excavators with their

Below, huge electric shovel makes workmen look like pygmies



Above, American revolver type derrick hoisting material from which its own roadbed is manufactured, a construction trestle over a stream

as 35 cubic yards of dirt at a single upward swing. The booms on these gargantuan machines exceed 100 feet. The handles on the shovels range over 70 feet, which is a far cry from the prehistoric man and his clamshell. These excavators can reach out

Below, huge six-foot plow built to bring up rich peat soil buried in flood sands

Caterpillar tractors

Paul Perso. Santa Ana, Calif.



Caterpillar Tractor Co
Peoria, Ill

K 1453

500-foot carry be increased much in size right away. Their great, rectangular "feet" which look like pontoons and permit them to walk across soft soil without sinking, have probably reached a temporary maximum size which is approximately that of a speedboat.

The conveyor is another of man's robots employing steel to perform both the supporting function of the arms and the transportation function of the legs. The newest conveyor, having reached a total length of 9.6 miles, is not likely to be exceeded by any such machine to be built anywhere in the world during the next few years. Its purpose is to move sand, gravel and stones for the construction of Shasta Dam. More than 12,000 steel troughing idlers



near Valley City, N. D.

The big Diesel-drawn plow, above, digs down three feet to turn up better soil

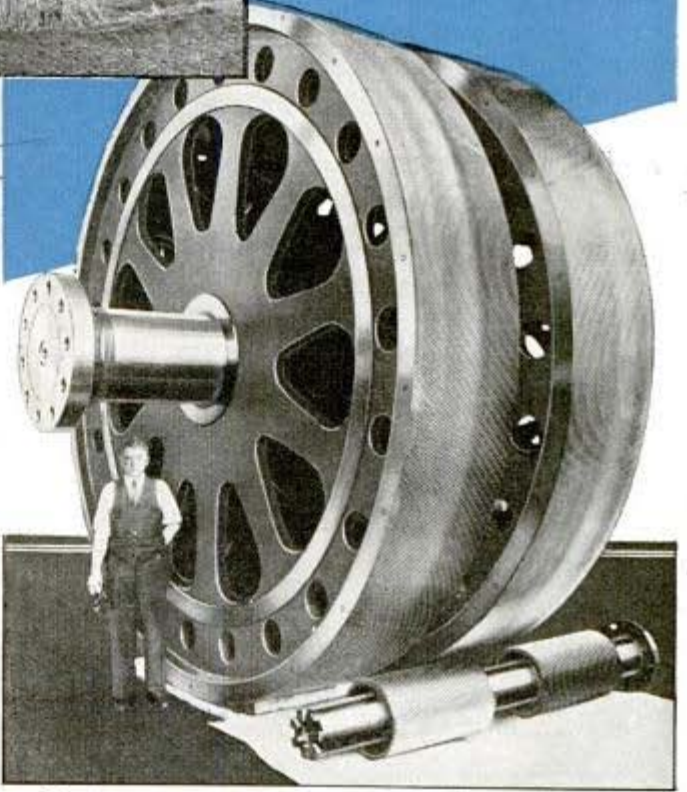
Below, one of two huge bull gears coupled to propeller shafts of S.S. America



"Caterpillar" Diesel tractor and scraper making fill on county road construction

rotating on sealed steel ball bearings support 20 miles of 36-inch, six-ply belting which involves the use of 500,000 pounds of cotton and a million pounds of rubber.

It took mankind a long time to develop the hammer and anvil to a point where the village smithy was extolled in verse and song and it is likely to be some time again before many such robots are fashioned much larger than the 1,023,000-pound steam drop hammer that recently was manufactured in the United States for a French corporation. The falling hammer section weighs 35,000 pounds. The anvil weighs 762,000 pounds.



(Continued to page 167)

Inf. Co Cedar Rapids, Iowa

L257

Small Working Gas Engine Makes 10,000 Revolutions

Jessie Kaplan



This tiny gasoline engine has tank holding two drops of gasoline and makes 10,000 revolutions per minute

Special tools had to be built for machining parts used in the construction of a tiny valve-and-piston type gasoline engine that runs three hours on an eyedropper of gasoline. Fuel is fed through an opening 1/1,000-inch in diameter. Built by Ray Arden, of Baldwin, Long Island, N. Y., the power plant has a tank holding two drops of gasoline and is capable of making 10,000 revolutions per minute.

Homemade Electric Motorcycle Runs for Half Cent a Mile

Cheap operation is claimed for an electric motorcycle made from spare parts



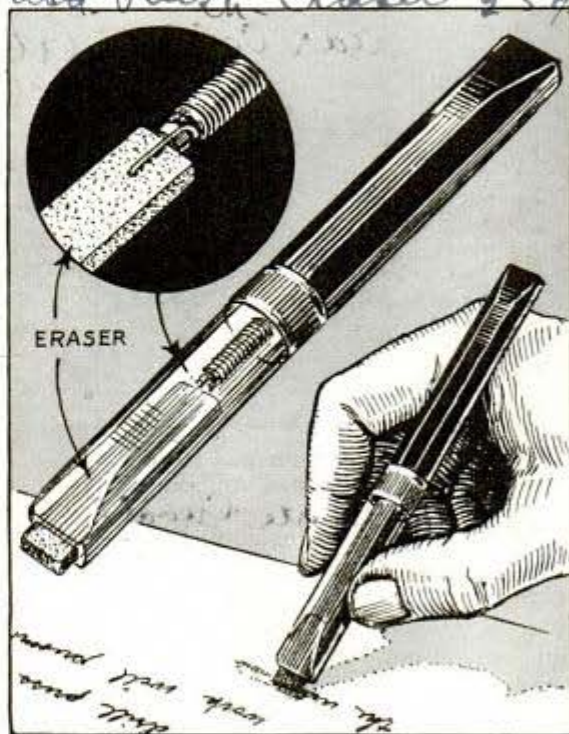
Battery-operated motorcycle runs 30 miles per hour

*The Eraser Co.
231 W Water St
Hyracuse, N.Y.*

mounted on an old frame. A $\frac{3}{4}$ -horsepower, 12-volt motor, driven by two six-volt batteries housed in a case in front of the motor, supplies the power. Batteries are charged, without removing them from the case, at 2½ amperes for four hours, four days a week, which will run the vehicle 25 miles. The cost is computed by the operator to be less than a half-cent a mile, at a speed of 30 miles an hour. As there is no clutch, the motorcycle starts traveling as soon as the switch, operated by foot pedal, is turned on. The brake pedal is on the opposite side.

Refillable Eraser Feeds Rubber As It Wears Down

Made in the form of a mechanical pencil, a long-lasting eraser is refillable and the rubber may be propelled outward as it is



Diagrams, upper left and center, show how rubber is hooked within holder. Right, it is held like pencil

worn down. Refills are made either of rubber or of mineral fibers. The latter type is especially useful for making erasures on tracing cloth, as well as for other delicate abrasive tasks as in cleaning and polishing.

(See index, page 4-A, to find where to buy articles described in this magazine. Say you saw it in Popular Mechanics.

*Frank R. Smith, Waterbury, Conn.
815 Vermont St.*

Wade Walker

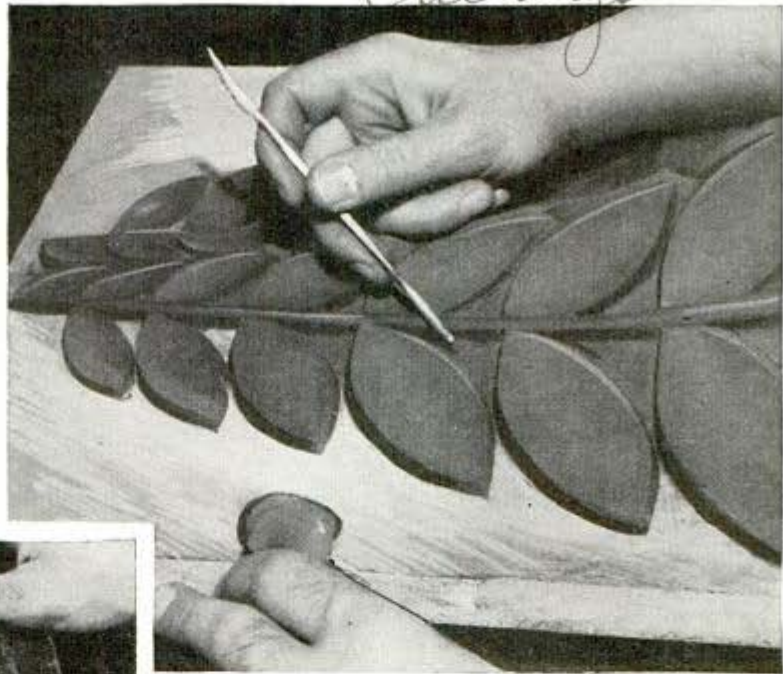
Porter Brush Eraser Co.

216

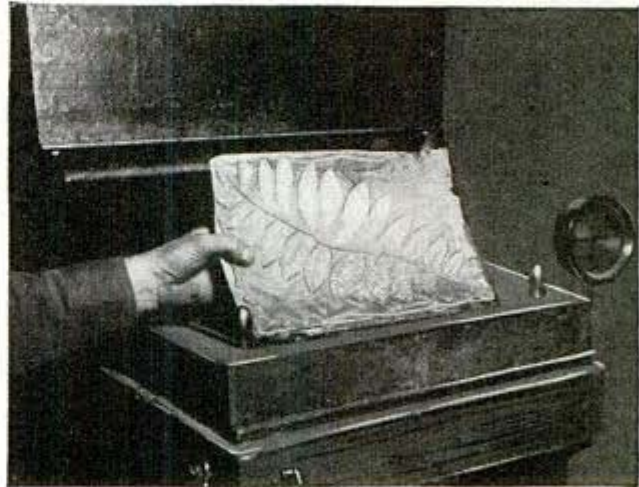
Multi-Products
1906 S. Western Ave
Chicago

Carvings Copied in Plastic Wood With Dies

Duplicates of hand carvings can be made in any number with the aid of lead molds made from the originals by a Chicago concern. Carvers can send their favorite ash trays, statuettes and other handiwork to the firm where lead is poured around the article to make a mold that may be used in turning out hundreds of copies, using



Fern leaf carved in wood by hand is used to make a tray



Above, lead mold of head, first carved out of wood, is good for thousands of plastic copies

Duplicate of fern, above, was formed by pressing Plastic Wood into lead casting made from the original

Plastic Wood as the molding material. It takes but a few minutes for the Plastic Wood to harden after it has been put into the mold and pressed out. Colors may be added to the finished piece to make it even

more attractive, in some cases, than the original. The molds and the plastic material are not expensive. For a small investment wood carvers can share their finest work with friends, or even sell it.

"Demountable" Rims for Sun Glasses Permit Lenses To Be Changed

Sun glasses now available have interchangeable rims so the wearer may change the color or density of the lenses whenever desired, in order to match the mood, attire, condition of weather, or to subdue glare. Thus with one pair of spectacles, the purchaser can obtain as many different lenses as he may wish. The "demountable" rims come in sets, each set containing glasses of a different color or anti-glare value.

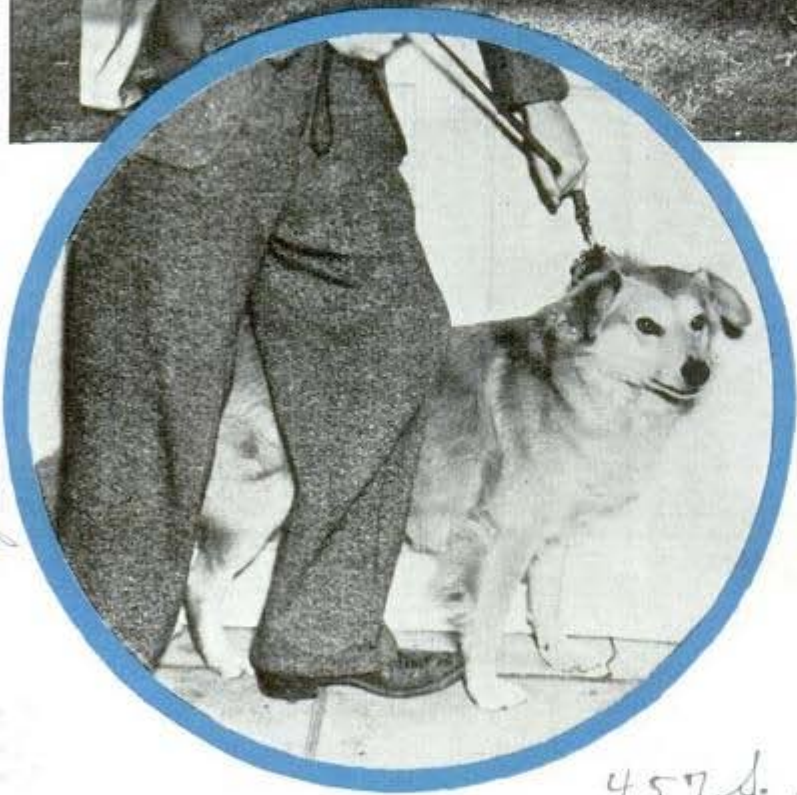


JUNE, 1941

2268
Lesh: H. S. Marshutz,
418 W. 6th St. City,
Los Angeles, Calif.

K1269

TRAIN your DOG



Above, the first step in training a dog to be a gentleman: teach him to come at call. Tie a rope to the collar, step 15 or 20 feet away, and pull firmly as you give the command "Come here"

Teaching the dog to "heel," left, walk him along a wall or fence and keep him in position with leash or knee, repeating the command "Heel"

By

R. DeWitt Miller

*457 S. Serrano Ave.
Los Angeles Calif*

benefit of their companionship—simply because the average man has not been shown how to teach his dog to be a gentleman.

"Training a dog to understand the few basic truths on which canine character is built is really simple," says Spitz. "Yet if you don't train your dog in these fundamentals, he's likely to become a cross between a nuisance and a criminal."

From here on we'll let Spitz take over. The methods outlined in this article are so

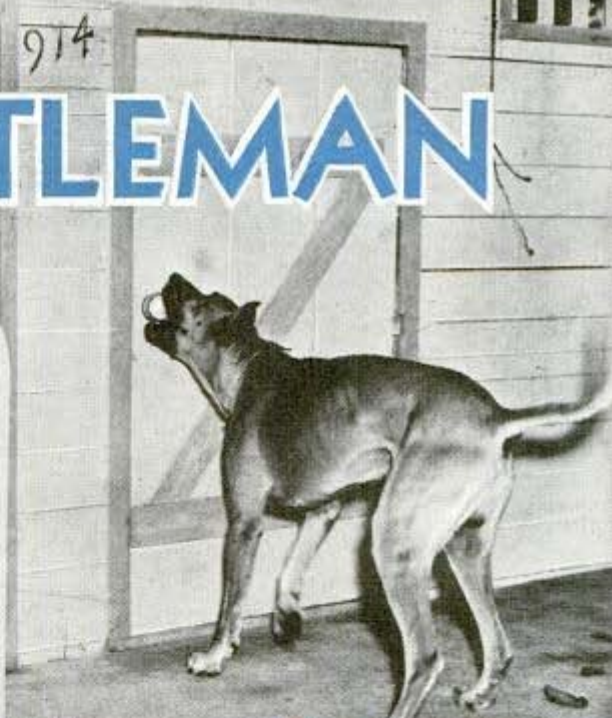
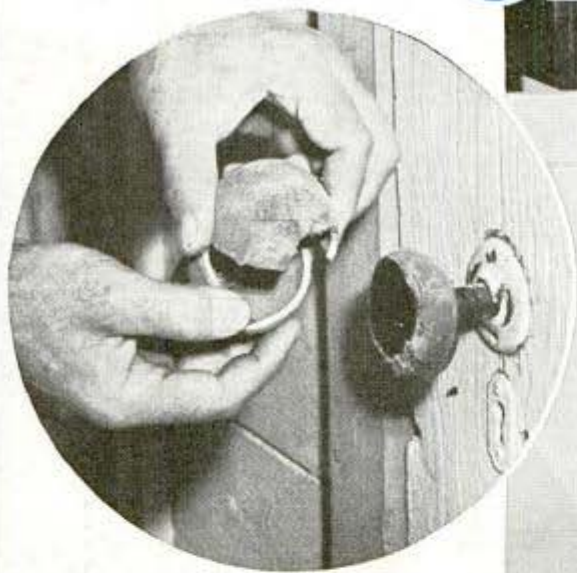
EVERY DOG should be a gentleman. That is the theme on which Carl Spitz, Hollywood's ace dog trainer, has concentrated for 15 years. For although Spitz, who is head of the world-famous Hollywood Dog Training School, can teach dogs to do almost unbelievable things on the screen, his great purpose in life is to train the American public how to train their dogs. He believes the average American and the average dog are losing half the

*12350 North Hollywood Calif
Riverside
Penn.*

K1269

914

to be a GENTLEMAN



Since dogs dislike to touch metal, the dog movie actor above was taught to turn a doorknob by covering the knob with a tennis ball, one of the dog's familiar playthings



RIGHT

fundamental that Spitz uses them as the basis for instruction of his dog actors. Toto, the woolly mongrel in "The Wizard of Oz," Buck, the St. Bernard in the "Call of the Wild," and a hundred other movie dogs went through the same course.

But to start with your puppy. . . The average person eventually succeeds in house-breaking a puppy and teaching it not to chew the piano, but

Save your dog from poisoning by teaching him not to touch stray food. Bait a few small mousetraps around the yard with meat (below). To make him sit down (right) use a "tong" grip, don't push down with flat of the hand



WRONG



Lead the dog over a hurdle with the command "Over" to teach the jump

he wastes a lot of time doing it. The chief cause of this is the tendency to allow a puppy the freedom of the house.

"A puppy," according to Spitz, "should be placed at once in a suitable dog box." The size depends on the puppy, but a standard dog crate is about two by two by three feet. The puppy should remain constantly in this box when he is in the house. At least four times a day he should be let out in the yard. As any dog will tend to keep his immediate surroundings clean, the puppy will form the habit of not dirtying his box. Moreover, keeping him confined to the box will prevent his world becoming too complex. Confinement should be kept up for about two weeks, or until the puppy is clean in the box. He should then be gradually accustomed to larger surroundings.

It is not, however, advisable to begin further training of a dog before he is eight months old.

Of all the lessons a dog must be taught, the most important is to come at call. This should be taught with the aid of a long rope attached to the collar. Stand 15 or 20 feet from the dog, and pull firmly on the rope,

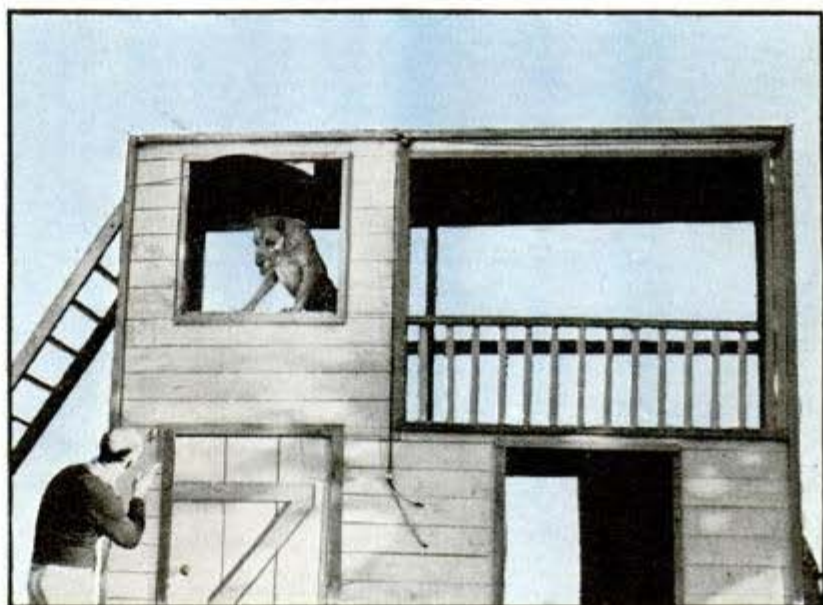
time, irrespective of what the dog wanted to do at the moment.

The second great failing of the average dog is the habit of eating stray food. Countless dogs are poisoned because of this habit, yet it is one of the simplest to break. Bait several mousetraps with meat, and place them about the yard. After his nose has been nipped a few times, he'll leave stray food alone. A small mousetrap will not harm a dog.

The next step is to teach your dog to walk beside you, at "heel." This is the first

at the same time commanding "Come here!"

Never change the wording of the command. That would be confusing. Always use a long rope; the dog must be taught to come from a considerable distance. After he begins to get the idea, take the rope off and call him. If he does not come at once, immediately use the rope again. This lesson should consume about 15 minutes a day. It must be learned thoroughly before more elaborate training is begun. Half the problems of dog owners would be solved if their dogs had been taught to come at call anywhere, at any



Carl Spitz, Hollywood dog trainer, uses this set to train canine actors; it includes every essential element of a house or street

Trainer holds dog's rear quarters down and pulls front legs forward as he commands "Down"

real test of a dog gentleman. A dog who tugs on his leash is neither a gentleman nor a pleasant companion. When teaching a dog to "heel," select a place near a wall or fence. Walk with the dog on your left side, between you and the wall. The dog should be on a leash. In fact, a leash should always be used in any basic training.

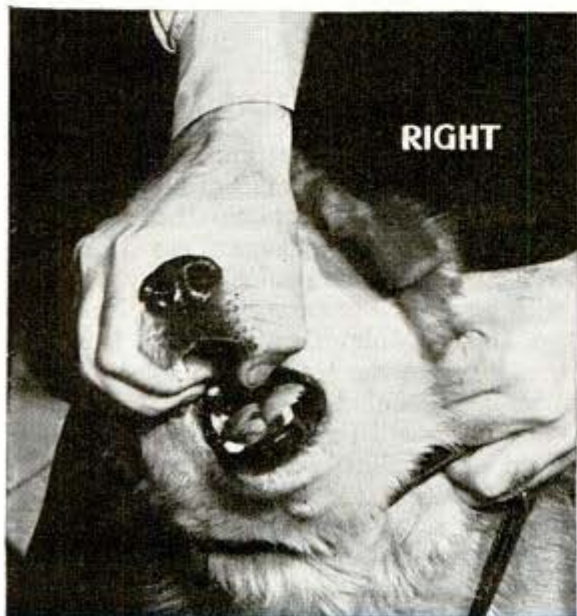
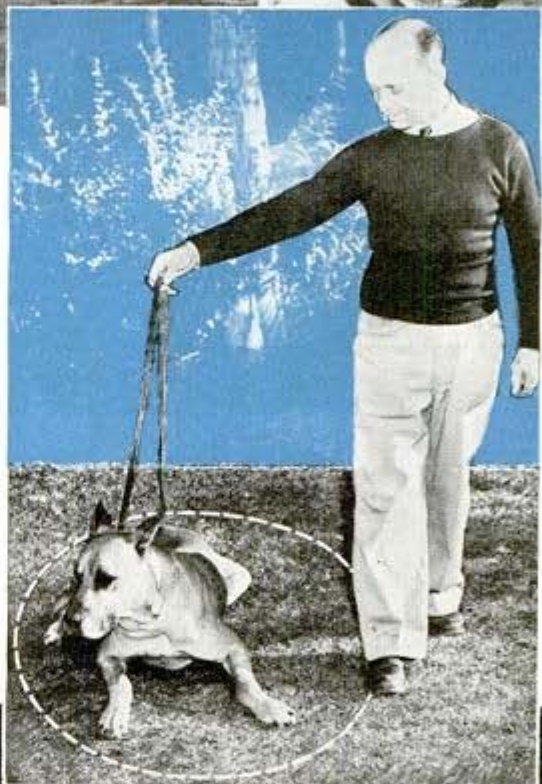
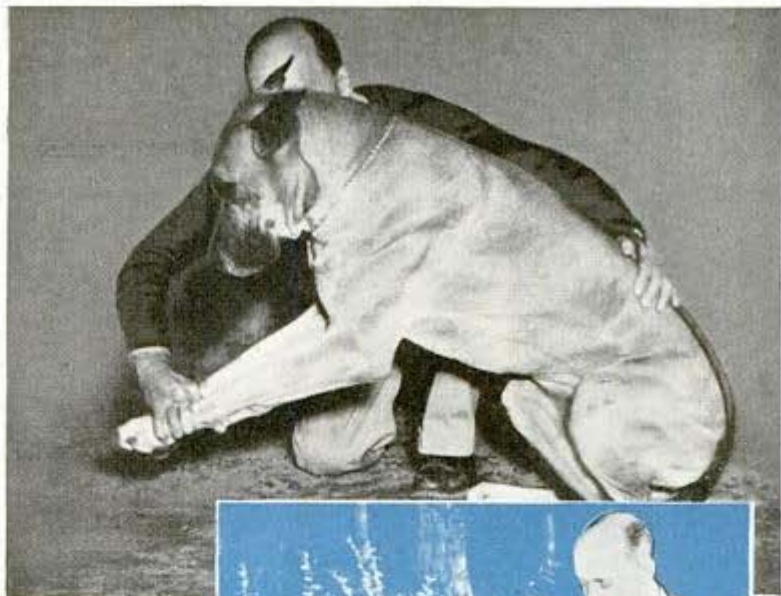
As soon as you begin to walk, the dog will either run ahead, or lag. If he stays behind, pull him forward with the leash. If he darts forward, push him with your knee against the wall or fence. Thus the dog learns to walk just even with your left foot. After this lesson is thoroughly taught, the leash should dangle loosely when you are walking the dog. A stroll then becomes a pleasure, rather than an athletic contest.

The next lesson is to "Sit!" Never use the command, "Sit down!"; the dog may

(Continued to page 170)

Teaching the dog to "Stay" (right), walk around him repeating the command; if he moves, force him back, again repeating the order. Always use the leash

Below, right and wrong ways of forcing mouth open. Wrap hand around nose, forcing fingers and thumb in



RIGHT



WRONG

L274

Skier Talks to Radio Audience in Record Leap



Carrying a short-wave transmitter as he soared through the air in what proved to be a record jump at Lake Placid, N. Y., Torger Tokle, champion ski jumper, described his experiences to a nation-wide radio audience. The microphone was fastened to a baseball catcher's mask which he wore, while strapped to his back was the portable radio set. His words, picked up by a more powerful set at the bottom of the slide, were relayed to Lake Placid Village, from there they were sent over a telephone wire to radio station WGY, Schenectady, and then broadcast over a coast-to-coast network. In the leap which he broadcast, Tokle set a new hill record of 243 feet for the Olympic jump.



Skier poised for takeoff, above, is wired for sound with short-wave radio transmitter strapped to his back and microphone on wire mask

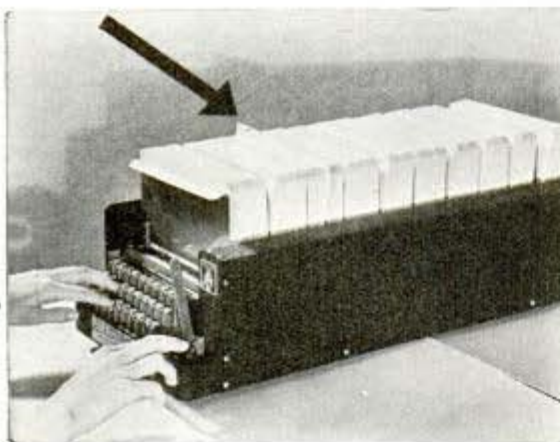
Right, camera caught jumper in mid-air as he broadcast to nation-wide listeners a description of record leap while it was in the making

dent.

Electrofile, Inc., 12 Sheridan Ave., Albany, N.Y.

L210

Electric File Lifts Desired Card When Keys Are Pressed



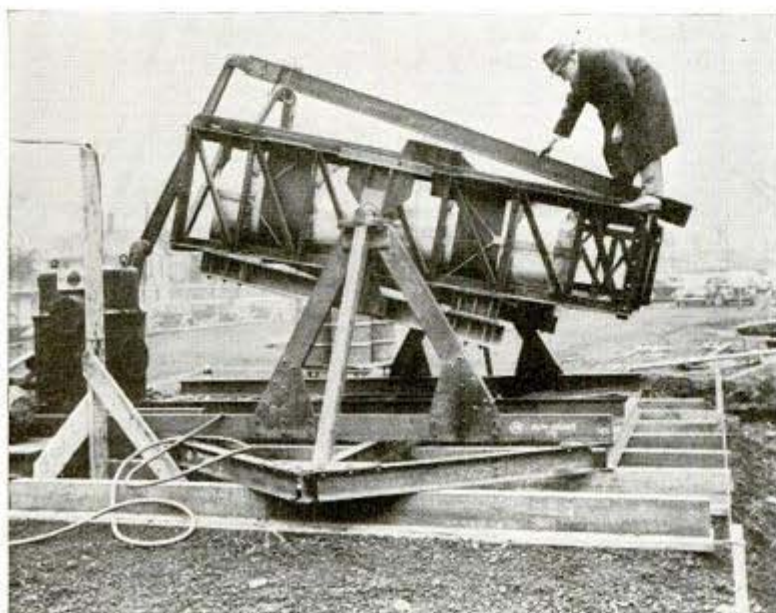
Arrow points to card raised in file by pressing keys

Pressing the first four letters of a customer's name on the keyboard of an electric card-file selector turns up the customer's card from the tray regardless of its position in the file. One selector may be used with any number of card trays. For instance, to find John Brown's card, the clerk would place the tray in the selector and press keys labeled "J," "B," "R," and "O." The card will bob up immediately, pulled out of position by energized magnets at the side of the selector. All the other cards are kept from bobbing up by means of four of the thirty metal rods lying parallel in the bottom of the selector which were raised when the keys were

struck, the four rods fitting snugly in slits between tabs at the bottom of the cards. John Brown's card was free to fly against the magnets because tabs to the left of the four slits corresponding to rods controlled by keys, J, B, R, and O had been clipped off when the card was originally coded for filing. In the same manner any other card in the file can be located by pressing the selector keys corresponding to its code letters.

Gas Tank for Plane Rocked in 'Cradle' To Test Strength

Before self-sealing gasoline tanks are placed on military airplanes, they are given a thorough testing, part of which consists of rocking them in a large cradlelike machine developed by B. F. Goodrich Co., of Akron, O. As the device oscillates with the tank mounted inside, measurements are made of the stresses and strains it endures.



Self-sealing gas tanks for warplanes are tested by rocking in this cradle

Mobile Electric Workshop Helps Build New Combines



Welder working at bench made by lowering tailgate behind mobile shop

When the caravan of International Harvester's experimental combines took to the fields for tests this year, it was accompanied by its own machine shop on wheels, equipped to make changes in various working parts as the tests proceeded. The workshop is outfitted with welding apparatus, several electric tools and lights operated by current from two generators which, in turn, are connected to the motor truck engine through a power takeoff. When the tailgate is dropped to horizontal position it forms a convenient work-

bench with a vise attached. Hinged side panels cover a large cabinet with space for tools and bins for bolts, rivets, nuts and other accessories. These panels, when raised, also provide shade in the daytime for workmen. The combines are worked with crops of all sorts and in many parts of the country. When faults or weaknesses are spotted during the field trials, the offending parts are changed or redesigned. Thus, before they are put into commercial production, the combines go through nature's own proving ground.

DEFYING the PACIFIC



By Captain Charles A. Borden

SAN FRANCISCO Bay skippers said it couldn't be done—sailing across the Pacific in "Confucius," one of the smallest seagoing boats in the world. But my wife, Rosalie, and I already have proved them to be at least partly wrong, for we've reached Honolulu on our globe-circling voyage.

Confucius is 17 feet over-all, 14½ feet long at the waterline and a six-foot beam. It is a Marconi-rigged sloop which we built in Hong Kong, China,

Checking position and mending sails in dead calm after the storm



Above, standing out to sea from Monterey at beginning of the long voyage

Left, the skipper and Rosalie in midst of creating a mulligan aboard "Confucius"

*Sloop Confucius
Honolulu, J. H.*

in a SAILBOAT



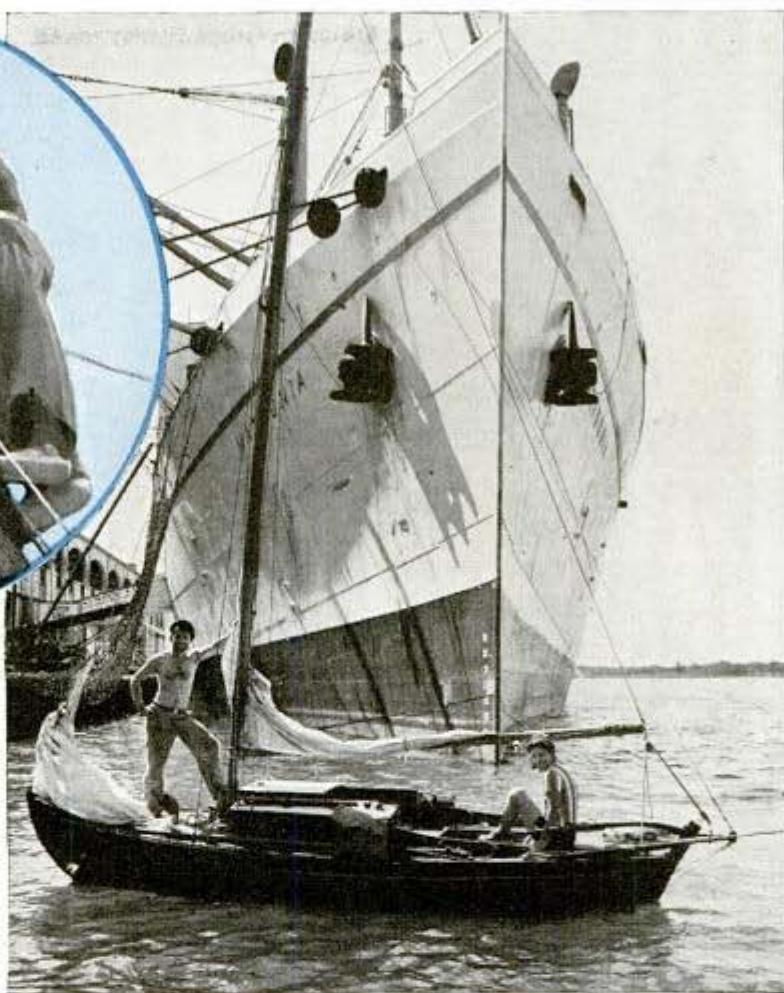
Above, up the tiny craft's mast goes the skipper

of teak and camphorwood. In the cabin are two comfortable six-foot bunks, a pot, pan, and stormproof stoves.

Our galley consists of a drawer four feet long that extends out and under the cockpit seat. It contains besides three small kerosene stoves, spices, olive oil, matches in a glass jar, and five days supplies which we replenish as required from our main stores kept under the bunks, under the floorboards and aft under the watertight self-bailing cockpit. All of our canned goods are marked with a key number with a waterproof crayon so in case bilge water washes the labels off we know what we are opening.

Each stove takes up eight inches of the drawer which is asbestos lined. Plumber's tape extends

(Continued to page 187)



Two extremes in Pacific "ships"—a big liner and the 17-foot sailboat. This photo was snapped at Honolulu Below, Rosalie and the skipper taking and checking meridian time sight. Instruments were homemade or secondhand



Artillery Range 'Suicide Squad' Blasts 'Duds'

Risking their lives daily tracking down and blowing up unexploded shells on the artillery range at Fort Benning, Ga., is the work of Lieut. Jesse D. Wadsworth and his

"suicide squad" of six men. These unsung heroes ride out each morning in search of faulty shells, and whenever one is found they go into action. In preparing the "duds" for explosion, the men carefully dig up the ground around the shell, place dynamite in the hole, pack it with loose earth, and attach fuses to the dynamite. When all is in readiness, they return to the truck and start the engine, as a rule leaving Lieut. Wadsworth to light the fuses and make a dash for the truck. The fuses take 15 minutes to burn, but in this hazardous task anything can happen. The expansion program at Fort Benning has uncovered hundreds of these unexploded shells, some of which have lain as long as 15 years in remote parts of the artillery reservation.



"Suicide squad" members (top) get ready to blast unexploded shell, run for lives (center), and (bottom) "dud" blows up

Liquid Oxygen for Planes Seen as High-Flying Aid

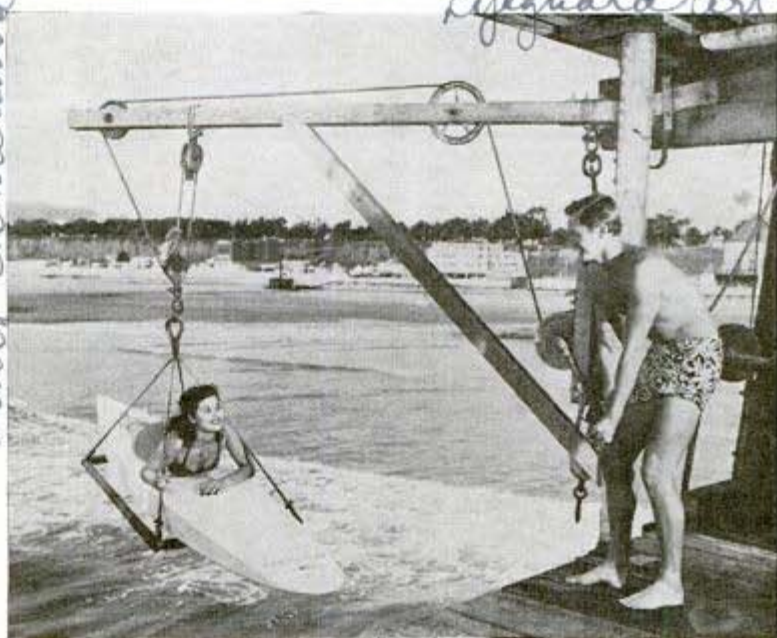
Liquid oxygen for high-altitude flying, replacing the large tanks of gaseous oxygen kept under high pressure, may mean increased safety for the pilot, greater maneuverability, and added armament for the ship, because of the lower pressure used in storage and the reduced weight and size of the tank required. In commercial flying, more space for passengers or cargo could be provided, according to Prof. John Akerman of the University of Minnesota, where the unit was developed. The new apparatus consists of a tank containing the liquid oxygen, enclosed within a large tank containing gaseous oxygen at about 80 pounds pressure. This compares with 1,800 pounds pressure under present methods, which presents the danger of explosion in the event it is struck by a bullet. As the gas escapes, the pressure is lowered, and then automatically the liquid oxygen is squirted into the enveloping tank, to become a gas by "boiling."

L116

Paddleboard Launched in Cradle by Guards

Paddleboards can be launched or lifted from the water by using a winch like one installed at Santa Monica, Calif. The launching device saves labor for lifeguards who have charge of lockers on the pier where the paddleboards are stored.

Ruth Calderwood



Lifeguard Bert Cole

Beach guards, using winch, make easy the task of lowering paddleboards into water, even with passenger aboard. Boards are lifted in same way

L111

Army's Midget Scout Car on Raft 'Swims' Across Rivers

John Aglethorpe, USA



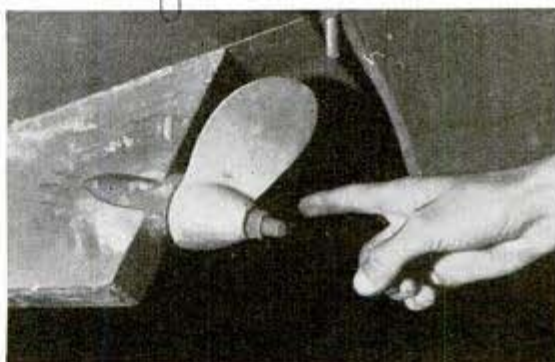
Among the accomplishments of the army's new midget scout car is that of "swimming," when it is properly mounted on a raft. Constructing the raft of empty gasoline drums and planking, soldiers place the car so specially designed paddles attached to the rear wheels can push the craft along at two miles an hour.

Rear wheels, with paddles attached, kick up water as midget car propels itself across river on a raft. Its speed is two miles per hour

Army Lt. Col. John A. Coxside, 6th Cavalry

Auxiliary Propeller for Sailboat Uses Single Blade to Reduce Drag

To reduce drag on the sailboat, a propeller with one blade instead of two has been installed for auxiliary power. This design permits the propeller to be turned up behind the skeg when sailing. Although one boat that uses the single-blade propeller is unusually light, no vibration is noticed when the motor is in operation.



Single blade of propeller may be turned upward behind skeg, thus reducing the drag

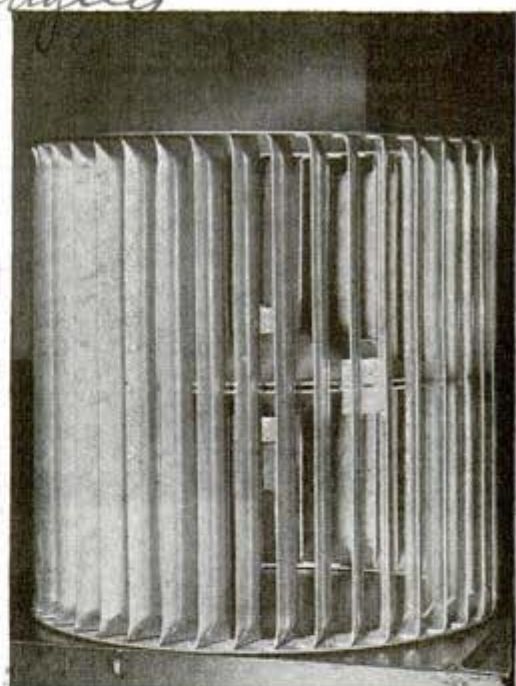
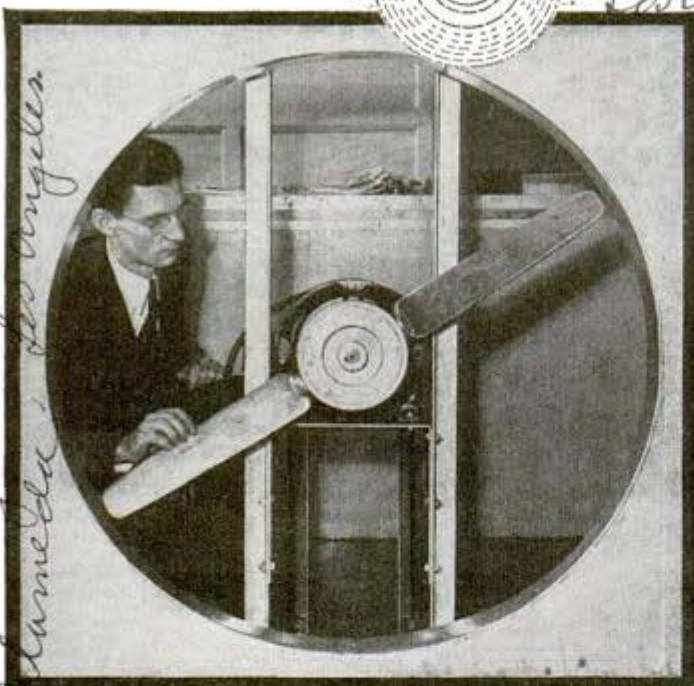
J. W. Greenwood, 5315 Hillier Drive, Oakland, Calif.

K1431

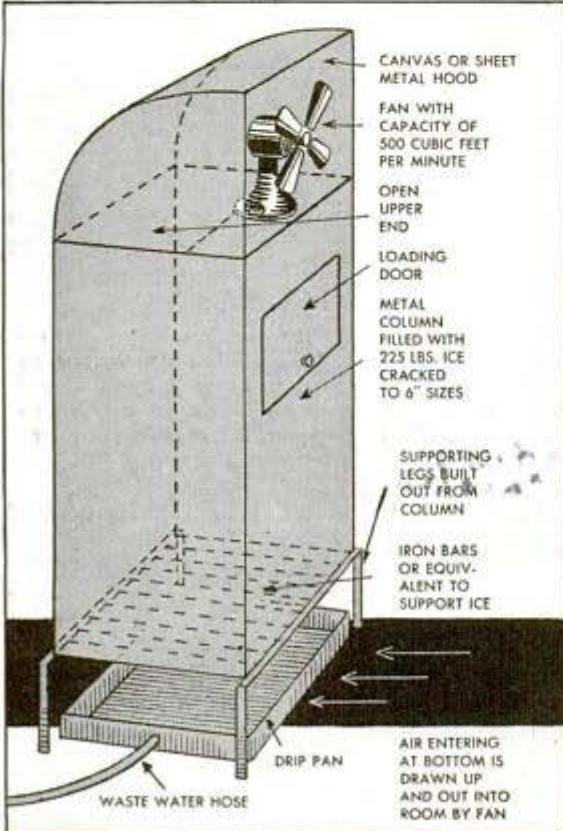
Cont. Thomas & Stinson, Jr.
3872 Franklin Ave.
Los Angeles

HOW TO

General information. evaporative coolers
M. Breslow, Utility Fan Co 4801 S
Carmelita, Los Angeles



Left, large type of ventilating fan that has adjustable-pitch blades to take care of different air loads.
Right, revolving blower cage that takes place of moving fan blades in many cooling systems



This diagram shows principal features of an ice cooler for single-room cooling

HAVE you ever shivered while standing near a large window in the winter time, though the window was closed and the air inside the room was warm?

If you have, you experienced the phenomenon called radiant cooling. You can be uncomfortably chilly in a room where the thermometer reads 70 degrees or more, if the walls and windows are cold. Your body loses heat by radiation to surfaces that are cooler than itself. This fact has been made the basis of research that seeks a new way to defeat summer heat.

Men who are studying radiant cooling and heating say that by means of it you can remain cool in summer temperatures of 90 degrees or stay warm in winter with the windows open. The idea is to control the temperatures of the surfaces that surround you instead of the temperature of the air. Such panel cooling has shown its worth in a Grand Rapids, Mich., hospital where surgeons remain perfectly comfortable at a temperature of 92 degrees accompanied by high humidity. Heat from their bodies radiates to two black 3 by 15-foot absorption panels in the walls. These panels are kept chilled by hidden pipes that

82 M. Jardine, Calif
Consumers Corp 23 St W.
Defusion Blvd. Los Angeles

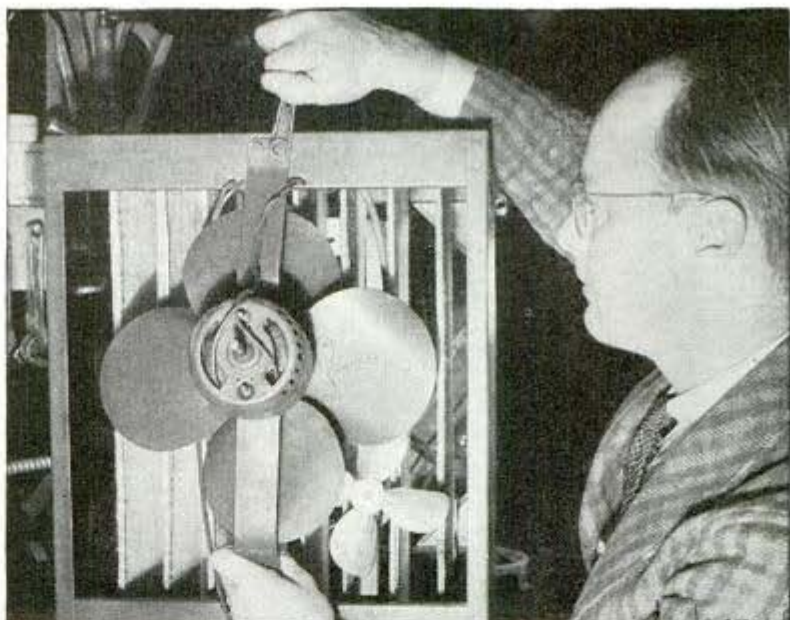
K1431

BEAT the HEAT

circulate water at 40 degrees. Troughs along the bottoms of the panels collect the moisture that condenses on the surfaces. In the winter, hot water in the pipes keeps the panels warm and thus warms by radiation, occupants of the room.

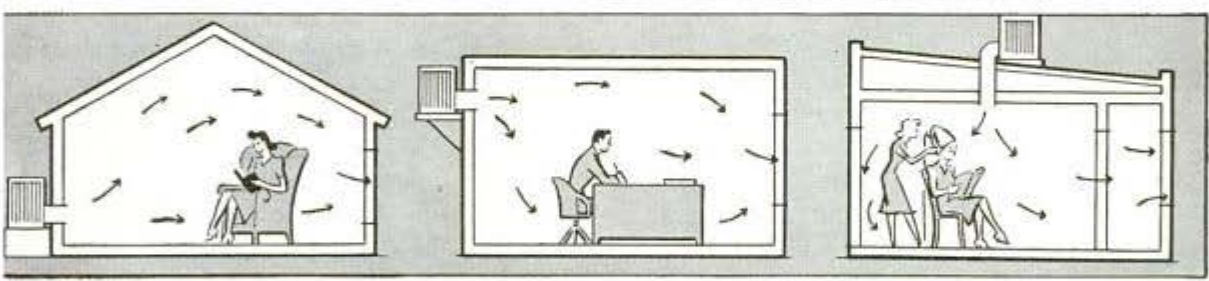
Experts of mechanical weather can't agree on the future of radiant heating and cooling, although it appears to have a place at least as an adjunct to other methods of air conditioning.

Big strides in air conditioning have been made in the last few years but even at \$1,000, the cost of



Main circulating fan of small evaporative cooler. Below, sketches of ways in which evaporative coolers may be installed (left to right) in the home, the office and the shop

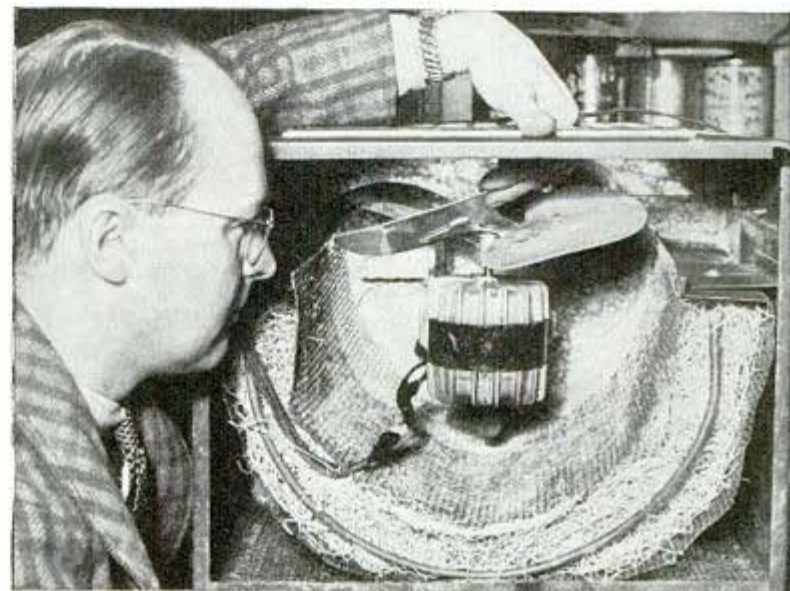
see opposite page



mechanical refrigeration for the average home is beyond the ordinary purse. To cut operating costs, some mechanical cooling systems operate only part of the time, circulating fresh air through the rooms at night, using cold water for cooling during the morning hours, and switching over to mechanical refrigeration to combat the peak afternoon temperatures.

At the University of Illinois' research residence an air-conditioning system is being studied that first dehumidifies the incoming fresh warm air,

Below, looking down into portable evaporative cooler. The electric fan draws air through saturated curved wall of excelsior and blows the cooled air out into the room

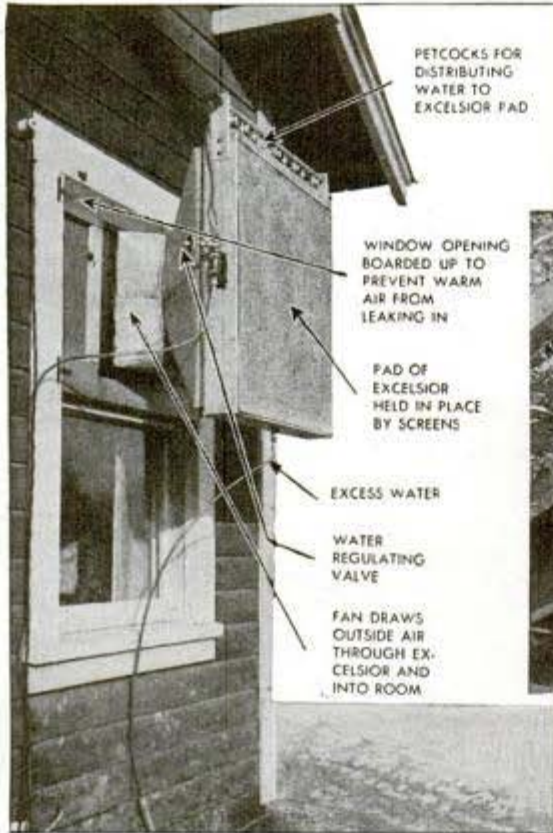


K14-31



Above, various types of blades used on special-purpose cooling fans

Below, how a small evaporative cooler may be attached to window opening of room



cools it by the evaporation of water, and then circulates the cooled air through the registers of the home heating system. Even this system runs into the stumbling block of costs: "It isn't the heat, it's the humidity." A dry atmosphere is much more comfortable than a moist atmosphere at the same temperature, but so far no inexpensive way to remove moisture from the air has been found. Silica gel, calcium chloride and several other chemical compounds readily absorb water from the air but once loaded with water they must be dried out before being used again.

In the meantime, how are you going to keep cool this summer? One big aid that hasn't always been used properly is attic ventilation. On a hot day, dead air in the attic may attain a temperature of 150 degrees and this heat radiates into the rooms below. A large attic fan with enough roof ventilation to permit positive air circulation will carry this heat load away. Everyone knows how much cooler it is to drive a car with the windows lowered to admit a breeze than it is to sit in the same car, parked in the sun, with the windows closed. This comparison illustrates the value of attic ventilation. The main thing is to use a large fan, ordinarily one of around three feet in diameter. If you have stairs leading up to the attic and down to the cellar, try keeping the doors open with all the outside doors and windows closed while the attic fan is going.

Even without a fan in the attic you can keep the house relatively cool by providing



Installing tin foil above ceiling of new home to form shield against high temperatures and to prevent hot attic air from entering room below

K1431

2253

plenty of ventilation under the eaves, keeping all windows open at night so that the interior of the house can cool off, and keeping the windows closed all morning to prevent the heat from getting in. Awnings outside the windows keep out a lot more heat than do interior shades. A white or light-colored roof reflects heat instead of absorbing it and some of the new insulation materials, placed in the upper ceiling, serve to keep out summer heat just as well as they keep heat in during winter.

Unless you live in a very humid part of the country you might try an evaporative cooler that you may either make or buy. These "hay coolers" got their start in the dry desert regions of the southwest and for years it was assumed that they would work only in the desert. Although they are most satisfactory in dry climates they are being used successfully in many parts of the country. These coolers use an electric fan to pull fresh outside air through a thick screen or pad of moist excelsior or other material and to circulate this cooled air through a room. On a hot day such an evaporative cooler will reduce the room temperature 15 degrees or more, at the same time increasing the humidity. In humid climates it is important to leave a window partly open, opposite the cooler, so that the moistened air may circulate out of the room. Occasionally the increase in humidity becomes objectionably high, at which times the water to the cooling pad should be shut off and the fan left on to provide the cooling benefit of air circulation alone.

Water evaporation is also the principle in a number of car coolers that keep the temperature down as long as the car is moving.

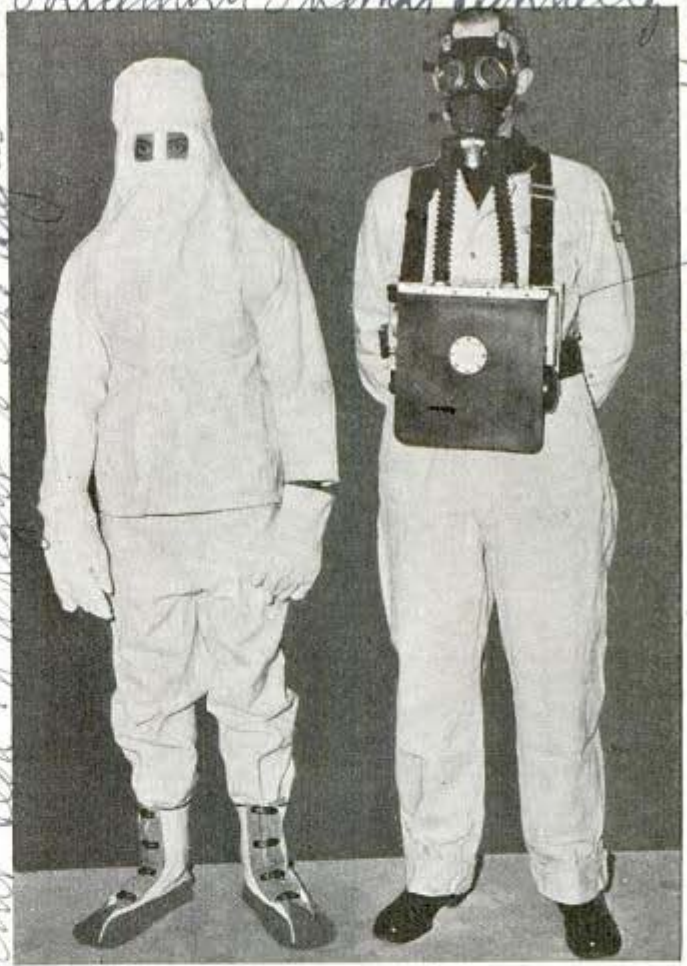
Portable room coolers that are enclosed in attractive metal cases and that need to be attached only to the electrical system of the home are on the market. Such coolers contain their own water

(Continued to page 168)

JUNE, 1941

Asbestos-Clad Rescue Squads Walk Through Flames

Policeman Thomas Donnelly



Flames and gas fumes do not stop these hardy rescuers. Suit at left is made of asbestos; right, new type "breather" mask

Emergency squads of police and fire departments at Rock Island, Ill., keep asbestos suits in readiness so they may enter burning buildings to rescue trapped persons. The garments are of new design. The men also wear a new type "breather" gas mask to guard against inhaling poisonous vapors.

2249

Lamp Socket Mounted by Suction Cup Clings to Smooth Surfaces

Fastened to tile, glass or other smooth surfaces by means of a substantial vacuum cup, an electric light socket is useful for show-cases and glass-door closets in the home or in stores. The large vacuum cup stays in place indefinitely.



A reflector on the bulb casts the light inward. The cord may be strung to the nearest wall outlet.

Dallard & Co
1141 Franklin Ave

rec 82

rec June 1940 70.

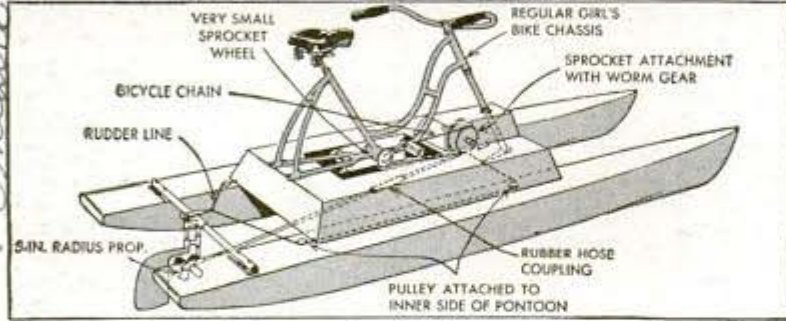
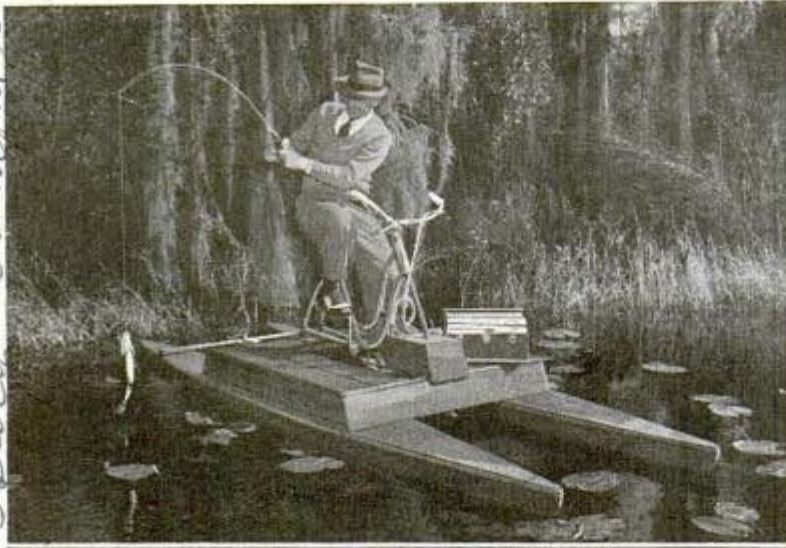
Conf. file on U.S. Dept. of the Interior Rock Island Ill.

Policeman Harry Weinhardt

Columbus, Ohio

L 192

Water-Going Bike on Pontoons Useful for Fisherman



Fisherman's boat made by mounting bicycle on two pontoons leaves hands free to handle rod. Bottom, diagram shows construction of the water bike

Mounting a bicycle on pontoons and hooking the sprocket to a propeller resulted in a foot-powered boat that is used for fishing in Dupree Gardens, near Tampa, Fla. Fishermen find that it solves the problem of fishing alone by relieving them of handling oars while using the rod. The water bike was assembled by erecting the frame of a girl's bicycle on a platform between two pontoons and using a rubber hose to couple two parts of the propeller shaft which is driven by a worm gear attached to the second sprocket.

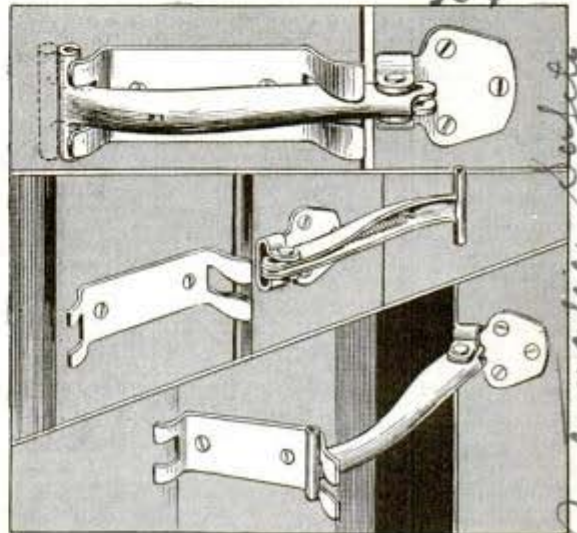
Germ-Killing Mist Sterilizes Air Without Affecting Humans

An odorless, unnoticeable mist of propylene glycol, sprayed into the air, will kill many disease germs, according to research workers at University of Chicago Medical School who developed the process. Although extensive studies are yet to be made, tests thus far have shown that the

method works when the mist is sprayed into germ-laden air, such as that resulting from a cough or sneeze. Since the chemical is said to have no ill effects on humans in the quantities used, its application in sickrooms, air-raid shelters, schools, factories and the like may cut down, or prevent entirely, the spread of certain air-borne diseases.

Latch for Windows Or Doors Allows Partial Opening

Only a screwdriver is needed to install a simple safety latch that fits nearly all doors and hinged windows, needs no keys and is locked on the inside. It is claimed that the latch cannot be picked, opened by a master key or unlatched from the outside. Without unlocking it, the door or window may be opened partly for ventilation, and the housewife may take a safe peek at callers before unlatching the door to admit them.



Top, latch locked with door shut; center, latch in unlatched position; bottom, door locked partly open

POPULAR MECHANICS

Ref: R. E. Mc Carthy Tampa Theatre Bldg. Tampa Fla. Science Service Feb 26, 1928

Delmar West L 80 Latch Co 5/6 Penkell Latch Co 504 Automobile Safety Latch Co

86 Mrs. C. H. Robertson Edward Bigg. Benj. J. Miller, Felina Baker.

L229

Oscar Brenner

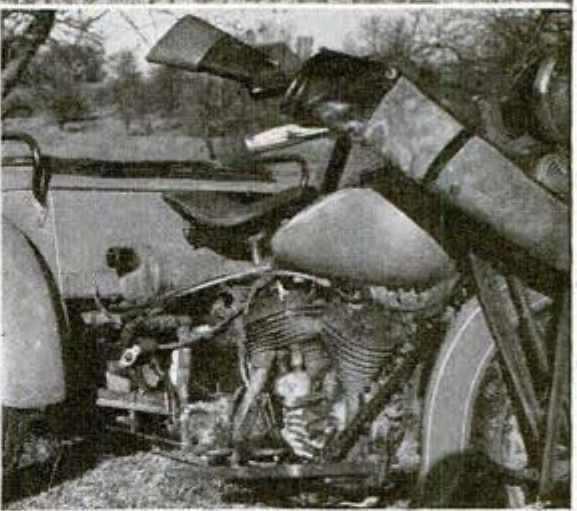
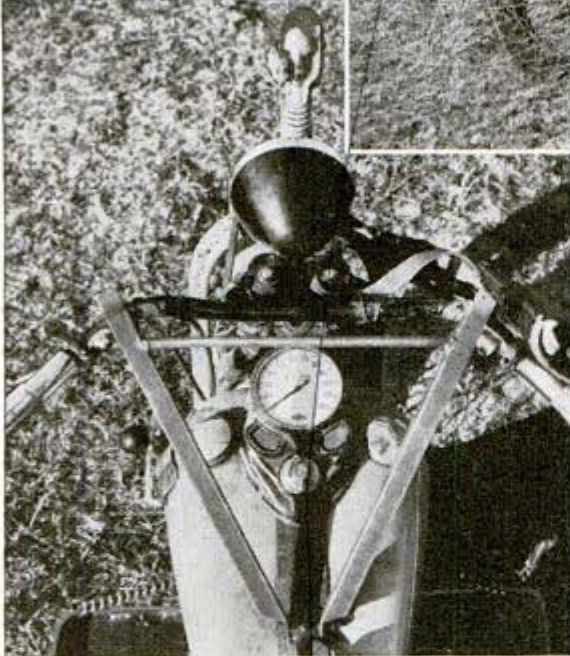
Three-Wheel Motorcycle for Crippled Hunter

652 N. Main St

Three-wheel motorcycle, right, easily rides through scrub and young saplings. Below, "wishbone" lowered to hold front wheel in straight line. Boot to right of hunter, lower right, keeps shotgun in quick reach



Wishbone wheel

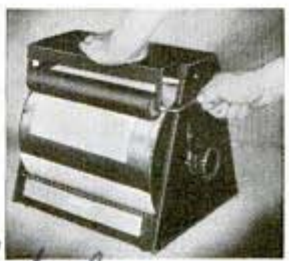


Loss of a leg in a hunting accident did not deter M. O. Devers of Dayton, O., from continuing his favorite sport. He sought the aid of a Harley-Davidson representative in rebuilding a motorcycle that would enable him to rove through fields. Deciding that a three-wheeler was needed, they first reduced the gear ratio, permitting the motorcycle to be driven at a speed comparable to a normal walk. To keep it traveling in a straight line with "hands off," a

"wishbone" is fastened to the front of the saddle so that it may be lowered to engage the handlebars firmly. Since much of the driving would be over rough terrain, the regular exhaust was removed and an automobile muffler installed behind the saddle. In this position the muffler is well off the ground, making the exhaust almost inaudible so that the game is not frightened by the noise. The muffler also serves as a heater for the hunter.

2262 Squeegee Roller Built on Electric Photoprint Dryer Saves an Extra Step

One extra step in printing photographs is saved by an electric dryer that has a built-in squeegee roller. Not only is the separate application of a hand roller eliminated, but prints can be applied faster and easier. The whole drying operation takes four to eight minutes. Operating on any current, the dryer has a 12 by 18-inch chromium surface suitable for photographs, photostats and blueprints. It will not scorch the prints even if left on indefinitely.

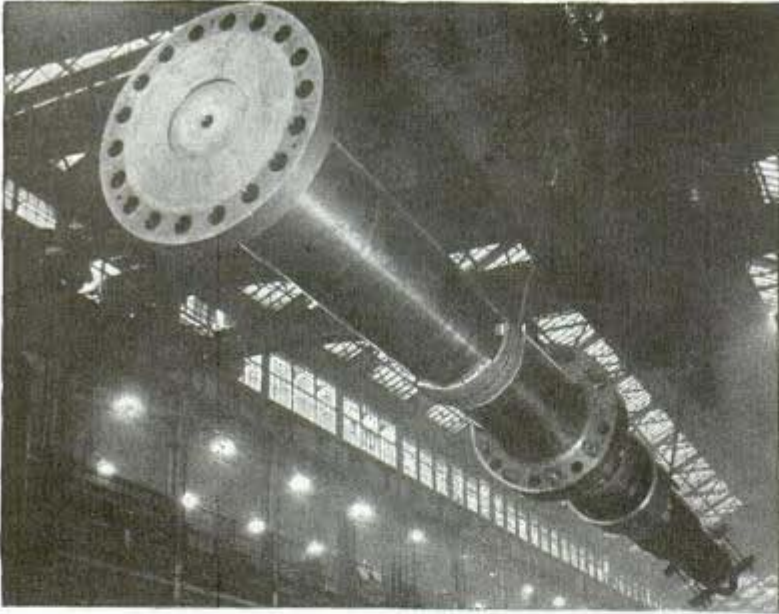


JUNE, 1941

Warren Electric Appliance Co., Warren, Ohio 87

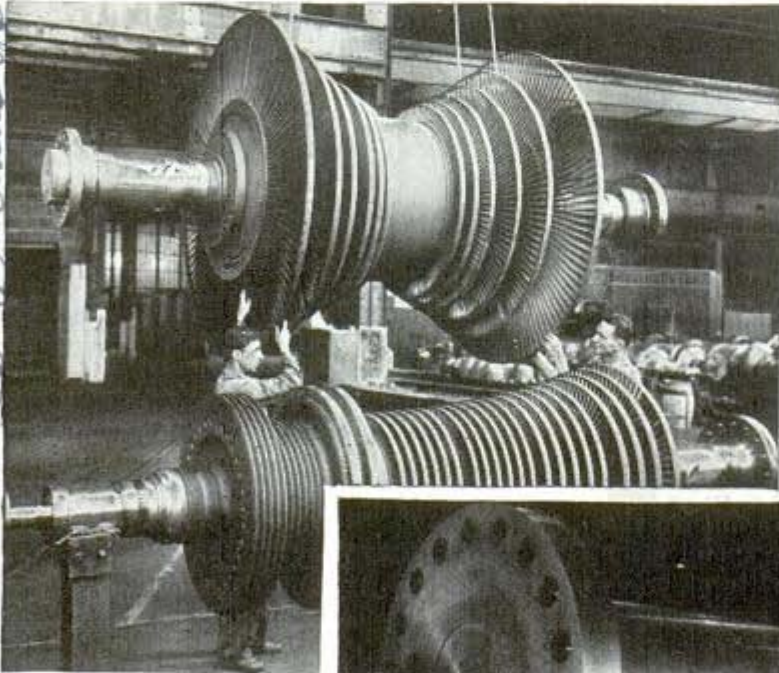
SUPER-POWER *from*

Westinghouse Steam and Turbine Plant. and Philadelphia



150-ton shaft which is part of waterwheel generator being installed at Grand Coulee Dam. The generator is rated at 108,000 kilowatts, making it the largest single power generating unit in the world

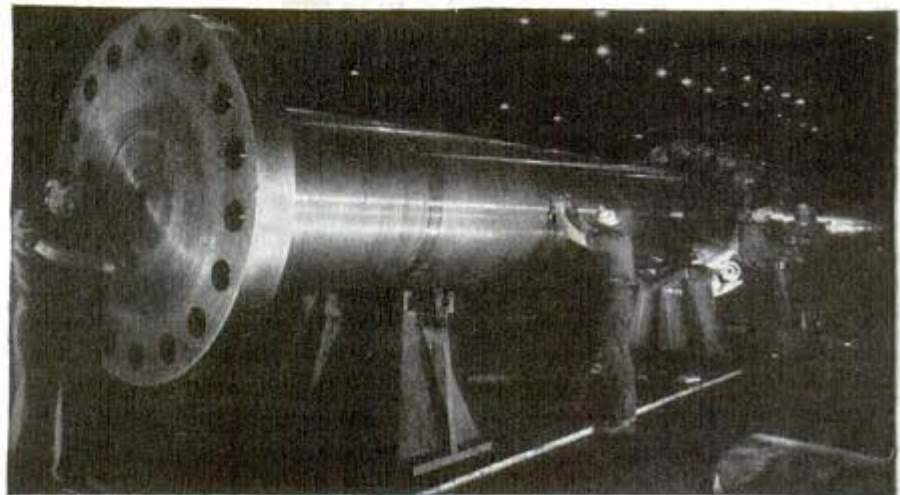
LAATEST of the mighty machines developed to produce vast quantities of power is the world's largest waterwheel generator now being installed at Grand Coulee Dam. It will go into service this summer. Built by Westinghouse, this machine is composed of 1,000 tons of parts, the heaviest of which are the steel frame, the "spider"—a single piece of steel weighing 50 tons and used to support the rotating mechanism on a shaft—and the 56-foot shaft, which weighs 150 tons and is so long it had to be made in two parts and bolted together.



Two rotors for steam turbine together weigh nearly 38,000 pounds, yet are made like a fine watch

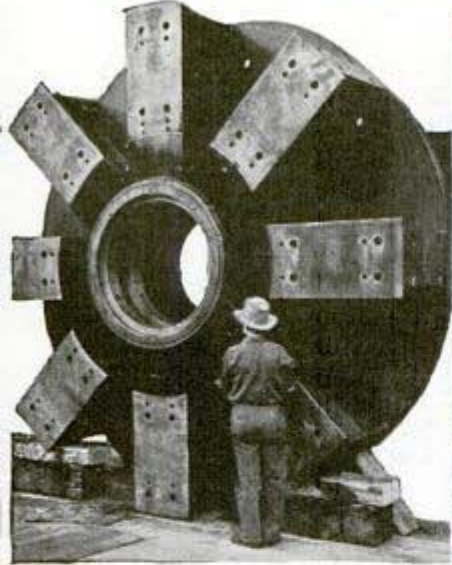
The generator now being installed is the first of three identical super-machines planned for Grand Coulee. Each is designed to produce 30 percent more power than any other waterwheel generator ever built in this country. Combined output of the three giants will be sufficient to light about 5,500,000 60-watt house lamps. If the 435,000

Putting the finishing touches (right) on gigantic shaft of waterwheel generator for Grand Coulee



L168

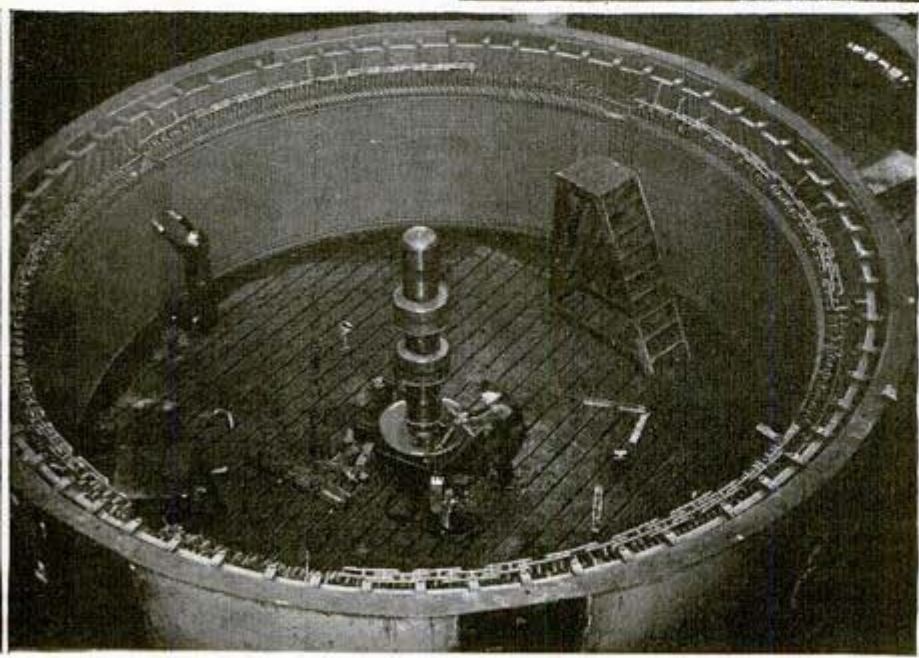
SUPER-MACHINES



Lower end of thrust-bearing support in huge power-generating unit already in use at Boulder Dam where many super-machines are at work



Leveling top edge of stationary member for one of the Grand Coulee waterwheel generators. This scene is in the Westinghouse works



Left, this circle of steel and copper windings is the stator of Grand Coulee waterwheel generator, 30 percent more powerful than any of its kind in the United States

horsepower of the three could be harnessed to the task, they could lift a 33,000-ton battleship more than 200 feet in one minute. When installed at Grand Coulee, the generators will help drive six 65,000-horsepower motor-driven pumps, each capable of lifting 12,000 gallons of water a second and speeding it on its way to irrigate 1,200,000 acres of arid but potentially fertile farm land in the Columbia basin of

central Washington. The mammoth generators will be operated by water rushing through the outlet pipes of the 46-story dam astride the Columbia river. This force will spin huge waterwheels which turn the generators' rotors—Gargantuan axles 30 feet in diameter—120 times a minute. The outer edges will travel approximately 130 miles an hour to convert the water's force into electrical energy.

O'Snell Shoe Co Humboldt Tenn

2219

Soldiers Cross Barbed Wire With Aid of Mat



How to cross a barbed wire barricade without displacing it is one of the lessons taught recruits at Fort Custer, Mich. A special mat, made of chicken wire interwoven with canvas, is unrolled across the barbed wire entanglement, covering the barbs and providing a pathway over which the detail may run.

Tossing mat over barbed wire barrier, left, enables troops to cross it with ease, below

2221

Shoes Remove Body Static

For protection against explosions where tiny sparks created by static electricity in the human body may ignite highly inflammable gases, a patented shoe now offered carries off the static charge before it can make a spark. Tests made by the manufacturer show that the shoes are two-thirds more efficient than necessary to establish an electrical ground. They will be worn in hospitals by those handling anesthetics, in chemical plants and in arsenals.



Motor Wheel for Heavy Towing Turns in Small Space

Factory mule gets power to tow heavy loads from engine mounted within wheel which is turned around for backing up



Handling medium-heavy loads in the factory is simplified by a motor wheel designed to move standard lift-trucks, towing trucks and other vehicles commonly used. Its power arrangement permits a 38-inch turning radius, and backing is accomplished by simply reversing the steering wheel. Known technically as a factory mule, it can be handled with ease through narrow aisles and

*R. L. Eaglesfield
301 S. La Salle
Indianapolis, Ind*

Original Illustration L 220

doorways, as well as in freight cars, trucks or elevators. It is built with either a gasoline engine, or an electric motor for lighter work. Mounted within a large wheel, the engine supplies power through a sprocket operating in a ring gear inside the rim, giving a gear reduction of 136 to one. The brake and clutch are operated by a rod passing through the steering column, which also supports the throttle control.

L 236

Noncapsizable Boat For Army Run by Diesel Engine

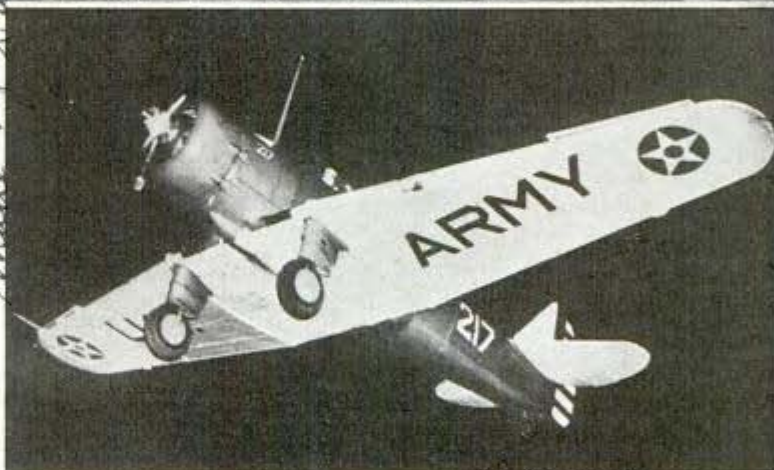
Constructed to withstand rough seas without capsizing, a new-type whaleboat craft to be used by the U. S. Army Quartermaster's corps in the Panama Canal Zone, recently went through rigid tests. Twenty-six feet long and equipped with a 40-horsepower Diesel engine, the boat was designed by Arno Apel, racing pilot and flyer, and built at a cost of \$4,185 by Ventnor Boat Works, near Atlantic City, N. J. More of the boats may be ordered if this one proves satisfactory.

Ventnor, N. J.



Safe boat built for army can ride rough sea without danger of capsizing

Four-Bulb Flash Takes Photo Of Plane in Air at Night



Photographer, top, demonstrates how he used four flash bulbs in taking night picture of airplane, bottom, while flying at 3,000-foot altitude

Using four flash bulbs fired simultaneously, an army photographer obtained an unusual night aerial photograph of a training plane, the BT-9, while in flight over Randolph Field, Tex. Bulbs were mounted above the camera and flashed by the synchronizer as the photographer's plane flew close to the trainer 3,000 feet above the field.

Look in the index starting on page 4-A to learn where to buy commercial products described in this magazine. To be sure of securing best results—say you saw it in Popular Mechanics.

Made by Staff Sergeant Leslie J. Blain
Staff Sgt. Leslie J. Blain

acme

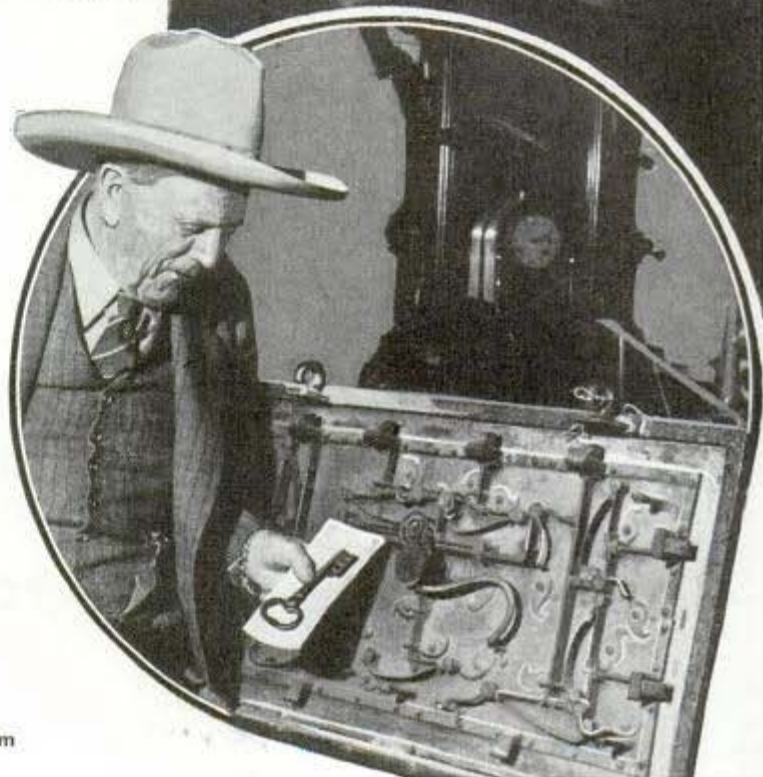
IS YOUR ATTIC



Left, exploring storage room may yield dividends in old furniture worth real money. Right, Venetian mirror like this brings hundreds of dollars today

STYLES in antiques are changing and it may be that some of the "second hand" things stored in your attic have a real market value today. Good prices are being paid for articles that the junkman would hardly have carted away in the past.

Everyone has heard stories of rare old museum pieces, worth thousands of dollars, tucked away and forgotten in old homes. Unfortunately most prizes like that have already been found. But much of the household equipment that was used in the last century is increasing in value. Ten years ago or so the ponderous furniture of the Victorian age was regarded as ugly and unfashionable. Then a couple of New York decorators began using a few Victorian pieces in modern settings and a new trend was started. The old horse-hair chairs and sofas of grandmother's time, reupholstered in attractive fabrics, proved to have



Right, complicated levers and locking system inside lid of old chest operated by key

Cont. Thomas E. Stinson, Jr. / Los Angeles
372 Franklin Ave.

K1350

Ref: nearby antique dealer K1350

A TREASURE CHEST?



Hand-painted porcelain clock made in last century is worth about \$100 today. Circle, collection of furniture, mostly of Victorian age, now in demand



Silver-plated fruit dish, about 100 years old, which brings a good price now

an appeal that is restoring them to popularity. Fabulous prices aren't being paid for such old furniture, yet a broken down chair may bring you \$25 and an old sofa twice as much. A well-stocked attic may contain \$1,000 worth or more of old "junk."

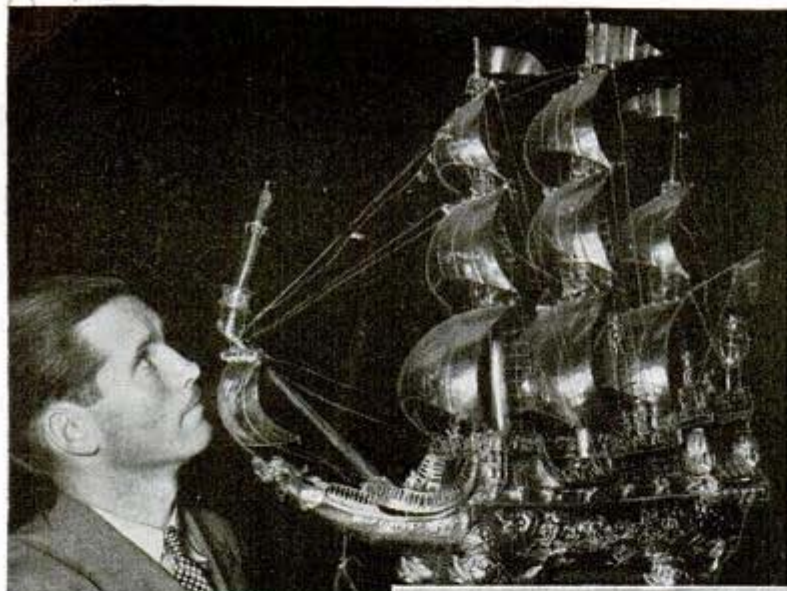
From start to finish, styles changed little during the Victorian age, which was roughly the last three quarters of the last

century. Yet you will get more for a piece of furniture built before the Civil War than a similar piece built in the 80's. By the later date first-growth wood was no longer available and the machine was taking the place of hand craftsmanship.

If you should be lucky enough to find a carved rosewood parlor set, made by John Belter in the 40's, you would have a treasure for which collectors would give several thousand dollars. Belter originated a laminating process for rosewood and his process died with him. His pieces are distinguished by thick borders of carving that usually pierce the wood and that usually are of vines and leaves.

An old marble-topped wash stand is worth 10 or 15 dollars and you would hardly recognize it later on after it is converted into a smart radio cabinet. Marble-topped tables also are being cut down to serve as coffee tables.

The fact is that practically everything made during the Victorian age has regained popularity and is in demand. As far as old furniture is concerned, so much of



Silver-plated galleon model that sells for about \$500. Right, old barometer-thermometer

it still exists that in most cases prices must compete with the cost of modern furniture, though even this is an improvement over the prices it formerly commanded. One exception is the average old bedroom set, for which there is still little demand. Ten years from now, it may be, these pieces will pick up value.

Below, assembling Venetian glass chandelier stored for years. It will bring \$100 when wired



The flowery china of the last century is the latest style again and old silver and old jewelry are now bringing high prices. Astral lamps, complete with crystal globes and sparkling prisms, are worth \$50 or more. Artificial flowers under glass domes, pictures made of horsehair and sea shells, and other old parlor decorations now can be sold readily. Sandwich glass, ruby glass, and "lion" glass, much of which was turned out in wholesale lots and given away as grocery premiums, now have a much higher value than they had originally. One good place to look for old glassware is in the cellar.

Do you have a pair of rusted legs from an old sewing machine, lying under the porch or leaning against the back fence? These old bases are being repainted and fitted with marble table tops, to be used in the patio or sun porch. If you find an old locket and chain that has been saved for years you can get a good price for it now, or it will make a very desirable gift. In the attic you are apt to find a box or two of old blown glass Christmas tree decorations. Many of these fragile pieces are collectors' items now. In nearly every collection of old things there is a gun or two and although prices for guns start at only a few dollars they are easy to sell. Even radiator emblems and other parts of early automobiles have a value now.

The old pier mirrors that extend down to the

K1350

L272

floor, out of style for decades, are again in demand and if you find one that you don't wish to sell you might bring it downstairs and put it on display again.

Valuable antiques are sometimes found in strange places and once a Los Angeles dealer discovered a \$450 sideboard in an outhouse, being used as a chicken roost. Refinished, the piece was a collectors' delight and it was even rented to a motion picture studio that needed some authentic-appearing furniture in a period picture. Country auctions and the auctions at which old estates are broken up are two fruitful sources of antiques. W. Parker Lyon, who has amassed a museum full of early California historical material that ranges from hoop skirts to fire engines, first goes to the fire department of a town when he is on a hunt for antiques. The fire-prevention bureau of the department, he knows, has listed all the attics and cellars that are stored full of old combustible material and these accumulations often contain just the sort of things he wants.

One of the first relics Lyon bought was an old Wells Fargo safe. He paid \$50 for it, then blew the rusted door open with dynamite. Inside was \$2,000 in gold coins as well as dozens of Pony Express stamps. Another time, having paid \$150 for 30 boxes and crates, unopened, at a storage company auction, Lyon opened them up and found a collection of old silver, a diamond ring, a first edition of Mark Twain, as well as Worcester and Doulton china and glass and other valuables.

Lyon paid half a dollar for a collection of old letters, once, and later found that one of them was signed by Thomas Jefferson. He traded this letter for a large pair of gold scales, used in the early mining days to weigh out gold dust, and later discovered that part of the scales, supposed to be gold plated, were actually of solid gold. After these parts were replaced with brass Lyon had a profit of \$1,850 on his original half dollar investment, and the scales as well. But discoveries such as these are exceptional and don't happen every day.

Collecting of one sort or another has become such a universal hobby that practically every old thing has a market value. Some people collect buttons and a large collection is apt to include 20,000 items or so. Buttons have been made of precious

Windshield Worn on Face Protects Army Cyclist

Prof. Iselen Weinger



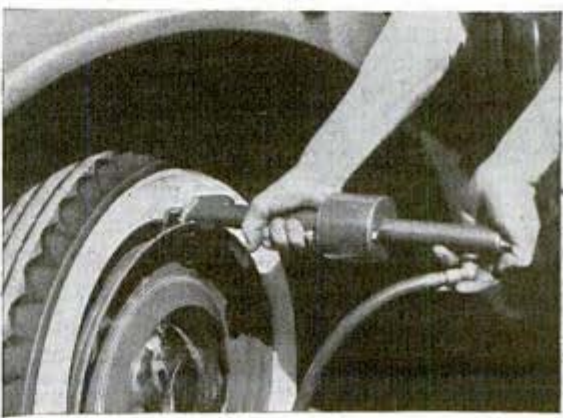
Face windshield does not block army cyclist's vision

As a defense against wind, dust and rain, a transparent face shield is worn by a private of the 19th Field Artillery, Fort Custer, Mich., while he rides in a motorcycle sidecar. Made of Cellophane, the mask fully covers the face.

L225

Air-Powered Tool Removes Tires From Safety-Rim Wheels

Little physical effort is required in removing tires with the aid of a special tool operated by air pressure, and designed particularly for prying tires off safety rim wheels. Use of the tool makes it unnecessary to take the wheel off the car.



This tool uses air power to pry tire off safety rim

acvle
San Angeles
Ballom Tire Mould Co.
527 Ceres Ave.

(Continued to page 173)

JUNE, 1941

See Sept. 1934-38

*161 Virginia Road
San Mereno, Calif.*

P 164

One-Man Tiltable Stretcher Can Be Carried on Back

*Australian
invention*



Here is how one man carries bomb victim on "vertical" stretcher

One man, using a "vertical" stretcher that does not have to be kept in horizontal position, is able to carry a victim from a bombed building without assistance. The patient is held firmly by straps and footrest so he cannot slip downward or sidewise even when the stretcher is tilted.

bones grow is being studied by use of radioactive strontium, and radioactive iodine is revealing facts about the thyroid gland. Plant growth and nutrition are studied by feeding a solution of radioactive elements and following their course through roots, stems and leaves.

P 265

"Block System" for Airline Shows Planes in Flight

Airline dispatchers will be able to tell quickly the exact position of any airplane in flight with the aid of an "automatic block signal" completed recently by aviation engineers. It is a panel consisting of a series of straight tracks for all of the airline's routes with the cities indicated in their proper places. Each plane, while in flight, is represented by a miniature ship moving along a track at the same relative speed. The "blocks" are separated by slots, and if a pilot fails to report his position before the miniature ship reaches the slot, it will drop into the slot and sound an alarm, warning the dispatcher to check by radio with the pilot. When the pilot sends in his report, the dispatcher closes the slot so the tiny ship may pass into the next block. One airline plans to install five block systems.

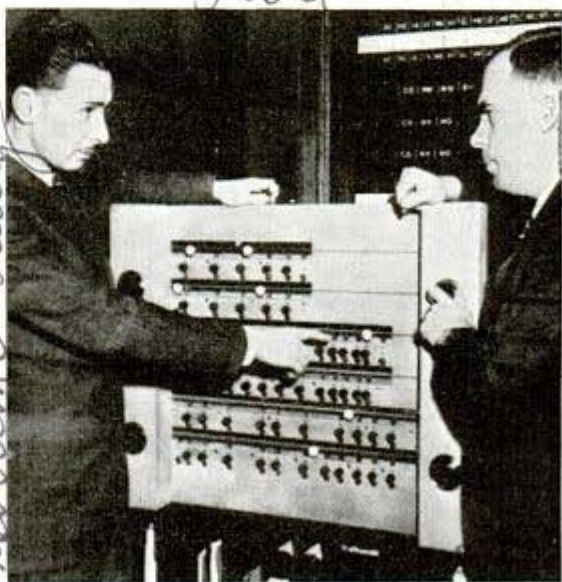
TWA Radio

TWA

P 301

Four New Radioactive Substances Made With Atom Smasher

Smashing atoms with Prof. Ernest O. Lawrence's cyclotron at University of California has added four artificial radioactive substances to those already known, bringing the total to about 360, more than 100 of which were discovered at the university. The four new radioactive substances are specimens of germanium, an element similar to lead, and one of the last of the 92 elements to be investigated for radioactive species. Some of the radioactive elements have proved valuable in medical and biological research. For instance, radio-phosphorus is being used in experiments on the treatment of leukemia. How teeth and



Tiny planes moving on board show location of planes

Edward R. Morgan

Ernest O. Lawrence

Science Service 3/24/41

*Dr. H. I. Seaborg
U of California
Berkeley, Calif*



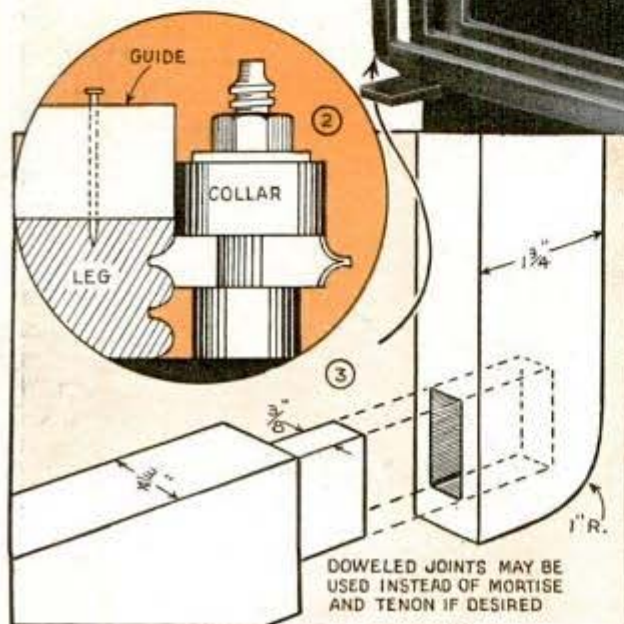
The CRAFTSMAN

Triple-Leg, Glass-Top Coffee Table

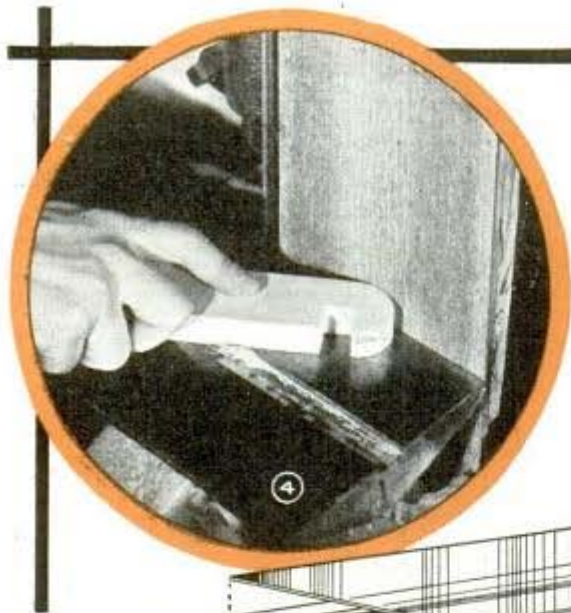
By W. W. Buffmire

WHILE you can use this coffee table at your davenport as in Fig. 1, from where an ash tray or a box of candy can be reached conveniently, you'll find it equally attractive and convenient when placed between two chairs in front of the fireplace. For a dark effect use black walnut; for a light effect, maple or birch. The original table was made to stand about 17 in. high, but you can vary this to suit the pieces with which it is to be used.

Begin with the

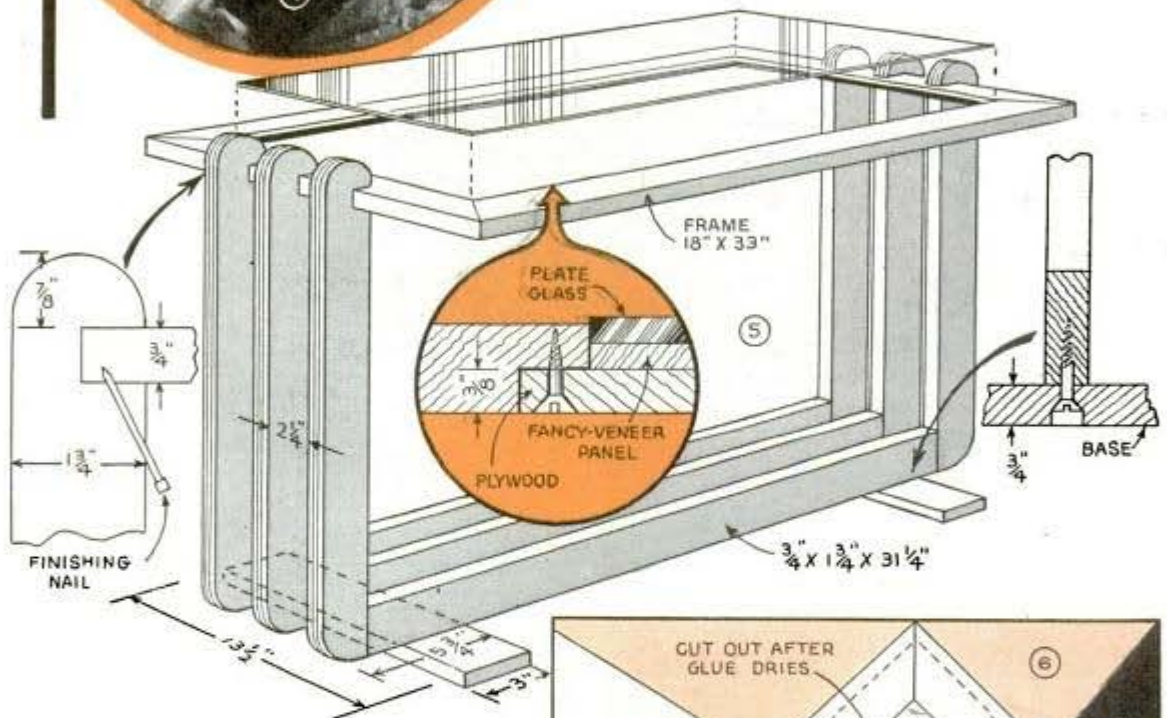


three U-shape legs which should be made identical in size. The notches at the top of the legs should fit the frame snugly. It is best to test these first with a scrap of stock to see that they do not fit too tightly. The three pieces of each leg may be joined together with a mortise and tenon as in Fig. 3, or fastened with dowels. At this stage, the rounded ends at the top of the legs are sanded to shape as in Fig. 4, but it is best not to round the lower corners until after gluing. The outer edges of



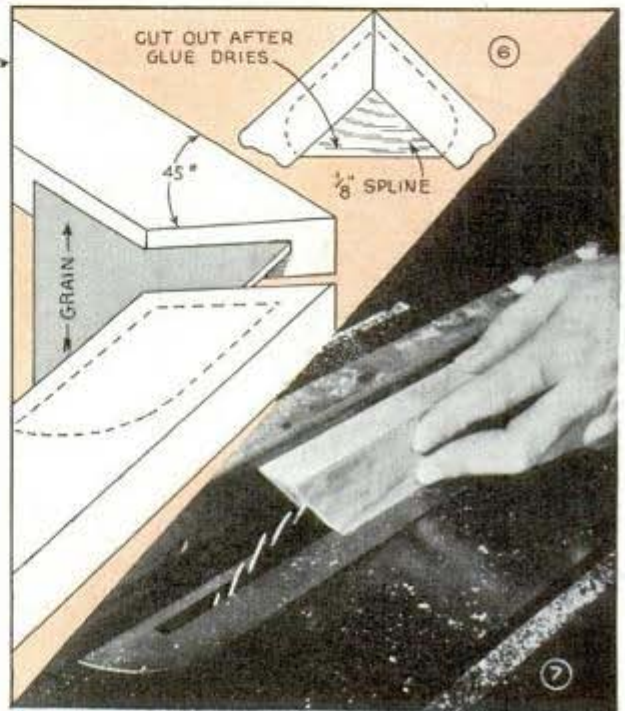
each cut from the face side of the work, and note that the grain of the spline should run across the joint for strength. After gluing, the portion of the spline extending into the frame opening is cut away.

To assemble the table, slide each leg assembly in place over the edge of the frame and space them $2\frac{1}{4}$ in. apart. Finishing nails may be used to fasten the legs at the top, while at the bottom screws are used in attaching a base piece at each end. The screws are driven up from the bottom as shown in the detail to the right of Fig. 5, being careful to see that the three legs are parallel. A beautifully figured panel should



the legs may be reeded or left plain. Fig. 2 shows how the beads are cut quickly on a shaper, but if the work must be done by hand, a combination plane fitted with a reeding blade can be used along the straight edges, and then continuing the beads around the curved ends with a file. When assembling the side and bottom pieces of the legs, a spreader strip placed between the legs at the top will keep the sides from being forced inward when clamping pressure is applied at the bottom.

Prepare the rabbeted top as you would a picture frame, mitering the pieces accurately to form perfect-fitting corners. Fig. 6 shows how a spline is fitted at the corners in a saw groove run in each end as in Fig. 7. Make



be used under the glass top and it may be finished the same as the rest of the table, or in contrast. Although plate glass is preferable for the top, double-strength window glass is satisfactory. The edges should be ground and polished.

When the original table, which was made of walnut, was finished, walnut paste filler was applied first. No other stain was used. After 48 hrs.,

MATERIAL LIST

6 pcs. $\frac{3}{4}$ x $1\frac{3}{4}$ x $17\frac{1}{2}$ in.—Legs
 3 pcs. $\frac{3}{4}$ x $1\frac{3}{4}$ x $33\frac{1}{2}$ in.—Legs
 2 pcs. $\frac{3}{4}$ x 2 x 33 in.—Top frame
 2 pcs. $\frac{3}{4}$ x 2 x 18 in.—Top frame
 2 pcs. $\frac{3}{4}$ x 3 x $13\frac{1}{2}$ in.—Base
 1 pc. $\frac{1}{4}$ x 15 x 30 in.—Veneer panel
 1 pc. $\frac{3}{16}$ x 14 x 29 in.—Glass top

two coats of transparent lacquer sealer were sprayed on and allowed to dry thoroughly, after which the wood was sanded lightly with No. 7-0 paper, dusted, and then two wet coats of clear lacquer, cut to a 50-50 proportion, were applied. After this had dried for 24 hrs., rubbing was done with 3F pumice and water; then with fine pumice and oil, used on a thick felt pad.

EVERYBODY IS AN INVENTOR

Nearly everybody has discovered some kink or short-cut to solve one of those seemingly trivial problems encountered in every home or in a person's work, hobby and play. But the solution may have saved time, money and energy. We pay for such ideas. Submit a sketch or photo and a brief description to our Homecraft Editor. If acceptable for publication, we will send you a check promptly and if we cannot use it, the material will be returned.

Entrance Gate of Iron Wheels Adds Novel Rural Touch



Discarded farm-implement wheels and belt pulleys welded together in progressively smaller sizes form an attractive gate with a rural touch at the entrance of a Minnesota country club. The gate is made in two parts and is pivoted to the posts supporting the club sign over the entrance driveway. Similar gates of smaller wheels will add an unusual touch to farms, summer camps, etc.

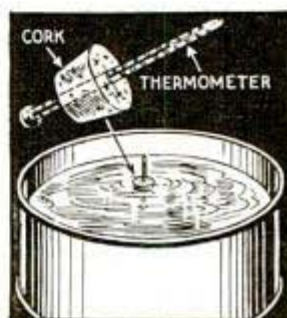
Abrasive on Ink Bottle Makes It Slipproof



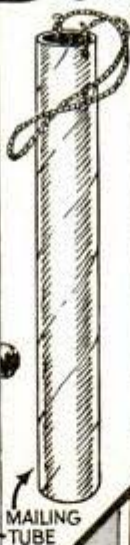
A good way to keep an ink bottle from slipping off of an inclined drawing board is to cement a disk of abrasive paper to the bottom and tack another piece of paper at the upper corner of your drawing board. Then when the bottle is set on the paper the two abrasive surfaces prevent any tendency of the bottle to slide down the inclined surface of the drawing board.

Thermometer Floats on Cork to Check Liquids

When a thermometer must be kept in liquids for a check on the temperature, just insert it in a cork as indicated and it will float on top where it can be read at a glance. The bulb on the underside of the cork acts as a counterweight to keep the thermometer in a vertical position so that the reading can be noted at regular intervals.

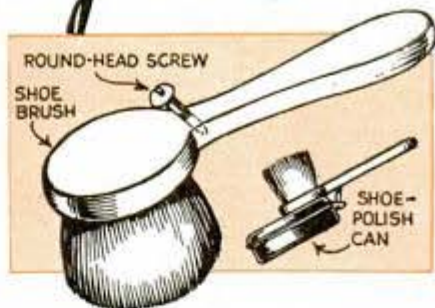


Solving HOME



MAILING TUBE

Umbrella hung up neatly by storing it in large cardboard mailing tube

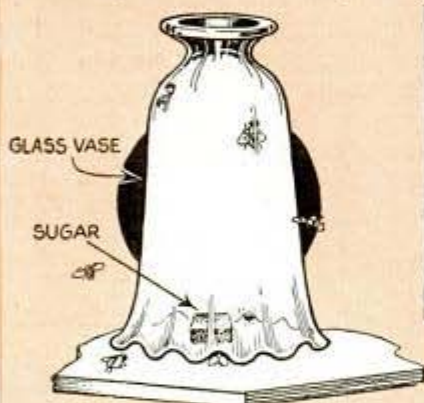


ROUND-HEAD SCREW

SHOE BRUSH

SHOE-POLISH CAN

You will always have a pry at hand to remove tight-fitting lids from shoe-polish cans if a screw is driven at an angle into the handle of the applicator brush as above



GLASS VASE

SUGAR

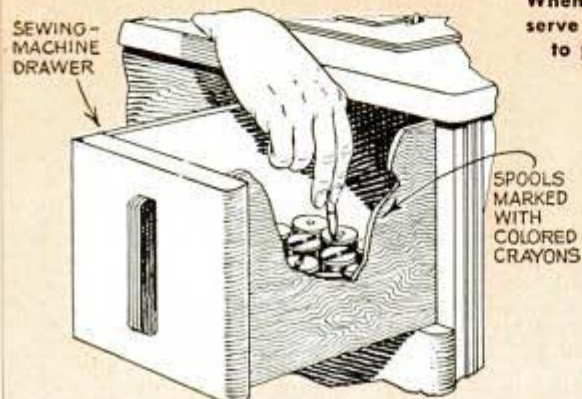
An emergency fly trap may be improvised by inverting a flower vase over a lump of sugar or a few drops of sirup placed on a piece of paper



RULER

CLOTHESPIN

When laundering a few articles in a pan a ruler will serve as a clothes stick if a clothespin is slipped over it to prevent hot water running down on your hand



SEWING-MACHINE DRAWER

SPOOLS MARKED WITH COLORED CRAYONS

Thread on spools kept in a deep, narrow drawer can be identified by marking the tops of the spools with crayons

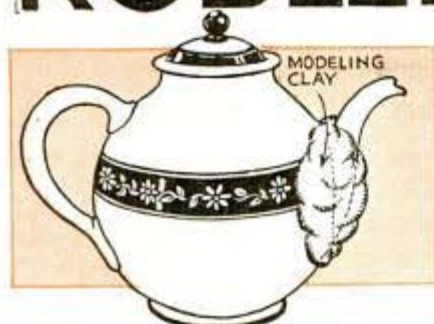


RUBBER TEETHING RING

CUT

You can get a good grip on screw caps to remove them by using a teething ring. A chain in the ring will permit hanging it on a wall

PROBLEMS



Modeling clay serves nicely as a "clamp" for holding mended chinaware together while the cement dries. The clay remains pliable so it's easy to remove



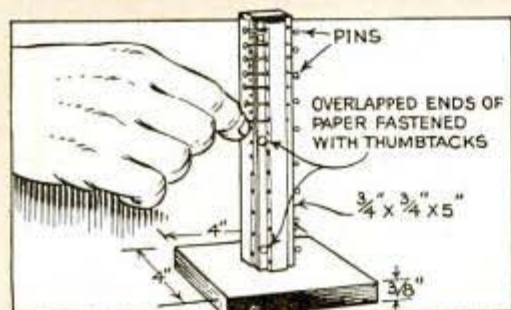
Screen wire placed so the vertical wires run diagonally from the upper hinged corner braces the door



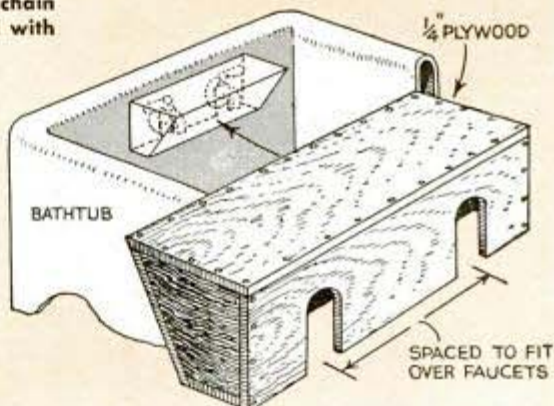
Your lavatory stopper will be out of the way if its chain is run through the drain slots and counterweighted with lead washers to slide inside the drain casing



If you use a dustcloth over a broom to clean ceilings, a slit hose makes a good clamp to hold the cloth



Pins are removed easily from their paper if a strip containing four rows is wrapped around a wood block supported vertically on a base



A plywood box made as above and slipped over the faucets of a bathtub will keep small children from opening them

Two Handles on Scroll-saw Blade To Cut Large Work



When work is too large to use a scroll-saw, try removing the blade from the frame and using spring-type clothespins as handles. If the blade is of the loop-end type, a pin set in one of the clothespin jaws will take the loop. On blades that have pins in the ends, shallow grooves cut in each jaw of the clothespin will serve to hold the blades.

—H. Taylor, Toronto, Ont., Can.

Wallboard Supported for Nailing With Force Cup on Pole

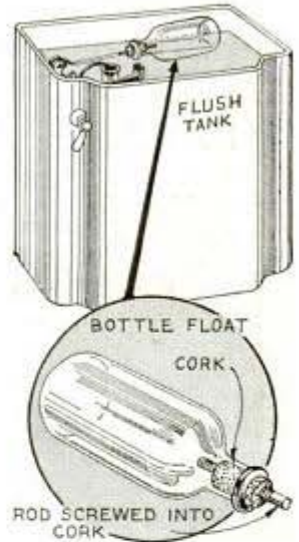
To hold sheets of plasterboard against a ceiling while it is being nailed in place, one



carpenter uses a plumber's force cup on the end of a pole of suitable length. The rubber cup can be forced against the sheet without damaging it.

Bottle Used as Emergency Float

If the float in your bathroom flush tank springs a leak or becomes damaged in any other way at a time when a new float cannot be obtained immediately, a bottle will serve as a temporary float. Cork it tightly, then make an undersize hole through the cork and screw it onto the float rod.



Jar Lid Placed in Double Boiler Warns When Water Is Low



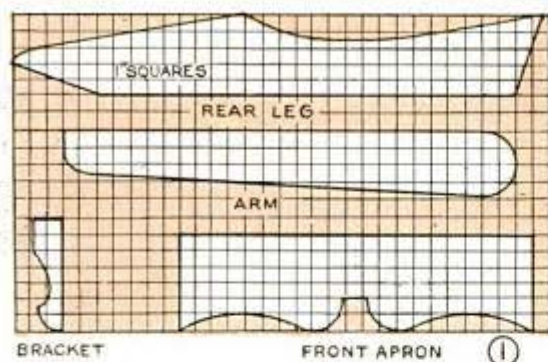
Since very little water can be used in a double boiler, it sometimes boils away without warning. You can avoid this by placing a jar lid in the water compartment. When the water gets low, the lid will rattle.

Curtain Prevented From Slipping Off Stretcher by Corks

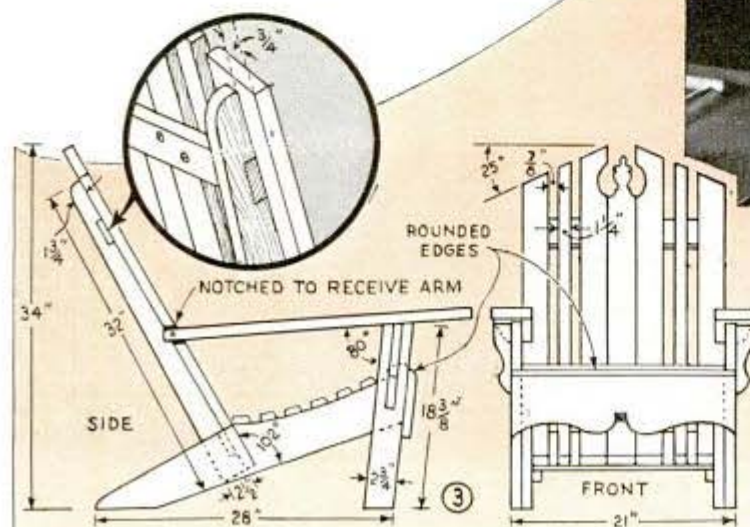
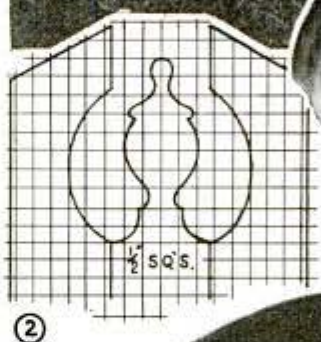
A curtain that tends to slip off the nails at the corners of a stretcher, can be kept in place by pressing small corks over the nails after you have put the curtain over them. A cork on each corner nail usually will be sufficient.—Wm. Swallow, Brooklyn, N. Y.



A Colonial Touch on the LAWN CHAIR



SCROLLWORK on the apron and back of this chair provides the touch necessary to make it fit in well with your colonial-type home. The chair can be made of white pine, although cypress is better due to its resistance to weather. Fig. 1 gives the sizes and shapes of the major parts, while Fig. 2 shows the layout for the decorative scroll on the back. Assembly of the chair is given in Fig. 3. The back is built as a separate unit and is screwed to the arms and legs, which are first assembled in two units and then tied together with the scrolled apron. If care is taken to assemble the back at the angle given, the chair will be comfortable for most users. After sanding, shellac all knots and apply one priming coat and two finish coats of flat white paint.



MATERIAL LIST

All dimensions net

- 2 pcs. 3/4 x 2 1/2 x 33 in.—Back
- 2 pcs. 3/4 x 1 1/4 x 34 in.—Back
- 3 pcs. 3/4 x 2 3/4 x 34 in.—Back
- 2 pcs. 3/4 x 2 3/4 x 18 in.—Back cleats
- 2 pcs. 3/4 x 2 1/2 x 32 in.—Back supports
- 2 pcs. 3/4 x 2 3/4 x 18 3/8 in.—Front legs
- 2 pcs. 3/4 x 5 x 31 1/2 in.—Rear legs
- 2 pcs. 3/4 x 3 3/4 x 27 in.—Arms
- 1 pc. 3/4 x 6 x 21 in.—Front apron
- 1 pc. 3/4 x 1 3/4 x 14 in.—Arm brackets
- 7 pcs. 3/4 x 1 3/4 x 19 1/2 in.—Seat slats

Each Machine Has Its Own Switch In This One-Motor Shop



One home workshop owner who operated several machines on a bench with one motor by moving the motor on a track from machine to machine as required, rigged up this switch arrangement so that the motor could be controlled from each machine. Besides ease of control, this method avoids possible damage to the motor or machine from inability to stop the motor quickly in case of accidental overloads. Back of each machine a wall outlet or receptacle is provided, into which the cord of the motor is plugged. The separate switch for each outlet is mounted on the front of the bench near the machine it controls.—G. L. Witte, Pondsosa, Ore.

Small Model Parts Picked Up With Looped Pin in Handle



Handling of tiny wood parts when making and assembling models is simplified by using this little tool. It consists of a pin having a loop formed near the pointed end and then stuck into a handle for a han-

dle. The parts are picked up by inserting the pin in them, and they are released by pressing down the handle so that the loop acts as a fulcrum to pry out the pin.

Cap Removed Without Damage When Opening Bottle

When removing the cap from a bottle that you want to close again, place a metal disk on top of the cap before using the opener. This will prevent the cap from being pried out of shape and it can be pressed on the bottle again to reseal it.



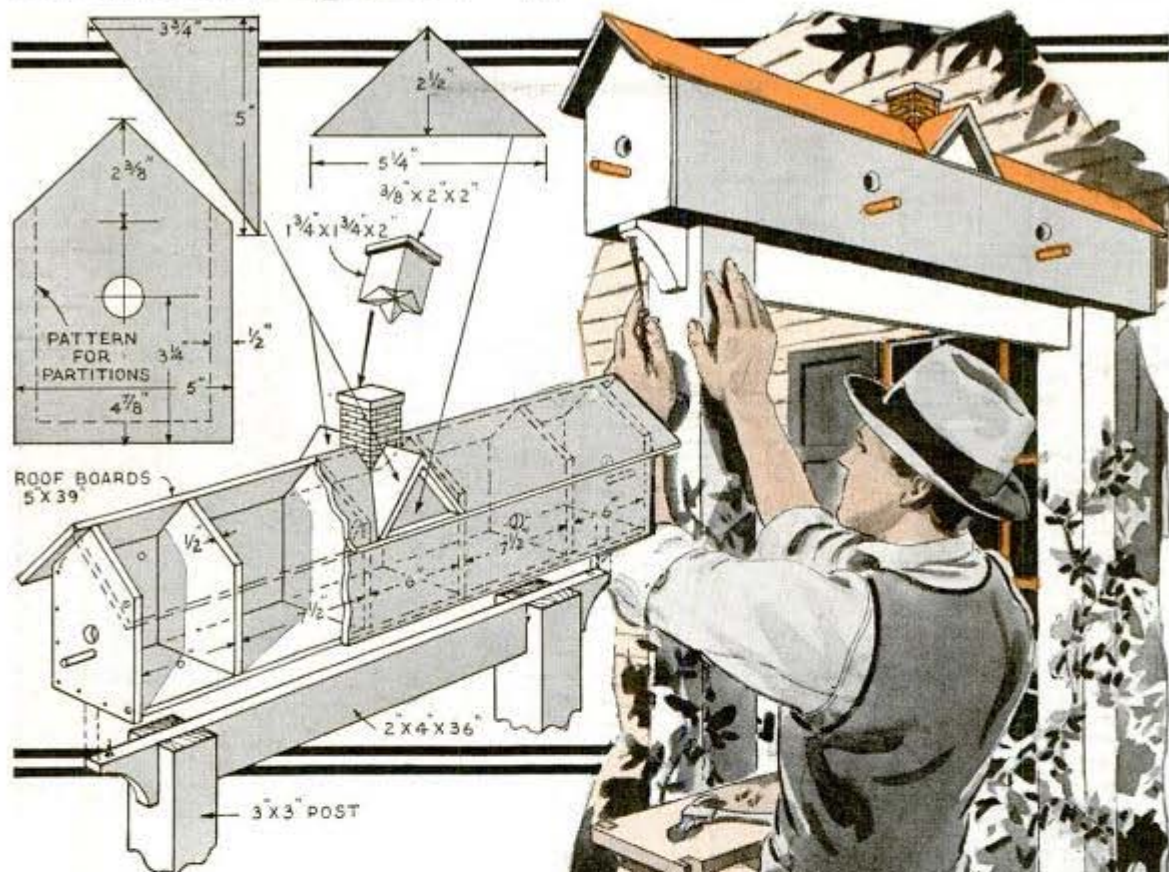
Handles on a Heavy Outboard Make It Easier to Carry

Fastened to the sides of a heavy outboard motor under the motor bolt heads, a couple of iron handles make it easier to carry or to attach or remove the motor from a boat. Your local blacksmith can shape the handles at little cost if you give him the correct dimensions.

—Herb Saltford, Poughkeepsie, N. Y.



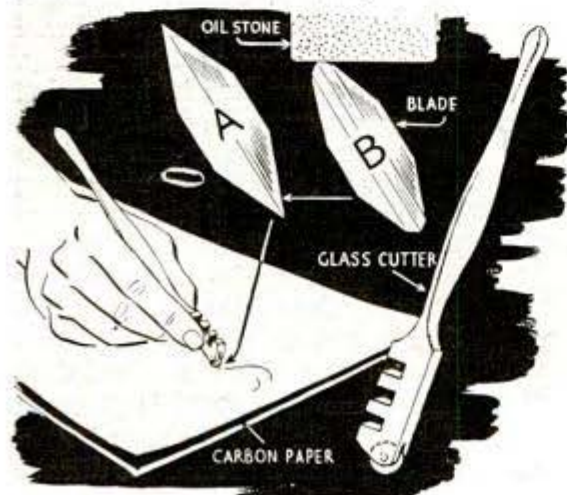
Birdhouse Spans High Posts of Garden Gate



Instead of just a plain tie strip across two high posts supporting a gate to his garden, one home owner mounted a long birdhouse on top of the strip. Simple in construction, the house has four nesting compartments, one at each end and two in the center. Two gables and a false chimney at the center tend to break up the plain lines of the house and give it a more

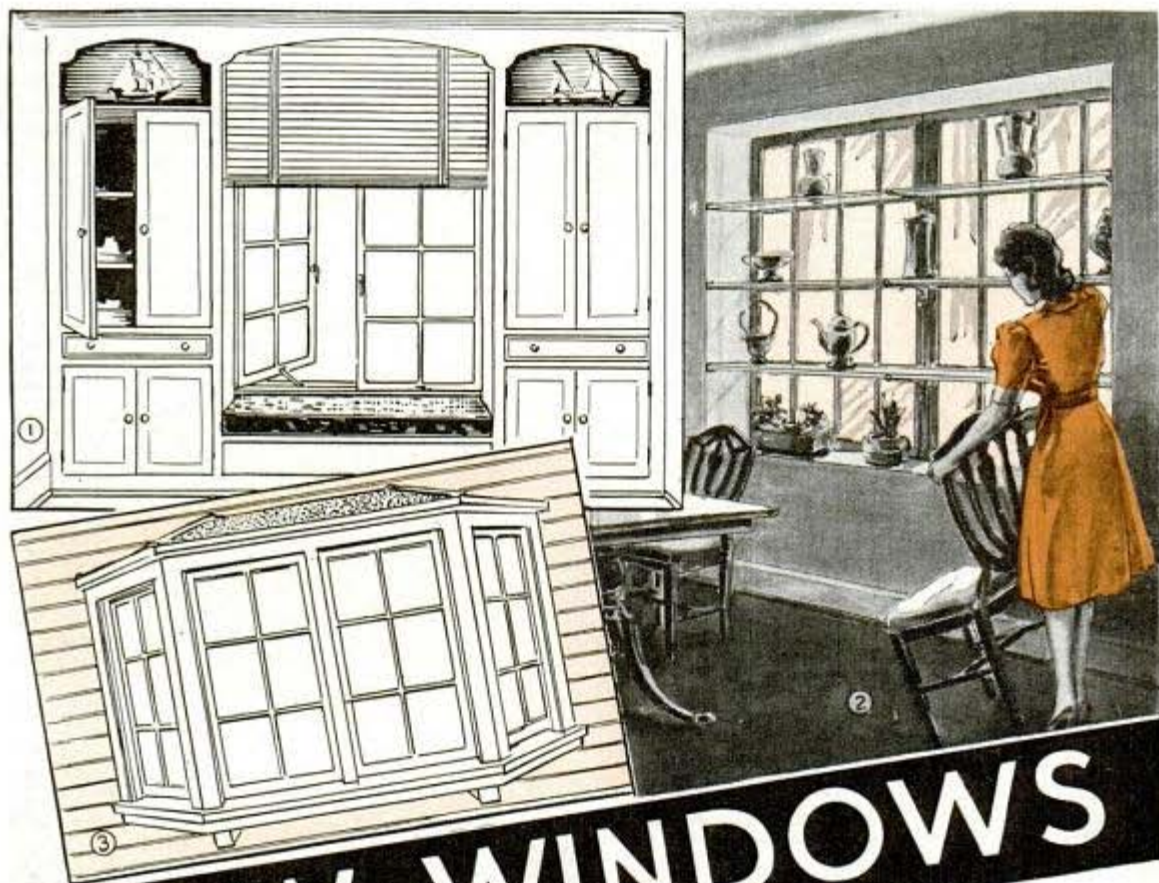
realistic touch. Screws through the tie strip and house bottom hold it in place.

Glass-Cutter "Stylus" Makes Fine Lines When Tracing



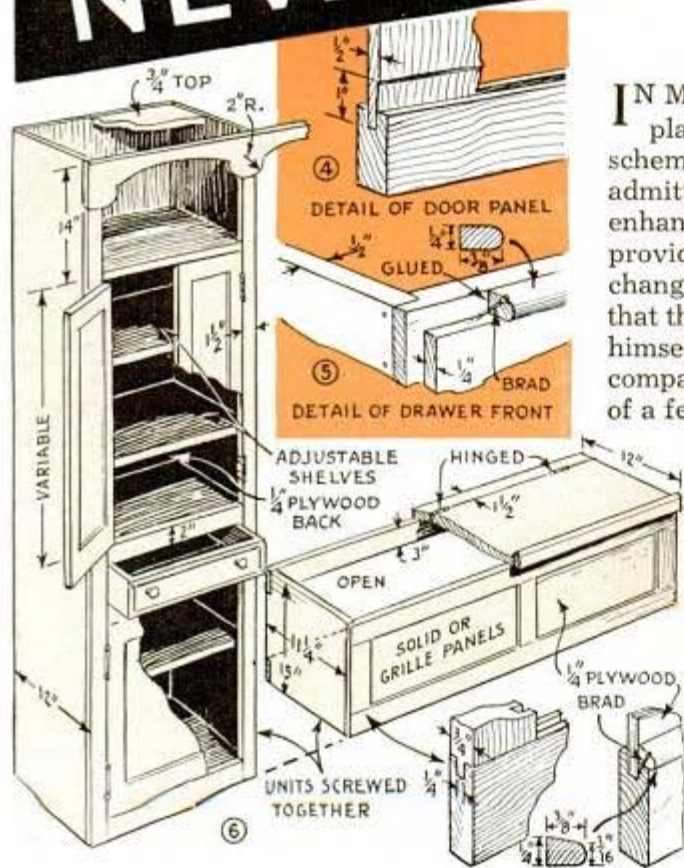
To avoid fuzzy lines when using carbon paper in tracing a drawing or design, try a cheap glass cutter as a stylus. One that can be purchased for a dime will do. If the cutter wheel is shaped as at A, blunt the cutting surface on a stone as at B so that it does not cut the paper. Then go over the lines that are to be traced with a firm, uniform pressure.

Keep a spring clothespin near the kitchen stove for lifting hot pan lids, turning or pulling pans from the back of the oven and lifting fruit-jar lids from boiling water when sterilizing them for canning.



NEW WINDOWS

By R. O. Buck



IN MODERNIZING your home, windows play a dominant part in the decorative scheme. Besides their prime purpose of admitting light and air, they also serve to enhance the appearance externally and provide centers of interest inside. The changes involved are relatively simple so that the average craftsman can do the work himself, bringing his house up to date at comparatively low cost. Often the addition of a few easily constructed cabinets placed around a window as shown in Fig. 1, will do wonders in improving the appearance of a dining or living room. While casement-type windows are shown, double-hung divided sash also would be effective. Unless otherwise desired, soft wood may be used in constructing the cabinets as shown in Fig. 6 and then enameled. The manner in which the raised door panels are assembled is given in Fig. 4, while Fig. 5 shows how a beading is used around the drawer

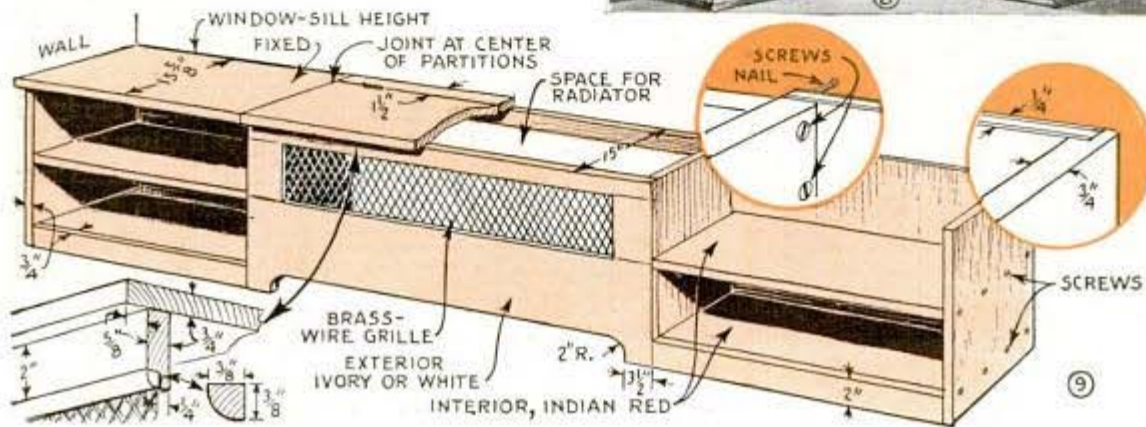
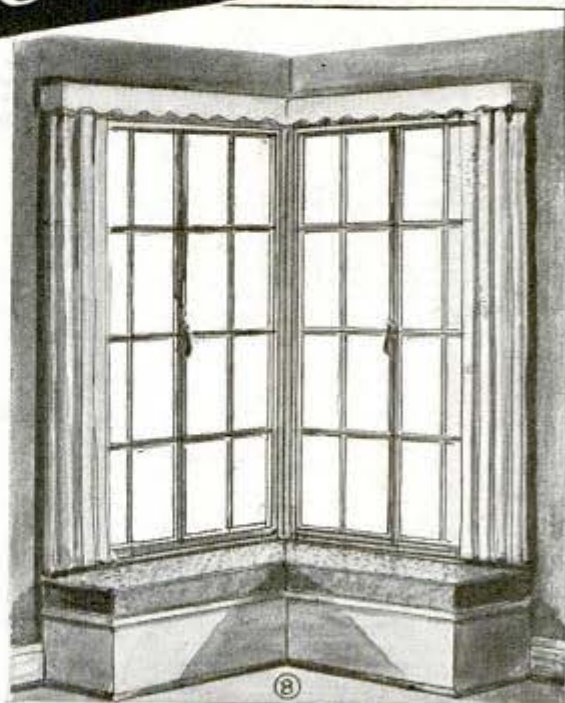


Modernize Old Homes

fronts. The chest, the top of which forms a window seat, may be used for storage purposes or to conceal a radiator.

"Picture windows" are used where the window will command a view of an attractive garden or landscape. How effectively such a window may be used is shown in Fig. 7. The drapes are of the draw-cord variety and reach entirely across the room. Fig. 9 gives the construction details for the cabinets.

Steel sash are weathertight, admit the maximum of light and air and are in every way desirable for a brick or brick-veneer house. They are generally used without a wood casing, as the plaster is returned at

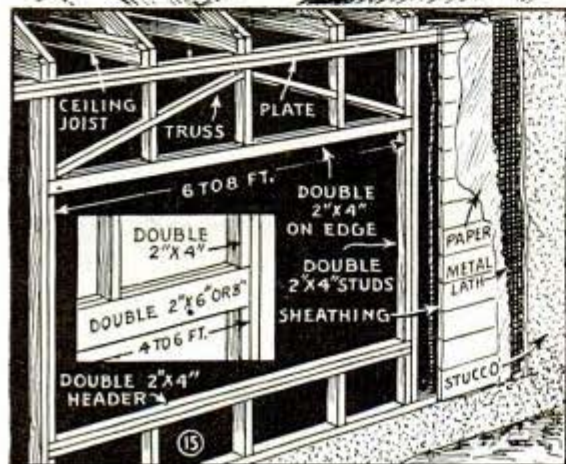
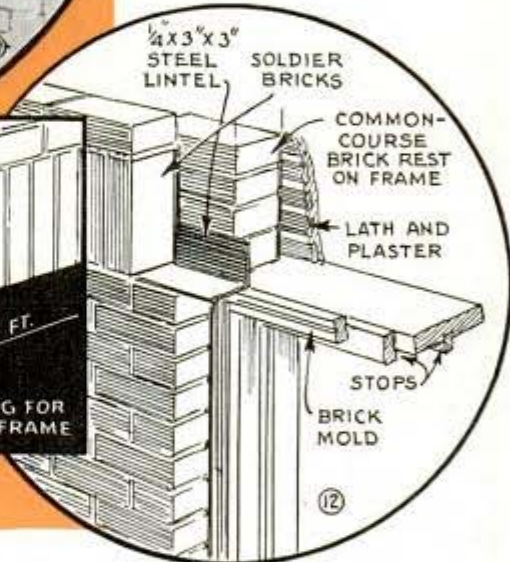


ENLARGING WINDOW OPENINGS IN BRICK WALLS



the corner and into the opening. As the sash swing outward, the screen must be on the inside. Roll screens which run in metal tracks are sometimes used instead of a frame.

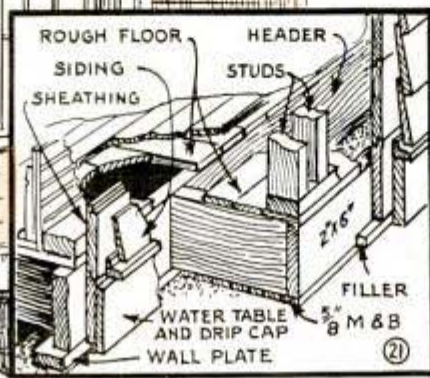
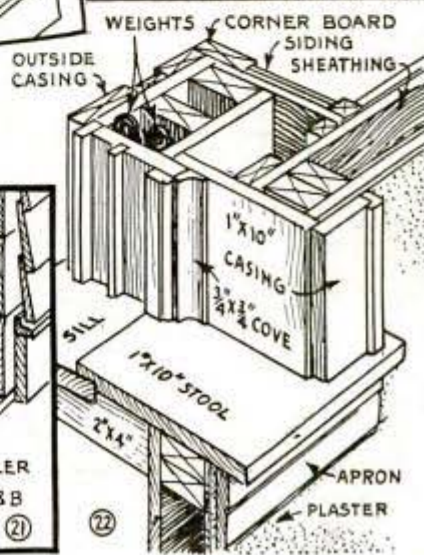
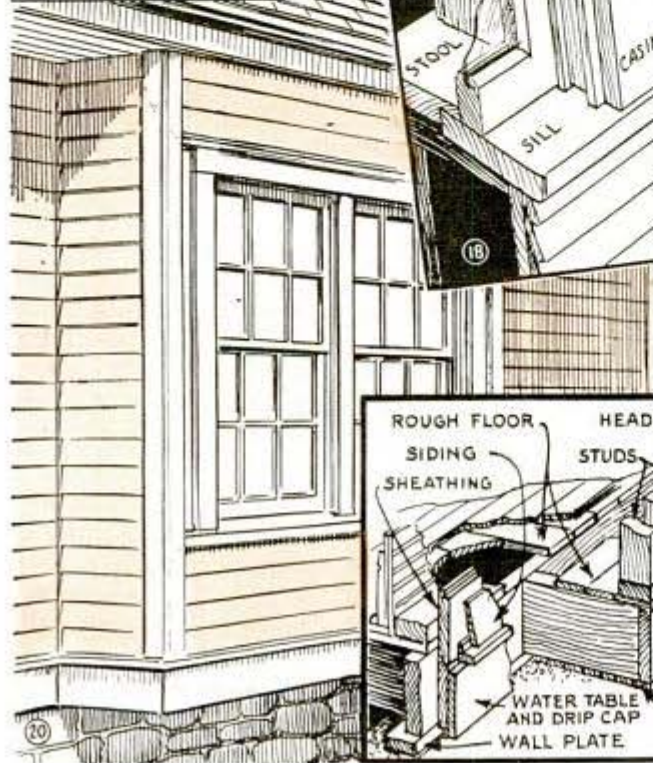
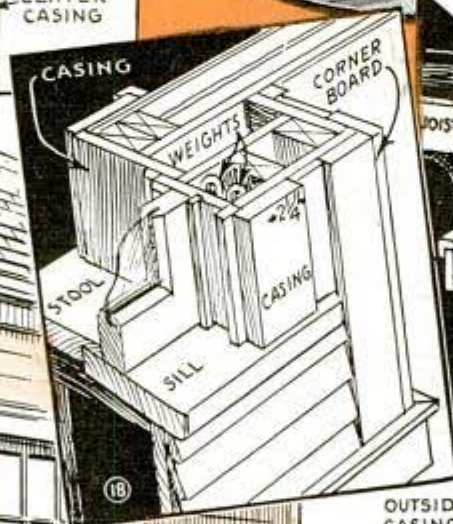
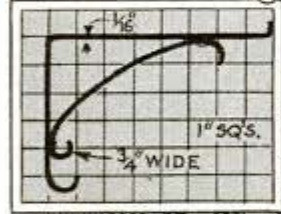
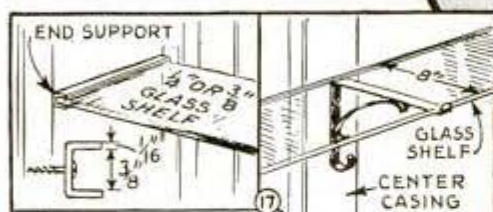
Replacing a small window frame with a larger one in a brick building is not as difficult as it may seem. If reasonable care is taken, a window opening of five feet or less can be cut in a wall without danger of damaging the



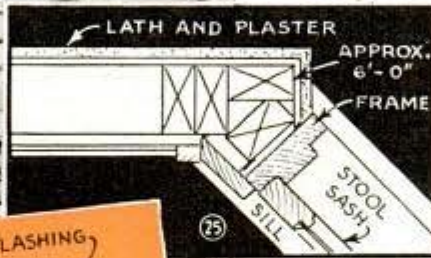
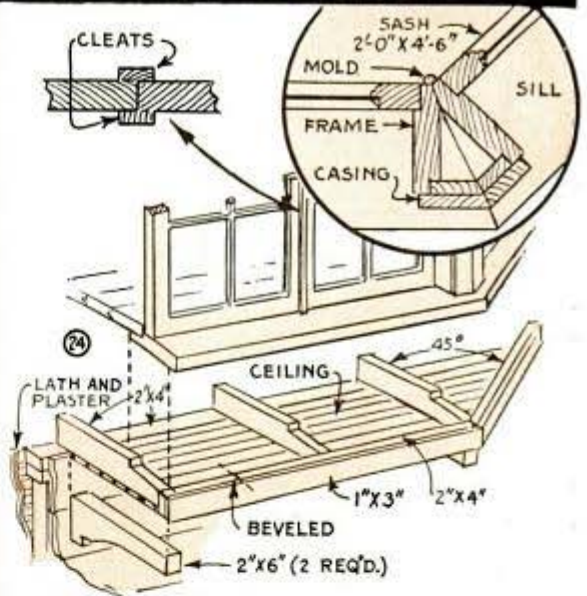
wall above. On larger openings a brace is suggested as shown in Fig. 10. A hole is made at the top to insert the brace before the enlarged opening is made. Note that the bricks are not removed in a straight line at the top, but that the opening is "stepped" so the new frame may be inserted before removing the brace. A study of Figs. 11 to 14 inclusive, will give you an idea of how a window frame is bricked into a building. On narrow windows a steel angle called a lintel, is used across the top to support the bricks in front of the frame. The inner bricks simply rest on the top of the frame. For wide openings, two steel lintels are used as shown in Fig. 11 to carry the weight of the bricks above the window.

GLASS SHELVES IN DEEP WINDOWS HOLD PLANTS

A popular treatment for a dining-room window is shown in Fig. 2. Here a deep window opening fitted with plate-glass shelves permits china, glassware or plants to be displayed most attractively. Such an arrangement can be worked out very well in a brick house, especially if the wall is 12 in. thick. To secure greater depth in a frame building, a shallow bay window which runs from



BAYS ON PLAIN WALLS GIVE PLEASING RELIEF

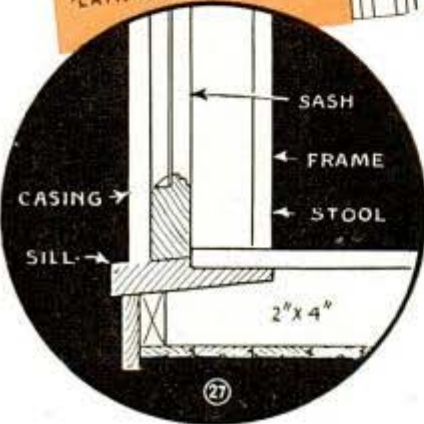
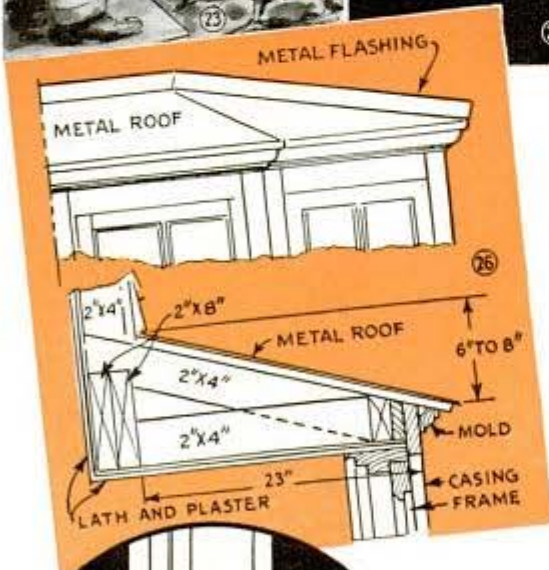


the top of the masonry wall to the eaves under the roof is suggested as shown in Fig. 20. This applies only to a one-story building. The opening in the wall for the bay is made or enlarged by first marking out and cutting

away the lath and plaster as in Fig. 16. The siding is next removed by sawing along a straightedge where the corner block is to be. Mark the stud line along the sheathing and complete the opening with a saw.

A sectional view of the bay showing how it may be framed is given in Fig. 19. The bay should extend from 8 to 10 in. beyond the sheathing of the house. A mullion or double window of the size desired is installed in the wall of the bay, and then the frame is extended with a casing to join the main wall as shown in Fig. 18. Fig. 21 shows the framing at the bottom of the bay. The part below the sill is simply boxed in and left unfinished, as cabinet doors in this type of window treatment would detract from the "horizontal-line" effect desired. Fig. 22 is a sectional view at the sill line from the inside, showing the arrangement of timbers, frame and casing. The glass shelves should be supported with metal channels at each end and by a bracket in the center as in Fig. 17.

For windows having a span of from 4 to 6 ft., a double 2 by 6 or 2 by 8-in. timber should be used. Spans from 6 to 8 ft. re-

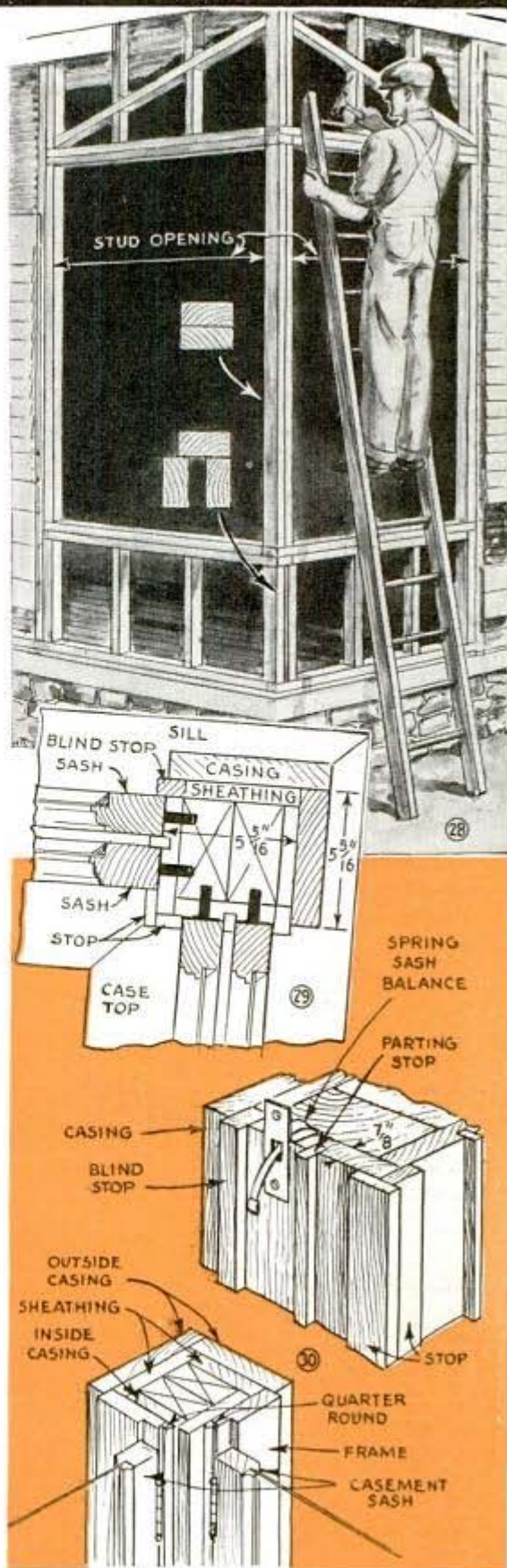


HOW TO INSTALL THE LATEST CORNER WINDOWS

quire a form of truss which is framed as shown in Fig. 15. The simplest way to determine the size of the stud, or rough opening, for a single double-hung window is to add 7 in. to the width of the sash to allow for jambs, weight boxes and clearance. Five inches are added to the height of the two sash (placed in locked position) for jamb and sill, and two inches for top clearance. For a mullion or double window an additional 5½ in. must be added to the width. To the sash width of casement windows 3 in. are added for jambs and clearance, and 1½ in. to the sash height for the upper jamb. In the case of sash that swing outward, 1½ in. are allowed for the sill at the bottom, while sash that swing inward, require 2¾ in. for the sill. For each mullion, 3 in. must be added to the width.

No type of ornamental window has enjoyed more lasting popularity than the bay window shown in Fig. 3. Windows of this type are being used singly, or in pairs, on many new homes. The roof, Fig. 26, is covered with sheet copper or galvanized iron, and is made rather flat. A double 2 by 8-in. header spans the opening, and the bottom is closed just under the sill as shown in Figs. 23 and 24. The frame may be constructed or purchased ready-made as a complete unit, lacking only the rough framing and roof-covering material. Stationary sash are suggested for the bay, although "swing out" casements, or double-hung windows, may be used if you wish. The stud framing where the bay joins the wall, the slope of the outer and inner casings and the joint between the frame and the plaster are all shown in Figs. 25 and 27.

The corner window shown in Fig. 8 is one of the latest types of window. Fig. 28 shows how simple the framing is. The truss at the top is adequate for spans of 5 or 6 ft. on each side. For smaller windows a double 2 by 6-in. header is sufficient without a truss. Where double-hung windows are used, weight boxes are omitted and spring sash balances used instead. Mortises chiseled into the corner posts house the part of the balance that extends through the jamb, Fig. 30. A sectional plan view of the corner is given in Fig. 29. Casement windows are suitable also for use in corners. The detail, Fig. 30, shows the corner arrangement for "swing-type" casements.



Shears for Cutting Wire and Rods Made From Two Old Files

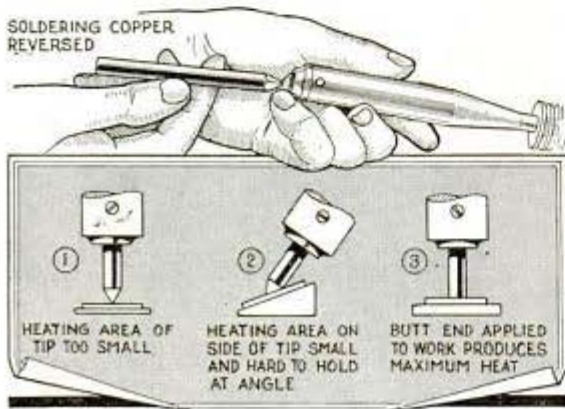


Instead of trying to cut wire and small rods with a pair of tin snips, which may be nicked or dulled by this work, make a pair of shears for the purpose from a couple of old files. Grind the ends to the same rounded contour and then grind notches of different sizes in the rounded part of one. Pivot them together near the rounded ends with a strong bolt and provide a stop at the handle ends to prevent the handles overriding each other.

—Arthur Chester, Seattle, Wash.

Bit of an Electric Soldering Iron Reversed for Sweating Jobs

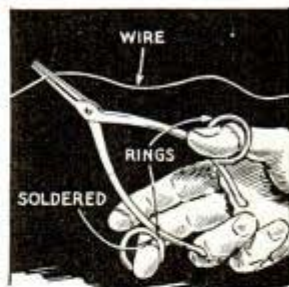
Owners of electric soldering irons of the type that are fitted with pointed copper



rods held in place with a set screw can do a better job of sweat-soldering if the bits are reversed to use the blunt end of the coppers. The greater contacting surface area of the copper with the work allows heat to be transmitted with greater speed and uniformity than with the pointed end.

Rings on Handles of Small Pliers Speed Up Your Work

If your work requires considerable use of a pair of small pliers or similar tool, metal rings soldered to the handles to fit the thumb and finger as indicated will save time. The



rings enable you to use the tool rapidly, and make it unnecessary to grip the handles continuously to keep the tool from slipping out of your hands.

Belting Strips on Top of Stepladder Hold Small Paint Cans



To keep small cans of paint from falling off a stepladder when it is moved from place to place, just tack a couple strips of rubber belting to the top of the ladder as indicated.

When a can is inserted between them the raised flaps will hold it securely in place.

Tight-Fitting Screw Cap Removed With Adhesive Tape

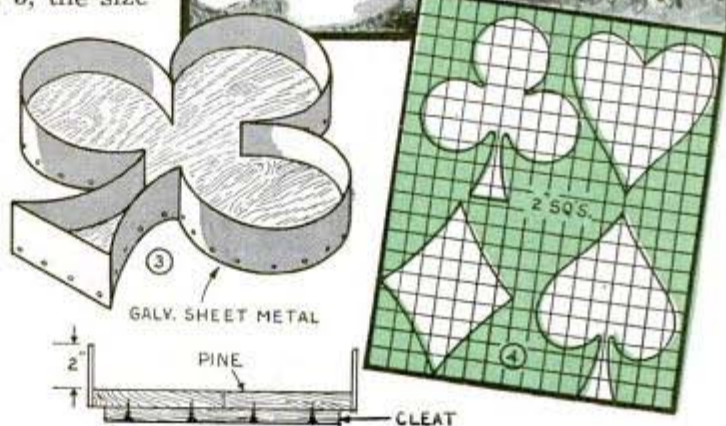
When a plastic cap fits so tightly that it cannot be gripped securely enough with the fingers to remove it, try a piece of adhesive tape. Just wrap a strip of the tape around the cap, leaving enough slack at one point to insert a finger as shown in the photo.



"Playing-Card" Stepping Stones of Concrete



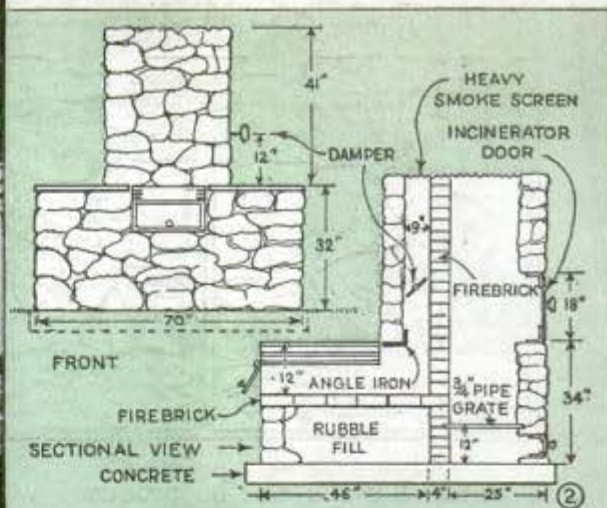
Unusual walks can be produced with concrete stepping stones cast to resemble symbols on playing cards. The stones can be laid in blocks to simulate playing cards, or arranged in other designs. And, if desired, a thin layer of colored concrete can be applied to each stone as it is cast. This is done after the forms have been filled by sprinkling colored pigment on the wet concrete, Fig. 1 and then puddling it in, Fig. 2. The forms are made as in Fig. 3, the size being taken from the squared diagram, Fig. 4. The concrete is mixed in the proportions of cement 1 part, sand 2 parts, and gravel 3 parts. If the aggregate is dry, use water in the proportion of $5\frac{1}{2}$ gals. to each sack of cement, but for moist aggregate, use water, $4\frac{1}{4}$ gals. This proportion is important for enduring concrete. Keep the concrete covered with damp burlap until it has set properly.



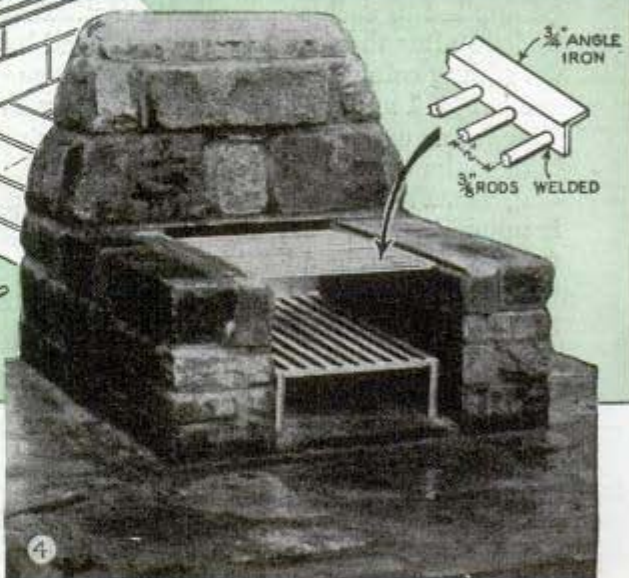
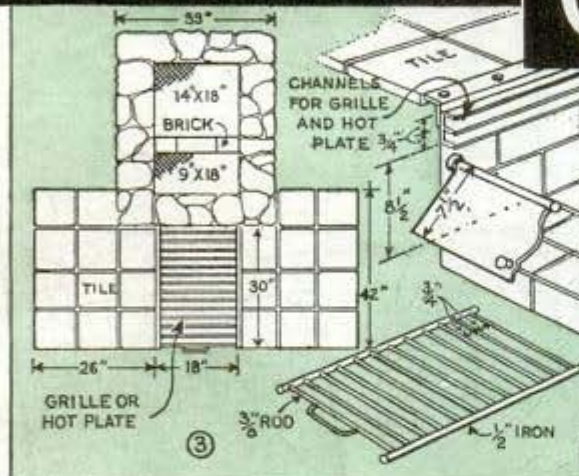
Wheelbarrow Boat for Use on Beach Affected by Tides



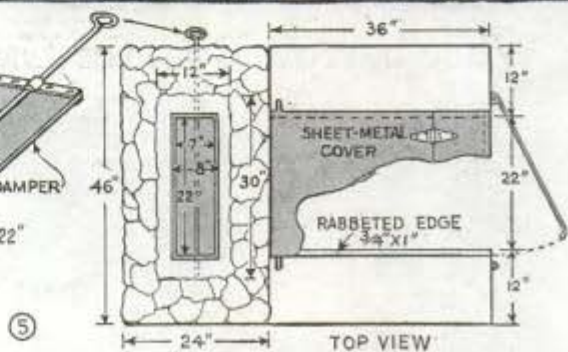
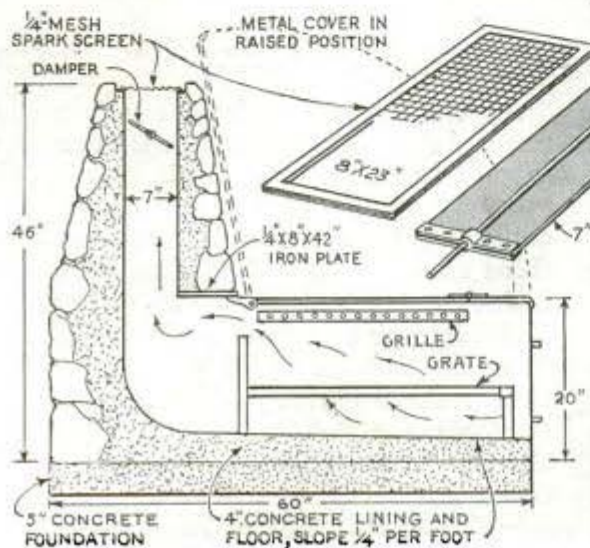
Anyone living along beaches where the rise and fall of the tides make it necessary to pull or carry small boats a hundred yards or so, can save a lot of work by equipping their boats with wheels like those used by lobster fishermen along the Maine coast. The fishermen use such boats as tenders, or to bring in lobsters from a short distance off shore where they are stored. The boats are pushed wheelbarrow fashion along the beaches single-handed. The wheel is installed by fitting a bulkhead near the bow of the boat to make room for it.—W. H. Schofield, Portland, Maine.



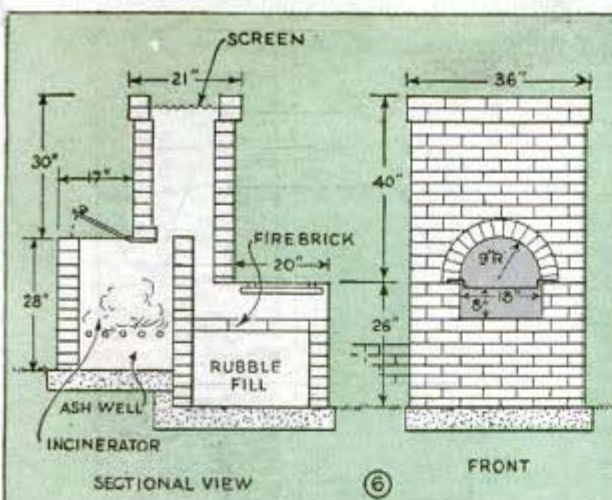
GARDEN



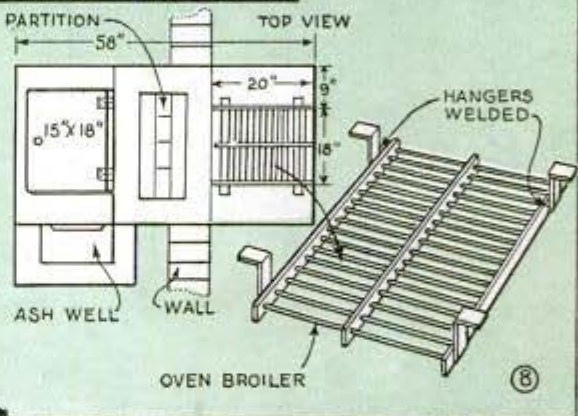
Combining a grille with an incinerator, the attractive fireplace shown in Figs. 1, 2 and 3 is just the thing for those who desire the best. It is constructed of field stone and has an interchangeable grille and hot plate with wide wings at the sides



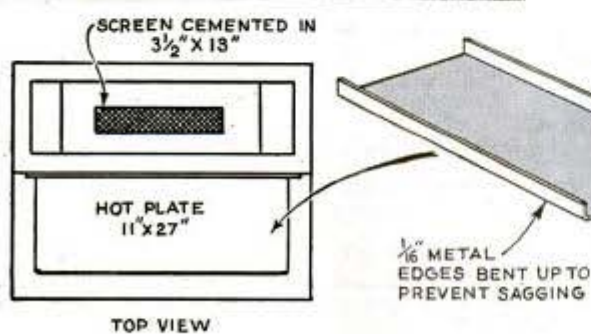
If you want a fireplace that is not too conspicuous, the one in Figs. 4 and 5 is low and narrow. Made of field stone too, it has a fire grate that can be removed easily for burning bulky material, such as paper and trash. A sheet-metal cover hinged at the back next to the chimney hides the grille when the latter is not in use



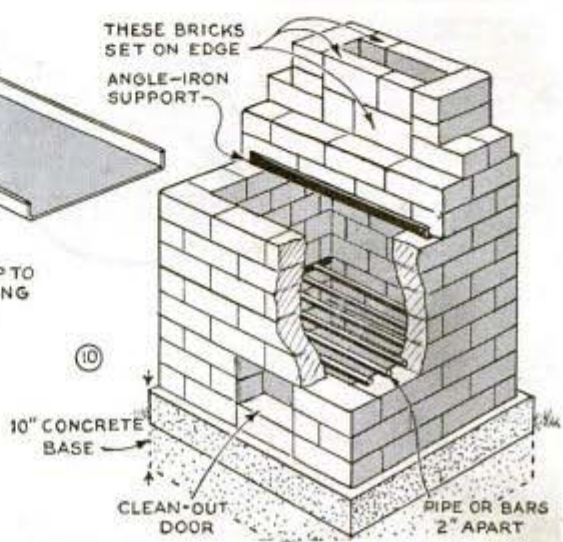
FIREPLACES



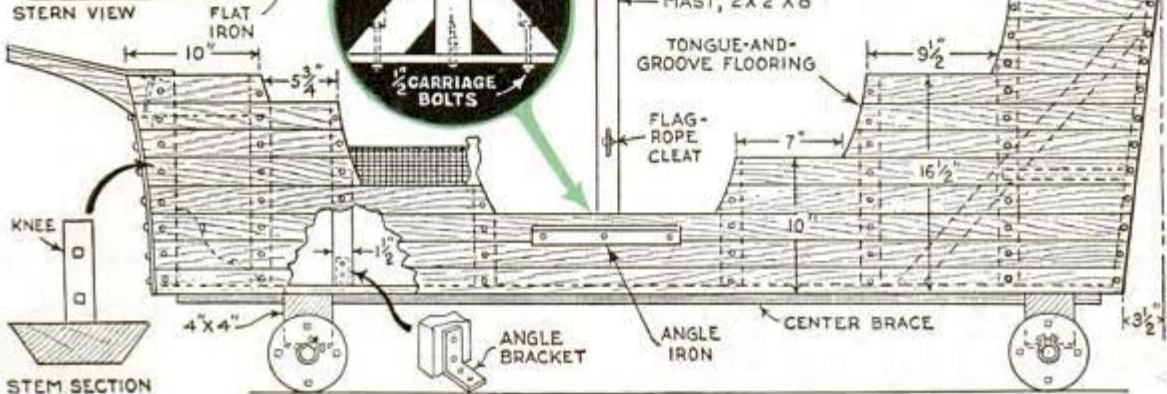
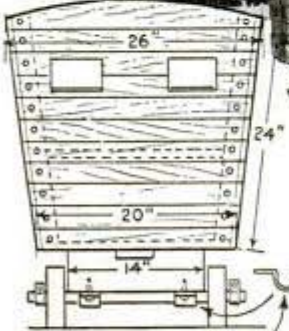
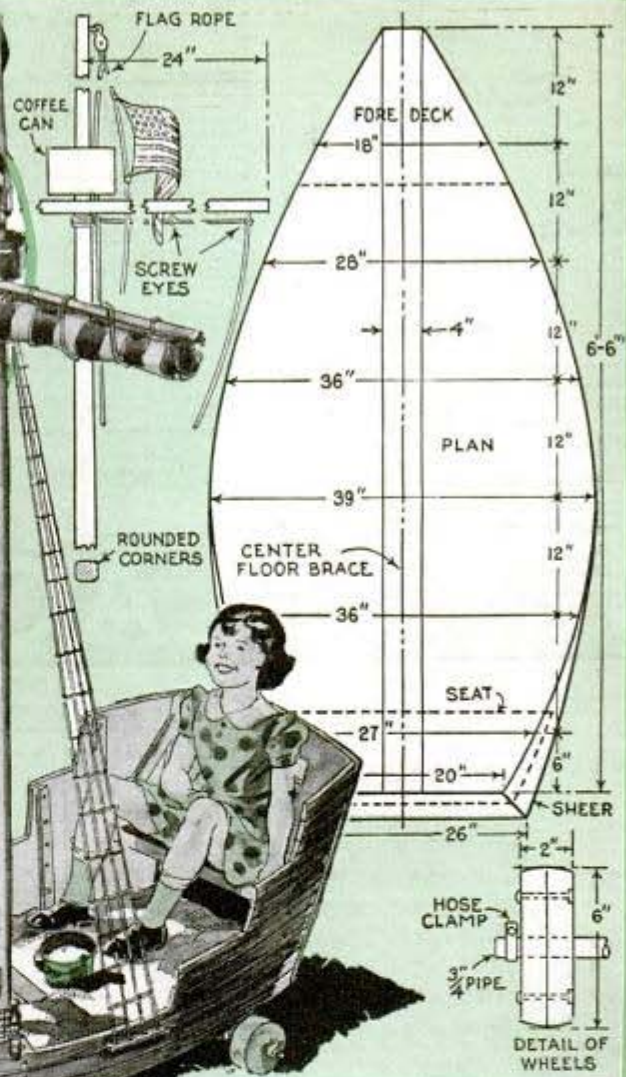
Figs. 6, 7 and 8 show an unusually attractive fireplace of brick that is a real asset to the garden landscape. It is built on two grade levels and has a high chimney for a good draft. Construction requires about 500 bricks and less than a sack of cement



Home owners who desire a fireplace more for utility than for appearance will find the one in Figs. 9 and 10 suitable. It is small and can be built at a cost of two dollars or less. Lengths of pipe with the ends embedded between the courses of brick serve as a fire grate and 1/16-in. metal with the edges bent upward for strength serves as a hot plate



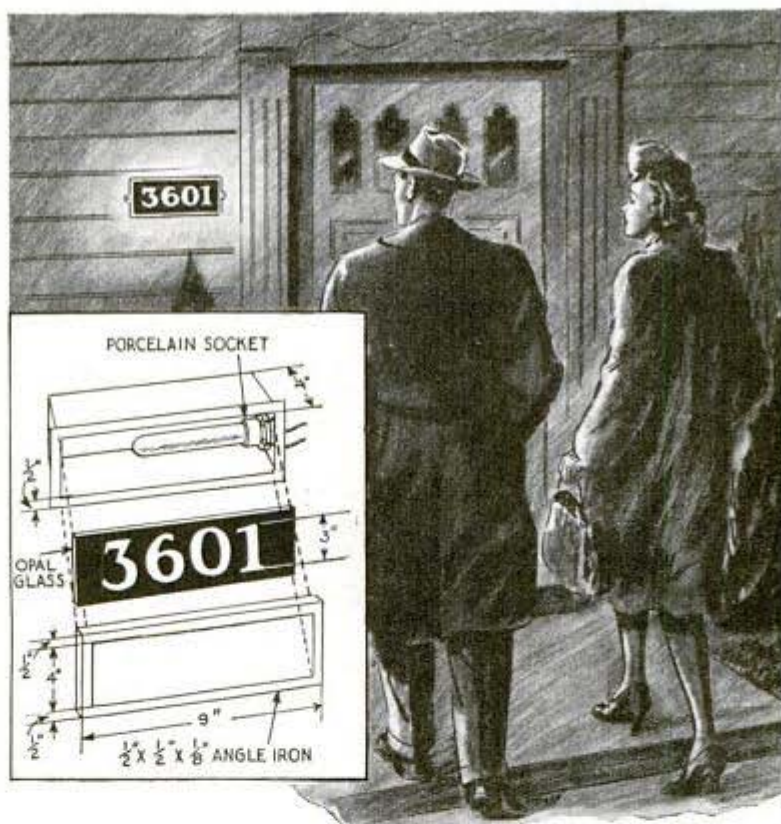
Pirate-ship SAND BOX wheels about the yard



This ship sand box will satisfy the desire of children to play "pirates" and to dig in the sand. Besides this, it's an unusual lawn ornament. The sail is a patchwork of old awning cloth, the shrouds and ratlines are awning cord, and the crow's nest is a coffee can. A forecastle serves as a locker for toys and a flag. The sail can be used as a sunshade, or it can be lowered to keep rain off the sand

Illuminated House Number Sets Flush in Wall

Easily seen at night as well as in the daytime, this illuminated house number sets flush with the wall. It can be wired to go on or off with the porch light, or it can be controlled by an independent switch. The lamp and socket are mounted inside a sheet-metal box, which is set in the wall much like a regular switch box. The numbers are laid out on a piece of opal glass and the surface around them is painted black so the light shines through the numbers. An angle-iron frame holds the glass against the box, and a narrow strip of sponge-rubber between them makes the joint weatherproof.—Robert E. Brittin, Lincoln, Nebr.



“Dressing Table” on Door Saves Space in Small Room

Occupants of small apartments or single rooms where space is very limited, will find this dressing table just the thing. It is

assembled on the back of a closet door and is brought into use by opening the door. When not in use, closing the door hides it. The assembly consists of a half-oval-shaped shelf and a mirror, the shelf being skirted with cloth. The mirror is held on the door by strips of molding rabbeted to take it as indicated.

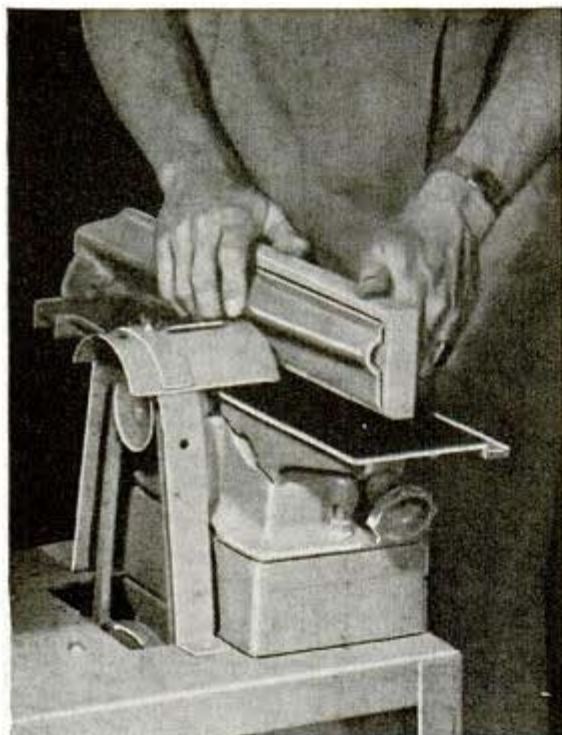


Flags Supported by Flower Pot

Instead of driving the staffs of several flags into the ground to support them on the lawn, place an inverted flower pot in the desired position and insert the staffs through the drain opening, as shown. The flags can be removed quickly and do not have to be cleaned before they are put away.



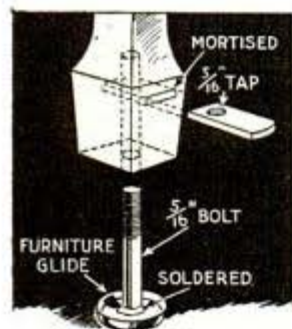
Guard at Back of Jointer Fence Protects the Fingers



Placed over the knives of a jointer at the back of the fence, a guard like the one shown will minimize danger of getting the fingers in the knives, especially when cutting rabbets. The guard is made of sheet metal and is held in place by a U-shaped piece of flat iron bolted to the bench or stand on which the jointer rests. A slot in the top part of the guard permits adjustments to be made on the jointer.

—Frank Hegemeyer, Monterey Park, Calif.

Adjustable Caster Steadies Table On Uneven Floors



A table that does not set level on an uneven floor, can be improved by fitting one of the legs with an adjustable caster of the type shown. To do this, saw off a piece about $\frac{3}{8}$ in. from the lower end

of the leg. Then mortise it to take a piece of metal, which has been drilled and tapped for a $\frac{5}{16}$ -in. bolt. Next drill the lower end of the leg to take the bolt. The head of this

is sawed off and a furniture glider soldered on in its place. To level the table, just screw the bolt up or down as required.

—W. C. Lammey, Naperville, Ill.

Rubber Shields on Bird Perch Prevent Ends From Splitting

If you sometimes split the ends of a birdcage perch when removing it, saw off a short piece from one end of the perch and slip on pencil erasers of the type shown. Notch the ends of the erasers. These will enable you to remove the perch



from the cage easily when necessary, yet will hold it in place securely.

Waxed Paper Aids in Typing On Adhesive Tape



When using adhesive tape to label bottles of solutions, the labels will look neater if they are typewritten. This can be done easily by placing the tape

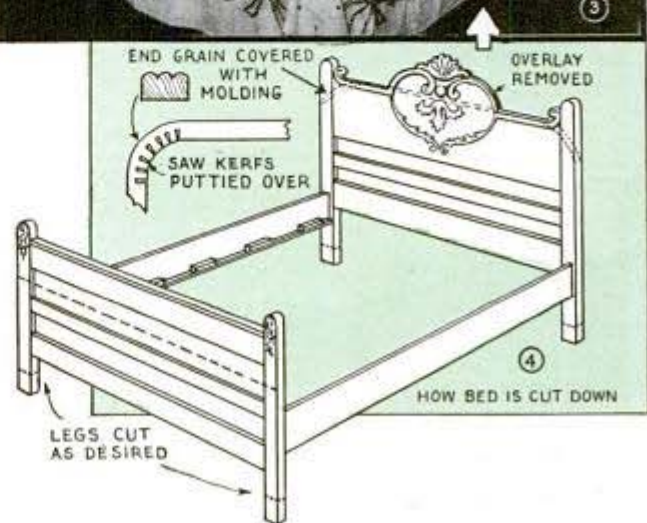
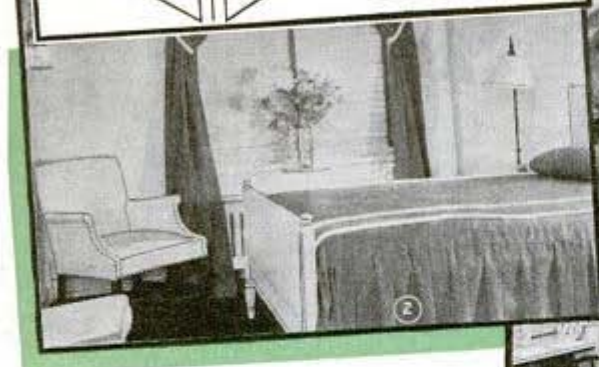
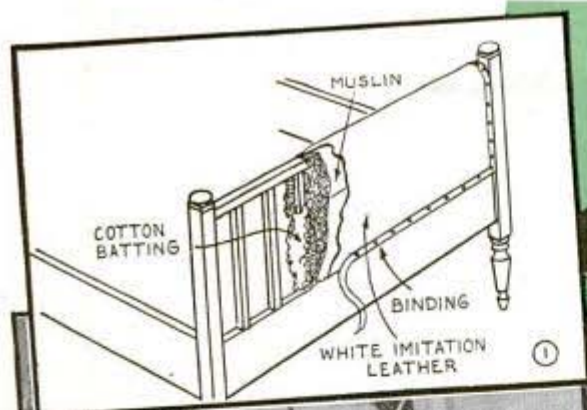
on a sheet of waxed paper to hold it in the typewriter. Several labels can be typed at one time, after which they are stripped off the paper and stuck to the bottles.

Bent Ice Pick Does Not Roll

By bending an ice pick near the handle, you can prevent it from rolling when placed on a sloping surface. Also, bending the pick in this manner will make it easier to use, especially when parting large cakes of ice.



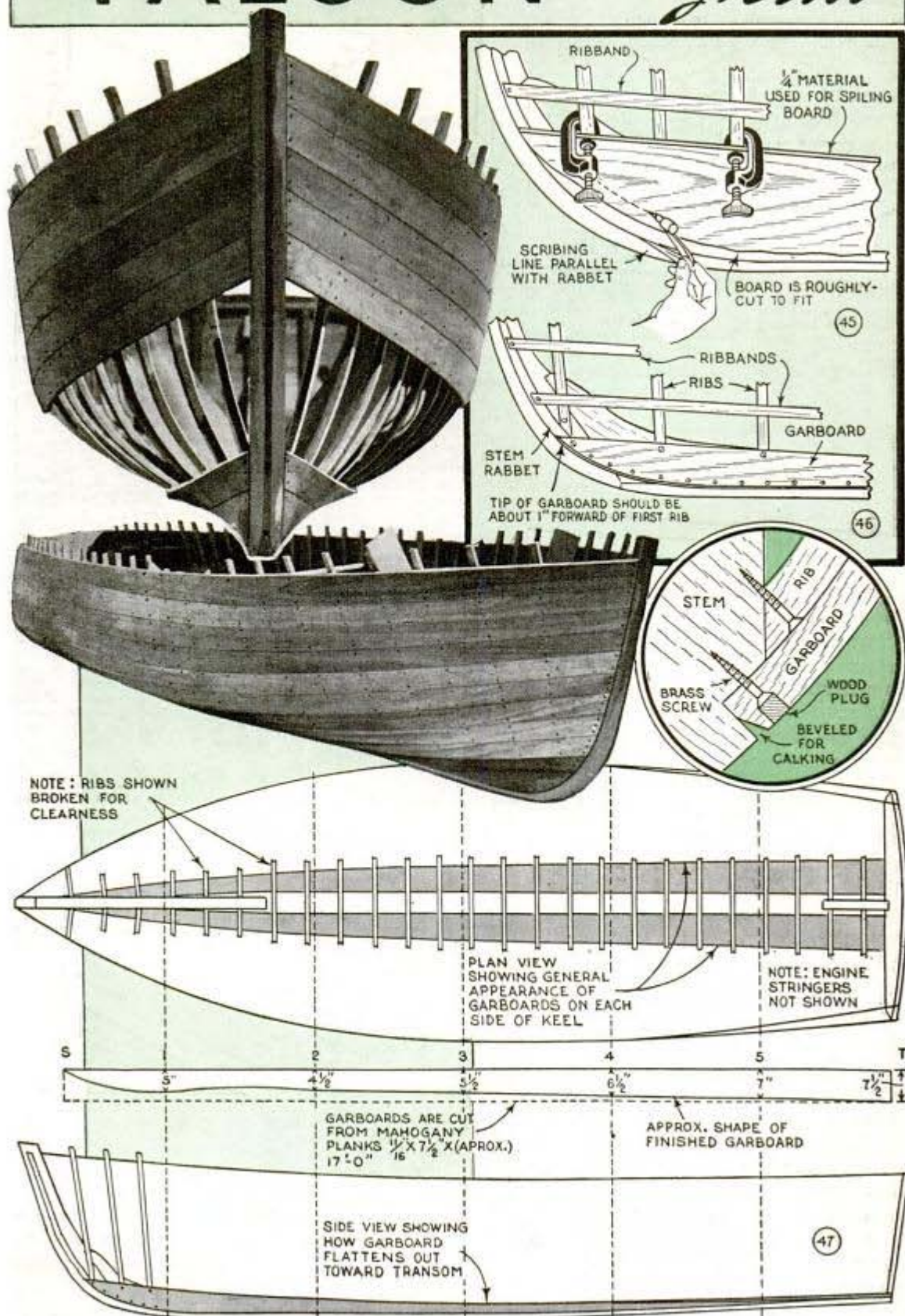
Outmoded Beds Restyled in Modern Taste



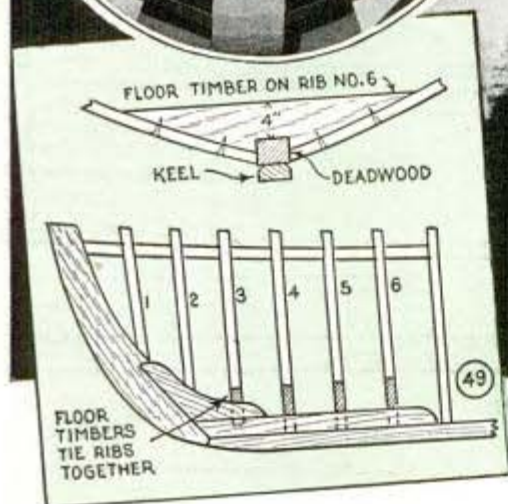
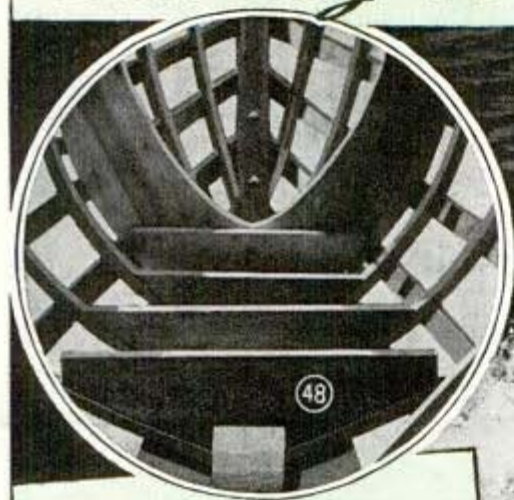
You will be surprised how easy it is to modernize an old wooden bed at a cost of only two or three dollars and a few hours of your spare time. Figs. 1 and 2 show a bed that has been modernized by upholstering the head and foot boards with imitation leather and painting the wood that has been left exposed to harmonize with the other furnishings in the room. If the head of the bed is shaped, just cut the upholstering material to follow the irregular contour. If you are unfamiliar with upholstering work, it is a good idea to first do the job with muslin or other cloth, and then use this as patterns for cutting the imitation leather. In this way, waste of the more expensive material is avoided if mistakes in cutting and fitting are made. Another method of modernizing the appearance of a bed that has solid head and foot boards is to cut them off as in Figs. 3 and 4, to eliminate all scrolls and produce straight edges, which are rounded at the corners. All overlays and other ornaments are removed, of course, after which the edges are cov-

ered with a decorative molding. Shortening the legs of high beds helps in producing a modern appearance, and the foot board should be cut off slightly below the upper surface of the springs as indicated.

"FALCON" - *Trim*



Sturdy 18-ft. Inboard



Part III Planking the Hull

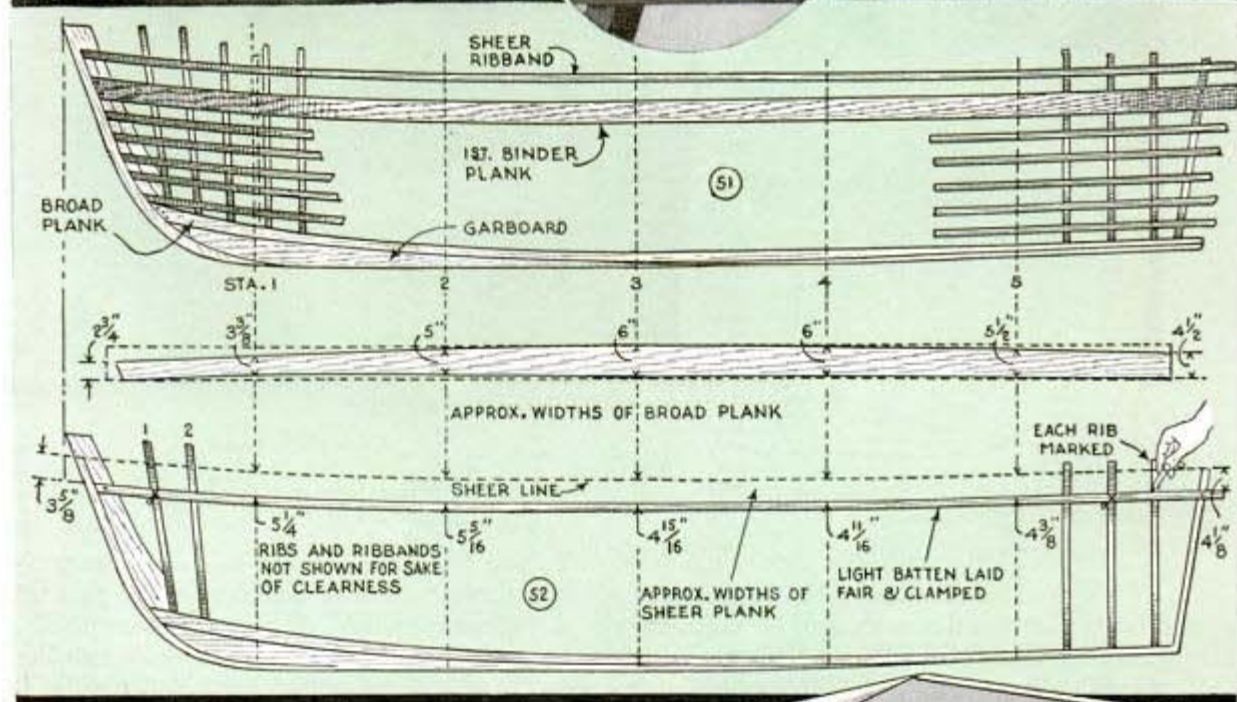
CONTINUING with the construction of the hull, it is a good plan to install the floor timbers at the bow, Fig. 48, before the planking is started. These timbers, which straddle the deadwood and knee, tie together the four divided ribs, Nos. 3, 4, 5, and 6 as indicated in Fig. 49. By fitting these in place now, any tendency of the ribs to bend inward when the planks are applied will be prevented. The first planks to be installed are the garboards alongside the keel. Of all the planks, these are the most difficult to fit as they assume a reverse curve forward and widen toward the transom. The plan and profile views in Fig. 47 show the relative position of each garboard, and also give its approximate shape. To first obtain, and then transfer the shape of the planks to your material, you'll need two or three $\frac{1}{4}$ -in. spiling boards, which should be a little longer than the hull and 2 or 3 in. wide. These can be either of straight-grain pine, spruce or fir.

To use the spiling board in fitting the garboard, first cut the board roughly so that it will fit into the rabbet of the stem, Fig. 45, and then clamp it in place to every other rib along the entire length of the hull, seeing that the plank makes contact with each intervening rib. Now, with a compass or dividers follow carefully the line of the rabbet with one point and mark the spiling board with the other. When this is done the spiling board is removed and used as a pattern to mark the profile on a plank $7\frac{1}{2}$ in. wide. The original hull was planked with $\frac{1}{16}$ -in. dark red Philippine mahogany, but if you wish, you may use pine, cedar or cypress instead. The garboards can be cut in pairs by nailing the two boards together. When the planks have been cut, the forward ends must be steamed for about 45 mins. to make them pliable. This can be done in the box previously constructed for steaming the ribs by wrapping burlap around the plank



and a 1½-in. No. 9 size at the stem and transom. The screws are driven in counterbored holes and capped. At the transom five screws are staggered as shown in the circular detail of Fig. 50. Each set of planks should be installed in pairs to avoid an unequal strain that would throw the whole framework out of line.

The second pair of planks to be fitted are the broads which lie next to the garboards.

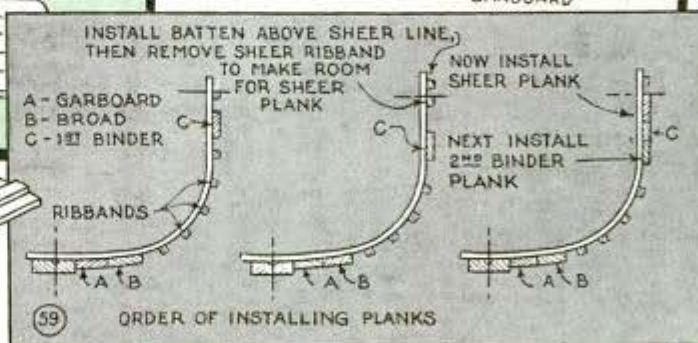
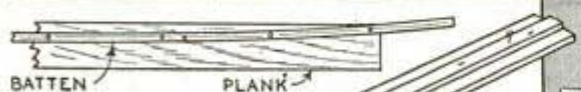
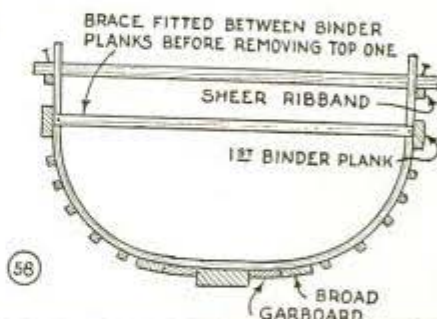
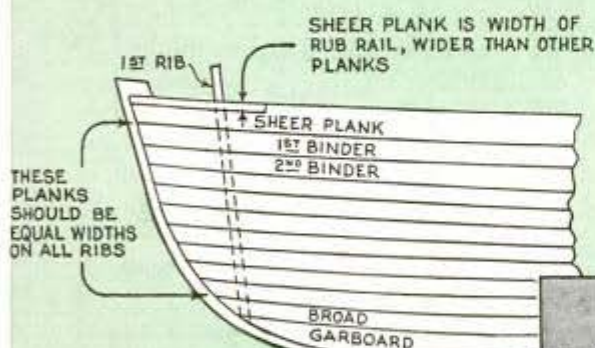
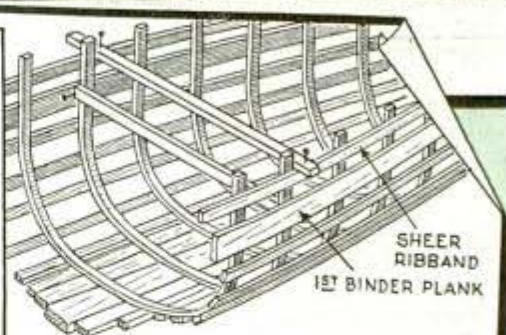
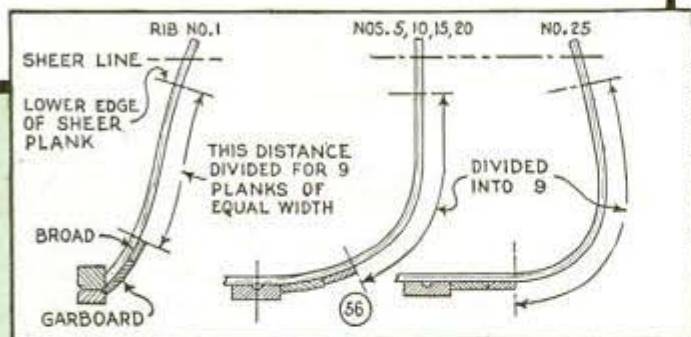


where it extends beyond the open end of the box. Then, when steamed, each plank is clamped in place while it is hot and allowed to set. It is to be expected that the plank will not fit perfectly yet. As previously mentioned, this is a tricky plank to install and requires a cut-and-trial method of fitting. You'll have to mark and trim the edge here and there, continually checking it against the keel, until a satisfactory fit is obtained. Fig. 46, and the circular detail below, show a bevel planed along the rabbet line for calking. The width of this bevel should be about one-third of the edge of the plank, and extend from the stem to the transom. When correctly fitted, the tip of the plank should extend about 1 in. forward of the first rib. Use two 1-in., No. 9 brass screws for fastening the plank to each rib,



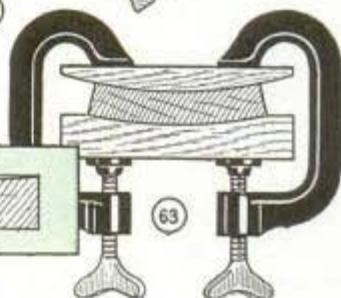
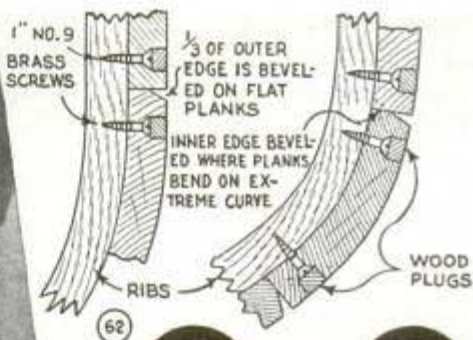
These are laid out with a spiling board in the same manner as used for the garboards, and the approximate width of the plank at various stations is given in the detail below Fig. 51. However, you may find that your broad planks fit better with some variation in these dimensions. Next in order is the third plank which is called the first binder. This is applied just below the space reserved for the sheer plank as shown in Fig. 51. To locate this on the ribs, first a ribband is removed and a straight-grain batten about $\frac{3}{4}$ by 1 in. in size is clamped to the ribs in a fair curve.

In trimming the ends of the planks flush with the aft side of the transom, saw them a little long to avoid scratching the surface, and then finish smooth with a hand plane



The forward end is placed about $3\frac{5}{8}$ in. below the sheer line at the stem, while the after end of the batten should be about $4\frac{1}{8}$ in. below the sheer line at the transom. See Fig. 52. These dimensions, as well as those given for the plank at various stations, were taken from the original hull and are more or less variable. Now, each rib is marked along the top edge of the batten with a

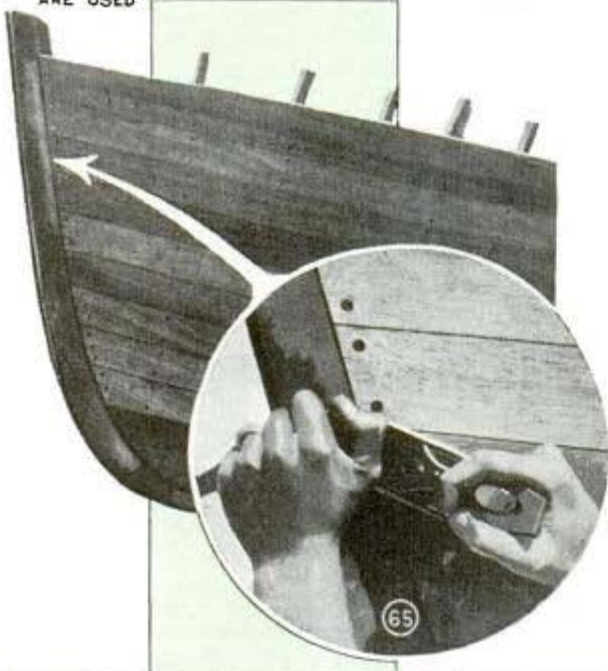
pencil, after which it is removed and a spiling board is clamped to the ribs just below the marks. Then the position of these marks is transferred to the board as in Fig. 50 and 53, and in turn the latter is removed and tacked temporarily to your material as in Fig. 54. With dividers, once more the marks on the spiling board are transferred to the plank stock and finally a light batten is curved along the marks to draw the top



Planks to be installed on extreme curves first must be cut slightly concave on the inside before they are steamed

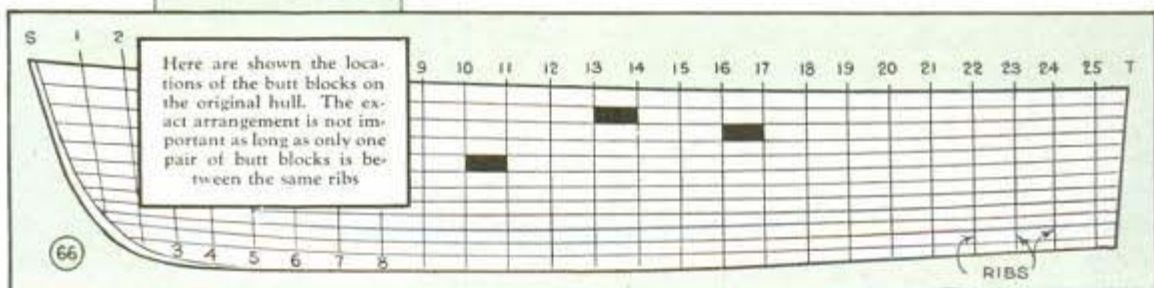


NARROWER WIDTHS POSSIBLE WHERE TWO PIECES ARE USED

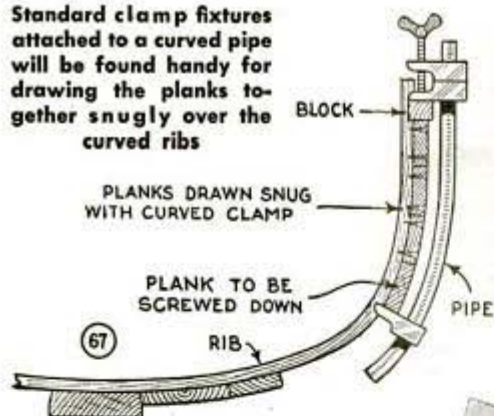


edge of the first binder plank. This same procedure is repeated later in fitting the second binder planks. For a uniform appearance, all planks between the sheer and the broad planks should be about the same width. At every fifth rib, divide this distance into nine equal spaces with a pair of dividers as in Fig. 56. A total of twelve planks should be on each side.

You will notice in Fig. 57 that the sheer plank is wider than the others, to provide space for a rub rail and yet appear uniform. Widths of this plank taken from the original boat are given in Fig. 52. Due to the flare of the bow, the plank when laid out flat assumes a somewhat puzzling profile, which must be expected owing to the inverted curve forward. Fig. 59 gives the order of installing the first four planks, and shows also how first a light batten is nailed temporarily to the ribs above the sheer line before the sheer ribband itself is removed. However, before the sheer ribband is removed, a temporary thwart brace between the first binder planks must be fitted as in Fig. 58 to prevent



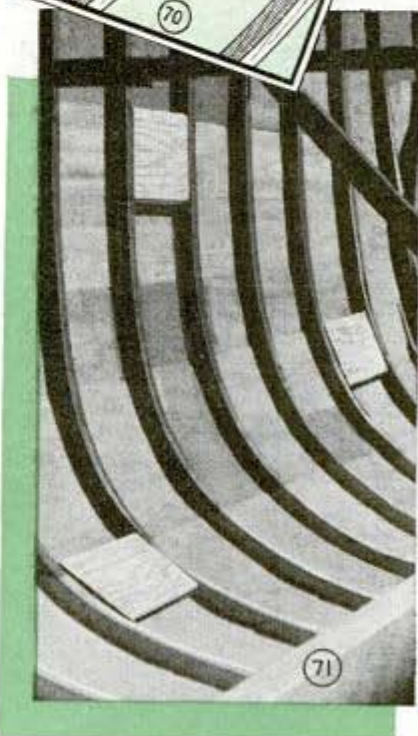
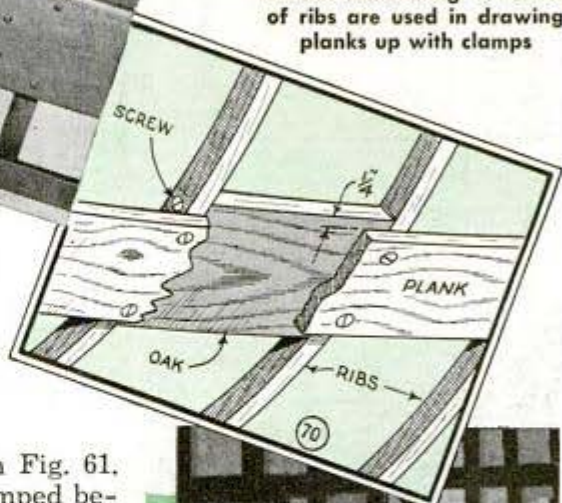
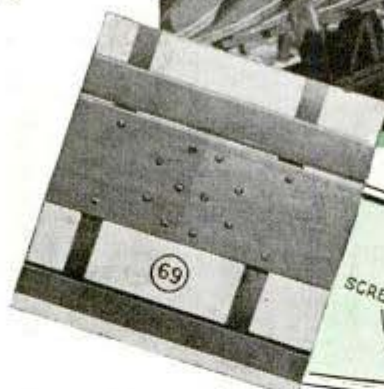
Standard clamp fixtures attached to a curved pipe will be found handy for drawing the planks together snugly over the curved ribs



Blocks conforming to curve of ribs are used in drawing planks up with clamps

the sides from springing inward.

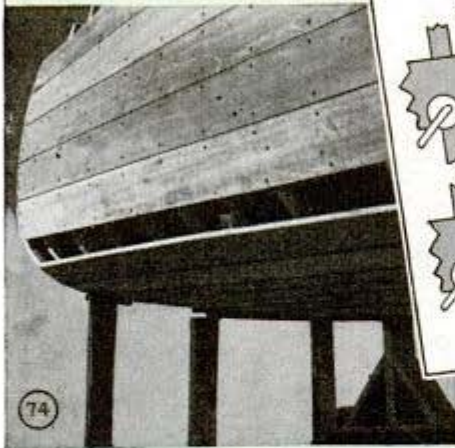
As the lower portions of the ribs assume a pronounced curve amidships and aft, it will be necessary to treat the planks applied at these points accordingly. Where the curve is extreme, the upper edge of the plank is beveled, not on the outside, but on the inside as in Fig. 62, whereas in the case of planks fitting fairly flat against the ribs, the bevel is naturally made on the outside edge. It is necessary also to first plane the inside surface concave about $\frac{1}{8}$ in. deep as in Fig. 60, and then finish smooth with a portable disk sander held at an angle as in Fig. 61. After steaming for 45 mins., the plank is clamped between curved blocks which are spaced about 20 in. apart as shown in Fig. 63 and left to set before fastening to the ribs as in Fig. 68. A bar clamp of the type having removable fixtures which can be used either on a straight or curved length of pipe, will be found handy for drawing the planks up snugly as shown in Fig. 67. While full-length planks are preferable since they make a neater job, for economy, some of the planks, with the exception of the sheer and garboards which should always be full length, can be made up of two pieces of narrow stock as indicated in Fig. 64. Here the butt joint of the ends is backed with an oak butt block to which the planks are screwed securely. Figs. 69, 70 and 71 detail these blocks, while Fig. 66 shows the position of the blocks used in the original boat. However, the exact location of these blocks is not important as long as corresponding planks do not have more than one pair of blocks between the same ribs. In joining divided planks, Figs. 72 and 73 show how a perfect butt joint can be made by simply running a handsaw repeatedly between the ends of the clamped planks. As each cut is made, the planks are tapped together and sawed again. This procedure is continued until no irregularity remains in the joint.



This view shows how neat the butt blocks look from the inside. They are shaped on the bottom to conform with the curvature of the ribs



Perfect joints in divided planks are easy to make by running a saw repeatedly through the joint



Above, only one plank—the shutter plank—remains to be fitted. This is applied over the opening as shown below, and then marked on the inside as in the circle at the right

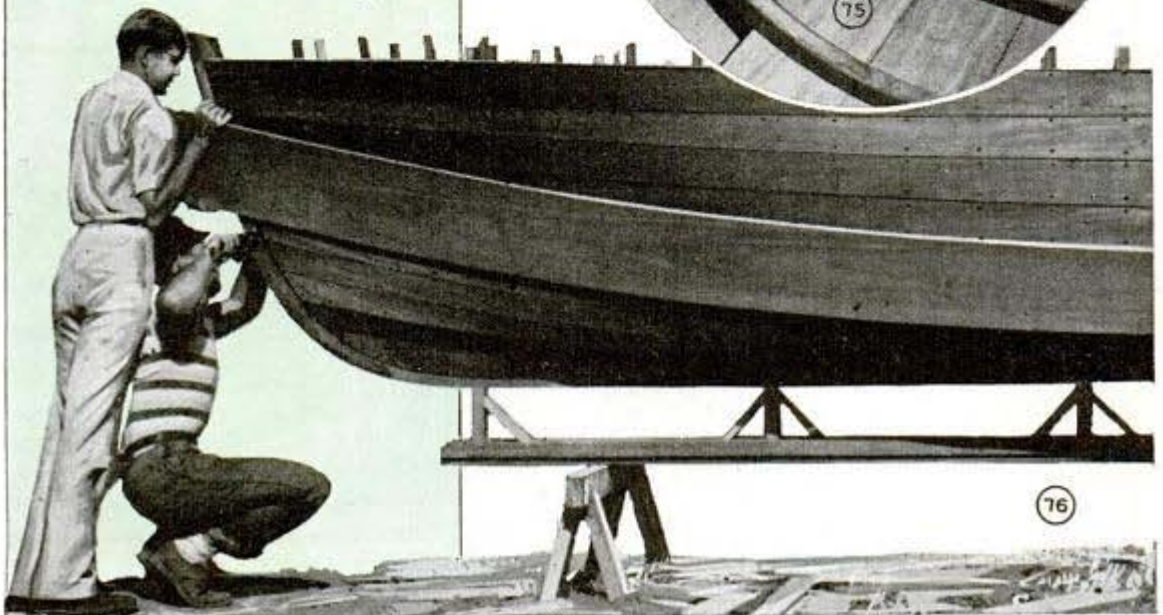
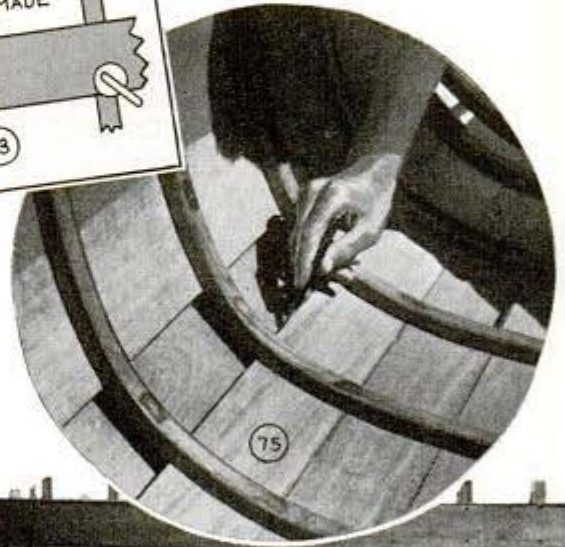
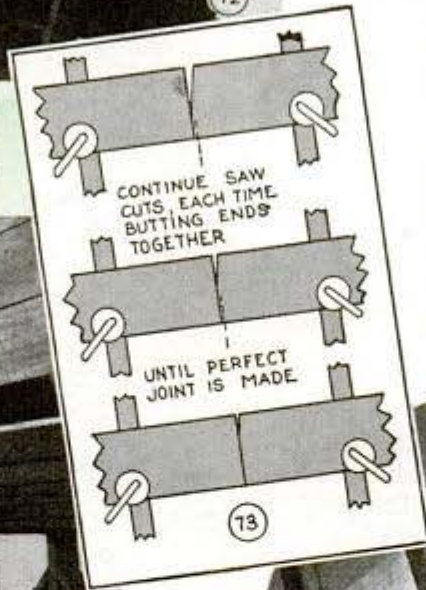


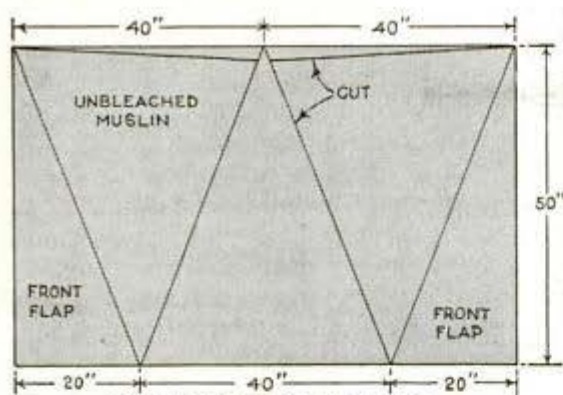
Fig. 69 shows how ten screws are placed around the joint in fastening the ends to the butt block.

The final plank to be installed is the shutter plank which is fitted in the opening remaining at the turn of the bilge as in Fig. 74. This plank can be in one or two pieces, placing a butt block, if used, near the stern. Fig. 76 shows how a wide plank is temporarily clamped in place over the opening and then marked from the inside as shown in Fig. 75. Remember to cut a calking bevel along each edge of all planks before fastening them in place permanently. When the hull has been fully covered, the ends of the extending planks are trimmed even with the aft side of the transom as in Fig. 55, and then the stem is planed flush as shown in Fig. 65.

(To be continued)



Child's Portable Tent Erected Without Stakes



LEATHER

BAMBOO
POLES



TRIANGULAR POCKET
AT BOTTOM OF EACH
INSIDE CORNER

Easily set up indoors or outside, this play tent folds compactly for storage, and is light enough for small children to move it about. Four lengths of bamboo fastened together at the top with leather, as indicated, serve as a support for the tent cloth, which is unbleached muslin cut and sewed together as shown. Small triangular pieces of cloth sewed to the muslin at the four lower corners hold the poles in place to keep the fabric stretched. The tent is decorated with pictures drawn with colored wax crayons. After the pictures have been drawn, the cloth is ironed between layers of newspapers with a very hot iron. The

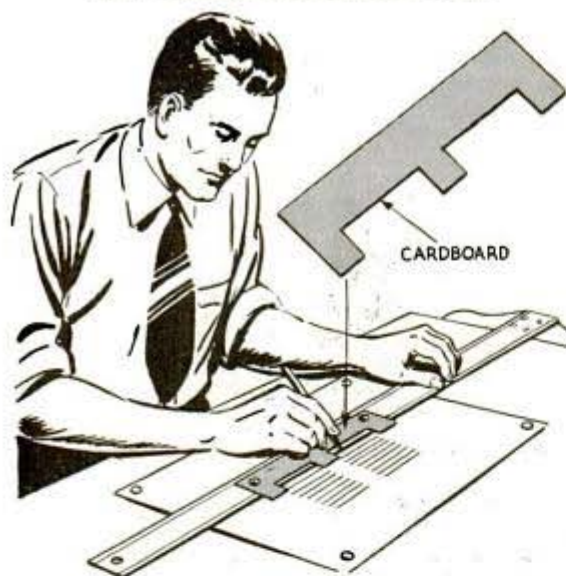
heat melts the wax, which then penetrates the cloth, the newspapers absorbing the excess wax.

—Lester Lehnherr, Milwaukee, Wis.

Corkscrew Is Handy Soap Holder

To eliminate the messy soap dish in her bathroom, one housewife turns a small corkscrew into the bar of soap and hangs it on a hook above the lavatory. The soap dries in a few minutes after being used and thus prevents excessive waste caused by a portion of it softening when laid on a flat surface while still wet.

Ruling a Series of Short Lines Aided by Notched Card

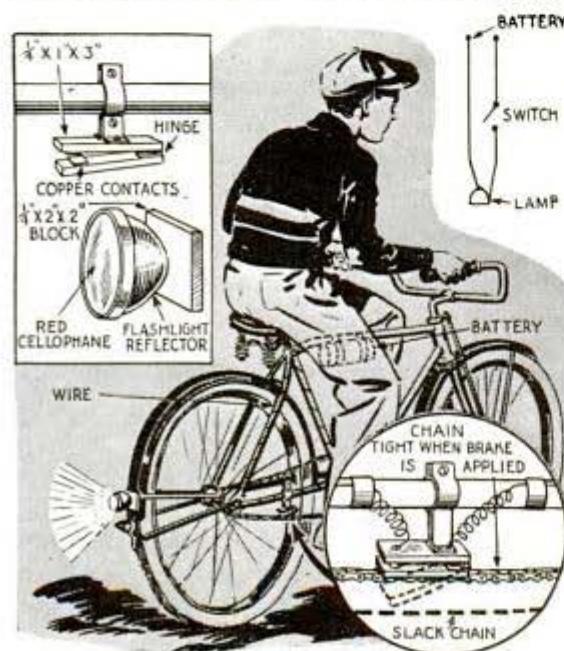


When I had to rule a large piece of paper with a number of short parallel lines, I notched a piece of cardboard to form the letter E as indicated, and tacked it to the edge of my T-square. The projections on the card served as accurate spacers for the lines and the notches measured the lengths so that the work progressed rapidly.

—G. E. Hendrickson, Argyle, Wis.

Stoptight Switch on Bicycle Operated by Chain

The safety added to a bicycle by using a stoptight, especially if you ride on heavily



crowded streets or highways at night, makes it well worthwhile to install this simple one, which flashes when the brake is applied. The light consists of a flashlight reflector fitted with a red Cellophane lens and attached to a block, which is in turn fastened to the rear fender of the bicycle. The light is wired to a dry cell as shown in the diagram, a switch being cut into one side of the circuit. The switch consists of two blocks hinged together at one end with a copper contact on each facing surface near the other end, wires from the lamp and dry cell being attached to the contacts. This assembly is fastened to the bicycle frame with a bracket. The switch is located so that its underside just clears the lower chain, or slack side when pedaling forward. In this position the switch contacts will be closed when the slack side of the chain tightens as the brake is applied.

—Jack McElwain, Trinidad, Texas.

Magnet on Box Picks Up Tacks

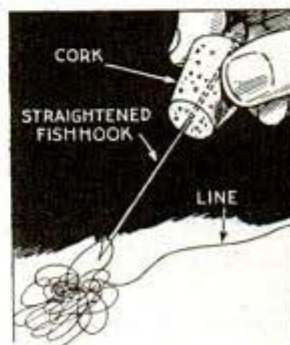


By attaching a small magnet to a tack box, one carpenter saves time in picking up surplus tacks that have been poured out for various jobs. In use, the magnet is merely brushed over the

tacks to pick them up, after which they are removed and dropped back into the box.

Fish Line Untangled With Hook

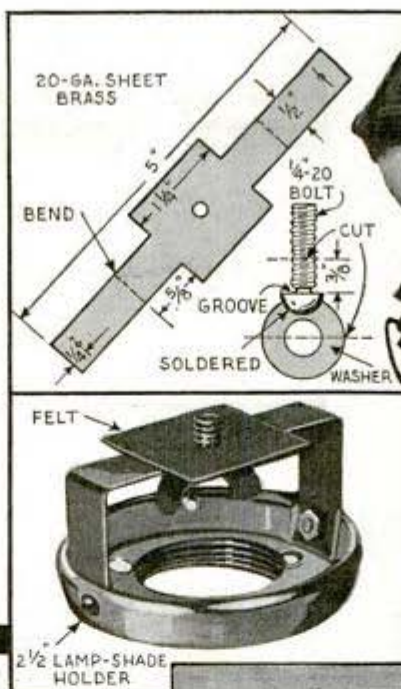
If some of your fishing line becomes so tangled that it seems impossible to straighten it out, try using a fishhook for this purpose. Just straighten out the hook and slip a cork over the end.



The barb will be found ideal for pulling out parts of the line in the entanglement.

☛ Cellophane envelopes slipped over recipe cards will keep them from being soiled.

Converted Desk Lamp Serves as Camera Stand



With this simple adapter a desk lamp having a flexible standard can be converted into an adjustable stand for miniature cameras used in table-top photography, or for photographing objects at close range. The alteration is simple. Just remove the lamp reflector and substitute a lamp-shade holder, which screws over the end of the bulb socket. A brass strip cut as indicated

in the upper detail and then bent to a U-shape, is attached to the holder with tiny bolts as shown in the lower detail. A tripod screw, which you can make if desired, attaches the camera to the strip.

—Arthur Trauffer, Davenport, Iowa.

Mirror Used as Reflector Spreads Flash Over Large Area

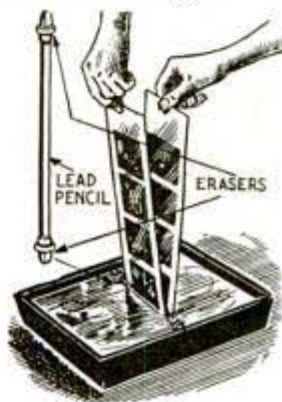
One flashbulb will cast light evenly over a large area if a concave shaving mirror is used as a reflector. The mirror is removed from its frame and fastened on the inside

of the regular reflector with small strips of adhesive tape. The "hot spot" which is apparent when most reflectors are used, will be eliminated entirely.



Pencil Wedged in Developer Tray Keeps the Film Submerged

Wedged between the sides of a tray, a smooth round pencil with a slip-on eraser on each end, will keep roll film immersed in the developer. Naturally, the uncoated side of the film should be next to the pencil.





SHADOWS *make the* PICTURE



SHADOWS in a photograph go a long way in making the picture a success or a failure. It is by means of shadows that irregularities of surface, texture and design, outline and relief, form and the impression of third dimension are brought out to make pictures realistic.

A rugged scene under a noon sun may appear simple to shoot but the results are often disappointing. However, if you make the exposure while a cloud shadow is progressing across the landscape, unsuspected slopes and prominences will become plainly visible as they are outlined in shadow against sunlit portions. The picture in Fig. 1 was made at such a moment; the low mountains in the center of the picture were completely unseen until the cloud-shadow covered them, giving them visible outline.

Fig. 2 shows how shadows are used effectively to dramatize a subject. The severe lines of the columns, especially the one at the right which shows the fluting, serve to accentuate the size of the figure. The nearer column and the figure in deep silhouette also tend to exaggerate the statue's size. Exaggeration is one of the most-used methods of obtaining drama in pictures. The statue is



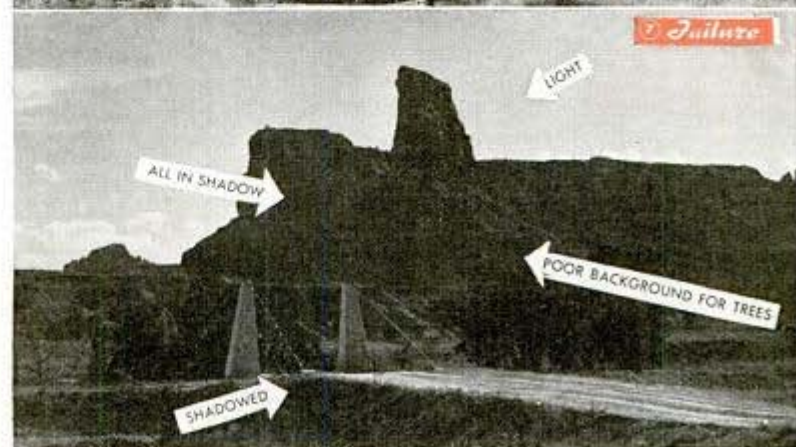
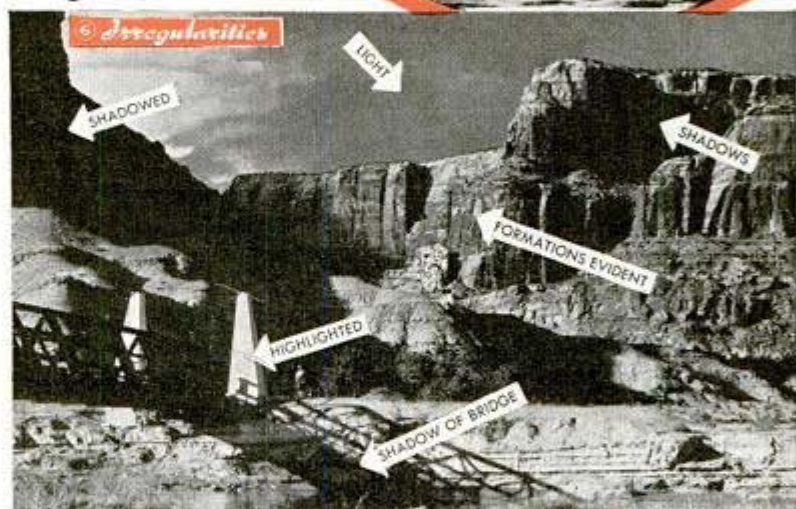


by Thomas P. Lake

lighted from the left, and the same source produced the graduated shadows in the fluting at the right.

In such pictures as that of Mount Vernon, Fig. 3, good lighting with resulting shadow gives relief to architectural forms. The highlighted column of the broad veranda appears to stand out, and the shadowed porch seems to recede as in reality. The shadows of the early spring leaves cast on the sunlit wall also help to make this portion stand out. A picture taken on a dull day from the same viewpoint would have been entirely lacking in this effect of relief, because there would have been no difference in the gray representing the various walls and faces of the columns.

Texture of delicate surfaces such as the dogwood blossoms shown in Fig. 4 are usually difficult to photograph. Here again use is made of shadows. In this picture, the branch bearing the flowers was pulled down until the noon-day sun struck across the blos-

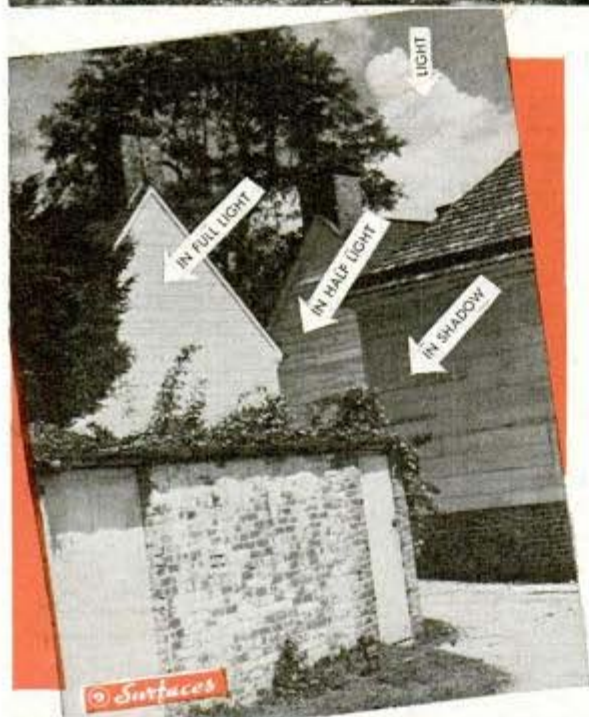


soms, producing shadows of the ridges on the petals. This is the dogwood's characteristic texture and could not have been reproduced with a flat or shadowless lighting. The highlighted portions of the twigs



stand out strongly against the dark background of the dense woods.

Shadows help to provide contrast between an object and a background as in Fig. 5. The overhanging portion of a rock cliff cast a heavy shadow which provided an excellent background for the white jersey and strongly lighted face, while the dark trousers contrast with sunlit rock. The photographs in Figs. 6 and 7 illustrate the difference which two points of view, and the accompanying presence or absence of shadows, can produce. In Fig. 7 the camera is shooting diagonally toward



the sun; in Fig. 6 the camera is shooting diagonally with the sun. While backlighting is often very effective, there is nothing in this scene to warrant such treatment, and as a result, the backlit picture Fig. 7 is a failure, the bridge columns being almost lost, while in Fig. 6 they are given prominence. Fig. 7 gives very little hint of the roughness of the rock while Fig. 6 brings this out.

Atmosphere in a photograph is an intangible something which is evident when present, yet difficult to get. Fig. 8 shows a wooded scene having an atmosphere of dreamy brightness. The leaning tree trunks and the relaxed pose of the figure, help to produce it. Also, the shadows on the ground, on the trunks of the trees, and on the surface of the water all play their part in creating this atmosphere. Exposure was made for the shadows by using the lowest reading on a light meter at the camera position.



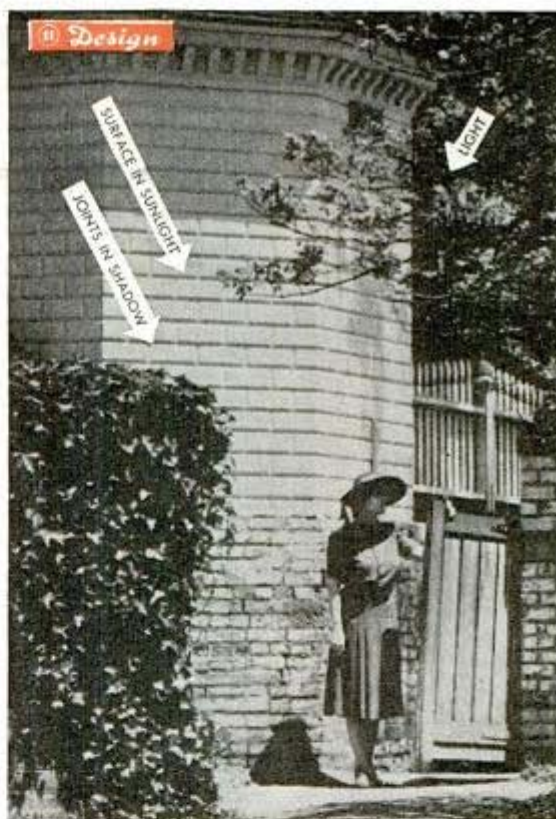
The emphasis of surface is another role of shadows. In Fig. 9 there are various intensities of light on the walls of the smokehouse, kitchen, and butler's house at Mount Vernon. The kitchen wall, in half light, shows clearly every irregularity. The wall in full shadow and the wall in full sunlight contrast strongly with the kitchen wall, and make a picture in which each surface is distinct. A sense of distance, depth, thickness, or third dimension is often difficult to obtain in a photograph, but possible if good use is made of shadows. In Fig. 10 the mountain slope in the

foreground is in shadow and acts as a setting, or as a foil, against which the distant mountain cliffs stand out in sharp contrast. Half an hour earlier the near slope was also sunlit and presented so little contrast that it merged with the distance.

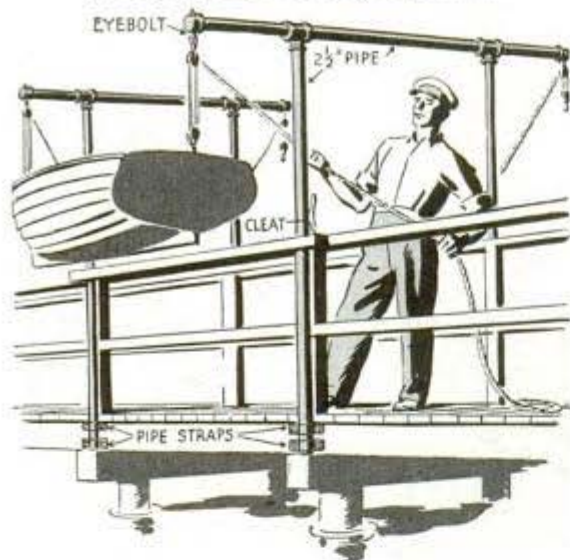
Fig. 11 shows a study in design in that the shape and form of the bricks in the octagonal tower are brought out by strong shadows. Even the shadowed portion of the wall shows brick design, because a white wall to the left and rear of the camera position reflected a large amount of light onto this surface. The form of an object, such as the aspen trunks in Fig. 13, is very effectively brought out by lighting that illuminates half and leaves half in deep shadow. This is a form of sidelighting which reaches its maximum effectiveness when photographing rounded objects. The sun was high enough to give strong highlights on the protruding portions of bark and these highlights are strengthened by contrast with the narrow shadows cast under them. Modeling is greatly aided by a strong sidelighting that casts shadows like those on the camper's figure in Fig. 12.

While highlights are important, the shadows in varying intensities give roundness to the muscles. In Fig. 14 the cloud shadow illustrates another role of shadows, that of revealing conformation. The angles made by the sides of the valley would have been difficult to guess, let alone photograph, without the cloud shadow, which in this picture is emphasized since it was taken on infrared emulsion.

Remember that two photographs of the same subject taken a short time apart will vary greatly due to the change in the position of the sun. Successful scenic photographers have learned to visualize a scene the way the camera will record it and are watching always for just the right conditions. Doubtless many scenes near you will make outstanding photos if snapped at the right time.



Sturdy Boat Davit of Large Pipe Assembled Easily on Pier



Anyone can assemble this boat davit from galvanized pipe and fittings. The vertical supports rest on the pier sills, and are kept from tipping by pipe straps, screwed to the pier framework. Large eyebolts,

which fit in holes drilled through the caps on the ends of the two horizontal pipes support blocks and tackle with which boats are raised or lowered.

Model Airplane Balanced to Fly With Modeling Clay

The nose of a flying model of an airplane can be weighted to establish efficient flying balance with the aid of ordinary modeling clay. A roll of the clay is pressed with the fingers over the nose block to form



a smooth, streamlined joint or the clay can be sculptured to resemble a motor cylinder block. Correct flying balance is obtained by supporting the model on the fingers at each wing tip and adding or removing the clay.—Ray J. Marran, Kansas City, Mo.

"Skipper"—Low-Cost, 14-ft. Outboard Runabout



At an expenditure of only \$30 to \$40 you can build this trim, five-passenger runabout, which is powered by a 4 to 24-hp. outboard motor. Its speed ranges from 9 to 24 m.p.h. depending on the size motor used. The boat has a 54-in. beam, 15½-in. freeboard, 24-in. depth, a 5-in. draft at 725 lbs., and a weight of about 275 lbs. Six plans (Nos. 1018 to 1023 incl.) showing details of building besides sheets giving material list and outline of procedure will be sent postpaid on receipt of \$1.50

Other Boats You Can Build

16-Ft. Canoe—811 and 812: Canadian type. Cedar planking covered with canvas. 33-in. beam, weight 70 to 80 lbs. Two plans 50c.

Canvas-Covered Kayak—928 and 929: 17 ft. in length and weighs about 40 lbs. Two prints 50c.

"Sea Saucer"—893: Lightweight sailboat. Length 9½ ft. Beam 4 ft. Deck, bottom and sides are 3/16-in. plywood. 25c.

15-Ft. Rowboat—644: Flat bottom, all purpose. Covered forward deck. Has three seats. 25c.

12-Ft. Utility Rowboat—707: Flat bottom, four seats. Very sturdy design. 25c.

"Arrowhead" Sloop—944 to 951: A fast and able sailboat. Over all length 21 ft., beam 5 ft. 11 in. Accommodates up to 10 persons. Set of 8 prints \$2.00.



"Roamer"—765 to 770: Outboard cabin cruiser. 16 ft. long, 66 in. beam. Requires outboard motor of 20 to 36 hp. Set of six prints \$1.50.

"Hi-Ho," 14-Ft. Family Runabout—840 to 845: Powered by 11 to 22 hp. outboard or light inboard motor. Beam 58 in. Set of six prints \$1.50.

Address—Dept. 262, Popular Mechanics Press, 200 East Ontario Street, Chicago



Radio

CONCENTRATED ENTERTAINMENT

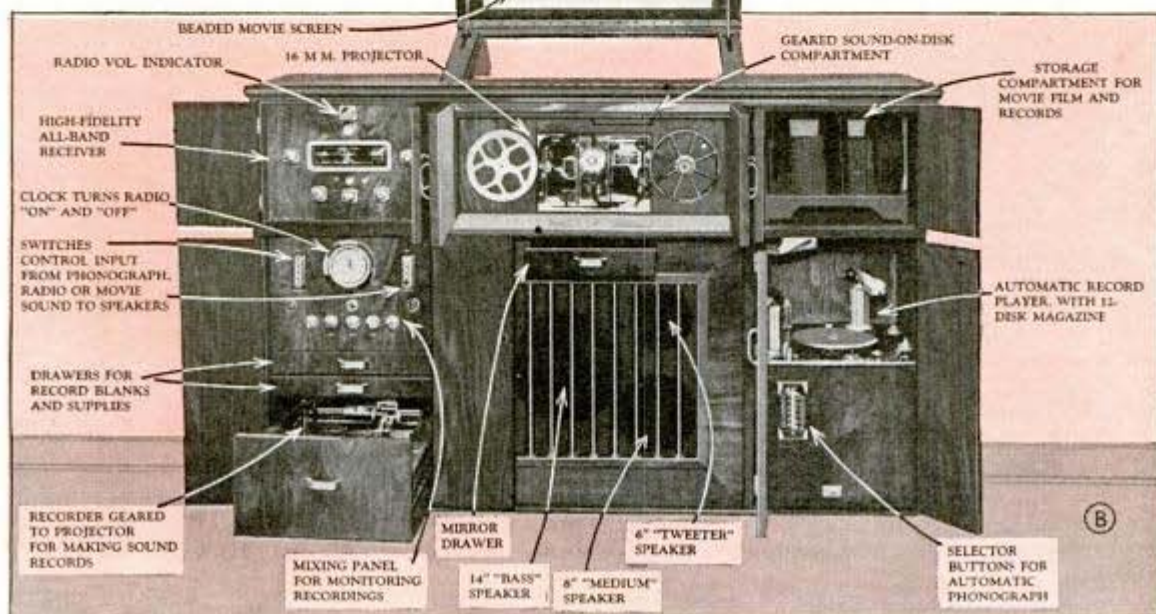
TO AVOID cluttering up his home with cabinets, one California radio enthusiast has combined his phonograph, home recorder, radio receiver and sound movie projector into one instrument which he calls a "phono-cine-radio-recordo-graph."

Photo A is a close-up view of the power unit compartment and high-fidelity amplifier used to drive the three speakers which are employed in a cross-over network for all sound applications. The combination instrument in all its glory, with many of its various and sundry parts identified, appears in photo B.

Each compartment of the cabinet has its own lighting system. The radio and phonograph sections of the instrument may be operated by remote control and sound can be



switched to speakers located at remote points. The completed instrument weighs 800 pounds and required a year of spare time to assemble.



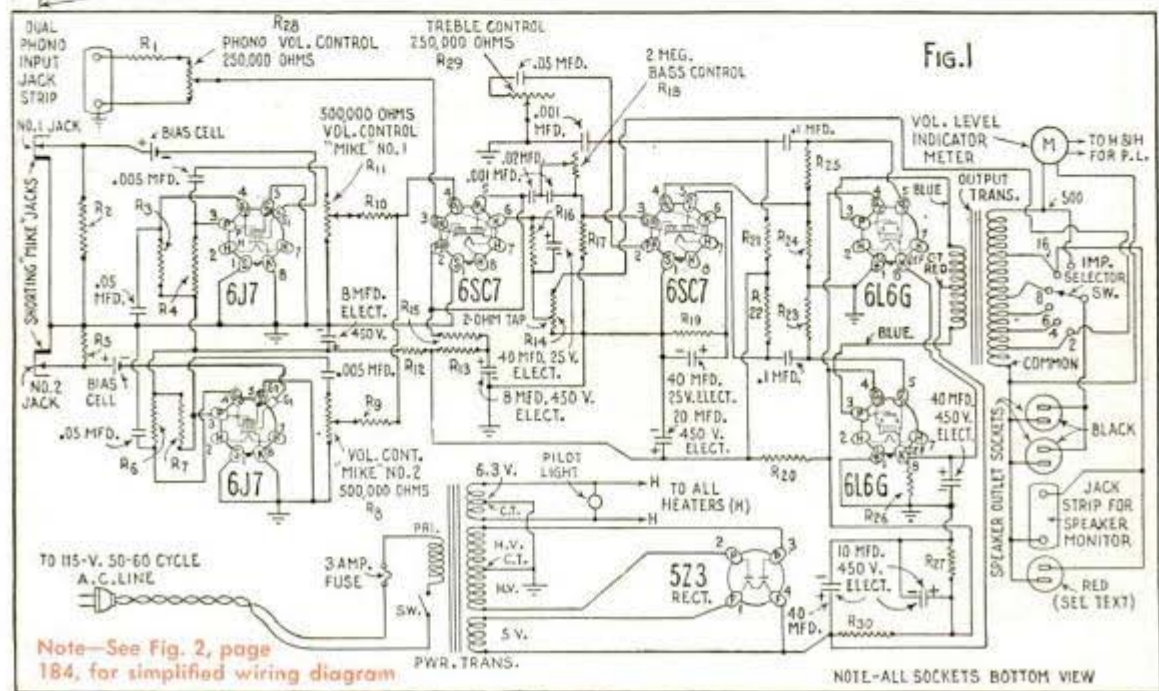
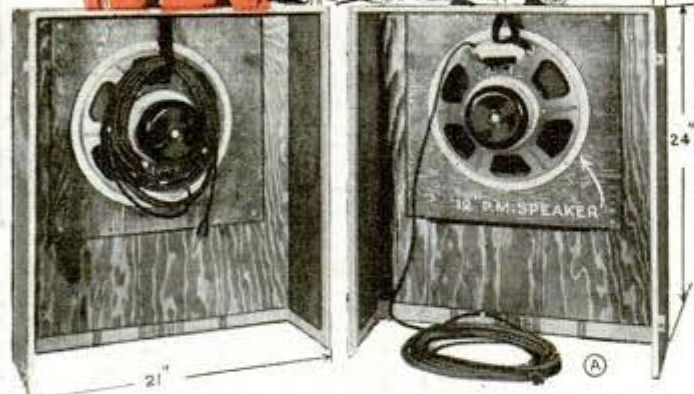
PORTABLE P.A. AMPLIFIER

By L. M. Feiler



DESIGNED for rugged dependability, operating ease and full 20-watt output, this modern public address amplifier is easy to build and includes many features found only in high-priced sound systems. Portable inasmuch as it is housed in a single sturdy case which separates into three units, two of which serve as speaker baffles, it is easily transported to summer camps, vacation resorts and similar locations wherever a good inexpensive sound system is required for entertainment purposes.

Input channels are provided for two high-impedance microphones and a record player. These may be used individually or all at the same time. Experienced builders will be interested in the practical and up-to-date features which include: bias cells, mixing circuit, inverse feedback, impedance selector, volume-indicating meter, monitor speaker

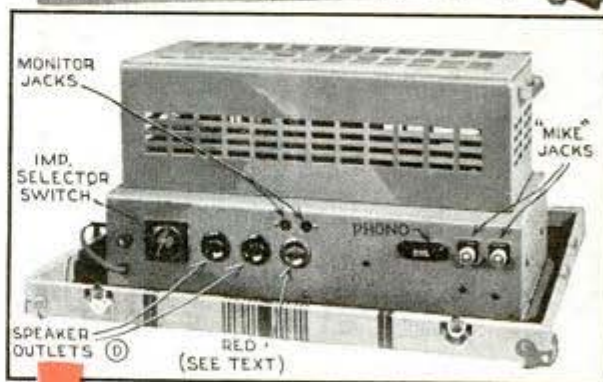


for SUMMER CAMP

Twenty-Watt Output Two Speakers

jacks and separate tone controls for treble and bass response. All controls may be placed in the top of the chassis base in the cutouts provided, see photo C, and the front openings in turn covered up, if desired. Shifted to the top and the cover in place, the controls cannot be tampered with, an excellent idea in many large group applications.

The metal chassis base is 18 in. long, 8 in. wide and 4 in. high. This base and the ventilated cover are available formed and drilled if desired. A schematic circuit diagram is given in Fig. 1, and a complete simplified wiring diagram appears in Figs. 2 and 2-A. This underside view of the base shows all parts in their relative positions and every connection is clearly indicated. Many parts are color-coded so that the work can be done easily by anyone. The red outlet in the rear of the chassis base is provided as an outlet for a booster power amplifier if additional power output is ever required. The 40-10-10-10 mfd. electrolytic condenser is plainly marked but is not provided with colored leads. The color indications given are suggested as a wiring aid, and the builder should have a small supply of red, yellow, blue, green and black hook-up wire on hand before starting construction. It will be



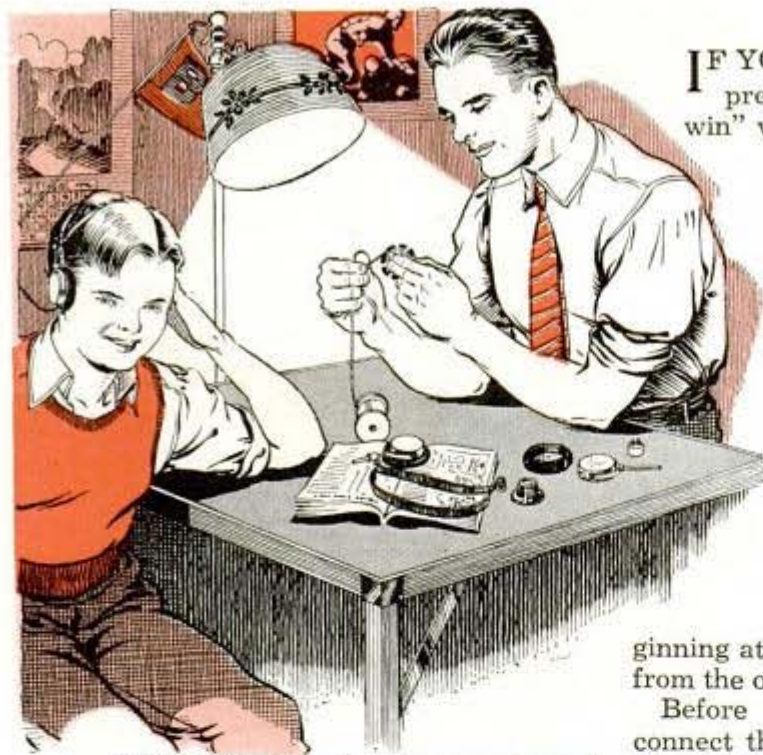
noted that two 10-mfd. sections of the electrolytic condenser unit are connected together to provide the positive 20-mfd. (blue) lead. The small 1½-volt bias cells in holders, are easily mounted on tie point strips and the polarity should be just as shown. Cushioned sockets are used for the 6J7 tubes. Use lock washers for mounting all parts and solder connections carefully.

The microphone jacks short-circuit the input when not used and eliminate noise pickup. Photos A,

(Continued to page 182)

Crystal Receiver Is Built Into a Headset Unit

By L. B. Robbins

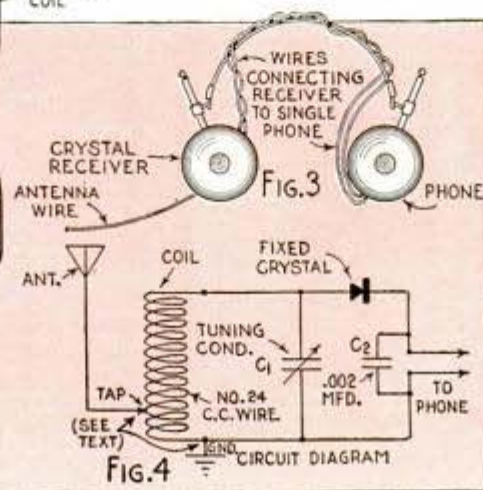
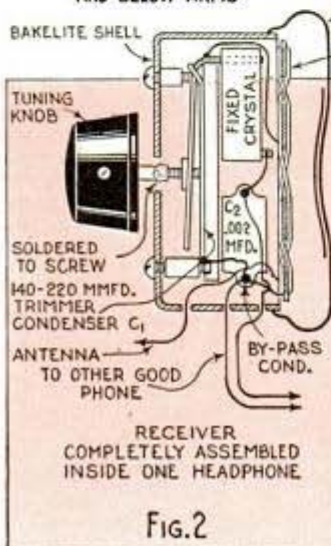
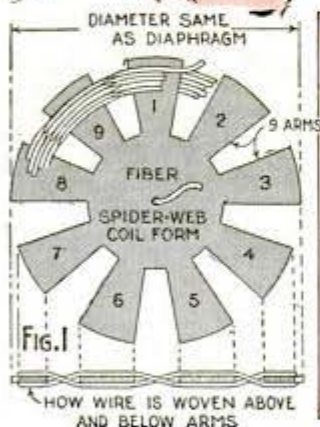


IF YOU have a pair of headphones, preferably the old style "Baldwin" variety with extra large Bakelite shell and cap, it is a simple matter to build a good crystal receiver in one phone shell and use the other phone to receive stations.

Test the phones and select the most sensitive one for listening. Strip the other and drill a hole in the center of the shell bottom for the shaft of the porcelain-base trimmer condenser (C_1). Wind thin spiderweb coil Fig. 1, photo A, with as many turns of No. 24 c.c. magnet wire as possible, beginning at center and ending about $\frac{1}{4}$ in. from the outer end of arms.

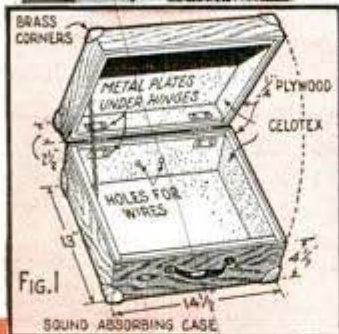
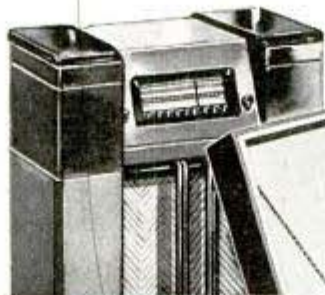
Before mounting parts in the shell, connect them for a temporary test on a small board and check coil turns, tapping off the antenna tap lead at the point for best reception, see Fig. 4, before soldering.

Assemble in the shell as shown in Figs. 2 and 3. The antenna and ground leads should be several feet long and terminate in small spring clips to fasten to any convenient antenna and ground. Ground connection is optional but helpful. The fixed crystal is a small, round, flat type with machine-screw terminals. Short bushings and machine screws are used to mount tuning condenser C_1 . Photo B shows completed set with small tuning dial.



Practical RADIO SUGGESTIONS

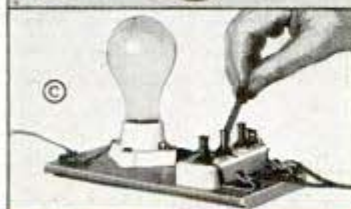
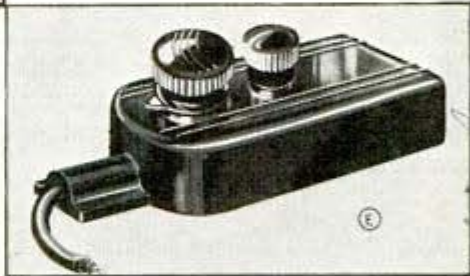
(A) Sound-absorbing case improves tone of any low-cost record player. Since most of the shortcomings of inexpensive open-type record players are mechanical rather than electrical, the performance of these popular units can be improved by operating them in an easily built sound-absorbing cabinet. General dimensions are given in Fig. 1. Built with simple tools at a cost of about \$2.00, it will house standard player units, or dimensions may be altered to meet requirements. Provide sufficient room to close lid over record player when it is in operation. The case is completely lined with ½-in. Celotex insulating material



(E) Contact microphone for musical instrument amplifiers has built-in volume control; connects to grid of first tube same as any high-impedance microphone



(B) With this universal A and B-battery eliminator you can operate your portable or home battery receiver at your office or anywhere that a 115-volt a.c. or d.c. source of power is available. The unit is only slightly larger than one standard B-battery

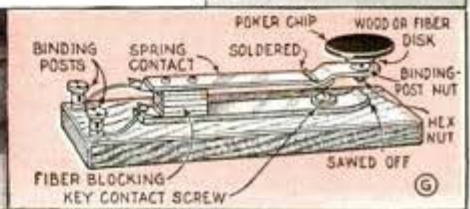
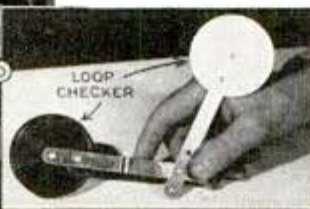


(C) Test the efficiency of your radio ground by means of a 60-watt bulb and a s.p.d.t. porcelain-base knife switch mounted as shown. Connect one side of the lamp to ground and the other side to the switch lever. A length of lamp cord with plug is connected to the outside switch terminals. For test—open switch and insert plug in wall socket. Throw switch lever to one side, if that is grounded side of line lamp will not light; thrown to other side, if lamp lights bright ground is good. If it is dim, look over connections as some resistance is causing poor ground



(D) Loop checker gives accurate and easy-to-read indication of poor or perfect loop-antenna tuning adjustment.
(F) Coffee-can soldering iron holder; steel wool for cleaning iron

(G) Practice key made from an old open-circuit jack and junk-box parts



*Merger Copied, Cedar & Co.
W. W. Dickler Co
300 Main St. Springfield*

Echo phone Radio Co.
 201 E. 26th Chicago
**Small Communications Receiver
 Provides for Code Practice**



Not only does this inexpensive set provide for the reception of both phone and code throughout its range of 545 kc. to 30.5 megacycles but in addition has self-contained facilities for keying and code-reading practice. With a standard telegraph key connected in series with the headphone tip jacks, the output of the receiver to the headphones will be broken up into dots and dashes as the circuit is keyed. Features include bandspread, a.v.c., standby switch, built-in speaker and three calibrated bands on main dial.

Compact Test Oscillator Unit

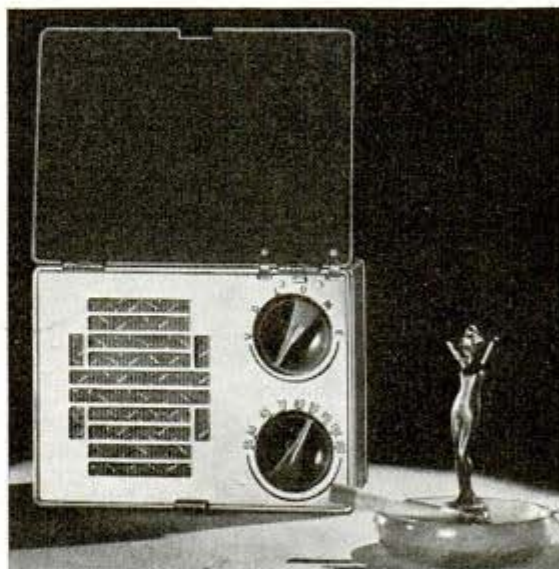


Aiding service men and radio dealers in the recent job of resetting push-button radio receivers for the new frequency allocations, this compact test oscillator generates a signal which is supplied to a radio as a guide for accurate station setting, and for tuning

ing the buttons in periodic check-ups. The instrument is provided with 8 push buttons that can be set to the frequency of any 8 stations in a given locality. Easily portable, the unit weighs only 5½ pounds and operates from a.c. lines or from self-contained batteries where power lines are not available. Battery operation is also useful when the instrument is employed to reset and adjust push buttons in automobile radios. Four-hundred cycle modulation is available when required.

Miniature Four-Tube Super

Small as a ladies' pocketbook and light as a camera, this tiny set employs four of the new miniature tubes in a highly sensitive superheterodyne circuit. Loop anten-



na is housed in the plastic front cover which also acts as the on-off switch. The set is only 6¼ in. long, 4⅝ in. high and 3½ in. deep. Complete with batteries it weighs 4¼ pounds.

Blueprints covering 80 simplified radio construction articles in this and past issues are available for 25c each. Original parts lists, with manufacturers specified can be obtained from Popular Mechanics Radio Department upon receipt of postage.

NEXT MONTH—Self-Powered Four-Purpose Amplifier for Experimenters. Simple and easy for beginners to build, this inexpensive unit has almost as many uses as parts. Also—**A Battery-Operated Code-Practice Oscillator.** With speaker for group code practice. Extra! **Seven Crystal-Set Hook-Ups for Experimenters.**



SHOP NOTES

Tested Materials Assure Good Concrete

STRONG, durable concrete requires first of all that the aggregate be of good quality. Without this, even the most careful proportioning, mixing, and curing of the concrete will not produce a good job. Therefore, practical tests for the cement and aggregate are an important help to the contractor or workman who must lay concrete.

Methods of testing Portland cement are generally too complicated to be made with simple apparatus. Generally, cement made by a reliable manufacturer and properly stored can be assumed to be satisfactory. However, cement that has been stored in a damp place is useless if it has absorbed enough moisture to damage it. Cement that contains lumps that cannot be pulverized readily by striking with a shovel, Fig. 1, is unfit for use. Any water suitable to drink is satisfactory for mixing concrete. It must be clean and free from oil, acid, alkali or strong mineral content.

Sand and the coarse aggregate should be sound, hard and durable. Soft or flaky materials impair the strength of the concrete. Clean, sharp sand for the fine aggregates, and clean gravel or crushed rock make the best materials. An important requirement for sand is that its content of silt, loam and similar materials be low. This can be determined by a "silt test," Fig. 2. Sand sometimes contains injurious vegetable matter, which can be detected by means of a color-reaction test. To make this test, fill a 12-oz. prescription bottle to the 4½-oz. mark with the sand, and add enough of a 3% caustic-soda solution to reach to the 7-oz. mark, Fig. 4. The caustic-soda solution is made by dissolving sodium hydroxide, 1

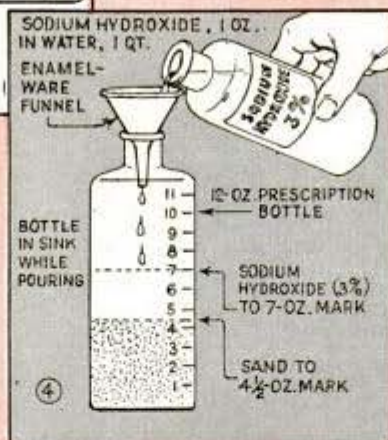


oz., in water, 1 qt., preferably distilled water. It should be kept in a bottle with a tight rubber stopper, and care must be taken not to spill the solution on clothes, skin, or other articles, as it is very injurious to animal and vegetable matter. After adding the soda solution to the sand, the jar is closed with a rubber stopper and shaken, then set aside and allowed to settle for 24 hrs. The color of the liquid layer at the end of that time indicates the



A "silt test" to determine the purity of sand is made by filling a quart jar with sand to a depth of 2 in. and water $\frac{3}{4}$ full. Then the jar is shaken vigorously. If, after settling, silt layer on top of the sand exceeds $\frac{1}{8}$ in. the sand is unsuitable

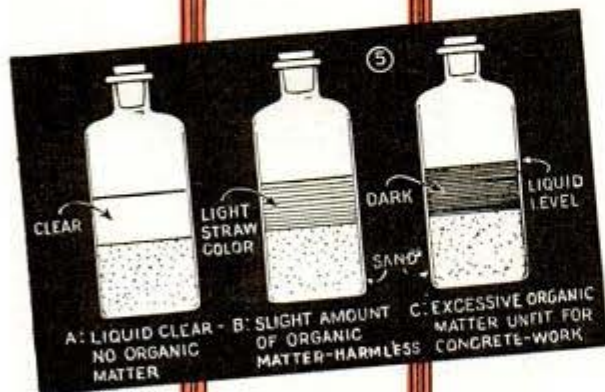
You can detect the presence of vegetable matter in sand by a color test as in Fig. 4, by pouring sodium hydroxide over the sand. After the mixture has set for 24 hrs. the amount of vegetable matter present is shown by the color as in Fig. 5



amount of vegetable matter in the sand, Fig. 5.

To obtain strong concrete, it is necessary to control accurately the quantity of water added. The table in Fig. 6 gives recommended total quantities of water that should be mixed with the cement and aggregates for various purposes. From this

total quantity of water, the amount of water carried by the sand must be deducted if maximum strength is to be obtained. A rough method of determining the moisture content of sand is shown in Fig. 3. Most sand would be classified as wet. The quantity of water to add to the batch is figured easily. For example, suppose a 1:2:3 mixture is to be made (1 sack of cement, 2 cu. ft. of sand, 3 cu. ft. of crushed rock) with 6 gals. of mixing water per sack of cement. Suppose the sand is wet—feels moist to the touch and leaves the hands moist after handling it. Fig. 4 indicates that such sand contains about $\frac{1}{2}$ gal. of water per cubic foot. Since one sack of cement requires 2 cu. ft. of sand, the sand will carry a total of 1 gal. of water. This must be deducted from the total water (6 gals.), leaving 5 gals. of water which must be added. Another method is to weigh exactly 2 lbs. of the sand, then dry it in an oven or over a fire. The sand is then reweighed to find the loss of weight. Multiplying this by .4 gives the moisture content in gallons per cubic foot. For example, if the loss is $1\frac{1}{4}$ oz., the moisture content is $(1\frac{1}{4} \times .4)$ or $\frac{1}{2}$ gal. per cu. ft.



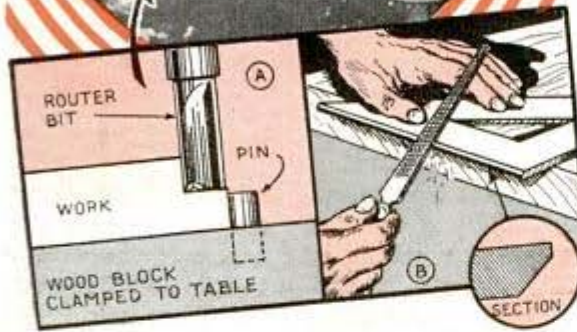
MIXING WATER RECOMMENDED FOR CONCRETE

Kind of Work	Total gal. of water for each sack of cement *
Foundation walls	7 gallons
Water-tight floors and foundations	6 gallons
Driveways, walks, tennis courts	6 gallons
All reinforced concrete	6 gallons
Tanks	6 gallons
Other water-tight concrete, or concrete subject to moderate wear or frost	6 gallons
Topping for wearing surface in two-course floors, pavements, walks, etc.	5 gallons
First course in two-course work	6 gallons
One course heavy-duty floors	5 gallons
Concrete subject to weak acid or alkali solutions	5 gallons

* Includes mixing water and moisture content of sand

⑥

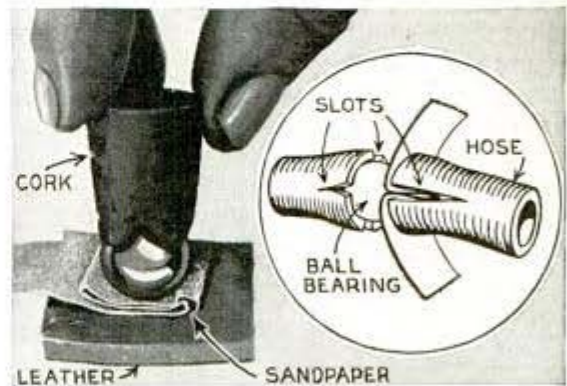
Undercut Edges Improve Drawing Triangles



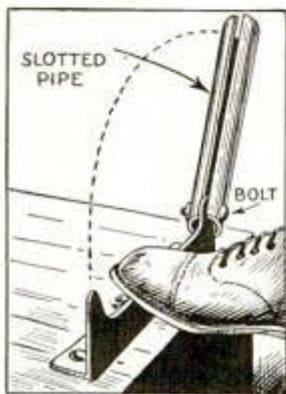
Triangles and French curves can be improved so that ink will not run under the edges when drawing, by undercutting the edges. This can be done by hand with a knife or a file, but a quicker way is to use a small router bit in a drill press. Such a bit can be made from a broken straight-fluted drill of small diameter. The sides of the drill should be ground so the cutting edges are relieved, and the end beveled in two directions to form cutting edges.

HOLDERS TO GRIP BALL BEARINGS WHILE POLISHING THEM

The next time you have ball bearings to polish, try these holders. One consists of a cork having two slots cut across the lower end. This enables you to hold the ball easily while it is run over a piece of abrasive paper placed on a piece of leather to prevent slipping. The other holder consists of two short pieces of hose. One piece has four shallow slots at the end to take the ball, and the other has two deeper slots to take the abrasive paper as indicated in the circular detail.



FOOT SCRAPERS AT SCHOOL HOUSE HAVE SHIELDS TO PROTECT THE CHILDREN



To minimize the possibility of children being injured by falling on foot scrapers at a school house while playing, the janitor fitted each one with a pipe cover. This was slotted along one side so that it would slip over the scraper, and it was pivoted to one end. A flip of the foot removes or replaces the cover.

TRACTOR RUNNING HOURS RECORDED ON SPEEDOMETER

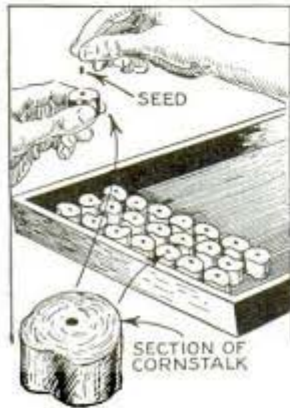
Finding it extremely difficult to keep track of the period between oil changes in his tractor because several persons use it, one farmer attached an old auto speedometer near the seat. At the end of each day, the speedometer is set to register the number of hours the tractor has run since the last oil change.

Tumbling Shields on Line Shafts Protect Your Clothing



When power-drive installations in small shops and other places are of such a design that it is difficult to shield the shafts against catching in the clothing, these tumbling shields will solve the problem. They are merely sheet-metal sleeves somewhat larger in diameter than the shafts. In use, the seams of the sleeves are opened, after which they are slipped over the shafts and the seams closed again. The shields fit loosely, allowing the shafts to rotate inside them without the sleeves moving.

Slices of Cornstalk Sprout Seeds



One nurseryman who often has valuable but small seeds to plant, sprouts them for transplanting in slices or disks cut from large cornstalks. A tiny hole is made in each slice to take a seed, after which the slices are placed

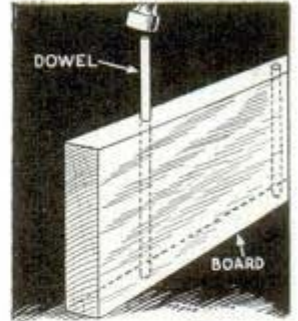
in a container and covered with sifted dirt. Then water is poured into the container to bring the level up about half way on the slices. At

transplanting time, the slices are lifted out one at a time and set into the ground. In this way, the delicate root systems of the plants are not disturbed, and the stalk slices soon rot.

—Dale Van Horn, Lincoln, Nebr.

Boards Are Kept From Warping by Doweling Them

Boards that are used in gates, yard fences, stock racks, etc., where they are exposed to the weather and rough usage, can be prevented from warping or splitting by driving small dowels into holes drilled at regular intervals along their lengths.

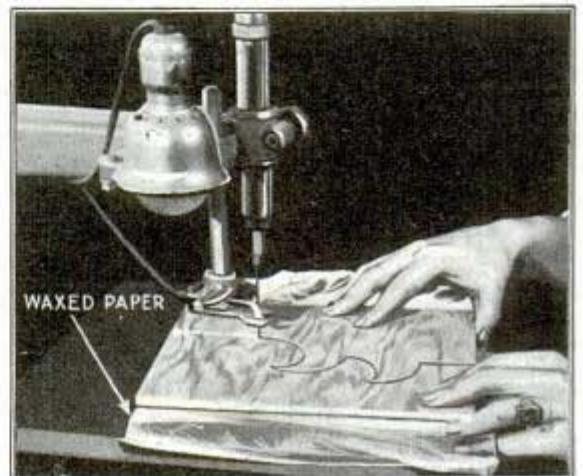


The dowels should go entirely through the board edgewise as indicated. It's a good idea to dip the dowels in paint or shellac before driving them to help keep out moisture.

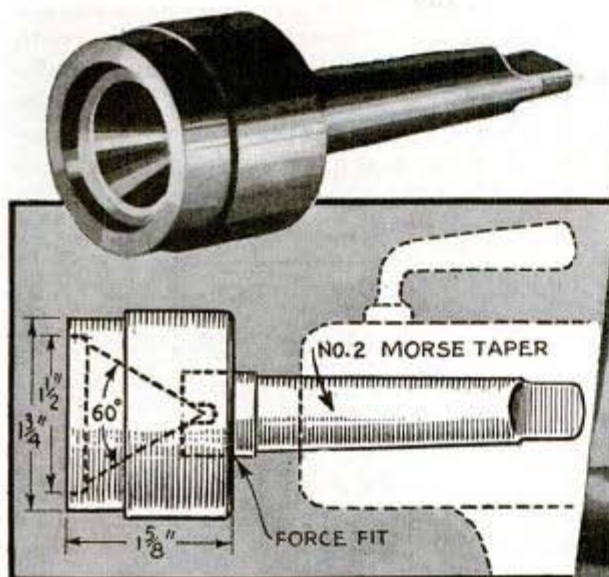
Waxed Paper Under the Work Lubricates Jigsaw Blade

Placed between the jigsaw table and work, a sheet of waxed paper will act as a lubricant for the blade and increase its cutting speed. As the paper feeds into the blade along with the work, it also lessens friction between the table surface and work, which permits the operator to slide the piece with greater ease and get a more nearly perfect pattern.

—W. C. Wilhite, Carlinville, Ill.



Cup Lathe Center to Turn Centerless Shafts



For use in truing a commutator on an armature shaft that has no center, this cup center in the tailstock of the lathe will support the end of the shaft. Made from a short piece of cold-rolled steel, the center is bored to a 60° angle, and a shank with a Morse taper turned on it is

driven into the hole at the rear end. The shank can be made from an old twist drill.

Reading Glass Magnifies Scale Graduations on Lathe



A lathe operator in a small manufacturing plant found that greater accuracy could be maintained in production work by using a reading glass to magnify the scale of graduated collars of the slide rest. A square piece of brass was drilled to take the handle of the reading glass, and was tapped for a clamping screw. The top of the lathe swivel saddle and the bottom of the brass holder were then drilled and tapped, to bolt the assembly in place. Loosening the clamping screw permits adjustment of the glass to the required position over the graduated collars. The attachment can be removed in a moment.

Bicycle Grip on Wrench Makes It Easy to Hold With Greasy Hands

When using a pipe wrench on jobs where your hands are likely to be greasy, try slipping a rubber bicycle grip over the handle. The rubber, having a corrugated surface on the upper side and an irregular surface on the underside to fit the fingers, gives you a better grip so that the tool is less likely to slip out of your hand.



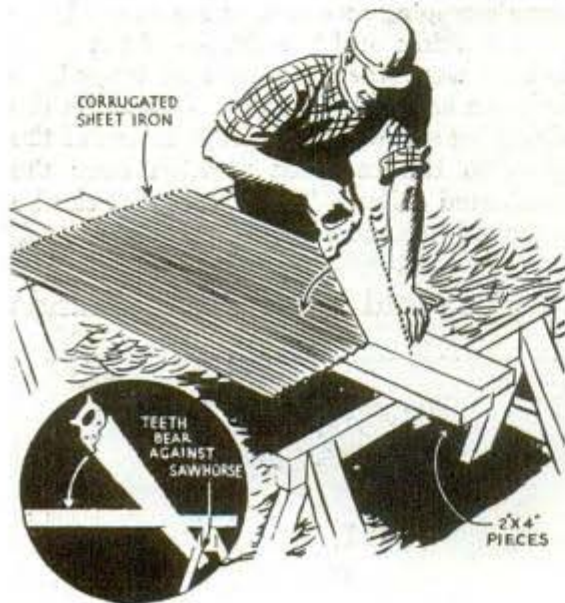
Funnel Is a Good Pouring Spout On Large Feed Sack



To prevent spilling expensive chick feed, and to avoid tying and opening a sack each time some of the feed was removed, one poultryman tied a funnel in the mouth of the sack. To remove the feed, the top of the sack was tipped as indicated.

Back of Hand Saw Used as Shear To Cut Sheet Metal

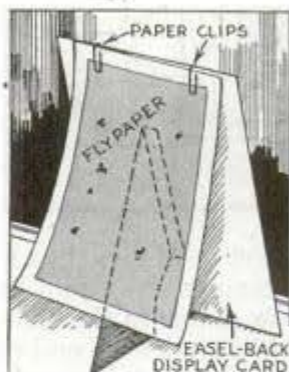
When applying corrugated sheet-iron roofing it was found that the back of a regular hand wood saw could be used as a shear in cutting the metal. To do this, the



sheet iron was laid on 2 by 4-in. pieces placed side by side across two sawhorses as indicated. Then the saw was inserted in the crack between the two pieces with the back against the sheet iron and the teeth against the underside of one of the two horse cross members. Pressing downward on the saw handle forced the back of it through the sheet iron with a shearing action.—Colin K. Lee, Bowling Green, Mo.

Flypaper Back of Window Card Is Out of Sight

Fly paper can be kept out of sight and yet be effective in window displays, if it is attached to the backs of display cards as indicated. A couple of paper clips at the top will hold the flypaper in place.



Chalk Kept on Nail in Tool Kit

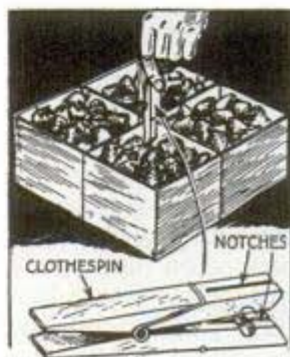


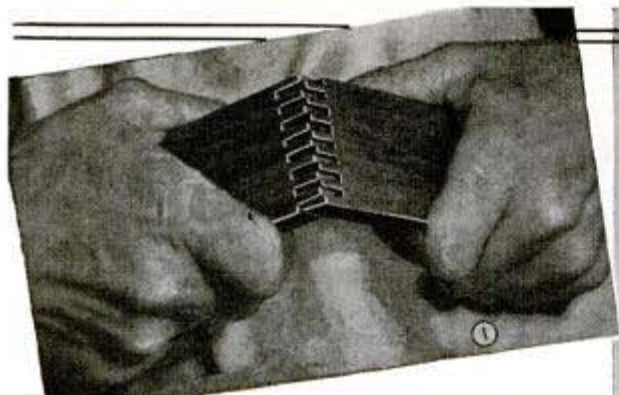
Instead of throwing a disk of carpenters' chalk around in the tool kit where it marks up the tools, hang it on a nail near the handle of the kit as indicated. It takes only a minute to drill a hole

through the chalk and to drive a finishing nail in the end of the tool box.

Four Berry Boxes Are Carried By Means of a Clothespin

As an aid to pickers in carrying a number of berry boxes in a field, one farmer sawed slots in the jaws of a spring-type clothespin. This was slipped over the four boxes at the corners as indicated.

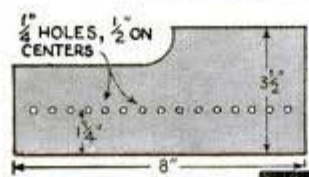
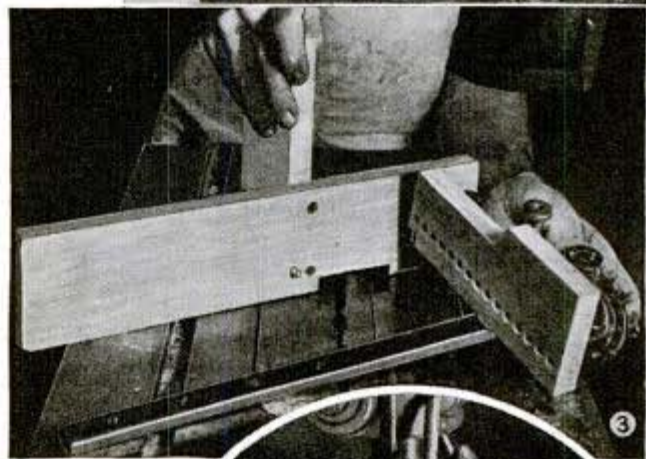




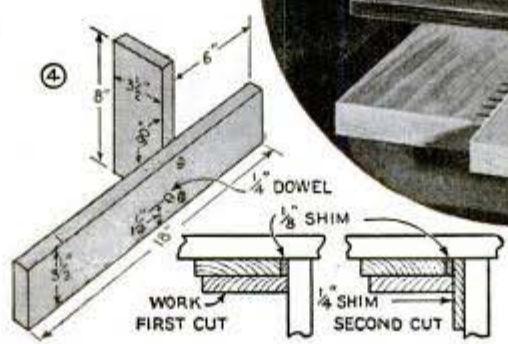
BOX JOINTS

easily cut with a jig

UNLESS a suitable setup is employed to assure uniform offset cuts, the cutting of box joints, Fig. 1, is a painstaking job, even though a power saw is used. But with the two-part jig shown in Fig. 3, multiple cuts, correspondingly offset, can be made quickly and accurately. Fig. 4 details the guide which is screwed to the miter gauge, and the holder to which the work is clamped vertically as shown in Fig. 2. A single dado blade is adjusted to project the thickness of the work above the saw table. Then the guide piece is screwed to the gauge in a position to allow the vertical upright of the holder to butt against the left side of the blade when the pin in the latter engages the first hole. Corresponding lengths of work are placed alternately in the jig, that is, the first is offset from the holder with a $\frac{1}{8}$ -in. shim, the second one isn't, the third is, etc., as indicated in Fig. 4. Then the work is passed over the saw, shifting the holder from one hole to the next. To make the intermediate notches, a second cut is required, using a $\frac{1}{4}$ -in. shim. By using two blades spaced with a $\frac{1}{8}$ -in. collar, the second cut can be eliminated.

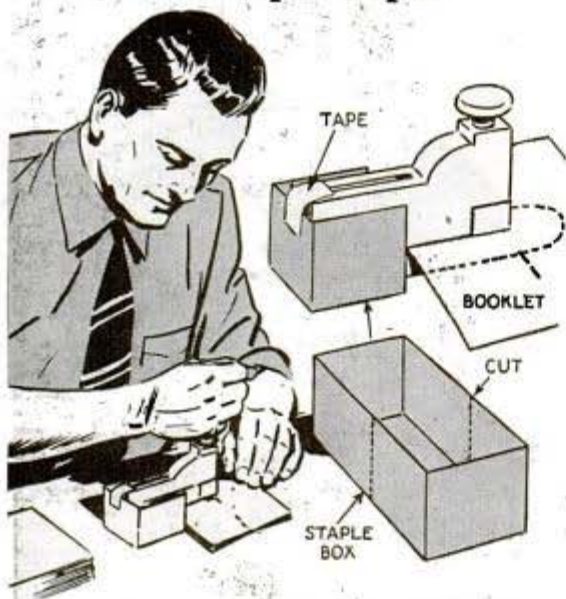


DETAILS OF GUIDE, AND HOLDER PIECES



Special care should be taken in spacing the holes in the guide as shown in Fig. 5

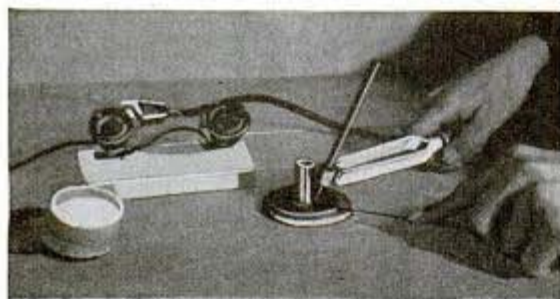
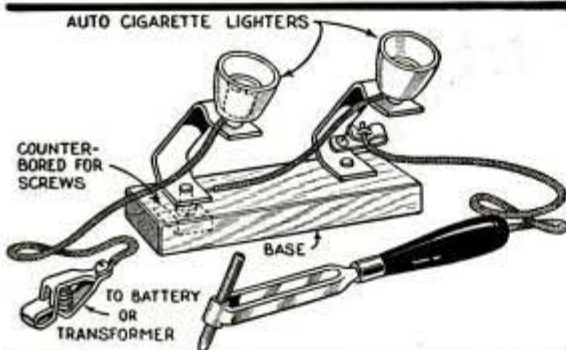
Empty Box Serves as Depth Gauge For a Paper Stapler



In stapling pamphlets or booklets where the staples must be inserted accurately along a folding line, the depth to insert the work can be gauged with an empty staple box. Just slip the stapler into the box, after breaking out one end. Then cut down the sides of the box to the depth that the work is to be inserted.

Heat of Carbon Soldering Torch Regulated by Resistance Bank

As carbon soldering outfits are designed to produce their maximum heat at all



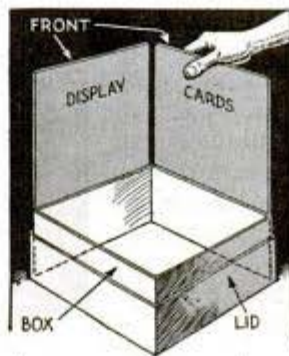
times, which is often too much when soldering or brazing tiny work, a resistance in the circuit will permit the heat to be controlled to suit the work. A couple of auto cigarette lighters will do for this purpose. These are mounted on a base and the electrode is connected so the current passes through one or both of the lighters, depending on the heat required.

Trowel Smooths Pocket Linings Before Steam Pressing

Annoyed by the time required to smooth out pocket linings before pressing garments, one owner of a dry-cleaning shop found that a small garden trowel was ideal for the purpose. The trowel is easy to insert in any pocket opening and a side-to-side motion smooths the cloth.



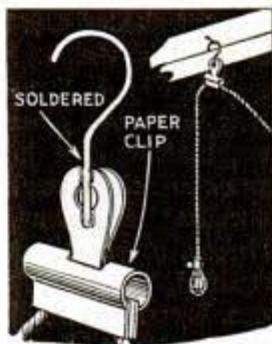
Inverted Box Supports Showcards



Large showcards in windows or on floor displays can be supported easily by using cardboard boxes of suitable sizes. The lids of the boxes are slipped over the bottoms and the cards inserted as indicated.

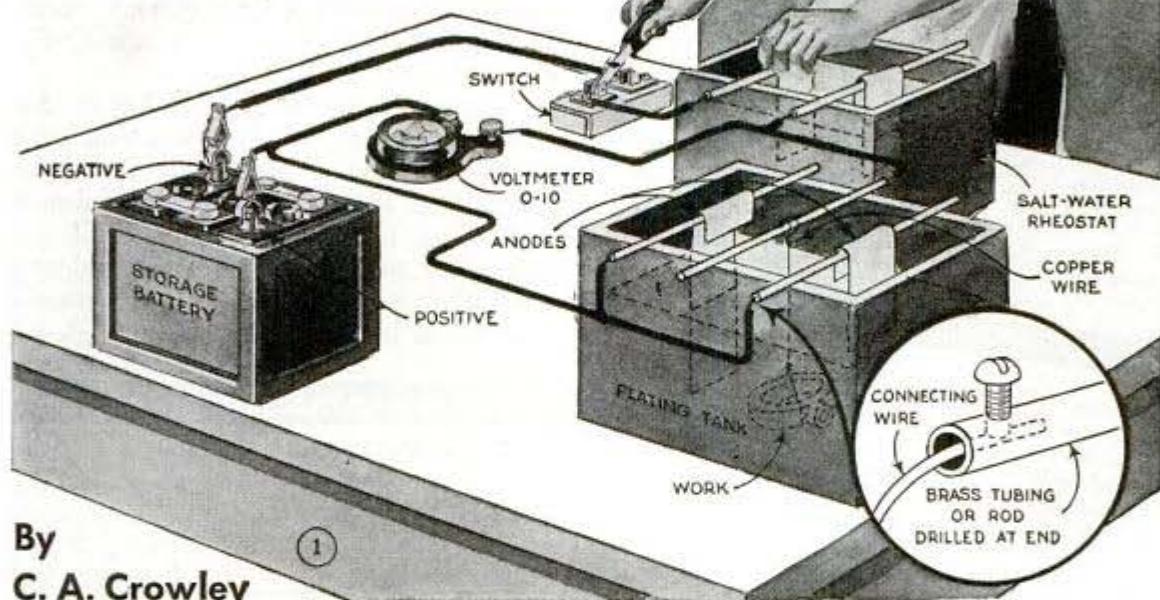
Clip Hanger Adjusts Shop Light

Handy for adjusting your shop light to any desired height, this simple hanger can be made in a few minutes by merely soldering a wire hook to an ordinary paper clip of the type shown. The hanger will also prove useful for gripping the light cord when hooked over a pipe or rod above the work.



Electroplating ALUMINUM AND ZINC-ALLOY DIE CASTINGS

IN ELECTROPLATING aluminum, aluminum alloys and die castings of either zinc or aluminum alloys, the most satisfactory method for general purposes is to give the aluminum or zinc alloy a prelim-



By
C. A. Crowley

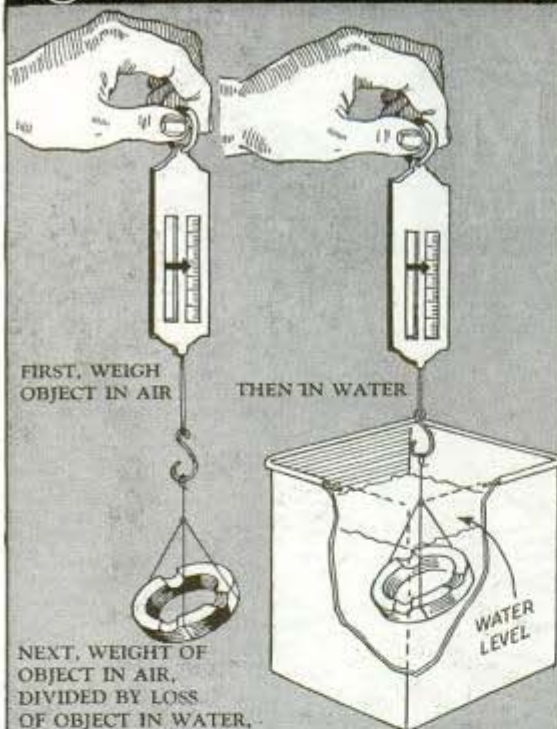
inary electroplate of nickel, after a careful cleaning and preparation. Copper, chromium, silver and other metals can be plated over the nickel by customary methods.

Identifying metals: Before electroplating it is important to be certain whether the metal is a zinc alloy, aluminum, an aluminum alloy, a magnesium alloy or some other metal. The plating methods given here are for use only on zinc and aluminum and their alloys. Magnesium alloys, which are used widely for lightweight castings, cannot be electroplated successfully, and other metals are best plated by different methods. The easiest way to distinguish zinc alloys, aluminum alloys and magnesium alloys is by their specific gravities, which are given in Fig. 3. To find specific gravity first weigh the metal object in air as in Fig. 2. For accurate results, use the most sensitive balance or scales available. Then

suspend the object in water by a light wire and weigh again. The weight of the article in air minus the weight of the article in water, is the loss of weight of the object. The specific gravity is equal to the weight of the article in air, divided by the loss of weight.

Cleaning aluminum: The first step in preparing aluminum alloys for electroplating is to clean and buff the metal thoroughly, freeing it from dirt and grease. Ordinary strong alkaline cleaners used in cleaning iron, brass, and other metals for electroplating cannot be used on aluminum or zinc alloys because they attack the metal. The formula for a satisfactory cleaner for use on any aluminum alloy is given in Fig. 5. The solution is used hot to remove all grease from the metal. After being cleaned, the metal should be rinsed in cold water. The next step with pure

2 WEIGHING TO IDENTIFY ALLOY



FIRST, WEIGH
OBJECT IN AIR

THEN IN WATER

WATER
LEVEL

NEXT, WEIGHT OF
OBJECT IN AIR,
DIVIDED BY LOSS
OF OBJECT IN WATER,
GIVES THE SPECIFIC
GRAVITY OF OBJECT

3 SPECIFIC GRAVITIES

Magnesium Alloys	1.7 to 1.8
Aluminum and Aluminum Alloys	2.7 to 3.0
Zinc and Zinc Alloys	6.7 to 6.8
Steel and Iron	7.0 to 7.6
Brass	8.4 to 8.8

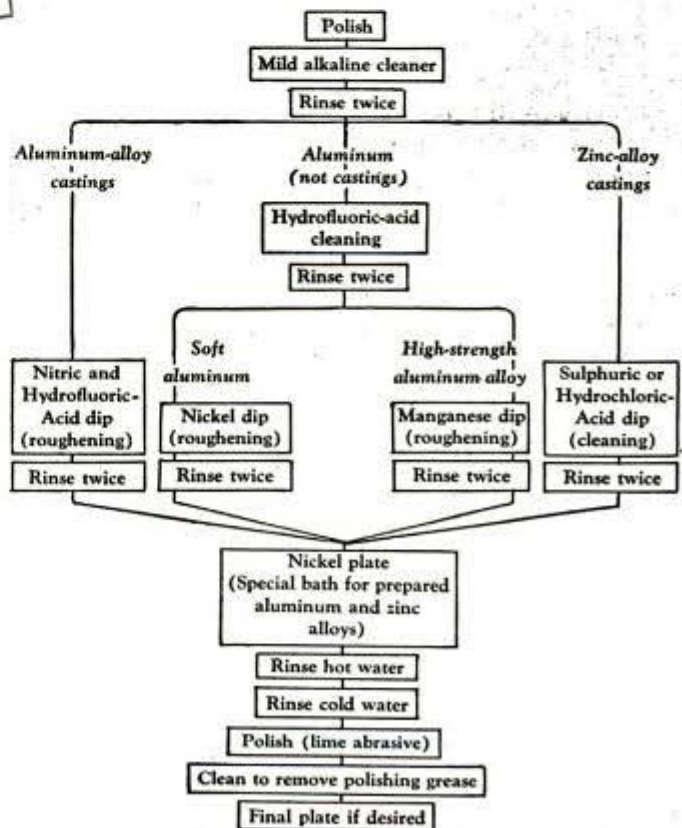
aluminum and aluminum alloys except castings, is to give the metal a quick dip in an acid solution, prepared by adding 50-percent hydrofluoric acid, 1 pt., to water, 9 pts., or same proportions in smaller amounts. The work should be dipped in this solution for about 15 seconds. This solution must be used in a lead-lined container, Fig. 6, as it will attack either glass or stoneware. Hydrofluoric acid produces painful burns on the skin which are slow to heal so great care should be taken to prevent getting it on the skin or clothes. If this should happen, immediately wash off in plenty of running water. After the acid cleaning, the metal should be rinsed thoroughly in cold water and transferred to the "roughening bath."

Roughening baths: The next step in the treatment of the aluminum will depend on the composition of the alloy being plated. Ordinary soft aluminum (known as "2-s," which is practically pure aluminum) should be given a "nickel dip" to roughen the surface slightly and give it a thin preliminary coating of nickel. Most sheet aluminum articles are made of this alloy and should be given this treatment. Aluminum-alloy die castings and sand castings are given an "acid dip" to roughen the surface before plating, instead of the hydrofluoric acid treatment. High-strength aluminum alloys (3-s, 17-s, 25-s, and 51-s, which contain various amounts of copper, silicon, and manganese) are given a "manganese dip" after the rinse, following the hydrofluoric acid treatment.

The formula for the roughening dip for soft aluminum is given in Fig. 7. The work should be dipped in this solution for a period of about 15 seconds to etch or roughen the surface to improve adhesion of the nickel plate, and also to give a preliminary nickel plate to the aluminum. The aluminum should leave this bath with a glossy

4 PROCEDURE FOR CLEANING AND PLATING

ZINC AND ALUMINUM ALLOYS

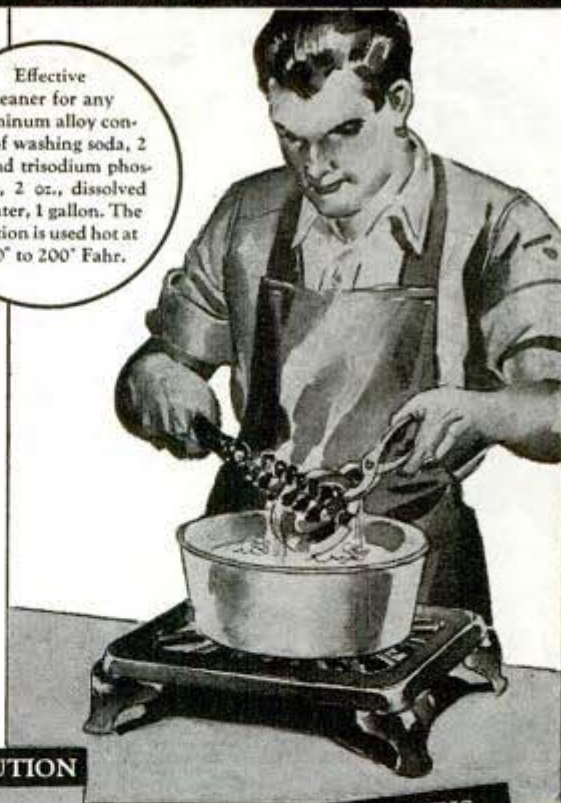


gray coating of nickel. The time required to achieve this result will vary somewhat with the surface being plated and the strength of the dipping bath, but the exact time can be determined by experiment.

With aluminum-alloy castings it is not necessary to use the hydrofluoric-acid cleaner as described above, and after removal from the alkaline cleaner and rinsing, the work can be transferred at once to the acid dip for roughening. Die-cast alloys should be immersed for 15 to 30 seconds in a mixture of concentrated nitric acid, 3 volumes, and 50-percent hydrofluoric acid, 1 volume. This bath should be used at a temperature of about 80° F. If the plating does not adhere properly the acid dip was too short. Too long a dip, on the other hand, makes the work too hard to buff. Since there will be some variation in the strength of the bath, and also because there is a very appreciable differ-

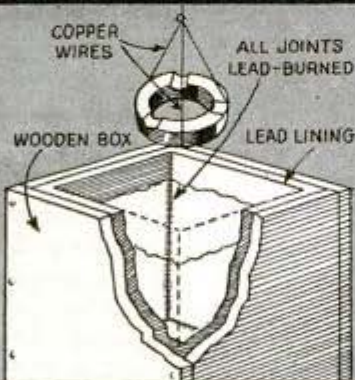
5 WORK MUST BE THOROUGHLY CLEANED

Effective cleaner for any aluminum alloy consists of washing soda, 2 oz., and trisodium phosphate, 2 oz., dissolved in water, 1 gallon. The solution is used hot at 180° to 200° Fahr.



6 QUICK-DIP, HYDROFLUORIC-ACID SOLUTION

After first cleaning, objects of aluminum and aluminum alloys (except castings) are given a 15-second dip in a solution prepared by adding 50-per-cent hydrofluoric acid, 1 pint, to water, 9 pints—(or smaller amounts of same proportions)



7 ROUGHENING BATHS

Nickel Dip for Soft Aluminum
 Nickel chloride, 36 oz.
 Hydrochloric acid, 26 fl. oz.
 Water, 1 gallon

Acid Dip for Aluminum Castings
 Concentrated nitric acid, 3 volumes
 50-per-cent hydrofluoric acid, 1 volume

Manganese Dip for High-Strength Alloys
 Manganese sulphate, 1/2 oz., dissolved in water, 5 1/2 gal., to which is added concentrated hydrochloric acid, 1/2 gal.

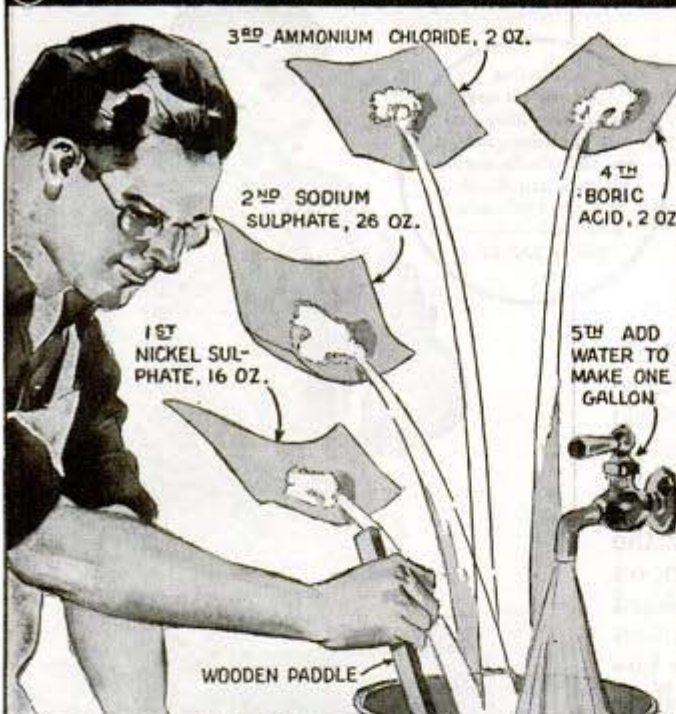
ence in the characteristics of various aluminum casting alloys, it may be necessary at times to adjust the acid-dip time on the basis of experimental results. With sand castings, the same acid dipping solution is used and the same conditions prevail, except that the time of dipping will run between one and two minutes. As this acid is highly corrosive, it must be kept in a container which is painted with a mixture of paraffin, 4 parts, and beeswax, 1 part. Glass and stoneware are attacked by this solution, and lead will be severely attacked at the air-acid surface. Because of its corrosive nature, the solution must be kept off skin and clothes.

The manganese dip for high-strength alloys, Fig. 7, should be used at about 90° F.

Generally a dip of 15 to 30 seconds is required. If too short a dip is used, the plate will not adhere properly, while too long a dip makes the plate too hard to buff.

Nickel plate: After the work has been given a roughening dip, it is rinsed well in two changes of water, and then transferred to the plating bath. Most standard nickel-plating baths will work on aluminum alloys which have been prepared according to the above directions, but the formula given in Fig. 8, has been found highly satisfactory. For plating tanks, use a stoneware crock or glass battery jars. The arrangement of apparatus and wiring is shown in Fig. 1. Across the tops of the plating tanks three brass rods, or better still, lengths of heavy-walled brass tubing,

8 NICKEL-PLATING SOLUTION FOR ALUMINUM



9 COPPER-PLATING SOLUTION

Copper sulphate 27 oz.
 Sulphuric acid 3 1/2 fl. oz.
 Water to make 1 gallon

STONEWARE CROCK

10 CHROMIUM-PLATING SOLUTION

Pure chromic acid, 33 oz., dissolved in water, 1 gal., to which is added concentrated sulphuric acid, 1 1/2 fl. drams

with the plates as far apart as possible, the voltage across the plating tank is still greater than 2 volts, remove some of the salt water from the tank and replace with fresh water. With 2 volts, a plate produced in about 45 mins. should give adequate corrosion resistance. After removal from the plating bath, the work should be rinsed in hot and cold water, and then polished, Fig. 12, using lime abrasive on a soft wheel. After removal from the plating bath, the articles should have a glossy gray coating of nickel which can be buffed up to a high luster.

Final plating: Nickel-plated aluminum can be given a further plate with other metals such as copper, silver, and chromium. When copper is to be applied, an acid plating bath is used. The for-

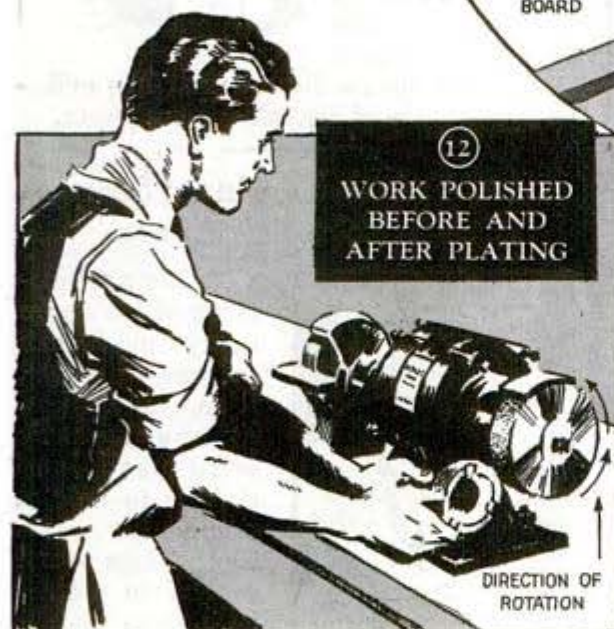
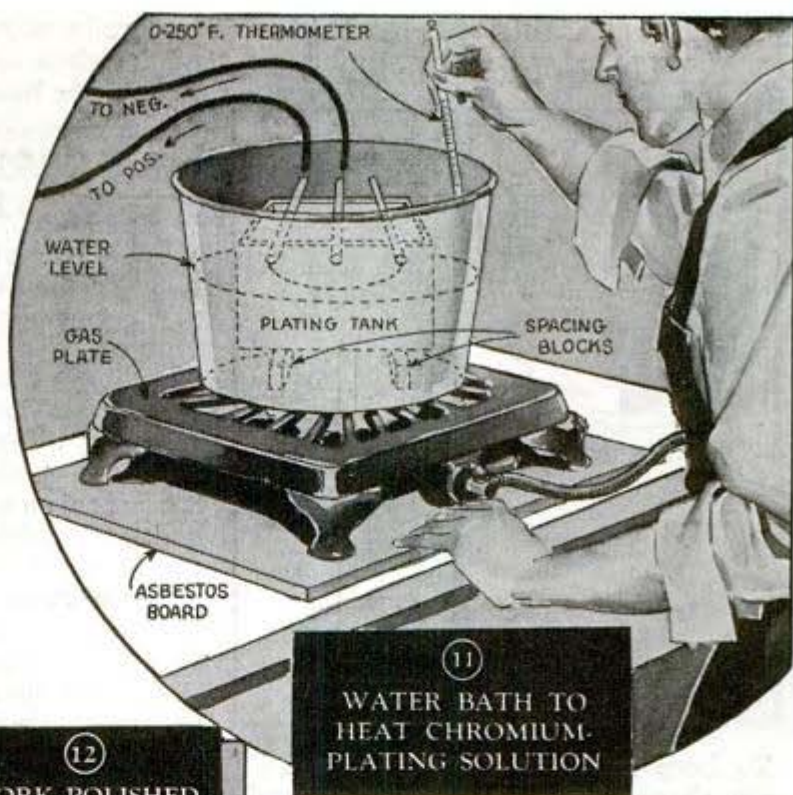
are laid. The work to be plated is suspended from the center brass rod, and two pure nickel anodes are suspended from the two outside bars. A heavy-duty radio-type rheostat, or a salt-water rheostat, also shown in Fig. 1, is connected into the circuit. Connections to the storage battery should be made with heavy spring clips. A d.c. voltmeter, reading 0 to 10 volts, is also required and should be connected as shown in the wiring diagram. If much work is being done a d.c. generator producing 6 to 10 volts will be found more convenient than a battery.

The nickel-plating solution can be used at ordinary room temperature, although it works better if it is heated to about 90 or 95° F. in a water bath similar to that shown in Fig. 11. When the work is ready for plating, it is hung by means of copper wires from the center support, and is completely immersed in the plating solution. The plates of the salt-water rheostat are moved as far apart as possible. The current is turned on and the voltage adjusted to about 2 volts, by moving the plates of the salt-water rheostat closer together. If,

mula is given in Fig. 9. The plating bath should be used at room temperature, with a voltage of 1 1/2 to 2 volts. Anodes of copper sheet are used. Plating for 30 mins. will give a fairly heavy plate. Chromium also can be applied to nickel-plated aluminum, using the solution given in Fig. 10. The solution should be kept at about 100° F. in a water bath, as shown in Fig. 11. Lead or steel anodes are used. The nickel-plated article should be placed in the solution and current turned on. The rheostat should be adjusted to give about 4 volts. If, after a few seconds plating has not started, the voltage will have to be adjusted up or down to find the proper voltage for plating. The plating voltage is very critical and will have to be determined in any case by experimentation, as it depends on the area of the surface being plated, bath temperature, and numerous other factors. A short plating period of about 1 1/2 minutes is recommended on nickel-plated aluminum as longer periods may raise blisters on the plate. When using the chromium-plating solution cover the tank with newspapers to prevent the

fine mist-like spray from being breathed.

Preparing zinc alloys for electroplating: Zinc alloys should be cleaned in a mild alkaline cleaning bath, for example the same cleaning bath that is described above for aluminum alloys. It should be used at a temperature of about 180° F., and the work should not be left in the cleaning solution any longer than is necessary to remove grease from the surface of the metal. Following the alkaline



cleaning, the metal should be rinsed well in water and then given an acid dip, in a solution made by dissolving hydrochloric acid or sulphuric acid, 1 pt., in water, 9 pts. The work is dipped in this solution until the first gas bubbles appear on the metal, after which the work is immediately removed and rinsed thoroughly. Then it is transferred to the nickel-plating bath. If the work is left in the acid dip too long, it becomes discolored and cannot be plated successfully.

Electroplating zinc alloys: Zinc alloys, cleaned according to the above procedure, can be given a nickel plate in the same bath as described above for aluminum. A light plate of 15 mins. to half an hour from the above bath is entirely satisfactory for

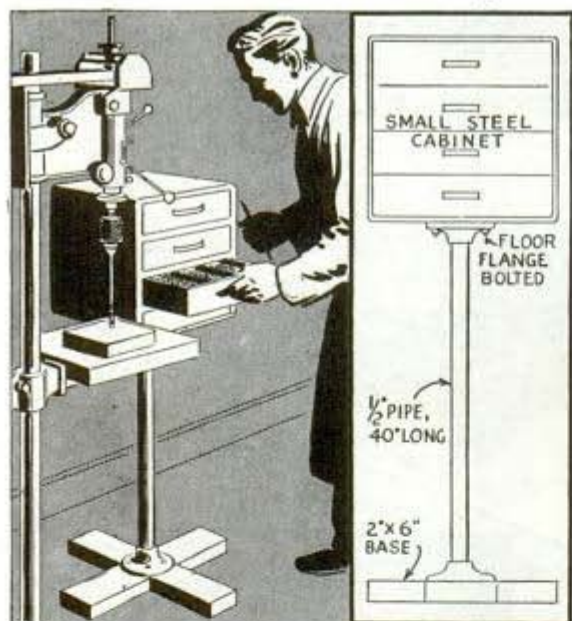
interior work, although it is not sufficiently heavy to give good corrosion protection. For a more durable nickel plate, the zinc alloy should be plated for 15 mins. in the nickel-plating bath described above, then rinsed thoroughly in cold water, after which it is transferred to a second nickel-plating bath, containing nickel sulphate, 12 oz., nickel chloride, 4 oz., and boric acid, 2 oz., dissolved in water, 1 gal. Nickel anodes are used, and the voltage is adjusted to 2 volts. A plate of about 45 mins. should be used. A handy chart for

cleaning and plating procedure on zinc and aluminum alloys is given in Fig. 4 and will be convenient to have at hand when planning your work.

Drawing Lines With a Typewriter

Typists who have to draw a line on their work can do it much easier than by the usual method of repeatedly tapping the "dash" key. Instead, just hold the key down with one hand and with the other hand, release the carriage control and pull the carriage back and forth a couple of times. This will give a straight line across the paper. If the ribbon tends to bunch up, a couple of turns of the ribbon spool will rewind it.

Accessory Cabinet Is Portable For Use in Machine Shop

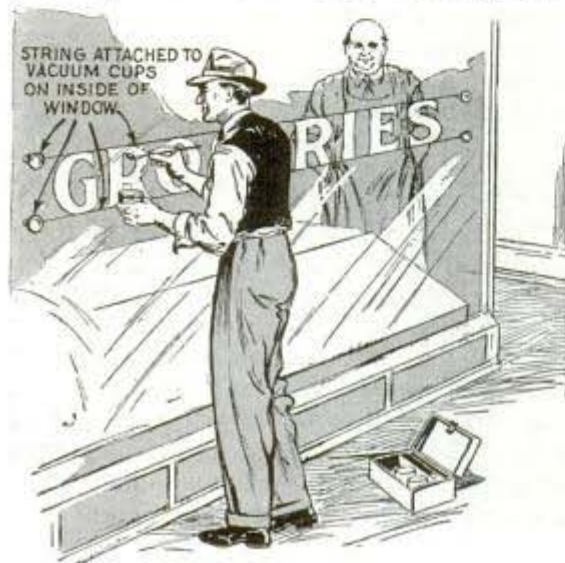


To keep small accessories for a drill press, shaper, lathe, etc., always at hand, I made this cabinet so that it could be moved from machine to machine. It consists of a small steel cabinet mounted on a standard of pipe. Floor flanges attach the pipe to the cabinet and to the base.

—Fred Hood, Walton, N. Y.

Vacuum Cups Hold Guide Strings Used in Lettering Windows

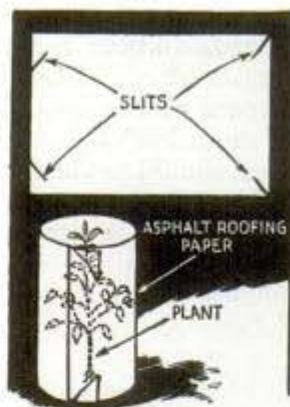
As a guide in making accurate letters on large store windows, one sign painter uses two colored strings stretched and held in place by four vacuum cups. The cups are



removed easily and are placed on the side of the glass opposite that on which the lettering is being done.

Self-Locking Paper Cylinders To Blanch Plants

Instead of stapling or pinning paper together to form cylinders for blanching plants, try the self-locking joint shown. With this method it takes only a second to assemble a cylinder, and after it has served its purpose, it can be easily taken apart and stored flat for future use. The cylinders are made of asphalt roofing paper.



Lead Sinkers Eliminate Strings On Mechanic's Apron

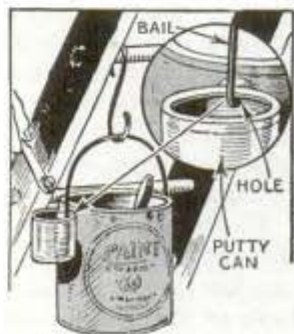


3 or 4 in., and the sinkers were tied to these. When putting on the apron, the sinkers were merely dropped into the hip pockets to hold it in place.

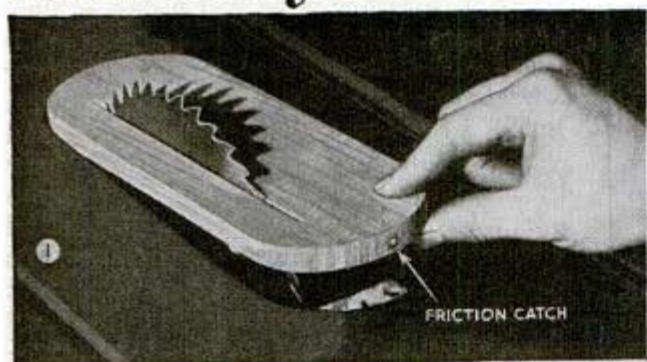
Tying and untying of his apron every time he had to remove or put it on, was avoided by one mechanic who used lead sinkers to hold it around his waist. The strings were cut off to project

Putty Can Attached to Paint Pail

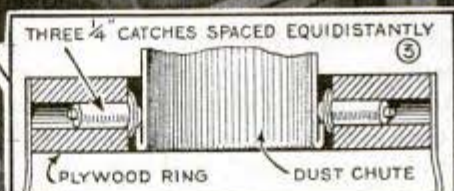
Your putty can be kept handy when doing outdoor painting by simply punching a small hole through the can so that it will slip on one end of the paint-pail handle as shown. Carried in this way, the putty is always in a convenient position for instant use.



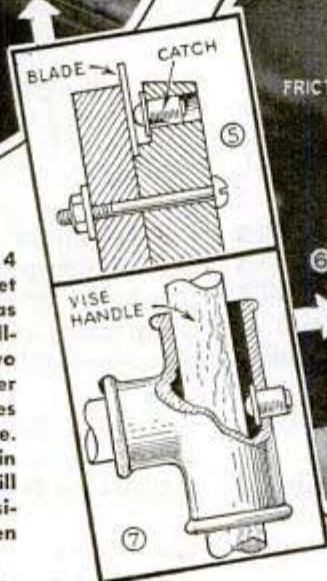
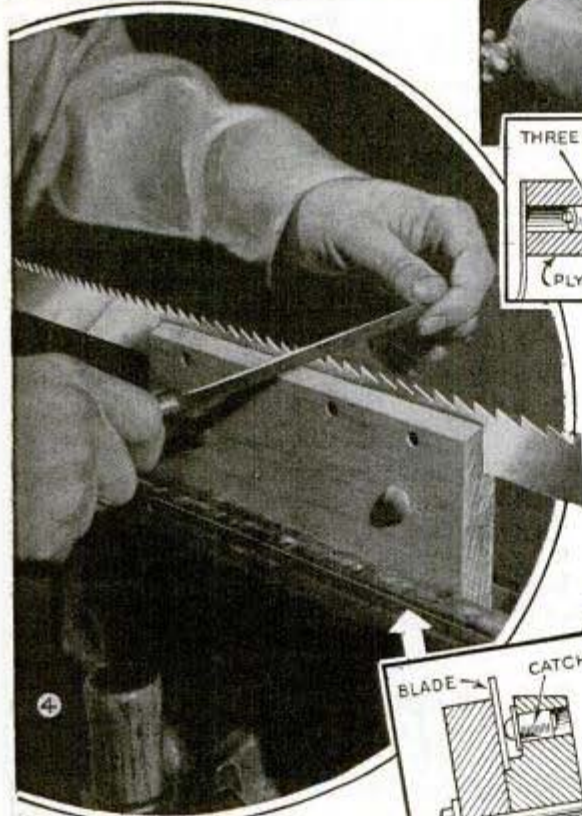
New Uses for FRICTION CATCHES



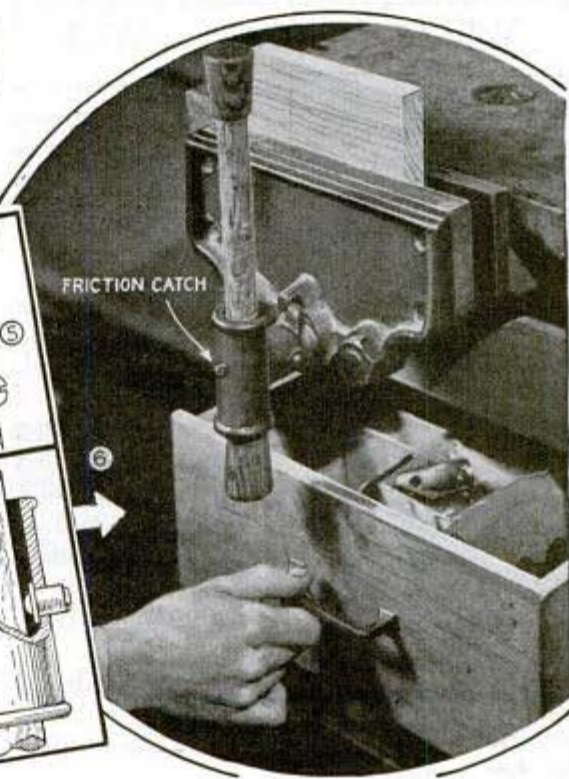
When table inserts of wood are used to accommodate various dado setups, a friction catch fitted in the edge of each one, Fig. 1, is ideal for holding the insert



A wooden ring fitted with three catches as in Figs. 2 and 3, and tacked in the mouth of the dust bag of a sander makes the bag easy to remove or replace



The saw-filing jig shown in Figs. 4 and 5 grips a saw blade firmly yet permits it to be moved forward as the filing progresses merely by pulling on it. The jig consists of two wooden blocks clamped together with bolts, and four friction catches as indicated to hold the saw blade. Set in the tee of a vise screw as in Figs. 6 and 7, a friction catch will keep the handle raised to any position desired, which is handy when there is a drawer under the vise



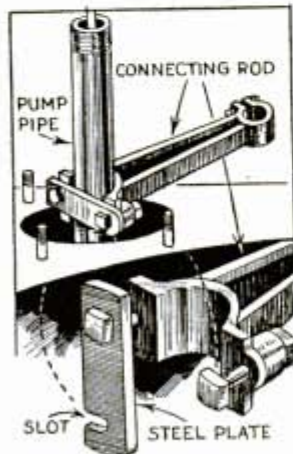
Cleaner for Pen or Pencil Points From Mohair Furniture Glide



Driven into an ink-bottle stopper or the handle of your sandpaper pencil pointer, mohair furniture glides provide good cleaners for pen and pencil points. In this position, they are always at hand, and are easily replaced when they become dirty.

—Axel Ogren, Chicago.

Connecting Rod Holds Pump Pipe When Lifting It From Well



Having to remove pump pipes from wells to repair the cylinders occasionally, one farmer made a pipe holder to assist in this work from an old engine connecting rod. The lower half of the rod bearing was replaced with a steel plate, which pivoted on one of

the bearing bolts and hooked over the other one. When clamped around the pipe as indicated, the rod held the pipe securely.

Ⓢ Before removing the cap from a tube of paste solder, it's a good idea to mix the contents by squeezing the tube from top to bottom several times.

Car-Top Racks for Campers

If you are planning a camping trip this summer, whether it be just a day or two, or of long duration, one of these car-top racks will enable you to carry luggage or a boat with ease. The luggage rack shown in Fig. 1 has large capacity and is attached securely to the car, yet is taken off easily by removing six screws. Fig. 2 shows the general assembly of the rack. Sides and ends are of wood, and the bottom consists of strips of flat iron and wire. Rubber at the crossing points of the strips and around the lower edges of the ends and sides protect the car top. The rack is attached to the gutters at six points above the doors and windows. Those who take frequent short trips, and want a boat rack that is removed or replaced in a few minutes, will find the one in Fig. 4 just the thing. It consists of two lengths of pipe or conduit arched over the car top and fastened to the upper hinges of the four doors by means of special brackets as shown in Fig. 5. Each bracket is attached with a bolt, which is substituted for the hinge pin and riveted in place. Being small, the bracket remains on the car and is painted to match it. Owners of coupes will find that the canoe rack in Fig. 7 solves their problem of carrying a boat above a short length top. The rack clamps to the bumpers, and a center brace from the rear support to the seat back takes care of end movement. Pipe is used for the supports, which have wood cross members padded as in Fig. 6 to prevent chafing the back. Clamps to fit over the bumpers are welded into the lower ends of the support pipes.

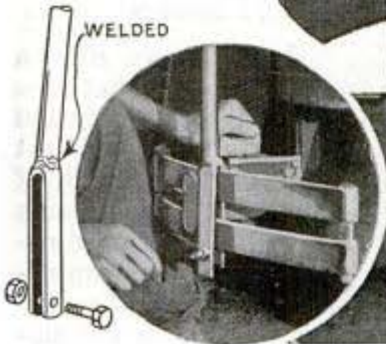
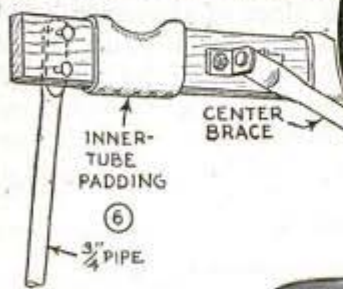
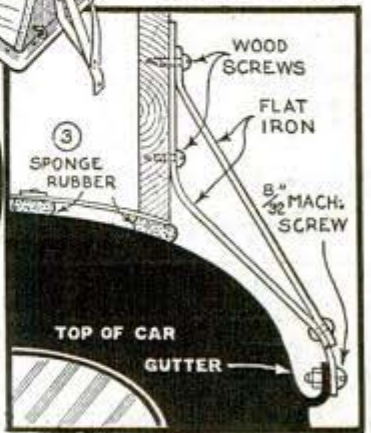
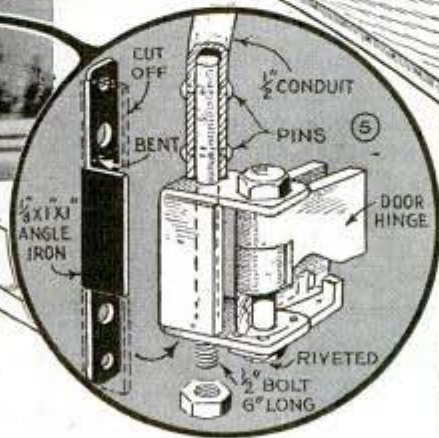
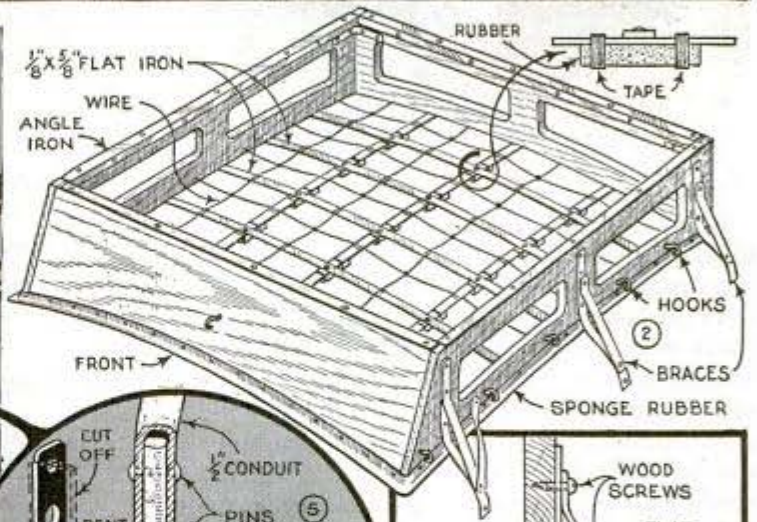
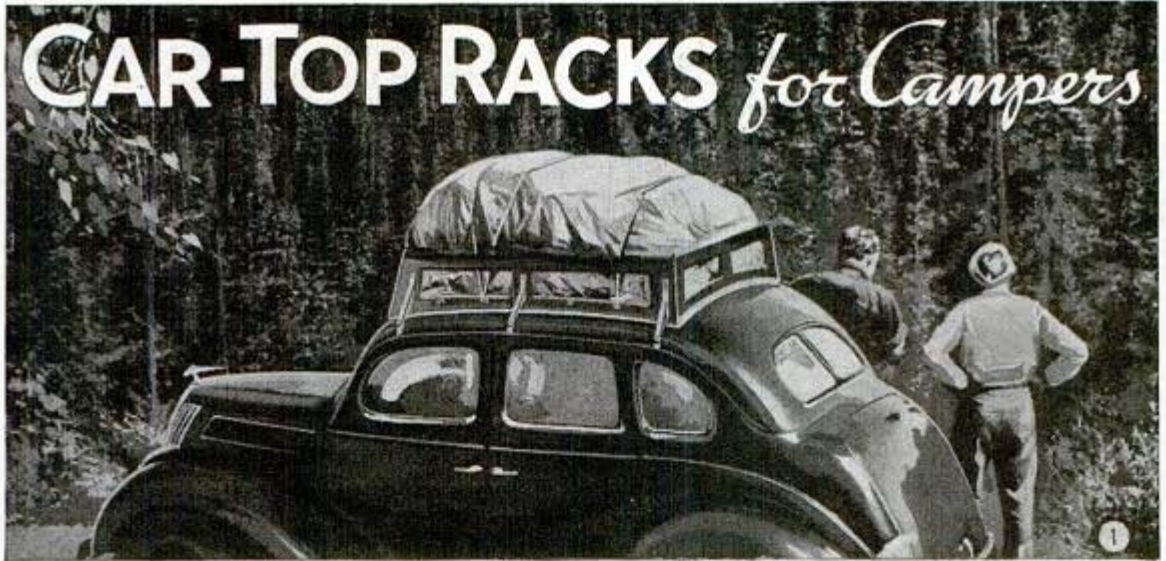
Mice Kept Out of Binder Canvas By Tar Paper in Roll

Mice that insist on living in your binder canvas can be discouraged of this habit by rolling a piece of tar paper up with the canvas before it is stored for winter. This is also a good method to follow when storing tents or other canvas articles in a place where mice can get to them.



—Walter Krushel, Morden, Man., Can.

CAR-TOP RACKS for Campers

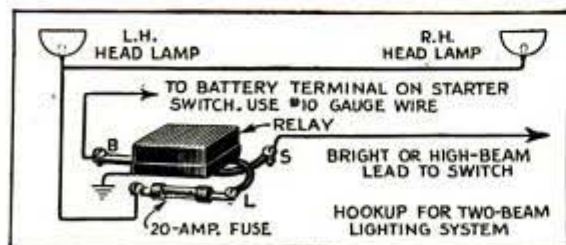


Portable Lamp Rests on Car Top And Directs Light Inside



For working inside a car, a mechanic in one garage uses a portable lamp which is supported by a weight resting on top of the car. The lamp is attached to a flexible shaft or conduit, which is in turn anchored in a concrete block. With this arrangement, the lamp can be moved or twisted about to direct a beam of light wherever needed. The block of concrete has sponge rubber on the bottom to prevent scratching the surface on which it is set.

Relay Installed in Electric Circuit Improves Old Headlights



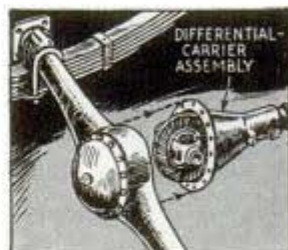
Owners of cars not equipped with sealed-beam headlights can improve them by putting a relay in the electrical circuit to bring the current directly from the battery to the headlights. This makes it unnecessary for the current to travel through the wiring and connections of the switch and instrument panel, with the result that resistance is reduced. First, have the battery fully charged. Then remove both ca-

bles and clean the connections carefully. Be sure to remove and clean the ground connection at the car frame. Next replace any worn or oil-soaked wires. Remove the reflectors from the lamps and clean or replace them. While they are out, see that all connections inside the lamp housing are clean and tight. Then replace the reflectors and install the relay. Place it as close as possible to the headlights. Use full size wire to avoid a drop in voltage.

—W. B. Glancy, Goshen, Ohio.

Removal of Axle-Housing Cover Unnecessary to Repair Axle

When overhauling the differential on cars that do not have the axle shafts locked inside the differential, it's unnecessary to spend time removing the dif-



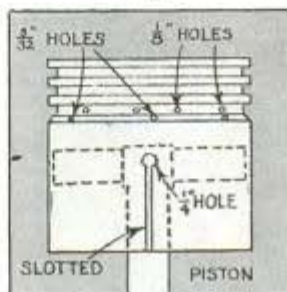
ferential cover. Instead, just pull the axles, and then remove the bolts and slip the differential carrier out from the front.

Cornstarch Aids in Waxing Car

I have found that a little cornstarch saves a lot of rubbing when waxing my car. After the entire surface has been thoroughly cleaned and wax is applied over a small area with a damp cloth in the usual way, dip a clean piece of cheesecloth into a box of dry cornstarch and rub it over the waxed surface. You'll be surprised how quickly the luster is brought out. Some white dust from the starch will remain on the car, but this can be wiped off when the job is finished.

—J. G. Schlichter, Memphis, Tenn.

Oil Pumping Reduced in Motor By Altering Pistons



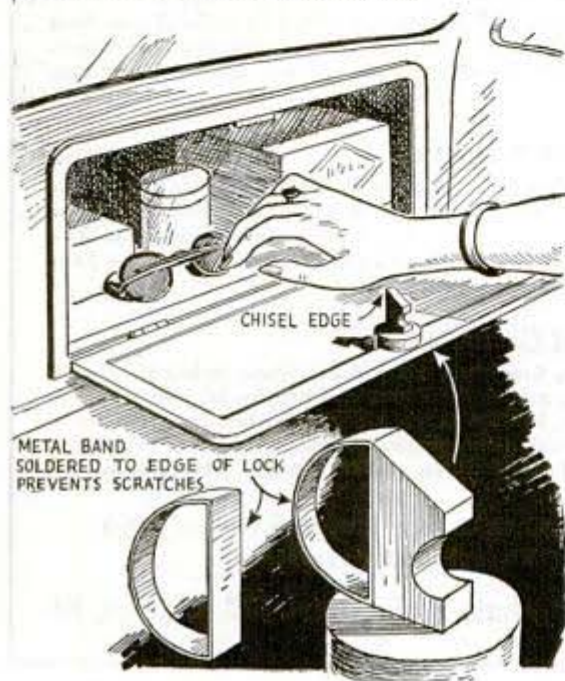
If you own a Ford V8 that uses oil excessively and do not feel that the condition of the car warrants the expense of repairing or replacing the motor, try altering the pis-

tons as shown. After removing the pistons and taking off the rings, clean the grooves carefully. Then enlarge the present holes under the oil rings to $\frac{1}{8}$ in. and chamfer the bottoms of the oil-ring grooves. Now drill six $\frac{3}{16}$ -in. holes through the chamfered portion around each piston. Next, drill a $\frac{1}{4}$ -in. hole one side of the piston in line with the piston pin and then slot the piston skirt from the bottom to the hole with a hacksaw. This will give the piston enough natural expansion to keep it tight in the cylinder, yet not enough to score the cylinder wall. Install a set of good rings and you should reduce oil pumping to a minimum.

—James W. Clift, London, Ohio.

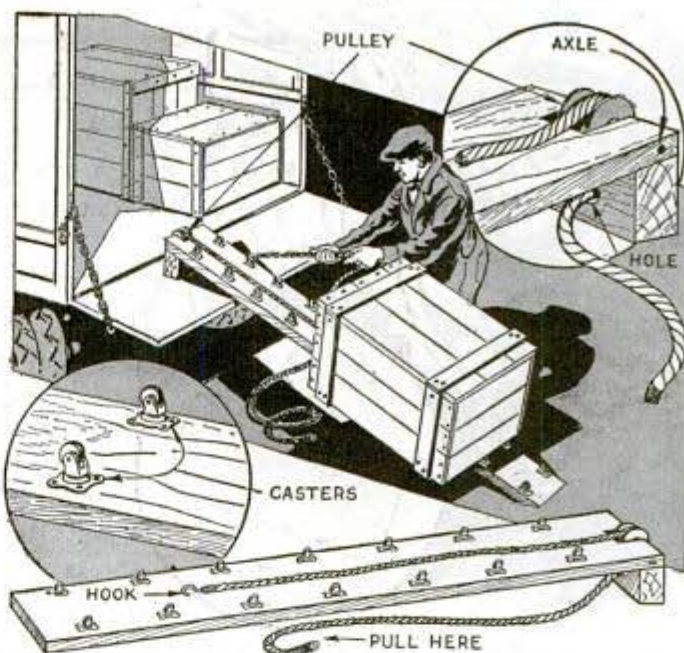
Glove-Compartment Latch Shielded to Protect The Clothing

After tearing his coat sleeve on the latch of his glove compartment when reaching into it, one motorist shielded the latch as shown to avoid this trouble. The shield is merely a piece of brass shaped as shown and soldered to the back of the latch. Installed as indicated, the shield will not interfere with the operation of the latch.



JUNE, 1941

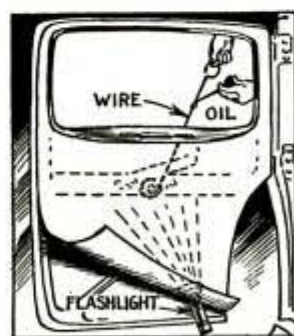
Castered Skid Loads Heavy Boxes on Truck Single-Handed



One truck driver who often had to load and unload heavy boxes single-handed used a skid like the one shown. It is nothing more than a heavy plank with two rows of trunk casters mounted near the edges of one side. In use, this is placed with one end on the tailgate and the other end on the ground. A rope passing over a pulley at the top of the skid is used to raise or lower the load.

Window-Raising Mechanism Oiled With Aid of a Wire

When the window-raising mechanism of my car needs lubricating, I do the job without removing the upholstery on the door. The upholstery is loosened at the bottom of the door enough to insert a flashlight to illuminate the mechanism. Then the glass is lowered and a wire with a hook on the end is inserted between the glass and the window molding. Looking down this opening, the hooked end of the wire is slipped over the part to be lubricated, and oil is flowed down the wire.—W. C. Wilhite, Carlinville, Ill.



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Glare From Rear-View Mirror Avoided With Shield



If lights of a car behind you reflect in your eyes from your rear-view mirror, a simple shield of colored celluloid slipped over the mirror will help stop the trouble. You can make the shield by first softening the celluloid in hot water and then shaping

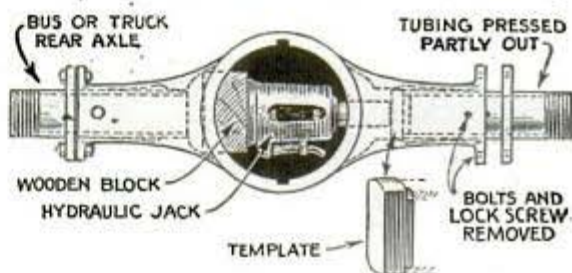
it. When not needed in the daytime, the shield can be removed from the mirror and carried in the glove compartment.

—Opie Read, Jr., Chicago.

Axle-Shaft Tubing Is Removed With Hydraulic Jack

In removing axle-shaft tubing of trucks and buses, I find that a hydraulic jack simplifies the job. After the differential and axles have been removed, a metal template is made to fit against the tube as shown to take the jack head. Then a wooden block shaped to fit inside the differential housing is made to take the base of the jack. With this setup, pressure can be applied with the jack against the inner end of the tube to force it out easily.

—Thomas L. Mino, Cincinnati, Ohio.



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KODACHROME FILM

Eastman's film for gorgeous full-color “stills”

2247

Rainbow of Steel

(Continued from page 43)

erected the steel towers on top of the abutments and tied the top of each tower back to the massive concrete "deadmen" by means of 32 steel wire ropes 200 feet long and 1 1/16 inches in diameter. The steel skew-back shoes of the arch ribs are placed on the arch piers by means of derricks standing on each concrete approach just beneath the 130-foot steel tower, and the sections of steel rib about 45 feet long are built out successively from the skew-back shoes by these and other derricks operating two to a side.

As the various sections of steel rib are swung into position, by first one derrick above and another below, they are tied back from time to time by means of the steel cables attached to the forward ends of the section and fastened to the tops of the steel towers. In all, four sets of such tie-backs will be used to support each half of the arch.

When each half rib is in place complete, extending out 475 feet from its skew-back, the two halves of each rib will be closed by means of temporary keystone pieces, the tie-back cables slacked off and the temporary keystone pieces adjusted to correct position by means of heavy hy-

draulic jacks. The permanent keystone sections will follow.

After the completion of the arch ribs, it will be a fairly simple matter, by normal construction methods, to erect the remainder of the steelwork and place the concrete deck of the 1450-foot bridge with its 950-foot arch.

The finished bridge will include a series of four concrete approach spans on each side of the arch span and a terminal for toll collection and customs and immigration inspection at each end. It will provide two 22-foot roadways separated by a four-foot central mall and a 10-foot sidewalk along the south side, facing the falls. This walk will probably be called something like "Honeymoon Lane" or "The Wishing Walk."

Hon. T. B. McQuesten, K. C., who is Minister of Highways for Ontario and chairman of the Niagara Parks Commission, is chairman of the Niagara Falls Bridge Commission, and C. Ellison Kaufmeyer is secretary. Waddell and Hardesty of New York and the Edward P. Lupfer Corp. of Buffalo, N. Y., are the consulting engineers, while Waddell and Hardesty were the designing engineers.

2322

Destruction Is Their Business

(Continued from page 53)

Another spectacular explosive is thermit, a mixture of iron oxide and finely divided aluminum. When ignited it produces an enormous heat and therefore makes excellent incendiary bombs. Warring nations claim great success with thermit mixed with sulphur as an incendiary bomb.

New air-compressor equipment has been developed for use of the demolition engineers. Tools included are an air drill, air saw, air shovel and pavement breaker. The drill and pavement breaker can penetrate the hardest concrete in a bridge or road; the saw will cut through strongest timber, whether it be a tree, road block or part of a bridge; the shovel removes debris with remarkable ease.

Several new methods for penetrating barbed wire entanglements have been developed. Wire cutting with torpedoes is fairly effective but it is too slow and re-

quires too much manpower. A better system involves the use of chicken wire. Three-foot lengths are wrapped in heavy burlap, and when a section of barbed wire is encountered, explosion troops simply drop a number of these heavy mats on the wire and it falls harmlessly to the ground.

A new trench mortar promises to be ideal as a high-angle, short-range weapon to assist the advance of the infantry for meeting the "enemy" at close quarters. It concentrates fire on machine-gun areas which, because of irregularities of the terrain, cannot be reached by flat-trajectory weapons. Two main sizes are available in the new mortar—60 mm. and 81 mm.

(Names and addresses listed in the index, page 4-A, show where to buy manufactured products described in this magazine. Say you saw it in Popular Mechanics.

WIN ONE OF THESE 2 FREE TRIPS TO RED RYDER'S ROCKY MOUNTAIN RANCHO



210 PRIZES GIVEN!

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Shoot a GOLD BANNED 1000 SHOT RED RYDER Saddle CARBINE

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101 FOURTH PRIZES DAISY TARGETEER PISTOL
 Win one of these 101 DAISY Targeteer Air Pistol Outfits with 500 Targeteer Shot, "Spinning Birdie" Targets, 25 Target Cards, Back-stop. VALUE each.....\$200

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 Win a pair of air rifle wall brackets, wooden cut-outs of Red Ryder's famous horse "THUNDER." VALUE each.....\$100

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 FLASH! 1st and 2nd Prize Winners get a PAIR OF HANDMADE COWBOY CHAPS from Fred Hartman, Cartoonist, as his PERSONAL GIFT!

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Other Daisys not illustrated: Buck Jones Special, 60-shot outdoor model, \$3.50 —Nickel 500-shot repeater, \$1.95—Single Shots at \$1 and \$1.50.

USE DAISY BULLS EYE SHOT—BEST FOR TARGET SHOOTING IN DAISYS, KINGS TUBE 5x

CONTEST RULES

- (1) Each contestant must shoot an Official Target and complete THE SENTENCE "I like to shoot a Daisy because" in 20 words or less. Sentence must be written in space provided on Official Target.
- (2) Contest starts May 1, ends July 25. ALL Targets and completed SENTENCES must be received at Daisy Manufacturing Company, Plymouth, Michigan by midnight, July 25, 1941.
- (3) Any air rifle using BB type shot may be used.
- (4) Contestants may be of any age up to and including 16 years, at start of Contest, May 1, 1941, and must be residents of the Continental United States.
- (5) PRIZES will be awarded on the combined basis of Target score plus aptness of thought in finishing the

- SENTENCE "I like to shoot a Daisy because" in 20 words or less.
 - (6) Official Targets only may be used. Target will be furnished you Free at your Daisy Dealer. If you write us direct for Free Official Target, enclose 3c stamp to cover our mailing-handling cost of sending Official Target to you.
 - (7) Decision of the Judges will be final. Duplicate prizes awarded in case of ties. Get Official Target for complete rules.
- Every boy in the U.S.A. has the opportunity to WIN one of those TWO FREE RANCH TRIPS—plus Fred Hartman's own PERSONAL GIFT of Hand-Made Chaps—or one of 5 new portable RECORDIO JR. HOMERECORDER RADIOPHONOGRAPH Wonder Machines each worth \$39.95—or one of 101 Genuine Daisy Targeteer Target Pistols—or one of 100 pairs of Horse-

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Head Gun Brackets! If you haven't any air rifle—get one NOW—at your nearest hardware, sports goods or department store! If Dealer is sold out or no Daisy Dealer near you—rush us the price of the Daisy you want—we'll send it postpaid! (Duty added in Canada on all rifles.)

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DAISY AIR RIFLES

DAISY MANUFACTURING COMPANY, 546 UNION ST., PLYMOUTH, MICHIGAN, U. S. A.

Trailer Blazing Through the African Jungles

(Continued from page 39)

replaceable instruments, a ruined pontoon, and a leg pulling from the whole colony.

With mixed feelings we arrive at the first break in the road, to find two scores of white people come from around the country to watch the show. Are we going to succeed, or are we courting disaster?



Introducing native to the magic of the electric light

My air of indifference is just for the benefit of the audience. Quietly I recommend that Charlie drive with his entire mind on the brake. I tell Jim to put the other trailer across the road, and the two cameramen to attach our strongest cable from the back of Charlie's trailer to the other; then to watch that our native boy lets the cable flow only as much as is strictly necessary. With my wife, I go where the leader must be—at the far end, where we may be tossed into crocodile-infested water.

I give the signal. The engine roars and the trailer begins to slide down the bank. Bang—the tractor's front wheels are on the two narrow planks uniting shore and pontoon, which begins to lift under our feet. Now the tractor's rear wheels are on the planks, and our canoe is almost entirely out of the water.

Careful, Charlie! More to the left! Slow!

The radiator is almost on me, yet the trailer's wheels have only begun to climb the planks. The wooden floor under us goes down, down. The front bumper arrives at the end of the platform.

Slow, Charlie. Only another foot to go. Heh! Stop!

I mop the sweat, bend down to look at the trailer's wheels. They are just on the platform, though a good three feet of trailer sticks out in back.

"Wah! Wah!" exclaim our boys. The white people applaud.

"Funga! Funga!" we shout to the natives. I can relax a little, now. The pontoon moves, scrapes the river bed, tips ominously, steadies, begins to acquire speed. The problem is solved for this, and 64 more crossings—four trips each time.

"Ngufu, boys, ngufu!"

Here we are, behind the frontier but not so far from civilization, after all. For we have our own post office to supply stamp collectors' craving for rare covers. It is the home, too, of OQ5-ZZ, our short-wave station on which we talk with the "hams" of the world, especially our friends in the U. S. Our beam antenna starts from the top of this tree in the middle of camp, denuded of branches, with a platform built on for movie work.

Behind the cab of each truck is a 110-volt power plant, 1,500-watts a.c. We need plenty of "juice" for cameras, drills, solderers, razors, the photo laboratory, spotlights, illumination everywhere. And for this single-wire fence encircling the camp, The transformer kicks up the voltage to 4,500. Anyone interested in it can inquire of the hippos, elephants, leopards which prowl around almost every night. Never the same ones, however. Once they try the shock of this wire they won't return.

Oh! And there is Dominick, lounging in his chair, doing nothing, saying nothing. Yet somehow he has become the trouble maker of the expedition.

A dangerous character? You bet! We'll discuss him further next month. Then, too, we must capture some Okapis; hunt with the pygmies; cross a wide river teeming with crocodiles, and face the charge of a hundred infuriated water buffaloes.

Until then, "Kwaheri!"

(Continued next month)

You may worry
about Junior's
cornet lesson



but here's one worry you can avoid

Junior's cornet blasts are jarring on the nerves and so are those first chassis squeaks that may tell of worn steering crank bearings, tie rods and king pins.

You can save yourself trouble and worry—get Peace of Mind about chassis lubrication, if you remember one word—"Marfak."

For Marfak lubricant is a special blend of heavy-bodied oils that will stick to its job at those vital points which take punishing tons of road-shock in every mile. It's cohesive and adhesive. It outlasts ordinary grease.

When you get a "Marfak job" you get Texaco's 40-Point Chassis Lubrication

Service—applied by trained experts, who work by chart and not by chance.

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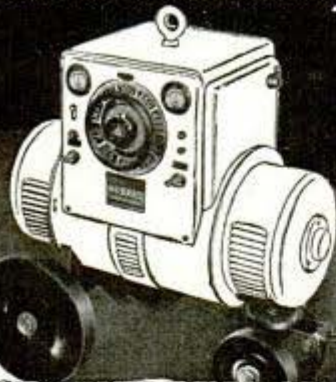


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K 1453

Man's Robots of Metal

(Continued from page 69)

Since the "S.S. America" is the largest and fastest vessel ever built in this country it might be expected that the reducing gears would set some kind of a record for size. And so it is, for the main reduction gears are believed to be the largest ever built for ship use in this country, the low speed gear having a pitch diameter of 174 inches. Two of these gears transmit a total of 42,850 shaft horsepower to the propellers.

The six-foot plow manufactured to dig down deep through sand and turn up the rich peat soil beneath the surface of California farms probably has set a mark which will stand for some time. Three Caterpillar type Diesel tractors are required to pull the plow.

Another robot, a "pumpcrete," lines the interior of a tunnel with concrete. Ten of these placed 1,000,000 cubic yards of concrete in 91 miles of tunnels required by the Colorado River Aqueduct.

Demands of the national defense program have halted what appeared to be an extremely valuable survey intended to help decide a question as old as modern machine itself. The question is: does the machine increase or decrease employment?

The New York State Labor Department has prepared records covering a span of 26 years in an effort to determine whether factory employment figures would settle the question. Just now, the demand for skilled labor has become so great in the state that the statistical lines are heading right out of the tops of the charts.

During the 26 years, however, they did discover that the state factory labor employment index had declined 1.8 points per year. The survey also showed that average weekly earnings in factories rose from \$12.48 in 1914 to \$27.41 in 1939. And the average factory worker was able to purchase 40 percent more goods with his earnings in 1939 than in 1914, indicating a steady rise in the standard of living.

Since the money the workers were able to spend opened new opportunities in fields of endeavor such as service, trade, professional, etc., giving jobs to workers replaced by machines, the general conclusion is that man's robots of steel are contributing to the welfare of millions of people who have never seen a giant excavator or conveyor.

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With the rear wheels of your car jacked up, the motor started and the hand throttle set so speedometer registers 20 m.p.h. . . . use WHIZ MOTOR RYTHM, following simple directions, and watch that speedometer climb! Up she goes, quickly, to 22 m.p.h. or more! Proving more power. That's MOTOR RYTHM!

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 For enclosed \$1.25, please send* me one quart of MOTOR RYTHM, enough for a complete tune-up. You agree to refund my money if I am not entirely satisfied.
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3-IN-ONE OIL

How to Beat the Heat

(Continued from page 85)

supply and a small pump, usually fan-driven in the breeze of the main circulating fan, lifts water from the reservoir to the drip pipe along the top of the excelsior pad. Excess water dripping down through the pad returns to the reservoir for recirculation. Larger evaporative coolers which may be fitted into a window opening cost \$30 and up.

More expensive to operate than evaporative coolers but more satisfactory on sticky, muggy, days are ice coolers that employ a fan or blower to draw air up through a stack of broken ice and force the cooled air out into the room. A small amount of air moving through a large quantity of ice provides better cooling than does much air that is carried over a small supply. A column that contains 225 pounds of ice provides room comfort all day long.

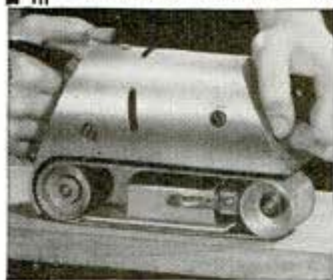
Some degree of summer comfort is being built into many of the latest basement furnaces, especially those that use a blower fan for forced-air distribution and that have return air ducts for circulation. In the summer time, with the heat shut off, such an "air conditioning" furnace draws its fresh air through a basement duct from the north side of the house, passes it through an air cleaner, and by means of the blower fan distributes this air through the heating ducts to the different rooms.

If yours is an older design of furnace, either coal, gas, or fuel-oil fired, a sheet metal contractor may be able to install a blower unit at nominal cost. If your heating system has return air ducts, all the windows of the house should be kept closed for best results; without such ducts several windows should be left partly open so that the air coming up through the registers can keep moving.

To make the best of it in hot weather you should wear light clothes, drink lots of cool but not ice-cold water, use a liberal amount of salt to replace the amount lost through perspiration, and stay where there is a circulation of air. Some of the new silent electric fans can be regulated to give a refreshing breeze without the bad effects of a draft. If you use any sort of cooler, keep room temperatures within 15 degrees of the outside temperature to avoid "entrance shock" when going in or out.

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X1269

Train Your Dog to Be a Gentleman

(Continued from page 75)

confuse it with "Lie down!" In this lesson the leash should be held so that there is little play in it. This will prevent the dog from moving backward or forward during the lesson.

When you say "Sit!", place your hand on the hind quarters in such a way that your fingers are on one side of the dog and your thumb on the other. This grip, resembling that of a pair of tongs, is very effective. By using it, the dog's hind quarters may be forced down without much effort. The average dog owner places his hand flat on the dog's back and tries to press the dog down by main force. This causes the dog to resist and spoils the whole lesson.

As the dog drops his hind quarters, keep his head up by means of the leash. In this way he will be forced to assume a sitting position. By this method the average dog can be taught to sit in a very few lessons.

Next the dog should be taught to lie down. The command for this may be either "Lie down!" or simply, "Down!"—but always use the same wording. Place the dog in a sitting position, and as you repeat the command, "Down," slowly but firmly pull his front paws forward. The paws should be held together in one hand. With the other hand hold down the dog's hind quarters, using the same "tong" grip employed in teaching the dog to sit.

The command "Stay!" is the next in importance. First teach the dog to stay in a sitting position; the command for this is "Sit-stay!" Next teach him to stay in a lying position. Naturally, the command for this is "Down-stay!"

To teach a dog to "stay," whether in lying or a sitting position, slowly walk around him, holding the leash in your hand. If the dog starts to move or get up, repeat the command "Sit!" or "Down!", follow it with the command "Stay!" and continue walking around him. After you have taught him this lesson, make sure he obeys it implicitly. A dog told to "Stay!" should remain until his master returns.

In teaching a dog to jump over obstacles, begin with a low hurdle. A box, provided it isn't too wide, will do nicely. First, lead the dog over it. Be sure you have the dog on a leash and that you step over the hurdle with him. Each time you come to the obstacle, repeat the command, "Over!"

After the dog becomes accustomed to jumping the obstacles along with you, bring him to it—still on the leash—repeat the command, but step around the obstacle rather than over it.

Next bring the dog to the hurdle—but not on the leash—and repeat, "Over!" If he doesn't jump, put him back on the leash. After the dog has been taught to jump the low hurdle alone, the height of the obstacle can be increased until the dog can make really formidable jumps.

Few dog owners know the proper way to open a dog's mouth. Usually they pry and struggle, pulling vainly at the stubborn jaws. There is a simple way to open the mouth. Take his muzzle in the tonglike grip and press your fingers into his mouth. Meanwhile, hold his head steady with the leash. His mouth will open readily.

Another problem is that of making dogs pick up metal objects. The dislike of picking up metal is natural on the part of the dog, as it is hard on his teeth. The best solution is to cover the object with something soft. This is well illustrated by a common motion-picture trick. A movie dog is often called upon to open doors. In such scenes the doorknob is covered with a tennis ball which has been painted to match the hardware. The dog readily grasps the ball, which it recognizes as a toy, and the knob is then turned from the other side by an assistant.

The rules given in this article are simple. They require no equipment. They can be taught to a dog by devoting 20 minutes a day to training. And the reward—a dog gentleman, a worthy member of society instead of an irresponsible animal whom you feed and house. Make your dog a gentleman and you'll know the true pleasure that can exist in companionship between man and dog.

Moreover, you won't be in the position of the man who came to Carl Spitz with the complaint: "I've taught my dog everything I know, and still he's a darn fool."

☐ Of the 9,600,688 miles of highways in the world the Americas lead with 3,975,421 miles, Europe has 3,501,784, Asia, 1,185,471, combined Australia, New Zealand and Oceania have 527,730 miles and Africa 410,282 miles.

New York Times
2/28/47



HIS MOTHER-IN-LAW WAS PLENTY SORE

—but he's out of the dog house now!



"WHERE YA GOIN' with my pipe?" wailed Henry. "To the incinerator—where *all* smelly things belong," snapped his mother-in-law. "That tobacco is impossible."



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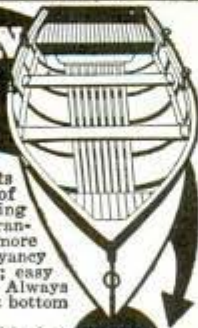
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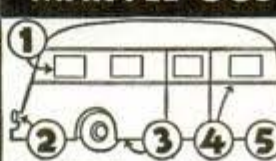


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In answering an advertisement with a coupon, be sure to write name and complete address clearly.

K1350

Is Your Attic a Treasure Chest?

(Continued from page 95)

metals, iron, bone, ivory, porcelain, cloisonne, among other materials, and some are engraved with pictures of important scenes and persons. Campaign buttons and badges from past presidential campaigns are prized by some collectors.

Doll collecting is another popular hobby and antique dolls, both American and foreign, bring good prices. There are thousands of coin collectors who are eager to



Old lamp base like this is worth \$50 or more when wired for an electric lamp

look over coins and paper money that have been hidden away. The old silver trade dollars, issued in the 70's, are beginning to command premiums that no one would pay in the past. Some of the other things that collectors want are old disc and cylinder phonograph records, old stamps and post cards, old bottles, early circus posters, miniature tea sets and other miniatures, old maps, cigar bands, and old stereoscopic pictures.

It would be hard to mention an item for which there is not some demand although it is pretty difficult, by yourself, to determine the value of any one object. A reputable antique dealer will give you a fair estimate or will be able to refer you to someone who can appraise the old things that you dig up.

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K1343

Whipping the Whip Ray

(Continued from page 63)

ard rays are purple with white spots. Wicked, four-inch spines bristle close to the end of their tails. Lashing with its tail, the whip ray attempts to drive these spines into its enemy. These rays are sometimes called eagles because their heads are bird-like.

The tail serves as both defensive and offensive weapon. It's employed both as whip and rapier. The gray ray is armed with a single spine in the center of its tail. It thrusts this with deadly accuracy. Dr. Bowen has witnessed one strike a harpoon handle a foot out of the water. But it's the gray ray's whip that carries the dynamite. It's seven feet long and the end is thick as a man's arm, and can crush a skull when it strikes. It snaps like a shot from a gun and is just as fast. Once the thrashings of a gray ray's whip bolted Dr. Bowen from his boat and knocked Paul over.

Harpooning one whip ray on a trip is an adventure. Getting six in a single day is stupendous, yet that's what the Bowens did on a recent hunt. Each scaled around 200 pounds. Their biggest thrill, they say, was running into three rays at one time. Dr. Bowen giggered two and the third escaped. One of those giggered charged the boat's propeller, sheared off the gear pin and got away. The boat had to be towed in to shore.

Big as they are—100 to 500 pounds—leopard rays are mere infants compared to the great horned manta of the Florida Keys. These mantas are truly the devil-fish they are classified. Some weigh 3,500 pounds and stretch 25 feet across. A mere flip of a flipper will crush a fishing boat. Dr. Bowen and Paul are planning a manta hunt soon. They'll have a stout, high speed craft and equipment to match the cunning and the strength of these leviathans.

There's one ray Dr. Bowen doesn't care to cross. That's the torpedo ray that carries a load of storage batteries between its head and its pectoral fin. These high tension "Elasmobranchii" generate enough electric current to stun and severely shock fish or man.

See index, page 4-A, to find where to buy articles described in this magazine. Say you saw it in Popular Mechanics.



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Science Looks You in the Eye

(Continued from Coloroto Section)

images, may even cause cross eyes. The perplexing problem of deciding whether cross-eyes can be treated successfully has been solved by the development of a new testing device which determines in advance of treatment whether the eyes of cross-eyed persons can work together after they have been straightened by exercise or surgery.

The new instrument, announced by Dr. J. F. Neumueller, director of American Optical company's bureau of visual science, consists of a glass tube containing an electric wire. The current is switched on and as the wire glows the patient looks through one eye only at a red dot on the center of the tube. The tube is then turned from its horizontal position to a vertical position and the patient peers at the red spot through his other eye.

Then the light is turned off and the patient, both eyes now open, looks at a fairly bright wall. Soon he notices two dark lines, the negative after-images. If these two lines form a cross, his cross-eyes can be treated successfully. But if the two lines do not meet, chances of restoring binocular vision are remote.

Optical scientists have lately developed a unique device for developing and training proper coordination of eye muscles. An almost automatic mechanism, the stereo orthoptor forces the eye muscles to function correctly by means of a complicated arrangement of mirrors, lenses, lights and stereoscopic images. Cases of squint, or cross eyes, formerly corrected only by surgery, have been successfully treated by the stereo orthoptor. The instrument also trains the two eyes to function together after an eye operation.

Two new developments concern cataract operations which comprise approximately 25 percent of eye surgery and consist of extracting the diseased lens of the eye which makes it incapable of focusing. Optical scientists have designed special lenses to compensate for the missing lens and to restore sight. And greater efficiency in cataract operations has been made possible by the development of a magic lamp by Dr. Elliott B. Hague and American Optical Company scientists which projects ultraviolet light into the eyes and causes the crystalline lens to fluoresce. The lens be-

comes brilliantly visible and this insures total extraction of the remnants, which may cause trouble later.

Recently two instruments were introduced to assist in diagnosing and correcting defective reading habits. One, the ophthalmograph, is essentially a motion-picture camera which photographs light reflected from your eyes as you read. The resulting film, or reading graph, reveals, upon analysis, the nature of your reading habits, such as speed of reading, fixations, span of word recognition, and other data.

If the reading graph discloses defective reading habits, the etronoscope can be called into action. This instrument has three shutters in front which open and close in sequence, exposing words printed on a revolving reading roll. You are thereby forced to read correctly, for the operation of the instrument will not permit you to pause excessively long or to retrace in your reading. In addition, the roll can be speeded up, teaching you by degrees to increase your reading speed. Ophthalmograph reading graphs of over 5,000 subjects of all ages revealed that only 25 percent read with real efficiency.

One of the great scientific contributions to spectacle lens precision is the development of Tillyer lenses by Dr. E. D. Tillyer of the American Optical Company. Ordinary lenses vary in power from center to margin. Tillyer lenses are corrected for the full sweep of the human eye.

In a study of the causes of automobile accidents, Drs. J. B. Feldman and William Ezickson of Philadelphia, cooperating with Pennsylvania state police, examined for night blindness 75 drivers in 142 accidents. They found 48 percent of the drivers showed night blindness, 54 percent of the accidents occurred at night, and 62 percent of the night accidents occurred in the night blind group. Those suffering from night blindness require a longer interval of readjustment before they can see in the dark. The eye defect may be caused by a lack of vitamin A or by certain diseases.

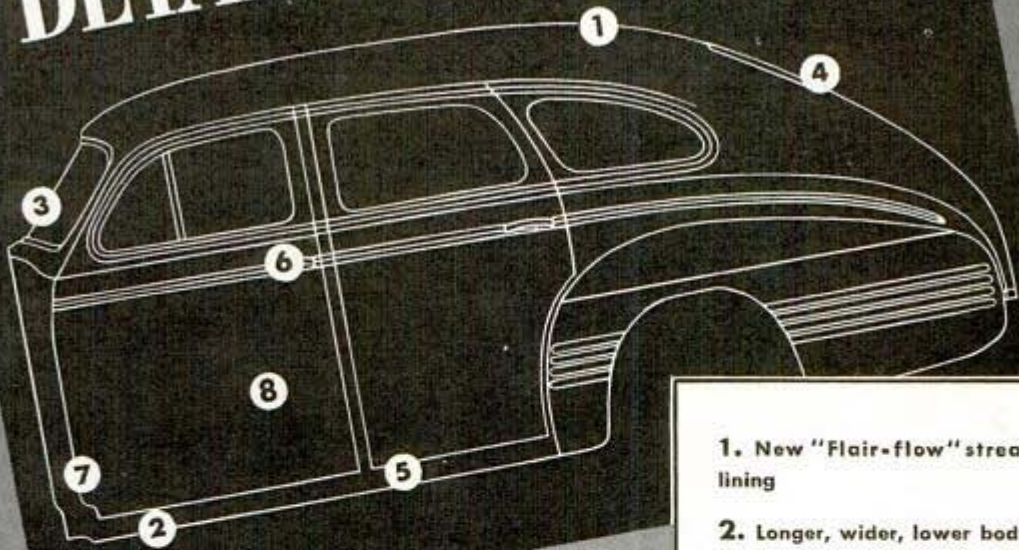
In a new malingering test, light from an illuminated test chart first passes through a disk of Polaroid material. The person being tested looks through a pair of polarizing lenses, one vertical, one hori-

(Continued to page 178)

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8. Wider door entrances

NO other cars have all the brilliant new style features the 1941 Unisteel Turret Top Body by Fisher provides. Some of these features are shown in the panel on the right as they apply to the Pontiac Torpedo Streamliner Eight Sedan. And even from this partial list, it's evident that no new styling job was ever more complete. Every detail has been made to conform with the new, more advanced streamlining of the entire body—from windshield to trunk back and roof to floor. So naturally, the word's going round that "Body by Fisher is '41's guide to better value"—which leads you, of course, to a General Motors car.

"It's Another Big Year for Pontiac" — and a big reason, certainly, is its new Body by Fisher, pictured here on the 1941 Pontiac Torpedo Streamliner 8 Sedan. Sleeker yet roomier than ever, it has foam rubber seat pads, a larger luggage compartment, a 2½" wider front seat.



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zontal. By rotating the first disk, the examiner can cut out the vision of either eye at will, so that the subject does not know with which eye he is seeing. It is thus impossible for him, if he is faking an injury in one eye, to give a reading which is consistent with the examiner's manipulation.

A normal person should be able to notice a moving object at an angle of almost 90 degrees while his eyes are fixed directly ahead. Anyone who fails in this test should

think twice before driving an automobile or flying an airplane, because "tunnel" vision and accidents go hand in hand.

Latest scientific device for measuring accurately the entire field of vision is the perimeter. The perimetric test furnishes indications of great value in the diagnosis of certain eye and brain diseases. For example, the visual fields are an important guide in the diagnosis of glaucoma, serious eye disease.

Tennis Tips From a Champion Maker

(Continued from page 59)

feet behind the net. The space between these two positions is "no man's land." Stay out of it as much as possible. After a stroke, get back in position; a player out of position is forced to make too many difficult returns.

Now for the stroking. The first of three fundamentals of forehand or backhand is to turn your shoulders sideways to the ball and draw the racket back—straight back—in time to allow a pause before starting the swing. Too many beginners wait until the bounce before getting ready. The second fundamental is to step into the shot. Shift your weight from back to front foot, feet parallel to the sidelines. Practicing this, you'll soon learn to hit with body weight, which steadies shots and adds power. Of course your feet won't always be in this position, because of the speed or angle of the oncoming shot, but in practice keep the position consistently. The third fundamental is to finish with the racket well up and slightly across the body; this holds the stroke in line and prevents the novice from poking at the ball. It is the surest way of keeping a consistent over-spun shot; practice it until the stroke is grooved. This one point kept Ellsworth Vines from being as consistent as Budge, for he was content to hit practically straight with a low finish, while Don's basic shot finished high.

With all Don's natural ambition, willingness to work and sound physical equipment, it took years of effort on the part of both of us to train his muscles so the reaction would always be the same under like conditions. Over and over I would demonstrate a point, and Don would make a perfect reproduction as long as he was shadow swinging, but the instant a ball was put in play he would revert to the

form we were trying to change. Of course he kept at it until the new technique was mastered, but "why the length of time" continued to bother me, long after Don had become famous. One day the answer came, as I was coaching a pupil who kept up a running conversation as he persistently misstroked the ball. Finally my safety valve popped and I said: "Bill, you'd make faster progress if you would not try to think of two things at once."

I reflected that a pupil cannot concentrate on form if the ball is moving. From that reflection came my Tennis Stroke Developer—a simple mechanical device that does for tennis what the punching bag does for boxing and the tackling dummy for football. Two "captive" balls are held at variable heights for practice strokes, one high for overhead smashes and service, the other low for drives, chops, ground strokes and the rest of the gamut. The player can practice his pivots, footwork and strokes on this stationary ball until the form is correct without the necessity of timing. The difference between this and shadow swinging is that the player gets the feel of hitting the ball.

To practice the three fundamental steps of the stroke, stand a step away from the stationary ball. Practice first the pivot, then the step-in, then the finish. When this can be done with ease, practice running from various distances and angles until footwork and strokes have rhythm. There is no room for jerks and awkwardness; rhythm relaxes the player, creates confidence, increases power and control. Look at the picture of Budge, playing the approach shot in perfect balance, his left arm relaxed, denoting absolute confidence.

(Continued to page 181)

NEW AUTO-LITE "PLUG-CHEK" FOR SPARK PLUGS GIVES VITAL FACTS OF MOTOR PERFORMANCE!



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(Continued from page 178)

The other strokes—the serve, smash and volley—can all be learned the same way, breaking them into parts until each motion becomes habit. The first motion of the serve, swinging your racket back and putting the ball up, is most important, for if the ball is placed straight above your head in the same place each time and your racket is back ready to hit, the stroke itself is rather simple. The main thing, after the toss is learned, is to spin the ball into the court. It will be time enough to learn a flat serve after this type of service has become steady.

For the smash or overhead shot, use the same stroke as for the serve. Hold your racket back early, go up for the ball and hit hard.

The volley should be learned by blocking the shot back with a slight cut. After this is achieved it is relatively easy to start stroking the ball.

In summing up, let me suggest that when trying to improve your game, take one stroke at a time and work on it until done to your satisfaction. Too many players practice all strokes and phases of the game at once, which usually ends in confusion and discouragement.

Tilden spent one entire winter on his backhand. I watched both Helen Wills and Helen Jacobs learn their game this way, one stroke at a time. I have taught this method for years.

To the average player who has been at it for years, perhaps, and has plenty of bad habits, the best advice is—don't be afraid to make changes. Study the forms and principles accepted as correct, then stay with them regardless of temporary difficulties and setbacks. Last year Sarah Palfrey Cooke changed her old soft game to a new forcing style. It took her most of the tournament season to forget the old and subconsciously direct the new style; she kept "trying to think of two things at once." Once this mental confusion is conquered and her arm and hand muscles respond habitually, relaxed, this little doubles champion will be hard to stop.

If you're really intent on putting your name high up on the challenge board, don't let discouragement stop you. Tilden, Riggs, McNeill and Budge didn't get there simply by banging the ball around the court. Work at it. Champions are made, not born.



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(Continued from page 137)

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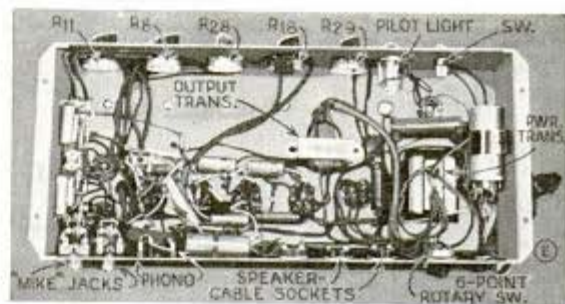
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When using two speakers in the same location, best results will be obtained if the speakers are properly phased. To do this simply place the system in operation with the speaker cones facing. Listen for a few minutes until the volume level becomes fixed in your mind. Now move the speakers apart so that the cones are not facing. If speakers are properly phased the volume will go up. If volume does not increase, reverse the plug on only one of the speakers and put a dab of red paint on the top of each plug so that there will be no difficulty in plugging them in correctly at all times. The blueprint number for this article is R-291.

(Continued to page 184)

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AGFA  CAMERAS
MADE IN U. S. A.

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ELECTRICIAN ?

See page 13A

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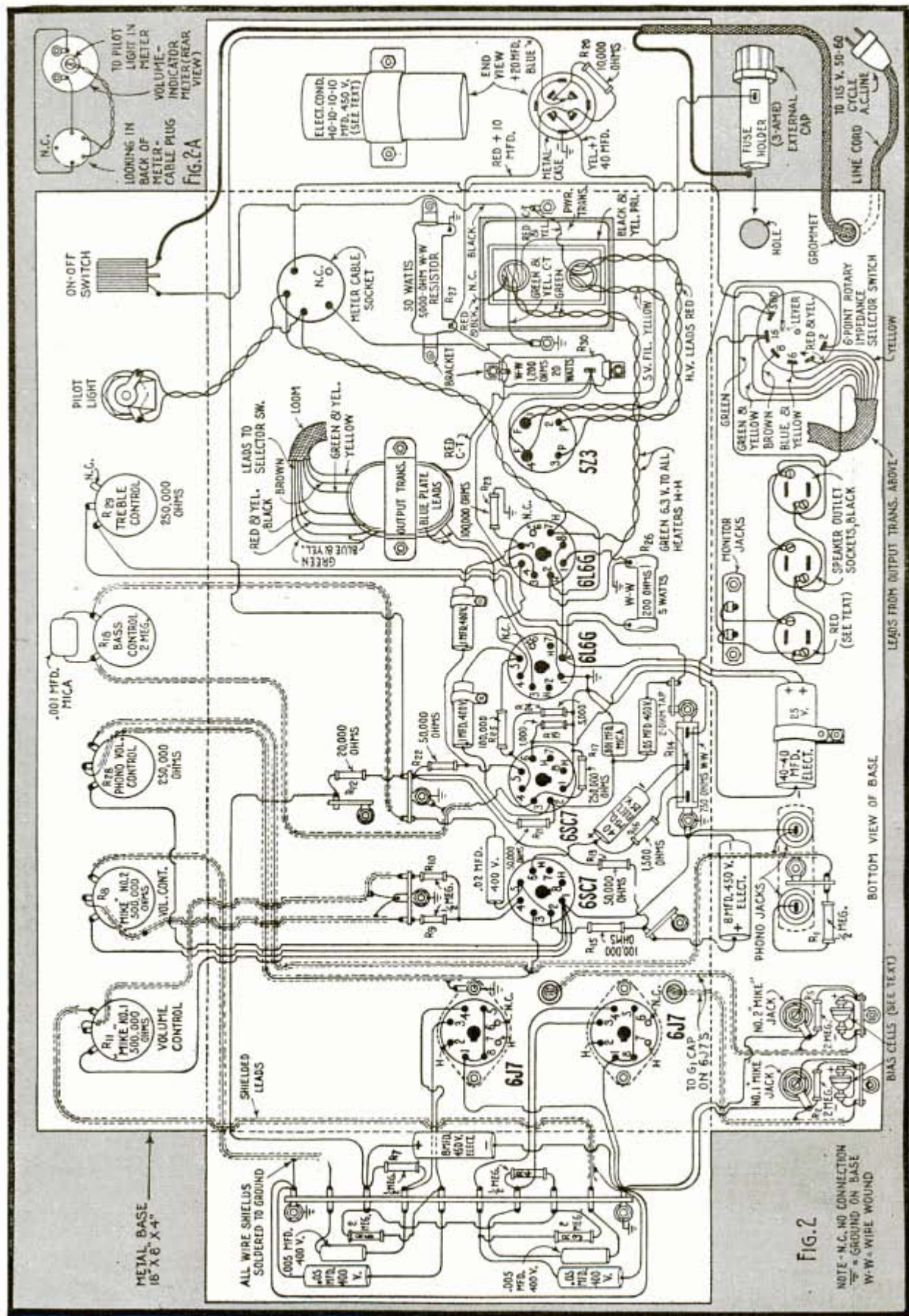


Fig. 2

NOTE - N.C. NO CONNECTION TO GROUND ON BASE W-W = WIPE WOUND

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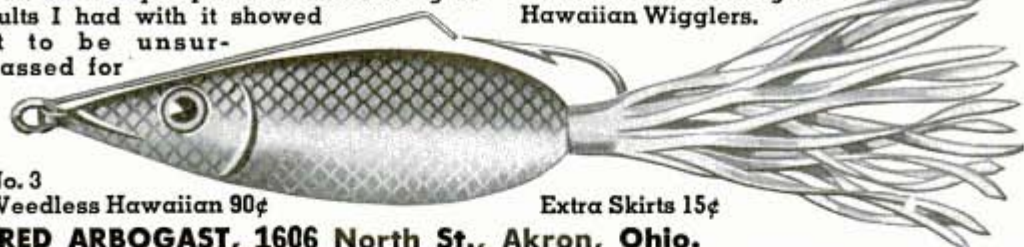
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See page 13A

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Defying the Pacific in a Sailboat

(Continued from page 79)

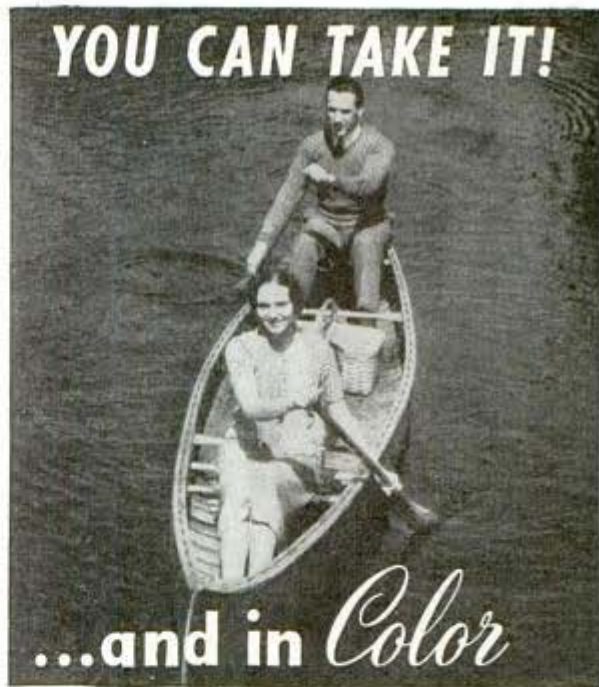
around the top of the drawer. Into holes through the wood are fitted three-sixteenths-inch rods to hold the mulligan or coffee pot during stormy weather. If we want a one course dinner, we pull the drawer out eight inches; two courses, 16 inches; and for a special occasion, we pull it out 24 inches and light all three burners. A small oven made of two one-gallon cans works fine. In preparation for our voyage to Honolulu, we stowed 1,500 pounds of concentrated foods, fruit juices, spare gear and 18 gallons of water.

We obtained clearance papers from the customs house in Monterey. Hoisting our homemade folding anchor and stowing it and with our homemade eight-foot plywood dinghy folded and lashed to the cabin side, we began our adventure. With a light mainsail and working jib set, we were soon averaging six knots on a south-southwest course. Heavily loaded, our deck was only 13 inches above the water and we were continually wet.

Three hundred miles out from Monterey, on the morning of the fourth day, blue skies gave way to scudding inky-gray clouds, the rhythm of the sea grew faster and its impact sharper. At noon, a scattering of raindrops increased to a hail like buckshot. The first huge wave curled aboard. At 2:00 p.m., we took in all canvas and tried to heave to under our navy-type sea anchor which is a steel hoop 32 inches in diameter with a conical-shaped canvas bag tapering down to an eight-inch opening. But we found that instead of taking hold of our bow and keeping her headed into it as a tail holds a kite, Confucius was held wallowing in the trough; the worst thing that could happen. We hauled in the sea anchor and let out our homemade sea anchor, which consisted of two pieces of planks one by twelve by forty-six inches long; set at right angles to each other, leaving an opening of four inches between each board, the lower board ballasted with lead to keep an even keel. With chain bridle attached, we found it had an immediate steadying effect.

At last, hove to and with everything on deck well lashed, we hung on together in the cockpit dripping wet in spite of oil-

(Continued to page 189)



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Many jobs are ruined by uneven and poorly jointed lumber. Not so when you use a Duro Production Jointer—your wood will be made smooth, straight, free from nicks and ripples and your work will take on a professional appearance. You get heavier than usual construction; one piece solid steel cutterhead and shaft; production fence that eliminates the gap between fence and rear table; extensions which give 60" support.

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DOENUT WHEELS with Outside Valves

These new wheels wear longer, ride easier, prevent jolting and spillage. Developed by Musselman, the inventor of the airwheel for airplanes. No matter how carelessly tire is allowed to run under-inflated, valve cannot be cut or damaged by "creeping."

Ideal for wheelbarrows, carts, hand trucks, spray and greasing rigs, boat dollies, etc.

Three sizes—10" x 2.75"; 12" x 3.30"; 16" x 4.40". Unless you are a rated manufacturer, enclose 10c postage in writing for literature. For boys wishing to build wheelbarrows, wagons, scooters or bicycle trailers, we supply blue prints at 25c each.

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Illustrated May Issue Popular Mechanics, P. 672.

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OFFER! Order from this ad, receive one additional tube of HEATABS FREE.

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Low "MASS PRODUCTION" Prices. 3/4 H.P. to 8 H.P. models. Walking and Riding Types. Plows, cultivates . . . does many other farm and belt power jobs.

MOWER ATTACHMENTS for all SHAW models are available . . . both Cutter Bar for hay, weeds or tall grasses, and Cylinder type for lawns, estates, golf courses, cemeteries, etc.

SPRAYING is another job that SHAW TRACTORS handle nicely. Picture at left shows 1 h.p. "Peggy Pal" with 25 gal. reservoir. Write for **SPECIAL LOW PRICE**—also 10 DAY TRIAL OFFER, FREE LITERATURE on this and other models. Address nearest office.

SHAW MANUFACTURING CO.
4506 Front St., Galesburg, Kansas; 5812-G Magnolia Ave., Chicago, Illinois; 63-G North 4th St., Columbus, Ohio.

Say you saw it in Popular Mechanics!

(Continued from page 187)

skins, boots and sou'westers. For us to be among waves 20 to 30 feet high was to be in a world of wild valleys and toppling mountains, and the wind blew for 76 hours at a velocity of 50 to 60 miles per hour.

Finding it useless to stay on deck, we crawled into the cabin. Unable to cook, unable to sleep and unable to lie down, we braced ourselves and hung on. On the fourth day the seas subsided, the wind lessened and we dug out the mainsail and working jib. But we could make little progress because the wind had died away, almost to the vanishing point.

For making observations to get our bearings, we had a small sextant that Rosalie had made out of two small vanity mirrors, five pieces of hoop steel, a small 15 cent telescope and a wing screw. I used a tiny second-hand Boyce Mier. A large precision sextant is impractical on a small boat at sea due to rolling and banging. We used a second-hand five-inch compass which I had bought for \$5.00 and built into a weatherproof binnacle made of galvanized tin. For chronometer, we had three one-dollar watches set in a case hollowed out of two small pieces of old mahogany.

During the night of the twenty-third day, there was a murmuring that was almost a whisper on the water and a salt freshness in the air. At sunrise we welcomed the sight of great scudding trade clouds out of the northeast. Soon a fresh breeze sent us flying along, leaving a bubbling wake behind. Just before dusk, on our thirtieth day out, a long gray submarine appeared. We signaled for half an hour without receiving recognition.

For the remainder of the voyage, we averaged a broken stay daily, due to sudden squalls and constant rolling in the swells.

At midnight on our 46th day out, according to our navigation, we should have been 30 miles from the Island of Maui. At 12:30 p.m., the starboard stay snapped for the fifth time; having already used all of our 50 feet of spare cable, I made the spinaker halyard fast to the chainplate and decided to come about and head straight for Kahului, Maui. And at daybreak, we saw Kahului just where we expected it to be. Carried ashore, we found the streets and houses apparently swaying, so we had to lie down for awhile, but we had made the first long jump in our tiny craft.

HE MAY LIVE IN YOUR HOUSE



57,256 Pipe Smokers are still missing!

Among hard-to-please pipe smokers a high percentage naturally enthuse about BOND STREET. Applying this percentage we know that about 57,256 pipe-smoking readers of this magazine—for whom BOND STREET is a "natural"—still have this grand discovery to make.

So come out of hiding—and try BOND STREET!

It contains a rare aromatic tobacco not hitherto used in a popular price mixture. Rich-tasting, bite-free—leaves no tobacco odor in the room—even the ladies approve.

Try it—today! Only 15c.

15¢ GENEROUS SIZE
POCKET TIN



A Product of Philip Morris

Wonders of Under-Water Movies

(Continued from page 15)

Before each scene the actors are carefully rehearsed. If Perry is directing, he simply asks: "Ready all?" Cameraman nods, cast does likewise, they dive in and the "take" is made. Most scenes require 20 to 30 seconds; a few have taken twice as long. For instance, in the wedding scene of "Underwater Romance," it took the preacher, the bride and groom and congregation a minute and 15 seconds to file through the underwater church doorway. Perry's actors and actresses range in age from about 16 to 25. Three out of four are girls.

A good surface swimmer isn't necessarily a competent underwater swimmer. Perry would rather start with an average swimmer and teach her his methods than try to train a girl who has had quite a bit of surface swimming and imagines she's a topnotcher. Give him a good novice with sturdy heart and lungs, strong physique and a will to work and Perry is satisfied he can teach her the technique. A main requirement is that all the actors learn to hold their breath at least 45 seconds. With this in mind Perry teaches them to "bob"; that is, to take a mighty breath just before they submerge and then exhale vigorously. They're all called upon to do this 100 times in succession. For two weeks prior to making a picture they bob at least an hour and a half each day.

Next they learn a special stroke Perry has developed for underwater high jinks, a variation of the crawl that utilizes a trudgen kick, or four beats and one scissors kick.

All his girls learn to swim in unison as if they were ballet dancers. Each must learn to stay under water for at least a minute and swim under water at least 60 feet at a stretch. With a couple of weeks' training they're able to do this with considerable grace and ease. The training starts with surface dives, followed by underwater swims of 20 feet, gradually increased to 60 feet or more.

Perry insists none of his scenes are faked. In "Neptune's Daughters," one of the pupils in the undersea school (Perry's sister Aileen), wrote several lines on the blackboard. Many observers thought that scene was faked. It wasn't. She actually wrote the words on the blackboard while swimming submerged, though it did take

considerable practice to make them legible.

Perry has had plenty of thrills. "I claim," he says, "to be the first swimmer in America to do fancy diving in a burning bathing suit. I did this for a Paramount News short. If the diver isn't careful the wind may whip the flames into his nose and lungs, which might prove fatal.

"Here's how I did the trick: first I put thin overalls over my bathing suit and sprinkled them with gasoline. Then, while perched on a springboard 30 feet high I set fire to the overalls and did a flip, or two-and-a-half. The stunt consumed only two seconds from the time I left the springboard until my body pierced the waves in a swan dive. I didn't even get scorched, but the fact that my eyebrows were singed was evidence of the close shave I had."

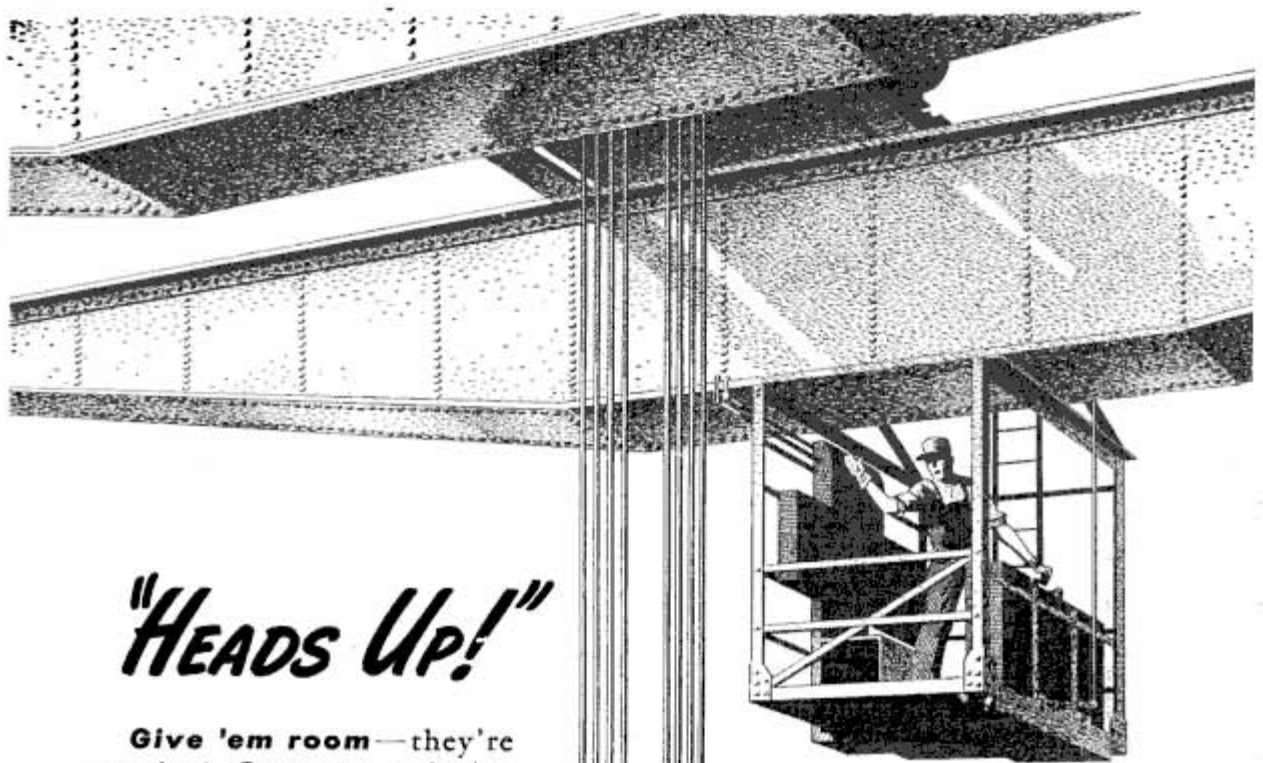
Perry had another thriller recently while making a safety movie with Elsie Davis, one of his pupils, for an automobile company.

"We were supposed to show how a person, after an accident, could break out of a 20-passenger bus lying on a river bottom," he said. "In one scene when we were 'trapped' in the bus, I was told to make the action look realistic. This wasn't difficult for actually we had a narrow escape. Several of the heavy seats were wedged against Elsie, due to a heavy current, and I had a tough time getting her free. The shooting of this scene took a minute and 45 seconds and I don't know to this day how I held my breath that long.

"While filming this same picture the cameraman was shooting a scene in which I was inside an automobile 20 feet below the surface. This was according to script, but when the doors jammed that was purely accidental. I tried to force them open but they wouldn't budge. Noticing my predicament the photographer signaled for Buddy Austin, a friend of mine who was on the bank.

"Meantime I failed to break the glass, and just as my breath seemed exhausted, Buddy placed one of his husky feet against one of the doors and forced it open."

¶ Names and addresses listed in the index, page 4-A, show where to buy manufactured products described in this magazine. Say you saw it in Popular Mechanics.



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him as helpers mechanical strong men in the form of power tools and machines. These multiply his effective strength; they help him to produce more—better—faster.

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America's "Sea" of Oil

(Continued from page 3)

produced by wells whose rate of flow, under a system of state regulation, is being held back. It is manufactured in refineries which are and have been operating substantially below capacity.

The petroleum industry has been called upon for continued expansion to meet growing needs in the past 20 years. Per capita consumption of oil is equivalent to eight barrels as against four. There are nearly 30,000,000 motor vehicles as against 3,000,000. There were 25,000 oil burners in homes and factories then, more than 1,500,000 now. Consumption of heating oil is 100,000,000 barrels against 10,000,000. The tonnage of oil-burning ships is nearly 20 times that of 20 years ago. In the past 10 years the consumption of fuels and lubricants by aircraft has increased tenfold.

Increasing production for defense needs means less an expansion of existing facilities than operation of the present petroleum plants more nearly at capacity. Our petroleum industry, which is the largest and most efficient in the whole world, has discovered and now possesses more oil than any other country in the world. Annually it produces two-thirds of the world's supply. This nation has the happy advantage of being the only one in the world in which military, commercial and civilian needs for petroleum and its products simultaneously can be met, war or no war. More than 1,000,000,000 barrels of oil a year are being produced from 395,000 oil wells located in 23 of our states. There are thousands of oil fields in this country. Some 306 new fields were discovered in 1940 alone—more than in any prior year, and more than 1,200 have been found in five years. This country now has not only the largest petroleum reserve in the world, but in the past decade its petroleum industry actually has discovered more oil than it has produced. In the last six years the industry has found twice as much oil as the nation has consumed.

Crude oil is transformed into gasoline, lubricants, and thousands of other products in more than 550 refineries located in 35 states. In the field of transportation this industry utilizes every available medium, and itself operates more than 200,000 miles

(Continued to page 194)



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(Continued from page 192)

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of pipe line, 140,000 railway tank cars, 75,000 highway tank trucks, and what probably now is the world's largest tank-ship fleet.

These operations, covering virtually the whole United States, are so decentralized that it would be a physical as well as a military impossibility to stop the industry's service of supply. Admittedly protection of stored products from bombing presents some difficulties. Yet while the industry's larger storage facilities are grouped near railway and waterway terminals, a large part of its storage is kept in widely separated bulk plants located at every sizable community throughout the country. This decentralization, an advantage to consumers in time of peace, becomes an important military asset. Just as motor vehicle operators can obtain fuel, lubricants, and service practically everywhere, so would military forces active in any section find supplies readily available.

While present warfare is different, with armies motorized, airplane fleets active, and navies more extensive, the petroleum industry has changed also. There are twice as many producing oil fields as in 1917, among them 250 with potential production above 20,000,000 barrels. Petroleum reserves are three times as large. There are twice as many refineries. Stocks and storage facilities are two to ten times as great. Marine transportation facilities are nearly 20 times as large, and those on land have been doubled. There are six times as many local storage plants, and 16 times as many retail outlets.

Remarkable progress has been made in operating techniques since 1917. Oil wells can be drilled five times as rapidly and two or three times as deeply. More than twice as much crude oil can be recovered from a field. The producing life of oil fields has been extended. Old fields can be, and are now being, restored to production. A doubled volume of refined products now is obtained from each barrel of crude oil. New refining processes unknown in 1917 and improvement in processes then employed make almost impossible a comparison of refinery efficiency between 1917 and 1941.

Developments in the field of aviation fuel provide means of measuring the progress of the petroleum industry. At least

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five different processes for making super-fuels for airplanes have been devised in the United States within the last few years. Already productive capacity is twice the demand, and will be ahead of demand at least for another year. These processes have given this nation not alone the largest but the only adequate available supply of super-fuels in the whole world. Within about the time it takes to build two battleships, and for even less cost, the industry's refinery capacity for producing super-fuels can be doubled.

Wartime service means more to the petroleum industry than merely production of essential products. It means the delivery of those products when, where, and as needed. It means the continuation of service to the civilian population, so that people throughout the country can continue to own and operate their own motor vehicles, boats, planes, tractors, and stationary engines. It should mean much to morale, to human comfort and convenience, and even to success in war, for the citizenry to know that even in wartime the family car can be used with normal regularity.

Suppose the war period were prolonged; that actual demand for petroleum products and services exceeds estimates. Suppose this vast industry, now producing two-thirds of the world's annual output of oil, were forced to change from a routine to an emergency operating basis. Suppose the demands of war proved to be not merely a change of markets for the industry, but a real test of its capacity to produce.

No great difficulties need be expected even under such emergency conditions. To increase the flow of the nation's oil wells would be a task only of hours. To increase the output of refineries generally would mean a stepping up of operations. So all along the line.

After the first World War, England's Lord Curzon said "the Allies floated to victory on a sea of oil." This was a tribute to the American petroleum industry's service in providing an abundant supply of petroleum products wherever they were needed by the Allies.

Today the leaders of the industry are working with our government to make certain of the adequate production, protection, and delivery of defense petroleum supplies. To them the undertaking is a pa-

(Continued to page 197)

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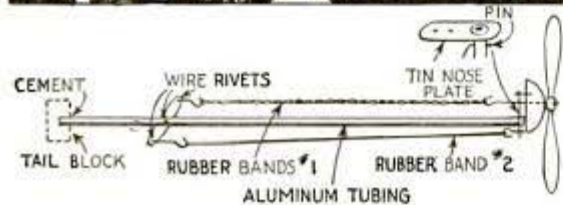
(Continued from page 195)

triotic duty, yet more in the nature of meeting specific needs for which facilities are adequate than an emergency enterprise. In an industry which in 20 years has multiplied its production of gasoline nine times, its production of fuel oil three times, and its output of other products correspondingly, and which has been able to increase production of certain products by one-quarter to one-half in less than a year, the demands of defense occasion little worry to the military authorities or to the industry.

Possibly the modern spirit of the industry best is summarized in this recent statement of oil men to government agencies: "Tell us what products you want, how much, and when. We'll deliver!"

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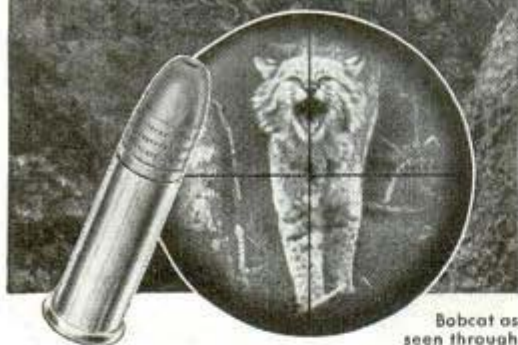
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Say you saw it in Popular Mechanics!

L208

Most Powerful Diesel on Wheels

(Continued from page 11)

the passenger streamliner. But instead of sustained speeds of 80 to 100 miles an hour, the freighter can pull a 100-car train at 75 miles an hour; over that speed a governor steps in and sets the brakes if the engineer doesn't. Loaded with 4,800 gallons of fuel it can pull that 100-car train weighing 5,000 tons for 500 miles without a stop.

Ordinarily nine big steam locomotives take turns hauling a freight from Chicago to Los Angeles, making 34 to 36 stops for fuel and water. The Diesel goes the whole distance, with just five stops for fuel oil. Water for the cooling system is no more a problem than adding water for your automobile radiator; some Diesels go a week without adding water. That's doing better than a camel. And it's important on western deserts and mountain lines where steam engines boil away tankloads on a short run and water is sometimes hauled 50 miles to the main line.

Wrapped up in its splendid blue and gold package, No. 100 has four 16-cylinder, two-cycle Diesel engines coupled to generators driving 16 traction motors on 16 pairs of drive wheels. The four units of the locomotive stretch out nearly as long as a city block—193 feet from blunt nose to coupler. Its 464 tons, loaded, hug the track, with a low center of gravity as compared with the high boiler of the iron horse. And, built in sections, it can take the curves easily. No 193-foot car could negotiate a railroad curve in one piece. The front and rear drive wheels of a big steam engine, with its long, rigid wheel base, grind against the rail on a curve, wearing down both rail and wheel. The Diesel, hinged at three points, bends around the curve. Less friction, less wear, less power loss.

Climb up into the cab at Supai, peak of the Arizona Divide, for a spectacular midnight ride down the steep western slope while the engineer tries the electric retarding brake, the first ever built into a Diesel-electric locomotive.

Five tiny beads of light against the night sky are waving the "highball." Those are the lanterns of brakemen standing guard at intervals on top of the box cars, watching for hot brakes or other danger signals. But there are no hot brakes tonight. Over

(Continued to page 201)

EASY TO BUILD

"U-Mak-It" BOAT KITS

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Mail to Popular Mechanics Press,
Dept. 288—200 East Ontario St., Chicago, Ill.

208
(Continued from page 199)

the pass No. 100 pulls its long string and begins rolling downhill around the bends, the green lamps of the caboose only now and then sighted far back, across a horse-shoe curve.

As the 20-mile "toboggan" starts, the engineer throws a lever. The generator fields reverse, drive wheels push against the motors, and—with somewhat the sensation and effect of driving your car down a mountain road in low gear—the reversed motors hold back the train.

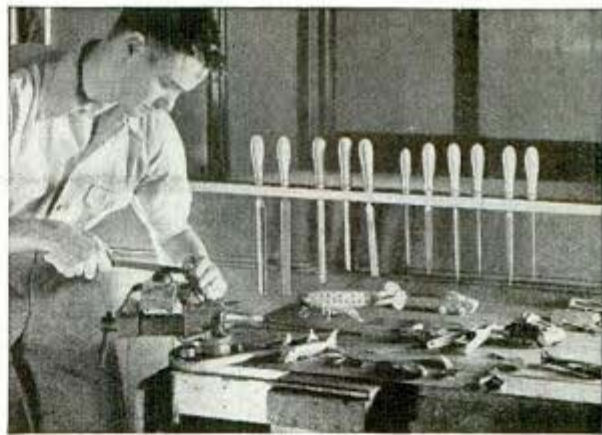
Electric retarding brakes have long been used on locomotives drawing current from trolley or third rail; there the current generated by wheels turning motors can be poured back into the power line. In the Diesel-electric there is no reservoir of power. Something must be done to get rid of the generated current, so it is fed into grids in the roof of the power car and dissipated in the form of heat. In simple terms these grids are electric heaters. Fans blow the heat away through the roof.

Down the long hill from Supai the regenerative brakes hold back the 3,150-ton train pushing against the heavy locomotive. On a steep stretch it slips beyond the 20-mile-an-hour limit of the electric brake. Warning lights flash in the cab, and the engineer applies air brakes momentarily. But only momentarily; there is no stopping this time to cool air brake shoes and wheels that burn smoking hot on ordinary runs here. Usually a freight must stop three or four times in these 20 miles to cool brakes. When No. 100 does stop for wheel inspection, as required of freights every 75 miles, the steel is only warm to the touch. Costly wear and tear on shoes and wheels, and much time for inspection have been saved.

On its "premiere" trip No. 100 used its electric brake over 83 miles; in that time the electric brake absorbed 19,700 million footpounds—about one-tenth of all the energy used to move the train from Kansas City to the coast.

The old iron horse is a tough rival to beat, but the Diesel-electric is gaining. Last year in the United States 462 Diesel-electrics were ordered, and only 219 steam locomotives. Since 1935, manufacturers say no steam switch engines of 600 horsepower

(Continued to page 202)



"BASEMENT INDUSTRIES" are booming, too!

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Nicholson and Black Diamond brands are "tops"—yet cost only a trifle more than lower grades. While Nicholson—world's largest file manufacturer—makes more than 3000 kinds, sizes and cuts, home-shop assortments should primarily include some small-to-medium-size Mill files (single-cut); fast-working Flats (double-cut); Slim and Extra-slim Tapers (triangular); Rounds and Half-rounds. Good hardware stores and mill-supply houses sell Nicholson and Black Diamond files.



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(Also Canadian Plant, Port Hope, Ont.)

(Continued from page 201)

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TRUES UP • PLANES • PANELS • RABBETS
ROUTS • TENONS • \$7.50 COMPLETE



A WONDER TOOL
Saves hours of tedious hand planing. Parallels and surface finishes to absolute smoothness all knots and tough grained woods. Hi-Speed, double edged cutter blades insure extra long wear. Unexcelled for paneling, rabbeting, routing, tenoning, grooving, bending and many other workshop uses. Safe-harmless to drill press. Thousands now in use. Money Back Guarantee Shipped prepaid on receipt of check or money order for \$7.50—or C.O.D. Full five day trial and refund guaranteed if not completely satisfied. You Risk Nothing. Barron Tool Co., 346 Architects Bldg., Detroit

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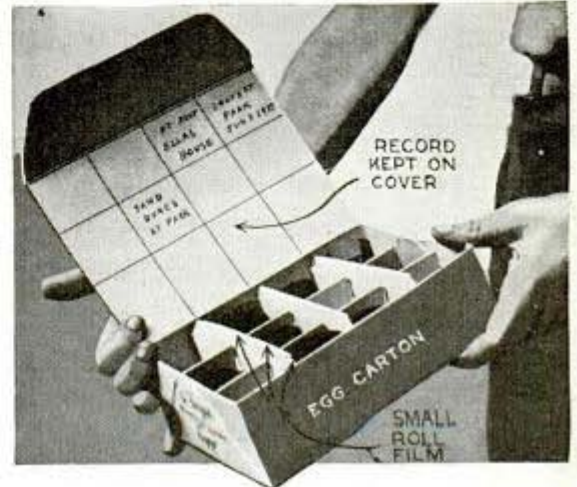
or more have been built; Diesels have pre-empted that field. The Diesel, available 95 percent of the time, can do nearly the work of two steam engines, which take more time for servicing. For a long time, Diesels cost three times as much as steam locomotives. But assembly-line production has cut prices.

Santa Fe No. 100—which, by the way, burned 6.05 gallons of furnace oil per mile on that first trip—pulled 3,150 tons of freight. Its twin once took hold of an 18,000-ton ore train in Minnesota and hauled it to town in eight hours where two big Mallet steam engines costing \$500,000 together spent twelve hours. The Diesel cost \$450,000.

After all, the worth of a locomotive is measured in ton-miles per year—and like old man river, the Diesel keeps on rolling; delivering the goods at speeds sure to squeeze hours, even days from the trans-continental freight schedule. With defense shipments swelling in volume, with perishable fruit and vegetables from California pouring eastward and aircraft engines and parts flowing westward in a steady stream, freight train speed is becoming ever more important. This may be the Diesel's opportunity.

Rolls of Film Filed in Egg Carton With Data Written on Lid

Twelve small rolls of film can be filed in a cardboard egg carton like the one illustrated. The inside of the lid can be ruled off in squares and information concerning each roll is written in a corresponding square.



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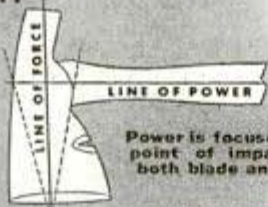
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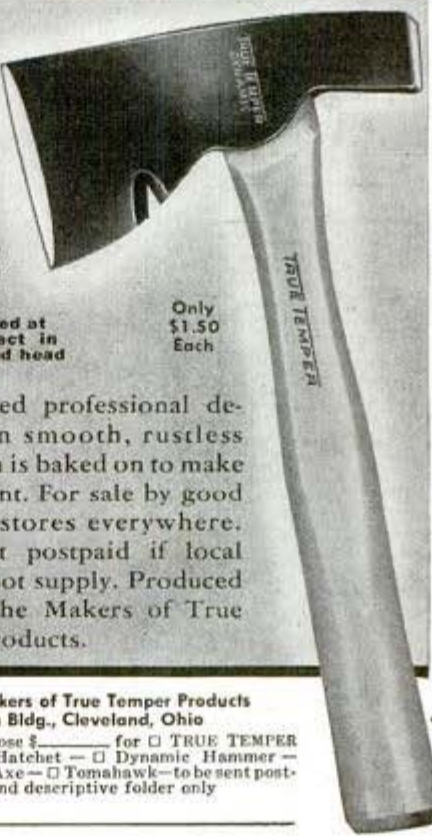
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I enclose \$_____ for TRUE TEMPER Dynamic Hatchet — Dynamic Hammer — Tommy Axe — Tomahawk — to be sent postpaid — Send descriptive folder only

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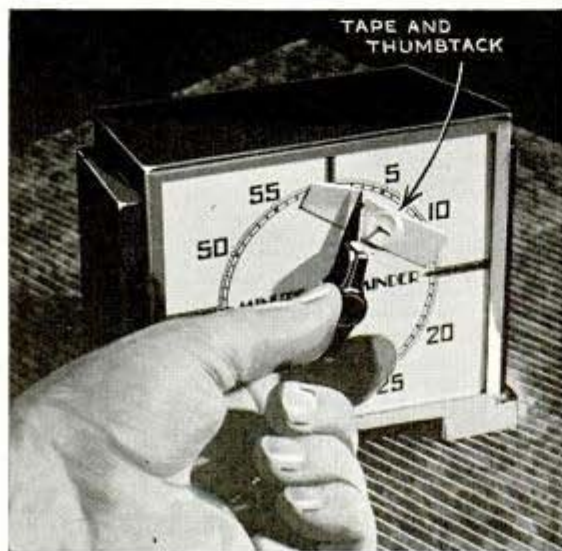
Plate Camera Reflex Attachment Focuses Low-Angle Shots



With this attachment on a plate camera, it is unnecessary for the photographer to assume an awkward position when focusing shots from a low view point. An open-top cardboard box is painted flat black on the inside and a mirror is set at a 45° angle inside the box. You can use cellulose tape for mounting the mirror in the box and for fastening the box to the camera.

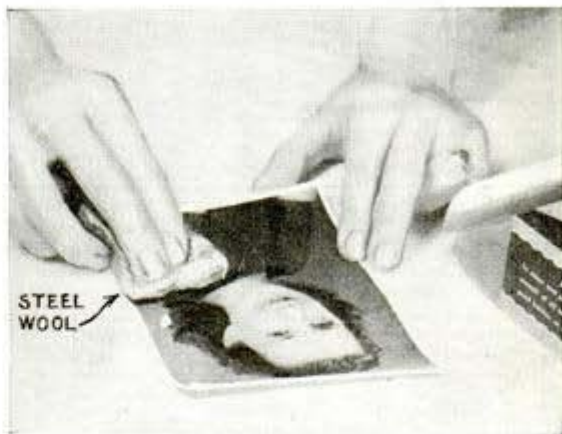
Improved Stop for Timer

A stop for setting a darkroom timer at a predetermined number of minutes can be



made from a thumbtack and a piece of adhesive tape. Press the tack through the tape from the adhesive side and stick the tape to the face of the timer.

Prints Rubbed With Steel Wool Are Given a Satin Finish



Glossy prints can be given a rich satin finish by rubbing them with steel wool. Use a fine grade of wool and work it lightly over the face of the print.

Rubber Tips on the Fingers Keep Marks Off Prints



A pair of rubber finger tips will keep you from getting finger prints on glossy paper while arranging it in your enlarging easel. The tips also are convenient in removing paper from the package.

—Bob Hurst, Chicago.

Photographic prints to be framed and hung on the wall of a home should be a trifle lighter than normal as interior illumination often is insufficient to bring out the print to advantage, especially when not viewed from a closeup position.



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KRW Air Compressors are built in Horizontal and Vertical types in sizes to meet every requirement. Compressor illustrated is the KRW Service Station Special (No. 720). Ideal for tire

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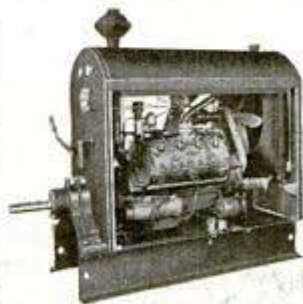
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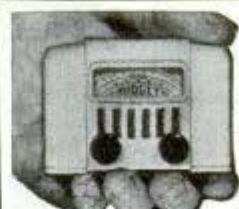


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