

ANC

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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**BUS TRAIN
PAGE 103**



HERE'S WHY NEW AUTO-LITE "Sta-ful" BATTERY...

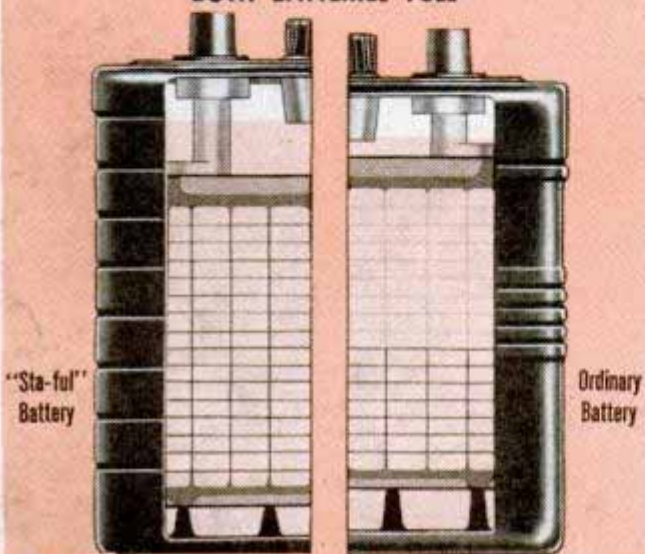


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water only

3

times a year!*

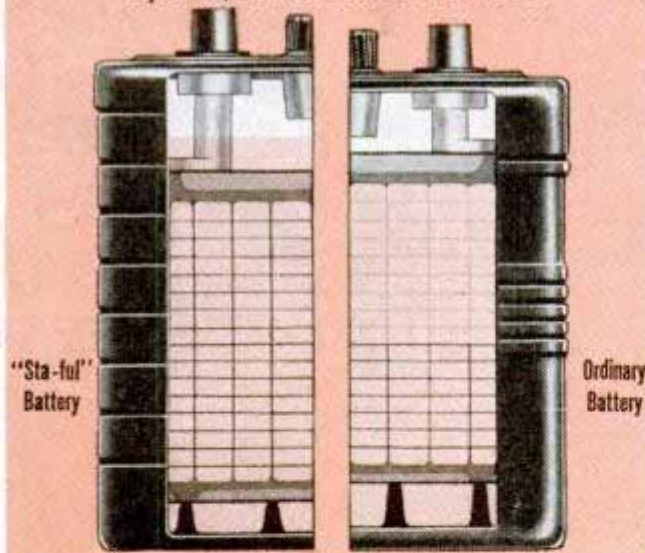
BOTH BATTERIES FULL



"Sta-ful"
Battery

Ordinary
Battery

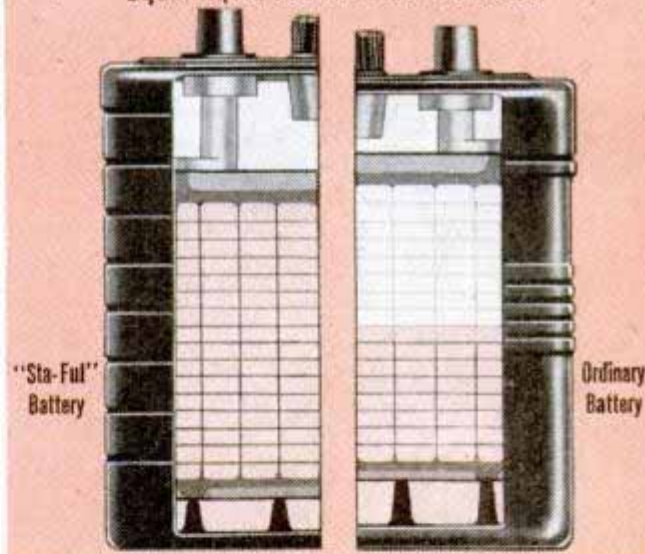
FIRST STAGE OF EVAPORATION
Equal liquid loss from both batteries



"Sta-ful"
Battery

Ordinary
Battery

ADVANCED STAGE OF EVAPORATION
Equal liquid loss from both batteries



"Sta-Ful"
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Battery

LASTS LONGER TOO! *In normal car use, because of "Sta-ful's" extra liquid reserve, plates are kept submerged to help deliver full life and power, when the same liquid loss leaves the plates in ordinary batteries exposed and inactive. This "Sta-ful" principle, oversize electrical capacity, plus Fibre-glass insulation, give longer life than batteries without Auto Lite "Sta-ful" features.

AUTO-LITE BATTERY CORPORATION
Toledo 1, Ohio

AUTO-LITE

**Sta-ful
BATTERIES**



More miles with
B.F. Goodrich
FIRST IN RUBBER



Typical example: the B. F. Goodrich tire that outwears prewar tires

CHARLES E. WATSON knows tires because they are part of his daily life. He services automobiles in Portland, Oregon, and does a lot of driving for both business and pleasure. In the picture above he is shown pointing to a B. F. Goodrich tire that has already given him over thirty-eight thousand miles of service. He writes:

"Less than eight months ago I purchased two B. F. Goodrich tires. The speedometer then read 35,504 miles. When these pictures were taken, it read 73,609. This represents 38,105 miles of the hardest possible passenger car service—and as you can see, there is plenty of tread left.

Though I am a service man, these tires were given no special attention."

Mr. Watson's report is *typical* of the experience of B. F. Goodrich owners, who state again and again that B. F. Goodrich Silver-towns outwear prewar tires. One of the reasons these tires give longer service is their wider, flatter tread. This tread puts more rubber on the road, spreads the wear more evenly, runs extra miles without wearing smooth.

Another worthwhile feature of this long-wearing tread is the hundreds of small curves molded into its rib edges to protect against skidding.

And B. F. Goodrich tires give you additional blowout protection, too . . . by means of double breaker strips to cushion sharp blows . . . a big, strong tire body made with cords of high tensile strength.

Prices Now Reduced!

Now you can get the tire that outwears prewar tires in all popular sizes at less than prewar prices! And there has been no lowering of quality. *The B. F. Goodrich Company, Akron, Ohio.*

B.F. Goodrich
FIRST IN RUBBER

A BILLION ORDERS A DAY

In a large modern telephone office 2,000,000 switch contacts await the orders of your dial to clear a path for your voice. They open and close a billion times a day.

At first, contacts were of platinum — highly resistant to heat and corrosion but costly. Years ago, Bell Laboratories scientists began looking elsewhere, explored the contact properties of other precious metals — gold, silver, palladium and their alloys — and with the Western Electric Company, manufacturing unit of the Bell System, restudied shape, size and method of attachment.

Outcome of this long research is a bar-shaped contact welded to the switch and positioned at right angles to its mate. For most applications, an inexpensive base is capped with precious metal.



Savings from these contacts help keep down the cost of telephone service. This is but one example of how Bell Laboratories serve the public through your Bell Telephone Company.

An engineer examines contacts in a cross-bar office. Horizontal bars seen in the cross-bar switches select contacts which are then operated by vertical bars to establish talking paths between subscribers.

BELL TELEPHONE LABORATORIES



EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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



ESKIMO TOGS were donned for a visit in Florida by Aub Cookman, our Aviation Editor. After struggling out of his parka he stepped into a climate hotter than the tropics. This may sound confusing, but at Eglin Field he found climates made to order. Men of the Army Air Forces press a few buttons and vary the temperature of a big hangar from 70 degrees below to 165 above. It's a project to test aviation equipment for any climate. Aub's account, "Florida's Cold Spot," is on page 98.

NEXT MONTH "Flight Plan for London" will reveal all the jigsaw details that are fitted into a plan for a transocean hop. Another feature gives the low-down on how to patent an invention. Also, there'll be a story about a home-movie expert who makes a chorus of flowers perform a ballet to music in front of a movie camera.

SPORTSMEN will discover a heavy bill of fare in next month's Craftsman section. There's an article for hunters on building a duck boat, and a feature that tells how to convert the Enfield rifle into a sporting arm. Another article gives tips on preparing your oil burner for the first cold snap.

OWNERS of spring-wound record players and small radios can get loud-speaker volume with a battery-operated amplifier described in next month's Radio section.

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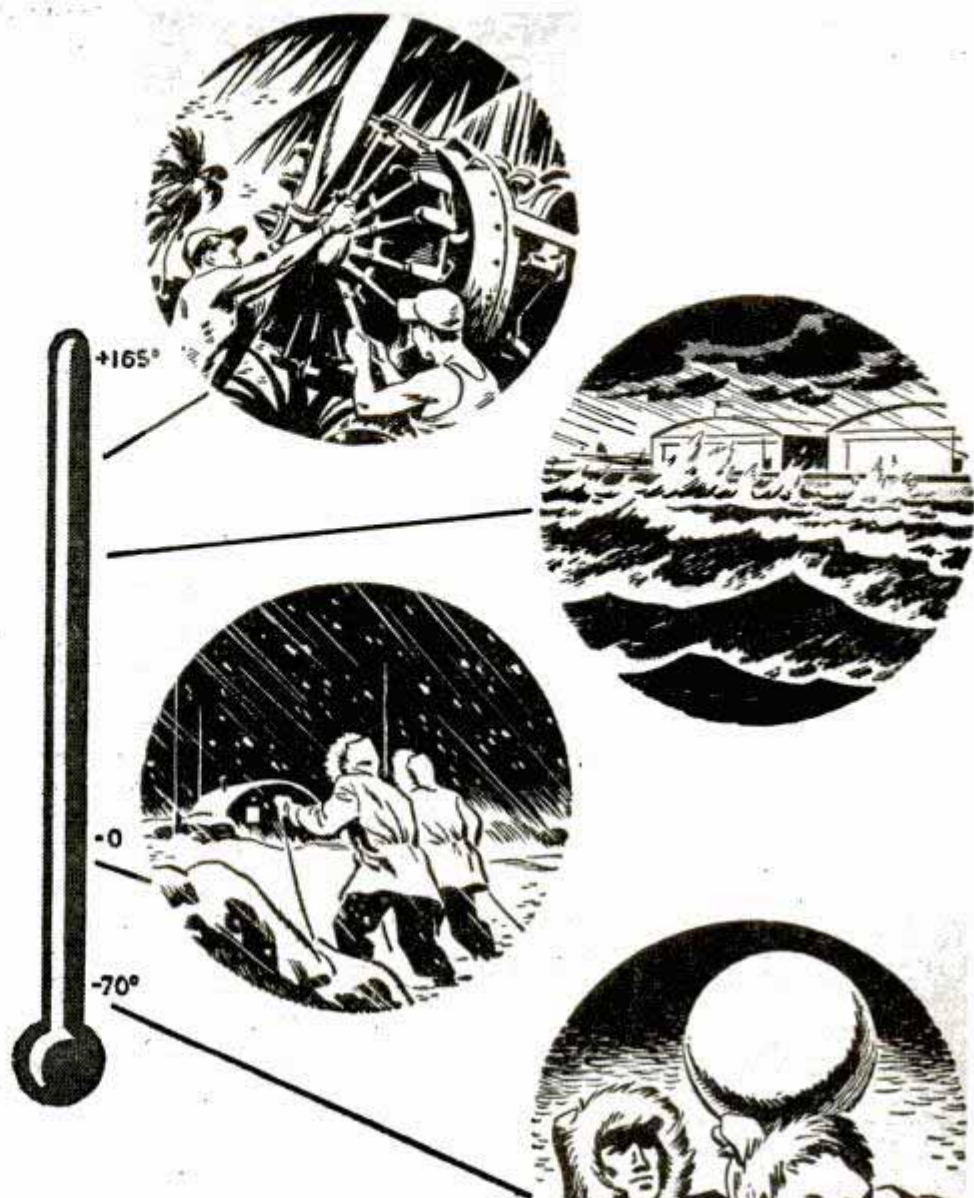
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ALL KINDS OF WEATHER— UNDER ONE ROOF!



At Eglin Field, Florida, the Army Air Forces' Proving Ground Command has built a huge Climatic Hangar. Inside it, temperatures ranging from an icy 70 degrees below zero to a torrid 165 degrees above can be quickly produced.

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The Climatic Hangar is another step in the Air Forces' quest for better, safer airplanes and equipment. If you are interested in a future in aviation, Air Force Day—August 1—gives you a chance to know your Air Forces better. See your nearest U. S. Army Recruiting Station today for details on AAF enlistments.

U. S. ARMY RECRUITING SERVICE

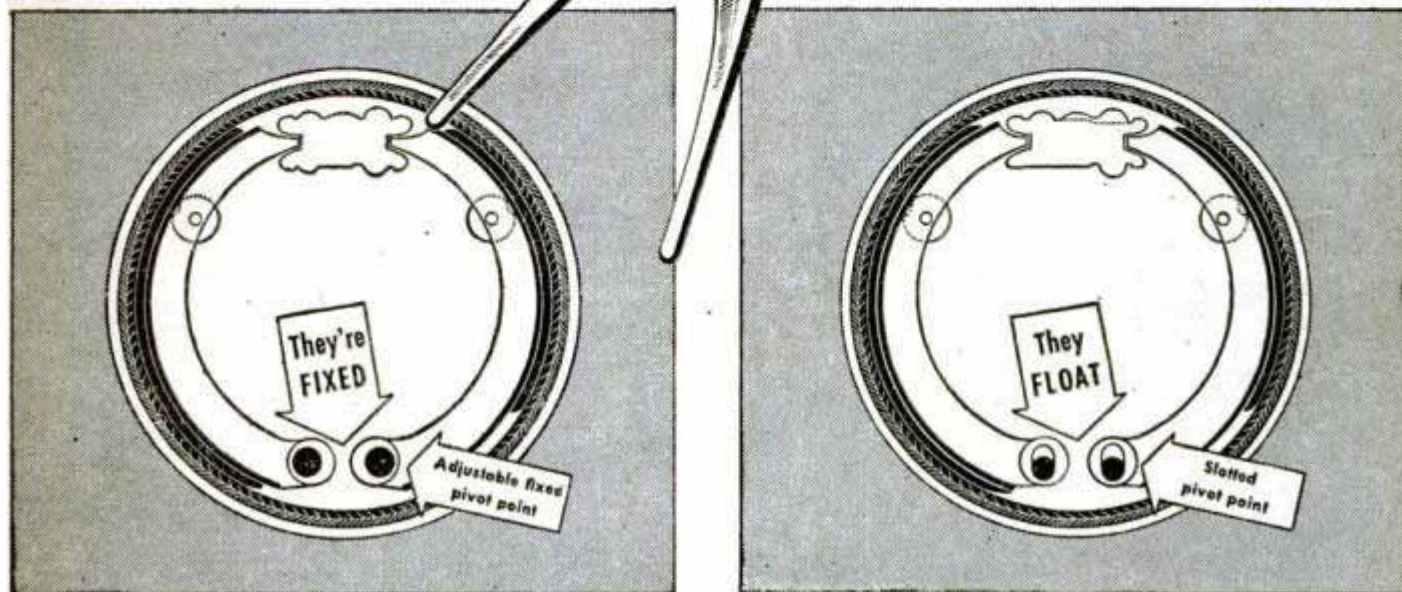
FROM DESERT HEAT TO ARCTIC ICE

In one building, 200 feet long by 250 feet wide, the Army Air Forces can simulate any one of the extreme weather conditions shown above.



How Ford brakes eliminate

"Nutcracker Squeeze"



Old-type brakes use a nutcracker-type pivot. They have adjustable pivot points using eccentric anchor bolts on the bottom pivots, and a spread at the top. To eliminate the uneven contacts of such a pivot, Ford has developed a completely new type of hydraulic brake.

New type Ford brakes are *self-centering*. This design allows the brake shoes to *float* into complete contact with the drums for evenly distributed contact pressures and increased braking efficiency with 15% softer pedal action. And they're oversized for greater safety.



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Ford oversized hydraulic brakes have 162 square inches of lining area, 264 square inches of drum area—the largest in their price class. This gives you braking areas greater in relation to car weight than even some of the heavier, higher-priced cars. 12-inch cast iron brake drums mean greater safety;

They're Self-centering

Ford's new floating shoe design, with fixed anchor and slotted brake-shoe pivot, centers the brakes against the drum for full-lining contact. This gives brakes even, long life . . . easier, less frequent adjustment.

They're Long-lasting Hydraulics . . .

Ford brakes get their longer life not only from their self-centering feature, but also from the long-lasting cast iron brake drums. *With features like these, no wonder "Ford's Out Front" for safety.*

There's a *Ford* in your future



This One



33NB-WJU-4W92



1200 magnifications reveal the structure of annealed forgings. Under the microscope, the laboratory technician can determine if the sample meets specifications.



The extent to which hardness penetrates is determined by the Rockwell test. In this procedure, a diamond test-point is

driven with equal, measured force into the sample at intervals. Readings at these points determine degree of hardness.

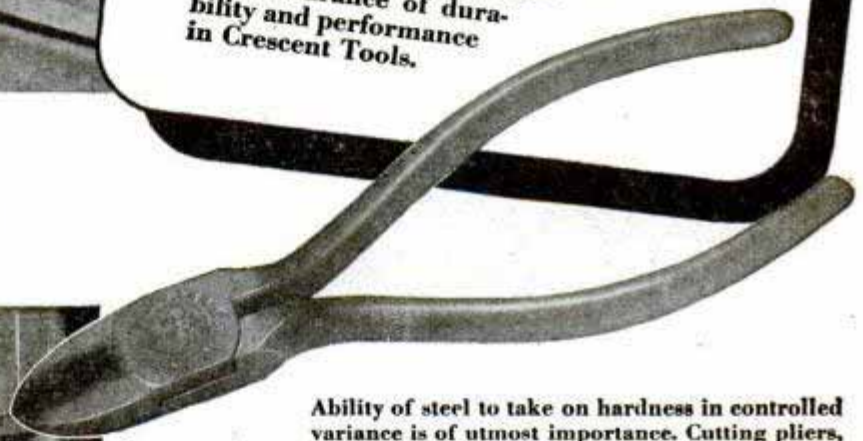
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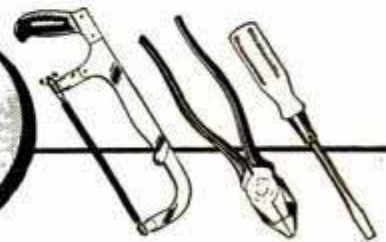
Only steel which meets or surpasses Crescent's rigid laboratory standards is released for production—your assurance of durability and performance in Crescent Tools.



Ability of steel to take on hardness in controlled variance is of utmost importance. Cutting pliers, for instance, require extreme hardness at the cutting edges, backed up by an area of tough, but not so hard, metal. Handles, too, must be reasonably hard at the joint but springy farther back. This photograph is of a hardened sample which has been etched with acid to show location and degree of hardness.

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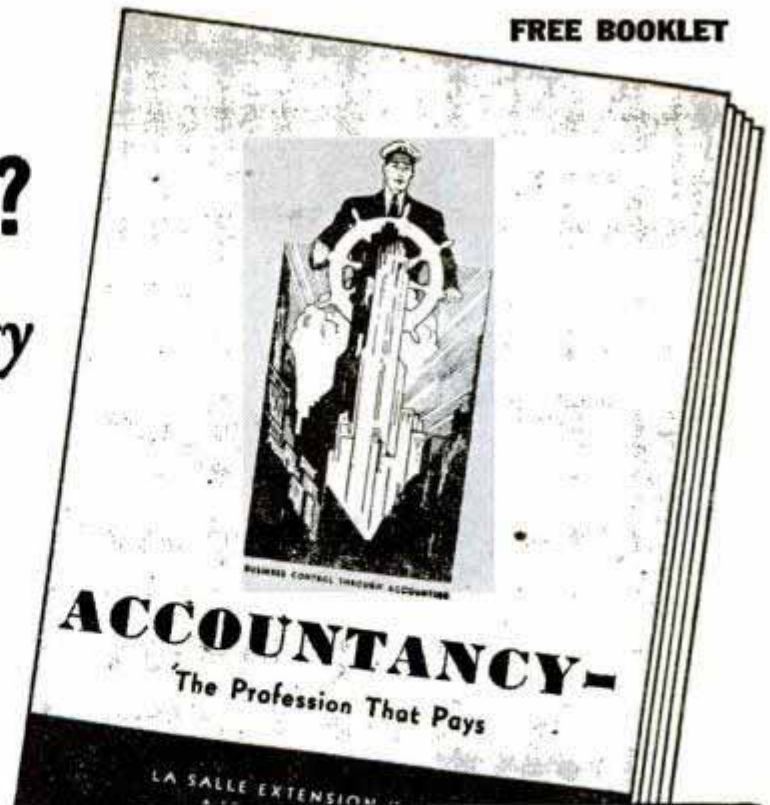
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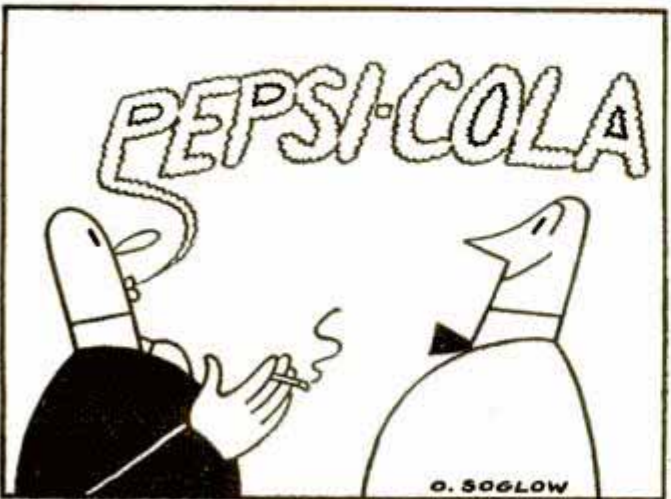
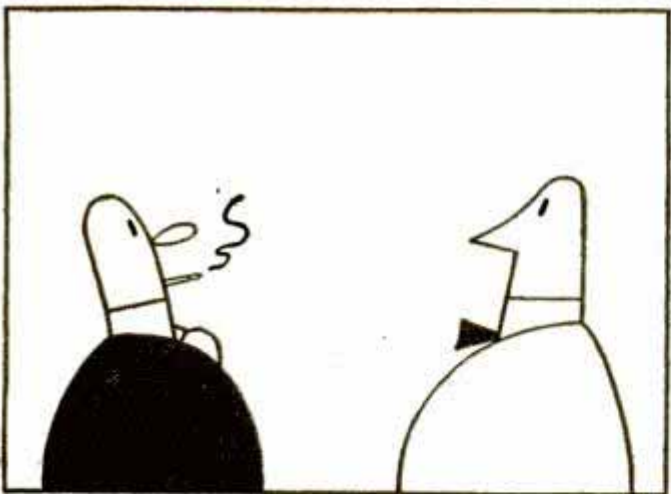
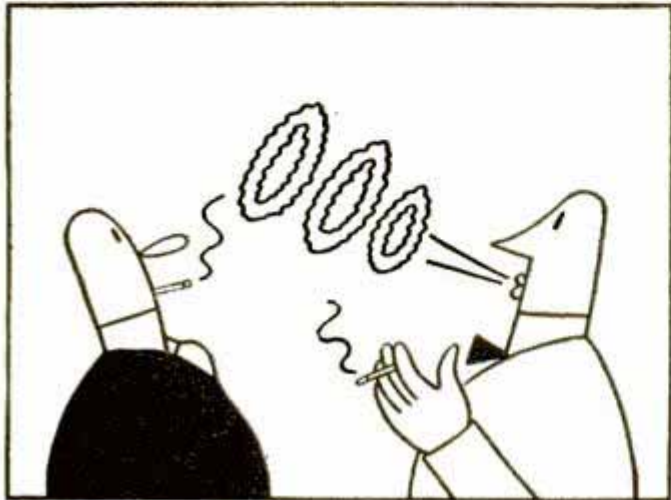
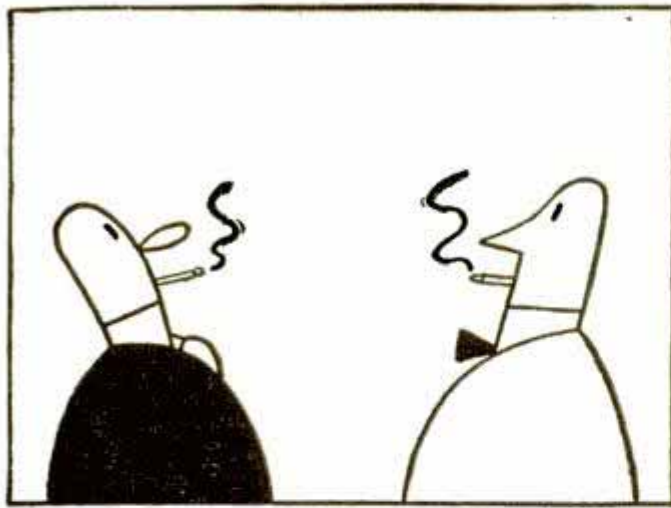
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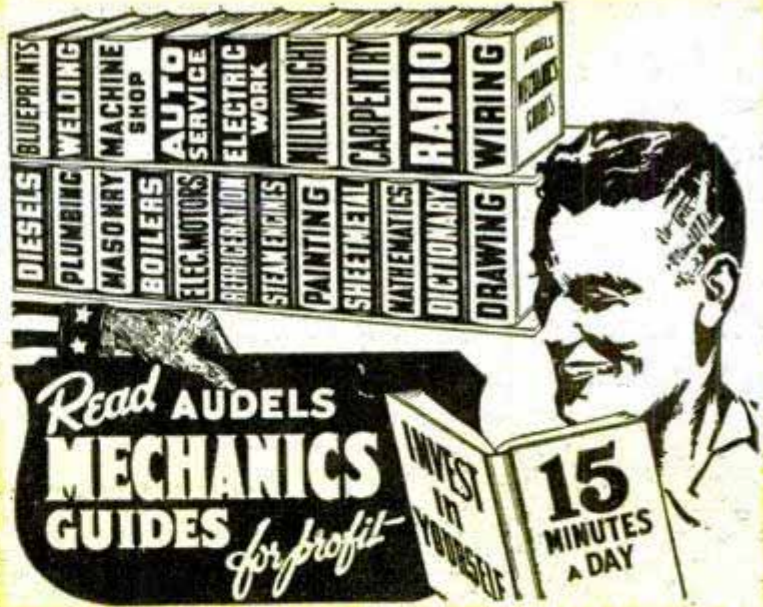
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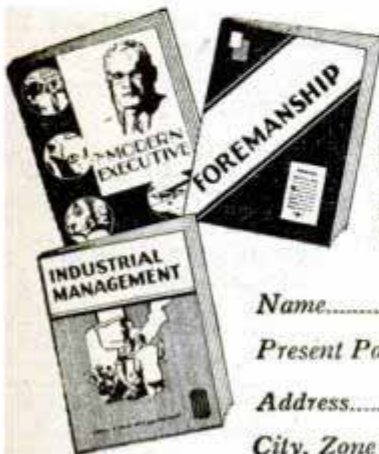
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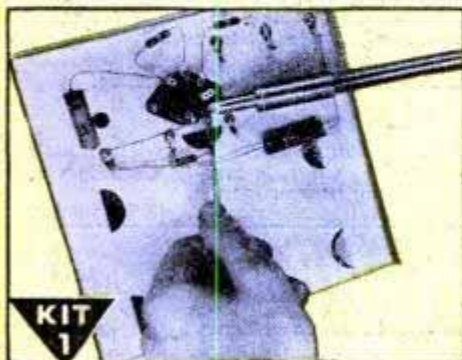
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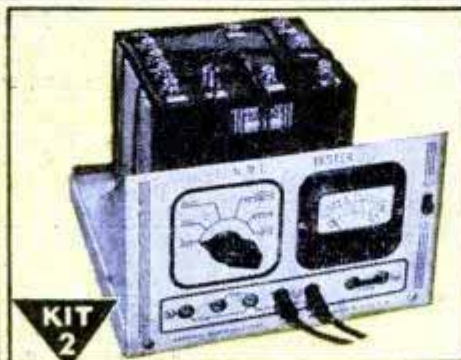
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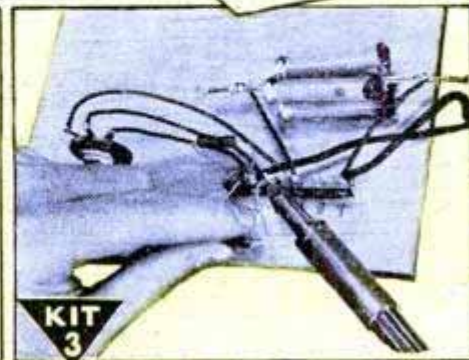
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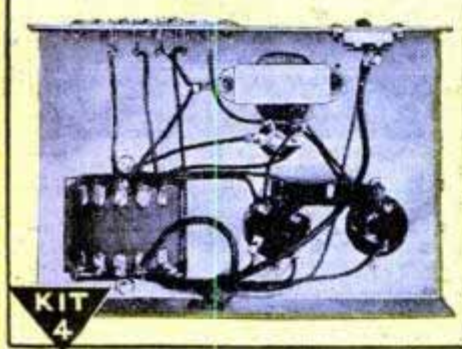
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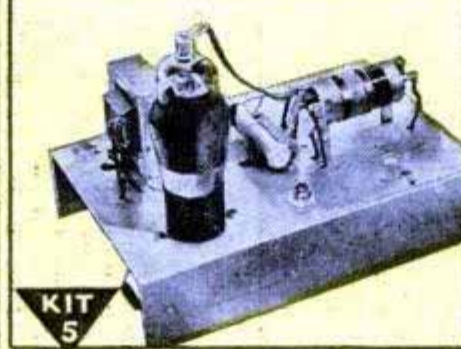
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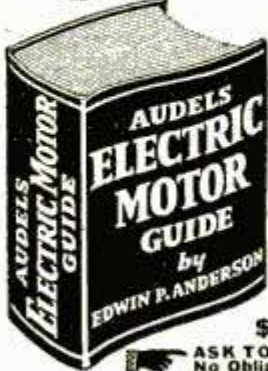
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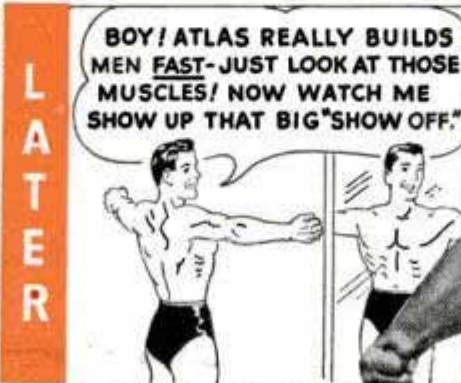


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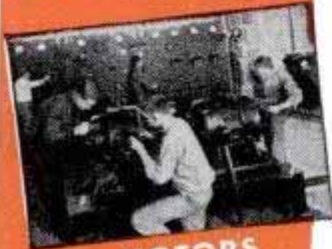
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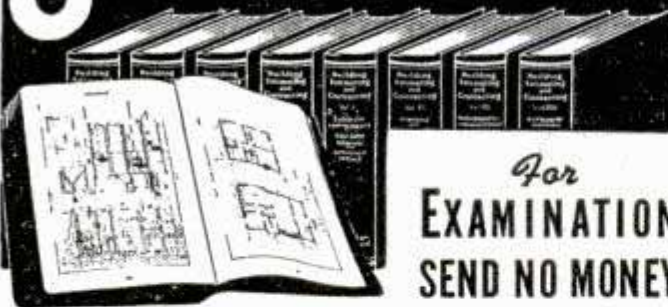
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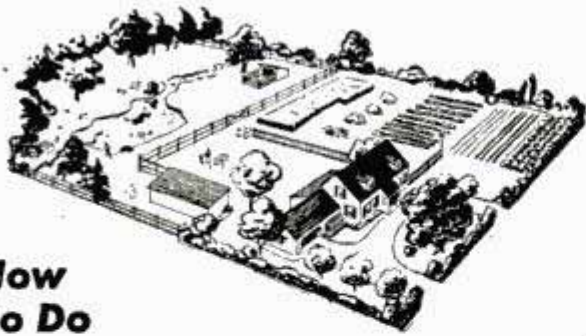
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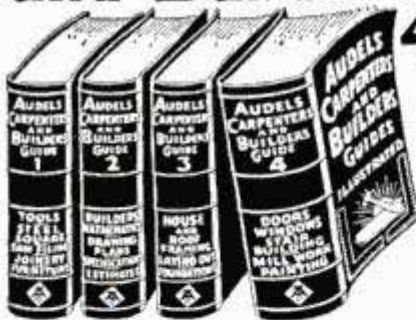
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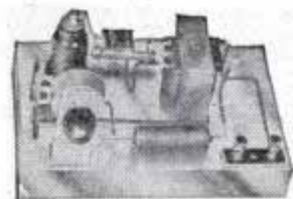
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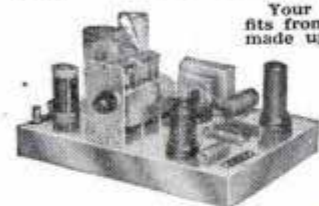
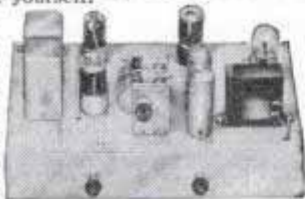
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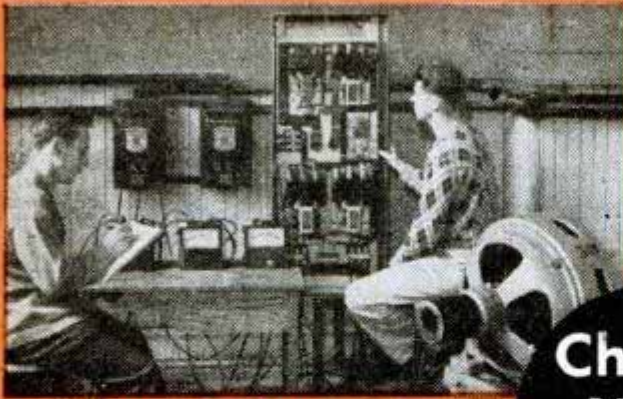
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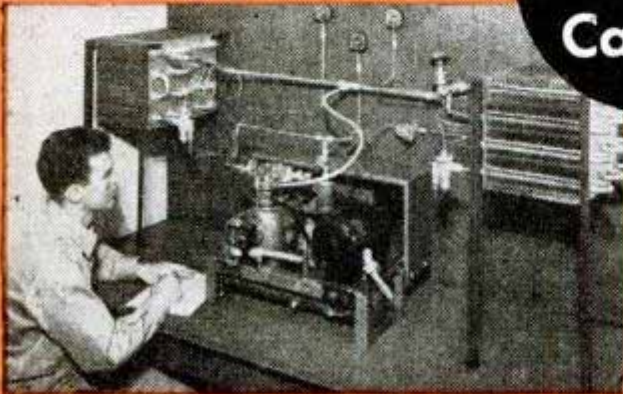


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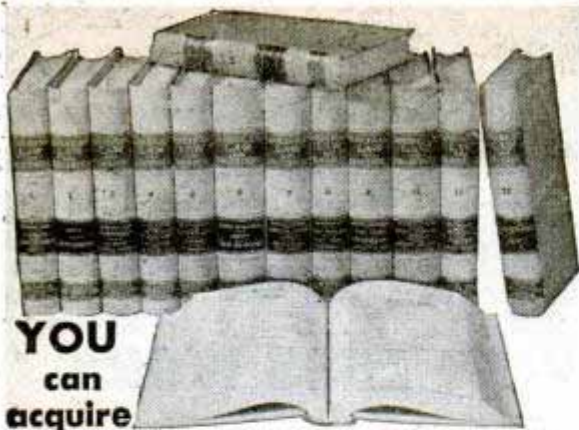
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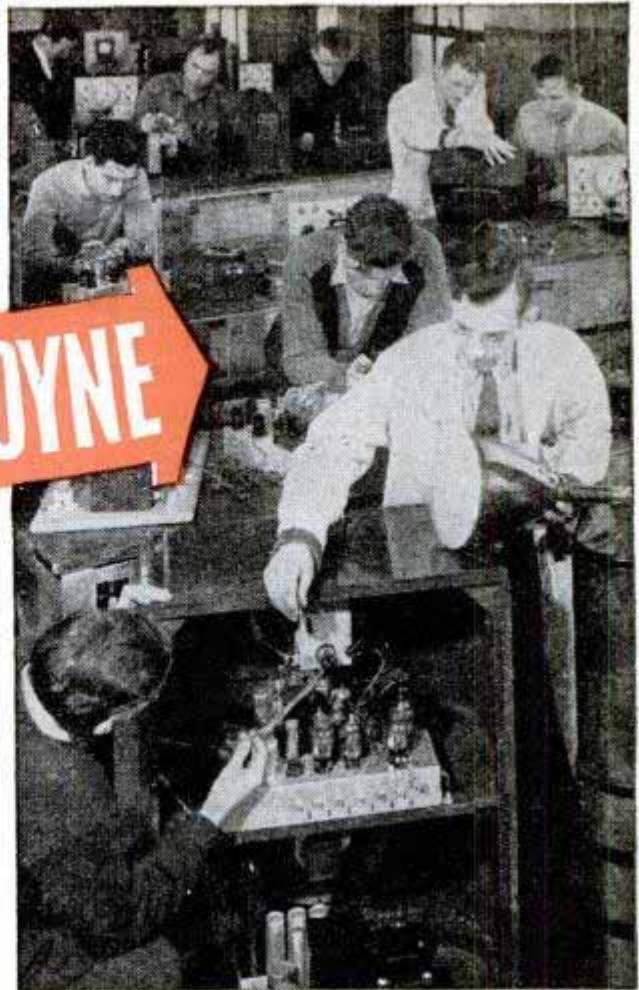
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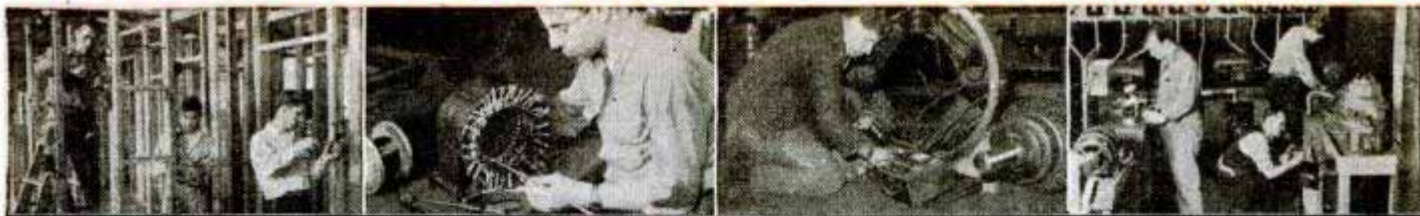
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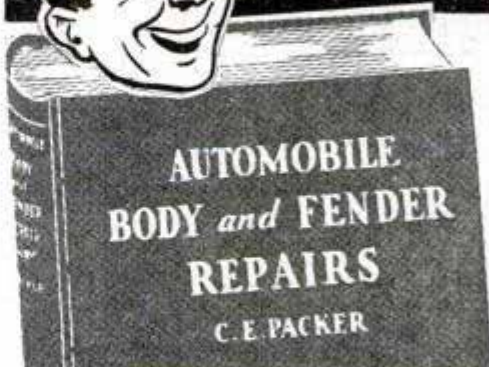
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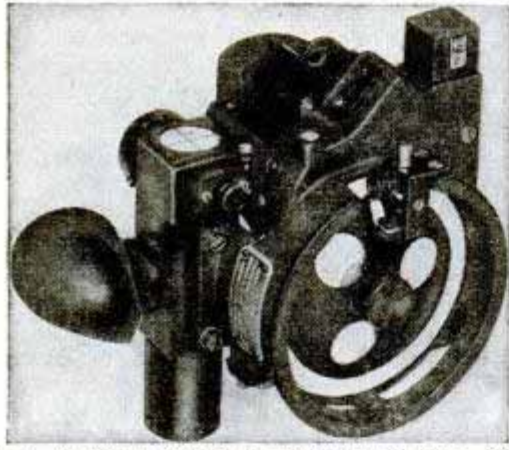
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\$1 STARTS You in business. Sell DeLuxe ties, 100% wool interlining. Costs you only \$7 per dozen, you make \$5.00 dozen. Send \$1.00 for special introductory offer two DeLuxe ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. K-14, New York 10.

SELL Joe Louis's champion cosmetics to colored men and Marva Louis's (his wife) cosmetics to colored women. Sells on sight, 100% profit. Joe Louis Products Co., Dept. P, 6 E. Garfield Blvd., Chicago 15, Ill.

QUICK Cash. Sell friends wonder-value 50 for \$1.00, extraordinary 25 for \$1.00 personal Christmas cards. Personal stationery. 32 sensational money makers. Up to 100% profit. Bonus. Write for 6 free self-selling sample portfolios of 50 for \$1.00 to 25 for \$2.50 name imprinted Christmas cards. Special offers. Rainbow Greeting Card Co., 36 East 12th St., Dept. 17-A, New York.

TREMENDOUS Profits selling new scientific soil acidity tester for lawns, farms, gardens. Sells \$2.00. Your profit \$1.00. Sample and full information \$1.00 postpaid. Willard Laboratory Supply, 2030-V Sunnyside, Chicago 25.

IMMEDIATE Big profits! Full or part time. Take orders for amazingly beautiful laminated lifetime plastic reproductions of any picture or negative. Customers everywhere! Write quickly. Gotham Products, Dept. A, Box 5427, Philadelphia 43, Penna.

100% PROFIT With new electric gas lighter, eliminates matches, pilot. Write Optical Research Products, Fairview, N. J.

NAMES—Addresses. Wholesalers, manufacturers, etc. Dime each. Three 25c. National, 3537-M South Hoyne, Chicago 9.

"SOLVEX" Cleans dirty hands without water. Exclusive territory. Solvex, Monticello, Iowa.

REBUILT Vacuum cleaners. Low prices. Easy sales. Big profits. Economical Distributors, Box 1402, Albany, N. Y.

DEALER Franchises. Power mower, gas model, \$74.00 net. Rotacut, M-2004, Excelsior Springs, Mo.

CHRISTMAS Card money-makers. 50, 25, 21, folder \$1.00 boxes. To 100% profit. Catalog free. Zeller, 1239P Riverside, Baltimore 30, Maryland.

SIGNS, Metallic letters for store windows, trucks, etc. Looks like gold leaf. 3 complete alphabets with numerals and catalog \$2.00. Globe, 61 W. Cordova, Vancouver, B. C., Canada.

EXTRA Money so easy. Sell friends beautiful 50 for \$1.00 name imprinted Christmas cards. Extensive line assortments 30c up. Profit to 100%. Extra bonus. Request free samples personal Christmas cards, stationery and leader \$1.00 Christmas, everyday assortments on approval. Special offers. Tom-Wat Studios, Dept. PM, Bridgeport, Conn.

FRIENDLY Social visits bring you big Christmas card profits. Show 33 different top-quality assortments as low as 30c each. Odd cards 2 $\frac{1}{2}$ c. Up to 100% for you. Cash bonus. Send at once for free samples 25 and 50 for \$1.00 personals, name imprinted stationery and feature \$1.00 assortment on approval. Special offers. New England Art Publishers, Box F, North Abington, Mass.

PROFITS And fast sales with famous Timex French Dry Wax Polish. A sensation! Different luster for all new and old cars, furniture, etc. Made by a long-established manufacturer. Good looking package that's a proven fast-seller with plenty of rapid repeat business. Quick and easy to apply. Gives hard, glass-like surface that lasts up to 6 months. Every car-owner, garage, service station, housewife, store-owner a live prospect. Good territories open on a money-making basis for aggressive representatives. Write for full details and quantity prices. Send \$1 for regular \$1.50 size. Money refunded on first order. Fully guaranteed. Timex Products Co., 5504 Virginia, St. Louis, Mo.

AGENTS, Big profits, fast selling plastic aprons and accessories. Free details. Texcraft Co., Manchester, N. H.

REAL Live Mexican jumping beans. 20, 25c; 125, \$1.00, 500, \$3.00; 1,000, \$5.00. J. J. Frank, 525 Palm, Rockford 1, Illinois.

MAKE \$300 Week selling patented auto towbars. Each \$2.73. Barnorari Industry, 19338 Griggs, Detroit, Mich.

NO Investment, throw rugs, big profits, good repeaters. Investigate this opportunity. Warren Rug Mills, Box 243B, Phillipsburg, New Jersey.

NU PROCESS Products Laboratories, Dept. 301, Aurora, Illinois, have some choice distributorships open. Exclusive territory franchise. Big profits. Wholesale and retail. Age no barrier. Men and women eligible. Cash profits start first hour. Two products (1) Silver Plating Liquid (NuSilver Trademark Patent No. 245,336 and Re-Plate-O Trademark Patent No. 367,355), and (2) Lectrik Silver Cleaner Plate for quick de-tarnishing of silverware. Full details free. Write them today.

FIRST Offering! New patented auto accessory. Sells on sight to jobbers, garages, filling stations. Only product of its kind, repeat orders, exclusive territory available. Send \$2 for sample display card with 12 fast selling accessories. Law Manufacturing Company, Box 628, San Diego 7, Calif.

300 MONEY Making deals. Ideas, formulas, plans, schemes. Polio free. Formico Service, Box 572, Dayton, Ohio.

NEW Bugwump cleans windshield. Dealers, agents. Sells on sight every car owner, gas station for 50c. Carton of six \$1.50. Season's ripe. Wheeler Corp., 1922 Raymond Com. Bldg., Newark 5, N. J.

WOMEN—Sell handkerchiefs. 20% commission. Ruth Pitts, Corinth, N. Y.

DISTRIBUTORS Wanted for unusual \$2.98 photographic product. Fine profits. No competition. Fast seller. Repeats for hundreds of dollars. Complete sample \$2.00—details free! E. E. Morrison, Box 9312-P, Sta. S, Los Angeles 5, California.

SALESPeople—Make extra profits selling our new 1947 greeting cards. Send 65c for sample box. Davis Specialty Shoppe, 607 Rialto Ave., Venice, California.

AGENTS Wanted for Evictor, DDT-Pyrethrum, refillable aerosol insecticide bomb. Nationally advertised, large profit item with profitable repeat orders assured. Haskris Co., 6700 N. Lincoln Ave., Chicago 45, Ill.

MAKE Money taking orders for "C-E Automatic Water Heaters." Write Crane Electric, Eugene 4b, Oregon.

MILLIONS Of dull scissors need our patented scissors sharpener. Sell to stores and homes. Exclusive territory. Demonstration sample 50 cents. Semco, Box 211, Lynwood, Calif.

PLASTIC Step blocks for machinists. Fast seller. Agents make over 100%. Sample, details \$1.00. Breese, Box 74, East Side, Providence, R. I.

AGENTS, Fast selling made-to-order show cards and signs. Parker, 246 Reo Blvd., Warren, Ohio.

SELL Superb line of stainless-steel bracelets with over 100% profit. Details and sample for \$1.50. Lastex, Box 391, Coraopolis, Penna.

SELL New, different, exclusive Christmas cards. 50 with name imprinted, \$1.00. Extra dollars with new bonus plan that earns you up to and over 100% profit. Compare our 21-folder "Champion" assortment, sells for \$1, sent on approval, no investment. Etchings, panoramas, florals, religious, gift wraps, birthdays, also stationery. Free samples of many extra-profit imprint lines. Work with a leader! Write today. Pen-n-Brush Studios, Dept. PM 8, 154 Nassau Street, New York 7, N. Y.

CHRISTMAS Cards. Earn \$5.00 with each ten \$1.00 21 card assortments you sell. Also new plastic cards, wrappings, imprint cards. Write for samples today. Howard P. Ellis, Dept. PM-9, Pitman, N. J.

A NATURAL! Big money selling new line one piece lace, plastic tablecloths. Sizes to 54x108. Also women's aprons; novel, embroidered cotton pillow cases. Free, "interesting" details. Royalty, Box 748-K, Passaic, N. J.

FREE! Big 32 page 8½x11 magazine, that tells how to make money in local or mail order selling! "Opportunities Preferred." 33-P Vassar, Dorchester, Mass.

LARGE Variety fast selling items from \$1. Manufacturers, 264—5th Ave., New York.

SALES Agents wanted to sell Fireaire fireplaces and furnaces in your localities. Every home owner is a prospect. Low in price. Variety of designs. See display advertisement elsewhere in this issue. Liberal commissions. Write for proposition. The Edwards Manufacturing Co., 235 Eggleston Ave., Cincinnati 2, Ohio.

MAGIC Cleaner and laundry soap deal. Hotter than a firecracker. Big profits. Sample free. Bestco, 5007 Irving Park, Chicago.

AMAZING Spare time earnings, sell name imprinted Christmas cards 50 for \$1.00. Leader box pays to 50c profit. 25 big moneymakers. Stationery. No money or experience needed. Approval samples. Empire Card, 155 Fox, Elmira, N. Y.

EARN Big money selling complete new line 1947 greeting and Christmas cards. Big profits. Liberal bonus. Sample on approval. Write today. Forest W. Kimball, New London, N. H.

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

AGENTS—Sell white shirts direct from manufacturer. Liberal commission. Jarod Mfg. Corp., Rockville Centre, N. Y.

CHRISTMAS Card agents! New, exclusive, patented children's linnette books. Four books in attractive packet. Retail 50c. Sample on approval. Also cut-out valentine assortment. Elmcraft Card Co., 5928 South Western, Chicago 36, Illinois.

AMBITIOUS, Sell Xmas cards, stationery, big profits, colored catalog free. Beacon Hill Greetings, 115 Chauncey M, Boston, Mass.

FOOT-MASTER Tablets. Amazing seller to those afflicted with foot trouble. Proven seller 45 years. Good profit. Repeats fast. Write Master Products Co., 6 East Oak Avenue, Moorestown, New Jersey.

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

AGENTS, Dealers, distributors. We have the fastest-selling item on the market today. 100% profit. Steady repeater. No competition. Rush \$2.98 for complete set-up, or write for details now! Morrison, Box 9312, Station S, Dept. 12, Los Angeles 5, Calif.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

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

AMAZING Discovery. Miracle glaze puts brilliant glass-like surface on cars. Free sample, information. Big profits. Miracle Glaze Company, 9714 S. Austin Ave., Oaklawn, Illinois.

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

MAKE Money in your spare time! Helps furnished. Easy sales. Voluntary repeat orders. Liberal commissions. Write for free wholesale price list today! McGregor Magazine Agency, Dept. P.M.-7, Mount Morris, Illinois.

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

90c PROFIT Each \$1 sale. Sell positive mothproofing solution to housewives, stores, agents. Experience unnecessary. Postal brings details. Kinford, Wayne 3, Penna.

GREETING Card agents, "line up" with "Pines" for bigger, better, quicker profits. Rush name, address on postcard today. Box 32, Flushing 5, New York.

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.

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

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

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

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

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

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

HIGH-GRADE SALESMEN

SELL Delicious candies, nuts, gum. Immediate delivery. Write Casterline, 2031-K Sunnyside, Chicago 25, Illinois.

AUTOMATIC Fire extinguishers—new and unique plan for distributors. Wall, ceiling and amazing new dwelling units. Two sizes glass balls. 50% to 60% profits. Freight free. Red Ball Co., Box 1552, Salt Lake City, Utah.

MAKE \$100.00 Weekly. Sell yardgoods. Send \$1.00. Samples and information. Western Fabrics, 832 So. Spring, Los Angeles 14, Calif.

AMAZING New zipper shoe sells on sight. Big profits for salesmen. Leads line 200 splendid styles. Territories open. Get free sample outfit. Write. Consolidated Shoe, Dept. 5-799, Chippewa Falls, Wis.

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

MAKE Money selling genuine leather jackets. Prospects everywhere. Top quality, full cut, exclusive features. Big cash commissions. Also 250 styles fine shoes. Sample outfit free. Victor Thomas, Dept. V-813, 610 W. Van Buren St., Chicago 7.

ADVERTISING Book matches—Cash in on political campaigns. Sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit. Low prices. Protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M87, 7530 Greenwood, Chicago.

BIG First commissions, sensational automatic repeats, with new sales building plan for retailers. First since V-J Day. Customers get big value tableware; cost retailers nothing. Positively hottest deal in selling. Rush name for facts. Alco Sales Company, 215 West Ontario, Dept. C-615, Chicago 10, Illinois.

ADVERTISING Book matches—World's largest direct selling manufacturer of advertising book matches offers opportunity for profitable year 'round selling; every business a prospect. No experience needed to start; full or part time. Factory service. Low prices for high quality; repeats; sales kit furnished. Match Corp. of America, 3433-43 West 48th Place, Dept. E-10, Chicago 32, Illinois.

DISTRIBUTORS. Revolutionary new metal polish. Write Donald Brown, 2912 Delaware, Kenmore, N. Y.

LOOKING For something different? Automatic high speed nozzle. Every user water through hose prospect. Indispensable for homes, car washers, service stations, factories, greenhouses. When hose is dropped, flow stops. Good profit. Fast seller. Sample \$1.50 or write Water Master Sales Co., 19465-P3 Ward, Detroit 21, Mich.

SALESMEN—Free advertising and demonstrating sales kit to qualified men. Product sold 15 years. Prospects everywhere. First ad for new men since the war. Write 707 Red Comet Bldg., Littleton, Colo.

SELL Christmas cards! Choice of forty assortments! Earn 60c on dollar sales! Bulletins free! Elfco, 434 North Wells, Chicago 10.

NEW Amazing personal initialed buckles with belts, cap badges, tie holders, emblems, uniforms, shirts, caps, ties, etc. Big profits. Quick repeats. Easy selling outfits—make fast profits. Write, Hook-Fast Co., Dept. 12, Roanoke, Virginia.

ADVERTISING Campaigns for small businesses. Excellent commission. Shaw, 2678 California Street, San Francisco, Calif.

MILLIONS Want foot comfort! Amazing daily profits. Sensational new arch support body-balancer for men, women selling like hotcakes. Experience unnecessary. Complete outfit free. Special deal to distributors, crew managers. Write: Colt Shoe Company, 244-D8 Purchase, Boston 10, Mass.

MAKE Money taking orders for "C-E Automatic Water Heaters." Write Crane Electric, Eugene 4a, Oregon.

YEAR 'Round income above average selling maintenance supplies. National manufacturer. Write Box 392, Dallas, Tex.

SALESMEN To sell well known brands of appliances and furniture for old established store in all states. Box 21, Fairfield, Penna.

AMAZING Daily profits, repeat business, selling direct, Colt's sensationally new Whippets, \$6.95 loafer oxford with DuPont neoprene crepe soles. Men buy on sight, stores, garages, colleges, factories. Experience unnecessary. Free catalog, outfit, 216 styles, Colt Shoes, 601-D8 Atlantic, Boston 10, Mass.

RESTAURANT Sanitation course complete. Good commission. Institute, 2385 Edgewater, Los Angeles 26, Calif.

BONUS Commissions selling photographic creations. Samples. Creative photography. Box 315, Cooper Station, New York 3, N. Y.

DISTRIBUTORS, Salesmen, bigger commissions with lowest priced home and auto extinguisher. Exclusive contracts. Carbo-gas, Box 2141-A, Portland 14, Oregon.

12 FANCY Boxes pure Vermont maple sugar postpaid \$6.60. Retail \$1 each! Eulalia Turner, Poultney, Vermont.

PRESSURE Cookers. Now available. Selling like wildfire. Amazing profits. Write quickly, Morris Mandell, Inc., 131-P W. 14th St., New York 11, N. Y.

SELL Calendars full or part time—every business house a prospect—also wholesale to printers—calendars, novelties, sheet pictures. Fleming Calendar Company, 6535 Cottage Grove Avenue, Chicago 37, Ill.

ORANGE Concentrate direct from our Florida groves. One quart bottle makes six quarts delicious natural orange drink simply by mixing with five parts cold water. Groceries, foodmarts, hotels, restaurants, taverns, roadstands, sodafountains, hospitals, resorts, camps, farmers, big buyers. Money-back guarantee. No investment. Protected territory. Salesmen earn \$100.00 to \$200.00 repeat commission weekly. Sunset Valley, 3357 N. Clifton, Chicago 13, Ill.

FREE! Latest issue Opportunity Magazine. Salesman's Guide. Inspiring, constructive. Shows how to earn money selling for others or in your own business. Hundreds postwar opportunities. Send name and describe what you have sold or are selling. Illustrated copy sent free. Opportunity Magazine, 620 N. Michigan, Dept. 17, Chicago 11, Ill.

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MODERN Welding school gives thorough training for one of industry's best paid jobs. Experienced instructors. Individual attention. Non-profit institution. Qualified under G.I. Bill. Write for literature and details. Hobart Brothers Co., Box M-876, Troy, Ohio.

MICROMETER And vernier micrometer. Learn to read in 2 to 5 minutes by new, sensational, copyrighted method. Never before anything like it. Send \$1.00 for complete instructions to S. L. Heylman, 4945 Edgemere Avenue, Baltimore 15, Md.

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NOW You can have an office. Learn credit-collection business by new home study course. Many earn up to \$5000-\$15,000 annually. Free bulletin. Franklin Credit School, Dept. 202H, Roanoke 7, Va.

HOME Study course, drugless therapy. Free literature. Institute of Drugless Therapy, Tama, Iowa.

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USED Educational books on all subjects sold, rented, also bought and exchanged. Moneyback guarantee. Write today for free catalog and details. Lee Mountain, Pisgah, Alabama.

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BIG Money rebuilding shoes. Help needed everywhere or start big-income business of your own. Learn practical, sure, easy way in 3 months. Anyone from 18-60 years can learn easily. Approved for GI training. Rush postcard today. Modern Shoe Rebuilding School, Est. 1927, 2935 Belmont, Chicago 18, Illinois.

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BUSINESS Representation, world's principal cities. Associates wanted. Universal-PB, Butler Building, Chicago 1.

TO Whom it may concern. We will represent you in all principal cities of the world. Representatives wanted. Will send you assignments immediately. James W. Farley, Citizens Bldg., Cleveland 14, Ohio.

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NEEDING Some information or something from Mexico? Let's know. Barrales Research Bureau, Bajio 131 Dept. 16, Mexico City, Mex.

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112 LESSON Course in sign painting, details free. Stewart Sign Co., Box 1329, Glendale, Calif.

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MAKE Signs. 9 complete alphabet pattern sets. 3 complete numeral pattern sets and catalog \$1.00. Sign Letter Distributors, P.O. Box 101, Mineola, N. Y.

SIGN Painting taught at home by an old master. Ben Kerns, Box 812, Greenville, S. C.

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MAILING Lists household names, also lists made up of any business, what do you need? 250 for one dollar or \$3 per 1000. Himes Service, 3341 Superior Ave., Cleveland, Ohio.

ADVERTISERS! Reach nearly 18,000,000 readers. 25 Sunday national key newspapers, 18 words, \$42.25. "Terrific pullers." 20 popular newspapers, \$8.50. "Free booklet." Special—One inch display 2,821,198 circulation, \$42.00. Newark's Advertising Agency, (Established 1893) 217-7th Ave., New York 11.

MAIL Order ads, circulars, letters, by leading advertising agency in mail order field. Low prices. Moran Advertising Agency, Box 104, Wilkes-Barre 3, Pennsylvania.

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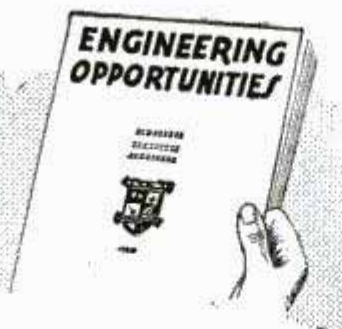
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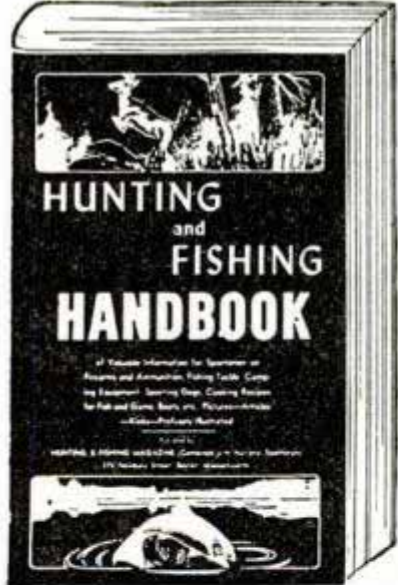
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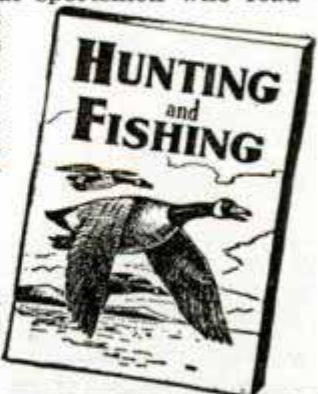
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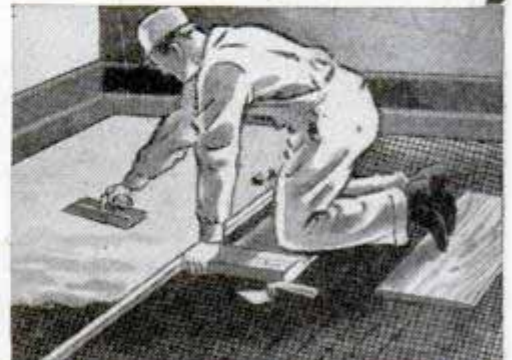
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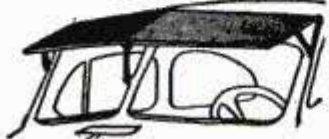
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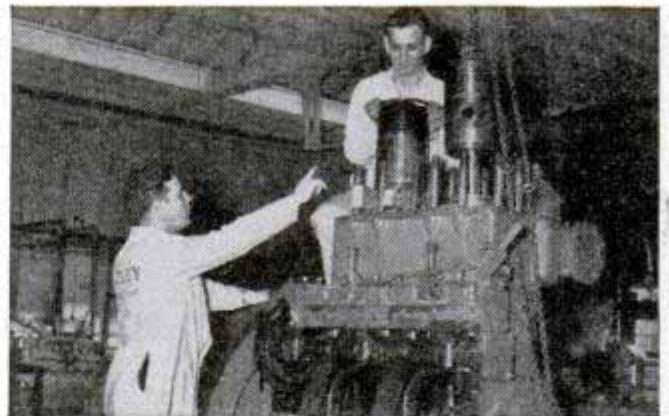
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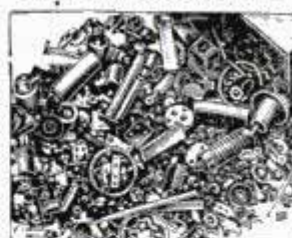
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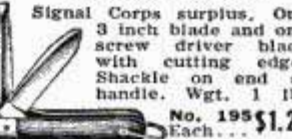
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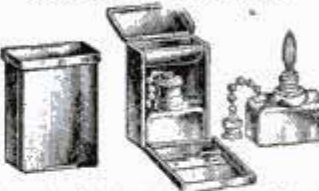
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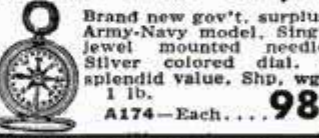
MEDICAL STERILIZER



Consists of alcohol burner and sterilizing tray in hinged metal case 17x11x2 1/2 inches. Burner may be used separately. Bright nickel finish. All brand new. A125-Each.....

98c

Officers Watch Compass



Brand new gov't. surplus. Army-Navy model. Single jewel mounted needle. Silver colored dial. A splendid value. Shp. wgt. 1 lb. A174—Each.....

98c

BERNARD WIRE PLIERS



Parallel acting jaws. Wire cutter at top. Brand new. Wgt. 2 lbs. No. 168. Each.....

\$1.29

ORDER DIRECT FROM THIS AD

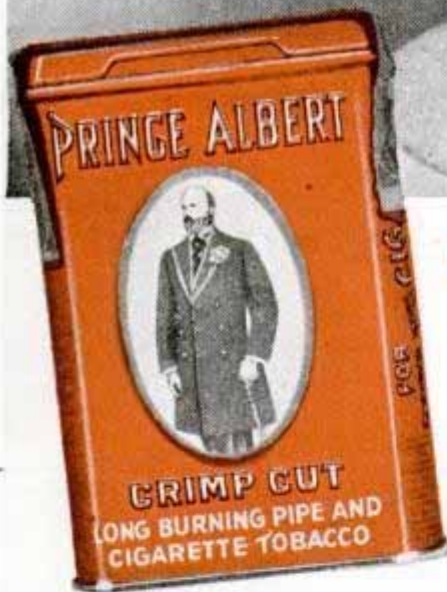
Values galore! Hundreds of hard-to-find items for home, shop and outdoors. Make remittances by money-order, bank draft or personal check. Send 25% deposit on C.O.D. orders. No C.O.D.'s on orders for less than \$5.00. Include sufficient postage on parcel-post orders—any overage will be promptly refunded. All quotations F.O.B. Chicago. Used items and materials are guaranteed serviceable and as described. Your money back if not more than satisfied.

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The girls look twice
at the man with P.A.*



P.A.* means Pipe Appeal

A man with a pipe gets *extra* attention ... for there's something so *masculine* about men smoking pipes. Women find it appealing.

means Prince Albert

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.



GREAT FOR CIGARETTE "MAKIN'S" TOO!

CRIMP CUT P.A.
ROLLS UP FAST AND NEAT
...RICH-TASTY-COOL!

A man with a pipeful of Prince Albert tobacco gets real smoking joy and comfort. P.A. is specially treated to insure against tongue bite. It's mild and easy on the tongue. Try crimp cut P.A.—and you'll see why more pipes smoke Prince Albert than any other tobacco!

THE NATIONAL JOY SMOKE



At the age of 19 the author amazed the aviation world when he designed, built and flew the first practical coaxial helicopter. Today, at 22, Hiller is president and general manager of United Helicopters, Inc., Palo Alto, Calif., engaged in research and manufacturing rotary-wing aircraft

POPULAR AUGUST 1947 MECHANICS

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 88 NO. 2

SO YOU WANT A HELICOPTER?

By Stanley Hiller, Jr.

"When will I be able to buy a helicopter for my personal use?"

That's a question often asked and my usual answer is that it will be several years yet at least before helicopters are ready for the general public.

It's true that we are testing a two-place machine that looks like an ideal personal vehicle. Powered by a 125-horsepower en-

All set for the take-off — the pilot and passenger in Hiller's two-place craft occupy "greenhouse" cockpit which he says is like sitting on edge of a cloud



gine, our trim coaxial Commuter rises easily from the ground, hovers at the pilot's will, and moves ahead at $\frac{1}{2}$ mile to 100 miles per hour. A tank of gas is enough for a 200-mile trip, cruising at 75 m.p.h. The craft can descend so slowly that you hardly know when you touch ground.

Several years ago, when our "airport" was a vacant lot next door to the factory in downtown Berkeley, a test pilot wanted to call on friends in the country and also wanted to do some fishing. For the trip we replaced the three landing wheels with a pair of large flotation bags so that the helicopter could land on water.

From the vacant lot the ship climbed straight up above the power lines and angled off slowly past some office buildings. The pilot located the highway he wanted and followed it out through the hills. After the pilot found the house, he hovered over his friend's swimming pool for a moment and then landed in the middle of it. Later, to show the helicopter was amphibious, he rose from the pool, climbed over the house and settled on the lawn on the other side. After lunch he headed for a lake 100 miles away, caught a few fish and was back at the factory before dark.

Reading this you doubtless wonder why thousands of helicopters aren't being used for business and pleasure today. There are several principal reasons:

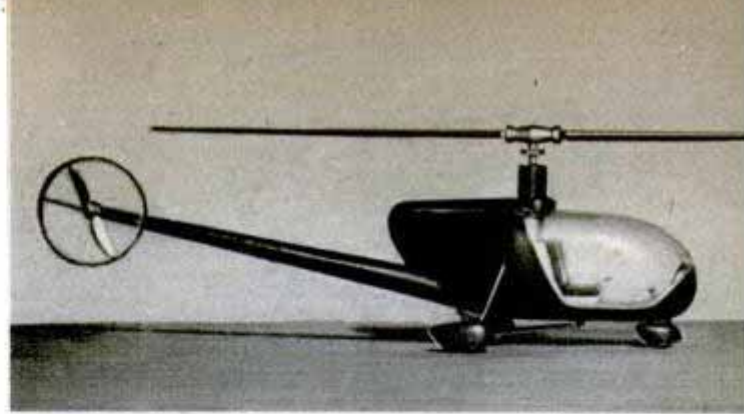
1. Flight technique. Flying any of the present types of helicopters requires considerable training. The pilot must use both of his hands constantly and has little chance to relax.

2. Cost. At present, rotary-wing aircraft are much more expensive than light planes.

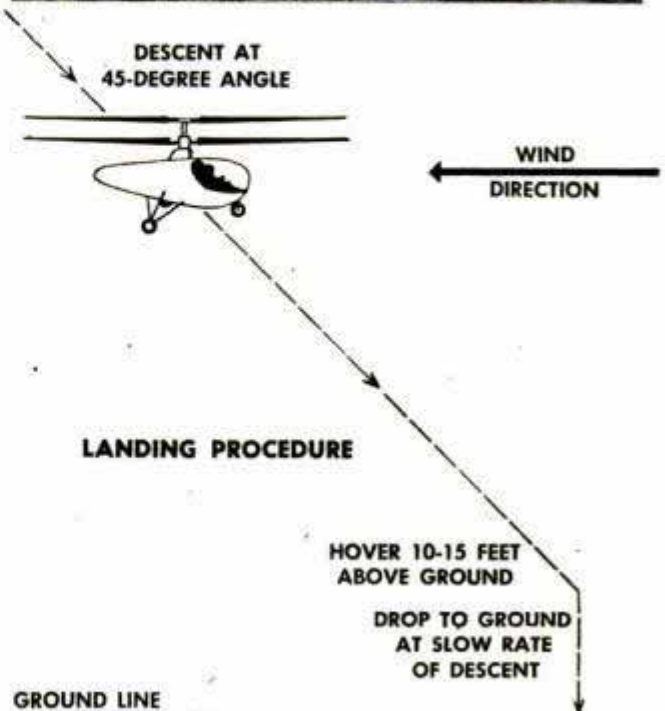
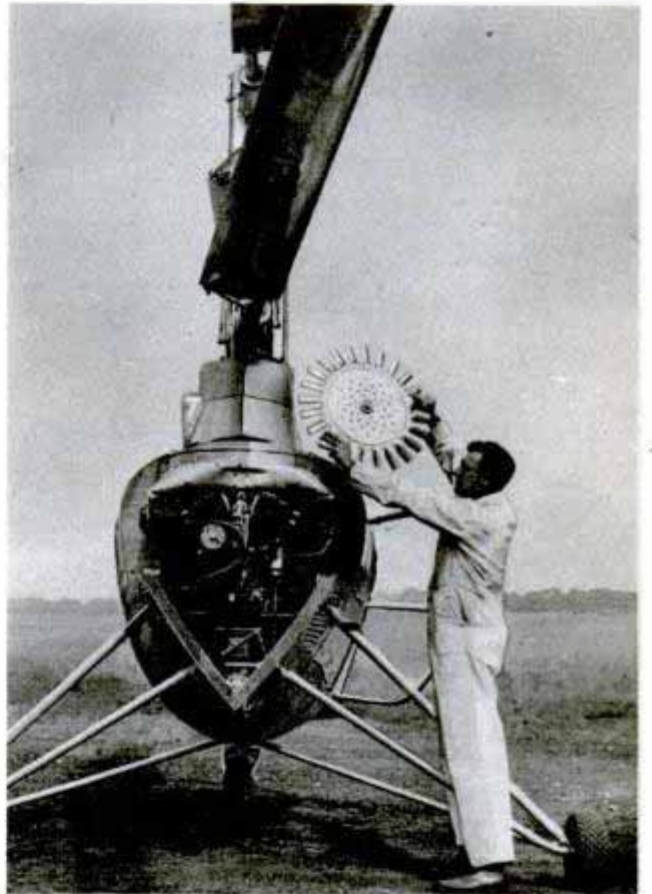
3. Landing places. There are few suitable landing places in metropolitan areas. Flat roof-top airports are an obvious solution, but few present roofs are strong enough for this purpose.

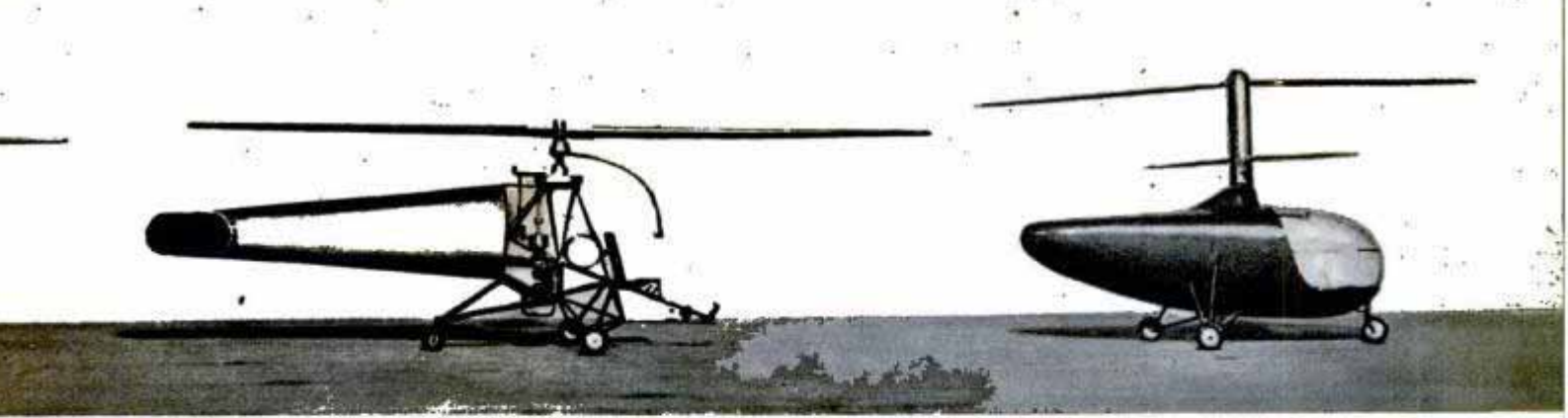
Helicopters are really just in the "Model-T" stage of evolution. Proper downtown landing places will be provided when the need increases and costs will go down as design becomes simplified and production steps up. Future helicopters will be much easier to fly. In fact, we are now testing a control system that greatly simplifies piloting and allows a helicopter to be maneuvered practically "hands off."

There are plenty of roles in industry, commerce and agriculture for which the present helicopters in the hands of trained pilots are ideal. They range all the way from forest patrol and crop dusting to pipeline inspection and mail delivery. These and comparable jobs represent the present market. At the same time the conviction that helicopters are to be the personal flying machines of the future is so widespread

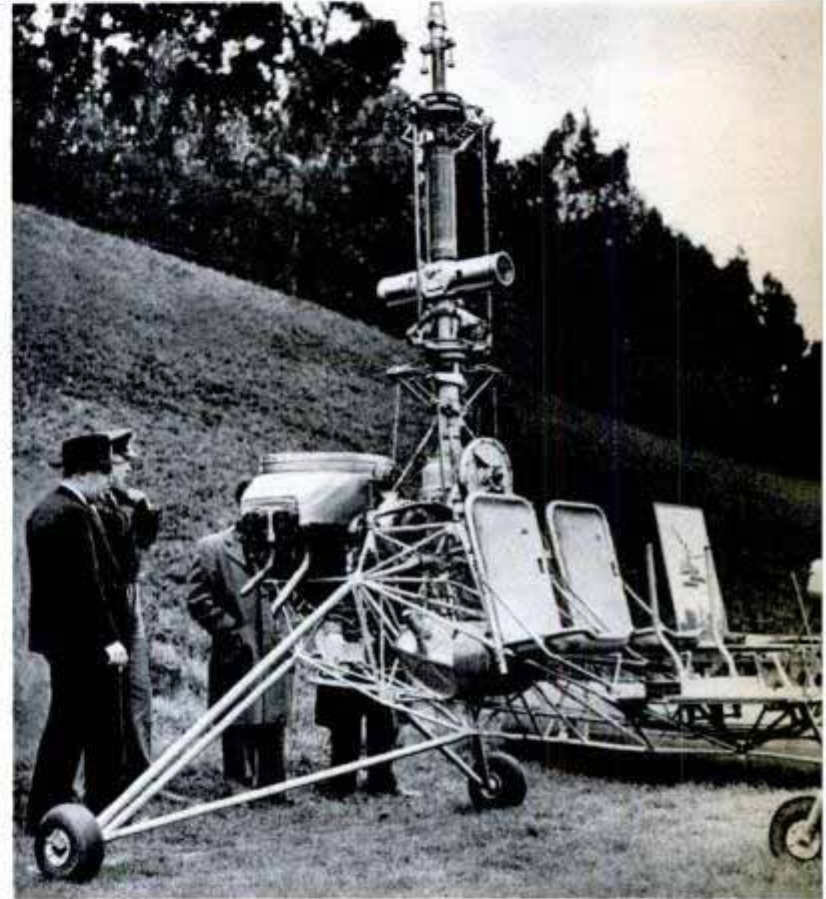


Below, cooling air is drawn down around engine from above. Here circulating fan above engine is being replaced. The Commuter has a 125-horsepower unit





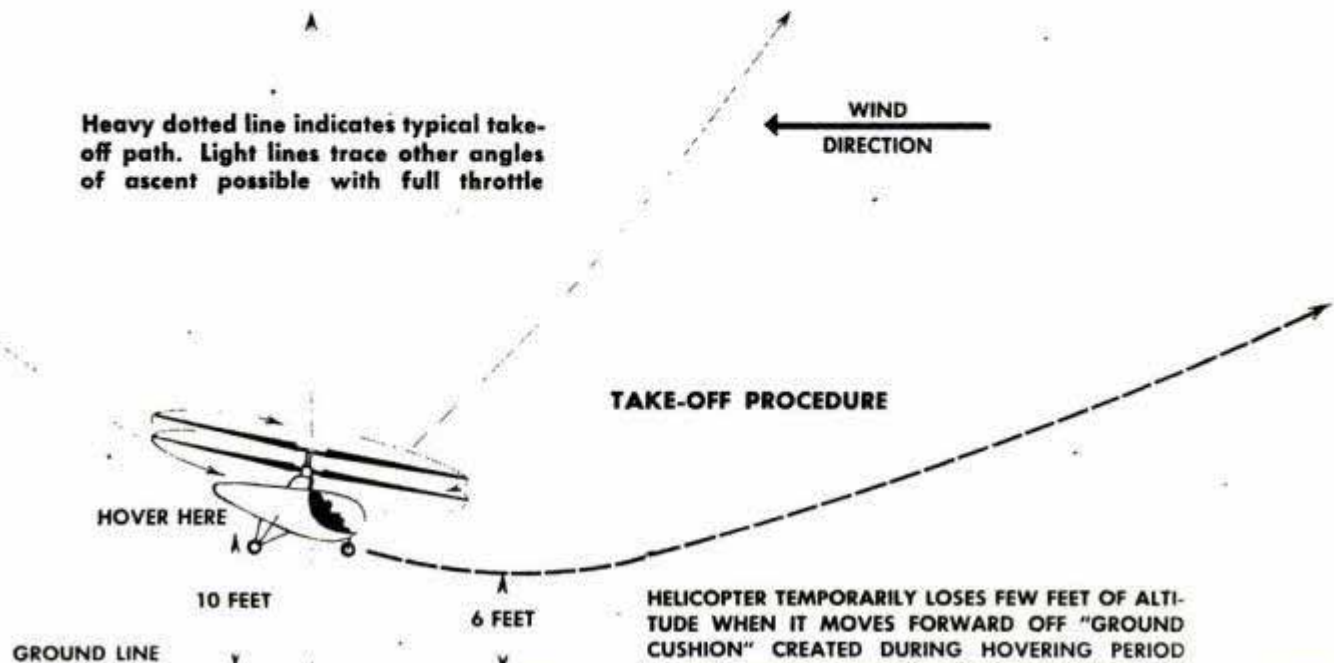
Helicopters at left and in the center counteract torque with a tail rotor and a tail jet, while coaxial type at right uses two overhead rotors for that purpose. Below left, checking mechanisms that change rotor blades' angle of attack. Right, with rotors and aluminum skin removed, helicopter is a maze of controls

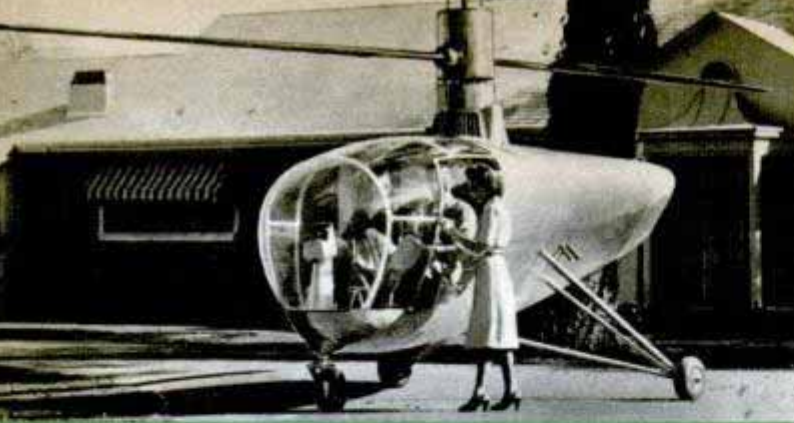


Heavy dotted line indicates typical take-off path. Light lines trace other angles of ascent possible with full throttle

WIND
DIRECTION

TAKE-OFF PROCEDURE





Taxiing out from under the trees, Hiller's craft can use the spacious lawn for vertical take-off. It rises from five to ten feet straight up before moving away



Firestone's two-seater can climb 1250 feet a minute and travel over 220 miles on 25 gallons of gasoline. This model has a 175-horsepower air-cooled engine



An old name in the rotary-wing-aircraft field, this Sikorsky carries loads up to 650 pounds. It weighs 1100 pounds empty. Below, a Bell model using pontoons. Many of these are used for rescue and patrol



that hundreds of individual experimenters are working on their own designs.

Vertical-lift aircraft in production at present are all basically the same, the chief difference being the methods used to overcome rotor torque. Uncontrolled, this thrust would cause the fuselage to rotate. Tail-rotor helicopters use a small propeller mounted sideways at the tail to counterbalance this pull. Jet thrust may also be used, directed sideways from the tail. Tandem rotors, side by side, that turn in opposite directions are another solution. In the coaxial type the two contrarotating rotors are mounted on the same axis and the torque of one cancels that of the other.

There is still another type, hardly past the theoretical stage, that uses jets or some other means of propulsion at the ends of the rotor blades. Its virtue is that torque is not created. However there are a number of serious design and construction problems connected with the idea.

Most helicopters to date have employed the same general system of control levers. Their effects are the same, but the specific actions vary with the type of machine.

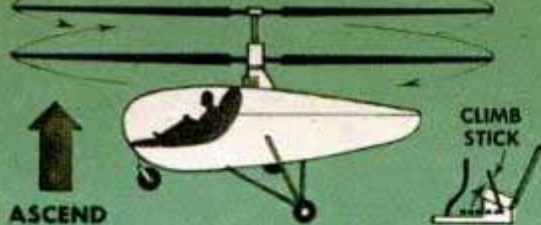
The pilot of a coaxial Commuter, for example, has a climb stick at his left hand that he pulls up for ascent. Its grip is a twist-type engine throttle like that on a motorcycle.

Between the pilot's knees is a control stick that governs horizontal travel through the air. Push the stick forward and the machine moves forward. Pull it back and the helicopter comes to a stop, then begins to travel backwards. The helicopter moves in the direction toward which the stick is pushed or pulled. Conventional rudder pedals are used for turning the fuselage.

The actions of these controls are interesting. The climb stick simply applies pitch to the rotor blades. Pulling up on the stick increases the incidence of all blades equally and when the throttle is opened at the same time, the ship begins to rise.

The control stick governs cyclic pitch. It is linked to a wobble plate or ring that encircles the rotor mast and to which push-pull rods that control the pitch of the blades are attached. The control stick tilts the wobble plate in the desired direction of travel. This in turn causes the rotor blades to vary their pitch so as to remain "parallel" to the wobble plate. The pitch of each blade is increased and decreased during each 360-degree cycle and the craft moves in the direction toward which the wobble plate is dipped.

The rudder pedals control differential pitch. That is, they change the pitch of one rotor in reference to the other, creating left or right-hand torque and turning the fuselage in that direction. The fuselage can



ASCEND

PULLING UP ON CLIMB STICK INCREASES PITCH OF ALL BLADES EQUALLY. TWISTING THROTTLE GRIP AT END OF STICK SPEEDS UP THE ENGINE



FORWARD

PUSHING CONTROL STICK FORWARD TIPS WOBBLE PLATE AND ROTOR BLADES IN SAME DIRECTION, CAUSING THE CRAFT TO MOVE STRAIGHT AHEAD



RIGHT

PULLING CONTROL STICK TO RIGHT SHIFTS FLIGHT PATH TO THAT DIRECTION. PRESSING RIGHT RUDDER PEDAL SWINGS FUSELAGE TO THE CORRECT HEADING



HELICOPTER'S HORIZONTAL MOTION IS OBTAINED BY PUSHING CONTROL STICK IN DIRECTION OF DESIRED FLIGHT. CRAFT MAY BE FLOWN FORWARD, SIDWAYS OR EVEN BACKWARDS.



HOVER

IT CAN BE MADE TO HANG IN AIR BY USING CLIMB STICK TO ADJUST PITCH OF BLADES AND TO VARY POWER OUTPUT OF ENGINE

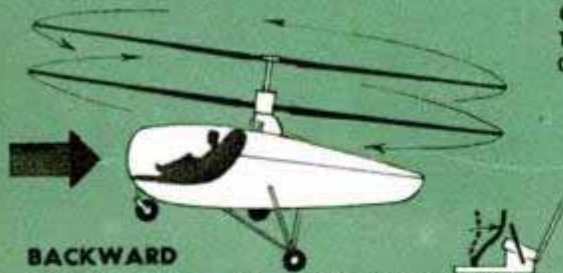
ENGINE INSTRUMENT PANEL

CLIMB STICK

RUDDER PEDALS FOR DUAL-CONTROL FLIGHT

THROTTLE GRIP REGULATES SPEED OF THE ENGINE

RUDDER PEDALS TURN FUSELAGE BY CHANGING PITCH OF ONE ROTOR IN REFERENCE TO THE OTHER, GIVING GREATER TORQUE IN DIRECTION OF INTENDED TRAVEL



BACKWARD

PULLING BACK ON THE CONTROL STICK BETWEEN PILOT'S LEGS REVERSES DIRECTION OF FLIGHT



DESCEND

SHOVING CLIMB STICK FORWARD FLATTENS OUT PITCH OF BLADES AND CRAFT DESCENDS SLOWLY

be turned entirely independent of the direction in which the ship happens to be moving, depending, of course, on the effect of varying drag. Each of the controls operates individually or all of them may be operated collectively.

Flying a helicopter is quite different from flying an ordinary airplane. The helicopter can be taxied into the wind for an easy, slow-speed take-off but the usual procedure is to rise straight off the ground for five or ten feet and then to climb away at an angle into the wind, at about 40 miles

per hour ground speed and a rate of climb of around 500 feet per minute.

There is a good reason for not using full power to continue to ascend vertically. In case of power failure the landing gear can stand the impact of a 30-foot drop. Above 300 feet the pilot has room for achieving forward motion and then autorotating down to a slow landing. Between these altitudes it is recommended that forward motion be maintained at all times as a precaution in case of motor failure.

For the same reason the recommended



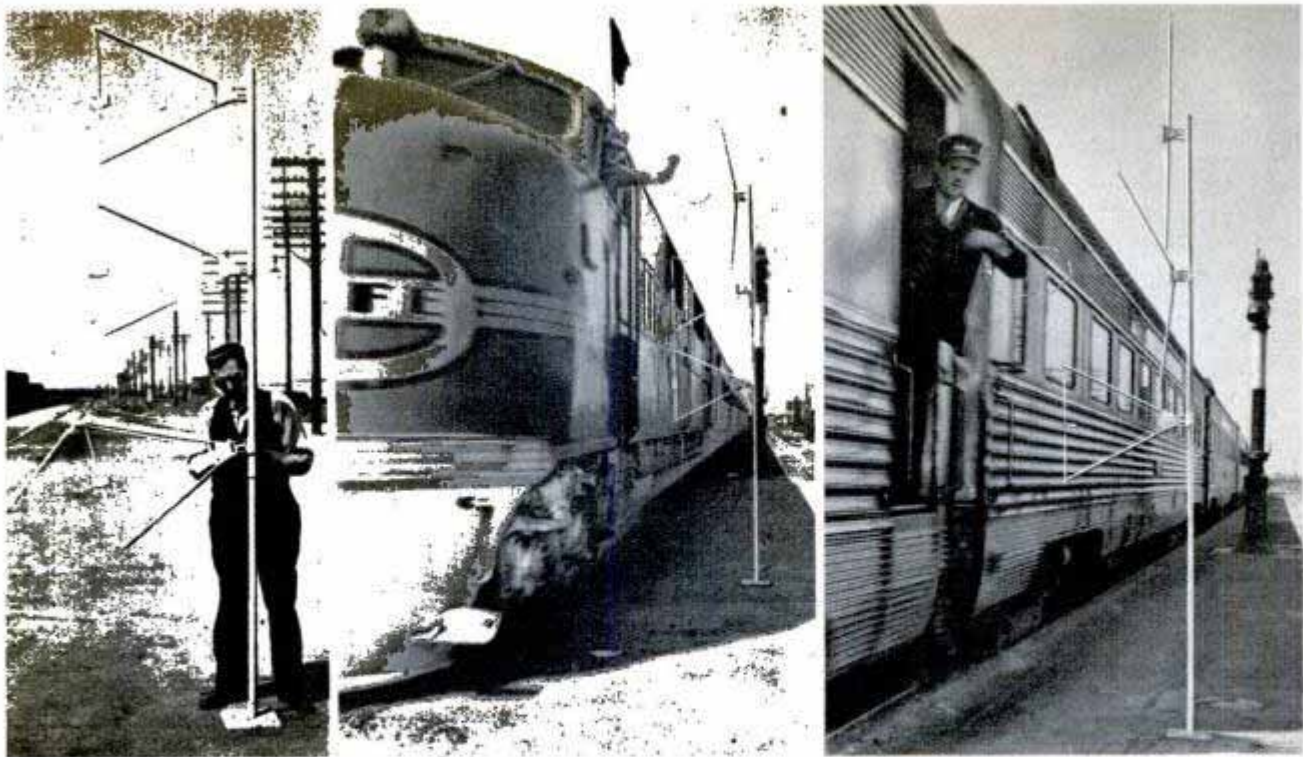
Hovering just off the ground, helicopter is pulled along by scarf in spectator's hand. Float-equipped, they bring Izaak Waltons direct to fishing haunts



"power on" landing procedure is to come down at an angle, as sharp as 45 degrees. Forward motion is maintained until within 10 or 15 feet of the ground, after which the craft is brought to a stop and allowed to settle in slowly.

Emergency landings after engine failures are handled practically the same as normal landings. Cyclic pitch is applied to the rotors by means of the control stick and the blades auto-rotate while the craft descends at about a 45-degree angle. Five or ten feet off the ground the control stick is moved in the opposite direction to kill the forward speed and more pitch is applied to the blades by pulling up on the climb stick. The blades act as a brake and the helicopter sinks to the ground at a safe, slow speed.

I've deliberately mentioned some of the limitations of helicopters to dispell the illusion that in the future you'll be able to hop into one of the machines and sail away in carefree flight, practically without instruction. Tomorrow's helicopters will be easy to fly, certainly, but skillful piloting will be based on training and practice. The types already in use are so safe that accidents due to pilot error are almost unknown. Today the industry is continuing its research in the hope that some day machines that are virtually foolproof will be developed for the public.



FORKS DELIVER ORDERS TO TRAIN CREWS

Train crews can pick up their orders from a multiple-unit delivery post while traveling at any speed. The messages are tied by cord to wooden forks which are attached to a telescoping post. This post is mounted in a permanent base beside the tracks when a delivery is to be made. The forks are attached to the post at three different heights with the engineer's orders at the top and messages for other crew members below. When the engineer approaches the delivery unit he thrusts his

arm out the side of the cab so that it passes between the arms of the top fork. The string with the attached message forms a loop around his arm. As the messages are delivered the arms swing apart. In one model several units can be attached at the same height with only one in delivery position. When the first message is delivered the fork snaps out of the way and another falls into place, making it possible to deliver orders to both engineers of a two-engine train traveling 90 miles an hour.

"Venetian" Screens

With tiny slots slanted downward and outward, a screen made from a continuous sheet of metal gives the same effect as a slightly tilted miniature Venetian blind. It keeps out the midday sun's glaring rays. The construction is said to afford greater ventilation with 20 percent more open space than woven screen. Made of either bronze or aluminum alloy, with 18 slots per inch, the screen comes in widths from 24 to 36 inches. The material can be cut with shears.

☐ Boeing Stratocruisers contain 435 feet of plastic water pipe which resists any chemical reaction.



RAIL FAN SPECIAL leaving on Track 3! All aboard!"

Ever wish you could charter a special train that would take you on exploration trips? A train you could stop whenever you wanted to snap a few pictures?

Thousands of railroad fans band together in groups of 100 or more and charter special trains for just that purpose.

Anyone can buy a ticket as a passenger on a main route; the rail fans prefer making gypsy trips along branch lines and over little-used tracks. They visit towns that hardly see a passenger train from year to year. They poke along old routes and stop wherever they like to take pictures of scenery and equipment.

Some short trips are completed in a day, others involve a week end and 1000 miles or more of travel. This summer one group of rail fans from the west coast traveled by special car to Colorado and spent a week riding the narrow-gauge railroads that were built during early mining days and are still in use.

Railroading has an enduring fascination for most Americans. Huge modern steam locomotives and Diesel engines thrill nearly everyone, and the dinky "tea kettles" of past years have a romance all their own. As a hobby, railroading is said to have nearly as many devotees as stamp collecting. Some enthusiasts build and operate model trains, others collect old train tickets, passes and

Railroad Fans



Pennsylvania Railroad photo

† More than 500 fans swarm off a rail special at Conowingo, Md., to snap photographs of huge dam and power plant. Stops are made to inspect old bridges, stations and rolling stock

operating schedules, and still others specialize in photographing different kinds of rolling stock. All of them are fascinated by railroad operations and look forward to the special fan trips and the occasional visiting days when they can tour roundhouses and shops. One big excursion of fans is scheduled for this month when hundreds of model-train operators in the East will charter special trains for a transcontinental run to Oakland where they will attend the National Model Railroad Association Convention.

The late Henry Ford was a rail fan. Many railroad employees spend leisure hours—playing with trains. Men, women and children all have the bug.

There are rail-fan clubs in all the large cities along the Atlantic coast, in the Midwest and on the Pacific coast. Many of these groups charter special trains several times a year at a cost of \$5 to \$65 per passenger depending on the length of the trip and the overnight accommodations desired.

BE A RAILROAD MAN FOR A DAY! "Off the Beaten Path" SCENIC AND HISTORICAL TOUR

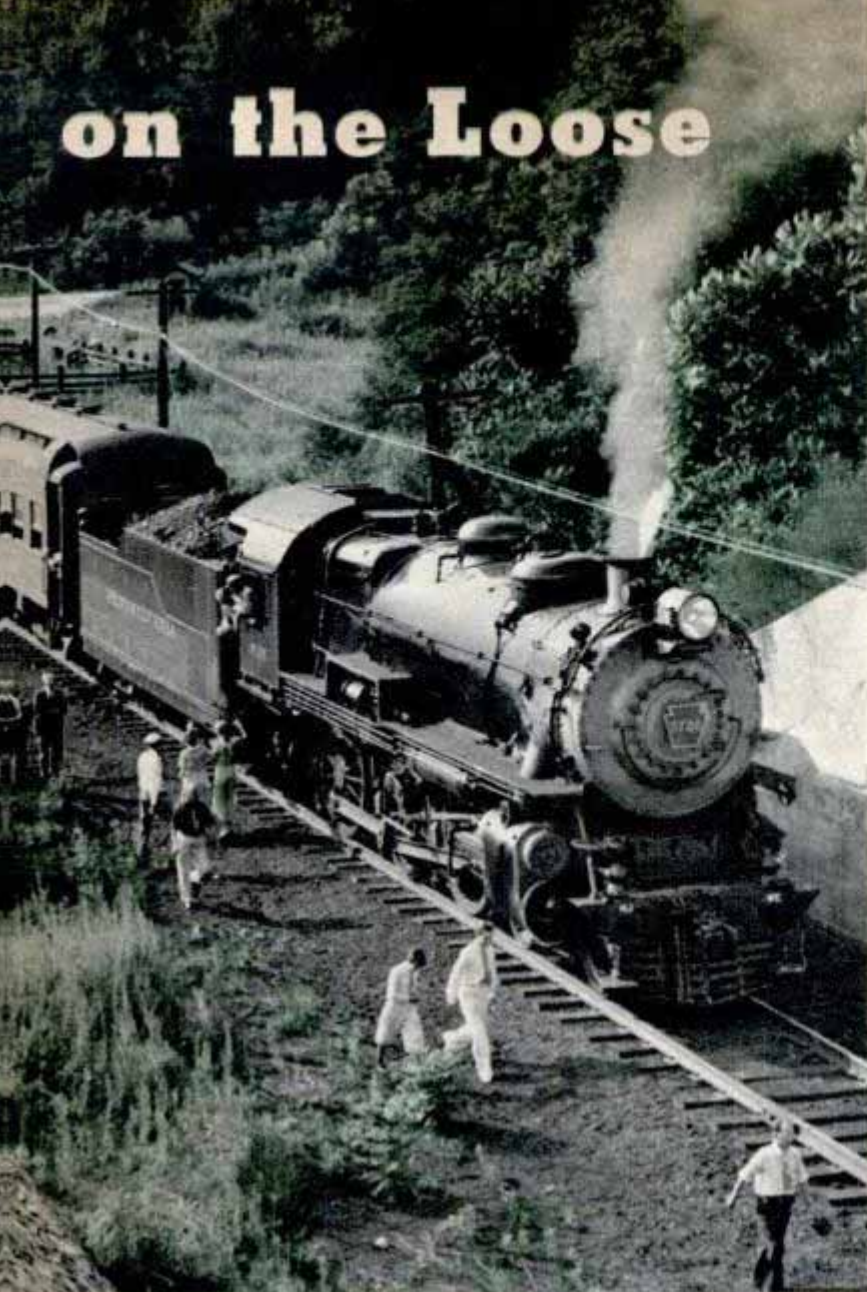
- Sponsored by Chicago Chapter, Railway and Locomotive Historical Society.
- For a thrilling, interesting Sunday to be spent in a different way—

RIDE over the route and on the schedule of the famous "DETROIT ARROW"—fastest stream train in America!
SEE the engine house at Fort Wayne, which houses the steaming giant iron horses of the Pennsylvania Railroad.
ENJOY the scenic beauty of Northern Indiana in cool, lean, quiet comfort aboard the train.

Route of Tour



on the Loose

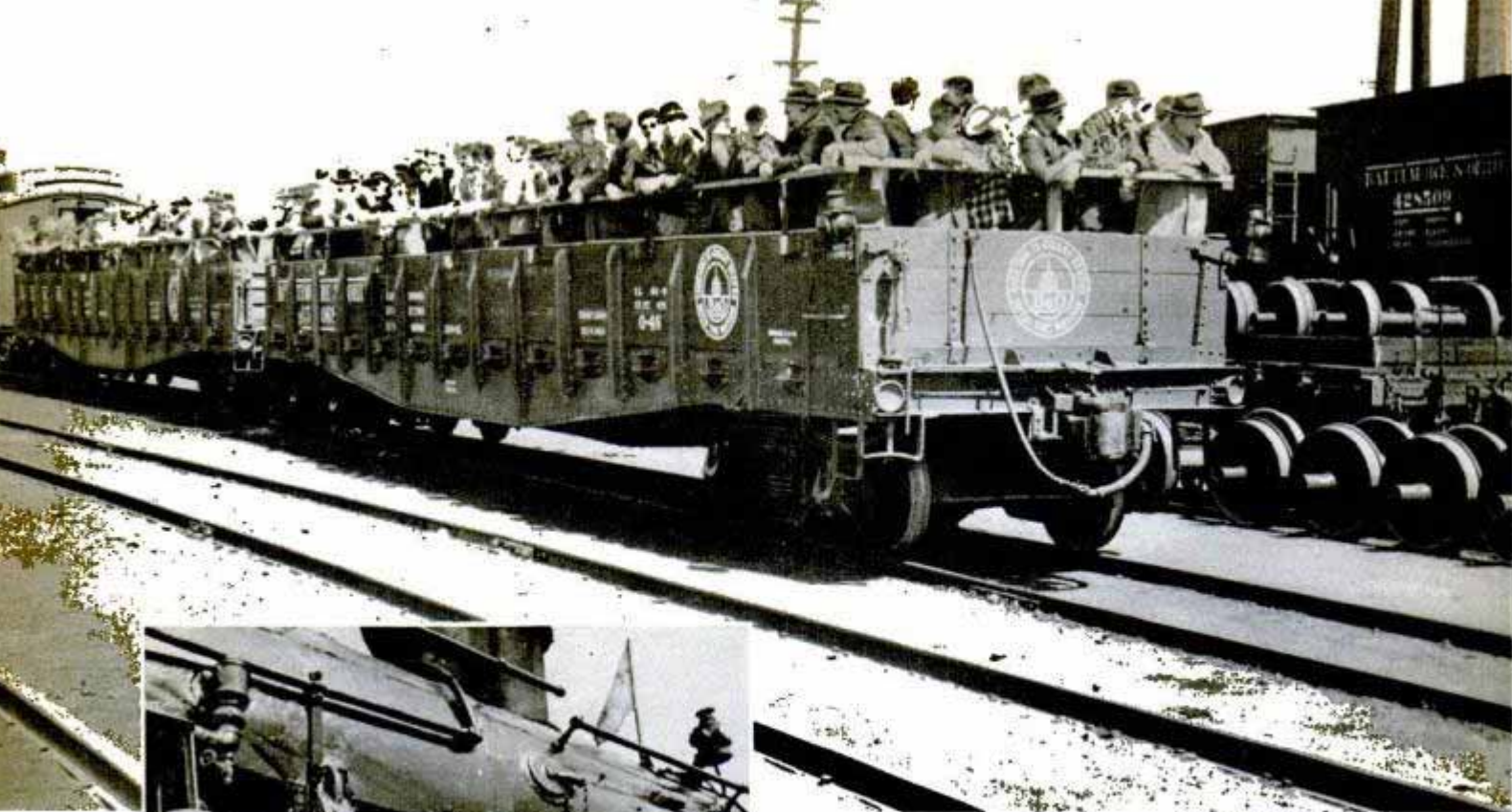


↓ Specials often nose through woods and back country along ancient tracks. Here the train has stopped on a spur no longer in use. The fans give the orders for stops along the route



↑ Most railroad "bugs" are also photographers and will hang from signals, freight cars and other equipment for unusual shots





Baltimore & Ohio photo

↑ Flatcars often are used to carry fans through switching yards for a detailed study of operating procedures
 ← Locomotives are the favorite camera subject. This enthusiast is taking motion pictures of the engineer



Most railroads make up a special to fit the needs of the group, provided a certain number of tickets, usually around 125, is guaranteed.

Oldest of the railroad clubs is the Railway and Locomotive Historical Society that was established in Boston in 1920 and now has divisions in the Midwest, West, and Canada. The society has aided in the renovation and preservation of several historical locomotives and publishes numerous historical papers. The Railroadians of America is another historically minded organization with chapters in many large cities. There also are numerous unattached local groups of fans. The public relations department of your local railroad usually can provide the addresses of these clubs.

The electric railway systems have their own fan clubs. Probably the most active is the Central Electric Rail Fans Association with headquarters in Chicago. Some of the groups often hold their meetings in empty passenger coaches set out for them in local rail yards.

The bigger the engine the better, according to rail fans who ride the specials. But if a big engine can't be spared, the fans like to be pulled by some old type that is ready to be turned out to pasture. A typical fan special consists of engine and tender, open-door baggage car with safety bars for side-door photography, diner, day coach, Pullmans, lounge and observation car.

The special travels a route selected ahead of time to yield interesting sights and experiences. Sometimes fans take a "mystery" trip over an unannounced route. They have complete freedom of the train en route and a few, picked by lot or ticket numbers, make part of the trip in the locomotive cab. Safety rules, of course, are always enforced.

The special leaves its terminal at a time when it won't interfere with normal traffic, often pulling out as the second section of a famous luxury train. Once it gets off the main line it makes a number of stops adjacent to bridges, old equipment or other attractions so photos may be snapped.

One typical trip made recently by 150 members of the Railway Club of Southern California started from Los Angeles on a Saturday night and crossed the Tehachapi Mountains into the San Joaquin Valley, reaching Bakersfield in time for breakfast. During the day the train rolled along 250 miles of rustic branch lines and some passengers were taken on automobile side trips by a group of fans from the town of

Ward Kimball, who owns a full-size engine, inspects a model that develops steam when its boiler is fired

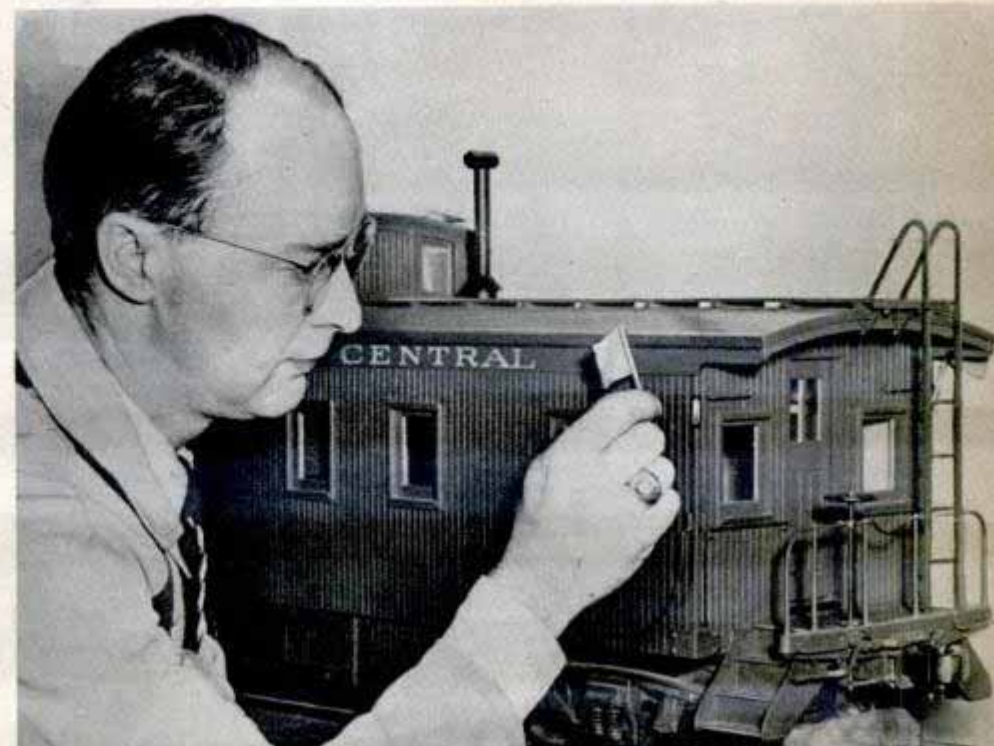
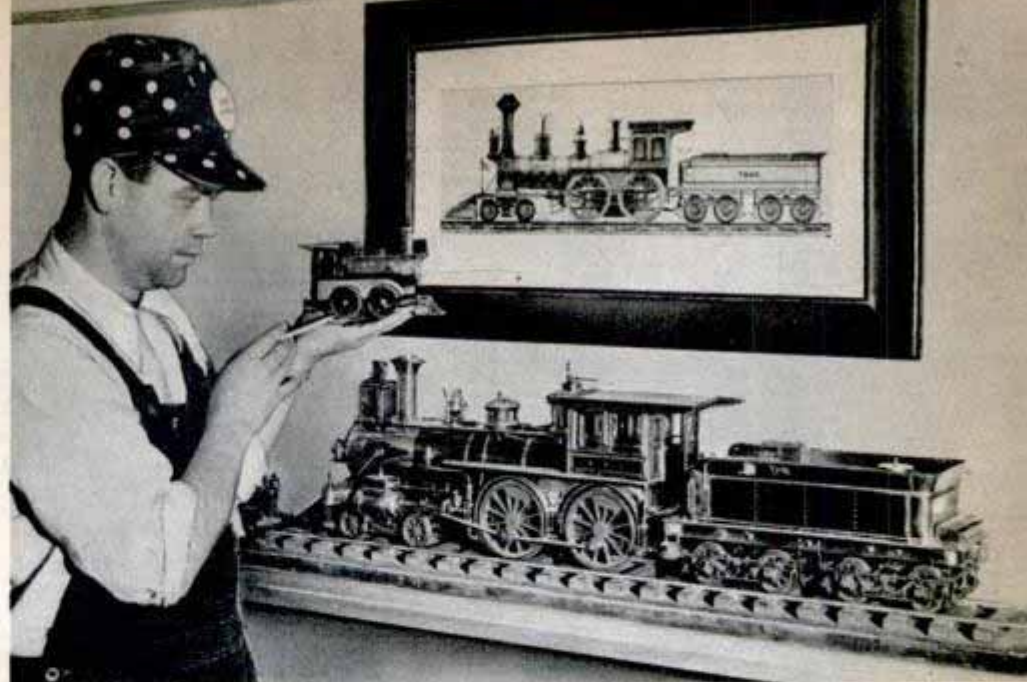
Orange Cove. The special traveled as far north as Fresno and returned to Los Angeles over main lines in time for breakfast Monday morning. The full distance amounted to 890 miles of railroading. Fourteen photo stops were made and some fans took several hundred pictures during the trip.

Most parts of the United States have little-known short lines or branch lines over which such excursions may be made. Off the beaten tracks, these lines normally carry nothing except freight and an occasional mixed train. New England has a number of small railroads that still use equipment which was modern early in the century. In the Midwest and South, rail enthusiasts sometimes spot relics of the early days of railroading that are still in use, and the West likewise has some unusual steam lines.

Excursions on the Pacific Coast Railway out of San Luis Obispo in central California were popular with rail fans until a few years ago when the line suddenly went out of business. Its demise was caused by a grade-crossing collision between its last narrow-gauge locomotive and a gasoline truck.

Another west coast narrow-gauge, the privately-owned Michigan-California that hauls lumber from the forest to a main line, is split by the 1200-foot-deep canyon of the south fork of the American River. The two pieces of trackage are connected, not by bridge, but by cables that span the chasm and carry an underslung tramcar. Two trains meet on either side of the canyon and exchange their cars, one by

Center, engine name plates are choice collectors' items for railroad fans. Right, built by a train enthusiast, this caboose has brakes, coupling pins, a stove and other furnishings



one, by means of the tramcar that shuttles back and forth on the cables. Railroad fans delight in visiting such oddities.

They also like to explain other little-known facts. For instance, they'll tell you that the side rods that drive a locomotive's wheels don't move back and forth but only in a forward direction. The rods are motionless during half their cycle while the engine moves ahead of them, then the rods move forward, pause again as the wheels go around, then move forward once more.

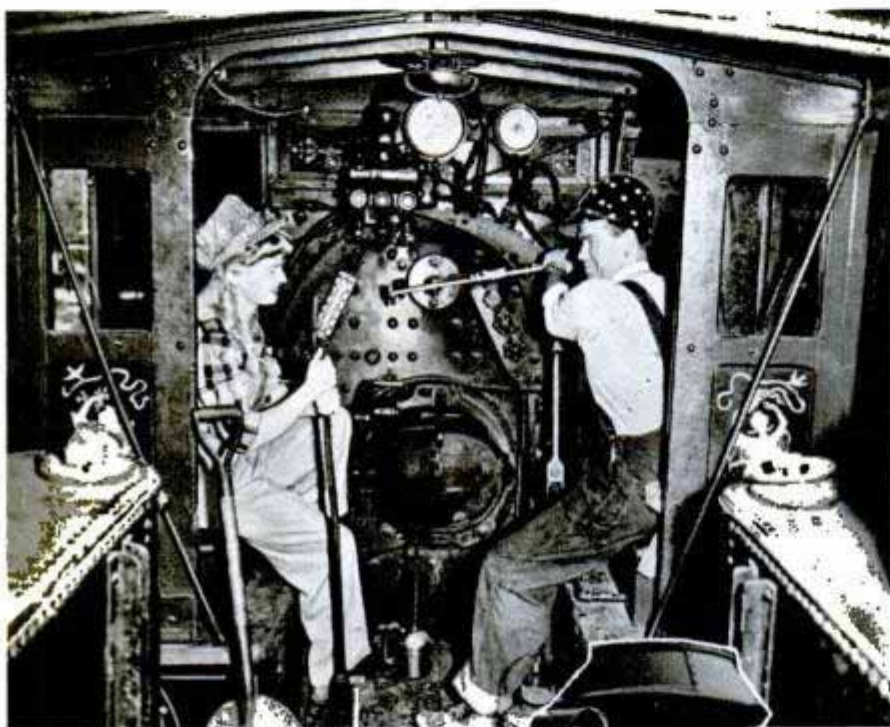
They tell the uninitiated about the "banana messengers," the specially trained refrigeration men who ride the fast freights carrying perishable cargoes of bananas.

Their unusual job is to watch and carefully adjust the temperatures inside the cars. They discuss the old 1875 locomotive, a relic of railroading's early days, that was put to work on the rails again during the war. Converted from wood to oil feed, it played its part as a switcher throughout the war.

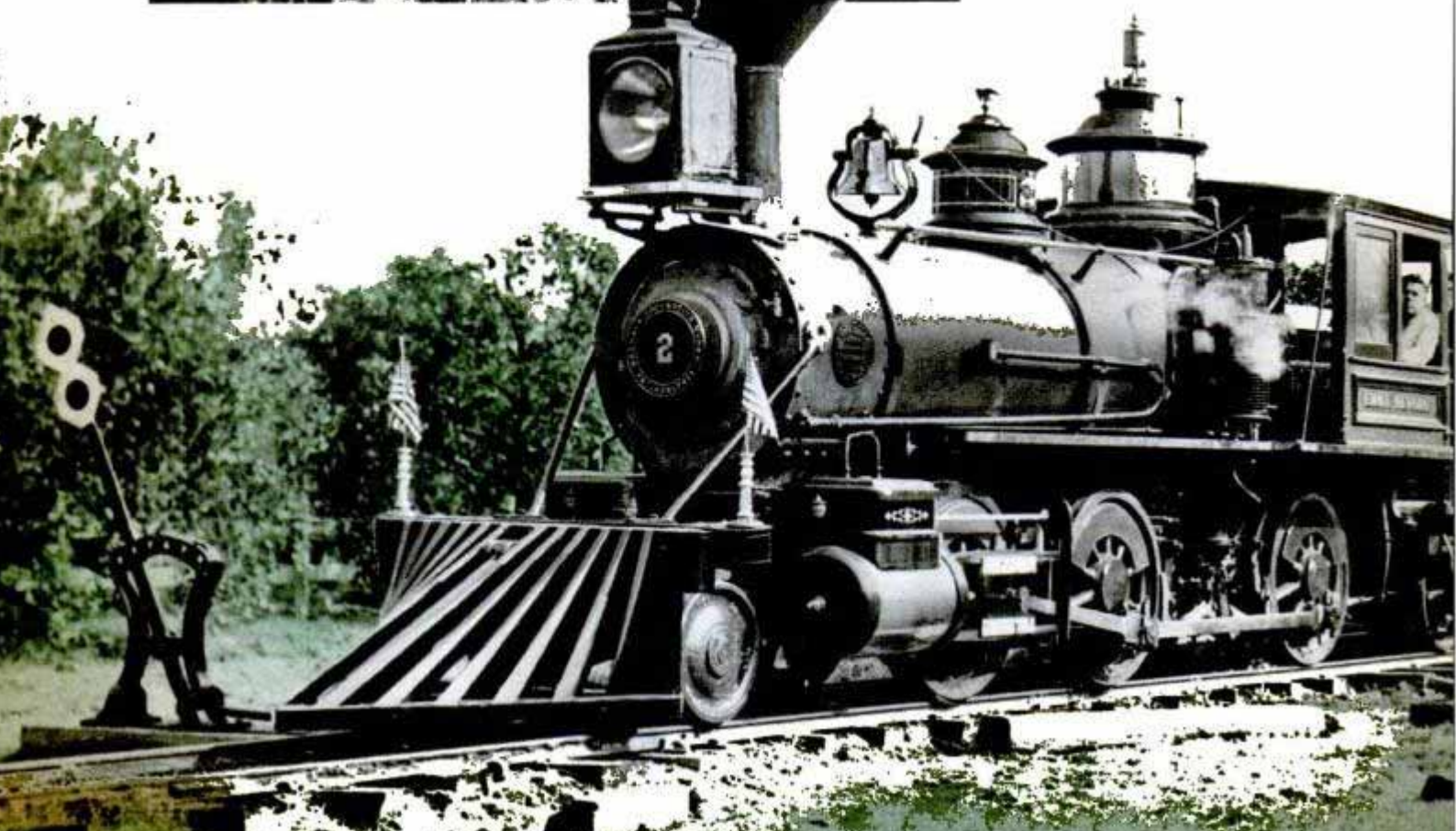
Railroad fans in all parts of the country point to Ward Kimball of San Gabriel, Calif., an illustrator for Walt Disney, as an example of what can happen to a railroad enthusiast who becomes deeply interested in his hobby. Kimball started out with the idea of building a few 1/4-inch scale models and operating them over a few feet of track.

Later he began to collect old tickets, timetables and dining-car menus, ultimately developing an extensive reference file.

A bell from an old locomotive attracted him and he bought it, then purchased an old switch stand. Finally just before the war he blossomed out as owner and president of the Grizzly Flats Railroad Company, his own private line. He acquired the railroad after he heard that the old Nevada



← Ward Kimball takes over throttle of his ancient engine while his wife serves as fireman. Below, the private Grizzly Flats line weaves through his orange grove




Central was disposing of ancient rolling stock at junk prices.

Kimball bought a 2-6-0 Baldwin locomotive complete with tender for only \$400. Built in 1881, it was old enough to make any railroad fan happy. At similar bargain prices he was able to purchase a passenger coach of early vintage, a freight car and a combination baggage car and caboose.

It took him two years to refinish and restore the old locomotive to its original appearance and to put its steam boiler in first-class shape. He built an engine shed in which to store it and installed 650 feet of track through the orange grove back of his home. Nowadays on birthdays and other special occasions, Kimball and his family fire up the old "Emma Nevada" and go for a jaunt over the line. He issues passes to friends and occasionally publishes an announcement of an "excursion over the great pleasure route of the Grizzly Flats R.R." on its "lightning express train." Every rail fan who gets an invitation invariably shows up.

The Only Line via Niagara Falls running the famous Dining Cars.



SEATING 75,000 Meals Served in these CARS To the PATRONS OF the Favorite Route Starting 1880.

NO DELAYS ON THE GREAT WESTERN RY FOR MEALS

Model Trains! Popular Features! WHICH THE TRAVELING PUBLIC APPRECIATE

CELEBRATED DINING CARS

AND THE NEW AND ELABORATELY EQUIPPED **SMOKING CARS,**

Fitted up with Reclining Chairs, Sofas, Locking Tables, &c.

ALL MEALS SERVED BETWEEN CHICAGO AND NIAGARA FALLS

THESE CARS ARE BUILT IN THE MOST ELEGANT MANNER IN THE COMPANY'S OWN SHOPS, AND ARE UNDER THEIR EXCLUSIVE CONTROL.

BILL OF FARE

First Class	Second Class	Third Class	Day	Night	Round Trip	Excursion	Special
Chicago to Niagara Falls	Chicago to Niagara Falls	Chicago to Niagara Falls	Chicago to Niagara Falls	Chicago to Niagara Falls	Chicago to Niagara Falls	Chicago to Niagara Falls	Chicago to Niagara Falls
Chicago to St. Louis	Chicago to St. Louis	Chicago to St. Louis	Chicago to St. Louis	Chicago to St. Louis	Chicago to St. Louis	Chicago to St. Louis	Chicago to St. Louis
Chicago to Kansas City	Chicago to Kansas City	Chicago to Kansas City	Chicago to Kansas City	Chicago to Kansas City	Chicago to Kansas City	Chicago to Kansas City	Chicago to Kansas City



INTERIOR VIEW OF RECLINING CHAIR CAR, DR. HORTON'S PATENT.

These Excursion Cars are run in all Through Trains, Day and Night, between Chicago and Kansas City, Chicago and St. Louis, and St. Louis and Kansas City, Without Change, VIA


Chicago & Alton R. R.

NO EXTRA CHARGE FOR SEATS IN THESE CARS.

↑ Old-time railroad advertisements and literature are prized by some collectors. Below, Kimball copies their style in issuing invitations for excursions on his "exclusive" line



ANNOUNCING AN **EXCURSION!**



Over The GREAT PLEASURE ROUTE OF THE **GRIZZLY FLATS RR.**

"THE ACETIC WONDER OF THE WEST!"



British Information Service photo

Air-Liner Bar

Accommodations on Britain's newest luxury air liner, the Avro Tudor II, include a plastic cocktail bar. The bar, which is the first to be built on a British plane, is located in the corner of the 14-foot-long observation lounge. Four Rolls Royce Merlin engines give the plane a 325-mile-an-hour top speed. It is 105 feet long and can carry 40 day or 22 overnight passengers comfortably.

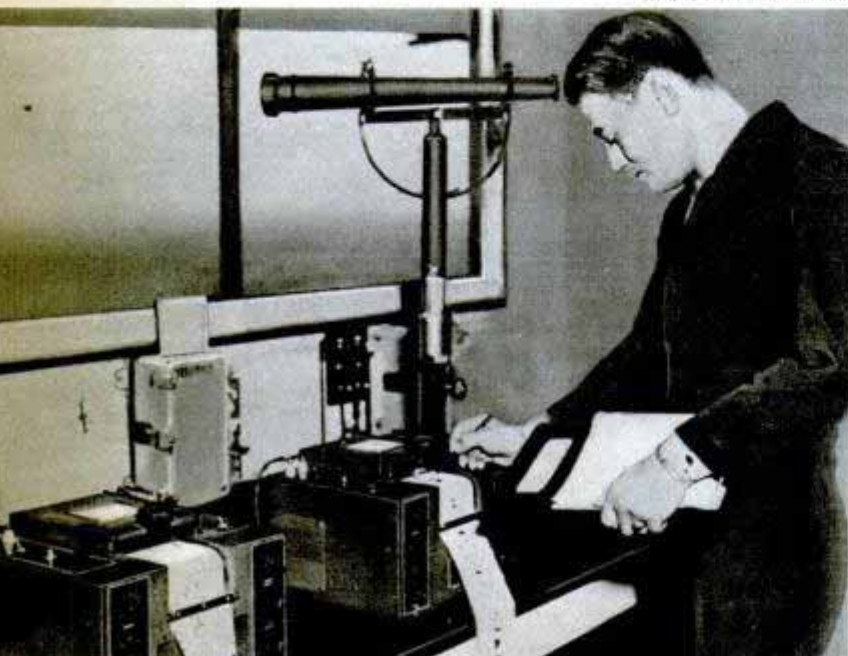
Hot-Cold Pipe

Compressed air is divided into hot and cold blasts by a 15-inch research pipe with a built-in steel spiral that creates a whirlpool of rapidly spinning gases. Warm air at the outer edges of the whirlpool is drawn off through a small hole at one end of the pipe. Cold air in the center of the whirlpool comes out the opposite end. Westinghouse scientists who developed the pipe from a German design explain that it will be a useful laboratory tool to produce low-temperature air for experi-



General Electric photo

ments with mercury vapor pumps, mass spectrometers and leak detectors. The compressed air is pumped into the pipe through a nozzle at the right end.



Ship Detector

Magnetic instruments installed on harbor bottoms in wartime guard against invasions by enemy ships under cover of darkness. One such "watchdog" is a fluxmeter which is connected to a loop of cables laid across the bottom of a harbor entrance. It detects the presence of iron or other magnetic materials in a ship passing overhead and flashes a warning to a shore-based meter.

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



ROOFS BUILT IN LADDER SECTIONS

Frames of tough steel built in ladder-like sections are replacing the normal wooden framework for tile roofs in some British buildings. The method is 10 times faster than building with wood, and the steel sec-

tions are light enough to be installed by one man. Donald Hamilton, the London architect who invented the system, says the steel will last 150 years and the sections can be installed by unskilled labor.

Czech Locomotive

Czechoslovakia's Skoda Works, recon-verted to locomotive production following the war, recently turned out a powerful engine weighing 175 tons. The 2800-horsepower rail giant is 82 feet long. In tests conducted by the government the locomotive made a speed of 90 miles an hour.





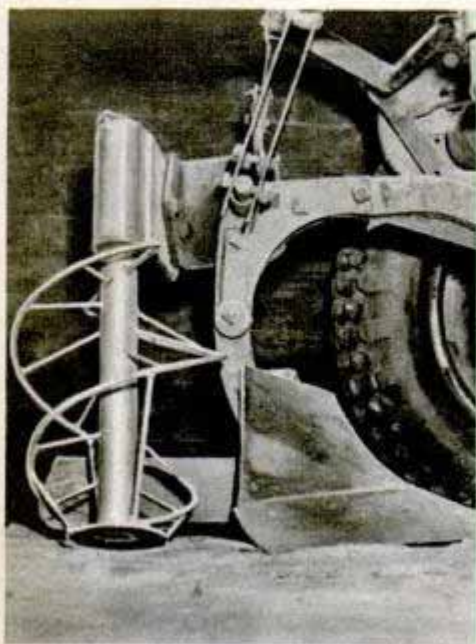
Stand unfolds from the bottom (top photograph) to balance the combination golf bag and caddy cart in an upright position (right). Lower picture shows the false bottom which contains stand, wheels and axles



GOLF BAG HAS FOLDING WHEELS

Wheels and handle are attached to a combination golf bag and caddy cart which takes up no more room than an ordinary golf bag. When not in use as a caddy cart, the axles are folded into a false bottom, wheels are stored in special compartments and the handle is folded against the bag. On a golf course, the outfit can be used as a caddy cart or carried as a golf bag.

HARVESTING SWEET POTATOES is speeded by a rotary digger which can be attached to a tractor or walking plow. The implement turns the soil over the vines and gently drops the potatoes on top of the ground. Tests have demonstrated that the device salvages from 15 to 20 bushels more per acre than hand labor and cuts labor costs in half. The digger is 18 inches long and has a shaft 2 inches in diameter, circled by a spiral sifter



GREASED

CAN AN AUTOMOBILE be driven at the rate of 400 miles per hour?

Can a car travel 4000 miles in 24 hours' time?

Two of the world's great speed kings hope to find the answers to these questions this summer.

John Cobb of England is scheduled soon to attempt to break his own world record for the flying mile on Utah's Bonneville salt flats.

Ab Jenkins, former mayor of Salt Lake City and the holder of dozens of endurance records, will set out to cover 4000 miles in 24 hours around a circular track on the salt.

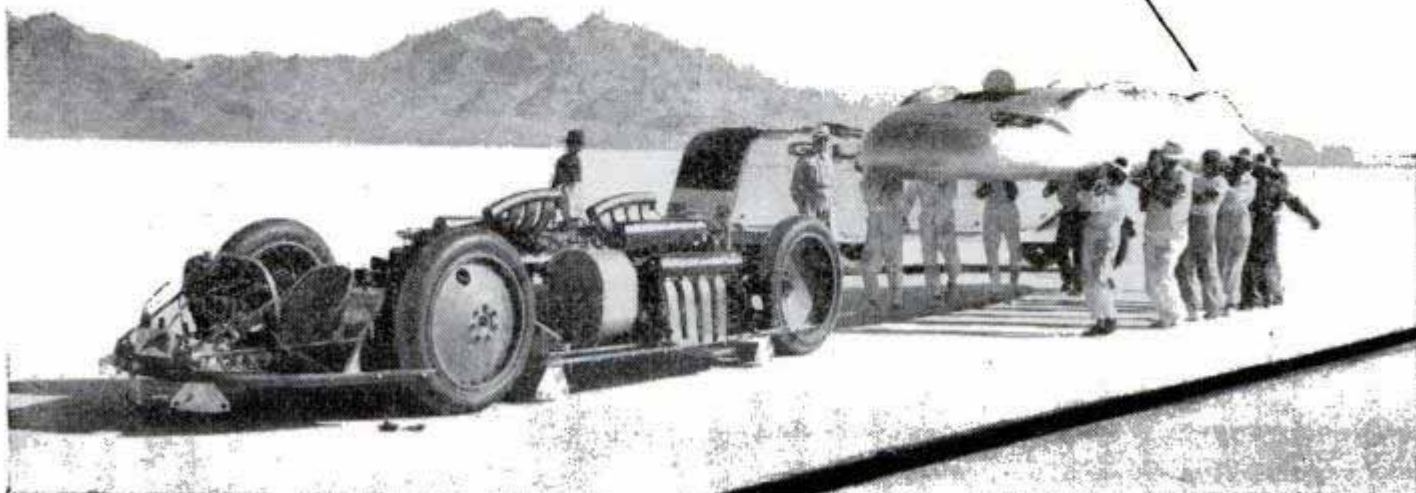
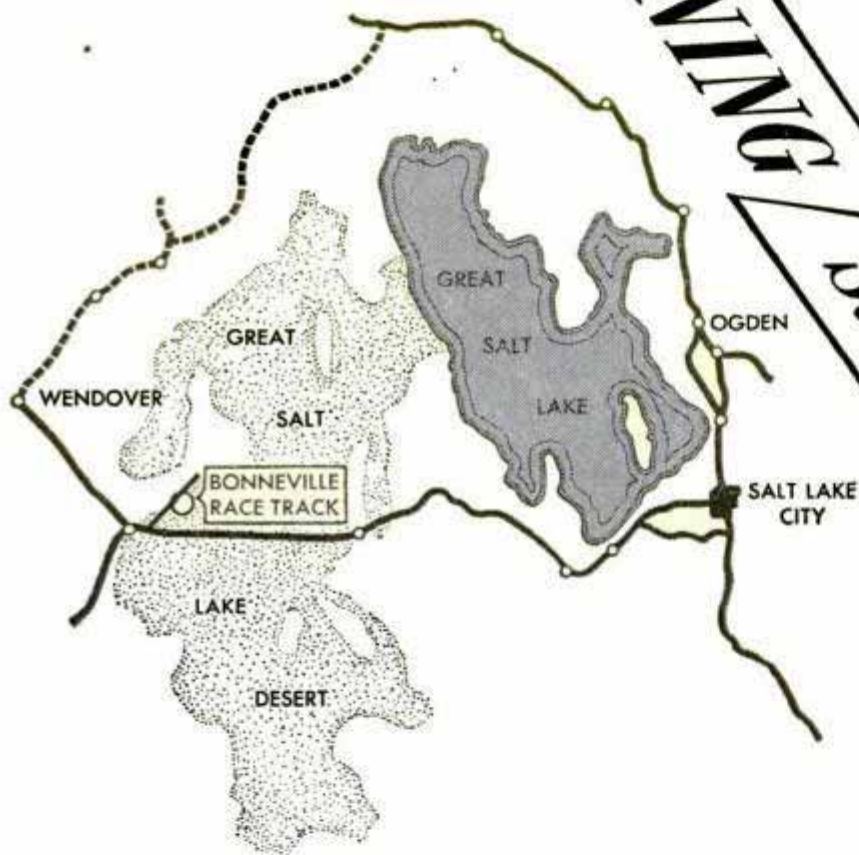
Cobb will drive the 3½-ton Napier-Railton with which he made his record of 368.9 miles per hour in 1939. Jenkins will be at the wheel of a Winfield Special built for the Indianapolis race and modified for the endurance grind. Using a relief driver part of the time, Jenkins hopes to average better than 166 miles an hour including time out for pit stops.

Known as the world's greatest speedway, Bonneville salt flats is to

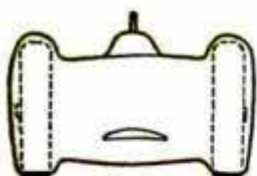
By Thomas E. Stimson, Jr.

LIGHTNING

Strikes the Flats



Mechanics "walk" aluminum body of Cobb's 368-mile-an-hour racer to chassis; car has two 1200-hp. engines



TWO SUPERCHARGED 1000-HORSEPOWER ENGINES

SKETCH OF PROPOSED 1948 RACING CAR DESIGNED FOR AB JENKINS

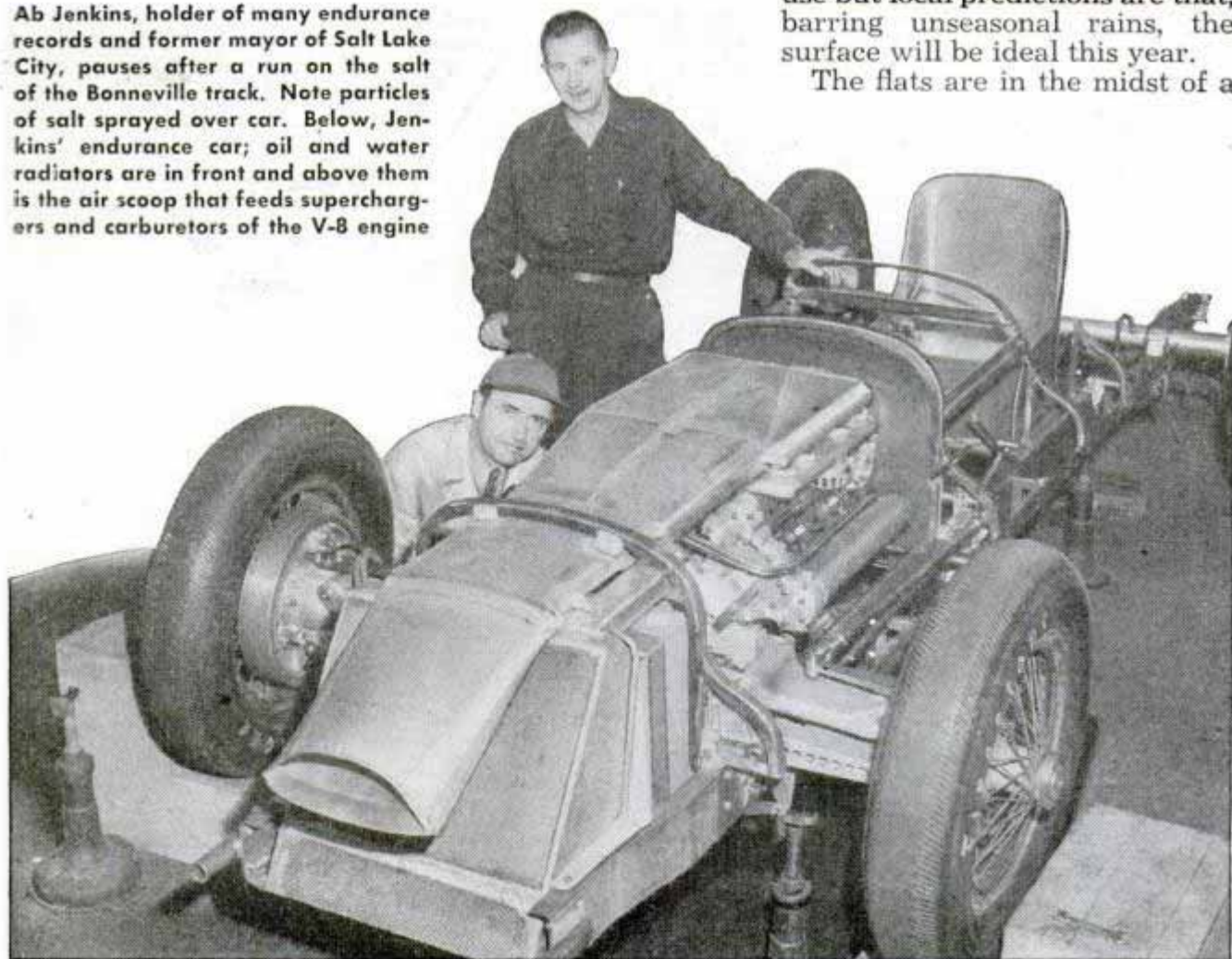


Ab Jenkins, holder of many endurance records and former mayor of Salt Lake City, pauses after a run on the salt of the Bonneville track. Note particles of salt sprayed over car. Below, Jenkins' endurance car; oil and water radiators are in front and above them is the air scoop that feeds superchargers and carburetors of the V-8 engine

be an arena of speed for several weeks this summer. Several stock cars have been nominated for races against time on the salt, seeking new speed and endurance marks in their classifications. A 250-mile competition in which the country's best drivers will compete also is planned.

All the events are contingent upon the condition of the salt. Each winter the flats are covered by a foot or more of water. Each summer the water evaporates, leaving a hard glistening surface that stretches to the foot of a distant mountain range. Some years the salt is too mushy for use but local predictions are that, barring unseasonal rains, the surface will be ideal this year.

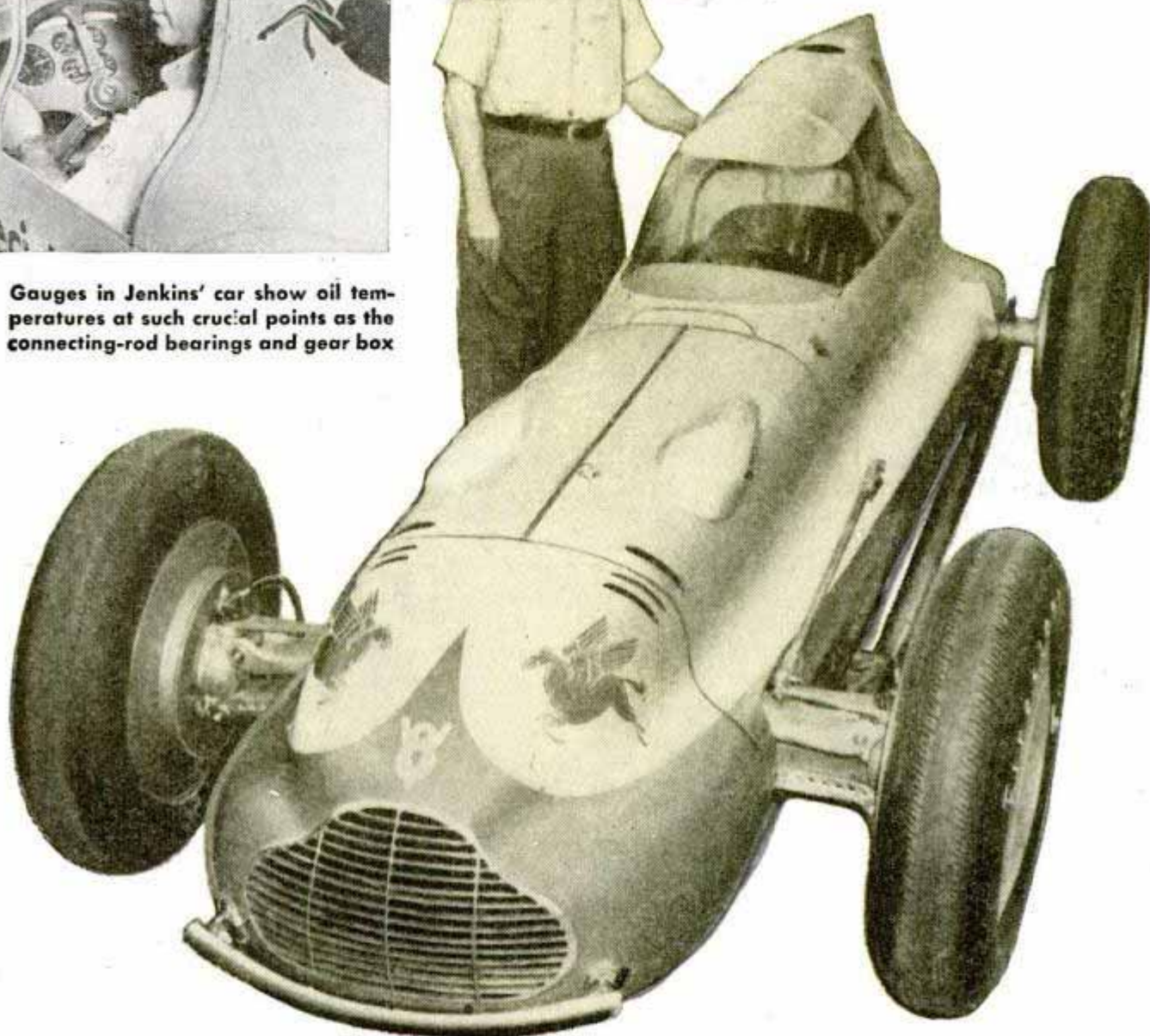
The flats are in the midst of a





Gauges in Jenkins' car show oil temperatures at such crucial points as the connecting-rod bearings and gear box

Ab Jenkins' 500-hp. endurance car was built to travel 4000 miles in 24 hours. Including time out for pit stops, the car would have to average about 170 miles an hour in race



vast shimmering desert 120 miles west of Salt Lake City on Highway 40. The nearest habitation is 10 miles away and everything must be trucked to the site including food and water.

Weeks before Cobb makes his speed attempt a tent city will spring up on the salt and scores of technicians and officials will arrive to prepare for the event. Sleeping quarters, cook shacks, tire-balancing stations, repair facilities, and a heavy-duty electric power plant will be set up.

An exacting task is the surveying and smoothing of the 14½-mile straightaway course. A metal tape is pulled to exactly the same tension each time and "balanced" against expansion or contraction due to temperature changes. After the course is surveyed it is then scraped smooth by state highway equipment. An 18-inch-wide

black stripe is painted down its center as a marker for Cobb to follow.

Finally scores of men go over the course by hand. Tiny inequalities on the surface, every piece of trash is removed. Even a matchstick might blow one of the thin tires used in the high-speed runs. A tune-up course nearby is used for preparing the automobile for its world record attempt.

Meanwhile, too, officials set up and test the photoelectric beams of the timing system. A new world record for the mile almost automatically assures new world records in the one-kilometer, five-mile and five-kilometer, and ten-mile and ten-kilometer distances. Beams are aimed across the course at the start and finish of each of these distances. Wires from each receiving cell are led to the center of the course and then off to the timing apparatus that makes

a permanent record on tape of the speeds accomplished. The entire timing apparatus is certified by the Bureau of Standards as being accurate to within $\frac{1}{100}$ of a second. The official speed will be the average of two runs, one in each direction along the course.

Dead lines are set up 2000 feet away from the course for the safety of the thousands of spectators who drive out from Salt Lake City. No one except Cobb and his team of mechanics may trespass beyond the dead lines during the record attempts.

Similar care is taken in surveying and smoothing the circular courses on which Jenkins plans to shatter his own record of 3868 miles in 24 hours. Usually three or four circles of from 10 to 15 miles in circumference are surveyed so that the driver may select the one that traverses the most solid salt. The courses are then marked by laths set upright in the salt.

Both Cobb and Jenkins are to make their runs under the international sporting code of the Association Internationale des Automobile Clubs Reconnus. The American Automobile Association is the representative in the United States of the AIACR, and A. C. Pillsbury, member of the contest board of the AAA, is to be in full charge of the speed attempts. Working with him are Ernest Clover, official timer, and a dozen other AAA officials. Both events are sponsored by the General Petroleum Corporation of California.

Cobb's one-mile "aluminum turtle" is virtually unchanged from the time it set its present record. Reid Railton, designer of the car, has specified only one important modification, an improvement to the gear-shift mechanism to increase acceleration.

The car is 28 feet long, 8 feet wide, and 4 feet high. It is powered by two 1200-horsepower supercharged Napier-Lion aircraft engines, each of which drives one pair of wheels. Clutches are not used and the engines freewheel during changes of gear. In the past they tended to stall during the shifts, reducing acceleration. The present change permits a faster shift operation with a subsequent improvement in pickup.

"Today the car is entirely capable of 400 miles per hour," Railton states. "Barring breakdowns, Cobb's speed will depend on how much of the course is safe to use. This depends on the condition of the salt.

"Cobb had a 12-mile run in 1939. He used $5\frac{1}{2}$ miles to accelerate, reaching 300 miles per hour within three miles of his start. After going through the measured mile he used the last $5\frac{1}{2}$ miles to brake to a stop. If the salt is dry enough for a 12 or 13-mile run Cobb can do 400 miles or better."

Cobb sits in an enclosed cockpit in the nose of the car, forward of the front axle.

The power plants are behind him. He has four pedals for his feet, a throttle, brake pedal, locking pedal for freewheeling, and a footrest. The engines are cooled by water that circulates through tanks loaded with ice. Conventional radiators would create too much drag. Brakes are on the propeller shafts instead of on the wheels and each brake is cooled by water discharged from the engine cooling systems. Clouds of steam shoot out from the rear of the car when the brakes are applied.

Braking is the trickiest part of the record run. Cobb applies the brakes in short bursts only after the car slows down to 300 miles per hour. Each application causes such a violent deceleration that the driver is thrown forward in his cockpit.

Oddly enough, Cobb's car has an ordinary electric horn. He uses it to signal the push truck that he is ready to start. The car has no starters for its engines and is pushed along the course in gear until the engines begin to fire.

Jenkins, too, has his eyes on the world's unlimited speed record but his run this year will be for endurance only. Next year he hopes to build a car that will be clocked at 450 miles per hour across the flying mile.

For the endurance run this year he will drive a low-slung, 1900-pound front-end-drive race car powered with a supercharged V-8 engine that develops 500 horsepower at 8000 r.p.m. A special body including a streamlined enclosure over the cockpit will be used and extra fuel tanks will be installed. A pyrometer on the instrument board together with a selector switch allows Jenkins to check oil temperatures at such crucial points as the connecting-rod bearings and the gear box.

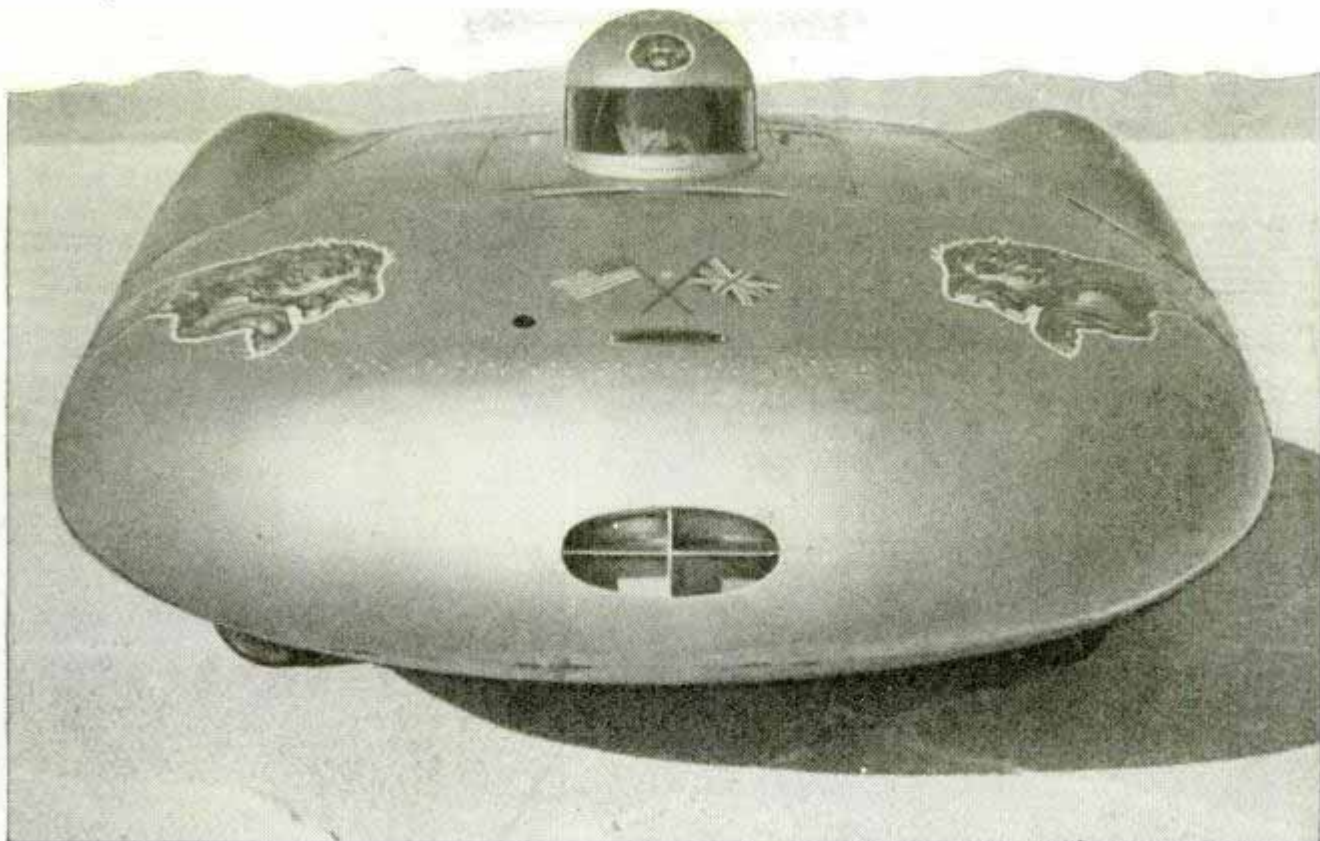
Making an endurance run on the salt can be an eerie experience because of the heat mirages. The region is noted for weird mirage effects, both night and day.

"Once when pounding around the course on an endurance run I was suddenly confronted by a huge truck and trailer on the course," Jenkins relates. "They were about a mile and a half ahead of me and since I was doing close to 175 miles per hour at the time I barely had time to turn out for them.

"Plain reasoning told me that the truck was a mirage, a reflection of an actual truck on an adjacent highway. That's what it proved to be but the illusion was too real to allow taking a chance. I turned out. I've had a mechanic beside me in the car drop to the floor in anticipation of a certain crash under similar circumstances.

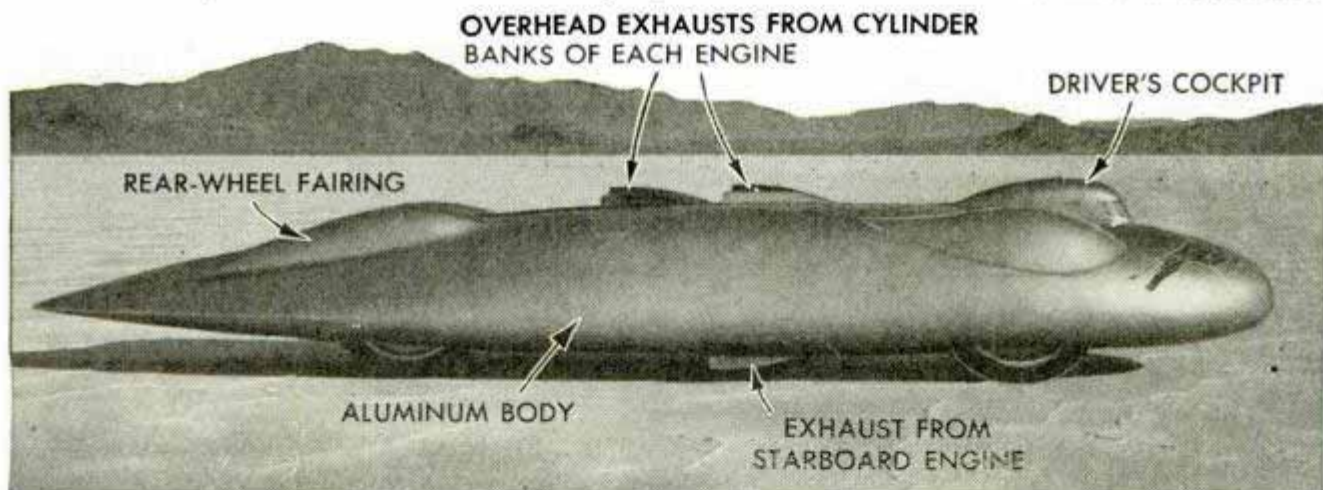
"At night the heat mirage can almost convince you that your senses have departed. A familiar airway beacon on the horizon climbs much higher in the sky than

(Continued to page 256)

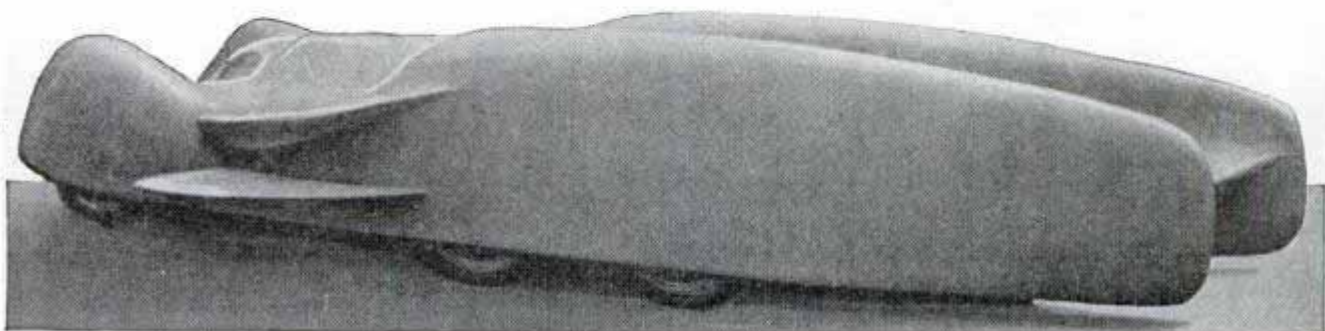
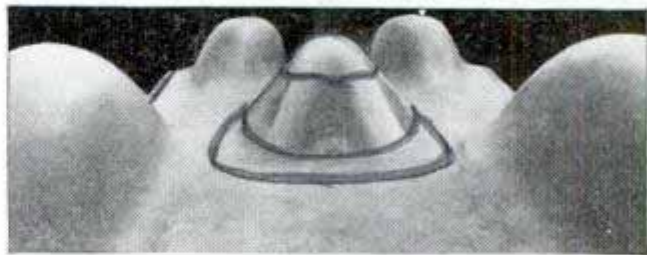


General Petroleum Corp. of California photos

Nose view of John Cobb's racer shows why he calls it his "aluminum turtle." This variety of turtle is the fastest thing on wheels and for the last eight years has held world record of 368.9 miles per hour

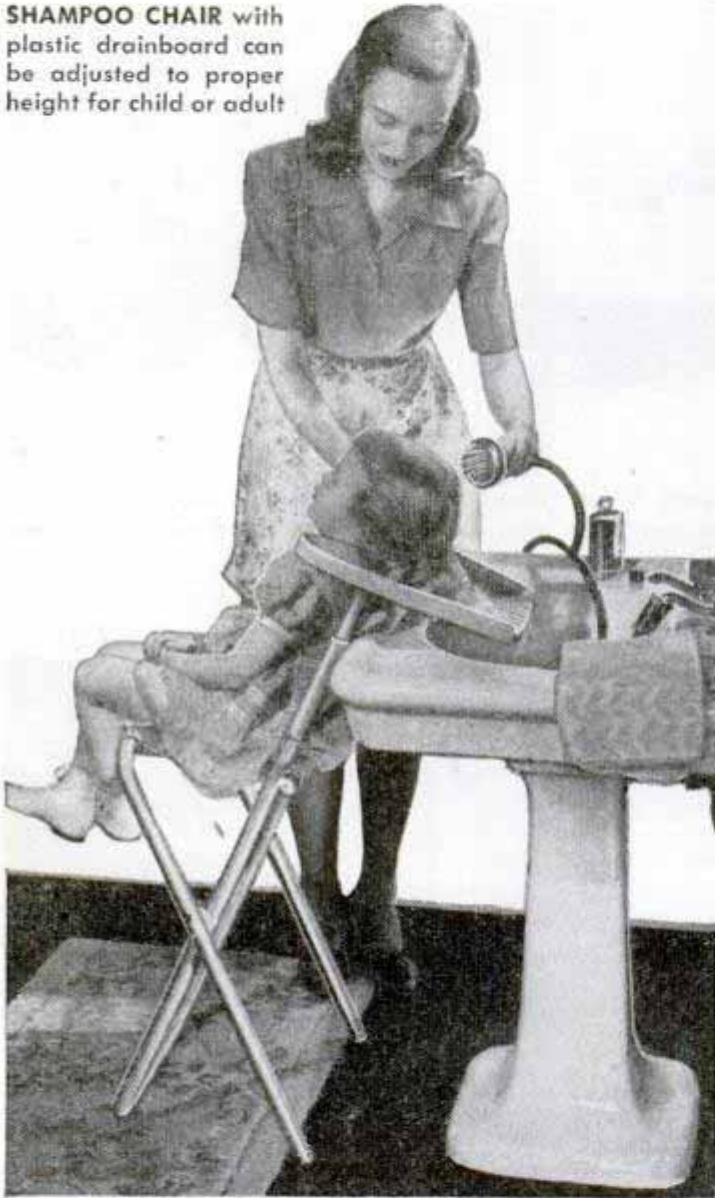


The strange-looking car below and with closeup of the driver's cockpit at right was found at the Daimler-Benz plant in Germany. It has a 3000-hp. engine designed to give it a top speed of 450 miles an hour



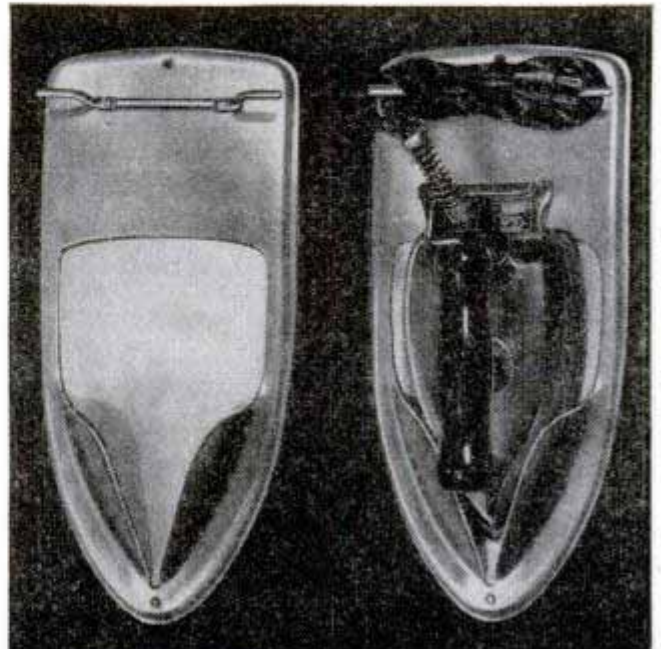
WHAT'S NEW *For Your Home*

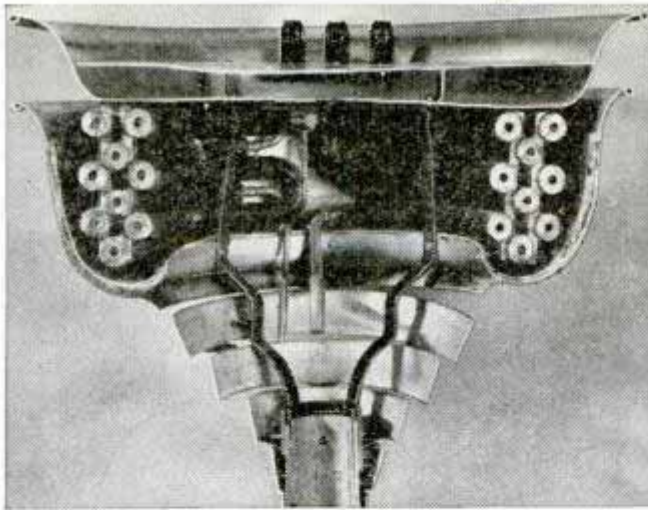
SHAMPOO CHAIR with plastic drainboard can be adjusted to proper height for child or adult



COMBINATION HASSOCK and record holder has dustproof storage for phonograph records

IRON HOLDER attached to wall keeps irons out of children's reach. The holder is fireproof





AIR CONDITIONER AND FLOOR LAMP are combined in one unit. Dome louver contains air inlet and outlet



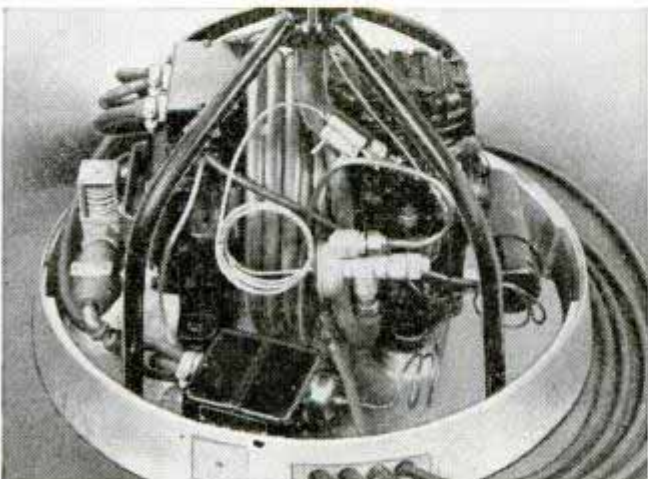
WINDOW WASHING DEVICE with adjustable elbow and arm enables woman to clean panes from inside



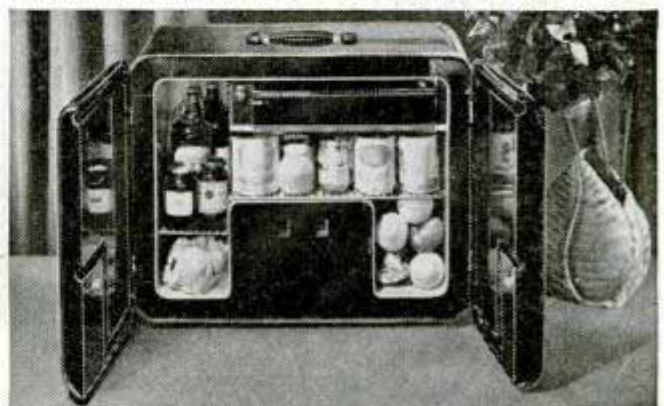
BASE contains condenser, 1/2-hp. motor and controls



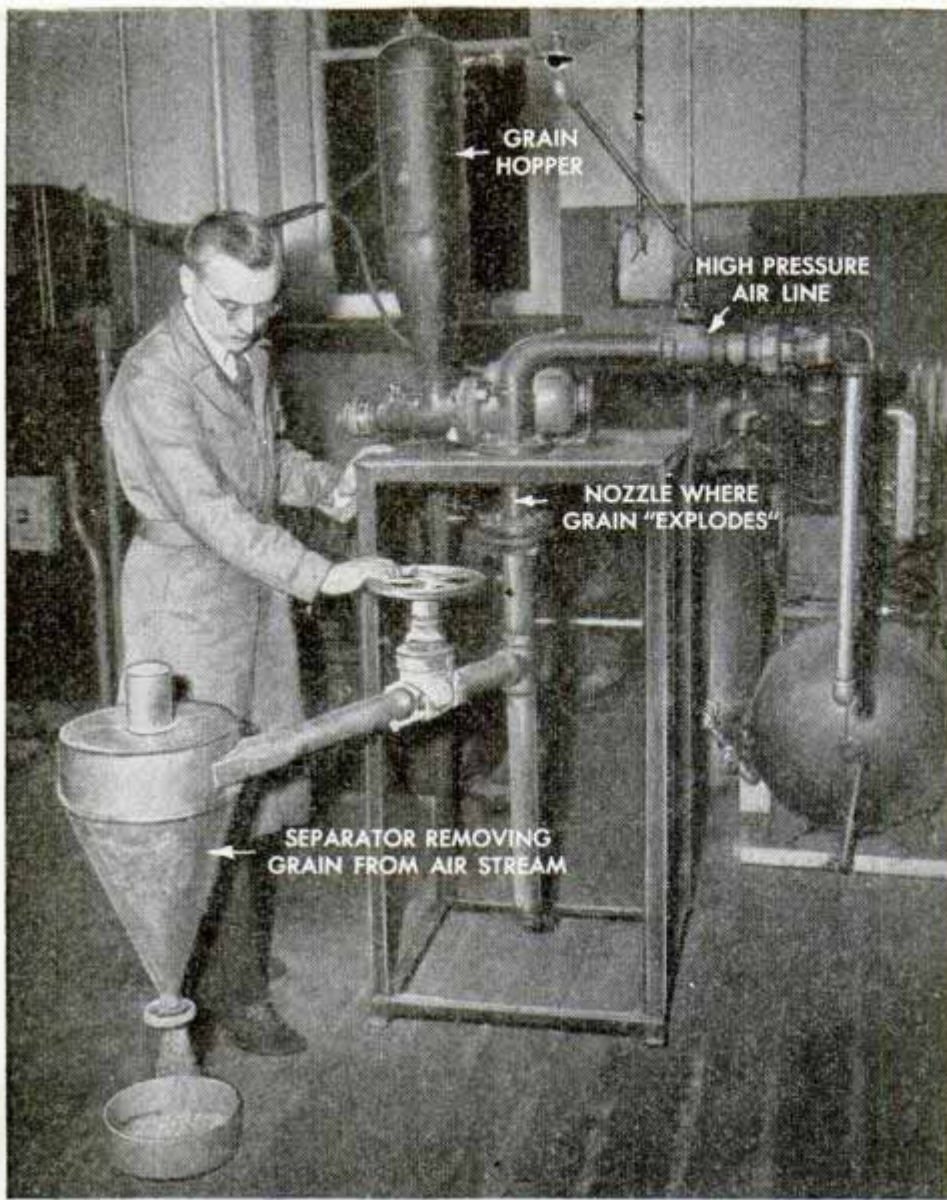
BATHTUB SEAT is anchored by suction cups



PORTABLE REFRIGERATOR weighs 55 pounds, is 16 by 22 by 28 inches in size, and operates on a.c. or d.c.



↑ SEE NOTATION ON WHERE-95
- AND IT SHEET IN FRONT

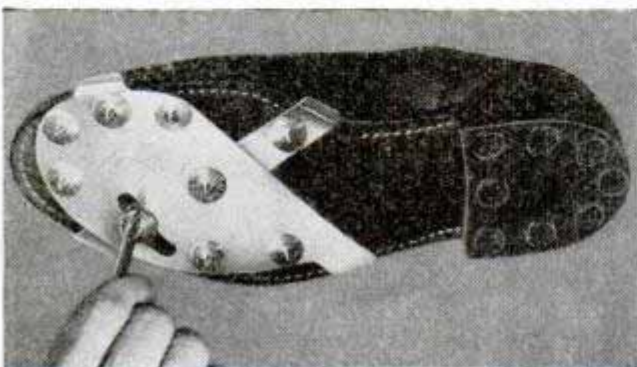


Grain fed through a nozzle within a pipe is shattered by the release of air pressure within the pockets of the grain. The results (right) reveal a sorghum berry (top) popping from its husk, and an oat berry emerging

CEREAL GRAINS ARE EXPLODED BY COMPRESSED AIR

Compressed air or other gases are used in a new method to explode cereal grains in the preparation of flour. Grain, under pressure, is fed through a nozzle within a pipe and is shattered by the instantaneous release of pressure within the pockets of the grain. Oat hulls can be removed completely without harm to the oat berry. With higher pressure, the oat is split and the

germ removed. With still higher pressures, oats or other grains can be pulverized. The Midwest Research Institute reports that this system offers possibilities of improved milling processes due to the easy separation of the component parts of cereal grains. Wheat flour, for example, can be made free of germ, a difficult procedure with conventional milling methods.



Clamp-On Golf Cleats

Cleats attached like skates, by twisting a key, convert ordinary shoes into golf shoes. The metal cleat plate is rustproof and adjustable to shoe sizes from 7 to 12. They are adjusted and locked in place at the same time. The cleats are removed easily and can be stowed in a golf-bag pocket, making a change of shoes unnecessary after the game.

Shortest Phone Line

One of the world's shortest telephone circuits is just 15 feet long. It extends from the underside to the cockpit of a big commercial air liner. The phone enables mechanics and flight engineers or pilots to talk back and forth despite engine and airport noises when checking last-minute details.

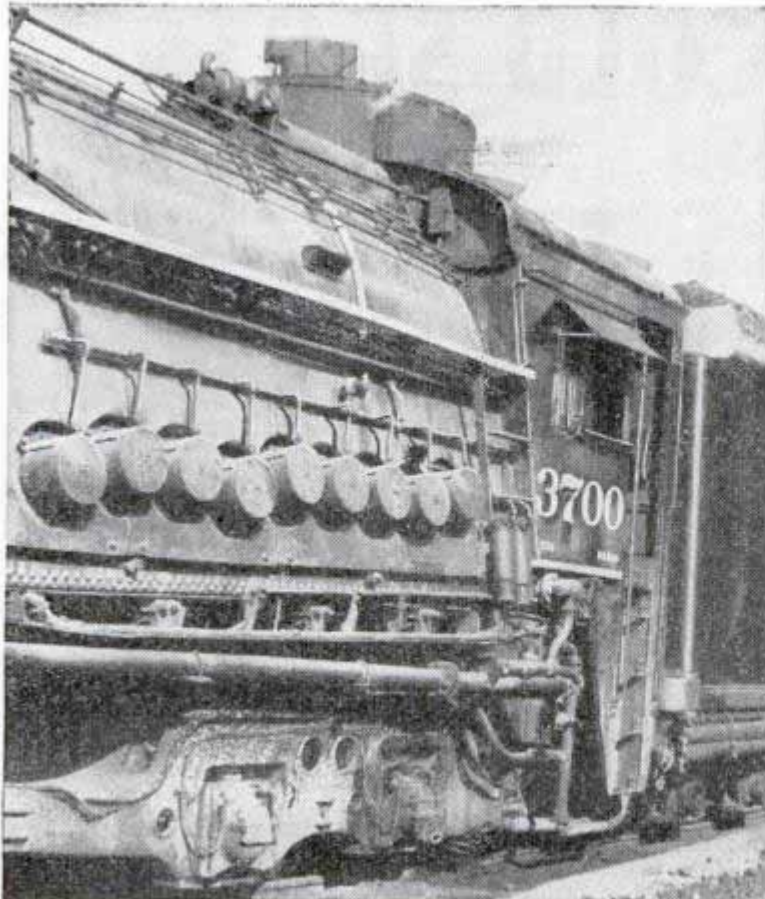
GM Auto Engine of Future Uses One Third Less Gas

Gasoline mileage is increased more than one third by an experimental automobile engine which has cylinder pressure of 1200 pounds per square inch, compared to 600-pound pressure in present engines. Developed by General Motors, the high-compression engine requires a special high-octane gasoline. The engine is designed along conventional lines except that it is rigid enough to stand up under the doubled compression ratio. It weighs about the same, per horsepower, as existing engines. Charles F. Kettering, retired research director of General Motors, says the engine offers a saving of \$1,000,000,000 a year to motorists. On 10 gallons of gas, it will take a car the same distance as 13 or 14 gallons in conventional type engines. Much cooperative



United Air Lines photo

research work by auto manufacturers and the petroleum industry is required before the new engine will come into wide use, Kettering points out.



Locomotive Oxygen "Mask"

Oxygen "masks" increase the efficiency of steam locomotives that pull freight and passenger trains across the Rocky Mountain continental divide between Pueblo, Colo., and Salt Lake City, Utah. The Denver & Rio Grande Western Railroad reports that by piping additional oxygen to the boiler fire at high altitudes, better combustion is produced, efficiency is stepped up and most smoke is eliminated. The oxygen units—called overfire steam-fire jets—have been installed experimentally on 10 locomotives.

Sprayed Ice Trays Won't Stick

Ice trays and packaged foods won't freeze to refrigerator compartments sprayed with a chemically treated liquid. It is harmless, odorless and won't injure foods or liquids. A 2½-ounce bottle will service the average home refrigerator about six months.



Air Proving Ground Command photos

65-below-zero weather makes retractable gears, like this B-29 nose wheel, work about 60 times slower

FLORIDA'S COLD SPOT

IN FIVE MINUTES you can walk from the arctic to a desert, or even a jungle if you like your weather humid. It can almost be done before the hoarfrost that collects on your lashes and brows at 60 below zero completely melts away. And you can experience a whirling sandstorm quite as punishing as the frigid gales you just left.

Those aren't wild thoughts from the pages of a travel folder. It all actually happens beneath a roof in Florida; the realization of the dreams of a man who didn't like to travel.

The place is the Air Proving Ground Command's giant new climatic hangar at Eglin Field, where all the world's weather—from 70 degrees below zero to 165 above—can be faithfully duplicated. The man is Colonel Ashley C. McKinley, now retired, who covered thousands of desolate miles with Byrd and other scientific explorers.

Weary of travel, McKinley argued for years that service equipment could be tested more simply and more satisfactorily

—is also its hottest spot. In Eglin Field's weather factory Air Force technicians give Army equipment the frostbite and blister test at 70 below zero and 165 above

By Aubrey O. Cookman, Jr.

"in our own back yard," and at far less cost, if we'd only go ahead and manufacture our own weather. Fitting out large expeditions is both expensive and bothersome. Often they wait weeks and months for weather conditions suitable for certain tests, only to see them disappear before the work is half completed. Or, if faults are detected and corrections made, there's another season's wait before the item can be tested again.

Eglin's hangar is the answer. A tremendous building, uniquely constructed, it has a main weather room 200 by 250 feet, almost the size of a football field. In addition to that there are eight other specialized test



Pressured air entering "tail" of cooling suit at left, finally billowing out at the face and pants legs, forms protective layer over body for work at 165 above. Right, fur-lined cold-weather garb with face protector

chambers. Within its walls 100-mile-an-hour winds can be whipped up, in combination with sleet, snow, rain, dust and sand, and altitudes up to 100,000 feet have been simulated. A twist of the wrist produces artificial light as powerful as the midday desert sun.

The biggest planes, completely assembled, can be tested in the hangar, even to running up the powerful engines. Foot-wide pipes carry the exhaust gases outside. Helicopters can rise and descend under their own power, while nearby planes at the same time may be dropping dummy bombs or firing live shells. Trucks and tanks can run through their operational tests on a 14-foot-wide track extending 300 yards around the hangar's perimeter.

Eglin is no stranger to this kind of assignment. Its inhabitants have long been respected as the Army Air Forces' prize "fault finders." Whenever a new piece of equipment is under consideration it's sent to Eglin to determine its operational suitability—and frequently the answer is "no." This testing extends well into the tactical realm, for it was here that Doolittle's Tokyo raiders and the B-29s went through their first rehearsals. Eglin's 800 square miles

offer plenty of space and privacy for the most extensive secret maneuvers.

The "weather" is generated by three 2250-horsepower Freon 12 refrigerating units, a steam heating plant and a series of heating and cooling coils in the air-delivery systems. Cooling poses the toughest problems, taking 36 to 48 hours to bring the big room down to lowest temperatures.

One interesting phenomenon already noted is the long "cold soaking" period required, sometimes as much as 72 hours, before big objects are thoroughly chilled down to the temperature surrounding them. Also, organic materials and plastics change composition as the thermometer soars or plunges. Cold's slow-down effect on machinery is typically illustrated by an airplane landing gear, which normally retracts in three to five seconds but takes three minutes at 65 degrees below zero.

Although cold is generally thought to stimulate appetite, studies of workers in the indoor arctic show they don't eat well and some even lose weight. They are also more susceptible to colds, though inclined to shake them faster than the average.

The hangar's insulated floor, strong enough to bear a 300,000-pound airplane,

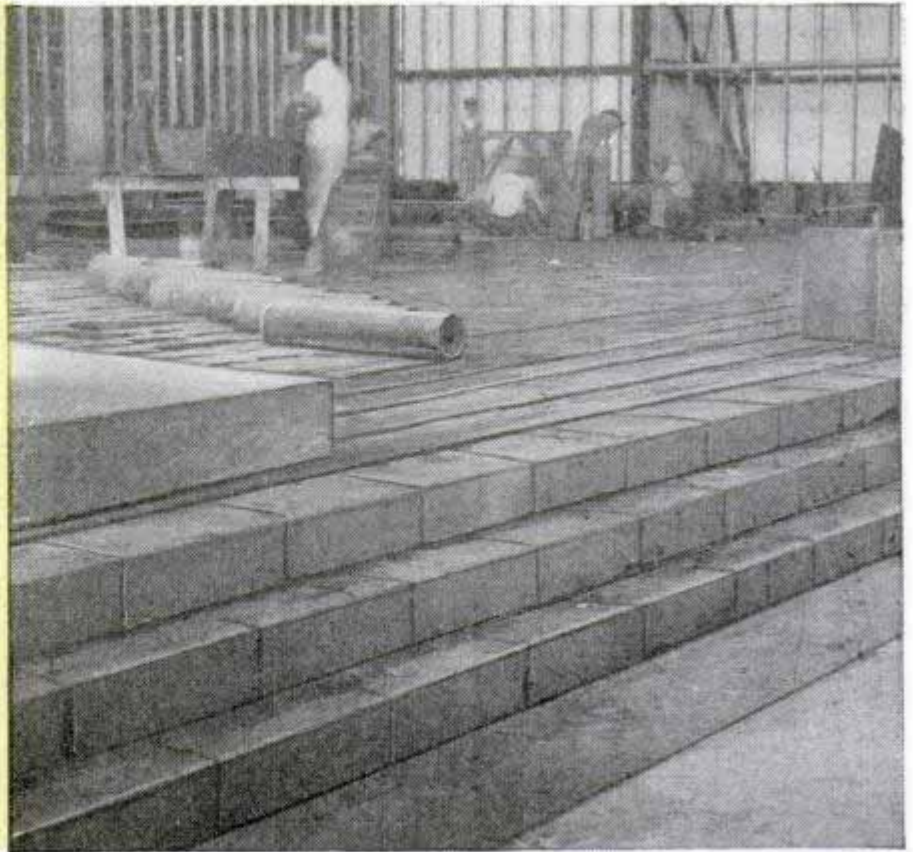
With the extreme temperatures involved, floor insulation was one of the knottiest problems. This construction cross section shows how it was finally done

Top layer is 12-inch thickness of concrete in 12½-foot blocks

Next comes a half inch of felt

Then there are three five-inch-thick layers of cellular-glass blocks. Each has asphalt binding and all the joints are offset

Under ¼ inch of felt are eight inches of concrete and 2½ feet of crushed rock at the bottom



is 5½ feet thick from the bottom of its crushed rock base. The top layer is 12 inches of reinforced concrete. Then come three layers of five-inch cellular-glass block, vapor sealed at top and bottom with a half and a quarter inch, respectively, of roofing felt. Underneath are an eight-inch slab of concrete and 2½ feet of crushed rock. Copper flashing in the concrete near the surface, topped with an inch of mastic fill, allows expansion and contraction with temperature changes and prevents water from seeping into the insulation.

Three sides of the hangar are mainly

insulated with 13 inches of glass-wool board, interlaced with wood reinforcements and a layer of coated asbestos. Air spaces on either side separate the insulation from steel sheeting that forms inside and outside walls. Tiny pet cocks at floor level are opened periodically to drain off condensation in the air space.

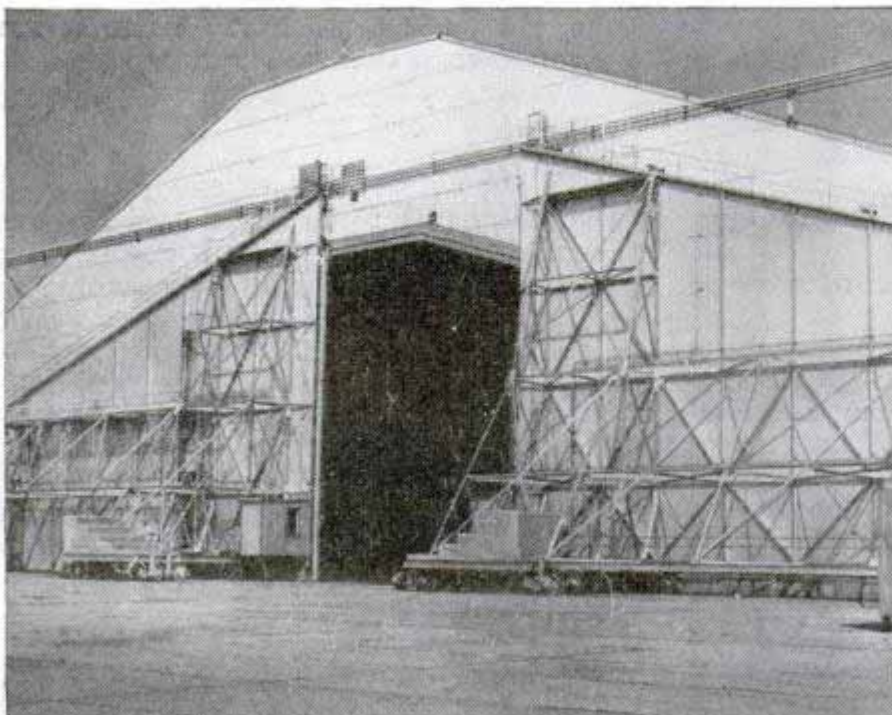
The fourth side has 200-ton doors that operate on rails 25 feet wide. After they close, another mechanism pulls the upper part of the door about six inches closer to the hangar, allowing sponge-rubber gaskets to form a tight seal around the opening.

A cam forces rubber pads at the bottom of hangar doors against the floor. Despite their bulk, the doors can be driven closed in seven minutes.

In the wall opposite the hangar doors are five gun ports, which can be opened for firing onto an adjacent range. Surrounding these and all other openings are electric heater strips to prevent them from freezing tight during cold tests.

The ceiling is built on a corrugated-steel deck, hung from the trusses by

After the 200-ton doors slide closed, another mechanism seals them tightly against the hangar



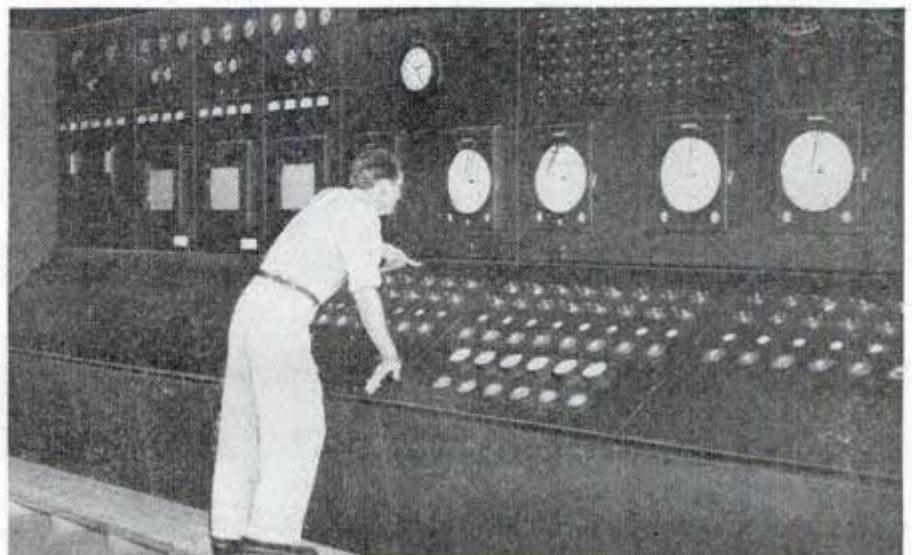
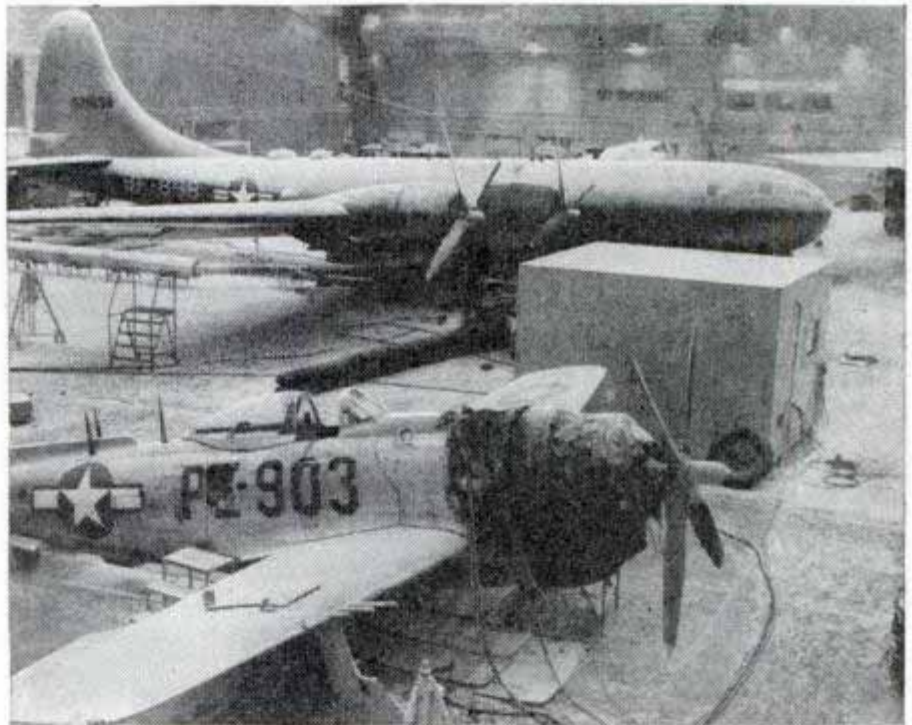


Mechanic examining effects of extreme cold on idler wheel of M-24 tank. Below, a P-47, mobile observation room and a Superfort occupy a small part of the huge hangar's 200 by 250 feet

chains. Heat transfer through it is small, since the chains are practically the only members piercing the insulation. The chain support also allows the ceiling to be semi-flexible to better adjust to thermal expansion.

Along the center line of the hangar is a pit 80 feet long, 10 feet wide and 9 feet deep for testing bomb racks and release mechanisms. The dummy bombs fall into the sand at the pit's bottom. High up on two sides are observation rooms, with multipaned glass windows that won't fog. Twenty feet square and equipped with microphones connecting into the hangar, the rooms are control centers for testing activities. Two mobile air-conditioned chambers, the larger 10 by 13 feet, can be moved

(Continued to page 260)



One "weatherman" who is never wrong. He controls climatic conditions in Eglin's big hangar



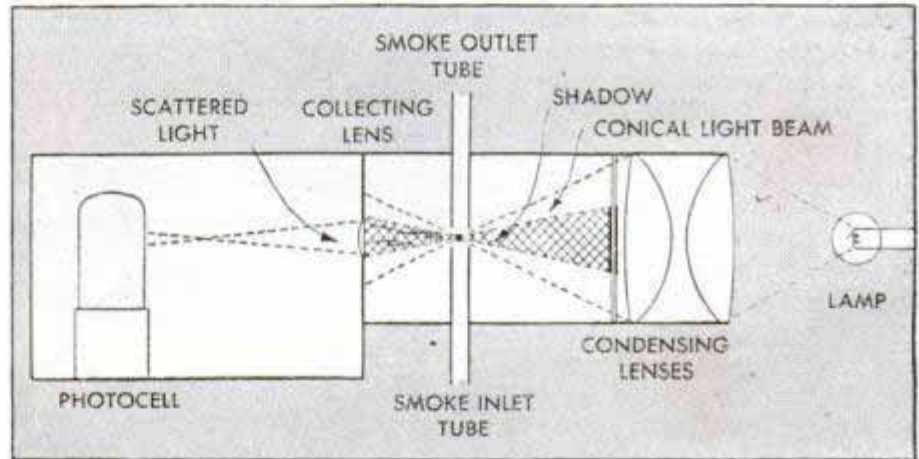
Plastic Glue Supports Jeep

Strong enough to support the weight of 160 jeeps, a new plastic glue withstands temperature changes from 60 degrees below zero to 300 above. The glue, reported to be 15 percent stronger than the strongest glue previously produced, hardens at room temperature and with exertion of high pressure. These characteristics make it ideal for many manufacturing processes where the use of ovens and presses is impractical. Two Westinghouse chemists developed the glue by "juggling" the ingredients of similar glues used during the war. The addition of oxygen and hydrogen atoms gives the glue its unique properties.

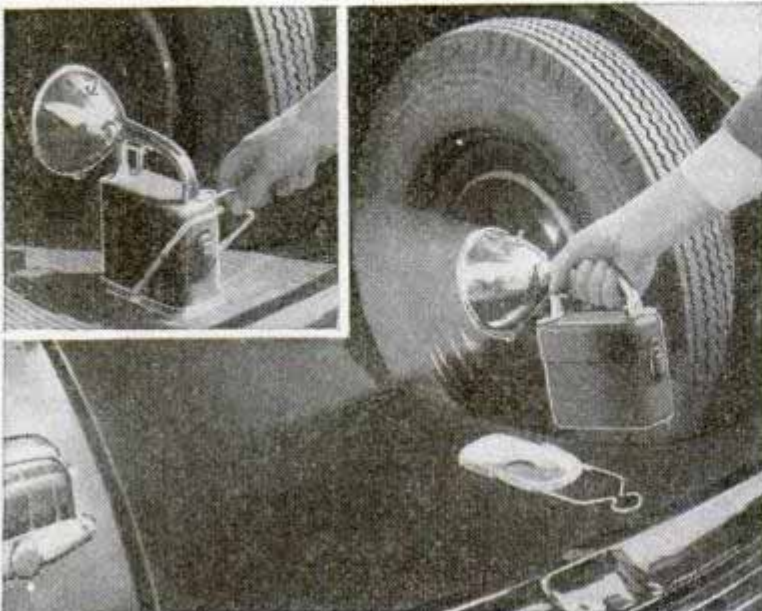
Striped block, made of two pieces of wood glued together, lifts a 2500-pound jeep

Bacteria Counted By Electronics

Smoke particles and bacteria as small as .000025 inch in diameter are counted automatically by a photoelectric instrument developed at Northwestern University. The counter makes its rapid calculations by translating into tiny electric pulses the light scattered by microscopic particles. Suggested uses for the instrument include testing contamination and detecting dust in factories which manufacture



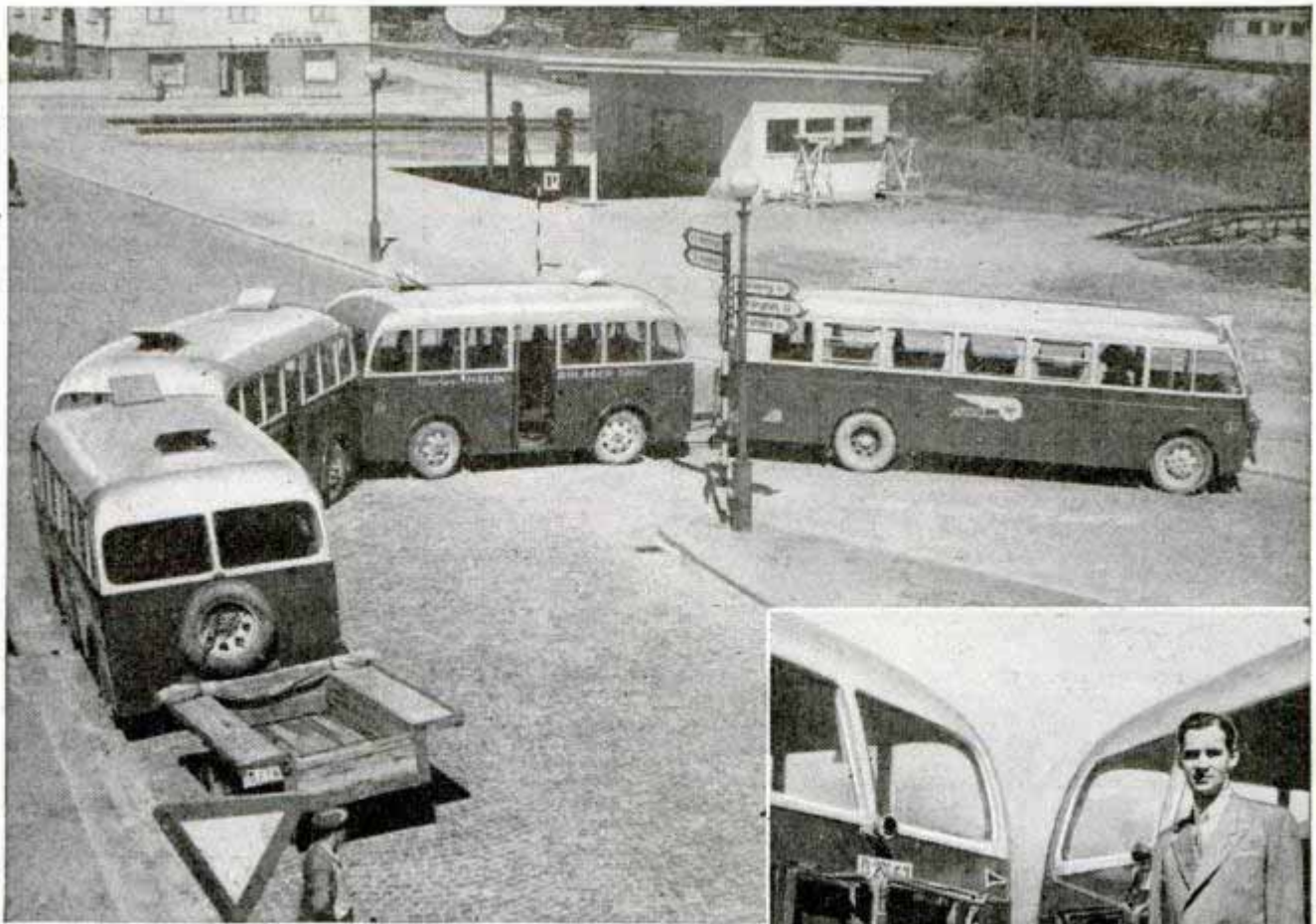
photographic film and optical instruments. Also, it will be useful in the production of penicillin and streptomycin.



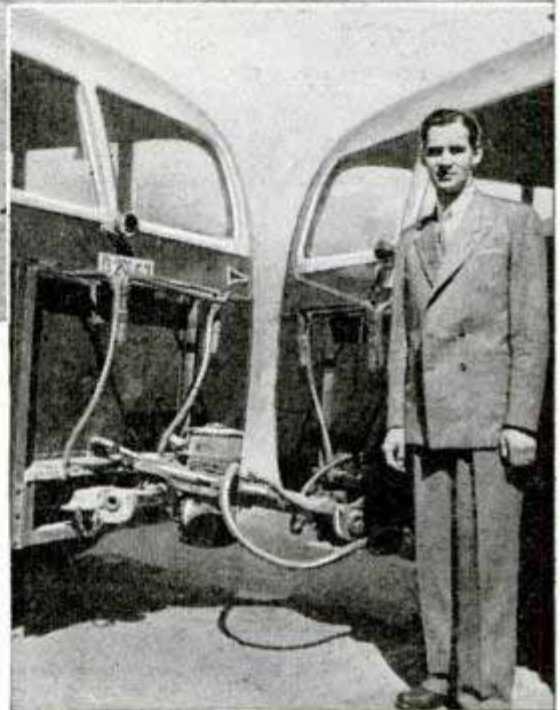
Spring Holds Portable Lamp

Light beams are thrown 1500 feet by a portable electric hand lamp that has a hold-down accessory to fasten it securely in auto trunks, boat prows or any flat surface. The lamp can be removed from the fastener by lifting a spring lever. Powered by standard dry cell batteries, it has main and auxiliary bulbs with a focus adjustment for spot or spread light.

☐ Fireproof fabrics designed for hotels, night clubs and schools are being woven of very fine glass fiber and flameproofed cotton yarn in a variety of colors.

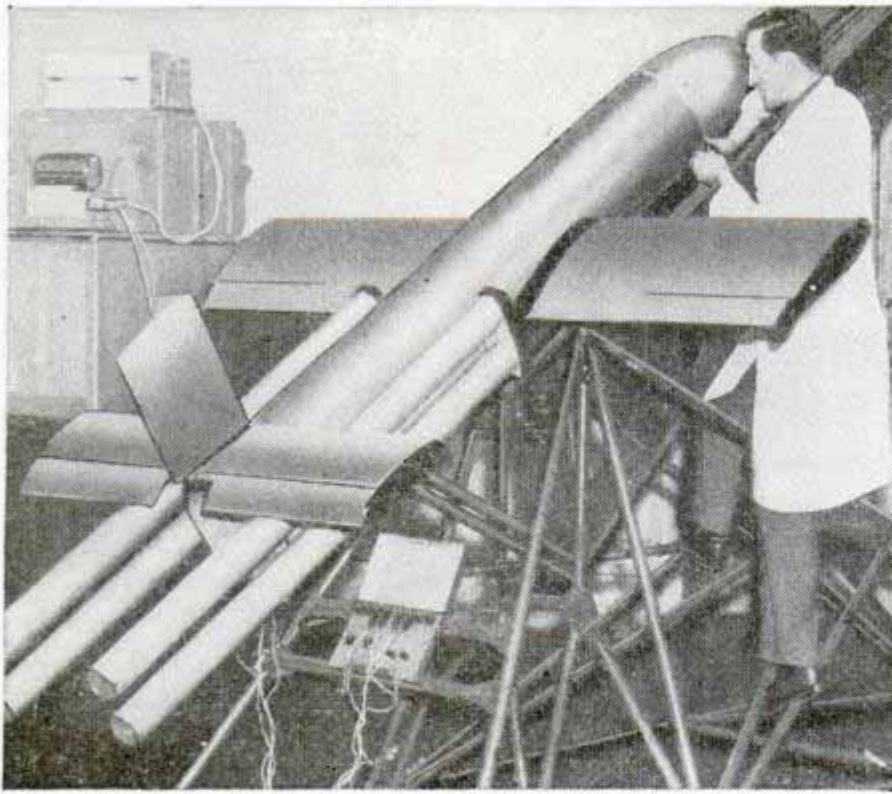


Gunnar Marden, Swedish engineer, stands beside the four-wheeled steering apparatus he developed for bus trailers. As a result of this mechanism, several trailers filled with passengers are pulled and steered by one bus. If the bus driver turns his steering wheel to the left, the direction change is transmitted immediately to the trailers' four wheels



SWEDISH BUS TRAILERS

Three or more passenger trailers are pulled and steered by a single bus in a highway-train system (see cover painting) now operating in Sweden, Denmark and Norway. An automatic, four-wheeled steering device makes it possible for a bus and attached trailers to travel at speeds up to 60 miles an hour, negotiating bends and S-curves with ease. The trailers, each with a seating capacity of 26, are hitched to the parent bus or preceding trailer by a single ball-bearing-socketed arm which is connected to the steering system. Each trailer has four-wheel hydraulic brakes, plus an inverted vacuum braking system which assures immediate application of brakes if a coupling breaks while the train is in motion.

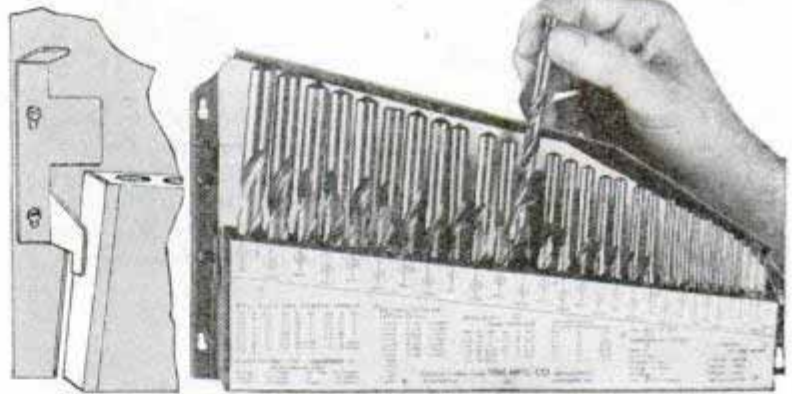


Radio-Guided Rocket Goes Over 500 M.P.H.

Britain's first pilotless radio-controlled rocket, the "Stooge," travels over 500 miles an hour within its eight-mile range. Originally designed to combat Japanese suicide bombers, the missile is also regarded as an effective weapon against planes carrying atom bombs. The cylindrical fuselage is 7½ feet long, has a 6-foot-10-inch wing span and weighs 738 pounds. It is propelled by eight rockets. The only control surfaces are elevators and ailerons. Tests have indicated that a rudder is unnecessary.

Metal Case Holds 29 Drills

Twenty-nine drills from ¼ to ½-inch are held by a metal drill case equipped with a built-in lock opened by finger-tip pressure. On the face of the case are tables listing drill sizes and angles, melting point of various metals and similar data. The case can be hung in a convenient position on a wall or placed upright on a bench or toolbox.



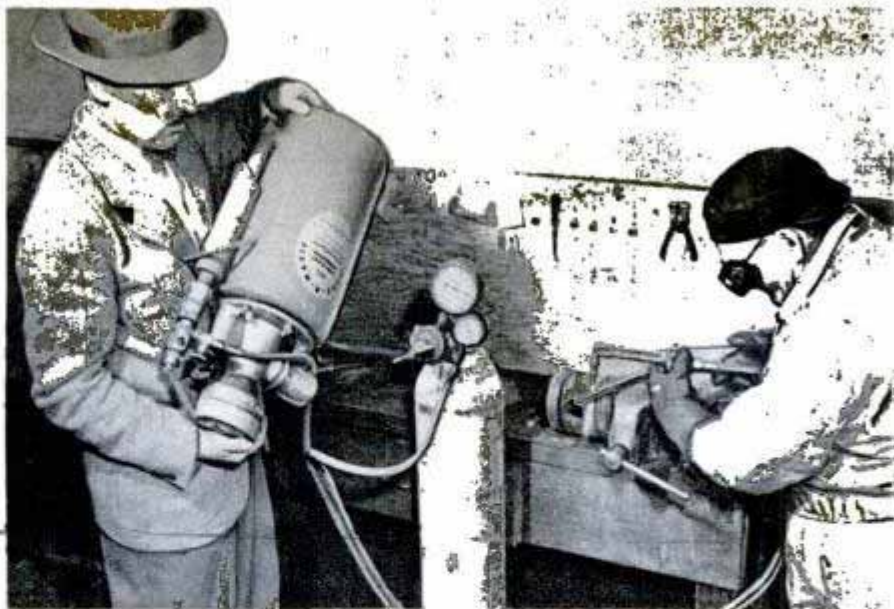
Passengers' Cars Carried on Train

Passengers on the Chesapeake & Ohio Railroad's run between Washington and Cincinnati can take their automobiles with them. An extra car with room for four autos is coupled to both westbound and eastbound passenger trains. The autos are loaded into the auto-car by ramp.

Information, including manufacturers' names, concerning products described in this issue may be obtained by writing Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11

Explosion-Proof Gas Generator

Internal baffles in a new portable acetylene-gas generator prevent water from reaching carbide when the unit is tipped over and thus eliminate the danger of explosion. Due to gravity feed, carbide is not fed to the gas-water chamber when the tank is on its side. This feature enables the operator to carry a 37-pound unit in any position without worrying about an explosion.



Handmade Sport Roadster

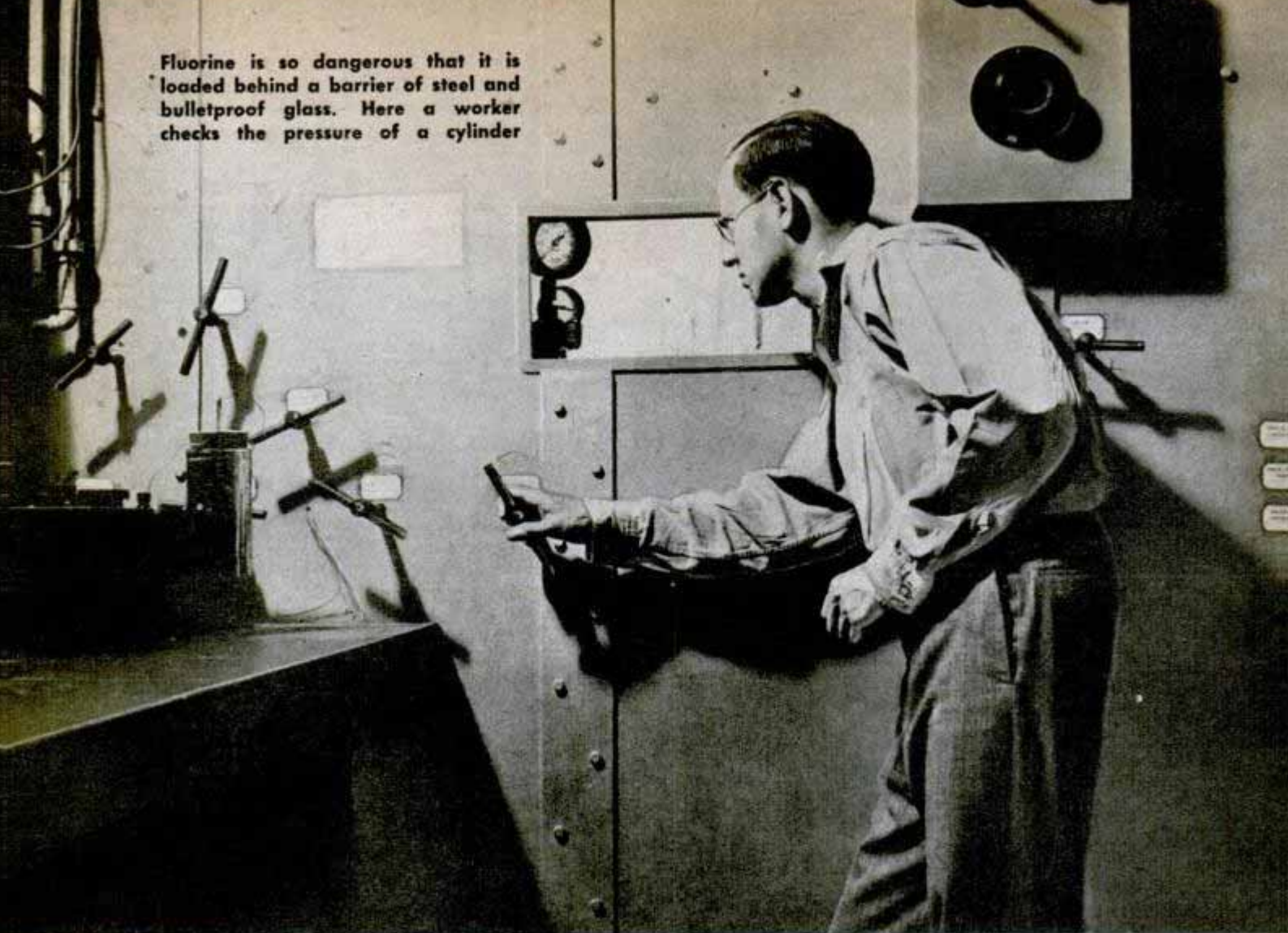
Designing and building his own sport roadster kept one ex-Air Forces pilot busy while he convalesced from combat injuries. Stock parts were used when they matched the design. Others were manufactured as necessary. The engine is a Mercury block with high-compression heads, dual manifolds and carburetors, and high-lift camshafts. Headlights are concealed behind the radiator grille. The top edges of the doors have been upholstered to serve as armrests. In bad weather a close-fitting top gives protection.

False Bow on Tug Fits It for Ocean

To enable a relatively small towboat to make an ocean voyage from Pittsburgh to Buenos Aires, the Dravo Corporation welded a false steel bow to the craft to absorb the shock of rough water. The craft was sold to the government of Argentina and made the trip from Pittsburgh by going down the Ohio and Mississippi Rivers to New Orleans, across the Gulf of Mexico, and down the east coast of South America. During the voyage it towed four barges.



Fluorine is so dangerous that it is loaded behind a barrier of steel and bulletproof glass. Here a worker checks the pressure of a cylinder



Pennsylvania Salt Manufacturing Co. photos

"BAD MAN" OF THE ELEMENTS

THEY'RE a tough family, the halogens. To chemists they've been powerful and unpredictable. Those famous gangster elements, chlorine and bromine, have been tamed only a short time. And today the most vicious member of the family—fluorine—has become a useful element.

For centuries chemists have been trying to put fluorine to work. The element is so dangerous that when combined with hydrogen it forms hydrofluoric acid, one of the most powerful and destructive reagents known to science.

Today, after years of heartbreaking experiments, science has transformed this bad man into a hard-working citizen. Now fluorine is an important ingredient of insecticides, plastics and refrigerating liquids. In its pure or elemental form, fluorine is used to make such materials as brilliant dyes; lubricating oils that won't oxidize; a gas that is nearly perfect insulation against high voltages; better fungicides; improved fumigants; solvents; fireproof-

By Eugene W. Nelson ing materials, and resins.

Fluorine's conversion from devil to angel has taken place within the past few years. This colorless, heavier-than-air gas with a highly irritating odor ranks twentieth in abundance among the elements.

From 1670 until 1886, some of the most brilliant minds in chemistry wrestled in vain with the problem of isolating pure fluorine. It remained for an obscure French chemist, Henri Moissan, to solve the problem. In 1886 he succeeded in isolating it by the use of the electrolytic process.

Today, after numerous false starts, a practical method for mass production of elemental fluorine has been perfected. Fluorine gas is being produced in a specially designed electrolytic cell which contains potassium fluoride and hydrogen fluoride. The temperature is maintained at 100 degrees Centigrade. As the electrolysis proceeds, both hydrogen and fluorine gases are produced. A special device prevents the two gases from combining for if they did

they would explode with such violence that the fluorine plant might disappear.

One big problem which faced the fluorine research men when they first attempted to market the pure gas was the production of a suitable container for packaging the diabolical stuff. Both steel and copper resist the corrosion caused by contact with fluorine gas at normal temperatures, but detailed research was necessary before suitable gasket material was developed to insure leakproof containers. When marketing the gas, only a small amount of fluorine is packed into each cylinder—about one half pound in a metal cylinder at 400 pounds pressure.

This pure fluorine has weird properties. Its atoms are extremely sociable. They rush to find chemical friends. In their hurry they often destroy other materials which we have always considered highly durable. For instance, silicon combines with fluorine to form a gas. Fluorine also has a much greater attraction for hydrogen than does oxygen.

So when a cylinder of pure fluorine gas is opened, glass, asbestos and rock disappear in puffs of smoke. They are all compounds of silicon and therefore unite easily with fluorine. If the jet of elemental fluorine is played over the surface of a pan of water, the water bursts into flame. This is because fluorine takes the hydrogen away from the oxygen. The energy set free by this unusual chemical reaction appears as flame. In like manner, heated steel goes up in smoke and wooden splinters blossom into flame.

Because elemental fluorine is so tricky, its sale at present is limited to experimental plants and laboratories where it will be handled by experienced men.

Although pure fluorine in large quantities is new, "mass production" fluorine

FLUORINE MAKES THEM ALL BURN



STEEL



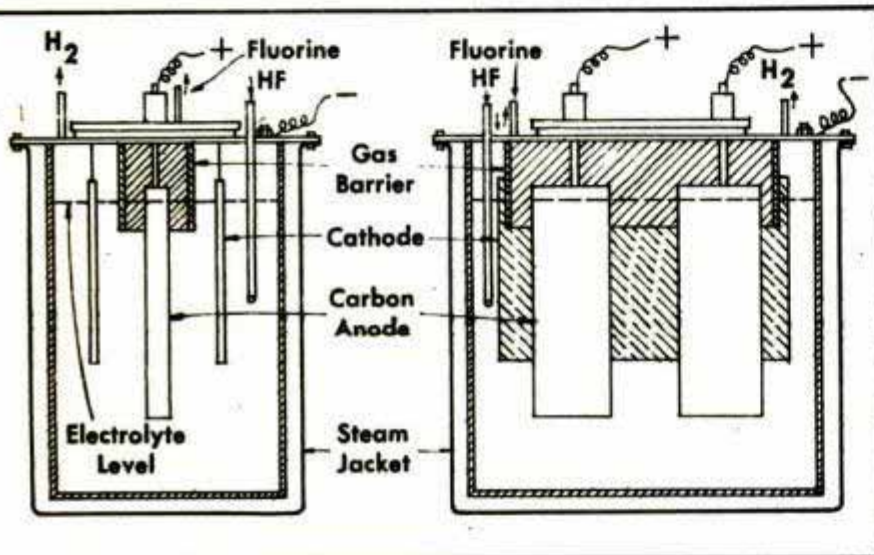
ASBESTOS



EVEN WATER

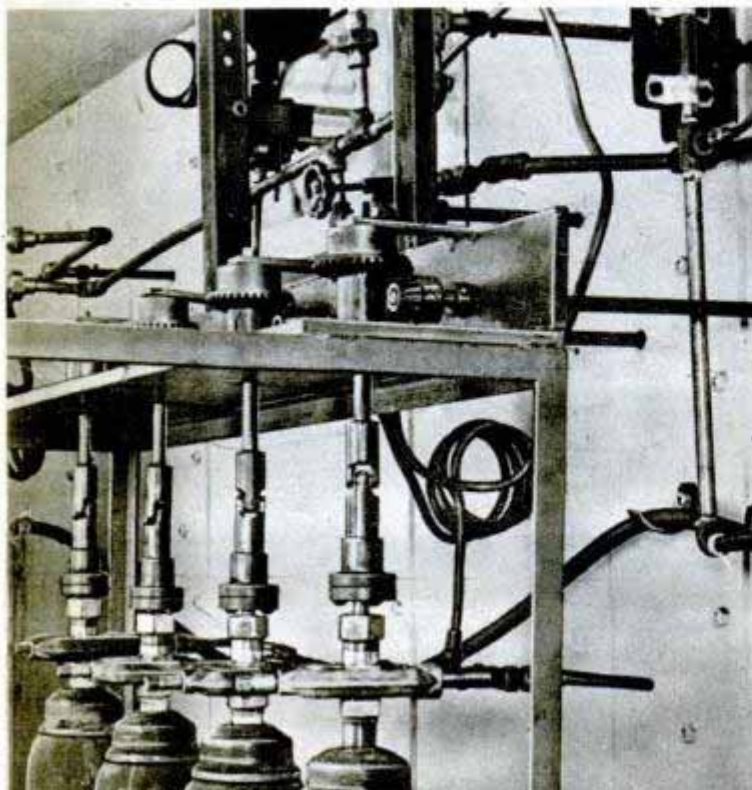


Recently developed electrolytic cell finally makes possible the separation of pure elemental fluorine



Courtesy Pennsylvania Salt Manufacturing Co.

Diagram shows how cell produces hydrogen and fluorine. Gas barrier prevents explosion. Below, into these cylinders is pouring the most active element known



compounds have been put to work for some time. Fluor spar (fluoride of lime) is the principal fluorine ore. It is a beautifully clear, crystalline mineral, often delicately tinted in pastel shades. Its appearance gives no indication of the demon lurking inside.

Fairly large deposits of fluor spar are found in Illinois, New Mexico, Kentucky and a number of other states. Its abundance is fortunate because from six to eight pounds of fluor spar are added to every ton of steel produced by the basic open-hearth process. This small addition of the mineral speeds the purification of the melt, saves fuel and produces a better grade of steel.

In preparing the enamels that have transformed our kitchens into "show rooms," large amounts of fluor spar are used annually. The fluor spar lowers the melting points of the other ingredients used in the enamel and helps give a high gloss to the finished material. Fluor spar also gives toughness and durability to structural glass and helps impart an opalescence to electric light bulbs, lamp shades and other lighting fixtures.

When fluor spar is mixed with concentrated sulphuric acid, a gas with a choking odor is given off. The gas usually is absorbed in water to form a concentrated solution of hydrofluoric acid. For a long time, about the only use for this liquid was for etching glassware and as a powerful reagent in making industrial analyses.

Hydrofluoric acid finally came into its own during the late depression years. At that time, intensive research produced a series of complex compounds known as Freons. The most successful Freon was a gas commonly called F-12. Although derived basically from destructive hydrofluoric acid, F-12 is an ideal refrigerant. The development of this economical refrigerant did a great deal toward bringing refrigerators into the average home.

The other commercial ore of fluorine is cryolite, aluminum's partner. This mineral—sodium aluminum fluoride—is the electrolyte material used in the manufacture of aluminum. Greenland is the only known commercial source of the natural mineral. Cryolite was so important during the war that special convoys were provided to transport it from the Greenland mines to the United States.

Now that elemental fluorine can be supplied in quantity, what is the future of this reconstructed rebel element? It's plenty

(Continued to page 260)



Motor Scooter From Scrap Parts

Using only salvaged parts and scrap metal, G. G. H. Lentz of Fredericksburg, Tex., has built an efficient and practical motor scooter. As he had no welding equipment available, all the parts of the machine are riveted or bolted together. The frame is made of scrap bedstead angle beams. The front wheel is cushioned by a coil spring and the rear wheel by multiple-leaf springs. Tires and wheels are AAF war surplus and the engine came from an old washing machine. Grille and trim were taken from an old cookstove reservoir.

Race Track Soil Sifter

Surface soil at Hollywood Park, Calif., is screened by a huge machine which removes rocks and other debris that would injure horses' hoofs. The screener follows a scraper and picks up the loosened soil, carrying it to the top of a chute. The soil then goes through a sifter and is deposited in a long row to be spread across the track by harrows.

Weight of self-sealing airplane fuel tanks has been cut 40 percent by the Navy's new method of curing and processing rubber.



Telescoping Leg for Typewriter Leaf

Extra support for a desk typewriter leaf is supplied by a metal leg which can be adjusted in the manner of a telescope. A ball-locking mechanism holds the "crutch" at the desired height and rubber pads at top and bottom prevent slipping.





"Gas Tank" Car

Its body made from an Army bomber's auxiliary gasoline tank, a three-wheel car goes 75 miles on a gallon of gas while traveling at 40 miles per hour. Each of the three airplane wheels is equipped with a brake, and the car has automatic shifting and knee action. Norman Anderson, Vernon Servoss and Lester Sworthwood of Co-runna, Mich., who built the auto, plan to mass-produce it to sell at \$350.

Eye for AAF

Objects photographed with a 48-inch-long telephoto lens built for the AAF appear twice as large as they do with present standard 24-inch-focal-length equipment. Developed by Eastman Kodak, the new lens snaps sharp pictures from as high as 10 miles, where a built-in heating system counteracts effects of subzero temperatures. It is a foot wide, weighs 125 pounds and has an f:6.3 aperture. An aerial camera fits on the lens-mount base.



Eastman Kodak photo

↑ Comparing size of giant telephoto lens with one for 16-mm. movie camera



Rear-Engine "Soap Box"

With its 1½-horsepower engine mounted at the rear, a "soap box on wheels," built by 11-year-old Richard Aulerich of Detroit, goes 20 miles an hour and uses very little gasoline. The engine is connected by pulley to a hydraulic device once used with airplane retractable landing gears. This device, in turn, is connected to the car's rear axle by another pulley. Rubber-tired wheelbarrow wheels were used to complete the assembly.

☞ As much as 9000 feet of mud covers some parts of the Atlantic Ocean bottom between New York and Bermuda.



Four-car experimental train, pulled by a Diesel, has a glass-enclosed top deck on each car for all-around view

GLASS-TOPPED Train of Tomorrow

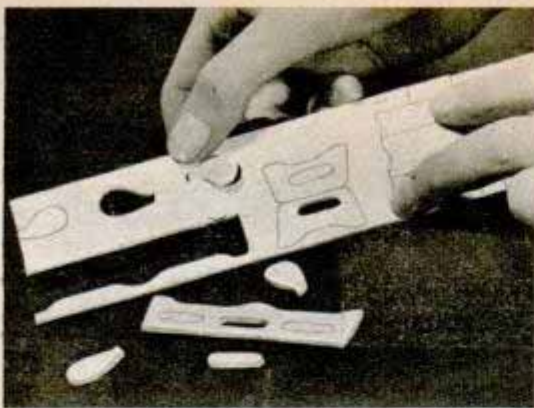
Comfort and entertainment for passengers are stressed in a luxurious four-car train pulled by a Diesel locomotive. The train was built by General Motors to contribute novel ideas toward the improvement of passenger travel. The outstanding feature of each car is the "Astra-Dome" built into the roof—a glass-paneled upper deck where passengers can enjoy an all-around view. The four cars consist of a chair car, sleeper, diner and observation car. Innovations in the new train include train-to-anywhere telephone service while the train is in motion, wire-recorded entertainment, a Diesel power unit for each car and a space-saving arrangement whereby the cars are built on either three or four levels. In the lounge car are 68 seats, more than half of them movable, arranged on four different levels. A suspension system originally designed for locomotives has outside swing hangers to reduce sideway. The train is now on an exhibition tour and will visit 30 leading cities.



"Penthouse" diners eat beneath heat-resistant glass

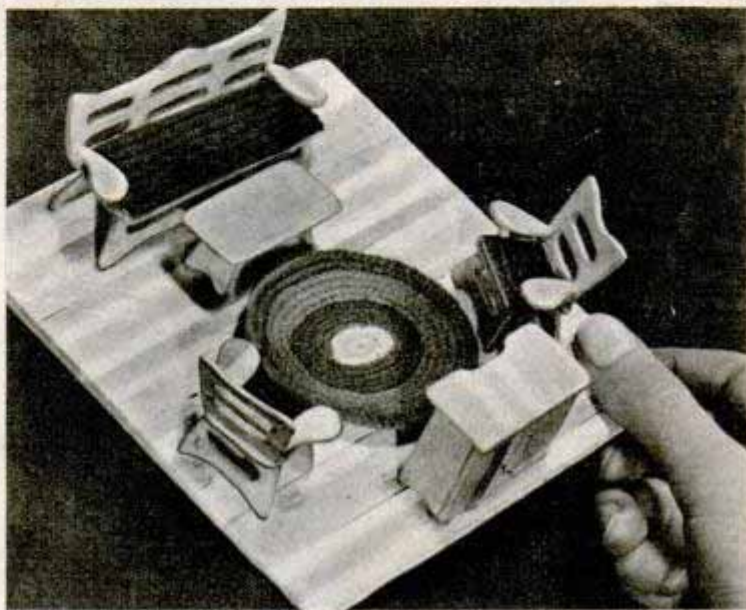
↓ Passengers enjoy a ride under the stars in the "Astra-Dome" of each car. Right, the luxurious observation car is built on four different levels. Note train-to-home telephone and the stairway that leads to the top deck





House and Furniture From Kits

With kits containing pre-cut parts modelmakers can build a miniature replica of a Cape Cod house complete with Early American style furniture. The walls and roof of the four-room house are nailed together. With the inside partitions removed, the entire interior can be seen through the picture window and with the garage attached the house can be used as two birdhouses. Complete furniture for the living room, dining room, kitchen and bedroom is available in separate kits. The parts are glued together and stained or covered with fabric scraps. The scale of the models is one half inch to one foot.



Tractor for Gardeners Weighs Less Than 100 Pounds



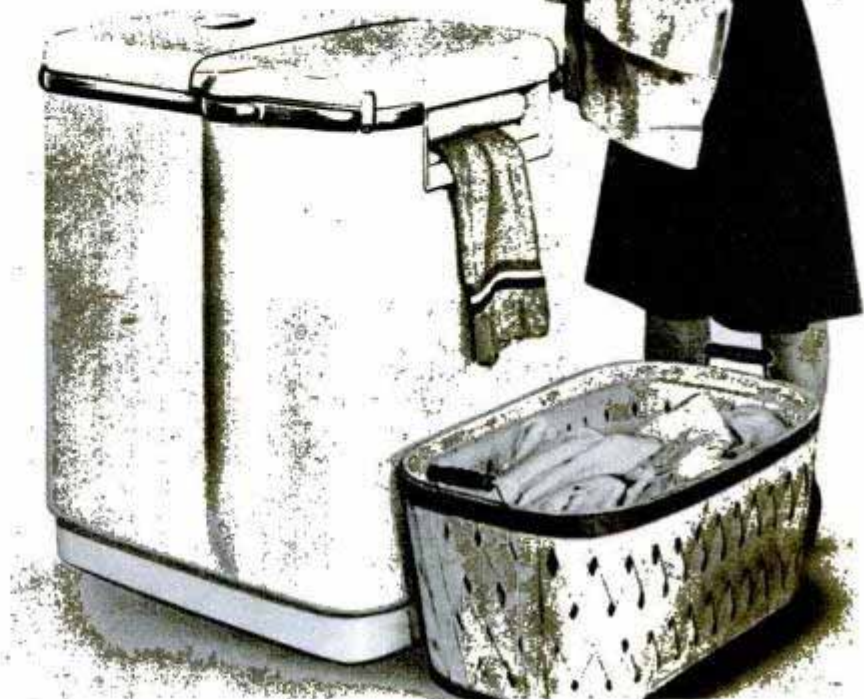
Suitable for gardening or small-scale farming, a midget tractor weighs less than 100 pounds. The tractor is controlled with levers on the handle bars. It has a $1\frac{1}{2}$ -horsepower engine and travels at four miles an hour—approximately walking speed. With the attachments now available the tractor can be used for plowing, furrowing, disking and seeding. Other attachments are being developed to convert the small tractor into a lawn mower or snowplow.

Radio Beam Guides Builders

Radio beams are guiding construction of the world's longest overhead power line on a straight path 600 miles long. Scheduled to be completed by 1950 at a cost of \$20,000,000, the line extends from northernmost Sweden to Hallsberg in the central section. Three thousand hollow 10-ton steel pylons will support the wires.

Automatic Washer Has Separate Units To Wash and Rinse

Separate washing and rinsing compartments in a new-type automatic washing machine permit full use of hot soapy water, thus conserving time, work, soap and water. The rinser floats away loosened dirt and graying particles of soap fat in a shower bath of clean water. The rinsing operation is performed in five steps and takes only three minutes. (1) Clothes travel through suds-extracting rolls; (2) then through penetrating sprays of fresh water; (3) a floating cylinder carries clothes into final rinsing stage; (4) cylinder dips, rinses and flexes clothes while submerged in water; (5) clothes pass through damp-drying rolls and drop into basket.



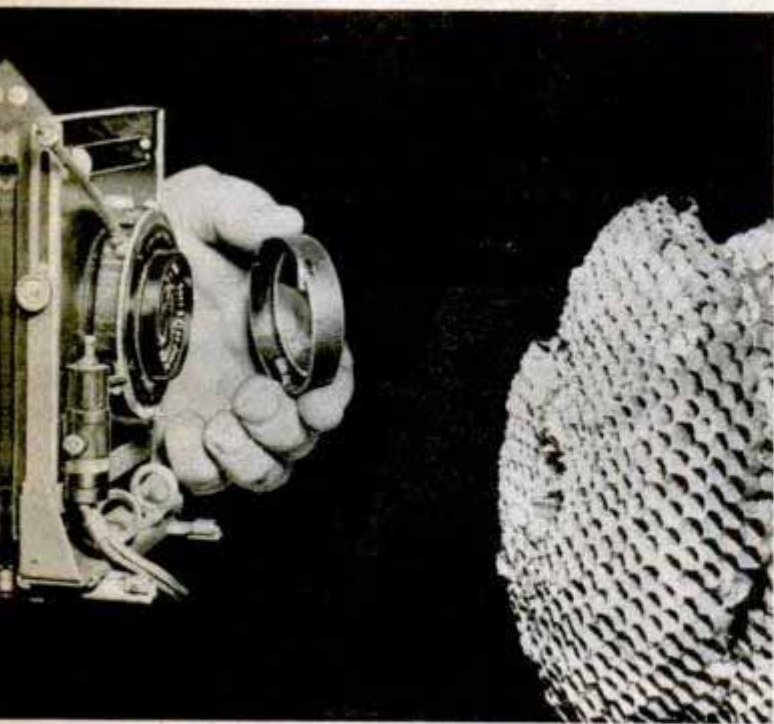
Minnows Ride "Elevator" In Bait Bucket

Minnows are brought to the surface of a floating bait bucket by an "elevator" tray that rises whenever the cover is removed. The bucket, made of Fiberglas impregnated with resin, is a double-cylinder, six-quart container. When it is placed in the water, the inner receptacle is flooded through perforations near the top, creating an air lock above the perforations to keep the bucket upright. Inside the inner cylinder is a sliding tray connected by Nylon cord with the lid. Lifting the lid raises the tray to the top of the bucket where the fisherman can pick up a minnow without searching for it. The bucket will not rust or corrode when used in salt water, according to the manufacturer.

⌘ Aircraft propeller blades could be "pressed out" at a rate of 80 an hour by a huge 30,000-ton hydraulic press discovered in Germany by postwar investigators.



By slicing through a paper-wasps' nest the photographer has bared the layers of paper walls and floors. His flash gun is plugged into a portable battery unit



When photographing an extreme close-up Chace uses an enlarging lens over the camera lens. Here he prepares for an enlarged shot of the cells of the wasps' nest. Such shots always should be made from a tripod

Industrial Photographer of the **INSECT WORLD**

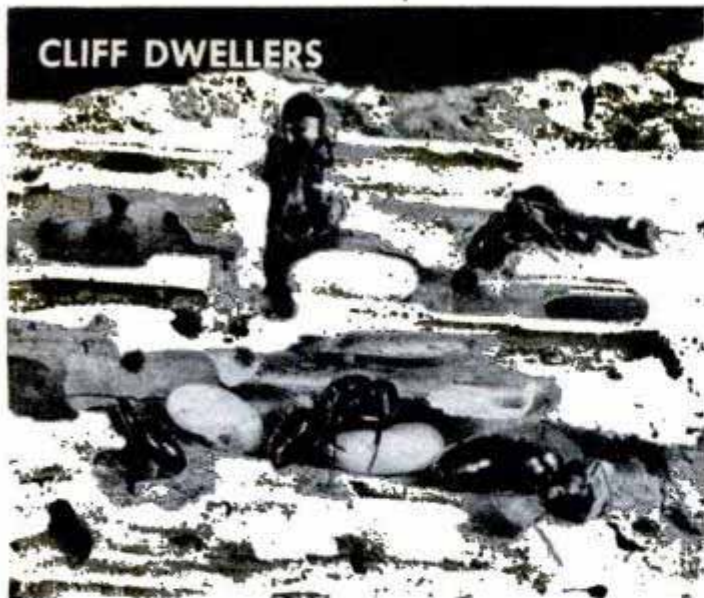
TO THE PHOTOGRAPHER seeking a new field of exploration there's always an exciting picture to be discovered in the insect world.

Exposing the working habits and private lives of weird bugs is like visiting a different planet. You'll find that insects are as businesslike in their jobs as we humans—and much more efficient in many cases.

Insects manufacture paper, spin silk, mix wax, carve wood and tailor their own clothing. The female horntail carries her home workshop with her wherever she goes; part

Insect Engineers

CLIFF DWELLERS



Carpenter ants, among Nature's finest wood carvers, cut their homes in logs with their sharp mandibles

of her job as a housewife is drilling wood.

These creatures have been doing the same tasks for millions of years—man was just a cave dweller long after they'd developed their working habits. Yet few photographers have investigated the wonderful opportunity for shots of insects at work.

Before you can start a camera adventure photographing insect industries you'll need the proper equipment. Mine is tailored to my needs and has been satisfactory for taking many such shots.

My camera is a 4 by 5 Speed Graphic, although any camera with a good bellows extension and a ground glass for focusing can be used. Both of these features are important, as the bellows extension is re-

By Lynwood M. Chace

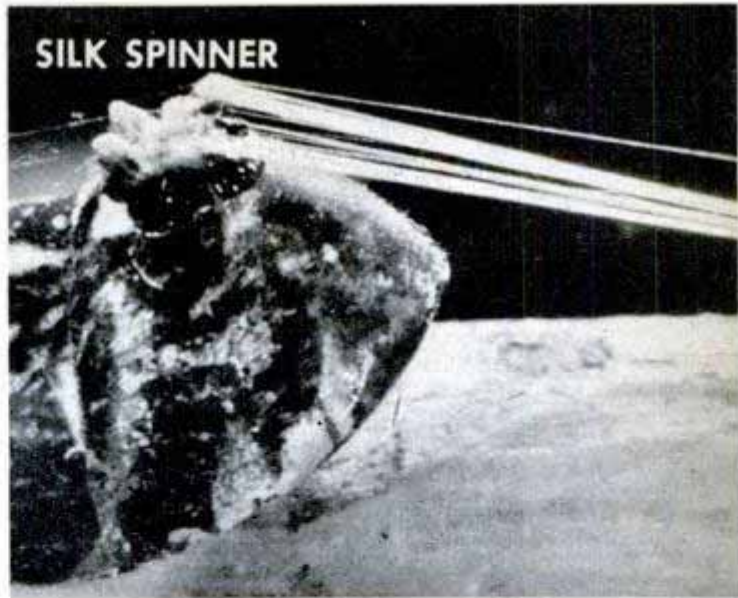
Photos by the Author

quired for extreme close-up work and the ground glass makes possible clean-cut negatives. My lens is a Carl Zeiss Tessar f:4.5, but a good lens of slower speed will be satisfactory for most purposes.

For lighting I use an Everflash with a speed of 1/10,000 second. With it I can stop all motion, which helps when I'm trying to snap these quick-moving subjects. In extreme close-ups with the camera less than six inches from the subject I stop down my lens diaphragm to f:32, which gives the photo great depth of focus. But a high-speed flash isn't essential, as you can get fine results with any type of flash. Before I had a portable speed-flash I snapped pictures with nothing but a mirror for light. Even in woods you usually can find sunlight filtering through the trees which can be reflected to spotlight the subject.

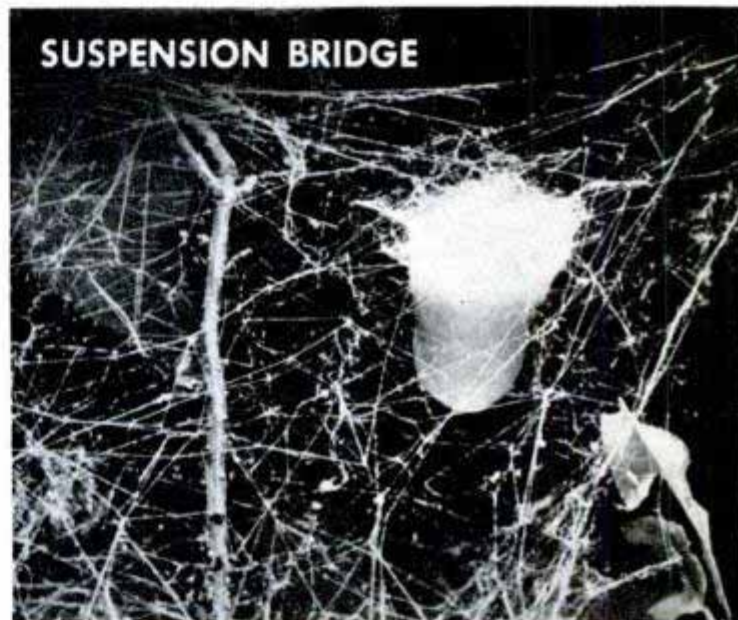
AUGUST 1947

SILK SPINNER



From the spinneret of the spider come fine strands of silk. The "fingers" control the thread's thickness

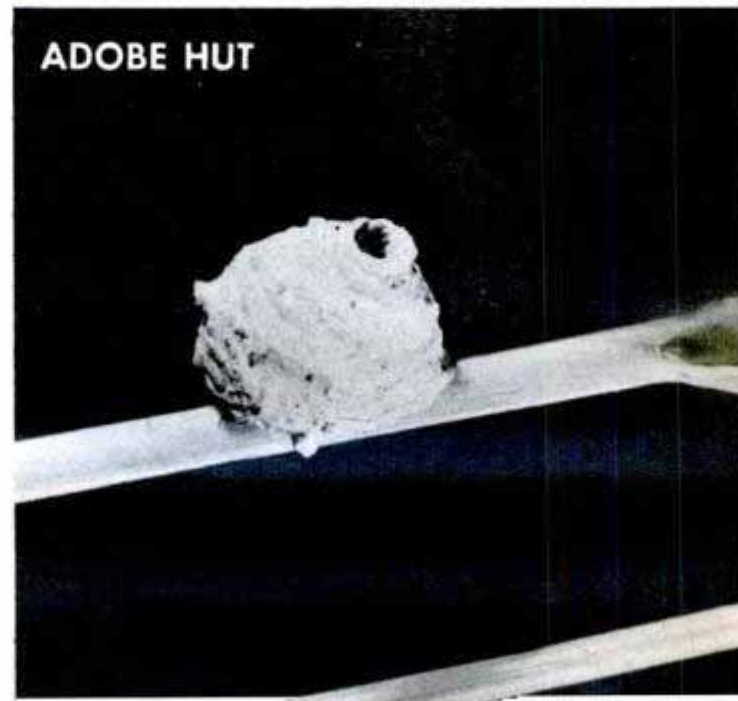
SUSPENSION BRIDGE



Thousands of silk guy lines support a spider's egg sac. The reinforced web will withstand strong winds

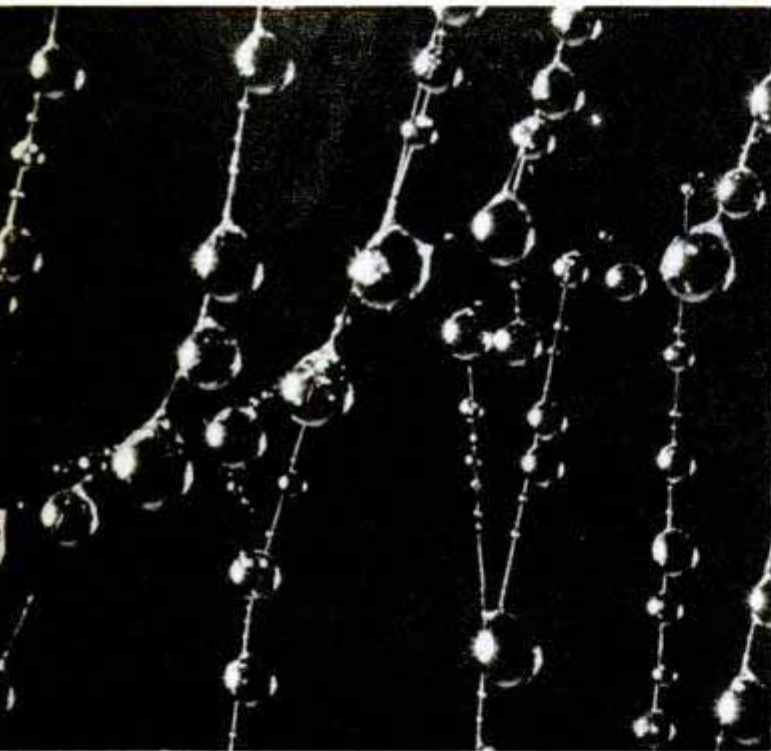
↓ Mud molded into shape becomes potter-wasp's home

ADOBE HUT

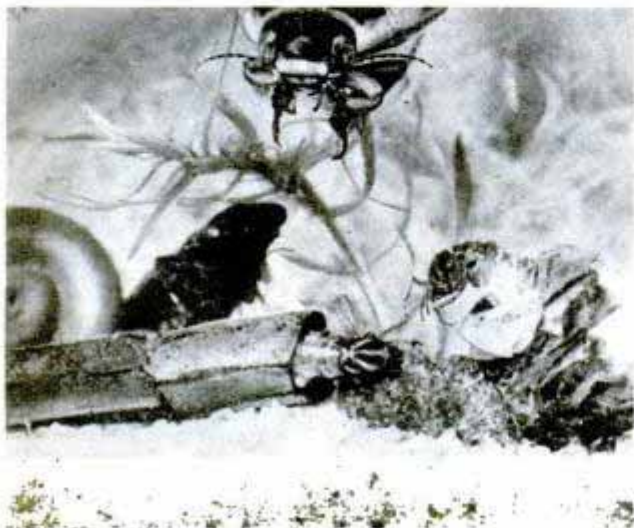




When the photographer cut away the side of a honeycomb he found young bees still in undeveloped state
 ↓ Sparkling dewdrops are supported by a spider web



↓ Self-tailored coat! Caddis fly larva cuts sections of water grass and sews them into garment with thread



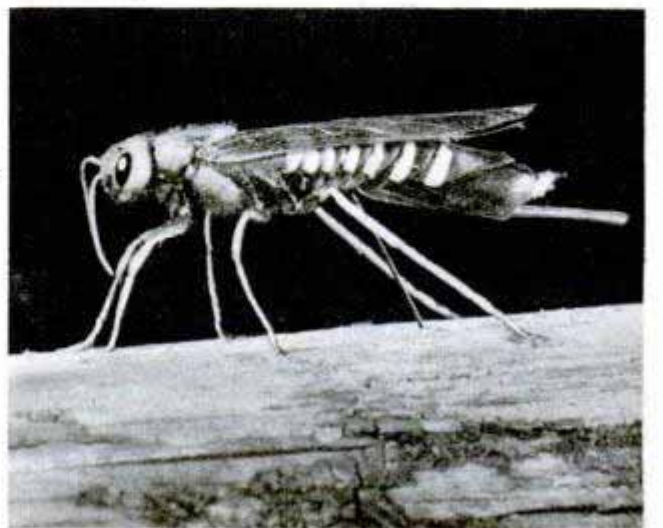
Fast film is best especially if a time exposure is necessary, which is often the case when the lens is stopped down to insure depth of focus and nothing but sunlight is used. I always have my camera on a tripod, and check the density of light with an exposure meter except when I'm using a flash. If the photo is to be a flash shot, the exposure is determined by the distance of the camera from the subject.

Prying into the working habits of subjects as small as insects usually requires an enlarging lens. With mine I can almost fill a 4 by 5 negative with a grasshopper's head or any other tiny object.

Insects outnumber in species all the rest of the animal kingdom so you have an unlimited field for "industrial" and home-life photography. For example, why not make a pictorial history of a butterfly? Snap the various stages starting with the butterfly egg, then the caterpillar, the magic transformation into the chrysalis, and finally the butterfly cracking his way out for his second look at life.

Once I cut away the side of a paper-wasps' nest and found a wonderful opportunity for "construction" shots which helped me in a photographic story on insect industries. No human works any harder than a wasp in building a home. First the wasp finds an old log that's dry and suitable for use as a building material. With his sharp mandibles he cuts thin strips of wood which he puts through his self-contained pulverizing machine, chewing the dry wood into a pulp and adding juices produced from glands in the mouth. When the paper pulp is just the right consistency he applies layer after layer, checking each layer for proper thickness. The dried pulp is a strong paperlike material which will withstand almost any kind of weather. The wasps divide the interior of their nests into tiers of cells in which they rear their

Female horntail carries her own workshop. With her drill she bores into wood and deposits her eggs inside



young. Frontier hunters often used this paper as wadding in their muzzle-loaders, preferring it to man-made materials.

For another picture story I decided to expose the craftsmanship of the golden garden spider. The spider is a skillful manufacturer of silk, turning out strands that are stronger than steel, weight for weight. By using my enlarging lens I photographed a bold close-up of the silk coming from the spider's spinning wheel, his "spinneret." A fine spotlight behind the subject brought out the silk strands in detail. Back-lighting is important in such shots, as the silken strands could not be seen plainly otherwise.

The horntail is a fascinating subject for industry photos. The female has a drill which she uses to bore holes in logs. In the hole she deposits her eggs. For a close-up of her drilling technique I extended my camera bellows full length and used no enlarging lens. The high-speed flash was 12 inches from the subject and the photo snapped at 1/10,000 second at stop f:32.

Millions of years before man started covering his body with skins the caddis fly larva was tailoring his own clothing. Here's an opportunity for both an industrial shot and a fashion photo. The larva cuts sections of grass with his mandibles and sews them together with a silken thread he produces. When the new cloak is finished the larva crawls inside the grass garment and walks away.

The carpenter ant is one of Nature's finest wood carvers, tunneling his way into wood with his sharp mandibles. Once I cut away an old log to take some shots of the ants at work inside their homes. One photo I prize shows the ants industriously lifting and carrying around the cocoons in which their young are developing. For this shot I used the high-speed flash. Incidentally, my unit has a six-pound portable battery which makes it ideal for field work.

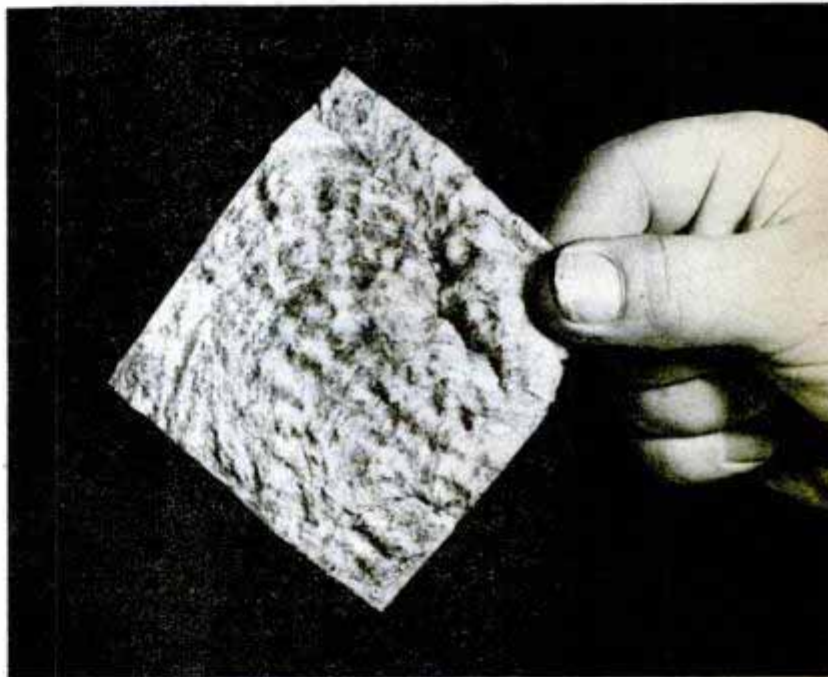
As a construction expert the potter wasp is hard to beat. He builds his unusual home out of mud and the finished nest looks like a rare piece of pottery. For convenience and a sharper shot I took the nest to my studio and photographed it with a spotlight against a black background.

Honey bees are continually on the buzz making wax from honey. They eat the honey, then manufacture it into wax which is projected from their body under scales on the abdomen. They build the scales into a honeycomb which is used as a storehouse for honey and a home for their young.

With a little study and ingenuity you can find countless other insect industries that can be photographed. Exploring the insect world with a camera is exciting and you'll find your horizons limited only by your own imagination.

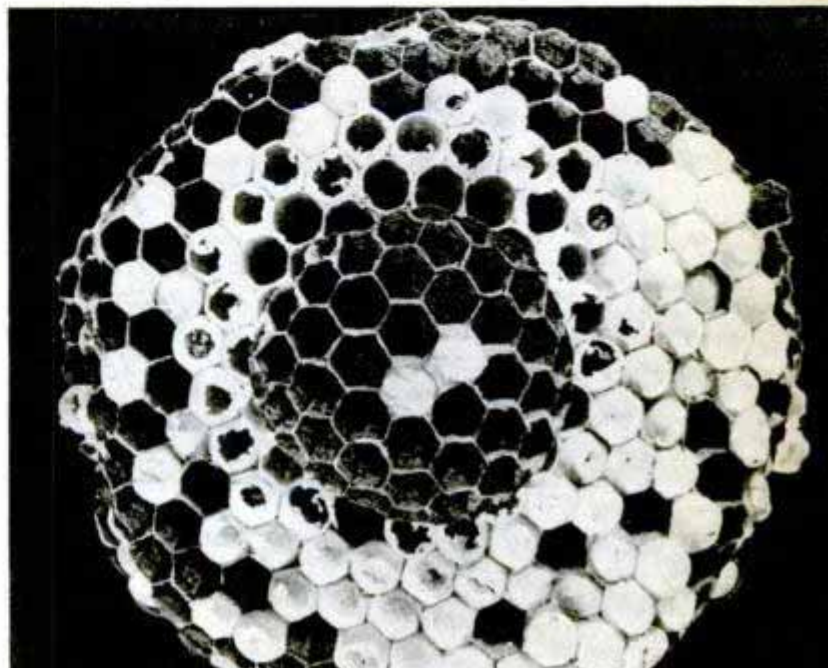


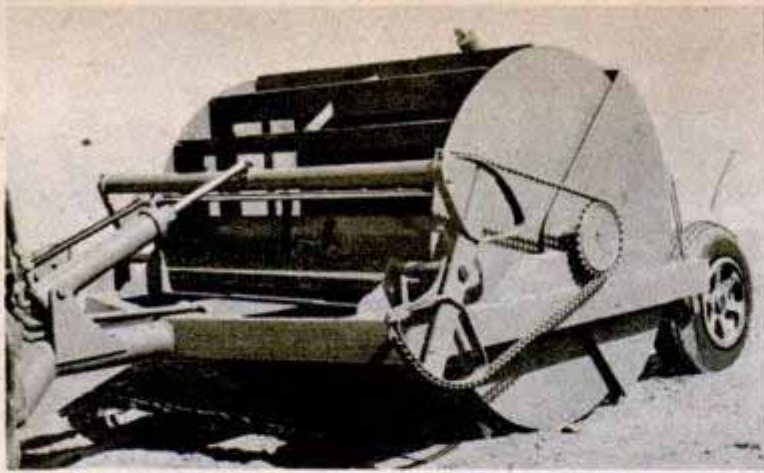
Fine craftsmanship goes into paper-wasps' home. Here a wasp applies the paper it manufactured from wood



Paperlike material will withstand almost any weather

↓ Individual cells in the nest are capped with fine white paper. All other sections of the nest are gray





Fins Moving Dirt Triple Scraper's Efficiency

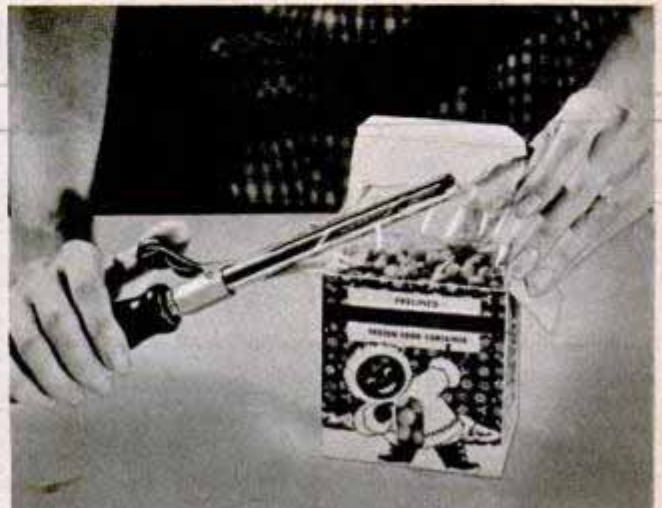
Power used to force earth into a scraper is saved in a unit with rotating fins that help carry the dirt away from the scraper blade to a container. It works a space three yards wide with a 12-horsepower engine now used on one-yard scrapers. Little more power is required to load the unit than is needed to pull it when fully loaded. The machine has an open-top cylindrical container and at either end, but not attached

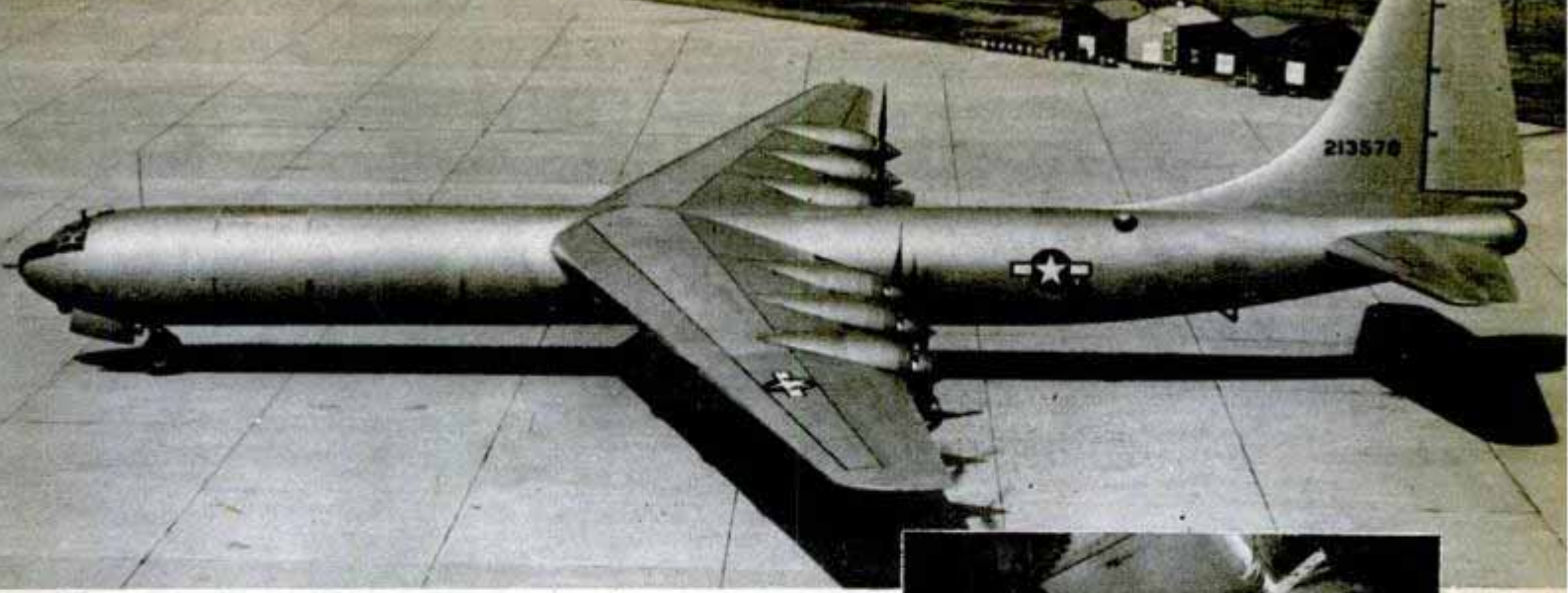
to it, is a disk with 16 fins running parallel to the container. A hood over the rear starts at the cylinder opening and extends down to the scraper blade. As the earth is cut it is moved away from the blade by the rotating fins, traveling between the cylinder and hood, and dropped into the container. When working over grassy land the fins gouge the soil and loosen it for the scraper blade.

Heat-Sealed Packages Hold Food for Home Freezing



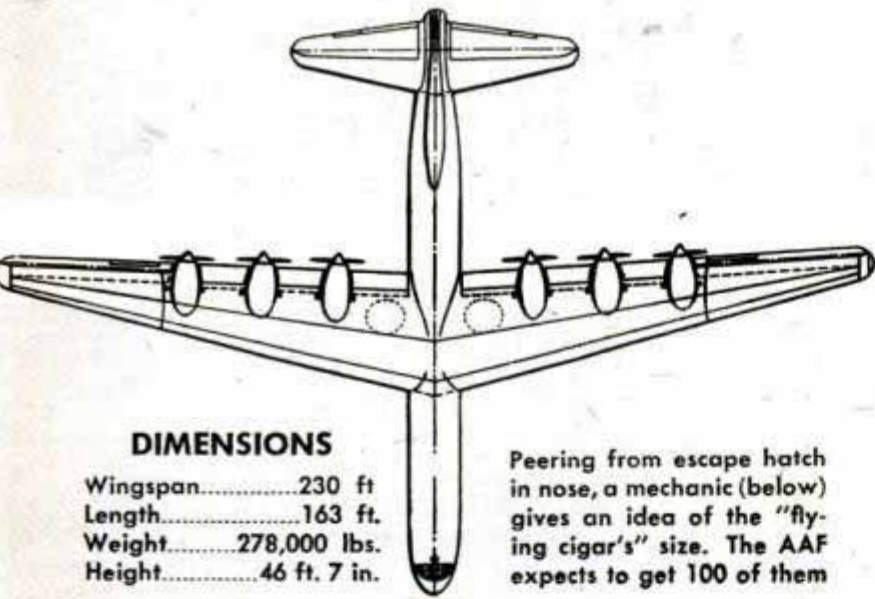
Fresh foods to be frozen for storage in lockers can be packaged conveniently in airtight Cellophane bags that fit inside waxed cardboard cartons. The packages are available in pint and quart sizes, folded flat for storage. When squeezed on the folds they spread into a box shape with the Cellophane bag in place. After the bag is filled, the top is heat-sealed with a curling iron or an electric iron. The contents of the carton can be identified through a window in the side of the package. The packages are available in quantities of 50 or in a kit that includes both pint and quart sizes, 100 feet of Cellophane, 50 feet of gauze for wrapping meats, and large Cellophane bags for miscellaneous storage.





ARMY'S B-36 BOMBER

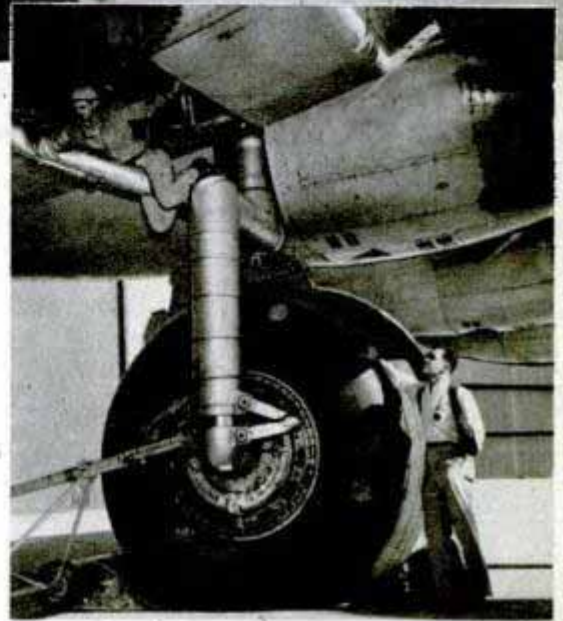
So big you have to ride a "railroad" from tail to cockpit, describing the B-36 requires generous use of superlatives. The fuselage of the world's largest bomber has cubic space equal to 10 large-size living rooms. It has lifted 139 tons. Crewmen stretch out on a four-wheel scooter and use an overhead trolley to pull themselves through the 85-foot tunnel



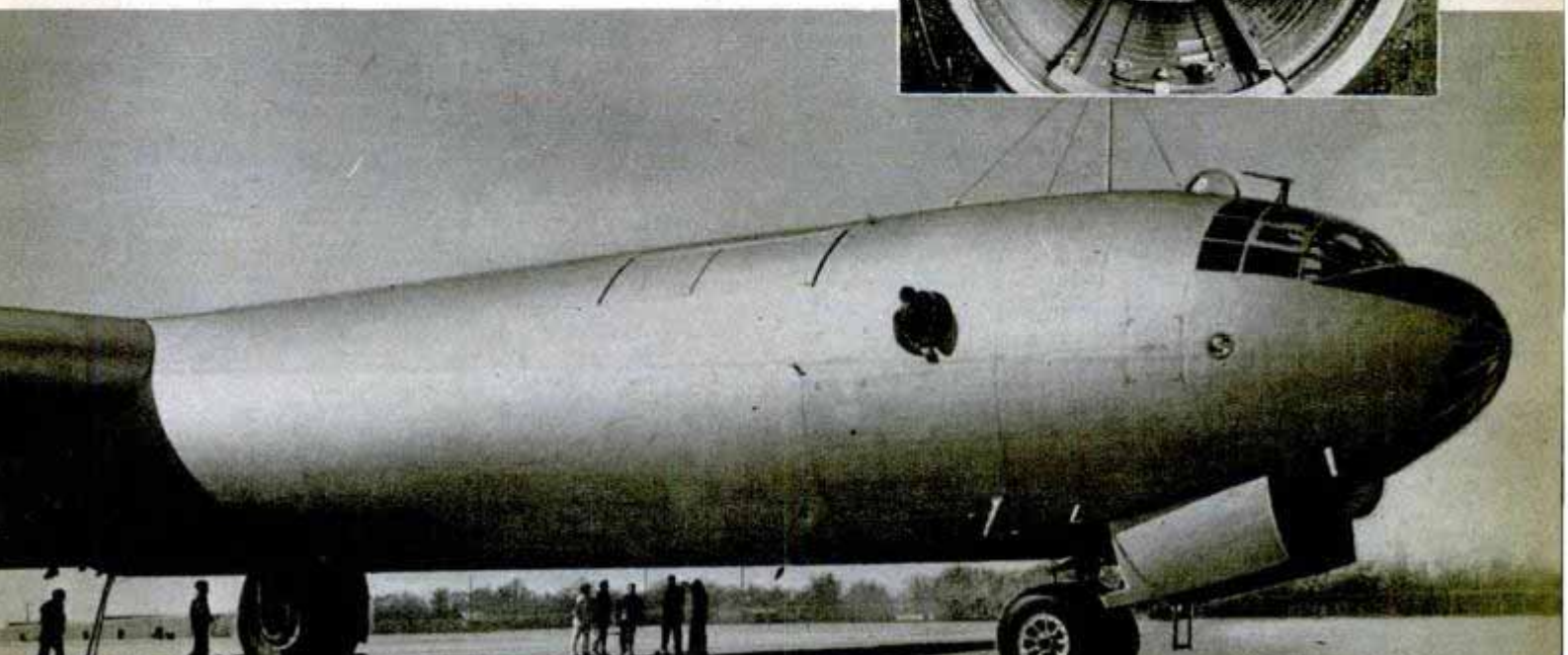
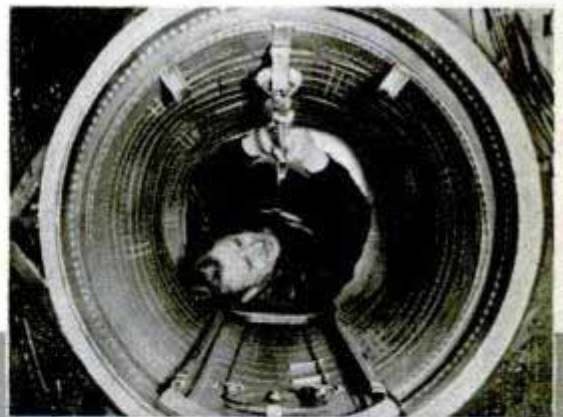
DIMENSIONS

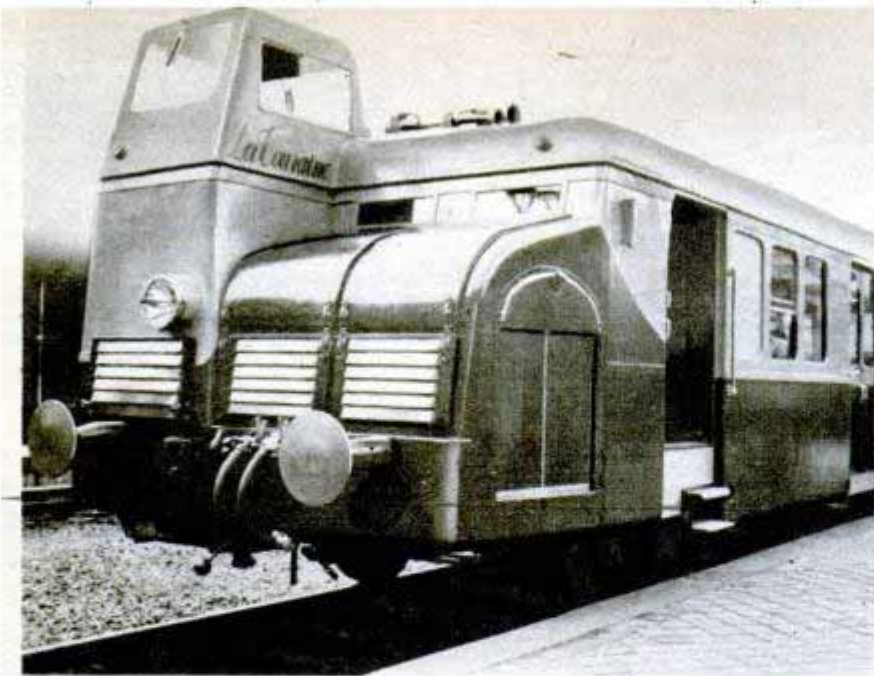
Wingspan.....230 ft
 Length.....163 ft.
 Weight.....278,000 lbs.
 Height.....46 ft. 7 in.

Peering from escape hatch in nose, a mechanic (below) gives an idea of the "flying cigar's" size. The AAF expects to get 100 of them



Inner tubes alone for these nine-foot-tall tires weigh 200 pounds. Below, tunnel scooter

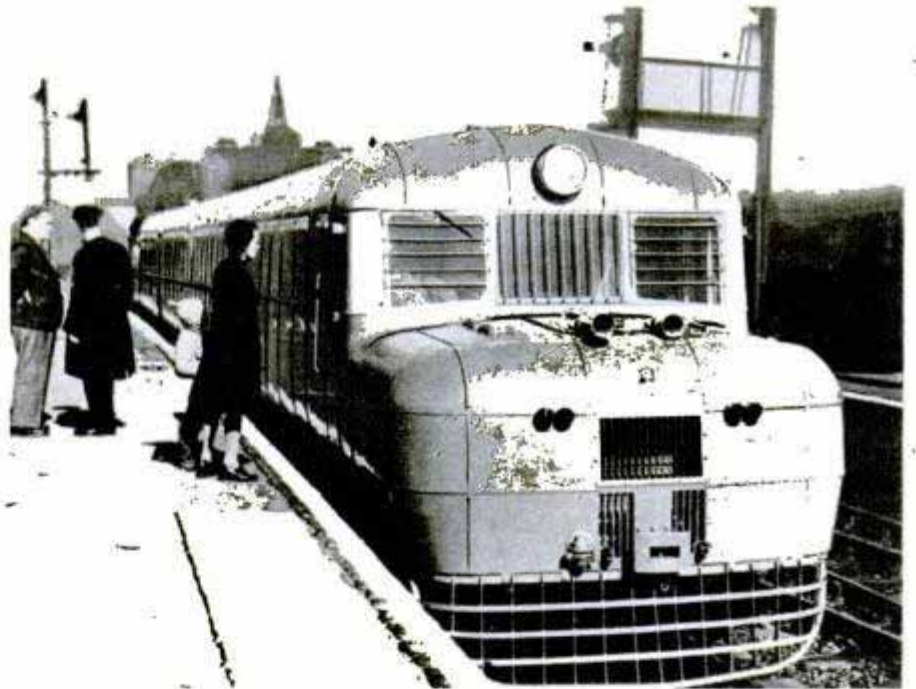




STREAMLINERS ABROAD

Postwar trains now rolling across several foreign countries are unique in appearance as well as motive power. French commuters are riding a train pulled by a locomotive with an automobile-type clutch. On the right side of the engine is a high tower that serves as the engineer's cab. In England, commuters on a short run are traveling in two luxurious self-powered coaches that were built for the Peruvian Central Railway. The coaches are being tested in England prior to shipment to Peru. Built to operate on a line that runs from sea level to 15,000 feet in the Andes, they have a powerful Diesel unit in the front end. Since

↑ French train with automobile-type clutch has a high cab for the engineer
↓ Coaches on train built for Peruvian railway have their own power unit



the war Peru has ordered six additional trains of the same type and Colombia has ordered five more-powerful versions.



Nondrip Rim

Less paint spills and drips over the side of cans when a lightweight metal rim is used as an extension of the top. The rim is jointed and flexible. It can be attached to any pint or quart can.

Many of the products described in this issue are already available or are ready to be marketed. If you want to know the name of the manufacturer or distributor, just write to Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11



U. S. Bureau of Reclamation photos

Shasta Dam, shown here from 5000 feet altitude, harnesses turbulent flood waters to irrigate thirsty soil during the dry season

TEACHING OLD RIVERS NEW TRICKS

By J. A. KRUG
Secretary of the Interior

AN OLD RIVER can learn new tricks when it is taught by the reclamation engineers of the Interior Department.

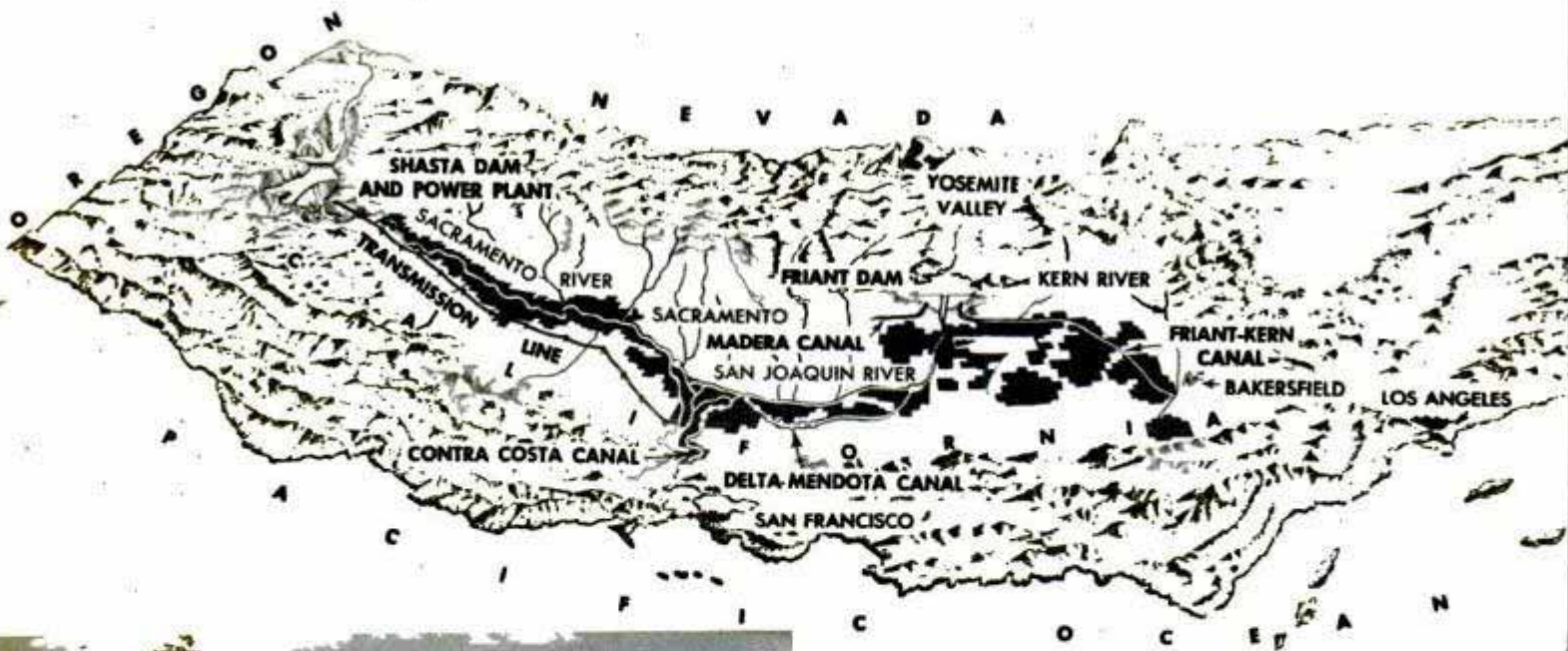
The Department's 44-year-old Bureau of Reclamation is using river-taming techniques that have revolutionized the 4000-year-old science of irrigation.

The Colorado, the Columbia, the Sacramento, and the Missouri, which for centuries ran wild and free are now being leashed and put to work by monumental dams and hydroelectric plants. They are

being trained to fetch and carry and thus lighten the labors of many men.

These are not the only American rivers that will be taught to work for man. Almost 40 river basins or sub-basins are included in reclamation plans for full conservation and development of the water resources of the West.

To understand the great need for river regulation, we must look at a weather map of the United States. One third of the land area of the nation lies in a zone where rain-



↑ Central Valley project will transform the desert heart of California into millions of acres of farms

← Near Fresno, once-useless lands now are irrigated to provide vast vineyards that stretch to the horizon

Reclamation Act. It provided for conservation and use of the water resources of the West on a scale theretofore impossible.

From projects providing only irrigation and flood-control benefits at the beginning of the century the Bureau of Reclamation has progressed to full-size river-resource-development programs. These include multiple-purpose projects, such as Central Valley in California, which provide irrigation and flood control as well as hydroelectric power development, silt retention, navigation, repulsion of salt-water intrusion and domestic water supply.

The Colorado, the Columbia, the Sacramento-San Joaquin reclamation projects already include many world-famous engineering devices for restraining these renegade rivers, harnessing their energies to serve homes and industries and sending their waters docilely on their way through canals and aqueducts to distant irrigation projects, farms and cities.

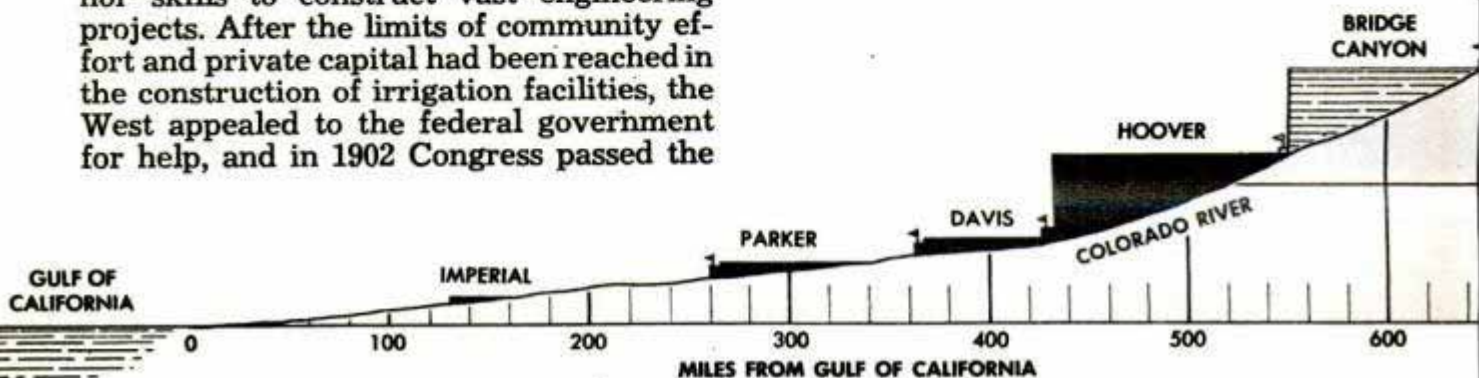
Hoover Dam, key feature of the Colorado River Basin development and highest dam in the world, celebrated a decade of accomplishments this year.

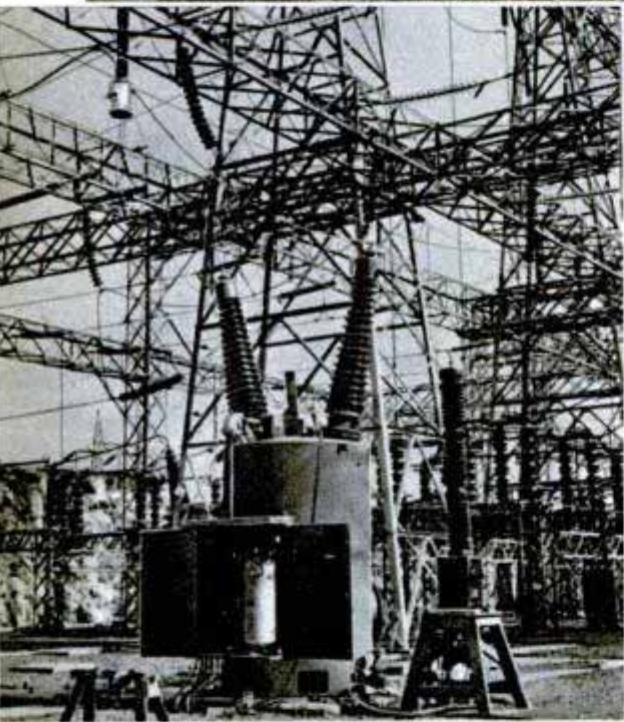
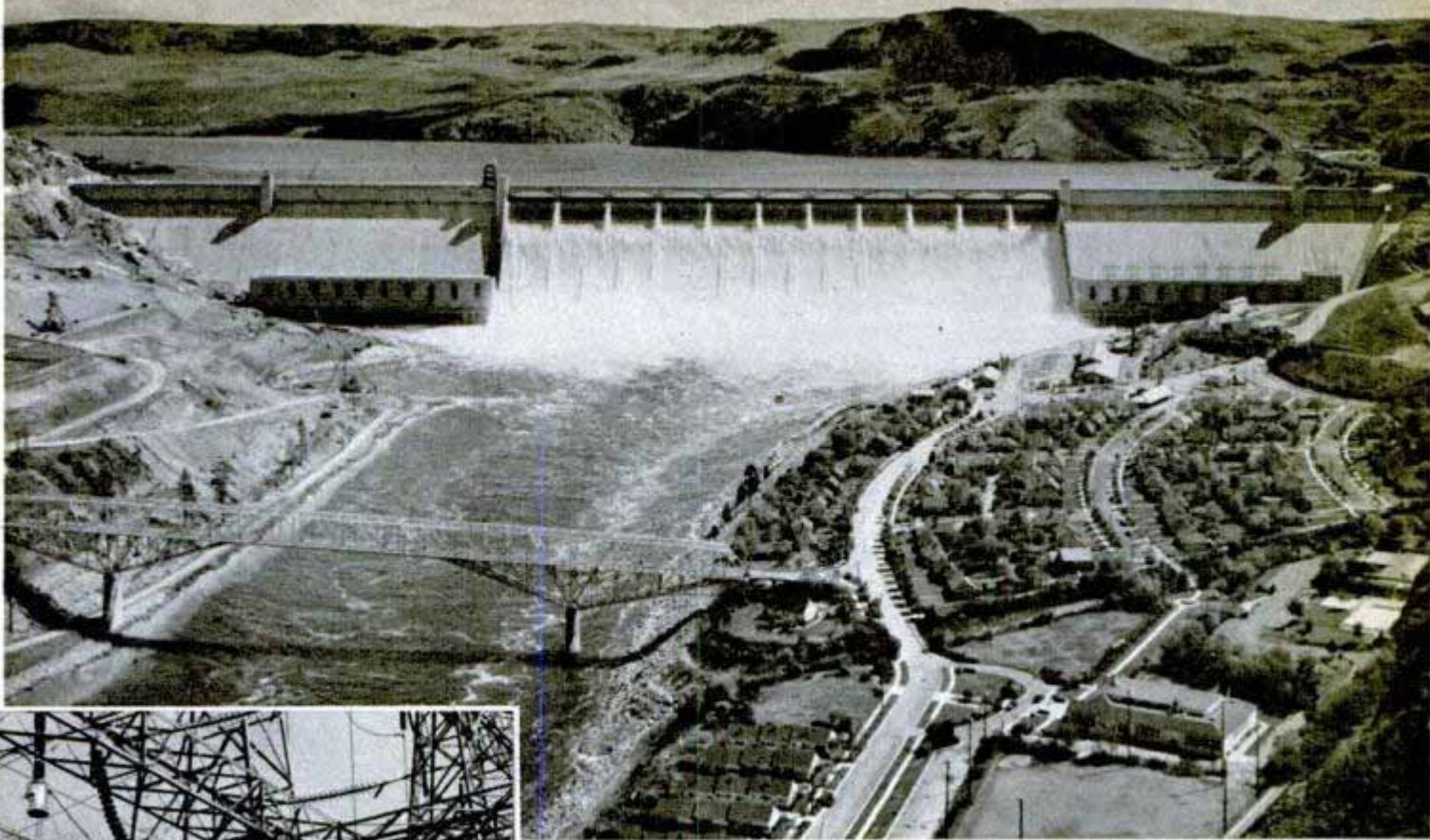
Each spring for 10 years Hoover Dam has

fall, except in the high mountains and on a narrow western coastal strip, is insufficient or improperly distributed for sustained crop production. For this reason, irrigation is essential for stabilized agriculture.

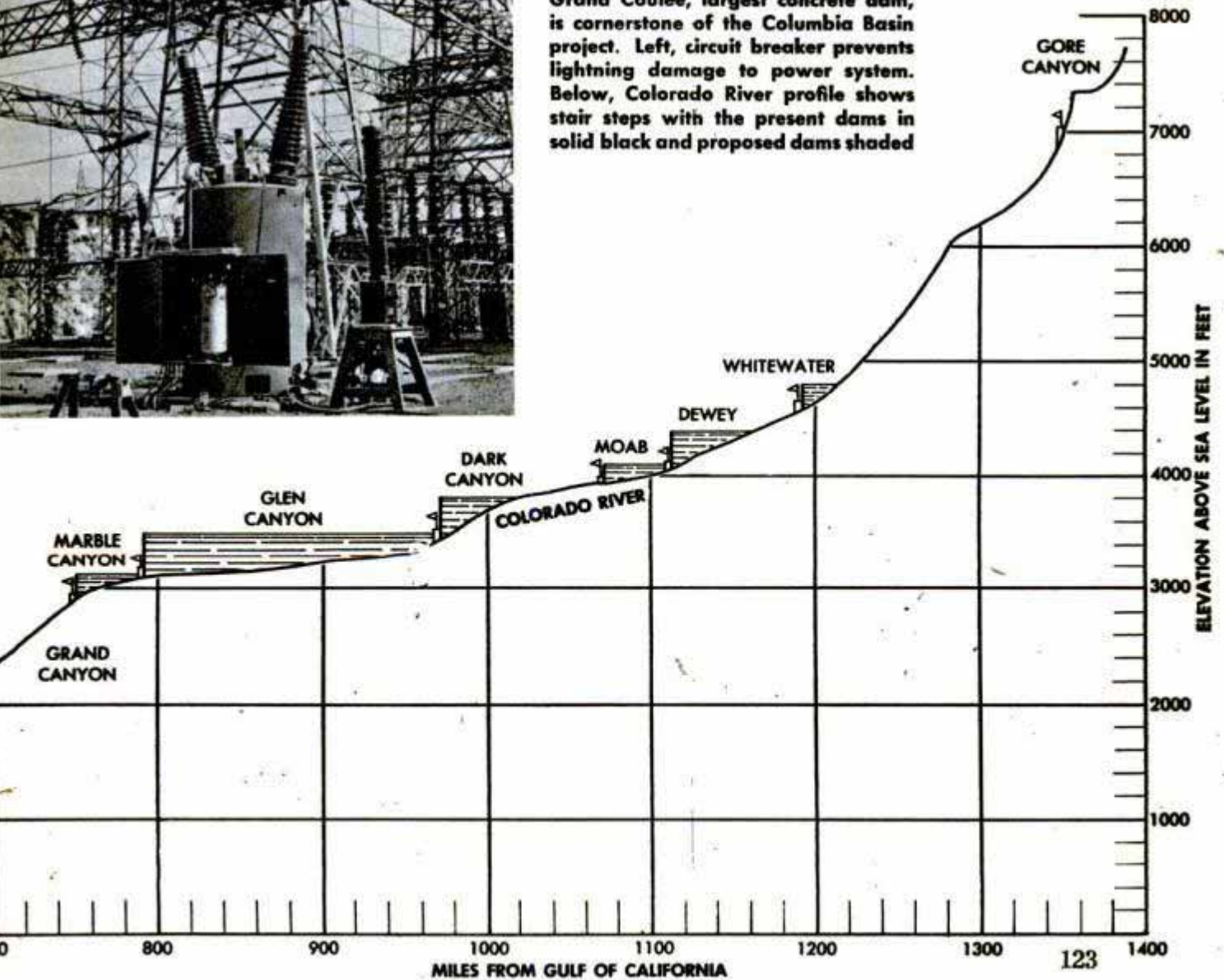
Early in our national history, western leaders realized that if the water that wasted into the sea were diverted to their arid but fertile soil, they could turn much of the desert wastelands into prosperous farm lands.

These men, however, had neither funds nor skills to construct vast engineering projects. After the limits of community effort and private capital had been reached in the construction of irrigation facilities, the West appealed to the federal government for help, and in 1902 Congress passed the





Grand Coulee, largest concrete dam, is cornerstone of the Columbia Basin project. Left, circuit breaker prevents lightning damage to power system. Below, Colorado River profile shows stair steps with the present dams in solid black and proposed dams shaded



stored flood waters in its great reservoir—Lake Mead—and released these waters during late summer and fall to quench the thirst of irrigated lands downstream.

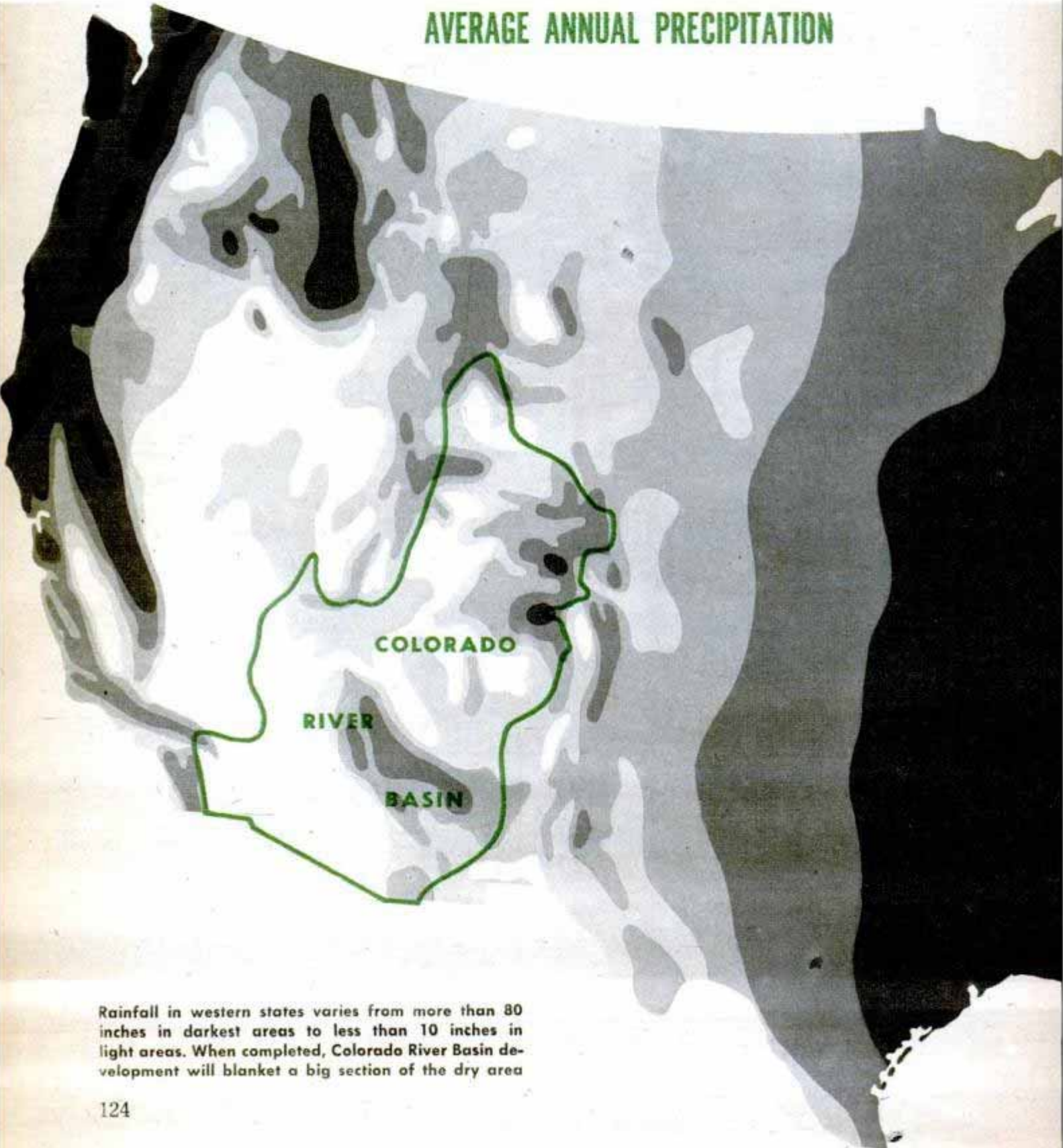
At present, about 500,000 acres of land in the Imperial Valley, (Calif.) are being irrigated with Colorado River water. Construction of a canal, 145 miles long, to bring water to 75,000 acres in the Coachella Valley (Calif.) is well under way. Other projects, such as the Yuma and Gila (Ariz.) are furnished an assured water supply. The several municipalities included in the Met-

ropolitan Water District of California also draw upon water stored in Hoover Dam's reservoir.

Hoover Dam's other role, however, is that of power producer for the Southwest. In 10 years, it has turned out more than 37,000,000,000 kilowatt-hours of electric energy which represent a gross value of \$57,000,000.

The first of the Colorado River Basin developments was Hoover Dam. Parker and Imperial Dams have already joined forces with Hoover. Soon Davis will take its place

AVERAGE ANNUAL PRECIPITATION



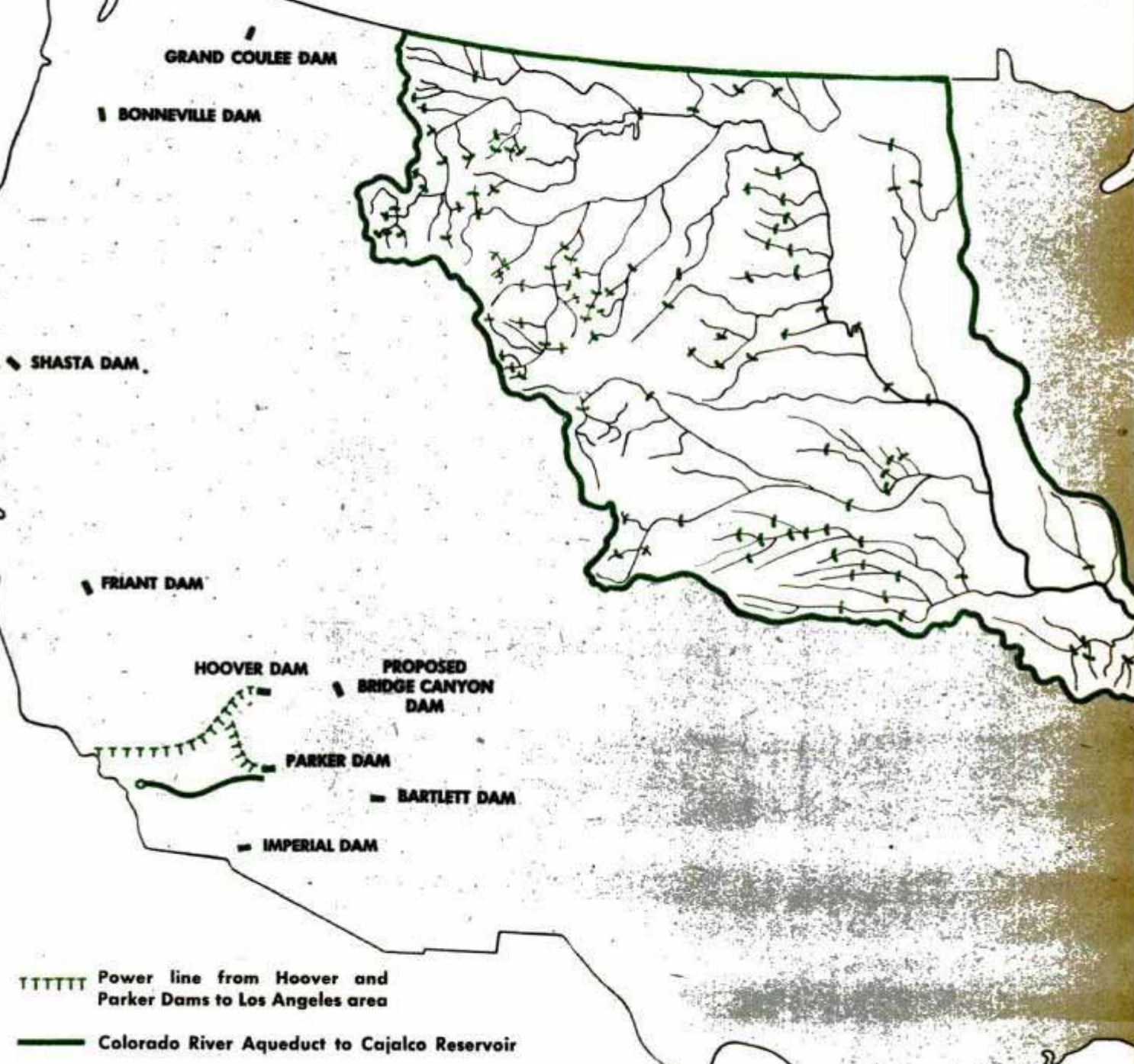
Rainfall in western states varies from more than 80 inches in darkest areas to less than 10 inches in light areas. When completed, Colorado River Basin development will blanket a big section of the dry area

Frank Hoover Dam in
 er upstream devel-
 by engineers.
 Basin report, re-
 ment of the Interior,
 es for further development
 river valley, is now in the
 the governors of the seven basin
 Out of this report should grow even
 water industrial and agricultural activity
 in this fertile area, once the report has been
 approved by the affected states, by appro-

We turn from the Colorado River Basin,
 setting of the highest dam in the world, to
 the Columbia River, site of the Grand Cou-
 lee, largest concrete dam ever built by man.
 The July 1946 issue of *Popular Mechanics*
 in an article "Garden in the Desert," by
 Thomas E. Stimson, Jr., featured the work
 of Grand Coulee Dam, foundation of the
 Columbia Basin project in the State of
 Washington.

The Bureau of Reclamation is rushing
 work on the irrigation distribution system

MAJOR DAMS AND PROPOSED MISSOURI VALLEY DAMS

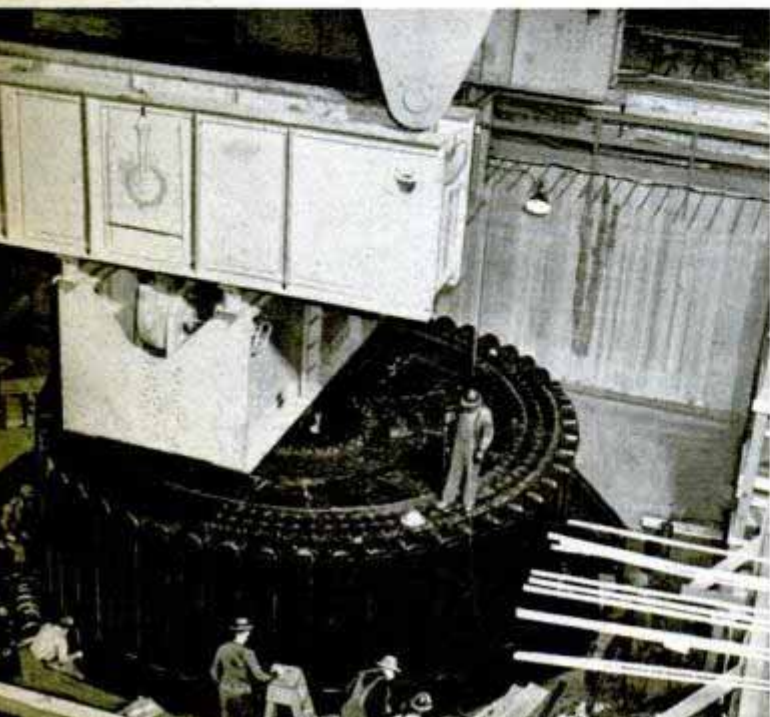




Concrete is chipped from massive generator at Grand Coulee so the power unit can be moved to Shasta Dam



↑ Workman drills concrete before removing it in blocks
↓ Power unit weighing 450 tons is lifted from temporary installation. It was loaned to Coulee during war



of this development so that 400,000 acres can be irrigated and made ready for settlement by 1950 or 1951. Ultimately 1,000,000 acres of land will be supplied with water from the giant dam and its smaller helpers.

Grand Coulee's power plant, which began operation during the war, is now proving its worth as a peacetime producer in the Pacific Northwest. In the five years the plant has been in operation its energy output has reached 20,000,000,000 kilowatt-hours—equal to the work performed by 1,000,000 men laboring eight hours daily every day for 79 years.

In addition to supplying energy for hundreds of industries mushrooming in the region, Grand Coulee power will be used to operate 65,000-horsepower motors to drive pumps which will provide water for the project distribution system. Each pump will be capable of lifting 12,000 gallons of water per second to a height of 270 feet. Ultimately 12 such giants will be placed in the pumping plant at Grand Coulee Dam.

A battery of six pumps will be installed initially in this plant built on a rock shelf of the canyon wall, upstream from the dam. Each pump, with its motor installation, will be approximately 50 feet high. Ten of them operating simultaneously for 19 minutes could pump the equivalent of a gallon of water for every man, woman and child in the United States.

Mammoth construction features are not the only wonders of the Columbia Basin project. Lake Roosevelt, the reservoir formed by Grand Coulee, is the West's longest lake. This 151-mile inland waterway creates at the dam site a magnificent waterfall that is a new mecca for travelers.

Reclamation engineers who designed the Columbia Basin project, where the Columbia River will flow uphill to irrigate an inland empire, have solved the problem of placing the Sacramento and San Joaquin Rivers in double harness. The San Joaquin River which normally flows north will be turned backward in its course to save an established agricultural region. Sacramento River floods during the stormy months of the year will be checked by Shasta Dam and stored for release during the dry season. Shasta Dam ranks second in size with Grand Coulee and second in height with Hoover as one of the world's largest concrete dams. Finishing touches are being given to Shasta and brother dams, Friant and Keswick, and work has been speeded on the network of canals and transmission lines needed to deliver water and power to the multimillion-acre Central Valley development.

Shasta Dam recently welcomed home two 75,000-kilowatt generators and their 103,000-horsepower turbines. While on spe-

cial detail to Grand Coulee they turned out more than 3,000,000,000 kilowatt hours of energy for war industries.

This power helped to produce plutonium for atomic bombs and also aided in making airplanes, ships, and materials for war at northwest industrial plants.

The huge generators, now installed in the plant for which they were designed, are helping to enlarge and to build more industries.

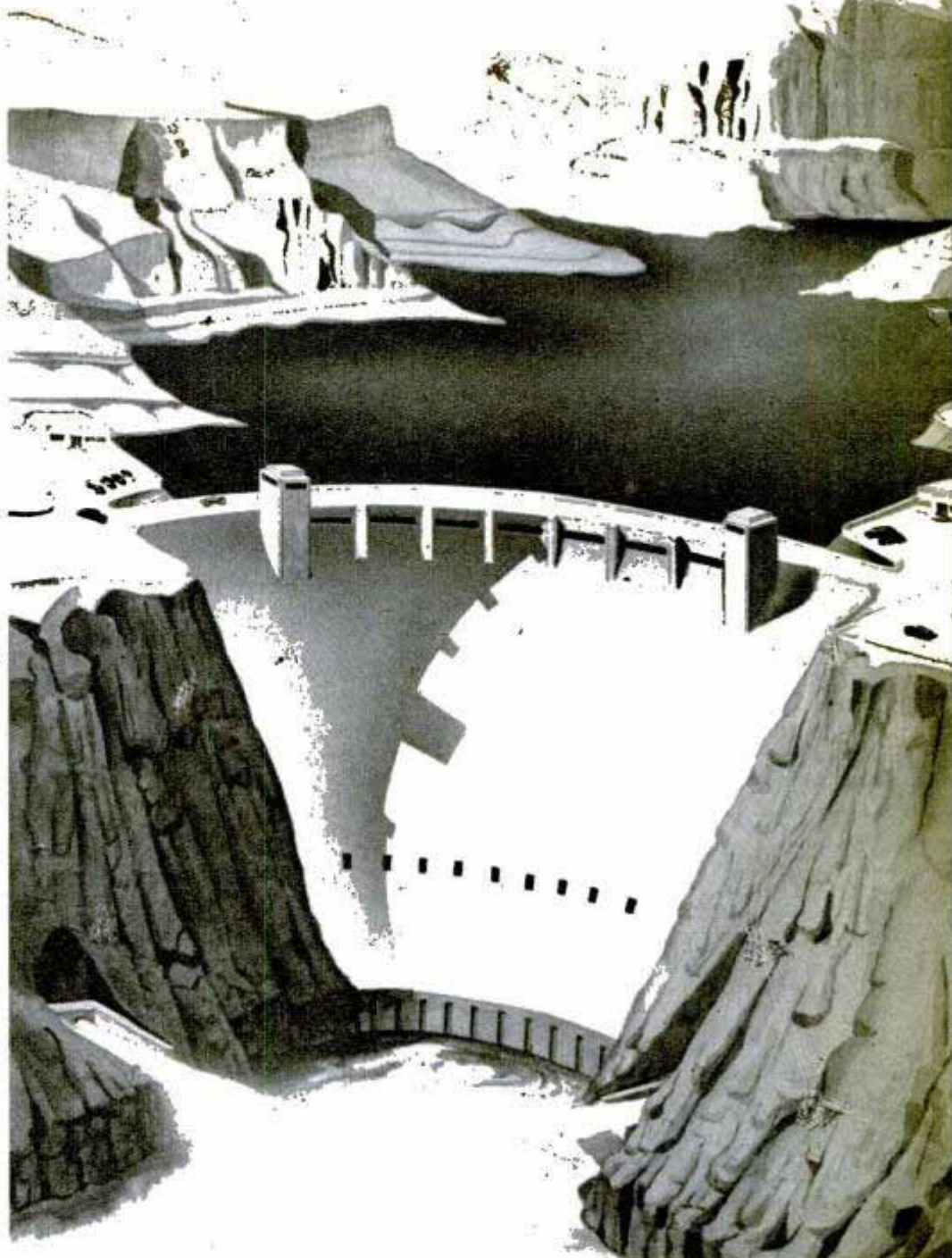
Additional power developments as well as irrigation benefits can be provided through the Central Valley Basin plan, which is an expansion of the multiple-purpose development. Some 760,000 of the valley's present 3,500,000 irrigated acres can be permanently rescued from impending water shortage, while 3,000,000 additional acres, now without water, can be irrigated.

The Sacramento, yoked with the San Joaquin, will be prevented from destroying life and property. The energy of the rivers, harnessed by great water-power plants, can provide 8,100,000,000 kilowatt-hours of energy each year for pumping irrigation water, for commercial and for domestic use. In addition, some 300,000 acre-feet of water annually can be supplied for industrial use.

In contrast to the Central Valley, the Columbia, and the Colorado, the Missouri River Basin Plan offers no world-challenging dams and power plants. The Missouri was, however, the first of the reclamation basin plans to be authorized by Congress. Features of other developments were started as projects that are now the keys for comprehensive valley developments.

Four reclamation dams, Kortes (Wyo.), Angostura (S. Dak.), Boysen (Wyo.), and Enders (Nebr.) were started this year—the first of a battery of 100 dams that will eventually master the Missouri.

The Missouri Basin, covering all or parts of 10 states, is one of the biggest resource-



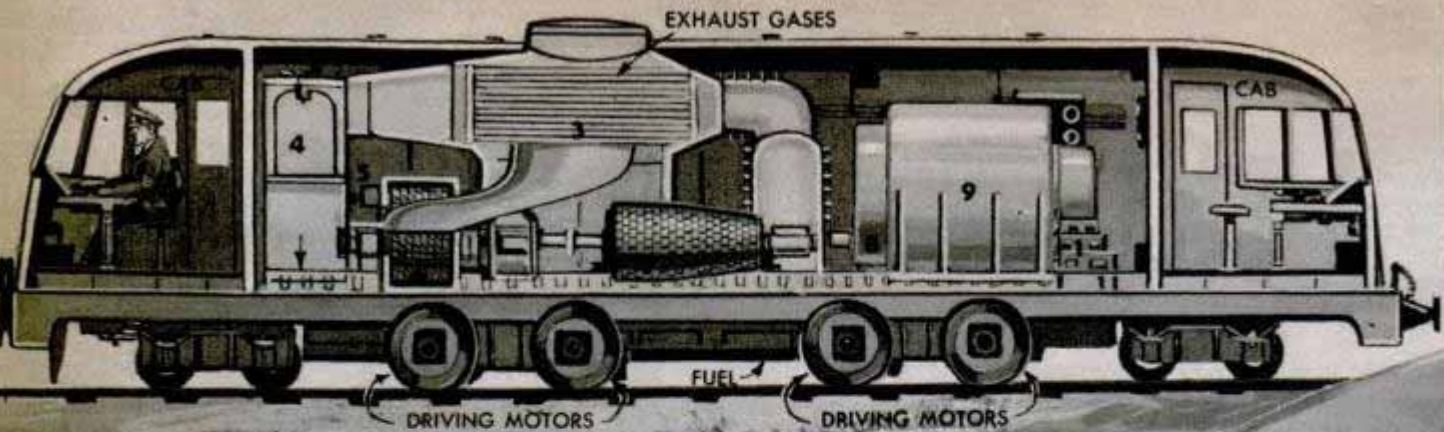
Artist's conception of mighty Bridge Canyon Dam which may be built above Hoover Dam. If built, it will be 730 feet high, 10 feet higher than Hoover

development programs ever undertaken.

Irrigation of almost 5,000,000 new acres of land, security for another 500,000 acres now inadequately irrigated, production of 5,500,000,000 kilowatt-hours of energy a year, flood prevention, domestic water supplies, improved navigation, recreational opportunities and wildlife preservation are included in the plan of the Bureau of Reclamation and the Army Corps of Engineers.

In addition to the Bureau of Reclamation, six other agencies of the Department of the Interior are cooperating on the development. They are the Bureau of Land Management, National Park Service, Fish and Wildlife Service, Indian Service, Geological Survey and Bureau of Mines.

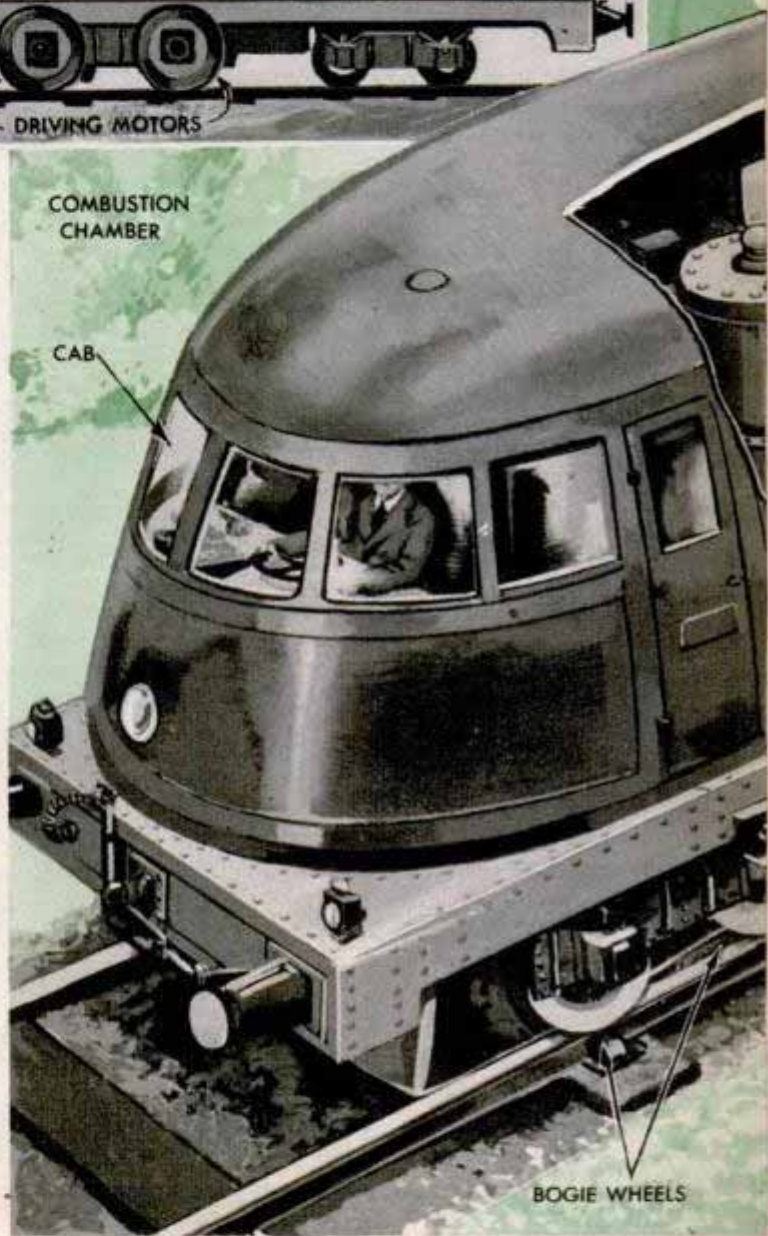
Tamed and taught new and useful tricks, "Big Muddy" will soon join other domesticated rivers of the West.



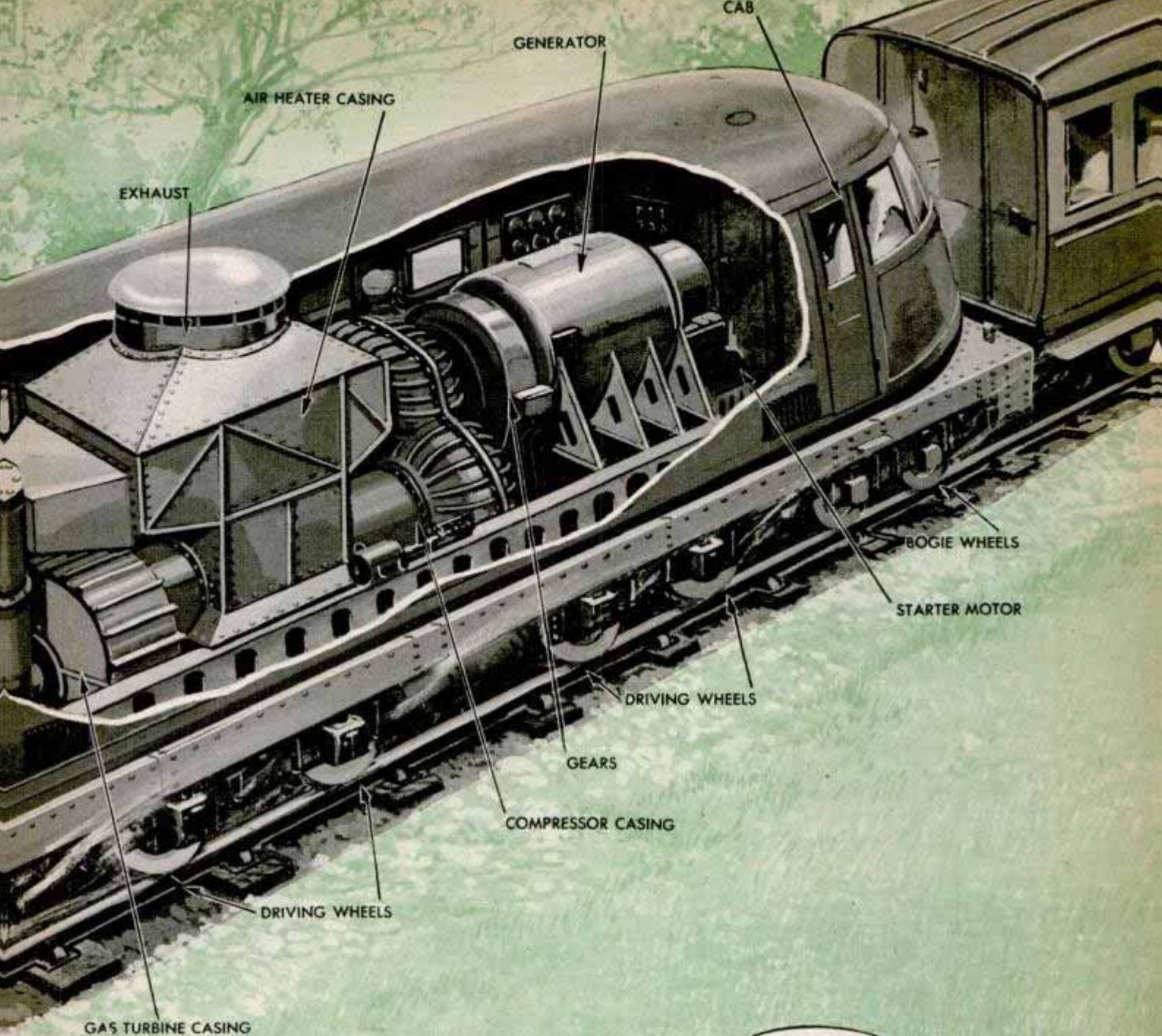
CYCLE OF OPERATION—The Diesel-electric starter (1) rotates a special compressor; the hot-wire firer (2) begins operation in the combustion chamber; air is drawn through heater (3) and then into combustion chamber (4) where it is fired with the fuel; excess air circulates around the heater chambers (5) to assist in cooling the engine; the combustion gases pass through and rotate the turbine (6), which is connected with the compressor (7) and the gears (8); the gears drive the generator (9) which supplies electric power to the driving motors located between the wheels



GAS-TURBINE LOCOMOTIVE

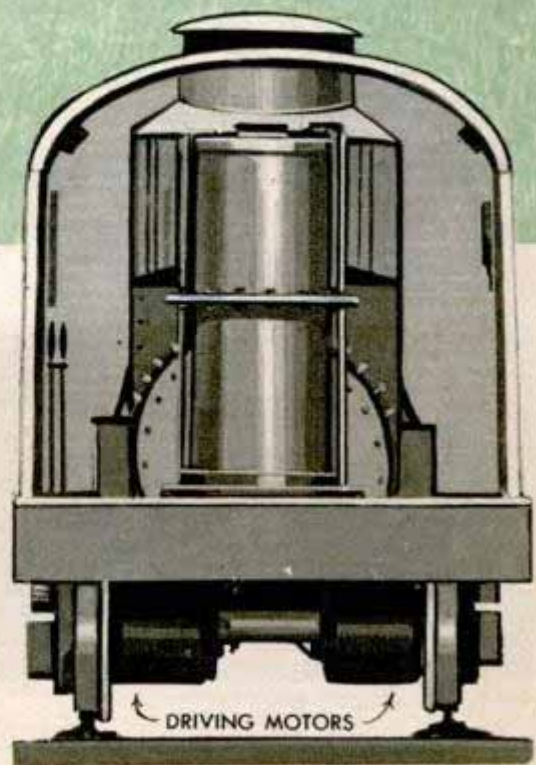


Under construction in England is a gas-turbine locomotive that is expected to develop 2500 horsepower which will be transferred to the wheels by electric motors on the axles. The experimental locomotive is being built for the Great Western Railway. It will average 80 to 90 miles an hour with relatively low fuel consumption. A smaller engine of the same type has operated successfully on the Swiss National Railways. The new gas-turbine locomotive will have many similarities to experimental locomotives being built in this country. Westinghouse is building four oil-burning gas turbines that will



G HEAVIS
1947

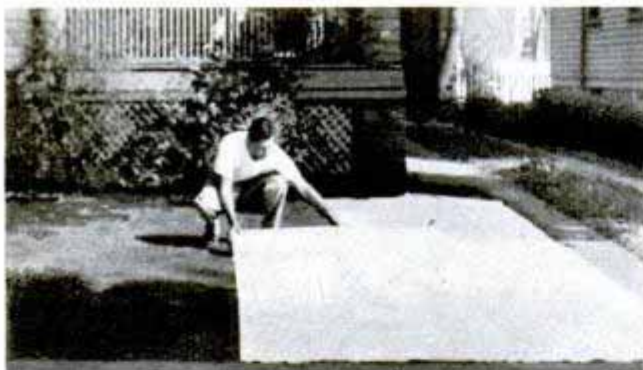
drive an 8000-horsepower locomotive. The engine will be only half the size of a conventional Diesel-electric design and will have quick-starting characteristics that are impossible in old-type steam engines. Air is sucked into one end, compressed and mixed with fuel oil, then burned to bring the air temperature to 1350 degrees Fahrenheit, and finally exhausted back into the atmosphere after driving the turbine. Another revolutionary engine under development is a gas turbine that will burn coal. An atomizer pulverizes coal finer than face powder and it is then introduced into a stream of swirling air and ignited by a spark. The engine is expected to operate more economically than oil-burning locomotives.





Sit-Down Barber's Chair

Tired of standing while trimming hair, Harry R. Gibson of Pueblo, Colo., rigged up a four-wheeled stool out of iron water pipe on which he mounted a bicycle seat. He also built a knee-high platform on which he can kneel if he gets tired of sitting. "No more footaches," Gibson reports.



Kollsman Instrument photo

Navigator's Periscope

As a substitute for plastic astrodomes, there is now a periscopic sextant for plane navigators. A navigator was blown out of an air liner in mid-Atlantic when air pressure caused an astrodome to break. Only a small part of the periscope, 1 inch wide and 1½ inches high, is exposed through the top of the plane. The sextant is removed from its shock mounting when not in use. It boosts the speed by eliminating drag created by a protruding astrodome, and removes danger to passengers from explosive decompression.

Grass Seed "Carpet"

Grass seed now can be planted by spreading seed-impregnated sheets over a yard. The sheets, available in roll form, contain a mixture of grass seeds, fertilizer and root-stimulating hormone. Yards are spaded, raked and rolled before the seed "carpet" is applied and covered with straw. The yard is then watered. Seedlings grow up through the sheeting—cellulose wadding which disintegrates—and young roots penetrate to the soil below. The roll-type planting is particularly suitable for terraces for it prevents seed washouts during heavy rains.

Mesh fabric made of Saran plastic filled with an acetate and coated with metal provides a new material for home decoration. A thin film of aluminum is applied to one side of the mesh and finished with lacquer in both gold and silver colors. The decorative material can be stitched or cemented if the cement used does not attack acetates.



Striking Tape Cleans Type Faces

Typewriter-type faces can be cleaned by striking them against a strip of adhesive material. The strip, $\frac{1}{2}$ inch wide and $6\frac{1}{2}$ inches long, is centered on a sheet of paper and protected by gauze until used. A single cleaning space may be used repeatedly.

High-Speed Printer for Color Photos

Color enlargements are printed in mass quantities at high speed by a new printing machine. The printer has an electronic timer that simplifies the operation and gives greater uniformity to the prints. Black-and-white printing machines made by the same company are designed so that they can be converted to color printing in 15 to 20 minutes.

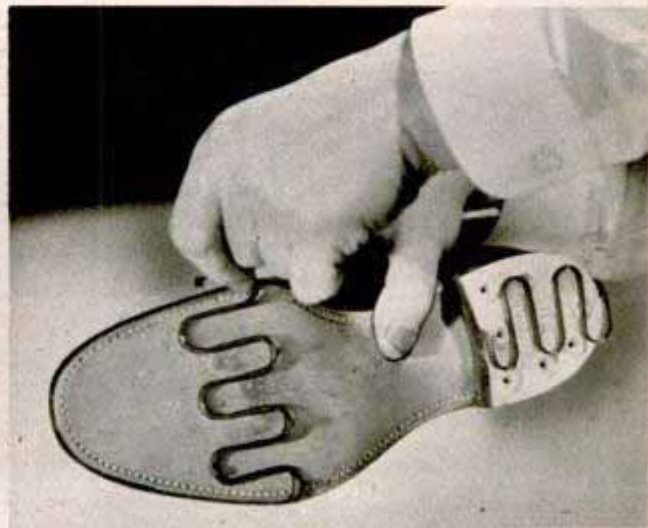


Plane Tie-Down Chain Is Adjustable

Instead of keeping a wide assortment of ropes and chains to tie down different kinds of planes, a flying service operator has contrived a link chain belt that is adjustable. Snaps at either end fit into eyes of sunken concrete blocks and onto the plane's wing struts. The chain can be adjusted to fit any type aircraft.

Tension Holds Cleats in Place

Sure footing on slippery surfaces is provided by slip-on cleats held in place by tension on the sides of the heel and sole. The cleats are easily attached or detached and do not mark the shoe. Devised for loggers, sportsmen and gardeners, they can be slipped into a pocket.

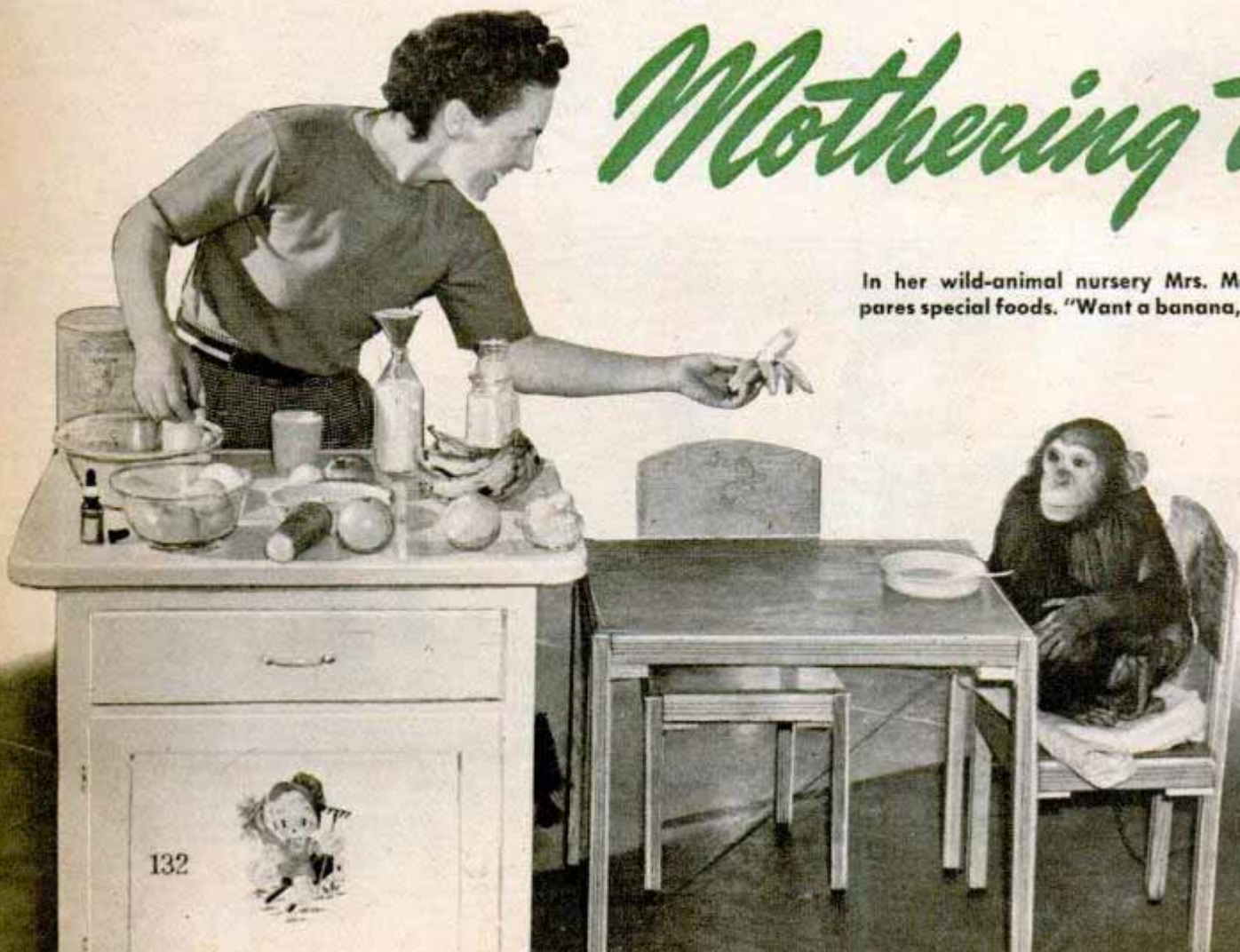


"Oh, oh, I've put on an ounce," a chimpanzee seems to say as Mrs. Helen Martini, Bronx-Zoo "mother," checks his weight



Mothering the

In her wild-animal nursery Mrs. Martini prepares special foods. "Want a banana, Chimpy?"



By Bill Reiche

WITH WILD ANIMALS for the zoo quoted at several dollars a pound, the business of bringing them up becomes a scientific specialty of considerable importance.

Something happens to the maternal instinct of captive wild animals and they often regard their young as unfortunate nuisances. When they refuse to bring up the infants born in New York's Bronx Zoo, it becomes the assignment of Mrs. Helen Martini, zoo "mother," to raise the babies.

It started in 1942 when a lioness refused to care for her cub, named MacArthur. Mrs. Martini's husband, Fred, was and is keeper of the lion house and the first thing the diminutive lady knew she was playing foster mother to a baby lion.

The procedure for raising lions from birth is fairly well established, since lions breed readily in captivity and all too often lionesses take the position that after they've given birth their responsibility is at an end. MacArthur grew and flourished and is a credit to his namesake.

But early in 1944 a much more serious emergency was at hand and this one was to end permanently the normal home life of the Martinis. A tigress refused to take care of her three cubs and Mrs. Martini took them home to her Bronx apartment.

No one at the Bronx Zoo—and, to the

Zoo Babies

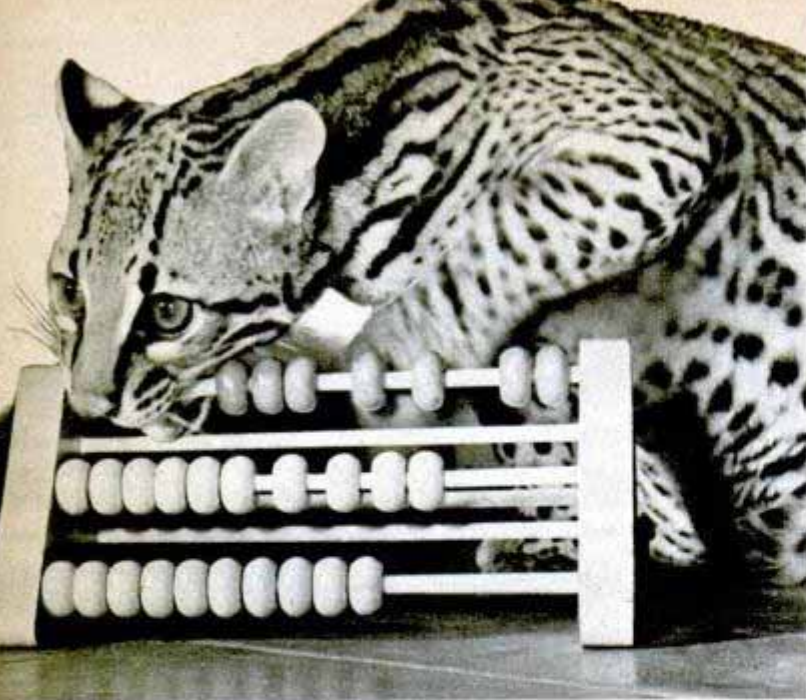
best of the curator's knowledge, no one in the country—had ever raised a tiger. What should they be fed to be protected from pneumonia and rickets?

By a combination of hard common sense and intuition, she arrived at a successful diet. For the first two months she fed them a formula of one part evaporated milk and two parts water, heated to body temperature, every three hours. Then chopped meat and bone meal were added. But the little animals balked at cod-liver oil.

Few animals, or persons, will take straight cod-liver oil if it can be avoided. Pills are useless for animals because they chew everything they eat; forced feeding

Ring-tailed lemur perches on her shoulder as the zoo "nursemaid" cooks a bowl of cereal. Baby marmoset (center) likes fruit, vegetables and milk. Below, Arizona round-tailed squirrel nibbles sunflower seed





A baby ocelot from South America amuses herself by playing with the wooden beads on a youngster's toy

would arouse their antagonism and destroy their trust in their keeper.

It was then that hunger came to Mrs. Martini's aid. The fast-growing cats woke up each morning ravenous and would "wolf" down the first food they got without stopping to smell it. By putting the malodorous oil in a couple ounces of milk the baby Bengals would be digesting it before they suspected any medicinal monkey busi-

This 600-pound Royal Bengal tiger was the first animal that Mrs. Martini reared in her Bronx-Zoo nursery



ness. Today, oil is given in chopped meat.

At three months, chunks of solid meat appeared on the diet and for the first year the cubs got a daily dose of vitamin concentrate. The result is three of the biggest, healthiest and handsomest tigers ever raised anywhere—and worth \$1500 apiece.

These three practically ruined the Martinis' living room, and a pair of lions and a tiger later that year completed the job. In 1945 she moved into a former storeroom in the lion house and began a full-time career by bringing up a black leopard—one of the most vicious of creatures. Bagheera, now in his third year, is a perfect gentleman and likes to have his foster mother reach into the cage and scratch him.

Since she moved into the lion house she has raised more than 30 animals of many breeds. At the present time her nursery houses a pair of ocelots, two marmosets, a round-tail Arizona ground squirrel, a ring-tail lemur, a kangaroo rat, a chimpanzee and a hedgehog. The chief cause for concern in this group is the chimp—a lady—who is subject to respiratory complaints, but too smart to be an easy target for vitamins, via cod-liver oil.

For a day or two she had taken it readily in orange juice, heavily sugared, but the day the writer visited the zoo she had indicated quite plainly that she knew a hoax when she tasted one and would have no more of that. She also gets sun-lamp treatments to make up for the lack of sunshine.

The feeding problem is not vexing with the present roster. Most of them eat fruits and vegetables. The ocelots take the tiger diet with some fish occasionally; the marmosets have a weakness for rare steak and the lemur has a weakness for boiled potatoes—cold—and pretzels. He doesn't eat the latter, but enjoys licking the salt off.

There have been a few minor crises. When the hurricane hit New York the zoo lady sat up all night with her charges, who were undisturbed. And once she hollered for the veterinary and the curator because one tiger cub was limping, a sign of rickets. He had just been sleeping on one leg and had a kink in it.

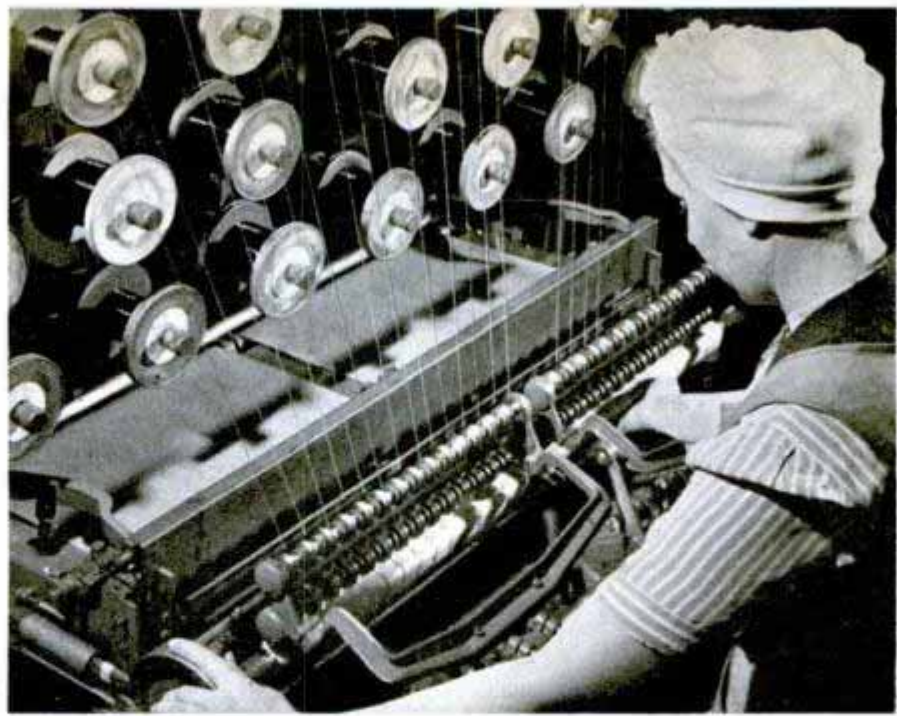
Mrs. Martini, who also is in charge of the birdhouse, showed where she was headed early in life.

"When my mother would give me money for a pair of shoes, I would buy a bird," she relates. "When I got half a block from home I'd start to cry because I knew I'd be punished. But it never stopped me—I always had a lot of birds."

Now she is hoping for a fine, big litter of tiger cubs, from two that she raised. She points to the cod-liver oil the prospective parents have had and declares, hopefully, "I'm looking for a baker's dozen."

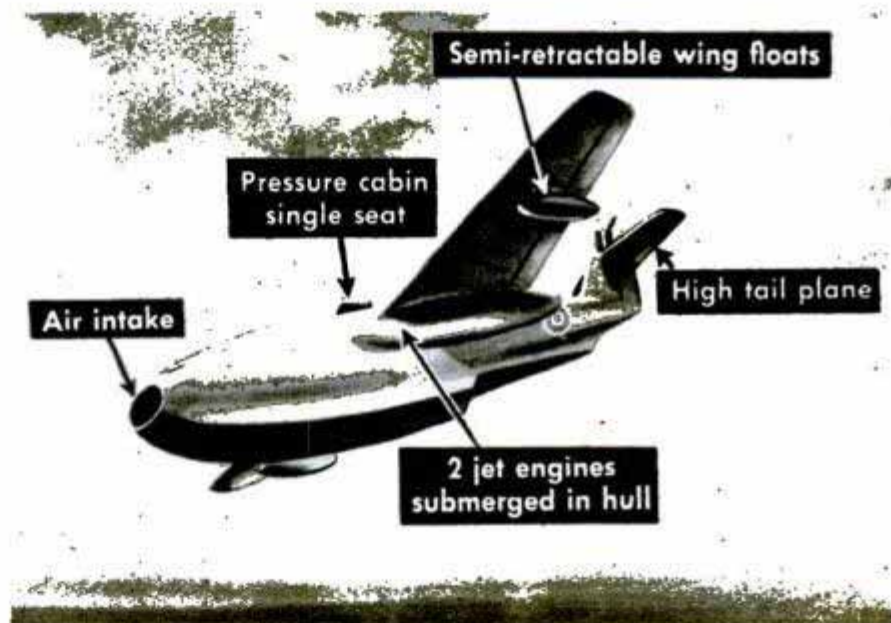
Winding Machine Handles 28 Coils

In 16 minutes one worker using a new winding machine can make 28,000 turns of fine wire on transformer coils. Developed by Westinghouse to speed production of fluorescent lighting units, the machine enables the operator to wind 28 coils at a time. The enameled wire, which is .028 inch in diameter, travels from overhead spools through pulleys to wire guides. It is then wound around a square paper tube. After the winding operation is completed, the tube is sawed into 28 sections, each a finished coil.

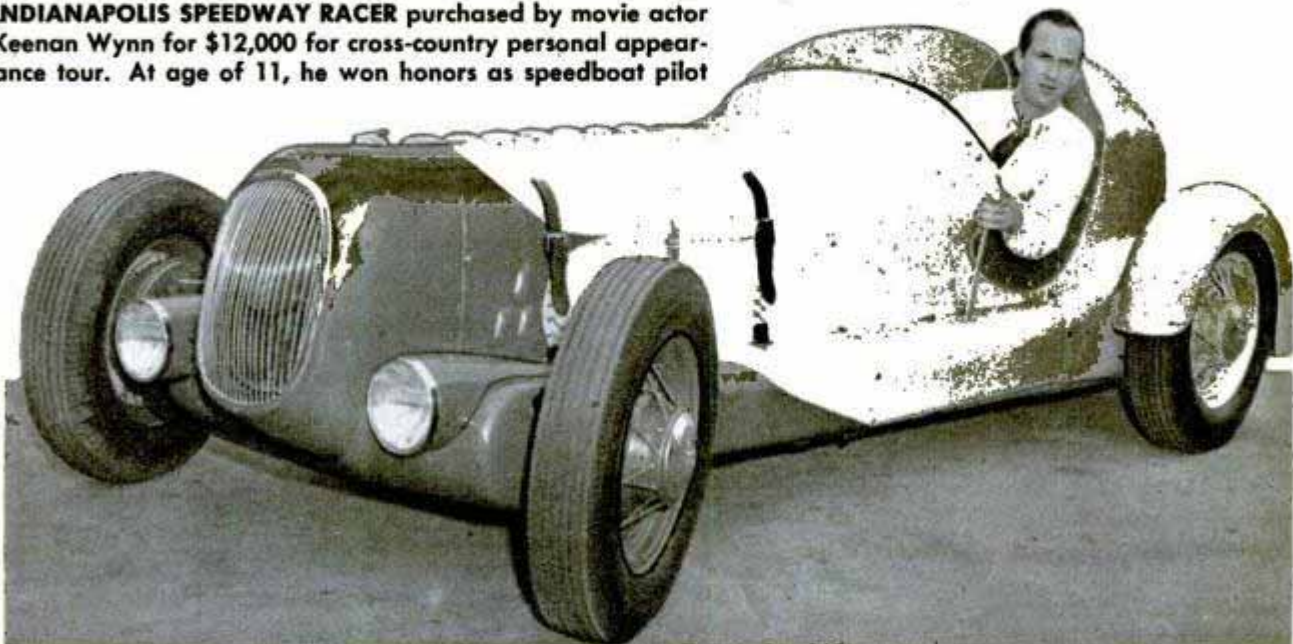


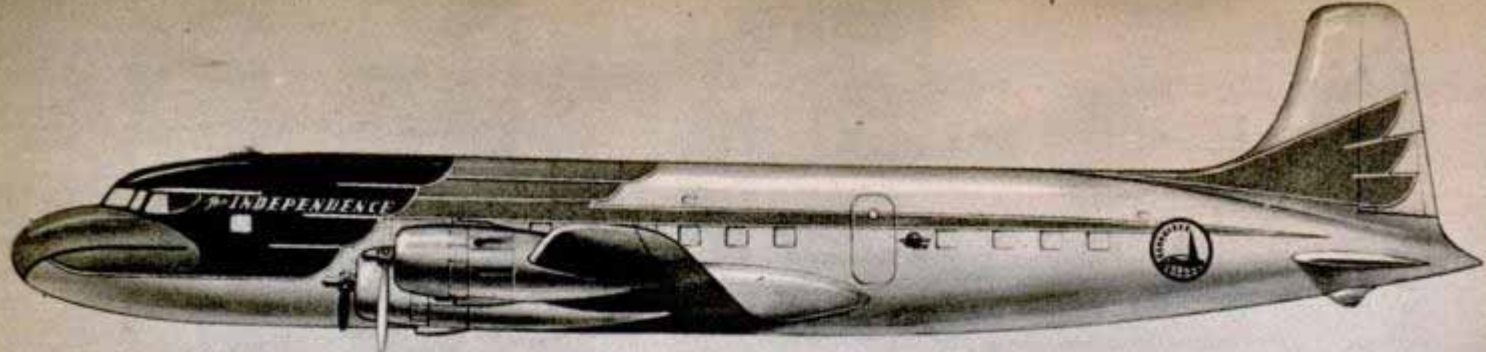
Flying-Boat Fighter

Guns and jet engines of the new Royal Air Force twin-jet flying boat are fitted in the hull for extra speed. The plane, a Saunders Roe A.1, is a high-wing single seater with semiretractable wing floats. Air intake for the two jet engines is in the nose. It is being tested to determine whether a flying-boat fighter can get into action faster in a naval battle than land-based planes.



INDIANAPOLIS SPEEDWAY RACER purchased by movie actor Keenan Wynn for \$12,000 for cross-country personal appearance tour. At age of 11, he won honors as speedboat pilot





Painted to resemble the American eagle (note beak and tail "feathers") President Truman's new DC-6 has four 2100-horsepower engines and 4400-mile range. His private stateroom is aft. The forward section seats 24 or sleeps 12

The PRESIDENT'S PLANE



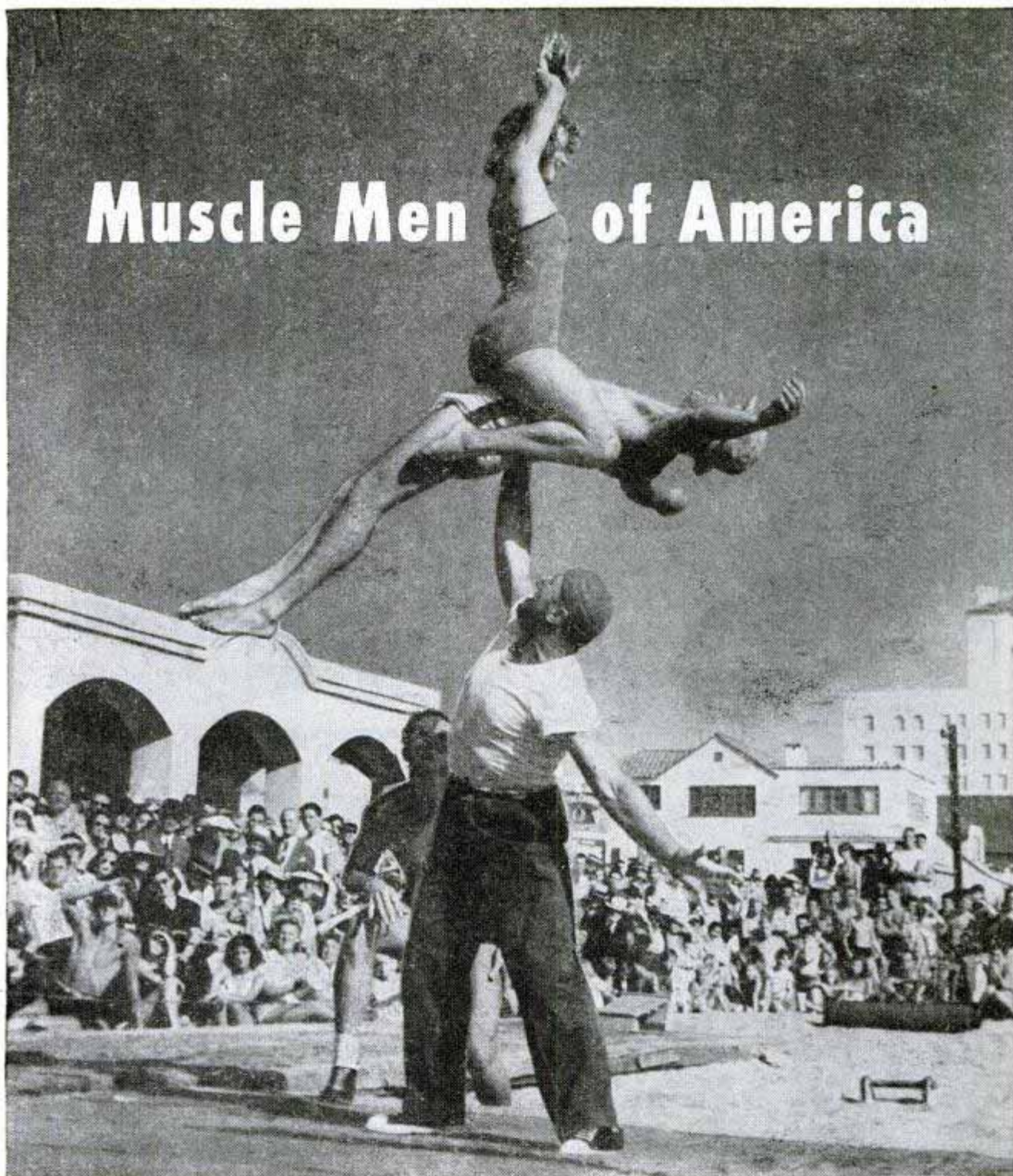
Special equipment on plane includes radio teletype-writer (above) which can code or uncode messages; it has 3000-mile range. Below, plastic nose of plane contains radar scanner for terrain or storm clouds



Phone circuits and controls for a concealed radio are in panel at left of President's chair in his stateroom. Below, inspecting a pair of new-style radio-compass loop housings projecting from plane



Muscle Men of America



Weightlifter at the beach thrills crowd by hoisting human "barbells" over his head with one hand

THE ANCIENT Greeks, worshippers of strong bod-

ies, told a favorite story about Milo of Crotona. Milo was a puny little guy who set out to build himself up by lifting a calf over his head every day. When the beast had developed into a full-grown ox, Milo was the world's strongest man.

Americans, like the Greeks, take pride in healthy and strong bodies. More than just a fad, some 2,500,000 men and boys in garages, attics and basements all over the United States are improving their physique through weightlifting.

By George E. Wilcut

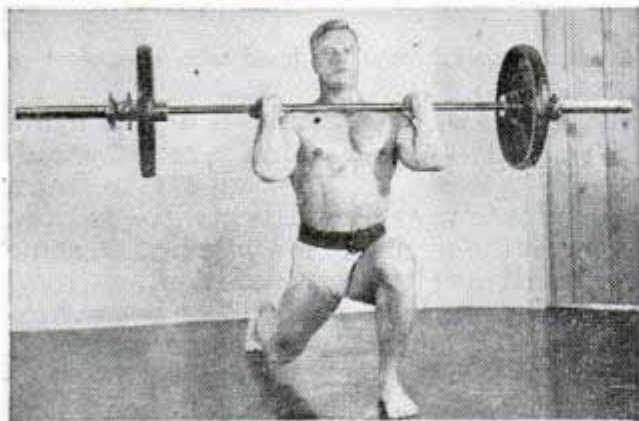
President, Southern California Weightlifting Assn.

About a year ago a thin, round-shouldered little man walked into my office. His name was Donovan. At the urging of his wife he had come to consult me about his condition.

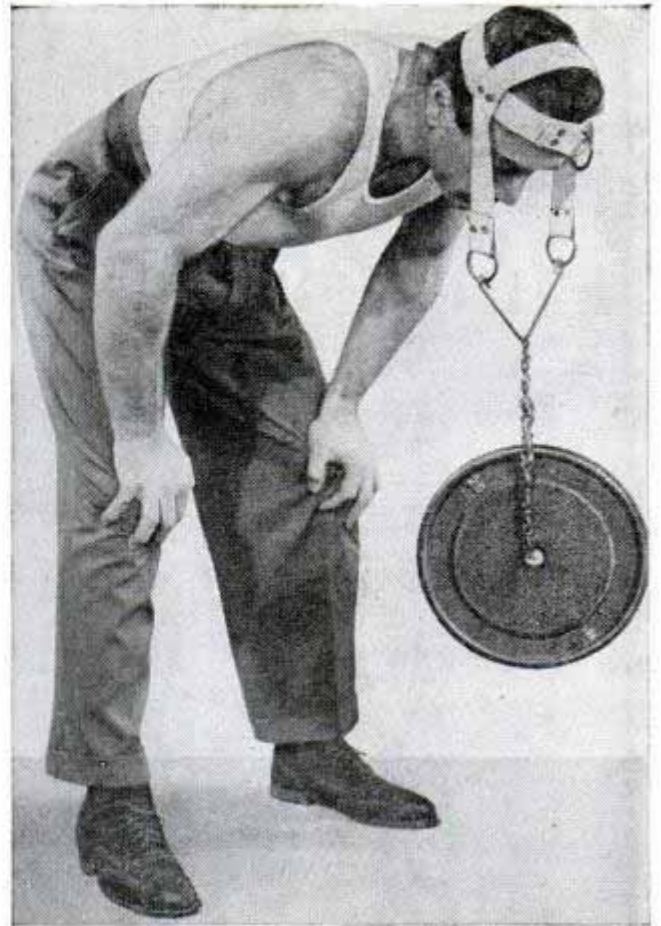
"I weigh only 135 pounds," he began hesitantly. "I'd like to gain some weight. I think I'd feel better if I did."

It was apparent that the man had never done much exercise. I suggested a program of dumbbells and iron shoes. I didn't hear from him for about a year. Then he entered my office again.

"Guess you don't know me," he grinned.



George Beedle of Santa Monica, Calif., demonstrates the three standard Olympic lifts. They are from top to bottom: **TWO-ARM MILITARY PRESS**, **TWO-ARM SNATCH** and the **TWO-ARM JERK**. See text for detailed description and world records for these lifts



The 25-pound head-strap builds powerful neck muscles

Frankly, I didn't. His head was erect, his shoulders were broad and straight and a pair of 15-inch biceps bulged below the short sleeves of his sports shirt. He looked like a middleweight boxer.

Men and women in all walks of life are turning to weightlifting to keep in trim. The joy of weightlifting and weight-exercising lies not in the lifting itself, but in the muscles it develops and the feeling of well-being it promotes. Hollywood motion picture stars are aware of the values of physical fitness. Bing Crosby, Van Johnson, Gary Cooper, Fred MacMurray, Cary Grant, Bob Hope, Joel McCrea, Buster Crabbe and Randolph Scott are only a few of the male stars who regularly practice weightlifting.

The war did much to promote this form of exercise. The accent on physical fitness and combat-conditioning made weightlifting a popular sport in the Army and Navy. Not long ago American men and boys practiced furtively with barbells and dumbbells in the privacy of their own bedrooms. Today the sport has come out into the open and is one of the fastest-growing in the country. Some 52 nations belong to the International Weightlifting Federation and it promises to be one of the most interesting features of the 1948 Olympic games.

Through the years there has been much debate and speculation about the best way to build a strong and healthy body. The-



Tom Harmon keeps in trim with this rubber exerciser

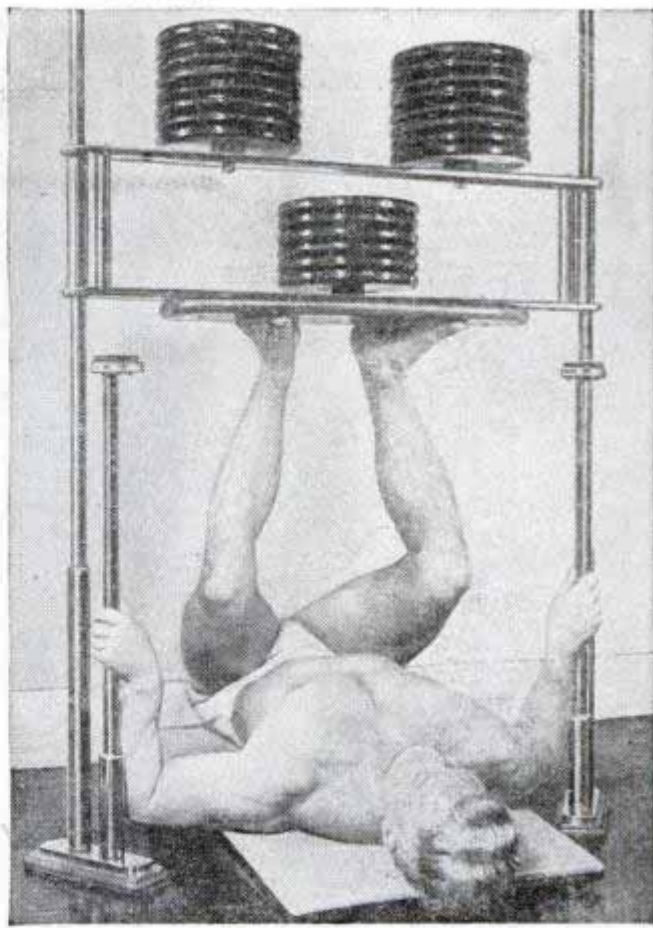
ories have ranged from taking cold showers before breakfast to living on an all-vegetable diet.

But science has shown that the quickest way to build muscle on the human body is by continuous resistance. This resistance should be applied when the muscle is flexed. When stretched, the muscle supports weight like a rope—by fiber rather than dynamic energy. Exercise should be done slowly and rhythmically—so that the bloodstream can remove the products of fatigue. Rest between periods of exercise is extremely important so that the muscle can rebuild itself.

The principles of weight resistance for muscle building are not new. Roman athletes used weighted shoes to build up leg muscles and improve their running. Norse warriors practiced with weapons twice the weight of those used in battle. And ever since the birth of baseball in America, a player going to bat will swing two or three clubs before he steps up to the plate.

Recent experiments by Army doctors have shown the value of weightlifting from a medical point of view. At the Gardner General Hospital in Chicago, some of the nation's top orthopedists were turned loose on the problem of rebuilding torn muscles.

A soldier recovering from a serious leg wound was placed on a specially constructed hospital table. Weights were strapped to his foot and he was told to lift his leg up



Calf and thigh-muscle builder—weightlifter uses foot press to hoist 440 pounds with his legs. Below, human body forms sturdy arch for a handstand



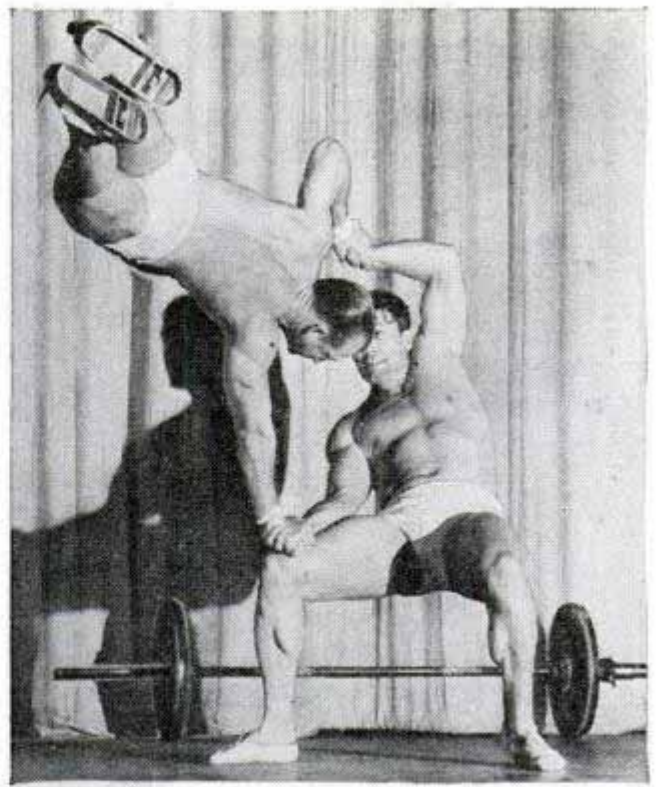


and down. He exercised the limb about 30 minutes each day—a few pounds being added to the weight each time. In three weeks the lifting power of his leg had increased from 10 to 80 pounds. The circumference of his thigh had grown two inches.

The preliminary experiment convinced the Army medics. They ordered the skip ropes, pulleys, springs and other apparatus in the hospital gymnasium ripped out. Weightlifting and weight-exercising were substituted and clinical observation was continued on 300 cases.

The results were spectacular. Patients immobilized for a year with broken bones of the upper leg—a difficult fracture—walked normally after four weeks' work with weights. Patients with machine-gun bullets through the chest increased their atrophied pectoral muscles to an even larger size than when wounded. The War Department was so impressed with these results that it ordered a motion picture made so that the experiment could be shown at other hospitals over the country.

What weightlifting can do for World War II veterans, it can do for you. A judicious weight-exerciser, starting with flabby muscles, cannot help but develop his body. And contrary to what you may have heard, you



Weightlifters demonstrate balance and strength. The iron shoes on man above makes his headstand a difficult feat. At left, two performers combine tumbling and acrobatics with their own sport of weightlifting

don't have to worry about developing hernia, getting "muscle bound" or acquiring an "athlete's heart." Under proper supervision, a course in weightlifting will add or decrease poundage as you desire, will give you strength and suppleness and will promote a feeling of well-being.

Weights generally used are these: barbells and dumbbells for the arms, shoulders and upper torso; barbells and iron boots for the legs, and a headstrap for the neck. The problem is to apply weight to the specific muscle you want to build up. For legs, arms and neck, weight can be applied directly. For the more difficult muscles to get at—the back, back of the leg, the calf, back of the arm—pulleys may be rigged to throw weight in the proper direction.

You may start with equipment that can be purchased for as little as \$10 or \$15 and work up to a complete set of championship weightlifting and weight-exercising devices that may cost from \$250 to \$300. Some beginners will find it helpful to join a gymnasium where instruction is given; others may profit by subscribing to a course by mail in body-building and weightlifting.

A beginner will start slowly with the type of weight that he can best handle. Later, like Milo and his growing calf, he will increase the poundage. For the average person it is best to exercise with the weights in the evening after work. Allow at least an hour of rest before eating and

(Continued to page 248)

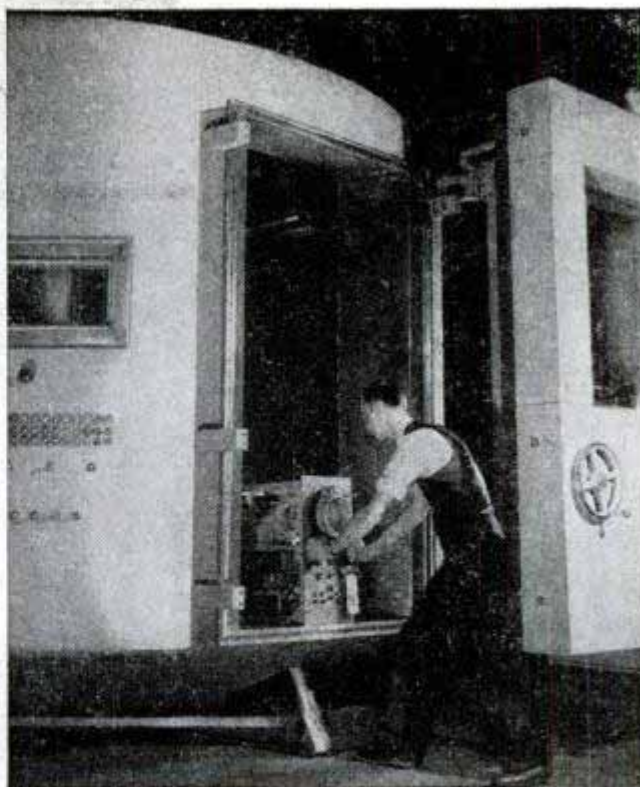


Speed Graphic—'47 Model

Completely redesigned, a series of Speed and Crown Graphic cameras has many improvements of value to news photographers and others who require cameras that can be used for almost any photo assignment. Changes have been made to provide a tilting front lens board, direct reading of the six focal-plane shutter speeds, and a frame finder with parallax stops. The back peep sight is round instead of rectangular and an elliptical spring snaps it back in place if it is touched by the photographer. The built-in body release trips either the front or focal-plane shutter. The focal-plane shutter speeds may be changed without firing the flash bulb through a redesigned shutter-synchronizing mechanism. Instead of fabric hoods the new cameras have removable four-sided hoods made of metal. An inertia governor cuts the three basic speeds in half to give a choice of six speeds to the photographer. All edges of the leather cover are bound with metal and the handle is adjustable.

Camera Arm Supports Floods

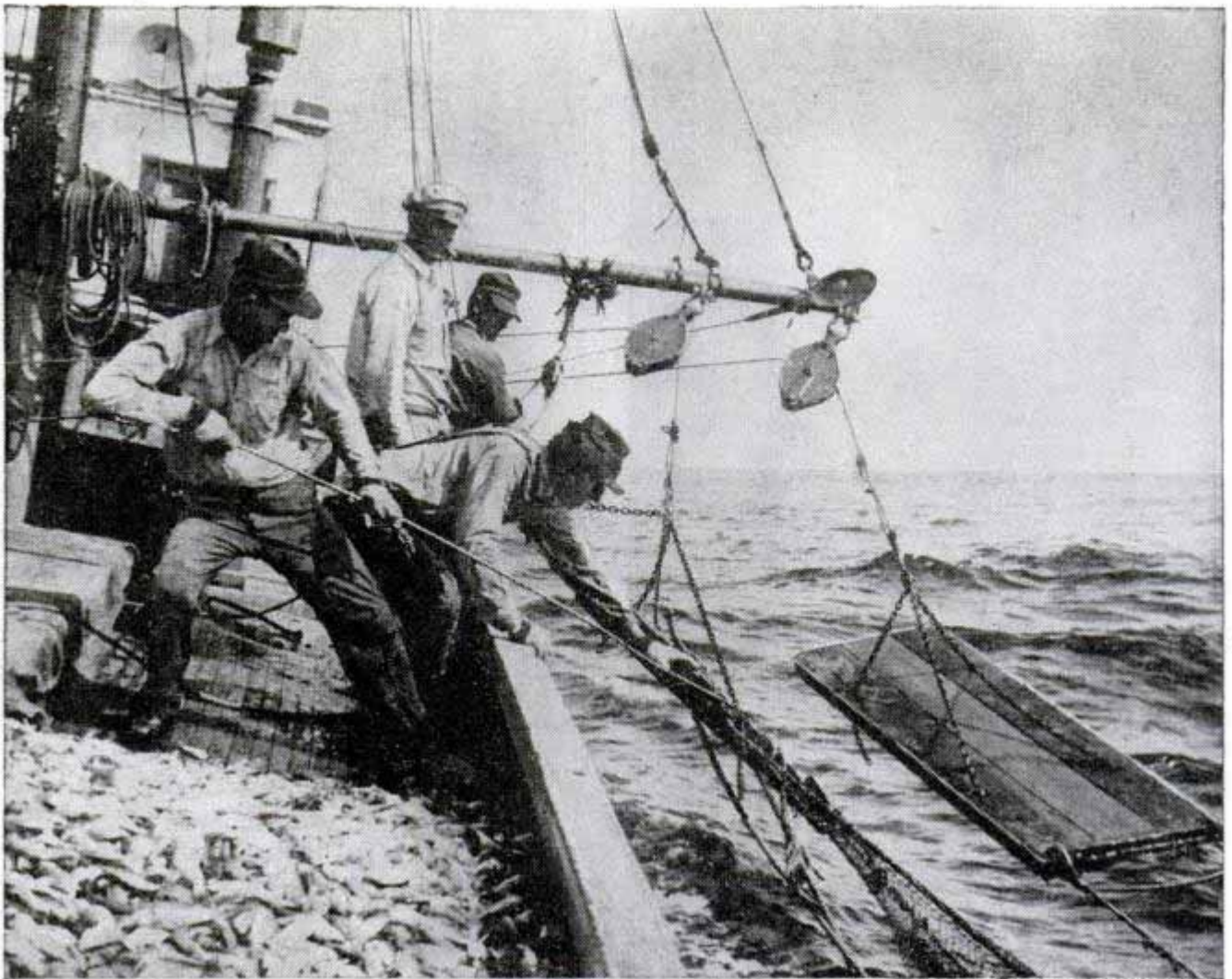
Photoflood bulbs can be fastened directly to the camera with an attachment that puts all the photographer's equipment in one hand and prevents the light from striking the lens. An aluminum arm is fastened to the base of the camera by a handle and holds two bulbs above and behind the lens. Whenever the camera is turned, the light source moves in the same direction. The attachment can be fastened to tripods and movie titlers.



Weather Chamber Tests Radar

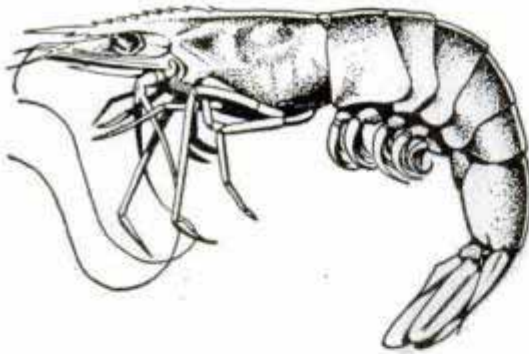
Weather chambers capable of a quick switch from a subzero arctic temperature to a humid tropical climate are used to test radar and communications equipment. Atmospheric conditions up to 80,000 feet are simulated inside the chamber. Because performance of electronic devices varies with weather changes, Westinghouse engineers test equipment at temperatures from 200 degrees Fahrenheit to 75 below.





Fish and Wildlife Service photo

Shrimp fishermen drop net off Louisiana coast; weighted board held by towline forces net to the bottom



THEY DREDGE *for* YOUR DINNER

By Wayne Whittaker

AS THE OYSTER BOAT, Elroy, chugs into the vicinity of Square Handkerchief marker, Captain Dudley Langlinais yells to the engineman:

"Slow 'er down, Willis! Going to take a sounding."

The 60-horsepower Diesel, which powers the squat 50-foot Elroy, slows its pace. Captain Langlinais, veteran oyster fisherman, thrusts the long sounding pole into the warm salt waters of the Gulf of Mexico. The marker with the strange name of Square Handkerchief locates a reef a couple of miles out from Pass Christian, Miss. The oyster beds here, some of which extend for miles, are found in about 15 to 20 feet of water along the edges of the reefs.

After several tries the sounding pole strikes something hard, indicating oysters, and one of the Elroy's two dredges is swung over the side with its heavy iron chain going away out. The captain swings his foot over the rail and presses it against the chain to "feel" how the dredge is biting into the oyster bed. In a few minutes he gives the order "Roll!" and the power winch pulls in chain and dredge.

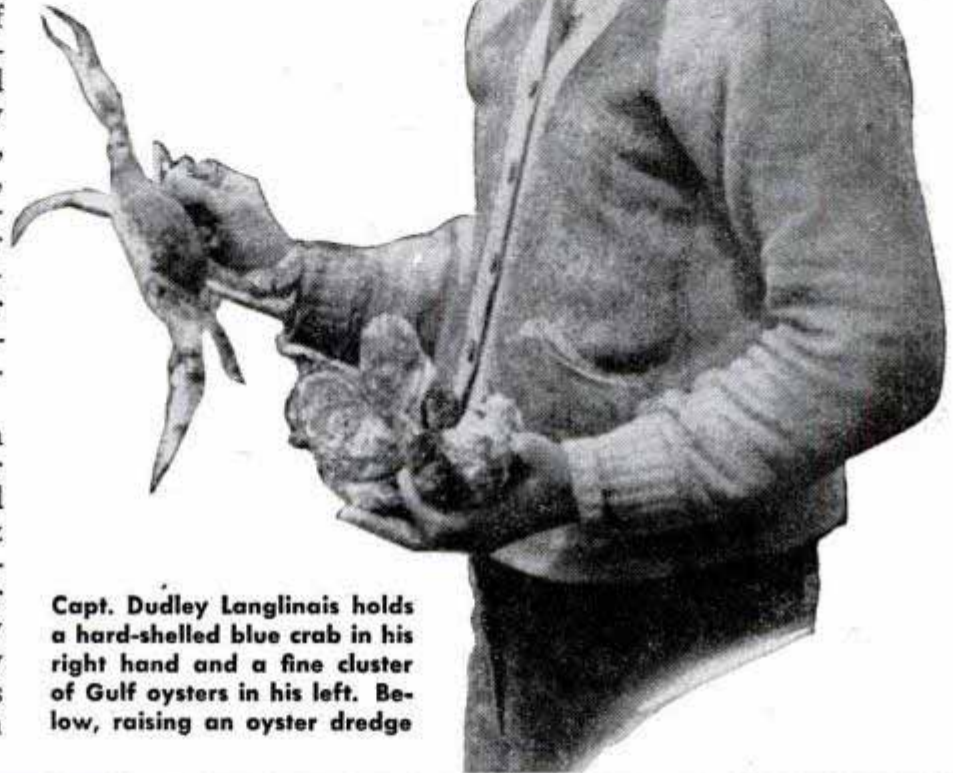
About four bushels of dripping shells and assorted marine life are dumped on the low sorting platform. Most of the shells in this sample haul are blue and "dead" and the few live oysters in the catch are too small for commercial use.

The Elroy moves on and after several

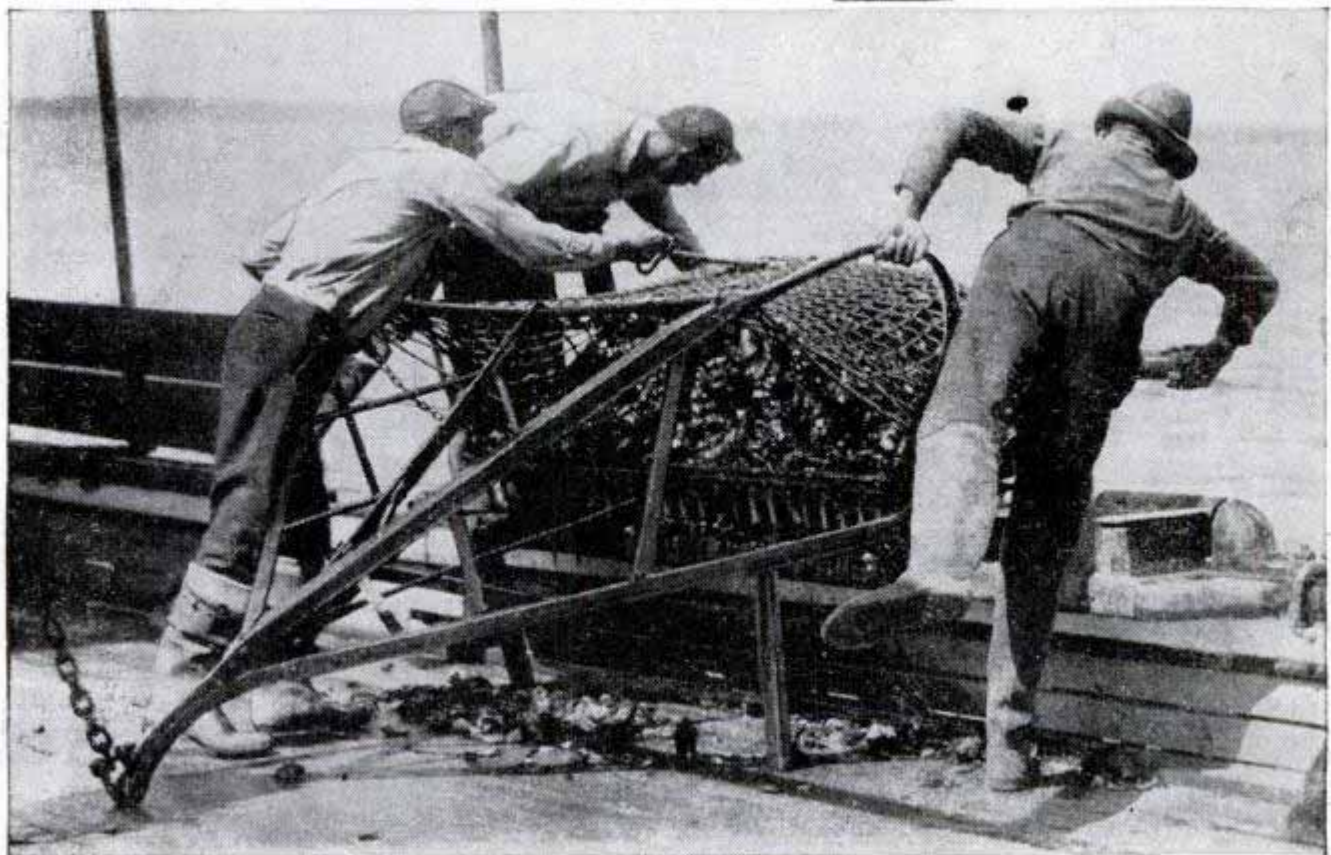
soundings and sample dredgings, a good haul is made. Over the side goes a buoy, consisting of an empty five-gallon can with anchor, to mark the spot. The sounding pole is stored away and the captain takes his position at the wheel in the pilot-house. The crewmen, two to starboard, two to port, take their positions at the two dredges and some concentrated oyster fishing gets under way. The crew is glad for some action because the early morning breeze is from the North and cold.

Soon other oyster boats that had been sounding along the reef move in to share the Elroy's find. The Elwood F, Lone Star, Mary Frances and the R.O.C., all out of Biloxi, Miss., join the merry-go-round circling about our buoy. This is an accepted procedure in oyster fishing along the Gulf—one boat's find is everybody's good luck.

The Elroy, one of a fleet of about 30 oyster and shrimp boats owned by the Mavar Shrimp & Oyster Co. Ltd., of Biloxi, is a typical oyster craft. It is manned by the captain and a crew of four. The crew works in pairs. With cotton



Capt. Dudley Langlinais holds a hard-shelled blue crab in his right hand and a fine cluster of Gulf oysters in his left. Below, raising an oyster dredge





"How's this for a dredgeful of oysters?" asks Willis Albert of the Elroy crew. Catch also included a flounder and one hated sting ray

gloves to protect their hands, they quickly sort each dredgeful of rough-shelled oysters as they are dumped from the dredges. The clusters of good oysters are thrown back on the deck to be shoveled later into deck bins or hold. Rejects, dead shells and unwanted marine life (such as the treach-

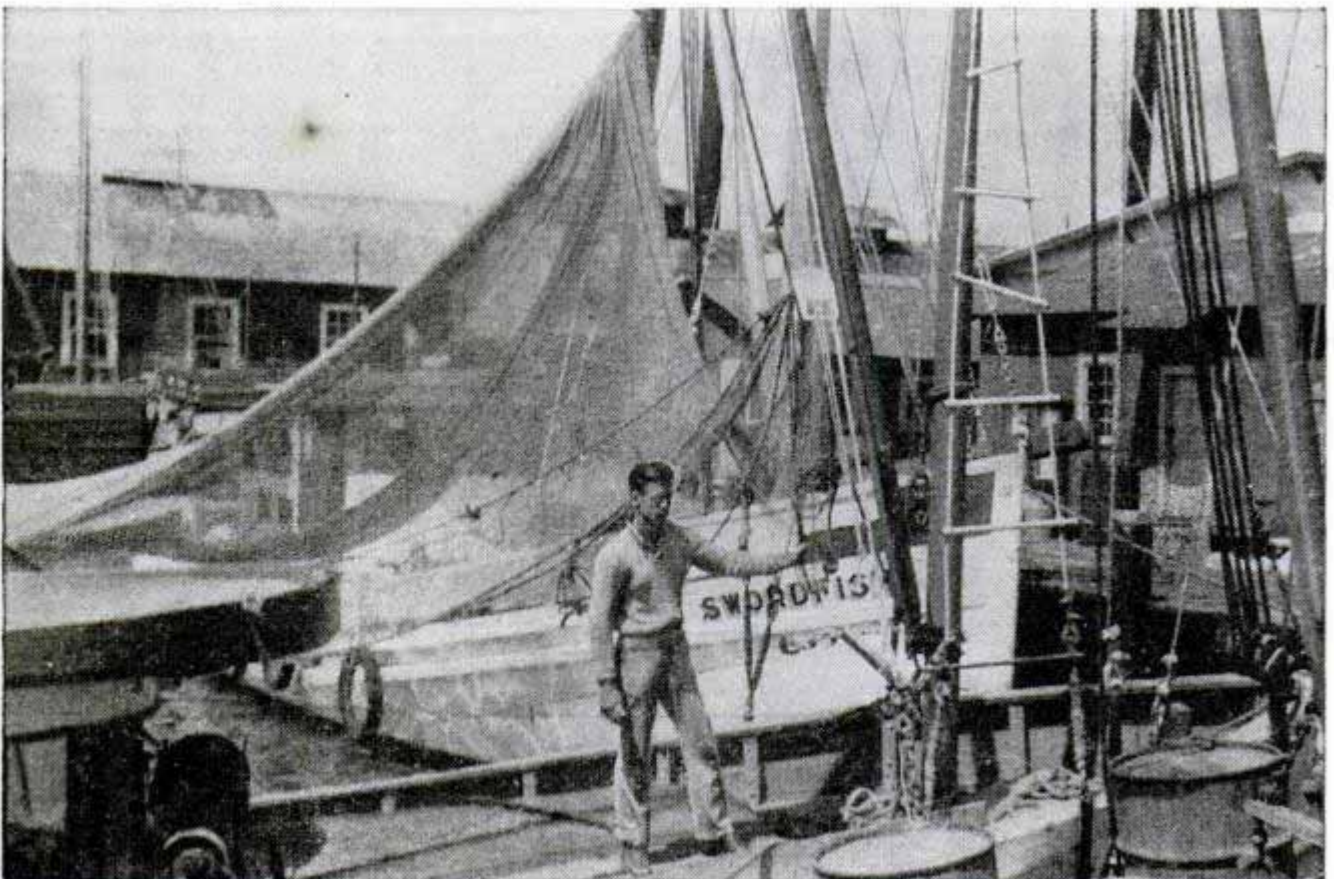
erous sting ray) are shoveled back into the Gulf. Flounders and other choice fish, as well as hard-shelled blue crabs, are tossed into a wire basket to be sold on the wharf by the crew. They ask only fifty cents a dozen for the choice crabs.

To an inexperienced land-lubber the first dredgefuls of oysters look all alike—neither good nor bad. However, as you work alongside an expert fisherman at the sorting platform, you soon learn how to pick out the well-filled oysters of three-inch size or better. The best ones on the reefs seem to grow in clusters of half a dozen or more.

Working from dawn to dusk, it takes the Elroy's crew about three days to get a boatload of oysters. The capacity of the hold and bins is estimated at 330 barrels with a weight of 69,300 pounds. A full load pulls the boat deep into

the water and when the waves are high on a return trip the deck is often awash. During the oyster fishing season—Jan. 1 to May 1—the Elroy and boats like it plying South Atlantic and Gulf waters bring in a harvest of about 12,000,000 pounds of oysters. This is one fourth of the oysters

Bill Kennerson, Biloxi shrimp fisherman, feels one of the big nets to see if it's dry enough to put away



consumed in this country.

Oyster beds along the Gulf are under the close supervision of the conservation departments of the various states. Some of the beds are privately leased to "oyster farmers" who plant shells, gravel and other material to which the young oysters can cling and grow. These beds may be fished out of season like a privately-stocked fish pond. The public beds are cared for by the state conservationists and special permits are issued for every trip by a fishing boat. The reefs are policed by state vessels, or marine "cops." During mid-morning one of them pulled alongside the Elroy and asked Captain Langlinais to show his permit.

"These state regulations are all to the good and sure discourage any poaching," said the captain as the state boat pulled away. "Our oyster beds along here are just recovering from the fresh-water floods that killed most of the young ones a few years back. It takes three years for an oyster to grow to market size.

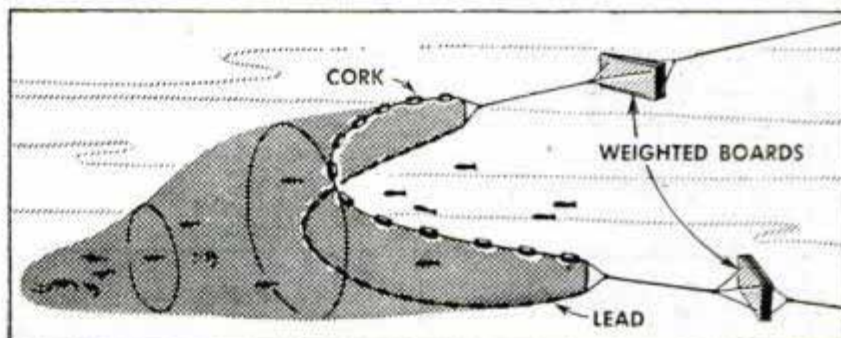
During the summer spawning season a female oyster lays several hundred million eggs. Although many of these eggs hatch into the larva stage, only a very few grow to maturity. During the first two weeks of an oyster's life he does all his traveling as a free-swimming larva about $\frac{1}{75}$ inch in diameter. Before the oyster can take on its adult form it must attach itself to a clean, hard object such as a shell or rock. This is called "setting" and millions of larvae die when they strike mud or marine growths to which they are unable to attach themselves. Two weeks after setting, the oysters have formed shells $\frac{1}{4}$ inch long and are known in this stage as "seed" oysters. Many of these are gathered and planted by oyster farmers in beds where they try to protect the young oyster from its enemies.

These enemies beset the

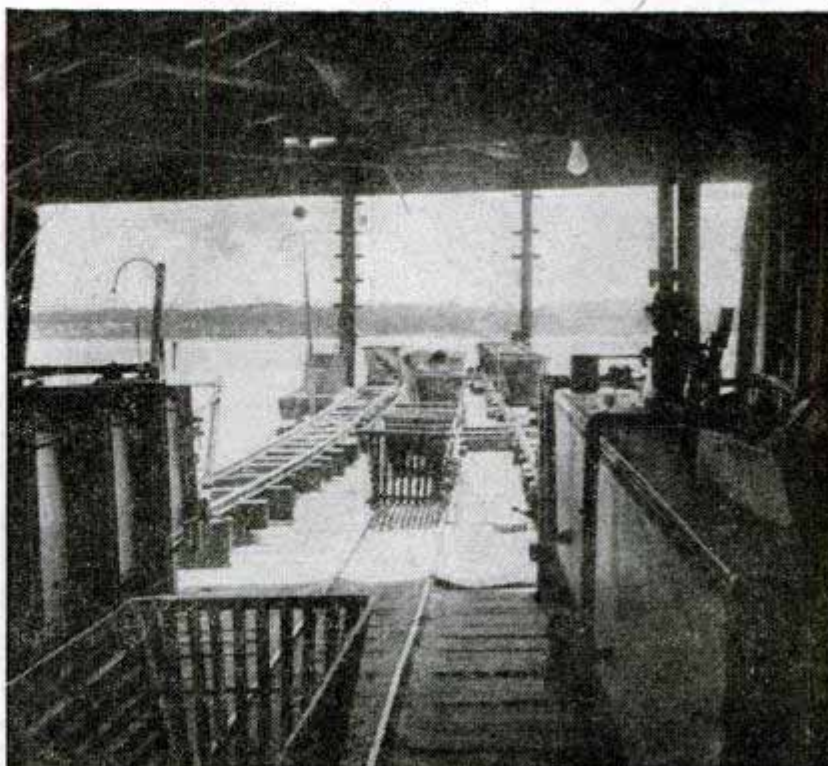
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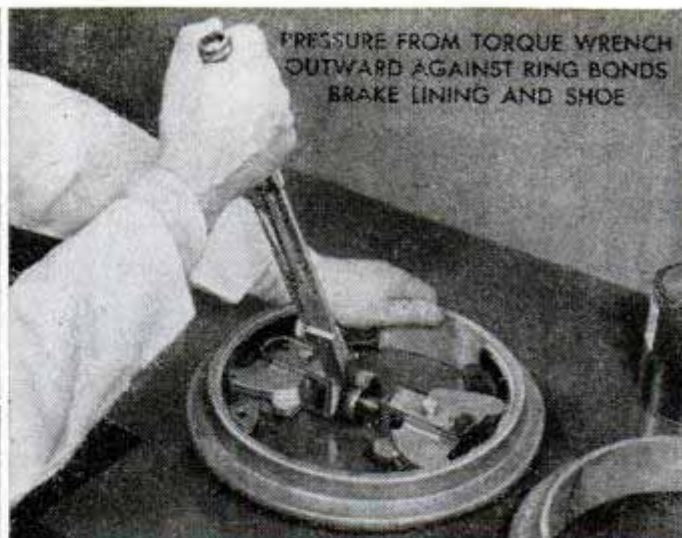
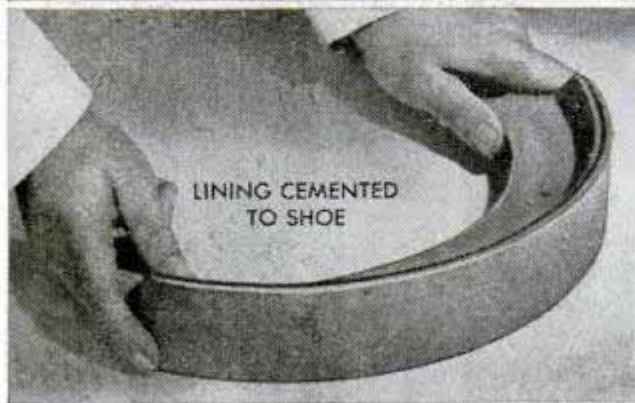
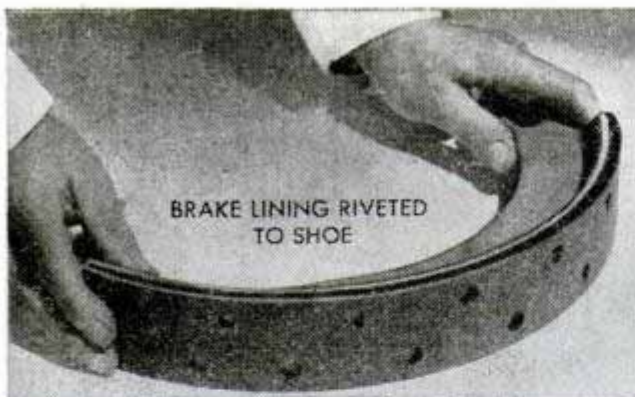


The Elroy edges toward Mavar dock with a 330-barrel load of oysters stored in the hold and deck bins. It takes three days to fill the boat



Bag of shrimp net known as otter trawl varies in length from 30 to 100 feet; a single four-hour drag may yield 40 barrels of shrimp. Below, rails on Mavar oyster pier carry the oysters in metal cars to cannery





Goodyear photos

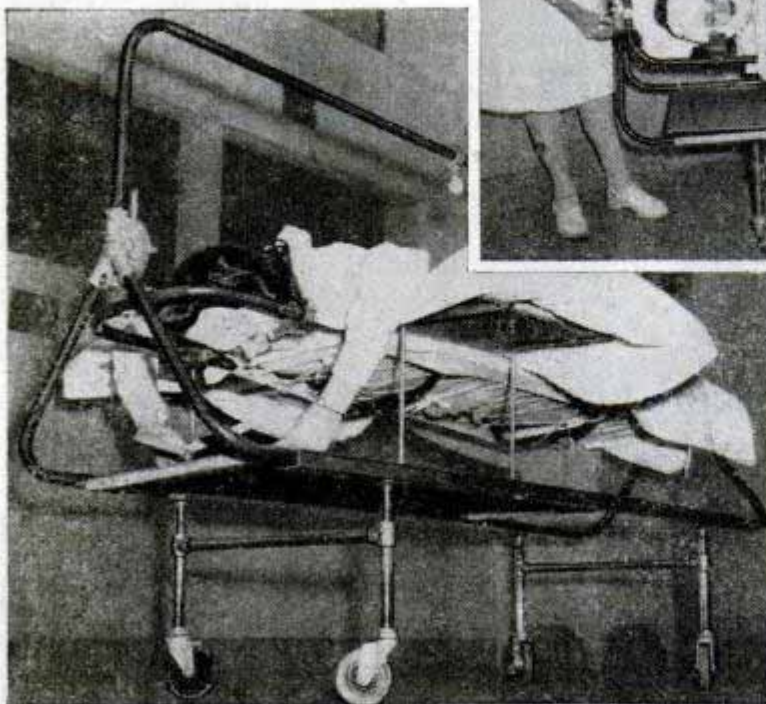
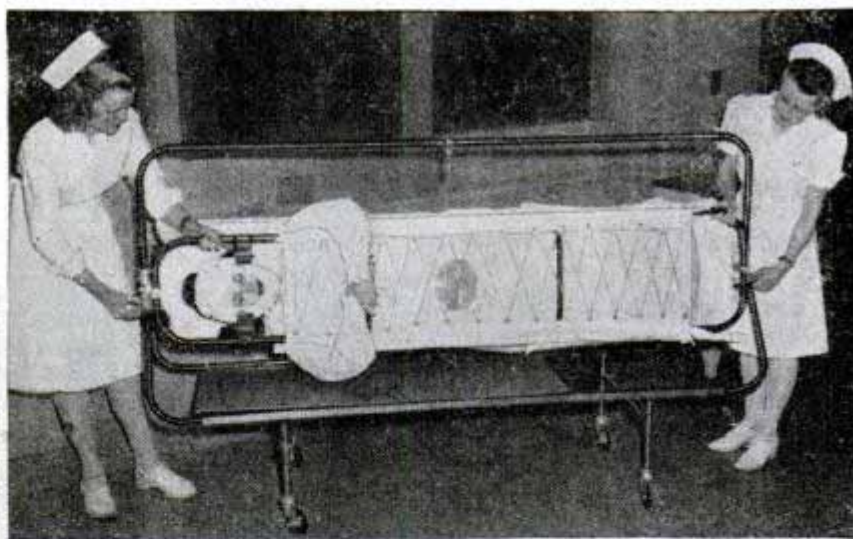
Comparison of riveted and cemented linings, left, shows larger braking surface provided by the latter. Cemented linings are "cured" in an oven after bonding

down to the shoe, instead of just to the rivet heads as was formerly the case. They also eliminate the drum scoring caused by abrasives that collect in the indentations above countersunk rivets. Better brake performance results from exposure of a larger contact area of the lining to the brake drum, increased by the absence of rivet holes. Tests indicate the cement's bonding efficiency is six to nine times greater than that of conventional rivets.

Cemented Brake Linings

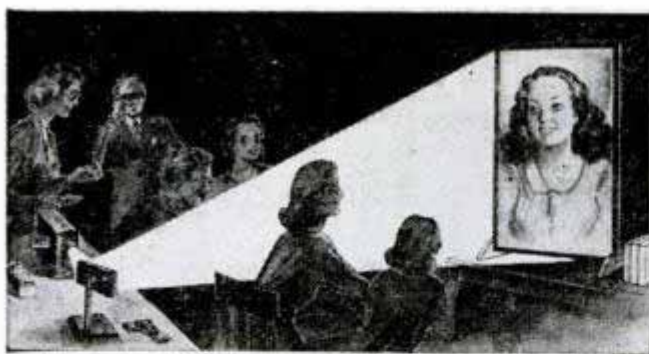
Brake linings applied by a new cementing process last twice as long and perform better than those put on with rivets. The rivetless linings can be worn completely

Names and addresses of manufacturers of new products featured in this issue will be supplied by the Bureau of Information, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11

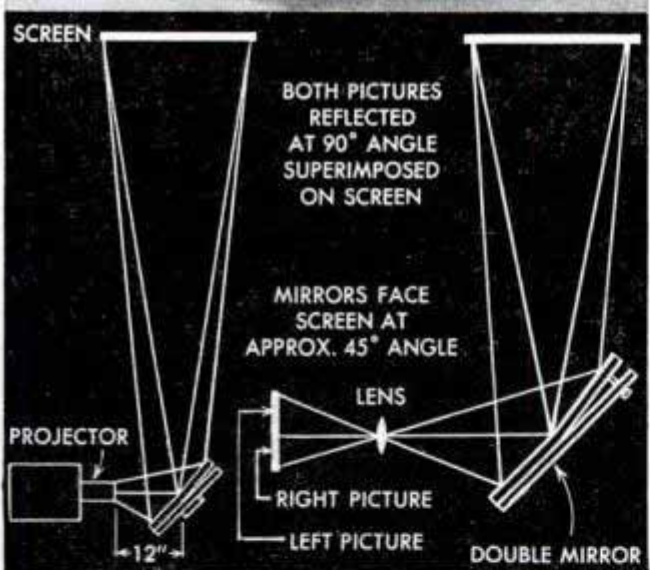


Hospital "Sandwich" Bed

Patients with severe fractures, particularly broken hips, can be turned painlessly in a "sandwich" bed. With the patient's back on one mattress, a second mattress is placed on top of him and secured to a frame. Nurses then rotate the frame and the patient is turned, stomach down, with the added mattress now beneath him. Turning fracture patients aids healing.



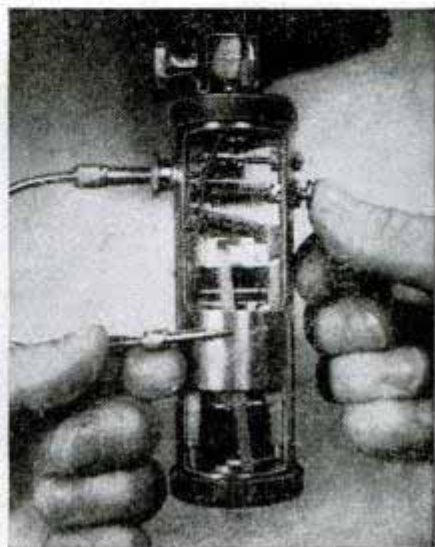
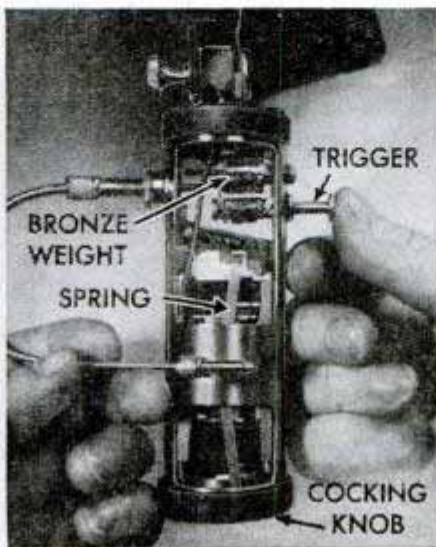
THREE-DIMENSION slides are thrown on screen by attachment for 35-mm. projectors. Viewers wear special glasses. Below, camera attachment snaps two photos at once for stereoscopic projection. Diagram shows how double mirror reflects both images to screen



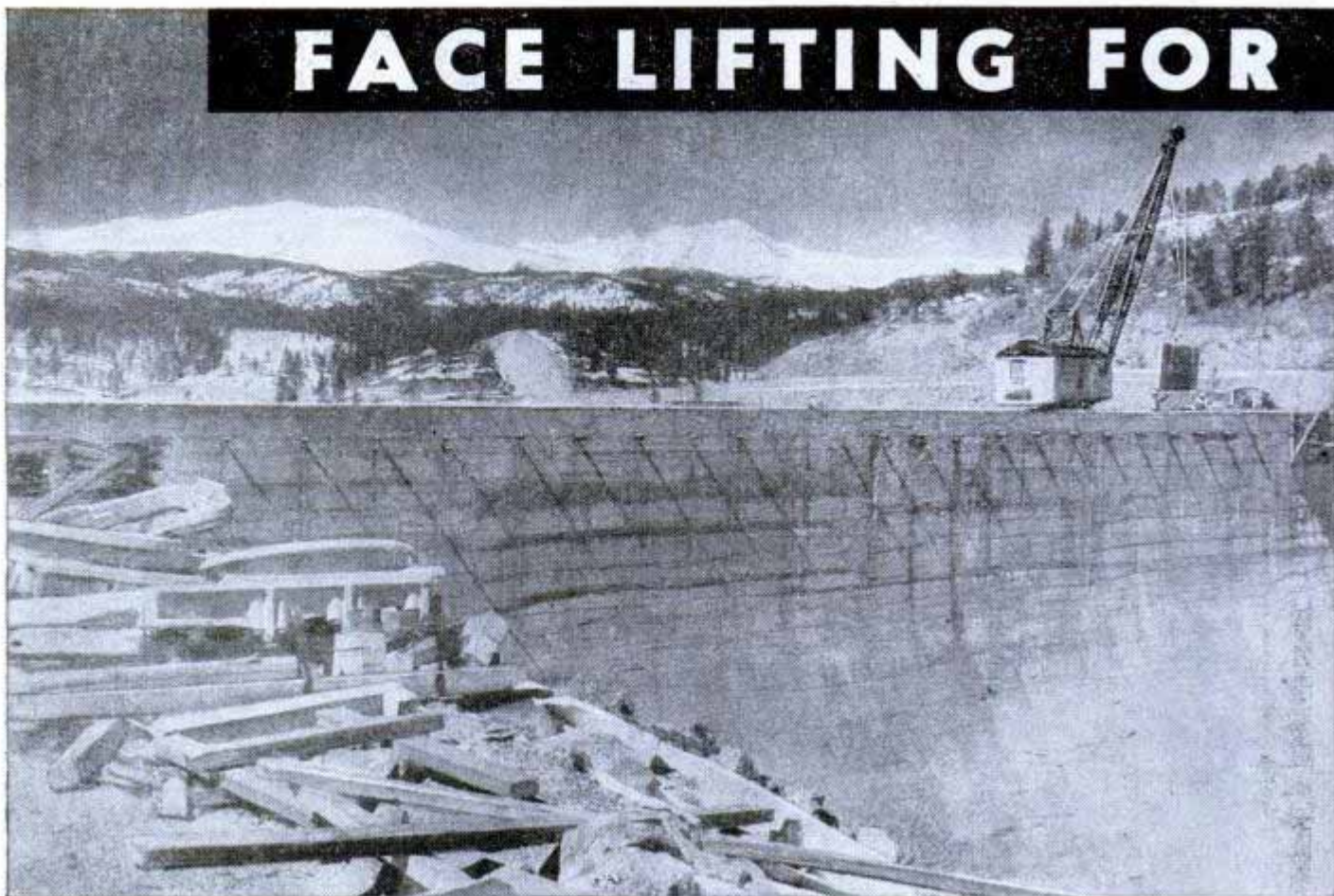
"ELEVATING" TRIPOD can be adjusted for height without manipulating the legs. By turning a crank the photographer raises or lowers the camera as much as 17 inches after the tripod legs have been tightened.

For CAMERA FANS

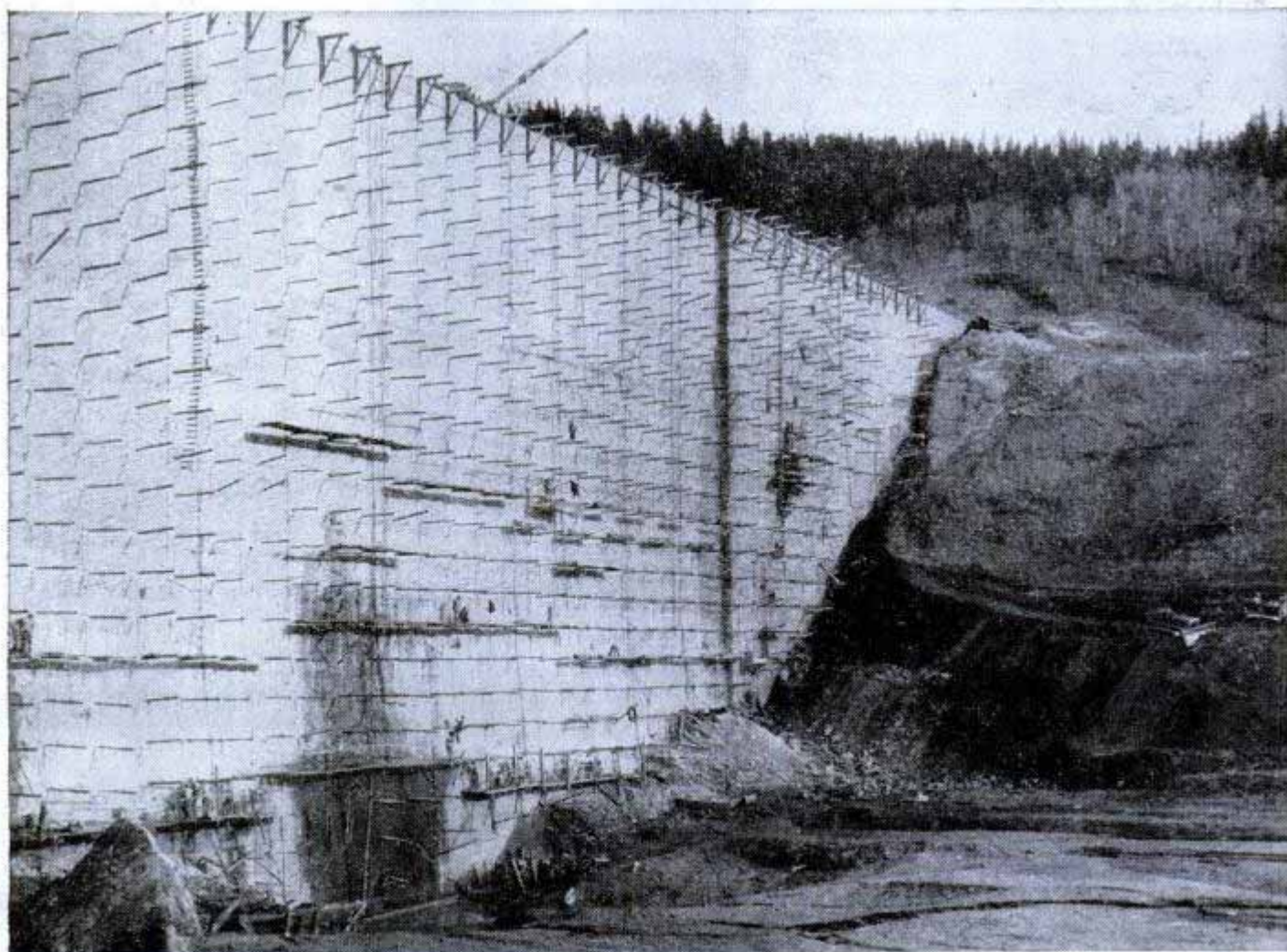
MAGNETIC SYNCHRONIZER for photoflash needs no batteries to fire the bulbs. Two magnets deliver a current of six watts. When trigger is pushed a spring moves an armature, releasing magnetic power to a coil which transfers the current to the flash bulbs



FACE LIFTING FOR



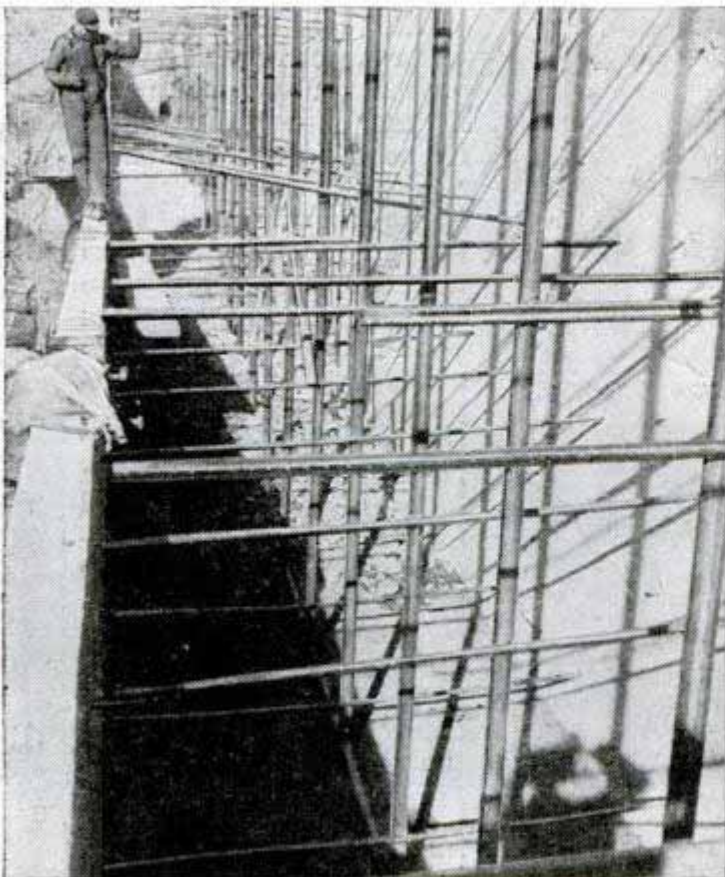
Crane lifts a prefabricated slab weighing seven tons into position for lowering down the face of the dam
↓ Workers dwarfed by the big dam clean decomposed concrete from the surface and install hangers for new face



A DAM



Precast concrete slab is ready to be fastened like a building block in the new face. Below, the dowels are welded together to hold the wall rigidly in place



By Forest Crossen

IN A NARROW CANYON of the Rocky Mountains west of Boulder, Colo., a crew of specialists in concrete engineering is rapidly completing a unique project—lifting the face of 166-foot Barker Dam by installing a new upstream face of prefabricated concrete slabs. The dam is being rebuilt for additional water storage.

First it was necessary to drain away the water, chip all decomposed concrete from the upstream face and pour a new concrete footing along the foundation. In addition, workers used diamond drills to bore down to bedrock. Grout, a concrete mixture, was pumped in to fill all voids.

In the meantime the prefabricated slabs were cast. Special reinforcing steel bars were laid in the forms and concrete filled in around them. The finished slabs measure roughly 7 feet wide, 12 feet long and 8 inches thick. They weigh about four tons.

Six steel dowel pins one inch in diameter were inserted in one face of each slab. These were located with precision to match the same size dowels driven into the upstream face of the dam. They hold each slab in place until the space between the dam and new wall is filled with concrete and gravel.

When the concrete footings for the slabs had been poured at the bottom of the dam and steps built up each side into solid rock, the slabs were ready to be placed. They were lowered by a crane which held them in place until welders could weld the steel dowel pins of the slabs to the matching dowel pins in the face of the dam.

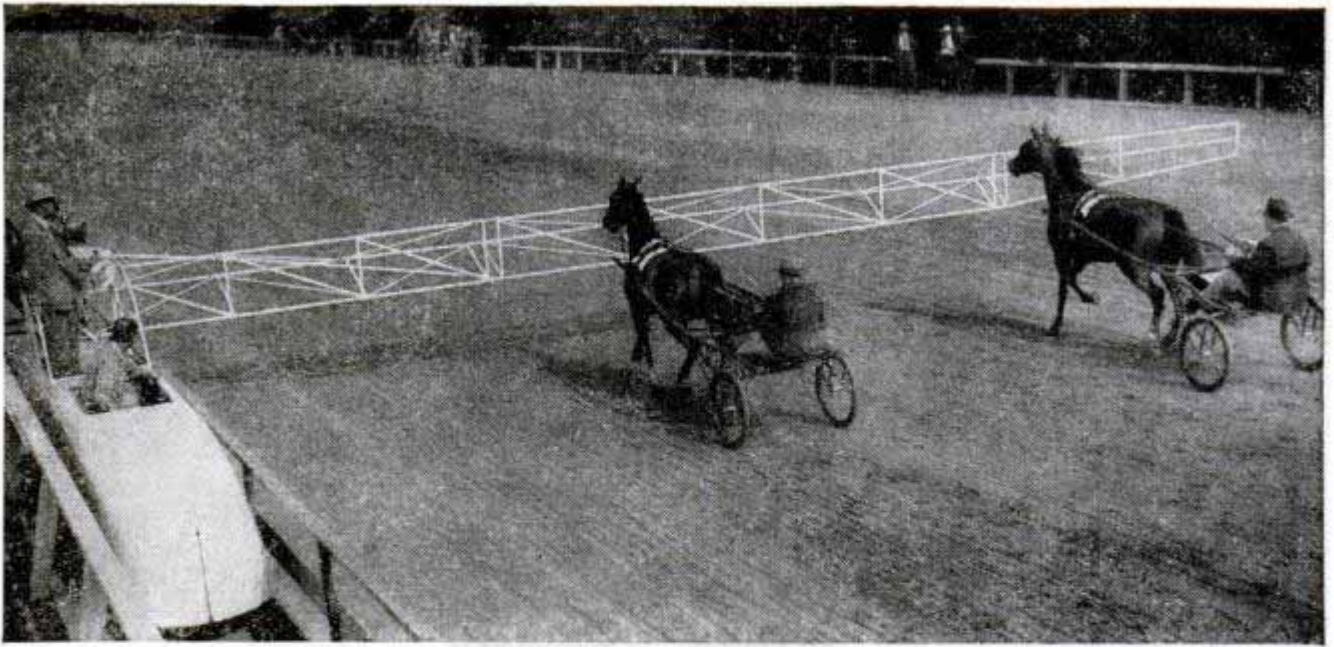
At the bottom of the dam the slabs were eight feet away from the dam. They were to slant upward until the two walls would be only 18 inches apart at the top.

As soon as the first row of slabs was in place, pipe fitters installed upright pipes two inches in diameter at intervals between the faces. These pipes had a series of slits $\frac{3}{8}$ inch wide and six inches long. As the slab wall went up, additional lengths of slotted pipe were welded to the first ones.

Also with the rise of the wall the joints were sealed with a special concrete mixture and clean, dry gravel was poured in to fill the void.

When the slab wall reaches the top, the space will be completely filled with gravel and the slotted pipes ready for use. Liquid grout containing a special ingredient which makes new concrete adhere to the face of old will be forced by a series of pumps down the slotted pipes. It will seep through the gravel to fill all holes between the walls.

Engineers say the resulting dam will be as strong as a completely new structure.

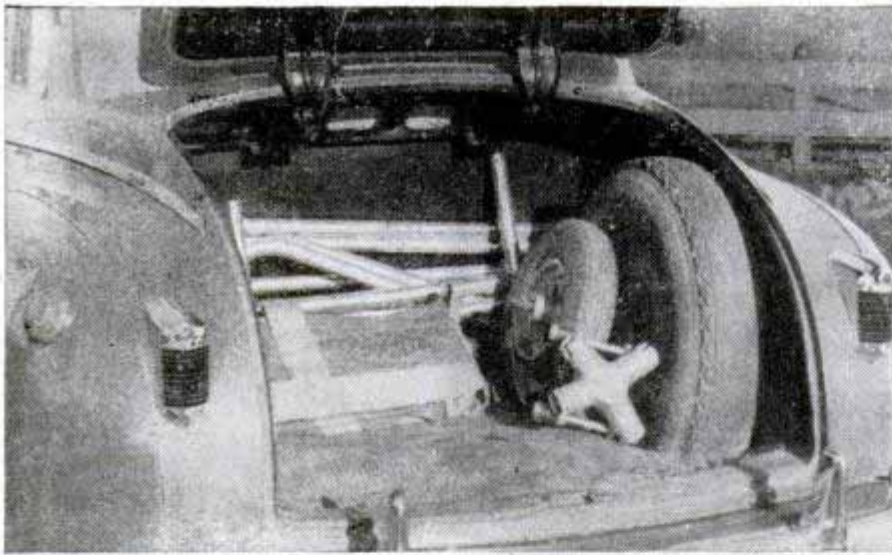


Harness Race Starting Gate

Two specially built cars, moving on steel tracks, operate the starting gates for harness races at Hollywood Park. A car on each side of the race track pushes the two arms of a gate, just in front of the horses. The six-cylinder Chrysler engines in both cars are synchronized to run at the same speed to assure perfect alignment of the

For starting only two horses, one gate arm is sufficient. Note car operator and starter with microphone

gate. An electrical cord connects the steel-tubing arms of the gate, but when the starter pushes a button the wire snaps apart and the arms swing forward and out of the way. A hydraulic shock absorber prevents damage to the gates as they swing open. The starter uses a public-address system to communicate with sulky drivers.



Automobile Trailer Collapses in Trunk

Built of waterproof canvas and tubular aluminum, a collapsible trailer can be stored in the rear compartment of an automobile when not in use. The trailer rides on a single wheel equipped with a pneumatic tire and a leaf spring. It takes less than five minutes to collapse the unit which occupies about one eighth of the average luggage compartment. In assembling the trailer, the tubular parts are slipped through loops in the canvas and locked in place. The trailer can be attached to the bumper of any car.



☞ Cotton can be sprayed with a chemical (pentachlorophenol) which has the same actions as a light frost—causing all balls to open at the same time to expedite picking.

ROOT FEEDER

Plants, grass and shrubs are watered and fertilized at their roots by a feeder tube that is inserted in the soil and connected with a garden hose. At the top of the tube is a transparent chamber which holds a chemical nutrient in cartridge form. When the water is turned on and a valve on the feeder is opened, the water swirls around in the chamber, dissolving the nutrient, then passes through the tube into the ground. The tube is inserted just a few inches for lawn treatments, about halfway for plants and all the way for trees. Cartridges are replaced easily when completely dissolved. Two different kinds are available, one for general use and the other for the feeding of specific plants.



Two-Faced Owls

Two-faced aluminum owls are aiding in an intensive campaign against pesky starlings at Decatur, Ill. City Pest Officer Joe Swisher discovered that the starlings shied away from the perch of an imitation owl. He and his co-worker, James Soules, invented a new species with two faces on a single body, hoping to double the owls' effectiveness. More than 30 of the aluminum owls have been placed in strategic spots about the city.

Fence Made of Bombs

Unexploded Nazi bombs have been rendered harmless and converted into makeshift fences by farmers on the island of Crete. The bombs were left behind after a German ammunition dump was smashed in an Allied air raid.

☞ Some frozen-food cabinets are equipped with a thermostat which flashes a light in case of power failure, giving warning before food thaws.





Seeder Sows One by One

Small seeds are sowed one at a time by a cylindrical tool which is operated by tapping the tube with the forefinger. Vegetable or flower seeds are poured into one end of the tube which has a removable cap. At the other end are small disks equipped with a thumb regulator to set the size of openings needed for various seeds.



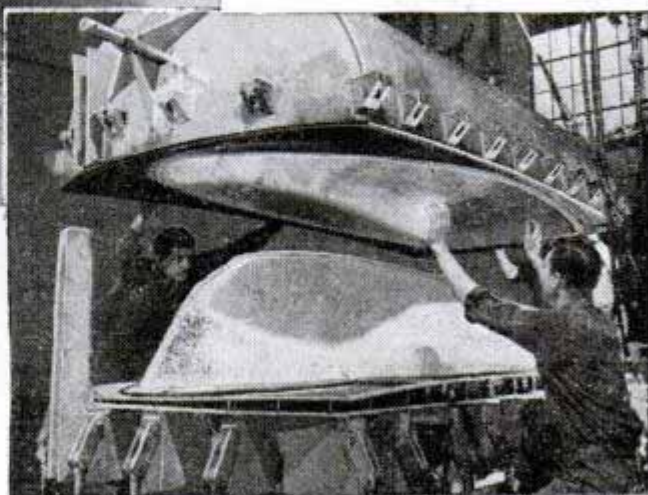
Safety Cage for Tire Inflation

Tire repairmen are protected from injury if truck tire rings should blow off during inflation by a cage made of two-inch steel tubing. The safety cage, developed by the Firestone Tire and Rubber Company, weighs 425 pounds and will accommodate tires up to 1200-24 in size. It permits easy access to the tire during inflation. The cage is designed for operators of large trucking fleets.

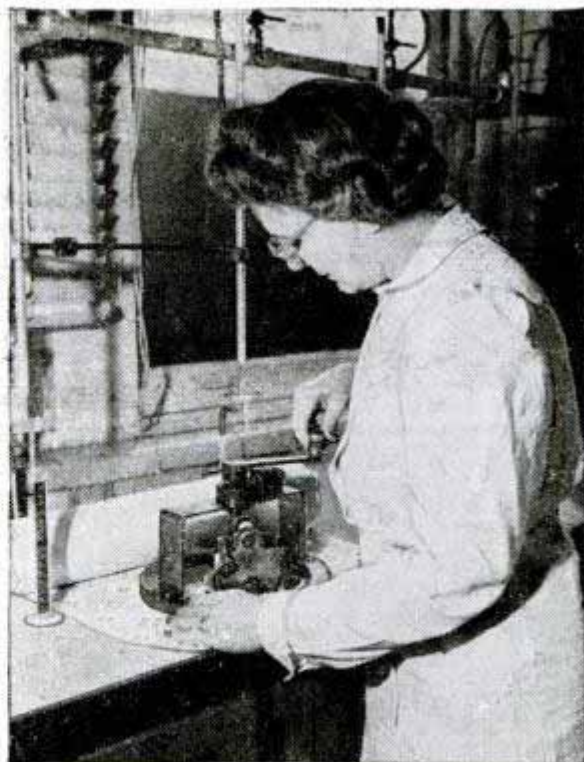
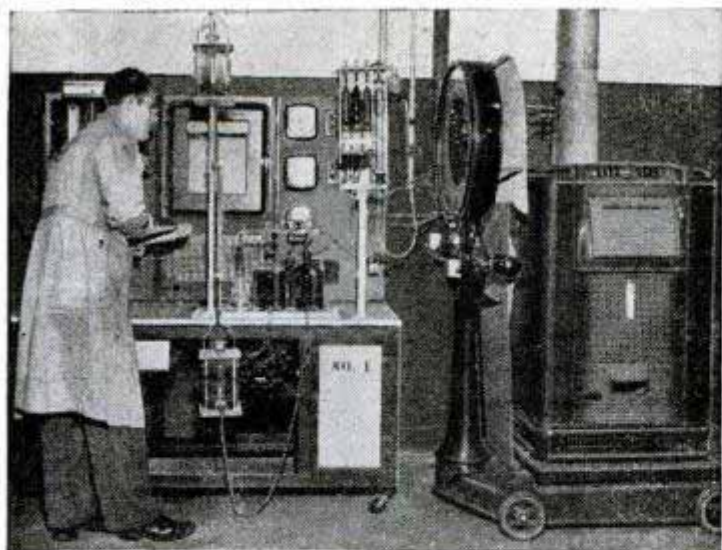


Seamless Plastic Boat

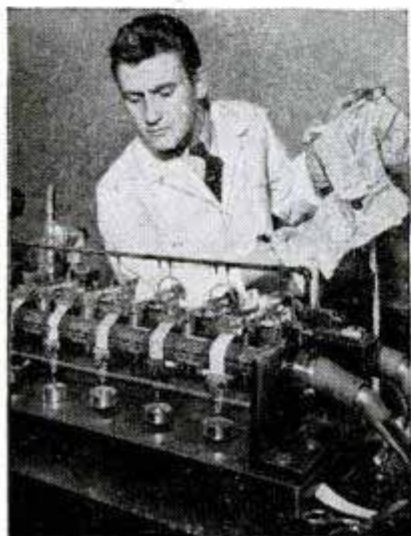
Weighing only 80 pounds, a nine-foot rowboat made of seamless plastic can be handled by one person. The boat is molded in about two hours by building glass fibers and a synthetic resin into layers which are cured by steam heat under pressure. Three rope holes and four oarlock sockets are molded into the boat and an outboard motor can be attached. The craft can be stored in any climate and will not be affected by salt water. It can carry five persons.



Refrigerators are defrosted automatically by a preset control that shuts off the motor for several hours during the night.

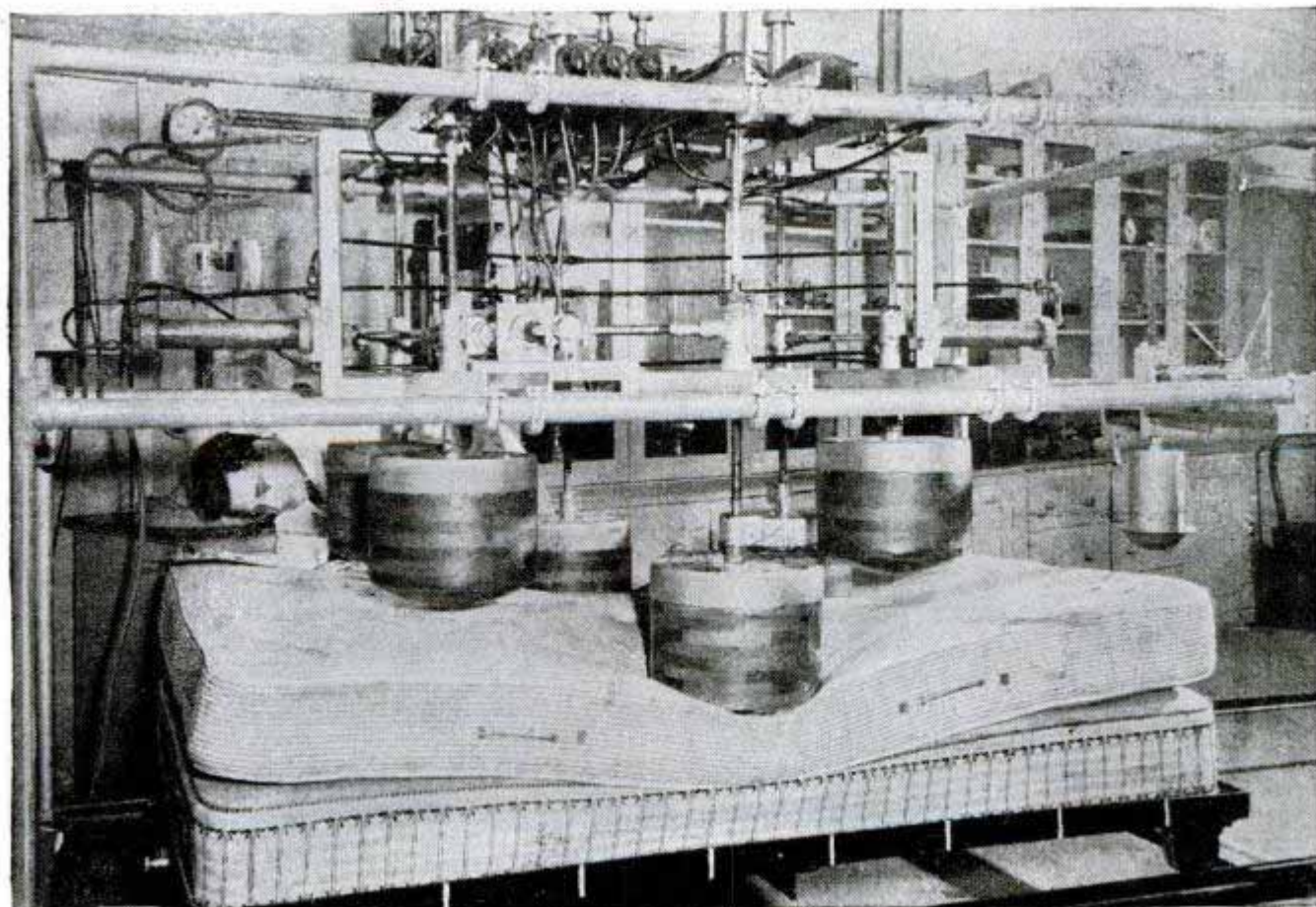


Above, a space heater undergoes test; at right, checking washability of wallpaper; left, testing the durability of dress fabric



TEST LABS BEHIND THE CATALOGUES

"Combat conditions" are simulated in the research laboratories of large mail-order companies where the products offered in catalogues first must pass endurance tests. In a few days the testing machines reproduce the effect of sleeping on a mattress for years (below), and wearing a dress for months. For actual field tests hundreds of people serve as "guinea pigs" and are given samples of shoes, hose and other products. Farmers use free machinery to test its endurance—one even received a new aluminum roof for his barn.



BLOWING UP HOLLYWOOD



By **Walter (Slim) Hoffman**

Explosives Engineer, Paramount Studios

DURING the past 35 years I've "killed" more than 300,000 persons. I've started wars in France, Germany, Russia, India, China, Pearl Harbor and Wake Island. I've dropped bombs and shells alongside Gary Cooper, Clark Gable, Betty Hutton, Bob Hope, Gloria Swanson and Dorothy Lamour. I've set off earthquakes, landslides, bridge explosions, fires, naval battles and volcanic eruptions.

Maybe we'd better get things straight before this gets out of hand. This is not the confession of a super war criminal. It's just a fancy way of saying that I've been handling explosives in the motion picture industry for more than three decades.

The Hollywood smoke-and-powder profession is one that has no counterpart anywhere in the world. At the same time you're creating the illusion of death and destruction, you're responsible for protecting the lives of hundreds of people and property worth millions.

It's a profession that was born in the early days of the D. W. Griffith and Cecil B. DeMille silent screen epics. And it has continued right up to the present—in spite of the fact that developments in miniature work create many of the illusions in today's motion pictures. Each of the major studios employs an explosives engineer—myself at Paramount, Lou Witte at 20th Century-Fox, Carl Hernandez at Columbia, Harry Redman at Universal, Clyde Peebles at M-G-M, Fred Ponedel at Warners and Lee Zavitz who works for the independents. In addition to these seven old-timers, a younger group of 25 or more smoke-and-powder boys is on the way up. Some of them are World War II veterans who have seen a lot of the real thing in Europe and the Pacific.

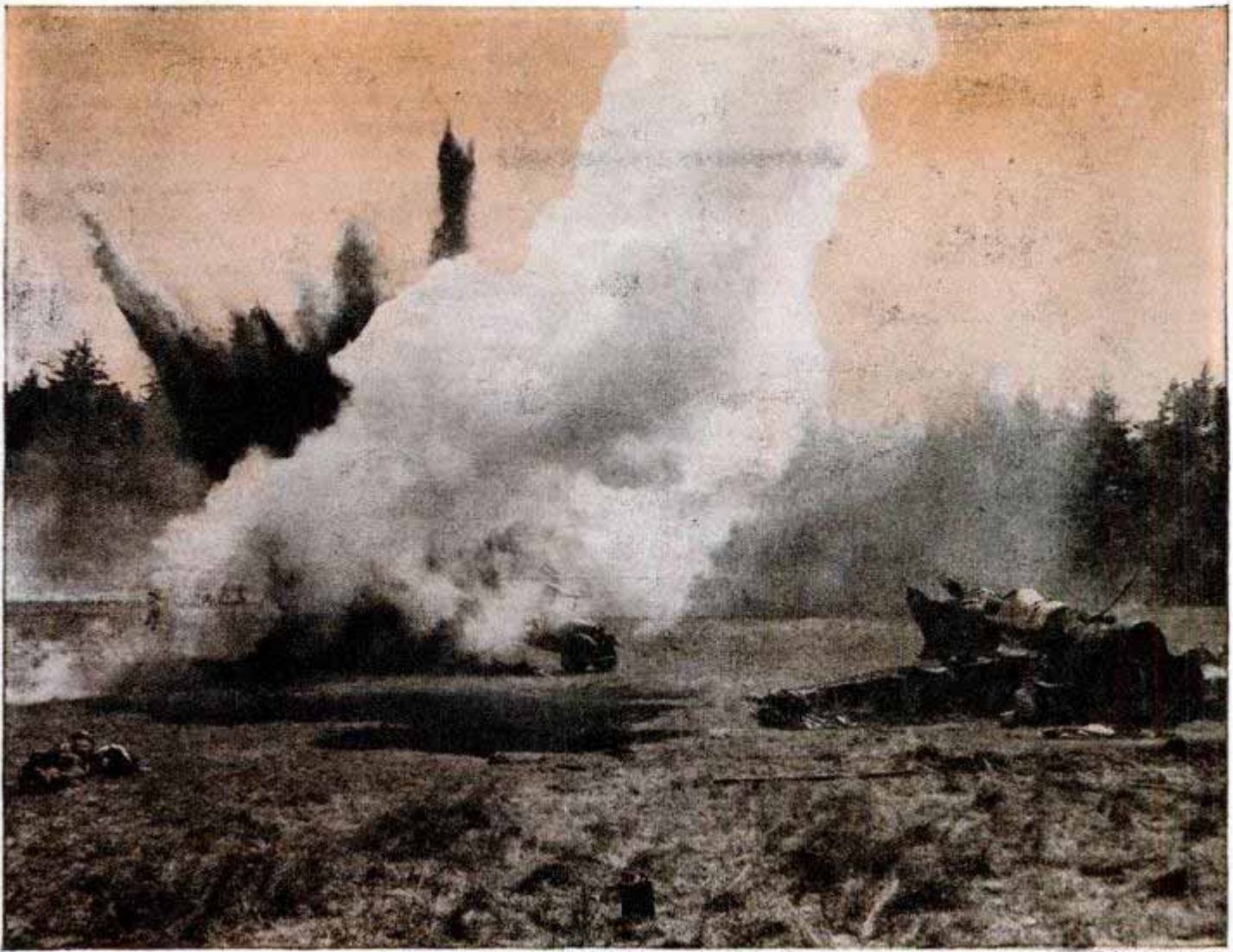
I've seen times, in years past, when a top-notch explosives man would be paid \$750 a week, \$1500 bonus for each picture, and earn \$14,000 a year. Today, in spite of the fact that no insurance company will bet a nickel on your life, the salary scale is around \$3 an hour. But money isn't everything and there is something in the profession that offers a challenge to skill and courage.

Explosives are a dangerous commodity that take a toll not only in broken bones and burned skin but sometimes loss of life. Nine Hollywood blow-up men have been killed making pictures during the time I've been in the profession. Most of these deaths were caused by carelessness—failure to make proper tests, failure to detect "hot" lines, failure to discover fire in the hole during a retake. A cardinal rule of this business of blowing up Hollywood is: don't take chances, someone might get hurt.

Personally I've been lucky. I've got scars from my younger days when I sometimes substituted courage for judgment. But I've had only one serious accident. While working on the picture "Painted Desert," my crew and I planted 1½ tons of dynamite in the side of a cliff. A premature explosion threw out chunks of sharp rock which cut my hands and broke a leg. A slight cut on the cheek was suffered by a young extra named Clark Gable.

Handling explosives on an outdoor location or on a huge sound stage, the explosives man is the boss—and even can override the decisions of the director. A first-rate explosives engineer always makes exhaustive tests before he sets off his charges. When actors and technicians get hurt, it's because they don't follow the advice of the smoke-and-powder man.

I am reminded of an incident that happened in the filming of "All Quiet on the Western Front." A battlefield scene was laid out and explosive charges were plant-



Columbia photo

Commandos strike—and explosives engineers must produce two-color smoke
 ↓ **Magic lacopodium blazes brightly without burning down the installations**
 Warner Bros. First National photo

ed. Before the charges were connected, a careful rehearsal took place so that the actors would know where to run and where to fall down.

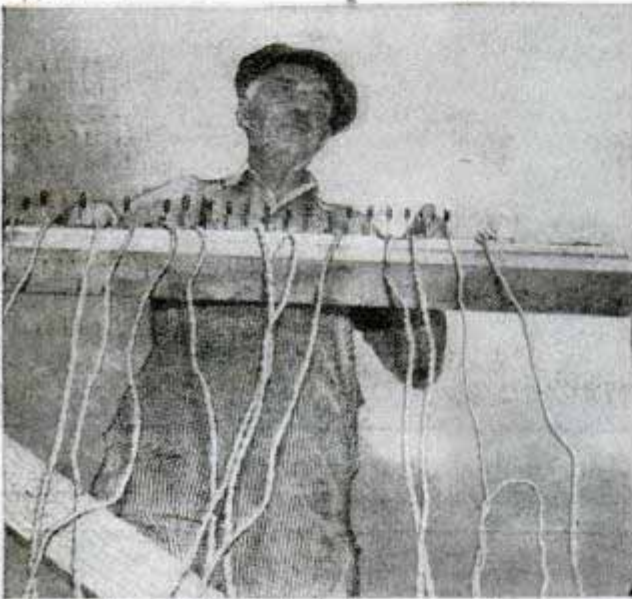
Located at a master control board, I was high enough to watch the entire battlefield. The cameras turned and the scene came alive. Actors charged up out of the trenches. Some of them flopped on their stomachs, others fell as if dead. Explosions were popping all over the field. Suddenly I noticed that one actor had fallen on a charge that had not yet been exploded. I skipped that key and went on to the next.

When the scene was over, I beckoned to him.

"Come here and watch that place where you were lying a moment ago."

I flicked the explosives





Explosives engineer must be an historian to duplicate the effects of old-time firearms and grenades. Top left, fireball used in Indian picture is handled with an asbestos mitt. Left, switches on panel give engineer control over battlefield scenes. Bottom, three dynamite charges are taped for a big explosion

key and the earth blew up in a geyser. He turned white and we saw no more of him that day.

From the smoke-and-powder man's point of view, the greatest picture ever made was "All Quiet on the Western Front." More than \$50,000 in explosives went up in flame and smoke in that picture. In an average film an explosives engineer has from 5 to 10 assistants. In "All Quiet" I had 68. We set off 10 tons of powder in 8000 separate charges—a record that has not been equaled since. Other pictures which called for heavy explosives work included "King of Kings," "What Price Glory," "The Fighting 69th," "For Whom the Bell Tolls," "Wake Island," and "So Proudly We Hail."

Tools of the smoke-and-powder profession include: dynamite, black powder, blasting caps and squibs, Primacord, springs, air mortars, dry ice, lacopodium, flamo and gasoline, plus your own wits and ingenuity. Because of the fast pace at which most pictures are filmed, you are often called upon to devise a trick explosion or flame sequence on the spur of the moment. That's where experience pays off.

Dynamite is probably the most useful



↑ Explosions, smoke and fire lend realism to tense battle scene from new film "Unconquered." Right, concealed ground charge gives effect of a five-inch-shell burst

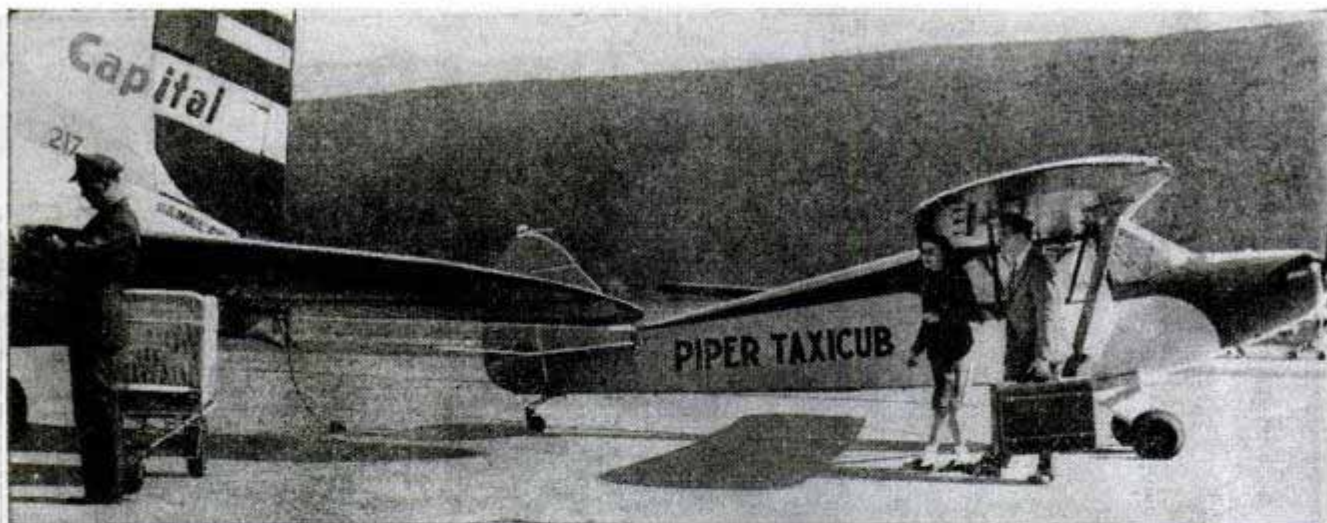
tool that an explosives engineer works with. It's usually low-powered stuff—perhaps 20 or 25 percent nitroglycerine, the rest corn meal. Most of the new types of explosives developed in World War II, such as RDX and others, are useless for movie work because they are too fast. Old, reliable dynamite can be employed with safety because you know for sure how it will act.

Black powder is used to some extent, but it is not as trustworthy as dynamite. Black powder tends to follow the line of least resistance and you can never be sure of which direction it will explode. When I use black powder, I choose the slow-burning kind. Like the dynamite we use, it is only about 25 percent.

A smoke-and-powder man lays out a battlefield scene almost as carefully as an architect

(Continued to page 228)



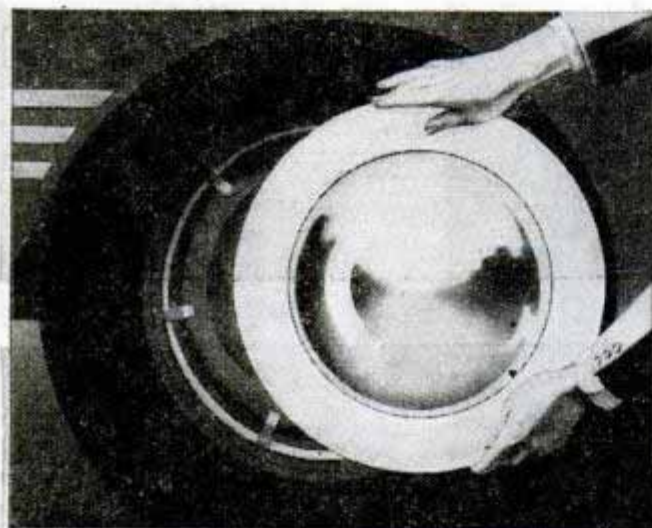


Piper Aircraft photo

AERIAL CAB FLEET

Aerial taxicab service at rates as low as six cents a mile has been started throughout the nation by a fleet of 1500 light planes. It is designed for service between air-line

stops and fields off the main routes, and for salesmen covering rural areas. Carrying two passengers and baggage, in addition to the pilot, the planes cruise at 105 miles an hour and have a range over 600 miles. They all have two-way radios.

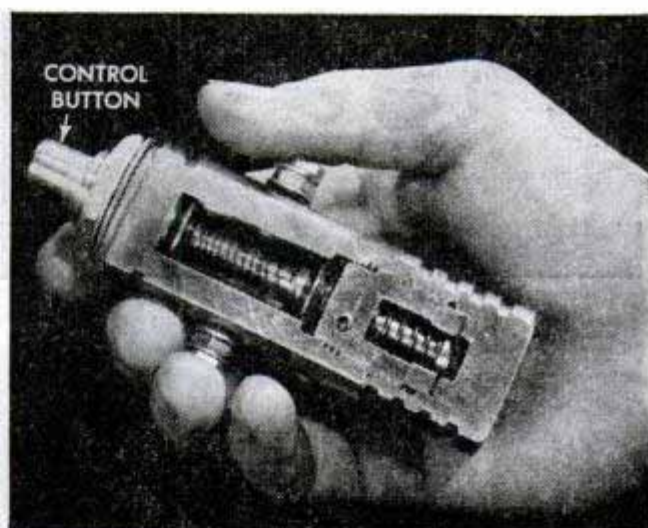


Single Unit Hub Cap and Trim

Hub caps with white wheel trim attached can be snapped on the wheels to give a distinctive appearance to both old and new cars. A spring retaining band is fastened to the rim to hold the cap on the wheel. The single unit is made of heavy-gauge steel with the hub finished in triple-plated chromium and the white trim given a baked-enamel coating. Sizes are available to fit most stock cars.

Lightweight Stainless-Steel Boat

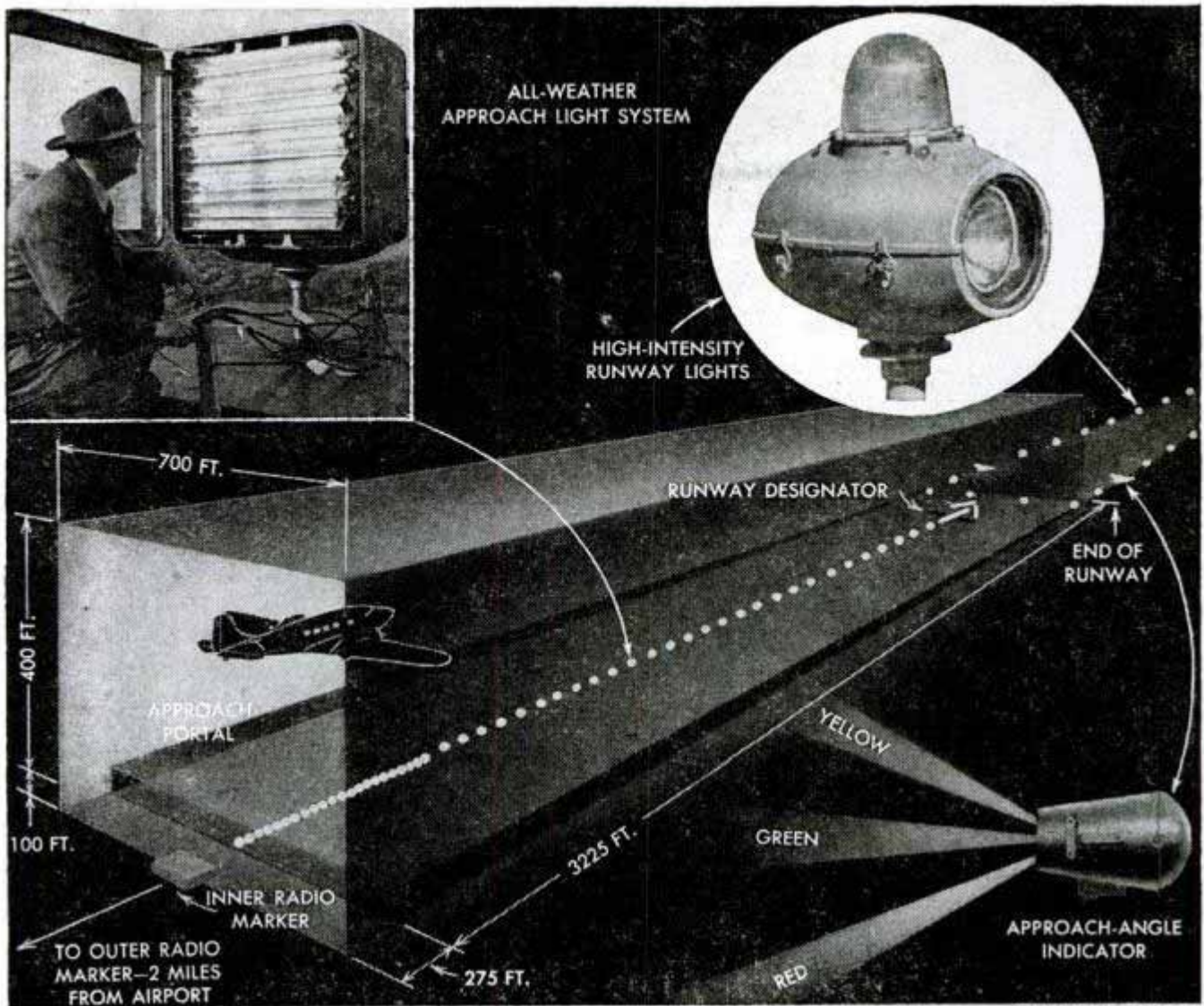
Although it's built of stainless steel, a 12-foot round-bottom boat now being mass produced for sportsmen weighs only 120 pounds. It resists rust in salt water or fresh water and is virtually punctureproof. The boat has built-in full-length spray rails for extra safety and stability, dry performance and added strength.



"Alarm" for Lubrication Trouble

Engine failures due to lubrication are prevented by a pressure-activated device that breaks the ignition circuit when the oil pressure drops low. It can be made to energize alarms or control systems to indicate insufficient pressure when used on engines without electrical ignition. When starting the engine a control button on the device is pushed down and oil pressure holds the switch closed. Any pressure drop below the preset minimum stops the engine. In emergencies on the highway or in traffic, pushing the button restores the system for temporary operation.

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

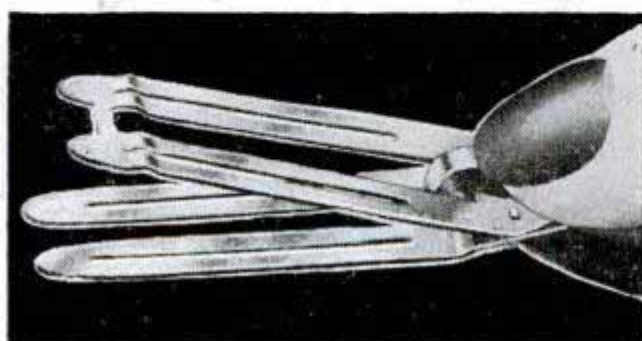


Westinghouse photos

"BOTTLED LIGHTNING" GUIDES PILOTS TO RUNWAY

"Bottled lightning" from the world's brightest lights is being tested to bridge the gap between instrument approach and visual touch down in all-weather flying. It is a 72-lamp approach system developed by Westinghouse, with 36 units each having over three million peak candlepower that is strong enough to penetrate any weather for 1000 feet. They are four-inch-long quartz tubes filled with krypton, a rare gas. They are arranged alternately with neon blaze units in a line about two thirds of a mile long beneath the approach path. In effect the illumination provides an "approach portal"—an imaginary frame of light 400

feet high and 700 feet wide. Flashing one after another toward the runway, 40 times a minute, the 72 lights appear as a stroke of lightning to the pilot. In poor visibility an 83-foot pattern of lights, forming a green arrow or a flashing red cross, serves as a last moment runway designator. The arrow indicates a clear runway and the cross is a warning not to land. Another part of the system is two approach angle indicators to guide the plane along the approach path. To the pilot, the indicators appear as flashing yellow lights if he is too high, red if he is too low and green if he is at the proper altitude.

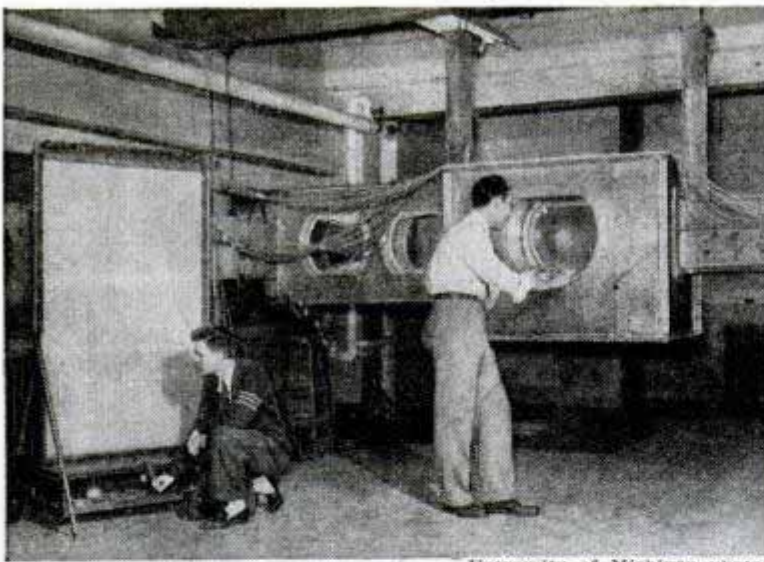


Pin-Curl Clip

Pin curls are held in place by a spring-steel clip devised for women who set their hair at home. The clip is nickel plated, light in weight and can be opened with one hand. They are designed so that users may sleep comfortably with them in their hair. The clips are also useful to hold bows or flowers and it is almost impossible to bend them out of shape.

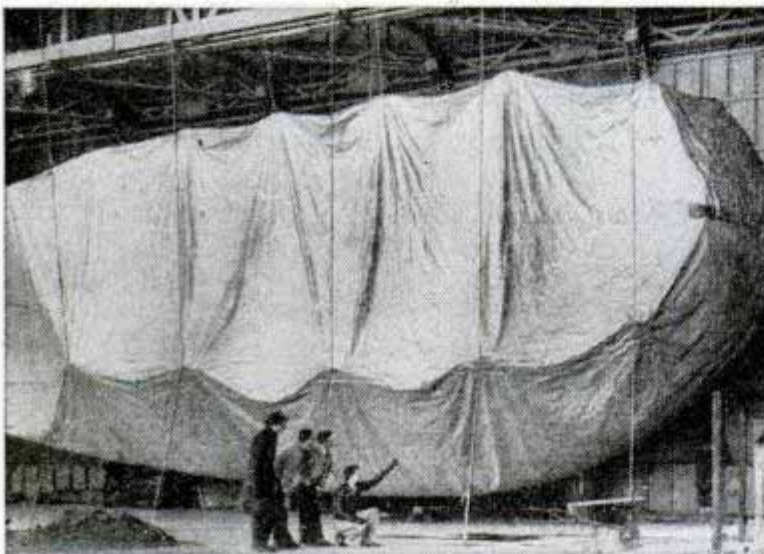
Air-Bag Wind Tunnel

By using nine surplus tank cars and a barrage balloon, the University of Michigan and the AAF built a supersonic wind tunnel at Ann Arbor for one tenth the usual cost. It operates on an intermittent principle. The balloon forms a storage bag from which air rushes through the scale model test section at supersonic speeds for from 13 to 15 seconds. The vacuum causing the air torrent is created by pumping out the tanks, which are manifolded together to provide about 12,000 cubic feet of space. It takes 15 minutes to pump the air back from tanks to balloon.

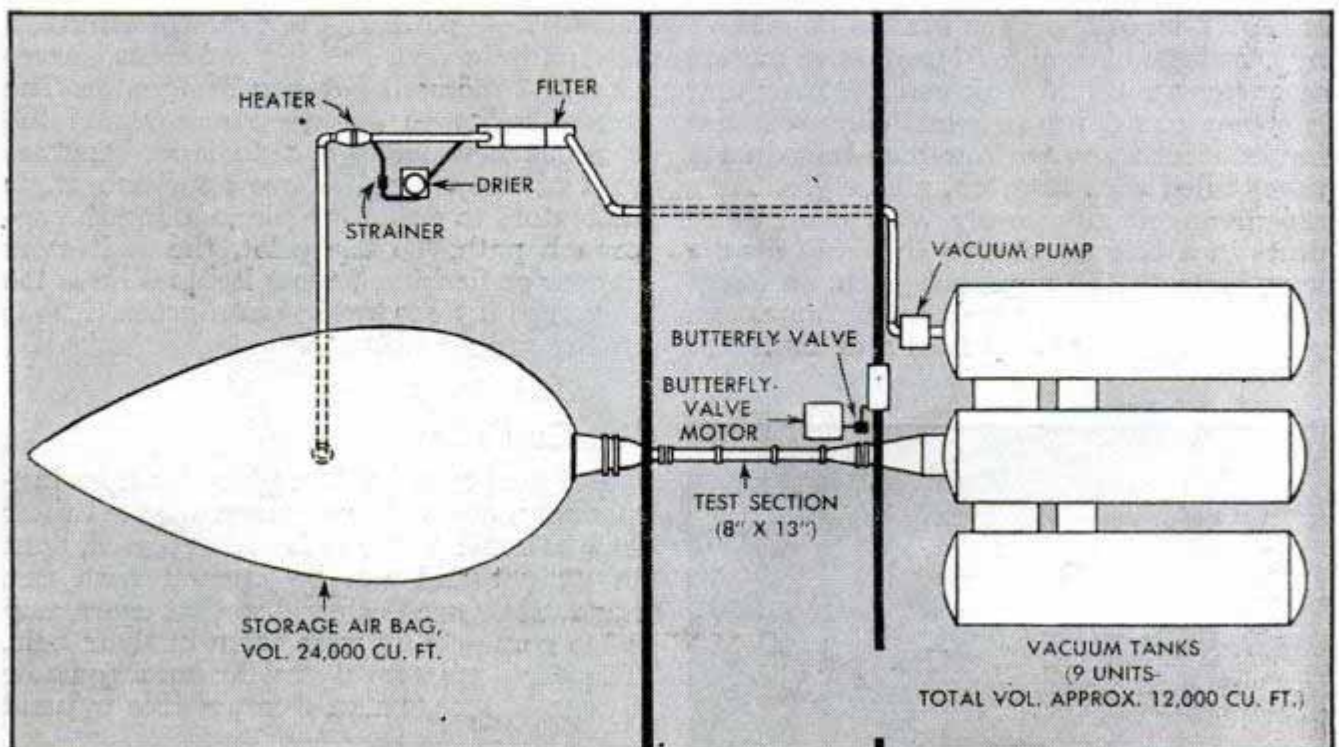


University of Michigan photos

Models up to a foot long "fly" for 15 seconds in test section above. It has a wind velocity of about 1250 miles per hour



Surplus barrage balloon serving as storage bag, upper left, has a flexible capacity of 24,000 cubic feet. Tank cars at right were destined for Russia when war ended. Below, vertical view of tunnel arrangement





NEAT MAILBOXES

The CRAFTSMAN

★ If you were sitting in the stern of that row-boat you'd appreciate the fine points of the skilled oarsman. He doesn't give you a shower with each stroke, he doesn't stand up and scrape bottom with the blades, he doesn't zigzag. He learned expert rowing technique by reading the article on page 170.

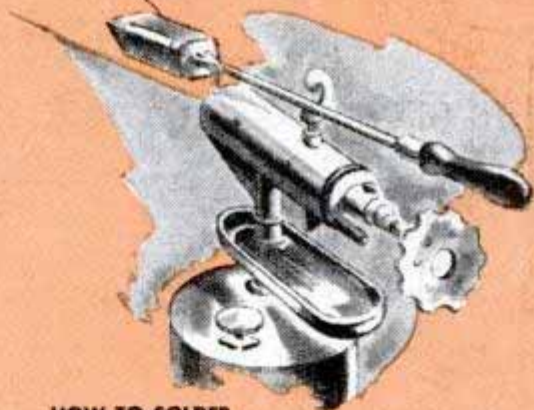
★ Soldering is so simple, you might as well do it right the first time. Even if you've been at it a long time you can pick up some pointers from the article beginning on page 201: "Solder It Right."

★ Did you ever wonder how your tinsmith made those neat, square bends in the sheet-metal job he did for you? The chances are that he used a bending brake — a tool you can make for yourself from the directions on page 207.

★ You folks living on an RFD route ought to show the story on page 186 to all your neighbors. Then watch the clever and distinctive mailboxes spring up all along the roadside!



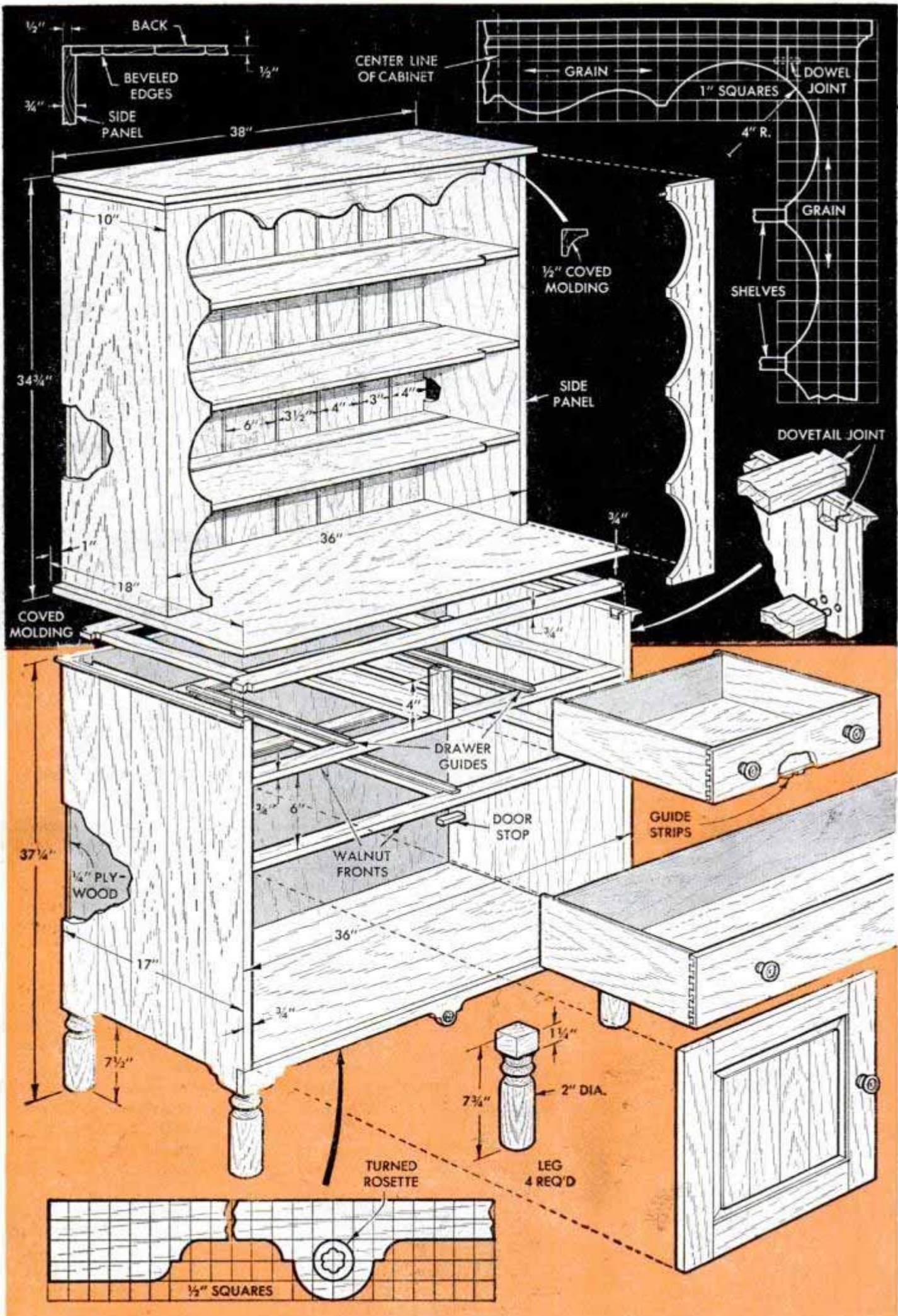
SHEET-METAL BRAKE



HOW TO SOLDER

ROW CORRECTLY





A fine, rugged piece of Early American furniture to lend authentic setting to your pewter or silver collection. Cabinet base provides storage galore for silverware, linen and china. Its plainness makes it simple to duplicate with ordinary tools

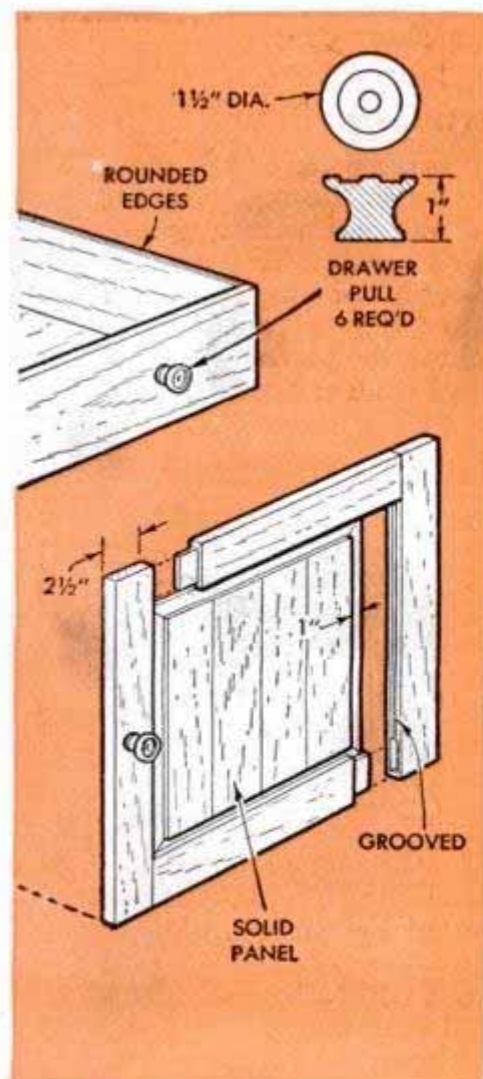
By W. W. Buffmire



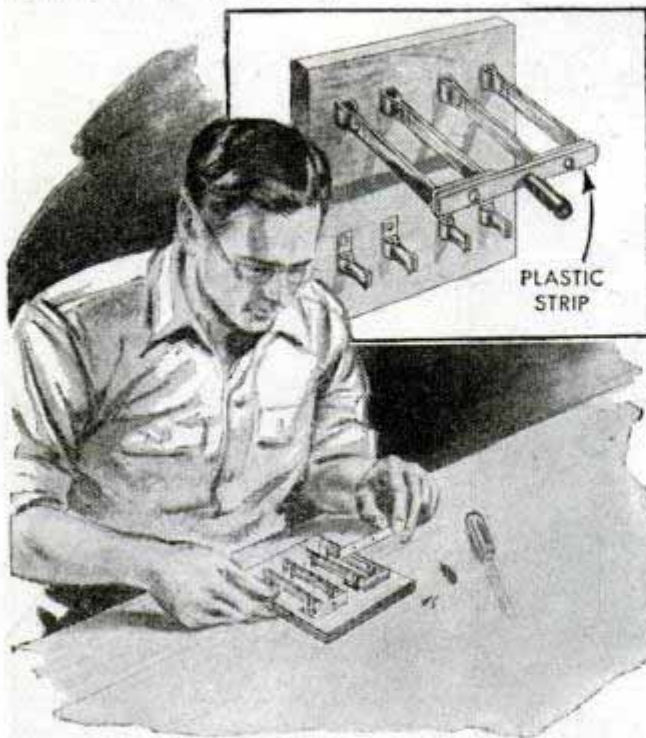
Reproduce this WELSH DRESSER for your best china

To be traditionally authentic this quaint old piece should be reproduced in American black walnut, although it can be copied in maple or birch and finished to match other Early American pieces that you may have. A study of the pull-apart view on the opposite page will acquaint you with the way the whole job goes together. Start by gluing edgewise two or more $\frac{3}{4}$ -in. pieces to build up wide panels for the top and ends of the lower unit. Except for the plywood panel covering the back of the cabinet, solid stock is used throughout, although the bottom could be of plywood, too, as the front edge of it is faced with a scrolled apron. The bottom is set $1\frac{1}{4}$ in. up from the lower edge of the ends and the turned legs are glued and screwed in the corners formed by the apron across the front. The bottom, however, is not assembled until the three drawer frames are made ready, then the whole unit is clamped together at one time. Note in the detail that the top frame is fitted to the ends in dovetail mortises, while the other two are simply doweled and glued in blind holes.

The $\frac{1}{2}$ -in. shelves of the upper unit can be doweled or set in grooves cut in the sides. The scrollwork around the face of the unit fits flush in the notched shelves and the back of the unit is paneled vertically with $\frac{1}{2}$ -in. pieces of varying widths. Drawers and doors are assembled as shown, the latter being held shut with spring-type friction catches.



Double-Pole Switches Converted For Multiple Setup

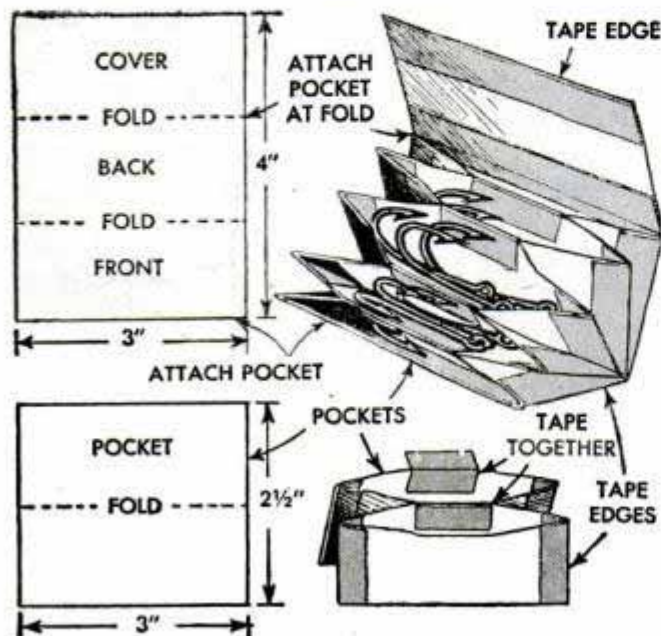


Double-pole knife switches can be converted to use for multiple setups, such as closing or opening several circuits with one operation, by using a common handle. First the switches and contacts are mounted on a common, insulated base, as in the upper right-hand detail, and the individual handles are removed. Then a strip of plastic or other insulating material is used to tie all switches together. A handle is fastened to the middle of this strip.

Bill J. English, Tucson, Ariz.

Paper Pocket Holds Fishhooks

Five different sizes of fishing hooks can be carried in a shirt pocket with this expanding paper holder. A lightweight,



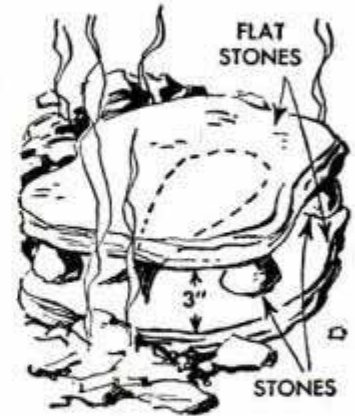
waxed cardboard should be used. Dimensions for the cover and individual pockets are given in the two left-hand details. All edges and folds are reinforced with tape.

R. A. Jenkins, St. Louis, Mo.

Fish Grilled Between Two Stones

Grilling fish or meat without a cooking utensil was an art practiced by the Indians but is little used today. One of the simplest ways to do this is to use two fairly large flat stones and four smaller ones about 3 in. high.

Lay one of the flat stones on the ground and place a 3-in.-high stone at each corner. Then place the second flat stone on top, leaving a space of 3 in. between the two. Pile dry branches around this improvised cooker; light the fire and heat the stones until they are hot. Allow the fire to die down and remove the coals from one side. With a leafy branch clean out any ashes between the slabs and slip the meat or fish between them. Cooking requires only a short time.



How to Cut Terra Cotta Pipe

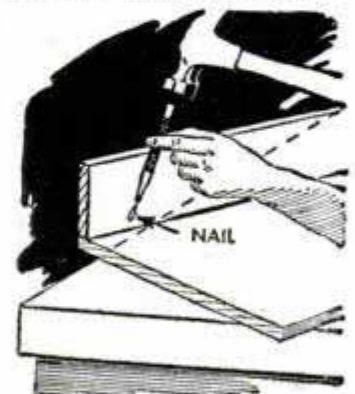
When cutting off terra cotta or tile pipe, or when cutting holes in the material, fill the tile with sand and tap with a small, sharp chisel, working continuously around the line where the cut is to be made. If care is taken, almost any type of cut can be made without cracking the piece.

Frank J. Malloy, Windsor Locks, Conn.

Removing Nails From Thin Stock

Occasionally a nail is driven into the end or edge of a thin piece of wood in such a manner that the nail protrudes from the side. Removing the nail by tapping on the point with a hammer often damages the wood, but this can be prevented by using a nailset. Place the set against the point of the nail and then drive it out with a hammer. The hole should be filled with putty.

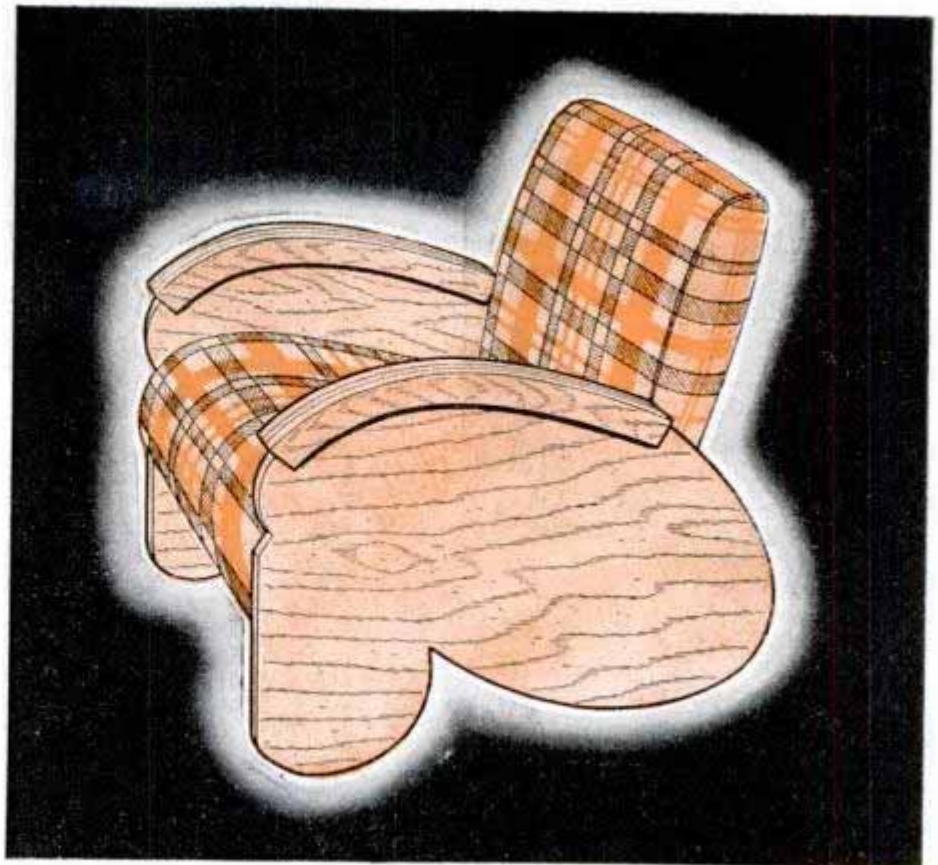
C. R. Schlegel, Jenkintown, Pa.



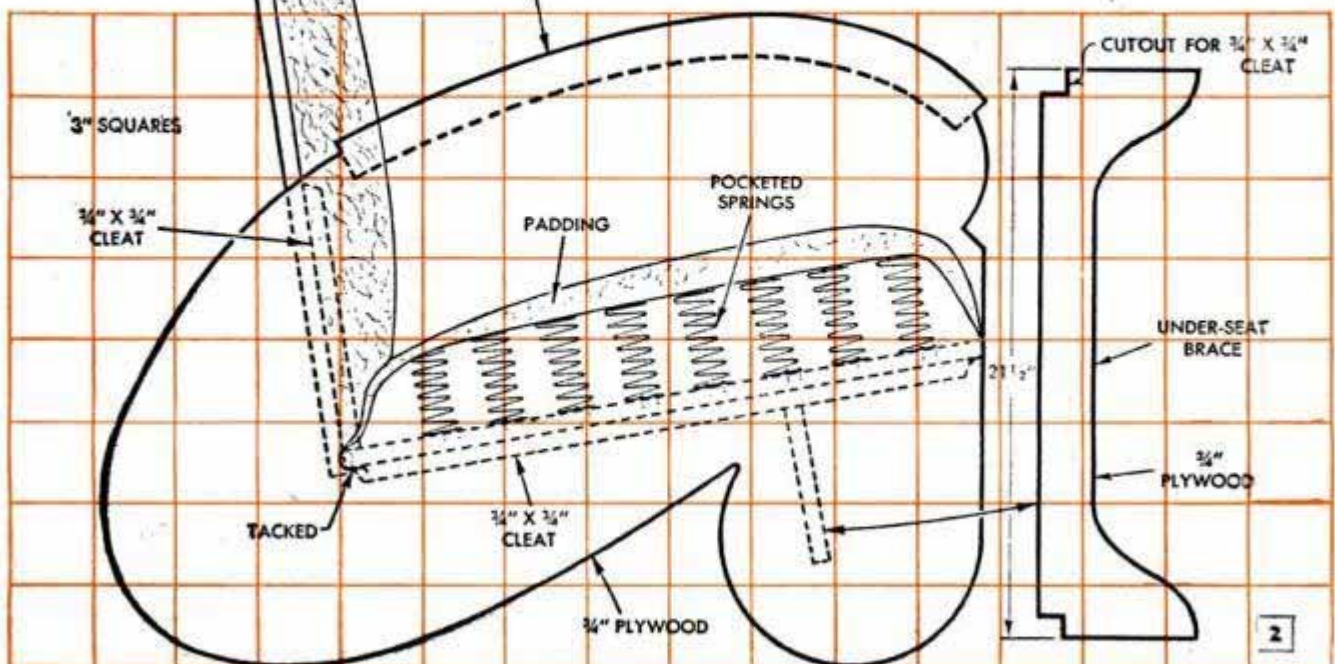
Rumpus-Room Armchair

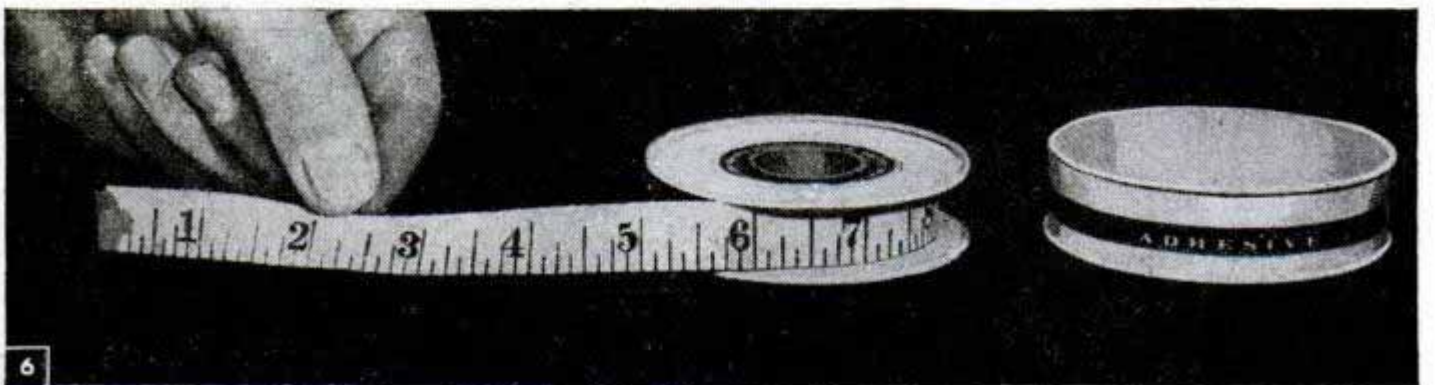
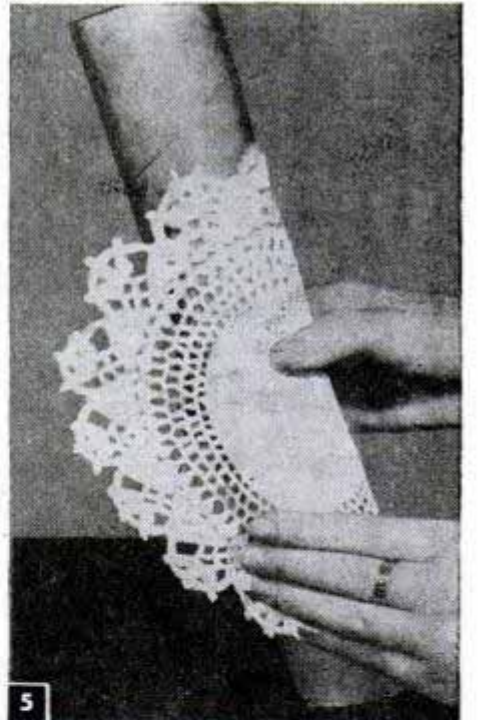
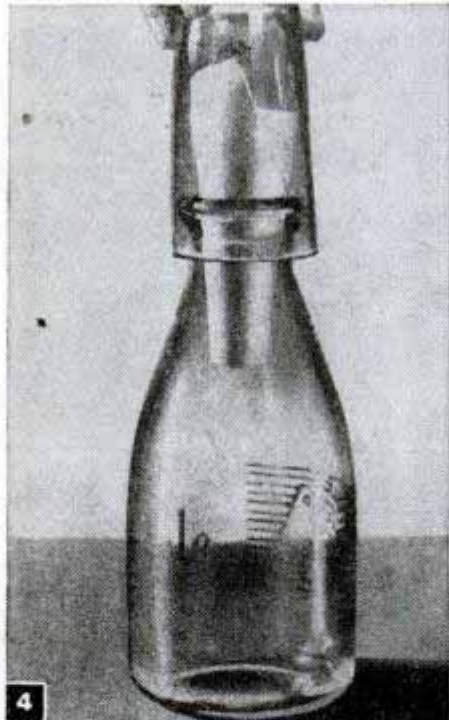
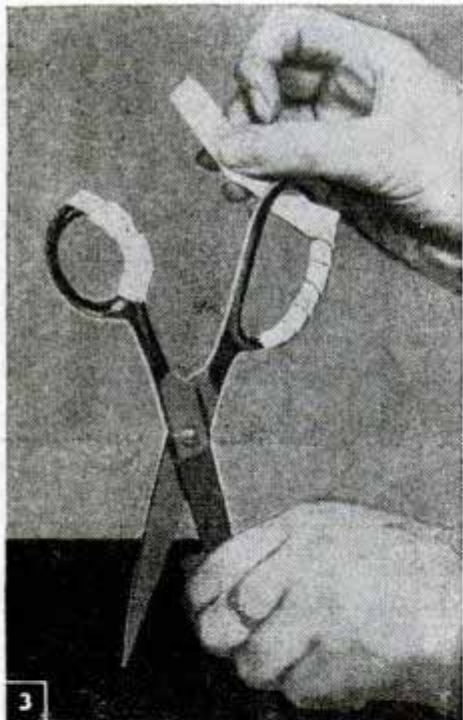
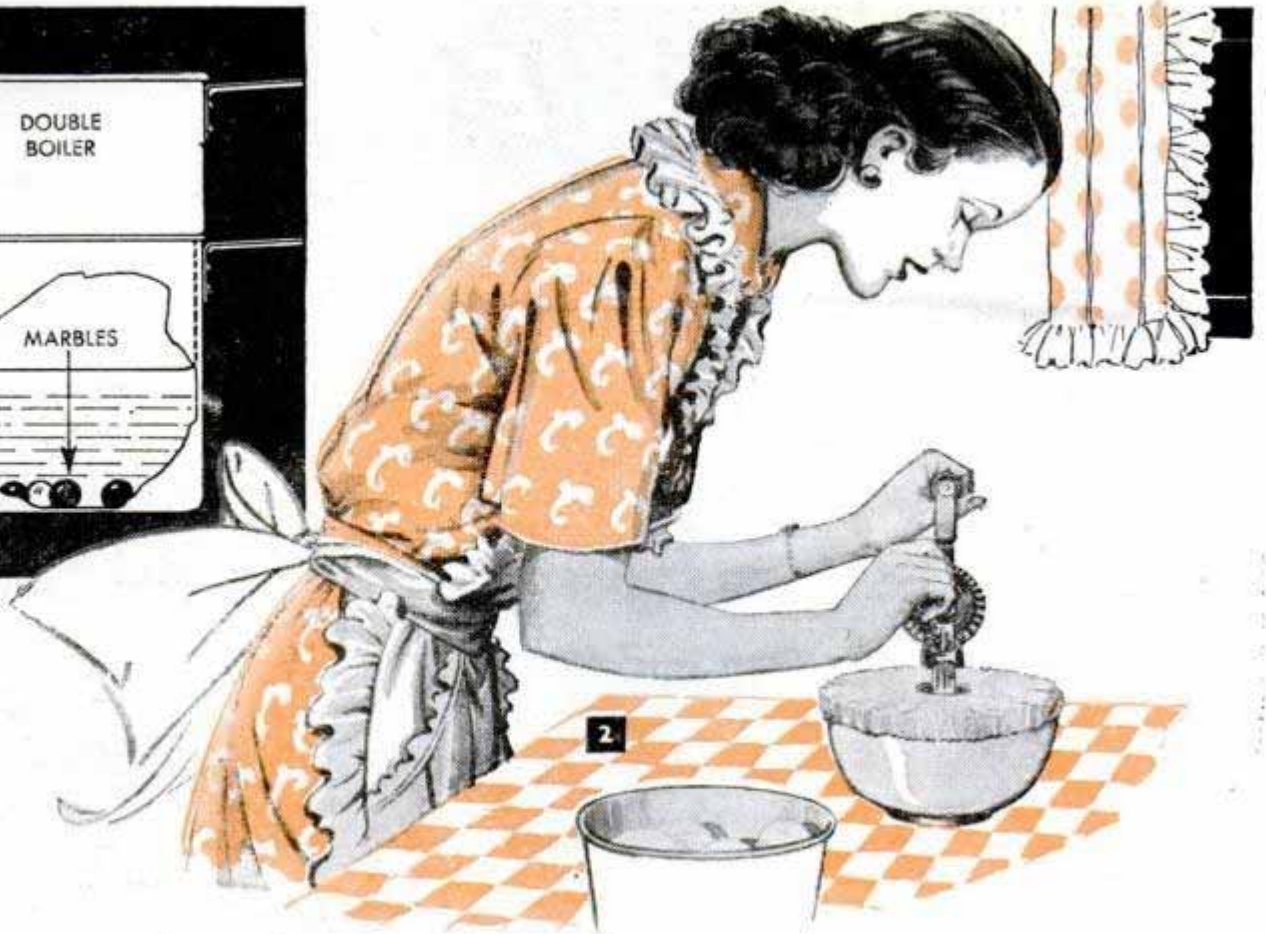
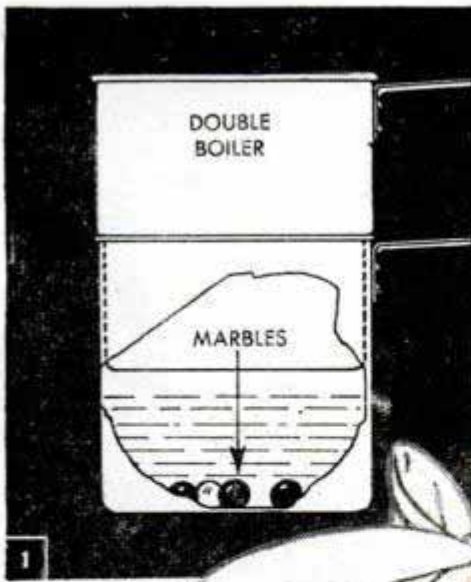
Strictly in the modern mode, this plywood armchair is easy to make and adds just the right informal touch to a basement rumpus room or front porch. First, saw out the sides and the four pieces for the armrests, Fig. 2, and then cut the bottom and back, and fasten in place by means of cleats, Fig. 1. The armrests are glued and screwed in place. In addition to the bottom cleats, an under-seat brace is required, right-hand detail of Fig. 2. When the sides, back and bottom are assembled, the chair is ready to be upholstered. Pocketed springs are used and are covered with padding and a suitable cloth. If foam rubber is available, it can be used instead of padding with good results. Stain the wood and finish with three coats of shellac. Or by way of variety, you might use a colored enamel finish that contrasts with the pattern of the cloth covering.

Benj. Nielsen, Aurora, Nebr.



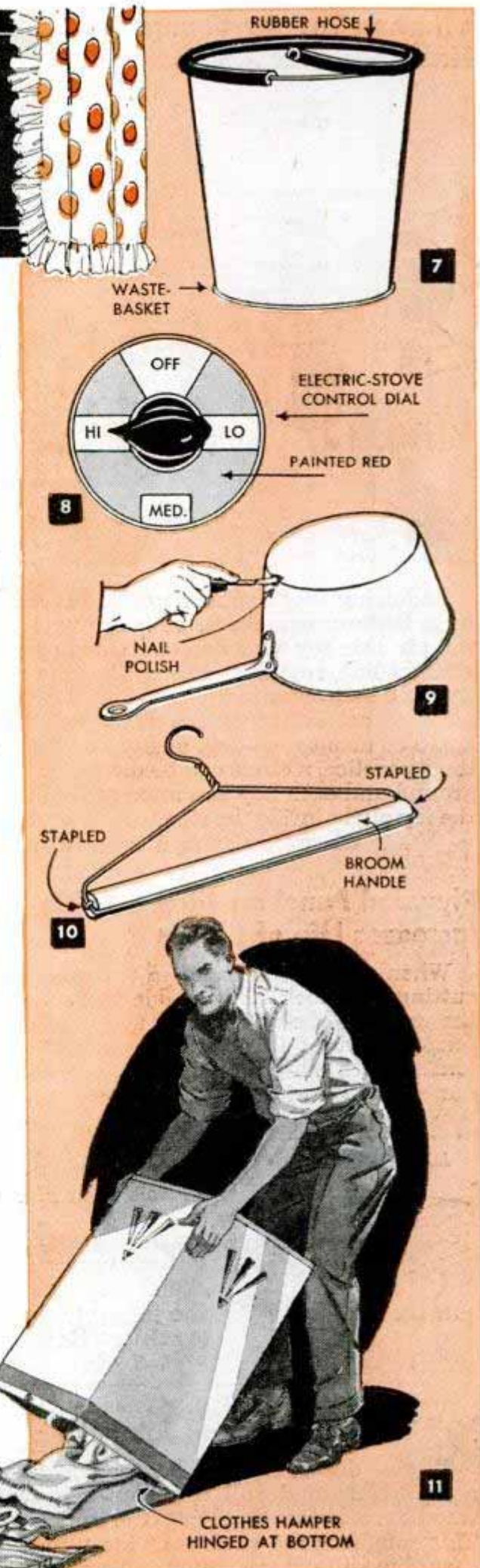
ARMREST
4 REQ'D



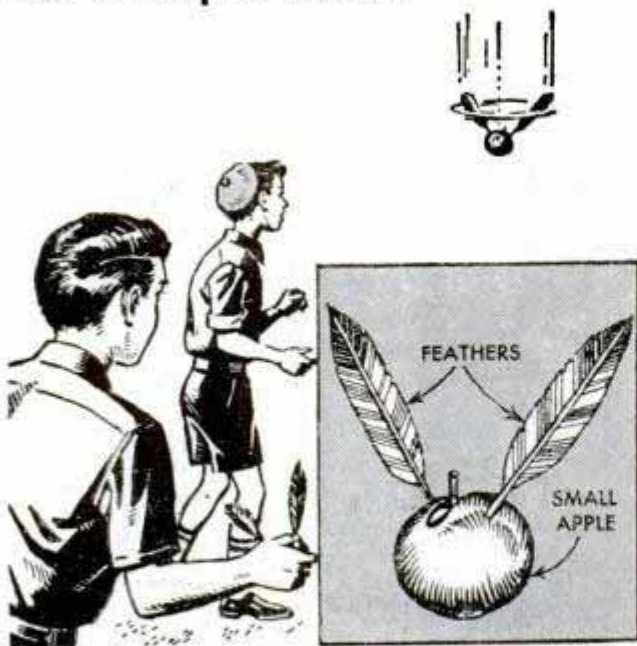


Solving HOME PROBLEMS

- 1 One way to tell when a double boiler is becoming dry is to place several glass marbles in the bottom pan. Then when the water level is too low, the marbles will rattle against the pan to serve as a warning.
- 2 To prevent spattering when beating eggs or whipping cream, use a plastic bowl cover with a hole in the center for the beater. Keep several sizes on hand.
- 3 Moleskin adhesive tape, which has a soft covering, can be wrapped around the handles of scissors to pad them and thus prevent sore or blistered fingers.
- 4 When leaving a note for the milkman, place a glass over the bottle as a protection from wind and rain.
- 5 Doilies and other fancy work will not crease when stored if they are wrapped around a cardboard tube.
- 6 Instead of keeping a linen tape measure loose in your sewing basket, wrap it around an empty adhesive-tape spool and then fasten the cover in place.
- 7 Slit rubber hose, slipped over the rim of a waste-basket, will keep it from scratching kitchen walls.
- 8 Because many electric-stove control dials are one color, it's not always easy to see the settings. However, if such areas are left white and the others are colored red, you can tell immediately what "heat" is on.
- 9 As an emergency repair for pots and pans, apply a coat of nail polish over the hole and dry at a low heat. If necessary, apply a second coat. Do not use the repaired pan over an open flame or a high heat.
- 10 Trousers that are hung on wire coat hangers wrinkle easily, but if a length of broom handle or dowel is stapled to the crossbar, this difficulty will be eliminated. Cut the handle so that it will be a snug fit.
- 11 Removing clothes from a hamper by lifting them out is an unpleasant and time-consuming task. To do the job in short order, fit the bottom of the container with hinges and a hook or catch. Then the clothes can be taken out in a hurry by opening the bottom.



Whirling Toy for Youngsters Has Helicopter Action

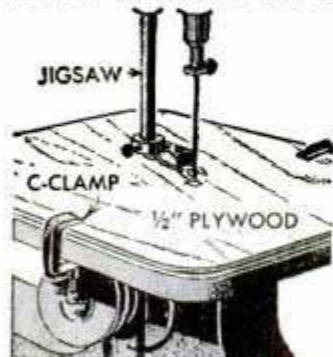


Requiring only a small apple and several large feathers to make it, when thrown into the air this toy will descend slowly in a straight line, resembling somewhat the action of a helicopter in flight. The two feathers that act as rotors are stuck into the apple at about a 45-deg. angle. For "spotting" practice, a circle can be drawn on the ground and each boy can attempt to make the toy alight inside the ring.

Clarence Kumb, Rockfield, Wis.

Plywood Panel on Jigsaw Table Increases Life of Blades

When using fine blades in a jigsaw for cutting thin stock, a false table will elevate the work and bring it into contact with an unused part of the blade, resulting in a longer cutting life. In many cases this will double the life of the blade. A piece of 1/2-in.



plywood makes an ideal table and C-clamps are used to hold it in place. For a neat-looking job, the wood is cut and sanded to the exact shape of the jigsaw table.—Arthur Beiser, New York.

Making Glued Dowel Joints Hold

To glue doweled joints, lay the dowel on a worktable and roll it under a coarse wood rasp before applying the adhesive. This roughens the surface of the wood so that glue will adhere better and a stronger

bond will result. Care must be taken when rolling the dowel not to reduce its diameter so that it is too loose a fit in the joint.

G. C. McClure, Los Angeles, Calif.

Rubber Hose Used as Siphon

If you want to drain several gallons of gasoline from the tank of a car, it can be done with a piece of rubber tubing long enough to reach from the gas tank to a container below the level of the tank. Insert the tube in the tank as far as it will go and then stop the open end with your thumb.

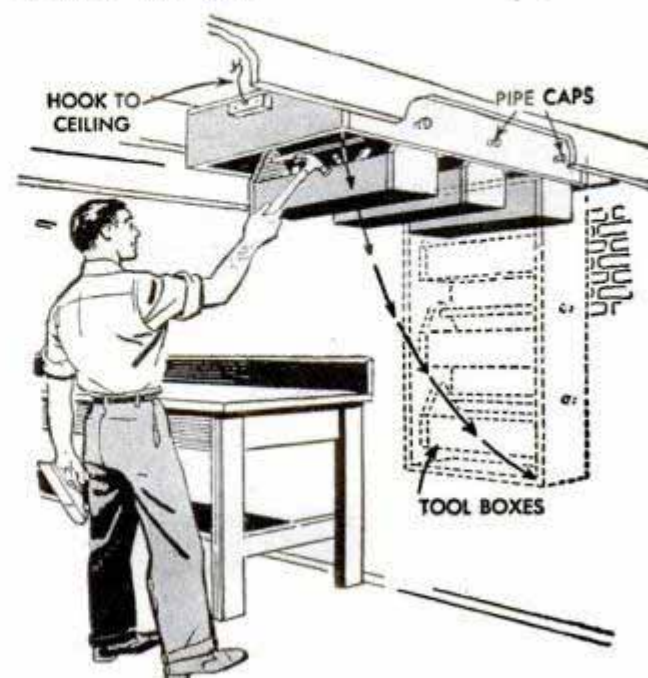


Still holding this end, insert it in the container you wish to fill and remove your thumb. The gas should start to flow immediately.

Buford E. Keen, San Francisco, Calif.

Tool Rack Hanging From Ceiling Saves Space in Workshop

To save space in his basement workshop, one craftsman devised a rack that would hold all his tool boxes and swing up against the ceiling, between joists, where it was out of the way. The boxes were pivoted to the sides of the rack by means of pipe which was capped at both ends to keep it from slipping out of place. When not in use, a hook holds the rack in place, but when tools are needed, the rack swings down against the wall.



Antique Candleholder for Basement Playrooms

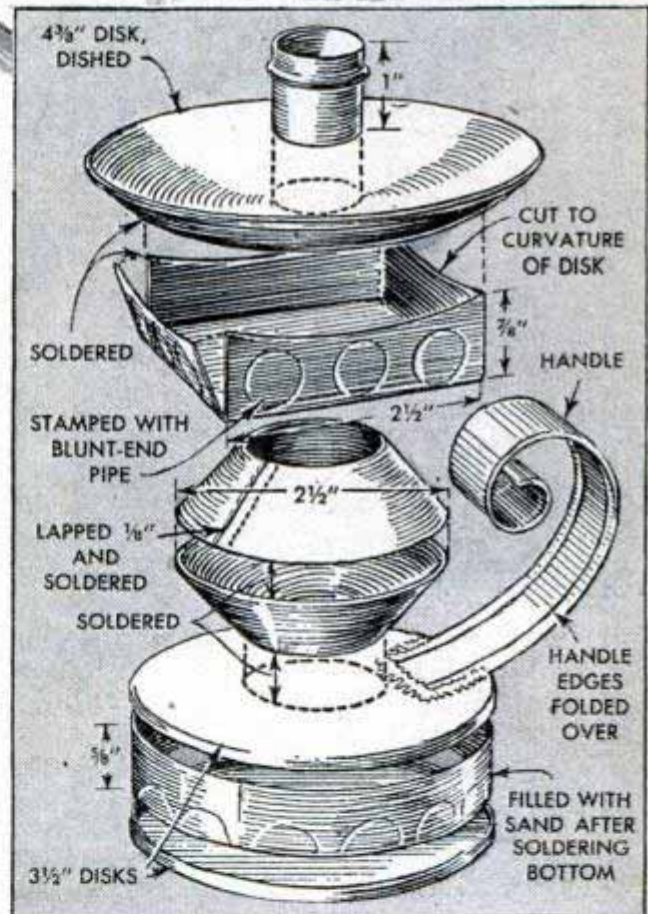


By D. C. Marshall

HOSTESSES will like this candleholder because it is especially suitable for the informal table, and home craftsmen with limited spare time will find that it's easy to build and requires the use of only a few simple tools. Although sheet copper can be used for all the parts, pieces of tin cut from coffee cans and used with the bright side out are the next best. If you use tin, be extra careful when cutting that the material is not sharply bent or dented in the process. Start with the base which consists of two sheet-metal disks and an encircling band, the ends of which overlap $\frac{1}{8}$ in. The decoration on the band is stamped into the metal with a short piece of pipe. Care must be taken to get the indentations of uniform size and equally spaced. Note that the same decoration is carried out on the four sides of the drip-tray support, except that here the full-circle indentation is made.

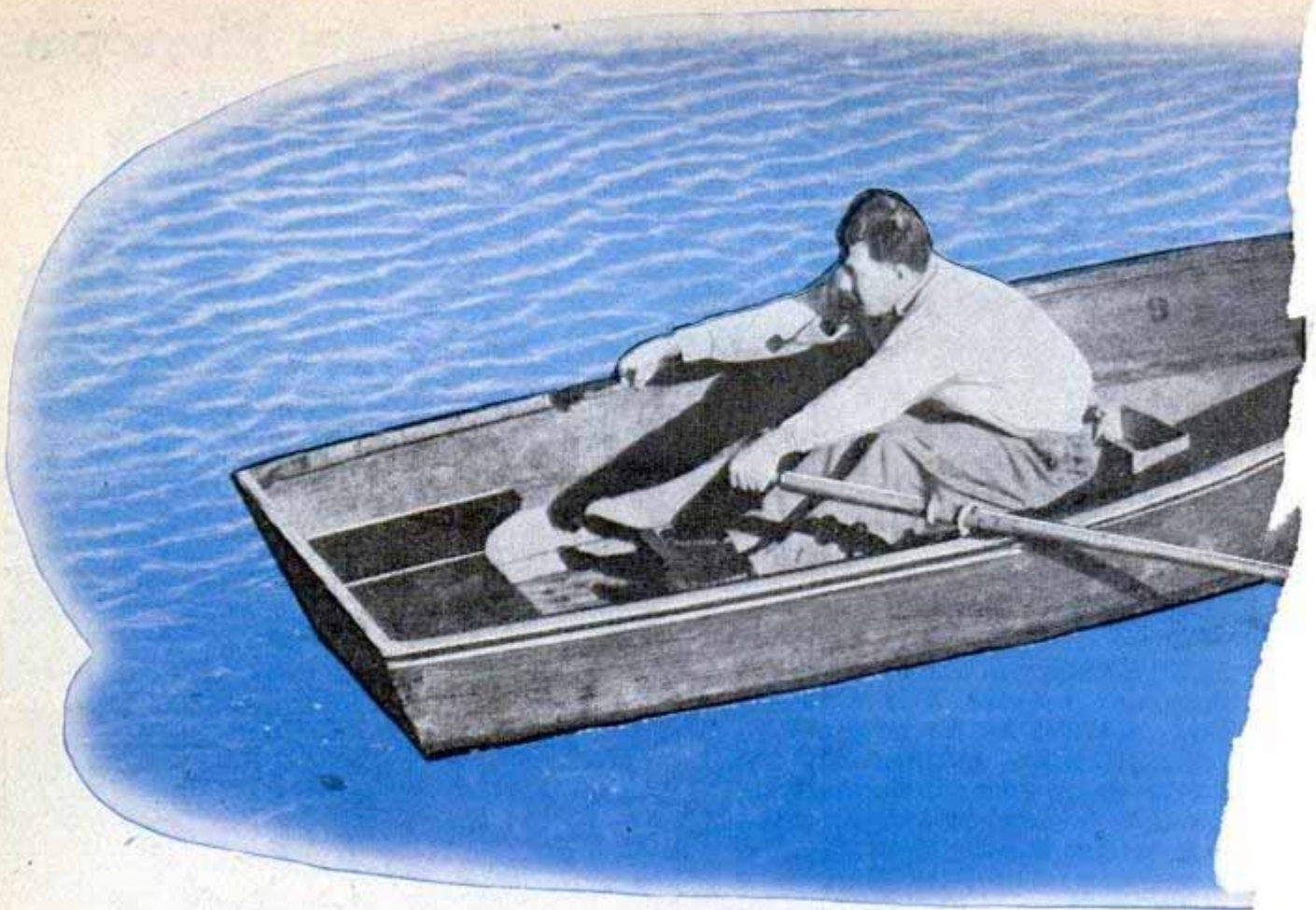
Cone-shaped sections which make up into the center ornament are formed separately and soldered together before soldering to the base. Form the drip-tray support over a block of hardwood, then shape the drip tray by beating down a sheet-metal disk into a circular recess cut in a block of wood. Use a wood mallet with a rounded end. The band of tin holding the candle is formed to the cylindrical shape by bending over a rod or pipe and is soldered to the center of the drip tray.

With all the parts made up, cut or file the drip-tray support to fit the curvature of the tray. Then solder all parts together. Use a small torch for soldering. The needle flame will get into those places where it is impossible to use an iron effectively. Final part in the assembly is the handle, which is a strip of metal bent to a scroll shape and



soldered to the base and the drip tray as shown in the photo. Note that the edges of the strip are turned or folded over to add strength. This is done before bending to the scroll shape. Smooth all edges bright, wash in a soda-water solution to remove the soldering flux and finish with a coat of water-white lacquer.

☛ Brighten discolored aluminum pans by boiling apple parings in them.



ROW GENTLY

YOU DON'T have to be a brawny weight lifter—or even half of one—to row a boat easily and well. The trick is in knowing how. Just watch an old-timer between the oars and you'll get a few pointers right away if you observe closely. There's no splattering of water, no rolls or gurgles—the stroke of the oars is slow, the rower's whole manner impresses one as plain lazy. But, unless you are a skilled boatman just jump in another rowboat and try to follow him singlehanded. He'll leave you behind as if you were painted on the landing.

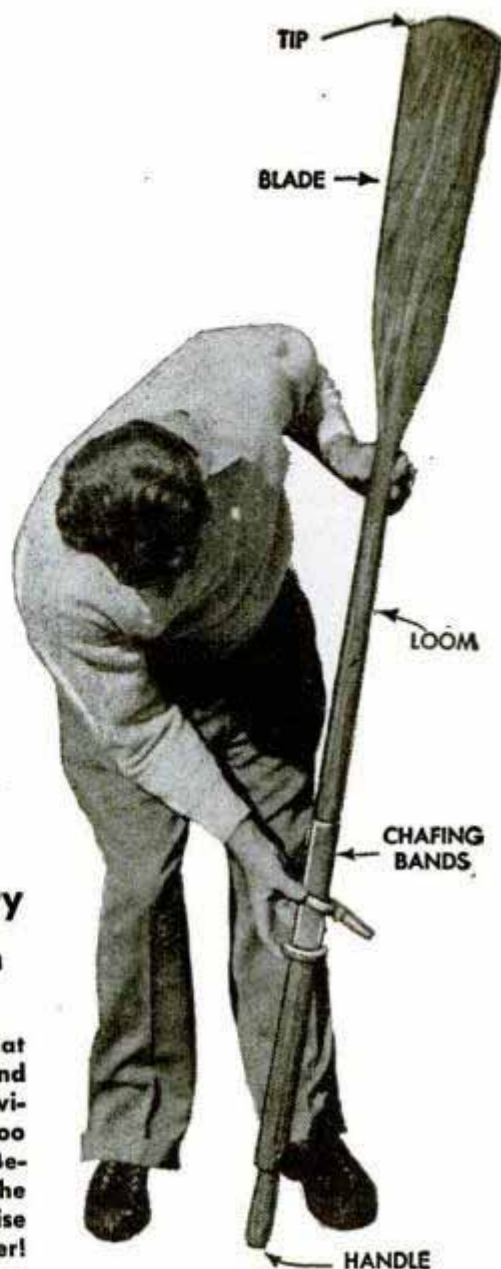
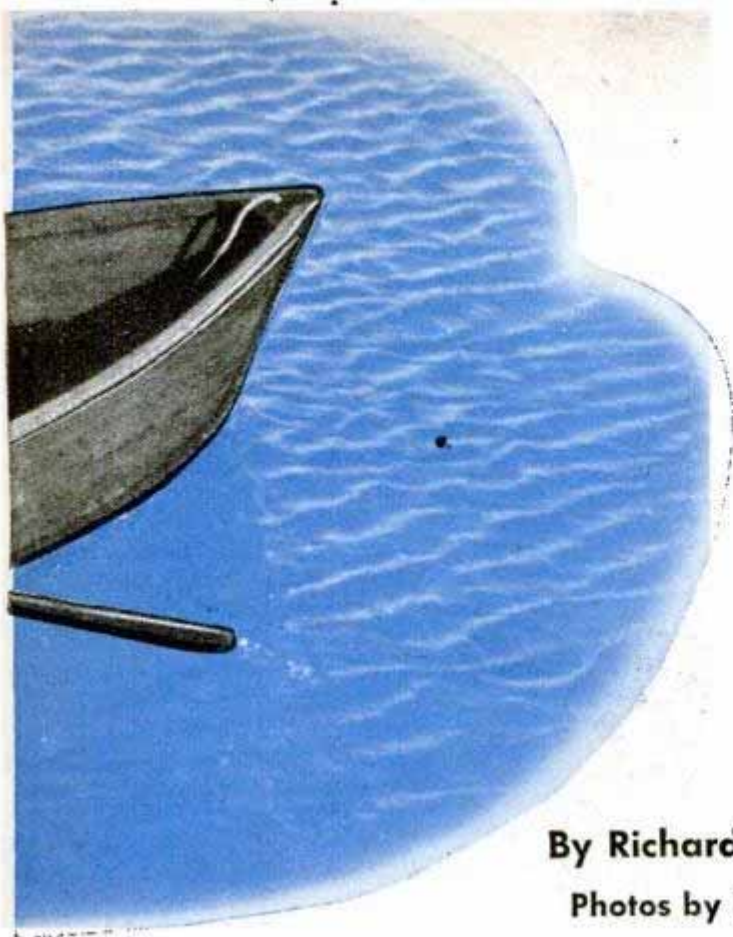
Here are some of the reasons why: In the first place, for rowing on rough water the pretty technique of collegiate racing crews won't altogether do. The average rowboat is a tougher, more seaworthy craft than the average racing shell and it rides higher out of the water. It lacks such refinements as "roller-coaster" seats and sliding footrests. But there are some ideas in racing which can be applied to ordinary rowing and they'll give you more miles with less manpower.

While it is true that you'll learn a lot by watching good oarsmen, the only way really to learn correct rowing technique is to get the oars in your hands and begin rowing, just as you would with any other work or sport requiring the development of manual dexterity through continuous practice. While you're learning, go out in the boat only on quiet days. It's not a good idea to attempt handling a rowboat in rough water, unless, of course, you take an experienced oarsman along to coach you. Always take it slowly during the practice periods. Speed and skill come later. At first concentrate on handling the oars—how to drop the blades into the water and get them out again without throwing or splashing water to no practical purpose. Getting down to first principles the theory says simply that the energy spent throwing water into the air should have been expended pushing the boat forward.

The rower holding the straight course and getting away fast is the one to watch, for you can be sure he



Ordinarily it's common practice to use oars that are twice the beam width or roughly twice the width of the thwart. Chafing bands should center in the rowlocks when the oars are in position

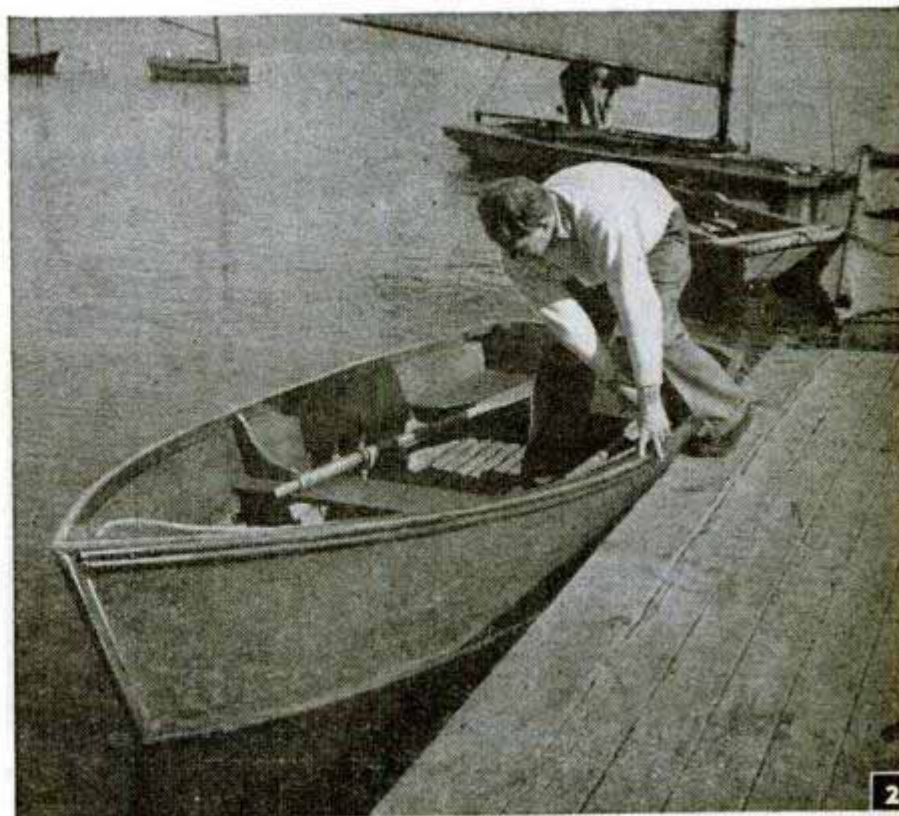


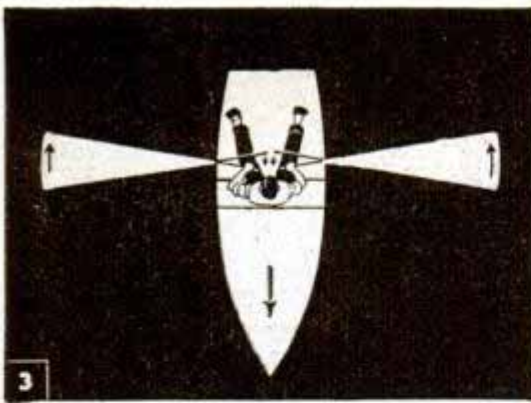
By Richard W. Emery
 Photos by Ray Chapin

Above, right, photo shows what a good oar should look like and also names its principal divisions. Oars should not be too springy in the loom section. Below, take that first step into the center of the boat, otherwise you may end up in the water!

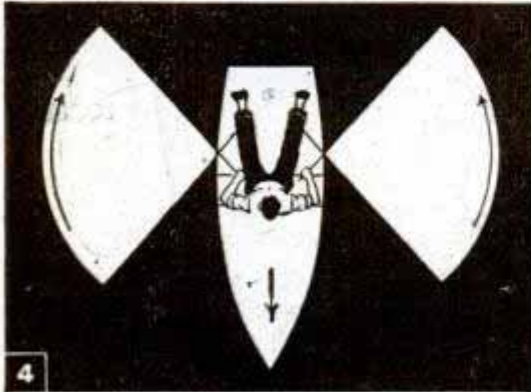
knows exactly what he's doing, where he's going and about how long it will take him to get there.

Don't take out a boat without first making reasonably sure it will bring you back. If it's your boat, look it over carefully before you launch it. Make this a habit and you won't miss. Do the same with any craft you rent. Look sharply to the rowlocks, the seats, or thwarts, if you want to be salty, and to the bottom boards—those you walk on. Do all this before you bother to examine the oars. If you're going out on fairly deep water where the wind may come up and make the water choppy, provide life preservers, a bailing bucket and an anchor with plenty of line. These are just ordinary common-sense precautions without much to do

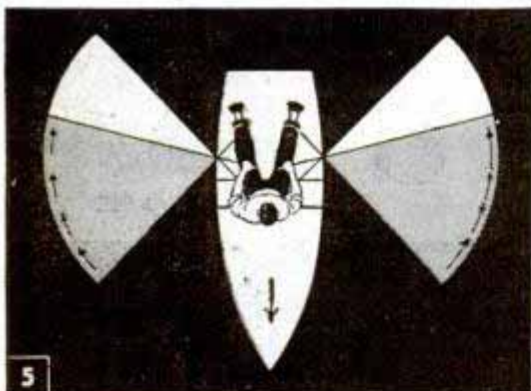




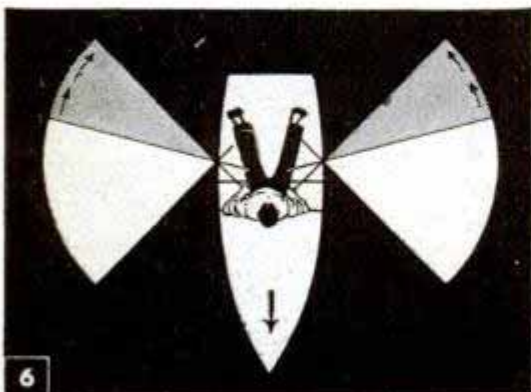
3 Short strokes get you away from the landing and well out into the open water. Long sweeping strokes will take you on from there



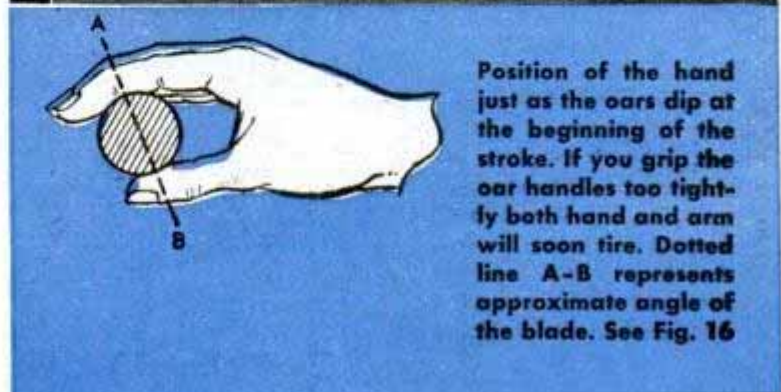
4 The arc described by the oars when making a full stroke is determined to some extent by reach of the rower. Above is average



5 About two thirds of the power stroke is made with the arms very nearly straight. Some good rowers keep arms straight out



6 The final one-third stroke is made with the arms bending at the elbows but with wrists still "locked" until they reach the chest



Position of the hand just as the oars dip at the beginning of the stroke. If you grip the oar handles too tightly both hand and arm will soon tire. Dotted line A-B represents approximate angle of the blade. See Fig. 16

with the actual rowing, but they may help to get you home again.

The oars should fit the boat. That's a first requirement. Fig. 1 gives the average proportions while the photo above Fig. 2 shows what a good, sound oar should look like and also tells what to call its principal divisions. Again the don'ts: Don't take out an oar that's warped or one that has a weather-roughened handle. It'll cut your hand to pieces on a hard row. A tear, break or bulge in the chafing band will bind in the rowlock and make the oar difficult to manipulate. Some oars, due to age or other causes, are too springy in the loom section for good rowing. An oar should be fairly stiff. Considerable pressure should be required to deflect a good one as much as 2 in. or so. When buying new oars or renting a boat for a long row on open water, check the oars for uniform weight and correct springiness. And note in Fig. 1, that the oar length is about twice the beam of the boat. That's an average requirement, not an absolute rule. But all things considered, oars of this length handle easier under average rowing conditions.

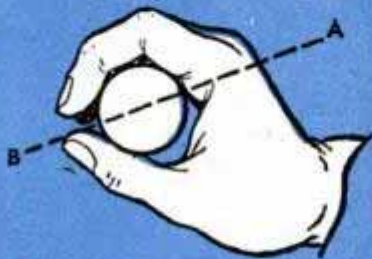
Another important feature is the position of the chafing bands. When you're in rowing position with the oars in place, ends of the handles should clear by at least 2 in. and the chafing bands should center in the rowlocks. Some good oarsmen like the ends of the handles farther apart, as much as 6 in. in some cases, but that of course is a matter of personal preference. In general the proportions of oar length to beam given in Fig. 1 give better purchase.

Stepping from the landing into a boat may be a trickier venture than it appears to be. If you step into the boat and push it away from the landing



8

Position of the hand as the oar nears the finish of the power stroke. Keep the elbows close to the body as you drop handles to lift blades clear. Line A-B is intended to show the approximate angle of the blade just before it leaves the water



9

Keep arms close together, elbows down, as feathered oars move forward to start new stroke. When arms straighten the wrists rise



10

This is the angle the blade should make with the water as the stroke begins. Note lower edge of the blade is leading slightly

with one foot, while the other foot supports part of your weight on the landing, you may end up in the water. Hold the craft against the landing, place one foot well into the center of the boat and on the bottom boards. Keep your weight low, as in Fig. 2, then transfer quickly into the boat and sit down. Always "trim" a rowboat by sitting in the center of the thwart and instruct your passengers to position themselves so that the craft rides on an even keel. You can't row well if weight causes the boat to list to port or starboard. Also, if you have a load, the boat should be trimmed fore and aft as well. As a rule the bow should ride a little higher than the stern. You'll stay a lot drier if you never stand on a thwart, but always on the bottom boards. And if you are boating solo, stow everything for the trip within easy reach so that you won't have to leave the seat while offshore.

A gentle push will put the boat clear of the landing. Only then do you place the oars in the rowlocks. Once the craft is riding free, the beginner at rowing should resist the urge to dig the oars deep and give it the heave ho. From here on you take a tip from the racing crews and dip 'em gently. Drop the blades lightly into the water and take a series of short, light strokes, only about 18 in. or so until you get underway. Then lengthen the stroke to the full sweep, Figs. 3 to 7 inclusive, and settle down to that long, rhythmic swing that makes the workouts of collegiate rowing crews something to watch.

If the oar handles are gripped too tightly, arms and hands will tire quickly. You won't be able to feather the oars correctly and your back will do work that your fingers should do. At the start of each stroke, the pull of the handle should lie within



11

Three-quarters of the blade under is about right for average rowing. At this point oar will take pressure without throwing water



12

Chopping the blade into the water perpendicularly will likely cause it to bite too deep. Some boatmen call this "crabbing"



If you find you must turn around in a boat length, just back-stroke one oar and pull hard on the other. Around you go—fast!

the curve of your fingers and thumb, as in the detail below Fig. 7 where the dotted line A-B represents the angle of the blade. In this way, several inches are added to the length of the stroke. Through about two thirds of the power stroke, Fig. 5, your arms should be nearly straight. Your legs and back do most of the work. Then the arms take over, for the final third of the stroke, Fig. 6, bending at the elbows and bringing the oar handles close to your chest. As the stroke ends, the wrists drop, and the blades emerge at a 45-deg. angle, dotted line A-B, Fig. 8, complete their turn to a 90-deg. angle parallel with the surface, and are ready to return to the starting point of the next power stroke. Study Figs. 8 to 12 inclusive, and also Fig. 16.

When you bend your elbows in that final one third of the power stroke, keep them close to your body, Fig. 14. Then they will be in position for easiest flexing of the wrists to make the special twist of the blades known as "feathering." This is necessary to prevent the wind from catching the flat blades and slowing forward speed. A little extra push or flip to the last part of the stroke gives speed to the boat just as a pitcher's fingers give speed to a ball. It also helps to bring the blades cleanly out



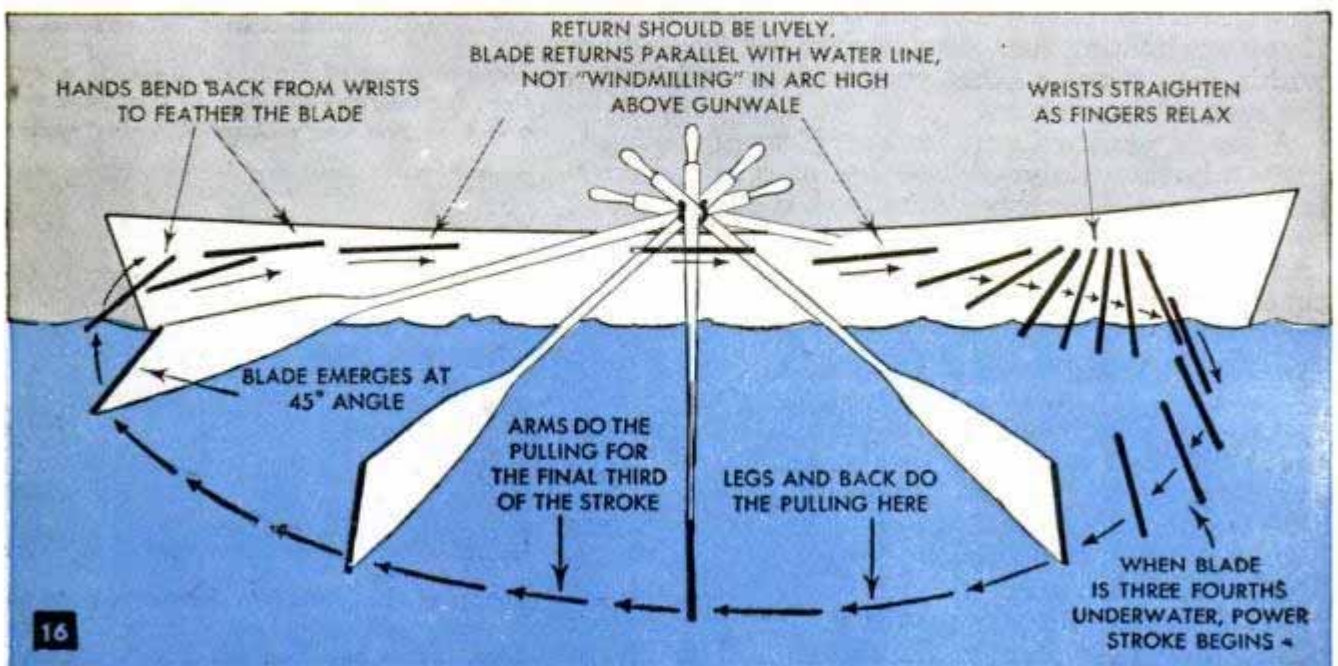
This happens when you pull hard on an oar which enters with the blade perpendicular to the water. It dips too deep. See Fig. 12



Power stroke nearly completed. Wrists do not bend until almost against the chest. Then the wrists snap down and hands rise



Blade at a 45-deg. angle at completion of stroke. Blade slips out without splashing water. Twist of wrist feathers the blade



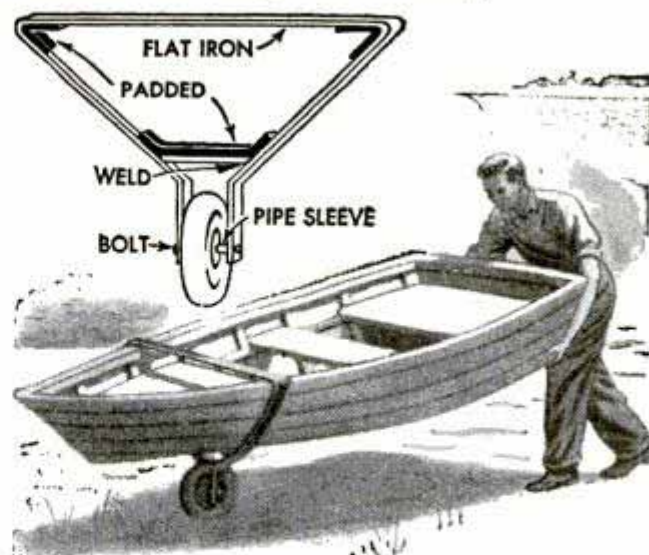
of the water, Fig. 15. Catching the oars on the rebound from that final flip against the water, and returning them briskly in feathered position, conserves strength and provides a resting point just before the beginning of a new power stroke. The rest is only momentary, of course, but it relaxes your arms, legs and back. The blades turn from feathered position in order to dip again into the water. See Fig. 16. Blades should be slightly off vertical, with the lower edges leading. This whole maneuver is a neat trick and it's worth a lot of practice. Fig. 16 shows the cycle of one complete stroke in ordinary rowing—not the racing stroke where feathered oars are skipped along the surface of the water.

Starting the power stroke before the blades are three-quarters immersed, Figs. 10 and 12, wastes strength and upsets rhythm. A skilled oarsman knows by the feel of the blade when to start the power stroke. From long practice he learns just when the blade will "bite" with full effect.

With a light grip on the handles you can slip the blades into the water without splashing. A moderate chop won't bother, once you get the knack of feeling for the water before pulling on the oars. In rougher waters, one blade probably will take hold before the other. This may be troublesome at first, but the same gentle pressure on the oars, until they both get a grip on the water, will bring you home dry.

To hold a straight course is generally quite easy. Just use the boatman's trick of taking a sight on two distant objects astern which happen to line up conveniently and then vary the pressure on one oar or the other, without breaking the rhythm of your rowing. You'll find a good boat quite sensitive to variations in pressure on the oars which makes it easy to keep the objects in line. After a time this dodge will be unnecessary. You'll get eyes "in the back of your head" like all good rowboat men. For maneuvering in close quarters, you may find single-stroking very handy. To rowing, it's what dog-paddling is to swimming. Stroke alternately, port and starboard, making the oars "walk" through the water. This stroke is restful, too, after rowing a long distance. You can turn a boat almost in its own length by pulling on one oar and pushing on the other. See the photo at the left of Fig. 13. Pull on the right oar to turn left and vice versa. By making quick, short strokes with one oar without lifting the blade out of the water you can warp a boat sidewise up to a landing or alongside another craft anchored well offshore. Finally, when anchoring in open water ship the oars. Don't take any chances on losing an oar. It floats, of course, but might be hard to recover in rough water.

Wheeled Dolly for Small Boats Makes Moving Them Easy

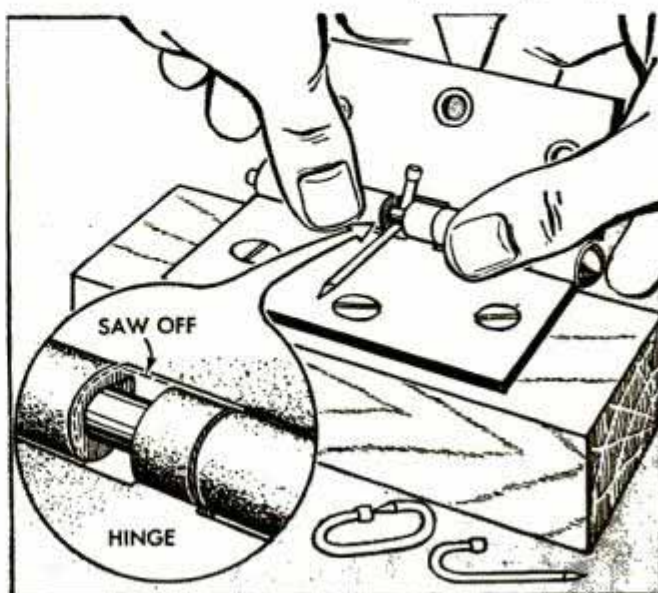


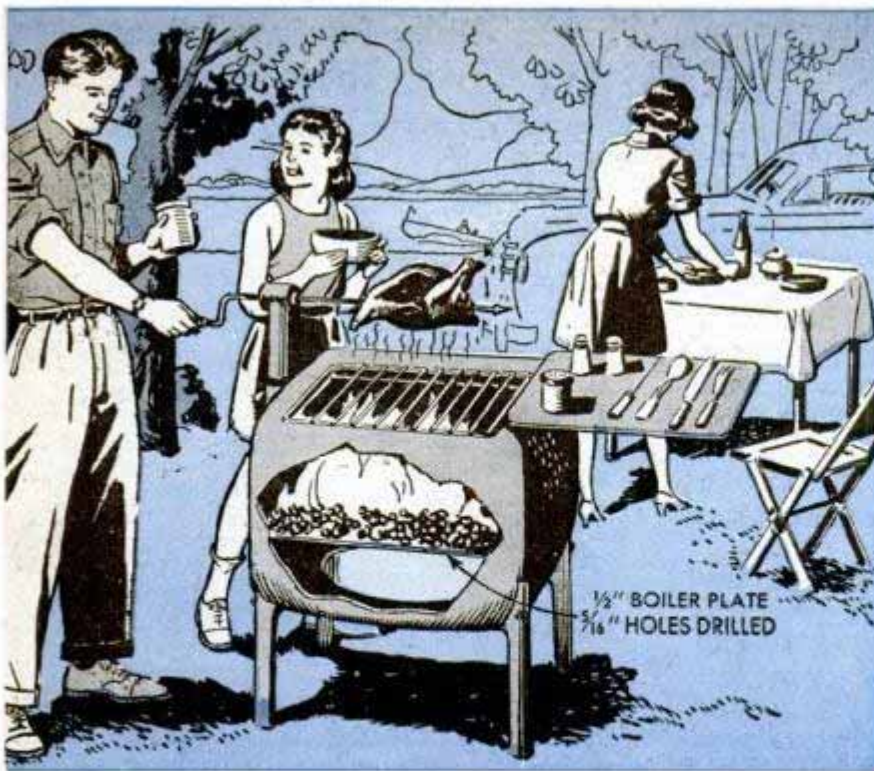
One man can handle small boats easily with the help of this dolly. It is made of flat iron formed to slip over the bow of the boat. Two legs extend downward to act as a fork for the wheel which is, preferably, one that has a large rubber tire. A bolt serves as an axle and spacing sleeves are used on both sides of the wheel to keep it centered. The corners of the dolly are padded to prevent scratching the finish on the sides of the boat.

Hinge Shapes Train Couplers

Needing a jig to shape train couplers, one craftsman screwed the leaf of a butt hinge to a small block of wood, after first cutting a section out of the eye of one of the hinges to form a slot indicated by the arrow. In use, a small finishing nail is inserted in the slot with the hinge in the open position; then the hinge is rotated and one bend of the coupler is formed. The nail is reversed to shape the other end.

H. Y. Nobles, Shreveport, La.

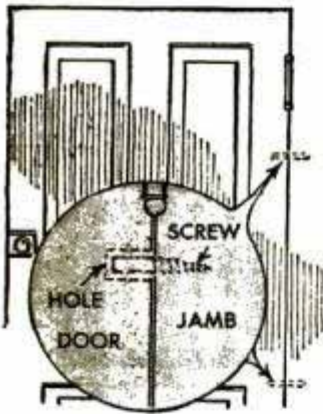




Portable Barbecue And Broiler

If you have a discarded washing machine with a cast-aluminum body, it can be made into a portable barbecue and broiler. Remove the agitator, motor, wringer and all driving mechanisms. A $\frac{1}{2}$ -in. plate with $\frac{5}{16}$ -in. holes is attached to the inside of the body and serves as a grate. Since the top of the machine usually is recessed somewhat, it should be easy to fit the grill in place. Note that the lid serves as a table when opened. The wringer post acts as a bearing for the spit.—Martin A. Tristine, Stratford, Conn.

Pins in Door Prevent Intruders



Any door which is hung with pin-type hinges having the pins outside can be opened easily by intruders, even though the door has a good lock. All that's necessary is to remove the pins and pry the door away from the jamb. To prevent

this, drive two or three fairly large lag screws into the door frame between the top and bottom hinges, allowing about $\frac{3}{4}$ in. of the screw to project. Then saw off the heads. Opposite the screws, drill holes in the edge of the door to fit as shown in the circular detail. Make the holes large enough to fit over the screws. This arrangement makes it difficult to remove the door.

Rubber Band Will Seal Leak



To stop a leak that has developed around the plug in a hot-water bottle, use a rubber band. Wrap it around the last thread at the top. The same remedy is applied to other attachments with threads that leak.

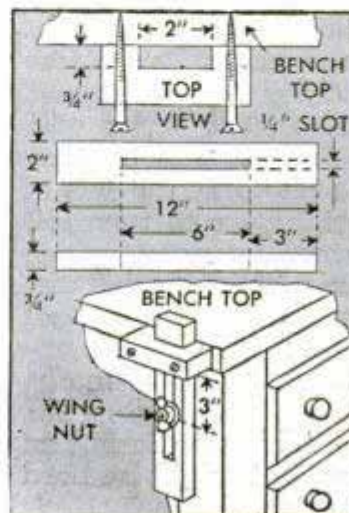
Protecting Lunch Box Lining

Metal lunch boxes have a tendency to rust at the inside corners after the box has been used for a time. To correct this, clean the rusted surfaces with steel wool or fine sandpaper and give the inside several coats of spar varnish. Water that may be left inside the box when it is washed will have little effect on these coated surfaces.

E. W. Moses, Jr., Blacksburg, Va.

Bench Stop Slides Out of Way When Not Being Used

Here's a handy bench stop that will slide out of the way when it's not in use. Dimensions for the bracket and the sliding member that acts as the stop are given in the left-hand detail. The stop is slotted and a wing nut is bolted through the bench and stop so the height of the latter can be adjusted to suit.—E. J. Wiczorek, Chicago.





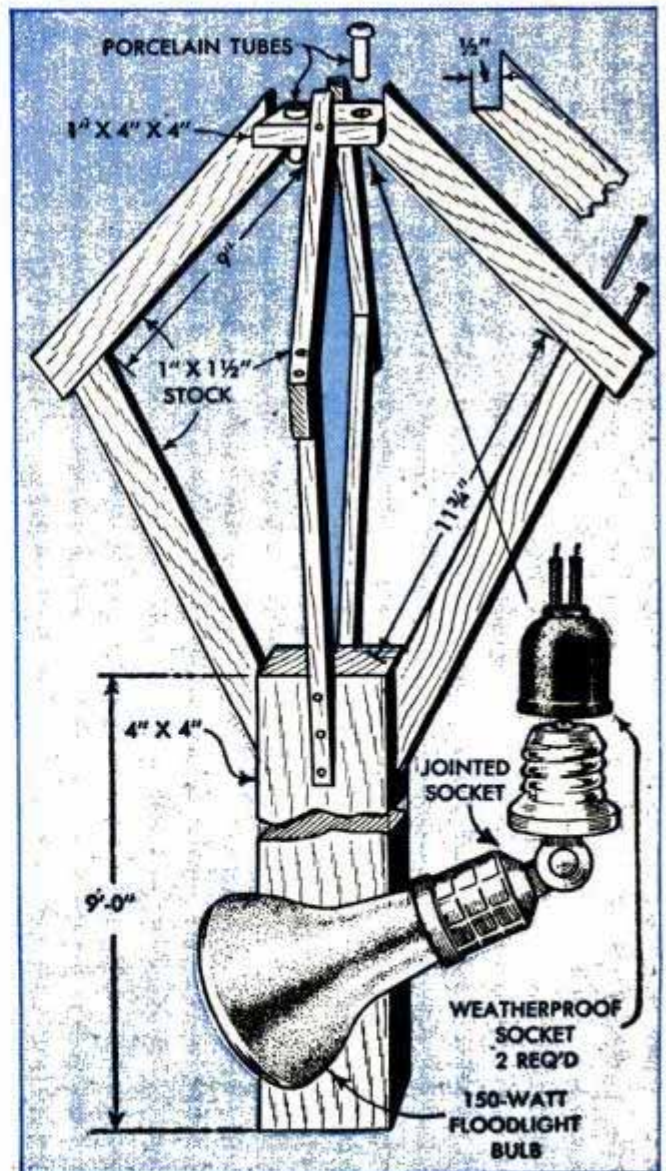
By Dick Hutchinson

FLOODLIGHTING your garden living room is another way of lengthening summer days for such sports activities as croquet, tennis, archery or the evening barbecue. And the plain utilitarian purposes of a back-yard light are served the year 'round, as well.

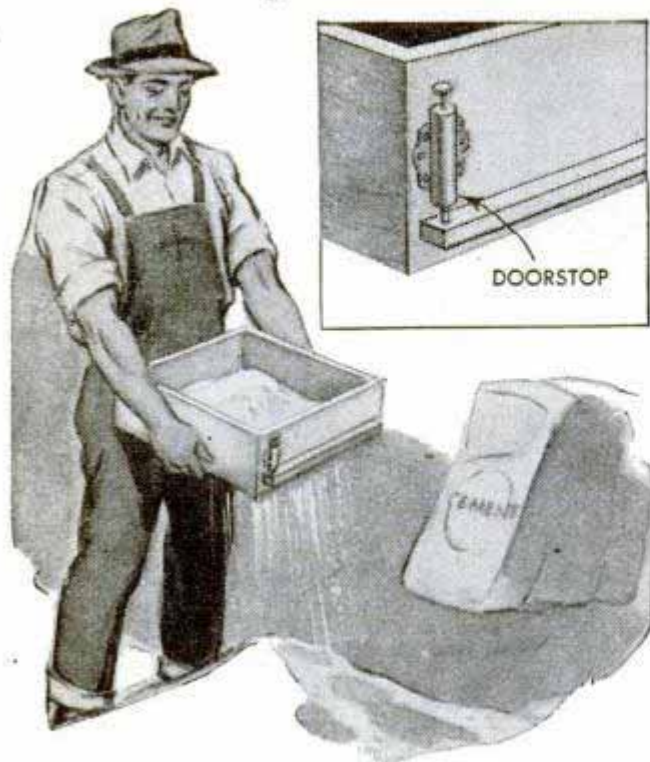
The general design of this lamppost is patterned after the early American street lamp. It provides a permanent fixture for two 150-watt flood lamps of the reflector-bulb type. The lamppost and frame supporting the lamp sockets are made entirely of wood. The 4 by 4-in. post is 9 ft. long and is hand hewn on all four sides, the corners being broken slightly with a hewing adz. The frame is made from 1-in. white pine cut out as shown in the detail and it is assembled at the top of the post with finishing nails or screws.

Two holes are drilled in the 4 by 4-in. top plate for porcelain tubes and two weatherproof sockets are attached to the frame and wired to a switch either at the house or garage. All wiring must be weatherproof and should comply with the local code.

If the post is placed directly in the ground, the bottom end should be coated with asphaltum to prevent rotting. If it is set in concrete, all the wood may be merely stained a weathered brown by painting with repeated coats of creosote. Or it can be painted above ground with an outside oil paint of whatever color you choose.



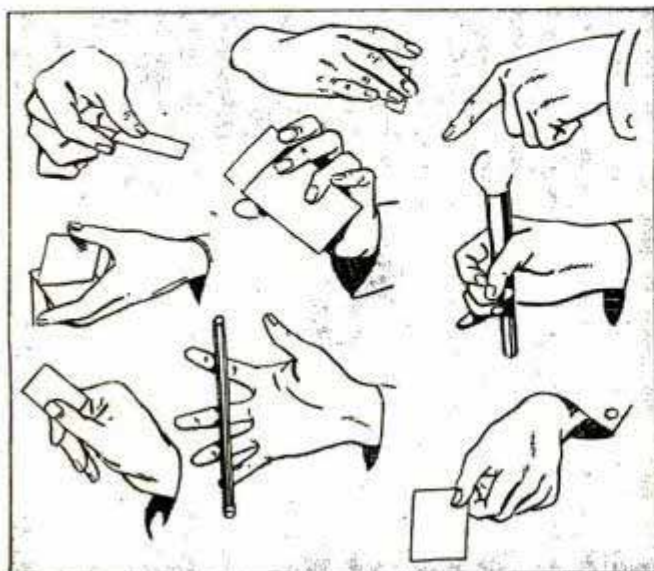
Small Frame That Sifts Materials Has Interchangeable Screens



For the person who has occasion to mix small amounts of concrete now and then, this sifter frame with interchangeable screens is handy and will handle several grades of material. The sides can be of any suitable dimensions, with a slot cut near the bottom of one for insertion and removal of the screens. Guides or slots in the other sides will hold the screen in place. A doorstop, upper right-hand detail, locks the screen in place. For average work, a coarse, medium and fine-mesh screen will do.

Magic Catalogue Provides Models For Studying Hands

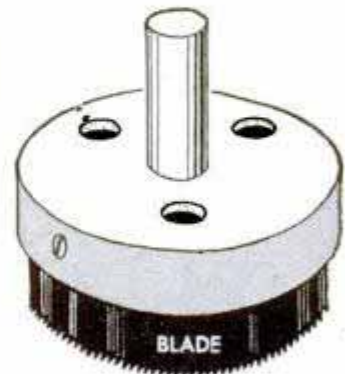
Many an amateur artist is stumped when it comes to finding models for hands in various positions. When there is no one avail-



able to pose, he will find that catalogues of magic goods will furnish drawings of hands—used to illustrate tricks—in almost any pose desired. Usually such catalogues may be purchased from dealers for a small amount.—G. E. Hendrickson, Argyle, Wis.

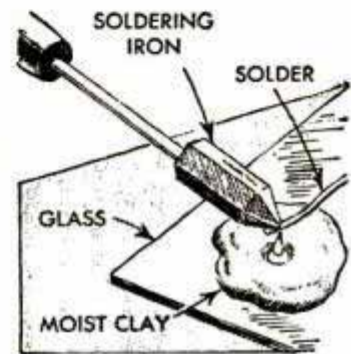
Knockout Holes in Rotary Hacksaw Aid Removal of Work

If several knockout holes are drilled in a rotary hacksaw holder, removal of disks cut by the saw will be easier. The holes are equally spaced and large enough for a $\frac{3}{16}$ -in. rod, used as a knockout.



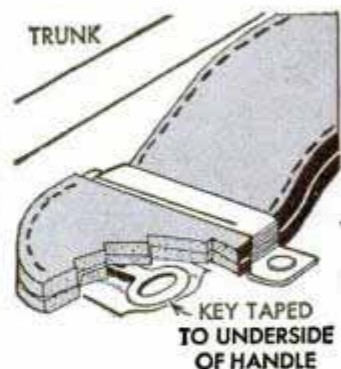
Easy Way to "Drill" Glass

Sometimes it's desirable to make a small hole in a pane of glass when no cutting tools are handy. In such a case, a soldering iron and length of wire solder will do the trick. Build a small dam of moist clay around the spot where you want the hole, leaving a small area of glass uncovered. Then let a drop of melted solder fall into the opening. Unless the glass is too thick, a small piece of about the right size will drop out.



Trunk Key Hidden Under Handle

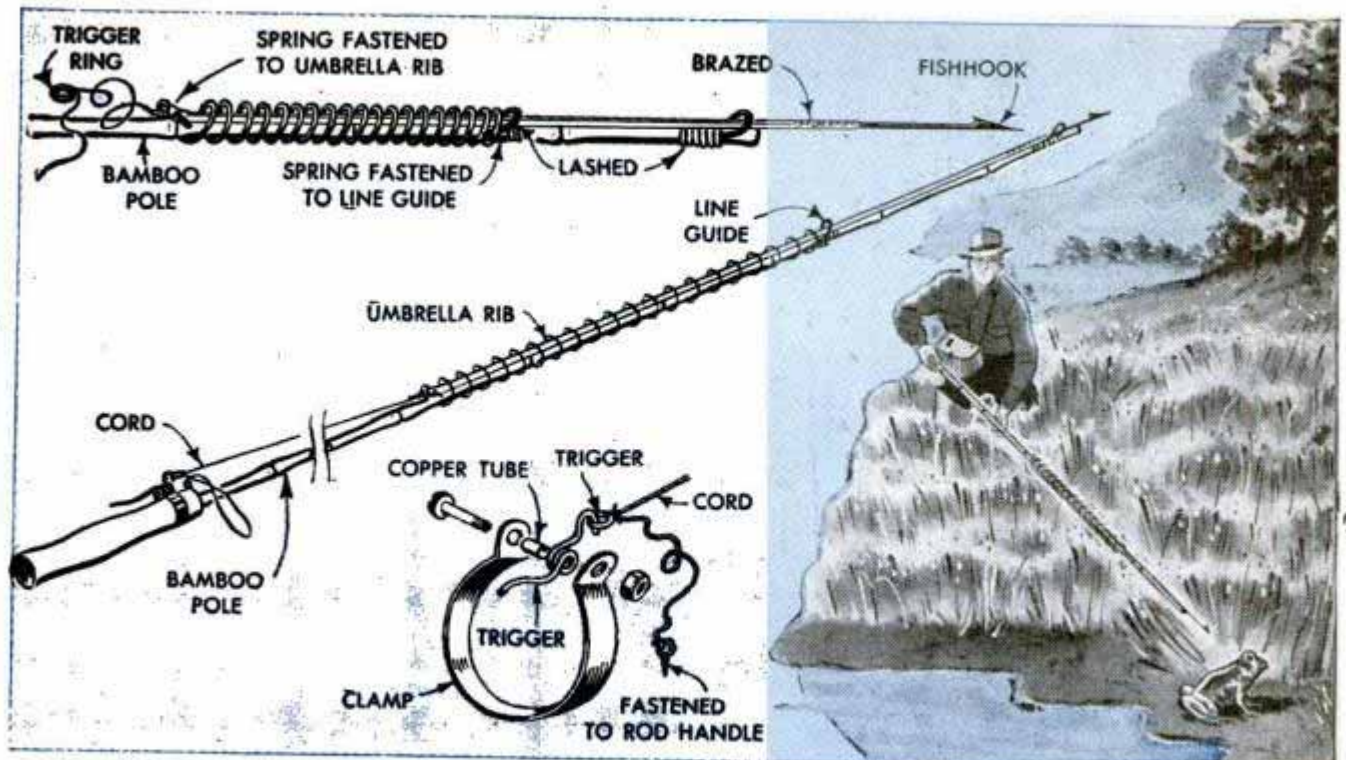
Should you ever lose the key to a trunk and have to force the lock to open it, you'll appreciate having this extra key which is concealed under a handle of the trunk. Since such keys are generally rather small, it can be taped to the underside where it will not be noticed.



Opie Read, Jr., Chicago.

☐ To straighten a carpet that has curled at the corner, apply a warm iron to the underside and it will lie flat.

Spring "Fired" Harpoon Is Deadly Against Frogs



Frog spearing is made both sporting and profitable with this simple, yet accurate harpoon. Simply cock it, draw a bead and zing — you've got your frog if your aim is good. The harpoon is rigged from an old bamboo bait-casting pole, an umbrella rib, a piece of strong fishline and a coil spring. As shown in the drawing, the pole is fitted with two spear guides of wire lashed near the end and a trigger assembly clamped to the handle. The umbrella rib forms the spear which has a large bass or turtle-type hook straightened and brazed to one end and a coil spring attached to the other; the spring being fastened in turn to one of the

spear guides. The fishline is tied securely to the end of the spear or rib and is fitted with a small ring and screw eye which anchors the line to both trigger and pole handle. With the spear in an extended or "fired" position, the line should be of such a length as to allow slack in it when the spear has reached its target.

The harpoon is cocked by drawing back on the ring, which expands the spring, and hooking it on the trigger. When cocked, respect it as a deadly weapon and take the same safety precautions in using it as you would in handling a firearm.

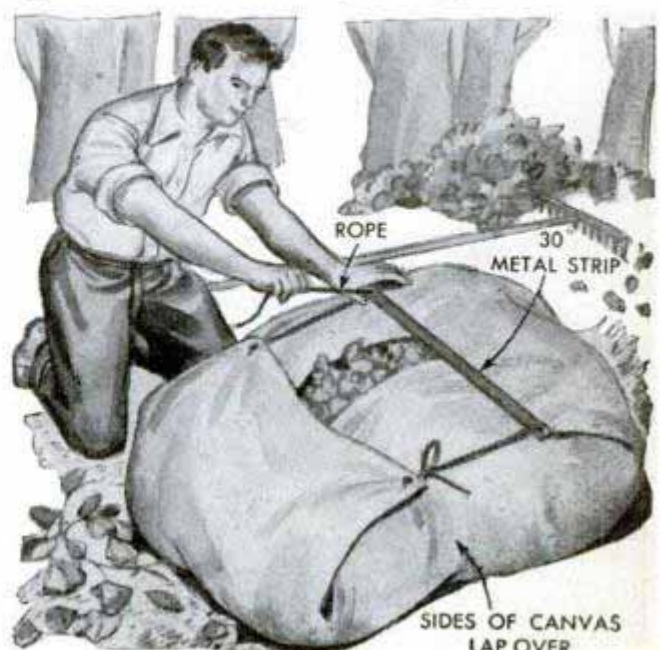
William P. Houser, Organ, N. Mex.

Simple Rigging Laces Canvas "Carryall" to Avoid Spilling Contents

The practice of raking leaves and grass onto a canvas or other large cloth and grabbing the four corners to carry it often results in eventually losing grip and spilling the load. To overcome this one gardener riveted a sheet-metal strip, having a hole at each end, to one edge of his canvas and fitted two eyelets, correspondingly spaced, along the opposite edge. Then he tied a 3-ft. length of clothesline or sash cord to each eyelet.

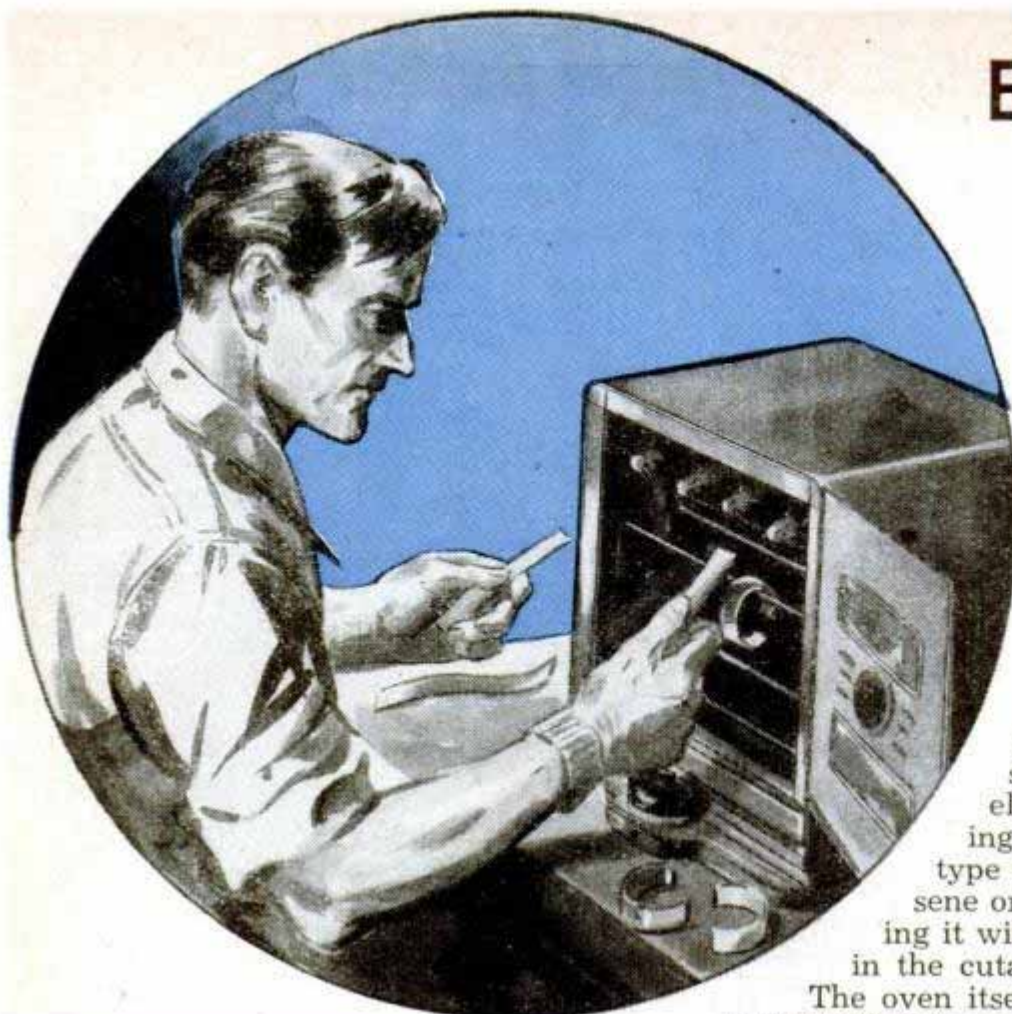
In use, the canvas is heaped with leaves in the usual way, two sides are folded inward as shown and then the ends are brought over. Finally, the ropes are threaded through the holes in the metal strip and drawn up snugly and tied. Wrapped in this manner, the load can be carried or dragged easily without spilling.

D. Roscoe Baldwin, Bellefontaine, Ohio.



ELECTRIC

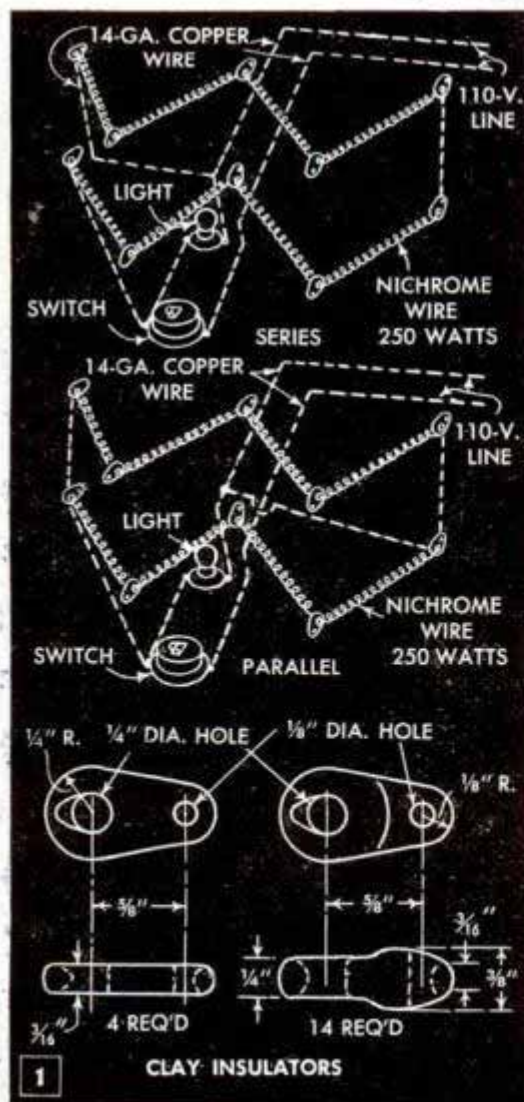
By
R. J. Dierkes



FORMING thermo-plastic material into novelties, bracelets and other useful articles requires a suitable oven in which to heat the work to make it pliable. While an ordinary kitchen oven can be used for this purpose, you can furnish your shop with a neat little electric unit by purchasing a portable oven of the type used on top of a kerosene or heating stove and wiring it with an element as shown in the cutaway drawing in Fig 2.

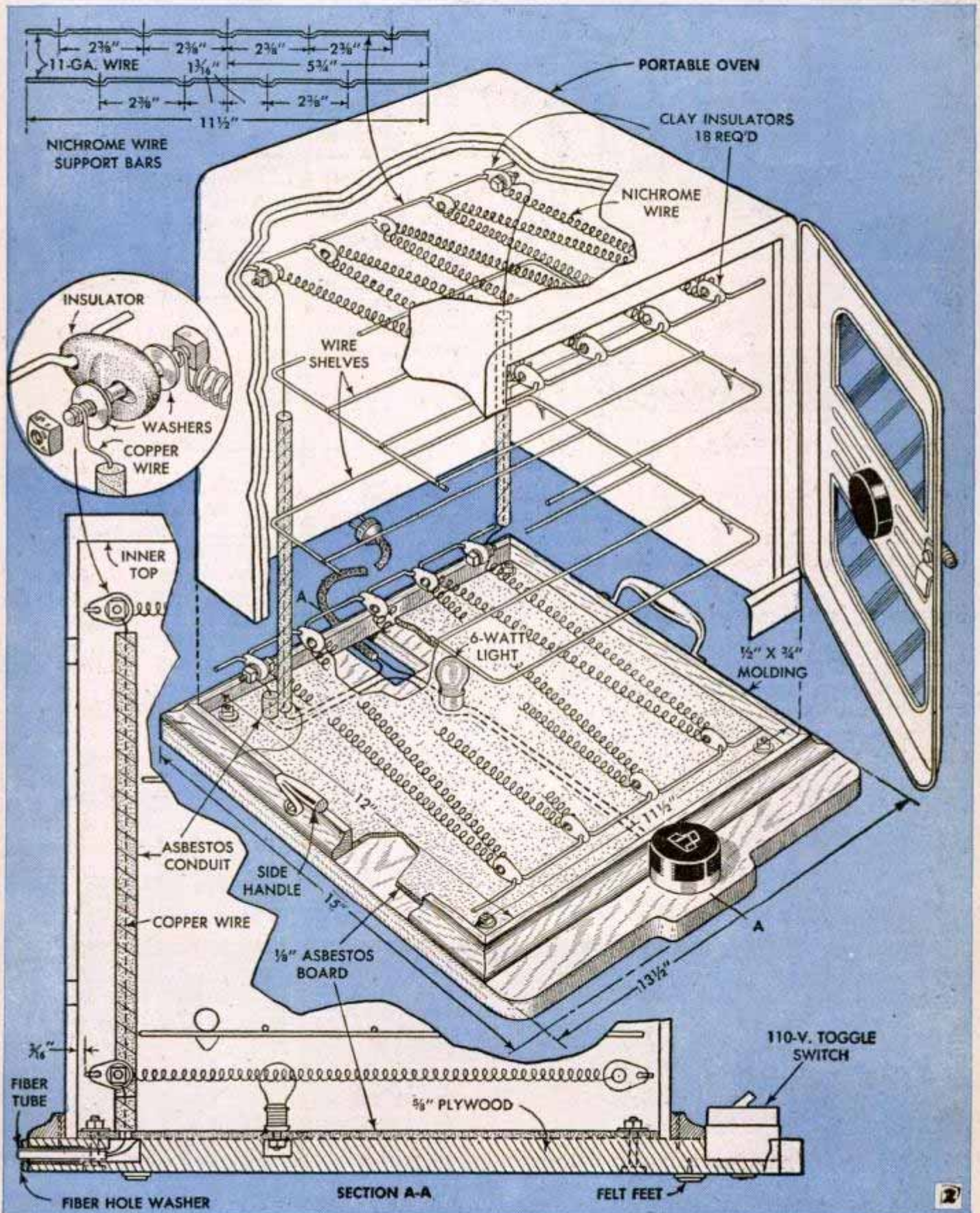
The oven itself is not altered except for installing four element-support bars on the inside above and below the oven shelves. The bars are shaped of 11-ga. wire according to the detail at the top of Fig. 2, and are threaded with insulators before being installed. Suitable insulators can be molded of ceramic clay and fired, or you can buy aviation-type antenna insulators, sometimes called "egg" insulators. Note that the end insulators on the rear bars are fitted with small bolts for connecting the 110-volt line. The Nichrome heating element required is removed from the cone core of a regular heater element of 250-watt size and threaded through the insulators in the manner shown in Fig. 2.

The oven sets on an asbestos-covered base within a wood molding bordering the edge, but before the asbestos sheet is fastened to the base, the bulb-and-switch wiring is first installed as indicated by the dotted lines in Fig. 2. Use asbestos, heat-resistant fixture wire for this, and insulate the socket from the wood base. You have a choice of wiring the elements either in series or in parallel as shown in Fig. 1. In series, a temperature of approximately 285 deg. F. is had; in parallel, the temperature is increased to 800 deg. With the higher temperature the thickness of the asbestos board covering the wood base must be increased to provide adequate insulation. Conduit encasing the wires connecting the two elements is formed by wrapping strips of asbestos paper around the wires to build up a thick insulation as shown. Heating thermoplastic material requires 5 to 10 minutes, depending on the thickness of the plastic and the nature of the work. When heated, the material becomes almost as flexible as rubber and can be bent by hand.

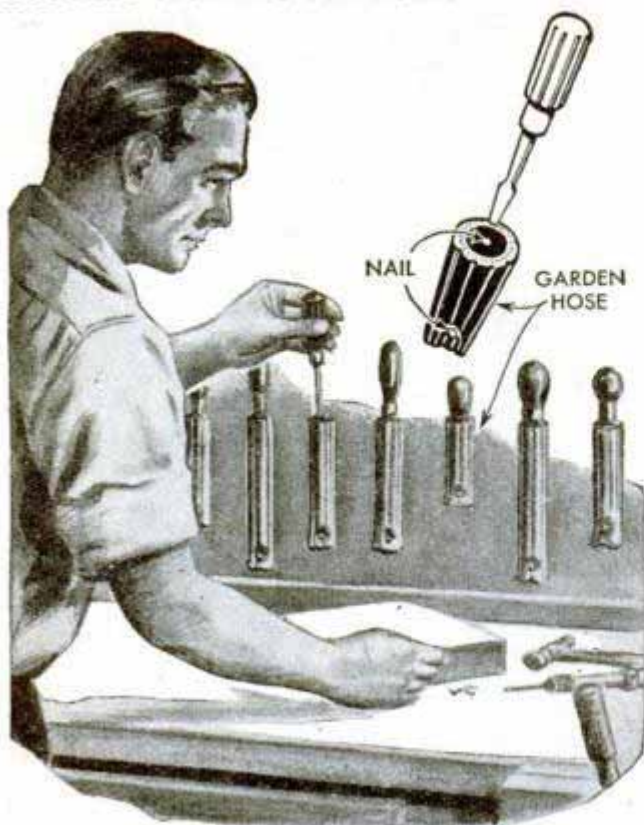


OVEN for heat-forming PLASTICS

Here's how you can take a portable (on-the-stove type) oven and wire it with a Nichrome heating element to produce temperatures up to 800 deg. F., for heat-shaping Lucite, Plexiglas and other thermoplastics



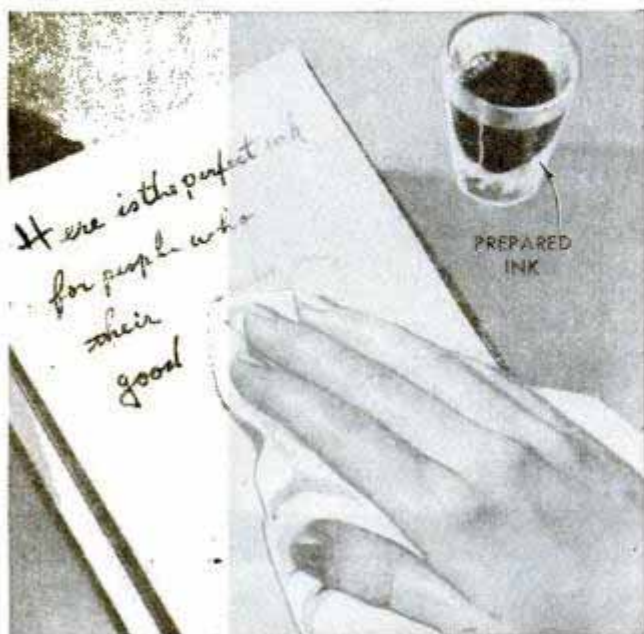
Hose Sections Nailed to Wall Provide Holders for Tools



Sections of discarded garden hose cut to the proper length will make safe holders for sharp-edge tools. Each section should be long enough to cover the tool up to the handle. To attach, nail through the hose at the bottom and through one side at top.

Prepared Ink Removed With Cloth

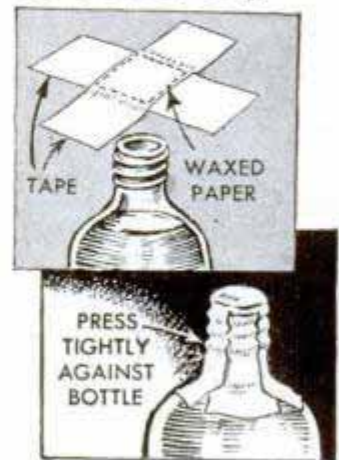
The magic of invisible inks takes a new turn with this simple trick—instead of slowly fading, or not appearing until brought out by some chemical process—this ink appears perfectly legible and non-fading, but it can be erased with the wipe



of a cloth. The secret lies in the composition of the ink, which is made by adding 1 teaspoon of cornstarch to 12 drops of tincture of iodine and 1/2 oz. of water. A message penned with this fluid will vanish when rubbed over with the cloth.

Tape Substitutes for Bottle Cap

Should the cap or cork become lost from a bottle, two short strips of adhesive tape and a small square of waxed paper can be used as a substitute. The paper should be large enough to cover the opening in the bottle. Cross the two strips of tape as indicated in the upper detail and place the paper in the center. When applying (lower detail) press the tape tightly against the neck.



Melvin R. Hickok, San Francisco, Calif.

Protecting Sharp Edge of Chisel



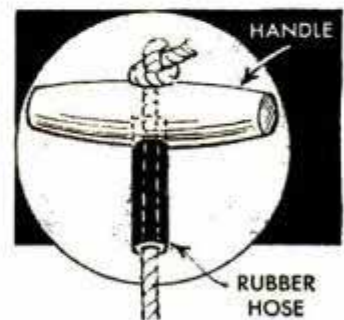
When you've honed a sharp edge on a chisel, it's disappointing to have it dulled or nicked through careless handling on the part of someone. A good way to protect a chisel is to cut a slot in a piece of

radiator or garden hose and slip it over the tip. The fit should be a snug one.

Gordon P. Jones, Seattle, Wash.

Chafe Guard on Starter Rope

If an outboard motor is a little balky in starting and requires repeated effort, chafed fingers and blisters caused by the starting rope will result. To prevent this, slip a length of rubber tubing over the rope and enlarge the hole in the handle enough so the tubing will fit into it. This provides a smooth surface for the fingers.



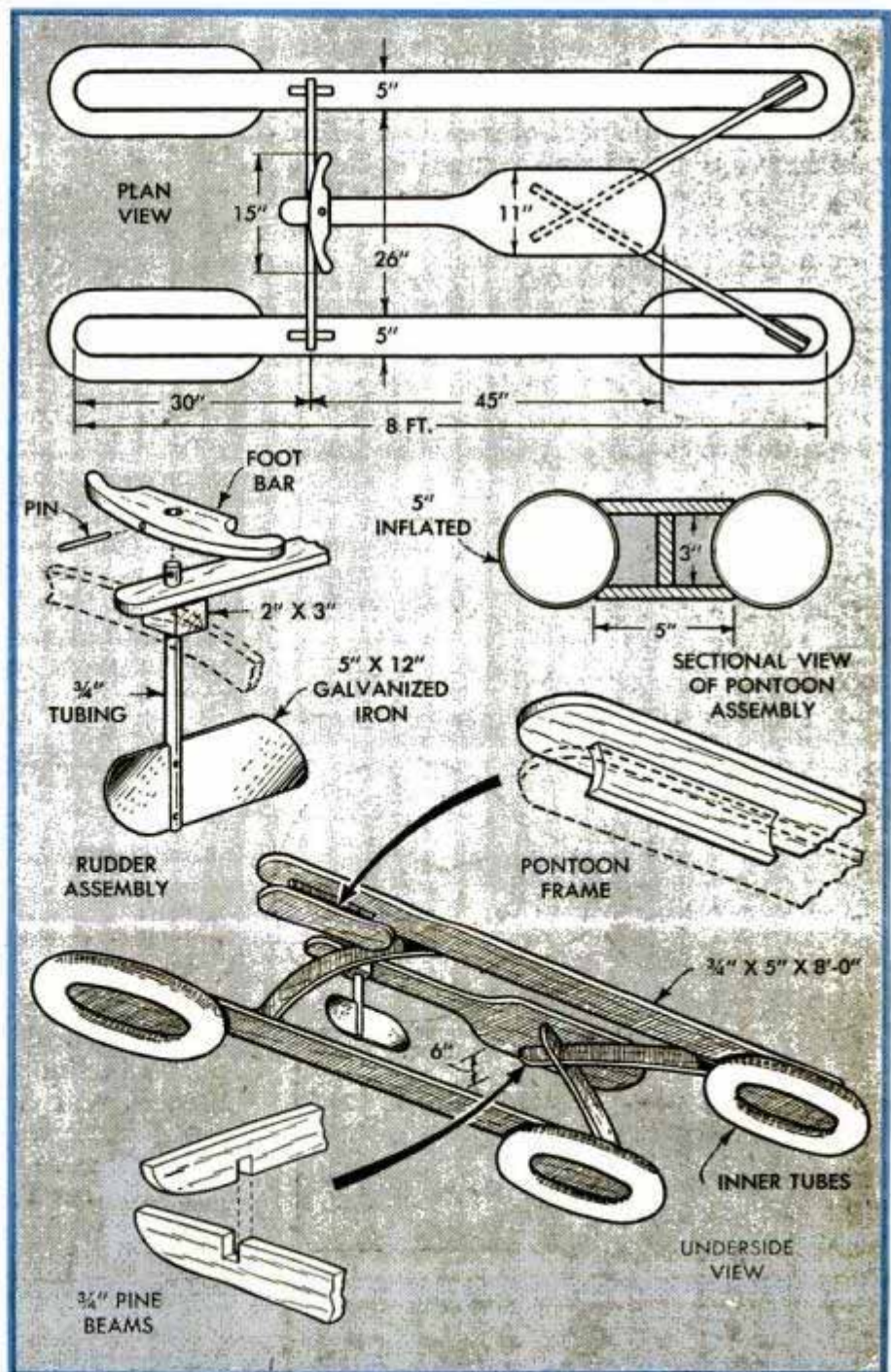
Albert M. Lindner, Jr., Cold Spring, N. Y.

TIRE-TUBE CATAMARAN



NOW that auto-tire tubes are on the market again, you can still get some use out of those old ones by building this novel catamaran. It keeps you high and dry above the water and it won't tip over easily.

The tubes are slipped over wooden frames after inflating, the valves being on the inside. Ample space is provided for action of the paddle. A foot-operated rudder, used in conjunction with the paddle, enables the passenger to make short turns. Although the rudder can be made of wood, using outdoor plywood for the blade, a slotted seamless-steel tube and galvanized sheet-metal blade make a better, more durable job. Curved brackets, band-sawed from $\frac{3}{4}$ -in. pine, support the seat. If you want a more durable job make the whole frame from oak. In either case use screws for joining all parts. The rear brackets, being set at an angle, serve to reinforce the entire structure. Paint the wood lemon yellow, or finish hardwood in the natural color with black striping. Either way you will have a smart craft.



Soldering Large Sheets of Metal Made Easy by Preheating



Because a large sheet of metal will dissipate heat quickly from a small soldering iron, it is often difficult to solder large areas. However, by preheating the metal over a burner and maintaining that heat, the job becomes quite simple. It's necessary to determine first the proper temperature for the metal, and also how far the work must be kept from the burner. The over-all temperature of the sheet should be just below the melting point of the solder.

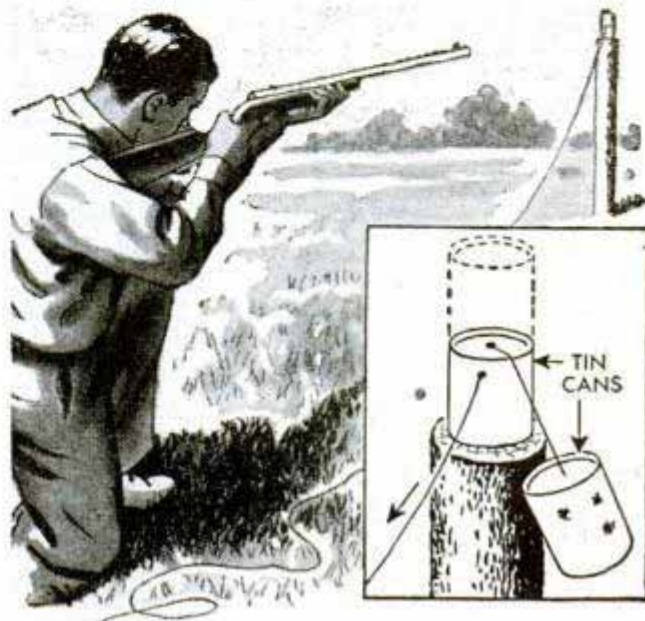
Flashlight Projects Silhouettes That Amuse Children

Here's a simple silhouette projector that is made easily and will amuse children for hours. All that's needed is a flashlight, some paper, strips of Cellophane, tape and



a length of wire. Cut the silhouettes out of the paper and paste them on a strip of Cellophane, fastening another Cellophane strip over them with tape to make a panel or "slide." Then fashion a wire holder that will slip over the light and hold the slide. A "focusing" type flashlight will make the best pictures. As you move the flashlight, the figures will go sailing across the wall.

Knock-Down Target Is Replaced From Shooting Position



You can knock this target over and then pull it back in place without so much as moving from your shooting position. Two tin cans are required for this setup, one for the target and one for the base. Holes are punched in the end and side of the base, which is attached to the post. Then a cord is fastened to the bottom of the can used for the target and run through the end and side of the base. Whenever the target is knocked off the base, it is returned to its original position by pulling on the string. When setting up the target, be sure there is a suitable backstop for the bullet or other missile that is fired.

Candle Stubs Will Start Fires

Short ends of candles are useful when starting a fire with damp kindling. Light one or several candles and place at various points in the stack of kindling. In a short time it will dry sufficiently to burn. As soon as the wood ignites, remove the candles and save them for future use.

Margaret Tatroe, Edmonton, Alta., Can.

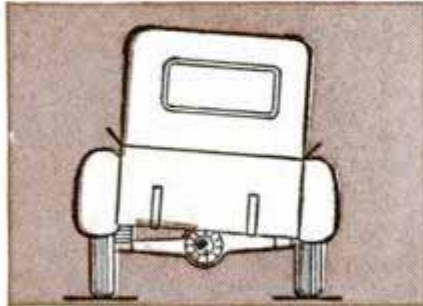
☐ Cut windows in your hatboxes and cover them with a piece of Celluloid or Cellophane. This will facilitate locating the desired hat.

12-POINT SPRING INSPECTION

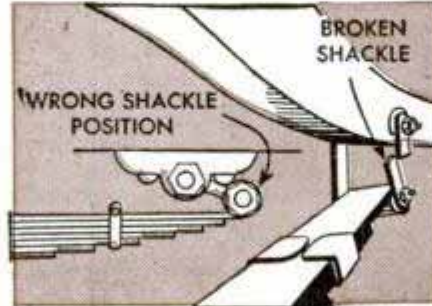
In most cases auto or truck springs do not break suddenly or unexpectedly. Rather they tend to deteriorate gradually by processes of metal fatigue. Usually a "tiring" spring will give you plenty of warning with such common symptoms as you see illustrated in detail below



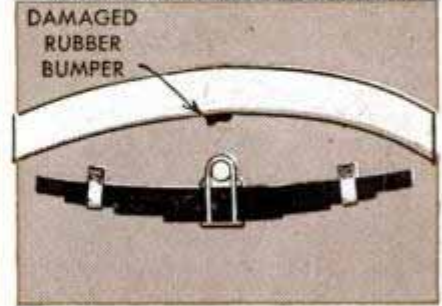
Courtesy Maremont Automotive Products, Inc.



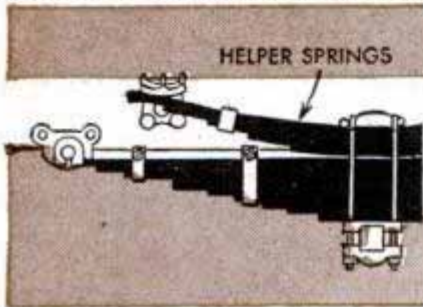
A low corner is almost sure to mean a broken spring or one that allows the body of the car to sag because of several cracked leaves



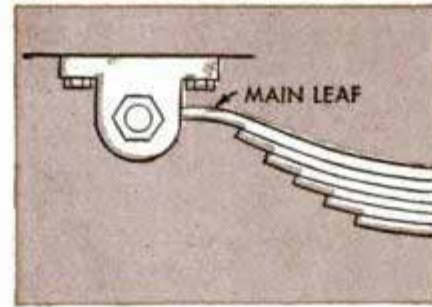
When the spring is weakened for any reason it pushes the shackle out of position. A broken shackle will eventually result from this



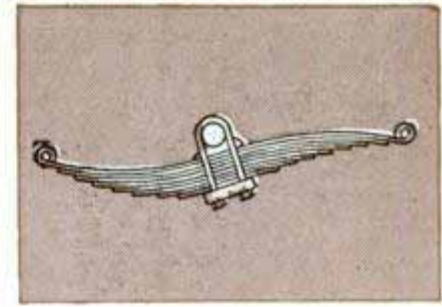
"Striking through" damages the rubber frame bumper. This not only indicates spring fatigue but sooner or later ruins the bumper entirely



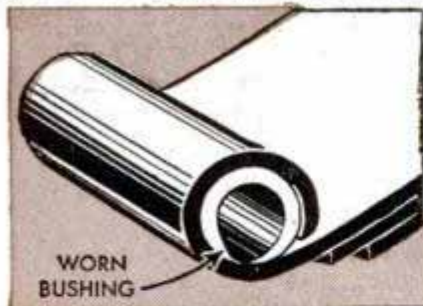
Should the helper springs touch the brackets when the truck is empty, the main springs should be replaced or repaired immediately



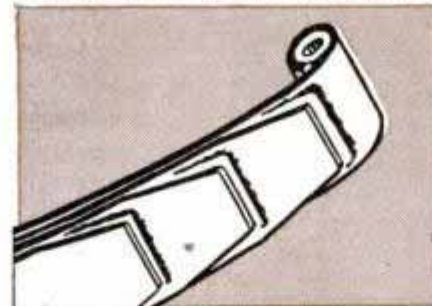
A frozen shackle will "seize" the spring eye and this will likely break the main leaf. Free the shackle, repair or replace the leaf



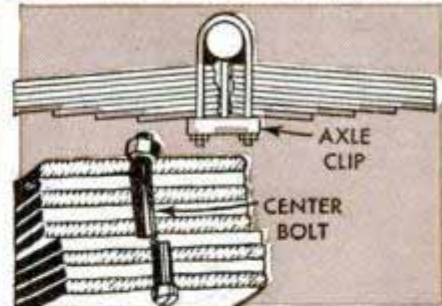
A "wrapped" spring is usually due to "rabbit" starts or repeated sudden, violent stops. Causes rapid axle wear due to misalignment



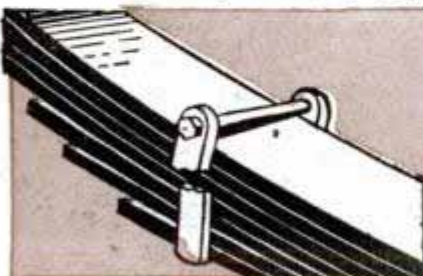
Worn bushings cause annoying knocks and rattles that are hard to locate unless you know symptoms. New bushings are the remedy



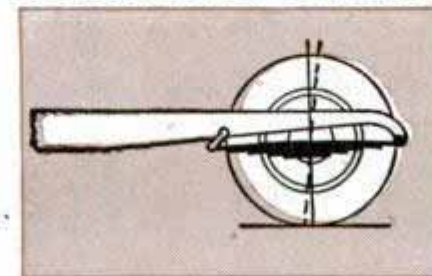
If the ends of the spring leaves cut in due to heavy loading, the spring will be weakened because of reduced thickness of the metal



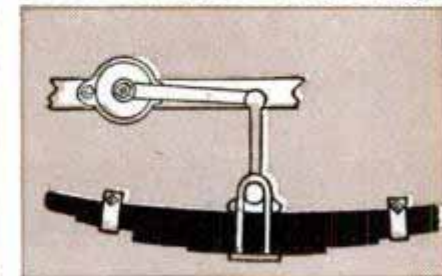
Sheared center bolts allow the spring leaves to shift. This quite often loosens the axle clip and causes breakage of entire spring



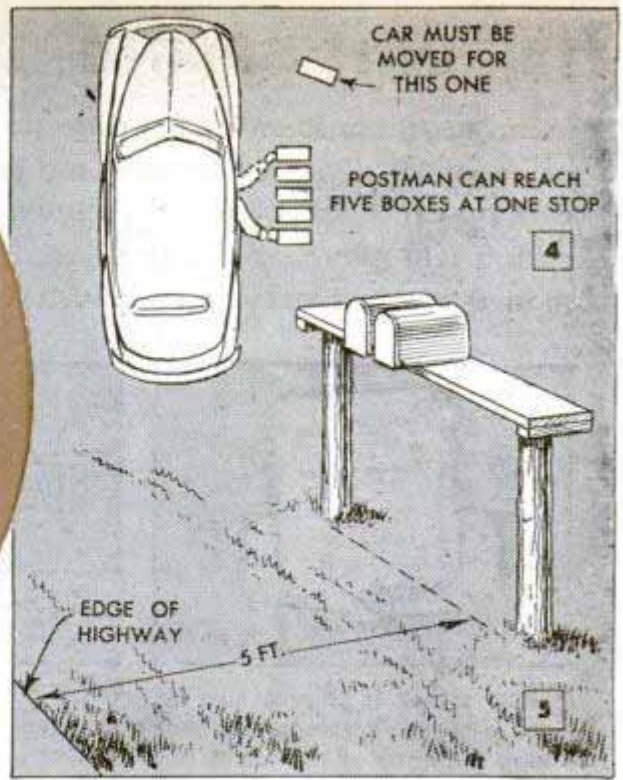
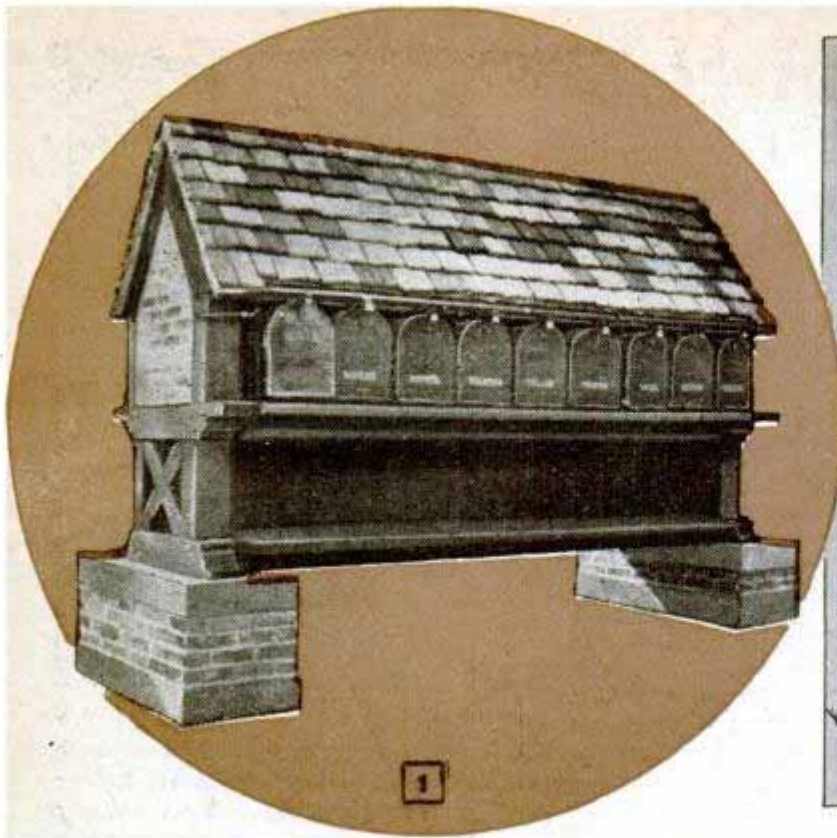
Broken rebound clips also permit the leaves to shift. This often has the effect of shifting the loading, causing springs to wrap or break



A sagged or broken front spring amounts to much the same thing as a shift in wheel alignment. It results in excessive wear on the tires



Defective shock absorbers can cause plenty of spring troubles, too. Keep them in good working order by periodic service and inspection



MAILBOXES

By Hi Sibley

BOTH THE RURAL mail carrier and the neighbors will thank you for promoting the idea of arranging the neighborhood mailboxes in a neat, orderly row. They'll all be glad to lend a hand in obtaining the material and constructing such attractive units as those shown in Figs. 1 and 3. Compare these with the usual unsightly group in Fig. 2 and you'll agree that either one is a much simpler arrangement than mounting the boxes on individual posts. Moreover, these structures are approved by the Post Office Department.

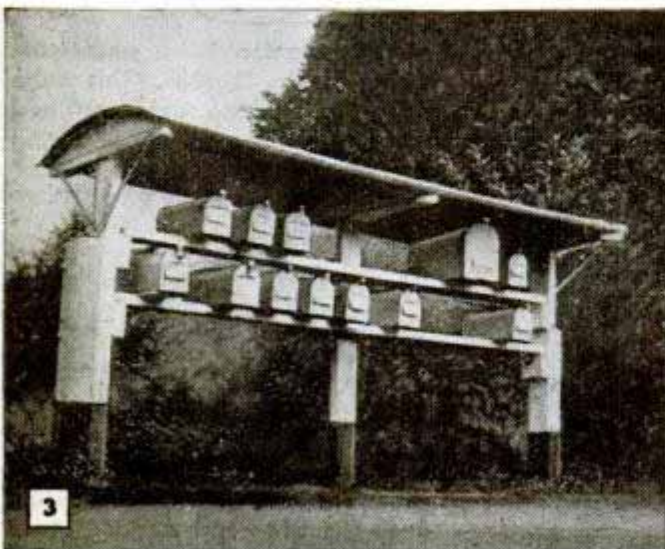
Where the boxes are at a uniform height of 4 ft., the postman can service five boxes with one car stop, Fig. 4, but he must move his car for any beyond this reach. Placed in two tiers, ten boxes can be handled at one stop.

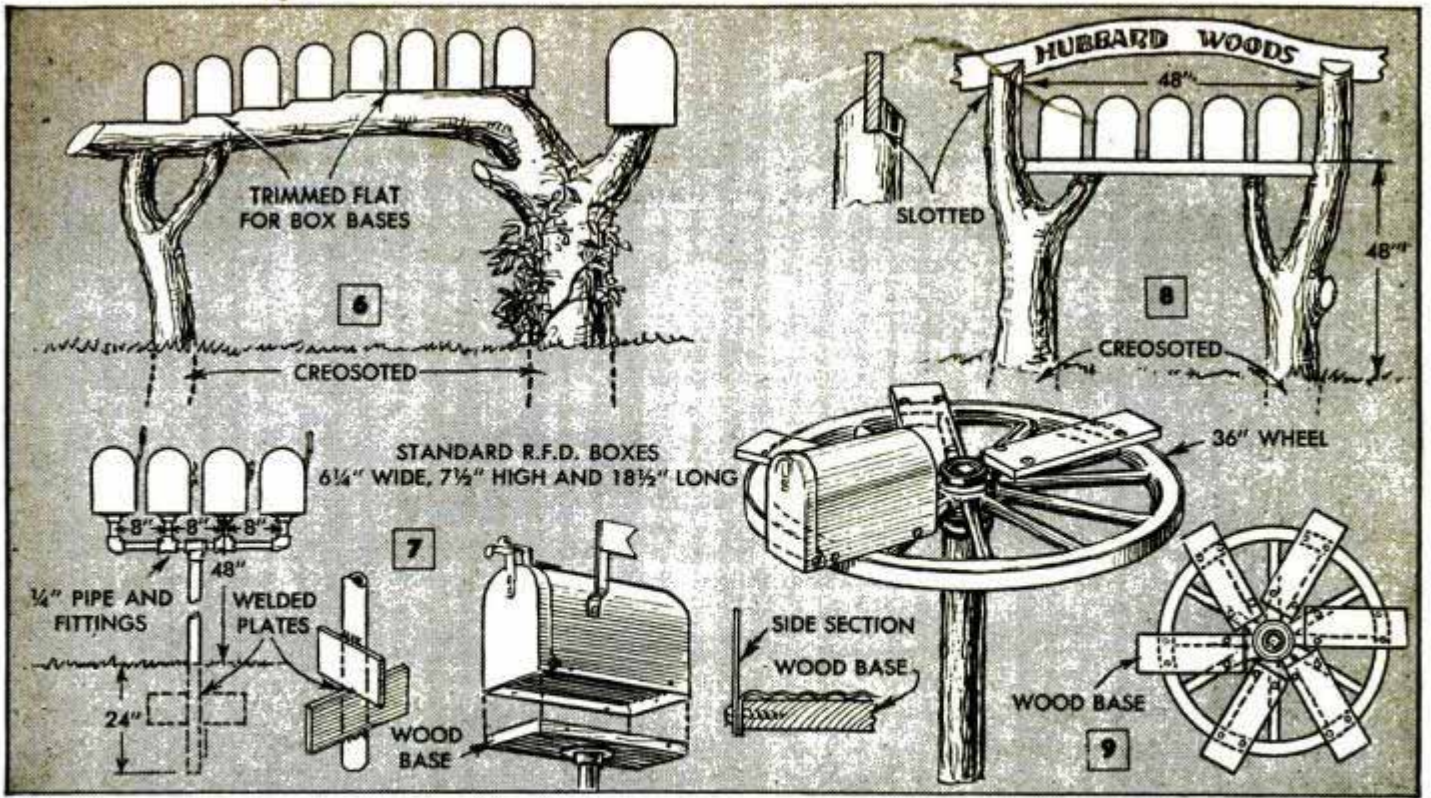
A very simple arrangement suitable for a rustic setting is to mount the boxes on a horizontal log raised 4 ft. above ground, as in Fig. 6. The top is hewn flat and also cut in low steps for boxes. Another one, Fig. 7, consists of iron pipe and fittings assembled in a candelabra style. Weld or pin the pipe fittings so that they cannot turn.

Where wood wagon wheels are available, boxes can be mounted in a turntable style very convenient for the postman. A 36-in. wheel is recommended, its spindle being anchored solidly to the post in a vertical position, Fig. 9. These wheels



The three illustrations, above and below, should make it easier for any community to decide to do something about that leaning cluster of rural mailboxes. Almost everybody will be glad to pitch in and help line them up





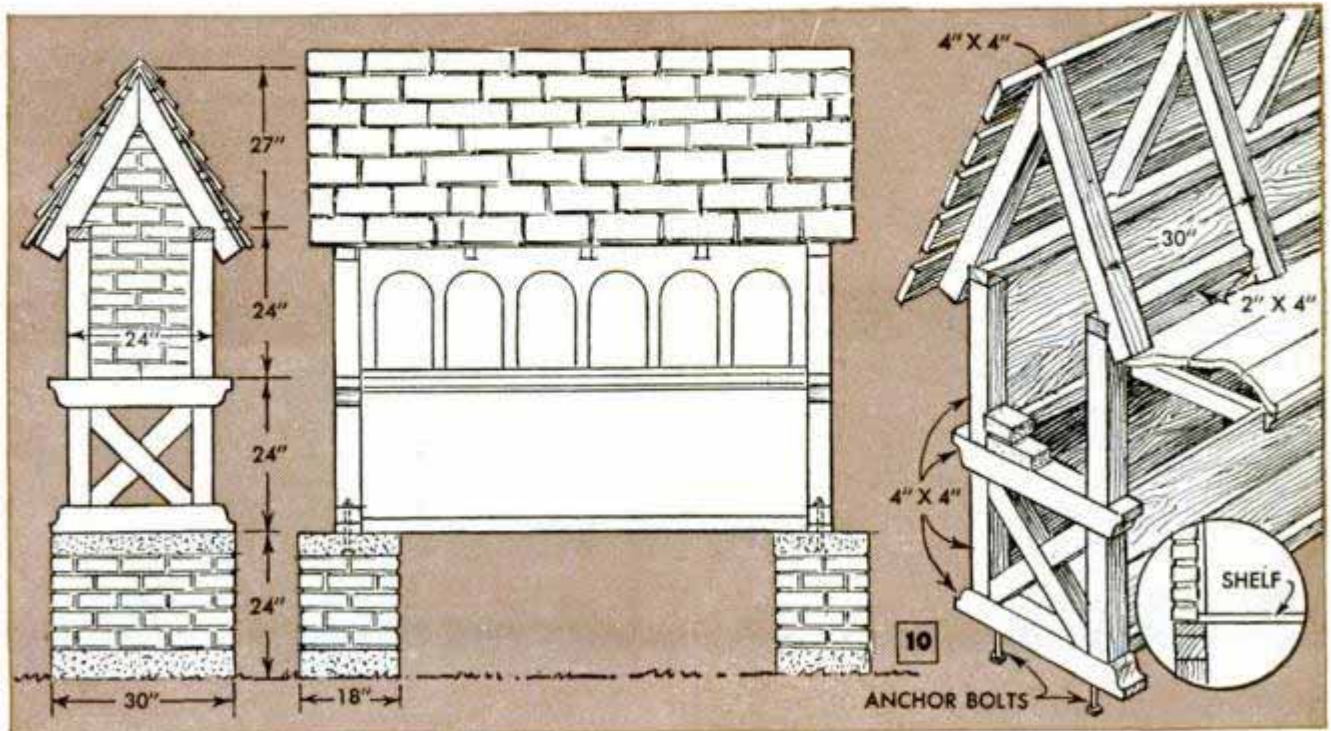
CAN BE MADE ATTRACTIVE

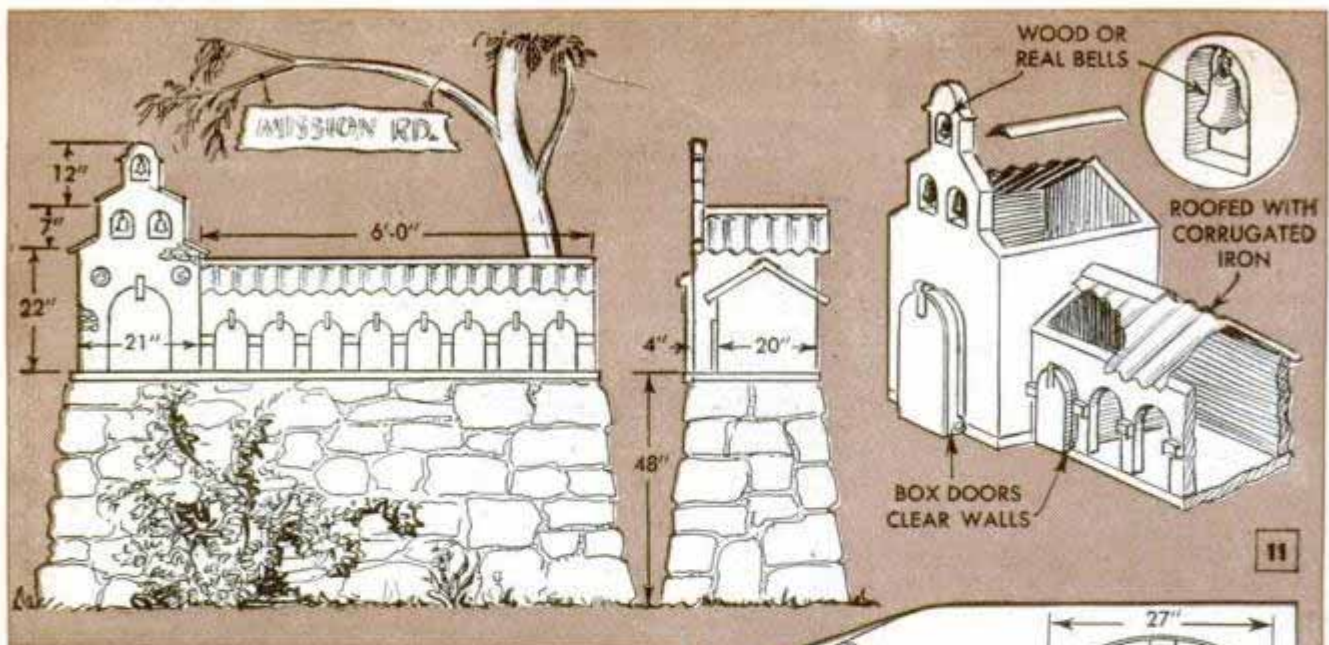
are large enough so that five boxes can be mounted radially, or six placed at an angle. This refers to the standard R.F.D. mailbox which is $6\frac{1}{4}$ by $7\frac{1}{2}$ by $18\frac{1}{2}$ in., inside dimensions. A wooden base is first screwed to the wheel rim and spokes, and the box is then screwed to the base.

An arbor effect is illustrated in Fig. 8, built along conventional lines and with the curved top members made in three pieces, glued and doweled together. Set two crotched logs in the ground to support the shelf. A curved branch adzed to a flat

section and mounted in slots, with the community name burnt into the wood, makes a pleasing job. All rustic construction should be of thoroughly seasoned logs, with the bark removed.

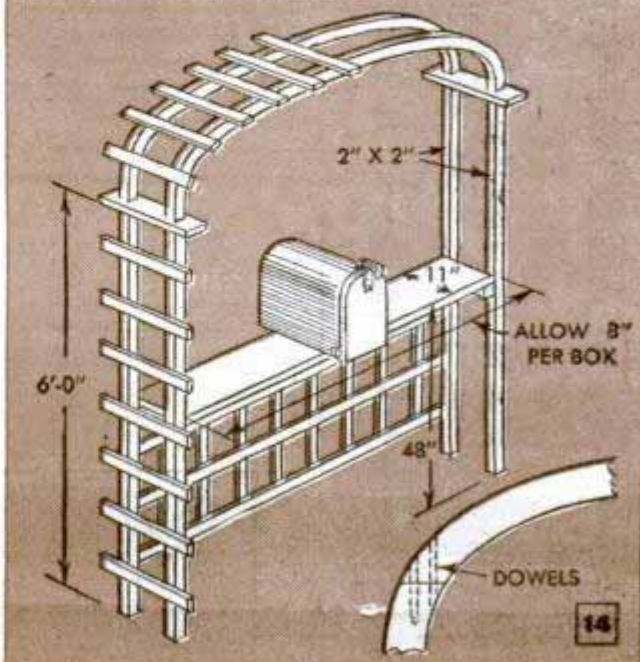
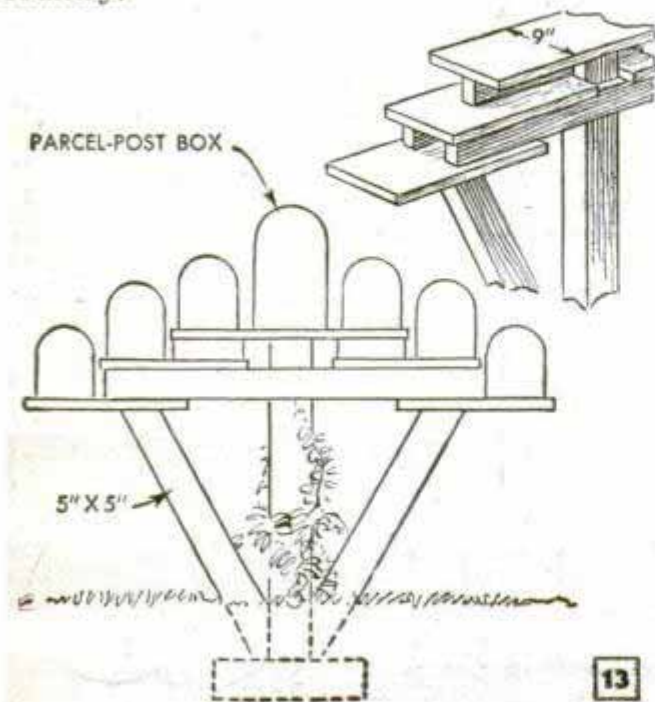
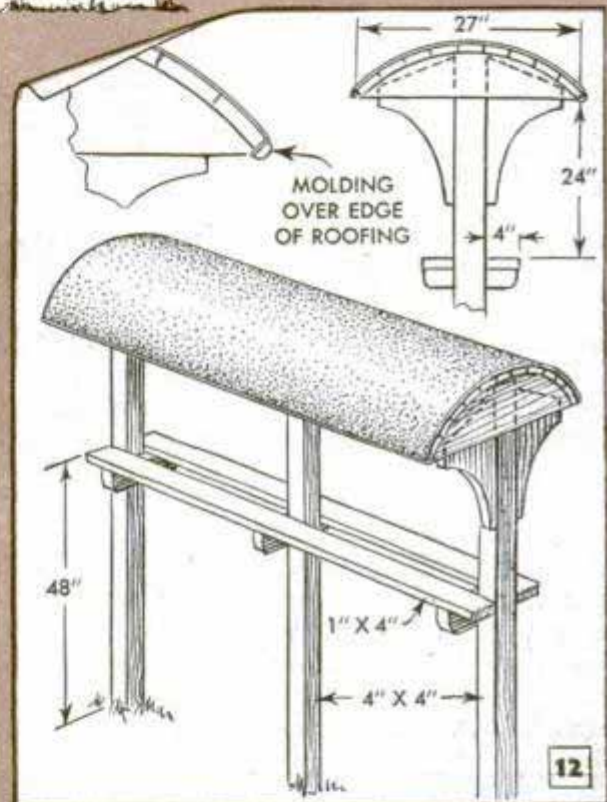
The design of the unit in Figs. 1 and 10 is patterned after the English timbered style. It can be built to shelter about eight boxes of the parcel-post size. Brick piers are mounted on concrete slabs. Where a single parcel-post box is to be used, place it in the center of the row of boxes as in the V-type mounting, Fig. 13.





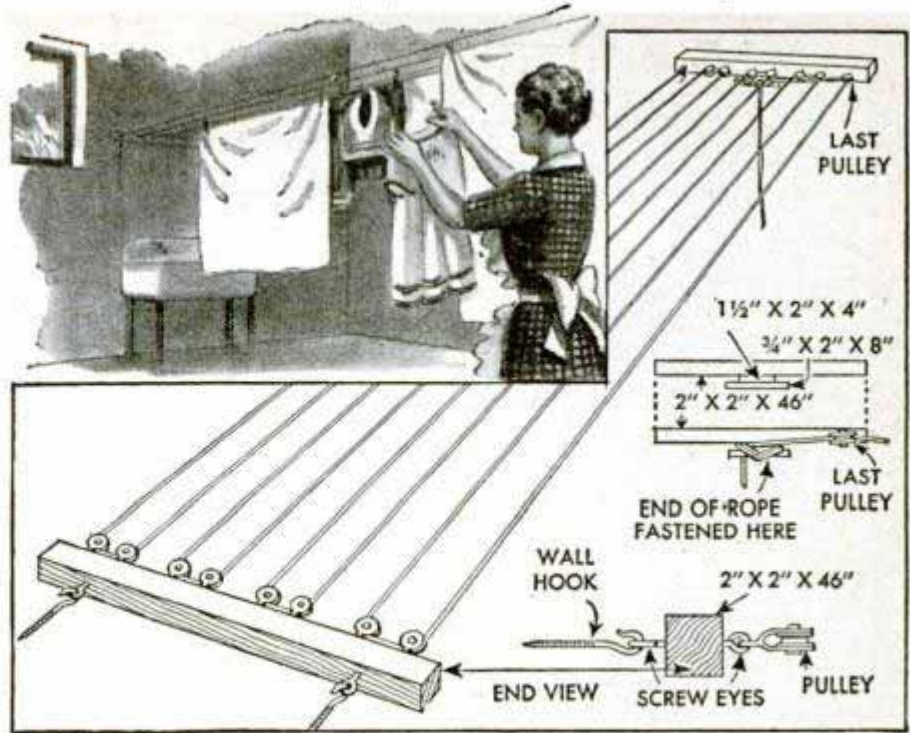
Another one, Fig. 11, is patterned after the mission style. It's mounted on a stone pier which can rest on a concrete slab. Use stock sizes of pine lumber for the box unit. The archways, typical of mission design, house the mailboxes. These should extend out far enough so the hinged fronts will swing out freely, Fig. 11, the right-hand detail. Corrugated iron roofing, or aluminum roofing painted brick-red resembles tile roofs quite closely. Wooden bells, or if you desire, real bells of suitable size can be mounted in the tower.

In Fig. 12, a simple canopy accommodates a number of boxes arranged in one or two tiers. Essentially the same design is pictured in Fig. 3. Allow 8 in. of space for standard boxes, and at least 12 in. for the parcel-post size. Another design, Fig. 14, is suitable for roadside installation in the country.



Multiple Indoor Clothesline Has One Adjustment

Instead of having to adjust each line, as is usually the case, this multiple indoor clothesline is connected by a series of pulleys so that adjustment is simply a matter of tightening one end and then wrapping it around a cleat. Another feature of the line is that it can be taken down with little effort. After the rope is removed from the pulleys, the two end pieces are lifted from the hooks that hold them and are stored out of the way until needed next wash day. The width of the end pieces is given as 46 in., and this will comfortably accommodate about eight lines. However, this width and the number of lines can be varied to suit the family's requirements. The manner in which the screw eyes are mounted in the end pieces for connection to the wall hooks and pulleys is shown in the lower right-hand detail. Care should be taken to space the screw eyes so that the pulleys and the



line will not be too close together when the latter is tightened. The wall hooks must be firmly secured to carry the weight and tension on the lines. Details and dimensions for the construction of the cleat that fastens the line after it has been pulled up are given in the center right-hand detail.

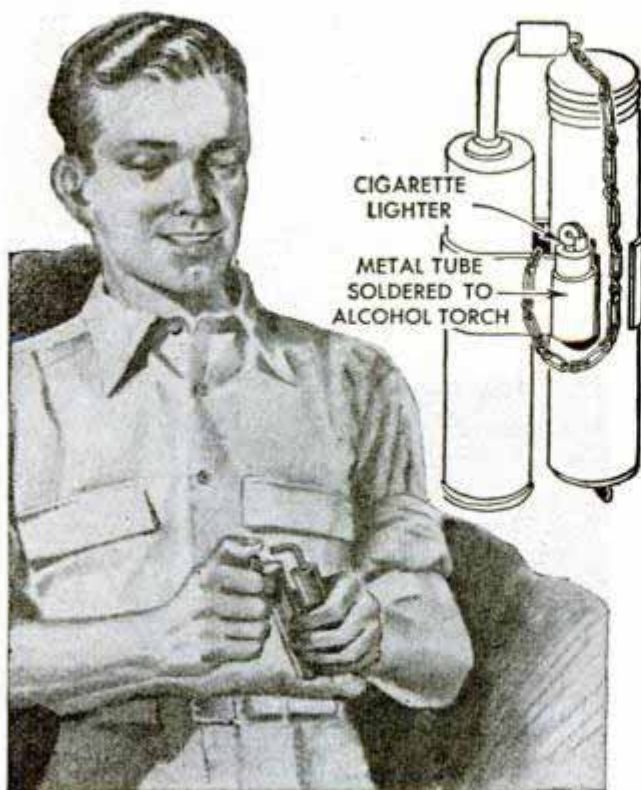
C. L. Meehan, Lakeview, Ont., Can.

Cigarette Lighter Flint Ignites Torch and Saves Hunting for Match

In order to eliminate hunting for matches, which are always somewhere else, one craftsman fastened the flint mechanism

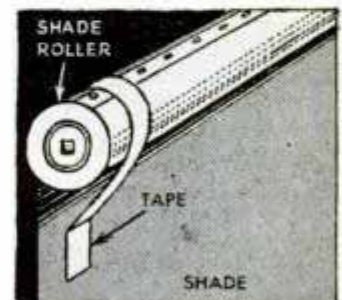
from a cigarette lighter to the side of a small blowtorch where it was always at hand. A holder for the lighter was made by wrapping a metal strip around the torch and bending one end to form a tube. It's not necessary to fill the lighter with fluid since the vapor from the fuel in the torch will ignite readily from the spark.

Robert Eichberg, Arlington, Va.

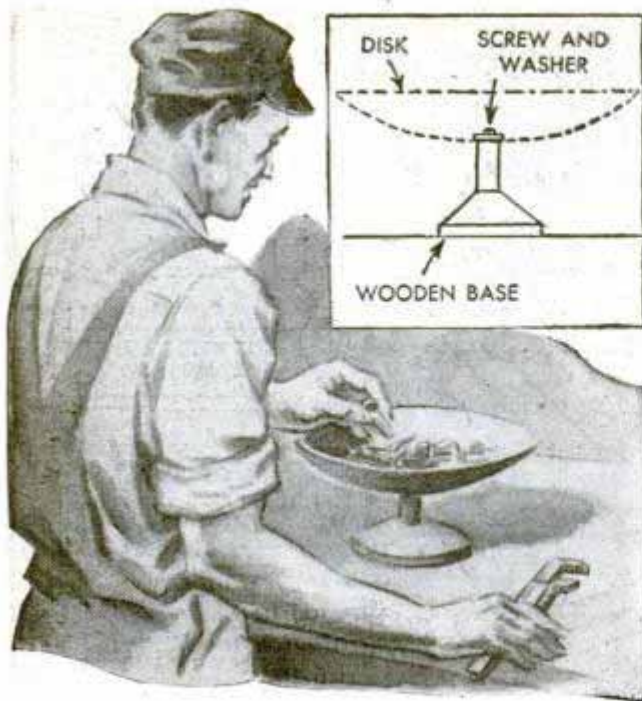


Roller Won't Tear Off of Shade If Taped in Place

By wrapping a strip of adhesive tape around each end of the roller and attaching it to the unrolled shade, as shown in the illustration, the latter can be pulled all the way down with little danger of its tearing off, as frequently happens when there is no tape reinforcement. If adhesive tape is not available, cellulose tape can be used.



Disk Blade Bolted to Wooden Base Holds Small Parts



If you have one or more blades from an old disk harrow, they can be made into ideal holders for screws, bolts and other small parts. A wooden base similar to the one in the upper right-hand detail will prove satisfactory. The disk is fastened to the base with a screw and washer.

Tissue Dispenser in Automobile Is Handy for Passengers

Conveniently mounted on the side panel of a car underneath the dashboard, a cleansing tissue dispenser will be handy for all passengers in the car. Any metal dispenser will do as long as it has some provision for mounting with screws. Or, if necessary, flanges for the screws can be

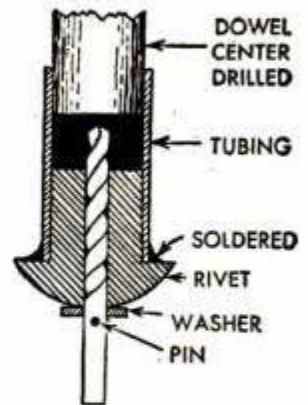


soldered to the ends of the container. Best location for the dispenser is, as shown, on the right-hand side of the car. In this position it will not interfere with the driver.

D. E. Horn, River Forest, Ill.

Drilling Jig for Centering Rods

For locating and drilling centers in plastic rods and wooden dowels, this jig is fast and accurate. Of course, you'll need a different jig for each size of rod. To make the device, select a length of tubing that will be a snug fit over the rod to be centered and use a rivet that will slip inside the tube. Drill a hole through the rivet for a small centering drill and adjust the latter to drill to the right depth by using a washer and pin as a stop. Then solder the rivet in the tube and the jig is ready for use.



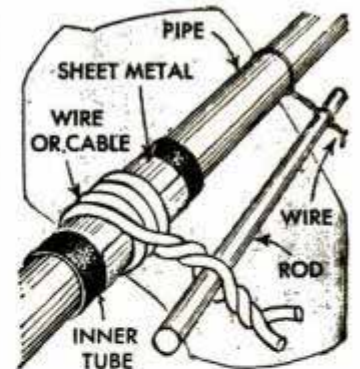
Alfred D. Beavin, Benson, Vt.

Pencil Sharpener Points Dowels

When there are a number of small dowels to be pointed, an ordinary pencil sharpener will do the trick in short order and all points will be uniform. More accurate fits will result than if the points were made with a knife or small chisel.

Repairing Broken Water Pipe

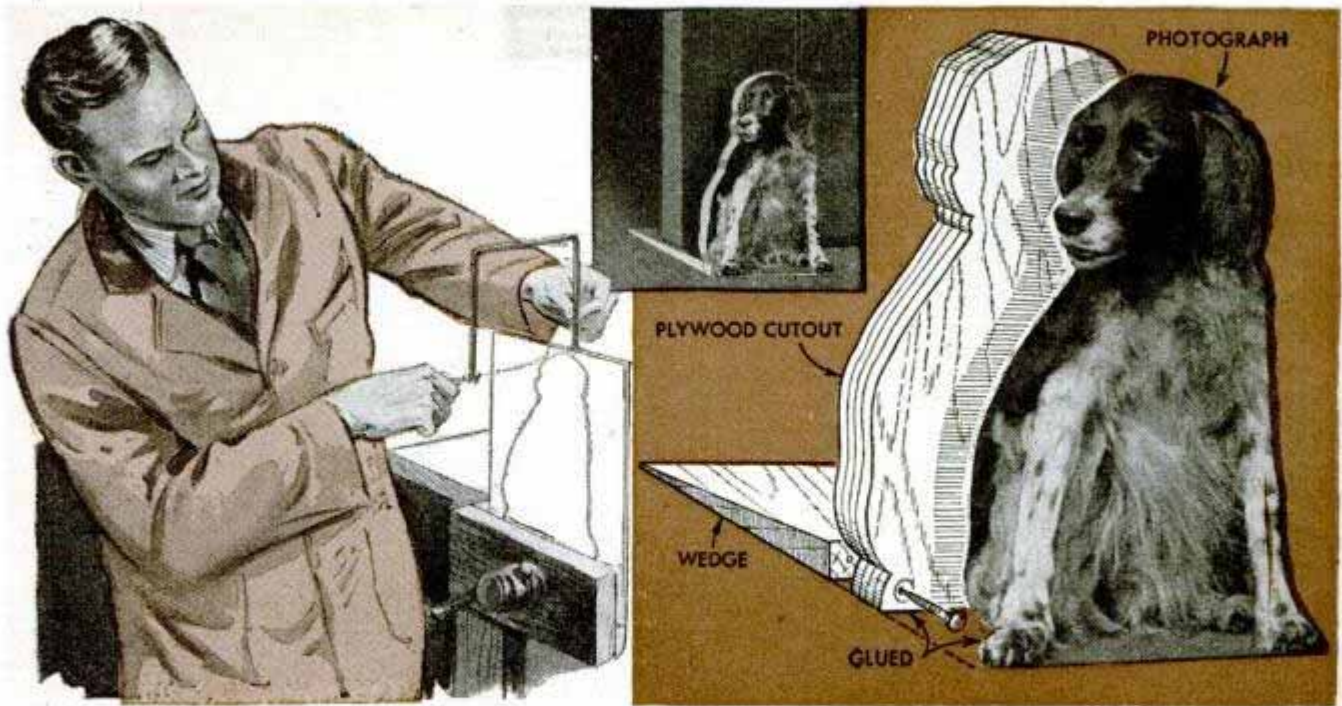
Provided the break in a water pipe is not too long, it can be fixed with a few odds and ends found around the house so the leak will be stopped until a permanent repair can be made. After shutting off the water, cover the broken part with a piece of inner-tube rubber and wrap lightweight galvanized sheet metal around it. Secure the patch with rope or cable tied around the metal and twist the cable tight by using a wooden or iron rod as a lever. Wire the free end of the lever to the pipe.



C. L. Meehan, Lakeview, Ont., Can.

Blotting paper is an excellent substitute for felt when applied to bases of table lamps and book ends to prevent scratching polished surfaces.

"Faithful Fido" Serves as Eye-Catching Doorstop



Even though he's only a cardboard cutout, this friendly dog will find a ready spot in your home to serve as a doorstop. The cutout is an enlarged photograph mounted on a plywood panel. Use a piece of stock large enough to take the entire picture and cut to shape on a jigsaw or bandsaw. The wedge which slides under the door is sawed from solid stock and secured to the panel with glue and brads or flathead wood

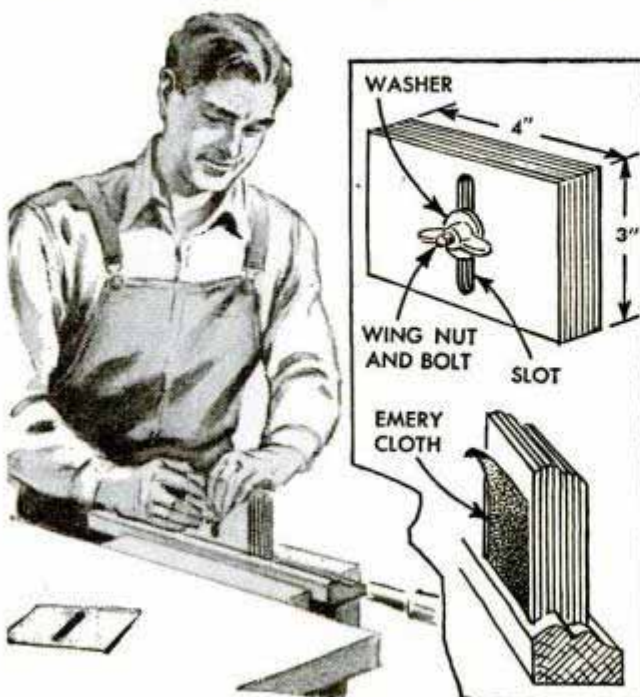
screws. If the latter are used, countersink them below the surface and fill the hole with wood filler or a plug. After the doorstop is assembled, sand the edges and surfaces, and then use an enamel that harmonizes with the trim as a finish. If you have the proper paints, you might retouch the photograph in color. Instead of the dog, a picture of any household pet will do.

Wm. H. Freeman, Baldwin, N. Y.

Adjustable Metal Holder for Emery Cloth Polishes Uneven Surfaces

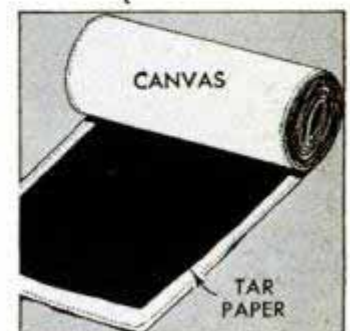
For polishing metal molding or other pieces of metal having irregular surfaces, this holder can be adjusted to the contour of the material to do the job in short order.

A number of rectangular pieces of sheet metal are used, each piece being slotted for horizontal and vertical adjustment. A wing nut, bolt and washer hold the pieces together. In use, an edge of the holder is made to fit the piece being polished; the emery cloth is wrapped around this edge.



Tar Paper Preserves Canvas

If you want to keep a roll of canvas or a tarpaulin from being damaged by rats and mice, roll it up with a strip of tar roofing paper when storing it. The canvas should be folded so that it is the same approximate width as the paper when rolled. As a double protection, suspend the roll from roof joists by means of several wires, which will make it almost impossible for the rodents to get at the canvas.





In the darkroom you spend considerable time working either in total darkness or in very subdued light. Likely you know the place as well as you know the inside of your pocket but unless there is adequate storage space you may discover at a critical moment that some needed item has been mislaid. Groping for it in the dark may give you ideas about how things should be arranged. Here are good, practical suggestions that will help

By Richard W. Emery

Photos by Ray Chapin

MAKE YOUR

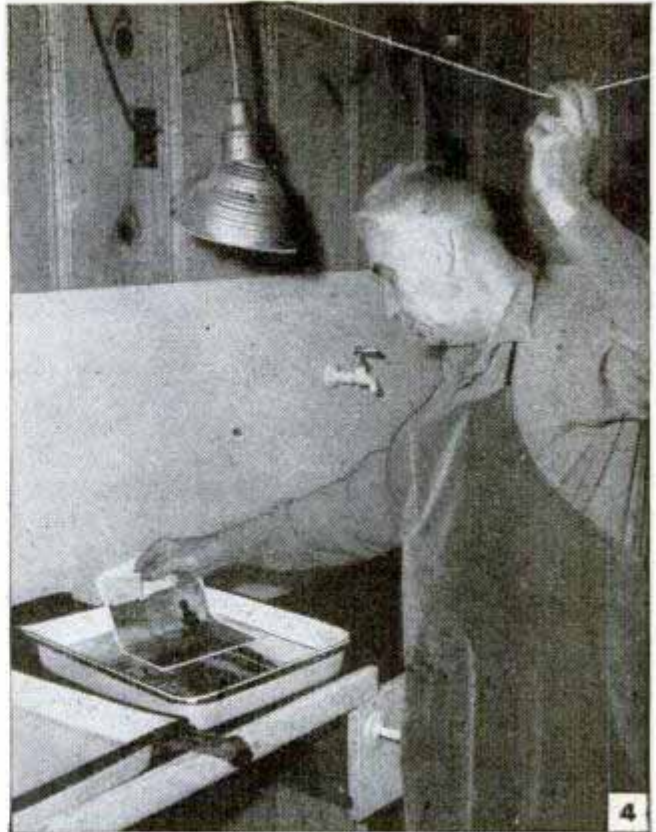


INVESTMENT ALONE won't make a darkroom easy to work in, but a carefully planned darkroom, even one very modestly outfitted, will enable you to save time as well as money. Also a darkroom well planned may enable you to improve the quality of your work. For example, vibration caused by a machine in the building may be fogging enlarged prints. If the darkroom is in your home, the motor of an electric refrigerator or automatic heating plant might transmit enough vibration through a floor to your enlarger to cause this trouble. Traffic on a busy street also could set up a vibration that would affect an enlarger. To prevent this, place thick pieces of sponge rubber under either the enlarger or the feet of the table on which it sets. A simple layout with all materials and equipment conveniently at hand is best. Figs. 1 to 4 inclusive are good examples.

Most photographers—amateurs and professionals alike—are inventive and resourceful. Their ideas on darkroom time-



Keep extra trays on shelves under the sink board. With this arrangement it won't be necessary to stack them one on top of the other. If you turn each one upside down it will always be dry and free from dust



Reaching for a metal pull chain on an outlet-box switch with wet hands isn't accepted practice in the safe, workable darkroom. Attach cords to switches and let them swing above your head within easy arms' reach

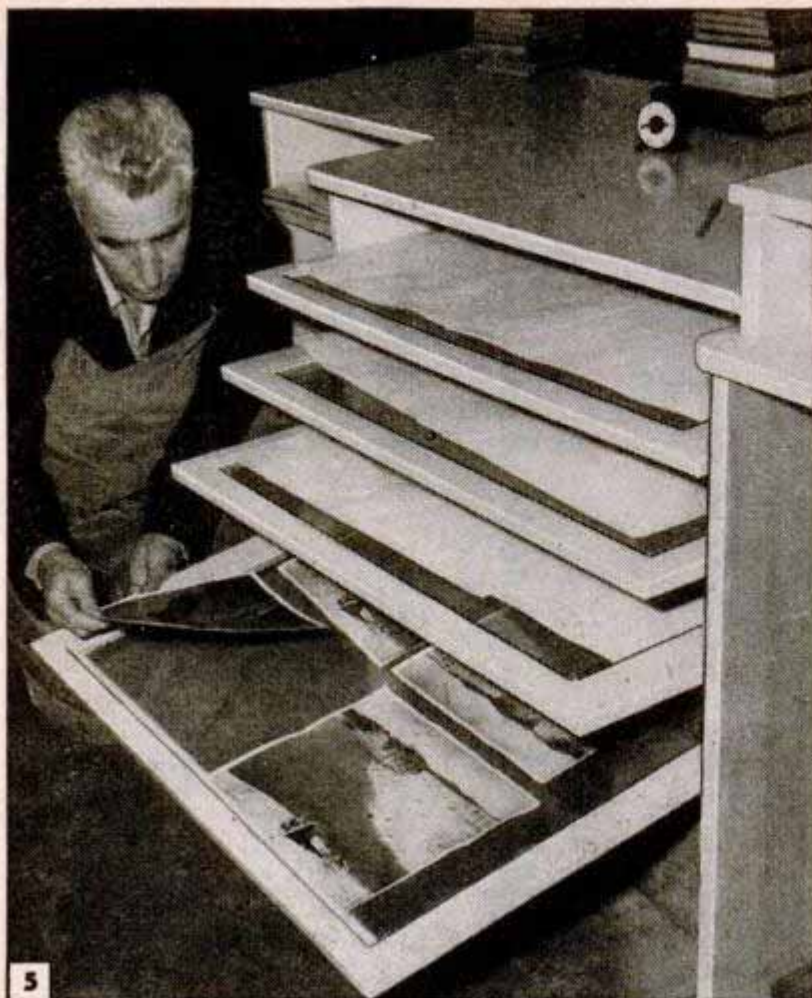
DARKROOM WORKABLE

savers are worth studying closely. In a few darkrooms you will see a complicated system of light switches. Some of these may be located where wet hands must grope near an electrical outlet box or reach high for a metal pull chain. Not so good, in fact, this arrangement could be dangerous under certain conditions—maybe a wet floor or faulty wiring. A better, handier and safer arrangement is shown in Fig. 4 where the lights are operated by cords attached to the switch and to the wall so that they swing at an easy-to-reach height above the operator's head. In the course of average work in the darkroom, you will often find it necessary to turn on a white light. Unless this light is shielded effectively you'll be momentarily blinded. Not only inconvenient and uncomfortable, but a serious strain on the eyes if continued for any length of time. It's a simple matter to rig shades over or around the lighting fixtures so that light will be directed upon the work.

When processing prints, it's annoying to have to fumble under the sink for the necessary trays. Build a rack for them under

the sink board where they can lie upside down, Fig. 3. That way they'll stay dry and they won't get dusty. Wastebaskets that permit discarded wet prints to drip puddles on the floor are troublemakers. A basket too small to hold an evening's quota of discards is a time waster. Get one that's big enough and make sure it's watertight. Install it under the drainboard where it's always handy.

If your darkroom "puts its mark" on your clothing, it is possible you can save expense by fastening buffers around the sink and drainboard. Measure the edges and buy towel racks, or make them of 3/4-in. dowels. Fasten to the business edge of the sink and drainboard where they will protect your clothing as you lean over the work. To further protect your clothes and to add a handy accessory, hang thick towels over the buffers by thumbtacking one end of each towel to the lower edge of the board and draping the towel over the buffer as in Fig. 2. Run a splash bead or rail around the edge of the drippy area, to prevent chemicals from slopping over onto



5—Frames screened with galvanized wire and built into the space under a table provide a convenient means of drying matte prints between blotters

6—To prop the wash tray at a more convenient height use glass jars with screw tops. Level the tray by turning the screw caps up or down

7—A windshield wiper is just the thing for squeezing wet prints. Treated in this way, prints will dry between the blotters in less than half the time

8—This hinged shelf supports a ferrotyping tin while prints are being placed on it from the wash water. The drippings naturally run into the sink

9—An addition to the drainboard folds back against the wall when it's not needed. This makes extra floor space available for any other work

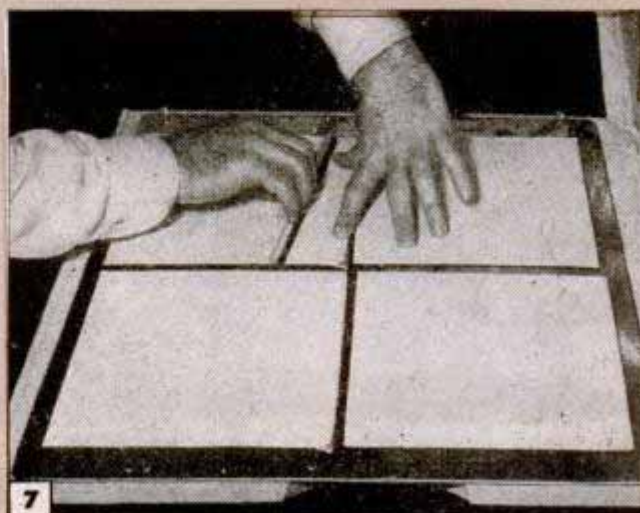
10—Plug-in outlets are a convenience, and thought must be given to the location of each one. All wiring should be installed in thin-walled conduit

11—Correct temperature for developer is important. If darkroom temperature varies, use a baby-bottle warmer. It warms the solution in a jiffy

the floor. Rubber aprons are clothes-savers, too. You'll see them in many a good darkroom. The money they save in clothing and cleaning bills can be invested toward a new print trimmer or maybe a box of matte paper.

If your darkroom has a concrete floor, you can cushion your feet by wearing wool socks and thick-soled shoes. Or better, do a little light carpentry. Nail 2-in. strips on cross-pieces, with ½-in. spaces between strips, to form a springy floorwalk. There's a lot of footwork in the darkroom and a little attention to comfort at floor level pays real dividends.

Many a darkroom boasts an imposing collection of thermometers, but often lacks the one that it should have. That's the one hanging on the wall near the developing tray. Air temperature acts on open trays of developer, regardless of how many heaters or chillers you may have. With a thermometer



telling you what's happening to the air temperature, it's easier to keep watch on temperatures of the stop-bath and hypo.

Those hard-working blotters deserve a place all their own. Frames screened with galvanized wire, built into the space under a table or wide shelf, provide means of drying matte prints between blotters or under blotters, Fig. 5. Then too, you can sandwich ferrotype tins between them to save the tins from accidental scratching.

Raising the wash tray a few inches above sink-board level for protection against splashing is simply and quickly accomplished by placing three or four glass jars under the tray. To level a tray on a sloping surface, put screw-top jars under it and adjust the tops until water level in the tray looks right, Fig. 6.

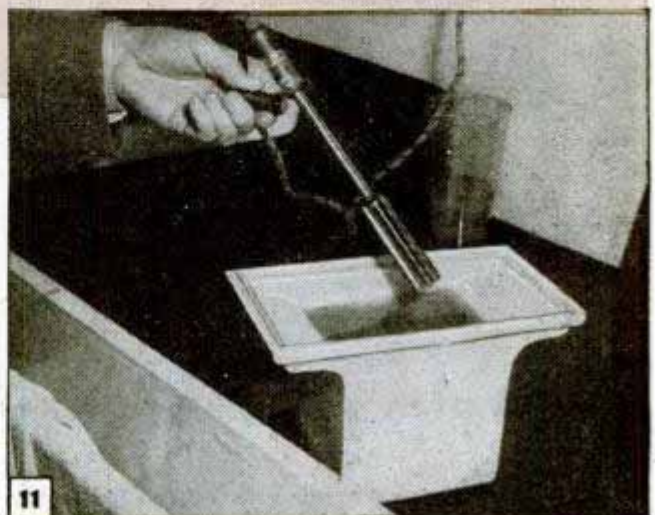
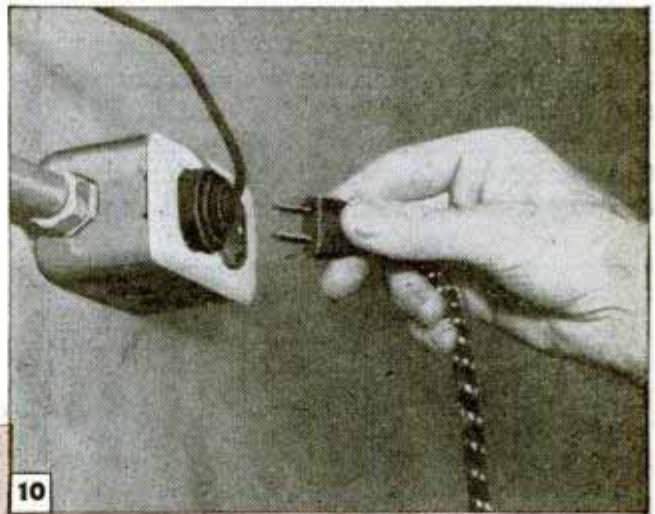
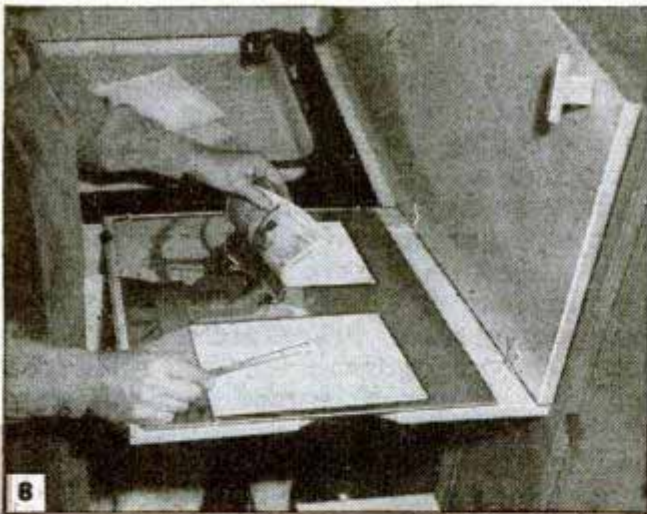
For speeding up the drying time of prints, give them a squeegeeing with a windshield-wiper blade before rolling the prints under blotters. You'll save wear and tear on the blotters and you'll keep the floor drier. Do the squeegeeing on a ferrotype tin, Fig. 7.

Slapping wet prints on ferrotype tins always has been a swampy part of photography. You can eliminate much of the dripping by building a hinged drainboard to hold the tin while you're putting the

prints on it, Fig. 8. Let it drain into the sink. A half-moon shape cut from the upper end of the board will give you a place to take hold of the slippery tin. Two screws near the lower edge will prevent the tin from sliding into the sink. Hinge the board to the wall and provide a hook or cleat to hold it up out of the way, Fig. 9.

One of the stand-by items in the average darkroom is the rubber roller for rolling wet prints under blotters. A useful, indispensable tool, but it's always in the way unless a special place is provided for it. If you build a rack especially for the roller, where it will be at hand when needed, you add workability to one more phase of darkroom routine. Electrical gadgets are used frequently and they're great time-and-trouble savers. But if you have to rig up double or triple sockets and yards of extension cord, your darkroom will have the appearance of an ill-concealed booby trap. A few extra outlets in the electrical circuit will solve the problem. Because you'll be handling the electrical equipment with wet hands, foolproof wiring is essential, Fig. 10. See that those extra outlets are properly wired and insulated. To warm the developer, try an electric baby-bottle warmer, the kind that you immerse, Fig. 11.

It's only when you have the darkroom





12

open or the white lights on that a good paint job on the walls, ceiling and fittings shows up. But paint regularly applied helps keep the place clean. Use flat black on surfaces where you don't want glare. Walls and ceiling can be most any color desired. It's best to use a semiflat paint rather than a high-gloss finish. Keep the painting material handy in a cabinet like that in Fig. 14.

A considerable portion of your work in the darkroom is spent in focusing the enlarging camera. Unless the easel is placed



14



13

Left, shelves near the enlarger are handy for printing paper. Incidentally, build a platform like this to raise your enlarging easel to a convenient height. It saves a lot of squint and stoop. Above, darkroom should have housed shelf compartments. They take more time to build, of course, but you've got to "live" with the furnishings a long time, so have them handy

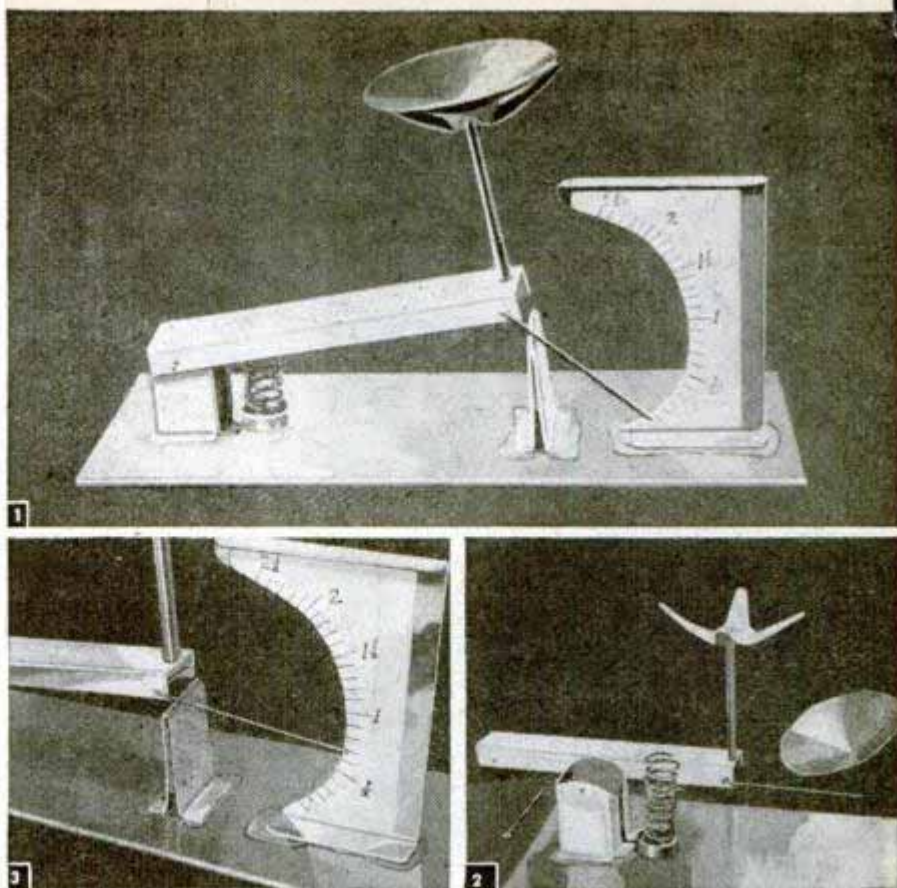
at a convenient height, you have to bend your back and twist your neck. This kind of thing isn't permissible in the smooth-working darkroom. Take time to build a platform to raise the easel waist-high. Leave the front open, and use the former table-top as a handy shelf, Fig. 1. If your enlarger is extremely high and cramped by a low ceiling, maybe a hole can be cut in the ceiling and boxed in to admit the lamp house.

Because they are of top-heavy construction, enlargers have a tendency to wobble. A wobbly enlarger wastes time and good printing paper. Vibration can be avoided by applying sturdy braces of flat iron to the top of the enlarger column. Two extra feet will provide a wobbleproof stance. Fasten the braces to the wall or ceiling, where they will be out of the way.

Spare corners are good spots for shelves, Figs. 12 and 13. The average darkroom has sufficient space but often the furnishings are not arranged to make the most of the space available. Shelves help. Big ones or little, they are needed for storing supplies where they won't clutter up the floor. They simplify the filing problem. If you want real efficiency and have the space, build a darkroom annex to be used as a film room. It's a smaller version of the main darkroom, but limited to the loading and processing of films. It will permit two-man operation and will give your films a higher degree of protection from light, dust and chemicals. In this film annex, you can build a lot of workability into a small space. A hinged shelf will make a film-loading table.

Photographic Scale For Dry Chemicals

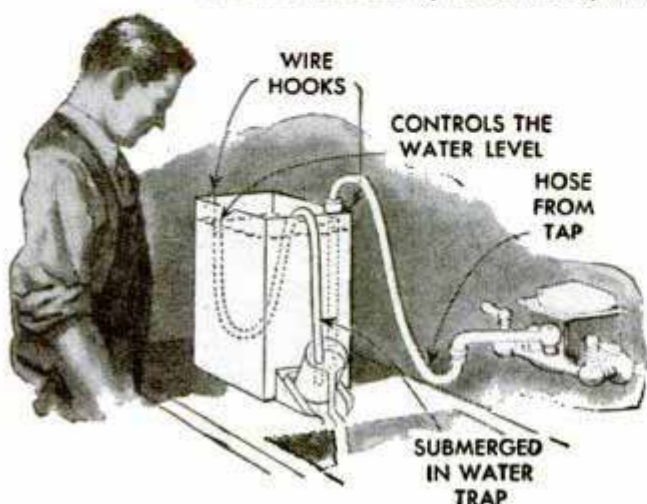
Inexpensive to make, this photo scale will prove satisfactory in measuring quantities of dry chemicals up to about 2½ oz. in weight. Most of the parts are formed from light-gauge metal, principal exceptions being the spring (taken from an electric ironing cord) that supports the balancing arm and the wire indicator. The arm assembly is detailed in photo 2, and the fulcrum and indicator is shown in photo 3. Note that all stationary parts are soldered together. After the unit is assembled, photo 1, the scale can be calibrated with regular weights. — R. Scott, Saltsburg, Pa.



Siphon Controls Level of Liquid With Novel Arrangement

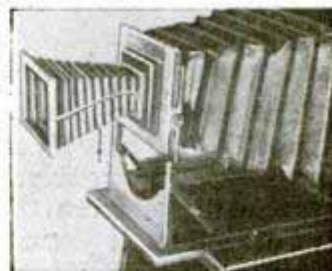
Constant level is maintained in a film-washing tank by means of a siphon and trap effect. Or for that matter, the same idea can be used in many containers where it is desirable to keep flowing water at the same level. The supply water from the tap runs through a tube to a point near the bottom of the container. The inlet side of the siphon is held at the desired level by means of a wire hook and the outlet spills into a smaller container that serves as a trap. From here the water is wasted. It is necessary to start the unit by drawing water through the siphon, but once all adjustments are made, it is merely necessary to turn the water on and off to use the tank.

Glenn McCoun, Rockford, Ill.



Camera Bellows Makes Lens Shade

If you have a small camera that has been discarded, the bellows will make an excellent lens shade for a larger one. No dimensions or directions for attaching to the lens are given as this will vary with the size and type of camera to which the shade is fitted. Stiff pieces of wire are used to hold the shade in place so it does not obscure the field of vision. When not in use, these are removed and the bellows collapsed for storing in the camera case.

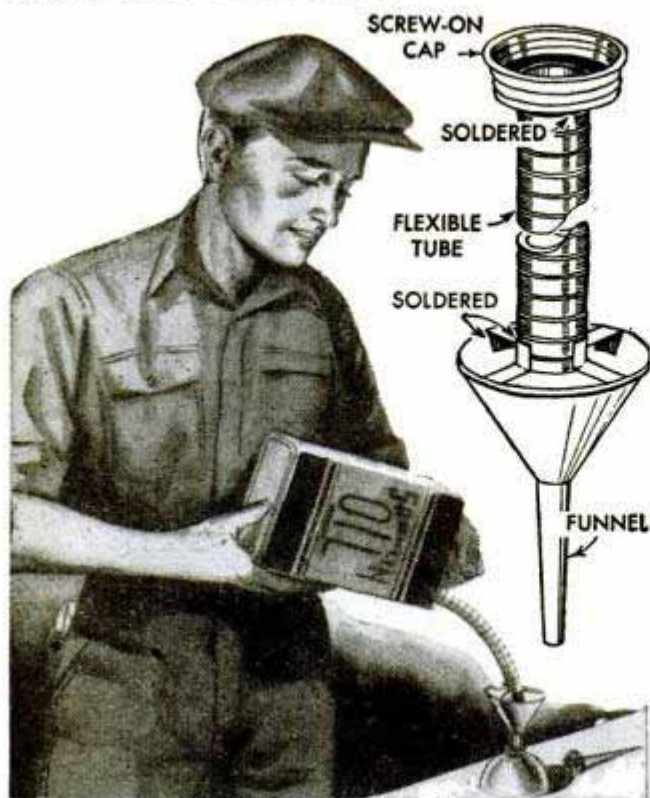


Wire Frame Holds Film-Tank Rod

Often the film-tank agitating rod is misplaced when the tank is being loaded or while the cover is removed to wash the film. A handy bracket to hold the rod when it is not in use can be made from heavy wire, such as coat-hanger wire. It is bent around the tank and twisted to form a loop for the rod. Kept here, the agitator is always at hand. — Richard Hanscom, Elmhurst, Ill.



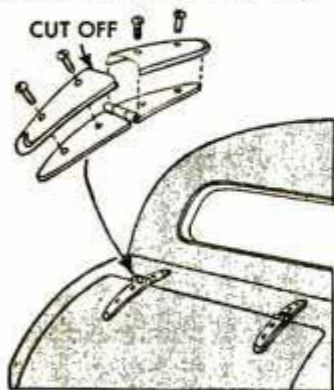
Use Funnel and Tube to Pour Oil Into Small Containers



If you've ever tried to pour oil from a large-mouthed container into a smaller one, you will appreciate this funnel-and-tube arrangement. A hole is cut in the screw cap of the container and a length of flexible tubing is soldered to it. A funnel is soldered to the free end of the tube by means of brackets fastened to the mouth of the funnel.

Repairing Broken Trunk Hinge

Broken auto-trunk hinges can be repaired inexpensively by using an ordinary strap hinge as reinforcement. Remove the broken hinge from the trunk and cut the pin off where it joins the two leaves. Then



fit these parts over a suitable strap hinge and fasten the two to the trunk and deck using chromium-plated nuts and bolts. The repair will look well and provide long service. — Francis C. Zuiker, Chicago.

Tees Provide for Future Outlets

When installing water lines, if a tee is used instead of an elbow at some point near a fixture and close to the wall, it will provide a connecting point for a future exten-

sion. The branch for the extension is, of course, plugged. If a heavy drain is expected from both installed and planned fixtures, it would be well to oversize the pipe that feeds them, especially if the drawoff from both occurs simultaneously.

G. H. Preston, Cincinnati, Ohio.

Undercutting Stair Will Save Carpet

In cases where it would be necessary to cut odd shapes in carpeting or other floor covering to make it fit, you may sometimes find it more economical to undercut stairs or other built-in fixtures that are in the way. It's necessary only to cut enough to allow for the thickness of the carpet and in most cases this will not weaken any structure that does not carry a bearing load.



R. E. Murray, Fremont, Ohio.

Checkerboard of Many Woods Helps Instruct Children

Children will learn to identify many species of woods with this unique checkerboard. Each dark square is a different wood and the light squares are painted white, or if enough squares of light wood can be found, they may be used. The name of each kind of wood should be labeled on the proper square. Protect the finished board with several coats of clear lacquer.

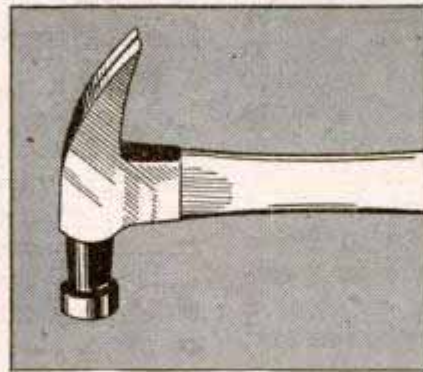


CRAFT QUIZ

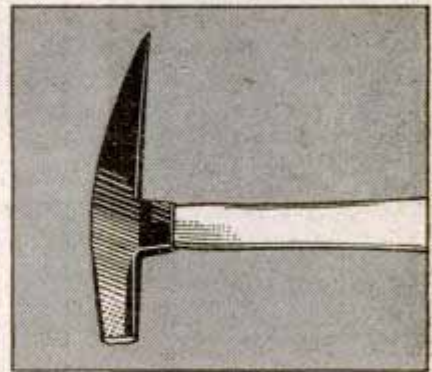
10 HAMMERS—can you identify them?



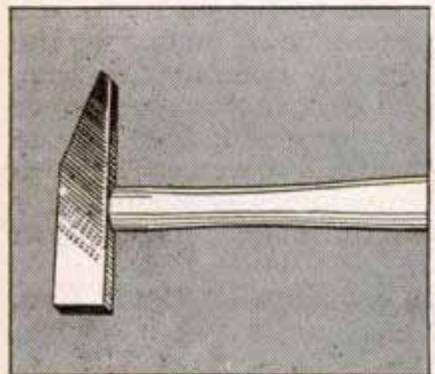
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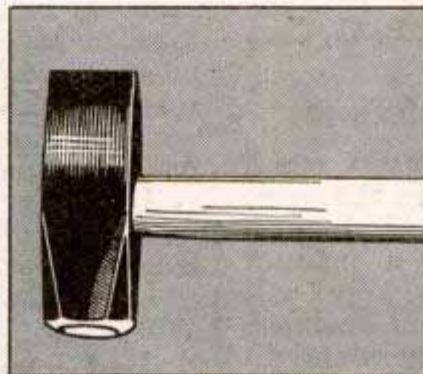
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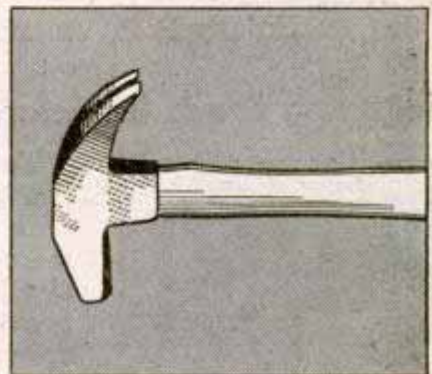
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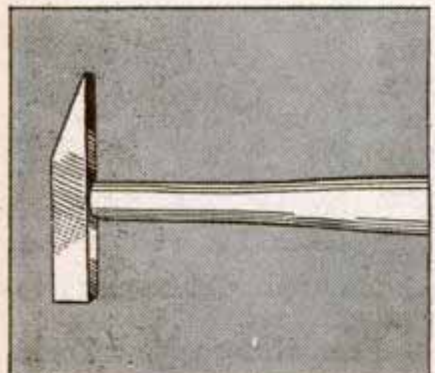
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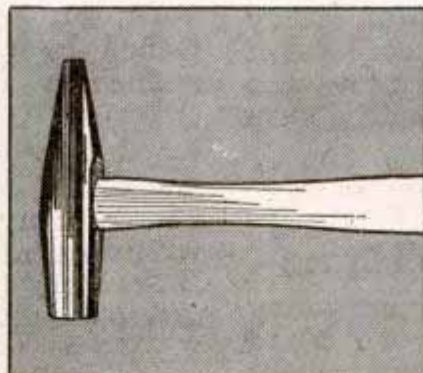
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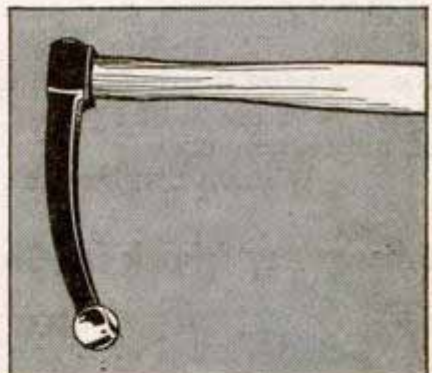
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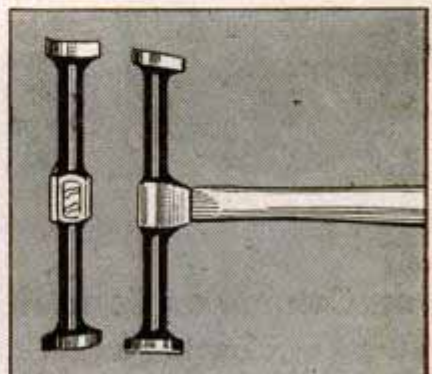


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9

ANSWERS: 1—Packer's Hammer; checked face. Used in shipping rooms but preferred by some workmen for roof shingling. 2—Carpenter's Ripping Hammer, bell-faced, with a straight claw especially suited to removing forms, siding, etc. 3—Geologist's Hammer or "pick"; used by geologists and prospectors for breaking out rock and ore samples. 4—Paneing Hammer, made especially for tinmiths. 5—Cooper's Hammer; used by the trade in making barrels and casks. 6—Farrier's Hammer, especially designed for horseshoers. 7—Tile-Setter's Hammer; used by the trade. Note similarity to Paneing Hammer. 8—Billposter's Magnetic Hammer, which is similar to the magnetic tack hammer used by upholsterers and others. 9—Fender-Bumping Hammer; used by the trade in repairing damaged auto fenders. Shape of head allows working on underside of fender without removing the wheel. 10—Offset Dinging Hammer for auto-body repair. Offset faces enable user to work on a curved surface



10

Sanding Drum Fits Drill Press

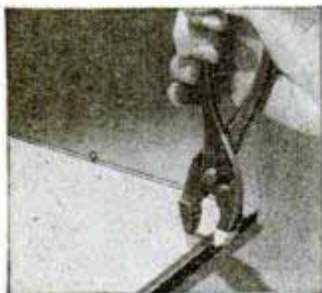


Neat and efficient, this sanding drum is made from two hardwood disks 1½ in. in diameter and ½ in. thick plus a piece of radiator hose of the same diameter and 1 in. long. The abrasive paper is fastened around the hose and held in position by expansion of the wooden end disks when the ¾

in. bolt and nut that passes through them is tightened. The end of the bolt, of course, is chucked in the drill press.

Sidney Pott, Victoria, B. C., Can.

Inserting Brads in Picture Frame

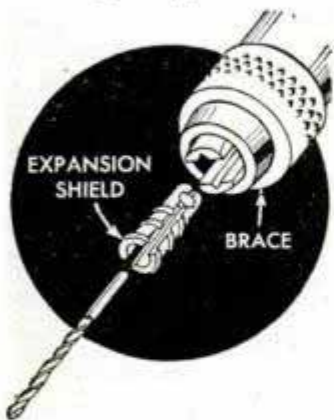


To insert small brads in the back of a light picture frame, a pair of slip-jaw pliers will prove to be more convenient and do a neater job than a hammer. Open the pliers to the

“wide” position and apply a firm, steady pressure with the jaws against the head of the brad and the outside of the frame. The outer jaws should be padded with a strip of adhesive tape.

William Swallow, Brooklyn, N. Y.

Emergency Chuck for Small Brace



An emergency chuck to hold small twist drills in a brace when the proper hand drill is not available can be improvised easily. Insert the drill in an expansion shield and chuck it in the brace.—H. Klein, Pittsburgh, Pa.

Iron Cement as Sand-Hole Filler

Sand or blow holes which occur in castings, while not always detrimental to the piece, are often unsightly and can be filled. One craftsman uses a good grade of iron

cement, after first filling the hole with steel wool. A second application of the cement may be necessary to insure a good “plug,” and a third coat is added and smoothed to make a finished-looking repair.

H. W. Swope, Danville, Pa.

Mousetrap That's Always Set

With a pail, a baking-powder can, a board and a length of wire, you can make a mousetrap that won't require resetting to catch any number of mice. Holes are punched in both ends of the can for the wire axle, which rotates in two holes punched in the side of the pail near the top. The board is used as an incline for the mice to walk on. To operate the trap, spread cooking fat over the can and cover with bread crumbs or grain; then fill the pail about one-third full of water. The mice will walk up the incline, and jumping for the food, roll off the baking-powder can into the water.

Paul Criton, Jr., Kayville, Sask., Can.

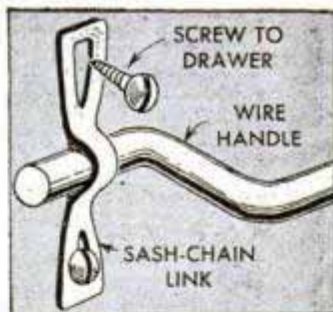


Links Fasten Handle to Drawer

Wire handles or workshop drawer pulls can be attached by using sash-chain links. One link is fastened over each end of the handle and held in place with wood screws.

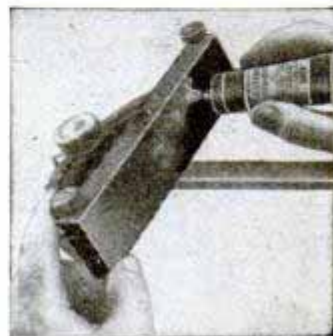
Links from brass chain should be used to add to the decorative effect.

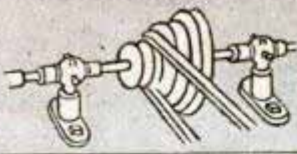
Frank Shore, New York.



Keeping Miter Work From Slipping

When work is being cut at an angle on the circular saw, it usually has a tendency to slip or creep, making the resultant cut inaccurate. This can be prevented by coating the work face of the miter gauge with rubber cement and allowing it to dry before use. The cement provides a non-slip surface for the work.—Kenneth Murray, Colon, Mich.





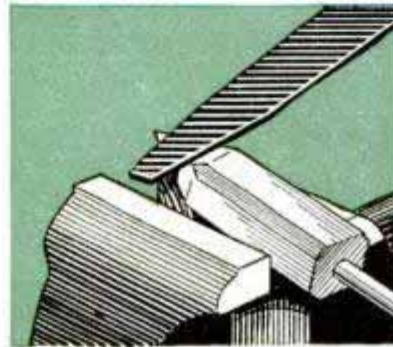
Solder it RIGHT

By Wm. Riederich

SOLDERING is something like painting—at some time or other nearly everyone finds it necessary or desirable to do the job himself and save both time and money. But in making the average soldered joint the procedure is so simple that there is a tendency to slight some of the details essential to good work. Correctly made, a soldered joint is durable. Take as an example gutter and downspouts, the parts of a building which are exposed to the most severe weathering. If you examine old gutters which have long since eroded to the point where they no longer serve their purpose you will see that in nearly every instance the soldered joints are still sound. The same will be found true of many other kinds of work, parts of which have been joined by soldering.

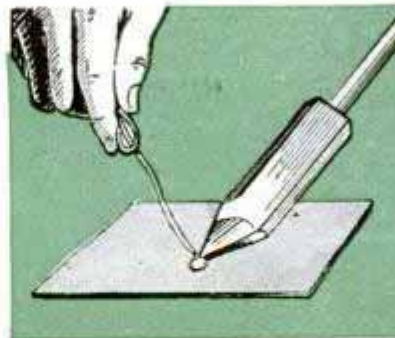
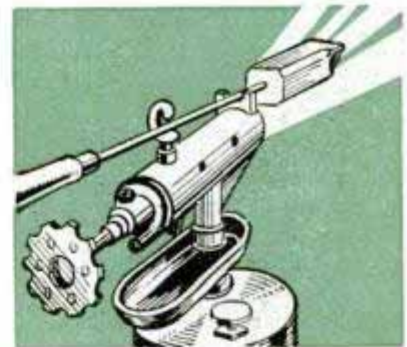
There are three general requirements for good soldering on average light work. They are, a correctly-tinned iron heated to the proper temperature, the right flux for the job, and a clean surface. Tools required for the ordinary job are a soldering iron or bit, as it is often called, a suitable means of heating the iron or the work quickly and efficiently, a coarse file, sandpaper and a wire brush, a damp cloth and clamps to hold the parts to be joined firmly in place. Of course, if the work is of such a nature that it can be dipped, you will need a ladle of sufficient size. If you use an electrically heated iron exclusively then that disposes of the heating problem.

A new iron must be tinned and where the iron is in continuous use frequent retinning is necessary. The chief purpose of tinning is to prevent the formation of copper oxides on the bevels of the tip. Oxides act as an insulator, interfering with rapid heat transfer from the iron to the work. Also an untinned bit won't "take" the solder properly. To tin a new iron or retin one that has been in use, first heat it to a temperature of 500 to 700 deg. F., and clean with a wire brush.



The soldering iron must be cleaned before tinning. Use a coarse file but be careful not to remove more copper than necessary

Heat the iron with a blowtorch and watch that it does not get too hot. Always place the iron in the special rack as indicated



Apply flux to the tip, then coat the four bevels with solder. Build up sufficient solder so that it can be spread out evenly

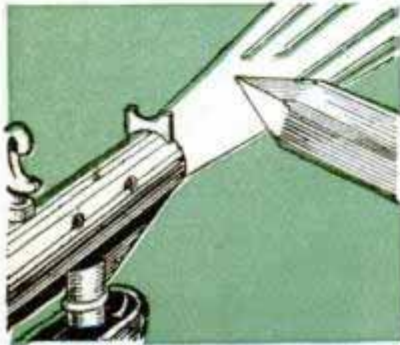
Finally, wipe and twist the tip on a damp cloth to spread patches that remain on the surface. Re-heat if necessary





Here's what happens when the iron is too cold. The solder won't flow, but only softens to a waxlike consistency on the surface

But when the iron is heated to just the right temperature the solder flows or "draws" smoothly into joint without piling up



Don't hold the tip of the iron in the blowtorch flame this way. Direct flame will overheat the iron and remove the tinning

Trick of sweat-soldering one small part securely to another is easy if you proceed correctly in the preparation of the work

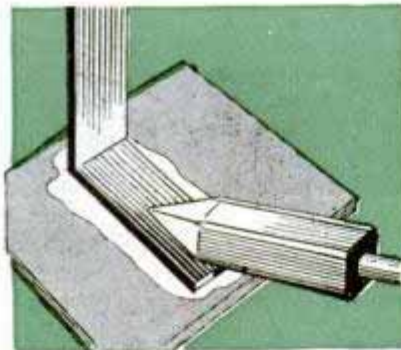


TABLE I
MELTING POINT OF VARIOUS SOLDER ALLOYS

Tin	Lead	Antimony	Melting Point °F.
0	100	0	618.8
10	90	0	577.4
20	80	0	532.8
30	70	0	491.0
31	67	2	370.4
38	60	2	370.4
40	60	0	446.0
49.25	50	.75	365.0
50	50	0	401.0
60	40	0	368.0
66	34	0	356.0
70	30	0	365.0
80	20	0	388.4
90	10	0	419.0
100	0	0	450.0
0	0	100	1166.

Sometimes it will help to rub the beveled tip on a block of sal ammoniac or ammonium chloride. Usually, however, it is only necessary to apply a rosin flux to the cleaned tip and flow on solder until the entire tip of the iron is covered. Finally, wipe and twist the tip on a damp cloth to spread the solder in a uniform coating.

The purpose of a flux is in most cases twofold—to help clean the work and to prevent the formation of oxides which interfere with the flow of solder. There is no all-purpose flux. Different metals require different fluxes. See Table II. Two commonly used fluxes are those made from rosin and from muriatic acid (hydrochloric acid) which has been "cut" with zinc, forming zinc chloride. Most fluxes are available ready to use in both liquid and paste forms. For light work you use the handy wire solder with acid core. The acid flux is contained in the hollow wire so no separate flux is necessary. Solder is also supplied in solid-wire form without the flux and in convenient bars. It comes in varying proportions of lead and tin, and in lead-tin-antimony and lead-tin-bismuth alloys. These are all commonly known as "soft" solders. A 50-50 solder, 50 percent tin and 50 percent lead, is good for average light work, although these proportions do not give maximum strength. Where the greatest holding power and resistance to bending or flexing is called for, a 60-40 solder, 60 percent tin and 40 percent lead, is generally used. Some alloys contain 67 percent tin and 33 percent lead. On the other hand, for special jobs such as soldering pewter, a solder composed of 1 part lead, 1 part tin and 3 parts bismuth is quite commonly used. The melting point of this alloy is only 240 deg. F. See Table I.

Cleaning of work to be soldered is done with sandpaper or emery cloth, steel wool, files or a wire brush. A power-driven wire wheel speeds up the job of cleaning where the size or shape of the work allows its use. Tinsmiths use reduced solutions of muriatic acid to clean galvanized sheet metal. Hydrochloric acid is an excellent cleaner on some metals, but it is necessary to give the work a thorough washing in a strong solution of soda water immediately after soldering to remove all traces of the acid and stop its corrosive action. Small, irregular-shaped parts, difficult to clean by brushing or by other means, can be dipped in hydrochloric acid. Suspend these on a wire and don't get the acid on your hands or clothing. Avoid breathing the acid fumes at any time. Some metals and certain types of work won't stand the acid bath. Don't use it to clean electrical work.

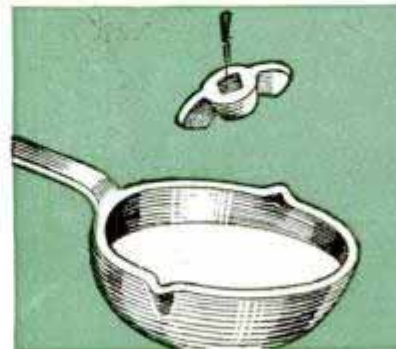
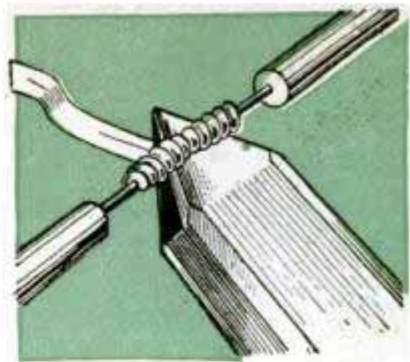
The requirements of the soldering opera-

tion are just as simple as actually doing the job. The first of these essentials is that the parts to be soldered shall be heated as nearly as possible to a temperature equal to the melting point of the solder. This assures the strongest bond. On large parts to be joined which contain considerable metal or where the cross sections of the parts are thicker than ordinary, preheating usually is necessary. This ordinarily is done with a blowtorch. Where work must be preheated it is necessary that it be held together with clamps during the heating period, also for a time after soldering until the work cools well below the melting point of the solder. Work soldered in this way should not be subjected to any strain during the cooling period. Where seams, butt joints, corner joints, and curved work are to be joined by soldering, parts must always be carefully fitted beforehand and provision made for holding the assembly in place while soldering. Galvanized sheet-metal parts should always be held together with clamps or by other means. Where you have an intricate assembly requiring soldering several joints in close proximity, use damp or wet cloths to protect the joints already soldered. When using a torch to heat large work preparatory to soldering, heat all the area about the joint but avoid playing the flame directly on the meeting surfaces or on the solder as it is applied. When doing such a job, flux the work first then heat until the flux boils. Apply the solder immediately. When it melts and flows into the joint, withdraw the heat and allow the work to cool to room temperature before removing the clamps or other fasteners that hold the parts together.

Soldering with an iron is much the same as with the torch except that the iron is used to heat the work and melt the solder in a more or less simultaneous operation. A suitable flux is applied to the work which is then heated by applying the iron to the surface. After a preliminary heating, solder is flowed into the joint. On some types of work such as a common butt joint, flowing the solder onto the iron as it moves slowly along the joint will often give the smoothest job. If the temperature is right the molten solder will flow off the iron onto the work in just the right amount.

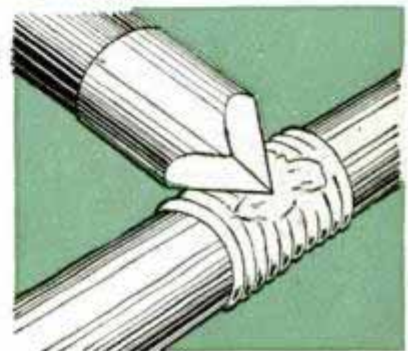
Making a lap joint on two flat surfaces is done by a method known as "sweat-soldering." First the edges are fluxed and tinned. The tinned surfaces are then placed together and heat applied. Where an acid flux is used wash the work immediately with a solution made by dissolving 1/2 lb. baking soda in a gallon of water. This will remove all remaining traces of acid and stop any corrosive action on the metal.

When soldering small parts such as a wire splice, hold the iron under the work. The solder will "draw" into the joint neatly



Small parts can be rustproofed by tinning in a bath of molten solder. Attach a wire to work and hold in solder until heated

To repair a cracked tube, wrap it with wire, closely spaced, then heat and run solder until spaces between wires are filled



Wash parts to remove the flux. A shallow porcelain-enameled pan is generally the best. Always do a good job of washing

TABLE II
SOLDERING FLUXES USED FOR VARIOUS METALS

Meta:	Flux
Iron - - -	Ammonium chloride or zinc chloride
Steel - - -	Ammonium chloride or zinc chloride
Copper - - -	Ammonium chloride or zinc chloride
Brass - - -	Ammonium chloride or zinc chloride
Bronze - - -	Ammonium chloride or zinc chloride
Gun metal - - -	Ammonium chloride or zinc chloride
Nickel - - -	Ammonium chloride or zinc chloride
Lead - - -	Resin or tallow
Steel (Tinned) -	Zinc chloride or resin
Galvanized steel	Hydrochloric acid
Zinc - - -	Hydrochloric acid
Pewter - - -	Tallow
Silver - - -	Chloride of zinc
Gold - - -	Chloride of zinc
Cast iron - - -	Chloride of zinc with tallow added
Stainless steel -	Muriatic acid

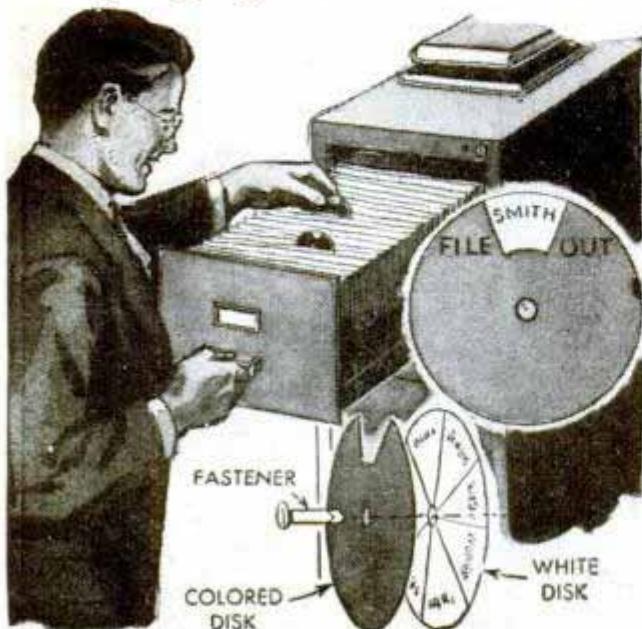
Combination Holder and Lighter Facilitates Welding Work



With this combination holder and lighter, a welder will not waste time looking for a place to lay a lighted torch, and when he wants to light it, the facilities are at hand. The base is fairly heavy material; the column can be of pipe threaded to fit the base and the two arms for the torch are made of flat iron. A small hand-operated generator is bolted to the pipe and connects to a spark plug mounted on top of the column. The plug is operated by turning the generator. Elmer Vandrey, Truman, Minn.

Index-Card System Locates Files Missing From Cabinet

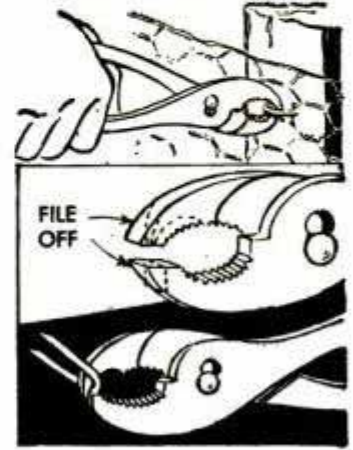
When papers and other records are removed from file folders, much time is wasted looking for the missing data, especially where several people use the same file. By slipping this index card onto the



folder when papers are removed, any of the office staff know where they are. The marker is made of two disks held together with a paper fastener. The names of persons authorized to remove material from the files are printed on the rear disk and they appear through an opening cut in the front disk.—G. E. Harrington, New York.

Pliers Converted to Staple Puller

Alter the ends of a pair of pliers so one overlaps the other, as shown, and you have a handy staple puller that is easy to carry in your pocket. The dotted lines in the lower detail show how the pliers are filed or ground down and the lower part of the detail indicates the manner in which the puller is used to remove staples.



A. H. Waychoff, Phoenix, Ariz.

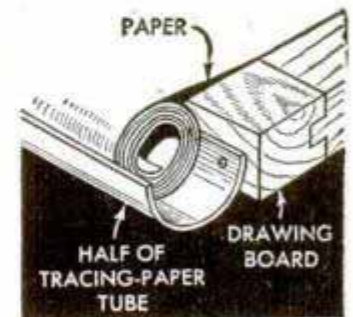
Removing Small Amounts of Varnish

One sign painter who uses small amounts of varnish at a time finds that by punching two small holes near the edges of the can he can pour liquid easily. Nails or small pieces of wood are used to plug the holes in the can.



Drawings Rolled in Paper Tube Will Not Drag on Floor

If half a tracing-paper tube is tacked to each end of the table when making drawings that are longer than the board and using a drafting machine, the extra length of paper can be rolled in the tube to prevent its dragging on the floor. This will keep the drawing neat and it is not apt to be torn.



W. B. Eagan, Charleston, W. Va.

ANTI-FRICTION CENTER-REST JAWS

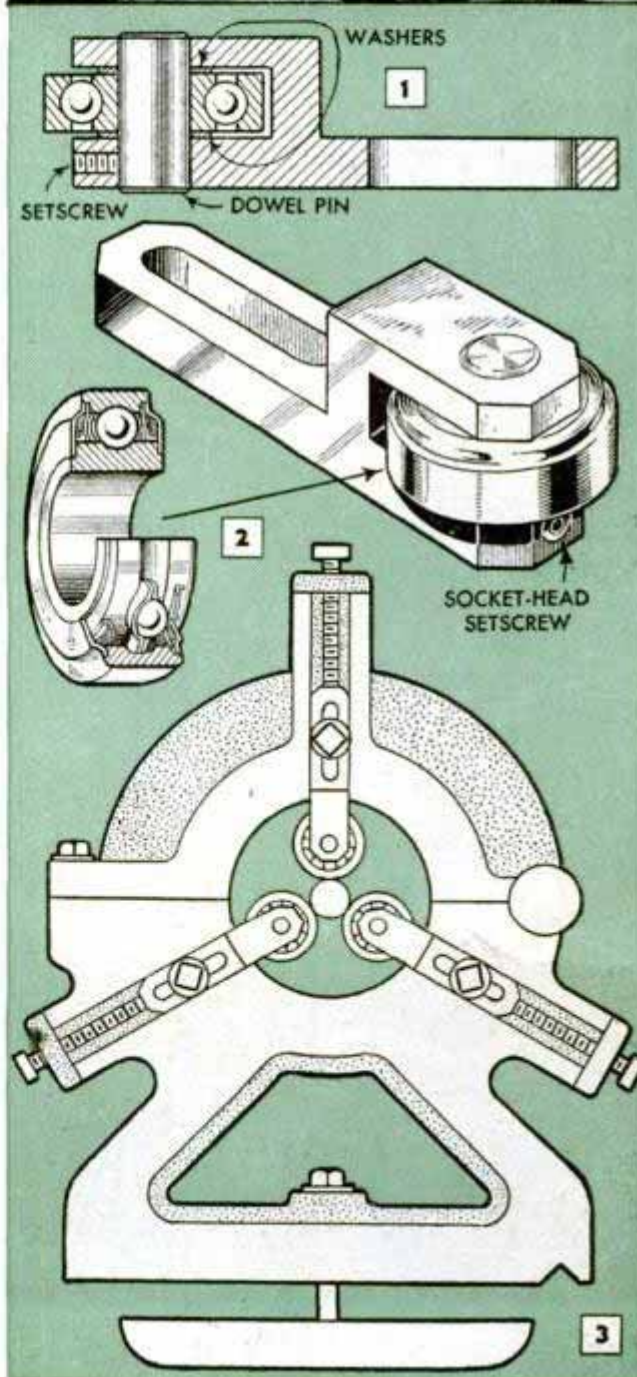
By Roy V. Hamlin

A few hours spent on the alteration of the standard lathe center rest will save a lot of time ordinarily spent in polishing out the marks left on finished lathe work by the center-rest jaws. The ball-bearing jaws shown in Fig. 3 will carry any load at any speed without leaving a mark on the work. Because there is less friction, it is possible to get a closer grip on the work when it is being set up. Also the rolling contact provided by the three jaws precludes any tendency to chatter, even when work of small diameter is being turned.

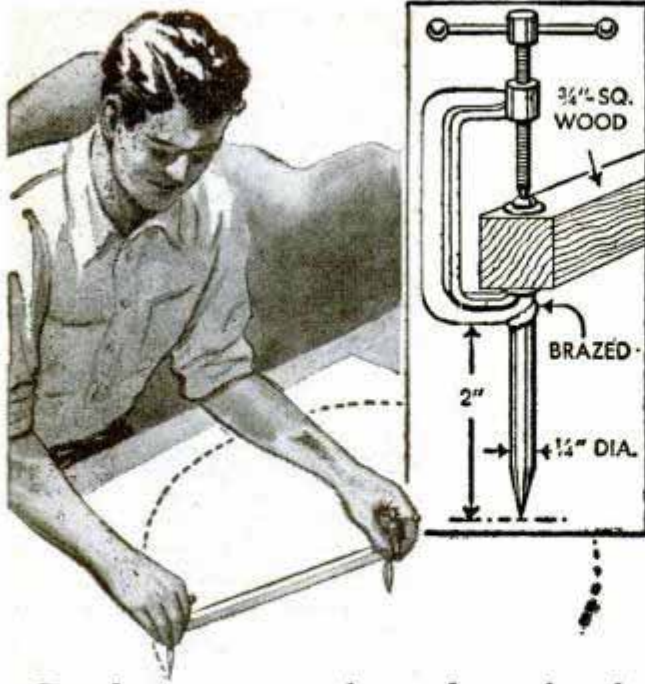
Three new jaws are milled from cold-rolled steel to fit the steady-rest frame. These are in the form of yokes, as you see in Fig. 2. The width, length and depth of the slot in which the jaws slide must be taken from the present jaws now in use in the rest, as well as the length of the elongated slot in which the lock screw is placed. All other dimensions can be taken from the rollers, which are ball bearings.

A double-sealed bearing, Fig. 2, with the inner race extending beyond the outer race width is best, although a regular bearing can be used with washers as shown in Fig. 1. Each bearing, which serves as a roller, is supported on a shaft which is simply a standard 1/2-in. steel dowel pin.

The really critical point to watch in machining the three yokes, or blocks, is to make certain that the drilled and reamed hole for the bearing shaft (dowel pin) is at a 90-deg. angle to the back surface—otherwise the roller will ride on one edge only and may mar the work. If you make sure this hole is correctly located in all three blocks, then you'll have no trouble. Be sure when making the setup that there are no metal chips on the sliding surfaces of the blocks or frame. Even a small metal shaving can throw a roller out of line.



Trammel Scribe for Large Work Also Used as Beam Compass

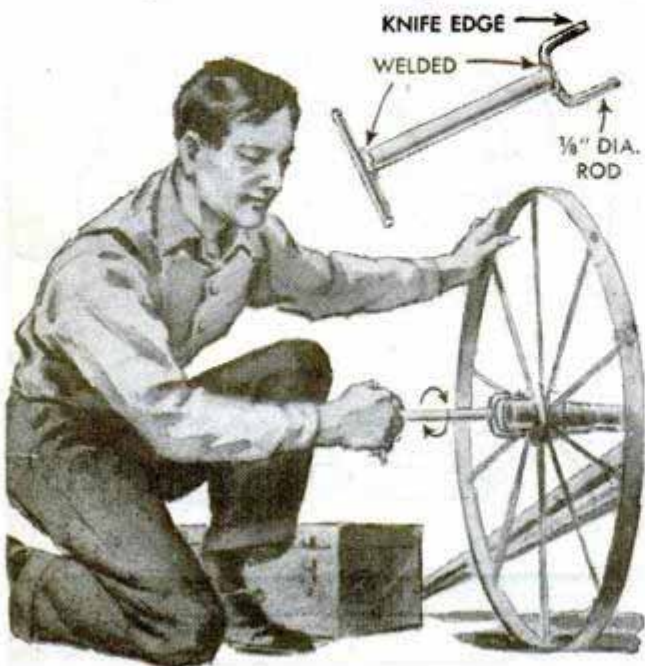


For laying out work too large for the ordinary dividers, a trammel scribe can be made with two C-clamps. Points are brazed to the bottom of each clamp and the clamps are fastened to a $\frac{3}{4}$ -in. wood beam. The points should be hardened to retain their sharpness. By brazing an empty cartridge case, which serves as a pencil holder, to a C-clamp, the scribe will serve as a beam compass also. Or a clip to hold a soapstone pencil could be used.

Phillip Wilson, Streator, Ill.

Cotter Pins Are Installed Easily With Pronged Spreader

If you have a number of cotter pins to install and want to save time doing the job, here's a spreader that will speed the work.



It is made as shown in the upper right-hand detail. One prong is left round and the other is ground to a knife edge. In use, the round prong is inserted in the eye of the pin and serves as a pivot. The knife prong slips between the legs of the pin, after which the tool is rotated to spread these two parts. All parts of the spreader are either rod or pipe.

Checking Ball-Bearing Diameters

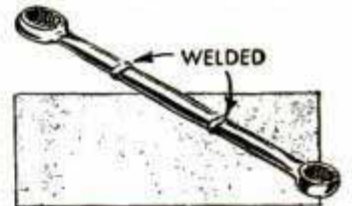
Here's an easily made gauge to check the diameter of ball bearings. Secure a number of blank key checks having the shape illustrated and drill each piece for a different size of ball bearing.



When you have completed a set that will suit your purposes, rivet or bolt the leaves together.

Extension Welded to Fan Wrench

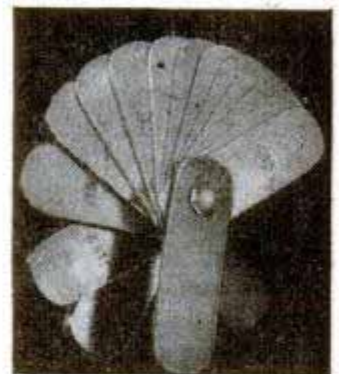
Using a box wrench of a suitable size, you can make a tool that will be easy to use when removing a fan or getting at other inaccessible parts of a car.



The wrench is cut in half and an extension piece is welded between the halves to increase the length. The extension can be of any length to suit your purposes.

Feeler Gauge Made of Scrap Metal

Mechanics who work with sheet metal will find this feeler or thickness gauge a welcome addition to their set of tools. The one illustrated is made of aluminum scrap ranging from .016 to .250 in. in thickness.



Cut the leaves uniform in size and use either metal or hardwood for the covers. Clamp the pieces together and smooth the edges with a file. Then drill a hole for the bolt that holds them together. Finally, identify each piece by stamping the thickness on it. When assembled, peen the end of the bolt over the nut so the gauge will not come apart.—R. J. DeCristoforo, New York.

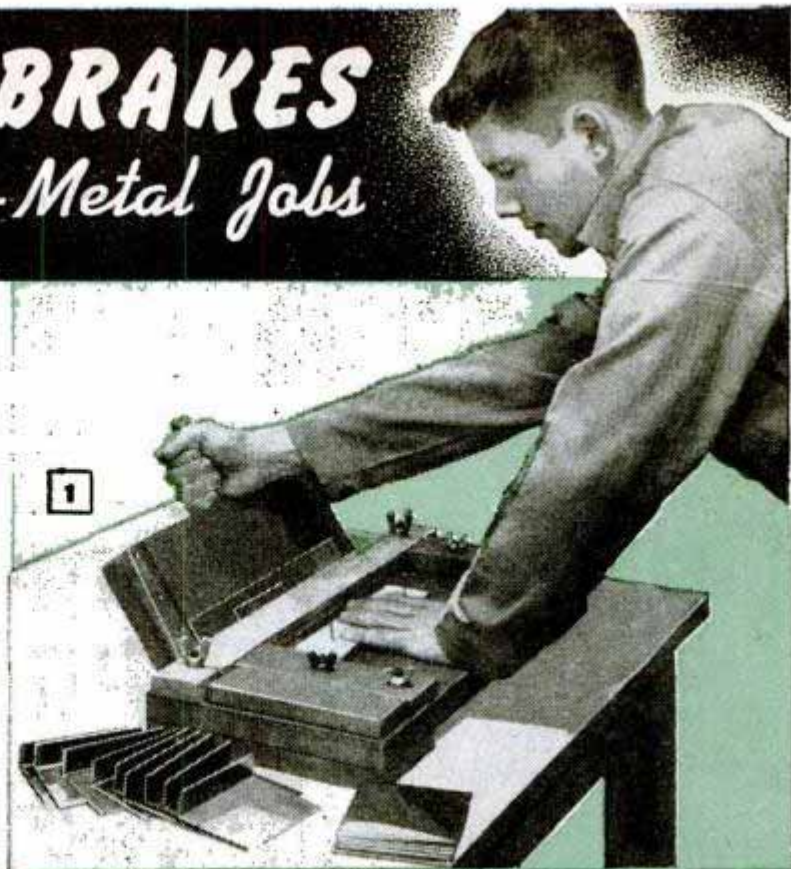
BENDING BRAKES

for Your Sheet-Metal Jobs

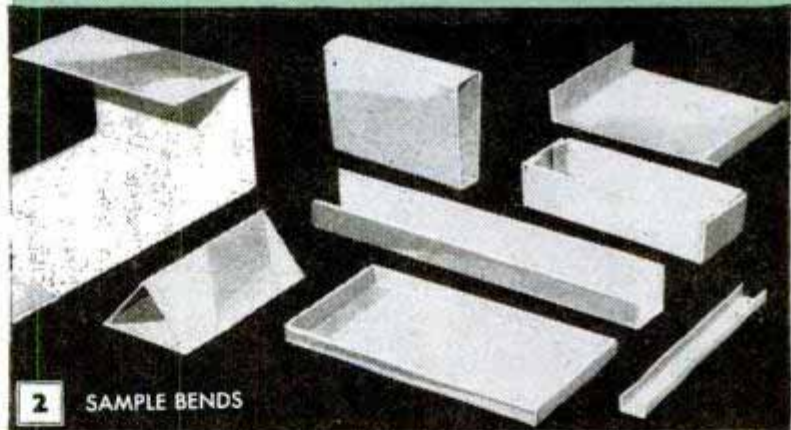
By Sam Brown

THESE bending brakes will simplify sheet-metal fabrication. Two designs are described, both capable of bending 24-ga. galvanized iron the width of the brake, or heavier metal when the bend is not at full 12-in. capacity. Design No. 2, Fig. 8, while more difficult to make, is somewhat superior in that it offers stronger construction and also permits partial (tab) and reverse bends which are not possible with No. 1 design.

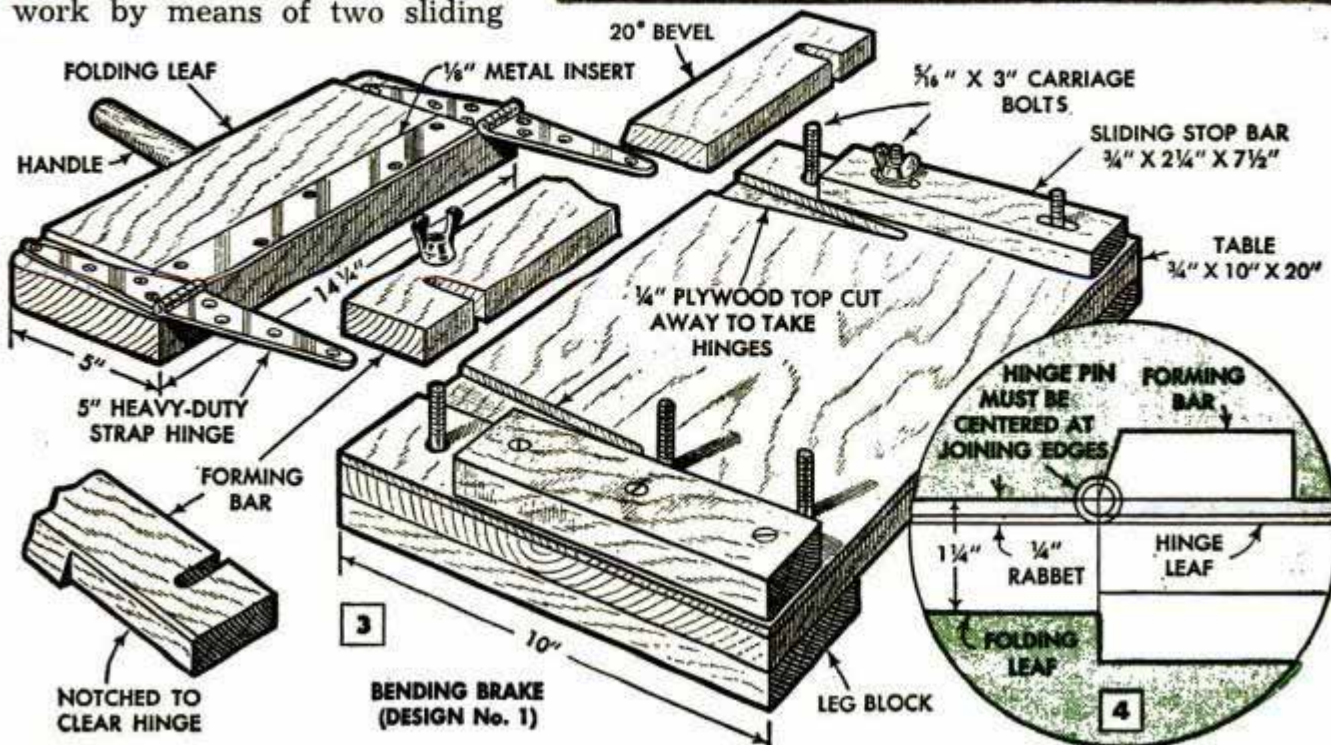
Design No. 1: Both designs are of the folding-leaf variety, and the general features of construction are grasped easily from Fig. 3. The essential feature is that the center of hinge pin must line up exactly with the meeting edges of folding leaf and table. This is diagrammed in Fig. 4. The working of the brake is shown in Fig. 1, the metal being clamped under the forming bar and then bent by pulling up on the folding leaf. The forming bar should be notched for easy removal. It is positioned exactly for duplicate work by means of two sliding

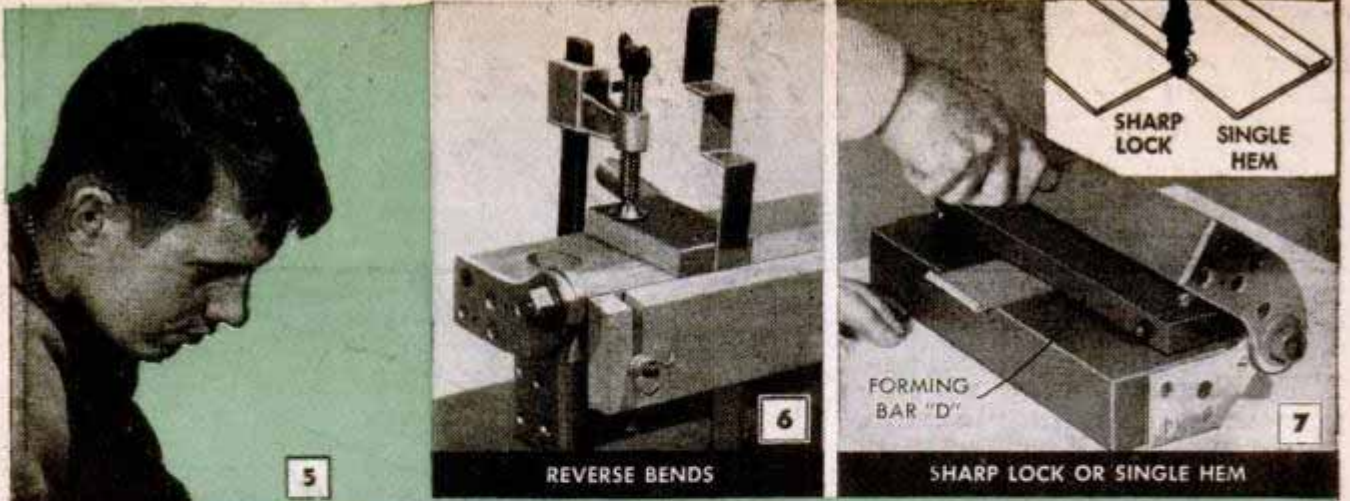


BENDING METAL TILE—ONE OF MANY JOBS POSSIBLE WITH BRAKE



SAMPLE BENDS





5

6

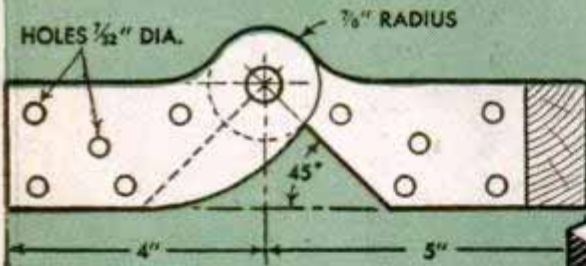
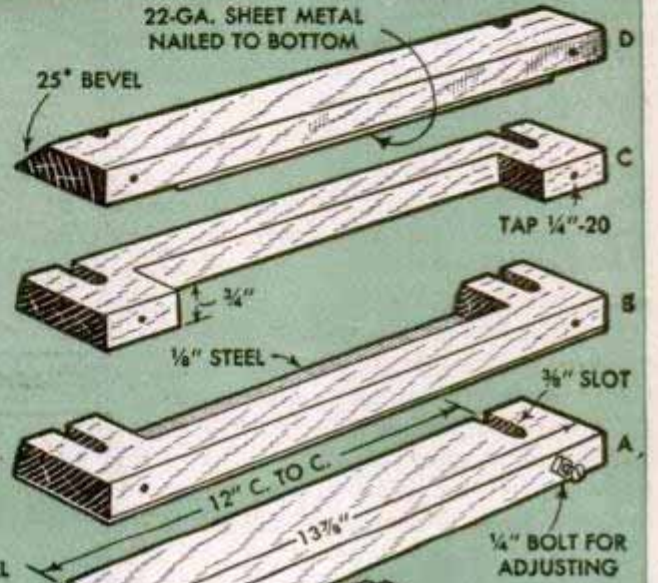
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REVERSE BENDS

SHARP LOCK OR SINGLE HEM



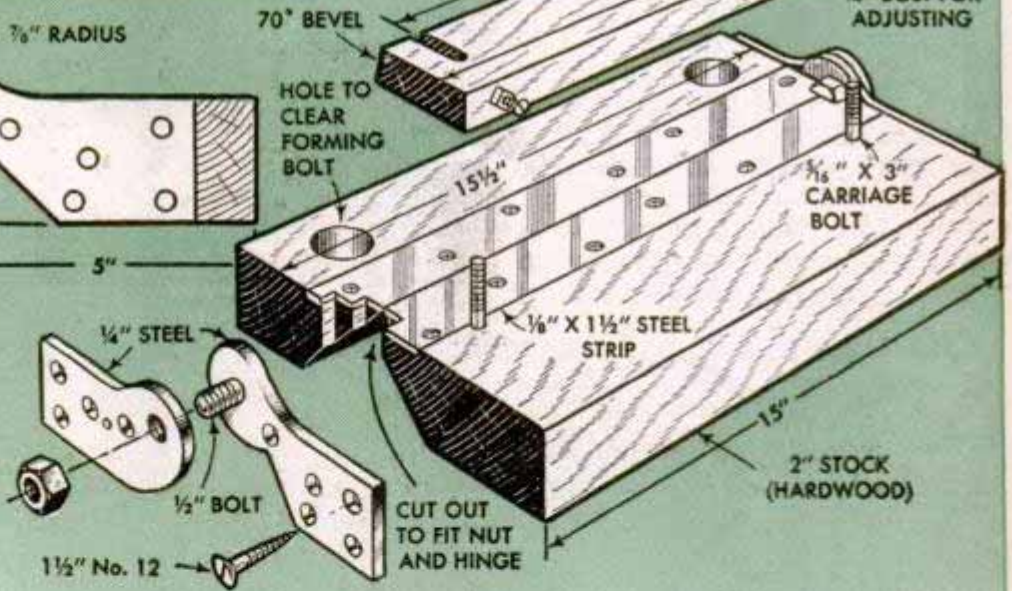
USING No. 2 BRAKE TO MAKE TAB BEND



HINGE LAYOUT
PIN MUST BE EXACTLY
CENTERED AT JOINING
EDGES

BENDING BRAKE
(DESIGN No. 2)

8



stop bars, as can be seen in Fig. 3. One of these works along a fixed block to provide a guide for right-angle bends. Any kind of wood can be used for folding leaf and table, but the forming bar must be hardwood or softwood faced with metal. The hinge should not be lighter than specified and is better made a little heavier.

Design No. 2: This is shown in Fig. 8. It is a heavier and more compact design than No. 1, and requires special hinges

cut from 1/4-in. steel, as shown. The 45-deg. cut on the underside of leaf and table weakens the construction somewhat, but offers an arrangement that is essential for reverse bends. The four styles of forming bars shown in Fig. 8, will handle all ordinary work. Care should be taken in assembly to get the pivot points in exact alignment. This design also works out nicely with hinges made from 3/4-in. plywood, pinning the bolt to the table member and providing



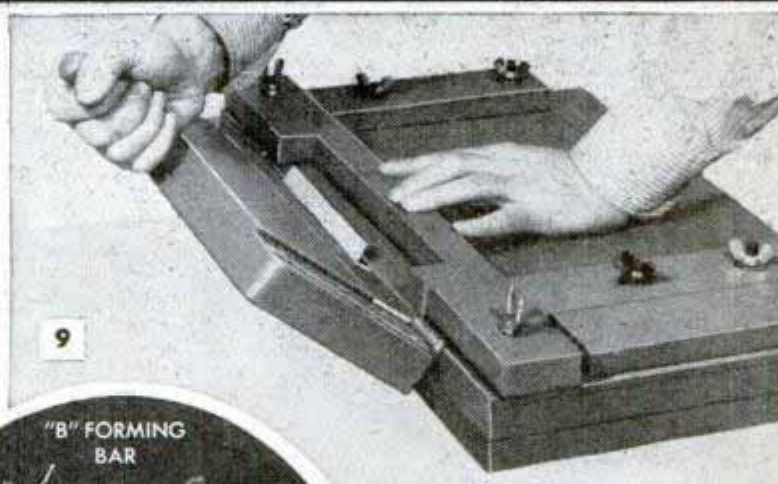
a brass bushing in the other to prevent wear.

Tab and reverse bends: Tab and reverse bends are worked on No. 2 brake by mounting the brake on edge in a vise and folding the leaf all the way back. A block of wood is clamped to the folding leaf and becomes the forming member. Fig. 5 shows the operation on a tab bend; Fig. 6 shows the same setup for reverse bends. Neither can be done on the No. 1 brake.

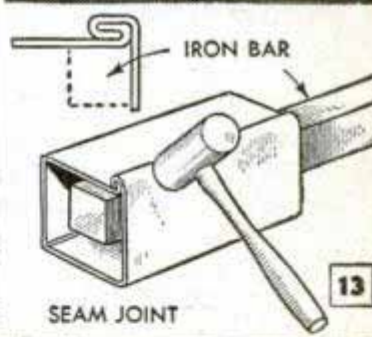
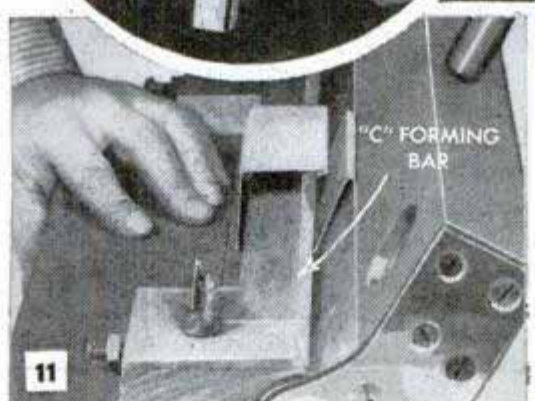
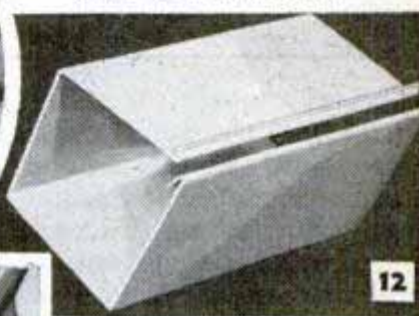
Standard operations:

The sharp lock, Fig. 7, is made by using the brake in a normal position with a style D forming bar. This bend is used frequently for fastening two pieces of metal together. If the bend is at full capacity (12 in. long), it is best to form it to a flange with the stronger A or B bar and then complete the lock with the sharp-edge D bar. The single sharp lock when pressed tightly together in a vise or by hammering becomes the single hem or bend, as shown. If the single bend is hemmed again, it makes a double hem. At full capacity on a narrow hem less than $\frac{1}{4}$ in. wide, this bend offers the ultimate strength and accuracy test for your brake—a poorly made brake will fail in this double-hem operation.

Large return bends or channels are made with the standard forming bar (style A), and offer no difficulties. Smaller channels are made with the B bar, which permits working as small as $\frac{1}{8}$ -in. cross section. This operation is shown in Fig. 9. The B bar is used also for bending small closed forms, as shown in Fig. 10. As can be seen, the brake does not fully close the form on the final bend, but it is close enough so that a little springing by hand will complete it. Style C bar offers another way of working small closed forms, as shown in Fig. 11. Complete closure is possible with



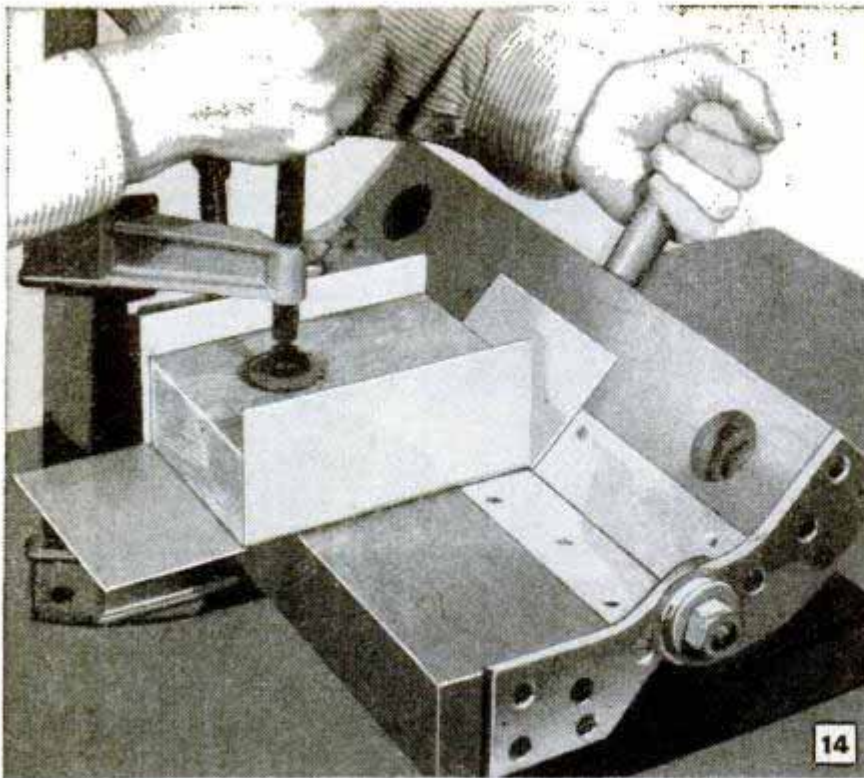
MAKING A CHANNEL WITH STYLE "B" FORMING BAR



SEAM JOINTS ON SMALL CLOSED FORMS CAN BE MADE WITH "B" OR "C" BARS

this bar, but the work must be resprung to remove it from the bar. When the closed form has a seam joint, Fig. 12, the final bend, as in Fig. 11, is really a reverse bend and is best worked by the method shown in Fig. 5. However, the reverse caused by the narrow flange is slight and does not materially affect the bending operation. Fig. 13 shows how the seam joint is closed by hammering. This is not an easy joint to make and should be practiced before you attempt it on finished work.

Box bends: One of the most used forms of sheet-metal work is the simple square box. Like its companion in wood, it can be made a dozen different ways. Simplest way is to cut out the corners and then bend the work over a forming block, Fig. 14, or over



MAKING A BOX WITH USE OF FORMING BLOCK

flange which can be riveted or soldered to the sides (a sample is shown in Fig. 2), and this style is made easily by first forming the tabs, working as shown in Fig. 5, and then bending the sides over a forming block.

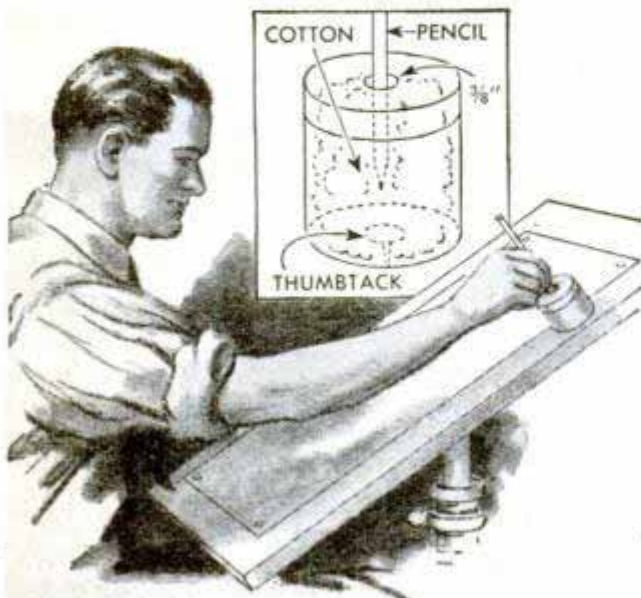
Work capacity: Work capacity of both brakes described is about 12 in. No. 2 design will work satisfactorily up to about 18-24 in. No. 1 brake will not handle metal thicker than 24 ga. (usual furnace-pipe weight as obtained at tin shops); No. 2 brake will work 22-ga. material. Both will handle much thicker metal if the bend is short. Dimensions given are working specifications and can be varied.

a special style A forming bar, Fig. 15. For the latter operation, the forming bar has notches cut to accommodate the flanges previously turned up. The notches (saw kerfs) do not affect the bend, and one bar can be notched many times to suit different sizes of work. The simple style of box shown, while easy to bend, presents a fair amount of work in soldering the corners. Some shapes in this style (such as lids), if shallow, are often strong enough not to require soldering. Most larger boxes make use of some kind of inside or outside



BOX MADE WITH USE OF NOTCHED "A" BAR

Absorbent Cotton Stuffed in Covered Box Cleans Drawing Pencil



Finding a way to clean the point of a pencil after sharpening it is always a problem for the draftsman. One solution is to fill a small, covered box with absorbent cotton. Cut a hole in the top large enough for the pencil. To clean the point, insert it in the hole and rotate in the cotton. This will remove powdered lead.

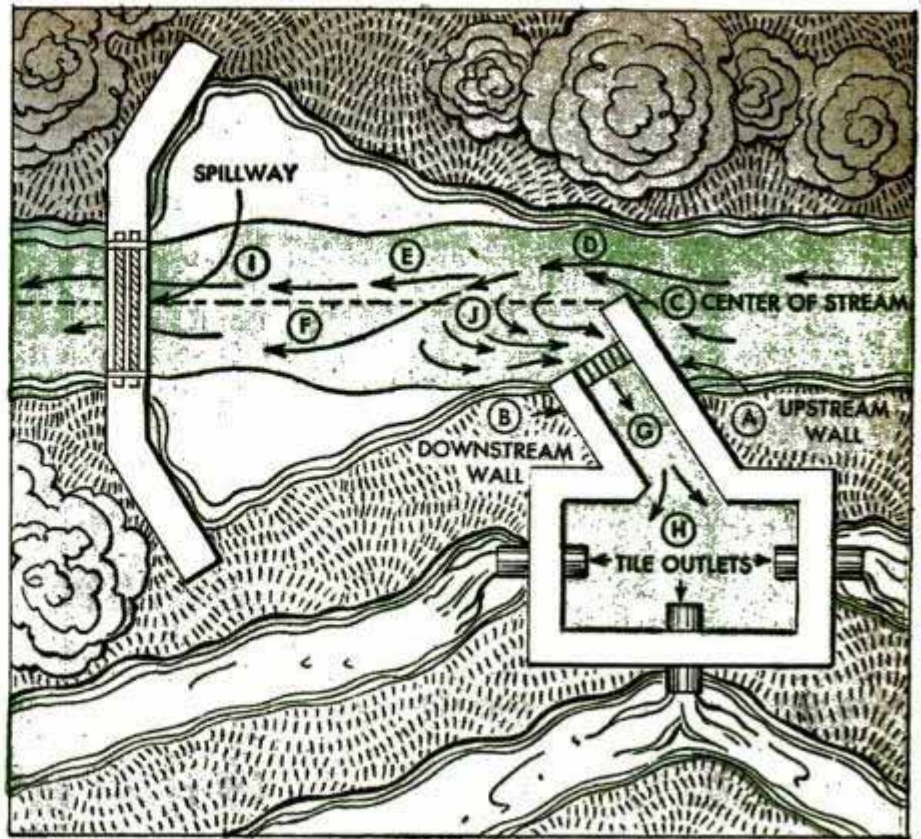
"Manicure" for Small Commutators

Emery boards, which are strips of fine sandpaper bonded together to form a resilient blade shaped like a nail file, are well suited to the job of cleaning, smoothing and polishing the commutators of small generators and motors. Because of the low cost, a new one can be used for each job.

Paul H. Woodruff, Chicago.

Irrigation Water Filtered by Backflow Intake

Farmers who want an irrigation intake basin free from floating debris, whether a gravity or pump-operated system, will find this backflow arrangement satisfactory. Main points to watch in the construction are that the upstream wall of the basin, A, terminates in the center of the stream, C, and that the spillway of the dam, I, is the same width as the original stream, indicated by the darker color. The intake is located upstream of the dam and can be on either side, depending upon the irrigation requirements. Note that the pond formed by the dam is Y-shaped and the downstream wall of the basin, B, is located near the stem of the Y. The basin proper, H, is a shallow pit having as many tile outlets as are required and an intake channel, G, protected by an iron grating. The manner in which the current moves to



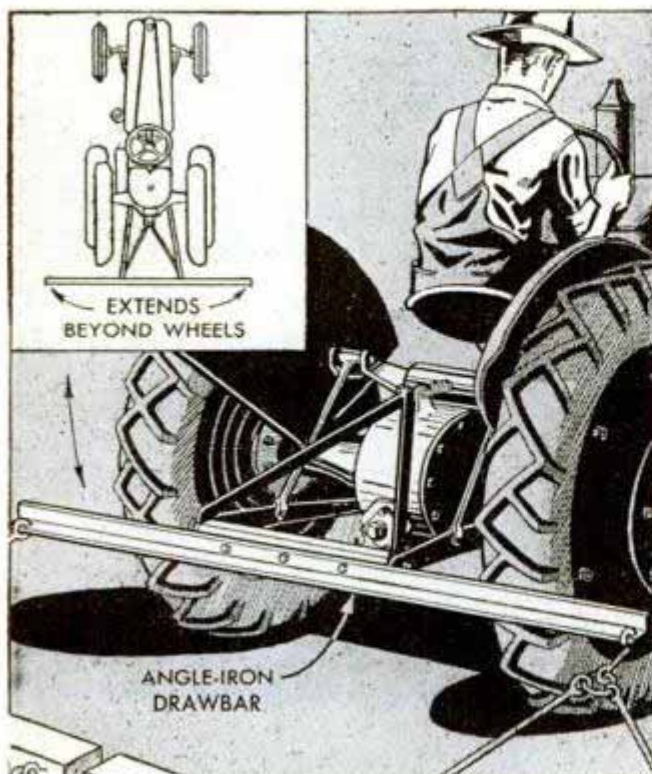
produce a backflow is indicated by the directional arrows D, E, F and J. This keeps the intake water free of debris.

Gilmer F. Horton, Mount Airy, N. C.

Extension Attached to Drawbar of Tractor Makes Harrowing Easier

Harrowing with a tractor is made easier if an extension piece which extends beyond the rear wheels on both sides is bolted to

the drawbar. If available, a heavy piece of angle iron will serve well for this purpose, although any suitable length of rigid metal, such as a channel or piece of flat iron would do just as well. This method has proved to be better than using a long, chain hitch, especially when making turns at the ends of the field. Because the extension is bolted in place, it's easy to remove when not in use.



Clay Holder for Lettering Pens

Press a ball of modeling clay onto the metal top of a bottle of lettering ink to provide a holder for lettering pens. Then you will have a wide choice from which to make a selection at hand without having to search through a box of pens. When doing a lettering job, it's a good idea to select the pens you will need and put them in the holder.



Thermometer in Perforated Pipe Tells Temperature of Grain



To tell the temperature in the interior of a corn crib or other grain bin that has been filled, use a length of pipe about 5 ft. long and a thermometer tied to a stick. The end of the pipe inserted in the crib should be perforated with a number of holes so that a quick reading can be obtained. To use, insert the pipe in the crib and then slip the thermometer into the pipe to the point where the perforations are; after a short time the thermometer is withdrawn and the temperature is noted.

Telephone Shelf Under Desk Top



In order to keep the top of his desk uncluttered, one office worker made a telephone shelf and fastened it to the kneehole side of the desk. Kept here, the phone was always within easy reach.

Auto Oil Pump Primed by Air

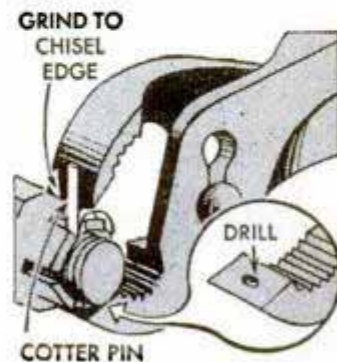
One mechanic found that a new or overhauled oil pump could be made to pick up suction by applying air pressure to the crankcase. After trying other methods on many makes of cars, the following proved effective: First, the rear breather tube, which leads down from the side of the mo-

tor to carry away oil fumes, was plugged with a rag. Then an air hose was inserted in the oil-filler tube, the nozzle being wrapped with rags to make a tight fit. With the motor idling, the air was turned on to force oil through the internal tubing and into the pump. Suction started immediately and the pump began circulating oil.

D. W. Brentlinger, Richmond, Calif.

Altered Pliers Spread Cotter Pins

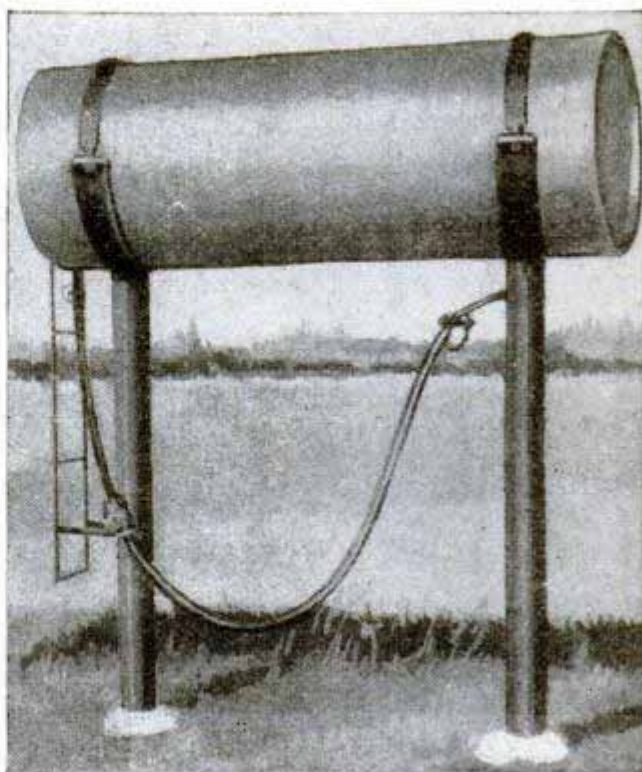
By grinding one jaw to a chisel edge and drilling a depression in the other, a pair of slip-joint pliers can be altered to serve as a tool to spread cotter pins. To use, set the head of the pin in the depression in the one jaw and close the pliers to bend one of the legs down; then reverse the tool and bend the other leg.



Gravity Feed for Gasoline Tank

Doing away with the need for a pump, this gasoline storage tank is suspended on two pipe columns and is emptied by gravity. The footings, columns and bands that hold the tank will have to be of heavy construction to support the weight of the full tank. An access ladder is welded to one end. The tank should not be built in areas where the fire code does not approve.

Glenn Lindberg, Cut Bank, Mont.



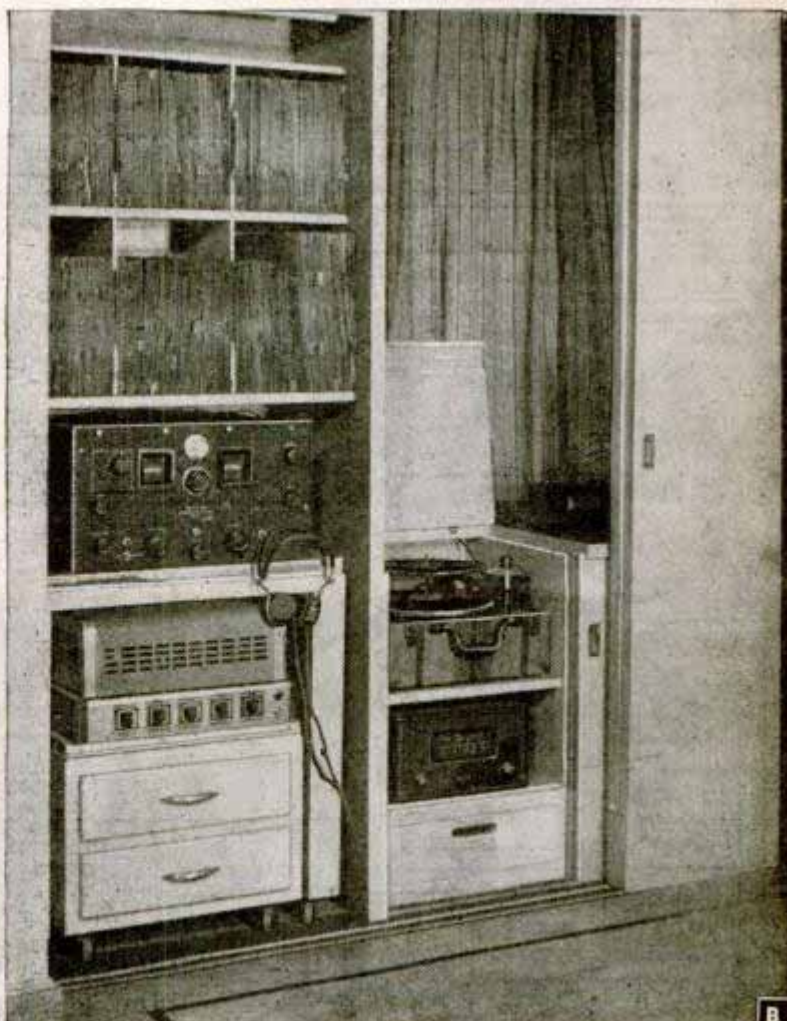
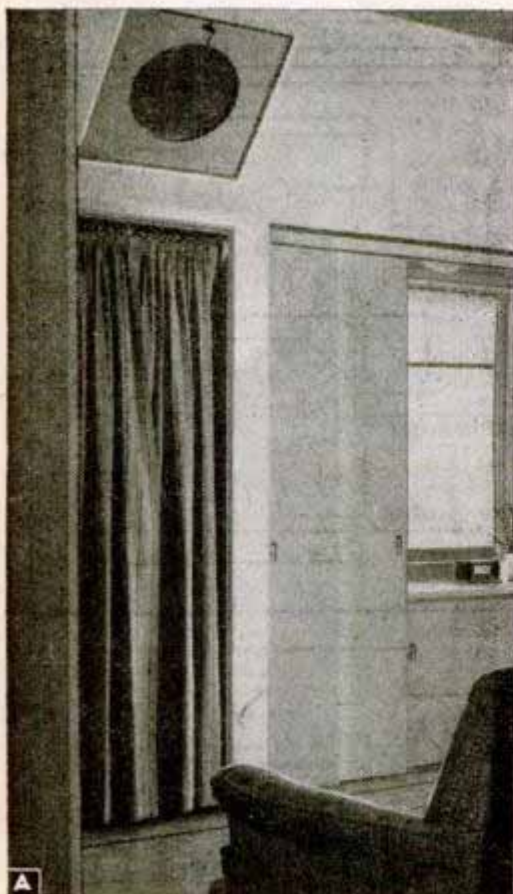


Space-Saving Cabinets for Radio And Record-Playing Equipment

Solving a common problem where space is at a premium, these wall cabinets brought joy to the wife of a small-home owner. Sliding doors hide all of the equipment from view. In this case there were valuable records to be cared for, and it was necessary to provide easy access to rather bulky radio equipment.

Photos A and B show the cabinets closed and opened; the small sliding door at right closes the cabinet with the hinged top which houses an automatic record changer and FM receiver. The high doors slide across the large cabinet at left. A loud-speaker is built in the wall above the adjacent curtained closet.

An outstanding feature is the telescoping tables with wheels, below the record shelves. A Hammarlund Super Pro radio is mounted on the large table; a high fidelity amplifier rests on the table below. These tables may be rolled out in the room permitting easy access for repairs, adjustments and cleaning. Antenna lead-in wires are run through conduits.



BRILLIANT "41-Q 50" FIVE-BAND

By L. M. Dezettel—W9SFW

F. L. Brittin—W9DCX

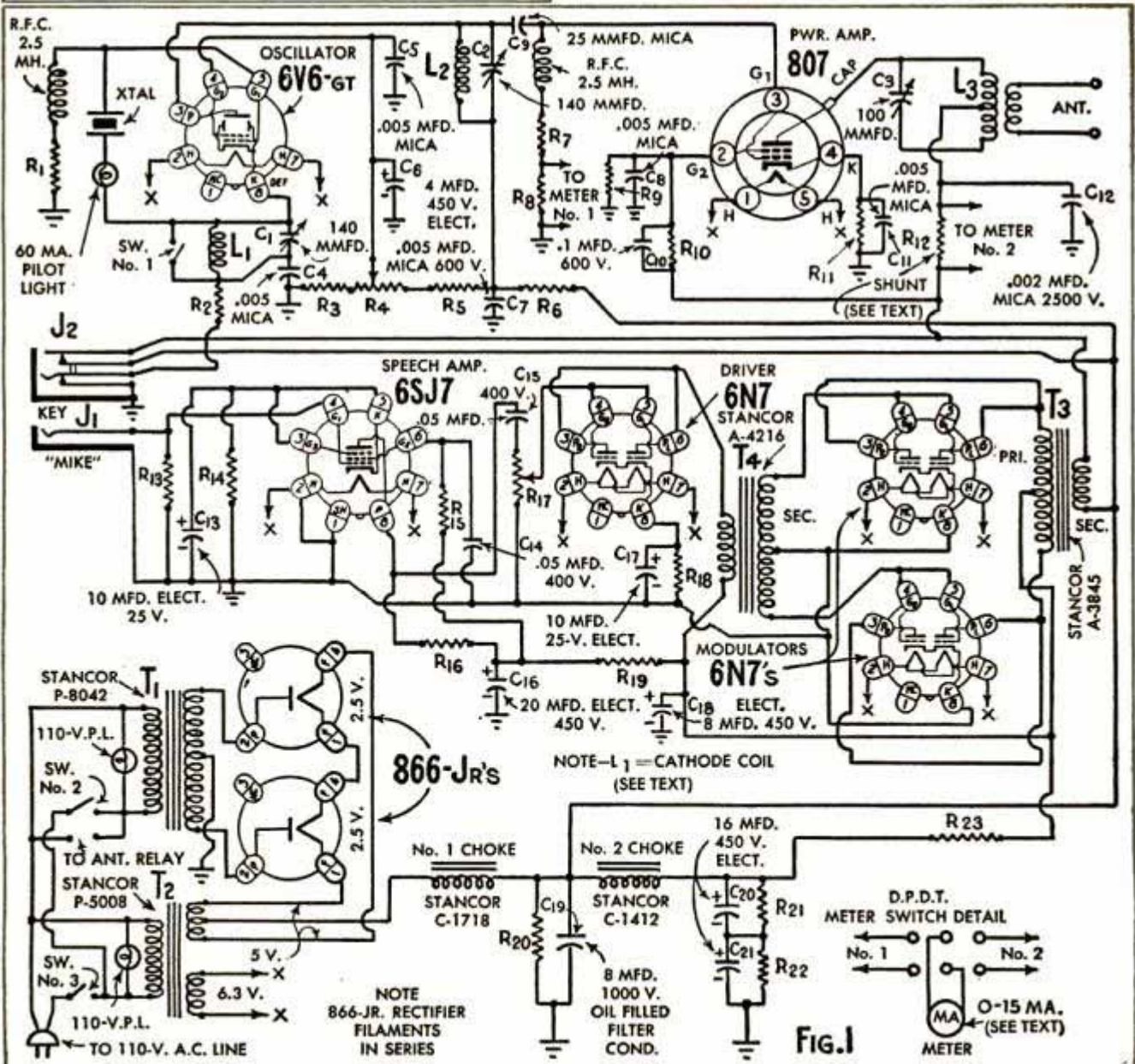


CAREFUL attention to the layout of important parts has resulted in the compact design of this low-power transmitter for the beginner "ham." It is hard to beat for efficiency and versatility. The horizontal position of the 807 final amplifier tube makes very short leads possible in both the plate and grid connections, thus losses are kept at a minimum and parasitics are prevented from developing.

The transmitter consists of three main parts, the R. F. section, the modulator and the power supply, as shown in diagram Fig. 1. It is complete on a single chassis base 17 in. long, 13 in. wide and 3 in. high. The R.F. section has a 6V6-GT crystal-controlled oscillator and 807 power amplifier. This crystal circuit is the familiar Tri-tet

RESISTORS

- | | |
|--------------------------------|--|
| R1—100,000 ohms, 1-watt carbon | R13—1 megohm, 1/2-watt carbon |
| R2—200 ohms, 10-watts (WW) | R14—1000 ohms, 1/2-watt carbon |
| R3—1000 ohms, 1-watt carbon | R15—1 megohm, 1/2-watt carbon |
| R4—20,000 ohms, 7-watts (WW) | R16—220,000 ohms, 1-watt carbon |
| potentiometer Mallory E20MP | R17—500,000-ohm pot. (audio gain) |
| R5—10,000 ohms, 10-watts (WW) | R18—1000 ohms, 1-watt carbon |
| R6—10,000 ohms, 10-watts (WW) | R19—15,000 ohms, 1-watt carbon |
| R7—15,000 ohms, 1-watt carbon | R20—30,000 ohms, 20-watts (WW) |
| R8—22 ohms, 1/2-watt carbon | R21—100,000 ohms, 1-watt carbon |
| R9—50,000 ohms, 10-watts (WW) | R22—100,000 ohms, 1-watt carbon |
| R10—30,000 ohms, 20-watts (WW) | R23—1500 ohms, 50-watts (WW) |
| R11—400 ohms, 10-watts (WW) | Note—(WW) = wire-wound |
| R12—Meter shunt (see text) | Note—(gain control R-17 = audio taper) |

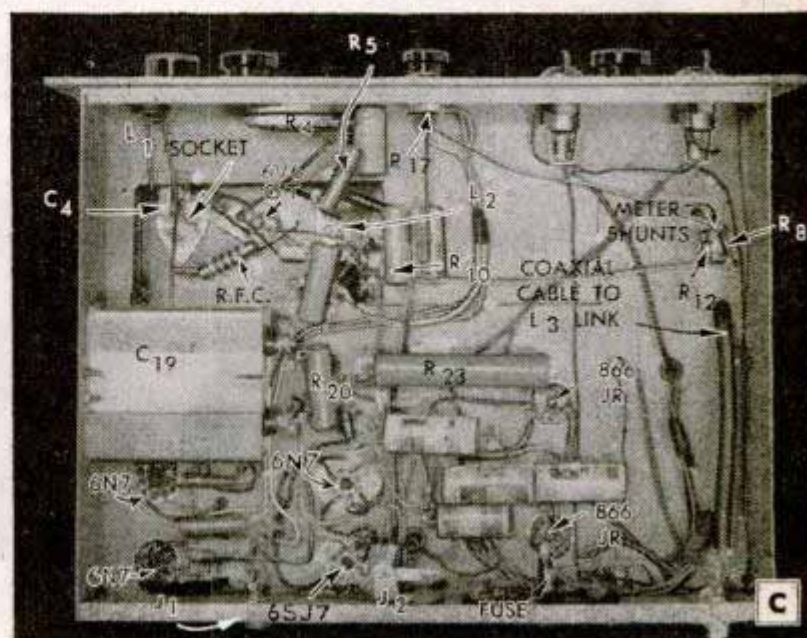
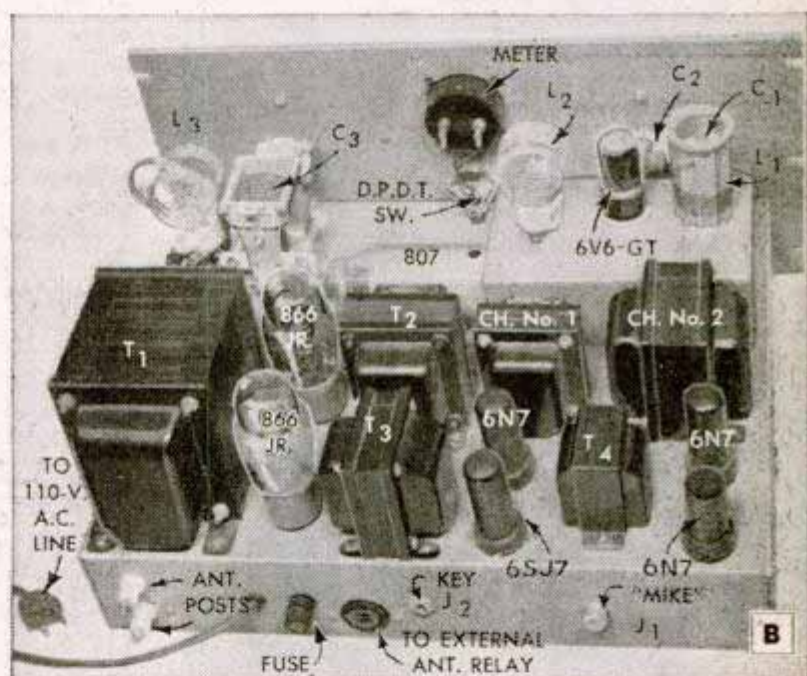
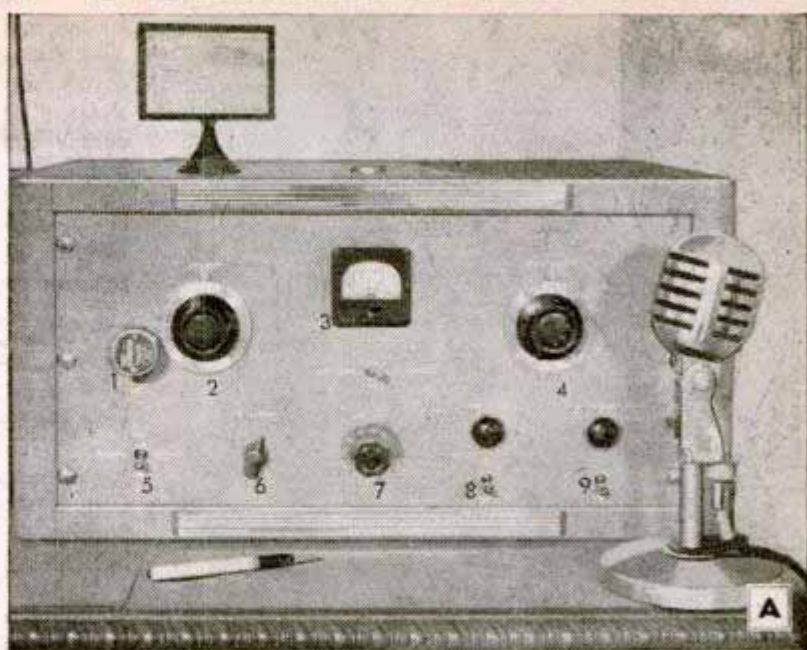


PHONE AND CW TRANSMITTER

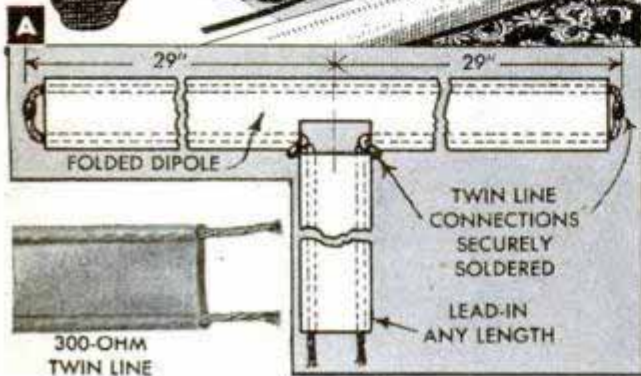
type, famous for generating strong useful harmonics by means of a tuned circuit in the cathode of the tube. Only two cathode coils are required for operation on any band with either an 80-meter or 40-meter crystal. These (L1) cathode coils are wound on Hammarlund SWF-5 plug-in coil forms having a 1½-in. winding diameter. The 40-meter L1 coil consists of 6½ turns of No. 20 enameled wire spaced out to ¾ in.; the 80-meter L1 coil consists of 13 turns of No. 20 enameled wire close wound. Hammarlund APC-140 mmfd. air padding condensers (C1) are mounted inside each cathode coil form. For straight-through operation on the fundamental crystal frequency a switch on the front panel cuts out this cathode coil. The 807 tube operates as a class "C" R.F. power amplifier. Plate tank coils L2 and L3 for the oscillator and amplifier are standard Bud OES and OLS series plug-in types for the 10, 15, 20, 40 and 80-meter bands. These coils fit into Amphenol 5-prong steatite tube sockets. The amplifier coil has a movable center pickup link for varying the "load" to the antenna. Photos A, B, C and D show various views of the completed 50-watt rig.

The modulator tube lineup begins with a 6SJ7 microphone amplifier. Any good crystal microphone such as the Cardax, or similar type, may be used; the 6SJ7 tube feeds into a 6N7 tube which, in turn, drives a pair of 6N7 tubes as a class "B" modulator. The modulation transformer matches the load of the R.F. amplifier to that required for the modulator stage, and Stancor power-supply transformers and chokes furnish the required voltage and current to all of the tubes. The Taylor 866-Jr. rectifiers have very low voltage loss, and easily carry the needed current. This power supply delivers 600 volts to the R.F. power stage; resistors are used to drop the voltage for all the

(Continued to page 220)



SERVICE HINTS FOR SET OWNERS



(A) An inexpensive folded-dipole FM receiving antenna, made from flexible 300-ohm twin-line transmission cable, can be placed flat on the floor under a rug. Cut approximately $\frac{1}{2}$ wave length long, it is shorted at both ends, with one conductor cut in the center for the lead-in point; insulating lacquer is applied to the soldered connecting wires.

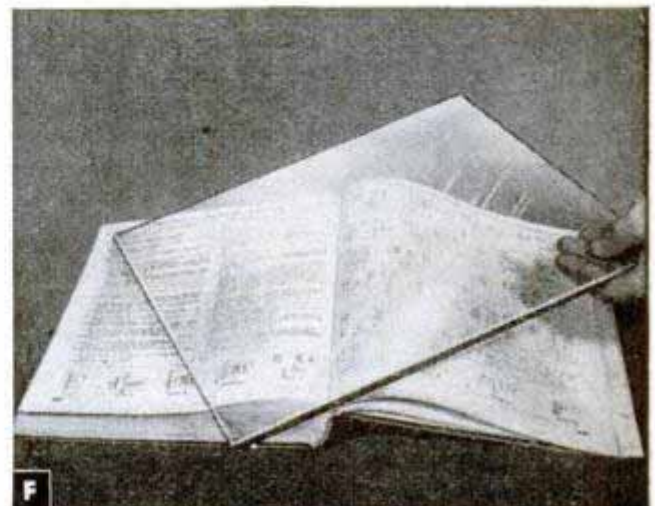
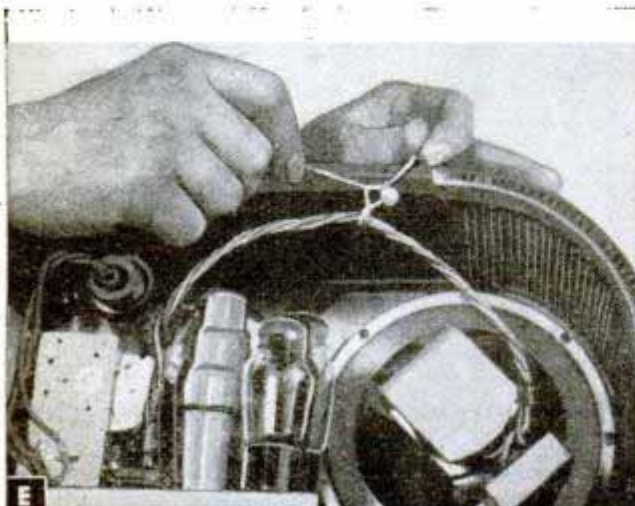
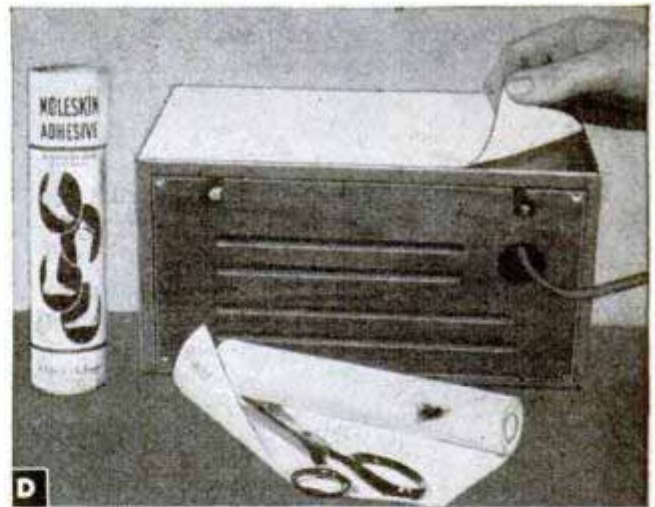
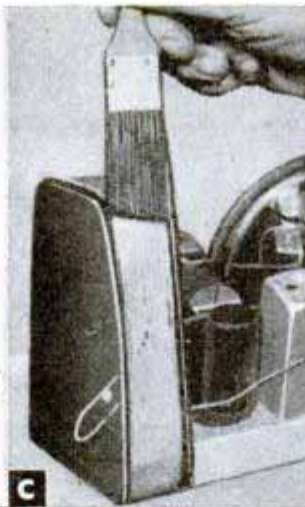
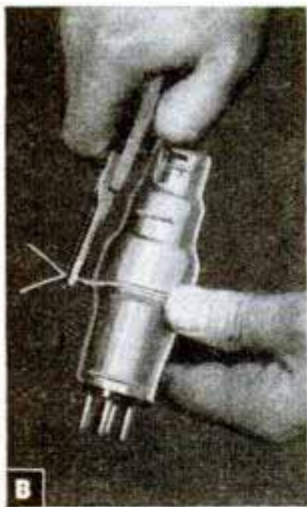
(B) A short length of wire twisted around split tube shields will hold them together when the original snap-in spring wire rings are lost.

(C) When wires on built-in loop antennas come loose, a coat of clear shellac, or "coil dope," applied with a flat brush, will hold them in place and prevent damage when the chassis is removed.

(D) When small radio sets, not provided with rubber feet, make scratches on table tops, use a piece of "moleskin" adhesive cut to fit as shown. This adhesive material has a soft coating on one side.

(E) Many small table-type sets have a flexible speaker cable that often rests against the power tube, or other tubes, which in time burns or weakens the cable insulation. A thumbtack and a piece of string arranged as shown will solve the problem in wood cabinets; in plastic cabinets use adhesive tape.

(F) A piece of heavy plate glass with slightly beveled edges will hold magazines, radio manuals and diagrams open on the workbench, and will also protect the pages from tools and soldering damage.





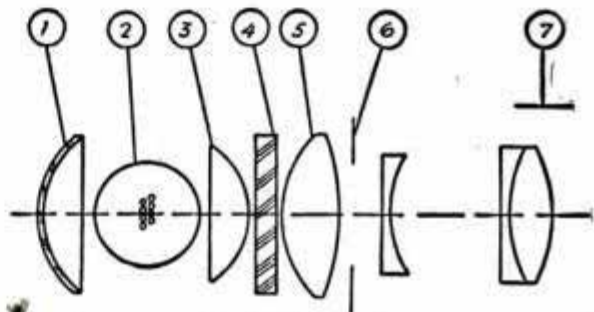
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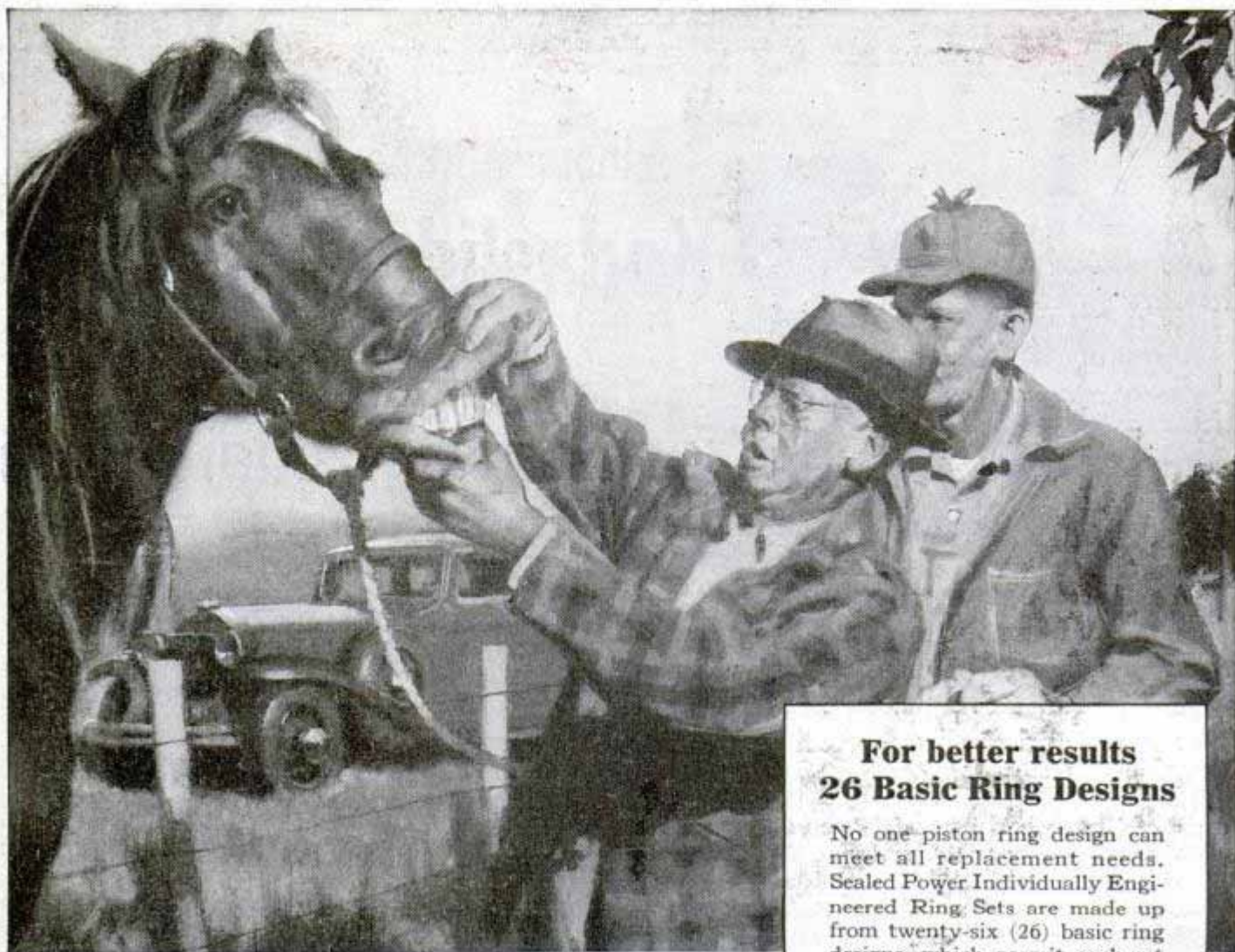
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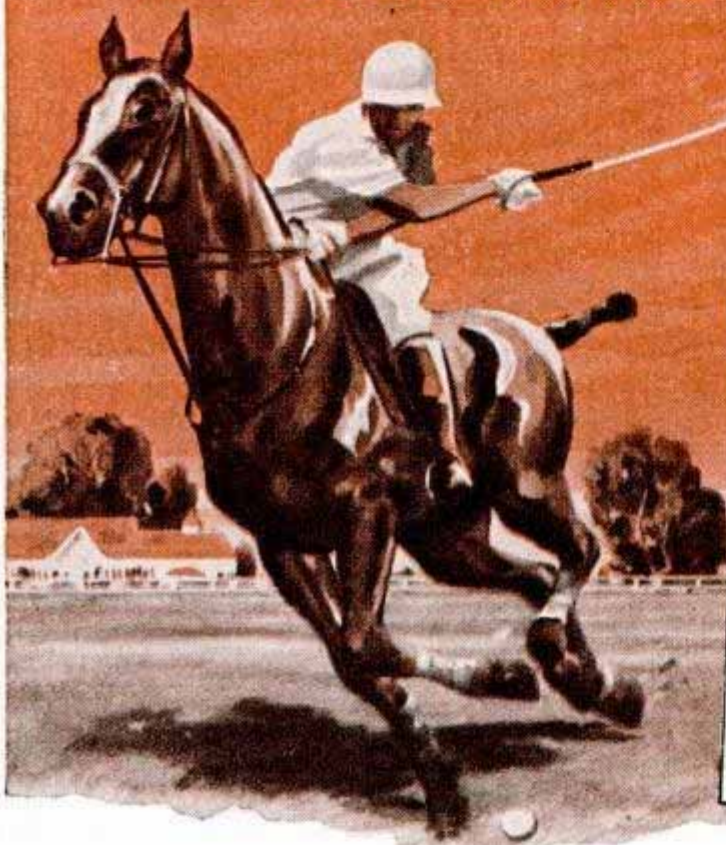
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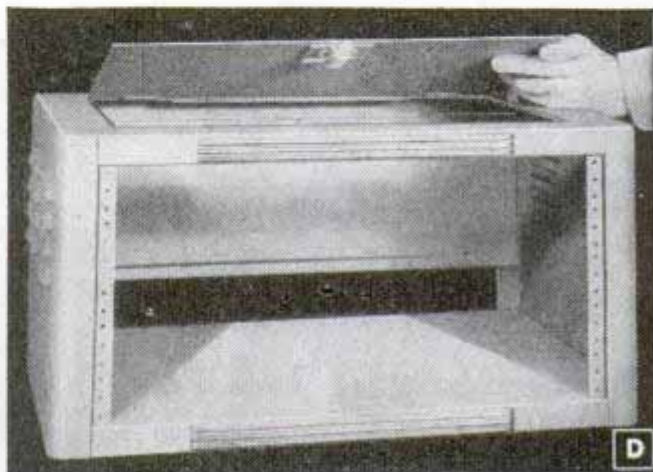


Beginner's Five-Band Transmitter

(Continued from page 215)

other stages. The modulator easily develops the 30 watts needed to modulate the final amplifier about 100 percent.

All controls are mounted on a $\frac{3}{16}$ -in. crackle finished hard-pressed-wood relay rack panel, 19 in. long and $8\frac{3}{4}$ in. high; this panel will fit any standard $10\frac{3}{4}$ by $14\frac{1}{2}$ by 22 in. cabinet rack such as the one shown in photo D. The panel controls are labeled with Millen white decals. The controls numbered from left to right in photo A



are as follows: No. 1 is the crystal; No. 2, oscillator dial; No. 3, the 0-15 ma. meter, with switch below; No. 4, power amplifier dial; No. 5, "on-off" switch for the frequency multiplier; No. 6, screen current; No. 7, audio gain; No. 8, "on-off" switch for high voltage; No. 9, "on-off" switch for the tube filaments. Red and green pilot lights are above these switches. Photos B and C clearly show the placement of parts.

Because of the ease with which the Tritet oscillator quadruples in this transmitter, only two crystals are necessary to operate all bands except the 15-meter band. A separate crystal is required for this band. Keying is done in the cathode of the oscillator; keying is clean and no additional key-click filter is required. It will be noted that a single 0-15 ma. meter is used for tuning; it is switched from the grid to the plate of the 807 tube by means of the D.P.D.T. switch. When switched to the plate, a resistor is placed in the circuit across the meter which multiplies the scale readings by 10. This shunt (R12) is handmade and consists of $9\frac{1}{2}$ in. of No. 22 resistance wire wound on a small piece of Bakelite.

The secret of the excellent performance of this rig is the method of obtaining short leads in the oscillator and R.F. section. This is accomplished with an additional small box-like chassis, built above the

(Continued to page 224)

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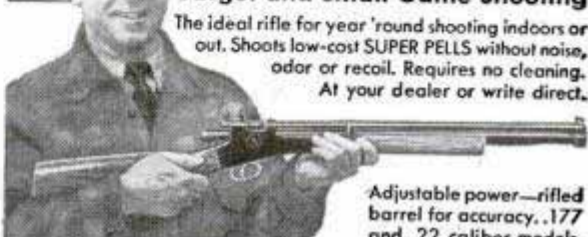
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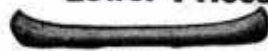
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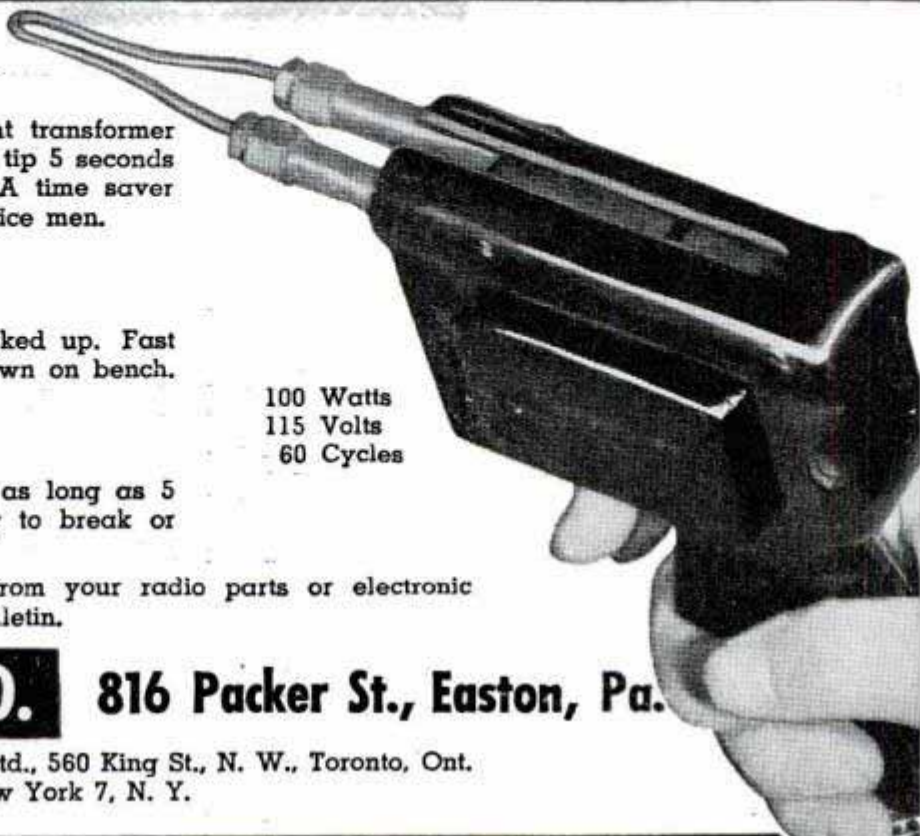
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main chassis, for mounting most parts in this section. The cathode coil, the oscillator tube and its plate tuning coil are mounted on top of this 2½ by 4 by 7-in. metal box, the bottom side of which is open over a rectangular hole about 4 in. by 7 in., cut in the main chassis. The 807 tube socket is mounted on the end of the metal box and it is shielded with a Millen No. 80010 tube shield. Install all sockets in position so coupling condensers and other connections between grids and plates follow shortest paths.

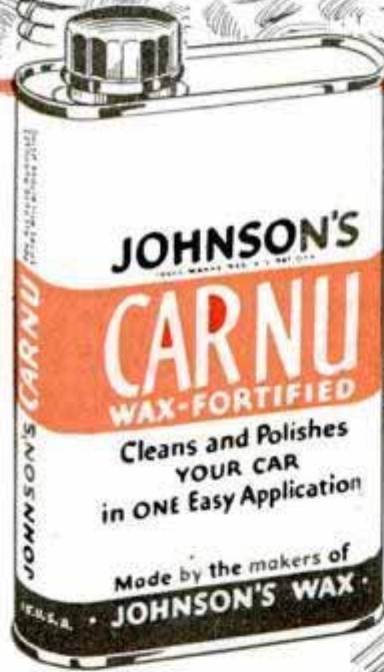
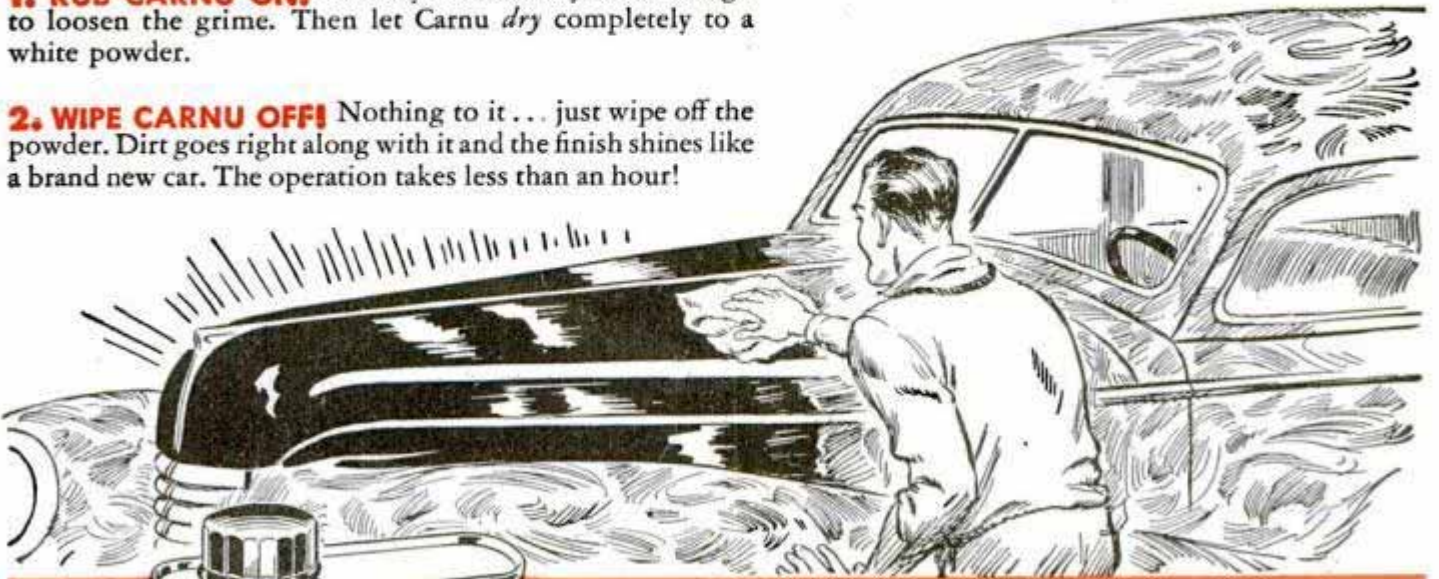
Operating and tuning procedure is as follows: for 80 meters use an 80-meter crystal and 80-meter plug-in coils in both the oscillator and output stages. Throw the "frequency multiplier" switch "off" to short out the cathode coil, and switch the meter to "grid." Tune the oscillator to maximum grid current; the "screen current" control should be at maximum. Grid current reading will be about 5 to 7 ma. Reduce the "screen current" control to a grid reading of about 2 to 3 ma. Now switch the meter to "plate" and, with the antenna disconnected, tune the amplifier condenser (C3) for lowest reading. Next, connect the antenna. Start adjustments with the antenna coil L3 link almost all out. Bring the link coupling in closer to the coil little by little, each time readjusting the amplifier tuning condenser for minimum plate reading on the meter. Be sure to shut off the plate voltage each time you make a link adjustment. If you are using an 80-meter crystal for 40 meters, operation is the same except that the frequency multiplier switch is in the "on" position and the 80-meter cathode coil must be in its socket. For 20 meters, either an 80 or 40-meter crystal may be used. Tuning is the same as above except that, of course, 20-meter coils are used in both the oscillator and R.F. stages. When doubling from a 40-meter crystal the 40-meter cathode coil is used, and in both above cases the frequency "multiplier switch" is in the "on" position. For 10 meters use a 40-meter crystal, with "multiplier switch" "on," and the grid current at from 3 to 4 ma. Always adjust grid mils and the swinging link for maximum output. The screen current should be at the maximum possible setting, just before the point where the output begins to drop due to overdriving the grid of the 807 tube. The type of antenna used is optional with the builder; half-wave types with matched Amphenol twin-line feeders connected to the adjustable link of the output-stage tank coil are simple and efficient; other types require special tuning systems. Detailed student material list R-358 is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

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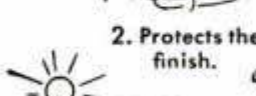
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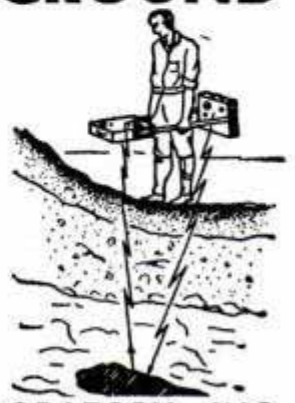
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**"That hammer?
You're kidding!"**



FRED: It's a fact, Bill. I've been using this same hammer for 29 years. It helped to build the house you were born in.

BILL: Well, I don't know how you do it. I hardly ever *use* a hammer, and yet I've broken two of them in the last year or so.

FRED: That so? What kind of hammers were they? What brand, I mean.

BILL: Gosh, I don't know. Guess they didn't *have* any brand names. But they were good bargains.

FRED: That's where the trouble is, Bill. Look . . . see the name on this hammer? Whenever you see that brand name, you

know it's a good hammer. Stick to the well-known, advertised brands when you buy tools, and in the long run you'll save a lot of money.

BILL: That makes sense, Fred. I'll remember it.

FRED: And do your buying at the hardware store, where they don't try to sell you anything but quality tools. That way you'll always get your money's worth.

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AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

Blowing Up Hollywood

(Continued from page 157)

plans a house. He must know exactly where every charge is buried and the time at which it must be exploded. He must know how close the actors can approach with safety. He usually makes a sketch of the layout and plants his charges accordingly. Dynamite is placed several feet below the surface in a V-shaped trench. Soil is carefully screened to remove rocks and other sharp-pointed objects and then repacked on top. Wires from the charges run to a central control board. Overhead charges are strung on invisible wires 5 to 25 feet above ground. After careful planning and planting, the explosives engineer plays his symphony of destruction.

The highest compliment that an explosives engineer can have paid him runs something like this:

Bill Boyd, who has made famous the character of "Hopalong Cassidy," was doing a picture that required him to run across a bridge. Just as he reached the far side it was to be blown up.

"Who's handling the dynamite?"

"Slim Hoffman," the director said.

"In that case, it's O.K.," Boyd declared. "I'd let myself be blown to kingdom come if Hoffman were handling the explosives."

One of the newer tools fast becoming more useful in the profession is the air mortar. It generates a sudden gust of compressed air that produces a force similar to a weak explosion. For small objects, such as a hat or a vase, hidden springs or electrical squibs accomplish the same result. In the new picture "Road to Rio" a scene calls for a match to be dropped on Bob Hope's hat which catches fire. Actually the fire was started by electrical contact of two tiny wires, carrying 110 volts, which ran up Hope's back. A dangerous trick unless handled right.

Primacord is one of the very few materials of World War II that can be used by the Hollywood special effects department. When first demonstrated to me by Army officers at Fort Rosecrans, Calif., several hundred feet of it were laid a few inches below the surface of the earth. One end was set off, but the detonation traveled so fast that it appeared as if the entire length had exploded at one time. About 38,000 feet per second, the officers said.

At that time I was working on the picture "O.S.S.," starring Alan Ladd. I was confronted with the problem of trying to show a 5-inch shell landing near Ladd and ricocheting away. When I saw the Prima-

(Continued to page 232)

For radiator
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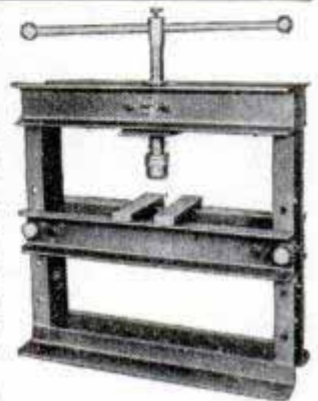
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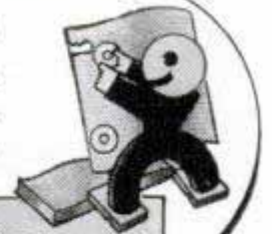


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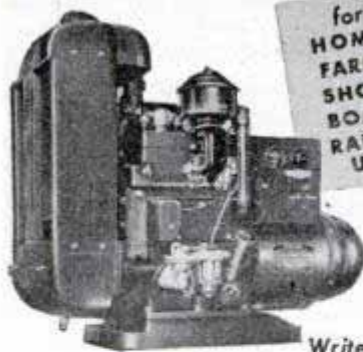
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Other Patents Pending

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It's fast... cuts on an average of 1 ft. per minute up to 3/4" medium hard wood. Operates on 110-120 V. 50 or 60 cycle alternating current. If your dealer does not yet have Moto-Saw, send \$5.85... we'll pay postage. Or send \$1. pay postman balance plus postage. MONEY BACK if not delighted after 5 days trial.

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cord in action I knew my problem was solved. I borrowed some of it from the Army and produced the effect of a large shell skipping along the ground.

Dry ice, or solidified carbon dioxide, has proved a boon to Hollywood's special effects men. Smoke, fog, haze, steam, clouds and other atmospheric effects are produced with the stuff. A wind machine will blow it in any direction you desire. It's heavy and does not disperse easily.

Another useful chemical is lacopodium—used by circus side-show fire eaters. It can be applied to almost any object—cloth, paper, wood—and it will burn brightly and briskly. The object it covers, however, won't even be scorched by the heat. Real fire is slow and colorless and most movie fires are pepped up with lacopodium.

Credit for the greatest fire scenes ever filmed must go to Lee Zavitz for his work in "Gone With the Wind" when he burned down sets representing 40 blocks of downtown Atlanta during the Civil War days. Zavitz rigged up an ingenious arrangement of gasoline and water pipes. The gasoline made the fires burn brighter; the water kept the blaze under control, according to the action required by the script.

The secret of success in the Hollywood blow-up business is to know what your explosives will do and to time them with the action and cameras. As a matter of fact, explosives are a lot easier to handle than people. You know what dynamite will do, but you can't always depend upon the unpredictable human element.

The psychology of fear is a curious thing. Almost anyone can walk along a curbstone. But lift that curbstone 50 feet in the air and the age-old fear of high places will grip the most courageous man. So with explosives. I've seen times when an actor would be so nervous that he would refuse to go through with an explosives scene. Such occasions call for strategy on the part of the explosives man.

A trick that I learned long ago to instill confidence in an actor is this: a dynamite charge is planted under several bags of sand, and a length of rope, head high, is rigged in front of the charge. A sheet of tissue paper is fastened with a clothespin in the approximate position that the actor will take. Then the blast is set off and the tissue paper sways a little in the wind but remains untouched.

If this doesn't work there are other methods. With the cooperation of the director, the explosion scene is delayed until the end of the shooting schedule. While the actor is told that the special effects depart-

(Continued to page 236)



Commercial shipping on the high seas and inland waterways is now freed by radar from delays caused by bad weather.

RCA Radar—enables ships to see through

**fog
darkness
storms**

With shipboard radar, developed and produced by engineers of the Radiomarine Corporation of America—a service of RCA—a pilot watches a viewing screen (similar to a television screen) that shows a large, clear, maplike picture of the area under observation.

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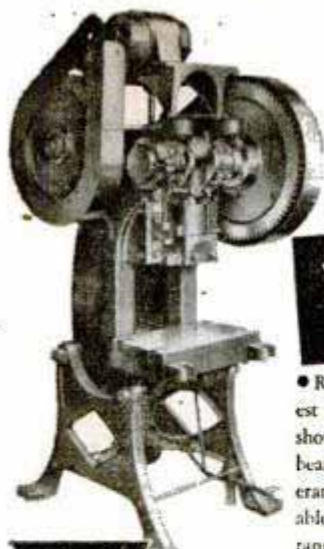
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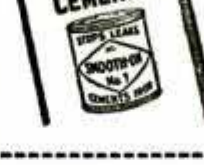
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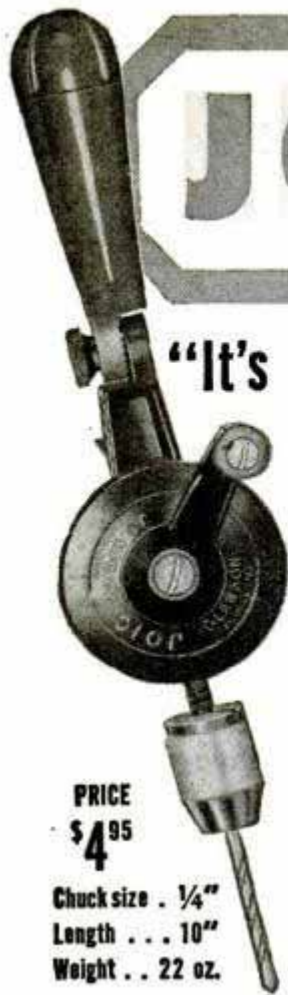
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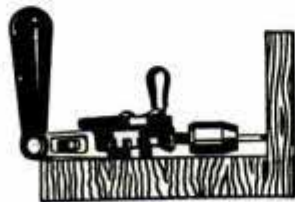
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Weight . . 22 oz.

JOIC can even drill around a corner. Here's why. It's adjustable, the only hand drill with swivel chuck and handle.

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Drill's flat side holds bit parallel to surface.



Handle's 180-degree range locked by thumb screw.



Turret locks chuck in seven different positions

ment will dub in the explosion later, hidden charges are actually placed on the scene without his knowing it. At the appropriate moment, the explosion is set off—and you can be sure that the emotions registered by nervous actors are genuine.

Two of the bravest stars I've ever worked with are Gloria Swanson and Henry B. Walthal. Miss Swanson never complained about a scene that called for the use of explosives. In scenes that might call for blowing out the side of a room, she was as calm as if serving tea in her own home. Walthal was once buried under 12 feet of dirt and it took 6 minutes to dig him out. His only comment when dragged from his temporary grave was:

"Great work, Slim."

Among the current heroes and heroines, Gary Cooper, Ray Milland, Betty Hutton and Paulette Goddard seem to be without fear of special effects.

As far as directors go, the one who stands head and shoulders above all the others is Cecil B. DeMille. He produces pictures on a lavish scale and his battle scenes call for a maximum amount of smoke and noise.

His latest, "Unconquered," which tells the story of the fight between British Colonials and the Seneca Indian chief, Gwaysuta, illustrates the point. In that picture we used 1500 arrows without flames, 500 arrows with flaming heads, 50 flintlocks, 300 fireballs made of dried moss and dipped in gasoline, 500 pounds of black powder, 300 pounds of dynamite and 50 pounds of flash powder.

Up to now, Hollywood explosives men have been stumped by only one type of explosion—and that is the atom bomb. In M-G-M's picture "The Beginning or the End," newsreel shots of the New Mexico tests and the actual dropping of the bomb on Hiroshima and Nagasaki were used. So destructive and terrifying are the forces unleashed in the bomb that even Hollywood doesn't attempt to reproduce them.

They Dredge for Your Dinner

(Continued from page 145)

oyster from its earliest stages to maturity and old age. They include the conch, drumfish, various rays and parasites. In dredge fishing, many newly emptied shells are pulled up with a well-fed snail-like conch attached. Birds, especially the scaup duck, prey on oyster beds near shore that are exposed at low tide. Oyster farmers sometimes construct elaborate fences to keep fish away from choice beds.

As the Elroy crew was pulling in its buoy

(Continued to page 240)

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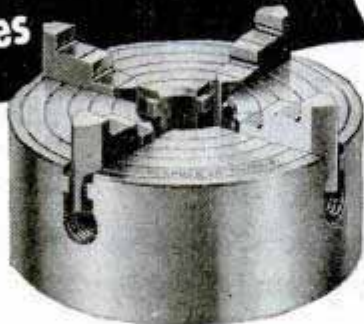
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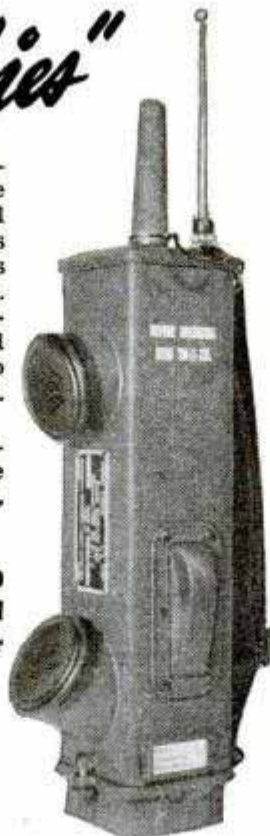
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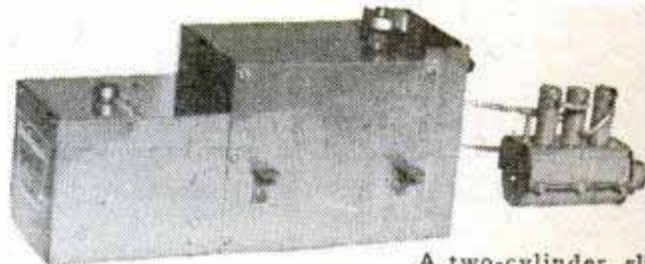
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to desert Square Handkerchief for another likely reef, known as Telegraph, a shrimp boat caught their attention.

"That's the life—shrimpin'," said Dorian "Tack" Romer, who has fished the Gulf for 23 years.

His fellow crewman, Joe Senseney, nodded agreement. "One drag with the big shrimp nets takes about four hours," he explained. "That's four hours when all you have to do is just sit. Then you pull her up and maybe you got 40 barrels of live gray shrimp."

Tack laughed. "Yeah, and maybe a shark or two to add to the excitement."

Sharks often play havoc with shrimp nets, tearing great rents in them in their wild efforts to escape. The big 65-foot shrimp boats, such as the Olivia Mavar and Pan American Clipper of the Mavar fleet, use a fishing gear known as the otter, or shrimp, trawl. The net is in the shape of a long bag and varies in width from 30 to 100 feet. Wings of netting at each side guide the shrimp into the bag while the "otter boards" at the end of each wing keep them stretched apart and force the net down. Towlines are fastened to the boards.

The Gulf provides practically all of the shrimp consumed in the U. S. with an annual catch of 150,000,000 pounds. Shrimp vessels are equipped to stay at sea for 12 to 14 days. The larger boats are powered by 120-horsepower Diesels, carry two-way radio and the most up-to-date navigating devices. The fishing captains, who know every reef and marker from Mobile to New Orleans and who have spent most of their lives in the open waters of the Gulf, regard these modern aids with a tolerant grin.

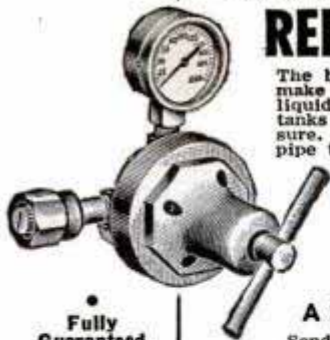
The big Diesel shrimp boats must carry 20 tons of crushed ice to keep a 250-barrel cargo fresh. This is a costly nuisance with which oyster fishermen do not have to bother. Oyster fishing ends before the hot summer weather and during the spring season oysters will keep in their shells on deck or in the holds for about a week.

The best shrimp-fishing grounds in the Gulf, Captain Langlinois explains, are 10 to 20 miles off the Louisiana shores near the mouth of the Mississippi River. Here is where the 8 to 10-inch "jumbo" shrimp were discovered by the Fish & Wildlife Service a decade ago. Before that time no one knew where the Gulf shrimp disappeared after they had spawned.

Compared with oysters, shrimp grow rapidly and reach marketable age in a few months. They spawn but once, at the age of about one year, and then retire to the shoals where they grow to jumbo size and die in

(Continued to page 244)

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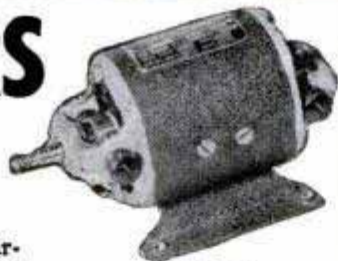
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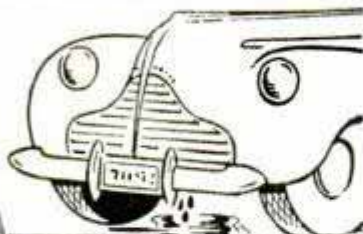
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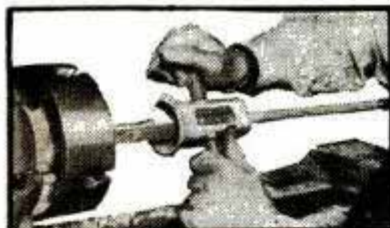
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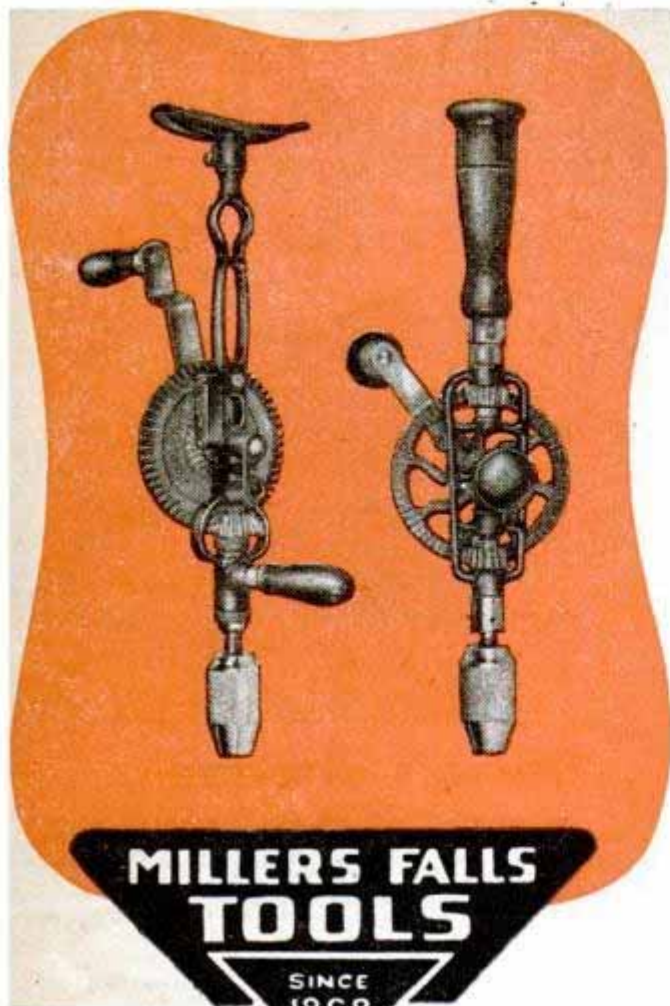
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Whether it's a drill, plane, brace, screwdriver, or some other tool, you'll find one that fits your needs in the Millers Falls lines. But be sure to look for the familiar Millers Falls trademark. It's your guarantee of quality and satisfaction in the tools you buy.

**MILLERS FALLS
COMPANY
Greenfield, Mass.**

about another year. The catch of jumbo shrimp is hailed as particularly valuable because it has increased the yield by millions of pounds without endangering a new crop of this most popular shellfish. Morgan City, La., a fisherman's boom town since 1937, processes 20,000,000 pounds of jumbo shrimp a year.

With native pride, Captain Langlinois reports that Biloxi is the big oyster-canning center of the world with an annual production of about 1,200,000 seven-and-a-half-ounce cans. Another major product of the Gulf and South Atlantic fisheries is crab meat with an annual yield of 33,000,000 pounds. However, more menhaden is caught in this area than all other species of fish and shellfish combined—250,000,000 pounds. This fish is little known to the public because almost the entire catch is used to make oil and meal, the latter a favored food for poultry and livestock. The menhaden is found all the way from Nova Scotia to Florida and the total U. S. annual catch is 600,000,000 pounds.

The big Florida fisheries produce by far the greatest and choicest varieties of fish: mullet, red snapper, Spanish mackerel, kingfish, bluefish, sharks, grouper and redfish. The smaller fisheries supply the market with spiny lobsters, pompano, blue runner, sheepshead, jacks and clams.

The thriving 21-year-old Mavar Company at Biloxi presents a typical setup for shellfish packers. The layout includes a small U-shaped harbor always full of boats waiting to unload or set forth on fishing trips, a newly completed canning plant with oyster and shrimp piers extending out to the boats, two dry docks, a boat building where at least one full-sized vessel is always under construction, warehouses and office building.

As the Elroy, with bins and hold crammed with oysters, makes its way toward the Mavar wharf of a spring evening, the tired crew loaf on the afterdeck. They talk about "layoff" time in the early part of the summer before the heavy shrimping begins. The favorite vacation sport of the crew is—you guessed it—going fishing! But not for oysters or shrimp, and not with dredge or net. Their choice is trout and they find some big ones, Joe says, in the waters near Cat Island about 30 miles out from the Bay of Biloxi.

"We sure missed our boats and fishing during the war," says Elmer Alleman. "All of us except Tack, who's too old, were in the Army. Although we sure tried hard, none of us could get in the Navy." He grinned. "Guess we didn't know enough about boats."

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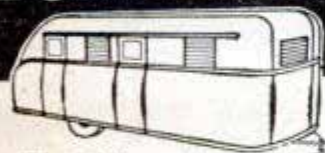
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**AC
SPARK PLUGS**

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

Muscle Men of America

(Continued from page 140)

about an hour and a half after your meals.

It is important to exercise regularly every other day—seven times during a two-week period. The length of the exercise period will depend upon what you wish to accomplish. From 5 to 15 minutes will do wonders for the busy person who merely wants to keep in good physical condition. For those who want to concentrate upon building up their muscles and entering weightlifting contests, from 30 to 60 minutes with the weights is recommended. Three months' regular practice should show marked improvement.

At present, weightlifting is a young man's game. Perhaps 65 percent of those engaged in the sport are under the age of 21. But with barbell exercises you can improve until the age of 50, stay at your peak until around 60 and be in better shape than many men half your age. At the age of 60, for example, John Y. Smith won the title of Strongest Man in New England.

Women, too, are taking up weightlifting to keep in physical trim and to remove avoirdupois. Claudette Colbert, Dorothy Lamour, Paulette Goddard and Joan Bennett keep in shape by a program of weight exercising. In a few instances even women are entering weightlifting contests. We have held several weightlifting contests for women in Los Angeles in recent months.

Weightlifting as a sport has grown enormously in the last few years. It was getting a good start before World War II and, in the two years of peace, has caught public interest. Local, state and national weightlifting contests draw thousands of spectators.

Originally the idea was to lift the greatest amount of weight over your head—regardless of how you got it there. Huge men with considerable excess flesh and large stomachs would hoist a tremendous weight to the chest in from two to four struggling movements and then jerk it overhead.

A modern weightlifting contest, however, puts more emphasis on skill and allows those with less weight and a somewhat more symmetrical figure to compete in their weight division. Weightlifters are divided somewhat like boxers: featherweights, lightweights, middleweights, light-heavies and heavyweights.

The three standard types of lifts are:

(1) The two-arm military press—in which the weight is pulled to the chest with two hands and then, holding the body erect, or in the military position, is pressed to arms' length overhead.

(Continued to page 252)



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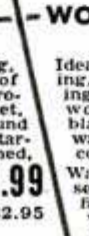
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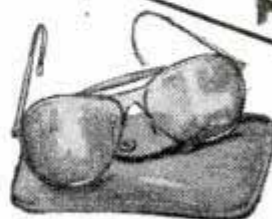
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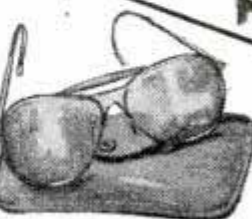
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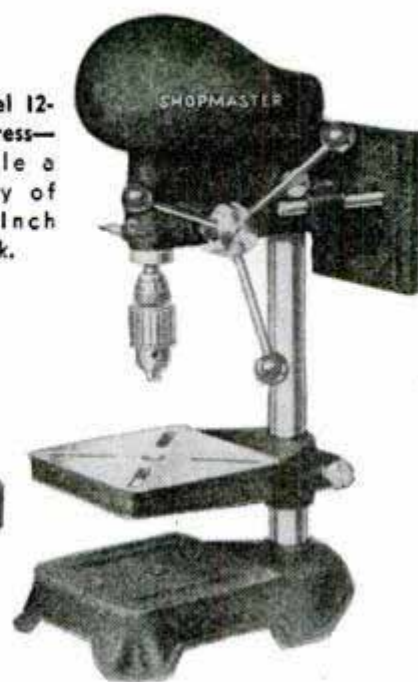
Shopmaster tools are designed for accurate workmanship even under hard usage. Frames are of heavy cast aluminum alloys. Working parts are machined to extra close tolerances. Con-

trols are precise and easy to operate. All are quality tools, priced for the beginner yet fulfilling the requirements of master hobbyists and professional workers.



er Model 15-Inch
g Table Jig

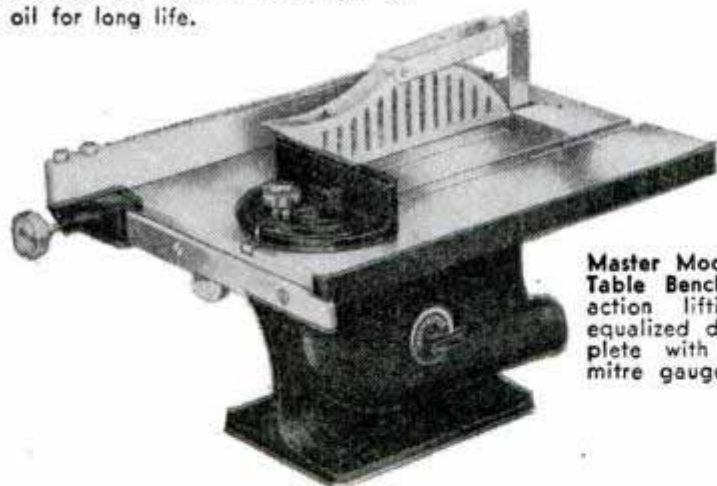
(1) Saw—Meets every demand for exact working. Among its features are an improved blade holder, an efficient blower, large table capacity and a mechanism enclosed in oil for long life.



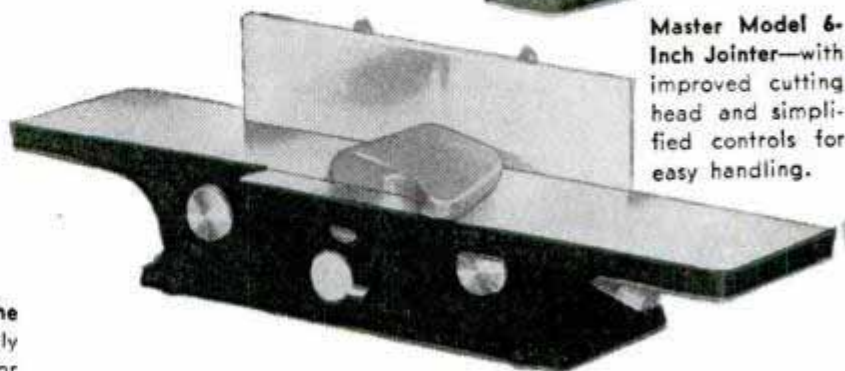
Master Model 12-Inch Drill Press—Will handle a wide variety of work. 1/2-Inch Jacob Chuck.



Master Model 12-Inch Tilting Table Band Saw—with many special features, fully enclosed mechanism, and sealed-for life ball bearings.



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Drop-forged from special analysis steel and given two "super heat treatments" to make a tougher head and stronger claws. Claws have a uniform split and beveled grip that bites into a nail shank. The handle of young, live hickory is in the head to stay . . . the eye pre-shrunk to exclude moisture. Make friends with a Stanley Hammer and have a friend for life.

(2) The two-arm snatch—in which the weight is pulled from the floor to arms' length overhead in one motion.

(3) The two-arm jerk—in which the weight is pulled to the chest in one clean movement and then by using the legs with a jump, is jerked overhead.

Records for these lifts are:

TWO-ARM MILITARY PRESS

Featherweight—Juitsu Nan—Japan—231½.

Lightweight—Fein—Austria—239¼.

Middleweight—El Touni—Egypt—259.

Light-Heavy—Novak—Russia—286½.

Heavyweight—Manger—Germany—319¼.

TWO-ARM SNATCH

Featherweight—Juitsu Nan—Japan—226.

Lightweight—Shams—Egypt—256¼.

Middleweight—El Touni—Egypt—269.

Light-Heavy—Novak—Russia—286½.

Heavyweight—Davis—U.S.A.—303¼.

TWO-ARM JERK

Featherweight—Fiad—Egypt—288¼.

Lightweight—Shams—Egypt—338½.

Middleweight—Ferrari—France—345.

Light-Heavy—Ferrari—France—372¼.

Heavyweight—Kutsenko—Russia—377.

The science of weightlifting should be studied by those who work on farms, on construction projects, in factories or at other jobs which require lifting heavy objects. The United States Department of Labor recently made a study of industrial accidents and its report showed that lifting accidents were caused principally by lifting the wrong way and by those physically incapable of tackling a lifting job.

Other reliable estimates indicate that as much as 25 percent of all industrial accidents cause strain, sprain and hernia. A hernia usually lays up a worker for about eight weeks while a bad back sprain may incapacitate him for 18 to 20 weeks.

A knowledge of the principles of scientific weightlifting would go far toward banishing these hazards. Here are some practical suggestions:

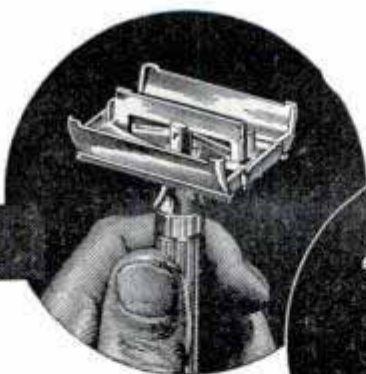
Use your leg muscles, the largest and strongest in your body, when you're hoisting a heavy weight such as a trunk or a basket of clothes. Don't bend over and try to support a heavy object with your arm, shoulder and back muscles. Squat down, grasp the object and straighten up—thus using your big thigh muscles.

Get as close as you can to the weight you're trying to lift. When lifting a wheelbarrow, for example, don't stand back of the handles. Get between them and as close to the load as possible.

Balance your weights as a Chinese coolie balances his burdens on a pole across his

(Continued to page 256)

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See how quick and easy shaving can be... with the modern

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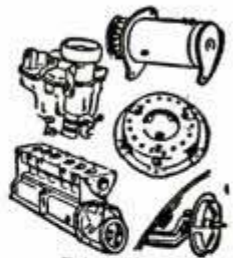
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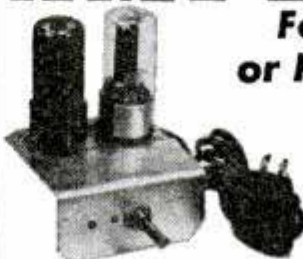
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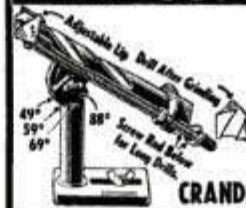
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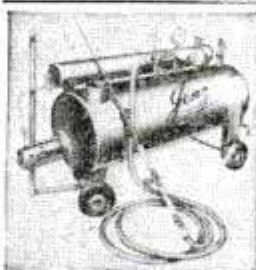
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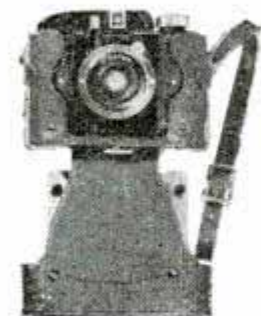
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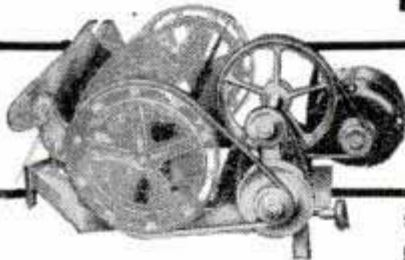


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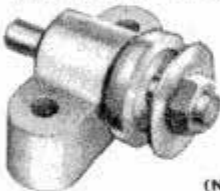


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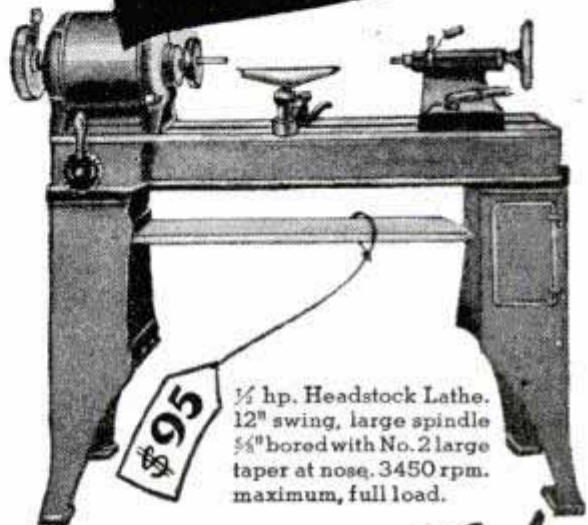
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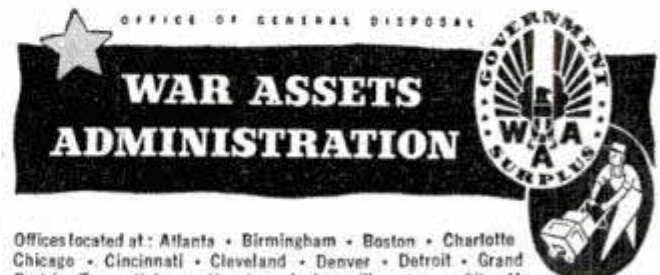
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12" swing, large spindle
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maximum, full load.

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Will seat adult riders as well as boys and girls.

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Weightlifting is no cure-all for the medical ills and aches of 20th Century America. And if you inherited a small frame, it won't give you the physique of Joe Louis. But it will add hard muscles to any man's body and make him feel fitter than ever before. There's only one way to find out—try it!

Greased Lightning Strikes the Flats

(Continued from page 92)

usual and the marker lights on your own big speed course appear to dip below the horizon. You seem to be racing around on a very steep slope.

"The men in the pits sometimes get similar illusions. Now and then, they tell me, my car seems to be suspended in the air hundreds of feet off the ground at the far side of the course. They can actually see a distant mountain under my wheels."

Jenkins' proposed one-mile car with which he hopes to challenge Cobb's record is in the preliminary planning stage. Ed and Bud Winfield and Leo Goossen of Los Angeles have designed a machine that has a theoretical top speed of about 450 miles per hour. This, of course, is faster than most aircraft can fly.

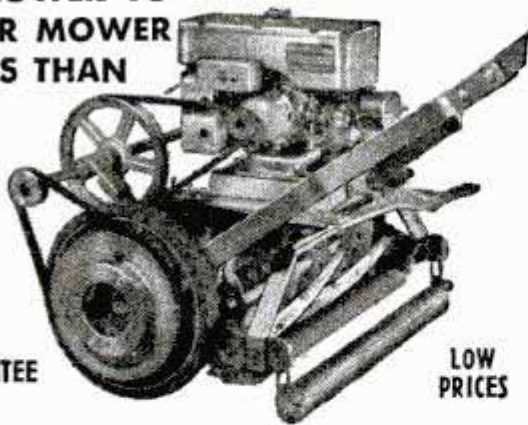
The American challenger would have less powerful engines than the Napier-Railton but also would be smaller and lighter. It would weigh 2½ tons, about one ton less than Cobb's machine. Specifications are: length, 21 feet; wheel base, 140 inches; height, about 30 inches; power plant, two specially built supercharged 1000-horsepower engines.

Each power plant would be connected to one pair of wheels and each would be ice cooled. The only opening in the body would be that of the carburetor air intake.

Radically streamlined, the car would be low and flat with a high fairing along each side to house the wheels. This design provides a channeling effect that reduces the frontal area and causes the air to sweep straight back over the body, contributing to stability. To fit into the car the driver would lie in a semireclining position.

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\$18⁹⁵



Sturdy 15-Jewel ELGIN men's wrist watches. Waterproof. Sweep second hand. Stainless Steel back. Unbreakable crystal. **QUALITY!** American made. Fully reconditioned with **ONE YEAR GUARANTEE!** Made for the U. S. Army Air Corps. They **HAD** to be good. **SEND NO MONEY.** Simply pay postman \$18.95 plus 10% tax and postage on delivery. Cash orders sent postpaid. Limited supply. **UNITED PRODUCTS CO.,** 7941 S. Halsted St., Dept. WES-309, Chicago 20, Ill.



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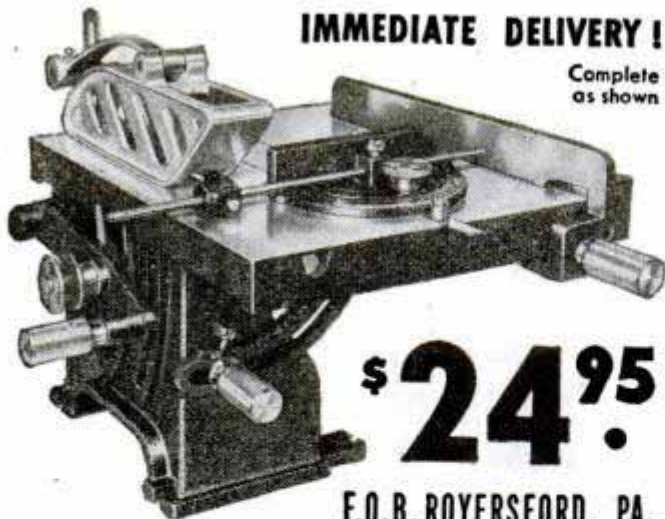
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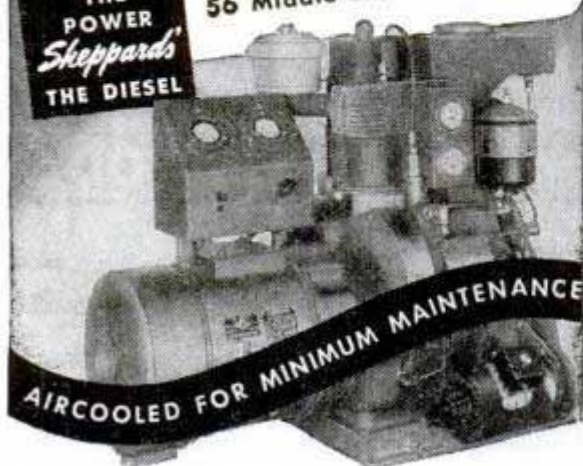
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Generating sets to 36,000 watts. Power units to 62 H. P.

New "THERMO-SAW" (CUTS WITH HEAT)
MAKE THINGS FOR THE HOME or FOR SALE

• Any Child Can Use It!

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CUTS RAPIDLY AND CLEANLY THROUGH WOOD AND OTHER MATERIALS... AN IDEAL GIFT! Difficult patterns are made QUICK and EASY... No turning of work... Cuts in every direction... Cuts plywood 1/8" or 1/4"... Cuts 14"x36" board... Special Transformer produces high frequency current in a tough steel wire "blade" from ordinary Alternating (AC) current. No radio interference. IMMEDIATE DELIVERY!



Machine Measures 11x4 ONLY 3 1/2" High, Throat 7" **\$4.50** Deep. PATTERN FREE. Postpaid COMPLETE SAW outfit as illustrated with transformer and 12 spare blades. READY TO USE.

NOTE: Operates on 110 volt Alternating (AC) Current: 50 to 60 cycle. NO C.O.D.'s

ORDER \$4.75 in Canada and TODAY Mexico. \$5 Elsewhere.

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- Mack Saw Blades, High Speed, Star Moly 10-32. Listed for \$40 per gross, Our price \$130 Doz., or \$12 gross.
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 - Roll, Brown Duck, 26"x52"—49 Pockets \$1.25 Ea.
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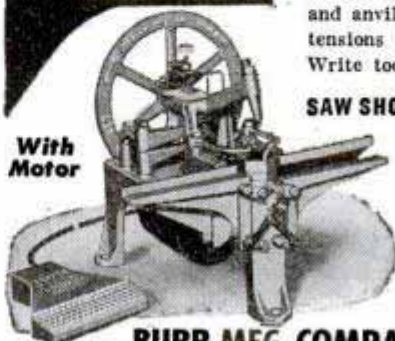
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Make Things From
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Radio, Fun Maker, Microphone, under pillow speaker, ear piece for hard of hearing all in one. Very small unit. For home, camping, trips, etc. Send no money. Order today. Be first in your gang. Pay postman \$2.99 plus C.O.D. Postage on delivery.

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Kills the fleas Quickly! Keeps others off for Days.

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- All-steel frame
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Comet Motor Scooters are handier than a second car for the family! They're easy to ride, economical—they go more than 90 miles to the gallon—and ideal for any use. Ride a Comet to and from school or work, for easy shopping (no parking problem), for deliveries, after-school jobs, sports, vacation trips, fun on the highway. There are four Comet models. All are lightweight, safe, durable. Send coupon below for free booklet.

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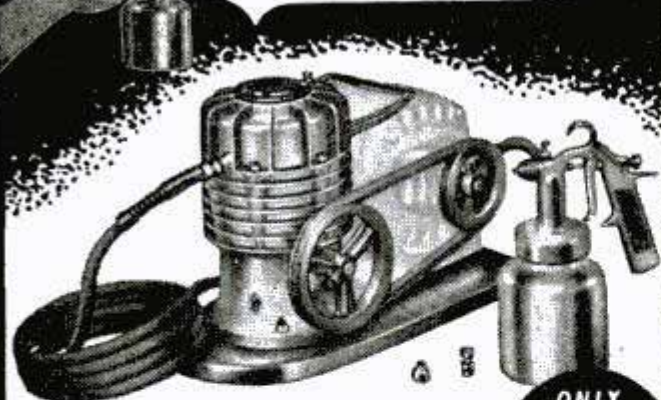
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"Bad Man" of the Elements

(Continued from page 108)

bright, say scientists who study the stuff.

For instance, one forecast says that a fluorine compound soon will be used to produce a lubricating oil so stable that it will stand up under the most rugged of present-day mechanical operations and make practical new engines that are impossible today because no lubricant can withstand the terrific pressure and friction. Incidentally, hydrofluoric acid is now being used in petroleum refineries to produce high-octane gasoline, and sodium fluoride is added to the water supply of several cities to reduce tooth decay.

Elemental fluorine will also be used, say the scientists, to manufacture a gas that is a nearly perfect insulator for the tremendously high voltages used in modern X-ray and other electronic work.

Then there is a new line of chemical tools for industry formed by compounds known as the metal fluoroborates. Sodium fluoroborate is coming into use as a preservative for protecting wood against insect attack, as a cleaning agent to remove iron stains in laundries, for cleaning stone and concrete surfaces and for exterminating bugs and rats.

The fluoroborates of lead, tin, copper and zinc are proving superior for high-speed industrial metal-plating processes. Potassium fluoroborate is an excellent fluxing material in the welding of numerous metals.

Some of the other products using fluorine which soon will be available include heat transfer materials, better insecticides and solvents, germicides, superior anesthetics, fireproofing materials, plastics, weed killers, fumigants and synthetic rubber with improved insulation qualities.

That's a brilliant, law-abiding record for the former "bad man" of the elements.

Florida's Cold Spot

(Continued from page 101)

into position where close observation within the hangar is necessary.

To whip up 100-mile-an-hour winds there's a mobile unit with a 53-inch fan, driven by a 250-horsepower motor. Sand and dust fed into its hoppers will do a thorough job of duplicating nature's harshest storms. Another device is being built to test landing gear in a manner simulating landing and take-off operations.

As a check against carbon monoxide and explosive vapor, an electrical detecting

(Continued to page 264)



MOTO-TOOL ★ THE "POCKET-SIZE" MACHINE SHOP



Moto-Tool Kit No. 2, with 23 accessories (high speed steel cutters, grinding wheels, polishing accessories) and heavy-duty professional Model 2 Moto-Tool in natural finish, hardwood case... **\$23.50.** (Items purchased separately would cost about \$30.00; you save \$6.50.)
Moto-Tool No. 2 with one emery wheel point... **\$16.50.**

"MAN... WHAT A POWERHOUSE!" A TOOL THAT PACKS YEARS OF PLEASURE

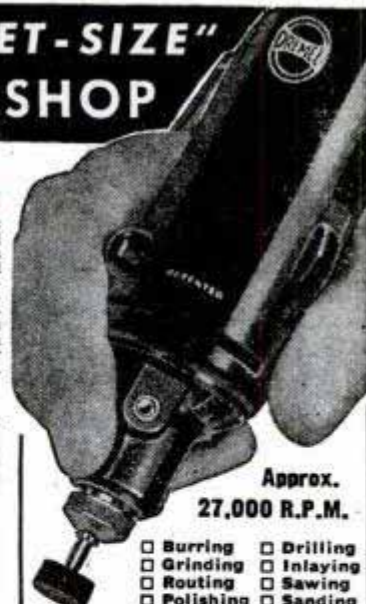
Here's a tool to please a man's heart... one that holds promise of endless creative hours. Dremel Moto-Tool... the little grinder that does big jobs... is a "war veteran"... used by all branches of the armed forces in far-flung repair bases... helped set production records at General Electric, Westinghouse, Remington Arms, Ford and others. Hobbyist or expert craftsman, first choice is Model 2 Moto-Tool Kit with its handsome felt-lined, highly finished wood case with rows of tools begging to be put to work. Write for FREE catalog of Moto-Tool attachments and accessories.

MOTO-TOOL FEATURES:

Oil-less, sealed bearings • Patented automatic chuck lock pin • Over-size armature shaft, hardened, ground, polished • 110 Volt, AC-DC motor • Sliding snap-type switch • Cord protector • Shockproof bakelite housing • Dust-filtered, air-cooling system • Weighs only 13 oz. • Dynamically balanced for vibrationless operation.

MONEY BACK GUARANTEE: Buy Dremel Moto-Tool and Accessories from your dealer. If he cannot supply you, order direct from factory on 10 day trial. Shipped postpaid for cash in full; or for \$2.00 sent C.O.D. for balance plus postage.

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 Racine, Wisconsin



Approx. **27,000 R.P.M.**

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- Grinding
- Routing
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AMAZING NEW Star SCIENTIFIC GAS BURNER for

Automatic, Self-Acting • Needs No Adjustments • Jet Type • Cannot Backfire • Powerful in Performance Natural, Manufactured or Butane Gas

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 Please rush.....Aridex Plaid Fibre Seat Covers @ \$2.98 each or 2 for \$5.00, as checked below:

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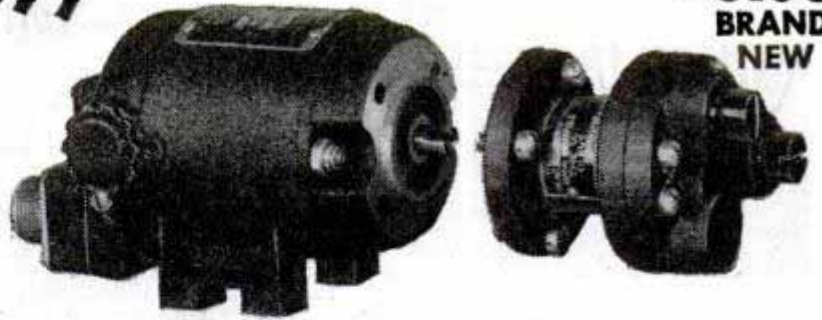
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Set No. 207 includes:

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- 8-page Folder Soldering Instructions
- Two sizes of Copper Tips
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COMPLETE
No Extras Needed

For soldering tin, brass, copper, etc. A necessity for every home workshop. Ideal for general repair, model, hobby, electronic, radio work, and other hard-to-reach jobs requiring exactness and speed. New 20-watt design gives 100-watt performance.

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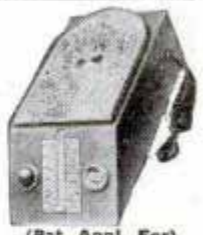
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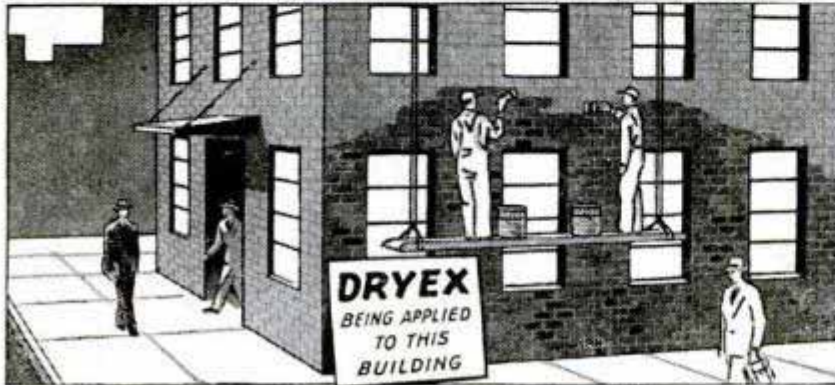
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The **SEAMAN TILLER** helps produce better yields by: (1) thorough soil pulverization; (2) hastening and promoting earlier and more complete seed germination; (3) milling fertilizer and green manure into the *Growing Area* of the seedbed; (4) helping to increase the supply of nitrogen through seedbed aeration; (5) eliminating "Air Pockets" and hard plow soles; (6) helping to destroy many crop pests and certain varieties of fungus; (7) providing more effective weed control; (8) reducing soil erosion.

SEAMAN ROTARY TILLERS are available in both power take-off and motorized models, 3 ft. to 7 ft. tillage widths. Write for complete information.



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Now you can enjoy *fully automatic* heat in your home by installing it yourself simply and quickly with a few tools. You can save at least \$150.00 in your spare time! The Delta Oil Burner comes completely assembled along with everything necessary for the complete installation by you for the low price of only \$195.00. Includes the famous Delta Photo-Installation Manual showing step-by-step photographs of an actual installation. And—you need not pay a single penny to get the Delta Oil Burner because a simple deferred payment plan is available. Just send the coupon below for full information and free brochure in color describing how you can install and enjoy *fully automatic* heat in your home. Mail today!

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IT'S FUN TO CUT GRASS!

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LAWN and GARDEN TRACTOR

36-inch
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system continuously draws air samples from eight points in the hangar and four in the engine test chamber. If the concentration of either reaches a danger mark, a horn or bell sounds and a red light pin-points the offending area.

Extreme precautions are also taken against fire, another hazard of aircraft testing. All areas are covered by water fog, foam and stream systems, along with hand extinguishers and lines that lead to 15,000 pounds of carbon dioxide. As a last resort a deluge system can saturate a fire site with 600,000 gallons of water in an hour.

While the hangar takes care of large-scale projects, there are eight other locations in the building particularly suited to specialized testing. Largest is the engine and equipment room, believed to be the best equipped in the world for testing both jet and piston engines. The inertia block beneath the test stand is completely isolated from the floor with cork to prevent any vibration of engines from affecting the rest of the building.

An all-weather chamber is used for physiological proof testing of personnel and personal equipment under extreme conditions. It is insulated with 12 inches of corkboard, covered by a stainless-steel interior liner. Because of its smaller size, temperatures in this chamber can be brought down from 170 above to 70 below in 26 hours. A rain-and-mist-generating apparatus simulates a fall of 15 inches per hour and the room can be partly filled with water for testing such items as life rafts and immersion suits.

In conjunction with the all-weather room there's a strato-chamber to make further tests at various altitudes and their corresponding temperatures. In preliminary trials the chamber has "flown" to 100,000 feet and a minus 104 temperature. In just three minutes it can go to 50,000 feet and 70 degrees below zero.

Small items can be tested at a much lower operating cost in the five remaining test rooms, all of which are about 13 feet square. The jungle, tropic-marine and desert cells can operate long periods at cycled day-and-night weather conditions, allowing more accurate checks on long-range weathering effects. Two others, the hot and cold chambers, can be held at extremes for an indefinite time.

Though the weather factory represents a \$10,000,000 outlay, officials believe it will save more than that in a short time. In addition to canceling the need for many large government research expeditions, it will probably be made available to industry for research at an appropriate cost.

First Choice

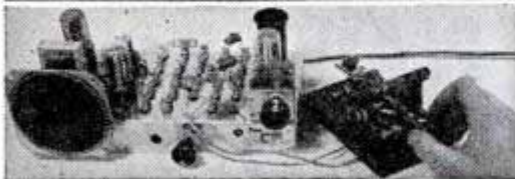
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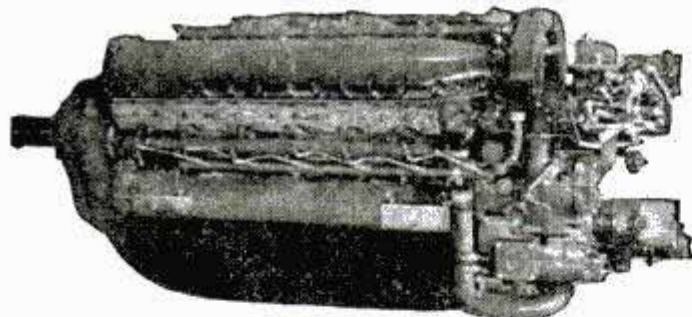
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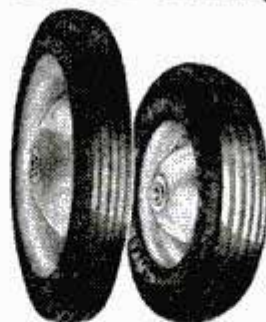
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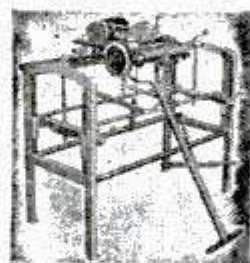
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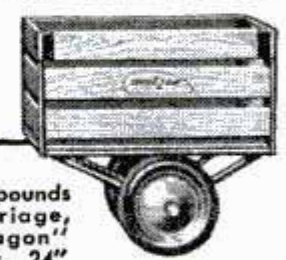
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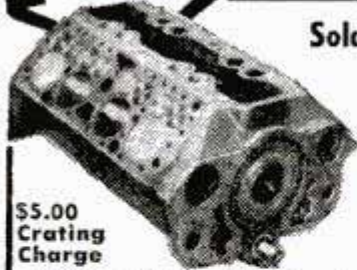
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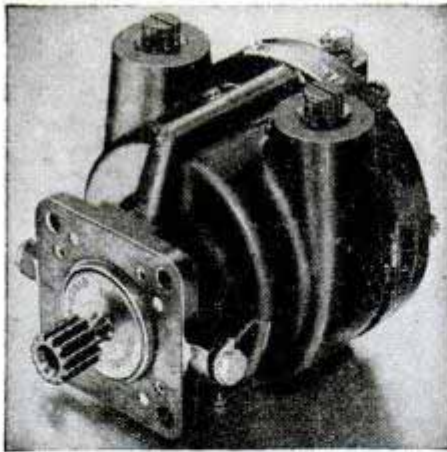
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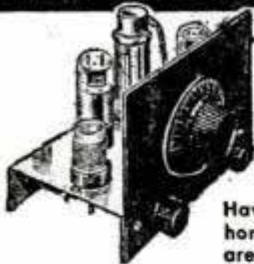
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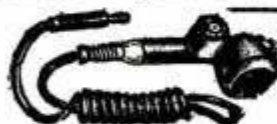


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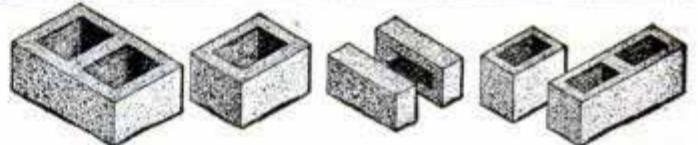
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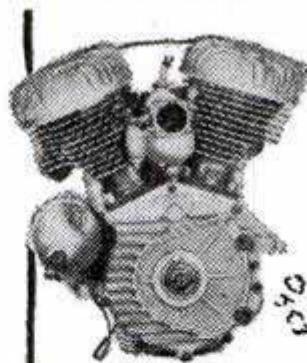
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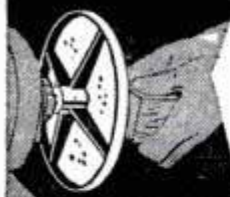


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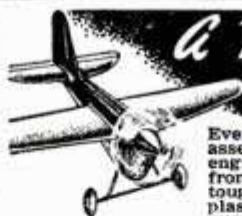


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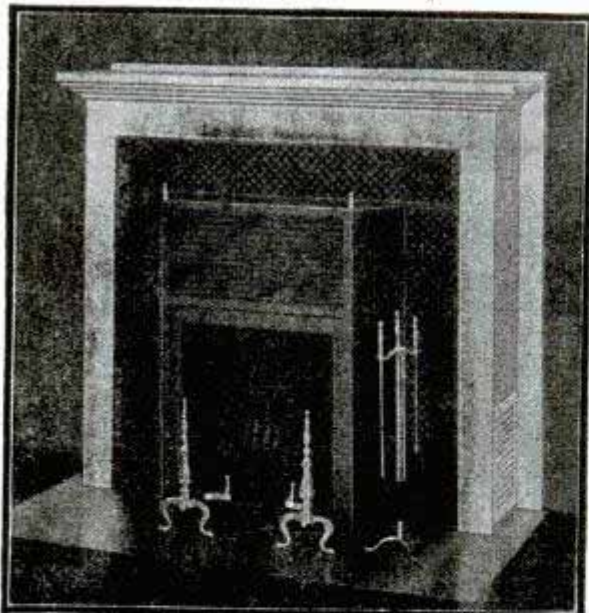
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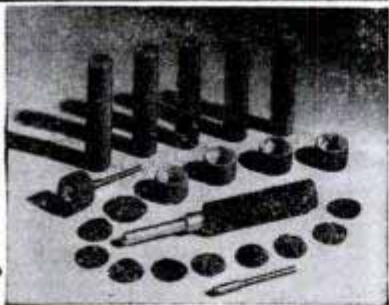
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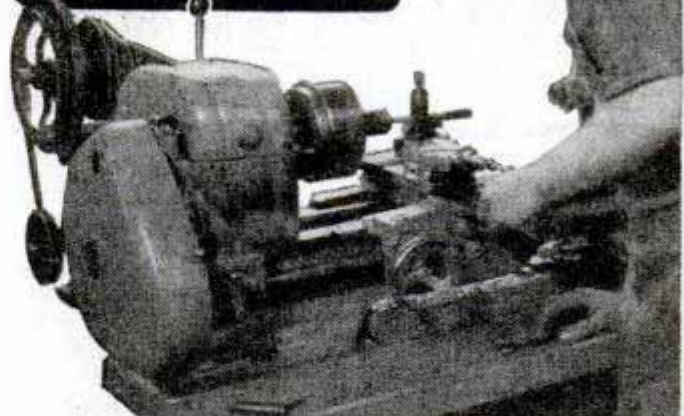
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6"-10"
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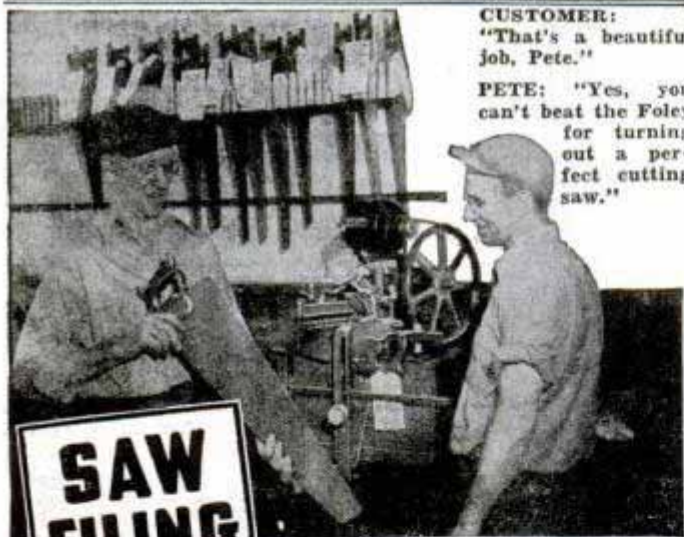
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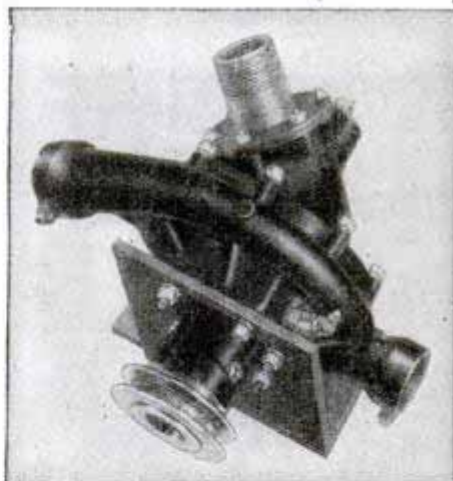
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READY TO USE ON ANY PUMPING NEED

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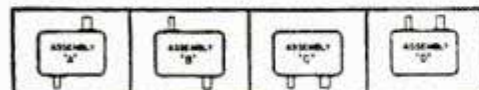
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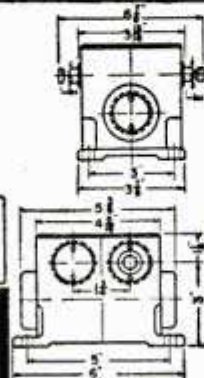
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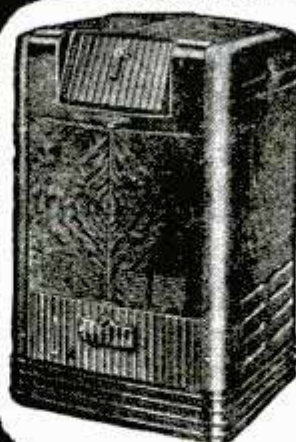
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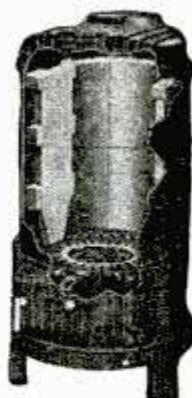
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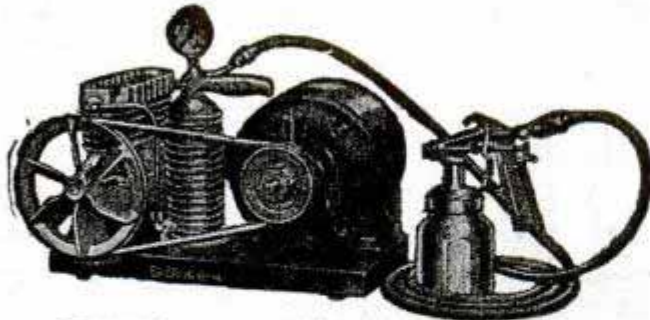
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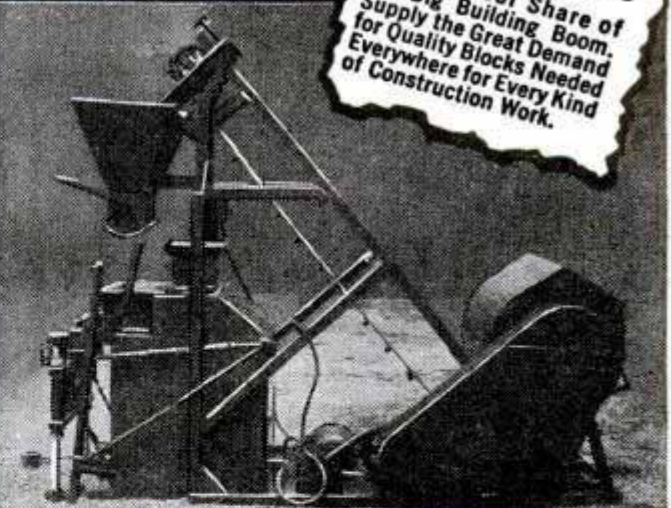
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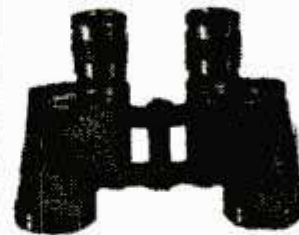
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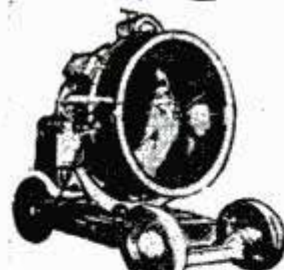
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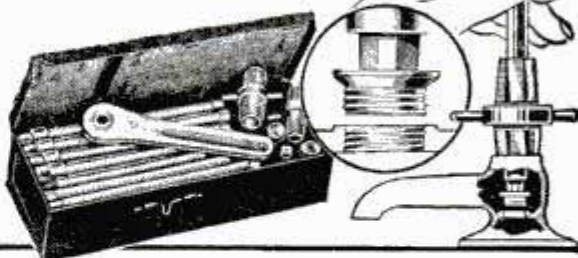
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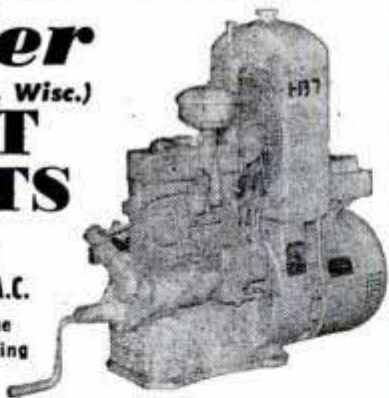


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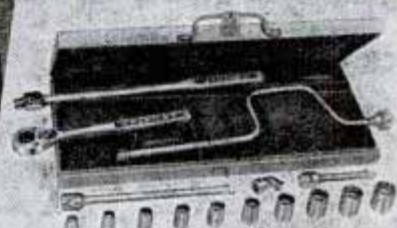
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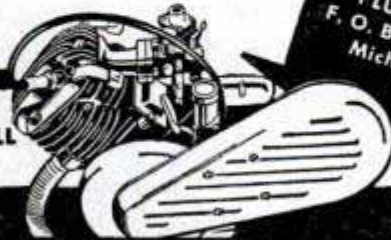
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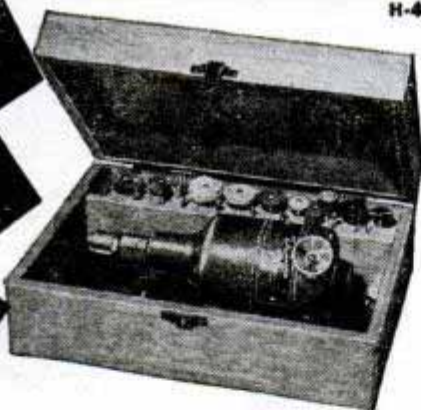
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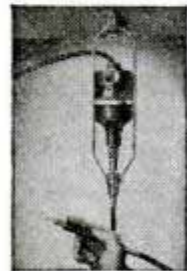
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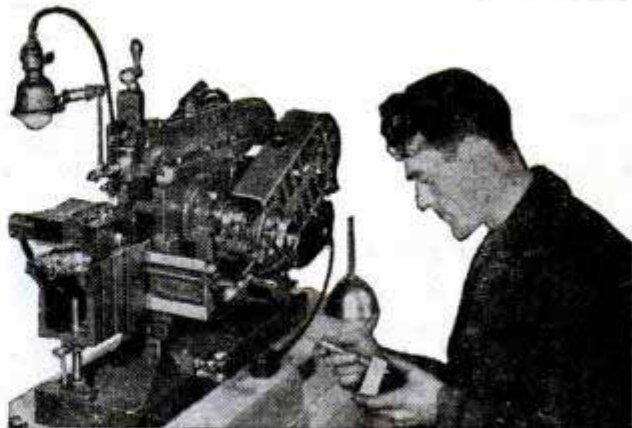
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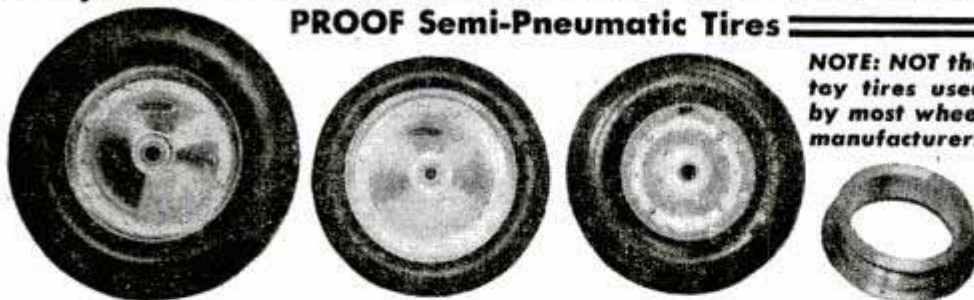
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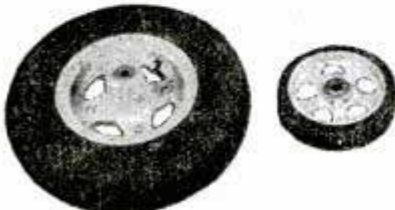
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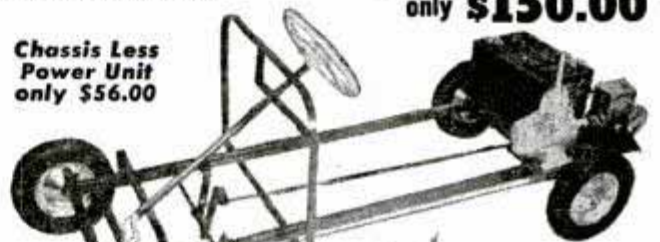
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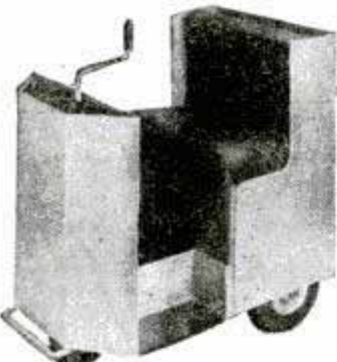
only **\$150.00**

Chassis Less Power Unit only **\$56.00**



Electric Motor only **\$33.50**

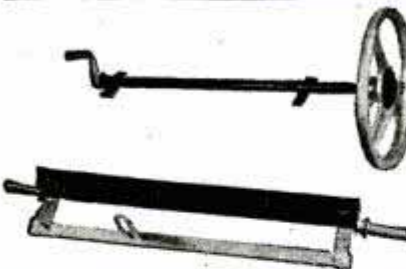
Electric WHEEL CHAIR For Any Age



Four Speeds Forward and Reverse. Runs on 2-6 Volt Auto Batteries. Steering, Power and Brakes, hand operated. Built-in Battery Charger. Runs 6 hrs. on level at 6 miles per hour. 40" long, 28" wide by 40" high. Ideal for homes, hospitals, plants and amusement centers. Our 12"x2 1/2" Ball Bearing Wheels in rear and 10"x2 1/2" front. Turns in less space than its length. Driven by 12 Volt Motor through a 18 to 1 ratio Boston Speed Reductor, V-Pulley and Belt to left rear wheel. Ruggedly built to give miles of trouble free travel.

Less Batteries Prepaid anywhere in U. S. A. only **\$275.00**

Front Assemblies

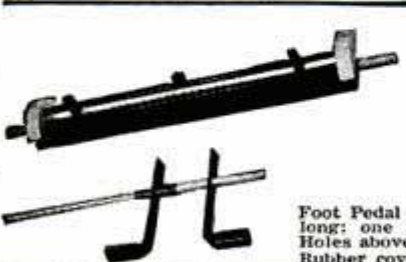


12" Aluminum Steering Wheel with semi-hard rubber center dome. Steering rod, Steering column and mounting brackets.

OR—
Auto type Front Axle—30" wide 5/8" dia. 1 1/2"x2" channel, tie links, tie rod and loop.

Either of above only . . . **\$5.50**

REAR ASSEMBLIES



Rear Axle 5/8" dia. 30" long with channel iron brace and internal Maple Brake Shoes to fit our Combination V-Pulley and Brake Drum Unit. Only . . . **\$5.50**

Foot Pedal Assembly 1/2" dia. rod 20" long; one pedal fixed, the other free. Holes above and below shaft. Rubber covered pedals. Only **\$3.00**

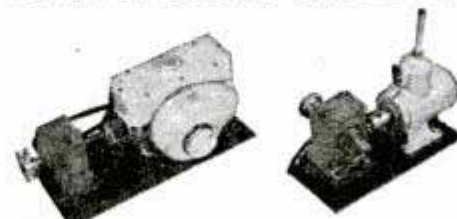
Homecrafters TREASURE KIT

- 2 pieces 3/4"x1 1/2"x1 1/2"x24" long Channel
- 2 pieces 1"x1" Angle 24" long
- 2 pieces 7/8"x1/4" Bar 24" long
- 2 pieces 2"x1 1/2" Flat 24" long
- 2 pieces 3"x1/2" Flat 24" long
- 2 pieces 5/8" dia. x 24" long Round

The above Material to Build Your Project, ONLY **\$5.00**

ADD 10% FOR PREPAID SHIPMENT IN U. S. A.

GASOLINE AND ELECTRIC POWER PLANTS



17 lb. 1 H.P. "Powers" Gasoline Engine; easy starting with Boston 9 to 1 or 18 to 1 ratio Speed Reductor, pulleys, tension idler and V Belt, mounted and READY TO RUN. **\$99.50** Only . . .

12 Volt D.C. 1/3 H.P. Electric Motor with FOUR Speed Control, flexible coupling, tension idler, pulley and base, 9 to 1 or 18 to 1 ratio Boston Speed Reductor. Only . . . **\$65.00**

NOTE: If you desire the shipment Prepaid simply add 10% to your remittance on all items except the Chassis. Without Power Units add 15%.

When requesting circulars please include 10c to cover cost of mailing.

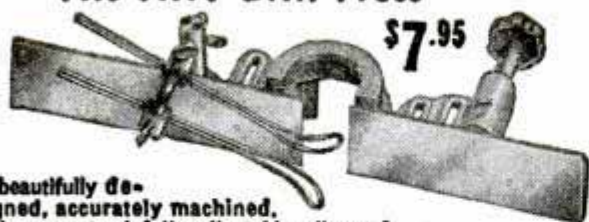
OSBORN WHEEL COMPANY, 115 So. Main St., Dept. P-8, Doylestown, Penn.

RUSH YOUR ORDER

It's Here!

BARRON ALL METAL SHAPER FENCE

Fits ANY Drill Press



\$7.95

A beautifully designed, accurately machined, fully guaranteed, fully adjustable, all-metal shaper fence. Made throughout of aluminum and non-rusting steel. No cast iron—no wood! Complete with anchor bolts, 2 hold down springs. A real value. See it at your dealer or shipped direct

FAMOUS 5-IN-1 DRILL PRESS PLANER

Planes-Rabbets
Panels
Tenons
Grooves

\$7.50

COMPLETE

NEW 2 1/2" DRUM SANDER

Fits All Makes
of Drill Presses
or Motor
Shafts

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Includes 5
sanding sleeves



OTHER DRILL PRESS ACCESSORIES

4" ROTARY SURFACE SANDER \$5.95 1/2" DOVETAIL CUTTER \$1.95
ALL-METAL AUXILIARY DRILL PRESS PLANING AND SHAPER TABLE \$9.85
TAPERED AND THREADED SPINDLE ADAPTERS
ROUTER AND ROUND END MORTISING BITS 1/8" TO 1/2" SET OF 6 \$9.50

Liberal 10 Day Money Back Guarantee

Workshop Guide FREE

BARRON TOOL CO.

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BARRON PRECISION TOOLS WORK SHOP

TABLE SAW ATTACHMENTS



fit any saw . . . SHAPER HEAD

Fits 1/2", 3/8" or 3/4" shaft . . . three 1" wide hardened and ground high speed steel knives furnished, other shapes available. Body is cast steel, precision made and balanced. When ordering specify side of saw (when facing saw) snapper is to fit. 3 3/8" diameter size . . . \$14.95
4 1/2" diameter (hole size 1" to 1 1/2"), prepaid . . . \$16.95



GROOVE-MASTER

for grooving, dadoing, tenoning, etc. Cuts with or against grain. 5 1/2" dia. with 5/8" or 1 1/2" shaft hole. Set consists of two—3/32" thick outside saws plus six—1/16" thick inside filler cutters, prepaid . . . \$5.95

Money Back Guarantee: these attachments are guaranteed as advertised and as to quality or your money back.

Immediate Delivery

ORDER DIRECT

UNIVERSAL TOOL CO.

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Send me the following postage prepaid.

- SHAPER HEAD Diameter _____ Hole Size _____ Side of Saw _____
 GROOVE-MASTER Dado Set _____ dia. hole _____
 I enclose _____ in check or money order
 Ship C.O.D., deposit of \$1.00 enclosed on each item ordered

NAME _____

ADDRESS _____

CITY _____

STATE _____

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Fix it with *Mortite*

a household friend

Shut out dirt and dust! Press pliable Mortite around windows, doors, baseboards, etc. It's done in a jiffy. Keeps out ants, insects; fine for caulking, stops rattles; the ideal weatherstripping. Roll covers about 80 ft. At Hardware, Paint, Dept. Stores, Lumberyards. Write for free booklet.

\$1.25 Higher West of Rockies and Canada

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VEST POCKET SIZE

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Each Baby Calculator in Beautiful, rich-looking Leatherette case—at no extra cost. FREE!!



UP TO
SAVE 85%

in WAR SURPLUS...SENSATIONAL VALUES
IN MANY ITEMS WE HAVE
THE WORLD'S LARGEST SUPPLY
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New Hydraulic Cylinders
VALVES, PUMPS, FITTINGS, HOSE & TANKS
The World's Largest Supply. 1001 Labor Saving Adaptations for pulling, pushing, lifting operations.
Finest precision workmanship and materials. Liquid and/or air operation, developing terrific power.
15% OF GOVERNMENT COST!
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A Real Buy!
A 1001 USES!
WINCH HOIST
Capacity 2500 lbs. Controlled worm gear drive winch, with 19 ft. 1/4" diam. alloyed steel cable. Ideal for garages, truck loading, machine shops, boat building, etc.
#100A Without handle... **\$10.75**
#100 With handle... **\$12.50**



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NEW! FULL STRENGTH For portable Radios, Signal Lamps, Boats, Electric Trains, etc.
#516 9 Volt 8 1/2 x 6 x 4 in. 3 run, 24 Volt Motor... **79c**
#515 90 & 1 1/2 Volt... **69c**
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Pistol & Gooseneck Type
#180 100 Uses, Chipping, Peening, Drilling and Breaking down body work
Chicago Pneumatic, Cleco, Ingersoll Rand Makes.
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\$55 Value
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PNEUMATIC ALLIGATOR SQUEEZER
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6 COMPARTMENTS
Rustless, Stainless Steel. Can be used for cooking as well. Ideal for restaurants. The perfect companion for that vacation trip, barbecue picnical. Saves dishwashing.
#311
NEW - 79c ea.



PLEXIGLASS DOMES
15"x19 1/2"x6" deep. 1/4" thick.
Can be used for home hot-house, fish bowl, washbowl, ornamental light. Can be flattened in oven and will make flat sheet 15"x19 1/2"x1/4". Weight 3 1/4 lbs.
#700 **\$1.69**
Also 200,000 lbs. of other plexiglass sizes and shapes.



NEW Amplidyne Motor-Generator
With 24 volt current, it gives 60 volt output. This unit has been adapted to independent coil and rind lighting power.
Welding and many other uses.
Weight 28 lbs.
Gov't. Cost Approximately \$237.00
#311
A Steal at **\$8.95**



AIR DRILLS
CLEVELAND THOR CHICAGO PNEUMATIC 1/4" JCB Chuck
Straight \$17.95
Angle Drill \$19.50




WINDSHIELD WIPER KIT
1/8 H.P. 24 volt, D.C. series wound motor, with 30" flexible shaft, switch circuit breaker, 10,000 forward or 5,000 reverse R. P. M.
Wiper & wiper bracket, or 2 in blade & switch.
only **\$7.95**



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24 PIECE
Make beautiful Jewelry, boxes, bookends, etc. for Pleasure or Profit Kit contains Lucite & Plexiglass material, 3 colors of dye, cement, and book of projects and easy-to-follow instructions for cutting, fabricating, carving, drilling.
#701 **\$2.39**




OPTICAL GYROSCOPE!
MARK 18 GYRO-SIGHT
An engineering marvel worth hundreds of dollars - Our Price **\$8.35**
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ELECTRIC DRILLS
CLARK and THOR
110 V. A.C. 50,000 cycle, 1/4 inch bit & JCB Chuck. Both side and trigger handle. High Speed. For commercial or home use. The best there is. Gov't. Cost Approx. \$60.00
A TERRIFIC VALUE **\$17.95**



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Stainless steel, shatter proof, 400 lbs. sq. in. G-1 2100 CU. IN. 26 x 12 in. #105 **\$4.75**
D-2 500 cu. #104 **\$2.25**



COMPASSES
#151 Marching, lensite, with luminous dial... **\$1.69**
#152 Matchbox, both jewel & liquid floating dial... **33c**
#153 Jeweled Pocket Watch Compass... **\$1.19**
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Electric GYRO PILOT Assembly Part
2 solenoids for reverse and forward motor control. 2 solenoids throw clutch to engage drive. With brake assembly. Can be used as boat rudder control, converted for lathe tapping and slow speed motor tool, wt. 29 lbs. Finest precision workmanship.
Cost Gov't. Thousand \$8.95
Your Cost **\$8.95**



1/3 to 1/5 Gov't. Cost (approx.)
Air Corp. Fleece-lined
LEATHER JACKET
To keep you warm in the coldest wind.
• Made to last practically a lifetime.
• Full sheepskin gab.
• Fleeced-lined collar.
• Leather tipped seams.
• Full length zipper.
• 2 slanted, deep, slash pockets.
• Adjustable strap & buckle at throat.
• Type D-1. Dyed for easy, hand-free action.
• Soft, elastic, "aviation type" leather.
Made to U.S. Gov't. specifications - "out and in!"
Sizes: #401, small; #402, medium; #403, large.
YOU'VE NEVER SEEN THEM AT THESE PRICES. RECONDITIONED, CLEANED AND BRUSHED.
PERFECT CONDITION! **\$8.95 WHILE THEY LAST!**



Valuable GEARS BARGAINS
#112
#1 Rate Spindle Drive #110... **\$2.98**
4 to 1 with screw shaft #111... **\$4.95**
Reversible #112... **\$3.25**
#113 1 to 1 Gear type... **\$1.19**
#114 2 to 1... **\$1.14**
#115 3 to 1... **\$1.10**



All Purpose HAMMER
As a hammer combination for wood & metal work. 3 1/2 lbs. 14 1/2" hardwood handle, hard steel cutting edge.
69c
Compound METAL SNIPS
Action
Hard steel blades. Expansion spring. Locking device.
New **\$2.59**



SLEEPING BAG
NEW! 100% wool. Mummy type. Heavy duty 30" zipper.
\$1 extra Gov't. cost \$22.00 for use **\$1.95**
water repellent cover.



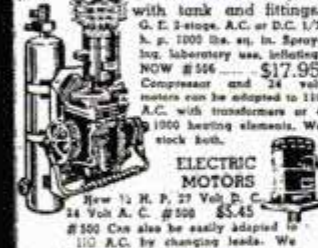
ELECTRIC SOLDERING IRON
#198
200 WATT "SOLDER MASTER" **\$3.95**
105, 110, 120 Volt
Nul-Sed



RUBBER GOODS
#201
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#203
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COMPRESSOR complete with tank and fittings.
G. E. 2-stage, A.C. or D.C. 1/2 h.p. 1000 lbs. sq. in. Spray-lub. laboratory use, inflating.
NOW #506... **\$17.95**
Compressor and 24 volt motor can be adapted to 110 A.C. with transformers or 4 1000 heating elements. We stock both.
ELECTRIC MOTORS
New 1/2 H.P. 27 Volt D.C. 24 Volt A.C. #508... **\$5.45**
#509 Cdn. also be easily adapted to 110 A.C. by changing leads. We have direct & drawing for \$1. extra.



COMPARE THESE PRICES
#301 CANTEEN, 1 qt., alum., plastic top... **29c**
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Sponge Rubber Frame...
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Rivets, spacers, nuts, clamps, bolts, gears.
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A gold mine... **\$1.19**



Fire Extinguishers
Kiddie Lux CO2 Type
Built in Gov't. Spec. 4 lb. Trip. con. with horn. fully recharged.
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7 1/2 lb. Weigh. Portable Control \$70.00 value #64 \$7.50
indispensable for small or large planes, trucks, auto, home, factories, etc.



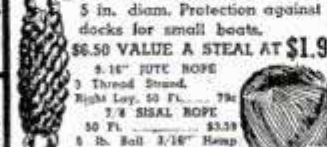
LEATHER FLEECE-LINED BOOT INSERTS
For hunting or around house as slipper, sizes: medium.
\$7.00 Value \$1.89 pr.



BEARING MIX
Needle, ball and roller bearings in excellent assortment. Sizes from 1/2" to 2".
#170 Introducing this shell treasure - Assortment of 15 Bearings at... **\$2.95**



#313 BOAT FENDER-21 in. long 5 in. diam. Protection against docks for small boats.
\$6.50 VALUE A STEAL AT \$1.95
#314
4.16" PUTE HOPE 2 Thread Strand, Night Lay, 50 Ft. #314
3/4" SISAL ROPE 50 Ft. #315
5 lb. Ball 3/16" Hoop Twice Treated #316



CLAMPS
Adel Aluminum, rubber lined. Mixed. #121 4 dozen... **89c**
Aero-Seal, Rust Resistant. Slotted with screw top. 1/2" to 3". #120 Regular 27c
Now 10c \$1.00 doz.



HORSEHIDE WORK GLOVES
ALL LEATHER GAUNTLET TYPE REINFORCED PALMS & FINGERS STITCHING.
LENGTH 13 1/2" #291 **\$1.95 pr.**
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Barbed wire, welding, all purpose work gloves.
A Steal... Gov't. cost many, many times more.



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Send 25% deposit with C.O.D. orders. Also Aircraft Supply Catalogue

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New, Original Box, Type B-14 Lap Safety Belt. Adjustable - full length 48", width 3". Forged steel, foot proof safety catch. Ideal for planes, jeeps, fun rides, farm equipment, etc. Try to beat this at **99c**



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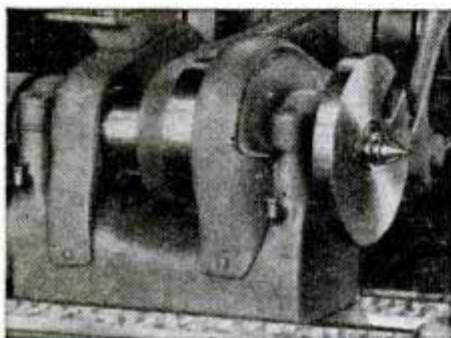
SOUTH BEND 9" LATHES

South Bend 9" Lathes are the answer for men who are not satisfied with mediocre shop equipment. Built for industry's finest toolmaking, experimental, and production work, their use makes it possible to duplicate industrial performance in small shops. Their accuracy, versatility and ease of operation will improve your craftsmanship.

Made in three models
priced from \$145.00

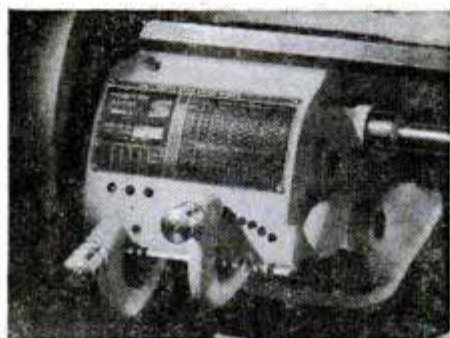


COMPARE THESE FEATURES! 9" Model A Lathe



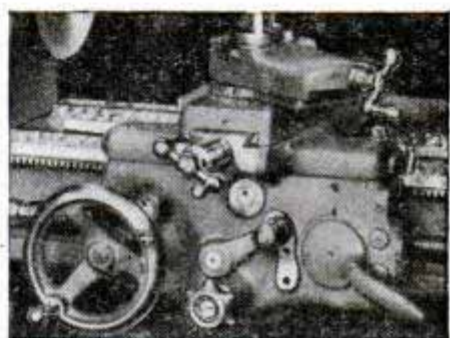
HEADSTOCK

Large diameter heat-treated spindle provides extreme rigidity. Bearing surfaces superfinished to 5 micro-inches rms. (.000005"), adjustable journal bearings, and ball thrust bearing assure precision. Direct belt drive for smooth operation at high speeds. Back gear drive for slow speeds.



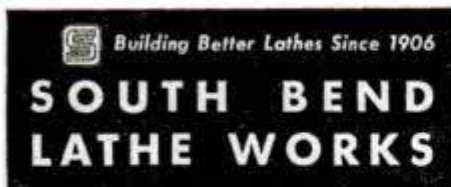
QUICK CHANGE GEAR BOX

Makes available 48 pitches of screw threads—8 to .224 per inch instantly selected by changing two levers, coarse threads from 4 to 7 per inch after changing stud gear. 48 power longitudinal feeds—.0015" to .0853", and 48 power cross feeds—.0004" to .0252" are similarly selected.



CARRIAGE

Saddle travels on two V-ways. Compound Rest Cross Slide operated by power or hand feed. Compound Rest Swivel adjustable through 180° for machining bevels and short tapers. Apron has worm drive from lead screw through friction clutch for all power feeds and half-nuts for thread cutting.



South Bend Lathe Works
455 E. Madison St., South Bend 22, Ind.

Please send items checked:

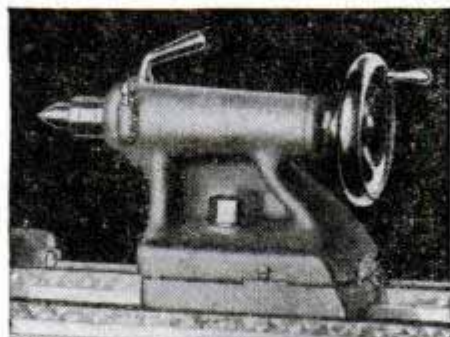
- Catalog of 9" South Bend Lathes
- Catalog of 10" to 16" Lathes
- Time Payment Plan Outline

Name _____

Street _____

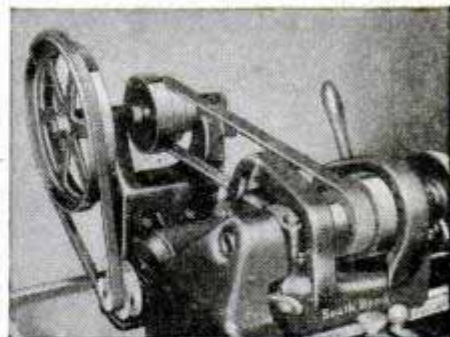
City _____

State _____



TAILSTOCK

Graduated spindle of special quality spindle steel. Hardened, self-ejecting center. Tailstock off-set top has set-over for taper turning. Long hand-scraped bearing surfaces for flat and V bed ways assure perfect alignment and reduce wear. Positive action spindle lock and tailstock clamp.



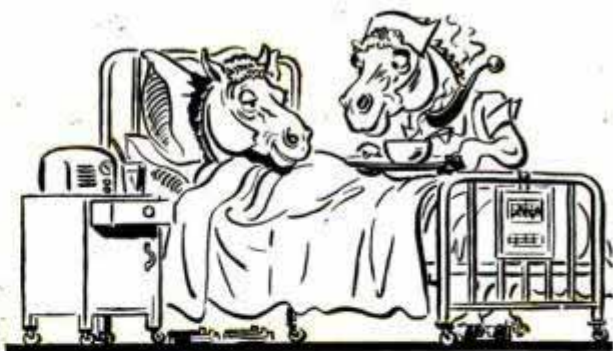
DRIVE

Practical, trouble-free, horizontal motor drives. Vibration-free and exceedingly quiet. Tension release makes selection of spindle speeds fast and simple. Positive belt tension adjustments. TWELVE-SPEED DRIVE provides spindle speeds from 41 to 1270 r.p.m., SIX-SPEED DRIVE from 41 to 658 r.p.m.

GIVE HORSEPOWER

Get-up-and-go

You'll be surprised how much easier your car breezes along after a Casite tune-up. Coughs, jerks and sputters quickly disappear—new smoothness, zip and power take over.



AND KEEP IT
rarin' to go...

Casite speeds lubrication . . . retards formation of sludge and gum . . . makes your motor really hum. Use Casite regularly—a pint through the air intake every three months and a pint in the crankcase every oil change.

THE *Guaranteed* **WAY!**

Double-Your-Money-Back if your car doesn't run better and smoother with Casite. And Casite makes this famous guarantee no matter what kind of motor oil you're using. You can't lose. Try Casite today at your service station, garage or car dealers. The Casite Corporation, Hastings, Michigan and the Casite Division, Hastings Ltd., Toronto.



CLEANS MOTORS
KEEPS
MOTORS CLEAN



65¢
A PINT
IN CANADA
75¢

SHEAFFER'S QUALITY IN TRIPLICATE



Color Photograph by Wesley Bowman

SHEAFFER'S *Threesome*

Three superlative writing instruments—one for each of your writing needs . . . and all of them Sheaffer's. Just try all three . . . You'll want all three because you need all three!

"TRIUMPH" pen for personalized character writing—for putting you on paper. 16 different points of 14-K gold to select from.

STRATOWRITER, most dependable ball-tip writing

instrument—for permanent notes in red, green or blue, for making carbons, addressing packages.

FINELINE pencil for erasable writing—figuring, sketching, jotting notes. Its Sleeve-Tip reduces lead breakage.

SENTINEL DE LUXE THREESOME—"TRIUMPH" PEN, \$15; STRATOWRITER, \$10; Pencil, \$5; complete set, \$30.00. No Federal Tax.

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