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MAGAZINE

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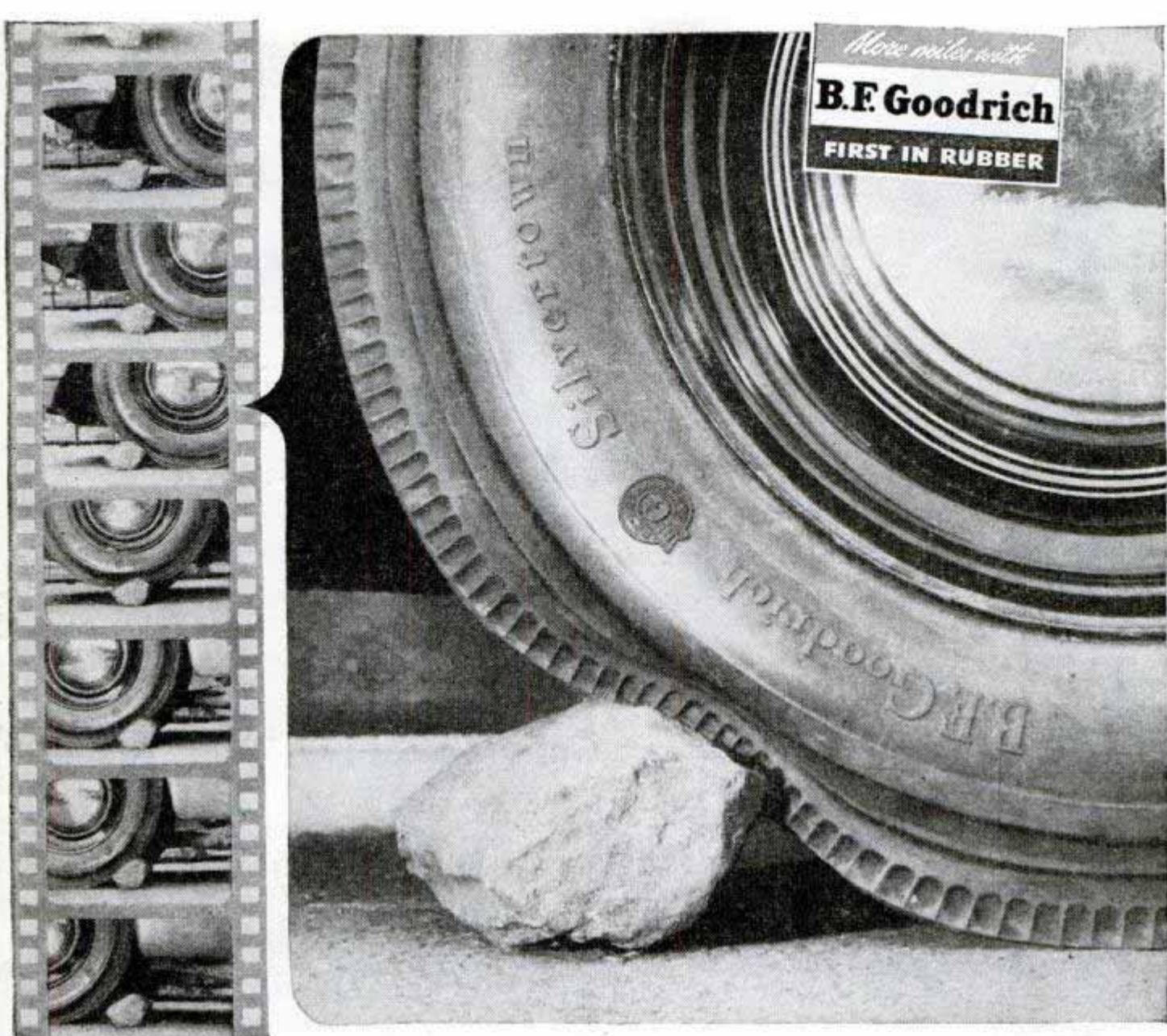
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The tire body is 35% stronger than in wartime tires. It is built with more cords and stronger cords and better engineered. It was developed primarily to enable it to carry a wider, flatter tread. Although such a tread gives longer wear, it is not practical on an ordinary tire because of the strains that it would set up in the tire body. Thus, in developing

a stronger tire body to carry a more durable tread, B. F. Goodrich engineers at the same time built into it greater resistance to "road shock."

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GUIDE LAMP DIVISION OF GENERAL MOTORS CORPORATION

SAFE HEADLAMPS ARE "CORRECTLY AIMED" HEADLAMPS—HAVE YOURS CHECKED TODAY

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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

WILL ATOMS soon heat our homes, power our ships and drive our automobiles? Must we scrap our factories and appliances for this new form of energy? In this issue a man who took part in the engineering work on the atom bomb project brings you a down-to-earth article on future uses of atomic energy. He tells how science has already solved three of the five major problems that stood in the way of harnessing the atom.

NEXT MONTH'S cue on how to improve your skill in a popular game comes from Willie Hoppe, one of the world's greatest billiard players. He gives three-cushion beginners a basic lesson in the game and tells oldtimers how to improve their shots.

HOW does it feel to be a fish? That's one of the questions asked of hundreds of persons in discovering hidden abilities. A November feature explains how aptitude tests become "Scientific Fortune Tellers" to reveal surprising talents in the average man.

ALL ABOARD for an exciting hobby. Spare-time "big shots" operate more than 5000 railroads in basements and attics. A feature next month tells how to "Build Yourself a Railroad."

PERENNIAL puzzle—what to give the family for Christmas. A peek into "Santa's Workshop" in the November Craftsman section will give you not only ideas but complete plans for 15 gifts—something for every member of the family. Then there's an article on machines that cast cement blocks for the man who wants to build his own home or start a timely business venture. Camera fans will find plans for a film viewer to show up those prize transparencies.

FOUR large speakers can be operated with the 32-watt audio amplifier featured in the Radio section next month.

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For the Craftsman

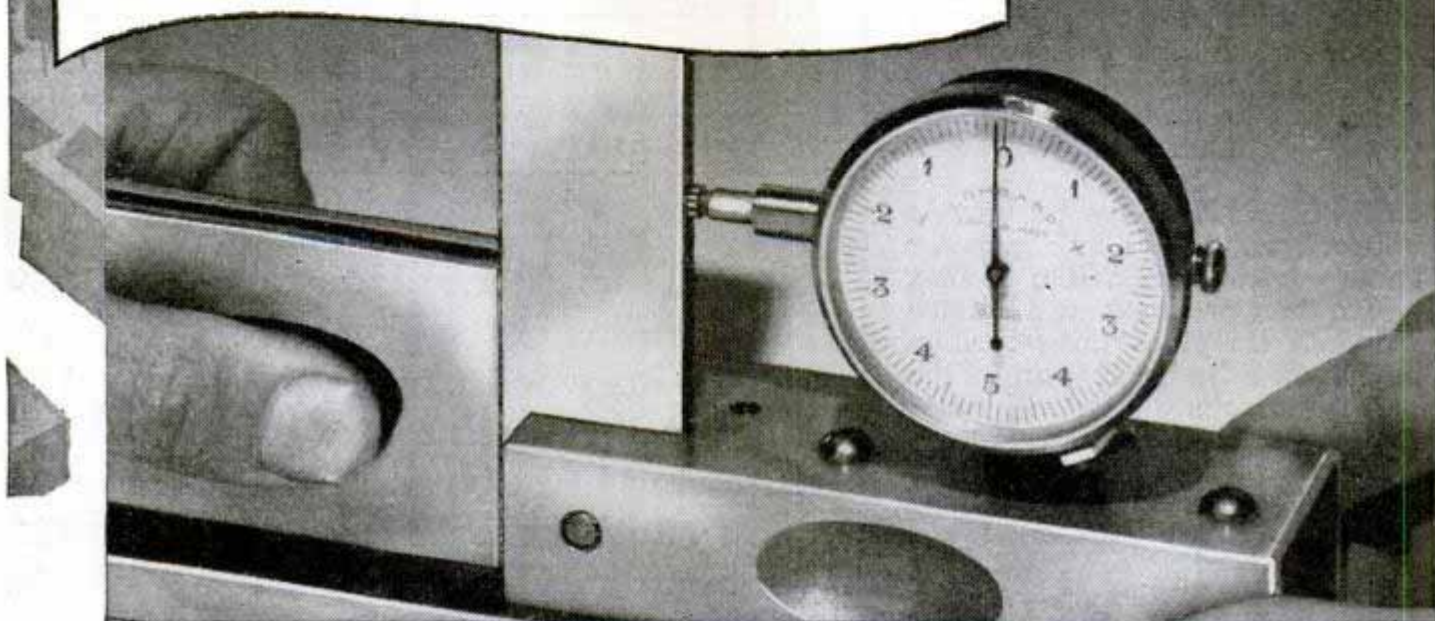
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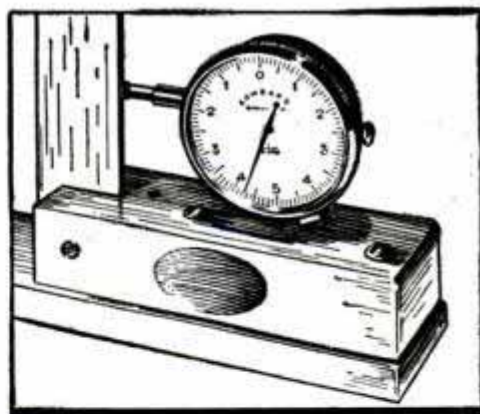
New Micro Square Instantly Checks Right Angles to One 10,000th Inch!

Ideal for precision testing, the Acro Micro-Sine Square quickly and accurately checks right angle work to 1/10,000th inch within a given distance. Its standard indicator dial instantly registers error, location of error, and amount of correction required. Designed for tool and die shops, machine shops and testing laboratories, it also provides a standard for checking master squares, tri-squares and tools.

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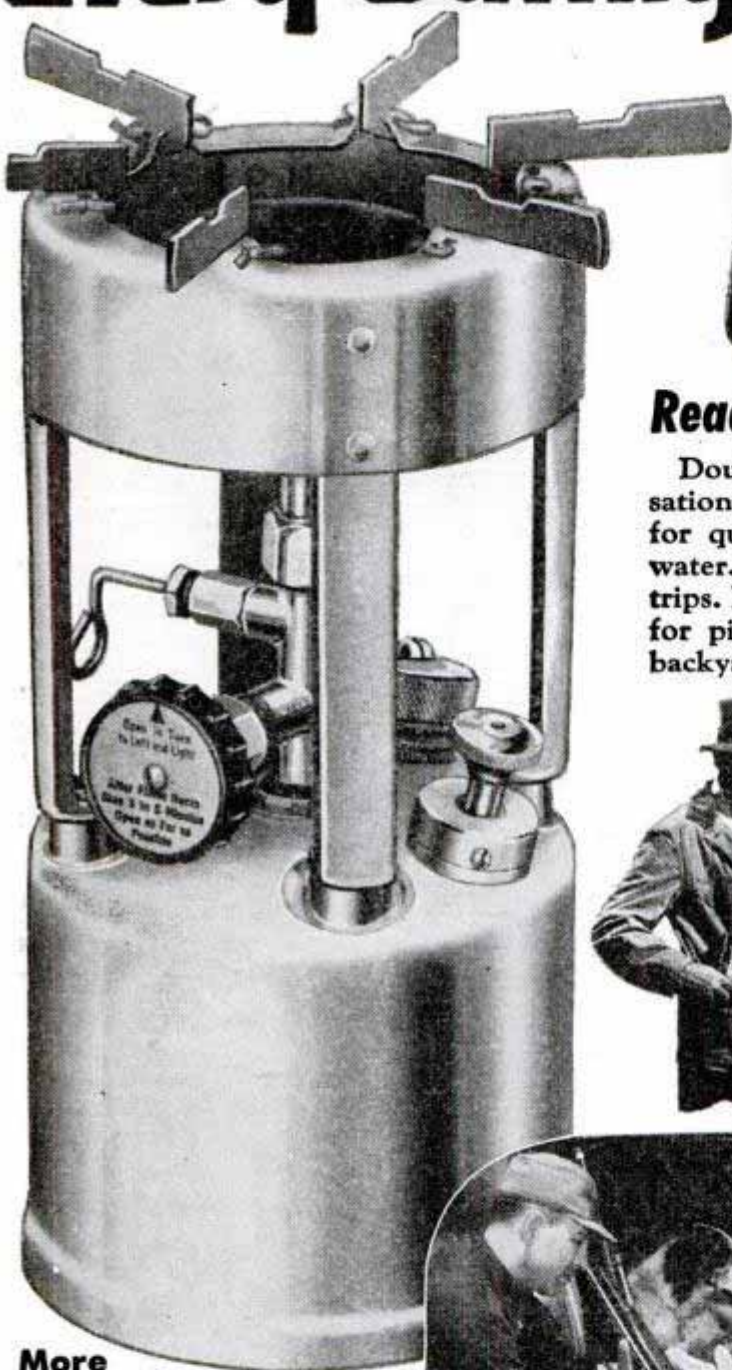
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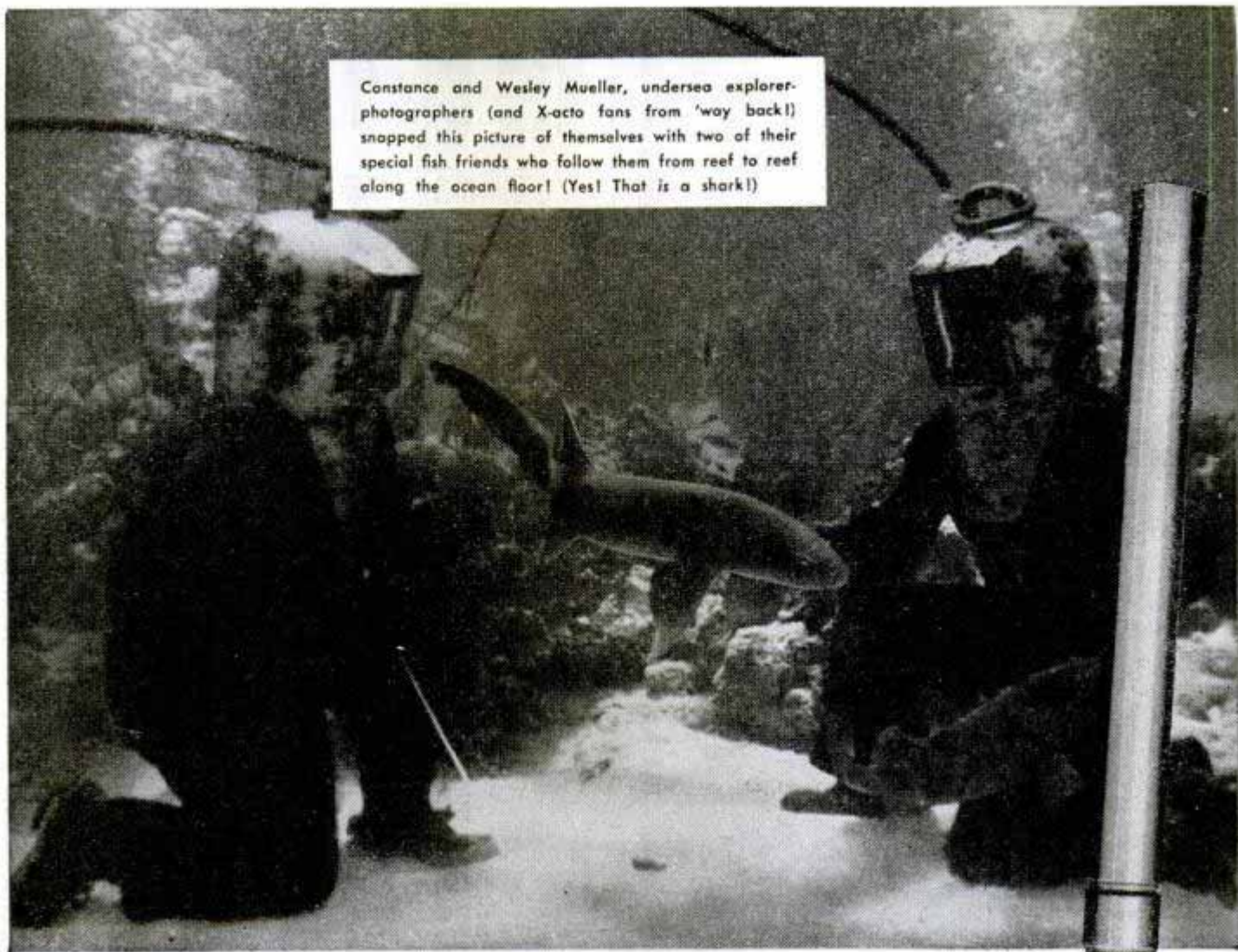


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Constance and Wesley Mueller, undersea explorer-photographers (and X-acto fans from 'way back!) snapped this picture of themselves with two of their special fish friends who follow them from reef to reef along the ocean floor! (Yes! That is a shark!)



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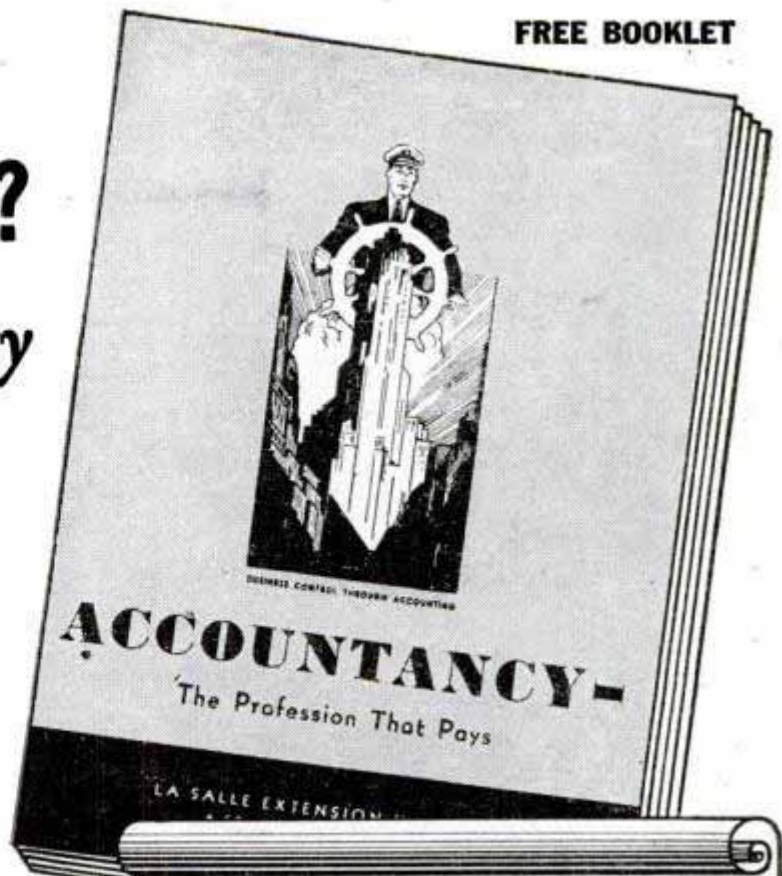
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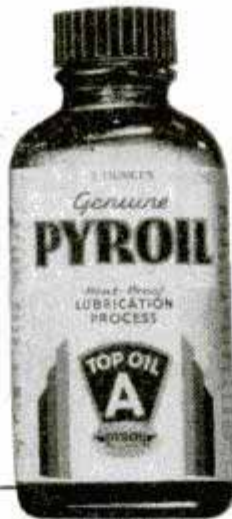


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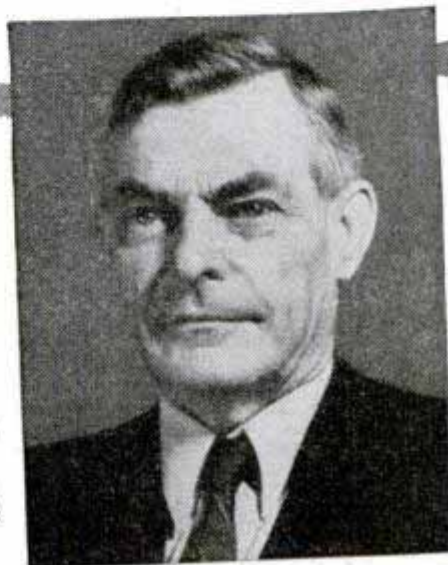
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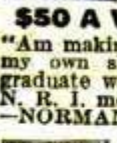
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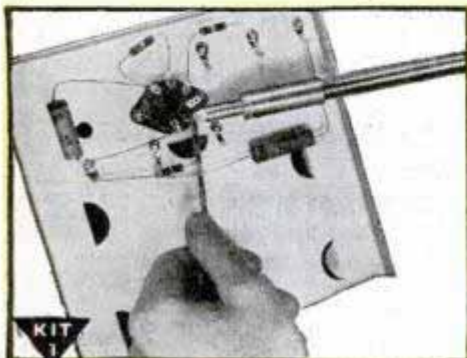
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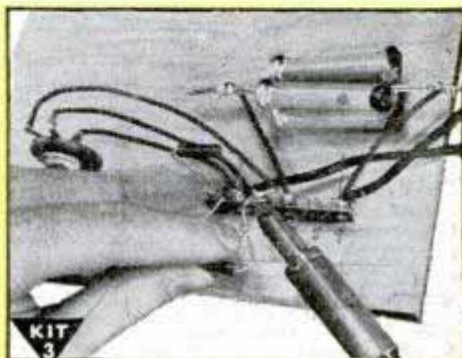
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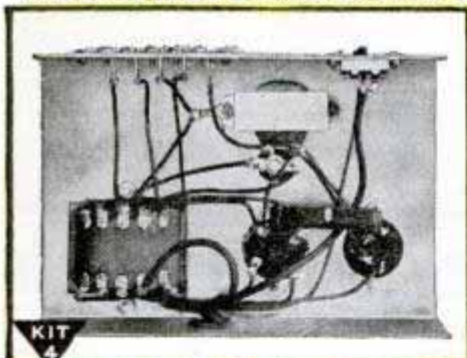
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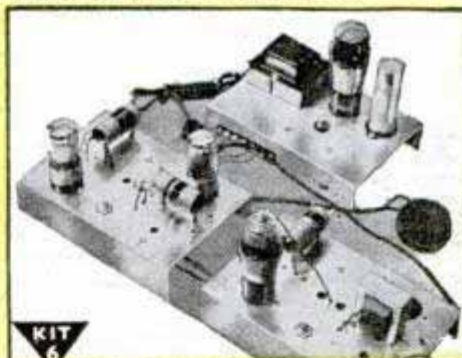
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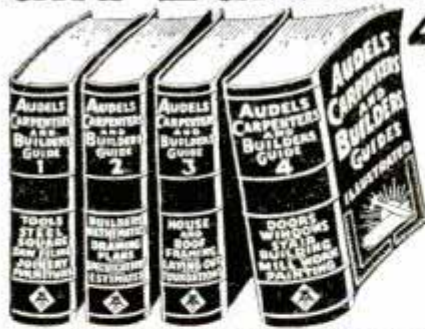
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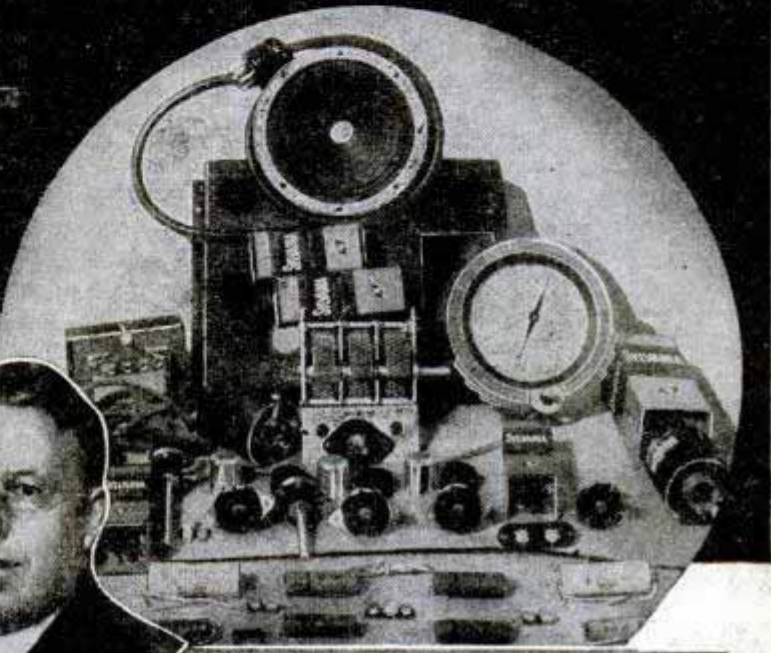
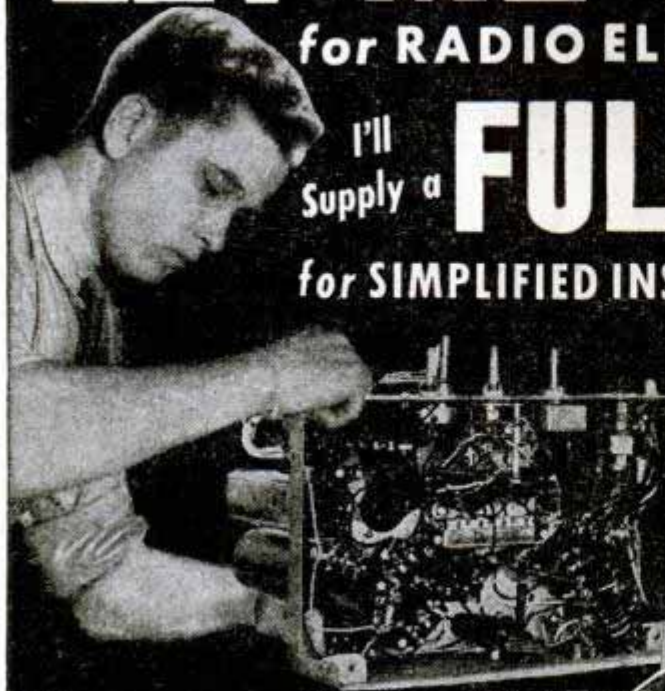
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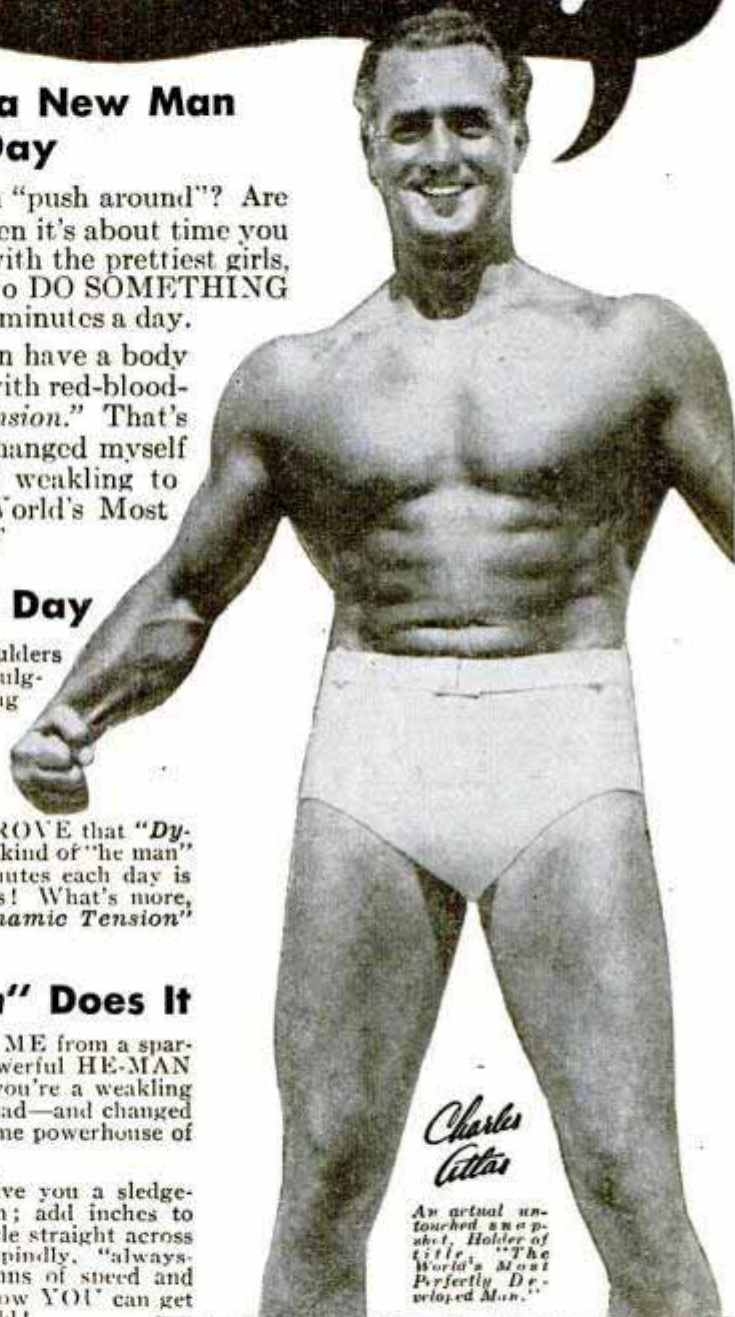
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Check here if under 16 for Booklet A.

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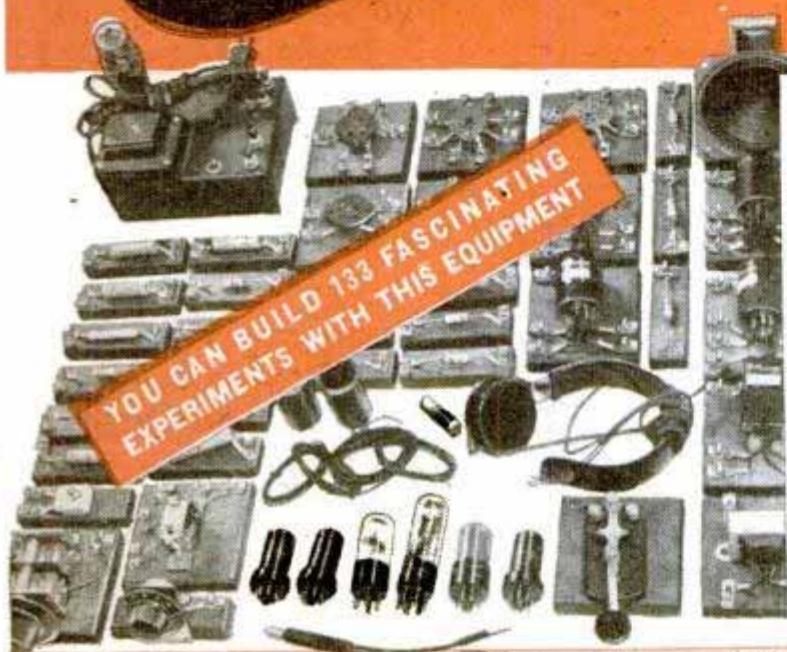
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By S. T. CHRISTENSEN

the "Fix-it Man"

WELL, I guess I'm the fellow to see, for I've repaired thousands of refrigerators (home and commercial both), vacuum cleaners, radios, washing machines, irons, fans, lamps, mangles, motors, etc. In fact, many of my customers call me their "electrical appliance doctor." And, "doctoring," I might add, has paid me a good substantial income for quite a few years. Funny, in a way, how I got started. Always liked to tinker and by experimenting around I found that most electrical appliances had many things in common. That, regardless of what the appliance was used for, or who the manufacturer was, the basic principles were much the same. From fixing my own appliances to fixing friends' and then for strangers at a fee, seems now to have been but a small step.

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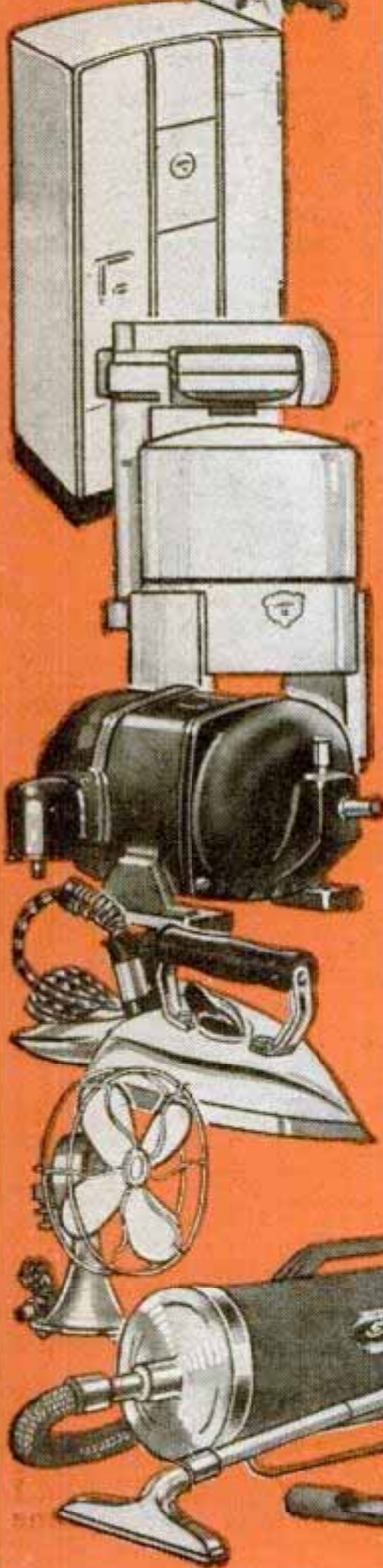
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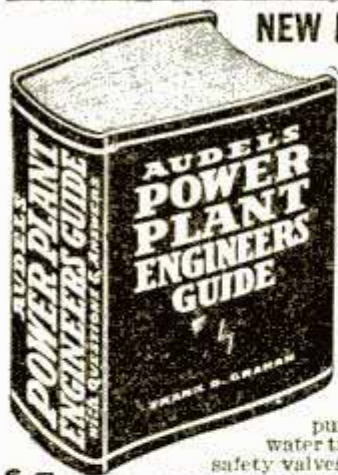
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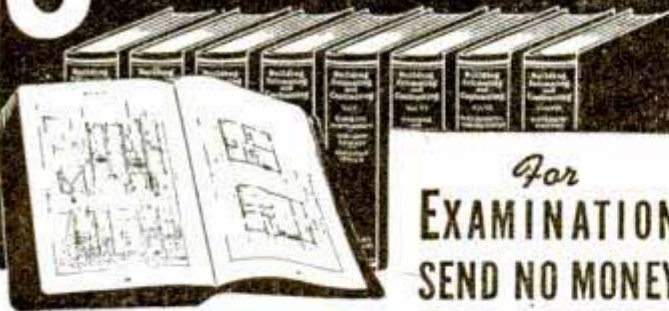
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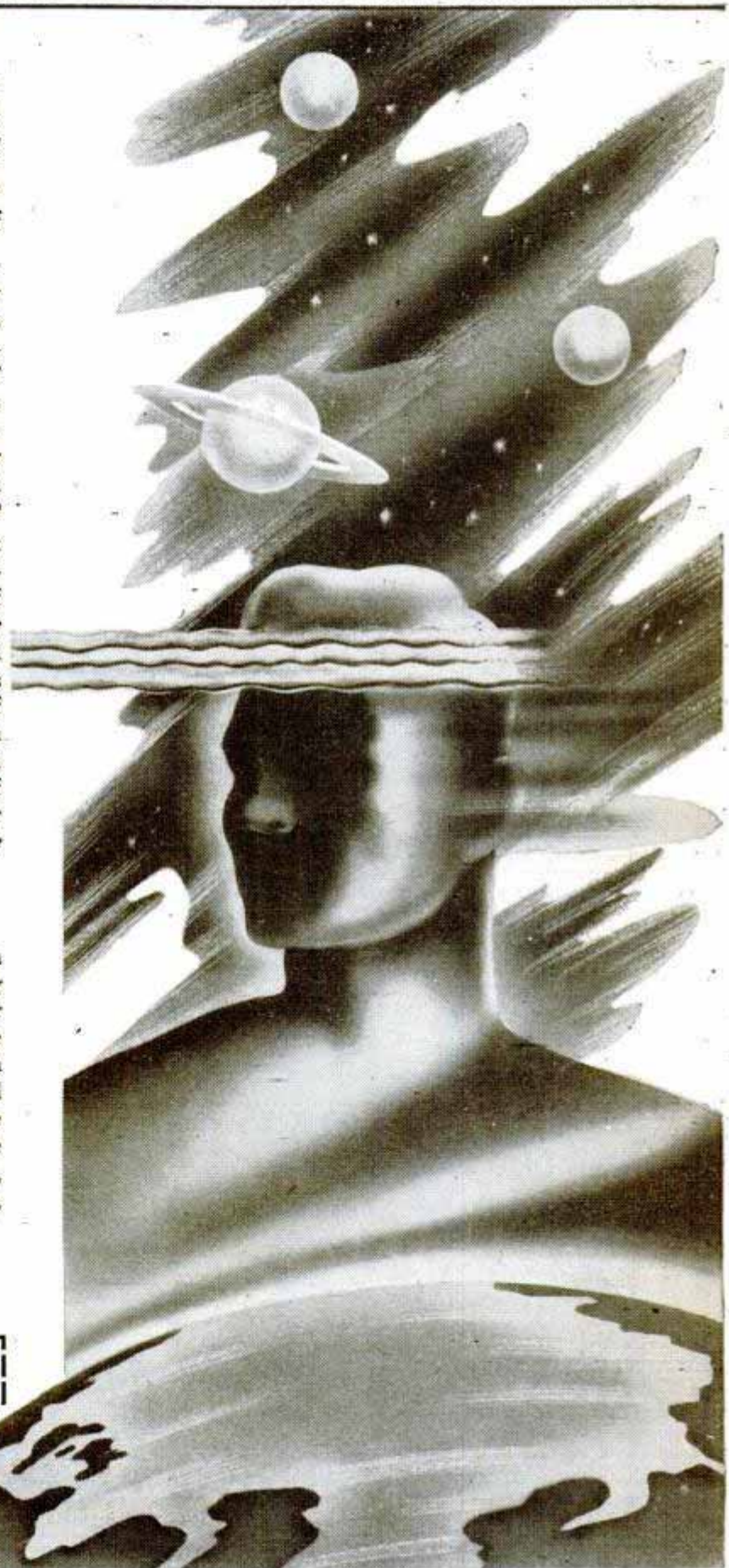
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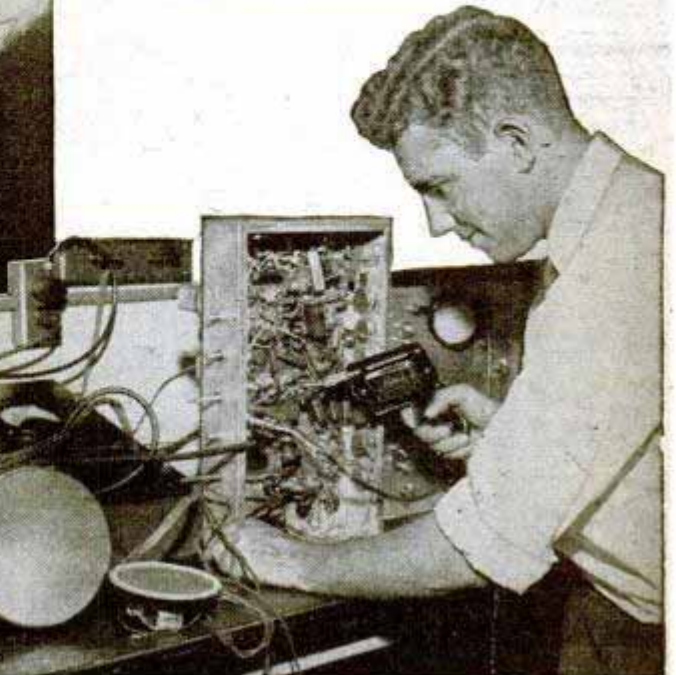
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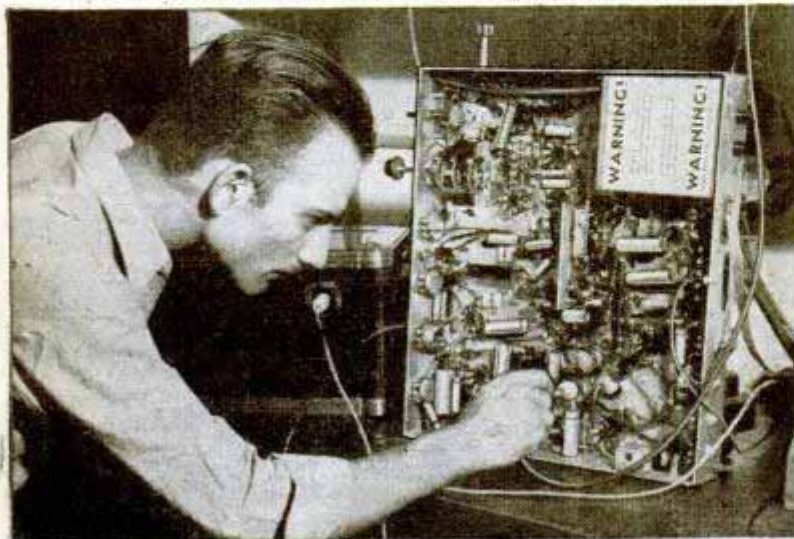
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MANY veteran students are now attending N.Y.T.I. of N.J. under the generous provisions of the G.I. Bill of Rights, which allows any approved school of the veteran's choice to charge the Veterans Administration up to \$500 a school year against the educational expenses of qualified veteran students. Full-time students, with dependents, are also paid a sub-

Student Walter E. Stevens, making engineering checks with \$395.00 United States Television Sweep Generator. The school is lavishly equipped with the most advanced test equipment.

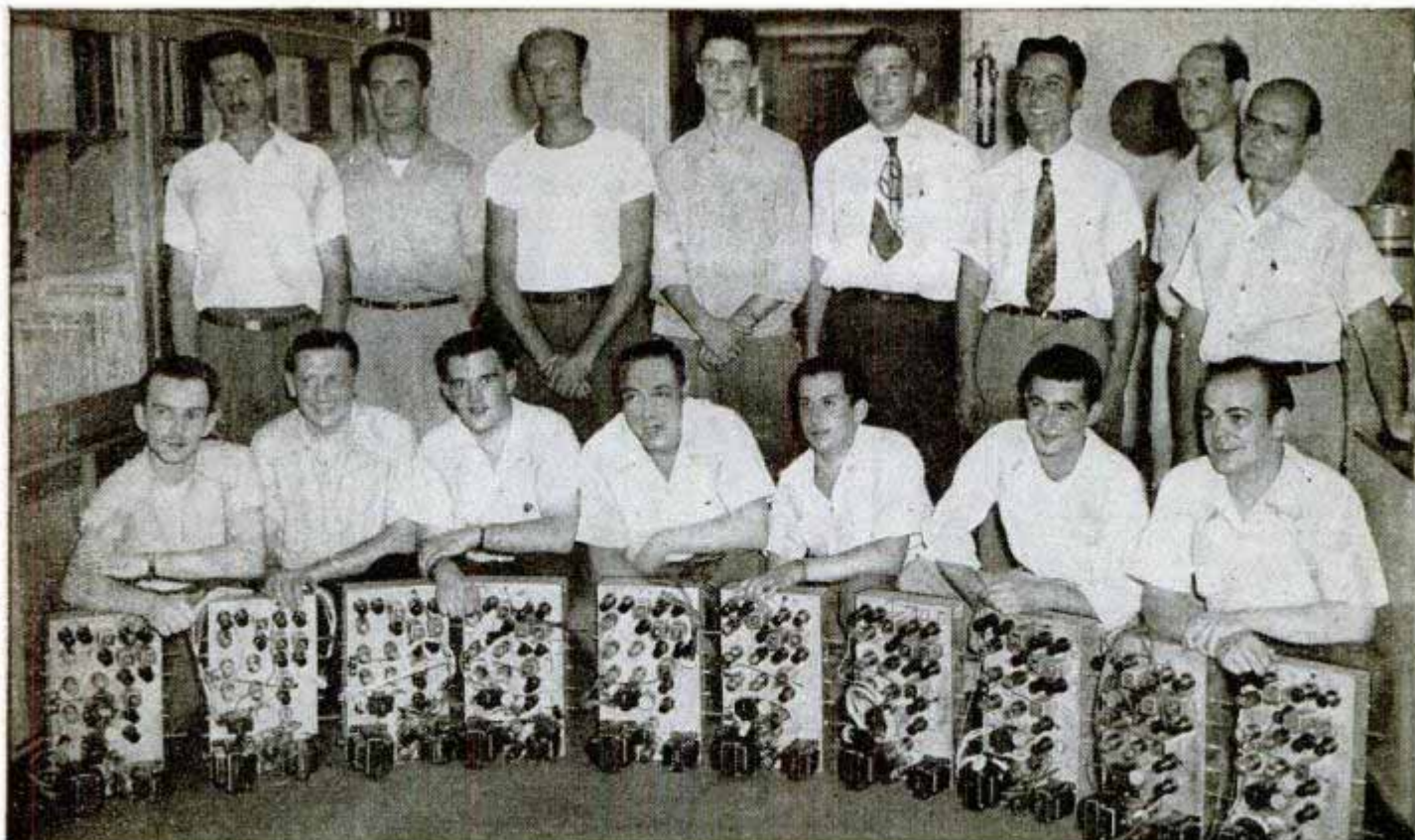


sistence allowance of \$90 monthly by the VA, and those without dependents, \$65. Many students hold part-time jobs, thus augmenting their monthly payments. However, you do not have to be a veteran to be accepted as a student.

A considerable number of out-of-state students attend the school because of its excellent, practical type of radio and television courses, so difficult to get anywhere else in the world today. Living quarters are obtainable by single students, but married students report considerable difficulty in finding quarters for their families.

No high-school diplomas are required. Every student must have at least a grammar-school education, however. And the school requires that a student be earnest, sincere and technically inclined. Students without proper mathematical backgrounds are taught the radio and television mathematics they need.

You probably have been wondering what N.Y.T.I. of N.J. means. It stands for the New York Technical Institute of



An Advanced Class in Television at N.Y.T.I. of N.J., famous television school, and the 17-tube television sets they built. Students at this school have been building television sets as part of their courses since 1939, when television programs were first broadcast regularly. School officials

found that this practical method of instruction is productive of very satisfactory results. Each student may build a set and keep it to use in his own home laboratory, if he chooses to. The school is located in the heart of the radio, television, electronics industry.

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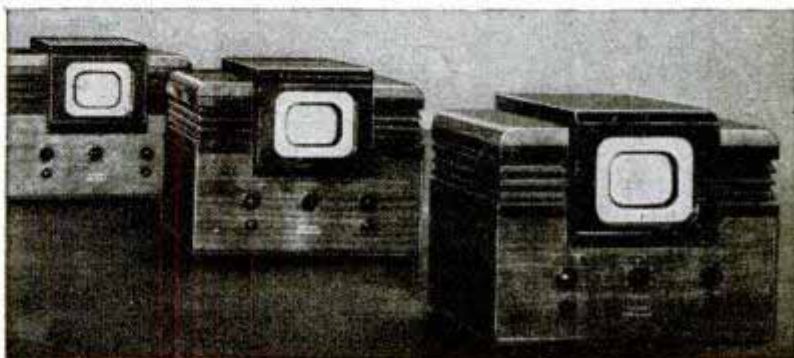
New Jersey, a resident school located in Newark, N. J., just across the river from New York City (Only 20 minutes from Broadway by subway or train). The school is located in the heart of America's great radio and electronics industry. Such leading television, radio and electronics manufacturers as Western Electric, Du Mont, Federal and Edison are nearby. Newark also is near Radio Stations WJZ, WEA, WABC and WOR; each a leader in broadcasts going on networks all over the country. This means that the school offers numerous advantages, as it is in touch with most recent developments in radio and television. This also means that qualified radio and television engineers are available to the school for teaching purposes.

During the war N.Y.T.I. of N.J. was approved for the training of Signal Corps personnel by the Army. When the war ended the enrollment increased because of the influx of veterans desirous of getting practical television training. At the present time, there are

120 openings for new students for the several classes beginning in October & November 1946.

The school issues a special Bulletin, Numbered 210, which illustrates and describes its facilities and equipment and shows students using its varied laboratory equipment. Bulletin 210 also describes classes that may be attended, housing conditions, costs, hours, etc. To get complete information write for Bulletin 210 (for which no charge is made) to the New York Technical Institute of New Jersey, 158 Market Street, Newark, New Jersey.

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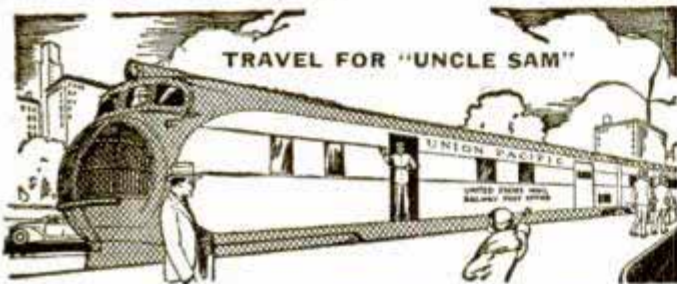
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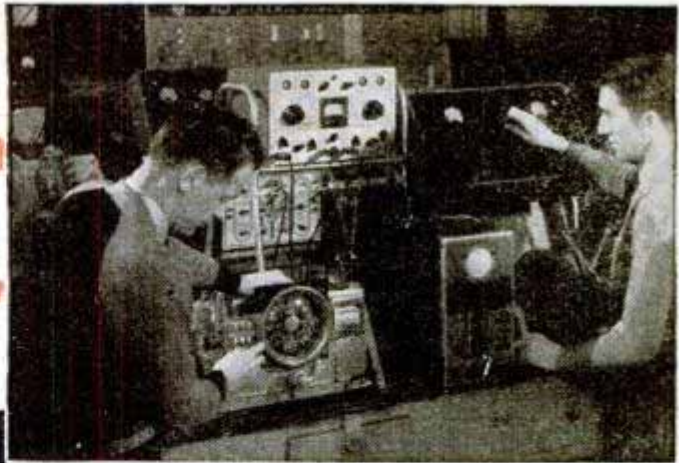
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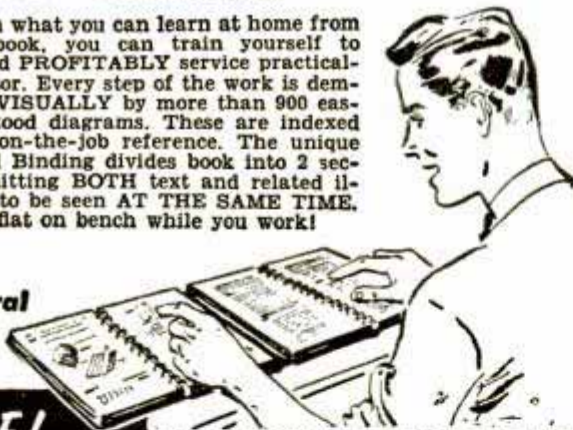
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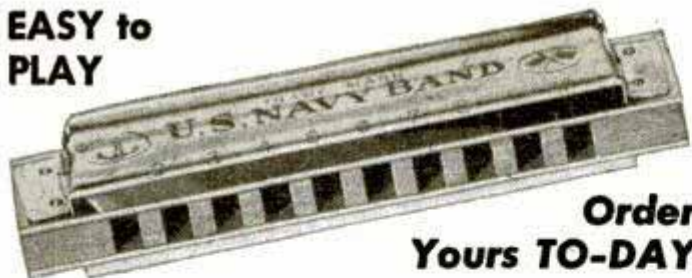
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150 MPH Model airplane. See International Research advertisement page 267.

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ELECTRIC Fan assemblies. Make your own. Ted Riseman, 425 East Jefferson, Springfield, Illinois.

LAMPS—All parts for building or repair. Catalog 10c. Refund first order. Gyro Lamps, 5416 N. Clark, Chicago 40.

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BOOK Matches—your name, address, or initials. 50—\$1.25. Samples, Press, 749 S. Plymouth, Rochester 8, N. Y.

THE Hobby Directory for men and boys. Box 91, Sc. Orange, N. J.

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VENDING Machines. Be independent. Own a big money business operating coin machines. Earn as high as \$7.00 weekly on machines costing as low as \$11.75 each. Car and experience unnecessary. Routes can be operated either in your spare or full time. Act quickly. Write for details and catalogue showing our amusement games, postage machines, candy-gum nut vendor, scales, and stationery machines. Parkway Machine Co., 623C-W, North Avenue, Baltimore 17, Maryland.

PLASTICS Directory—Wholesale and retail sources for thousands of items, materials, molds, equipment, machinery, supplies. \$1. Plastics Digest, 3937P Tracy, Kansas City 4, Mo.

MECHANICALLY Inclined men—Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply, Dept. 169, 2835 N. Central Ave., Chicago.

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SELL Religious goods by mail. Make your own items. Universal Sales, Box 1076-A, Peoria, Ill.

FORTUNES In formulas and trade secrets, details free. Stillman, 555 Kingston Ave., Brooklyn 3, N. Y.

APPLIANCE And building repairs. Simplified. Free literature. Porter, Box 6346-A, Pittsburgh 12, Penna.

CO-PUBLISH Magazine. Many profits. 16-page booklet 10c (refundable). Goldenberg, 5209-E Lindsay, Houston 3, Texas.

OPERATE Profitable business selling, packaging products under your own name. Lyle Products, 5 E. Spaulding, Willoughby, Ohio.

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LIQUID Marble, plastics, marbleite, plasters, make your own. Universal Sales, Box 1076-A, Peoria, Ill.

EXCLUSIVE Franchise (patent applied). Exterminating device; big profit. Vogel Mfg. Co., 4510 N. Paulina St., Chicago 40, Ill.

PLASTICS—Casting, molding, forming easily learned. Simplified work-sheets, 70 illustrations, explain reliable methods. \$1. Circular free. *Plastics Digest*, 3937M Tracy, Kansas City 4, Mo.

1000 REPRESENTATIVES Needed. Ford accessory, tremendous profits. Acme, Box 809, Milwaukee 1, Wis.

OPERATE Profitable mail order business. Splendid opportunity. For details, write: Cardinal Sales, Box 146-A, Morganfield, Ky.

MAKE Money making movies, 23,000 word "how" book, \$2.00. Information stamp. World in Color Productions, Box 392X, Elmira, N. Y.

ACCOUNTANTS—Bookkeepers: Operate our system. Forms furnished. Professional assistance. Barnhart & Kennedy, Public Accountants, Chambersburg, Penna.

RUBBER—Airlastex, red or black, prewar quality mold making liquid. Quart \$2.25, gallon \$5.50. Instructions free. New Era Products, 1321-N Belmont, Chicago.

OPERATE Profitable mail order business. Good opportunity to make \$5000 yearly. Details free. Leroy Harris, 310 W. 14th Street, Cincinnati 14, O.

GET The facts concerning "My View Points" about mail order schemes, plans, ideas, sales letters, circulars, booklets, formulas, advertising, circular-mailing and mailing-lists. Know the relationship of these "ten vital subjects" to the "direct-by-mail" order business. Only 25c a copy. Henry E. Piltz Publications, Box 148, East Orange 3, New Jersey.

SIGNS Made easily. Instructions and ten sets modern alphabets, numerals, patterns. Sizes up to eight inches. All for \$1.00. Co-operative Business, Box 638, Chicago.

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JOIN The National Imprint Dealer Union. 100,000 circulars, your name and address. Look 50,000 circulars \$1.00. Information 10c. Tipton, 229 Overton Place, Knoxville, Tenn.

HOMEWORKERS—Make \$50.00, \$75.00, \$100.00 weekly; plastic gifts, plaques, novelties; material, molds, instructions furnished. Sample pint with rubber mold \$2.00. Plastic Products, 1416-24 Fletcher, Chicago.

LIQUID Marble; snow-white, multi-colored. Glazed. Unglazed. Composition flooring. Lifetime wear. Any color. Flexible molds. Plaster casting. Get into the big money now. Full information given free. See our large ad page 35. Write—Compo-Tex, Box 786-R, St. Louis, Mo.

PROFITS From scrap. Above average return for spare time work. An excellent and interesting hobby. Material cost of less than 50c returns \$2.50. Only tools needed are hammer, chisel, tin snips, file and paint brush. Send for particulars now. Wud-N-Metal Products, Ferris, Texas.

START Profitable mail order business. Write Harry Punch, 1329 Grace, Cincinnati 8, Ohio.

BELTS! Make 'em and make money. No tools! Sample 50c. Artinc Leather, 411 Joseph Ave., Rochester 5, N. Y.

RUBBERFORM—Airlflex "self-cure" latex makes molds overnight; quart \$2.00, gallon \$5.75 with sample mold, directions. Plastic Products, 1416-24 Fletcher, Chicago.

METALLIZE Baby shoes! Learn this money making business from nationally recognized consultant. Get "know how" from outstanding authority! See Kushner ad. page 267.

A BUSINESS Of your own. Make your spare time pay you a profit. A few hours a week can build a profitable enterprise for you. We tell you how. A. F. Giannelli, P.O. Box 993, Schenectady 1, New York.

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MONEY By mail! Profitable proven plan. Valley Service, Box 745-B, Appleton, Wis.

CASTONE—Hardest coldcasting composition on earth, snow white and colors. 15 pounds assorted colors \$2.00, hundred pounds \$7.00. New Era Products, 1321-N Belmont, Chicago.

EARN Up to \$500 month part or full time keeping books for small firms. Simplified system. Write Tax-Saver System, Dept. F, Ft. Worth, Tex.

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FIBERGLASS—Liquid plastic, china glazes any plaster object. Sample quart \$1.00. Gallon \$3.00. New Era Products, 1321-N Belmont, Chicago.

SPECIAL Training for entering successful businesses. You start small, grow big. We tell you what to start. What will pay. What to sell. Who will buy. Write. Hilton C. Cornwell, 1384 Dekalb Ave., Atlanta, Ga.

LIQUID Rubber, for making flexible molds, literature and sample free. H. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

START Profitable home business. Write Donald Eakin, Route No. 1, Harrisville, Penna.

START A clock shop. Fascinating, easily learned profitable business requiring little capital. We teach you how to repair all kinds of clocks. Information free. Houston Clock Shop, P.O. Box 5086A, Houston 12, Texas.

START Home manufacturing business making Cleaning Compounds, Soaps, Insecticides (DDT), Cosmetics, Polishes, No machinery. Literature free. Kemix, Park Ridge, Ill.

ONE "Best" item for mail operation. Repeats 100%. Literature, ideas, samples, 10c. Central, Simpson 1, Kansas.

MEN, Women, "Everybody Likes Candy." Learn to manufacture professionally at home. (Our 36th year.) Ragsdale Candies, East Orange 2, N. J.

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PLASTIC-INTERMIX Makes ordinary casting plaster "shatterproof." Gallon develops 100 pounds. Pint \$1.50, gallon \$4.00. 20th Century Products, 3151-NW Southport, Chicago.

PROFITABLE Small investment reclaiming crankcase oil. Particulars. Chechot, 5421PM Pine, Philadelphia 43.

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INCORPORATE Your business. Delaware laws. Many advantages, free details. Tax Research Bureau, Inc., Delaware Trust Building, Wilmington, Delaware.

SPECIALTY Manufacturing, the big money business that can be operated anywhere, start on a very small capital; we supply dependable formulas and complete instructions; get interesting free booklet, "Moneymaking Opportunities in Specialty Manufacturing." Howard Robinson, Ph.G., 1300-A South Ohio Street, Sedalia, Mo.

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DO It with sea shells. Attractive jewelry. Big profits. Free instructions. Werts, 1429-56th Ave., Oakland, Calif.

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START Home business making statuary, plaques, novelties, garden furniture, artificial marble flooring, liquid marble. Make your own flexible molds. Amazing profits. Folder free. Creative Publishers, Box 236-L, Winnetka, Illinois.

MINK Raising, information free. Complete. Lake Superior Mink Farm, Superior, EE, Wisconsin.

PROFITABLE Mailing merchandising business. Write Riegel, 1111 Harrison, Phila. (24), Penna.

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SMALL Capital starts your own advertising agency, at home in spare time. Complete operation exposed. No stock or equipment. Opportunity for large earnings. Stamp brings folder and proof. P. Snyder, Box 4907-A, Philadelphia 19, Penna.

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LIQUID Marble—Colorful, glazed! Molded, brushed, sprayed! Composition floors. Rubberlastic molds. Particulars free. Marbleizing Service, Edwardsville, Ill.

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BUILD Miracle homes. Yours. Others. Chamberlain, Fitzsimons Building, Pittsburgh 22, Penna.

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LATEX For making flexible rubber molds. Thoroughly tested. No shrinkage. Complete instructions with each order. Stoneham Rubber Co., Box 244, Stoneham 80, Mass.

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

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REAL Mailorder profits. Make 90c each dollar sale. Write Smith, 1126 Vermont, Bristol, Virginia.

HOMEMAKERS. Make money on side. Read "100 Selling Ideas," worth reading. Price 50c. Goulding, 1037 Elm, Manchester, N. H.

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RAISE Giant Chinchilla rabbits. Tremendous profits from gorgeous fur, delicious meat. Ideal business. Willow Farm, R15A, Sellersville, Penna.

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BE Smart, make your own Christmas gifts or start a business. \$1.00 brings an illustrated instruction book on making shell jewelry, etc., with materials complete for two pins. Send for catalog. Woods Shellcraft, Box 308, Bradenton, Florida.

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WHOLESALE Catalog, directory 10c. Thousands of articles. Stafford, 961½ N. Jefferson, Indianapolis 1, Ind.

PAINT Wall plaques at home. Big profits. No experience needed. My course tells how. Valuable information free. Alfred Novak, 2601 Division, Cleveland 13, Ohio.

ILLUSTRATED Two-color agents, opportunity-seekers directory, 10c. National, R5, Saginaw, Michigan.

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1001 MONEY-MAKING Ideas! Free details. Newway Institute, Box 5463-M, Chicago 80.

WOULD You pay 3%—first \$350 made? Color-illustrated book "505 Odd, Successful Enterprises" free! Proven by "Little Fellows." Start at home, office. Expect something odd! Pacific, 2207½ Cloverfield, Santa Monica, Calif.

HOMEWORKERS — Assemble colorful handmade jewelry! Profitable sideline. Free details. Beginner's outfit, \$1 (refundable). Hughes, 712 Kimball, Danville 3, Ill.

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

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FORMULAS — Latest, best. Analysis. Giant formula catalog and chemical instruction sheet 10c. Refunded first order. Belfort, Engineering Building, Chicago 6.

NEED Chemists? Formulas, Analyses. Ideas, Consulting Scientific Company, Swarthmore, Pennsylvania.

MANUFACTURE Cleaners, flavors, cosmetics. Formula catalog free. Kemico, Park Ridge 16, Illinois.

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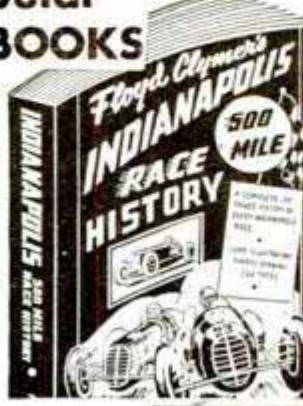
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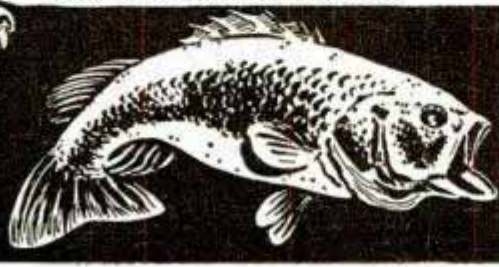
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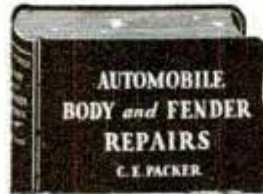
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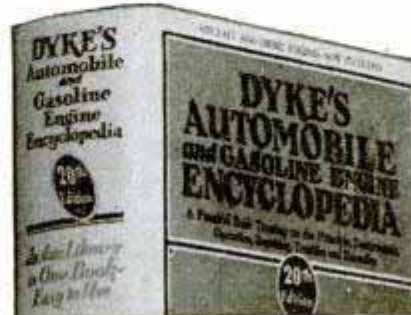
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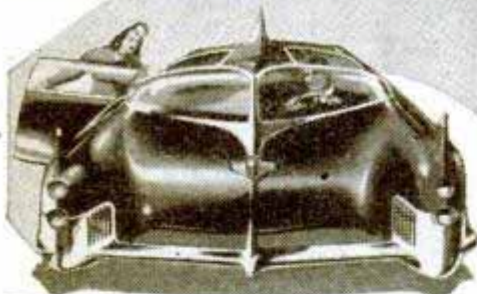
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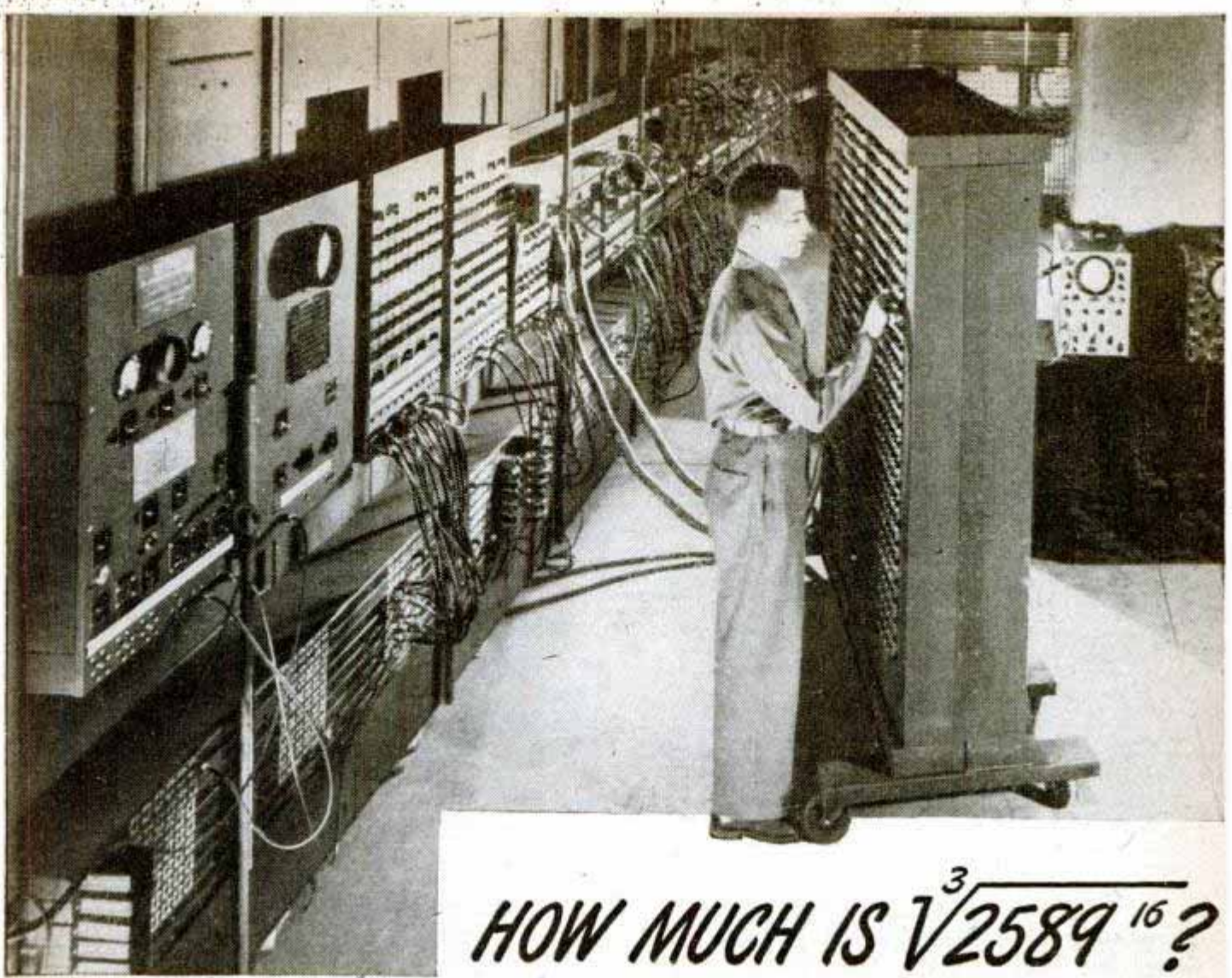
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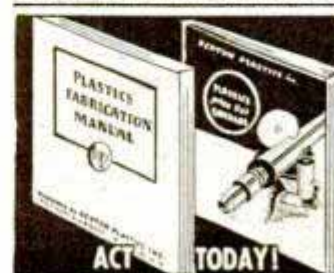
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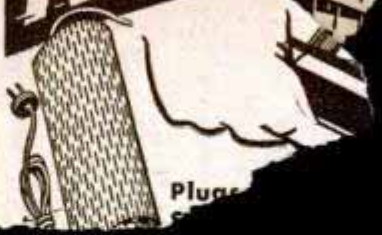


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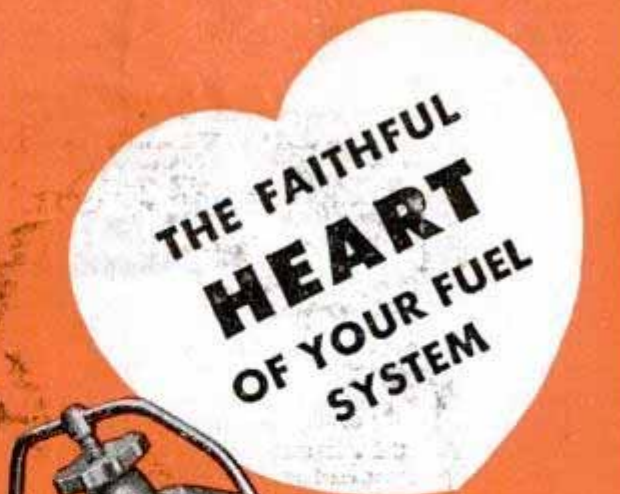
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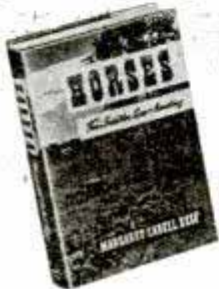
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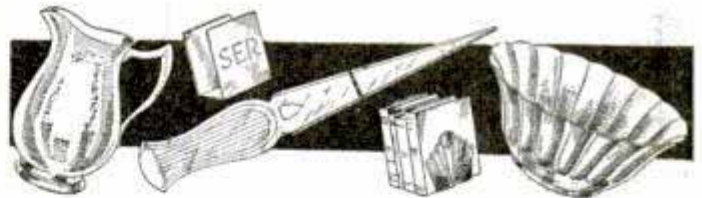
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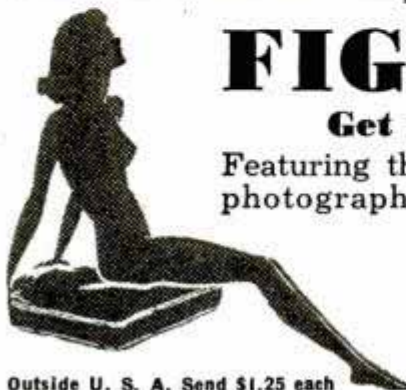
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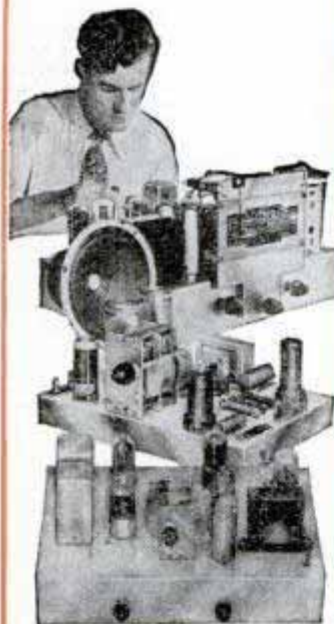
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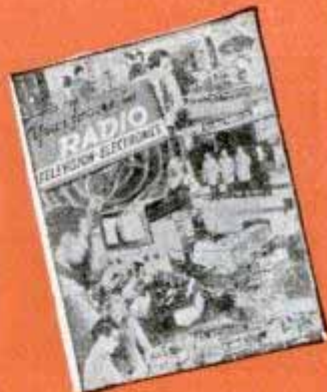


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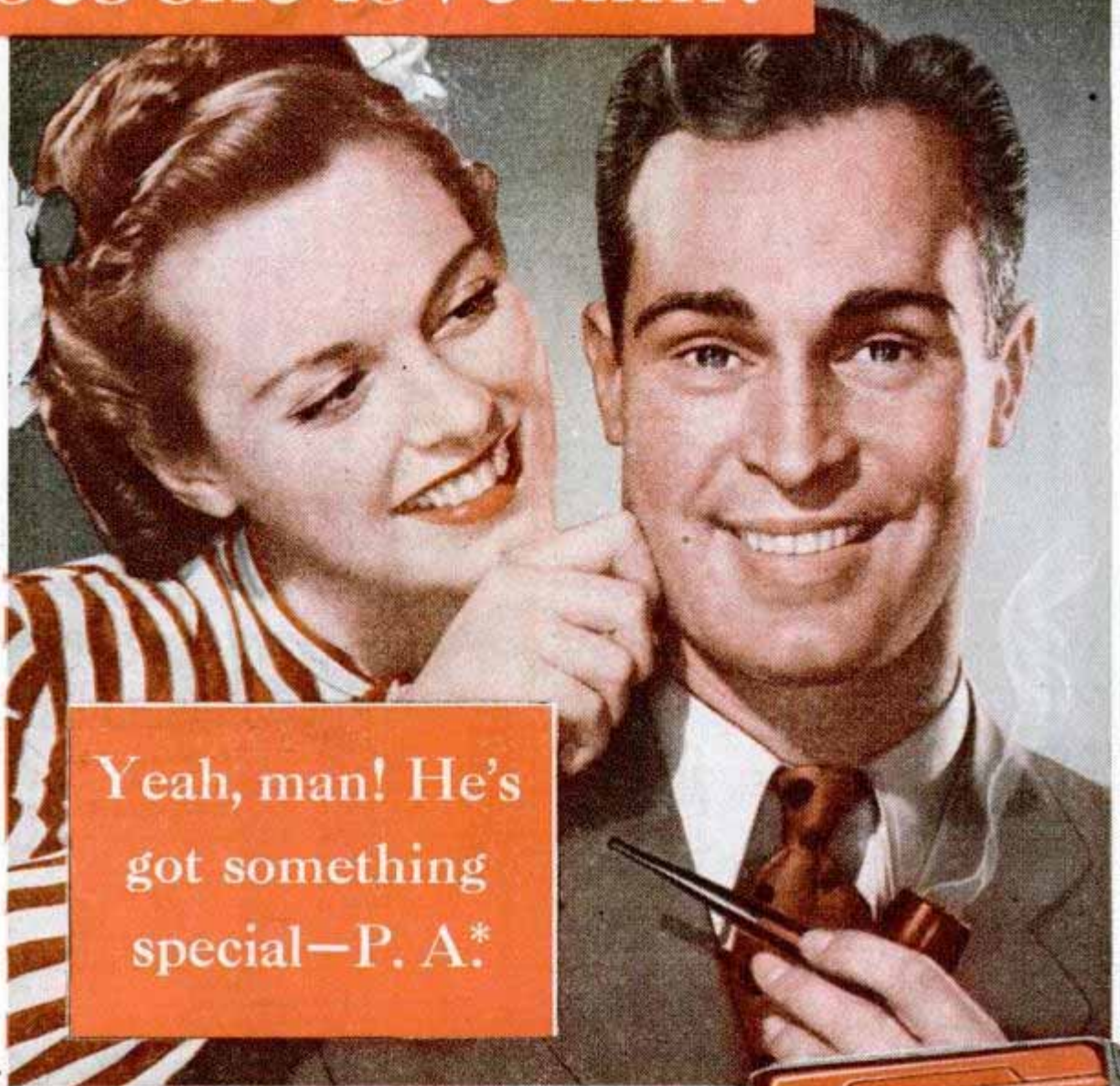
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Does she love him?



Yeah, man! He's got something special—P. A.*

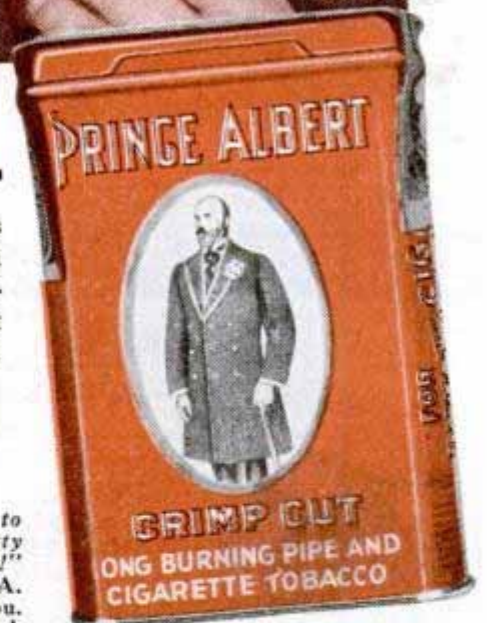
R. J. Reynolds Tobacco Co.,
Winston-Salem,
N. C.

P.A.*

means Pipe Appeal—

Boy meets girl. Boy lights pipe. And *up* goes boy's chances of girl going for boy. Women prefer to see men smoke pipes. Like fine leather and tweeds, there's just something smart and masculine about a pipe. Women love it.

means Prince Albert



Great for roll-your-owns. Clings to the paper. No mess, no spilling. Twirls up into a firm, smooth cigarette.



MY TONGUE'S MIGHTY GRATEFUL FOR P.A.'S GENTLE MILDNESS. TONGUE-EASY FOR CERTAIN!

• Many a man has wanted to smoke a pipe to please his pretty one, but his tongue said "No!" Tongue bite is no fun. Page P. A. if that's ever happened to you. It's gentle to your tongue. Rich flavor. Crimp cut too, for cool burning. Get P. A. (Pipe Appeal) with P. A. (Prince Albert).

THE NATIONAL JOY SMOKE

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 86 NO. 4

POWER From Atoms: How Soon?

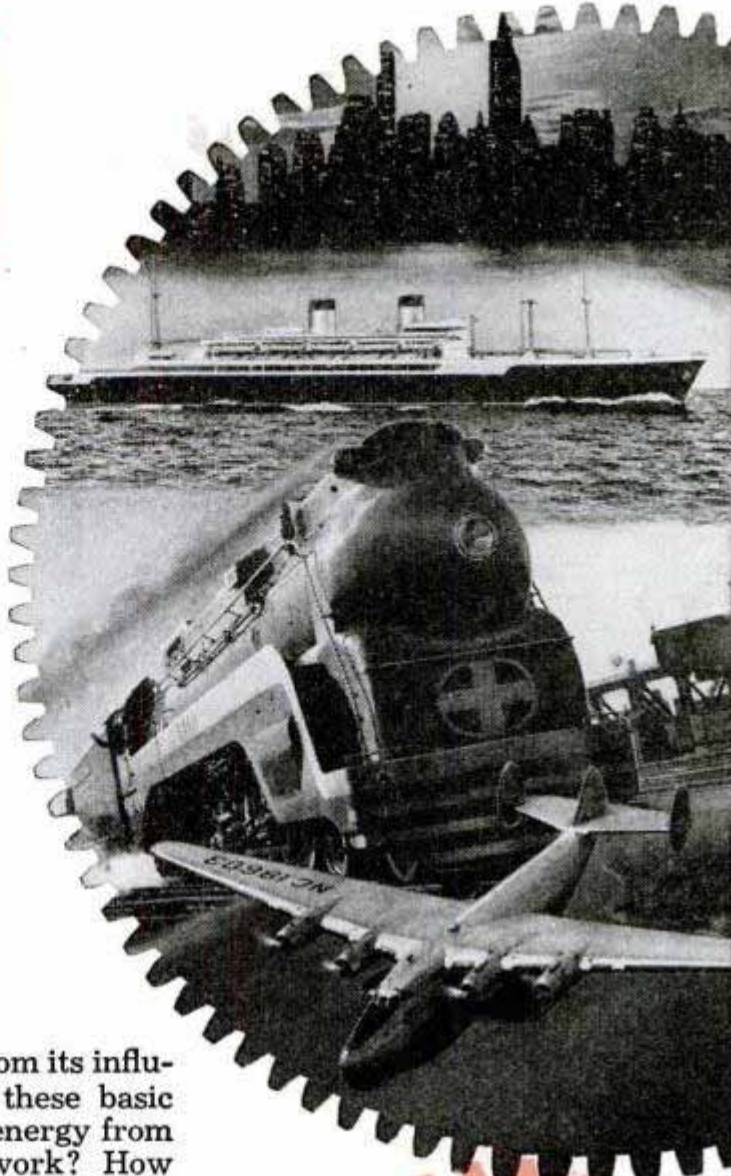
By **E. V. Murphree**

Mr. Murphree, executive vice-president of the central research and technical organization of Standard Oil Company (New Jersey), was one of the scientists who participated in the engineering work on the atom bomb project. This significant article on the peacetime use of fissionable material was originally prepared for The Lamp, a company publication.

CREATION of atomic energy, aside from its influence on war or peace, has posed these basic questions for the world: How soon can energy from atoms be harnessed to do man's daily work? How much of this power will there be, to what degree will it supplant present fuels, and what does it imply for the future? The answers are encouraging.

An atom—once thought to be “the smallest building block of matter”—may be pictured as made up

Scientists who helped usher in Atomic Age include, left to right, Dr. H. C. Urey, Dr. Leo Szilard, Dr. L. B. Borst and J. C. Stearn



of particles which, with one exception, are electrically charged; the charges are either positive or negative. The electrical attraction of these particles for each other holds the atom together.

The one uncharged particle is called a neutron because it is neutral in its relationship to the electrically charged particles. It is the neutron which makes possible release of atomic energy.

An atom of the type useful for the production of atomic energy is split when its nucleus, or core, captures a neutron. On being split, such an atom releases both particles and rays. The energy of the particles in motion and the energy of the radiation together make up what we call atomic energy.

In beginning the process, neutrons may be set free by one of several well-known means or be picked up from the atmosphere. As each atom is split thereafter, other neutrons are released to continue the process.

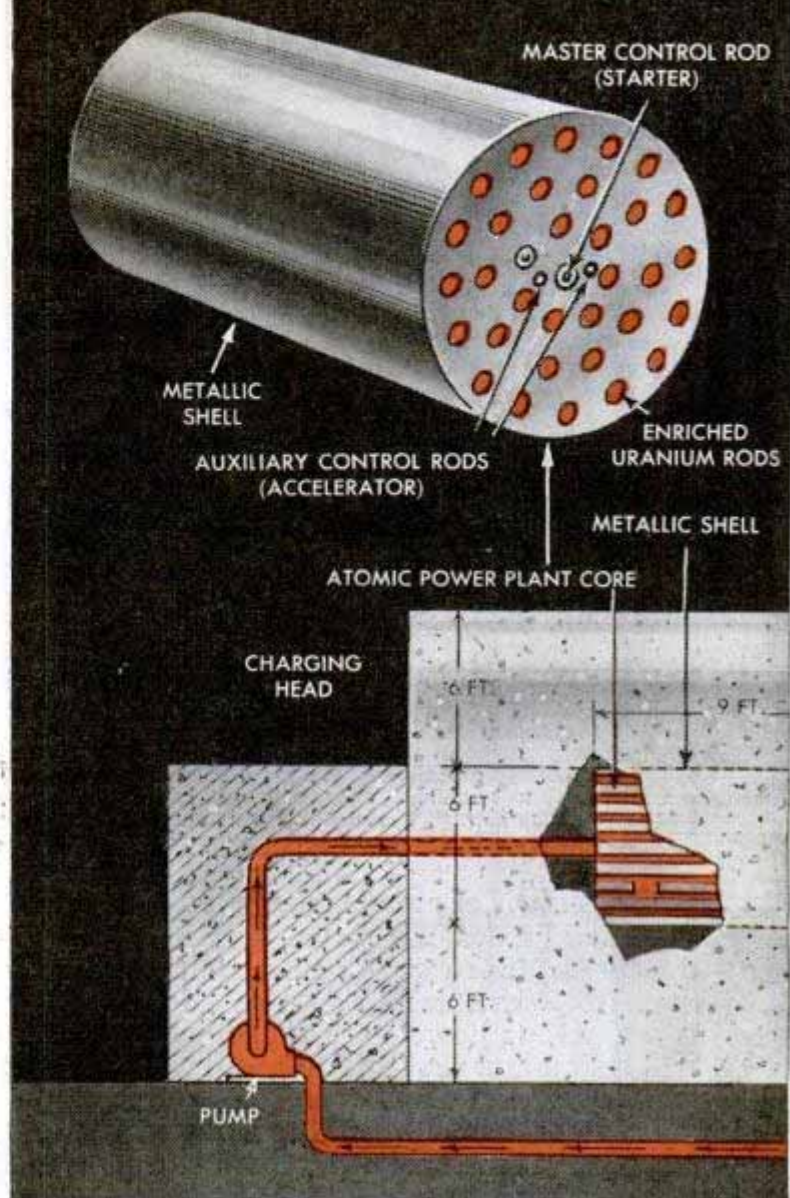
To produce effective atomic energy, the initial reaction must grow in intensity. This is what is called a chain reaction. To achieve a chain reaction, more material which can cause fission, or breaking apart of the atom's particles, must be produced than is consumed in the process. Therefore, to bring about a chain reaction, more than one neutron must be produced from each atom as it is split.

Actually the process is more complicated than that. There may be impurities present which capture some of the neutrons so that they do not cause further fissioning. Some neutrons may get out of the reaction without causing fissioning and be lost. Further, for most applications it is desirable to create new material that will fission to replace the material which is used up. If this is done, one additional neutron per fission is required. These various factors mean that more than two neutrons per fission must be liberated to produce a practical chain reaction of the type now known.

One of the first questions that is encountered in considering the application of atomic reactions is whether such reactions can be controlled.

Fortunately, this has been adequately demonstrated by the operation of the government plutonium plants at Hanford, Washington. Here nuclear reactions are carried out on a very large scale involving liberation of about a billion British thermal units per hour. This hourly heat liberation is equivalent to that obtained from about 7100 gallons of fuel oil. It has been possible to operate these plants day in and day out with the

ATOMIC POWER PLANT



reaction controlled at the intensity desired. There should therefore be no question that, under proper conditions, reactions involving nuclear fission can be controlled.

How can people in the vicinity of an atomic energy machine be protected against radiation in a practical way?

Of the lighter higher-speed particles given

Chart shows that atomic engines might power ships and locomotives but wouldn't fit into planes and cars because of heavy shield required to protect passengers from rays

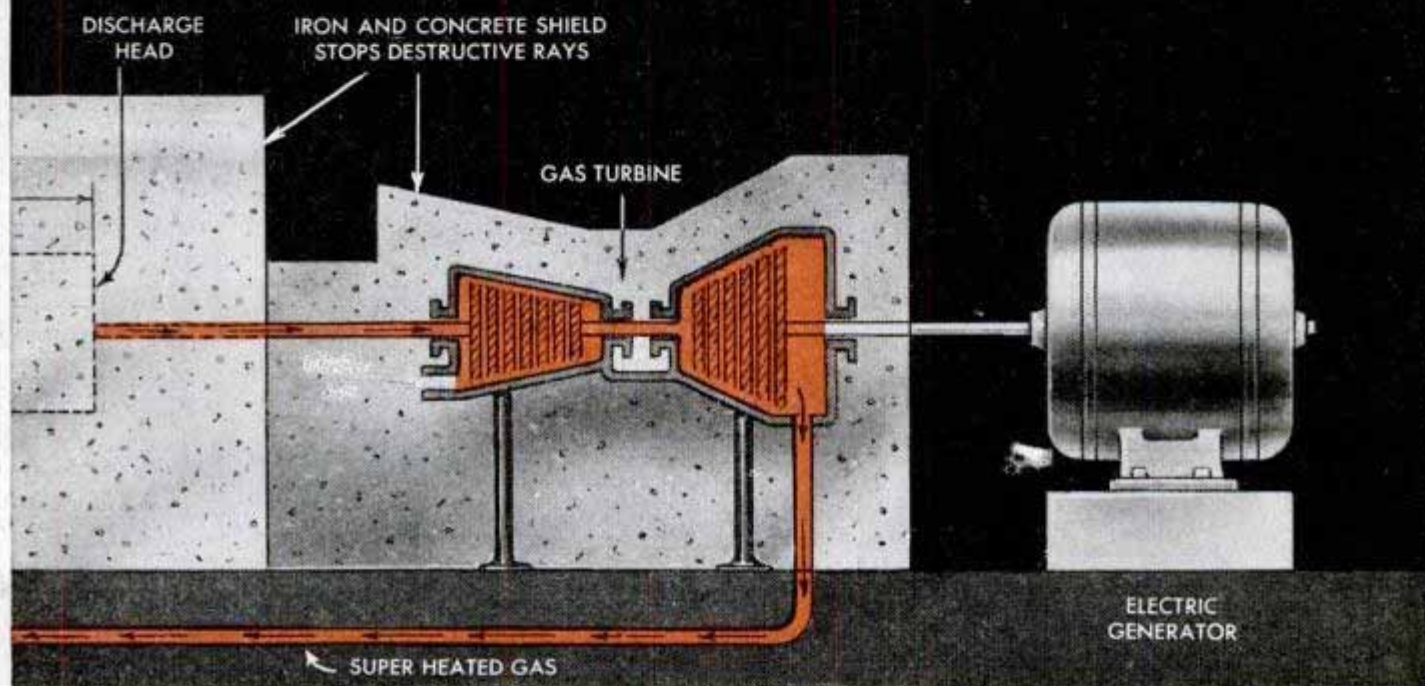
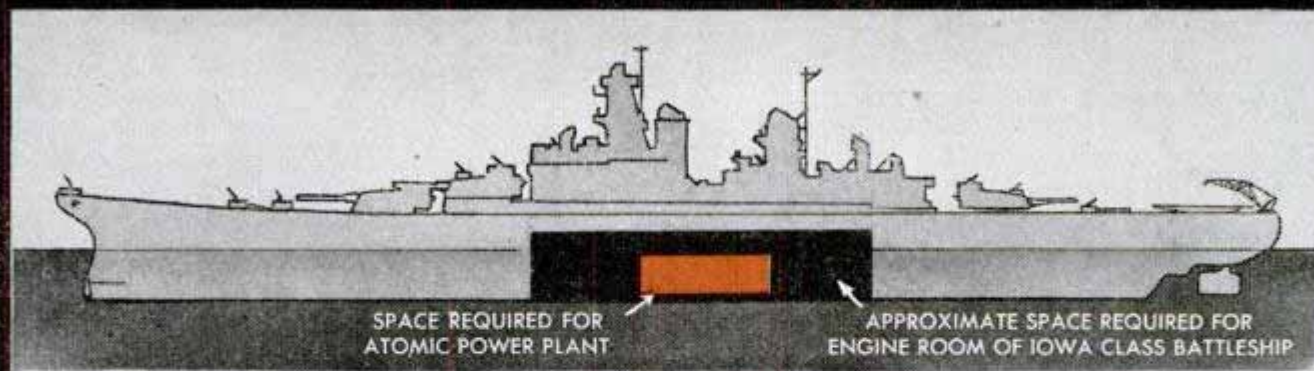
ARE ATOMIC ENGINES PRACTICAL?

	Total weight (tons)	Horsepower	Weight of atomic power plant for equivalent hp.
Battleship (Iowa class)	52,600	200,000	500 tons
Locomotive (turbine)	496	6,900	100 tons
Airplane (DC-6)	42	8,400	15 tons*
Automobile	1½	100	50 tons

(Atomic powered car would cost \$500,000)

* Would weigh same as auto engine if equipped with full shielding

FOR BATTLESHIP OF THE FUTURE?



Artist's conception of a 200,000-horsepower atomic power plant for a battleship. It would weigh 500 tons but would require less space than today's engines. Ship could stay at sea for long periods without refueling

off by a bursting atom, four are electrically charged. These four—alpha particles, deuterons, protons and electrons—provide almost no problem in shielding. Because of their electrical charge, they interact with other particles as they fly through matter. Thus, when going through even a thin shield they are slowed by the electrical charge of nearby atoms, deflected from their course and finally stopped. In general, a mere sheet of paper can shield against alpha particles; six sheets, against deuterons; 10 sheets, against protons; 500 sheets, against electrons. But great complications arise when we seek a shield against the uncharged neutrons and gamma rays.

We know, of course, that any substance in the world—even a sheet of hardest steel—consists of an enormous number of atoms with a great deal of space between their

nuclei. The intervening space is occupied by clouds of electrons which are held in place by the electrical charges of the nuclei. Since neither the neutrons nor the gamma rays have electrical charges to attract them to the atoms of matter through which they pass, they may easily continue their penetration for some distance. Neutrons can be halted or slowed down only if they crash headlong into the nucleus of an atom or pass very close to it. Gamma rays interact with both atoms and electrons under circumstances that have a low degree of probability, and thus are not very likely to be deflected.

Thus extensive shielding against both neutrons and gamma radiation is required. Roughly, it takes the equivalent of two inches of lead to shield against gamma rays; it takes six feet of water to shield against



neutrons. In both these cases the shielding is still incomplete in that the particles or rays are not stopped but merely decreased in concentration and speed or intensity. The bulk of such shielding is a major problem in applying nuclear energy to many commercial uses.

We know it is possible to shield against neutrons and gamma rays because this was done successfully in the wartime atomic piles at Hanford. These piles—latticelike structures in which plutonium was produced from uranium—were run by remote control and built within massive shields that hemmed in radiation. The tremendous bulk of the shielding required for the wartime piles is not practical in many commercial uses, and scientists are searching for a more compact method of shielding. Whether this quest will be successful is very questionable.

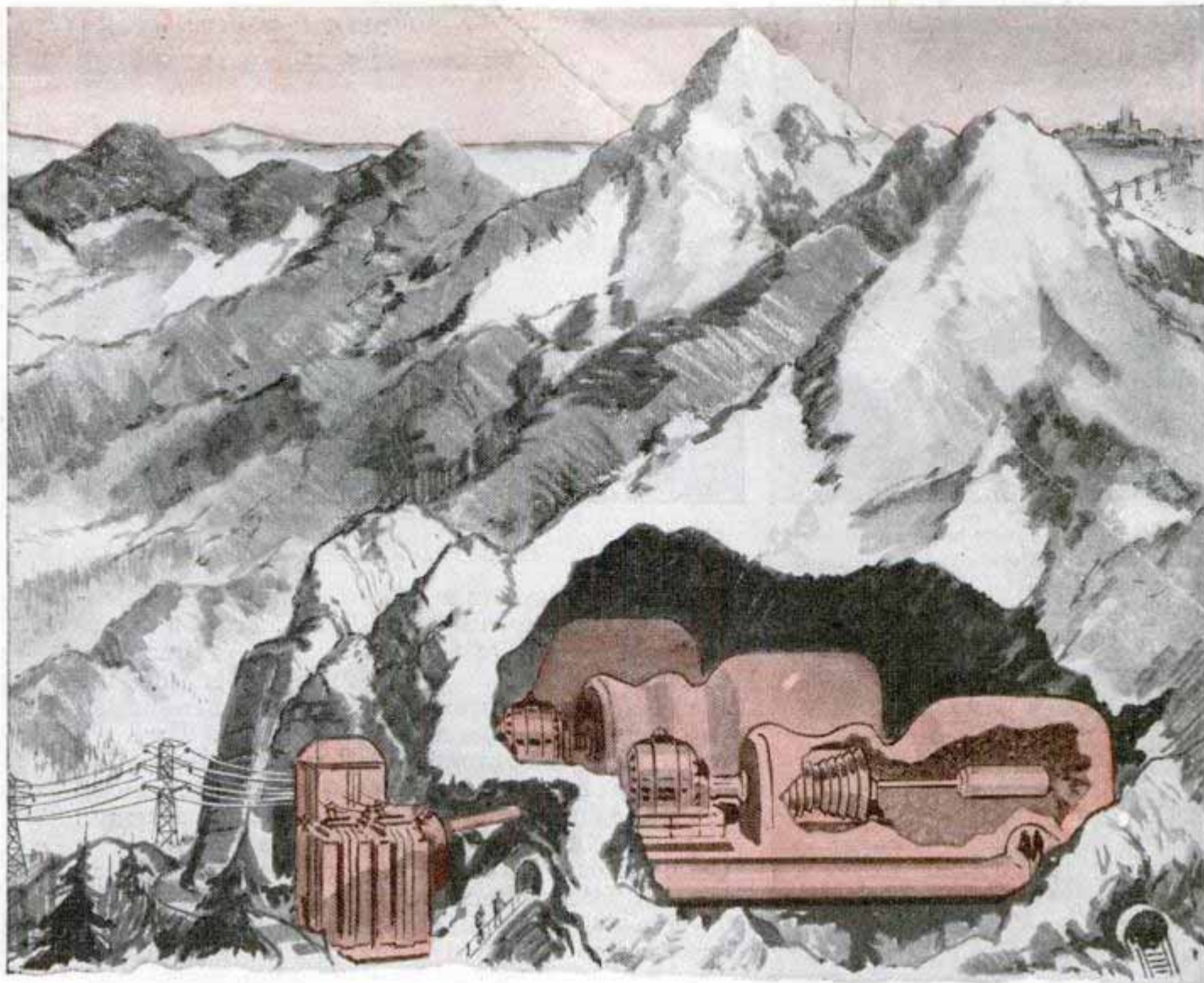
Will we have an adequate supply of fissionable materials?

Uranium is basic in our atomic work today. While accurate figures on the world's known deposits of normal uranium are not available, it is believed that readily available deposits are about 30,000 tons. Normal

uranium consists of about 99.3 parts of uranium 238, which as such is not fissionable, and only 0.7 parts of another uranium isotope—uranium 235—which is fissionable. (An isotope is a form chemically similar but with certain physical differences making possible methods by which it can be separated.) Thus 30,000 tons of normal uranium yield only 210 tons of uranium 235.

The situation is more hopeful, however, than these figures indicate. Plutonium, which is equivalent to uranium 235 from the standpoint of atomic energy, can be created from uranium 238 by absorption of a portion of the neutrons liberated in fissioning uranium 235. By proper design, the amount of plutonium so created can be made equivalent to the uranium 235 destroyed. The plutonium so produced will, on fissioning, in turn produce an equivalent amount of new plutonium.

By continuing this process all of the normal uranium (uranium 238) can eventually be utilized to give atomic energy. Since one pound of uranium when fissioned gives heat equivalent to that of 6000 barrels of oil, 30,000 tons of uranium would be equivalent, from the standpoint of energy produc-



Atomic power plants, buried deep in the earth for protection, soon may provide electricity for entire cities

tion, to 360 billion barrels of oil, or about 18 times the proved U. S. oil reserves.

Thorium, another heavy metal, can be converted by neutron absorption into uranium 233, another isotope which also is fissionable through a process similar to that used for making plutonium.

If it becomes possible to get more than one part of plutonium produced for one part of uranium 235 destroyed, then the excess plutonium could be added to thorium which then could be made to yield atomic energy by a process similar to that discussed for uranium. In this way the supply of atomic energy could be still further extended. Also, the demand for uranium and thorium will certainly inspire new searching for deposits to bolster the known supply. It may reasonably be concluded that ample raw materials for atomic power will be available for the world's predictable needs.

The fourth problem is: How will nuclear power be geared into our industrial and social system?

The popular fancy of pellets of uranium burned like oil or coal in something like

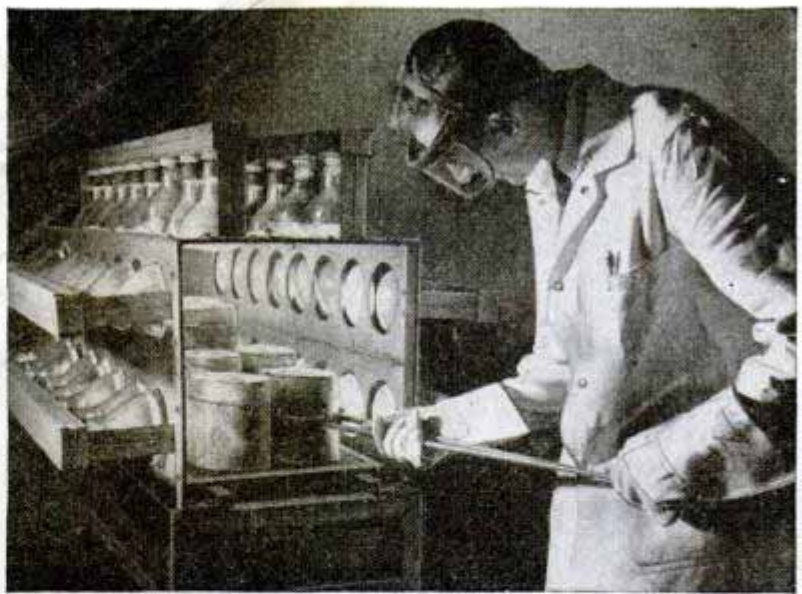
an internal combustion engine does not fit present facts. A chain reaction cannot be created unless there is a certain minimum amount of fissionable material present. This is what physicists call "critical size." This minimum amount depends on the concentration of fissionable material. For high concentrations the critical size may be measured in pounds; for substances containing low concentrations of fissionable materials the critical amount of such substances may be measured in tons. In any case, bulky shielding is required for protection of human beings nearby.

The two considerations of critical size and shielding, particularly the latter, make it undesirable at the present time to adapt atomic power from piles to small units. Energy from the atom will not, so far as we can tell now, power automobiles and airplanes, and an atomic furnace will not be feasible in the basement of a home. But atoms may very well furnish energy to cities and large industrial installations where space and weight are not a consideration. We already have means at hand

(Continued to page 276)



Model blades are cast in wax and mounted in holder. Below, assembly is surface-treated and covered with flask. Above right, flask filled with hardened cement is baked in oven to melt wax, leaving mold



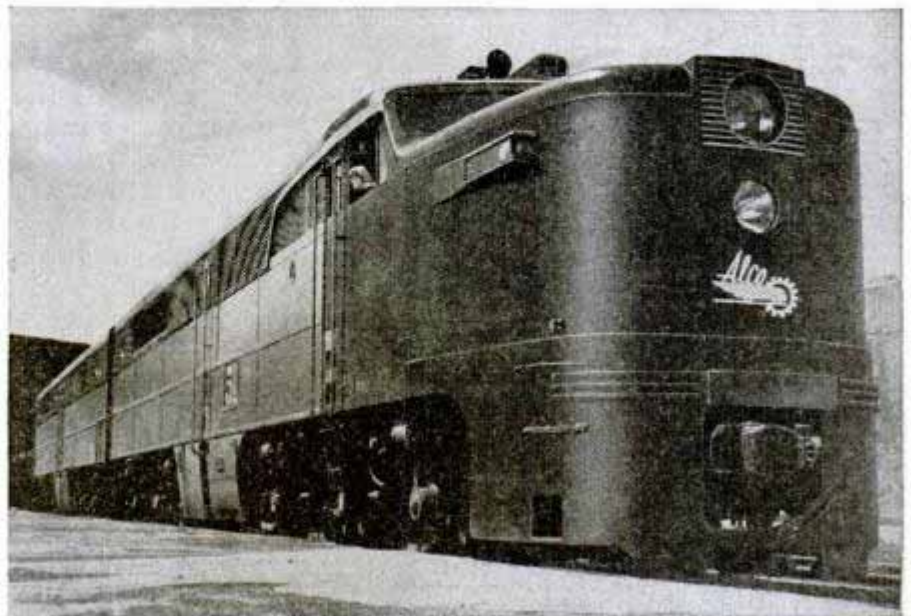
Gas Turbine Blades Cast in Wax

Four hundred years ago the Italian sculptor Benvenuto Cellini invented a casting process that modern engineers have revived to mass produce gas turbine blades. These four-inch blades turn the shafts of jet and turbine type engines when blasted with compressed gas at 1500 degrees F. They are made of cobalt-chromium alloy. In the original method of making the blades, the superhard metal broke the dies of the drop forge. Then metallurgists at Westinghouse turned to a process developed by Cellini to cast statues. A die from a master pattern is filled with molten wax to make a model blade. Twelve of these blades are mounted on a hollow wax base and covered with a metal flask. The flask is filled with a cementlike solution. When the mixture has hardened, the flask is baked in an infrared oven, melting away most of the wax to leave an exact mold in the cement. The mold then is filled with the cobalt-chromium alloy. When the metal has cooled the cement is smashed loose to reveal the 12 blades, each as precise in measurement and smooth in surface as though it had been machined on a lathe.



New "Million-Mile" Diesel Locomotive Develops 6000 Horsepower

Six-thousand-horsepower Diesel-electric turbines provide the pulling power of a new locomotive built by the American Locomotive Company. The locomotive, which was built in three units, was designed for passenger trains traveling at speeds up to 120 miles per hour. The "6000" was developed to give increased power in a relatively lightweight engine. It is designed to operate over a million miles during three years of service without a major overhaul.

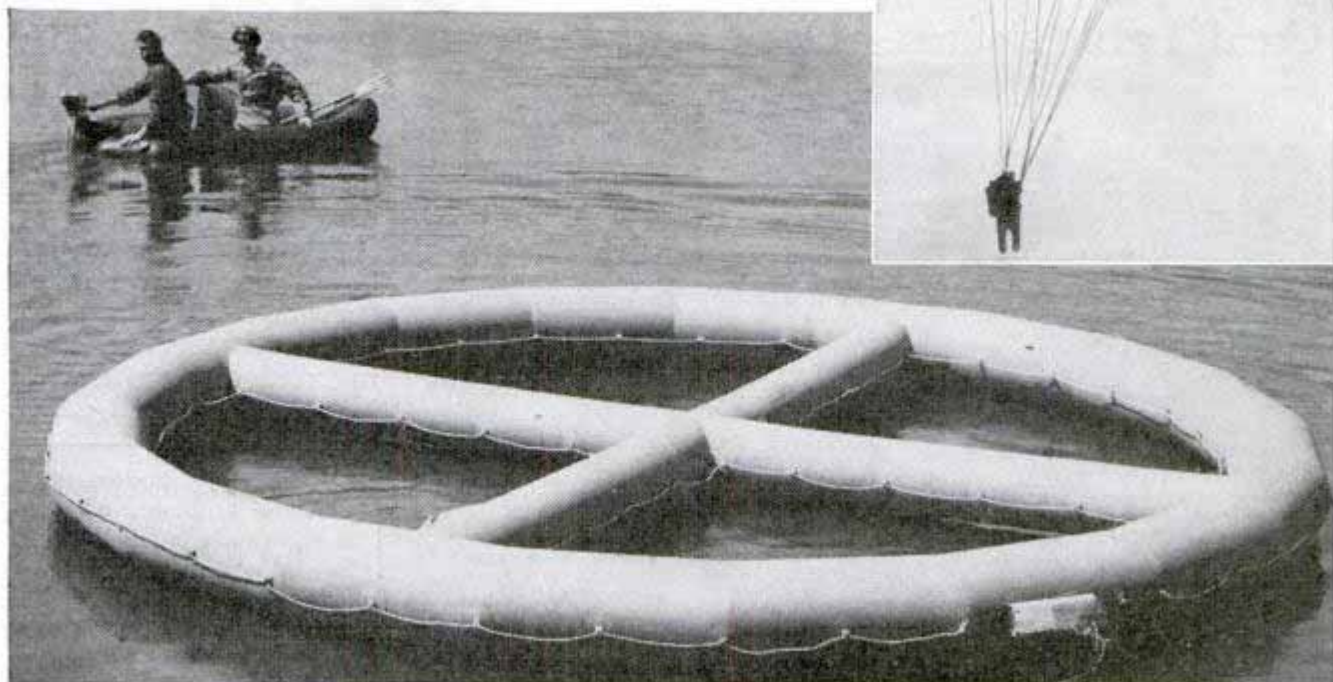
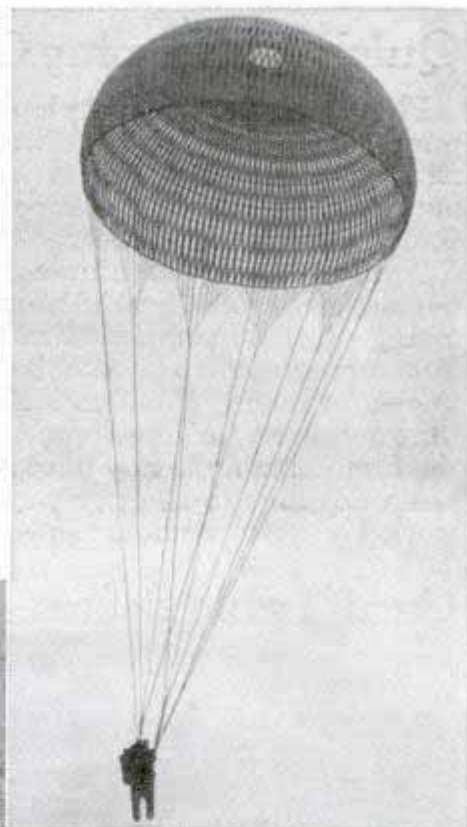


Mr. Sci. Co. 11/10



Lifesaving Aids For Airmen

Lifesaving is always the top objective of the Air Materiel Command's personal equipment laboratory. A trigger pulled by the airman above fires a gun which shoots both him and his seat into space at 60 feet a second. The container below his arm automatically explodes three seconds later, freeing him from the seat. The aneroid parachute release, upper right, opens the chute automatically after the user falls free to an altitude safe from anoxia. Air pressure compresses the aneroid and discharges a cartridge pulling the release. Most of the jar from jumps at high altitudes and speeds is eliminated with the slower opening ribbon chute at right. The 104-man rescue raft below, carbon dioxide inflated, is for large transports and surface vessels.



Radiophone Speeds Freight Pickup for Air Shipment



Two-way radiophone communication between truck dispatchers and truck drivers—successful at distances up to 15 miles—is speeding pickup and shipment of air freight. When an air line receives notice of freight to go by air, the dispatcher calls the air freight truck driver over the radio-

phone. The driver's itinerary is rerouted to pick up the shipment so that within a few minutes it is enroute to the airport. Previously the dispatcher had to check the driver's schedule, telephone to his next stop and leave word for the driver to call, sometimes resulting in several hours' delay.

Quick-Developing Color Film Processed in Any Darkroom

Photographers can develop color transparencies in their own workrooms with a new color film and processing kit developed by the Eastman Kodak Company. Called Kodak Ektachrome film, the new film requires only 90 minutes for complete development. The first 19 minutes of processing must be completed in a darkroom, but subsequent steps can be carried out under ordinary illumination. The short time required for development may make the film valuable to any photographer who has a deadline to meet or wants to see his work before a studio setup is torn down.

Fidelity to the subject's basic hues and no significant change in shadow areas beyond a deepening of color are features claimed for the film. Tests have indicated that the developers now available for processing the film are less likely to cause skin irritation than black-and-white developers. Chemicals for the five required solutions are available in kits that process 8, 16 and 56 eight-by-ten prints. The film costs approximately one half as much as equivalent sizes in Kodachrome sheet film. It is available in types for both artificial and daylight illumination.

Card Table Secures Deck and Discards in Outdoor Play

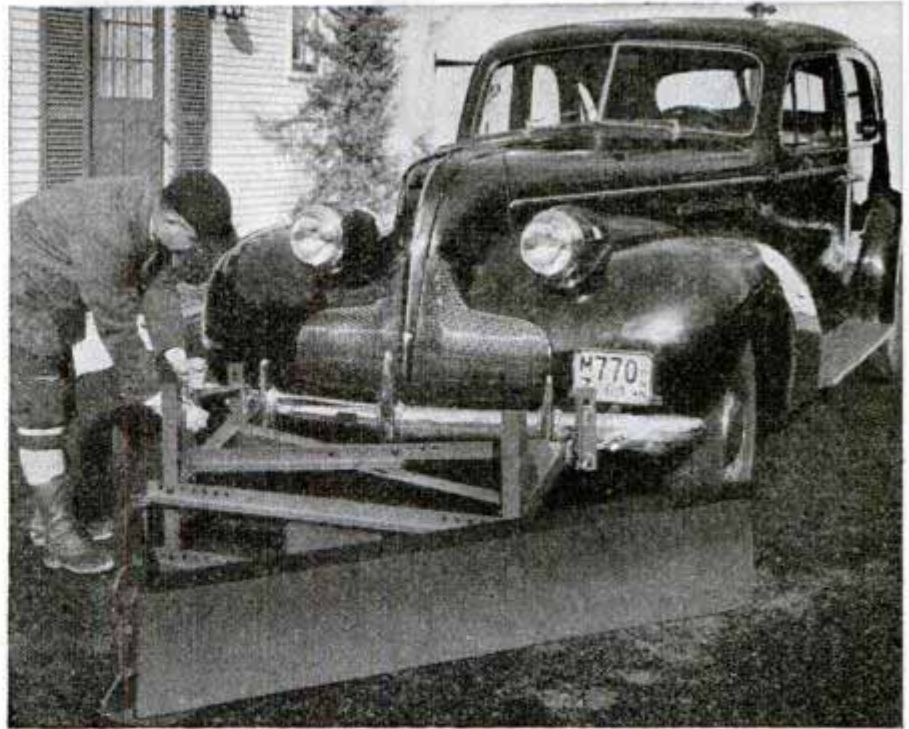


Strong wind fails to disturb outdoor gin rummy games played on a game board equipped with small metal springs and slotted borders to hold the deck, discards and spreads. The board folds compactly for easy carrying and can be used for all types of card games.

Information, including manufacturer's names, concerning products described in this issue may be obtained by writing Bureau of Information, Popular Mechanics, 200 E. Ontario, Chicago 11

V-Shaped Automobile Snowplow Removes 24-Inch Drifts

Attached to the front bumper of an automobile, a V-shaped snowplow makes short work of removing snow 14 to 24 inches deep from a driveway. Weighing 175 pounds and made of steel, the plow is equipped with a shoe that helps it over rough places. The blades rest on the ground instead of hanging suspended to avoid strain on bumper.



U. S. Patent Office Seeks Invention

Although the U. S. Patent Office has granted over 2,400,000 patents in its 110 years of operation, officials are now seeking an inventor who can invent something for them. The office needs a new system of classification for scientific and technical developments. Over 8000 applications for patents are received monthly, and officials must search through extensive files to determine whether the applications are for

inventions that are actually new. Scientists and inventors also have difficulty in finding the information they seek. Because of the enormous number of patents and many recent developments, the inventions defy efficient classification by any filing system known at present.

Farmers Use Walkie-Talkie to Reach Workers in Field



War surplus walkie-talkies, the midget radios that provided communication between small Army units during the war, have been given a new job on the nation's farms. Progressive farmers have purchased the hand radios for communication between farm buildings and fields. With two of the radios the farmer at the barn can direct work in the fields or his wife can talk kitchen-to-tractor with the farmer himself.

Nazi "Bubble Bath" Suits Protect Against Chills

Chemicals rubbed into protective suits produced a bubbly foam when German airmen toppled into the sea, diminishing loss of body heat for three hours and prolonging chances for rescue. The foam powder contained sodium bicarbonate, citric and benzoic acid crystals, a gelatine emulsion and two other chemicals. Experiments with captured equipment are being conducted by U. S. armed forces.



United Air Lines photo
Paris shopping tours will be overnight from New York in the Stratocruiser

NEW QUEENS of the

By Aubrey O. Cookman, Jr.

TAKE your pick—they're all "queens" in their own right. The nation's newest air liners and those on the eve of service will provide wonders of mass transportation that will reach out to every home in the United States.

No less than seven major aircraft manufacturers are potential suppliers of one or more models. In 1941 the air lines had 6200

seats on 359 planes, only five of them four-engined. By the middle of next year they expect to offer more than 45,000 seats on 1300 planes, more than a third four-engined. They'll be used on overseas lanes and some 150,000 regular air route miles in the U. S.

Many prophets envisioned 200 to 400-passenger airborne leviathans, with every-

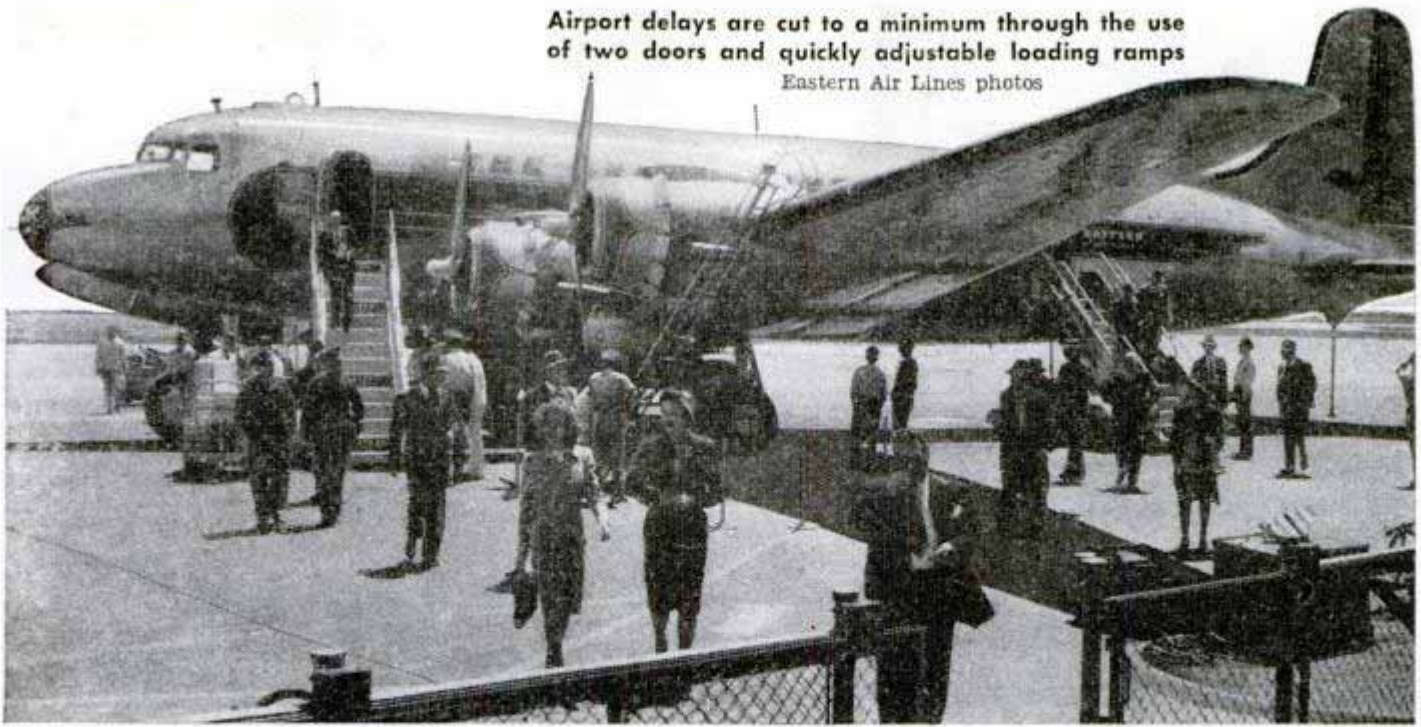
thing but a grand ballroom, in operation by 1947-1948. Actually, though, you'll probably be riding the more practical 30 to 80-passenger models in the 300-mile-an-hour class for a long time. The frequent service and high percentage of occupied seats demanded for economical air line operation dictates the size, though there is no doubt about the flying abilities of the big birds.

The Air Transport Association predicts the trend will be to greater speed, economy of operation and increased passenger comfort. There'll be no letup in safety advances, though the industry points proudly to 1945 when 18 lines went with-

There's more leg room and aisle space for passengers on daytime flights
Boeing Aircraft photo



Airport delays are cut to a minimum through the use of two doors and quickly adjustable loading ramps
Eastern Air Lines photos



SKYWAYS

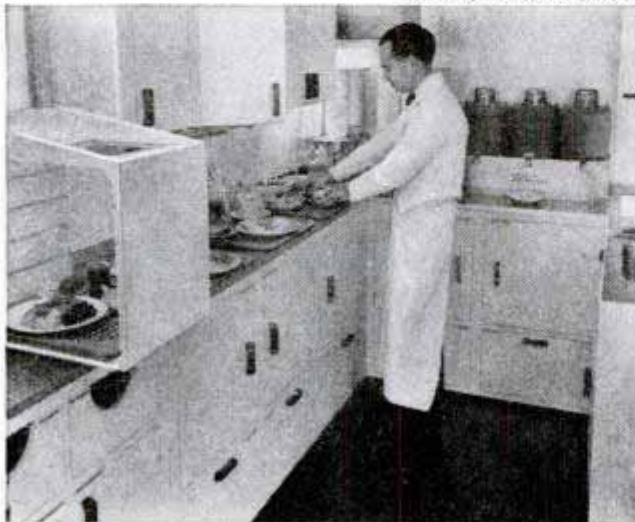
out a fatal accident. Comparing latest statistics, air travel is safer than autos or taxis.

Wartime research pushed the development of flying aids 5 to 10 years ahead of its normal pace. There are now radar and electronic devices which will permit landing under practically zero ceiling and visibility and avoid risk of collision by enabling pilots to see other planes in even the murkiest weather. Some of the new inventions are the gyro-synchronized compass, the radio altimeter and Loran, long-range radar navigation.

Most of the nontechnical innovations are common to all the new models, differing only in the distinctive touch of the manu-

Roomy galleys have replaced cramped serving shelves

Boeing Aircraft photo

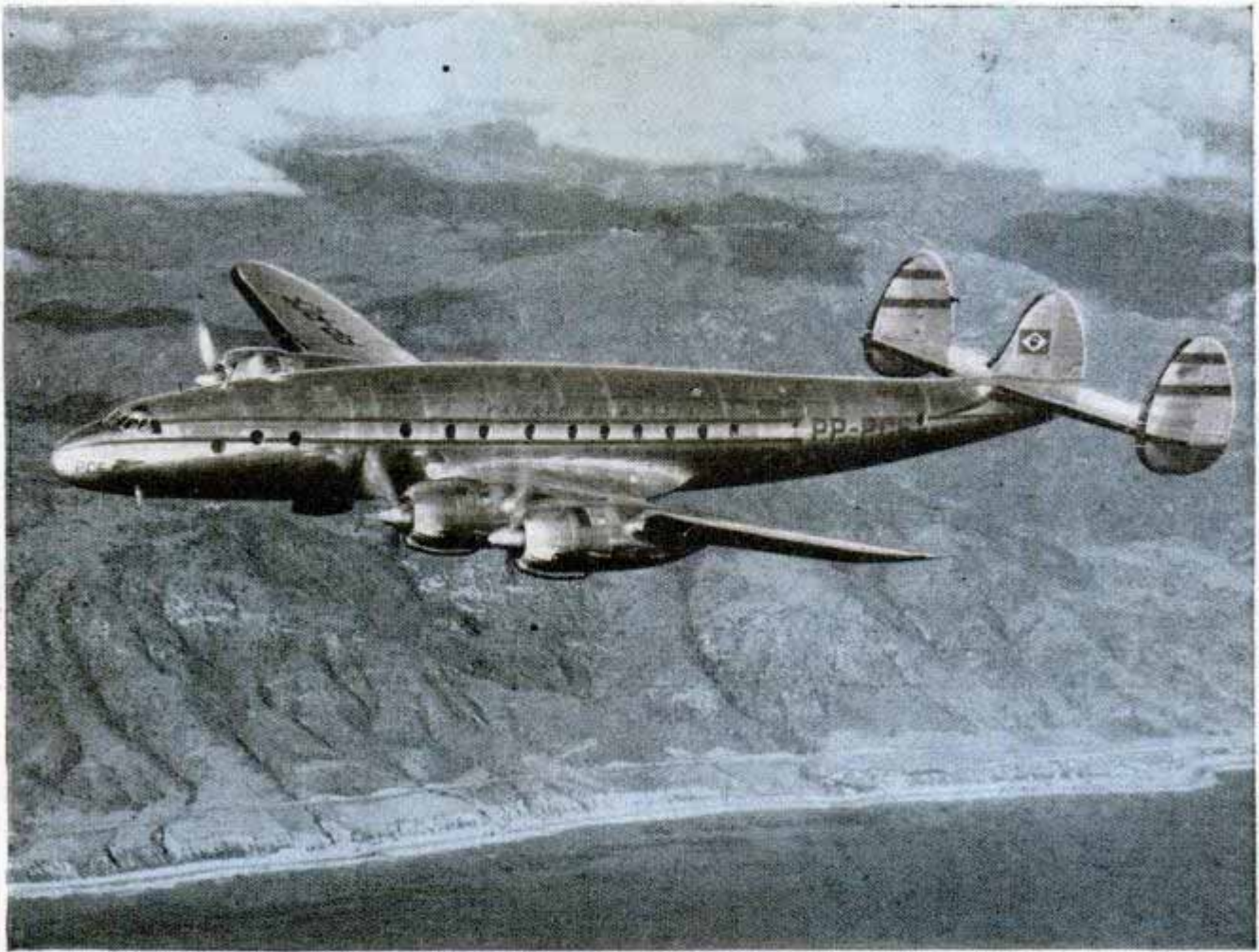


facturer or in special modifications made for a particular air line. Some will arrange the same number of seats differently, or eliminate a few to add elbow room, especially for long overwater schedules.

Berths are seven inches wider than those on trains

Boeing Aircraft photo





Lockheed Aircraft photo

First new plane to go into commercial operation, Constellations set overseas and transcontinental speed records

The commercial fleet now in the making was planned with a particular eye to the demands of women. Where only every fifth prewar passenger was a woman indications are they'll soon match the males in number. Their lounges will have dressing tables with indirect lighting and other frills.

Interiors will run to the greens and blues decorators have found most restful, though some of the shorter-run planes will continue with the more exciting color combinations. There'll be closet space opposite the entrance where coats and hats may be stowed without wrinkling and also handy luggage compartments where traveling

bags can easily be reached during flight.

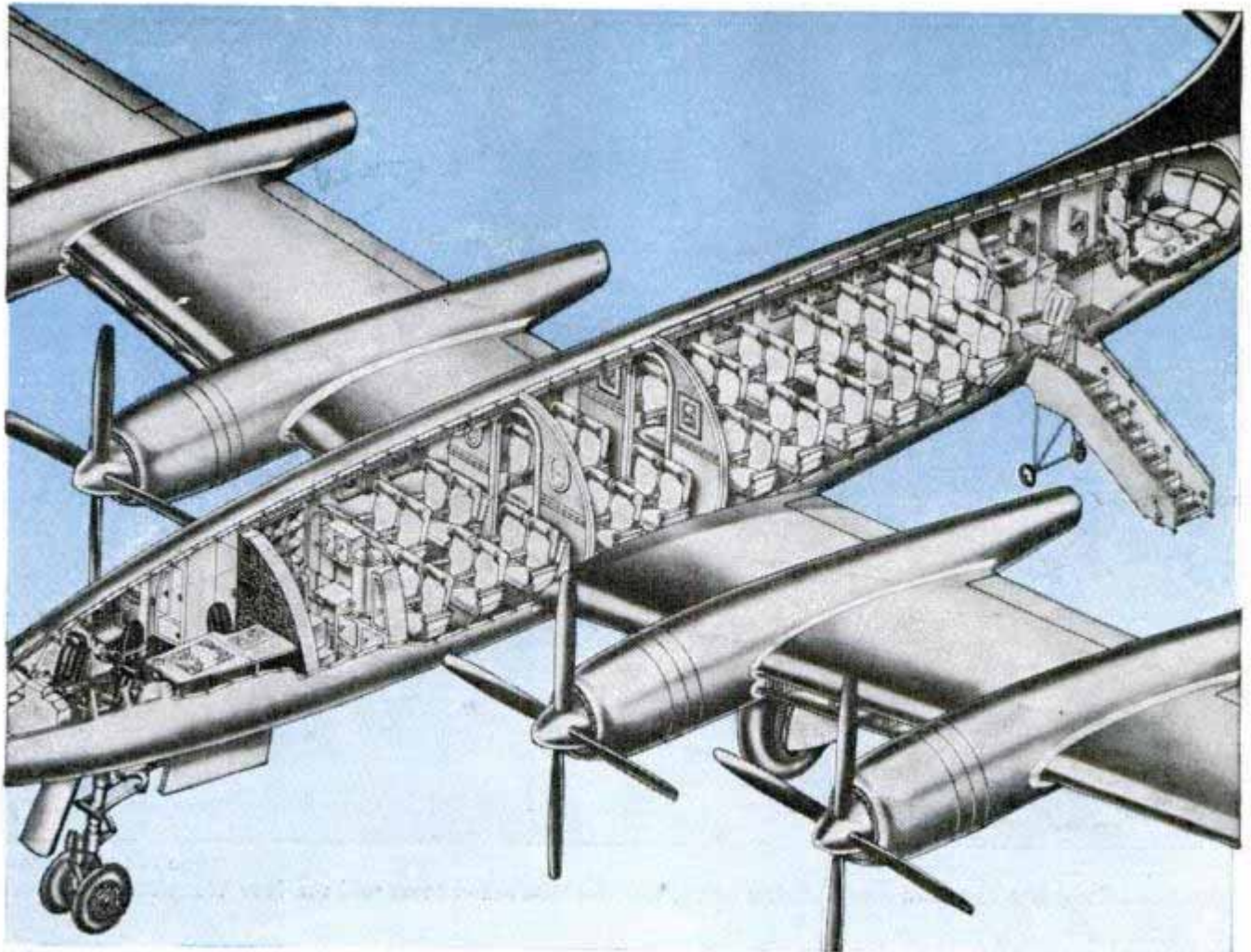
For "over-the-weather" flying pressurized cabins maintain sea-level conditions at 15,000 feet and an 8000-foot "altitude" up to 30,000. The new planes are as quiet as your living room and shock mountings throughout virtually eliminate vibration. The frostproof windows are larger and better arranged for observation and there's always fresh air circulating.

Seats are wider, with adjustable shaped backs and head rests and, instead of a meal tray on your lap, a table attaches to your seat. Sound movies are on hand to help kill time during long night flights.

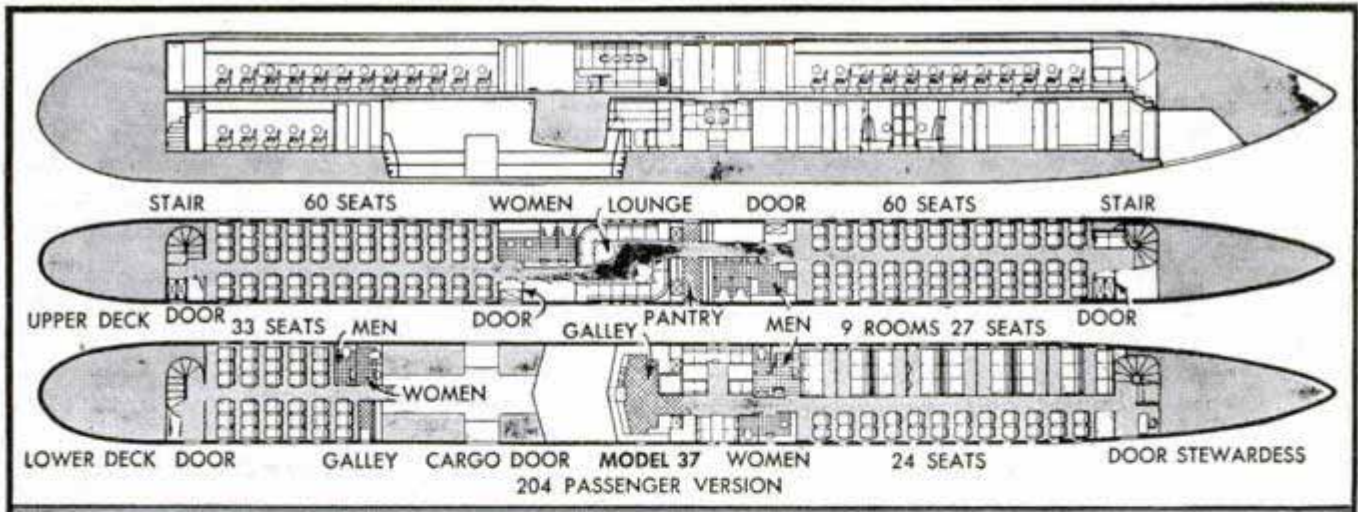
Republic's 400-mile-an-hour Rainbow relies on jet thrust from exhaust gases for added cruising power and range

Republic Aircraft photo



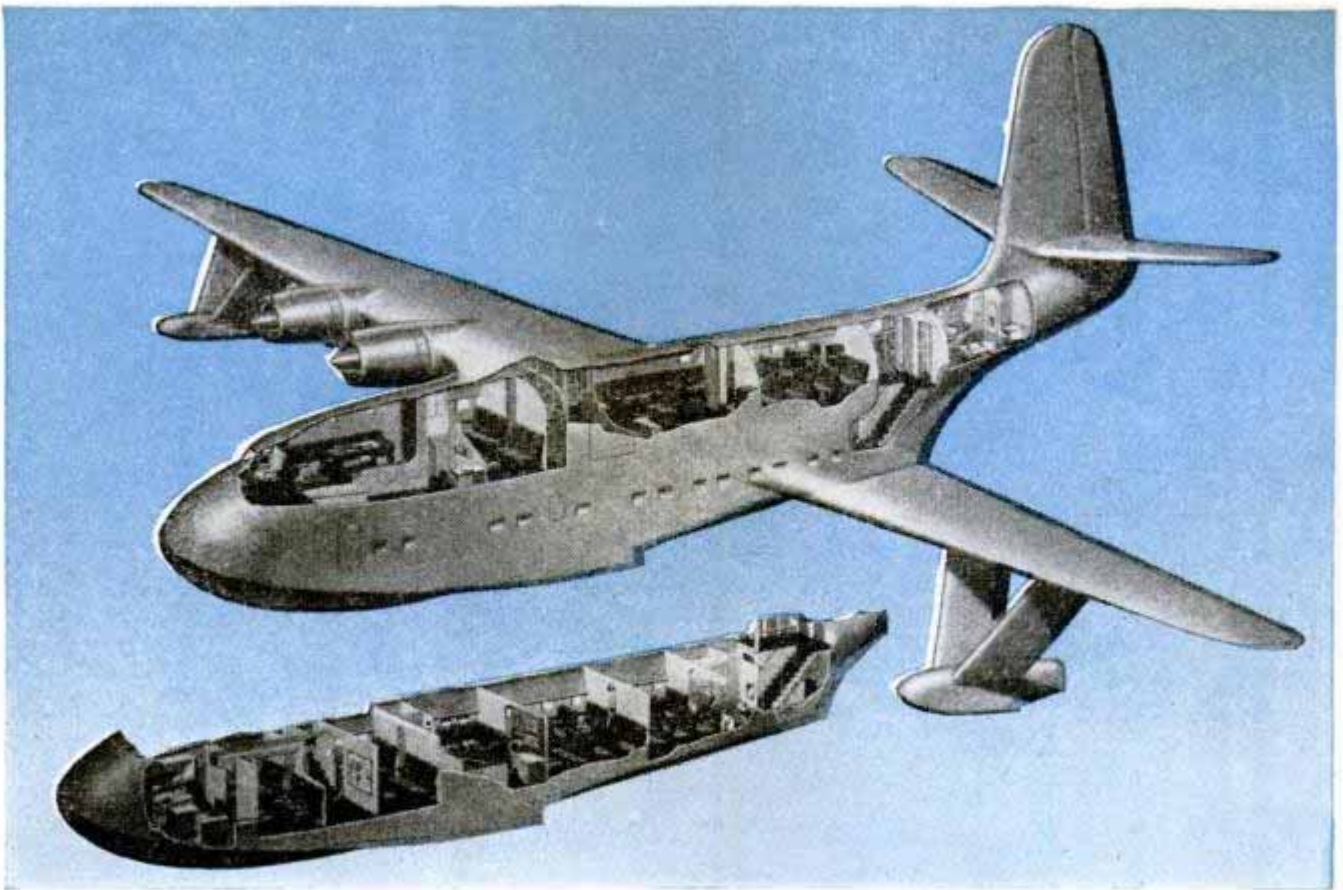


Sectioned view of the Rainbow (above) shows three passenger compartments, galley and a lounge in the tail Republic Aircraft photo



Biggest of those slated for production, Consolidated's Model 37 weighs 67 tons. Sketch above shows how its space will be utilized Consolidated-Vultee photo





Glenn L. Martin photo

Latest of a long line of Glenn Martin flying boats, this double-decked Mars will use four Wasp Major engines

An old bugaboo, airsickness, took a bad licking from the bigger planes during recent years and may disappear entirely with altitude-conditioned cabins. It was recently brought out that now only three out of every 1000 passengers become airsick and only one in 2000 has ear trouble.

Most recent of the air liners to be introduced for both global and domestic operations is the Douglas DC-6, a bigger, faster version of the war-working C-54 (DC-4) Skymaster. It carries 72 daytime passengers and cruises above 325 miles an hour. Four Pratt & Whitney Double Wasp engines drive its electrical reversible-pitch

propellers. Just over 100 feet in length, it has a wing span of 117 feet and a gross weight over 80,000 pounds. Along with the DC-4s and 6s, the twin-engined 21-passenger DC-3, backbone of prewar air line operation will remain a familiar sight on the airways for shorter runs.

Fastest newcomer is the slender 400-mile-an-hour Republic Rainbow, capable of New York to Los Angeles flights in six hours and New York to London in nine. Equipped for high-altitude transoceanic schedules, the Rainbow carries 46 passengers and crew. Slightly shorter than the DC-6, its wing span of 129 feet is nearly

Stratocruiser's lighting and interphone control unit

Boeing Aircraft photo



As comfortable as your home—five miles above the earth

Boeing Aircraft photo





Bigger and faster than the war-famed C-54 Skymaster, the Douglas DC-6 cruises more than five miles a minute

12 feet greater. Four Pratt & Whitney Wasp Major engines are augmented by extra jet thrust from compressed exhaust gases. Its gross weight is 116,500 pounds.

Boeing's candidate is the double-decked Stratocruiser, 67-ton descendant of the B-29 Superfortress. It rates one of the "biggest" tags with accommodations for a maximum of 114, wing span of 141 feet and over 110-foot length. Further emphasizing its roominess, the top main cabin is 80 feet long, 10½ feet wide and almost eight feet high. A lower deck snack bar and lounge has space for 14 or more passengers. It has Wasp Major engines and cruises at 340 miles an hour. The company is also producing the 417, a twin-engined high-wing transport for local or feeder service.

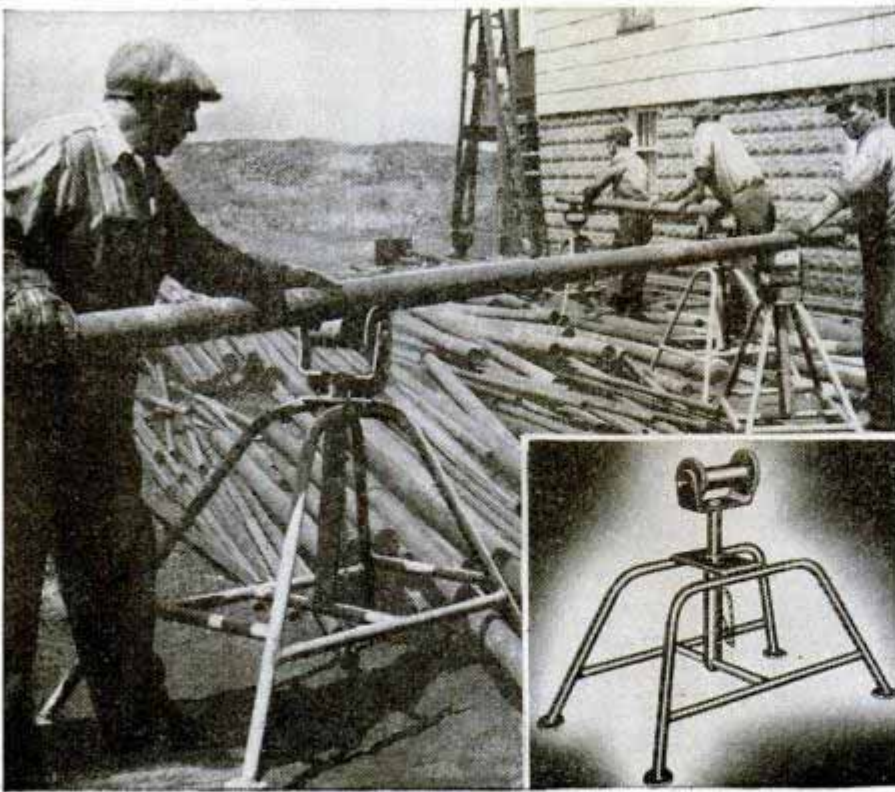
First of the high-speed heavyweights in commercial service was Lockheed's Constellation, readily spotted by a sharklike appearance and novel triple tail. She cruises around 320, carries up to 64 passengers and has a fully loaded range of 3000 miles. Guinea pig for many postwar air line innovations, the Connies were grounded briefly following a training accident caused by an electric short circuit which ignited cabin insulation material. This hazard has been eliminated. Lockheed is also bidding for short-haul recognition with the 14-seater Saturn, a high-wing twin-engined transport cruising 250 miles an hour.

Veteran builder Glenn L. Martin is putting three planes forward, topped by the

giant Mars, a double-decked flying boat with a span of 200 feet and more than 120 feet long. It seats 125 and four Wasp Major engines pull its nearly 90 tons through the air. In the short-range group Martin has the 202 and 303, both twin-engined and carrying 40 passengers. The latter is pressurized and will cruise above 300, aided by jet thrust. Both have optional front and rear doors to speed loading.

Biggest plane slated for commercial use is Consolidated-Vultee's Model 37, a 160-tonner accommodating 204 passengers in a double-decked fuselage. It is a mid-wing type with a span of 230 feet and a length of 182 feet. Six pusher-type engines are expected to provide a cruising speed above 340 miles an hour. In the medium class Consolidated has the 30-passenger Model 110 and the 40-passenger Model 240. The latter will be pressurized and cruise over 300 miles an hour, using exhaust thrust. Some of the planes are being built with rear loading ramps installed.

A potential in the field is Northrop, with the XB-35 Flying Wing presenting a radically new design for air transport. Its 10,000-mile range is exceptional and engineers estimate it will carry one fourth more passenger load than the same size conventionally designed plane. Gross weight of 65 tons and a wing area of 4000 square feet represent sufficient size for converting the plane, now flying as an Army bomber, to commercial transport use.

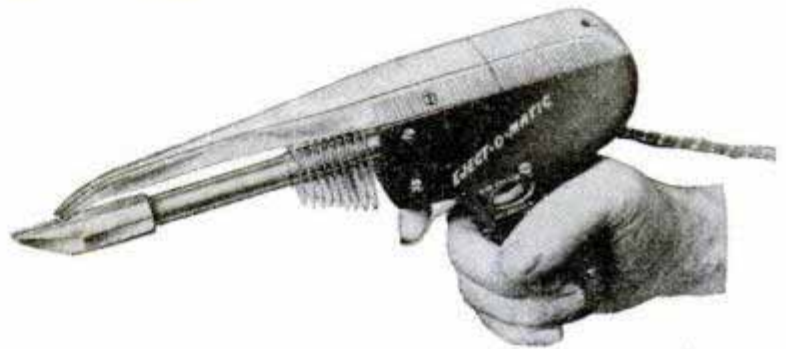


Roller Conveyor For Steel Pipe

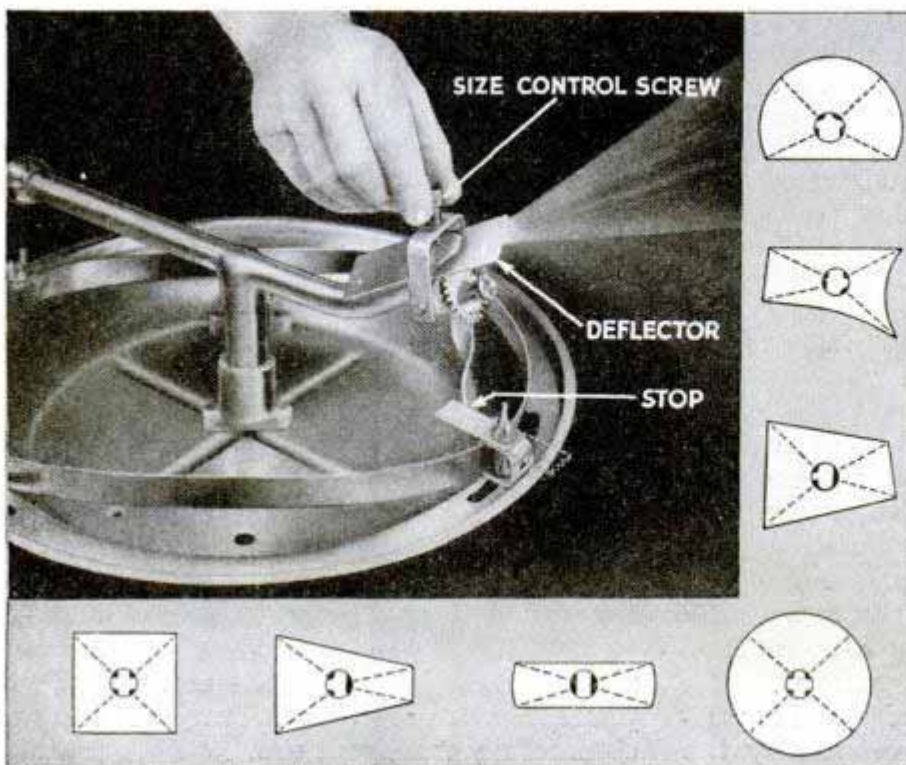
Used as a single unit or in line, a portable roller conveyor for quick loading or unloading of steel pipe, rods and bars saves muscle power and handling time. The material to be loaded is placed on the roller of the conveyor and pushed along to its destination. An adjustable swivel center post permits the roller to be raised to a height of 51 inches. Minimum height is 38½ inches. Built of tubular stock and weighing 81 pounds, the conveyor will take pipe up to 12 inches in diameter. Its capacity is 1000 pounds.

Automatic Soldering Iron Ejects Measured "Doses"

Measured amounts of solder are ejected from a reel in the handle of an automatic-feed, electric soldering iron. The amount of solder released is regulated by a micrometer adjusting wheel. The tip, drop-forged and covered with a corrosion-resistant alloy, needs no filing or sanding and can be "painted" clean while hot with a stick of solder. The iron is balanced at a point over the trigger to lessen operator fatigue, and is equipped



with a stand that minimizes the danger of a workman or bench being burned. The stand also enables the operator to use the iron while both his hands hold the work.



"Pattern" Sprinkler Waters Odd Plots

Whether a lawn is shaped like a triangle, semicircle or rectangle, every square inch can be watered thoroughly (with no waste spray covering sidewalks, drives and buildings) by a sprinkler that has an adjustable stainless steel track. The track is adjusted to the pattern of the plot to be watered.

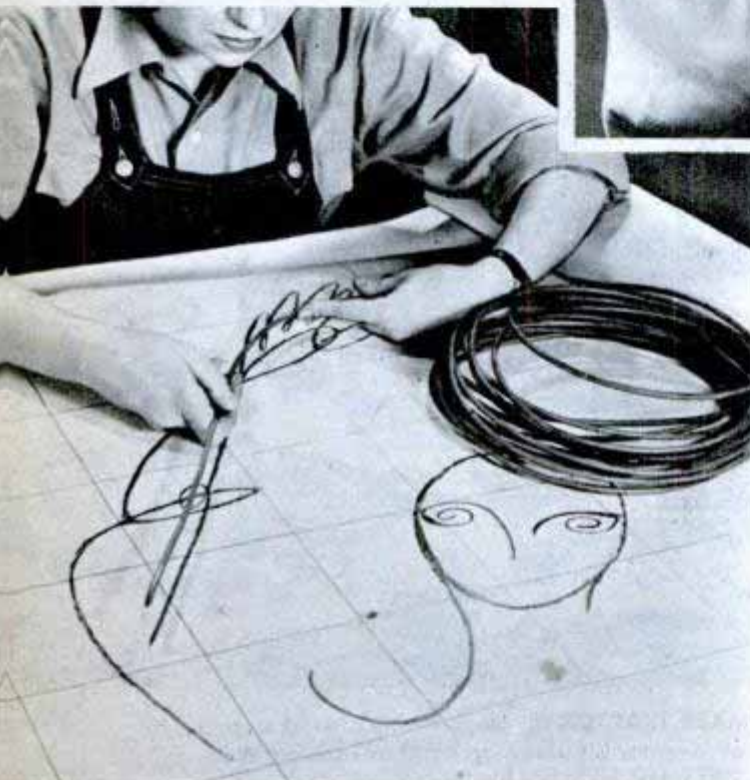
Due to lack of rail facilities, Bolivia plans to transport meat by airplane between slaughterhouses set up in grazing areas and principal cities.

Sculpturing

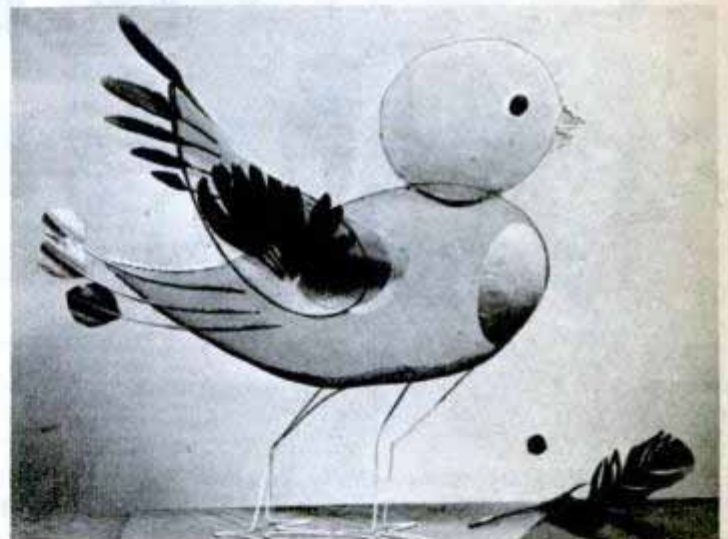
WITH WIRE



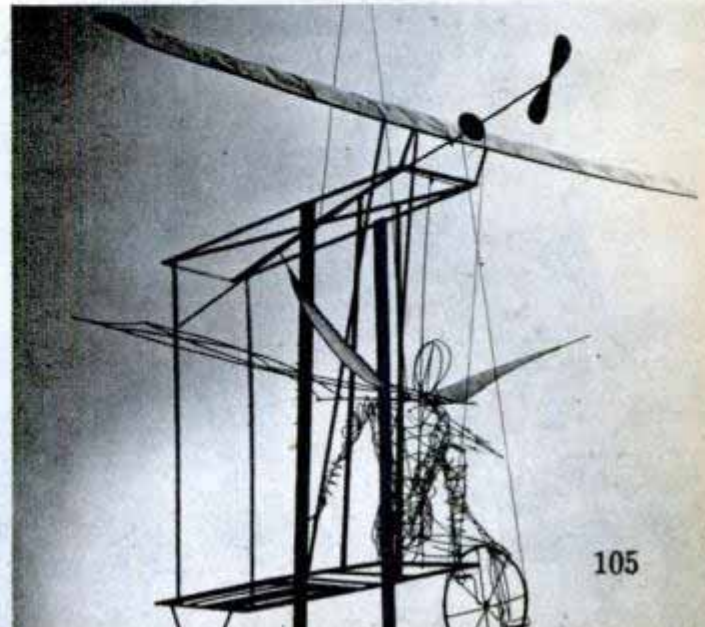
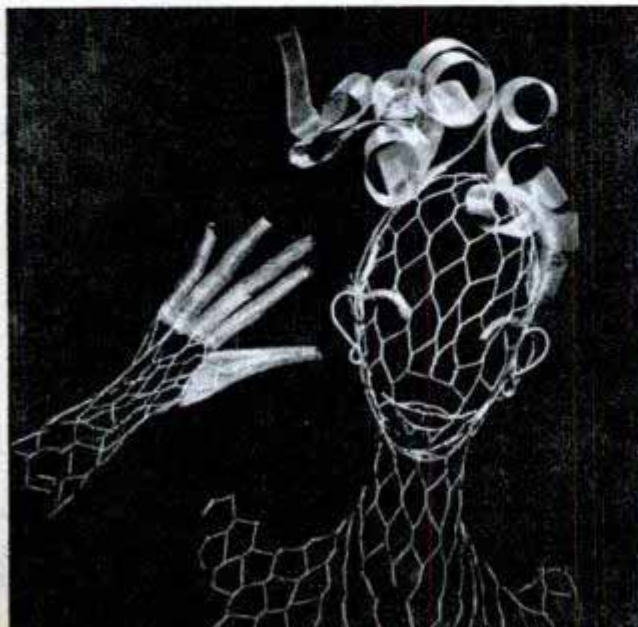
Wire, shaped in fanciful forms, and glass reflectors give a bizarre effect to headdress of Bali dancer

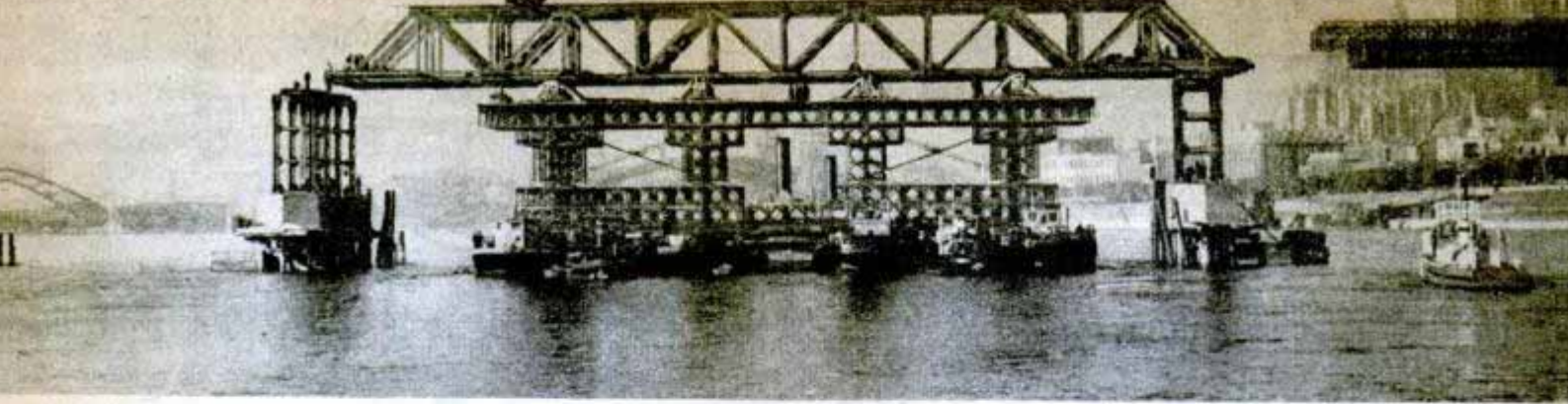


For figures, wire is bent to conform to sketched shape, then soldered in place. Face, below, was created of chicken wire, copper screening and artist's imagination



Chicken feather plumage adds to novelty of bird, above, made of wire screening. As capable of flight as design it copies is metal model of early airplane, below





BIG BRIDGE across the Rhine at Cologne was floated into position on a raft. Four 1000-ton barges were joined together to form the huge float. The spans, weighing 450 tons each and standing 50 feet above water, were mounted on the raft. When the bridge was in position the barges were partially sunk and floated away



SANDLOTTERS try unsuccessfully to break the glass in one of the new GE floodlights at New York's Yankee Stadium. The "ballproof" glass is only $\frac{1}{4}$ inch thick

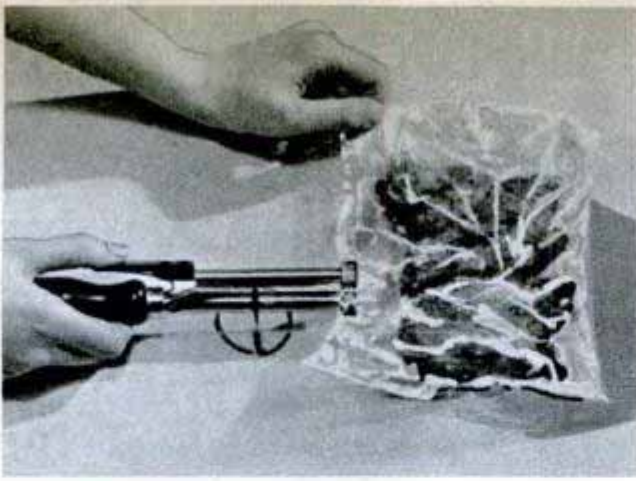
NEEDLES on this machine, developed by a Michigan State College horticulture expert, inject chemical nutrients and dissolved fertilizers into sick fruit trees



HOMEMADE TRACTOR for small farms proved so popular that inventor Charles Marchand of Tacoma, Washington, has set up an assembly line to manufacture them

FLUORESCENT LAMP designed for stenographers can be attached to all standard copyholders, flooding light over the desk and eliminating clamps and bars





Home Sealer "Bags" Leftovers

Flat sheets of moistureproof Cellophane can be fused with an electric sealing iron into airtight bags for storing perishable foods, leftovers, pastries or lunches. Any size bag can be formed by pulling two Cellophane sheets in either a curved or straight direction through the serrated rollers of the sealing iron. Such protective envelopes also seal tools or garments against moisture, rust or moths.

Special Wrench for Dual Wheels

Dual wheels are removed easily from trucks with a leverage wrench operated by one mechanic. The tool removes the outer and inner wheel cap nuts separately by means of an inner socket wrench that holds the inner cap nut tight while the outer nut is being removed. The wrench stand has a height adjustment mechanism and a self-locking device.

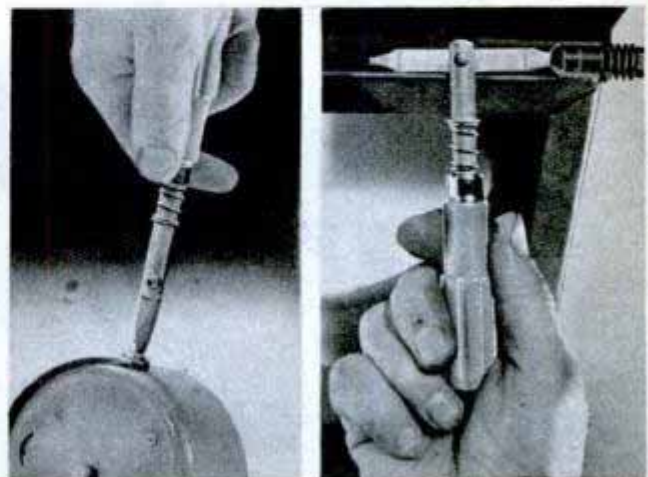


Circus Clown Uses Stilts at Home

Not for laughs does Bill Alcott, a professional circus clown, buckle on his circus stilts when he is at his home in Minneapolis. He uses them as a substitute for a ladder while washing windows or cleaning hard-to-reach spots around the house.

Right-Angle "Driver" Fits Corners

With a revolving blade center-mounted in a split shank, a reversible, double-end screwdriver fits different size screw heads. A spring-locked sliding cuff holds the blade in place so that either point may be used. The blade can be turned at right angles for work where space is limited.



WHERE REDWOODS ARE

By Thomas E. Stimson, Jr.

CALIFORNIA'S redwoods are the largest trees that ever grew and when you pause before an exhibit of them in the California State Museum and Exposition Building in Los Angeles you wonder if the 300-foot giants of the forest have produced a grove of pygmies, for the redwoods on display are only five feet tall.

The miniatures have shaggy red bark, drooping limbs and fine green needles, typical of the huge redwoods, 1000 years old or older, that flourish on the West Coast. Scattered between their bases are the houses, automobiles and outdoor theater of a public park, all scaled down in proportion to the trees that tower over them.

Natural as they appear to be, the trees are artificial models created by A. Nick, model artist attached to the museum who is famed for his skill at modelmaking and for his method of preserving foliage and other natural materials in their true colors.

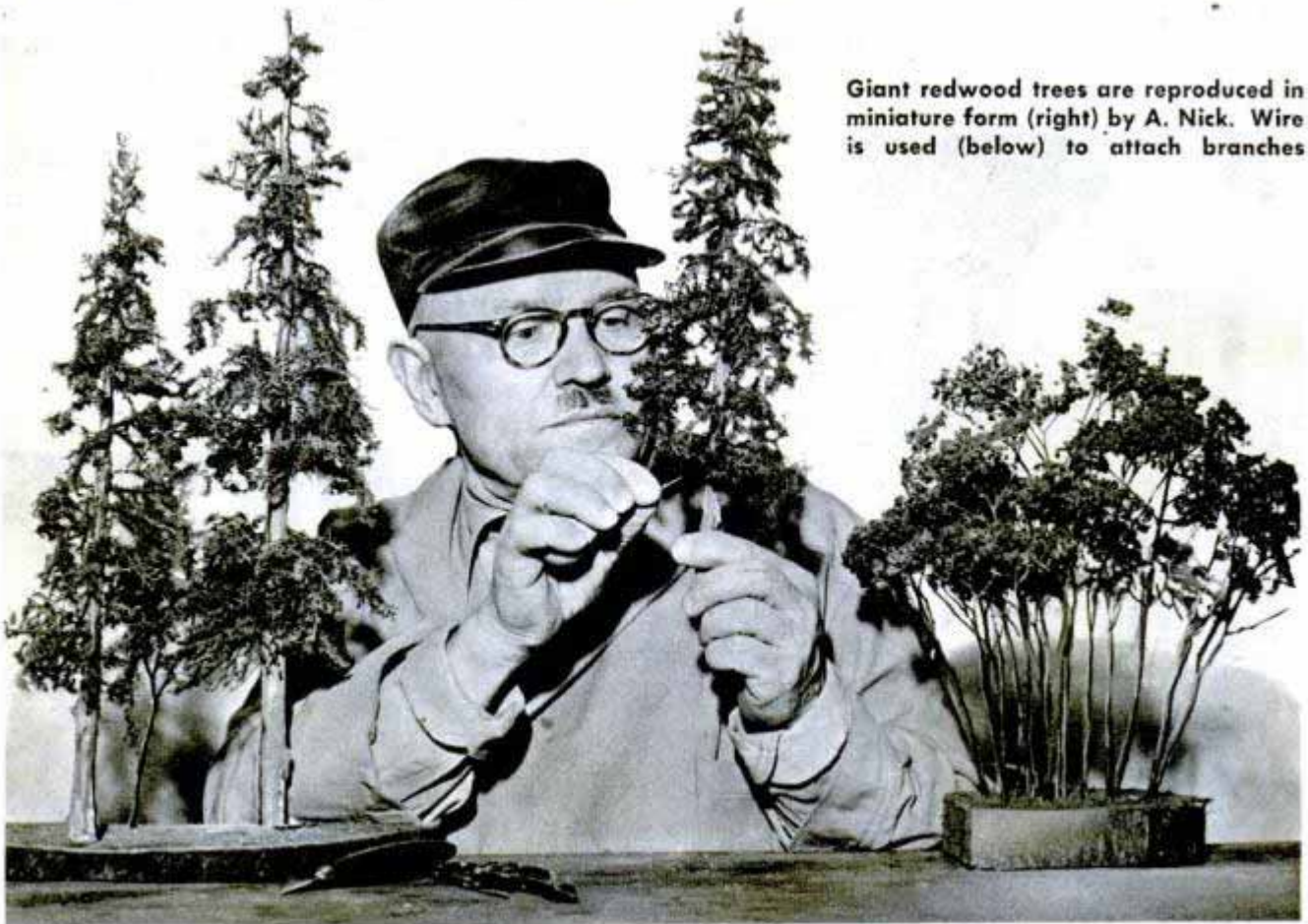
The trunks of the miniature redwoods, Nick explains, consist of strips of redwood bark glued to wooden poles cut to the right sizes and shapes. The limbs and branches are twigs of the right proportions. The nee-

dles that make up the foliage, while not as small as they should be, are the smallest evergreen needles he can find. This greenery and the other miniature trees and shrubs have been treated to retain their natural colors for decades to come.

With a sharp knife Nick can carve a castle out of soft sugar pine in a matter of minutes. Complete to towers and battlements, the model is no larger than a silver dollar. After sawing out the main parts he needs only half an hour to finish and assemble numerous bits of wood into a five-inch model of a part of Jerusalem. He takes less time to build a tiny church with windows, bell tower and ornate outer walls.

Cycloramas that depict mountain sports areas or other scenes in miniature are one of Nick's specialties, and many of the cycloramas at the State Museum and Exposition Building were built by him. These realistic miniatures, assembled in front of backdrops that are painted to carry out the perspective, give spectators an airplane view of many of the state's famed scenic spots.

Occasionally some of these cycloramas need to be brought up to date. Miniature



Giant redwood trees are reproduced in miniature form (right) by A. Nick. Wire is used (below) to attach branches

PYGMIES

Nature's rival is this king of craftsmen who creates realistic forests five feet high and midget cities complete with sound effects





Flowers that look real are made of plastic that retains color for decades. Below, cyclorama of a California resort

automobiles, for instance, must be replaced by more modern designs to keep up with the times. Under the direction of Louis C. Venator, director of exhibits, Nick is preparing to change many of the details of one huge cyclorama that shows the port of San Pedro. Tiny radar antennas and clusters of anti-aircraft guns must be added to some of the battleships that are shown clustered behind the breakwater. Drydocks and airfields built during the war must be added to adjacent Terminal Island.

Department stores often call on Nick at Christmas time for Nativity scenes and other miniature exhibits for display in their show windows. During the war he built realistic scale models of the scenes of many of our invasion undertakings. One 11-foot-long model of the Normandy invasion showed all of western Europe from the south of France to Finland, with cities, mountain ranges and rivers indicated and colored as they would appear from a tremendous height.

Nick's pride is not his modelmaking or the realistic flowers that he cuts and shapes from plastics or even his reproductions of animal life from dinosaurs to present day types. The accomplishment for which he is best known is his method of preserving insects and vegetable life in special solutions

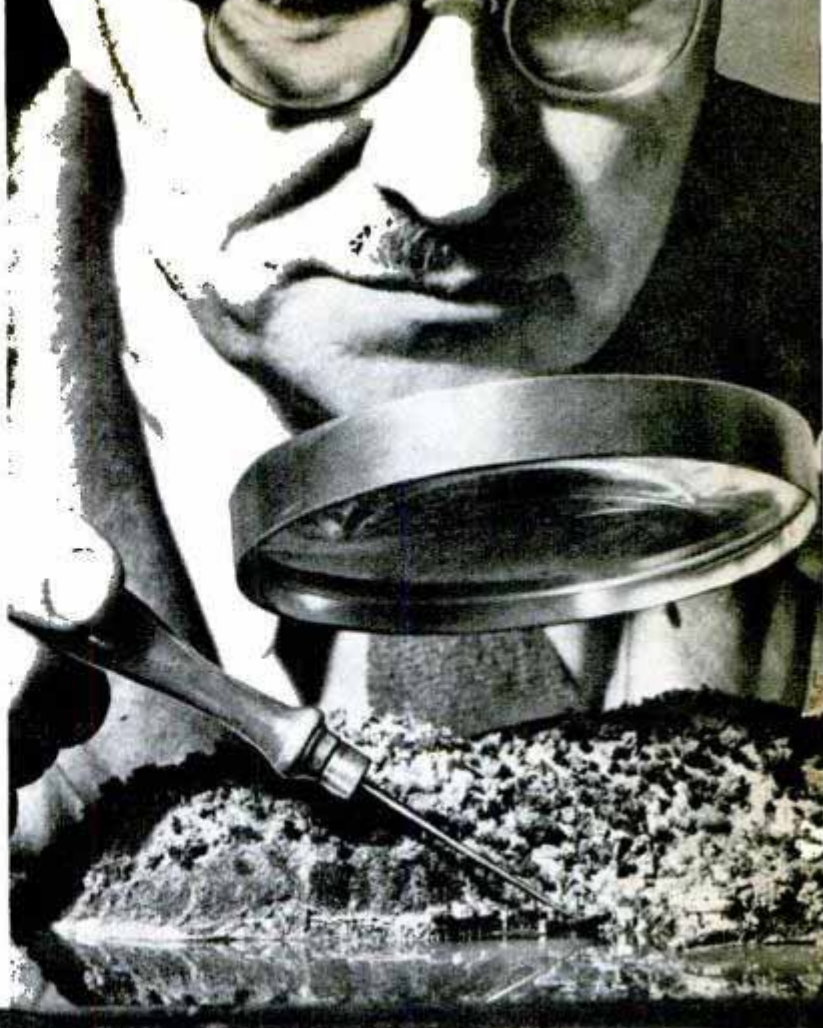


prepared from seaweed. The process preserves the shape, natural coloring and texture of the material, whether it be flowers, leaves or even a collection of bugs. Some 500 different shades of color are found in different varieties of seaweed and kelps, and his method consists basically of steeping the material for days in an essence prepared from a seaweed of the desired color.

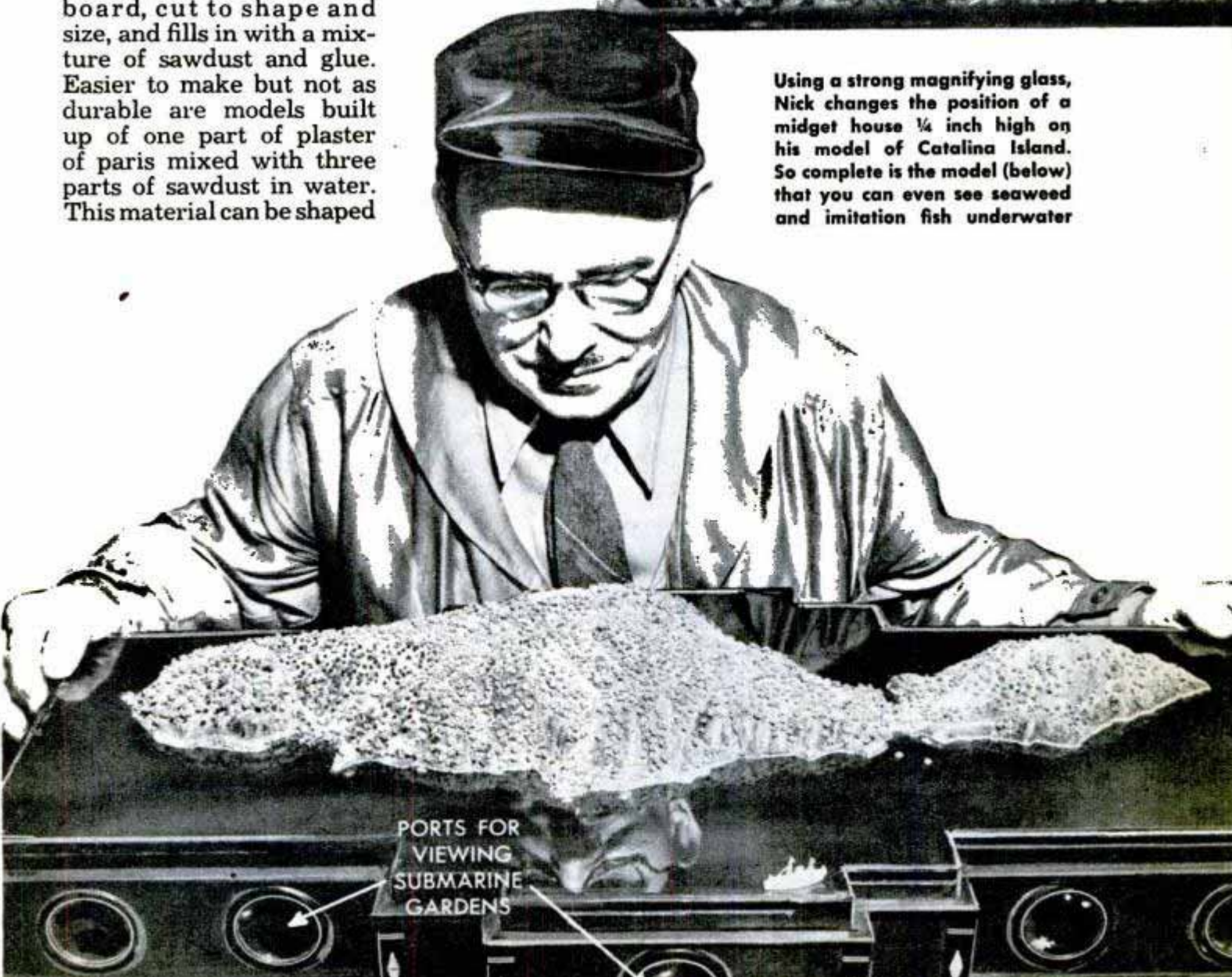
He won't go into details of the process but the results are amazingly lifelike. The Geneva International Museum Association has awarded him a gold medal for re-creating groups in their natural colors.

Nick is an all-around expert at the arts and crafts required in museum work. One of his early specialties was re-creating groups of animals from their fossilized bone structures, then placing them in surroundings indicated by the other fossilized materials found with the bones. In the last 35 years he has been attached to museums in London, Capetown and Leningrad, and has done work for several museums in the United States.

In creating a permanent model for a museum Nick builds up the ground contours with layers of thick plaster board, cut to shape and size, and fills in with a mixture of sawdust and glue. Easier to make but not as durable are models built up of one part of plaster of paris mixed with three parts of sawdust in water. This material can be shaped



Using a strong magnifying glass, Nick changes the position of a midget house $\frac{1}{4}$ inch high on his model of Catalina Island. So complete is the model (below) that you can even see seaweed and imitation fish underwater



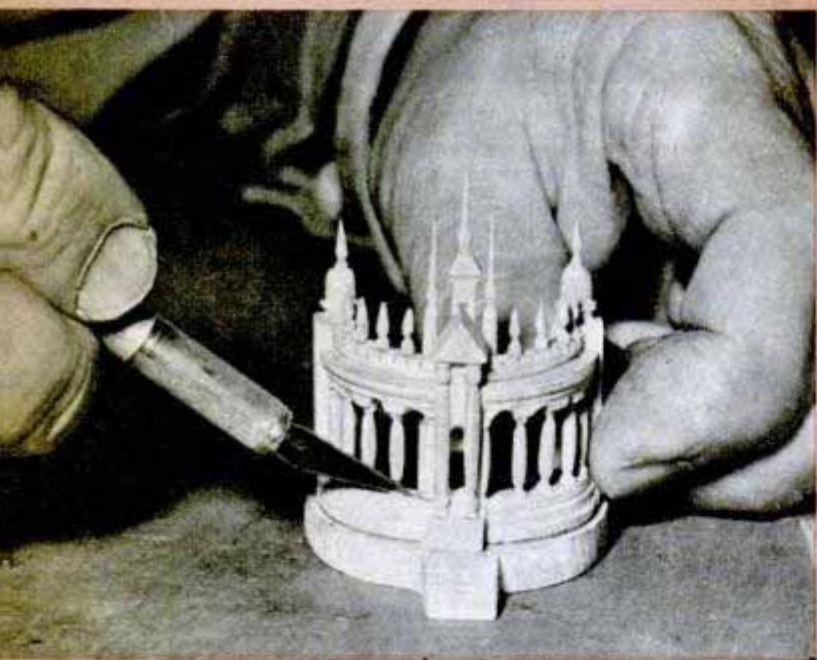


into hills and valleys and remains soft for several weeks, allowing time for "planting" the tiny twigs that represent trees.

Dry colors are mixed in turpentine for painting this imitation earth. Oil paints are not used because they produce shiny, unreal-looking surfaces. Water colors are preferred for coloring the tiny wooden buildings. When oil paints must be used their dried surfaces may be rubbed with a cheesecloth pad saturated with fresh buttermilk to remove the shine.

Nick uses no nails and puts his scale model buildings together with plastic glue. He uses a small round file for indenting lines in his buildings, and he produces round towers or the slants of the roofs by rubbing the models against a sanding block. He uses three blocks, each surfaced with a sandpaper of a different degree of coarseness.

Small trees may be shaped from bits of sponge cut with scissors but more natural effects usually are produced by hunting through a patch of brush for small growths that can give the effect of trees in miniature. Nick keeps a collection of some 400 kinds of weeds, seed stalks and twigs on hand for such uses.

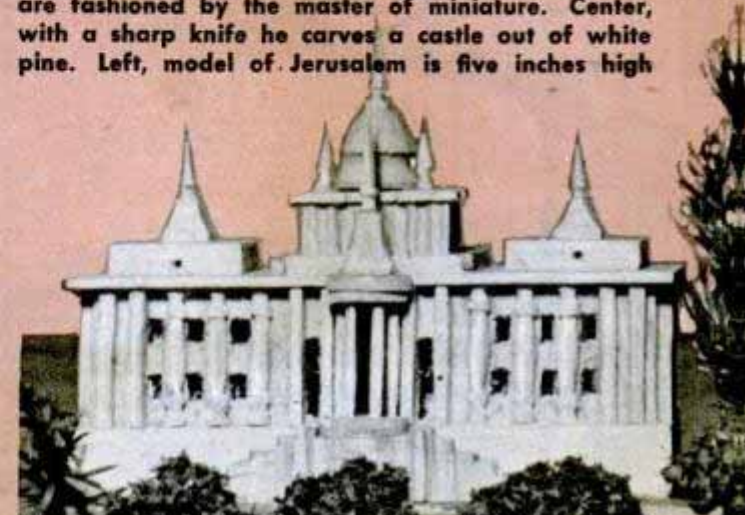


A fairly good method of preserving these natural materials is to dip them in liquid celluloid, prepared by dissolving celluloid chips in acetone in the proportions of one pound of celluloid to one gallon of acetone. After dipping, shake to remove the excess solution, and let it dry. The material then may be spray-painted with permanent color. Celluloid and acetone are both highly inflammable and must be kept away from any kind of fire.

Realistic lakes and rivers are created by pouring acetate, dissolved in acetone, over flat glass used as the base. Dust is added to the mixture if the water is to appear muddy. During the time the material is hardening it can be wrinkled to produce the effect of waves. When making large bodies of water a cardboard or wooden base usually takes the place of the glass base. The wood or cardboard can be paint-



Intricate powerhouses, dams and reservoirs (top) are fashioned by the master of miniature. Center, with a sharp knife he carves a castle out of white pine. Left, model of Jerusalem is five inches high





Nick adds the last plaster cow to an exhibit which ed light blue to imitate the reflection of the sky, mottled to indicate varying depths of water, and darkened along the shore line to indicate the shadows of trees. This coloring shows through the thin layer of acetate that is poured over the base.

Modeling clay is the best material for waterfalls or other turbulent water since it can be shaped to the wave patterns desired, then painted. Tiny human figures are best simulated from a bit of cotton covered with soft wax. This makes a pliable material that can be worked into shape. Finishing touches are added with a toothpick or knife and the figure then is painted.

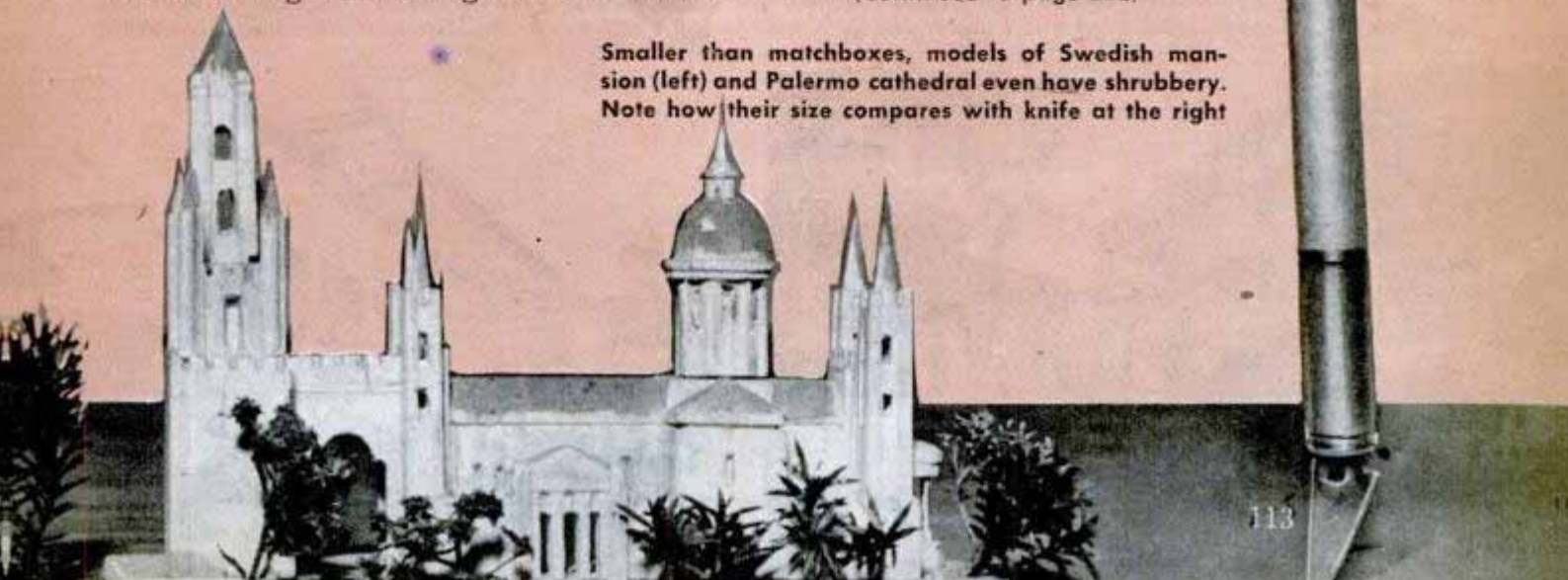
Most of Nick's museum pieces, realistic as they are, seem crude in comparison with the diminutive scale models on which he works during his evenings. One of these is

represents California's beef industry a 10-inch model of a Balkan mountain wilderness that contains a church and other buildings, including a castle. There also is a tiny lake with a boat "afloat."

The model contains 300 trees and shrubs from $1\frac{1}{4}$ inches to $\frac{1}{8}$ inch high. Each tree consists of a young cedar shoot or other natural material, selected for size and trimmed to shape, then preserved by one of Nick's formulas. The castle and other buildings are carved of ivory and illuminated from within. Windows are $\frac{1}{32}$ inch square.

(Continued to page 252)

Smaller than matchboxes, models of Swedish mansion (left) and Palermo cathedral even have shrubbery. Note how their size compares with knife at the right

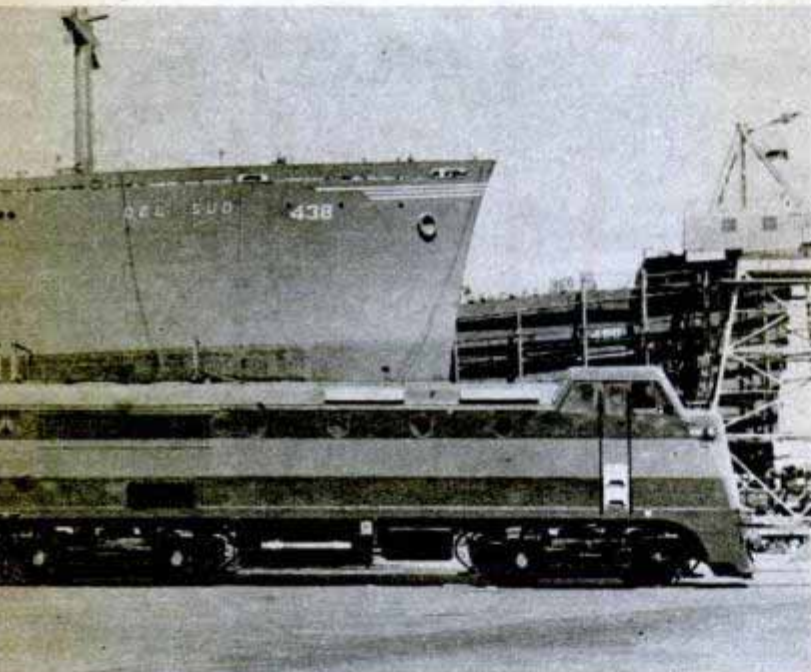




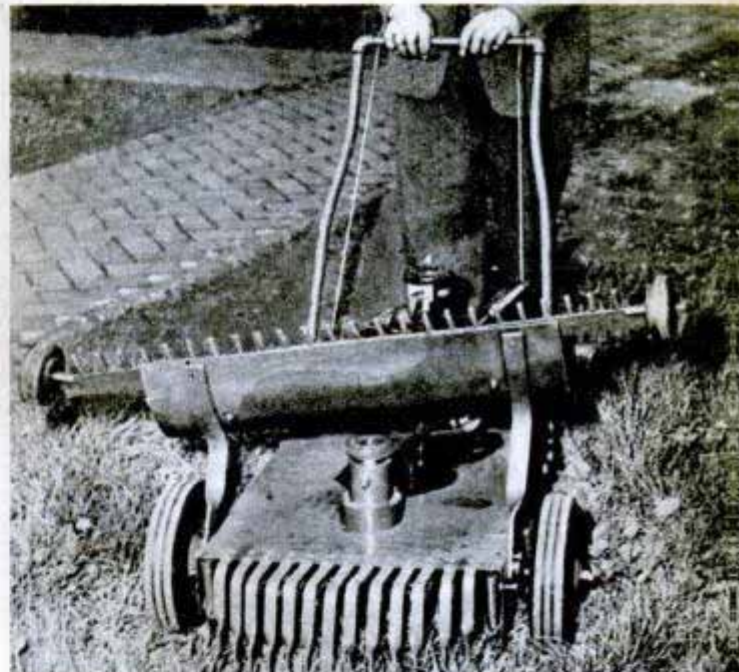
SURPLUS AMMUNITION CASES provided part of the lumber for Carl Hendrickson of St. Paul, Minn., to build a house. When this picture was made, the boxes still bore Army and Navy ammunition labels on the side



HOT BOX heated by charcoal in a pan at the bottom keeps food hot for three hours and is useful for delivering meals from restaurants or for picnics. Holes in the shelves permit heat to reach all the dishes



DIESEL LOCOMOTIVE that incorporates specifications furnished by 22 railroads was built in the shipyards of the Ingalls Shipbuilding Corp. at Pascagoula, Miss.



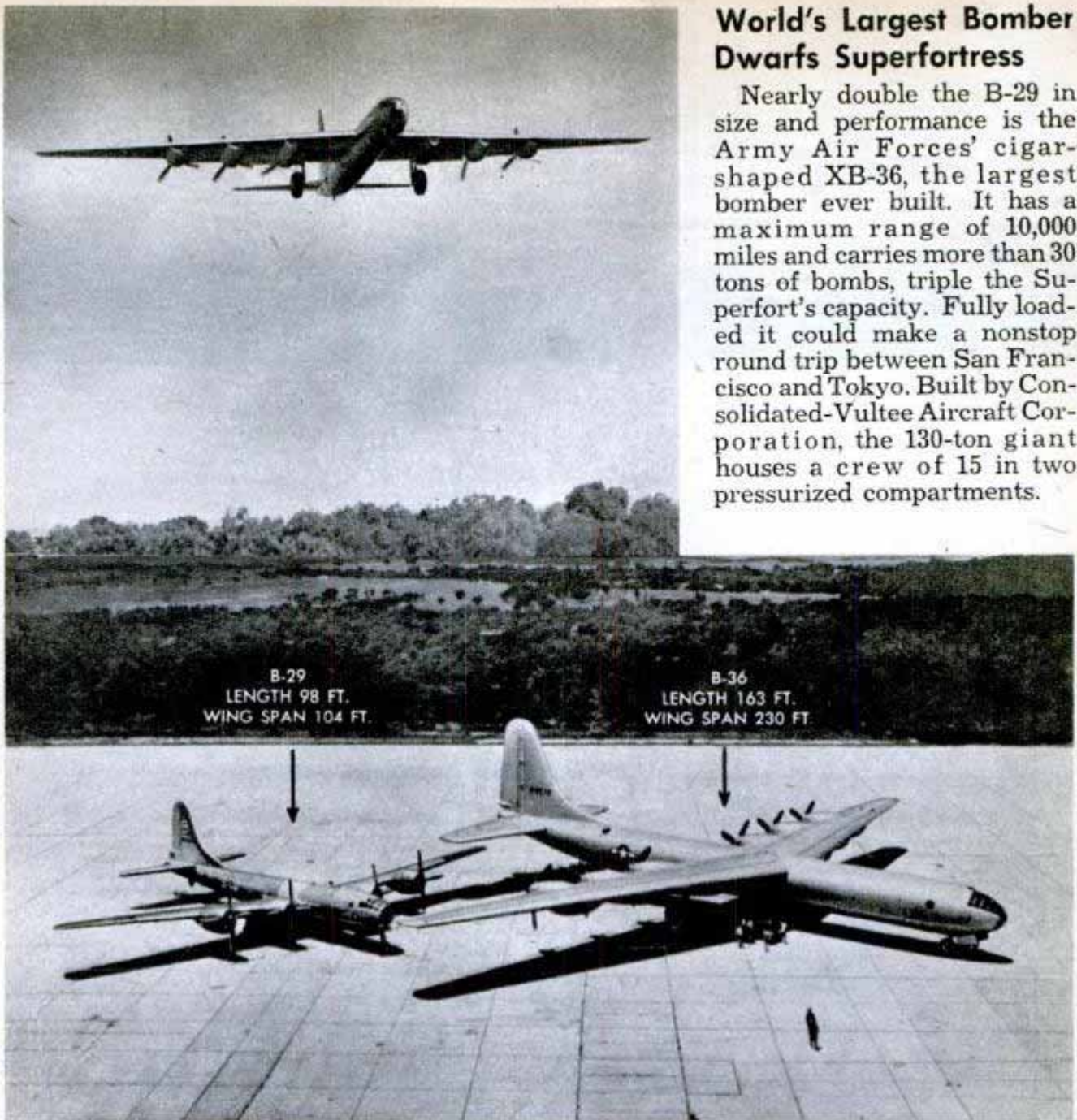
COMBINATION LAWN MOWER, rake, snowplow invented by James Badlat, Des Moines, Iowa, is powered by $\frac{3}{4}$ -horsepower motor. Brush sweeps sidewalk

JEEP FIRE ENGINE, a dwarf compared to a regular size machine, is ideal for hurdling ditches and speeding across bumpy fields to combat fires in rural communities. Some industrial plants also use the modified war jeep to scoot through production aisles and hurriedly reach the scene of a fire or explosion. The fire jeep costs \$2800



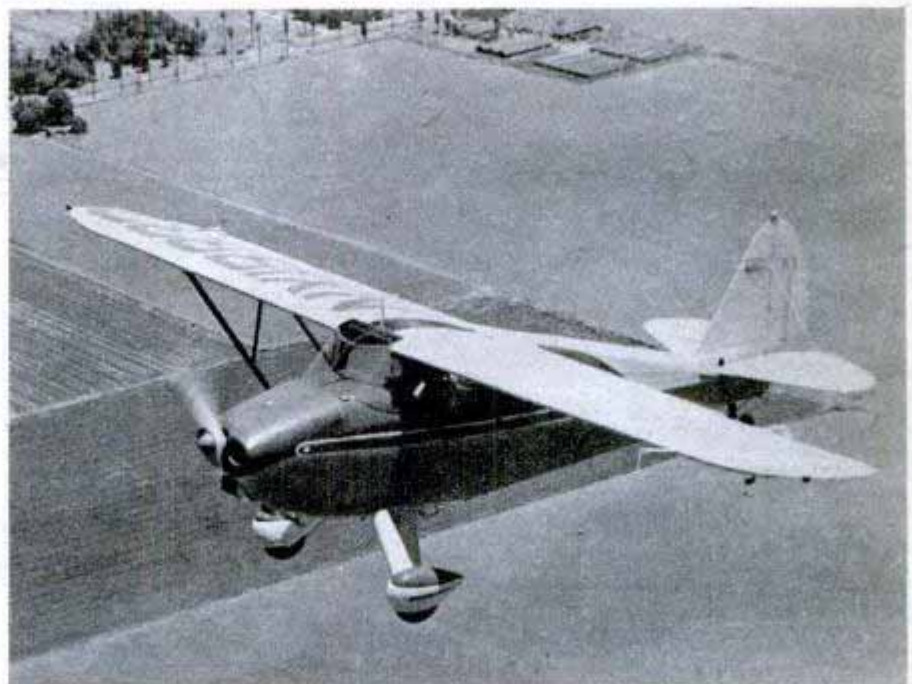
World's Largest Bomber Dwarfs Superfortress

Nearly double the B-29 in size and performance is the Army Air Forces' cigar-shaped XB-36, the largest bomber ever built. It has a maximum range of 10,000 miles and carries more than 30 tons of bombs, triple the Superfort's capacity. Fully loaded it could make a nonstop round trip between San Francisco and Tokyo. Built by Consolidated-Vultee Aircraft Corporation, the 130-ton giant houses a crew of 15 in two pressurized compartments.



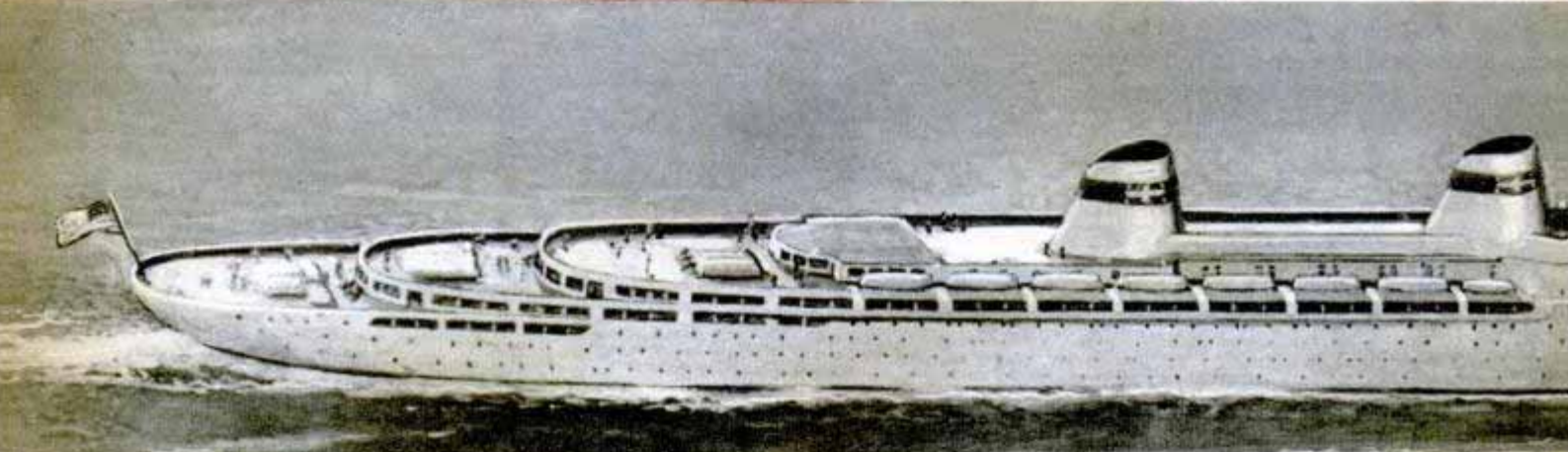
140-Mile Top Speed For Hockaday Comet

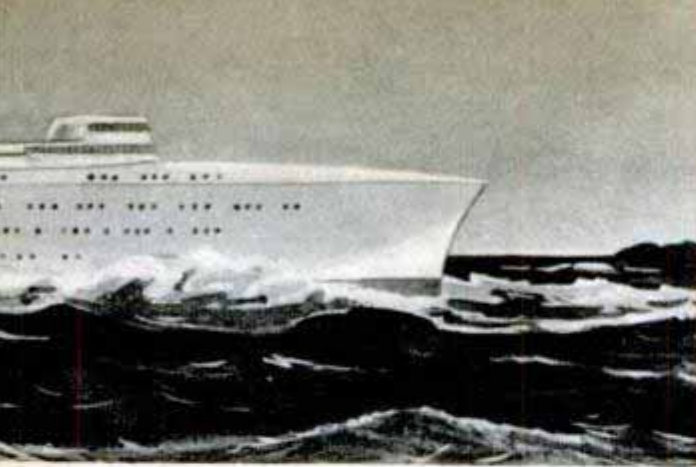
With either a Continental or a Franklin 125-horsepower engine, the two-place Hockaday Comet has a top speed of 140 miles an hour and a range of 500 miles. It features a quickly removable metal cowling for speeding engine servicing and a curved safety windshield affording unobstructed vision over a wide area. The fuselage is metal covered to the rear of the cabin and fabric back to the tail. It lands at 50 miles an hour.





*Luxury
goes back
to sea*





Largest and fastest American ships ever built are coming soon. Liner above is Maritime Commission design. War-born radar protected troopships and will add to safety of peacetime service

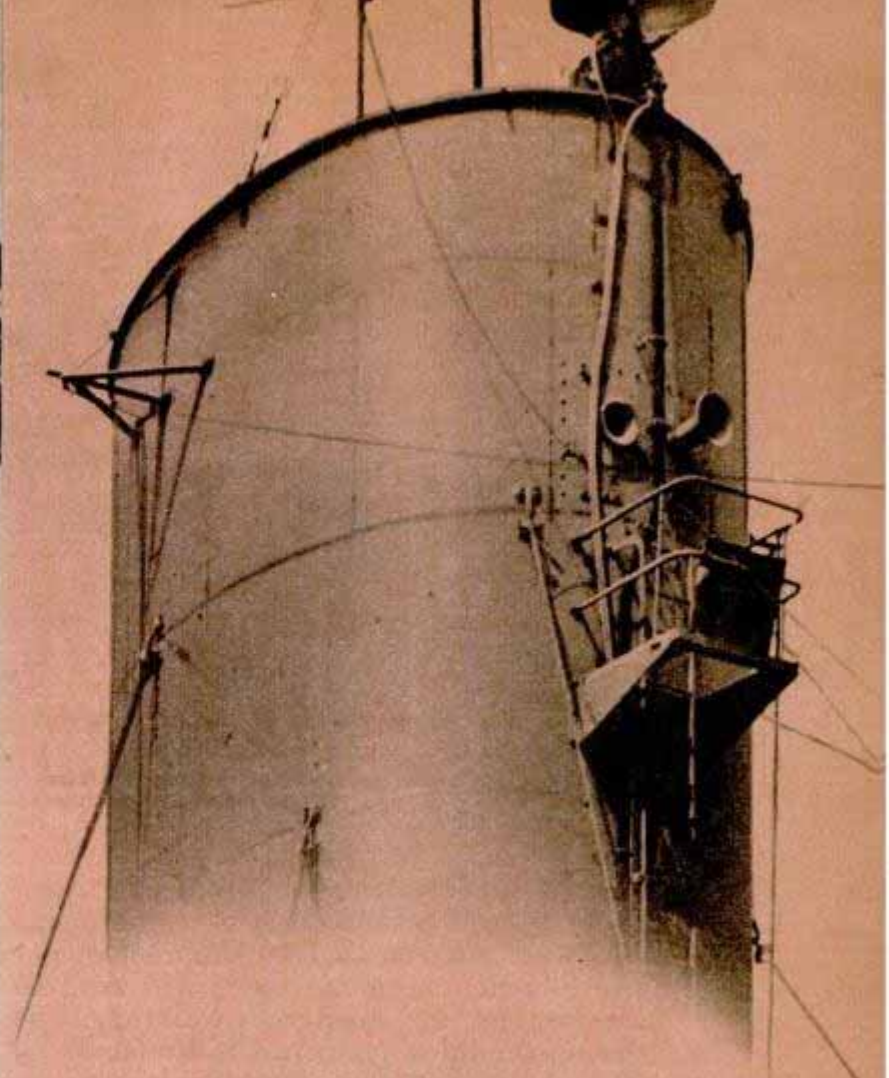
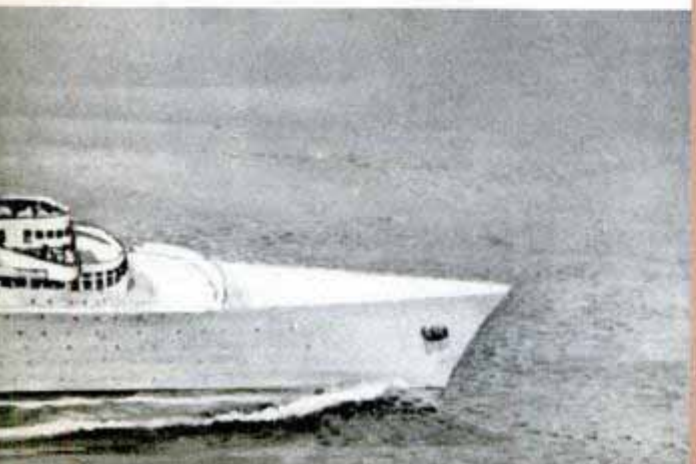
UNLESS you're a diplomat, a government official or a foreigner being repatriated, your chances of enjoying an ocean voyage during the next few months are remote.

The freedom of the seas is not for you—not yet, that is. But within the next two years you'll be able to take that long-delayed trip to Europe, the Orient or Hawaii. If you were disappointed this summer by lack of passenger accommodations, you may, by next summer, find it possible again to travel on the seven seas.

According to the National Federation of American Shipping, which represents 95 percent of American shipowners, 11 major steamship lines plan to place 89 new vessels in world-wide passenger and cargo service within three years.

Several ultramodern speedy ships are already under construction and others are scheduled to be delivered this year. Two of these ships are to be 920-foot express passenger liners, larger and faster than any ever built in this country. The 33,000-ton vessels, known as Great Circle liners, will be of the U. S. Maritime Commission de-

One of three Good Neighbor vessels, reconverted SS Uruguay, left, goes on South American run. Great Circle liner, below, is 920 feet long, will carry 1200 passengers to Orient in eight days

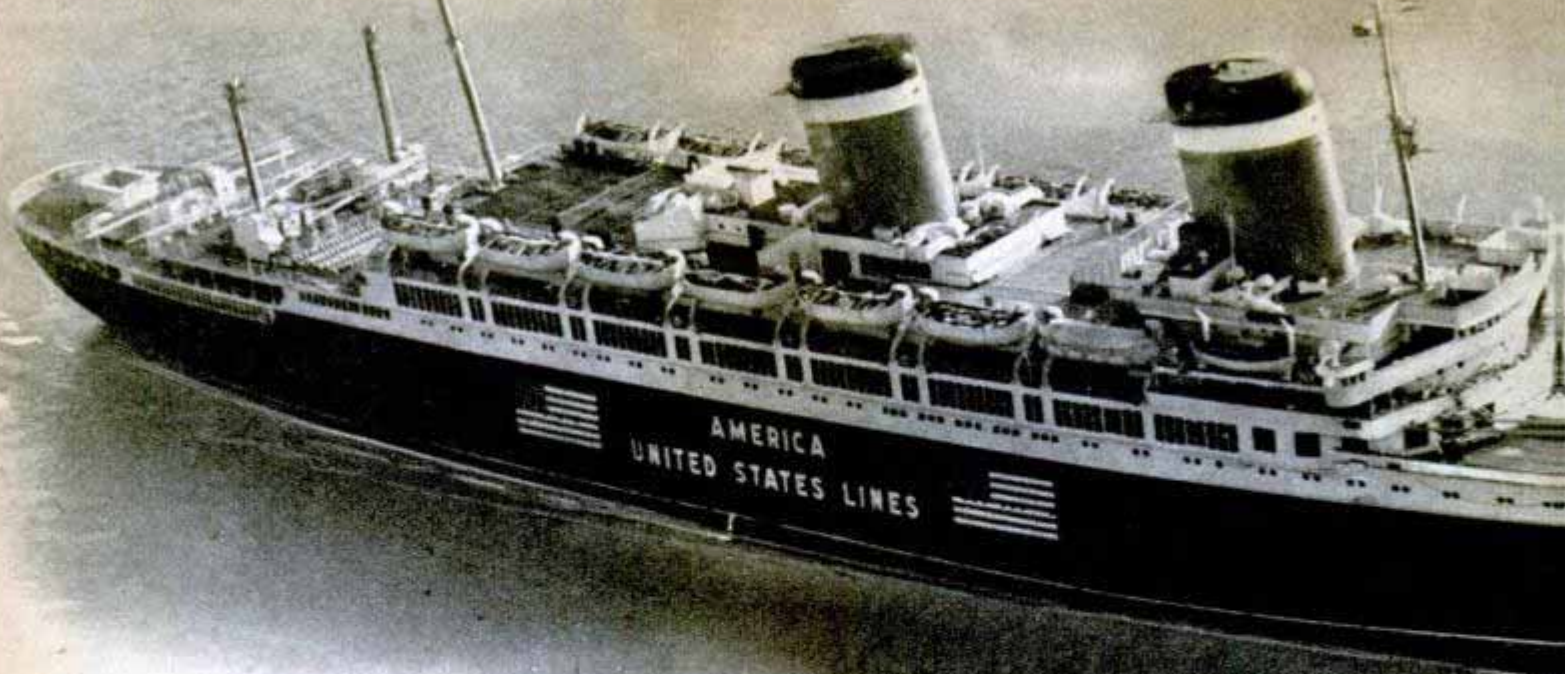


sign P5-S2-E1 which the Commission has had under preparation for several years. They are planned for transpacific service.

Capable of transporting 1200 passengers on each sailing, they will be able to reach Japan over the northern route in eight days. They will have twice the horsepower of the largest liner thus far built in the United States—the SS America—and under average sea conditions will have a speed of 30 knots. All accommodations are on a luxury scale including three swimming pools, complete air conditioning and a theater. A crew of 590 is required.

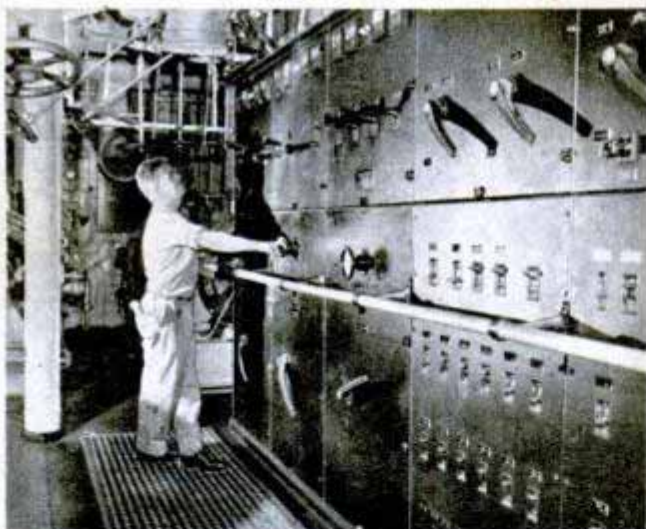
One outstanding feature will be the superstructure which is to be built mainly of aluminum. About 770 tons of the metal will be required. Research by naval architects of the Maritime Commission has established that use of aluminum will enhance the vessel's stability by permitting her to have a beam of only 86 feet. The ship thus can attain greater speed with considerably less horsepower than heretofore has been possible.

Another innovation of the Great Circle liners will be a circular marine veranda on the teardrop-shaped sun deck. This play spot, 72 feet in diameter and 55 feet above the ocean surface, complete with bandstand, dance floor, cocktail lounge and bar, will command an unobstructed view of the blue water ahead across enclosed bow sec-



During the war the 26,000-ton SS America, largest ship yet built in U. S., was troopship USS West Point. It will be luxuriously refitted for passenger trade
Official U. S. Navy photo

tion machinery. Unusually extensive open deck space is provided on the promenade deck. In addition to 1700 square feet entirely open to salt air there will be 1700 square feet for sheltered walking. The three swimming pools are 16 by 60, 22 by 32 and 16 by 29 feet. The theater accom-

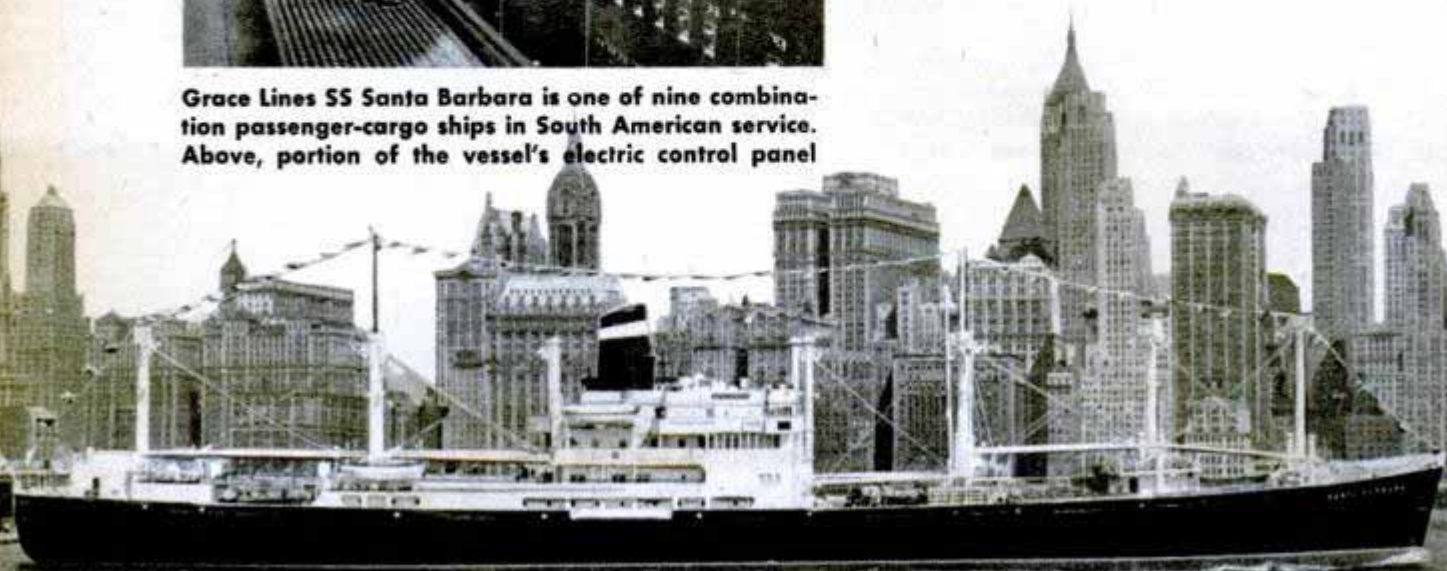


Grace Lines SS Santa Barbara is one of nine combination passenger-cargo ships in South American service. Above, portion of the vessel's electric control panel

modates 300 people. There will be four dining salons in which a total of 826 can be seated at one time.

How soon the commission's new construction program will get started is problematical. President Truman recently ordered a 50 percent cut in expenditures for new ships. But there is no intention of abandoning the entire program of new construction, according to Robert W. Straus of the commission.

Two other types of streamliners are planned. For the South American trade, the Maritime Commission contemplates construction of two Southern Cross ships, but has deferred award of contracts until 1947. Passengers may breakfast in their rooms. Luncheon will be served on deck. Dinner will be a formal meal, followed by open-air dancing and fiestas. The ships are open to the sun and air conditioned





Vladimir Yourkevitch, Normandie designer, proposes 34-knot super-liner for Atlantic service carrying 4000 persons

below decks. Refrigerated fast freight will fill the hold.

Powerful turbines will drive the 731-foot liners at an average speed of 28 knots and enable them to make the New York to Rio trip in one week, cutting existing schedules in half. Because of the cargo they will carry but 543 passengers. A crew of 447 is required.

For the Mediterranean service, 681-foot turbine-driven Sunliners are planned. Although running at only 22 knots, they will make two trips each month to ports in the Mediterranean. They will go by the southern route and will have great sunny play decks for recreation and sun bathing. The Sunliners are designed to carry 654 passengers, a crew of 452 and a refrigerated cargo of 45,900 cubic feet.

When completed, the Great Circle liners, the Southern Cross ships and the Sunliners will join the war-service ships now being reconverted for peacetime service.

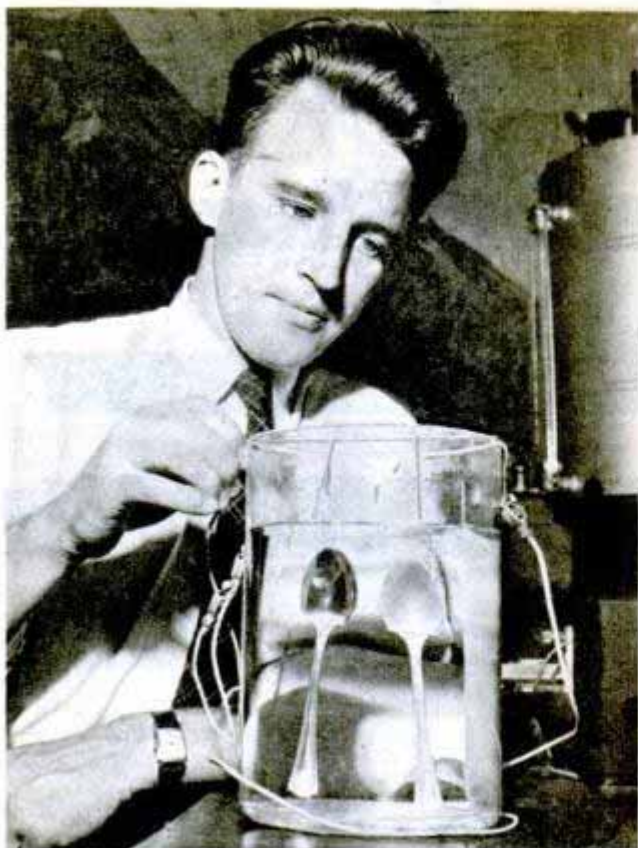
During the war every passenger and merchant ship was pressed into service as a troop transport or cargo vessel. The 26,000-ton SS America became the troop transport USS West Point. Two other large passenger ships, the SS George Washington and the SS Manhattan, carried troops as the USS Mount Vernon and USS Wakefield. Scores of other ships also became troop carriers. Now the job is to reconvert them. The work is estimated to cost \$500,000 during the next three years.

Restoration and modernization of a ship
(Continued to page 264)

Upper berths in cabins of SS Amerita fold into ceiling, right. In another design, below, they fold into wall. During daytime, lower berths serve as sofas



Accidental "Bath" for Silver Wire Reveals New Way to Polish



Accidental use of a silver-plated wire in cleaning tiny parts for electronic tubes has given birth to a new polishing process that may be a boon to the silver industry. Dennis R. Turner, Westinghouse physicist, stumbled onto the process when he attached a diaphragm from a tube to a dull white silver-plated wire and suspended it in a cyanide solution through which positive electricity was passing. When he removed the wire he noticed it had taken on a high luster. Further tests revealed that this system, in less than a minute, adds the glittering finish to dull silver-plated objects that formerly required buffing. The silver industry has been searching for years to find a way to electropolish silver plating.

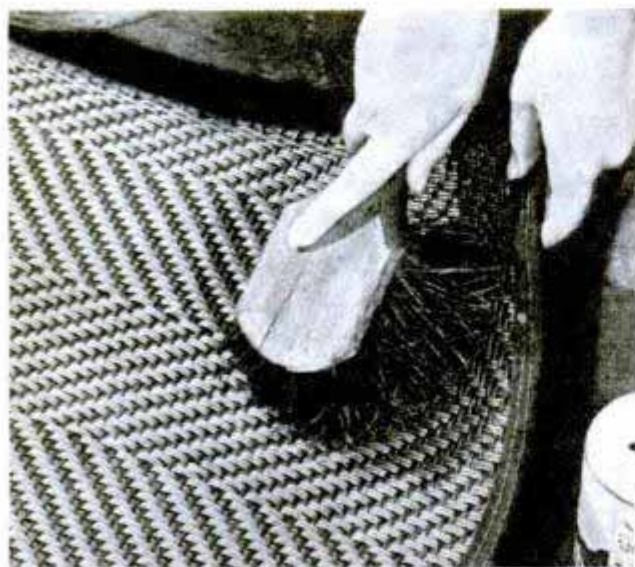
Loader Fitting for Grease Gun

Speedier and less wasteful loading of hand grease guns is accomplished with a new system that saves taking them apart. A loader fitting mounted on the hand gun permits grease to flow into the reservoir in



Ink or Oil Spots Wash Off Rugs Made of Plastic-Coated Paper

Paper-fiber rugs coated with flexible plastic are nearly immune to stains from ink, gravy or food and may be cleaned by scrubbing with a brush or wiping with a damp cloth. They are made by coating paper-fiber twine with plastic before weaving. Color is added to the rugs, which are resistant to water, wear, mildew and fading, by dyeing both the paper twine and the plastic cover. In addition to its use as porch and playroom floor coverings, the plastic-coated paper can be made into handbags, shopping bags, shoe tops, auto seat covers and furniture slip covers.



the same manner it flows into a bearing in normal lubrication. The gun fitted with the loader is placed on a companion loader valve while the pump is operated, automatically disconnecting when fully loaded.

Artificial Eye Turns Naturally

Improved fitting techniques are giving artificial eyes a more natural appearance. Dr. A. D. Ruedemann of Cleveland, Ohio, stitches the artificial eye into the socket so that it moves with the natural eye. A fine mesh of tantalum is fastened to the back of the plastic artificial eye. The eye surgeon then stitches the mesh to the eye muscles.



For personal transportation in Milan, rent a bicycle or roll along in trailing seat of bicycle taxi, right

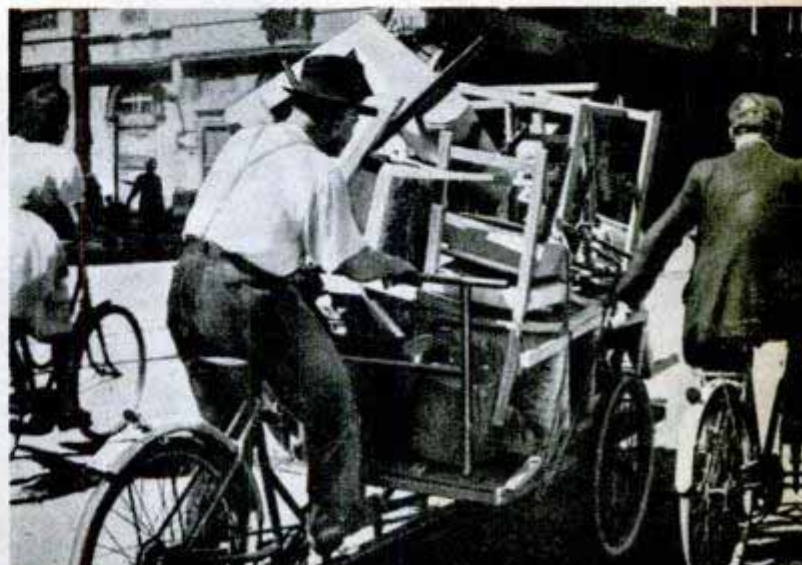


Versatile vehicles carry woman shopper to market, above, or haul furniture, right. Flat tires are headache to driver of cab-over-front-wheels taxi, below



MILAN Pedals to Work

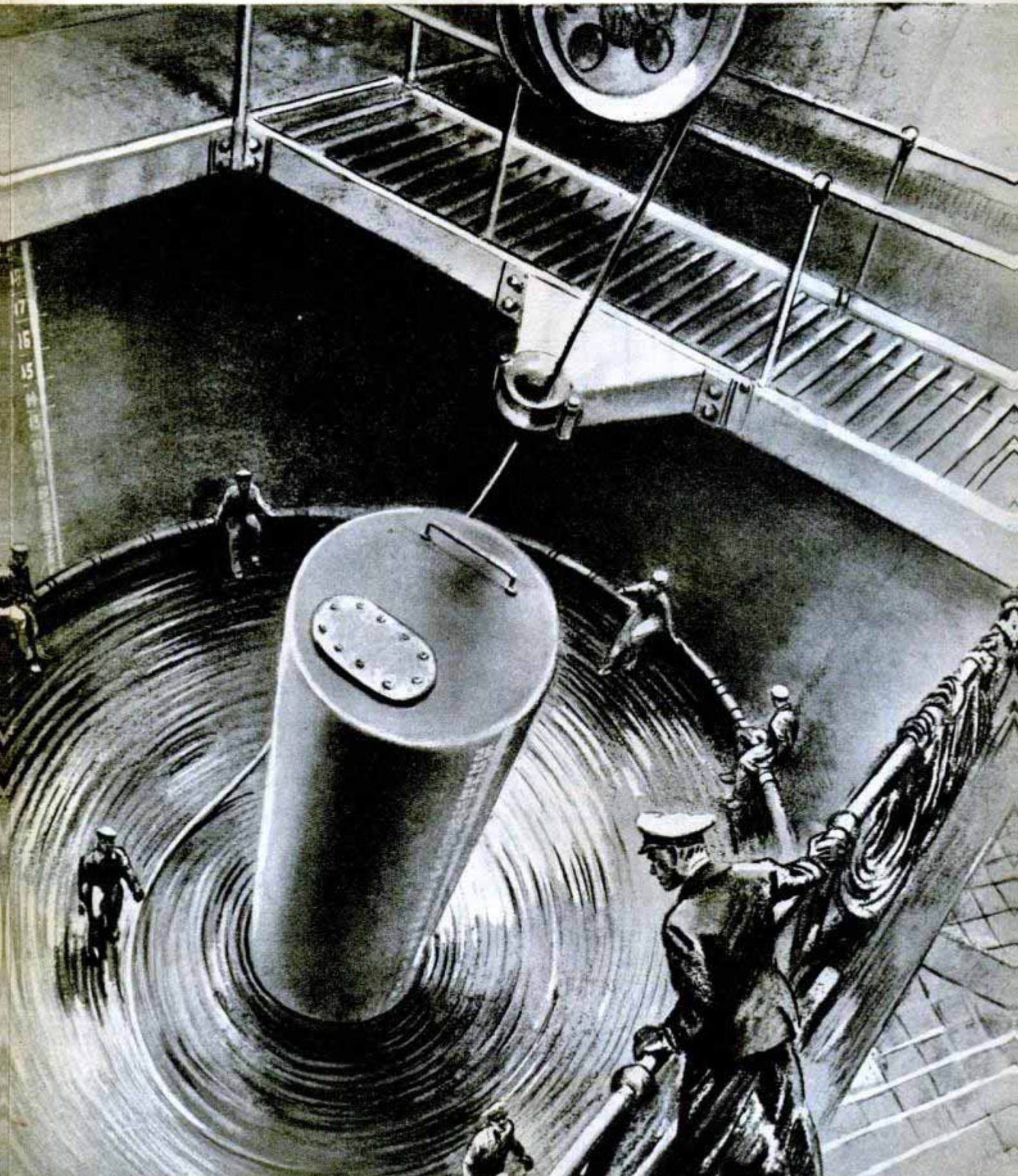
BICYCLES always have been a favorite mode of transportation in European cities. They are more important than ever now. Few civilian trucks or automobiles are running. Pedal power drives almost every kind of conveyance in the large industrial city of Milan in northern Italy. The "bicicletta," remodeled and redesigned to fit particular hauling needs, serves as personal vehicle or light truck. Even the taxicab drivers depend on pedal pushing for a livelihood. In one model, passengers ride in a cab built over the front wheel. Instead of one front wheel, many models have two and must be classified as tricycles.

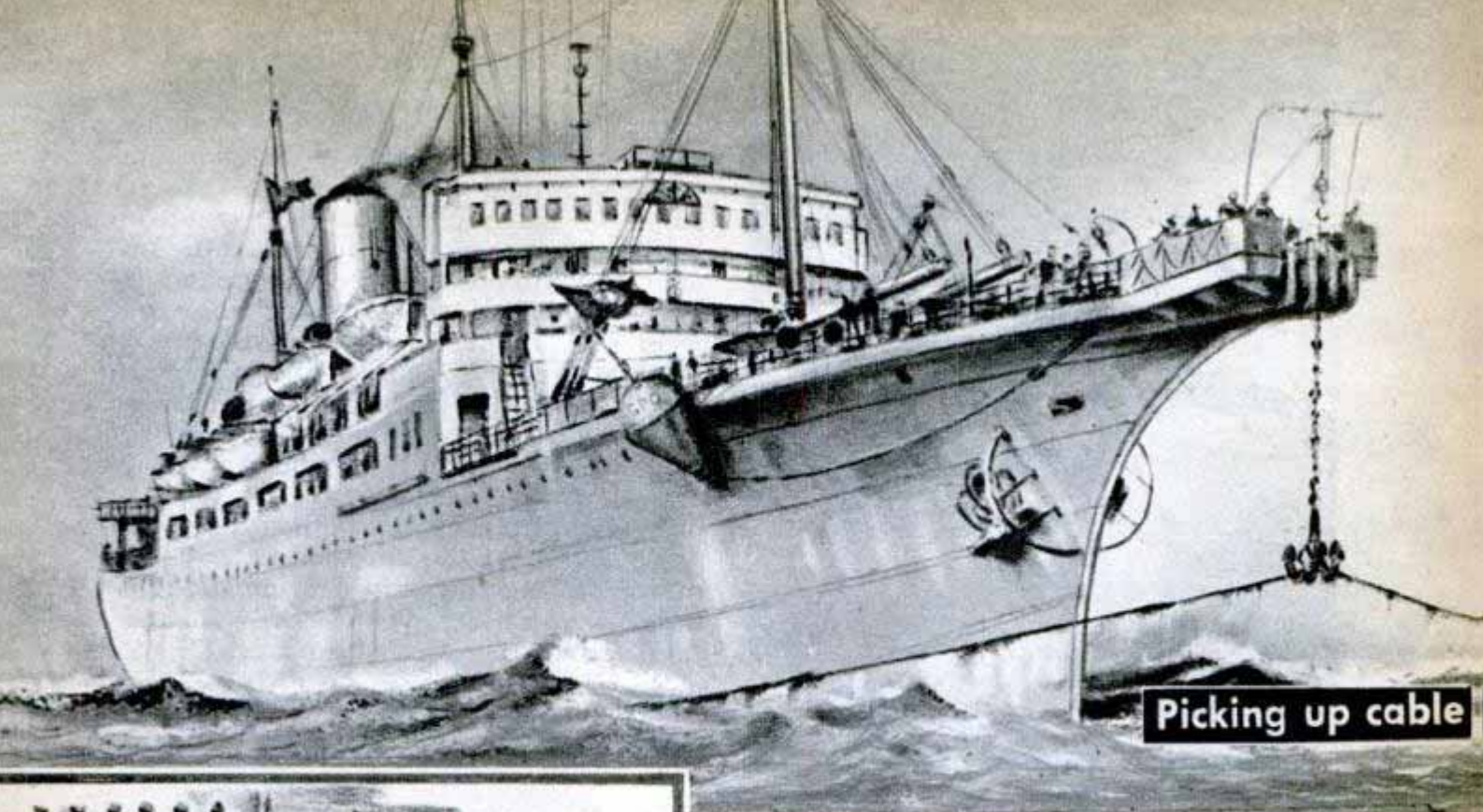


Mother Ship of the Cable Lines

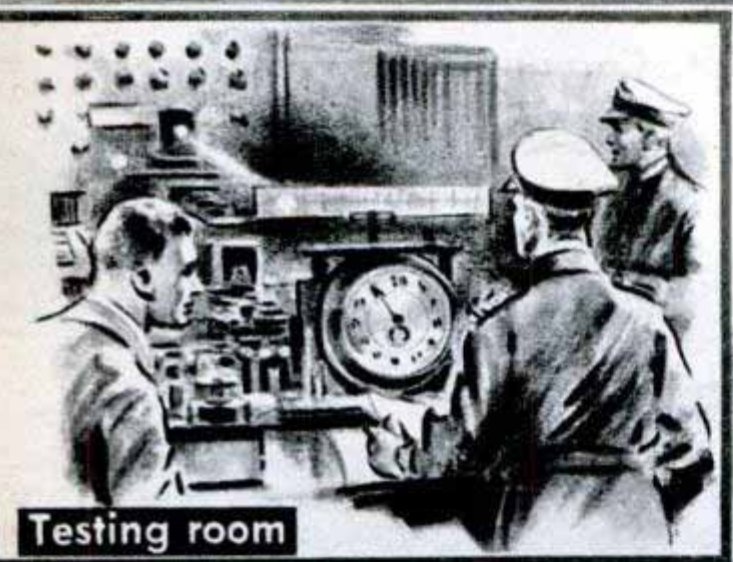
THE world's largest cable-laying and repair ship carries enough cable—2500 miles—to span the Atlantic in one operation. The cable is coiled around four huge spools sunk in "cable tanks" on the new British vessel, Monarch. Because the ship may be lightened by some 8000 tons (weight

of cable laid and fuel and fresh water consumed) on a single trip, it has special water-ballast equipment. It is the first cable ship to have electrically driven cable gear. Radar is used for navigation. As the message-carrying cable comes off the spools (below) 10 men check it to prevent kinking.





Picking up cable

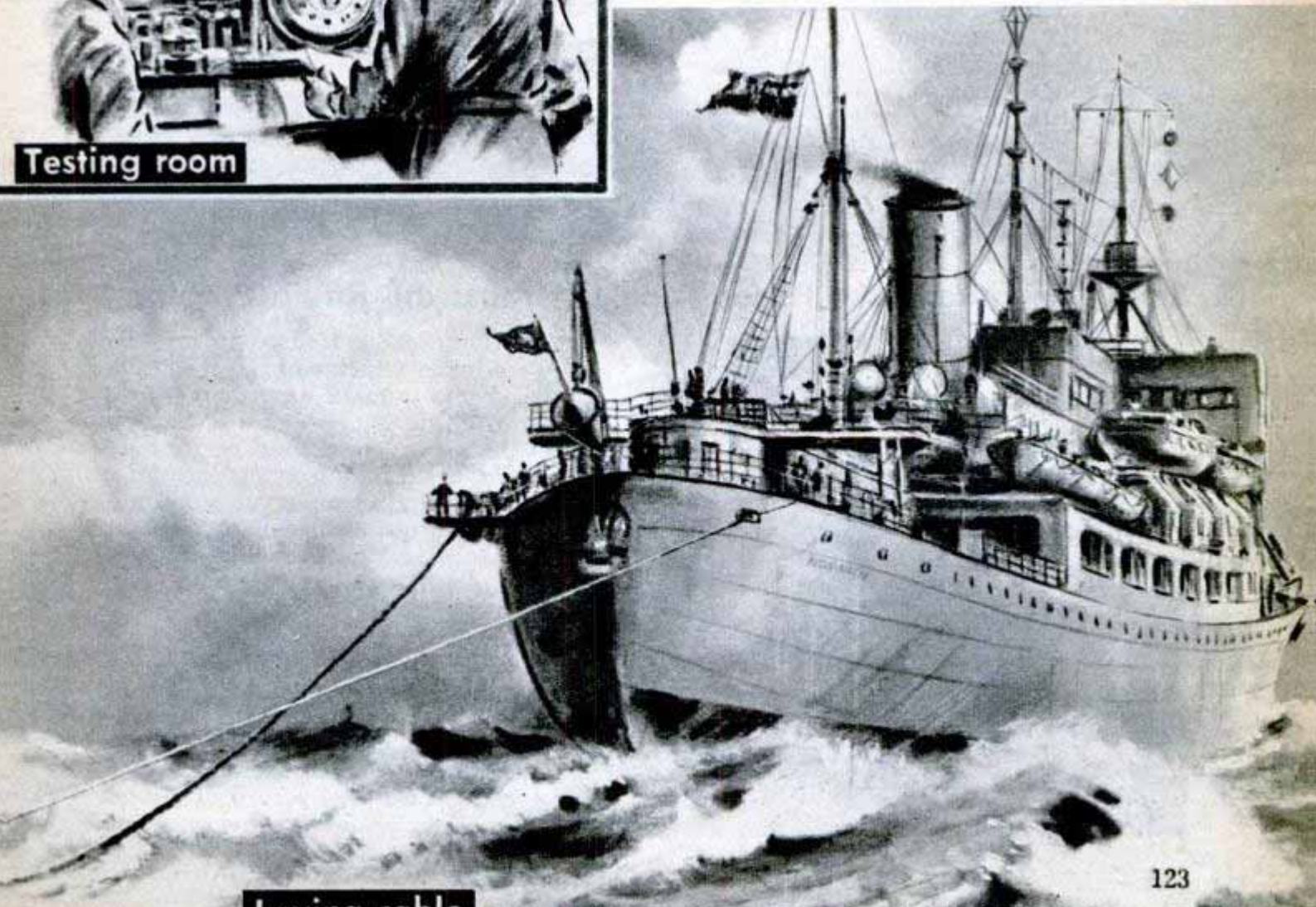


Testing room

Cable is picked from sea bed for checking or repair by pronged grapple raised or lowered from bow sheaves

In the testing room, technicians look for cable flaws. When the light moves on the scale something's wrong

Fine wire crossing the cable aids in calculating slack needed so cable will lie flat on uneven ocean floor





"Stethoscope" for Machinery Listens to Ailments

Engineers listen carefully for hums and wheezes through a resonance tube "stethoscope" to diagnose the ailments of steam turbines just as a doctor examines the human body. In normal operation steam turbines have little characteristic noise but when something is wrong unusual hums or wheezes may be heard. The resonance tube, which consists of a hollow plunger fitted into a "sleeve," tunes in the discordant sound frequency when the plunger is extended or retracted. At any one position only one frequency can be heard and the wave length of the sound can be determined by a mathematical formula. Westinghouse engineers, who use the resonance tubes, have precomputed the wave lengths of various "trouble sounds." After the diagnosis, minor repairs can be undertaken without tearing down the entire machine.

Bellanca Cruisair Travels 153 M.P.H. Carrying Four Passengers

Among the fastest personal planes, cruising 153.6 miles per hour, the four-place Bellanca Cruisair Senior has many other features demanded by prospective plane purchasers, such as a retractable landing gear, one-piece full-view Plexiglas windshield, electric starter and dual controls. Stalling speed is just under 45 miles an hour and the plane requires 485 feet of runway with no wind.



Sound Recorder Uses Paper Tape to Transcribe Radio Programs

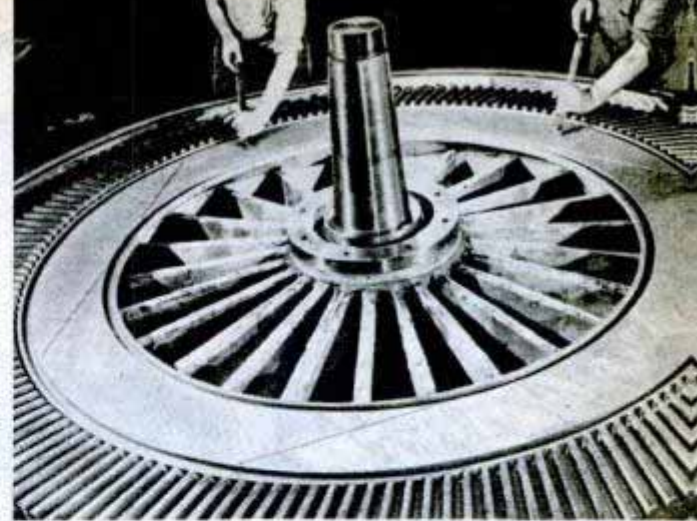


Paper tape is used in a sound recorder which can be attached to a radio to make a permanent record of various programs. Parts in the recorder include two movie-film spools for reeling the paper tape, an electromagnet, small motor and two radio tubes. To eliminate part of a recording, the tape can be cut and spliced with cellulose tape.

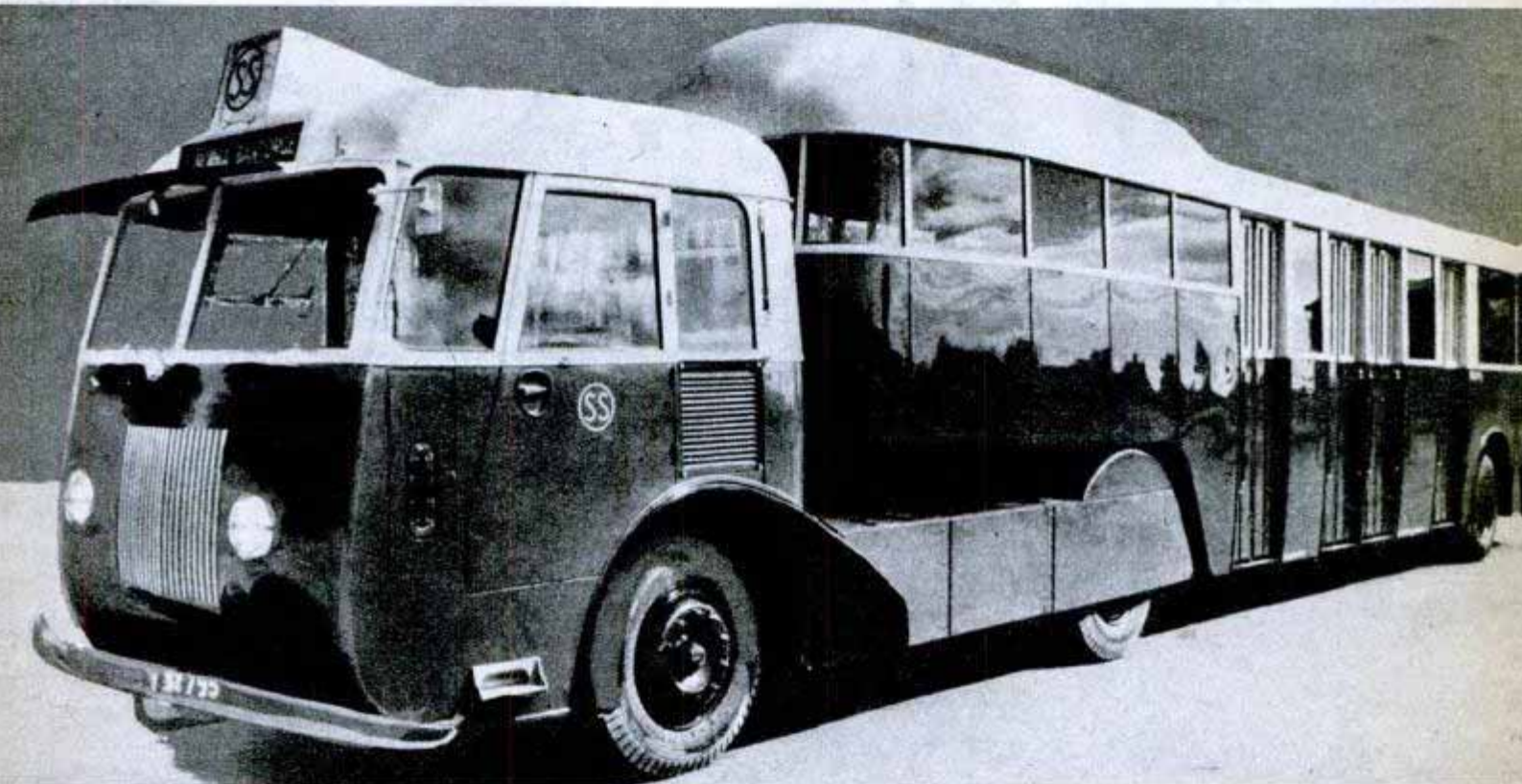
By inserting a fine wire in an elbow vein and pushing it forward until its tip rests inside the heart and connecting the other end to a recording galvanometer doctors can get a direct record of electric currents of human heart action.



BIG BABY BUGGY is a labor-saver for nurses at an English children's home. One nurse can push about a dozen kids to mass outings in the novel "buggy-truck"



TURNTABLE aids in polishing huge bearings used in giant generators. Westinghouse workers grind the "doughnuts" with abrasives, then rub with hands



LARGEST BUS in Sweden is this 180-hp. semitrailer-type vehicle, 45 feet long with an air-conditioned body. Both the driver and the conductor can give information to passengers through a public address system

ABANDONED LIGHTHOUSE was moved from the juncture of the Columbia and Willamette Rivers to Burlington, Oregon, to solve the housing problem of an enterprising couple. A huge crane mounted on a barge lifted the lonesome 50-year-old structure from its heavy pilings and carried it to its new site on the shore





Sunshine and soil are strangers to these soybeans grown in chemicals and under light bulbs

Throwing Light on

By John R. Kinsey

SCIENCE has the plant world all confused. Chrysanthemums, which normally bloom in October, now may hold off until Christmas. On the other hand, asters, Shasta daisies, pansies and other spring flowers often burst into bloom weeks ahead of schedule.

It's all done by light—artificial light. Rows of light bulbs in reflectors above the plants are turned on when the sun sets. The plants think it still is daytime. Mums figure, with days so long, this can't be October, so it isn't time to bloom. Spring flowers interpret artificially lengthened days to mean that winter is over, so let's bloom.

Some florists fool chrysanthemums in another way. They cover the plants with black cloths in the late afternoon to simu-

Which orchid would you want? The one on the right, of course. It has had a five-week dose of extra light



WITHOUT
ARTIFICIAL
LIGHT

126

WITH
SUPPLEMENTAL
ARTIFICIAL
LIGHT



Fluorescent lamps radiate less infrared than Mazda lamps and are used when little daylight is available

late shorter days and trick the mums into blooming ahead of schedule.

Maybe plants don't think but they do bloom—when science lets them alone—in

Mother Nature

accordance with the amount of light energy they absorb every 24 hours. Plants which normally bloom in the spring and fall do so as a result of the relatively short hours of



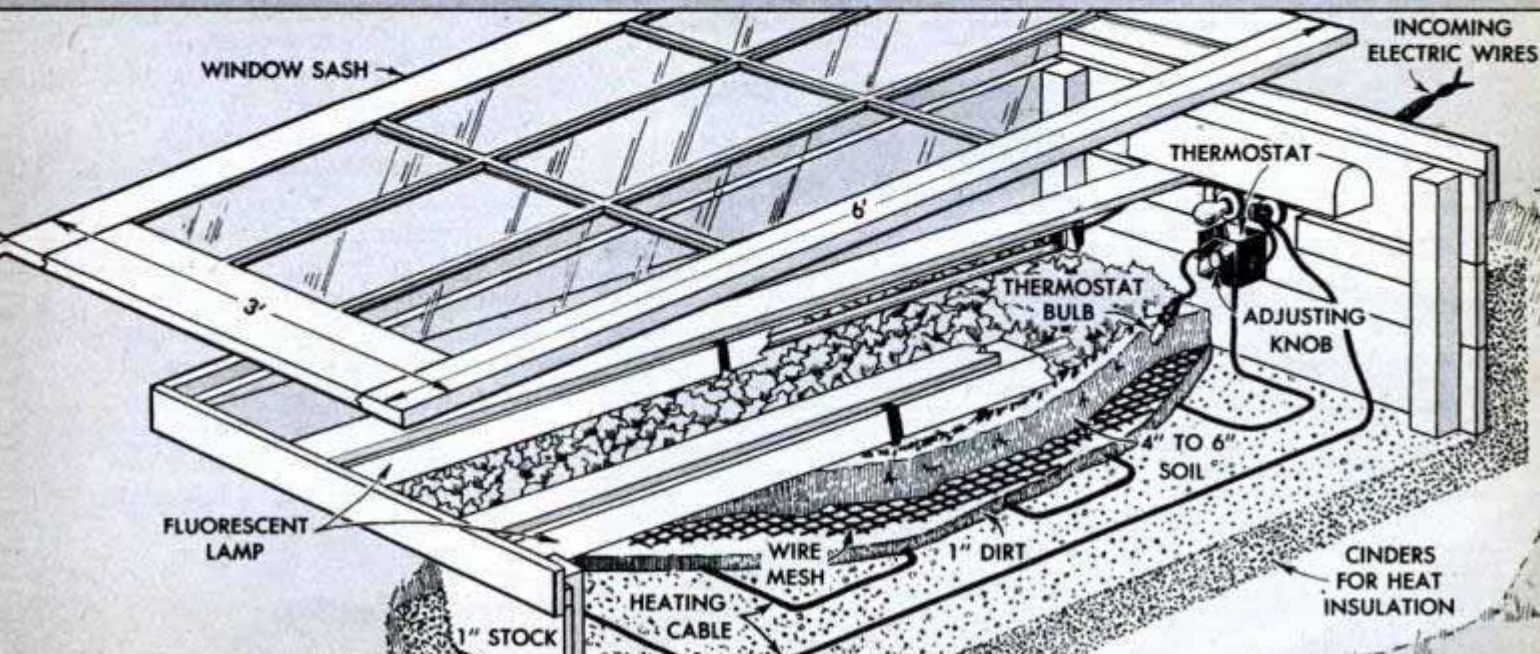
Growers profit by out-of-season tomato seedlings hurried to maturity under 300-watt spot and floodlights

daylight. Plants that bloom in the middle of summer are influenced by the long daylight period.

What difference does it make if a gorgeous chrysanthemum doesn't bloom until Christmas, or delicate snapdragons peep their colorful heads through green raiment a couple of months early?

Well, for one thing, you can make your wife happy by buying her a beautiful bouquet of spring flowers while soot-covered snow still blankets your garden. This

Hotbed stimulated by soil heating cable and overhead lights produces larger seedlings than usual manure bed

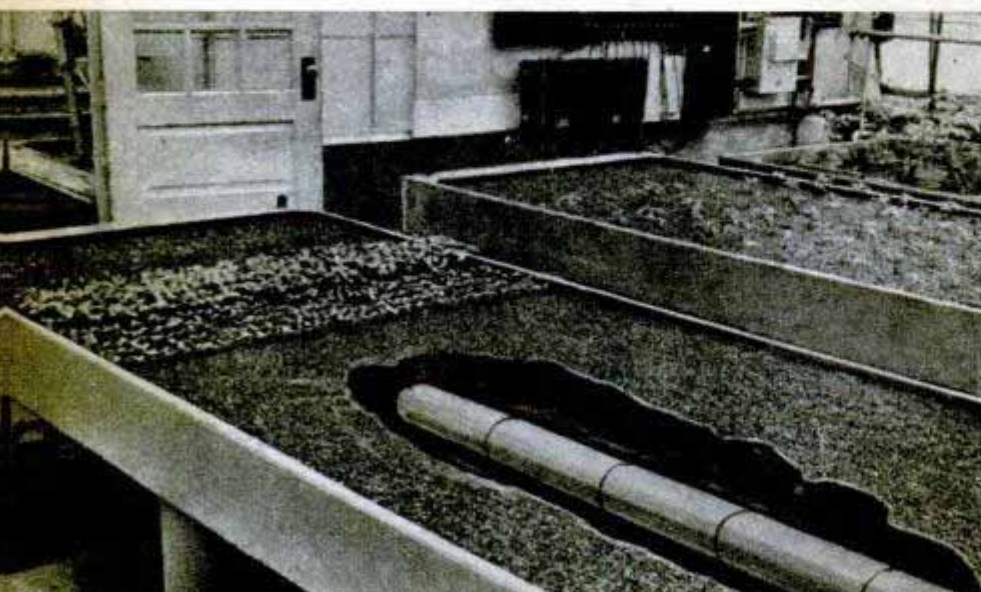




↑ Studies made by Mrs. Alice P. Withrow, research assistant at Purdue Agricultural Experiment Station, have revealed growing secrets. With meter she measures intensity of fluorescent light over test bed



↑ Chrysanthemums on left get four hours artificial light stimulation each night in delayed blooming demonstration. Those on right get none.
↓ Plants in gravel-covered concrete bed are nourished with chemicals



means more business for florists and greenhouses.

Most progressive florists are turning more and more to the use of artificial light to supply the public with out-of-season flowers and for many other reasons. For example, man-made daylight, when used to hasten blooming, shortens the time that plants occupy valuable greenhouse space. Artificial light also increases the number of flowers per plant and increases stem length and size.

Vegetables, for the most part, have not proved commercially profitable when grown under supplemental lighting with its increased costs. But there are some exceptions—notably tomatoes. When tomato seedlings receive extra light, bud drop is greatly reduced and the final weight of the harvested tomatoes is increased considerably. A 150-watt or 300-watt reflector bulb spot and floodlight works well for lighting tomato seedlings.

For speeding or retarding the blooming of flowers, tungsten filament incandescent bulbs (commonly known as Mazda lamps) are the most satisfactory. They come closest to duplicating the radiation composition of the daylight that comes into greenhouses. Radiation from a Mazda lamp has somewhat smaller components of near ultraviolet and violet radiation and larger components of red and infrared than daylight. However, all daylight wave lengths are present.

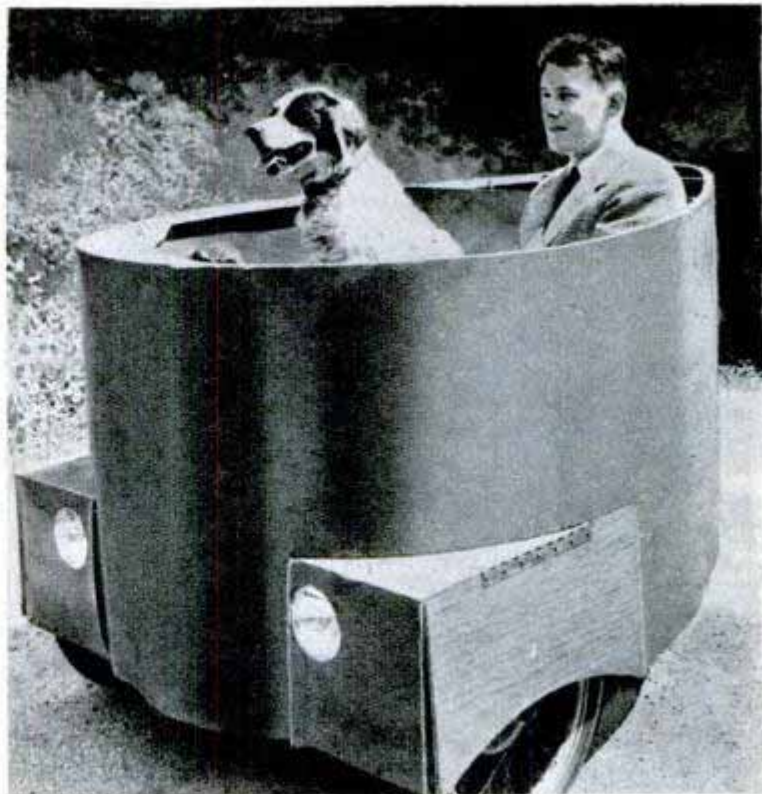
Size of the bulbs depends upon a number of things. From 5 to 15 footcandles of light are sufficient to hasten blooming. But to make up for the deficiency of daylight on dark, gloomy days, 50 to 100 footcandles may be required, according to General Electric engineers' tables based on hundreds of tests.

Biologists at the University of Houston estimate that the electricity needed to advance a plant's blooming from one

(Continued to page 272)

"Scrapmobile" Travels 30 M.P.H. With 1½-Hp. Lawn Mower Engine

Scrap wood, sheet metal, a 1½-horsepower motor, tires and wheels from a lawn mower and bicycle were used by Robert Mustard of Wellesley, Mass., to build a car. His tub-shaped auto has a top speed of 30 miles an hour and averages 40 to 50 miles per gallon of gas. He uses an iron bar for a steering lever and a window seat for the driver's seat.



Chemical Beads Dry the Air In Toolbox or Storeroom

Moisture from the air is picked up by a new beadlike chemical that can be used in homes or applied to industries. A few beads of the material keep tools in a kit from rusting or prevent salt in a shaker from caking. The humidity of rooms can be reduced sharply by using the chemical in air-conditioning units to dry the air as it passes through. Air dried with the chemical keeps machinery and equipment of idle war vessels from corroding. Each bead is honeycombed with microscopic pores that absorb as much as 40 percent of the moisture from air. When the beads are saturat-

ed they can be dried out at 300 degrees Fahrenheit and used again. The new substance, developed by the Socony-Vacuum Oil Company, does not become powdery after use, the chief objection to other absorptive materials.

Zipper-Sealed Chair Tent for Winter Sportsman Turns in Any Direction

Discomforts of winter hunting or ice fishing can be avoided with a one-man tent which provides easy-chair comfort for the

sportsman. Lightweight steel tubing forms the center chair and frame which supports the tent. The tent revolves on a central pivot so that the hunter can rotate it to face any desired direction. It is sealed by zipper fastenings which can be adjusted to govern the size of the gun-port openings. It can be folded into a package small enough to stow in an automobile luggage compartment.



Cotton Insulates Freight Cars Saving 3000 Lbs. on Each

Cotton insulation for refrigerator cars has been used experimentally by the Illinois Central System railroad in transporting strawberries from Louisiana to various points throughout the nation. Combined with aluminum-foil jackets, the cotton batts insulating 1550 square feet in a single car provide a 1½-ton weight reduction and 25 to 50 percent more heat resistance, according to W. A. Johnston, president of the railroad.



Light from enlarging camera goes through plant leaf (above) to print photo resembling X-ray. Below, framing a pansy with ferns in a holder



“X-RAY” PATTERNS

with your camera

By Lynwood M. Chace

THERE is always new adventure for the candid camera hobbyist. Let me tell you how I unexpectedly hit on a method of producing an X-ray effect in pictures.

One sunny day I was taking pictures in my flower garden with a Korelle-Reflex camera, equipped with a Radionar f:2.9 lens. I spent an hour working around an elephant ear plant, or yam. While concentrating on one huge leaf I had the camera on the ground shooting up and with strong backlighting.

I noticed that the veins and structure of the leaf seemed to stand right out, creating a beautiful photographic effect. If strong sunlight rays coming through the leaf made such an unusual effect, I thought, what would happen if I put this leaf in the negative holder of my enlarging camera and projected strong light through it?

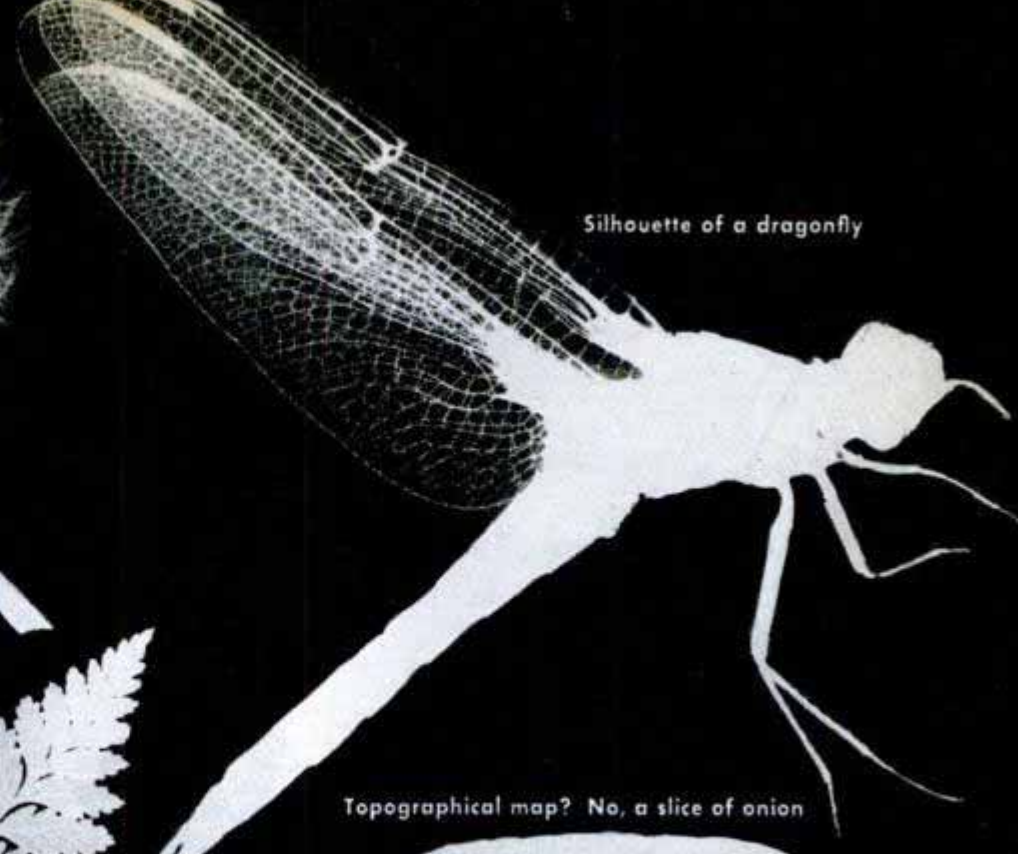
Trying the experiment, I placed a leaf in the negative holder and slid the holder into position in the enlarger. I put a piece of white paper into an 8x10 printing frame and switched off the light, snapped on the enlarger and started to focus on the white paper in the printing frame.

There was the same effect I had seen in the garden, except that the veins and structure of the leaf seemed to show up more prominently. I was using a 5x7 studio enlarger equipped with a Carl Zeiss Jana-Tessar f:4.5 lens—12 cm. Then I put a sheet of 8x10 No. 1 enlarging paper into the printing frame and made an exposure of eight seconds. I next put the paper into the developer (D-72—two-to-one mixture) and soon the leaf began to “come up.” However, my first print was a little overtimed so I tried another and gave this one five seconds, then developed it. This one was just right, and by using contrast paper it brought out the veins and texture of the leaf in a strikingly clean-cut manner.

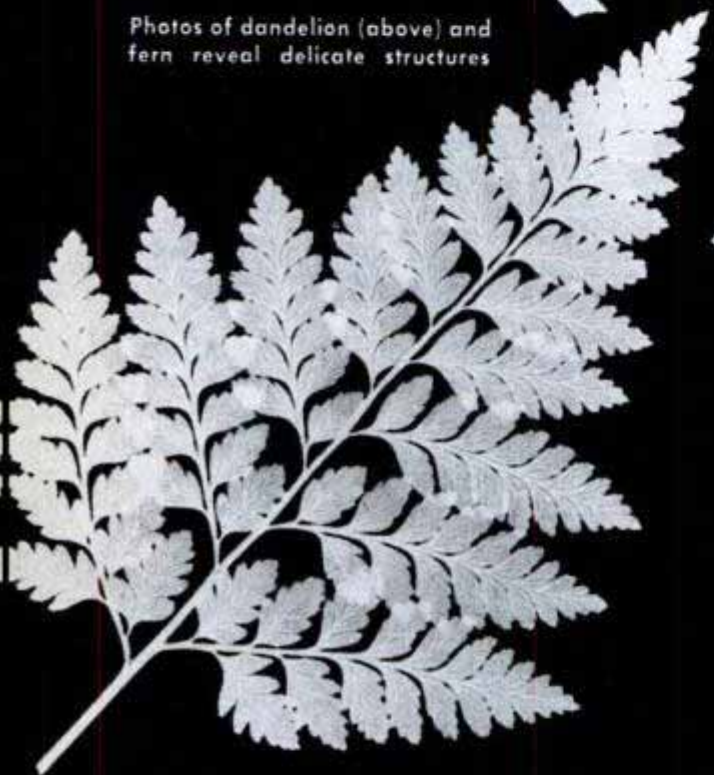
Later I produced a similar effect with insect wings, sliced vegetables and skin shed by a water snake.



Photos of dandelion (above) and fern reveal delicate structures



Silhouette of a dragonfly



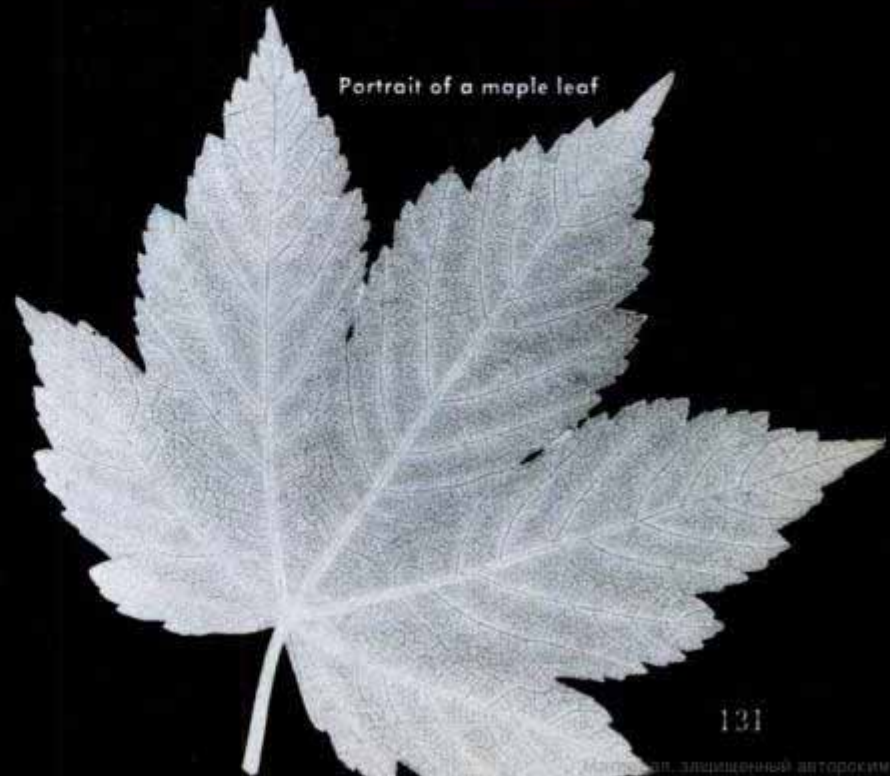
Topographical map? No, a slice of onion

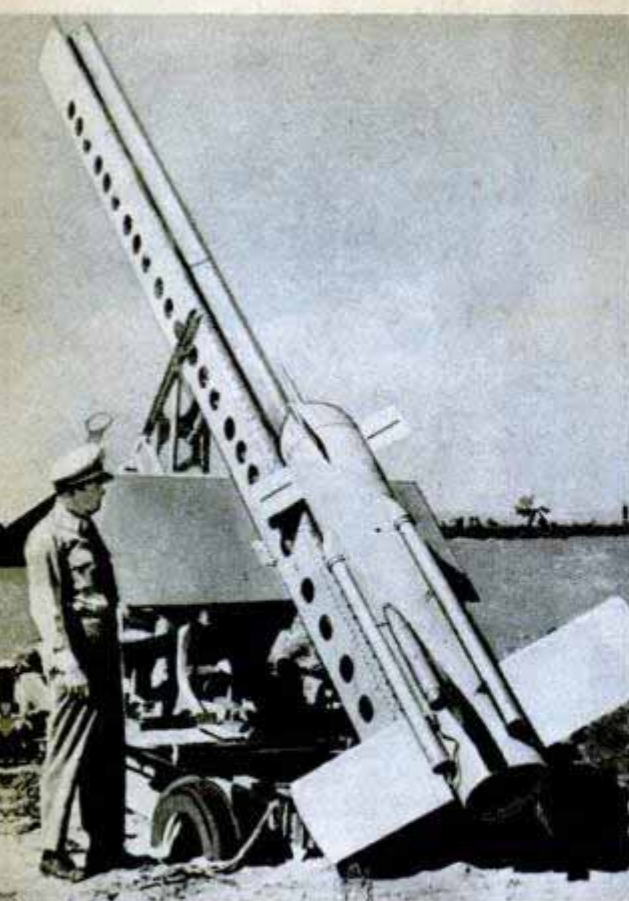


An "X-ray" of a water snake's skin



Portrait of a maple leaf





One of the many new developments in military weapons is the U. S. Navy's "Little Joe," a radio-guided missile for launching from shipboard. It was recently tested in

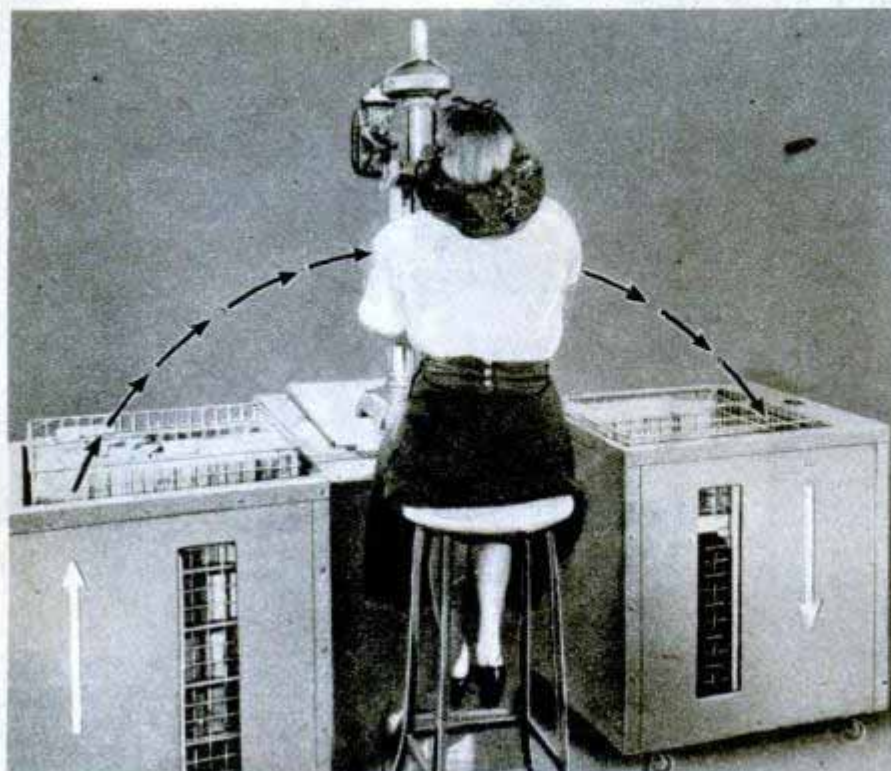
Radio Steers Navy AA Rocket

the desert at Mojave, Calif. The rocket weapon was designed for use against attacking aircraft. No details of the missile's construction have been revealed.

Processing Rack Keeps Work at Hand Level Despite Weight Changes

Self-leveling racks are designed to increase production by maintaining work to be processed at a convenient working level despite changes in weight as the material

is handled. Items to be processed are placed on a rack to the left of the operator. Finished work is dropped into a similar rack on the right. Trays in the left rack automatically rise to working level as the rack is emptied. As finished parts are placed on the rack at the right the trays are depressed by their weight. Springs built into the racks actuate the trays. When a rack is filled it can be wheeled away on its casters and used for storage. Reloading is accomplished by placing material on the platform, where it automatically finds the proper level.



When a rack is filled it can be wheeled away on its casters and used for storage. Reloading is accomplished by placing material on the platform, where it automatically finds the proper level.

Electric current to light an automobile fog lamp for an hour or more is developed by a tiny storage battery weighing only a few ounces and small enough to be held in the palm of the hand.



Showman Turned Inventor

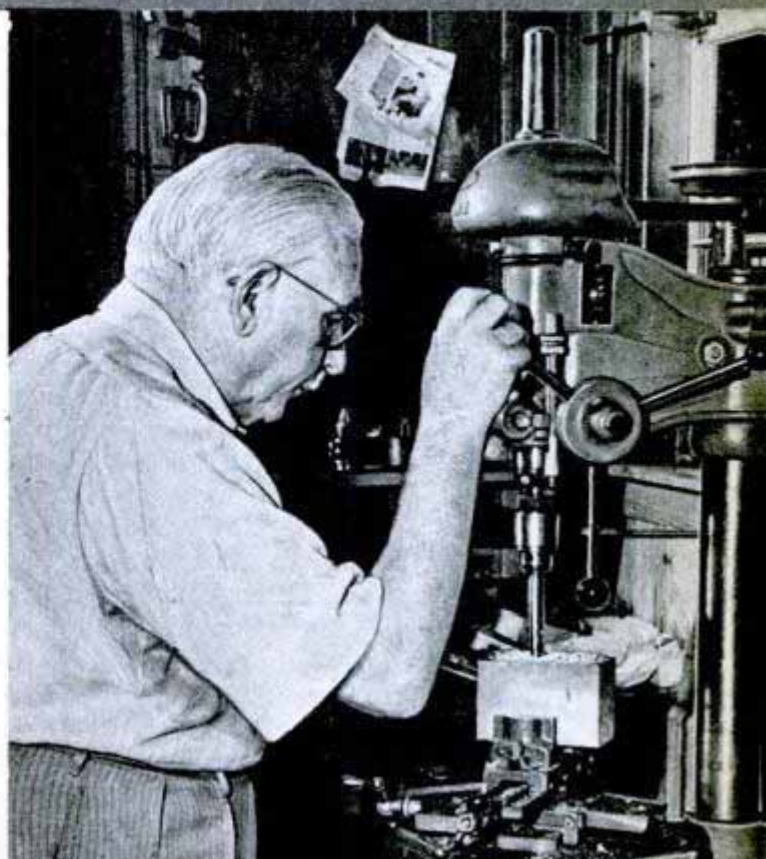
REMEMBER Arthur Hammerstein, the theatrical producer who staged 31 consecutive musical comedy hits including "Rose Marie"?

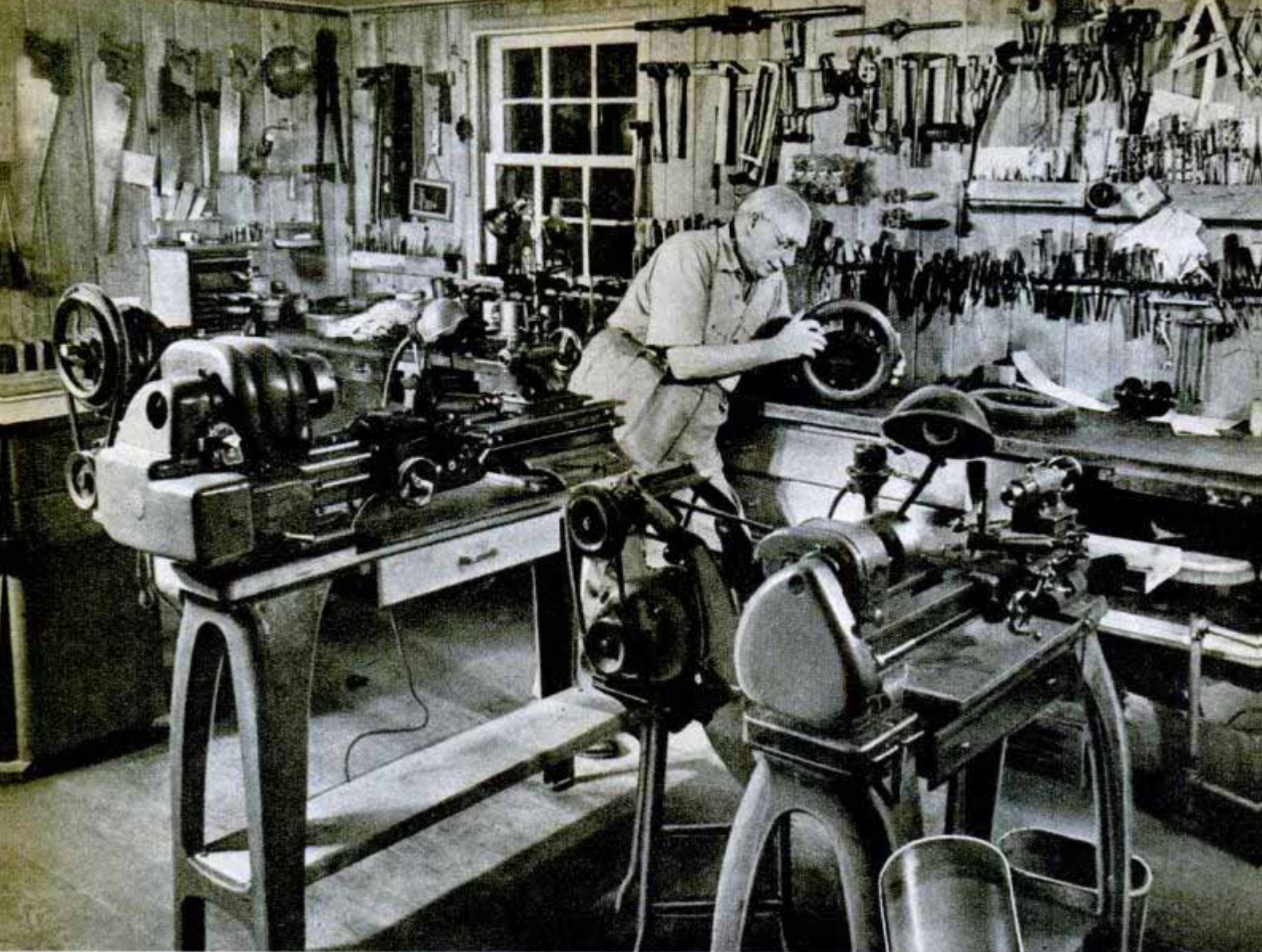
Today, white haired and 73, he has graduated from the show business to an inventor's workshop that would be a midwinter night's dream to any hobbyist of mechanical bent.

This "cathedral" of shops is one of the busiest spots on Hammerstein's 300-acre dairy farm near Chicago—the place he calls "Headacres Farm." Within its tool-lined walls he spends hours, night and day, repairing electrical and mechanical equipment and inventing things, such as a salt shaker that never clogs.

Interest in mechanical contrivances was first displayed by Hammerstein when, as a boy of 13, he took a job setting type at his father's

With a superworkshop as his "stage," retired theatrical producer Arthur Hammerstein now invents things. At top he inspects a wind indicator, shown next to an electric glass cutter. Right, expansion drill he designed





Hammerstein keeps all mechanical devices on his dairy farm in top shape. Here he adds a rubber tire to the wheel for a new milk truck

U. S. Tobacco Journal in New York. The father, Oscar Hammerstein, who later was in show business, had a machine shop that provided Arthur's first education with tools.

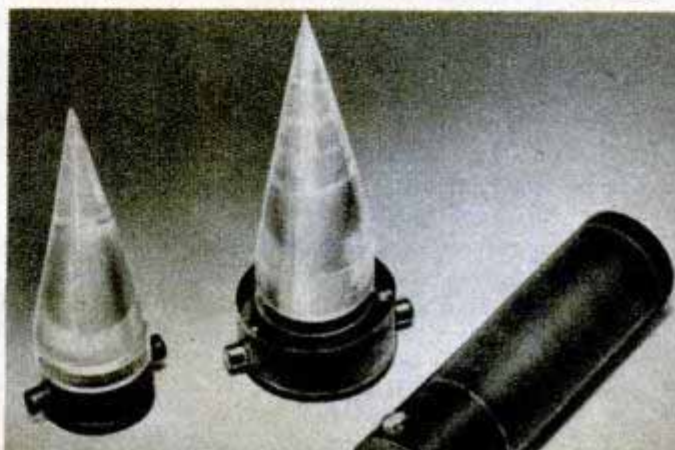
While still in his teens Arthur also learned plastering and brick laying and became construction superintendent when his father built a number of theaters. About this time, Arthur's theatrical "blood" took charge and he jumped into show business and put aside his mechanical inclinations for almost half a century.

Now that he's retired, Hammerstein has returned to his first love. He spends many hours in his workshop which contains \$4000 worth of tools. Every conceivable kind of hand tool hangs ready for use, such as 18 pliers of various types and sizes. In the power tool line he has two drill presses, two lathes, circular saw, band-saw, planer, polisher, sander and grinder. There are delicate gauges to check the accuracy of his work and stop watches to clock the revolutions of shafts.

Hammerstein sometimes gets up in the

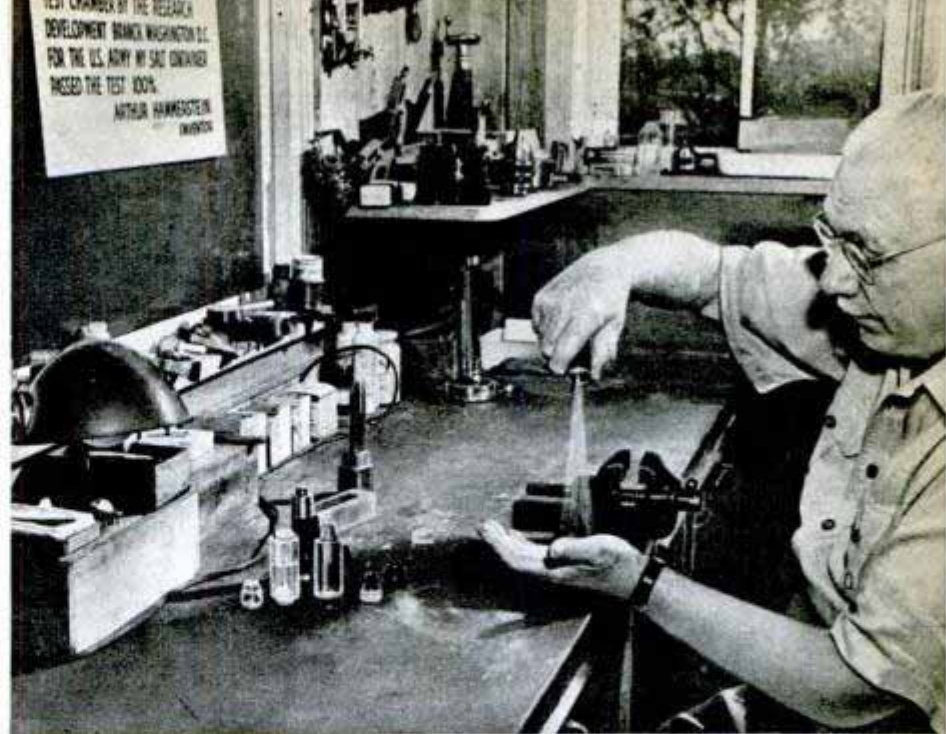


A push on the knobs of Hammerstein's never-clog salt shaker (above and below) and salt pours out freely





Hammerstein's wife, Dorothy Dalton of the silent movies, takes charge of the animals



The clogless salt shaker, demonstrated here by the former producer, has a rubber valve which prevents moisture from entering

middle of the night and rushes down to his workshop to start experimenting with an idea for an invention.

One night recently he hit on an ingenious scheme to build a wind indicator that would reveal—in the living room—from what direction the wind was blowing.

He hopped out of bed and worked until dawn. Then he took a nap and went back to work. In a few days he had built a complicated instrument equipped with electrical contacts, which he proposed to erect on the roof of his 20-room house. Next he made a circular dial with holes punched in the top in which he planned to install electric lights that would glow to indicate the direction of the wind.

When his wife (Dorothy Dalton of silent movie fame) learned of his plan, she said, "No, I'm not going to have holes chopped in my living room ceiling just so you can hook up a thing to show where the wind is coming from."

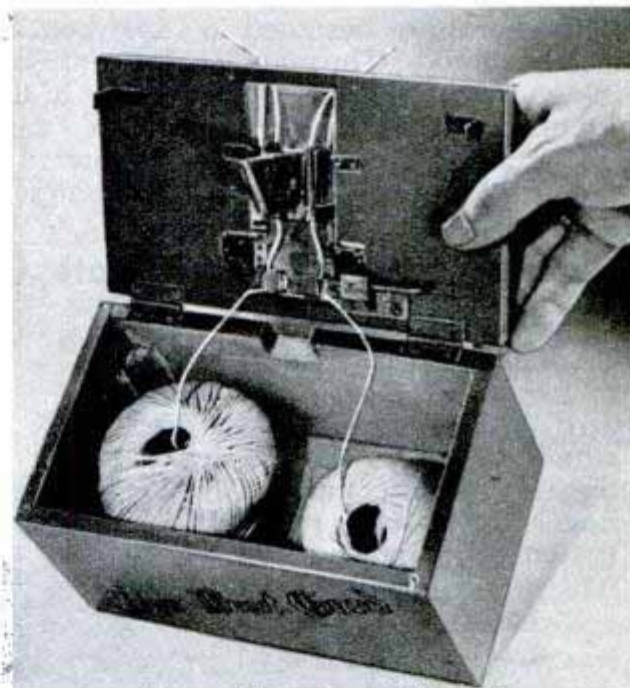
Thus died a Hammerstein invention.

But the former showman has come up with one invention that promises to be a real success.

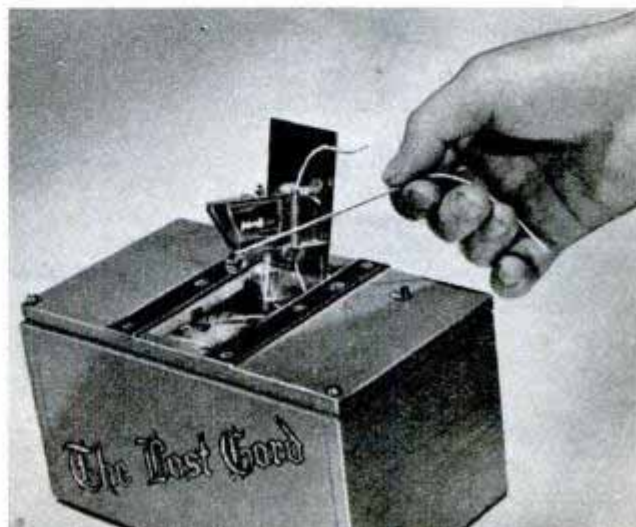
It's a salt shaker that permits no moisture to reach the salt and consequently never gets clogged. Key to the shaker is a tight-fitting rubber valve which opens only when two knobs are pushed. With the valve closed, no moisture can reach the salt as it does in the ordinary shaker. The container is of transparent Lucite, a material Hammerstein likes to use. A Chicago firm is manufacturing the "pinch-o-salt" shaker which is considered a natural for lunch boxes and picnic baskets.

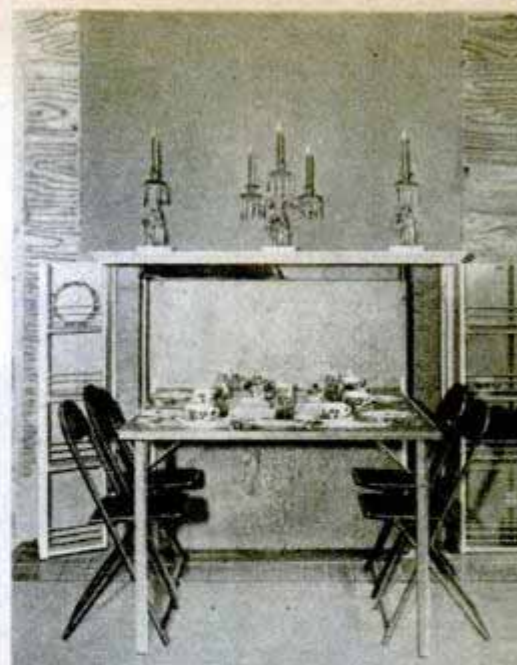
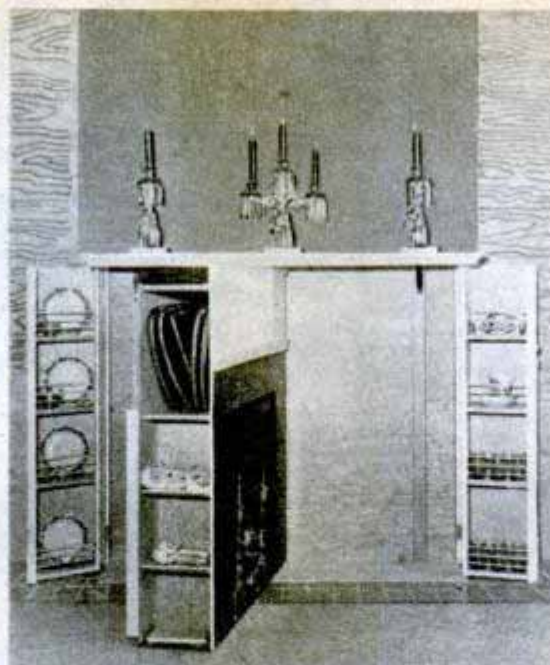
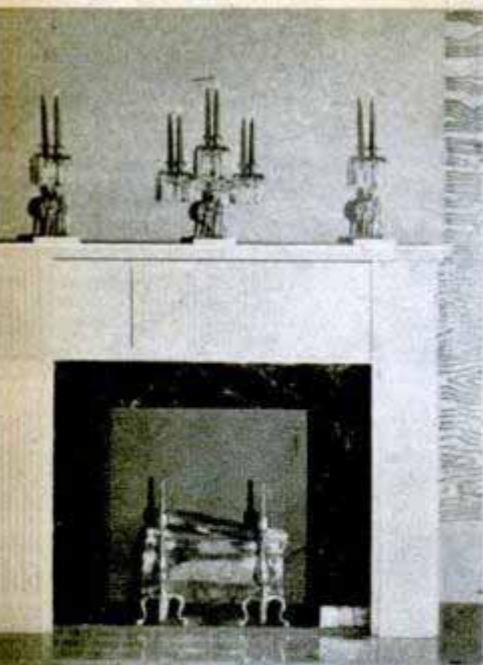
Hammerstein, proud of his clogless salt

(Continued to page 256)



Another invention by the gentleman farmer is a twine cutter which uses a razor blade to snip the cord. Named "The Lost Cord" by Hammerstein, the device actually prevents lost cords by a snap-up spring





Decorative mantel, left, opens out to reveal storage space, center. Complete dining set is shown at right

Distinctive mantels that can be converted into dining tables with chairs are designed to save room in modern homes. The mantel is conventional in appearance with an electric outlet in the fireplace for installation of a bulb to simulate a fire. When the fireplace is rotated it reveals a compact storage area complete

MAGIC MANTEL

with four to eight folding chairs.

A 42 by 46-inch table lifts away from the mantel and is supported on four folding legs. Two outlets are provided above the table for electric appliances. The open mantel also reveals eight end shelves that provide extra space for dishes, linen, silverware and other table service.

One Finger Plays Four-Note Chords With Keyboard Attachment

Playing the piano is simplified by mechanical fingers which play three and four-note chords when touched by a single finger. The mechanical fingers are attached to the bottom of a plastic box which fits over the keyboard. On the top of the box are eight numbered white keys which are operated in accordance with numbers on sheet music.



House Moved on River Barge

Cut into sections, a house near Rumson, N. J., was floated 2½ miles by river barge to its new site. Two small boats towed the house and barge to the main channel of the Shrewsbury River where it was picked up by a river tug.

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

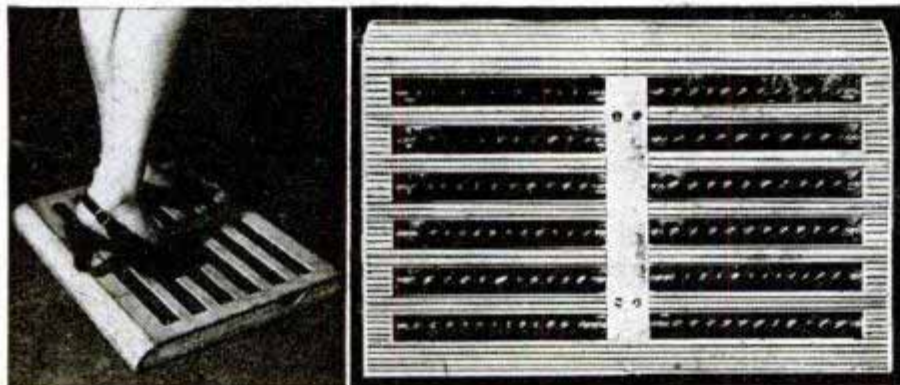
Giant 20-Seat Helicopters Are Planned for Air-Bus Line

Use of helicopters carrying from 12 to 20 persons is planned by Greyhound Lines in setting up nationwide air-bus service. Tests have been conducted at Detroit with four-place helicopters landing within 100 feet of highway intersections where buses stood ready to take on passengers, mail and light freight. Further trial flights will be made with the four-place helicopters until larger models are available. Residents of small towns and cities not served by air service are expected to be the principal users of the air-bus service



which also will provide feeder service for air lines. Approximately 80 bus lines have filed applications to operate helicopters.

Door Mat With Revolving Brushes Removes Shoe Dirt



Twelve revolving brushes on a door mat wipe the dirt off shoes and deposit it in a tray beneath the unit. When the tray is full the top section of the mat can be removed and the tray emptied. The brushes permit a wiping motion without tripping. All the parts except the brushes are of aluminum.

"Elevator" on Bread Trailer Loads 645 Loaves a Minute

One man can load a 33-foot truck trailer with bread in 20 minutes with an electrically operated winch and ramp. This loading apparatus unfolds from compartments beneath the trailer. After the loading, the remote control switch is disconnected and the winch and ramp are returned to their compartments.

Freight planes equipped with a dry-ice compartment, a blower and sealed cabin are making cross-continental test flights with perishable shipments of gardenias and orchids to test the practicability of refrigerated planes.



Platinum on Four Feet

Don't expect to get rich overnight raising chinchillas. One fur coat may sell as high as \$35,000—but the entire jackpot doesn't go to the farmer



Chinchilla litters are small—one to three animals—with weight at birth only two ounces

RAISING the world's most valuable and luxurious fur is a back-yard hobby with scores of people who started with a couple of chinchillas each and now have herds worth more than \$20,000.

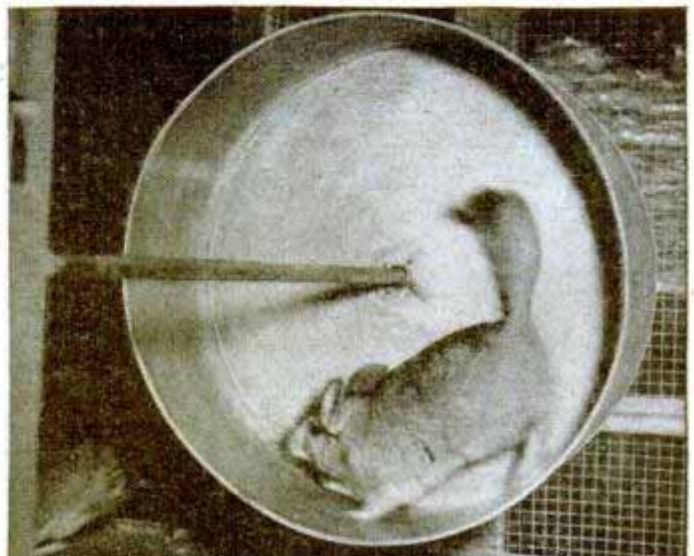
It takes only half an hour a day to care for several dozen chinchillas. Pens tucked away in the garage or along the garden wall shelter the fabulous animals. Feed bills are insignificant—only two dollars a year per head, as the balls of fur consume only a couple of ounces of food daily. Yet their pelts are worth from \$10 to \$75 with prime skins bringing \$100 or more. But

don't think you can make a fortune overnight raising fur coats—a chinchilla farm has many a drawback.

Chinchillas are strange little animals that look like squirrels who wanted to be rabbits. They originally breathed the thin air of the high Andes in South America. Native hunters almost killed off the species before M. F. Chapman captured 11 specimens in 1923 and shipped them in his private stateroom to the United States. All 20,000 or more chinchillas in this country are grandchildren, several times removed, of this handful, plus a few later importa-

Favorite food of this expensive ball of fur is a raisin

Popular pastime is scurrying along an exercise wheel



tions. Ten years ago a dozen people raised chinchillas. Today about 300 own valuable herds.

You can make money raising chinchillas with a minimum of time and trouble, but it takes more than a few dollars to get started, and you won't get rich overnight. Cheap breeding stock is worthless. A pair of prime breeding animals costs \$800 to \$1200. Five or six years from now your herd may become profitable. Then you can look forward to a steady income of several hundred to several thousand dollars a year.

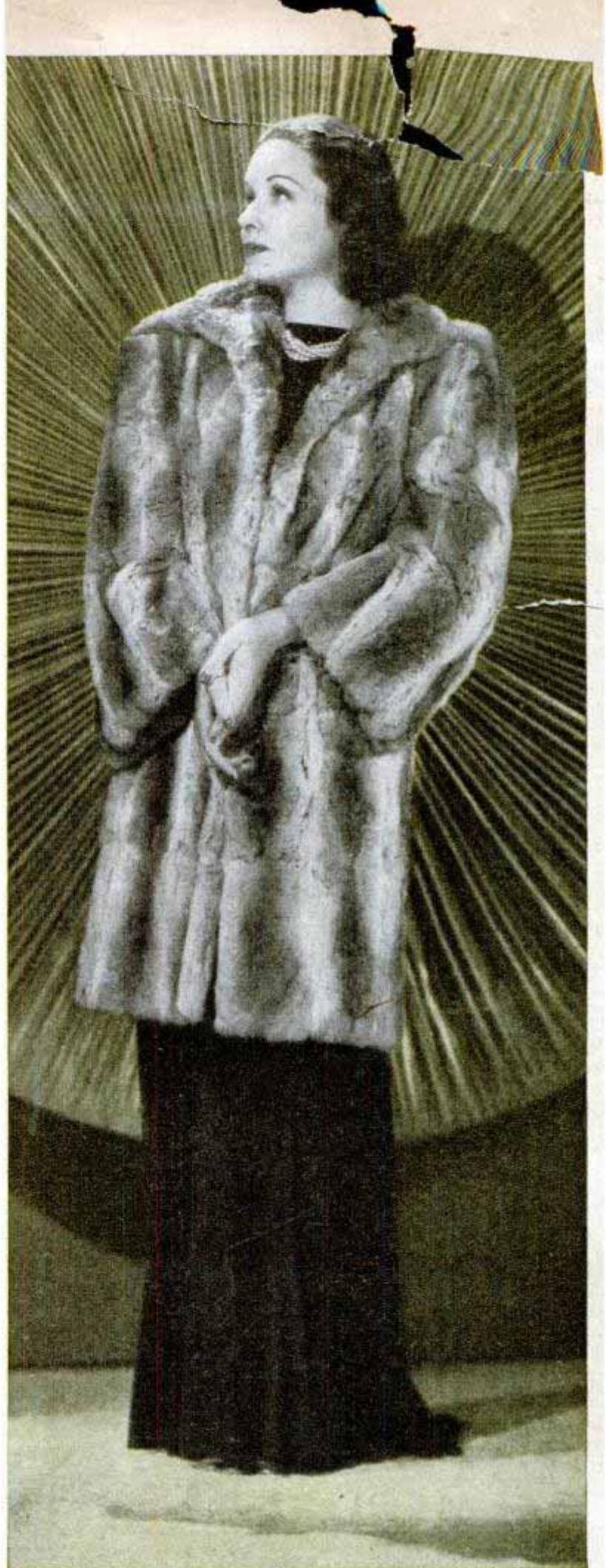
Chinchillas breed twice a year and produce one to three offspring per litter. This multiplication rate has led to extravagant claims that one pair of chinchillas will multiply into a large herd within a few years. Actually, conservative owners figure on no more than a 100 percent increase in desirable animals per year. They cull out the poor specimens instead of keeping them in the herd.

Raising chinchillas in captivity is still a young industry. Owners have made most of their money by selling top quality animals as breeding stock to new chinchilla farmers. Few animals have been killed for the value of their pelts and most of the skins that have been marketed have come from nonproducers, undesirables or casualties. That's the reason why good chinchilla fur is practically unobtainable and explains the fantastic prices that have been charged for the 30-odd chinchilla garments that have been manufactured to date. A full-length chinchilla fur coat made up of 180 to 200 skins has sold as high as \$35,000.

Now, with the herds built up to comparatively large numbers, more animals are being killed for their pelts. Several thousand pelts will be auctioned in 1947. Owners expect prices to drop shortly and perhaps stabilize eventually at \$25 to \$50 for the better grades of skins.

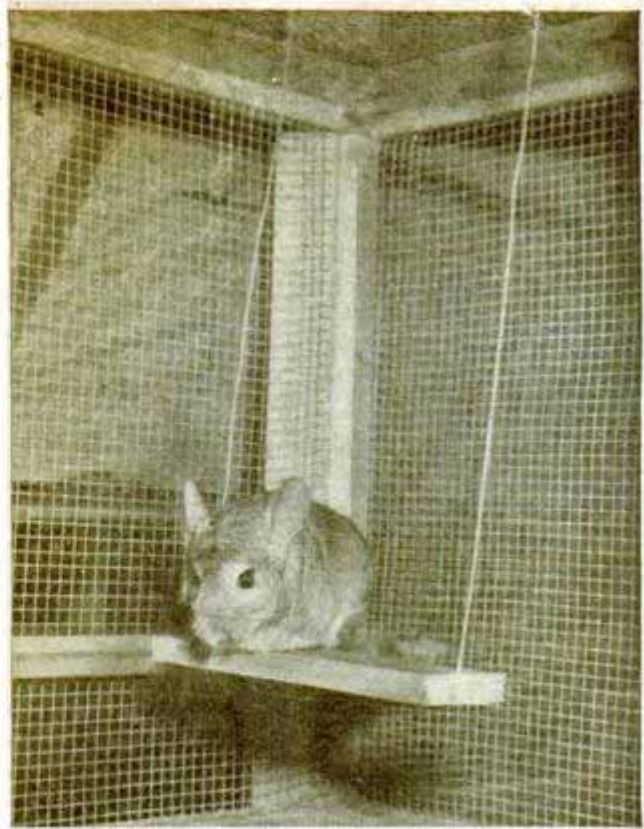
Lower prices will mean more

Chinchilla fur, prized for its luxuriant softness, durability and rarity, makes the world's most expensive coat. A single chinchilla garment once sold for \$35,000





Milk formula is fed to baby chinchilla with eyedropper



Frisky animals like to play on swings in their cages

money, the chinchilla ranchers agree, for chinchilla will be able to compete with fox and mink on a much wider market. Possibly within a decade the price of chinchilla garments will sink to a low of \$3500! But by the time the market price for skins is down the chinchilla ranchers expect to have bigger herds to boost their income.

Small back-yard chinchilla ranches are scattered throughout the United States and Canada. The hardy little animals will thrive practically anywhere. They should be protected from the sun in hot weather and insulated with wood-floored nest boxes in subzero weather.

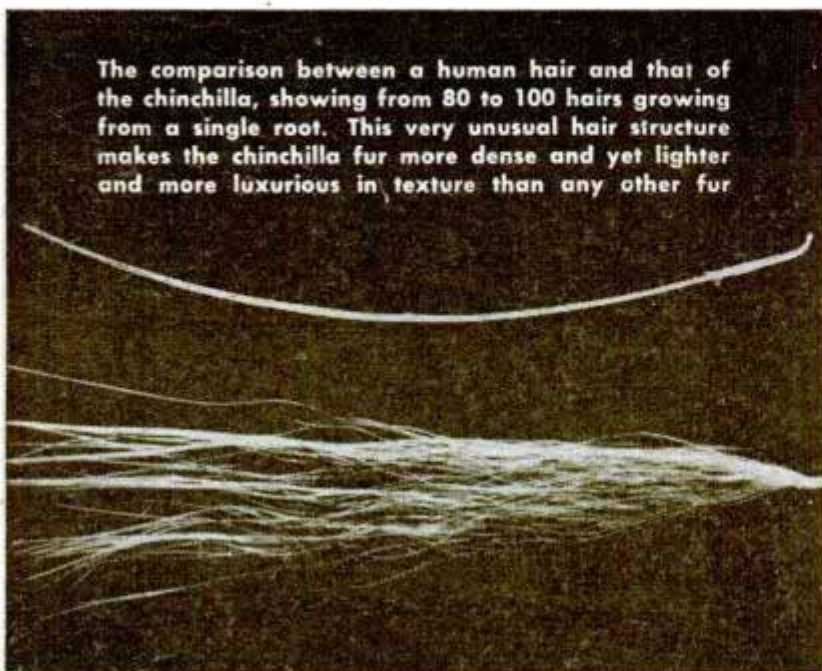
A typical small rancher, Dr. George E. Davis of Pasadena, Calif., started in 1940 with a single pair and now has a herd of some 40 animals, exclusive of the animals he has sold to cover his initial investment. He also serves as secretary to a group of nine other chinchilla breeders.

Some of the earliest entrants into the chinchilla business have long since passed the hobby stage and are now large commercial enterprises. Chapman Chinchilla Farms, Inglewood, Calif.; Fur Farms, Inc., Gardena, Calif., and R. E. Hughes, Idaho Falls, Ida., all have more than 1000 chinchillas each in their farm pens.

Baby chinchillas are born with their eyes open, fully furred and active. They weigh no more than two ounces at birth, nurse for about 50 days, and attain an average weight of 22 ounces within four months. They are ready to reproduce within a year to 18 months. If a chinchilla is not to be used for breeding it is usually killed at 10 months when its fur is in prime condition. Chinchillas have amiable dispositions, thrive under intelligent care, are odorless and free from parasites.

Chinchilla fur is highly prized both for its rarity and certain basic qualities that include beauty, softness, thickness and durability. The body

The comparison between a human hair and that of the chinchilla, showing from 80 to 100 hairs growing from a single root. This very unusual hair structure makes the chinchilla fur more dense and yet lighter and more luxurious in texture than any other fur





A fortune in fur is tacked to the board and held by the owner. Prime pelts bring as much as \$100 apiece

of the fur is blue-gray, with a pearl-white bar just below a black tip. It has never been imitated successfully.

Other fine furs such as fox and mink are made up of one hair per follicle but a single chinchilla follicle sprouts as many as 100 hairs, all of extreme fineness, giving the fur density and luxuriant softness. The fur is so soft that most people actually can't tell when they're touching it with the palm of their hand. Visitors at a chinchilla farm who doubt this statement are asked to close their eyes, lower a hand, palm down, on a chinchilla pelt, and open their eyes the instant they feel the fur. Surprisingly, they find that their hand sank a quarter of an inch into the fur before they noted contact.

Chinchillas ordinarily are housed in wire cages or pens about 2½ by 5 feet in cross section, 18 to 24 inches high, with wood or wire floors. Being seminocturnal, the animals spend most of their time in the dark nest boxes, one of which is placed inside each pen or is attached to the side of the pen. A wooden nest box with a wire floor may measure 12 by 18 by 12 inches. Chinchillas enjoy exercise and some owners place small swings and exercise wheels inside the cages for their use.

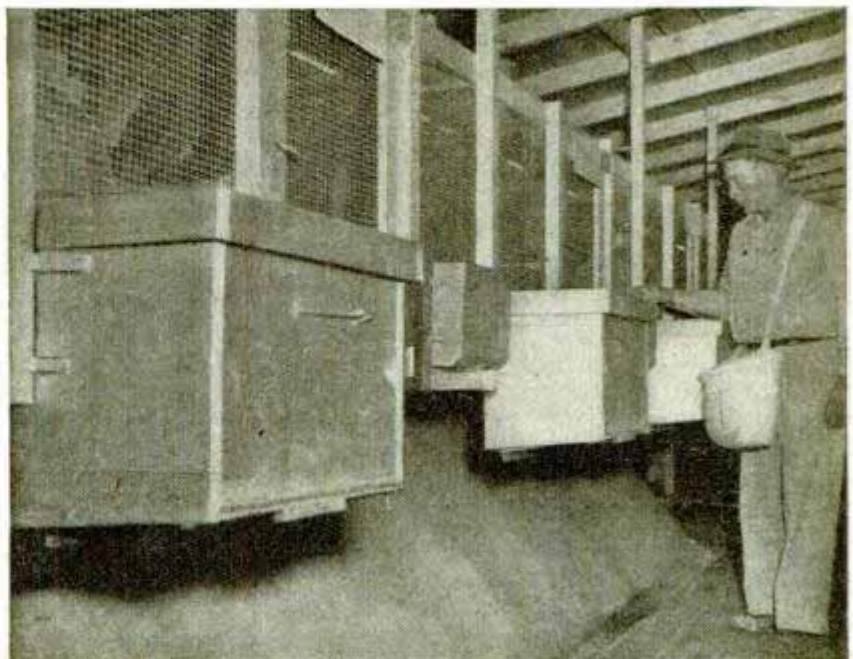
Feed consists of grains and large seeds, plus hay, bean or carrot tops, or even a few

green weeds. Prepared pellets similar to rabbit pellets are also available as food.

Good money can be made in the chinchilla business but beginners need sound advice in getting started. When fox and mink farming enjoyed its first boom about 20 years ago many enthusiasts who plunged into the new occupation were disappointed when the breeding animals for which they had paid high prices proved to be poor, unproductive specimens. Many owners failed, too, because they didn't learn the rudiments of animal care and management.

Purchasers of chinchillas can have the same unfortunate experiences unless they

Large nest boxes attached to the wire cages provide sleeping quarters



NATIONAL CHINCHILLA SHOW
3003 118 First ave
SALT LAKE CITY, UTAH



Owner examines some of his prize animals that were shipped by airplane

take sensible precautions. Only 25 percent of the chinchilla population ranks as first-class breeding stock and an untutored purchaser needs help in making sure he is getting sound stock for his money.

Probably the best advice is that he should deal with a well known, reputable ranch where others have made satisfactory purchases. He should expect to receive a pedigree with his animals, which is no guarantee of quality in itself but should show that blood lines have not been crossed. Reputable ranches also issue a warranty with the provision that if a pair of animals proves to be nonproductive they will be replaced free with another pair of like quality plus the average increase in young. Some ranchers are adopting a scoring system by which their animals are individually judged according to general appearance, clearness of color, luster and texture of fur, and other points based on the preference of the fur trade.

Most large ranchers advise that prospective purchasers spend from several days to two weeks at the ranch before they take home their new animals. This is the best way to learn the methods of housing, feeding and general care. Mating must be carried on according to hereditary laws and accurate records must be kept of the blood lines of all the animals so they can be mated to produce the largest litters of the most desirable specimens.

Chinchilla owners have their own national magazine with articles on successful breeding and raising of the little animals. Some owners who live in the same community have also organized clubs.

The future of all kinds of fur looks optimistic. The United States imports millions

of dollars worth of fine furs every year. Hundreds of thousands of pelts are taken from domestic trapping and ranching annually. Most fur ranches are a steady source of profit to their owners. There are 2800 mink ranches alone in the United States. Ranchers receive an average of \$20 to \$25 per mink pelt. These facts may indicate a similar future for chinchilla ranching.

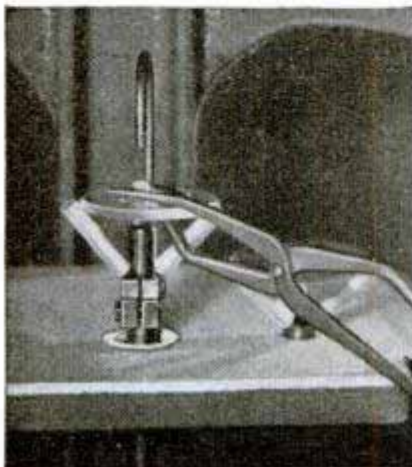
Like fox and mink, chinchillas that are raised in captivity have pelts that are vastly superior to those taken in the wild state. Plenty of food, controlled conditions in captivity and intelligent management have produced larger, heavier animals with longer fur of better coloring and quality. Chinchilla pelts today are running 12 to 13 inches in length with an occasional 15-inch skin, as compared with the 10-inch pelts of the original chinchilla importations.

That platinum sheen in a chinchilla's fur can mean money in the rancher's pocket. But the novice faces a big initial investment and he'll have a good many headaches unless he knows the tricks of fur farming.

Each pelt is carefully tacked to dry before tanning. Ranchers test the quality of the fur by blowing on it

Each pelt is carefully tacked to dry before tanning. Ranchers test the quality of the fur by blowing on it





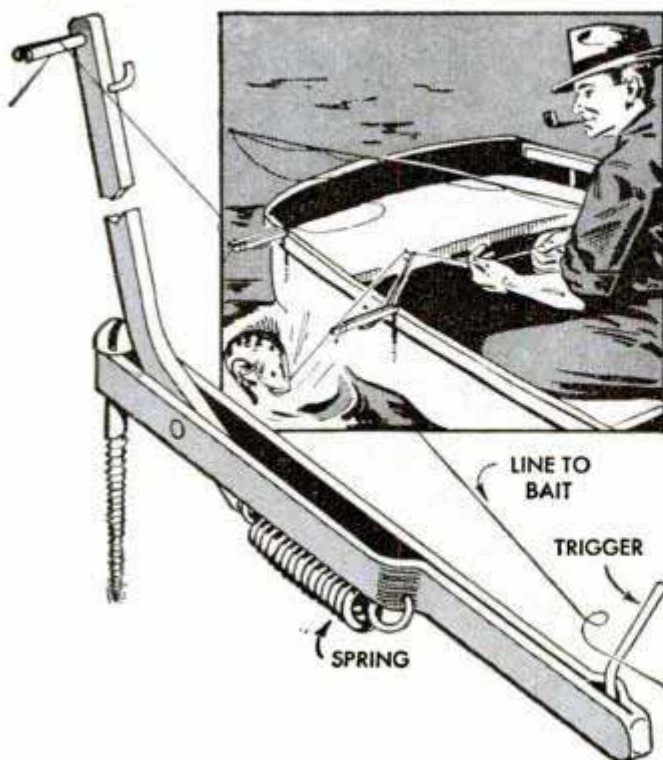
Spectacle lenses are accurately hardened in an automatic electric furnace and cooling chamber in about the same time it takes to soft-boil an egg. Hardened lenses are approximately 16 times stronger than untreated lenses. The auto-

1330-Degree Heat for Lenses Increases Strength 16 Times

matic unit, developed by Bausch and Lomb, weighs 264 pounds and

operates at a temperature of 1330 degrees Fahrenheit. The unit raises the lens into the electric furnace, heats it, cools it and lowers it from the cooling chamber.

Spring-Powered Fish Catcher Sets Hook Automatically When Fish Bite



Fishermen can take life easy with a new fish catcher that sets the hook automatically. The catcher is a four-inch lever with a spring on one end that is screwed to the boat or dock. The lever is cocked by forcing it down against the pull of the spring and fastening it with a free-swinging trigger pin. The line is passed through a split pin and looped around the trigger. When a fish bites, the slightest tug releases the trigger. The lever then flies back, jerking the hook to set it.

Scented Oil Taken From Grass Perfumes Toilet Soap

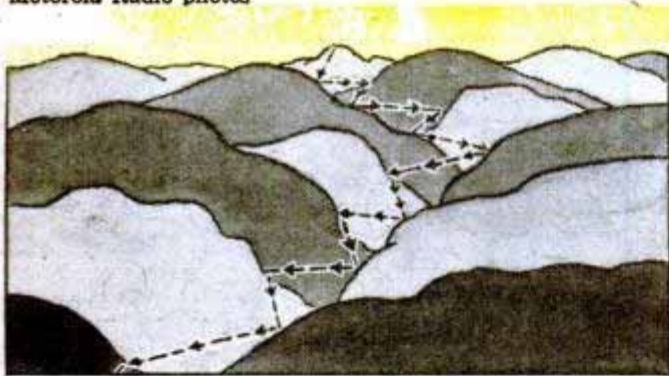
Grass provides the delicate scent of many perfumed toilet soaps. In Guatemala, lemon grass and citronella, also used as an insect repellent, are being raised in quantity for their scent. This is a comparatively new industry in America. Most of the world supply formerly came from the Far East.



Talking Mountains



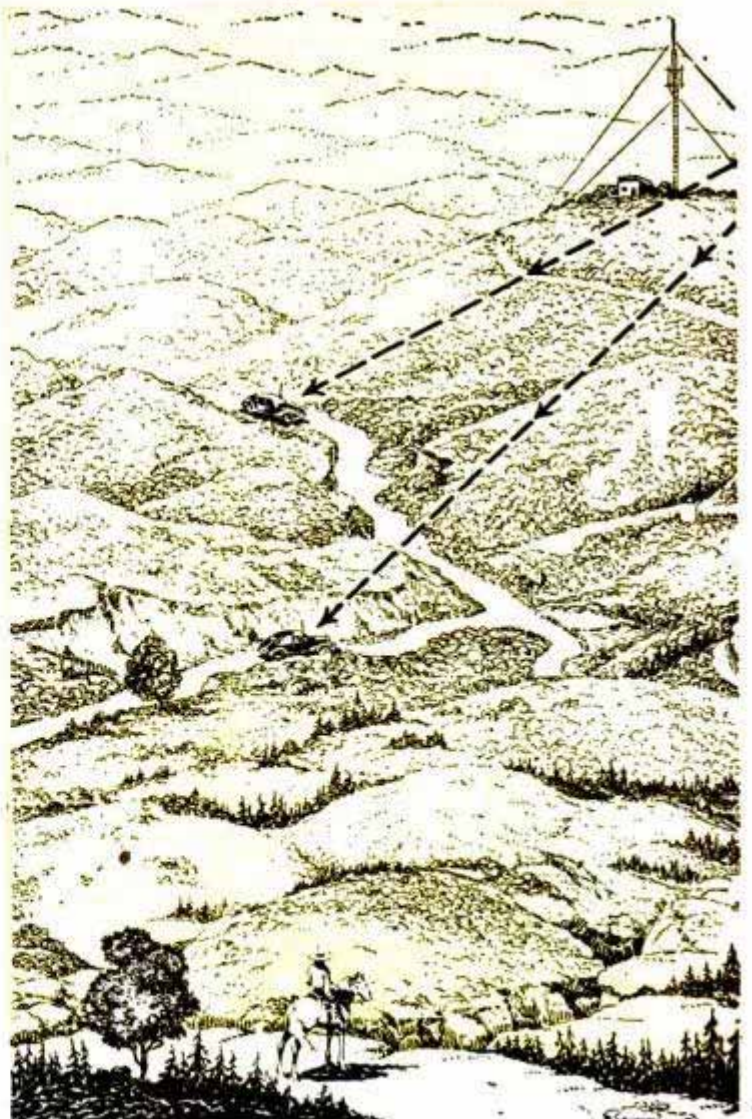
Motorola Radio photos



Officer speaking into the "mike" can beam his voice across the roughest terrain, even bouncing it through historic Deadwood pictured above. The sketch shows how the beam ricochets between the sides of valleys

TWO mountains that once looked down on the roaring gun battles of Wild Bill Hickok and other characters of the Old West have joined the police force to become "officers" in a police radio system that blankets the South Dakota Black Hills.

This radio blanket isn't woven in the same pattern as conventional police radio systems. Messages for high-frequency police radios are usually piped by phone lines to transmitters that can reach line-of-sight to patrol cars. But the messages sent to and from the mountain tops skid along on "Yagi" beams, zigzagging through gullies and bouncing off sheer cliffs. The path of the beams is definitely not line-of-sight. The message actually ricochets across the



rough terrain from one station to another.

Here's the way the system works. Atop Mt. Terry's 7070-foot mass and Mt. Coolidge's peak 50 miles away are lonely shacks that house unattended radio transmitters. The system's headquarters is in Pierre, the state capital, 173 miles east of Mt. Terry. Chief Agent Les Price of the attorney general's law enforcement division can sit comfortably in his office and transmit a message that tightens a road net around any part of the state.

When a police officer at Pierre sends out instructions, the message is automatically picked up by one of the two top-of-the-mountain stations. The message itself "triggers" a receiver that kicks on a relay transmitter and the orders angle off on the second leg of their journey.

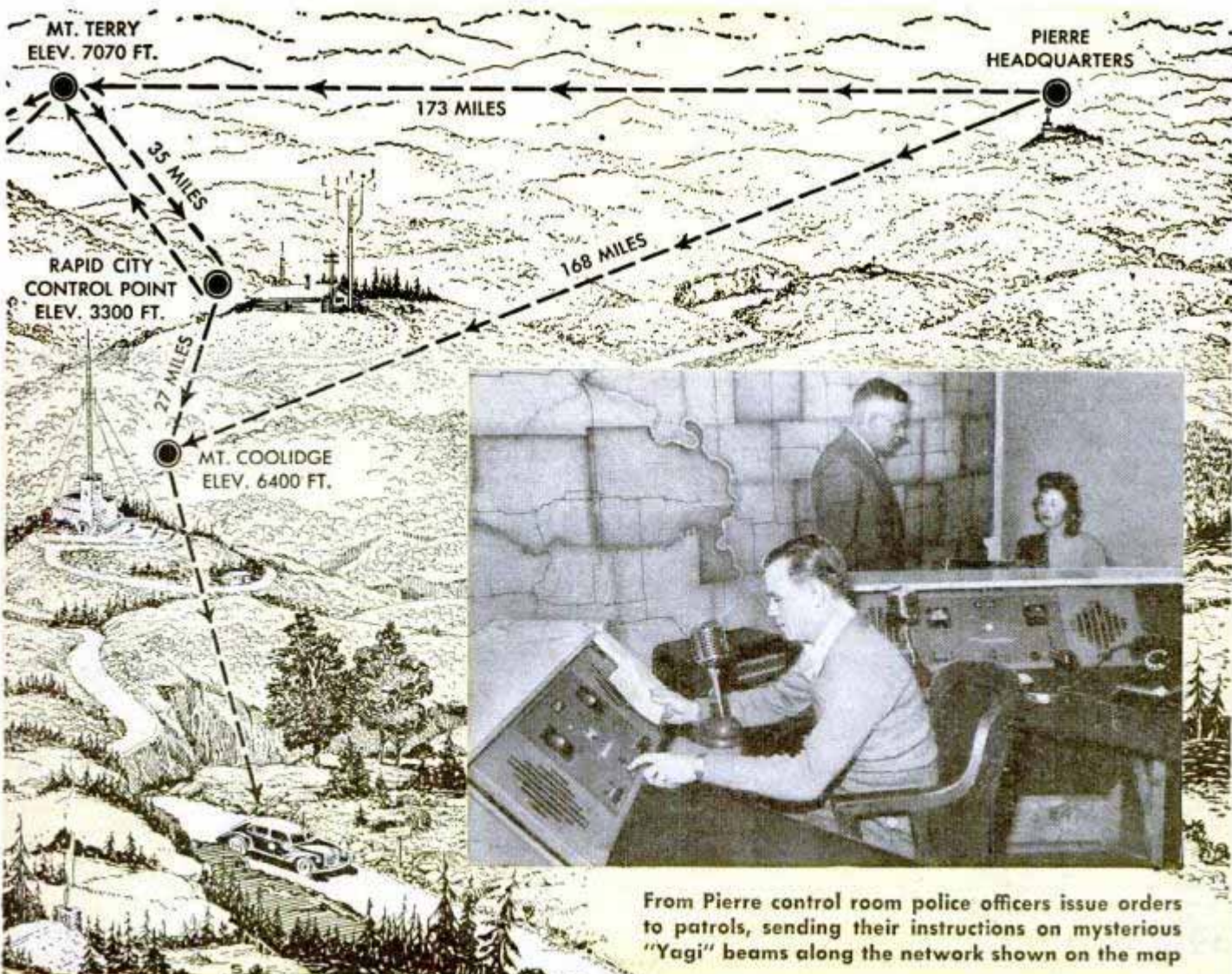
Rapid City subheadquarters, about midway between the two mountains, is next to pick up the message. There the instructions are interpreted and orders are sent, via the mountain tops again, to individual patrol cars.



Switches on these panels control 500 pinpoint lights on a wall map to maintain a visual check on each patrol car's position

It's the transmission across the rugged area between the mountain tops and Rapid City that's unique. Mountain masses, jagged cliffs and deep gullies are obstacles that stand directly in the path of the radio beam. Line-of-sight transmission is im-

(Continued to page 248)



From Pierre control room police officers issue orders to patrols, sending their instructions on mysterious "Yagi" beams along the network shown on the map



Some Boston women keep their hats in refrigerators, which really isn't strange because the hats are decorated with real orchids and other costly flowers. Florist Elynor O'Neil designs the blooming bonnets and sells them for \$10 to \$75, depending on the number and rarity of the flowers. The

"ICEBOX" HATS

flowers are chosen to be in their best bloom on a birthday, wedding anniversary or some other special occasion. When not being worn, the hats are kept in refrigerators to preserve the freshness of the blossoms for perhaps six wearings. Foundations are of felt covered with maline and veiling.

Extension Hood for Cameras Aids in Picture Composition

Stray light is kept out by an extension hood which aids in focusing or picture composition with reflex-type cameras. The hood folds flat when not in use and can be

carried in the pocket or camera case. It fits many types of reflex cameras. Use of the hood makes it possible to see the ground glass more clearly while shooting the picture from waist height.



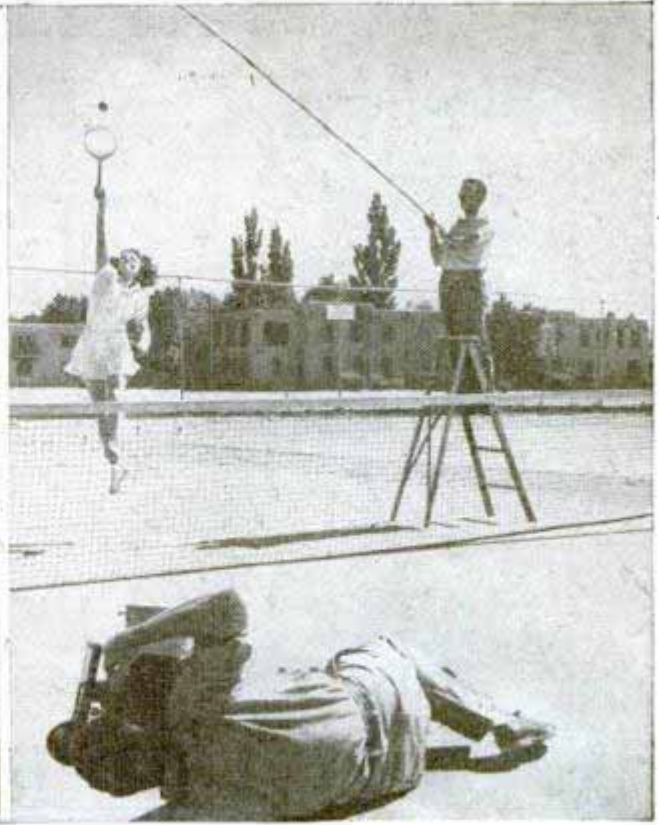
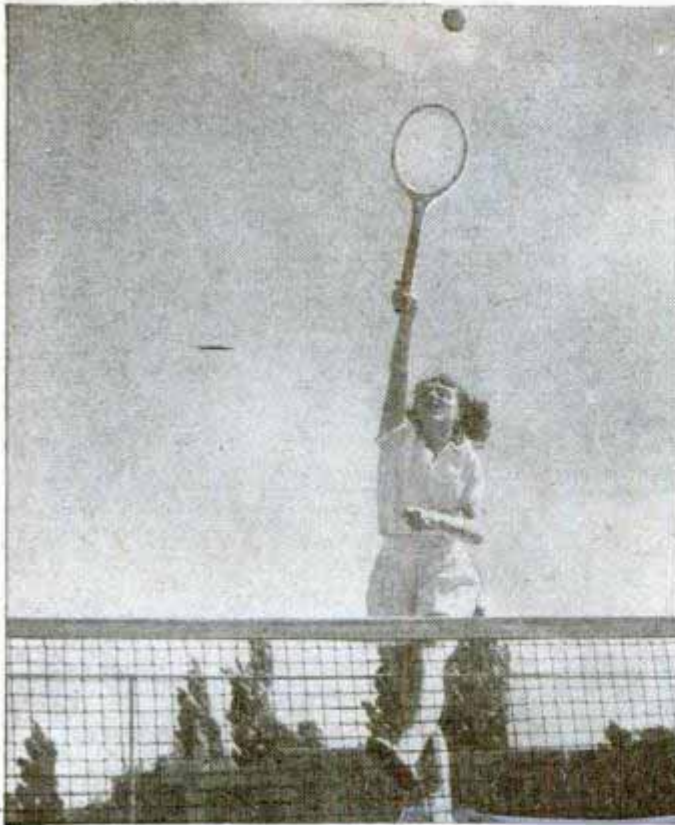
Lubricant Is Floated on Air In Form of Dry Powder

Finer than face powder, a new lubricating powder is applied by squeezing the sides of its bellows-type container. The lubricant is light gray in color and therefore does not soil hands or clothing like black graphite. It does not freeze at 40 degrees below zero and withstands heat up to 6300 degrees. Because the powder is so fine it will float in the air, it works into many places that conventional lubricants cannot reach. Squeezing the sides of the container ejects a small amount of powder in a stream of air.



More than 700 different languages are spoken in Africa exclusive of dialects.

Trick Photos of Girl Tennis Player Give Illusion of Action



By planning the "action" in advance a photographer can give the illusion of movement in still pictures. For a photo of a girl tennis player smashing at a drive, Dale Britton, of Albuquerque, N. Mex., needed

an assistant, a fishing pole and a length of string. He tied the ball to the fishing pole and his assistant dangled it into the picture area while the girl leaped into the air and swung her racket as if she had hit it.

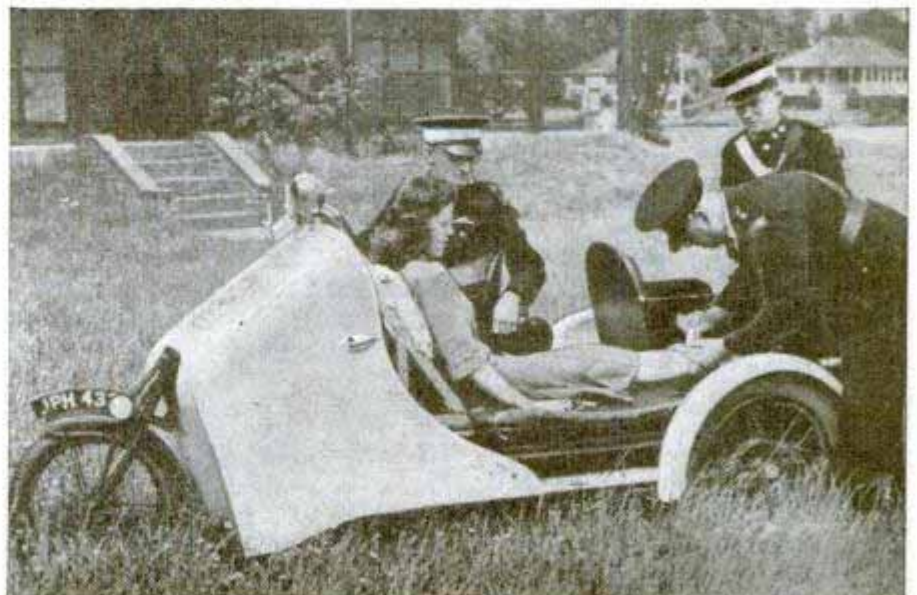
Semiwaterproof Paper Bags Will Hold Contents in Rain

Bags made of "wet strength" paper will absorb the moisture on wet vegetables or cold beverage bottles without splitting. They will hold their contents safely even when drenched with rain. The paper is made by treating the paper fibers with chemicals which impart extra strength

when wet. Seams of the bags are sealed with a waterproof adhesive which can remain in water from four to 48 hours without losing its grip. Some "wet strength" paper bags, fitted with Cellophane windows, are being used for prepackaging moist fresh vegetables at produce markets.

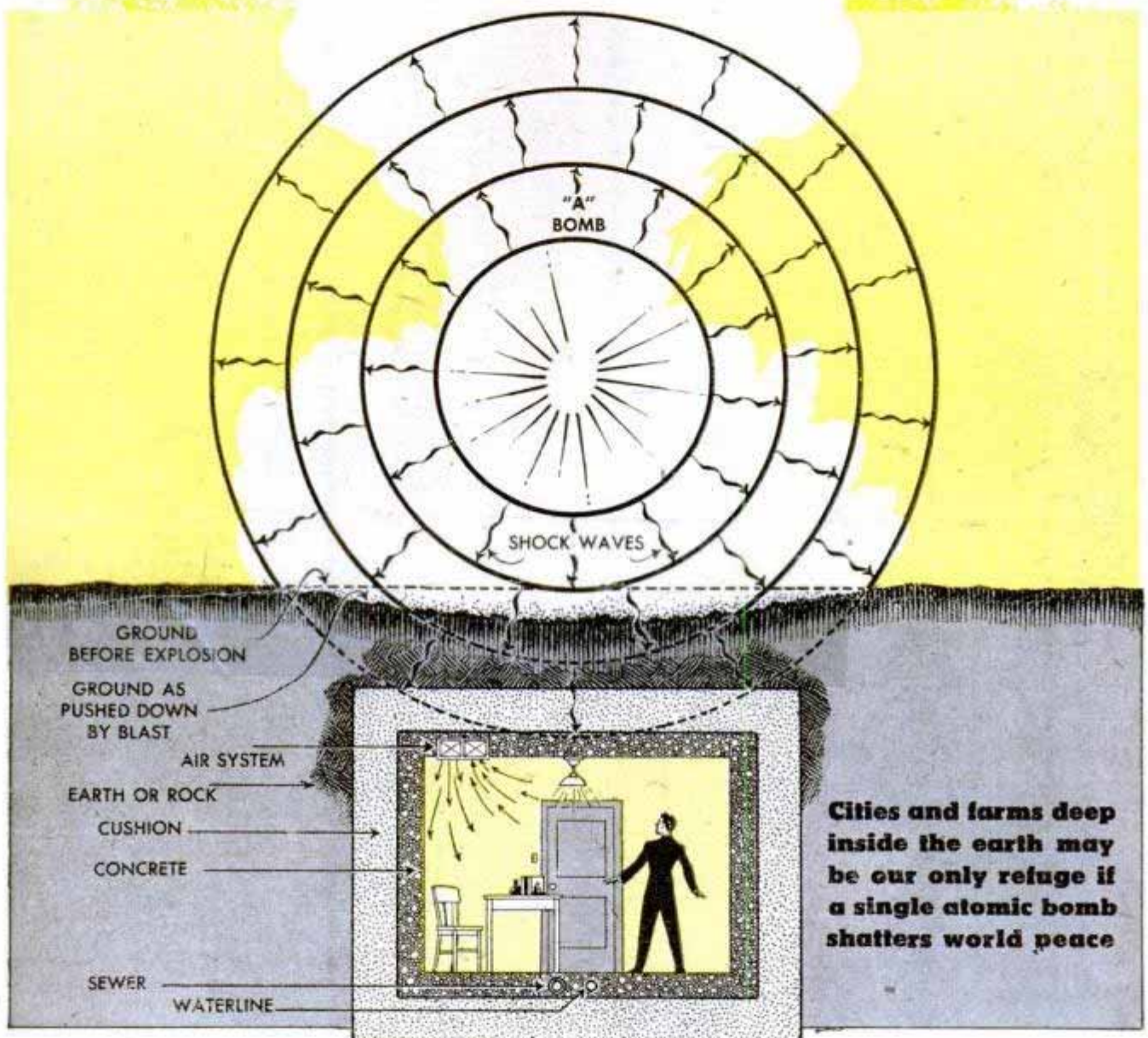
Motorcycle Ambulances Designed for Rough Terrain

In England motorcycles have been redesigned to serve as ambulances in places where poor roads would make it difficult for the usual first-aid vehicles to operate. They can be driven by one man, at speeds up to 60 miles an hour on highways.



Names and addresses of manufacturers of new products featured in this issue will be supplied promptly by the Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Illinois.

Will the Atom Drive Us Underground?



WOULD you like to live and work in a cave? **By John L. Kent**

The unhappy possibility that we might again become cave dwellers, fulfilling the gloomy predictions of sociologists and historians, was given a basis in fact recently.

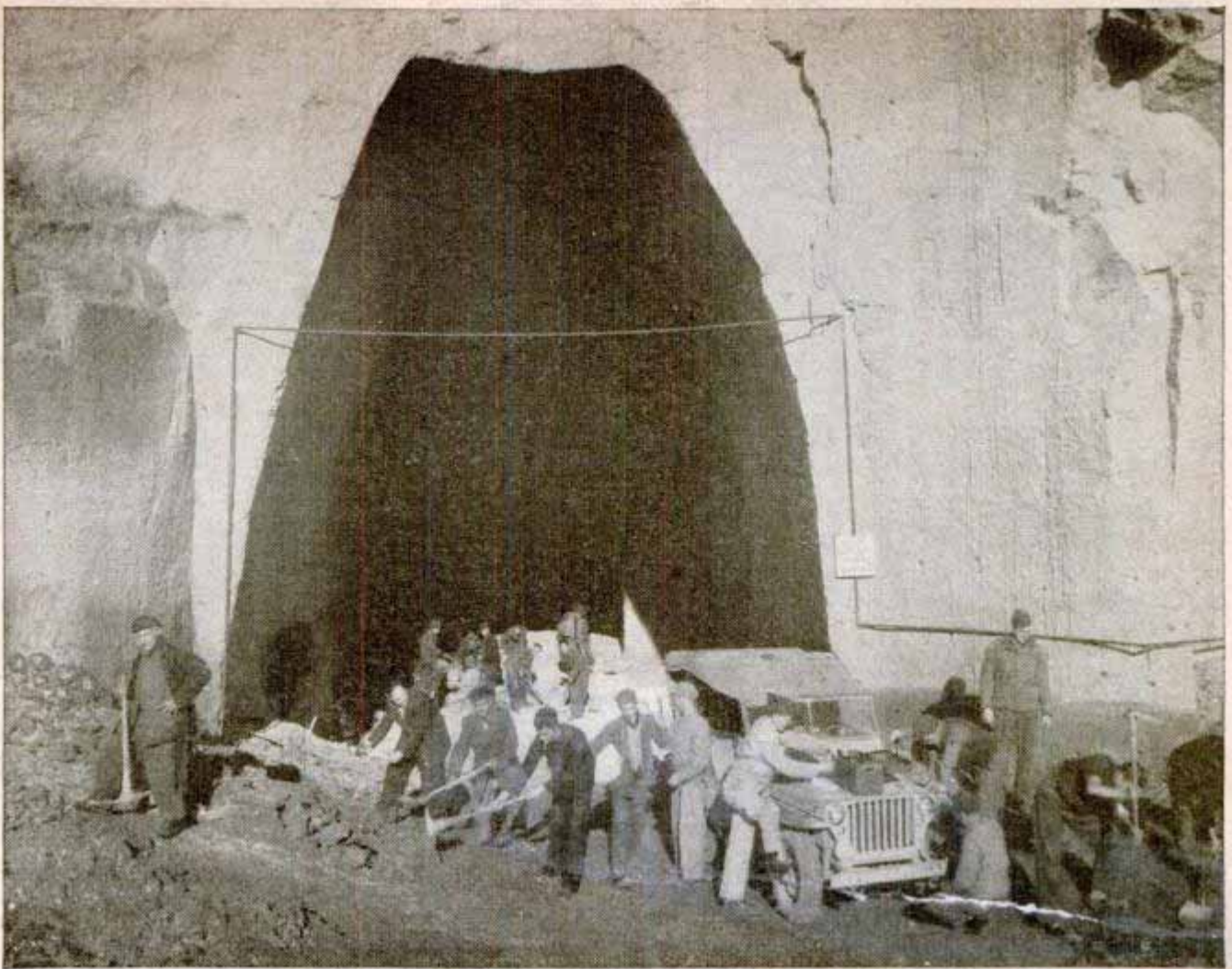
The Army and Navy plan to move industrial and military installations underground in the event of another war because it might otherwise be impossible to defend them against enemy atom bombs. To obtain the same protection, Americans might live in caves close to the underground workshops.

The Army and Navy Munitions Board, charged with industrial mobilization in an emergency, has started a survey of under-

ground sites which might be used for long-term storage of

machine tools and war production equipment, and which, if necessary, may be adaptable in wartime for industrial production. Army engineers, working under the direction of a special "underground sites committee" of the board, are now cataloging underground areas and will grade them according to their various characteristics. Both natural caves and man-made caverns such as mines are being studied.

Production can conceivably be carried on in the caverns of many national parks. Carlsbad National Park in New Mexico, for example, has 45,000 acres of underground trails and rooms, some still unexplored.

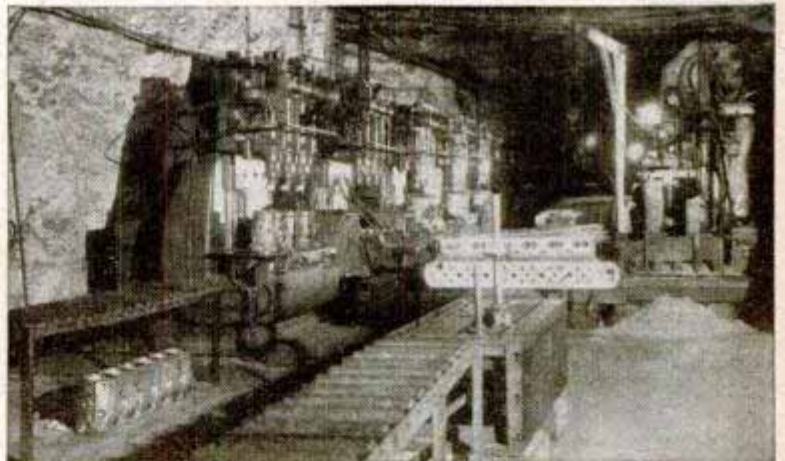


Dark entrance leads to huge cave that was home to 1000 Italian families during the war. U. S. Army equipment was stored there later. At right is a section of the underground assembly line of a German airplane engine factory. Below, concrete shields cover each machine in a synthetic rubber plant

There are also the nationally owned Mammoth Cave Park in Kentucky and Wind Cave Park in South Dakota. Then there are privately owned caverns kept as scenic attractions, such as the Howe Caverns in New York and the chain of caverns in the Shenandoah Valley of Virginia.

Using caves for storage is not new. The Europeans have used both natural and man-made caves for the storage of wine, beer and cheese for centuries. In the United States, a 15,000-acre cave near Atchison, Kansas, is a vast icebox for the storage of surplus food. Built for \$2,000,000 by the War Food Administration, the natural limestone vault can hold 52,000 tons of food. Three compressors maintain a temperature of about 40 degrees Fahrenheit.

Underground factories are not new either. Key factories of the





Caves along the Italian beach provided ideal shelter for invading GIs. The "bedroom" can be seen at the rear

German armament industry were dispersed in subterranean locations in France, Germany, Italy and especially in the former protectorate of Bohemia.

The British used underground factories,

Will these steps in Kentucky's Mammoth Cave some day lead to an assembly line? The cave has five distinct levels which afford living as well as working space



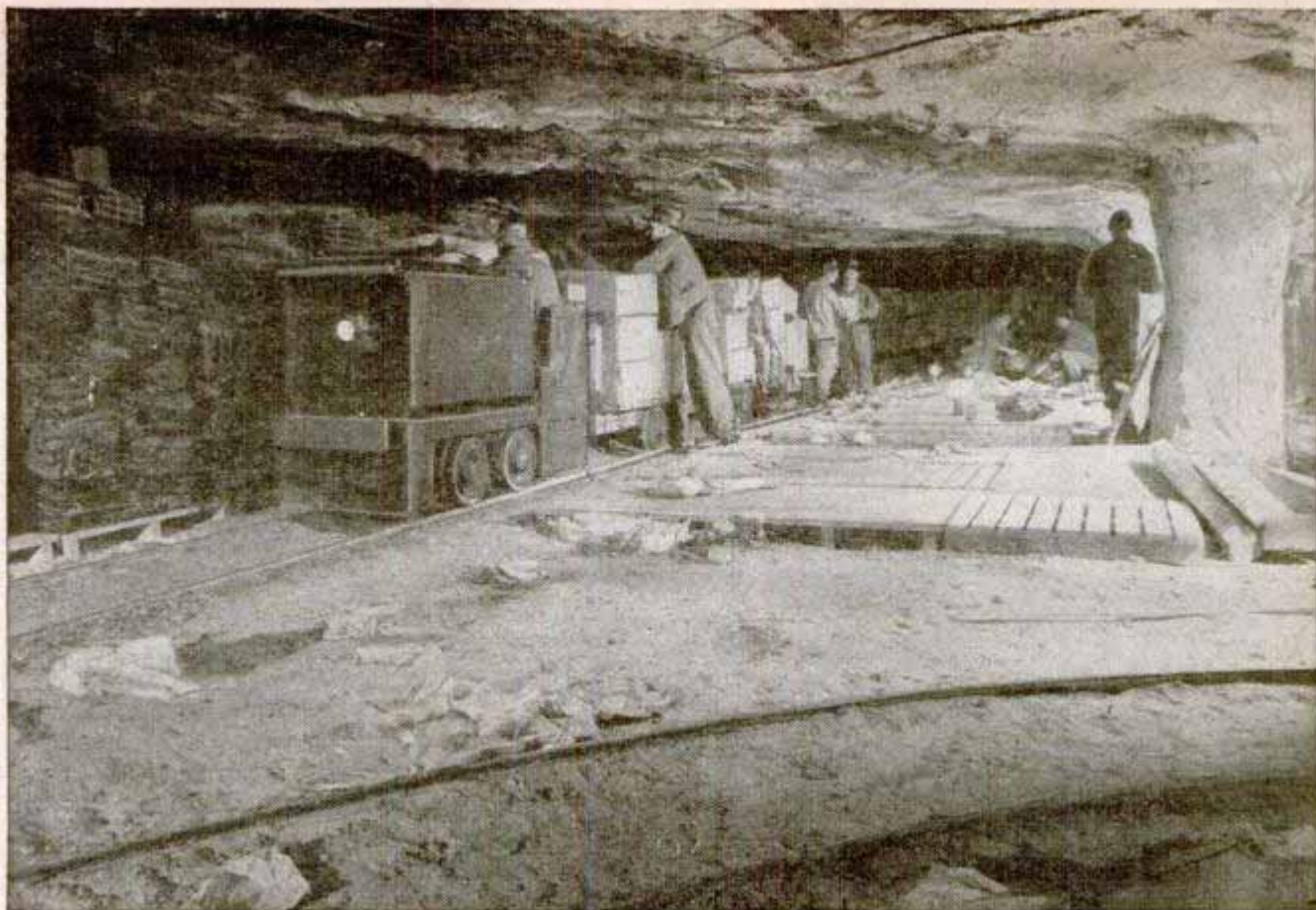
too. When war interrupted the London Underground extension, completed sections of the railway tunnel were used to house an aircraft factory.

In Riva, Italy, the Fiat factory produced airplane motors for the Luftwaffe in a seven-mile-long tunnel. Another factory, making JU-88 engines, was in an old stone quarry in the Mossbach area. It had a working area of 16,000 square feet. At Thil, France, an underground unit was making parts for flying bombs.

At Neuhof, Germany, a vast storehouse of ammunition, medical supplies and clothing in an underground salt mine covered some 64 square miles. In June 1946 an entire German wartime underground city was discovered in Polish territory. Consisting of nearly 80 miles of tunnels, it had its own power plant, electric railway with four stations, and water mains.

Underground dispersal by the Nazis had progressed to such a point that within six months after V-E day they might have been able to ward off the worst effects of our air attacks. The Germans admitted that they began to build these underground factories and depots too late.

U. S. investigators questioned former Nazi officials about the underground storage and manufacturing facilities, especially for making synthetic oil. Field Marshal Milch, former inspector general of the German Air Force, and Albert Speer, former Reich minister for armaments, stated they



Vast stores of ammunition and supplies were cached by Germans in this 64-square-mile underground salt mine

had consulted competent authorities on the possibility of locating synthetic oil plants in underground sites, such as mines, but that difficulties involved were said to be too great. The synthetic oil plants were a prime target of Allied bombers. Finally, the Nazis decided to put the plants underground, and from October 1944 onward, SS troops were assigned to projects in the Nordhausen and Porta Westphalica areas.

The Germans believe they have solved the ventilation problem—a big step—because a synthetic oil plant gives off quantities of steam and smoke.

How underground storage of oil saved one third of the Germans' strategic reserve of this vital fluid was recently revealed by the Army and Navy.

Before the Normandy invasion, the Ger-

(Continued to page 240)

Natural limestone vault near Atchison, Kansas, covers 15,000 acres; holds about 52,000 tons of perishable foods



Auxiliary Engine for Soaring Plane Weighs 40 Pounds



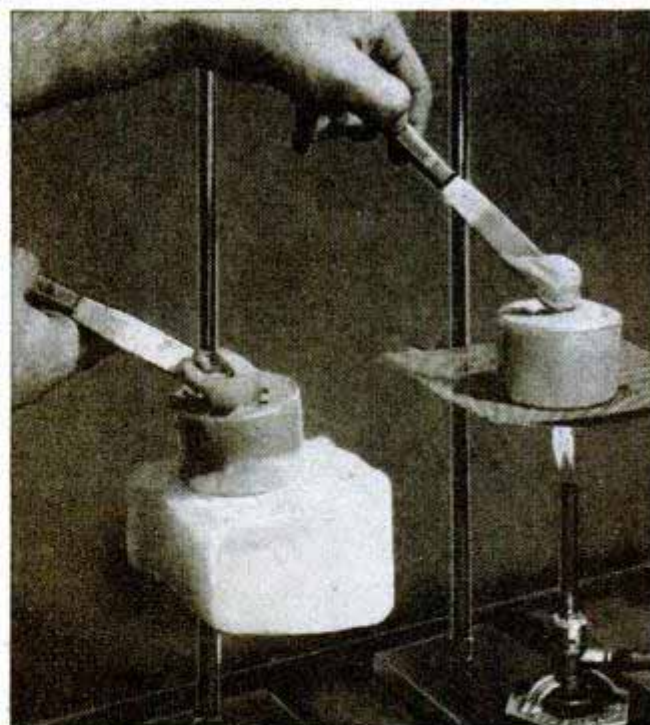
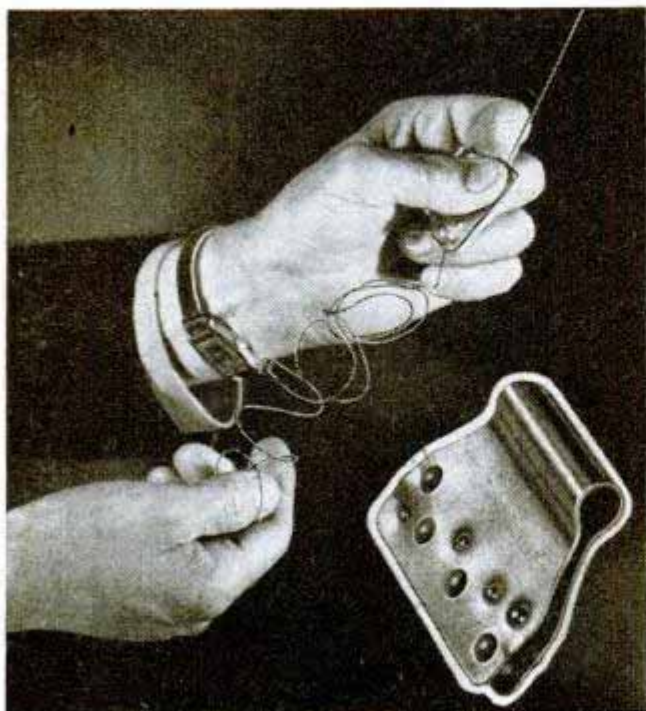
Soaring planes, which depend on rising air currents to keep them aloft, can draw auxiliary power from a 25-horsepower magnesium engine weighing only 40 pounds. The engine is a four-cylinder, two-cycle, air-cooled, horizontal opposed type. Steel engines of comparable size and power weigh up to 125 pounds. Installed in a soaring plane, the engine is fed by a three-gallon gas tank, permitting its intermittent use for a total of an hour and a half at 65-mile-per-hour cruising speed.

Synthetic Plane Grease "Buttery" at 100 Below

Lithium-base grease mixed with a synthetic compound remains "buttery" at all temperatures between 100 degrees below zero and 300 above, providing efficient operation for such aircraft equipment as bearings, propeller governors, instruments, cameras and tiny radar motors. Light tan in color, the grease also is prepared in a form containing rust inhibitors for use where excessive moisture or salt sprays are encountered.

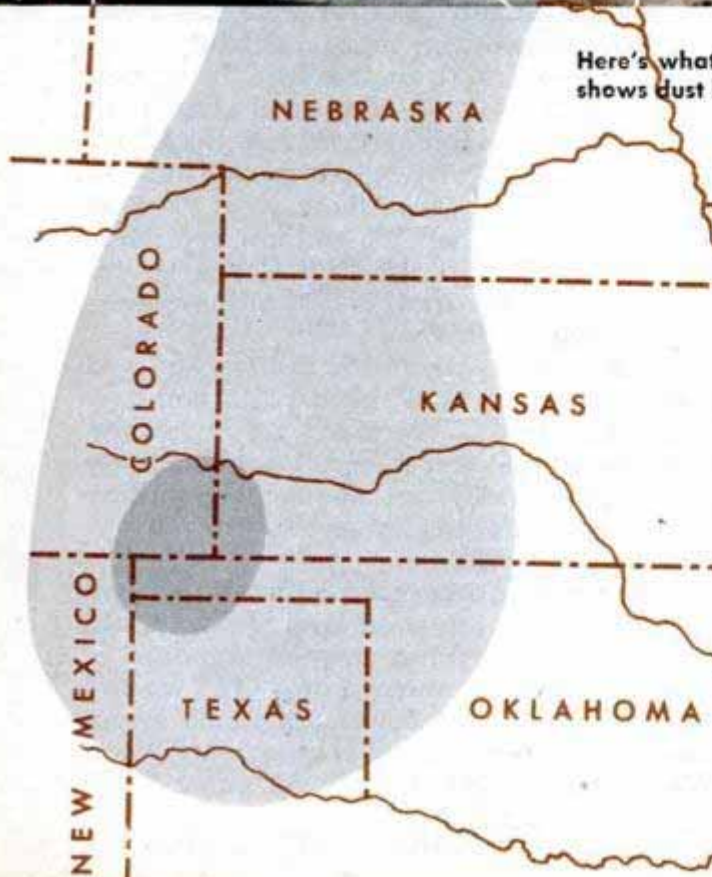
Steel Clamp Straightens Leaders Attached to Fishlines

Wire leaders for fishlines can be straightened easily with a rustproof device small enough to fit into a tackle box or pocket. The straightener is a stainless-steel plate bent until the two sides almost touch each other. Indentations on the ends guide the leader between the sides which are pressed tightly together. Bumps on one side with corresponding depressions on the other straighten the wire when it is drawn through the device.



☐ Sheets of aluminum, preformed to interlock and fit over the 32,000 square feet of curved roof area of the half dome and barrel arch ceiling of the Cincinnati Union Terminal, insure a strong weather-resisting surface weighing only one twentieth as much as the former terra cotta tile roof.

The Dust Bowl is Restless Again



Here's what happens when 30-m.p.h. wind lifts lid from field. Map shows dust bowl and other areas seriously menaced by wind erosion

By Clifford B. Hicks

SOIL in the Great Plains "dust bowl" is growing restless again, like a runaway kid who's strayed from home once and wants to repeat his adventure. Strong winds swept topsoil by the inch off farm lands this year, leaving a wake of wasted fields. Black blizzards similar to the disastrous dust storms of 1934 and 1935 rolled across the Great Plains to dump their heavy loads miles from home.

Wind erosion this year was on a small scale compared to the scouring of great land areas in those bleak days of the dust bowl. But keeping the nation's topsoil at home is a recurrent problem. Conservation experts squint anxiously at capricious funnels of dust above the Great Plains farms and wag their heads ominously at



Contour furrows anchor this field in place and snag soil blown from the poorly protected field in the background

occasional storms that roll across southwestern states. These are warnings of a return to the dark days of the dust bowl.

Always short of moisture, the southern plains have suffered a serious drop in rainfall during the past year. Moisture conditions have improved in a very few localities, but in others the soil is dry and caked, in ideal shape to tag along with the wind. And the storms that swept across the Great Plains last spring climbed to mile-high altitudes in places. Aviation was hampered at Kansas City when visibility was reduced to a half mile. The winter wheat crop in Kansas and Oklahoma was threatened when tons of dust settled over the fields.

Three ingredients mixed in the dust bowl mean danger to farm lands—drought, high winds and loose soil. The farmers can't do a thing about the rainfall or the wind, but the soil itself is under their control. Use or abuse of the earth can keep the soil in its place or drive it far from home.

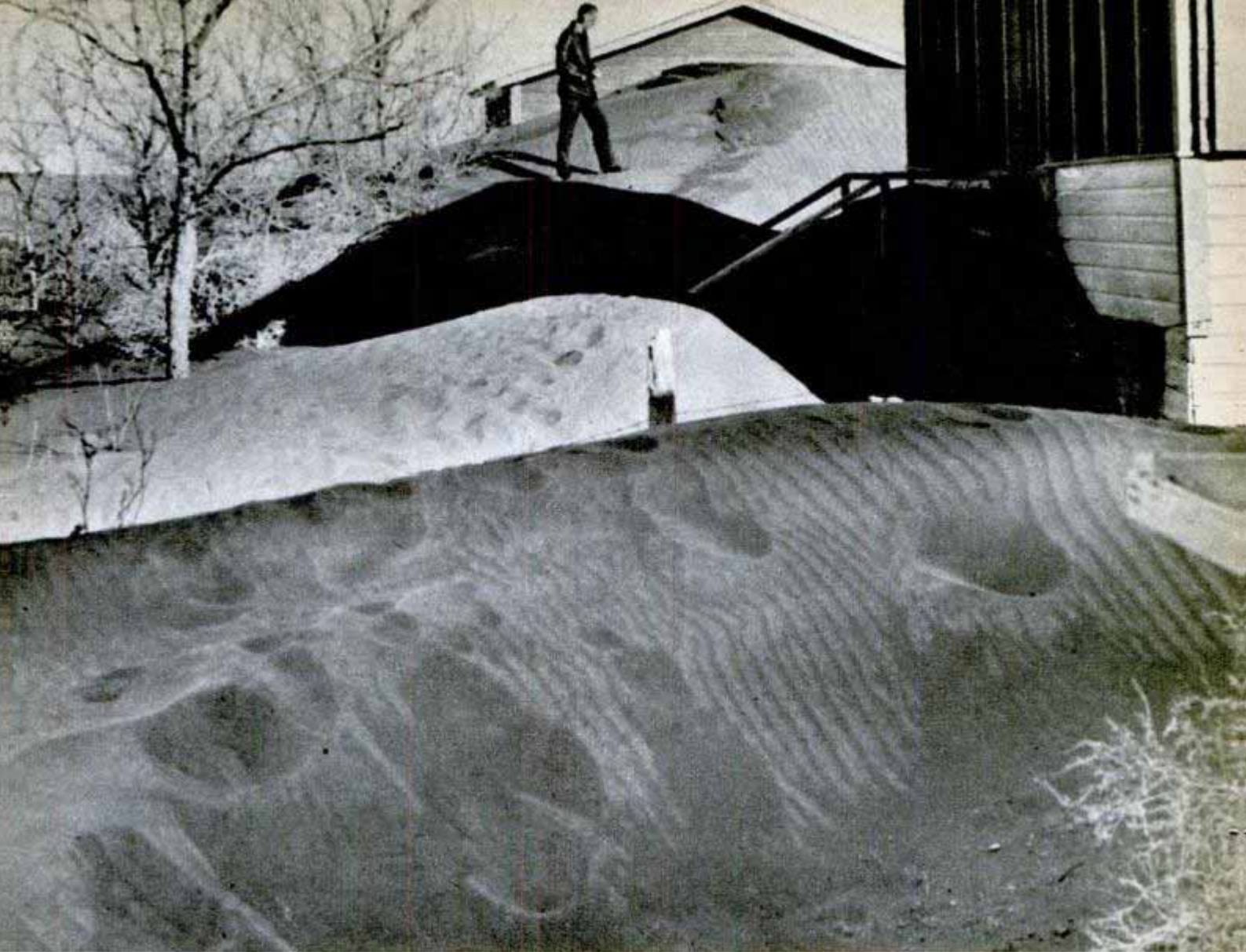
Experts blame the new dust threat on a minority of thoughtless farmers who are completing the same cycle that brought disaster after the first war. The world's

hunger again calls for all the crops that can be harvested. The farmer is sure of a market for all he can raise, and he can raise more by plowing up marginal land.

After the first war the farmer turned over 11 million acres of natural grass land and about 20 million acres of marginal land to plant crops. Further extravagant use to date has ruined 100 million acres of good crop land. Another 100 million are damaged, according to the Soil Conservation Service, and still another 100 million acres are eroding too fast.

We now have about 460 million acres of good crop land available in the country. That's all there is. We can't get any more. If we spend that soil we'll not only be broke but starving. All but about 72½ million acres of this total is subject to erosion unless it's protected.

Conservation experts point out that we can survive on the good land we have left, but we can't keep our present standard of living if we lose much more. Yet we are allowing about 500,000 acres to be swept away by some form of erosion each year. We give away this land at an annual cost



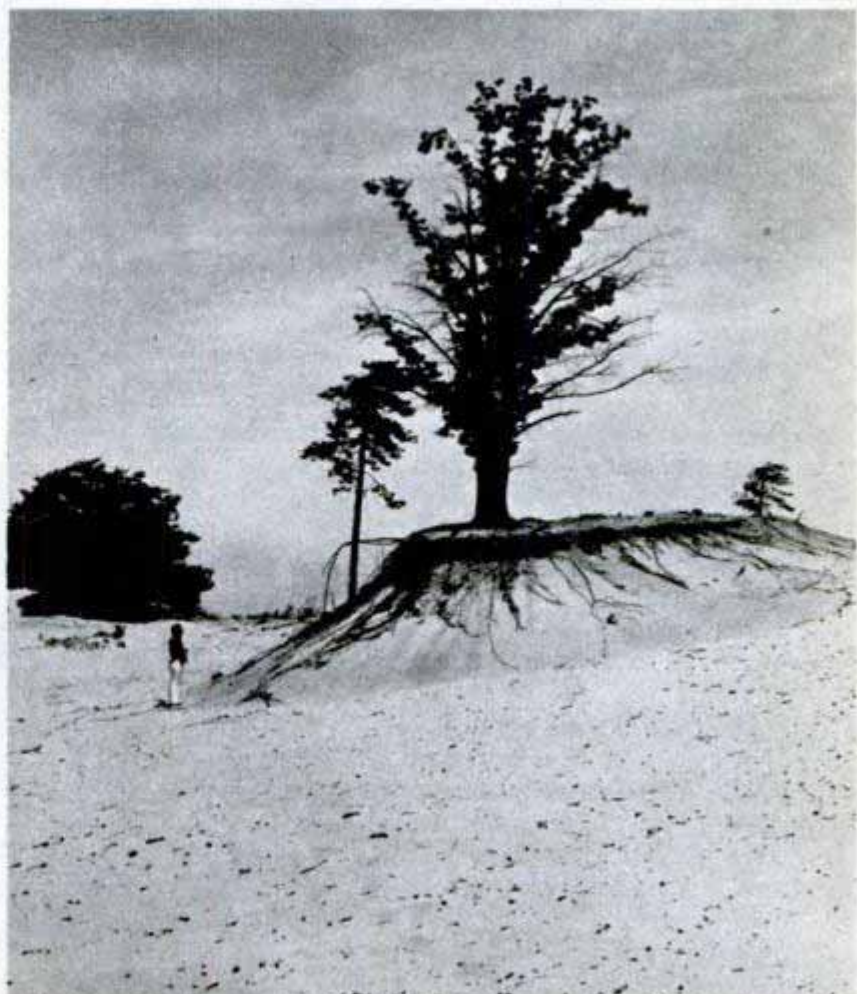
Drifts of dust 10 feet deep smother an abandoned farmyard. Right, a lonely tree held soil around its roots when the surrounding field was blown away

of almost four billion dollars—dollars that come from every taxpayer.

Wind-blown soil does not disappear. It does still more damage. Often it is dumped on neighboring farms or areas many miles away to smother acres of crops.

By plowing up thousands of acres of natural grass land to meet the war-born need for greater harvests, farmers are gambling with their personal prosperity as well as the prosperity of the country. Listen to Dr. Hugh H. Bennett, chief of the Soil Conservation Service:

“A dangerous trend, accelerated in recent years, is the plowing of additional range and pasture land for crop production. Wind recently has been whipping the surface soil off culti-



vated fields in areas of sandy and shallow lands not suitable to cultivation. In some cases the land has been sheared off down to the subsoil."

Soil can be eroded by wind or water a thousand times as fast as new soil is produced by the disintegration of rock. Wind erosion blows the mantle off the earth, leaving the ground naked and sterile. Soil-blowing is really a landslide with the force of the wind substituted for the force of gravity. The slide starts in a small way at various points, gathering momentum and size until whole field-tops move into the air in a murky cloud. That's why conservation experts are worried about the miniature whirlpools of dust that are rising from the fields today—they can grow to landslide proportions if the topsoil isn't protected.

Farmers learned quickly the methods of preserving soil when they saw their fields rise into the air and float away during the dust bowl days. They're gambling their land against increased production by lifting the lid from their fields again.

Landslides can't occur unless the land lies loose and unbalanced. The art of preventing the blowing of soil consists in keeping heavy nonblowing materials on the surface. Big chunks of earth cover a field that has been plowed properly in a wind-menaced area. Crops and crop residues are left above the surface to bind the soil together.

But when the soil does blow, it can be stopped only in the same way a landslide is stopped—by cross ledges that snatch part of the moving mass. That's why fields are cultivated in ridges, terraces and strips, and why wind-breaks are recommended.



Plow was abandoned at the end of a furrow just after this field was blanketed by dust from adjacent pasture land, plowed up for crop production



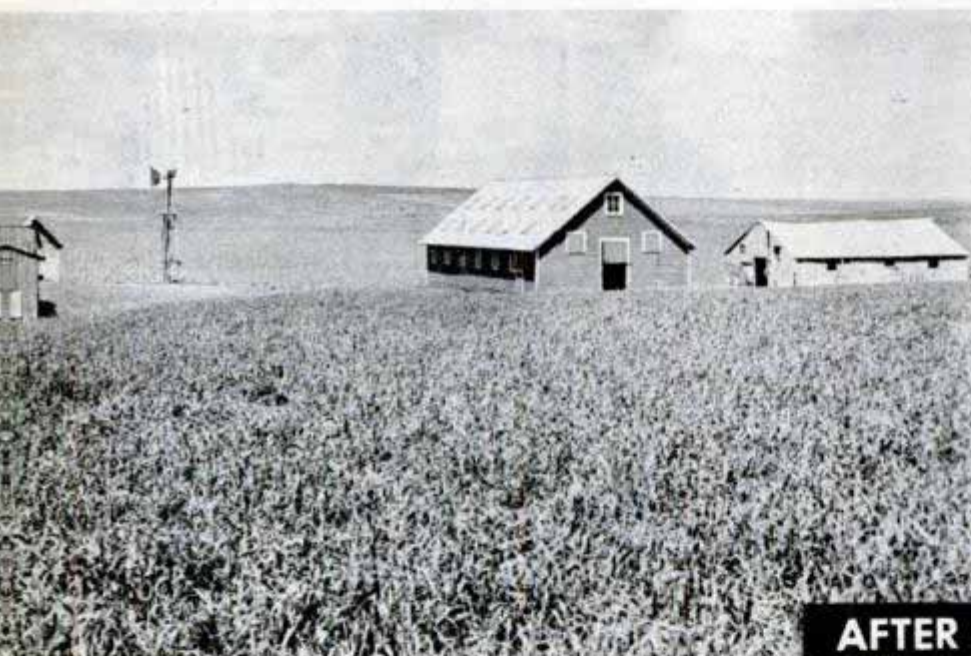
↑ Farm teamwork clears the "blow" dirt away from half-buried buildings

↓ Drifting sand has reached almost to the roof of this little farm home; fences have been torn down to permit the suffocating sand to blow away





When the government purchased the land, a cover crop of sudan cane and broom corn was planted. Next step will be revegetation with native grasses



↑ Same farm made a comeback when plowed in strips and planted to barley

↓ An adequate cover crop was planted by the government. When the soil has been completely reclaimed it will probably be used as pasture land



Here are some of the ways the farmer can anchor his land where it belongs:

By plowing his fields in contours, he fits his furrows to the lay of the land. Rainfall is trapped in each furrow and soaks into the ground. The topsoil stays moist and strong to resist wind.

Terraced slopes hold the water on a hill like the rim of a saucer. The rain can't run off because low barriers have been built up to keep it from flowing away.

Strip-cropping—planting strips of close-growing grass or clover between strips of cultivated crops—keeps the soil moist and offers a barrier to the wind. The grassy plants hold water to feed the cultivated strips.

“Trashy cultivation” sounds like the way a lazy man would manage his land, yet it's practiced by the most progressive farmers. Also called “stubble-mulching,” it consists of leaving crop residues on the ground instead of plowing them under. These materials, such as grain stubble, straw and cornstalks, tie down the soil and protect it from baking and blowing.

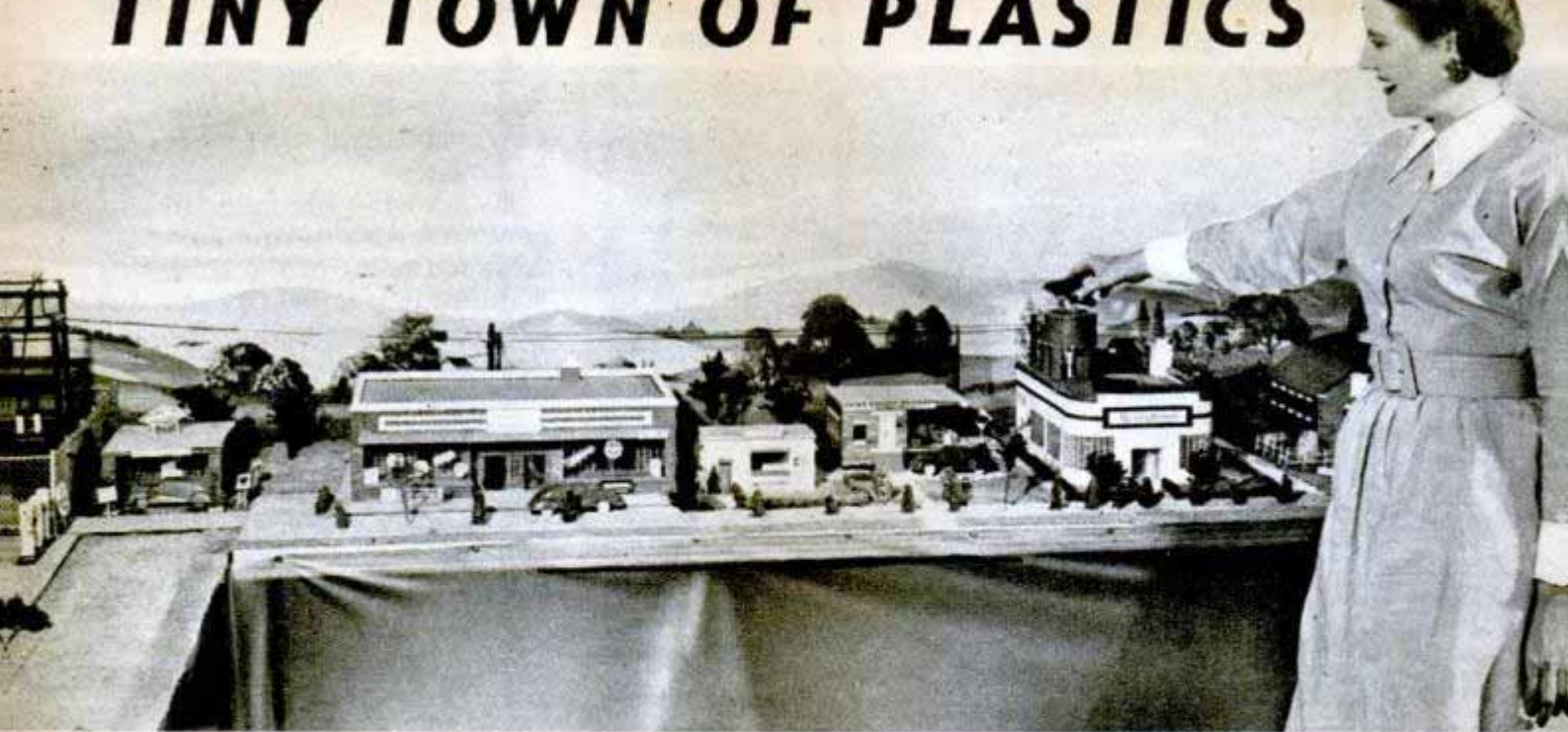
Cover crops such as clover blanket the ground like a mat of hair. Fields can't be lifted by the wind when they're tied in place with millions of threads.

Irrigating drought-baked soil is another way man can conserve rainfall. Enough rain falls across the nation to provide sufficient water for most fields. Distributing it is the problem. Water-logged soil won't blow away, but it's difficult to move the water to some areas.

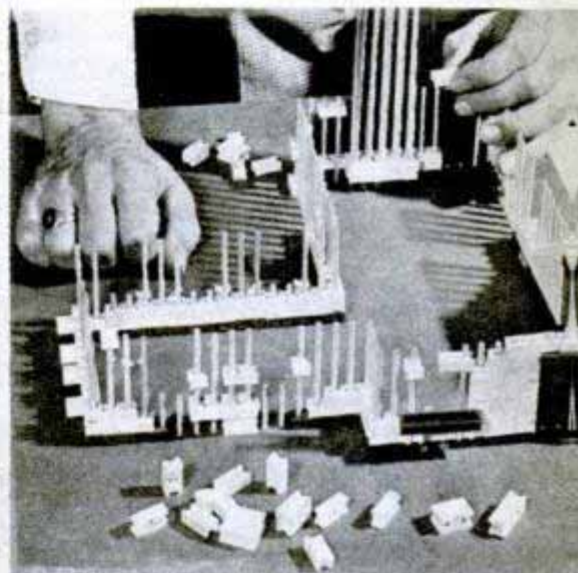
If land unsuitable for cultivation is planted to hay the farmer protects neighboring fields. Shelterbelts and windbreaks

(Continued to page 256)

TINY TOWN OF PLASTICS

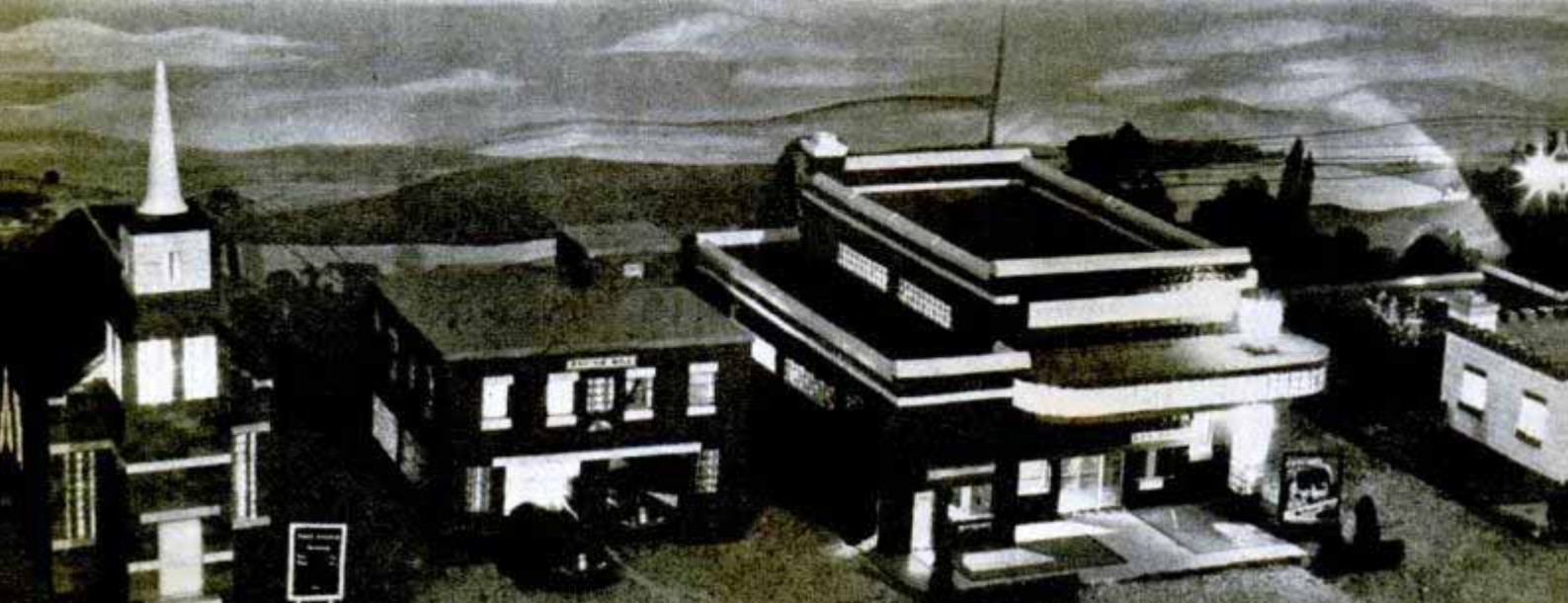


Built of slender sticks and plastic bricks, this miniature village is complete with a factory, stores and homes. The tiny parts are included in a new toy building set that may also be valuable to average home planners

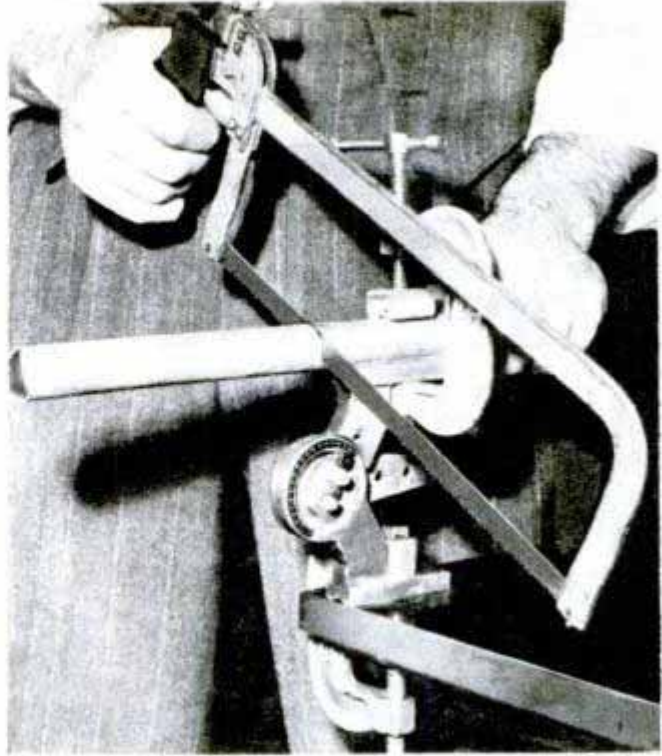
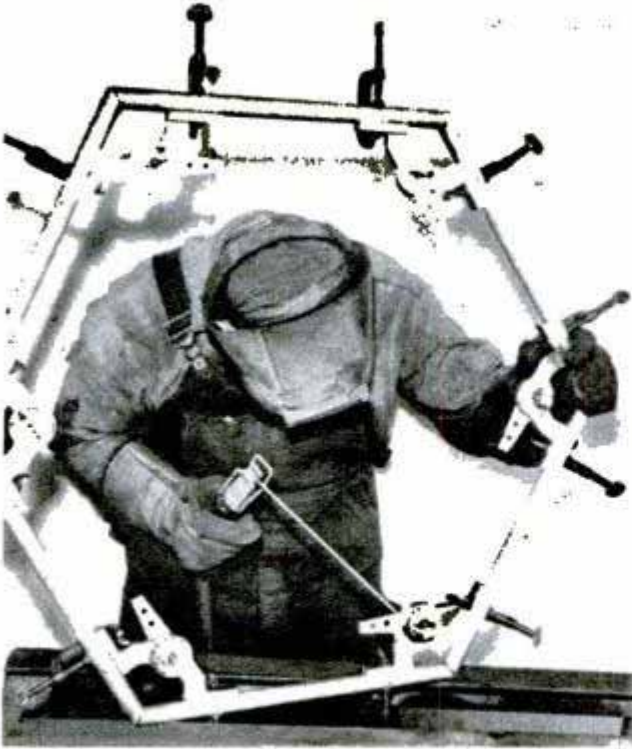


Ingenious landscaping makes grass of dyed towels, sidewalks of sandpaper and trees of painted weeds. Buildings have been wired with tiny bulbs. Church, firehouse and theater are brightly lighted at night

Four different building sets are available, complete with blueprints. The town was built with several of the sets. At right is first step in building house at far left, showing how bricks slide over the sticks



Work Holder Dials Angles of Many Sizes in Joining Operations



Joining operations, such as welding pipes together at odd angles, are simplified by a work holder equipped with two clamps and an adjustable dial that registers any angle from zero to 180 degrees. Double-head

screws on the face of the dial assure positive locking. Cast aluminum alloy is used for the bracket of the holder which is built in three sizes with 2½-inch, 4½-inch and 6½-inch faces.

Bus Powered by Two 93-Horsepower Engines Can Use One or Both

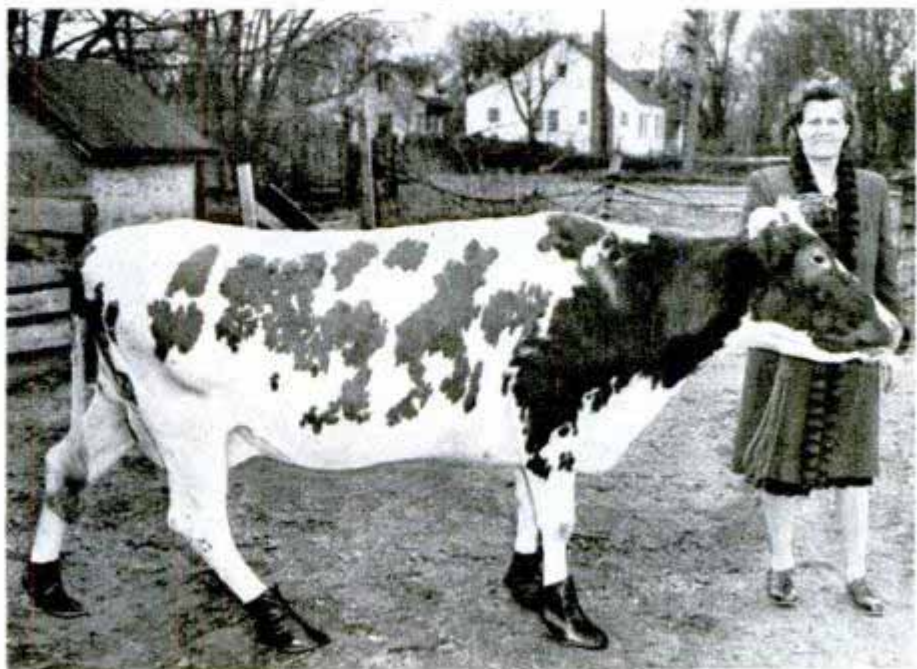
Two 93-horsepower engines, mounted side by side in the rear, power a new style passenger bus that seats 37 persons and has air cooling in summer and air heating in winter. Heat controls are provided at each pair of reclining seats. Power of the two Chevrolet engines is combined through

a chain of gears into a single transmission. There are separate starter motors for each engine, and the bus can operate on only one engine in case of failure of the other. Designed and built by the Flexible Company, Loudonville, Ohio, the bus has 168 cubic feet of luggage space.

Zipper-Equipped Rubber Boots for "Bossy" Aid Hoof Treatment

Special zipper-equipped rubber galoshes protect cows' feet against disease and aid in the treatment of hoof diseases. U. S. Rubber Company's technical laboratory at Passaic, N. J., designed the new type footwear.

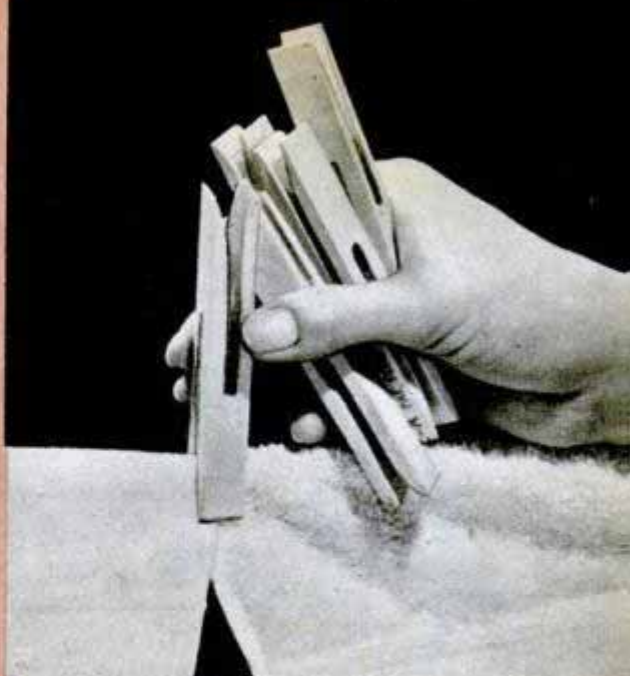
Protein foods, which the digestive juices of the human body break down into body-building acids, can be predigested and dissolved in water so that persons unable to take nourishment normally can "drink" such foods as beefsteak.



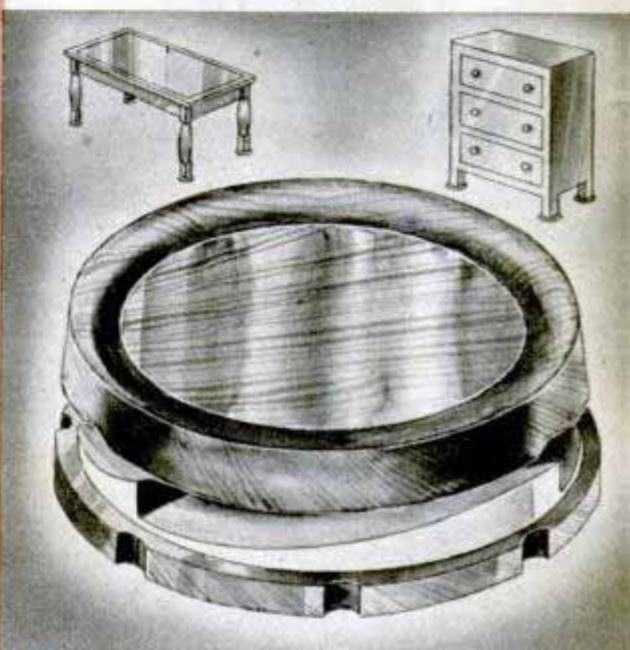
"Inside Stubb" for Your Home



»
CLOTHESPINS with double ends are ready for instant use no matter how they're picked up. Made of wood, they save time and tempers



«
IRONING BOARD for apartment dwellers and travelers can be hooked to any door knob for support and folds flat for easy storage



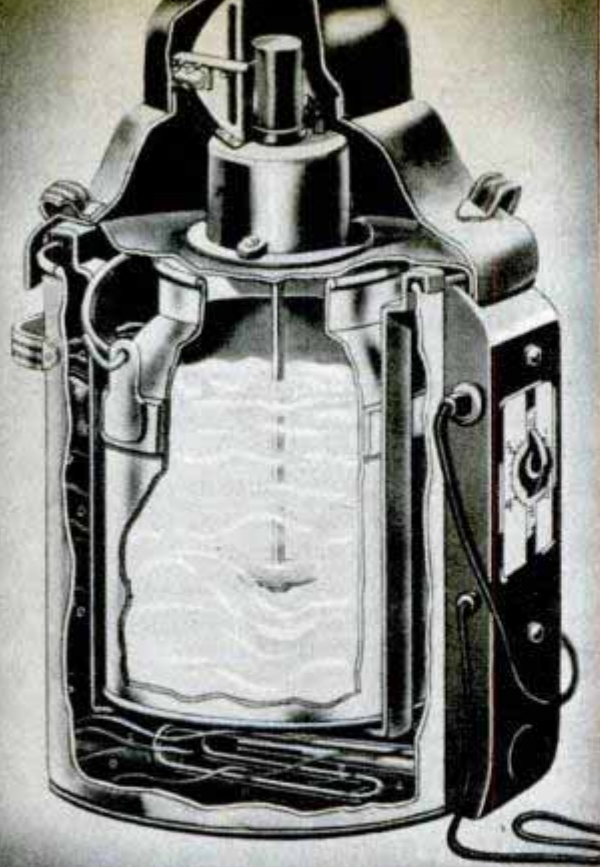
»
FURNITURE CUPS for rug and floor protection can be adjusted to any height to take the limp out of uneven desk and table legs



«
LAMP SHADES bring the garden indoors with real flowers, specially treated, pressed between two sheets of frosted Lumarith plastic



»
PLASTIC MIXER churns butter, whips cream, mixes desserts and malted milk, and colors margarine in plain view of the operator



« **MILK PASTEURIZER** protects farms and homes where pasteurized milk is not available, heats two gallons of milk electrically

» **STEAM OVEN** preserves natural flavor and color of vegetables by eliminating water in pans. It can be used to sterilize dishes

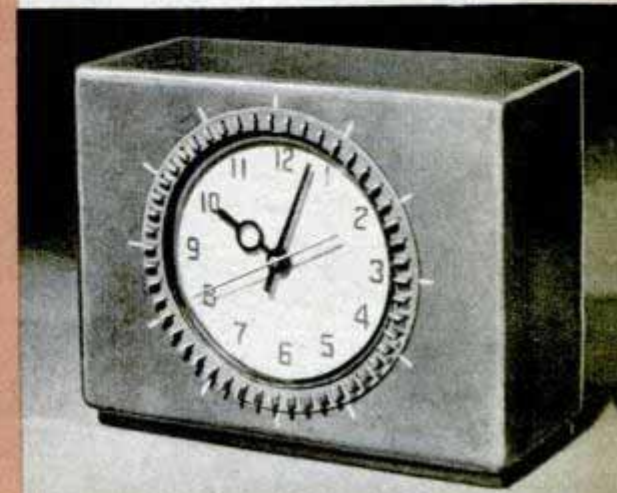
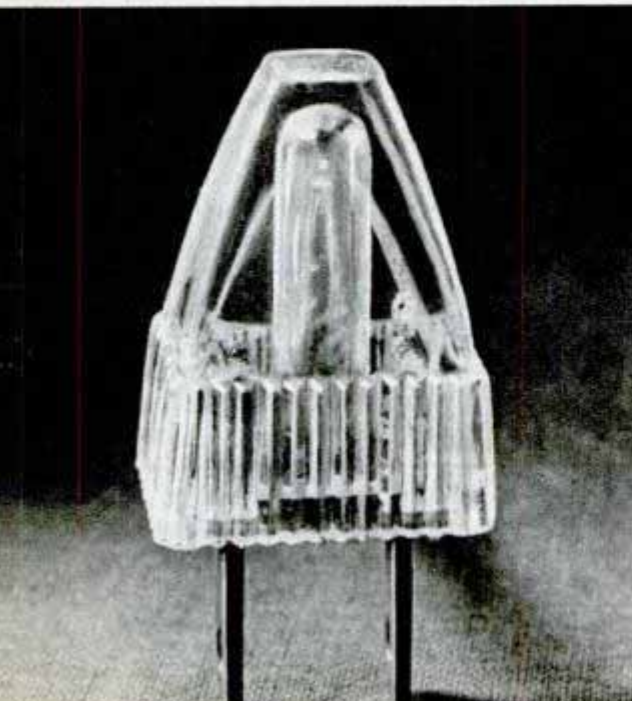
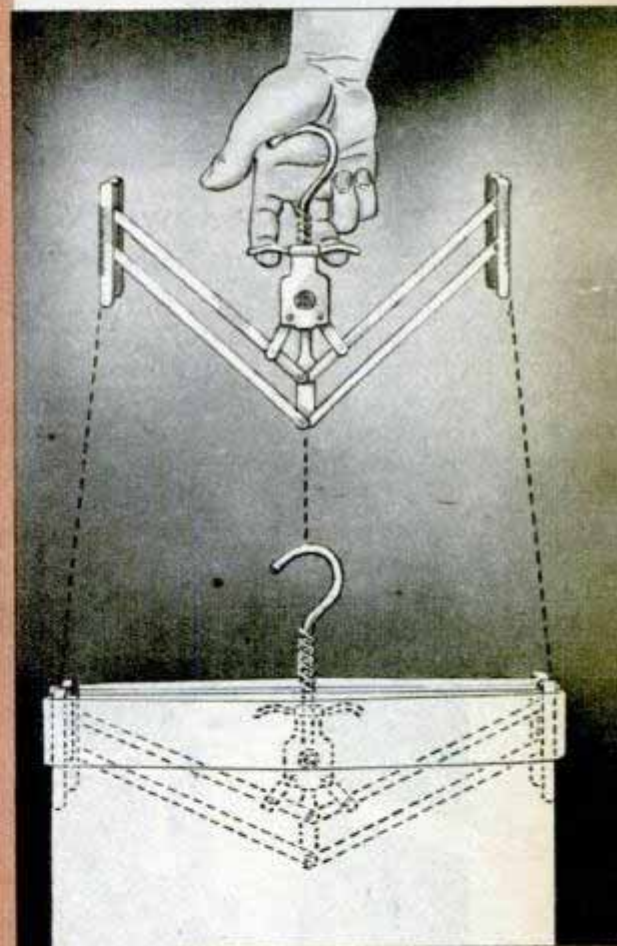
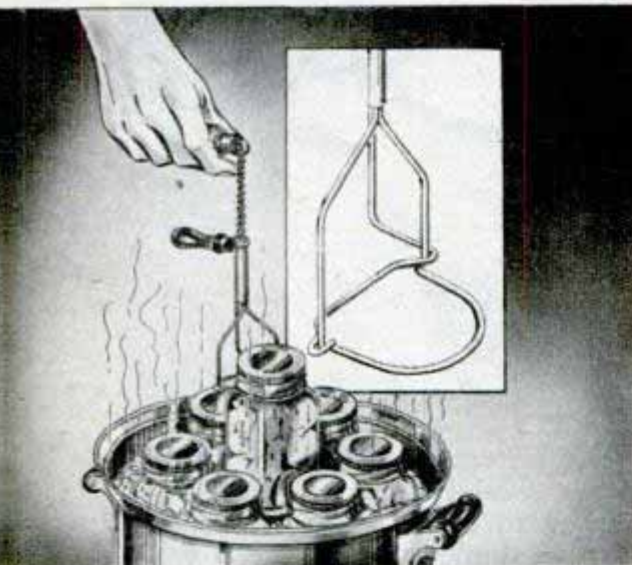


« **JAR LIFTER** protects home canners from burns. Clamp grips the top of the jar securely and a trigger handle permits quick release

» **TROUSERS HANGER** with a spring handle for insertion snaps quickly inside the cuffs and holds a neat crease down each pant leg

« **TINY NEON LIGHT** plugs into ordinary sockets to prevent sleepy stumbling. Current consumption costs less than a cent a month

» **TIME-SWITCH CLOCK** turns electric appliances on or off at preset intervals. Owner can set up favorite radio programs for the day



Pilot Boats Adopt Facsimile Telegraphy to Report Incoming Ships



News of ocean-going vessels approaching New York Harbor is now flashed by facsimile telegraphy from pilot boats to the Marine News room at New York. The captain of a pilot boat which meets incoming ships writes the message on a telegraph blank and wraps it around the cylinder of a transmitter in the wheelhouse of the pilot boat. The telegram then is transmitted over a radio beam to New York where it arrives as a facsimile reproduction of the message. Replacing the old method of telescopic observation, this procedure, developed by Western Union engineers, eliminates error in identification or failure to report ships due to fog or darkness.

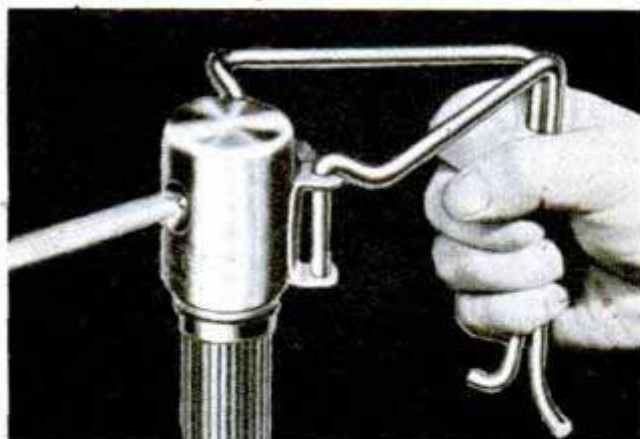
Plastic Bubble Covers Antenna Of Radio Compass on Planes

Only four inches in diameter, the loop antenna of a new lightweight automatic radio compass for planes is housed in a streamlined plastic bubble. Although



Dual Purpose Lawn-Hose Nozzle Also Serves as Sprinkler

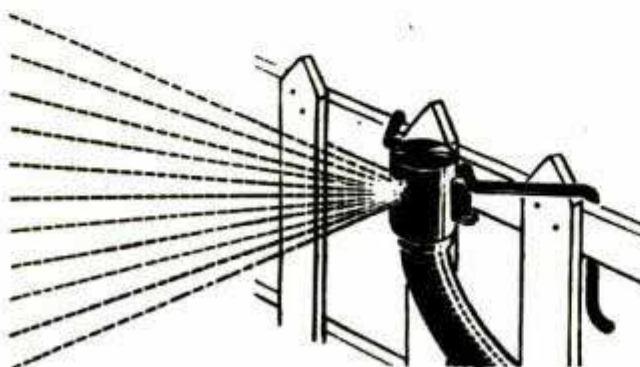
Equipped with a folding grip which can be held in the hand or hung on a fence or clothesline, a hose nozzle also can be used as a lawn sprinkler. The grip is so constructed that water will not drip on hands or clothing when the nozzle is hand held. When hung as a sprinkler, the nozzle can be adjusted to release a fine spray.



smaller than antennas in general use the tiny loop has greater sensitivity, according to the manufacturer. Its plastic housing is designed to minimize drag and weight for increased aircraft payload.

Near-Fireproof Paint for Ships Contains Aluminum Powder

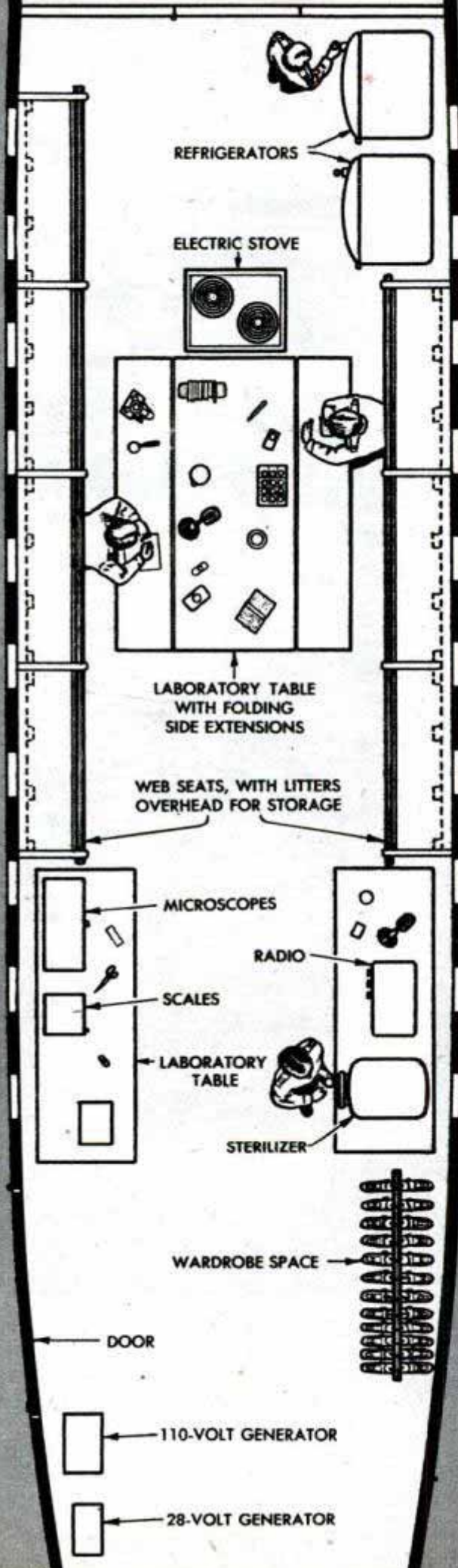
Sailors may do less chipping of paint in the future because the Navy has found that aluminum powder added to priming coats helps stop the spread of fire. Formerly when repainting, all old paint was chipped off. This was done to lessen the fire threat of thick paint. The mixture is obtained by adding 80 percent aluminum powder paste to the primer coat in the proportion of one pound of paste to two of primer.



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

Laboratory On Wings

FIVE tons of laboratory fittings were installed in a C-54 sent to the southwest Pacific by the Air Materiel Command for a study of the factors that cause deterioration of equipment in the tropics. High-power microscopes, sterilizers, two refrigerators, an electric stove, DDT bombs, two motor-generator sets and screen doors were among the items carried to make the flying laboratory complete. The scientific mission's 19 members also were equipped with both motion and still-picture cameras.



Laboratory tables, overhead storage litters and wardrobe section extend toward the rear of the fuselage. The refrigerators and electric stove are shown below.



RIGGING AN EIGHT-TON



Purse seines of the fishing fleet cover a wharf at a Pacific port. A record catch of tuna and a season's profits depend on the knots of these fish nets

By RICHARD W. EMERY

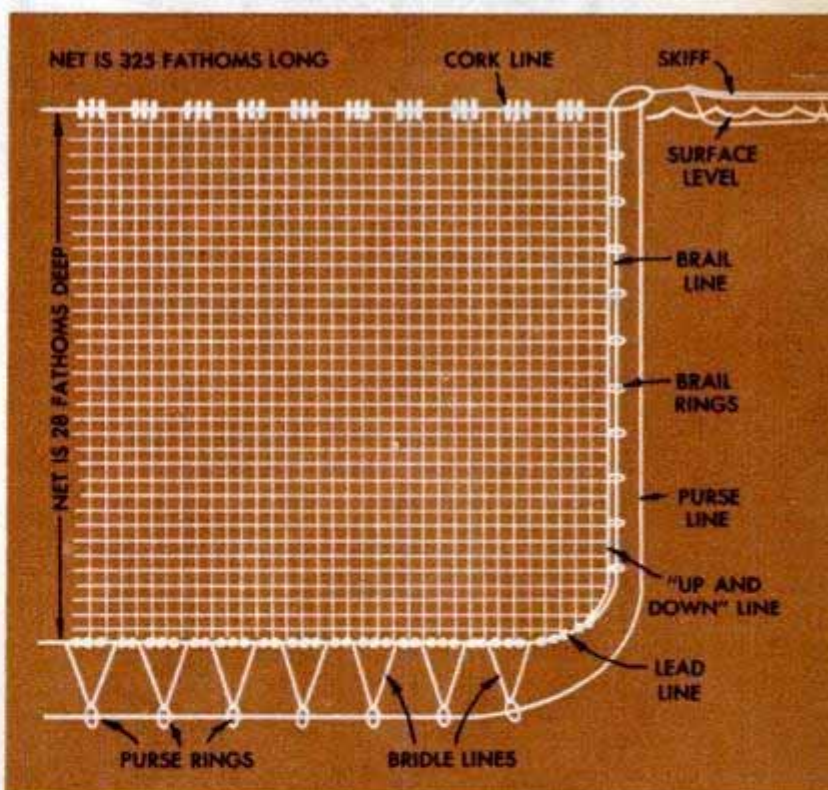
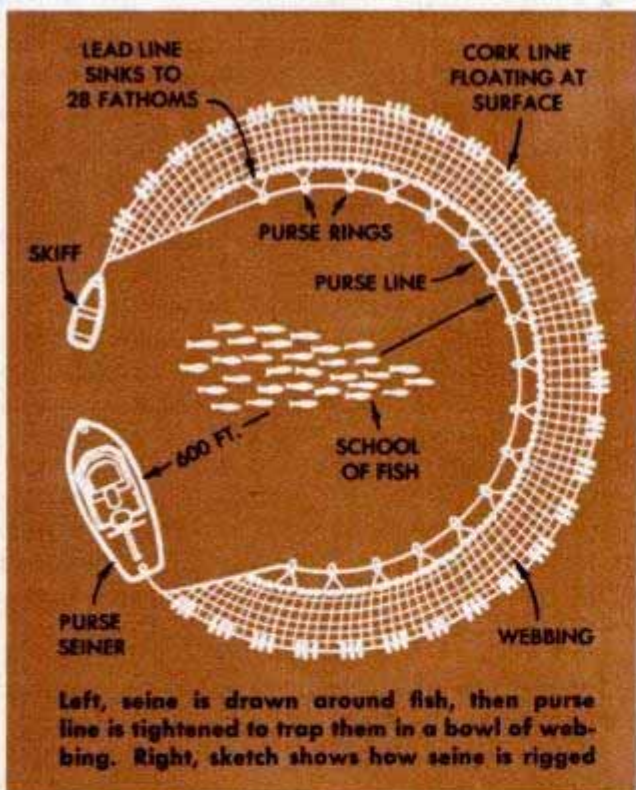
Photos by R. O. Ritchie

If PAUL BUNYAN, fabulous lumberjack, had been a salt-water fisherman, he might have used such a net! The modern purse seine, which wraps up 150 tons of live fish at a single haul, would give the prodigious Bunyan a burden worthy of his strength. To rig that enormous net, fishermen must

TUNA NET



Cork beads for a tuna man. In groups of three, 10,000 of them are tied to the cork line to keep afloat the \$15,000 circle of tarred net that pulls in tasty tuna for your table. A crew of 11 men handles the net



have enough webbing to carpet 12 football gridirons. They must have two miles of strong rope. They must have 10,000 sinkers and 10,000 big cork floats.

Day after day, on sun-scorched wooden wharves reeking of tar, they must labor to sew together the edges of six or seven narrow strips of webbing. They must thread

rope lines through the thousands of ring-shaped sinkers and through the thousands of doughnut-shaped corks. Steel rings for the purse line must be tied to bridles and the bridles in turn must be tied to the lead line. It's a labor of knots, knots and more knots—and the season's profits depend on those knots holding under great strain.



No place to lose a needle. Five to seven strips of mesh like that above are hand-sewn edge-to-edge to form complete net. Along half-mile-long lead line are strung 10,000 sinkers such as on salvaged net, right, which pull it down to form underwater tuna trap



↑ Fishermen prepare a purse seine for use with wood tools which have changed little in over 3000 years

↓ In a good season when the fish are running, the crew will haul from the sea a cargo worth \$75,000



The whole net must be tarred or tanned, or both, to protect its fibers from fish slime. And when the fishermen are done with their big job of rigging the net, the net weighs eight tons. Its materials alone have cost from twelve to fifteen thousand dollars. The net itself contains hundreds of thousands of hand-tied knots and around 10,000,000 machine-tied knots.

No simple rig is this immense fishing net! It's designed for big-scale fishing operations in deep water on the open sea, and does its job both well and spectacularly—if the net makers have built it right. At full speed, the seiner turns in a wide circle around a school of tuna, paying out the net. Corks float one edge of the net; sinkers quickly pull the other edge down. Within minutes, a vertical wall of mesh, 28 fathoms deep and 325 fathoms long, surrounds the fish in a circular area about 600 feet in diameter. Then members of the seiner's crew pull in the "purse line" which draws the bottom of the net together, closing off escape for the fish.

By pulling in the net until all the fish are crowded into a small area, the fishermen can dip a brailing net into the threshing mass and hoist the catch aboard.

Big purse seines can "wrap up" 150 tons of tuna or 200 tons of yellowtail. Seines of smaller mesh can scoop up a bigger batch of sardines than even the great Bunyan might have tried to lift.

If they're lucky and the net holds togeth-



Purse seiners, right, moored alongside wharf at San Pedro, Calif., for overhaul of fishing gear. Since success of voyage depends on nets, inspection of them is thoroughgoing



↓ Like old-fashioned moneybag, enormous purse seine has a "drawstring." It's a one-inch rope threaded through steel rings tied to bottom lead line. After several seasons of use, this one must be replaced

↓ Husky crews man the fishing boats. They go to sea in good weather or bad and stay until hold is filled with fish. Powerful booms and the crow's nests of the lookout identify Pacific purse seining fleet





A power-driven turntable at the stern hauls in the eight-ton tuna net when everything is ready. The big skiff, which marks the free end of the seine, and the utility boat, top, are loaded aboard; then the purse seiner (below) heads for the open sea and—with luck—good fishing

er through the fishing season, the 11-man crew of a typical purse seiner should pocket \$5000 per man for the year's work. An average take is \$3000. But troubles with the net can spoil everything. One big shark, snarled in the net and slashing back and forth in an effort to escape, can lay the seiner up for many days while members of the crew repair the mesh.

The modern purse seine has developed step by step in fairly recent years, and has been enlarged and improved in the wartime and postwar effort to feed a hungry world. Seiners do not account for the entire Pacific Coast catch, but they take a large share. And the ocean catch of California alone runs around \$30,000,000 per year.

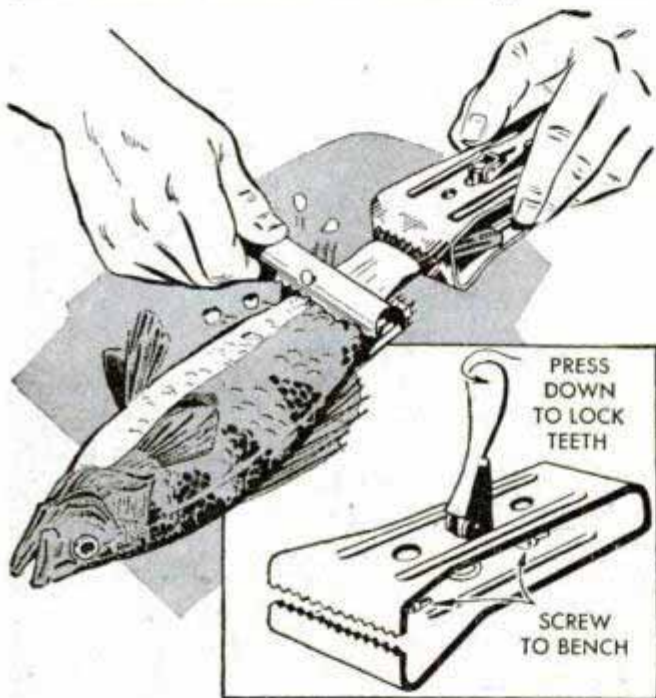


Peaches Frozen in Acid Syrup Hold True Color for Years

Fresh peaches stored in a syrup of sugar and citric and ascorbic acid will retain their natural color even if kept frozen for years. Dr. J. G. Woodroof, who used the process at the Georgia experiment station, recommends the following formula for home freezing: sliced peaches, six pounds; sugar, one pound; citric acid, one teaspoonful; ascorbic acid, one half teaspoonful. Make a syrup of the sugar and acids and cover the peaches after placing them in containers.

Steel Gripper for Holding Fish Helps Angler Scale His Catch

Clamped firmly on the slippery tail of a fish, a gripper aids the angler in scaling his catch. The device is a piece of spring steel bent double so the ends form jaws with

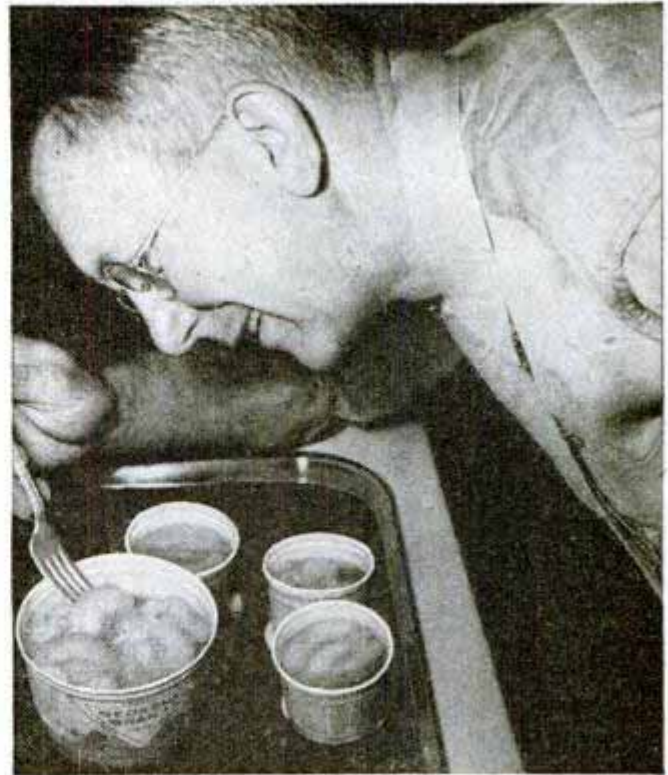


interlocking teeth. It is screwed to a board or a bench. After the fish tail is inserted, a lever is pressed to clamp the jaws tightly to the fish. The fisherman's hands are then free to scale his catch.

"Take It or Leave It" Music

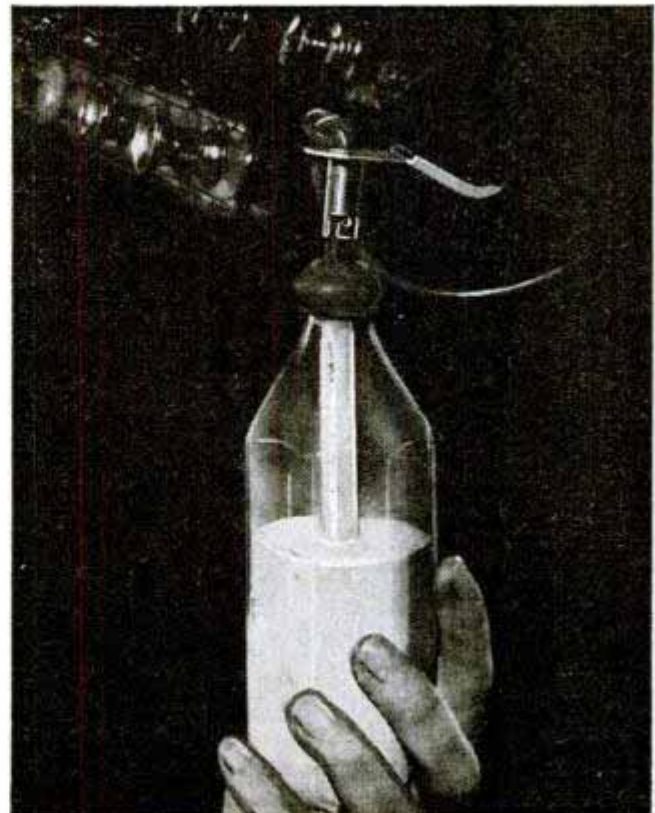
Studios "piping" recorded music by telephone wires to wall boxes in restaurant booths now announce the next selection to be played. If the customer wishes to hear the number, he inserts a nickel. Otherwise, no music comes out.

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, Illinois, for a prompt reply.



Dashboard Baby-Bottle Warmer Is Operated by Car Battery

With a heating element operated by a car battery, a baby's bottle can be warmed during an auto trip. The heating element is sealed in a Pyrex glass tube inserted in the bottle. A surgical-rubber cap fits over the tube and mouth of the bottle to assure sterility. The heating element plugs into a dashboard socket. The bottle is warmed to proper temperature in about eight minutes.



WANTED JOCKEYS

WANTED—Several good jockeys. Can earn \$15,000 per year and up.”

So rapidly has the sport of horse racing grown in the last few years that, although advertisements like the above have not really appeared, owners and track managements are on the lookout for good lightweight riders who can be depended upon to win races.

A few of the country's very best jockeys earn upwards of \$75,000 per year, as much as is paid the President of the United States. Incomes of \$10,000, \$15,000 and \$20,000 are not at all uncommon among the many riders who compete on the country's 20 major racing strips.

Such large sums are paid because it is the best riders plus the best horses, combined, that win the most races. Often a good jockey can help a mediocre horse along so well that the team beats a better animal that is not as expertly ridden.

So much are good jockeys in demand that at a number of tracks classes are conducted to teach apprentice riders and stable boys the secrets of fast racing. Experienced jockeys put the boys up on horses, show them how to grip with their knees and how to stay in rhythm with the moving animal. The instructors explain how a rider can move his body to help the horse along. The jockey travels in an even line, so to speak, and the horse moves up and down under him. That way the horse doesn't have to lift the rider at each stride.

These informal classes culminated last fall in the opening of a complete jockey school at the Santa Anita track in California. The school had its own dormitory, classrooms and racing stable. Restricted to a few students at the start, only 16 boys were accepted from 175 who applied. Nine of these were graduated at the end of the eight weeks of instruction. All the gradu-



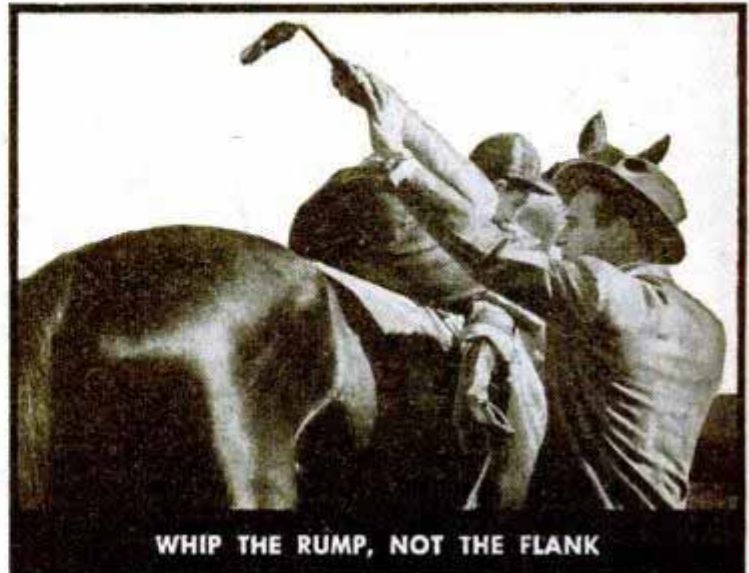
SIT WELL FORWARD, GRIPPING WITH KNEES

ates received jobs with well-known racing stables at once, starting out as exercise boys. They can look forward to receiving their papers as apprentice riders this season or next.

The Santa Anita school is planned as an annual affair, starting on October 15 of each year. Tuition and room and board were furnished free last year.

To be eligible, applicants must be between 16 and 21 years of age, weigh 100 pounds or less (certain exceptions made) and furnish reports on their scholastic, athletic and business backgrounds. They also must tell of their past experience with horses and racing and provide other information. They must submit written statements as to why they wish to become jockeys, what their conception of the work is and their ideals in reference to the sport. Final selection of the students is made after personal interviews with Carleton F. Burke, director of racing at the track.

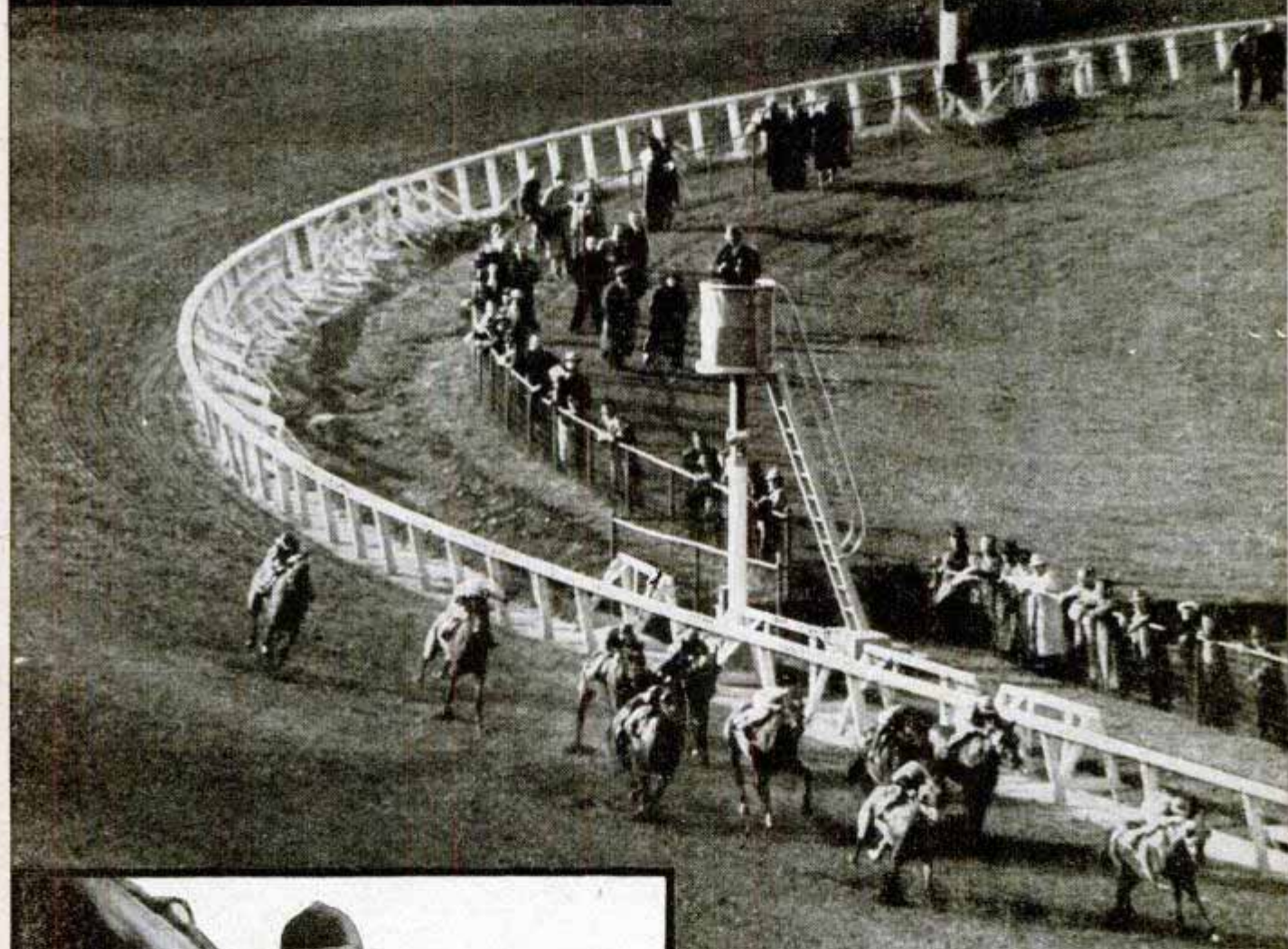
Students at the Santa Anita school received practical training as well as classroom instruction. William Mills, Santa Anita starter and former jockey, acted as



WHIP THE RUMP, NOT THE FLANK



CROSS THE REINS FOR A FIRM GRIP



Still bunched after coming out of the turn, fast-flying horses head into the stretch at a California racetrack



PUSH AGAINST NECK TO LENGTHEN STRIDE



Normal running stride of a race horse is from 18 to 24 feet. The problem of the jockey is to keep his mount running at full normal capacity because every inch the horse extends itself will count at the finish line

out-of-doors superintendent. James Tunney, football referee and high school instructor, was in charge of indoor classes. The school day began at 6 a.m. with the manual work of a racing stable. The boys cleaned out stalls, carried water, walked hot horses and rubbed them down. Riding instruction was conducted in a practice ring and on the main track itself.

Among other things, Mills explained to his students that a good jockey makes friends with the animals he will ride. He studies the temperament of each and handles each horse accordingly. Meanwhile the horse is sizing up its riders. It may like the way one jockey handles it as compared to its other riders. It actually seems to run faster for its favorite jockey.

Little things count. The students dis-

cover that some horses have a tender mouth and won't take hold of the bit. These must be ridden with a loose rein. Others clamp onto the bit and will respond to every slight movement of the reins.

Some horses, the students learn, pay no attention to their companions and move down the track with their minds on their own business. Others are flighty and are curious about everything that goes on around them. Riders must chirp to these to keep their minds on the job of moving ahead at full stride.

One of the first things that the student jockeys are taught is to watch the animal's ears. A horse that pins its ears back against its head when the whip is applied, for instance, is going to be nervous and unreliable under the whip. For such animals the

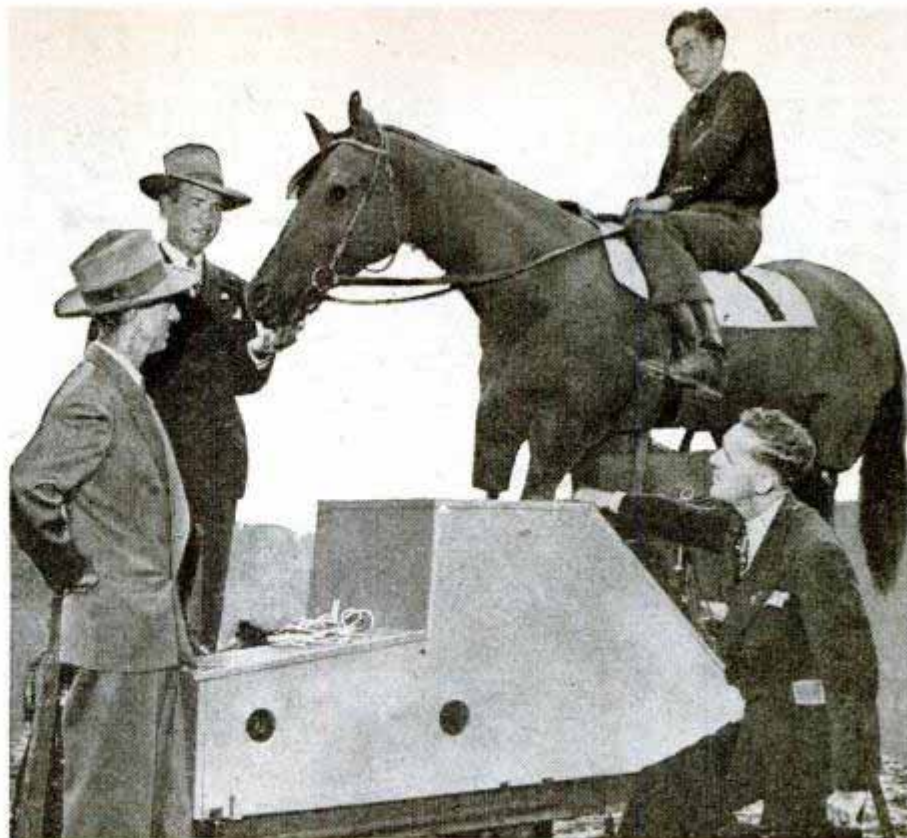
Student jockeys line the rail at the Santa Anita training track while others of the class get practical instruction in the secrets of fast riding. In order to win, jockeys must know racing quirks and peculiarities of their mounts



whip is not to be used. Mills teaches his students that the normal stride of a race horse is from 18 to 24 feet, depending on the size of the animal and the way it handles its legs. But, he adds, the horse doesn't always run at its full stride. A jockey's task is to get the animal to extend itself to its full normal capacity, reaching out and taking full strides. Every extra inch that the horse can be made to extend itself will count at the finish wire.

Encouraging the horse with the voice is often a big help. Tapping the animal on the rump with the whip just as it starts its stride helps it to reach out. Correct use of the whip is a course of study all by itself because if the whip is improperly used a horse is apt to be knocked off stride and thus will run slower.

The fundamentals of hand riding, at which few riders excel, are also taught. Essentially this consists of using the hands to lift and push at the animal's neck just as the horse is in its stride. Seemingly unimportant, this can be a big help in causing the horse to stretch out and cover more ground at each stride.

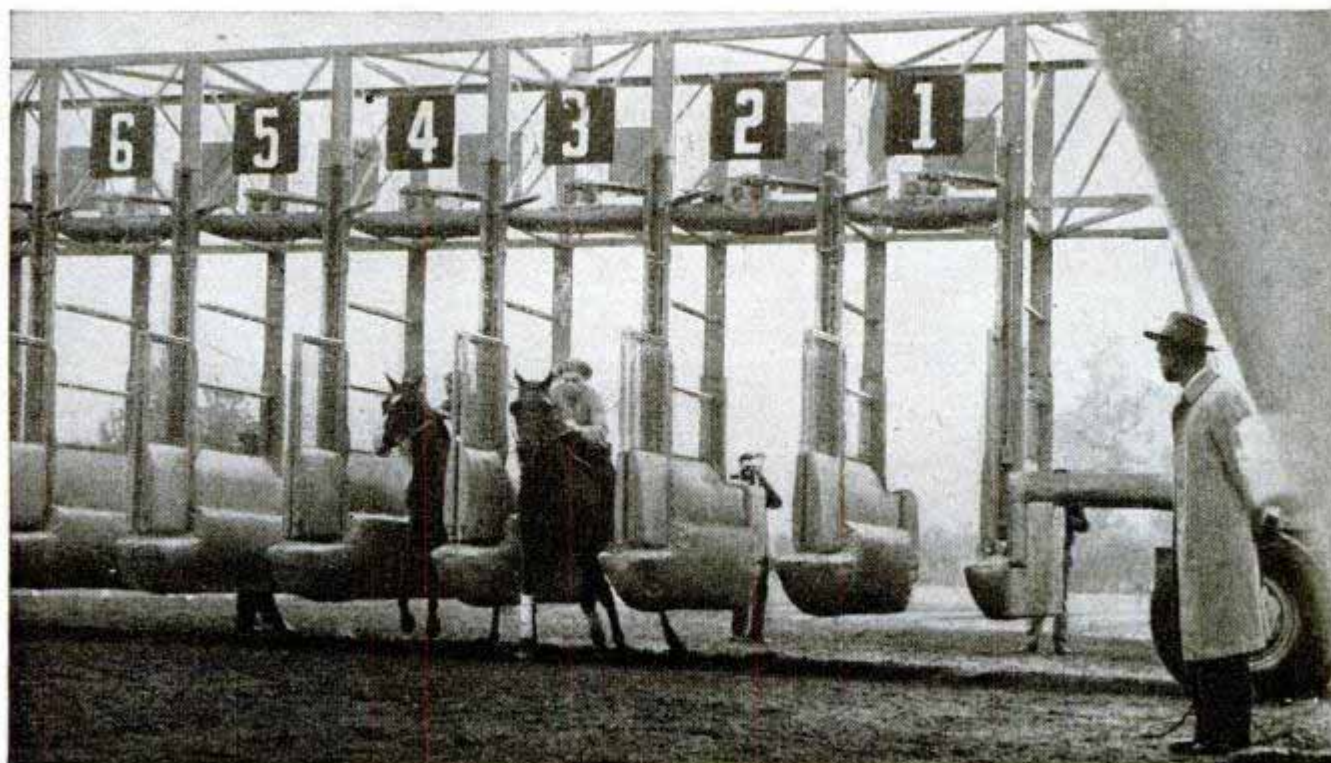


Movements of mechanical horse controlled by motors in box match those of race horse. It is used at Hollywood Park to teach proper riding positions

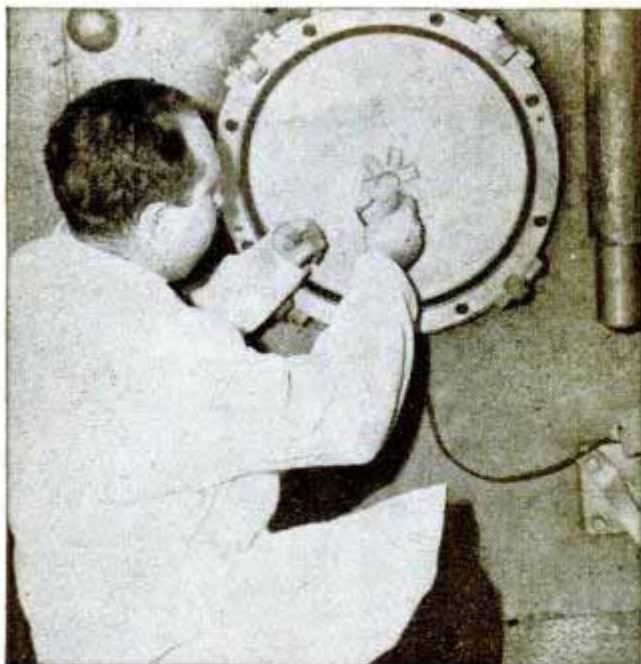
"All this sounds pretty simple," Mills warns his students, "but you must learn to do everything in moderation. Some of you are going to try too hard at first and one result may be that you will make your mount overstride. He'll take one big leap, get out of balance, and will need a few short strides to get back in form. Meanwhile the whole field will breeze by you."

(Continued to page 236)

Riders learn through practice how to hold their tense horses steady in the padded stalls of the electric starting gate. They must get out in a hurry the instant the bell rings and the barrier snaps open, or be left at the post



Decompression "Test Flight" Amazes Experts



In this test an electric wire punctures a hole in paper panel to let air enter decompression chamber. Contact with the subject in the chamber is maintained by means of an intercommunication system.



Dr. Fred Hitchcock of Ohio State University locks the heavy steel door of the decompression tank for a test. With a loud report, the panel is blown out and pressure in the two chambers rapidly becomes equalized.



Can a pilot flying seven miles up survive if the pressure in his cabin is suddenly released, either by accident or by penetration of an enemy missile? Yes, says Dr. Fred A. Hitchcock of Ohio State University, and he can back his statement with personal experience, plus that of more than 250 others who have subjected themselves to explosive decompression in tests performed there for the Office of Scientific Research and Development. To the amazement of scientists, Dr. Hitchcock insists there will be no serious effects. The research at Ohio is done, not in high altitude aircraft, but on the ground in a thick steel two-room pressure chamber. Pressure

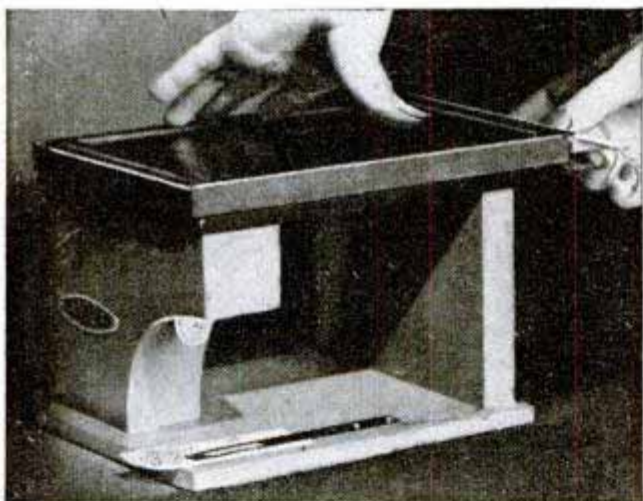


equal to that at 8000 feet is maintained in the compartment in which the subject, wearing an oxygen mask, is placed. In the second room, air is pumped out until the pressure is equivalent to that at 70,000 feet, nearly a vacuum. Between the two compartments is an airtight porthole with a piece of paper as "window pane." At the proper moment, experimenters rupture the paper electrically by sending a current through a high-resistance wire attached to the paper. The result is literally an explosion. The "pane" is blown into the low-pressure compartment and, in less than a second, the pressure in both rooms becomes equal to that at 35,000 feet. "There is a rush

of air from the nose and mouth," says Dr. Hitchcock, who has personally undergone the test dozens of times. "There is also a feeling of distension in the chest and abdomen, and there may be severe gas pains, but in more than a thousand experiments no ill effects have been noted." The research has also indicated that chances of getting "aviator's bends" are only slightly greater when decompression is explosive than when it is slow. Although humans have been explosively decompressed to the pressure found at 45,000 feet, dogs have been "sent up" to 50,000 feet in 1/50 second, and, at slower rates, to 70,000 feet.

Numbering Machine Marks Film In Bright Daylight

Film negatives can be marked with identifying numbers in bright daylight with a numbering machine that acts as a second camera. Formerly it was necessary to take the cut film in holders into the darkroom to write the number along the edge. To operate the daylight printer the number is



placed in position on the base of the machine and the film holder is placed on top. The slide is withdrawn about one inch from the holder. The numbering light is turned on and the number is photographed by a small segment of the negative. The numbering machine is made for four by five, five by seven or eight by ten film.

"Aquajet" Pushes Small Boat

Even outboard motors have felt the impact of jet propulsion. The "aquajet," a motor built by an English manufacturer, propels the boat by squirting a powerful jet of water from a nozzle in the underwater housing. The submerged pump which discharges the water is driven by a three-horsepower motor that will run 3½ hours on a gallon of gasoline and propels the boat at a speed of eight miles an hour.

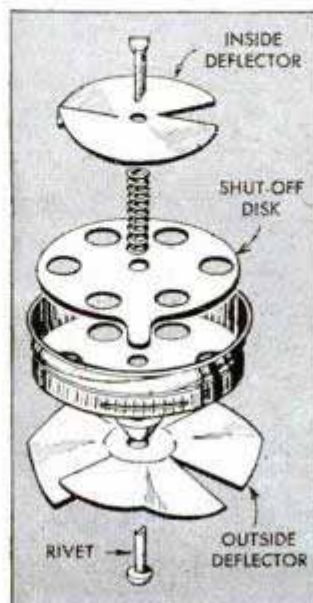
"Para-Scooter" in Civvie Garb Carries Factory Messages



Declared surplus as military equipment, a paratroop scooter designed for quick movement of men behind enemy lines is now doing duty as a light delivery vehicle at a radio manufacturing plant. The scooter is used within the plant for messenger and delivery jobs. The only addition to the vehicle is a carryall box in the rear.

Spreader Cap to Sow Grass Seed Fits Over a Fruit Jar

To spread grass seed evenly over a lawn, a spreader cap which fits a fruit-jar top is useful. Shaking the jar sets up a rotating motion which causes a disk inside the cap to tumble the seeds over a wide circular area. The rate of flow can be regulated.



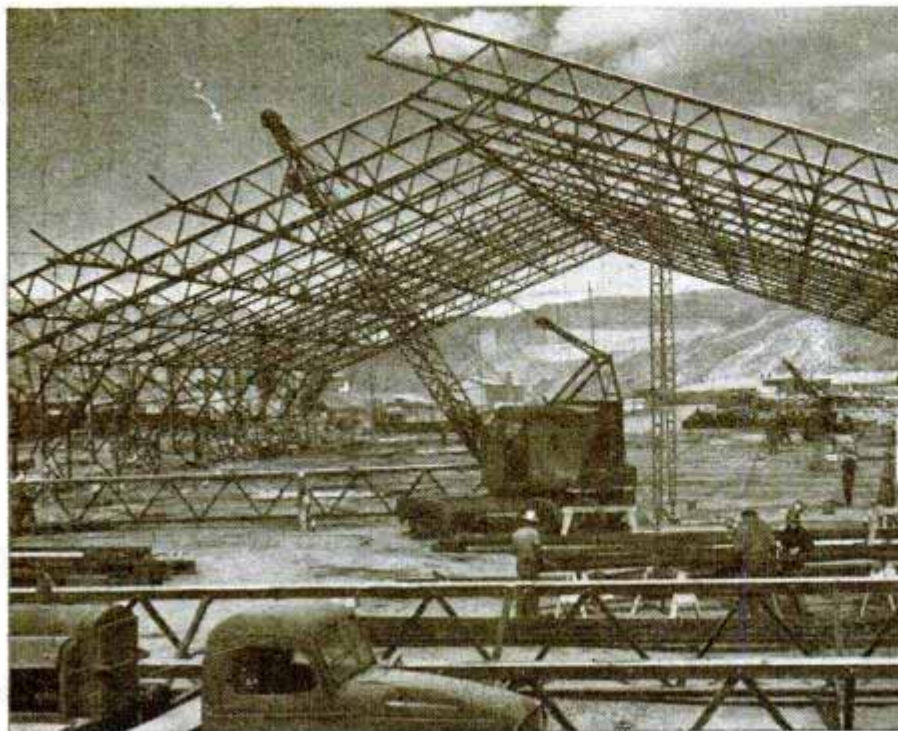


Servicing 'Cafeteria' For Planes

Starting power, fire protection and fresh water are supplied to big air liners with a single mobile ground servicing unit. It is operated by one man. Two 24-volt generators provide 400 amperes of power for engine starters. A carbon-dioxide bottle with a 75-pound charge hooks into a plane's internal fire-fighting system to snuff out fires. Wash water from the service truck's 50-gallon tank is pumped at the rate of 10 gallons a minute into an air liner's tanks.

'Covered Wagon' Life Raft Supports 20 Persons

Latest development in air-sea rescue equipment is a "covered wagon" life raft, so named because of a large canopy to protect as many as 20 occupants. Designed by the Air Materiel Command, the raft is made of rubber and inflated with carbon dioxide, which also fills the tubular arches supporting the canopy. If one side is punctured, the other half is so constructed that it still will support 20 persons. An inflated seat is provided for the protection and comfort of each occupant.



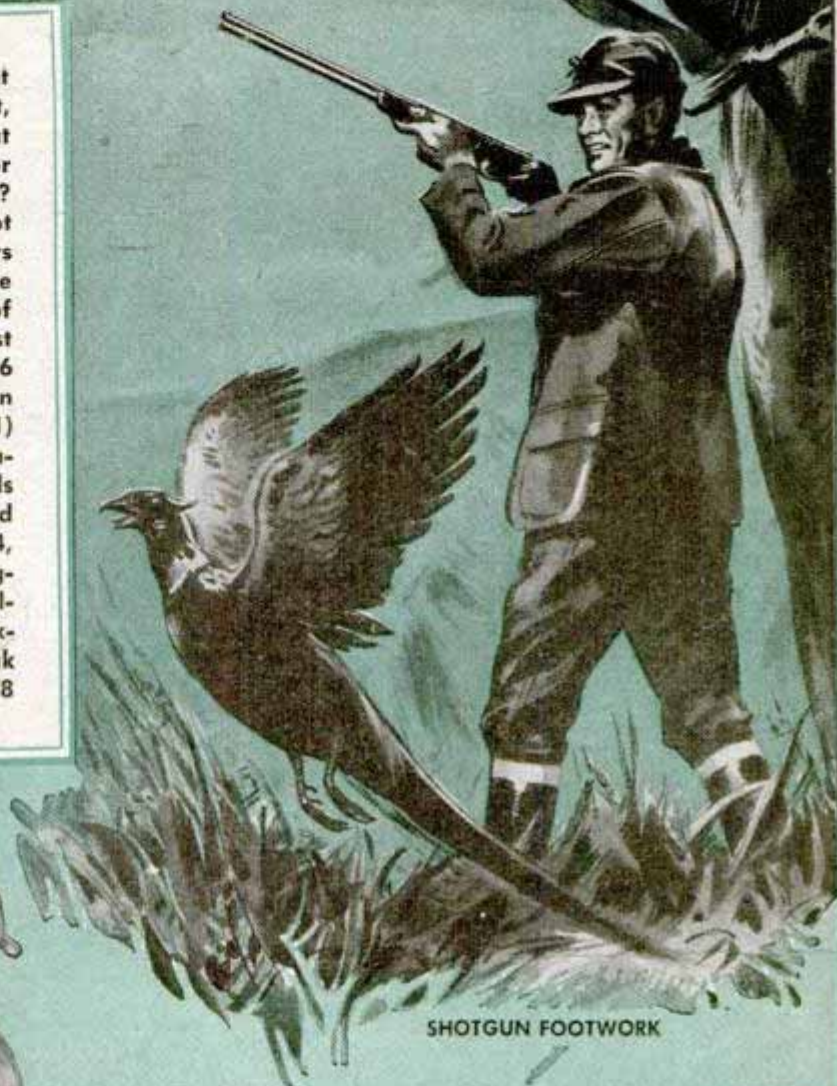
Surplus Hangars Become Workshop

Using two surplus combat-type Army aircraft hangars, the Bureau of Reclamation is building a combination shop for repairing trucks, tractors and power shovels used at Grand Coulee Dam in Washington. It is 140 feet wide, 274 feet high and will be covered with corrugated aluminum.

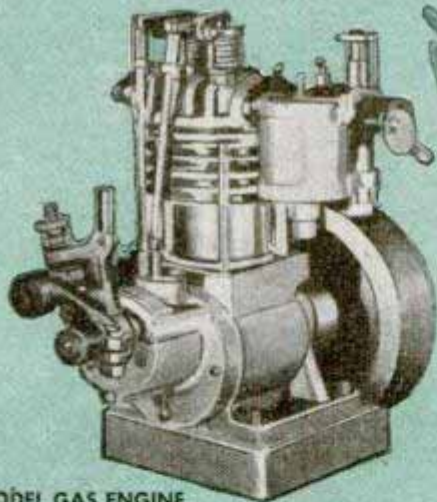
Female oysters lay eggs only when minute quantities of manganese are present in sea water over oyster beds, according to the U. S. Fish and Wildlife Service.

The Craftsman

Ever have quail or pheasant boil out from under your feet, giving you such a start that you spent the next second or so blasting away at the sky? Of course, nothing fell—except silence. But good shotgunners say it happens to everyone and that often it's a case of faulty footwork and not just "nerves." A story on page 186 discusses this angle of shotgun shooting. An article (page 201) starts the modelmaking season with constructional details on a small gas engine, and tying in with it, page 224, there's a piece on milling-machine technique by a well-known authority. Woodworking craftsmen get a good break on the corner table, page 178

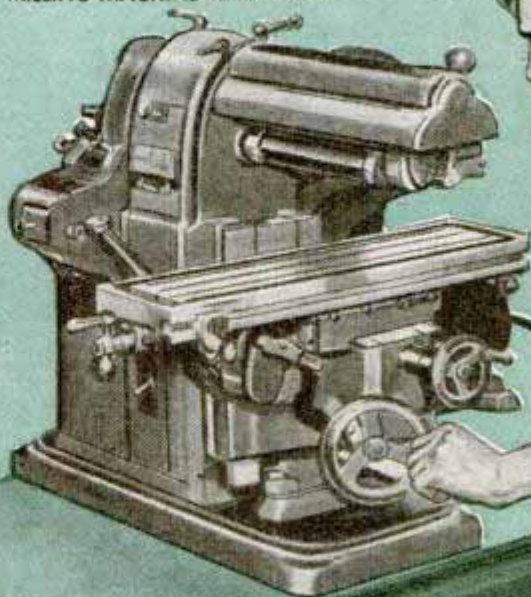


SHOTGUN FOOTWORK

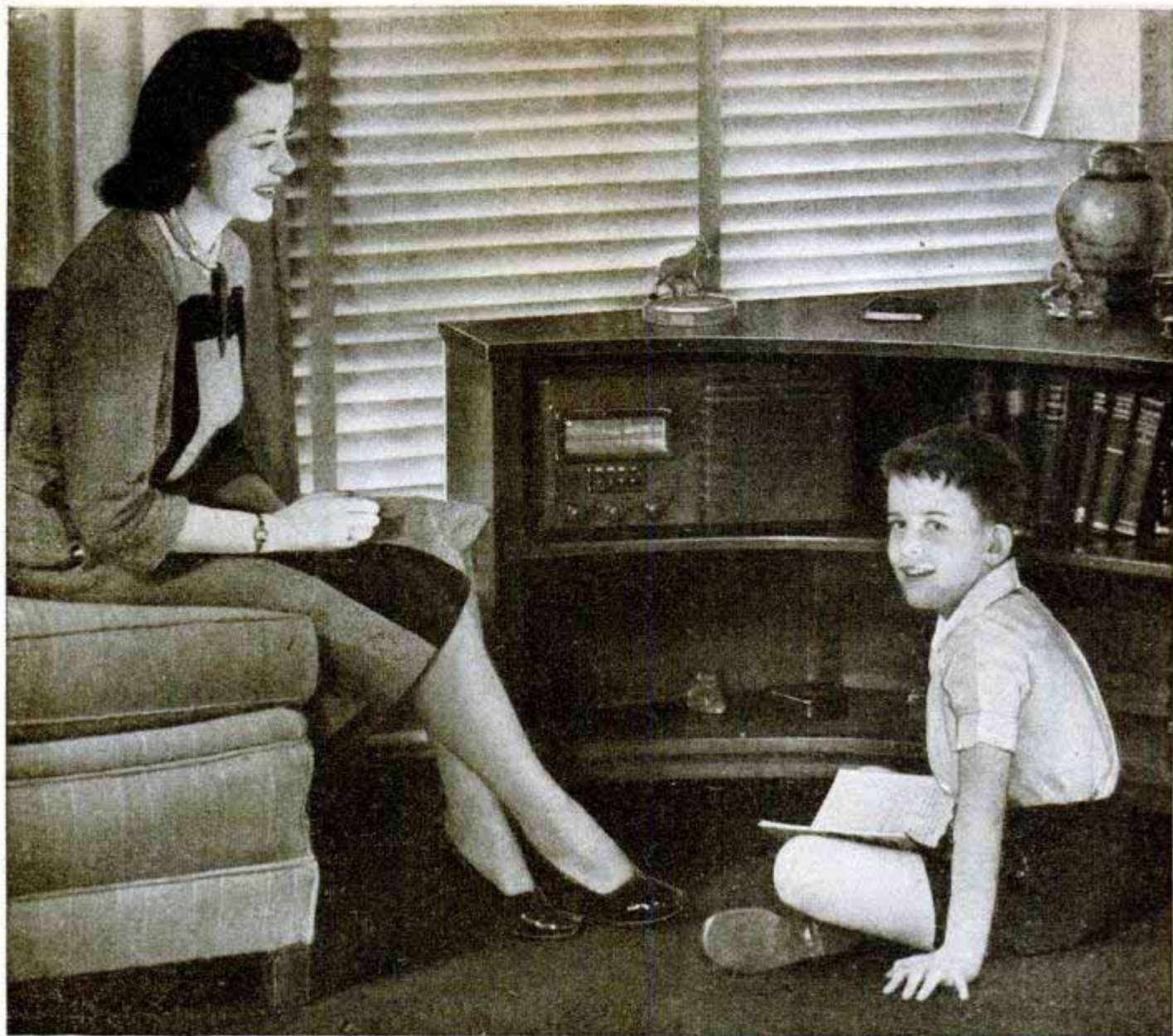


MODEL GAS ENGINE

MILLING MACHINE TECHNIQUE



CORNER TABLE



“Round-the-Corner” Table

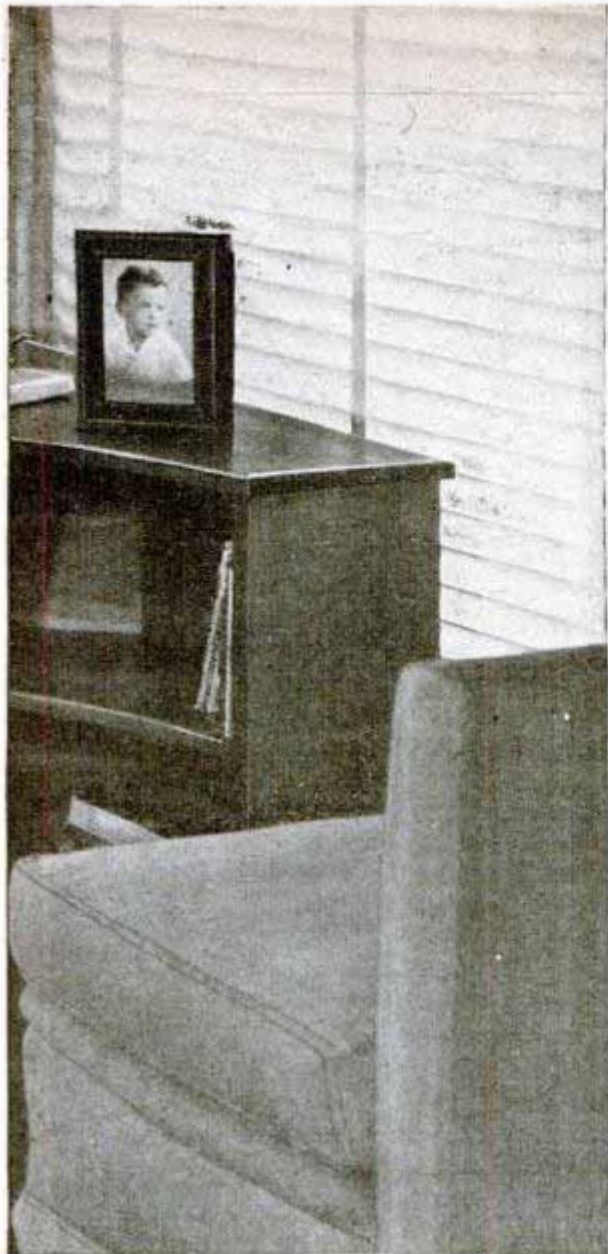
WITH a sectional sofa this smart-looking table is the latest treatment for a corner window, although you'll find it adaptable to almost any room. Whether in the living room, bedroom or game room, you'll think of a dozen ways to make use of its utility and space-saving features.

If available, plywood will save a lot of gluing, but if you prefer to work with solid cabinet woods, the drawings show how the top and shelves can be built up economically of random pieces and then trimmed to size later. Select pieces with the nicest grain for the top of the table and joint them carefully edgewise. Plain butt joints will do, although a doweled joint or a groove-and-tenon joint is considerably stronger. As shown in the cutaway view in Fig. 1, the table requires seven full-length legs

“Triangular” table utilizes waste corner space and has place for books and radio

and one stub leg which is doweled between the halves of the curved stretcher as in Fig. 2. Begin work by

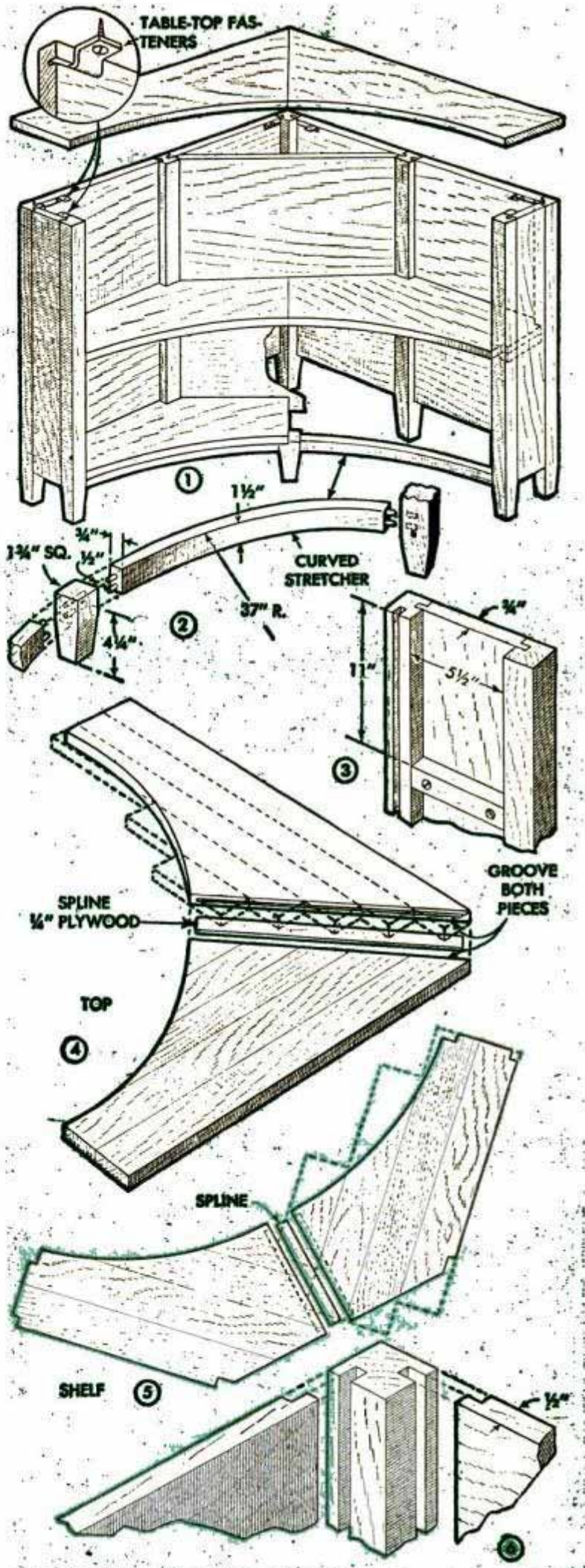
assembling the two end units as in Fig. 3. Note that each leg is grooved to a point $2\frac{3}{4}$ in. from the tapered end for the rabbeted members which fit flush with the outer face of the leg. Keep in mind that you must have a right and a left-hand unit. The three remaining legs are likewise grooved to take rabbeted members, after which the whole thing is glued and drawn together with several bar clamps. After this, a false back is fitted between the back legs (see Fig. 7) and glued and nailed in place. While the curved stretcher can be bent of steamed wood kerfed on the back, you may prefer to bandsaw it from wide stock. The stretcher is doweled and glued to the stub leg first and then to the rest of

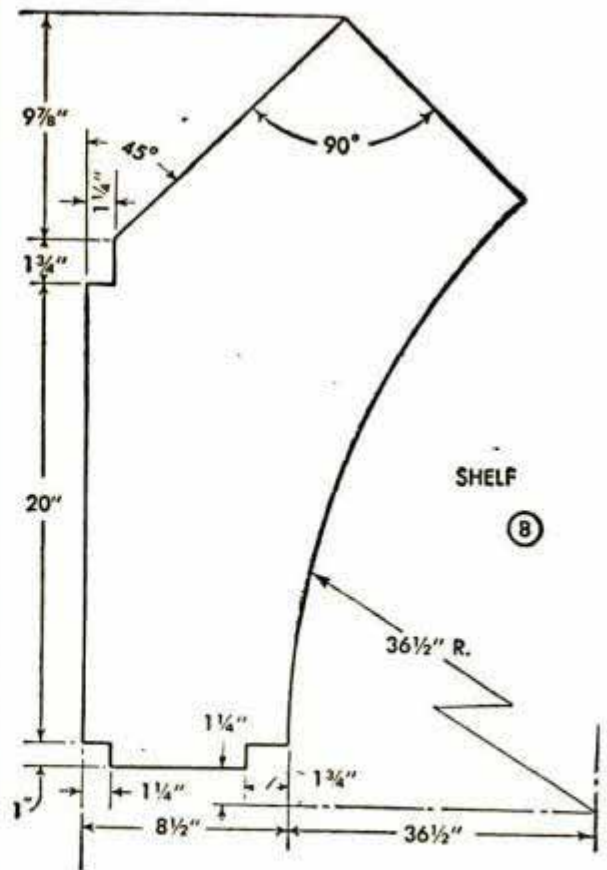
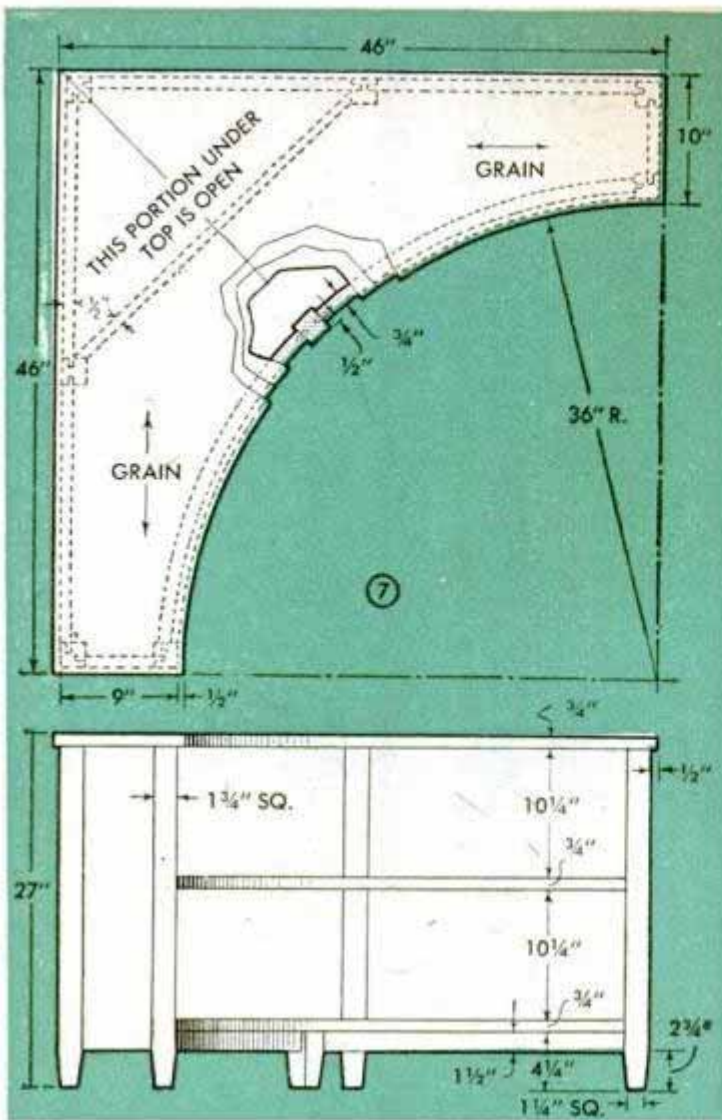


By
WALLACE W. BUFFMIRE

the assembly. In the latter case, you'll be able to spring the ends of the table outward sufficiently to engage the dowels in the holes in the legs.

This leaves only the fitting of the two shelves and the top, Figs. 4, 5 and 8. Each one is made up of two parts, mitered and grooved edgewise at the center to take a plywood spline. The bottom shelf is fastened with screws driven up through the stretcher and also in from the back of the table. The center shelf is fastened similarly, while the top is held with standard, metal table-top fasteners of the type shown in the circular detail in Fig. 1. This method of assembly conceals all fastenings and makes a neat job.





BILL OF MATERIAL

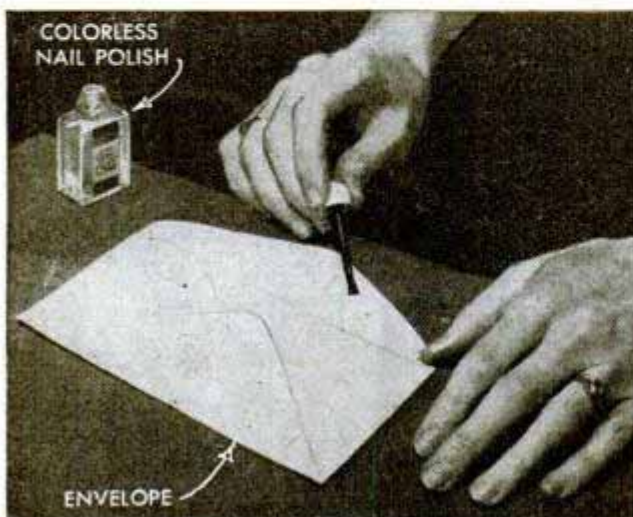
2 pcs.	3/4 x 21 x 46 in.	Top
7 pcs.	1 3/4 x 1 3/4 x 26 1/4 in.	Legs
1 pc.	1 3/4 x 1 3/4 x 4 1/2 in.	Stub leg
2 pcs.	3/4 x 6 1/4 x 23 1/4 in.	Ends
4 pcs.	3/4 x 18 x 33 in.	Shelves
4 pcs.	1 1/2 x 23 1/4 x 20 in.	Back
1 pc.	1 1/2 x 23 1/4 x 29 1/2 in.	False back
2 pcs.	3/4 x 1 1/2 in.	Curved stretchers

Now to finish the table. The type of wood used will vary the finishing procedure somewhat but for the most part it is the same whether you have used walnut, mahogany, birch or maple. First you should go over the whole table and give it a thorough sanding, beginning with a coarse paper and using progressively finer grades until all flaws have been sanded away and the surface is glass smooth. Here you must

decide whether you want a natural finish. If so, then you omit staining the wood and strive to bring out its natural beauty by the use of varnish or wax alone. In the case of birch or maple, unless a blond finish is desired, the wood is usually stained to imitate walnut or mahogany. In this event you forego filling the wood because birch and maple are close-grained woods and do not require filling.

HSC-51

Envelope Sealed With Fingernail Polish Will Stay Closed



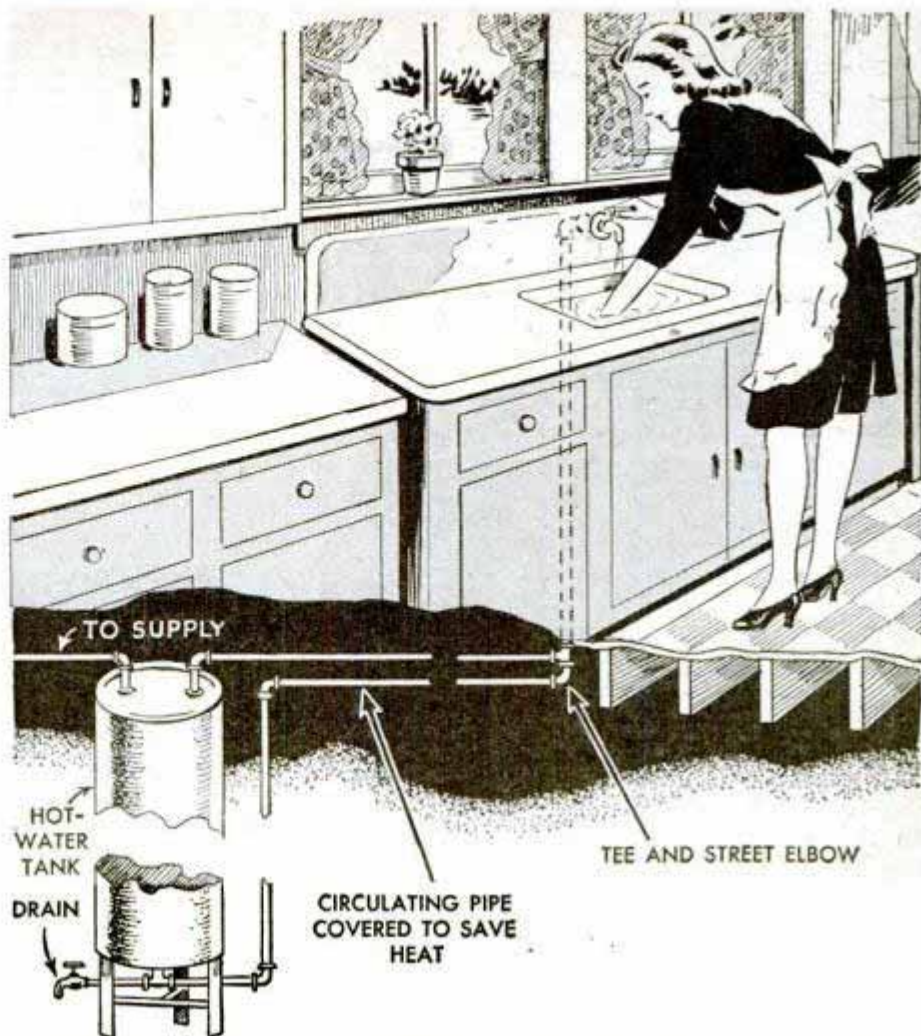
When the adhesive on an envelope flap does not seal tightly, use colorless nail polish as a glue. It dries almost instantly and leaves no smudge. A letter sealed in this manner cannot be steamed open.

Play Ball Made From Basketball

If you have an old basketball that is no longer usable because the bladder is worn, try making it into a play ball for small children. The bladder is removed and the cover is stuffed with kapok. This makes a ball that is light and soft enough so that it will not injure children should they be hit accidentally.—C. E. Edson, Lakewood, Ohio.

Recirculating Connection Conserves Hot Water

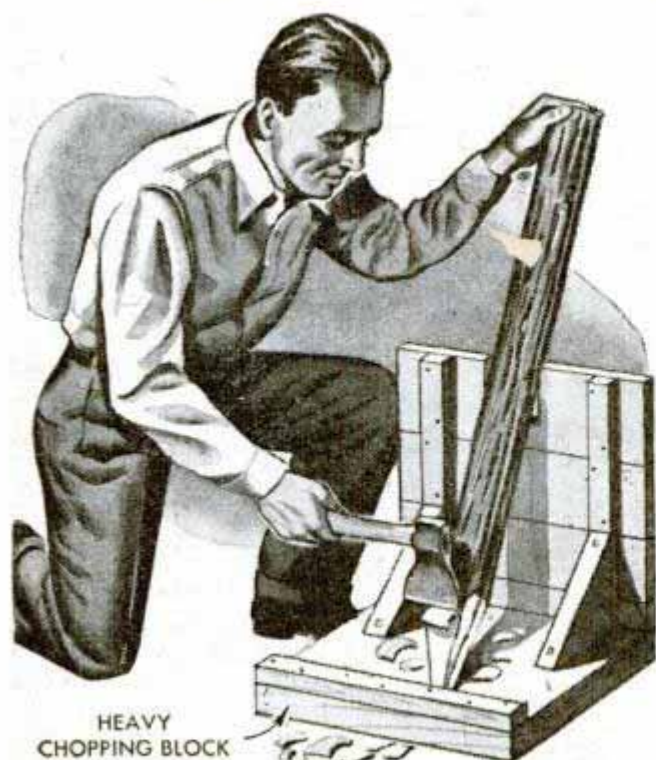
Here's one way to conserve hot water and avoid a long draw-off until the temperature at the faucet is hot enough. By recirculating the water through the heater continually, that which normally would cool off in the piping remains hot. In this case, the recirculating connection was made at a tee in the drain and at another tee in the riser. This latter connection should be as close to the faucet as practical to allow as much recirculation as possible. Hot water coming off the top of the tank will flow through the horizontal run and back into the tank through the lower connection in much the same manner that water circulates through the radiators and piping in a hot-water gravity-feed system. To avoid loss of heat through the piping, it should be covered with insulation. Although this may seem to require extra piping, the economy is considerable and



the annoyance of waiting while the cold water runs out of the pipe is overcome.

Lee W. Panney, Ionia, Mich.

Fence Posts Are Pointed Easily When Held in Standard



One man can point fence posts easily when using this simple standard. The upright has a slot that holds the post at the desired angle and the base has a stop to keep the post from slipping. The base should be made of fairly heavy wood.

Formation of Mildew on Leather Prevented by Copper Sulphate

To prevent leather-bound books from mildewing, copper sulphate can be applied. A piece of absorbent cloth is soaked in a solution made by dissolving a small amount of the sulphate in water and then the cloth is allowed to dry. When dry, the cloth is rubbed over the book to protect the binding.—Walter E. Klein, Mansfield, Ohio.

Small children who cannot read will quickly learn to identify phonograph records if appropriate pictures are pasted over the labels. Then they will no longer have to ask older persons to select records.

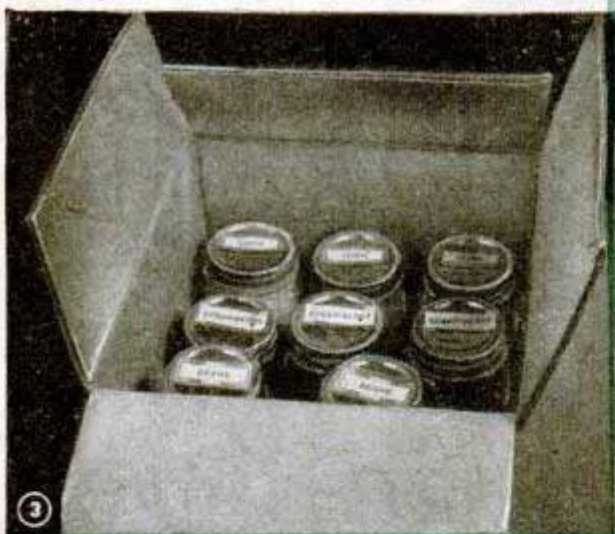
Solving Home Problems



①



②



③

① Serving meals to someone in bed is something of a problem because the dishes will slip on the tray. A corrugated mat that is trimmed to fit the tray, with cutouts for the dishes, will solve this problem

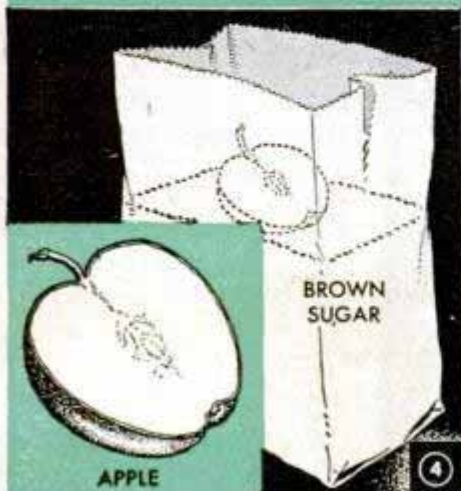
② Removing the kinks from yarn that has been used can be done easily with a quart milk bottle. When unraveling the yarn, wind it around the bottle and then dip it in water. When dry, it will be free of kinks

③ When shelf room is taxed to capacity and canned goods must be stored in boxes, it's a good idea to place the label on the top of the jar where it can be seen rather than the side as is done usually

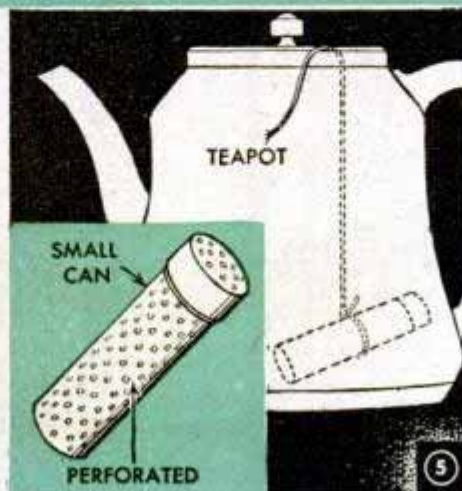
④ To keep brown sugar from drying out and hardening into lumps, cut an apple and place half of it in the sack with the sugar. This should provide enough moisture to keep the contents in the proper condition

⑤ For those who prefer to use bulk tea rather than in small bags, this "tea ball" will come in handy. A small can is perforated with a darning needle and is suspended in the teapot from a strong cord

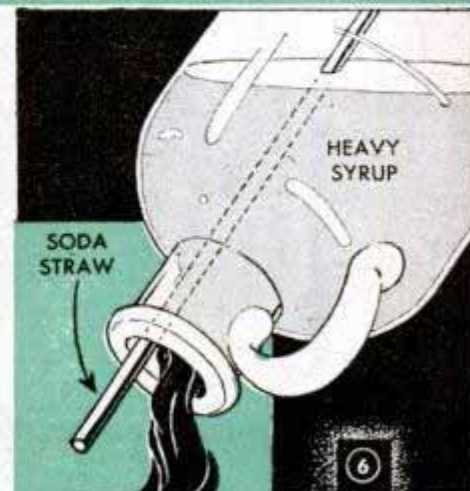
⑥ If you have trouble pouring heavy syrup from a bottle with a small mouth, insert a soda straw in the opening so air is admitted above the liquid. This will cause it to flow more evenly than before



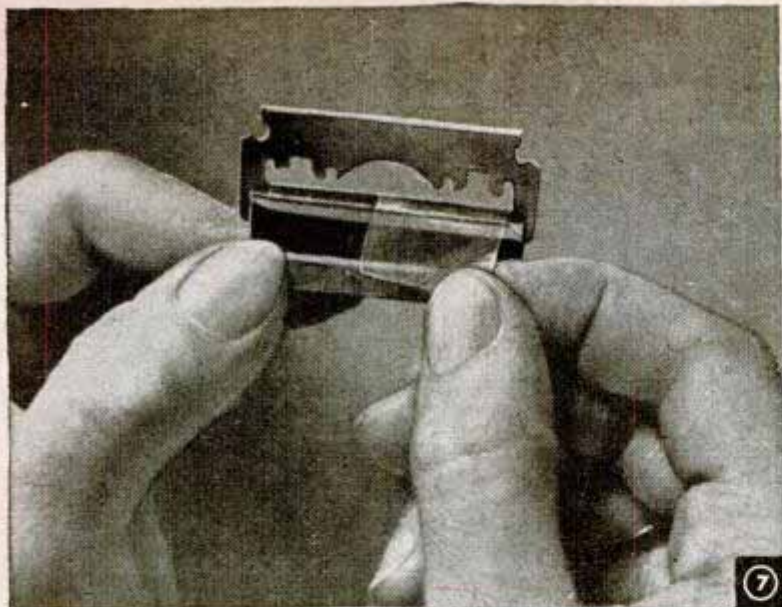
④



⑤

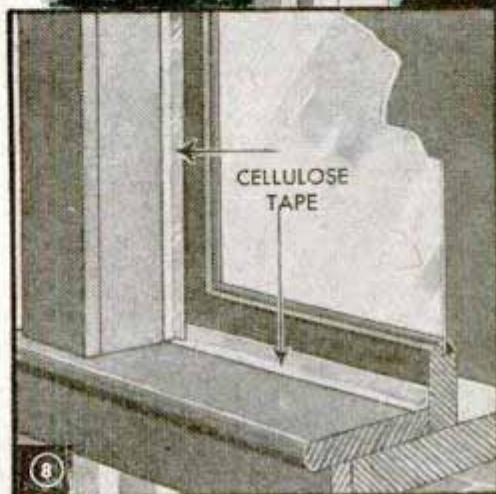


⑥



7

7 Although ideal for ripping sewing, a double-edge razor is difficult to handle without cutting yourself. For a holder, use the striking end of a paper-match book and fasten in place with cellulose tape



8

8 Here's an easy way to weatherproof your windows for winter if you don't have storm sash. Apply cellulose tape to the inside of all cracks around the sash and sills, being sure it doesn't wrinkle

9 Try removing those stubborn jar lids by using a length of rubber hose of a suitable size as a hand grip. The hose is looped around the lid and then the ends are grasped to provide a firm hold

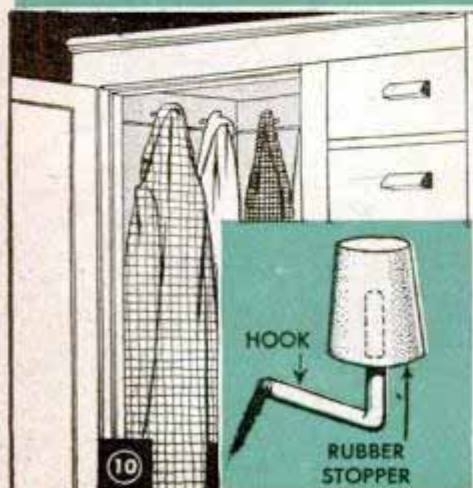
10 With a screw hook and a rubber stopper of the type used in ammonia bottles, you can make a wardrobe hook that will be satisfactory. A hole is drilled in the stopper which slips over the hook

11 Converting a large cupboard drawer into a vegetable bin is not a difficult job. Just cut out a section of the front and cover this opening with a coarse screening to secure adequate ventilation

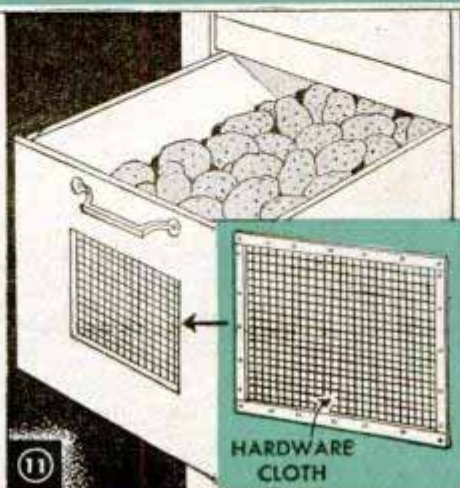
12 Small children cannot tamper with gas-stove jets if this wood and metal guard is placed over them. The boards are held in place with flat-iron strips that are bent and clamped to the top of the stove



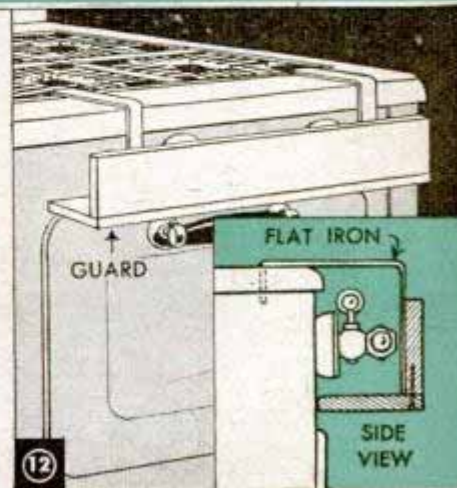
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10



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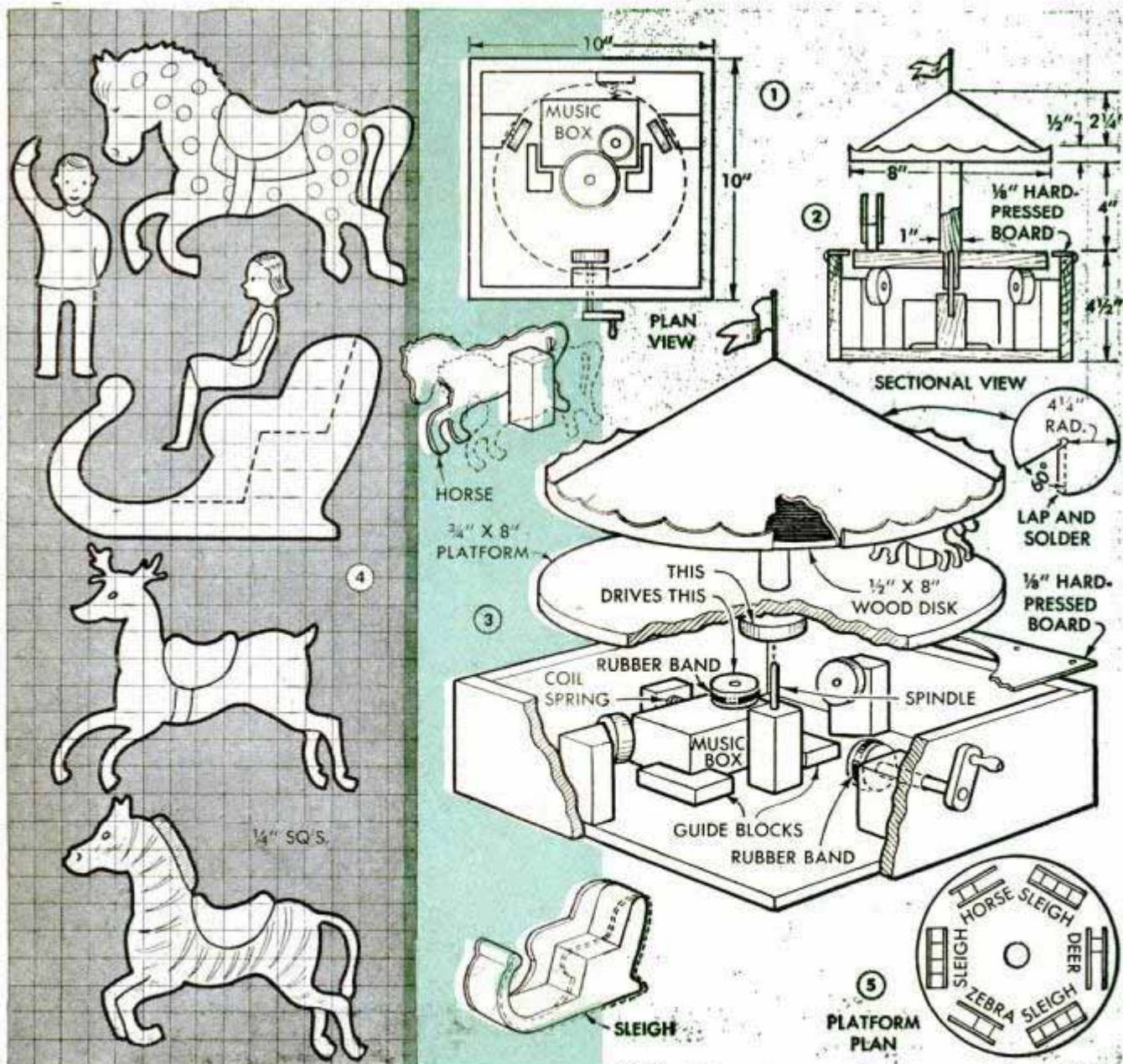


12

Musical MERRY-GO-ROUND



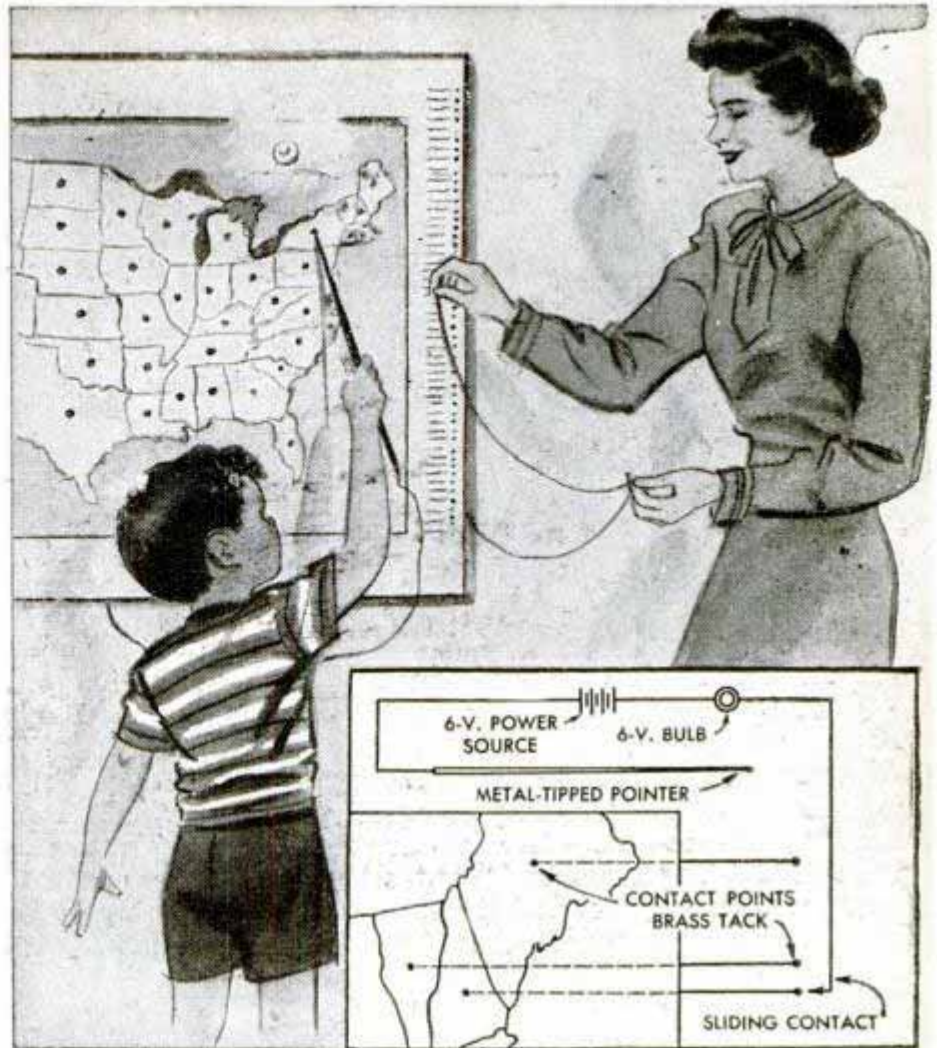
IN THIS toy, which is crank operated, a small music box of the type often used in ladies' powder boxes provides the sound effect every youngster likes. Fig. 1 gives the plan view showing the location of the music box and rollers on which the circular platform rotates. The sectional view in Fig. 2 and the cutaway in Fig. 3 indicate the general assembly. Note that one of the rollers is fitted with a crank and is wrapped with a rubber band to provide a friction drive for the platform. A roller on the platform standard drives a small roller on the music box, the latter roller being wrapped with a rubber band to produce a friction drive. Fig. 4 suggests a sleigh and animal cutouts, and Fig. 5 shows their relative positions on the platform. Mount the animals in pairs with each sleigh.



Indicating Light on Map Makes Geography Fun

Studying geography is a lot more fun with this map that has a flashing light to indicate when the pupil has touched the right city with the pointer. In this case, the map was mounted on a piece of $\frac{1}{8}$ -in. hard-pressed board. The contact points are brass tacks to which the wires on the back of the map are soldered. Names of the cities are listed along the side of the map and wires run from the tacks here to the tacks corresponding to the cities in their proper locations. The teacher has a sliding contact which is connected to a 6-volt power source. A bulb is in series with this connection. When the teacher touches the contact at a certain city, the pupil completes the circuit by touching the pointer to the tack representing the city on the map.

—G. R. Ursenbach, Toronto, Ont., Can.

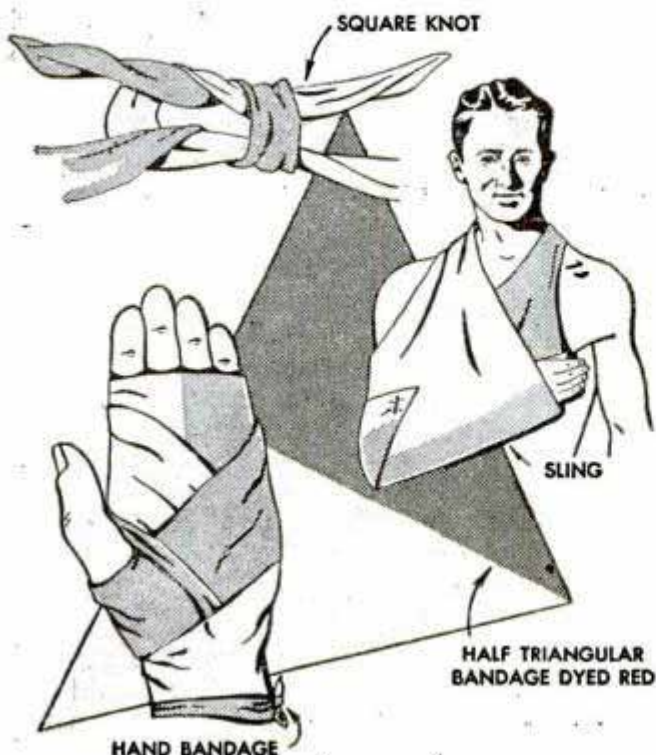


Two-Color Triangular Bandages Identify Different Knots

To teach students in first aid quickly, one instructor found that if one half of a triangular bandage is dyed red and the other

half remains white, the pupils will learn to tie knots and apply bandages rapidly. The folds and turns stand out much more clearly than they would if the cloth were one color.

John C. Sommer, Saginaw, Mich.



Masking Tape for Window Panes

If you are painting window frames and do not have a brush small enough to avoid getting paint on the glass, a substitute for masking tape can be had by utilizing newspaper. Cut the paper into strips about 2 in. wide and dip them in water. When wet they will adhere to the glass and after the painting is finished they are removed easily.

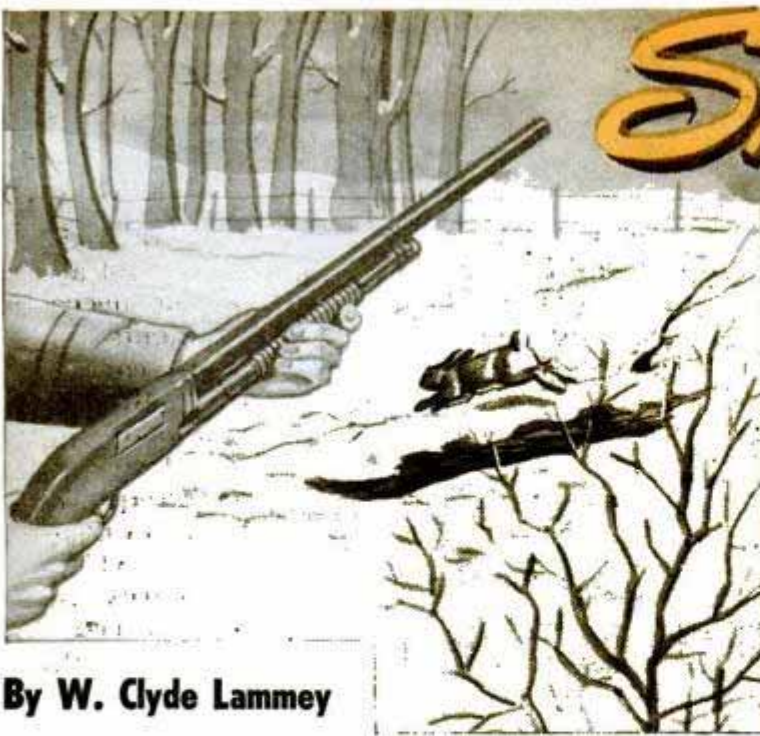
W. L. Dysart, Louisville, Ky.

Getting Rid of Hub Cap Rattle

If you have an annoying rattle in one of your car hub caps, put adhesive tape around the opening where the cap contacts the hub. The same treatment is good for hood squeaks. Find the spot that's rubbing and stick adhesive tape to it.

James W. Campbell, Willimantic, Conn.

Shotguns



By W. Clyde Lamme

WHEN quail rise from nearby thickets and streak away through the low cover, or a cock pheasant blasts unexpectedly into the air from a spot almost under your feet, you'll find it easy to agree with those experienced shooters who have called shotgun pointing a sport of "controlled relaxation." That's just what it takes—a delicately controlled coordination of feet, legs,

shoulders, arms, hands, head, eyes and senses. Each mental and physical process must be assigned a definite place in a smooth continuity of motion, all to the end of accomplishing several specific things in a split second of time. Like other outdoor games requiring a high development of skill and dexterity, it calls for a lot of practice. When flushed birds are winging away at mile-a-minute speeds there's no time to take into deliberate account all the variables offered by each shot. Essentially the problem is simple—mainly that of intercepting one moving body, the target, with another, the shot charge. But suppose you are standing in the open and, without warning, a flying target suddenly appears, moving across in front of you from left to right at a speed of say 88 feet per second, or about 60 miles per hour. Some game birds fly even faster. How to place a shot charge at just the proper distance and posi-



① Beginning of the gun swing in firing at a target crossing in front at right angles from left to right. Note that the shooter first swings left to pick up the target, using the gun as a "pointer"



② Here the shooter starts the reverse swing, the pivot to the right continuing until after the shot is fired so that speed of gun swing will not diminish. Note that feet remain in the same position

Footwork

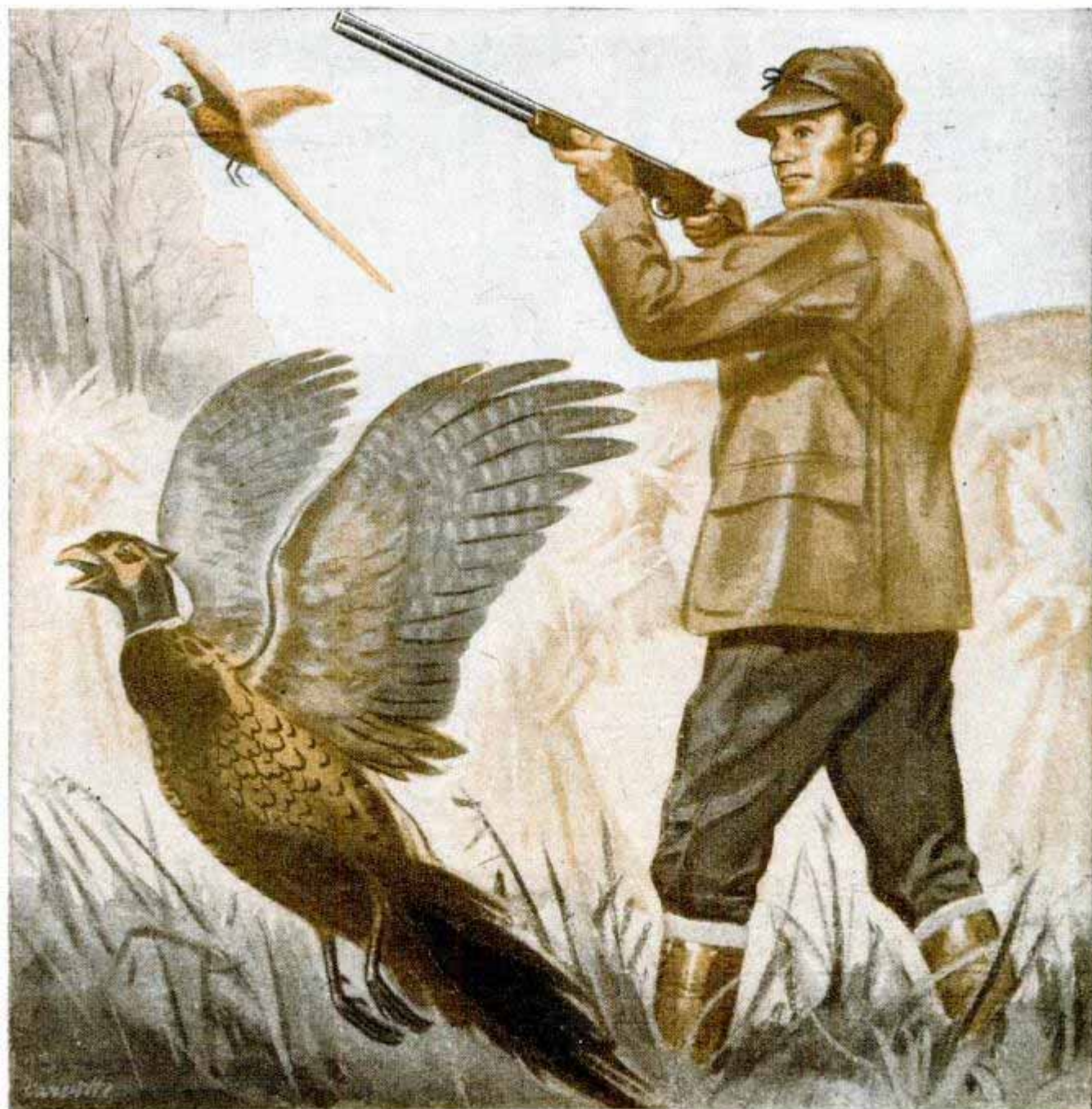


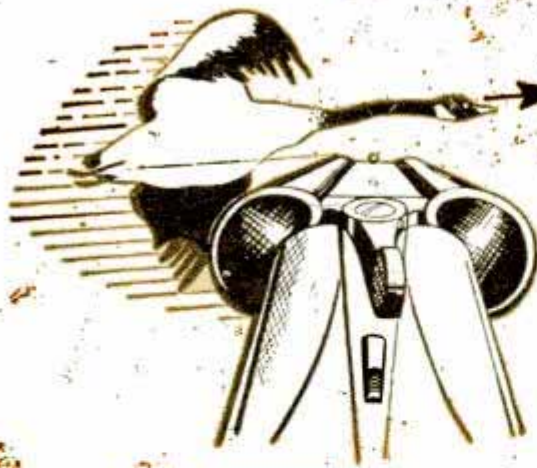
tion in the sky ahead of this speeding target to catch it when it comes along—that's the trick.

It begins with footwork. If a shooter is caught off balance at the instant his target is trapped, or has the wrong foot forward when a bird flushes in the field, he's almost sure to miss, unless he's practiced approved methods of getting quickly into shooting position. Many grouse hunters move through likely cover with a short, halting step and gun held in both hands. Experienced quail shooters, moving in for the flush behind dogs holding rock-steady on point, do much the same. Each must have his feet "under him," ready for quick,

controlled action when the birds take off.

If all the variables of any given shot are calculated mathematically and the necessary impulses and body movements are considered separately, the thing can be made to appear impossible. But the answer to that one is that a single mental process can be trained to control several physical reactions which may be required to produce a definite result, just as in driving a car or playing golf or tennis. At the outset the shotgun pointer acquires the habit of "facing the shot." If he's a right-handed shooter he comes to think of the right leg as the balance or "steering" leg. His left leg becomes the "pivot" leg. In





SWINGING PAST



POINTING OUT

trap, skeet and upland game shooting the feet normally are kept quite close together. Irregularities in posture, such as feet spread wide apart, bent knees, or body bent far forward, destroy the muscular torsion and body balance so necessary to a quick, rhythmic swing to right or left. In facing the shot the left toe usually points slightly to the right of the spot where it is expected the shot charge will be delivered. The feet are separated at an angle, the right foot normally a few inches back of the left. Nearly everyone can take this position, raise, or mount, the gun and swing it right or left through a combined angle of 60 degrees or so without experiencing undue muscular tension or discomfort and without lifting either heel from the ground. In this position most of the weight will be on the left foot. When a swing is made in either direction, muscles of the feet and legs will be placed under a torsional strain which increases progressively until the extremes are reached. The gun muzzle is lowered to follow running game by bending the body forward at the hips, raised by a slight backward bend and swung right or left by pivoting, not swaying. Arms, head,

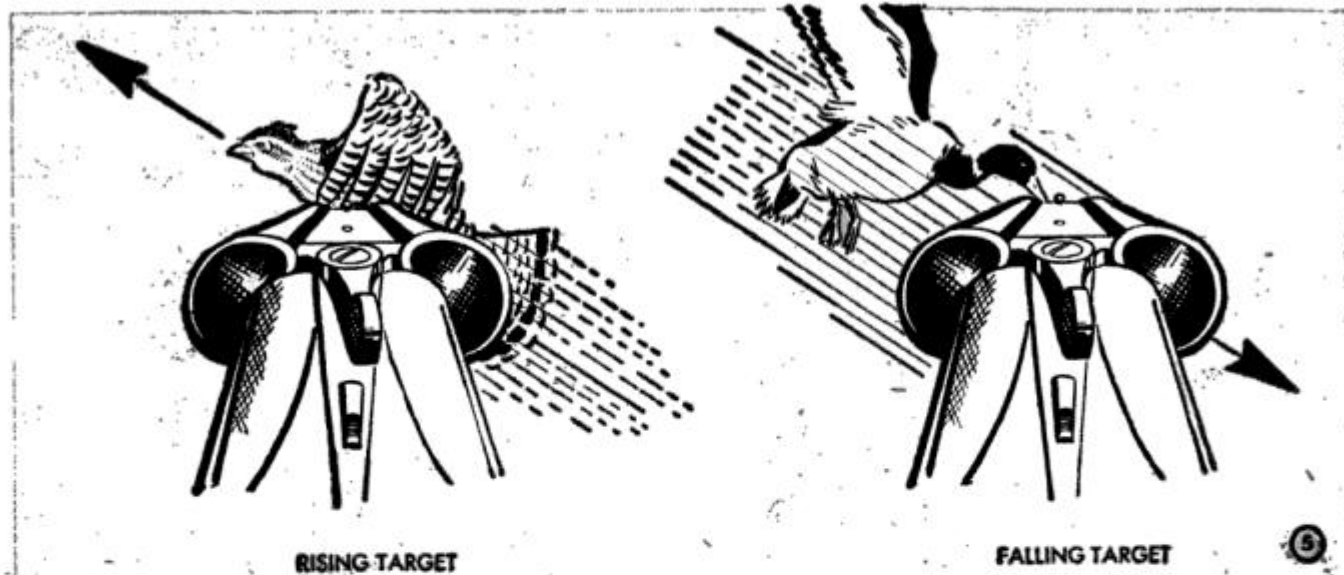
torso and gun move as a unit, except that in a swing from left to right, right-handed shooters may find it necessary to slide the cheek along the comb of the gunstock. In depressing the muzzle the left leg takes more of the weight, while in elevating the gun the right takes the greater share. However, in a good shooting position the transfer of weight is hardly noticeable.

Body and foot positions in Figs. 1 and 2, A to F inclusive, show in a way how the whole procedure works out in practice. The broken line shows the approximate position of the gun in relation to the foot position. Some good shotguns stand with the feet even closer together than indicated, while others, especially skeet shooters, find it more to their advantage to stand with the feet somewhat farther apart. There are no hard-and-fast rules but in any case when facing the shot the feet are the foundation from which the gun swing is made and both should be firmly on the ground during the whole maneuver.

Watch a top-rate wingshot take the four pairs of doubles in a round of skeet, where the traps are sprung simultaneously, and the shots usually are taken from stations



④ This shotgunner is taking a surprise target flying away sharply to the right. He must withdraw the right foot, pivot on the toe and step in the direction of the flying target with the left foot



RISING TARGET

FALLING TARGET

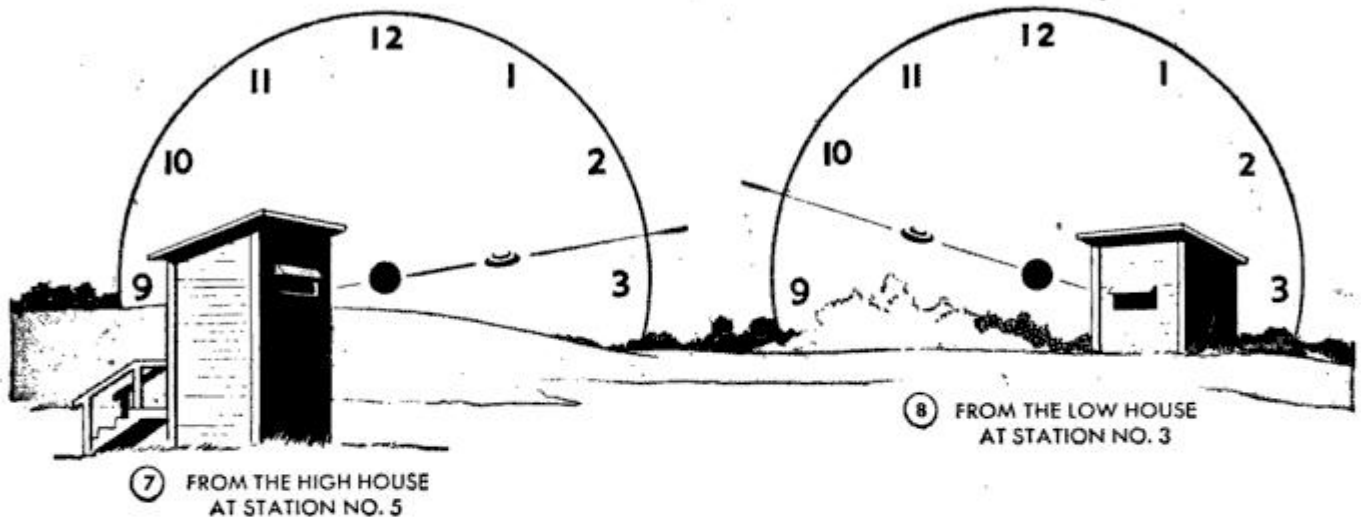
1, 2, 6 and 7. In the ready position the shooter faces the shot on the near side of the spot where the targets will cross in flight. In this way he has his feet already placed in the best position to swing on the second bird. He takes the outgoing target first, then swings for the incomer from the same foot position. Also, if you observe closely you will see that the gun swing doesn't start at the precise instant the targets are trapped, but that the shooter holds for the briefest moment until the targets are in clear view. Then, like the golfer, he must have perfectly controlled coordination, but he must move a lot faster.

In this demonstration two things take place that you don't see. In order to estimate instantly the apparent speed and direction of the swiftly moving targets, the shooter very likely is using the imaginary vertical clock system, Figs. 7 and 8, and, to bring the gun to bear on the flying clay birds before they get out of bounds, he must cut his timing pretty thin. There's no time to swing the gun in front of each individual bird and maintain a measured lead. So the shooter uses a trick effective at the shorter ranges and known to shotgun

pointers as the fast swing or "swinging-past" method, Fig. 3. In this the gun muzzle follows the line of the target's flight in a fast swing, overtakes it from behind and swings past. As the gun muzzle passes the target the shooter pulls the trigger, and the gun, swinging faster than the bird, builds up the required lead. The essential thing is that the gun be moving uniformly. Any irregularity in the swing, such as flinching or stopping the swing at the instant the trigger is pulled, likely will cause a miss. Speed of the swing is important, too. For example, the speed of the swing in a crossing shot must vary from that employed in a quartering shot. Practice of the fast-swing method usually is to be recommended only for the shorter ranges where flight of the targets is uniform and predetermined, such as in skeet or certain shotgun games and also in upland game shooting where the nature of the cover and the character of the bird's flight call for quick work at close range. Some wild-fowl hunters using high-speed ammunition use the fast swing at medium-long ranges. On the other hand, at the traps, pass shooting, or along game-bird flightways where the



6 Caught out of position with the right foot forward and the target flying to the right rear, the shooter throws his weight on the right leg, pivots and swings the left foot to face the target



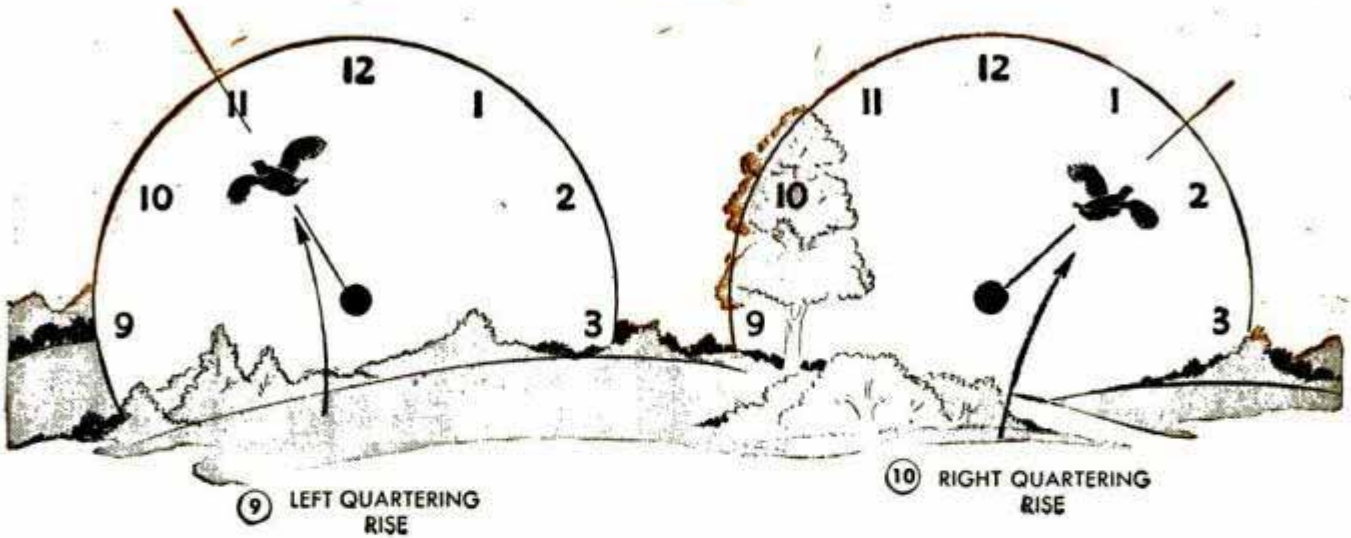
shots are taken at comparatively long ranges, good shooters generally use what is known as the slow swing or "pointing-out" method, Fig. 3. This involves a more precise calculation of distance, apparent speed of flight and gun swing. Actually the eye controls the whole procedure. Here the gun is swung ahead of the bird and a measured lead maintained until after the shot is fired. In this the apparent speed of the target is important. A target crossing in front of you at right angles and another quartering away either right or left may be moving at the same rate of speed but the quartering target will appear to be moving much slower. This is due to perspective, or obliquity of the line of flight to the eye. Because of this apparent reduction in speed the forward allowance or lead will need to be reduced accordingly. All this assumes that the target is maintaining a more or less level flight. Sharply rising or falling targets, Fig. 5, introduce another factor. You have to lead a rising bird above as well as ahead. To connect with a falling target you have to get well under it. Figs. 3 and 5 are merely approximations. The sketches do not represent actual leads.

Most right-handed shooters find it easier to swing on a target crossing from right to left than on one from left to right. Often it will take considerable practice with the gun before one can accomplish the maneuver with equal facility in either direction. If you're a right-handed shooter, it's a good idea to practice the left-to-right swing shown in Figs. 1 and 2, details A to F inclusive. This can be done anywhere there is room to swing the unloaded gun. Keep the feet in the same position during the whole maneuver. Such practice, "dry shooting" as it often is called, is a valuable aid in mastering the finer points of gun swing and coordinated footwork. Left-handed shooters will find it extremely helpful to practice

a right-to-left swing in the same manner.

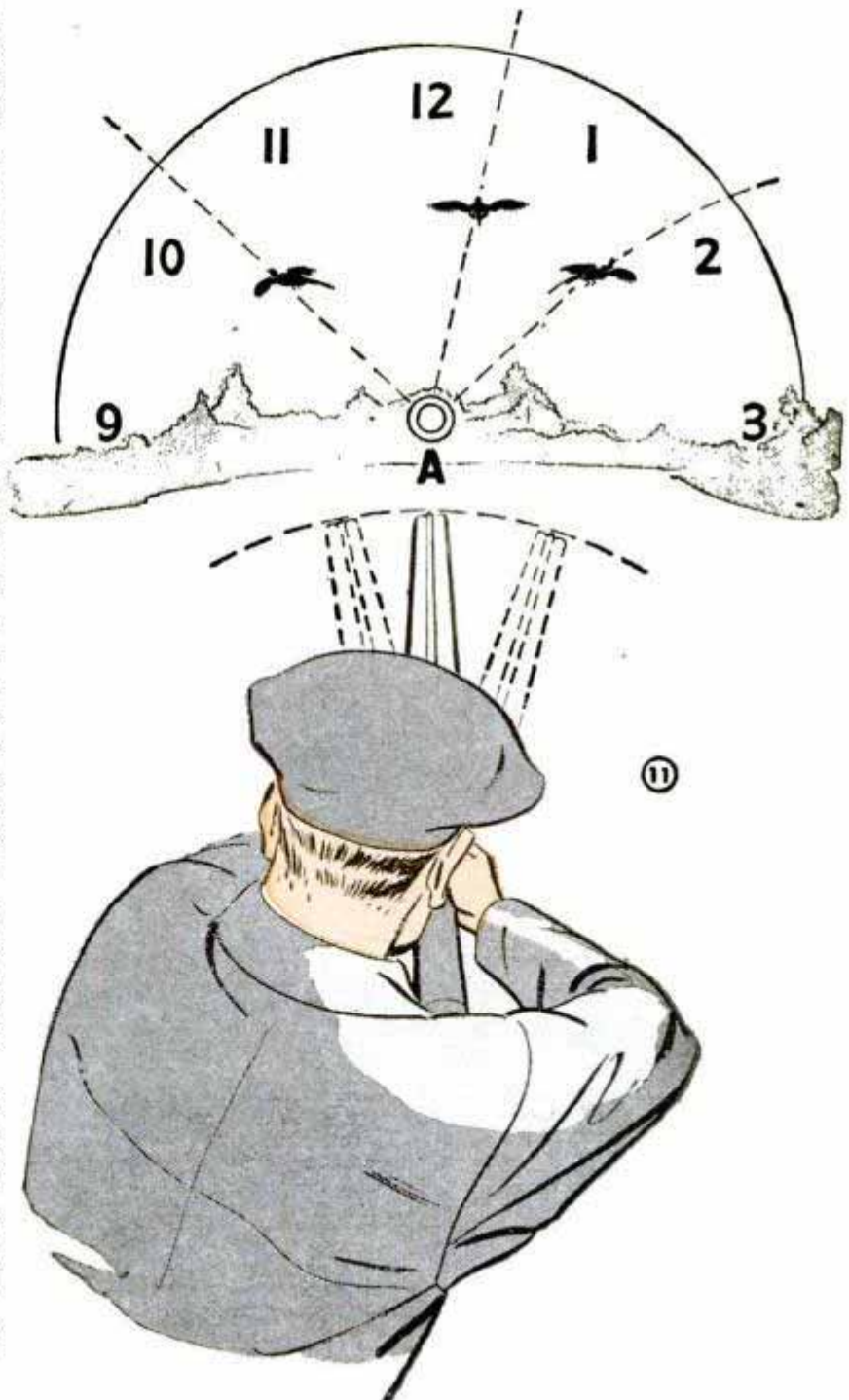
Fig. 4 illustrates a surprise situation where the shooter is moving through cover in the field. As the bird flushes and makes away well to the right and toward the right rear, the shooter's left foot is forward as at A. He must shift the right foot, pivot on the right toe and step in the direction of the flying target with the left foot as at B. Then by a third movement he comes to the position shown at C with the gun raised to point out the bird. Note that in this maneuver swinging and mounting of the gun and the footwork are done simultaneously. Fig. 6, A, B and C, shows much the same thing as Fig. 4, with one important variation. In this case, the shooter is taking a surprise shot to the right while advancing at a normal pace but caught out of position with the right foot forward when the bird gets up. The shooter finishes the step as at B, then pivots on the right foot and brings the left foot into position as at C. The foot positions in Fig. 6, C, have purposely been shown slightly incorrect to illustrate what often takes place. In making a quick pivot of this nature the tendency is to place the feet directly opposite whereas the left foot should be farther forward for good balance. Some practice may be necessary to correct this tendency. The maneuvers shown in Figs. 4 and 6 are among the most difficult foot movements for the upland gunner on uneven ground, or at the various "walk-up" gun games where the shooter must fire at surprise targets thrown at unknown angles. Practicing these foot movements for surprise shots from both the right and left will be a help in field shooting.

Use of the imaginary vertical clock face in applying method to the business of pointing a shotgun is quite simple in both theory and practice. In skeet or trap shooting the clock-face zero, represented by the

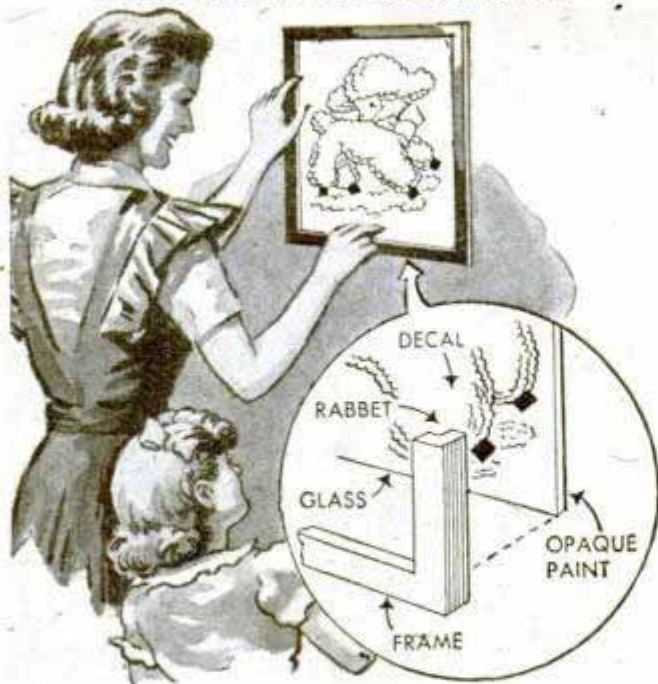


solid black circles in Figs. 7 and 8, will be the point in space near the trap house where you expect the target to appear in clear view. Once the target is sighted clearly, it's easy to think of it as a "2-o'clock" shot, a "2:30-o'clock" shot or a "9:30-o'clock" shot, depending on where the apparent line of flight will cut the circle of the imaginary clock face. When you face the shot at that point where you expect the target to appear, it takes only a comparatively short swing to put the gun on either a 10-o'clock or a 2-o'clock bird. This will be more clearly seen from Fig. 11, the zero point A representing the point at which the bird was first sighted. In upland shooting at birds which rise from cover, the zero point of the clock face can be thought of as being only in the vicinity of the spot where the bird was first sighted, as in Figs. 9 and 10. If you accustom yourself to its use, the clock face will form in your imagination the instant you recognize the flushing bird as a legitimate target.

In the 11:30-o'clock or 12:30-o'clock shot, Fig. 11, the lead and swing are reduced almost to zero, gun movement merely compensating for the rise of the target. In addition to footwork the shooter should consider stock length, drop, pitch and barrel boring to suit his purpose.



Decal on Framed Piece of Glass Decorates Child's Room



Pleasing wall plaques for a child's room can be made with a small frame, a piece of glass, an amusing decal and some paint. The decal is transferred to the glass and the reverse side is painted. For this purpose aluminum or bronze paint is particularly suitable as it will reflect the figure in the manner of a mirror. When dry the glass is framed. Several such plaques will do much to add to the gaiety of the room.

H. Klein, Pittsburgh, Pa.

Leaves Insulate House Foundation

One farmer who had an unheated basement found that in cold weather the inside cellar walls would frost over and food would freeze. He remedied this condition by insulating the foundation with leaves held against the outside walls by a picket fence of the lath-and-wire type. The fence is staked about 8 in. from the wall. In the spring the fence is rolled up and put away and the leaves are used for mulch in the garden.—D. R. Baldwin, Bellefontaine, O.

Spring Fastened to Eaves Trough Screens Trash From Downspout



Leaves and other trash that may be blown into an eaves trough will not clog a downspout if a mattress or chair spring is inserted in the mouth of the spout. If no spring of this type is available, a length

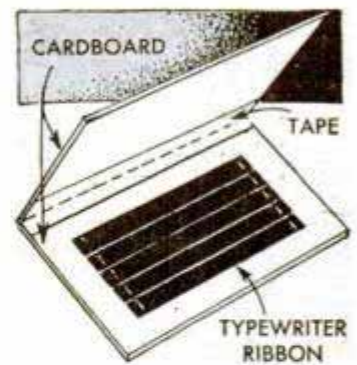
of stiff wire such as is used for fencing will be suitable if it is coiled to a tapered spiral.

D. L. Pfister, Aurora, Ind.

Ink Pad Uses Typewriter Ribbon

An emergency ink pad that may be carried in your pocket is made of old typewriter ribbon. Attach a cloth hinge to two 2 by 3-in. pieces of cardboard and staple on several strips of ribbon. Stretch the strips tightly and place them close together but do not overlap or the surface will be uneven.

Frank Shore, New York, N. Y.



Vegetables Are Accessible If Kept In Unheated Building

Vegetables stored in barrels sunk in the garden or yard are difficult to get at during the winter, but if you have a garage or other unheated building with a dirt floor, try the solution adopted by one householder. In one side a pit is dug about 8 ft. long by 30 in. wide and 30 in. deep. Then a bottomless box of the same outside dimensions is sunk into the hole. The box should be divided into four equal compartments with a hinged lid for each section. To prevent sweating, air holes are drilled in the lids and the vegetables are packed in layers, preferably spread out so they don't touch. To fill between layers, sawdust or sand and leaves can be used. The division of the box into four compartments makes it easier to find the vegetables.

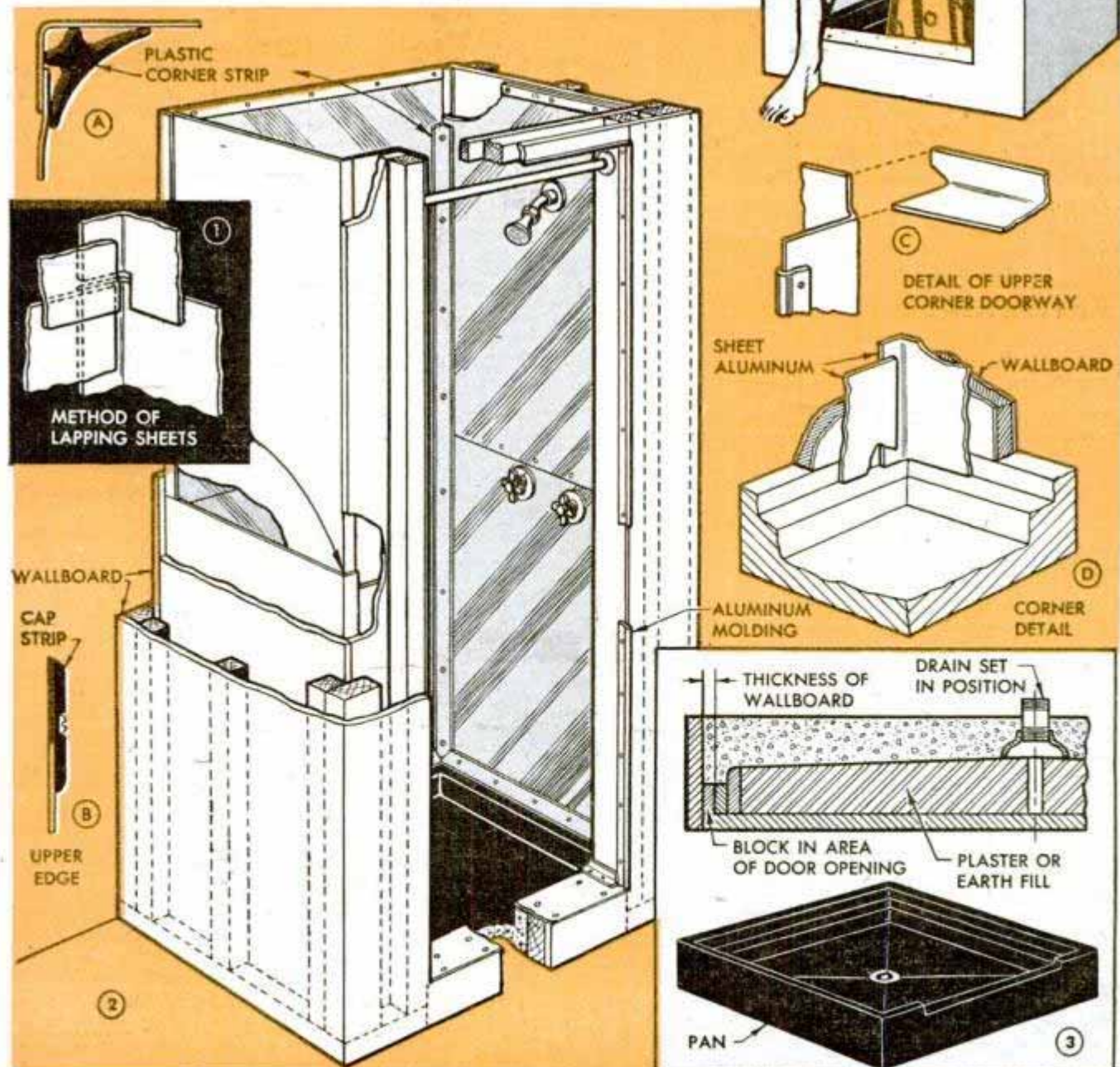
Margaret E. Singleton, Rochester, N. Y.



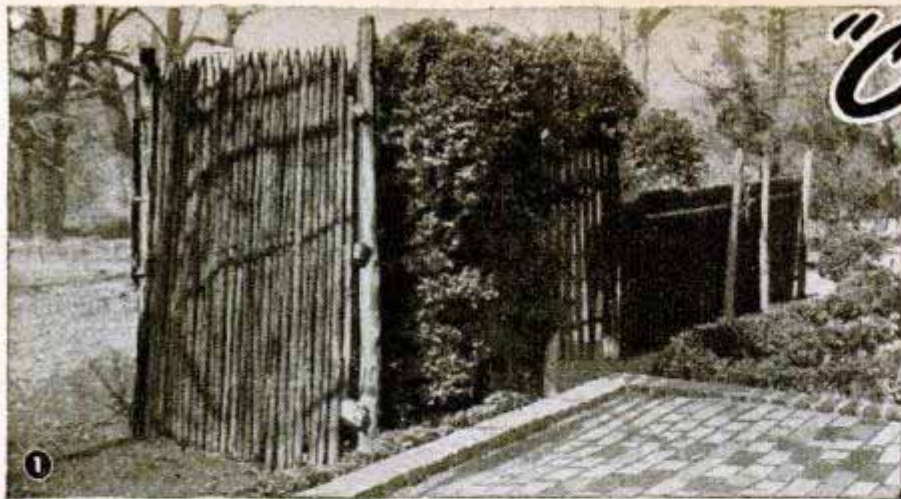
Aluminum-Lined SHOWER CABINET

LINED with war-surplus aluminum sheets, this shower cabinet is attractive in appearance and easy to keep clean. Any light-gauge aluminum will do as the metal is backed with wallboard. If the sheets are obtained in 3-ft. widths, they will fit the walls without requiring any vertical laps. The shower pan is cement cast in the form indicated by Fig. 3. The rim of the pan should equal the thickness of the wallboard that serves as backing for the metal lining, and the latter is lapped over to make a waterproof seal, detail D, Fig. 2. The frame is made of 2 by 2-in. lumber with 2 by 4-in. pieces at the corners and at the sill. Either wallboard or plywood can be used for the inner and outer sheathing. The aluminum is applied as indicated in Fig. 1 and details C and D of Fig. 2. It is bonded to the wallboard with any adhesive that is suitable for the purpose. Plastic edging strips are applied to the corners and edges by the methods shown in details A and B of Fig. 2. The sill plate in the doorway is of stainless steel.

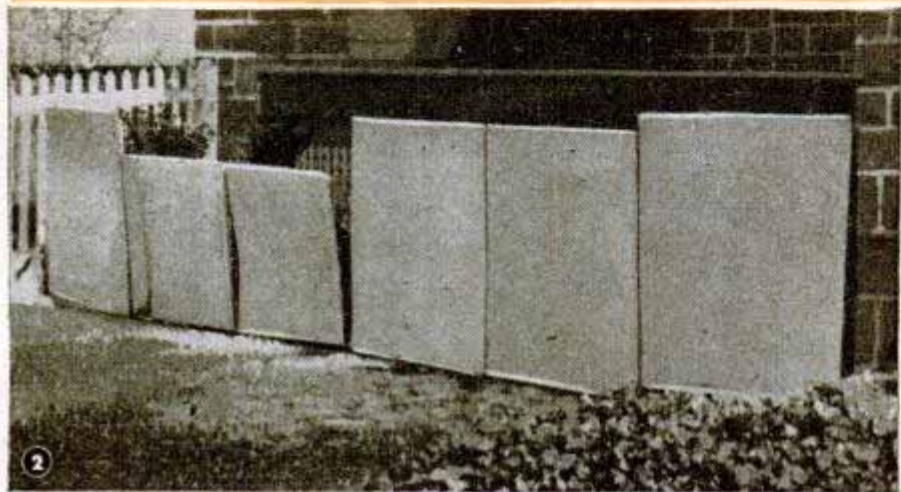
John L. Hathaway, Los Angeles, Calif.



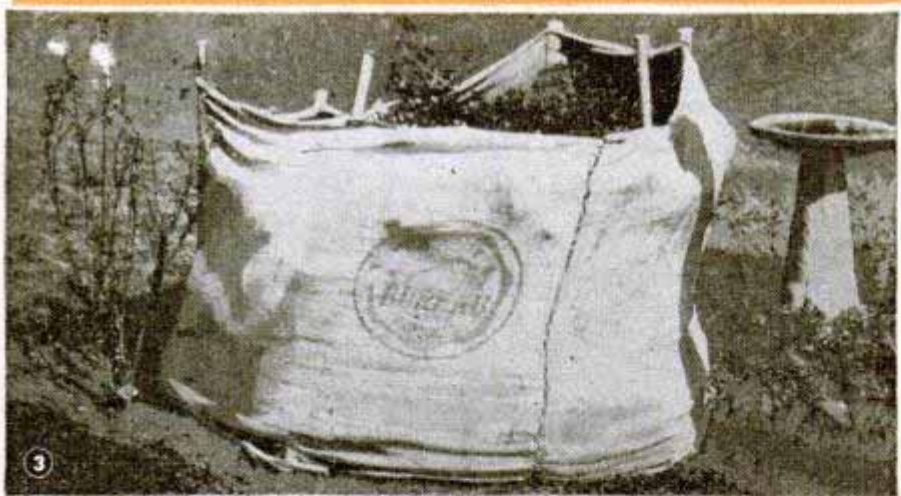
"Overcoats"



Pole fence on the windward side protects the taller-growing shrubs from severely cold winds



Pieces of corrugated cardboard cut from packing boxes and nailed to stakes make a good windbreak

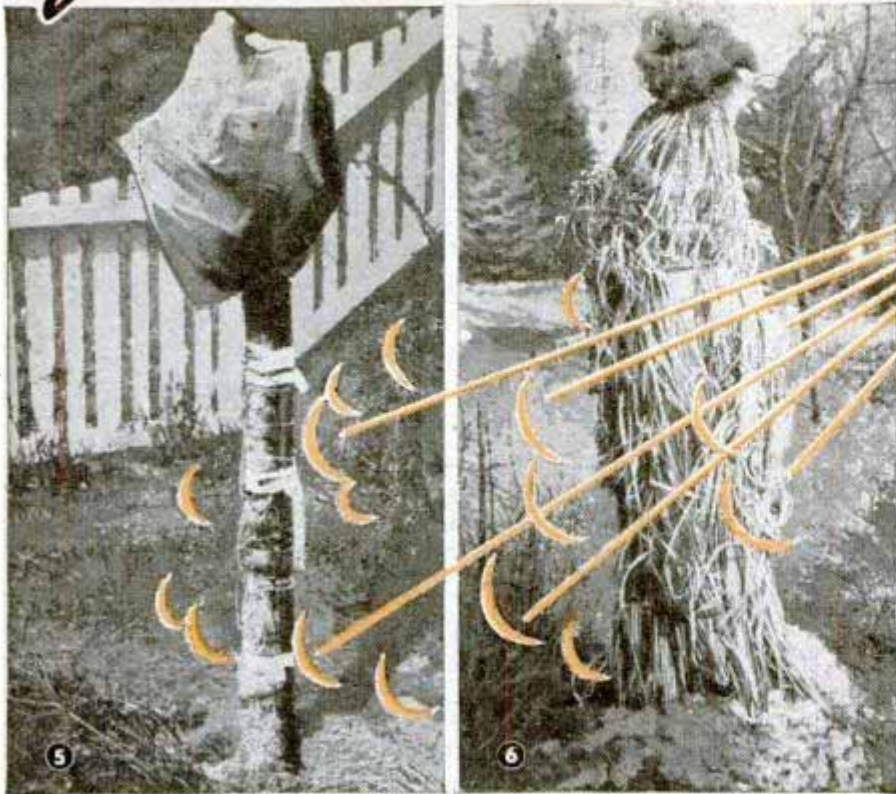


For low-growing shrubs a combination windbreak and sunshade can be made from burlap and stakes



Sunshades made by tying long grass or cornstalks in bundles and supporting them with a frame

for Tender Shrubs



Most high and low-growing shrubs exposed to winter winds and reflected sunlight need additional protection

By Paul Hadley

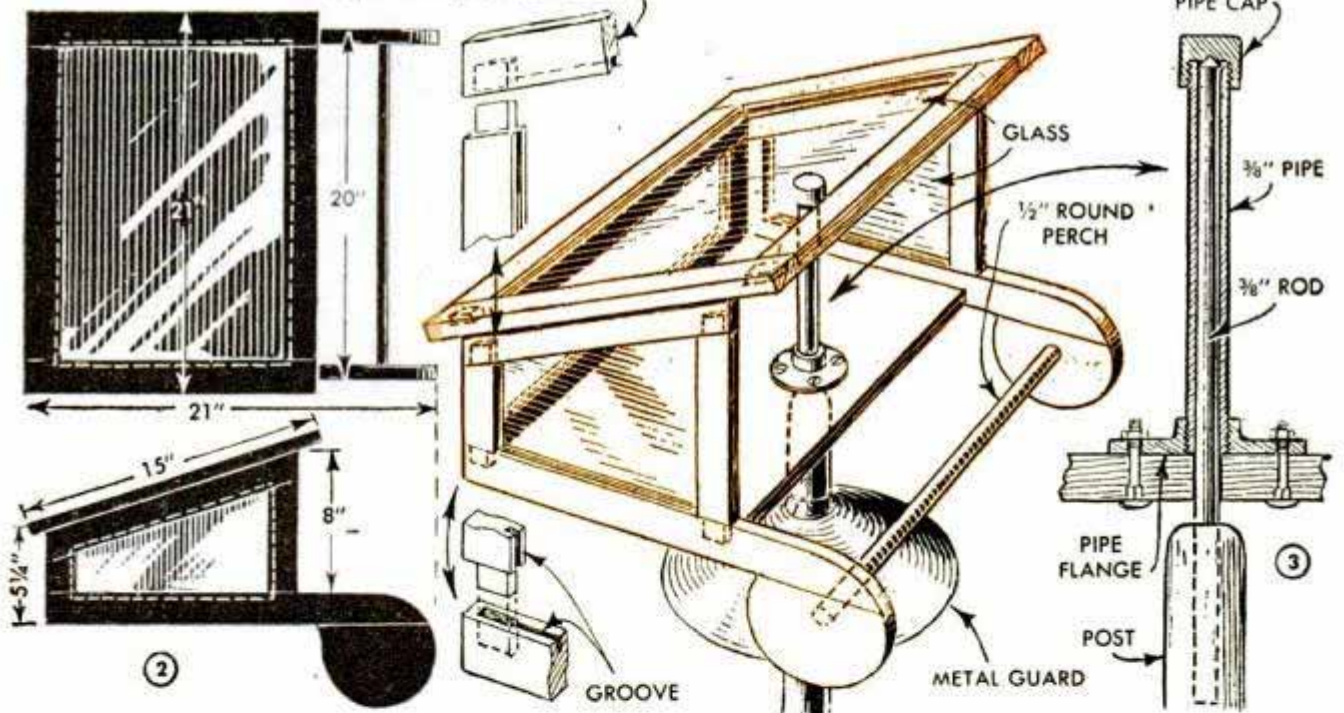
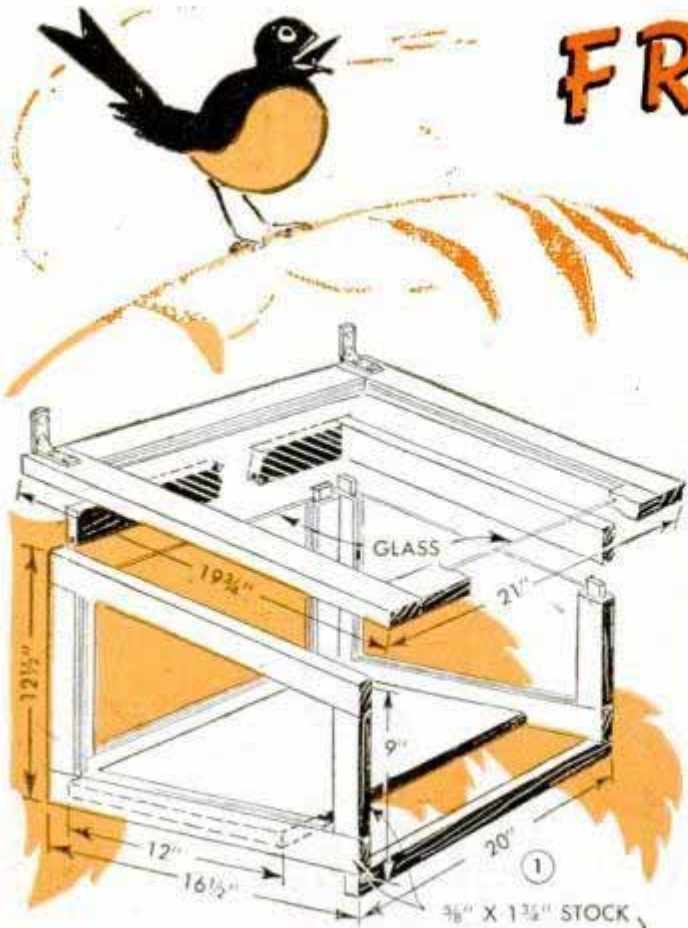
MANY valuable shrubs, plants and small ornamental trees require some protection from cold winds and drifting snows if they are to survive the winter without damage. Species which are hardy in protected locations during average winters will often winterkill when fully exposed to cold winds for long periods. Others suffer from freezing and thawing of the bark when exposed alternately to bright sunlight in daytime and the cold of long winter nights. Some plants, particularly evergreens, which are located close to white walls that reflect the sunlight on the foliage while the roots are still frozen in the ground, often suffer from "winter-burn," which dries and withers foliage and twigs.

Single shrubs may be protected by driving stakes around the plant and covering these with burlap as in Fig. 3. The purpose of the burlap "fence" is not to keep out the cold, but to keep the temperature more nearly uniform. Tender shrubs, such as English boxwood, need this protection in the colder climates. Sheets of cardboard cut from large packing cartons and arranged about the plants as in Fig. 2 make a good windbreak or a sunshade when necessary. Other materials suitable for making windbreaks are coarse straw, tall grass and dry cornstalks. Small trees may be wrapped with a thick covering of tough grass, Fig. 6, or a long windbreak may be made by using posts and supporting strips to hold the material in place as in Fig. 4.

Low ornamental trees can be wrapped with burlap and the top pruned back to such an extent that it also can be covered with a protecting layer of the same material, Fig. 5. Heavy paper may be used for this purpose, but it must be tied securely in place. When wrapping shrubs, be careful not to break the tender twigs or stems.

Rustic pole fences, Fig. 1, snow fences or latticed frameworks make good two or three-sided windbreaks. Where a low shrub planting covers considerable area, an open board fence along the windward side will offer some protection and also will help to drift protective snow over the planting. Often a pole fence, such as that in Fig. 1, along one side of a hedge or other planting will be sufficient protection. A thin coating of dry straw spread uniformly and held down with light woven wire or poultry netting makes a good covering for hedges or other low growth which require protection from wind and cold. In some locations a sunshade is more important than a covering or even a windbreak. This is especially true on the south side of a white wall or on any southern slope or exposure where heat from the midday sun raises the temperature above freezing for several hours during the day. Evergreens of most varieties never become entirely dormant; some growth takes place the year 'round. After a dry fall water evergreens before the ground freezes. If soil around the roots freezes "dry" the plant is very apt to suffer.

FREE LUNCH



Providing abundant free lunches by means of a feeder will induce many types of birds to remain with you all winter. Feed scattered on the ground not only brings the birds down where they are easy prey for cats, but is wasteful and invites rats and mice. The two types of feeders shown will serve most birds which remain during the winter. The weathervane type is an all-purpose feeder that rotates so that the open end is always away from the wind. The window-sill type was made primarily for cardinals.

The sill-type feeder, Fig. 1, is nothing more than a glass-paneled box open on one side and having a sloped top and a wood bottom. On the weathervane feeder, which is of similar size and shape, the vanes are glued to the underside of the bottom members as indicated in Fig. 2. It is best not to extend the bottom of either feeder beyond the glass top as any projection beyond the top will catch the snow.

The weathervane feeder is set on a post which has a pointed rod in the upper end. This fits into a pipe assembly attached to the bottom of the feeder as in Fig. 3 and located so that the feeder balances on the rod. The pointed end of the rod resting in a shallow countersunk hole in the pipe cap provides a needle-point bearing. Cats and other climbing animals are kept from the feeder by a metal guard.

Carved Letter Opener Is Cut From Rosewood

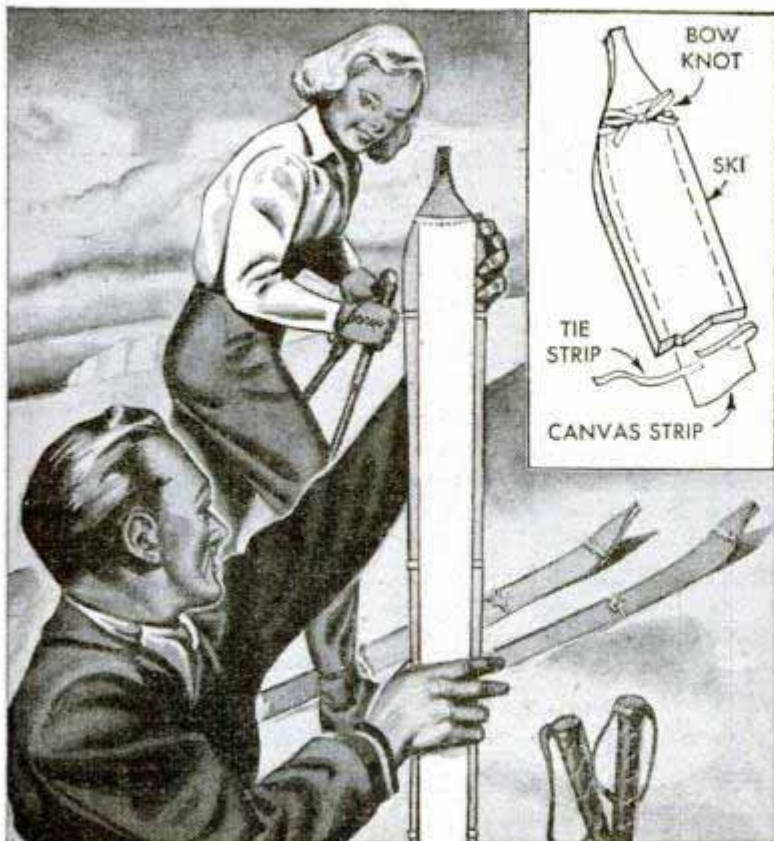
Although this particular letter opener was carved from South American rosewood, any similar species possessing fine grain and deep color will be satisfactory. Or stain may be used where the grain is desirable but color is lacking. A block of wood $\frac{1}{2}$ by 2 by 12 in. is about the right size for the opener. Draw two patterns on paper, one for the front and one for the side view. Trace the front on the surface of the wood and cut out the silhouette on a jigsaw. Then do the same for the side view, roughing out the high and low areas. After the blocking-in is complete, touch up the work with a sculptor's rasp. To finish, start with coarse sandpaper and work through progressively finer grades. Then rub in wood filler and, when this has hardened, apply a wax finish to give the letter opener the proper highlights.



If a high gloss is desired; apply several thin coats of shellac without waxing.

Simon S. Palestrant, New York.

Canvas Strips Tied on Bottom of Skis Aid Uphill Climbing



You can climb steep slopes without herringboning by fastening a homemade canvas strip to the bottom of each ski. The canvas should be an inch less than the width of the ski and should run almost the entire length. Cloth tapes are sewed to the canvas at regular intervals and the strip is tied to the ski with bow knots. When the top of the hill is reached, remove the strips and you're set for the downhill run. — Ormal I. Sprungman, San Diego, Calif.

Inexpensive Wood Filler

When it is desired to stain or color a common wood to imitate a more expensive one, coat the entire surface with thin hot glue and when dry rub it with fine sandpaper. The glue will prevent the stain from penetrating the soft parts of the wood and rendering an uneven color.



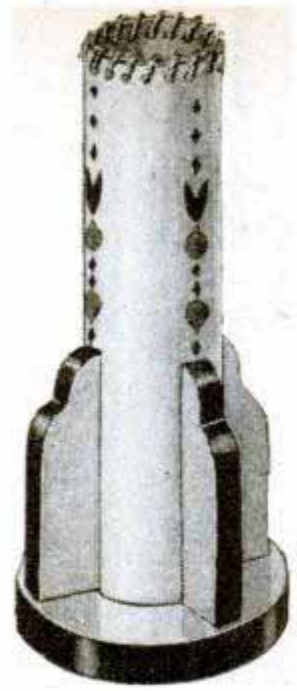
STRAW SERVER

Dapper Dan purposely "blew his top" to let you put soda straws in his stovepipe hat. Make him from a tube 8 in. long and see that the brim of his hat fits snugly around the tube, 3 in. from the top. He's attached to a circular base by a disk nailed to the top, and then dolled up with a sporty polka-dot tie. His features can be applied with a wax crayon and the rest done in water colors as suggested below. Finish with clear shellac and let dry



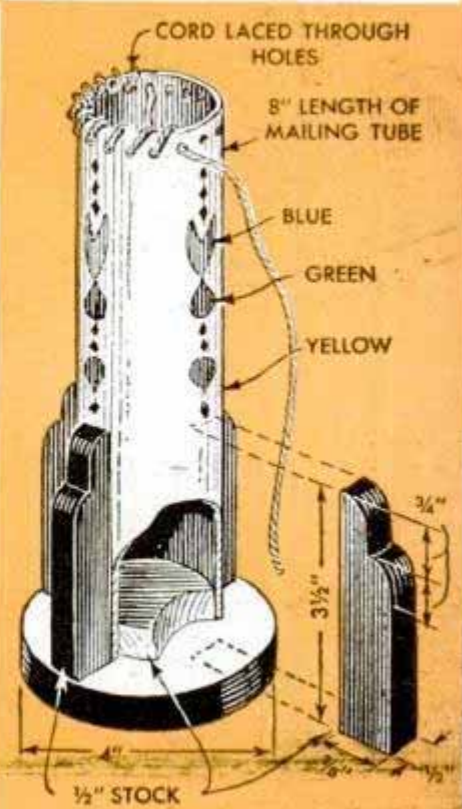
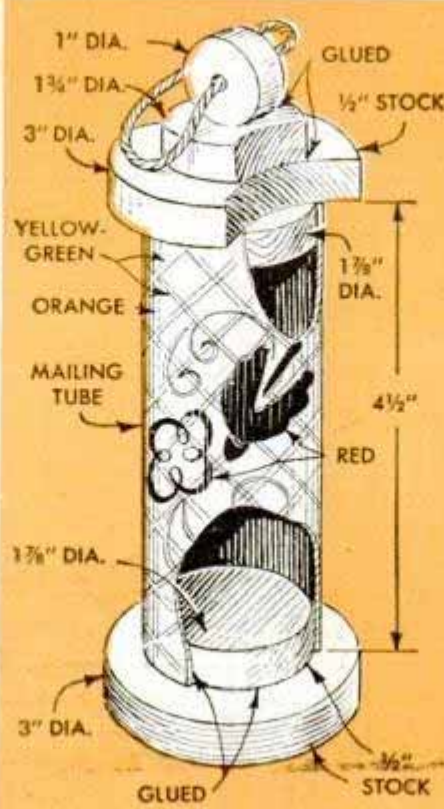
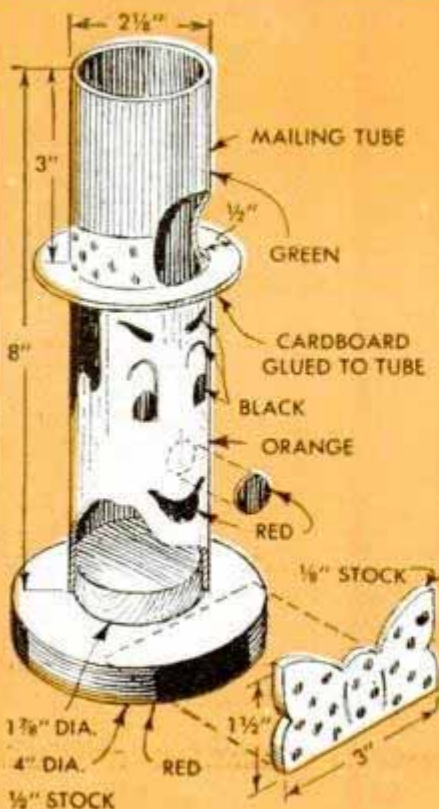
CIGARETTE BOX

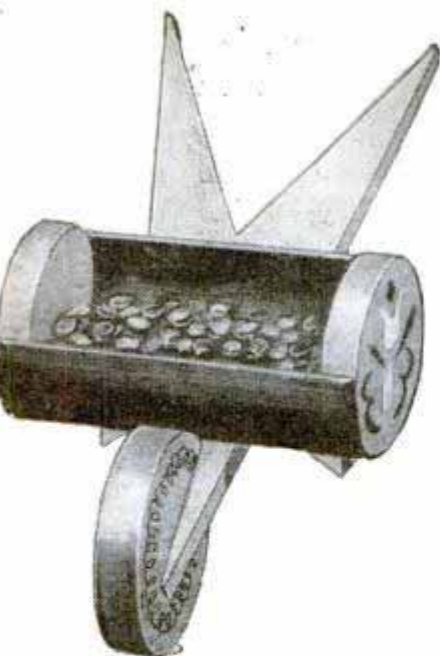
Treat your friends to a smoke from this novel cigarette box. The lower end of the tube is capped with a two-part base the same as Dapper Dan. The lid is built up of 4 disks, the topmost one being drilled for a cord and set on edge. A screw driven up from the bottom fastens all 4 disks together. The design and cross-hatching are drawn with wax crayons and then the background is done in water colors. Seal the colors with a coat of shellac



ARTIFICIAL FLOWER VASE

Just the thing to hold paper flowers. You start by making a two-piece base like you did for the others. The tube sets over the top disk of the base and is glued or nailed to it. Four side supports are spaced equidistantly around the tube and fastened to the base with brads. Then holes are punched around the upper edge of the tube and laced with a cord to give a finish. Wax crayons color the side pieces; the tube is painted with water colors





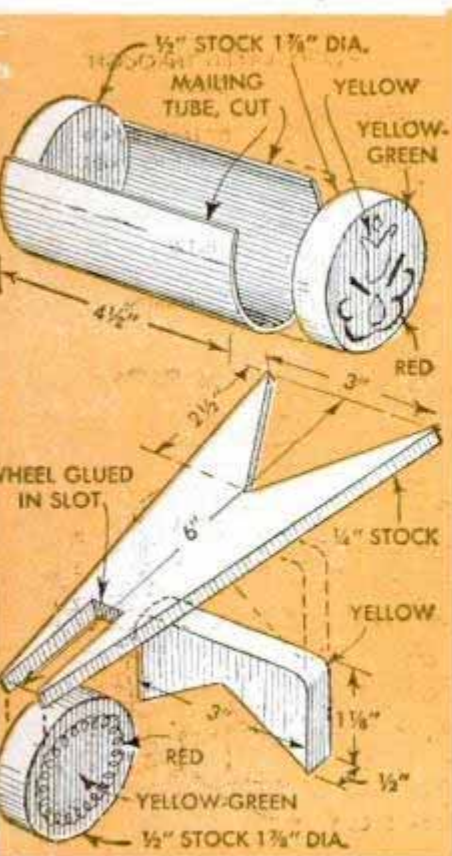
CANDY AND NUT TRAY

Candy by the wheelbarrow—or you may put this little novelty to work as a cigarette holder. A length of mailing tube, cut as shown and fitted with wooden ends, forms the hopper. The rest of the cart is made of scraps of $\frac{1}{4}$ and $\frac{1}{2}$ -in. pine. The wheel can be made to turn or it can be simply glued in the slotted end. Draw in the flower designs with yellow and red crayons and give the rest of the work a coat of yellow water-color paint

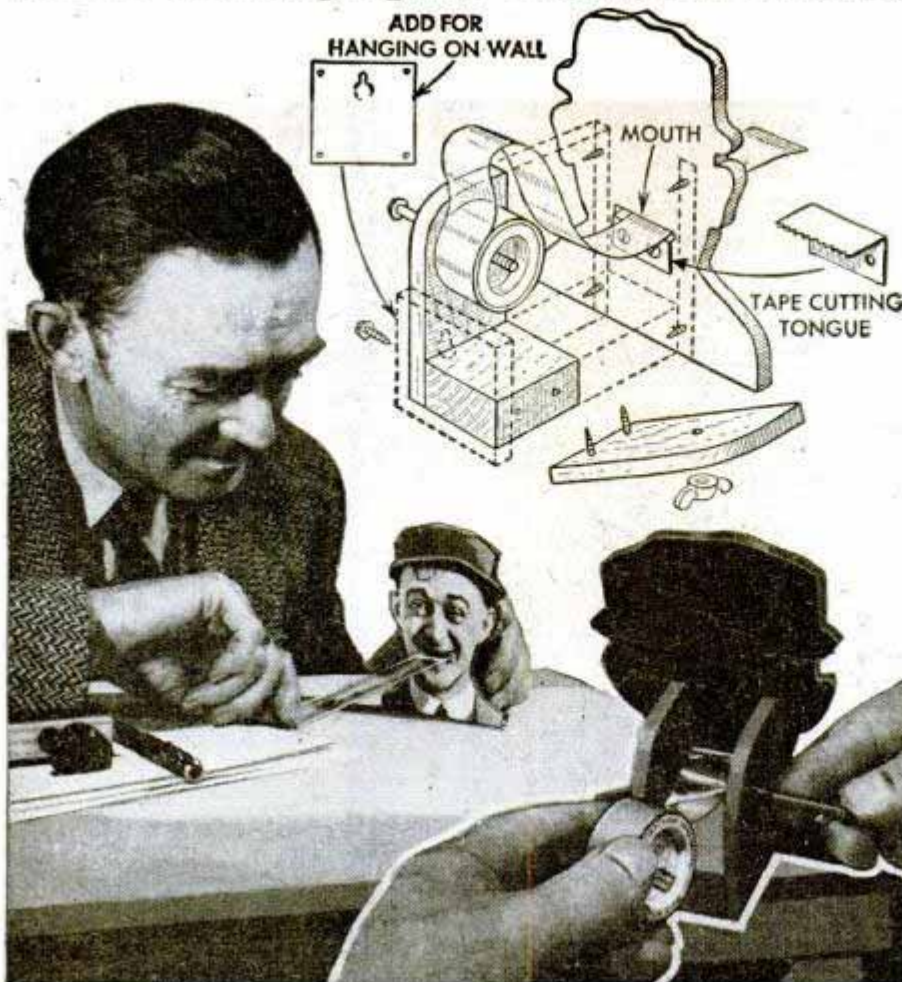
MAILING TUBE NOVELTIES

By Roberta L. Fairall

WITH a few paper mailing tubes, some scrap wood and a little ingenuity you'll be surprised at the number of unusual and attractive novelties that can be made at practically no cost. And with a ready market for such novelties here's your chance to cash in. Wax crayons and water colors are used to decorate the novelties, after which they are finished with clear shellac to seal the colors. The four examples presented here show what can be done and will give you a start. Notice in each case that the novelty is built around a piece of mailing tube. Bases are of scrap wood and, if desired, you could perhaps incorporate plastic. If you have a lathe, you'll be able to turn out perfect disks for the bases in a jiffy, or you may find that you can do better by cutting them on a scrollsaw, sawing several at a time, and then smoothing the edges with sandpaper or a file. Choice pieces of scrap wood, such as walnut, maple or cherry, could be used and finished in their natural color with a coat of shellac or varnish. Quick-drying lacquers can be used to speed the painting. If you size the paper tubes first with a thin wash coat of clear lacquer or shellac, the paint will not be absorbed as readily. Another finishing method is flocking. Flock can be had in a variety of colors and is simply sifted onto the work after it is coated with glue. The excess flock is shaken off and re-used. The finish obtained is a velvety texture resembling cloth and gives a professional looking job. Natural or dyed sawdust sprinkled on a tacky surface and pressed with your fingers will also give the work a novel finish.



Novel Photographic Cutout Is Cellulose-Tape Dispenser

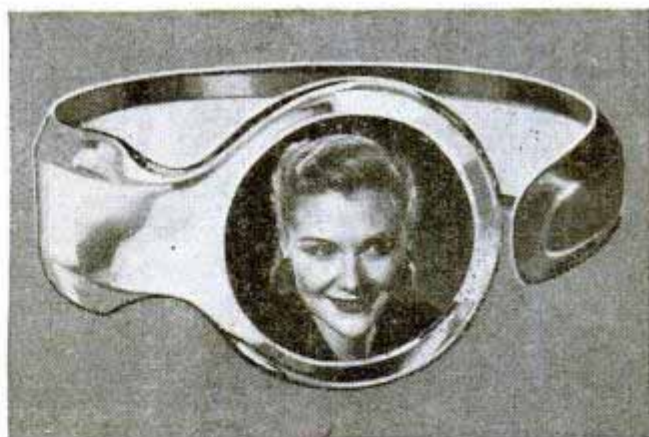


Any portrait can be used to make one of these novelty holders for cellulose tape, but a comic picture is more amusing. The tape is pulled from the mouth and torn off on the saw-tooth edge of the metal "tongue." Glue the picture to a piece of thin plywood and cut out the head with a scrollsaw. The two side pieces and spacer block are screwed to the panel as shown in the upper right-hand detail. The lower right-hand illustration shows how the tape is held in the holder. Cut the tongue from a piece of thin steel or brass and notch one end. Then fasten it so the notched end projects through the mouth. When desired, the holder can be made to hang from the wall if the hanger indicated by the dotted lines is added.

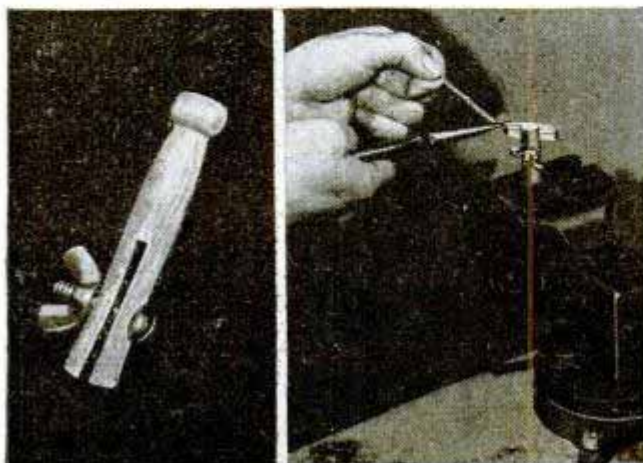
Attractive Plastic Photo Bracelet Made From Lens and Letter Opener

Made from either a combination lens and letter opener or a plastic scale and lens, this photo bracelet is a novel bit of costume jewelry. Numbers or scale markings are removed with sandpaper and the scale is then formed to the desired shape by immersing it in hot water until it is soft enough to bend. The photo should be cut to fit inside the circular mounting and then glued to the lens with transparent glue. The plastic has sufficient spring so the bracelet can be put on and removed easily.

Wm. Riederich, Flint, Mich.



Clamp to Hold Small Articles Formed by Using Hardwood Clothespin



Handy for holding small articles such as jewelry, trinkets and model parts, this clamp is made from a hardwood clothespin. The ends of the pin are cut off and bolt holes are drilled through the pin as indicated. A bolt is slipped through the holes and fastened with a wing nut and washer.

☐ When making a cedar chest, use cedar that is kiln dried as it is more apt to hold its shape without warping. When cedar is not available for the whole chest, a plain wood chest lined with cedar $\frac{3}{16}$ in. thick generally is satisfactory.

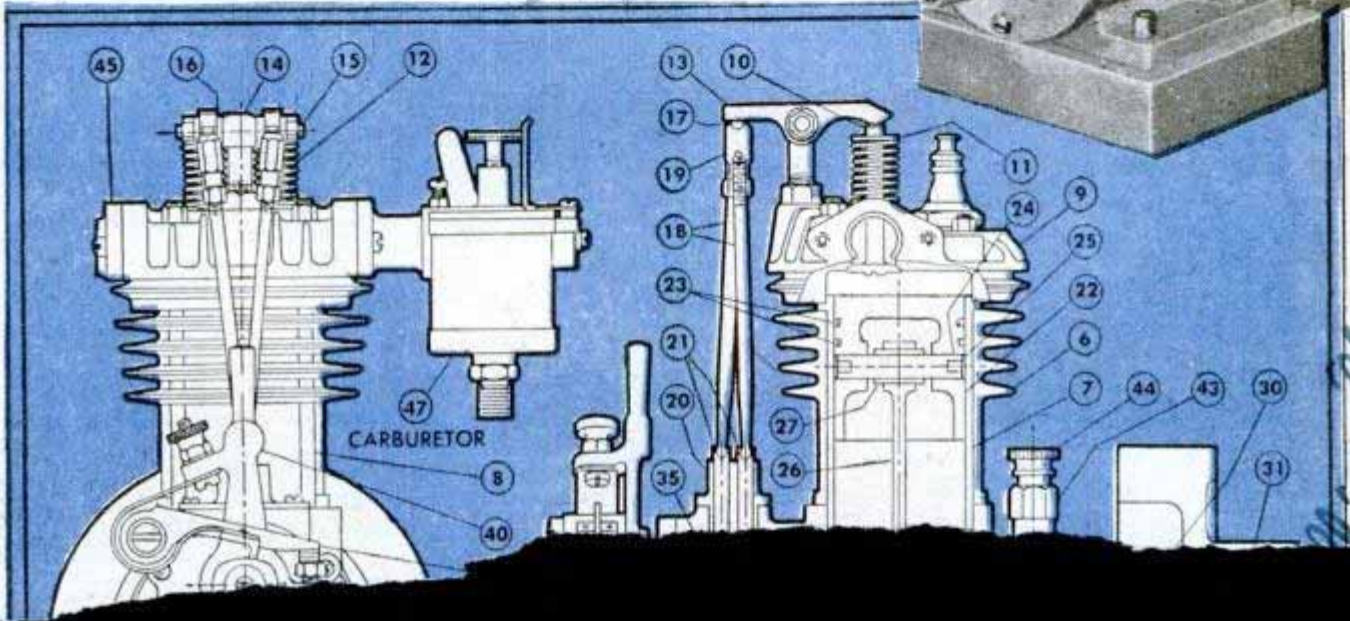
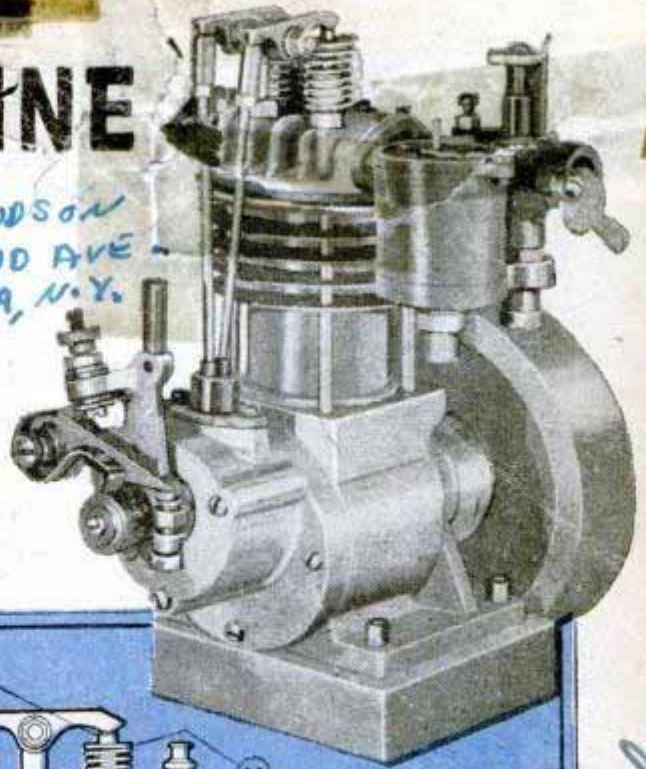
MODEL GAS ENGINE

PART I

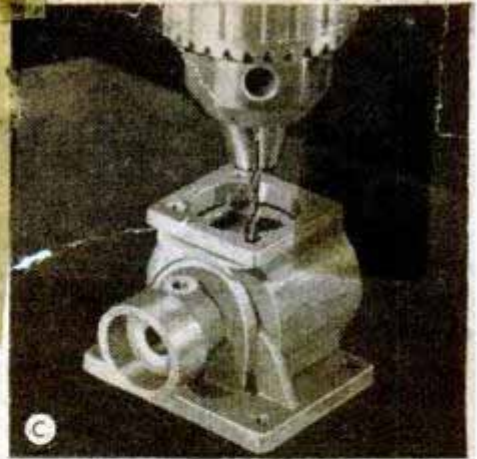
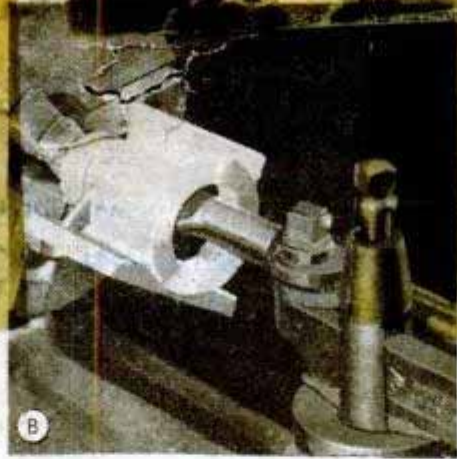
By Gary Moore

c/o C. W. WOODSON
376 OAKWOOD AVE
EAST AURORA, N.Y.

HERE'S something really good in a model gas engine — watchmaking precision, usable power and spectacular high-speed performance packed into just about the smallest model it's practical to build in the four-cycle type. With the exception of the valve mechanism, carburetor, studs, cylinder liner and

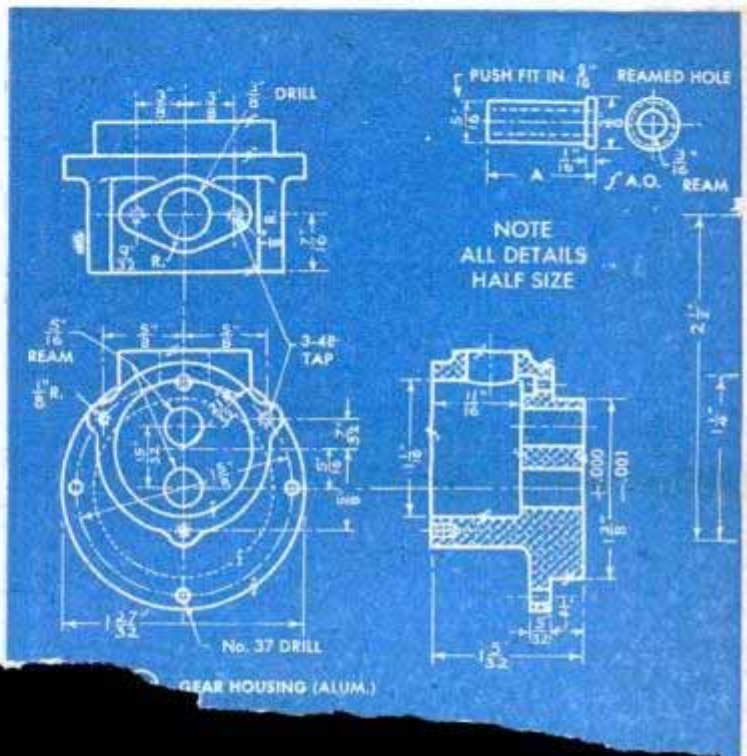


W. Field
St. Louis, Mo.



in photo C. This first stage of the job then ends up as in photo D, which shows the inner crankshaft bearing in place.

The valve-gear housing, Fig. 2, and the cover, Fig. 5, are chucked as in photos E, F and G. The gear housing is faced off and step-machined to a snug snap fit in the crankcase opening. Hold the step dimension closely, as bearing alignment depends largely on its accuracy. Then the work is chucked off center, photo F, and the inside bored out to size. Bore holes for the inner camshaft bushing and the long bushing carrying the floating crank which drives the valve gear. See Figs. 3 and 4 and also the assembly drawing. Note that the outer camshaft bushing is in the gear-housing cover, and that the cover is step-machined. It is well to hold this step dimension to the same limits as that given for the housing.



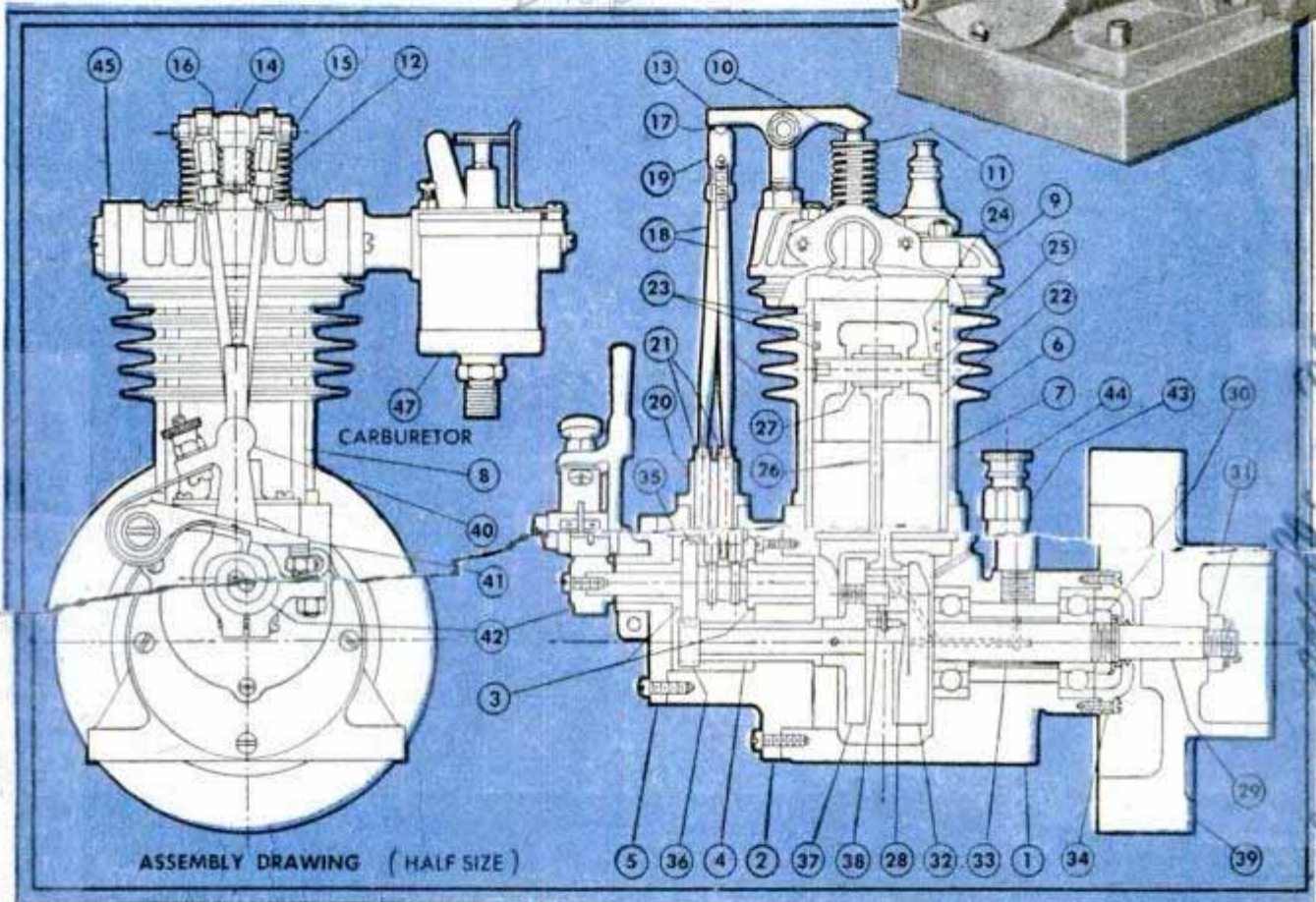
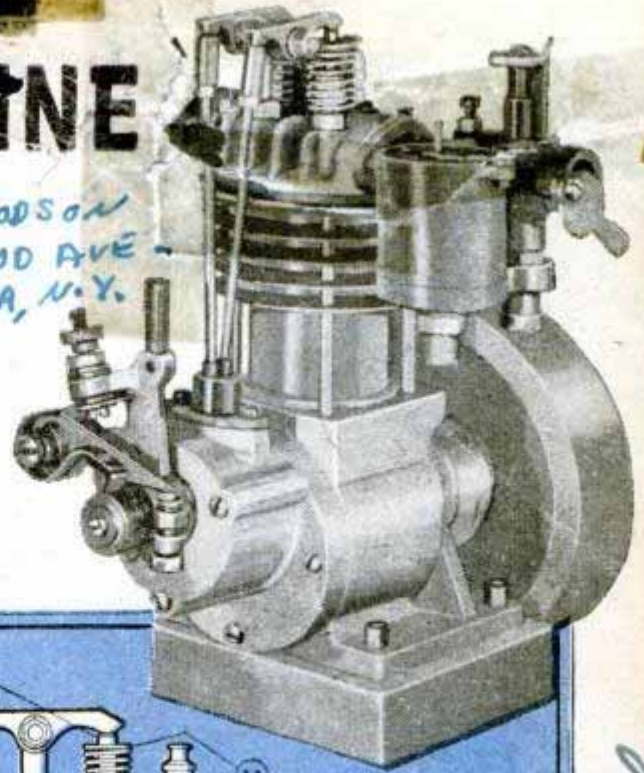
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ASSEMBLY DRAWING (HALF SIZE)

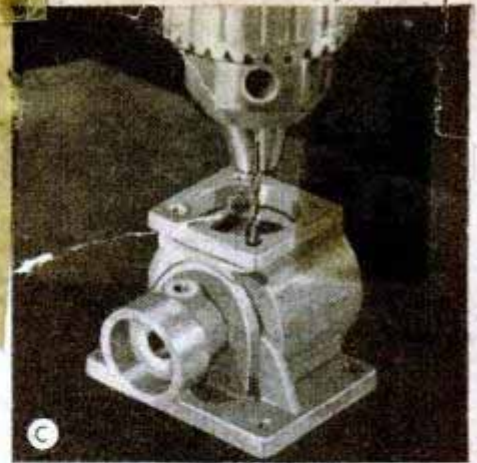
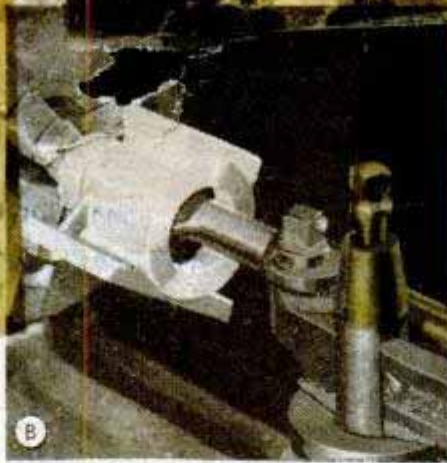
*Elmer H. Woodfield
5700 N. Ogden, Ill.*

certain rotating parts the engine is made wholly of aluminum. A complete set of castings is available. As you can see from the assembly drawing above, the counter-balanced crankshaft is mounted on high-speed angular ball bearings and the outer end of the shaft housing is fitted with an oil seal to prevent loss of the crankcase oil. Note that the key numbers given above correspond to the figure numbers on the detailed parts; that is, part No. 5 above is detailed in Fig. 5. Fig. 46 has been purposely omitted from the assembly drawing. It will be referred to in Part II.

Work begins on the crankcase casting, detailed in Fig. 1 and shown in the four-jaw chuck in photo A. A light facing cut trues

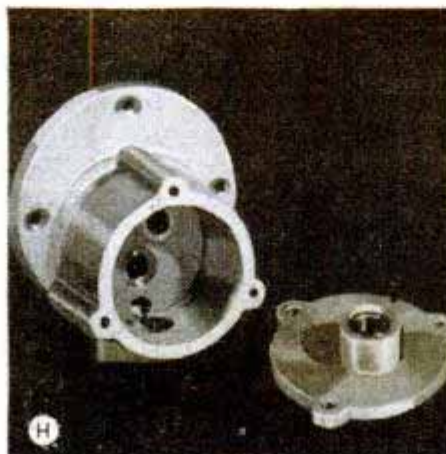
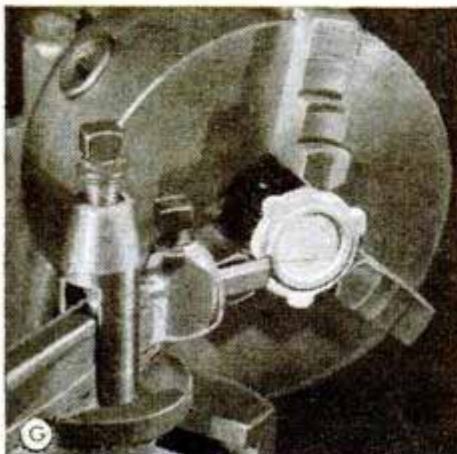
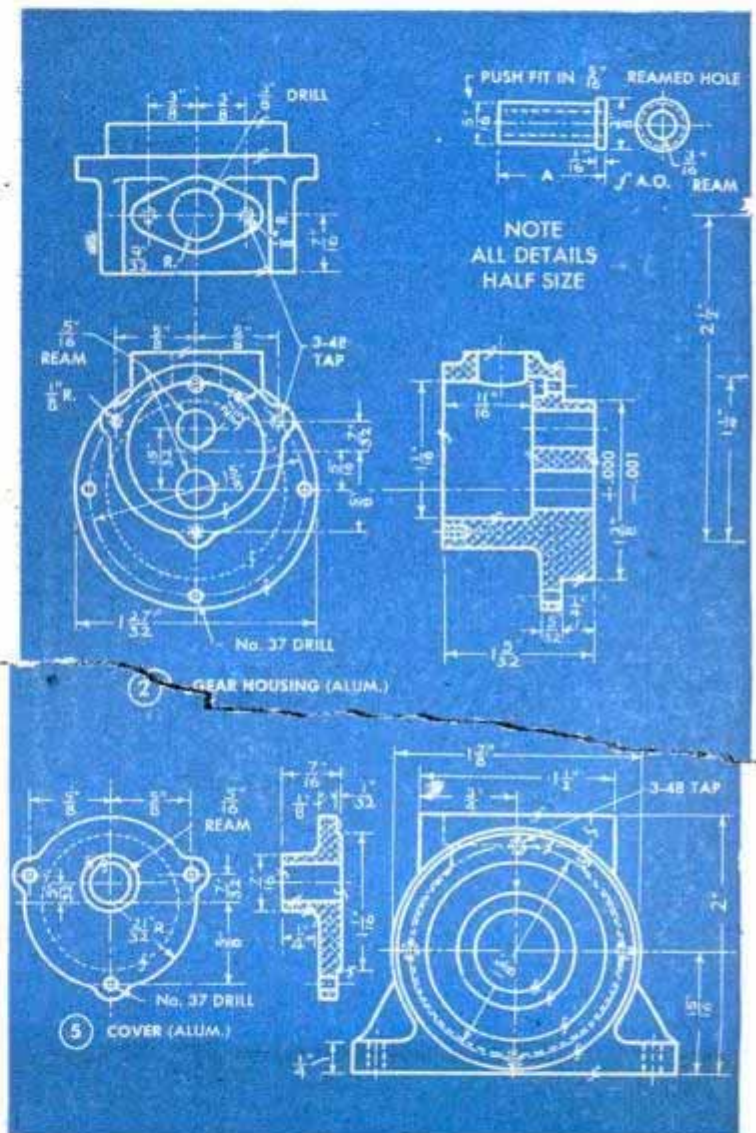
the bottom of the casting and assures that the base will set squarely on any flat surface. Then the casting is reversed in the chuck, the top faced off to the height dimension, and counterbored to take the cylinder liner. Next you set up the job in the three-jaw scroll chuck, using the chucking lug as in photo B. Note that certain dimensions on the crankcase must be held within plus or minus .001 in. The opening for the valve-gear housing is faced and bored to size and the hole for the crankshaft drilled through and reamed. The inner recess for the ball bearing is bored at this stage, but the recess for the outer bearing should be machined with the work mounted on a mandrel. Finally, tap and screw holes are drilled as

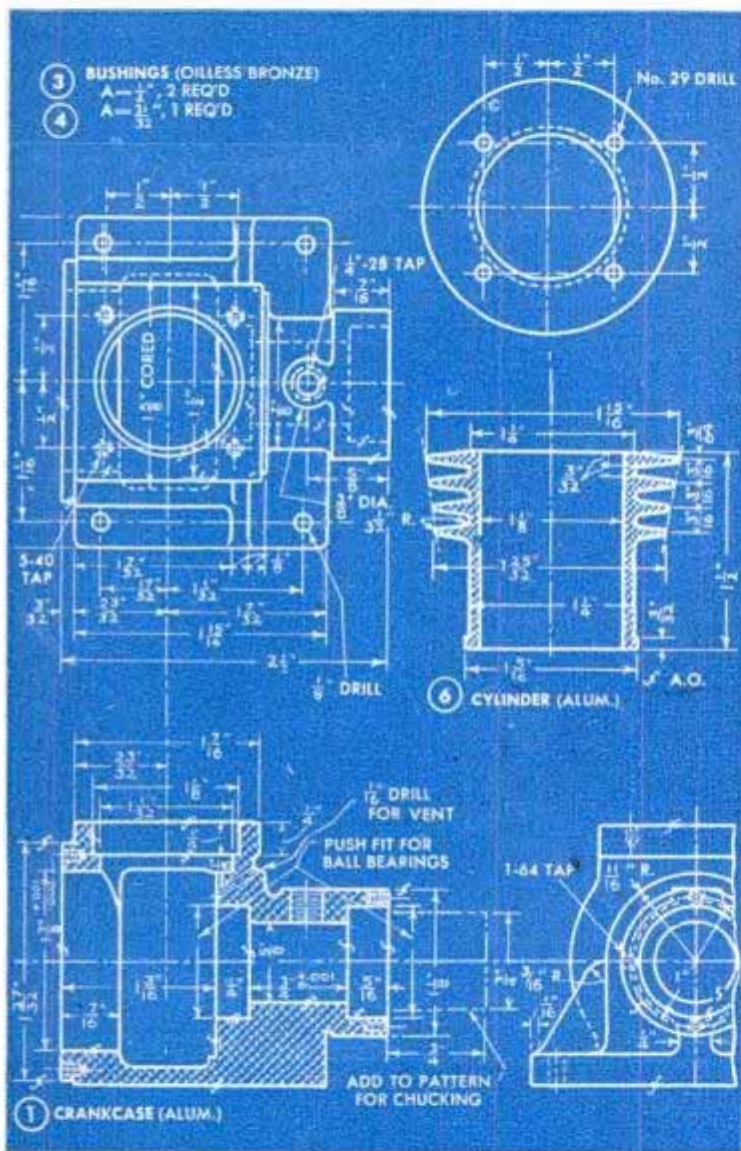
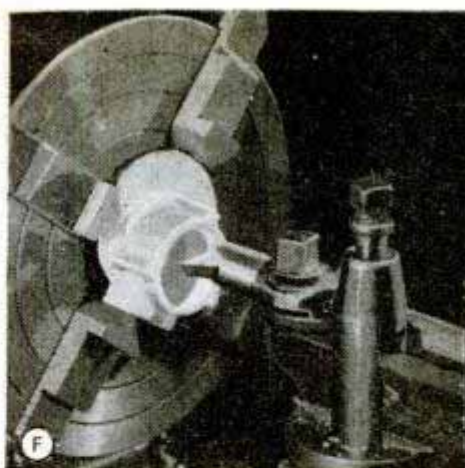
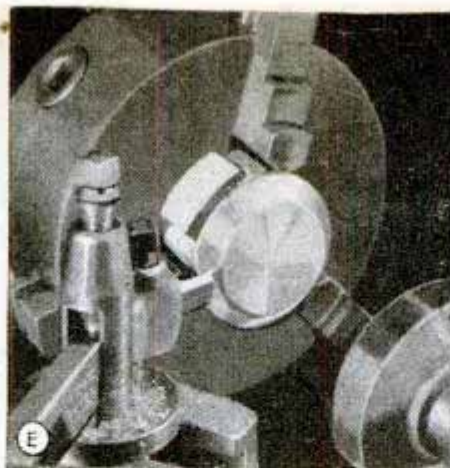
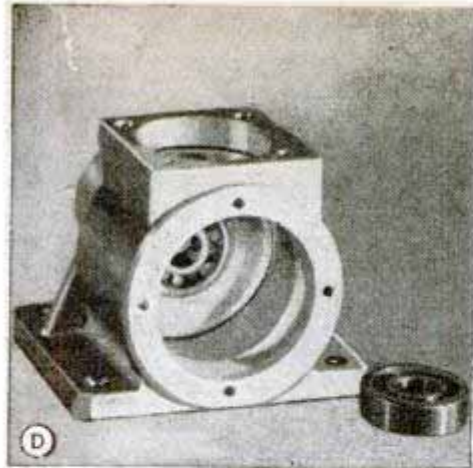
Castings



in photo C. This first stage of the job then ends up as in photo D, which shows the inner crankshaft bearing in place.

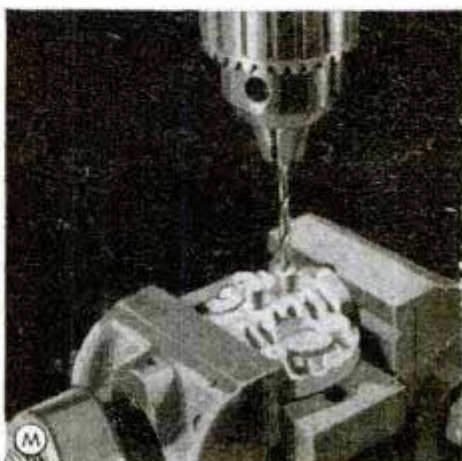
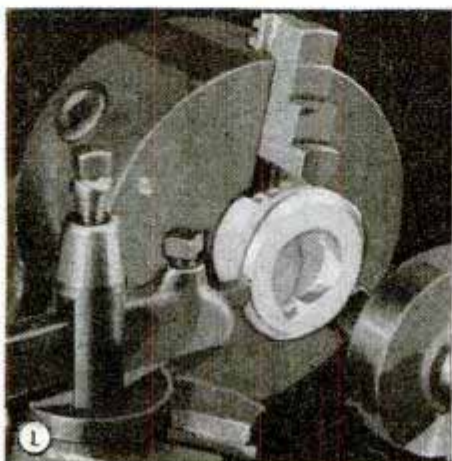
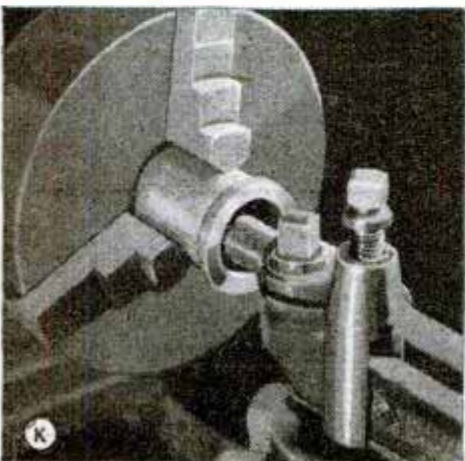
The valve-gear housing, Fig. 2, and the cover, Fig. 5, are chucked as in photos E, F and G. The gear housing is faced off and step-machined to a snug snap fit in the crankcase opening. Hold the step dimension closely, as bearing alignment depends largely on its accuracy. Then the work is chucked off center, photo F, and the inside bored out to size. Bore holes for the inner camshaft bushing and the long bushing carrying the floating crank which drives the valve gear. See Figs. 3 and 4 and also the assembly drawing. Note that the outer camshaft bushing is in the gear-housing cover, and that the cover is step-machined. It is well to hold this step dimension to the same limits as that given for the housing-to-crankcase fit. In rechucking to finish the bearing boss cast on the cover, be sure that the work is backed snugly against the chuck body. Bore and ream for the bushing in the same setup. Drill all screw holes in both parts with a tap drill through the cover into the housing. Then run through the tap-size holes in the cover with a body-size drill. Holes for screws holding the housing to the crankcase are drilled in the same manner. The angular boss for the valve guide is finished by milling or with a hand file. Photo H shows the finished parts with bushings in place.

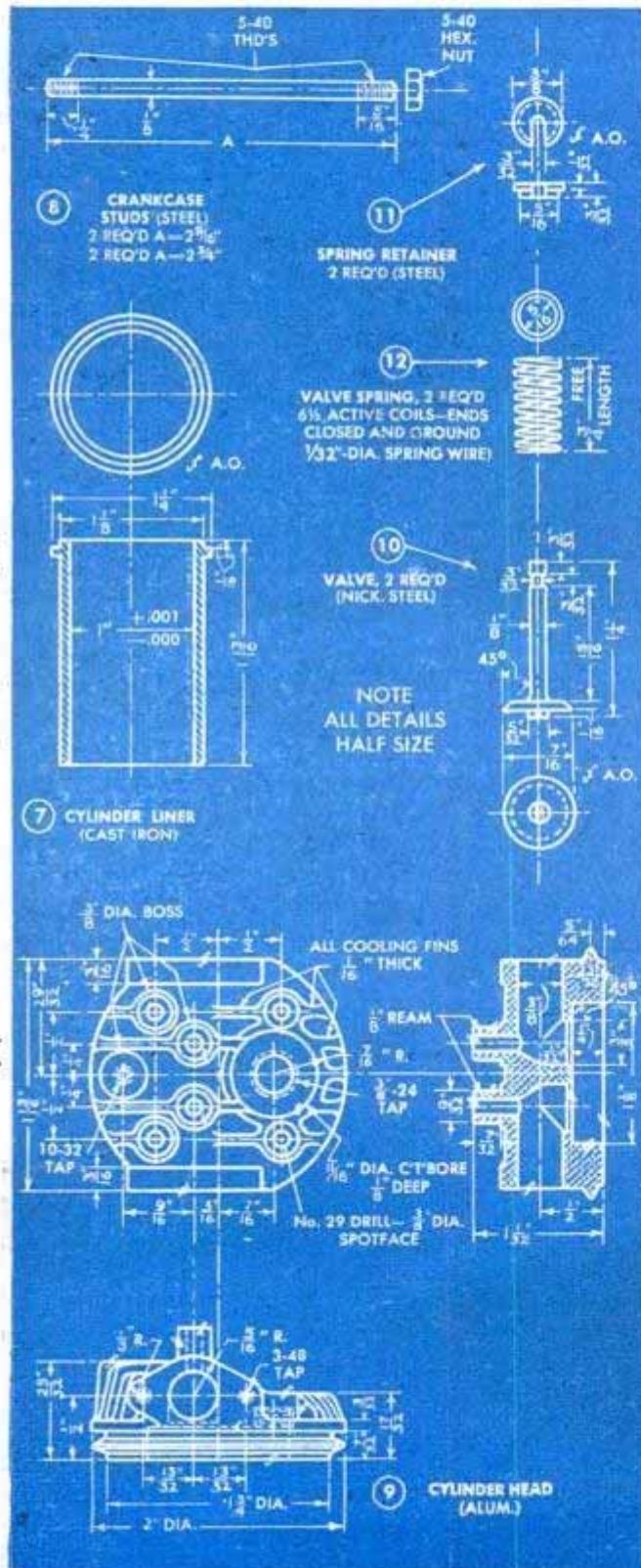
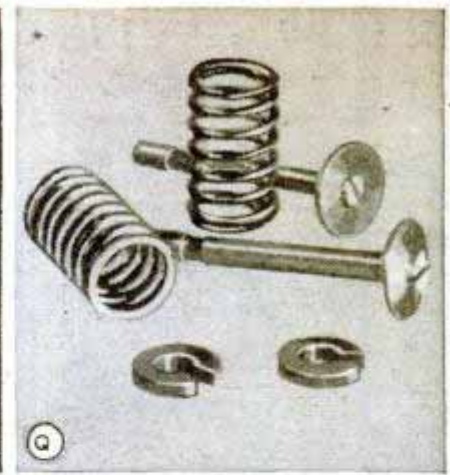
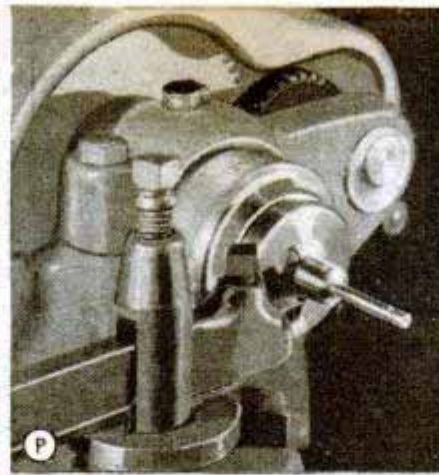




Next comes the cylinder casting, Fig. 6, and the first operation is boring out the barrel to diameter. Then the job is mounted on a mandrel, photo J, the fins are trued up and the lower half of the barrel turned down to the two diameters given, leaving a flange at the lower end. Note the symbol "f.A.O." which, of course, means that the casting is finished all over. Both sides of the fins are machined down to the barrel diameter to assure that they are the same thickness. Sides of the fins are tapered and the cuts end in a $\frac{1}{32}$ -in. radius at the barrel diameter. Spacing between the fins must be exact.

Machining the iron cylinder liner, Fig. 7, is a simple lathe job, but it requires care. For the bore, chuck the work in the three-jaw chuck as in photo K. In this, care must be taken not to clamp the chuck jaws too tightly, for there is some danger of distortion. Easy on the chuck wrench does it. Come down to within about .002 in. or so of the finish dimension with several light roughing cuts, then regrind the tool bit to a sharp V-point in the same manner as you grind a threading tool. Hone the tip so it is just slightly rounded. Set the lathe to the finest power feed and the slowest speed and bore through to the finish dimension. Then, without moving the tool or the feed setting, reverse the power feed and back the tool out. Carefully done, this will give the bore the next thing to a mirror finish.





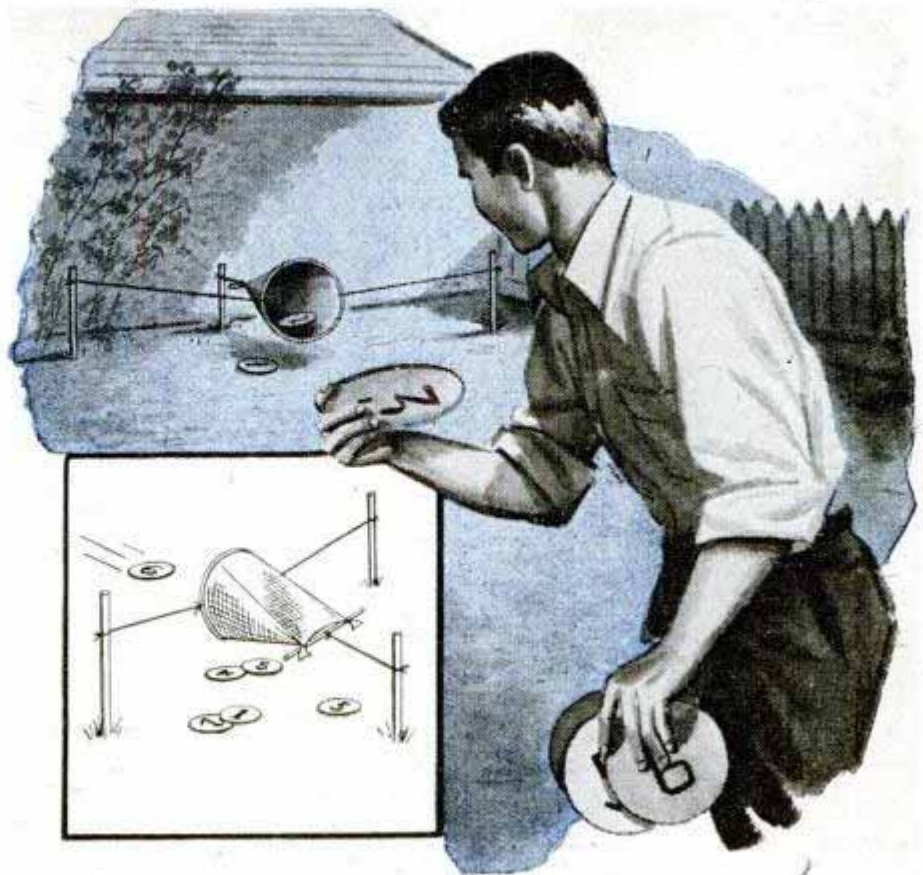
Outer diameters on the liner are machined to dimensions on a mandrel. Be sure that the latter is clean; also, precautions must be taken to prevent the liner from "freezing" on the mandrel. With the parts cold the liner should be a tight drive fit in the cylinder. Heat the cylinder and force the liner into place with a vise. This operation must be done quickly before heat from the cylinder can transfer to the liner.

The cylinder-head casting, Fig. 9, first is chucked bottom out by holding the flat surface of the casting hard against a drill pad mounted in the tailstock spindle. Leave a projection beyond the chuck jaws to allow for machining to fit the cylinder as in photo L. Then face off, bore to depth and turn to the size given. The angular bosses for mounting the carburetor and exhaust pipe can be faced with a shaper or, with care, a hand file. Of course you can use a lathe milling attachment if available. Balance of the work indicated on the head is completed on the drill press as in photo M. Valve seats are carbored with a tool turned from 1/2-in. drill rod, photo N. Cutting teeth are formed into a beveled section of the tool by heat treatment. These teeth cut the valve seats. The tool must be hardened by heating to a bright straw color and quenching in hardening oil. The tool then is reheated slightly to draw the glass hardness so the cutting edges will stand up without chipping. Holes for the stud bolts, valve stems and the single hole for the spark plug are spot-faced with tools made in a similar manner. The valves are turned from 1/2-in. drill rod as in Fig. 10 and photo P. Check to see that both valves seat properly. Finally there are the four long cylinder studs, made from mild steel rod, Fig. 8, and valve springs and retainers, Figs. 11 and 12. The valve springs are wound on a mandrel from ordinary spring wire, both springs being wound as one and later cut apart. Ends are ground flat. With these finished as in photo Q, you're ready for crankshaft, valve gear and remaining parts.

(To be continued)

This Disk-Throwing Game Tests Skill of Players

It looks easy, but when you try to toss the disks into the bag you'll find they can be tricky in flight. The bag, which serves as the target, is a net onion sack or other bag of similar material, the mouth being held open by a barrel hoop cut down to a diameter of 15 to 18 in. This target is suspended between two uprights by a cord or light rope. The two ends of the sack are tied to a piece of broomstick which, in turn, is fastened to a third upright. The disks with which the game is played are 6 in. in diameter; there are six sets of disks numbered from 1 to 6, and each set is painted a different color for identification. Either plywood or pressed board is a suitable material from which to make them. To play the game, each person throws his set from a base line that is 50 ft. from the target. Throwing one set of disks is counted as a round and each



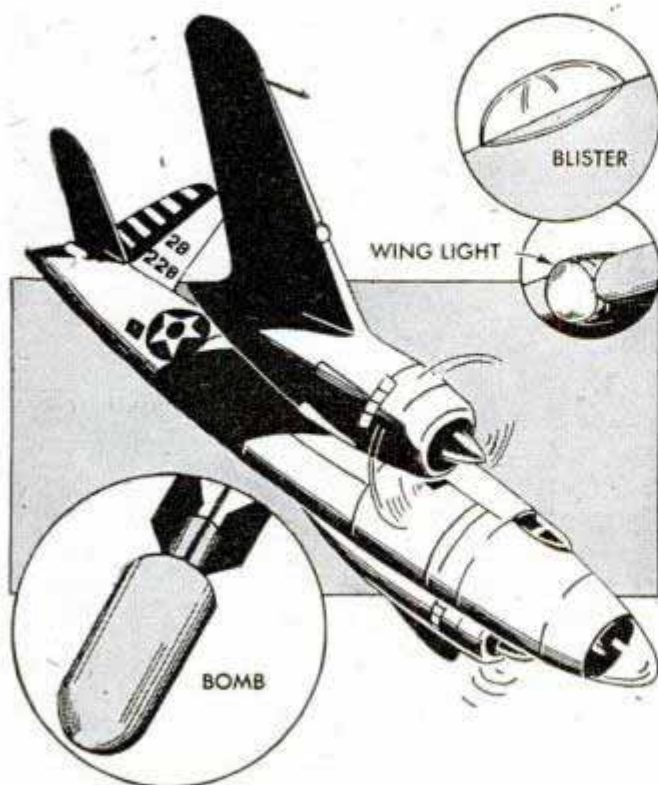
player has two rounds to a game. The numbers on the disks that remain in the bag are added and the high scorer wins the game.—C. L. Meehan, Lakeview, Ont., Can.

Capsules Used on Model Airplane Add Realistic Touch

Capsules of the kind that can be obtained at any drug store will add realism to parts of your model airplane. They are cut and

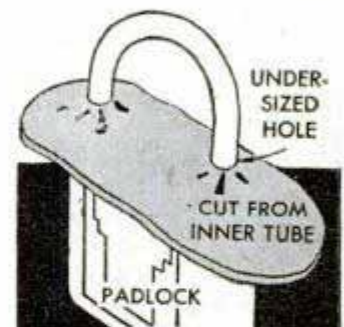
formed to represent blisters, wing lights and, as the lower circular detail indicates, they will also make good bombs.

Fons Conway, Jr., Shamokin, Pa.



Rubber Cover Protects Padlock

Padlocks that are exposed to the weather may rust or freeze so they are no longer usable, or at best, hard to open and close. If an oval piece of inner tube is cut with two holes that fit tightly over the shackles, this will keep out moisture. For padlocks that have a keyhole in the side, the rubber should be cut to lap over the hole.



☐ Clothes can be kept from freezing to the line in cold weather by dipping a cloth in strong salt-water solution and wiping the line with it. Adding a small amount of salt to the last rinse water also will help.

Baby Walker Made With Chair Will Please Small Child



Made from an old cane-bottom chair, this baby walker will please any small child. After the cane is removed the seat frame is covered with oilcloth which is tacked to the underside. A paddle-shaped seat is cut from $\frac{3}{4}$ -in. wood and bolted to the front and rear rungs of the chair. The casters in the legs are the ball-bearing furniture type.—E. T. Gish, Mt. Joy, Pa.

Bolts and Nuts Are Stored in Jar

The double jars in which photographic chemicals are packed are useful for storing small bolts and nuts in your workshop. Labels which are pasted on the jars will serve to identify the contents. The bolts are placed in the bottom jar and the nuts in the top. Kept in this manner, any size is located with a minimum of effort.—D. E. Horn, River Forest, Ill.



Oil Colors Applied to Scratches Touch Up Furniture

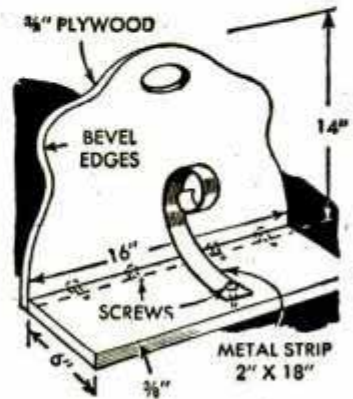
To touch up scratched spots on furniture, obtain a tube of oil color to match the finish, and mix this putty-like pigment with a small amount of turpentine. Apply with a

brush and wipe off with a soft, dry cloth. This will cover all scratches or spots except those that are very deep. These spots should be filled with stick shellac, after which color as it comes from the tube is applied with the tip of your finger. After the color and shellac have hardened, the entire piece is either varnished or shellacked to complete the job.

Francis W. Henry, Pottsville, Pa.

Rack Patterned After Book End

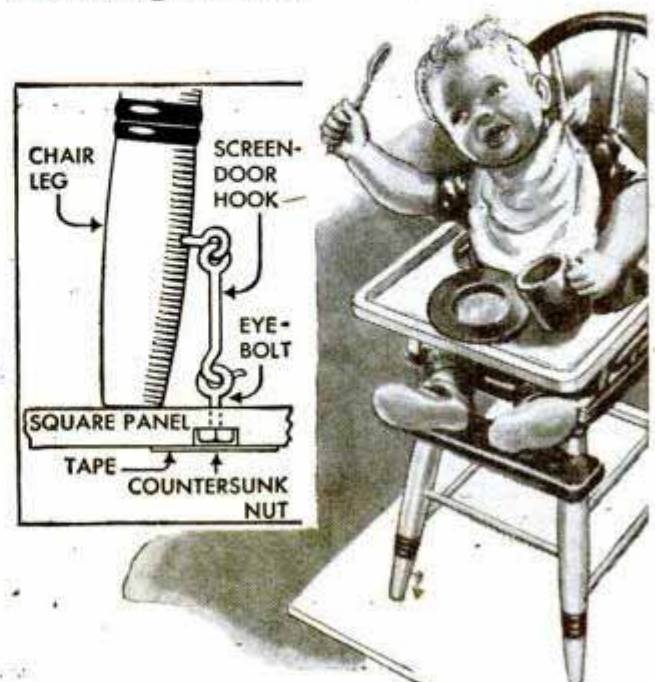
Patterned after a conventional type of book end, this magazine rack will hold a dozen of your favorite magazines. The back and base are of plywood and the back has beveled edges. The metal strip which holds the magazines is formed over an iron pipe. After the assembly is completed and sanded, it can be finished to suit your particular taste.



R. M. Woodbury, Haverhill, Mass.

Panel Hooked to High-Chair Legs Prevents Bad Falls

Many an accident will be prevented if the legs of baby's high chair are fastened to this panel. In size the panel should extend several inches each way beyond the legs of the chair. Screen-door hooks are screwed to the legs and eyes are fastened to the board, which can be of $\frac{3}{8}$ -in. plywood. Nuts holding the eyes should be countersunk and covered with tape to avoid scratching the floor.



ETCH IT!

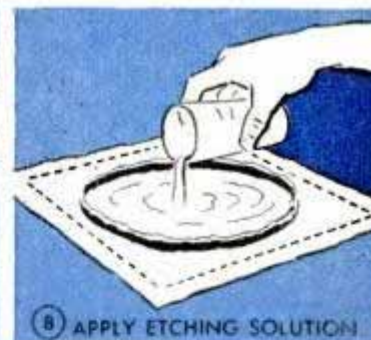
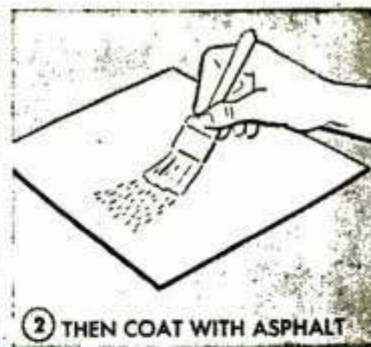
By Nathan Bogoch

UNUSUAL wall plaques can be made by etching designs in sheet brass or copper or thin brass or copper plates of the desired size. When completed, the plaques may be framed or frames can be simulated on the plates by etching suitable designs. The steps in Figs. 1 to 12 inclusive give the general procedure.

After cleaning the work, warm it and apply a smooth coat of asphalt and immediately press lead foil over it. Smooth the foil carefully and then sketch or trace the design onto the foil with a sharp, hard pencil. Cut out the design, cutting through the foil and asphalt to the copper. Scrape off as much of the exposed asphalt as possible and remove what remains with a cloth and turpentine.

Next mold a ring or dam around the design to retain the acid, using a mixture of yellow beeswax, 2 oz., pine resin, 2½ oz., tallow, 1 oz., and turpentine, ½ oz. Simmer this over a low flame. After the dam has been formed, level the work and apply equal parts of hydrochloric acid and nitric acid. When the design has been etched to the desired depth, wash off the acid with copious amounts of warm water, pull off the foil and remove the asphalt by scraping and then washing with turpentine.

If desired, you can color the design. To do this, again warm the work and press colored sealing wax into the etched lines. Excess wax should be scraped off while still soft. The plaque can now be given a mat finish by a second etching, which consists of coating it with acid, immediately applying common salt and then scrubbing with a soft brush, after which the acid and salt are washed off, using plenty of water to remove all traces of acid.



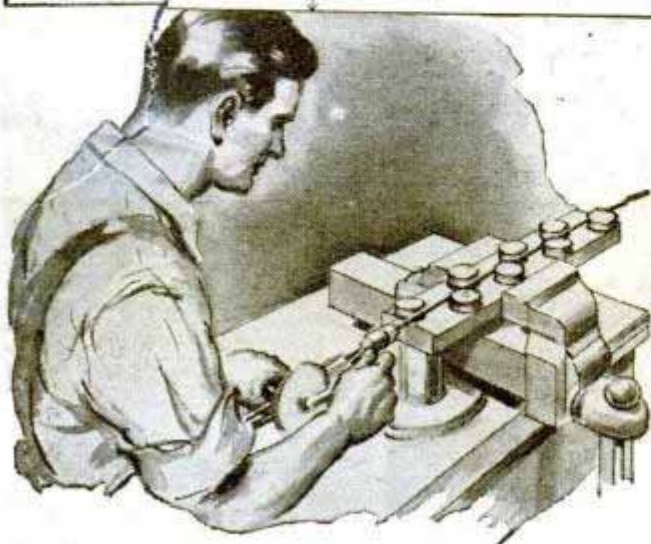
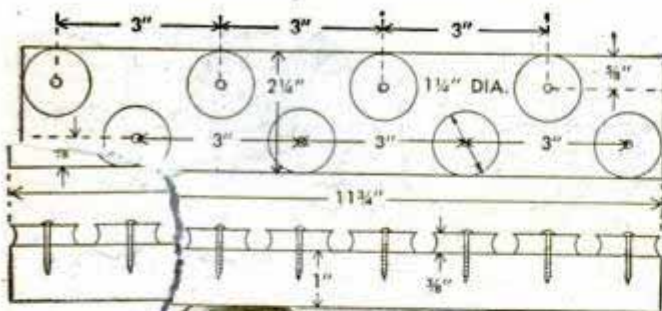
Dog Is Kept Safely in Automobile With Hook Fastened to Leash



To prevent his pet from unexpectedly jumping out of a car, one dog owner fashioned a spring-steel hook to which he attached the dog's leash. The hook slips over the back of the front seat and can be removed when the animal is not in the car.

Straightener Held by Bench Vise Removes Kinks From Wire

Easily made, this wire straightener will perform its job in a jiffy. The round pieces are made from a discarded shovel handle or other 1 1/4-in. dowel. The edges are filed

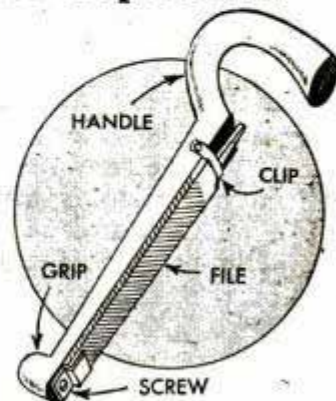


slightly concave to guide the wire. In operation, the straightener is clamped in a bench vise and the piece to be straightened is oiled. It is then threaded between the round pieces and one end is chucked in a hand drill which is rotated slowly as the wire is drawn through. As the rounds are worn, they can be turned to a new position.

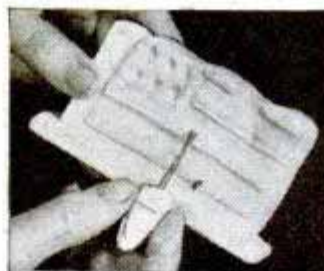
Wallace H. McClay, Pasadena, Calif.

File Has Pistol-Grip Holder

Working with a large file or wood rasp is easier if you fashion the holder shown here. The pistol-grip handle and the knob grip provide a comfortable hold. The file is held with metal clips screwed to the holder.



Nail Polish Used as Protection For Soap Carvings



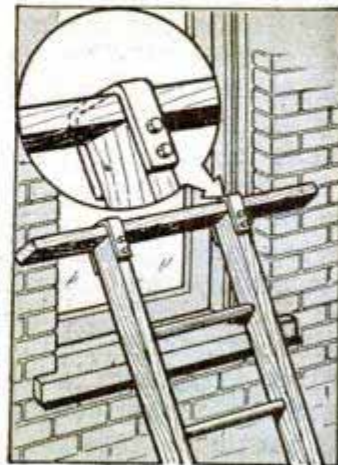
A coating of colorless nail polish will keep that collection of soap carvings clean and new looking. It is applied easily and dust and grime will not adhere to

its surface. To get into small crevices, it may be necessary to use a finer brush than the one that comes with the bottle.

Benj. Nielson, Aurora, Nebr.

Removable Crosspiece on Ladder Simplifies Window Washing

When second-story windows are washed on the outside from an ordinary ladder, the job is both difficult and dangerous because the ladder has to be placed at one side of the window or rest on the sill. From either position it is not easy to reach all parts of the window pane. However, if two pieces of flat iron are bolted over the ends of the ladder and a wood crosspiece inserted, the ladder can be placed directly over the window.



Decorative Ribbon Ornaments Framed Photos



If the appearance of some of your framed photographs becomes monotonous, give them borders of colorful Cellophane ribbon of the type used for tying Christmas packages. Use the narrow ribbon in color combinations of red or blue with gold or silver. Lengths of the ribbon are placed near the edges of the photograph and secured on

the back with cellulose tape. The glass should be laid over the picture before inserting it in the frame so that the ribbons will stay in position. If you can obtain narrow strips of colored cellulose tape, which comes in a variety of bright colors, it can be used in place of the ribbon and will not require any additional adhesive.

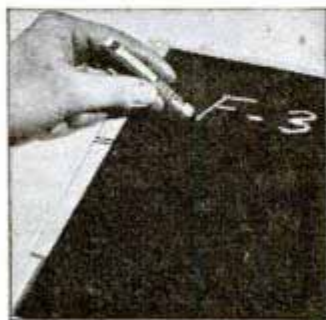
Glass Strip in Developing Tray Keeps Film From Sticking

To prevent cut or pack film from sticking to the bottom during tray development, lay a strip of glass diagonally across the tray so the film will not lie flat on the smooth enamel bottom. This will also provide a finger hold for turning or agitating the film. The edges of the glass should be rounded with fine emery cloth.

David W. Roberts, Bartow, Fla.

Marked Papers Eliminate Waste

Confusion and waste of photographic printing paper occur when the outside envelopes and the black wrapping papers become separated in the box. There is a possibility that the different grades of paper



will become mixed, and printing with the wrong grade means that the sheet is wasted. To avoid this, mark the black wrapper with a white or yellow crayon or marking pencil.

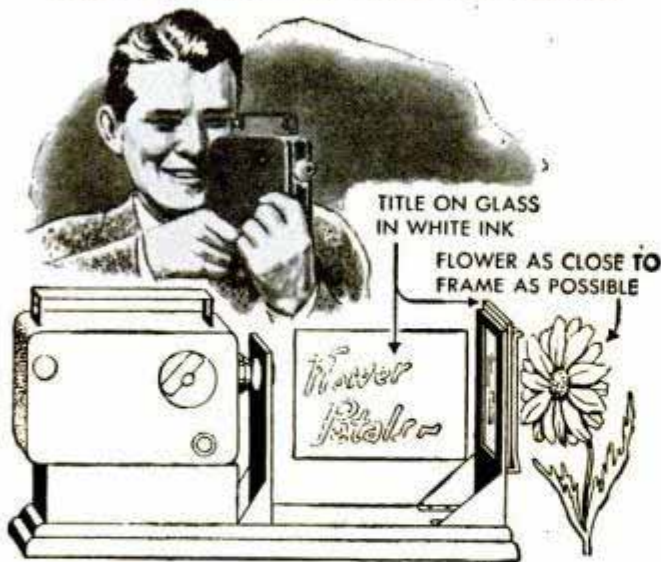
Cracks and chipped places on plastic developing tanks can be repaired and filled by using a mixture of clear plastic cement and lampblack.



Viewing Glass Aids Photographer

A blue viewing glass helps a photographer "see" the picture better since the glass eliminates most of the color from the scene and shows how the picture will look in black and white. Such a glass, large enough to cover both eyes, can be carried in the case with the other camera equipment.

Animated Motion-Picture Titles Photographed Through Glass



For those who want movie titles that are different, here's an unusual effect that can be obtained with a standard titler. A sheet of glass is cut to fit the frame and the lettering is done with white ink. Then, if the subject matter is flowers, for example, several blossoms are placed behind the glass and made to wave as in a breeze. The flowers will be slightly out of focus, but this will serve to increase the artistic effect. Many variations of subject matter are possible.—W. V. Athanas, Ashland, Ore.

Cloth Diffusers for Photofloods Are Attached Easily

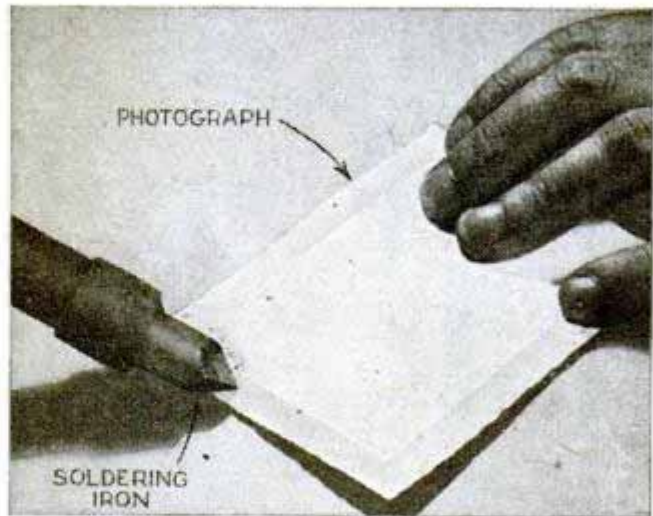
Diffusers for any size of photofloods are made from a piece of cheesecloth and a few spring paper clips. The cloth should be folded to form a triple thickness, although more may be used if desired. The air spaces at the top, bottom and sides serve to pre-



vent overheating. One advantage of this diffuser is that it may be detached and washed when soiled.

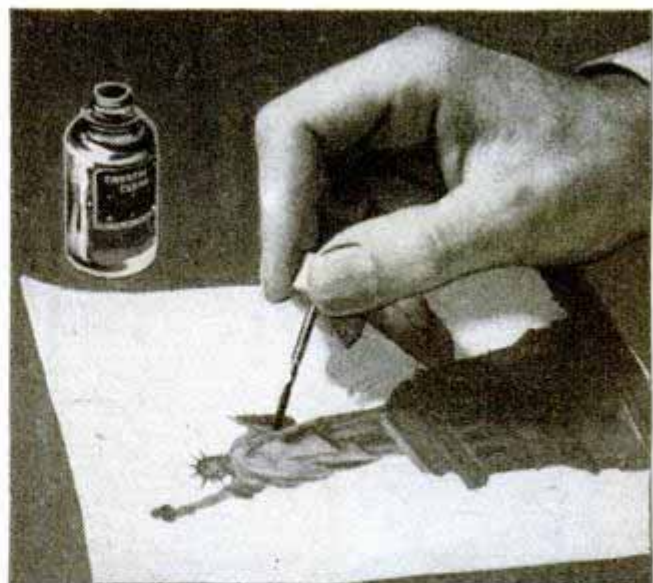
George A. B. Hulbert, Springfield, Mass.

Photographs Recessed With Iron



It is not easy to give a plate-sunk or recessed finish to a glossy photograph without cracking the gloss, but this difficulty can be overcome by using a warm soldering iron. Moisten the back of the print slightly with a damp sponge, lay it face down over a cardboard template of the right size and press around the border with the tip of a soldering iron. The iron should not be so warm that it will discolor the surface of the paper.

Clear Nail Polish Adds Luster To Spotted Glossy Prints

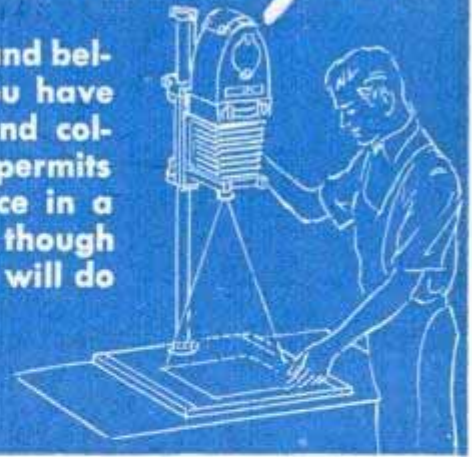


If a glossy print is spotted with small dull areas when it comes off the tin, instead of ferrotyping it again just touch up the dull spots with clear fingernail polish. This dries rapidly to a high luster which matches the finish of the print.

William Swallow, Brooklyn, N. Y.

Camera Becomes Enlarger

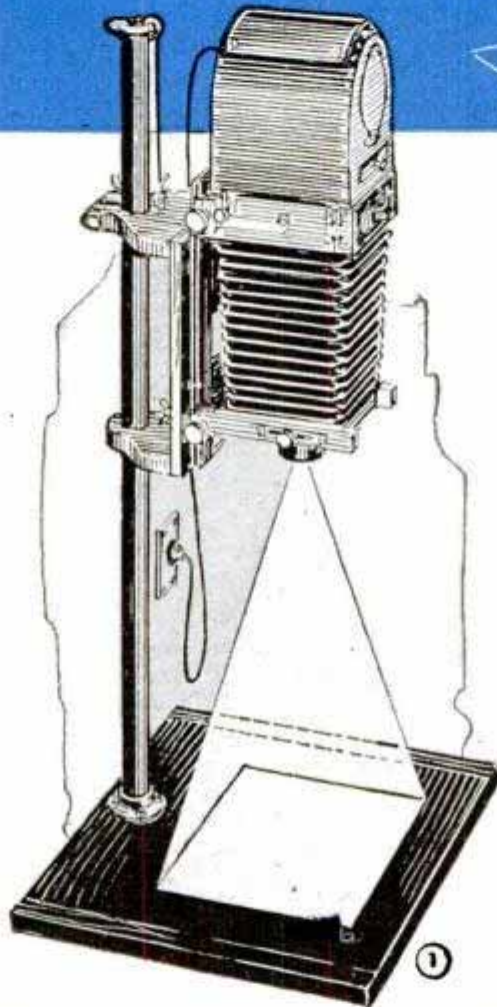
Your camera supplies the lens and bellows for this enlarger — all you have to make is the lamp house and column. Quick-change adapter permits camera to be clamped in place in a jiffy. View camera is preferred, though most any folding-type camera will do



By **Walter B. Ford**

IF YOU have a bellows-type camera, it's likely that it can be used as an enlarger simply by removing the ground glass and constructing a lamp house and column to fit. The enlarger described here, Fig. 1, was made with a 5 by 7-in. view camera, but others can be adapted by altering the size of the lamp housing, column and platform to suit your camera. It may be necessary, in this case, to experiment and determine the height of the standard and the position of the camera in relation to the enlarging board and the focal length of the lens so the negative is properly projected.

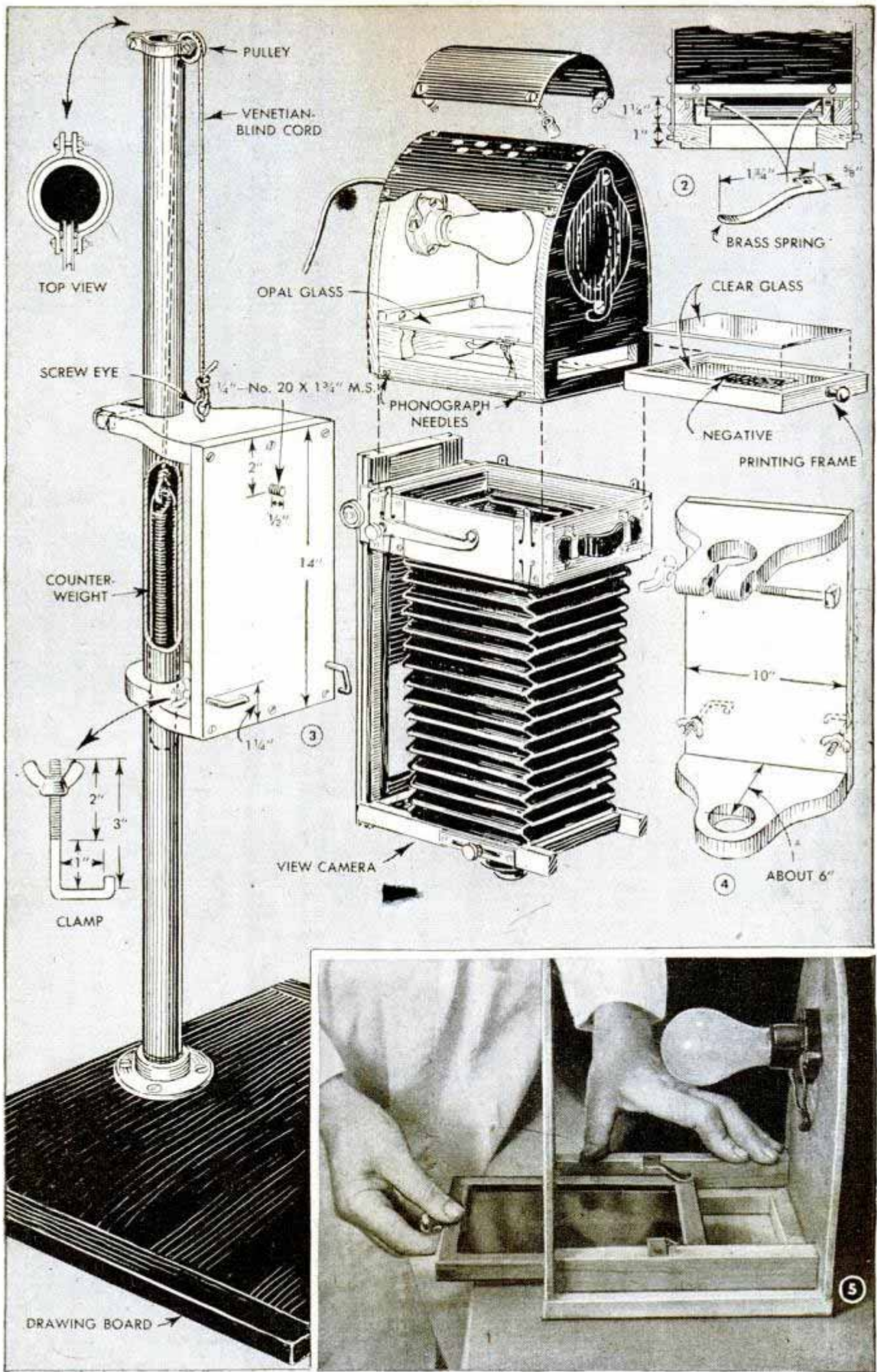
Two pieces of plywood form the ends of the lamp house and are cut in the form of a parabola. Only the part that shapes the contour of the sheet-metal reflector need be a true parabolic curve, however; the rest is straight. Cut a 5-in. circle in one piece and fit it with a sheet-metal access door as indicated in Fig. 2. This is provided for the removal of the lamp. In the same piece cut an opening for the negative holder, which may be a contact printing frame of a size to fit the camera. The lamp base is mounted on the other endpiece and a hole is drilled above the socket for the lamp cord. The lamp should be centered so light is distributed uniformly over the opal glass. This can be checked with a light meter as in Fig. 6. The hardwood sidepieces that serve as guides for the negative holder, Fig. 5, are cut and fitted with spring



clips, right-hand detail of Fig. 2. Place the opal glass and secure it with two small strips on the endpieces. After the ends and sidepieces are assembled, the sheet-metal cover is added. To provide adequate ventilation, holes are drilled in the top. A baffle is provided for the ventilation holes and is held in place with spacers and machine screws. The interior of the house is finished with aluminum paint. After rabbeting the ends and sidepieces to fit the back of the camera, drive in phonograph needles to engage the ground-glass retaining clips. If you use a contact printing frame as a negative holder, Fig. 5, remove the back and

any clips on the sides that may have been used to hold the back in position. A knob is added to remove and insert the holder. Two sheets of plate glass are cut to fit the holder and the negative is carried between them. If desired, a set of masks can be made for different sizes of film down to 35-mm. film. Paint all exterior parts of the lamp house a dull black.

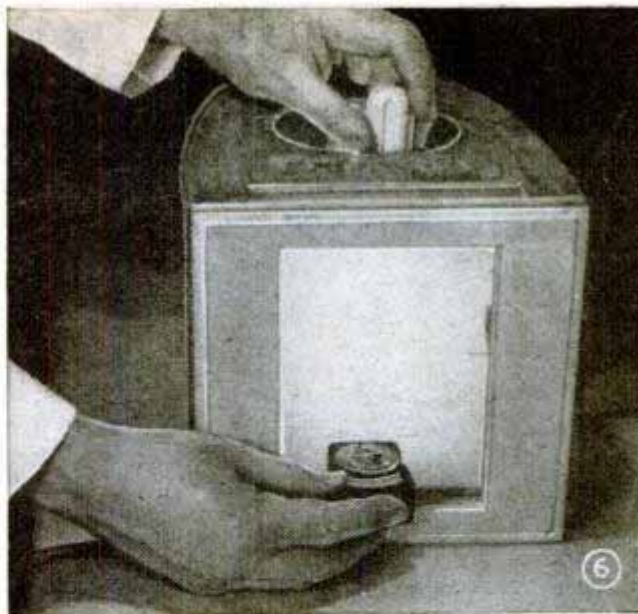
To make the camera platform and column, cut a piece of 1/4-in. pipe—48 in. long in this case—and thread one end. Notch the other end and fit it with a collar and pulley as in the upper detail of Fig. 3. The platform consists of a base and the two endpieces, Fig. 4. The lower piece serves as a guide only, and the upper piece, which is slotted, clamps the platform in position when the wing-nut-and-bolt adjustment is tightened. The camera is held in posi-



tion on the platform by means of a 1/4-in. No. 20 tripod screw, which fits the tripod base, and two adjustable clamps that fit over the bed. Here again it will be necessary to take measurements from your own camera to determine the size of the platform and location of the screw and clamps.

When the platform is attached to the camera, it should be weighed and a lead counterweight made which rides inside the pipe, Fig. 3, using venetian-blind cord to attach it. The weight should be equal to that of the camera and platform. This will make raising and lowering the camera easier. A suitable base for the enlarger is made from a drawing board of the type used by students. A 1 1/4-in. floor flange is screwed to the center of one side. The column is screwed into this. All exposed wood parts should be finished in a dull black color to prevent unwanted light reflections.

Although no particular type of switch is indicated, a snap switch can be installed in the cord, or, to leave both hands free, a foot switch can be used. The latter usually is



preferred. A standard enlarging bulb of the proper size for your lamp house should be used. Any enlarging easel will do as long as it fulfills the requirements of your work and is not too large for the platform.

Handy Shelf Arrangement When Ferrotyping Photoprints

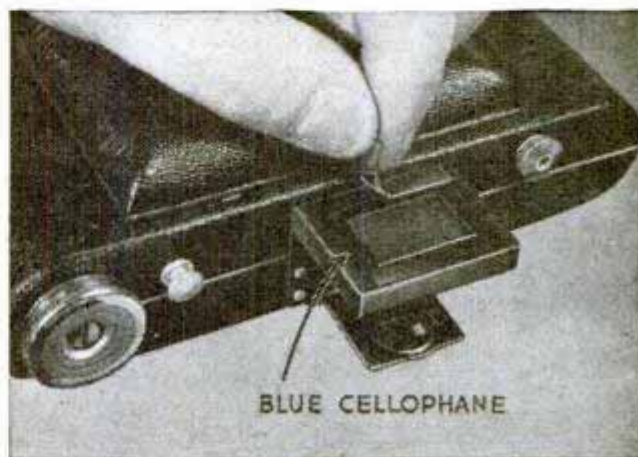


Here's a handy shelf for your ferrotype tin that will eliminate much of the muss and fuss when ferrotyping photoprints. It is made of any suitable hardwood and should be several inches larger than the tin. The shelf is hinged to a board that, in turn, is screwed to the wall. This will permit folding against the wall. The shelf is covered with rubber matting as a protection from the water and it also makes a good backing for the tin. A leg is attached to the lower end of the shelf and this also folds when not in use. A table is placed beneath the shelf and a tray is set on the table to catch the water that drains off the tin. After the prints are squeegeed, the tray is removed and the prints, when dry, will drop onto the table.

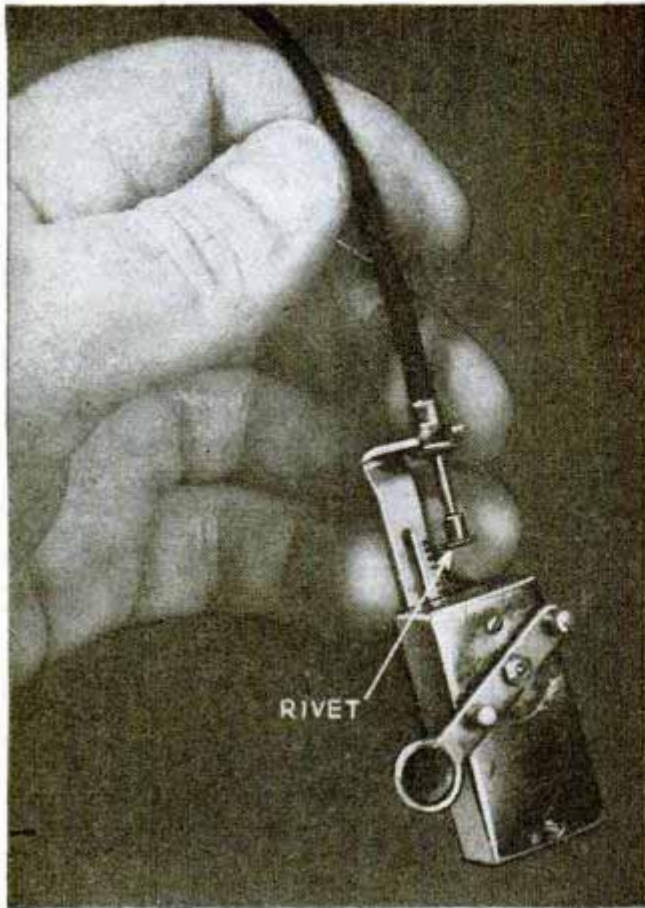
George T. Hewitt, Salem, Ore.

Blue Cellophane Attached to View Finder Eliminates Need for Filter

Many photographers use a blue filter to aid them in judging light values properly. If you have been using such a filter you can eliminate one piece of equipment from your case by making the view finder do double duty, both as a finder and filter. Select a sheet of blue Cellophane that is the correct shade for such a filter and cut a piece that will fit the larger opening in the view finder with no white-light leaks around the edges. The fit should be close as too much white light might affect the evaluation to some extent. The Cellophane is held in place with cellulose tape.



Obtaining Longer Interval With a Photographic Self-Timer



It's possible to obtain a longer delay interval with your photographic self-timer by making a few alterations on the cable release. Cut off the release button so the stem will be as short as possible while still allowing the shutter to be tripped. Then solder a small rivet on the stem to replace the original button. This means that the body will have to travel a greater distance on the timer arm before touching the button and releasing the shutter and, in turn, this will allow you more leeway to get in the picture. Learn to count the seconds exactly so you will know when the shutter will be tripped. Knowing this will be an aid in posing the picture to best advantage.

Cut-Film and Film-Pack Drier

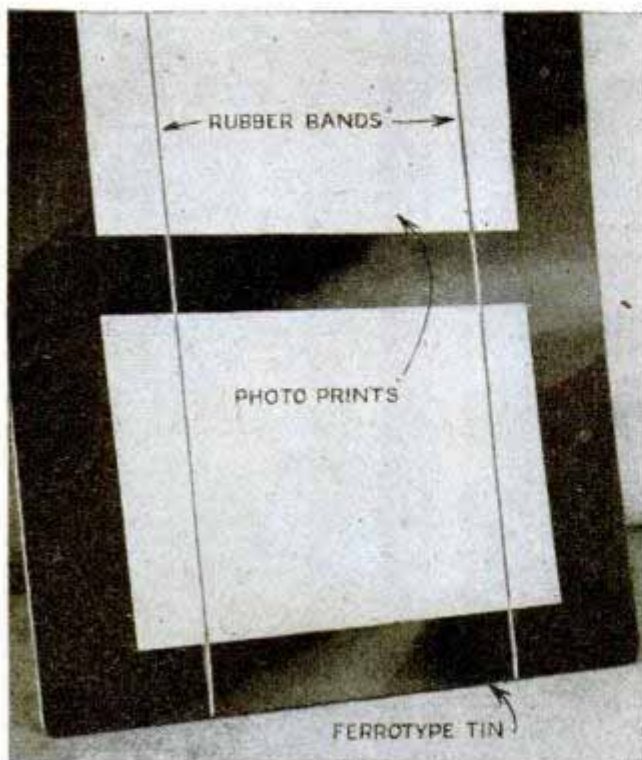
This drier will dry film in about 15 min. if the surface moisture is removed first with a chamois or sponge. It consists of a wooden disk 12 in. in diameter with wood clips fastened to the edge. A 100-watt bulb and socket are mounted in the center of the disk. The unit is suspended by means of a screw eye and a cord or wire.



Max Navis, Brooklyn, N. Y.

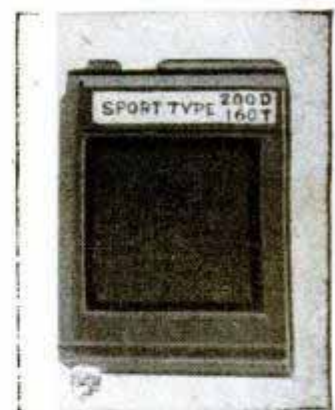
Keeping Ferrotypes Tins in Place

Ferrotypes tins will not slip when leaned against a wall while prints are drying if they are held in place with rubber bands slipped over the tins. In addition, the rubber bands will catch and hold the prints as they drop off the tins, preventing them from falling to the floor.



Tape Is Used to Identify Film

When using different types of film in several holders, some method of identification is necessary. I use short pieces of light masking tape and fasten them on the holders. The type of film and the emulsion speed are noted on the tape with indelible ink so that it will not smear. The tape is easily removed when unloading the film.



George T. Lundeen, Madison, Wis.

When a number of glossy prints are to be made with a limited number of ferrotypes tins, the sun will speed the drying time. The tin with the prints on it is placed in a sunny spot and finished pictures are ready in a short time.

CRAFT QUIZ



1. This operation requires a—
 (a) Knurling tool (c) Faceplate
 (b) Spur center (d) Center rest



2. 1000 4-penny nails weigh—
 (a) 4 lbs. (c) 10 lbs.
 (b) 6 lbs. (d) 3 lbs.



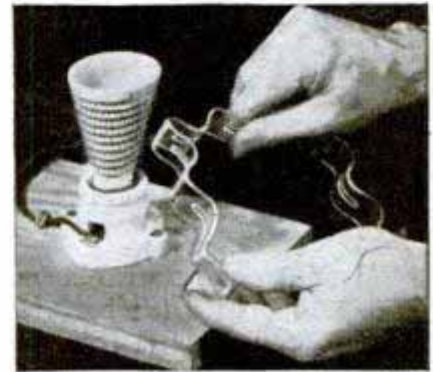
3. This finishing material is—
 (a) Paint (c) Varnish
 (b) Lacquer (d) Filler



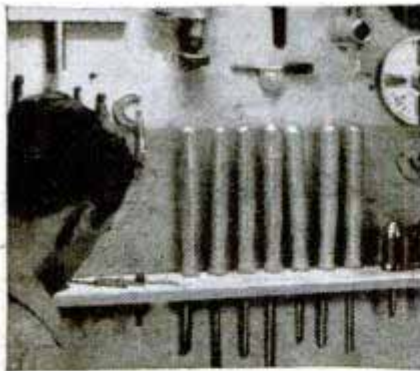
4. Wrong in this picture is—
 (a) Hand position (c) Plane direction
 (b) Kind of plane (d) Kind of wood



5. On boat frame he is planing—
 (a) Chine (c) Batten
 (b) Garboard (d) Keel



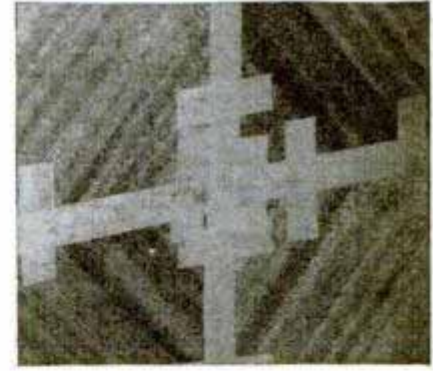
6. You can see this plastic is—
 (a) Thermoplastic (c) Laminated
 (b) Thermosetting (d) Phenolic



7. This tool panel goes with a—
 (a) Bandsaw (c) Wood shaper
 (b) Wood lathe (d) Tenoner

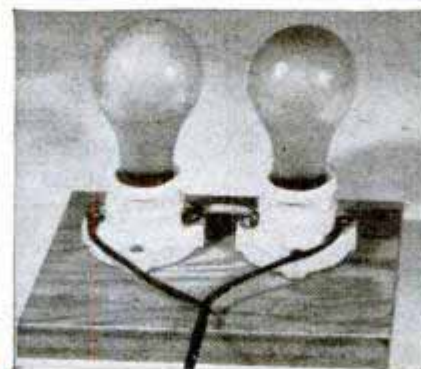


8. What is wrong here?
 (a) His hands (c) The guide
 (b) The work (d) The blade

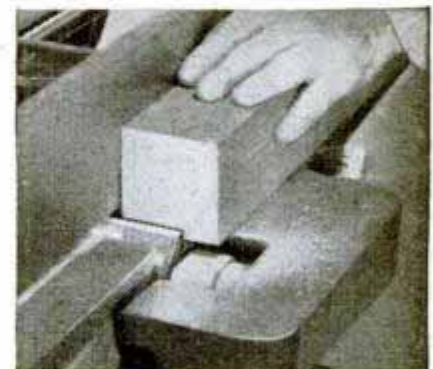


9. This veneer pattern is called—
 (a) Diamond (c) Herringbone
 (b) Book (d) X-match

ANSWERS: 1—b; 2—a (4-penny is same as saying 4 lbs. per 1000 nails); 3—c (typical varnish cup with strike wire); 4—c (against grain); 5—a; 6—a; 7—b; 8—c (guide 190 high); 9—a; 10—d (connected in series); 11—c

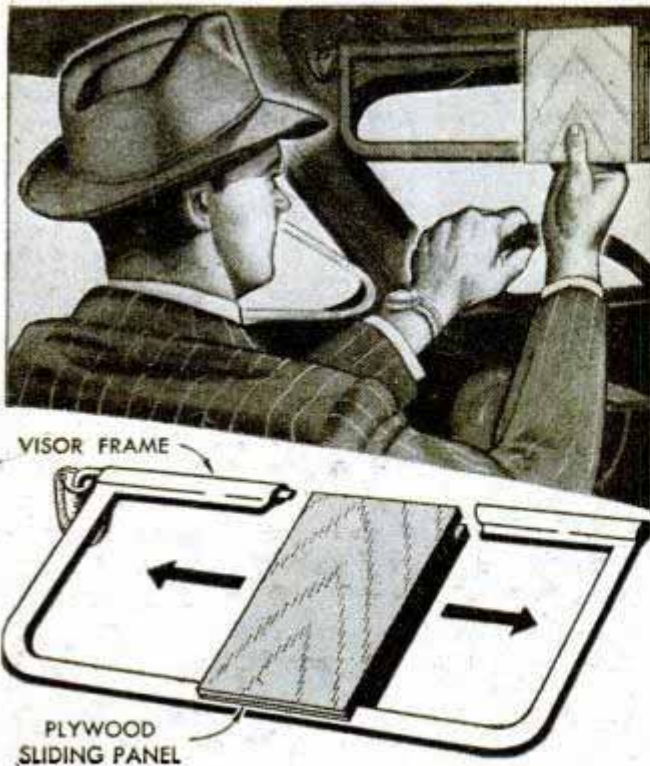


10. Lamps in this circuit will—
 (a) Burn bright (c) Blink
 (b) Burn out (d) Burn dim



11. He is cutting a—
 (a) Groove (c) Rabbet
 (b) Dado (d) Mortise

Motorist's Vision Is Increased With Sliding Visor



Because the area blotted out by the sun visor on a car often interferes with driving, one motorist used this panel which slides in the framework of the visor. The panel is large enough to cut out the central glare and it can be adjusted to any position normally covered by the visor. The panel is made of plywood and grooved to fit the visor frame after the cloth has been removed.—Opie Read, Jr., Chicago.

Plastic-Glue Filler Mends Holes In Rotted Frames and Posts

When parts of window frames or other sash work subjected to the weather have rotted or checked badly, repair them with a filler made of plastic glue. Mix the latter

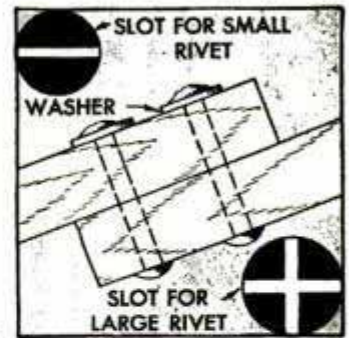


with enough water to form a creamy consistency, then add sufficient sawdust to make a thick paste. The material is unaffected by water.

How to Rivet Softwood Joints

Fastening a softwood joint that must withstand severe twisting is done usually with a bolt having a flat washer, a lock washer and a nut on the end. A much smoother and less conspicuous joint can be made with a round-head rivet. Bore a hole with a diameter slightly less than the rivet so that it will be a drive fit in the hole. Then place a flat washer over the end and cut off the projecting portion, leaving only enough to form a head. To be sure the rivet will head up right, slot the projecting end. Large rivets should be cross slotted.

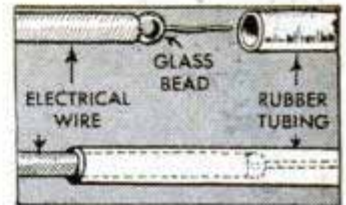
Charles Kimball, Los Angeles, Calif.



Bead Aids When Slipping Tubing Over Insulated Wire

Slipping rubber tubing over insulated wire sometimes is desirable in automotive and radio wiring because it furnishes additional protection. This can be done easily if the insulation is stripped off for a short distance and a glass bead slipped over the bare wire. The circumference of the bead should be slightly larger than the outside diameter of the insulation.

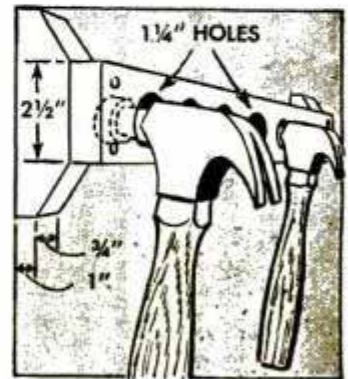
A. H. Waychoff, Phoenix, Ariz.

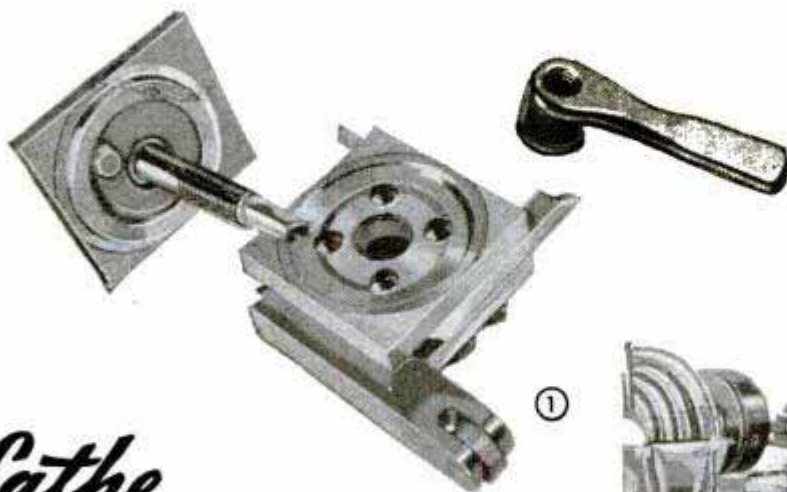


Rack for Hammer Assortment

A rack that holds your assortment of hammers in an easy-to-reach position is made with a few odds and ends of scrap lumber. The dimensions given are general and can be altered to suit the number and types of hammers you have. One advantage of this holder is that there are no clips to scratch the hammer heads.

Carlton A. Burmeister, Toledo, Ohio.





①

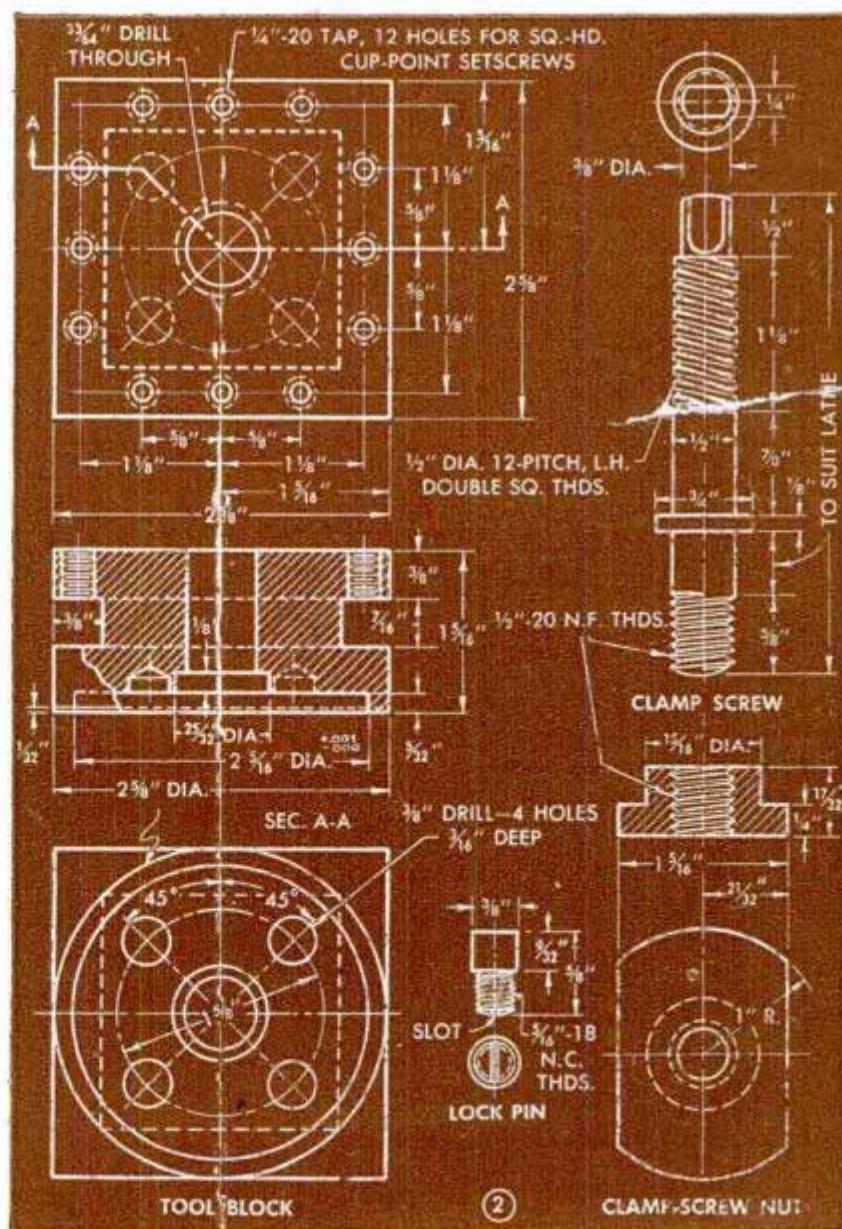


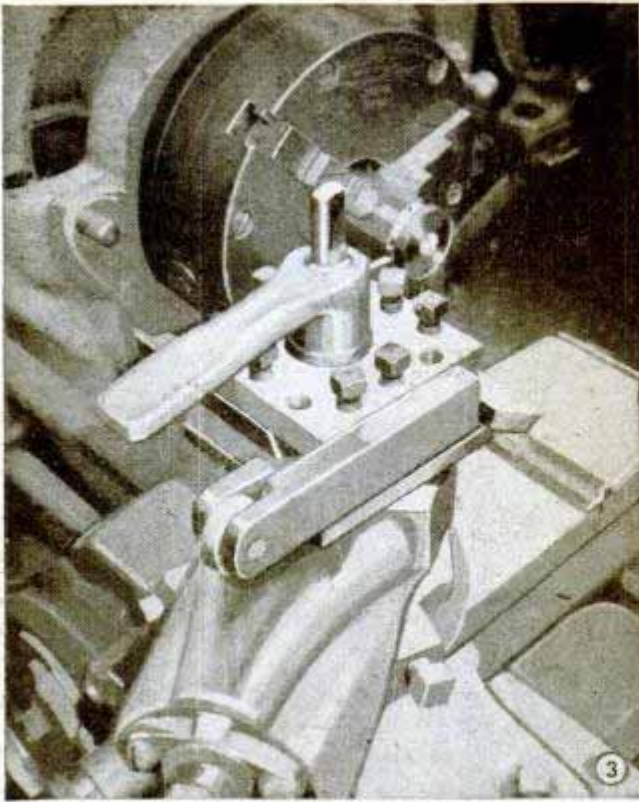
Lathe TOOL-POST TURRET

By Kenneth Murray

THIS four-way turret can be made to fit any lathe in the small and medium sizes and is especially handy where machining operations are required on duplicate small parts. A double-threaded locking screw equipped with a convenient handle provides for a quick change of the tools. Positive alignment in all four positions is assured with a lock or index pin.

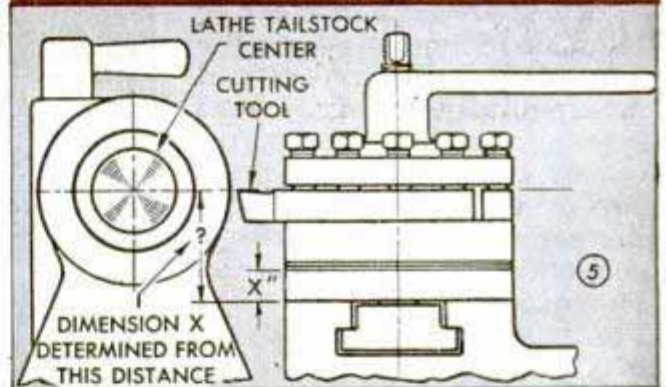
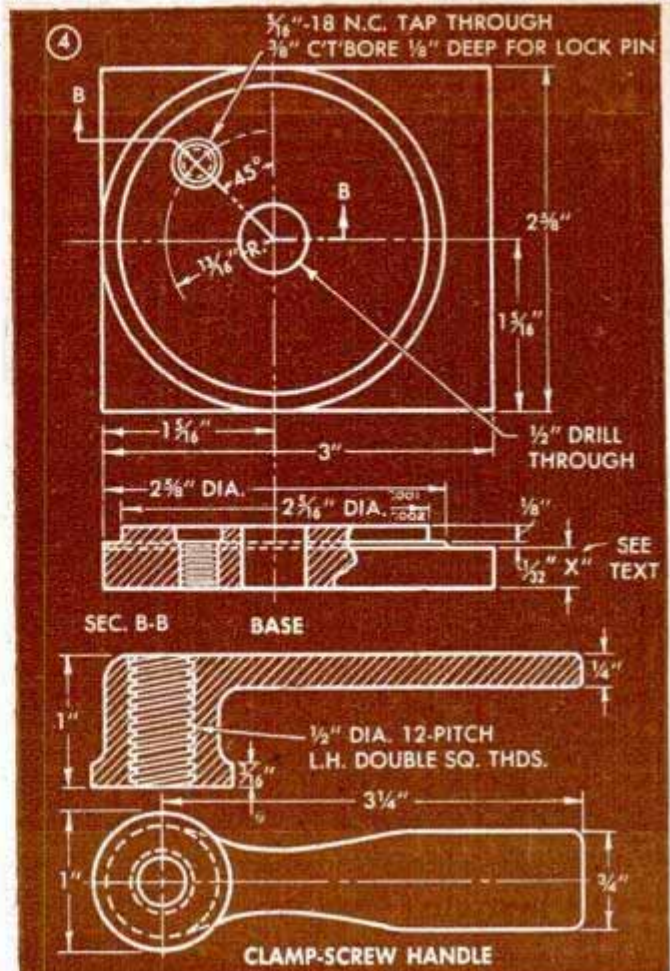
Looking over the detail drawings and the photos, Figs. 1 and 3, you'll see that all the machining operations can be done in the lathe with the aid of a milling attachment. Mild steel in stock sizes or scraps from bar stock can be used for the machined parts. Although on the original turret the handle was a brass casting, an ordinary cast-iron handle of the same general shape will serve the purpose. Two dimensions on the clamp screw, Fig. 2, and also the dimension "X" in Figs. 4 and 5 have been omitted. These must be determined from the lathe on which the turret is to be used. The dimensions will vary according to the swing of the





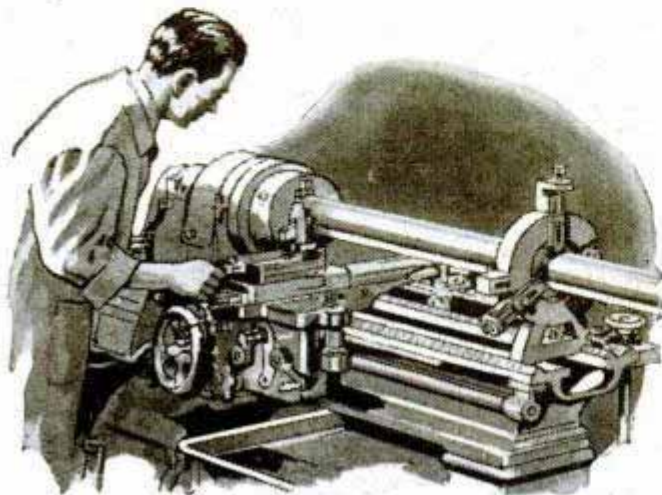
lathe. Before machining the clamp-screw nut, Fig. 2, be sure to check the dimensions of the tool-post slot on the lathe carriage. This also may vary. The thickness of the base must be such as to locate the cutting tools on the lathe center line, Fig. 5, when the turret is assembled.

Accuracy of the turret depends to a considerable extent on maintaining the tolerance dimension on both the tool block, Fig. 2, and the base, Fig. 4. Special care also must be taken in laying out the four indexing holes on the bottom of the tool block. It's a good idea to drill $\frac{1}{16}$ -in. pilot holes. The drill press should be carefully checked for the proper depth setting, and drills should be ground to the correct angle. Although not indicated, a $\frac{1}{32}$ -in. chamfer on the end of the indexing pin will facilitate quick action in shifting the cutting tools.



Permanent accuracy depends to a considerable extent on maintaining the tolerance dimension on the tool block and base, as indicated in Fig. 2 and detail above. Also, dimension "X" should be carefully determined

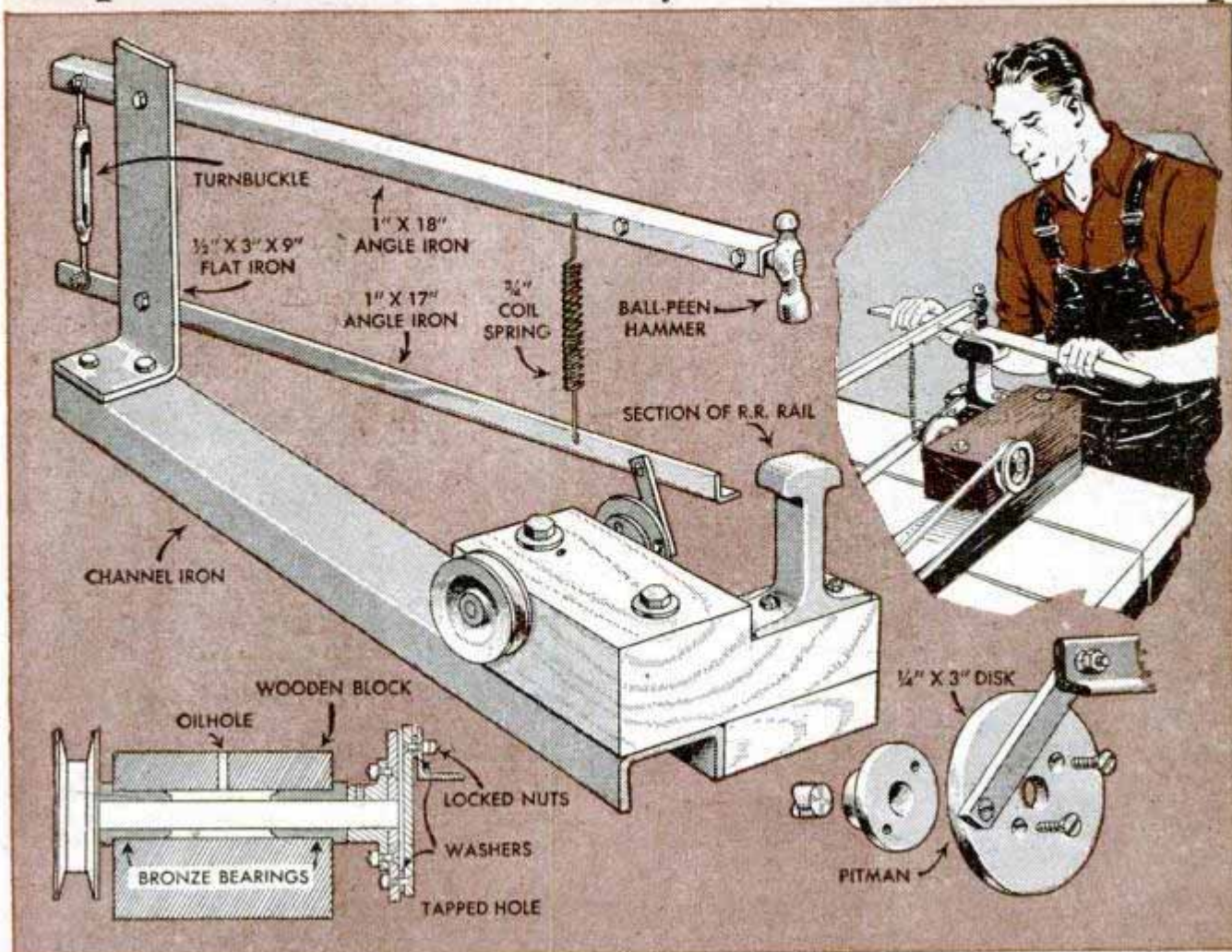
Steady Rest Supports Long Pipe When Threading in Lathe



When threading large-diameter pipe in lengths too long for the lathe, the tailstock can be removed and a steady rest used in its place. The work is chucked from the inside so threads can be started at this end of the pipe. When one thread has been cut the pipe is turned end for end to repeat the process. This operation is necessary for pipe too large to be threaded with a pipe die.—Wm. D. Evans, Glendale, Calif.

☞ To bring a new art brush to a fine point, first clean it with soap and water, dry it and then soak it in turpentine. Allow it to hang overnight and the brush will be ready.

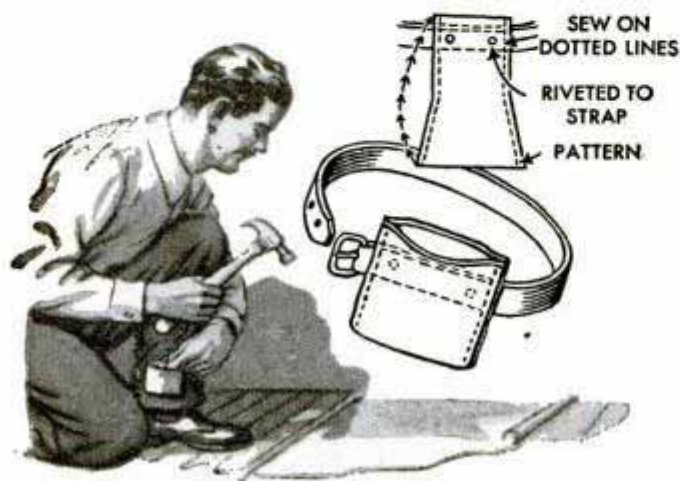
Trip Hammer Has Many Uses in Small Shop



Operating somewhat like a jigsaw, this power-driven hammer is ideal for light peening and riveting operations, and various kinds of decorative metal hammering can be done with it in a fraction of the time required by hand. As an example of its versatility, the builder of the original machine used it to hammer dents out of the lids of carbide cans. The base consists of a length of channel iron and a block of hardwood shaped as indicated. The latter also serves as a housing for bronze bushings

which carry the drive shaft. Parts are not fully dimensioned as you have considerable choice of bearings and other fittings. However, for best results the arms should be of the length given. Efficient operation depends largely on careful fitting of the moving parts and particularly on adjustment of the turnbuckle. Size of the motor and machine pulleys should be such as to give about 500 to 800 hammer strokes per minute.—Everett Goddard, Sidney, Vancouver Island, B.C., Can.

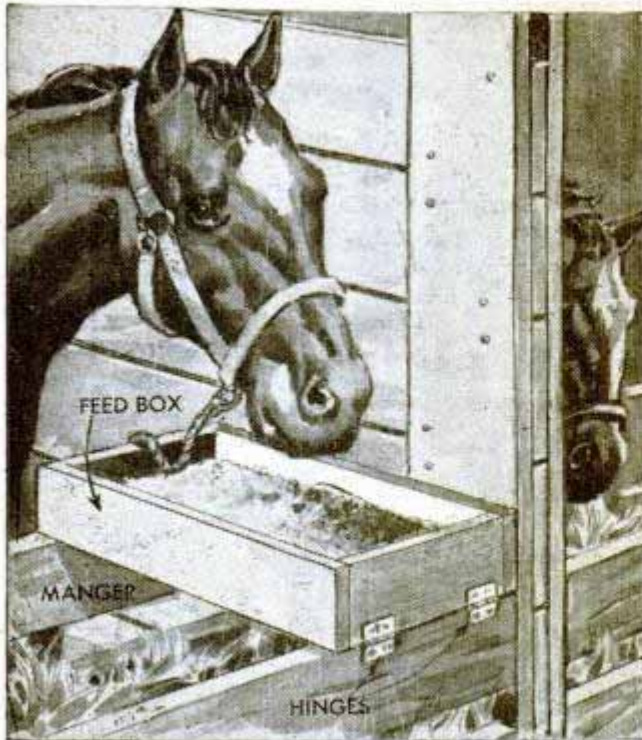
Canvas Pocket Strapped to Ankle Carries Finishing Nails



Here's a convenient pocket in which to carry nails when laying a floor. It is made of heavy canvas and cut according to the pattern so there will be a slight bulge for greater nail-carrying capacity. The pocket is riveted to a strap that is buckled around the ankle.

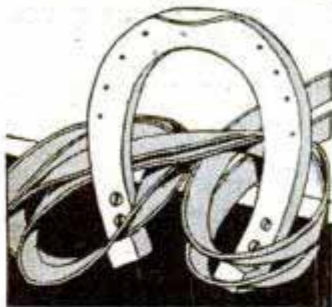
☐ If no other source of heat is available when forming certain types of plastics, a 100-watt lamp bulb mounted in a No. 2 tin can and suspended about 1/2 in. above the material will warm the plastic so that it can be molded into the desired shape.

Feed Box Is Hinged to Manger For Easier Cleaning



In order to have a feed box that is cleaned easily, attach the front end of the box to the manger with hinges. To clean, just turn the box over. Another way to make the box movable is to place round pegs in the manger and drill registering oversize holes in the bottom. The box can be lifted out for cleaning.

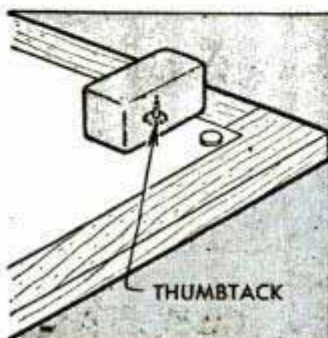
Driving Reins Kept From Falling If Looped Around Horseshoe



To hold the driving lines of his team and keep them from falling to the ground and tangling in the wheels, one farmer attached a horseshoe to the dashboard of his wagon. The reins are pulled through the shoe and looped in the manner shown.

To hold the driving lines of his team and keep them from falling to the ground and tangling in the wheels, one farmer attached a horseshoe to the dashboard of his wagon. The reins are pulled through the shoe and looped in the manner shown.

Thumbtack Pins Eraser on Board

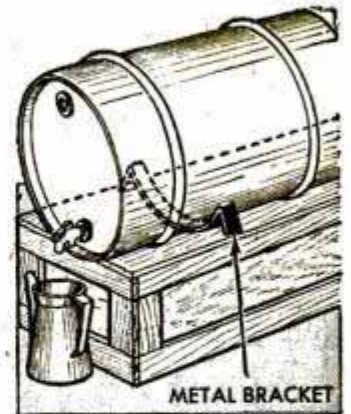


One draftsman uses a thumbtack which sticks up through the drawing paper with the head resting on the board to keep his eraser from rolling off. When not in use, the eraser is

pressed down on the point of the tack. The tack is placed at the upper right-hand corner of the board.

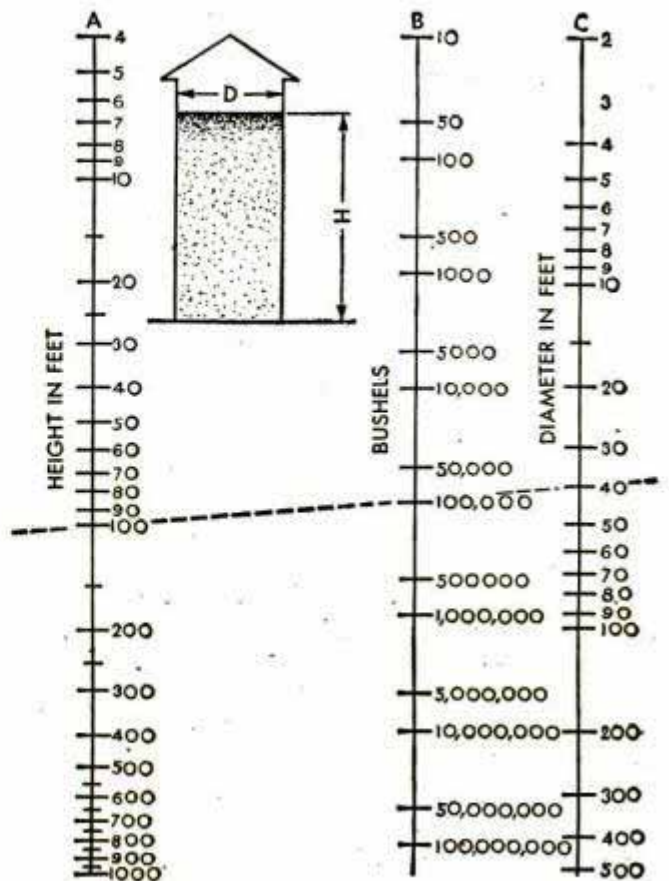
Bands Hold Oil Drum in Position

Metal bands, bent to form a semicircle with the ends extending downward for legs, make a good support for an oil drum. Held in this manner, the drum will not roll off the platform or stand upon which it has been placed.

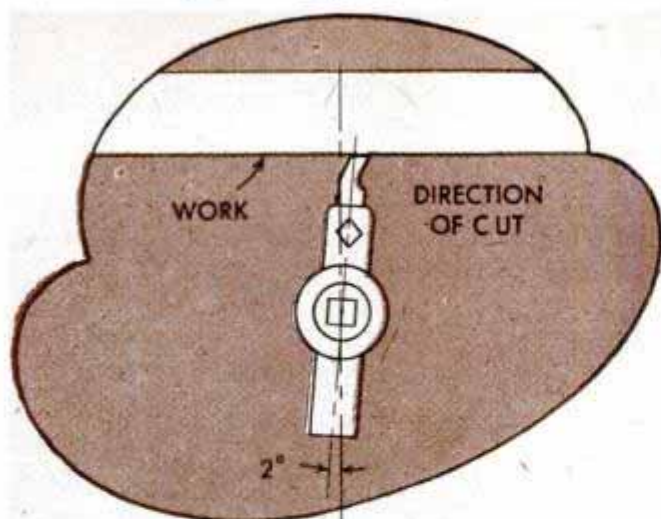


Amount of Grain in Bin Estimated With Aid of Chart

With this alignment chart, it is easy to determine the number of bushels of grain stored in a cylindrical bin if the diameter and the height of the grain in the bin are known. The inside diameter is noted on column C and the height on column A. Then a line is drawn to connect these two points. The number of bushels in the bin is read at the point where the line crosses B. In the example given, the diameter is 40 ft. and the height is 100 ft. A line connecting the two points indicates there are 100,000 bushels.



Cutting Keyways Without a Milling Attachment



Machining either a blind or open keyway without a special milling attachment is a simple trick that can be done accurately on any metal lathe having a screw feed. Here's the way it is done: First a shallow hole is drilled in the work at each end of the proposed slot as in Fig. 1. Size of the holes is governed by the desired width of the keyway. Next, the tool bit is ground to look like the one shown in the detail above, after which it is inserted sideways in the tool holder as in Fig. 2. To make the initial cut, the lathe compound is advanced to engage the tool bit in the left-hand hole in the work. Then, taking a light cut, the bit is advanced to the opposite hole by turning the carriage handwheel. With each passing of the bit, the tool is returned to the starting hole and the operation is repeated until the desired depth is reached. Reversing the tool bit in the holder and reversing the direction of travel permits cleaning up the keyway at the starting hole.

To cut a groove or open keyway in a shaft a setup is used such as shown in Fig. 3. Here the lathe chuck is removed and replaced with the live center, and then the work is center-drilled for the live center and gripped by a drill chuck placed in the tailstock. This permits using the automatic feed of the carriage to make the cut while the work is held stationary. A very coarse feed and high gear speed are recommended

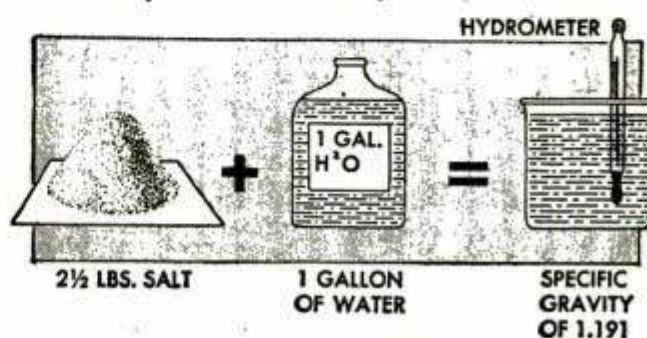


to obtain rapid travel of the carriage and to assure a smooth cut. As before, only light cuts should be taken with each passing of the bit. Sometimes chattering of the tool will cause trouble in a cut of this nature. Where this happens you often can correct the tendency to chatter by moving the tool in or out very slightly without changing the angle.

Axel E. Jensen, New York City.

Salt Solution Is Used to Check Accuracy of Battery Hydrometer

To test the accuracy of a battery hydrometer, one garage mechanic uses a brine solution. Pure salt (sodium chloride), 2½ lbs., is dissolved in water, 1 gal., being sure that all the salt is in solution. The resultant mixture should give a specific gravity reading of about 1.191, accurate enough for all practical purposes. As a further check, the solution may be weighed. It should weigh about 10 lbs.—Jack Bronte, Colfax, Calif.



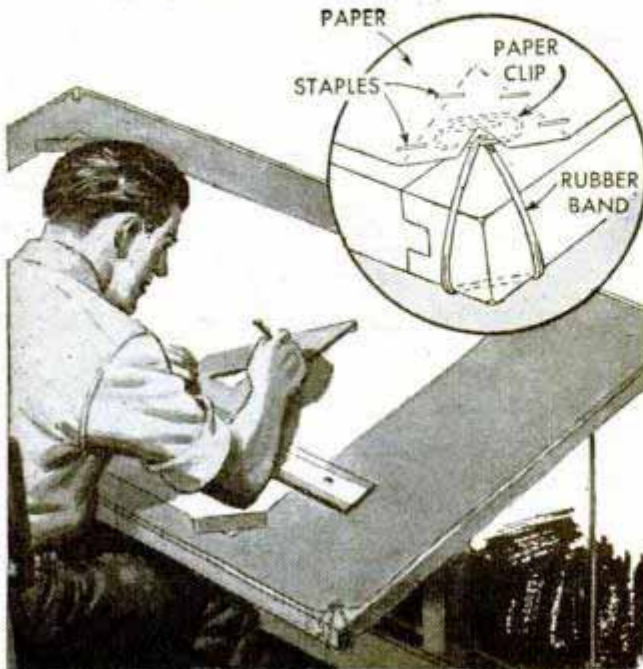
Trouser Clamp Keeps Floor Mat Away From Working Space



To keep the floor mat in a car out of the way while removing floor boards for inspection or repair, one mechanic slips a bicycle trouser clip over the rolled mat. Secured in this manner, there is less likelihood that grease from the floor boards will smear the mat.

Backing Paper Held in Position With Rubber Bands

Due to conditions of high or low humidity, backing paper tacked or stapled to a drawing board will wrinkle and make it difficult to ink work on either drawing or tracing paper that is taped to it. To prevent

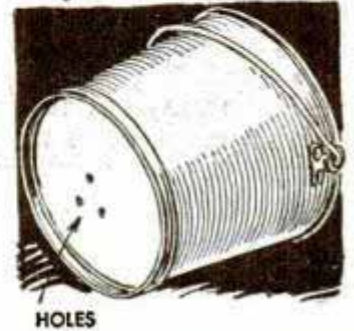


wrinkling, trim the backing paper to fit the board, turn each corner under to form a pocket and cut a V-shaped opening in the doubled thickness on the edge. Slip rubber bands into four paper clips and place a clip inside each corner pocket with the rubber band extending through the V-shaped opening. Close the two sides of the pockets with staples and fasten the paper to the drawing board by slipping the rubber bands over the corners.

B. Tolks, Brooklyn, N. Y.

Holes Punched in Fire Bucket Assure Its Proper Use

Because workers in a freight depot kept using fire pails hung above sand and water barrels for other purposes, members of a fire-fighting crew punched three holes in the bottom



of these buckets. The holes were not large enough so there would be a rapid loss of water or sand, but it did make them useless for any purpose other than fire fighting.

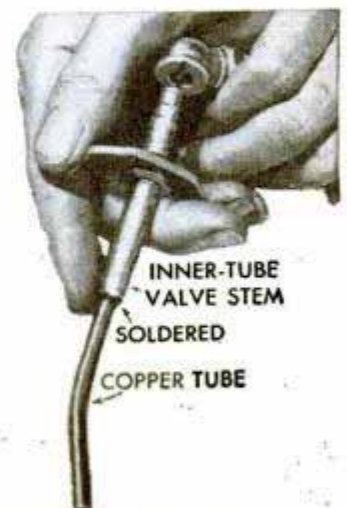
Thomas Carey, Staten Island, N. Y.

Fixing Synthetic-Rubber Tubes

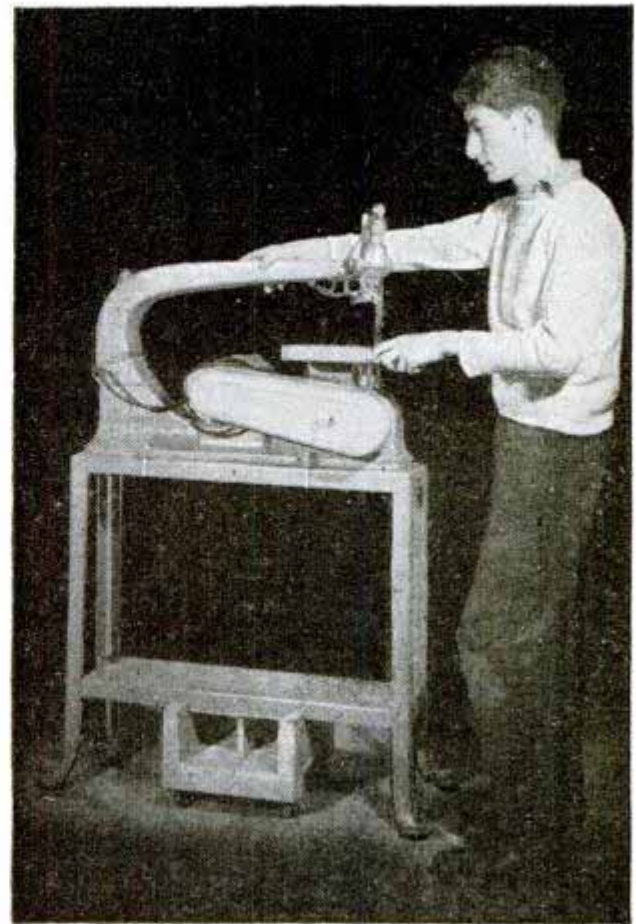
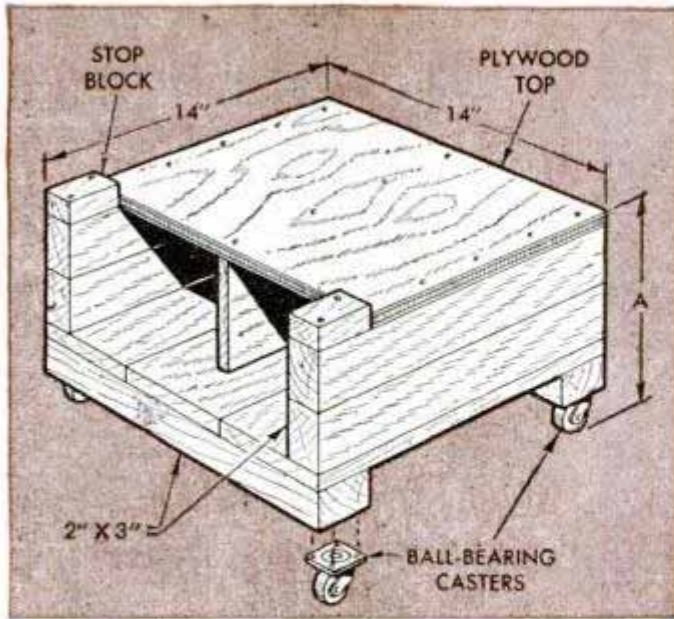
Before a tear in a synthetic-rubber inner tube is patched, the ends of the tear should be rounded to prevent an extension of the opening after the patch is applied and the tube has been inflated. This can be done with a $\frac{1}{8}$ -in. hollow punch of the same type that is used when cutting holes in harness and leather belts.

Blowing Tool Uses Valve Stem

In order to blow water or dirt from the top of a motor block, to dry out the distributor of a car or to perform any other blowing-out operation, one auto mechanic uses a valve stem with a copper tube soldered to one end to direct the air stream. In use, the valve is pressed into an air-hose chuck and the air is blown out through the discharge tubing. The flange which is on the stem provides a good hand grip.



Dolly Facilitates Quick Shifting of Shop Tools



If your garage doubles as a workshop where your power tools must line the walls to provide room for the car, don't strain yourself moving heavy machines about when you wish to use them. All you need is this sturdy dolly to slip under the machine stand. It can be made of any scrap lumber that you may have. The important thing is its height. Distance A, which includes the casters, should be about $\frac{3}{8}$ in. greater than the distance from the floor to the underside of the machine-stand shelf. To mount a machine, you merely slide the dolly alongside the stand, lift up one end of the machine and kick the dolly under.

The machine then can be pushed out to the center of the room with little effort. The dimensions given will accommodate a narrow-type machine stand, such as a scroll-saw, belt sander or lathe.

D. J. Bachner, Jackson Heights, N. Y.

Adjustable Holder for Grinding Produces Accurate Work



To do more accurate grinding, one mechanic made this adjustable holder for round work. The flat-iron bracket is bolted to the bench, and the holder, which also is of flat iron, is fastened to the bracket with a bolt, wing nut and washer. The V-cut in the holder supports the work.

Will D. Candee, Los Angeles, Calif.

Repairing Ignition System Shorts

As a temporary repair for some short circuits that develop in automobile ignition systems, try two or three coats of fingernail polish. Allow a few minutes between applications for the polish to dry. Best results are obtained with the polish when applied to shorts on distributor heads and coils.—Wm. L. Matthews, Pensacola, Fla.

One of the most important reasons for keeping your car in a garage at night is the fact that dew and moisture condensing on the surface harms the exterior finish.

FUNDAMENTALS of MILLING -

RANKING second only to the lathe in importance in many machine shops, the modern milling machine is so efficient from the standpoint of operation that it compensates for at least 85 percent of operator experience. Because of this and the fact that the small bench-type machines of today incorporate to the smallest detail all features found in modern floor-type tools, owners of small machine shops, garages and even home workshop enthusiasts are becoming interested in them. Although intended for the reader who has had very little of this phase of machining, this article also should prove of value to the lathe hand who has had some experience with a milling attachment.

Milling Machine Technique

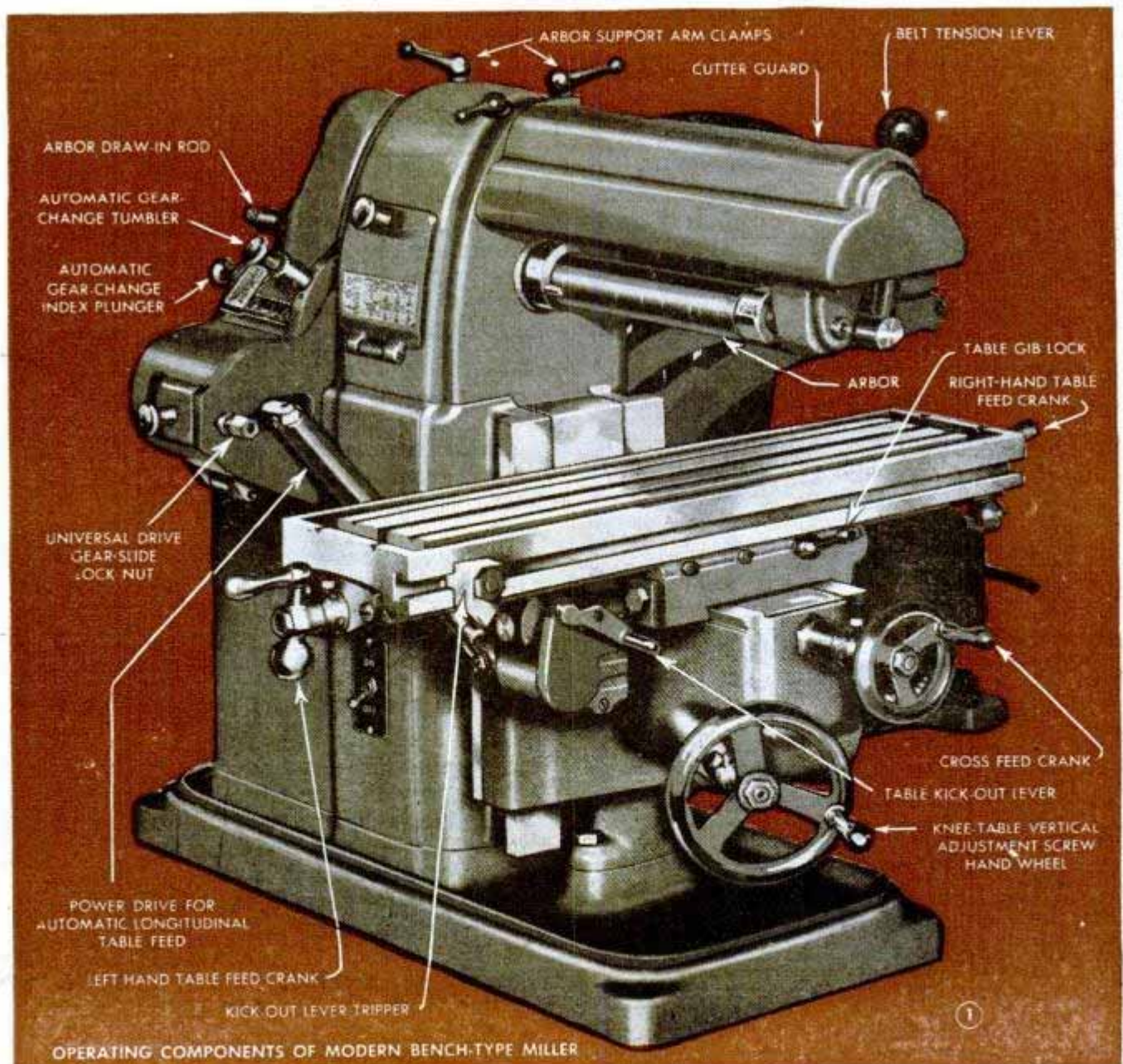
The first step in mastering the miller is to study the various components of the ma-

chine, such as movements, and the levers, cranks and other means which control them, Fig. 1.

Acquaint yourself thoroughly with the micrometer dial facilities which permit raising the table on its traverse and transverse advance in increments of .001 in. As with most machining operations, the essentials for milling accurately are based on the selection and care of the cutting tools and the speeds and feeds favoring their life, as well as the cutting rate and quality of work.

Know Your Cutters

Only milling operations on work held in a swivel vise or on an angle plate are covered here. Cutters described are therefore those commonly used on such work. High-speed steel cutters are preferred as they give long service when proper attention is given to preserving the cutting edges.



OPERATING COMPONENTS OF MODERN BENCH-TYPE MILLER

MACHINE OPERATION

The cutter being used in Fig. 2 is called a plain or slabbing mill and is intended to make a cut equal to, or less than, its own width. Since this cutter has peripheral teeth only, it is used for surfacing, or slabbing, as this operation often is termed. The cutter in Fig. 3 is a side mill, the teeth having cutting edges on both sides. It is used when milling a certain depth of cut the width of the mill, or any desired width through repeated cuts. Fig. 4 shows a slitting saw, its chief purpose in the small machine shop being to cut off bar stock.

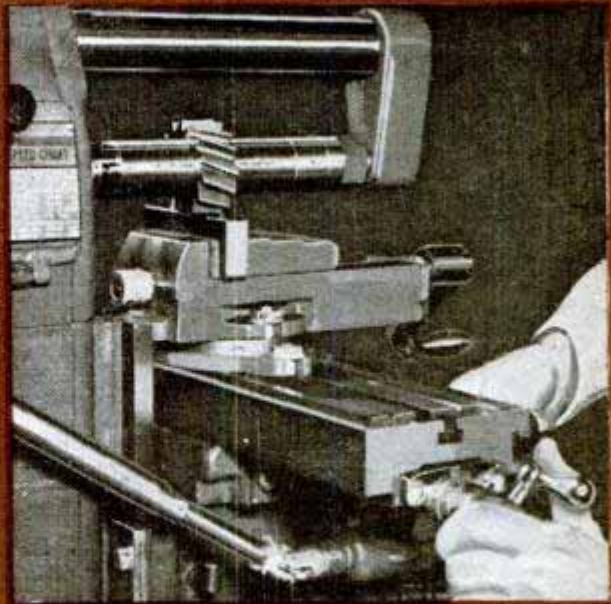
One of the most popular cutters is the shell end mill shown in Figs. 7 and 8. This is the most efficient tool to use when the nature of the cut permits because it is mounted on the end of the spindle nose and gives maximum cutting power. A similar but lighter cutter is the end mill shown in Fig. 9. With this tool, the end teeth and not the peripheral teeth do most of the cutting. A typical application of an end mill is shown in Fig. 10 where the tool is sinking a cut into a small steel plate bolted to an angle plate. Another very useful cutter is the angular or dovetail mill shown cutting a male dovetail in Fig. 11. It also has side teeth and requires careful use to preserve the delicate points resulting from angular peripheral teeth. Fig. 12 shows the same mill cutting the female or mating dovetail.

Right and Left-Hand Cutters

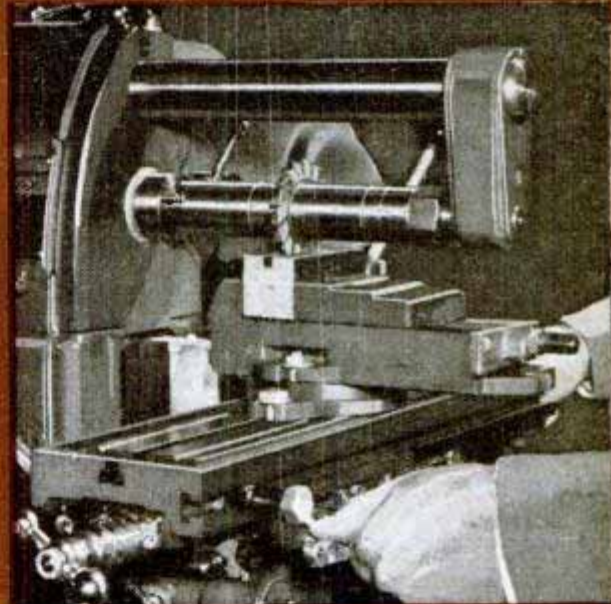
Milling can be done with the spindle rotating in either direction, but on most machines the cutting must be done with the work or table traveling in the direction opposite to cutter rotation. However, climb milling or feeding the work in the same direction as cutter rotation is now being done in machines designed for this method. To attempt this in a light milling machine not intended for this purpose will prove disastrous to both machine and cutting tool. The cutters shown in Figs. 2, 3, 4 and 5 are of the type that only have to be reversed on the arbor to operate right or left hand. Other cutters cannot be used in this way as the teeth are made to cut either left or right hand.

To determine the difference, hold a mill with the top of the teeth coming toward you as in Fig. 6-A. Note that the side teeth are cut on the left side of the mill which makes it a left-hand angular or dovetail cutter. Cutter 6-D is therefore the opposite, or right hand, and so are end mill B and shell end mill C.

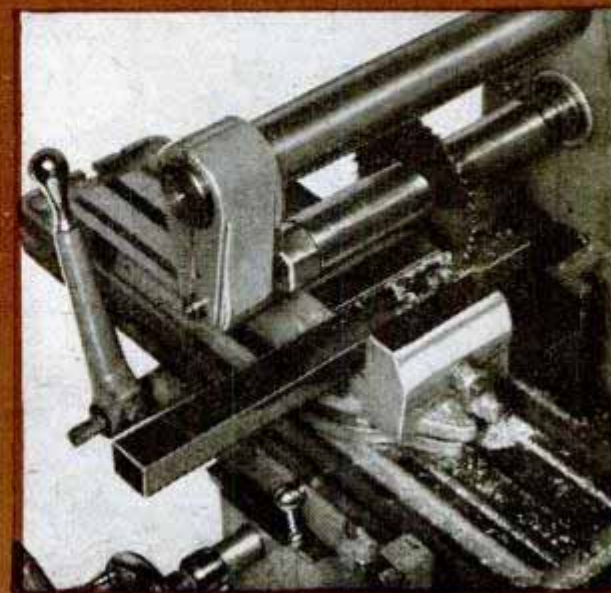
There is no need for having cutters of both hands, particularly for experimental



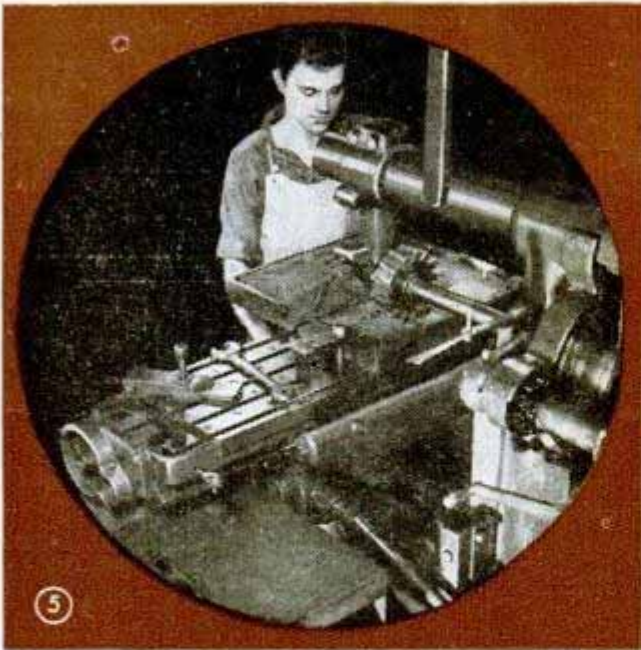
② SLAB MILLING STRAIGHT WORK HELD IN SWIVEL VISE



③ SIDE MILL MAKES CUT THE FULL WIDTH OF TEETH



④ SLITTING SAW CUTTING OFF STOCK IN SWIVEL VISE

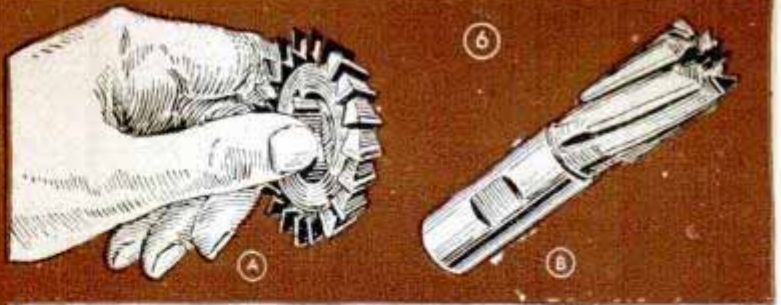


or limited milling operations; instead, specialize in either right or left-hand cutting mills. All cutters used herewith are milling right-hand.

Keep Cutters Sharp

There's no secret about keeping cutters sharp. Simply go over them frequently with a medium-grade oilstone. If you viewed one of the cutting edges through a high-power microscope, it would appear rough; that is, full of peaks and valleys. The cavities thus formed pick up small particles of metal which cause the edge to roll over. On the other hand, oilstoned edges have a straight, uninterrupted line. The idea is to use the oilstone so that minute chips don't have a chance to become embedded in the cutting edges. The oftener the stone is used, the better.

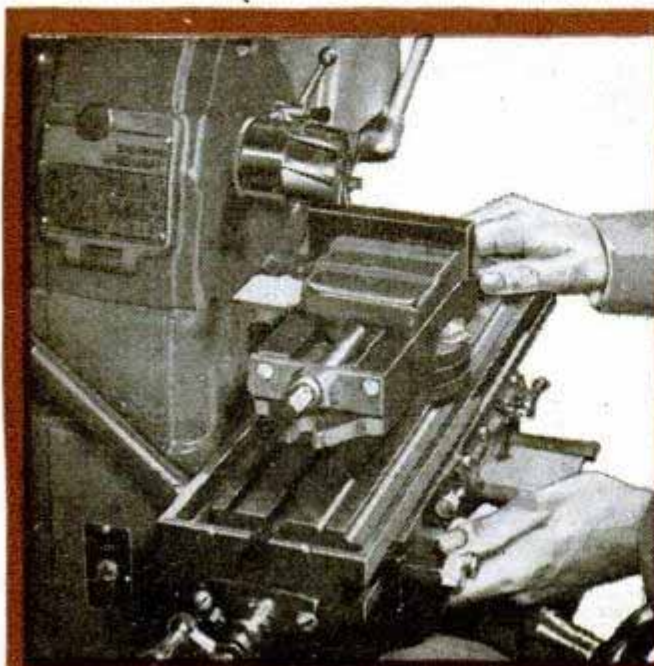
Peripheral teeth of all cutters should be



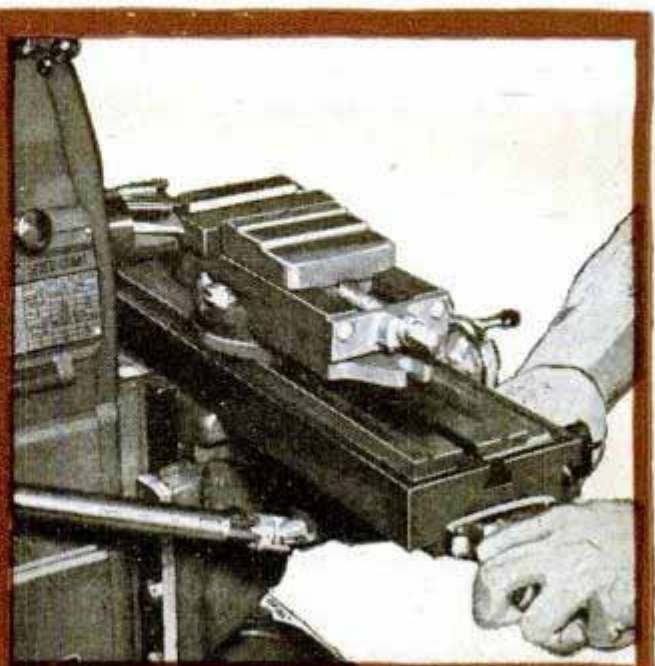
oilstoned while mounted on the arbor, taking care to preserve the original clearance of the teeth; the stone should be held at the correct angle to avoid destroying the edges of adjacent teeth. The side teeth of shell end mills should be oilstoned by resting the cutter on a small surface plate or similar smooth surface as in detail A of Fig. 13. The side teeth of side mills always should be favored. It is advisable to oilstone them only every fourth time the peripheral teeth are conditioned. A good way to check the side teeth is shown in detail B. All that's needed is a pencil and a shaving action which shows whether or not the cutting edges are still in good shape.

The end mill gets its toughest treatment on the end teeth and it is imperative that all end teeth present a flat surface or be square in relation to the peripheral teeth. After oilstoning as shown in detail C, squareness is determined by holding the mill on any flat surface, detail D. Any rocking action indicates a variation in the height of the end teeth, which must be corrected by stoning until the mill will remain upright on the plate without holding it and with no light showing under the teeth.

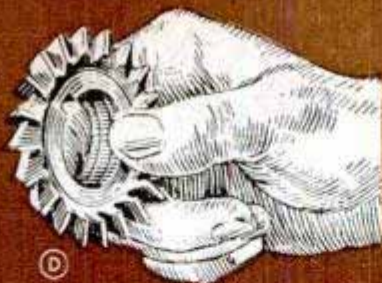
Although some cutters are still being made with teeth cut on center, as shown in



7 SHELL MILL HAS CUTTING EDGES ON SIDE AND END

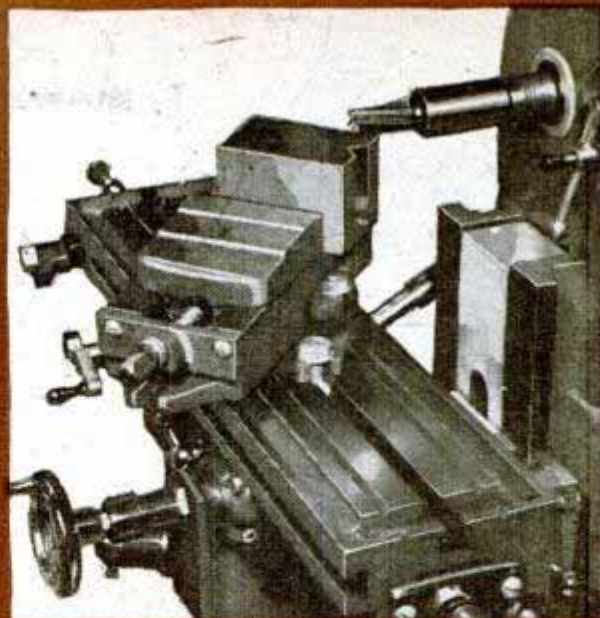


8 SHELL-END MILL FACING WORK HELD IN SWIVEL VISE

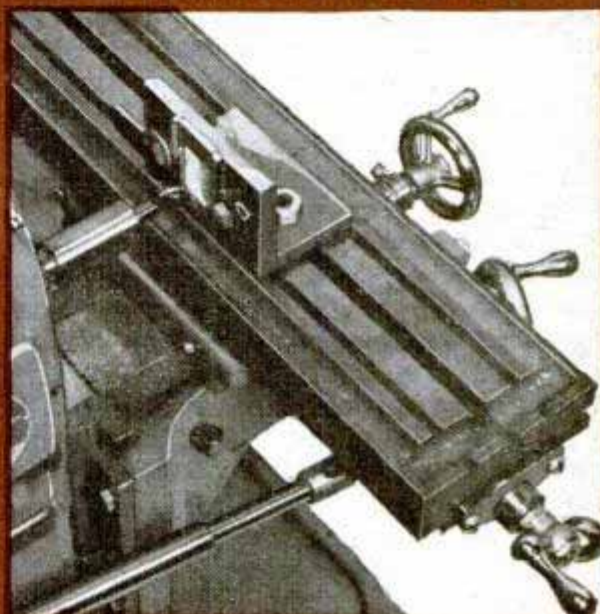


detail A of Fig. 14, most of them have undercut teeth as in detail B. In the process of manufacture, the cutter blank is located on center in relation to the tool doing the cutting, then the blank is relocated or thrown off the actual center at a predetermined margin, X, detail A, to provide a 10-degree undercut as shown when the cutting edge of the tooth coincides with the center or axis of the blank as in B. The usual tooth clearance is from 4 to 6 degrees with 5 degrees a standard, provided the face of the tooth is on center as in detail A. However, if the undercut cutter at B had only a 5-degree clearance, its cutting edges would actually be in reverse in relation to its axis by 5 degrees. To compensate for the 10-degree undercut, the clearance of cutter B must therefore be 15 degrees as the gauge indicates; in other words, this represents a compound angle of 5 plus 10 degrees, although the cutting edge actually has but a 5-degree clearance.

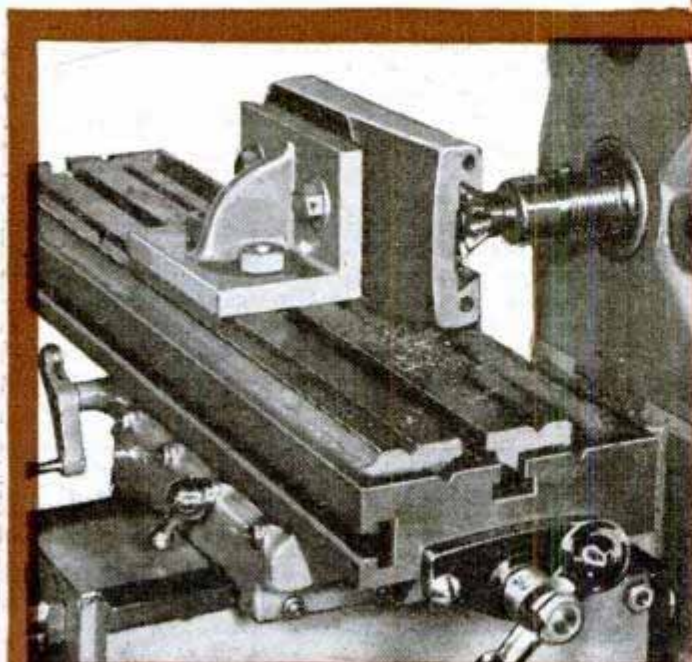
The clearance of side or end teeth on a cutter is approximately one half that of the peripheral, usually $2\frac{1}{2}$ or 3 degrees. Care must be exercised when oilstoning side or end teeth to avoid reducing the original clearance. It's equally important not to alter the shape of the cutting edges.



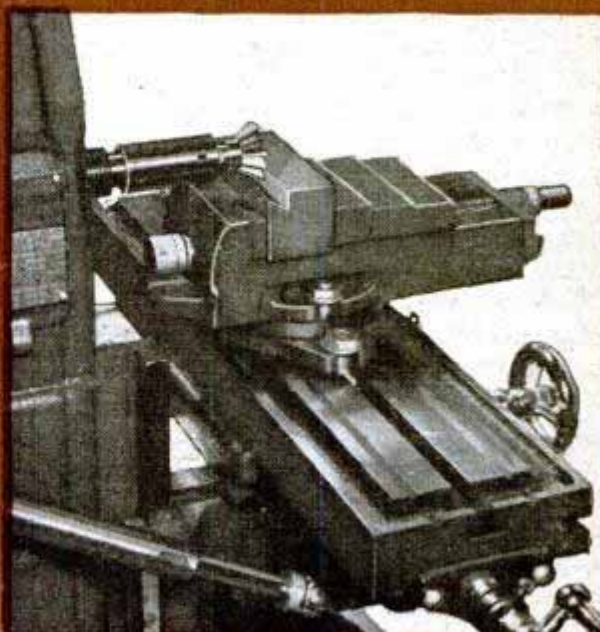
9 END MILL CUTTING VEE IN WORK SET AT 45 DEGREES



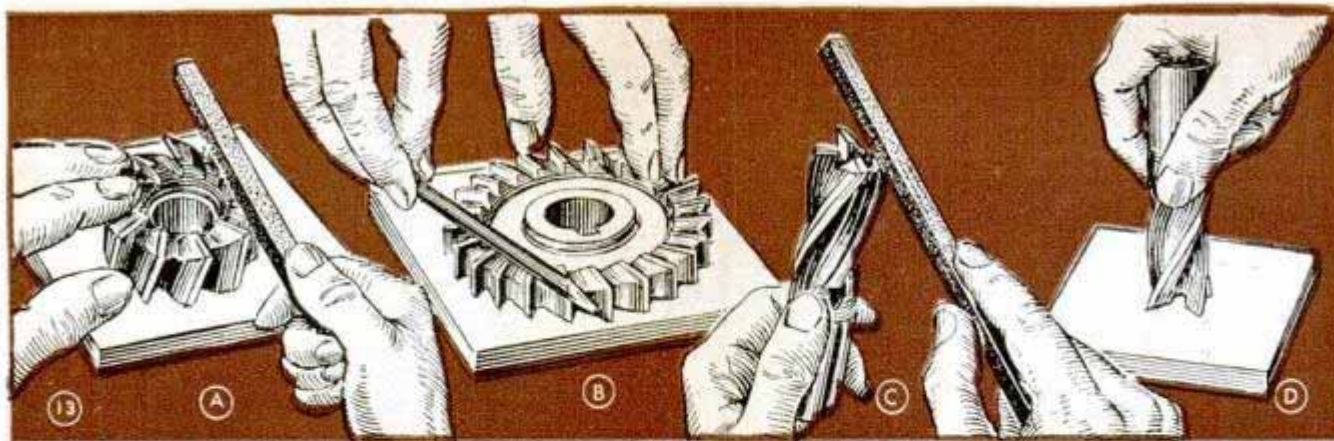
10 END MILL CUTTING WORK MOUNTED ON ANGLE PLATE



12 ANGULAR MILL CUTTING FEMALE HALF OF DOVETAIL



11 ANGULAR MILL MAKING FIRST CUT IN MALE DOVETAIL

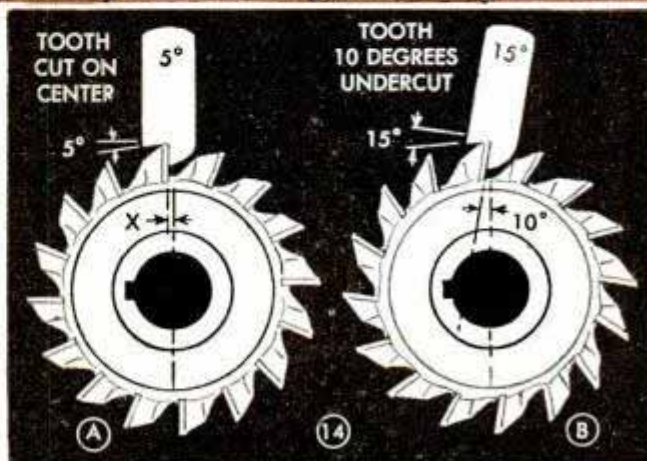


Spindle Speeds and Work Feeds

The term "speed" refers to the rotation of the spindle or cutter, and "feed" means the rate at which the work is moved into the cutter. The kind of material to be milled, the kind of material of which the cutter is made and the depth and width of cut all are factors affecting the selection of cutter speeds. These factors, as well as the rigidity and power of the machine, finish desired and accuracy of work, must be taken into consideration in determining rate of feed. General speed recommendations to aid the beginner are given in Fig. 15.

The rate of spindle speed is computed in surface feet per minute, or the distance the cutter would travel if it were rolling on the ground. Table or work feed is, of course, in linear inches. It is well to remember that the speed of a cutter in revolutions per minute does not by itself determine the rate at which the cutting edge is advancing through the work. The diameter of the cutter and its revolutions per minute really determine what is referred to as the surface feet per minute of the cutter. For example: If a cutter is 2 in. in diameter, its circumference is approximately 6 in. (2×3.1416), so at 500 revolutions per minute it covers 3000 inches or 250 surface feet per minute. The table of speed recommendations is at least a good starting point. Depth of cut is a problem you must solve yourself. The various cutter speeds given apply to a normal depth of cut, meaning the most efficient work the cutter can produce without being overloaded.

To determine the speed and feed for the respective machine dial or chart settings, knowing the diameter of and number of teeth in the cutter, let us again refer to Fig. 15. The rule to establish cutter speed is to divide cutter speed in feet, as given in the table for the kind of material being milled, by the circumference of the cutter expressed in feet. To establish the amount of table travel or work feed per minute, multiply feed per tooth per revolution by number of teeth in cutter and then by speed (number of revolutions per minute). The



15 GENERAL SPEED RECOMMENDATIONS

Kind of Material to Be Milled	Cutter Speed in Feet Per Minute Using High-Speed Steel Cutter	
	Min. F.P.M.	Max. F.P.M.
Steel—Soft	60	90
Steel—Medium	50	80
Steel—Hard	30	50
Cast Iron—Soft	50	80
Cast Iron—Hard	30	50
Cast Iron—Chilled	20	40
Malleable Iron	70	100
Brass—Soft	70	175
Bronze—Hard	65	130
Bronze—Very Hard	30	50
Aluminum	500	1000

Note — With cutters made of carbon steel, reduce speeds given from 40% to 50%.

Five Simple Rules in Speed-Feed Arithmetic

- 1—Diameter of cutter in inches multiplied by 3.1416 (circumference), multiplied by revolutions per minute, divided by 12 gives speed of cutter in feet per minute (F.P.M.).
- 2—Feet per minute divided by circumference of cutter in feet (diameter multiplied by 3.1416, divided by 12) gives revolutions per minute (R.P.M.).
- 3—Feed per minute divided by revolutions per minute gives feed per revolution (F.R.).
- 4—Feet per minute in inches divided by number of teeth per minute (number of teeth in cutter multiplied by revolutions per minute) gives feed per minute.
- 5—Feed per tooth per revolution multiplied by number of teeth in cutter, multiplied by revolutions per minute, gives feed per minute. Also, feed per revolution multiplied by revolutions per minute gives feed per minute.

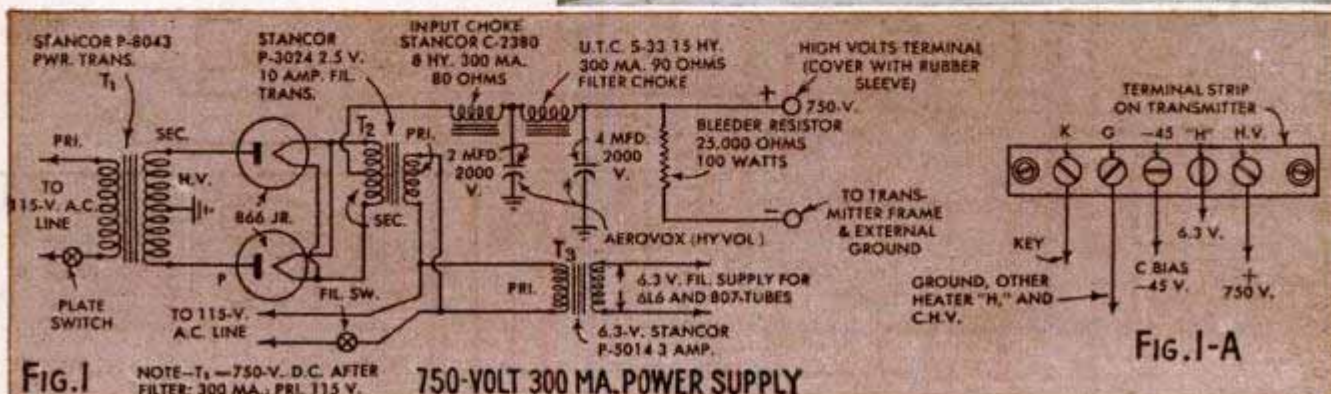
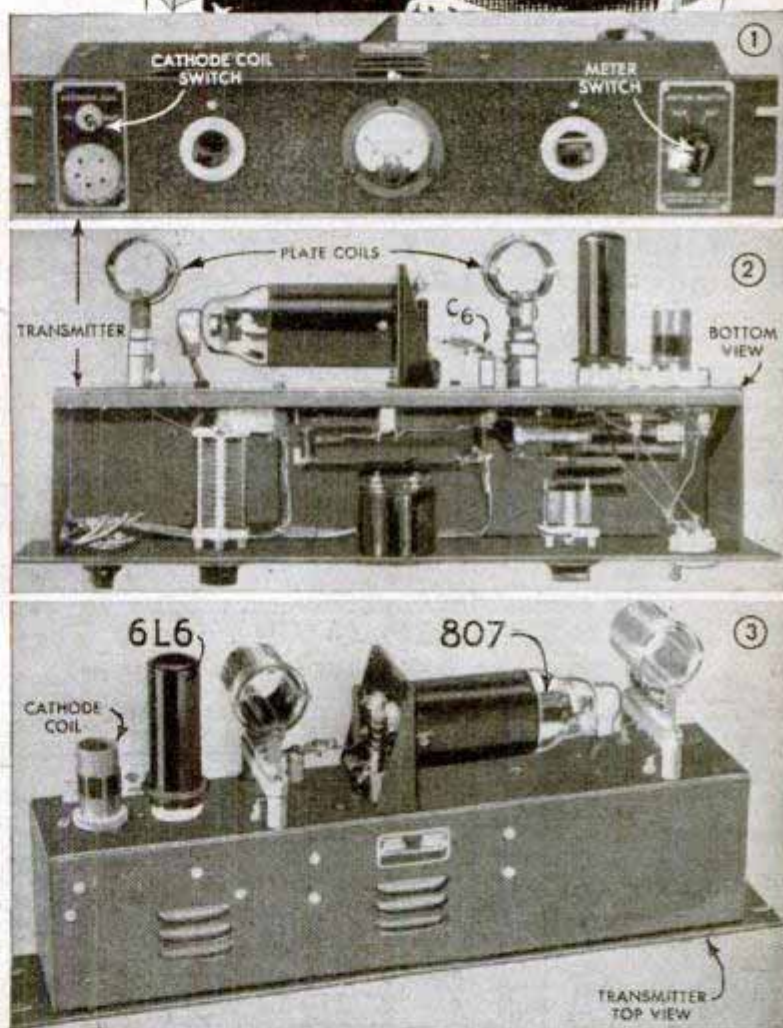
five rules given serve to make all computations easily. Figures obtained will not, of course, correspond exactly to those listed on machine charts or dials, but will come close enough to be dependable. On most work of a more precise nature it's always well to calculate the speed-feed ratios as a precaution against overloading.

Flexible Low-Cost Transmitter

This compact amateur transmitter unit is capable of a power output of 50 watts in any amateur frequency band up to and including the 14,000-14,400 kc band. It may also be used in the 28,000-30,000 kc (10 meter) band with an output of 20 to 30 watts. Based on an original design that appeared in the American Radio Relay League's Radio Amateur's Handbook, it is a commercial version of a "ham's" favorite two-tube plug-in coil transmitter-exciter unit. It consists of a 6L6 tri-tet crystal oscillator-doubler or beam tetrode crystal oscillator, driving an 807 amplifier or frequency doubler. The 6L6 may also be used as a frequency doubler driven by a "signal shifter."

Photos 1, 2 and 3 show various views of this flexible unit, which is ideal for either low-power transmitting or as an exciter unit for high power amplifier stages. In other words, it provides the main unit, or heart, of a highly efficient amateur transmitter. In photo 1, the switch at right controls the meter for reading plate current on either the 6L6 or the 807 tubes.

A suitable power supply diagram is shown in Fig 1. This separate power supply unit and a 45-volt C-bias battery are all that are required for CW operation as illustrated in the station transmitter rack assembly sketch at top right. The transmitter unit terminal strip showing the power supply connections is detailed in Fig. 1-A.



T.R.F. ALL-WAVE A.C.

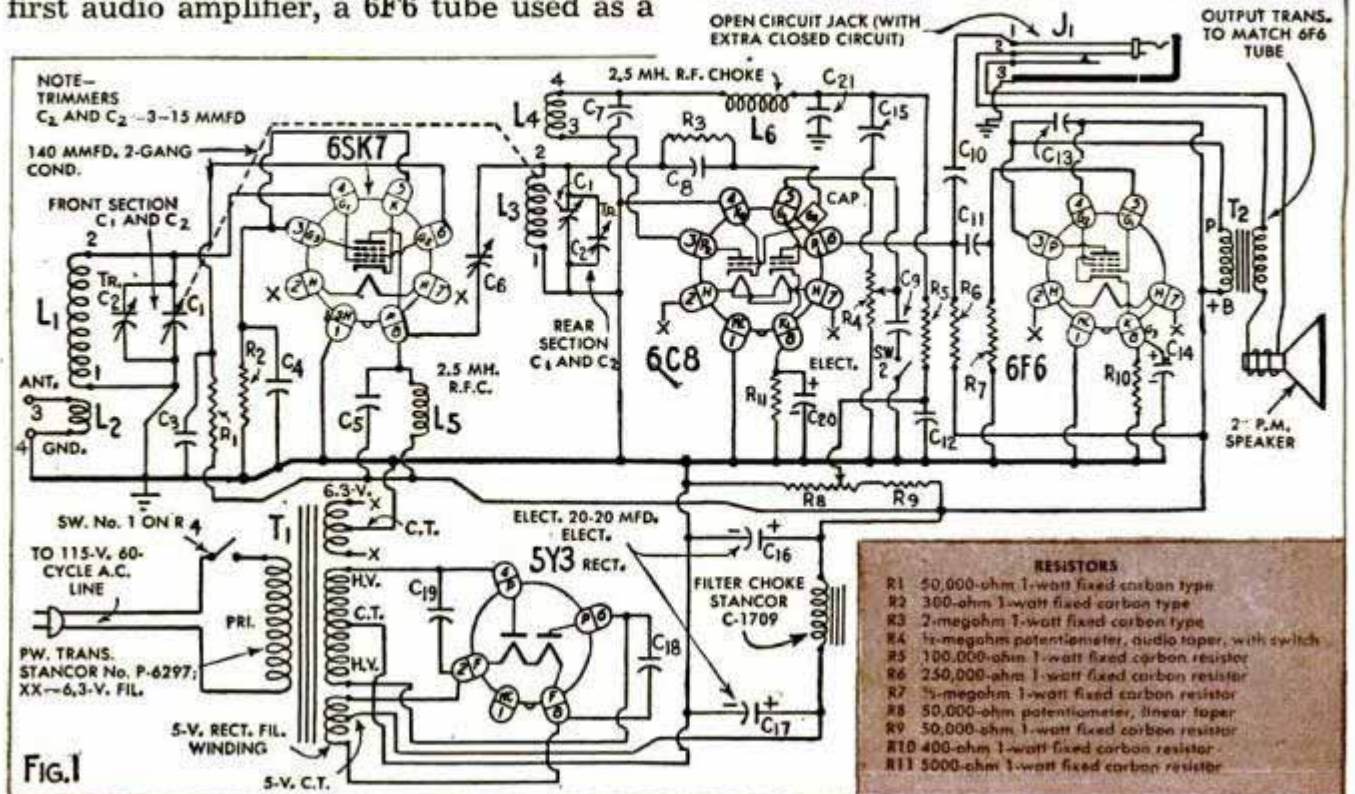
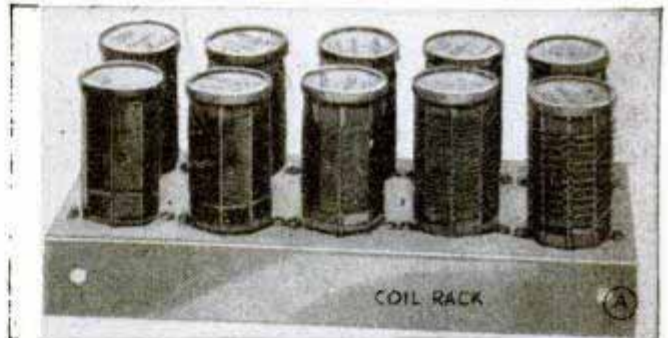


By Arthur I. Rattray

COVERING five ranges with six pairs of standard 4-prong plug-in coils, this 4-tube tuned-radio-frequency receiver operates on your 115-volt 60-cycle a.c. line and is designed for either headphones or a small built-in PM speaker. Now that the foreign DX stations are again broadcasting programs, short-wave listeners and experimenters are asking for all-wave receiver circuits. Some parts for superheterodyne circuits are still scarce, therefore this t.r.f. set offers the experimenter an opportunity to assemble an all-wave receiver that is an excellent performer from available non-critical materials now listed in the radio parts catalogs.

The circuit consists of a 6SK7 r.f. amplifier tube, a 6C8 regenerative detector and first audio amplifier, a 6F6 tube used as a

power amplifier and a type 5Y3 serving as rectifier. It will be noted that the r.f. stage is capacitively coupled to the detector instead of being inductively coupled as in the average t.r.f. set. This makes possible the use of standard "Bud" type 2-winding plug-in coils that are available. Twelve coils are used in pairs and cover from 11 to 565 meters; two pairs are required to cover the standard broadcast range. One pair tunes from 185 to 360 meters and the other pair from 350 to 565 meters. The coil rack, photo A, is 9 in. long, 3 $\frac{3}{4}$ in. wide and 1 $\frac{1}{4}$ in. high. It is made by bending a piece of sheet metal over a block of wood; holes 1 $\frac{1}{8}$ in. in diameter are drilled to take ten 4-prong wafer-type sockets. The chassis base also is made from $\frac{1}{16}$ -in. sheet metal and is 7 in. wide, 8 in. long and 2 $\frac{5}{8}$ in. high. This base is fastened directly to the 8 by 8-in. metal front panel. The original model is housed in an I.C.A. hinged metal cabinet 8 in. high, 8 in. wide and 10 in. long, and the front panel is supplied with the cabinet. A complete schematic circuit diagram is given in Fig. 1; the detailed pic-

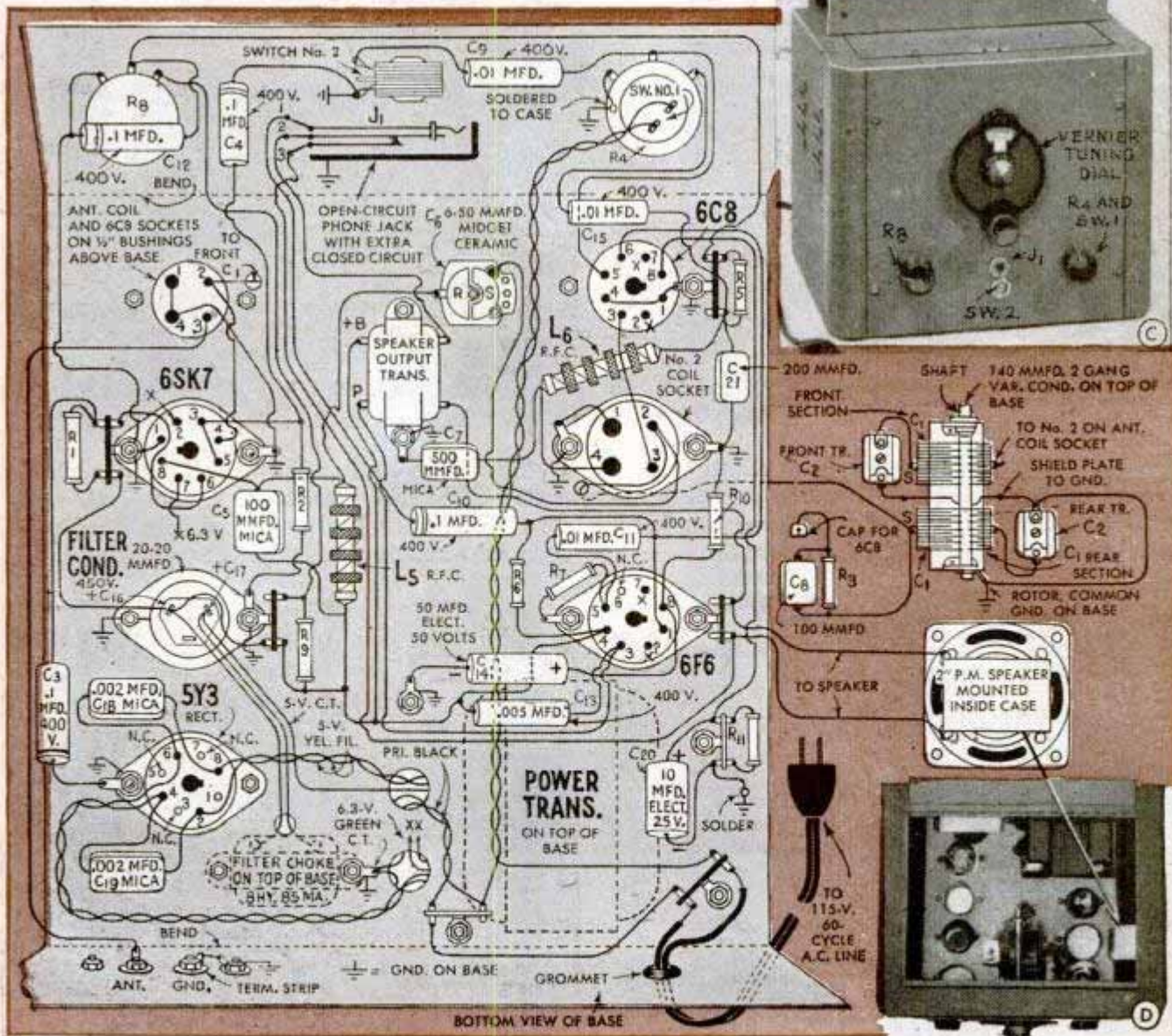
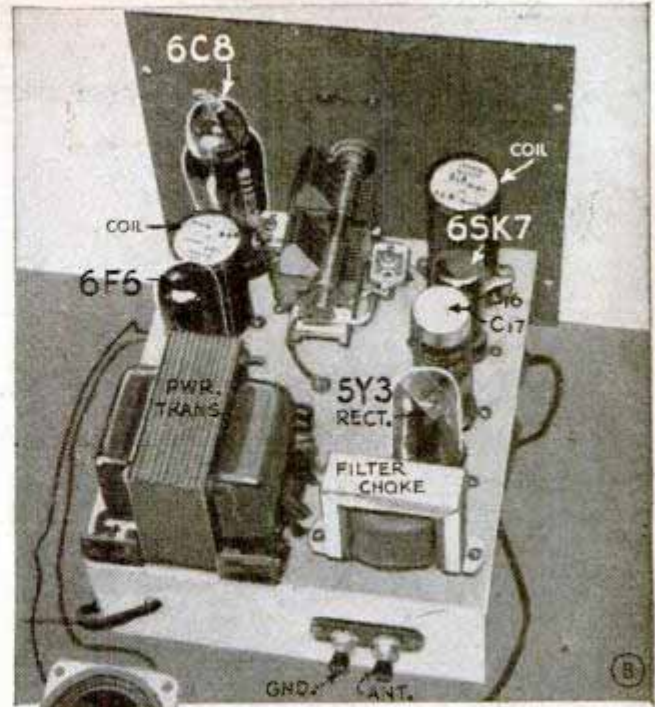


FOUR-TUBER for EXPERIMENTERS

torial wiring diagram that appears below shows all parts in their relative positions under the base, and all connections running to the 2-gang variable condenser and other units that are mounted on top of the base. The tiny 2-in. PM speaker is mounted on the inside of the cabinet directly back of the louver as indicated in photo D.

The toggle switch on the front panel connects a .01-mfd. by-pass condenser across the plate of the output tube to give better tone on broadcast reception. For broadcast stations it will be found that best results are obtained with the r.f. coupling condenser (C6) set at minimum capacity. This setting gives a fairly good relationship between selectivity and sensitivity. On short waves it may be necessary on some bands to couple the r.f. stages more "tightly," depending upon the antenna that you are using; therefore the best setting of C6 is a matter of experiment. Tuning follows common t.r.f. regenerative set practice. Any ordinary 50 to 75-ft. outdoor

(Continued to page 240)



Practical Thinking Behind Electronics Devices



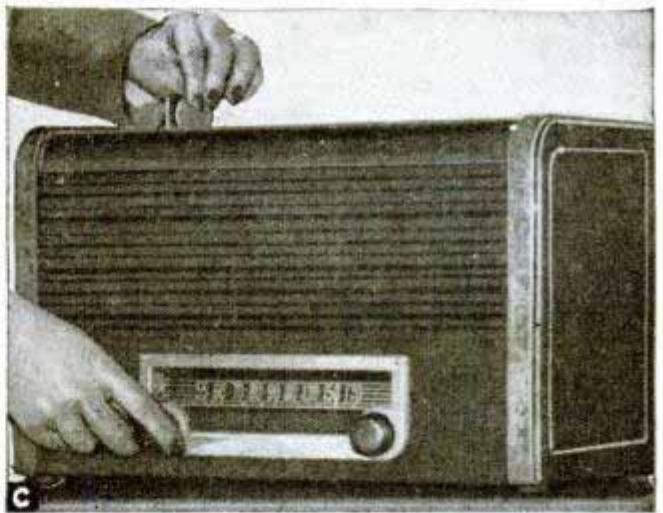
A—Convenience was foremost in the minds of General Electric engineers who designed this portable self-charging broadcast receiver. The compact 5-tube set employs a small leakproof airplane-type storage battery that will operate the set for 20 hours at full power before recharging. Power is quickly restored when the set is played on ordinary a.c. house current.

B—The Operadio Soundcaster shown is a rugged 40-watt amplifier planned especially for plant broadcasting service. A 3-way switch on the control panel permits preset volume selection for continuous "work" music, voice paging and announcements.

C—Photo shows a Radio-Matic coin-operated receiver for hotel rooms. It is similar in appearance to recent table models but is equipped with a coin mechanism on the top of the cabinet where quarters are inserted. An electric timing device, which runs only when the set is in operation, determines the listening period. The number of coins deposited registers automatically.



D—Low cost and simplicity are features of the Belmont television receiver demonstrated here. It employs a 7-in. picture tube and tunes as easily as a broadcast set.



E—Accuracy and speed highlight the Finch home facsimile receiver, claimed to produce 46 square inches of broadcast picture copy or 550 words of 8-point type a minute.



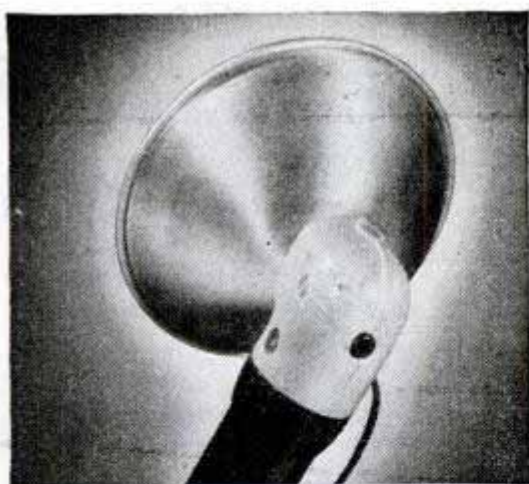
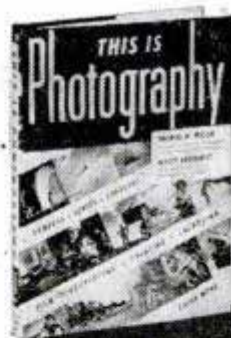
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School for Jockeys

(Continued from page 173)

The student jockeys are shown how the electric starting gate operates and they learn to hold their mounts steady in the stalls of the starting gate. They learn, too, how to get their animals out with a rush at the instant that the bell rings and the barriers snap out of the way.

No small part of a good jockey's bag of tricks is the generalship that comes partly from training but principally from experience. In time he learns how long he should hold a horse in to save the animal's energy and when, depending on the competition, he should make his attempt to get up in front and stay there.

A jockey must be a responsible individual. Mills explains that a rider may be in full charge of an animal valued as high as a fifth of a million dollars and that in one race alone he may be competing for stakes that comprise more money than the total lifetime earnings of some people. Obviously a jockey must conduct himself as a good sportsman.

The rules and ethics of racing are also stressed. Jockeys have succumbed to temptation in the past and have tried using illegal devices and stunts to make their horses go faster or to slow down their competition. Mills explains just how each of these tricks is attempted, then shows how unerringly all such tricks can be detected.

The boys are taught to conduct themselves always as gentlemen, for they will be under almost constant scrutiny by the public and racing officials. During a race itself, for instance, the actions of each jockey are recorded by four telefilm motion picture cameras placed at different angles around the track as well as the "photo finish" cameras at the finish wire. In addition, six patrol judges are stationed on towers around the track and these officials, as well as the three placing judges and the three stewards at the finish line, watch the horses and riders constantly during the race.

Students at the Santa Anita school were taken on trips to outlying breeding farms and were taught the points by which prospective good horses can be recognized. They watched motion pictures of famous races and listened to talks by outstanding turf officials.

A jockey's career seems to be a colorful one yet it is not at all easy. Even a short race is hard, gruelling work, for the rider hangs on and maintains his balance principally by the grip of his knees. A good

(Continued to page 240)



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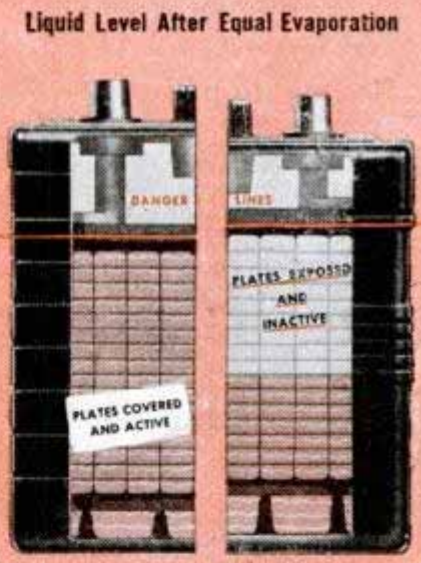
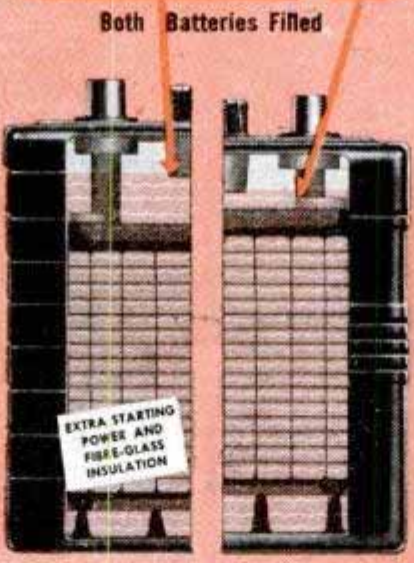


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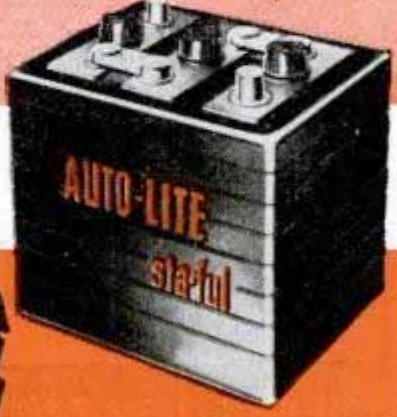
Unique new design and construction gives Auto-Lite "Sta-ful" more than 3 times the liquid reserve of ordinary batteries.



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Newest thing in comfortable, serviceable boots. Ideal for hunting, fishing, hiking and all kinds of outdoor use. Made in soft, pliable, heavy-oiled waterproof elkskin. Same design, construction and high quality standards as famous boots worn by Paratroopers during war. Write to our Dept. PM-10 Specify size and width. Enclose check or money order for \$9.87. Boots sent immediately, postage C. O. D. Money back if you are not entirely satisfied on receiving boots.

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IN WINTER WEATHER
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Get your car ready for the cold weather ahead. Knock that "winter starting problem" for a row of ten pins—with Casite! Even at sub-zero, Casite retards congealing of oil—lets motors spin over rapidly for fast battery-saving starts—greatly reduces start-up wear.

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Every Sunday Afternoon • 4:30 EST

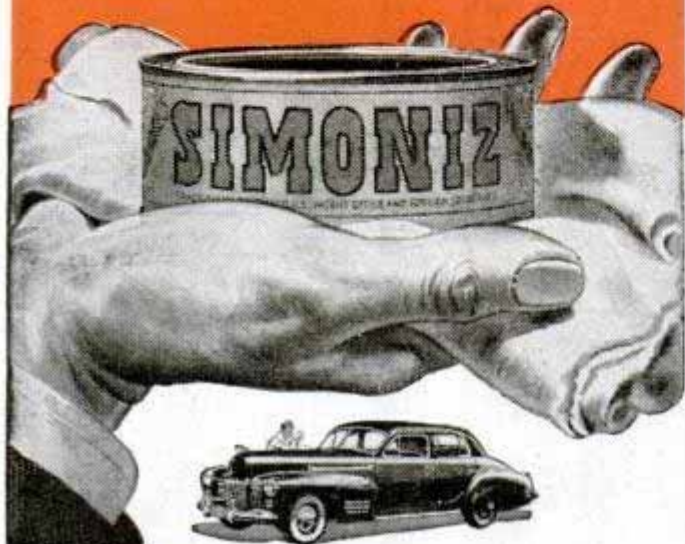
GUARANTEE—Add Casite to crankcase and run through air intake according to instructions, then drive your car 100 miles or for 60 days, whichever is first. If not convinced that Casite gives you better and smoother performance, you

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rider actually doesn't need to use stirrups.

Too, as he grows older a jockey tends to become heavier, and every extra pound he puts on is a handicap to fast riding. He tries to eat a balanced, sensible diet that will keep his weight down and still give him strength. Going without meals and using chemicals will reduce his weight, but these drastic measures also reduce his strength. Nearly all jockeys bundle themselves up in wool and rubber sweat suits for daily exercises or lean themselves down by taking daily sweat baths.

T.R.F. All-Wave A.C. Four-Tube For Experimenters

(Continued from page 231)

antenna may be used. Regeneration is controlled with R8 and the line switch is combined with the volume control R4.

Optimum efficiency is realized only when the r.f. and detector stages are balanced properly. This is done by first plugging in the two 185 to 360-meter coils; tune in a station near the minimum capacity of the tuning condenser; then with a small screwdriver adjust trimmer condensers C2 on the front and rear sections of the 2-gang condenser until the station is received at maximum volume. This setting is sufficient for all coils. On short waves when tuning the foreign bands you should tune slowly, since three or four stations may be passed in one turn of the tuning knob on the vernier dial. Detailed student material list R-348 is available from our radio and electronics department upon receipt of ordinary letter postage.

Will the Atom Drive Us Underground?

(Continued from page 151)

man supply was concentrated in three large surface dumps at Paris-Argenteuil, Bordeaux and Lyons. In July 1944 they discovered to their dismay that nothing had been done about changing the location of the dumps. The Nazi commander ordered the Argenteuil dump moved into the Metro subway tunnels of Paris, and the transfer of this oil saved it. The dumps at Bordeaux and Lyons, however, went up in smoke following an air raid on August 2, 1944.

German officials believe that bombing was not as effective against their aircraft plants as it was against oil refineries. They believe that this was due partly to the use of underground aircraft workshops.

Although the head of the Messerschmitt

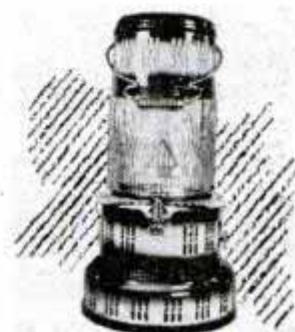
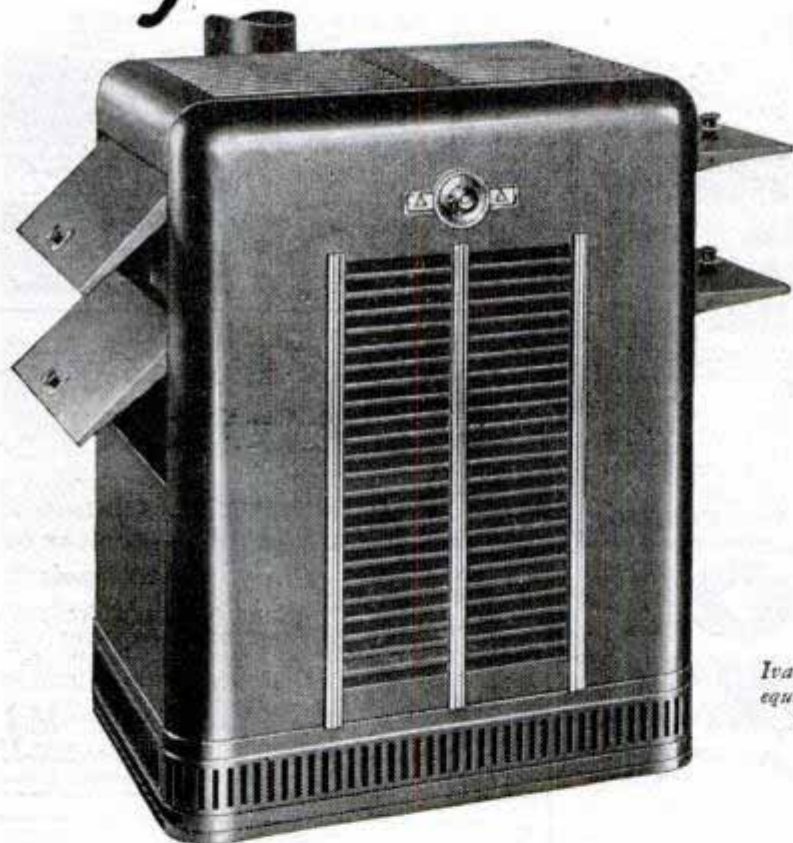
(Continued to page 244)

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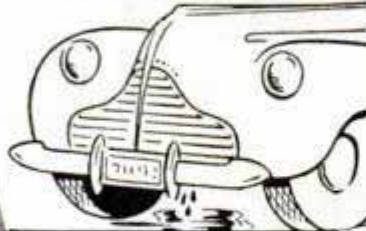
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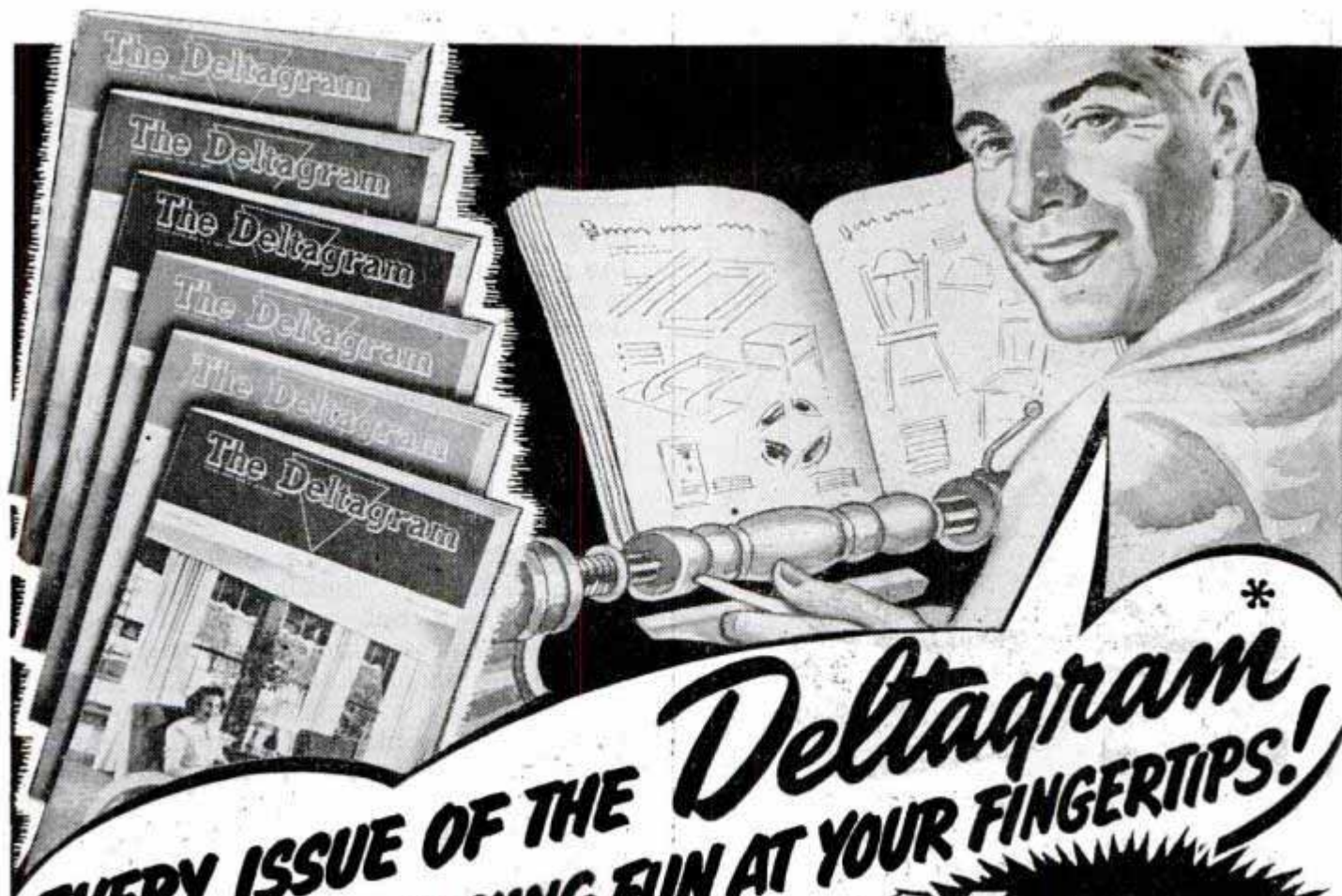
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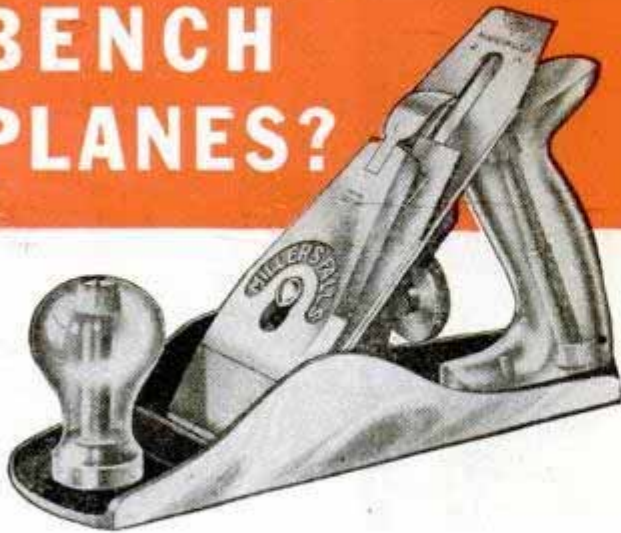
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**GREENFIELD
MASSACHUSETTS**

airplane company estimated that Germany's potential aircraft production was reduced by as much as 50 percent due to plant dispersal, he was a strong advocate of underground factories. He said that in 1935, believing it the best safeguard against air attack, he sought to place his plants underground. He received no support from the government, however, because of the expense involved and because of overconfidence as to the strength of the Luftwaffe.

Lessons learned from the German attempts to put their industrial plants underground, and the results of the Bikini atom bomb tests, are helping to guide our policy.

Authorities differ on possible results of an atom bomb explosion over an underground storage or manufacturing site. Dr. Verne R. Mason of the University of Southern California believes that three feet of concrete is protection against the type of atom bomb dropped on Japan. Dr. Mason, who studied the effects of the Jap atom bombing, based his opinion on the fact that 22 telephone operators who fled to a concrete underground shelter at the approach of the bombing plane were uninjured although their dugout was directly under the main blast area.

On the other hand, experts at the Army Ordnance Ballistics Research Laboratory at Aberdeen Proving Ground, Maryland, believe that shock waves might make even deep underground caverns untenable during atomic attack.

Using complicated electrical hookups, laboratory scientists are examining shock waves in connection with atomic fission experiments and will apply what is already known to lessons learned during the atom bomb tests.

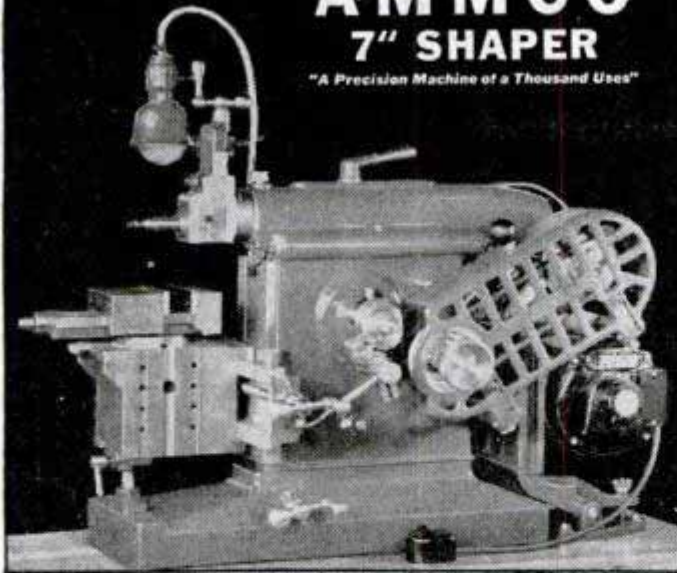
Colonel Leslie E. Simon, director of the Aberdeen Laboratory, asserted that after the results of the Bikini blasts are compiled they could "determine at what height an atom bomb should be exploded to crush solid rock to a depth of 150 to 200 feet." According to Colonel Simon, these studies, based on the performance of shock waves in both earth and water, are a continuation of experiments made during the war on shock waves in air. A 24-channel recording cathode-ray oscillograph is used in determining their extent.

These shock waves, upon which much of the effect of the atom bomb depends, do not always perform uniformly. This is revealed in a recent report by Major General Leslie R. Groves, commanding general of the Manhattan Project, which makes public some of the details of the Hiroshima and Nagasaki bombings.

(Continued to page 248)

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Construction incorporates many features you would expect to find only in larger, more expensive machines... For example: WAYS of ram, tool head, and front face of the main frame are of the "VEE" type, hand scraped to insure accuracy and long life. Available for stationary installation or as portable unit.

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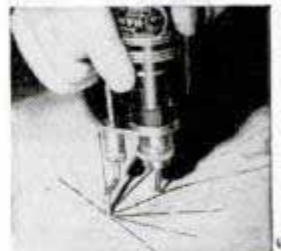
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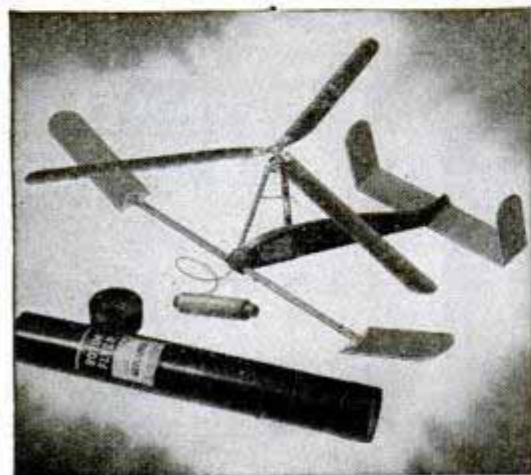
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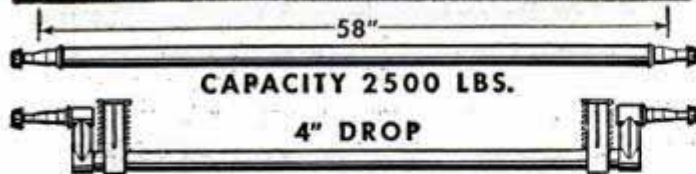
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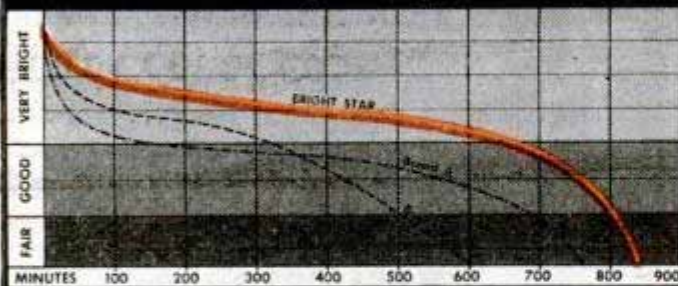
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In Nagasaki, 2000 feet from "X"—the ground point directly below the burst—reinforced concrete buildings with 10-inch walls were collapsed and some 9-inch concrete walls were completely destroyed. Yet, at the same distance, reinforced concrete walls only 4 inches thick, although damaged, remained standing.

Engineers probably will find a way of insulating the caves or concrete walls of underground buildings from these shock waves so that humans can live in them. This and protection against radioactivity are major problems awaiting solution.

Although it will take some time to get accustomed to living underground, man will not suffer physically from it. We can live without natural sunlight or free air. Some of our newer office buildings do not have windows either for light or ventilation, relying on air conditioning and electric lights.

In the underground city water under pressure will be brought to any level. Smoke and gases will be exhausted by giant fans. The housewife will buy fruits and vegetables produced by farmers who will cultivate "fields" under artificial sunlight lamps. Workmen in factories will work under ultraviolet-ray lamps which will furnish the beneficial rays given off by the sun.

Regardless of whether or not we are forced to live in underground caves or cities within our lifetime, members of the Army and Navy Munitions Board are taking no chances. It is their responsibility, working with other agencies, to plan full application of the nation's strength for military purposes in the shortest possible time in an emergency. The underground sites survey is one phase of that responsibility.

Talking Mountains

(Continued from page 145)

possible. So little-known "Yagi" beams give enough zip to the messages to carry them in a wandering path across the cluttered terrain.

"Yagi" beams were named for the Japanese radio engineer who discovered them. Most radio transmission is in a complete circle with the transmitter in the center. But all the strength of "Yagi" beams is focused in one direction, toward the receiver. Grotesque antennas do the job, pulling radio beams from one direction to boost them along in another. The antennas act as a funnel to pour all the strength of the transmission toward the receiver.

The resultant gain in strength sends the

(Continued to page 252)

The case of the Shedding Brush



A brand new paint brush on its very first job, but it's losing hair like a mangy terrier. Whose fault? The buyer's fault—for letting himself be tempted by a "bargain counter" price.

Things like that don't happen to you. One reason you read *Popular Mechanics* is that you like to do things *right*—and that goes for buying as well as building.

Your hardware dealer is just as quality-minded as you are. He *has* to be—his business success depends on it. When you need tools and hardware, you'll always get more for your money from him.

**YOUR HARDWARE DEALER
Sells QUALITY Tools and
Hardware. Buy from HIM.**

✓ **POPULAR MECHANICS**

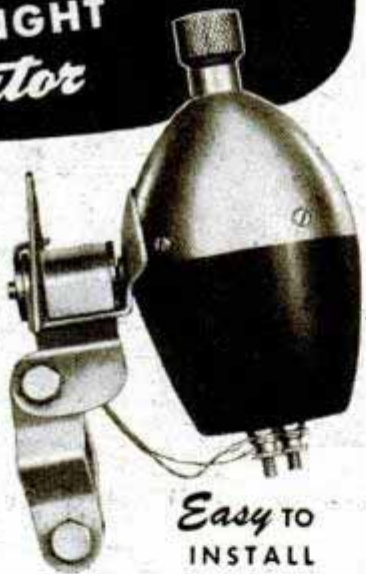
Dependable Bike Light MEANS SAFETY



GOOD LIGHT
EVEN AT A WALK
WITHOUT BATTERIES

CAN'T
BLOW BULBS

MAKE-A-LITE BICYCLE LIGHT Generator



MAKES night cycling safe! Run-down batteries and dim lights account for numerous accidents. Make-A-Lite provides bright, unfailing light, even at a walk, without batteries! Generates electricity, cost-free.

Automatic voltage control generator prevents blowing of bulbs at high speed. Separate circuits for head and tail lamps prevent damage of one from affecting the other. Both lamp bulbs interchangeable.

At Your Bicycle, Hardware
or Sporting Goods Store

Easy TO
INSTALL

MAKE-A-LITE DIVISION
Chefford Master Mfg. Co., Inc., Fairfield, Ill.

SAY YOU SAW IT IN POPULAR MECHANICS

and a "YANKEE"

Quick-Return Spiral Screw Driver

Got to drive screws where it's hard to use both hands? Take it easy . . . with one hand and a "Yankee" 130A Spiral Driver. "Quick-return" spring in handle keeps the bit in the slot, returns the handle after each push.

Write for the "Yankee" Tool Book.



NORTH BROS. MFG. CO.

Division of The Stanley Works
Philadelphia 33, Pa.



WELD ANYTHING ANYWHERE ANYTIME



ALL PURPOSE ARC WELDER

9 Models . . . 32 Volt D.C., 110 to 440 A.C.
A complete workshop in itself! Weld, cut, braze or solder any type metal; iron, castings, aluminum, steel, bronze . . . in any gauge or weight, with equal ease. Compact, complete, sturdy as the Rockies. Formed steel and cast aluminum case, welded steel base, 4" cast wheels. Built with voltage control. Better on R.E.A. lines. No training needed. Sold throughout the world. Unconditionally guaranteed for 2 years. Fully equipped—ready to use.

FORNEY MFG. CO.
FORT COLLINS 2, COLORADO



BRASS RODS For Home Work Shops

Write Dept. A for Free Catalog
of 45 Kits Today
MEIER BRASS & COPPER CO.
1155 Bellevue, Detroit 7, Mich.

For use on model boats, airplanes, etc., keeps a supply of these free-turning brass rods on hand. Each kit contains a complete assortment of sizes.



HUNTER'S COMPASS

Hunting Case, Watch
Type, All Metal, **\$2.50**
Jeweled Longines

Engineers All Metal Army
Type Hand-Sighting

LEVELS
\$1.50



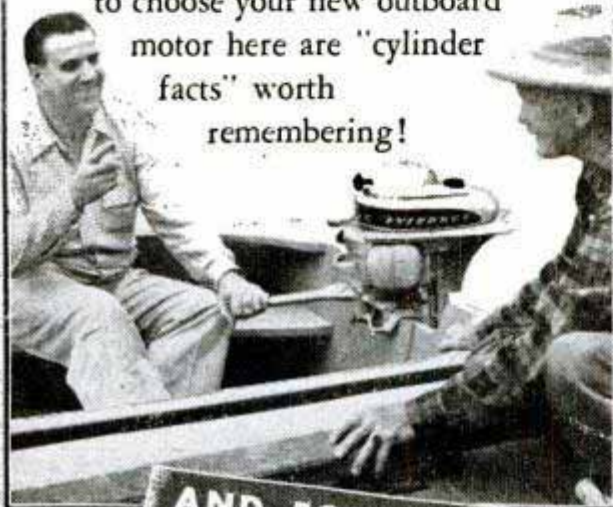
PUBLIC SPORT SHOPS

13 S. 16th St., Phila. 2, Pa.

No COD's

"How many cylinders should an outboard have?"

Of course there is much more to an outboard motor than cylinders and pistons. But the *number* of cylinders does have a lot to do with smoothness, flexibility, power, *performance!* When you come to choose your new outboard motor here are "cylinder facts" worth remembering!



AND FOR TOPS IN THRILLING PERFORMANCE — CHOOSE A "FOUR"

Tens of thousands of enthusiastic owners will tell you, "For tops in performance and pleasure — own a four". Only Evinrude offers four-cylinder outboards, and Evinrude builds with a background of 18 successful years in perfecting these superbly smooth and spirited motors Four great "fours"* to choose from — two of them smack in the range of two-cylinder power, weight, price!

See your Evinrude dealer — look for his name in your classified phone directory under "Outboard Motors". Complete catalog of 8 Evinrude models sent free . . . address EVINRUDE MOTORS, 5374 N. 27th St., Milwaukee 9, Wis.

In Canada:
Evinrude Motors, Peterborough, Ontario.

*Motor shown is the "Lightfour", 66 lbs., 9.7 O.B.C., certified brake horsepower at 4000 R.P.M.

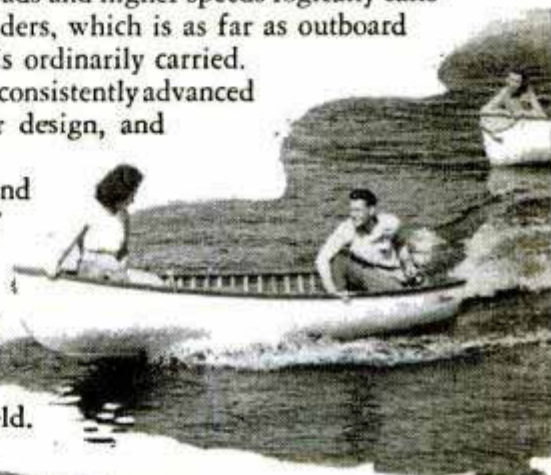
ONE CYLINDER IS FINE . . .



For small outboard motors, where light weight and handy portability are prime considerations; single cylinder construction is highly satisfactory. Single cylinder design has come a long way since Ole Evinrude "started it all" back in 1909, and Evinrude's highly developed "Ranger" and "Sportsman" are favorites with outdoor folks everywhere.

TWO CYLINDERS . . . EXCELLENT

The next step up in power for heavier loads and higher speeds logically calls for two cylinders, which is as far as outboard engineering is ordinarily carried. Evinrude has consistently advanced twin cylinder design, and Evinrude's "Sportwin" and "Speeditwin" are today two of the most popular models in the two-cylinder field.



EVINRUDE

OUTBOARD MOTORS

**ARMY SURPLUS
SENSATIONS!**

OFFICIAL

**U. S. AIR FORCE
PARACHUTE
SEAT CUSHIONS**

A "Natural" for seating concessionaires! Heavy Khaki canvas, hair-filled for resiliency, double-stitched, water-repellant—they'll wear for years! Use 'em in home, offices, ball games, theatres!

SINGLE CUSHION \$1.29

M. O. or Cash
(10 OR MORE, \$1.00 EA.)
(100 OR MORE, 85c EA.)
POSTAGE PREPAID!
BIG! 13 x 16 x 2"

**THE REAL "McCOY"
U. S. NAVY
DEBARKATION LITE**

Lamp of 1,000 uses! Sturdy steel construction, Forward and side deflectors. Ideal for road distress signal, boating, night light. Uses single cell batteries. Kids!—get these and set up signal system in the gang!

only **\$2.95**

MONEY ORDER OR
CASH POSTPAID

**5 DIFFERENT COLOR
LENSES!**



Here it is!
**THE WAR FAMOUS
WILLYS
JEEP ENGINE
COMPLETE!**

With all accessories including Carburetor, Generator, Starter, Fuel Pump, Fan and Clutch. For car replacement, boats, power units.

\$169.00

SEND \$25. M. O.
OR CASH—BALANCE
C. O. D. ON DELIVERY

F. O. B.
CINCINNATI

Order Direct!
**ASSOCIATED
SUPPLY COMPANY**

118 E. 8TH ST. CINCINNATI 1, OHIO
TELEPHONE MAin 1942

message with enough force to cross the uneven ground even though it's not line-of-sight. The beam travels in one direction until it strikes an obstacle, then bounces in another like a ball on a billiard table. It actually ricochets between the mountains and cliffs in the general direction of the receiver without the benefit of relay transmitters. The receiver atop the mountain or at Rapid City, depending upon which direction the message was sent, then snatches the message out of the air.

Despite the need for relay stations on top of the two mountains, the system is extremely flexible. Either headquarters can talk to any patrol car and the cars can talk among themselves. Pierre headquarters can plug up a road net 200 miles away minutes after orders are transmitted.

Where Redwoods Are Pygmies

(Continued from page 113)

Nick's tiniest and most perfect creation is a scale model of Catalina Island, 21 inches long, an inch to the mile. The island is covered with Lilliputian trees from 1/4 to 1/8 inch high. Tiny roads wind through the hills. About 100 of the principal buildings of Avalon are in their proper places, complete to windows and chimneys. You can even hear the soft notes of chimes being played from the chime tower on the hillside.

After dark, Nick turns a switch and immediately the windows of the microscopic buildings glow with light. Lighthouses along the coast send out their beams. A general moonlight effect is created by soft illumination from a Lucite moon.

The model rests on an ebony base containing five inspection ports fitted with magnifying lenses. When you peer through these ports you see typical underwater scenes, with tiny bits of seaweed in the foreground and giant kelp stalks towering overhead. Each illuminated scene is like a bit of fairyland, in natural colors.

Suddenly, to your amazement, you see a tiny fish swimming through the underwater forest. It tugs at a bit of seaweed and then moves away. Other fish swim past and seaweed sways just as it does in a current.

The animated fish, typical of the species in Catalina waters, are actuated by three small electric motors in the base. Each thumb-sized motor had to be built for its job. They also operate gears that make the seaweed sway back and forth.

This Catalina Island model is the greatest of Nick's achievements. He has been working on it for four years and some of the details still are unfinished. It would be hard to estimate its value.

America's costliest cars have V-type engines. Only Ford has it in the low-priced field!



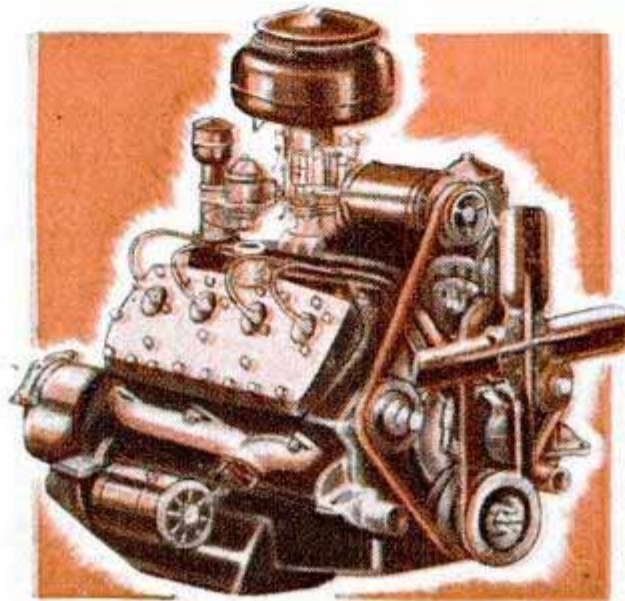
Ford's out Front

WITH THE ONLY V-8 ENGINE
IN THE LOW-PRICED FIELD!

The only 100 h.p. engine in its class...the champion performer!

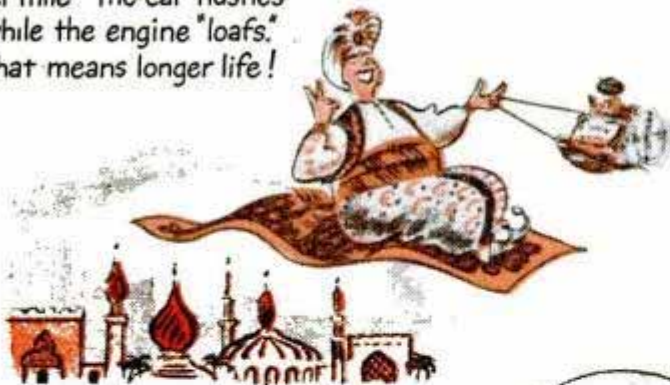


New 4-ring aluminum pistons save ye a pur-r-ty penny on gas and oil!



V-8's extra smoothness comes from overlapping power strokes!

V-8 makes fewer turns per mile the car "hustles" while the engine "loafs." That means longer life!



Look! Only Ford production magic brings you this finest type engine at lowest cost!



THERE'S A



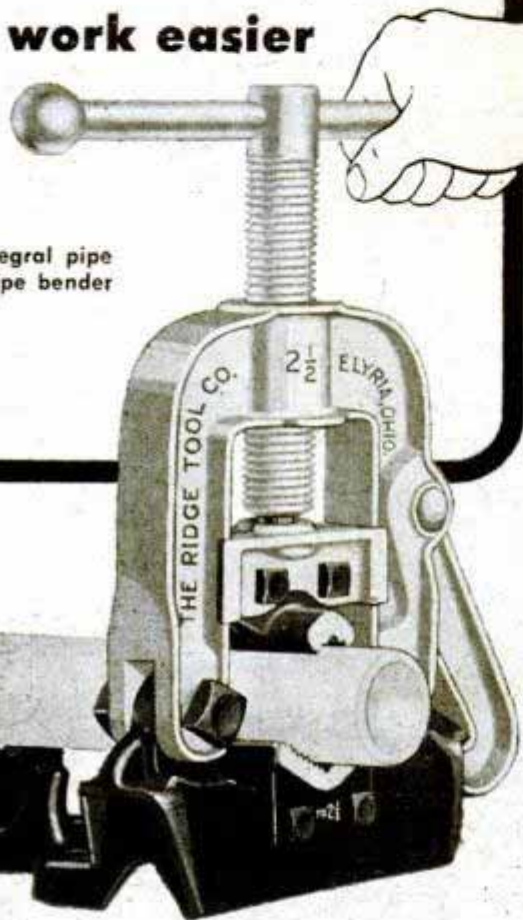
IN YOUR FUTURE!

This handy Red-Top

RIGID

yoke vise makes your
pipe work easier

Handy, integral pipe
rest and pipe bender



● Look for the red yoke on a black base when you buy a bench vise—for this sturdy RIGID of strong special malleable offers you unusual convenience. It has an integral pipe rest for easier cutting and threading; it has a handy pipe bender. Its tool-steel LonGrip jaws are easy on polished pipe. It's more for your money—buy in any of 8 sizes for pipe to 6 inches, at your Hardware Store or Supply House.



RIGID Vises,
Yoke & Chain
in 9 styles, 23
sizes.

RIGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

**YOUR ENGINE
CAN FILL FLATS!**



Why sweat and strain pumping up flat tires by hand? Replace one sparkplug with this Engine Driven Tire Pump and substitute 10 Horsepower for One Manpower! Adapters furnished to fit any

gas engine. Clean air from outside engine pumped through 12 ft. of hose to tire.

ENGINE DRIVEN TIRE PUMP Only \$4.95

**DUAL POWER
SPRAYER
Only \$14.95**



Spray 600 to 1000 sq. ft. per hr. with paint, varnish, lacquer, insecticide or any other free-flowing liquid, using this Dual Power Sprayer, which

converts your car, truck or tractor into a high-powered air compressor. Equipment includes 2 Auto Power Air Pumps, 2 sets adapters, 2 Pulsation Chambers, Y hose connection, 25 ft. hose, and Pistol Grip Sprayer as shown.

Also **SINGLE POWER SPRAYER** with Pistol Grip, only \$10.00 will handle 300 to 500 sq. ft. per hr. as above. Includes single set of units to operate off one sparkplug hole with 10 ft. hose.

Send Money Order and Save Shipping Charges

MARS PRODUCTS COMPANY

Dept. C, 1170 Broadway

NEW YORK, N. Y.

DRILL CONCRETE *The Easy Way!*

CONCRETE
ASPHALT
BRICK



SLATE
WALLBOARD
LIMESTONE
and all other
construction
materials.



SLIP A CARBOLY MASONRY DRILL INTO YOUR ROTARY DRILL, HAND BRACE, OR DRILL PRESS, AND WATCH IT GO—AND GO FAST!

- DRILLS 4 TIMES FASTER!
- STAYS SHARP 50 TIMES LONGER!
- CUTS CLEAN, TRUE-SIZE HOLES!

Goodbye to back-breaking masonry drilling! Cut clean, true-size holes in all masonry jiffy-quick! Use your rotary drill, hand brace, or drill press. Drill holes 1/4" apart without break-through. Ask about Handy 6-Drill Set (canvas case, free). See your dealer, or write.

Tipped with Carboly Cemented Carbide—harder than the hardest steel.

CARBOLY COMPANY, INC.

11185 E. 8 MILE BLVD., DETROIT 32, MICH.



**TORNADO
GAS TORCH**

The Modern Way of Soldering

Ideal for hard and soft soldering. Will heat quickly; solder will flow freely and smoothly. No compressed air required. Nothing to pump. Self-adjusting. Safe. Economical. Can be used for annealing small parts and bending metal parts. Generates a heat of 1700° Fahrenheit. Simply connect to any illuminating gas jet with a rubber hose and

operate. Tornado Torch No. 119 comes with three (3) tips, (3/8", 1/4", 3/16" blast).

The Tornado Gas Torch No. 119, complete with three tips, is \$2.95. See your dealer or order direct. Send check or money order—post paid.

Robert Manufacturing Co. Inc., 202 E. 44th St., New York 17, N. Y.



John Surrey's

Golden Burl Prima

...\$5



THE COLLECTOR'S PIPE...

AN EXTRA MEASURE of pride comes with the ownership of a John Surrey GOLDEN BURL PRIMA. For its beauty says what its performance proves... here is a pipe of unmistakable quality.

Fashioned from the choicest imported briar, John Surrey's GOLDEN BURL PRIMA is hand-made with infi-

nite care by expert pipe craftsmen. Observe its rich golden finish, unmarred by varnish or lacquer sprays. Instead, the briar is polished with a costly wax to bring out the full beauty and color of its handsome grain.

Ask for John Surrey's GOLDEN BURL PRIMA at your favorite tobacconist's.

OTHER LINES: Sir John \$2.50, Royal House \$3.50, Drury Prima \$5.00, Sun Flame \$7.50

JOHN SURREY, LTD., 509 FIFTH AVENUE, NEW YORK 17

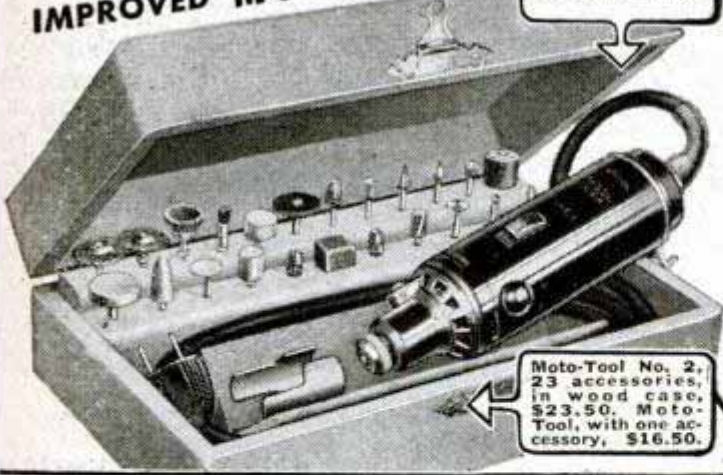


OWN A "POCKET SIZE" MACHINE SHOP

IMPROVED MOTO-TOOL

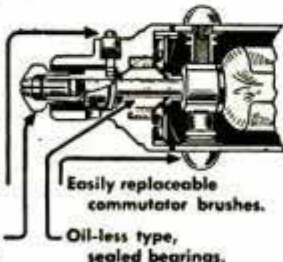
27,000 R.P.M.
CUTS CLEANER.
SAVES CUTTERS

Moto-Tool No. 2,
23 accessories,
in wood case,
\$23.50. Moto-
Tool, with one ac-
cessory, \$16.50.



LOOK
FOR THESE
MOTO-TOOL
FEATURES

Patented, automatic
chuck lock pin.
Instant-acting,
wrenchless chuck.



Weights only 13 oz.
• Operates on 110-
120 AC or DC current
• Shockproof bakelite housing fits the hand • Dynamically balanced armature eliminates vibration
• Cooled by dust-filtered air • Sliding, snap-type switch • Hang-up hook • Cord protector.

• Dremel "Moto-Tools" have been used by toolmakers, machinists, pattern makers, electrical and radio repairmen, home craftsmen, model makers, jewelers, hobbyists, sportsmen and handymen for over 10 years. "Moto-Tool" is a "war veteran" . . . Thousands of them were used at far flung maintenance bases by every branch of the armed forces. "Moto-Tools" are in use in tool rooms and on production lines at General Electric, Westinghouse, Remington Arms, Ford, Nash-Kelvinator, Consolidated Aircraft, Douglas and others.

DO THESE JOBS BETTER AND FASTER WITH A "MOTO-TOOL" Sharpening taps, gouges, chisels, wood drills, lawnmowers, knives, scissors, cutting tools, etc.; for grinding, routing, drilling, cutting, carving, engraving, sanding, polishing, cleaning, etc., in metal, wood, plastics, etc.

MONEY BACK GUARANTEE—Ask your dealer about Dremel "Moto-Tools" and accessories. If he does not handle them, order direct from the factory on a 10 day trial, money back guarantee.

DREMEL MFG. CO. Dept. 116-K RACINE, WIS.

MAIL THIS COUPON TODAY
DREMEL MANUFACTURING COMPANY, Dept. 116-K
Racine, Wisconsin

- Enclosed find \$..... (Money order or draft). Ship the following at once:
 - "Moto-Tool" Kit No. 2—\$23.50
 - "Moto-Tool" Model 2 with one accessory—\$16.50
- Enclosed find \$2.00. Ship above C.O.D. I'll pay postman balance plus postage.
- Send catalog of Dremel Tools and Equipment. FREE.

Name.....
Address.....
City..... Zone..... State.....

THE ONLY BRUSH THAT

Keeps the Air Clear as it Cleans the Floor

Also Eliminates
Sweeping Compound!



Arbitrin Sweeping fluid is put into a steel reservoir in the back of the Dustless brush.

As you sweep Arbitrin filters through the tufts — surrounds particles.

The dust itself is converted into sweeping compound — cannot rise into the air.

Dustless brushes used with Arbitrin sweeping fluid are 100 times more effective in controlling dust than ordinary floor brushes used with sawdust. When used daily, Dustless brushes actually reduce bacteria, normally in the air between sweepings, as much as 97%. These facts have been proved in tests made by independent health authorities. Dustless brushes are used in thousands of stores, factories, offices, schools, and institutions. They are unconditionally guaranteed to meet your requirements. Write today for sizes, styles, and prices.

MILWAUKEE DUSTLESS
BRUSH COMPANY

530 North 22nd Street • Milwaukee 2, Wisconsin

MANUFACTURERS OF DUSTLESS, SPEED SWEEP AND SPEED WASH BRUSHES

Milwaukee Dustless Brush Co., 530 N. 22nd St., Milwaukee 2, Wis.

Please send complete information about Dustless brushes and Arbitrin sweeping fluid.

Name.....

Address.....

City and State.....

108

Showman Turned Inventor

(Continued from page 135)

shaker, shows visitors a sign in his workshop which reads:

"After six weeks in the tropical test chamber by the Research Development Branch, Washington, D. C., for the U. S. Army, my salt container passed the test 100%. Arthur Hammerstein, Inventor."

Other Hammerstein inventions include:

(1) Clock-operated egg timer in which water is released from a cylinder to conclude the cooking at the right time.

(2) Clamp attached to a cord to hold a hot soldering iron and prevent it from marring a work surface.

(3) Machine that cuts twine and holds onto the spool end of the cord to keep it within easy reach and to avoid snarls. It was designed for wrapping counters.

(4) Glass cutting machine that employs an emery wheel cooled by dropping water.

(5) Electrical magnetizer which magnetizes screwdrivers to pick up small screws.

(6) Bottle cutter that uses heat from an electric wire. (Asked why he wants to cut bottles, Hammerstein said, "I just wanted to see if this idea would work.")

That typifies Hammerstein—"workshop showman" full of ideas and action.

The Dust Bowl Is Restless Again

(Continued from page 157)

reach into the air to snare soil that starts to blow, protecting nearby fields by dissipating the force of the wind.

These are a few of the many methods recommended by the Soil Conservation Service of the U. S. Department of Agriculture. Congress passed the Soil Conservation Act authorizing the service in the days of the dust bowl when the nation watched helplessly as great sections were blown from the heart of America.

In 1937 the first state enabling acts were passed authorizing soil conservation districts. Today nearly 1500 such districts blanket three million farms and 800 million acres of the country's land. All the states now have soil conservation district laws or other legislation enabling farmers to carry on organized erosion control and obtain federal and state assistance in doing so.

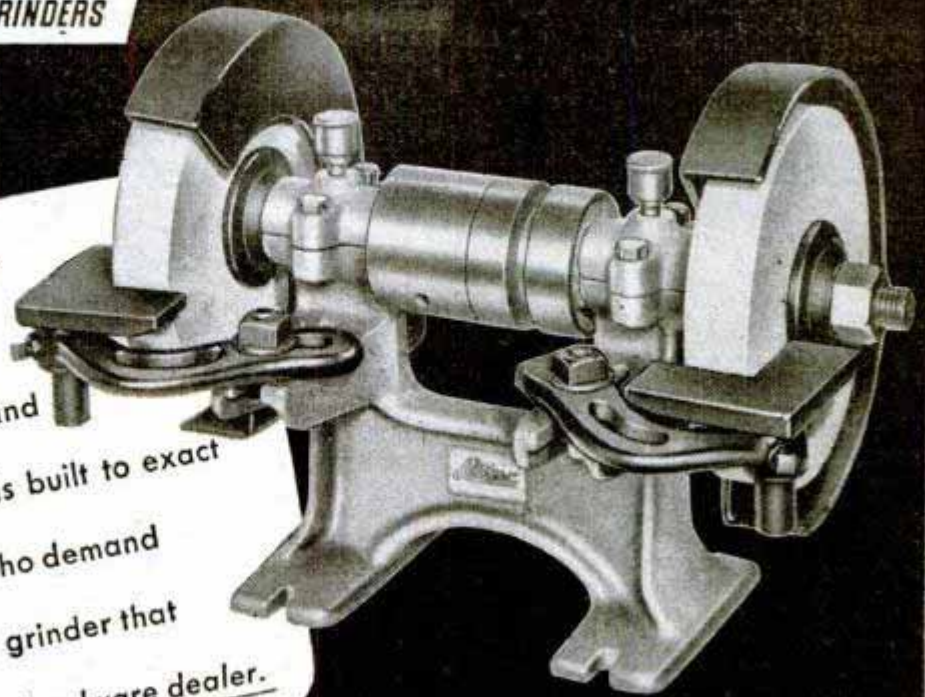
Here's the way the system works. Each district is a cooperative unit independent of federal dictation. Any of the three million farmers or ranchers living in these districts can seek assistance from the Soil Conservation Service. Any farmer has complete access to the information and

(Continued to page 260)

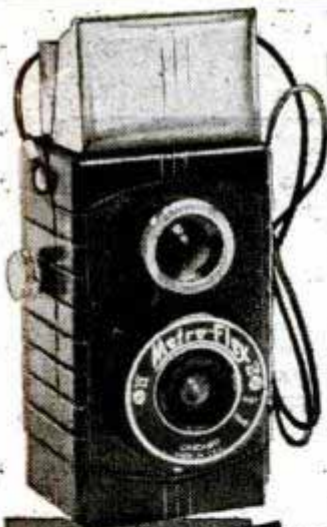
Luther POWER GRINDERS

HAND AND POWER GRINDERS

Like all Luther Grinders, the power grinder shown here is famous for high quality and rugged construction. It is built to exact specifications for those who demand fine tools. For the Luther grinder that fits your needs, see your hardware dealer.



LUTHER GRINDER & TOOL CO.
(Established 1896) Sheboygan, Wisconsin



AMAZING NEW DOUBLE LENS CAMERA

Only \$6.95 Complete with shoulder cord

Now you can take perfect pictures ... because you see exactly what you'll get on your film before you snap the shutter! Yes, you see the ENTIRE IMAGE in sharp, clear focus (as in the costliest cameras) with the **GROUND GLASS VIEW FINDER** of the amazing new double-lens Metro-Flex Camera ... available for the first time since the war at a remarkable low price! With the Metro-Flex Camera you're sure of results on all kinds of shots. Close-ups, scenes, people, events ... they all come out just as you see them in the Ground Glass View Finder ... before you snap the shutter!

TWO MATCHED LENSES ...

One lens focuses the picture for you. The other snaps the picture. Both lenses, working in harmony, give you sharp focus never before available except in most expensive cameras. The Metro-Flex is a beautiful camera ... handsomely, sturdily made ... modern-design plastic case ... bright aluminum, rust-proof trimmings ... high speed, optician-ground lens ... time exposure adjustment ... and complete with plastic shoulder cord. Easy to load and use. Will give years and years of picture-taking fun. Takes 8 exposures on standard No. 127 film.

GROUND GLASS VIEW FINDER

Same Type as in Highest Priced Cameras

- 1 Easy focusing ... you see entire picture before you take it, just as it will look when developed!
- 2 No tilting ... your eyes tell you if picture is centered on film.
- 3 Everything you want to take ... no disappointments, because you see the whole picture, framed as it will appear on the film.

SPECIAL! 20-Page Photo-Album included with Camera at no extra cost!

SEND NO MONEY!

Order your Metro-Flex Camera now, complete with Ground Glass View Finder, double lenses, and shoulder cord. Send No Money. Just mail coupon at right and pay postman only \$6.95 plus postage on delivery — we pay postage if you enclose \$6.95. Use Metro-Flex Camera for 10 days, and if you're not delighted, return it, and your money will be instantly refunded. Rush coupon. Supply limited.

Williams Camera Co., Dept. C-603
412 S. Market St., Chicago 7, Ill.

WILLIAMS CAMERA CO., Dept. C-603,
412 South Market Street, Chicago 7, Ill.

Please rush Metro-Flex Camera, complete with Ground Glass View Finder, double lenses, and shoulder cord. Include 20-Page Photo-Album at no extra cost. I will pay my postman \$6.95 plus postage on delivery. **ALSO**

SEND ME 3 Rolls—127 film for 96c 6 Rolls—127 film for \$1.92

No film sold without camera, on first order, but as a METRO-FLEX owner you may order future supplies of film from us at above prices.

NAME _____

ADDRESS _____

CITY _____ STATE _____

CHECK HERE: If you are enclosing full payment. Then we pay postage. Satisfaction guaranteed.



SEE the picture BEFORE You Take It!

FILM AVAILABLE!

The METRO-FLEX uses any standard make of No. 127 film. Order a supply of film on coupon below when you order camera.

3 Rolls (8 exposures per roll) 96c

6 Rolls (6 exposures per roll) 1.92

No film sold without camera, on first order but as Metro-Flex owner you may order future supplies of film from us at above prices.

FREE ALLIED'S 1946 RADIO CATALOG



**LARGEST STOCKS
OF EVERYTHING
IN RADIO . . .**

SERVICEMEN! Dealers! Soundmen! Amateurs! Builders! Experimenters! Send for the handiest, most complete 1946 Buying Guide for Everything in Radio! Features latest radios, sound systems, amateur and builders' gear, thousands of radio and electronic parts—world's largest and most complete quality stocks—at lowest prices. Fastest service; expert help!



MORE THAN 10,000 ITEMS

Everything for every radio use: new model home radios, phono-radios, communications receivers, Ham kits, radio parts, tubes, tools, test instruments, public address equipment, easy-to-build kits, diagrams, instructive books—all at lowest prices!

HELPFUL RADIO BOOKS

- Radio Formulas & Data No. 37-752 10c
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- Radio Circuit Handbook No. 37-753 10c
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- Radio Data Handbook No. 37-754 . . . 25c
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- R-F Resonance and Coil Winding Calculator. No. 37-955 25c

ALLIED RADIO

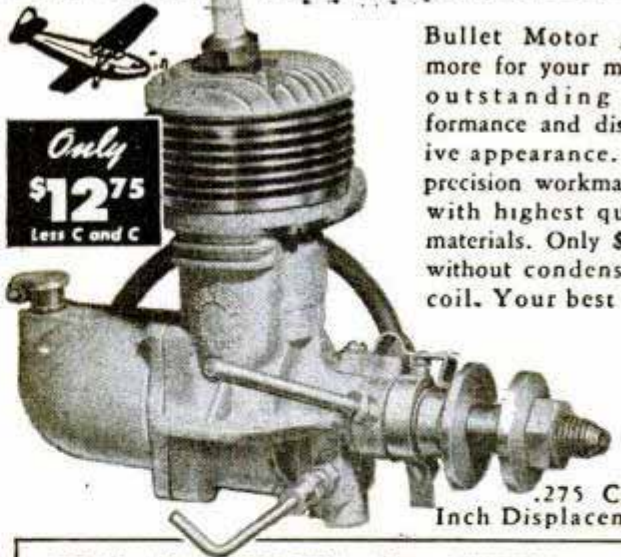
ALLIED RADIO CORP.
833 W. Jackson Blvd., Dept. 5-K-6
Chicago 7, Illinois

- Send FREE 1946 CATALOG
 - Send Six Books No. 37-799
 - Send Books checked above
 - Send Calculators checked above
- } \$...enclosed

Name.....
Address.....
City..... Zone..... State.....

FREE
CATALOG

BETTER FLYING MODELS!



Only
\$12.75
Less C and C

Bullet Motor gives more for your money, outstanding performance and distinctive appearance. Fine precision workmanship with highest quality materials. Only \$12.75 without condenser or coil. Your best buy!

.275 Cubic
Inch Displacement.

BORE — ¼" • STROKE — ⅜" • WEIGHT — 4 ¼ oz. (Bare Wt.) • RPM — 6 to 10,000 • FINISH — Baked crinkled black plastic. External parts nickel plated. • GAS TANK — Center screw attached. Can mount motor any position. • CYLINDER — Broached for concentricity, super-honed for smoothness. • PISTON — Mechanite, centerless ground for fine finish.

If hobby dealer is unable to supply Bullet Motor, send order to us with name and address AND name and address of dealer.

BULLET MOTORS

Manufactured By MINIATURE MOTORS, INC.
8557 HIGUERA STREET • CULVER CITY, CALIF.

Appliance \$10.95 Tester



Pat. Pend.

LOCATES TROUBLE INSTANTLY IN ALL ELECTRICAL DEVICES

In this single unit are all the necessary tests for examining every appliance. Checks thermostats under working conditions. Tells instant it opens or closes. Controls heat on soldering irons. Prevents over-heating. Tests continuity, open circuits, automatic irons, vacuum cleaners, motors, coin machines, bulbs, 3-way switches, etc. Great time, and money saver! ONLY \$10.95 COMPLETE. No C.O.D.'s, shipping wt. 3 lbs.

FREE with each Tester. New, Complete Practical Course in electrical appliance repairing. WRITE FOR CIRCULAR.
HANLAN CO., 1419-A, West Jefferson, Los Angeles 7, Calif.



- Test ALL Home Outlets
- Find Open Circuits

STAR TEST-PLIERS

- Locate Blown Fuses
- Remove Fuses SAFELY

A must tool for electricians, maintenance men, home owners. Made of a transparent, shock-proof Plastic. Replaceable lamp inside Plier tests 110 to 250 Volts. Plier pulls fuses from 10 to 100 Amperes. Requires the use of only one hand. Can be obtained from General Electric or Westinghouse stores, or

from local electrical dealers. Order one TODAY.
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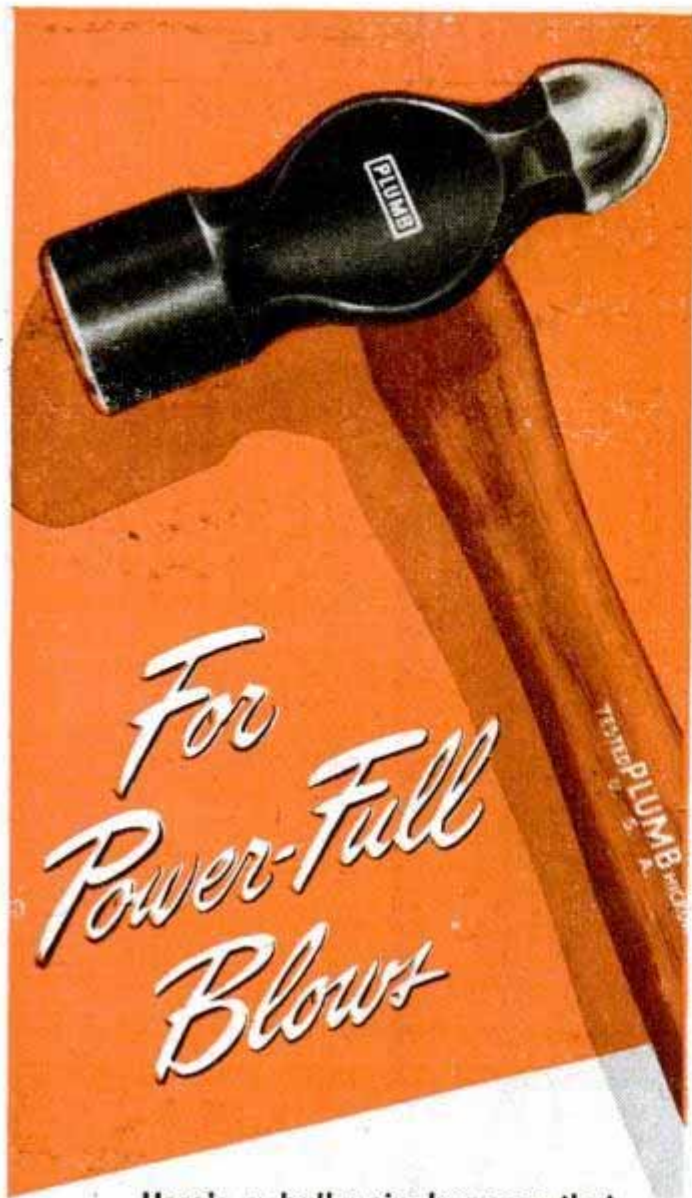


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records provided by the service. Under certain conditions a farmer in any one of the districts can obtain special equipment or stock, seed and other materials.

The farmer himself has absolute authority over his own land. Soil conservationists assist him—when he asks for help. Together, a farmer and a technician walk from field to field, studying each patch of land and checking it with the "land capability map," a chart drawn by the service that shows the best possible use of the land. Then they work together on a blueprint for the future. Land that can be used for "cash crops" is selected, then second-rate fields for growing feed for livestock. Farmers like to make their own decisions. They do it with the help of the Soil Conservation Service.

If the farmer is determined to carry out these plans, he may be forced to move fences and farm roads to follow the contours of land and fit the terraces he will plow. Field boundaries may be changed so that each field will have land of only one class. Tired cropland may be converted to pasture, meadow or woods.

Perhaps the farmer can do only a small part of this work each year. But when he's finished he knows that he's using each particle of loam the way it should be used—that he's not mistreating his soil.

Planned use of the land pays off, too. A survey taken during the war, when soil helped to fight the nation's battles, shows that soil conservation practices boosted yields by at least 20 percent on the average. Such a boost means a 20 percent raise in the farmer's income and probably more than that in the sale value of the farm.

Complete conservation methods have been applied with the aid of the Soil Conservation Service to some 80 million acres of land. Additional millions of acres have received indirect benefits from the service. In the opinion of Dr. Bennett there has never been any program started anywhere on earth that can compare with this one in the accomplishment of permanent protective work on the land.

But Dr. Bennett emphasizes that this is just a start. Farmers in some of the areas where soil is the most restless have not yet organized conservation districts. In other areas conservation is forgotten in the desire to boost the crop yield and thereby cash in on today's market. Marginal land is again plowed and planted to corn or wheat.

Signs of possible disaster appeared in southeastern Colorado during a dry spring season that made dust of unprotected fields. Winds as high as 60 miles an hour recently

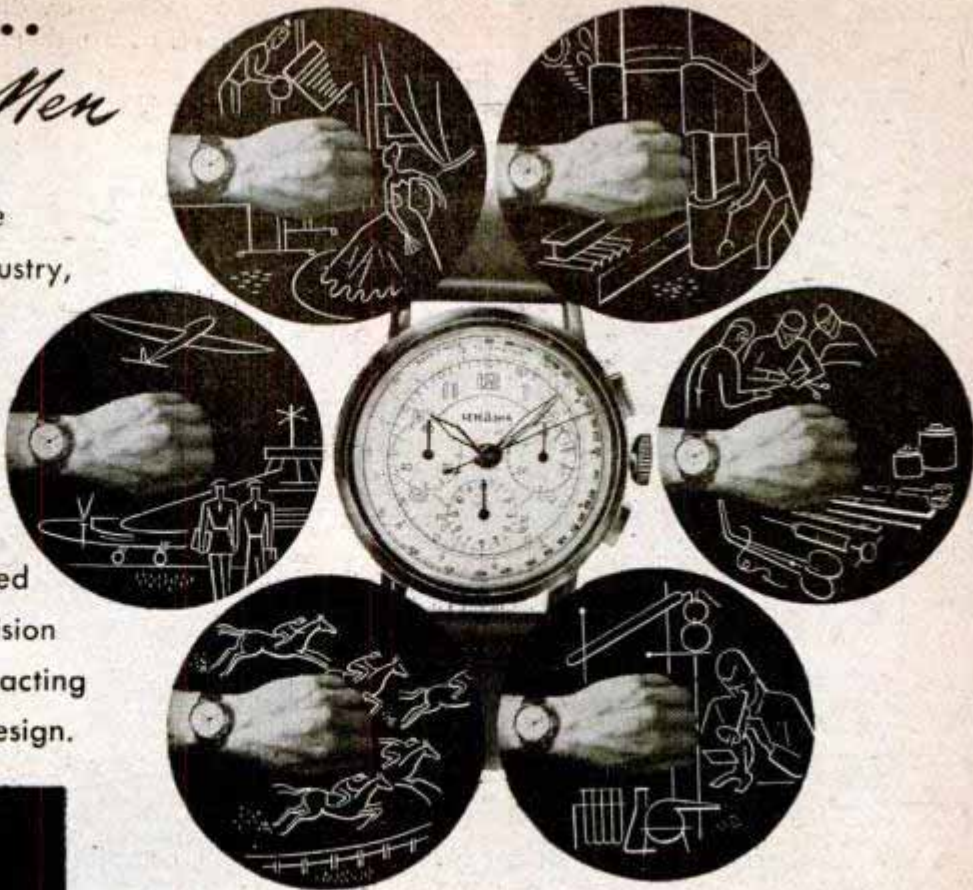
(Continued to page 264)

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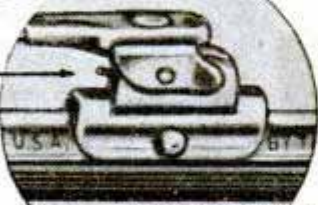
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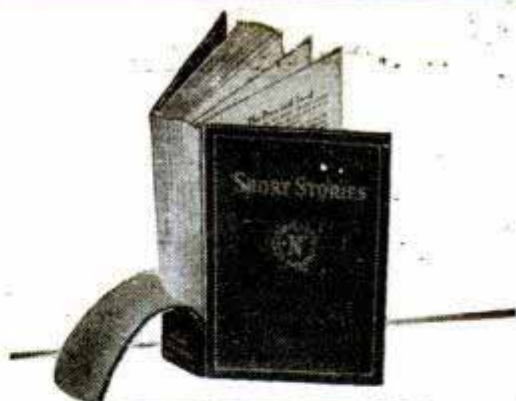
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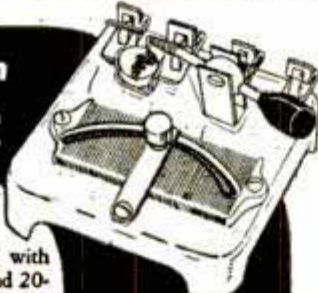
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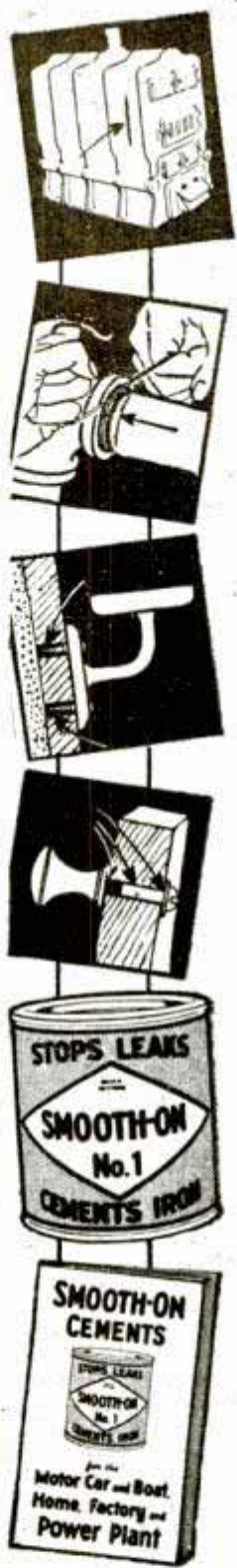
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whipped across western Nebraska to do a good deal of damage. Last spring, dust storms swept across western Kansas and the Texas and Oklahoma panhandles. Heavy rains that blanketed the fields at the last minute saved wheat crops.

The soil may run away again unless the farmer anchors it at home through intelligent application of conservation methods.

Luxury Goes Back to Sea

(Continued from page 119)

is not cheap. F. A. Bailey, president of the Matson Navigation Company, has stated that a total of \$18,000,000 will be spent upon reconversion of three of his company's liners, the Lurline, Mariposa and Monterey. This is \$6,000,000 per ship. It will take up to six months' work on each ship before it can receive passengers.

The Matson Line, which operates to Hawaii, plans to go back to the prewar schedule of weekly sailings in each direction with the modernized ships. Other lines are also rushing reconversions.

The American Export Lines expects to have ready in 1948 three new luxury liners to serve their routes to the Mediterranean, Near East and north Africa. They will be streamlined and air conditioned.

Moore-McCormack Lines will use five new ships on their South American and Scandinavian runs; the Grace Line nine to South America; Atlantic Gulf and West Indies Steamship Lines five to West Indies; United Fruit Company 20 to the West Indies and Central and South America.

Other companies putting new ships in service are American South African Line, American President Lines, United States Lines Company, American Mail Lines and Mississippi Shipping Company.

The Mississippi Shipping Company is placing three new combination passenger-cargo luxury ships on its South American routes. The first of these ships, the SS Del Norte, slid down the ways at the Ingalls Shipbuilding Corporation yards at Pascagoula, Miss., early this year. The Del Norte is the first passenger liner to be constructed as such since the war and will make her maiden voyage early this fall. The ship will be joined later by her sister ships, the Del Sud and the Del Mar.

The three ships are modifications of the Maritime Commission's C-3P design, built during the war as cargo vessels. This type now has been redesigned to provide passenger accommodations exceeding even those of prewar luxury liners. In outward appearance the Del Norte, with raked stem

(Continued to page 268)

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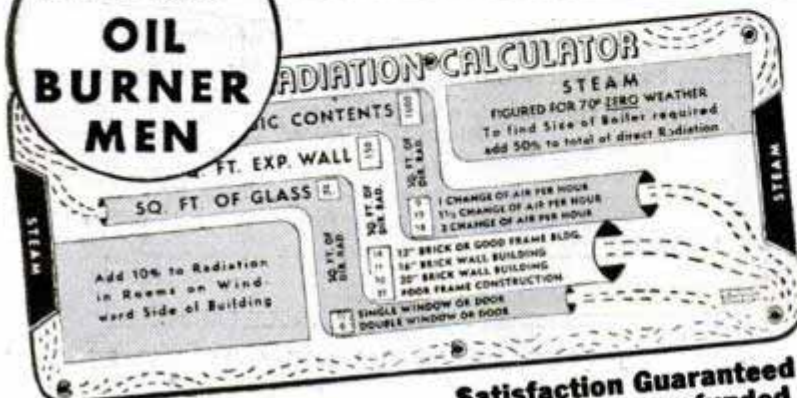
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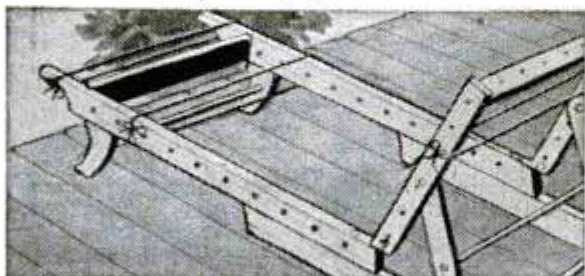
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CASCOPHEN



and cruiser stern, gives a glimpse into the future of streamlined ships. Among the many engineering advancements built into the ship is a new method of dispersing smoke and gases above the deck. The ship is air conditioned, even to crew's quarters. Casement windows replace the usual portholes in the staterooms.

Passenger-cargo combination ships are popular on the South American runs. The Grace Line's nine new ships are to be of this type. These follow the basic design of the C-2, another wartime cargo ship slightly smaller than the C-3, but with a greater cruising radius. The Grace Line ships will have a speed of 15½ knots on 80 percent of their 6000 horsepower. They will carry 52 passengers and a crew of 76. They are air conditioned and offer many facilities normally found only on premium transatlantic ships. The staterooms are provided with studio beds and furnishings which give them the daytime appearance of living rooms.

Safety has not been forgotten. The ships are equipped with the most modern fire detection, safety and navigation devices. Radar equipment will be added as soon as it is ascertained which type will best meet requirements. Radar already has been installed on many passenger liners. One of the most decisive weapons of the war, it also played an important part in the return of troops to the United States. Almost all of our troop-transport ships were radar equipped. Several disasters were averted by the efficient use of radar which spotted floating mines that had broken loose from their moorings following a storm. Official Army reports showed that the Rensselaer Victory, the India Victory and the Kokomo Victory, ships that normally carried 1500 or more troops, had spotted the mines on their radar indicators and thus were able to change course in time to prevent a collision and possible disaster.

In passenger ships, radar will eliminate the delays caused by bad weather, and to a great extent will avoid reducing speed during periods of poor visibility and waiting outside harbors for fog to lift.

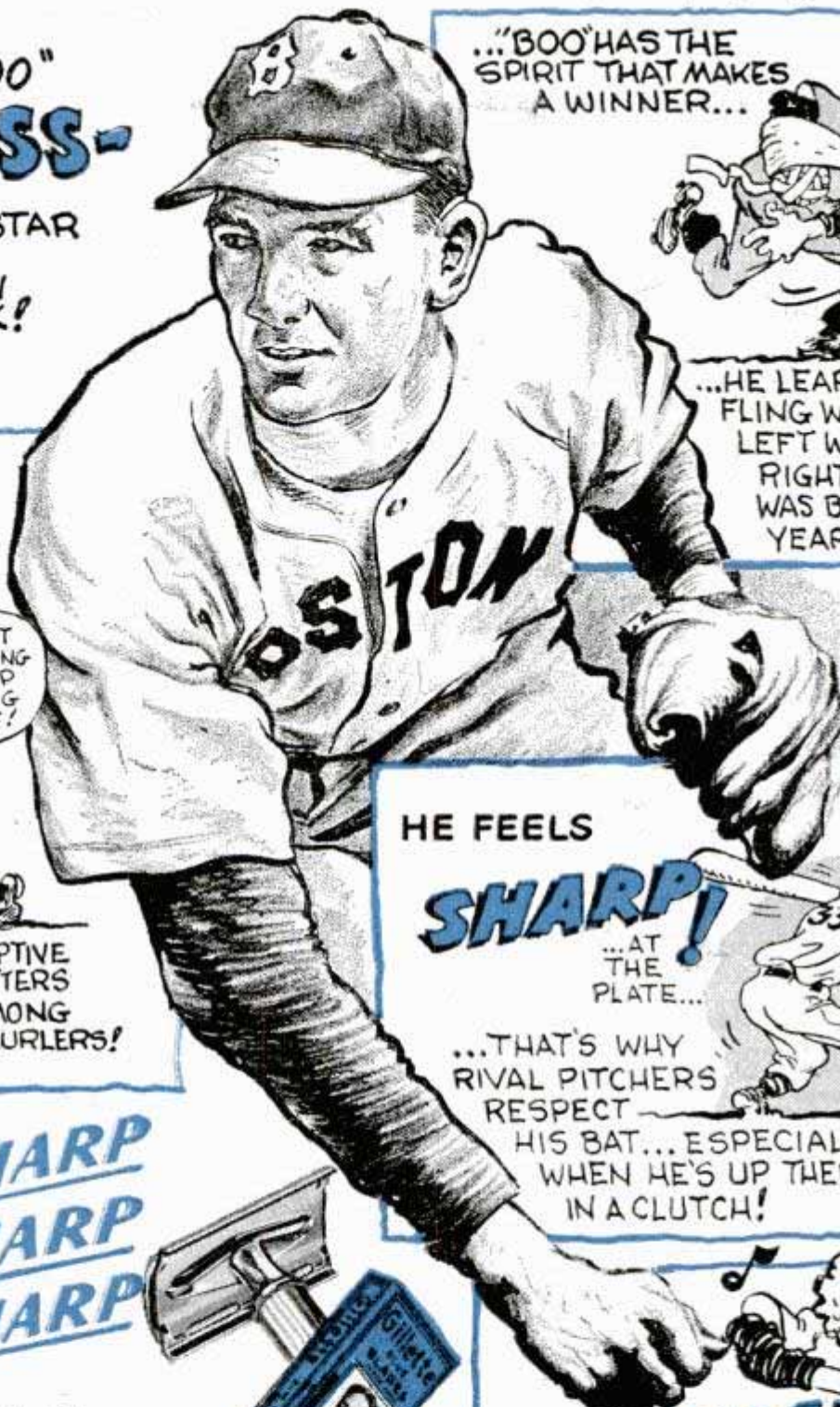
The new ships for tomorrow's passengers are not going to be pipe dreams, but in many respects they will offer startling innovations in shipbuilding. Ship speeds are being increased, cutting prewar schedules in half in some cases. Nearly all ships feature outside cabins with private baths, air conditioning and more space and light. New light metal, plastics and glass will be in evidence.

Some time next year you should be able to see for yourself.

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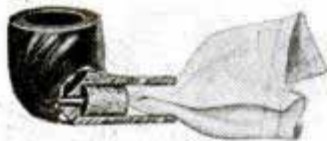
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Throwing Light on Mother Nature

(Continued from page 128)

to four months costs from .9 to .006 cent per flower. This is a small fraction of the increased price for out-of-season flowers.

Tests made at Purdue University by Robert B. Withrow, associate professor of biophysics, and his wife, Mrs. Alice P. Withrow, research assistant at the Agricultural Experiment Station, have supplied a vast amount of data on the use of artificial light in horticulture. They found that sufficient light to advance the blooming of most greenhouse plants was supplied by low light intensities produced by 15 to 40-watt Mazda lamps. Also, they discovered that one lamp will light as much as 30 square feet of bench space. Good results were reported when lights were automatically turned on for four to six hours nightly.

Electric lights are used even in hotbeds to speed up the growth of seedlings. Experiments conducted by General Electric revealed that eight 15-watt bulbs, plus a 60-foot electric soil heating cable, produced in 60 days various seedlings whose stems often were twice as long as seedlings grown in a manure hotbed.

At Bradley Beach, N. J., newly seeded golf greens were floodlighted at night to hasten the growth of grass and make the greens playable as quickly as possible. Not only was the growth hurried, but toughness and quality of the grass were improved.

Artificial light is used by some aquariums to stimulate the growth of plants on which fish feed. The U. S. Department of Agriculture and Cornell and Ohio Universities have grown plants entirely under artificial illumination in rooms with closely controlled temperature and humidity.

In apartments with few windows, combination floor lamps and plant holders supply light for reading and at the same time disperse light energy to the plants.

As a result of advances in electrical horticulture and nutriculture (chemically growing plants in water or fine gravel), the advantages of Mother Nature are being duplicated and the disadvantages eliminated.

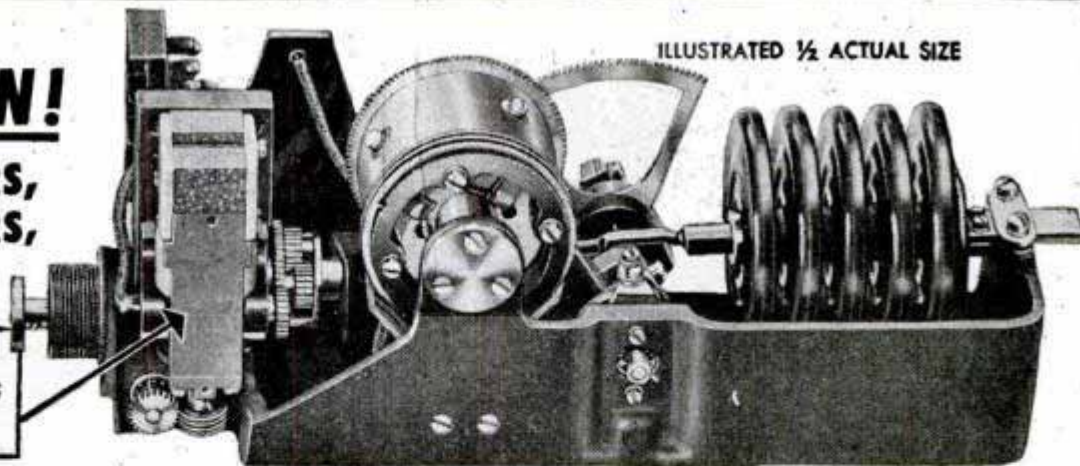
Maybe the day is not far away when perfect plants will be produced in windowless greenhouses in which everything is controlled—light, temperature, humidity—and germ-killing rays will eliminate airborne bacteria.

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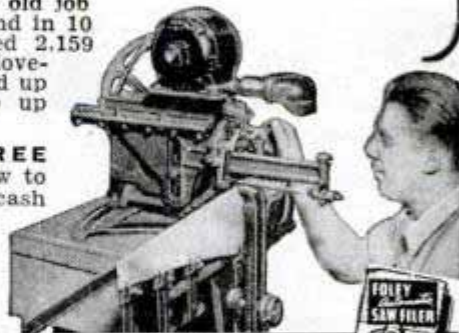


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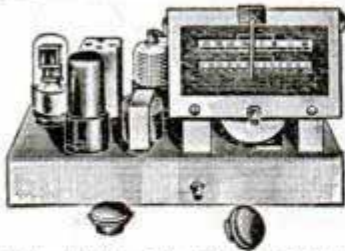
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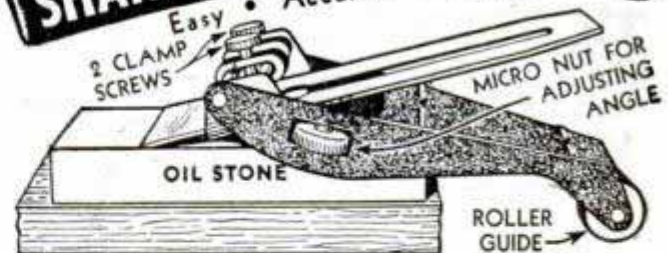
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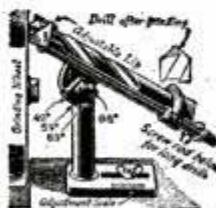
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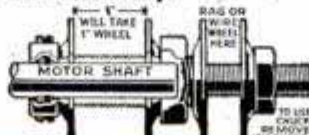
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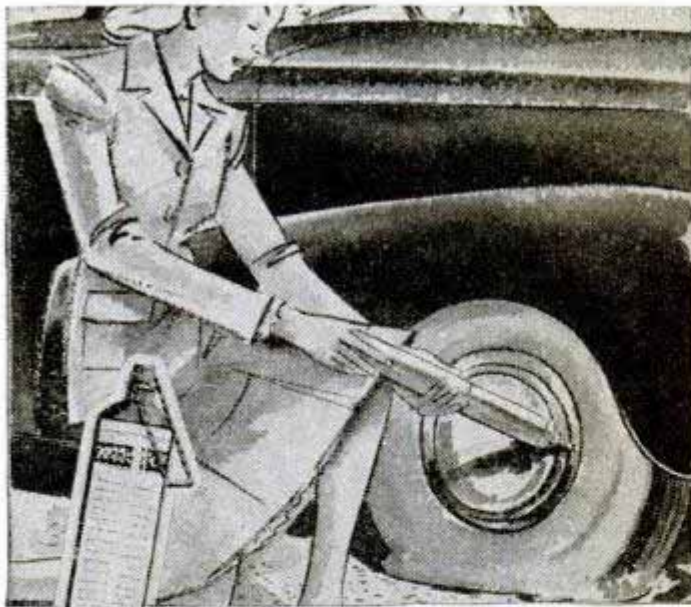
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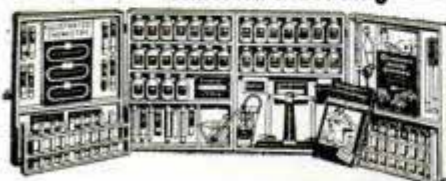
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Power From Atoms: How Soon?

(Continued from page 93)

for creation of stationary atomic energy plants on land and there are definite possibilities for the use of such plants on ships.

The piles such as those at Hanford that make plutonium for atomic bombs also produce heat in quantity. Heat is, of course, one form of energy. At present the heat of these piles is dissipated through use of cooling water. The reason for this is that the piles were built to make plutonium for atomic bombs and not to make power.

However, the water used for cooling piles could be converted into steam which in turn could be used for generation of electricity. Such steam would be radioactive and in general not suited to use for steam heating or purposes other than to generate electricity. The radioactive steam could be used to convert additional water into steam of lower pressure; the steam so generated would not be radioactive, at least to an appreciable degree. As an alternative to generation of steam, an inert gas may be used as a cooling means for the pile and the hot inert gas under pressure passed through a gas turbine to generate electricity. In either case the electricity could be fed by wire to cities or industries.

Obviously, therefore, it would not be necessary for industries to discard their present machinery with the coming of a new era, for the power they would receive would be in the same form as the power they now use.

The fifth major problem is: Will atomic energy be commercially economic?

To supplant oil and coal as a means of producing power, energy must be produced from atomic reactions at less cost than energy produced from conventional fuels. Atomic powerhouses will probably require somewhat greater investment than power based on oil or coal. To attract capital, atomic energy must be produced at sufficiently lower cost than energy from oil or coal to bring a return on the greater investment that may be required.

The cost of production of pure uranium 235, even if produced in improved plants, will be high, amounting to perhaps \$40,000 to \$50,000 per pound. From the standpoint of heat, this would be equivalent to fuel oil at about \$8.00 per barrel, compared to the present selling price in New York Harbor of \$1.72 per barrel as of July 1, 1946. Normal uranium—which can be used for production of power at central power stations or in ships—contains about 0.7 percent of uranium 235. The uranium 235 in a pound

(Continued to page 280)

The first pipe smoke!



Sir Walter Raleigh, father of pipe smoking, never knew the pleasures of a Sterncrest pipe. Poor chap, he was born too soon to puff an LHS of genuine Imported Briar, vita-fused for sweetness from the first puff.

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FLOOR SURFACING MACHINE CO.

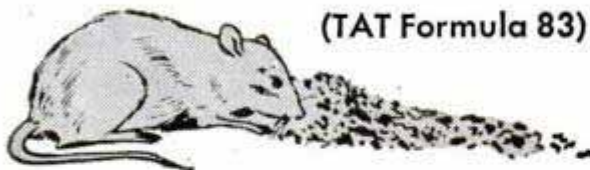
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Gentlemen: Enclosed find 25c in stamps or coin for booklet "Opportunities in Floor Surfacing," telling me how I can start my own floor sanding business.

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• Rid your home of rats and their menace to your health and property. Use TAT Formula 83 . . . SO POWERFUL ONE LICK KILLS RATS. Contains ANTU, remarkably effective new rodenticide, tested and used by U. S. Public Health Service.

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\$1.00 Enclosed Send C.O.D.

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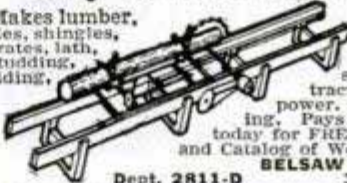
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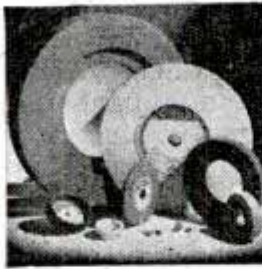
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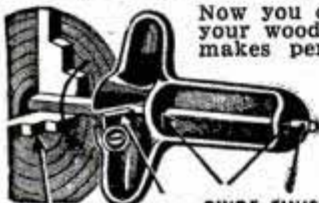
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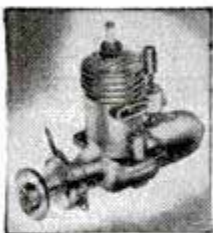
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if you work on an  or a  or a  Contains 7 thin wall sockets ranging from $\frac{3}{8}$ " to $\frac{1}{4}$ " with $\frac{3}{8}$ " square drive, a Hinge Handle and Cross Bar, all in a Steel Box.

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of normal uranium is the equivalent of 0.7 percent of 6000 barrels of fuel oil, or about 42 barrels. The cost of production of normal uranium metal eventually may be about \$4.00 per pound. On this basis the cost of the uranium 235 in normal uranium from a heat-producing standpoint measured in terms of fuel oil would be around 10 cents per barrel. It can be seen, therefore, that basically atomic energy can be cheap providing it may be economically liberated and converted into a usable form of energy such as electricity.

This is the problem for the future; from here on getting power from atoms is primarily a development and engineering problem for it may be said to be largely out of the research phase.

The problems presented here are not regarded as insurmountable. Indeed, if economic application were certain enough to warrant the manpower and facilities necessary, it is conceivable that we might have atomic power within three years.

At the outset, it might be immediately practicable in those isolated sections of the world where transportation makes the costs of other sources of energy such as coal, oil or water power comparatively high.

For ships, particularly naval vessels, atomic energy is of real interest since here the need for carrying a heavy load of fuel oil as well as the need for frequent refueling could be eliminated.

Of the five problems discussed, those dealing with control, protection from radiation and adequate supply of raw materials may be considered as essentially solved, so far as they concern large installations such as would be used in central powerhouses and on ships. The two remaining problems, that is, how to convert atomic energy into useful energy and the economics of so doing, are definitely related and their solution from the standpoint of commercial energy is a challenge to the development and engineering skill of the world.

In addition to the opportunities offered for more economic large-scale generation of power, atomic power can give us new substances we never have known before.

Already atomic by-products — the particles made available by the splitting of the atom — are doing service in laboratories and medical research. New radioactive materials and isotopes produced through atomic reactions will give a new insight into medical problems and the natural sciences, thus promising great benefits to humanity.

Few scientists would care to predict to what extent our world will change in the decade ahead, but it seems unlikely that the change will be very sudden.

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MAKES LEATHER and LEATHERETTE LIKE NEW · IN 5 SECONDS

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VARNISH BUT
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As a representative for Leathercote, I'll show you how to cash in on an exclusive territory. I'll show you the secrets of this business—put you in business for yourself. You do not risk one penny of your money. Just send me your name and address on a penny postcard, I'll do the rest.

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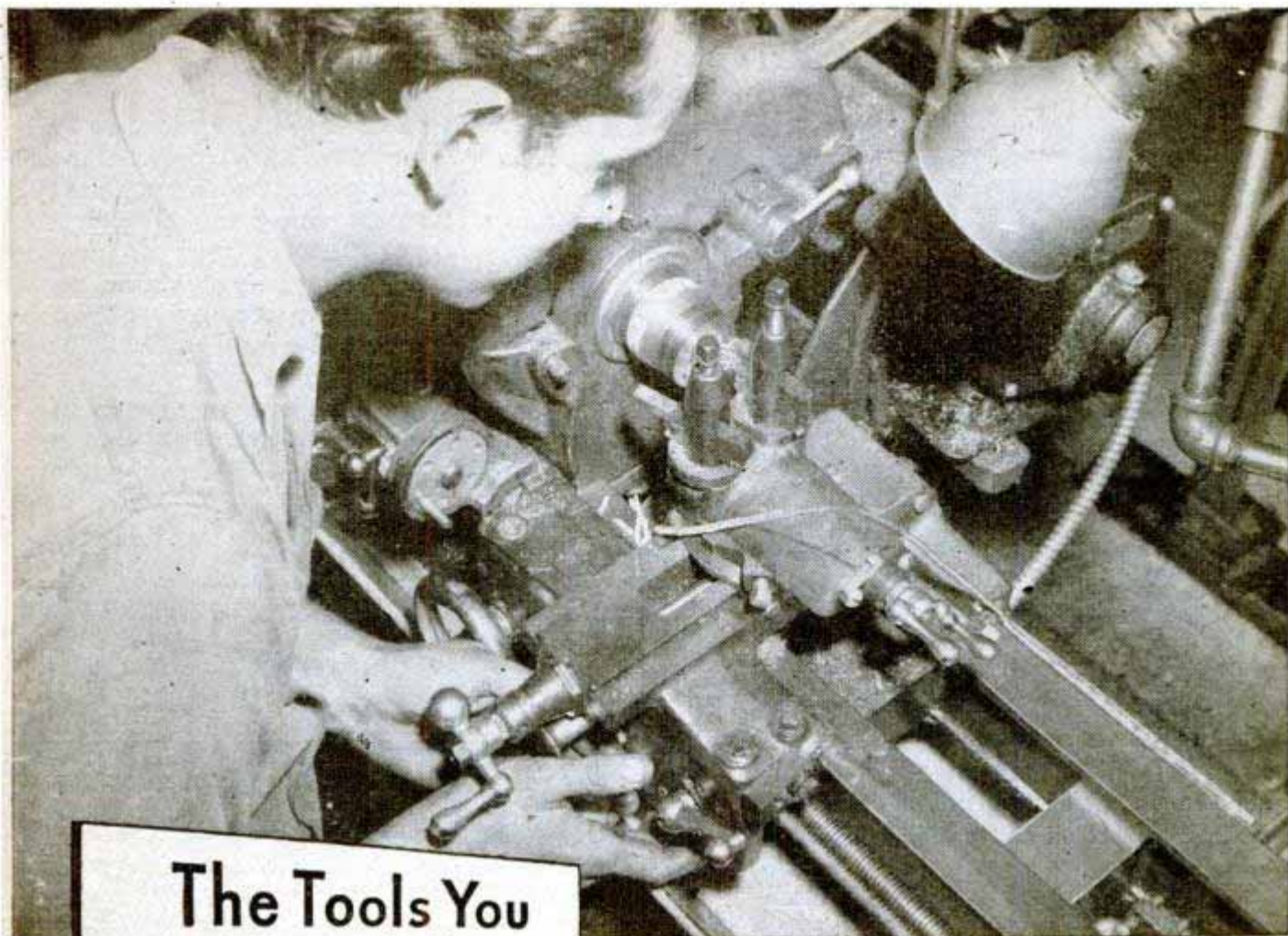
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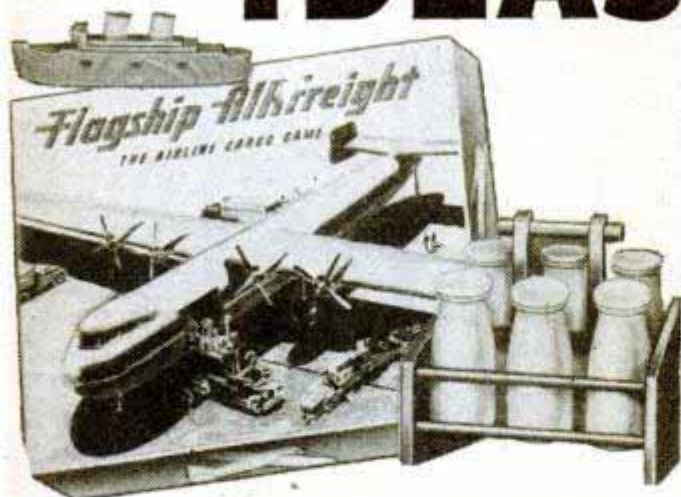
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Write me today about your ideas — a brief letter or rough pencil sketch will do for the present. I will let you know our decision promptly and sincerely hope that it will be the most profitable letter you ever wrote.

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President

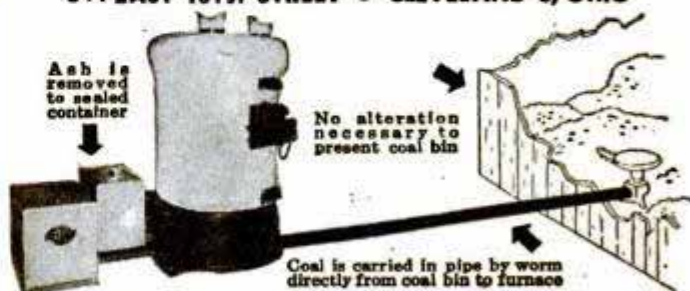
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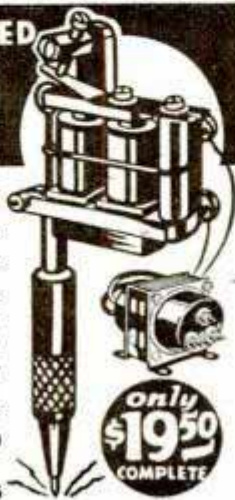
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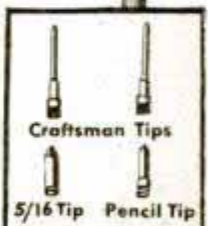
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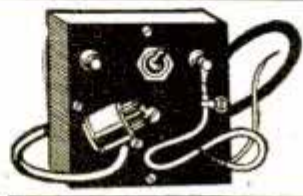
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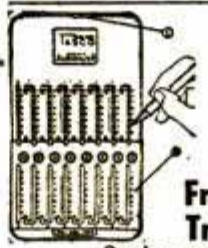


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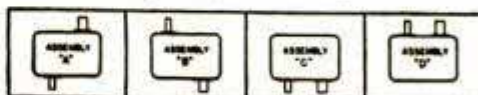
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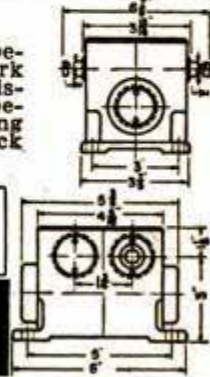
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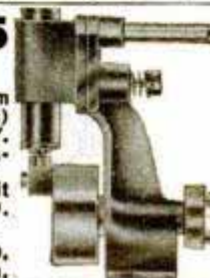
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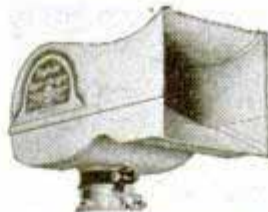
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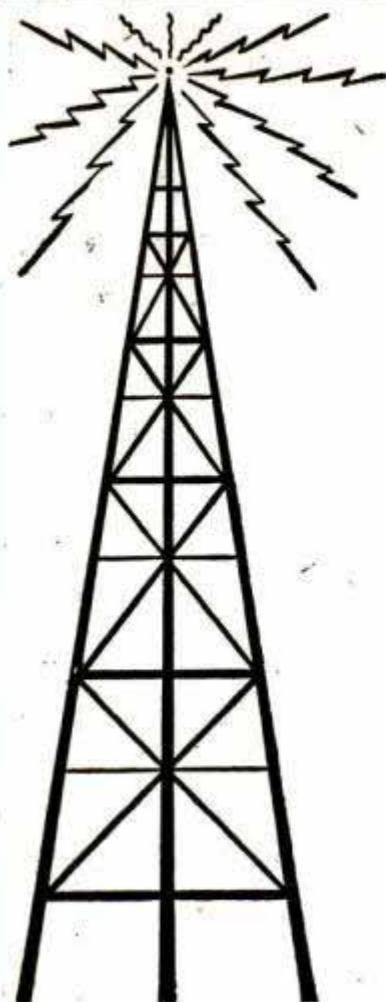
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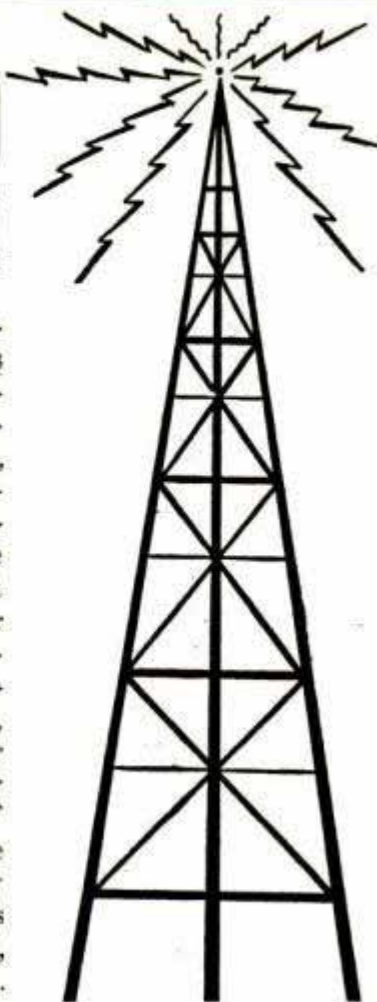
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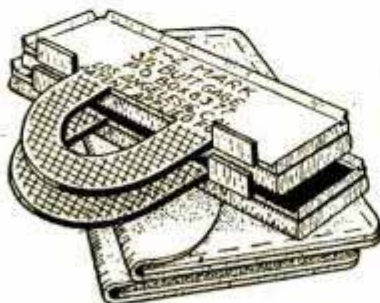
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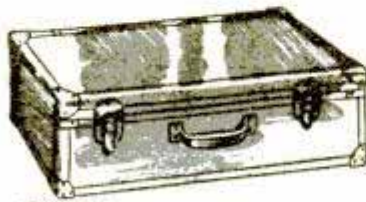
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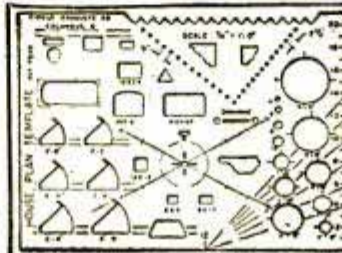
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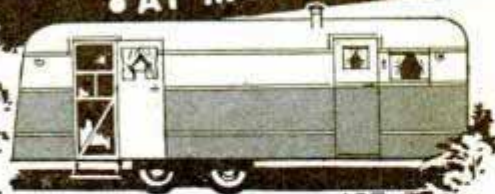
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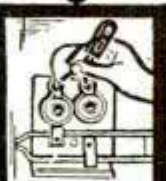


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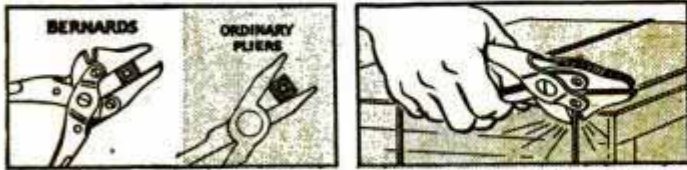
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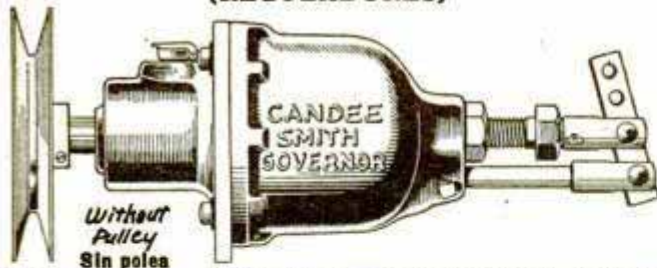
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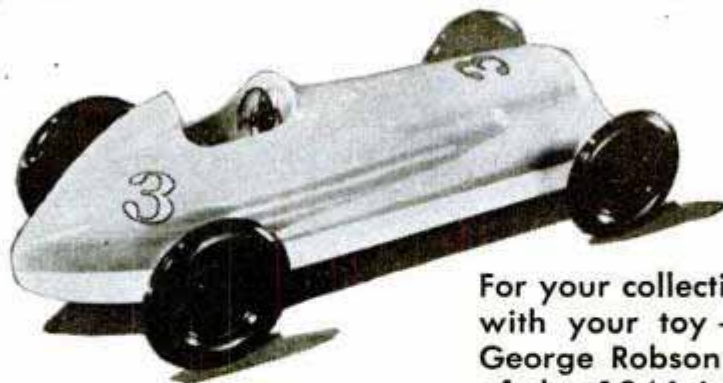


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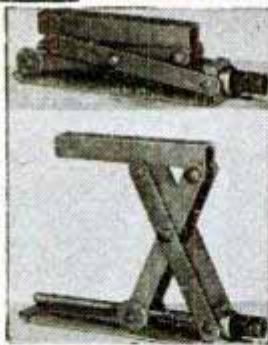
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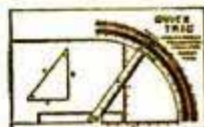
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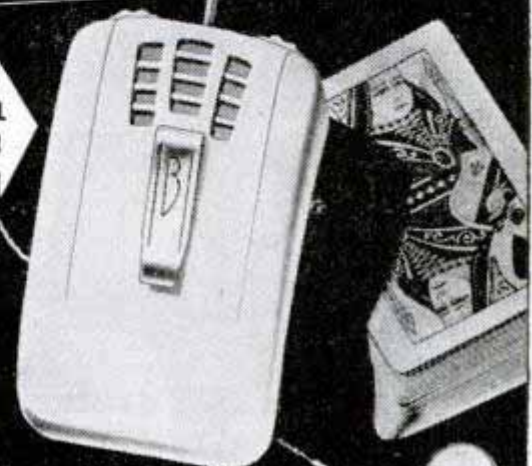
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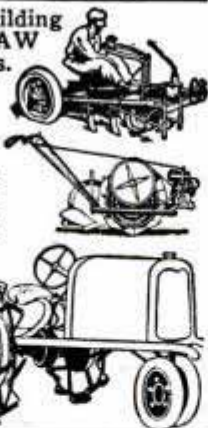
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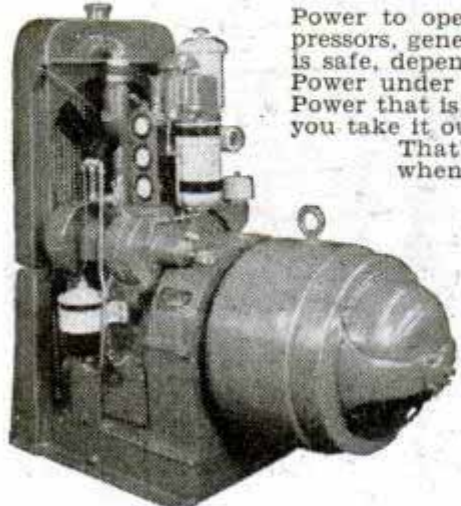
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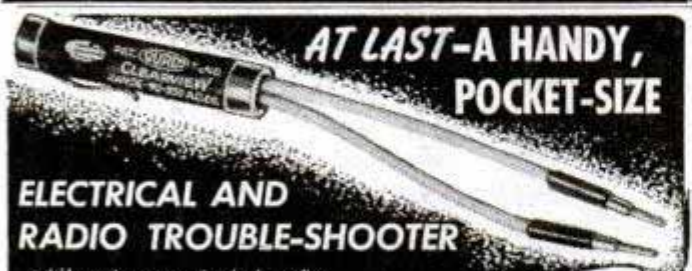
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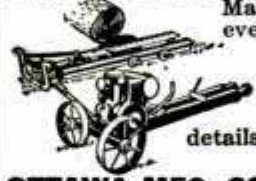
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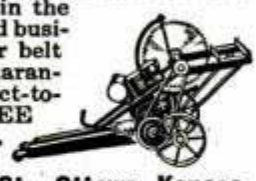


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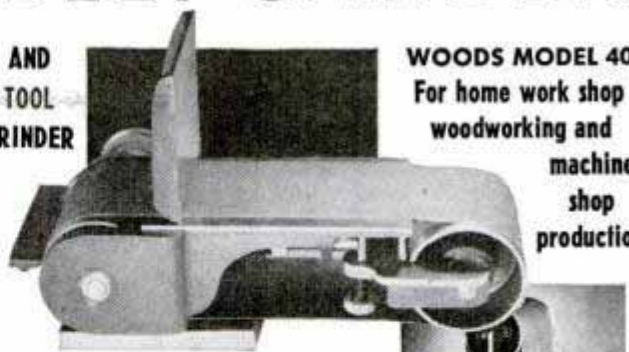
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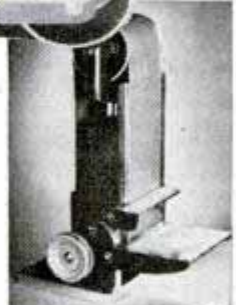
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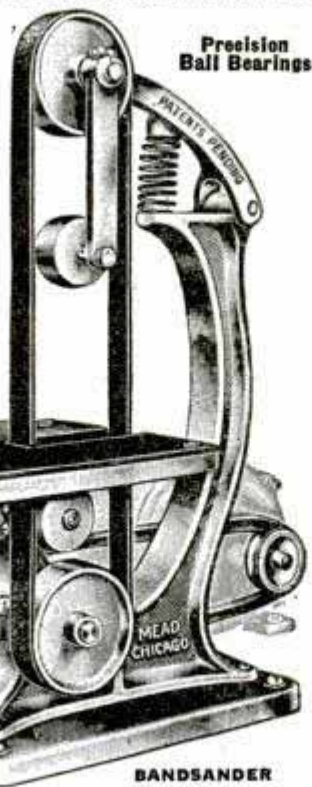
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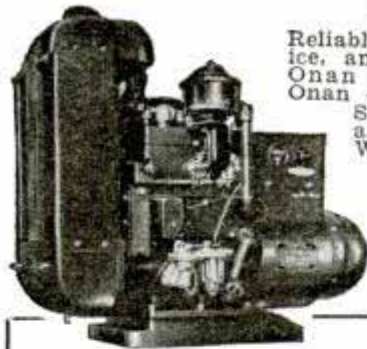
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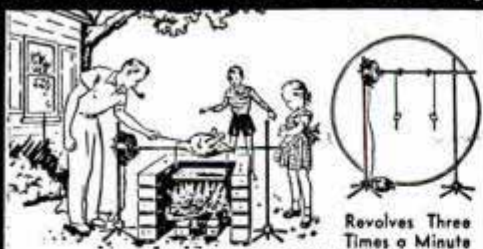
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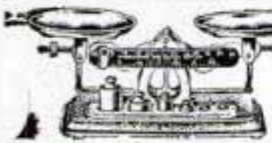
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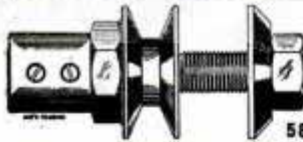
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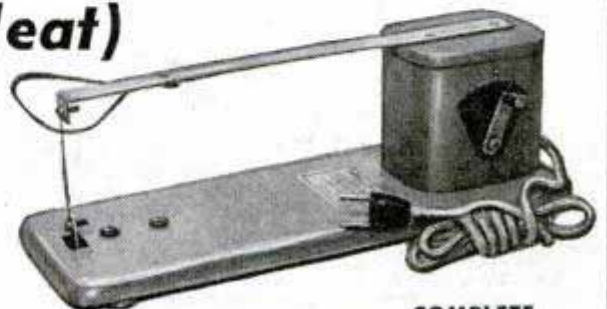
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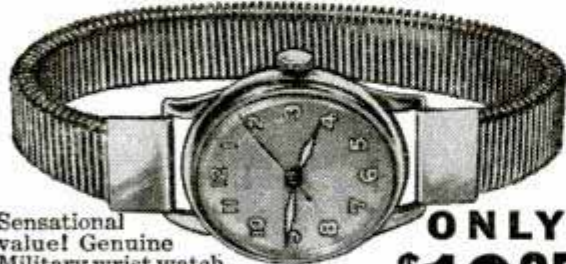
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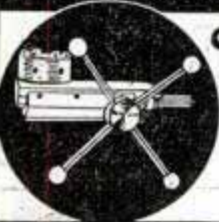


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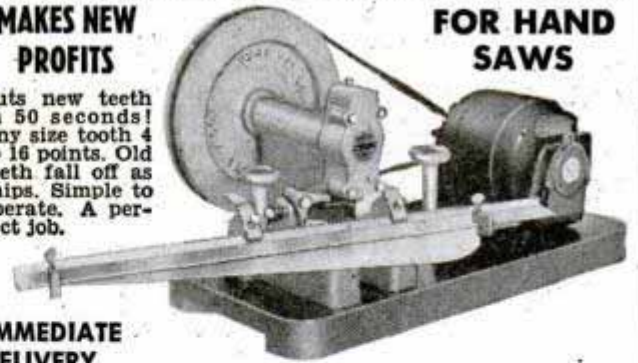


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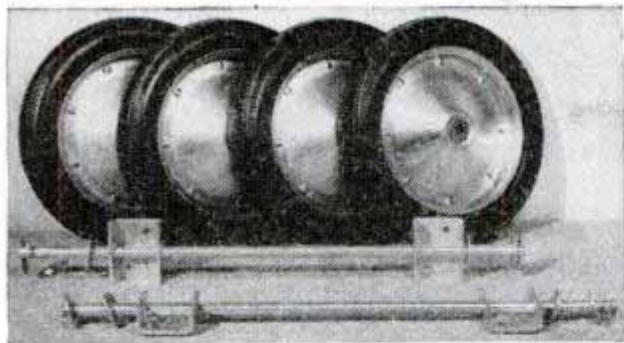


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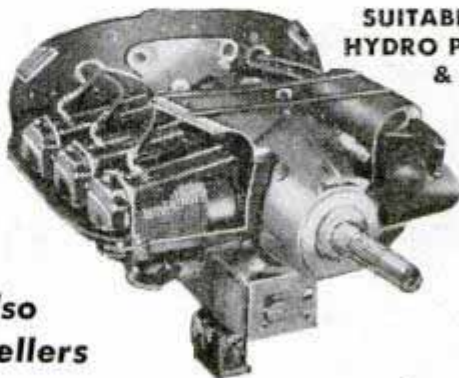
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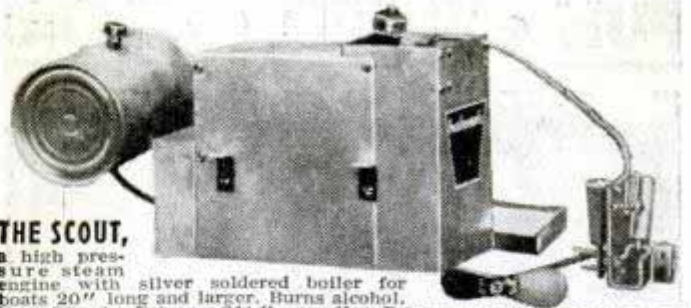
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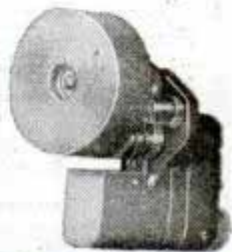
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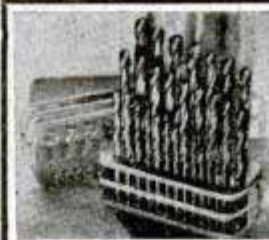
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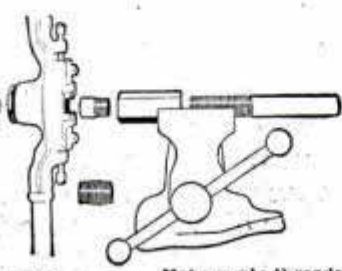
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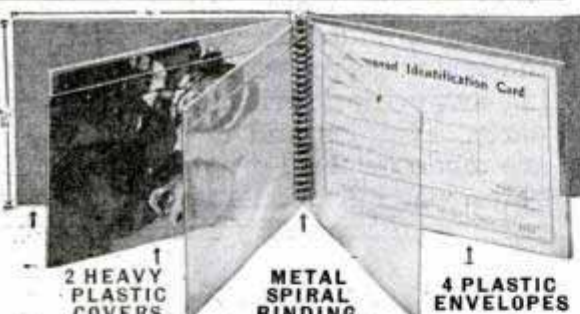
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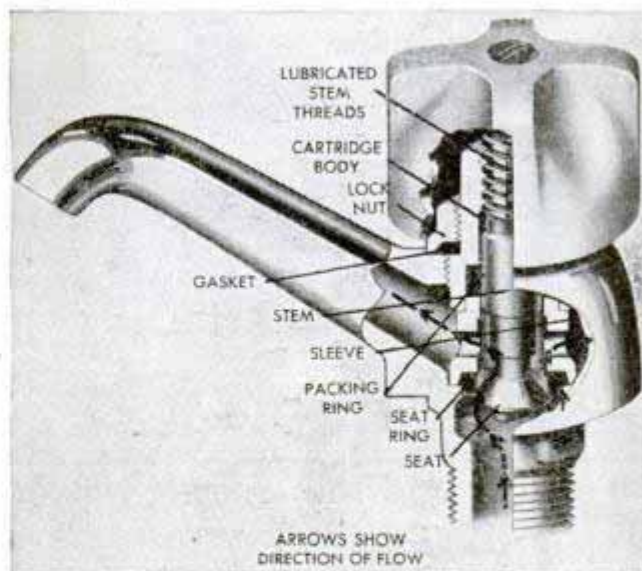
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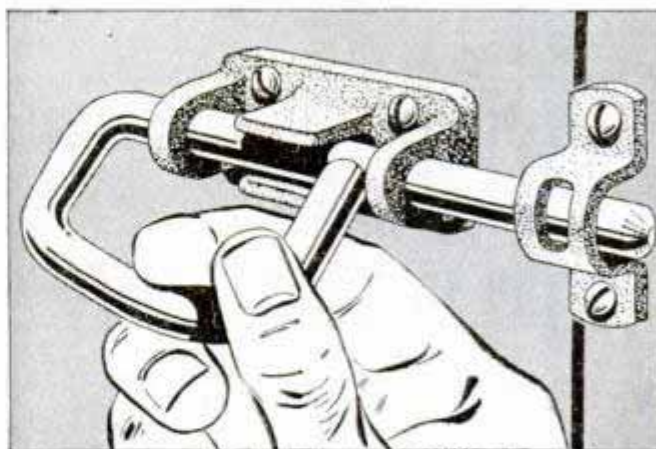
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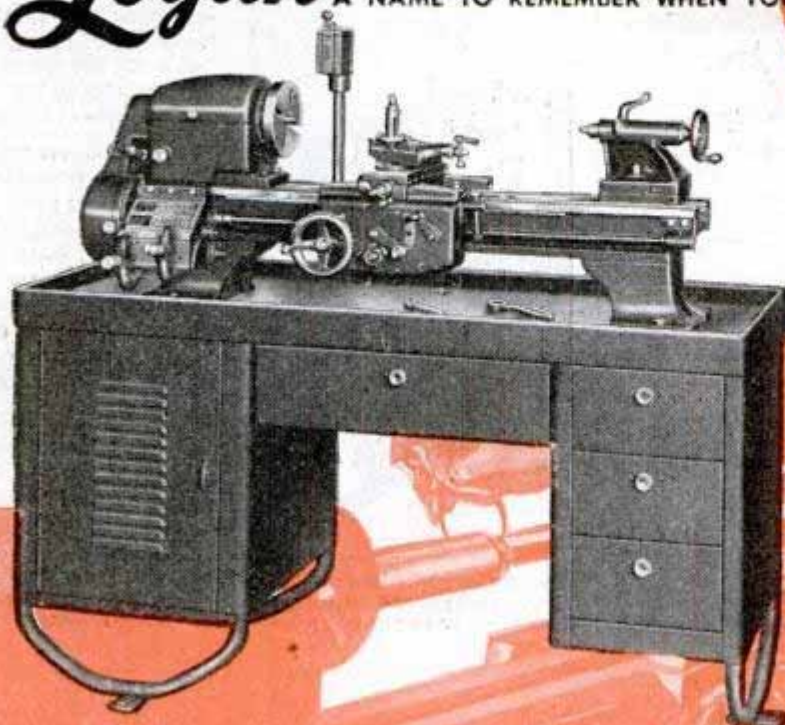


Open or closed, the weight of a large handle causes a latch bolt to fall into locking position. Its weight causes the handle to lie flat against the wall, making it difficult to jimmy from outside.

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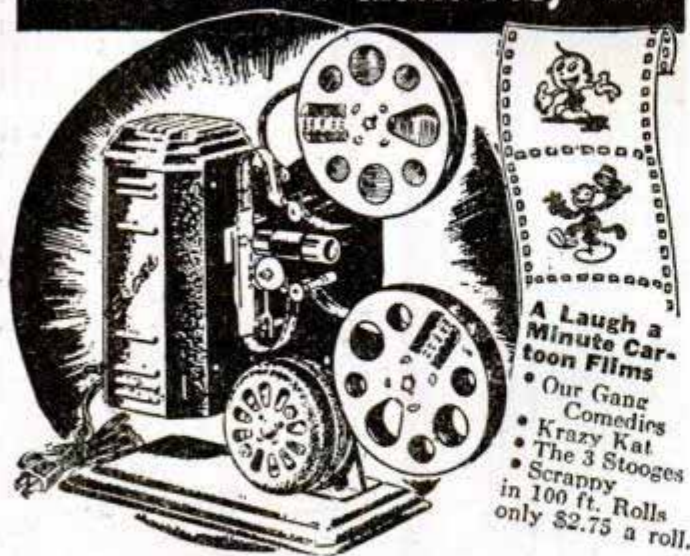
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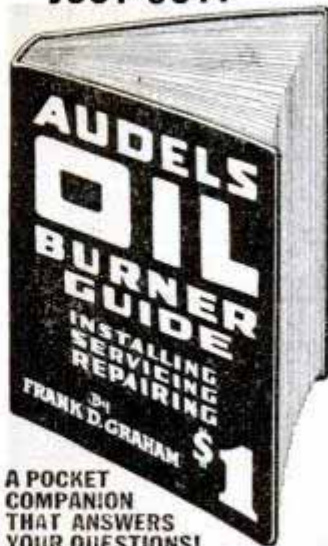
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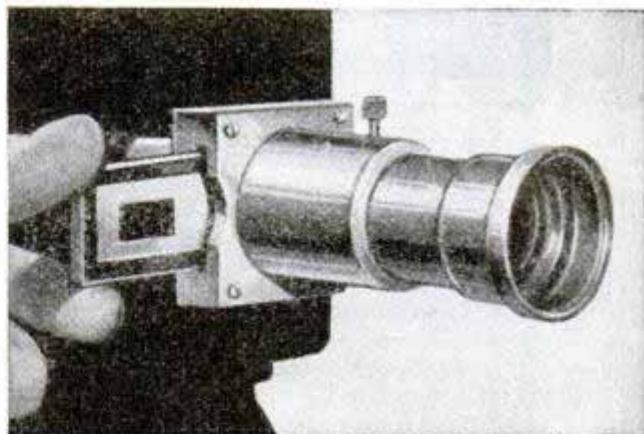
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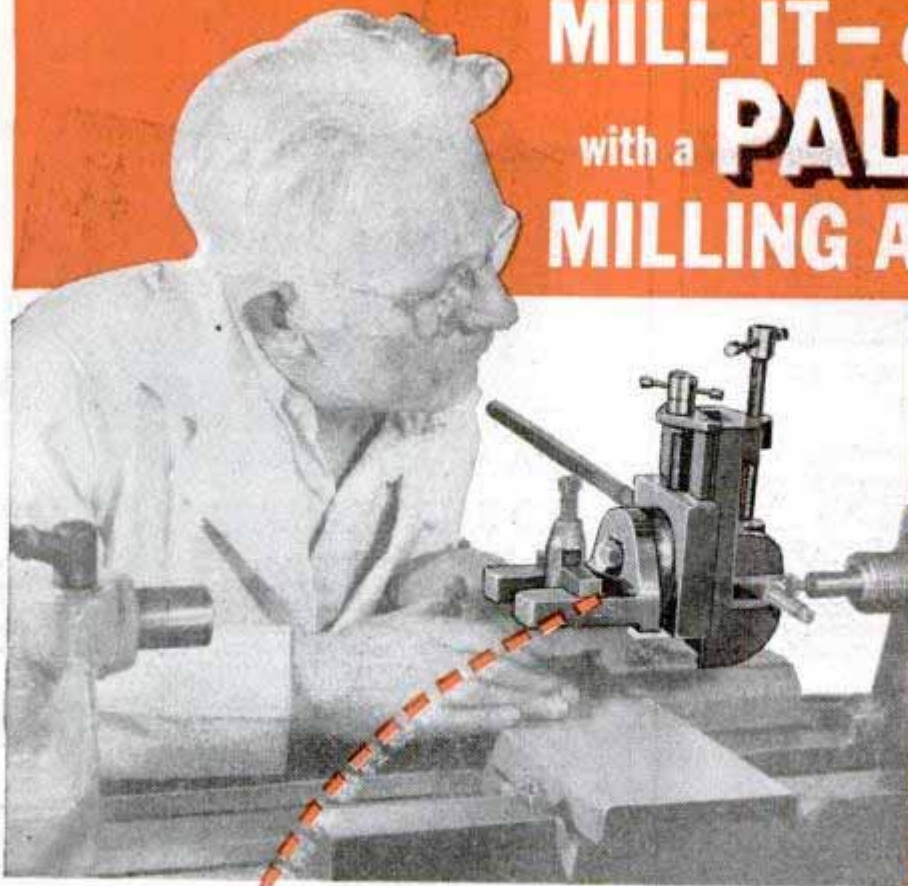
Movie Projector Shows "Stills"



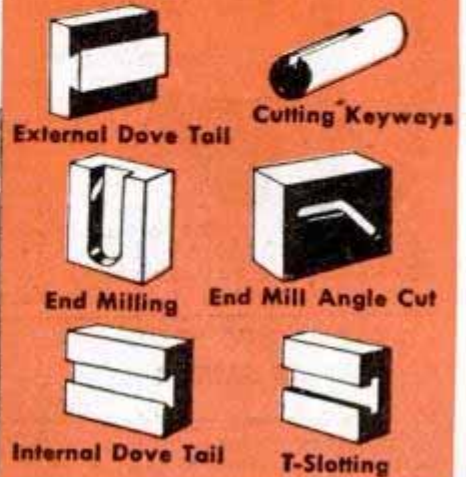
By fitting a 16-millimeter movie projector with a series of tubes and a slotted receptacle for slides it can be converted into a still projector. To install the slide holder the lens is removed from the projector and the long barrel of the slide holder inserted in its place. The lens then is inserted in the short barrel. The projector is kept in full operation with both the motor and lamp on when showing stills.

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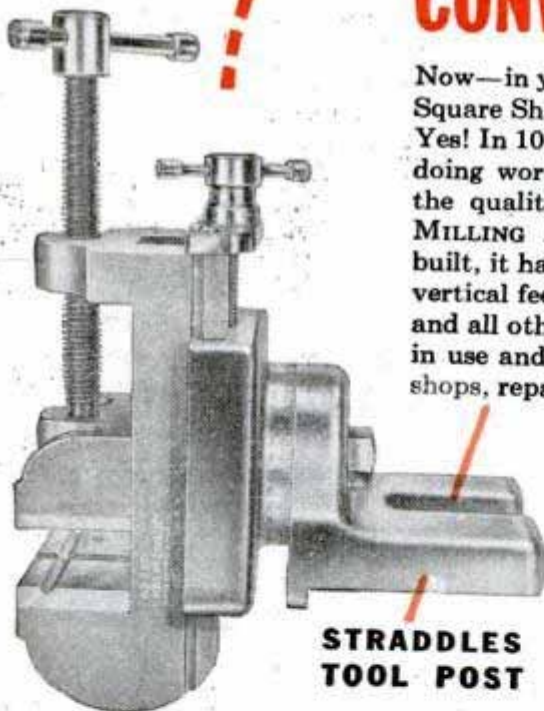


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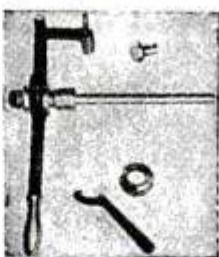
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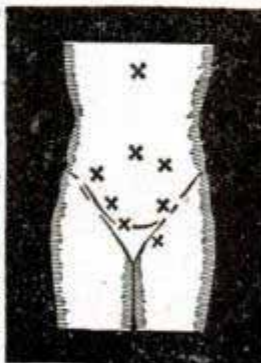
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IDEAL FOR Auto-Home Appliance and Farm REPAIRS

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Designed to Do High-Grade Welding *Inexpensively*

Maintenance men, farmers, mechanics, machine shops, foundries, auto, general repair and job welding shops using the DYNAMIC WELDER find it so indispensable and useful that they cannot afford to be without it. If inexperienced you can easily learn to do a variety of high-grade welding jobs by following the practical, simplified operating and welding instructions furnished.

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Repair Shop Owner says, "It will do more than you say"

"I want to say I operate a repair garage and am more than satisfied with the welder. It will do more than you say." C. P., Butler, Ohio

It's the Greatest Portable Outfit

"Now I am equipped for all kinds of welding and I must say it's the greatest portable outfit for welding any man could ever wish to own. I wouldn't sell mine for the cost of plenty welders I have seen which were very high in cost but not in convenience. You may put me on file as a booster of your wonderful welding product." W. J. B., St. John, N. B., Canada

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"I have done quite a little welding with my welder and will say it is better than I expected. The price, convenience, and variety of work that can be done with the Dynamic are the attractive points." W. R. P., Portland, Ore.

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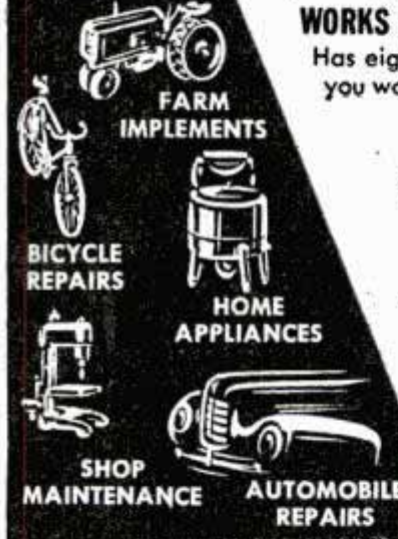
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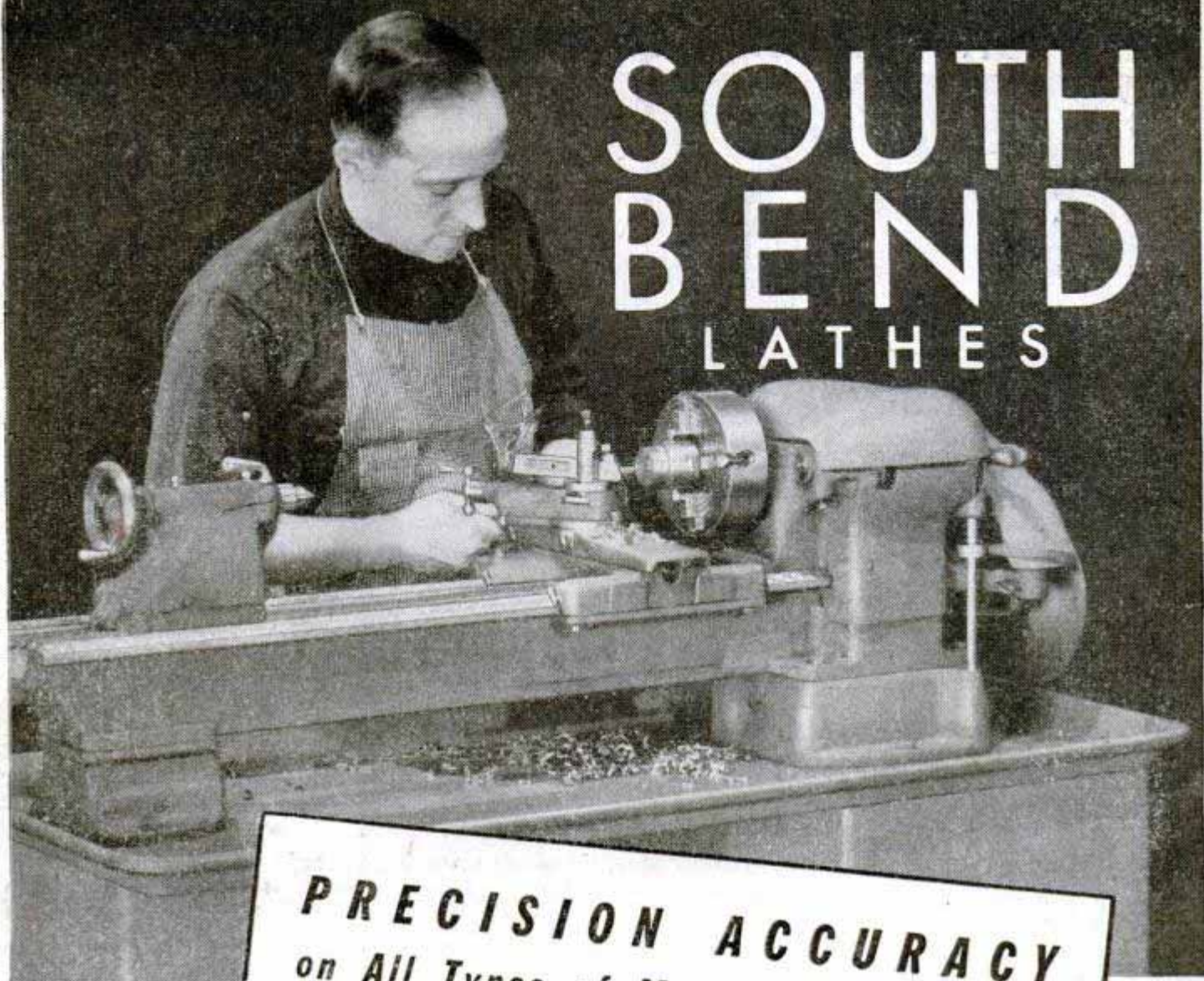
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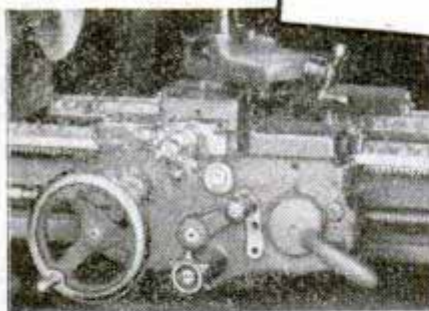
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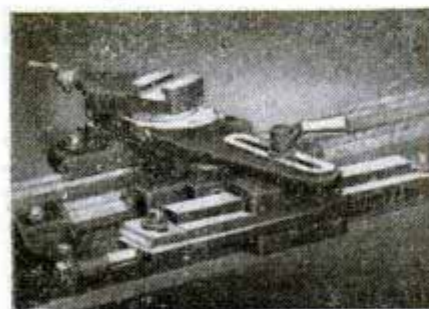
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PRECISION ACCURACY
on All Types of Machining Operations



ACCURATE OPERATION is assured through large, graduated collars on cross-feed and compound rest screws, and through convenient apron controls.



TAPER ATTACHMENT for 9-inch lathes, designed and built for accurate taper turning and boring. Features degree and taper-per-foot graduations.

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WHY

there's still a "Prestone" anti-freeze shortage:

1 "Prestone" anti-freeze, like most other products, depends on the utilization of raw materials and equipment drawn from many fields. Recent industrial dislocations have affected our plant-expansion program, which was not authorized during the war. Planned for years, it is well advanced; but the real benefit will not be felt in 1946.

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