

ANC



POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. TRADE MARK GREAT BRITAIN No. 40428



RUNNING ROPES

— Page 121

NOW... LIGHT
WHEN YOU NEED IT!

Ray-O-Vac LEAK PROOF batteries
stay fresh for years!

(because they're sealed in steel!)



© 1948 BY RAY-O-VAC COMPANY, MADISON, WIS. RAY-O-VAC, CANADA LTD., WINNIPEG, MAN.

See how much more you get

in these truly modern batteries. Each Ray-O-Vac Leak Proof starts with a powerful, well made battery. Then . . .

1. Steel bottom is added.
2. And a steel top.
3. Next—multiple insulation. Nine layers of protection against corrosion.
4. Last—a steel jacket. This completes an air-tight seal, to stop corrosion and keep the battery fresh and powerful. Only Ray-O-Vac builds batteries with all four of these safeguards.

GUARANTEE on every Ray-O-Vac Leak Proof:
"If your flashlight is damaged by corrosion, leakage or swelling of this battery, send it to us with the batteries and we will give you FREE a new, comparable flashlight with batteries."

Ask for Ray-O-Vac Leak Proofs

Buy Spares... *they stay fresh*



5 B.F.G. TIRE, with over 30,000 miles
t, "looks to be good for as many
e": F. H. Neely, Columbia, Tenn.



26,007 MILES on this B. F. Goodrich tire
... "and still plenty of good tread left,"
reports Dr. H.C. Baumann, Pottstown, Pa.



63,479 MILES on this B. F. Goodrich tire.
"Need you ask if I'm satisfied?" writes
J. C. Hinrichs, Jr., Waterbury, Conn.

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regardless of price, because research—now
backed by the world's greatest rubber research
center, recently opened at Brecksville, Ohio—
keeps B. F. Goodrich First In Rubber.



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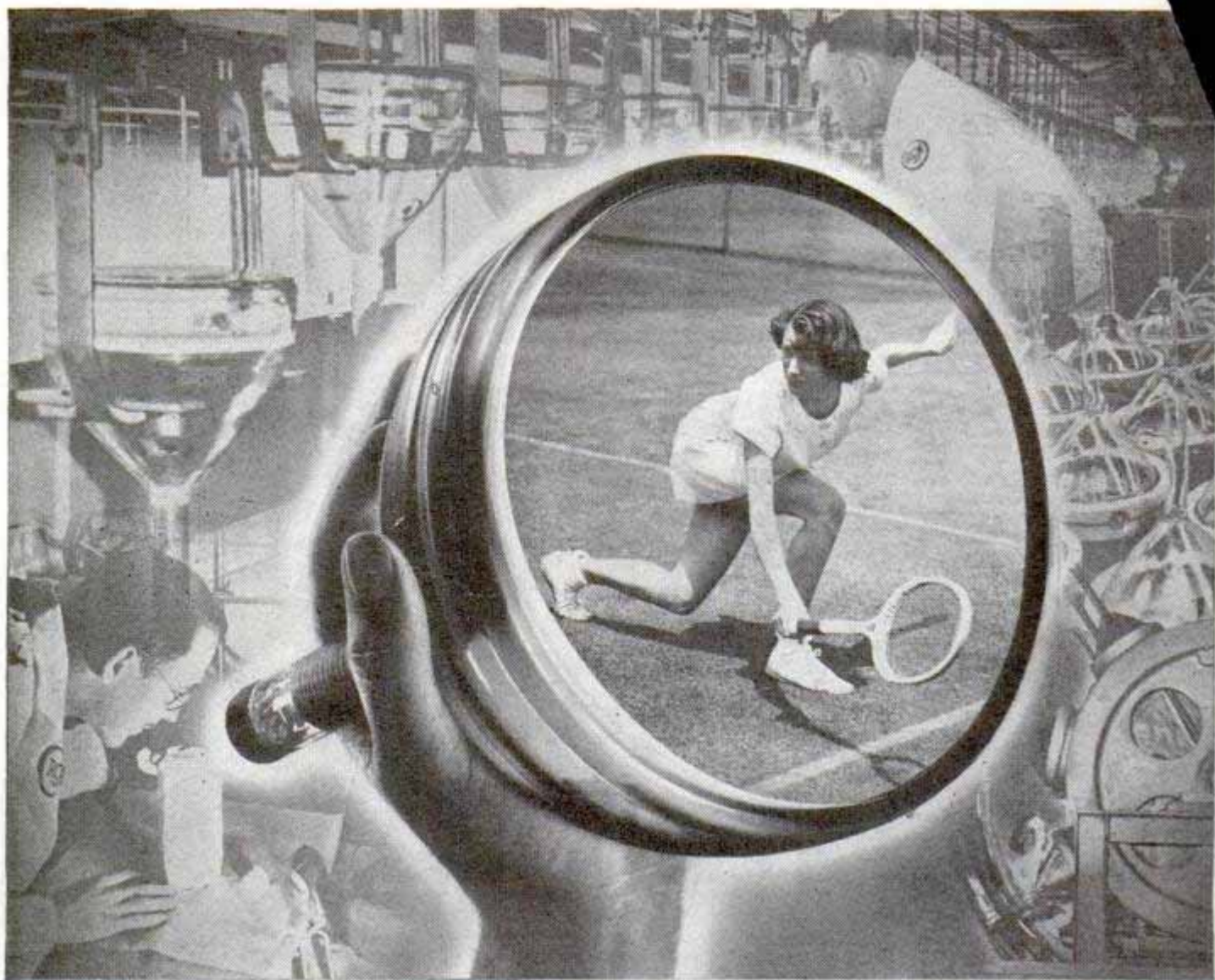
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ALWAYS LOOK FOR THIS SIGN





Machines in RCA's Lancaster Tube Plant are designed for mass production of Kinescopes—television picture tubes—at lowest possible cost.

Behind the magic of a Television Tube

Every morning, 14 tons of glass "bulbs" go down to the production lines at the RCA Tube Plant in Lancaster, Pa.

By evening, the bulbs are television picture tubes, their luminescent faces ready to glow—in television homes everywhere—with news, sports, entertainment, education, politics.

Born of glass, metals, chemicals, the picture tube comes to life through flame and heat. Its face

is coated with fluorescent material—forming a screen on which an electron gun "paints" moving images.

Each step is so delicately handled that, although RCA craftsmen are working with fragile glass, breakage is less than 1%.

Water, twice-distilled, floats the fluorescent material into place on the face of the tube, where it clings by molecular attraction—as

a uniform and perfect coating.

Every phase of manufacture conforms to scientific specifications established by RCA Laboratories. **Result:** Television tubes of highest perfection—assuring sharp, clear pictures on the screens of RCA Victor home television receivers.

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, New York 20.



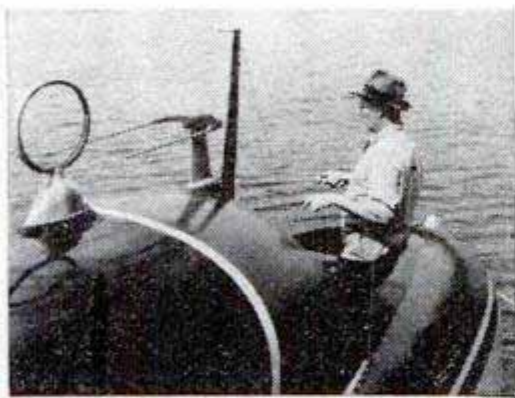
RADIO CORPORATION of AMERICA

Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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



DR. SAMUEL EDDY is one lucky fisherman who had a chance to prove his story (page 114). A couple of our staff men took Doctor Eddy along to a northern lake to get photos to illustrate his article. Doctor Eddy, who teaches a class in fishing at the University of Minnesota, was given an "A" by our staff when he caught a big northern pike by simply practicing what he preaches.

NEXT MONTH'S bill of fare includes a story on the "Top-of-the-World Weather Run." Air Force pilots cruise to the pole three weekly to spot the kind of weather that may strike this country many days later. Another feature takes you through Pearl Harbor's secret caverns, where oil is stored in tanks so huge that each could hold a 30-story building. On the November "must" list is Aubrey Cookman's second installment of "We Drove to Alaska."

POURING MONEY out the window? Winter heat loss through windows and doors ranges up to 40 percent of total heat loss. A Craftsman feature next month tells how to weather-strip to plug the leaks. The first of two articles on "57 Ways to Save Gasoline" appears next month. Another practical feature tells how to build two sanders.

RADIO experimenters will find a phono amplifier for the new reluctance, or magnetic-type, pickups next month.

Volume 90 OCTOBER 1948 Number 4

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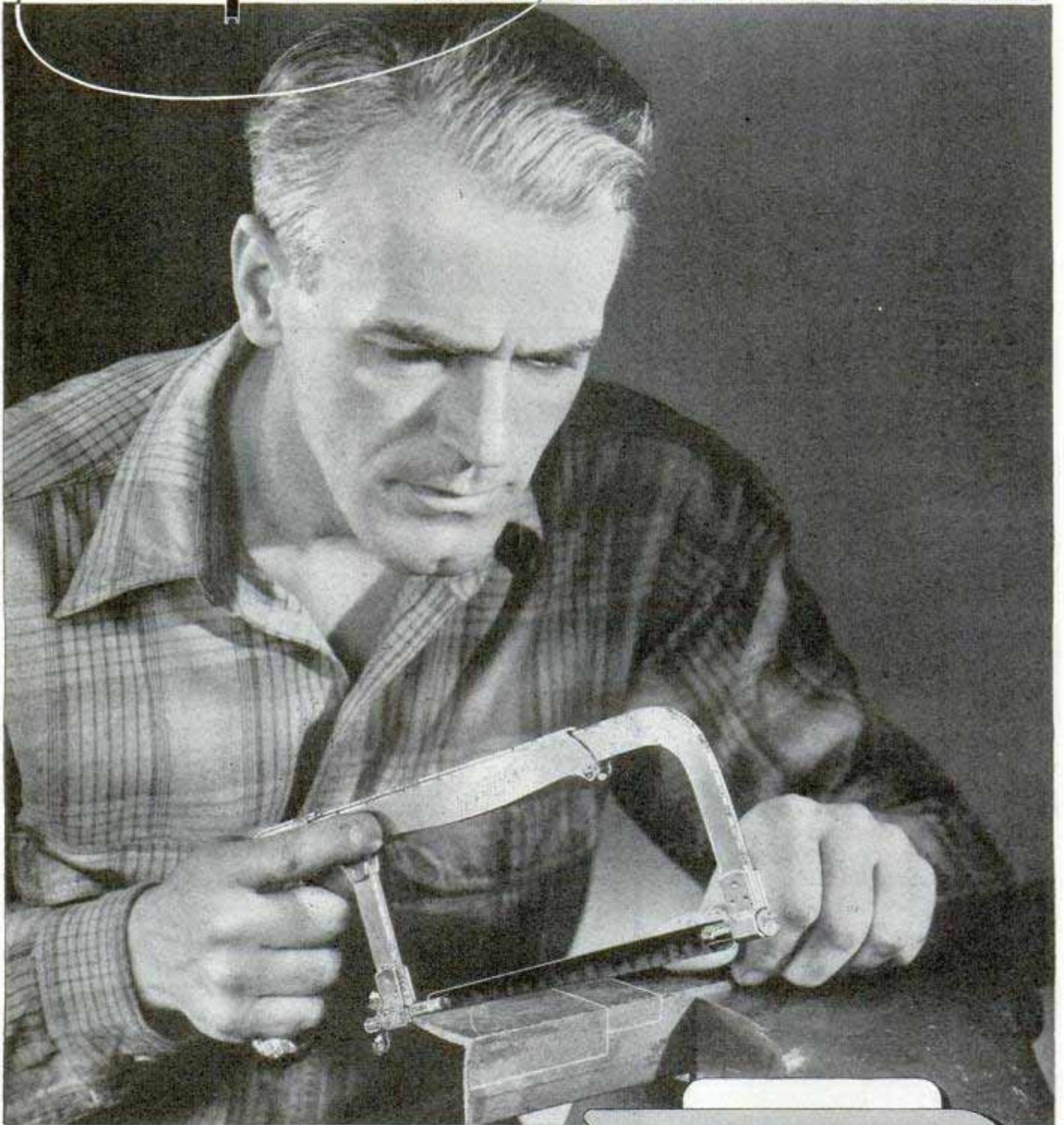
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OCTOBER 1948



T9DY-N64-KKQ3

ARE YOU LOSING YOUR HAIR?

READ THESE CERTIFIED FACTS!



Left—Carl Brandenfels before using his home course. Right—Carl as he looks today.



Eldon Beerbower, 2905 N. Portland Blvd., Portland, Ore., was completely bald. Left, Eldon after 8 weeks use and right, Eldon getting his first haircut since total baldness.



Mrs. Amy Clevenger, Central Point, Ore., age 62, says, "I was completely bald for 2 years. Now I have almost all my hair back."



Left, O. K. Nulton, Olympa, Wash., age 65—"My hair was falling out by handfuls. Now my head is almost covered with hair." Right, Rev. L. C. Elliott, 2033 S.E. 51st Ave., Portland, Ore., age 70—"I purchased on advice of my barber and I got results."

WHAT MAKES HAIR GROW?

Scientists agree that hair will continue to grow as long as the hair follicle remains undamaged and as long as a sufficient supply of blood reaches the follicle. If the hair follicle is completely dead there is no way known to bring it back to life.

Carl Brandenfels of St. Helens, Oregon, believes that in many bald or partially bald people, the hair follicles are still alive even though no hair is growing from them. Carl also believes that proper use of his formulas and massage will, in many cases, bring about a condition which will help nature allow hair to grow.

RESULTS SPEAK FOR THEMSELVES

Back in 1929 Carl Brandenfels began to search for the causes of baldness. In 1945 he developed two formulas and a unique pressure massage. Recently, certified public accountants made an impartial audit of the result letters in Carl's files.

By this certified count, Carl Brandenfels has received 11,236 letters from users who report from one to all of the following results after using Brandenfels' Scalp and Hair Applications and Massage:

- Renewed Hair Growth**
- No More Excessive Falling Hair**
- Relief From Dandruff Scale**
- Improved Scalp Condition**

These letters came from every state in the Union and from people in every walk of life. They were from youngsters in their teens and from oldsters

in their 80's. They were from men and from women. Some users had been totally bald and some had just begun to lose their hair.

A RECOMMENDATION

Carl Brandenfels sincerely recommends his home course to men and women who are bald or who are losing their hair. Carl does not classify his formulas and massage with the so-called "hair-growers" nor does he guarantee to promote new hair growth for every user. Carl does believe he has solved some of the problems of baldness, and he is genuinely proud of the results obtained by users of his formulas and massage.

APPLIED AT HOME

Brandenfels' Scalp and Hair Applications and Massage are applied in the privacy of your own home. One of Carl's formulas contains the important agent lanolin. The other contains a small percentage of sulfanilamide. Carl's home course is designed to bring about a more healthy condition of the scalp, to soften the scalp, and to increase the blood supply to the scalp area.

Carl's formulas are not sticky and will not rub off on hat bands, clothing or bed linens. Directions are easy to follow. A five-week home course costs \$15 plus \$3 Fed. tax, and orders should be sent to Carl Brandenfels, St. Helens, Oregon.

DO A FRIEND A FAVOR...

Cut out this page and send this story to a friend who needs it.



SEND THIS ORDER TODAY

CARL BRANDENFELS, St. Helens, Oregon

Please send me—in a plain wrapper—a 5-week supply of Brandenfels Scalp and Hair Applications and Massage with directions for use in my own home.

- Cash—I enclose \$15 plus 20% Fed Tax (\$3) total \$18 (Cash orders shipped postpaid)
- C.O.D.—I agree to pay postman \$18 plus postal charges

Name.....

Address.....

City..... Zone..... State.....

If you are still skeptical, contact any of the above people direct.

NONE GENUINE WITHOUT THIS SIGNATURE



Brandenfels'

SCALP AND HAIR APPLICATIONS AND MASSAGE

THE ONLY APPLICATIONS AND MASSAGE OF THEIR KIND IN AMERICA



IF you're that man, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—a salary of \$3,000 to \$10,000?

An accountant's duties are interesting, varied and of real worth to his employers. He has *standing!*

Do you feel that such things aren't for you? Well, don't be too sure. Very possibly they *can* be!

Why not, like so many before you, investigate LaSalle's modern Problem Method of training for an accountancy position?

Just suppose you were permitted to work in a large accounting house under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then more difficult ones. If you could do this—and could turn to him for advice as the problems became complex—soon you'd master them all.

That's the training you follow in principle under the LaSalle Problem Method.

You cover accountancy from the basic Principles right up through Accountancy Systems and Income Tax Procedure. Then you add C. P. A. Training and prepare for the C. P. A. examinations.

As you go along, you absorb the principles of Auditing, Cost Accounting, Business Law, Statistical Control, Organization, Management and Finance.

Your progress is as speedy as you care to make it—depending on your own eagerness to learn and the time you spend in study.

Will recognition come? The only answer, as you know, is that success *does* come to the man who is really *trained*. It's possible your employers will notice your improvement in a very few weeks or months. Indeed, many LaSalle graduates have paid for their training—with increased earnings—before they have completed it! For accountants, who are trained in organization and management, are the executives of the future.

Write For This Free Book

For your own good, don't put off investigation of *all* the facts. Write for our free 48-page book, "Accountancy, The Profession That Pays." It'll prove that accountancy offers brilliant futures to those who aren't afraid of serious home study. We'll also include "Ten Years' Promotion in One"—a book which has helped many men. Send us the coupon *now*.

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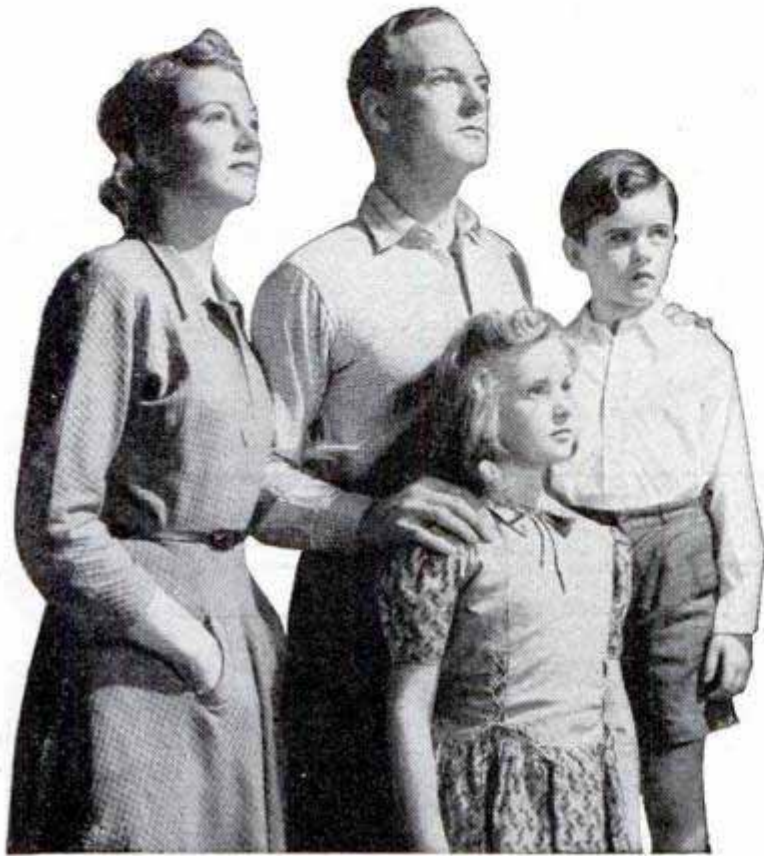
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What's ahead?



A world of rapid changes and new economic problems, that's certain. Just as surely, however, there's *one* thing that will be unchanged. In the near future and the long future, the important positions will be held by *trained men*.

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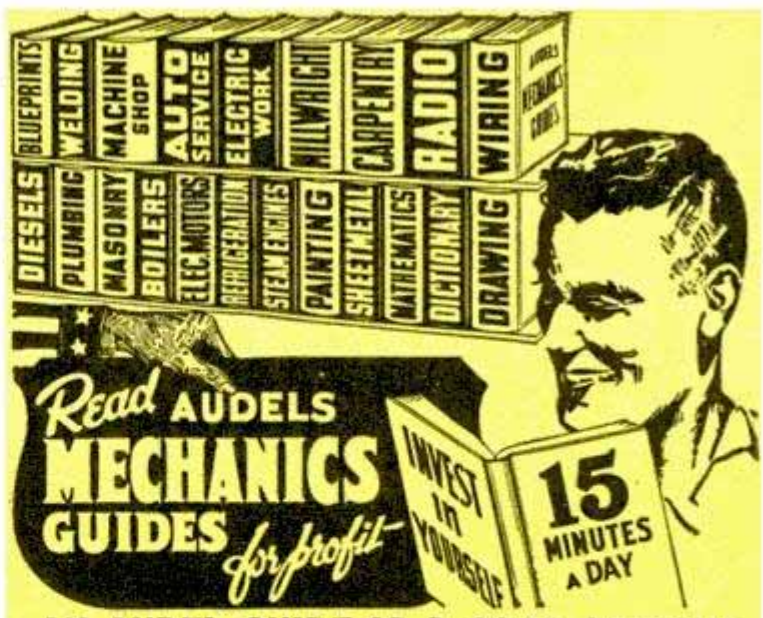
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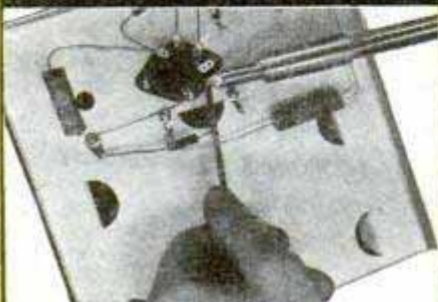
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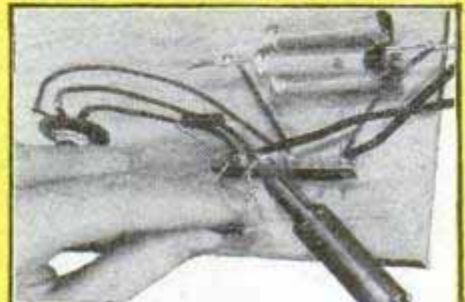
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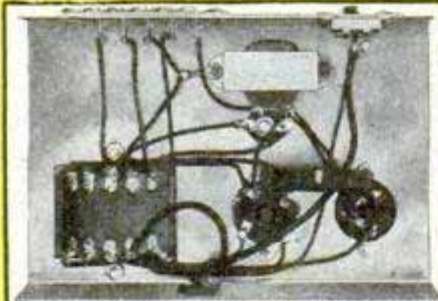
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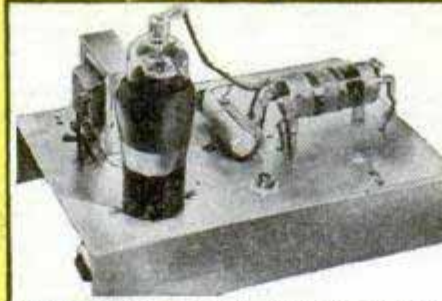
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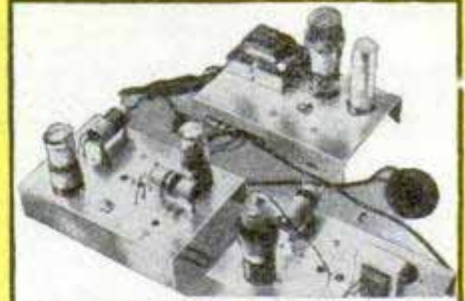
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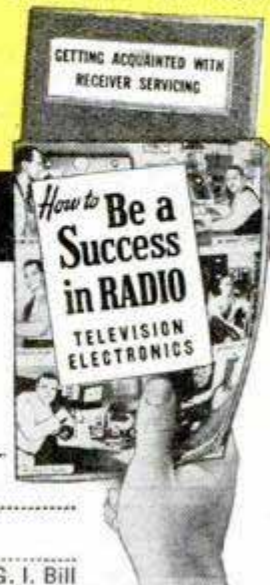
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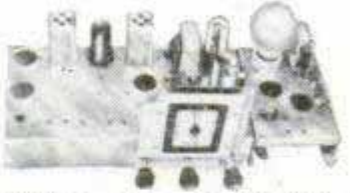
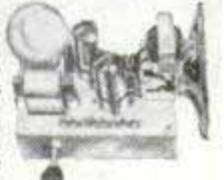


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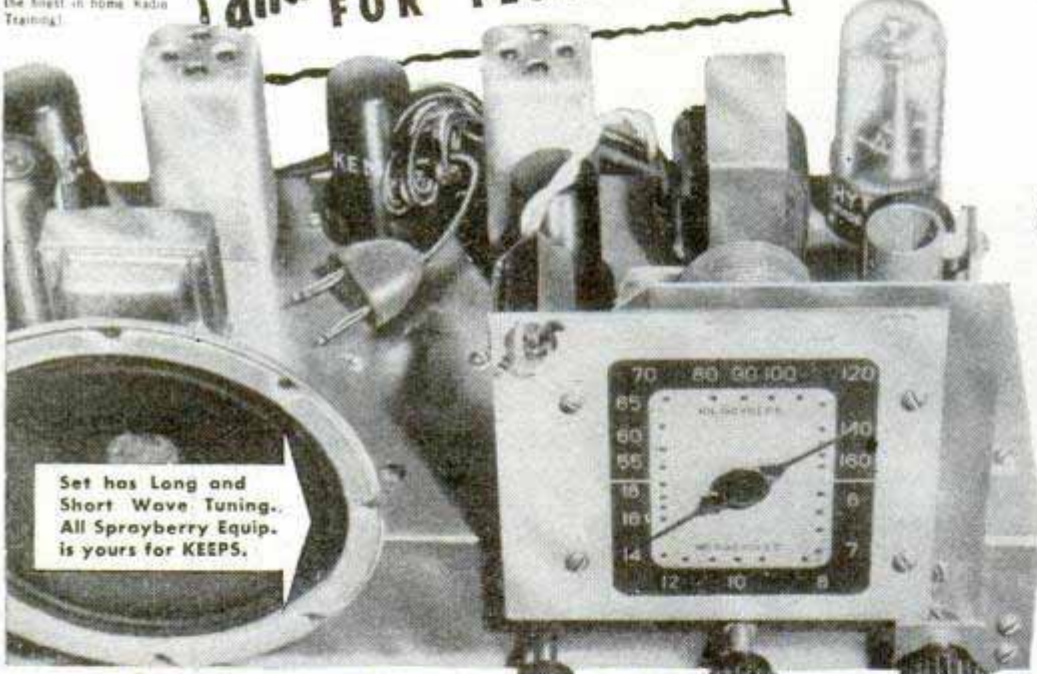
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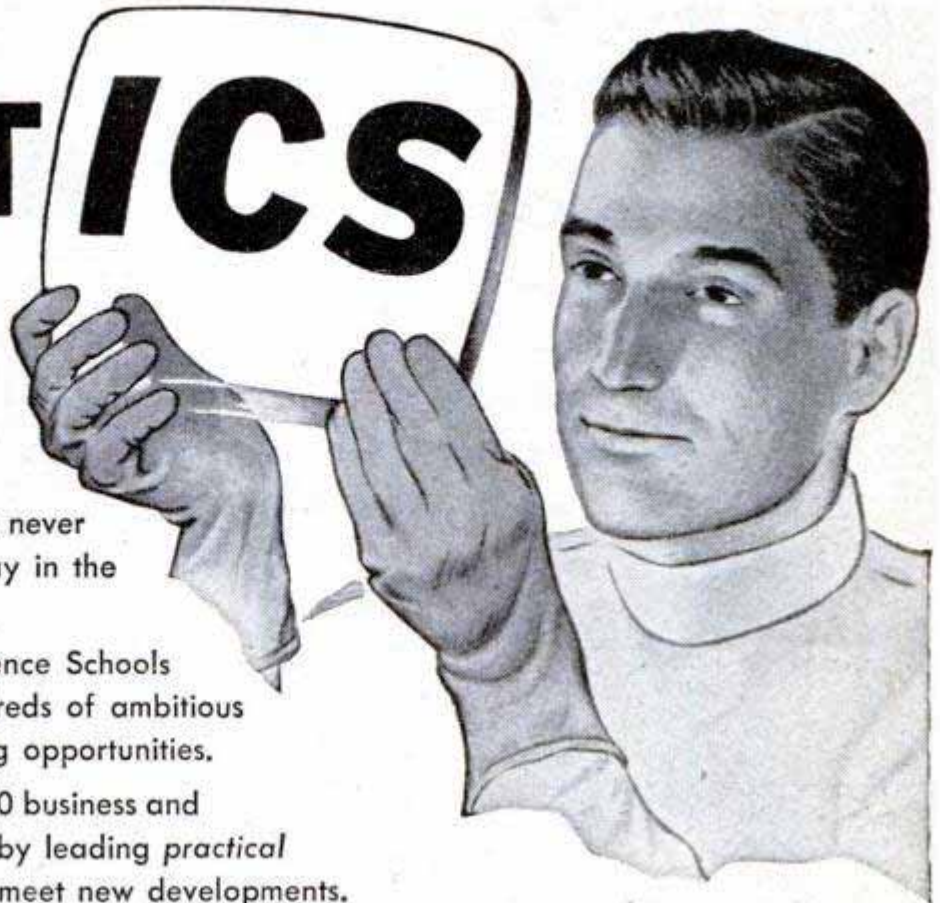


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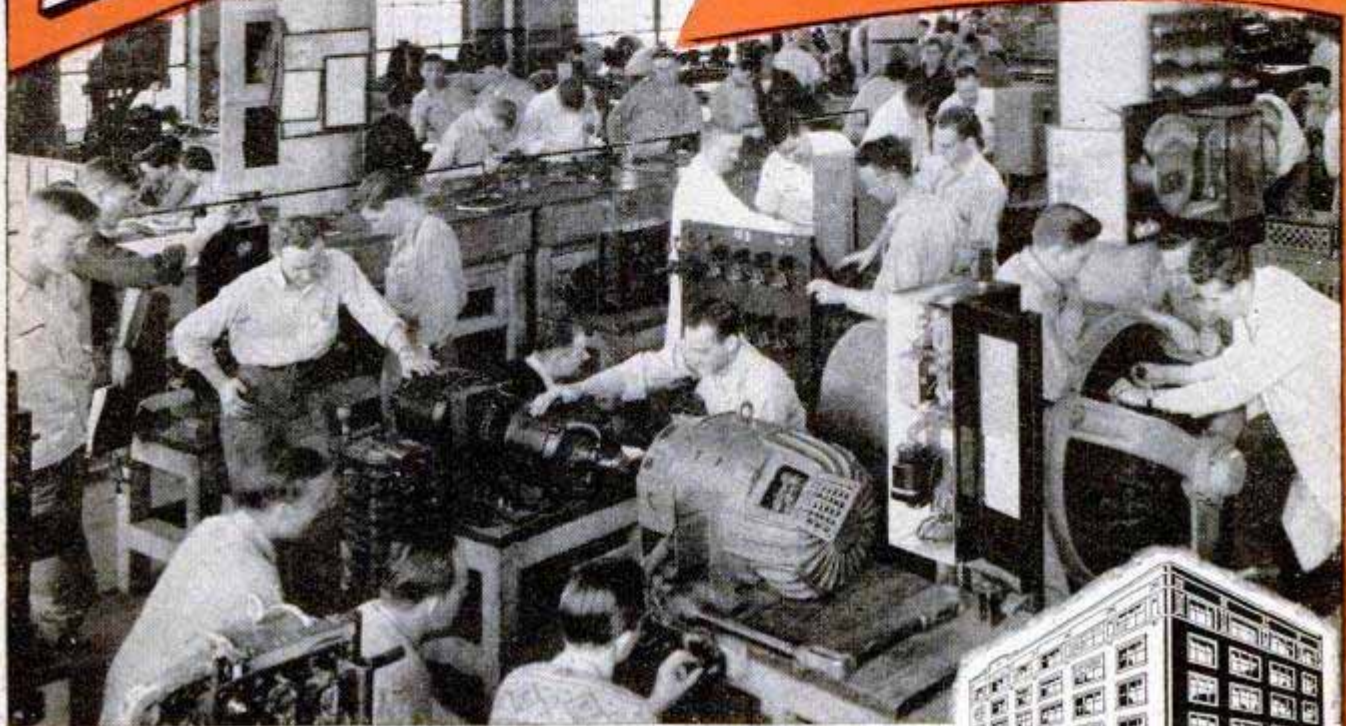
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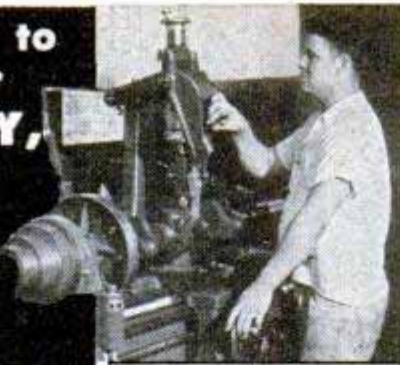
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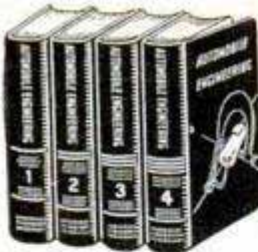
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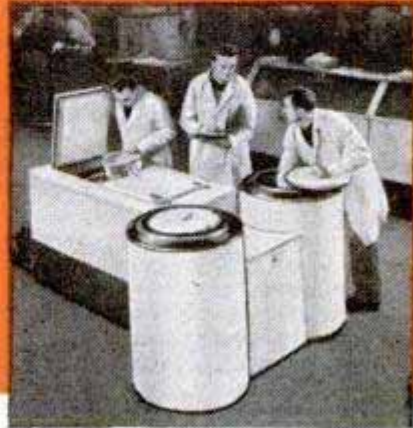
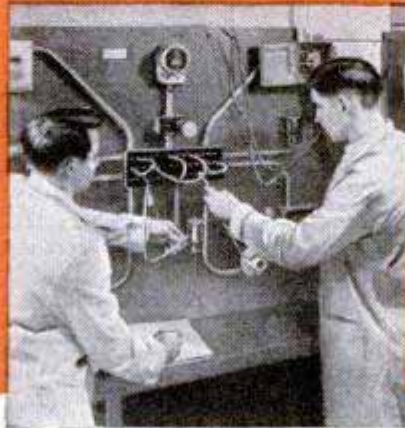
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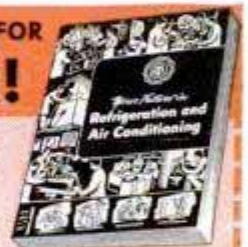
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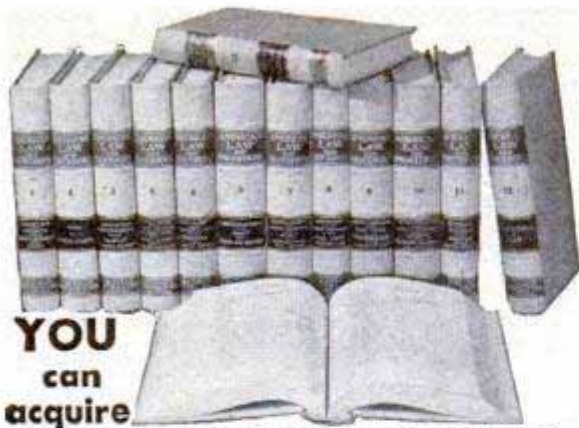
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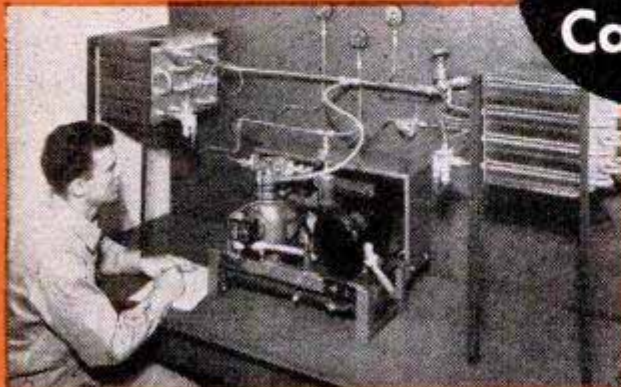


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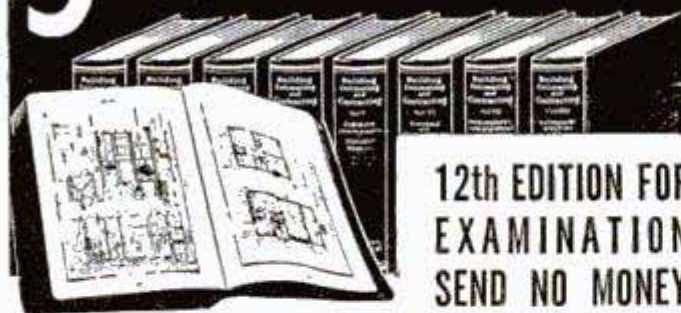
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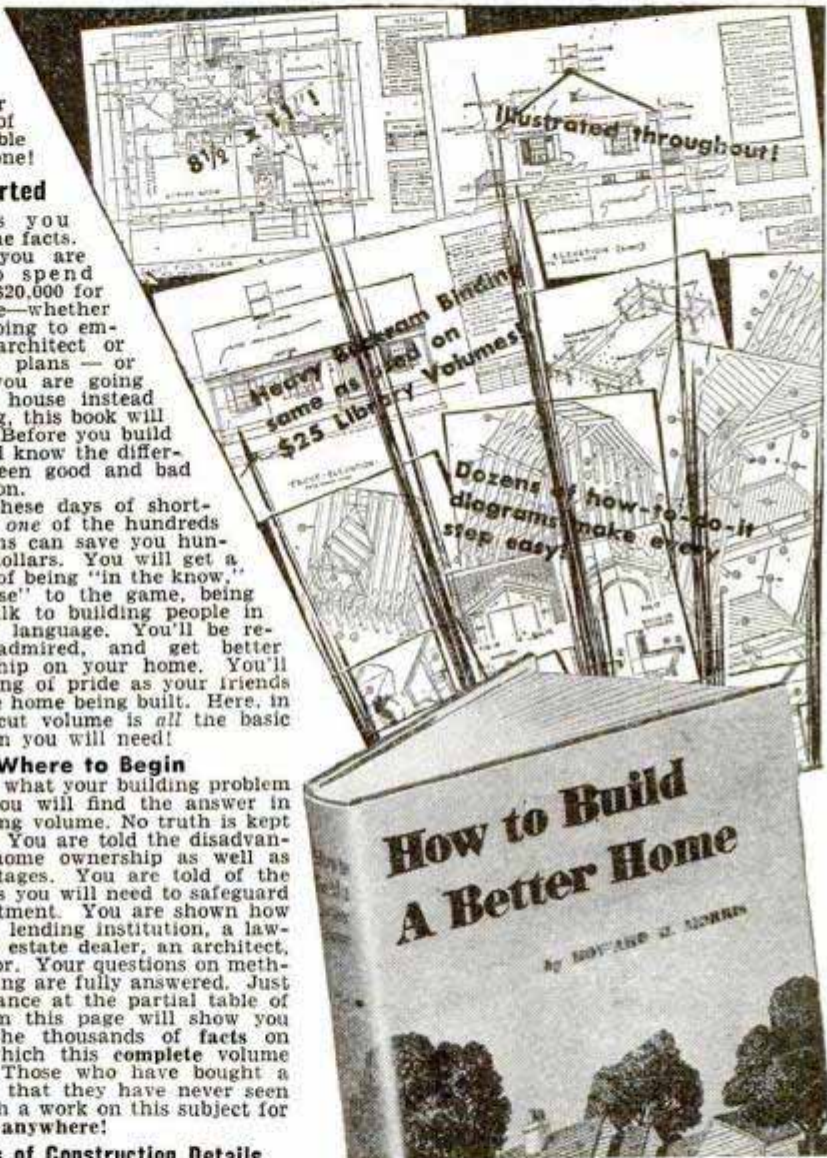
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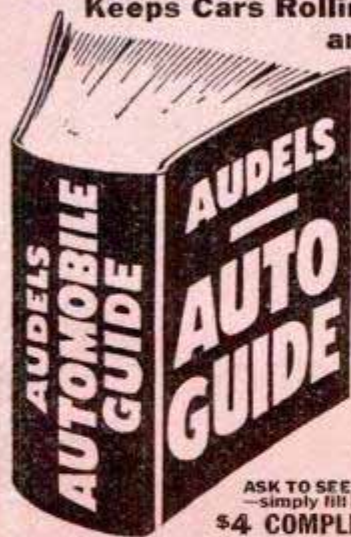
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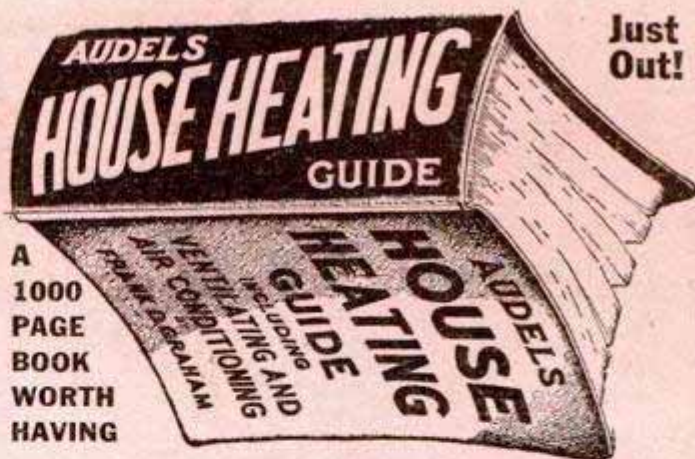
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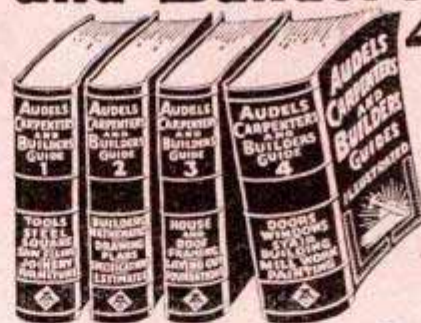
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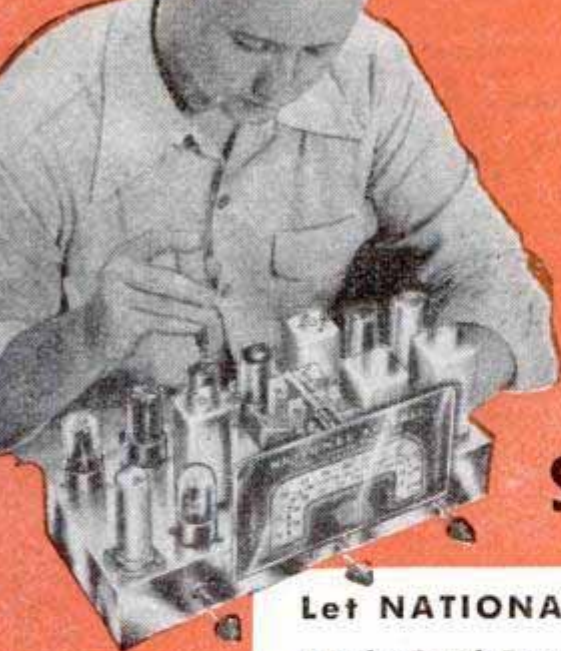
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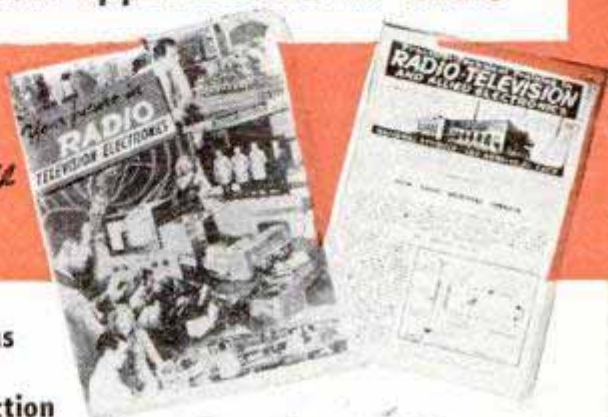


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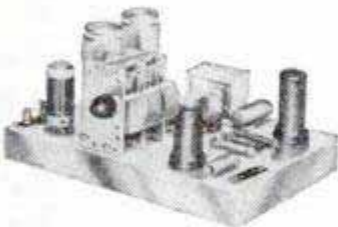


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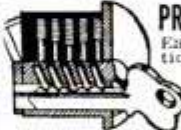
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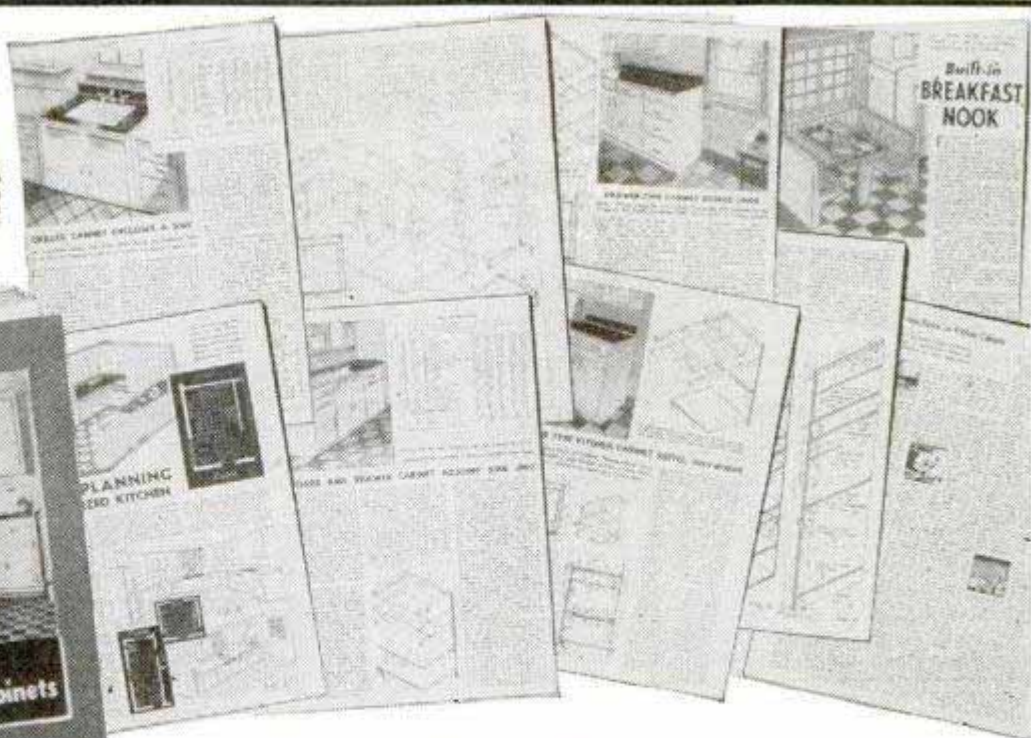
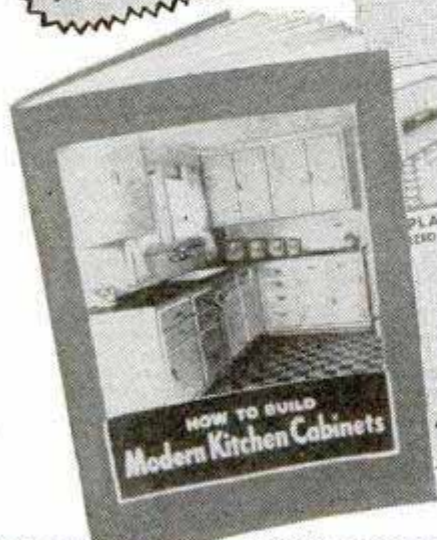
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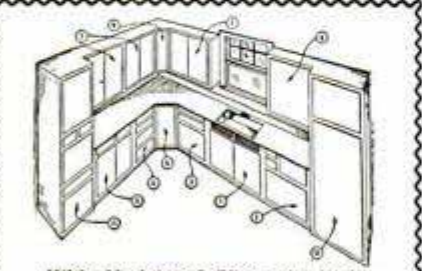
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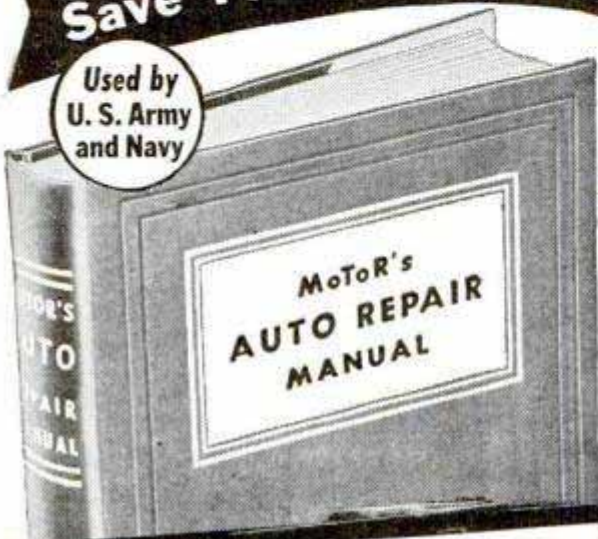
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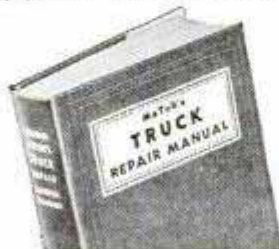
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MAILING Postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers, Box 23, Pawtucket, R. I.

CO-PUBLISH And advertise in The Central Mail Advertiser. Sample copy for stamp. Low rates. Large circulation. Bagby Printing Co., Georgetown, Ohio.

MAIL Order opportunities. Full or spare time. Hundreds of chances. No charge. Postal brings copy. Blackstone Press, Somerville, New Jersey.

BRONZING Baby shoes is big business. Start your own business for \$3.95. All materials furnished. Metaloids, Box 2095, Wichita, Kansas.

START Home plaster novelty business. Amazing course tells how. Literature free. Kemo-Courses, Dept. A, 4862 Catalpa, Chicago 30, Ill.

MAKE Rubber stamps, Metalize baby shoes, silver mirrors, make plaster novelties. Catalogue of "20 Ideas" free. Universal, Box 1076-A, Peoria, Ill.

1948 CARD Guide, sales plans, better, quicker, cheaper results. Small capital. Guide \$1. Information stamp. Matsonian, No. Grafton, Mass.

FREE Offer. Income for life plan. Bowen's System, 317 American Bank Building, Portland 5, Oregon.

METAL, Onyx, plastic mountings for bronzed baby shoes, 20 styles. Hardening solution. Wholesale. Box 2095, Wichita, Kansas.

LIQUID Marble—Colorful, glossy! Molded, brushed, sprayed! Cast novelties, statuary, colored tiles. Flexible molds. Composition floors. Particulars free. Marbleizing Service, Edwardsville, Illinois.

START Profitable business on \$25.00 capital; like I did, instructions 25c. Alan, Box 2587, West Palm Beach, Florida.

RUBBER Molds, natural liquid rubber, flock filler (for making sectional molds), statuary plasters, felt finishes for novelties. Catalog and "Plastercraft" course free. Blue Rapids Supply, Blue Rapids, Kansas.

SHELL Jewelry, novelties. Profitable home work. Free lesson. Werts, Sharp Park (1), California.

50 BUSINESSES You can start with \$10 and make \$10 per week! Complete—detailed! Copy, \$1.00. Literature free. Carey, 25-P, Waverly Place, Melrose 76, Mass.

OWN—Operate ball gum, nut, cigarette vending machines. Amazing profits, no selling. Write for free details. Cameo Vending, Dept. P, 432 West 42nd, New York.

EARN \$200 Weekly installing new amazing "Styron" plastic wall tile in homes, offices. Easily applied. Tile your own kitchen, bathroom, too. Instructions, everything furnished. Literature free. U. S. Tile Co., 30 W. Washington St., Chicago 2, Ill.

NEW Mail order manual tells how, what, where to sell. Details free. Everett, 542A Barclay, Naperville, Illinois.

WHERE To buy at wholesale 100,000 articles. Free list. Maywoode, 1133 Broadway, New York.

YOU Make them. We sell them! New liquid plastic makes many items! Terrific demand! Earn minimum of \$50.00 per week at home. No experience or machinery required. We supply raw materials and instruction. Write Travaco Laboratories, P.O. Box 1883, Boston 5, Mass.

\$10.00-\$20.00 WEEKLY, Sparetime. Amazing opportunity. Free literature. Teepee Co., Cleveland 3, Ohio.

COPUBLISH Leading m.o. paper. Latest copy Mail Sale Advertiser and proposition, dime. Vanroy W. Shirk, Lebanon, Penna.

MOLD-MAKERS Finest quality natural latex. Sample and instructions on request; also latex for casting rubber articles in plaster molds. Lowest prices. Major Chemical Co., 131 Inman St., Cambridge 39, Mass.

ELECTRIC Appliances—Our new booklet No. 111 gives hints on the care and repair of all electric appliances from clocks to washing machines. Also details for making simple time switches to control appliances. Only 25c. Popular Mechanics Press, 200 East Ontario Street, Chicago.

MONEYMAKING OPPORTUNITIES

EARN \$25 Distributing 50 boxes of greeting cards. Over 20 different top quality assortments for Xmas, birthday plus deluxe boxed stationery. Also make extra money taking magazine subscriptions. Details free! Cassell Co., 11-D Elm St., Westfield, New Jersey.

BE A Notary Public. Largest notary supply house equips you for \$18.97, guarantees your appointment by governor. Honor, prestige. You certify legal papers, collect fees. Easy. At home, office, anywhere. You use official seal made with your name. Notaries needed everywhere. Be one. Write Stationers Exchange, Helotes 16, Texas.

MAKE 100% Selling beautiful hand carved plastic pins and earrings. \$1.00 for sample. Winston Sprague, 817 Gene-see Pk. Blvd., Rochester 11, N. Y.

HUNDREDS Of plans, wholesale supply sources, formulas, novelties. Literature and sample 10c. Lewis Davis, 3431 Campbell, Lynchburg, Virginia.

RAISE Earthworms. This new field offers unlimited profits as a full time or part time business. Send for "The Worm Turns into Profits for You." It's free. Earthworm Culturists, Box 83, Station "C," Atlanta 5, Ga.

EARN Up to \$520 month part or full time keeping books for small firms, simplified system. Write Tax-Saver System, Dept. 1, Ft. Worth, Texas.

RESILVER Mirrors at home. Formula 25c. Ideal Service, Park Ridge 6, Illinois.

START Your own business on our capital. Always your own boss. Hundreds average \$6,000 to \$25,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh's, Dept. J-U1-PPM, Freeport, Ill.

METALIZE Baby shoes. Further information 3c stamp. Metal Crafts, Box 125-R5, Tampa 4, Florida.

EARN While you learn clock repairing. Your income can start immediately. Akron Clock Clinic, 964 Wye Drive, Akron 3, Ohio.

LEARN Year round air conditioning at home. Free information. Don Nelson, Warner Robins 2, Georgia.

MONEY-MAKING Service. Particulars free. BC Company, 760 North Main St., Fall River, Mass.

"WESTERN Advertiser" offers many worthwhile mail order opportunities. Sample copy free. H. Edlund, 577 Kensington, Los Angeles 26, Calif.

PROFITABLE Business at home spare time. Write Treasure-Trove Bookshop, Box 125-R5, Tampa 4, Florida.

OPERATE Successful mail business with our tested plans. Details free. Reynolds, Box 103Y, McAlesterville, Penna.

MONEY Making plans. Send dime for magazine. James Carter, Rocky Mount, Virginia.

\$12.00 PROFIT On 25c investment. Free folder. Suproco, Ogema 5, Wisconsin.

BABY Shoes preserved. Formulas, instructions \$1.00. Supplies and bases. Novelty Bronzing, Box 56, Hyde Park 36, Mass.

START Your own business! Big money manufacturing novelties, plaques, statuary. Free catalog. Write Bing Products, 88-A10B Broad Street, Boston 10, Mass.

EARN \$3.00 Hour! Service aquariums! Professional booklet \$1.00. Aquarium Assembling Service, Box 47, Cathedral Station, New York 25.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 1, Wisconsin.

FINE Opportunity to have pleasant outside business of your own. Supply every home with food products, flavors, washing preparations, and scores of other daily used items. Work part or full time. Many dealers with us for from five to twenty years. Exclusive territory assigned. No age limit. Selling experience unnecessary. Don't delay. Every day counts. Write now for details. C. I. Togsstad Co., Dept. PM-10, Kokomo, Ind.

"WHOLESALE Catalog," (illustrated 10c). Bargains galore. Stafford, Box 5211B, Indianapolis 1, Indiana.

FAST Sales, cuts food cost. Nets \$9 a case. Sell 6 daily. Exclusive territory. Jeld, Ltd., Burbank, Calif.

BIG Seller, Christmas ceramic jewelry. Send 35c for sample and details. Box 272, Cooper Station, New York 3, N. Y.

\$3.41 PROFIT Per hour interest you? Easy, amazing process velvetizes interiors, signs, novelties, radios, lamps at low cost. Free sample. Sparks, 1145 Queen Anne, Los Angeles 6.

ANALYZE Handwriting for profit! Complete outfit \$1.00. Graphologists, POB-971, Philadelphia.

PRIZE Contest bulletin gives various contests now operating, and valuable hints. 3c stamp. National Contest Bulletin, Box 2685P, Miami, Florida.

WIN Contest money. General Contest Magazine gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609 1/2 East 5th, Duluth, Minn.

WOULD You pay 3%—first \$350 made? Color-illustrated book "505 Odd Successful Enterprises" free! Proven! Work at home, office. Expect something odd! Pacific, Oceanside, Calif.

PUBLISH Your own magazine. Handsome 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 25c brings sample. details. National, Ord. Nebr.

FREE Booklet "How To Raise Worms For Bait." Tells how to propagate, package, sell. Send postcard. El Sobrante Earthworm Farm, 749-A Rincon Road, El Sobrante, California.

INCREASE Your earnings: Local business opportunities; mail order information; wholesale supply sources; valuable money-making tips; information, free details, rush name. Wilkin Company, Hillsboro, Ohio.

EARN Money at home! Thousands do! "Home Worker Magazine" tells how. Sample, 25c. Sizemore, Box 7, 4917 Kostner, Chicago 30, Ill.

SCHOOL Seniors—Sell classmates America's most beautiful graduation name cards. Largest selection. 40% commission. Outsells all others. Free sample kit. Printcraft, Dept. M, 1425 E. Elm St., Scranton 5, Penna.

FORMULAS, PLANS, ETC.

"EVERYBODY Likes candy." Learn to make professionally. (Our 38th year.) Ragsdale Candies, D5, East Orange, New Jersey.

10,000 FORMULAS And trade secrets. Free literature. Stillman, 555 Kingston Ave., Brooklyn 3, N. Y.

MAKE—Sell cleaners, soaps, polishes, flavors, cosmetics. No machinery. Formula literature free. Kemico, Park Ridge 16, Illinois.

\$1.00 GETS You 21 money-making popcorn, candy apple formulas. We supply equipment. Concession Supply Company, Dept. A, Station "B," Toledo, Ohio.

TESTED Formulas. Interesting descriptive booklet free. Pont, Box 635-PM, Terre Haute, Indiana.

PRODUCTS Analyzed. Duplicated. Improved. Formulas. Consulting Scientific Company, Swarthmore, Pennsylvania.

YOU Name it. We'll airmail formula. \$1.00. Brown, 9111 Hoyne, Chicago 20.

SAWDUST Principal ingredient of product universally used. Easily manufactured in cellar or garage. Manufacturer's formula \$2.00. Hoyt, 344 Broadway, So. Portland 7, Maine.

PHOTOGRAPHS anywhere, three formulas \$1.00. "Photo," 2437 Hollywood Ave., Toledo, Ohio.

OPPORTUNITIES! Catalog describing 200 helpful formula, money-making books. Airmailed throughout world for stamps. Adams Brown Company, Boston 67, Mass.

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

PLASTICS

PLASTICS—Sheets, rods, tubing, coatings. Shells, findings, dyes, craft supplies. Lucite scrap 25-65c pound. Illustrated fabricating manual, price list, 10c. Lucite sample, 35c. Courtesy to dealers. Gem-O-Lite, 5350F Riverton, North Hollywood, Calif.

PLEXIGLAS. Lucite, Acetate, sheets, rods, tubes, jewelry findings, craft supplies, over 1700 items. 25c which brings catalog, internal carving folder, information on fabricating plastics, deducted from first order. Plastic Parts, Dept. H-2108, 1157 S. Kingshighway, St. Louis, Mo.

AMAZING Liquid plastic pours cold, hardens in half hour. Clear, colors. Expensive equipment unnecessary. Embed photographs, coins, flowers, seashells. Complete kit only \$3.25. Kristalon Plastics, Dept. A-10, Box 29, Wilmette, Ill.

CRAFTSMAN Special. Supply kit including powdered and liquid, carving and tinting dyes. Luminous powder and cement. \$1.75 postpaid. Lucite, Plexiglas, sheets, rods, tubes, findings. Free catalogue. Craft Plastics, Somerville 1, New Jersey.

LUCITE, Plexiglas. Any article you make polishes itself crystal clear by merely dipping in "Liquid Shine" for thirty seconds. Quart \$2.95, gallon \$8.75 postpaid. Send check or money order. Instructions free. Acwood Products Co., Box 263, Long Island City, N. Y.

DON'T Throw away broken plastic articles. Use WestCol plastic cement. 40c postpaid. WestCol Mfg. Co., 108 North 3rd, Grand Junction, Colorado.

PLEXIGLAS, 19c Per pound and up. Free list. Engineering, Box 5989A Metro. Station, Los Angeles 55, Calif.

INTERNAL Carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Somerville, New Jersey.

PLASTIC Injection machine. Plexiglas, jewelry findings, sequins, dyes, cements, tools, drills. Catalog. G. Baker Company, River Edge, New Jersey.

MAKE Your own Christmas gift jewelry. Internally carved flowers beautifully colored in Plexiglas ready for assemblage. Kit contains earrings, brooch, and pendant with silver-plated bow-knot pin. Complete with findings, cement and instructions \$3.95. Pilot Plastics Co., 69 Beekman Street, New York City 7.

BARGAINS In plastics. Lucite, Plexiglas, Catalin. Many colors and sizes. Details free. George Plastics, 6938A George St., Chicago 34, Ill.

RENEW Leather and leatherette—Make cloth into imitation leather with plastic discovery called Leather-New. Opportunity to make real profits taking care of sales resulting from national advertising. Write for free sample of Leather-New covered material and complete deal. 4723B Troost, Kansas City, Missouri.

PLASTIC Materials and supplies for your hobby or business. Catalog and internal carving instructions free. Art Plastics of Calif., 8125 East 14th Street, Oakland 3, Calif.

LUCITE, Plexiglas. Any size sheets. Cost square foot (12"x12") 1/16" 96c; 1/8" \$1.25; 3/16" \$1.52; 1/4" \$1.80; 5/16" \$2.23. Include 10% postage. Almac Plastics, 1150 Broadway, New York 1, N. Y.

PLASTIC—Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2901 No. Grand Blvd., St. Louis 6, Mo.

BOOKS—All Kinds—Homecraft, Radio, Plastics, Boat Building, Photography, Model Building. Catalog free. Popular Mechanics Press, 200 E. Ontario St., Chicago 11, Ill.

CHEMISTRY

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 10c. Dept. M-26. Biological Supply Co., 1175 Mt. Hope Ave., Rochester 7, N. Y.

LEARN Chemistry at home, from the house of Winn. Home of supplies for student chemists. New idea chemical and apparatus outfits for home experimenting. Photographic scales, semi-professional microscopes and accessories. Send 15c for retail catalogue. Established 1931. John H. Winn, 124A West 23 Street, New York 11, N. Y.

NEW Laboratory supply catalog of chemicals and apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company, 1232 N. Paulina St., Chicago 22, Illinois.

FREE Catalog: Chemistry, mineralogy, physics, biology. Tracey Laboratories, Evanston, Illinois.

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

LABORATORY Chemicals, apparatus, books. Catalog 10c. Fleischer's Laboratories, Everett 49, Mass.

HELP WANTED

ACT. Sell new Xmas photo greeting folders. Big profits, we deliver. free kit. Spooner, 115 Chauncy, Boston, Mass.

AGENTS WANTED

HERE Is an opportunity for men, women, and children to earn a big cash commission, selling our beautiful tinsel religious mottoes at 25c each. They sparkle in the light and glow like stars in the dark. They are new, they are different from all other mottoes. They sell on sight. Satisfaction guaranteed. Send for 12 mottoes to sell at 25c each. Send no money, we trust you. Pay after you have sold all 12 mottoes. The Diamond Motto Co., 920-PM Manchester St., Lexington, Ky.

PHOTO-Salesmen-agents. Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card, for free sample kit. Novel Portrait Co., 3343 North Ave., Chicago, Ill.

SELL Guaranteed new product thoroughly sales-tested. Turbine action brush automatically washes cars, windows, boats, floors. No rubbing, no wiping. Be first in your city with this amazing item. Send for sample only \$4.20 with free package "Magic" crystals. Sells for \$6.95. Write for quantity prices. Melaire Distributing Co., Dept. A, 420 Lexington Avenue, New York 17, N. Y.

MAKE Money fast! Sell Christmas cards to friends, neighbors, others. Big variety etchings, religious, 50 for \$1.00, wrappings, stationery. New \$1.25 line "Little Ones," flower box, plastic frost-eds, Saints 'n' Sinners. Special offers, bonus. Fund raising opportunity for individuals, clubs, churches, schools. Mail postal today for feature 21 card \$1.00 Christmas assortment on approval. Hedekamp, 343 Broadway, Dept. 0-42, New York 13.

BRAND New: "Liquid Stitch" repairs snags, stops runs to all hosiery. No woman should be without it. (Ideal gift.) Retail 49c. Take orders, department, variety, drug stores, etc., or carry own stock. Good commissions. Attractive store display. Write: Porter Mfg. & Supply Co., 2500 West Sixth St., Los Angeles 5, Calif.

SUCCESS Seekers. \$1-\$3 advance commissions plus cash bonus plan selling quality shoes direct. Amazing features. 73 styles entire family. Experience unnecessary. Free starting outfit. Moench Shoes, 10 Boston, Mass.

AGGRESSIVE Agents wanted to demonstrate guaranteed Copper-Cote ironing pad and cover sets. Endorsed by housewives everywhere. Sure-fire sales plan helps you get started. Generous commissions. Protected territories for producers. Real deal for live wires. The Sheldon Company, Box 1347, Milwaukee, Wisconsin.

MAKE 100% Profit selling name imprinted Christmas cards and \$1.00 assortments. Also personalized napkins and stationery. Request samples. Dunbar, Sanford 2, Florida.

GUARANTEED Product in protected territory, if you are now selling or intend to sell house-to-house. For full 1 qt. sample amazing High Shine Windsor No Rubbing Wax, send only 25c covering handling and postage. (Sells for \$1.25.) Windsor Wax Co., Inc., Dept. P.M.-2, Hoboken, N. J.

\$1 STARTS You in business. Sell lined ties, 100% wool interlining. Costs you only \$7 per dozen, you make \$5.00 dozen. Send \$1.00 for special introductory offer two ties. Catalog complete line free. Phillip's Neckwear, 20 West 22nd St., Dept. K-28, New York 10.

AMAZING Offer—\$40 is yours for selling only 50 boxes, each containing 25 new, entirely different deluxe Christmas cards with or without name imprinted. Also 50 for \$1.00. Free samples. Other boxes on approval. Write today. It costs nothing to try. Cheerful Card Co., 445, White Plains, N. Y.

WANT Pleasant outdoor work in a business of your own? Good profits selling over 200 widely advertised Raleigh home /farm necessities. Pays better than most occupations. Hundreds in business 5 to 20 years or more! Products-equipment on credit. No experience needed to start, we teach you how. Write today for full particulars. Raleigh's, Dept. J-145A-PPM, Freeport, Ill.

SELL Ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. "7x11" cost 6c, sells 35c. Make money. 15 samples ultra-blue signs "7x11" \$1.00 postpaid. Lowy, 8 West Broadway, Dept. 416, New York City 70.

ENTIRELY New—Entirely different specialized men's shoe line. Advance commissions to \$2.50. Bonuses, personal discounts. Free selling kit. Concordian Shoes, M-2, West Concord, Mass.

EASY Cash yours—Steady, quick. Sell friends quality Nylon hosiery, lingerie, blouses. Free displays. Complete line greeting cards. Leader Christmas assortment on approval. Special outfit offers. Wear Wright Company, 1709 Arch St., Dept. B, Philadelphia, Penna.

SCHOOL Seniors! Your postal will bring our wonder, Kwick-Sell Cardalog of popular graduation name cards. Biggest profits! Only firm giving free souvenir chest and card case. Don't miss out! Hurry that postal! Craftcards, Box 235-L, Pittsburgh 30, Pennsylvania.

PLASTIC Tablecloth covers, curtains, drapes, baby pants, bowl covers and other plastic articles selling like wildfire! Make big money now! Free details. Write L & M Co., Dept. 58-K, 510 St. Charles, St. Louis, Mo.

SEWING Machine electrification kit. Nationally advertised guaranteed product. Unusual opportunity for right men. Potential earnings unlimited. For complete details write today to Brownell Co., 308 Canal St., New York 13, N. Y.

SPECTACULAR Guarantees, popular prices, make selling easy. Biggest steady repeat profits selling Colt's famous men's, women's guaranteed shoes, hosiery. Experience unnecessary. Free selling outfit. Colt Shoes, 601-J10 Atlantic, Boston 10, Mass.

PATENTED Flood lights. Sell to theatres, lodges, auditoriums, schools, stores, homes. Literature free. Communications Inc., 110-B University, Seattle 1, Wash.

I'LL Put a "shoe store business" in your pocket! Nation's leader trains you to make big money! Fit men, women. Free sample outfit, write today! Consolidated Shoe System, Dept. S-139, Chippewa Falls, Wis.

POCKET Pal: replaces knives, new, safe, beautiful. Always razor sharp. 50c seller. 321% profit. \$15.00 or more daily. Agents, salesmen, distributors. Sample 25c. Nelson Mfg. Co., 222 W. Kellogg, St. Paul 2, Minn.

DEALERS And Agents—Sell E-Z View day or night, anti-glare attachment for car visor. Make 40% on investment. Send for information. Jewel Industries, Inc., Dept. A, P.O. Box 889, Canton, Ohio.

OUTSTANDING 50c Seller. Million dollar flight airplanes. Sample 25c. Dozen \$2.25. A. F. Kolinski, 759 South 25th, Milwaukee 4, Wisconsin.

MAKE Easy money selling finest line name imprinted Christmas cards, 50 for \$1 and others. 20 bargain assortments, stationery, gift wrappings, up to 100% profit. Write for 21 card leader on approval, free offer, and free portfolios. Dept. 221, Silver Swan Studios, 320 Fifth Avenue, New York.

DIRECT From factory. Make \$100.00 weekly selling watches. Advertised brands with guarantee. Free catalogue. Ergim Watch, 833 Columbus Ave., New York.

A DRESS Yours with every 3 you order for yourself and family. Amazing new bonus plan. Everything free. Harford Frocks, Dept. T-9128, Cincinnati, Ohio.

DOUBLE Duty shopping bag. Zips open. Instantly changes from small to large size. Lightning seller. Samples sent on trial. Kristee 126, Akron, Ohio.

REPRESENTATIVES Needed in every state. Write details. M. Thomas, 2 Callo-dine, Eggertsville, N. Y.

AGENTS, Distributors. \$28 upward daily possible. Flo-Glo plastic linoleum finish. Acme, Box 404-PM, Mount Vernon, N. Y.

200 SURGICAL Steel blades \$1.00. Pen sets \$1.00. Jerome Sales, Box 16 Station K, Brooklyn 19, N. Y.

AGENTS Wanted for our coin operated amusement and slot machines in every town and community. Sell, or start your own route. Big profits! Write for free wholesale catalog and deal. Aerobilt Products Co., Dept. 27, 3767 Druid Station, Baltimore 17, Maryland.

GREETING Card salesmen, saleswomen—Add fast-selling pictorial plaques to your card line and double your earnings. Rush name, address for free details, pictures. Marsh-Art, 1308-P Browne, Yakima, Wash.

MAKE Sensational profits! New, sell-on-sight plastic line: Tablecloths, aprons; many other splendid fast-selling items, novelties. Postal brings free details, special deals. Hurry! Royalty, Box K-748, Passaic, N. J.

SELL The famous \$3 "Fire-Killer" extinguisher with bracket, wholesale or direct; exclusive territory. Demonstrating sample \$2; refilled free. "Fire-Killer," Syracuse 1, N. Y.

FREE Nylons given if Kendex hosiery runs or snags! World's only women's hosiery sold with a written guarantee that amazes everybody. Mere words could not possibly express the almost unbelievable opportunity you now have to make money. Fantastic and "impossible" earnings now become a reality. Can you imagine a guarantee that replaces hosiery regardless if damage is due to use or abuse and regardless whether it is the fault of the hose or the wearer? Here is sales dynamite that will blast your earnings to the sky! Even if you never sold a thing in your life, three magic words: "guaranteed against everything" will open doors for you—will make women listen and will pour money in your pocket. Kendex stockings are not sold in stores, so you have no competition. Complete line includes beautiful sheer nylons; long wearing, durable service nylons; three different lengths; genuine outside nylons; latest shades; choice of full fashioned with seams or seamless; lowest priced rayons. Also separate complete line of men's hosiery including nylon, lisle, rayon, cotton, mixtures etc.; plain and fancy; long and short. Thousands of pairs shipped daily. No money or experience needed. Nothing to invest or risk. No samples to buy. Nothing to pay, now or later! Simply write orders. We deliver and collect. Liberal advance cash plus huge cash bonus. Write orders spare or full time; exclusively or as a side line. Become a manager and appoint others to sell for you with steady income on their sales! Complete money-making outfit, including salesbooks in color, samples cut from actual hose, instructions, order blanks etc. furnished free and prepaid. Rush name and address on postcard and start making money next week. Kendex Co., Babylon 176, New York.

REAL Money showing neckties! You can salt away plenty of extra cash right at home part time or full just showing neckties that "sell on sight." Men grab these fashionable Fifth Avenue Ulster Cravats that bristle with style, smart patterns, becoming colors. Practically impossible to resist the low factory price half the retail cost. You net \$40 to \$60 per 100 Ulster Cravats ordered by friends and associates. Gift possibilities wide open—churches, bazaars, fund-raising drives, etc. For information to get started, write Ulster Cravats Co., Inc., Dept. PM-1, 545 Fifth Avenue, New York 17, N. Y.

USE Your home as magazine subscription station. Represent all magazines. Liberal commissions, we supply everything. Big Christmas business ahead. Catalog, full details, free. McGregor Magazine Agency, Dept. 12, Mount Morris, Illinois.

BUY Thousands of nationally advertised products direct from manufacturers. Write for "buy direct and save." Consumers Ass'n, 287-A Lebanon Ave., Mt. Lebanon, Penna.

HOTTEST Xmas item. Sells on sight. Details free. C & C Sales Co., Box 1046, P, Chicago 90, Ill.

GOOD Sparetime profits daily. Information free. Polesi, 666 East 233rd Street, Bronx 66, N. Y.

AMAZING Dust cloth. Picks up dust like a magnet. Cleans glass, furniture, autos beautifully. Sells like wildfire. Carry day's supply under arm. 100% profit. Sample, details free. Hobart Rude, 3953 Whiteside, Los Angeles 33, Calif.

BIG Profit opportunity! Cash in on volume sales, amazing traction tracks. Patented June, 1947. Get cars out of snow, mud, sand in jiffy. No tools, no shoveling, no ashes. Money-back guarantee. Sample \$1.00. Details free. Consolidated Equipment Corporation, 2737 Guardian Bldg., Cleveland, Ohio.

FAST Sales, cuts food cost. Nets \$9 a case. Sell 6 daily. Exclusive territory. Jeld, Ltd., Burbank, Calif.

QUICK Money. 100% profit. Show Christmas cards, stationery to friends, coworkers. No experience. Approval samples. Torres Company, 373 Fulton Street, Brooklyn 1, N. Y.

BIG Profits selling used clothing. Operate from home, auto or store. Men's suits \$4.00. Overcoats \$4.00. Field jackets \$2.00. Ladies' coats \$1.50. Army shirts \$1.50. Other big bargains. Catalog free. Kadetsky & Son, 702 Barber Street, Dept. 103, Chicago 7, Ill.

CHRISTMAS Cards—50 for \$1, other series, over 25 from \$1-\$2.50. Also box assortments. Free sample albums. Commission-bonus. Richar Greeting, 16 East 18, New York 3.

EARN Big money year 'round. Be a one-person-department-store. Take orders for shirts, ties, hosiery, lingerie, Household linens, etc. For information, Corporate Merchandisers, Dept. PM-7, 110 West 34 Street, New York City 1.

SILVER Plating liquid—(NuSilver). Apply with cloth. Durable, guaranteed, genuine, silver finish. Renews silverplated ware, articles, pieces. Silverplates brass, copper. District, state, sales-distributors wanted, exclusive. NuProcess Products, Aurora, Illinois.

\$5.00 CASH Advance commission every sale 38-piece "Lady Ann" silverware. Guaranteed quality, value bring sales galore. Also varied line of other silverware and housewares. Write for sure-fire sales outfit, Dexter Silver Co., Dept. PM-10, 303 Fifth Ave., New York 16.

MAKE Big weekly commissions selling nationally advertised aluminumware, silverware, pressure cookers, canners and gift items. No investment required. Simply take orders, collect commissions, we do the rest. Complete sales kit free. Write Ury Co., Dept. 12C, 222 - 4th Ave., New York 3.

BIG Money—Fast! Sell quality plastic tablecloths (from \$4.00 dozen), curtains, aprons, and complete plastic line. Direct from factory. Free samples. Dur-Ever, 314-C Albany Ave., Brooklyn 13, N. Y.

LARGER Profits; fastest sellers! Newest hits, for men and women. Many offers. Literature for stamp. McCurdy Service, P.O. Box 1877, Miami 11, Fla.

FAMOUS Bostonian shirts now in full production again—This nationally known shirt maker, est. 1863, making one of the finest lines of shirts in the country, is now adding a limited number of sales agents selling direct to the consumer; liberal commission; fast selling, quality line, repeat sales, no investment, immediate commission, establish your own business; make up to \$5000 yearly. Write for free sales kit, Bostonian Mfg. Co., 89 Bickford St., Boston 30, Mass., Dept. PM9.

MAKE Real money next 60 days selling all-metal interlocking weatherstrip sets. Prospects everywhere. Experience unnecessary. Write E-Z-ON-9, Box 1061, Chicago 90, Illinois.

BOYS! Earn big money and bonuses easy selling brass name plates for neighbors' doors. Write Hubstamp, 357-A Congress, Boston, Mass.

BIG Money selling cast iron and aluminum cooking utensils direct to consumer, exclusive designs. Free illustrations. Jones Machine & Foundry Co., Chattanooga 2, Tenn.

BIG Bargains for big profits. Over 100 sensational wholesale values. Men's used suits \$2, pants 35c, topcoats \$1.25, overcoats \$2, shoes 20c. Experience unnecessary. Free catalog. Superior, 1250-A Jefferson, Chicago 7.

FREE Sample! Big profit opportunity with amazing Glow-in-the-Dark house numbers, switch plates, pictures, decals, religious articles. Represent large manufacturer. Madison Mills, 303 Fourth Avenue, New York 10, N. Y.

PLASTIC Christmas cards. Exclusive new plastic, sachet, panoramic and carols Christmas assortments. Five leading 21 card \$1.00 feature assortments. Six portfolios of personal cards. All this plus America's fastest imprint service. Free samples. Elmcraft Card Co., 5930 South Western, Chicago 36, Illinois.

AMAZING Profits. \$25.00 for selling 50 \$1.00 deluxe Xmas boxes. Embossed 50 and 25 for \$1.00, name imprinted. Free samples. Ed-Brite, Dept. 12, 435 North Terrace Avenue, Mt. Vernon, New York.

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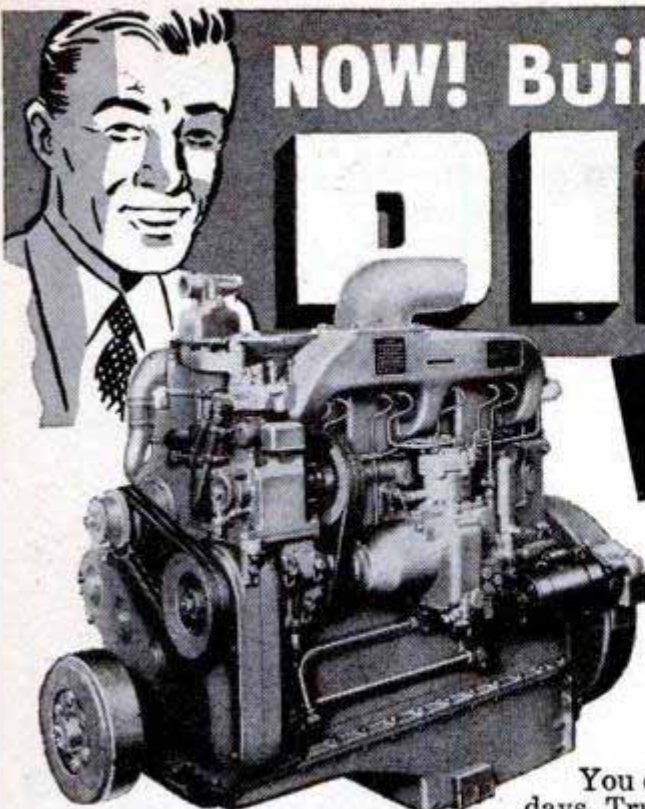
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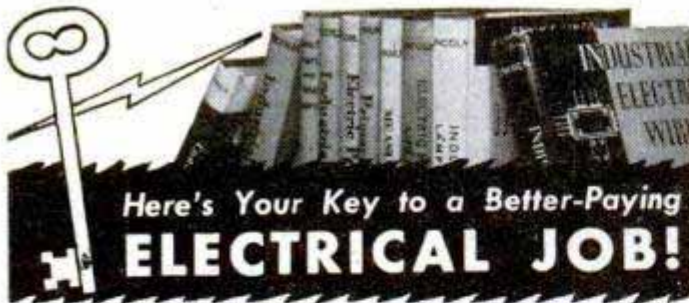
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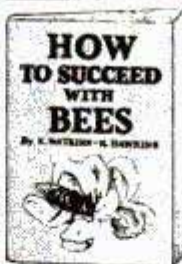
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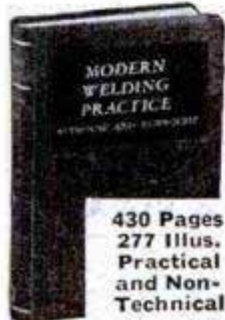


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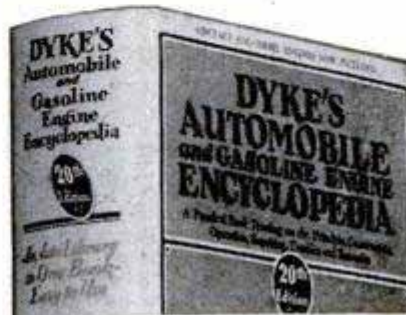
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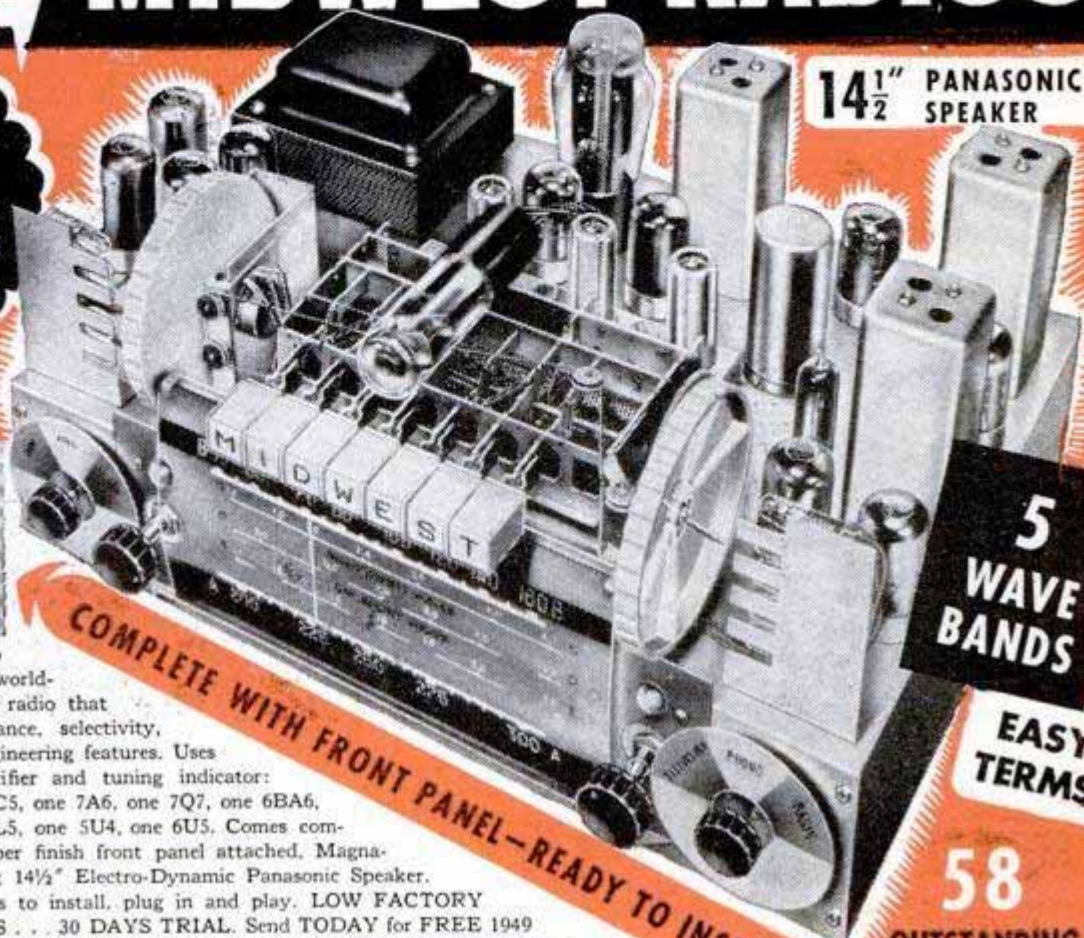
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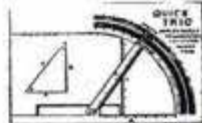


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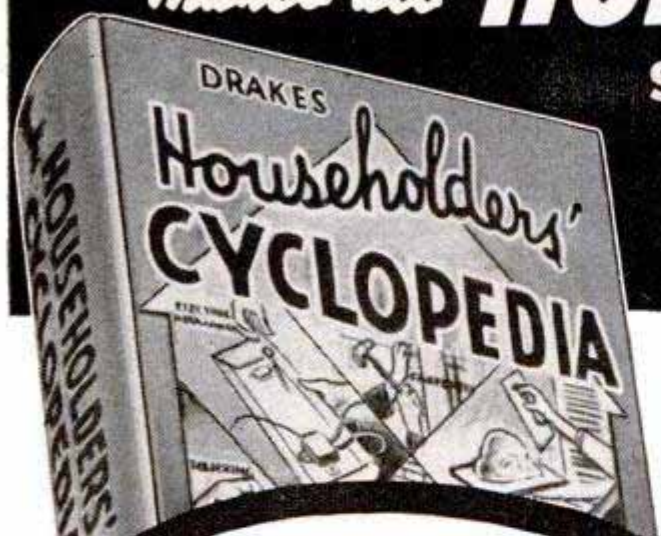
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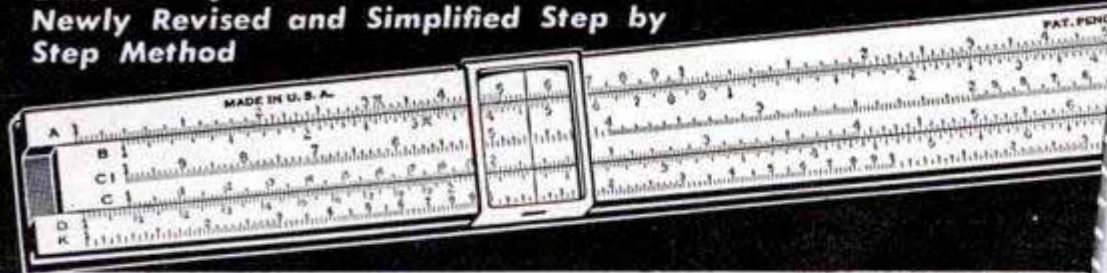
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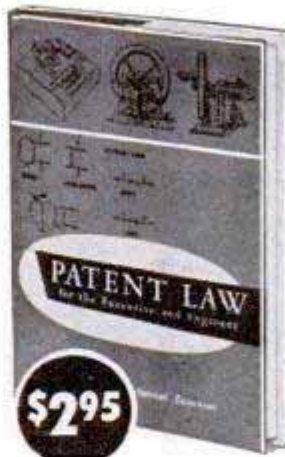
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Fifty records of modern dance, race, blues and hillbilly selections. No two alike. Famous name bands and artists included. Used in juke boxes, but guar. perfect. Shipped exp. collect only—no exchanges or refunds. Wgt. 28 lbs. No. A303—50 records **\$9.64**

No. A300—25 Records. All Dance. Wgt. 14 lbs. \$4.88	No. A301—25 Records. Hillbilly, Race and Blues. Wgt. 14 lbs. Set... \$4.88	No. 302—25 Records. All Hillbilly numbers. Wgt. 14 lbs. Set... \$4.88
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STIRRUP PUMP

Works with any pail or bucket. Shoots a high pressure stream up to 30 feet. Use it for spraying garden and trees, for whitewashing, fire fighting, drainage, etc. Complete with 10 foot flexible hose. All brand new. Regular \$3.80 value. No. 244—Each **\$1.49**



ELECTRIC MOTOR

Small but powerful. Shaded pole type, designed for fan application. 115 V 60 cycle. Has 1/4 inch shaft, one inch long. Operates at 3150 RPM under no load, 2000 RPM under 2.33 oz. inches load. Full load current .6 amp. Ideal for use on toys, window displays, etc. Shp. wgt. 1 1/2 lb. Stock No. 555—Each **\$1.95** only.



McCLELLAN SADDLE

Brand new! Top grade cowhide. 12 inch seat. Hair girth. Has straps for blanket roll and knapsack. Gun boot and sabre loops. Shipping weight 15 lbs. Stock No. A145. Each. **\$16.95**



BAYONET BLADE

Fine forged steel. Ground but not polished. May be made into throwing or hunting knife or spear. Blade 6 1/2 x 7 1/8 inches, 1 1/4 inches overall. Will take and hold a fine edge. Shp. wt. 1 lb. No. 664-R—Each **49c**



15 JEWEL STOP WATCH U. S. AIR CORPS SURPLUS

Genuine Elgin 15 jewel movement. Ideal for split second timing in racing, sports, time study, etc. Full sweep split second hand graduated in 1/10th seconds. Stem wind, start, stop and reset. Used but guaranteed perfect. Wgt. 1 lb. No. 200—Each **\$9.95**



VEEDER ROOT COUNTING MACHINE

Five wheel type—counts to 99,999 and repeat. Nickel finish case. Has 1/8 inch round shank. Use it for any counting job. Brand new. Shp. wgt. 1 lb. No. 241—Each **98c**



CLINOMETER

Shows degree of incline. The pendulum acts as a plumb bob. It swings back and forth over a calibrated scale that shows you the degree of incline. Use on ships to show amount of roll—may be used for any purpose where it is desired to determine the degree of incline. Plastic body 12 x 7 inches. Brass pendulum in black finish. Shipping weight 3 lbs. Stock No. 393. Each only **\$3.95**



RUBBER OVERBOARD SUIT

Here is a buy! Fits over your regular clothes and shoes. Can be cut apart for waist high waders, hip high or knee high boots, also arm length rubber gloves. Heavy gun rubber over fabric. Fine for commercial fishermen, sewer diggers, etc. Use it as is or cut it up for waders. All brand new! Wgt. 14 lbs. No. 183, Each. **\$4.95** Please include 75c for postage.



7 LB. EXPERIMENTER PARTS ASSORT. KIT



A "gold mine" for the radio serviceman. Hundreds of valuable radio parts, new radar and electronic parts and sub-assemblies, coils, resistors, trimming condensers—worth many times this low price. A130R—7 lbs. **\$1.79**

RAIN SUITS

New 2 piece rain suits. Of durable wear resisting water and wind repellent OD fabric. Bib style pants, zipper fly. Jacket has parka attached. Guaranteed 100% weatherproof. Small, medium and large sizes. Shp. wgt. 3 lbs. No. R549—Ea. **\$4.95**



Officers Watch Compass

Brand new gov't surplus. Army-Navy model. Single jewel mounted needle. Silver colored dial. A splendid value. Shp. wgt. 1 lb. A174—Each ... **98c**



OXYGEN TANK

Loaded with aviator's breathing type oxygen at 1800 pounds pressure. Tank measures 13 1/2 x 5 1/2 inches with rounded ends. Tank is of solid metal fitted with brass release valve at top. Brand new! Loaded—ready for all types of emergency use. Shp. wgt. 13 pounds. Ship exp. only. Stock No. 390—Each, **\$3.50** only.



AVIATOR'S OXYGEN

Ball out type. Consists of all metal tank, release valve, gauge and breather hose, all enclosed in khaki colored cloth bag. These tanks are loaded with oxygen at 1800 pressure. Ideal for use as reserve oxygen supply for all types of emergency use. Shipping weight 4 pounds. All brand new. Stock No. 391—Each **\$4.95**



HIGH PRESSURE SHATTERPROOF TANKS

TYPE D2 400 LB. TEST A high pressure shatterproof tank of 500 cubic inch capacity—for 50 pound pressure or 6.9 cubic feet. All metal—measures 6 1/2 x 2 1/2 inches. Threaded plug end vents. Shp. wgt. 6 lbs. No. 388— \$2.45 Each	TYPE F1 400 LB. TEST A high pressure shatterproof tank of 1000 cubic inch capacity—for 50 pound pressure or 13.8 cubic feet. All metal—measures 9 1/2 x 17 inches. Threaded plug end vents. Shp. wgt. 1 1/2 lbs. No. 389— \$3.75 Each
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AMMUNITION BOX

Used for 50mm ammunition. Heavy, all metal design with latching top and folding handle. Provides safe, fire-proof storage for valuables, etc. Measures 12x8x7 1/2 inches. Used but in new condition. Shp. Wgt. **79c** 8 lbs. No. 338—Each



Waterproofing Compound
Gov't surplus! A liquid formula for tents, tarpaulins, canvas clothing, etc. Use on old or new materials. Gallon covers 100 to 120 sq. ft. Stays flexible—will not peel or chip. Shp. wgt. 10 lbs. No. 423—Per Gallon. **\$1.49**

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

SEND 10c TO COVER POSTAGE AND MAILING ON BIG CATALOG—READY IN ABOUT 30 DAYS

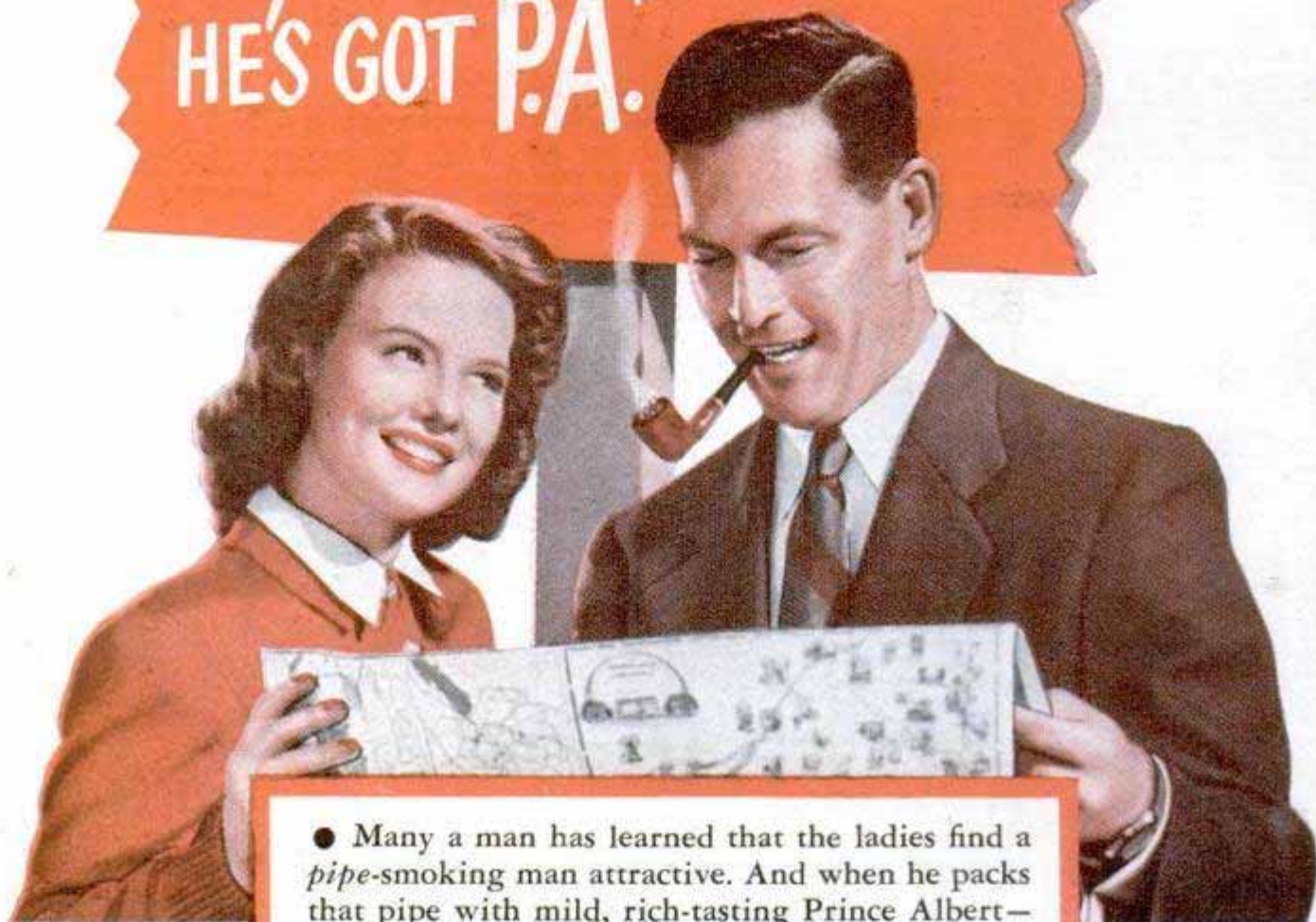
STARK'S Dept. PM10
509 So. State St.
CHICAGO 5, ILL.

WILLARD 1 1/2 VOLT STORAGE BATTERY

A rechargeable, wet plate battery good for years of service. Brand new. Battery is shipped dry but fully charged—any battery station will add acid. Use singly or in multiples for radio sets, bell circuits, alarm systems, etc. Measures 5 1/4 x 4 3/8 inches. Ball floats indicate condition of charge. Shp. wgt. 4 lbs. Stock No. 297—**\$2.95** Each Only.



HE KNOWS THE WAY—
HE'S GOT P.A.*



● Many a man has learned that the ladies find a pipe-smoking man attractive. And when he packs that pipe with mild, rich-tasting Prince Albert—it shows he knows real smoking pleasure!

NEW
HUMIDOR TOP
Locks Out the air—
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ness and Flavor!

P.A.* means **P**ipe **A**ppeal
P.A. means **P**rince **A**lbert

I SURE LIKE THE
WAY P.A. ROLLS UP FAST
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RICH-TASTING CIGARETTE!



Get P.A.—Prince Albert, the National Joy Smoke—in the new pocket tin with the Humidor Top. Enjoy that rich taste—that tongue-easy mildness. P.A.'s choice, crimp cut tobacco is specially treated to insure against tongue bite. You'll see why Prince Albert is America's largest-selling smoking tobacco!

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



THE NATIONAL JOY SMOKE

WE DROVE TO *Alaska*

Part I

Photos by Frank Fritz

At the trip's start, photographer Frank Fritz, left, and the writer with their shiny new car



By Aubrey O. Cookman, Jr.

DON'T LET "Caspar Milquetoasts" talk you out of that long-dreamed-of trip up the Alaska Highway. It is a last look at frontier life, a first-hand exposure to real wilderness and the problems pioneers face that you'll never forget.

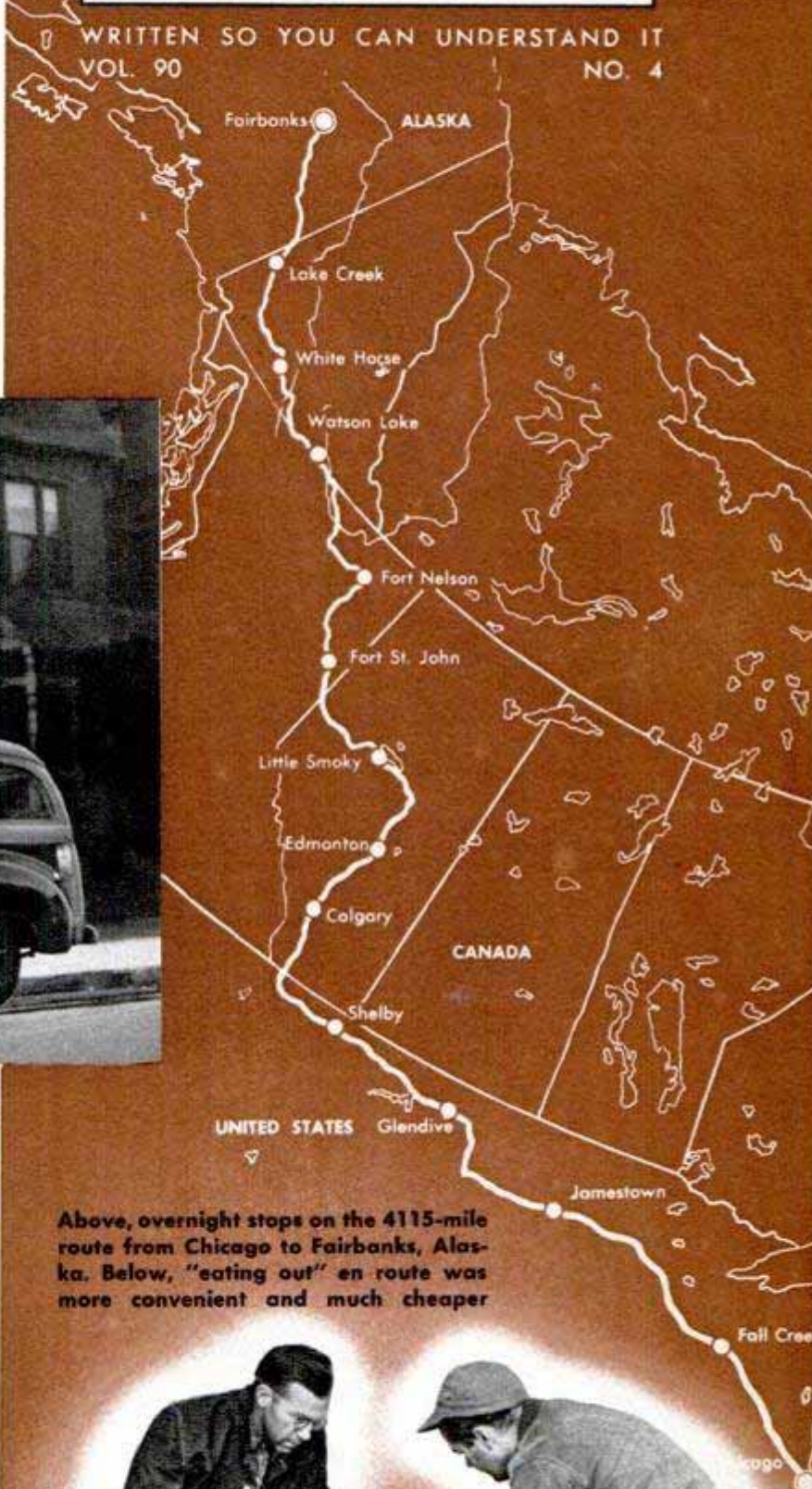
It can be made, and was, by two very average motorists—a *Popular Mechanics* staff photographer, Frank Fritz, and the writer—traveling without advance reservations.

First, be sure that you have (1) a mechanically sound automobile with good tires, (2) adaptability to simple, and sometimes rude, accommodations,

OCTOBER 1948

POPULAR OCTOBER 1948 MECHANICS

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 90 NO. 4



Above, overnight stops on the 4115-mile route from Chicago to Fairbanks, Alaska. Below, "eating out" en route was more convenient and much cheaper





Poorly marked roads were a problem in Canada. The travelers faced this after missing a turn near Cardston

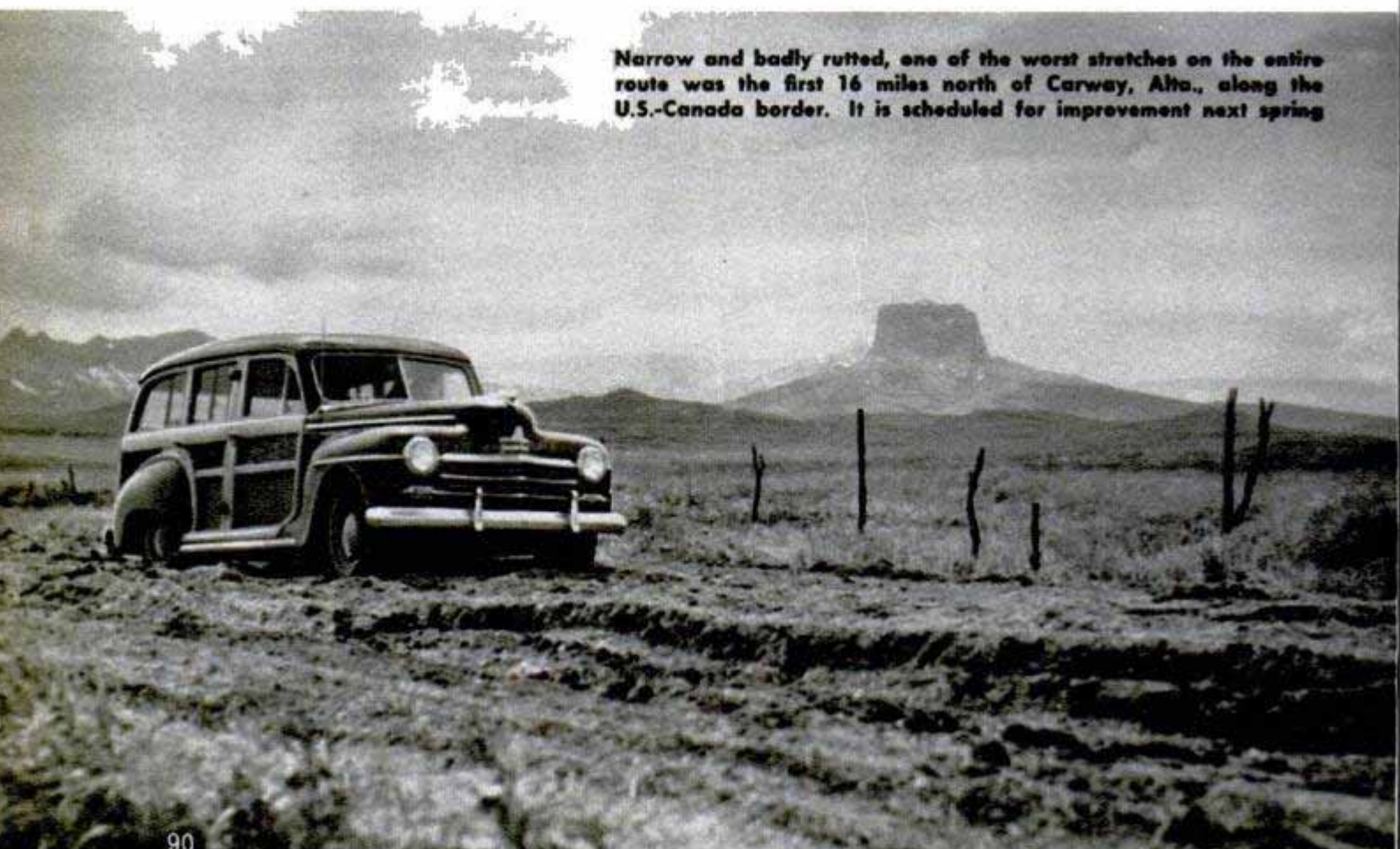
(3) a healthy cash reserve and (4) plenty of time. Thus equipped you can lick any eventualities that might arise.

You can discount most of the wild exaggerations making the rounds about ferocious animals nuzzling your tent at night, bloodthirsty, king-size mosquitoes, the impossibility of finding overnight sleeping space, and \$5.00 ham-and-egg breakfasts en route. Other than the ever-present dust along the gravel road, a nuisance most U. S. hard-road drivers have happily forgotten, the hardships aren't much worse than would be experienced over similar distances elsewhere.

Certainly, there are problems peculiar to travel over the Alaska Highway, but more of that later. In this installment and two others we'll describe our experiences, good and bad, over 4115 miles from Chicago to the edge of the Arctic Circle—in just two weeks.

To satisfy the first requirement, a sound automobile, we made the trip in a 1948 Plymouth station wagon. Ours was brand new—but that is not the essential; the essential is a car in A-1 operating shape. That handy garage "just around the corner" at home isn't much help if you run into serious trouble on the Alaska Highway.

Narrow and badly rutted, one of the worst stretches on the entire route was the first 16 miles north of Carway, Alta., along the U.S.-Canada border. It is scheduled for improvement next spring



The average age of cars we saw on the road was well over three years. A 1923 Reo from Missouri had chugged along as far as Whitehorse in the Yukon when last seen.

It is smart to take along a few extra parts and at least two complete spare tires on wheels. Though they fortunately weren't needed, we packed a set of points, spark plugs and a fan belt with our luggage on advice that they might be difficult to purchase en route. Our total of six punctures in new six-ply tires going through Canada and Alaska underscores the recommendation of a second spare tire.

For variety, as well as a ready answer to overnight-lodging dilemmas, take along and use camping equipment. Elbow room is one thing you'll have plenty of on your drive, so don't worry about finding a place to pitch your tent. Along the highway, particularly the latter part, you'll find excellent free camping sites.

Carrying portable cooking equipment and a fair-size food supply also widens your choice when meal times roll around. Eating costs go up as you go north, so the budget bugaboo will likely influence your rustling up at least some of your meals.

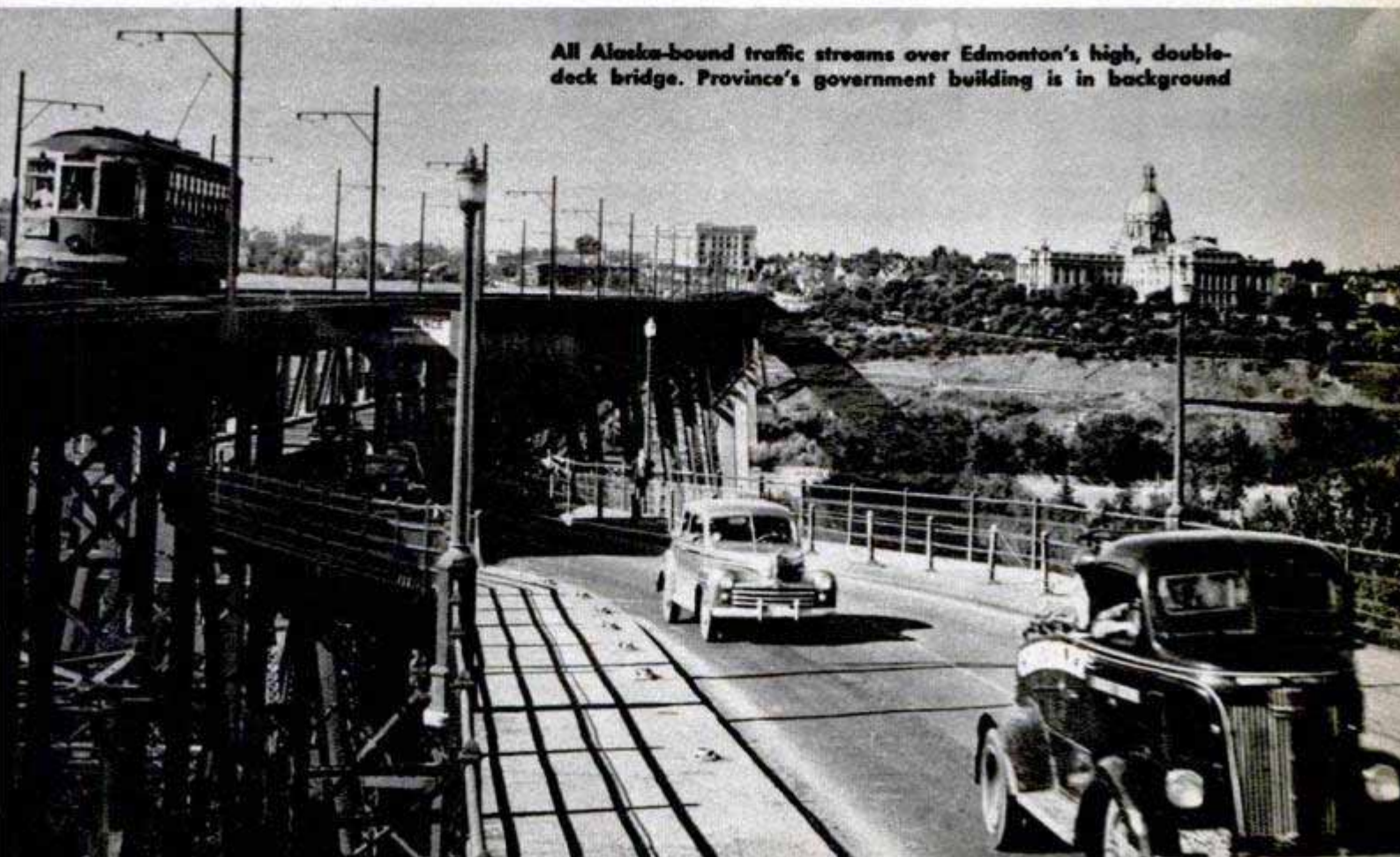
A "must" for the journey is an official listing of all accommodations and facilities from the beginning of the highway at Dawson Creek, B. C., to its terminus at Fair-



Pete Elder's homemade gravel loader, in use near High Prairie, Alta., typifies the pioneer ingenuity demonstrated along the way

banks, Alaska. All points are listed according to their mileage from Dawson Creek, a handy reference system used all along the road.

A typical entry, brief and to the point, reads: "Mile 804, Teslin, Yukon Territory. hotel, store, meals, gas and oil, 40 beds." At other points, repairs and camp grounds are noted. Altogether there are 45 stopping places listed, most of them about 30-40 miles apart with the widest separation, 92 miles. This material can be had free by writing either the Alaska Road Commission, Juneau, Alaska, or the Northwest



All Alaska-bound traffic streams over Edmonton's high, double-deck bridge. Province's government building is in background

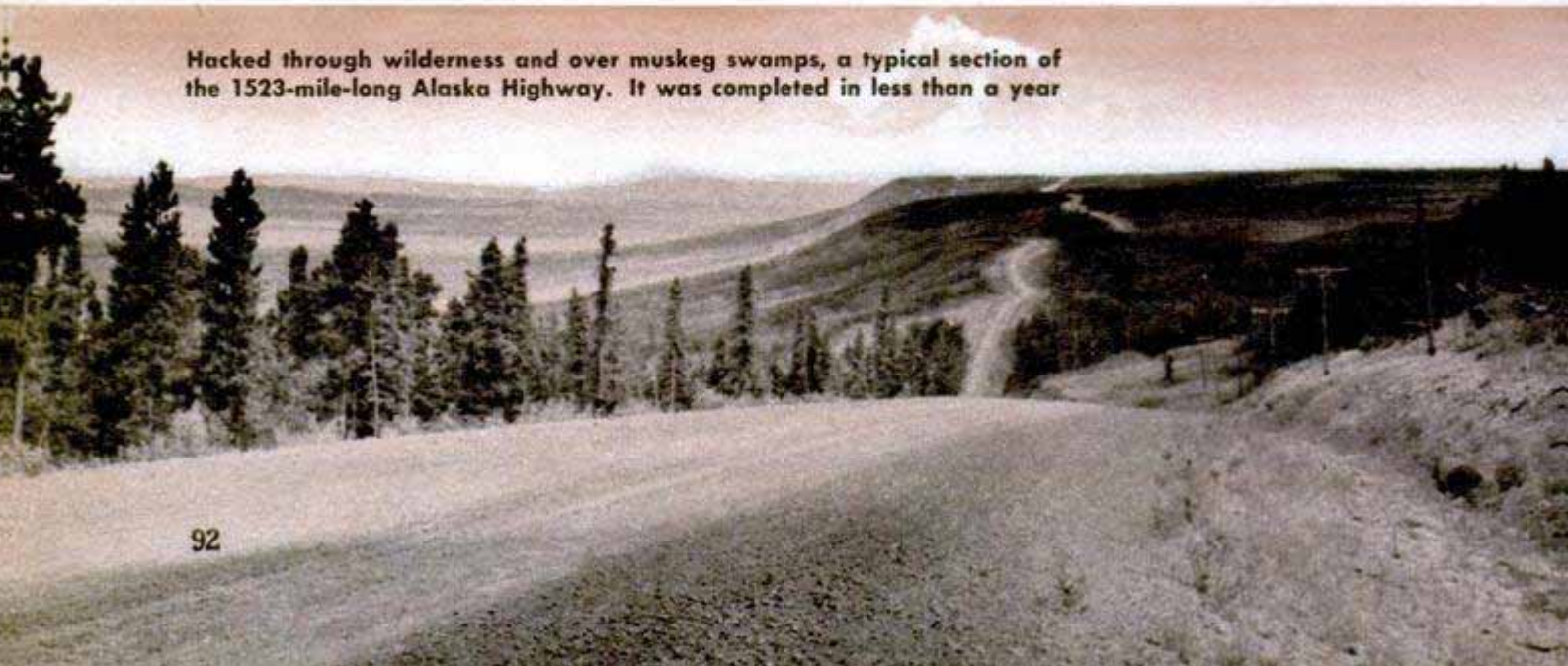


When trouble comes, at 40 or 50 degrees below zero, construction shacks abandoned after the Alaska Highway's completion afford welcome refuge



Surveying crews are familiar sights on the poorer Canadian roads. This year Alberta alone is expected to spend 15 million dollars on road work

Hacked through wilderness and over muskeg swamps, a typical section of the 1523-mile-long Alaska Highway. It was completed in less than a year



Highway System, Whitehorse, Y. T., Can.

It is no longer necessary to get a permit to use the road. Prospective travelers formerly had to satisfy officials that their car was in good mechanical shape and supplied with 25 pieces of spare parts and equipment as insurance against breakdown in remote areas. A spare rear axle was one of the recommended items. Now the travel decision is left entirely up to the motorist.

The highway was begun in April, 1942, when the Japanese threatened to cut off our sea approach to Alaska. Building over muskeg swamps, hundreds of streams and rivers, and alongside mountains, a force of 14,000 U. S. Army Engineers and civilian contractors completed the 1523-mile gravel road in the amazingly short space of seven months. It is 26 feet wide, four feet broader than the requirement for new public roads in the U. S.

By far the greater share of the road, 1221 miles, is in Canada and maintained by the Canadian government. The Alaska Road Commission maintains it from the border to Fairbanks.

Our journey began from *Popular Mechanics'*

New six-ply tires were no insurance against flats. Cookman repairing first of six on last 2000-mile lap of grueling Alaska trip

home office in Chicago and followed the most direct route, U. S. 14, from the city's edge to Madison, Wis., thence over U. S. 12 to St. Paul, Minn. From there it was U. S. 10 to Anoka, Minn., and then U. S. 52 to Fargo, N. D., where we picked up U. S. 10 again to Glendive, Mont. Montana state routes 18 and 13 brought us to U. S. 2 at Wolf Point, which we followed all the way to Glacier National Park.

Most of our mileage was through the slightly rolling, thinly populated Great Plains country, only mildly scenic except for the Wisconsin Dells region, North Dakota's badlands region and Glacier National Park. From a sight-seeing standpoint, more interesting approaches would be from the south. One choice winds through the Black Hills of South Dakota and Yellowstone National Park, while another swings through hundreds of miles of magnificent mountain scenery in Colorado and Wyoming, and includes both Rocky Mountain and Yellowstone National Parks.

Except for an occasional short detour, the roads in all cases were hard surface and well marked. Western tourist facilities are on the upgrade again and we were almost always able to get comfortable, reasonably priced accommodations without advance notice. In only one instance, a night in a basement room at a Jamestown, N. D., hotel, was our luck bad. If you are carefully scheduling your trip, however, it is advisable to write or wire ahead to recommended hotels and cabins for lodgings, particularly if more than two are making the trip.

Time is an important item in most trip-planning so it is well to know that your rate of travel will be much faster in the United States than in Canada and Alaska. Based on our experience, averages of around 50 or 55 miles per hour could be maintained to the Canadian border, since communities are widely spaced and small. Between there and the beginning of the Alaska Highway, surfaces are generally gravel and in poorer

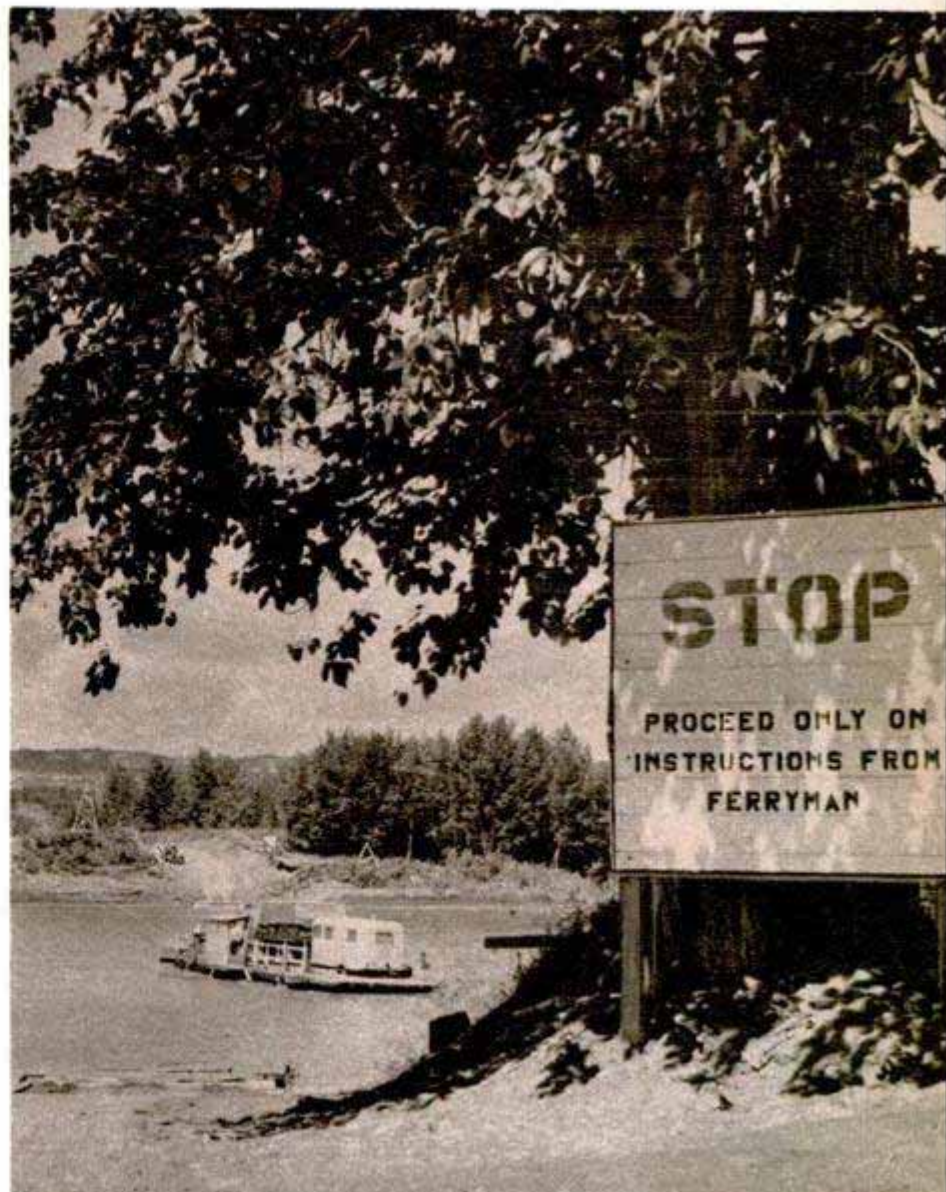
Trees and logs hurtling along in the fast current sometimes halt traffic for days at this free ferry over Big Smoky River

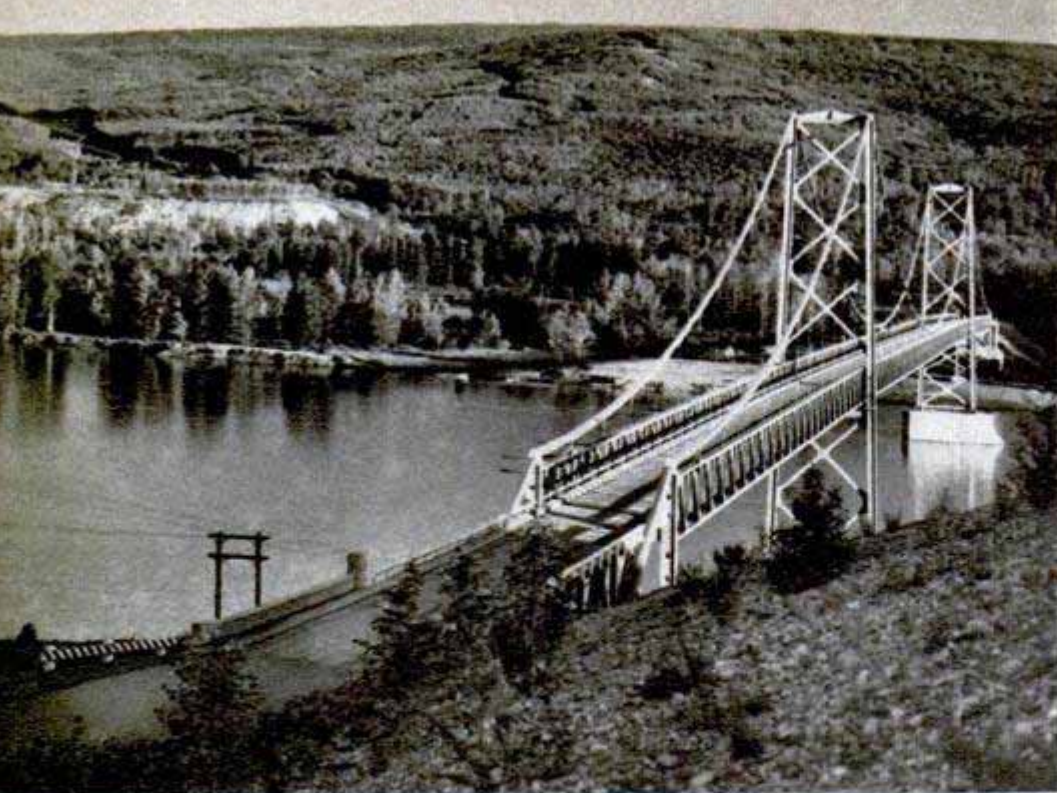


condition, with a drop of about 10 miles an hour, or more, in safe-driving speed.

On the highway itself, we settled for an average of about 40 miles an hour, after learning the hard way what sharp gravel can do to tires. Another factor likely to influence your timing is that hours of daylight increase considerably as you go north. Over the latter half there are about 20 hours of daylight during June and July.

Driving north from Glacier park, we tried

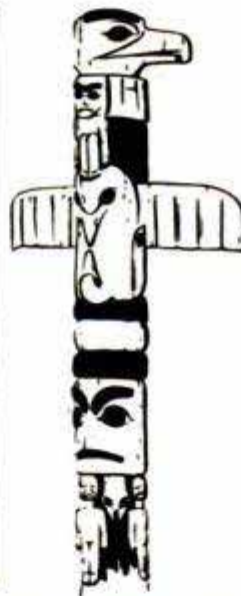




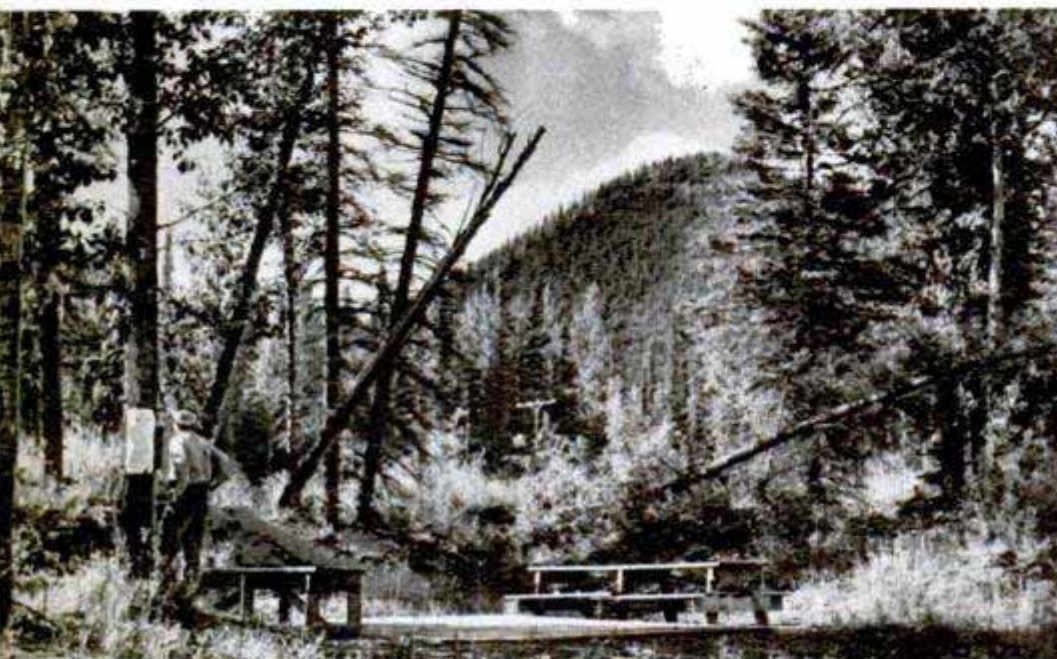
Most impressive man-made structure on the entire highway is Peace River bridge at Mile 35. Its winding approach can be seen in left background

Distance Between Overnight Stops, Chicago-Fairbanks

	Miles
1. Fall Creek, Wis.	345
2. Jamestown, N. D.	474
3. Glendive, Mont.	348
4. Shelby, Mont.	423
5. Calgary, Alta.	322
6. Edmonton, Alta.	198
7. Smoky River, Alta.	295
8. Ft. St. John, B. C.	246
9. Fort Nelson, B. C.	251
10. Watson Lake, Y. T.	334
11. Whitehorse, Y. T.	274
12. Lake Creek, Y. T.	234
13. Fairbanks, Alaska	371
TOTAL	4115



For the use of campers, benches and tables dot the roadside. Hundreds of clear, cold streams nearby insure good water for drinking and cooking



to out-expert the motor club's routing directions, and lost. Instead of turning left on U. S. 89 at Babb, Mont., and heading for the customs and immigration offices at Chief Mountain, we took a right fork that promised mileage saving. Probably, we'd have made as good time and had more comfortable riding over the longer, but paved, road to the left.

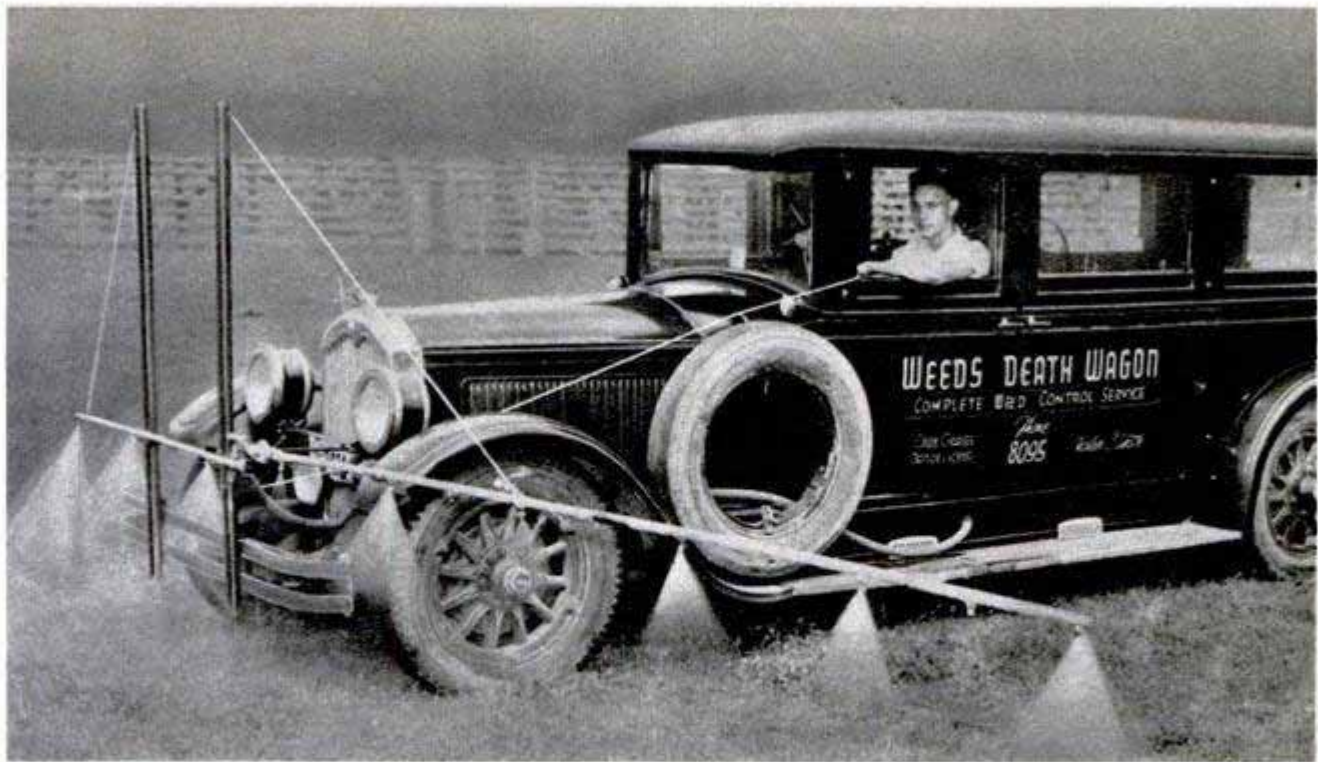
Passing through the U. S. Customs and Immigration office on the way up to Carway, Can., was a mere formality. There was no inspection and we were waved on immediately. A double wire fence marks the boundary between countries.

Entering Canada was almost as simple. Passports aren't required but it is recommended that visitors carry sufficient personal identification in case questions arise. We were asked how much money we carried, to make sure that we had enough to cover expenses.

We had to produce proof of car ownership and state the purpose of our visit. Since smoking is a more expensive habit across the border, travelers are permitted to bring in 200 cigarettes, 50 cigars and two pounds of tobacco. There was no duty on our camping equipment, cameras and film or the small stock of food. The traveler's declaration is generally accepted at face value and only under suspicious circumstances are cars or baggage searched.

After a stop that didn't take more than 20 minutes in all, and with apologies for the condition of the next 16 miles of road into Cardston, Alta., the Canadian customs officer cheerily waved us on our way to Alaska.

(Continued next month)



Death Wagon for Weeds

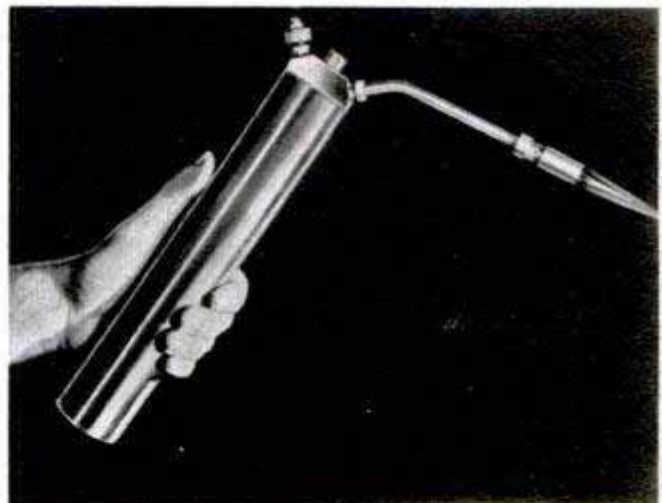
Death is carried to weeds by an old hearse equipped with spray equipment. The hearse was converted into a weed killer by Harlan Smith of Pueblo, Colo.

Pressure tanks and other equipment are carried inside, and spray beams are mounted on the front bumper. For ridding small lawns of dandelions, weeds and crab grass, Smith parks the hearse at the curb and unrolls hose to reach all corners of the lawn.



British Model Racer Is Diesel-Powered

Powered by a tiny Diesel engine, a British model racing car set what is believed to be a world record for its class when it made two runs over a quarter-mile distance at 41.7 miles an hour. Over the half-mile distance, the car, which has a wheel-base of 14 inches, averaged 41.86 miles an hour. Its record for the one-mile course was 41.4 miles an hour. The Diesel engine uses a mixture of Castrol XXL, paraffin and ether in equal parts and develops 7500 revolutions per minute under load. The engine fits neatly beside the driver's seat.



Hand Torch Burns Seven Hours For Less Than a Nickel

Fuel costs are a fraction of a cent an hour with a hand-size heating torch that burns propane-butane gas. Only 12 inches long, the torch can be adjusted from a pin-point blue flame for close, accurate work to a $\frac{1}{8}$ -inch blowing flame for paint burning or pipe-joint heating. It operates at temperatures from 900 to 3800 degrees Fahrenheit and will burn seven hours without refilling. The fuel tank serves as a handle and holds one pint of liquid or 4.5 cubic feet of gas. The cost of refueling the torch ranges from two to four cents.

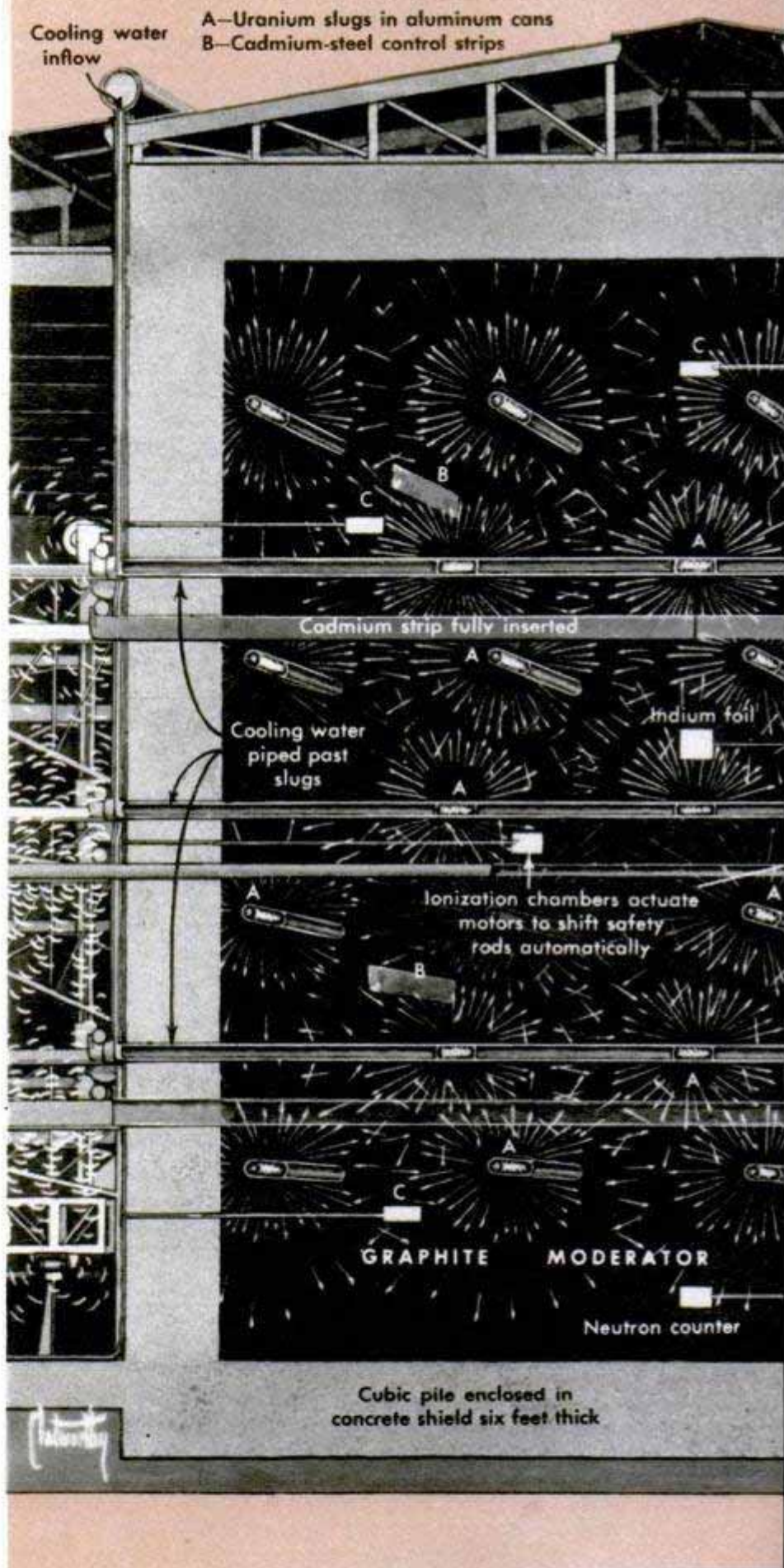
THE ATOMIC PILE



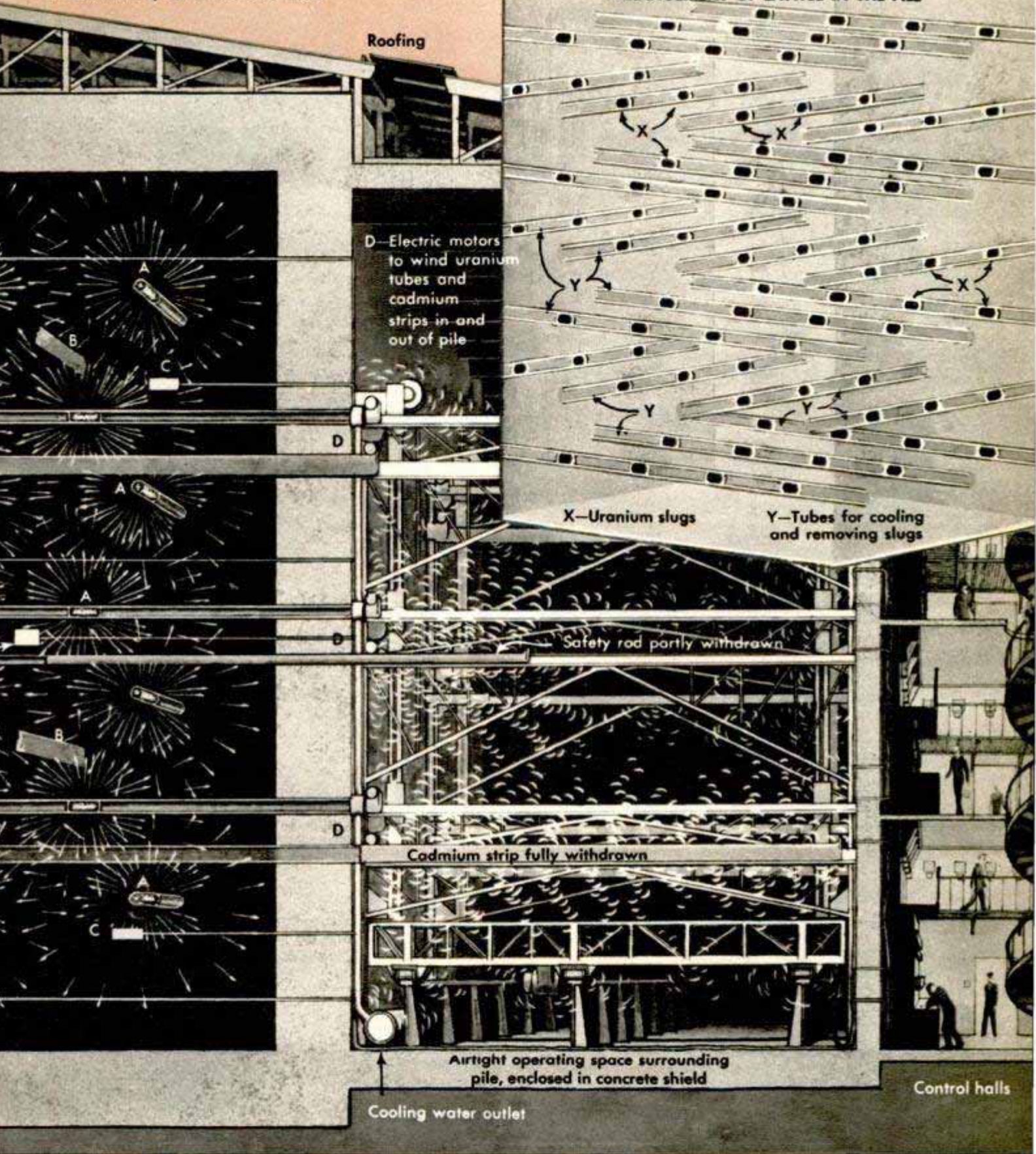
By S. W. Clatworthy

THE PICTURE diagram on these pages is the first detailed illustration of an atomic pile to be made public. The drawing is based on official reports, but the precise form of the details is necessarily conjectural. It is a large, 1,000,000-kilowatt pile of the best known type—the uranium-graphite water-cooled pile as used for the production of plutonium bombs, but which may prove to be the best first stage for atomic energy. This great hulk contains chiefly a built-up cubic mass of solid graphite. Graphite is used because the obstruction it offers to neutrons is within a certain required range. "Heavy" water would be much better, but it is too costly to produce.

Fission—splitting into roughly equal halves—occurs in uranium nuclei only when they are struck by slow neutrons. But the one or two neutrons then emitted from each fission are fast, and incapable of causing further fission. As they fly from one slug of uranium to another they are slowed down in the graphite sufficiently to cause fission in a second slug; the graphite is therefore termed the moderator. These slugs are spaced in a lattice arrangement. Repetitive fission commences spontaneously from stray neutrons and, as the pile grows, the fission sequence spreads. This could be disastrous but con-



trol devices are built in. These are strips of cadmium steel inserted in channels through the graphite which stop some of the neutrons. The strips are pushed in to reduce neutron intensity or drawn out-



Roofing

D—Electric motors to wind uranium tubes and cadmium strips in and out of pile

ARRANGEMENT OF LATTICE IN THE PILE

X—Uranium slugs

Y—Tubes for cooling and removing slugs

Safety rod partly withdrawn

Cadmium strip fully withdrawn

Airtight operating space surrounding pile, enclosed in concrete shield

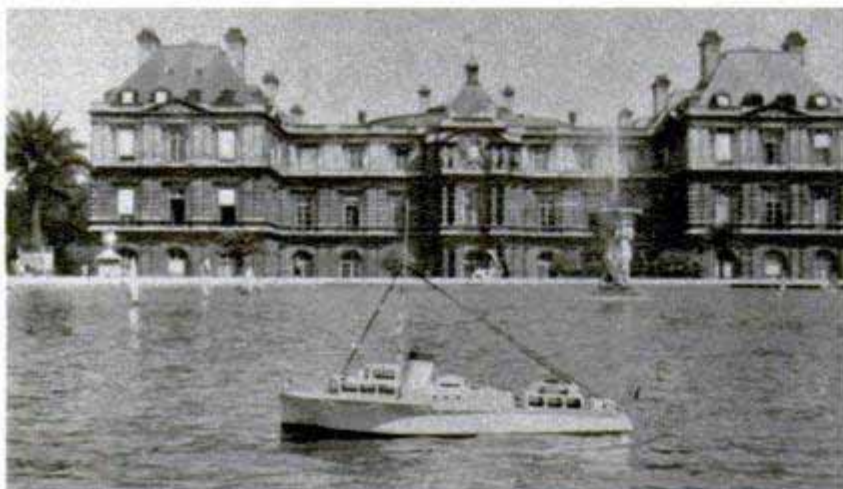
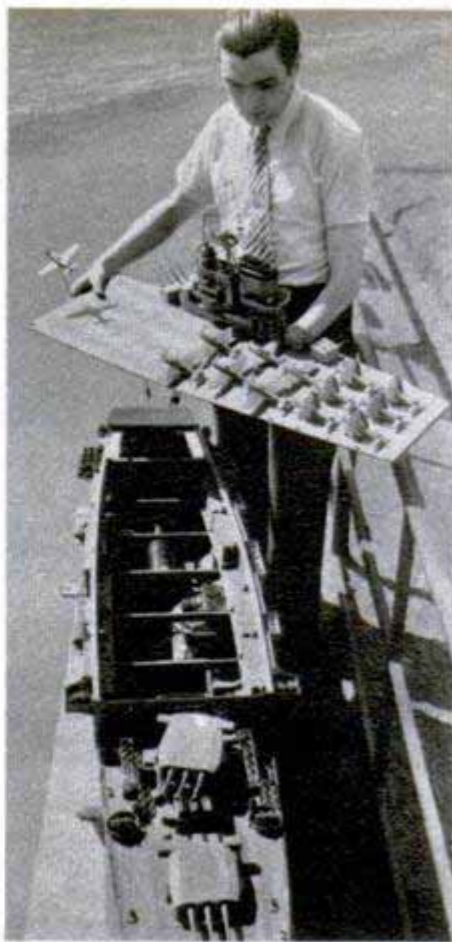
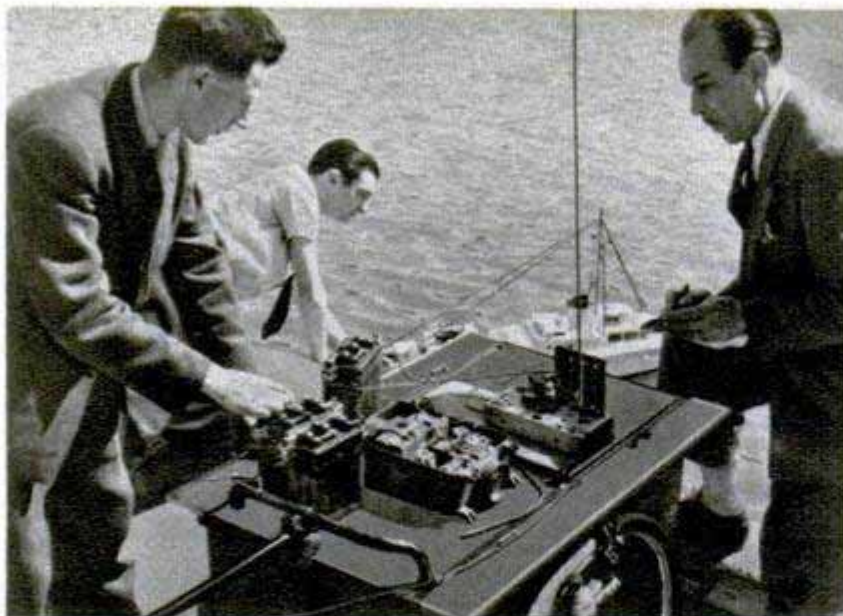
Cooling water outlet

Control halls

Drawing by S. W. Clatworthy; copyright, 1948, King Features Syndicate, Inc.

ward to increase it. There are also two central control rods of boron steel, automatically operated through instruments by fluctuations in the neutron intensity itself, which they detect. These piles can be sim-

ply, precisely and completely controlled with an ample margin of safety. The whole great cube is enclosed in an unbroken shield of solid concrete six feet thick to keep in the ultra-lethal radiation.

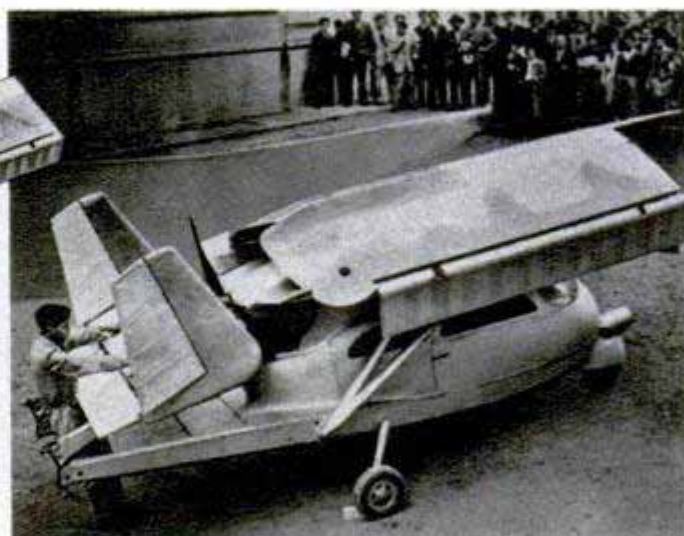
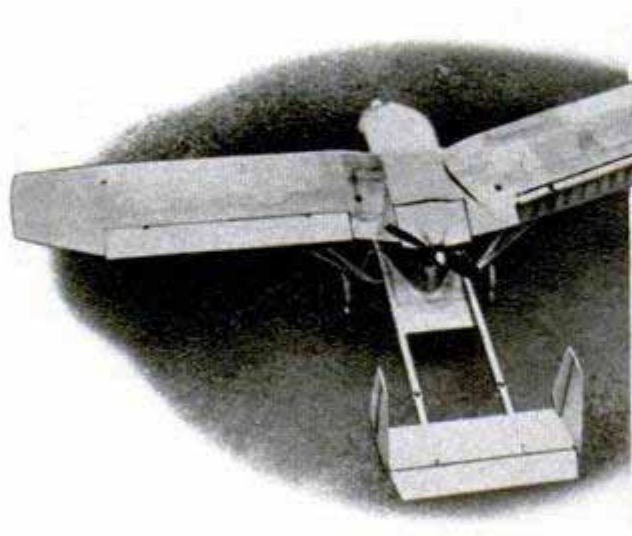


Top left, model builder launches miniature craft while assistant stands by radio controls. Left, this boat won first prize in French contest. Above, builder assembles aircraft carrier

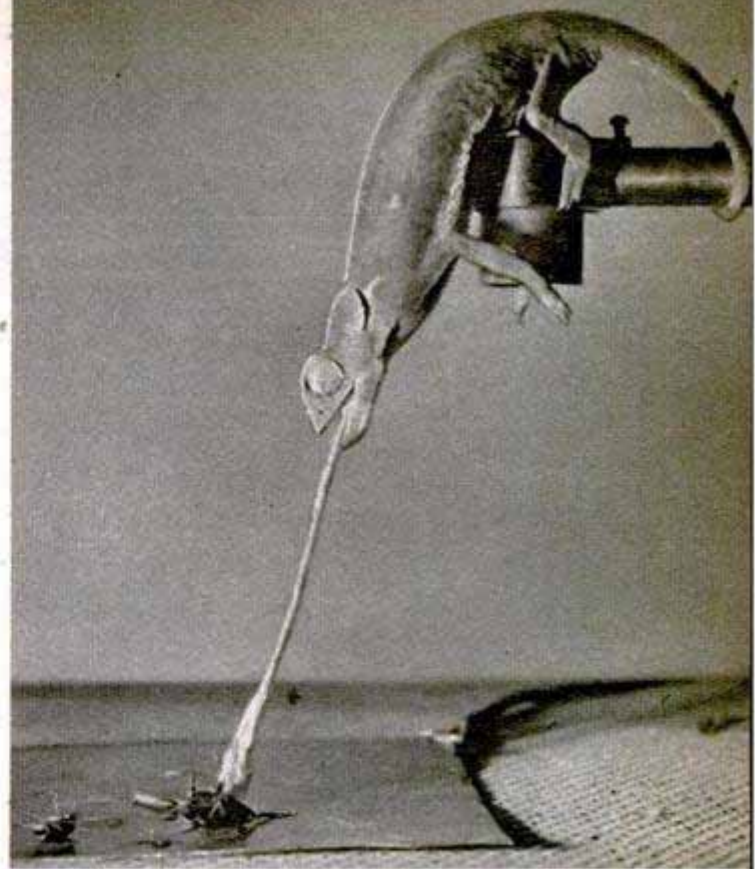
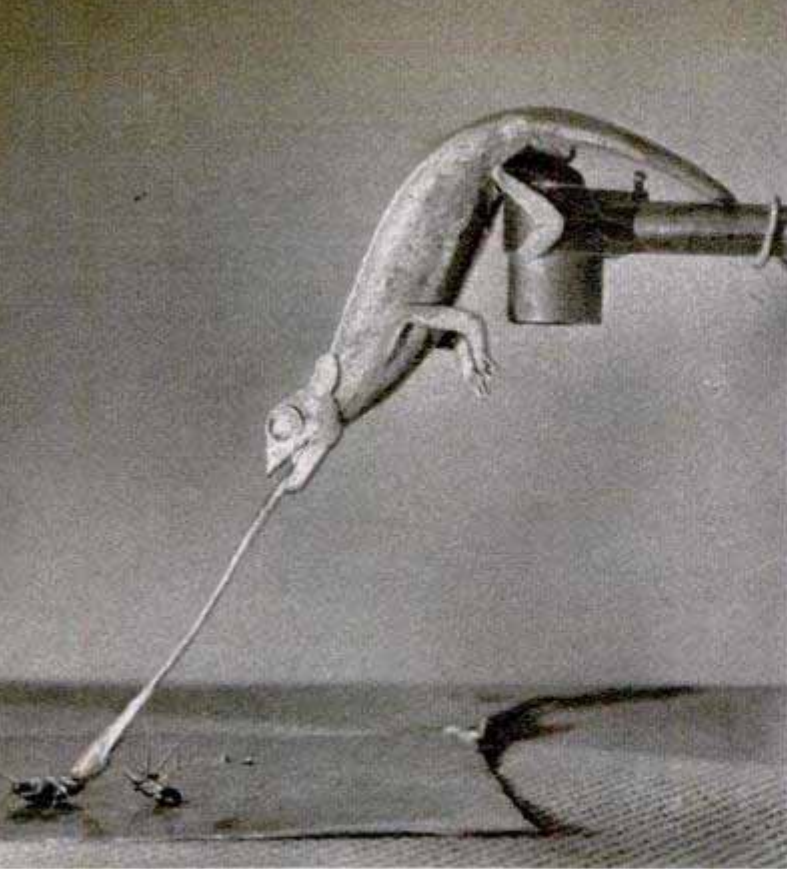
Radio Operates Turrets and Guns of Model Warship

Even the turrets and guns of a model aircraft carrier built in France can be controlled by radio. The boat was built by Jean Falconnet of Paris and is complete to

tiny planes on the flight deck. A radio transmitter controls the engine and guides the craft. Another of Falconnet's boats won first prize in a competition held near Paris.



FOLD-UP PLANE built in a machine shop in Tarcento, Italy, can be converted into an automobile for highway travel. The wings fold parallel with the fuselage and the tail section pivots forward to shorten the body. The plane is driven by a pusher-type propeller. On the road the vehicle travels about 60 miles an hour

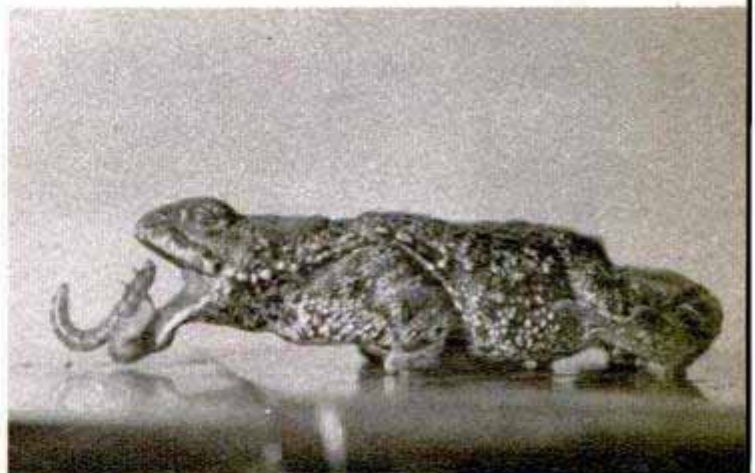
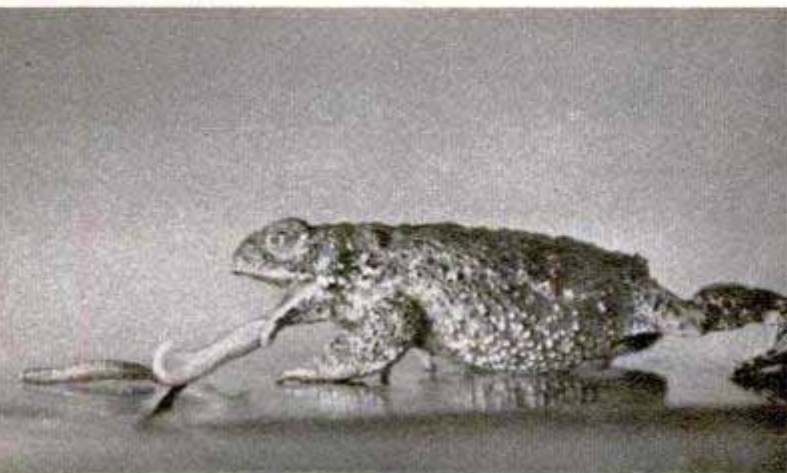
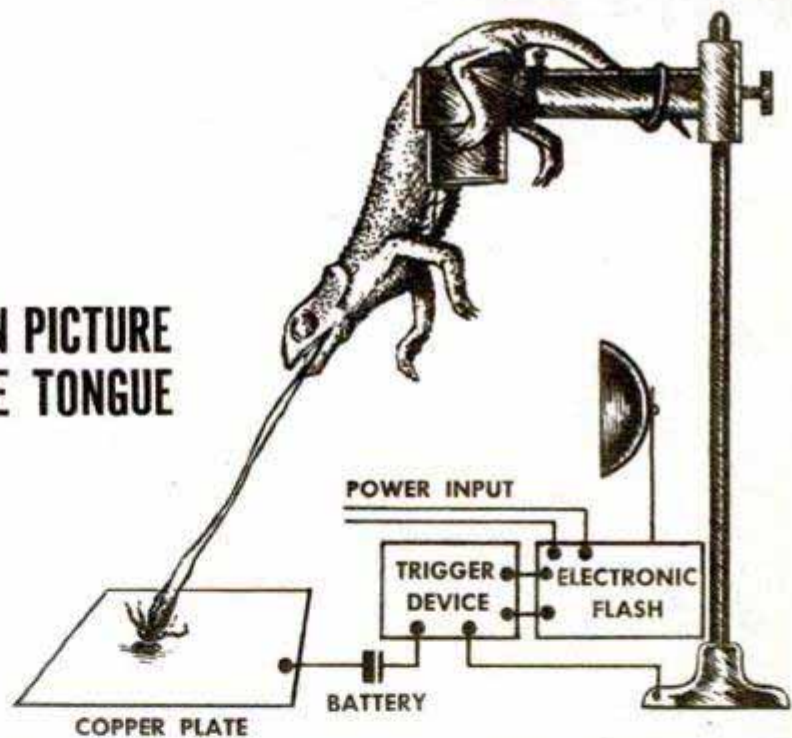


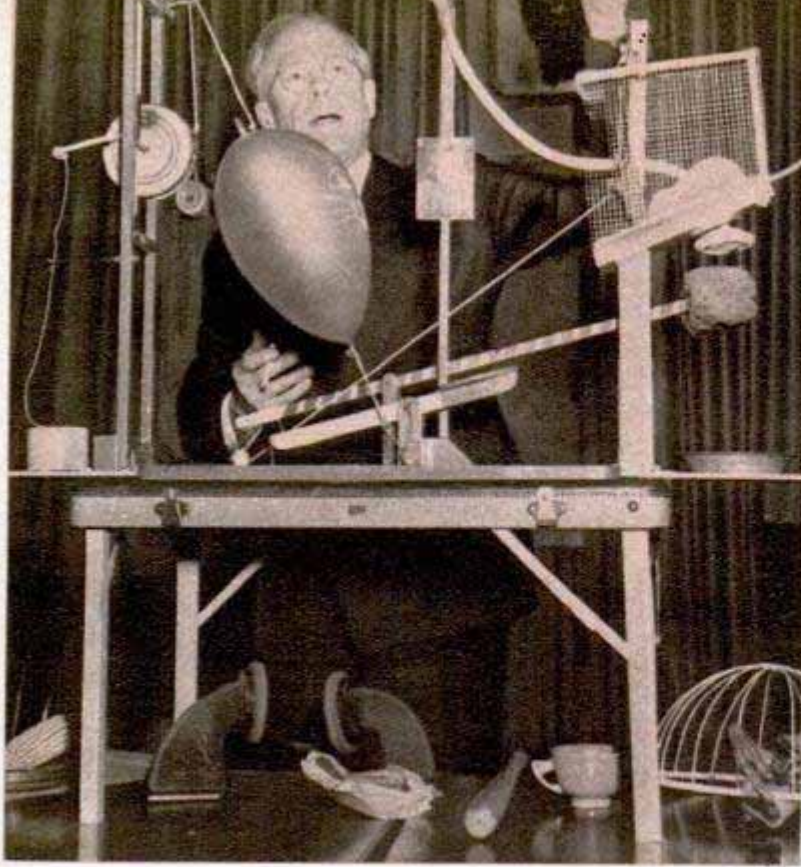
Too fast to be seen by the human eye, the long tongues of chameleons and toads dart in and out as they eat. Their tongue tips are tacky and the food, usually small insects, sticks to the tips and is thrown back into their mouths. To photograph the action, London Zoo technicians designed a trigger device that fires a Dawe electronic flash lamp as the tongue hits the food

REPTILE SNAPS OWN PICTURE WITH FLICK OF THE TONGUE

Top, stopped by an exposure of two millionths of a second, tongue of chameleon is fully extended as it darts after food. Below, a toad gets his dinner. Right, the circuit used in top pictures. For photos of toad, two copper plates were used, one for the toad and the second for the food. Tongue completes circuit by touching food plate. Current was too minute to be felt

Kodak Ltd. photos





"Professor" Oakes demonstrates his cigarette lighter which involves water, sponge, rat cage and balloon

By William J. Duchaine

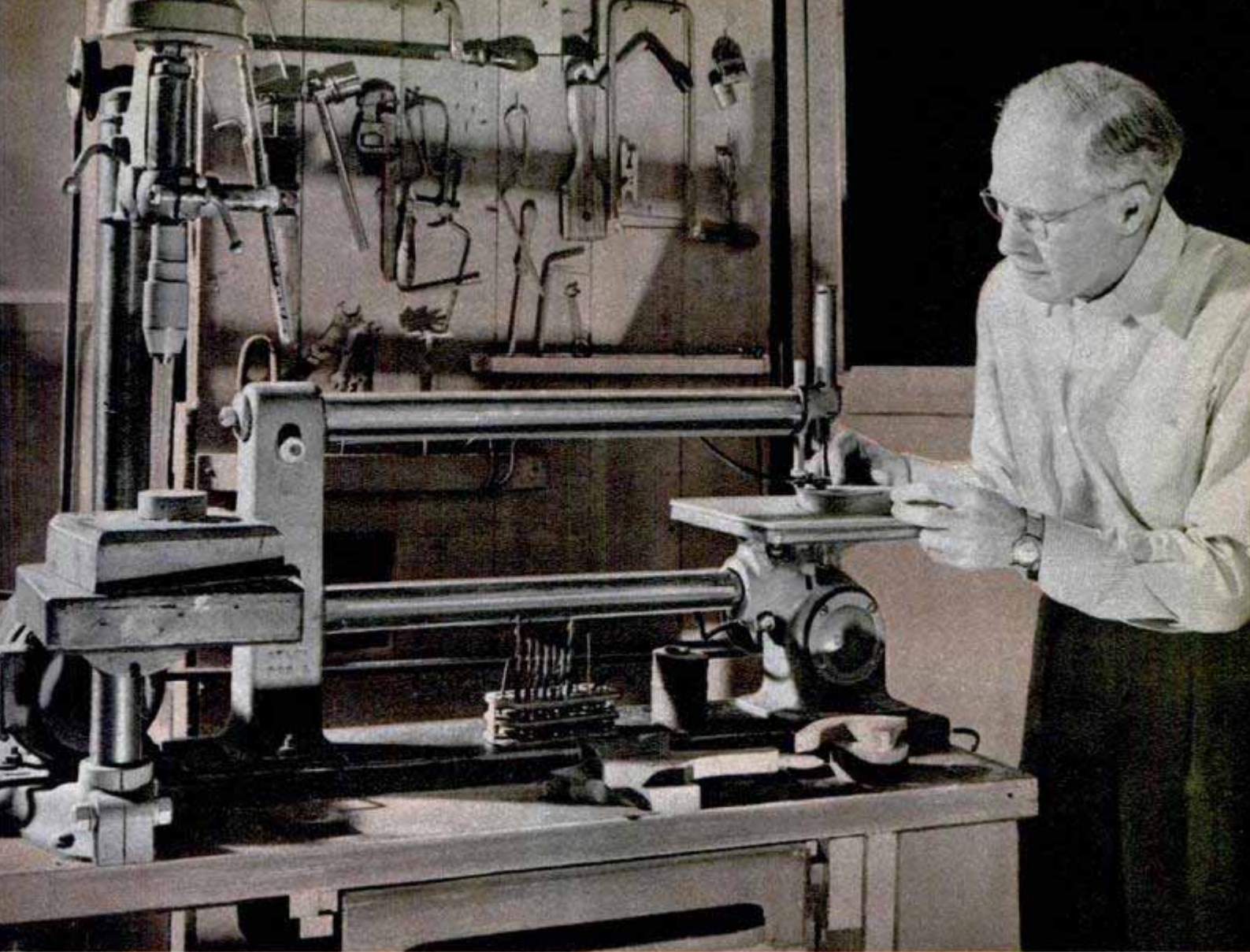
Here the professor brings gales of laughter from an audience as he exhibits the Oakes Doughnut Dunker

RUSSELL E. OAKES of Waukesha, Wis., has been "making things" ever since he was big enough to wield a jackknife. Away back when makers of electric drills offered lathe attachments, Oakes had the yen for power tools. So he started equipping his shop, suffering occasional pangs of guilt over such an "extravagance," and never dreaming he was laying the foundation for one of the most unusual careers in the U. S.

The Oakes hobby, which has more than justified any expenditures he has made, has brought enjoyment to thousands of persons. Oakes is now "Professor" Oakes, the wizard of Waukesha. Perhaps you have seen some of his weird and imaginative inventions in the movies where they have been featured. Or, you may have encountered the busy inventor in person. Oakes

**WORKSHOP
WIZARD
on the stage**





When Oakes gets an idea he rushes to his home workshop to add to his list of 60 "goofy gadget" inventions

gives humorous talks and demonstrations of his inventions. Recently his services have been in such demand that his hobby has become his profession.

Oakes has some 60-odd inventions to his credit. To call them odd is an understatement. He simply calls them goofy gadgets.

Oakes served as a writer and idea man with a Milwaukee advertising agency for 17 years. Most of his leisure time he spent in his home workshop.

Back in 1935, a friend induced him to demonstrate his mirth-provoking devices at a banquet held for salesmen of a hydraulic-jack manufacturer. Attired in a Prince Albert coat, Oakes began his program with the announcement of his greatest contribution to science. Then he demonstrated his Hydraulic Cigar Lighter.

The lighter is a Rube Goldberg mechanism and the hydraulic salesmen got a big kick out of its demonstration. First, Professor Oakes asked for a glass of water. He poured the water into a funnel. The water flowed from the funnel onto a sponge operating a lever which opened the gate of

a rubber rat's cage, revealing a piece of cheese. When the rat snapped at the cheese, she hit a paddle, operating another lever. This lever punctured a balloon and released a weight which caused a flywheel to revolve. Sandpaper on the flywheel ignited a firing unit. Then, all the professor had to do was to tip up another lever and light his cigarette.

Oakes has devised many "labor saving" inventions to make the pastime of eating more enjoyable. He's particularly proud of his Catsup Getter-Outer. Everyone knows how difficult it is to coax the catsup out of a bottle. With the Oakes Catsup Getter-Outer, you merely place a plate bearing a hamburger sandwich on a special platform. Then you turn a crank and a mittened hand does the pounding!

The Fresh-Bread Tester is another vitally important invention in the food-handling line. The tester makes it unnecessary for homemakers to squeeze the bread to ascertain its age. They merely insert the bread between two "hands," and pull a long lever. If the bread is hardened with



Fresh-bread tester makes squeezing unnecessary. Day-old bread gets amber light; soft bread "Fresh"

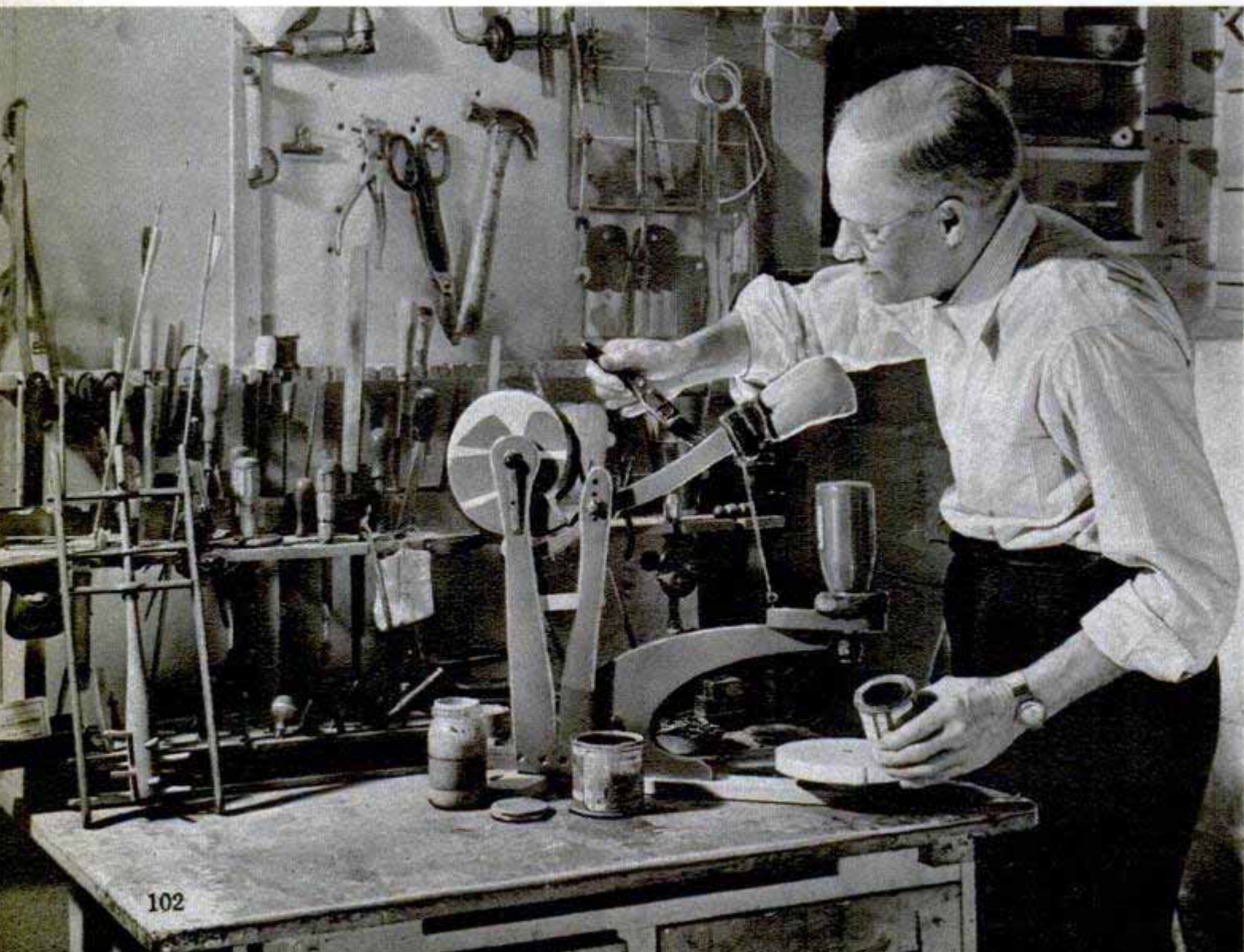
Below, the "professor" puts finishing touches on a Catsup Getter-Outer. When crank on rear of device is turned the mittened hand pounds bottom of bottle

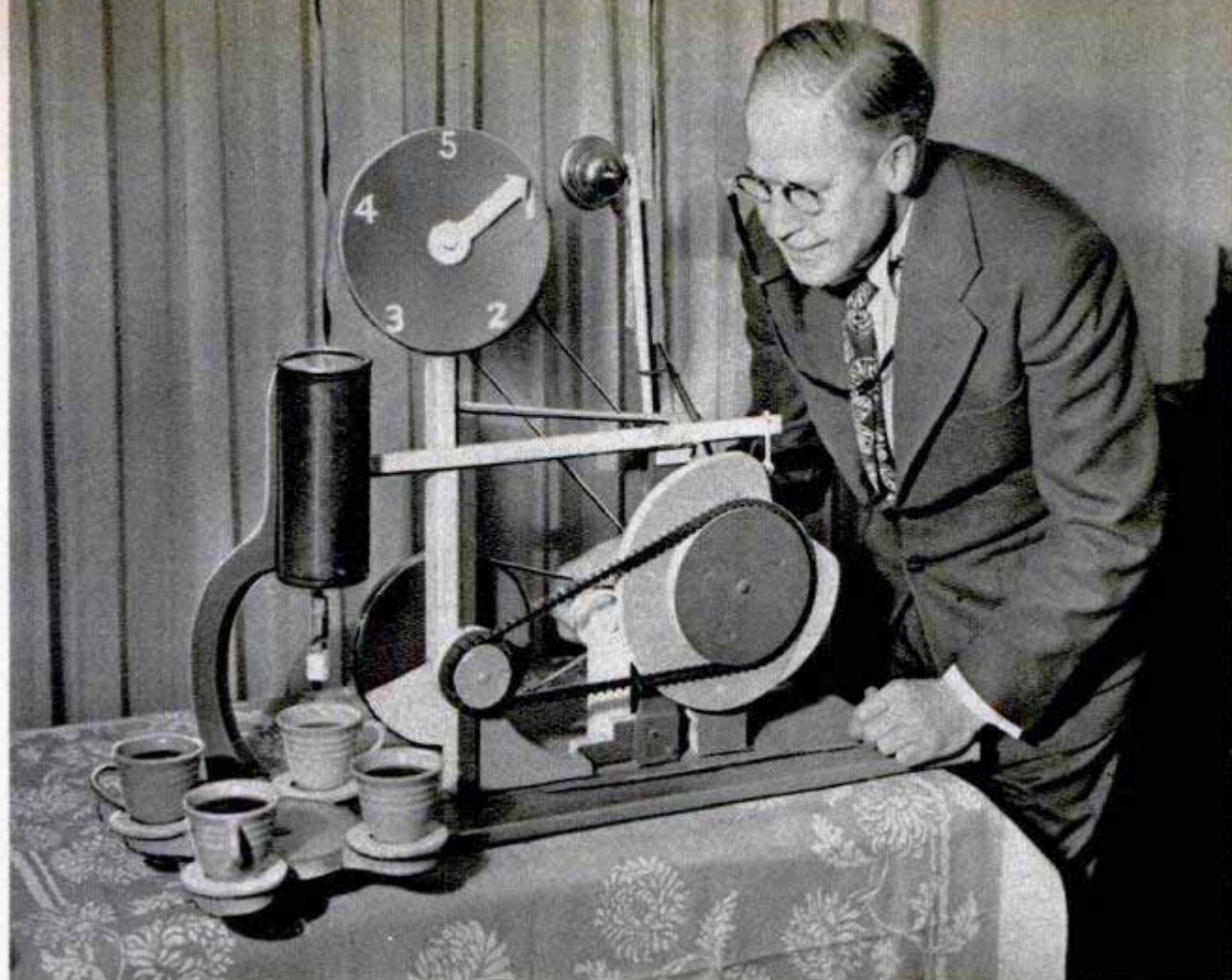
age, it resists more. Day-old bread flashes an amber light. But if the bread is soft and yielding, the word "Fresh" appears—and a green light shows it is safe to buy the loaf.

Recently, Oakes introduced his "patented" Dripless Doughnut Dunker to a group of men attending a smoker given by the Green Bay (Wis.) Chamber of Commerce. The mechanical dunker dips the delectable morsel—either bite by bite or totally—and holds it for the convenience of the nibbler, while a hinged drip pan catches the coffee overflow and saves the tablecloth. In addition to protecting the tablecloth, the dunker also is a godsend to the diner who likes to dunk but is afraid to scald his thumb and forefinger, Oakes explains.

To those worried about the high-cost-of-living bugaboo, Professor Oakes recommends his Sugar Conserver device. It is guaranteed to get more "mileage" out of each lump of sugar by making a single lump serve a family of four. First, the coffee is placed on a turntable. The operator turns a crank, and a cam arrangement lowers the lump into the cup. After two seconds, a bell rings and the sugar is yanked out of the cup. The next cup then moves into position, repeating the action. A dial indicates the number of cups sweetened!

Oakes has a unique invention to benefit





Lump-sugar conserver is operated by turning a crank and cam arrangement lowers a lump into the cup. After two seconds a bell rings, the sugar is yanked out and next cup moves into position. Below, Oakes works his back patter. Hot air (breath) inflates balloon on top to power patting device

the type of person who is always patting himself on the back. It's the mechanical Back Patter. When the man brags into a microphone arrangement, the hot air rises to inflate the "air chamber." Then by operating a lever the wind turns a paddle wheel, which in turn operates a crank to cause a hand to pat his back in a gratifying fashion.

One of the most prolific inventors since the days when Benjamin Franklin flew a kite, Professor Oakes also has "patents" on a Chatter Eliminator. It fits over the head like a radio headset. The rubber pads over the ears help eliminate conversations behind you. Assume you are at the movies. The amplifiers on this gadget face toward the screen so you can hear every endearing term spoken by the movie stars. But if the picture is dull you can reverse the headset and pick up the gossip from behind.

The Self-finding Golf Ball is a great boon to golfers who are always slicing the ball into the rough. When it lands in the tall grass, the ball sends up a red flag and blows a horn to indicate its location.

For picnickers, there's the Sandwich Shoosher, a sort of third hand

(Continued to page 244)





"Eggplant" Scares Tropical Lizards

Looking like fantastic "eggplants," tropical shrubs in Puerto Rico are decorated with eggshells to scare away destructive lizards that prey on them. Residents of the area claim that tropical sunlight, reflected by the white shells, keeps the lizards from damaging the shrubbery.

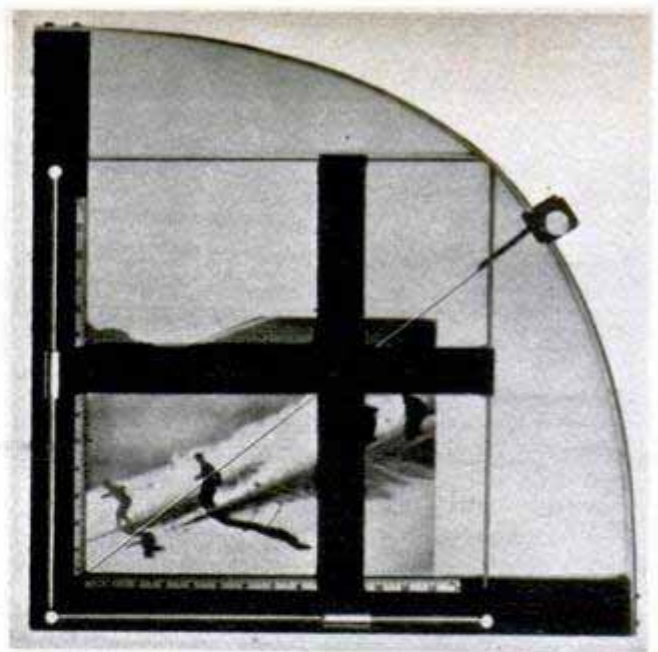


Photo Triangulator

Designed for editors, layout men and artists, a triangulator quickly shows how a photograph will appear in any desired proportion. The photograph is placed on the triangulator and the two sliding leaves moved to correspond to the size you want the picture to be when printed. A wire, fastened to a holder that slides along a curved rod on the open side of the device, is moved to the point where it cuts diagonally across the photograph. The masking leaves may now be moved to any position to determine the best composition and, as long as they cross at some point along the diagonal wire, the masked area will be in proper proportion for the size chosen.

Motor-Driven Chart Shows 2000 Items

As many as 2000 separate inventory items can be scanned in 45 seconds with a motor-driven production-control machine. The machine combines data from all departments into a single presentation of complex plant activities and is a boon to supervisors. Eliminating wall charts and card systems, the unit consists of a graph chart on rollers driven by an electric motor. Controls enable the user to move the 50-yard-long chart in either direction at varying speeds. Production goals and units completed are charted on a nonmoving scale at the top of the machine and can be compared



quickly with inventory lines on the moving chart. Shortages show up quickly and corrective steps can be taken without delay.

THIRTY-ONE television stations now are beaming pictures to a million or more screens from New York to Hollywood. To millions of sports fans these figures are big news, for the television bill of fare is heavy with athletic programs.

About 850,000 receivers of every price and size will roll from the assembly lines of more than 45 companies by the end of the year, and a whopping share of these screens will end up in the living rooms of sports enthusiasts. The fan now can view almost any kind of sport from baseball, football, basketball, boxing and hockey to track events and even rodeos.

This doesn't mean that he's completely satisfied with the method of airing athletic contests. Frequently, baseball fans are given an excellent view of home plate while there's a crucial double steal under way at second and third. Nor is the football fan satisfied when the cameraman is tricked into following Smith around right end when



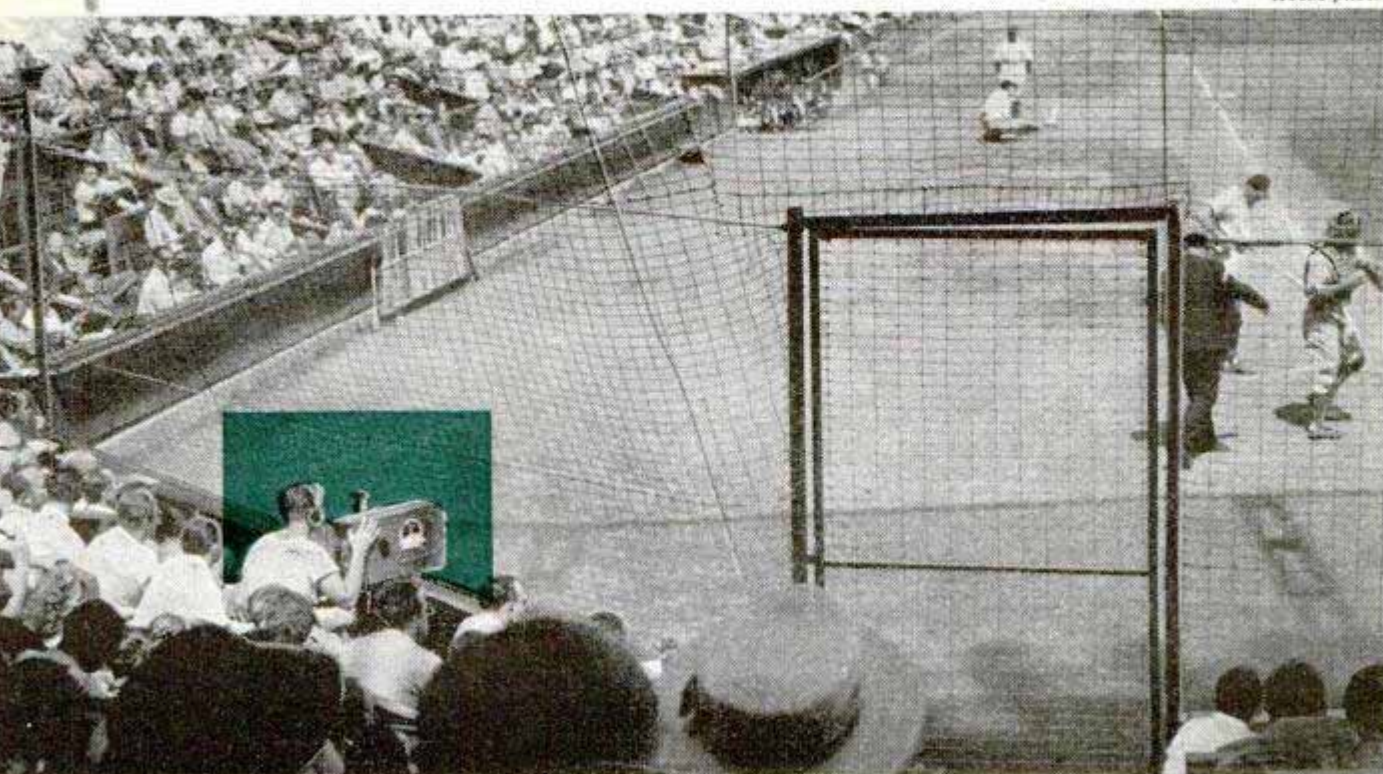
CBS photo

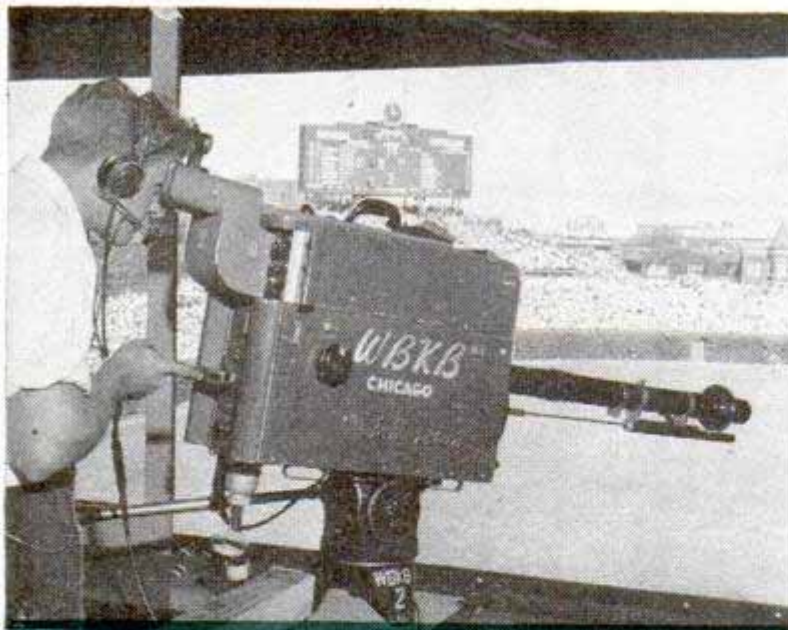
Monitoring screens Nos. 1, 3 and 4 show views of separate cameras. No. 2 shows picture on air. Top screen picks up picture after it is broadcast

Television covers the game

Behind-the-plate camera shoots through netting to show the pitched balls

KTLA photo





At Wrigley Field in Chicago, cameraman gives his Zoomar lens a pregame test. By manipulating lever he can change focus for a close-up of ball or wide-angle shot of field

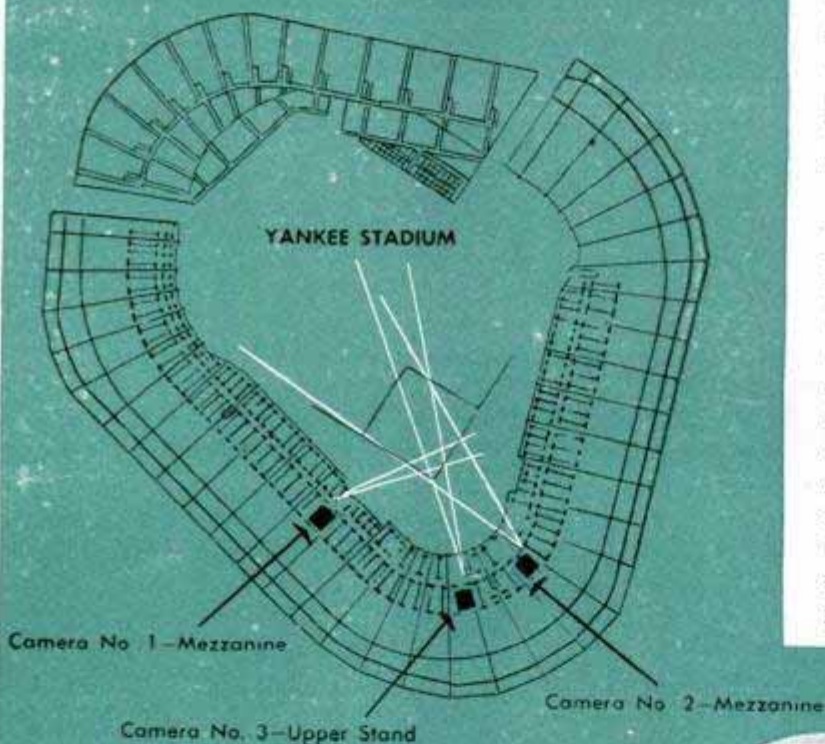


Diagram shows placement of Du Mont's cameras for airing baseball games. Camera No. 1 picks up infield close-ups and dugout shots. No. 2 covers pitcher and batter. No. 3 high in stands follows outfield hits

Right, photos of a television screen show what the sports fan sees from his easy chair. Left to right, a batter lays down a bunt, a runner slides safely into third, and usual player-umpire argument starts



Jones carries the ball the other way for the winning touchdown.

Fortunately, these incidents are rare, and most stations are feeling their way into systems that will put the right picture on the screen at the right time.

There are a good many bugs that face the producer of a sports program. Let's take a look at the infant art from cameraman to commentator to producer to find out how these problems are overcome. In baseball, probably the most popular sport that is telecast, the producer has the following typical setup:

Two or three video cameras are placed in the stands in the area running from behind first base to behind third base and are connected with the control room by coaxial cable. The commentator, who generally is near one of the cameras, has a line running from his mike through the control room to the transmitter. The producer in the control room has lines for communication with the cameramen and commentator.

The producer is the key man who decides what you'll see in the comfort of your living room. Before the game he locates his cameras, depending on local conditions as much as personal judgment, and briefs his cameramen on how he wants the game covered—the focal area of each camera in various situations that may arise during the game. This is vital since a lack of coordination among the boys behind the lenses might result in all cameras fo-

cusing on one point when the producer wishes to show his customers something happening at another point.

In most ball parks the producer is buried deep in the stands. In front of his seat are monitoring screens which show what each camera is viewing at any given moment. The producer orders the engineer to throw onto the air waves the most important picture. Some producers also have a regulation receiver which picks up the transmitted signals so they can see exactly what the home viewer is seeing. When such a receiver is not in use, the commentator's voice is piped in through a loudspeaker so the producer can instruct any cameraman to cover the incident being described.

In New York City, the National Broadcasting Company, Du Mont and the Columbia Broadcasting System are airing the games of the Giants, Yankees and Dodgers respectively. NBC at the Polo Grounds has three cameras hung in cages from the upper tier of the grandstand, one directly behind the plate and the other two halfway between home and first base. Producer Bill Garden uses a wide-angle lens behind the plate to show most of the playing area. On an outfield smash, the Zoomar lens, which can be converted from wide-angle to close-up with the movement of a rod, follows the ball through the air until it is returned to the infield. The third camera is used for close-ups.

Although some cameramen say the Zoomar lacks the clear image other lenses pick up, it provides a thrill to the viewer, who can fly through the air behind the ball or



Camera's turret mounts four different types of lenses. Cameraman can change from one lens to another by manipulating the controls

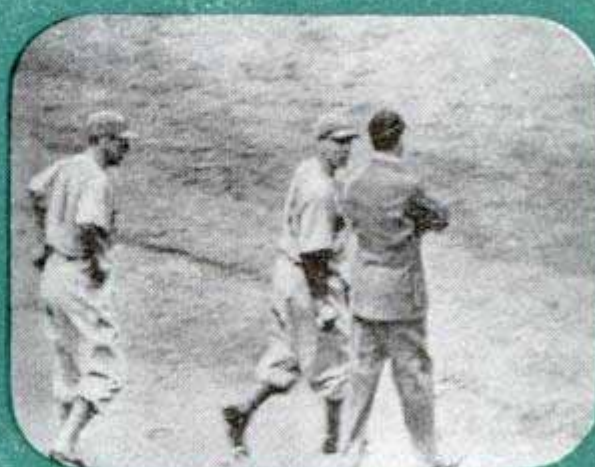
enjoy the sensation of catching a pegged ball practically in his own mitts.

Du Mont uses one camera directly behind third base for close-ups, another at an angle slightly to the right of the plate to cover pitcher and batter, and a third in the upper stands to follow hit balls.

CBS, covering the Dodgers at Ebbets Field, uses only two cameras less than six feet apart to the left of home plate in the grandstand. Two wide-angle lenses on one camera and two close-up lenses on the other do the job.

Producers often disagree on the placement of the cameras. Three lenses can cover more ground than two, but the shift from one side of the diamond to the other may confuse the sports fan at the other end of the air waves.

One problem in televising a baseball





KTLA photo

High in the stands at the Los Angeles Coliseum a cameraman points long lens at football action on field below

game hasn't been overcome with complete satisfaction. The producer is the boss, but can't see the game from the control room except through the eyes of his camera lenses. The commentator can see the whole game, but must follow what appears on his monitor so that video and audio don't go riding off in opposite directions. The cameraman can be guided only by his pre-game instructions and his own judgment in what to pick up. The problem of correlating all the members of this televising team is difficult to solve.

Football is another fine television spectacle and one that can be aired with less difficulty than baseball. It's played on a somewhat smaller field, the ball is much larger and doesn't travel as far or as fast.

Station KTLA in Hollywood, which is running a heavy sports program, telecasts

all home games of one of the professional football teams and probably will telecast some of the collegiate gridiron games this fall. Its facilities were used last year to put the Rose Bowl on the air waves.

In televising football, two cameras high above the 50-yard line and as close to the playing field as possible make an ideal setup. NBC in New York uses its Zoomar lens to follow the ball on kickoff and punts. On plays from formation, both teams are shown in a wide-angle shot—or at least the offensive team and the defensive line. This is cut back to a close-up of the offensive backfield as the play develops.

Two unfortunate things can happen in a football telecast. On a sparkling, open-field run, such a long lens may be used that the sports fan sees only the runner and none of the blocking. The other—and big-

CBS telecasts basketball game from New York. Commentator's monitoring screen, left, shows him what's on air



gest bugaboo to the cameraman—is that he will be fooled by the offensive team and follow a decoy instead of the ball.

Track and field meets may gray the hair of a producer since the field looks like a three-ring circus with a good many events in the process at the same time. No one wants to miss part of the mile race or the pole vault, but they frequently overlap. CBS licked this problem by covering the runners until the vaulter appeared and then cutting to him.

Station WBKB of Chicago has an aggressive sports program that includes ice hockey, boxing, harness racing and wrestling in addition to football and baseball. Hockey is particularly difficult to televise because the black puck won't show up well on grayish ice. This problem is partially met by leading a rush, either three-man or solo, down the ice so that a fast pass won't zip out of range.

Fights are easy to air since they are held in a restricted area and a cameraman can follow every move of the participants. Don Lee's Station KHJ in Los Angeles telecasts boxing matches every Friday night and wrestling on Monday. The scene is viewed by two image-orthicon cameras and microwaved to the main transmitter atop a mountain overlooking the city. Sound is piped over a balanced phone line to the transmitter.

KHJ also has televised tennis matches from a small court set up by the studio, and outdoor swimming events from its own pool. It has discovered that rodeo action is particularly suitable for television, but auto races often appear dull



Du Mont photo

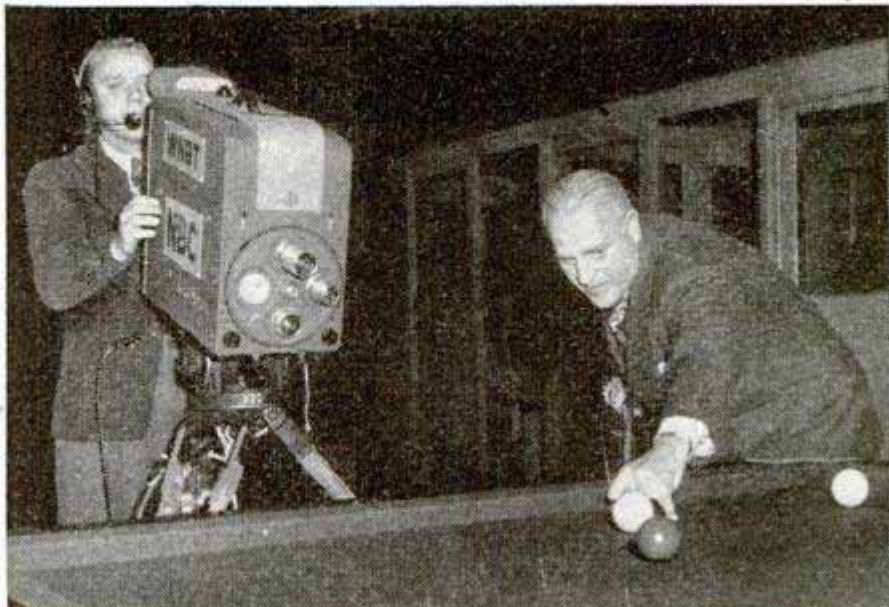
Camera behind the plate in the upper stand of Yankee Stadium chases a hit ball to the outfield and shows a close-up of the player fielding it



CBS photo

Strikes and spares are nothing new to television sports fans. The telecast of a bowling tournament requires an additional battery of lights. Below, Willie Hoppe, billiard champ, performs for video audience on special events show. Fans now can see almost any kind of sports event on screen

NBC photo





Television eye high in the grandstand follows the horses around Santa Anita race track in southern California

because there are no breaks in the action.

Basketball is a television natural that can be handled with a single camera and lens under the proper lights. Running and harness races pose no difficulties except how to fill in the half-hour waits between events when an entire card is telecast. Golf can't be covered well until helicopter-borne cameras can be brought to bear on tee, fairway, rough and green.

To view these programs, the sports fan has his choice of a good many new receivers, many of them featuring larger screens. One company has announced a projection-type set with a retractable screen 20 inches wide by 15 inches high. Late this year another manufacturer expects to bring out a 16-inch picture receiver in both tube and projection models. RCA Victor recently unveiled the first commercial equipment for showing life-size television programs to large audiences in hotels, clubs, churches and schools. The picture may be adjusted from three

by four feet to seven by nine feet. Other manufacturers are bringing out models that combine AM and FM with a record player and television screen. General Electric's receiver has a 10-inch tube with an aluminum-backed fluorescent screen.

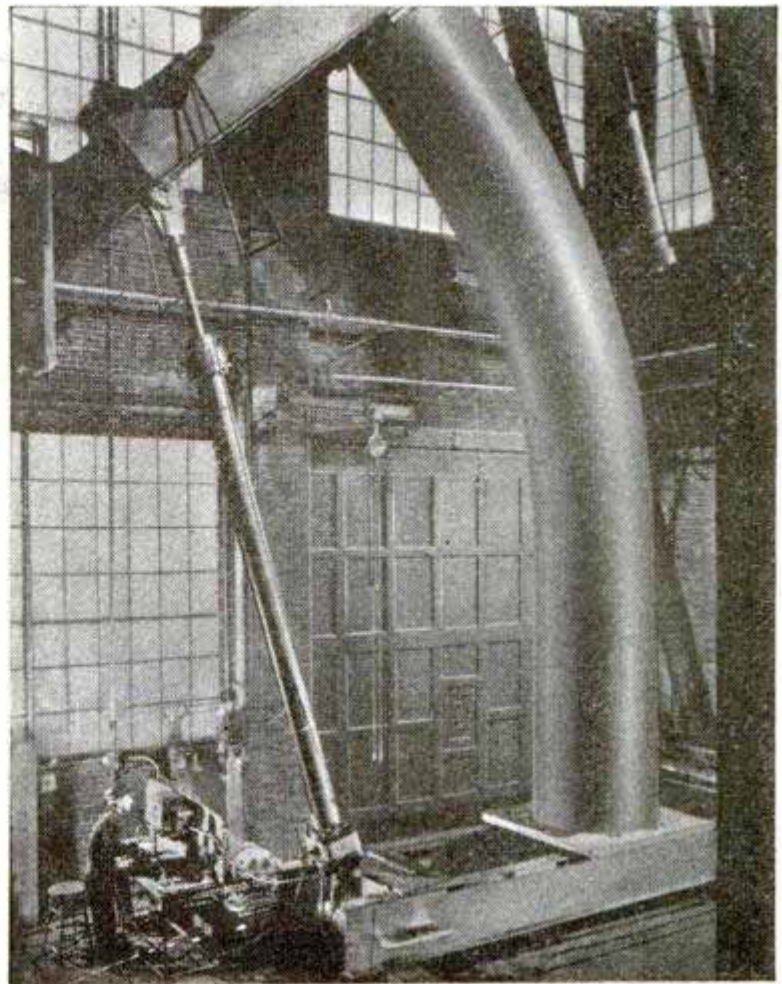
Thus the sports fan, once he has bought and installed his receiver, can enjoy a holiday doubleheader, a billiard lesson or a thrill-packed rodeo for practically no additional expense. His living room may become the grandstand of the neighborhood.

Line-of-sight "dish" antenna at baseball park beams pictures to main transmitter on mountain



Giant Pipe Bender

Bending steel pipe 50 inches in diameter and almost an inch thick is less than a day's work for the giant pipe bender designed and used at the M. W. Kellogg Company. The bend is of uniform contour and has a round cross section without the wrinkles that usually result on the inside of a bend. Heat is applied to raise the metal to 1450 degrees Fahrenheit and hydraulic pressure bends the pipe. Electronic controls regulate the operation, assuring the exact bend desired. It takes less than a day to bend a 30-foot section of the pipe.

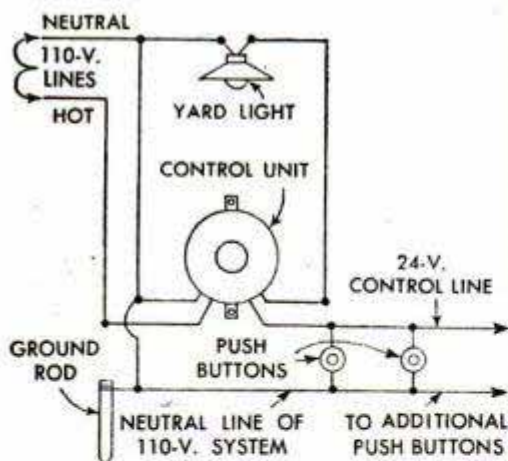


Atomic Superbomb

While the world still trembles over the destructive capabilities of the present atomic bomb, science is forecasting an atomic superbomb, a thousand times more violent than the present type. The superbomb would be made principally from the double-weight variety of hydrogen, called heavy hydrogen or deuterium. The tremendous energy-releasing reaction of deuterium bombardment was known long before the discovery of the fission of uranium, but construction of such a bomb was apparently held up by the

problem of discovering a means of starting the reaction. It is believed that the explosion of a fission bomb may be used to trigger the newer deuterium bomb.

HOOKUP DIAGRAM



Any number of remote switches for the yard light can be used in the 24-volt control circuit shown in above model. Insert shows wiring diagram

Remote Control For Yard Light

Only one wire is needed to install any number of control switches for a yard light or other electrical device when a 24-volt control unit is used. The remote switches are connected to the unit by a single low-voltage line such as is used with bells or telephones. The other side of the circuit connects to the neutral ground wire of the wiring system. Pressing any push-button switch turns the light on or off by energizing a magnetic ratchet in the control unit. The low-voltage control unit saves the cost of installing expensive circuits to each switch and also reduces fire and shock hazards.

CAR QUIZ



1 _____



6 _____



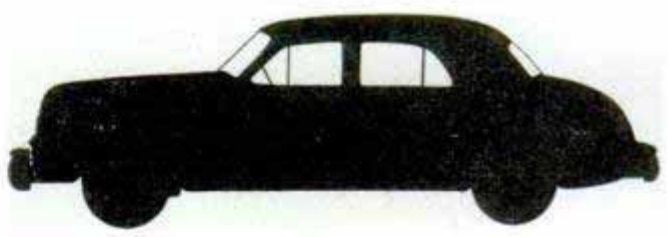
2 _____



7 _____



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10 _____

HOW MANY OF THESE SILHOUETTES OF 1948 U. S. AUTOMOBILES CAN YOU IDENTIFY?
EACH CAR HAS BEEN DRAWN TO SCALE. (Answers on page 268)



11



16



12



17



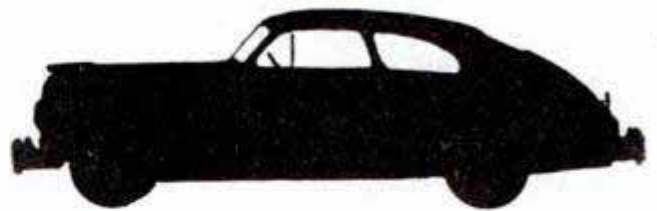
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18



14



19

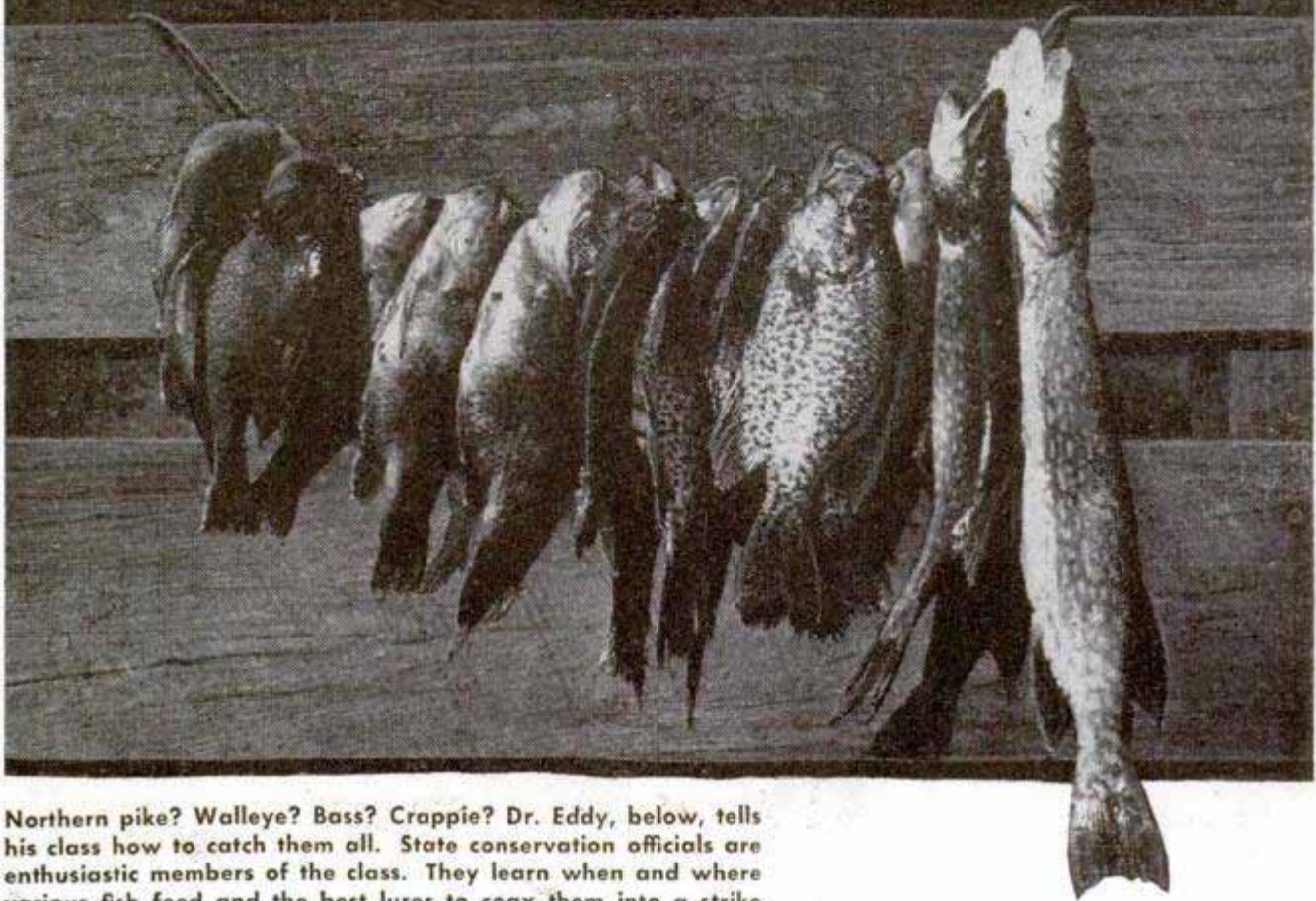


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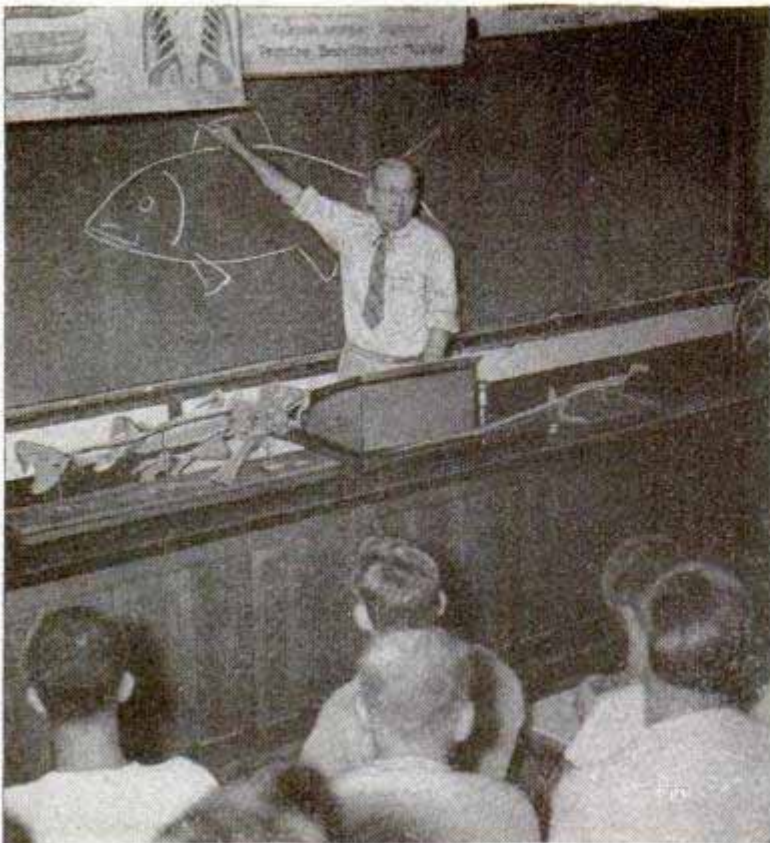


20

SCHOOL FOR FISHERMEN



Northern pike? Walleye? Bass? Crappie? Dr. Eddy, below, tells his class how to catch them all. State conservation officials are enthusiastic members of the class. They learn when and where various fish feed and the best lures to coax them into a strike



By Dr. Samuel Eddy

*Professor of Zoology, University
of Minnesota*

WHAT MAKES FISH bite? What time of day am I most likely to catch them? Where?" These are the questions most frequently asked me by students of my course in fishing at the University of Minnesota.

Several colleges and universities offer fishing courses in their physical education departments. These courses generally consist of the mechanics of bait-casting and fly-fishing. In Minnesota nearly every high school boy lives within hiking distance of a lake and can plunk down his bait within inches of his target. The course at the university, therefore, is in the zoology department and offers a scientific study of why fish bite

Angler pulls in a big northern with a fly rod. Learning about the private lives of fish can help any fisherman land them

and where to find them. The course is based on research in lake dynamics and the feeding habits of different types of fish. Many conservation officials attend this course—men who can't be taught fish stories but are eager to learn fish facts.

Soon after man invented the fishhook he discovered that sometimes he caught a good many fish and other times he caught none. For thousands of years he has been trying to figure out why. He has blamed spirits, weather and the moon. Even today he may consult a fishing almanac or calendar that is supposed to tell him what day the fish will bite.

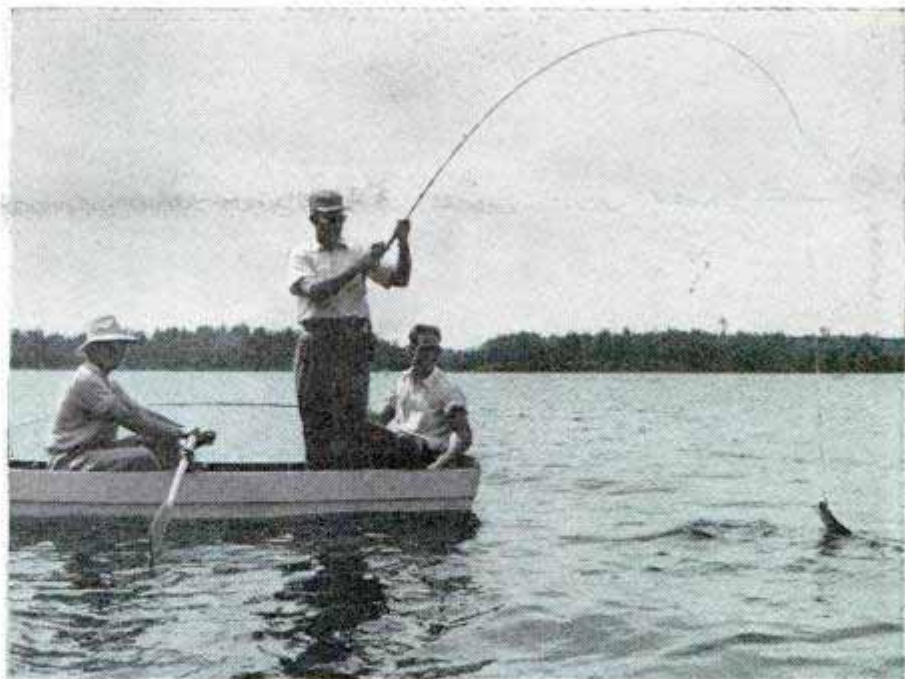
Some modern anglers consult the barometer in the belief that fish bite more readily when atmospheric pressure is increasing. A fish swimming a few feet up or down in the water is subject to changes in pressure far greater than slight fluctuations in air pressure.

There are only three reasons why a fish bites. It's hungry, mad or just curious.

Some fish are natural fighters and strike viciously at any moving object. A few, such as the sunfish, are insatiably curious and will crowd around a strange bait.

Hunger is the main reason fish strike. When a fish has eaten all it can hold, it takes very little additional food for the next 24 hours. Under natural conditions, a fish starts hunting food early in the morning and fills its stomach as fast as possible. It then has little interest in a baited hook until evening, when it may look around for a bedtime snack.

The working hours of fish vary. Most



Under Dr. Eddy's guidance, students gather water-life specimens, which show amount of food available for fish

St. Paul Pioneer Press photo





Pilot of Popular Mechanics' plane tests some of Dr. Eddy's advice on fishing. (He caught two northern pike)

hunt their food at night. Sunfish and crappies are primarily daytime feeders, starting the job when the sun is high enough to penetrate the water. Northern pike and muskellunge move into shallow water at daybreak to hide in the weeds and wait for their prey. In the late afternoon they move out to deep water for the night.

It's usually a waste of time to fish in the middle of a lake where the water is more than 30 feet deep. In most lakes there is insufficient oxygen in the deeper waters, but a few lakes near the Canadian border have plenty of oxygen even in the deep areas. Lake trout seek these deep bottoms in the summer to escape the heat of the surface. Test nets prove one rule: fish seldom go deeper than 30 feet except in these lake-trout lakes, where they are found at almost any depth.

game fish have primarily daytime habits although if they are still hungry they may lurk around after dark. Large fish, which have difficulty in stuffing their stomachs, often strike after dark. Consequently, the fisherman may catch his largest brook trout or northern pike late in the evening.

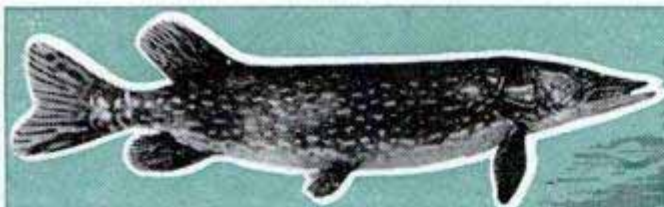
The walleye or pike perch is a well-known night feeder, lying in water from 10 to 20 feet deep just outside the weeds during the day, but moving into shallow water at night to feed on small fry. Large bass frequently do the same thing. Bass feed most frequently in the evening and early in the morning. Eels and bullheads

Sunfish, crappies and perch are so sociable that they like to travel in schools. The fisherman who catches one of these fish is wise if he drops anchor and tries for the rest of the school. Incidentally, these schools seem to be organized into "grades," as the fish are age-conscious and those of one size tend to school together. You'll find the larger ones in deeper waters just outside the weeds and smaller ones inside the weeds. Favorite playground of this type of fish is around brush piles, old docks and fallen trees.

Young bass tend to school, but older

Dr. Eddy tries his luck from forward hatch of Popular Mechanics' "Apache III," a twin-engine Grumman Mallard





NORTHERN PIKE—Eddy recommends fishing in deeper waters late in evening for large ones. Good bait is a spoon



PAN FISH including crappies and sunfish—still-fishing with worm in weeds close to shore is most popular method



BASS — still-fishing in early morning or evening in weed-strewn water about 15 ft. deep can bring in big ones

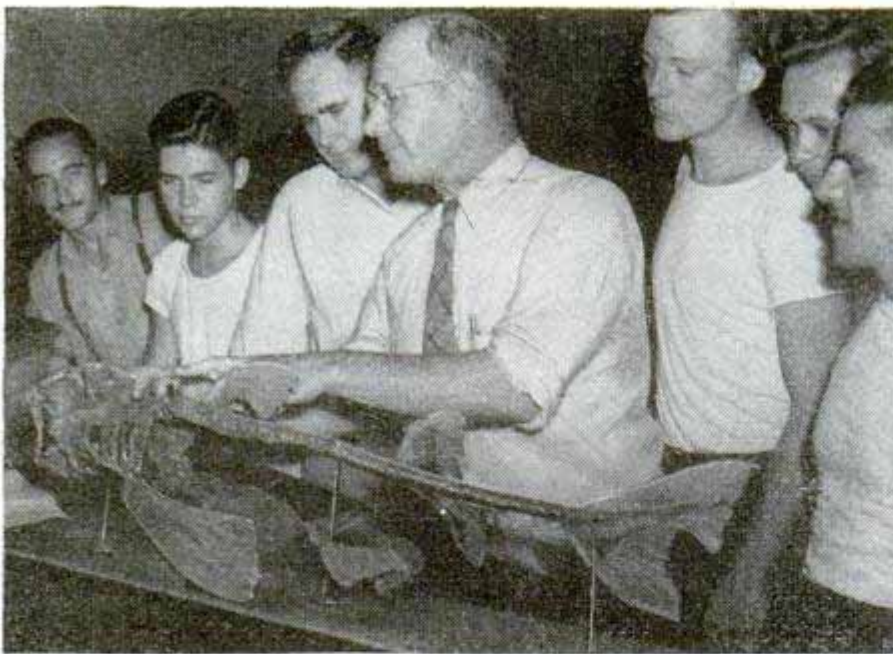


WALLEYES—one good system is to cast in 20 feet of water just off weed bed during daylight. Bait is a plug

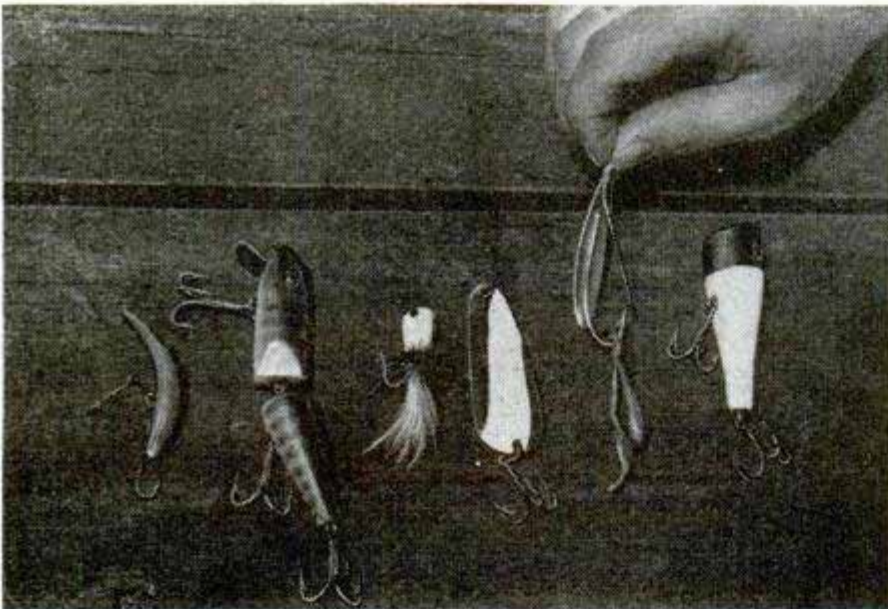


TROUT—lakes with deep water and rocky banks are best. Wet or dry fly gets brown trout, troll for big lake trout

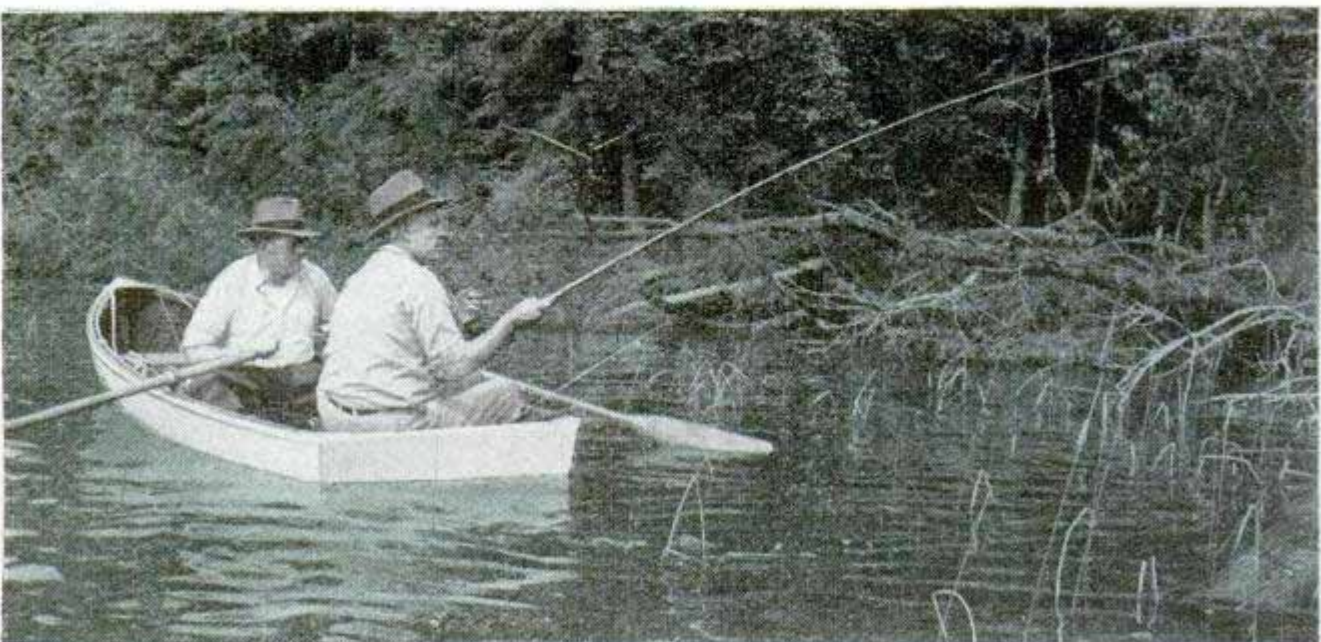




Dr. Eddy reviews structure of fish skeleton for some of his students



† Author recommends these basic baits. Below, pan fish such as crappies and perch hide in weeds during day



bass are rugged individuals, each selecting his own territory where he can lurk in the shade of weed beds and lily pads. Northern pike like to run alone, and can be found scattered over weed beds. Although walleyes are often solitary, they may range around the lake in groups, hunting for food.

Most game fish locate their food by sight, as the senses of taste and smell are apparently poorly developed or they would not strike and swallow bits of wood and even pebbles. Therefore, you'll find them most easy to fool with moving artificial baits. A northern pike is attracted by the movement of its prey; the moment the bait makes another move the fish strikes in a flash. Bass hit hard the moment they sight the moving object. Walleyes may strike on sight but often they peck cautiously at the bait.

Other fish such as catfish, suckers and carp have a well-developed sense of taste, usually located in the skin around the head. Bullheads seem to have their taste organs in their "whiskers."

When offered food they do not strike as it settles through the water but gyrate madly until their whiskers come close to the food; then they turn and engulf the bait in their huge mouths.

Most pan fish, such as sunfish, crappies and rock bass, seem to use a combination of sight and taste in locating food. They see the food and if it moves they may strike it. Frequently they will make a series of short dashes at it, apparently tasting or nibbling before seizing it. If the hook is too large they can clean off the bait without ever taking the hook in their mouths.

We discover the "biting rate" of fish by taking a "creel census" in which every fisherman on a lake is asked how many fish he has caught and the time he spent in catching them. Seasonal changes in the rate of biting have long been known to experienced anglers and are clearly shown by the census. In June most fish have finished spawning, yet food production has not increased sufficiently to satisfy them. Consequently they are hungry most of the day and bite readily. In July they are not very hungry and in August they bite very poorly. As the summer progresses, heavy growths of insects, worms, minnows and other organisms leave the fish fat with their stomachs full.

The temperature of the water in August is highest for the year, causing many fish to lose their appetites. During September the water cools, the excess food has been consumed and the fish become hungry, providing many more strikes.

In winter when the temperature falls to just above freezing, sunfish, bass and bullheads lose all interest in food. However, crappies, perch, northern pike and wall-

eyes are hungrier than ever and may offer the best fishing of the year.

During some years fishing is very poor, while in others it is excellent. This does not necessarily mean that there are fewer fish. Apparently in some years conditions are favorable for the production of a large food crop and the fish have no appetite for even the most tantalizing lure.

"What kind of lure shall I use to catch a certain kind of fish?" That's another question which frequently pops up in class discussions. Still-fishing is best for pan fish such as crappies, sunfish, perch and rock bass. Many others such as black bass, northern pike and walleyes may also be caught by this method, especially if the hook is baited with a minnow.

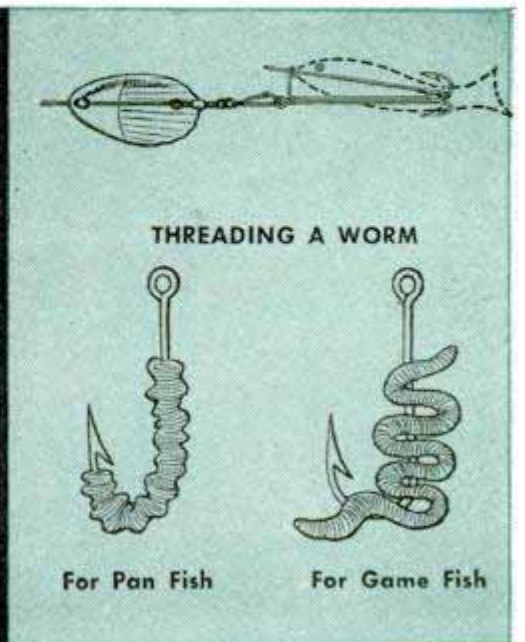
Baits for still-fishing range from live minnows to angleworms, grasshoppers, grubs and even bits of liver and fish. Looping a worm back and forth on the hook presents a much more enticing bait than merely threading it on the hook. Minnows should not be threaded except for casting, but should be hooked through the back muscles just under the dorsal fin, giving them a chance to move and give action to the lure. When fishing for pan fish, keep the hook a foot or so above the bottom.

For casting or trolling, try to make your bait or lure imitate natural food. Fish are nearsighted and not so particular about the detailed appearance of the lure as its action. Most sports stores offer a bewildering array of artificial baits, but only those that give plenty of action in the water should be considered.

Spoons are very effective for northern pike and may work for walleyes. Artificial

(Continued to page 268)

↓ Night is good time to still-fish for large walleyes, bass, northern and bullheads. Right, bait developed by Dr. Eddy has safety pin, two hooks which hold minnow for casting. Drawings show ways of threading worm



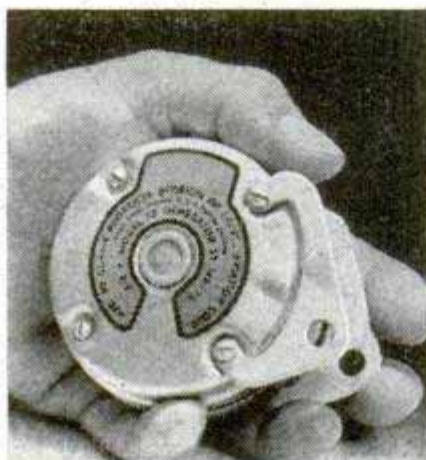


Three-Way Gear System For Outboard Motors

Both the dangers and hard work of rip-cord starting are eliminated by a neutral, reverse and forward-gear system devised for outboard motors. It adds only one to five pounds to the motor's weight, depending on the horsepower. The reverse gear minimizes overshooting the destination and simplifies docking. Use of neutral during stops cuts down the number of starting operations. It also makes it possible to avoid immediate acceleration on starting that often causes accidents.

"Handful" Generator

Current for lighting small motor vehicles such as power bicycles, scooters and motorboats is provided by a tiny generator with a friction disk that is mounted against the engine flywheel. The power unit, only 3½ inches in diameter and 1½ inches thick, produces 35 watts at 6 to 8 volts. It gives steady, flickerless light even when the motor is idling. To provide automatic voltage regulation, four segments are attached to the rotor shaft, each by a separate leaf spring. At low speeds all four segments run clear



of the rotor to allow the full magnetic field to act on the coils. At predetermined speeds the segments extend by centrifugal force, touch the rotor and shunt the magnetic field to regulate the voltage.



Shadow Box in Kit Form Depicts Chinese Scene

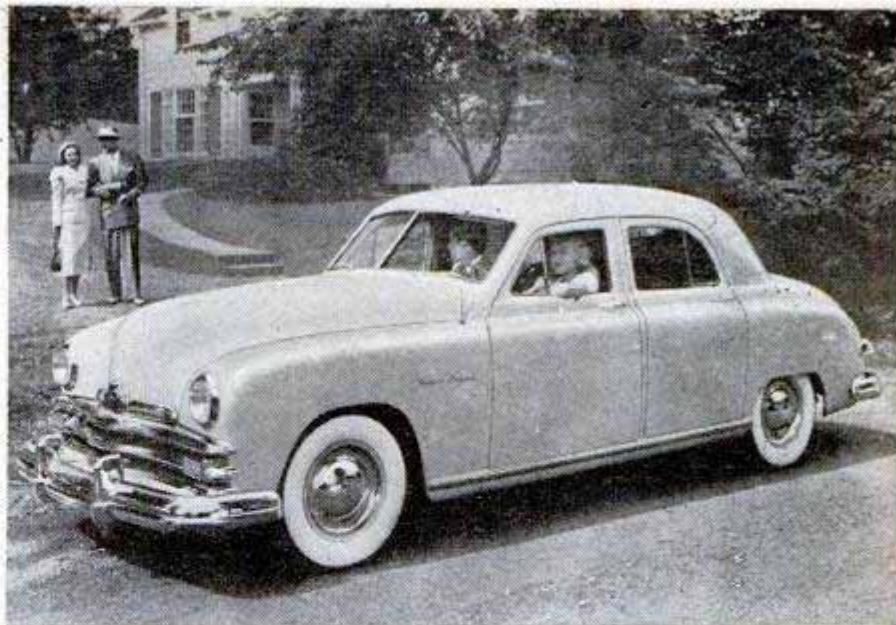
With a kit that includes all the required parts, hobbyists can build a shadow box that depicts a Chinese scene. The completed project shows an old man sitting beneath a Ming tree. The kit contains the glued and sanded frame, the box, tree, foliage, moss for the tree, cement, colored sand and the hand-painted ceramic figure.

Luminous Flashlight

Coated with a luminous material, a new flashlight can be quickly spotted in the dark in case of power failure or other emergency. The case glows with a bright blue-white light for several hours and then glows in a more subdued manner all night.

1949 Kaiser

First postwar car to undergo extensive model changeover, the 1949 Kaiser offers 72 changes in styling and 30 in engine and mechanical features including a boost in horsepower from 100 to 112 with the six-cylinder engine. The '49 has a new simplified clutch and improved steering, accelerator and brake mechanisms. Restyling of the body resulted in a silhouette three inches lower, new grille, bumpers and rear fenders.



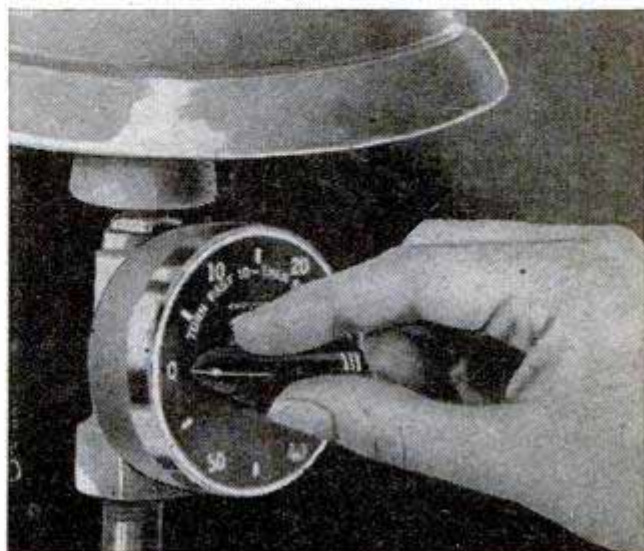
Two-Place Helicopter

Exceptional maneuverability and braking power highlighted first tests at Seattle of a coaxial-rotor helicopter secretly designed and built on a ranch in an isolated part of the state. The two-seater's only control surfaces are a pair of contrarotating 27-foot-long rotors. Its 125-horsepower engine is shock-mounted on rubber, with dual mufflers silencing engine noise. From a hovering standstill the craft reaches its cruising speed of 80 miles an hour almost immediately. An overriding clutch permits the rotors to continue turning for a safe landing in case there is an engine failure.

Timer Turns Off Water Heater

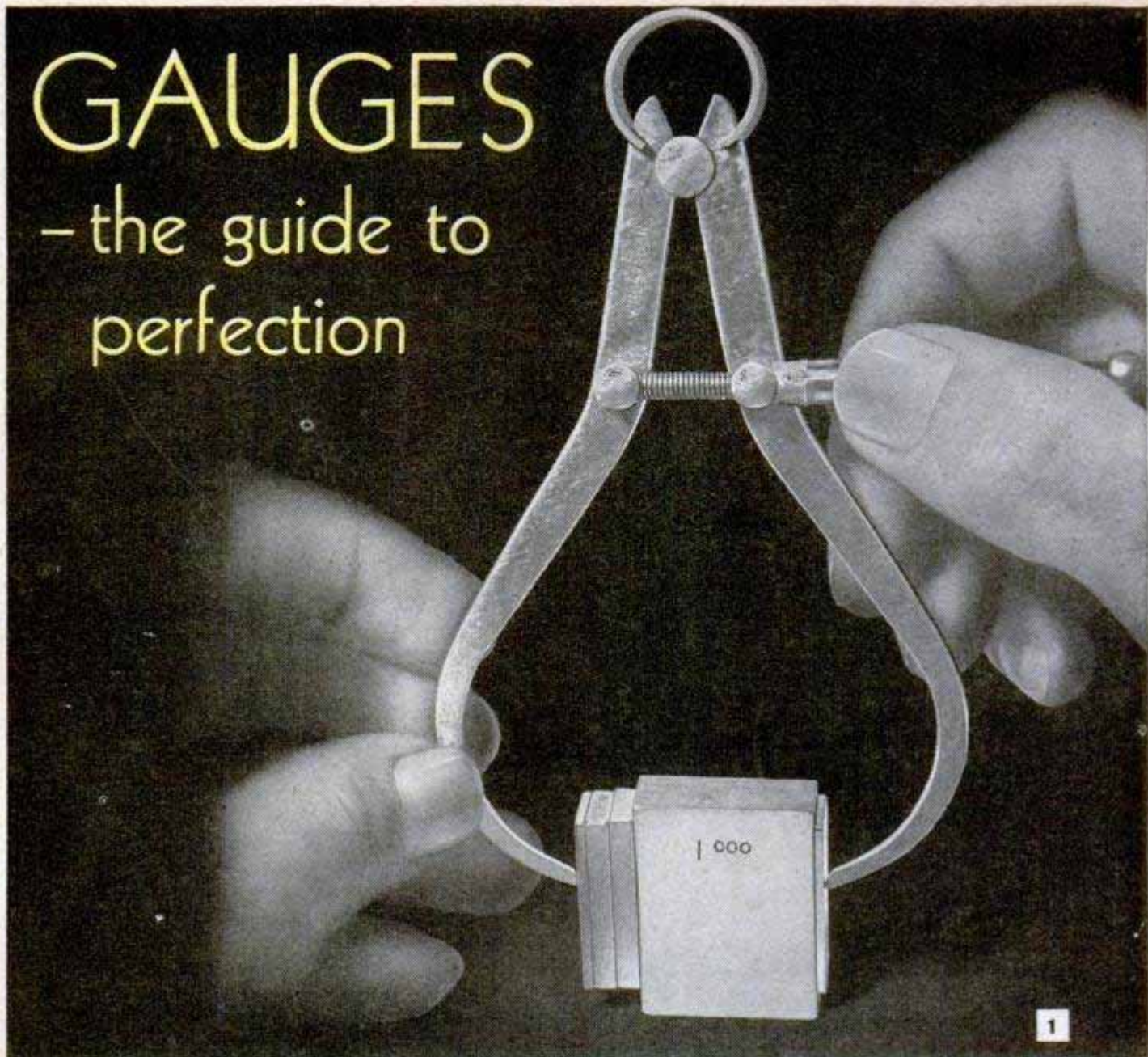
Water heaters turned on manually can be converted to semiautomatic operation with a timer that turns off the gas at the end of any desired period, eliminating the need for a second trip to the basement. A maximum interval of one hour is possible with the timer. The gas can be turned off manually at any time if desired.

Our WHERE-TO-FIND-IT INDEX, listing manufacturers' names and addresses and sources of further information for products in this issue, is available free upon request. For your copy of the index, just write Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11

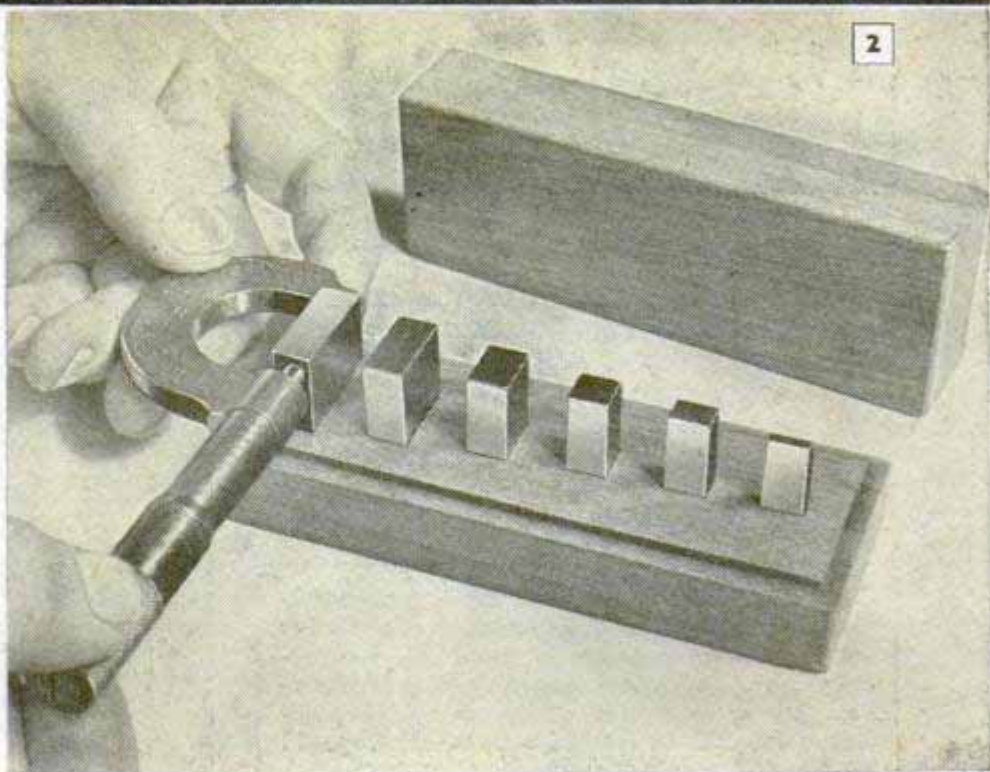


GAUGES

- the guide to
perfection



Ordinary calipers are precision tools in the hands of a skilled machinist. Here a pair is being set with gauge-block assembly



By
Alexander Maxwell

Designed specifically for testing micrometers, a set of gauge blocks provides checks at every stage point from $\frac{1}{8}$ to one inch

THE FAMILY excitedly piles into the car and you point the radiator cap toward the blue horizon and step on the gas, perfectly confident of making the long journey before you. A huge plane roars up from the New York airport and heads east. Those on board relax, knowing full well they will eat supper in London. The steam turbine roars loudly, turning huge generators that make your electricity. Meters on the control board show the current being delivered and the needles are as stationary as if glued to the dials. The light never fails. The electric refrigerator runs on and on, year after year, and no one ever pays any attention to it.

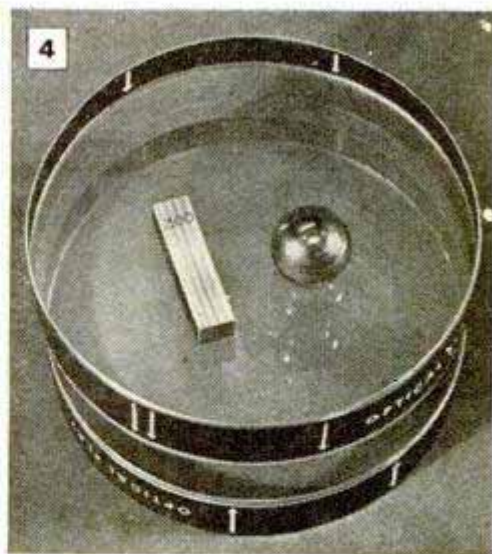
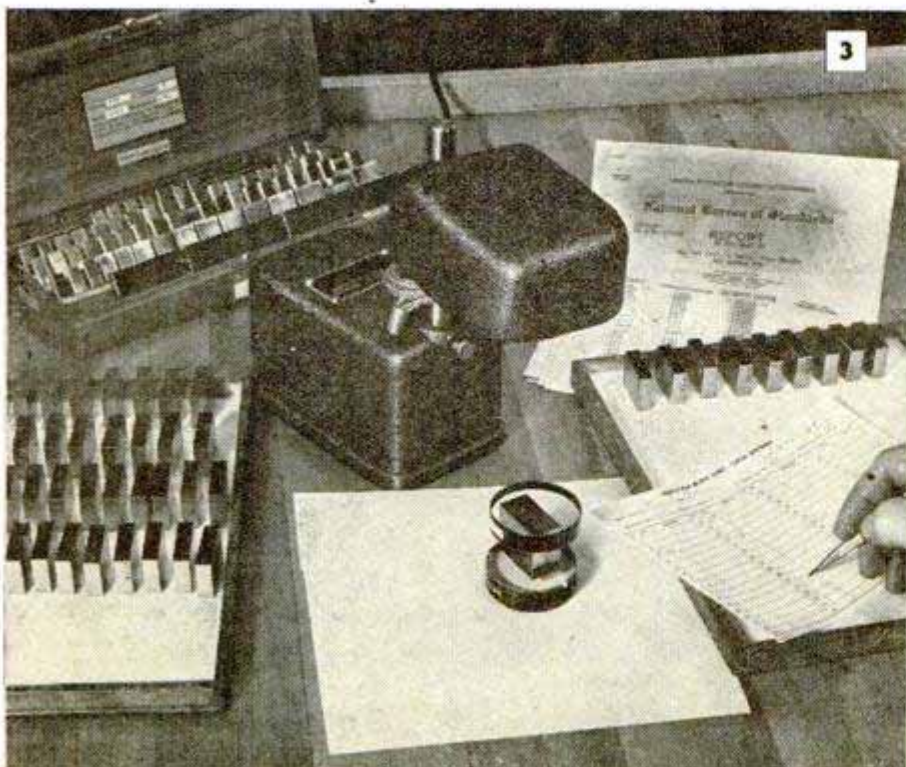
Something strange and remarkable has happened. Things don't break down as often as they once did. Time was, not so long ago, when the average motorist considered himself lucky if his car ran a week without something folding up. A journey of a thousand miles made the headlines. It was only 21 years ago that planes started crossing the Atlantic and 10 that they did it with any degree of assurance. Refrigerator manufacturers advertised they used non-poisonous, odorless gas. Every year, or maybe more often, the service man called and replenished that which had leaked out. Yes, times have changed.

There are a number of factors responsible for the changes, but all are secondary to the worldwide acceptance of the Johanson block ("Jo-block") as a unit of measurement. In World War I it was a novelty more or less ignored by manufacturers and honored only by the serious machinist who bought a set out of his own income and took it home with him every night. In

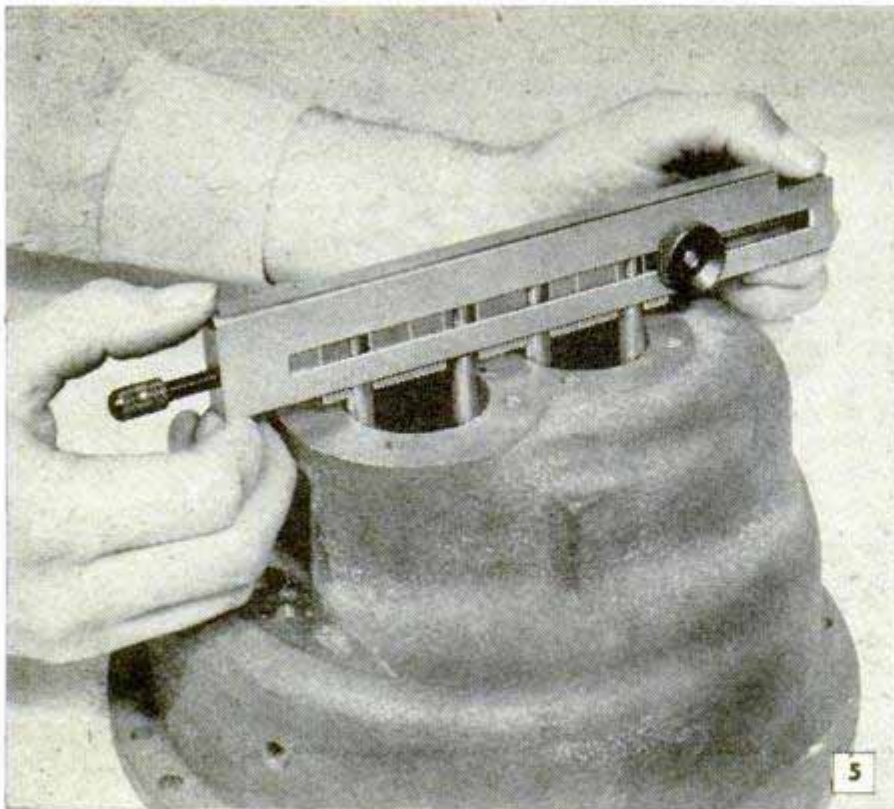
World War II the government specified that all contractors not only had to own Jo-blocks, they had to use them.

This ultimatum provoked smiles from many of the leading industries because they learned the hard way that there is no shortcut to perfection—competition had forced the decision long ago. Others moaned long and lustily about the terrific expense incurred. But they bought the blocks and they used them. Hardly had the first month's production reports been tallied after the change-over than there were raised eyebrows and gasps of astonishment. The improvement in quality and decrease in the number of rejects were rapidly paying for the blocks.

A Jo-block itself is a harmless looking slug of steel. It is smooth and highly polished. It is not the block itself, but what it does that gives it value. It settles the often disputed question, "How long is an inch?" The length of an inch is of vital importance to modern industry. In a machine shop, there may be three steel rulers, each one foot long. They are all top quality and all supposed to be accurate. For ordinary measurements they are, but on ruler No. 1 the third inch is $\frac{3}{1000}$ inch shorter than the others. That means any measurement over two inches will be in error. Ruler No. 2 has a slight bow to it which gives an over-all error of $\frac{3}{1000}$ inch, but none when the inches are checked individually. Ruler No. 3 is accurate. What happens when the three machinists using these rulers to set their calipers turn out three parts of a mechanism? The parts don't fit and have to go back for hand dressing. Everything is blamed but the rulers, but that doesn't pay



Left, a completed gauge block being tested alongside the master block between optical flats. Above, testing diameter of ball bearing by same system. Lines on block check diameter



Blocks are inserted in a holder to make a gauge to measure internal diameters in production

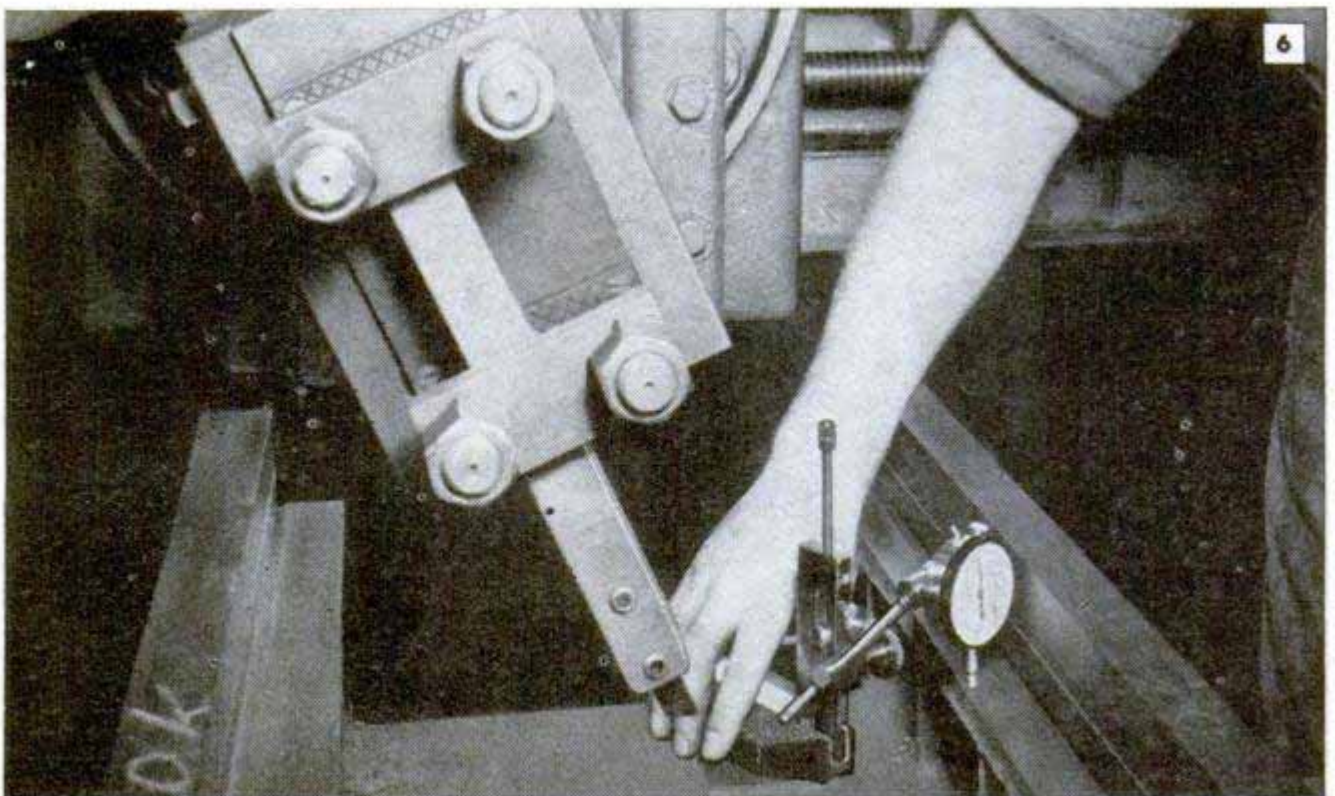
lated length of kernels of grain placed end-to-end. Queen Elizabeth put a stop to all that foolishness by having a metal bar engraved into 36 units, each an inch, the total a yard. That was good until it was discovered that metal expands and contracts in heat and cold. Astronomy and optics at last came to the rescue. Light waves are constant. They are the same everywhere. Why not use light as a standard? It was done, and 39,450.3 waves of cadmium light now constitute one inch.

for the time lost and tempers ruined. This is a very elementary example of how a variation of inch lengths can gum up precision manufacturing. The same statements can be applied to micrometers, comparators or more complex measuring devices.

The length of an inch was never really standardized until quite recently. It started out being $\frac{1}{12}$ the length of the king's foot. New king, new inch. Then it was the width of his thumbnail; then the accumu-

The governments of the United States and Great Britain make available a standard inch to anyone requesting it. France does the same with the standard centimeter. Incidentally, the length of the inch is based directly upon the French centimeter, so there is no conflict between them. It was a Dane, E. S. Johansson, who first did something about making a standard inch available to the man who needed it the most, the machinist. He perfected a technique of stabilizing steel so that its tendency to ex-

Dial gauges are easier to read than micrometers, but they are useless until calibrated with gauge blocks



pand when heated would be minimized. He then proceeded to use light waves to check his grinding. His one-inch block was exactly one inch, down to the last light wave. It created a mild sensation, but not until Henry Ford, who was looking for just such a device, took notice and brought Johanson and his business to America, did anything important happen. The rest is history. Ford got the jump on all his competitors and everybody else had to buy Jo-blocks or go out of business.

The demand for gauge blocks grew so rapidly when the nation started tooling up for World War II that a dozen firms took it upon themselves to create an adequate supply. In use, the gauge block is simplicity itself. The blocks are available in inches and multiples of an inch as well as decimal fractions of an inch. The largest practical block is four inches and the smallest is .010 inch which is a mere wafer of steel. The measuring surfaces are so flat and smooth the blocks will stick together when wrung and an assembly can be lifted and handled as a unit. It takes a good tug to pull them apart.

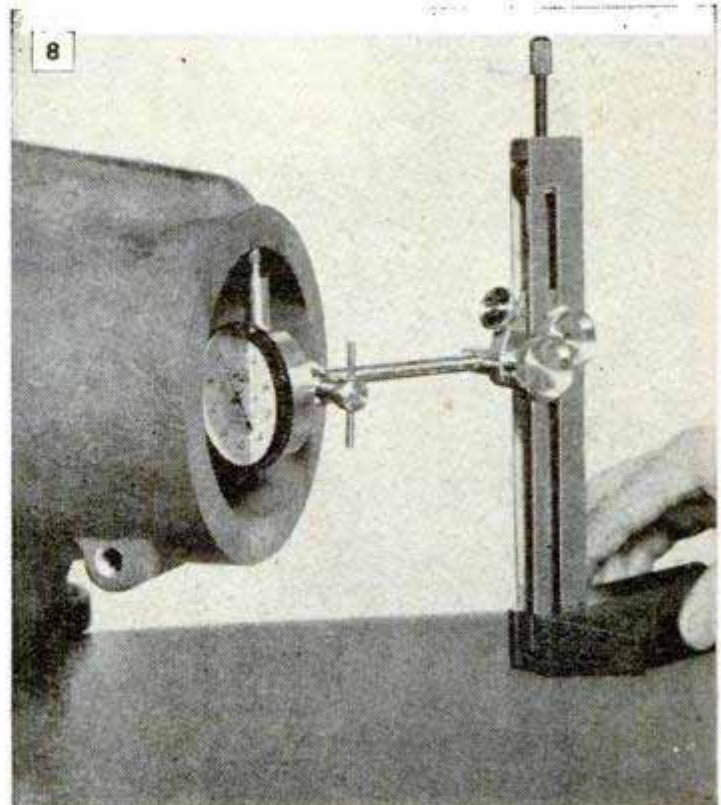
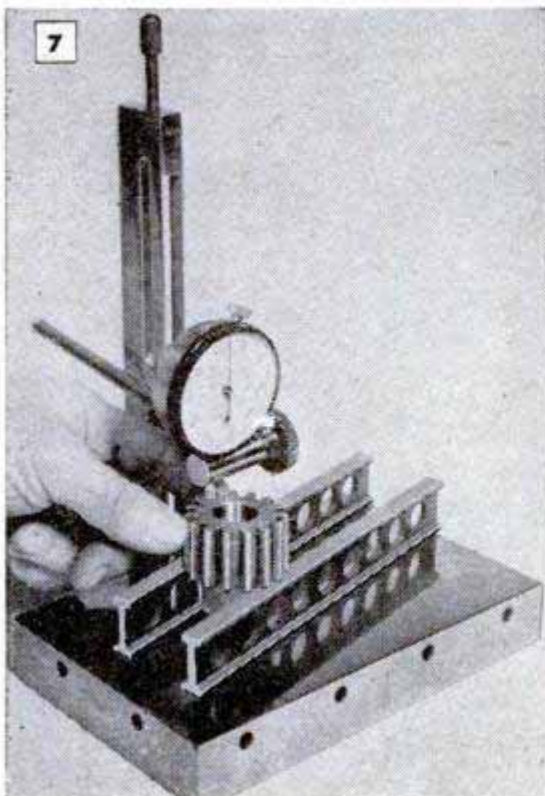
Calipers were used by the pyramid builders of Egypt and by just about everybody else since. Simple as they are, in the hands of a skilled machinist they will measure down to a thousandth of an inch. It was customary to set them with a steel ruler but by wringing an assembly of gauge blocks (photo 1), an accurate dimension can be obtained quicker and easier.

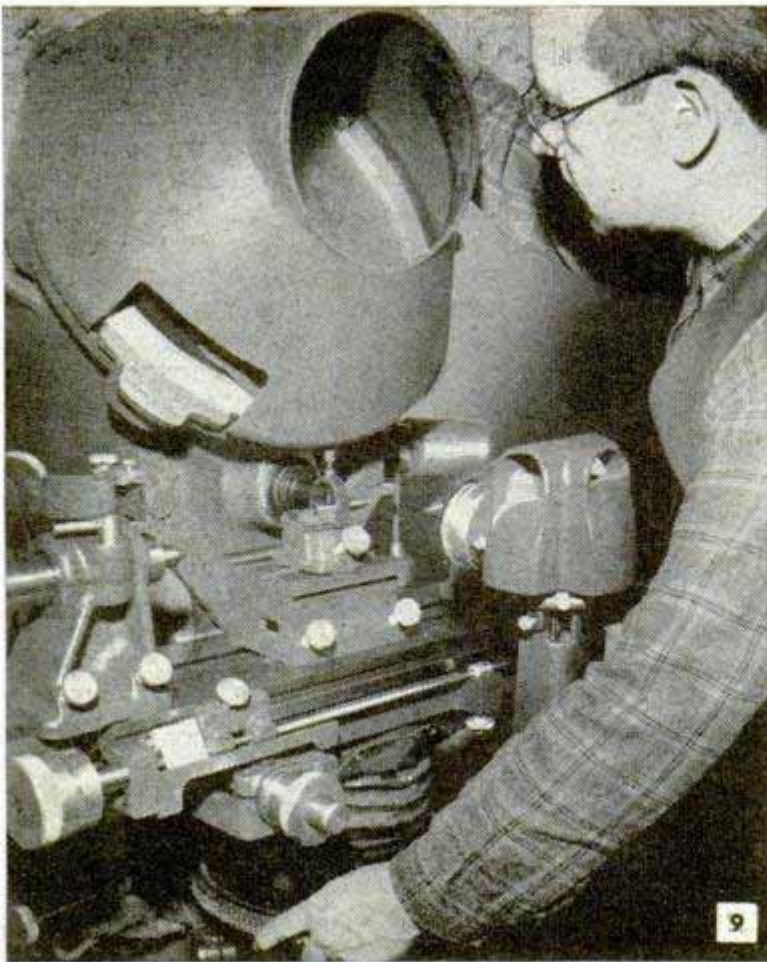
A micrometer caliper carries its own cal-

ibration and all that is required is to check it periodically against a master. Too energetic or improper use often results in springing or thread stripping. Then the "mike" will read accurately up to a point and from there on errors may multiply fast. An ingenious set of gauge blocks (photo 2) has been devised especially for checking micrometers. Starting at $\frac{1}{8}$ inch, readings are taken at every stage point, namely, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ and one inch. If errors are present, they will show up here. Quality-control inspectors in one large plant discovered only 20 percent of the company-furnished micrometers were accurate after a period of service. A system of testing every mike in the building each week end and adjusting or repairing it was set up and the percentage of spoilage dropped by almost half.

The manufacture of gauge blocks is an exacting, highly specialized procedure. It involves the cutting and grinding of blanks to limits, then a long process of stabilization. The blanks are placed in a wire basket, heated to the boiling point of water, then plunged into a sharp-freeze cooler and the temperature brought down to 150 degrees below zero. White with frost they are again heated to the boiling point, then again cooled, until the molecules at last give up the struggle and remain permanently passive. Now, no reasonable degree of heat or cold will alter the size of the block. They are laid away to season, then ground down to final size, and lapped. Lapping is the step which makes the slug of

Left, checking spur gear with dial gauge. Right, this gauge gives several bore measurements simultaneously





Optical comparator projects magnified image of part on screen

steel into a gauge block or proves it is worthless. Sixty-four blanks are placed in slots in a rotating disk. The lower faces of the blocks rest on one lapping plate. Then another free-floating plate is lowered until it touches the upper faces of the blocks. The holding disk is slowly rotated and the 64 blocks are crushed, smoothed, scraped and polished until the two surfaces are ab-

Light-beam comparator indicates size by shining light on dial



solutely parallel and mirror-bright. The work is done in an air-conditioned, dust-free room.

Each revolution of the lap reduces the diameter of the blocks one millionth of an inch. Periodically they are removed, measured and replaced. Then the lap is rotated six times, once or even a quarter revolution. If the block is oversize, more metal can always be taken off. If it is under, all that can be done is grind it down to the next size.

Now comes the calibrating against a standard (photo 3). This requires the use of a pair of optical flats, which are glass or quartz plates ground and polished to an absolutely flat surface. Light from a monochromatic source, a cadmium vapor tube giving rays of an exotic orange pink, is directed upon the flats. Now a master gauge block, which has been certified by the Bureau of Standards in Washington, is wrung to the lower flat. Alongside is wrung the block to be calibrated. The upper flat is placed on top of the two blocks. Light passing through and striking the two gauge blocks reflects a brilliant rainbow pattern

of light and dark lines. It is the position of these lines which tells the story. The dark lines are interference patterns where reflected light from the under surface cancels out reflection from the blocks. Each dark band indicates a vertical distance of one half wave length. If there is one dark band the difference in height between the two blocks is 11 millionths of an inch. If

there are two dark bands then it is 22 millionths. If the two blocks are identical there are no dark bands, only straight lines of brilliant color. If these lines are curved it means there is a bow in the block. If there are whorls or eyes it means a high or low spot is present. Blocks which develop irregularities that persist are junked. A surprising paradox is that the more exact the measurement, the easier it is to observe. With a pair of optical flats anyone can detect surface irregularities as slight as three millionths of an inch. If an inch were as high as a 16-story building a three millionth would be the thickness of this magazine page.

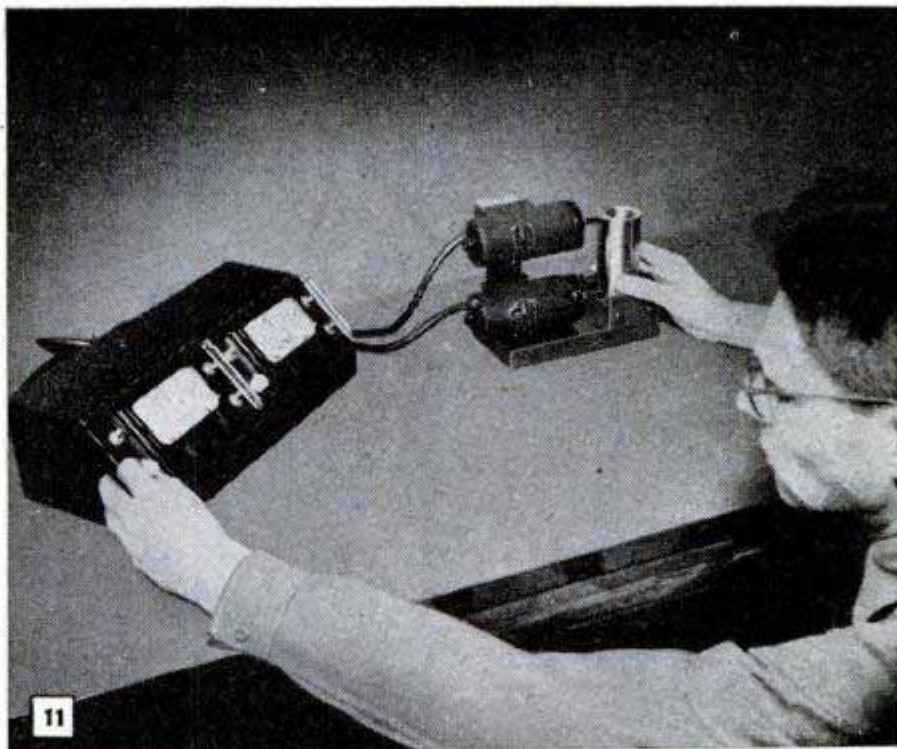
Optical flats are not confined to calibrating gauge blocks. They can be used directly in industry

for measuring the wear on a plug gauge and matching the diameter of ball bearings (photo 4). Notice that the color lines are so brilliant they can be photographed. To optical flats go the credit for the supreme perfection of gas seals on refrigerators and the high compression ratio of Diesel engines. Bearing surfaces and pressure seals are measured directly by means of flats as the machine is built.

Manufacturers of precision equipment, which includes everything from toy trains to locomotives and from vacuum cleaners to airplanes, use a tremendous quantity of gauge equipment. By use is meant actual consumption, not mere employment. Take plug gauges for instance. Each plug is lapped to a close tolerance. After the machinist or inspector has inserted it in fifty or a hundred holes, some wear is bound to occur. Periodically the plugs are collected and measured by the quality-control department. Rejects are ground down to the next smallest usable size. At first glance this seems like a terrible waste of expensive equipment, but the failure of one unit in service would often offset the cost of a thousand plug gauges. Modern industry cannot afford to take a chance.

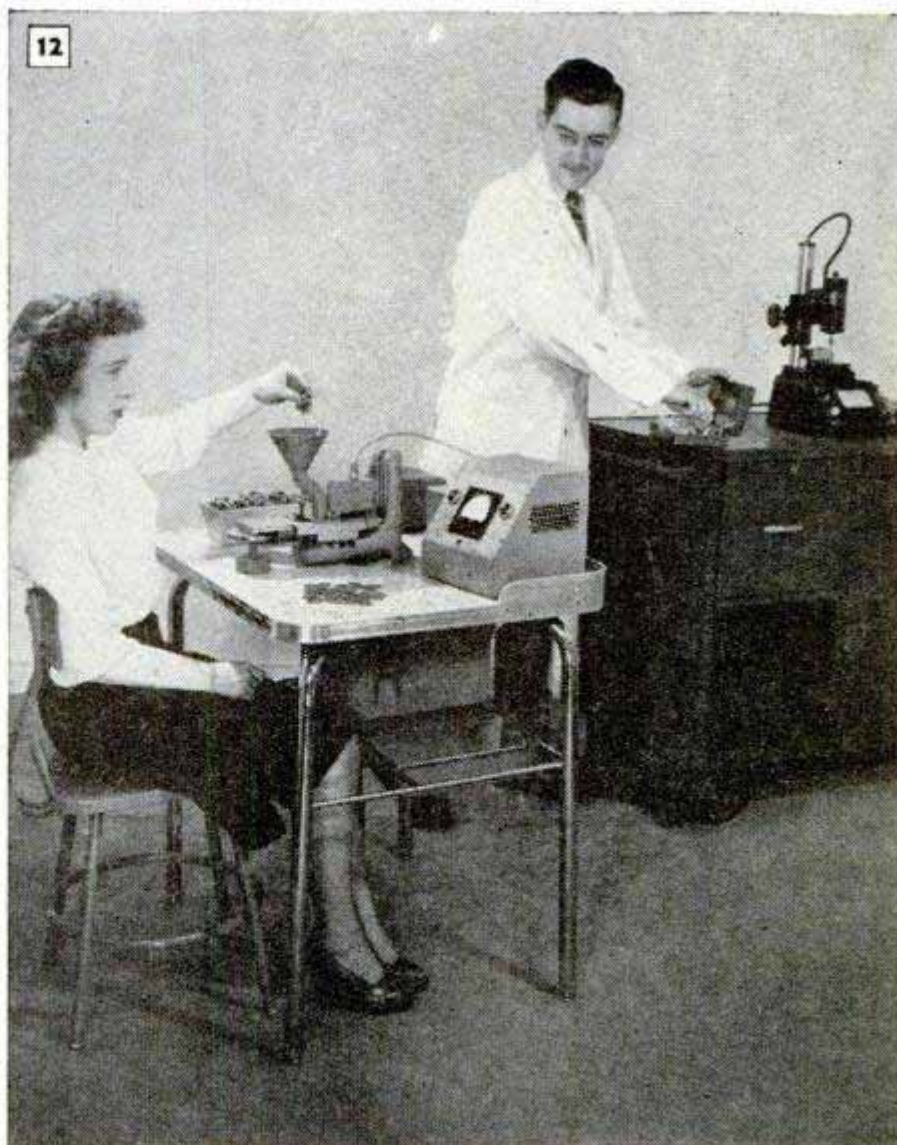
In addition to being used to set instruments and check other gauges, the Jo-blocks themselves can be used as production gauges. When a special setup is to be measured or a short production run inspected and time and circumstances do not warrant the purchase of a special plug gauge, the blocks can be placed in a holder between caliper

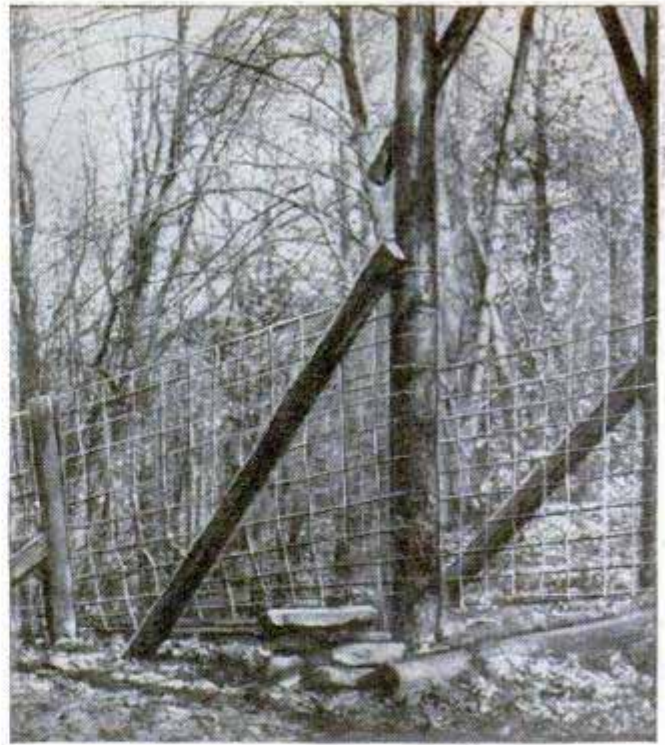
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This electromagnetic comparator works the same way as a phonograph pickup arm. Its sensitive needle reacts to infinitesimal amounts of pressure

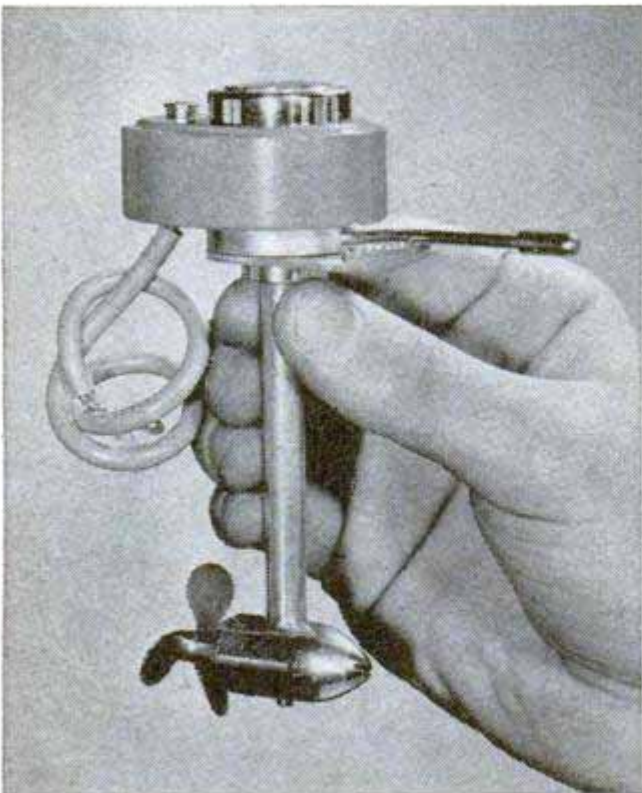
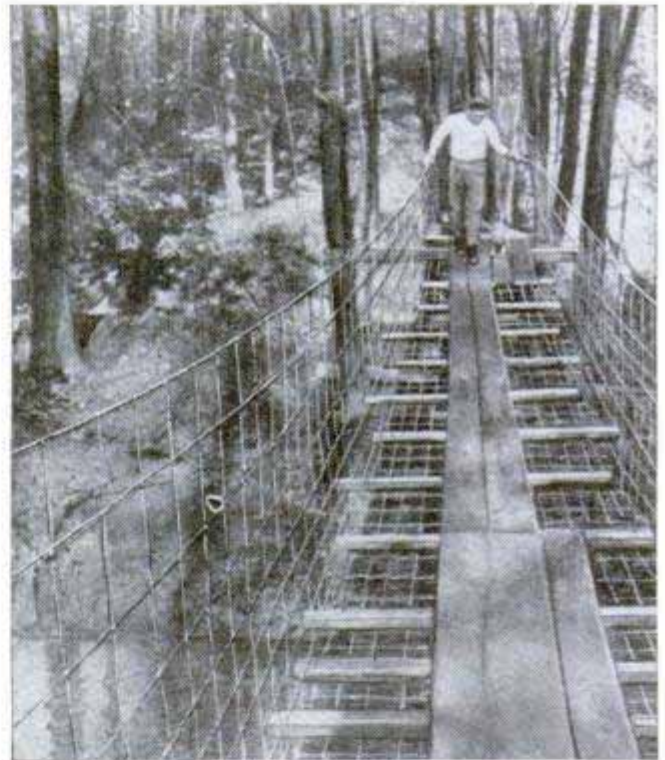
Below, electronic segregator sorts the good from the bad as the pieces are dropped into the hopper by the operator as fast as 10,000 an hour





Wire-Fence Suspension Bridge Is Practically Floodproof

Made of wire fencing, a 75-foot suspension bridge has eliminated the annual chore of rebuilding a foot bridge over a creek after every spring flood. Hanging high above the creek, the wire bridge, built by an Ohio farmer, is not damaged by the swollen river. A two-ton chain pull was used to stretch the fence between trees on one bank of the creek and two posts on the opposite bank. Heavy timbers brace the posts against the pull of the bridge. Two lengths of fencing are used as guard rails.

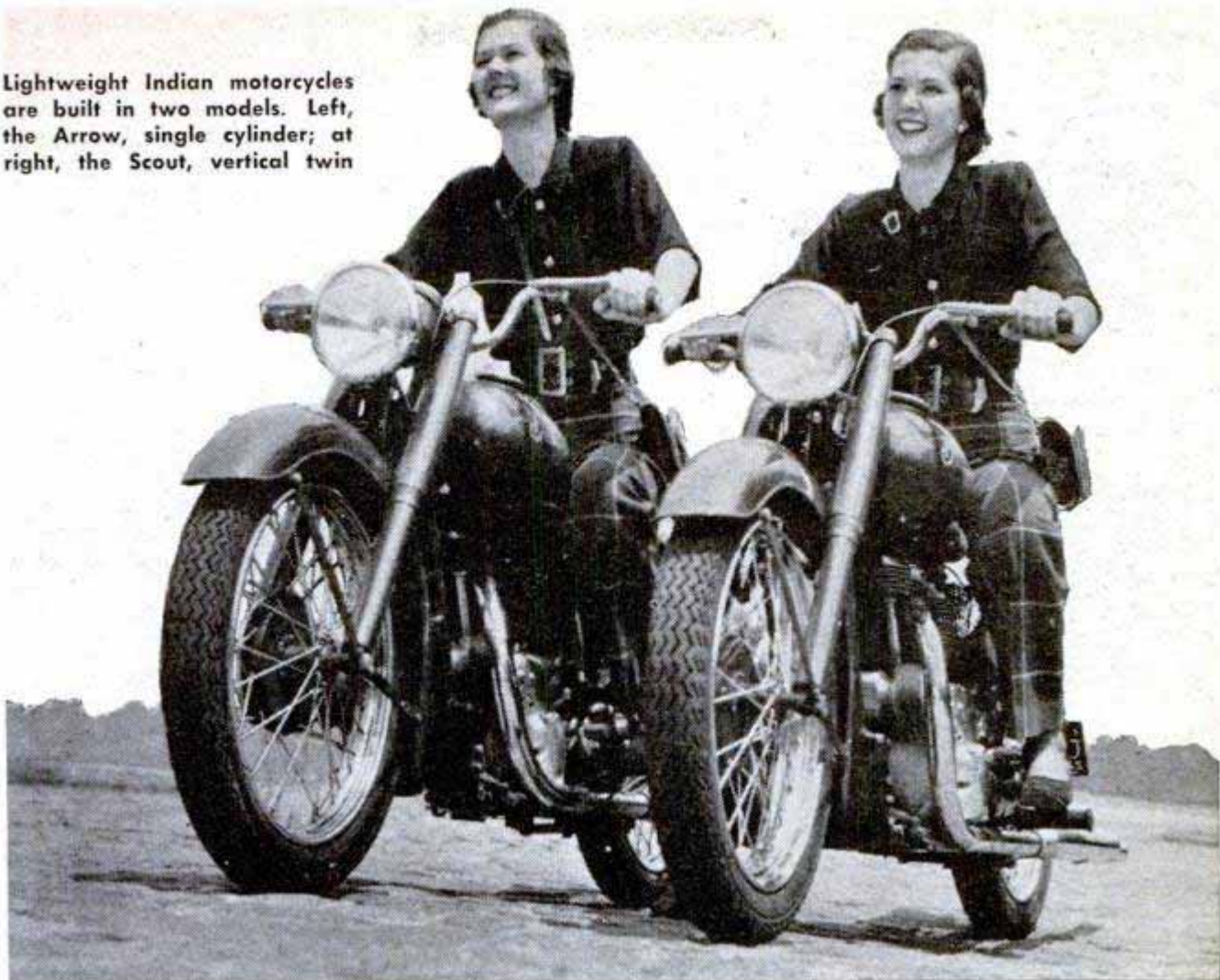


← Outboard Motor for Model Boats

Operating on a six-volt dry cell battery, an electric motor for model boats turns over at 5000 revolutions per minute. The motor can be installed on any boat from 12 to 24 inches long. Designed to look like an outboard motor, it is rustproof and has an adjustable tiller that can be locked to guide the boat in any direction. The motor is about five inches tall, has a 1 $\frac{3}{8}$ -inch-diameter propeller and weighs five ounces.

☞ Blind persons in Omaha circle raised numbers on special bank checks to denote amounts and sign them with thumbprint and signature.

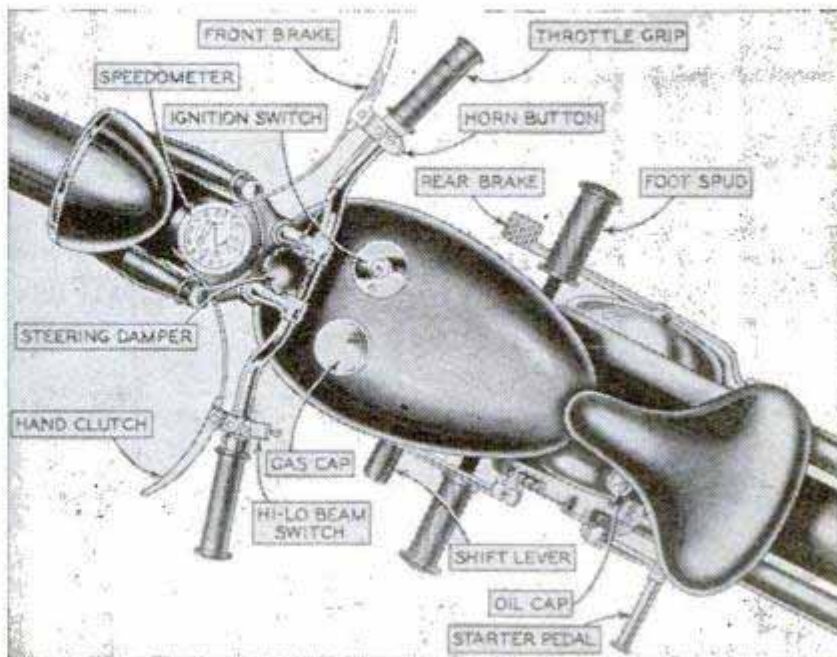
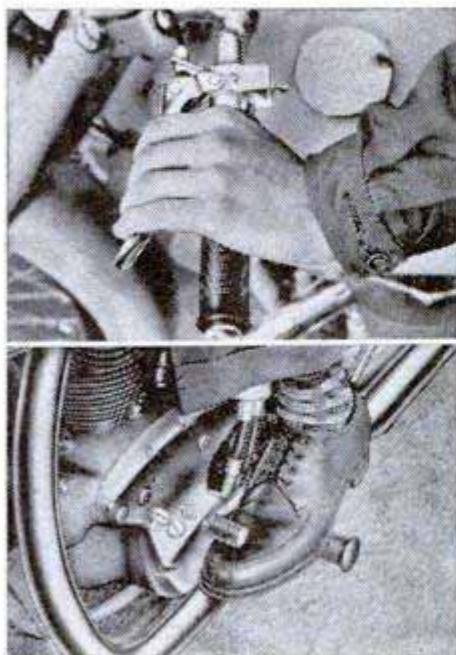
Lightweight Indian motorcycles are built in two models. Left, the Arrow, single cylinder; at right, the Scout, vertical twin



LIGHTWEIGHT MOTORCYCLES

Designed to outperform popular lightweight European motorcycles, two American models in that class are now in production. A single-cylinder model weighs 240 pounds and cruises at 60 m.p.h., going almost 100 miles on a gallon. The vertical-twin model weighs 275 pounds, and has a top speed of more than 90 m.p.h. Both have overdrive.

Lever on handle bar (left) replaces the old foot clutch and a light touch of the toe (below) operates shift pedal. Right, the controls are located so driver need not take hands off handle bars or feet off foot spuds

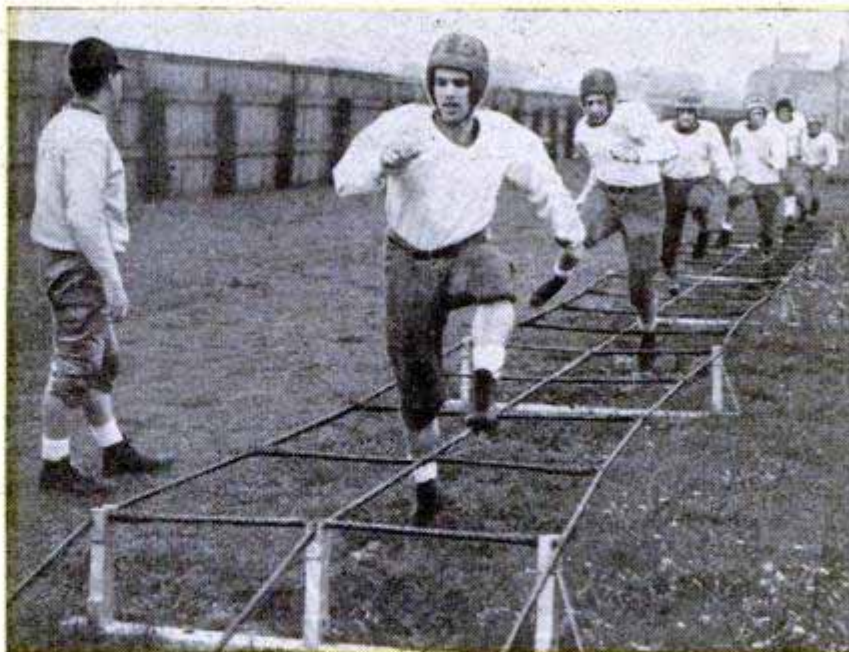


HOW TO WATCH A FOOTBALL GAME



What did you see in the photo above? If you are an average fan your full attention was on the ball carrier—completely missing blocker, center foreground, who is making gain possible

ON THE COVER is a rope maze used by both college and professional football coaches to teach players to run with a high knee lift that makes them more difficult to stop. It is also used in drilling them to twist, dodge and zigzag more effectively. Three ropes two feet apart extend the length of this patented training maze, with cross ropes every three feet, creating a ladder design. The ropes are about 15 inches above ground



University of Notre Dame photo

HOW ABOUT sitting down with me some time this week, Bernie, and explaining just what those backs of yours were doing in last Saturday's football game?"

Who asked that question? Some foreigner, trying to get the hang of a game watched by millions of Americans every fall? Far from it. The puzzled questioner was Bobby Hargrave, a star Notre Dame quarterback of the early 1940s. He was asking an old teammate, Bernie Crimmins, now Notre Dame's backfield coach, about a game he'd seen the week before.

Hargrave's plight isn't surprising when you stop to consider how much the "T" formation, the spinner system and other offensive twists have changed the football picture—especially from the stands. They all put the emphasis on deceptive ball-handling and faking so artful that even opposing coaches and scouts are fooled. One backfield was adept enough at this sleight of hand last year to gain national fame as the "Four Magicians."

Up through the 1920s and until the late '30s, football remained a fairly simple game to watch.

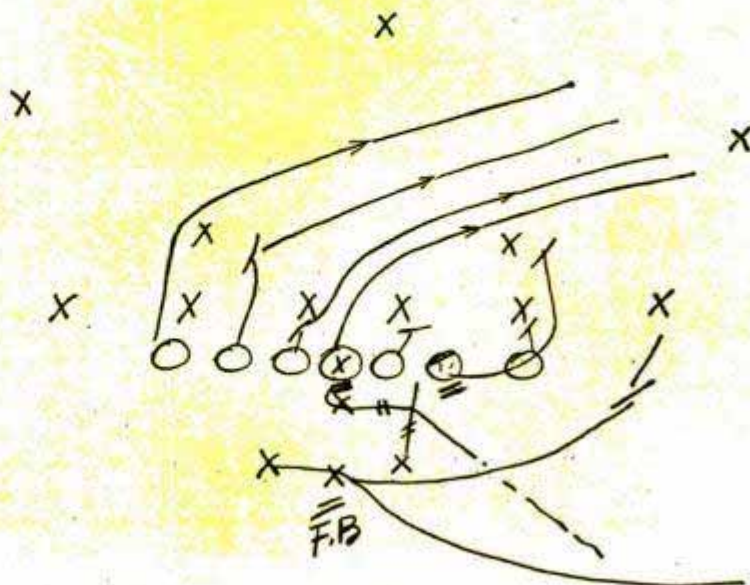
As drawn by Coach Crimmins, success of this end-run play depends on two perfectly timed blocks, by right tackle and the fullback, and clever faking by the quarterback who hands the ball to back racing toward line of scrimmage. Broken line is path of ball to actual carrier

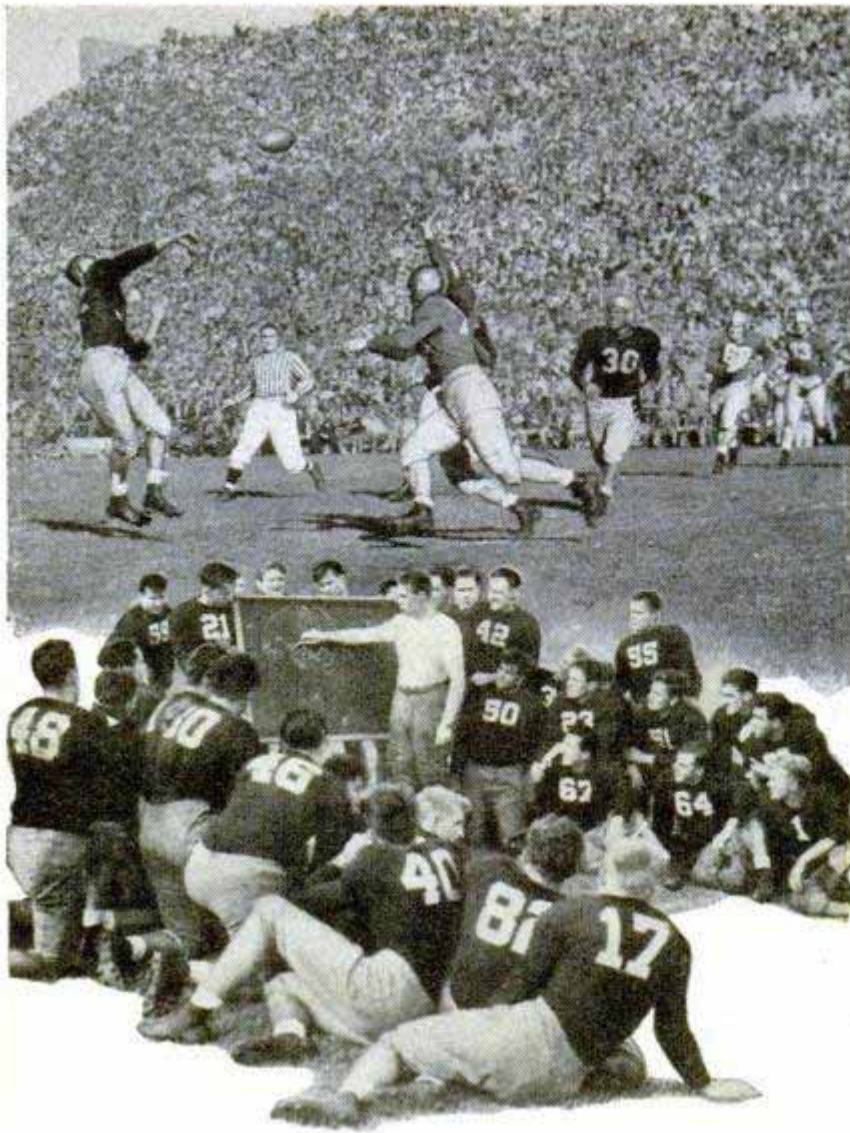
It put a premium on speed, shiftiness and power. Plays were set in motion by direct passes "floating" from the center to one of the backs, five to six yards behind the line of scrimmage, in full view of the spectators.

Now, with the popular "T" for example, there is a short, quick snapback—a man in motion to one side—and a concerted effort to hide the ball-carrier's identity.

The days when a dozen plays were enough to carry teams through a championship season are now long gone. One top professional team each season hands its squad members a full-size book of 500 plays, with instructions to know every one of them in complete detail.

No less an authority than Frank Leahy, Notre Dame's head coach and a man whose great teams entertain millions yearly, says





Top, two men rushing passer are coming in correctly, with hands raised high, forcing a high, fast throw. Above, Coach Frank Leahy of Notre Dame giving chalk talk in which each man's assignments are given

the average fan sees only about one fourth of the important action taking place on the field. Most spectators miss the blocks, fakes and decoys that mark a real team, according to Leahy. Others say that fans see even less of the vital play, the "little things" that may mean victory instead of defeat.

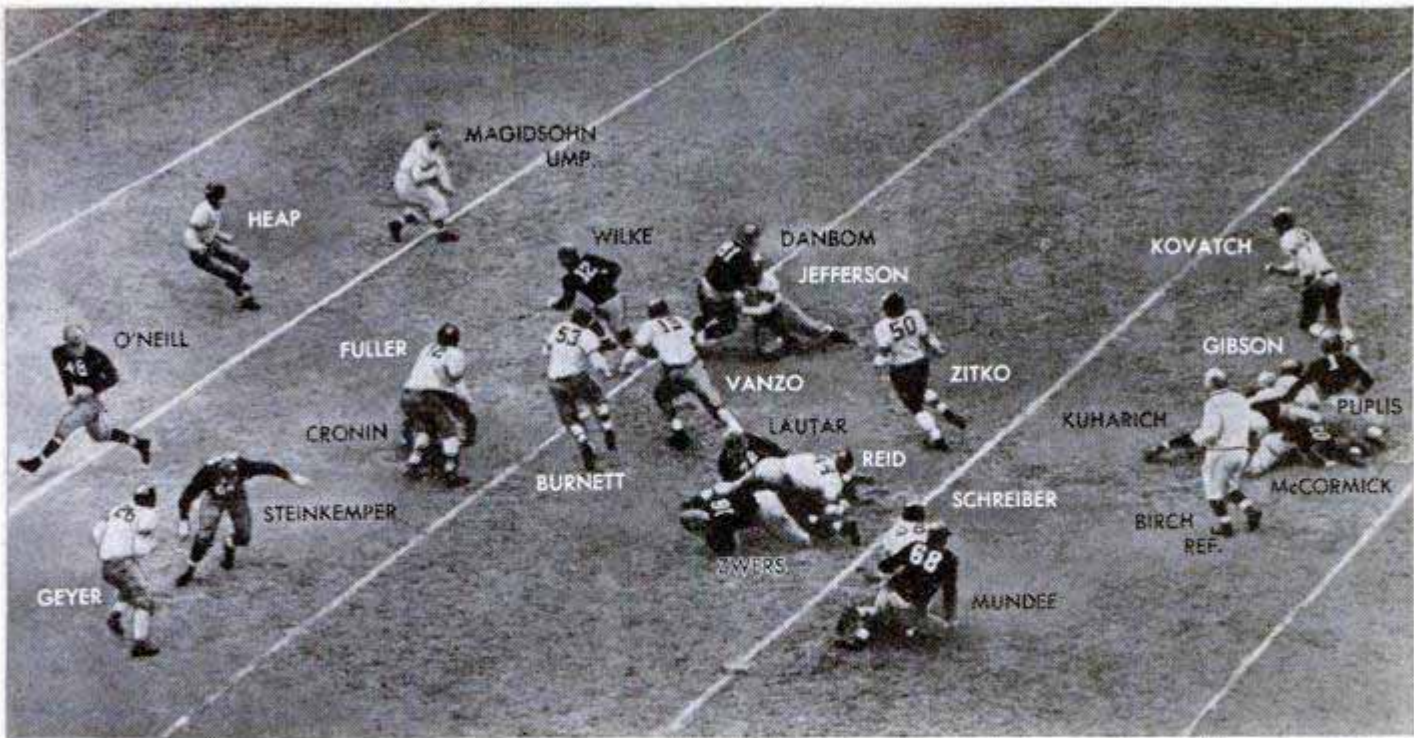
Here are six suggestions Crimmins offers fans on how to see more real football at a football game. As the first man in Notre Dame's history to win varsity letters at three different positions—halfback, fullback and guard—and as a coach and scout since, Bernie knows whereof he speaks. At guard he was practically a unanimous choice on the major All-American elevens of 1941.

1. Keep a wide vision, was his first and most significant piece of advice. Spectators generally make the mistake of riveting their full attention on a single point of action, totally oblivious of things happening only 5 or 10 yards away. Let your vision roam, Crimmins and

Below, illustrating the quick exchange of offensive and defensive roles, all 13 players at right have already switched their attention to the receiver, although the ball has barely left the kicker's toe

University of Notre Dame photo





One of football's rarities, a photo taken during Notre Dame's "perfect play" against Northwestern in 1936 that includes all 22 players. Wilke's path was cleared from far right as he sprinted 33 yards to a touchdown

others urge, so that you take in a bigger picture around the ball or its handler.

2. Select a half dozen of the outstanding players on the field, both linemen and backs, and focus your main—but not complete—attention on their efforts during parts of the game. This will help increase your understanding of each position's responsibilities, as executed by experts. Particularly note how they block, tackle and use their hands and weight. On the 1948 Notre Dame team, for example, Crimmins suggests that the play of Fischer, Hart, Martin, Sitko, Tripucka and Swistowicz should provide some interesting watching.

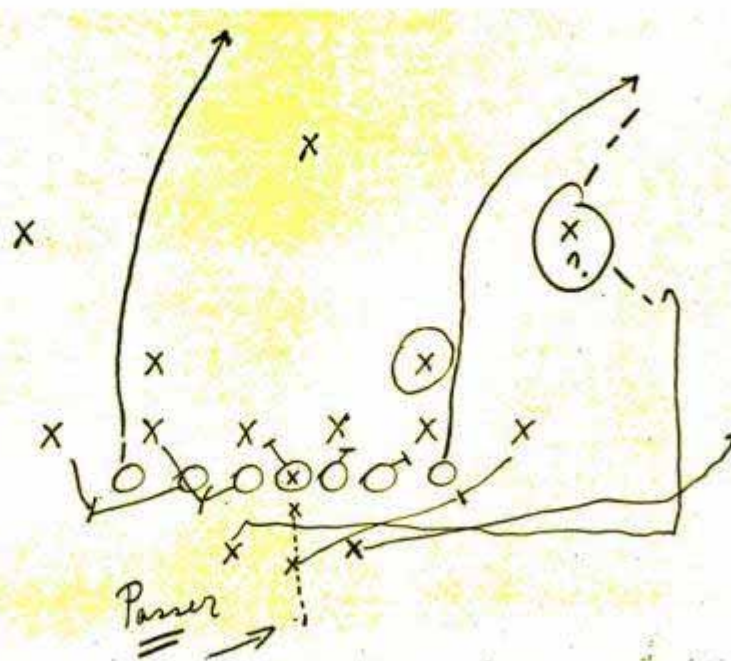
3. Once a play has progressed to the stage where a pass is almost certain, shift your full attention to the probable receivers and especially note their maneuvering, one of the most difficult and entertaining of football skills. The "acts" put on by ends and backs trying to get into position to catch the ball unhampered are the most vital part of the play, rather than their

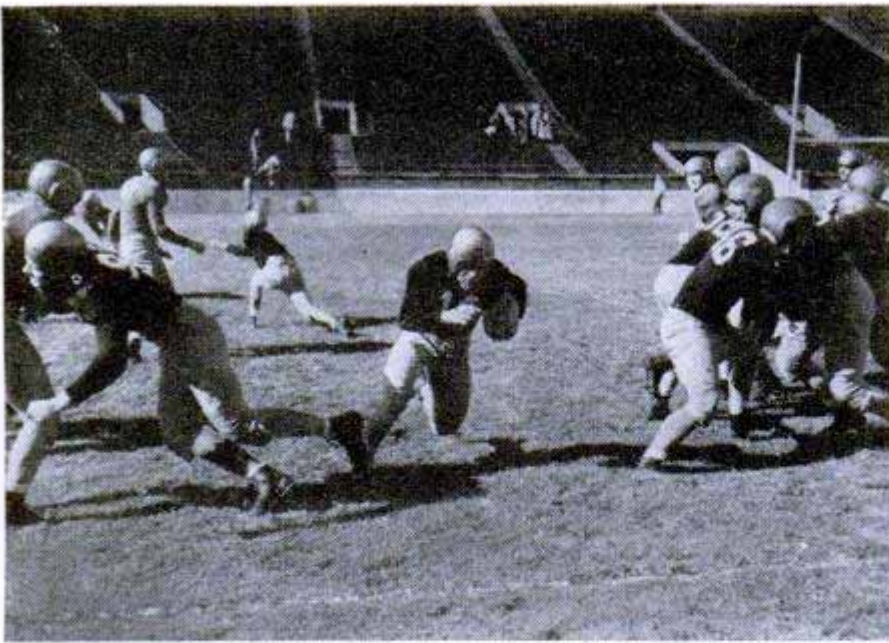
In this pass play, the offense "gangs up" on defensive half-back (circled x at right) and gives him impossible task of guarding two receivers, one in front and another behind him. Line backer (circled x at left) should shift right to help him

catching ability or the thrower's accuracy.

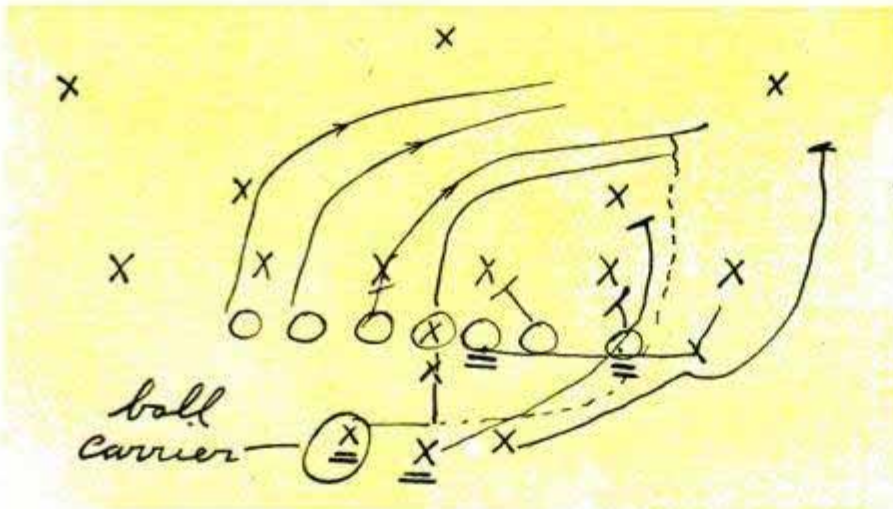
Generally, the receiver can do one of three things: run directly at the defensive back and then break to either side; run toward the defensive man and then retreat back toward the passer, or run out, stop, and then start up again quickly in an attempt to deceive and outrun the defenders. Some players will fake as many as four or five times on a single play before catching the ball. But whatever they do, and how they do it, offers action that is easy to watch if you're looking for it.

4. For a tip-off on pass plays keep an eye on the five men in the center of the offensive line. Knowing that those five men





On off-tackle run, players at right are blocking correctly, but the man at left is "reaching" and off balance. Quarterback is completing his fake in background. Crimmins' diagram below shows how this play works



Key men in play below are the three blockers in the center foreground. Ball carrier, right, will cut in when opposition is blocked out of play



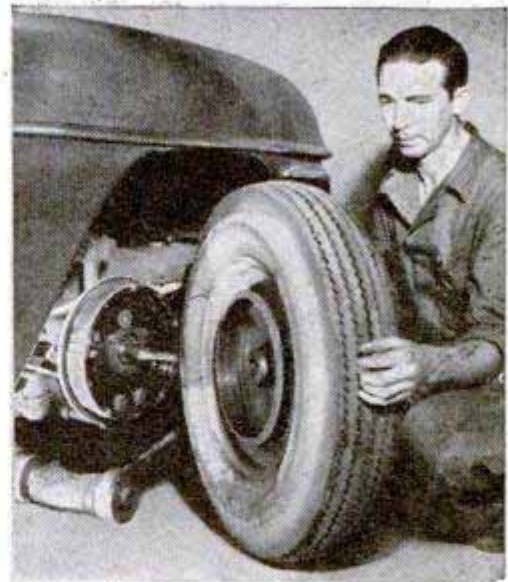
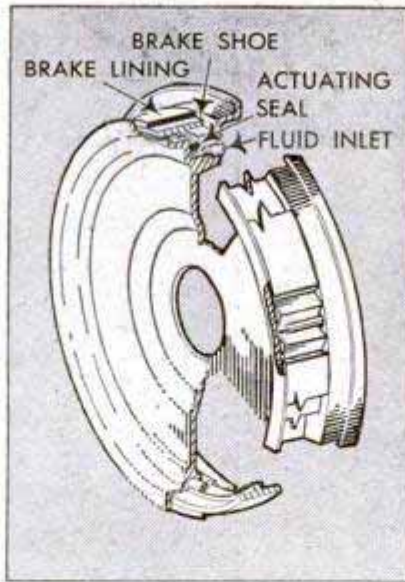
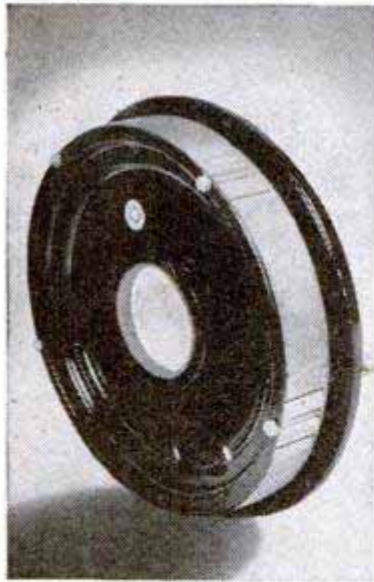
can't penetrate the line of scrimmage on a pass play, though they can move ahead after the ball is thrown, line backers and defensive halves watch them as a partial clue to the play that is shaping up. You can do the same thing.

5. Learn how at least three or four of the game's most frequently used plays work, so you'll better understand how the eleven players function together as a unit. On well-coached teams, every man has a definite assignment on every play. How well each does his job, from the ball-handler to an end racing away as a pass decoy, decides the play's success.

6. Ignore the ball and watch the players on punts. You'll see an abrupt change of roles once the ball leaves the kicker's toe. Blockers immediately become tacklers and tacklers switch to blocking, with the defensive ends sweeping downfield to force the receiver to take a path between them.

Crimmins and most other trained observers prefer to watch games from near the center of the field and high up—in the second deck if there is one. Occasionally, they'll choose a seat high in the end zone, if they are looking for some special detail. This is one of the few spectator sports where seats closest to the playing field are not considered best by experts. With the choice of locations in an empty stadium, many big-time college coaches trudge up to the second deck during practice so they can better detect individual playing flaws. So don't feel badly if you fail to get that sought-after sideline seat on the 50-yard marker.

Simplified Hydraulic Brake for Cars Has 50 Percent Fewer Parts



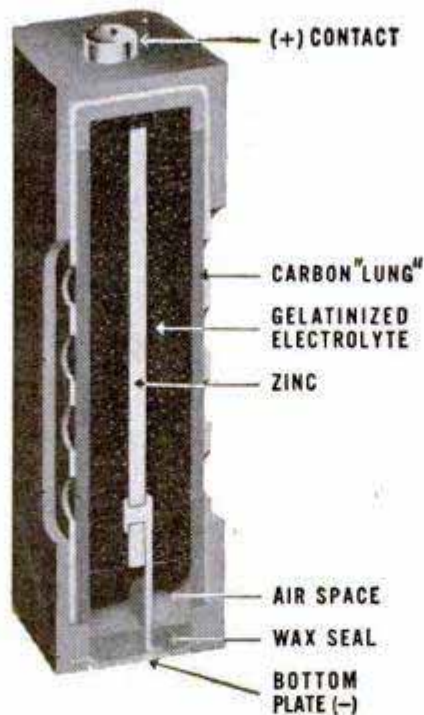
Simplified Martin brake was adapted from new airplane brake and engages all of drum. Complete brake assembly is shown at left. The brake at right is inspected after extensive road tests. It showed but few signs of wear

Originally developed for use on airplanes, a new hydraulic automobile brake has 50 percent fewer parts than conventional types. The brake requires no wheel cylinders, pistons or linkages and is said to be ideally suited for the smaller wheels with less room for brake mechanism. A continuous ring seal fits in a groove in the brake-shoe support and hydraulic fluid, actuated by the brake pedal, enters this groove and forces the shoe outward. This actuates the brake shoe in virtually a 360-degree engagement with the drum. In con-

ventional brakes the shoe lining engages only a fraction of the drum. The brake is extremely responsive to a light touch of the foot because full movement of the actuating seal is attained with relatively little fluid. The new brake, developed by the Glenn L. Martin Company, has been under tests for two years. Although it has been licensed for manufacture by the U. S. Rubber Company, extensive road tests in all kinds of weather are continuing and no plans for mass-producing or marketing the brake have been announced.

Hearing-Aid Battery "Breathes" as Used

Hearing-aid A-batteries which actually "breathe" are said to last three times as long as conventional types. An activated-carbon electrode acts as a "lung," permitting oxygen from the atmosphere to enter the battery to depolarize it. In conventional batteries, manganese dioxide is added to the mix to perform this depolarization. Because air does it in the new battery, more energy-producing chemicals can be packed in the same size case to provide more power. Air polarization is more efficient, also adding to battery life. When shipped, the battery has a sealing strip to prevent it from "breathing" until it is ready



for use. The new battery has virtually constant voltage and can be used continuously without decreasing its effective life.



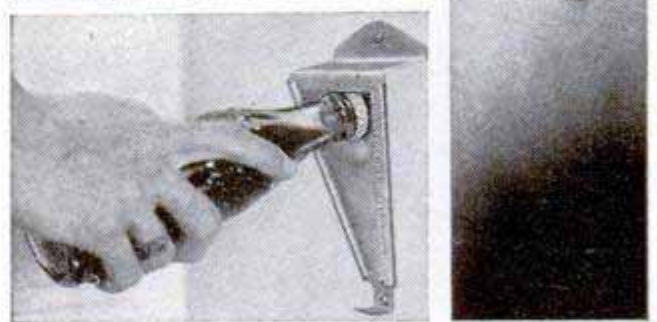
Hand Truck Moves Paper Rolls

Designed specifically to handle rolls of paper, a hand truck lifts and transports heavy cylindrical objects of any type. It can be used for moving drums, barrels and coiled wire as well as paper rolls. The truck is wheeled up to the roll and the top arm swung in place against the roll. A fingertip control locks the arm in place, holding the load securely. The truck is then tilted back and the load wheeled away. Two models are available, one for loads up to 800 pounds, the other for loads up to 1500 pounds.

Walking Robot → Has Radio Controls

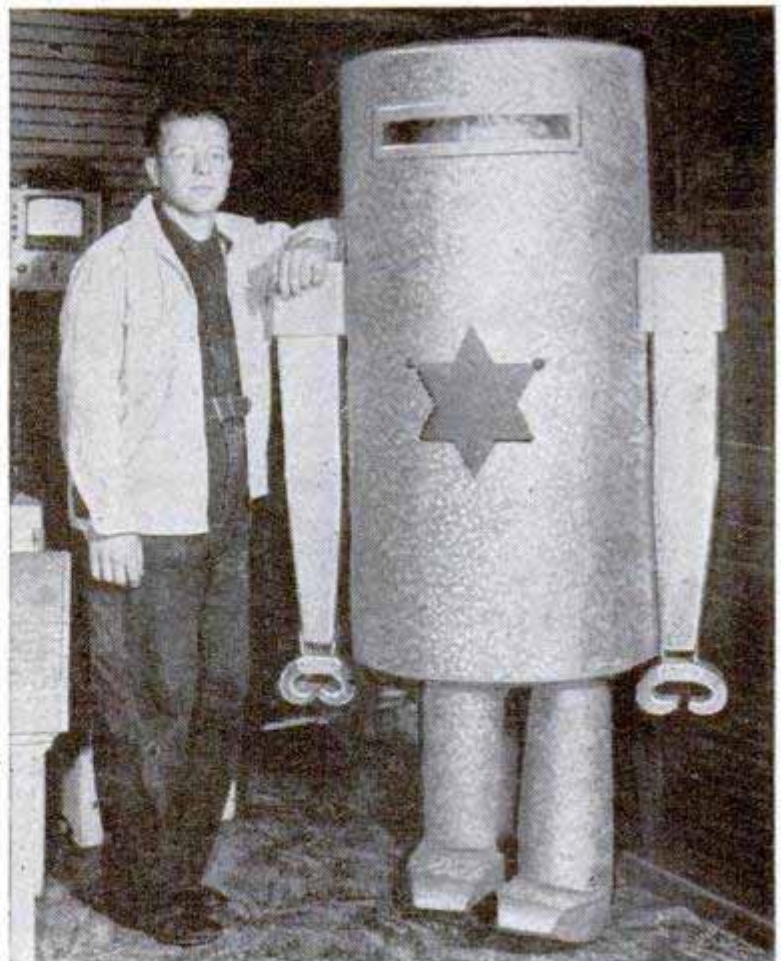
Controlled by a radio installed in a truck, a 400-pound robot can walk under its own power. The mechanical man, built by Reat Younger of Springfield, Mo., stands over six feet tall and weighs 400 pounds. Younger was intrigued by a robot he saw in a motion picture when he was a boy, and started building his own automaton while he was in high school. He now is working on plans to make the robot walk through a complicated system of transmitters, receivers and relays.

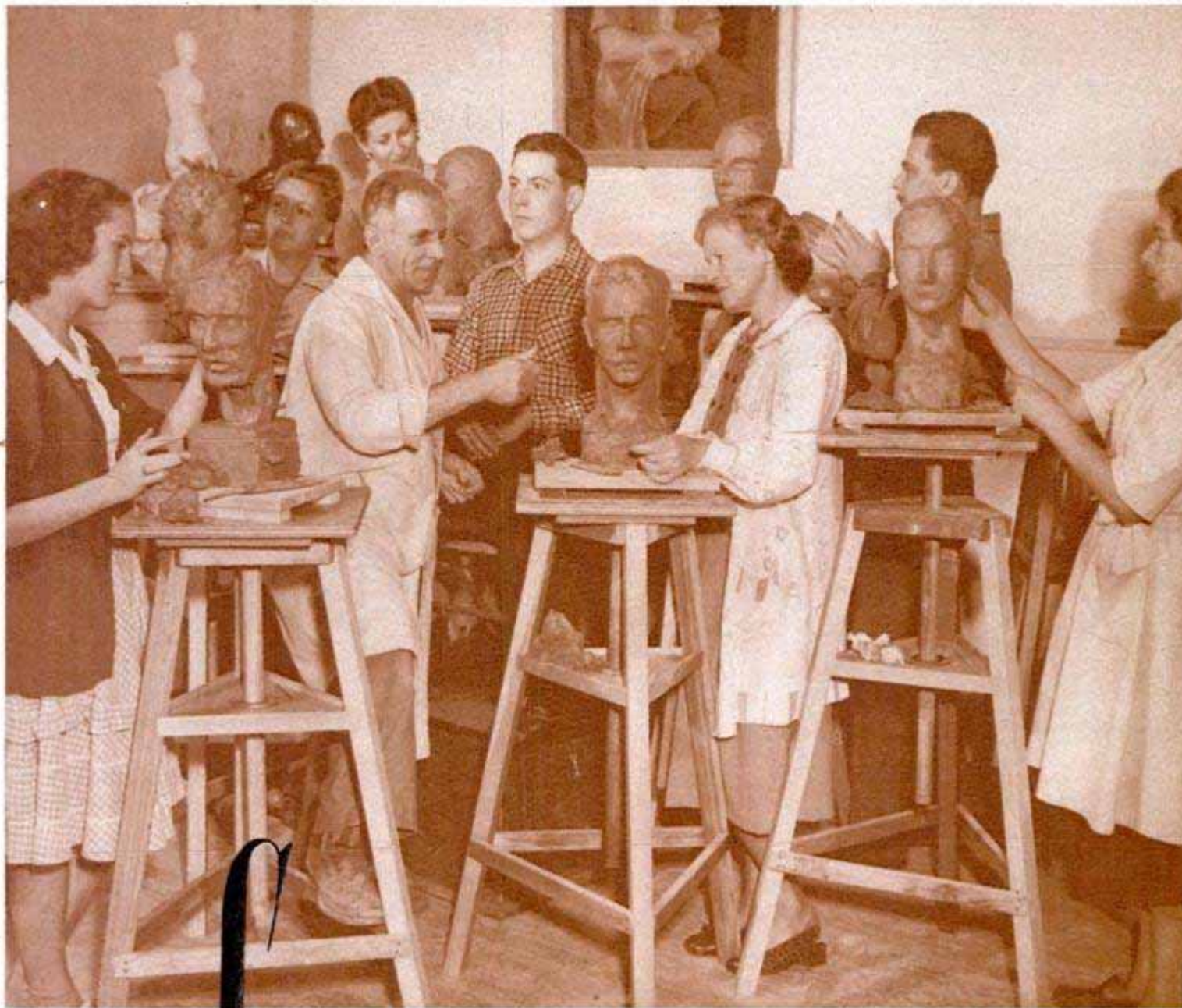
☐ Overseas shipments of steel products from this country during World War II totaled an estimated 123,800,000 tons.



Opener Pries Lids From All Jars

Lids can be removed from all types of glass containers including Mason jars with an opener that fastens to the wall. Metal teeth grip the lid of a Mason jar firmly while the container is rotated. A recess with a projecting lip pries the tops from soft-drink bottles.





Amateur artists in clay are taught by Sculptor Ott at his once-a-week class

SCULPTURE FOR FUN

By Richard W. Emery

Photos by Ray Chapin

A GOOD sculptor can design anything from a kitchen kettle to a monument with his clay. He knows that sculpture is not just for the art gallery. It's a means of putting into three dimensions the ideas that can be sketched on paper in only two.

Industrial modelmakers are sculptors. Their work is practical. It may or may not be art—but just like the statue in the park, it starts out with clay.

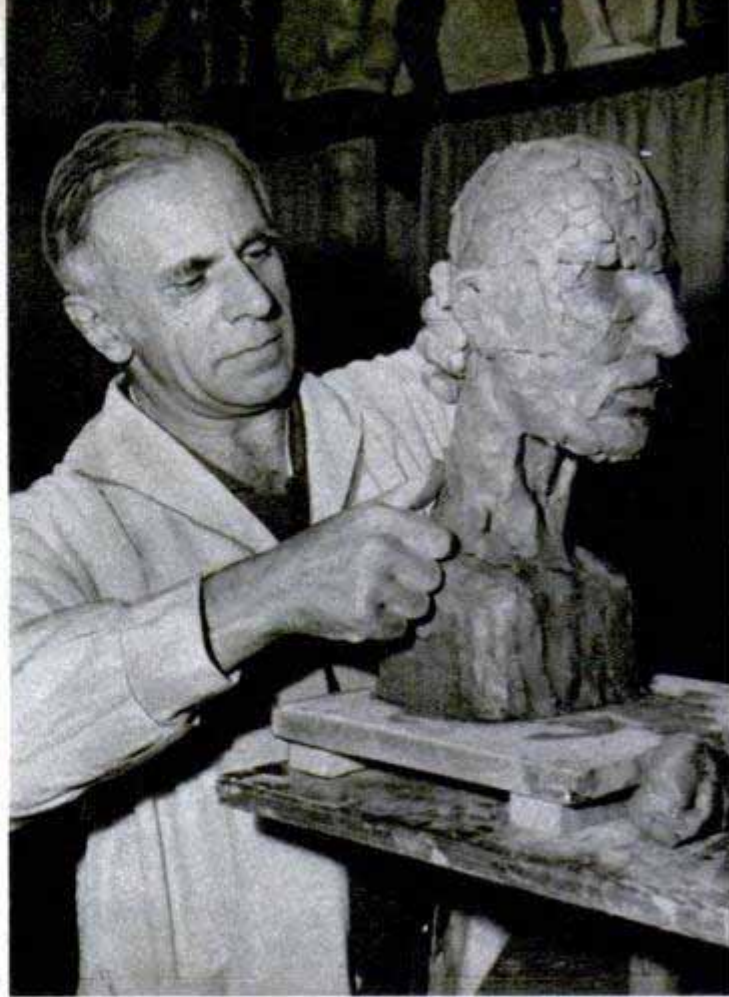
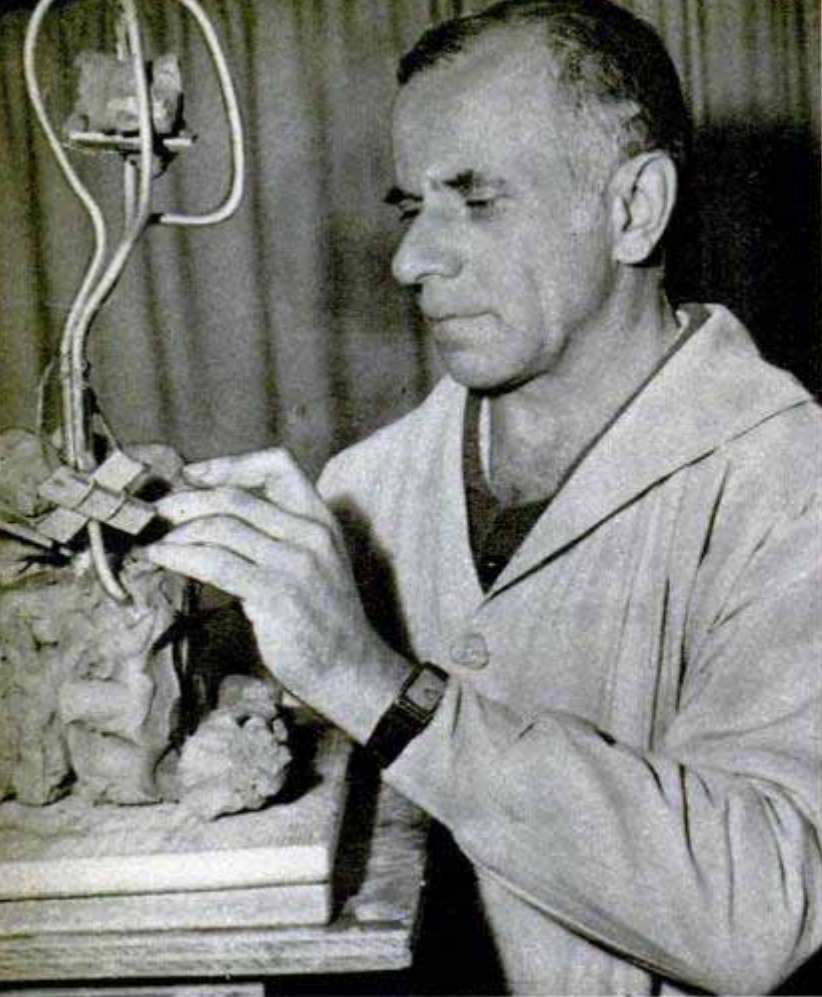
In the sculptor's hands, clay is a wonderful building material. It can be measured, it can be cut, it can be added to, or bent or hammered. From a clay model, a plaster mold can be made. And the original clay

model can then be reproduced over and over in a permanent material such as metal or concrete.

Because clay modeling is a popular hobby, many sculptors teach classes of amateurs who claim no artistic genius. They frankly admit they are "sculpting" just for fun, and they'll laugh with you over shortcomings of their work.

"But just wait," they say. "My next one will be better!"

In a sunny studio in the hills of Laguna Beach, Calif., a distinguished sculptor, Peterpaul Ott, puts his own work aside one day each week to teach a beginners' class.



Left, sculpturing a head starts with this frame, called an armature. The wooden crosspieces or butterflies prevent clay from sagging. Right, clay is added, first in large, then in smaller pieces to form the figure

"And why not?" he asks. "I have always thought, why should sculpture not be fun? In the Old World where I was taught, if we made a mistake we got our knuckles rapped with a stick!

"There was no fun in those lessons. Here in my class, if we make a mistake we laugh about it. We start over. That is a better way! That is the American way.

"And once in a while, I find a pupil who learns rapidly and well. And I go along with his progress. For him—whoever he is—I have great hopes. Sculptors are needed in America."

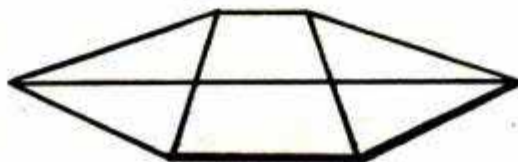
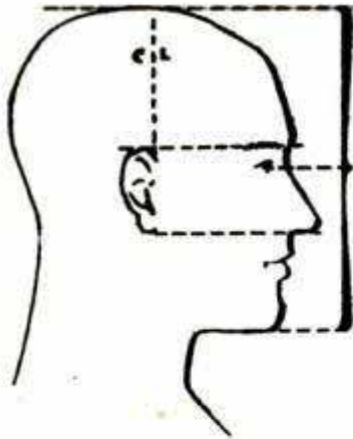
To start a beginner, Ott supplies a board and plastic clay.

"First, pick up a handful of clay. Work it between your fingers. Mold it into simple geometric figures—get acquainted with it!"

The clay needs an anchor to keep it from skidding on the modeling board. If the model is small—up to fist-size—a couple of nails driven partly into the board will hold the clay. Larger models call for larger armatures, which serve as skeletons for the work to be done. A wooden peg, driven in at a slant, will hold a sculptured head on the board. For head and shoulders, the armature is a sturdy skeleton of pipe and wire, with floating supports called "butterflies" to prevent the clay from sagging.

The work in clay modeling calls for building a model to proportion by adding smaller and smaller quantities of clay. The principle is the inverse of the cutting and chipping process. In general, the wire skeleton should be designed so that its wires represent the center of the arm, leg, body or head.

Above left, sketch shows placement and proportion of features. Left, facial features rest on curve formed by round head. Below, geometric figure aids in forming lips



"You can then add clay equally around the wire. Students like to rush ahead on one part of their model—a nose, or an arm, we'll say. They cannot wait to finish it.

"After a few bad starts that way, they learn that they must bring their work up to the same degree over the whole model before going farther. The work must progress as a unit. Only then, can proportions be kept right!"

Ott gives his pupils this Rule One: *Don't start details until proportions are right.* The rule applies to constructing the armature and to later work with clay. You can compare the armature with the subject of your modeling by sighting with one eye, lining up key points as shown in the sketch on page 140. Later, the same check can be applied to the clay masses.

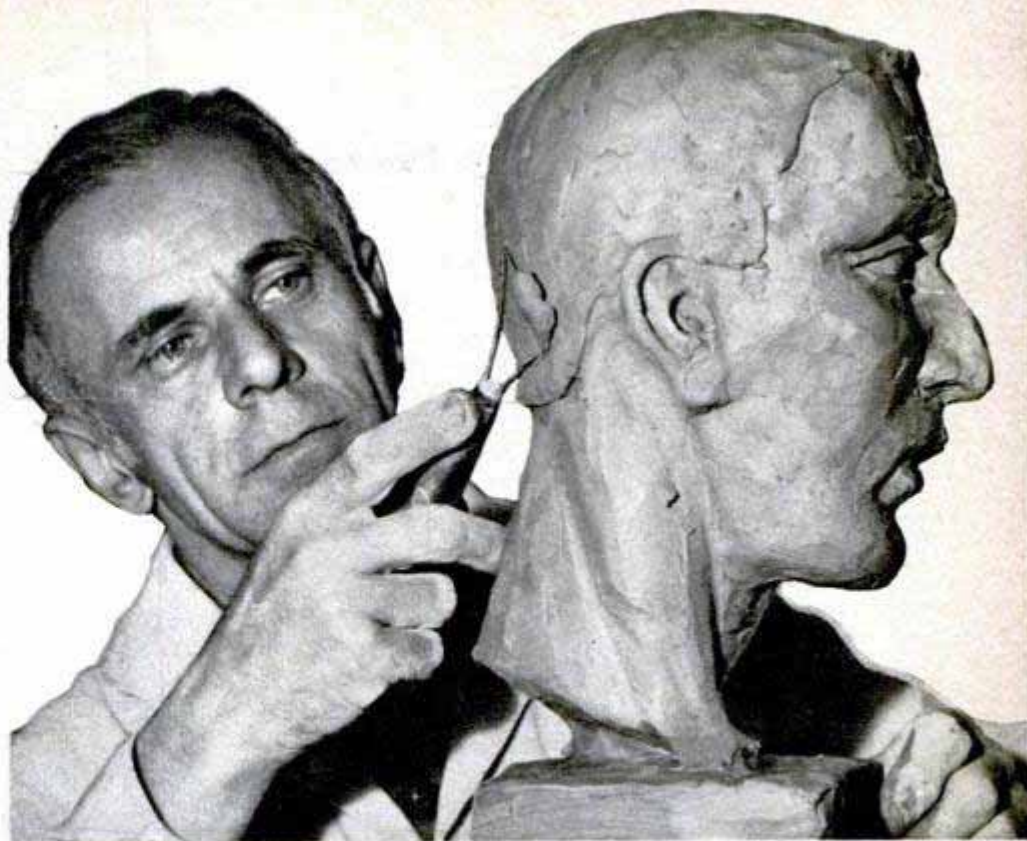
"Use your eyes! Sharpen your observation! As your work progresses, turn your model constantly; sculpture must be round. You must look at your work not just from front and back and sides, but from high and low."

How about calipers? Ott says not for first measurements. He believes that much of the fun in sculpturing comes from training your eye to measure what it sees, and from training your hands to translate those measurements into three-dimensional clay.

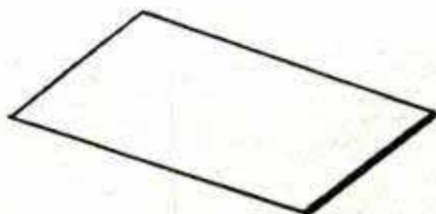
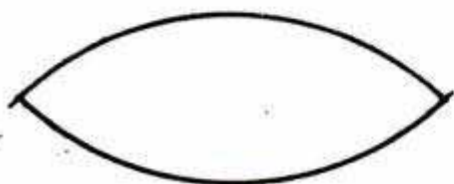
"Use calipers only to check possible mistakes," he says.

When your sculpture piece approaches right proportions in its over-all outlines, build it very gradually out to final dimensions by adding tiny pellets of clay. Roll them between your fingers one at a time and press them upon the surface of your work where it needs more clay.

Below, the eye is not shaped like a buttonhole (left), but fits inside a figure shaped as in center and looks like the sketch at the extreme right



Above, a wire tool is used for final trimming where too much clay has been added. Below, Sculptor Ott instructs his students to use their fingers rather than tools for all but the final work on the figures. But for delicate work such as forming an eyelid, he uses a wooden modeling tool because the fingers are too blunt for this



This process will give your work an alligator complexion, but don't let that disturb you. The problem is to get the work in correct proportion; in the finishing stage you can polish up the surface by filling cracks between flattened pellets.

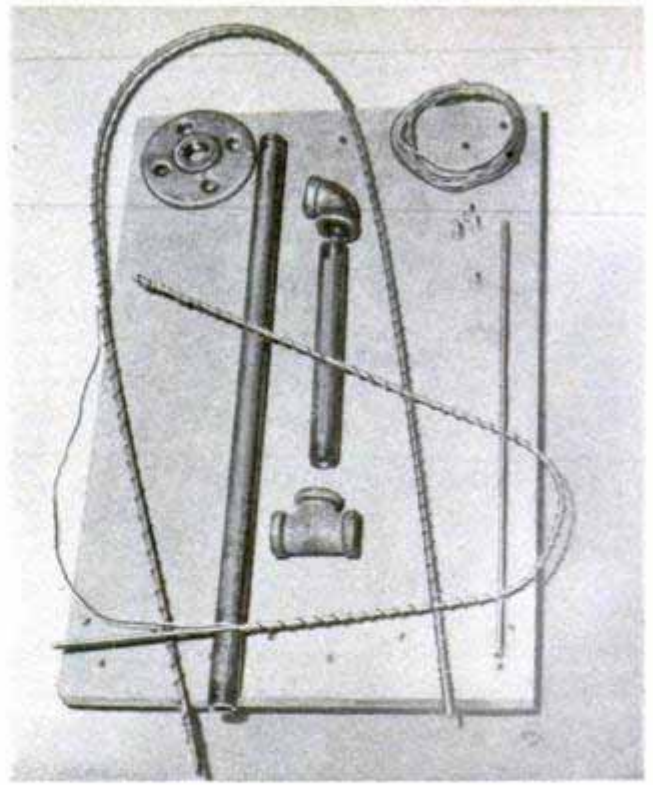
Rule Two in Ott's class for beginners is this: *Build with small pieces of clay.*

The sculptor suggests, also, that his students keep a generous supply of clay close to their work. "That's always a student's problem," he says, "having enough clay. Keep it handy in a big bucket where it can be covered between working periods."

Ott believes that the best tools for clay modeling are the fingers.

"The longer you work with sensitive fingers instead of insensitive tools, the better for your work. *Tools should be used only for finishing!*" (That's Rule Three.)

Beginners trying their first sculpture of a head are almost sure to make the head somewhat square, instead of round, Ott says. To check against this error, study your work from all angles as you build. Complete the basic form of the head and then add the projecting features—the eyebrows, nose, cheeks, lips, chin and ears. Note the basic form in the accompanying illustration, which shows the relation between this curved surface and the features.



These look like something the plumber might carry, but they form the frame that holds the clay upright

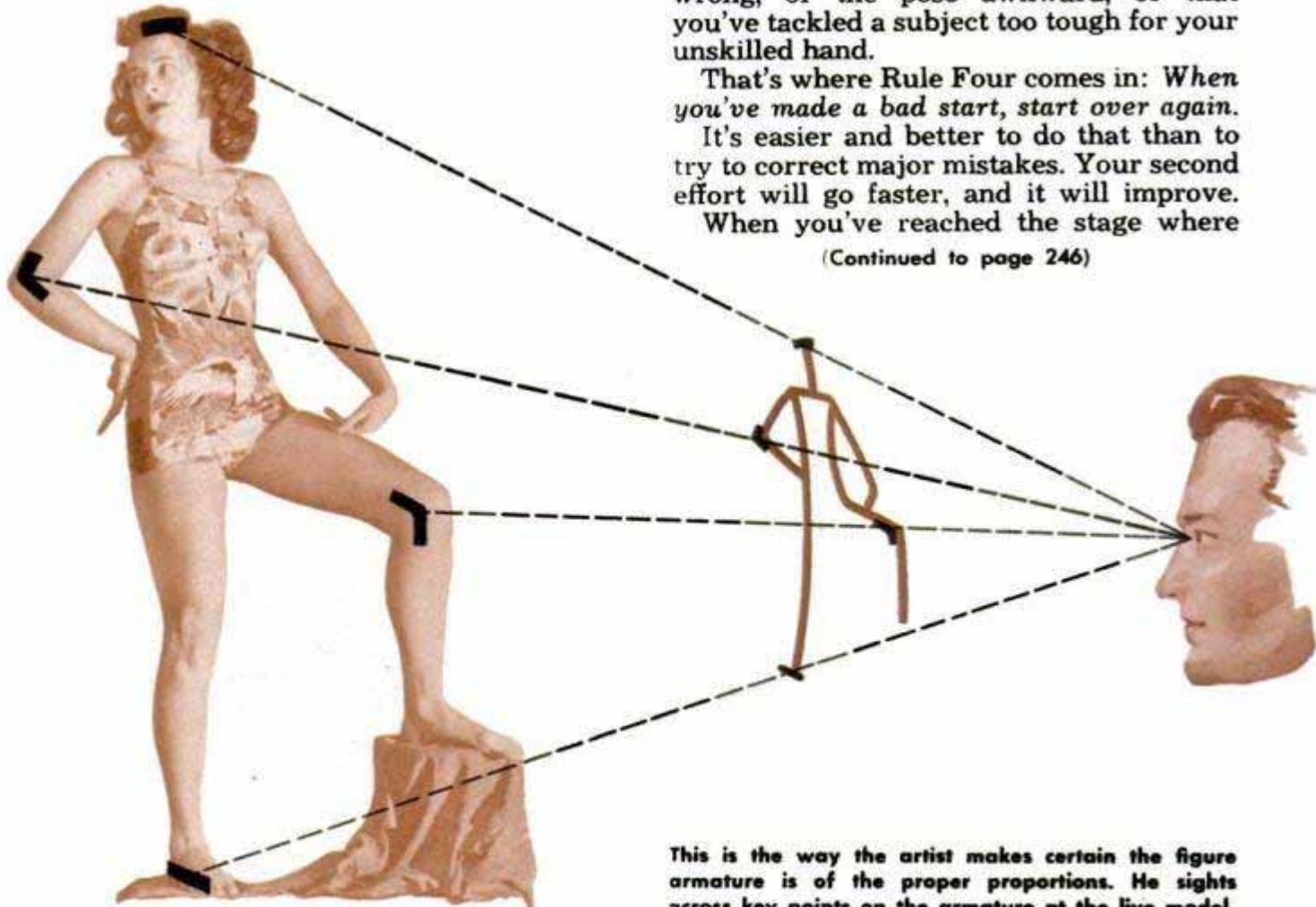
Somewhere in your first sculpturing project, you may suddenly decide that you've got the proportions hopelessly wrong, or the pose awkward, or that you've tackled a subject too tough for your unskilled hand.

That's where Rule Four comes in: *When you've made a bad start, start over again.*

It's easier and better to do that than to try to correct major mistakes. Your second effort will go faster, and it will improve.

When you've reached the stage where

(Continued to page 246)

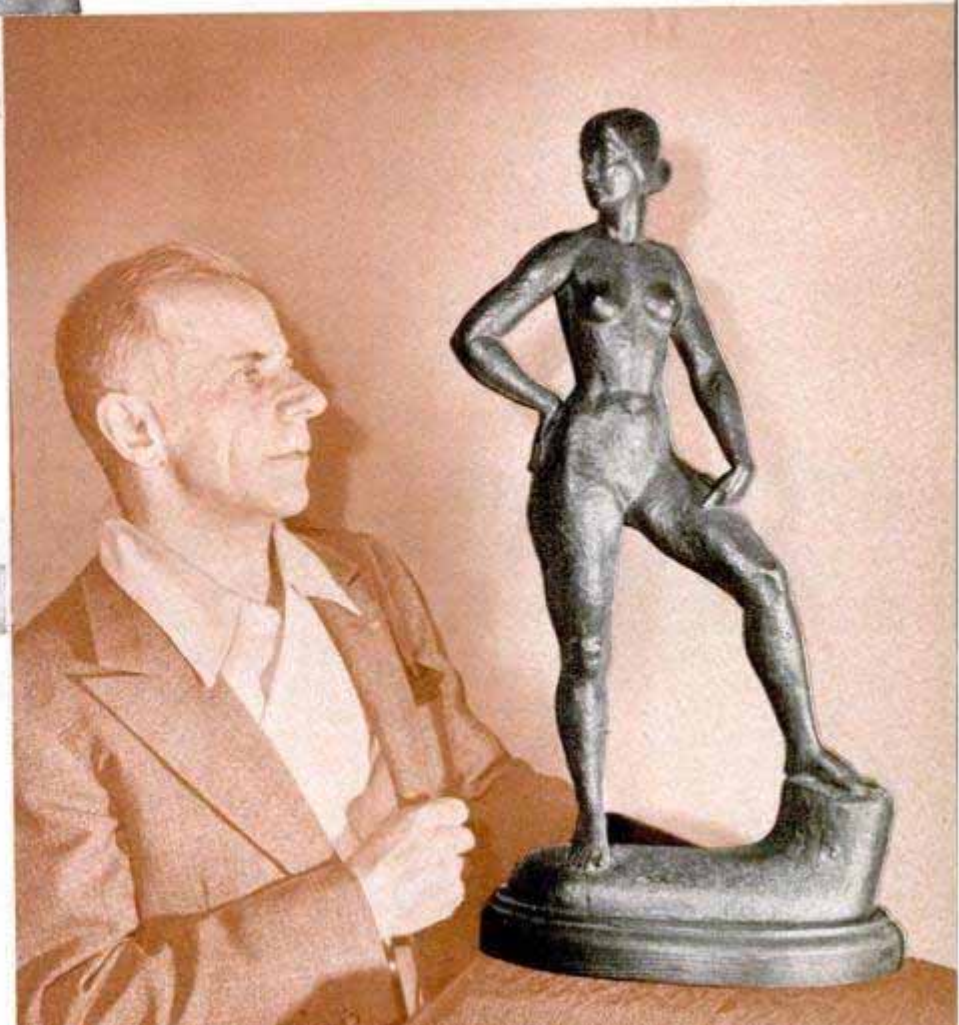


This is the way the artist makes certain the figure armature is of the proper proportions. He sights across key points on the armature at the live model. The wire of the armature must be aligned with center of arms, legs and body since clay will be added



Upper left, Ott, having assembled the figure armature, is now bending it to match the subject's pose. This will provide the framework on which he builds up the clay figure. Above, small pieces of clay are pressed around the wire armature as the figure slowly develops into a likeness of the model. The entire sculpture is kept in approximately the same stage of development in order that its proportions remain accurate. For most of the work, Ott needs no tools but his fingers. Only in final work are tools used

Above, rear view of the sculpture shows how the armature is supported by a pipe. Clay already covers the front of the wire frame and small pellets of clay are being added to the rear. On completed figures, equal amounts of clay surround the frame on all sides. At right, Ott poses with a finished bronze. Made by pouring molten metal into mold made from clay statuette



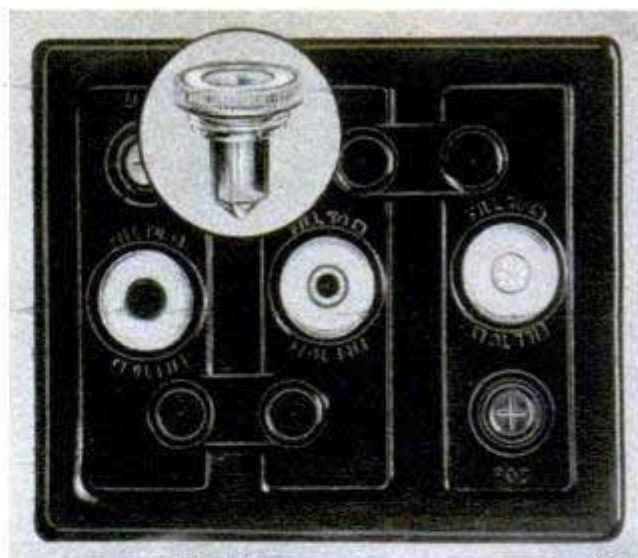
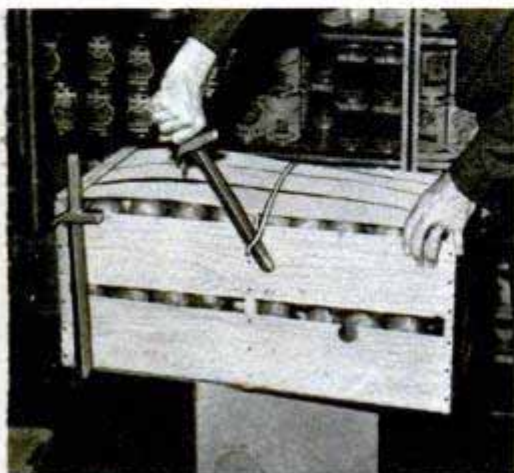


"Trailer" Unit Powers Lawn Mower

In 10 minutes you can convert your hand lawn mower into a power mower by adding a gasoline motor mounted on a trailerlike chassis. The motor drives two rubber-tired wheels that push the mower. To attach it, you remove the handle from your mower and bolt the chassis in place. The handle is then attached to the rear of the chassis. It can also be used to push hand cultivators or other wheeled implements.

Daggerlike Tool Opens Boxes

Resembling a long dagger, a box-opening tool can be used for six different purposes. It serves as a hammer, crowbar, nail remover, tacker, knife and staple remover. The tool is made of steel and has a long blade that is unsharpened so that it can be used as a handle.



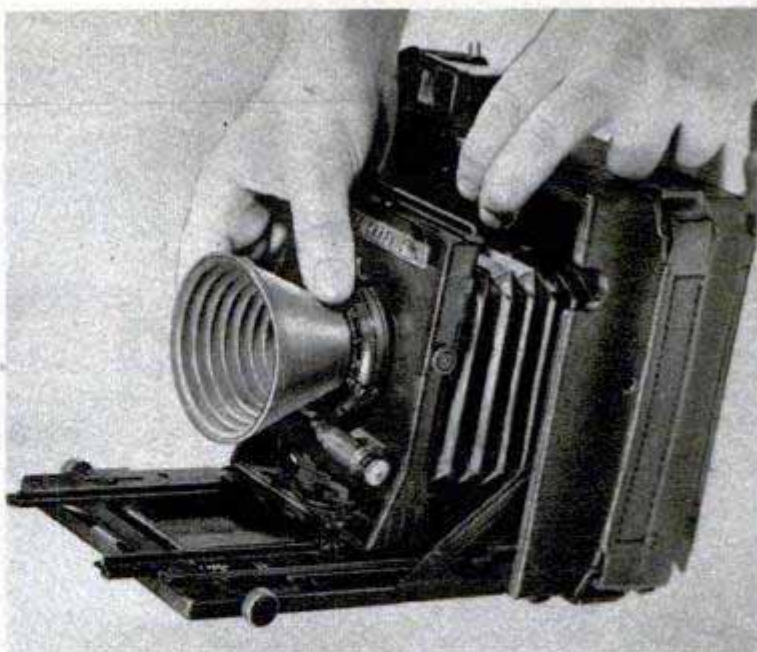
Battery Plug Shows Water Level

Motorists can "see into" their storage batteries to determine the water level when a new battery plug is used. Prisms at the bottom of the plug refract light when not in contact with water. When the prisms are covered with water a solid black disk can be seen through the plug, meaning that no water is needed. When the water is low the words "add water" can be seen by looking down the barrel.

Auto Desk Swings Out of Way

Swinging out of the way when not in use, an auto desk provides a sturdy writing surface and is complete with paper pad and pencil. It is attached with one bolt to one of the "knock out" holes found under the dash. The desk is handy for salesmen, doctors, shoppers and others who have occasion to jot down notes while driving.





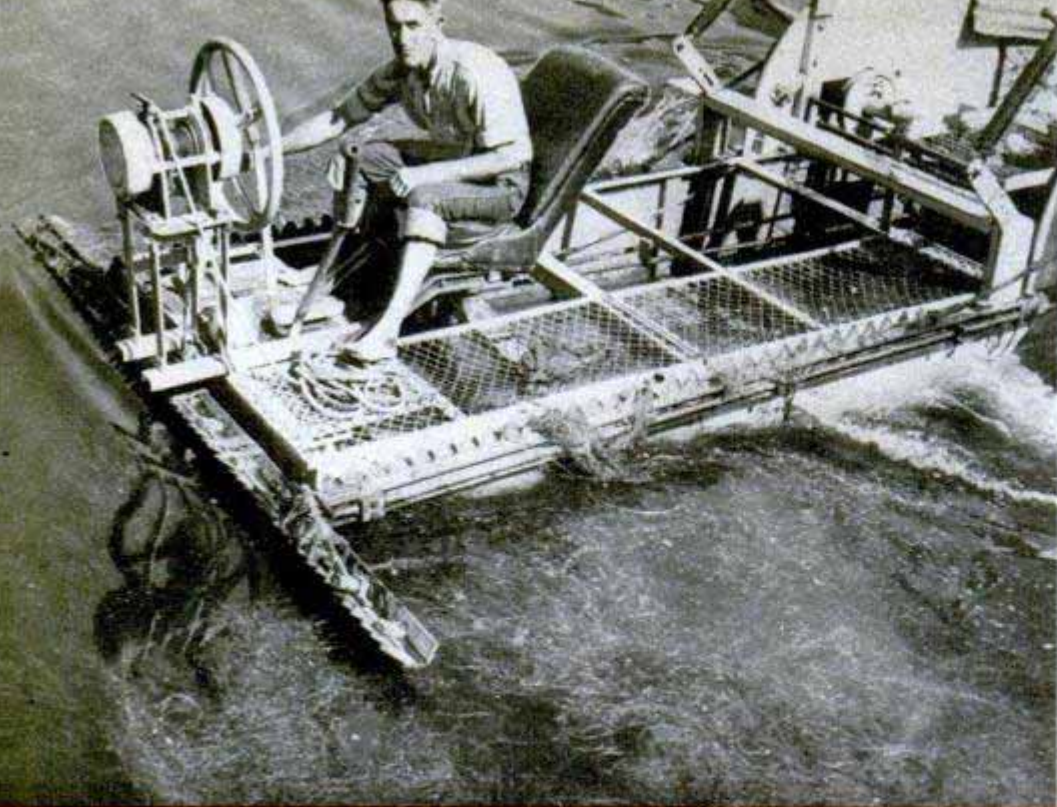
FOR CAMERA FANS

LENS SHADE and filter holder (top) is always on your camera ready for use. Made of soft rubber, the shade cements to the lens mount. It is flexible and the camera can be closed with it in place. Concentric grooves inside the cone act as filter holders. Its one size can be trimmed to fit almost any lens

BORDERLESS EASELS are easily made by pouring a long-lasting adhesive from a can. Heated until it melts, the material is poured into a shallow tray and allowed to cool. It hardens into a smooth, even surface that holds paper securely. The easel can be used for copying work as it needs no glass or pins

EXTENSION FLASH (below) eliminates long cords as it is fired by a photoelectric cell built into its reflector. When the bulb on the camera goes off, the light is picked up by the "eye" on top of the extension light and an electronic switch fires the slave bulb. The eye can be aimed in any direction

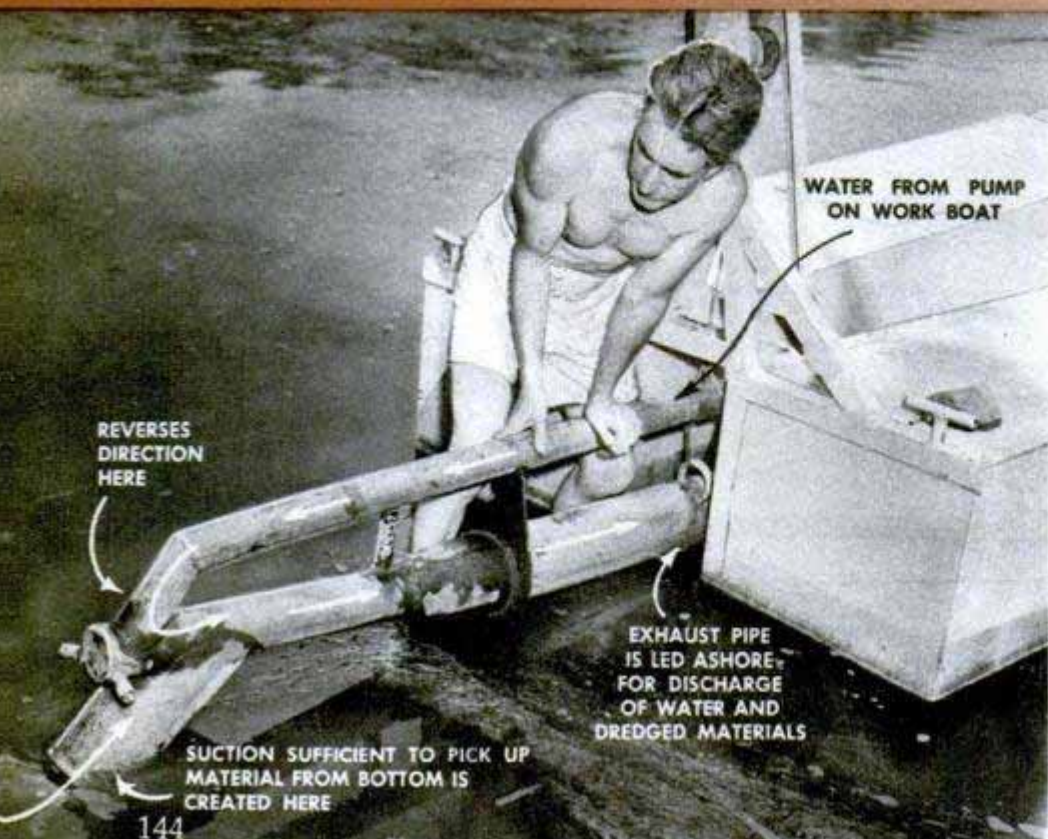




Mechanical weed cutter (note blades under water) is being rebuilt to operate by hydraulic power so it can be used with new hydraulic boat

Hydraulic Jet Drives Work Boat

To operate dredge, water is pumped under pressure through upper pipe and reverses to flow back through lower pipe to create needed suction



AN UNDERWATER hydraulic jet takes the place of a propeller on a novel work boat used for dredging, fire fighting and other odd jobs at Malibu Lake near Los Angeles. The all-hydraulic boat is powered by a 500-gallon-per-minute pump driven by a 90-horsepower engine.

Water from the pump is discharged through a curved underwater nozzle pipe to push the boat at speeds up to 12 miles per hour. A steering wheel turns the nozzle in any direction.

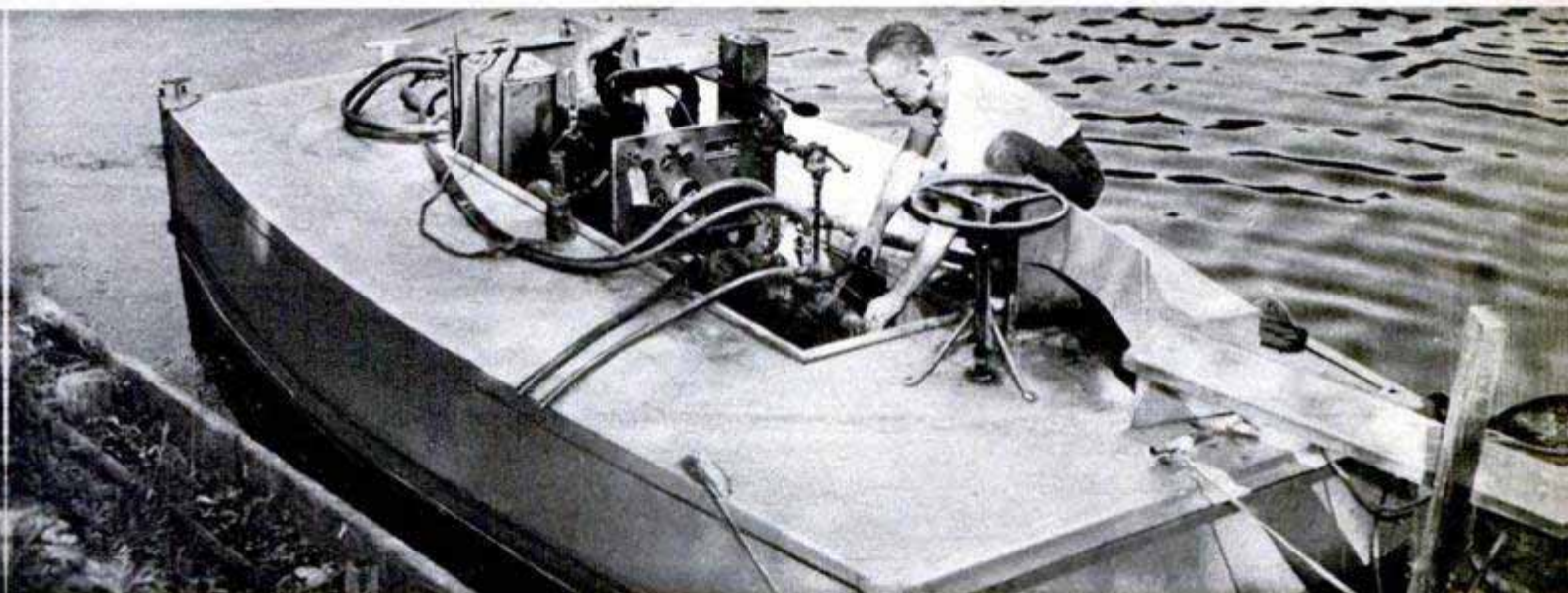
The boat is a simple 8 by 12-foot plywood box with a draft of 6 inches. Water for fire fighting is supplied by the pumping unit at a pressure of 120 pounds per square inch.

For dredging operations the work boat is attached to a float that supports a double dredging pipe that may be lowered to the bottom. Water under pressure from the pump flows through one dredge pipe and returns through the other, creating a suction that sweeps in materials through an open nozzle. Water and materials are pumped ashore through a flexible tube that is supported on floats. The dredge can handle up to 150 cubic yards a day.

Delbert Dickenson, who planned and built the craft, is constructing a weed-cutting attachment, hydraulically operated, that will allow the boat to replace the mechanical weed cutter now used at the lake for cutting lake grasses and weeds. The weed cutters resemble hay cutters and are lowered to the bottom for shearing the grass close to the roots. The cut grasses are gathered in a net and are towed to the beach where an endless belt lifts them to a truck.

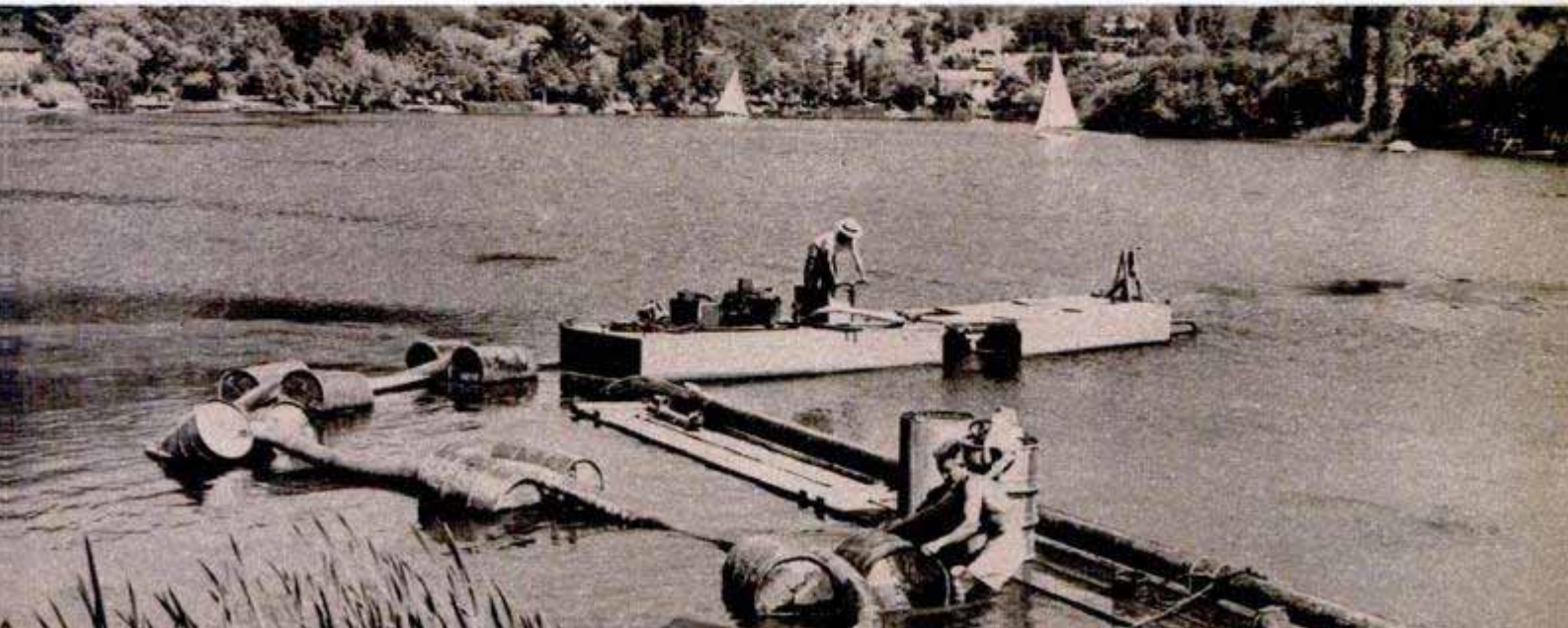


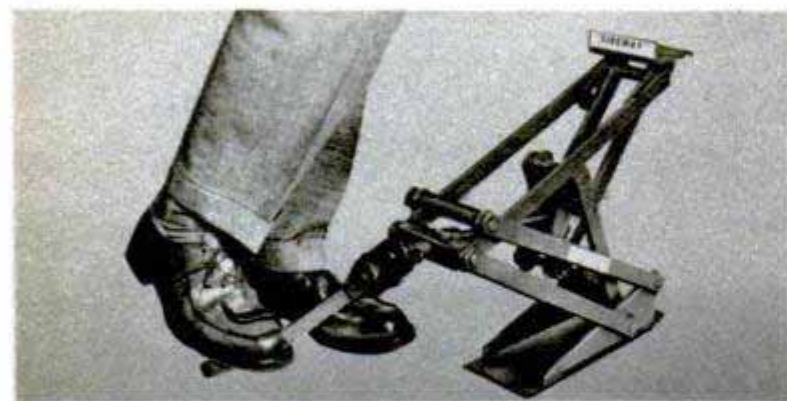
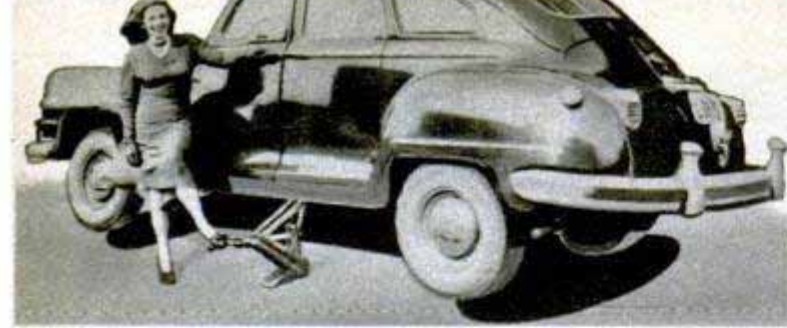
Where's the fire? Pumping unit can shoot a heavy stream of water 100 yards or more and carries ample hose



Mounted amidships in the plywood hull is the pumping unit which consists of a 90-hp. gasoline engine and a 500-gallon-per-minute pump. The propulsion nozzle is under the steering wheel at the near end of the boat

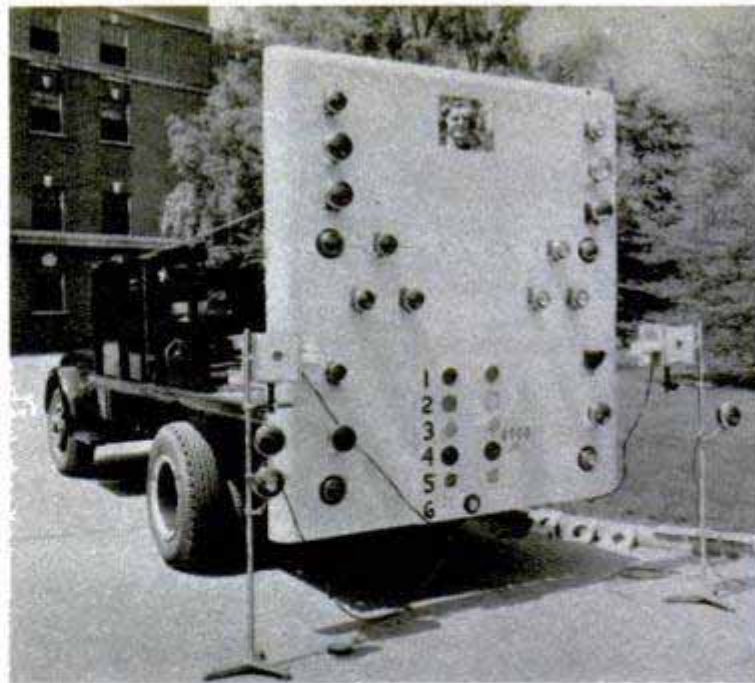
Floating drums serve as supports for large rubber tube that carries the dredged material ashore. Shallow portions of Malibu Lake are being deepened and the dredged materials are used to build up shore elevations





Jack Raises Car Sideways

Automobiles are jacked up from the side by a foot-operated jack that is placed under the chassis frame. It's not necessary to get under the car to put the jack in place and there's no danger of the car slipping off the jack. The foot lever has a ratchet action and the car is both raised and lowered smoothly.



Tester for Truck Lights

Test equipment consisting of more than a score of red and amber "stop" and "turn" lights mounted on a panel may result in more effective signals for trucks. The lights are studied at distances up to 500 feet under both day and night conditions. Tests show that lights should be red or amber at the rear of a truck; preferably red, amber or white at the front; that they should be at least four inches in diameter, and that they need not bear printed instructions or arrows. The studies were made by the Society of Automotive Engineers with the cooperation of General Electric.

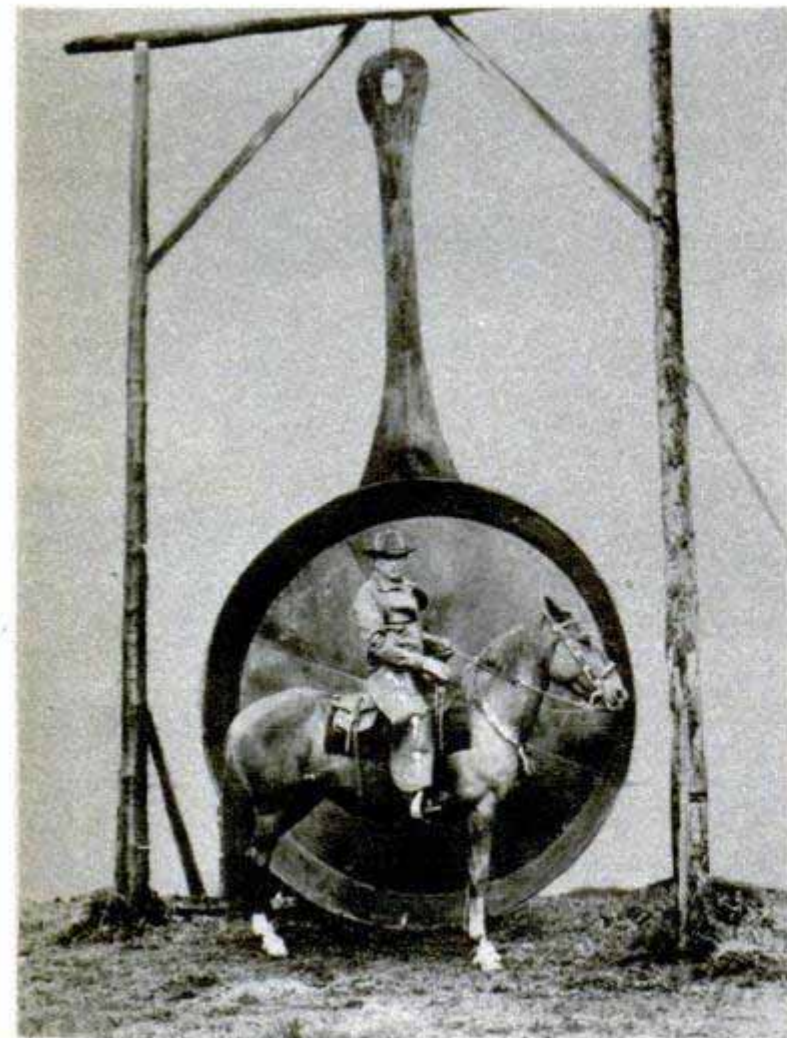
← Giant Frying Pan

Only a Paul Bunyan could flip flapjacks from a giant frying pan that weighs 1100 pounds. The big skillet is made of steel. It was used to fry clams for 2500 people attending a Chamber of Commerce clambake at Long Beach, Wash.

Convertible-Top Cover

Convertible-top covers made of translucent plastic protect canvas automobile roofs from rain, snow, salt air and dirt. The covers fit snugly and can be installed in five minutes. They are easily cleaned with soap and water and can be washed in any standard washing machine. Tops can be raised or lowered with the covers in place.

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, for a prompt reply





musical toys from planes

Above, some of the materials salvaged from the war-surplus planes. Top right, the Tennessee trio didn't stop with musical instruments. The sportsmen's trailers were once training planes

When three Tennesseans bought 350 war-surplus planes for \$1750, nobody dreamed it was the start of a musical-instrument business. But that's what happened. While salvaging miles of aluminum tubing from the planes, they discovered that various lengths produced musical tones when tapped. That started them producing toy xylophones. Mahogany veneer from the fuselages is now used in building cabinets for tiny grand pianos which make their music with lengths of the salvaged tubing instead of strings.

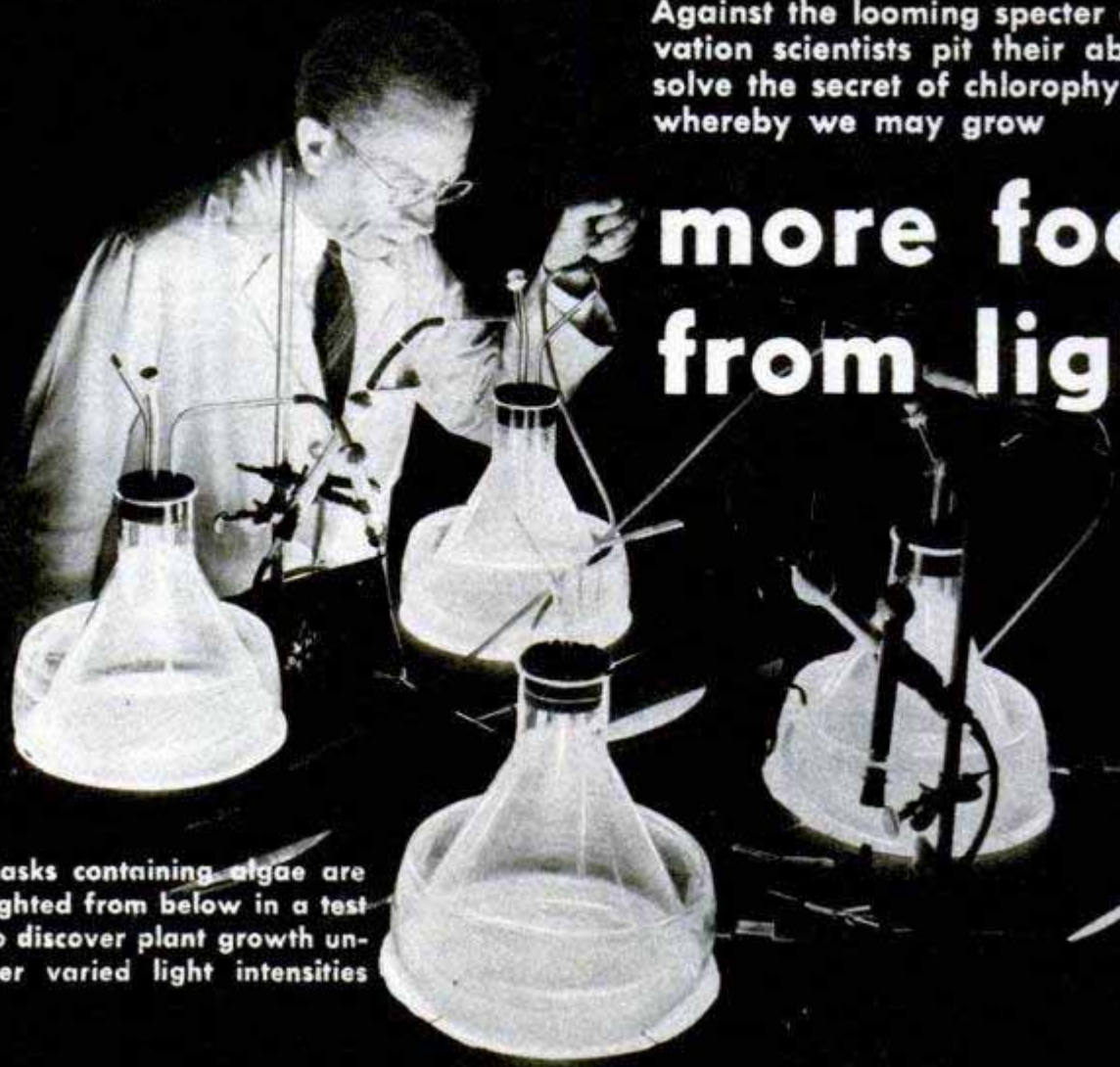
Right, one of the three men has a background that fits the new business. He made this xylophone with plate-glass strips and paper tubes. Below, the tiny baby grand piano. Below right, playing a duet on aluminum-tubing instruments



The world's peoples are increasing faster than the earth's ability to feed them.

Against the looming specter of starvation scientists pit their ability to solve the secret of chlorophyll, whereby we may grow

more food from light



Flasks containing algae are lighted from below in a test to discover plant growth under varied light intensities

By Thomas E. Stimson, Jr.

SCIENCE has a task confronting it that is far more important than the job of putting atomic energy to work. Science must, almost immediately, find a new way of creating the fats, sugars and proteins that are needed to fill the world's stomach. The timetable of necessity shows that this must be done in the next 52 years. By the year 2000 the need for food will be desperate. This is because 50,000 people are being

added to the world's population every day. In spite of the war, for example, the populations of the countries encompassed by the Marshall Plan have increased by some 100 million people in the last decade. Agriculture can't keep abreast of the increasing demand for something to eat.

What science hopes to do is to discover some way of controlling or duplicating the process of photosynthesis, the method by which living plants convert light energy into chemical energy. If this can be done it will open the way to manufacturing foods in almost any amounts that are needed. The difficulty is that photosynthesis is so complicated that even after a century of research the process is still a mystery.

"A plant takes carbon dioxide from the atmosphere and water and a few minerals from the ground and then by means of light it converts these ingredients into palatable foods," states Dr. C. Stacy French, who directs the division of plant biology of

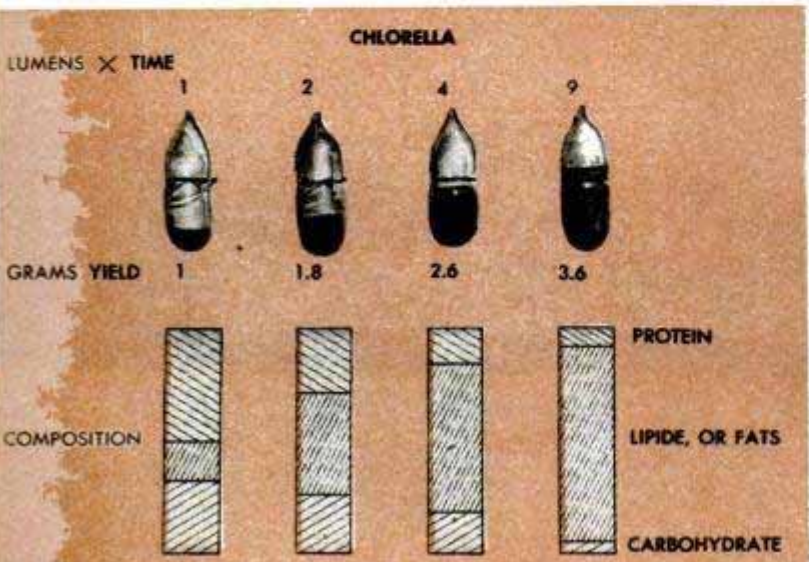


Chart shows how composition of Chlorella can be controlled by varying the period of exposure to light

Pure-white barley, grown in the dark, is exposed to light to determine the time required for it to become green



working knowledge of photosynthesis is developed it will be possible to force plants to produce whatever foodstuffs are desired. A plant's fat-production apparatus, for instance, could be blocked off so that proteins or carbohydrates would be manufactured in greater than normal amounts. Or, if desired, an abundance of vegetable oil could be produced in a plant from which only moderate quantities can be taken now.

One important step in this direction was taken recently when Dr. H. A. Spoehr of the Carnegie research group was able to produce plants that assayed 85 percent in good vegetable fat. Doctor Spoehr performed his experiments with *Chlorella*, a common freshwater alga. This microscopic form of plant life is a standard laboratory guinea pig of photosynthesis research workers. *Chlorella* has a simple structure, is similar in photosynthesis characteristics to other plants, and is easy to

the Carnegie Institution of Washington.

"Presumably the plant's green chlorophyll, triggered by solar energy, splits the molecules of water in two. The oxygen is given off as a gas and the hydrogen apparently is attached to some substance that then is able to reduce carbon dioxide into sugars, fats and proteins.

"We can't duplicate the process and we don't understand all the reactions that occur. We don't even know what catalysts, if any, are involved."

Some authorities think that as soon as a

handle and measure. Ordinarily, this alga has a fat content of around 10 percent.

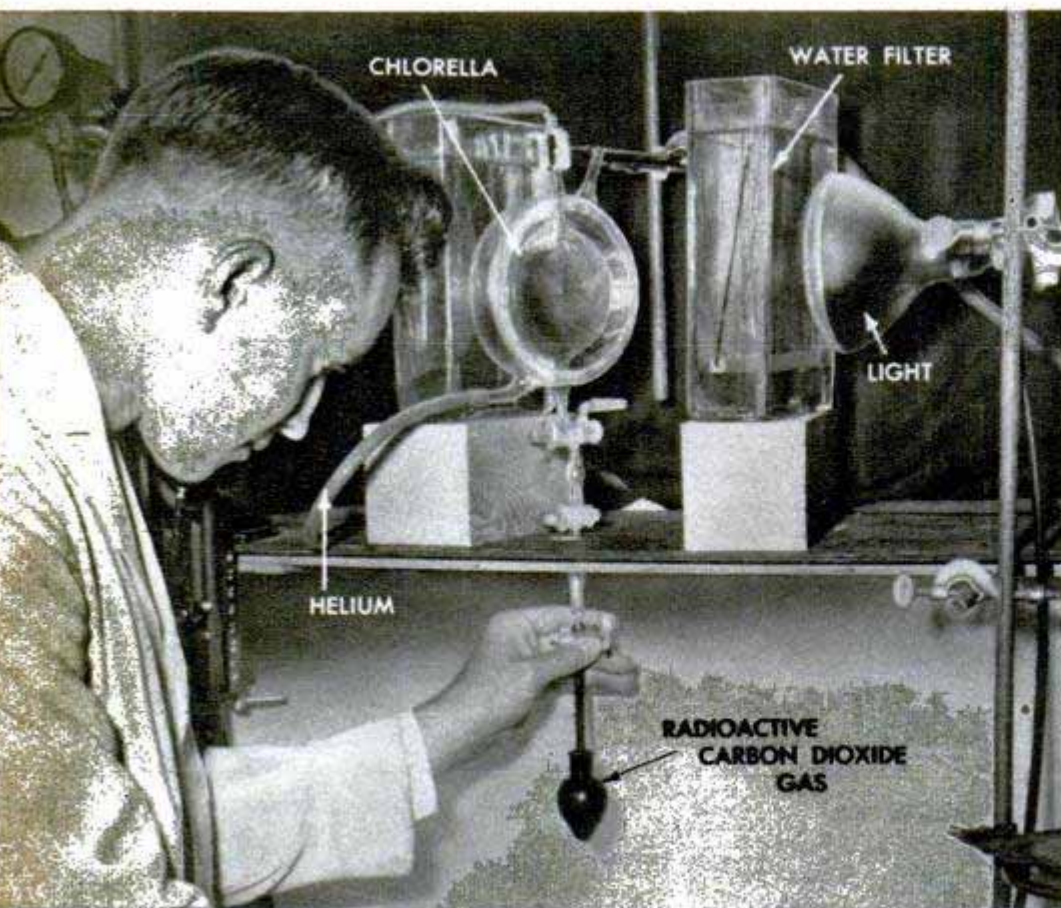
Working in the photosynthesis laboratory of the institution, located on the campus of Stanford University in California, Doctor Spoehr found that by controlling the amount of light that is radiated on the *Chlorella* and by controlling other factors he could produce vegetation that has a fat content of 85 percent and a protein content of almost 9 percent. By changing the environment he increased the amount of protein to 58 percent and at the same time reduced the fat to 4 percent. The

amounts of carbohydrates varied from almost 6 percent to about 37 percent.

This important accomplishment doesn't suggest that we will soon be able to harvest cubes of butter from convenient bushes or to grow beans that are as big as your fist and that are super-rich in protein. Structurally, the higher



Small evergreen tree in center has a white top. It was placed in the dark after a period of growth in the light



Chlorella in flask is illuminated and transferred to lightless black container below it, proving photosynthesis can occur briefly in dark

plants are so complicated that it's hard to say when such miracles will come about.

It does suggest, however, that algae might become important sources of fats or proteins. The next step is for some laboratory to investigate the commercial possibilities of food production from Chlorella on a larger scale than the test-tube experiments conducted so far.

Informally, Doctor Spoehr estimates that to produce one pound of fat it would be necessary to grow a culture of Chlorella for 30 days in about 30 gallons of water that contains some 600 grams of nutrient salts. Filtered air containing five percent carbon dioxide, instead of the $\frac{3}{100}$ of one percent in the atmosphere would have to be bubbled through the water. Sunlight would be used for illumination to keep the photosynthesis process in operation. Two major problems would be the keeping of the algae at their best growth temperature, from 70 to 75 degrees Fahrenheit, and to keep the water agitated so all algae would receive light.

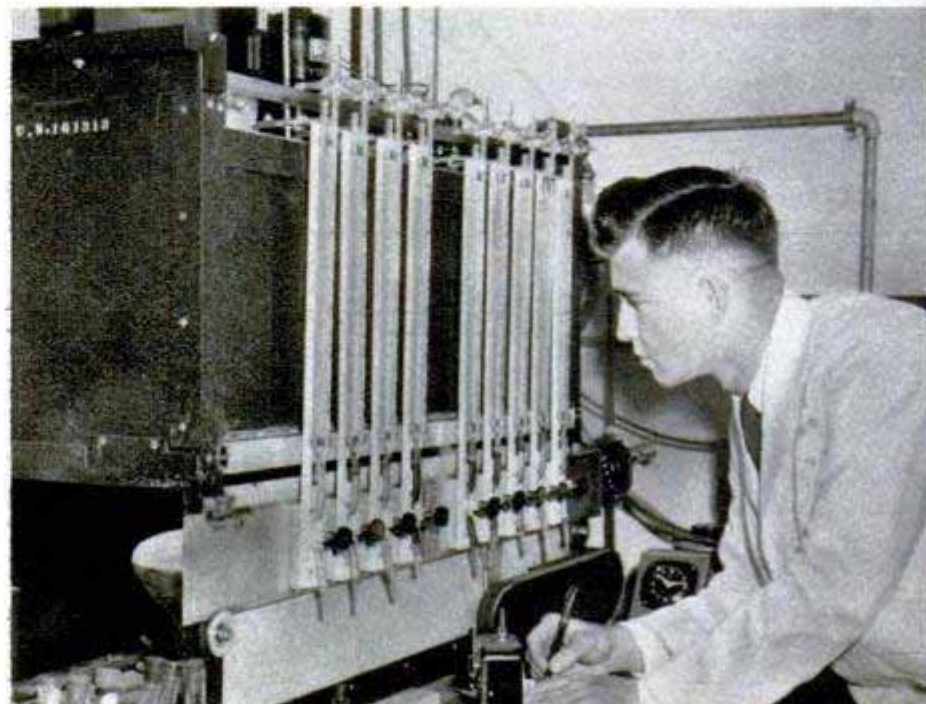
It might be possible to grow the algae in long, tall glass tanks that are only a few inches in cross section, in Pyrex pipes or even in transparent plastic bags. If investigation shows that the costs are too high, the next suggestion is to attempt cultivation of salt-water algae and other simple plants that thrive in the ocean. Possibly a bay that is almost landlocked could be dammed off from the ocean so that algae could be grown on a vast scale. Marine farming, in fact, is considered an industry that civilization will have to take up in the future.

Doctor Spoehr's work does not reveal the actual mechanics that are involved when a plant manufactures the materials that we use as food. That, still, is the basic problem under study at almost a dozen research centers in the United States alone. Living plants are subjected to all sorts of treatments in these laboratories,

then the plants are taken apart by means of chemicals, by ultra-high-speed centrifuges, and even by means of supersonic generators to discover what has happened to them. Chlorophyll and other pigments are tested by means of spectrographic apparatus. The effects of certain wave lengths of light on chlorophyll are studied.

In short, every modern technique and tool that seems applicable, including the

Tubes show pressure changes resulting from liberation of oxygen during photosynthesis as Chlorella flasks inside cabinet are exposed to light



use of radioactive materials, has been drafted.

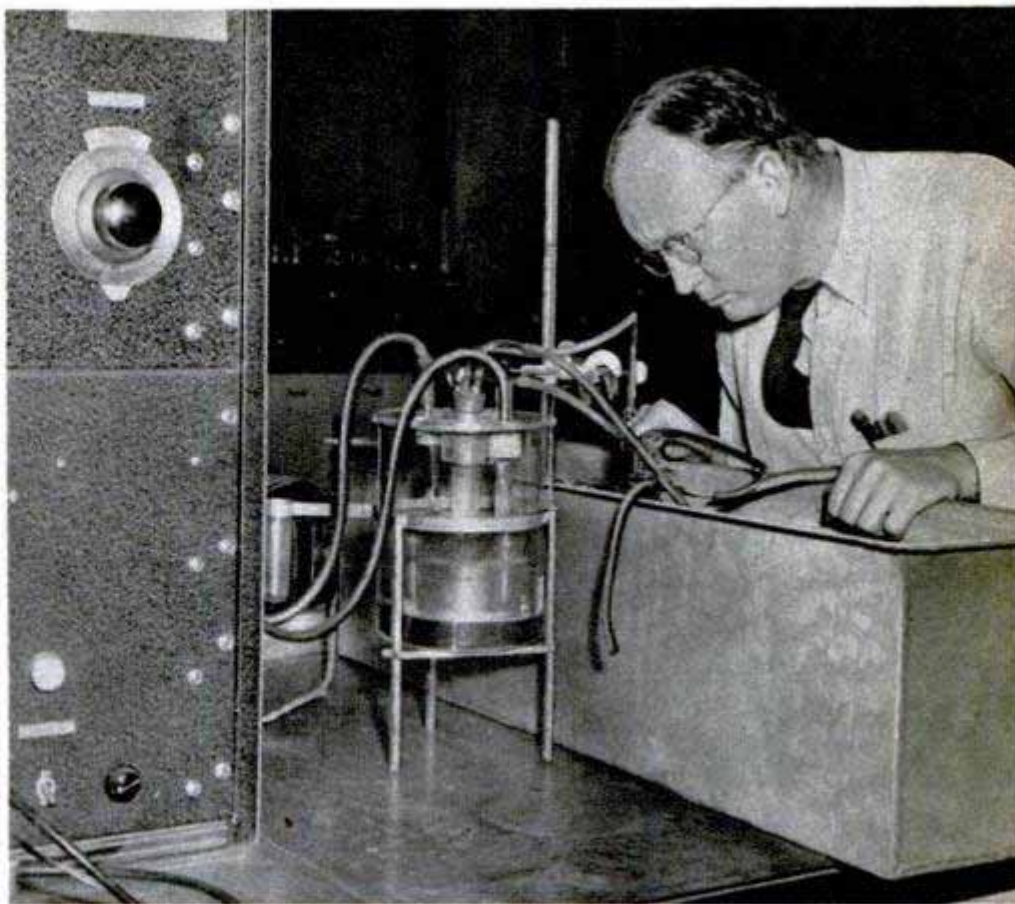
Specifically, the Carnegie photosynthesis laboratory is probing the means by which chlorophyll is formed in a plant, is studying the yellow carotenoid pigments that may or may not have something to do with photosynthesis, and is trying to learn more about the functioning of the chloroplasts, tiny bundles in which chlorophyll is contained.

At Carnegie you find such oddities as pure white plants that were grown in the dark or even small green trees whose upper halves are white.

Barley, for instance, that is grown in the dark isn't able to produce chlorophyll and so it doesn't take on a green color. It lives only on the substance contained in its seeds. At a certain time in its growth it is placed in a lighted cold room where the length of time required for it to turn green under the action of the overhead lights is studied at various temperatures.

The green tree with the white tip was grown out of doors, then it was placed in the dark where it continued to grow by drawing on the materials stored up in its system. This growth in the dark produced a crop of white leaves. Unless it is exposed to light by the time it uses up its reserves, the tree dies.

Each photosynthesis laboratory is working on some particular portion of the sub-



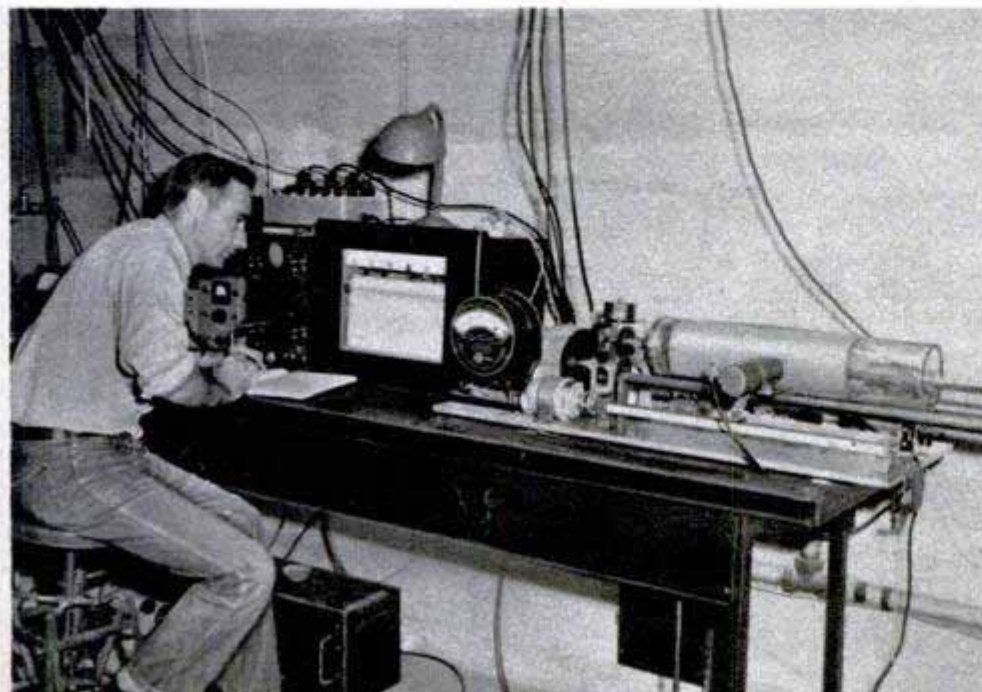
Supersonic generator (center) uses silent sound to break down vegetation so that the chloroplasts can be separated for intense study

ject. A Stanford research group that has its laboratory beside the ocean at Pacific Grove, Calif., is investigating an ocean alga that contains green chlorophyll but that seems to use a red substance for photosynthesis instead of its chlorophyll. Purple bacteria that convert carbon dioxide into organic matter under the influence of light are being investigated.

At Oak Ridge, the University of Chicago and the University of California, studies that make use of radioactive isotopes are in progress. At California, for instance, a research team consisting of Dr. Melvin Calvin and Dr. Andrew A. Benson, plus a group of young scientists, is trying to isolate the intermediate steps of the photosynthesis process. They feed radioactive carbon dioxide to *Chlorella*, then try to find out what transformations occur.

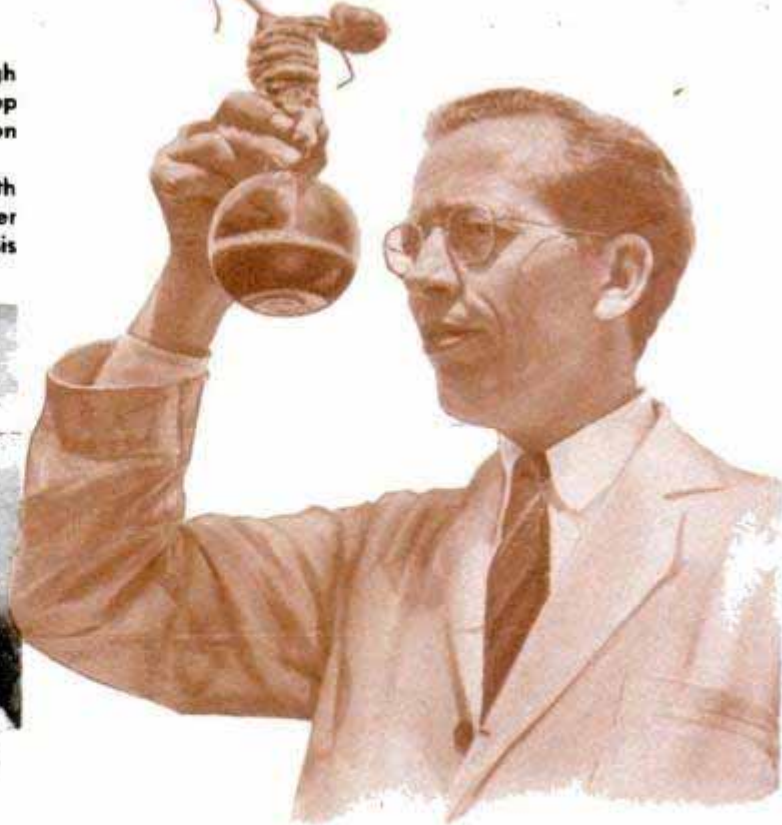
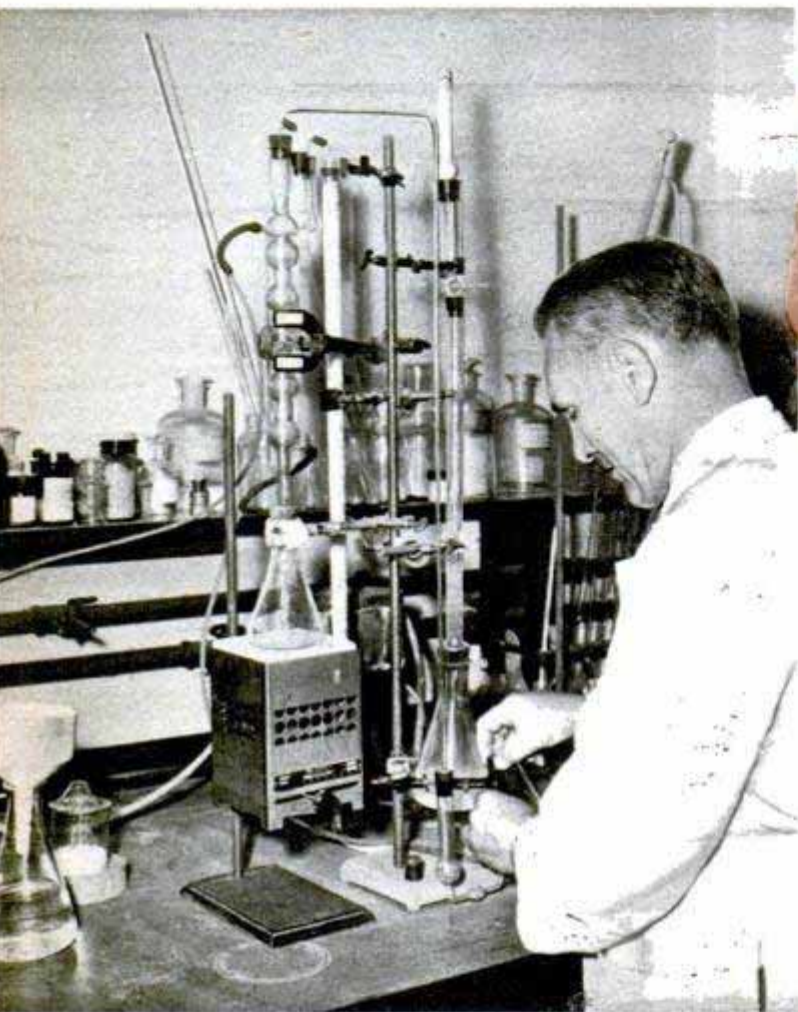
In one type of study, *Chlorella* is exposed to light and to ordinary carbon dioxide for several hours and then for only 30 seconds it is exposed to

Apparatus measures color shades of chlorophyll and other plant pigments to determine what portions of the sun's rays are used in photosynthesis



Right, scientist examines flask containing a high concentration of *Chlorella*. Bindings around the top of the flask are filters to keep out contamination

Below, Dr. H. A. Spoehr, who produced *Chlorella* with a high fat content, tests green leaves to discover acid content as he seeks secrets of photosynthesis



favor of a possibly more simple oxidation-reduction process that is induced by light and that proceeds with the aid of special pigments. The belief is growing that some of the steps are not unique but are similar to some other biochemical reactions such as occur, for instance, in oxidative and fermentative decompositions.

Even the latest theories are mere broad conceptions that don't explain the actual mechanics involved. In this connection the University of California scientists have evolved a step-by-step explanation of photosynthesis that they haven't been able to disprove and that they are now engaged in testing. Within a year, possibly, a major announcement on how photosynthesis works will be made by these scientists.

It's too soon now to speculate as to whether the theory will permit industry to manufacture food by a synthetic process or whether it will be a key for extracting more food from growing plants. Certainly research will continue until either or both of those goals are realized.

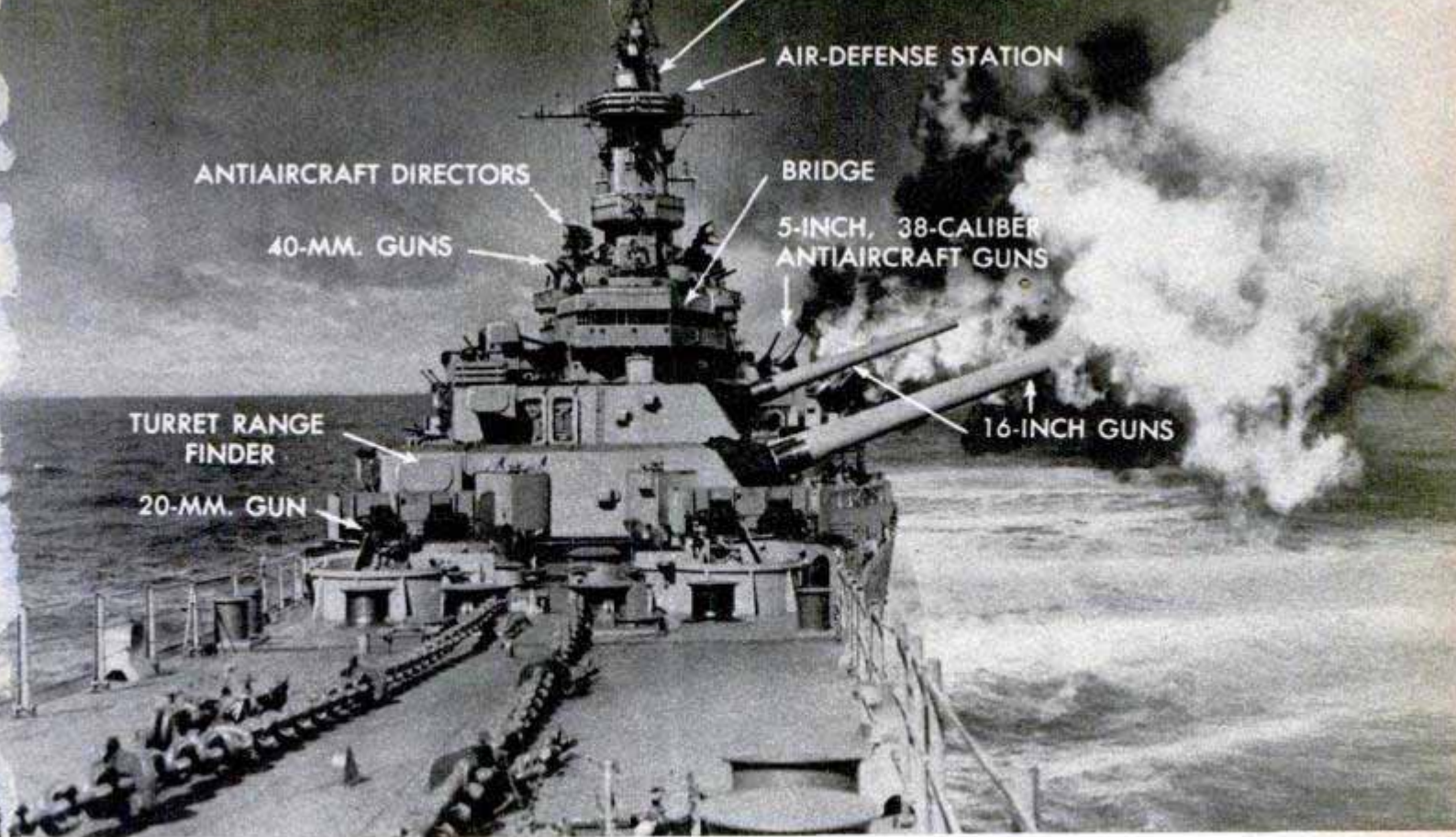
The entire animal kingdom, and that includes man, can be described as a parasite that lives on the millions and millions of members of the plant kingdom. Without plants we would, of course, have no hope for survival. These plants produce proteins, sugars and fats from inorganic materials by photosynthesis. To do this, they require only sunshine. The rays of sunlight are the difference between life and death for the living things of the world. Only when we have learned to duplicate the photosynthesis process will we cease being parasites that live on the plants of the world.

radioactive carbon dioxide. After that it is taken apart to learn what happened to the radioactive tracer.

In other experiments the algae are exposed to light in an atmosphere of helium that guarantees the absence of carbon dioxide and then the algae trickle down into a dark flask containing a radioactive atmosphere of carbon dioxide. Apparently the plants are able to store up and save some of the light energy, for in the darkened flask they convert the carbon dioxide into normal products of photosynthesis.

Theory after theory has been advanced in attempts to explain the photosynthesis process. Until recently it was thought that carbon dioxide combined with chlorophyll and water and that in a photochemical reaction these constituents were rearranged into chlorophyll and formaldehyde peroxide. Next, this arrangement changed into chlorophyll, formaldehyde and oxygen, after which the formaldehyde was converted into sugar.

This hypothesis has been dropped in



Fire and smoke belch from the 16-inch guns of the USS Missouri as she hurtles a broadside during exercises

By Andrew Hamilton

LOUDEST voice in the U. S. Fleet is "big mouthpiece," the 16-inch naval rifle. Its barrel weighs more than 100 tons and fires a one-ton projectile. The main batteries of a modern battleship thunder at the rate of one to two shots per gun per minute; the projectiles have a muzzle speed of more than 1800 miles per hour; they can hit a target more than 20 miles away with remarkable accuracy.

The Navy's biggest weapon is the result of millions of hours' brain work and sweat by engineers of the Bureau of Ordnance. It is the culmination of a 350-year development of the naval gun.

At the beginning of World War II, arm-chair strategists had practically relegated the battleship and its 16-inch guns to the Smithsonian Institution. But the big mouthpieces of the U. S. Fleet fired more than 25,000 rounds, representing more than 30,000 tons of ammunition, at enemy targets from North Africa to Tokyo.

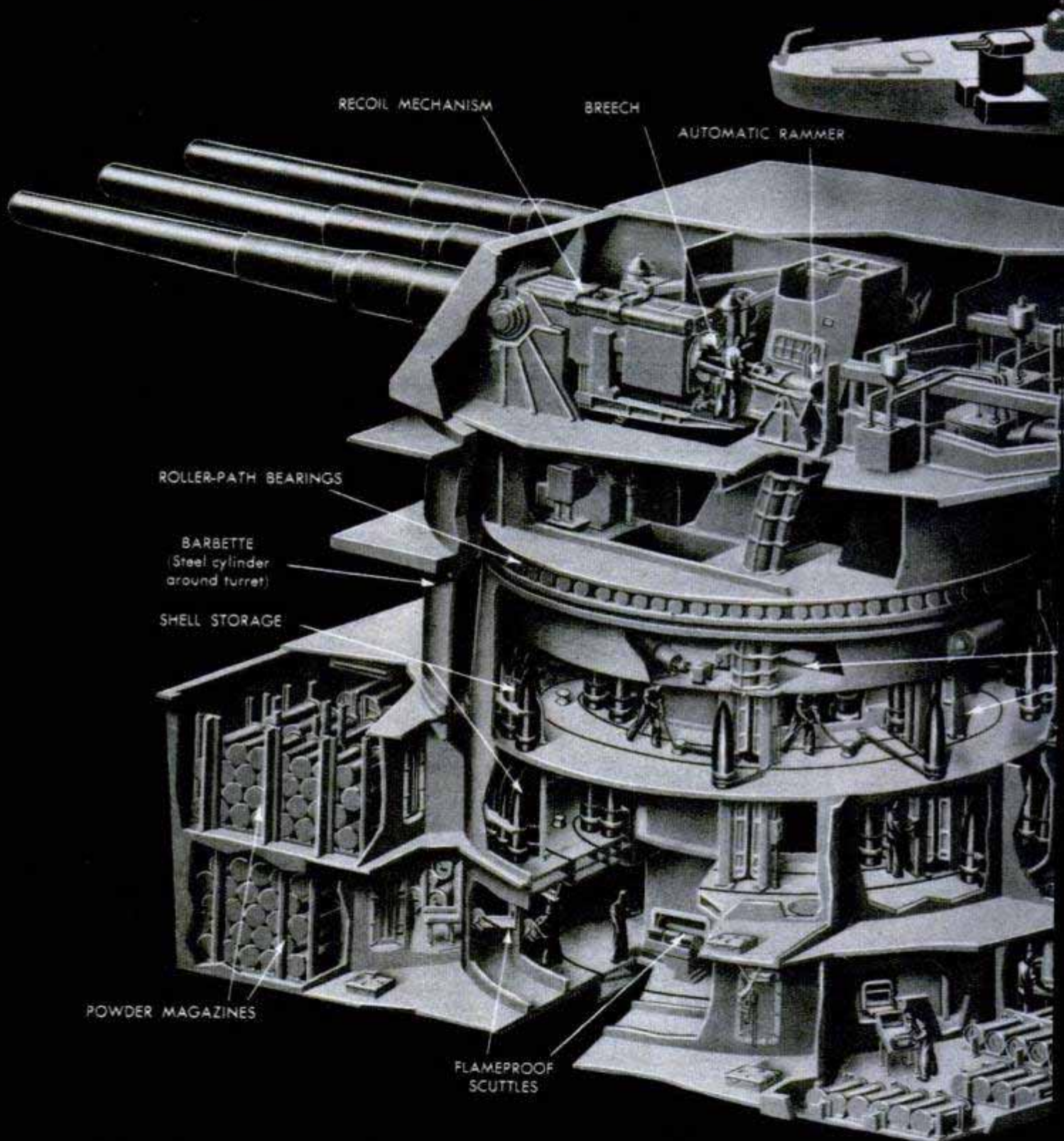
The first 16-inch gun was mounted on the USS Maryland, commissioned in 1921. Today's 45,000-ton battleships have three turrets of three 16-inch guns each—two forward and one aft. Guns can be elevated to an angle of 45 degrees (to provide maximum range) and can be swung to command the entire circle of sea around a battleship. They can be fired separately or all nine in one thunderous broadside.

How They Fire The Battleship's Big Guns

Captain of a battlegun's gun crew peers through a powerful periscope to get a true bearing on target
U. S. Navy photos



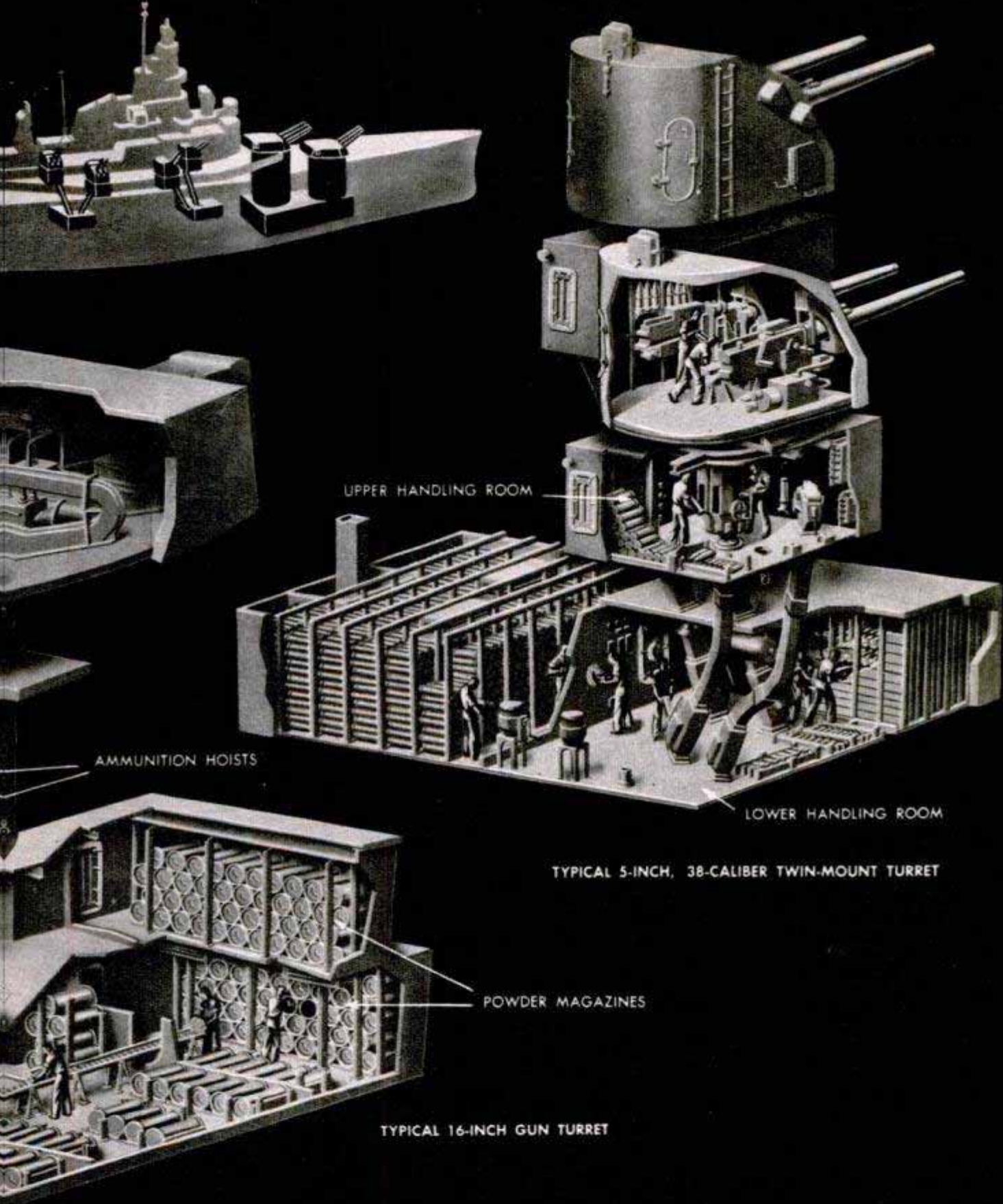
MEN AND MACHINES "PASS THE AMMUNITION" INSIDE A BATTLESHIP'S TURRET



A complete turret with its guns and equipment weighs more than 1800 tons. One of the most complicated engineering feats in the construction of a battleship is the installation of its nine 16-inchers, their turrets and mechanism. This is how it's done: Turrets are put together and then completely disassembled. Next, a 350-ton crane lifts the individual parts onto a

barge, which is towed alongside the fitting-out pier. The turrets are then put back together again. Special gauges are used to insure leveling accuracies of $\frac{1}{4}$ inch, centering accuracies of $\frac{1}{64}$ inch.

A 16-inch gun is like an iceberg—the gun barrels and turret housing visible above decks are only a small part of a great, heavily armed fort which extends



into the bowels of the ship. Inside the turret are breech and recoil mechanisms where the guns are loaded. The turret structure revolves on roller-path bearings. Below this is the turret foundation containing elaborate power-driven hoists and elevating and training-gear motors. All this equipment is protected by a huge steel cylinder called a barbette. At the base of

the barbette are shell-storage compartments and powder magazines.

Large naval guns are fired by the old "powder and shot" methods used by the gunners in John Paul Jones' navy. Steel projectiles, 6 feet high and 16 inches across, are fed into the breech, bags of powder are rammed in, the breech is locked shut and the gun is fired.



One-ton shell slips easily into the breech of 16-inch gun. The effective range of the missile is 20 miles

Sounds simple, but don't be fooled. Loading, sighting and firing a 16-inch naval rifle is one of the most complicated operations of modern warfare. Some of the most efficient machines and intricate devices naval engineers have been able to dream up go into the process of "laying a shell on a dime" at 20 miles.

Gun crews are divided roughly into two teams which load, direct and fire a big gun—the pointer group and the loading crew. In addition, there is the party whose main job is to "pass the ammunition." Ammunition is stored below decks in fireproof compartments fitted with double-locking, flameproof scuttles and water-flooding systems designed to halt the spread of fire or explosion. Projectiles and powder are kept in separate magazines.

Projectiles are of two general kinds: (1) armor-piercing shells (used against ships), which have a tough steel nose and a small explosive charge of not more than 2.5 percent of grayish-cast TNT, and (2) high-capacity shells (used for bombardment of shore positions), thin-skinned and containing a 10 to 25-percent bursting charge.

The propellant charges for the one-ton projectiles are cylindrical bags of smokeless powder—which is neither a powder nor completely smokeless. This powder consists of brownish pellets of nitrated cellulose, perforated to insure complete combustion. The pellets are placed in silk bags with a quilted bottom that contains a small amount of black powder as a primer charge. During shipment or storage, these



Automatic ramrod shoves bags containing 60 pounds of smokeless powder into breech of "big mouthpiece"

bags are encased in airtight containers.

From the storage compartments, projectiles and powder bags move by conveyor belts and power-driven mechanical hoists toward the turret. While the ammunition is moving in a steady stream toward the gun breeches, activity is taking place in other parts of the ship that would make a mathematician go mad if he had to figure out the problem in longhand multiplication and division. Fortunately, the Navy has developed computing and calculating machines that do most of the heavy thinking rapidly and accurately.

The battle problem boils down to this: How to hit a moving target on or beyond the horizon, taking into account its course and speed, your own course and speed, the course and speed of the wind, the roll of your ship and even the rotation of the earth during the flight of the projectile.

The Navy's fire-control system is one of its most carefully guarded secrets—ranking second only to the atom bomb. At the end of World War II the Navy revealed much about such weapons as the V-T fuse, sonar, radar and influence mines. But it has remained close-mouthed as a clam about its fire-control secrets.

Without getting technical, here is how it is done: First, you must locate the target. Seaplanes are sent up to do the "spotting." A cruiser, that gets in closer, may also help. Radar has stepped up the accuracy of naval gunnery considerably—and can be used even when the target is out of sight over the horizon, day or night.



After the big gun has been fired, bluejackets clean the bore with a cylindrical brush pulled by a rope

Information from many sources is relayed to the plotting room, far below decks, where ranges to be set on the guns are worked out. Here are located the precise computing machines called rangekeepers—heart of the Navy's fire-control system.

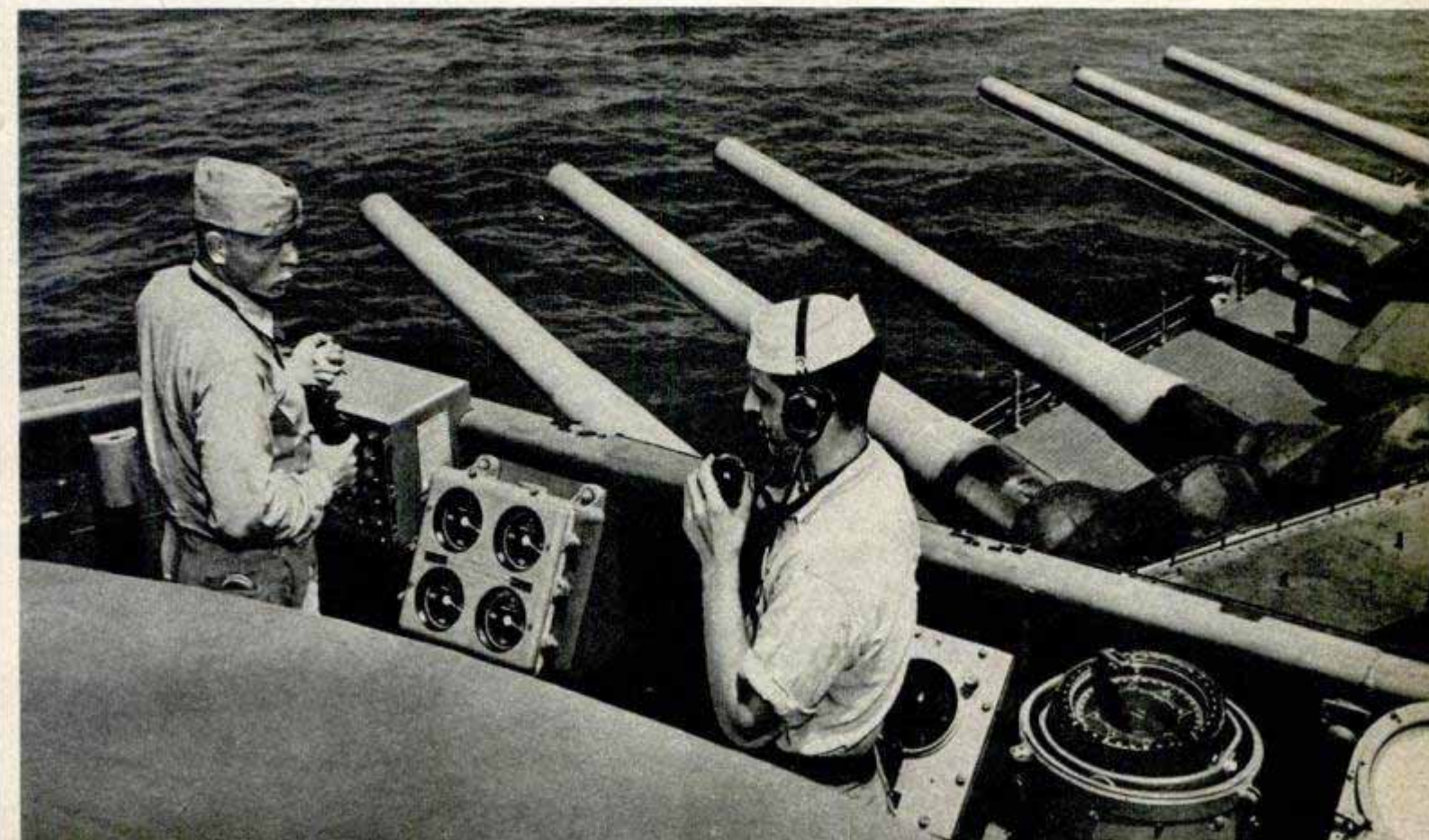
As outlined in *Naval Weapons and Their Uses*, published by the U. S. Naval Institute, Annapolis, Md., this machine supplies the following data:

(Continued to page 238)



Dangerous business! Far at sea a big battleship takes a load of ammunition from an LST supply ship

From the bridge the executive officer passes an order to his "talker" who transmits it to the turrets



"Snow Jeep" Tows 1500-Pound Load Across Drifts at 30 M.P.H.

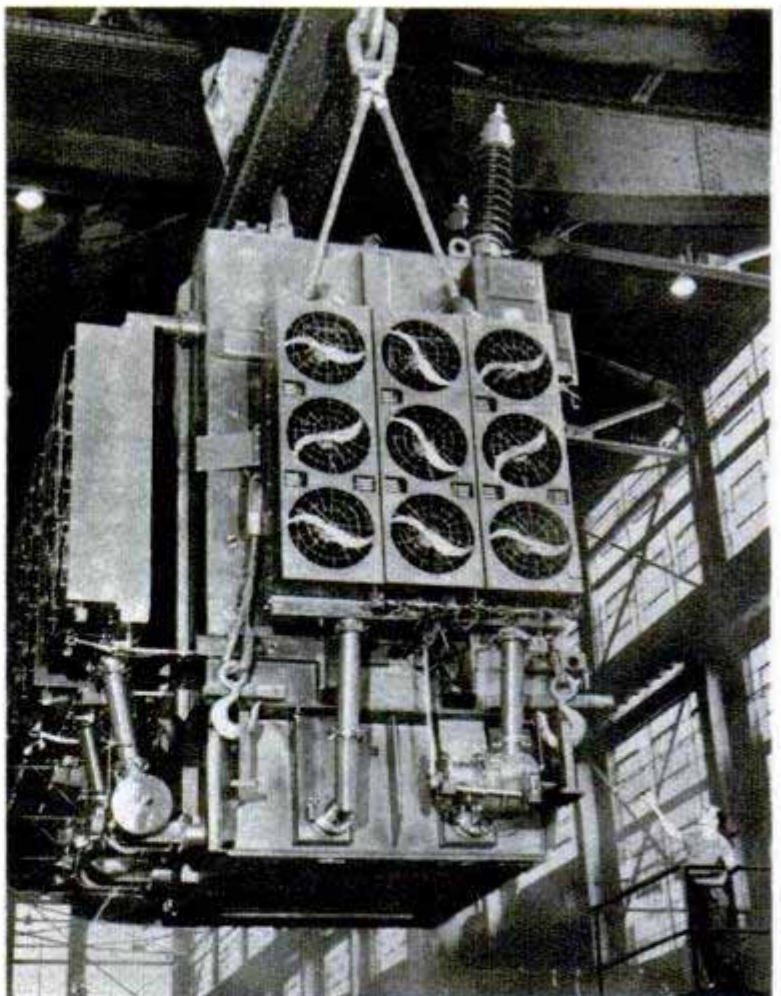
Heavy loads can be towed across deep snow by a "snow jeep" that travels along the surface on broad Caterpillar treads.



The vehicle, developed by George Bettes of Sparta, Mich., is an improved version of the snow jeep portrayed on the cover of *Popular Mechanics*, February 1947. Bettes spent several months in the James Bay region of Canada making tests. During that time the machine was used by a doctor and the Royal Canadian Mounted Police for emergency missions. Powered by a four-cylinder, 26-horsepower engine, the snow jeep travels 30 miles an hour. The aluminum body is heated and seats four. Weighing 1475 pounds, the vehicle can turn in its own radius on snow or bare ground and will tow a load of 1500 pounds. Mr. Bettes is building a larger one for long trips.

142-Ton Transformer Serves City of 200,000

Capable of handling enough power to meet the electrical needs of a city of 200,000 persons, a 142-ton transformer, the most powerful ever made in this country, has been built by Westinghouse. The giant, which handles 150,000 horsepower of electrical energy, is of a new "form fit" design that reduces weight by about 20 percent. In operation, great amounts of heat are generated in the core and coils and this heat is carried off by oil circulating through the assembly. Propellerlike fans force cooling air over radiators through which the circulating oil passes. The transformer takes power at 13,200 volts and builds it up to 115,000 volts before feeding it into the transmission network.



Waste Anthracite Silt May Provide Gasoline

Anthracite silt, washed from the coal after mining, may provide gas for heating homes and gasoline for automobile engines in the near future. About 200 million tons of silt are available today and more is being produced every year. Tests are to be made in a pilot plant at Wilkes-Barre, Pa. The silt, as

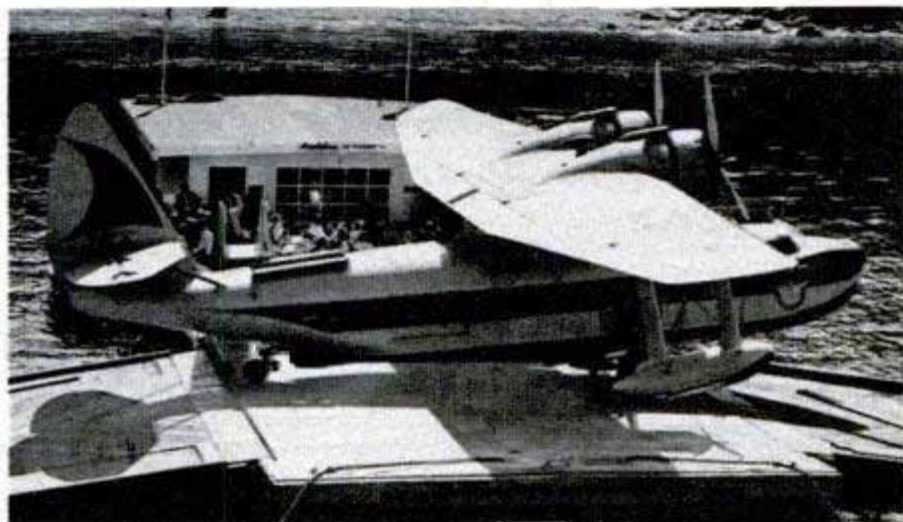
fine as granulated sugar, is noncoking, noncaking and free of tar. It also has a low sulphur content and a high ash-fusion temperature.



Avalon Seadrome Made From Barge

Floating in Avalon Bay off Catalina Island is a seadrome for amphibians made from a large barge. The drome, which speeds the loading and unloading of passengers from five amphibians operating between the island and the mainland, is 35 by 110 feet with two 30 by 45-foot ramps. It has a roomy deckhouse with rest-rooms, baggage and radio room and a glassed-in passenger lounge. Passengers are transported from the seadrome to the downtown ramp at Avalon, a few hundred yards distant, by water taxi. Travel time between Long Beach, Calif., and downtown Avalon is 25 minutes. A boat or water-taxi trip from the mainland to the island takes over two hours

Amphibians are easily wheeled up the barge's ramp to discharge and load riders. Water taxis complete trip to Avalon, a few hundred yards away



and land-plane service to the airport atop the island requires a 45-minute bus trip into Avalon. The new seadrome replaces a floating dock in the bay which could not be used in rough weather, upsetting the 28-flights-a-day schedule.

Navy Tests Longer Hull to Make Flying-Boat Landings Safer



Official Navy photo

For safer rough-water landings, the Navy is experimenting with a longer hull in the newest Martin flying boat. It is expected to reduce pitching and bouncing, as well as giving the tail section added buoyancy to protect it from wave damage. The longer planing surface also cuts the time and distance required for take-off. Designated the XP5M-1, the craft has two 2700-horsepower Curtiss-Wright engines and flies with an 11-man crew.



COMPACT VACUUM CLEANER flattens to a thickness of five inches and can be hung in broom closet



KITCHEN CLEAVER is very versatile. It cuts, chops, opens jars, bottles and even pulls nails

WHAT'S NEW *For Your Home*

Sources of supply for these products may be obtained from Bureau of Information, Popular Mechanics Magazine



COASTER-HANDLE keeps liquid stains off furniture and broad base reduces danger of upset glasses



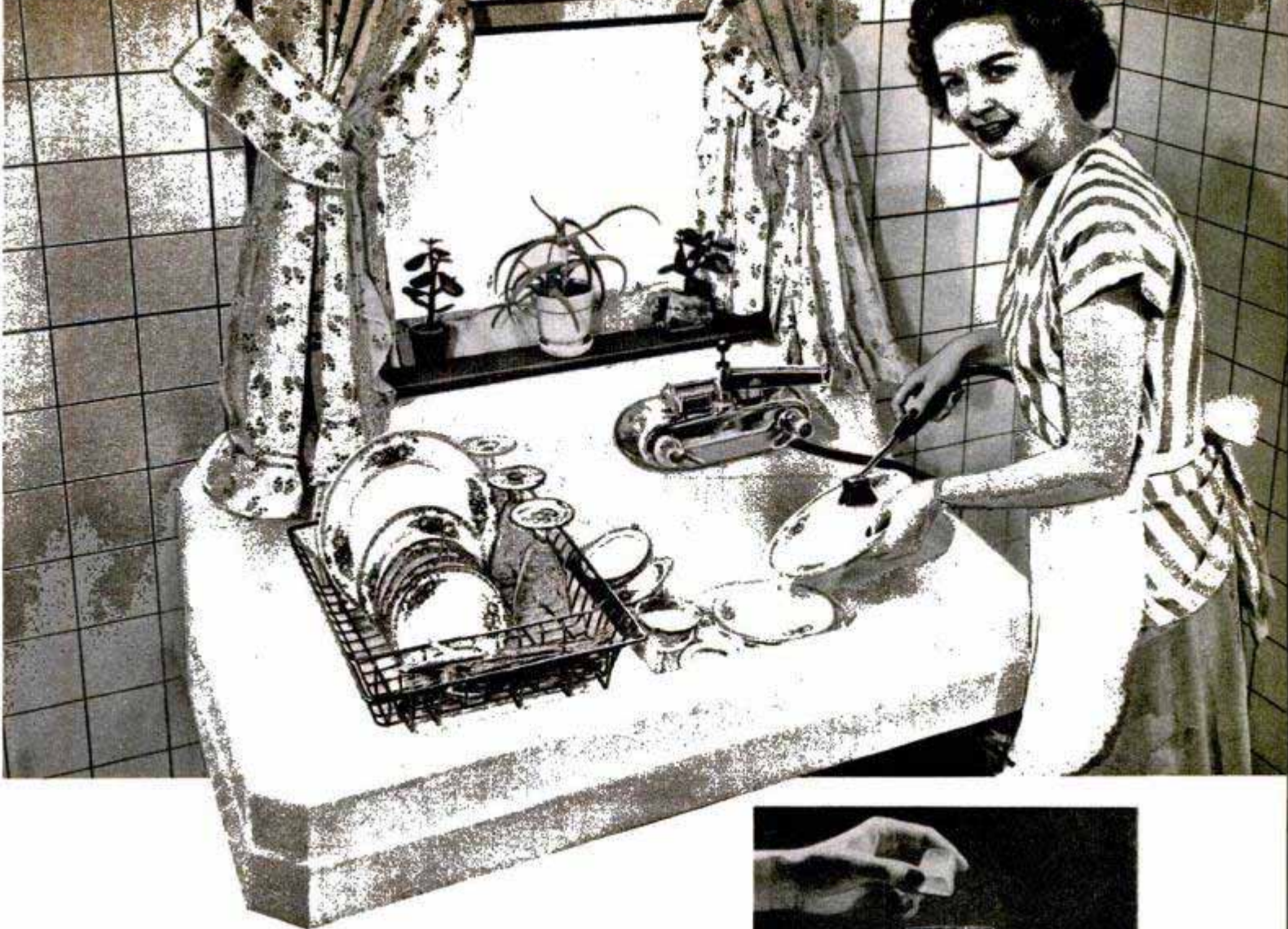
TABLE-TOP REFRIGERATOR has the usual storage space and also provides a counter-height work area



SILVER DETARNISHER is battery operated. Unit is self-contained and works by electrolytic action

DISH SHELVES eliminate stacking in crowded cupboards. They're made in three different sizes



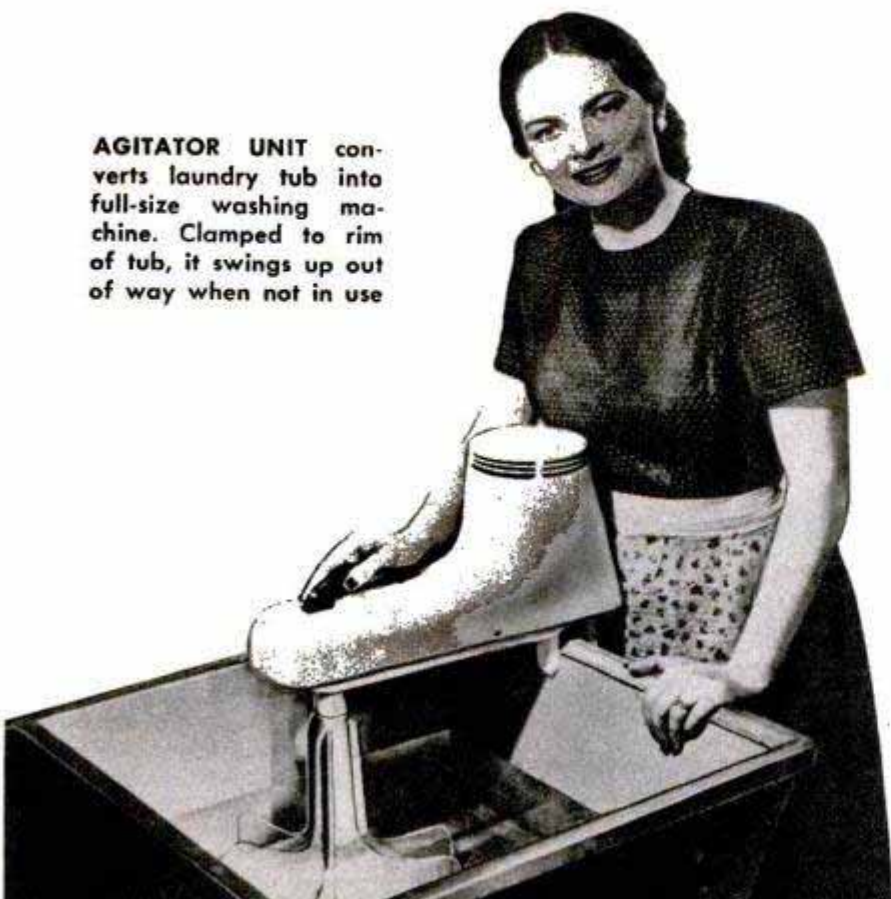


DISHWASHING FAUCET can be fitted on any sink. Soap is dissolved in small tank behind spout. Mixer pipes either clear or sudsy water into brush head

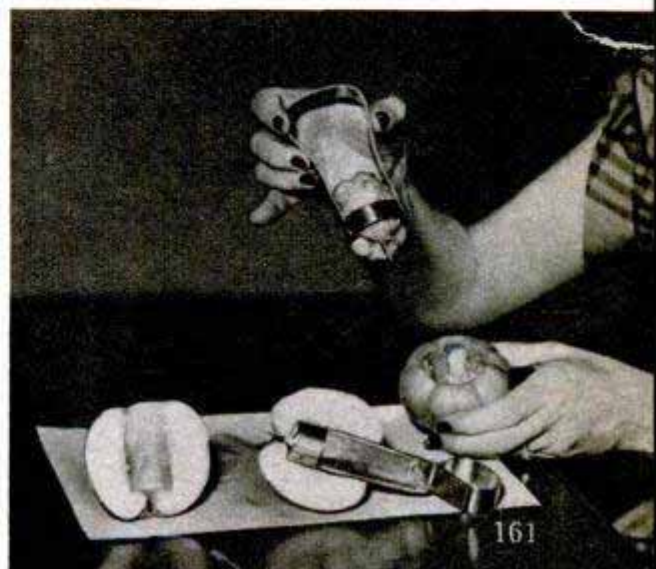
PLASTIC ICE CUBES won't dilute your drink because the water is sealed inside crystal-clear plastic. When the cube "melts," simply freeze it again



AGITATOR UNIT converts laundry tub into full-size washing machine. Clamped to rim of tub, it swings up out of way when not in use



CORERS for tomatoes and apples don't cut all the way through but leave seal to hold juices. They are designed for coring fruit before filling and baking





"Horace"—Britain's Uncomplaining Test Pilot

Hinged in eight places, "Horace, the model airman" spends his days whizzing up and down a high tower track in tests of new pilot ejector seats. Britain's Ministry of Supply made the scientifically designed

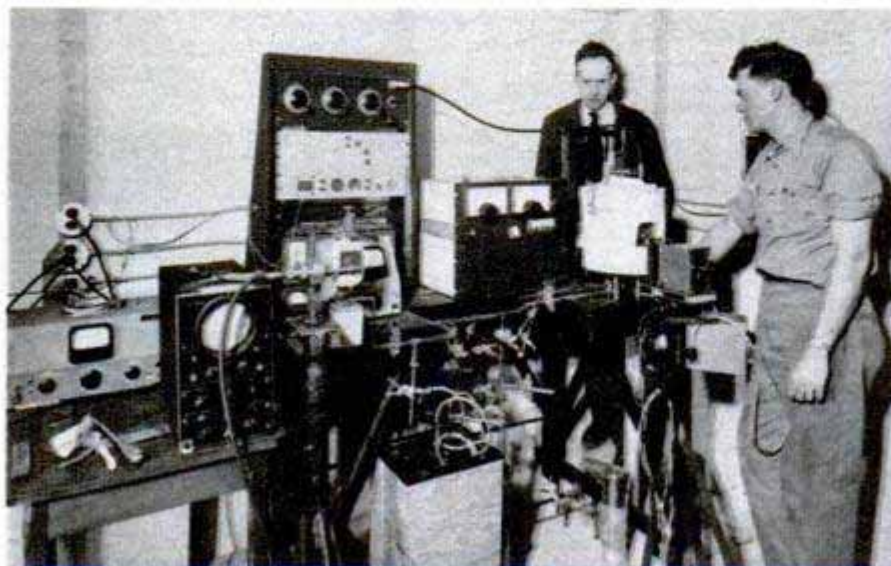
dummy flier for plane designers. Cordite cartridges propel the ejector seat upwards. Fully dressed for his work, Horace weighs 200 pounds, is over six feet tall and is as much as two men can manage.

Sound You Can't Hear Detects Light You Can't See

Infrared light, invisible to the eye, can be detected with crystals vibrated by high-frequency sound waves, inaudible to the ear. This strange combination of super-human light and sound may even be ex-

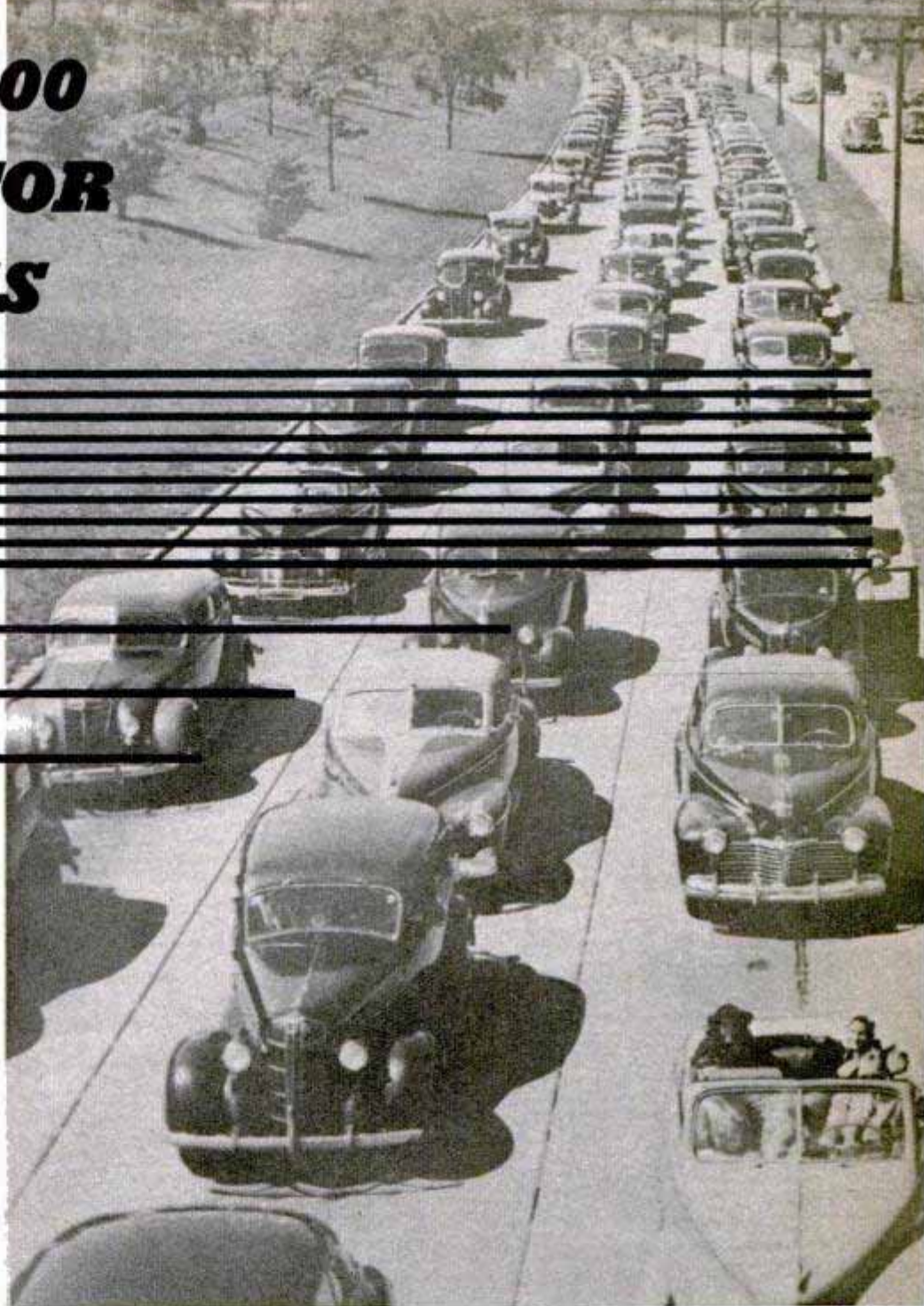
tended to detect radar waves which, like infrared light, are becoming increasingly important in modern warfare. Developed at the University of Illinois, the detector uses two crystals with a gas confined be-

tween them. These crystals are vibrated at an even rate by high-frequency sound waves. When infrared rays strike the layer of gas between the crystals, the rate and pattern of the vibrations are changed to such an extent that it can be observed by instruments, thus detecting the presence of infrared light.



In the white casing at right of the picture, two crystals, with a layer of gas between them, detect infrared rays projected on the crystals by a shutter unit opposite the opening in casing

100,000,000 U.S. MOTOR VEHICLES



United States 100,000,000

United Kingdom 7,000,000

Canada 5,250,000

France 4,500,000

Germany 2,750,000

Russia 2,500,000

Italy 1,250,000

Czechoslovakia 180,000*

Japan 150,000

Belgium 120,000

Sweden 90,000

Austria 75,000*

Switzerland 16,000

Poland 11,000

Hungary 6,000

Spain 6,000

Denmark 3,000

Finland 1,000

Netherlands 1,000

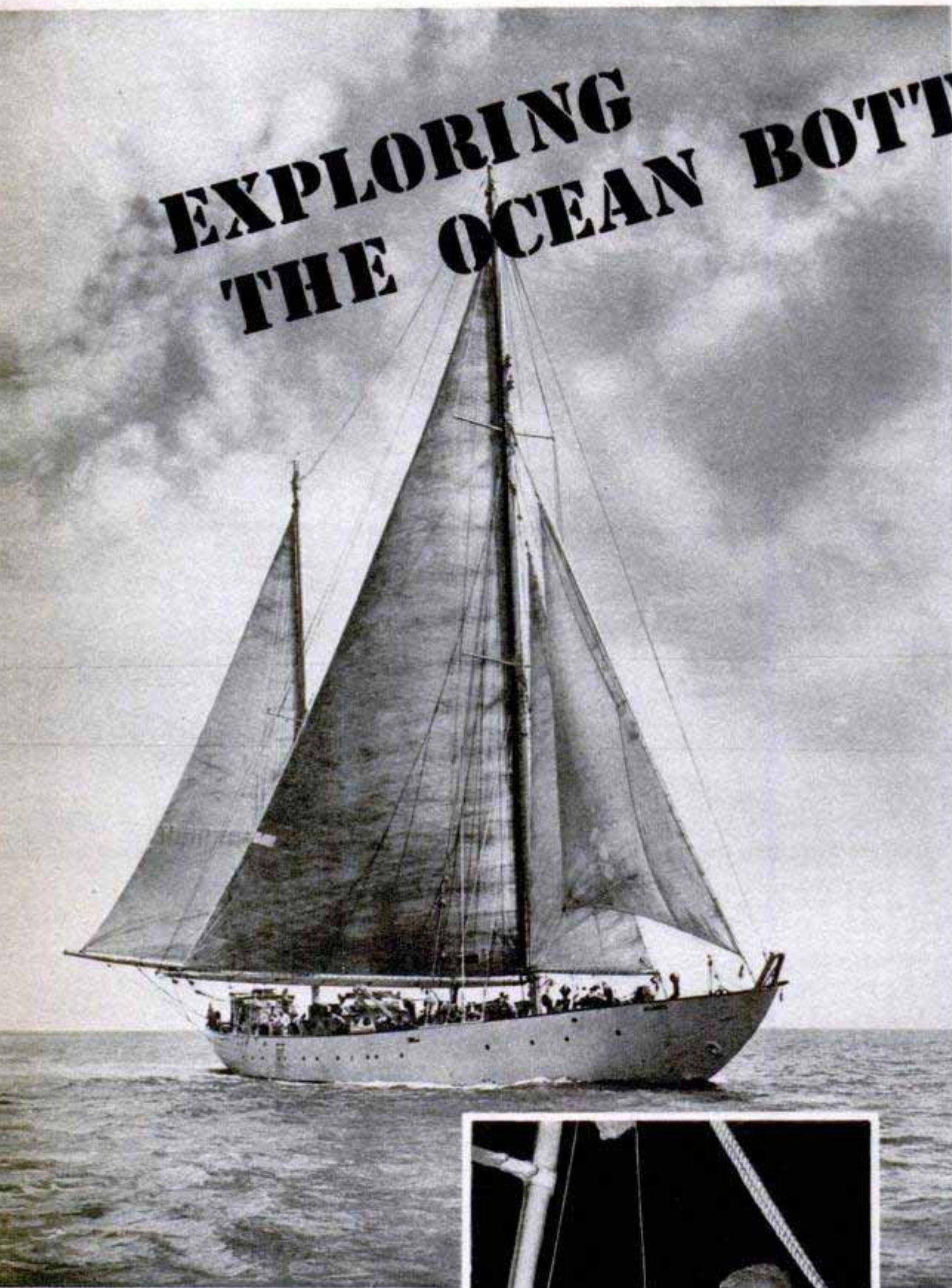
WORLD TOTAL 124,000,000

*Some of the vehicles produced in Austria and Czechoslovakia during World War II are included in the total for Germany

Here is the dramatic picture of U. S. automotive production—100 million vehicles, surpassing our nearest competitor by 93 million

POPULAR MECHANICS, which has recorded the development of the automotive industry from its early days, joins the nation in saluting the U. S. automotive industry for the production of more than 100 million motor vehicles. Eighty percent of these vehicles were passenger cars. The one-hundred-millionth unit was turned out last August. Automotive production has mounted steadily from 1900, when 4192 cars were built, to 1941 with an all-time high of 4,840,502 cars and trucks. During the wartime year of 1943 only 139 passenger cars were built. Those were the days when the industry devoted its tremendous energies to the production of military vehicles. In 1947, production climbed back to 3,558,178 passenger cars and 1,239,472 trucks for a total of 4,797,650 units. Despite supply shortages in various branches of car production, the industry is striving to exceed that figure in '48.

EXPLORING THE OCEAN BOTTOM



Research ship Atlantis under full sail heads out into the Atlantic to search the ocean floor. Auxiliary Diesel engine provides extra power

Crewman prepares to lower Ekman meter which records information on ocean currents. Dials show direction and speed of the current



AT A DEPTH of 3½ miles the long frame containing the camera settled through the water and struck the ocean floor with a soundless bump that triggered the flash bulb and opened the shutter of the camera. The film recorded the strange creatures that live beneath the overwhelming pressure of the ocean.

No human saw the same sight as the camera, which was lowered on a long wire from the research ship, Atlantis. The photo is one of a series taken during a recent cruise of the Atlantis for the Woods Hole Oceanographic Institution, a private, non-profit organization.

During the cruise the Atlantis covered 20,000 miles to chart the contours of the sea bottom in portions of the Atlantic Ocean. The expedition brought back much new information on ocean depths, currents, water temperatures and marine life. Special instruments acted as eyes and ears for the scientists to discover the nature of the terrain and wildlife miles beneath the surface of the ocean.

The Atlantis is a 142-foot steel sailing ship covered with so many instruments that there was scarcely room for the 9 scientists and 17 crew members who made the expedition. M. J. Pollak, scientist-in-charge, states that by means of the instruments the ocean-depth explorers were able to bring back much valuable data concerning the land that lies beneath the sea.

A new sea mount which rises more than 6000 feet above the ocean floor was discovered southeast of Bermuda. The scientists also learned that the Ampere Bank in the Atlantic, west of Gibraltar, is at least 36 feet shallower than was formerly believed.

The photographs were taken with a special underwater flash camera designed by Dr. M. W. Ewing, professor of geology at Columbia University, who took the Atlantis on another cruise late in the summer to find out more about the Mid-Atlantic

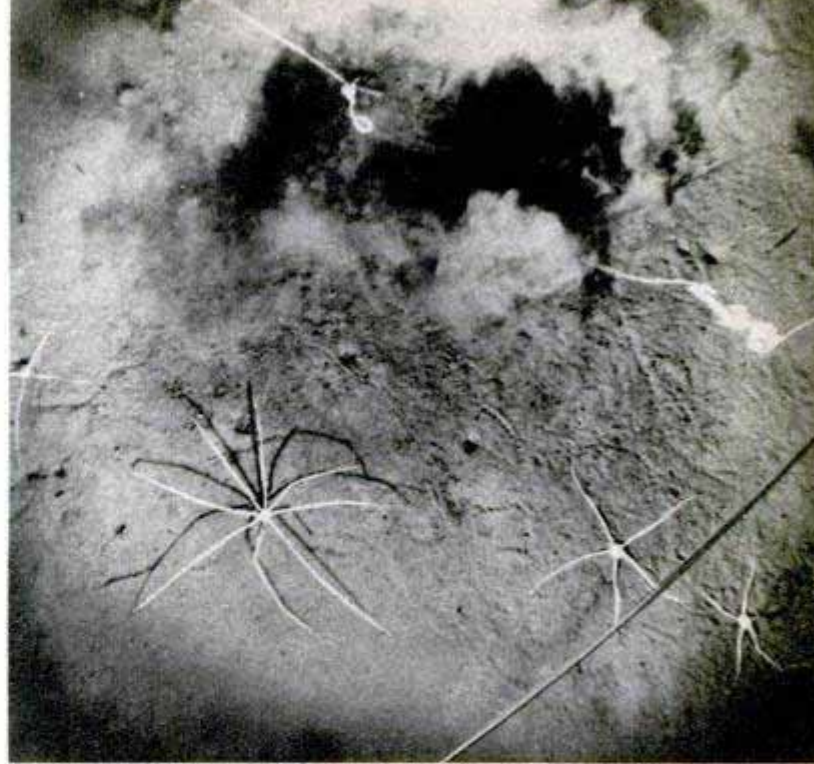
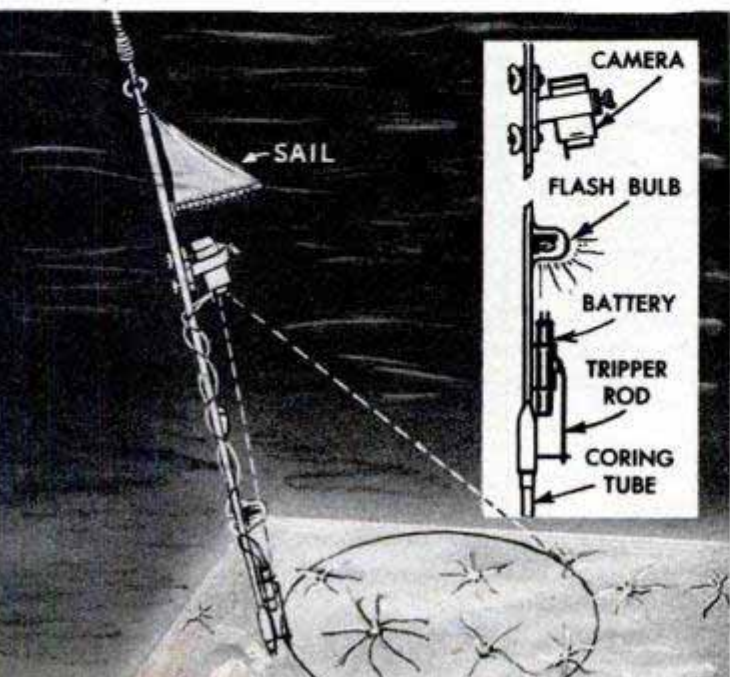
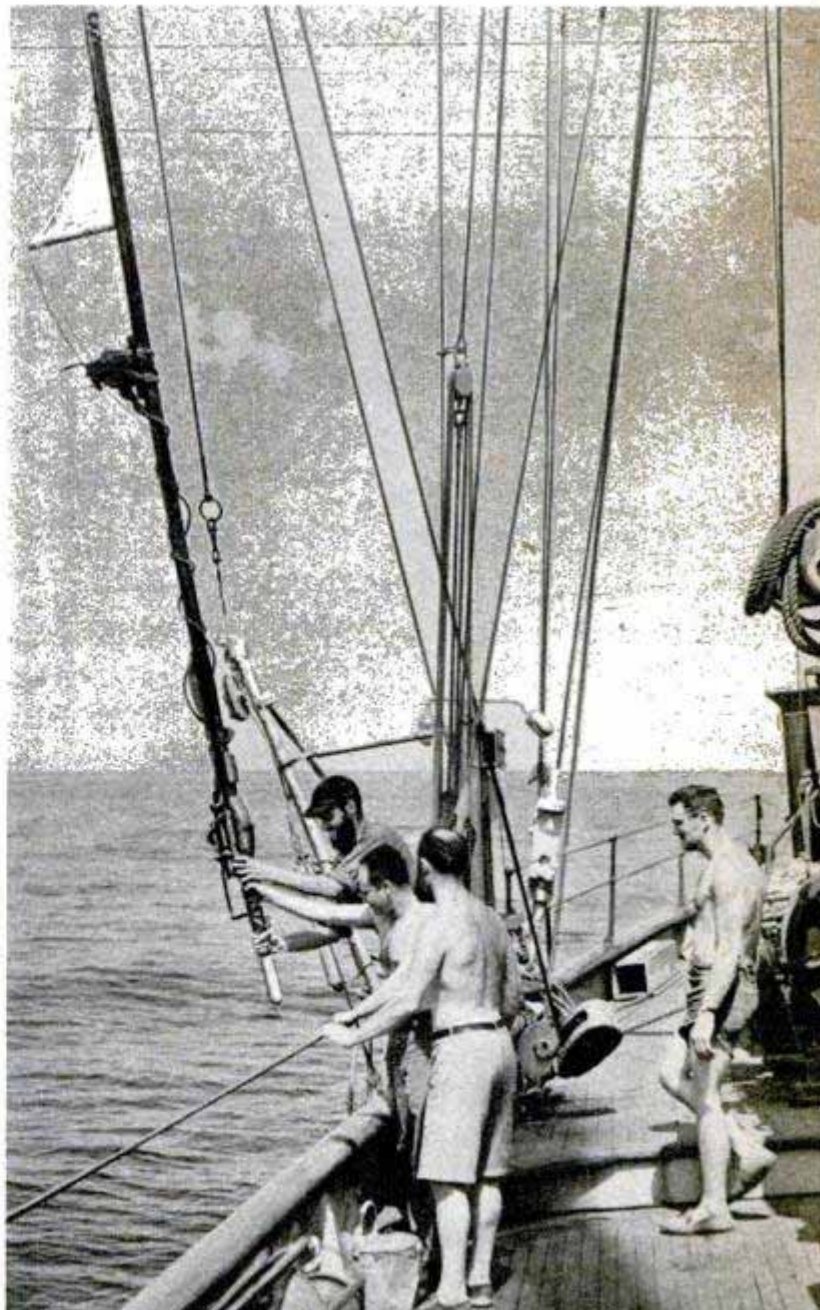


Photo snapped more than a mile beneath the surface shows sea spiders, largest one 28 inches in diameter. Below, underwater camera is lowered into the ocean. Drawing, bottom, shows how above photo was taken



Ridge. During this cruise he planned to make color photos of the ocean bottom.

To take the black-and-white photos, the camera was lowered on a wire by an electrically powered winch. When the frame struck the bottom, a trigger mechanism flashed the bulb and exposed the film. Several hours were required to reel out the wire and retrieve the camera each time a photo was taken. Exactly the right amount of wire had to be payed out in lowering the camera, as too much wire could foul the instrument.

The pictures, valuable because they reveal deep-sea life in natural surroundings, indicate that life on the deep ocean bottom is far more plentiful than was formerly believed. One photo reveals a 28-inch sea spider at a depth of 6000 feet, an ocean denizen that looks like a giant "daddy long legs." Pictures taken in the Mediterranean area show colonies of mysterious holes, each about 2½ inches in diameter and in groups that spread out for 12 square feet. It has not yet been determined what type of sea life makes its home in these sea-bottom caves.

Many of the photos show no living creatures, but are valuable because they record the nature of bottom deposits and may indicate bottom currents.

The expedition also discovered that the

Scientist in the laboratory of the Atlantis checks thermometers to learn temperatures at various levels



mysterious "false echo" on depth finders occurs in the Mediterranean. For some time, operators of depth finders have noted that they receive a false reading in certain areas. Some of the scientists believe this layer, moving some 1200 feet below the surface, is made by myriads of shrimp. Since the upward and downward movements of the layer are influenced by light, light-transparency tests were made during the cruise of the Atlantis. The scientists used a photoelectric cell and a wooden disk painted white to discover how far light penetrates beneath the surface. Such information reveals how much light is available for microscopic ocean plants.

An instrument called the Ekman current meter was used to determine the speed and direction of subsurface ocean currents. The meter contains a propeller and a compass. The compass automatically records the direction of flow, while the propeller is driven by the moving water to indicate the speed.

An instrument resembling a miniature torpedo was towed behind the Atlantis to make sound observations. The instrument was towed at some distance astern to escape the noises made by the ship's engines.

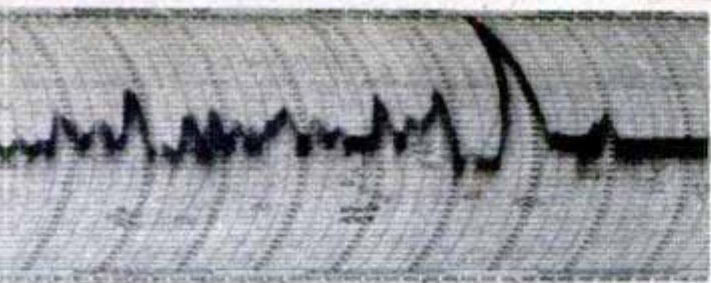
Reversible thermometers accurate to within 1/100 degree Centigrade recorded the water temperatures at various depths. An instrument called the bathythermograph was lowered more than 2000 times to record water temperature at depths to 800 feet while the ship was underway.

The scientists picked up all possible marine information during the cruise of the Atlantis. They followed flights of migratory birds on the radar screen and recorded data on ocean waves. Samples of sediment were scooped from the bottom and records of the sea-surface temperature, the air temperature and wind force were made. More than 2500 samples of sea water from various depths were brought back to the home port for chemical analysis. They will yield data that may indicate the flow of horizontal and vertical currents.

Very fine mesh nets were towed behind the Atlantis to obtain plankton, the minute plant and animal life which forms the basic source of food in the ocean. This information proved that the Mediterranean area is relatively poor in marine life.

The Atlantis left home port on another expedition during the summer to study the underwater mountain range which divides the Atlantic Ocean. There, valuable information on the origin and history of the continents is hidden beneath miles of water. In their attempt to chart parts of the ridge the scientists use the sonic depth finder to determine the topography of the

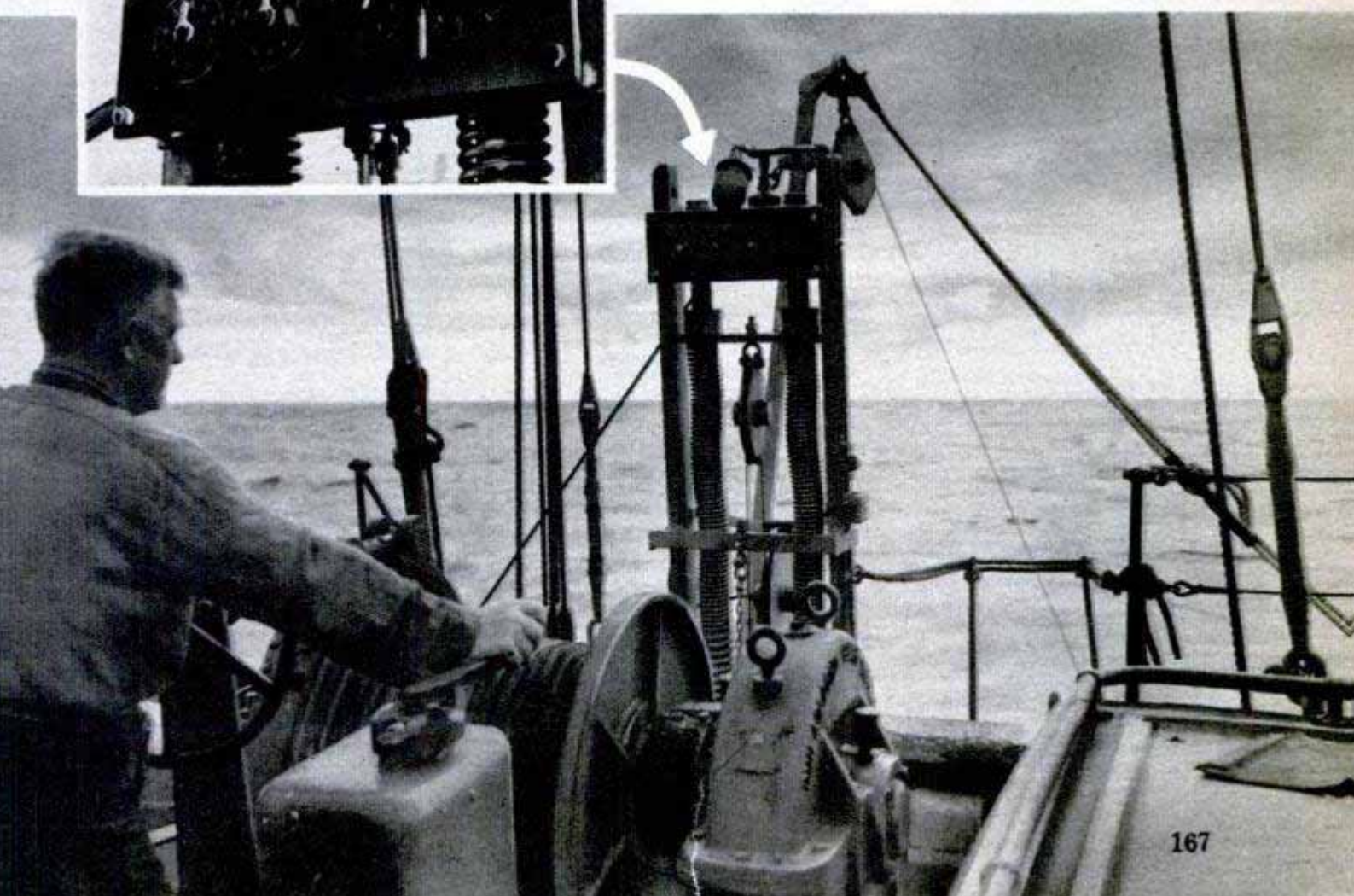
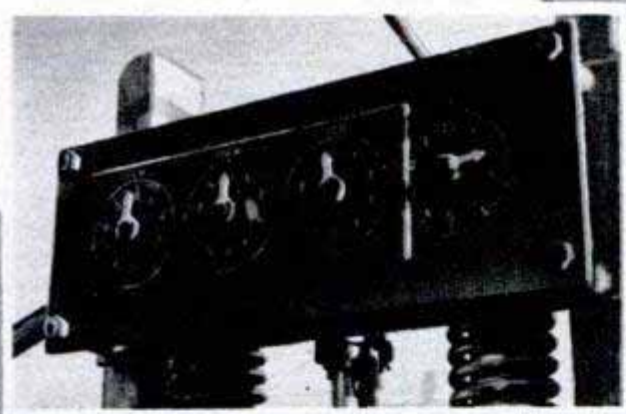
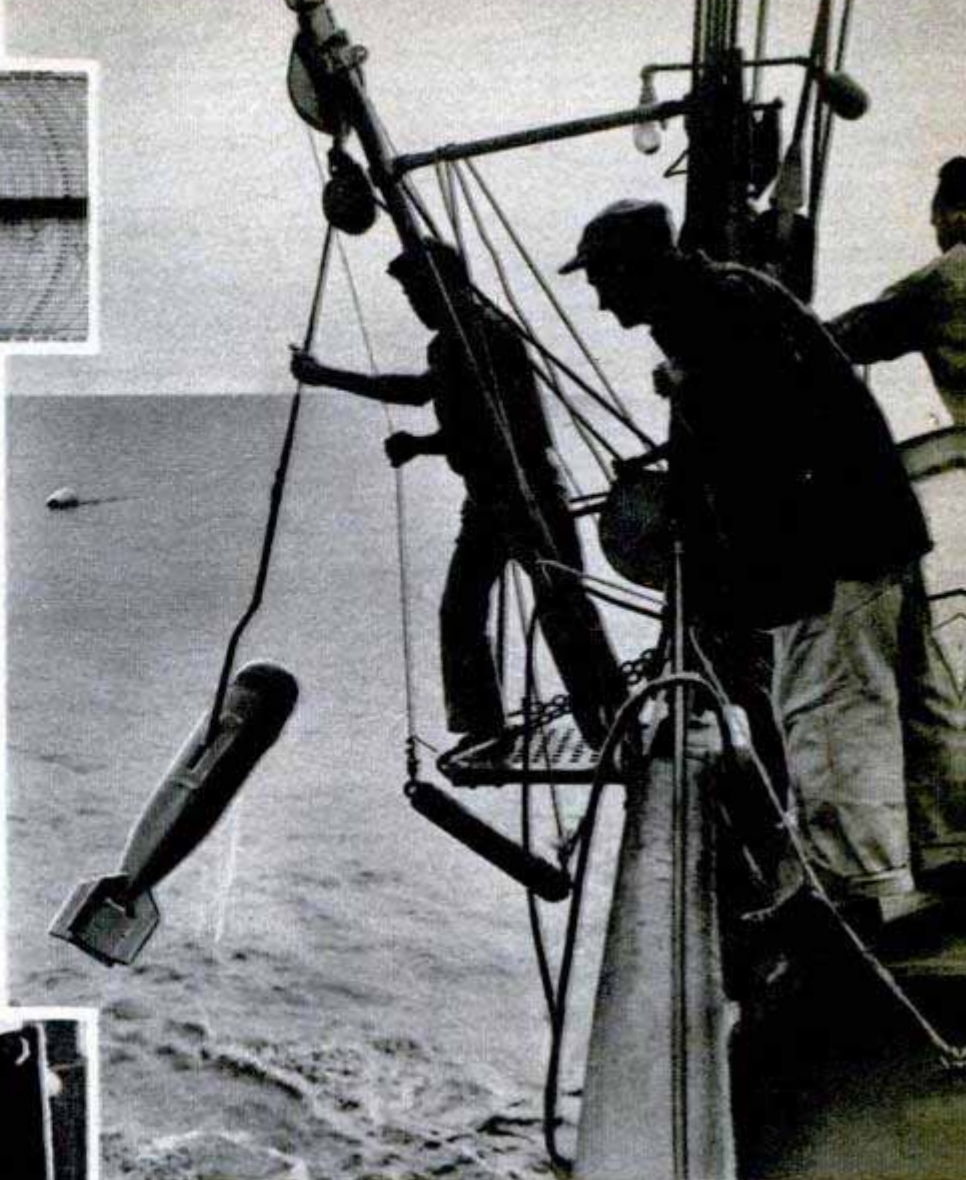
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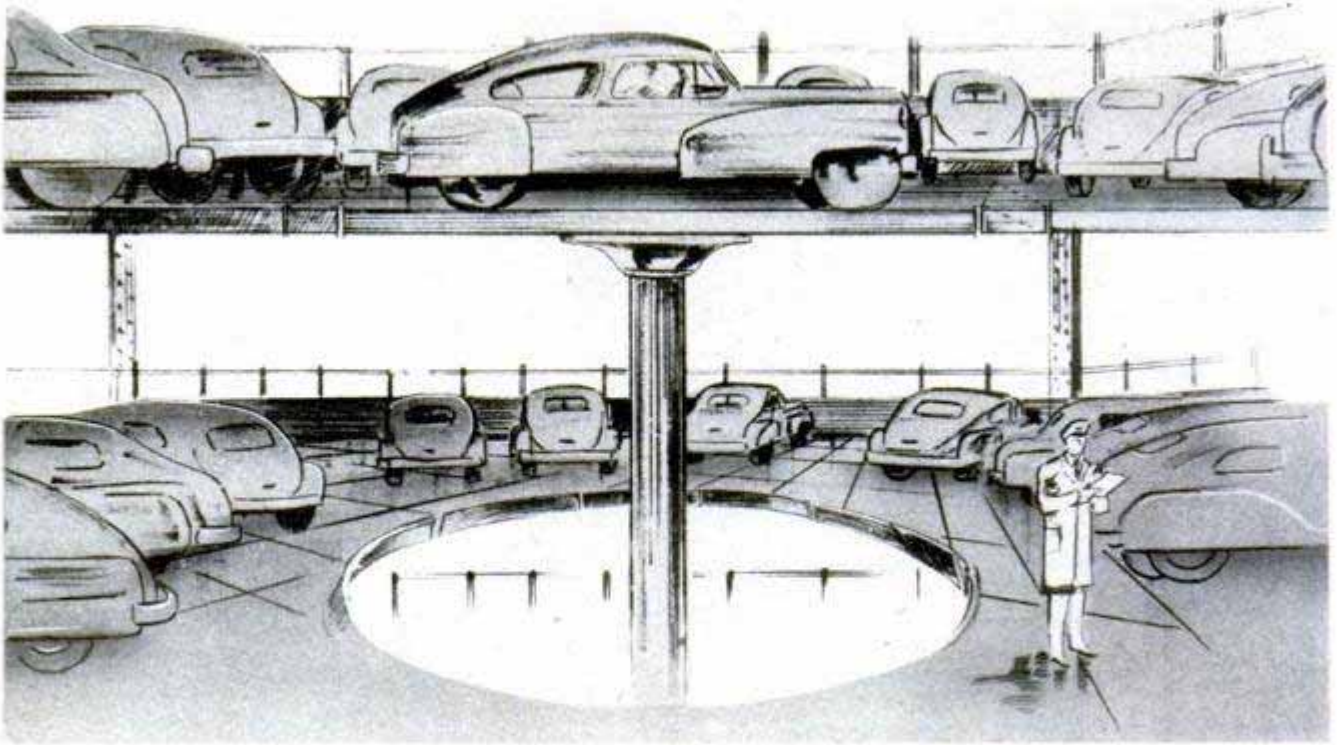
↑ Recording pen of the Fathometer traced this record on graph paper, which shows a sea mount rising about 6000 feet above the ocean floor southeast of Bermuda

Instrument for picking up sound under→ the surface is hoisted back aboard the Atlantis. It is towed behind the ship to escape interfering noise from engine

↓ Hydrographic winch pays out wire to which the underwater instruments are attached. Dials, shown in inset, show length of wire and angle so depth at which instrument is operating can be determined

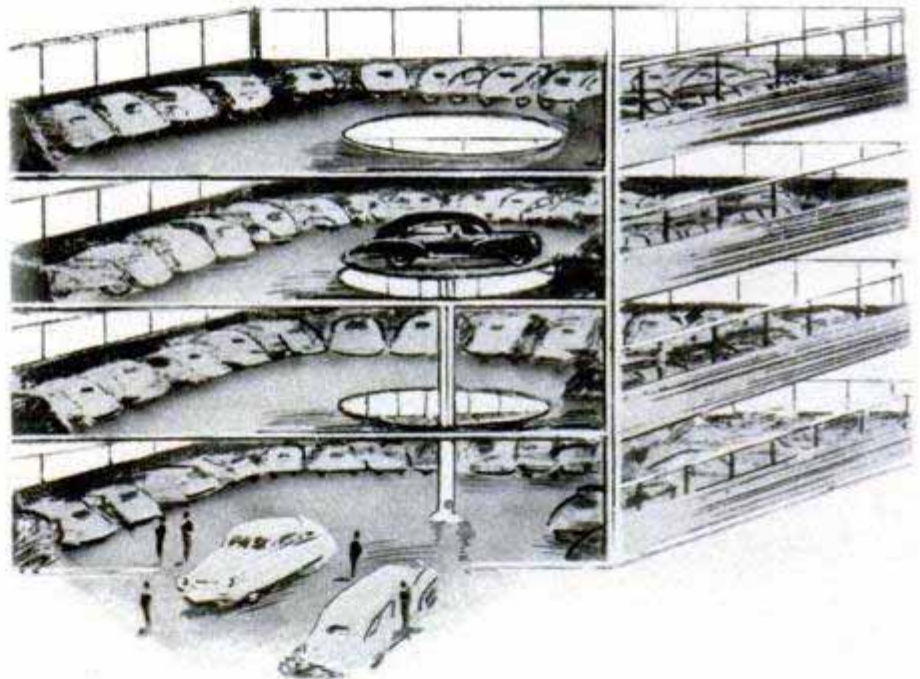


Portable Garage Designed to Solve Parking Problem in Large Cities



Top, turntable on the elevator enables the attendant to swing the car around until it faces a vacant stall. Below, a cutaway drawing of the proposed garage

Designed so that it can be taken apart and moved easily, a portable garage will provide maximum parking space on small, vacant lots in downtown shopping areas. The garage consists of several floors connected by a circular elevator. No walls or roof are used. The garage will be fabricated of structural-steel parts that bolt together, thus making it easy to disassemble and move when the space is to be used for some other purpose. A turntable platform in the center of the building is raised and lowered by a hydraulic elevator. The car is driven on the platform and the elevator lifts it to the desired floor. The attendant then



swings the turntable around until the car heads toward a vacant parking stall. An automatic curb springs up when the elevator leaves each floor to prevent cars from accidentally rolling into the opening.

Detector Guards Workers Against Beryllium Particles

Quantities of beryllium as minute as six one-trillionths of a pound are detected in the air by a technique designed to protect workers who might inhale the particles. An infinitesimal amount of beryllium goes into the air in machine shops where beryllium alloy is being cut. To measure the rare element, the mouth of a tube is placed where

the worker's face normally is located. Air is drawn through the tube by a pump and passed through a fine filter capable of snaring the tiny beryllium fragments. The filter is burned in a furnace and the ash analyzed under the spectrograph to find out whether beryllium is present in amounts that would be dangerous to the worker.



War-Surplus Glider Becomes Trailer Home

Once part of the Air Force, a war-surplus Army glider is now the comfortable trailer home of a Navy veteran and his family. Veteran Russel Bouton, a carpenter, converted the glider by removing the wing and tail and lining the interior with birch plywood. The pilot's compartment became a modern kitchen-dining room with plenty of natural light provided by the Plexiglas nose. A living room in the center and a separate bedroom in the tail section furnish enough room for four adults and two children. Hydraulic brakes that were part of the original glider are operated from the tow jeep for braking the trailer.

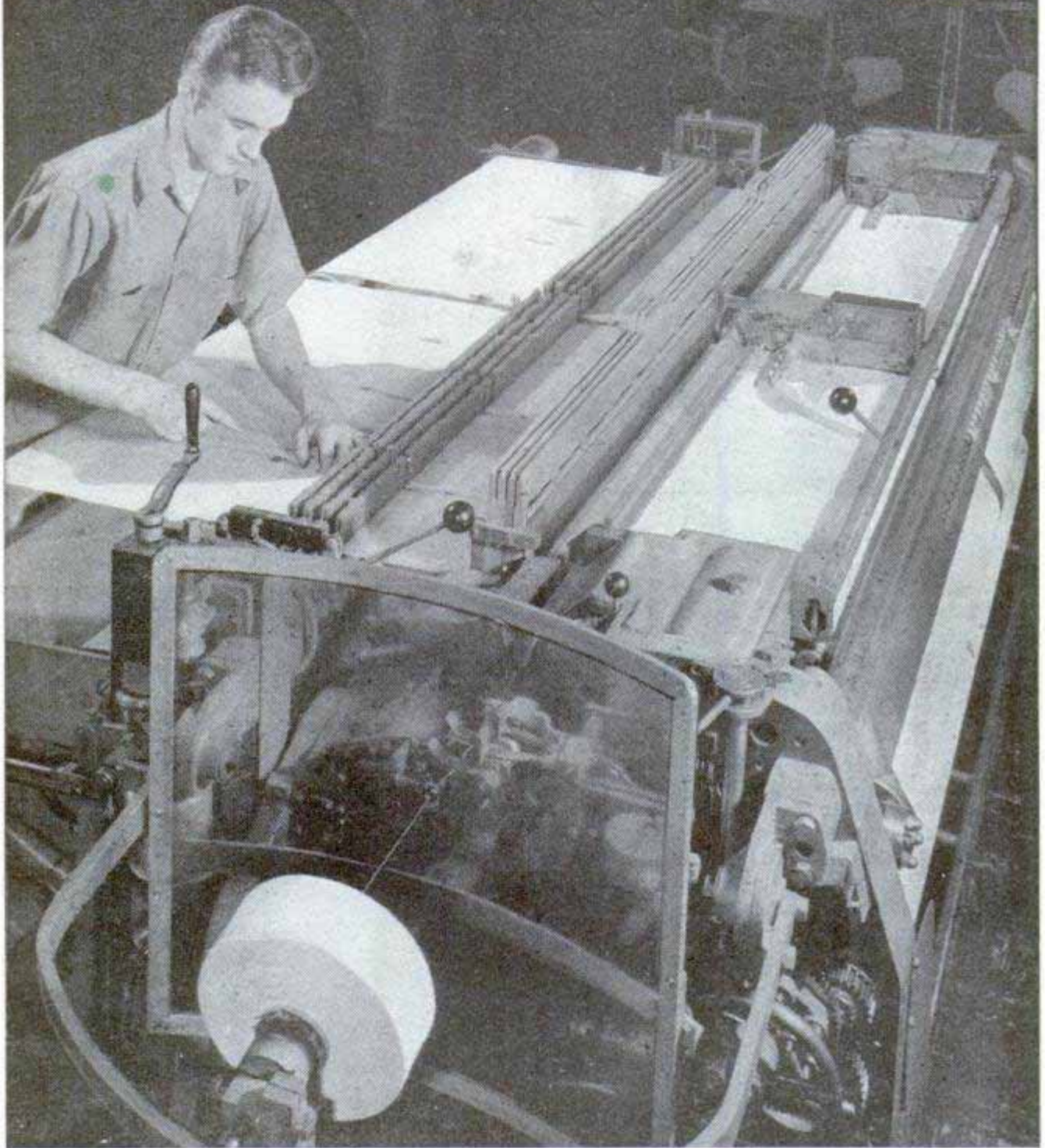
Above, there's plenty of daylight in the kitchen-dining room built in the Plexiglas nose. Below, exterior view of trailer



← **JOINTED STEM** on a new pipe enables the smoker to tilt the bowl or bit in any direction for convenient holding. The center unit of the stem is made of a lightweight alloy. It uses replaceable filters and the stem, being flexible, is almost unbreakable

Our **WHERE-TO-FIND-IT INDEX**, which lists names and addresses of the manufacturers or distributors of the products described in this issue, is available to readers without charge. For your copy, just write to Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11, Ill.

Revolution in Weaving



New loom uses a tiny shuttle and no bobbins. Filling thread is supplied by the large cone in the foreground

WEAVING, one of the world's oldest industries, is on the verge of a revolution. Leading the revolt is an invader from Switzerland that has eliminated the wooden shuttle and bobbin and promises to speed up the weaving process by 300 percent or more.

The welcome invader is a weaving machine that represents the first radical ad-

By Arthur R. Railton

vance in the weaving art in decades. The machine is so much more advanced mechanically than the traditional power loom that its American manufacturers, the Warner & Swasey Co. of Cleveland, Ohio, insist it can't properly be called a loom.

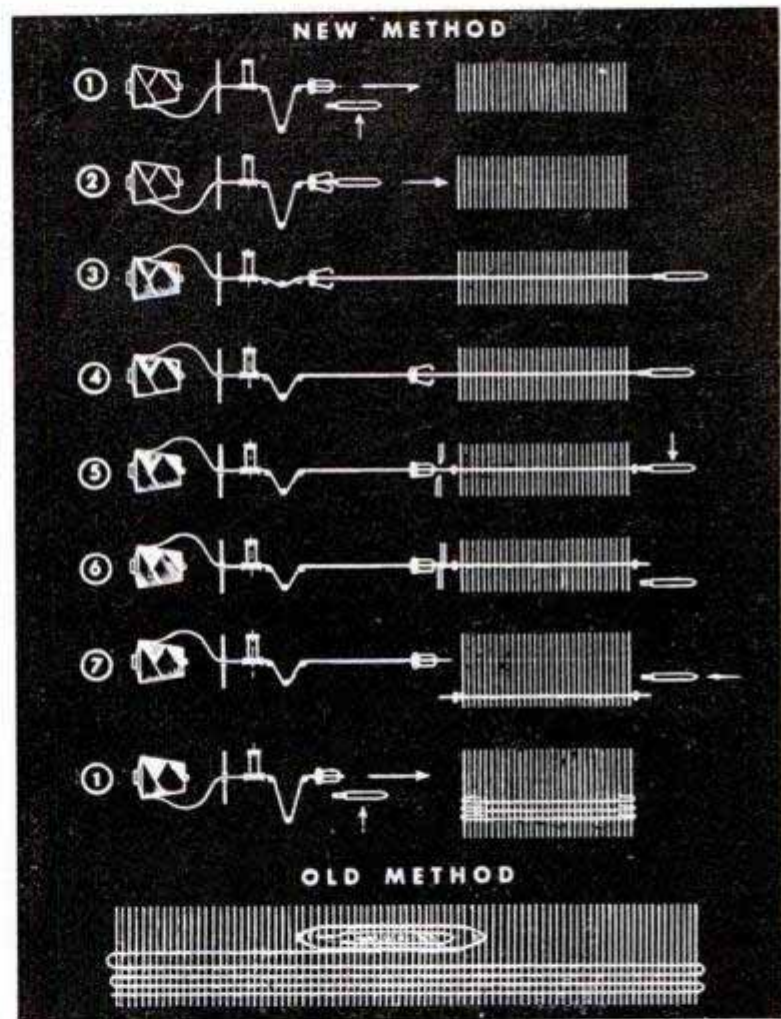
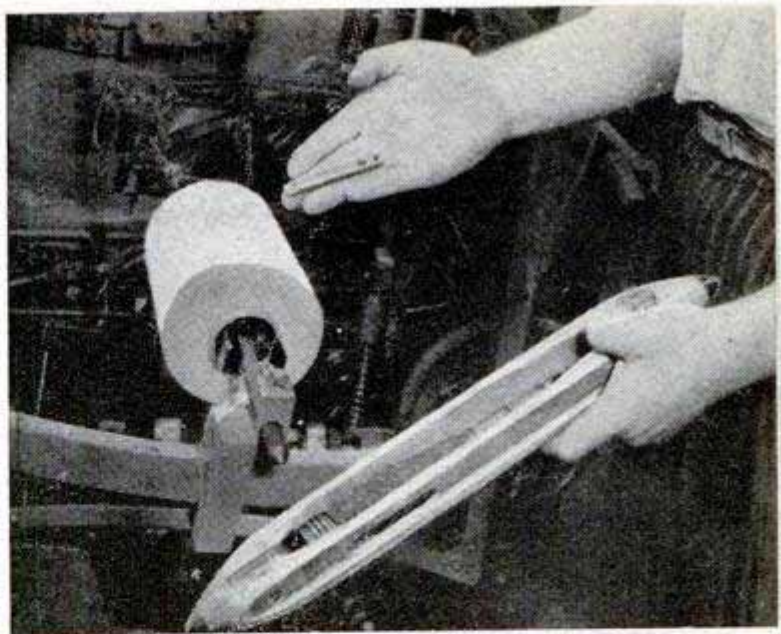
Basically, weaving is the interlacing of threads at right angles to form a fabric.

Whether this weaving is done by hand or by power machinery, a loom is used to hold a series of warp threads while cross threads (called weft or filling) are pulled through at right angles to the warp with a shuttle. To make these cross threads interlace with the warp to hold the fabric together, a thread-shifting arrangement, called a harness, is used. The harness shifts warp threads up and down, creating the over-and-under pattern of the fabric.

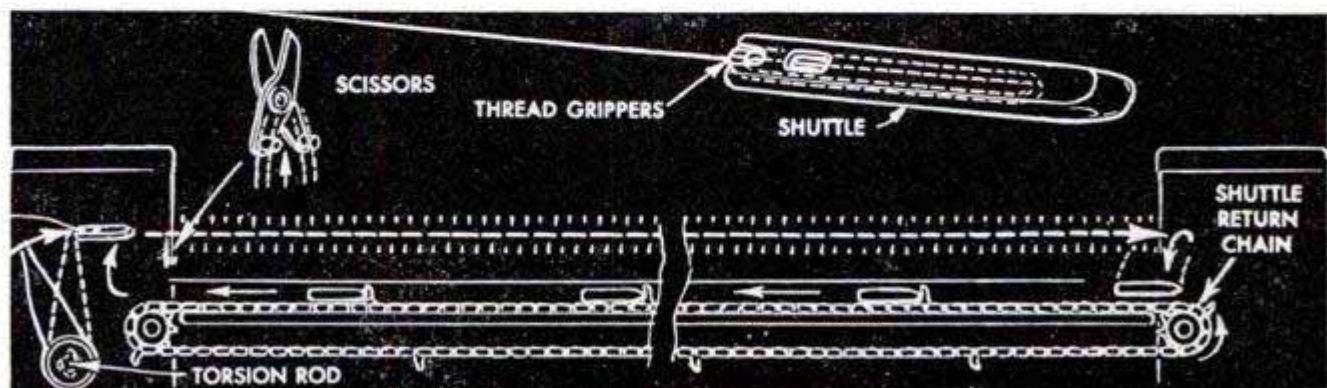
The new Warner & Swasey-Sulzer weaving machine or loom, being produced in an improved version based on the original design of Sulzer Brothers in Switzerland, doesn't change this basic weaving technique. Warp and weft are still interlaced. But the method of weaving has been brought up to date by modern industrial methods.

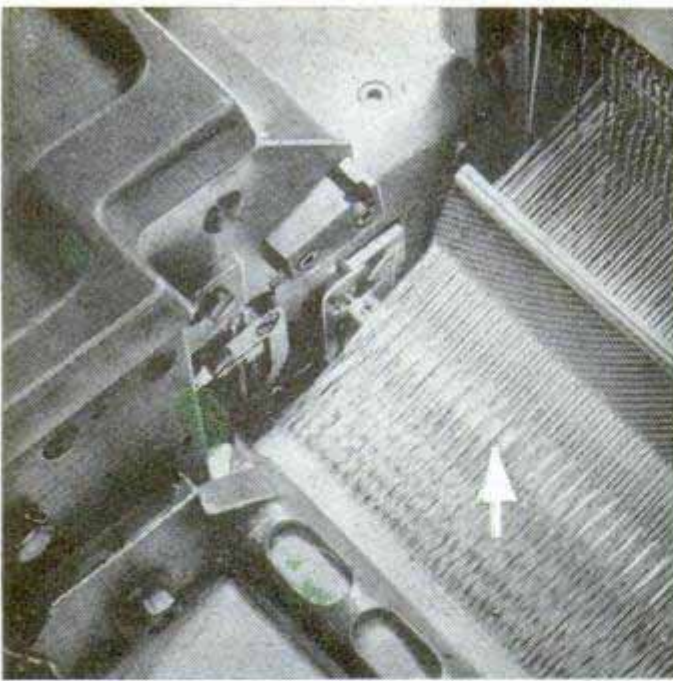
In the conventional power loom, the shuttle, which carries the filling or weft thread back and forth, is a slender piece of wood tapered on both ends like a double-ended torpedo. The cross thread or filling unwinds from a bobbin inside the shuttle. Leaving a trail of filling thread that is continuous through the fabric, the shuttle is driven back and forth across the warp. Because it carries the bobbin, the shuttle has to be large and because it is large it rubs against the warp threads as it travels to and fro at tremendous speeds, causing yarn abrasion.

As the filling thread is continuous, only one shuttle can be used. It makes thousands of trips across the warp, leaving a trail of thread like a spider dropping from



Top, tiny, new shuttle compared with old. Right, the new and old weaving systems. Below, sketch of new shuttle action with enlarged drawing of shuttle and scissors





Left, shuttle (arrow) starts across loom between warp threads. Right, close-up shows tucking-needle action

the ceiling. Large and comparatively heavy, the shuttle limits weaving speed and cloth width. Also because of the large shuttle, the harness has to raise and lower the warp threads a relatively long distance to permit the shuttle to pass through.

The Warner & Swasey machine has surmounted these limitations that have plagued weavers for years. It does it by eliminating the traditional shuttle and replacing it with tiny, all-metal shuttles that are "fired" across the warp like bullets from a machine gun. Unlike the old-fashioned shuttle, the new type doesn't carry a supply of filling thread. With mechanical fingers, the slim, one-ounce gripper shuttle grabs the end of the thread from a large, fixed cone, pulls it across the warp at about 65 miles an hour, releases it and drops down on a conveyor chain to return for an-

other thread. As soon as one shuttle has completed its cross-warp trip, another is fired, pulling another thread with it.

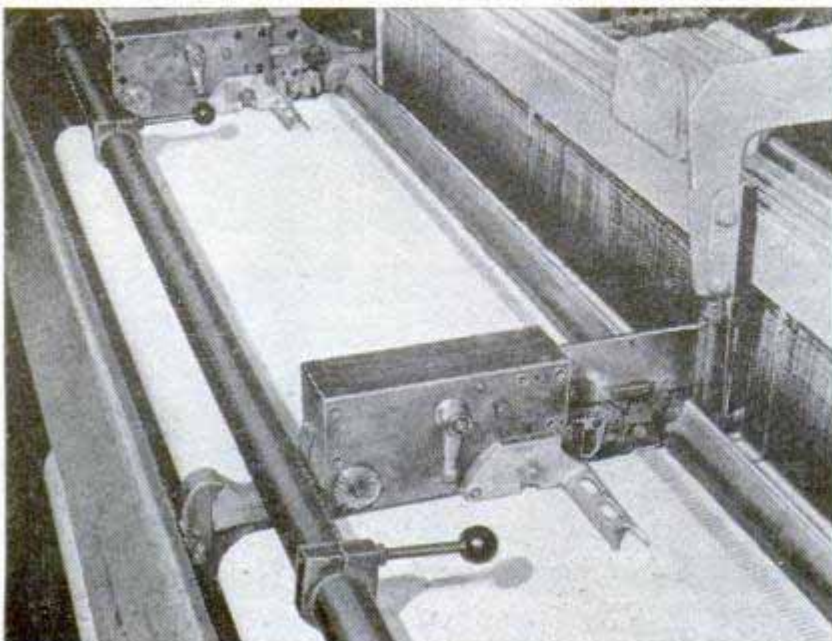
The fingers which grip the thread are set into the shuttle at the rear. They close and open at precisely the right time to grab and release the thread. As soon as these fingers have gripped the thread, a steel torsion rod about 30 inches long is released, flipping the shuttle at terrific speed through guides to the opposite side of the warp.

Instead of having a continuous filler thread running through the fabric, the new machine cuts off each thread when the shuttle has pulled it through the warp. Tiny scissors cut the thread at the starting end as it is held by two grippers. These grippers move the thread out of the way of the next shuttle and wrap it around two

needles, one at each end, that tuck it into the warp so rapidly you see nothing but a blur as they move. Tucking the thread prevents it from pulling loose in the fabric.

This cycle is repeated as many as 240 times a minute with shuttles being fired across the warp so fast they are invisible. About 16 shuttles are used to provide an almost continuous stream when the loom is operating.

The filling thread comes from a large cone mounted on a curved bar at one end of the



Tucking units, mounted at any place across the warp, enable the loom to weave several widths simultaneously

machine. Several cones (they're called packages or "cheeses") can be mounted on the bar and their threads tied together to provide a continuous supply of filling. Mechanical fingers hold the filling thread at the correct tension by an ingenious cam arrangement.

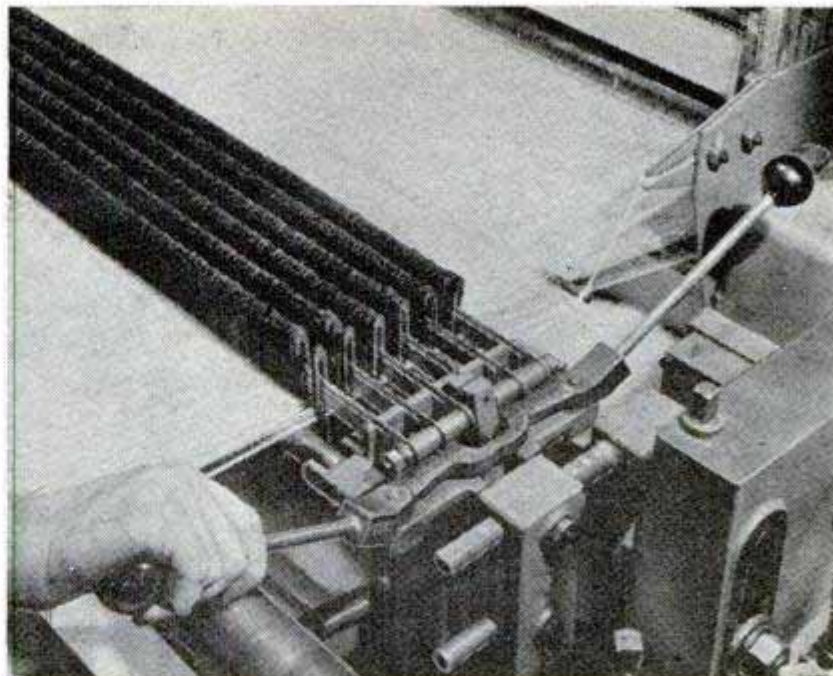
Because of the small size of the shuttles and because they travel inside a tunnel of guides, there is no rubbing of the warp threads by the shuttles as in conventional looms. The small shuttle also reduces the up-and-down travel of the harness and thus speeds up loom action.

Operation of the new machine is just about foolproof. Automatic controls prevent one cycle from beginning until the previous one has been completed. The controls stop the loom at once, preventing damage to the machine and fabric.

Because the shuttle uses no bobbins, the new weaving machine eliminates several processes preliminary to the weaving. Filling yarn doesn't have to be wound on hundreds of small bobbins. The packages or cones, which are used just as they come from the winding room, contain many times as much thread as the small bobbins.

By placing tucking units, consisting of needles, scissors and grippers built into a small assembly requiring only one inch of cloth width, at any place across the loom, the weaver can convert the machine for weaving more than one width of cloth at the same time. Thus with the 110-inch machine, it is possible to weave three strips of cloth, each about a yard wide. Conventional looms weave only one width at a time because of the continuous filling thread.

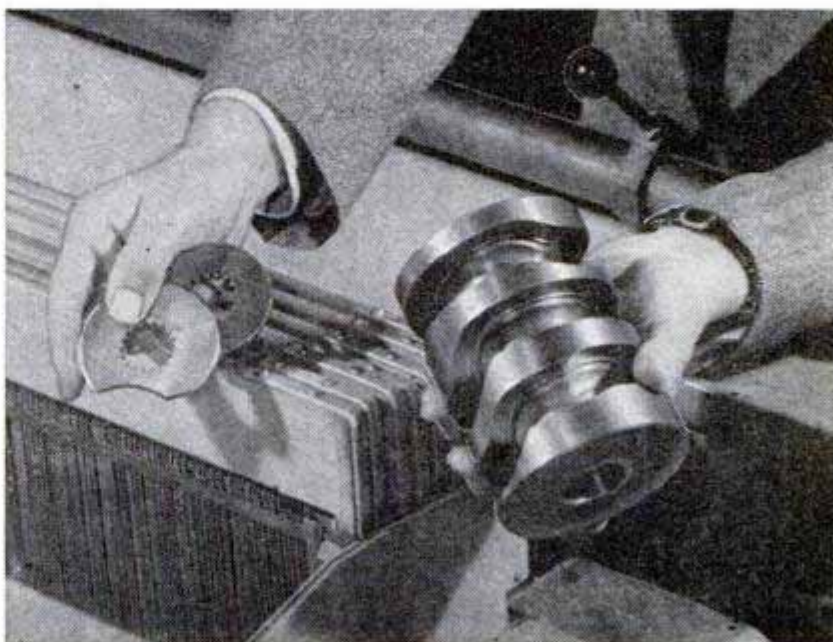
Adapting the Swiss machine for American mass production was a laborious task. Warner & Swasey engineers worked two years on the problem before it was completely solved. The basic step was the conversion of all machine dimensions from metric to English units of measure. But the biggest task was reducing the number of parts that required time-consuming machining. The Swiss



Copper strips rest on warp threads and drop, stopping loom, when a thread breaks. Lever separates strips to reveal the broken thread

models were produced carefully and with considerable hand work. No attempt was made to design them for mass-production. Cleveland engineers had to redesign many parts for modern production methods. For example, one cam, requiring 35 minutes to machine originally, was redesigned so that it is now made in only two minutes.

In 1661 a Polish inventor built what may have been the first successful power loom. The shortsighted rulers of his day promptly killed him and destroyed his loom, claiming it would ruin the people who did hand weaving for a living. Warner & Swasey believe that their loom is the greatest advance in weaving since that first power loom, but this tragic story doesn't worry them. The world now knows that labor-saving devices are not detrimental, but beneficial to society.



Large cam at right is part of Swiss model. Flat cams are the new design that cuts production time 95 percent



Two-Brush Polisher Also Scrubs, Waxes

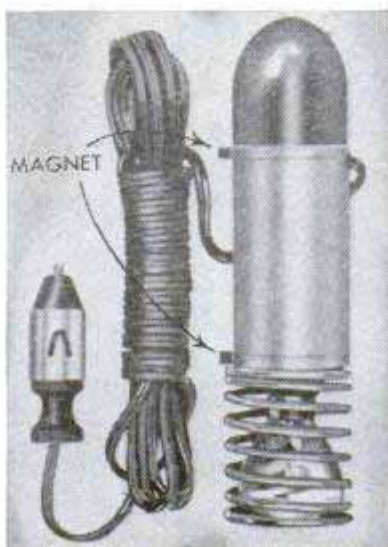
Waxing, polishing, scrubbing and sanding are all part of the day's work for a double-brush, floor-maintenance machine. When the long handle is removed and two hand grips substituted, the machine can be used for polishing automobiles and furniture. The two brushes revolve in opposite directions assuring perfect balance and easy directional control.



Top right, for floor work, the long handle is used. Top left, hand grips convert it for use in sanding and (left) polishing

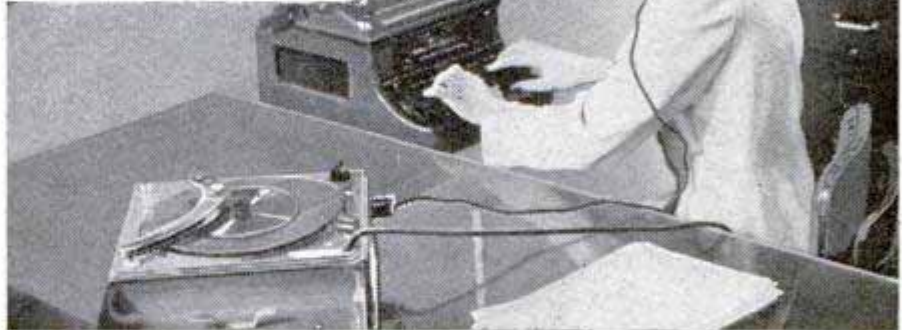
Car Trouble Light Has Warning "Flare"

Combining a trouble light with a red "flare," an emergency light for motorists plugs into the cigarette-lighter socket. The light has a powerful electromagnet that holds it against the body or motor. The white bulb is protected by a guard and the opposite end is made of red plastic that glows brightly as a warning to approaching cars.



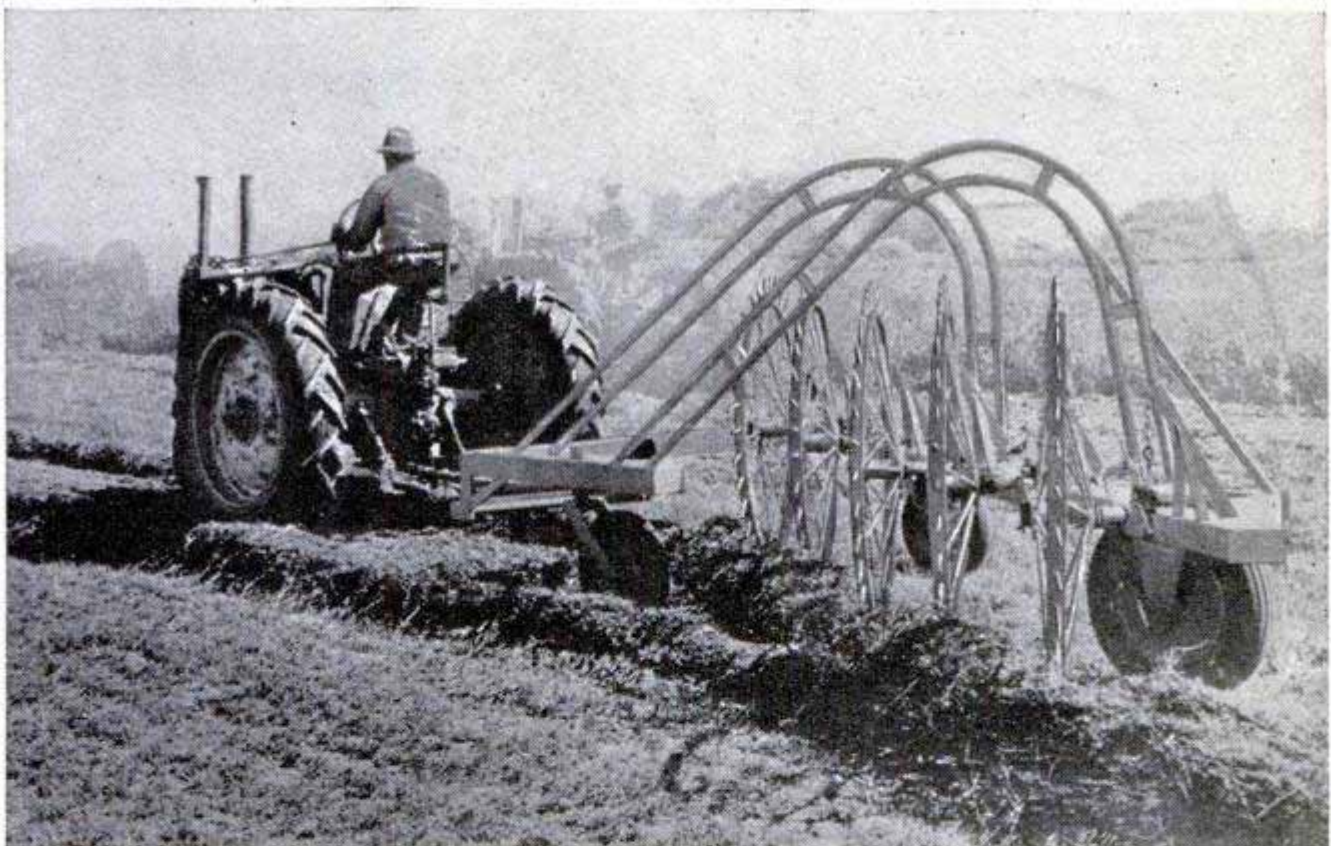
Coded Recordings

Confidential messages are recorded in code on paper records that can be played back only on a recorder equipped with a coding disk identical with the one used during the recording. This disk, made of plastic, consists of concentric wavy grooves that control the path of the pickup arm around the paper record. Only two copies of each control pattern are made so that complete secrecy is assured. Recording is done magnetically on the paper record, leaving no grooves or marks to guide the pickup. Without the deciphering device, the pickup arm cannot follow the magnetic path on the record and the message is garbled and unintelligible. The record can be folded and placed inside an



Dictation can be played back only by using coding disk (top) identical with one used for recording. Grooves control path of the recording head

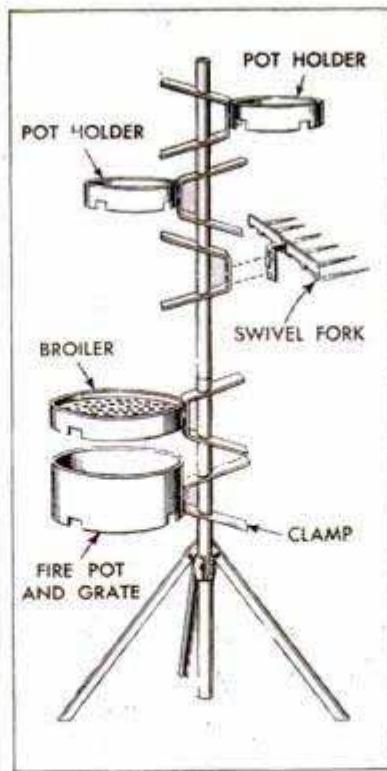
ordinary letter envelope for mailing. It is designed for transmission and filing of confidential material.



Side-Delivery Rake Reduces Excess Leaf Shatter

Excess rolling and leaf shatter are eliminated by a side-delivery rake that makes windrows for baler pickups and windrow harvesters. Having no gears, chains or sprockets, the rake is almost foolproof in operation. Five large wheels rotate freely

on individual axles, raking the crop gently into narrow windrows. It can be used with any tractor and its full-floating action permits its use on contours and rough land without difficulty. Maintenance is simplified because it has few wearing parts.

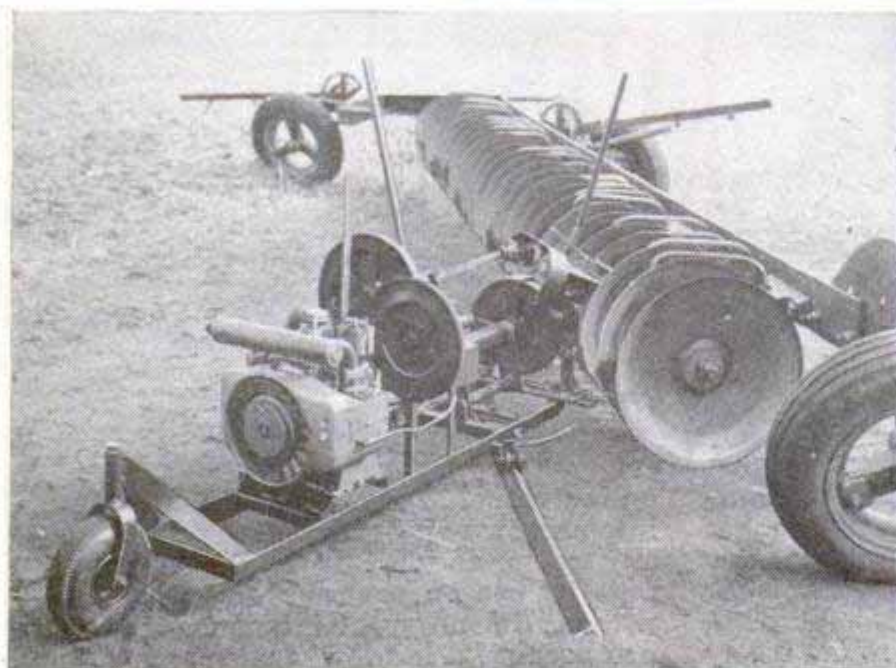


Portable Cooker Stands on Tripod

With a tripod base that holds it upright, an outdoor cooker has adjustable racks for holding a skillet, coffee pot and wieners. The six-pronged wiener fork toasts four at a time and swivels to cook both sides. Wood, charcoal or coke can be burned in the fire pot. The racks and fire pot have clamp-type brackets that lock in any position on the upright tube or can be removed entirely. For ease in carrying, the cooker packs into a compact kit, the long upright being made in two sections.

Rear-Engine Tractor

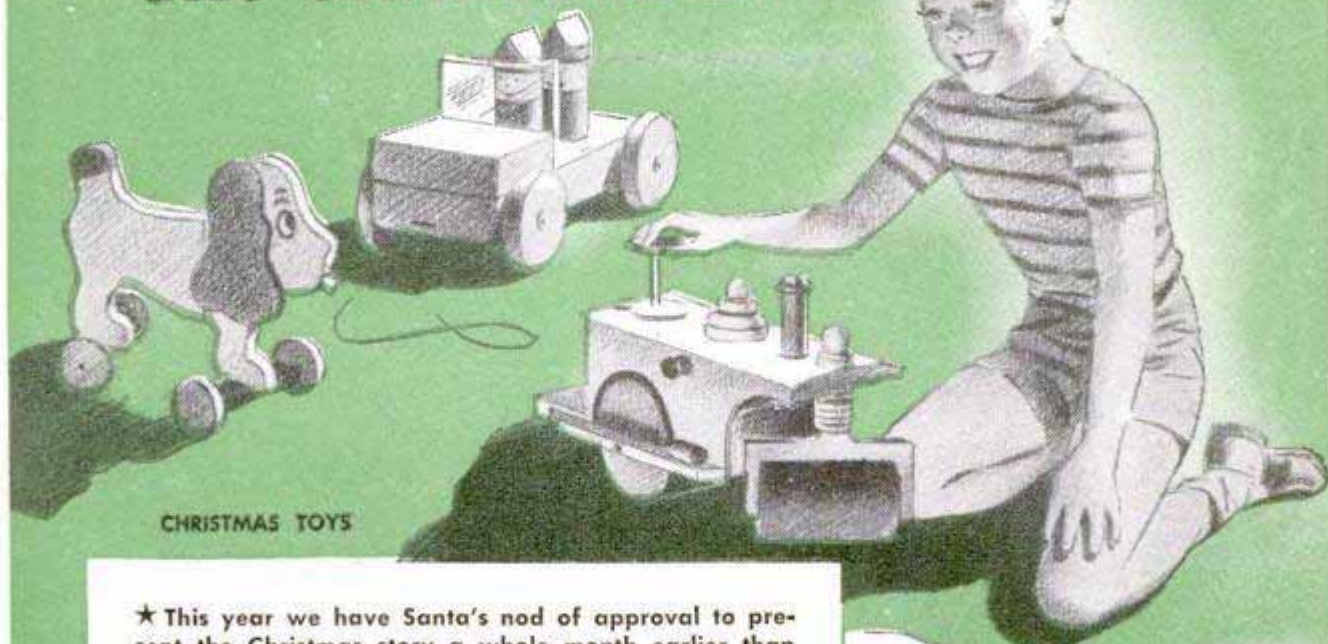
Tractor operators see exactly what the implements are doing without turning around when driving a rear-engine tractor that mounts its implements just behind the front wheels. Any implement can be attached or removed in five minutes or less. The engine, located behind the seat, is economical to operate, using from two to three quarts per hour under medium to heavy loads in average soil.



Disks Are Ground Without Dismantling

Disk blades on farm implements are sharpened right on the machine by a portable grinder powered with either a gasoline engine or electric motor. It will sharpen a one-way disk in less than an hour without the bother of dismantling. A fiber drive roller rotates the blade against the emery wheel insuring complete sharpening. A metal track, laid on the ground parallel with the chassis of the implement, holds the grinder at the correct angle.

The CRAFTSMAN



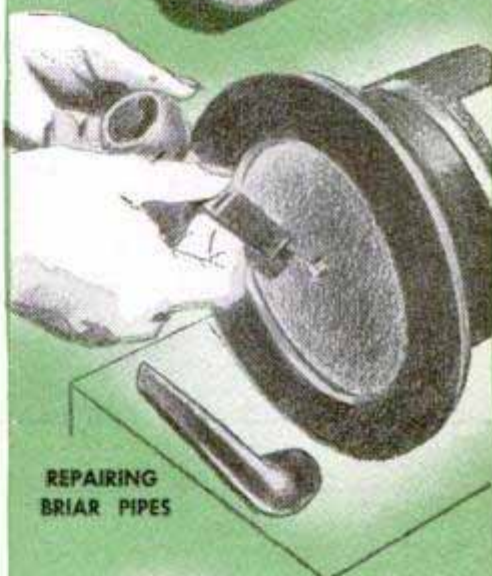
CHRISTMAS TOYS

★ This year we have Santa's nod of approval to present the Christmas story a whole month earlier than usual. On page 190, several of our experienced toy designers present their own ideas of what are tops in easy-to-make toys. Dads with long Christmas-gift lists, small workshops and limited time will find this story made to order, and early enough to get a head start.

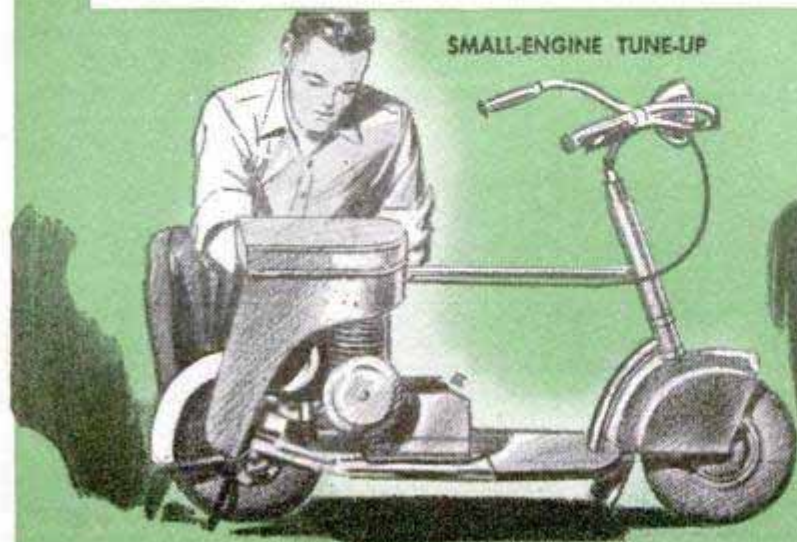
★ To craftsmen who like to work with fine hardwoods, pipecrafting will be a challenge to manual skill. Yet it takes only a few tools plus the craftsman's touch to make a fine briar pipe any smoker would be proud to own. Our story on page 208 is of special interest because it gives step-by-step instructions both on making and repairing pipes.

★ An article of particular interest to homeowners, and those planning new homes, outlines approved methods of preventing wall condensation in houses already built and also those in the planning stage. Page 197.

★ New power demands on single-cylinder, air-cooled engines range from the simple motor scooter to complicated machines requiring drives capable of delivering uniform speeds. These unusual power demands on the little "one lungers" make a regular service schedule necessary. A practical shop article, written by an authority on gas-engine tune-up, begins on page 222.



REPAIRING
BRIAR PIPES



SMALL-ENGINE TUNE-UP



PREVENTING
WALL
CONDENSATION

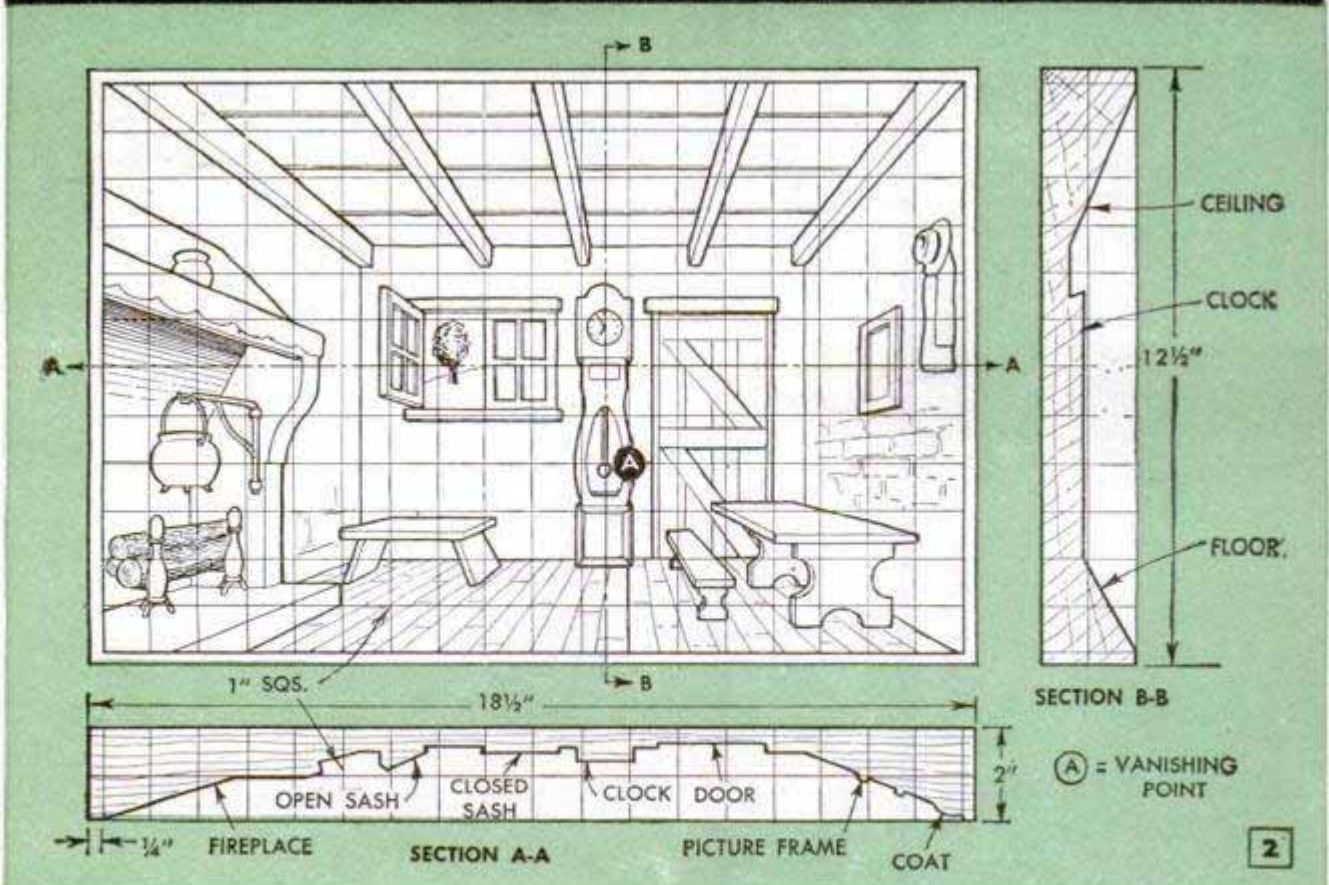
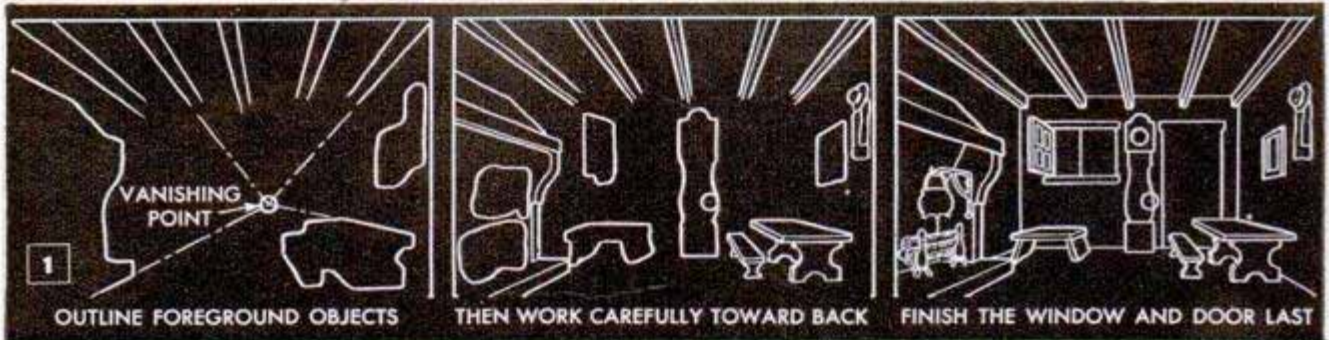
PICTURE CARVING

By Hi Sibley

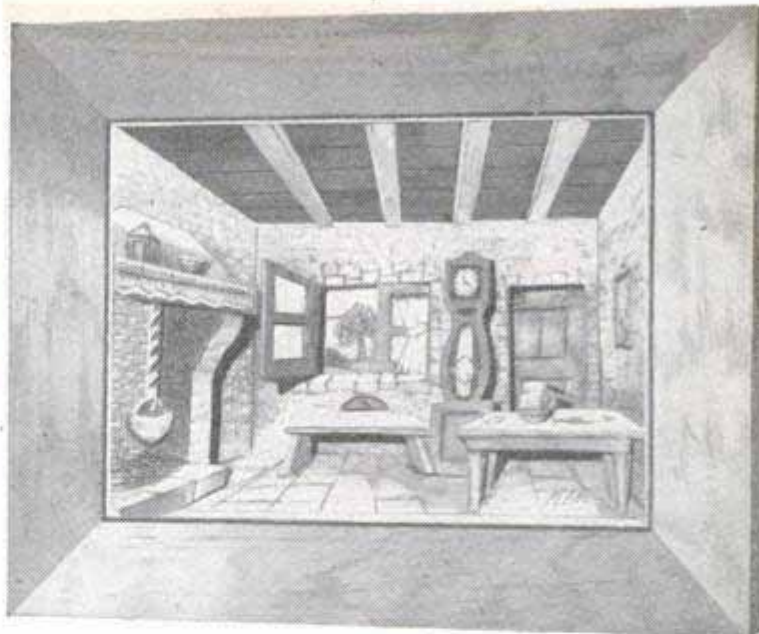
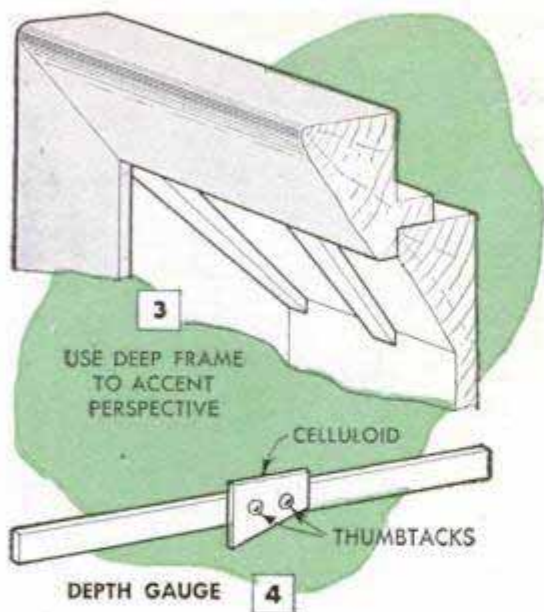


PAINTING" pictures with a jackknife is a fascinating pastime in which a scene is carved in sunken bas-relief to give a striking third-dimensional effect. Carving is done in a plank only 2 in. thick, but the illusion of depth is emphasized by carving the scene in perspective, working from a vanishing point.

First enlarge the pattern in Fig. 2 and mark the vanishing point as given. The picture can be enlarged to almost any size, although the original picture, depicting a Swiss kitchen and shown on the opposite page, was carved $6\frac{1}{2}$ by $9\frac{1}{2}$ in. In enlarging the pattern, rule on paper the same number of squares as given below and then duplicate the scene by drawing the lines in each square in a corresponding square on the paper. Mark off a border around



in RELIEF



Completed carving mounted in wide frame. Landscape scene behind open window is represented by picture pasted in place

the picture $\frac{1}{4}$ in. from the edge and score the line with a knife.

Start carving the ceiling beams and then outline the objects in the foreground, gradually cutting away the remaining area. The three stages to follow in carving are given in Fig. 1. Work carefully and proceed cautiously. A depth gauge, like the one in Fig. 4, is required to check the carving for depth at various levels. The gauge consists

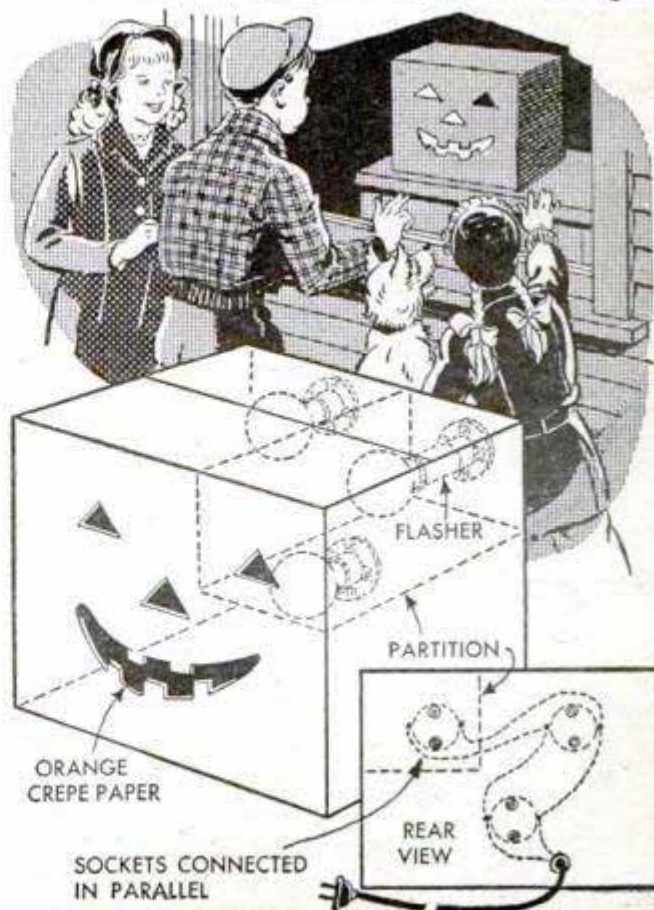
of a piece of celluloid or stiff cardboard fastened to a straightedge with thumbtacks. The gauge is set for depth by adjusting it to conform with sectional views A-A and B-B, Fig. 2, which also must be enlarged to actual size.

When the carving is completed mount it in a deep frame, as in Fig. 3. Small brads driven through the tongue formed in the frame hold the picture in place.

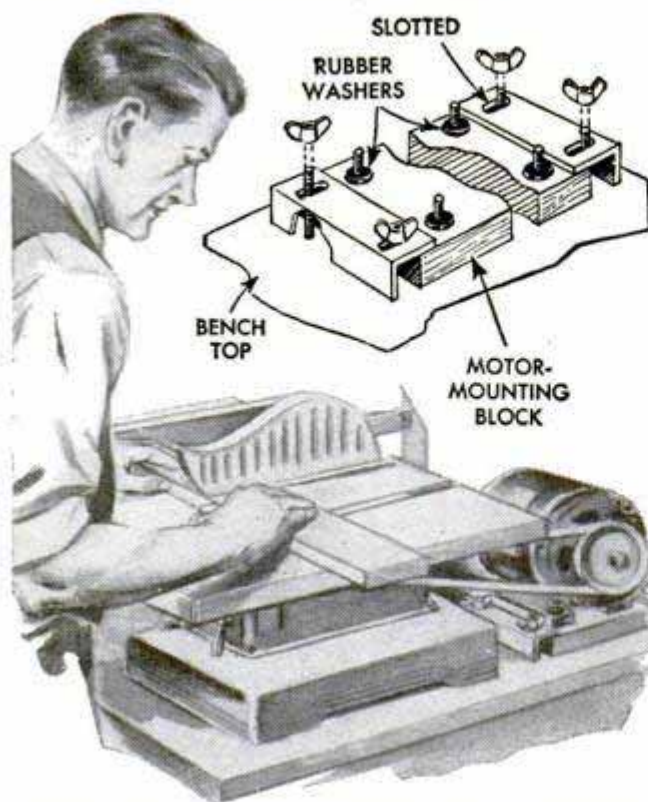
Halloween "Pumpkin" Delights the Children by Blinking One Eye

When my little nephew asked me to make a pumpkin-face for him last Halloween, I decided to make something different, and it proved to be the sensation of the neighborhood. I took a large cardboard box, cut a smiling face in one side, and pasted a sheet of orange-colored crepe paper behind the openings. At first, I put a single 60-watt bulb in the box and placed a flasher between the bulb and socket so the face would flash on and off to attract attention. Then, one of the children suggested that it would be nice if I could make just one of the eyes blink on and off. So, I enclosed one eye with a cardboard partition, installing one socket equipped with a flasher unit inside the partition and two more in the other part of the box. The sockets are wired in parallel, as shown in the detail. Twenty-watt bulbs were used throughout. A rubber grommet protects the cardboard where the extension cord enters the box. It's best to use sockets that have enclosed terminals and also to seal the carton shut so the children are not likely to injure themselves. The box can be placed in a window or on the front porch.

Arthur Trauffer, Council Bluffs, Iowa.



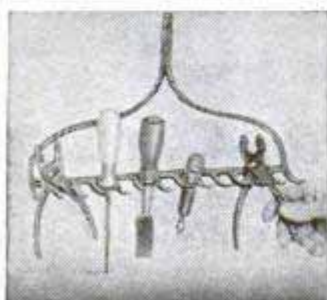
Quick-Change Mounting Block For Home-Workshop Motor



If you do not have enough electric motors to use one on each power tool, a mounting block, such as the one shown, will enable you to use a single motor for several tools and change it quickly from one to the other as desired. As in the detail, the block is a piece of hardwood to which the motor is bolted. In the correct position behind each tool, short lengths of angle iron are mounted with bolts and wing nuts, the bolt holes in the iron being slotted to permit adjustment of the angle-iron pieces. In use, the hardwood block to which the motor is fastened is merely slipped in between the two angle irons so that the upper edges of the latter frame the block. In this way, tightening the wing nuts clamps the block and holds it in place, while loosening them allows the block to be slipped out and moved to another tool. If necessary, one side of each angle iron can be ground down so that its height closely approximates the thickness of the wooden block.

D. I. Symington, London, Ont., Can.

Garden Rake Makes Tool Rack



The metal head from a broken garden rake provides a handy rack for small tools in the basement workshop or garage. Just remove the broken handle and

hang the head from a nail driven into a stud or wall. Screwdrivers, chisels, pliers, etc., fit nicely between the teeth.

Benj. Nielsen, Aurora, Neb.

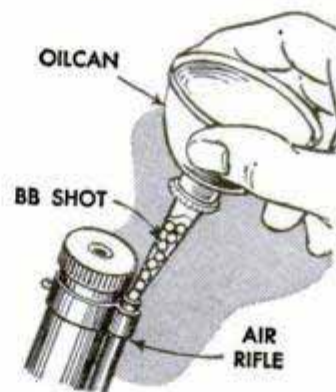
Steel Wool Strains Water When Bathing Dog in Tub

Next time you give the dog a bath in the sink or tub, try placing a wad of steel wool in the drain opening. This permits the water to drain out of the tub, but catches the dog hair which will clog the drain.



Oilcan Loads Air Rifle

Repeating air rifles are loaded quickly and easily by using an oilcan to insert the shot in the small, tubular magazine. To modify the can for this purpose, remove the spout and drop a pellet into it. Then,



with a wire, measure the distance the shot has lodged from the end of the spout, and saw off the tip of the spout slightly above the place where the pellet stopped. After this, remove the burr caused by the saw. To load the rifle,

just fill the oilcan with BB shot, replace the spout and feed the pellets into the magazine from the tip of the spout. This not only saves time, but reduces the chance of spilling the shot.

Keeping Brick Fireplaces Clean

A brick fireplace is easier to keep clean if its front is coated with liquid wax. The wax gives the bricks a slight gloss and a comparatively smooth finish, filling the porous surface in which dust usually accumulates. In this way, soot and dust are less likely to collect and any that does can be wiped off quickly. A small brush makes a handy applicator.

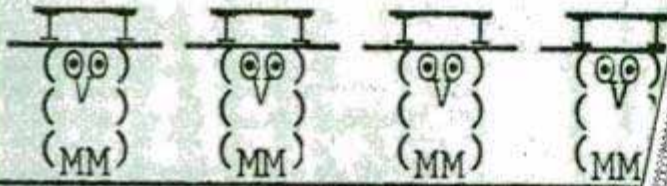
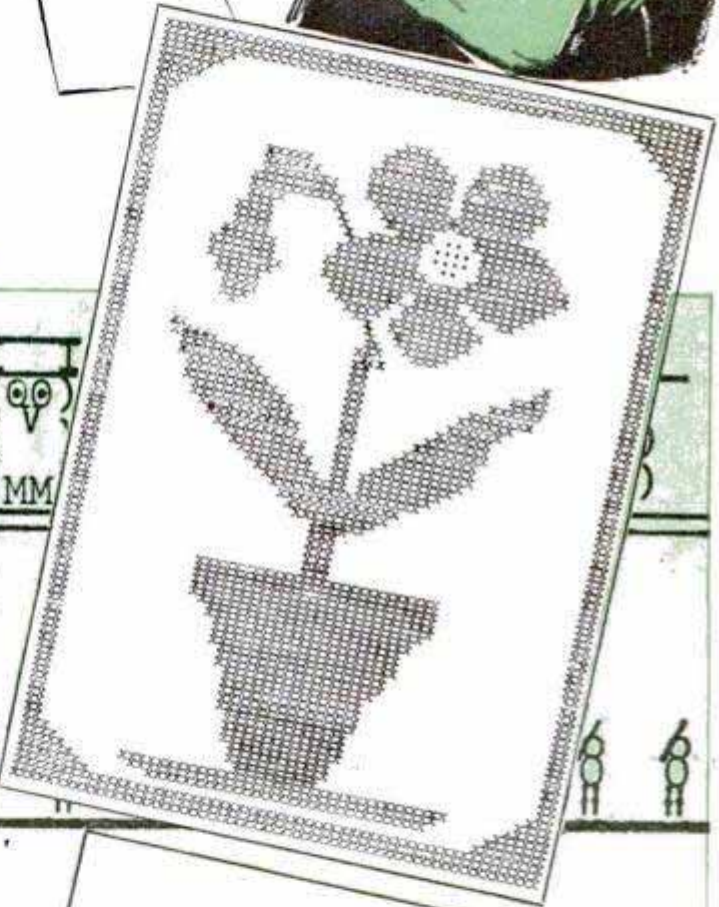
Dorothy Morley, Highland Park, Ill.



KEYBOARD ART

By Paul Hadley

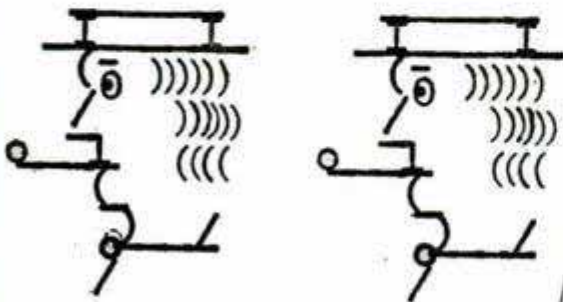
WHILE purely entertaining, doodling with a typewriter gives vent to the imagination and originality of both the experienced and the hunt-and-peck typist. Fill-in pictures are the easiest to "draw" with a typewriter. An example is shown in the flower which is made with the letter X alone. Such pictures, whether a flower or a portrait, are made by using an outline of the subject as a typing guide. This is done by tracing the outline lightly on paper and backing it with carbon paper to type the picture. Caricature or cartoon "drawing" combines letters with symbols as shown in the examples below. Here, half-spacing of the typewriter is required, as in the case of the owl's beak and feet. The log cabin shows what can be done in drawing a picture in perspective.



Capital letters I, O, V and M are combined with dashes, parentheses and periods to draw the owls. Half-spacing is required to locate the eyes, beak and feet of the owl



Quotation marks represent the legs of the soldier. His body is formed by a large and small letter O and the gun is a diagonal



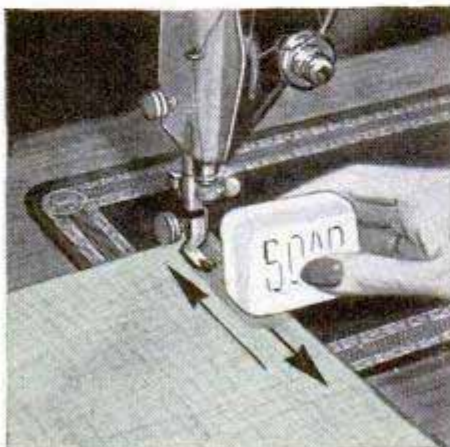
Above uses diagonals, parentheses, dashes, hyphen, period and letters I, O, 1 and o



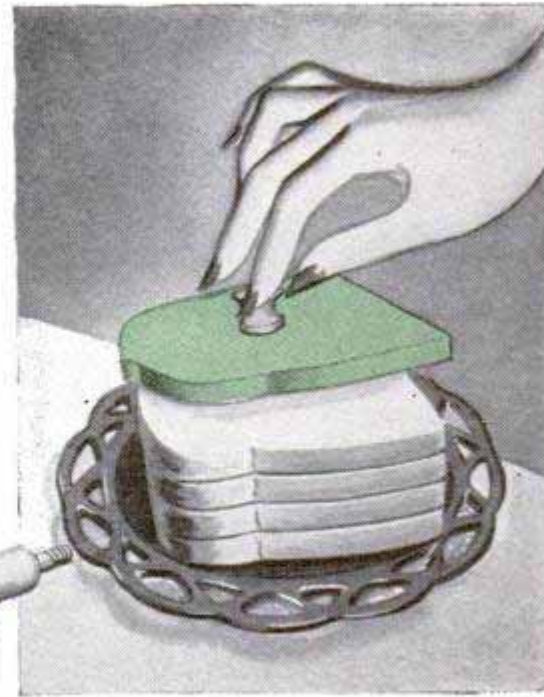
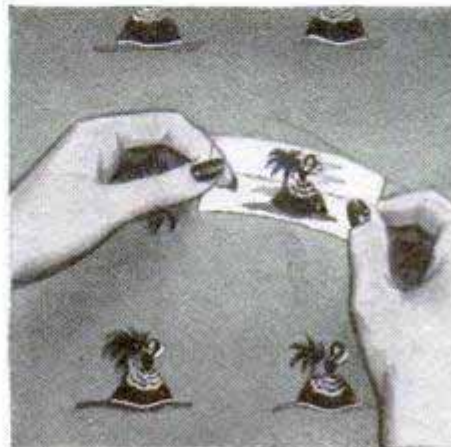


SHARP CREASES are avoided when storing a large linen tablecloth for long periods if the cloth is rolled on a broomstick or mop handle

SOAP LUBRICATES NEEDLE to prevent breakage when stitching seams in canvas and other heavy material. Rub the soap along the line of stitch



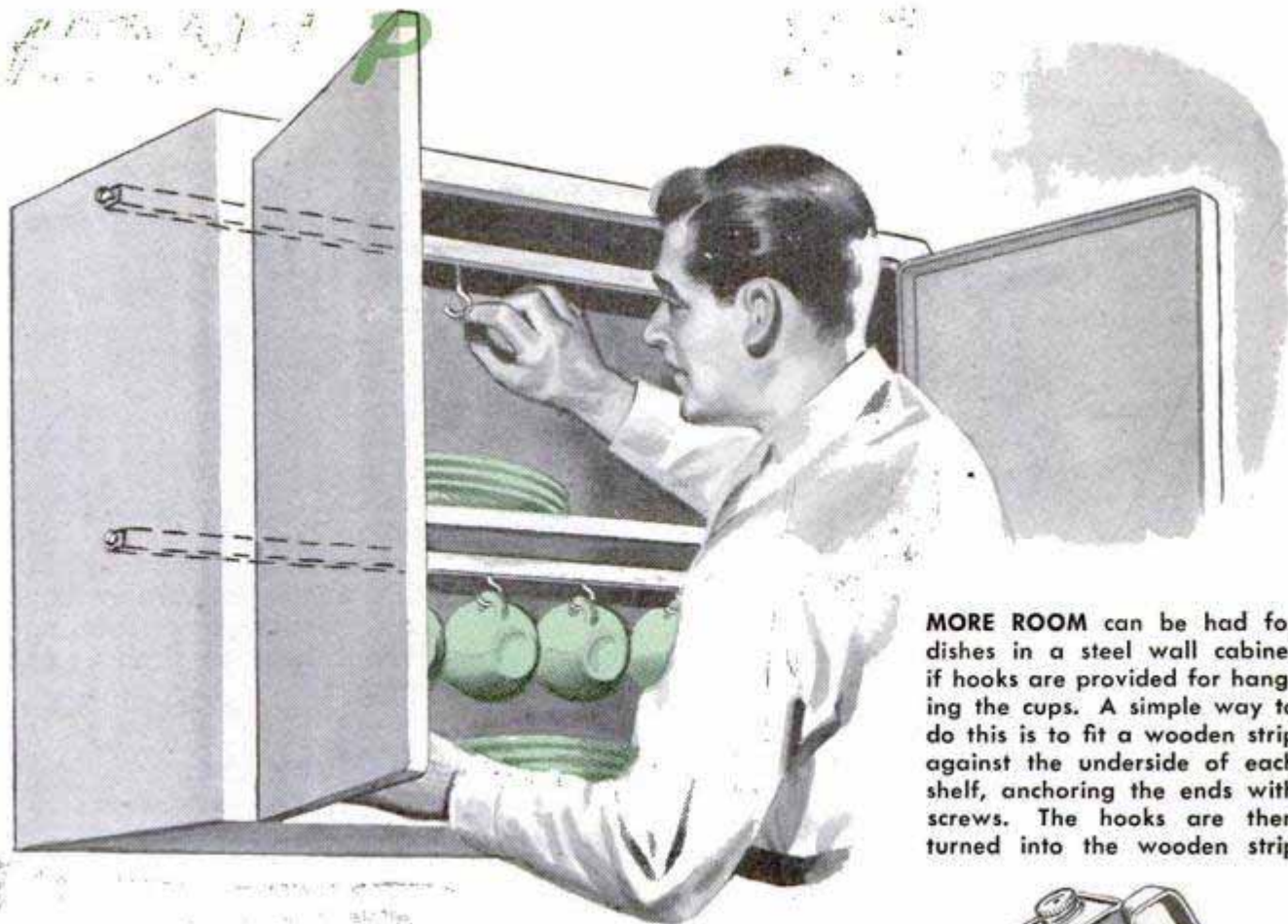
REMOVING DECALS is made easy if cellulose tape is applied to transfer and used to lift it off. The design will adhere and peel with tape



WOODEN BREAD COVER prevents top slice from drying when bread is on table during or after a meal. Cut the cover to represent a slice of bread, then paint it a bright color and fasten small drawer knob to the top to serve as a handle



SPONGE WATERS PLANT when buried at the bottom of a flowerpot. By retaining water, the sponge serves as wick to feed plant roots. Idea is especially desirable when plants are unattended for several days



MORE ROOM can be had for dishes in a steel wall cabinet if hooks are provided for hanging the cups. A simple way to do this is to fit a wooden strip against the underside of each shelf, anchoring the ends with screws. The hooks are then turned into the wooden strip

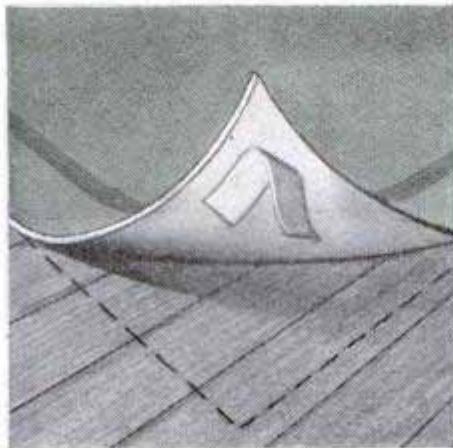
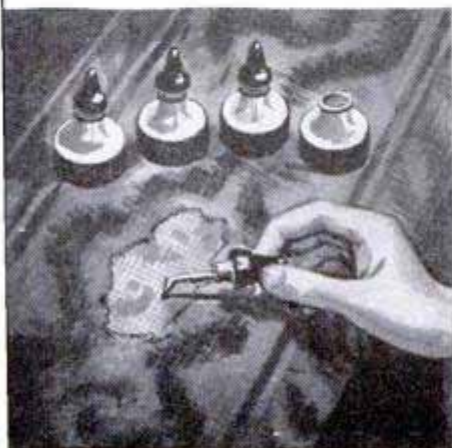
WATERING CAN for plants which reduces spilling to a minimum is made from flat can of type shown. Spout is length of copper tubing soldered over hole near bottom of can and braced near top. Vent hole is punched in top of screw cap and suitable handle provided



WORN SPOTS in rugs are made less noticeable by filling in the original pattern with waterproof drawing inks. Use colors that match as closely as possible and apply carefully with regular bottle quill

TRIPPING OVER RUG will not happen if curled corners are anchored to the floor with strips of adhesive tape. This is especially useful in the case of small linoleum rugs that have a tendency to curl when new. Apply tape by folding back-to-back

WALLPAPER CLEANER that sticks and streaks the paper can be made more convenient to handle if cornstarch is kneaded into cleaner. Add cornstarch, about three tablespoonfuls, until cleaner is no longer sticky. Cornstarch will not retard cleaning



Steaming Brightens Illustrations Drawn With Indelible Pencil



Drawing or writing done with an indelible pencil will become brighter and last longer if steamed by ironing under a damp blotter. The blotter should be damp but not so wet that the paper will wrinkle.

Improved Veneer-Taping Method

If transparent cellulose tape is used instead of the usual paper or cloth-backed tape to hold veneer for gluing, it is possible to see when a perfectly matched joint is obtained. This is particularly helpful when intricate marquetry work is being done, and if shifting of the pieces is necessary, the cellulose tape is easily stripped off and reused.



Wood-Burning Pen Provides Light



Wood-burning pens of the type having a screw-in heating element make excellent trouble lights if the element is replaced with a 7-watt light bulb. Because of its small diameter and extension cord, this light is ideal for illuminating otherwise inaccessible places when checking plumbing and wiring. In addition, by lowering the light

into closed containers, such as barrels and drums, they can be checked for holes and cracks.—Don G. Pittwood, Moscow, Idaho.

Gas Burner Preheats Blowtorch

The smoke and much of the delay usually encountered in preheating a gasoline blowtorch is eliminated if the nozzle is preheated with the flame from a Bunsen burner.



The torch nozzle and mixing chamber should be heated, but under no circumstances should the flame contact the tank. Ordinarily, about one minute is sufficient time to preheat the torch in this manner.

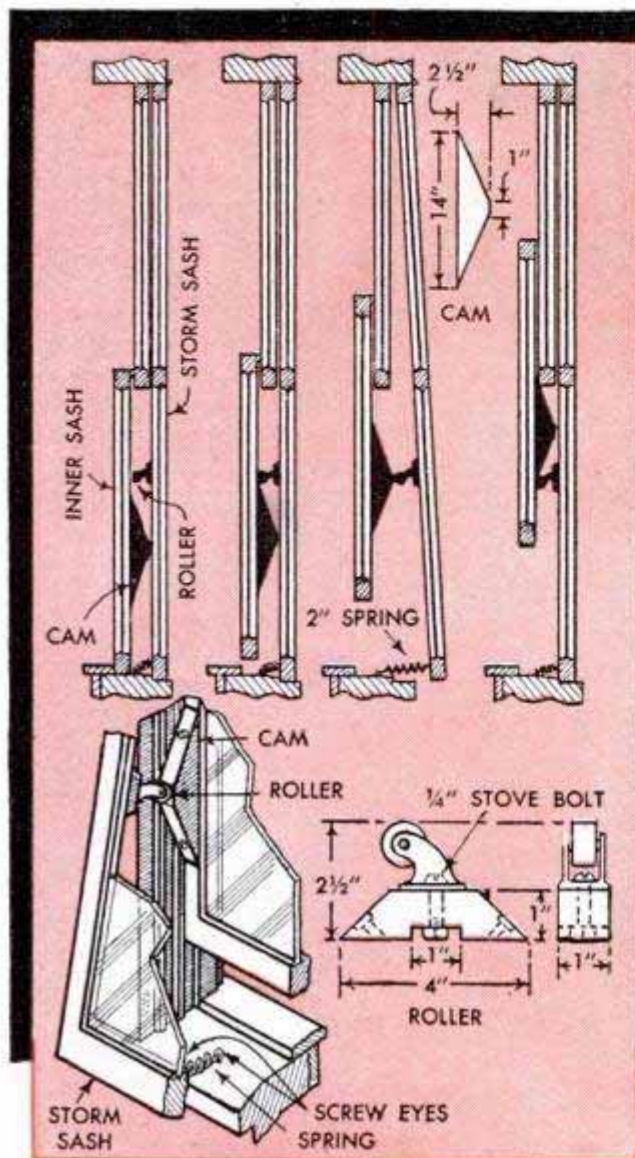
Heat Lamp of Many Uses Made From Spare Parts

An old bridge lamp which has long been relegated to the attic, can be converted into a handy heat lamp by combining it with parts from a gooseneck desk lamp. All you have to do is remove the base from the latter, the top from the bridge lamp, solder the two rigidly together and add a metal photoflood reflector for a shade. Using an infrared bulb, the lamp is ideal for drying hair and fingernail polish or for treating muscular aches. Also, the unit makes an excellent health lamp when equipped with an ultraviolet bulb. *Caution:* When using either of the above bulbs, follow manufacturer's directions carefully or obtain instructions from your physician.

Mrs. W. E. White, Eugene, Ore.



Storm Sash Opens When Window Is Raised



Raising the inner window will open the storm sash to admit fresh air directly into the room. Merely lowering inner sash closes the storm sash tightly

Designed particularly for use on bedroom windows, but an excellent idea for other windows where periodic ventilation along with adequate insulation is important, this novel device permits a hinged storm window to be opened and closed simply by raising and lowering the bottom sash of the inner window. It also prevents anyone from closing the inside window and forgetting to close the storm window. A caster-and-cam arrangement produces the automatic action while a tension-spring attachment for the bottom of the storm sash holds the sash tightly closed or firmly against the cam. As the inner window is raised, the storm sash opens, gradually reaching a maximum opening of approximately 3 in. when the roller is midway on the cam. Raising the window higher causes the storm sash to close entirely. In this closed position, air which normally enters around the storm sash gives a minimum amount of ventilation. The variety of positions of both sashes allowed by the device affords a wide range of ventilation. A

wooden cam is fastened to each side of the lower sash and a caster assembly to each side of the storm sash with countersunk screws, as shown. Stove bolts anchor the casters to their mounting blocks. The 2½-in. dimension both for the cams and the roller assemblies should be varied, if required, to provide a clearance of ½ in. between cams and storm sash and rollers and inner sash. This clearance assures complete closing of the storm sash and avoids the possibility of rattling. When assembling the device, make sure that the casters and cams are in correct alignment so that the caster rolls true throughout the entire length of the cam. Two springs, 2 in. long and with a stretch of 4 in., are attached with screw eyes between the bottom rail of the storm sash and the window sill. The screw eyes should be fastened to the storm sash about 2 in. from each side and 1 in. from the bottom of the rail. Those on the sill should be attached opposite the ones on the storm sash and just outside the inner window sash.—Martin J. Gresho, Chicago.

It's Easy to CEMENT

By Sam Brown



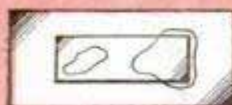
NO MATTER how much care is given to shaping and polishing the parts of plastic articles, such as those shown in Fig. 10, their entire appearance can be ruined by poorly cemented joints. Here is a simplified cementing technique along with two jigs to help produce the good joints upon which the beauty of plastic craftwork depends. This method applies only to the acrylic plastics (Plexiglas and Lucite).

All cements for acrylic plastics are solvents for the plastic, the bond being made by a softening and intermingling of the plastic at the joining surfaces. The best type of solvent for craftwork is vinyl trichloride, commercially known as Plexiglas

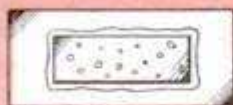
3	CEMENTS	NATURE OF CEMENT	SETTING TIME*	DRYING TIME	REMARKS
	VINYL TRICHLORIDE	SOLVENT TYPE WATER-WHITE	30 SEC.	3 HRS.	BEST CEMENT FOR CRAFTWORK
	ETHYLENE DICHLORIDE	SOLVENT TYPE WATER-WHITE		3 HRS.	FAST-SETTING. SECOND-BEST CHOICE FOR CRAFTING
	METHYLENE DICHLORIDE	SOLVENT TYPE WATER-WHITE		3 HRS.	TOO FAST. JOINTS MAY DRY BEFORE ASSEMBLY
	SOLVENT MIX	ANY OF ABOVE MIXED WITH PLASTIC SHAVINGS	1 MIN.	4 HRS.	SLOWER-SETTING THAN PURE SOLVENT. GOOD FOR BRUSH APPLICATION
	MONOMER MIX	THE ORIGINAL PLASTIC IN LIQUID FORM	4 HRS.	24 HRS.	MAXIMUM STRENGTH. BEST BOND FOR SOAK CEMENTING

*NOT HARDENED, BUT WORK CAN BE REMOVED FROM JIG.

4 RESULTS



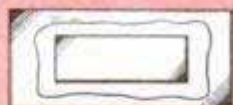
POOR CONTACT



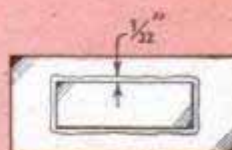
BUBBLES



CRAZING



RUNOVER

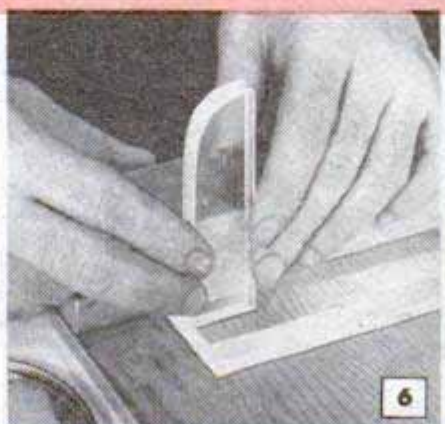


PERFECT JOINT

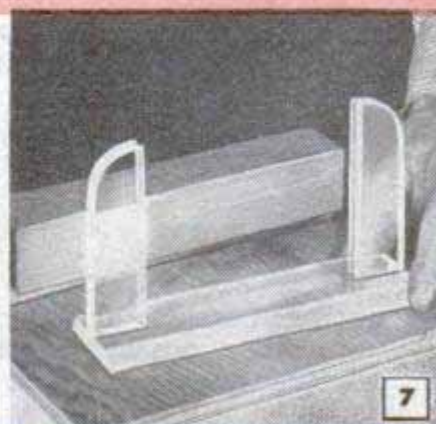
Above, poor contact indicates a badly fitted joint or insufficient cement. Bubbles are likely to occur with heavy cements. Crazing results from faulty cement or heavy clamping pressure. Runover happens most frequently when heavy cements are used. The perfect joint is crystal clear with just a slight runover



DIP WORK IN CEMENT



FIT JOINT IN JIG



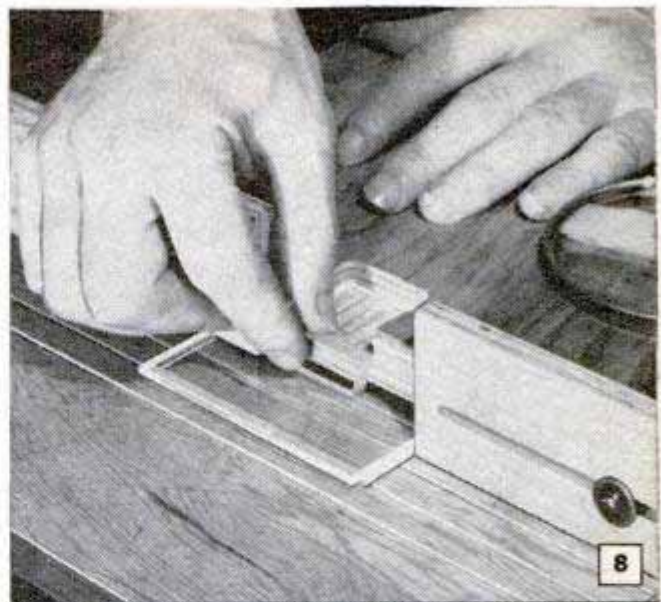
IT'S SET IN 30 SECONDS

PLASTICS

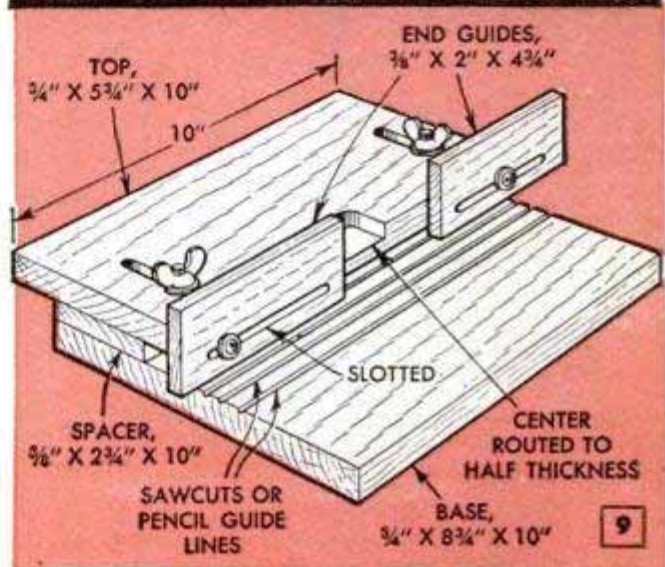
1-C cement. Fig. 3 lists the five most suitable cements in their order of preference.

The best method of application to use with pure solvent-type cement is a fast dip. To do this, obtain a shallow container, such as the lid from a glass jar. Next fold a piece of soft cloth twice to form a pad and place the pad in the lid. Then, with an eye dropper, add solvent to the container until it is level with the top of the pad. The work to be cemented is pressed on the solvent pad, Fig. 5. Due to the slight give of the pad surface, the work actually is immersed to a depth of about $\frac{1}{32}$ in. In order to distribute the cement evenly, the work is dipped three times in rapid succession and the joint is made immediately, Fig. 6. Cement is applied to one surface of the joint only. As quick and exact positioning of the cemented part is essential, a cementing jig should always be used. The joint is held in place with very light pressure of the fingers for about 20 to 30 sec. after which the work can be removed from the jig, Fig. 7. The joints are quite rigid within a minute and completely cured in about three hours.

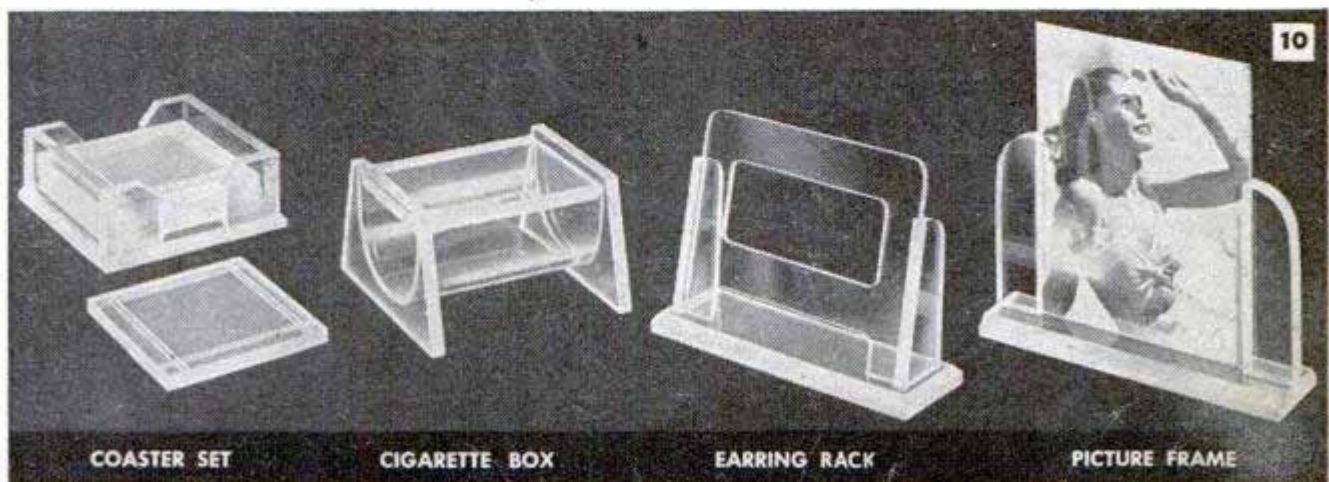
Fig. 1 shows a simple jig for picture frames which also can be used for a cigarette box as in Fig. 2. As this type of T-joint is common in all plastic projects, it is worthwhile to make an adjustable jig like the one shown in Fig. 9. The dimensions are not critical and the sawcuts across the base serve as guide lines when positioning the work. A portion of the center of the movable top piece is routed out to provide a finger hole. This hole is helpful when cementing small pieces, as can be seen from Fig. 8. The corner jig, detailed in Fig. 12, is used as shown in Fig. 11. The rabbet in the guide strip prevents the cement from sticking to the wood.

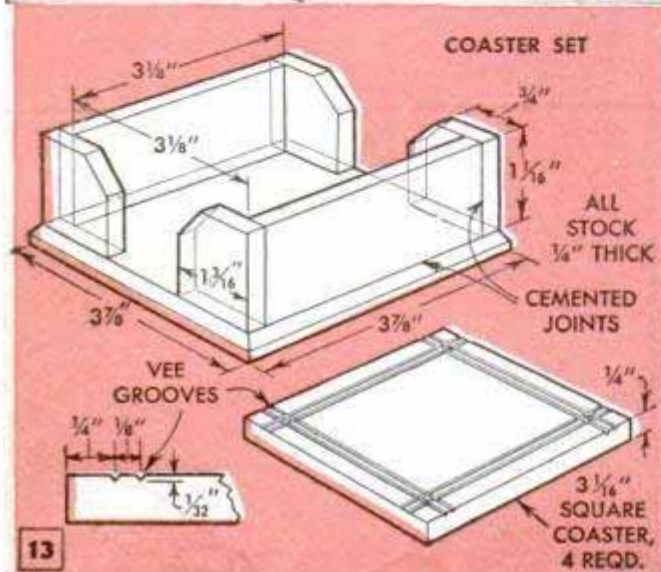
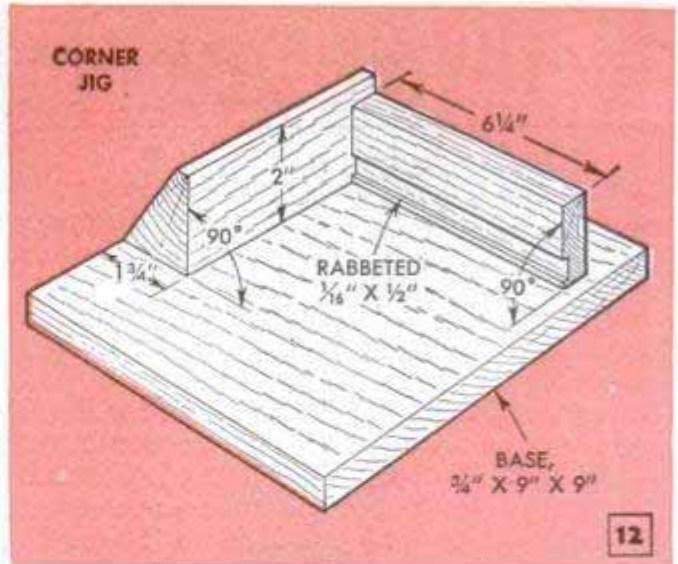
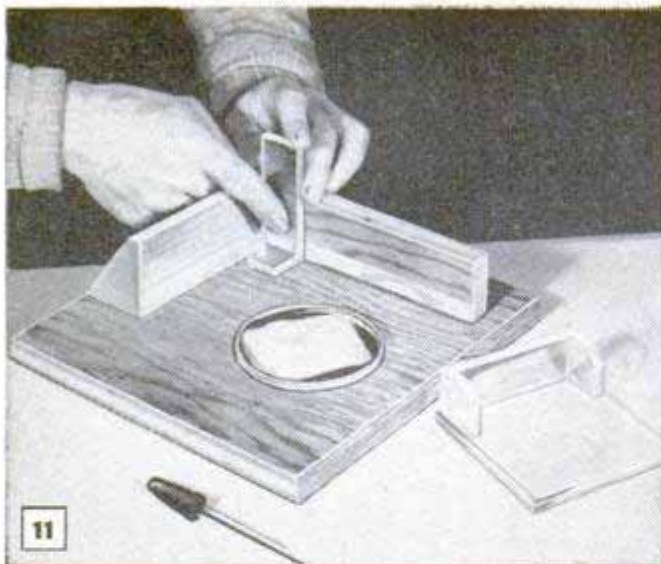


ABOVE, CEMENTING HANDLE ON BOX LID WITH T-JOINT JIG DETAILED BELOW



Because the cement has no body and will not cover unless the joint is in good contact, the work to be cemented must have close, smoothly fitted joints. Joints direct from the saw (hollow-ground planer blade) are satisfactory, as fine saw marks will vanish completely if the joint is perfectly cemented. Joints finished with 80 or 100 grit sandpaper also are satisfactory, but care





must be taken not to round off the corners.

Fig. 4 shows the usual faults of plastic joints, poor contact being the most common one when pure solvent is used. An accurate-fitting joint, and dipping the work three times and immediately fitting it, will eliminate this fault. It is important that the plastic edge carry all the cement possible. For this reason, all joints should be made with the cemented piece vertical and with the second piece flat and horizontal, as in Fig. 6, as more solvent can be carried on a horizontal joint without danger of runover. The bubble fault is common with heavy cements but rarely occurs with pure solvent. Crazeing, which consists of hairline cracks at the joint, usually is caused by too much pressure at the joint or by use of certain solvents, such as acetone. Runovers are common if you use any type of thick cement made by dissolving a small quantity of plastic shavings in a solvent. The thicker the mixture, the more likely you are to apply too much of it to the joint, thus resulting in runover of the excess. Thick cements are not used with the dipping technique, but are handy for brush application on some types of joints.

However, work of this kind should be clamped very tightly. The perfect joint is absolutely clear with a slight runover of cement all the way around.

In addition to the cements listed in Fig. 3, acetone and glacial acetic acid are solvent-type cements which can be purchased at almost any drugstore. Both do fairly good work except that acetone is somewhat too fast and liable to craze, while acetic acid is slow drying and tends to corrode and etch the polished surface around the joint, thus spoiling the appearance.

The coaster set, dimensioned in Fig. 13, makes an excellent project in plastic cementing. Use the dip application of solvent cement for all joints, assembling the ends first. The assembled sides can be dipped one end at a time. Remember to get the work thoroughly wet, shake it lightly to remove any excess cement and assemble immediately. If a drop of solvent should accidentally fall on the work, do not rub it. If rubbed it will smear, but if allowed to remain untouched, it will dry and disappear with little damage to the polished surface. Fig. 14 shows how the vee grooves in the coasters are cut on a circular saw.

Whether it's a 10 by 20-ft. pond for tiny tots on their "double runners" or a large-size rink for adults, the whole family will enjoy a skating rink which can be made in the back yard or on a vacant lot. If the rink is prepared in the fall before the ground freezes, the pond area can be banked by one of two methods. One way is to enclose the area with 2 by 8 or 2 by 10-in. planks set on edge and staked to hold them in position. The other method is simply to bank the pond area with earth. If the ground already is frozen, well-iced snow banks will effectively confine the water within the rink area. These banks are built up as flooding and freezing of the pond progresses. The flooding is done with a fine spray so that not too much water collects in any one spot. The ice should be built up in layers, allowing time for the first application of water to freeze solid before the next one is applied. A heavier stream of water may be used as the crust of ice becomes more solid. However, do not use a stream heavy enough to wash away the base or collect in pools and leak through holes in the crust. If snow is on the ground, this should be packed with a lawn roller before flooding. Sometimes it is advisable to roll the rink again after the crust starts to harden. After the ice has built up to a thickness of $\frac{1}{2}$ to $\frac{3}{4}$ in., a good surface will begin to form. At this time the rink is filled, or leveled. Some of the low

Book for usage

An Ice-Skating Rink in Your Back Yard Is Inexpensive and Fun for Everyone



spots in the ice probably will contain small holes up to about $\frac{1}{4}$ in. in dia. These should be packed with slush to make them watertight, and the whole area sprayed with a film of water. After the film freezes, the low spots in the surface are filled with water and allowed to freeze solid. This procedure is repeated until the surface is fairly level. During the filling operation, pay special attention to the banks to make sure that they are solid enough to prevent the escape of water in case of a thaw. The pond is finished by spraying until the surface becomes as nearly level as possible. The maintenance of a rink, of course, depends on weather conditions and the amount of use. It should be resurfaced as required to prevent the formation of holes and to keep the surface in good skating condition. This also is necessary to keep the base watertight.

Paul H. Dunakin, Wheaton, Ill.



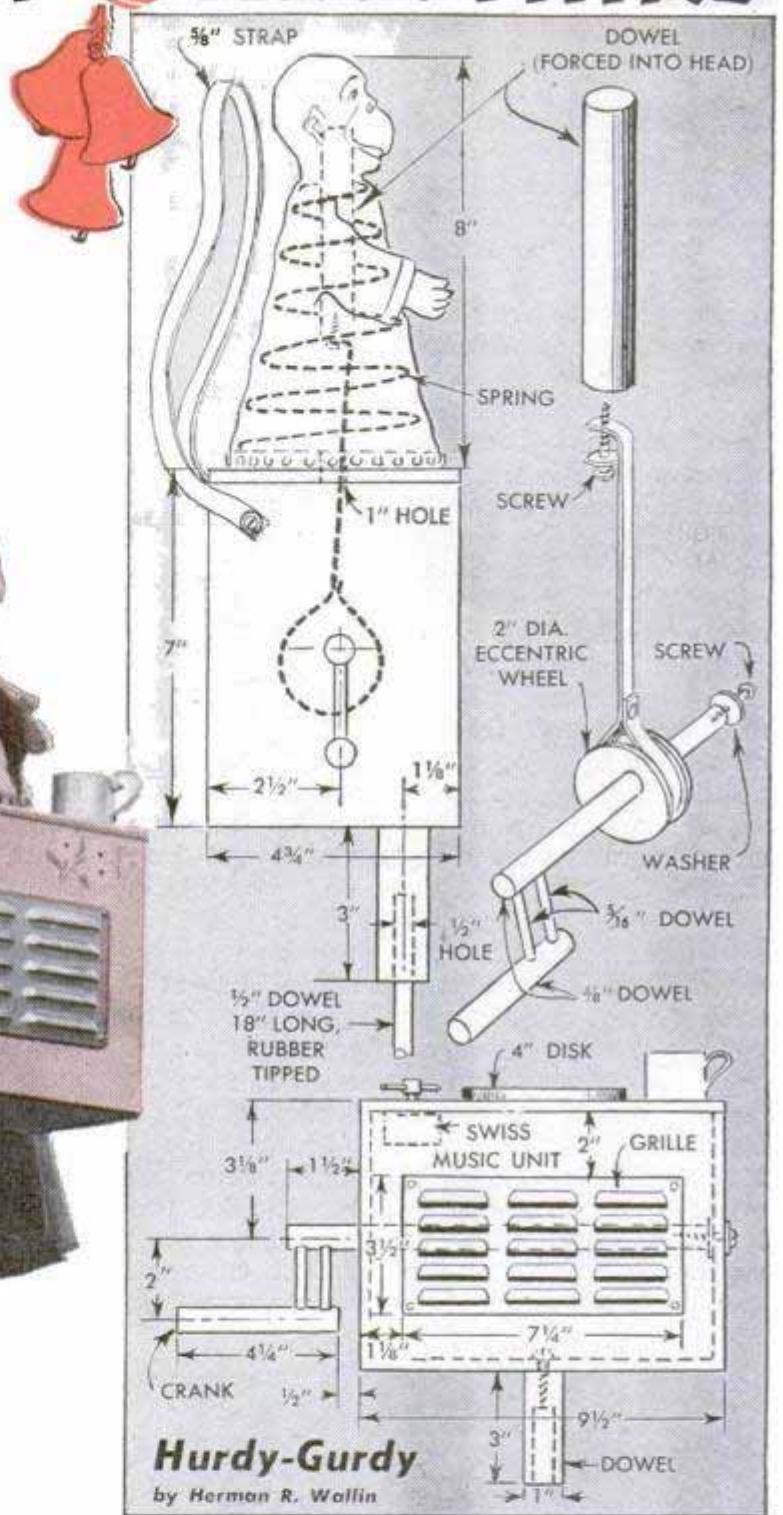
Shirt Fitted With Game Pocket Worn During Warm Weather

For hunting small game, such as squirrels, in fairly warm weather when an ordinary hunting coat is uncomfortable, just sew a game pocket to the inside of a shirt and wear the shirt as a coat. This type of pocket can be made from lightweight canvas and will adapt any shirt to a useful hunting coat.

☐ A few spare nickels kept in the glove compartment of the car will make certain that you have change available when it is needed for a parking meter.

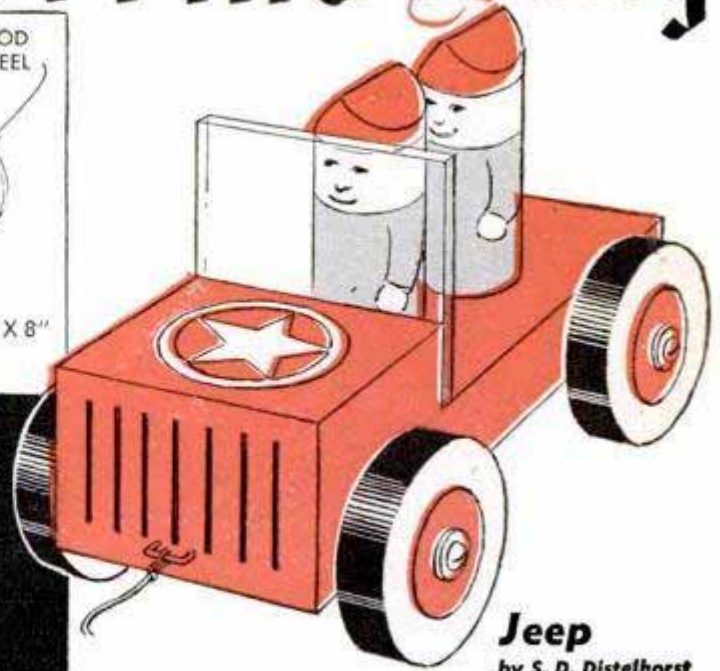
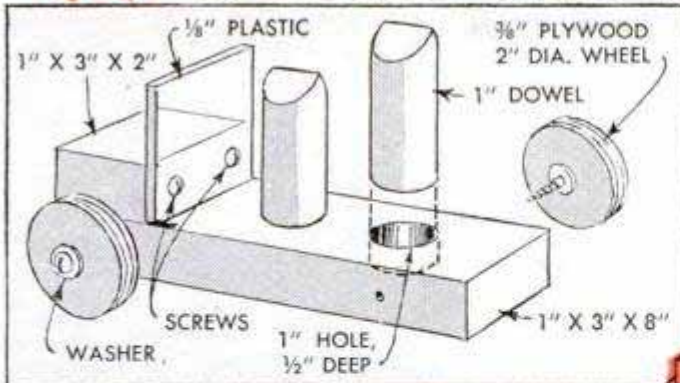
Start Your CHRISTMAS

ELEVEN EXCITING TOYS

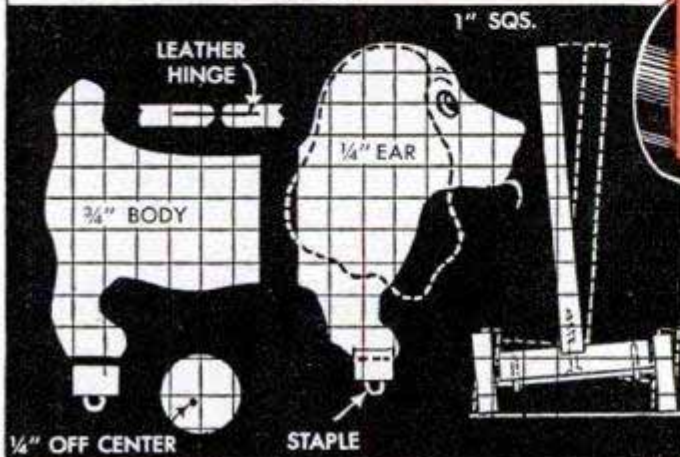


HURDY-GURDY is a musical action toy in which a puppet monkey on a spring bobs up and down to the tune of a Swiss music unit. The monkey is actuated by an eccentric which provides movement to the head as a handle is turned. Details above show assembly. Leather strap connects the eccentric to the monkey. Make sounding box of plywood and attach a dowel leg to the bottom. Cover the grille opening with a metal window ventilator and tack the monkey to the edge of a disk fastened to the top of the box. The handle which rotates the eccentric is supported at one end by a screw and washer. Music unit is located so that winding key projects through top of box.

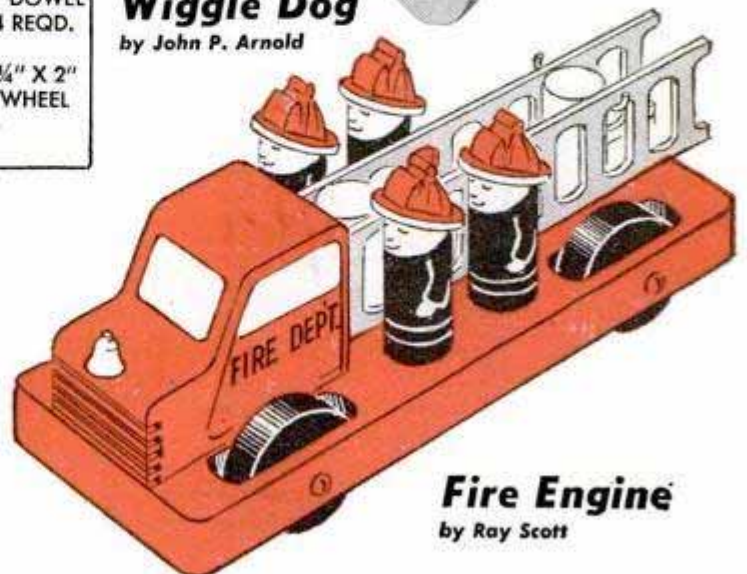
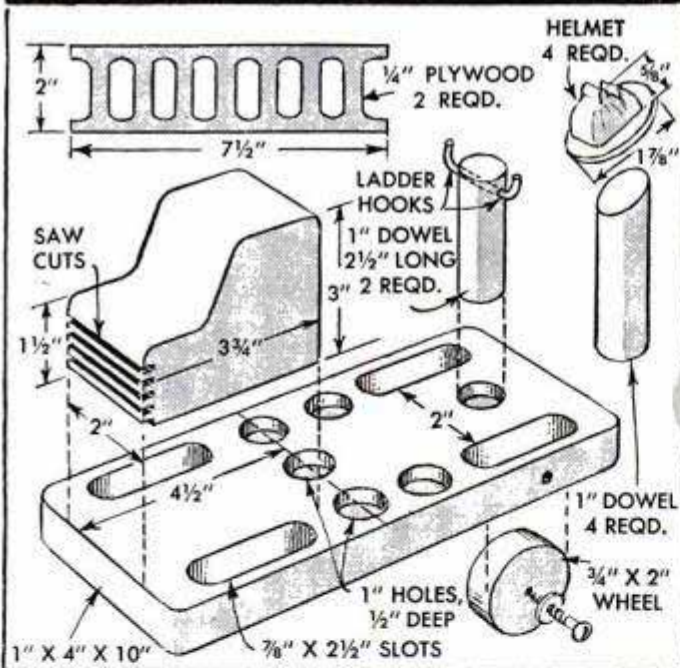
WORKSHOPPING Early



Jeep
by S. D. Distelhorst



Wiggle Dog
by John P. Arnold



Fire Engine
by Ray Scott

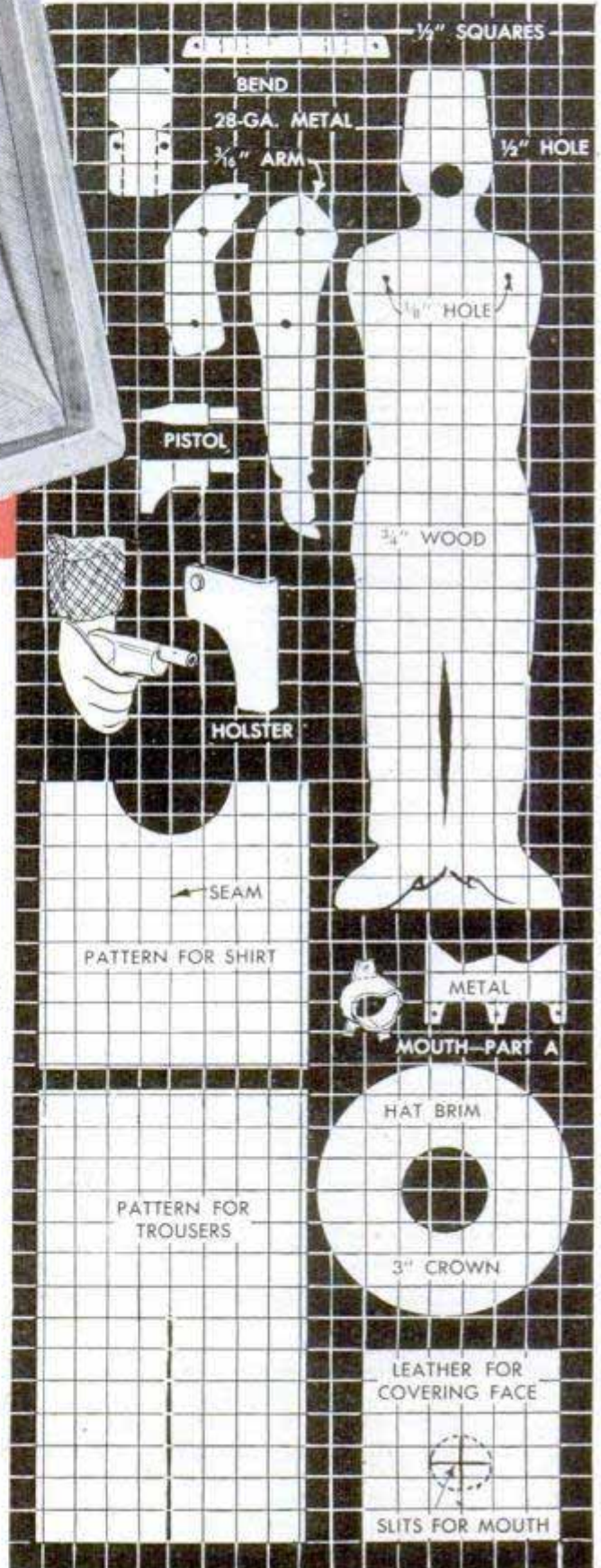
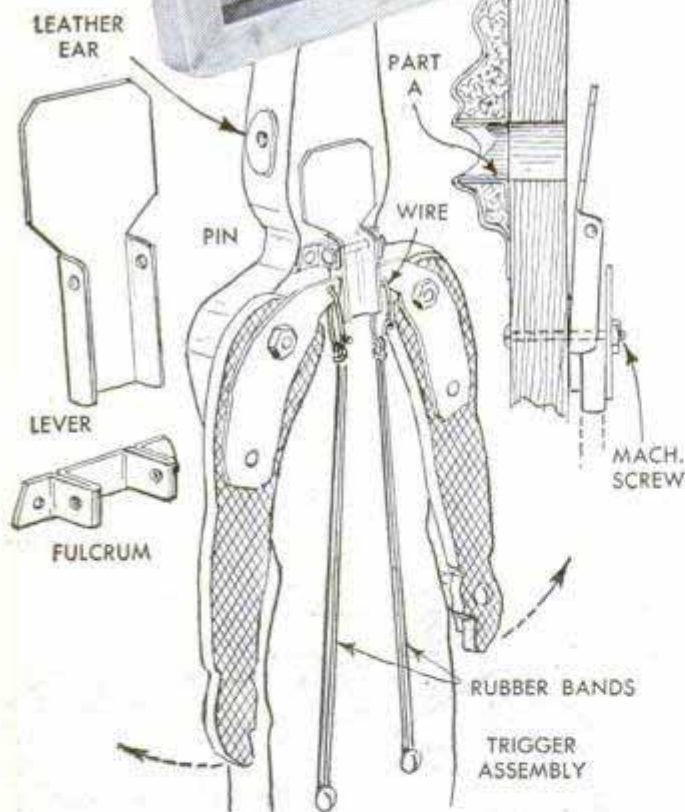
JEEP AND FIRE ENGINE are two simple pull toys. In both cases, the men are dowels or pieces of broomstick that are set in blind holes. The jeep body consists of two wooden blocks and a piece of plastic. Ladders of fire engine hang on L-hooks screwed in fixed posts

WIGGLE DOG not only wiggles but wobbles. Double action is produced by wheels being mounted off-center and the two-part body connected by leather hinge. Wheels are fixed on dowel axes which rotate in staple bearings. Body is solid wood, wheels and ears plywood



Target Game

by Clyde C. White

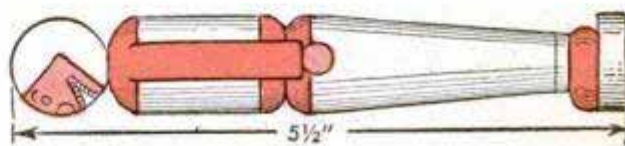
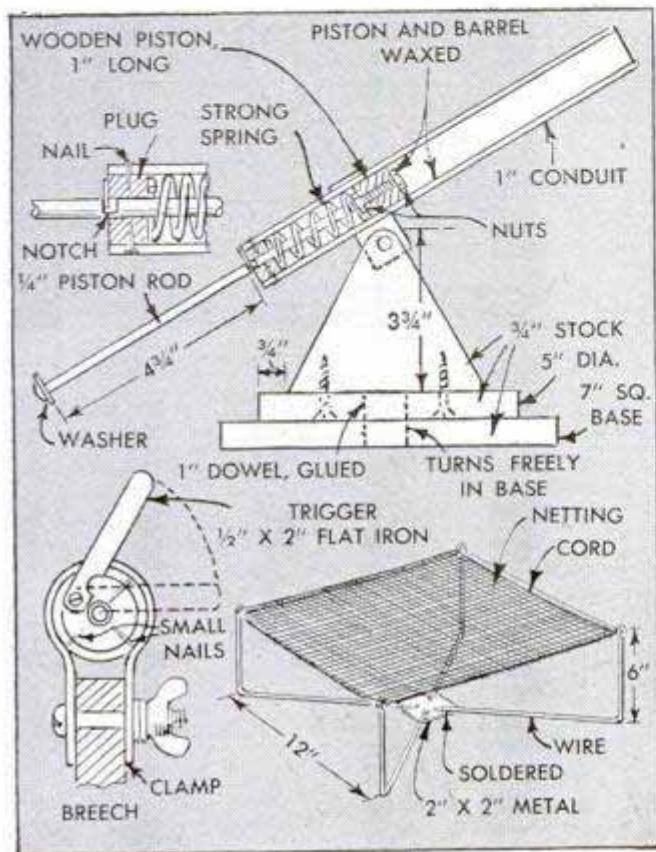


TARGET GAME consists of armed bandit who defies capture until direct hit in the mouth with a pellet trips mechanism and causes bandit to throw up his arms in surrender. Body is wood, arms hard-pressed board, and rest of parts are metal. Rear view shows how trigger is set, rubber bands providing the spring action. Cloth bag tacked to wooden frame catches pellets. Stick is used to support frame at an angle. Dress the bandit in the manner shown in the photo



Gunshot Joey

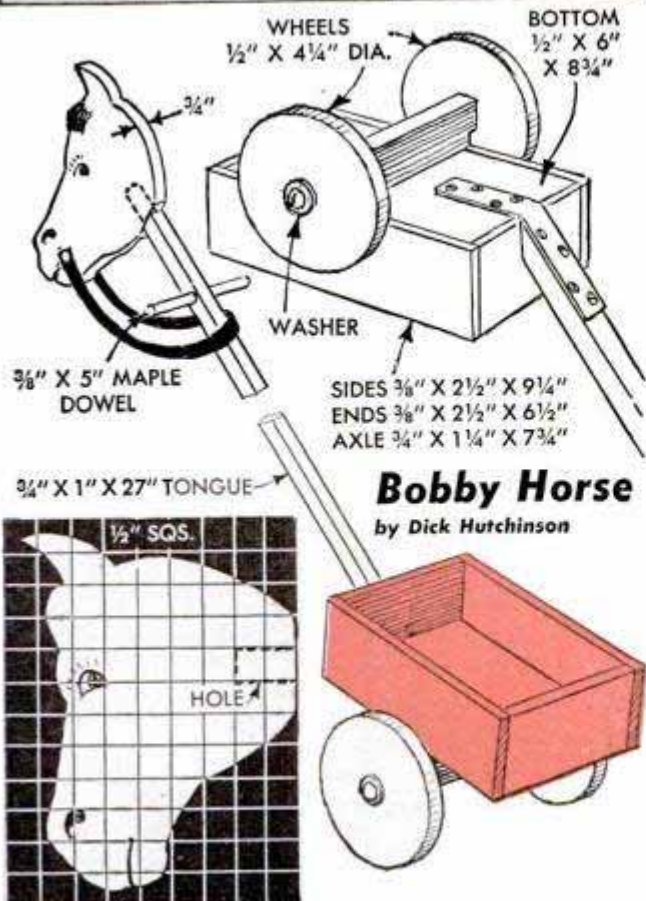
by C. L. Meehan



GUNSHOT JOEY, the human cannon ball, performs his daring feat just as in the circus. Cannon is fired by releasing trigger which engages notch in a spring-loaded piston. Joey must fit freely in cannon

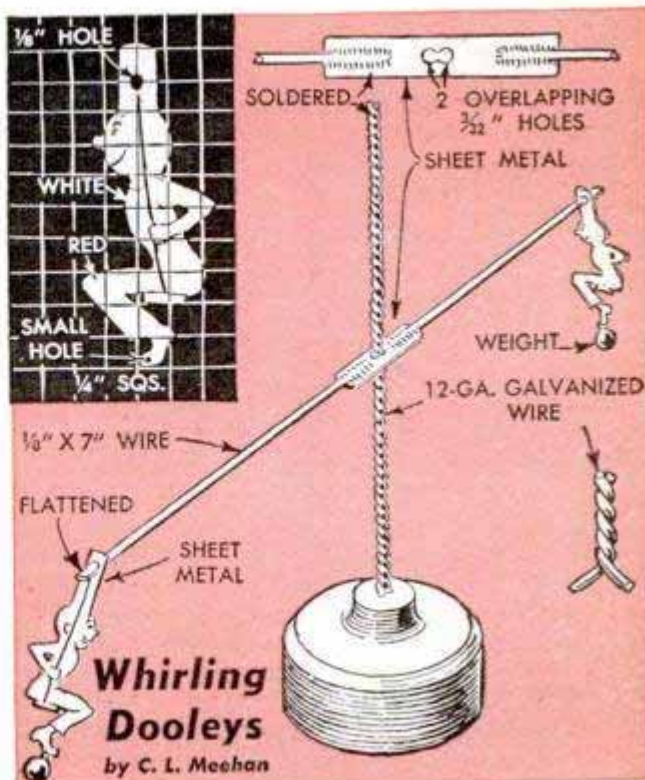
BOBBY HORSE gives the small tot a merry ride. Wagon is typical box construction, the wheels being screwed to a cleat axle. Detail shows method of fastening tongue to wagon and to jigsawed horse head

WHIRLING DOOLEYS go on and on—when they reach bottom of spiral, the shaft is turned end-for-end in the base and around they go again. Two wires twisted together in a spiral form shaft. Riders are weighted



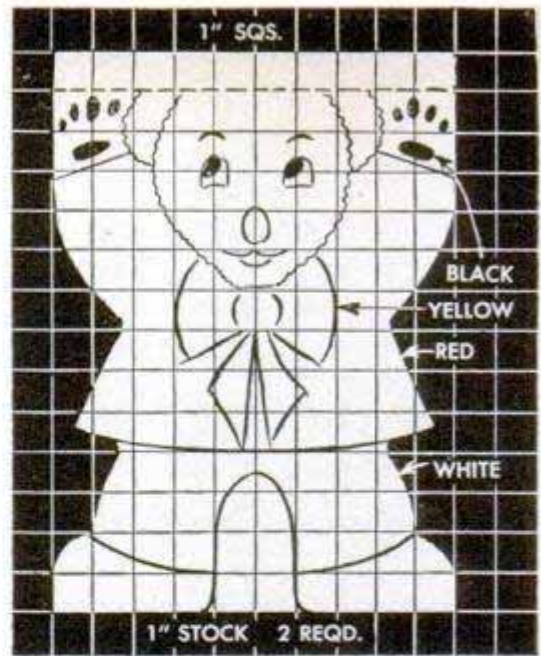
Bobby Horse

by Dick Hutchinson



Whirling Dooley

by C. L. Meehan

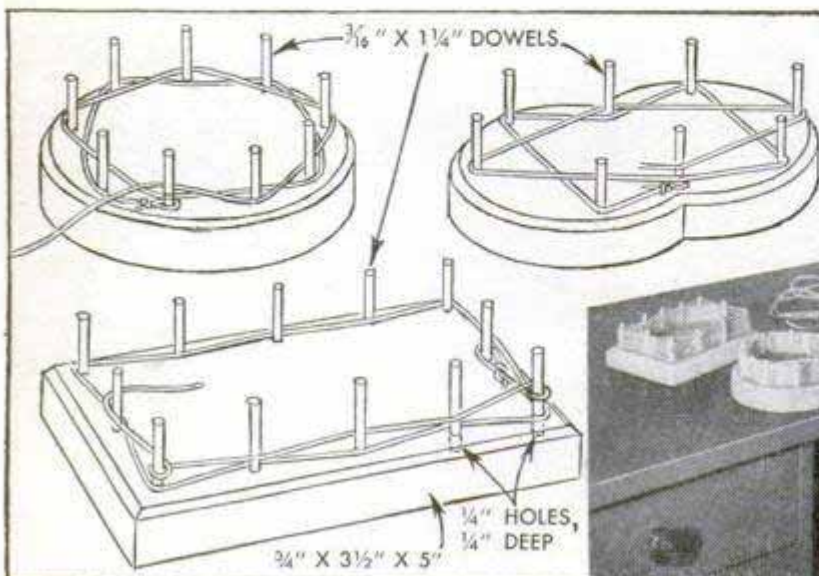
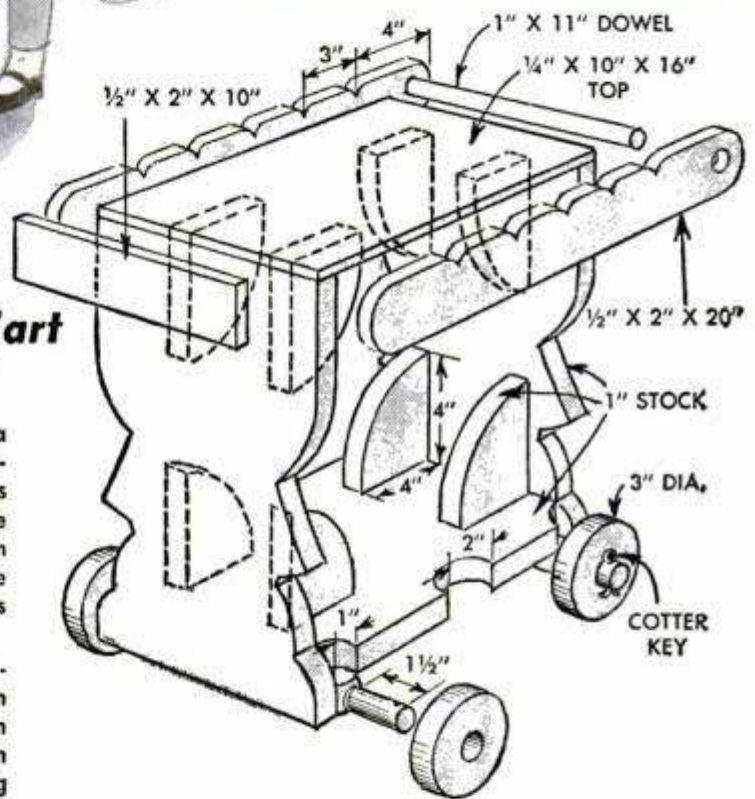


Serving Cart

by Roberta Fairall

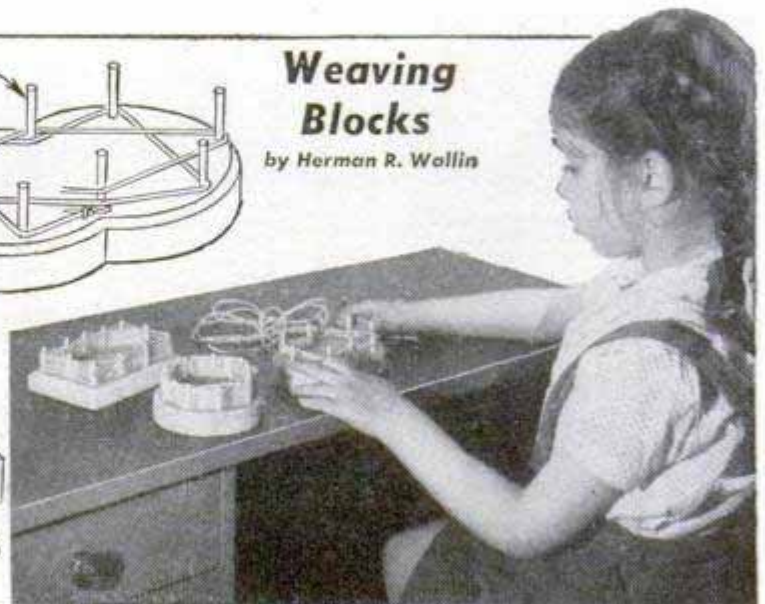
SERVING CART for the tiny hostess makes tea parties more fun. Upraised arms of jigsawed cut-outs hold scalloped tray. Pull-apart detail shows assembly. Except for tray top, entire cart is made of 1-in. stock and braced as shown. Both wooden cutouts can be sawed at one time. Tenons on the ends of cross cleats provide axles for the wheels

WEAVING BLOCKS will keep youngsters entertained for hours. Dowel pegs fitted in wooden bases provide forms on which string is wound in and out around the pegs like a basket. When done it is stiffened with shellac before removing

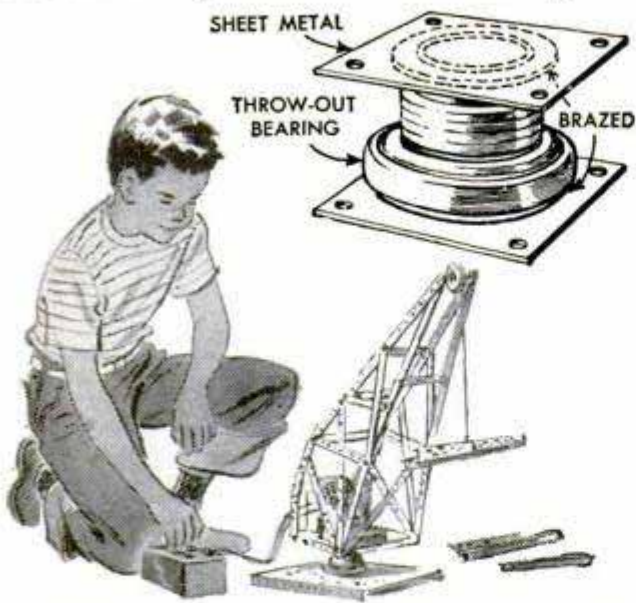


Weaving Blocks

by Herman R. Wallin

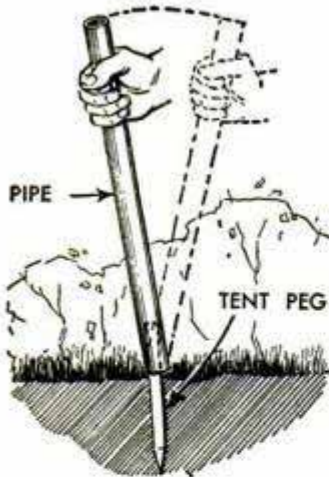


Rotating Base for Construction Set Provided by Throw-Out Bearing



The throw-out bearing from an automobile clutch makes an excellent rotating base for model cranes and similar pieces of equipment assembled from a toy construction set. After cutting and drilling two sheet-metal plates to fit the base plates supplied with the construction set, braze them to the throw-out bearing. This results in a sturdy, smooth-turning base that adds to the appearance of the model. Paint the bearing and plates to match other pieces in the set.—Bill Jeter, Hornbrook, Calif.

Pipe Loosens Steel Tent Pegs



Steel pegs used to anchor large tents are easy to remove from the ground if they are first worked loose with a length of pipe. The pipe should be fairly long to provide leverage and should have an inside diameter large enough to fit over the top of the peg.

Extension-Cord Connector

Made from two blocks of wood bolted together, this clamp prevents breaking the connection of an extension cord. It is especially handy when using an extension cord to



operate portable electric tools, hedge shears, or a vacuum cleaner where there is a considerable strain on the connection. The clamp is made by drilling two parallel holes, slightly smaller in diameter than the extension cord, through a wooden block. Then the block is sawed apart lengthwise through the centers of both of the holes. The cords are placed in the holes, as shown, and the two pieces of the block are bolted together. Thus, any strain on the extension cord will be absorbed by the block and the connection will not be broken.

Tumblers Stored on Wooden Pegs Conserve Space in Kitchen Cabinet

Many women find that the space in their kitchen cabinets is insufficient to store all the things they desire to have conveniently at hand. The husband of one woman solved this problem by inserting wooden pegs in the cabinet side at an angle so that glass tumblers could be inverted over them. By doing this, space otherwise not used could



be utilized. Diameter of the pegs is determined by the weight of the tumblers. Also, the length of the pegs depends on the size of the glass to be placed over them. If there is not sufficient space for the pegs on the cabinet sides, they could be put on the inside surfaces of the doors, positioning them so they will not contact dishes on the shelves when the doors are closed. If this is done, care should be taken not to overload the doors and thus cause them to sag or the hinges to bend out of shape.

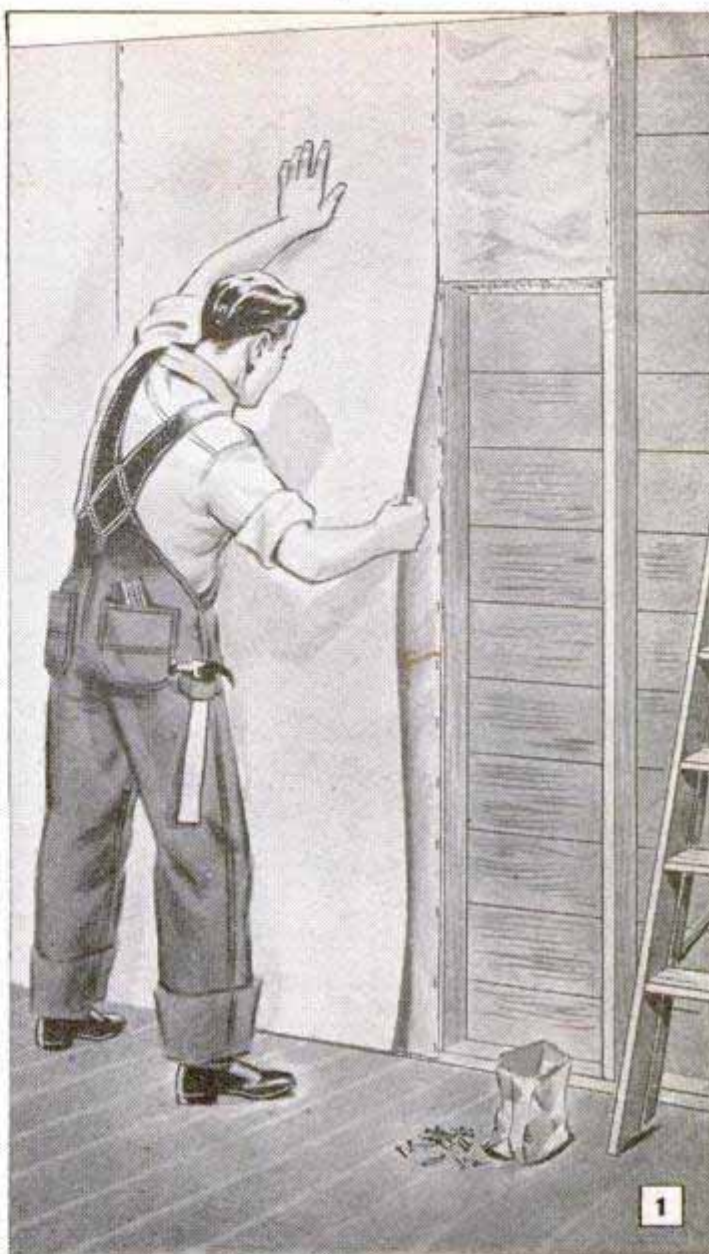
DRY WALLS

Moisture condensation in any part of the house can result in rotted framing, ruined paint jobs and damaged walls

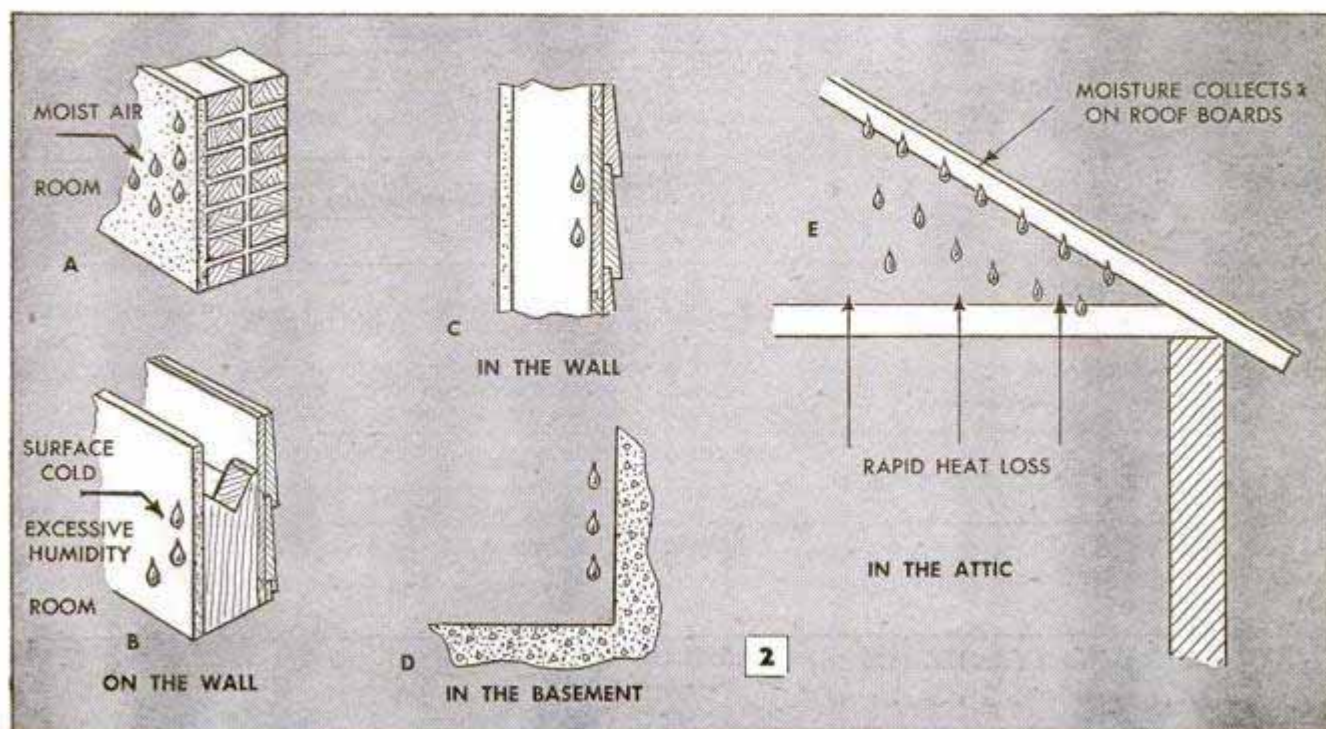
By W. Clyde Lammey

WHEN water vapor comes in contact with a cold surface it condenses to form either frost or water droplets, depending on the temperature of the surface. In older homes having porous, uninsulated walls and ceilings, the space within the walls or ceilings is constantly warmed by passage of heat. Ordinarily, there is no condensation except on the windows, for the warm, moist air passes directly through both walls and ceilings and the vapor does not condense within the structure. One occasional exception is when uninsulated walls are painted on the room side with several coats of oil paint. This acts as a vapor barrier and to some extent as insulation, allowing cold air to penetrate the wall from the outside. When the air in the house is excessively humid and the structure is in an exposed location, moisture will condense on the room side of the wall as in Fig. 2, detail B.

Condensation troubles usually begin when weather stripping, storm sash, calking and insulation are used,



To avoid condensation troubles in homes under construction, vapor barriers are installed between the plaster and studding. The barrier prevents moisture from air in the room penetrating to inner wall space





3 Blistering and peeling of paint are more often due to dampness within the walls than to any other common cause



4 ■ - Average Jan. Temperature 35° F. or Less

as leakage of moist, warm air through the walls is greatly reduced. Certain of these weatherproofing materials are more or less porous but at the same time they reduce heat loss to the minimum. This greatly reduced heat loss allows cold air to penetrate the walls from the outside. Warm, moisture-laden air from the inside meets this dry, cold air and vapor in the warm air condenses within the wall, Fig. 2, detail C.

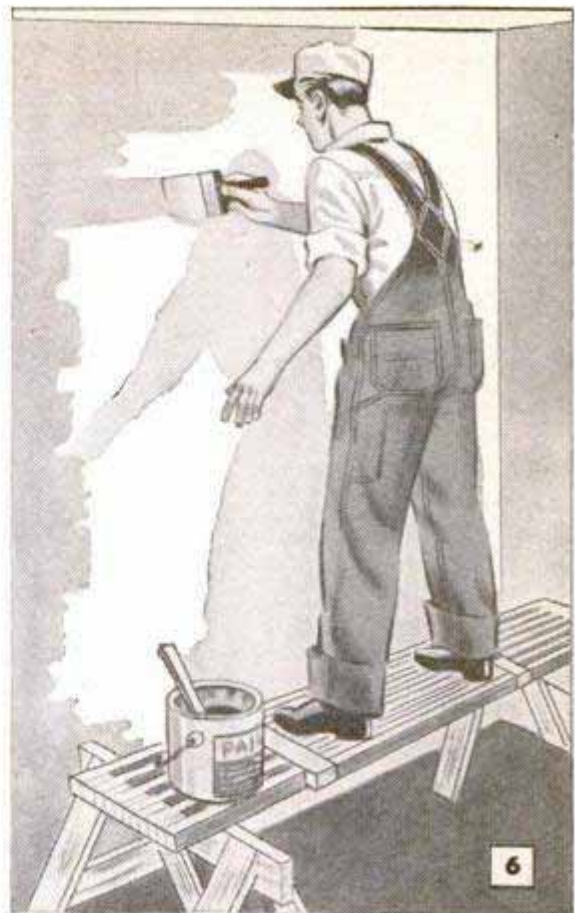
In winter, moisture condensation usually will be evident as damp spots on the ceilings and room-side surfaces of exterior walls, water and ice on inside surfaces of windows and loose particles of ice on the attic floor. If the attic is not fully insulated or if the insulation of the attic floor is not adequate, the heat loss is correspondingly more rapid, Fig. 2, detail E. Moisture will condense on the underside of the roof boards, particularly on nail points which project through them. The beads of ice which form on the nail points eventually loosen and drop to the attic floor. When these melt the water is likely to cause damage to the plastered ceiling underneath.

Blistering and peeling of the paint on the outside of the exterior walls, Fig. 3, are more often due to condensation than to any other common cause. The paint acts temporarily as a vapor barrier and as a result moisture coming from inside the house gathers underneath it and forms blisters, eventually causing the paint to peel and expose the bare wood.

5	PLACE	CAUSES
	WINDOWS (Inside surfaces of windows.)	Excessive condensation on the windows may cause: <ul style="list-style-type: none"> ● Paint to peel from sash. ● Water to run down frame causing dampness around frame and perhaps paint-peeling on outside of building.
	EXTERIOR WALLS 1. Condensation on exterior walls and ceilings of room. 2. Condensation within ceilings and walls (inside of exterior wall).	Moisture may condense directly on cold surfaces of room. This occurs in certain uninsulated homes. Unobserved condensation may also occur within wall. Probability depends on humidity of inside air, outside temperature, and vapor permeabilities of wall.
	CLOSET WALLS (Problem similar to that of exterior walls.)	Condensation on or within such walls is caused by closet being unheated. The inner surface temperature of the wall becomes lower than the temperature at which moisture in inside air condenses.
	ATTICS (Problem is essentially the same as condensation within walls.)	Condensation in attics may occur when: <ul style="list-style-type: none"> ● Insulation is applied without vapor barriers in the upper ceiling or attic floor. (Roof boards become very cold as a result.) ● Attic doors are poorly fitted. (Large volumes of high-humidity air pass from living quarters to attic.) ● Vapor penetrates the side walls and passes to attic.
	FLOORS (First floor in basementless house.)	Concrete floors laid on ground present condensation problem.
	BATHROOM	Vapor from running bath water or shower condenses.
	KITCHENS AND LAUNDRIES	Humidities are high because of cooking, washing and drying processes.

In homes under construction, vapor barriers to prevent wall condensation should be used wherever the average January temperature is 35 deg. F. or colder, Fig. 4. In new homes various types of vapor barriers are available for application to inside walls under the plaster or other finishing material, as in Fig. 1. To be fully effective the vapor barrier should be continuous and unbroken, with joints lapped and securely tacked.

In homes already built, oil paint applied to walls and ceilings, as in Fig. 6, has proven value as a vapor barrier. Usually two coats of interior oil paint will be required to obtain best results. As a rule, water-emulsion paints are not good barriers. Condensation on the room side of uninsulated masonry walls above and below grade, Fig. 2, details A and D, often can be prevented, or at least minimized, by some means of ventilation. This can be a window fan, in the case of a basement, or an outside cold-air intake in a warm-air heating system which brings fresh, dry air into the house continuously. This arrangement has proved effective in homes having solid masonry walls where visible condensation and frost sometimes occur on the room side of the walls. In basementless homes built over a shallow excavation or "crawl space," ample ventilation under the floor, plus insulation between the floor joists, will minimize any tendency toward condensation. Fig. 5 gives causes and cures in more detail, although the causes and cures given will not apply fully in every instance. Much depends on peculiarities of the individual structural design.



Oil-base paints and also varnishes applied to the room side of walls and ceilings form effective vapor barriers in homes already built. Usually two coats of paint will be required for best results. As a rule the water-emulsion paints are not good barriers to moisture

CURES

- Install:
Double windows
or
Storm sash.
- Insulate walls.
- Use vapor barriers.
- For condensation on walls:
Insulate, if house is uninsulated.
- For condensation within walls:
Use vapor barriers.
- Ventilate attic.
- Prevent moisture from reaching attic by:
Weather-stripping attic door.
Using vapor barriers to prevent moisture from penetrating side walls, and ceilings under attics. Seal off basement air from stud space.
- Insulate by using gravel, cinders, crushed stone or other insulating material underneath floor.
- Install mixing faucets for hot and cold water.
- Avoid running excessively hot water.
- Install ventilator to bring in outside air. (Cold drafts are avoided by careful installation.)
- Decorate bathroom walls with vapor-resisting material (oil paint, linoleum, tile, etc.).
- Ventilate (exhaust fan).
- Decorate kitchen walls with vapor-resisting material (oil paint, linoleum, tile, etc.).
- Avoid excessive evaporation of water.

NOTES

Double windows permit about 33% relative humidity at 70° without condensation, compared to 14% with single window.

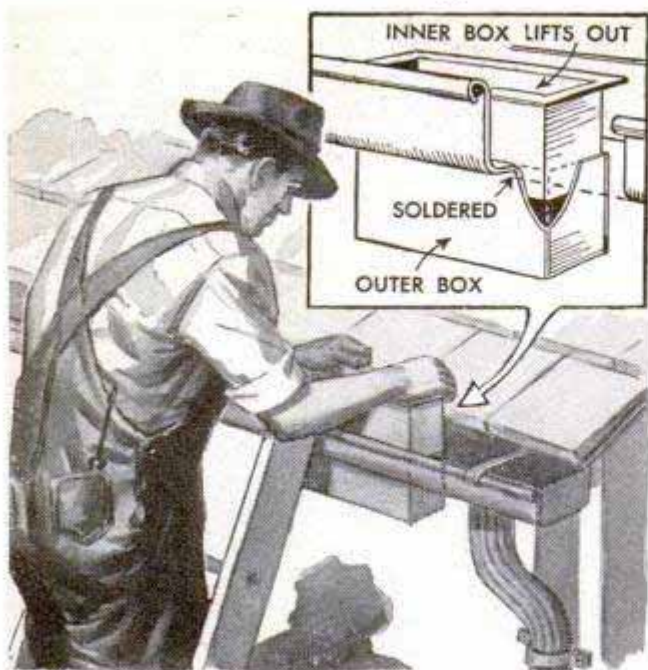
Insulation keeps inner surface temperature of the wall warm enough to prevent condensation.

A vapor barrier must be continuous and unbroken.

Excessive humidities can be reduced most effectively by proper ventilation. Water found in attics is more often caused by condensation than by leaky roofs.

Install insulation at edges of slab.

Catch Basin in Eaves Trough Collects Leaves and Twigs

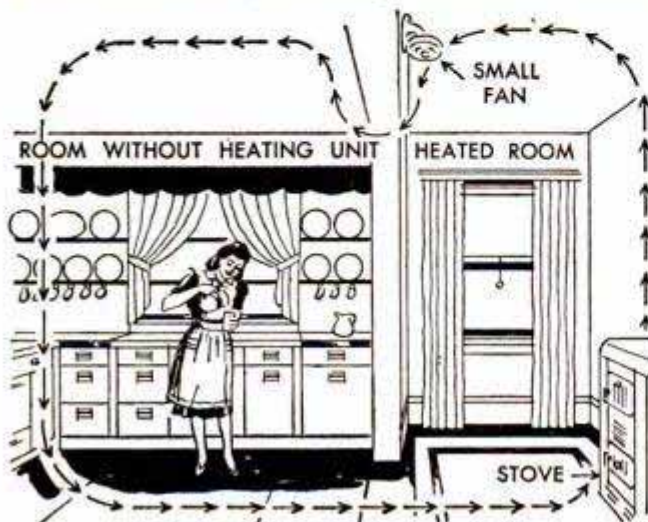


This catch basin, built into the eaves trough a few inches in front of the drop outlet, collects leaves and sticks which otherwise would be likely to clog the downspout. The basin consists of two sheet-metal boxes of soldered construction. The outer box is soldered to the edges of a rectangular hole cut in the bottom of the trough. The inner box, which is slightly smaller than the outer one, has a flange around its top edge so that it rests on the bottom of the eaves trough. The catch basin is easy to keep clean simply by removing the inner box and discarding the refuse.

Adam Szczepanowski, Michigan City, Ind.

Fan Circulates Warm Air Uniformly Through Stove-Heated Home

In many homes where a space heater is used, the warm air tends to collect just below the ceiling of the room in which the stove is located, leaving the other rooms



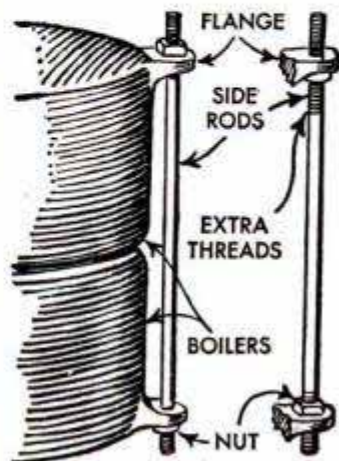
uncomfortably cool. An easy way to distribute the heat and relieve this situation is to mount a small electric fan over the doorway between the rooms. The fan is directed downward and through the doorway so that it draws the warm air from the ceiling and circulates it throughout the unheated room as shown in the drawing.

Wm. E. Danneman, Chicago.

Separating Steam-Boiler Sections

When repairing the old sectional-type steam boiler in my home, I found that the sections would have to be separated. Fearing to damage the boiler by doing this with the usual sledge hammer and wedges, I devised a method which does the job without danger of breakage.

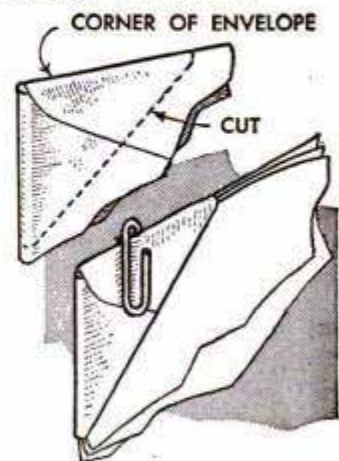
First, I removed the tie rods from the boiler and cut extra threads on one end of each rod. Then, with a nut turned all the way on the extra threads, this end of the rod was inserted through one lug. As the opposite end of the rod now cleared the other lug, it was possible to turn a nut on it so that both nuts were between the lugs. When all the side rods were replaced on the boiler in this fashion, I used them as jacks to separate the boiler sections. This was done by gradually turning all the nuts on the extra-threaded rod ends so that the stress was even on all sides of the boiler as the sections were forced apart.—Clair M. Potts, Vestal, N. Y.



Reinforcing Document Corners

If several documents or drawings must be clipped together and mailed in an envelope, their corners can be reinforced by covering them with envelope corners as shown, and fastening with ordinary paper clips. This protects the corners from damage due to rough handling and holds the papers together while minimizing the indentations caused by the paper clips.

W. F. Schaphorst, Newark, N. J.





LICK COLD-WEATHER STARTING PROBLEMS

DO YOU step into your car on a cold morning with a doubt in your mind that the motor will start? It will if it is in good mechanical condition. And good mechanical condition does not necessarily refer to a new car. Unless your car has already passed the 50,000-mile mark, the chances are that a few simple checks of the fuel and ignition systems, to bring them to peak condition, will enable you to start the "old bus" on the coldest mornings.

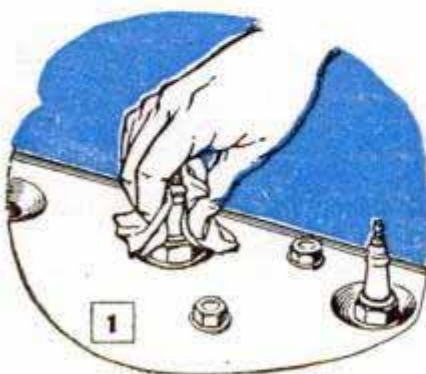
Probably the most frequent cause of hard starting in winter is a weak or defective battery. As winter approaches, the load on the car battery increases. Also, as temperature lowers, the efficiency of the battery decreases. As the weather grows colder, careful drivers keep a check on the battery charge with a hydrometer, Fig. 8, and if periodic checks show that the load is steadily decreasing the hydrometer readings below 1.250, the charging rate is increased sufficiently to main-

tain the full-charge reading, 1.250 or slightly higher. Many motorists supplement normal generator charging with a trickle charger connected to the battery overnight. If the battery is more than a year old, it's a good precaution to take a voltmeter reading of each cell at least twice a year. If a defective cell is detected by this test, the battery should be replaced.

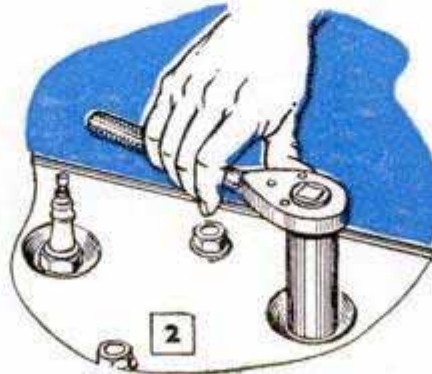
Defective or weak-battery symptoms also can be caused by a loose ground connection or badly corroded cable connections. Often it is necessary to make a careful check to be sure that one defect is not mistaken for another. Keeping all battery and ground connections clean and tight will avoid any trouble from this source.

Cars kept in unheated garages frequently give trouble in starting due to wet spark plugs. When the temperature rises after a cold snap the engine "sweats," due to moisture condensation. Moisture coats the plugs and cables and the high-tension current jumps from the

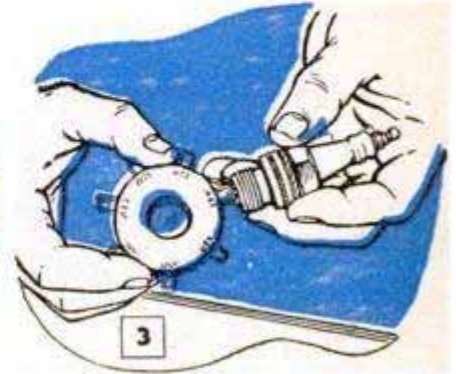
By Glen F. Stillwell



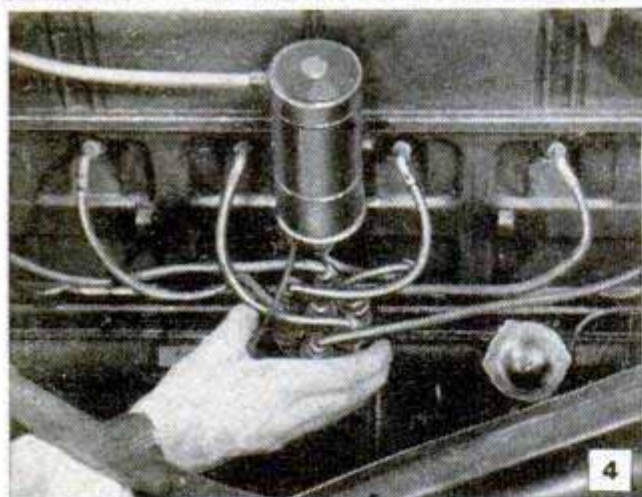
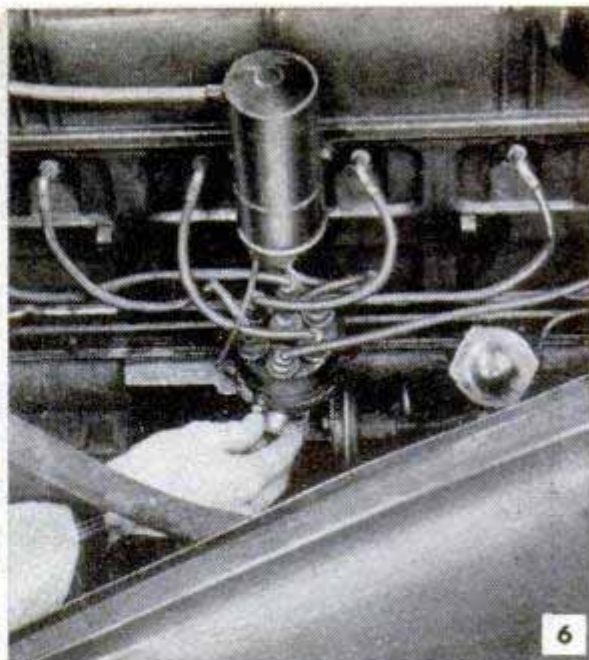
Wipe moisture from spark plugs and cables with a soft, dry cloth



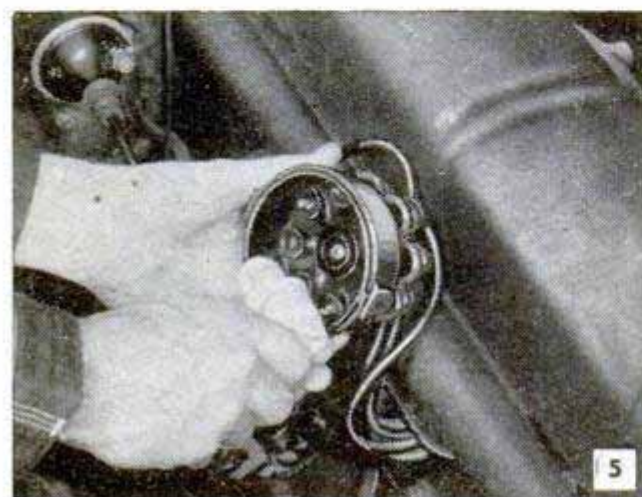
Use a deep-wall socket when tightening spark plugs to avoid breaks



Check the electrode gap with a wire gauge made for the purpose



Above, lift the distributor carefully to avoid damaging the gasket. Below, clean the inside of the cap thoroughly with a dry cloth. Examine cap inside and out for cracks. Also check condition of rain guards

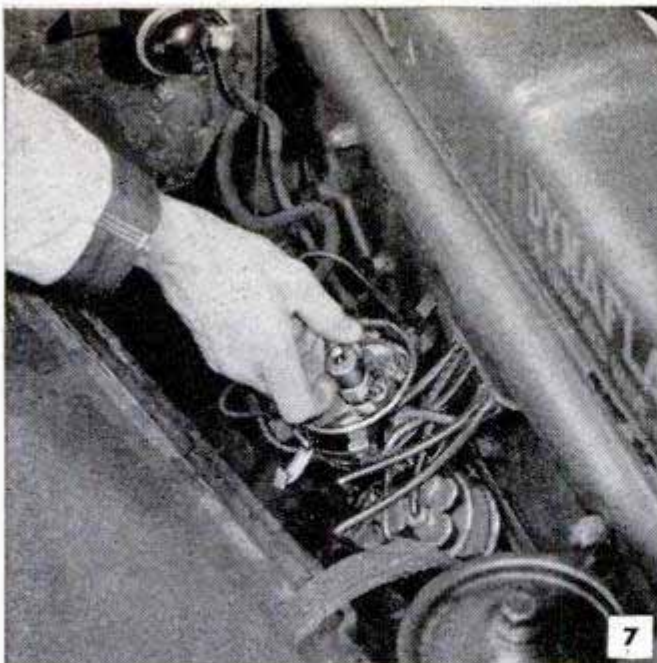


Overlubricating distributor may force grease into breaker mechanism and foul the points

plug terminal to the cylinder head, "shorting out" the plug. When this is the cause of failure to start, remove the cables and wipe the plugs and the cables with a dry cloth as in Fig. 1.

Exact gap spacing of the spark-plug electrodes, Fig. 3, is especially important in cold-weather operation of the car. Commonly recommended gap settings range from .025 to .029 in., but there are variations up to .040 in. Wide gaps and irregular gap settings in the same engine are a common cause of hard starting in cold weather. Some manufacturers recommend two settings, one for warm weather and another for cold-weather driving. In adjusting the gap always bend the side electrode and when removing plugs use a special spark-plug wrench or a deep-walled socket as in Fig. 2, to avoid cracking the porcelain. Make it a practice to clean the electrodes with fine sandpaper each time the plugs are removed. As plugs are replaced, always check the gaskets. Any that are scored should be renewed.

Making sure that the battery, battery cables and the spark plugs are in good condition eliminates a number of the common causes of wintertime starting troubles. This leaves the distributor still to be examined. Remove the cap, Fig. 4, and wipe the inside with a clean cloth, Fig. 5. Examine the cap carefully for cracks and indications of arcing. Unless the distributor is kept in good order by frequent cleaning and inspection, there is a tendency in some types of distributors for a dirt track to form inside the cap where the rotor contact travels. Here, fine dust, moisture and oil combine to form a heavy, sticky coating which in time will cause arcing, burn-

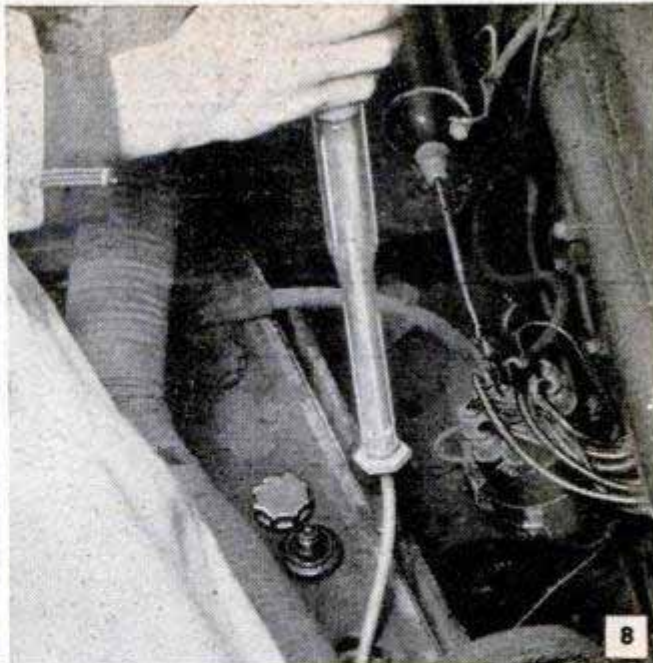


Remove rotor by pulling it off the driving shaft. When replacing be sure that it is properly positioned

ing and even cracking of the cap. Examine the top of the cap particularly for cracks. Be sure the spark-plug cables and the center cable from the coil make good electrical contact inside the socket terminals. Also be sure the rain guards over the cables fit tightly and have no cracks or wide breaks. Condition of the guards is especially important to good winter performance as they prevent moisture or a water splash from entering the distributor and suddenly "drowning" the ignition system.

Next, lift the rotor, Fig. 7, and examine the breaker mechanism. If the points are burned and deeply pitted so that they make only a partial contact, the parts should be renewed; also the condenser, which is a likely source of this trouble. On the other hand, if the parts seem to be in reasonably good condition, the points can be dressed to a true contact with a breaker-point file. The specified breaker-point gap ranges from .018 to .022 in. Check with a thickness gauge and set the gap according to the manufacturer's instructions. After setting the gap be sure the eccentric screw is tightened to hold the adjustment. Avoid overlubrication of the distributor shaft. Give the grease cup a turn or two after each 1000 miles, Fig. 6.

Automatic chokes generally have a winter and summer setting, which makes it possible to vary the richness of the starting mixture of fuel, and some are fitted with a fast-idle mechanism that simplifies starting a cold engine and gives better control during the warm-up period. The choke is operated automatically by a thermostatic control so located that it is actuated by changes in manifold temperature. Where the choke-control system includes a fast-



Hydrometer readings of 1.250 or above normally indicate full battery charge. Check cells with voltmeter

idle control, the thermostat actuates not only the choke valve but also a vacuum valve or piston which measures the idling fuel mixture. As soon as the engine reaches normal operating temperature, the choke becomes inoperative, but as the engine cools after operation, all parts of the choke mechanism return to the starting position. By carefully following the manufacturer's directions for setting, anyone can adjust the automatic choke. On older cars equipped with manually operated chokes, correct operation depends on the skill of the driver. Overchoking will flood the engine and make it difficult if not impossible to start. Flooding also will dilute the crankcase oil with unburned fuel, which passes the pistons. Running with the engine partially choked also can result in rapid wear of cylinder walls and piston rings as the raw fuel washes away oil which normally reaches the upper part of the cylinders. Ordinarily, the trick in operating the manual choke is to synchronize operation of the choke with that of the starter so that a rich fuel mixture is drawn into each of the cylinders on the first intake stroke. After the engine starts, the choke is closed by stages until the engine has reached operating temperature.

Poor compression due to leaky valves or worn rings causes hard starting any time. Such an engine needs both a valve and ring job to put it in proper condition for winter service. If poor compression is the cause of hard starting, an instrument check of the engine will show what parts are at fault. Sometimes a defective head gasket or possibly spark-plug gaskets are the cause of poor compression. These parts are quite commonly at fault in older cars.

Shock Absorber of Elastic Tape Safeguards Exposure Meter



The accuracy of a sensitive exposure meter is more likely to be maintained if jarring of the instrument during use is kept to a minimum. One way of accomplishing this is to attach a shock absorber of elastic tape to the neck strap. After the tape is looped around the strap and through the eye on the meter case, the ends are sewed together carefully to provide a strong joint.

Funnel Aids Filling Film Tank

Cementing the top part of a plastic funnel to the cover of a roll-film developing tank makes filling the tank much easier and reduces spilling to a minimum. The cup-



shaped funnel shown was taken from a discarded lamp fixture, but you can make any small funnel do by cutting off the spout. The handle of the actuating rod is lengthened by cementing it to a piece of hard-rubber tubing.

C. A. Oldroyd, Lancaster, Eng.

Ferrotypic Polish Lubricates Reel

If film does not slide easily when loading the reel of a daylight developing tank, wax the grooved spiral track with ferrotypic waxing solution, applied sparingly with a brush and polished with a soft cloth.



Determining Correct Exposure When Using Filters

Instead of bothering with complicated factors in determining the correct exposure time when using a filter on the camera lens, simply take a light reading through the filter by placing it in front of the meter. The reading obtained will give the proper lens settings for that particular filter under light conditions of the moment. The filter must be larger than the meter light opening so that the meter will not register extraneous light around the edge of the filter.

Spotting Prints With Eyebrow Pencil

When a regular spotting pencil or retouching paint is not available, tiny specks or lint that are difficult to retouch on small negatives can be touched up on the enlargement with an ordinary eyebrow pencil or a grease-type marking pencil. Such pencils are available in black and brown for spotting black-and-white or sepia prints. They work well on both dull and semigloss enlargements.

Detergent Cleans Condensing Lens

Cleanliness is essential if the condensing lens of an enlarger is to do its best work. To keep the lens sparkling, wipe it with a sponge moistened in a solution of dilute detergent of the kind used to wash dishes.

A scant drop of detergent in 8 oz. of water generally is sufficient.

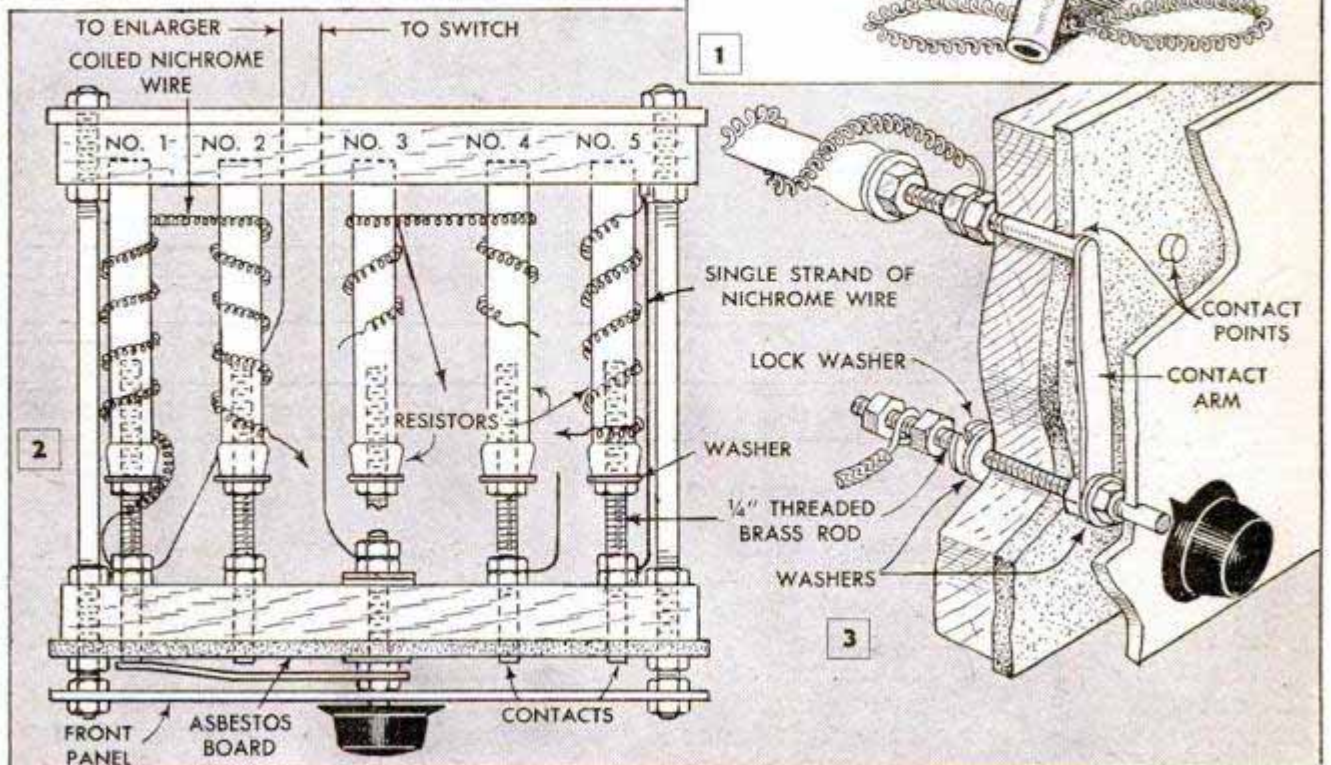
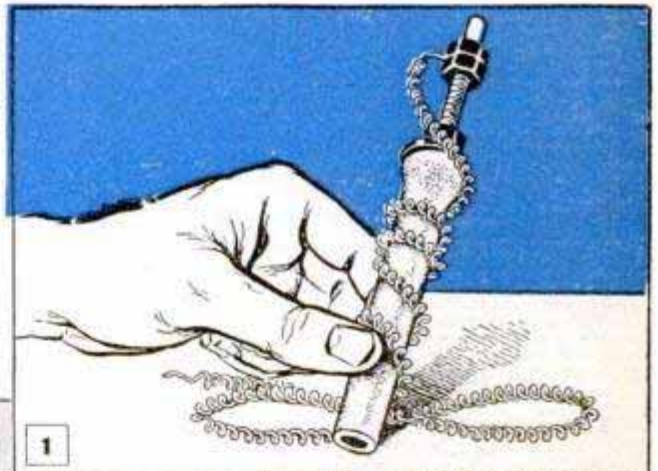
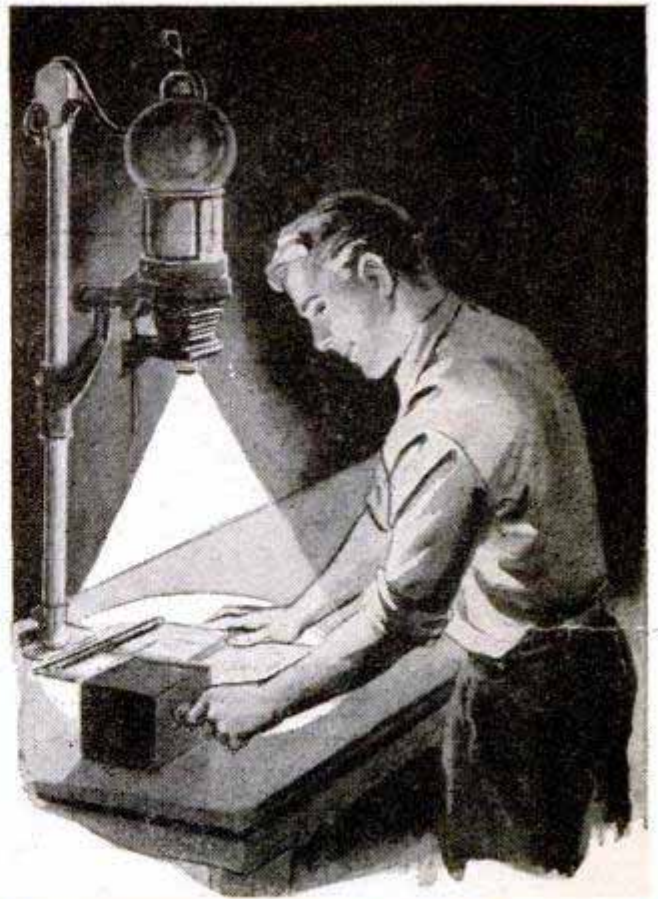


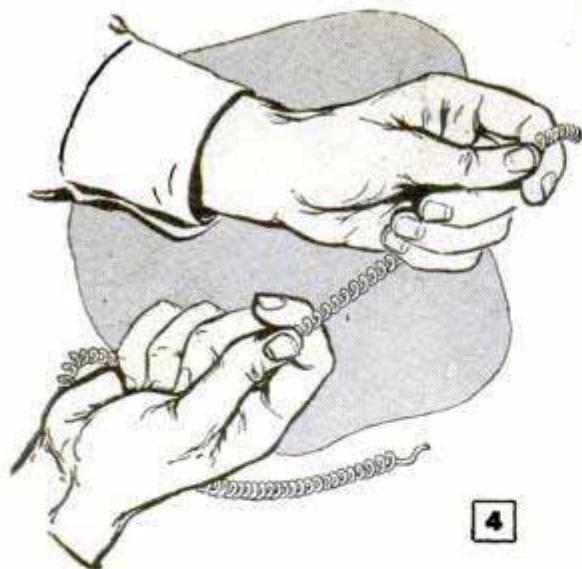
CONTROLLED ENLARGING LIGHT

By C. H. Schrepfer

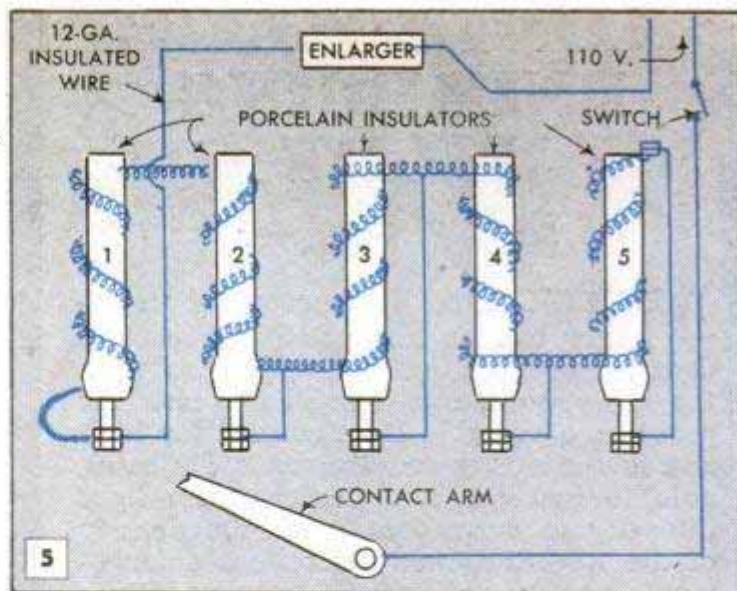
ALTHOUGH the light output of an enlarger can be controlled to a certain degree by regulating the iris diaphragm in the lens-mount, this inexpensive rheostat provides a variable light control for high and low-intensity requirements. By being able to increase and decrease the light intensity to correspond with the density of the negative, many excellent enlargements can be made from poor negatives which otherwise would be lost. In the case of a thin negative, a low light intensity lengthens the exposure and gives highlights time to register, while with a very dense negative, a high-intensity light will permit penetration with a shorter exposure. In addition, the rheostat permits control of excessive heating of the enlarger lamp house and thus avoids possible damage to the negative by using a low-intensity light while focusing and cropping. The rheostat can be used similarly in prolonging the life of photoflood lamps by using them at full brilliancy only at exposure.

The wooden front and rear panels of the rheostat case are 1 by 8 by 8 in. Five 1/2-in. holes are drilled 1/4 in. deep in the rear panel to seat the ends of the porcelain resistors, while an equal number of 1/4-in. holes are drilled through the front panel to take the brass contact points. Note that the





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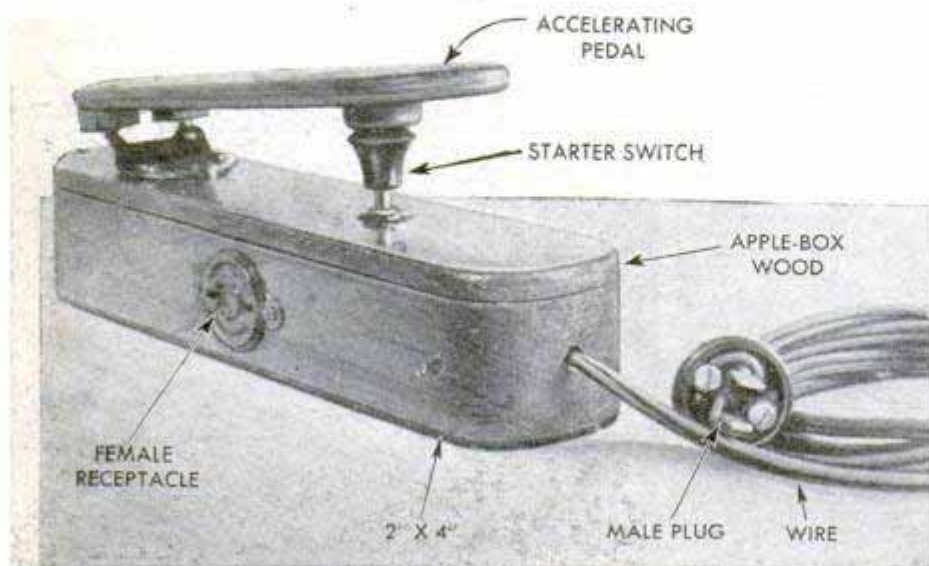
latter holes must be drilled on a radius equal to the length of the contact arm. Fig. 1 shows what each resistor looks like when fitted with a contact. Each contact consists of a threaded, 1/4-in. brass rod fitted with 3 nuts and a washer. These are inserted part way in the ends of common, knob-type insulators and then all 5 resistors are clamped in place between the wooden panels by a tie rod at each corner, as shown in Fig. 2. Before the outside nuts are in place, insulate the wooden panels with a 1/4-in. asbestos board. Aligning the holes in the asbestos to register over the protruding contact points is simplified if the board is drilled at the same time as the wooden panel. An outer control panel of hard fiber or Bakelite supports the contact shaft and knob which is installed as in Fig. 3. Note that a lock washer is used to produce tension on the contact arm. The upper end of the contact arm is bent V-shape to engage the end of the contact points which are cupped slightly for positive contact.

The contact arm is made from a piece of 20-ga. brass, 3/8 in. wide and 6 in. long. It is drilled to fit over the end of the shaft.

The resistors are made by winding coiled Nichrome wire around the porcelain insulators, stretching the wire slightly, as in Fig. 4, so that coils of the wire do not touch each other. Follow the wiring diagram in Fig. 5 when winding the wire from one insulator to the next. On resistor 1, the No. 12 insulated wire is connected to the Nichrome wire at the same terminal on the contact. The contact lead from resistor 5 is fastened to the Nichrome wire by means of a connector. Now, top, bottom and sides of the unit are covered with plywood to complete the case. Several holes should be made in the sides to ventilate the element.

By means of the 5 contacts, the rheostat will reduce light intensity from a high of 250 w. to a low of 50 w. The use of a photoelectric meter to check the rheostat will determine the exact difference of light intensity in foot-candles at each contact.

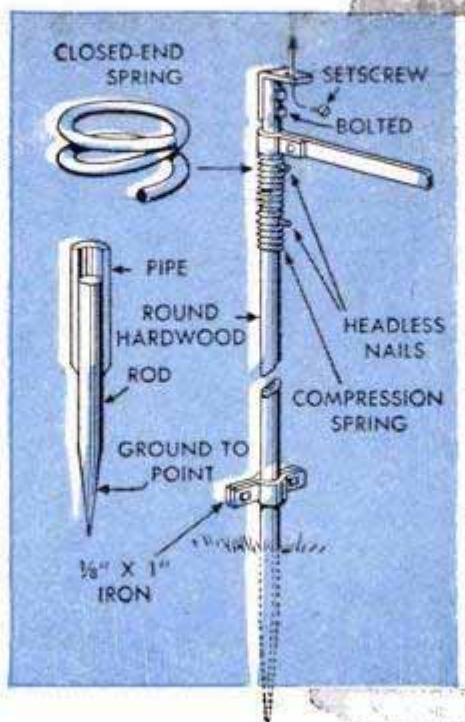
Foot Switch for Enlarger or Contact Printer Made From Auto Parts



Here is a low-cost foot switch for your enlarger or printer. It consists of an auto starter switch and a female receptacle fitted in a wooden base. The receptacle is wired to one switch terminal and a rubber-covered extension cord is wired to both terminals of the switch. An auto accelerator pedal is mounted as shown. To use the switch, plug the enlarger or printer in the female receptacle and the switch in a wall outlet.

If you've been wanting a pan-head tripod for outdoor action shots, here's an inexpensive substitute that will pan a home-movie camera with good results. It's easily carried and is set up by simply pressing the pointed end of the shaft into the ground with the foot. The shaft can be of round hardwood or a length of pipe and is cut in two parts several inches below the top. If pipe is used, a pointed steel rod is pressed tightly into the lower end of the shaft. The two parts of the shaft are held together with a strong compression spring crosspinned with metal dowels or headless nails. A setscrew fastens the camera to a bracket bolted to the top of the shaft.

Pan-Head "Tripod" Made of Hardwood or Pipe Utilizes Compression Spring for Swivel Joint



Iodine Bleaches Pinhole Spots On Photo Negatives



Should a negative be spotted with objectionable pinholes, household iodine can be used to bleach the spots and salvage an otherwise good negative. To do this, touch the spots lightly with

iodine by using the glass applicator and then touch them with hypo to stop the action of the iodine. Finally, remove the hypo with a bit of cotton placed on the end of a toothpick and dipped in water. The iodine bleaches the spots by converting concentrated deposits of silver to silver iodide which is transparent.—Bob Hurst, Chicago.

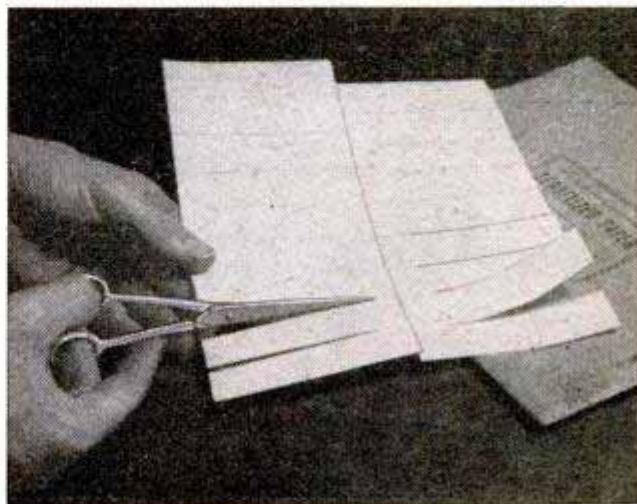
Making Slow Exposures

Some small cameras are fitted with shutters that will not work at speeds slower than $\frac{1}{25}$ sec. and, thus, when it becomes necessary to make exposures of $\frac{1}{3}$ sec., the usual method is to set the shutter at "bulb" and click it as quickly as possible. A more accurate way is to leave the shutter set at $\frac{1}{25}$ and then click the shutter five times in

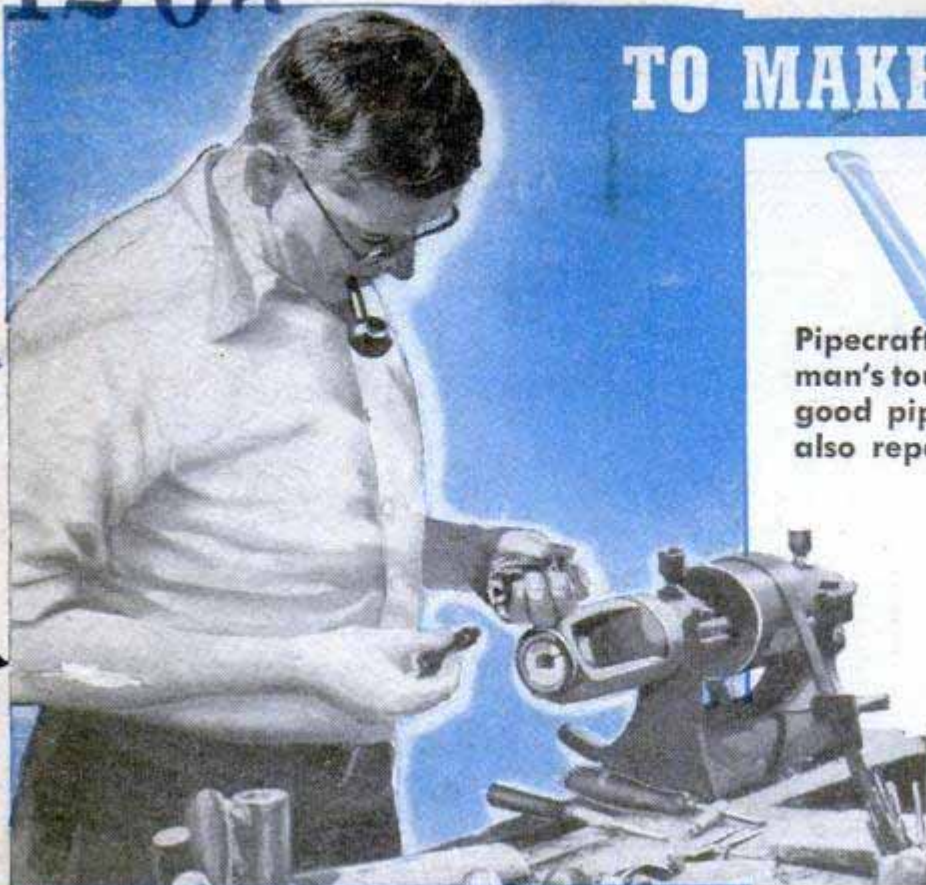
succession without moving the camera during the process. A tripod is necessary, of course, and the subject must not move during the five exposures. Variations of this idea cover slower shutter speeds.

Test Strips Are Easier to Handle When Left in Sheet Form

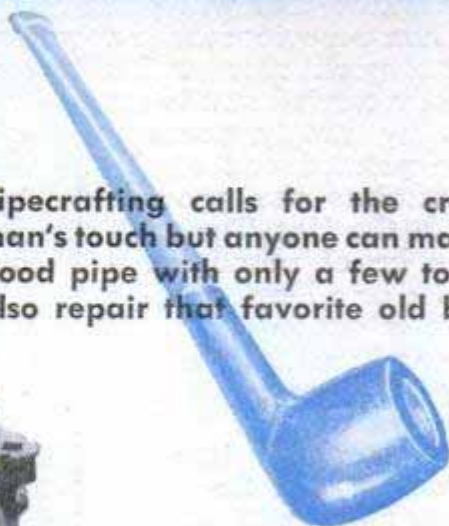
Test strips used in making enlargements, as well as contact prints, are more convenient to handle and store if they are partially pre-cut and left in sheet form. The common practice of cutting them free makes it inconvenient to retrieve the strips from the bottom of the envelope. But if the strips are cut almost to the edge of the sheet, they can be torn off as needed.



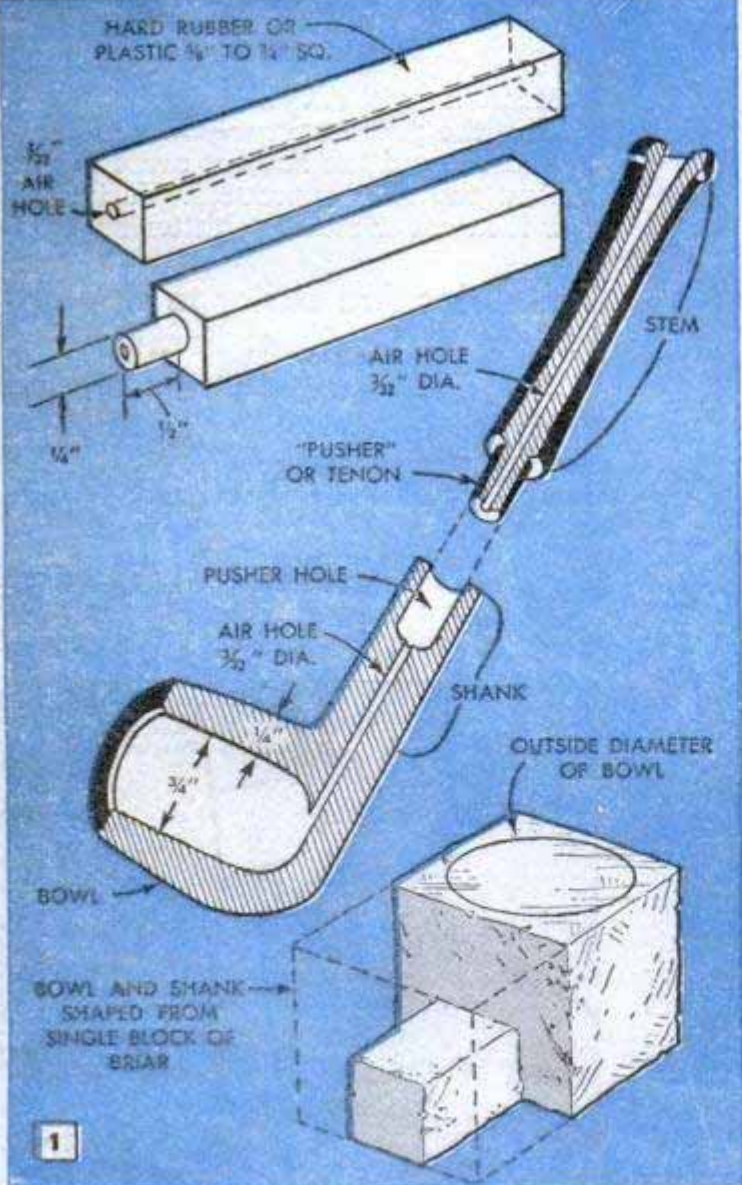
TO MAKE OR REPAIR



Pipecrafting calls for the craftsman's touch but anyone can make a good pipe with only a few tools—also repair that favorite old briar

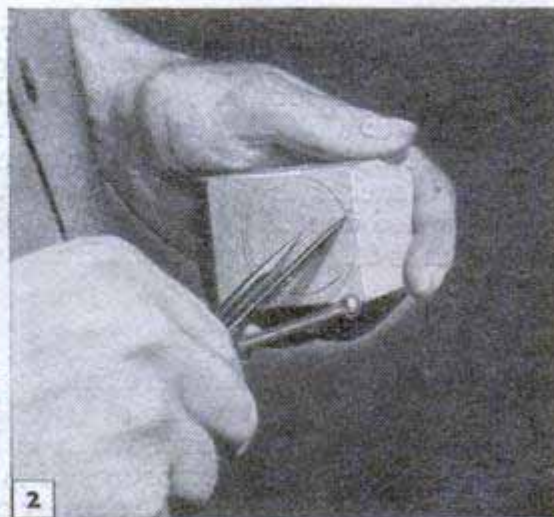


By
Richard W. Emery



GENUINE briar, as used in pipe-making, is a tough, hard root-wood and comes in pieces of comparatively small size. The grain in a single piece may vary from a distinct burl or "flame" figure through several gradations to a plain, flat grain. In cutting the rough blank for a pipe of conventional design from any but the choicest blocks of briar, the pipe maker often must modify the design to eliminate flaws in the material, or to take full advantage of the variations in the grain.

The bowl and shank of the conventional pipe are shaped from a

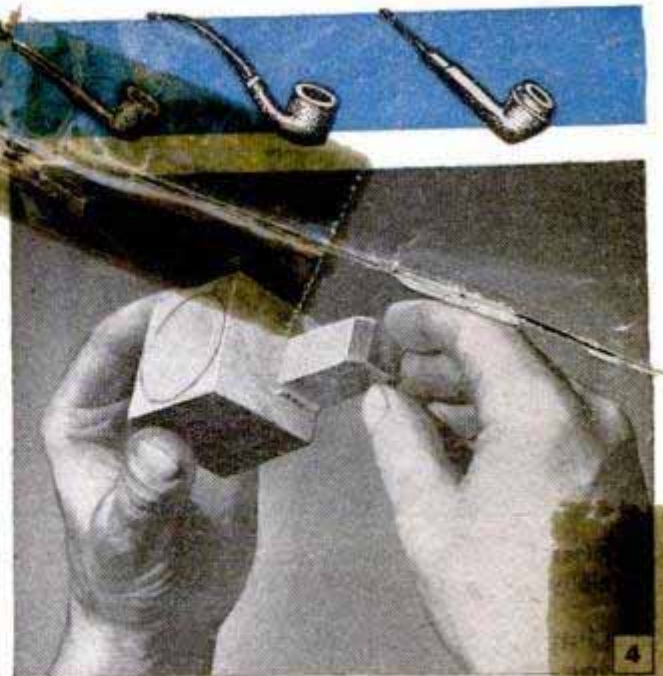


Scribe the inner and outer diameters of the bowl on the blank with sharp-pointed scribe

A BRIAR PIPE

single blank of briar, Fig. 1, but the stem, or bit, usually is a separate part made from hard rubber or plastic. The bit is flattened at the outer end to form a comfortable mouthpiece. The air hole, usually $\frac{3}{32}$ in. in dia., is drilled lengthwise through the bit before the final shaping. Before cutting a blank of briar to the rough shape, examine it carefully for flaws and pattern of grain. Then square the top surface which is to be the top of the bowl. Scribe the inside and outside diameters of the bowl on the wood, Fig. 2. In sawing the blank to the rough shape, Fig. 3, make the first cut from the end of the shank to the bowl and the second down from the top of the bowl to meet the first cut. Allow waste for shaping the bowl and shank to exact size. Shape the shank roughly by running additional cuts in from the end of the shank to the bowl. Then two cuts run in from the outside to meet the last two at the shank will produce a blank shaped as shown in Fig. 4. Next, mount the blank in a special chuck in the lathe and bore the tobacco hole as in Fig. 5. Round the bottom of the hole to a uniform radius. Counterbore the shank while the work is still in the blank or make a special chuck to hold the semifinished part as in Figs. 7 and 8. Counterboring forms the air hole and the pusher hole as in Fig. 1.

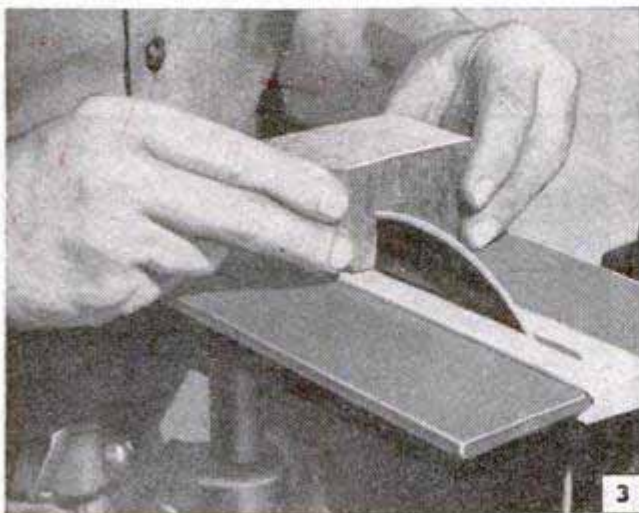
Now the blank is ready for shaping, which is done on a recessed wooden disk faced with abrasive, Fig. 6. Both the outer face of the disk and the recessed center are coated with abrasive grains bonded to the surface with a special adhesive. In use, the speed of the abrasive disk should not exceed 2000 r.p.m., otherwise there is danger of burning and discoloring the work. The



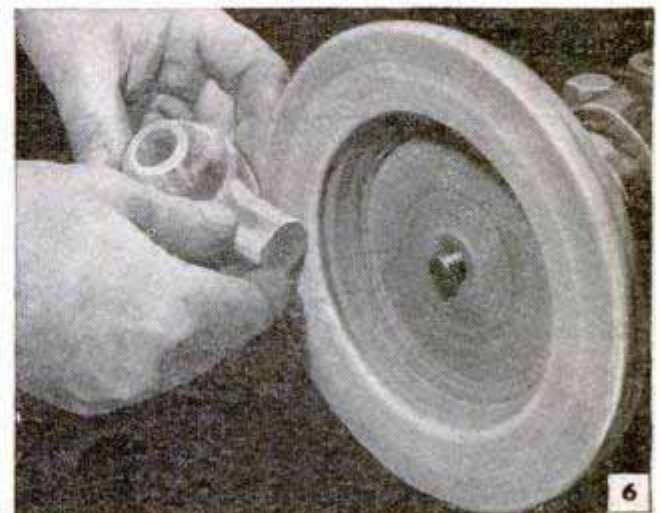
When sawed to rough shape, the completed shank-and-bowl blank is ready for sanding to final form.



Boring the tobacco hole in the bowl, using a special chuck. Bottom of the hole is rounded uniformly.



Next, the rough blank is sawed to shape with a circular saw. Be sure to allow stock for finish-sanding.



Final shaping of bowl and shank is done on a recessed abrasive disk made especially for the purpose.



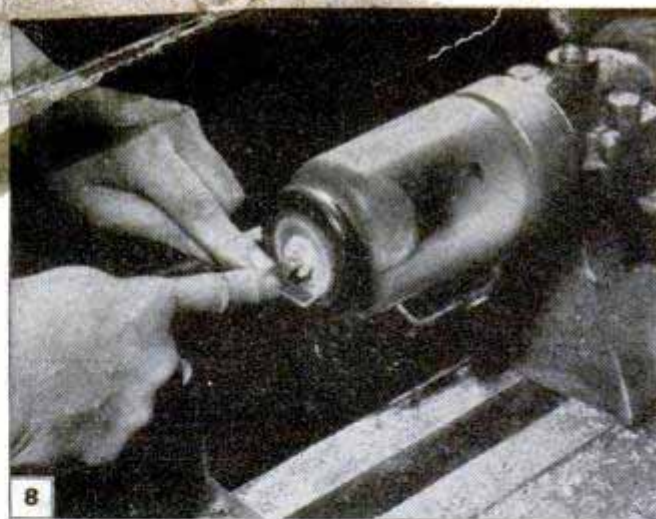
After final shaping, the work is clamped in a specially made chuck tightened with a friction ring

shaping procedure is simply that of bringing the shank and the bowl gradually to the rounded contours by alternately rounding over the corners of both shank and bowl. By working in this manner, the bowl and shank can be brought accurately to uniform shape and size.

At this stage the stem should be shaped. This is done on the abrasive disk but special care is taken to avoid overheating. Some hand-finishing will be necessary after assembly of the pipe. Turning the tenon to fit the pusher hole in the shank is the tricky job, but with care it can be done in a special chuck mounted on the lathe faceplate. Make several trial fits as in Fig. 9. After the stem is fitted to the shank, press it into the shank and touch lightly to the abrasive disk, Fig. 11, to finish the joint flush. If the stem fits too loosely, expand the end by heating it and inserting a metal taper pin as in Fig. 10.

High-grade pipes of fine briar usually are oil-finished and polished by hand. To do this, mix fine pumice and sweet oil to a light paste and rub the bowl, shank and

The stem is held in the same chuck when turning the tenon. Always trial-check the fit in the pipe shank

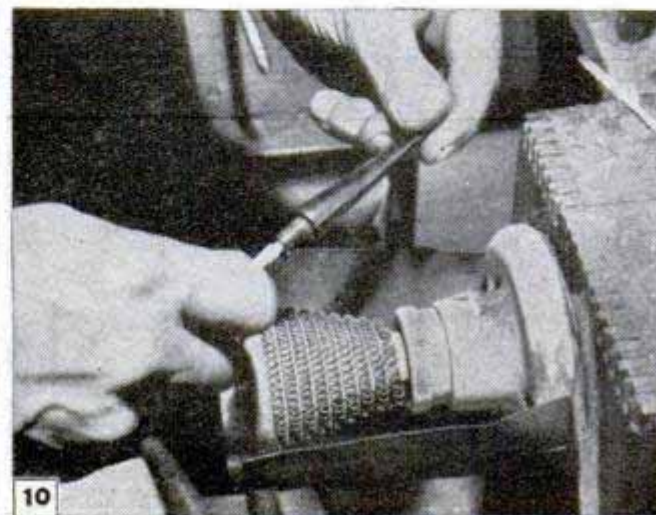


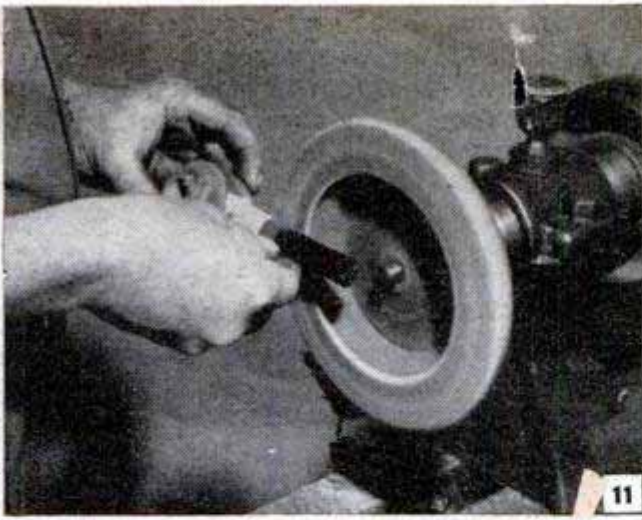
Counterboring the shank to form the air hole and the pusher hole. Pusher hole must be of exact diameter

stem to a high luster. That's all. The pores of the wood in a good pipe should never be sealed with varnish or lacquer.

Figs. 12 to 18 inclusive detail the methods of repairing common breaks in the stem and shank. If the stem tenon snaps off, leaving a portion in the shank, Fig. 12, just square the broken end and turn a new tenon on the stem. A second method is the use of an insert tenon as in Fig. 13. If the stem is short, this method often is the best. If, on the other hand, the shank breaks close to the stem, cut the shank as in Fig. 14 and drill a new pusher hole. Pipe repairers often add a metal band, Fig. 16, as a part of this repair. When the shank breaks close to the bowl, the repair problem is somewhat more involved. Then the repairman uses what he calls a bone screw, which is merely a coarsely threaded tenon or dowel made from bone and available from pipe suppliers. Broken ends of the shank are squared and joined as in Fig. 15. Use a waterproof glue and, as soon as the glue has dried thoroughly, refinish the shank and stem on the disk as in Fig. 11, to

If pusher fits too loosely, expand it by holding the bit over heat and inserting taper pin in the air hole



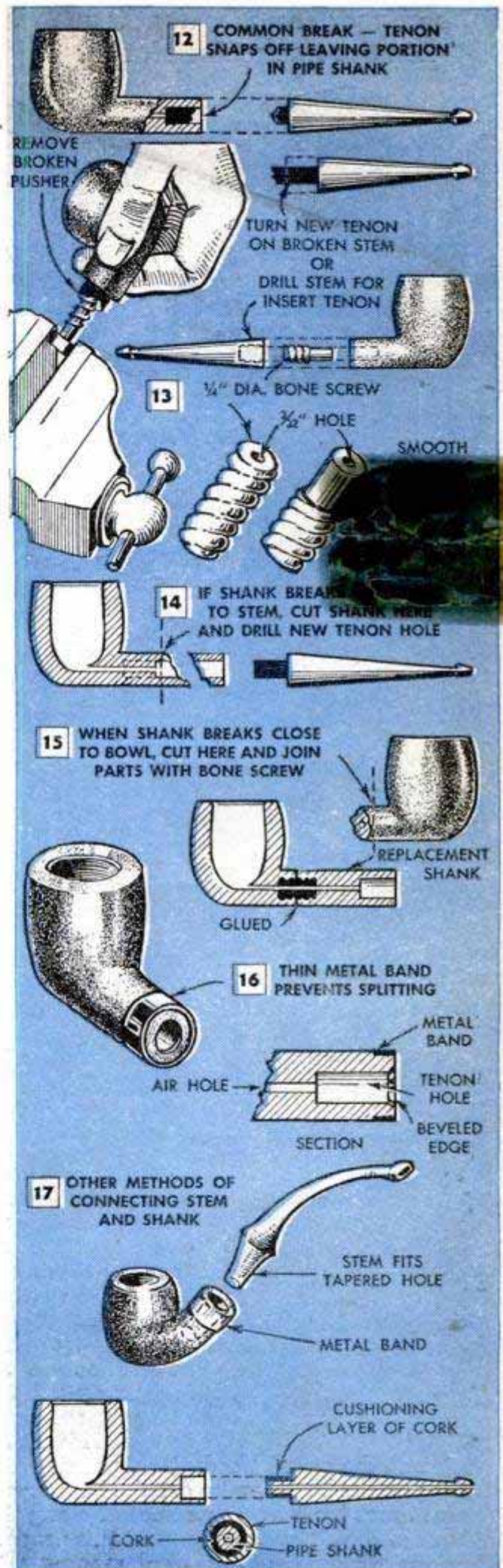


When the stem has been fitted to the shank, sand joint flush to assure a neat, close fit of these two parts

bring the parts of the joint flush. Then polish with oil and pumice. If care is taken in fitting the parts, the joint will be practically invisible. If the wood shows lighter at the joint (which it is likely to do on an old pipe) it can be brought back to the original color with a drop or two of stain. This is applied after finishing on the disk. Curved-stem pipes, Fig. 17, can be repaired in much the same way as a straight-stem pipe, provided the break is not too close to the bowl. In the former, the pusher hole must be taper-reamed. If the bit of a straight-stem pipe becomes unduly loose in the shank, the bit tenon is turned down slightly and fitted with a cork sleeve as in Fig. 17. The sleeves are available from dealers in pipes and accessories. Be careful when knocking out the ash to avoid striking the pipe shank close to the bowl.

Keep pipes in a rack when not in use. As a rule, the type of rack which holds the pipe with the bowl down is considered best, although there is some difference of opinion among pipe smokers on this point.

If you break the shank of your favorite briar, it can be repaired by using a coarse-threaded bone screw



Forefinger Provides Reading Glass When Spectacles Are Not Handy



People who wear spectacles will find this an excellent emergency measure when they wish to read a short printed item but discover that they have forgotten their glasses. By crooking the index finger, as shown in the drawing, and holding the hand near the eye, the field of vision through the hole formed by the finger is localized and the printing becomes readable. The smaller the opening made with the finger, the greater will be the exaggeration of the type. The paper is best held approximately 8 to 10 in. from the eye. A little experimenting will determine the correct size for the hole in the crooked finger and the distance at which the paper should be held.—R. Logan, Spokane, Wash.

Cutting Hard-Pressed Board



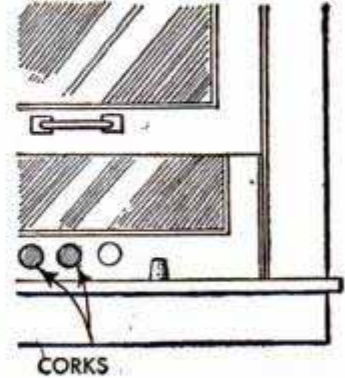
Hard-pressed board, especially the tempered type, can be cut faster than by sawing if it is scored with a sharp chisel guided along a wooden strip. A butt chisel is best suited for this purpose as it is easily held against the strip. To do this, position the strip on the board and score the board several times by drawing the chisel along the edge of the strip. Then, repeat this process on the other side of the board, making sure

it is done directly opposite the original scoring. After this, snap the board apart at the cut and smooth the rough edges with a coarse file. Of course, this method can be used only for straight cuts.

Pio Panieri, Roslyn, Wash.

Cork-Plugged Vents in Storm Sash Regulate Amount of Air

If your storm sash are without ventilators, and turn buttons prevent swinging the window open at the bottom, a simple method of installing vents in each sash is to bore three or more large holes through the sash at the bot-



tom. Then by fitting corks in the holes, it is easy to regulate the amount of air as desired by inserting or removing the corks.

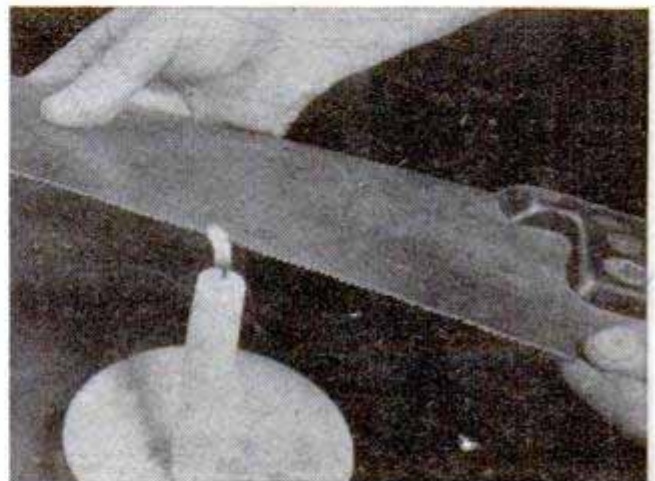
Freezing Saves Leftover Food

Leftover cooked foods which ordinarily would spoil in a few days, can be safely saved for future use by freezing in the refrigerator. Of course, care must be taken to make sure the food has not spoiled before freezing. However, if the food is several days old but still good, heat it thoroughly and then cool it quickly before putting in the freezer.

Mrs. R. McLeod, Knoxville, Tenn.

Smudge From Candle Flame Speeds Filing a Handsaw

Time will be saved when sharpening a handsaw if the saw teeth are first blackened with a candle flame. The smudge makes it easy to see the fresh file cut and eliminates refiling teeth already sharpened, thus considerably speeding up the job.





Build your own

ARC WELDER

Part II

By
Evan Wright

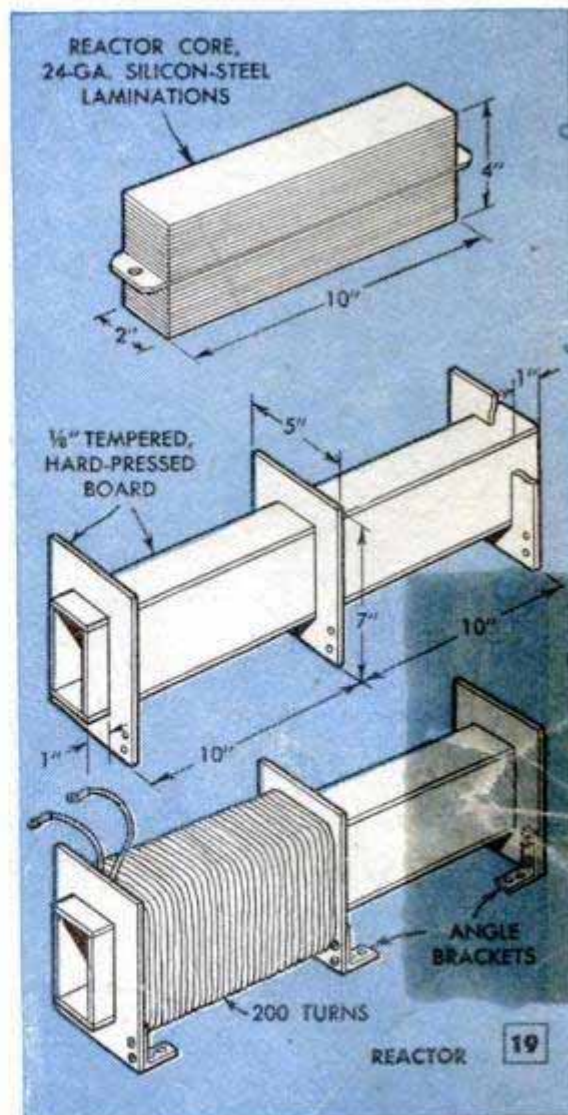


The welder parts are wired temporarily and used to weld the cabinet frame

NO ATTEMPT has been made to rewind the transformer, described in Part I, with enough primary resistance to prevent blowing the line fuses when an excessive load is thrown on the secondary. In fact, it is best to have the primary resistance comparatively low to permit a current-controlling device known as a reactor to be introduced in the primary circuit, as shown in the wiring diagram, Fig. 20. Selection of the various welding currents or "heats" is controlled by inserting plugs, connected to a primary loop and two welding cables, into jacks connected to the transformer leads. A jack board, Fig. 21, supports the jacks which are labeled for ease in selecting the different secondary and primary combinations. Further adjustment of the current is made by regulating the reactor.

To make the reactor, cut enough laminations to make a core the size indicated in the upper detail of Fig. 19. Note that the center lamination is slightly longer than the others, and has holes drilled in each end. The laminations are held together by wrapping tightly with tape. A square tube having inside dimensions just large enough to permit easy insertion of the core is glued together as detailed in Fig. 19. One half of the tube is wrapped with 200 turns of wire of the same size used in the transformer primary coil. Each layer of wire should be insulated with cotton cloth and shellac.

To make the jack board, cut out and drill 3 pieces of hard-pressed board to the dimensions given for the cover plate, Fig. 21. The holes should make a snug fit with the 3-in. lengths of



Reprinted in S-9.

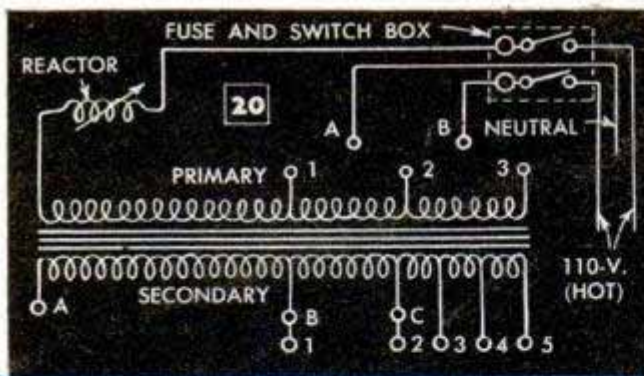
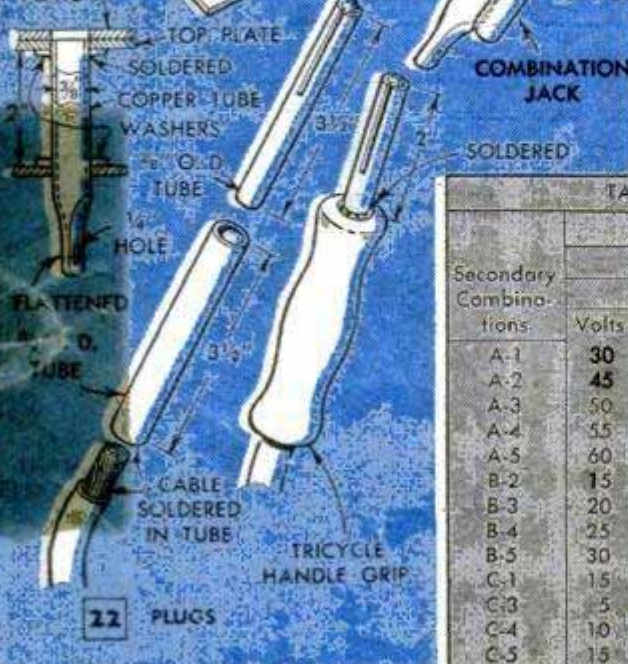
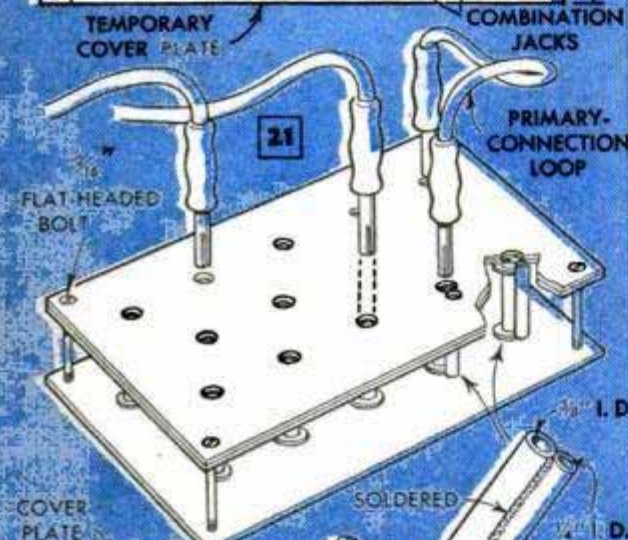
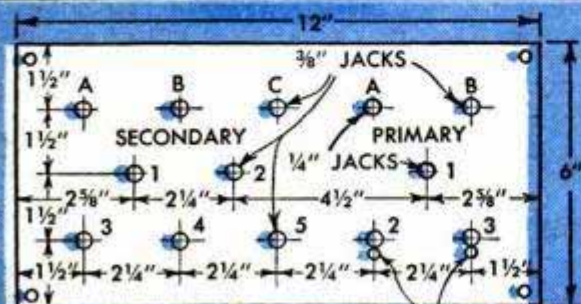


TABLE III — SECONDARY CONNECTIONS

A-1	30 turns	B-1	dead	C-1	15 turns
A-2	45 turns	B-2	15 turns	C-2	dead
A-3	50 turns	B-3	20 turns	C-3	5 turns
A-4	55 turns	B-4	25 turns	C-4	10 turns
A-5	60 turns	B-5	30 turns	C-5	15 turns



copper tubing used for the jacks. Note that jacks A and 1 for the primary are made of $\frac{1}{4}$ -in. i.d. tubing and that combination jacks 2 and 3 of the primary consist of $\frac{1}{4}$ and $\frac{3}{8}$ -in. tubes soldered together so that either of the two loops, described later, can be used. All others are of $\frac{3}{8}$ -in. i.d. tubing. The jacks are sandwiched between the pieces of board which are spaced by washers soldered to the jacks as indicated in the sectional drawing, Fig. 21. The whole unit is held together by bolts at each corner of the boards. The ends of the jacks that project through the bottom of the jack board are flattened and drilled for connection with the transformer leads.

The primary-connection loop, Fig. 21, is next. Although only one loop is used at a time, two are required, one with $\frac{1}{4}$ -in. plugs, the other with $\frac{3}{8}$ -in. plugs. These two loops of different sizes are necessary to prevent a connection across B and 1 on the primary, which would give high-voltage currents on the secondary that would be dangerous to handle and unsuitable for arc welding. The plugs, Fig. 22, are made from lengths of $\frac{1}{4}$ and $\frac{3}{8}$ -in. copper tubing each of which is split lengthwise with a saw for a distance of $1\frac{1}{2}$ in. from one end to produce a tight fit when inserted into the bore of the jack tubes. The other end is soldered into a $3\frac{1}{2}$ -in. length of $\frac{1}{4}$ or $\frac{3}{8}$ -in. i.d. copper tubing so split end projects 2 in. A 12-in. length of No. 8 gauge flexible wire is soldered to the ends of the larger tubes. The plugs are then insulated with tricycle handle grips, leaving the split tubing exposed for a distance of 2 in. Plugs for the ground and electrode-holder cables are made in the same manner. These cables are of No. 2 gauge rubber-covered flexible wire each about 20 ft. long. In use, these cables are plugged into the secondary circuit.

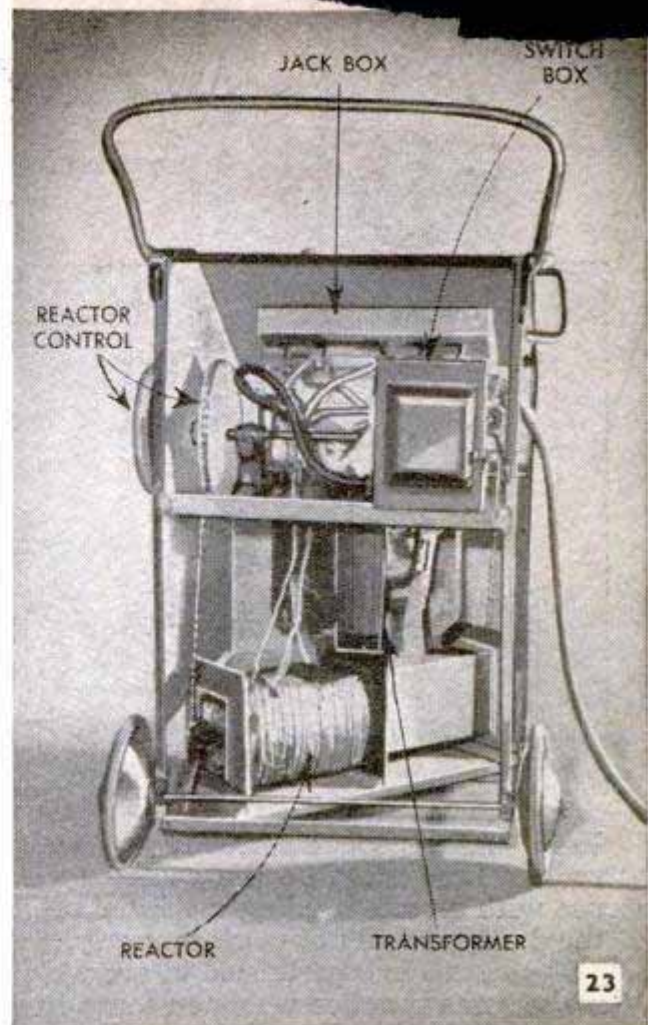
The transformer and other electrical parts now can be mounted in a temporary wooden frame as shown in Fig. 18, and used to weld the frame for the welder

TABLE IV — NO-LOAD VOLTAGES AND MAXIMUM AMPERAGES

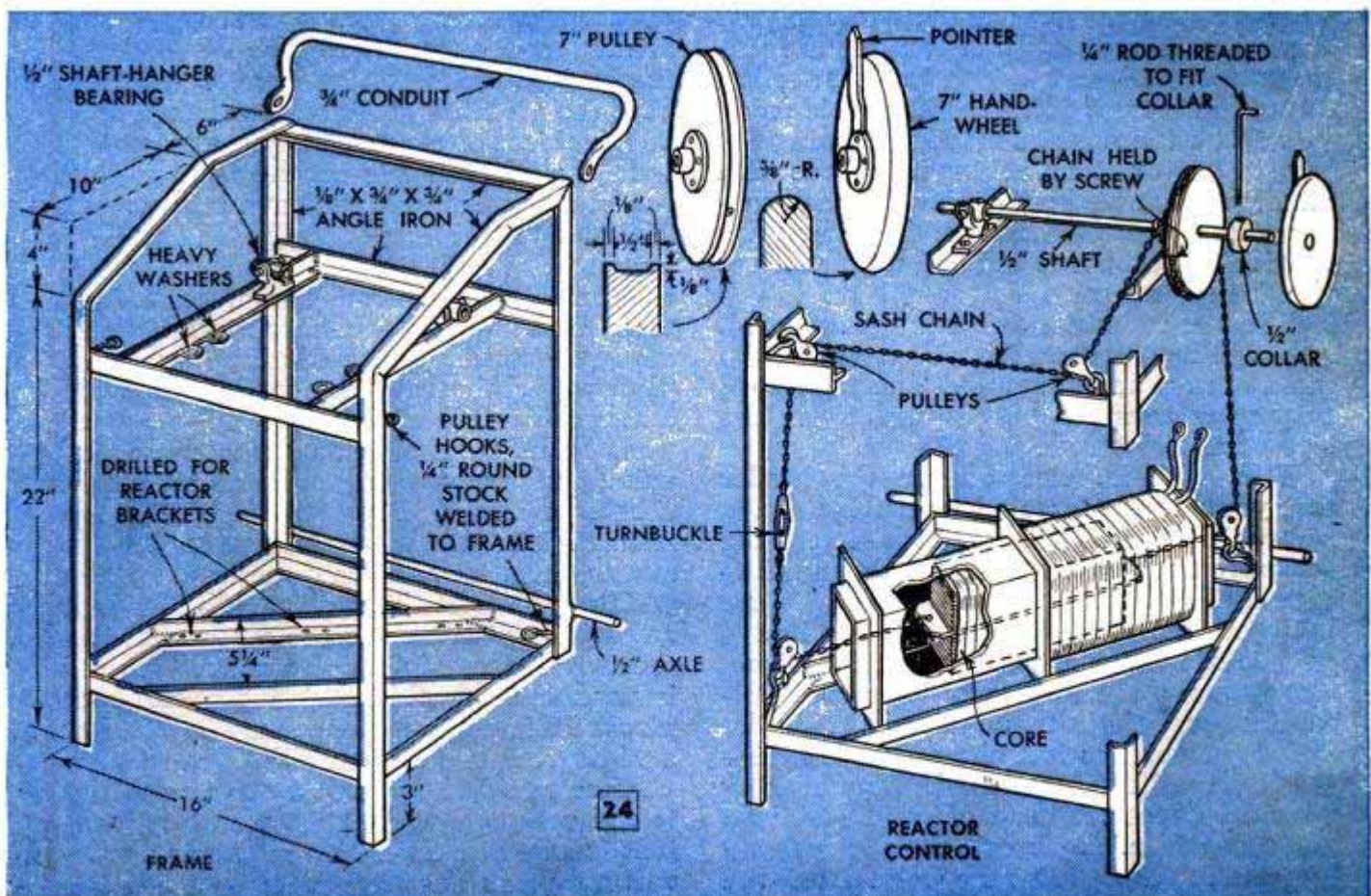
Secondary Combinations	Primary Combinations									
	110 Volts						220 Volts			
	A-1		A-2		A-3		B-2		B-3	
A-1	30	110	20	165	15	220	40	165	30	220
A-2	45	73	30	110	23	143	60	110	45	148
A-3	50	66	33	100	25	132	67	98	50	132
A-4	55	60	37	89	28	118	73	90	55	120
A-5	60	55	40	82	30	110	80	83	60	110
B-2	15	220	10	330	8	415	20	330	15	440
B-3	20	165	13	252	10	330	27	244	20	330
B-4	25	132	17	195	13	252	33	200	25	264
B-5	30	110	20	165	15	220	40	165	30	220
C-1	15	220	10	330	8	415	20	330	15	440
C-3	5	660	3	1100	3	1100	7	940	5	1320
C-4	10	330	7	470	5	660	14	508	10	660
C-5	15	220	10	330	8	415	20	330	15	440

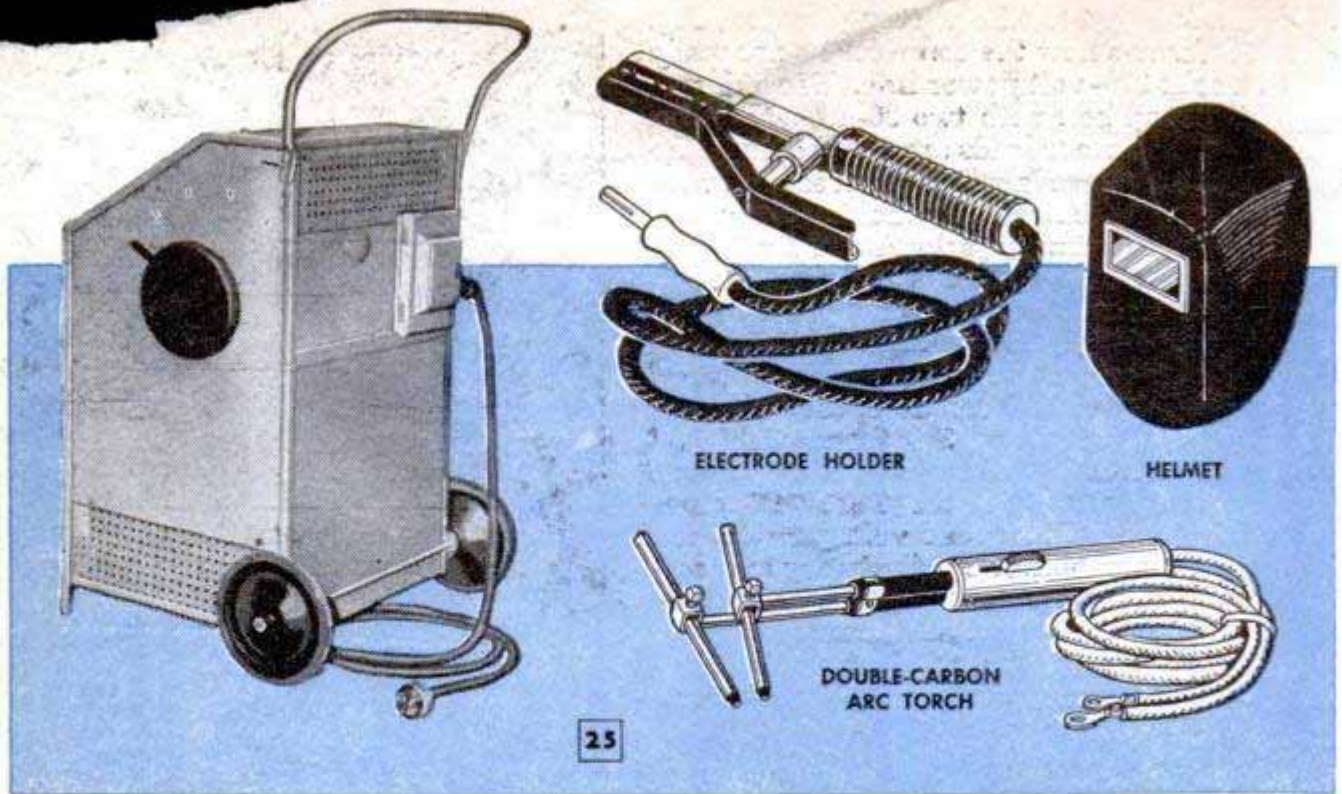
cabinet, Fig. 24. The wiring diagram, Fig. 20, indicates how the connections are made to a split 220-volt power line. Use a d.p.s.t. switch and box with two 30-ampere fuses. The transformer leads are connected to the jacks, which are labeled to correspond with the tags on the leads. By making a connection across primary jacks A and 1 with the connection loop, 110 volts are impressed on the 110 turns. The combinations of jacks A-2 and A-3 give 110 volts through 165 and 220 turns respectively. When connections across B-2 and B-3 are used, the voltage is 220 through 165 and 220 turns. Table III gives the number of turns for the various secondary combinations. Table IV gives the approximate no-load voltages with the different combinations of primary and secondary hookups. These voltages can be varied by adjustments of the reactor.

Before starting to weld, several accessories must be purchased. An electrode holder as shown in Fig. 25 is connected to one of the 20-ft. cables and a lug or clamp is connected to the other to serve as a ground cable. A helmet of the type shown in Fig. 25 or a hand-held face shield, shown in Fig. 18, must be used to protect the eyes and face from the rays of the welding arc. Do not attempt to arc weld with dark-colored goggles such as used for oxyacetylene welding. To protect the hands, leather welders' gloves should be used. In addition you will need 5 lbs. each of $\frac{1}{16}$, $\frac{3}{32}$ and



The electrical parts are mounted in a frame having two wheels for ease in moving around the workshop





$\frac{1}{8}$ -in. mild-steel electrodes or welding rods. These must be the coated type for use with an a.c. welding machine, because the d.c. type will not work properly.

If you are inexperienced in arc welding, make some practice welds on scrap iron to get the feel of handling the arc before welding the frame. To start welding, clamp the ground-cable lug to the work and then connect the cable to jack B on the secondary. Connect the electrode-holder cable to jack 5 on the secondary. Then connect the primary across B and 2 with the connecting loop. Adjustment of the reactor, which may be laid on the floor, is made by sliding the core in the tube and locking it in place with small wooden wedges. Start with the reactor wide open and cut down the current by moving the core into the coil until you get the desired current. You may have to use a different combination on the jack board. Arc welding requires from 30 to 40 volts to maintain an arc manually. The amperage may vary considerably depending on the size of the electrode used.

With a $\frac{1}{8}$ -in. electrode in the holder and your eyes protected with the helmet, scratch the tip of the electrode across the scrap iron as you would a match, and then quickly lift it about $\frac{1}{8}$ in. to form an arc between the tip and the iron. When a puddle of molten metal forms on the iron, slowly move the rod toward the right. Simultaneously with this movement feed the rod downward as it melts off, thus maintaining a uniform arc length. The melting rod will deposit a bead of weld metal on the scrap iron. To break the arc, merely pull the rod away from the weld. After the

weld cools, remove the coating of slag, which covers the surface of the weld, with a cold chisel and wire brush. The surface of a good weld will have uniform ripples in it. If the tip of the rod sticks or "freezes" to the work, move the rod from side to side vigorously while pulling upward. If this does not free the rod it must be immediately released at the jaws of the holder to avoid overheating and injury to the rod coating. Difficulty in starting and maintaining an arc usually can be overcome by increasing the welding current slightly. Practice welding straight, flat beads with various sizes of electrodes, and experiment with the adjustments on the welder until the best current settings have been found. Then butt two pieces of scrap iron together, leaving a gap of $\frac{1}{16}$ in. Make a small weld at each end of the scrap-iron pieces to hold them together, and run a continuous weld along the joint. After cooling, break the pieces apart through the center of the weld and examine it for depth of weld penetration. Insufficient penetration is caused by using too low a welding current or too fast a rate of travel. Fillet welds, which are used to join two pieces of metal at right angles, also should be practiced. When welding joints of this type, hold the rod at an angle which bisects the angle between the two plates. If difficulty is encountered in producing a weld that is fused into both pieces uniformly, the work may be tilted at a 45-deg. angle and the rod held vertically.

After satisfying yourself of your ability to make a good weld, start making a cabinet frame, Fig. 24, which supports all the various parts shown in Fig. 23. All the

angle-iron parts for the frame should first be cut, fitted and tack-welded together. Then, after checking for trueness, make continuous welds at all the joints. The entire assembly is mounted on wheels. Dimensions for locating the angle-iron supports for the transformer are not given as they must be determined from the size and type used. Four large washers, welded to the supports to correspond with the bolt holes in the mounting brackets of the transformer, hold it firmly in place. The reactor is set on angle irons welded diagonally across the bottom of the frame and is controlled by a handwheel, as shown in Fig. 24. By turning the handwheel, the position of the core in the tube is adjusted. However, as a strong pull is exerted on the core when the reactor coil is energized, the core must be locked in place after it is adjusted. This is accomplished by turning the $\frac{1}{4}$ -in. rod, Fig. 24, which is threaded to fit a tapped hole in a $\frac{1}{2}$ -in. collar on the handwheel shaft. The rod, which extends through the top panel of the cabinet, acts as a setscrew and thus prevents the shaft from turning. The jack board is supported by a panel of hard-pressed board covering the slanted portion at the top of the frame. This panel becomes the permanent jack-board cover. The temporary jack-board cover may be used as a template to drill the holes accurately. The switch box is welded to the rear of the frame and the electrical parts are wired as in Fig. 20. A length of 3-wire (No. 10 gauge) flexible cable and a 3-way plug and receptacle are used for connection between the switch box and power line. The sides of the frame are covered with panels of hard-pressed board and perforated metal, as shown in Fig. 25. All panels are bolted to the inside surface of the angle-iron framework. After painting the entire cabinet, label the jacks and number five equally spaced positions of the reactor handwheel to indicate the position of the core in the reactor coil. A record of best operating current adjustments for various rod sizes should be kept for reference.

The double-carbon arc torch, Fig. 25, is a useful accessory for this welder as it supplies a self-contained arc flame for welding and heating metals.

The End

Water Helps to Remove Tires

Sometimes an auto tire which has "frozen" to the wheel rim is almost impossible to pry or jar loose. However, if water is poured into the groove formed by the rim and the tire bead and allowed to stand for a few minutes, the tire will loosen with comparatively little effort.

Charles R. Best, Lethbridge, Alta., Can.



PHOTOGRAPH OF WINDOW DISPLAY

Photograph of Window Display Aids Customer's Selection

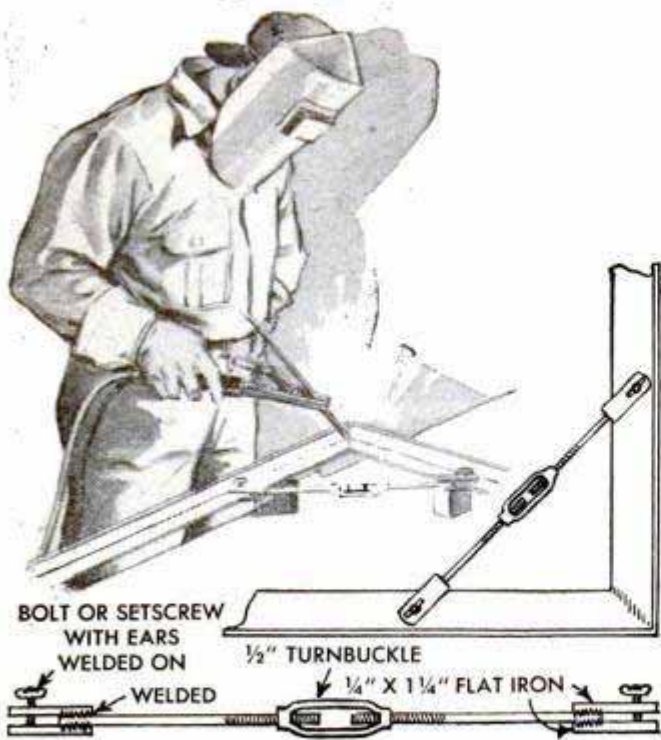
As his window display contained many items that the customers often could not name specifically, one enterprising merchant kept a large photo of his window display handy at the store counter. This saved time for both the customer and himself by enabling the customer to point out the desired item without leaving the counter.

Lathe Dog Holds Rods for Cutting

Several lengths of small rod or tubing may be cut off accurately at one time if they are clamped in a lathe dog. As these dogs come in different sizes, use one in which the material can be clamped as shown. After the work is clamped, the dog is held in a bench vise for cutting. To prevent damaging thin-wall tubing, a small V-block should be used between the clamping bolt and the tubing.



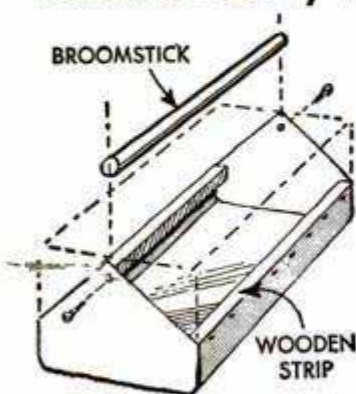
Improved Clamp Positions Work For Welding Angle-Iron Corners



Some time ago our shop had a job of assembling and welding a large number of angle-iron stands. Cutting and bending the top frame was simple enough but holding the mitered corners in position and the legs square for welding posed a problem. We finally devised a simple clamp consisting of a turnbuckle and two threaded rods having a flat-iron yoke welded to each end. The clamp is attached to the work with thumbscrews tapped in the yokes and then the turnbuckle is used to draw the joint together. In the case of the legs, we tack-welded each one lightly to the frame and then fastened two clamps, one on each side of the leg, to hold the leg square.

Hobart Bros., Troy, Ohio.

Portable Poultry Feeder



which runs the length of the can. This not only eliminates sharp edges which might injure the chickens, but also forms a lip reducing the amount of feed scattered about during feeding. Wood screws, driven

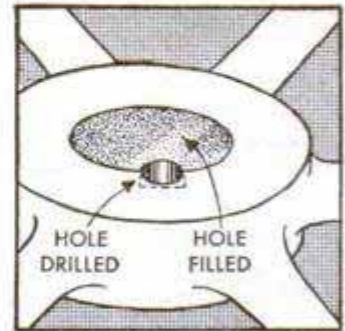
An inexpensive poultry feeder can be made easily from a rectangular-shaped 5-gal. can, utilizing a piece of broomstick for a handle. The feeder is cut from the can, as shown, and each side is nailed to a strip of wood

through an oversize hole in each end of the can, hold the broomstick handle in place. This should be fastened loosely so it will rotate to prevent the chickens from roosting on it. Sharp edges on the ends of the feeder should be smoothed before using.

A. Zanelli, Clifton, N. J.

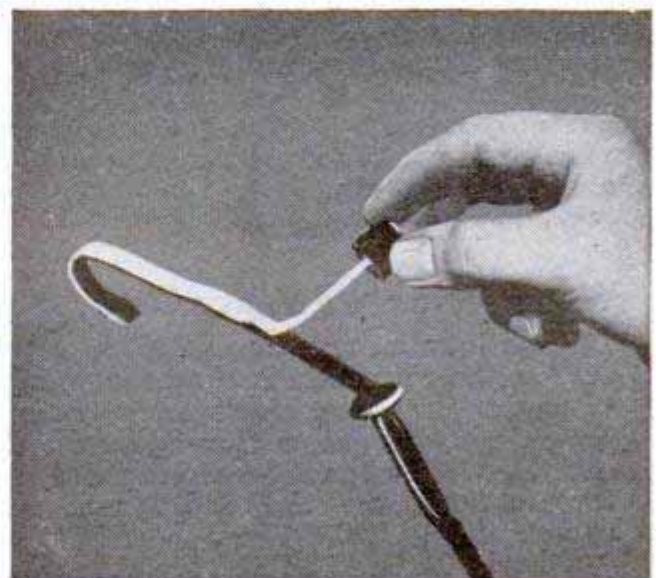
Simplified Method to Cut Keyway In Large Pulley or Gear

Desiring to substitute a keyway for the setscrew often used to fasten older-type pulleys and gears to a shaft, one small-shop owner formed the keyway in the following manner. He turned a metal plug slightly oversize for a force fit in the bore of the pulley and drove it in the hub so that it was flush with both sides. Then he drilled a hole, centering it over the edge of the bore, knocked the plug out and used a round pin for a key. Although more work, a regular key can be used by filing the half-round hole square.

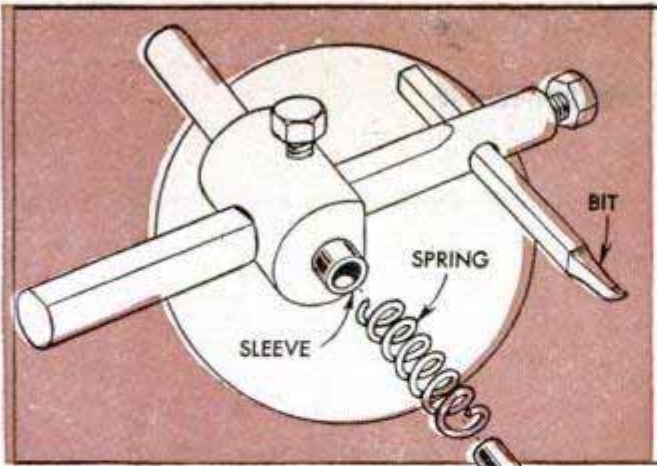


Oil-Gauge Stick Readily Located By White Enamel on Handle

If the oil-gauge stick in your car is difficult to find in the darkness under the hood, try painting the handle of the stick with white enamel to make it stand out. White enamel applied to the engine block where the oil-gauge stick enters it also will aid in replacing the stick. Because of the heat from the engine, this paint must be renewed occasionally, but the time saved when checking the oil is well worth the trouble.—H. Leeper, Canton, Ohio.



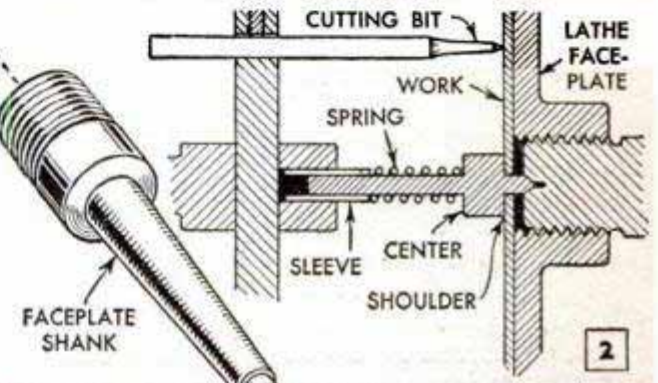
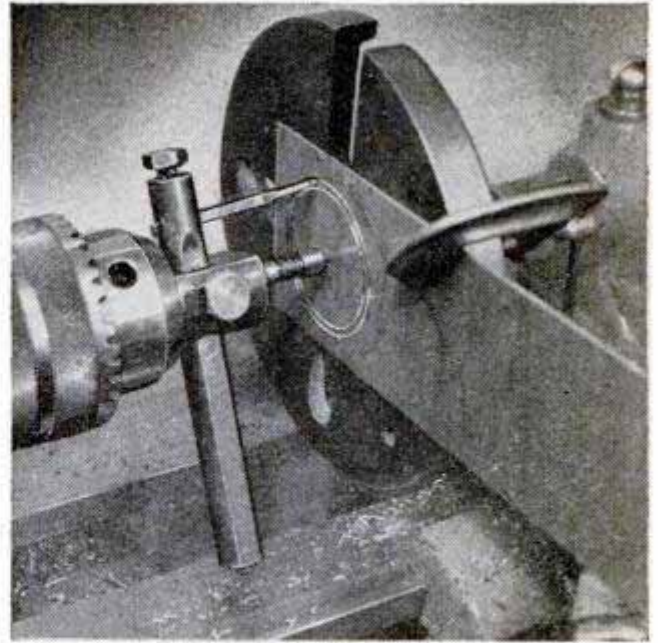
TRUE HOLES in LIGHT METAL



1

CENTER, RUNNING FIT IN SLEEVE BORE

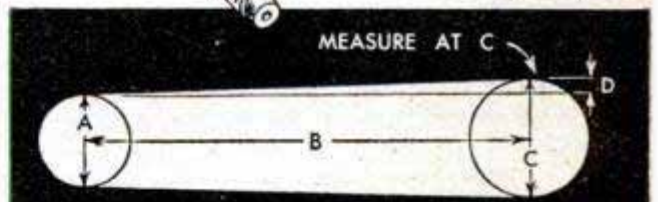
60° CENTER



2

USING this exceptional tool, it's possible to cut a true hole every time without the usual distortion or elongation. The tool is attached to the headstock of a lathe and the work is backed by a faceplate screwed on the end of a specially turned shank inserted in the tailstock spindle. The tool is made from a standard adjustable hole cutter by removing the center drill and installing a steel sleeve, spring and center fixture, as in Figs. 1 and 2. The shank of the center should be a running fit in the sleeve bore and the bearing surface should be kept well oiled. A 15-lb. diemaker's spring is required to produce the desired thrust. Faceplate shank is threaded to fit the faceplate and the shank is turned to a Morse No. 1 or 2 taper, depending on the tailstock spindle. Dimensions for both tapers are given in Fig. 3. The threaded end of the shank is center-drilled to take pointed tip of the center fixture. In operation, the pilot hole in the work fits over the 60-deg. center which is engaged by the faceplate shank. The faceplate is advanced to allow the flat face of the center fixture to grip the work. When once adjusted, the feeding is done with the tailstock ram. Should a disk be desired without the pilot hole, it can be cut by clamping the work to the faceplate.

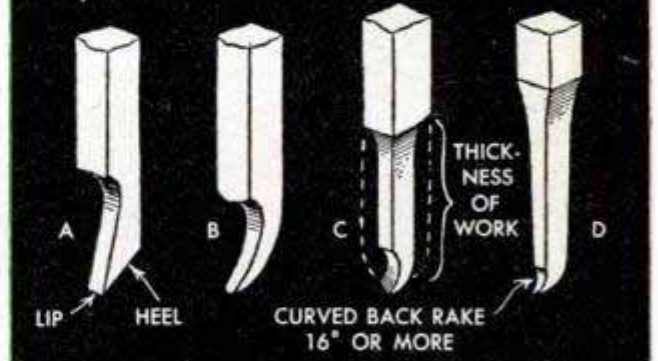
Various cutter bits and their uses are indicated in Fig. 4. These bits are made only from the hardest alloy steel honed to a razor edge. When a bit is used on a hole of smaller diameter than that for which it was designed, it may rub. In this case, part of the heel must be ground away to give the desired-clearance. When using the tool, remember to keep the feed pressure light, as heavy feed will cause the bit to dig in.



SPECIFICATIONS FOR MORSE TAPERS

MORSE #1	MORSE #2
A—0.369"	A—0.572"
B—2 ³ / ₁₆ "	B—2 ³ / ₁₆ "
C—0.475"	C—0.700"
D—0.0498 PER IN.	D—0.0499 PER IN.

3



BIT SHAPES FOR VARIOUS TYPES OF WORK

- A—LARGE HOLES IN SOFT METAL
- B—HOLES IN BRONZE OR STEEL
- C—SMALL HOLES IN SOFT METAL
- D—HOLES IN THIN METAL, 1/32" TO 1/16" THICK

4

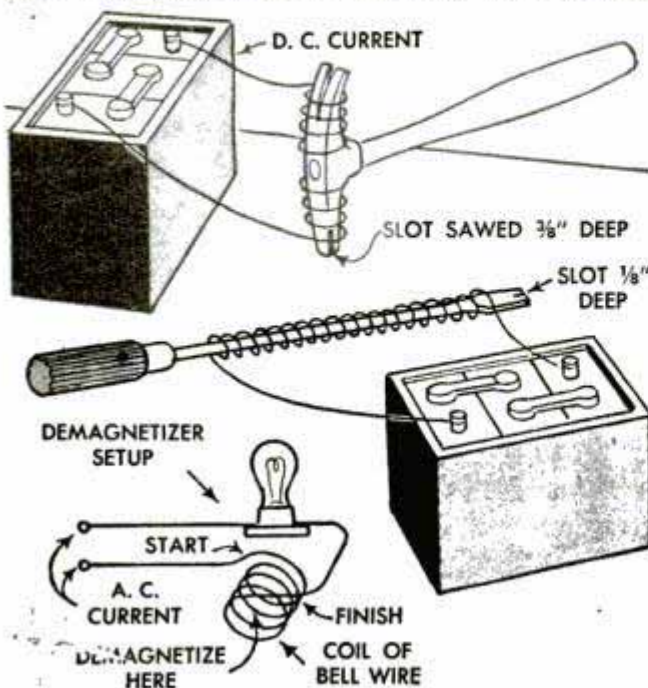
Sickle Section Bolted to Handle Forms Handy Bundle Cutter



A useful tool for cutting grain-bundle bands is made by bolting a section from a power sickle to a slotted wooden handle. The latter can be cut from a broomstick or tool handle. A leather thong or piece of rope looped through a hole drilled in the end of the handle will permit carrying the tool on the wrist.

Tools Permanently Magnetized With Battery and Wire

If you have a screwdriver, tack hammer or other tool that you wish to magnetize, this may be done easily with a storage battery and a length of heavy-gauge, flexible wire. First, slot the face of the tool with a hacksaw to provide two poles, similar to those on a horseshoe magnet. Then, form

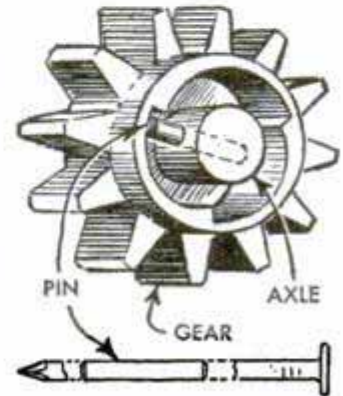


the wire into a coil of about 10 turns and fasten each end to a storage-battery post. Insert the tool through the coil, allowing it to remain there approximately 10 min. Rub it lightly on a piece of iron or steel during this period. To make a demagnetizer, take a coil of bell wire and connect it in series with a lamp bulb on a.c. current. Pass the tool through this coil several times, testing it for magnetism each time until the tool is completely demagnetized.

Phillip Wilson, Streator, Ill.

Repairing Lawn-Mower Gears

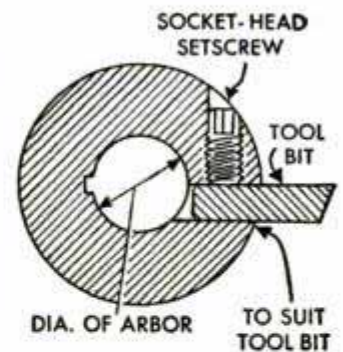
Some lawn-mower drives are fitted with round pawls, and when the pawls and ratchets become unduly worn, the drive will slip or engage and release intermittently. This may be corrected by inserting new pins made from pieces of nail.



These should be about $\frac{1}{16}$ in. longer than the old pins and the edges should be chamfered slightly instead of rounded, so the pins will not slip over the ratchet teeth. These pins will remain serviceable for about one season and they will not cause additional wear on the gears. You may have to file the pins lightly and check several times before you obtain the proper length.—C. Siegrist, Rexmont, Pa.

Collar Prevents Chattering Of Boring Bit

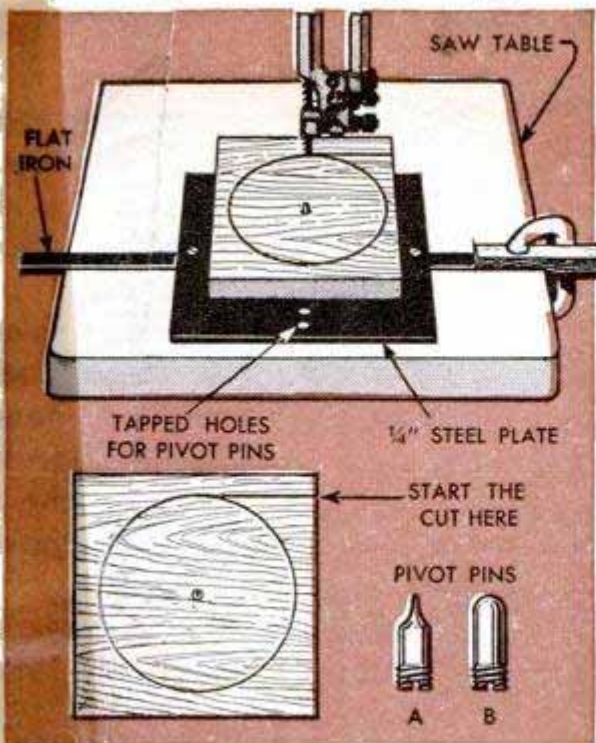
Excessive chattering of a milling-machine fly cutter is reduced considerably if the tool bit is supported and locked in a keyed collar instead of being mounted directly on the arbor itself, as is the common practice.



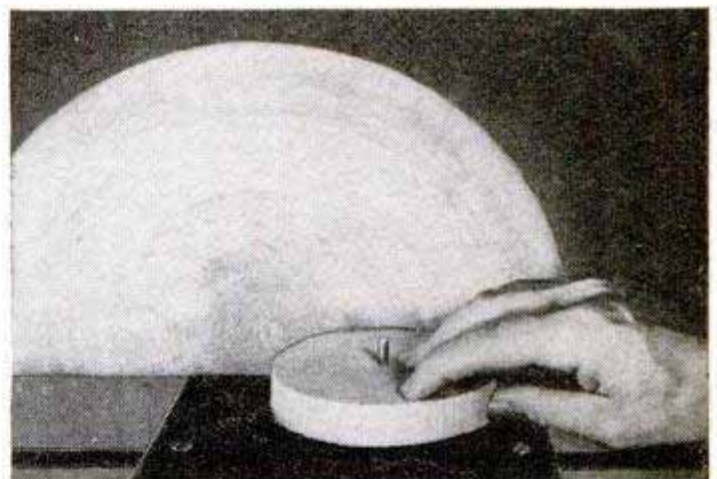
A square hole is made in the edge of the collar to take the tool bit. The bit is locked in place with a socket-head setscrew which is fitted in a tapped hole drilled at right angles to the square hole. The square hole is located so that the face of the tool bit is on the center line of the collar and therefore does not change the outline of the cutting edge. The hole for the tool bit is made by filing a round hole square.

M. R. Therien, Barriefield, Ont., Can.

Circle-Cutting Jig Slides in Saw-Table

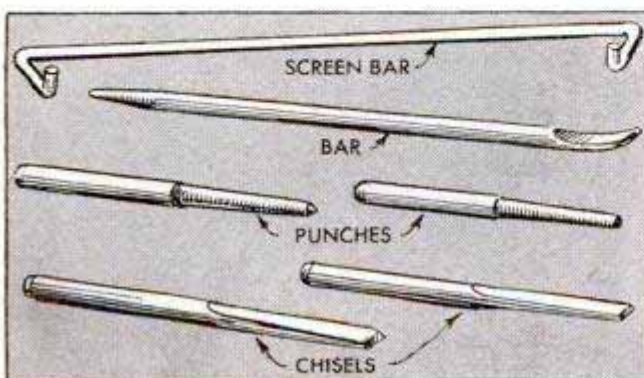


Cutting out wooden disks on a band-saw or accurately finishing them on a sander becomes a quick, accurate operation when this sliding pivot jig is used. It consists of a steel base fastened to a length of flat iron, the latter sliding snugly in the miter-gauge groove of the saw or disk-sander table. A row of holes spaced to handle a variety of disk sizes is drilled and tapped across the base, as shown, to take threaded pivot pins, A and B. Pin A is for stock in which a hole has not been drilled, and B is for drilled stock. A stop is clamped in the end of the table groove to align the pivot pin correctly at a 90-deg. angle with the cutting edge of the saw blade. The sliding feature allows the jig to be pulled away from the saw blade or sanding disk for mounting and removing the work. For use on the band-saw, the work is mounted and the jig is pushed forward, permitting the saw to take a straight cut into the wood. Then, when the stop is reached, the work is rotated on the pivot and the disk sawed. The jig op-



erates similarly on the sander and is readily moved to any position, thus avoiding loading of the sandpaper at any one point. If the bandsaw or sander table does not have a miter-gauge groove, the jig may still be used by attaching a guide strip to its base so that it overhangs and rides against the edge of the table. A stop can be clamped to the table top.

John P. Arnold, Doylestown, Pa.



Bars From Potato-Grading Unit Used to Make Hand Tools

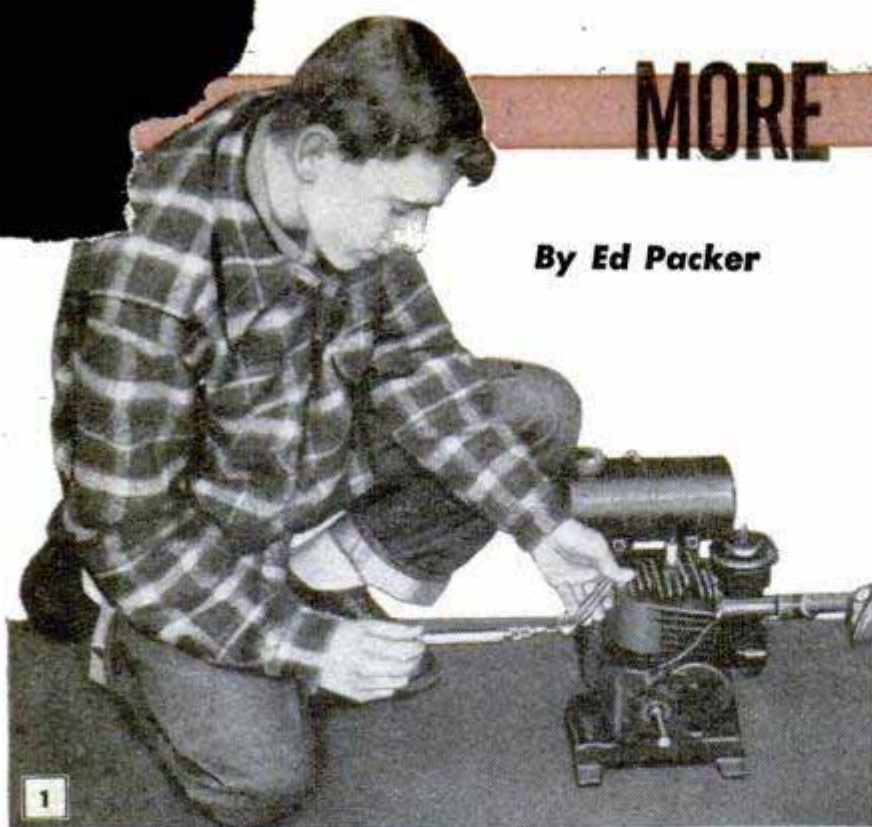
Round, spring-steel bars of the type used on potato-grading equipment, provide excellent material from which to make a variety of small tools needed around the farm or shop. The bars usually have a diameter of $\frac{1}{2}$ or $\frac{5}{8}$ in., and being of high-carbon steel they are exceptionally suitable for pry bars, chisels, punches and similar tools.

Earl R. Goddard, Denver, Colo.

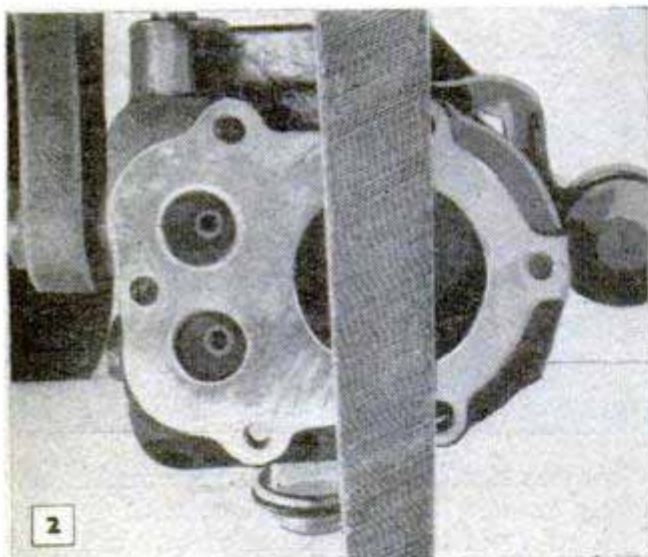
MORE POWER FOR

By Ed Packer

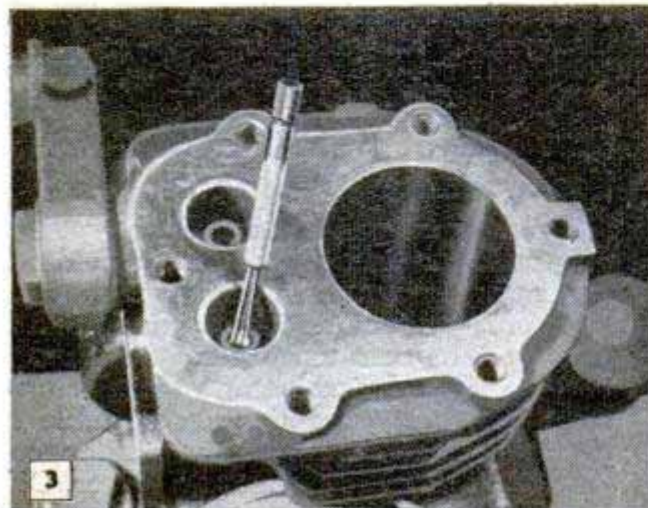
New power applications prove the adaptability of small one-cylinder engines for use on almost any type of small power-driven machine. These uses emphasize the need for careful attention to a special service schedule that will keep these engines operating at top efficiency over a long period of time



If a torque wrench is not available, use a socket wrench and spring scale to tighten cylinder-head bolts



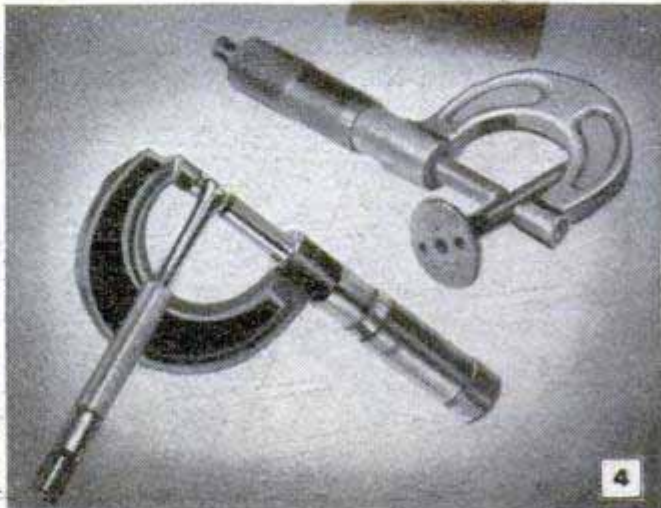
Distorted areas, due to head bolts drawn too tightly, can be located by passing a file lightly over the head flange. Careful filing removes the high places



SINGLE-CYLINDER engines of the air-cooled type are designed to operate at relatively high speeds and this means that all working parts, especially the piston rings and valves, must function perfectly at very high temperatures over long periods of time. Special care and servicing on a regular schedule are necessary to keep the engine in condition to deliver top performance. Most of this simple servicing can be done by the owner.

More power and smoother operation often result from cleaning out the carbon. These engines have small parts and care must be taken when dismantling and re-assembling not to cause permanent damage. Use a torque wrench when tightening cylinder-head and crankcase bolts to assure uniform tension. Another method, used where a torque wrench is not avail-

Lower left, check valve guides for clearance with an expanding ball gauge. Below, measure valve stem and gauge with a "mike" to get the actual clearance



"ONE LUNGER" ENGINES

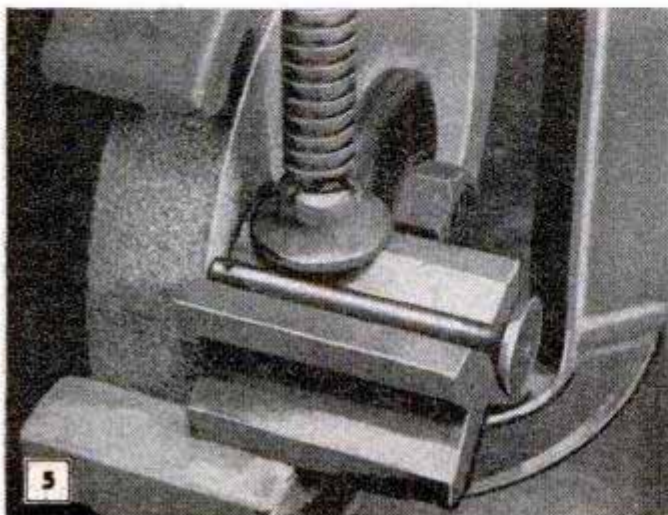


able, is illustrated in Fig. 1. Here the mechanic is drawing each bolt down to the same tension by means of a common socket wrench and a spring scale, which is pulled at exactly right angles to the wrench. The manufacturer's recommended torque should be followed.

Fig. 2 shows a simple way of checking the top of a cylinder block for distortion. Pressing down at the center of contact as the file is moved lightly across the top of the block, reveals the high spots. Such distortions can seriously affect the operation of the valves, causing compression leaks and rapid wear of the valve stems and guides. When reassembling the head to the cylinder block, always use a new gasket and be especially careful to draw the head bolts to a uniform tension. If the engine manual gives the order in which the bolts are to be tightened, it's important that this be followed.

It's a good idea to keep a record of the engine compression. When available, use a compression gauge like that shown in Fig. 6. Two things happen to engine compression in the course of normal use. As carbon accumulates, compression builds up and the engine begins to run hot and knock under load. When there has been a 10-lb. rise in the compression, it usually is wise to clean out the carbon. Following this rise in compression there may be an actual drop in pressure as carbon interferes with the normal action of the valves and rings. Usually this indicates the necessity of servicing the valves. In connection with valve servicing, here's a trick that is worth knowing. Before the engine

As many small engines do not have adjustable tappets, the ends of the valve stems are ground to give correct clearance. Use a V-block as shown below



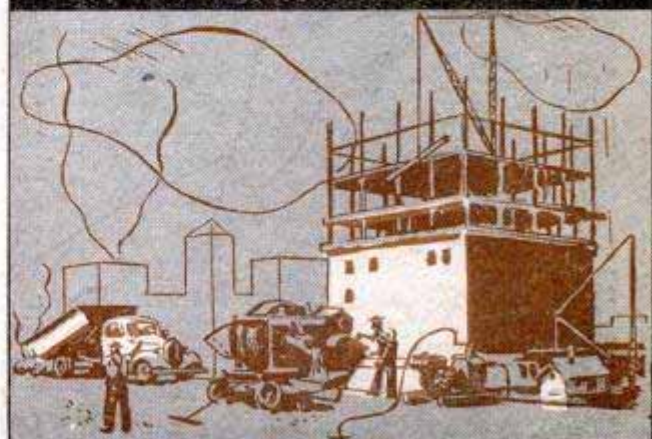
FOR MOTOR SCOOTERS



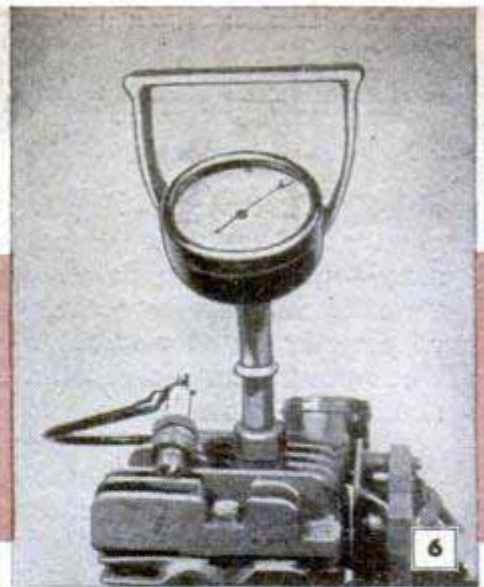
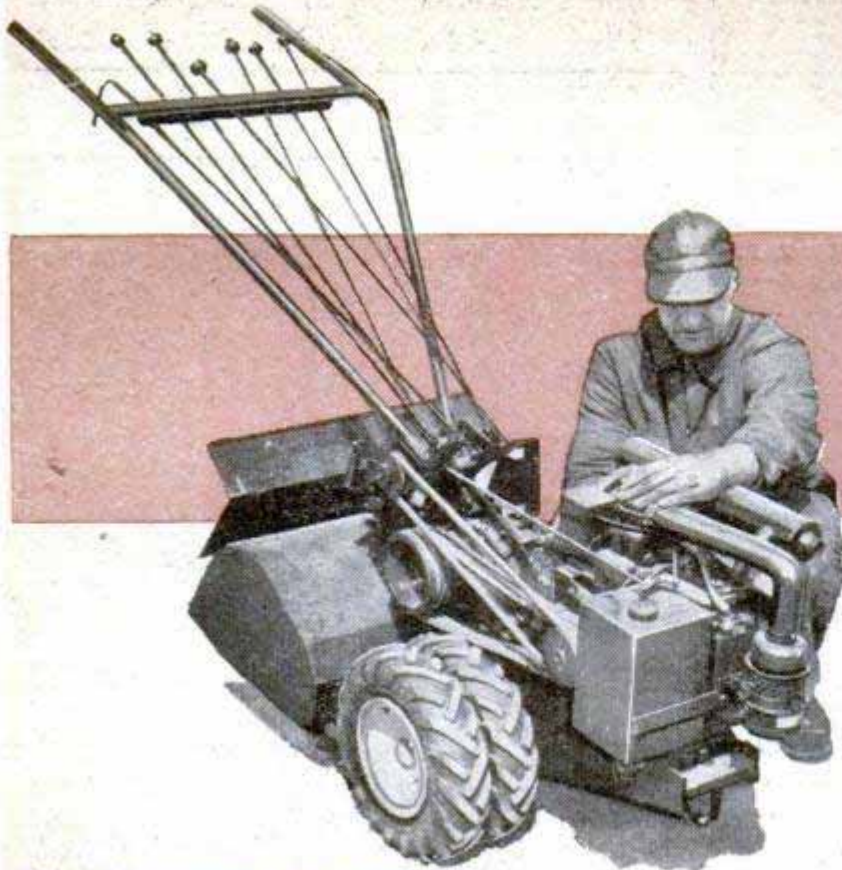
GARDEN TRACTORS



FARM LIGHT PLANTS

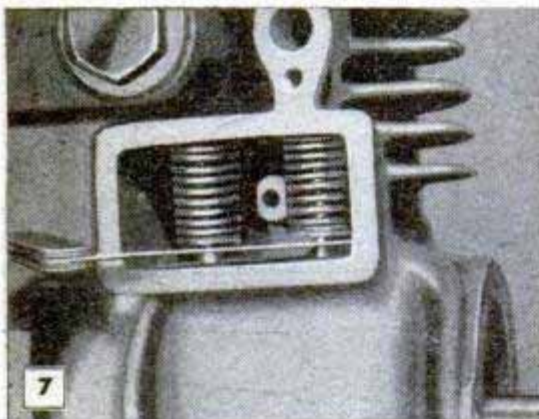


AND CONTRACTORS' TOOLS

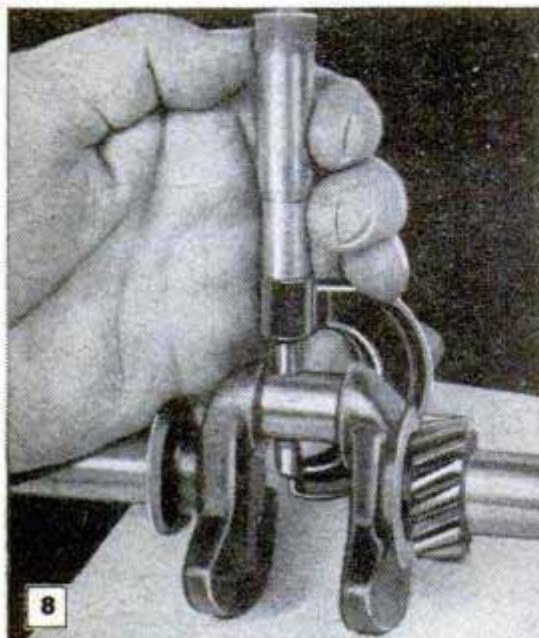


Before disassembling an engine, check compression with a dial gauge such as shown above. It gives a true reading

Engines operating in dusty conditions, such as on garden tractor at the left, usually need more frequent attention



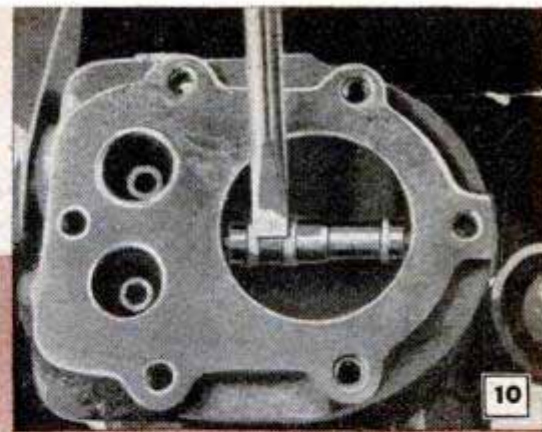
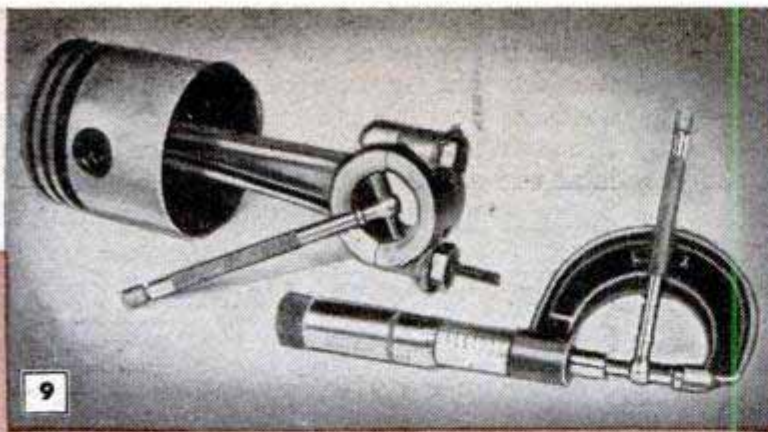
Above, check and double check valve clearances with a feeler gauge. Below, whenever engine is disassembled measure the crankpin



is opened, allow it to idle on closed throttle for a minimum of 5 min. Then, shut it off without accelerating. As the engine is disassembled, the intake valve should be closely inspected for signs of oiliness. This condition indicates a need for new valve guides. Unless one has the necessary equipment for this work, the engine should be taken to a qualified mechanic. One of the tools needed for a valve job of this nature is a precision expanding ball gauge of the type shown in Fig. 3. This instrument accurately checks the inside diameter of each valve guide, giving readings in thousandths of an inch, Fig. 4. By comparing this reading with the valve-stem diameter, also being checked in Fig. 4, the actual clearance is easily determined. In reaming new guides, follow the manufacturer's service manual.

Valve clearance, that is, clearance between the stem and tappet, controls timing of the valves. Too little clearance will cause the valves to burn and pit. In most "one lugger" engines there is no adjustment on the tappets so the valve stem must be ground to give the correct clearance specified in the service manual. To do this, clamp a V-block to the grinder tool rest, as in Fig. 5, for facing off the end of the stem. Most service manuals on the small engines call for an exhaust-valve clearance of .007 to .009 in. with the intake valve set for .005 to .007-in. clearance. Keep in mind that refacing valves or reseating always reduces valve clearance. Always double check when measuring clearances, Fig. 7, to be sure that the piston is on top dead center of the compression stroke.

After the valves have been serviced, it may be found that the engine still lacks power. This can mean a scored cylinder wall or badly worn rings.

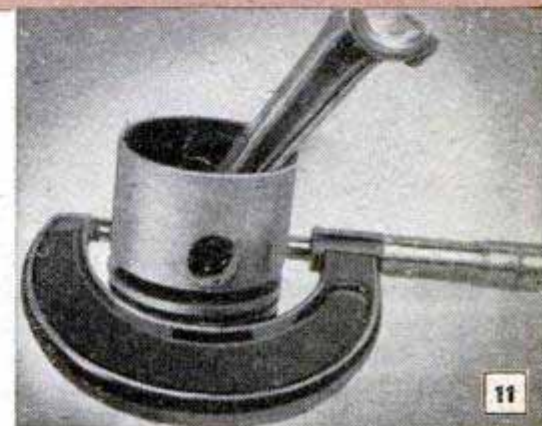


Left, use a telescoping gauge to determine the exact inside measurement of the connecting-rod bearing. Then mike the gauge to get the true diameter. Right, check diameter of cylinder bore at top and bottom

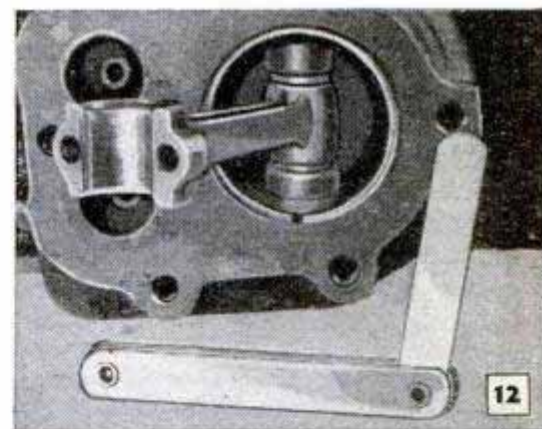
If the engine is disassembled for the purpose of installing new rings or other parts, check the crankpin and connecting-rod bearing. If the micrometer, Fig. 8, shows an out-of-round or tapered condition of the pin up to .001 in. the shaft is still serviceable. But if the wear is greater than this, it may be necessary to machine the pin and install an oversize connecting-rod bearing. When reassembling the engine, see that the connecting-rod bearing is not set up too tight. One way of checking this bearing is to use the telescoping gauge, as in Fig. 9, and then measure the gauge with a micrometer. The clearance should not be less than .0005 in. The crankshaft bearings, if of the plain-bearing type, should have similar clearances.

Checking the cylinder bore with an inside micrometer, as in Fig. 10, is always desirable, but a fairly good check of cylinder conditions can be had by running the piston up and down in the cylinder, trying feeler blades between the cylinder and the piston skirt. The measurement is always made between the skirt of the piston and the lower half of the cylinder wall. Clearances ranging to .0045 in. are generally satisfactory on small engines of the air-cooled type. When measuring the diameter of a new or used piston, the measurement always should be made at right angles to the wrist pin, as in Fig. 11. Some pistons are cam ground to allow for extra expansion of metal at the center.

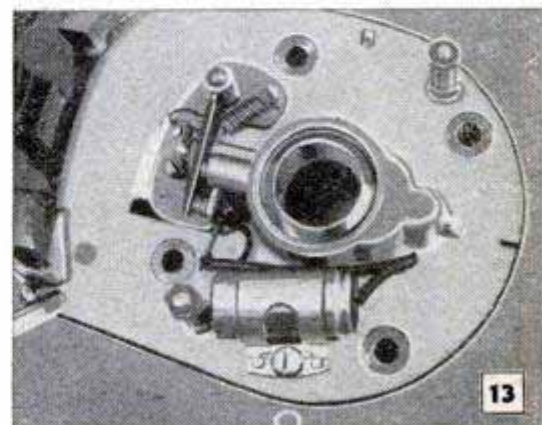
When installing new rings, first roll them around the ring grooves to be sure that they are free. This play should not exceed .002 in. Now slide the piston, without the rings, upside down into the cylinder bore. To test the rings for end gap, place them, one at a time, on top of the piston skirt, as in Fig. 12. Tap each ring lightly with the piston from below to be sure that the ring stands square with the bore. The ring gap for these small engines should range between .007 and .017 in. As the rings are checked for end gap, they should be laid out carefully in order that the ring with the greatest gap goes in the top ring groove, and the ring with the least gap goes in the lowest ring groove. When reassembling these parts, oil liberally. Before reassembling the magneto, check the breaker-plate assembly, Fig. 13, and be sure that the condenser-mounting screw is tight.



When checking piston diameter, always place the mike at right angles to the wrist pin

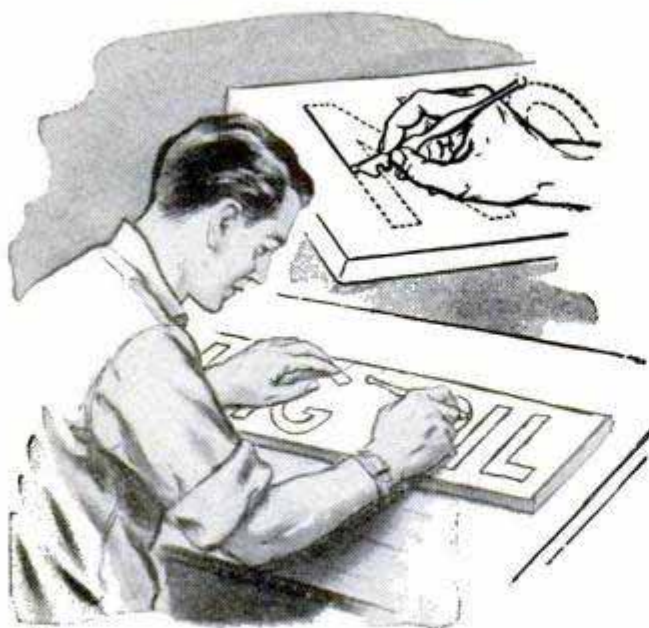


To check the end gap of rings, place them in the cylinder on top of the piston skirt



Renew worn parts of the distributor and be sure the condenser connections are tight

Outlining Letters With Glass Cutter Aids Amateur Sign Painter



The amateur sign painter can do a quick, neat job of lettering a wooden sign if he first outlines the letters with a glass cutter. The V-shaped groove made by the cutter keeps the paint from flowing onto the background of the sign.

G. E. Hendrickson, Argyle, Wis.

Marker for Lathe Threading Chart Reduces Possibility of Error

Accurate reading of a lathe threading chart is simplified by use of a sheet-metal marker. When setting up the lathe the marker is moved to the proper position on the chart, and, if left in place, the threads or carriage feed to which the lathe is set can be noted at a glance. The guide is formed by bending the ends of a 1/2-in.-



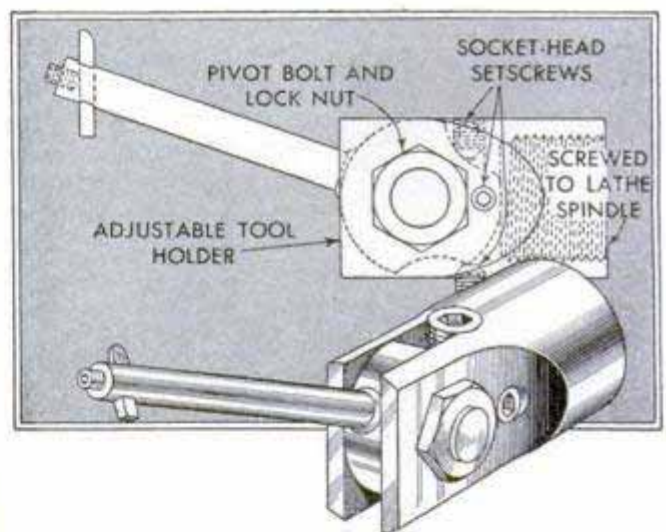
wide strip of sheet metal so that they clip under the edges of the threading chart. The marker will operate best if the bends are made to permit a slight clearance between the strip and chart face so the only contact is at the edges and back of the chart.

Henry Hanscom, Elmhurst, Ill.

Removing Broken Head Bolts From Engine Block

Sometimes cylinder-head stud bolts break in the engine block just above the threads. Every mechanic knows how nearly impossible it is to remove these with the ordinary tools, but one man devised the following method that does the job without removal of the head. With the head tightly in place, he selects a twist drill that is an exact fit in the bolt hole, and with it drills a shallow hole in the center of the broken bolt. Then, he uses a 1/4-in. twist drill to drill a hole completely through the bolt stub, leaving little more than the threads to be cleaned. This he does with a standard tap of the proper size.

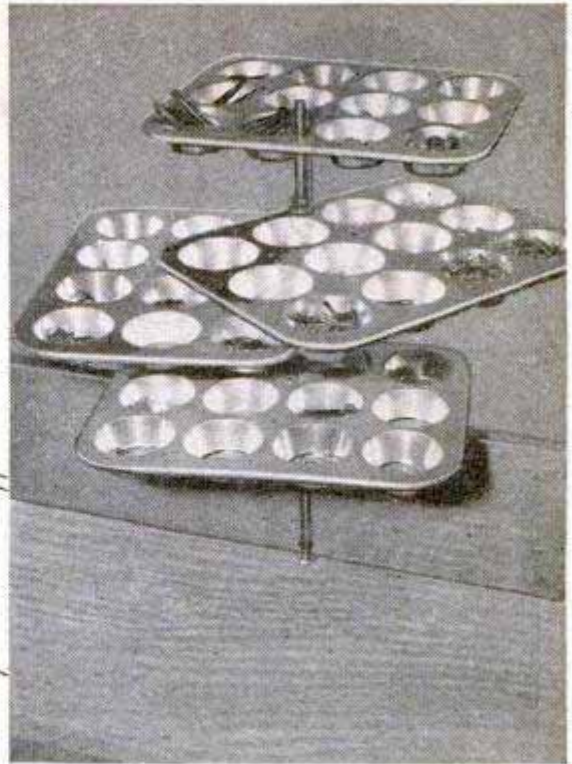
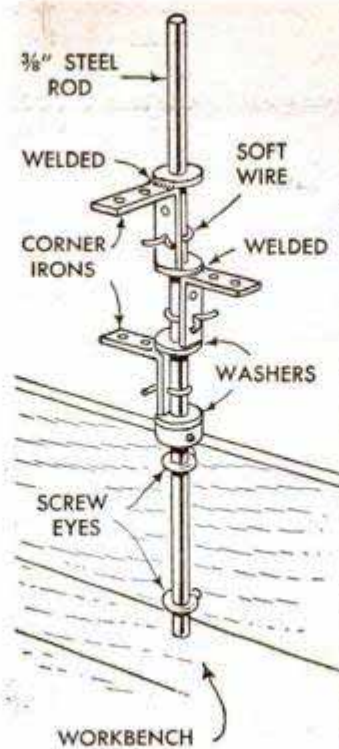
Stub Boring Bar Fits Lathe Spindle



Designed for boring and facing operations on work which is too large to swing between centers, this unusual boring tool is screwed onto the threaded lathe spindle and operated eccentrically, in a manner similar to a fly cutter. The tool-bit holder pivots and is adjusted for swing by means of two socket-head setscrews, while a third setscrew serves to hold the bar in position until the locknut on the pivot bolt is tightened securely. The locking setscrew should be a wringing fit to overcome the tendency to loosen by vibration. With the work remaining stationary and the tool rotating, the size and shape of the work determine the manner of mounting it, whether it be on an angle plate or the saddle of the compound rest.—George Holman, Marissa, Ill.

Muffin-Pan Rack Keeps Small Parts Handy

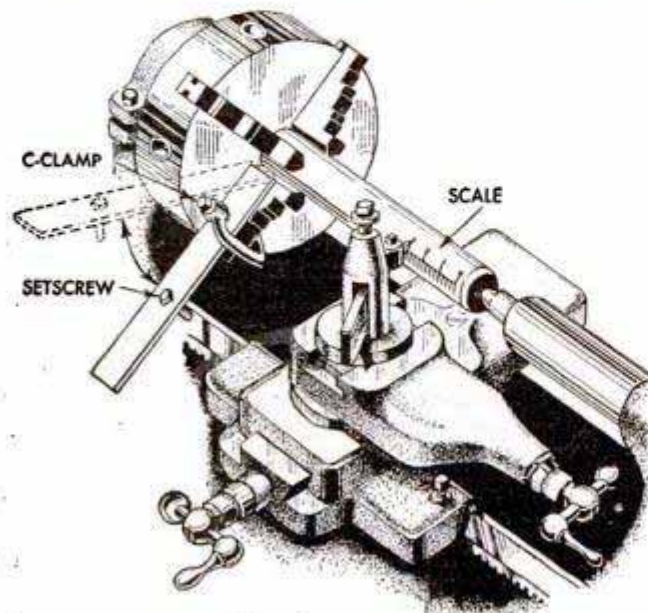
Muffin pans furnish the many separate compartments of a single-post small-parts rack. Mounted on a rod at the back of the workbench, the pans can be swung out of the way when not in use and pulled quickly over the bench for easy selection of a particular part. The rod is inserted through screw eyes turned into the bench back and is held in place by means of a collar. Each muffin pan is bolted to a corner bracket which, in turn, is welded to a washer. Then, the brackets are fastened to the rod with short lengths of soft wire. —Wilbur E. Baur, Leonia, N. J.



Lathe Pinch-Hits for Special Machine When Marking Calibrations

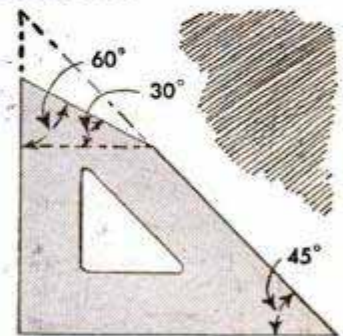
An occasional job of calibrating cylindrical work can be done neatly and uniformly, right in the lathe, by using a threading tool bit in the compound rest and a depth stop clamped to the lathe chuck. A thread-cutting stop on the cross slide also is helpful in setting the tool to a uniform depth for each cut. With the compound rest set parallel with the work, a base line is scribed on the work by advancing the cross slide. Next, a stop, consisting of a length of flat iron tapped at one end for a long setscrew, is attached to one of the jaws of the chuck with a C-clamp. Note before scribing the base line that this

jaw of the chuck must be positioned to give the desired amount of swing. Adjustment of the setscrew in the stop determines the length, or depth, of the calibrations. To scribe the calibrations, the scale on the collar of the compound rest is set at zero. Then, with the stop set for the short lines, the tool bit is advanced to enter the base line and the stop is pressed downward until the setscrew touches the lathe bed. After each cut, the tool is withdrawn and the compound rest is turned to the next calibration. The procedure then is repeated for as many calibrations as required. To make the long lines, the setscrew is backed out and scribing is done as before.

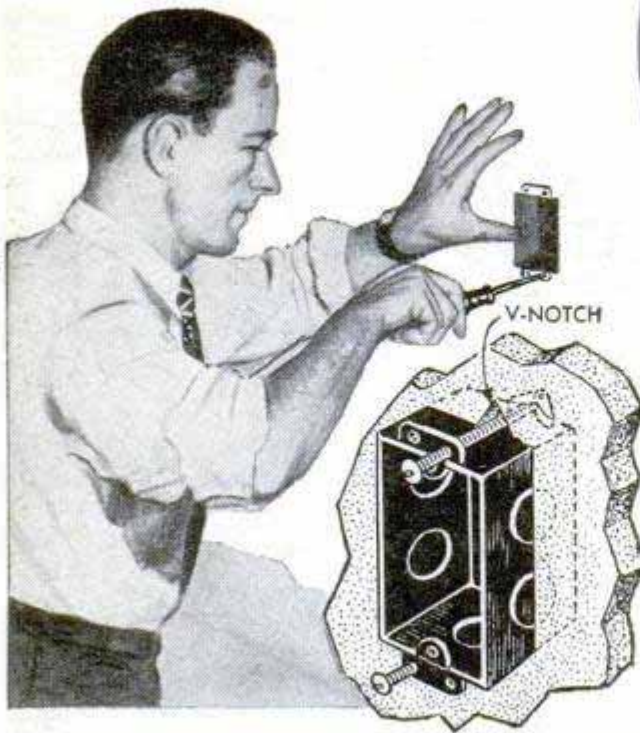


Modifying 45-Deg. Triangle Increases Its Usefulness

Cutting a 45-deg. triangle as shown in the drawing increases its range to include angles of 15, 30, 60 and 75 deg. These, of course, are obtained by placing the triangle in various positions against the T-square. To modify the triangle, mark off the 30-deg. line and cut slightly above the line. Then carefully finish to the line with a fine file.



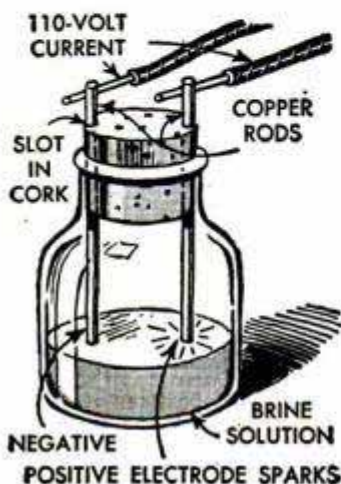
Toggle Bolts Anchor Outlet Box In Soft Wallboard



One man solved the problem of installing electrical outlet boxes in walls paneled with soft wallboard by anchoring the boxes with small toggle bolts instead of wood screws, which, of course, couldn't be made to hold firmly in wallboard. The openings for the boxes were cut slightly oversize and then V-notched at the top and bottom to take the toggle part of the bolt. The notches were aligned with holes in the mounting brackets and then both box and bolts were slipped into the opening at the same time, thus getting the toggle in position to grip the wallboard at the rear when the bolts were tightened. The notches will be covered by the outlet surface plate.

Polarity Tester for Electric Current

Many times it is necessary to know the polarity of an electrical circuit, but a tester for this purpose not only is quite expensive but also may not be available. A simple tester can be made from two small copper rods and a glass jar that measures 2 to 3 in. across the top. Select a cork that will fit the jar and slot opposite sides of the cork to take the copper rods. Then dissolve 1½ teaspoonfuls of table salt in a cup of water and pour into the jar. Ad-

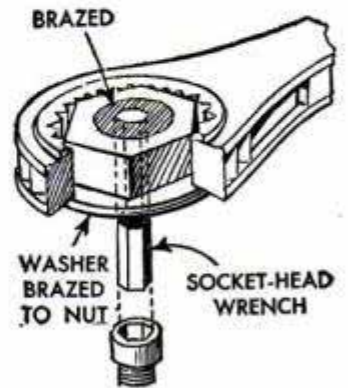


just the rods so they just touch the liquid, and hold the bared ends of the wires in the circuit to be tested against the projecting ends of the rods. The rod that sparks at the surface of the liquid is the positive side of the circuit. The other rod, of course, is the negative side.

Herbert E. Fey, New Braunfels, Tex.

Socket-Head Wrenches Adapted To Ratchet End Wrench

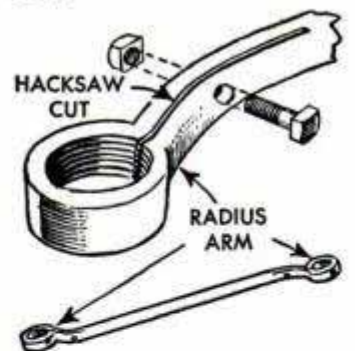
To speed the driving of socket-head setscrews and bolts, I made up a set of wrenches in the following manner that could be used in a ratchet-type end wrench. First, I selected several regular hexagon nuts of a size to fit the ratchet wrench.



Then I cut off short lengths of each size socket-head wrench and brazed a length in the center of each nut. To provide a collar or shoulder so that the ratchet wrench would not slip down over the nut in use and hinder its operation, I brazed a washer to the bottom of each nut as shown. Thus, I was able to use the wrench rapidly by merely working the handle back and forth.—Howard Care, Lakewood, Ohio.

Radius Arms Kept Tight On Knee-Action Car

After experiencing considerable difficulty in keeping the radius arms tight on his knee-action car, one man altered the arms as shown. All he did was remove the arms from the car and slot them from the thread holes along the arm for a distance of approximately 2 in., using a regular hacksaw fitted with two blades for this purpose. Then, he drilled a hole through the arm near the center of the slot to take a small bolt. When the arms had a tendency to loosen up, all that was necessary was to tighten the bolt, thus partially closing the slot and, in turn, reducing the diameter of the threaded opening at the end of the arm. This treatment apparently did not weaken the arm and made it possible to keep it tight.



Carl J. Fritz, McKeesport, Pa.

Do Not Remove

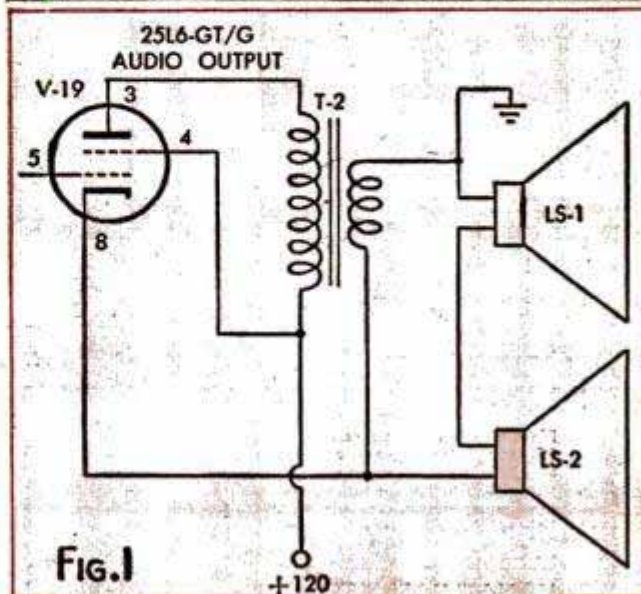
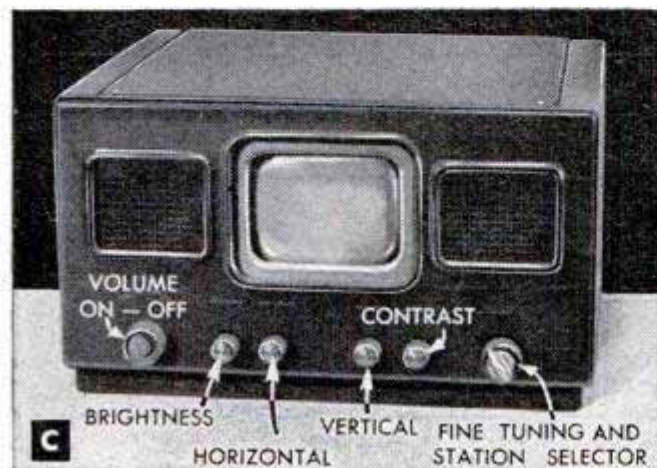
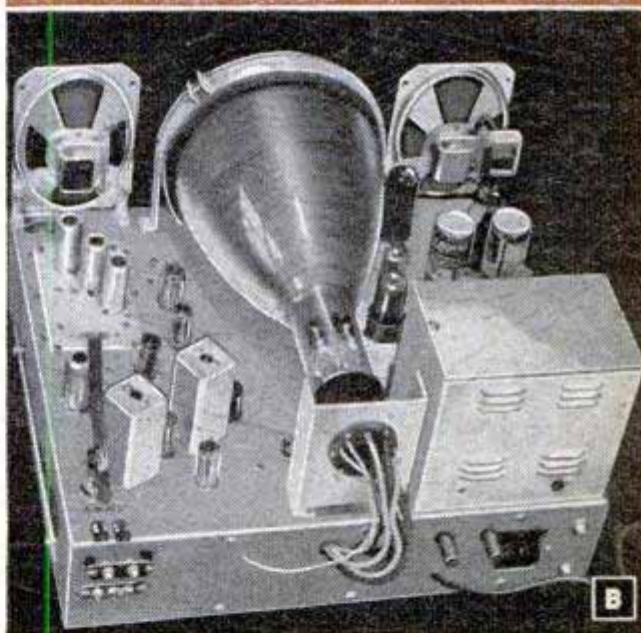
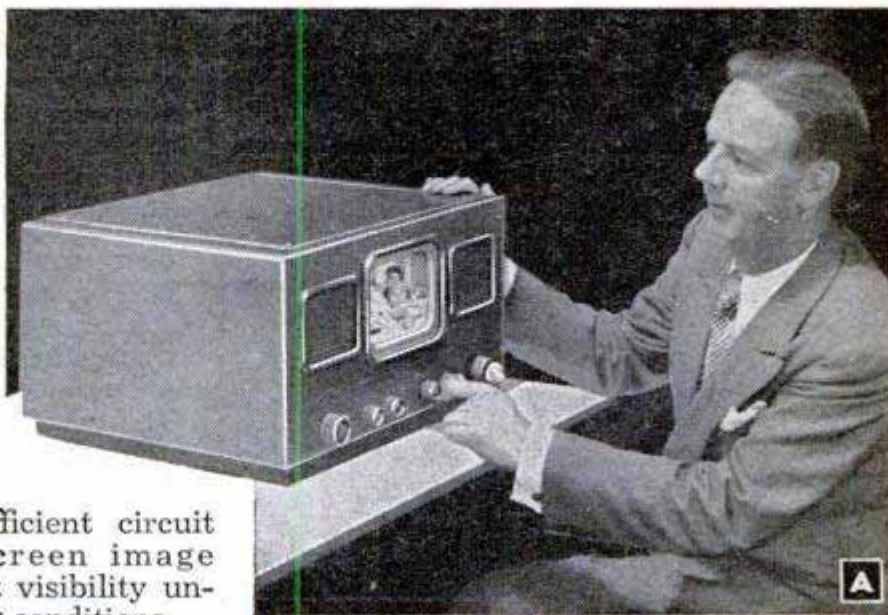


DUAL-SPEAKER TV SET

USING two 6-in. oval loudspeakers to reproduce the FM sound in a realistic manner with more than ample volume, this 22-tube television receiver includes a 7-in. picture tube. It tunes all 13 television channels by means of 8 front-panel controls. An unusually efficient circuit provides a well-defined screen image bright enough for excellent visibility under all normal room-lighting conditions.

Housed in a neat metal cabinet that provides shielding not to be found in the usual wooden cabinet, this National TV receiver is claimed to give excellent, interference-free pictures in difficult receiving locations. It is also available in wooden cabinets of advanced styling, if the extra shielding is not required. Although in the low-priced group, the engineering is of the high-quality, low-loss type which is just as necessary in a good television set as in a high-grade, communications-type short-wave receiver.

Photos A and C show this receiver housed in a soft-toned, gray-finished metal cabinet. All front-panel operating controls are identified in photo C. The top rear view of the chassis, photo B, shows all tubes and the dual speakers in position; these speakers are connected in the circuit as indicated in Fig. 1. Other nonoperating controls are located at the rear and on the bottom of the receiver chassis.



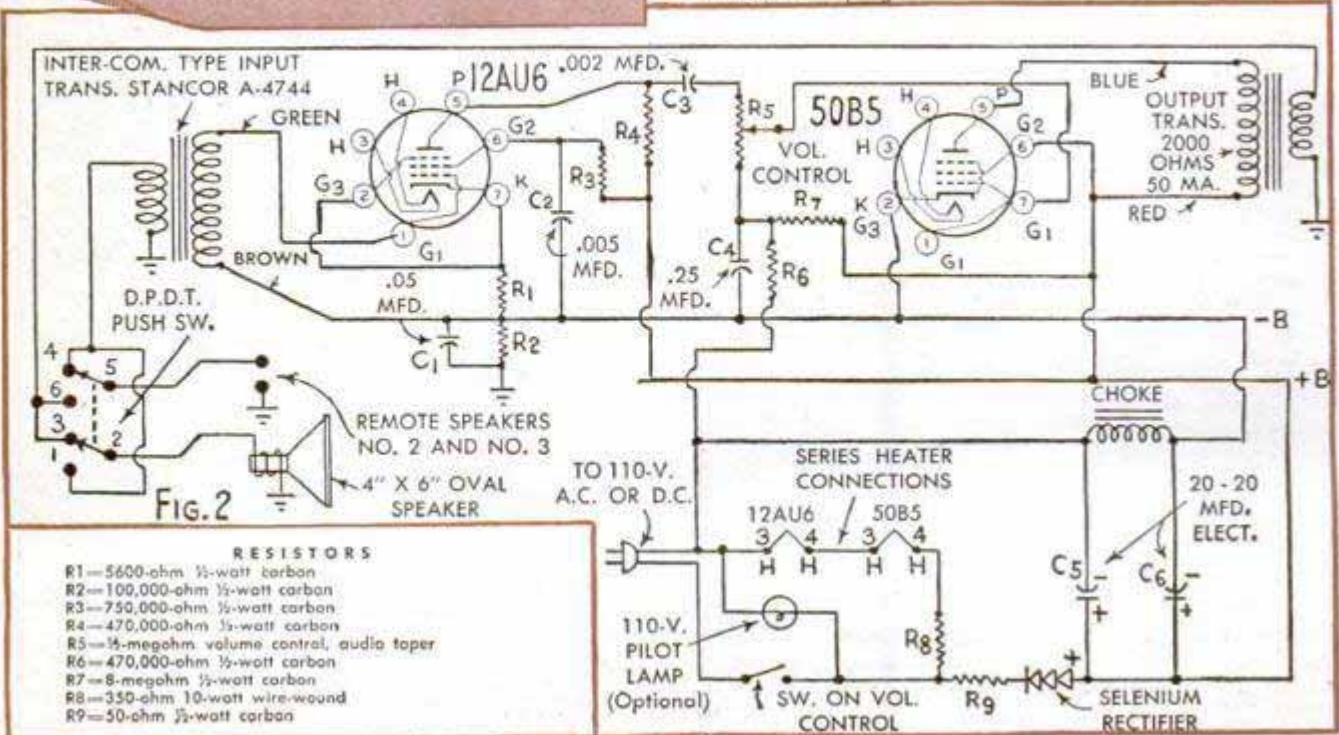
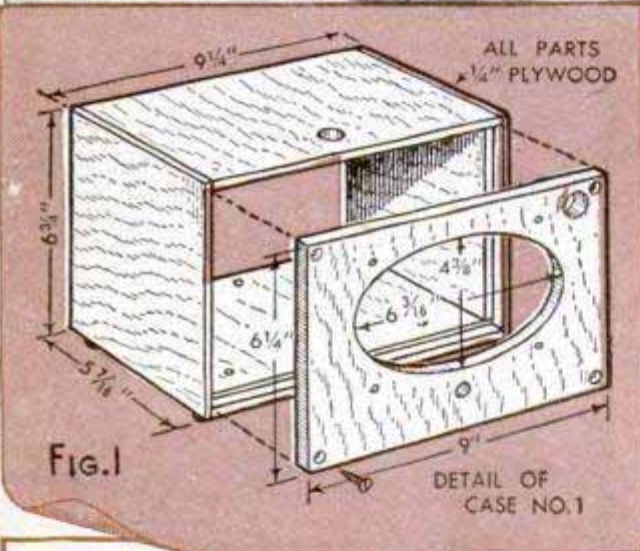
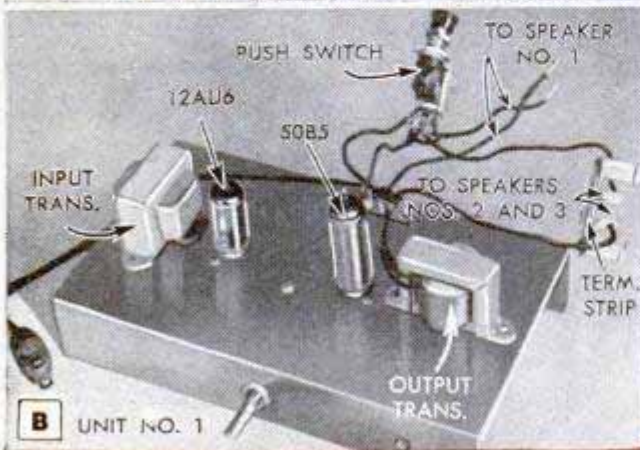
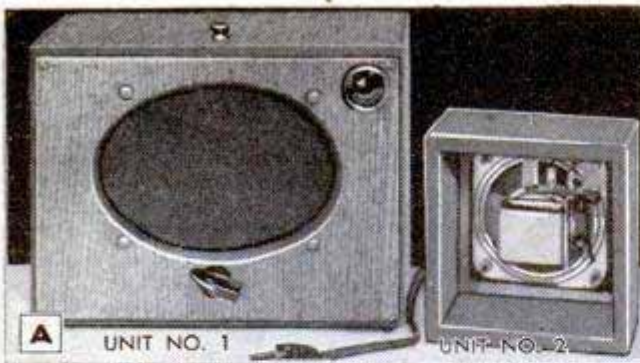
LOW-COST PHONE SYSTEM

By L. M. Dezettel—W9SFW

ONLY TWO miniature tubes are employed in this simple and inexpensive intercommunication system that provides 2-way phone service between master station and other rooms, garage or workshop. It may also be used as an electronic nurse by locating one of the remote speaker units in the nursery and the master station in the living room. The baby's cry or other sounds will be picked up, amplified and reproduced at the master station.

The system consists essentially of a high-gain amplifier and 2 speakers that are connected with the master-station unit. The circuit is so arranged that one speaker is used as a microphone. A switching circuit switches the order of use. When the push button on the master station is in the "listen" or up position, the speaker at each remote station is connected to the input of the amplifier, and the speaker of the master station to the output. Thus a person can talk into the speaker at the remote point, and he will be heard in the speaker at the master unit. When the switch is pressed, as indicated in photo D, to the "talk" or down position, the speaker at the master unit, No. 1, connects to the input of the amplifier, and the speaker at the substation to the output. The person operating the master station then talks and is heard at the remote point.

The circuit, Fig. 2, fea-

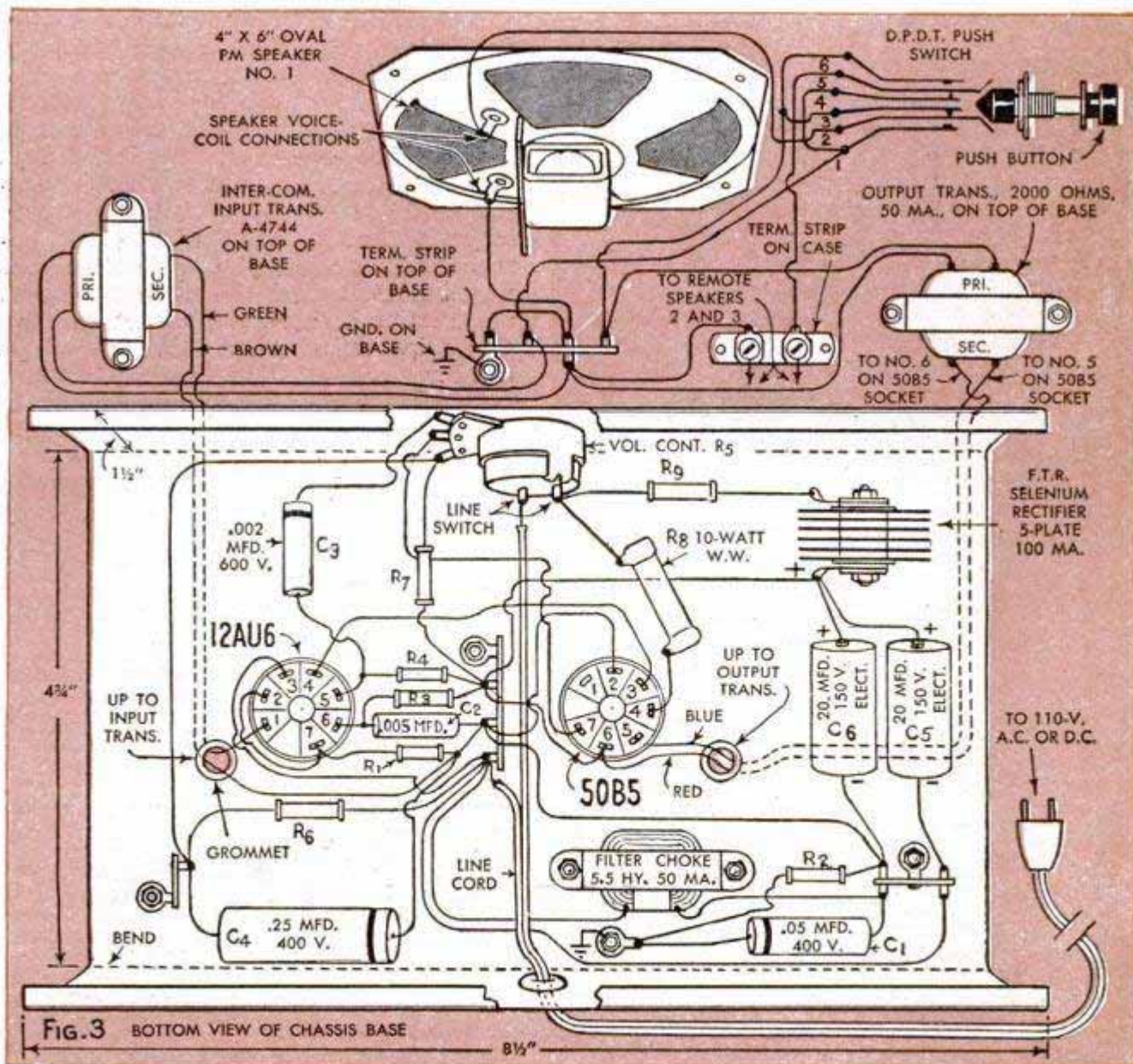


ALSO SERVES AS AN ELECTRONIC NURSE

tures a long-life selenium rectifier, a 12-AU6 tube as a voltage amplifier and a 50B5 beam-power amplifier with its high-power sensitivity. The unusual circuit with the choke in the negative-B side of the filter is to supply the steady fixed bias to the 50B5 tube and is used with the 8-meg. resistor from positive-B to furnish the proper bias voltage. This is a distinct advantage over the customary cathode-bias arrangement where the signal causes changes of the bias.

Construction should start with the chassis base of unit No. 1. Mount the tube sockets in the positions shown in the pictorial wiring diagram, Fig. 3; then mount the input and output transformers, the filter choke and selenium rectifier, and finally, all tie-point strips and soldering lugs. Wire one circuit at a time. For example, using rosin-core wire solder, wire all tube

(Continued to page 234)



Improving Television Reception In Fringe Areas

By Perry Graffam

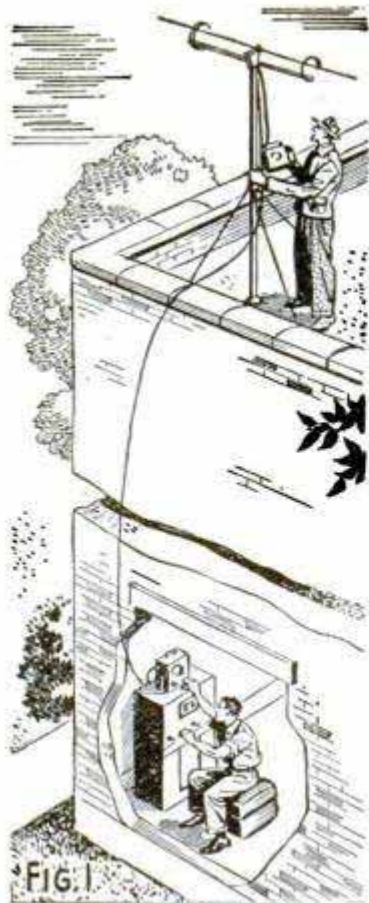
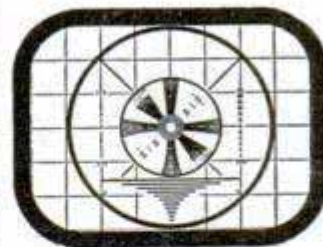
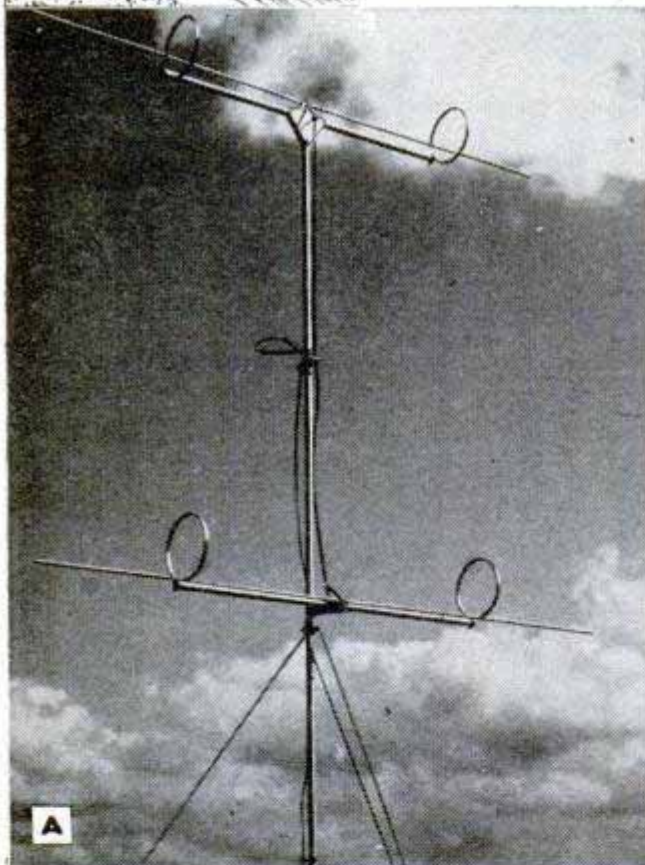


FIG. 1

TELEVISION signals travel in straight lines and do not follow the curvature of the earth's surface as do standard and short-wave signals. For good television reception a receiver must then be in the line of sight of the broadcasting station. Thus, a transmitter on a high building, well above surrounding buildings, and with no hills or mountains intervening, will reach out to distant points and can be received provided that the receiving-antenna installation is properly designed.

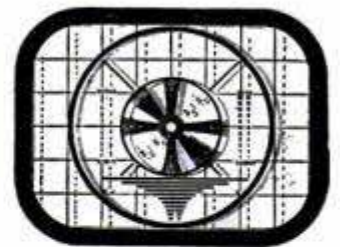
A single-section antenna of the type illustrated in Fig. 1 is all that is necessary in the average city installation. It is an all-wave Tricraft type that is claimed to cover both low and high television bands and also FM bands, and is designed so that an additional section, photo A, may be added at any time to increase the pickup of the antenna. The additional section comes in kit form and may be added for country or fringe-area installations where signals are weaker. The second section is installed at an added height which improves the signal strength and reduces noise and multiple images.

Service engineers, in making the primary installation illustrated in Fig. 1, are using an intercommunication system developed by the Raytheon-Belmont Corporation. The operator on the roof orients the directive antenna for best pattern results as reported by his co-worker stationed at the receiver. This is an important procedure, especially where multiple reflected images appear in the pattern as indicated in Figs. 3 and 4. For long-range reception an additional two-section array may be installed in the same plane as the first section. Theoretically, each additional array increases the signal strength and distance covered if no obstructions intervene, as shown in Fig. 2; these signals are, of course, stronger near the transmitter.



Correctly Adjusted

The pattern is clear-cut and steady. There is proper contrast between black, white and the various shades of gray.



Multiple Images (Ghosts)

Due to signals reflected from tall buildings, mountains, etc. Can be minimized by proper orientation of the antenna.

FIG. 3

FIG. 4

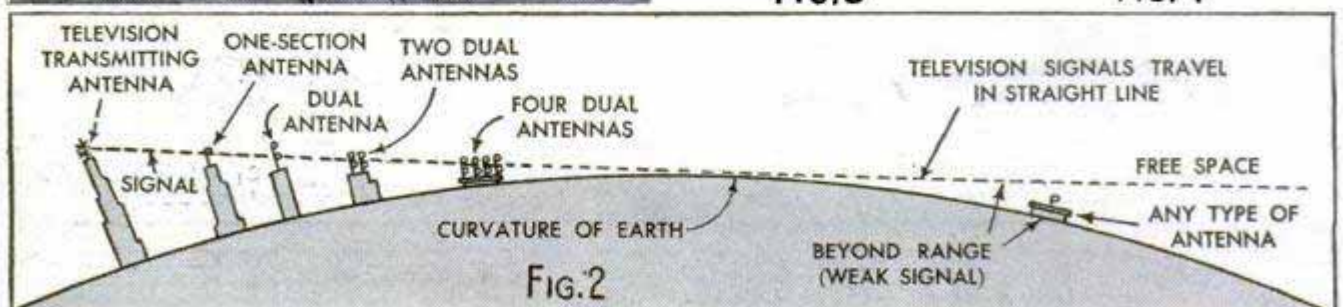


FIG. 2

KODAK REFLEX CAMERA



You won't miss with the big, unusually brilliant ground-glass view finder—you see your picture as you take it.



You catch fast action shots when you convert the focusing hood to open, eye-level frame finder.



You get exciting flash pictures with accessory Kodak Flashholder—shutter has built-in synchronization.



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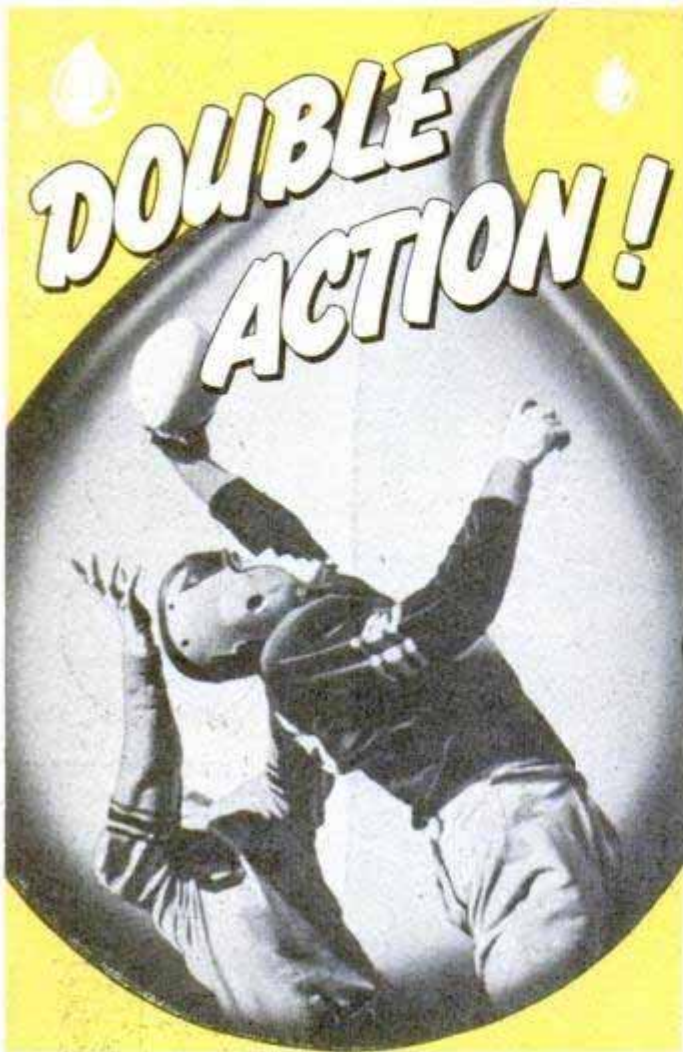
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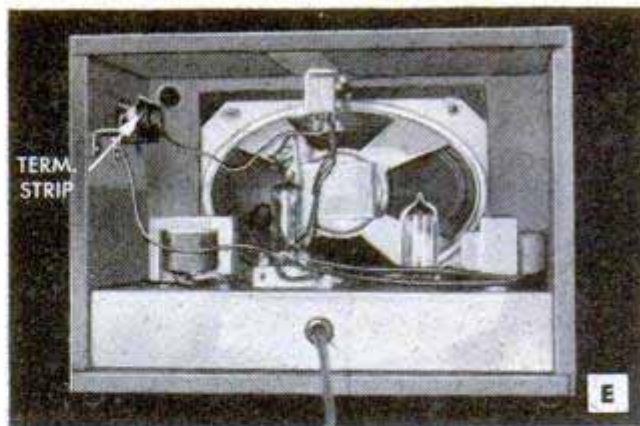


At this sign of better dealers, coast to coast

Tough-film PENNZOIL* gives all engines an extra margin of safety

Low-Cost Phone System

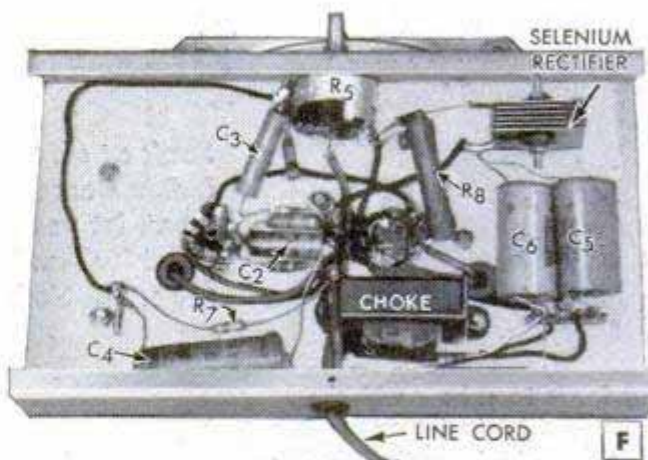
(Continued from page 231)



heater connections which are connected in series as indicated in the schematic circuit diagram, Fig. 2, before going on to the next. It is a good idea to check off each part of the diagram as it is completed. An extra few minutes spent in careful wiring and thorough checking always saves time and later possible trouble shooting.

After the chassis wiring is completed, wire the push switch in its normal position following the numbered terminals as shown in Fig. 3; these correspond to the numbers indicated in Fig. 2. The push-switch is mounted in the top of the cabinet detailed in Fig. 1. The remote-station cabinets are detailed in Fig. 4, and the speakers are mounted as shown by means of rosette-head screws. The speaker opening in each case is backed with brown-flocked, metal grille screen. Photos A, B, C, D and E show views of the completed units.

To test the system, connect one of the remote-station units to the terminal strip mounted inside the master-station cabinet at the point indicated in photo E. The 2-conductor line can be any insulated wire

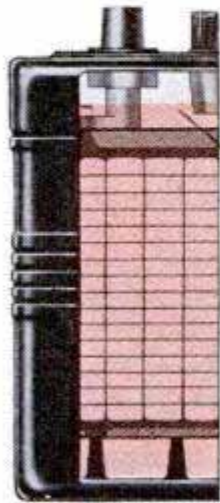


not smaller than No. 18 and lengths up to 500 ft. may be used. Plug in the master set, turn it on and let it warm up a few minutes. Have someone call on a remote

(Continued to page 236)

Here's Why New AUTO-LITE STA-FUL Battery

*...needs water
only 3 times a year**



ORDINARY BATTERY



BOTH BATTERIES FULL



STA-FUL BATTERY

HERE'S WHAT HAPPENS INSIDE AN ORDINARY BATTERY

This battery is now full. Small liquid reserve gives battery plates little protection against damage and loss of power if evaporation lowers liquid level.

HERE'S WHAT HAPPENS INSIDE AUTO-LITE "STA-FUL"

The new "Sta-ful" has more than 3 times the liquid reserve of ordinary batteries. Gives its plates added protection. Battery lasts longer too!

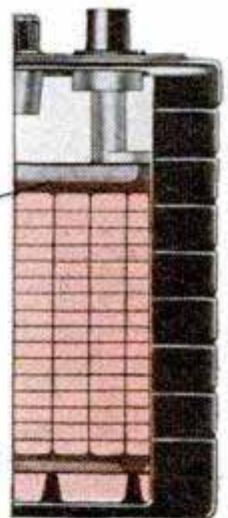


ORDINARY BATTERY



ADVANCED STATE OF EVAPORATION

Equal Liquid Loss From Both Batteries

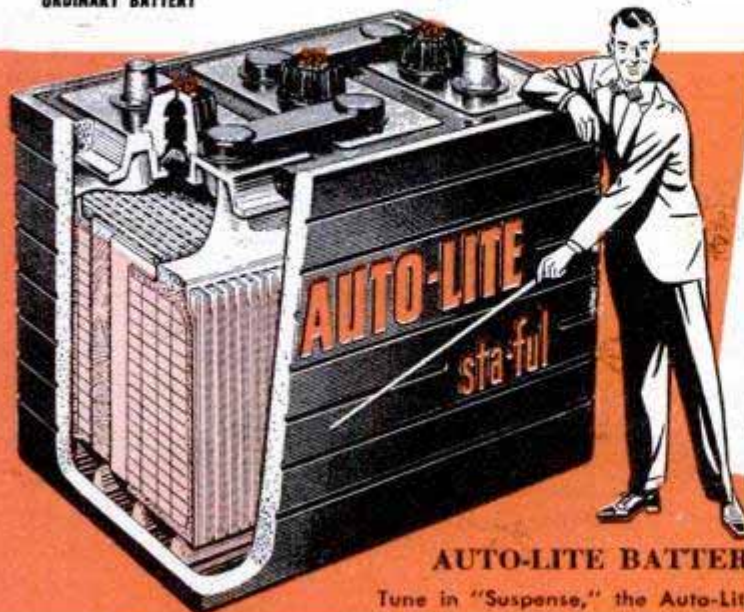


STA-FUL BATTERY

Plates at the left are now exposed and inactive because of the small liquid reserve provided in ORDINARY battery.

The "Sta-ful" Battery plates are still kept fully covered and protected because of the more than 3 times greater liquid reserve.

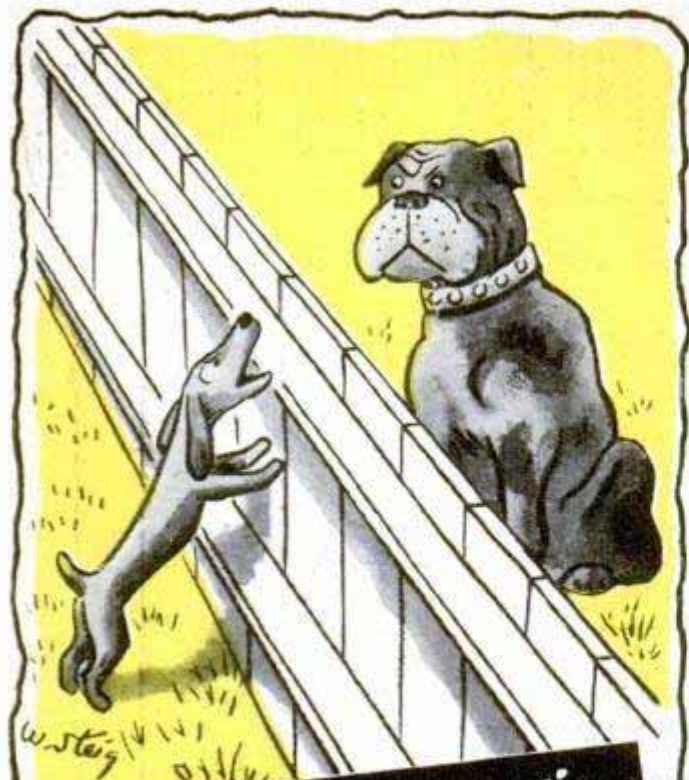
*In normal car use



Why the "Sta-ful" Design Is Possible
Fibre-glass mats help to keep the power-producing material from shedding—add to battery life. This makes possible the "Sta-ful" construction with its smaller sediment well which permits room for a liquid reservoir with over 3 times the usual capacity at the top of the battery. Make your next battery an Auto-Lite "Sta-ful."

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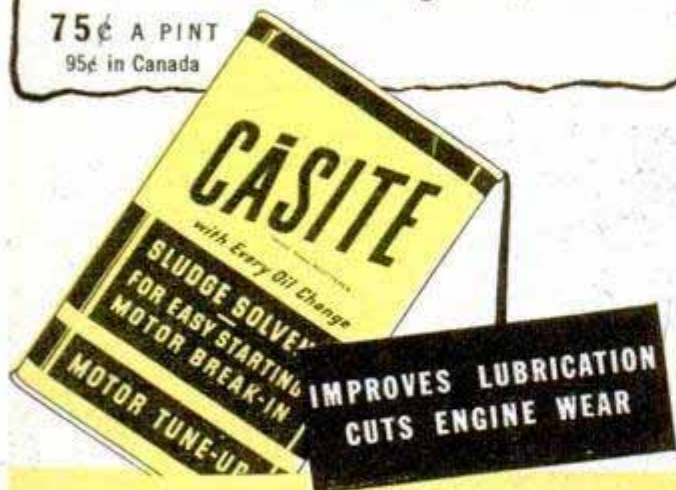
What's Extra Protection Worth to You?



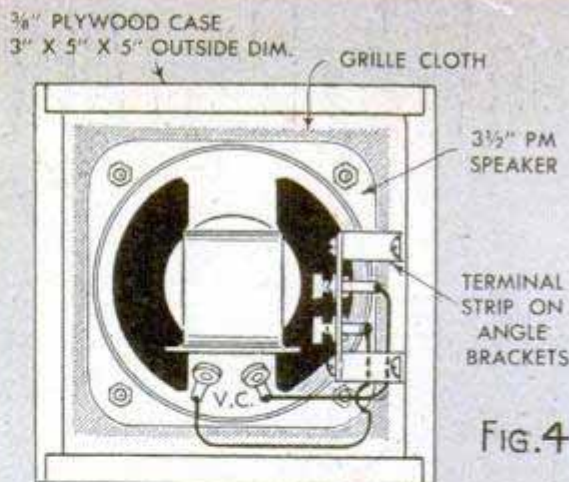
To keep your engine alive and powerful—give it Casite's extra protection.

Casite cuts engine wear and cuts repair bills—because it improves lubrication. No matter what kind of motor oil is being used, Casite helps it get around—quickly and into the tight spots. Casite retards the formation of sludge and gum . . . frees sticking valves and rings . . . cleans motors and keeps them clean. The Casite Corporation, Hastings, Michigan, and the Casite Division, Hastings Ltd., Toronto.

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BETTER AND SMOOTHER PERFORMANCE OR DOUBLE-YOUR-MONEY-BACK



REMOTE SPEAKERS NO. 2 AND NO. 3 (2 REQD.)

station; push the switch and call back. If excessive hum is heard, reverse the position of the line cord in the wall socket. If howling is encountered, it is due to acoustic feedback resulting from the proximity of the 2 stations. Try lowering the volume, or separate the 2 stations as far as possible. Remote-station unit, No. 3, may be connected in parallel at the terminal strip in the master station. Detailed student material list R-371 is available from Popular Mechanics Radio and Electronics department upon the receipt of ordinary letter postage.

Television-Receiver Construction

Students and experimenters not familiar with TV-receiver construction often request plans and articles on the subject and wonder why such articles do not appear in various publications. For a student-type TV receiver suitable for home-workshop construction, specially wired and tested units would have to be available from radio-parts houses. For a 13-channel receiver kit, lock-in sweep oscillators, and completely wired and tested r.f. front-end tuners for both FM and AM would be required as the average experimenter is not equipped with the necessary instruments for assembling and testing such stages.

Although the high voltage used in a television receiver is in the order of from 2000 to 7000 v., it is of the r.f. type at very low amperage. However, elaborate precautions are necessary to prevent the possibility of a dangerous shock. There are several specially engineered commercial television receivers available in kit form. Precautions have been taken to provide safety interlocks and all critical wiring and checking has been completed. Such kits are possible only under specialized manufacturing and laboratory-testing conditions.

Dependable

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America's Favorite Spark Plug

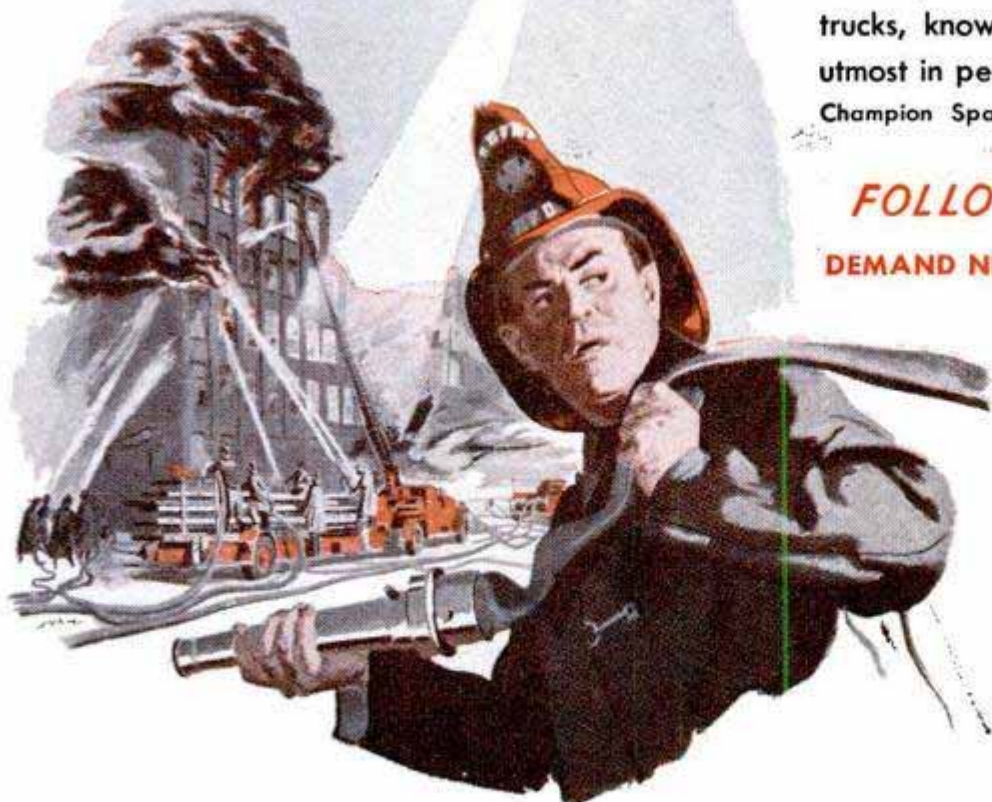


When the fire department is called, fire apparatus must start instantly, accelerate quickly, and reach the scene of action with all possible speed. This requires absolutely dependable spark plugs. That's why leading producers of fire-fighting equipment specify Champion Spark Plugs. They, like other experts such as race drivers and operators of fleets of buses and trucks, know that Champions insure the utmost in performance and dependability. Champion Spark Plug Company, Toledo 1, Ohio

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FOR YOUR CAR



Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

How They Fire the Battleship's Big Guns

(Continued from page 157)

(1) Range, from range finders located in each turret, (2) target bearing, electrically, from a director high in the ship, (3) own ship's course, electrically, from the gyrocompass, (4) own ship's speed, electrically, from the speed indicator, (5) wind, manually, from estimate, (6) target course, manually, from estimate, (7) target speed, manually, from estimate, (8) muzzle velocity loss, due to gun erosion and powder temperature, (9) other non-standard conditions such as air density and parasitic errors, manually, from previous calculations, (10) time, electrically, by constant-speed motor.

Information computed by the range-keepers is supplied instantly to the bridge and fire-control tower. Here is located a super-gunsight that tries precisely to "keep on" the enemy target. Its minutest movements are transmitted to the guns in the turrets. A gyroscopic device regulates firing so that guns always shoot at the same stage of the ship's roll.

The gunnery director tries to straddle the enemy with short and long salvos of two to find the proper mean between them. Radar has stepped up the accuracy of this

initial salvo. He does not usually try to fire a broadside until he is well on his target. Then he presses the master key that may fire up to all nine of the 16-inch rifles in one tremendous thunderclap that shoves the monster 45,000-ton ship sideways in the water.

The next salvo means working out an entirely new gunnery problem. The enemy ship has moved. Your own ship may have veered to dodge a torpedo. Other ships may have fired at the target at approximately the same time, making "spotting" difficult. A lucky enemy hit on your own ship may have knocked out a part of the fire-control system, making it necessary to use auxiliary controls.

A decade ago, when battleships of the fleet went out for gunnery practice, it was customary to lash down everything movable, throw away the wardroom china and sometimes even to jettison the ship's piano lest it be reduced to kindling wood by the shock of firing the big guns.

Such have been the improvements in ship design and the recoil mechanism of big guns that when all nine guns of the USS Missouri were test-fired in a broadside, only a few soap dishes were cracked.

Most of the 16-inch guns of the fleet are

(Continued to page 244)

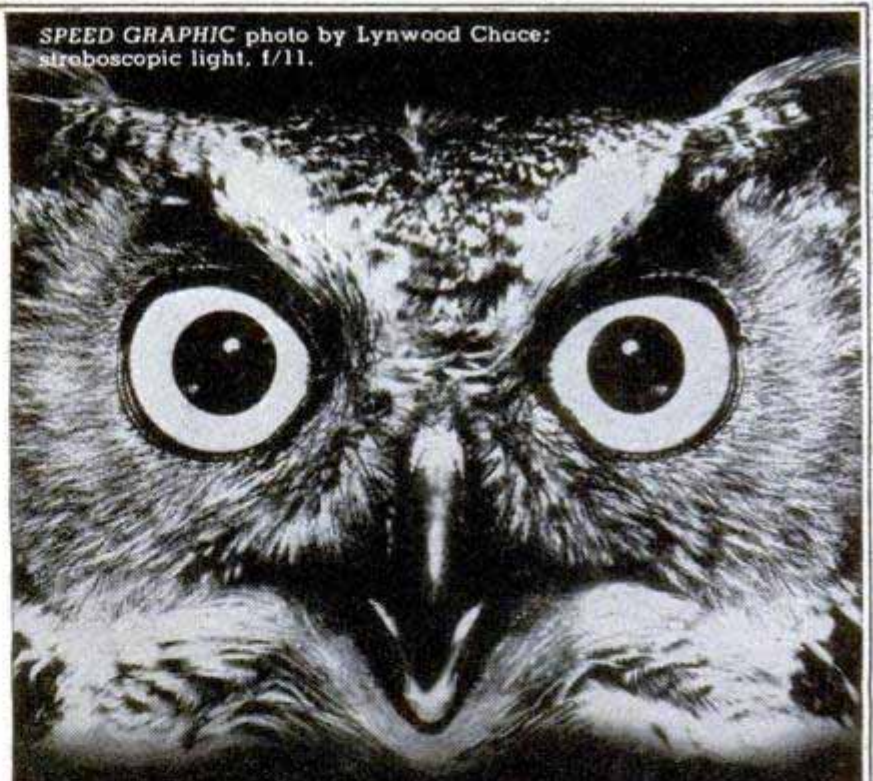
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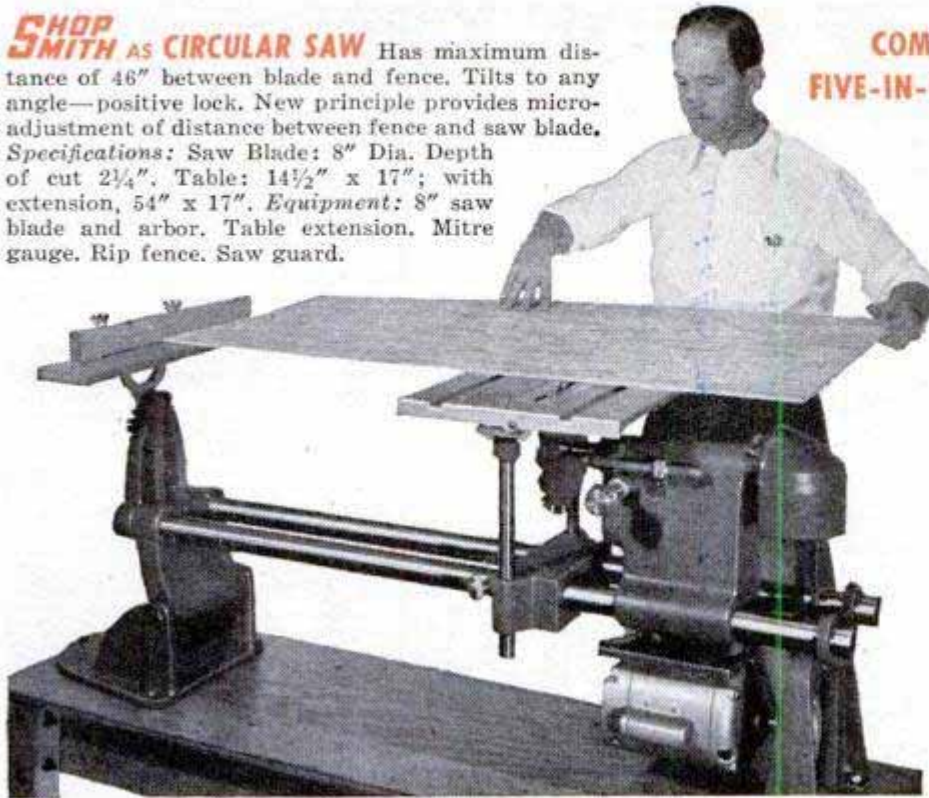
SPEED GRAPHIC photo by Lynwood Chace; stroboscopic light, 1/11.



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SHOP SMITH AS CIRCULAR SAW Has maximum distance of 46" between blade and fence. Tilts to any angle—positive lock. New principle provides micro-adjustment of distance between fence and saw blade. *Specifications:* Saw Blade: 8" Dia. Depth of cut 2 3/4". Table: 14 1/2" x 17"; with extension, 54" x 17". *Equipment:* 8" saw blade and arbor. Table extension. Mitre gauge. Rip fence. Saw guard.



COMPLETE FIVE-IN-ONE TOOL **\$159.50**

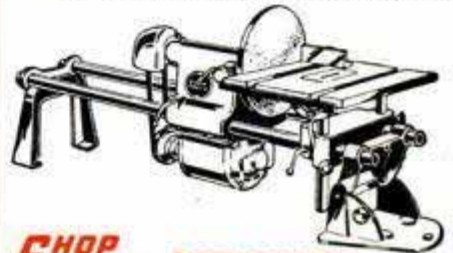
With special 1/2 H.P. ball bearing motor, \$195.50



SHOP SMITH AS VERTICAL DRILL PRESS

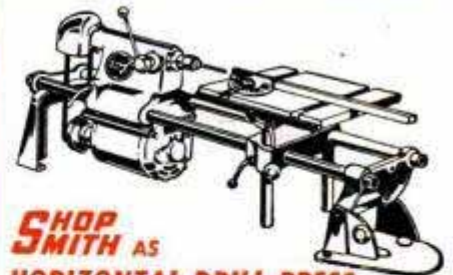
Capacity: Drills to center of 15" circle. Clearance: Table to chuck—27" max. Spindle: 3/8" Dia., 6 spline, hardened tip. Spindle Feed: 4 1/4". 4 grease-sealed

Fafnir ball bearings. Variable speeds. Table: 14 1/2" x 17". *Equipment:* 1/2" Jacobs key chuck. Fence.



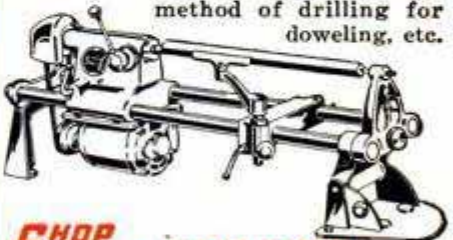
SHOP SMITH AS DISC SANDER

Disc Diameter: 12". Table Dimensions: 14 1/2" x 17". Tilting Table. *Equipment:* 12" disc. Mitre gauge.



SHOP SMITH AS HORIZONTAL DRILL PRESS

Only SHOPSMITH performs this highly useful function. No limit to length of work. Provides accurate method of drilling for doweling, etc.



SHOP SMITH AS WOOD LATHE

34" between centers. Swing: 15". Variable speeds. Quill Feed: 4 1/4". *Equipment:* Tool rest. Drive center. Dead center.

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Has cast iron headstock and carriage. Centerless ground and polished steel ways. Heavily reinforced table. Four life-long grease-sealed Fafnir ball bearings. Weighs over 200 pounds.

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You can build this bookcase for less than half the store cost. New, full-size patterns, step-by-step directions, and assembly illustrations make it easy. Use *Cascamite Resin Glue*, described below, for strong, stainfree joints throughout.

*Trade-Mark © 1948, Easi-Bild Pattern Co.

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For boats, outdoor furniture, sports equipment—joints that must withstand outdoor exposure—*CASCOPHEN* (Resorcin Resin Glue). The first completely durable glue available to home-craftsmen.



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Enclosed is¢ for material checked below
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() 32-page Pattern Book, illustrating 94 projects—20¢

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Crystal Lacquer "Frosts" Windowpane

Q—I have two windows, one in a hall and the other in the bathroom, with clear panes which I would like to coat in some way so that at least the lower panes will admit light but obstruct vision. Thus far I have been unable to obtain "frosted" glass of the kind made for this purpose. Is there any material or coating I can apply to the existing panes to get the desired effect?

M.R.—San Francisco, Calif.

A—A special lacquer is available for this purpose which crystalizes as it dries into irregular frostlike patterns. The sash must be removed so that it can be placed in a horizontal position as the lacquer dries. Although this special lacquer can be applied with an ordinary varnish brush a better job will be had if a spray gun is used. Apply a fairly heavy coating only to the inside surface of the glass and protect the painted or varnished sash frame with masking tape, as most lacquers will soften paint.



Pointing Stonework

Q—The front wall and fireplace chimney of my home are of stone laid with what I suppose is called a beaded mortar joint, or pointing. The joint is about $\frac{5}{8}$ in. wide. In some joints the pointing has chipped and in others it has broken out altogether. What is the formula for making this mortar, or pointing, whichever it is, and can I do this repair job myself? I'd like to try it.
J.B.—Philadelphia, Pa.

A—Ordinarily, laying or pointing ornamental stonework is a highly specialized job calling for special skills. However, if you wish to try the job yourself, first clean the walls and chimney with a stiff-bristle brush and scrape all loose material out of the affected joints. Wash down the chimney and walls with a hose to clear away all loose dust and sand. Then make a white pointing mortar by mixing 1 part white portland cement, 1 part hydrated lime and 6 parts of fine sand with water to the consistency of a fairly heavy paste. Apply this mortar to the joints with a pointing trowel made especially for the purpose. Keep the wall damp but not wet. Some stonemasons smooth the joints lightly before the mortar sets with a clean paint brush dipped in water.

(Continued to page 242)

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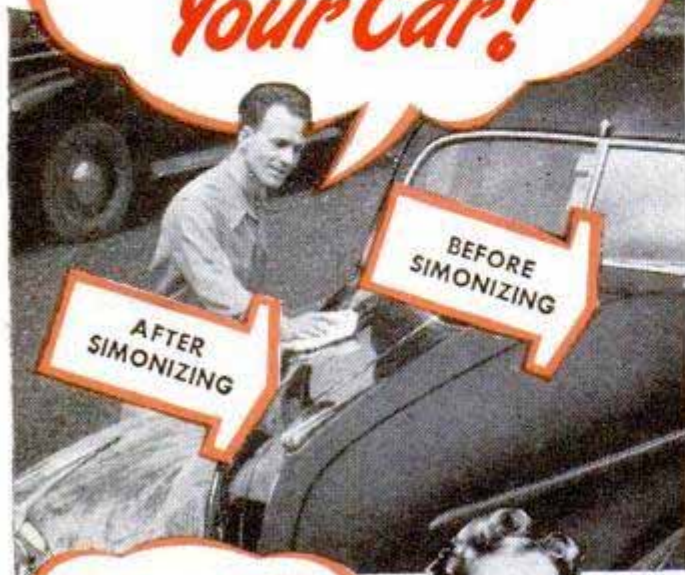
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Refinishing a Porch Sunshade

Q—I have a large porch sunshade made from rough wooden slats and lashed with cord. I would like to refinish this but don't know how to go about it, as it seems impossible to dismantle the shade without damage. Apparently the original finish was a wood-brown stain and this has faded and weathered to the point where the bare wood shows through. I would like to paint it but how can I do it without getting the paint on the cords?

B.A.—Denver, Colo.

A—Don't paint it. Refinish with a stain of the same color as the original. If the shade is used on an open porch where it is exposed to some weathering, a shingle stain will give a good protective coating. Place newspapers on a flat surface and unroll the shade on them. Apply stain with a brush to the slats and cords and be especially careful to get an even, uniform coating. When one side is dry turn the shade over and do the other side.

Refinishing Venetian Blinds

Q—I have wide Venetian blinds with wooden slats which were originally stained and finished a light brown color. As the blinds are quite old the finish along the edges and also on about half the width of the slat nearest the window has worn away, exposing the bare wood. I would like to refinish the slats in the original color. Is there any way I can refinish the worn edges to match and if so what materials should I use?

A.E.—Ft. Worth, Tex.

A—It will be necessary to disassemble the blind and go over all the affected slats lightly with fine sandpaper. Unless the wood is badly discolored you probably can match the original color fairly well by simply dampening a cloth with a light-colored oil stain and rubbing the worn edges. After applying the stain, immediately wipe off any excess with a clean cloth. Continue rubbing with the cloth until the new color matches the old as nearly as possible. After staining and allowing to dry, finish each slat with a clear liquid wax of the self-polishing type.



Wooden Arbor Posts Crack Concrete Anchors

Q—A year or so ago I installed 4 by 4-in. wooden posts to support a grape arbor. I anchored the posts in concrete poured in holes 30 in. deep and about 8 in. in dia. Now each of the concrete anchors is cracked in several places and the posts are loose. I have thought of enlarging the holes and adding more concrete. Would this be a satisfactory repair or will it be necessary to dismantle the arbor and reset the posts to make the structure rigid? **A.R.**—Fort Wayne, Ind.

A—To repair the damage, it would be necessary to remove the posts. Inasmuch as the arbor is already built and dismantling and rebuilding it would require considerable labor and time, try filling the cracks with a thin mix of cement. Then coat the top of each anchor with roofing cement to keep water out of the joint between the post and the concrete.



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manufactured at the Naval Gun Factory, Washington, D. C. Big Navy guns do not consist of a single tube of steel. They are built up, layer on layer, for extra strength and toughness. They also contain a rifled liner. This gives projectiles a spinning motion for greater accuracy—just as a good passer puts a spiral twist on a football.

After a number of rounds of firing, these riflings become worn and accuracy is reduced. The gunnery officer of a ship keeps an accurate record of the firings of each gun. When the liners get too bad, the guns are returned to the Naval Gun Factory for relining. The gun is lowered into a deep, vertical oven which heats it to a cherry-red. The liner then slips out easily and a new one is slipped in. Once the new liner is locked in the barrel, the cooled-down assembly is lifted from the pit and the tedious rifling process is begun. The rifling machine literally shaves grooves out of the hard steel, the adjustable cutters digging a little deeper with each stroke. The inside is chromium plated and yoke and breech mechanism are reinstalled. The gun is finally subjected to tests as if it were brand new.

The long-range future of the Navy's long-range guns is cloudy at present. Some ordnance experts think the 16-inch rifle

has reached the peak of its usefulness. Some predict that battleships will be converted into "missile ships," their broad decks serving as launching platforms for rockets.

But even if it should go the way of wooden ships and sail, the "big mouth-piece" will long remain a symbol of the U. S. Navy—a powerful, seagoing weapon, an engineering marvel, a strong voice for freedom.

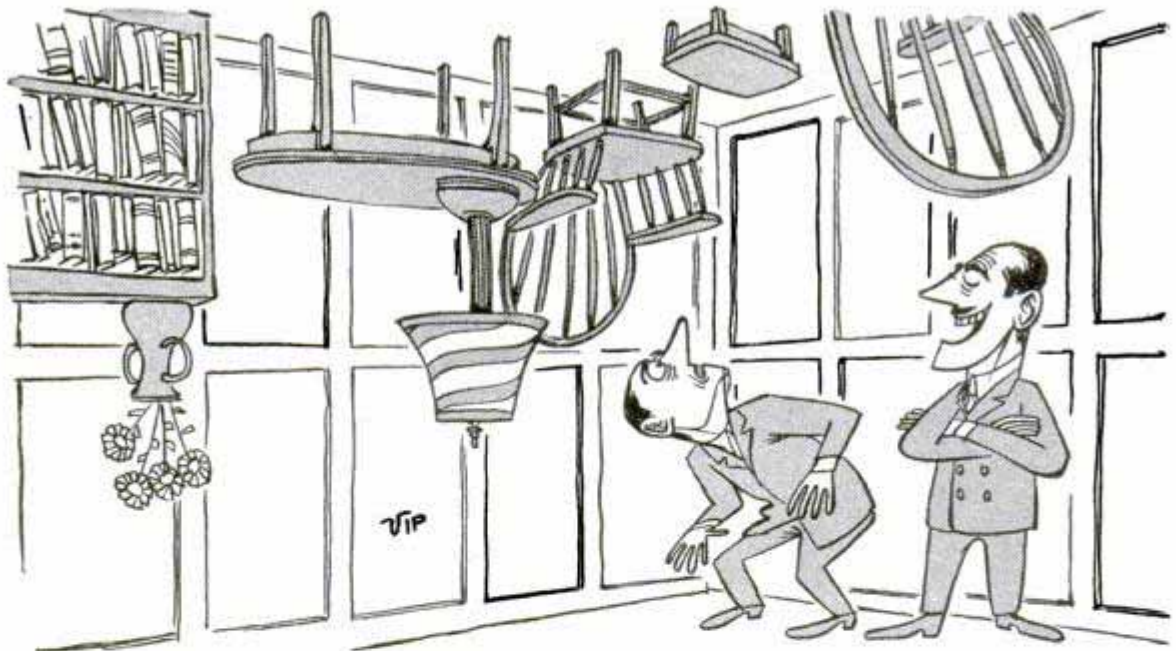
Workshop Wizard on the Stage

(Continued from page 103)

with red fingernails. You merely place the sandwich in the third hand. Then you can drink your coffee in peace—because wagging the thumb operates a Shoosher, enabling you to shoo flies off your sandwich.

There's also the Sure-Strike Bowling Ball. It overcomes two common problems of all bowlers—getting fingers cramped or stuck in the holes, and eliminating low scores. When you give this ball a heave, an automatic clutch operates, enabling you to keep the finger holes in your hand. When the ball slides down the alley and smacks the first pin, automatic extension bars pop out, doubling the width of the ball and really mowin' the pins down.

(Continued to page 246)



"Without Weldwood Glue we wouldn't be able to pull this gag on Jones"

When you want a wood-to-wood bond that will really hold . . . remember Weldwood Glue. It's quick to mix . . . easy to use . . . tremendously strong . . . stain-free . . . rot-proof . . . and permanent. At hardware stores, lumber yards, chain stores, in 15¢, 35¢, 65¢, 95¢ and larger sizes.

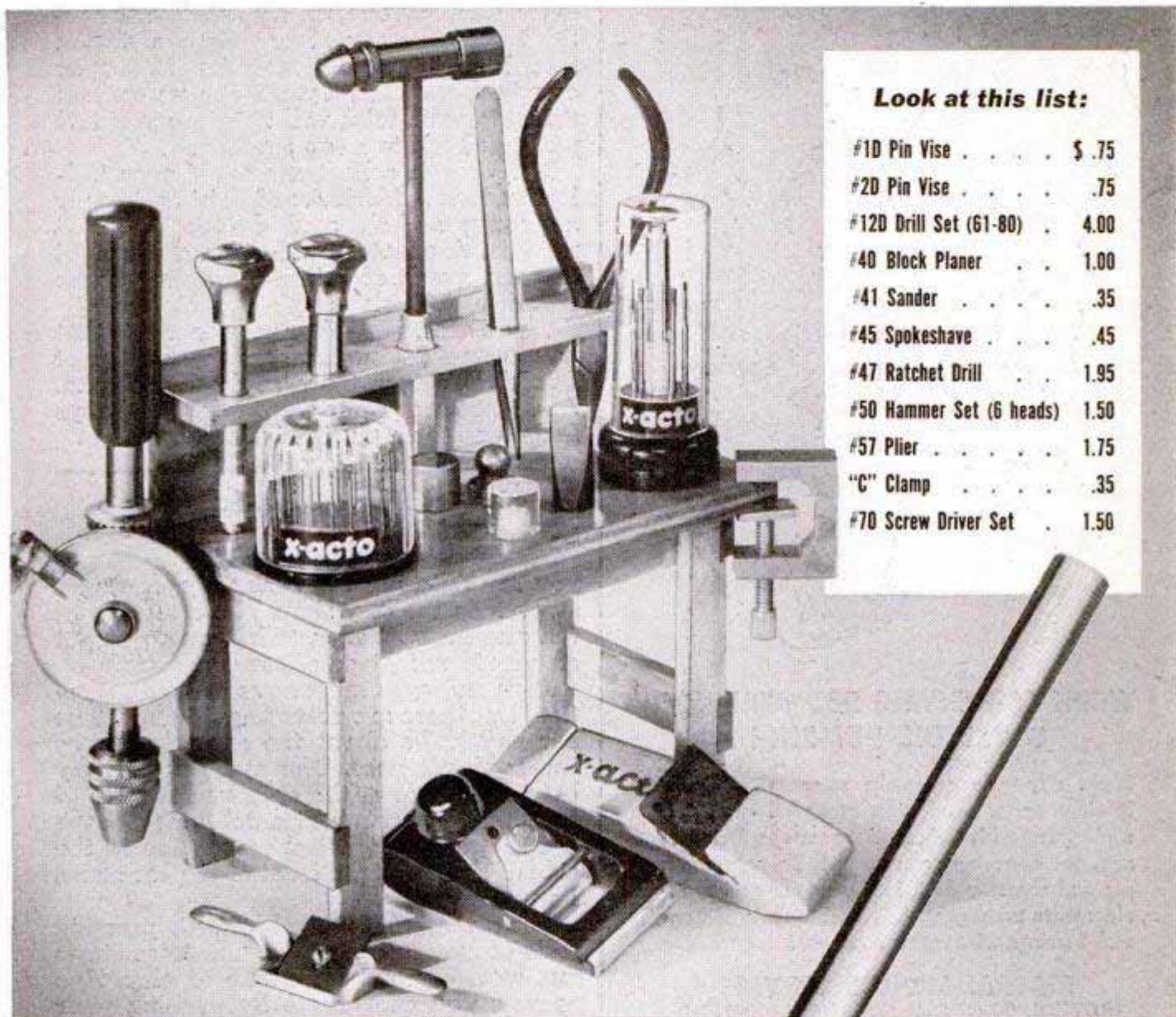


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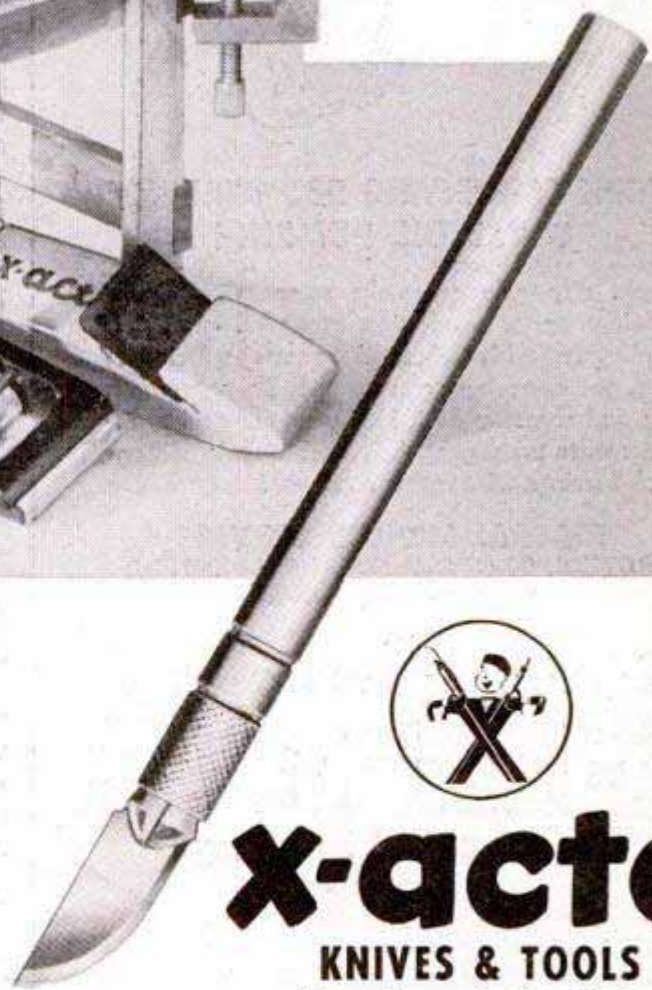
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#1D Pin Vise	\$.75
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#12D Drill Set (61-80)	4.00
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#41 Sander35
#45 Spokeshave45
#47 Ratchet Drill	1.95
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#57 Plier	1.75
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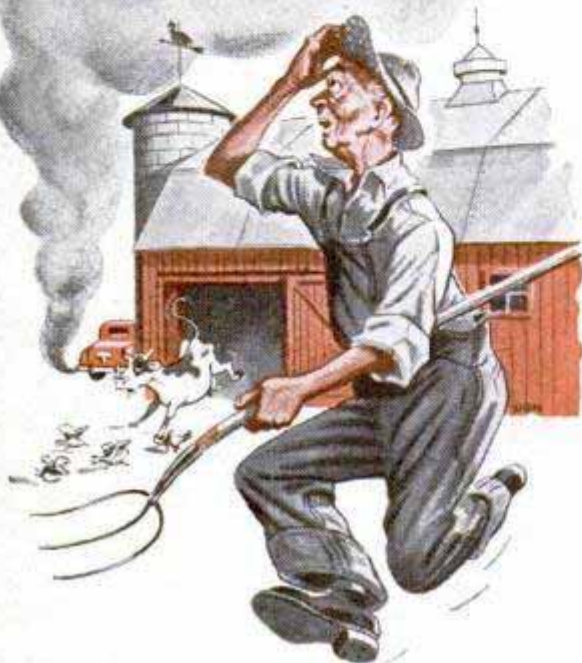
Handicraft Tools, Ltd., Hermant Bldg., Toronto

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WORN CONNECTING ROD BEARINGS CAUSE OIL PUMPING

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COLDWATER, MICHIGAN

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Oil-Control Bearings
in your car



For insomnia victims, Professor Oakes has invented his Automatic Sheep Counter. Insomniacs need no longer worry about the sheep who come up to the fence but refuse to jump. The invention counts only those which actually cross the top bar—and a mechanical counter keeps tab on the number that do go over and reports them to the sleepless one, until a sufficient quantity to produce sleep have passed over the rail. Even then, the counter keeps on counting, and should you wake, a glance at the automatic total will reassure you and put you back to sleep again.

For church collections, the Oakes Collection Box is ideal. A red light flashes for a penny; nickels and dimes are not marked. A quarter produces a green light and the sound of chimes heralds a dollar bill. A button brings a pistol shot.

There are many other goofy gadgets that have come out of the home workshop of Russell E. Oakes, the wizard of Waukesha. And there are more to come, for he always finds time to return to his hobby.

Sculpture for Fun

(Continued from page 141)

you are finishing the surface, your finger strokes on the clay should be crosswise of the muscles, Ott says. "That way, you get convex form instead of concave form."

Ears and eyes must have careful attention, but there are rules to guide you. The ear should be about the same length as the subject's nose. The eye lies halfway between levels of the chin and the top of the skull. Where a horizontal line from the eye intersects a vertical center line on the side of the head, the front of the ear starts its upward curve.

Form the bulging eyebrows by pressing rolls of clay into position. The nose starts out as a carrot-shaped roll of clay. Eye sockets you can create by pushing your thumbs into the clay; then place eyeballs in the sockets and press them down. Rolls of clay will make eyelids—one roll per lid.

Hair is represented in sculpture as a mass. Ott says his beginners worry about what to do in this regard. "They even take out pocket combs and comb the clay, trying to make hair," he says, "but that's not the way."

What to sculpture? "Be versatile," Ott tells his pupils. "It's more fun. In painting, in photography, you have color and two dimensions; in sculpture you have form—the third dimension. You are working with form and masses.

"Try a head—a hand—a foot. Try a

(Continued to page 248)

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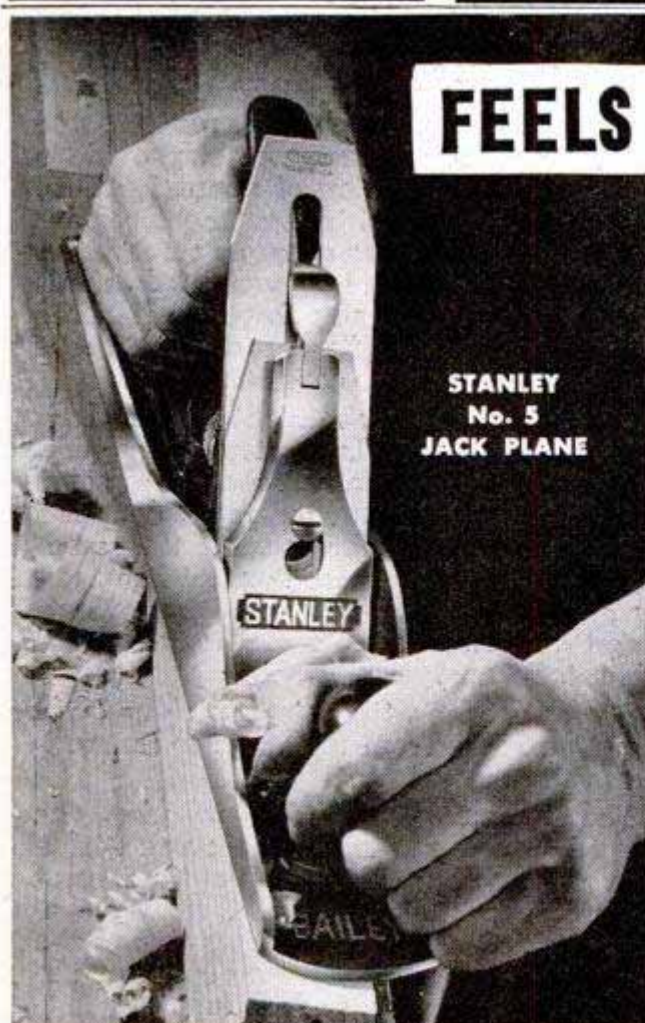
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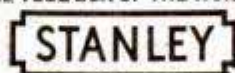


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group of simple geometric forms—they are abstractions of other things. If the piece you are sculpturing won't come out right, start anew! Your second attempt will be faster, your third faster still!"

For an easy subject, choose a mature face with strong, prominent features. A man's face is easier to sculpture than a woman's. A baby's is most difficult of all.

The Laguna Beach sculptor, a distinguished man in his profession, is a firm believer in the value of sculpture in recreation and rehabilitation.

"Your hands—and a chunk of clay—and you can create something! You need no tools. You would be astonished what even children can do, in simple sculpturing. If you model, you are creating; and creative work builds your spirit."

Exploring the Ocean Bottom

(Continued from page 166)

ridge. By exploding small bombs underwater, they determine the thickness of the sediment overlying the rock bed of the ocean and by seismic refraction they determine the nature of the rock beneath the hundreds of feet of sediment.

The sediment on the ocean bottom accumulates at the rate of about one inch during each 2000 years, so attempts are being made to obtain 60-foot-long cores of the sediment for study. Fossilized remains of minute sea life give an indication of the climatic changes which took place in the ocean. Such long cores would provide a geological cross section of about 1,444,000 years of the earth's history. The cores are obtained at depths as great as three miles below the surface. A long weighted tube is lowered on a wire and allowed to fall free when nearing the bottom. It obtains a core much as a housewife cores an apple.

All of the ocean sediment obtained by the Atlantis during last summer's expedition was found to be radioactive to some degree, which is true of most deep-sea sediments. The specific cause of the radioactivity in this material has not been determined but the latest expedition will attempt to bring back more material for laboratory analysis.

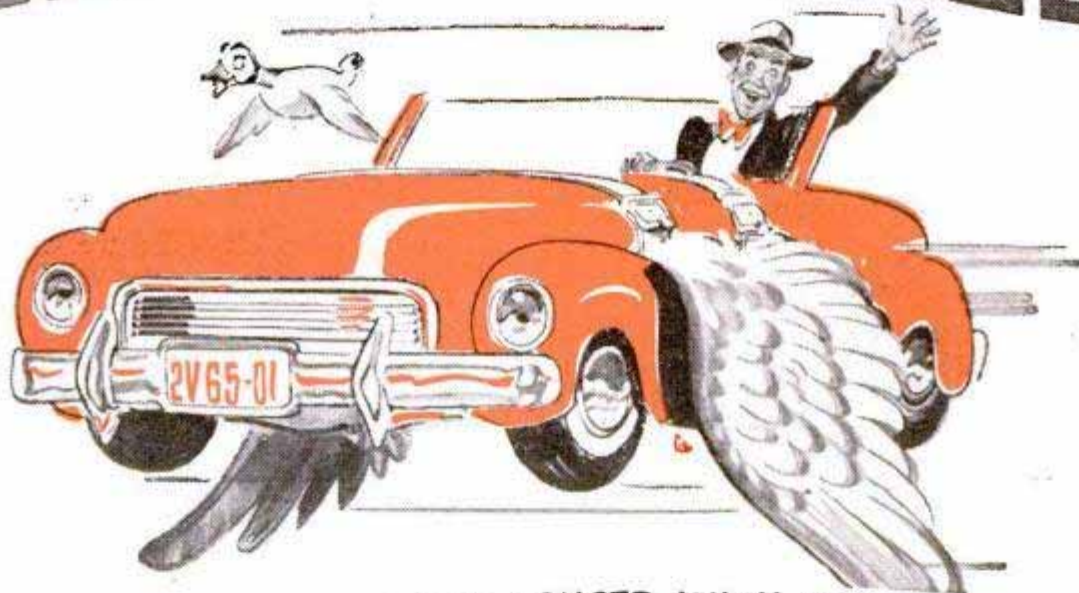
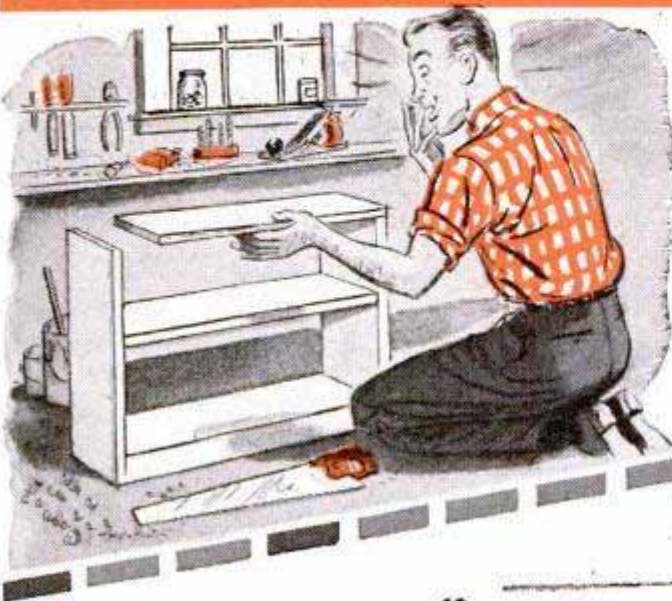
A rock dredge with a steel-mesh bag will bring up rocks from the ridge to be studied in the laboratory.

The Atlantis is helping to map the rugged sunken mountain chain and with a deep-sea trawl will bring up specimens of the creatures that inhabit the murky bottom of the ocean. The scientists aboard the research ship are explorers of one of the world's last geographic frontiers.

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OUT LIKE THIS...IT'S TIME TO
CHECK THE BLUEPRINTS ...

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IF YOUR CAR FEELS LIKE THIS...
IT'S TIME FOR MARFAK
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Gauges—the Guide to Perfection

(Continued from page 127)

rods of known diameter (photo 5) and the whole unit becomes an improvised snap gauge, limit gauge, plug gauge, or whatever is desired. A few moments later the component parts may be dismantled and assembled into something different.

The great difficulty in using a micrometer is it is often awkward to read in the measuring position. To overcome this, dial gauges (photo 6) were introduced. Here, the reading can be observed across a room. The dial in itself is valueless. It must be used with a surface plate or a fixture. It is first set up on the surface plate and calibrated with gauge blocks until the desired reading is zero on the scale. Then it is transferred to the work, in this photo a giant planer, dressing the ways of a surface-grinder casting. When set on a prepared base pad, the dial button rests on the way and shows at a glance how much in ten thousandths of an inch must still be removed before the job is down to limits.

Ingenuity of shop men knows no limits and the skilled machinist can improvise a measuring device at a moment's notice. Typical is the setup to measure a run of spur gears (photo 7) which is made out of a bench plate, two parallel beams, dial gauge and holding fixture. Calibrated with gauge blocks it does the work of a made-to-order instrument costing over a hundred dollars. A similar improvisation, a modification of the device used to measure the planer ways (photo 8), makes several measurements at once. It tells the height of bore above base line, diameter of bore and whether or not bore is parallel with base line. Work is placed on a surface plate.

Where large quantities of one item must be measured and inspected, it is economical to invest in specialized instruments such as the optical comparator (photo 9) where a silhouette image, greatly enlarged, is cast on a screen. On the screen is drawn an outline pattern of the part being inspected. The projected shadow should register with this outline. Initial adjustments are involved. As with the simpler instruments, gauge blocks are used to establish a working standard.

Speed is important in modern production and the fatigue factor of the operator is also taken into consideration. A versatile device which inspects as the operator inserts the pieces is the light-beam comparator (photo 10). It has a scale but no needle. A pin point of light does the indicating. This is the highest development of

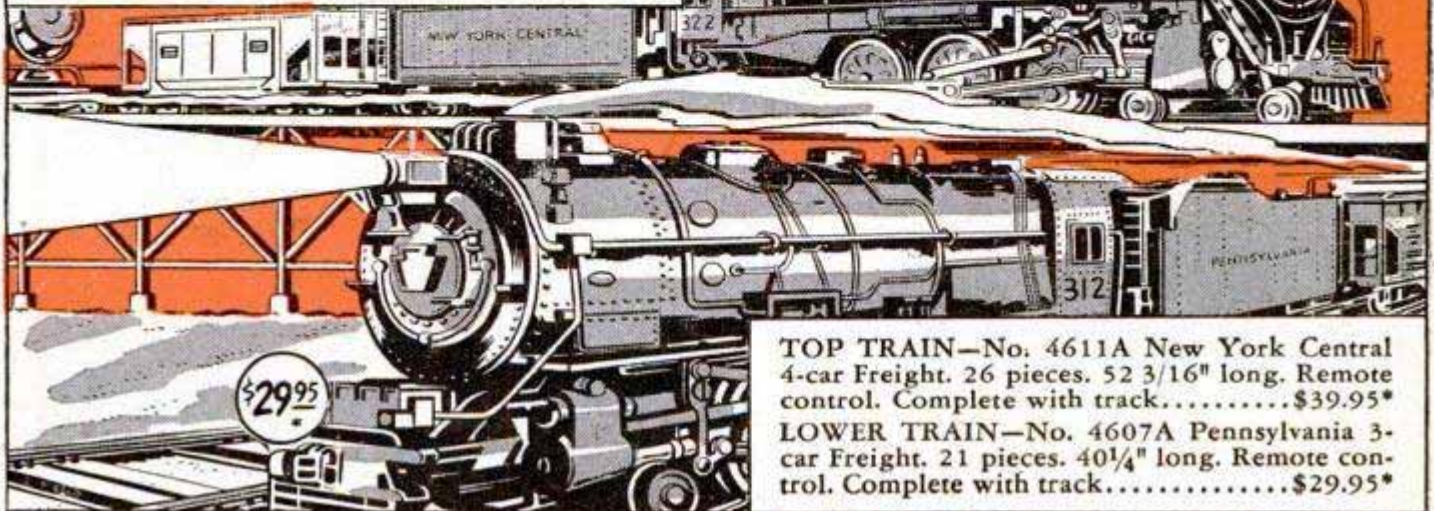
(Continued to page 252)

AMERICAN FLYER

Developed at the GILBERT HALL OF SCIENCE

WATCH 'EM PUFF SMOKE!
HEAR 'EM CHOO-CHOO

Only American Flyer has real smoke and realistic "choo-choo" sounds synchronized with train speed. The faster your train goes, the heavier are the puffs of smoke . . . the louder and faster the "choo-choos."



\$39.95

\$29.95

TOP TRAIN—No. 4611A New York Central 4-car Freight. 26 pieces. 52 3/16" long. Remote control. Complete with track.....\$39.95*
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NEW TALKING RAILROAD STATION



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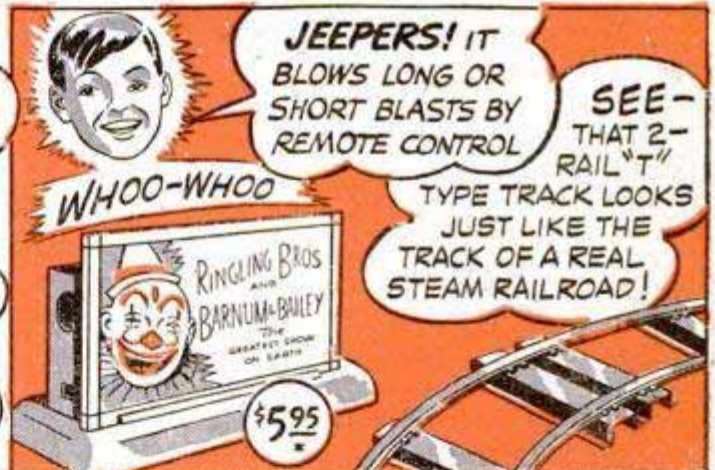
WHO-O-O
...WHO-O-O

NEW YORK-
PHILADELPHIA-
CHICAGO-AND
ALL POINTS
WEST!

ALL ABOARD

\$14.95

CHUG-CHUG



JEEPERS! IT
BLOWS LONG OR
SHORT BLASTS BY
REMOTE CONTROL

SEE-
THAT 2-
RAIL^T^

WHOO-WHOO

TYPE TRACK LOOKS
JUST LIKE THE
TRACK OF A REAL
STEAM RAILROAD!

RINGLING BROS
AND
BARNUM-BAILEY
THE
GREATEST SHOW
ON EARTH

\$5.95

The new American Flyers bring you all the wonder and glory of railroading. They puff real smoke. They reproduce the "choo-choo" sounds of a real locomotive under full steam. Both smoke and "choo-choos" vary in intensity as you increase or decrease the speed of your train. Locomotives, tenders, cars and track are all built to uniform 3/16" scale, so that your train looks like real—hugs the track like real. And a two-loop track layout takes space only 6 feet square. Cars have automatic couplers that couple anywhere. Uncouple by remote control. Die-cast locomotives have superpower worm drive for smooth, steady pull at all speeds from a crawl to 120 scale miles per hour. See and hear the sensational American Flyers at your nearest toy or department store.

*Denver and west, prices slightly higher

HURRY!
SEND FOR YOURS

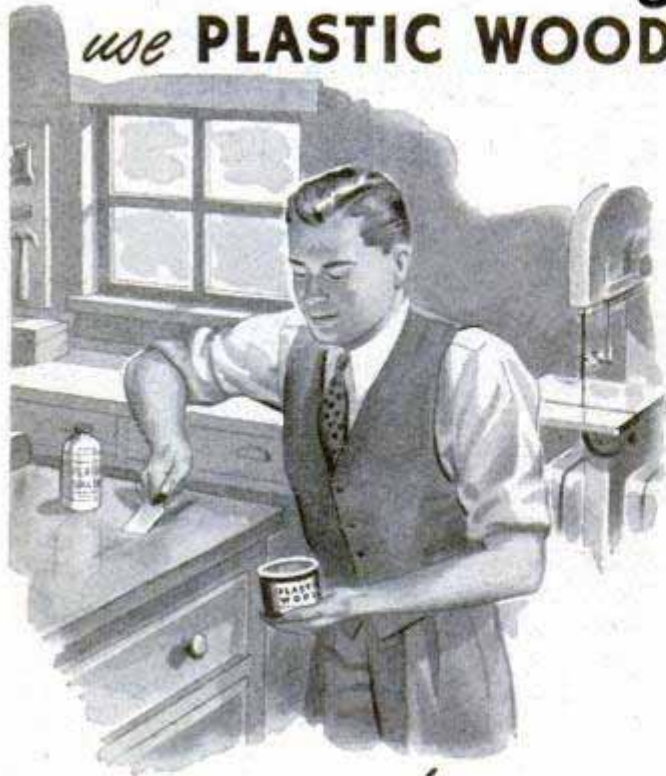
COLLOSSAL TRAIN BOOK. 32 big pages with color illustrations of American Flyer trains, automatic log loader, coal loader and other sensational equipment. Mail coupon with 10¢, Gilbert Hall of Science, 41 Erector Square, New Haven, Conn. I enclose 10¢. Rush colossal train book.

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Street.....
City..... State.....
(This offer good only in U. S. A.)

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FOR FILLING . . .

- Countersunk screws
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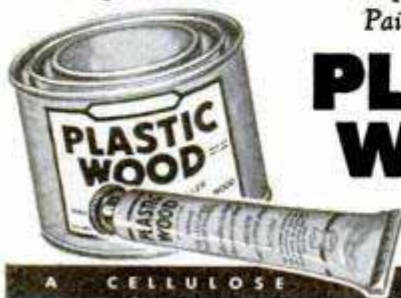
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- *You'll want Plastic Wood SOLVENT, too.* Get both at one time. It is made especially to control the consistency of Plastic Wood . . . useful also in removing dried Plastic Wood from tools and fingers.

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PLASTIC WOOD

Tube or Can

A CELLULOSE FIBRE FILLER

the mechanical measuring devices. It is a far cry from the ancient and honorable caliper, but is still only half way up the scale of precision measuring devices.

The electromagnetic comparator (photo 11) works on the same principle as a phonograph pickup. Pressure on a plunger causes a needle to move. It is extremely sensitive and can be used on tin foil, wire gauze and other materials which would be crushed by less gentle methods. In its conventional form it resembles the light-beam comparator, but it can be used in any position and for just about any measuring purpose. The model illustrated shows a device for checking the squareness and top and bottom diameters of a master gauge.

From here, measuring devices take a leap which staggers the imagination. High-frequency electronics are used to measure to one millionth of an inch at a speed of 10,000 measurements per hour. That is faster than the most skilled operator can feed. Parts are merely dumped in a hopper. The machine runs itself.

This electronic segregator, as the machine is called, does what has never been done before. It takes a complete run of screw-machine products, ball bearings, spark-plug insulators, sheet-metal stampings, thrust plates and kindred items and gives them a complete inspection, sorting the good from the bad, oversize from undersize, or even classifying into five or more size groups, and it does it as fast as the automatic machines can turn them out, sometimes faster.

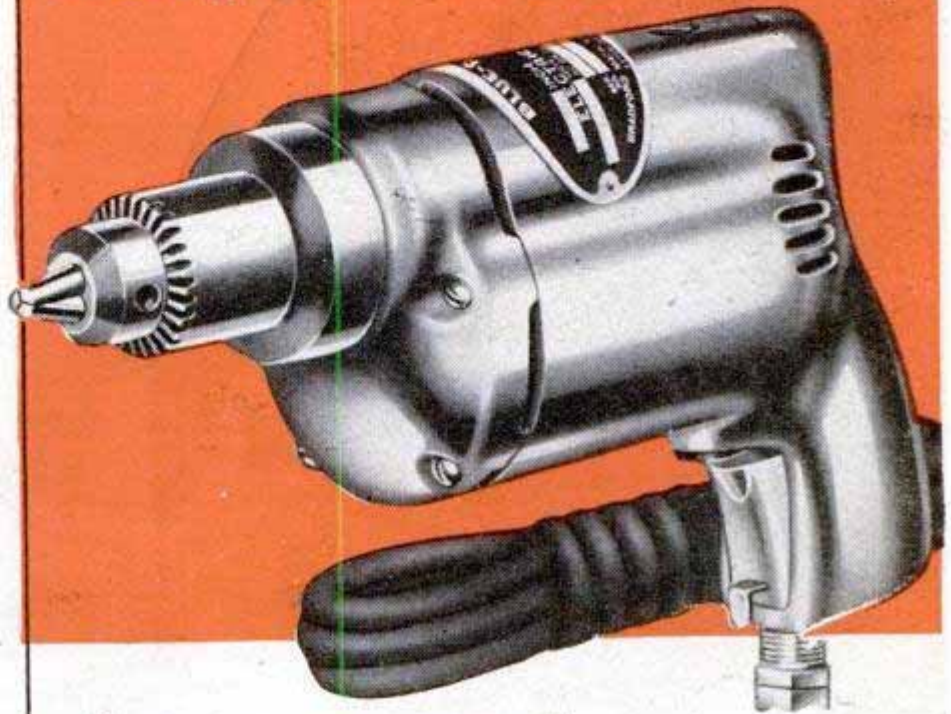
Earlier methods of quality control depended largely upon spot checking a run and trusting to luck that no bad ones got through. That was good as long as the screw machines were in adjustment. Let a cam slip, and a thousand or more bad parts would be delivered before anyone discovered the trouble. Then either the whole lot had to be hand picked or junked, whichever was more expedient. Now, as fast as the parts are delivered they are degreased, fed into the hopper of the segregator and what comes out is already sorted, classified and counted. Let more than a dozen rejects drop through in succession and a bell rings, stopping the whole works so the trouble can be investigated.

The simple segregator consists of a high-frequency oscillator operating on 30 megacycles, driving a balanced bridge circuit. In one leg of the bridge is a variable condenser, which is the measuring head, and in the other a bank of thyratrons which control the distributing mechanism. As a piece of work is fed in, it unbalances the

(Continued to page 256)

Snap-on
BLUE-POINT

Midget 1/4" Electric Drill



**gives you more speed...
more drilling power in close places!**

Here's a sturdy, dependable electric drill that packs a lot of power, yet is so compact that you can hold it in the palm of your hand. It's a great favorite with mechanics because it gives them drilling speed and power in close places... it gets in wherever your fist will fit. Comes complete with 1/4" Jacobs Chuck, key, and 15 feet of 3-conductor cable and plug. Mail the coupon for complete information.

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CARBON BRUSH

Made of tightly twisted spirals of steel wire. Removes hard carbon deposits.



ARBOR ADAPTOR

Has 1/2" dia. arbor for use with brushes and grinding wheels up to 4" dia.



CIRCULAR HOLE SAWS

Has 1/4" pilot drill. Saw sizes range from 5/8" to 2". Shank fits 1/2" drill chuck.



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Made of crimped bright music wire. Cleans carbon from cylinder heads and blocks.



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"My Dad's smarter'n your Dad"



BETTY: He is not!

BILLY: He is too. How about that wrench your Dad bought last week? It's already broken—and today he had to borrow one from my Dad.

BETTY: What of it?

BILLY: Well, if he'd bought a *good* wrench, like the one *my* Dad has, it wouldn't be broken now.

BETTY: Oh, you think you're pretty smart, don't you?

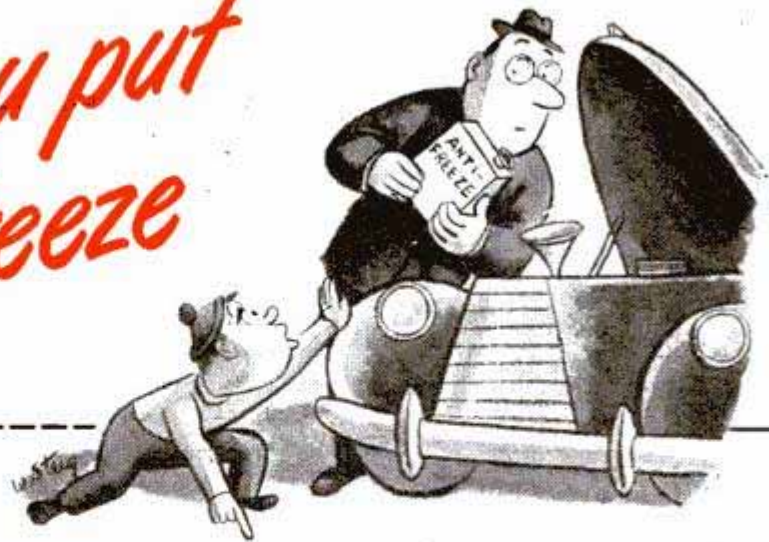
BILLY: I'm not saying *I'm* smart, but my Dad is. He says people who buy tools at bargain counters are just throwing money away. He gets all his tools at the hardware store, and he always looks for the brand name before he buys. He wouldn't even pay *one penny* for a wrench like your Dad bought—because there's no brand name on it.

Your **HARDWARE DEALER** sells **QUALITY tools**
and hardware... Buy from HIM



POPULAR MECHANICS

*Before you put
in anti-freeze*



Clean out rust with

DU PONT Cooling System CLEANSER

Don't put anti-freeze into a rust-clogged radiator. Clean out the rust and scale *now* before winter sets in. Just pour a can of DU PONT COOLING SYSTEM CLEANSER into your radiator, run the engine 30 minutes or more, then drain. That's all! It cleans thoroughly without reverse flushing. It's safe, sure, dependable, and easy to use.



Then keep out rust with

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After cleaning out the radiator, you can keep it free from rust all season by pouring in a can of DU PONT ACID AND RUST INHIBITOR. This neutralizes the acid and prevents damaging rust from forming.



Avoid leaks and loss of anti-freeze with

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You can stop leaks quickly and securely—and make the cooling system LEAK-PROOF—by pouring in DU PONT COOLING SYSTEM SEALER. It will not clog the radiator or harm hose or metal parts.



DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

circuit, actuating one of the thyratrons. This in turn opens a gate directing the piece into the proper chute. The operator pushes the pieces past the measuring head and forgets them. They drop down through a hole in the table and into tote trays suspended underneath.

Like the other devices, the segregator is calibrated with gauge blocks for the initial setup. When the runs come faster than a girl can feed by hand, the installation of a ram and hopper speeds things up (photo 12). An electric motor does the driving and the operator's sole responsibility is to keep the hopper filled. As with everything else, wear can destroy the accuracy of the instrument, so the inspector makes frequent checks, testing the gate-opening mechanism by means of gauge blocks. Wear has been reduced by using a diamond for a gauge tip and hard alloy steel for the anvil.

With the number of measuring, checking and inspecting devices now in use one can see the decided improvement in the past 10 years is no accident. It has resulted in other changes, too. The old all-around mechanic who could start right in with the raw forgings and end up with a Rolls Royce, singlehanded, is almost extinct. His work was superb, he used few, if any, measuring devices, handfitting each piece as he went. There are 70-year-old, hand-

fitted Corliss engines still running day and night. The old custom-made autos were laughed off the streets, but they still run. But times have changed. Today the demand is for quantity as well as top quality so machines do the work instead of men. To make all parts fit there is a standard and that standard is the gauge block.

Science Seeks New Means Of Reaching Absolute Zero

Scientists are constantly striving toward a temperature of absolute zero—the absence of all heat—and a newly suggested technique may enable them to cool a substance to within one-millionth of a degree of their goal. By electron demagnetization, temperatures have been reduced to four one-thousandths of a degree above absolute zero. A refinement of this process would demagnetize nuclei, the centers of the atoms, as well as the paths of the electrons. By studying substances at temperatures near absolute zero, scientists hope to solve the mysteries of atomic motion.

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more *effectively* the plating action in *Graphite Lubrication* reduces wear, saves lubricant and labor.

There is a ready-to-apply GRAPHITE "PLATING" LUBRICANT for nearly every use in every home, industry, auto, boat, railroad, airplane etc. Illustrated here is one typical product of each of these *four types* of Dixon's Graphite Plating Lubricants stocked by the nation's supply houses.

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Oil . . . 30¢**



MAILED FREE for the asking—this Data Sheet Directory shows what free descriptive printed matter is available on 20 Dixon Lubricating "Plating" Graphites.

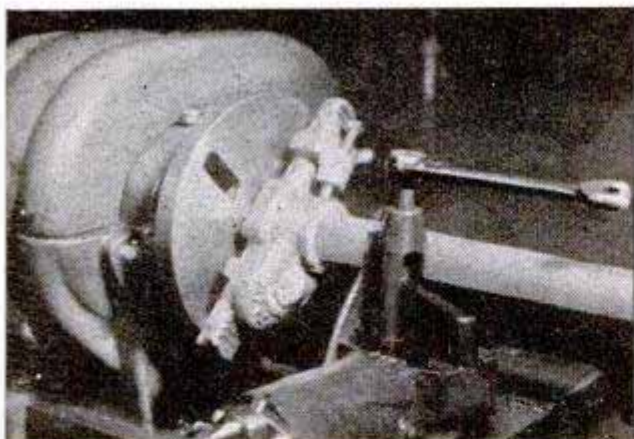
Lever Uncouples Toy Rail Cars

Cars of a toy electric train are uncoupled merely by pressing down on levers behind and above the couplings. The train is made of plastic and is powered by four flashlight batteries. It can be started, stopped and reversed by a single remote-control switch.

Sanding Disk With Adhesive Back

There are no messy adhesive sticks or gluepots to worry about when you use sanding disks with an adhesive backing. You merely spread a little alcohol on the backing and apply the disk to the metal sanding plate. It can be used immediately and there are no high spots to cause uneven sanding. The disk is easily removed when necessary. For internal sanding, the abrasive material is cut into strips and wrapped around a steel rod.

Dog Vise Holds Small Parts in Lathe



Small parts of almost any shape are held firmly for machining by a dog vise that can be mounted on a lathe or drill press. The tool has two independent adjustable jaws on a rack. It can be mounted on a 9 to 12-inch lathe with a No. 2 center, and has a stock capacity ranging from zero to three inches in diameter. The rack is equipped with pins to prevent the jaws from loosening. The tool also can be used as a vise to position parts for grinding and buffing.

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He's been using them for years. And, as long as he can remember, they've been Nicholson or Black Diamond files*. For, like every other old-timer—and a good many young craftsmen, too—he takes pride in working with fine tools.

He knows, for example, that Nicholson and Black Diamond quality pays off in faster filing, better work, longer lasting service. What's more, he knows the importance of using exactly *The right file for the job*. That's why he keeps a good assortment of kinds, cuts and sizes. No telling what kind of fix-it-please job those kids will bring in next.

Your hardware dealer will be glad to help *you* make up an all-purpose set of Nicholson or Black Diamond files. See him about it!

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OR THE ALL-DAY GRIND**

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That reason is AC's patented insulator. *

In heavy traffic and cross-country driving alike, you'll find these plugs outstanding in performance and reliability. Ask your AC Spark Plug Service Dealer about them.

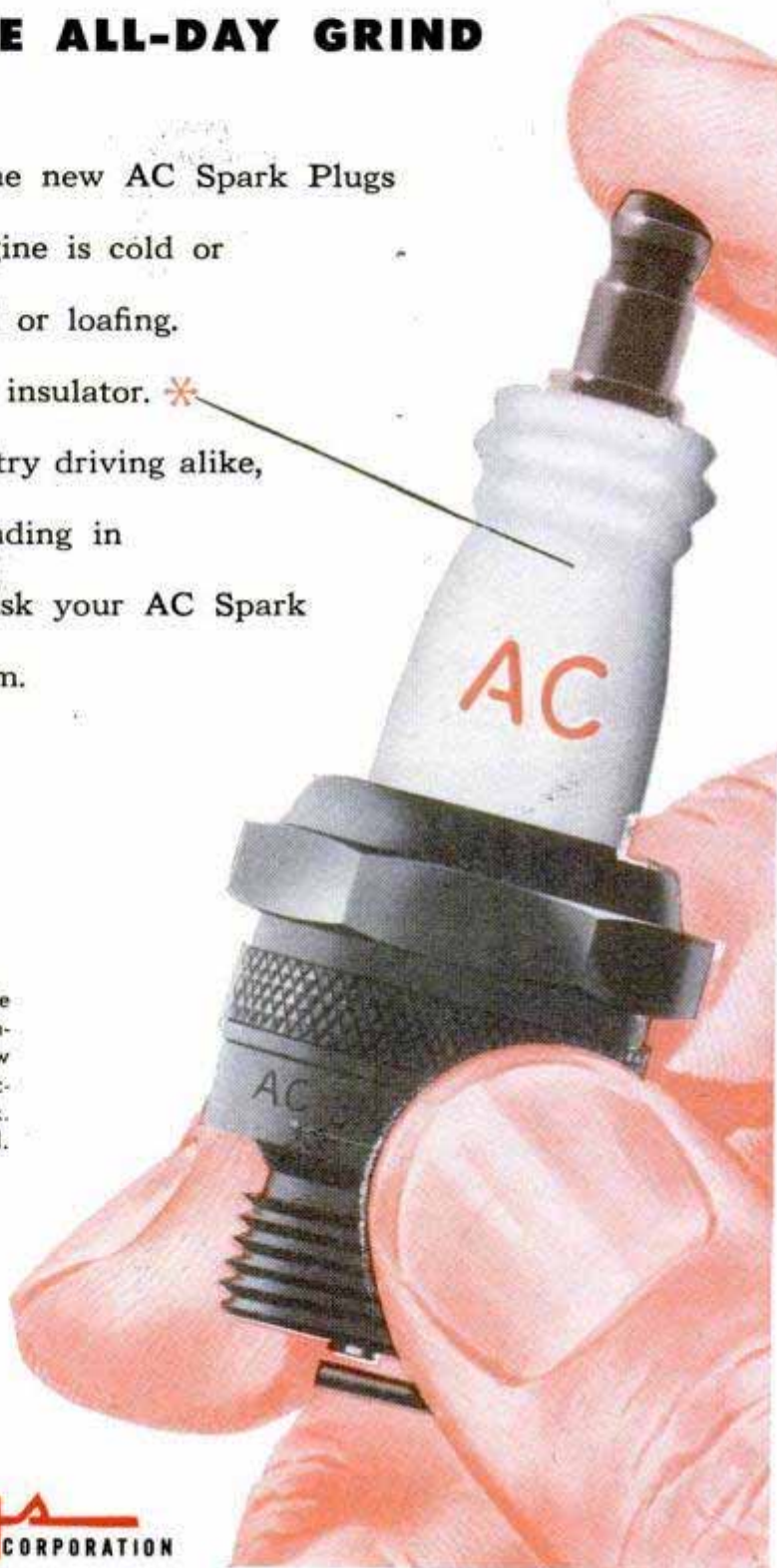
LOOK FOR THIS SIGN



* AC's patented processes make this the finest insulator in spark plug history. Improved electrical insulation, no matter how high the temperature. Better heat conduction. Maximum resistance to heat shock. Less fouling. Harder, stronger, longer-lived.



Spark Plugs
AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION



Exterior painting requires PLANNING



Measure surface accurately and estimate amount of paint needed by using average coverage figures of the paint being used. (Eagle RTU White Lead Paint covers 600 to 700 square feet per gallon, depending on condition of surface.)



For best results, paint in dry weather, with temperatures above 40°F. If you must paint on cooler days, start later, after moisture on walls has dried. If possible, allow three days between coats for drying.



Select brushes carefully. Buy brushes with soft, flexible bristles. (Four inches wide for walls, two inches wide for trimming.) A quality brush may cost slightly more, but lasts longer and lets you do a better job.



Use quality paint . . . it's more economical in the long run. Eagle RTU is pure White Lead Paint that's all ready-to-use. You just open, stir and apply . . . it brushes on evenly and easily, is most satisfactory to use.

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Yes, it's true. Now you can get famed, durable, beautiful white lead paint that's all ready to use. Eagle RTU is *pure* carbonate of white lead, in *pure* linseed oil. It's carefully formulated and mixed for instant, easy use. Eagle RTU has the opacity, covering power and endurance qualities that only pure white lead paint gives—*plus* the convenience of being ready-mixed. It's made by the Eagle-Picher Company, makers of quality white lead since 1843. Two forms: Primer Sealer and Outside White Finish Coat. Quarts, one, two, and five gallon cans.



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*The red handle with the black head
—exclusively Plumb.*

Quality Comes FIRST
PLUMB
is FIRST in Quality

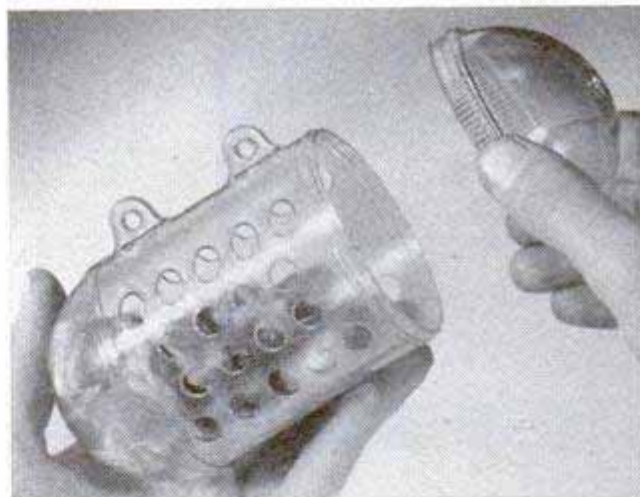
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Designed as a space-saver, a combination chair and desk can be used as a telephone stand and for writing. It is over three feet high and 35 inches from front to back. The desk section is fluorescently lighted and has compartments for writing materials.



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Transparent bait containers lure crabs into one-way traps, but keep the bait from being eaten by the shellfish. Made of Tenite plastic, the containers are perforated cylinders with rounded ends, one of which unscrews for inserting chopped clams or other bait. Perforations allow the scent and small bits of bait to escape, attracting the crabs. Bait can be inspected without removing the container from the trap.

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for the price of one!



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Only \$44.50

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Actually no other grinder of the same type compares with the new Porter-Cable Disc Grinder. No other grinder offers the same features. No other grinder is so rugged . . . or so versatile!

ONLY the Porter-Cable Disc Grinder has ALL these advantages!

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2. The disc on the Porter-Cable Grinder is 6 inches in diameter . . . cuts 53% larger surface than ordinary machines. Grinds any material—wood, steel, plastic, glass.
3. Its rugged motor is twice as powerful—a reserve protection from overloading.

4. Shaft is extra heavy: $\frac{5}{8}$ inches diameter.
5. Chuck for drills, wire brushes, cut off discs and many other accessories.
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8. Porter-Cable Disc Grinder stands up longer . . . holds sustained speed . . . lasts indefinitely.

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See the Porter-Cable Disc Grinder. Try it. Compare. And you'll agree that no other machine gives you as much for your money! At hardware, lumber and mill supply dealers everywhere. Nearest dealer's name furnished on request.

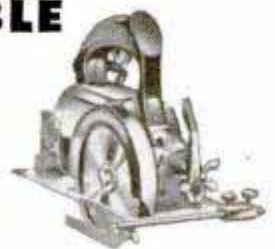
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SAWS-SANDERS-GRINDERS

PORTER-CABLE

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PORTABLE ELECTRIC TOOLS
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A **AMERICAN**
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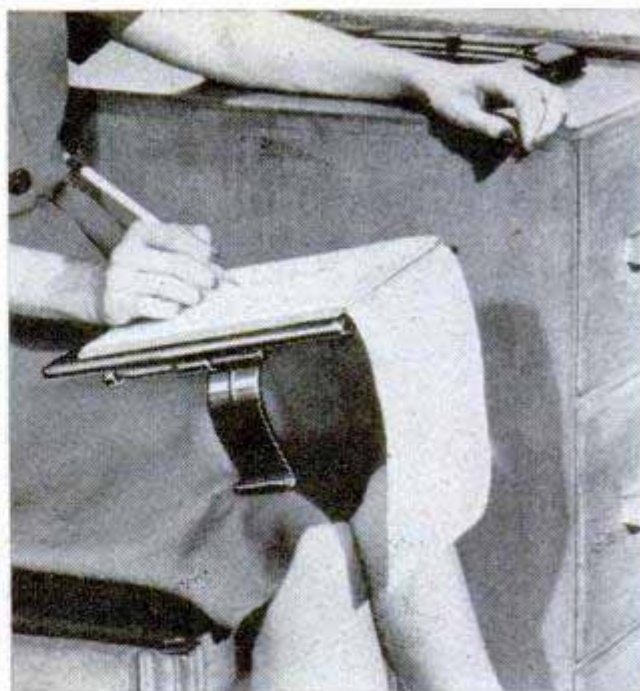
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Enclosed find 25c in stamps or coin for booklet "Opportunities in Floor Surfacing", telling me how I can start my own floor sanding business.

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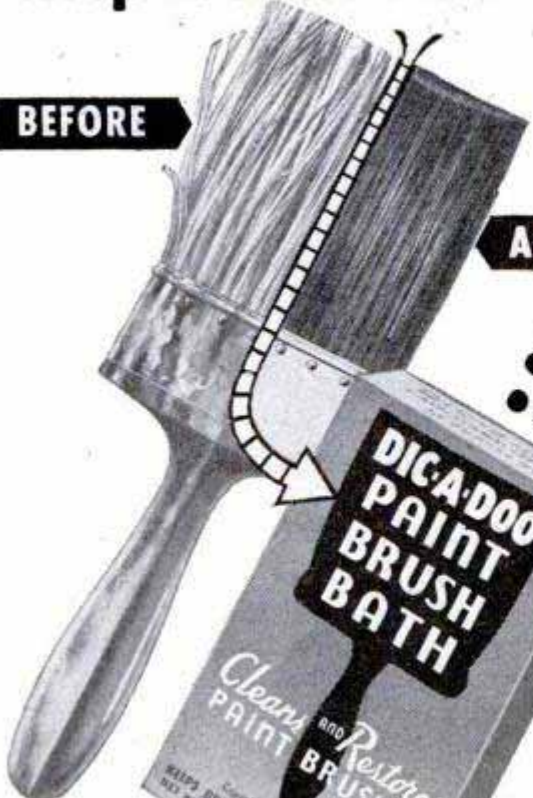


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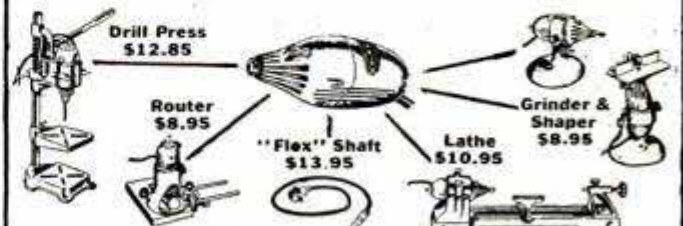
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WRITE FOR FREE CIRCULAR giving full details on the *Super Power Tool Kit* and the new, low cost home workshop units.

DURO METAL PRODUCTS CO.
2673 N. KILDARE AVE., CHICAGO 39, ILL.

WILL YOU SPEND 3 MONTHS . . . to BUILD A *New* BODY?

Will you work three months for a stronger, more handsome physique? If you have that much ambition, **PARAMOUNT BAR BELLS** are your sure, fast way to physical development. In no time at all you'll actually see your neck, chest, arms, shoulders and thighs growing to new, shapely proportions. Thru the use of Paramount Bar Bells you will be providing these sets of muscles with the right kind of resistance for fast development.



**WRITE FOR
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**8.95
UP**

See **PARAMOUNT'S** complete catalogue of barbells, dumbbells and home gyms. You can save 20 to 30% on body building equipment. **ACT NOW! WRITE TODAY!**

FACTORY PRICES

INDEPENDENT IRON WORKS
2416 East 23rd St., Dept. 21, Los Angeles 11, California

NOW...SANDING IS FUN!



**Amazing
MOTO-SANDER
AND POLISHER**

Saves Time - Saves Elbow Grease!

Only \$14.85

POSTPAID

Here's an inexpensive Sander and Polisher so easy to handle that a child can use it. All you do is guide it! **Moto-Sander** delivers 7,200 strokes a minute... does a magically smooth job... gets into places other sanders can't reach. Has only two moving parts... never needs oiling or adjustment. Uses 110-120 volt, 60 cycle A.C. electric current. Has 8 ft. (Underwriters' Approved) rubber cord. Furnished with 6 sheets assorted grade Garnet paper for sanding, plus 1/8" thick felt pad and sheepskin pad for wax polishing.

FINE FINISHES - FAST!

Use **Moto-Sander** to get satin smooth sanded finish on woodwork, stairways, doors, furniture; ideal for finish sanding of boats, painted walls, bird houses or scale models. Use it also for speedy, effortless polishing of waxed furniture, automobiles and other surfaces, simply by removing sandpaper and clamping on polishing pad. **Moto-Sander** is the lightest, most practical electric sander on the market, and is patented.

MONEY-BACK GUARANTEE

See Dremel **Moto-Sander** at your dealer's. If he cannot supply you, use coupon below to order on 5-day trial, money-back guarantee. **Moto-Sander** will be sent complete and postpaid for \$14.85 (check or money order in full). Or, send only \$2 with order and pay postman balance plus postage upon C.O.D. delivery. Remember, **YOUR MONEY BACK** if not delighted after 5 days' trial.

DREMEL MFG. CO.

DEPT. SP118-K • RACINE, WIS.
MANUFACTURERS OF THE FAMOUS
MOTO-TOOL AND MOTO-SAW



EASY FOR
AWKWARD PLACES



SANDS FLAT
SURFACES EVENLY



GETS INTO
TIGHT CORNERS



ROUNDS CORNERS
LIKE MAGIC



GREAT FOR
AUTO POLISHING



Self-Powered Telephone System

Self-powered telephones with a range of 20 miles for ringing and talking are now offered for uses where industrial safety requires nonsparking sets or for isolated farm use where telephone service is unavailable. The set is all-plastic, and uses no batteries or other power source. It is designed especially for installation on oil tankers and barges, and in plants where there is an explosive hazard. A manually operated lever is provided for calling.



Gun Drives Heavy-Duty Staples

Broad staples are driven into hard as well as soft woods by an automatic stapling gun designed for installing electric wiring for telephone and intercommunication systems, television, alarm systems and similar installations. The broad-backed staple will hold single or double wire and hollow tubes to baseboards, plaster walls, door and window frames, the gun making it easy to drive staples in difficult places.

**IF YOUR DEALER CANNOT SUPPLY YOU
USE THIS COUPON TO ORDER**

DREMEL MFG. CO. • DEPT. SP118-K • RACINE, WIS.

- Enclosed find \$14.85 (Check or money order in full). Ship **Moto-Sander** at once Postpaid.
- Enclosed find \$2.00 as part payment on **Moto-Sander**. I will pay postman balance plus postage upon C.O.D. delivery.
- Please send Free Catalog of Dremel Tools and Equipment.

NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____



Moto-Tool

THE "POCKET-SIZE
MACHINE SHOP"



Great for
Hobbyists



For Sharpening
Tools

Grinds, Routs,
Drills, Carves,
Engraves, Cleans,
Polishes, Finishes.



MOTO-TOOL KIT No. 2
With 23 Accessories
(High-Speed Steel Cut-
ters, Grinding Wheels,
Polishing Accessories)
\$23.50



APPROX.
27,000 R.P.M.



Saves Time
and Labor



Indispensable
to Machinists

A SHOP TESTED TOOL

Moto-Tool is backed by over 12 years of industrial use . . . packs years of extra pleasure . . . yet, due to increased production, pre-war prices still prevail!

LOOK FOR THESE MOTO-TOOL FEATURES

Oil-less, sealed bearings • Patented automatic chuck lock pin • Oversize armature shaft: hardened, ground, polished • Shock-proof, bakelite housing • Dust filtered air cooling system • Dynamically balanced for vibrationless operation • Exclusive hanger hook • Weight only 13 oz.

New DRILL PRESS

ONLY **\$9.95**

(Less
Moto-Tool)

Only Dremel offers you a portable, precision drill press at such an amazingly low price. Just the thing for creating costume jewelry, model making, wood carving, routing, etc. Utilizes Model No. 2 Moto-Tool, which can be raised or lowered, swung in any direction, or quickly removed for off-hand use. Drill Press stands 12" high. Base is 6 3/4" x 4". Weighs approximately 3 1/2 pounds.



MONEY-BACK GUARANTEE

Buy Dremel Tools from your dealer. If he cannot supply you, use coupon below to order desired items on 5-day trial, money-back guarantee. Items checked will be sent complete and postpaid for check or money order in full. Or, send only \$2 with order, and pay postman balance plus postage upon C.O.D. delivery. Remember, YOUR MONEY BACK if not delighted after 5 days' trial.

DREMEL MFG. CO.

DEPT. T118-K • RACINE, WIS.

Here's
BIG VALUE!

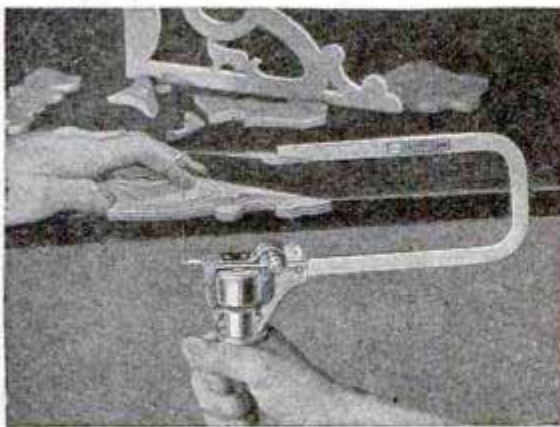


MODEL No. 1
MOTO-TOOL KIT
ONLY **\$17.50**

This highly popular Kit contains lighter Model No. 1 Moto-Tool and 34 practical accessories in attractive, lacquer-finish wood box. It's the biggest bargain in the field.

MOTO-SAW

THE AMAZING ELECTRIC SCROLL SAW



This electric coping saw works like magic! Easily cuts intricate scroll designs in medium-hard wood up to 3/4" thick. Runs 7,200 strokes a minute . . . just guide it! Has only two moving parts . . . never needs oiling. Operates on 110-120 volt, 50 or 60 cycle A.C. electric current. As safe as a handsaw . . . thousands of satisfied users. Comes complete with 3 saw blades, at only... **\$5.85**

USE THIS COUPON TO ORDER

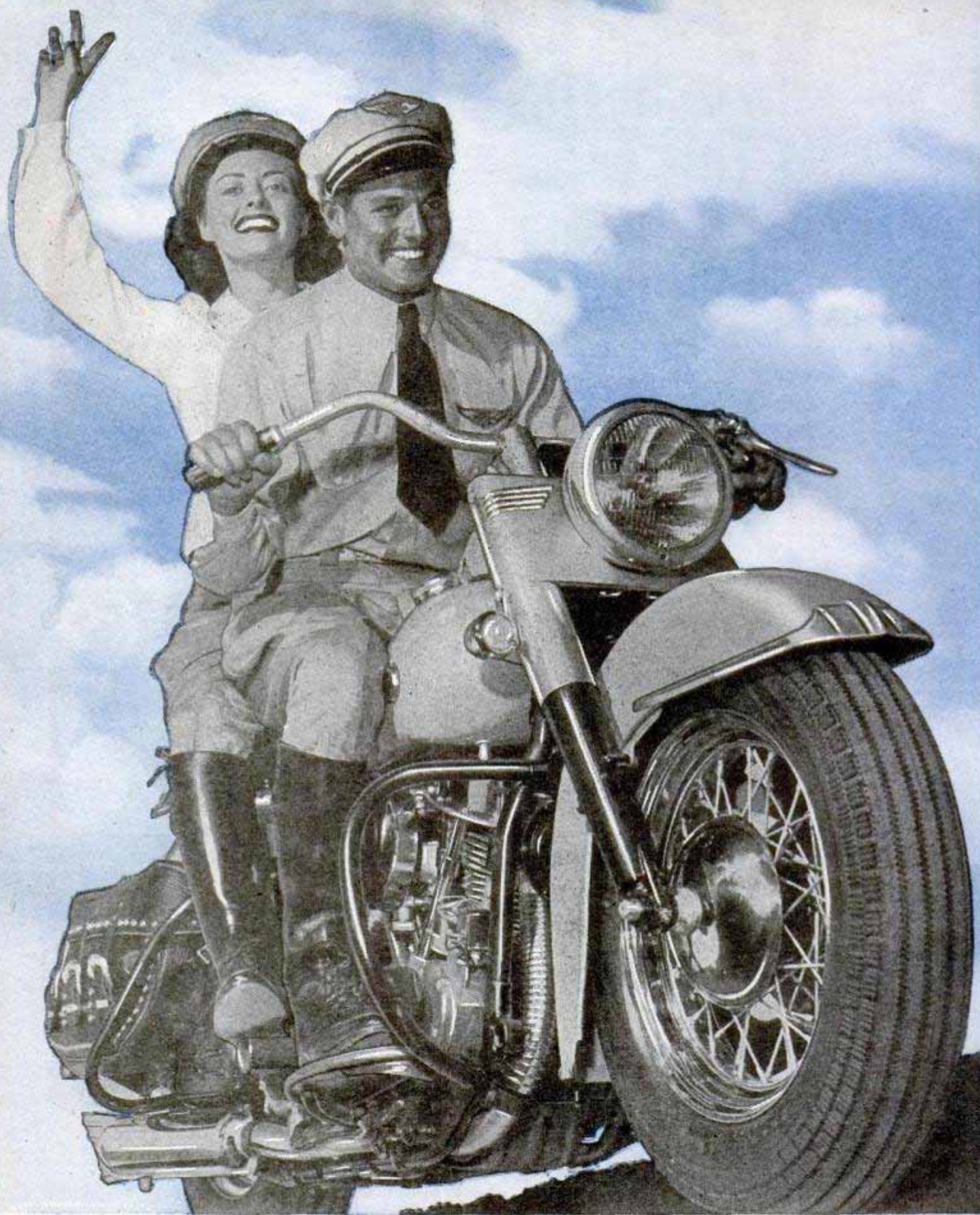
IF YOUR DEALER CANNOT SUPPLY YOU WITH DREMEL TOOLS

DREMEL MFG. CO., Dept. T118-K • RACINE, WISCONSIN

- Enclosed find \$_____ (Check or money order in full). Ship items checked below at once Postpaid.
- Enclosed find \$2.00 as part payment on items checked. I will pay postman balance plus postage upon C.O.D. delivery.
- Moto-Tool Kit No. 2, \$23.50 Moto-Saw, with 3 blades, \$5.85
- Moto-Tool Kit No. 1, \$17.50 _____dozen blades (60c per doz.)
- Drill Press (Less Moto-Tool), \$9.95 Free catalog of Dremel Tools and Equip.

NAME _____ ADDRESS _____

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NEW "flight-smooth" comfort that irons out bumps like magic!

NEW "road-hug" stability that makes handling easy and sure!

NEW "sure-grip" steering that gives positive control at all speeds!

NEW "feather-touch" braking that provides stopping power to spare!

NEW "speed look" that makes people stop, look and envy!

NEW unmatched performance for greatest fun and thrills!

HARLEY-DAVIDSON ••• WORLD'S CHAMPION MOTORCYCLE

1949 HARLEY-DAVIDSON

with the new

HYDRA-GLIDE FORK!

HERE'S *your* motorcycle . . . with all the comfort and performance features you ever dreamed of . . . with the sleek, trim, modernly beautiful lines that catch the eye of the girl friend . . . the power, stability and handling ease for which Harley-Davidson Motorcycles have always been famed!

The 1949 Harley-Davidson is sensationally advanced! New Hydra-Glide Fork brings you unheard-of comfort on roughest roads, "road-hugging" control, effortless steering ease. Bigger, faster-action brakes give you increased stopping power. Sealed ray headlight turns night into day. Air flow fenders give you protection in any kind of going. Many other features add to your comfort and pleasure . . . take you into a new world of motorcycling performance, thrills and fun. It's the kind of motorcycle only the finest engineering and most modern production methods can produce. Here it is . . . greatest of a long line of great Harley-Davidsons. *Your* motorcycle! See your dealer today and take a ride.

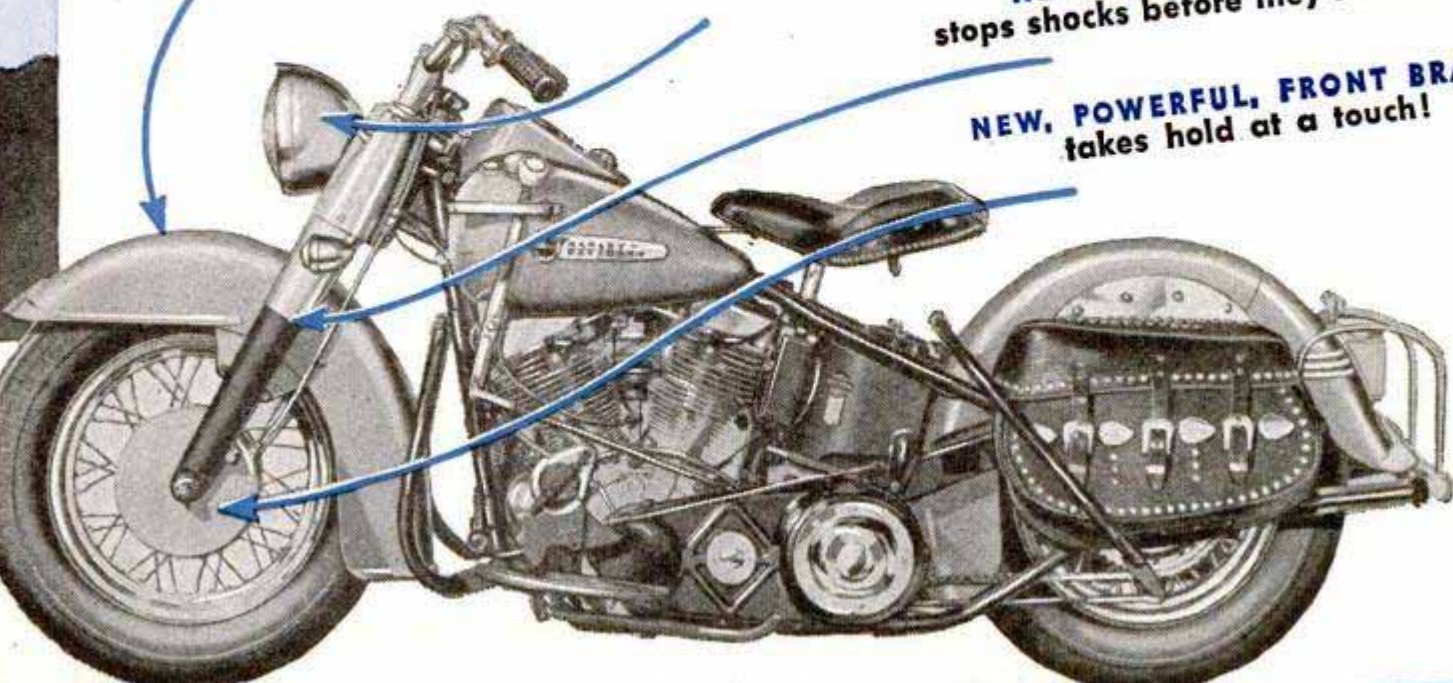
HARLEY-DAVIDSON MOTOR CO., Dept. P, Milwaukee 1, Wis.

NEW AIR FLOW FENDERS
for streamlined beauty!

NEW SEALED RAY HEADLIGHT
turns night into day!

NEW HYDRA-GLIDE FORK
stops shocks before they reach rider!

NEW, POWERFUL, FRONT BRAKE
takes hold at a touch!



America's Most Useful* Hobby Tools

*Each of these high quality tools can be quickly and easily converted to a number of other handy tools by simply interchanging attachments.



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Mall Saw
REG. U.S. PAT. OFF.

\$54⁹⁵

In U. S. A.
Saw Only

Cross Cutting
Lumber



CUTS EVERYTHING FROM WOOD TO STEEL

Used as a hand saw, the Model 60 Mall Saw cuts all kinds of materials, grooves mortar joints, scores tile and other compositions. When set in its sturdy, all-metal table stand, it serves as a table saw—complete with rip fence and miter guide. Other available attachments equip it as a shaper, sander, grinder or wire brush.



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Concrete

\$32⁵⁰

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As a Table Saw

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\$17⁵⁰

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1/4" HOBBYIST

Mall Drill
MULTI-TOOL

**EASILY CONVERTED
TO 10 OTHER TOOLS**

Takes the work out of drilling in wood, metal or plastics, sanding, wire brushing, grinding, rotary filing, sawing wood or metal, countersinking, shearing metal and hole sawing. Special stand converts it to a drill press. A 1/2" Model is also available.



Sanding

See Classified Telephone Directory for dealer nearest you.
FREE Booklet "Mall Portable Power Tools" mailed upon request.
Write TODAY.

MALL TOOL COMPANY

7805 South Chicago Avenue Chicago 19, Illinois

School for Fishermen

(Continued from page 119)

minnows and some plugs are excellent for walleyes and may snare bass or northern pike. Bass often prefer surface lures that make a splash, but may strike at spinners. The popular live frog on a weedless hook cast in shallow water is hard to beat in early summer. Spinner combinations with pork strips and live minnows work well with most game fish.

Fly-fishing is an art in itself. Although flies will lure most game fish, they are most frequently used for trout, which is the wariest of all game fish and the hardest to fool.

Cork and feather lures on a fly rod will often catch surface-feeding crappies in the late evening. Outside of weed beds where the water drops deeper, grasshoppers on a snelled hook are irresistible to sunfish.

Fishing is mainly an attempt to fool the fish into thinking a lure is something to eat. If he's not hungry he won't bite. Fish also have perverse personalities and will ignore your most enticing lure. The largest fish in the lake may pass up your luscious minnow-spinner combination and proceed to take your small son's worm at the other end of the boat. Then you can use the time-worn excuse—just shrug and call it luck. For luck does play an important part in fishing. If it were not for the chance that you might catch the largest fish of your life, most of the thrill would be removed from angling.

"Forest" Moved by Air

Airplanes have moved an entire "forest" in a project to develop pine woodlands in Iceland. The country is without forests at present. Recently 65,000 two-year-old pine and fir trees, cultivated in Norway, were flown to Iceland, where they were planted. As a result of similar plantings in Norway years ago, the northern part of that country has large areas covered by valuable forests.

ANSWERS TO CAR QUIZ

- | | |
|---------------------------------------|---------------------------|
| 1. Cadillac | 11. Crosley Station Sedan |
| 2. Oldsmobile | 12. Chrysler |
| 3. Nash | 13. Chevrolet |
| 4. Buick | 14. Studebaker |
| 5. Dodge | 15. Packard |
| 6. Plymouth | 16. Lincoln |
| 7. Willys-Overland Jeep Station Sedan | 17. Hudson |
| 8. Frazer | 18. Mercury |
| 9. Kaiser | 19. Pontiac |
| 10. Davis | 20. Ford |



INCH BY INCH... MILE AFTER MILE

It's PLYMOUTH for Roomy, Pillowed Riding Ease

The big, roomy Plymouth won't knock your hat off. And even for the lanky, there's legroom to spare.

This low-priced car is engineered to give you extra inches where inches do the most good. But Plymouth's great ride comes from more than space to move around in. It's an *Air-Pillow Ride*—comfort built into mile after mile.

Seats are chair-height—so a man can sit up like a man. And you literally ride on air when you ride on Airfoam Seat Cushions, available on

Special De Luxe Plymouths at moderate additional cost. Millions of tiny air pillows give to your slightest body pressure, mold themselves to you for restful support.

You ride *between* the axles, not over them. That's a comfort difference. Bigger, fatter Super-Cushion Tires, standard equipment on Plymouth, soak

up road shocks from sides and below. The longest wheelbase in its price field makes for a still more level ride.

These are only a few of the dozen and more Plymouth features that speak up for a great ride—and a great car. There is a difference in low-priced cars, and Plymouth makes the difference.

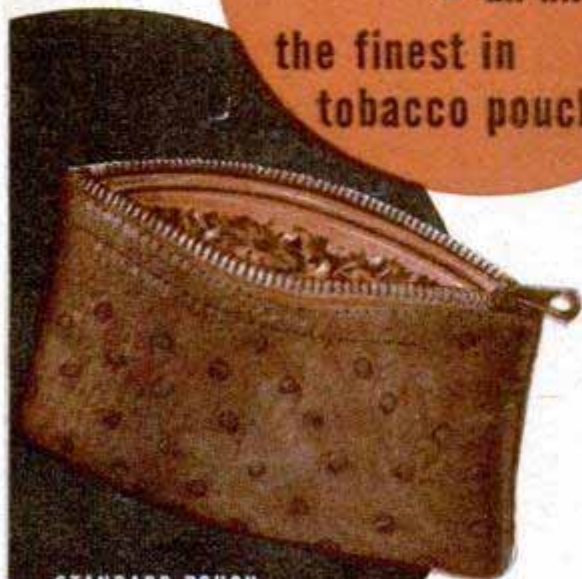


PLYMOUTH BUILDS GREAT CARS . . . GOOD SERVICE KEEPS THEM GREAT. Your nearby Plymouth dealer will provide the service and factory-engineered parts to keep your present car in good condition while you're waiting for your new Plymouth. PLYMOUTH Division of CHRYSLER CORPORATION, Detroit 31, Michigan

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of fresh tobacco

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Air-tite®

the finest in
tobacco pouches



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Choice of leathers . . . \$2.50 to \$20
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The Rogers Air-tite® with its patented inner pouch of moulded, seamless rubber, protects freshness and flavor. Exquisitely made of fine leathers in a variety of models, by Rogers craftsmen. The largest-selling tobacco pouch made. At better shops everywhere.

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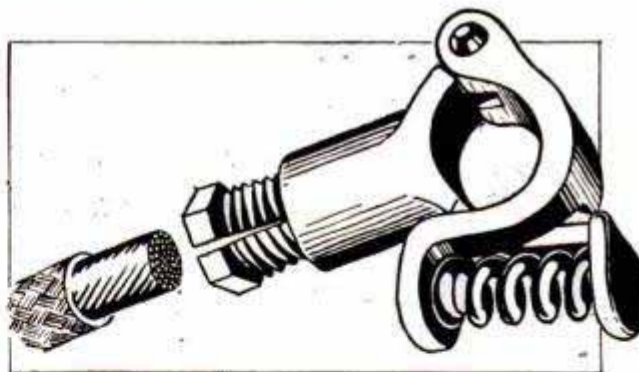
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Rogers Air-tite Pouches in Canada—G. T. Lanning Ltd., Toronto

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**Colored Slides Projected on Screen
To Illustrate Children's Records**

Synchronized with a story being told by a children's record, colored slides are projected on a translucent screen built into the record player. There are 17 pictures on the strip and they are changed every 11 seconds by means of a cardboard guide that tracks with the needle. A projector head, mounted at one corner of the phonograph, flashes the slide on the screen by means of a lens and mirrors. Popular story records have been illustrated on strips for use with the instrument.



Boltless Battery-Cable Terminal

Battery-cable terminals slip on and off without sticking when they are of a new spring-clamp type that has no troublesome tightening bolt. Two sections of the aluminum terminal are held tightly around the battery post by a 122-pound-pressure steel spring, cadmium plated to resist corrosion. To connect or disconnect the terminal, you merely compress the spring with pliers, loosening it from the post.

☐ To keep it from being flooded, the average anthracite mine pumps out approximately 13 tons of water for every ton of coal that is mined.

CHOOSE YOUR FUTURE!

Select the kind of technical training YOU want... earn GOOD PAY WHILE YOU LEARN

As you may know, the more than 60 courses offered by the U. S. Army Technical Schools are rated among the finest in the world. And now you can choose the kind of technical training you want—before you enlist.

Here's how it works. You select two of the several fields of interest. Then you pick two specialty courses in each of these fields. The Army checks to make sure there's an opening in one of the four courses you have selected, and a place is reserved for you. Then you en-

list, complete basic training, and attend the course you have selected.

You start drawing pay the day you enlist. And in today's expanding Army, there's plenty of room for rapid advancement. You can get ahead *fast!*

If you've graduated from high school and are 18 to 34 (17 with parents' permission), here's the greatest educational opportunity you could hope to find! Begin your career now... while you can choose your future! See your Recruiting Station... today!

Here are only SOME of the COURSES AVAILABLE!

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Automotive Mechanic
Medical Equipment Mechanic
Locomotive Repairman
Construction Equipment Mechanic
Refrigeration Mechanic

Office Machine Service Man
Marine Engine Mechanic
Track Vehicle Mechanic

CONSTRUCTION

Electrician
Water Supply Technician
Construction Machine Operator
Boilermaker
Ship Carpenter

CRAFTS

Sheet-metal Worker
Leather and Canvas Worker
Tire Rebuilder
Tailor Shoe Repairman

ELECTRICAL and RADIO

Cable Splicer
Telephone and Telegraph Installer Repairman

Telephone Central Office Repairman
Automatic Telephone System Maintenance Man
Power Generator Man
Teletype Repairman

SCIENTIFIC—MEDICAL—TECHNICAL

Surgical Technician
Medical Technician

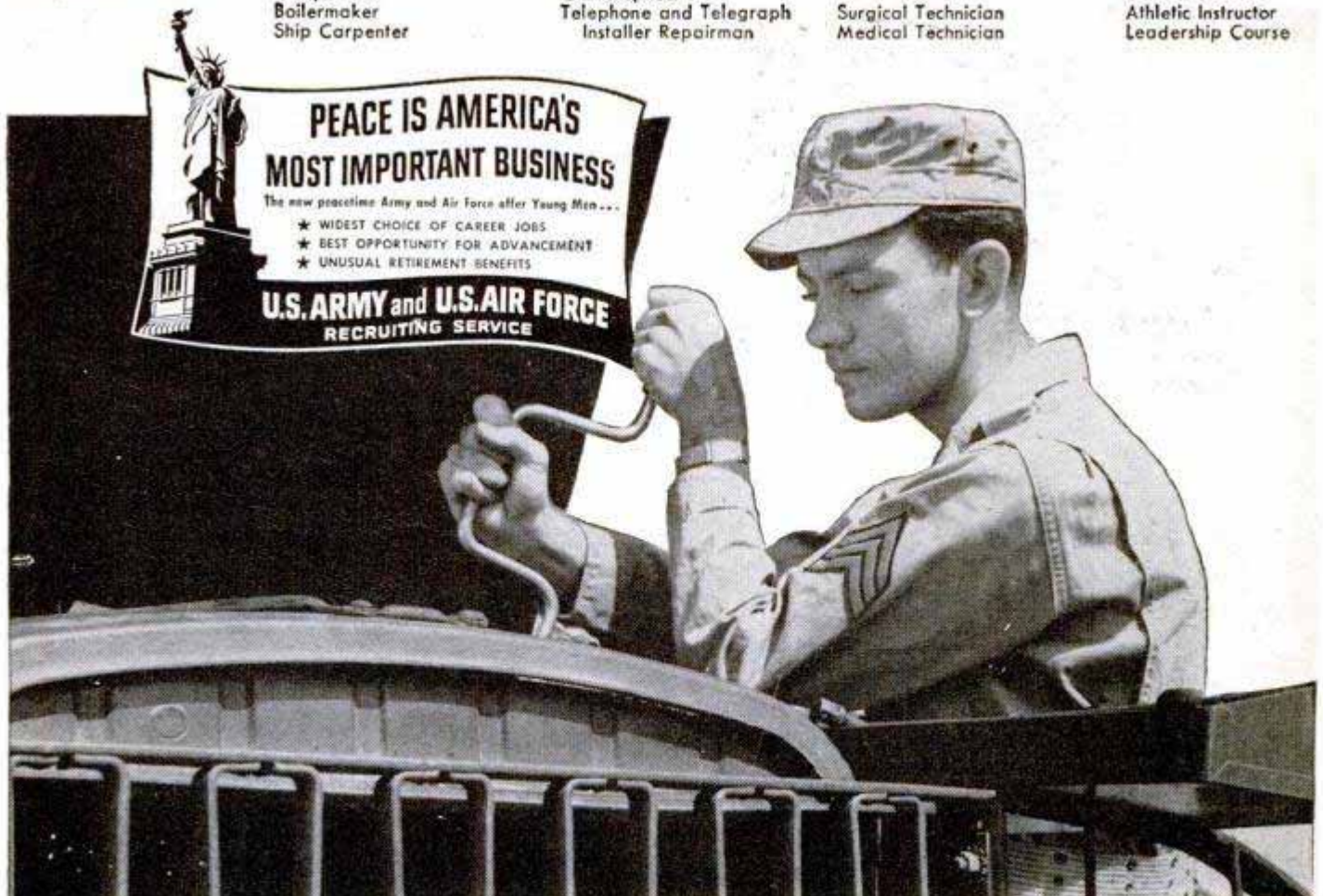
Medical Aid Man
Map Reproduction

PRECISION TOOL

Watch Repairman
Fire Control Instrument Repairman

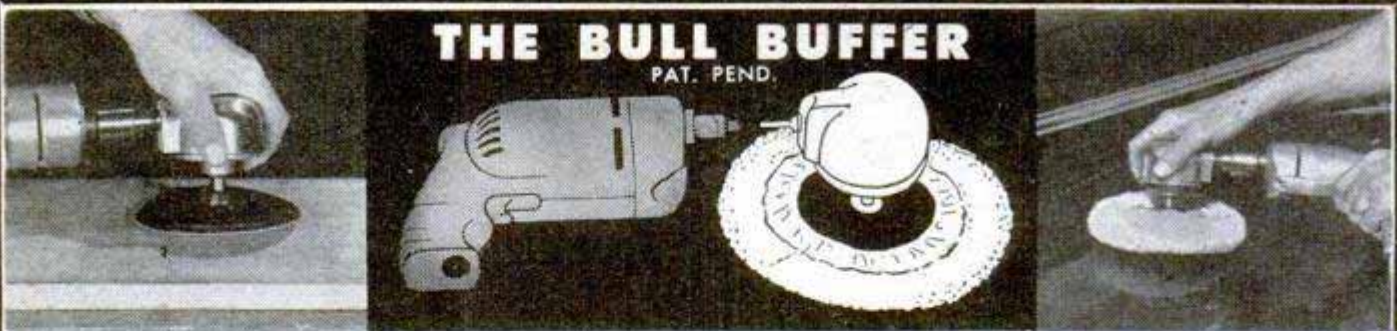
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PAT. PEND.



You polish and sand faster, easier—do beautiful, professional work—with this amazing new attachment for your hand drill. And it more than pays for itself the very first time you polish and sand your car, floors, woodwork, furniture. The Bull Buffer fits any chuck on an electric drill

(or flexible shaft). It's the only buffer you can turn in a complete circle while you hold your hand drill stationary. Reaches all curved and flat surfaces. It's packed with power, built of lifetime materials and guaranteed.

If your dealer doesn't stock, send cash, check, or money order for your Bull Buffer, complete as pictured below..... **\$9.95**

ORDER THESE ACCESSORIES FOR YOUR BULL BUFFER:



Cup wire brush attachment for removing paint, rust, scale, etc. **\$1.75**



Jacobs key chuck increases 1/4" drill to 1/2" capacity—reduces speed, increases power. **\$5.00**

- Bull Buffer car cleaner \$.50
- Bull Buffer car polish 1.00
- Extra sheepskin bonnet 1.25
- Extra sanding discs (000-00-0-1-2 1/2-3-4) .. .10
- 1/2" Jacobs No. 6425 key chuck (see photo) .. 5.00
- 2 1/2" cup wire brush (see photo) 1.75



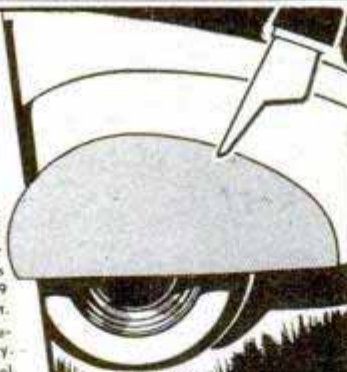
Bull Buffer comes complete with 5-inch rubber disc, sheepskin bonnet, and 2 sanding discs, only **\$9.95**.

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Install these "heavy steel" prime finished fender skirts yourself—and pocket a "substantial savings." Your car will have that "new look!" Hooks on in a jiffy to any 1935 to 1949 model of the cars listed at the right. Enclose money order—or \$5.00 deposit, and pay balance on delivery. Specify car make, year and model. DEALERS WANTED.

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Heavy malleable iron. Tail fits face plate slot. Standard Dog has square head screw. Safety Dog has headless screw. Prices are for either style.



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	1-3/4"	1.65	1-1/2"	1.45
	2"	1.80	* 13-inch or larger lathes.	
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MAKE \$ MORE MONEY

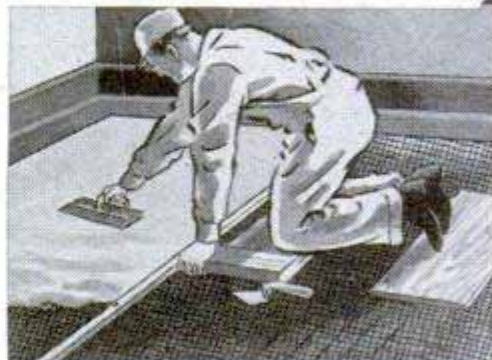
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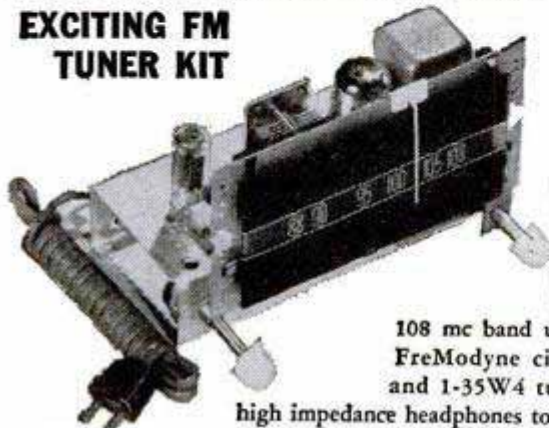
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Tube kit \$2.46

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SPECIAL BURNING PENCIL

6 in 1 electric tool. Easy to use. Ideal for personal marking and decorative burning of wood, leather, velvet, cork. Embosses foil. Forms plastic. 6 brass tips are interchangeable. Complete kit - pencil, plastic, cork insulated grip, 6 colors of metal foil, emery cloth, and instructions. **\$1.95**

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RUGGED SELENIUM RECTIFIER

May be used to replace 117Z6, 117Z3, OY4, and other rectifier tubes and socket in AC-DC battery type portable radios, intercoms, etc. Peak inverse V. 380 V; 100 milliamps max. 1 1/4" square x 11/16" high. Amazing value. **75c**



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Without wires, lets you broadcast through your own radio. Simply turn on radio and tune to any clear channel between 1250 and 1700 KC. For home, office, restaurants, nurseries. New low price. **\$5.98**
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Alnico V Permanent Magnet Dynamic Speaker. 1" voice coil with 6-8 ohm impedance. 14-18 W. capacity. Dust proof construction. Ideal for fine FM reception, public address work, etc. An unbeatable value, limited quantity. **\$5.95**

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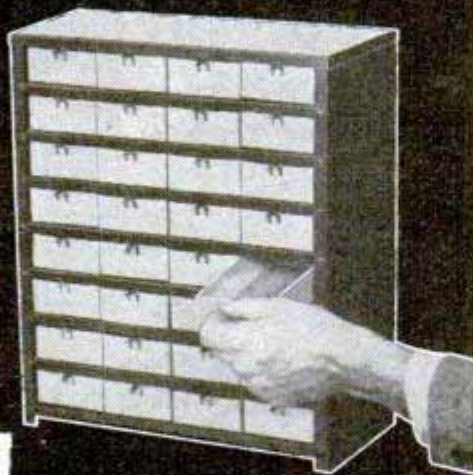
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for home or shop,
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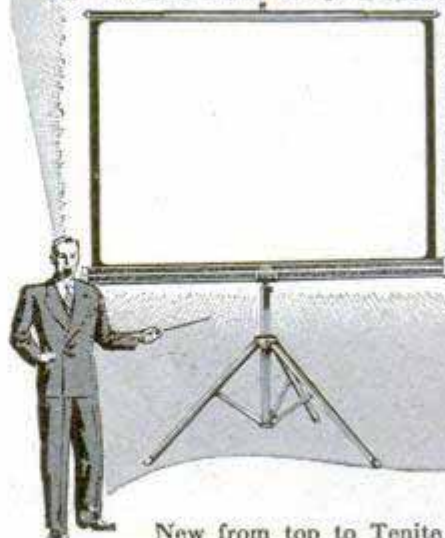
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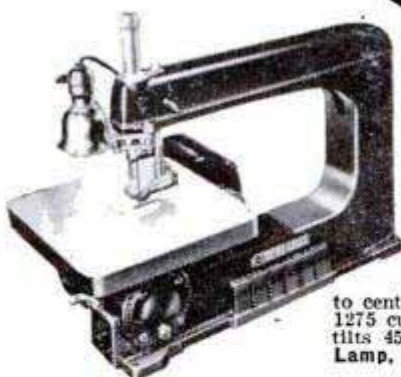
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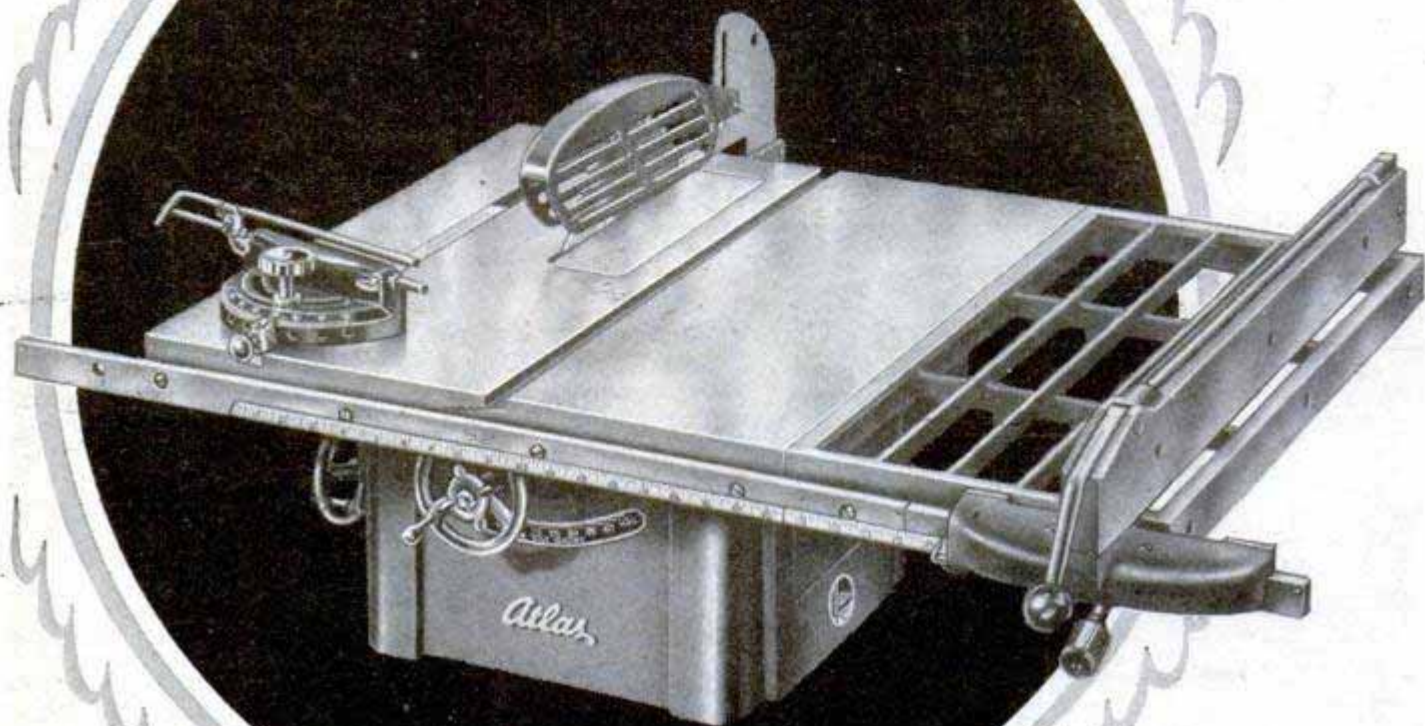
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No. 3060 (no extensions) is 25" deep, 22" wide. Gives you 12 $\frac{3}{4}$ " surface ahead of blade — 13 $\frac{3}{4}$ " to right of blade.

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No. 3080 (two extensions) is 25" deep, 45 $\frac{1}{2}$ " wide. 12 $\frac{3}{4}$ " surface ahead — 25 $\frac{1}{2}$ " right — 19 $\frac{3}{4}$ " left of blade.

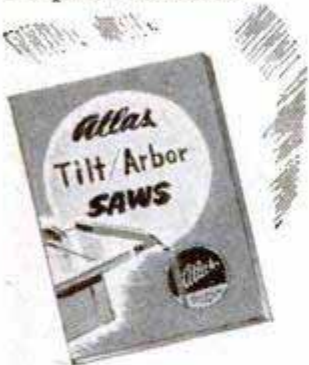
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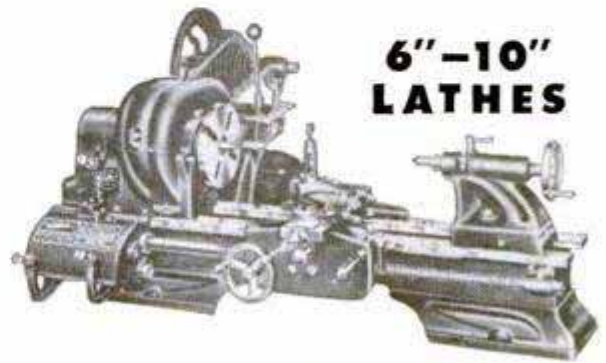
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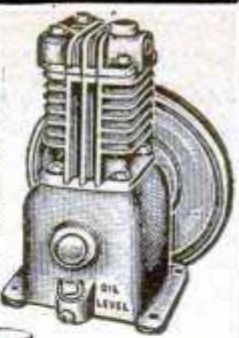
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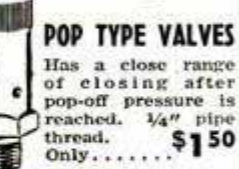
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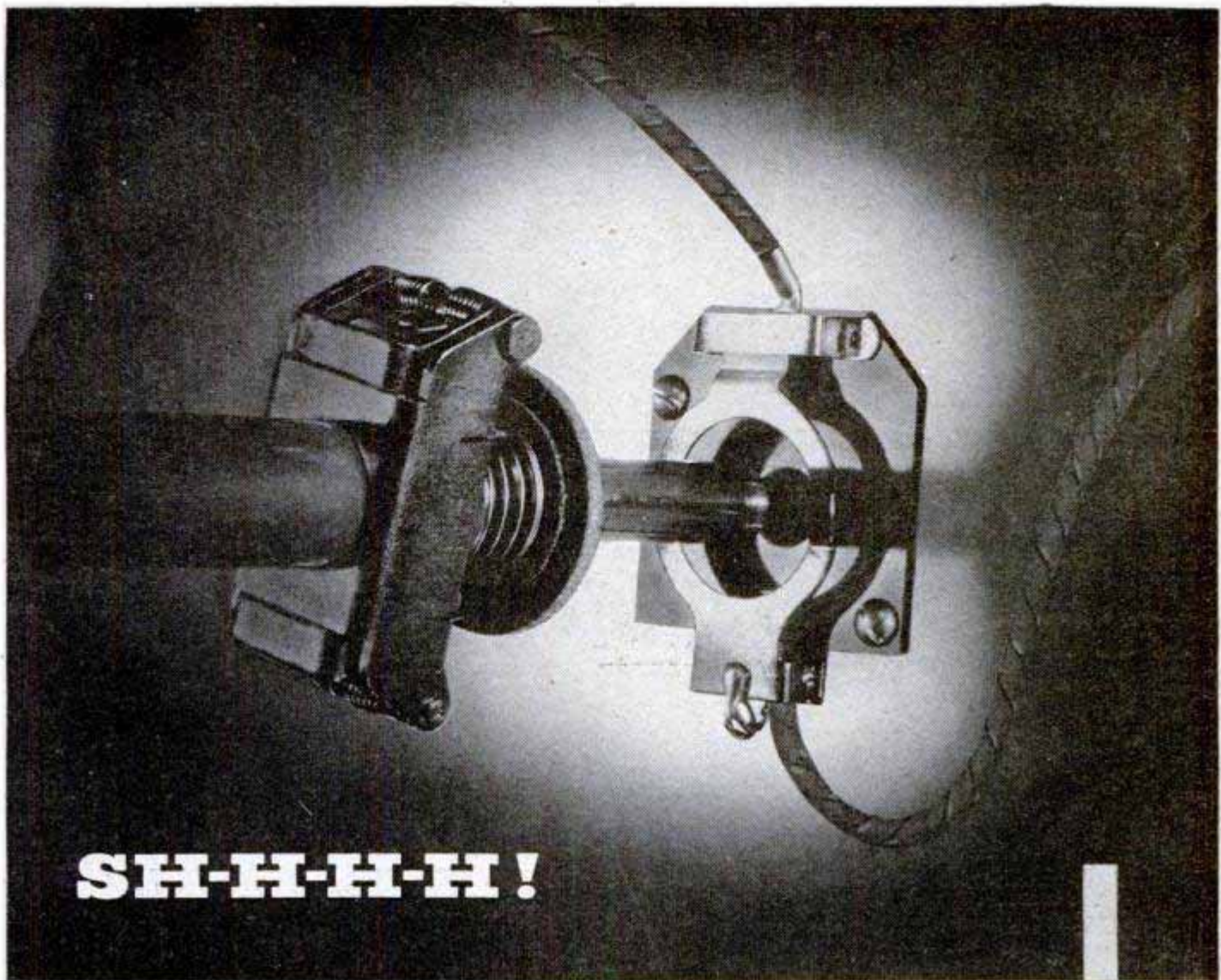
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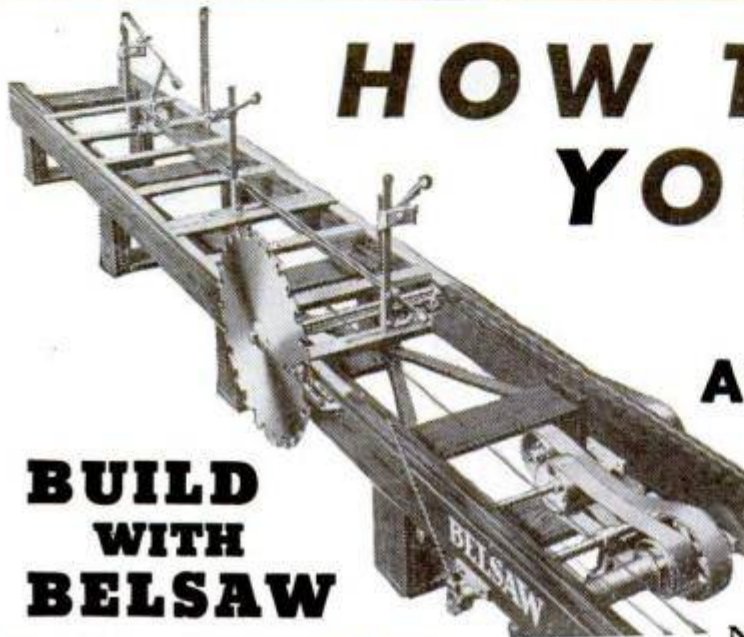
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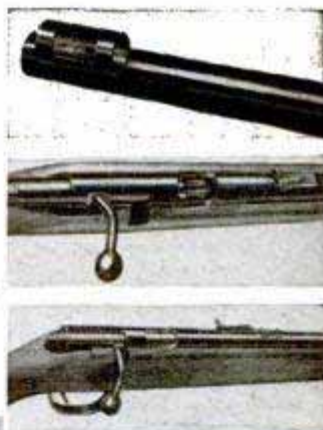


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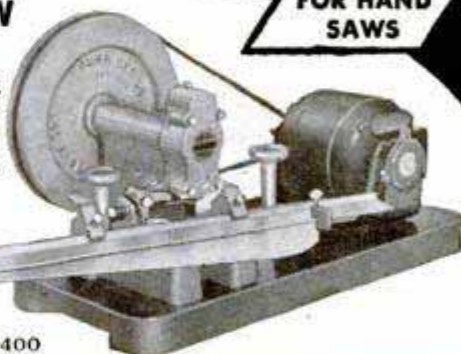
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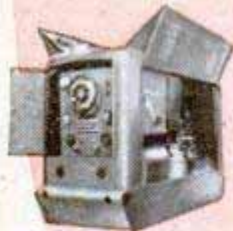


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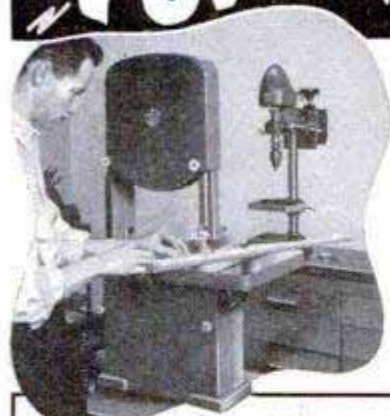
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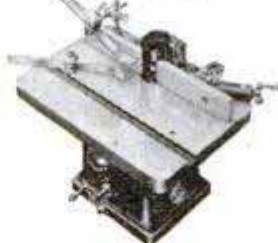
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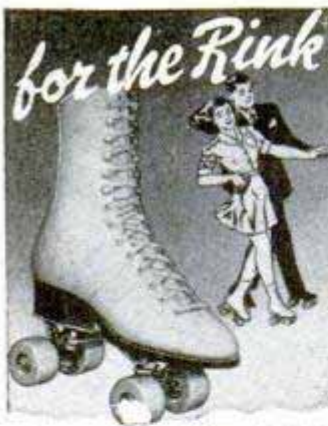
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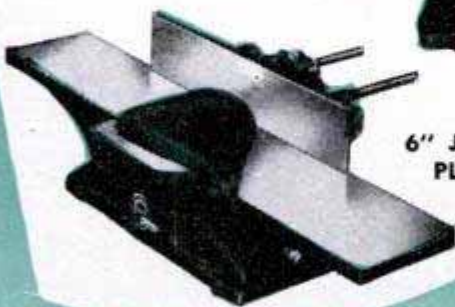
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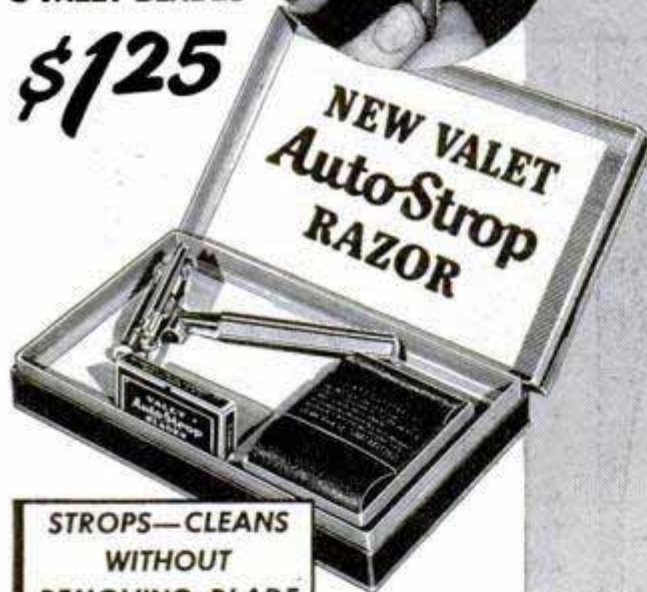
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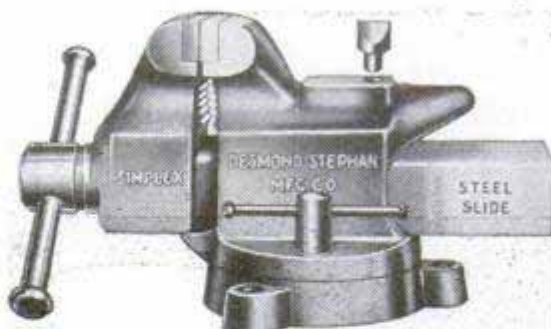


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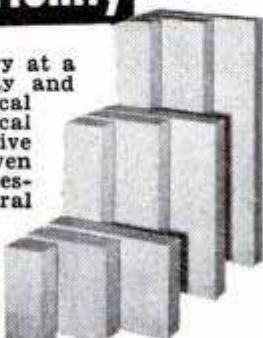
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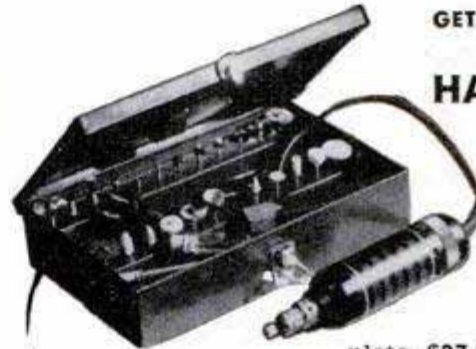
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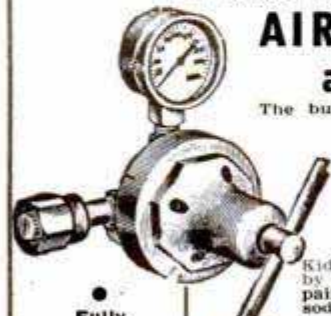
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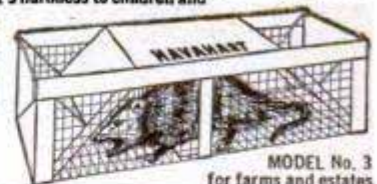
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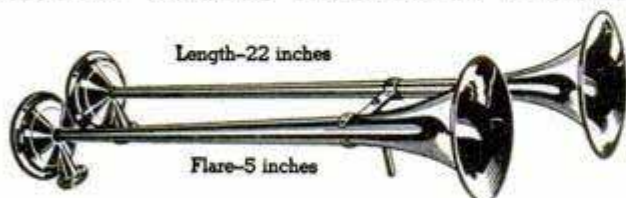
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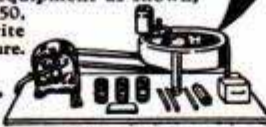
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Test your wits and your hands. You can earn big money if you design a new or different motor driven toy, powered by the mighty MINI MOTOR.

The manufacturer of the MINI MOTOR (also the famous "75" water pistol and "500" machine water gun) offers you a 5% royalty for the rest of your life on all sales of your "brain-child," if it is manufacturable.

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Fill in the coupon below and mail it with your check or money order for \$2. You will receive your motor by return mail with full instructions and suggestions to help you get started in this toy award plan, and also a contract for your protection. Nationally known engineers and scientists will judge the designs. Don't tell us your ideas until you receive your contract.

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Do it yourself, or ask your service man.



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New ARMY MINE DETECTOR

AN/PMS-1 is a portable device for detecting Metallic and Non-metallic objects. You can use them to ferret out all kinds of Buried-Treasures, in the Mountains or on the Beaches. Its private use suggests the following: In the hills or mountains, all types of Metals and Non-metals; on the beaches any type of objects such as jewelry and coins. For commercial use such as tracing buried cable, wire and sewer tile. Locating buried metal or wooden boundary stakes, etc.

TECHNICAL FEATURES:

This unit actually is a Ultra high Frequency transmitter. A variation in radiance resistance, caused by any change in soil density, shows in a deflection of the Microammeter, discriminating between Metallic or Non-metallic objects by a swing to the right or left. Audio response in the Headset also indicates changes by an increase or decrease in the volume of the 1000 cycle tone. By lengthening dipole rods operator will be able to increase the depth sensitivity.

This unit comes complete with spare tubes, antenna, dipole and reflector, and instructions manual, in wooden chest 9 1/2" height x 28 1/4" length x 15 1/2" depth. Weight in operation is only 22 lbs. I.B.S.S. Batteries. Power supply: Three 45 volt and one 6 volt batteries. Uses standard batteries. Original COST \$285.00. Shipping Weight appr. 80 lbs. F. O. B., N. Y.

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with battery
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**Every home needs these
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Not only the home craftsman, model maker and mechanic, but everyone with a home, a car or a hobby needs a SpeedWay Combo Kit.

Here are the basic power tools needed wherever things are made, installed or repaired. No. 69 SpeedWay 1/4" Drill, with attachments for sanding and polishing

A No. 129 SpeedWay Hand Grinder, that takes all arbor-mounted grinding wheels, rotary files, cutters and brushes, and accessories as shown (left)

With this kit you can drill holes up to 1/4" diameter, can grind, cut and shape steel, brass, wood, plastics, bone, etc. Tedious jobs like sand-papering, polishing and filing, scraping off rust, etc., actually become fun.

Designed and built by SpeedWay—manufacturers of quality power tools for over 40 years. These are not toys but capable electric tools with lots of power and correct operating speeds.

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Write for *FREE* descriptive circular and the name of your nearest dealer.

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Powerful 1/4" Capacity Electric Drill—drills holes in steel or wood. Quality drill bit included.



with adapter, rubber backer and abrasive discs, it makes a portable power sander. (Adapter backer and 10 assorted abrasive discs included)



with the slip-on lamb's wool bonnet, it is a portable power-driven polisher or buffer.



Snapped in the chromium plated Speed Stand, it becomes a horizontal drill stand, bench sander or polishing head.



High-Speed Hand Grinder (20 000 R P M)—For all mounted cutting burrs (for cutting steel, wood, bone, plastics), grinding stones, brushes and abrasive discs. Seven assorted accessories plus 1/8" and 3/32" collets included.



Instruction Manuals—easy-to-follow guides to year 'round fun and useful pleasure with your Combo-Kit.

Note: The tools in the Combo-Kit operate on either 110-120 V AC or DC current.



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\$35⁰⁰



Flex-O-Shaft is an improved all-purpose machine for homes, schools, shops, or factories. The slender, light-weight aluminum hand piece is ideal for grinding, drilling, sawing, buffing, scoring, etching, polishing, and scores of other uses. There is no bulky, throbbing, pulling motor in your hand. The light-weight motor can hang on the wall, or can be set down on working table. Speed is controlled by foot-operated rheostat, leaving hands free. This precision ball-bearing tool is as easily guided as a pen, speeding up operation because of ease in handling. It is a wonderful, compact, power house for making all kinds of objects. This unit consisting of Flex-O-Shaft with 6-ft. cord, 1/16 H. P. Motor, Rheostat with cord and plug, all for \$35.00. Send for complete information today! Use coupon below.

Flex-O-Shaft
and complete
Tool Kit with
66 accessories
only

\$50⁰⁰



FLEX-O-SHAFT SALES CO. (Dept. C)
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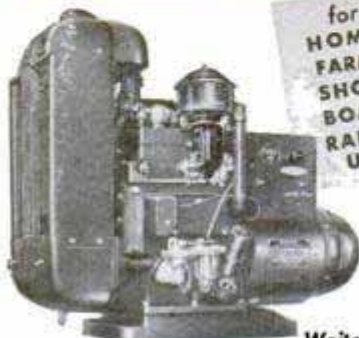
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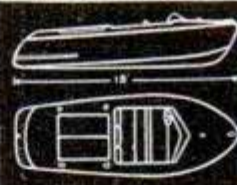
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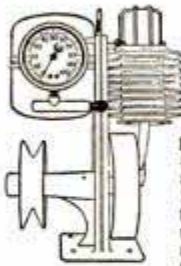
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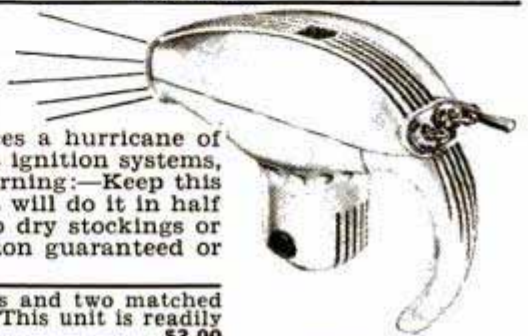
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Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch, natural grip handle, and balance like a six shooter. Precision cut gears—turbine type cooling blower—extra long brushes. No stalling under heaviest pressure because of powerful 110 Volt AC or DC motor and multiple ball bearing thrust. Other bearings self-aligning lifetime-lubricated Oilite type. Made for toughest year-in and year-out service in plant or on construction jobs. Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use.

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ALUMINUM GEAR BOX 18x8x7 that contains two powerful electric motors and two matched gear trains. 62 gears in all varying in size from 1/2 to 4 inches in diameter. This unit is readily converted to rotate a beam antenna or for any other similar use..... \$3.00

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This analyzer, featuring a sensitive repulsion type meter housed in a bakelite case, represents the culmination of 15 years achievement in the instrument field by a large company specializing in electronic test equipment.

Specifications of the AC-DC Model Volt-Ohm-Milliammeter:

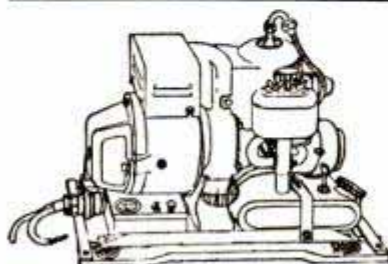
AC Volts—0-25,50,125,250
DC Volts—0-25,50,125,250
Milliamperes AC—0 to 50
DC Milliamperes—0 to 50
Ohms Full Scale—100,000
Ohms Center Scale—2400
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Total Price, prepaid anywhere in the USA—\$7.00
Similar DC Meter, lacking the AC operated ranges of above, \$5.50 prepaid.

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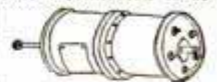
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Latest supersensitive type with rubber earpieces. Every pair guaranteed perfect, \$5.99 per pair OR 3 PAIRS FOR \$16.00.

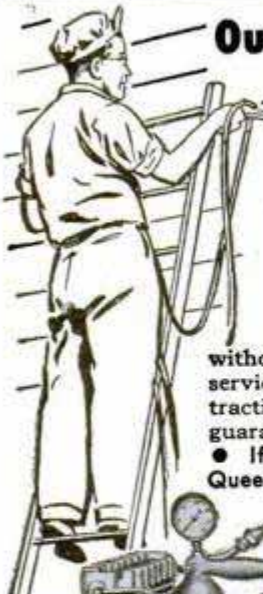
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ORDER NOW—DON'T DELAY—NO C.O.D.s

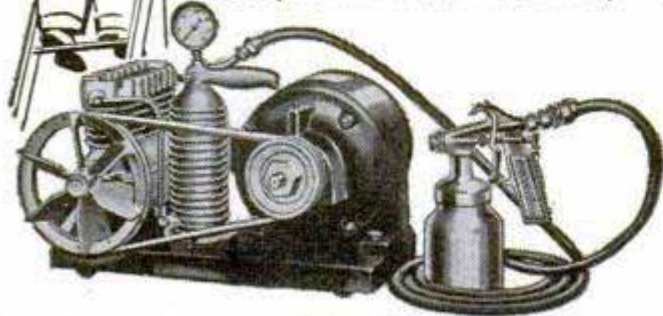
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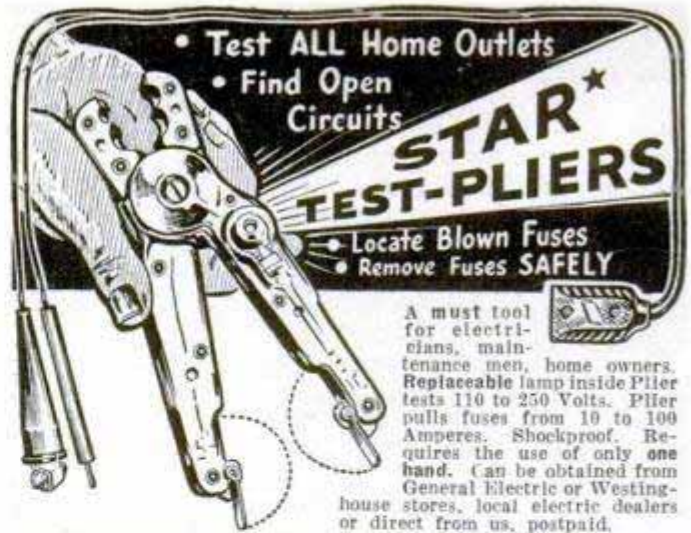
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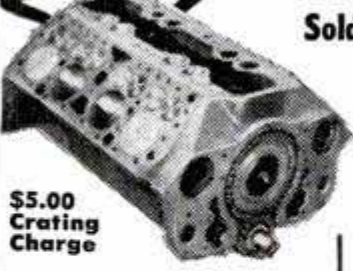


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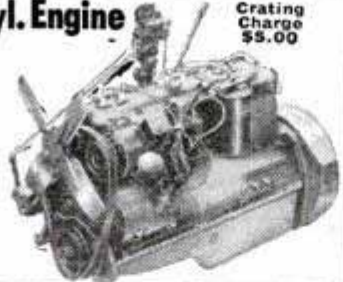
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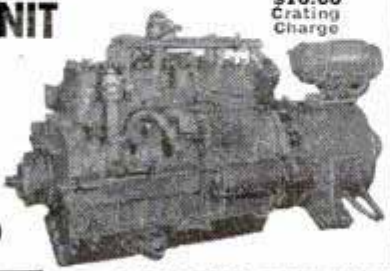


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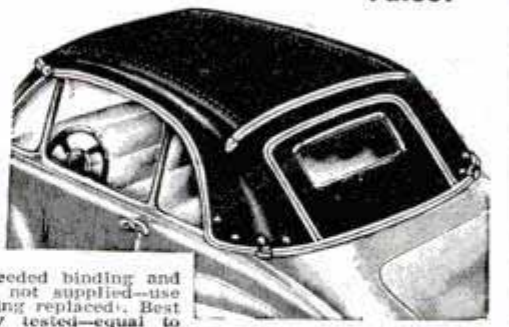
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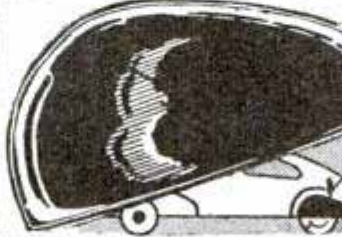
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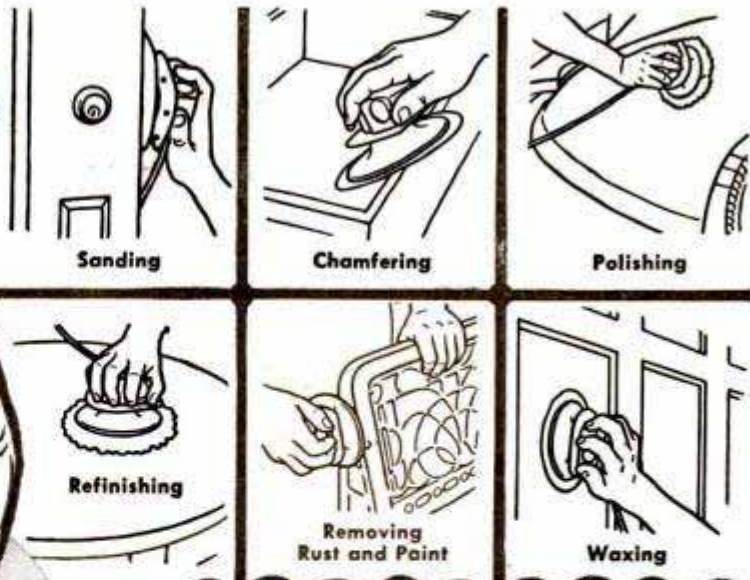
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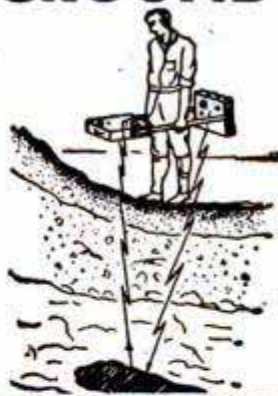
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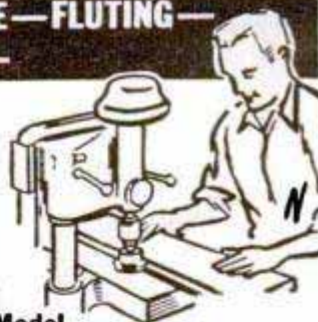
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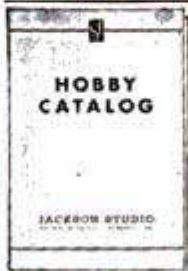


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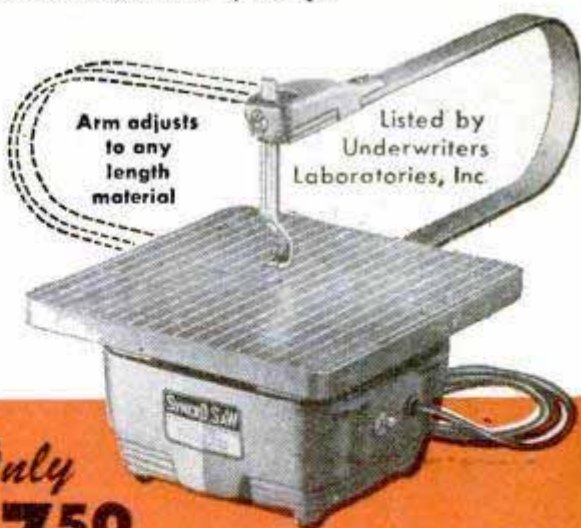
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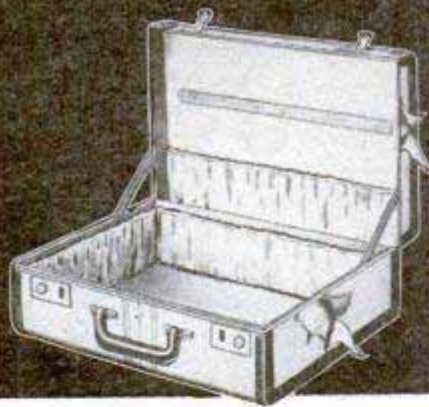
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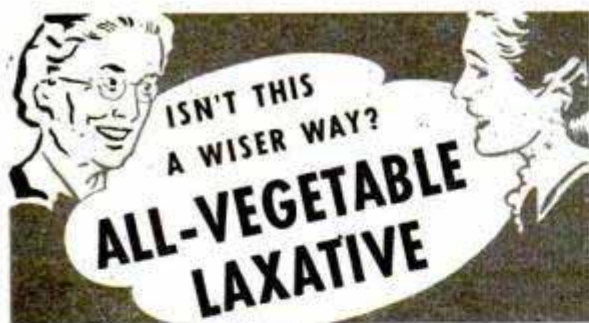
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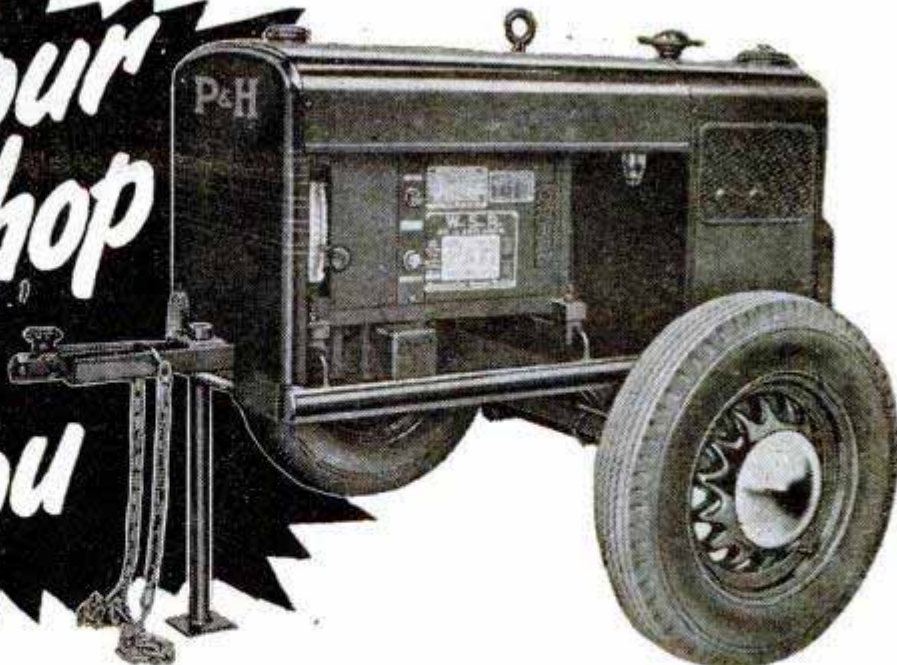
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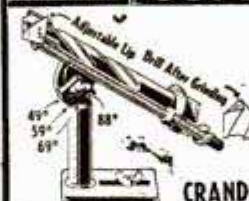
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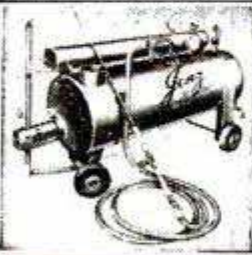
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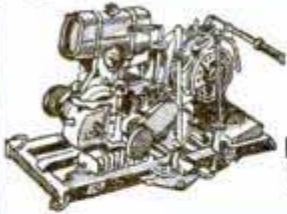
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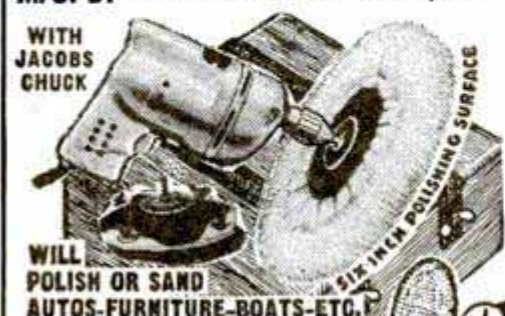
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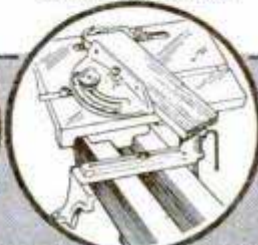
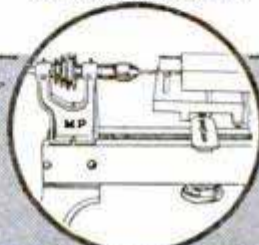
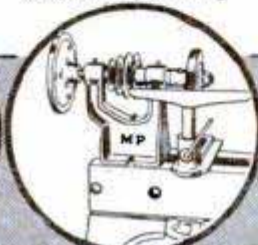
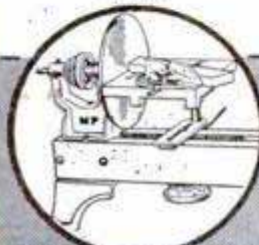
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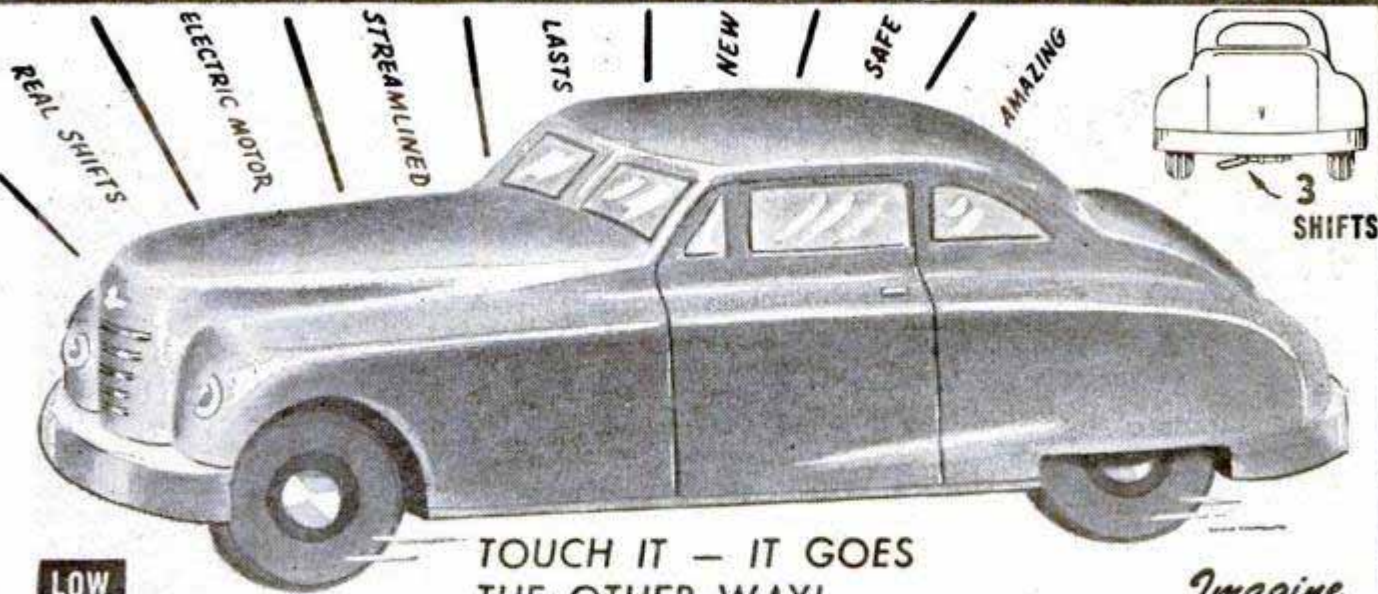
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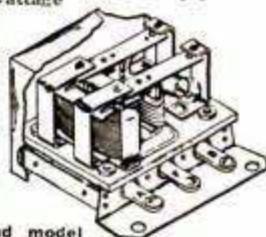
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7 3/16	8 1/2	Ball	5.50
6 3/8	7 5/8	Ball	5.50
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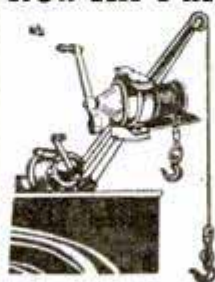
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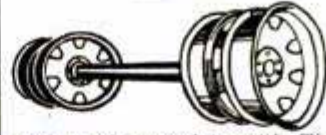
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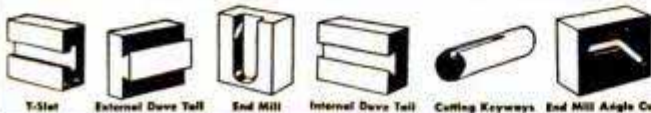
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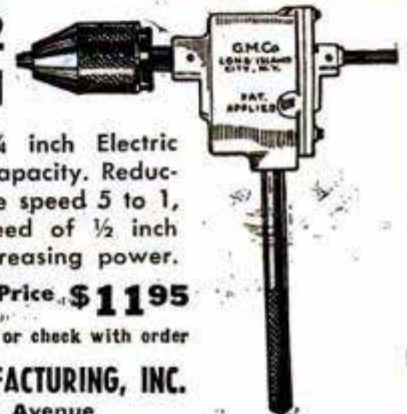
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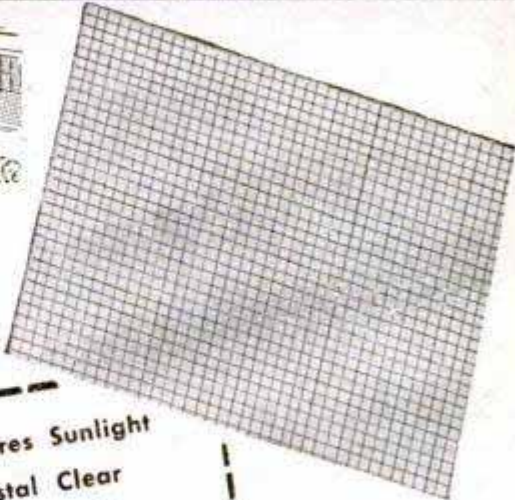
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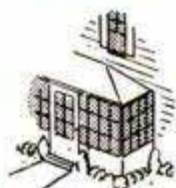


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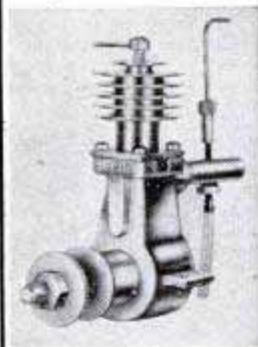
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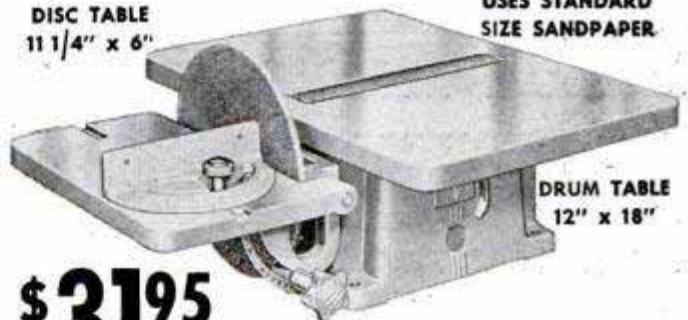
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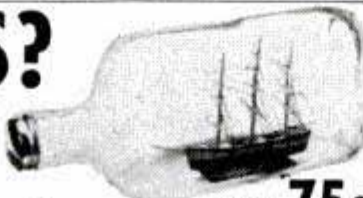
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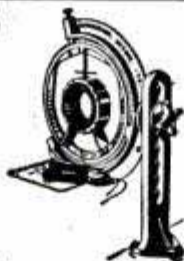
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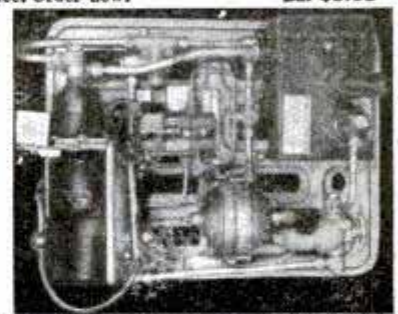
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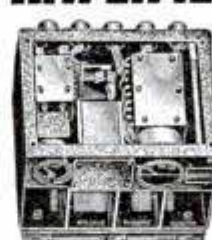
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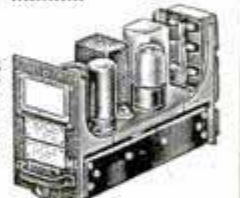
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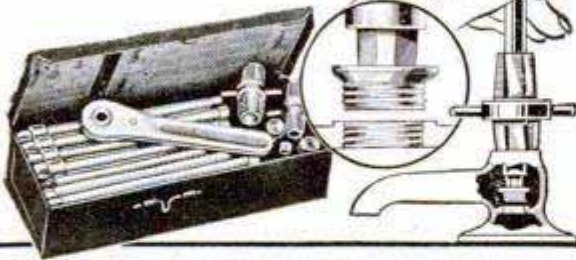
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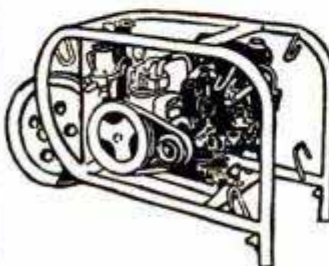
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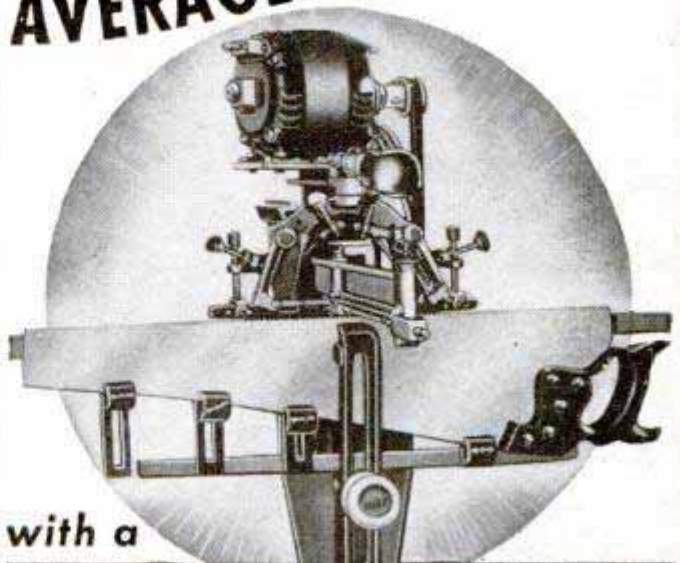
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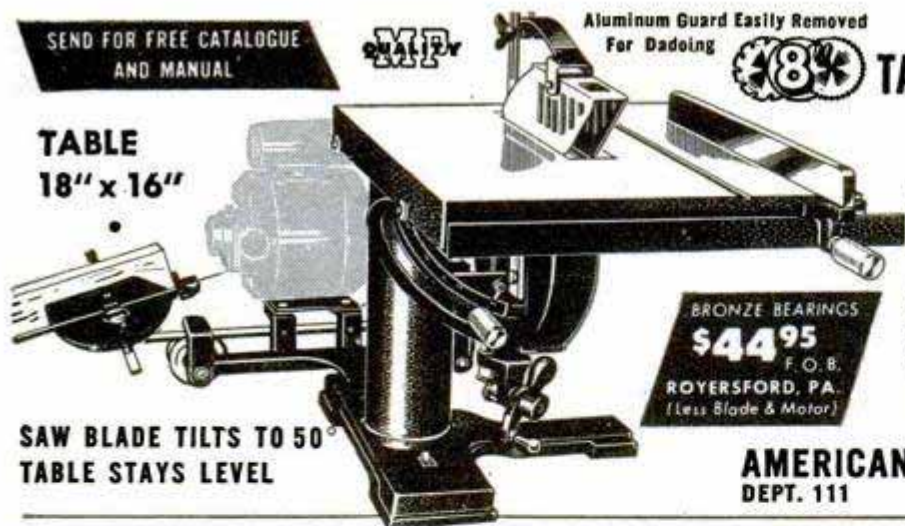
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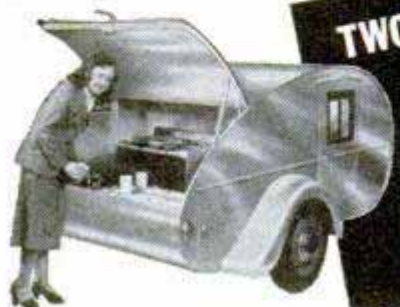
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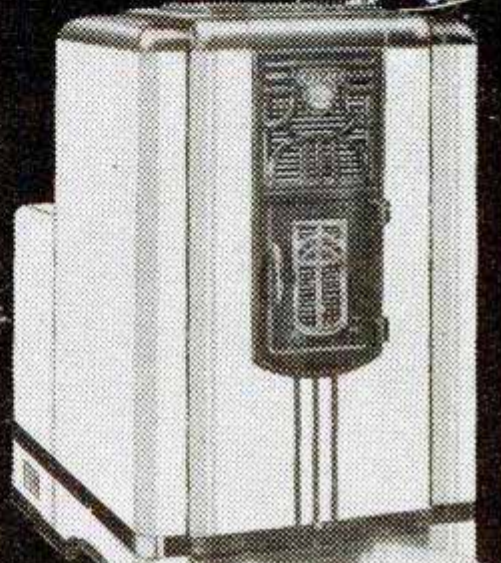
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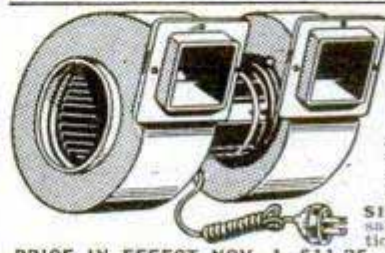
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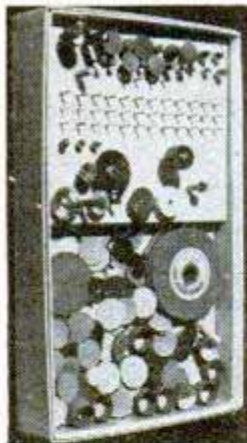
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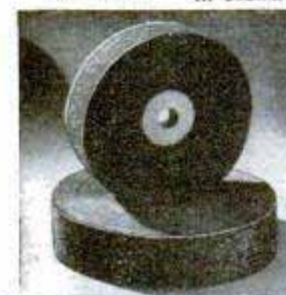
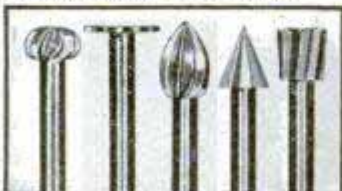
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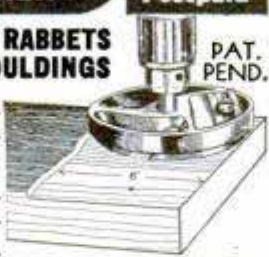
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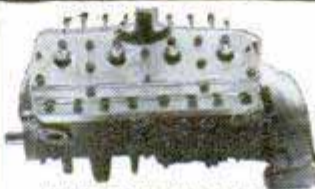
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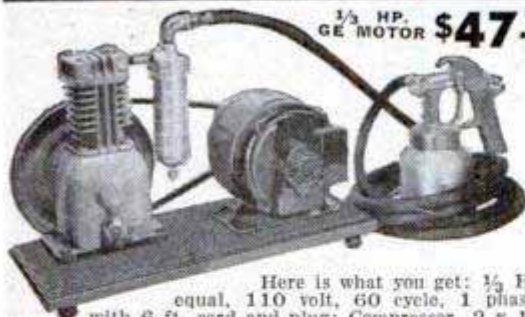
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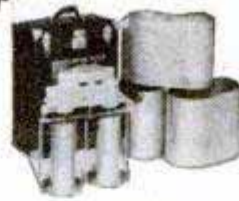


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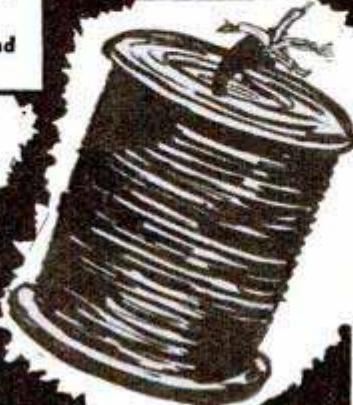
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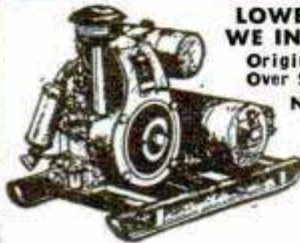


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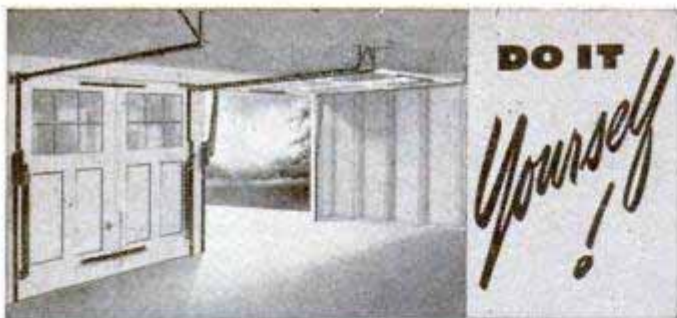
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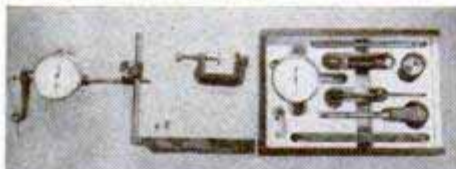
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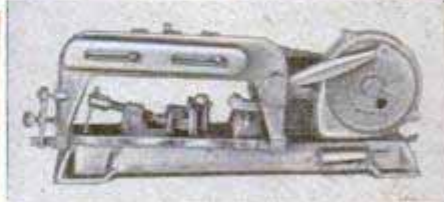


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6 H.P. GAS ENGINES NEW COST \$140.00
BRIGGS-STRATTON, BUSY BEE

World's Finest Gas Engines. Ideal size for garden tractors, pumps, sprayers, saws, etc. The buy of the year! Will not be duplicated.

- Briggs Model ZZ-6.5 h.p. Fully reconditioned... \$86.80
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- Busy Bee, 6.5 h.p. gas engine (a real unit) Brand new... \$82.90



ONLY \$86.80
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ROTARY GEAR PUMP
PRECISION BUILT ORIGINAL PRICE \$24.00



Precision pump made for B-29s, 4" x 8" size, 1/2" shaft. Mechanics say "Most versatile pump made." Useful for pumping liquids, vacuum, pressure; capacity to 3 g.p.m. Vacuum 29 in. Pressures to 200 lbs. Full instructions and operating data furnished with pump.

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Also brand new \$1200 Power Winch with 11 h.p. engine at \$186.50 for Kentucky. Will pay all freight up to \$15.00. Flexible steel tow line, 50' complete with hooks. \$2.95 Ppd. We guarantee customer satisfaction. Reference National Bank of Commerce. Order direct from ad or send for catalog. We accept checks.

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It's FREE

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GIL-BILT 12 Inch Band Saw

- Cuts to center of 24 in. circle
- Handles stock up to 6 in. thick
- 18x18 in. table tilts 45 degrees
- Each wheel turns on two heavy 5/8 in. flanged Oilite bearing
- Two blade guides. Each has self-lub. jaws and ball thrust bearings
- Choice of cast aluminum wheels or make-your-own wood wheels on metal hubs. Both have heavy rubber tires
- Takes all 78 in. blades up to 3 1/2 in. wide
- Upper wheel alignment mechanism of cast aluminum, completely assembled

GIL-BILT 8 Inch Tilting Table Saw

- 21x27 in. table tilts full 45 degrees
- 8 in. blade cuts from 0 to 2 1/2 in.
- New Departure ball bearing arbor, precision, ready to run
- Graduated miter gauge, cast aluminum head mounted on 3/4x3/4 in. bar
- Self aligning rip fence guide
- Cast aluminum, ready to install

GIL-BILT Build-It-Yourself Features

- Sturdy wood, steel and aluminum construction
- No machining—build easily with hand tools
- No blueprint reading. Pictorial type plans, full scale patterns

GIL-BILT Step-By-Step Plans, simplified pictorial type drawings, actual photographs, full size patterns. Plans for either of above tools... \$1.00

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Same kit with 8 inch combination blade... \$19.90

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Same kit with two 12 in. cast aluminum wheels... \$20.95

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BUILD YOUR OWN POWER TOOLS

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FOR **FALL** COLOR SHOTS



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NEW  **EXPOSURE METER**

Gives correct exposure . . . helps your camera capture the full beauty of autumn color. Exclusive Trident Analyzer. Measures reflected or incident light. And it's so easy to use. Type PR-1, **\$32.50***. General Electric Company, Schenectady 5, N. Y.

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FOOTBALL SCORE BOARD

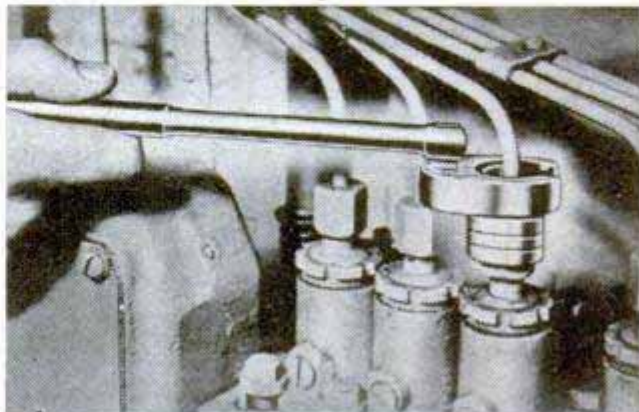
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Follow all the thrill-packed action! Keep the facts at your fingertips . . . score, downs, gains, losses, position of ball on field. Not a mere toy—useful and practical. 6½ inches long. Durable, long-lasting—use again and again. Tear out this ad, write your name and address in the margin, mail with twenty-five cents to **ALBERT RICHARD SPORTSWEAR, 1659 S. Second St., Milwaukee 4, Wis.**

ONLY 25¢ POSTPAID

Open-End Ratchet Wrench



Fittings around pipes, tubes, conduits and cables can be tightened or loosened easily with a ratchet wrench that has an open channel in the head and the sockets. The channel permits the head to pass over the pipe and then down on the fitting. The ratchet mechanism is inside the head, which operates in a 7½-degree arc or less. Available in most sizes, the open sockets can be purchased individually or in sets. With a small adapter, the wrench can be used with standard sockets.

Typewriter-Line Justifier

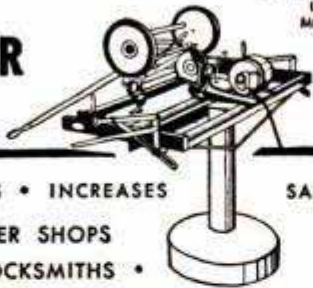
Typewritten copy with both margins justified is produced by an electric typewriter with a reel attachment. In the past, methods for aligning the right-hand margin of typewritten copy have required preliminary calculation by the typist or typing each line twice. In the new method the characters are typed on a reel of special paper tape made stretchable by fine creping. The operator then presses the tabular key and a gripper seizes one end of the paper strip while the carriage moves to the margin with the other end. The back of the tape is coated with adhesive and the line is glued to a sheet of paper in much the same way a telegram is formed. The method is effective for reproduction by photo-engraving, photo-offset and gravure.

Ⓞ Measuring 17 inches in circumference, a hailstone that fell at Potter, Neb., July 6, 1928, rates as the largest ever recorded in the world.

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THE MODERN LAWN MOWER SHARPENER

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\$241⁵⁰
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FOR LAWN MOWER SHOPS
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*Sharpens All Reel Type Mowers • Hand, Power or
Gang • 10 to 20 Minutes • No Dismantling
No Extra Attachments Needed*

All reel type mowers, from 5-inch edgers to 36-inch power mowers, are quickly sharpened to extreme ends of both left and right twist reel blades. Handle, wheels, roller and motor remain in place when sharpening is in process. Bed knife is sharpened in same brackets that hold mower in grinding position. No extra attachments required. One lever puts mower or bed knife in grinding position. 100% steel construction. Grinding head rides on five ball bearing races. Small, compact, easy to operate. Sharpens wood chisels, joiner knives and planer blades without extra attachments.

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60 CYCLE

2500 R.P.M. Minimum
— 2750 Max. — Start
90 V. — Runs Clockwise.
1 3/4" long by 2 3/4"
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\$2.95



AIRCRAFT GALLEY STOVES

Operates on 110 and 24 volts. Fine
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steam table, hot cup, and grille. New,
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Control for the auto-
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Hearing Aid for Cat

"Unfortunate" heard for the first time recently when the cat's owner, Mrs. A. H. Cooper of Fort Worth, Tex., had a hearing aid fitted to the feline. The hearing aid is the latest of a series of steps by Mrs. Cooper to improve the life of the unfortunate cat, which was born deaf, crippled in the hind legs and had no teeth until the age of two. The owner massaged the cat's gums until the teeth finally came through and had a wheeled support built which enables the cat to scoot around the house.

Mountain Eggs Lack Oxygen

Extra oxygen piped into incubators on high-altitude ranches produces more and healthier chicks, according to poultry researchers of the University of Wyoming. Eggs in the mountain states always have turned out a relatively low percentage of healthy baby fowl. The researchers discovered that at a 7000-foot elevation not enough oxygen passes through the eggshells to keep the embryos alive—the unhatched chicks literally smother. Under the new system oxygen must be piped into the incubator throughout the incubation period or the effect is worse than no supplementary oxygen at all.

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LOW COST FIRE EXTINGUISHERS

A little foresight now may save LIVES and PROPERTY later. Equip your home, your garage, your office, your boat with **AutoFyrstop**, the modern fire extinguisher and alarm that is setting new records . . . Write for **FREE** literature today.



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CONCRETE • BRICK
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Goodbye to back-breaking masonry drilling! Carboloy Masonry Drills—round shank for shallow holes, fluted for all-purpose drilling—cut through masonry jiffy-quick! Priced as low as \$1.40. Ask about Economy 3-Drill Set, 3/16", 1/4", 5/16", 3/8", 1/2" and 5/8" in canvas kit, \$10.40 postpaid or C.O.D., from your dealer or direct. Ask for leaflet SA296.

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Write for Information.



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FREDONIA, PA.

HOW FAR
WILL THE OLD
CAR GO?

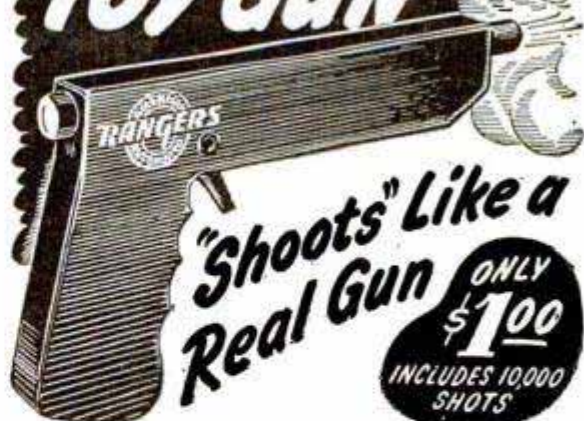


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Real Gun **ONLY \$1.00**
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Just send name and address. On arrival deposit only \$1.00 plus C.O.D. postage for one gun or \$2.00 plus C.O.D. postage for three guns. If not completely satisfied return and your money refunded. Save money. If you send cash with order, we pay postage. Write TODAY.

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The New Family Mutual Hospitalization Plan gives you protection that is high in value but low in cost—only \$1.00 per month for each adult, 50c per month for each child.



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Hospital Room and Board up to	\$6.00
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The policy provides indemnities for actual expense incurred at the time of hospitalization but will in no case exceed the amounts shown above.

Be protected against hospital bills, in case sickness or accident strikes you, by allowing the Family Mutual Life Insurance Company to aid you in meeting your hospital expenses. You may choose any hospital. Benefits for children are one-half those paid to adults.

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Please send me, without obligation, complete information on your Economical Hospitalization Plan.
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For faster, more accurate sighting equip with a combination of

MARBLE'S SIGHTS

Flat Top Rear. Price \$2.00

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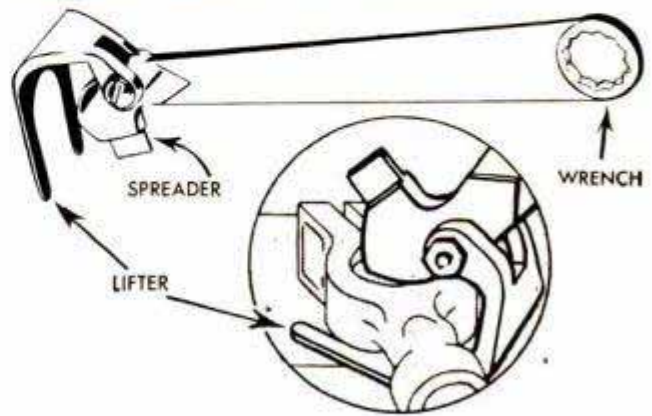
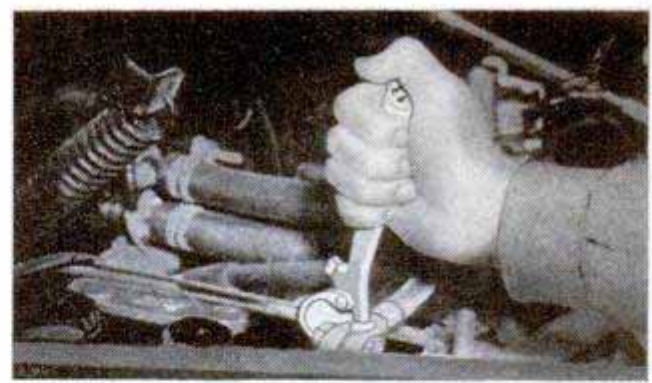
Marble's Flexible Rear Sight, with automatic spring joint. Can be locked down. With 2 discs. Price \$5.50.

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Sheard "Gold" Front Sight \$1.75

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Battery-Cable Tool

Combining three tools in one, a battery tool serves as a wrench, terminal spreader and lifter. A box wrench in the end of the handle loosens the nut and a short blade spreads the cable terminal. To remove the cable, a two-pronged lifter is placed under the terminal and upward pressure on the handle pries it loose.

100-Below-Zero Battery Developed by Signal Corps

Temperatures of 100 degrees below zero have little effect on an electric battery being developed by the Army Signal Corps. Experimental test cells are already functioning at this temperature. The batteries are needed for planes flying in the stratosphere, sometimes at 70 degrees below zero, and for use in artificially cooled research chambers.

50,000-Watt Vacuum Tube

Radiating as much energy as the largest standard broadcasting station in this country, a new vacuum tube produces 50,000 watts at the extremely high frequency of one billion cycles a second. Called a magnetron, the tube heats up everything near it, including human beings, who develop a fever when standing nearby. The intense radiations have heated eggs so quickly that they explode with a loud report. Unlike most vacuum tubes, it uses an unheated cathode that emits electrons when bombarded with high-speed electrons.

TELESCOPING MEASURING TOOLS

Highly Precise Beautifully Finished and fully guaranteed the greatest advance in telescoping tool design in 23 years. The straight leads make for ease of inserting the tool with the hole or slot being measured and very definitely add to accuracy in making angle measurements.

Micrometer Accuracy
Inside Measurements
5/16 inch to 6 inches

\$5.95

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Completely finished parts. Save \$10. Assembled quickly. No tools needed.

THE HUNDREDS ON ALL FOUR TOOLS ARE HARDENED AND POLISHED GROUND TO VERY CLOSE LIMITS

Tool 23 measures approximately 900 to 2300 inches

Tool 24 measures approximately 2300 to 6 inches

Tool 22 measures approximately 400 to 900

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● Save your wrist: drive and draw screws faster. Just push on a "Yankee" 130A Spiral Driver. Your weight and the spiral turns the screw without blisters or fatigue. Quick-return spring in handle holds blade in slot and returns the handle after every stroke.

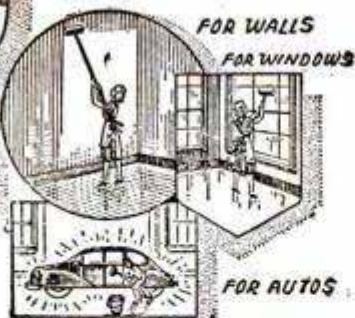
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FOR MOPPING
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Hands Never Touch the Water—Can be put in Boiling Water. Housewives Like It.

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SOLD EVERYWHERE

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"Enclosed you will find 56 orders representing 9 1/2 hours' work on Monday and Tuesday."

"Enclosed are twelve orders secured after supper this p.m."

Sales QUICK, EASY EVERYWHERE

SALES ARE EVERYWHERE . . . Sells quick to Taverns, Clubs, Hotels, Hospitals, Stores, Restaurants, Large and Small Buildings and the Homes . . . Scores can be sold on a single street . . . Note the Drain Bracket in the illustration . . . This squeezes out the water so thoroughly that HANDS NEVER TOUCH THE WATER . . . Makes no difference what you ever sold, you will like this proposition . . . Your name on a Post Card will bring you FREE PARTICULARS.

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Gets down under and around for MOPPING, DUSTING or WASHING . . .

DOES THE WORK OF 6 TOOLS IN 1
HOLDS 20 TIMES ITS WEIGHT IN WATER



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SPECIAL GIFT OFFER! ARC TORCH WORTH \$6.80 YOURS at NO EXTRA COST!

Twin Carbon Electric Arc Torch worth \$6.80 with every DYNAMIC WELDER. Act now to get this valuable premium at the single low price of welder alone.



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Send me FREE details of your ELECTRIC Arc Torch Gift Offer and Dynamic Welder 10-Day TRIAL OFFER.

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Ideal for:

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Designed for automotive truck or tractor mounting. Can be run off fan belt or power takeoff. Comes with automatic clutch. Can be installed for use on: farm trucks, jeeps, tractors, tire or garage service trucks, contractor or road building machinery, pneumatic devices, etc.

Can be operated with 1/2 H.P. or more electric motor or equivalent portable gas engine.

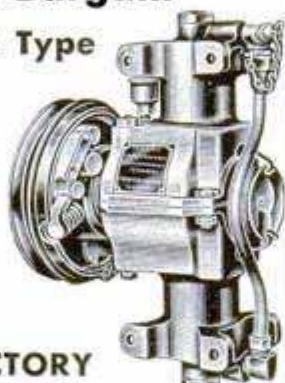
Light weight, compact and versatile unit... delivers "oil free air"... simple in operation; requires minimum of maintenance; operates under all climatic conditions; suggested operating pressure 75 P.S.I.; equally efficient operation in either direction of rotation; approx. displacement 3.27 CFM at 600 RPM, 6.54 CFM displacement at 1200 RPM. Has 2 inch bore—1 1/2 inch stroke. Overall dimensions: width 9", height 11 7/8", depth 6 5/8"; approx. wt. 23 lbs.

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Self-Priming ELECTRIC PUMP Compact — BRAND NEW



APPLICATIONS: oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc.

MOTOR MFD. BY BLACK & DECKER; double ball bearing series wound, continuous duty, 1/30 H.P. electric motor, rated 12,000 R.P.M. Transformer included for use on 110 VAC current. Also applicable for 24-32 VDC.

PUMP MFD. by WELDON TOOL CO. with standard 1/4" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder.

OVERALL DIMENSIONS: 7 3/4" long x 3 1/4" high. Approx. wt. 5 lbs. \$51.00 value...

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THREE-IN-ONE MULTI-PURPOSE PUMP

Three independent pump sections running off of one shaft, for single or multiple pumping. Use one as a vacuum pump capable of drawing 25 inches of mercury. Use one or two as a liquid pump for hydraulics, insecticide spraying, pond and basement draining, stock watering, aeration, etc.

Supplied with 4" V belt pulley. Inlets and outlets 3/8". Easy to use — foot mounting. Constructed of bronze and aluminum to exacting ordinance specifications. Dimensions: 6"x5"x4 3/8". Ship. wt. 10 lbs. Government acquisition cost \$74.00. YOUR PRICE

Satisfaction Guaranteed



\$19.75

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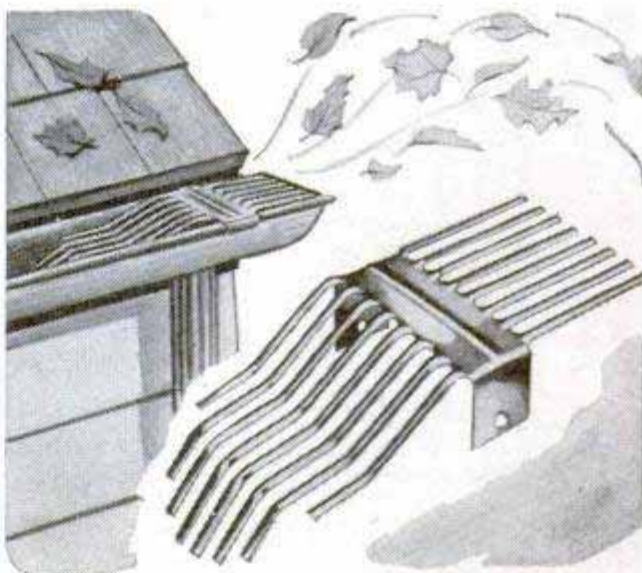
DEPT. PM10, 1507 S. MICHIGAN AVE., CHICAGO 5, ILLINOIS

Polio Study Reveals Location Of Two Vital Brain Centers

Two tiny bits of tissue, each no bigger than a grape seed, are the vital centers of the brain that control breathing and blood circulation. Really twins, the two centers work together and provide the body with a spare should one of them be damaged or destroyed by injury or disease. Their exact location in the medulla, which connects the spinal cord with the brain, was discovered by doctors during a Minnesota infantile-paralysis epidemic.

Downspout Shield Is Self-Cleaning

Leaves can't clog the downspout and cause the eave trough to overflow when a self-cleaning shield is installed. The shield, made of aluminum, has long tinelike fingers that prevent leaves from entering the spout. The water washes the leaves up on



the shield permitting fine dirt to pass through. After the rain, the leaves dry out and are blown away by the wind. No screws are needed to attach the shield. It is merely snapped over the edge of the trough. For center and corner downspouts, two shields are used.

Fish to Be Frozen at Sea in Tests

Fish may soon be frozen at sea immediately after they are caught if equipment tests being made by the Fish and Wildlife Service prove satisfactory. This will enable boats to remain at sea for longer periods and also will save valuable by-products now lost when fish are processed on the boat. The fish will be brought ashore and defrosted at regular processing plants. After the fillets have been cut, they will be frozen and packed for distribution.

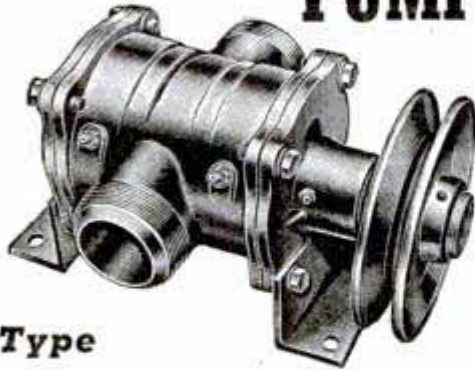
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Self-Priming BRONZE PUMP

Brand New

Positive Displacement

Gerotor Type



Perfect for draining basements, irrigation, fire fighting, sprinkling, pressure booster, insecticide and other spraying, fuel transfer, stock watering, industrial pumping, deep well jet pumping and home water systems. Rated 25 ft. suction and 100 ft. head pressure at 65 gallons a minute with 1725 RPM at one H.P.

Complete engineering report and instructions **FREE** with pump

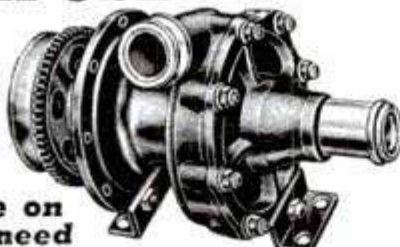
Supplied with mounting brackets and 6" V belt pulley, ready for instant use. Standard 1 1/2" inlet and outlet pipe thread. Dimensions: 9 1/2" x 7 1/4" x 4 1/4". Ship. wt. 18 lbs. A \$142.00 value. . . .

\$32.50

F.O.B. Chicago

ALL-PURPOSE WATER PUMP

Brand New



Ready for use on any pumping need

Use it for: DRAINING BASEMENTS

HOME WATER SYSTEMS

FIRE PROTECTION

PRESSURE BOOSTER

IRRIGATION

DRAINING PONDS, TANKS, etc.

SPRINKLING SYSTEMS

STOCK WATERING

INDUSTRIAL PUMPING

Complete with pulley and mounting brackets, ready for use.

Belt Driven — Centrifugal Pump

An extraordinary value for all types of intermittent or continuous pumping in the home . . . farm . . . factory. Built to exact specifications of Packard Motor Car Co. for use in Rolls-Royce Merlin Aircraft Engines. May be run with electric motor, gas engine or power take-off on tractor. Delivers up to 25 gallons a minute with 1/4 H.P. motor; 80 gal. a min. with one H.P. motor. Will deliver up to 44 ft. head or 25 ft. suction. Use 1" outlet hose; 1" or 1 1/2" inlet hose (recommended).

COMPLETE ENGINEERING REPORTS AND OPERATING INSTRUCTIONS FREE WITH PUMP

Has cast aluminum housing, accurately machined 5" bronze impeller; 3 1/2" V belt pulley and mounting brackets. Shaft rotates on ball bearing; has grease gun fitting.

Original cost approx. \$88.00. Shipping weight 10 lbs. A REAL BUY. Mail orders filled promptly. **\$21.50** SATISFACTION GUARANTEED F.O.B. Chicago

BRAND NEW

AIR OR OIL HYDRAULICS



Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks — push or pull, tilt or turn, press or squeeze, open or close, lift or lower — and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship.

1. Double action, 1 1/2" bore, 5" stroke, will lift 1760 lbs. in one second with Vickers MF6 Pump. Wt. 3 lbs. A \$35.00 value. **\$8.95** postpaid
2. Double action, 1 1/2" bore, 9" stroke, will lift 1760 lbs. in one second with Vickers MF6 Pump. Wt. 4 lbs. A \$45.00 value. **\$10.95** postpaid
3. Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1 1/2" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Vickers Pump.) Wt. 8 lbs. A \$55.00 value for only **\$12.95** postpaid
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Outlets are standard 1/4" pipe thread and inlet takes standard 1/4" copper tubing fitting.

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VICKERS MF6 HYDRAULIC PUMP OR MOTOR



Compact, powerful, rated 1,000 P.S.I., .507 cu. in. per revolution, 8 gal. per min. at 3750 r.p.m. Change rotation by reversing flow. Delivers up to 6 H.P. BRAND NEW, Wt. 4 1/2 lbs., \$60.00 value for **\$14.95** Postpaid

Brand New CHECK and RELIEF VALVE. **\$2.95** post-adjustable for any pressure. paid

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For tractors, bull-dozers, construction machinery, lift trucks, industrial applications, etc. Used on Ross carriers. Delivers 18 gal. per minute at 1000 P.S.I. at 1200 R.P.M. using 10 H.P. Has 1 1/2" intake; 1 1/4" outlet; threaded and keyed 3/4" shaft for direct or pulley drive. Wt. 40 lbs. Dimensions: 5 3/4" diameter, 7 1/2" high. Original value \$148.00. NOW **\$39.50** F.O.B. Chicago

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New type hi-speed steel spiral flute bits. Available in individual sizes or sets of 6 attractively packaged from 1/8" to 1/2" at **\$9.50**



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**SAFETY SHAPER &
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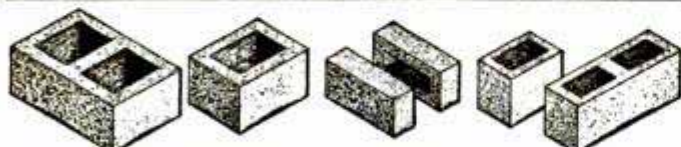
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Entire set less than one cubic inch in size, rests in bowl of teaspoon! Radar 1N34 detector, world's best for crystal sets. Works anywhere—never wears out—needs nothing to operate. Safe and foolproof. Reception is guaranteed. With connecting leads and complete directions. **\$2.39** postpaid without phone. **\$3.19** postpaid with phone. Foreign orders 10% extra, prepaid only.

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To fit SOUTH BEND 9" and 13", POWER-KRAFT, LOGAN 9" and 10", CLAUSING and SHELDON Lathes. Aluminum alloy casting, Torrington needle bearings and steel cut gears. Will cut 78 threads. Easily installed.

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4,000 B.T.U. attaches to any gas hose; furnished with 2 jets for natural and bottled gas; equipped with adjustment set screw. **\$2.00** Postpaid



Mack's GAS BURNER
Jet Power, Self-Acting (Pat. pending), 24,000 B.T.U., for natural and bottled gas, industrial and home use. **\$2.00** Guaranteed. Postpaid

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Approx. 20 gal. capacity and larger for home and industry. Easily installed. Amazingly low-priced. **\$32.50** Guaranteed. Del.



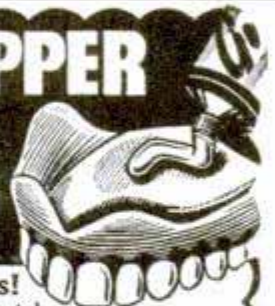
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For every purpose at 15% of Value.

PV-1
May be used as air or fuel pump for pressure or vacuum. Will pump 1 1/2 gals. oil at 2000 R. P. M. Builds air pressure 20 lbs. per sq. in. at 1000 R.P.M. Vacuum draws 24 in. of mercury at 1750 R. P. M.

Valve Type **\$9.49**

ROME C FUEL
800 GPH at 30 PSI. can also be used as hydraulic for 4 GPM at 400 PSI or for Vacuum drawing 15 in. mercury at 1500-RPM. **\$6.29 ea.**

NEW PRESSURE TANKS

Stainless steel - Shatter proof. Rustless. 10,000 available in 6 different sizes. 1951 used.

G-1 12 1/2 x 24 inches - 3160 Cu. in. capacity **\$4.75**

D-2 8 1/2 x 24 in. - 500 Cu. in. capacity **\$2.49**

F-1 - 10" x 18" 1000 Cu. in. Capacity **\$3.95**

F-2 8 x 48 in. - 1000 Cu. in. capacity **\$3.95**

A-4 5" x 8" 104 cu. in. Capacity **\$1.35**

Excellent portable tanks for emergency use in car or trailer. Ideal for painting, cooking, spraying, ocean buoy, underwater fishing or diving. #OR-1 Oxygen Resistor with 100 lb. gauge will fit all tanks **\$1.39**

DC GENERATOR NEW

140 AMP
Direct Current Generator, especially suited for adaptation to homemade welding unit. A fast moving item at **\$17.95**

P-1 GENERATOR 200 AMP \$22.50 ea.

K-1 GENERATOR 75 AMPS. \$14.50 ea.

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Especially prepared for the ROBBYIST. Nivets, Spacers, Bolts, Screws, Nuts, Gears, etc. A good mixer. **\$1.19**

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12 pairs of strap and butt hinges. Sizes 1" x 1" to 1 1/2" x 4" in length to 8" deep. **#170H. \$1.09**

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50 Pieces including bearing stone, pencil rolls, wheels, abrasive wheels, etc. A really sharp value. **#175AG. 99c**

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Torsion, Compression & Tension Springs, steel, brass. A treasure trove for small mechanics. **#206 89c**

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Combination of all above, all in one package deal. At special introductory price **\$5.79**

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12" Dia. x 18" High. Has fine wire screen, cylindrical filter. Glass gauge for checking water accumulation. Drain cock for water removal, shut off valve for control of flow of filtered Gasoline. Complete with 2 hoses 1 1/4" & 3/4" x 10" long hoses.

BE SURE OF YOUR GAS AIRCRAFT, TRUCKS, GARAGE

NEW \$5.95

Stewart-Warner Gasoline New HEATER

AIRCRAFT TYPE. New. 14V. 10 Amp. 40,000 B. T. U. Diameter 8 in. Length 15 in. Stainless steel housing. Complete with Spark plug, gas valve, Thermostatic Control Switch. Adaptable to most cars, Trucks, Home, Boats, etc.

SW-1 A SWELL DEAL for ONLY **\$6.95**

SW#2 HEATER
A smaller Compact Car-like Gasoline fired heater with motor, fan blower, Automatic, Thermostatic Control. Copper element, glow type spark plug. Made by Stewart-Warner, 24V D. C. - Can operate on 3 Volt. Ideal for Auto, Boat, Light Aircraft, etc. A Swell at **\$5.95**

Here's a Real "Lite Special"

Farm, Auto, New U. S. Navy Portable Pistol Grip. Sealed Beam, 12v. Search Spot, Emergency. Light - featherweight Gov. Cost our price **\$35.00**

3 Extra fillers - Red **\$25.00**
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110 V. A. C. 13 ft. wire with socket, switch and plug. In mounting bracket suitable for home or workshop. Wire alone worth our price of **99c each.**

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Sell contained, 2 H. P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output R. P. M. 10 to 1/2 input R. P. M. in both directions. Input R. P. M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R. P. M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, Etc.

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with knobs and rubber pads for non slippage on work surface. A must for navigators, mechanics, draftsmen, engineers... You've never seen 'em at **97c ea.**

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now equipped with mounting frame, handle, cable, etc. complete. Thousands of Satisfied Users! Hundreds have written, telling us it's the most wonderful tool in the world!

Capacity 2500 lbs. 20:1 ratio
Bronze Worm Gear
Ideal for Garages, Truck loading, Machine Shops, Boat Builders, etc.

\$100 Value for ONLY \$16.99

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NEW 6 SOCKETS
3 1/4", 3 1/2", 3 3/4", 4", 4 1/2", 5" in. extension, pocket, flat-handle.

All in steel case, New. A **\$3.95**

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Little Lux Col Type. Built to Gov't. spec. wirebound phosphate New York. Fully recharged. 1 1/2" lb. 26" x 4" Trigger control with horn #18 1999- \$35 Value **#601A \$13.25**

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#500 new 1/2 H.P. 27 Volt D. C. 24 Volt A. C. This motor can be readily adapted to 110 A. C. by the simple method of rearranging armature brush leads. We furnish free diagram of instructions with each order. A Sensational Value @ **\$5.95**

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1 1/2 H. P., 24 Volt D. C. Motor, Series Wound. New, **#501. \$3.95 ea.**

#502 - 2 H.P., 24 V D.C.M. used, **\$8.95**

COMPRESSOR, 1000 lb. pr. 2 stg. with 1/2 H. P. 27 V. D. C. motor. **\$17.95**

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4 INCH PAINTERS DUSTER BRUSH Only **59c ea.**

Side cutting beveled head a **\$3.50 Value** Only **\$1.79**

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2 1/2 lb. with metal center, insert type, head, 1 1/2" x 4". Used for non marking of metal on plastic surfaces, driving pins, etc. leather replaceable. **\$1.19**

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10,000 in various popular makes, sizes, types. Cleco, Aro, Ingersoll Rand, Chicago, Pneumatic, Buckeye, etc.

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#180 Goose-neck
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GUNS
Pistol & Goose-neck Type
101 Base, Chipper, Boring, Hammer, Breaking, cement and auto body work.

Chicago Pneumatic, Cleco, Ingersoll Rand Makes. **E3, E2, 3X, 2X, OY \$55 Value \$8.95**

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with 3/4" JCB Chuck Straight

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With Terry Adapter ea. **\$12.50**

CHI. PNU. IMPACT WRENCH
Model 337re 3/8" sq. dr. fwd. & revrs. 6 spd. cntrl. **\$17.50**

Send for Catalogue and List of Other Sizes, Types of Pneumatic Tools.

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New. Will hold up to 3,000 lbs. PSI. with Co2 used as air inflator or fire extinguisher, with oxygen for sick room or deep-water diving, etc. Completely equipped with brass valve, 26" hose, dial gauge, & canvas bag **\$2.29 ea.**

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Capacity 21.7 gallons. Aluminum 4 threaded ports. Filler Capacity, Size 7" x 28" x 28". Ideal for Water or Gas Tank on Auto, Boat, Truck, Tractor, Etc. New, **#126 \$5.29**

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Overall Width	Length	Price
1 1/4" (3/4" side)	72" alum.	\$1.00 ea.
2" (1" side)	72" alum.	\$1.19 ea.
1 1/2" (3/4" side)	53" cad. steel	.75 ea.
3/4" (1/4" side)	33" steel	\$1.00 ea.

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Alloyed steel, rust resistant, 3/16" dia. 18 ft. long, with turnbuckle ends. **99c ea.**

On reels in any length

1/16"	3c ft.	5-32	5c ft.
3-32	4c ft.	3-16	6c ft.
1/8"	4 1/2c ft.	9-32	8c ft.

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#325 .020"	1/64 36"	.75
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SOUTH BEND 10" Precision Lathes

The 10" Swing, 1" Collet Capacity South Bend Precision Lathe is engineered for the most exacting close-tolerance machine work. The direct belt drive to the carefully balanced spindle assembly provides smooth, vibration-free speeds up to 1357 r.p.m. Slow speeds for heavy cuts on large diameters are driven through back-gears. Full quick change gear equipment makes any of 48 different threads and 48 different feeds instantly available.

The precision, speed, and versatility of this lathe assures an efficient output on toolroom or

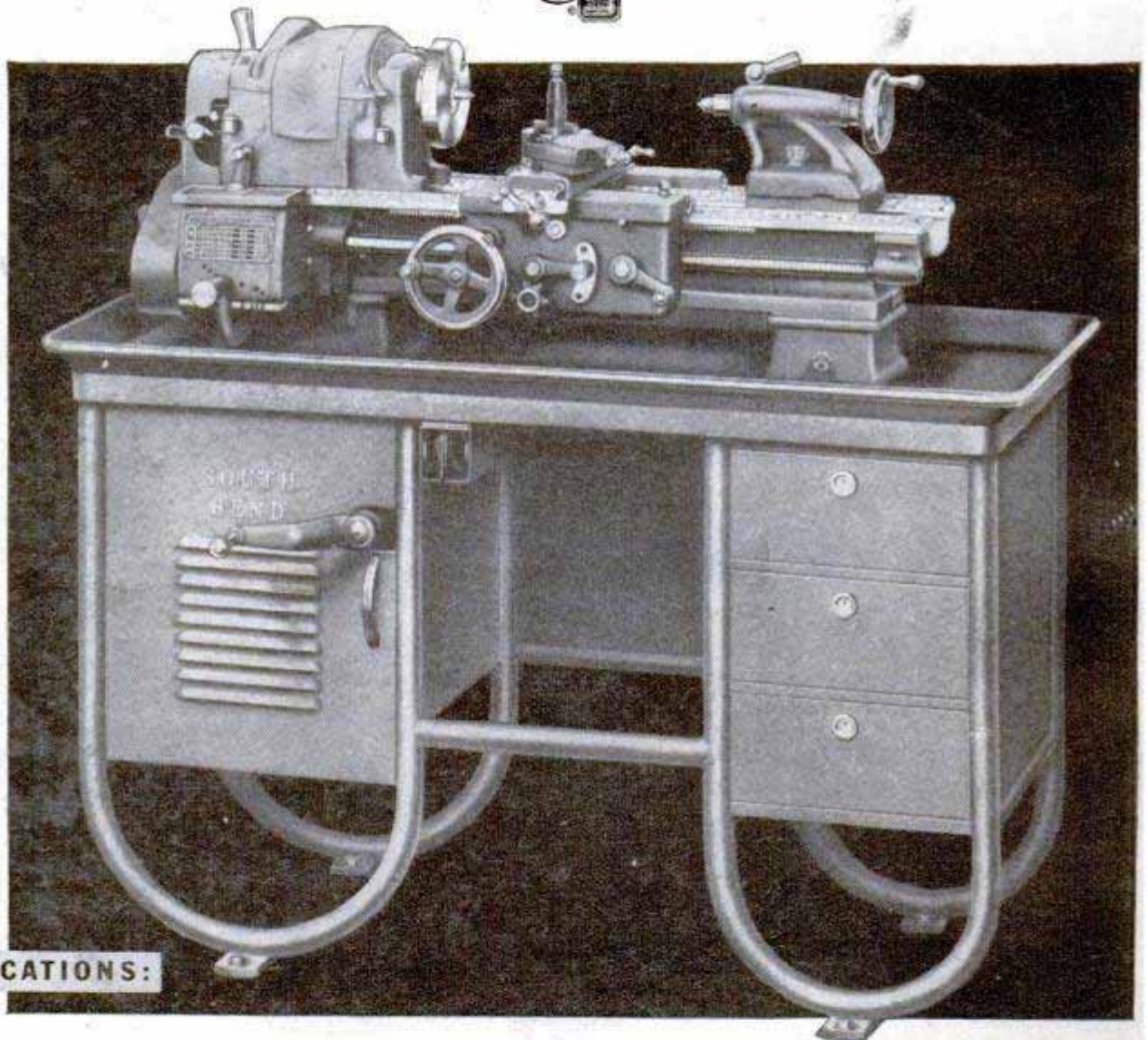
manufacturing jobs. The 1 1/8" bore through the head stock spindle makes it especially suited for machining parts from bar or tube stock. A complete line of practical attachments greatly simplifies tooling the lathe for a wide variety of operations.

South Bend Precision Lathes are made with 9", 10", 13", 14 1/2", 16", and 16/24" swings. We also manufacture Turret Lathes with 1/2" and 1" maximum collet capacity, and 14" Precision Drill Presses. Immediate deliveries can be made and a Time Payment Plan is available.

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SPECIFICATIONS:

Catalog No. 187-Y5 South Bend 10"-1" Collet capacity Quick Change Gear Bench Lathe illustrated. **\$994³⁵**
 Price—f.o.b. factory with 3 ph., 60 cy., 220 v., A.C. motor; drum switch; and bench

SWINGS: 10 1/8" over bed and saddle wings, 5 3/4" over saddle cross slide.
BED LENGTHS . . . 3, 3 1/2, 4 and 4 1/2 feet
CENTER DISTANCE . . 14 3/4 to 32 3/4 inches
COLLET CAPACITY 1 inch
SPINDLE BORE 1 1/8 inches

12 SPINDLE SPEEDS . . 50 to 1357 r.p.m.
CROSS SLIDE TRAVEL 5 1/4"
COMPOUND REST TOP ANGULAR FEED: 2"
POWER LONGITUDINAL FEEDS: 48 R.H. or L.H.0015" to .0836"
48 POWER CROSS FEEDS: .0006" to .0309"

THREAD CUTTING: 48 R.H. or L.H. pitches 2—224 per inch

PRICE RANGE OF SOUTH BEND 10" PRECISION LATHES
 Quick Change Gear Lathes . \$755 to \$1009
 Toolroom Lathes \$1050 to \$1263
 These prices f.o.b. factory, less electrical equipment . . .

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JOHNNY LUJACK, GREAT ALL-AMERICAN COLLEGE AND PROFESSIONAL FOOTBALL STAR,

says,

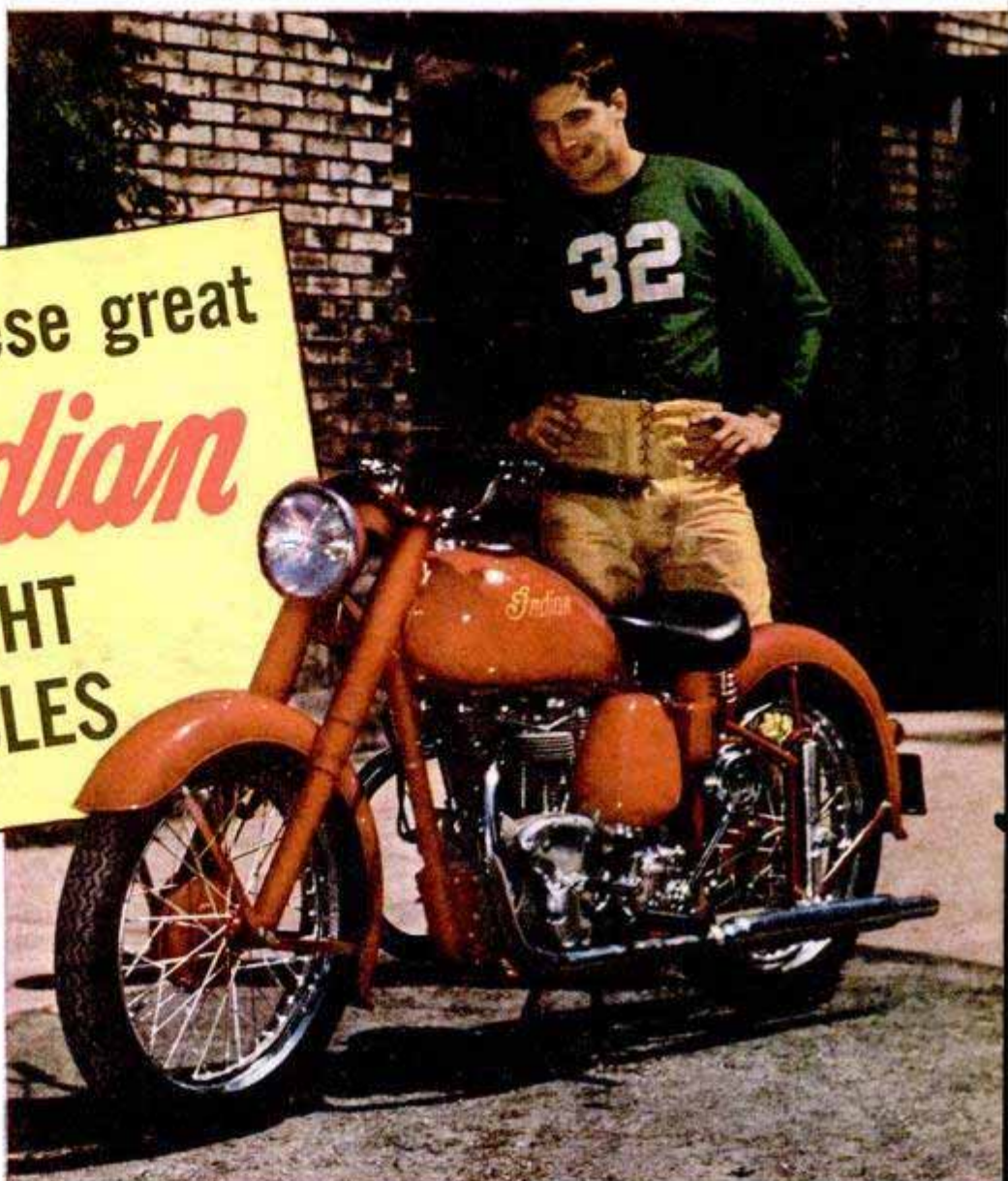
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MOTORCYCLES

**SENSATIONAL IN
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YEARS AHEAD IN
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NOW, THOUSANDS WHO NEVER RODE BEFORE CAN ENJOY MOTORCYCLING

Never been on a motorcycle? You can learn to ride these new safety lightweight Indians in a few minutes. And then you'll join hundreds of thousands who make motorcycling their hobby.

Indian now makes it possible for everyone to enjoy this sport by introducing the new lightweight Arrow and Scout, the world's most modern motorcycles.

These machines are completely different from any previous motorcycles. In one step,

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Indian WORLD'S MOST MODERN MOTORCYCLES

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Tells all about new Arrow and Scout



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Please send me Catalogue containing complete information about your new Indian lightweight models.

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Anti-Freeze



GUARANTEED!

Ask your dealer to show you the guarantee. It's your assurance of all-winter safety.

\$3.50 PER GAL.

"Prestone" anti-freeze is America's Number One brand. Year after year, more motorists depend on it than on all other brands of all-winter anti-freezes combined. There is nothing else like it!

PRESTONE
BRAND

The registered trade-marks "Prestone" and "Eveready" distinguish products of National Carbon Company, Inc.



SAFETY'S A MUST with Fire Chief Ivan Curry, of Osseo, Wisconsin. "In my job a freeze-up can be fatal. It pays to have 'Prestone' anti-freeze—the best anti-freeze you can buy, I find that 'Prestone' anti-freeze also prevents rust!"



SAFETY'S A MUST with Ambulance Driver David Landew, of Muhlenberg Hospital, Plainfield, N. J., who says, "I put one shot of 'Prestone' anti-freeze in my radiator every fall and I *know* I'm safe from freeze-ups all winter long!"



SAFETY'S A MUST with Police Captain Emerson Payne, of Jeffersonville, Indiana, whose car is out in every kind of weather. "No matter how quickly the weather changes, 'Prestone' anti-freeze keeps my car free from freeze-ups."



In your car too!

NO RUST...

NO FOAM...

NO FREEZE...

NO FAILURE...

One shot lasts all winter!

Anti-Freeze

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