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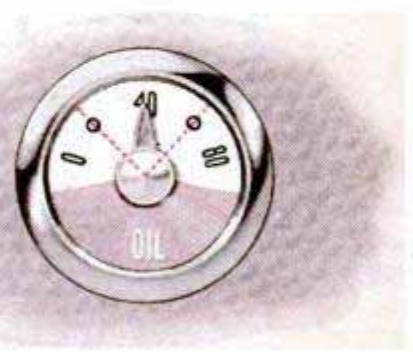
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PILOT FINDS OLD SANTA FE TRAIL
Read his great story-Page 88

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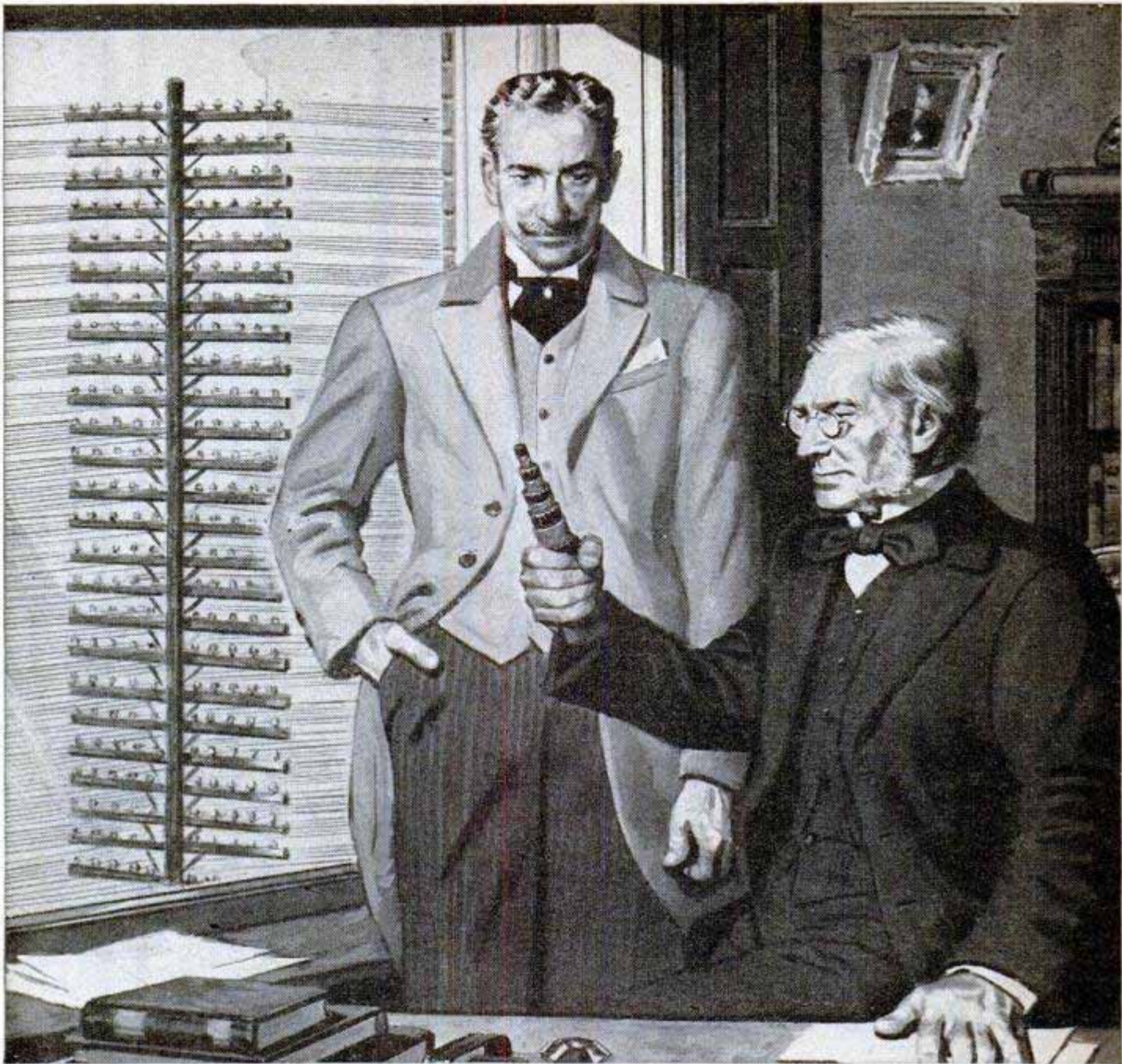
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this month's cover

WE DIDN'T KNOW we had a portrait artist of front rank on our own art staff until Bob Korta came in with our cover painting for January. Working from the photographs that appear in the article beginning on page 88, with one or two brief looks at Captain Heath Proctor himself, Artist Korta produced a portrait that any airline pilot or stewardess between Chicago and Los Angeles will recognize. Proctor is portrayed as he photographed the ancient ruts of the Santa Fe Trail from the cabin window of his DC-6, which he sometimes steers a bit off the direct airline course in order to show his passengers the historic trail. Like a postman on vacation, Bob Korta spent his next week ends, after doing the Proctor painting, in a project more important to Mr. and Mrs. Korta: a portrait of their five-year-old daughter, Barbara. It's a honey, and so is she

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IN THIS ISSUE

- A Half Century of Miracles - - - - - 81
An Airline Pilot Rides the Wagon Trail - - 88
Rainbow on the TV Screen - - - - - 97
I Fly Faster Than Sound - - - - - 108
What's New for Your Home - - - - - 118
Dry-Land Submarine School - - - - - 127
Homestead on the Range - - - - - 133
The Dizzy Merry-Go-Round of Industry - - 144
On the Trail of the Bat - - - - - 151
Oil Drillers Throw Curves - - - - - 160
CID—the Army's Crime Bureau - - - - - 166

For the Craftsman

- Tooled-Leather Writing Case - - - - - 174
Occasional Furniture - - - - - 181
Window Upkeep - - - - - 194
Tire Care Means Long Wear - - - - - 202
Sliding Shaper Jig - - - - - 213
Vapor-Zone Grinding - - - - - 217
Disk and Spindle Sander - - - - - 224
Radio-Television, Electronics - - - - - 229
Clinic for Homemakers - - - - - 240

Other items, and manufacturers of available products described, are listed on pages 10, 14 and 18



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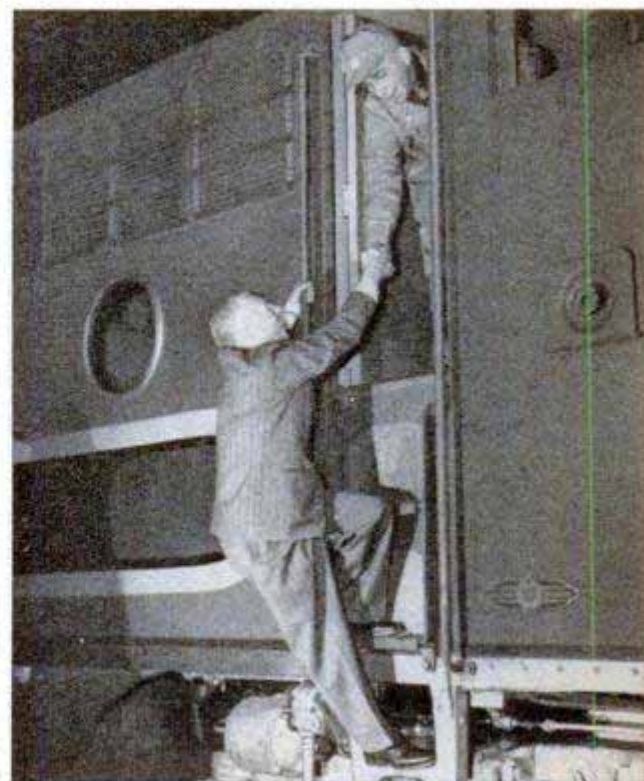
Signing out the borrowed Jeep at Dodge City, Kans.

OUR "cover story" began one night, months ago, when the managing editor bumped into his neighbor, Heath Proctor. The talk got around to his latest "discovery," the Santa Fe Trail.

Several years ago, when he was flying an airliner between Chicago and Washington, Proctor had spotted the Mason and Dixon Line. Most of us had assumed it was an imaginary line drawn through our history

(Continued to page 8)

Pilot Heath Proctor boards the Super-Chief "cockpit"



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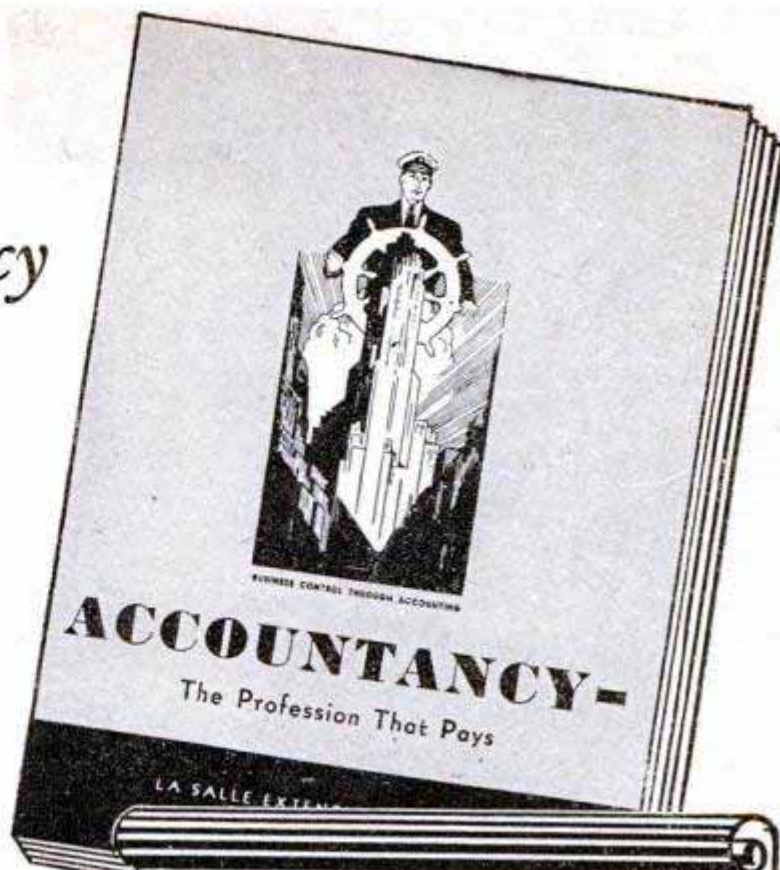
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TRAIN IN MIAMI--AIR CAPITAL OF THE WORLD

(Continued from page 6)

books. He found it was really there, visible, a surveyor's cut through a forest dividing the Old North from the Old South. He photographed it from the air, and the pictures were "front page" in 1500 newspapers and magazines.

Now Proctor, senior pilot of his line, flies a Douglas DC-6 between Chicago and Los Angeles. History being a hobby with him, he had looked for and found the old wagon tracks of the Santa Fe Trail, and was itching to explore them.

So the managing editor treated him to a camping trip over the trail with an associate editor and photographer. The Santa Fe Super Chief deposited them in Dodge City, Kans., where they borrowed a Jeep from Tyson and Reinert, Inc., local Willys-Overland dealer, and took off over the wagon ruts.

Airline Captain Proctor—he was a colonel of the U. S. Air Transport Command in India during the war—has been flying commercial airliners since 1927.

* * *

We're Sorry

On page 112 of last November's P.M. we described an engine heater for easy cold-weather starting. Mistakenly, the "Where-to-buy-it" index listed the manufacturer as "British Railways, Rugby, England."

The heater is sold by Roscoe Industries, Roscoe, Ill.

Our apologies to all at Roscoe.

* * *

You Can Still Crunch

One of the latest boons to suffering humanity is a noiseless popcorn bag. It's paper, but of a porous texture that will give noise-making youngsters at the afternoon movies a sense of frustration. It won't pop, because you can't blow it up. And you can't fill it with water and bomb the folks below the balcony. Someone is always taking the joy out of one person's life and putting it in another's.

* * *

Chicks Fly the Atlantic

Three dozen baby chicks now growing up at an English agricultural college will probably boast to their grandchildren about the 2000-mile flight they made back in 1949. But they'll probably never fly again—and they weren't looking out the window as they flew the Atlantic in a BOAC Constellation. They were still in the shell, 36 eggs of the wingless chickens bred by Peter Baumann of Des Moines, Iowa.

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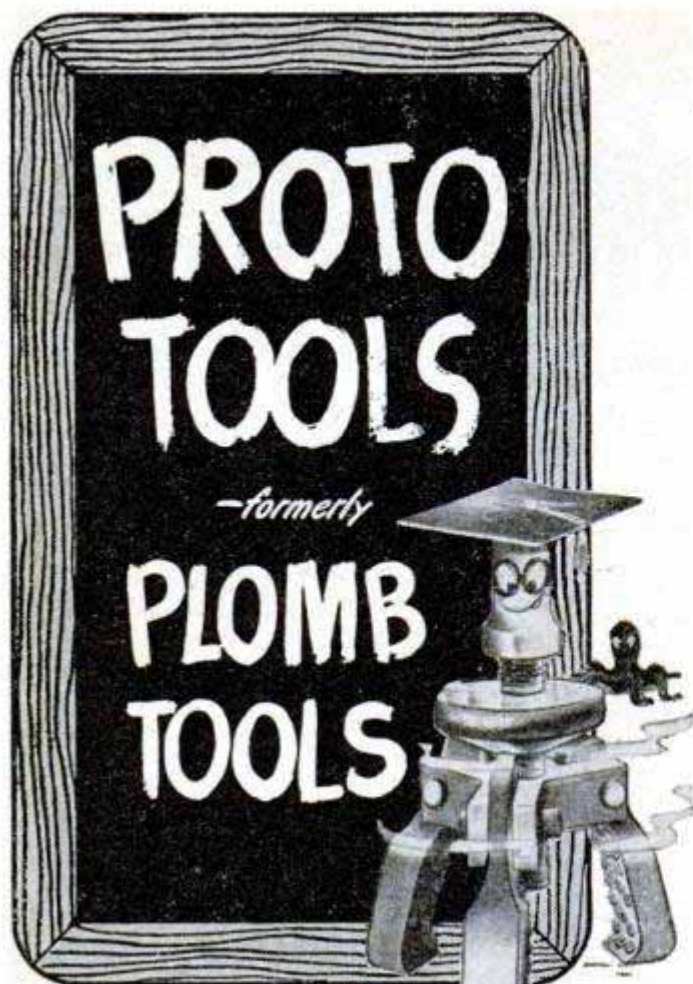
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WHERE-TO-BUY-IT INDEX

Source of supply appears after items commercially available

AUTOMOTIVE

Windshield glass stops glare, heat.....	18
Retread design makes worn tires skidproof (Robert B. Sommer, 1731 Townsend Ave., Apt. 1A, Bronx 53, N. Y.).....	106
Dashboard pressure gauge checks tires remotely (Henry Addy, 1543 N. Cass St., Milwaukee, Wis.).....	131
Strap-on chain applier (J. Randolph & Co., 526 Liberty Road, Englewood, N. J.).....	132
Australian auto has front-wheel drive.....	158

AVIATION

Aerial tree planting.....	114
Sperry zero reader.....	114
Air "gas stations" stretch plane range.....	125
Lampighter with a 25-mile reach.....	154
Spray kills insects in planes.....	264

FARM

Modern Peter Piper picks from old car.....	87
Chemical kills hardy weeds (E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.).....	158
Barrage balloons store grain crop (J. W. Berger Co., 3305 Broadway Ave., Cleveland, Ohio).....	165

HOBBIES, NOVELTIES AND TOYS

Ride 'em kids!.....	104
Satin tape (Freydberg-Strauss, Inc., 419 4th Ave., New York City).....	122
Model rotary press prints newspapers.....	139
Four-acre rock garden.....	140
Model tram.....	165

HOUSE AND HOME

Weathertight window (Anderson Corp., Bayport, Minn.).....	87
Home is where they park it.....	115
Detergent makes rinsing of laundry unnecessary (Lever Brothers Co., 50 Memorial Drive, Cambridge, Mass.).....	117
Air deodorizer shaped like wick lamp (Metro Specialties Co., 363 Broadway, New York City 13).....	118
Kitchen counter rolls on casters (Moorex Industries, Inc., 1419 E. Main St., Richmond 19, Va.).....	118
Clothesline winder worn like apron (Bok Machine Products Co., 845 Walnut St., Fort Wayne 6, Ind.).....	118
Ice-cube tray (Cube Drawer Corp., 1301 Kentucky Ave., Akron 14, Ohio).....	119
Reel-type plug (Page Industries, Box 927, Hollywood 28, Calif.).....	119
Toy sewing machine (Betsy Ross Sewing Machine Corp., 666 Lake Shore Drive, Chicago 11).....	119
Slack hanger holds six pairs (Kit Mfg. Co., 668 S. Coronado St., Los Angeles 5, Calif.).....	119
Deep-fat fryer (Dulane Mfg. Co., 754 W. Jackson Blvd., Chicago 6).....	120
Automatic home pasteurizer (Guard-It Mfg. Co., 1501 S. Lafflin, Chicago).....	120
Ice-water tap operates without opening door of refrigerator (KoolerKoil, 101 Chataqua Blvd., Santa Monica, Calif.).....	120
Clothes hook has folding arm (R-Kay, 411 Provident Bldg., Cincinnati 2, Ohio).....	120
Automatic lock for window (Novel Products Corp., 19 W. 44th St., New York City 18).....	120
Skillet rings for eggs (Benmatt Organization, Merchandise Mart, Chicago 54).....	121
Electric mat safe on wet ground (Dan Morey, Dept. P-6, 814A S. Robertson Blvd., Los Angeles 35, Calif.).....	121
Indoor gardens with aluminum frames (Edmund C. Hanley, 215 W. Larch Ave., Muskegon, Mich.).....	121
Ladder has adjustable back legs (B. F. Pratt, 290 Mill Road, Falmouth, Mass.).....	121
Twin-bladed knife for grapefruit (Conklin Products Corp., 215 W. 7th St., Los Angeles 14, Calif.).....	121
Hanger for car or home (The Gayelon Co., 2848 W. Pico Blvd., Los Angeles 6, Calif.).....	122
Heating cord for blankets (Alva T. Smith Co., 161 W. Wisconsin Ave., Milwaukee, Wis.).....	122
No more KP duty (Miller's Pre-Prepared Potato Co., Inc., Box 268, Blue Island, Ill.).....	150
Rain closes windows.....	155
Hand-shaped chair.....	158
Rust preventive (Temperature Equipment Corp., 4505 Euclid Ave., Cleveland 3, Ohio).....	165
Tile with cutout center (Fremont Rubber Co., McPherson Highway, Fremont, Ohio).....	170

INDUSTRY

Flexible pipe-line support.....	106
Bridge shift.....	107
Duplicate tape recordings made by "contact printing" (Minnesota Mining & Mfg. Co., St. Paul, Minn.).....	125
Fluorescent-tube disposal device.....	131
Giant treadmill tests locomotives.....	138
Graphite coating for engine parts (Electrofilm Corp., 7116 Laurel Canyon Blvd., North Hollywood, Calif.).....	138
X-ray orange grader detects frost damage (Automatic X-Ray Corp., 5138 Jefferson Ave., Los Angeles, Calif.).....	139
Machine tops man.....	142
"Water wheel" boosts voltage.....	143
Gas-turbine engine pumps pipe-line gas.....	143
Injection engine burns cheap oil.....	150

(Continued to page 14)

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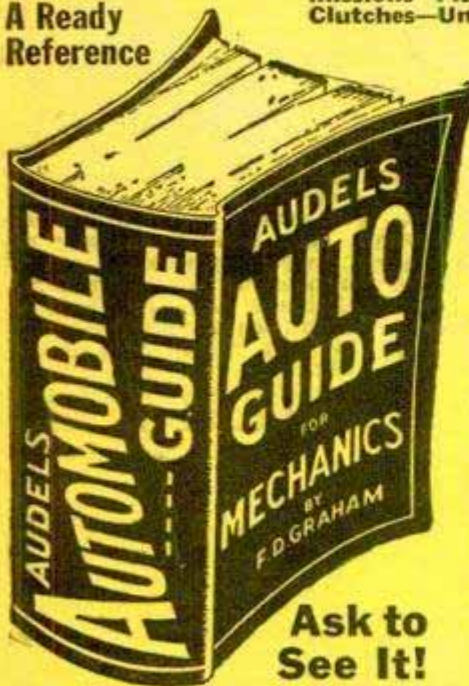
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V. MARCHESA, Philadelphia, Pa., writes, "After finishing my N.R.I. course I have been busy servicing and installing television."



S. W. DINWIDDIE, Chicago, Ill., writes, "After finishing course, working in servicing shop. Now Chief Engineer of WCUN Police Radio Installation."



A. HERR, New Castle, Pa., writes, "Have doubled my salary since starting in Radio full time. Am employed by Station WKBO as transmitter operator. Future looks bright to me."



L. M. HAUGER, San Bruno, Calif., tells us that "N.R.I. helped qualify me for job as Radio Mechanic with United Airlines. Have my Radio-telephone 2nd Class License."



L. ARNOLD, Pontiac, Mich., says, "While learning, I made from \$5 to \$10 a week in spare time. Now I am earning as high as \$25 a week in my own spare time shop!"



M. LINDEMUTH, Ft. Wayne, Ind., writes, "When I started N.R.I. Course, didn't know a condenser from a resistor... but was soon averaging over \$9 a week in my spare time."



H. B. MILLS, Washington, Ohio, finds, "Word traveled fast in regard to my N.R.I. training. Have been doing Television installation and servicing, tracing out and eliminating interference, etc."



C. STAETH, Fort Madison, Iowa, informs us, "Do Radio Servicing full time in my own shop and am making more money than ever before. I owe this to N.R.I."



T. S. NORTON, Hamilton, Ohio, says, "My first job was obtained for me by your Graduate Service Department. Am now Chief Engineer, Station WQOX."



W. R. NICK, writes from... in control



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Many N.R.I.-trained men each year start their own Radio-Television sales and service business without capital. Let me show you how you, too, can be your own boss, have a good income from your own shop. Robert Dohmen, of New Prague, Minn., shown above standing in front of his store, writes that he is "now tied in with two Television outfits and does warranty work for dealers."



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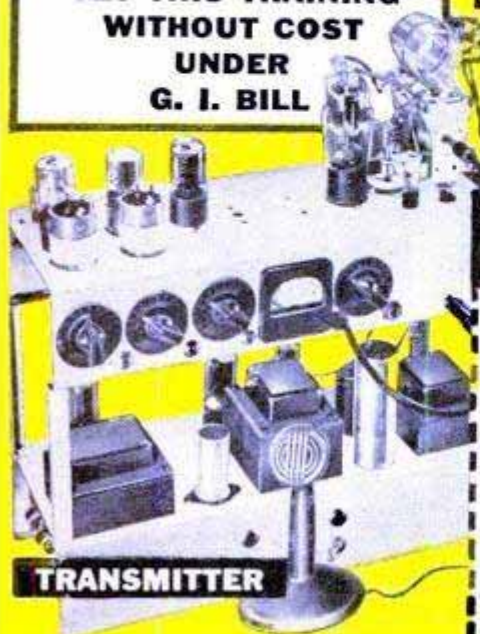


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Television Offers Bright Future

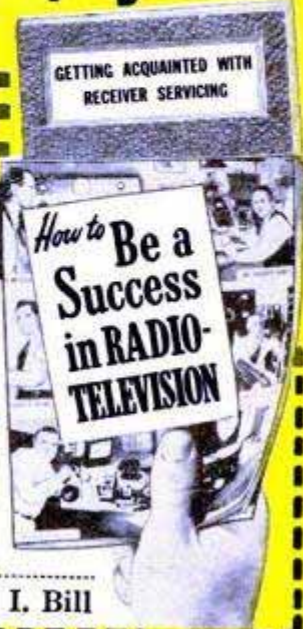
In 1945, there were 943 Radio Stations. Today, about 2700 are on the air! RESULT--THOUSANDS OF QUALIFIED MEN STEPPED INTO GOOD JOBS. Another example--only 19 Television Stations were on the air in 1947. Today, more than fifty. Within a few months, 150, say the experts--and 1000 within three years. Then add developments in FM, Two-Way Radio, Police, Marine, Aviation, Microwave Relay Radio. Think what this means! New jobs, more

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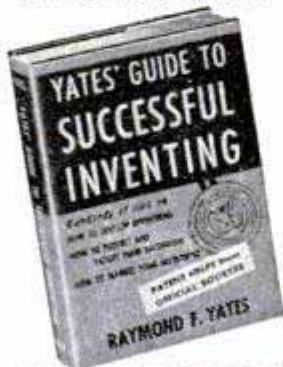
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(Continued from page 10)

Boats on dry land store drilling mud.....	159
Arctic tires.....	159
Heating with paint (Electrofilm Corp., 7116 Laurel Canyon Blvd., North Hollywood, Calif.).....	170

MOTORCYCLES

Motorcycle convertible.....	117
Cycle salesman tows his wares.....	143
"Flying egg".....	154

OFFICE, SHOP AND STORE

Paper sorter (Keith Macey, 6830 Beersford Ave., Parma Heights, Ohio).....	86
Pen-size stapler (The Fastener Corp., Chicago 14).....	106
Carton tongs (Kenworth Mfg. Co., 3455 N. Holton St., Milwaukee 12, Wis.).....	131
Overhead screen door.....	142

PHOTOGRAPHY

Film editor on hinged base folds into compact case (Craig Manufacturing Co., 1053 Olive St., Los Angeles 15, Calif.).....	87
Photo trimmer guides let you cut in dark (Webster Instrument Co., 11856 Mississippi Ave., Los Angeles 25, Calif.).....	106
Midget German camera.....	132
Trick photo effects made with shutter-shade (Workrite Products Co., Dept. H, 808 W. Doran St., Glendale, Calif.).....	132
Resin filter permits reuse of photo wash water.....	139
Speed light kit (The Anglo Corp., 4234 Lincoln Ave., Chicago 18).....	142
Camera with a roving eye.....	156
Quick test for synchronizer (Conway Camera Co., 34 N. Clark St., Chicago).....	170

TOOLS

Stand converts wrench into vise (Hartmann Mfg. Co., 1637 Gould St., Racine, Wis.).....	96
Drying agent protects tools (Tamms Silica Co., 228 N. La Salle St., Chicago 1).....	116
"No bounce" hammer has plastic tips (Tahlen Metal Industries, Ltd., 643 E. Hastings, Vancouver, B.C., Can.).....	165

MISCELLANEOUS

You can still crunch (Riegel Paper Corp., 342 Madison Ave., New York City 17).....	8
Carry-or-roll golf cart (Burns Specialties Co., Fort Pierce, Fla.).....	86
Dog in splints.....	96
Paintbrush box has wringer (Y & N Manufacturing Co., Wooster, Ohio).....	96
Cardboard umbrella.....	96
Kids like this dentist.....	107
Ladderless painting.....	114
Giant "eye" gets second test.....	116
Funnel-shaped theater built like an airplane hangar.....	117
Sun cooks food.....	122
Skater leaps through "egg beater".....	123
Caltech tunnel is fastest in world.....	124
Hydraulic exerciser (Physical Services, 10830 Santa Monica Blvd., Los Angeles 24, Calif.).....	154
Radioactive trees test effectiveness of chemical.....	155
Germ powder emits light.....	155
Radar "measuring tape".....	158
Balloon tests weather at 99,000-foot altitude.....	159
Ultrathin slices for microscopic study.....	172
Trigger conversion unit for military rifles (Dayton-Traister Co., 34 S.E. 66th Ave., Portland 16, Ore.).....	172

Craftsman and Shop Notes Index

AUTOMOTIVE

Preventing ignition-lock trouble.....	192
Extension handle on car heater aids turning control knob.....	200
Jeep seat cushions of looped foam rubber.....	221

DRAFTING AND DRAWING

Double-pencil lettering.....	193
Storing artists' brushes.....	215
Clock spring aids drawing arcs.....	216

FARM

Small oil drums double for large storage tank.....	177
Rats attracted by grain camouflage drown in barrel.....	215
Barrel canopy protects rock salt.....	216
Quarter round saves poultry feed.....	216
Nipple insures that pail-fed calves will drink slowly.....	221
Tractor low-load platform.....	222

HOUSE AND HOME

Match-book covers level furniture.....	177
Clothespin belt holds washcloths within easy reach.....	177
Keep needle with each spool of thread.....	178
Window shades protected when top sash is opened.....	178
Cellulose tape aids threading curtains on rods.....	178

(Continued to page 18)

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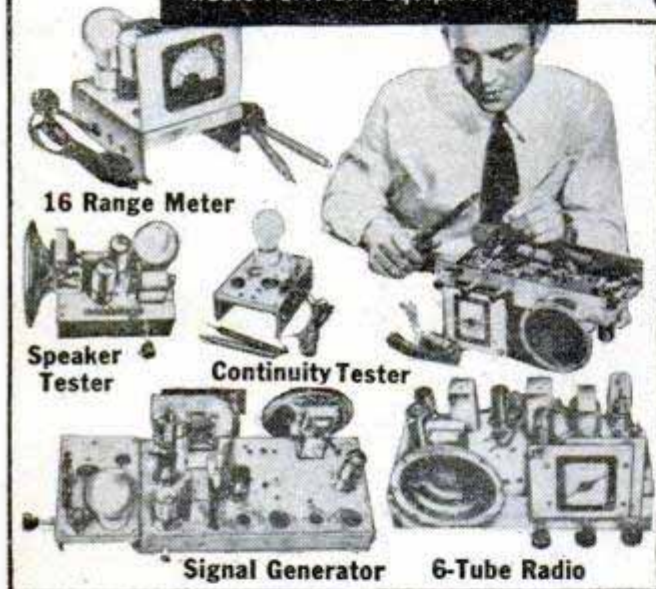
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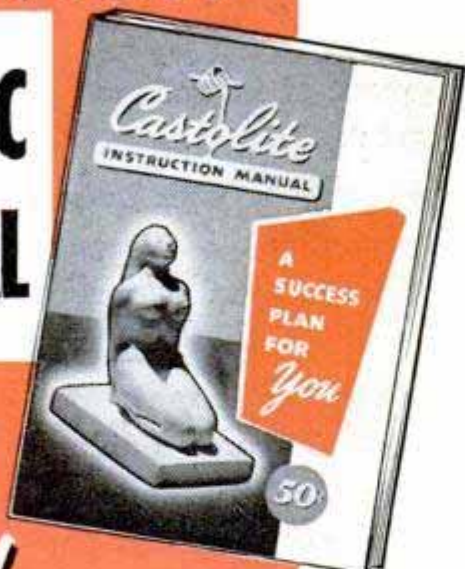
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DEALERS

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(Continued from page 14)

Adhesive tape reinforces plastic shower curtains.....	178
Handy spot for recipes while cooking.....	178
Efficiency tip for Venetian-blind cleaning.....	179
Olive oil removes paper from varnished surface.....	179
Watering house plants while on vacation.....	179
Reset loose picture-frame nail with help of cloth strip.....	179
Basement windows kept cleaner with concrete splash aprons.....	180
Concrete laundry tubs repaired by waterproof crack filler.....	180
Rubber bumper for stepladder.....	180
Kitchen knife fashioned from hacksaw blade.....	190

OFFICE, SHOP AND STORE

Coffee can forms lamp shade.....	192
Light socket taped to C-clamp forms portable shop lamp.....	207
Rubber-stamp rack is automatic.....	216
Compound girder improvised by sheathing beams.....	221
Sheet-metal clip on platform scale holds weighing slips.....	223

OUTDOOR RECREATION

Underspring trap concealed in top of stump outsmarts fox.....	177
Pencil erasers sheathe fishhooks.....	192
Outdoor gym.....	206
Take care of your camp ax.....	207

PHOTOGRAPHY

"Positive negatives" for projection.....	208
"Flash" pictures from photoflood lamps.....	210
Photo paper held between pages of magazine.....	210
Adding household detergent to final wash water improves glossy prints.....	210
Carrying wet news films.....	210
Transparency viewer doubles as retouching stand.....	211
Handy photo-paper dispenser has individual compartments.....	212
Film identified on holder slide.....	212
Detergent speeds drying.....	212
Swabbing insures clean negatives.....	212
Reducing dense areas in negative.....	212

TOOLS

Dowel wound with strip of sandpaper provides efficient spindle sander.....	190
Pipe held securely in bench vise to facilitate threading.....	192
Clock gears used in craftwork.....	200
Table listing spindle speeds mounted on lathe headstock.....	207
Variety of hammers turned from automobile axles.....	215
Miter-box base prevents clogging.....	216
Taper-measuring gauge for lathe.....	223
Correct punching strengthens belt.....	223
Chalk-line reel drilled to prevent unwinding.....	223

TOYS AND NOVELTIES

Whittled salt and pepper shakers provide novel decoration.....	180
Rattail file aids stuffing toys.....	180
Eight-sided cupola improves garage roof lines.....	191
Metal clips screwed to toy provide wheel mounts.....	200
Weighted toy clown swings precariously on rail.....	201
Arrow inserted through heart provides bewildering puzzle.....	201
"Crazy jug" covered with baubles is interesting novelty.....	207

MISCELLANEOUS

Paper clip forms bookmark.....	177
Asphalt tile cut in saw vise.....	190
Warped boards forced in place by C-clamp and pry bar.....	191
Safety pin locks lunch box.....	192
Door held during lock fitting by sand-filled sack.....	200
Milk carton holds patching plaster.....	200
Removing gum from shoe soles.....	201
Wood screw kept from loosening.....	207
Mounting test meter on turntable facilitates reading dial.....	214

Radio-Television, Electronics

Utility television today (Three-unit TV receiver for any cabinet, National Company Inc., 61 Sherman St., Malden, Mass.; television set for the kitchen, Motorola Inc., 4545 W. Augusta Blvd., Chicago).....	229
No. 1 progressive all-wave "overseas dxer" for students.....	230
"Black" tube for sharp-contrast TV pictures ("Black" face glass for TV tubes, Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh 22, Pa.; TV set employing "black" tube [photo B], Zenith Radio Corp., 6001 Dickens Ave., Chicago).....	232

Windshield Glass Stops Glare, Heat

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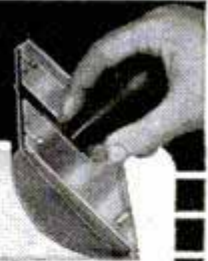
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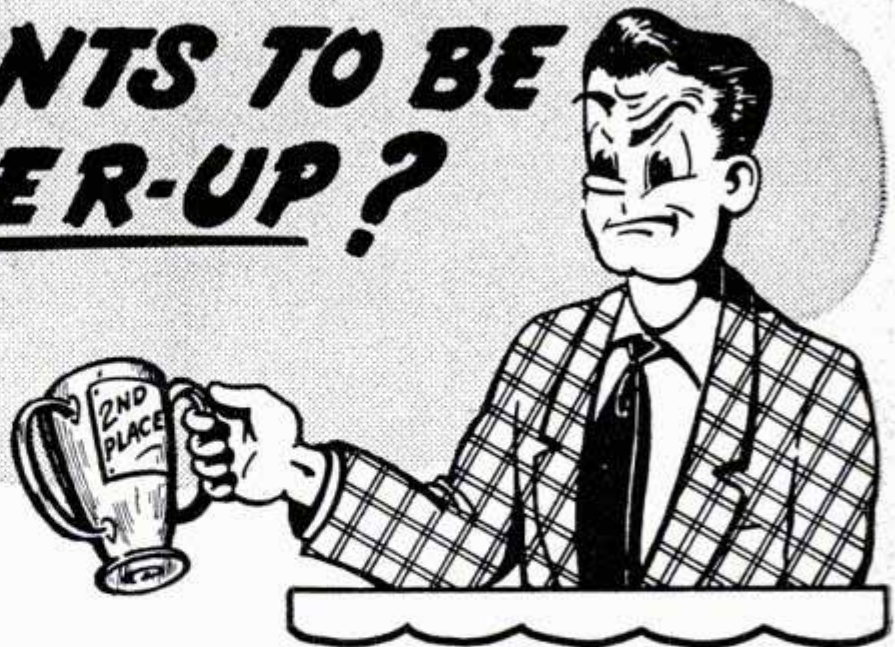
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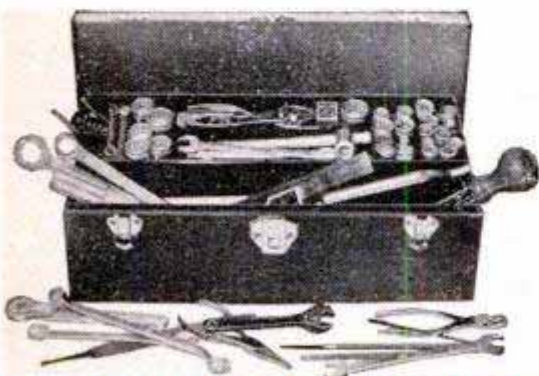
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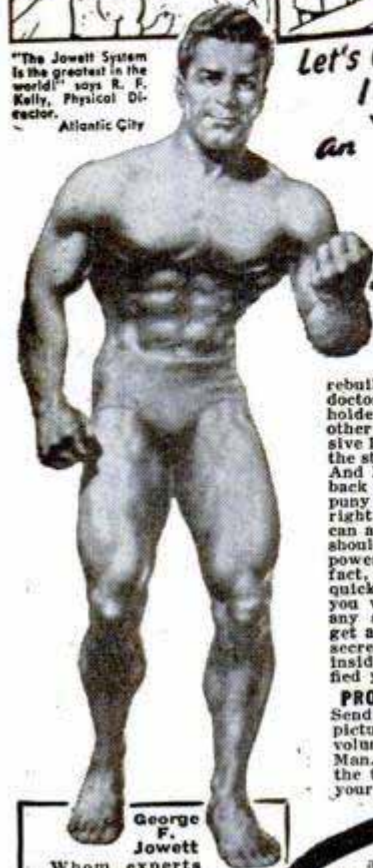
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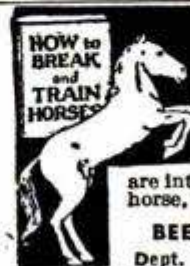


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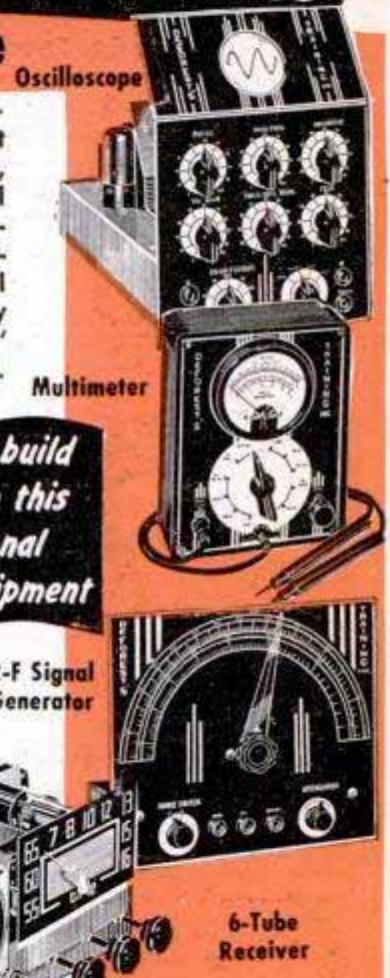
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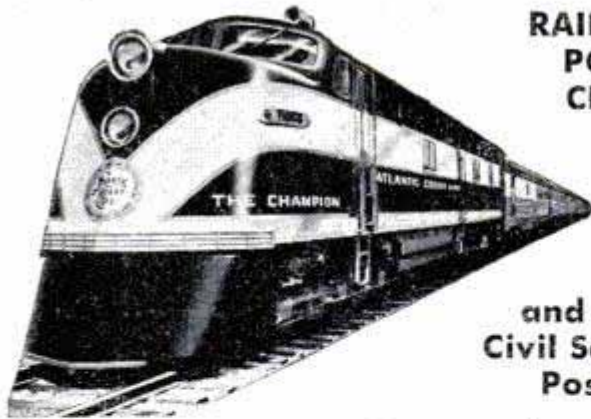
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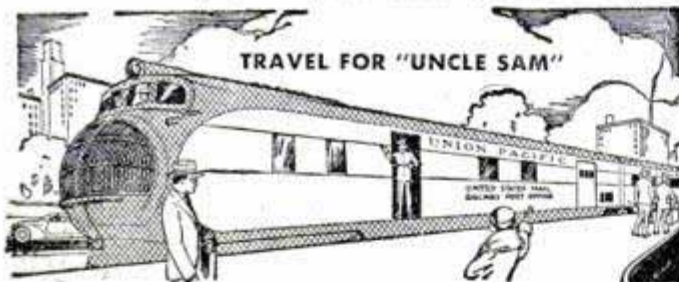
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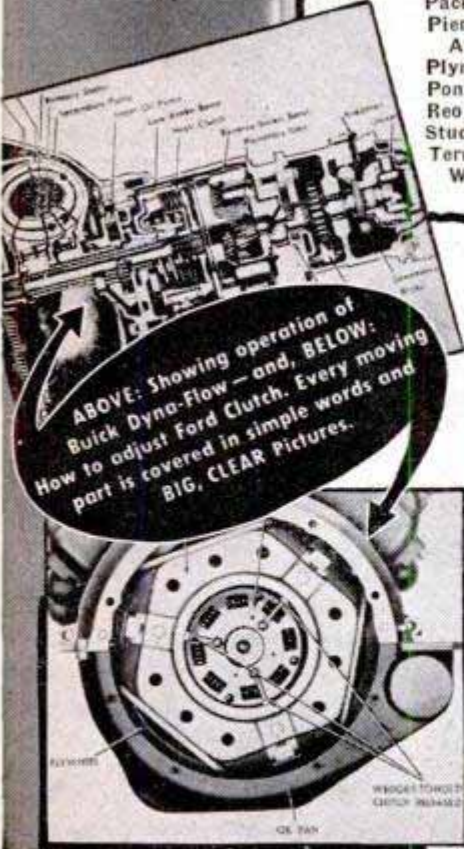
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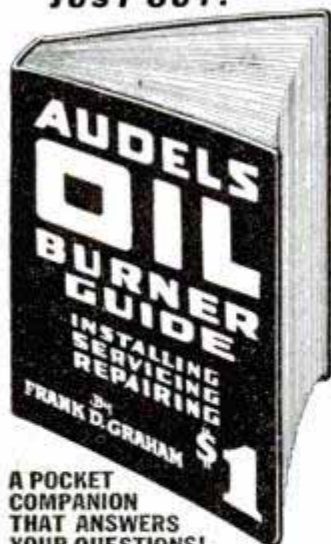
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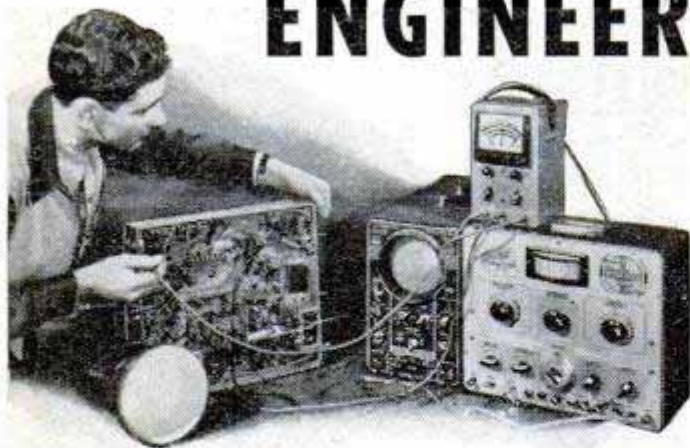
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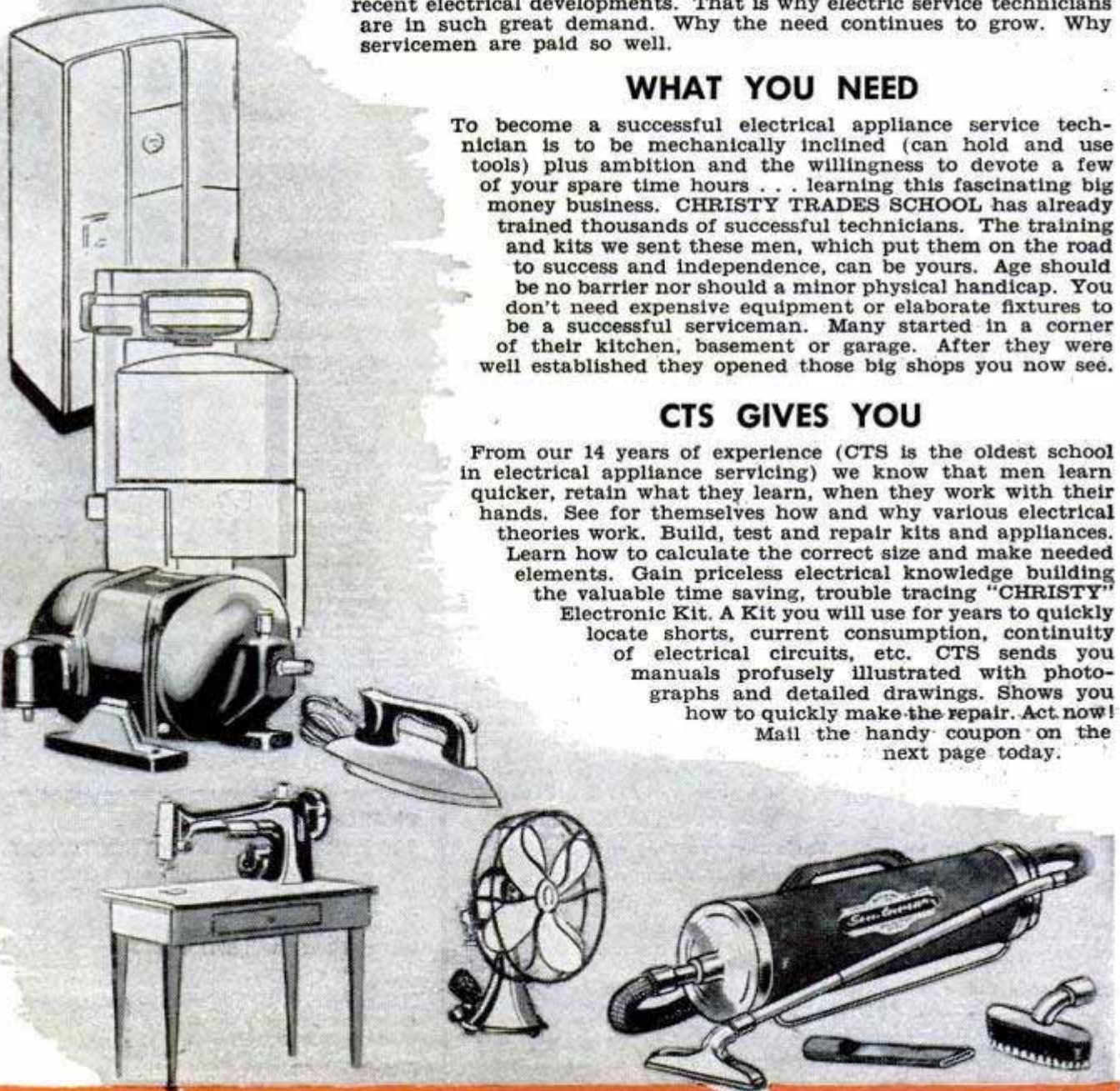
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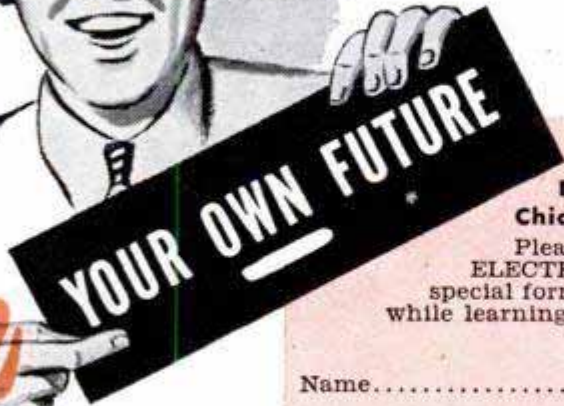
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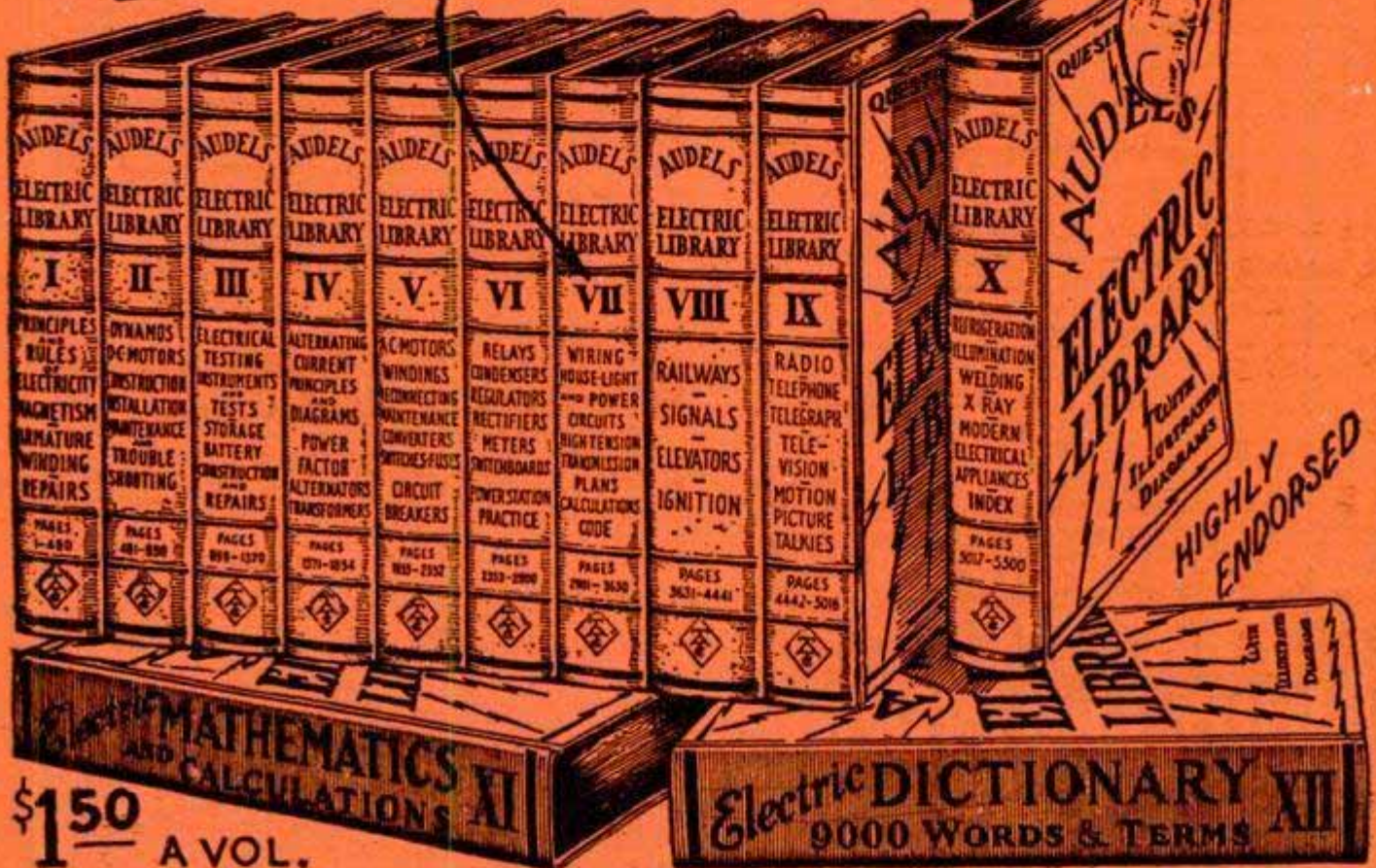
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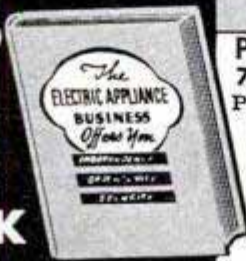
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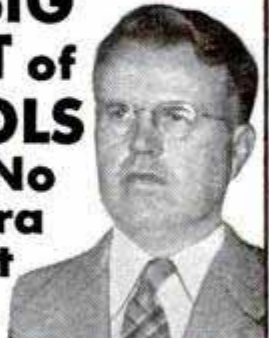
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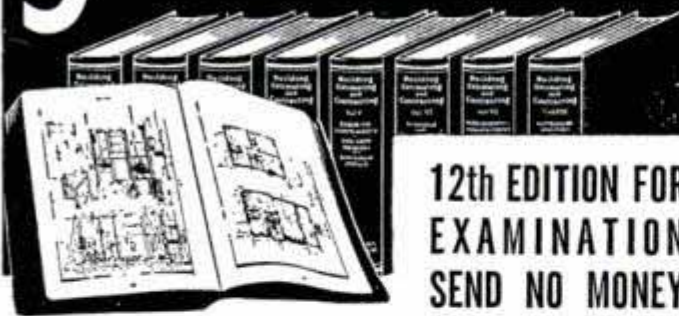
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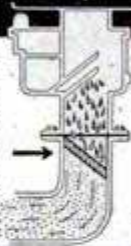
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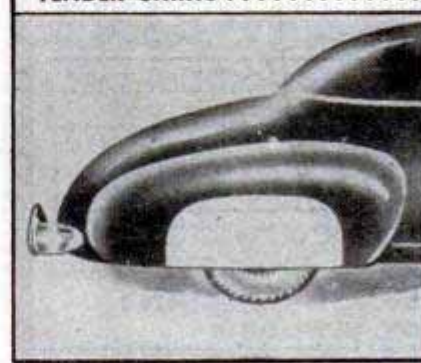
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REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

PLASTICS

INTERNAL Carvers—Guaranteed fast cutting, high speed, tapered drills with sharp points that make carving easier. 1/16", 3/32"—80c; 1/8"—\$1.00 each postpaid. Send for literature. Bay Sales, 101 Fifth Ave., New York 3, N. Y.

PLASTIC Consulting and engineering. 65 East Rich Street, Columbus 15, Ohio.

PLASTICS Supplies. Free catalog. Terrell's Plastics, 3562 4th Ave., Sacramento, Calif.

NEW Liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Sew, drill, carve. Complete kit only \$3.95 postpaid, or send 25c for exciting new home project manual showing how to get started. Castolite, Dept. A101, Woodstock, Illinois.

AMAZING Liquid Plastic kit \$3.25. Embed photographs, keepsakes, coins. Make solid objects. Clear, colors. Beautiful results in half hour. Inexpensive hobby. Send 15 cents for catalogue. Kristalon Plastics, Dept. Z-10, Box 29, Wilmette, Ill.

MAGNIFICENTLY Carved plexiglas wall plaques, 2 1/2" x 4" x 3/4", \$3.39 pair postpaid. Free plastics supplies catalogue. Craft Plastics, Somerville, New Jersey.

EARN Money with plastics. New book, "Money-Making Hobbies," shows you how. 160 pages, \$2.00. Popular Mechanics Press, 200 E. Ontario, Chicago 11, Ill.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16", 96c; 1/8", \$1.25; 3/16", \$1.52; 1/4", \$1.80. Colors add 10%. Include 10% postage. Almac Plastics, 230 Fifth Ave., New York 1, N. Y.

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

PLASTIC, Sheets, rods, tubes, etc. Free list. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

WHOLESALE Plastics supply catalog. 10c. Lucite, clear, colored. Metallic acetate, 15 colors. Thick lucite cutoffs, polished blanks for carving. Metal findings, tools, ideas, bargains galore. Quantity prices on casting plastic. Gem-O-Lite, Box 686S, North Hollywood, Calif.

CHEMISTRY

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

NEW. Used catalog 10c, refundable. Atlantic Laboratory Supply, 21 Wenham, Boston JP, Mass.

LIVE Within 800 miles of Chicago? Send 5c for catalog "Everything for the Home Lab." Medal Laboratories, 1521 121st Street, Whiting, Indiana.

USEFUL Laboratory item, catalog of chemicals, laboratory apparatus, kits, 10c. Rex Laboratories, 2849-A Birchwood, Chicago 45, Illinois.

NEW Catalog: Chemistry, mineralogy, biology. 10c. Tracey Laboratories, Evanston, Illinois.

NEW Idea chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biological and laboratory supplies in small quantities. Catalog 15c. Established 1931. John H. Winn, 124A West 23rd Street, New York, N. Y.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N. Y.

HELP WANTED

LOCAL Farmer for part-time representative to assist field engineer. National Aluminum Sprinkler Irrigation Co., P.O. Box 777, Spokane 3, Wash.

AGENTS WANTED

NEW "Sponge" wall cleaner. Erases dirt like magic. Wallpaper, painted walls, ceilings. Saves redecorating. Lightning seller. Samples sent on trial. Kristee 141, Akron, Ohio.

MORE Money, selling Sunshine's everyday greetings. Little Dutch garden 21, millinery fashion notes, value-packed 48 Sunshine notes, beautiful pastelle suede plus birthdays, sympathy, plastics, children's, gift wrap, imprinted stationery and napkins. Outstanding values, profits. Write today, samples on approval. The Sunshine Art Studios, 115 Fulton St., Dept. PM-1, New York 8, N. Y.

MORE Money—So easy! Sell distinctive new greeting cards, stationery. Fast selling plastic, metallic, 3-dimension, 21-card \$1.00 all-occasion assortments. Profits to 100%. Exclusive gift wraps. Novel "double" cards, animated books, gifts. Bonus. Special offers. Write for free samples exclusive name imprinted decorated stationery and feature all-occasion samples on approval. Elmira Greeting Card Co., 2109, Elmira, New York.

DRESSES, 18c; Coats \$1.00, blouses 35c. Free catalog. Crown, 164-P Monroe Street, New York 2.

300% PROFIT Selling razors. Send 25c for sample. 4-S-Razor, Hutchinson, Kans.

WHERE To buy 800,000 articles and nationally advertised merchandise direct from manufacturers and jobbers. Sent free. "Buy direct and make bigger profits." Glass Pub. Co., Ellwood City 7, Penna.

GREETING Card moneymakers. Birthday, everyday, valentine. Catalog free. Greenport Art Company, Brooklyn 15, New York.

LOOK! New proved Flea-No-Mat rids pets of fleas overnight. Specially treated mattress wanted by all dog owners. Make \$20 day. Sample \$1.50. Sells \$2.95. Write V. P. Garrett Company, Box 1143-P, Dallas, Texas.

\$100.00 FAST—Easy. New office necessity does it. Hudson, 934 Lakeside, Chicago 40.

NEW! Stainless steel, burglar-proof window guard! Sells itself! Millions of eager prospects! Literature, samples: \$1. Artware Corporation, 11110 Ventura Blvd., North Hollywood, California.

BE Renewal headquarters for all magazines. Handle everything at home. Big profits. No experience—no capital needed. Free catalog tells how. Write: McGregor Magazine Agency, Dept. 500A, Mount Morris, Ill.

GET Rich deal! Redybilt mowers—\$25.00. Complete, less motor. Smith Agency-3, Excelsior Springs, Mo.

MAKE \$25.00 Quickly showing Write-well greeting cards, stationery, name labels, "How to make money" booklet free. Samples on approval. Writwell, 4501 Transit Building, Boston.

MEXICAN Feather pictures. Free details. Samples 10c stamps. Sylvia, Apartado 9036, Mexico City.

NYLON Uniforms. Immediate delivery, immediate profits. Sell to doctors, dentists, nurses, waitresses, beauticians, housewives. Free sales kit. Superior Fabrics, Dept. P1, 3936 Market, Philadelphia 4, Penna.

SELL DuPont nylon uniforms. Complete line famous exclusive Hoover styled nylon uniforms for beauty shops, nurses, doctors, waitresses, others. Best quality, splendid values. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. B-100, New York 11, N. Y.

DOUBLE Your income—Sell wool and cotton uniforms, badges, initial buckles, belts, etc. Write Hook-Fast, Box 480PM, Roanoke, Va.

FREE Literature—Thousands wholesale supply sources. Money-making business ideas. Wilkin Company, Hillsboro 2, Ohio.

FREE Samples. Big profits showing amazing glow-in-the-dark specialties. House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

MAKE Money calling on friends. Show nationally advertised greeting card assortments. 16-card all occasion assortment only \$1.00. Also birthday, gift wrapping, plastics, imported English napkins, floral stationery, children's books, many more! Up to 50c profit on each assortment. Experience unnecessary. Samples on approval. Write Wallace Brown, 225 Fifth Avenue, Dept. G-4, New York 10.

BIG Money taking orders. Shirts, ties, Sox, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-BG Lincoln, Chicago.

AMAZING Offer—\$40 is yours for selling only 50 boxes. Also entirely different, new deluxe all-occasion assortment with television card, Little pearls, hankie gift greetings, other surprise items. Feature boxes on approval. Free samples imprinted stationery and rose scented notes. Write today. It costs nothing to try. Cheerful Card Co., 1088, White Plains, N. Y.

BETTER Way to extra money! Sell outstanding new plastic, metallic greeting cards. Gift wrappings, scented stationery. Profits to 100%. Bonus. Request free samples exclusive name imprinted and floral stationery, free catalog and feature all-occasion samples on approval. Special offers. New England Art Publishers, North Abington 201, Mass.

MAKE Money fast. Sell gorgeous, new metal and \$1 plastic greeting card assortments. 100 other sell-on-sight items. 21 all-occasion cards for \$1.00, birthday, Easter, relative cards. Wrappings, scented stationery, gifts. Amazing profits. Bargain offers. Write for samples on approval. Hedenkamp, Dept. PM-3, 361 Broadway, New York.

FREE Samples, and amazing plan, giving you gorgeous dress without penny cost. Rush name today, with dress size. Harford, Dept. B-235, Cincinnati 25, Ohio.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 5275, Cincinnati 3, Ohio.

"NO-FOG" Windshield cloth. Instantly removes blurry mist, frost, sleet, snow. Stops windshield fogging. Samples sent on trial. Kristee 142, Akron, Ohio.

RED Hot office device. Stamps 1500 envelopes hourly. Sells like hotcakes. Big profits. Postway, Gorham 3, Maine.

AGENTS! 100 Brand new products. Confidential bulletin monthly. Publishers, Gardenville 8, N. Y.

BIG Money career. Sell guaranteed Nylon uniforms—white, colors. No investment. Highest commissions. Easy, quick sales to waitresses, beauty shops, hotels, nurses, etc. Complete variety fabrics. Exclusive styles. Free catalog sales kit. Upland Uniform, 255 West 28th Street, Dept. G-3, New York.

FREE Nylons given if Kendex hosiery runs or snags! World's only women's hosiery sold with written guarantee amazing everybody. Mere words could not express unbelievable money-making opportunity. Fantastic earnings become reality. Armstrong earned \$202 in 9 days. Watkins sent 92 orders in one day. Imagine replacing hosiery free regardless of cause—whether use or abuse! Truly sales dynamite for terrific profits. Even if you never sold before, three magic words: "Guaranteed Against Everything" will open doors for you—make women listen and pour money in your pocket. Nationally advertised in Life, Ladies Home Journal, Saturday Evening Post, McCall's and Woman's Home Companion. Awarded Seal of Approval by Good Housekeeping. 75 million readers will see Kendex advertising to help you make quick sales and big money. Complete line from sheerest 15 denier 5 1/2 gauge to heavy 70 denier service. Sizes 8 1/2 to 11 1/2; lengths 28 to 35 inches; latest fashion colors plus white; full fashioned seamed and seamless. No competition because Kendex nylons are not sold in stores. Also complete line men's hosiery actually guaranteed for one full year or replaced free. Nothing like this anywhere. Includes rayon, nylon, lisle, wool, cotton, mixtures etc. All styles, patterns, colors, prices to please everybody. 200,000 pairs constantly in stock for fast delivery. Thousands shipped daily. Over 30 years in business. You need no money or experience. Nothing to pay now or later. Just show free outfits. Write orders. We deliver and collect. Big advance cash plus huge bonus. Earn money spare or full time—exclusively or as side line. No restrictions. Become manager—appoint others to sell for you—earn steady income on their sales. Man or woman, young or old, experienced or beginner, you can make money and friends writing orders. Everything you need is furnished free, including sales books in color, samples of hosiery materials etc. Simply write your name and address on postcard and make money next week with money-making outfits sent free and prepaid. No obligation. Kendex Company, Babylon 43, N. Y.

START Your own business on credit. Always your own boss. 1554 dealers, sold \$5,000 to \$26,500 in 1948; their average \$6,742. We supply stocks, equipment on credit. 200 home necessities. Sales experience not needed to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh Co., Dept. A-U-PPM, Freeport, Ill.

DRIVER Agents wanted. Demonstrate Crosley cars. All or spare time. Crosley Motors, 2534-1 Spring Grove, Cincinnati, Ohio.

NO Selling! Sell our business cards by mail. Successful "beginners" plan. Lynn, 5710 Bankfield, Culver City, California.

START The New Year right selling Cell-U-Mop, the finest DuPont cellulose sponge (not rubber) mop on the market! Exclusive patented construction; ideal for every cleaning, waxing purpose in homes, business places, institutions. Quick, easy sales; big profits. Amazing opportunity for full or part-time business of your own. Write today! Cell-U-Mop Co., Dept. PM-1, Freeport, Illinois.

\$1 STARTS You in business. Sell top quality \$1.00 ties. Now only \$7.20 dozen, your profit \$4.80 dozen. Regular \$1.50 up values. Send \$1.00 for introductory offer two ties. Catalog complete line free. Phillip's Neckwear, 20 West 22nd St., Dept. K-39, New York 10.

AGENTS. Sell finest food products direct to homes. Successfully sold for 25 years. Big profits. Powerful combination sale plans make sales easy. Permanent repeat business. Powerful premiums and free door openers for easier sales. Samples furnished. Live territories open to distributors. Mother Hubbard Products Co., 4139 Grand, Dept. M-1, Chicago.

BRAND New! Amazingly different and smart everyday cards. Magic window designs. 2 in 1 metallics. Take easy orders. Pays up to 100% cash profit. Big line of everyday assts. retail 60c up. Personal stationery, coasters, napkins. Free imprint samples. Assortment on approval. Write today. North Star, 31 Glenwood, Dept. D-18, Minneapolis, Minn.

AT Last! Something new and sensational in everyday cards. Make extra money fast! Show gorgeous satin velour metallic cards. Get orders easy. Scented stationery, charmettes, napkins, kiddie cards. 25 other assts. retail 60c to \$1.25. Samples on approval. Puro Co., 2801 Locust, Dept. O40-A, St. Louis 3, Mo.

BIG Profit, wooden product, 39c seller. Cost 9c up. Four samples \$1.00. Samson, Box 31, Dowagiac, Michigan.

BUY Thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save." Service Publishing, 218-A Investment Bldg., Pittsburgh 22, Penna.

FAST Selling religious article. Big profit. Write: Universal Sales Co., P.O. Box 663, North Attleboro, Mass.

DREAM And reality: Juiciest plum that ever fell into the lap of agents. Daily net earnings \$100. Capital required, \$15. Sample with convincing details, 50c. If you want big money quickly and easily, made in a dignified and legitimate manner, this is your chance. Emmen Tee, Box 612, Hollywood, Ill.

JEWELRY Factory desires salesmen, distributors, jobbers. Pickcraft, 19 Bank Street, Attleboro, Mass.

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

AGENTS: Stamping names on key protectors. Sample 25c. Stamping outfits, checks, social security and name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

AMAZING Ketchup dispenser! Pumps ketchup out of bottle. Sells fast to housewives, restaurants, stores. King, 55-P Oleander, West Springfield, Mass.

NEWEST Money-making sensation, miniature authentic replicas, police and firemen's badges also pocket pieces, key chains. Write for descriptive folder. Hook-Fast Specialties, Dept. 20, Box 1425, Providence, R. I.

SELL Big money-maker to men and women. Easy handwork makes fast-selling useful articles. Sunmade Company, Brockton 64, Mass.

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

LOOK! Make money all year round selling personal initialed individualized belts, buckles, cap badges, tie holders, complete line police and firemen's badges, 2000 emblems to choose. Big profits, whole or part time. Please write today special outfit offer. Hook-Fast Specialties, Box 1425, Dept. 6, Providence, R. I. Established 1926.

SEWING Machine electrification kit. Nationally advertised. Has Good Housekeeping Guaranty Seal. Can be demonstrated and sold in 5 minutes. Make at least \$5 per sale. For complete details write today to Brownell Distributors, Inc., Dept. PM, 308 Canal St., New York 13, N. Y.

FREE Water and our concentrates, make flavors, lotions, shampoos, 125 products, labels, bottles supplied. Qualco, E20030 Russell, Detroit.

MAGIC Cleaner—Laundry soap deal. Hotter than a firecracker. Big profits. Sample free. Bestco, 4642 No. Central, Chicago.

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

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

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.

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

CLEAN Up with plastic rayon towels. Powerful quick demonstration. Ink, grease rinse right out. Every home, every business a prospect. Package 6 towels sells \$1.00. Gross \$54.00. Send \$1.00 sample package. Sunbeam Products, 701 Third St. So., St. Petersburg, Florida.

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BURT'S Course in salesmanship is designed to improve your position and salary. Send for valuable information free. Mead Publishing Co., 404 Halliburton Bldg., 1709 W. 8th, Los Angeles 14, Calif.

ADVERTISING Book matches—Cash in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M-150, 7530 Greenwood, Chicago.

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. 512, New York City 7.

RICH Opportunity for men in their 50's. Healthful, pleasant occupation. No investment needed. 150 of our men made \$500 to \$3,000 in one month; many just beginners. Wallace made \$164 first 2 hours; Crowley made \$224 first day; exceptional earnings. Openings available. Write President, Box 711, Dept. PM, Fort Worth 1, Texas. Canadian address: Box 158, Dept. PM, Terminal "A," Toronto, Ontario.

SALESMEN. Earn \$50.00 weekly, selling only three pairs shoes daily. Commission and bonus. Wide variety for men, women, children. No investment. Experience unnecessary. Free catalog. Tanners Shoes, 559, Boston, Mass.

SELL New automatic floor waxer. Trigger on handle. Hands never touch floors or wax. Retail \$2.95. Profit 125%. Write Smith, Inc., Greenfield 2, Mass.

AMAZING Discovery, Master Glaze, puts brilliant glass-like surface on cars. Free sample, information. Big commissions. Master Glaze, Dept. 686, 7720 Harwood, Milwaukee, Wis.

SELL Automatic fire alarms now. Low cost, big profits. Needed every home, store, farm. Write Harmony Brass Co., Plano 3, Illinois.

SELL Art and commercial calendars. Advertising specialties. Over 1000 good-will items. Diversified line. Highest commissions. Territorial protection. Send \$1.00 refundable deposit for prepaid initial set of samples. Standard Calendar Company, Madison, Illinois.

AMAZING Profits—Repeats sell Lastic Plastic, world's best work gloves. Outwear canvas 10 to 1. Literature free. Modern Company, 12392-D Ohio Street, Detroit 4, Mich.

WHY Not try selling? Men have succeeded selling shoes who believed they could not sell. Free selling outfit puts you in secure business. Consolidated Shoe System, Dept. S-421, Chippewa Falls, Wis.

SALESMEN—Sell America's finest, biggest line of adv. specialties. Sensational sellers to all types of business. Big commissions advanced. Sensational sales plan nets you top earnings. Free outfit. Charms & Cain, 407A South Dearborn, Chicago 5.

SALESMAN. Sell custom made aluminum name plates. Easy to sell. Good profits. Write for particulars. Jackson Aluminum Co., Box 26, Jackson, Ohio.

UNIFORMS Highly styled for nurses, beauticians, waitresses, doctors, housewives. In nylon and other materials. All colors. Highest commissions in industry. Write for details. Uniform Corp. of America, 121 E. 59th St., New York 22, N. Y.

OVER \$500 Weekly average several weeks for Maurice and Ruffo. \$250 weekly common, selling patented tool. Demonstration 2 min. Inexpensive. Prospects everywhere. Exceptional sales proposition. Palcoseel Co., Ltd., Massena PM1, N. Y.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 17, Chicago 4, Ill.

BIG Money taking orders. Shirts, ties, Sox, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

LONG Needed invention. Established company. Every home, factory, store, farm a prospect. Low price, long profit. Exclusive. Fine outfit. No deposit. Information sent airmail. Write: Red Comet, Inc., Dept. 515, Littleton, Colo.

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PIANO Tuning pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—52nd year. G.I. approved. Write for booklet. Niles Bryant School, 78 Bryant Bldg., Washington 16, D. C.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "dollar-a-week" bookkeeping and tax service. Full or spare time. Details free. No obligation. Ellis, Box 200, Cedar Grove, N. C.

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USED Correspondence courses and educational books, bought, sold, rented, catalog free. Educational Exchange, Summer-ville, Ga.

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NON-Resident courses: High school, college. Earn Triplespeed selfstudy shorthand. Capital City College, Washington 5, D. C.

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INCREASE Your earnings—Learn watch repairing at home. Ten easy lessons. We furnish free watches and all tools. A licensed school. Large percentage of students make up to \$40 a week in spare time while learning. Write today for free information. Illinois School of Watch Repairing, Dept. CPM-1, 2870 Elston Ave., Chicago 18, Ill.

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WRITE For pay and pleasure! You can make extra money, have fun, when you take our "earn while you learn" writing courses. We back up our statement with 31,000 satisfied students. Send penny postal today for free details. Comfort Writer's Service, 200 S. 7th St., Dept. PM150, St. Louis 2, Mo.

SHORTHAND In one week. Easy long-hand system. Excellent for secretaries, students. \$1.48. Zinman, 215J West 91, New York 24, New York.

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I WANT New writers to cash checks of \$1 to \$100 offered daily. The easiest way to write for pay. No previous experience necessary. Free details. Saunders M. Cummings, 468-11 Independence Bldg., Colorado Springs, Colo.

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SHOWCARD Writing pays big! Learn rapid, artistic lettering quickly, easily. Our low-cost course shows how. Details free. Sherwood Publishing Co., Irvington 3, N. J.

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CARTOON Your way to success! Internationally known instructor, Raye Burns, will personally teach you to create salable, original cartoons at home. Course of 26 lessons only \$2.85. Send remittance with order or write for free details and addresses of successful students. Raye Burns School, Box 3583-M, Cleveland 18, Ohio.

CARTOONS Printed. Write School of Cartoons, Box 3291, San Francisco 19, California.

FAMOUS \$75 Lockwood Art Course now only \$6 postpaid. Other smashing art bargains. Catalog 10c. Art Book Shop, Arnold 7-D, Mo.

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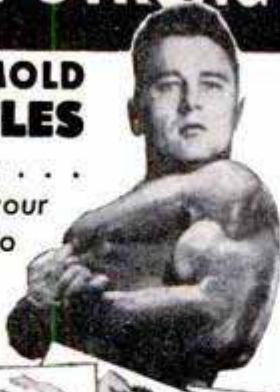
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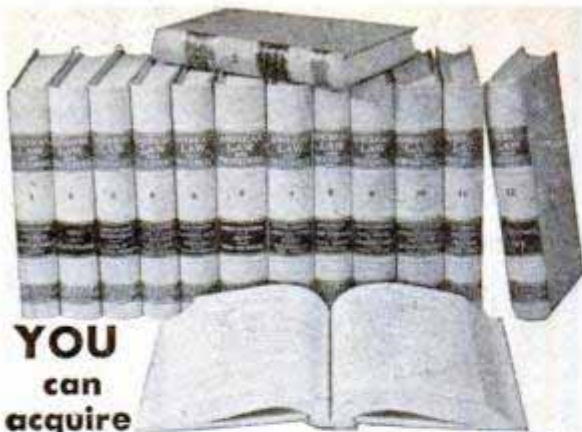


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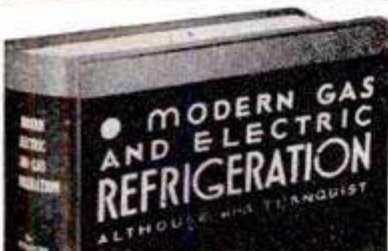
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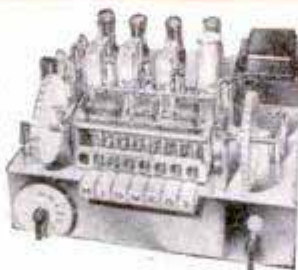
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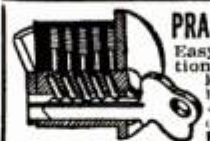
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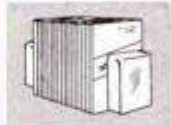
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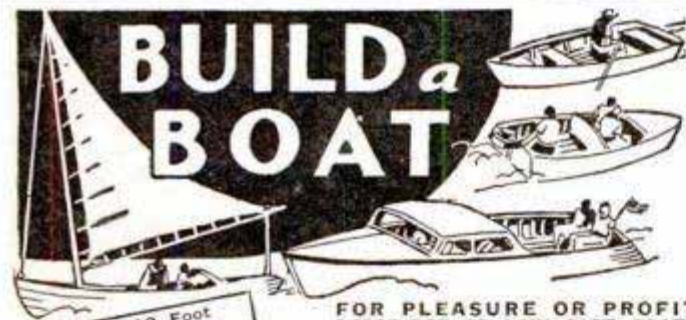
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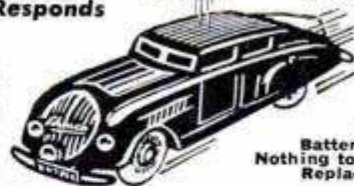
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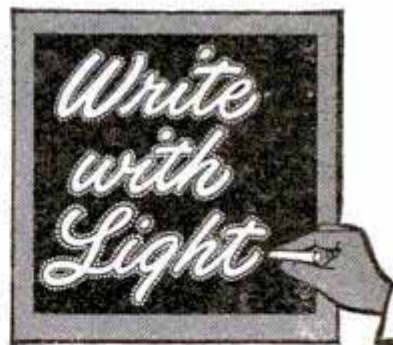
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POPULAR JANUARY 1950 MECHANICS

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 93 NO. 1

A Half Century of Miracles

This is 1950. We have lived these 50 years amid a tremendous revolution. Look back on this greatest half century of scientific achievement — and look ahead next month as Mr. Kaempfert tells what A. D. 2000 will bring

By **Waldemar Kaempfert**
Science Editor, The New York Times

WHEN MIDNIGHT came on December 31, 1899 and pealing bells and raucous horns ushered in the year 1900, a few paused to wonder what marvels science and invention would produce in the century to come. There never had been a century like the 19th, with its steam engines, its development of electricity, its crude "wireless telegraph," its "horseless carriages," its telephones and telegraphs. What next?

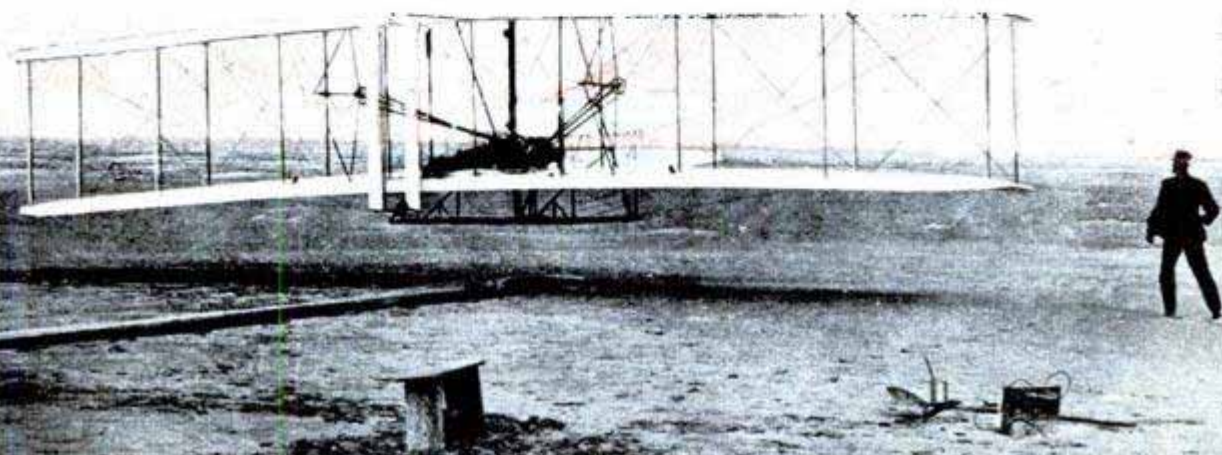
Fifty years have passed, and half the answer can be given. That half eclipses anything of which the wildest writers of scientific fiction or of speculative newspaper articles dreamed in 1900.

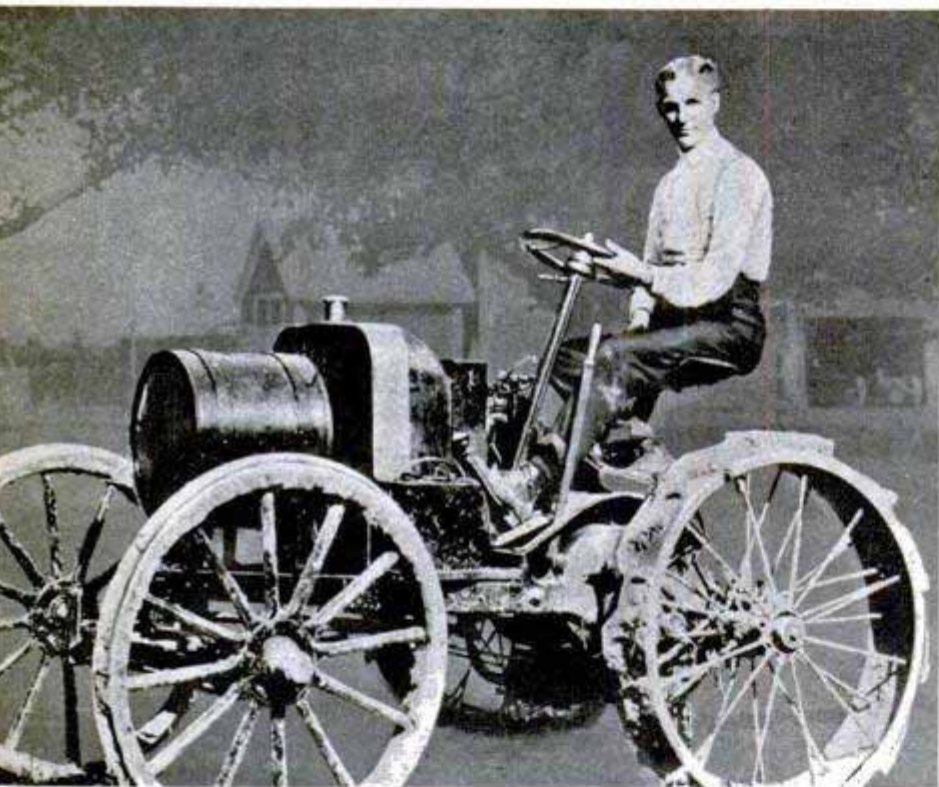
The automobile was the doubt and wonder of 1900. The doubt came from the derision that a stalled car always provoked, the wonder from the ingenuity of the contrivance. Benz and Daimler "horseless

carriages" had been running since the eighties in Europe, and by the nineties a few bold Americans, Elwood Haynes, Alexander Winton, Henry Ford and a few others had cars that sputtered and rattled on the roads. Back in 1895 Haynes was told by a Chicago policeman to "get that horseless carriage off the street." About the same time Cortland Field Bishop was arrested for disorderly conduct because he drove an auto through Central Park, New York.

The great contribution of the United States to mechanical road transportation was progressive assembling, which Henry Ford learned from the packing industry and greatly improved. In 1912 it took 14 man-hours to put one Ford car together. The cost was \$8.75. Two years later, the average time for assembling had been reduced to two man-hours, and the cost to \$1.25.

One of the century's most spectacular developments has been the airplane, from the Wright Brothers' craft, below, which stayed aloft 59 seconds in 1903, to today's 600-mile-an-hour Boeing jet bomber, above





It was Walter Flanders, an Ohio machinist, who really created the Ford system. The machining of a whole cylinder block, boring and reaming the inside, drilling bolt holes, grinding valve seats, planing off the base and head—28 operations in all—took only 45 minutes. The principle revolutionized the production of cars—made it possible for one American out of five to own one.

What really did astonish us in the first decade of the century was the airplane. Inventors of flying machines were still regarded as harmless cranks in 1900. Yet in 1903 the Wright Brothers, two obscure bicycle makers of Dayton, Ohio, announced that they had flown at a speed of 35 miles an hour for almost a minute. Nobody believed them. But the air age had dawned. By the time World War I broke out fighters were making 200 miles an hour. In World War II, 350 and 400 miles an hour were attained. Record-breakers made over 600. Today 300 miles an hour is considered about right for a commercial passenger plane, but some experimental planes have actually traveled beyond the speed of sound—730 miles an hour at sea level. Engineers talk of supersonic speeds of 1000 miles an hour, which means that a man will leave Chicago for London early in the morning and return the same night by the end of this century.

The cry for speed, more speed

Mechanization has radically changed the farmer's life. During the 1900s he has switched from the animal-drawn plow, top, to early tractor made by Ford, left, and eventually to the modern equipment below



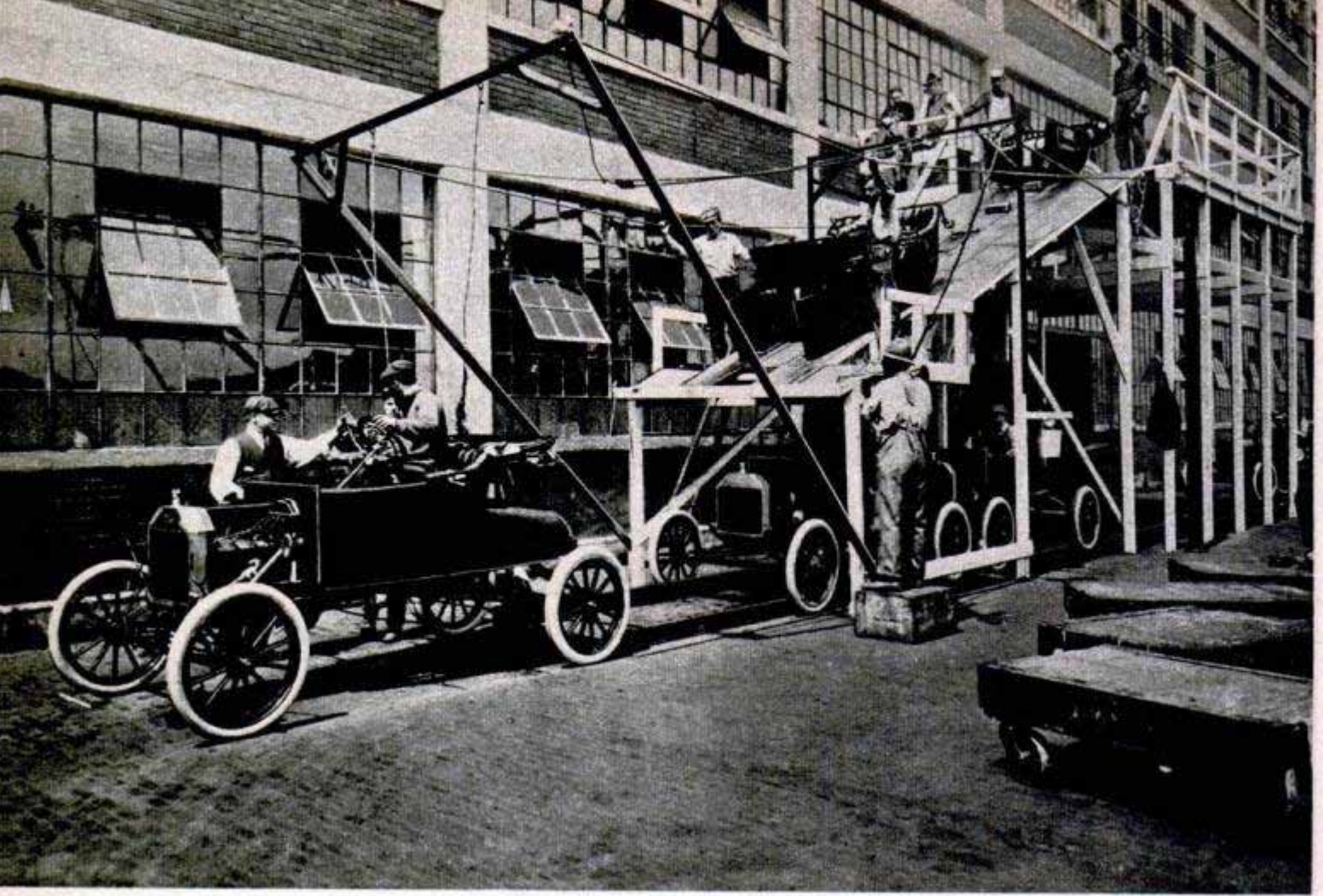
One atomic explosion like this could generate enough electric power to supply the United States for months. Though first harnessed in 1945 for destructive use, atomic energy has a limitless peacetime potential

and still more speed came from the military forces of all countries. It was a cry that could not be stilled by the conventional piston engine. After years of research, British Air Commodore Sir Frank Whittle answered it during the last war with jet propulsion. But even jet propulsion will not give us supersonic speeds. So government physicists are turning to rockets with stubby, swept-back wings. Rocket planes have been made and flown for a few minutes. To design them, new principles had to be invoked; for when the speed of sound is reached ordinary machines are hammered and torn apart by the resistant air. Because the rocket engine simply kicks itself along and requires no air from the outside, nobody laughs at the "astronauts" who think of traveling to the Moon and even to Mars.

The new high speeds drive home the importance of mechanical and electrical power in our culture. There were about 27,000,000 horses in 1900, many of them engaged in farm work. Today a horse is not often seen even in rural districts. The all-purpose tractor, the Jeep and motor truck have taken his place, and the stationary gasoline engine saws wood, grinds feed and does most of the chores on a farm.

The farmer has become not only more power minded but more scientifically minded. In 1900 the Abbe Gregor Mendel's laws of heredity were rediscovered after having been embalmed for 41 years in an obscure botanical publication. A science of heredity grew up. It became possible to create plants and animals almost to order. The farmer applied this new knowledge, so that today his cows yield more milk and butter, his steers produce better beef, his wheat stands up in high winds, his hybrid corn yields huge crops. If despite the trend of population from the country to the cities American farms are more than able to feed us, it is because of the development of power-driven agricultural machinery and the application of Mendel's principles of heredity.

Up to 1945 we thought of power in terms of fuel that could be burned in a furnace. In that last year of World War II came the announcement that at a cost of two billion dollars a team of physicists had devised an atomic bomb. By splitting the uranium atom in the manner discovered by two Germans, Hahn and Strassmann, at the end of 1938, some of the enormous energy that bound it together was released with terrifying results over Japan. The energy can



Above, assembly-line techniques like those Ford was using in 1913 sped production to the point where one American in five could buy a car. Below, nylon, introduced in 1938, was the first synthetic fiber

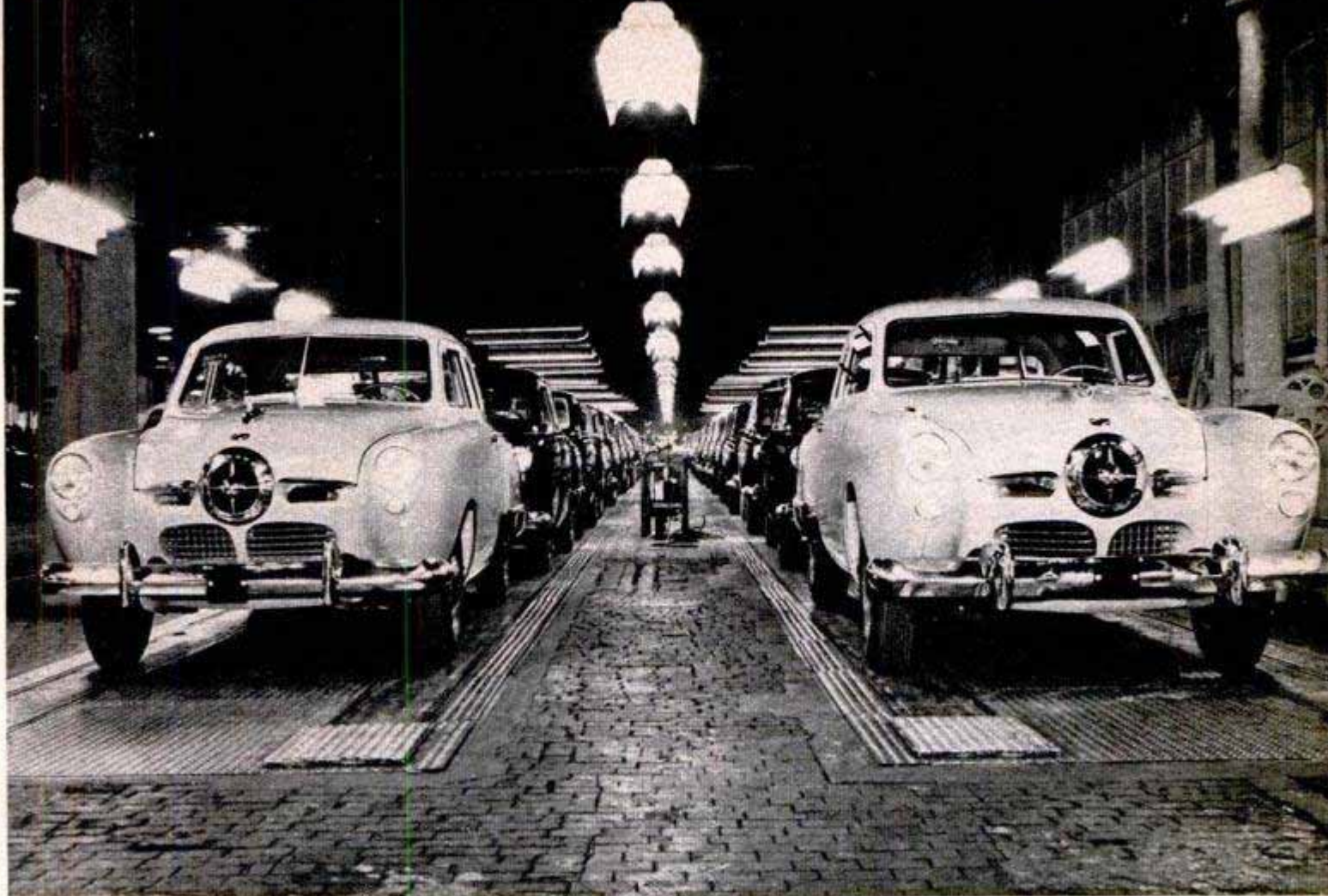


also be tamed for use in a power plant on land or in a ship before the century ends. Not since some savage, who was still a half-ape, found out a million years ago how to make a fire and use it had human ingenuity scored such a technical triumph.

This achievement had been foreshadowed. Soon after the century had opened physicists were telling the world that there was enough energy in a glass of water to drive a liner across the ocean. A young examiner in the Swiss patent office, Albert Einstein, had announced his special theory of relativity in 1905, and from the simple formula given, any high-school boy could calculate how much energy there was in a speck of dirt. The answer ran into staggering figures.

Even before the scientists had proceeded as far as this, they realized that what was happening in the laboratory was also happening in the stars, but on a grander scale. There were the same atoms all through the universe. But in the stars temperatures ran into millions of degrees and pressures into millions of tons. Atoms were being torn apart by these terrific forces and put together again. In the process, matter was transformed into energy and energy into matter. At last it was known why the stars shone.

The lines in the spectrum of the stars



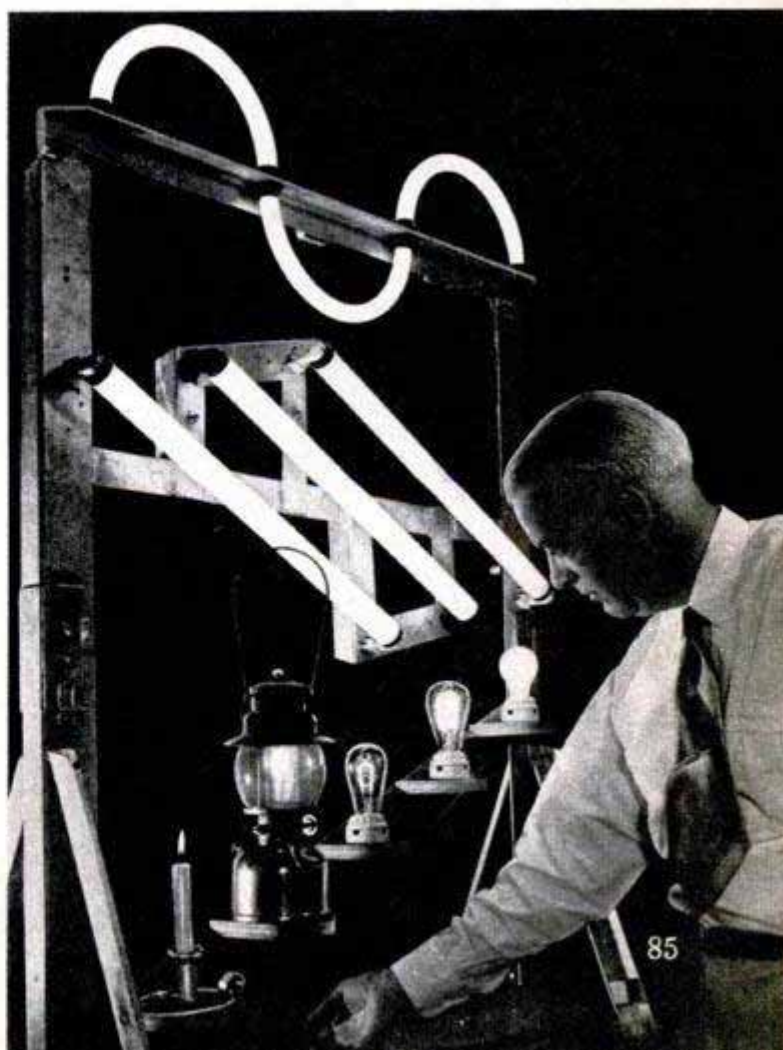
were telling all this, but not until it was known that the atom is a complex of much smaller particles could the message be read. The biggest telescopes in the world—the 100 and 200-inch reflectors of Mount Wilson and Palomar Mountain—were built in the first half of the century, to gather more light that could be broken up into spectral messages.

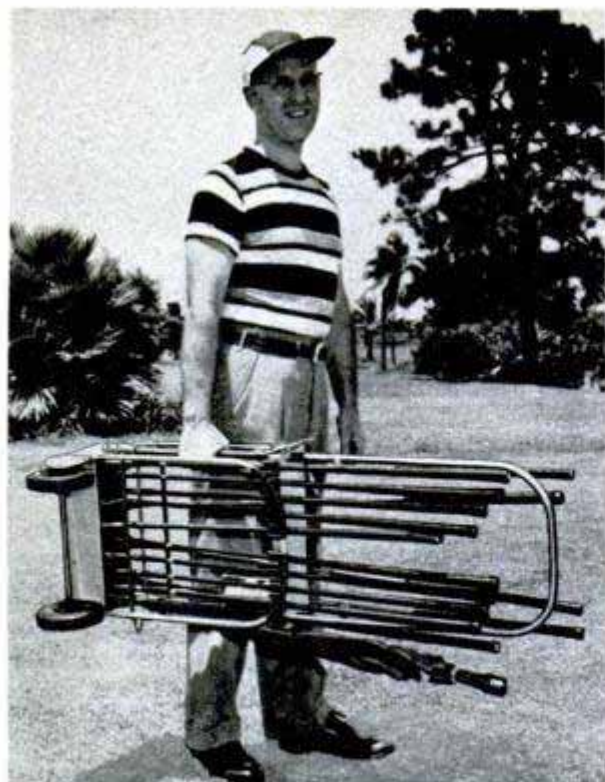
In the process of battering atomic bits, Ernest Rutherford discovered in 1919 that some elements can be changed into others. Since then microscopic specks of mercury have actually been changed into microscopic specks of gold. So the alchemists were not mad after all. Not only this but entirely new elements were made—elements unknown in nature. Neptunium and plutonium are among them.

After battering atoms of all kinds with the aid of high-speed particles, most of the elements proved to be mixtures of what we call isotopes. For example, there are half a dozen kinds of isotopes of lead, which can be distinguished only by weighing them. There are several hundred of these isotopes. Some of them are radioactive, some of them not. Both kinds are used as "tracers" to find out what happens in the human body when an egg or a piece of beefsteak is digested. The whole theory of

(Continued to page 254)

Above, production lines like this one at Studebaker enable the industry to turn out 140,000 vehicles a week. Below, Westinghouse exhibit showing progress of light from the candle to the incandescent bulb





Carry-or-Roll Golf Cart

Golf clubs can either be rolled or carried in a metal cart weighing only 7½ pounds. It is lighter than most bags. Each club is



in a separate rack, head down, and the cart is balanced so that it will even stand upright on the side of a hill. The golf balls feed out from the bottom of a clear plastic tube attached to the cart.



Paper Sorter

Mimeographed or printed sheets are assembled into booklets and inserted into envelopes by a large office machine. The machine also tosses imperfect booklets into the wastebasket and detects misplaced sheets. Vacuum operated, it can stack

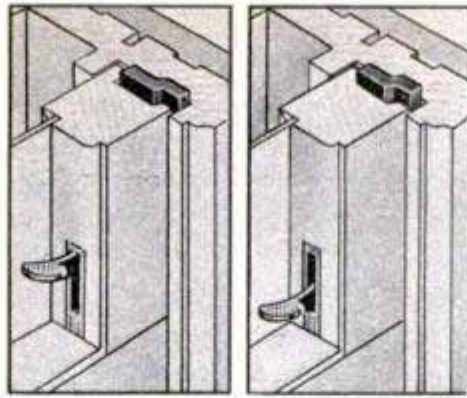


19,200 sheets an hour into booklets of eight pages each and prepare them for mailing. The pages are gathered on an assembly line and then slipped into the envelopes.

☛ Egg-case fillers made of foam rubber to cushion hatching eggs during shipment have been developed in England.

Weathertight Sash

Wedged against its frame, a new wooden window seals the cracks on the sides, eliminating the need for weatherstripping except at the head, meeting rail and sill. The double-hung units have no weights, springs or balances to hold them in place. Two levers wedge the sash against the parting stop, holding the window at any desired level. The sash can be slipped out for painting or cleaning.



Above, left, when the lever is up the pressure strip pushes sash against frame, sealing all cracks. Above, right, with lever down pressure is off and window can be moved. Right, sash can be removed for cleaning

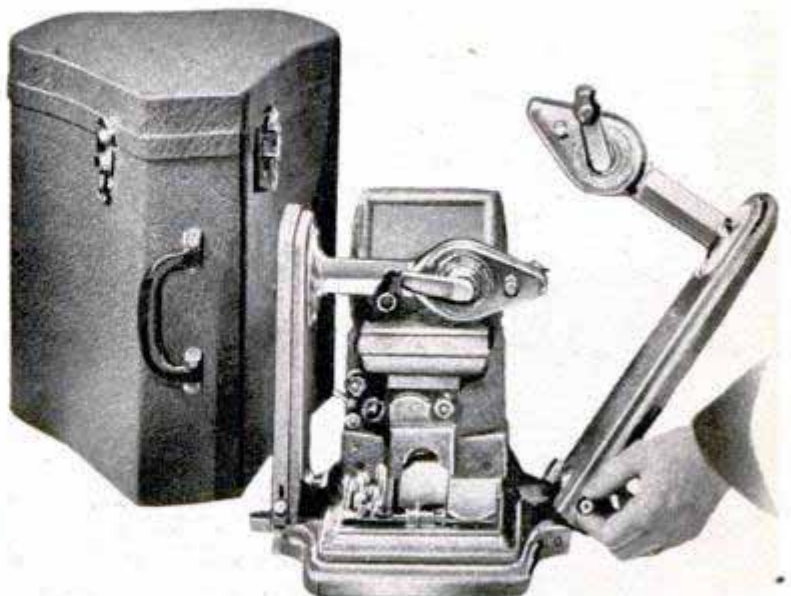


Modern Peter Piper Picks From Old Car

Pickle picking, a one-time backbreaking chore, now is done with ease from the frames of stripped-down automobiles on Clinton Carter's farm near Mottville, Mich. The pickers work in a sitting position from outriggers extending on either side of the chassis. The machines can be regulated to travel through the field at the rate of $\frac{1}{4}$ mile per hour, steering themselves between the rows.

Film Editor on Hinged Base Folds Into Compact Case

Amateur movie makers can fold all the parts of a film editor into a compact unit when the instrument is mounted on a special base. Made of lightweight metal, the base permits the rewinds, splicer and other parts to be folded into each other, then packed in a carrying case measuring only 16 inches wide, 14 inches high and 15 inches deep. Knurled knobs lock or unlock the parts of the hinged base.



Popular Mechanics provides two sources of further information concerning articles published in each issue: the WHERE-TO-BUY-IT INDEX, starting on page 10, and the WHERE-TO-FIND-IT INDEX, available without charge from Bureau of Information, Popular Mechanics, 200 E. Ontario St., Chicago 11



Airline pilot Heath Proctor peers across the horizon from a DC-6, flying between Los Angeles and Chicago



AN AIRLINE PILOT

By Heath Proctor

Senior pilot of a transcontinental airline and a wartime colonel of the Air Transport Command in India, Heath Proctor discovered the Old Santa Fe Trail from the window of his DC-6. Popular Mechanics sent him by Jeep to explore the old wagon tracks

MAYBE I'm different from other airline pilots, but ever since I was a kid I've liked to look out of windows—house windows, automobile windows, train windows and in recent years cockpit windows.

Late one wintry afternoon on a flight from Chicago to Tucson, Ariz., I was engaged in my window-gazing pastime just west of the Cimarron River in Kansas. We were at a good altitude for observing scenery on a big scale and our DC-6 was purring like a kitten filled with high-octane milk. I had turned the controls over to my copilot and feeling warm and content was





Aerial view of old wagon-trail ruts, in foreground, brought out in sharp relief by snowfall

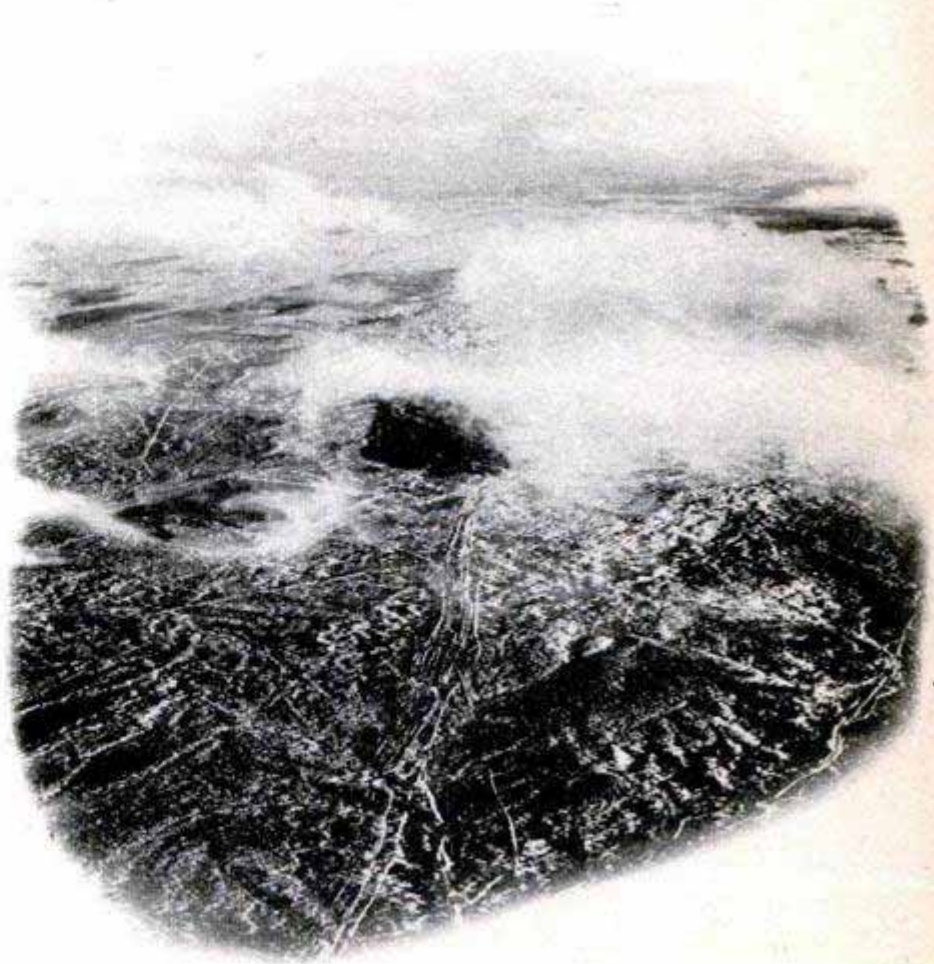
RIDES THE WAGON TRAIL



looking down at wisps of snow being blown across the wide-open spaces.

In places, the short grass or ruts had caught enough snow to make a rather interesting pattern. Suddenly I sat bolt upright and pressed my head against the cockpit window. That was no haphazard pattern of ruts down there on the prairie. It was a trail, wide in places and narrowing from time to time where the going was apparently rough. This old trail headed majestically into the Southwest toward Wagon Mound, N. Mex., and Santa Fe. I knew I had found the old historic Santa Fe Trail!

I've always been an avid reader of American history and 25 years of chauffeuring planes has given me a bird's-eye view



Despite wind and weather, traces of the Santa Fe Trail are still visible across the prairie. It was used until the 1870 s



From a bluff, Proctor points out to Aubrey Cookman of Popular Mechanics a clear marking of the old route

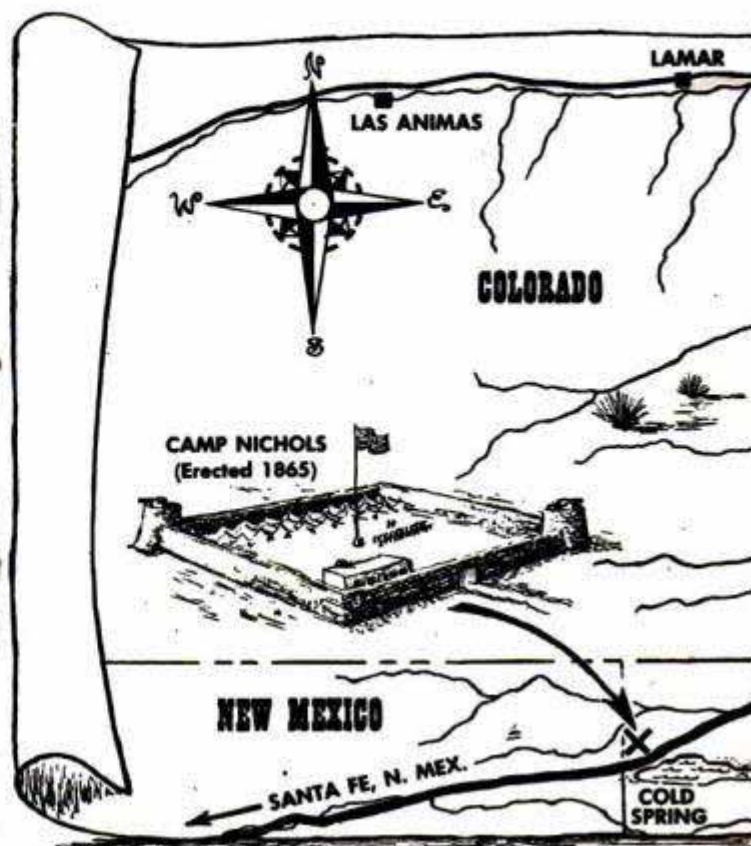
of geography. This has made me appreciate some of those terrific distances traveled by our forefathers on horseback and in ox-drawn wagons. Back in 1935 I found the old Mason and Dixon Line and took a picture of it from the air. This photograph was widely printed because most Americans thought the line existed only in musty history books.

After finding the old Santa Fe Trail I could hardly wait to get to a library and

So many travelers scratched their names on one rock ledge that it has become known as "The Trail Album"

look up some dope on it. It was used principally as a freight route and was well organized. This was in contrast to the old Oregon Trail, which was a "passenger" route traveled by stray groups of families.

The general route of the Santa Fe Trail, via the Arkansas River, was used by the Indians long before white men appeared. Early trappers and explorers followed it, but it wasn't until 1804 that the first pack train freighted the entire distance from the Missouri River to the Mexican settlement of Santa Fe. By 1824 wagons replaced the pack animals and the Santa Fe White Top became the standard vehicle.





Across Oklahoma, pairs of rutted tracks nearly a foot deep are reminders of the trail's once-heavy traffic

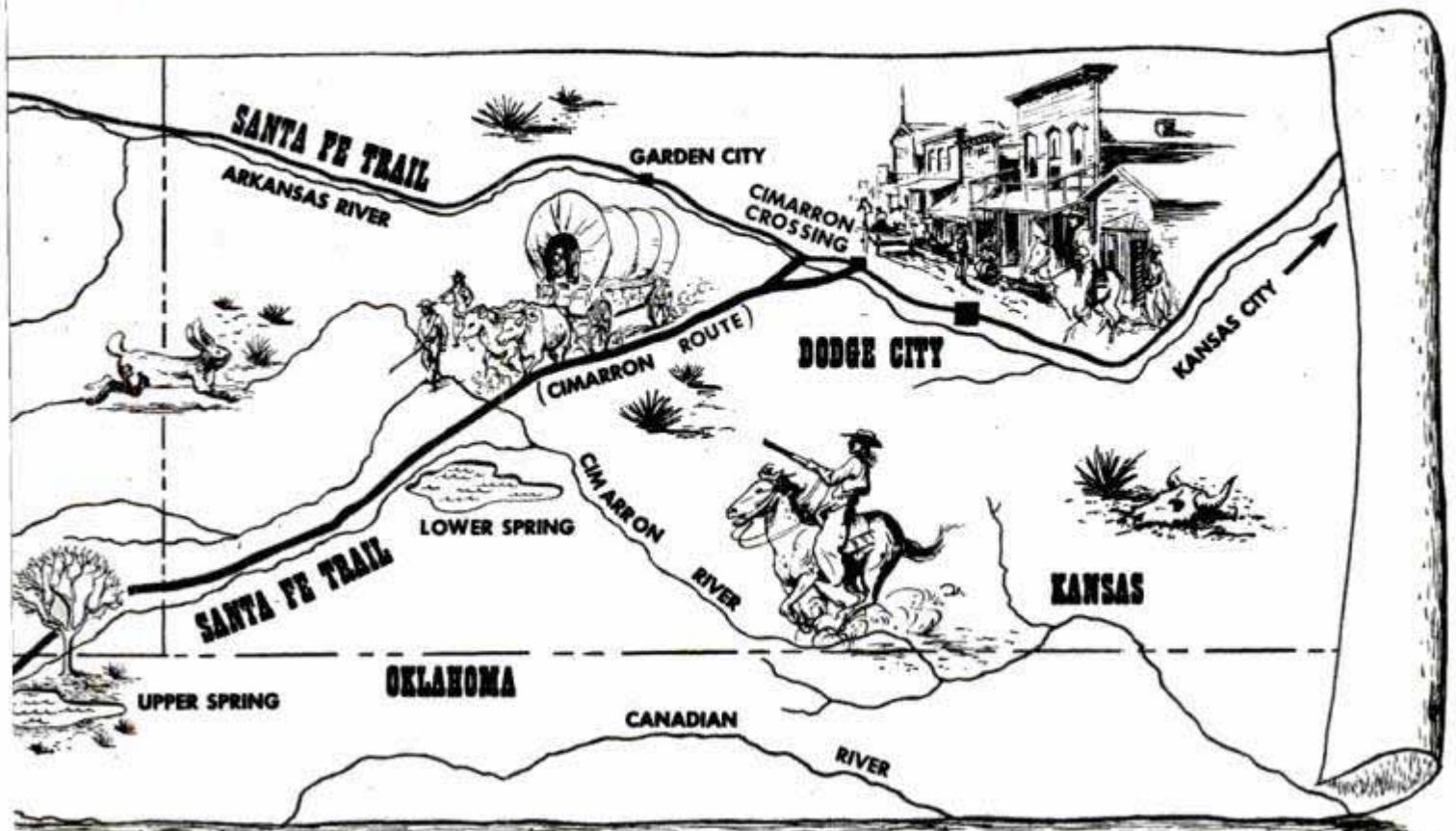
Every time I flew the route between Chicago, Tucson and Los Angeles I would go back among my passengers and point out the marks left by the old wagon trains. And having spotted this bit of history from the air I determined that some day, between flights, I'd come down to the ground and explore the trail on wheels.

Meanwhile, I kept learning more about the trail. Santa Fe back in the early days was part of Mexico and an important city, supplied mostly by the Spanish. As our forefathers expanded westward they naturally entered into competition with the Spanish for the rich Santa Fe market. Over

the trail they sent a flood of low-priced merchandise that entirely supplanted the Spanish or Mexican importations.

The Mexicans retaliated by levying a heavy tax on each wagonload of freight. Yankee ingenuity was put to work and soon the wagon trains took on a new look. They consisted of units made up of three wagons each, a large one followed by two smaller trailers. As they approached the

At Dodge City the Popular Mechanics party followed the Cimarron fork of pioneer freight path westward. Camp Nichols, built by the famous Col. Kit Carson, had a brief life as an Army post to protect travelers





Roy Hardin of the Boot Hill Museum in Dodge City shows Proctor one of a collection of rifles popular in the old West, when a gun was a man's "best friend"



Above, Merritt L. Beeson, son of a Dodge City pioneer, answering questions about an old map of the trail. Below, "Uncle Billy" Baker, county land agent for 25 years, holds a wheel hub found near Boise City



border, where taxes were collected, freight from the two trailers was loaded onto the large "schooner," the trailers were burned and one wagon lumbered and creaked slowly on into Santa Fe.

After the Civil War stagecoach service was established over the trail between Westport (the old name for Kansas City) and Santa Fe. Carrying 11 passengers, 9 inside and 2 in the boot on top of the stage behind the driver, the distance could be made in two weeks of continuous travel. They stopped only to eat and to change horses and drivers. The fare was \$250.

I was amazed at this figure compared with today's airline-passenger fare of \$45 for the same trip! The gap between those figures, and the fact that more people were buried along the wagon trails in one summer than have lost their lives in air accidents during the entire history of commercial flying, are testimonials to the advances made in transportation.

From the air I discovered that most of the trail has been obliterated by plow and weather. From Kansas City to Wagon Bed Spring, Kans., near where the trail reaches the Cimarron River, the ruts are visible only in a few scattered spots. I discovered later that it is almost impossible to find this remnant of the trail on the ground. Actually, it can be seen better from aloft because in places the route seems to have left more of a stain than a trace.

However, from the Cimarron River to Wagon Mound the old route is plainly visible and is a magnificent sight from 20,000 feet. The known camping places, such as Middle Spring, Upper (Flagg) Spring and Cold Spring can be located from a plane. In places the trail is surprisingly wide, with from four to six sets of ruts.

I had begun to doubt if I would ever realize my dream of exploring the trail on the ground when my telephone rang one evening. It was the editor of *Popular Mechanics*. Word had gotten around about my research on the Santa Fe Trail and the editor wanted to know if I would accompany an exploring party along the trail. Would I! Assigned to the story were Aubrey O. Cookman, Jr., an associate editor, Frank Fritz, a photographer, and a Jeep full of gas.

We rode a Santa Fe Railway streamliner to Dodge City, Kans., picked up the Jeep there and started out. The Jeep was a wonderful idea. The man who had marked "rough and rocky" on that part of the map we were to travel had been over it. We followed what is known as the Dry Cimarron Route on the old trail. On it are stretches of rolling prairie where the going is good, but there are others where a Jeep is about the only self-propelled passenger vehicle that could make the grade.

On an expedition such as ours one had better stay right with the tracks, rough or smooth, or he stands a good chance of losing them. We wanted to get right between those ruts and stay there, and we did, but at times we found it necessary to use everything that Jeep had in the way of four-wheel drive and extra-low gear.

The ruts are still deep, generally covered with short prairie grass, but not infrequently bared in rocky land by wind. The pilgrim attempting to follow the route had better carry a compass. In some places it becomes confused with later-day roads or is lost temporarily in heavy growth for a time and has to be relocated by zigzagging back and forth in a general direction of from 20 to 30 degrees south of west.

The first day we were chilled by our inability to locate wagon tracks, visible from the air, along the north bank of the Arkansas, west of Dodge City. The possibility that we might have the same difficulty on the Cimarron Route haunted us, and we lost no time heading out for the unbroken prairies of Cimarron County, Okla., and New Mexico.

The weather didn't cheer us any. It rained and the wind blew, and by the time we reached Boise City, Okla., we felt and looked like three real explorers.

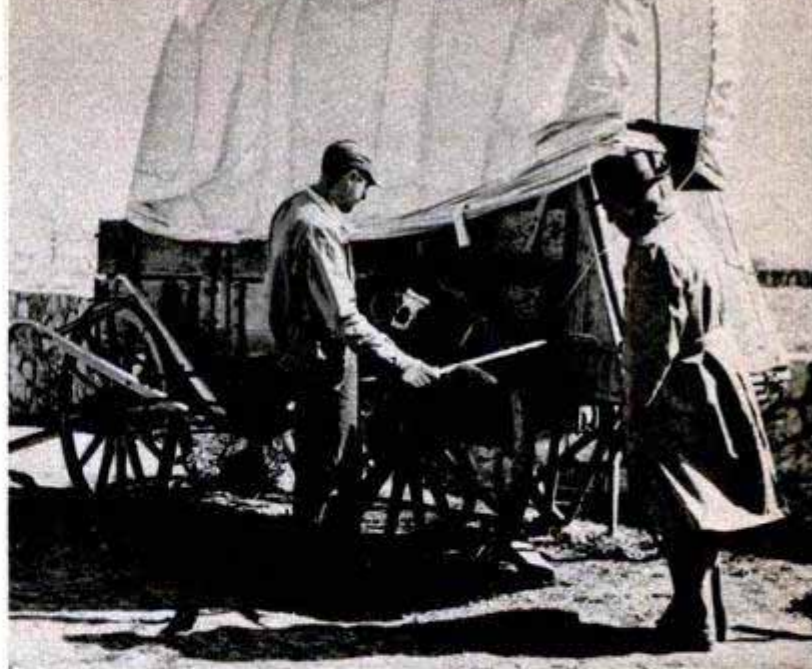
From Boise City we drove north on U. S. Highway 287. We thought that south of the Cimarron River we could identify an area a mile or two wide in which the trail lay. We found the county has erected an historic marker at or near the place where the trail crosses the highway, so we turned west, crossed a parallel railroad and fence line and were out on the open grassland.

Three worried individuals climbed to the summit of the first high knoll to search the country with glasses. Here, if anywhere, was the place we should find our objective. We were not disappointed, for across a creek bottom to the north on a long grassy slope were four parallel tracks reaching away to the west-southwest as far as we could see.

Here were the actual footprints of the great westward migration of American civilization. I truly believe that we, by pure chance, stood then on the exact spot where the illustrator of Gregg's "Commerce of the Prairies" (1844) sketched his picture of a wagon train, four abreast, on the old trail.

This portion of the route was first attempted about 1813 by a party of 30 men using pack animals to carry freight. Failing to find water between the Arkansas and the Cimarron Rivers, they eventually made their way back to the Arkansas after great hardship and continued to Santa Fe over the mountain route.

During the next 10 years, however, buffalo hunters and traders located springs



On exhibit at the Dalton Boys' Hideout Museum near Meade, Kans., is an old-time chuck wagon. They served as mobile kitchens of early travel in the West



Above, Buck James displays a rusted bolt from one of the wagon trains that paused to rest on what is now his father's Oklahoma ranch. Below, the Popular Mechanics "pioneers" in camp on the James' ranch





Photo courtesy Beeson Museum, Dodge City, Kans.

Dodge City's main street in 1872. The newly laid tracks of the Santa Fe Railway that was to doom use of the old wagon route are in the foreground. Pioneer Beeson's father owned Long Branch saloon shown at left

and marked a route to Wagon Mound, which became for 40 years the principal freight road to Santa Fe. It wasn't until 1880 that the first train entered that trading center of early New Mexico.

Even the Jeep seemed to pick up pep as we bounced onto the grass-covered road. Hours later the tracks veered sharply to the North, and we could see them on the slope ahead slanting back in again.

A rocky mound came into view in the direction of the detoured tracks, and alongside it a clump of trees. It was "Upper Spring," known locally now as Flagg Spring. Here, in 1828, the first party of freighters to use wagons instead of pack

animals was waylaid by Comanche Indians on its return from Santa Fe.

Upper Spring is peaceful enough now. Boy Scouts have a hut there, and ranchers use the site for rounding up cattle. We took some pictures, searched for relics and moved out again on the trail.

Toward evening we reached Cold Spring. There were two camps here a couple of miles apart. Both sites boast sandstone formations in which trail travelers carved their names and dates of visit. There are literally hundreds of those autographs, of Army officers, buffalo hunters, travelers and trail drivers. The cliffs are a veritable Who's Who of the Santa Fe Trail.

"Miles of nothing" faced the trail explorers during most of their trek across the prairies of Oklahoma





Nearly 80 years later, the same Dodge City street and Santa Fe Railway roadbed shown on the opposite page

We spent the night at Cold Spring, spreading our sleeping rolls in the lee of the Jeep. Our wish to travel the trail of the 49ers had been granted and now we were camping at one of the regular trail camp sites. We had all the atmosphere, except the wagons and the Indians. Before morning we would have been almost willing to put up with a few Indians for the shelter of a wagon or two.

While no one in the party was heard to suggest that tourist camps or hotels might be found preferable to the camp sites on the old trail, the fuel problem did, oddly enough, fit into a schedule of daily travel that made unnecessary any more nights on the lone prairie.

We experienced only one disappointment, and that was that we didn't have time to travel more of that famous old trail. It's there today, but won't be for many more years. The encroachment of civilization on parts of it has been slow, and the wind and weather have been kind to those footprints of the old-timers on the prairie, but it can't be long now.

As I look down now from the heated cockpit of a DC-6 at those deserted tracks winding across the prairie, I'm reminded of a day not many years ago when I chanced to complain of the quality of an Air Force mess in a foreign theater, and was told by the Commanding Officer, "Buddy, you ain't never had it so good."

South of U.S. Highway 287, this boulder-strewn area was a popular camping and watering place on the old trail



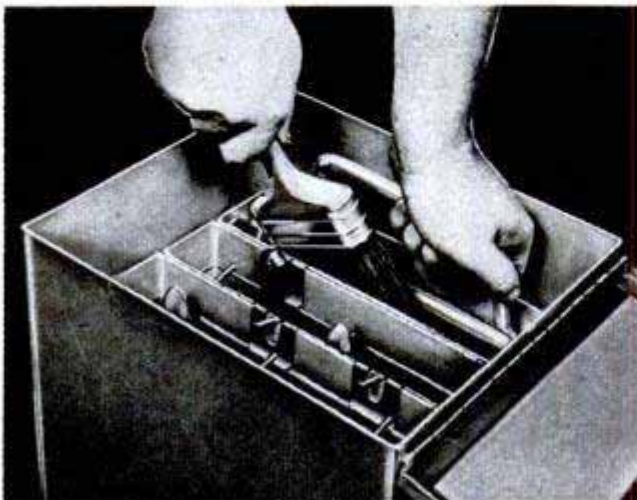


Cardboard Umbrella

Sudden showers won't mean wet clothing when you can step into a store or newsstand and buy a cardboard umbrella that you won't mind discarding later because it costs only a quarter. Invented by Charles A. Mueller of Cleveland, the umbrella is called a "Brell." The wire handle is attached on one side so you can stand directly under the center, something you can't do with a rib-type umbrella. When not in use, it folds in half and you carry it under your arm like a newspaper.

Paintbrush Box Has Wringer

Paintbrushes are easily cleaned and stored inside an airtight all-metal box. One compartment of the box has a wringer which removes surplus paint from the brushes. They then are hung on adjustable clips in the other two compartments, which hold solvent or preserving fluids. With the lid in place, the box forms a convenient carrying case.

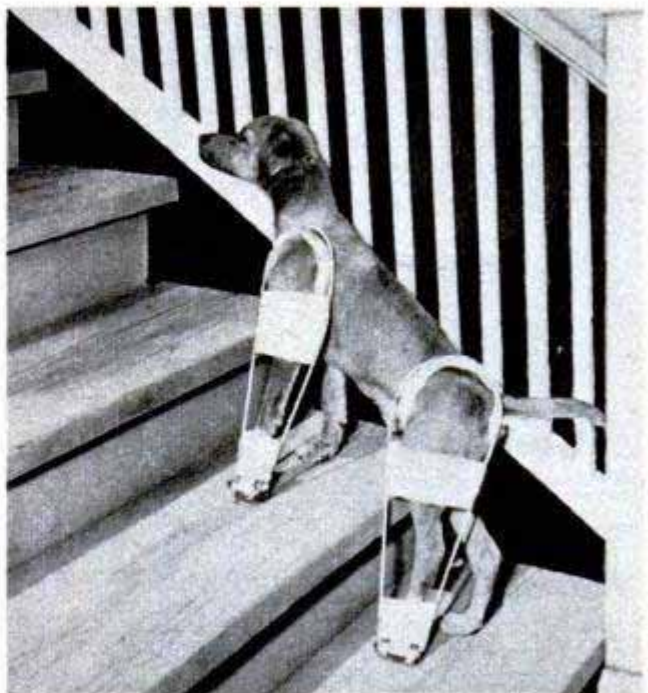


Stand Converts Wrench Into Vise

Plier wrenches, which lock to grip with tremendous pressure, become the jaws of a convenient bench vise when a wrench clamp is used. Mounted on the workbench with one bolt, the clamp provides swiveling as well as pivoting adjustments to hold the work at the desired angle. The wrench can be removed from the clamp quickly for normal use.

Dog in Splints

Yankee, a four-month-old pup, walks and negotiates stairs even though both his left legs are in splints. The dog belongs to Ray Prest of Chicago. Recently the pup fell from a third-floor window, breaking two legs, so his master rigged up the splints to keep him moving until the bones heal.



Rainbow on the TV Screen



Above, two stars of black-and-white TV, Kukla and Fran Allison, go into their act in front of an RCA color-television camera during the demonstrations in Washington. Below, these photos of an RCA color receiver in operation give you a sample of what you will see at home when television converts to color

By Richard F. Dempewolff

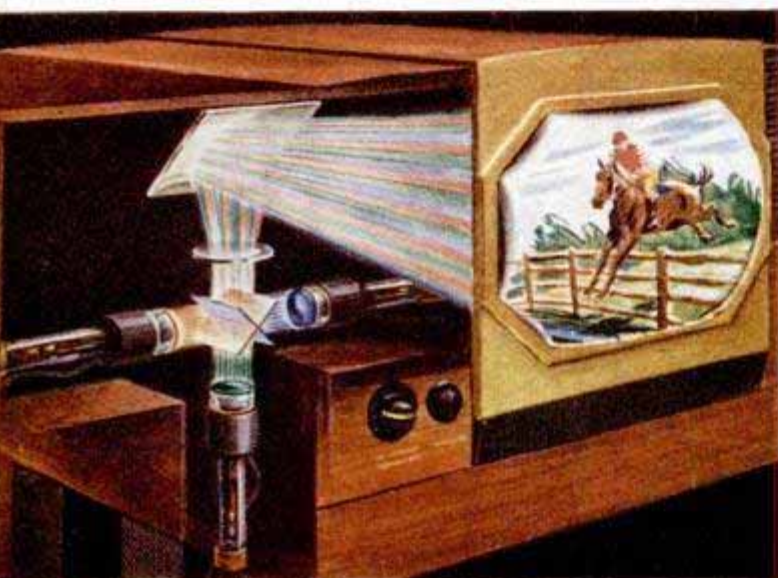
IN THREE Washington, D. C., hotels last fall, harried television engineers hustled around a collection of ordinary-looking TV sets, tinkering and making adjustments. Seated in rows of chairs before the sets, hordes of newspapermen, radio and FCC executives stirred and chatted noisily. Suddenly, on each screen, light flashed. "Television," someone announced, "brings you a package of rainbows."

A hush fell over the audiences as the video sets came alive with a parade of programs in brilliant full color. Dancers in pastel gowns whirled across multihued set backgrounds. Brilliant yellows, reds and blues of a puppet show leaped from the screens. Some audiences saw a football game; watched the tan pigskin travel back and forth across the white-marked greensward, while red and blue jerseys of the players stood out with such clarity that they seemed almost to have a three-dimensional quality—a phenomenal characteristic of this new miracle. What's more, people look human—even in close-ups.





Above, drawing of RCA projection system, with its three kinescopes. The two dichroic mirrors, center, superimpose the three colors to form a single image



Above, RCA converter changes black-and-white sets into color receivers. Estimated cost: \$145 to \$195



For 10 years, color on the TV screen has been an established fact in the laboratories of several large radio companies, while an eager public drools with anticipation. Its sin was in being born so close on the heels of black-and-white TV which today, comprising some 2,500,000 set owners and 87 stations, represents a staggering investment of millions of public and business dollars. The Gordian knot of the industry has been to produce a system of color that will not make obsolete all the black-and-white equipment now in existence.

Now, three companies—RCA, CBS and Color Television, Inc.—claim they have licked the problem of “compatibility.” The Washington demonstrations before the FCC were aimed at determining which system is most practical.

How do these systems differ and how do they work? Few people, even today, know what makes the picture on their black-and-white video screen. Actually, it is not a solid mass of light and shadow at all, but is made up of a series of lines—like old woodcuts.

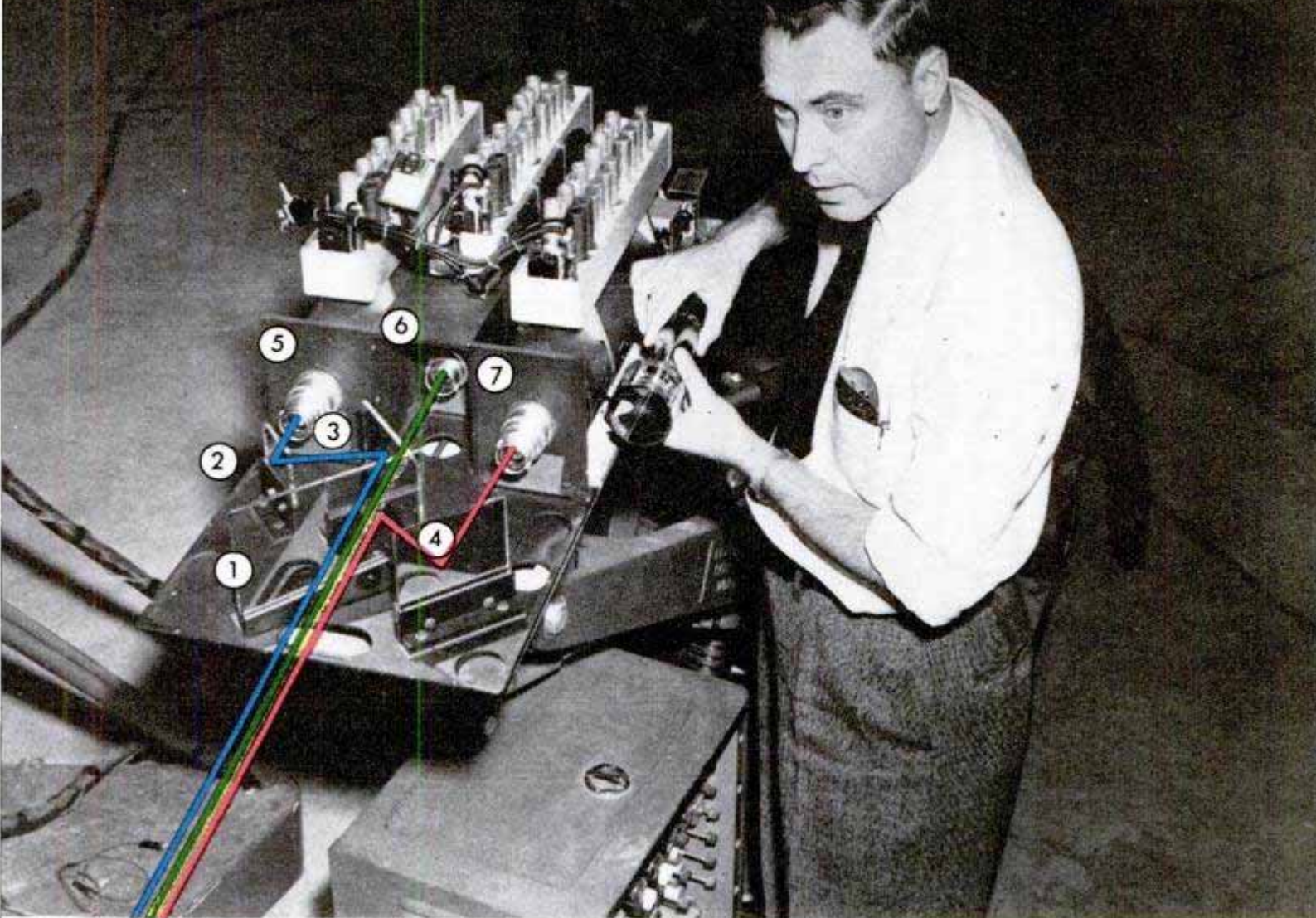
In television, the lines are “etched” by a single ray or “flying dot” of light, about the diameter of a pinhead. This ray moves back and forth, progressing downward across the screen of the cathode-ray tube, at a speed so incredible that to the eye it appears like a solid square of light, the size of the screen.

In $\frac{1}{60}$ second it makes a trip of $262\frac{1}{2}$ lines, then repeats it in another $\frac{1}{60}$ second. On the second trip, it covers the spaces between the first lines of light. This is known as “interlacing,” and its purpose is to minimize flicker.

That tiny pin point of light, as it moves along, literally paints the picture on the screen. In the studio, a camera is “scanning” the scene in similar lines, and as light or shadow is picked up by the scanner, it is translated into electrical impulses, which in turn are transmitted and picked up by the receiver in your living room. These impulses make that “flying dot” of light in your own set get brighter or dimmer in just the right places, as it flies along. In black-and-white TV you get a completely new picture of 525 lines every $\frac{1}{30}$ second. Result: wireless movies.

In all color systems, the same flying dot is used—but the electronic geniuses have rigged special devices which make it paint colors instead of just shadows and highlights. CBS’ device is a mechanical color wheel. Newer, but still undergoing development, are the electronic systems about

The RCA receiver at left has direct view instead of projected image. Two dichroic mirrors superimpose the images from three tubes so they are seen as one



RCA's color camera without cover. Blue rays go through dichroic mirror 1, are reflected by dichroic mirror 3 and regular mirror 2 into lens 5. Red rays bounce off dichroic mirror 1 and regular mirror 4 into lens 7. Green rays pass through both dichroic mirrors, 1 and 3, directly into lens 6 in the center of the camera

which there is much controversy. Let's look at both methods.

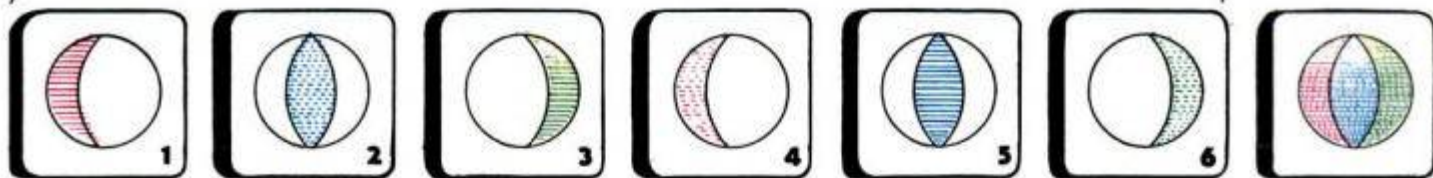
Dr. E. W. Engstrom, vice president in charge of research at RCA laboratories, introduced a purely electronic color system which makes the flying-dot "paintbrush" do everything but turn handsprings. Magicians of the system, he explains, are "time multiplex transmission," adapted to television from radio telegraphy, and the complex "electronic sampler." Those are just words; in a minute you'll see what they do.

The camera, developed by a tall, handsome RCA engineer named Dick Webb, has three lenses—one for each of television's three primary colors—green, red and blue. Suppose the camera is focused on the brilliantly colored stage on which Kukla, the puppet, and Ollie, the green dragon, cavort for the TV audience. All those colors pour into the open front of the camera. But suddenly they start bouncing around. A tricky system of dichroic mirrors, which transmit some colors, but reflect others, permits only green to enter the center lens. Red is bounced off one mirror and reflected into the right lens.

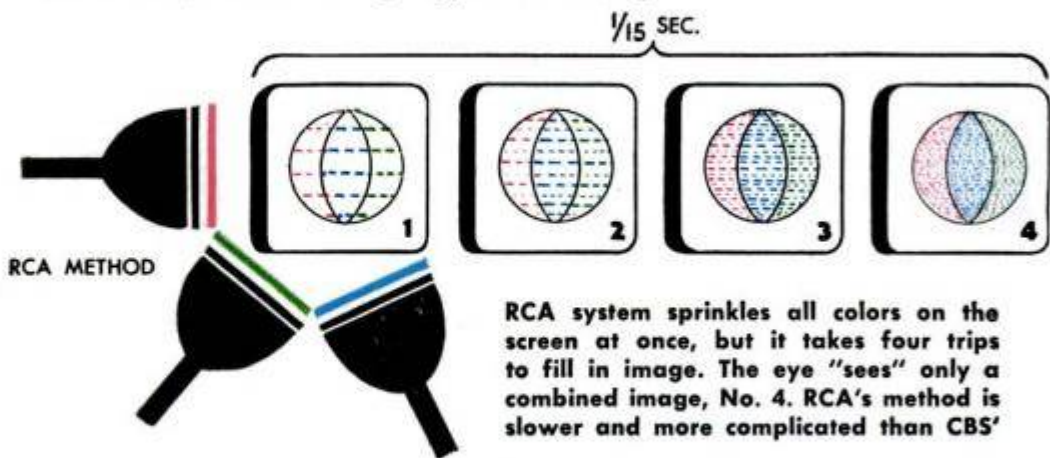
Blue bounces off another and is reflected into the lens on the left.

Now, three scanner tubes, one behind each lens, are scanning three pictures of Kukla and Ollie—one showing only the red in the scene; the others only the blue and green.

And here's where the sampler comes in. It actually samples the color intensity picked up by each of those three scanners as it moves along. It samples in sequence—first the green, then the red, then blue, and the speed of its sampling is clear out of this world. Each color is sampled 3,800,000 times a second, for a total of 11,400,000 color samples a second. The green sampler dot, for instance, may be just starting its trip across the first line of the picture field. It samples the picture for green, and exactly nine hundred-millionths of a second later the red is sampled, and so on. Now, in these microscopically split seconds, each color signal is turned into an electrical impulse, which goes out over the time multiplex transmitter—an ingenious device that times and synchronizes the sequence of all those impulses and sends them out as one signal—and is unscrambled and



CBS color wheel, left, creates six color fields in $1/24$ second, which to the eye appear as one, right



RCA system sprinkles all colors on the screen at once, but it takes four trips to fill in image. The eye "sees" only a combined image, No. 4. RCA's method is slower and more complicated than CBS'

changed back in reverse order on your home receiver. Out come Kukla and Ollie in gorgeous full color.

It's not as simple as that, of course. In the RCA system, the receiving unit contains three kinescopes, each receiving an image from a flying dot painting the picture in its own color. All these dots are flying along at the same relative position as samplers in the studio, and each is splattering the screen with millions of specks of its own specific color, one after another. So each line on the screen is actually made up of a whole string of color specks; green, red, blue, green, red, blue, ad infinitum.

Besides coming back to "interlace" lines, Doctor Engstrom's flying-dot paintbrushes also jog sideways a hair each time the field is covered so that the color specks also "interlace" every $1/60$ second. The result is the biggest mess of color specks you ever saw in your life and so fully is the image "covered" that no human eye in the world can detect a flicker. Even looking close up, the picture seems to be made up of solid masses of color, with just a faint swirling motion like the movement of wind across a wheat field.

Doctor Engstrom points out that with this system, people with current black-and-white sets would be able to get black-and-white reception of the color programs without doing a thing to the sets they own. To receive color, they would have to buy a converter unit.

Actually, black-and-white reception from RCA's color cameras beats anything you're seeing now. Engineers, sweating out the FCC demonstrations at the RCA studios in the cellar of the Wardman Park Hotel in Washington last fall, proved this

to everyone in the audience by accident.

The color demonstrations dragged on too long and the regular scheduled telecast time was creeping up. Black-and-white TV cameras must be warmed up before use, but all the engineers were too busy that day on an important color demonstration to get the black-and-white cameras ready. Finally, the color program ended—simultaneously with starting time for the scheduled network telecast. "There was only one thing to do," explains an RCA engineer. "We turned the color cameras on the black-and-white set, prayed and let fly. Five minutes later phone calls began to come in from points as far as Cleveland. They all said the same thing 'Hey, this is the best definition and brightest reception we've ever had. Why can't we get it this way all the time?'"

What will RCA color cost? Set manufacturers have estimated that converter units to make present black-and-white sets

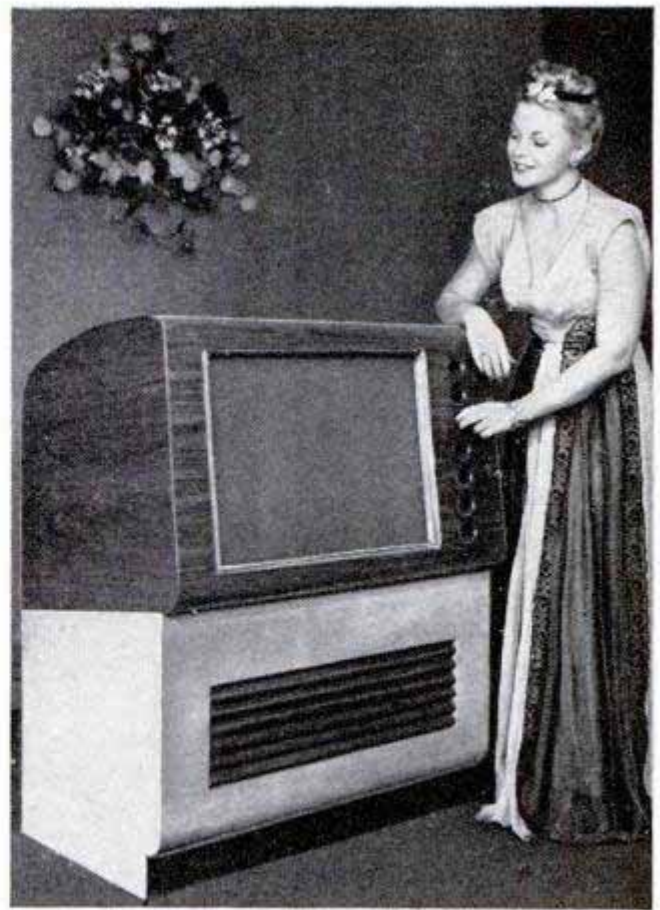
RCA's two-color receiver is cheaper than the three-tube models, but it can't give true-to-life colors



spew color, would cost from \$145 to \$195 installed. New sets would cost you from \$400 to \$1000, depending on how lavish you want to get.

The only other all-electronic system up before the FCC is one devised by Color Television Incorporated, a West Coast organization that veils its technique in mystery. In many ways, it resembles the RCA system except that the flying dots lay down the color sequences by lines instead of specks. In split seconds, red, green and blue lines of color follow each other down the screen, painting as they go. Since the company has held no public demonstrations, few people know what the pictures look like.

Oldest and most tried color TV system is the one developed by Dr. Peter Goldmark of CBS, an earlier version of which was fully described by *Popular Mechanics* in April 1941. It employs standard black-and-white-transmission apparatus and a single receiving tube. Its secret is a couple of disks with red, green and blue filters. One, with 12 color filters, turns at 720 revolutions a minute in front of a pickup tube in the camera. The other, with six filters (to cut down size) turns at 1440 revolutions a minute in perfect "synch" with the camera disk, in front of the receiving tube on your set. When the red filter is in front of the tube, the red elements of the picture being "shot" appear on the screen. The disk is so timed that, in the split second it takes the flying dot to make one tour of 441 lines down the screen, the wheel has turned to the next color, blue, and the fly-



This is a CBS color-television receiver. It uses a projection system to fill its giant 21-inch screen

ing dot paints the blue in the picture on the screen. Then the green dot goes down the screen. Now the red comes back and interlaces. This goes on and on at a rate of 29,160 lines of color per second, or somewhat faster than you can count them. Twenty-four color pictures appear every second.

Actually what is happening is that single-color pictures are being laid down one on top of another at a speed so great that the human eye can't follow them and they merge into one full-color picture. In effect, it is like a three-color printing process.

Because of the rotating disks, the CBS system has become known as mechanical, much to the annoyance of the engineers who point out that the actual transmission of impulses is just as electronic as any other system.

An interesting feature of Columbia's system is the tremendous control achieved by the man at the "color mixer." By turning dials, he can

With the CBS color camera focused on Patty Painter, known as "Miss Color Television," technicians get ready to shoot a scene at the FCC hearings



produce almost any lighting effect desired on the scene being televised. By increasing blue he can make a sunny day gloomy. By adjusting red, scenes shot in the studio can be made to look like outdoors on a sunny day. Auras of blue, red, green, purple can be cast over an orchestra or dance team for "mood" setting.

The brightness of the CBS color pictures is almost uncanny whether the light at the scene of televising is good or bad. To demonstrate this, CBS engineers in Washington televised a girl under full studio lighting. Then they began to douse the lights, one bank at a time, until the light level was too dim to read by. In spite of this, the pretty model gleamed 15 times brighter on the receivers than in the studio.

This odd but handy quirk would be a boon in televising outdoor sports, CBS points out. To prove it, they televised a football game on a rainy day in Washington. The players' jerseys were so bright on the screen that, for all the audience could tell, the sun was shining.

What happens on current black-and-white screens when Columbia color cameras are televising? A shapeless gray mass of shadow appears. Adapter units to make black-and-white reception possible would cost \$20 to \$50 or a handyman can build his own. Converters to make present sets bring in color would cost from \$75 to \$80 and new color sets from \$250 up.

Which brand of color TV will be approved by the FCC, nobody knows at this writing. Most set owners don't care, as long as they get rainbows on their screen. But the value of color TV goes much further than that.

Last year, CBS, in cooperation with Smith, Kline and French, pharmaceutical

manufacturers, demonstrated beyond doubt that its system works and has a terrific potential in science and industry as a teaching medium. At Atlantic City, Denver and Chicago medical conventions, adaptations of CBS equipment, built for the pharmaceutical house, were used to televise surgical operations.

The unique camera, specially designed by CBS for teaching surgery, can be focused so the screen image is actually bigger than what the surgeon sees. Hooked to one end of a six-foot steel arm and balanced at the other end by a metal box containing the scanning equipment, the camera sits high on an upright standard and peers directly down on the patient. Students, instead of craning necks from distant seats in an amphitheater, sit back in easy chairs and see every detail as though they were looking over the surgeon's shoulder.

So graphic were the pictures on the screen, that six members of the audience fainted during an eye operation. No details escaped the color camera. When a surgeon severed the wrong blood vessel, the audience leaned forward tensely, heard him cry, "This never happened to me before," and watched every motion of his swift hands as he called for instruments and quickly sutured the vessel.

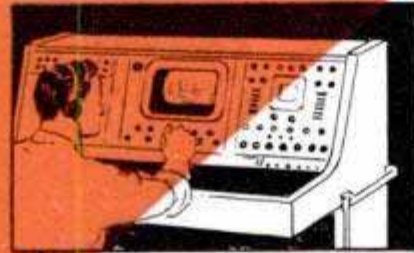
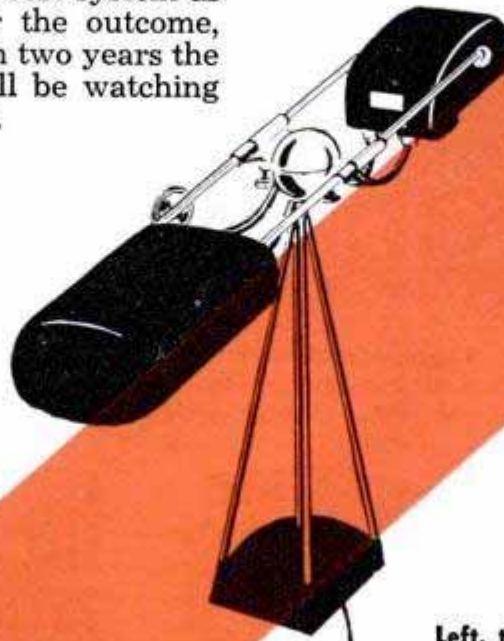
The fact is that color television is here. One by one, the problems are being solved. Recently, Dr. Willard Geer of the University of Southern California announced that he had a new receiver that can pick up telecasts transmitted by any of the systems known—including present black-and-white. The heart of the set is a single tube, which shoots out three separate flying dots from three little electron guns in its base. They will paint colors on the screen one after



If you own a black-and-white set and CBS color is authorized by FCC, all you will need to pick up pictures in full color is an adapter like the one this girl is sliding in front of the set. Circular case contains a color wheel. Cost of unit: About \$75

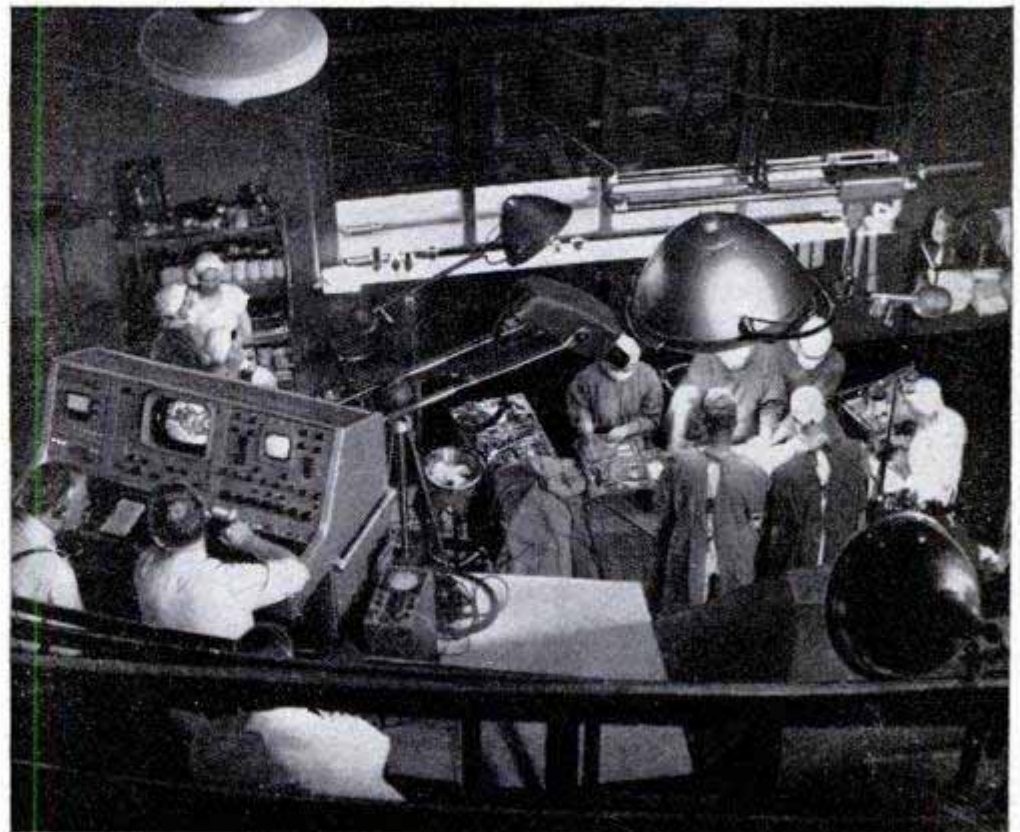
another, all at once or, simply by turning a switch, all the guns will get the same signal and black-and-white will result.

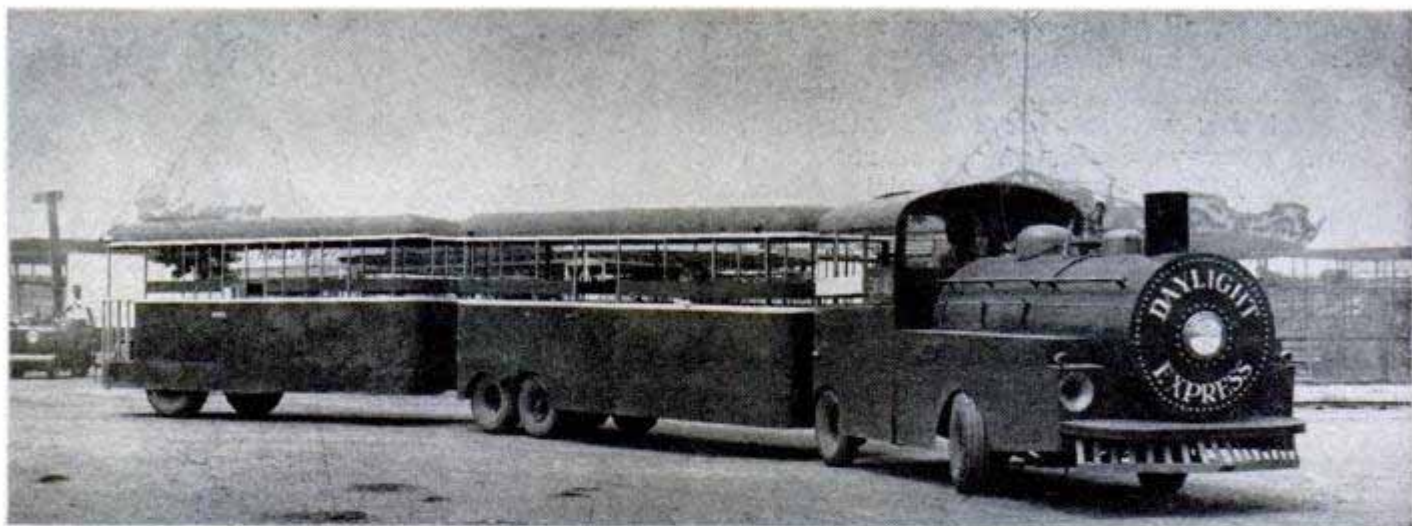
At this writing, the FCC, watchman of the airways, is testing color receivers of CBS, RCA and Color Television, Inc., to be sure the public gets the best system as soon as possible. Whatever the outcome, most experts feel that within two years the chances are good that you'll be watching color on your video screen.



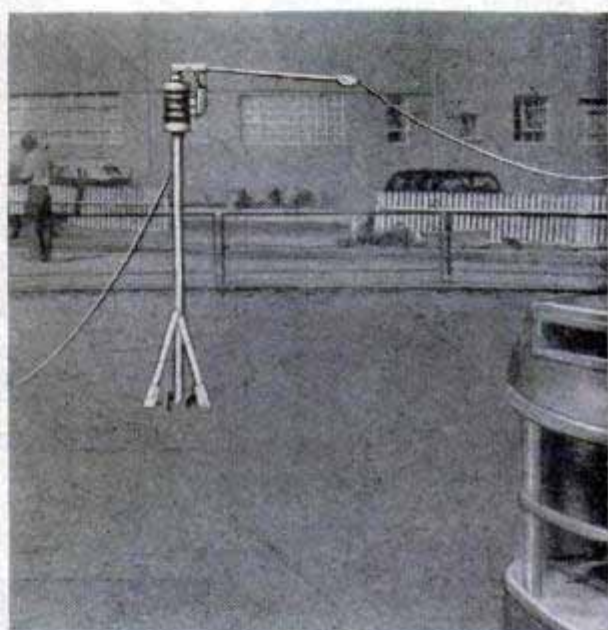
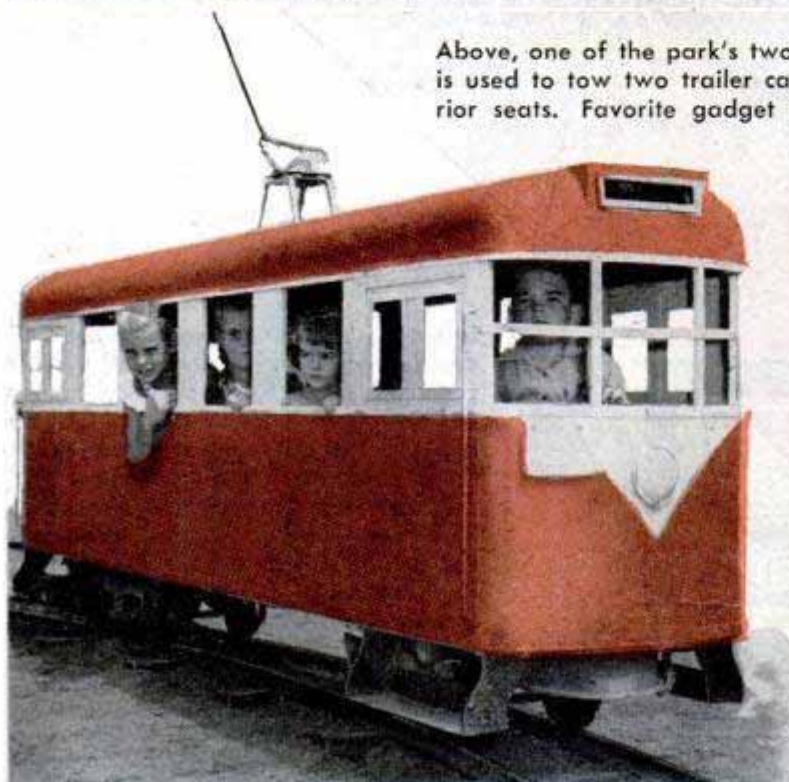
Left, the diagram shows how the CBS color system works. Above, the color camera picks up the image and breaks it down into sequential impulses. An engineer at the control panel feeds these impulses to the transmitter and they are then broadcast, the same as black-and-white, to color receivers. Set shown here has the color adapter in front of it. Of course, color sets can be made with color wheel built in

Already, CBS color TV has proved its value to surgeons all over the country. Right, at St. Luke's Hospital in Chicago, the TV color camera, center, telecasts an operation for study by surgeons who see it on receivers on the other side of town. That's the control panel at the left of photo



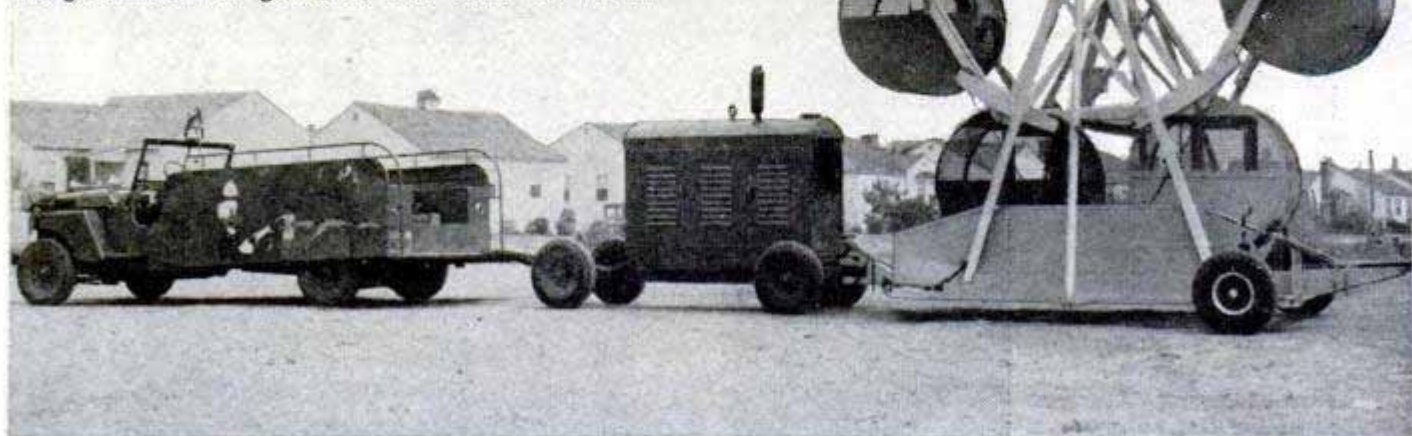


Above, one of the park's two Jeep-engine-powered locomotives. This one is used to tow two trailer cars having aluminum sides and wooden interior seats. Favorite gadget is the automatic mechanism that rings bell



Above, left, happy passengers ride in a miniature trolley car with the child in front "operating" a set of dummy controls. Above, right, current for the trolley's motor comes over a line that extends from a commutator pole in the center of the track

Below, en route to a child's carnival location, one of the fire engines tows a miniature Ferris wheel and the gasoline-driven generator that turns the wheel

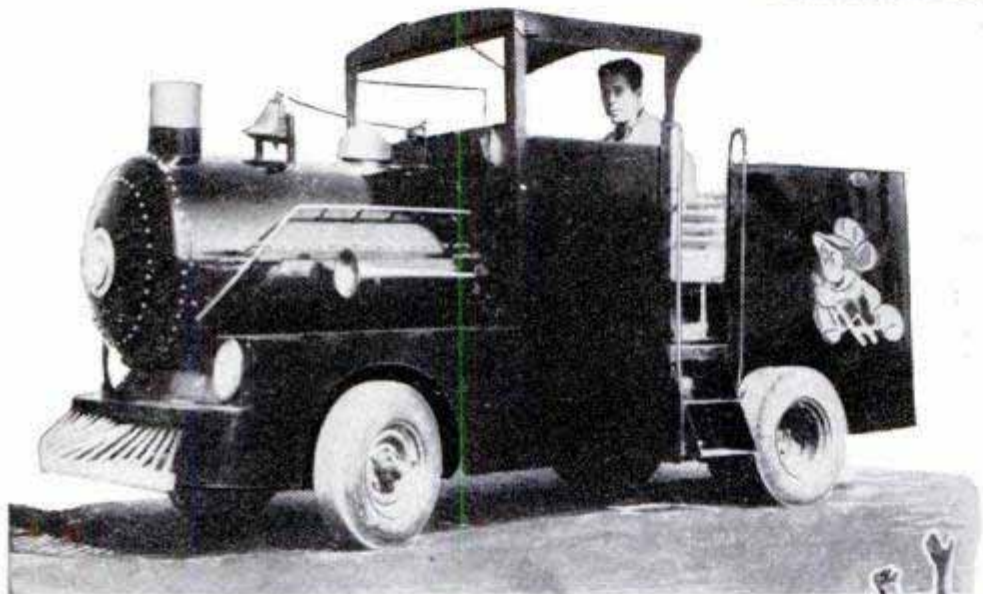


RIDE 'EM KIDS!

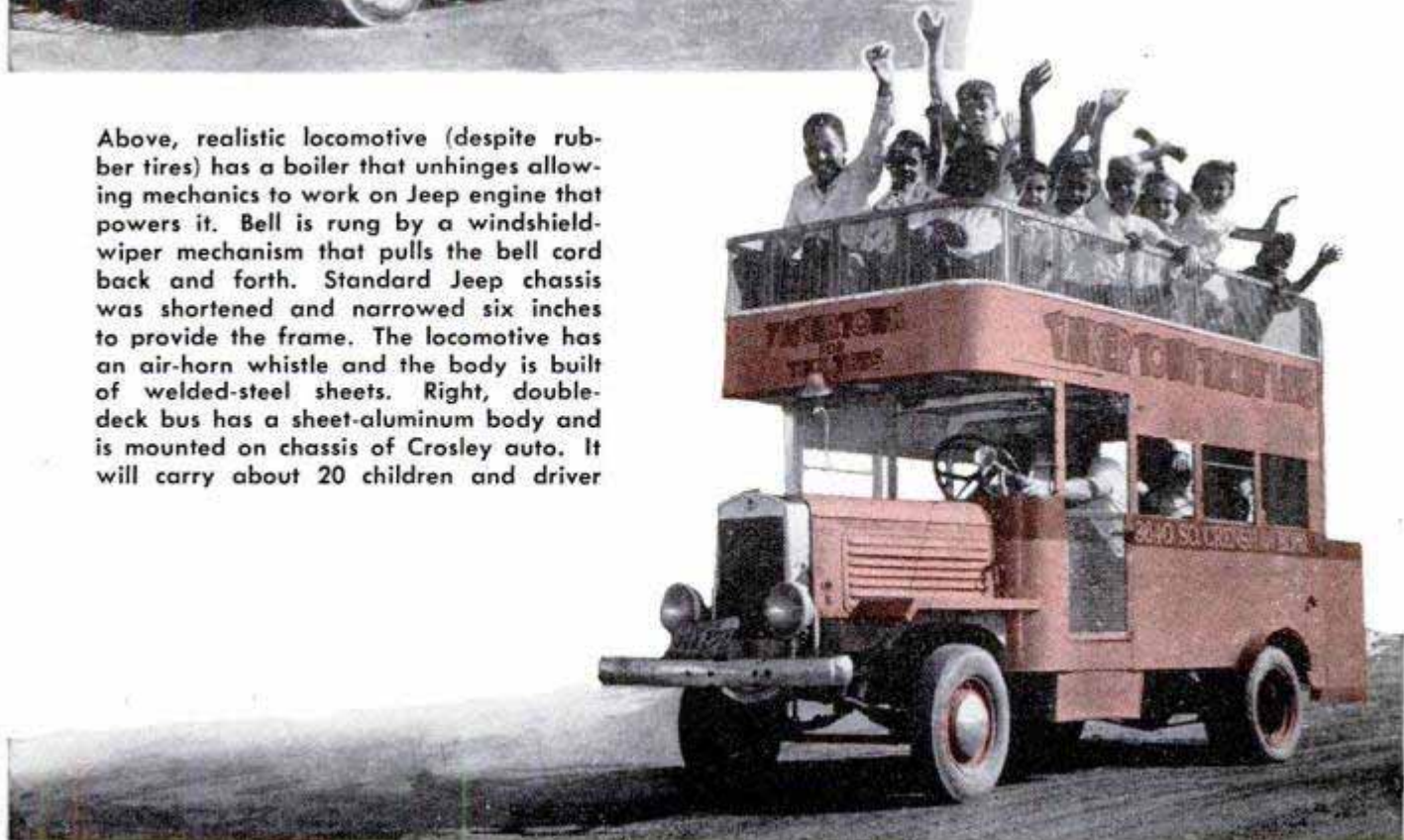
Tinkertown might easily be a place dreamed up by some mechanically minded youngster — but it actually exists as an amusement park in Los Angeles. There children can ride a "real" fire engine equipped with red light, bell and siren or a double-deck bus or a miniature trolley car that seats 12 or a toy locomotive and tender powered by a Jeep engine inside. Anybody got a nickel?



↑ Young passengers in the fire engine get all the thrill of going to real fire. They travel over the park on a dirt road graded for climbs and bumps while the red light flashes, the bell rings and siren moans. The engine is made of a standard Army Jeep equipped with small wheels and tires and with fender skirts to improve its looks. It will carry 10



Above, realistic locomotive (despite rubber tires) has a boiler that unhinges allowing mechanics to work on Jeep engine that powers it. Bell is rung by a windshield-wiper mechanism that pulls the bell cord back and forth. Standard Jeep chassis was shortened and narrowed six inches to provide the frame. The locomotive has an air-horn whistle and the body is built of welded-steel sheets. Right, double-deck bus has a sheet-aluminum body and is mounted on chassis of Crosley auto. It will carry about 20 children and driver



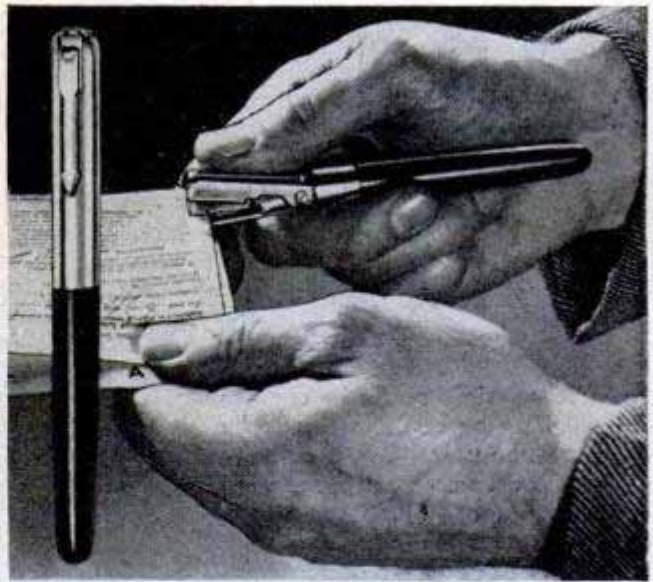
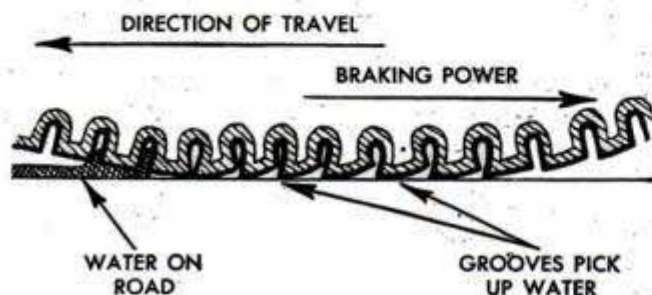


"Gallows" Support Pipe Line

Sinister-looking gallows help absorb the expansion and contraction of 1800 feet of a pipe line that crosses the Red River. The length of the 24-inch-wide pipe changes as much as eight inches between a cool night and a hot day. From points well back from the shore, where the pipe emerges from the ground, it is carried in saddles attached to the crossbars by suspender cables. Turnbuckles in the cables allow the tension on the sides of the saddle to be equalized and the grade between the earth and pipe to be maintained.

Retread Design Stops Tire Skidding

Retreaded with a gridded pattern, automobile and truck tires are said to be so skidproof as to make chains unnecessary even on ice. The grooves between the blocks are only about $\frac{1}{8}$ inch deep. During acceleration and braking, the edges of the blocks dig into the pavement, resulting in faster pickup and stopping. On wet pavement, water is forced to one side by the action of the grooves. An ordinary tire can be retreaded with the new pattern about three times during its useful life.

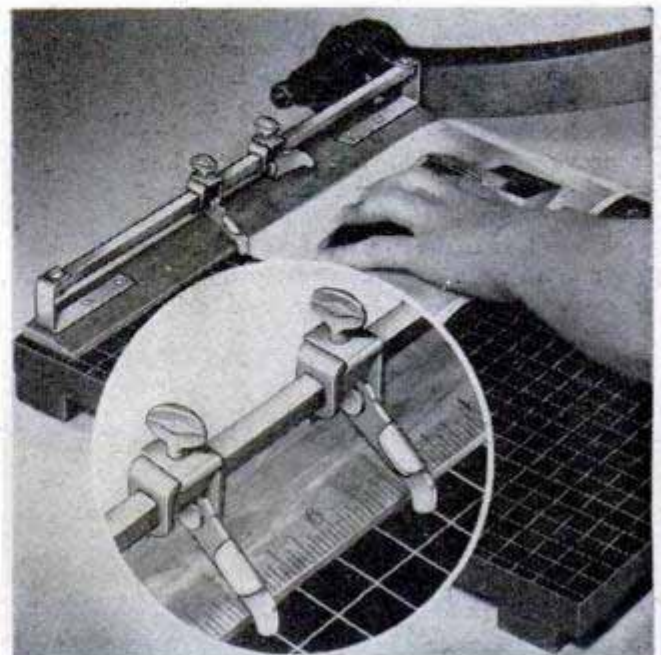


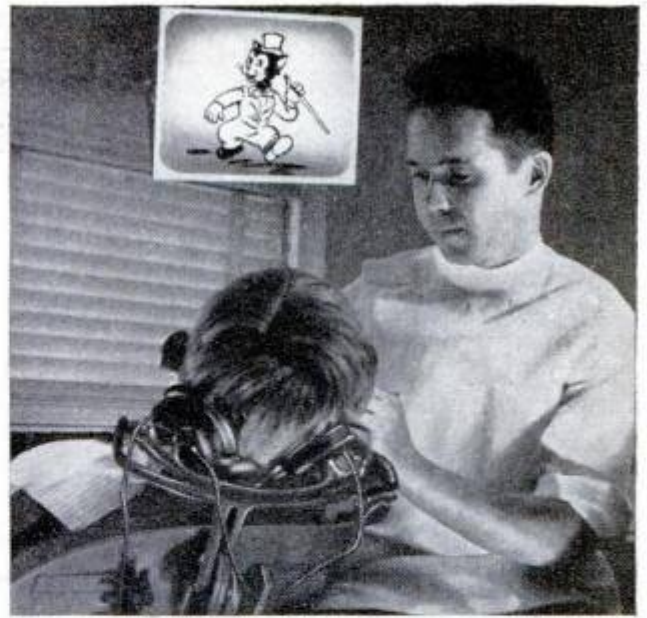
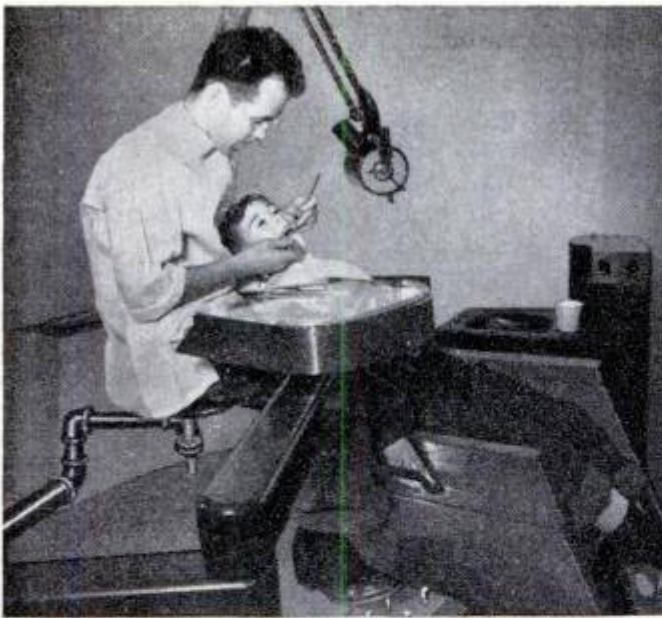
Pen-Size Stapler

Shaped like a fountain pen, a stapler clips to your pocket ready for use wherever and whenever you need it. It weighs only $1\frac{1}{2}$ ounces and holds 100 staples when fully loaded. The staples are a little smaller than standard size, but they will fasten together as many as 12 sheets of paper. The staplers come in five different colors.

Photo Trimmer Guides Let You Cut in Dark

Trimming negatives or enlarging paper in the dark or semidarkness is made foolproof by a pair of adjustable stops that attach to any standard trimming board. By setting one stop for the width and the other for the length, you can cut negative stock down to size in total darkness and each cut will be accurate. The stops swing up out of the way when not in use. The bar on which the stops slide is attached to the cutting board with screws or bolts.

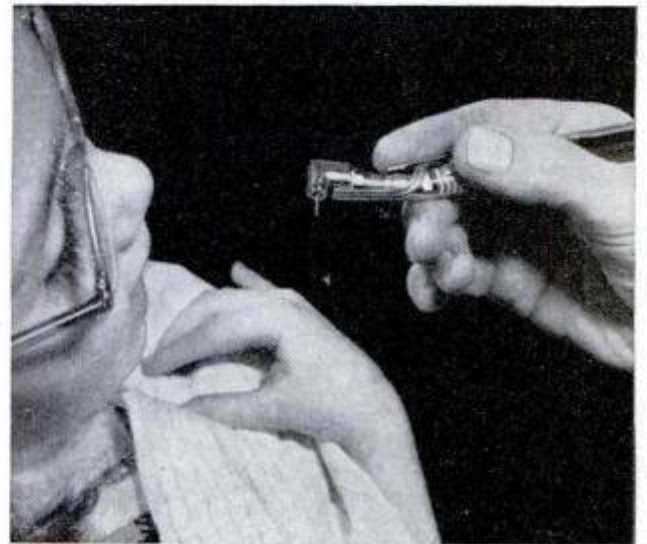




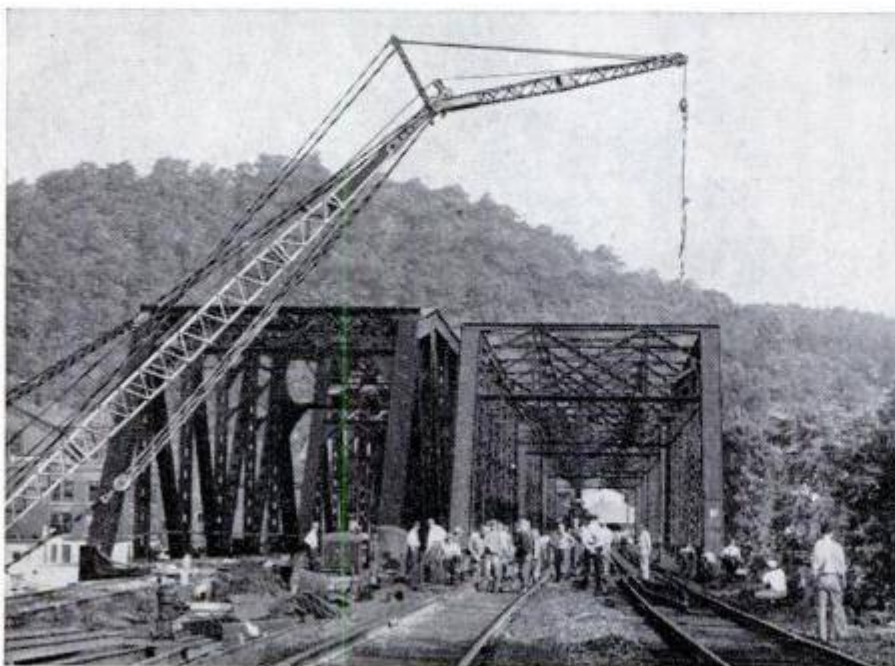
Above, no jitters here. All sinister equipment is hidden in cabinets. Right, patient relaxes while watching movies. Sound is piped into headrest. Below, drill has two tubes, one for water jet and the other for air

Have Fun at the Dentist's

Ten years ago Dr. Richard W. Page of Chappaqua, N. Y., began designing a dentist's office that wouldn't be a chamber of horrors. Today his patients walk into a circular, streamlined room where everything grim, including the drill, is hidden. They relax in a foam-cushioned chair surrounded by attractive cabinets. Hydraulic platforms send patient or dentist up or down at the touch of buttons. Doctor Page can flick a switch and Mickey Mouse will appear on a screen directly in front of the patient. No one but the patient hears the sound track because the speakers are two earphones built into the headrest of the chair. Doctor Page's drill has a pair of tiny pipes which send water or air over the whirling bit. Water cools the bit, thereby cutting pain, and the air jet blows the water



away so the dentist can see what he is doing. The drill is completely concealed in a near-by cabinet when not in use.



Bridge Shift

Rail traffic was interrupted for only a few hours when a new bridge was installed over the Allegheny River at Warren, Pa. The new and larger bridge was assembled alongside the old span, which continued to carry traffic. When the new structure was assembled, the old bridge was winched to one side and the new one moved into the spot vacated by the old, all in one operation. Pilings supported the old bridge until it could be dismantled.

RED WARNING LIGHTS flashed on the instrument panel and the alarm horn began squawking alongside my ear. Both signals meant the Skyrocket was on fire.

Anything could happen in the next second, for I was 40 feet off the ground and the air-speed needle read 600 miles per hour. I did three things automatically and almost simultaneously.

I began pulling back on the control wheel to gain the altitude I'd need if I had to bail out in the jettisonable nose, and I yanked the handle that operates the fire extin-

guisher system. Then I killed the jet engine.

I hoped that nothing was happening to the ton and a half of explosive rocket fuel 10 feet behind me.

"I've got an indication of fire," I told the Muroc Air Base tower, "and I'm landing down wind, right now!" Muroc replied that the crash wagons were at the landing end of the runway, almost five miles from where I would touch down. They wouldn't be of any help.

Seventy-five seconds later the wheels were on the ground and I was rolling along at 240 miles per hour, faster than I ever want to land an airplane again. Then came

I Fly

Most men begin to slow down at the age of 45. For Gene May the pace gets faster and faster. A graying grandfather, he probably worries about his pilot sons as he routinely pushes his Navy Skyrocket past the sound barrier

May examines yaw meter attached to needle nose, whose sole function is to hold instruments well out in the undisturbed air ahead of the plane



the anticlimax. A malfunction in the warning system was to blame and there was no fire after all.

That false alarm was one of several times that I've been badly frightened since I began testing aircraft at supersonic speeds. Once the engine stalled at 40,000 feet and immediately the plate-glass windshield frosted up so I couldn't see out. It wouldn't take much to put the plane in a dive or a stall and I did some very careful instrument flying in a shallow dive until I got the jet fired up again. As soon as hot air from the engine ducts began blowing across the glass once more the frost cleared away in a

hurry and I could see where I was going.

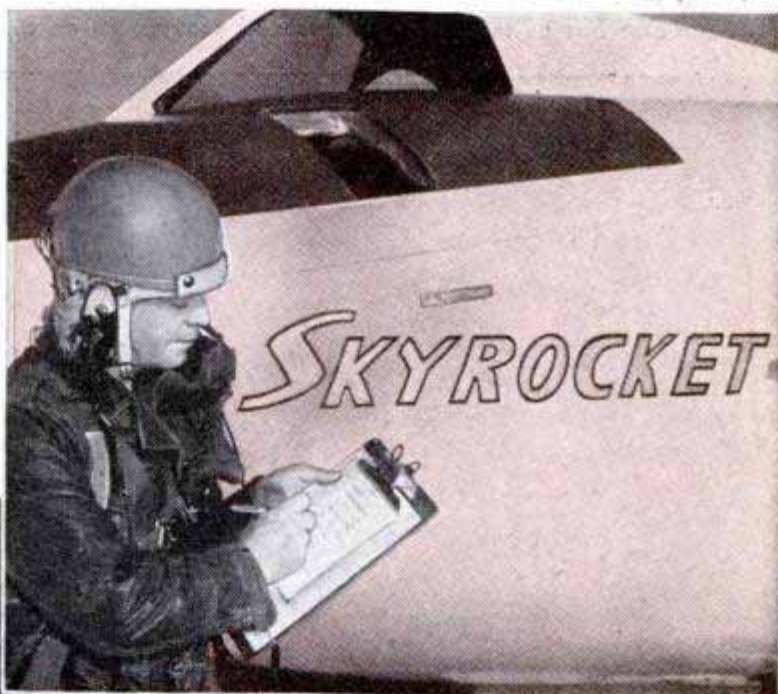
Another time, at lower altitude, the cockpit temperature jumped to 175 degrees and there was nothing I could do about it. Air resistance alone at high speed can raise the cockpit temperature 135 degrees above normal. Usually the refrigerator unit keeps the temperature down. On this flight the heater valve opened instead of the cooler valve. The heat climbed up close to the boiling point and I handled the controls just as expertly as I could during the eight minutes that it took to get back to Muroc. It was a relief to climb out into the 110-degree summer heat on the ground.

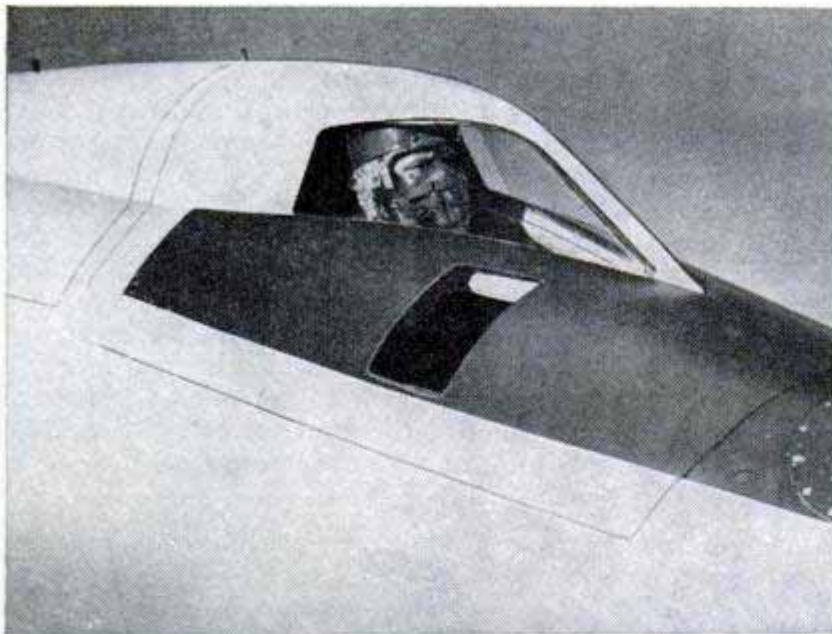
Faster than Sound

By Gene May

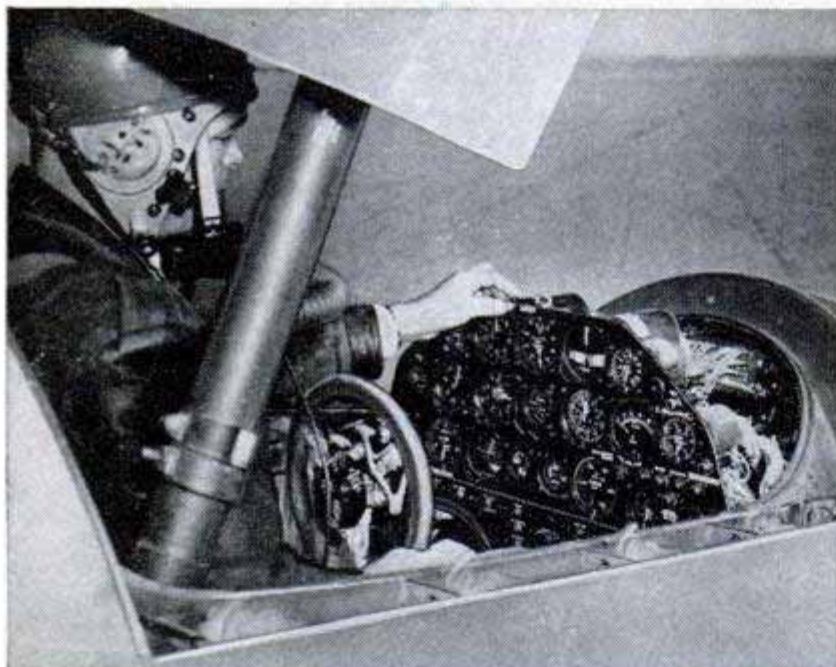
Supersonic Test Pilot

Speed gets the headlines, but other performance data is equally important for flight research. Here May checks over a lengthy report after a transonic dash





Above, some light for the small, dark instrument panel comes through oblong, plate-glass covered "windows" flanking the cockpit. Below, the Skyrocket has as many instruments and controls as an airliner



These instances may seem like minor difficulties and yet it's the little things that can bring on disaster when you are flying an experimental airplane at speeds it has never before attained.

So far none of the dire things that are supposed to happen when an aircraft smashes through the "wall" of sound have happened to me. Some planes have flown to pieces in the air when they approached the sound barrier, some have almost shaken themselves to pieces. Some "tuck under" in a dive. I've flown through the speed of sound repeatedly and the Skyrocket does none of these things.

The Skyrocket is Phase Two of a scientific program by the Navy for studying phenomena in the transsonic range. The Douglas El Segundo plant built the swept-

wing plane and its two identical sister ships specially for the job. Phase One was the Skystreak, powered by jet alone, that set a record of 650.8 miles per hour.

The Skyrocket likewise has a jet engine and in addition can blast from four rocket tubes at once to overcome the terrific air resistance that builds up at the speed of sound. This speed varies with the temperature and is 761 miles per hour at standard sea-level temperature, or 663 miles per hour at the —65 degrees or so of 40,000 feet. Speed of sound at any altitude is referred to as a Mach Number of 1.

The Skyrocket weighs almost eight tons loaded and has a wingspan of only 25 feet. It is 45 feet long. Its jet is fueled with aviation gasoline, not kerosene, and the rocket motors burn a combination of liquid oxygen and alcohol water. A hydrogen-peroxide pump, similar to the one in the V-2, pumps the fuel, and all of it can be burned in less than two minutes.

The plane is the fastest in the world at ordinary altitudes. Already it has exceeded its design requirements and I haven't yet flown it at its maximum speed.

Transsonic flight isn't as wild as some people have imagined. The air becomes extremely rough, to be sure. It's like riding a solid-tire truck over bumpy cobblestones.

And the normally sensitive controls become slow and stiff. Instead of flying with finger-tip pressures, I need both hands on the wheel. It takes a long hard push to move the rudder. The cockpit stays about as quiet as usual. I can hear the crash of each rocket motor when I turn it on, then the sound seems to die away.

When you hit the speed of sound it's about like flying through a short stretch of extra turbulence. On the other side, the air smooths out again. Slowing down, you go through the same turbulence once more when your speed and the speed of sound coincide.

With its rockets, the Skyrocket doesn't need to dive to attain its designed speed. The plane accelerates to supersonic speed in level flight or even in a climb. And it

smashes through sound at operational altitudes.

At high altitudes there is no extra sensation of speed but, when I make a run on the deck, just off the ground, the sensation is terrific.

I can catch a glimpse of the Muroc dry lake bed and the parked cars of the observers while I'm turning preparatory to the low-level run. Then, with all four rocket motors blasting, only the horizon in front of me remains clear and visible. It's impossible to focus my eyes on anything long enough to recognize it. Everything near by and at the sides is a blur. The observers and their cars are only a couple of hundred feet away as I go by—but I never see them.

The observers can see me coming but they don't hear me until the Skyrocket is well past them. Then there's a smash of sound and a dwindling roar as the exhaust racket goes by. Ground photographers can't swing their cameras fast enough to get a close-up picture at superspeed and the only good action pictures that have been made of the Skyrocket were taken

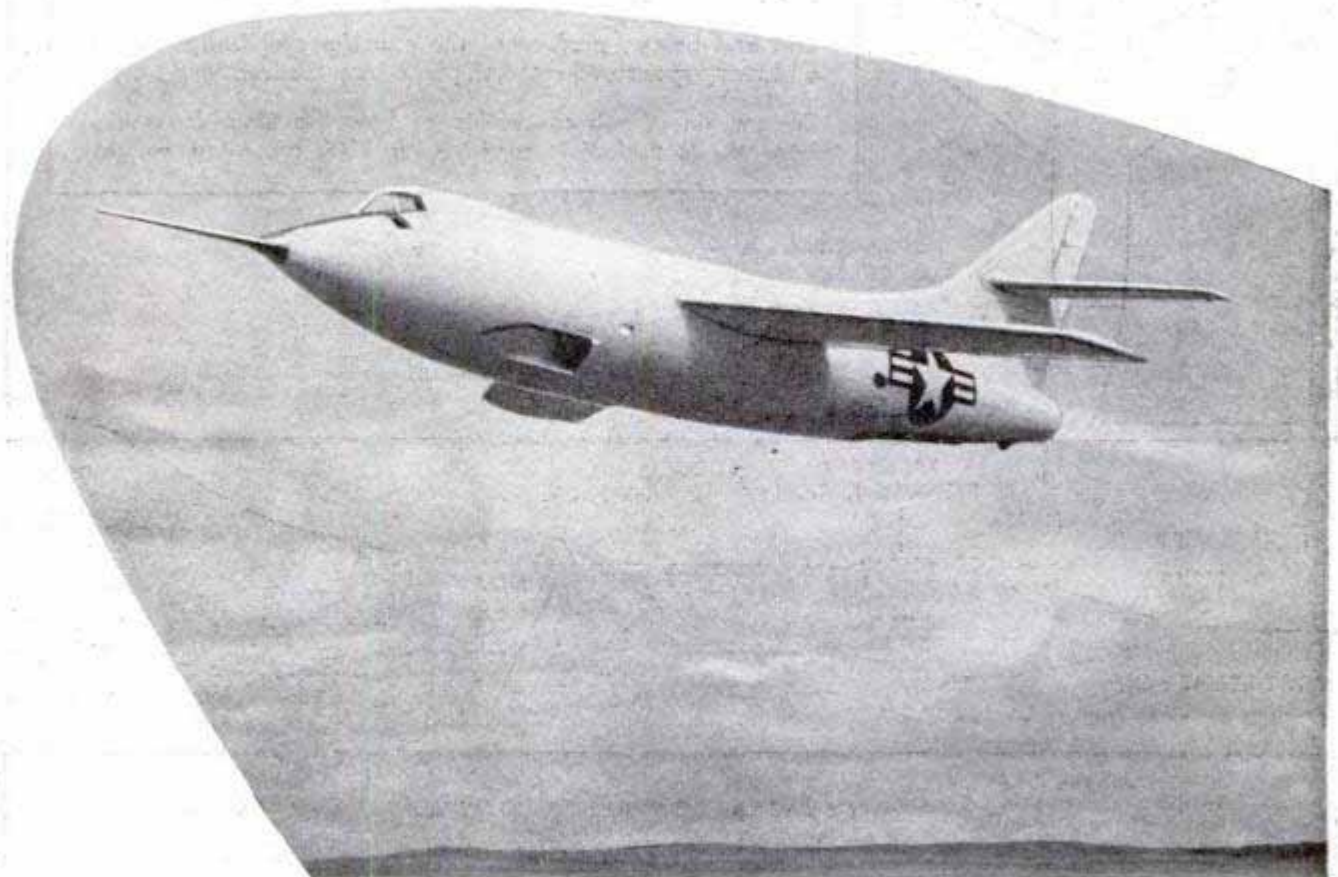


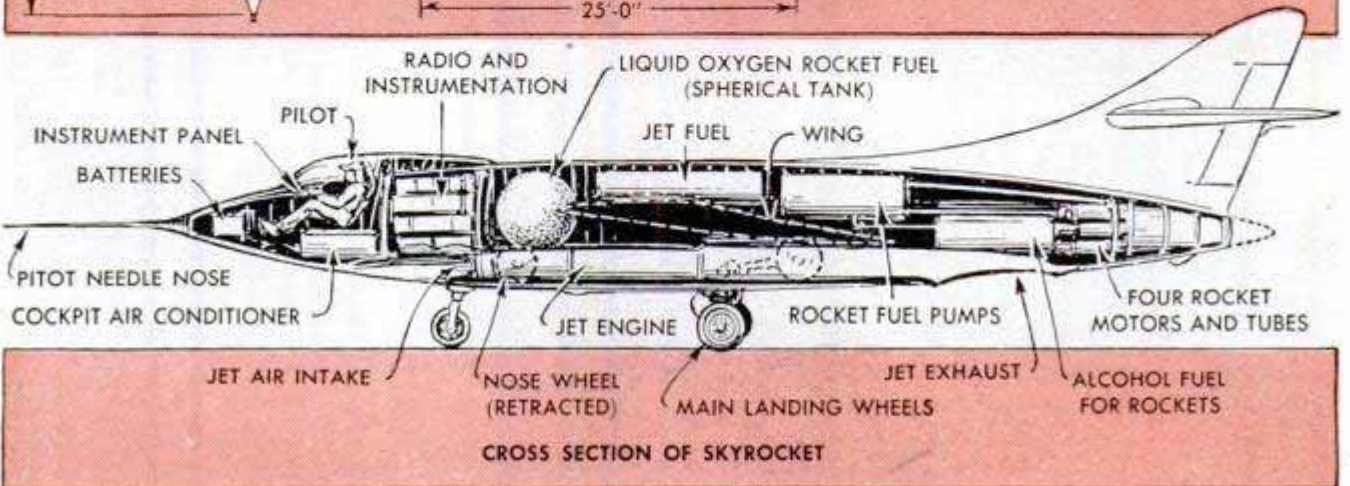
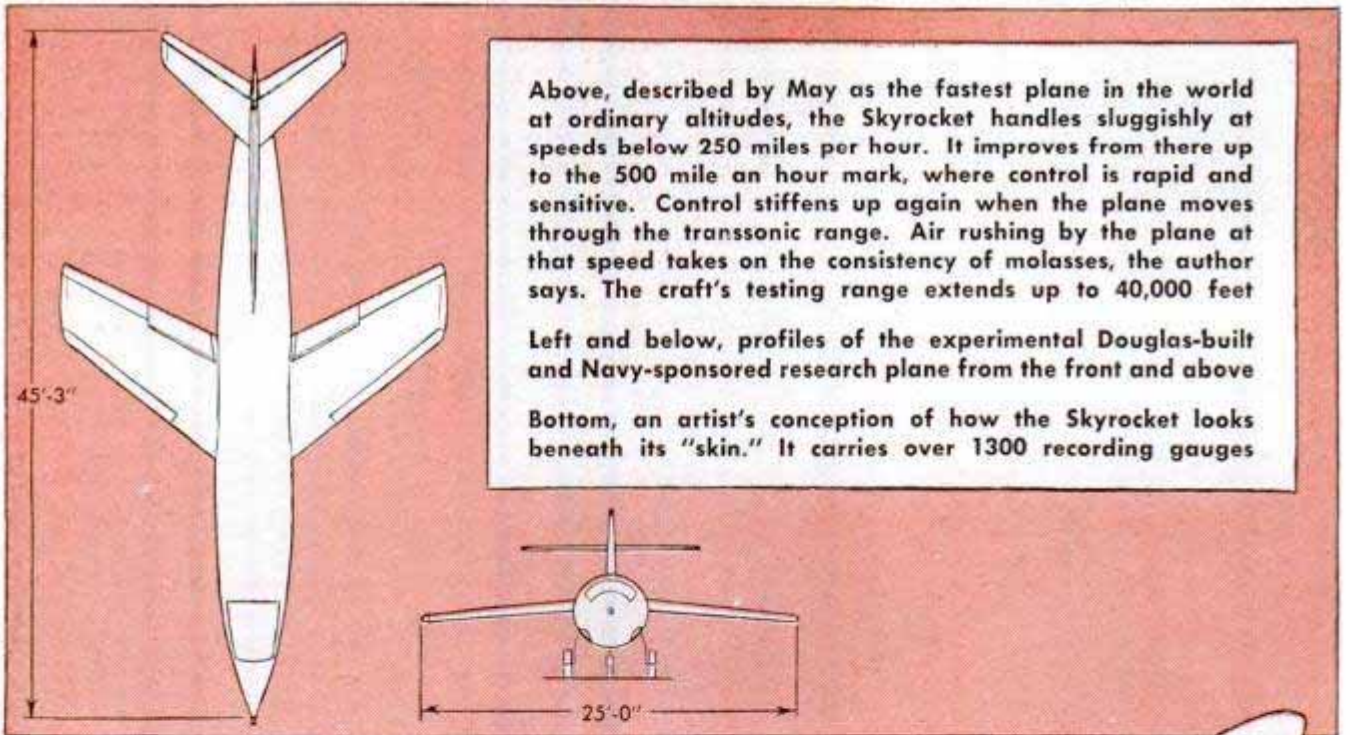
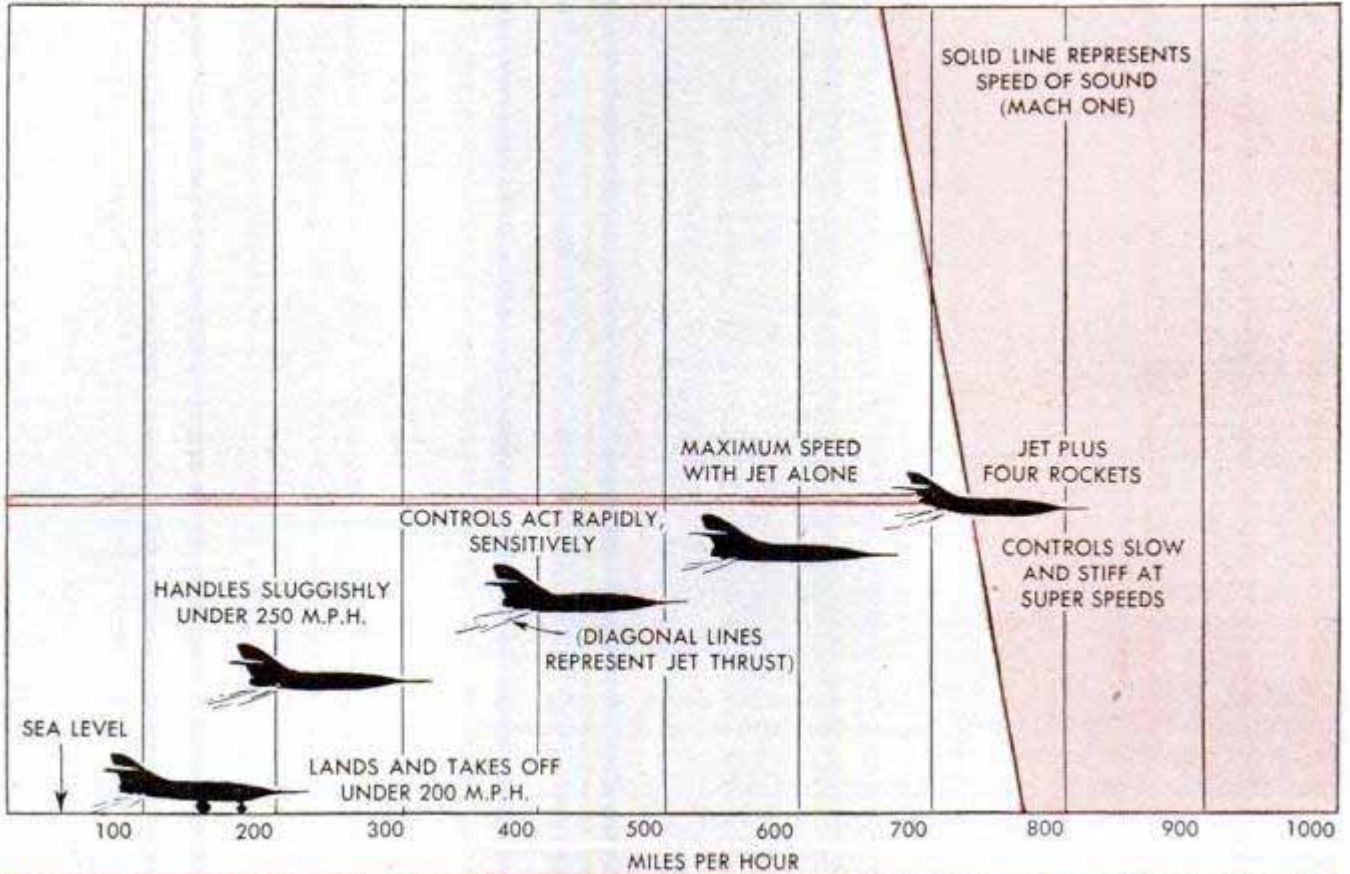
Tube extending down at an angle from below the four rocket nozzles is used for jettisoning the remaining rocket-engine liquids before landing

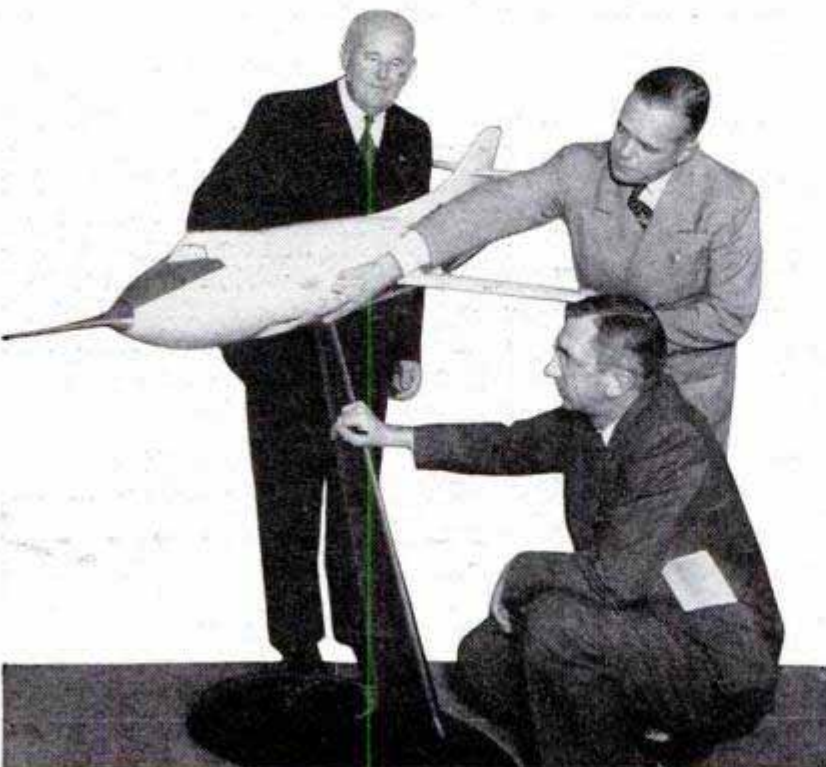
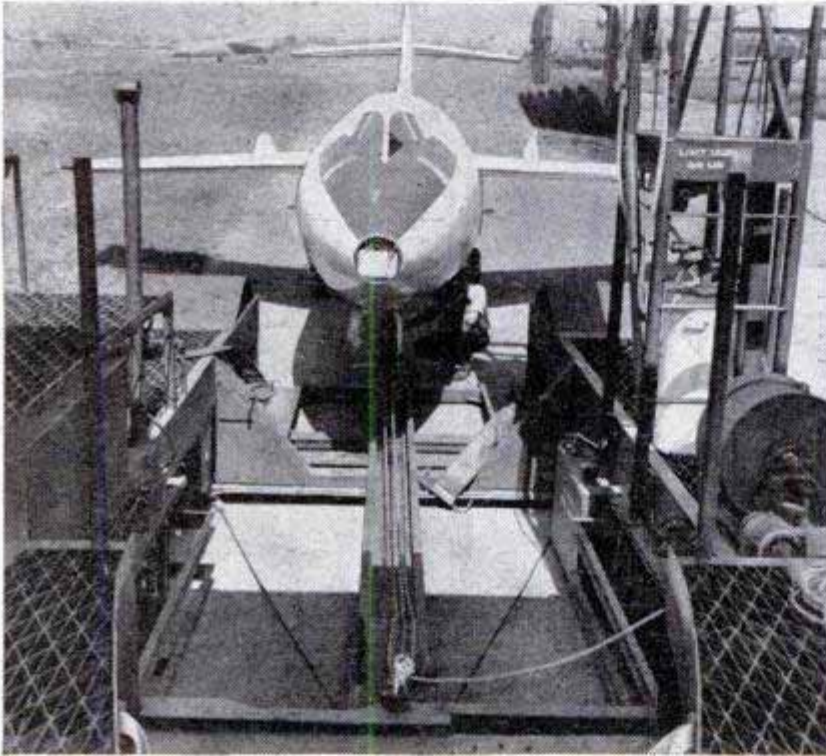
from a distance or when the plane was flying relatively slowly.

It's almost a tradition in aviation that the pilot of a hot airplane has to be in his early twenties. I'm a gray-haired grandfather, so I'm one exception to the rule. Two of my sons are pilots and the third is about ready to start flying. I'm 45 years old and the doctors haven't found a reason yet to restrict me to slow aircraft, say with top

With all four rocket tubes going, the Navy's transsonic-research craft can get off the ground in 2700 feet







Above and left, going between hangar and runway, the speed-research plane rides on a special trailer. A canopy shields cockpit from the desert sun. Bottom, left to right, T. E. Springer, May and E. H. Heinemann inspect model of Skyrocket. Springer and Heinemann are manager and chief engineer at El Segundo, Calif., plant

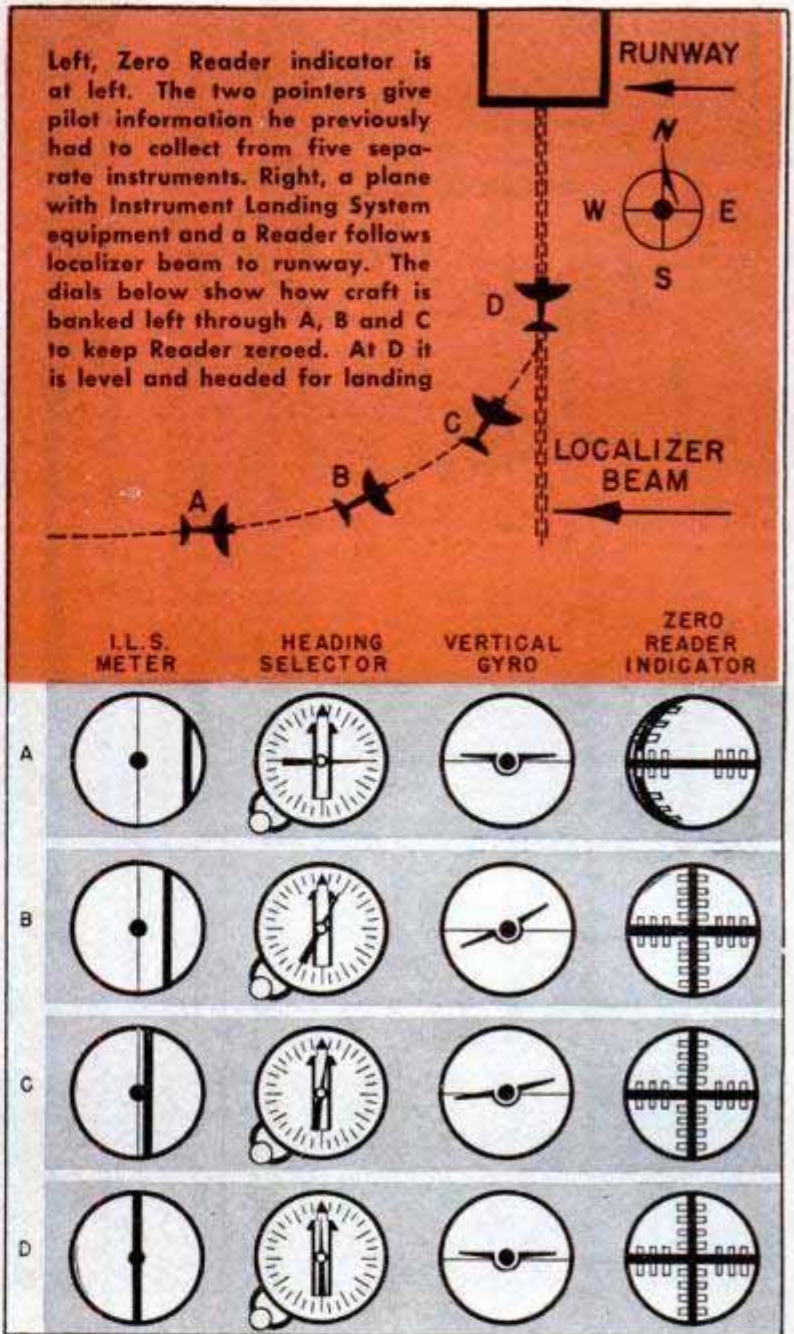
speeds ranging from 400 to 500 miles per hour.

A pilot has to be keyed up mentally and physically for supersonic flight, of course, because his life may depend on an instant diagnosis of an unusual condition and an immediate corrective action. He has to think in terms of many miles per minute instead of miles per hour and he flies with his eyes and his mind about 10 miles ahead of the plane.

Actually, top speed is only a small part of the whole Phase Two program. Speed makes the headlines but there are hundreds of other things that are just as important. The way the plane flies and handles at its lowest speeds must be studied with just as much care. The stability and lift of the sweptback wing and tail sections, the stall characteristics at different altitudes, safe take-off and landing speeds, all these must be learned.

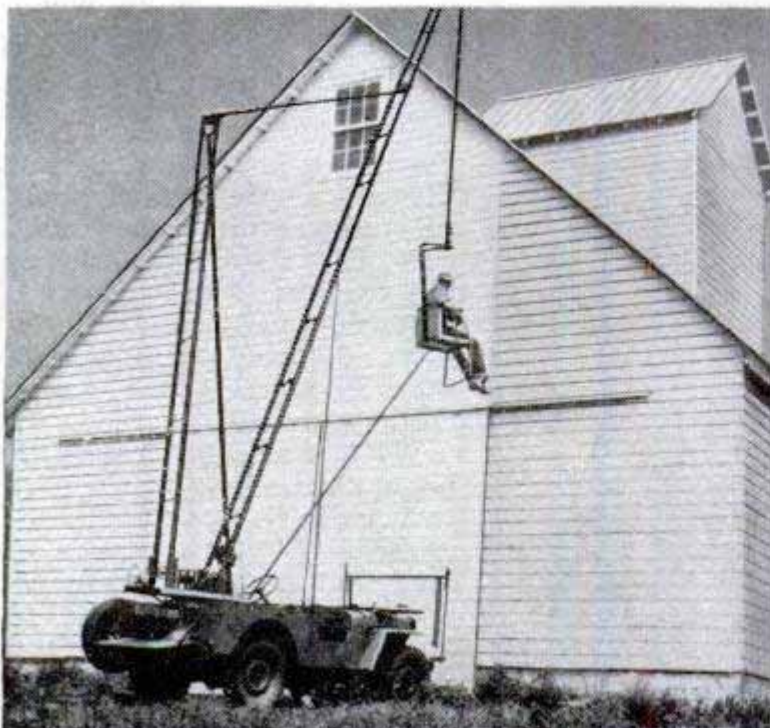
With a wing loading of about 90 pounds per square foot, twice that of fast fighter craft, the Skyrocket takes off loaded at 190 miles per hour. It doesn't handle very well at under 250 miles per hour and it normally lands at around

(Continued to page 266)



Five-in-One Instrument

Flight information usually supplied pilots by five panel instruments is combined in one called the Sperry Zero Reader. Its two-element indicator tells the airman exactly how to move the controls to steer left or right and to fly up or down. By turning a knob, the pilot can choose whatever compass heading he wants to fly and a thin pointer shows his actual compass heading. The instrument provides coordinated information that permits the human pilot to fly and navigate with a degree of precision and accuracy almost equal to automatic control.



Ladderless Painting

Suspended high in the air, a painter in Lincoln, Ill., sits in a comfortable chair and wields his brush without using ladders or scaffolds. He has developed a telescoping boom which extends to a height of 35 feet. The painter's chair dangles from the boom. The rig is mounted on a Jeep.

Aerial Tree Planting

Department of Agriculture experiments indicate large-scale tree seeding by airplane costs half as much as seeding by hand. For more effective distribution on the ground, the seed was mixed with sawdust and dropped while snow was on the ground. Later snows protect the seed from rodents.



Home Is Where They Park It

When the Priggs of Miami, Fla., go for a ride, they take with them all the comforts of home! Their family car is a neatly arranged "sedan cruiser" that looks like a bus that didn't grow up.

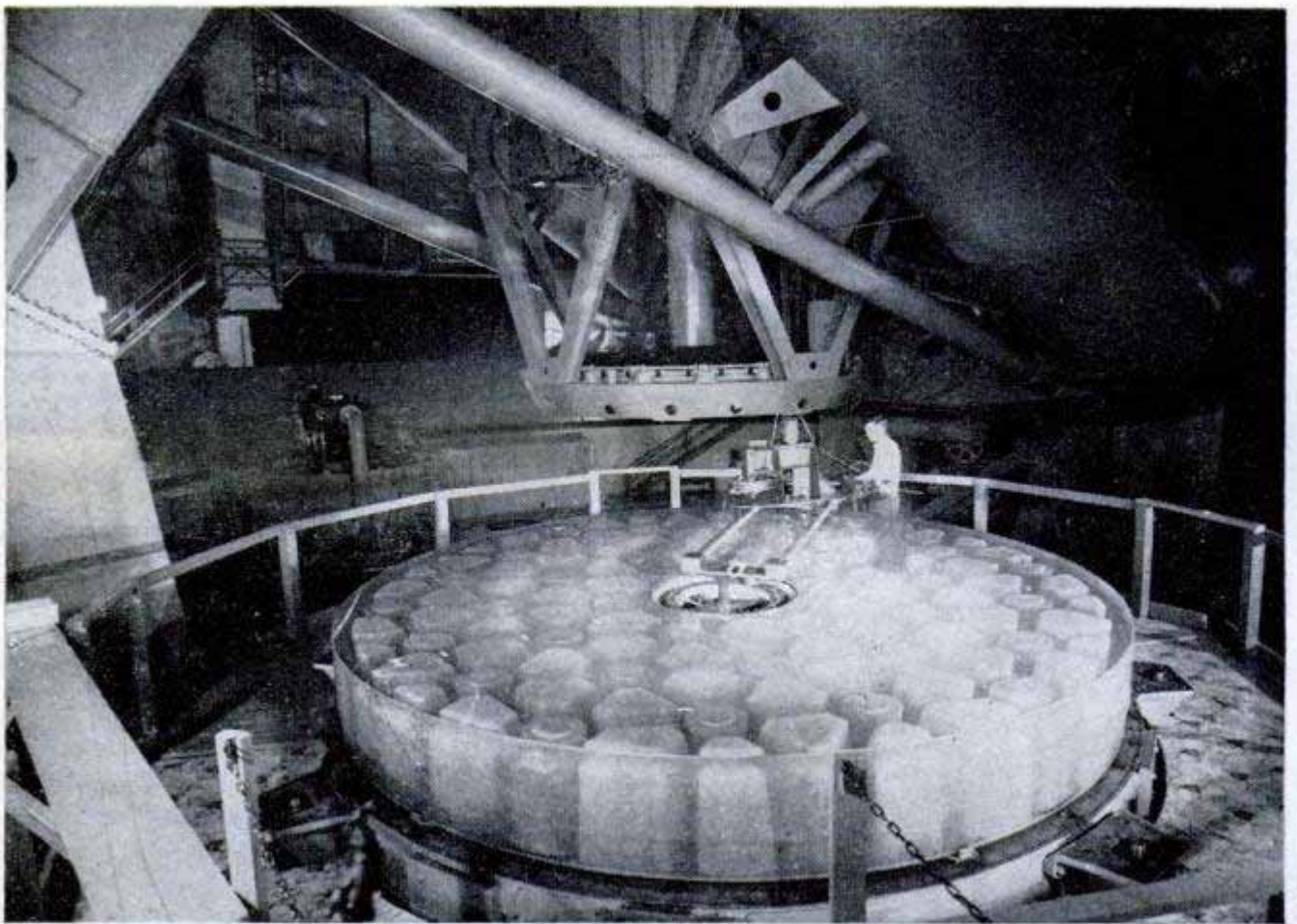
Using a Packard chassis as a base, Paul Prigg designed a rolling home, with sleeping space for two, hot and cold water, closets, dinette and other conveniences. On test trips to New York and Texas, the family had no worries about hotels or motor courts. Although the cruiser is designed to sleep only two adults, the Prigg youngsters are still small enough to fit in comfortably. When they get a little older, Dad Prigg is planning to build a larger model with room for four.

Above, left, with the rest of the family relaxing in the lounge, Mrs. Prigg handles the wheel. For night driving, curtains are drawn behind the driver so interior lights can be turned on. Right, in minutes, the lounge is converted into a bedroom



In the cozy dinette, there is ample space for two adults plus the two youngsters. Below, when Prigg goes fishing, the whole family goes, too, because they take their home along with them





Giant "Eye" Gets Second Test

Tests now being made with the giant 200-inch Hale telescope at Palomar Observatory are expected to reveal that it can photograph stars that are 20 percent fainter than those recorded on its first test plates, now that about $\frac{1}{10}$ ounce of glass has been polished away from its mirror surface.

As little as five or six millionths of an inch of glass were polished away from the

mirror disk, mostly along the outer edge. The polishing job required five months, although no more than seven hours were spent in the actual polishing operation. The balance of the time was consumed in tests, cleaning jobs and arranging the polishing tools. Now recoated with a thin layer of reflective aluminum, the giant mirror is expected to reveal objects more than four million times fainter than are visible to the naked eye.



Drying Agent Protects Tools From Rust and Corrosion

Tools, fishing tackle and other metal objects are protected from rust and corrosion by a perforated canister containing silica gel, an efficient drying agent. One canister absorbs excess moisture from as much as 12 cubic feet of air. When saturated, the silica gel, visible through a window in the center of the canister, turns pink. By placing the unit in a hot oven until the crystals become blue again, you can dehydrate the canister, making it as good as new.

Diethyl ether has been found to be the most effective and convenient means of starting diesel engines in cold weather.

Motorcycle Convertible →

Buzzing around the streets of Munich, Germany, is a strange vehicle that offers most of the comforts of a car and the economy of a motorcycle. August Paul, a mechanic, built it by adding a de luxe sidecar to his motorcycle. It seats two and has a convertible top for protection from the weather. In the sidecar are a steering wheel, gearshift and other controls, so that even a long trip can be made in comfort.

Detergent Makes Rinsing Of Laundry Unnecessary

Housewives can do the family wash in shorter time when they use a new detergent that eliminates all rinse operations. Clothes are ready for the line as soon as they leave the wash water. The dirt, held in constant suspension in the water, floats away when the wash water is removed by the wringer or spin-drier. Another advantage is that the detergent can be used with hard or soft water, quick, thick suds being produced with either. Not only does the no-rinse detergent save time, but it also cuts water consumption, an important point in areas where water is limited at certain times of the year. Whiteness and color-



brightness tests show that the detergent does as thorough a job of cleaning as regular soaps and detergents. It can also be used for washing dishes, windows, floors and other household chores.

Funnel-Shaped Theater Built Like an Airplane Hangar

Like an airplane hangar, a new motion-picture theater in Los Angeles has no interior columns or supports. The rounded roof is supported on laminated wood arches. Located in a residential area where tall, vertical walls are undesirable, the

theater proved to be 25 percent cheaper to build than a conventional theater. The acoustics of the building are excellent because of the sloped ceiling. The theater seats 1800 people and is equipped with a standard-size screen.



WHAT'S NEW *For Your Home*

A four-page "shopping section"
dedicated to modern homemakers



AIR DEODORIZER, shaped like an old wick lamp, can be hung on a wall or placed on a shelf. Deodorizing fluid in the base is noninflammable should anyone try to light the wick of the "lamp"

KITCHEN COUNTER, right, has casters and rolls anywhere you need it. Inside are paper and garbage containers plus storage locker. An inner lid, shown in use below, is handy cutting board

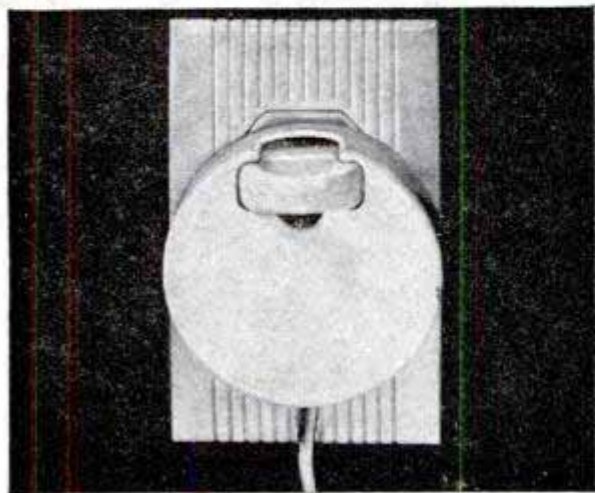


CLOTHESLINE WINDER is worn around your neck like an apron, leaving both hands free to clean the line as it is being payed out or for tying the line on a hook. To wind the line on the reel after use, you just crank as you walk



ICE-CUBE TRAY, at right, frees cubes with finger-tip pressure. You don't even have to take the tray out of the freezing compartment. Cubes are frozen in a latex liner which is placed in an aluminum rack

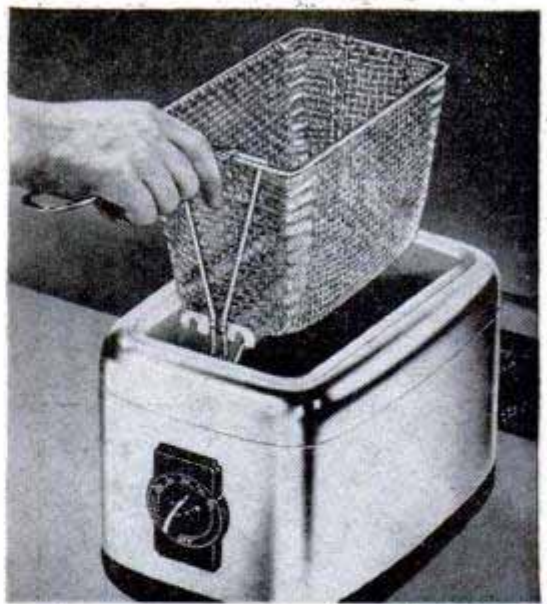
REEL-TYPE PLUG, below, has storage space for winding excess cord, thus getting it off the floor for neatness and safety. It can be attached to any cord and plugs into any standard wall outlet



TOY SEWING MACHINE, below, sews well enough to be handy for mother's light stitching, yet it's simple enough to operate to be called child's play

SLACK HANGER, below, attaches to a closet door or wall and holds up to six pairs. Any of the six pairs can be removed without disturbing the others





DEEP-FAT FRYER, above, can be set to maintain fat at any desired temperature. A wire frying basket can be locked in raised position for draining. Fryer also pops corn

HOME PASTEURIZER, left, processes any amount of milk from two gallons to two quarts. It is fully automatic in operation, shutting itself off when process is complete

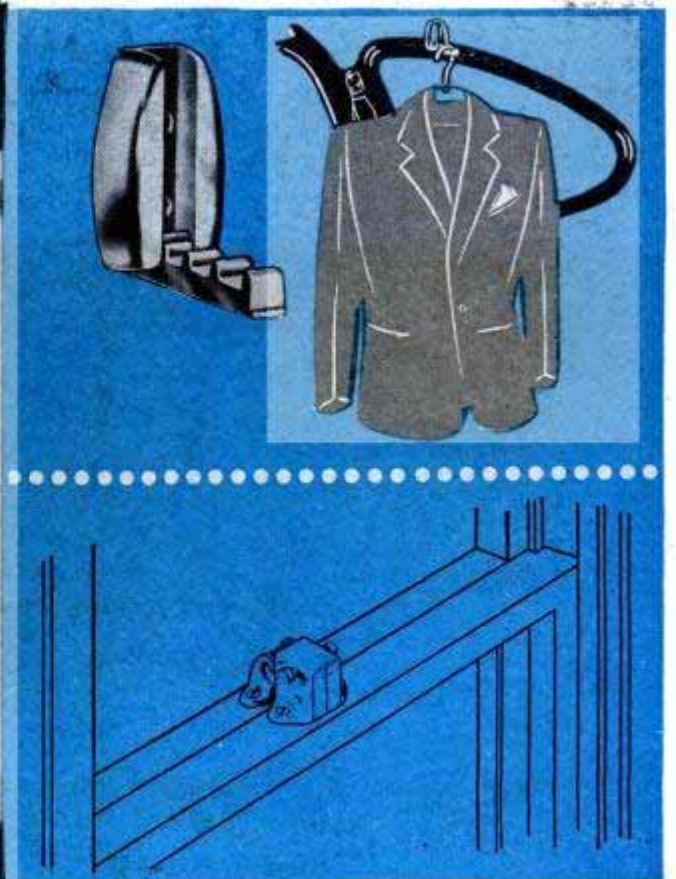
ICE-WATER TAP, lower left, provides cold drinking water without opening door of refrigerator. Cooling coil, tapped to water pipe, hooks onto one of refrigerator shelves

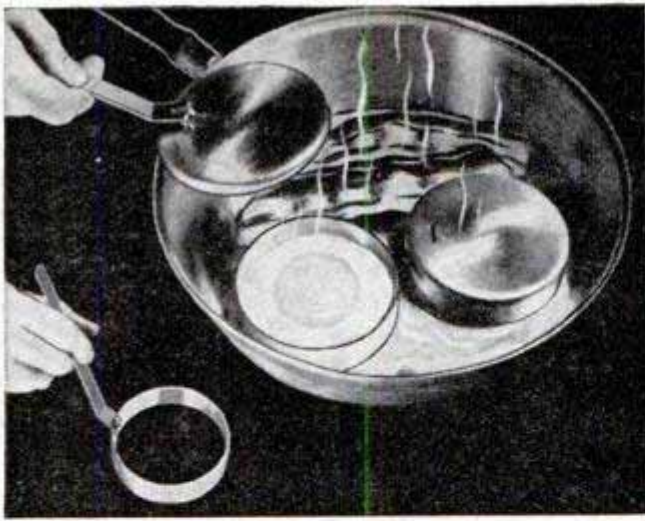
CLOTHES HOOK, below, can be used in a car or home. Arm folds up when not in use

SELF-ACTING LOCK for window, bottom, locks automatically when window is closed

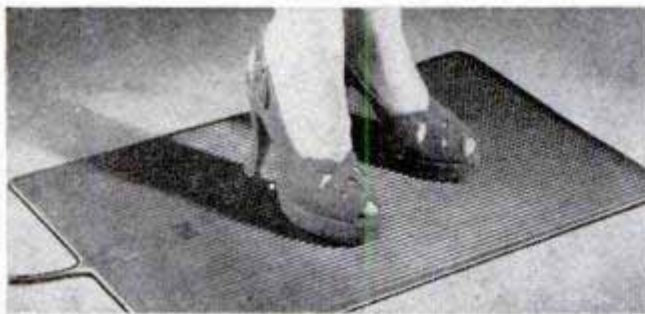
WHAT'S NEW *For Your Home*

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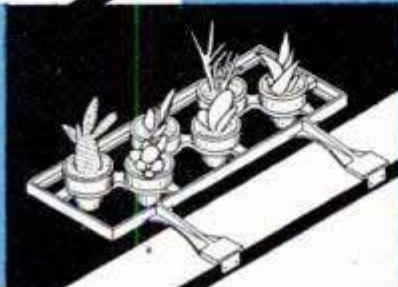
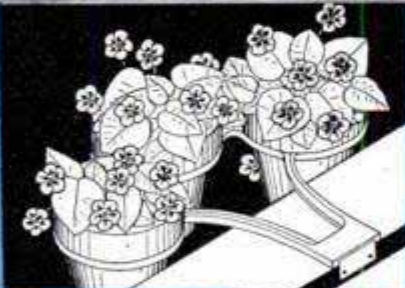
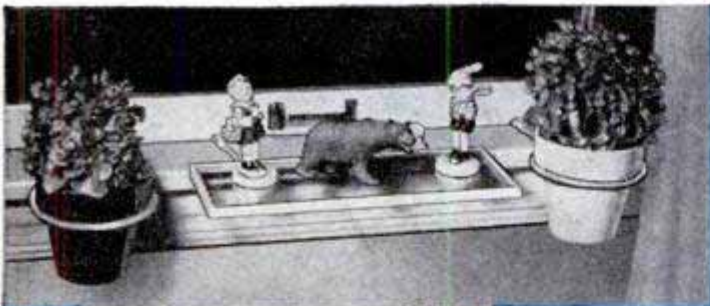


SKILLET RINGS, above, hold eggs in place when frying. Removable handle fits both covers and rings



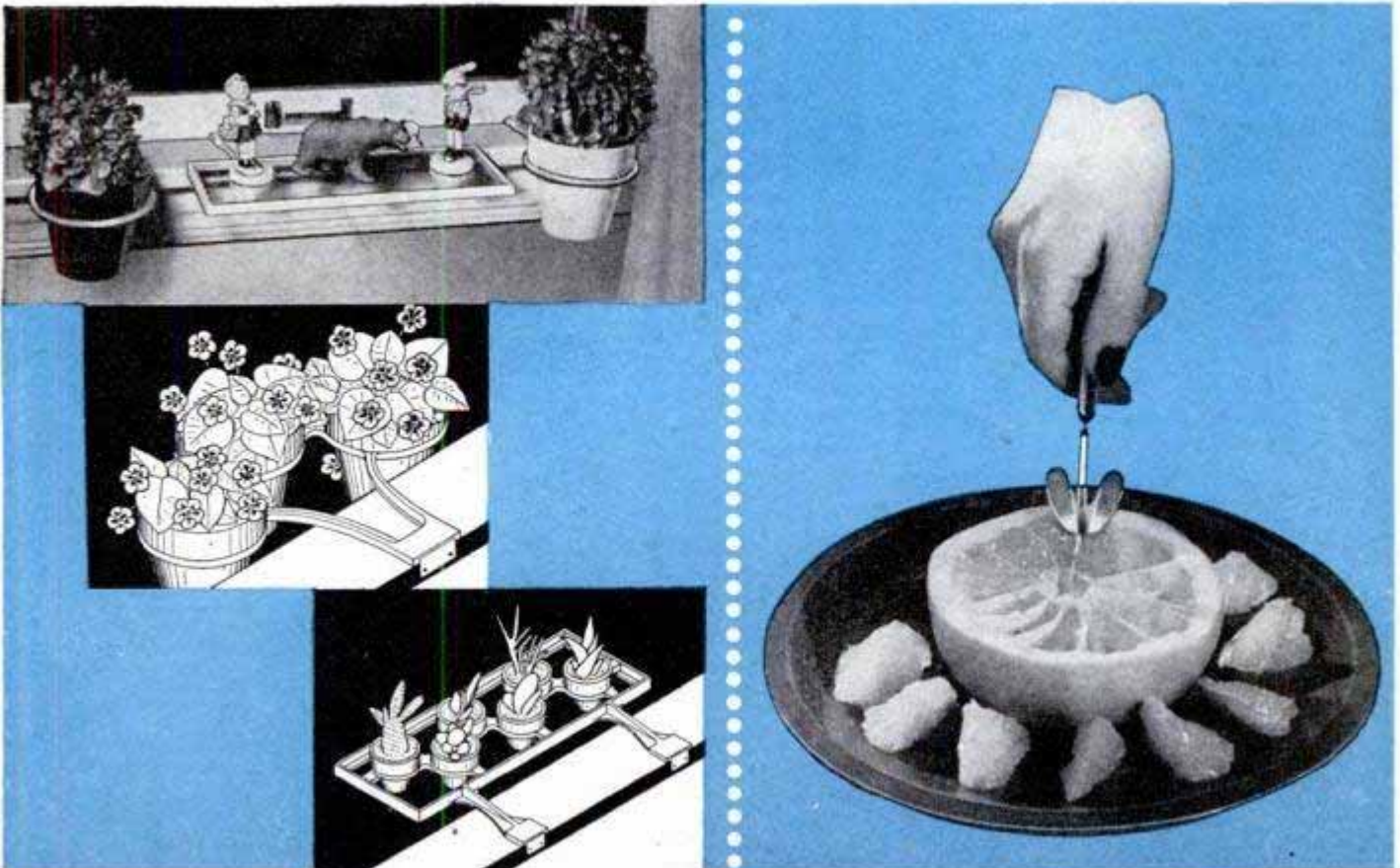
ELECTRIC MAT, above, keeps feet warm when you have to stand on cold floor. Made of rubber, it is safe on damp or wet ground. It plugs into any outlet

INDOOR GARDENS, below, are anchored to the sill by tacks which don't interfere with operation of window. Aluminum frames come in several designs



STAY-LEVEL LADDER has adjustable back legs so you can keep it level on stairs or uneven surfaces. The extension parts of the legs are heavy aluminum

TWIN-BLADED KNIFE, below, removes grapefruit segments without squirting! It cuts two segments in one operation without rind or web clinging to them





← Sun Cooks Food

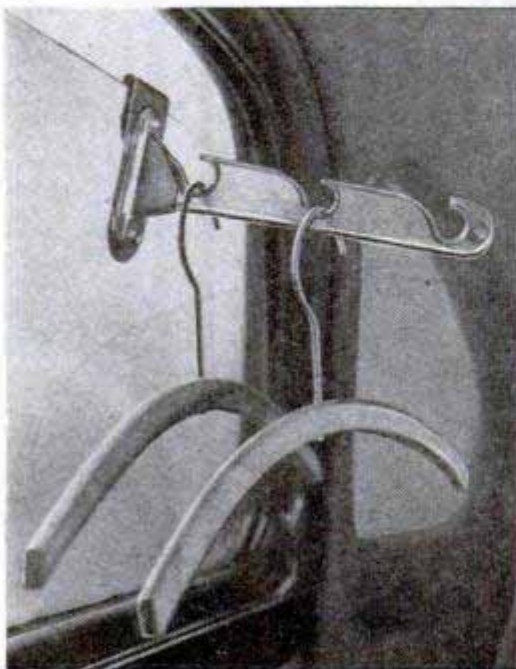
Sun rays supply the heat for cooking in a new solar sauce pan. The cooker was developed by French inventor M. Tarcici. The cooking pot hangs in the center of a large dish-shaped reflector which catches and focuses the sun's heat. The reflector follows the sun's movement through an automatic control which also is powered by sunlight.

Satin Tape

Self-sealing tape that looks like glossy satin is designed for both decorative and practical uses. It can be applied as a decoration to packages, used to edge shelving, for framing snapshots in an album and for any purpose where a ribbonlike effect is desired. It is available in 15 colors.

Heating Cord for Blankets

You can convert your regular blankets into the automatic electric variety with a plastic-covered heating cord that has a thermostatic control. Laid out in any pattern between two regular blankets, the cord provides enough heat to keep you warm on sub-zero nights. It consumes less than 75 watts. You can arrange the cord so it merely warms the feet, or just one half of a double bed or all of it, if desired. Fasteners, provided with the 30-foot cord, attach it to the blanket.



Hanger for Car or Home

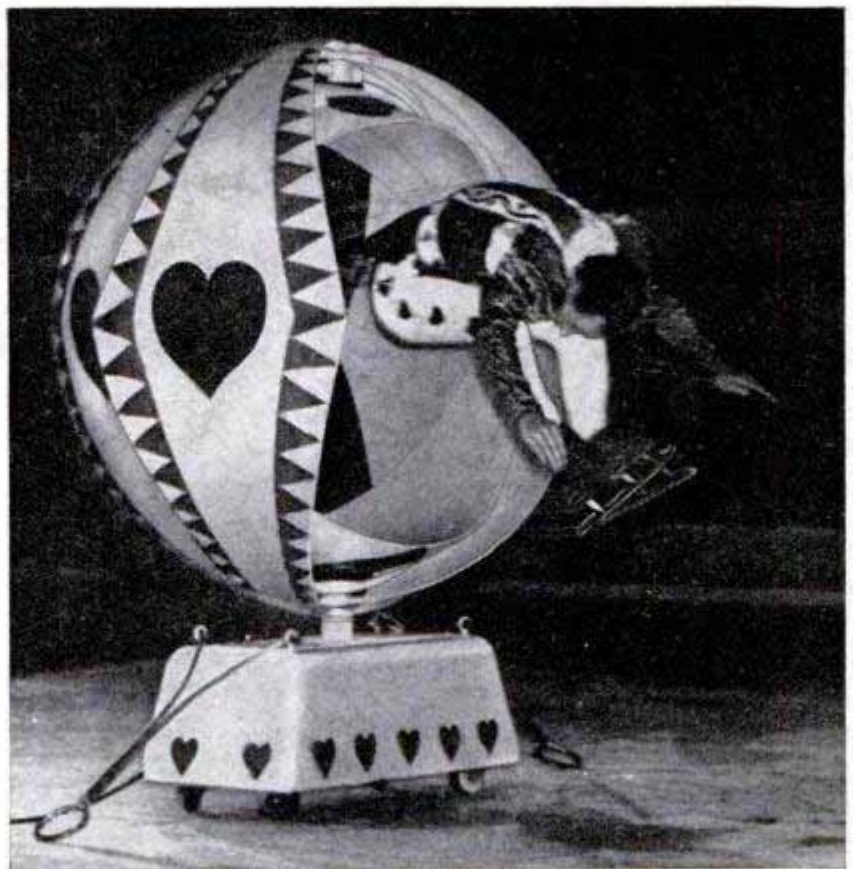
For use either in the car or at home, a portable clothes rod holds 45 pounds and up to six hangers. One of the two back plates supplied with the hook slips over a car window to support the clothing. The other is large enough to fit over the top of a door. The hook also can be attached permanently by screwing the larger back plate to any surface. It can be used in a horizontal or vertical position.

Valves in the heart and at the entrance of the main artery, or aorta, to the heart can be replaced by hollow Lucite balls, according to Dr. Charles A. Hufnagel of Harvard Medical School.

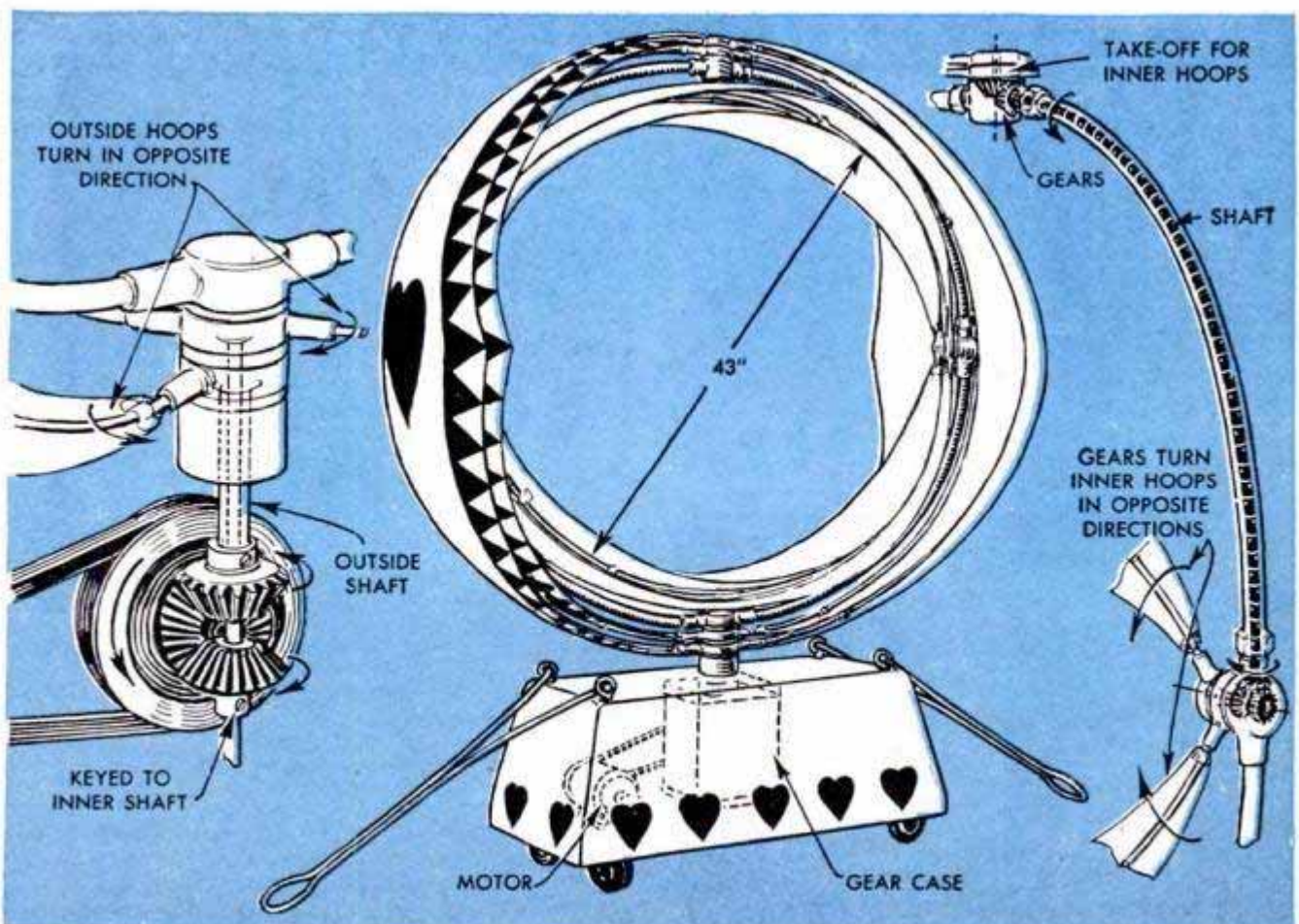
"EGG BEATER" ON ICE

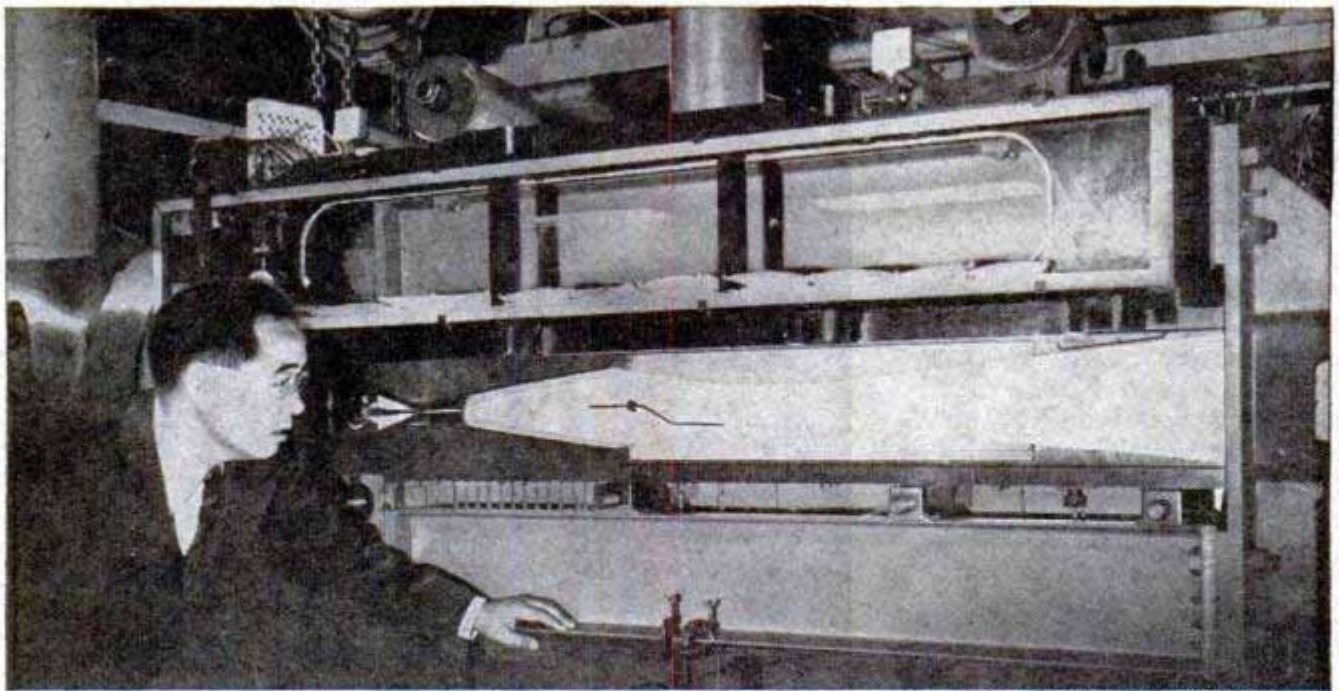
HARRIS LEGG, one of the Ice Follies stars, designs and builds his own "death defying" machines for use in his famous jumping act. This season he is thrilling audiences with a double egg-beater sphere which has two sets of steel blades, one turning within the other. As the blades are revolved by a quarter-horsepower electric motor there is an interval of about one fifth of a second when there is an opening in the center of the egg beater exactly 43 inches in diameter. During this split second, Legg must leap through the device—or be caught in the spinning knife edges of the beater. Occasionally he clicks a skate on the edge of a blade and sparks fly, for he is traveling 30 miles an hour. Legg's act depends on

perfect timing and perfect synchronization of the blades. His first jumping machine was a single revolving hoop, then he added another tubular hoop. Last season he used four hoops filled with butane gas and jets which were lighted to make a ball of flame. This created a problem with fire departments in cities where the Ice Follies played and Legg finally substituted steel spikes as a hazard to replace the prohibited flame.



With perfect timing, Harris Legg of the Ice Follies is shown clearing the revolving blades of his "egg beater" which presents a 43-inch opening in the center for about one fifth of a second. Below, details of the beater





California Institute of Technology photos

Air rushes through Caltech-Army hypersonic tunnel at speed of 7600 miles an hour, making it fastest in the world

CALTECH TUNNEL IS FASTEST IN WORLD

Velocities 10 times the speed of sound, equal to a rocket trip from the United States to Australia in about an hour, are attained in a new hypersonic wind tunnel at the California Institute of Technology.

The tunnel will allow the testing of rocket and missile models at speeds up to 7600 miles per hour, about three Mach numbers faster than the highest rocket speeds reported to date. (A Mach number of one represents a speed equal to the speed of sound, which is approximately 760 miles an hour at sea level.) It can be run continuously for as long as 20 hours.

Air for the hypersonic tunnel is furnished by 15 compressors and is stored in a six-ton reservoir, with steel walls up to 2½ inches thick. Height of the slot in the throat of the tunnel that admits the air to the test section can be varied to obtain the desired Mach number. For a speed of Mach 10, the slot is the approximate thickness of a piece of paper.

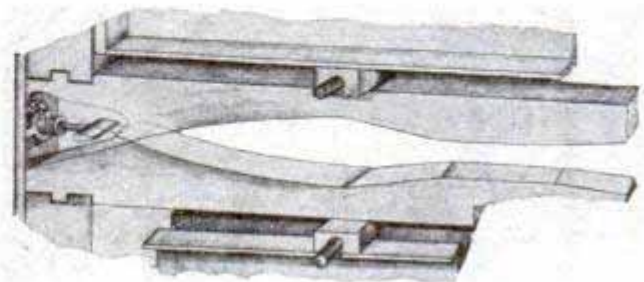
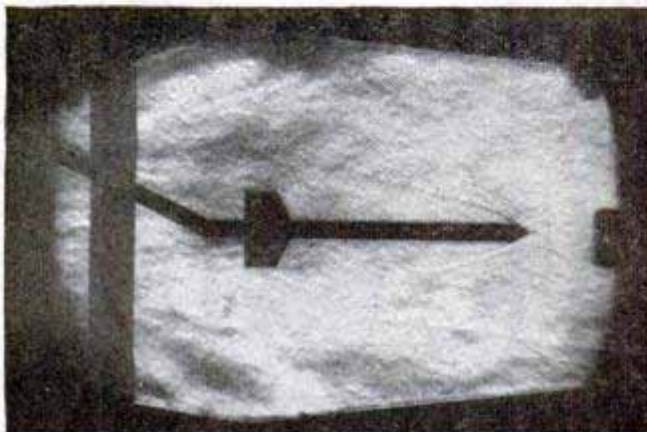
Special driers remove moisture from the air to prevent the icing up of model shapes

that are being tested. In the hypersonic tunnel the problem is accentuated by the fact that the sudden expansion of the incoming air drops the temperature in the five-by-five-inch test section to as low as 430 degrees below zero Fahrenheit.

A guided missile designed with the tunnel's aid could take off from San Francisco and arrive at Sydney, Australia, in about an hour. Flight from practically any spot in the United States to Buenos Aires or from New York to London, would take less than an hour.

The highest known rocket speed is 5200 miles an hour, made by a two-stage missile at White Sands, N. Mex., proving ground. It was a Wac Corporal attached to the nose of a German V-2, from which it was fired after the latter reached maximum velocity.

The tunnel, built for the Army Ordnance Department, is being used for obtaining basic information about the design, performance and instrumentation of tunnels for testing rockets and missiles intended to move at hypersonic speeds.



Above, nozzle slit at left of the tunnel throat is .006 inch wide when speed of Mach 10 is reached. Left, Schlieren photo shows shock waves streaming back from nose of rocket model in the test section



Air "Gas Stations" Stretch Plane Range

Almost unlimited ranges are possible for both jet and piston-engine aircraft aided by two new aerial-refueling systems. When perfected they will enable planes of all types and sizes to fly anywhere in the world nonstop. Demonstrating a technique developed in England by Flight Refueling, Ltd., a fighter took on fuel 10 times in the air to set a jet endurance record of more than 12 hours. A hollow probe with an automatic locking device at the tip is fitted to the nose of the receiving plane and a hose with a three-foot-wide cone at the end trails from the tanker craft. The probe is "flown" into the cone when the two planes are flying at about 190 miles an hour. Three toggles in the cone latch over a groove on the probe. A valve operated from the receiver's cockpit opens a valve in the probe at the same time it opens a valve in the cone, permitting the fuel to flow. Each contact took about two minutes and 2500 gallons of fuel were exchanged during the flight. The receiver slows his speed to break contact. A distinguishing feature of the other system, used experimentally by the U. S. Air Force, is that the tanker is primarily responsible for making the con-

Above, left, using British system, up to 300 gallons of fuel a minute are transferred from tanker to receiver. Above, right, probe on nose of receiving plane nears cone trailing from tanker. Below, American technique has telescoping metal tube guided to contact with receiver



U. S. Air Force photo

tact. A telescoping metal boom is positioned by an operator in the tanker's tail. Small airfoils on the boom allow it to be guided up, down or sideways until contact is made with a socket on top of the receiver. The fuel is pressure fed in both British and American systems. A radar beacon in the receiving plane enables the tanker to "home" on it during bad-weather fuel transfers. The U. S. Air Force is also experimenting with another technique that allows three fighters to be refueled simultaneously from a tanker transport.

Duplicate Tape Recordings Made by "Contact Printing"

Borrowing an idea from photography, sound technicians now are making duplicate tape recordings by "contact printing." Recording tape is permanently coated with iron oxide, which forms magnetic patterns

when a recording is made. These patterns in turn can be reproduced on another tape by holding the two in contact with an electromagnet. The method makes it practical to duplicate recordings in large quantities.

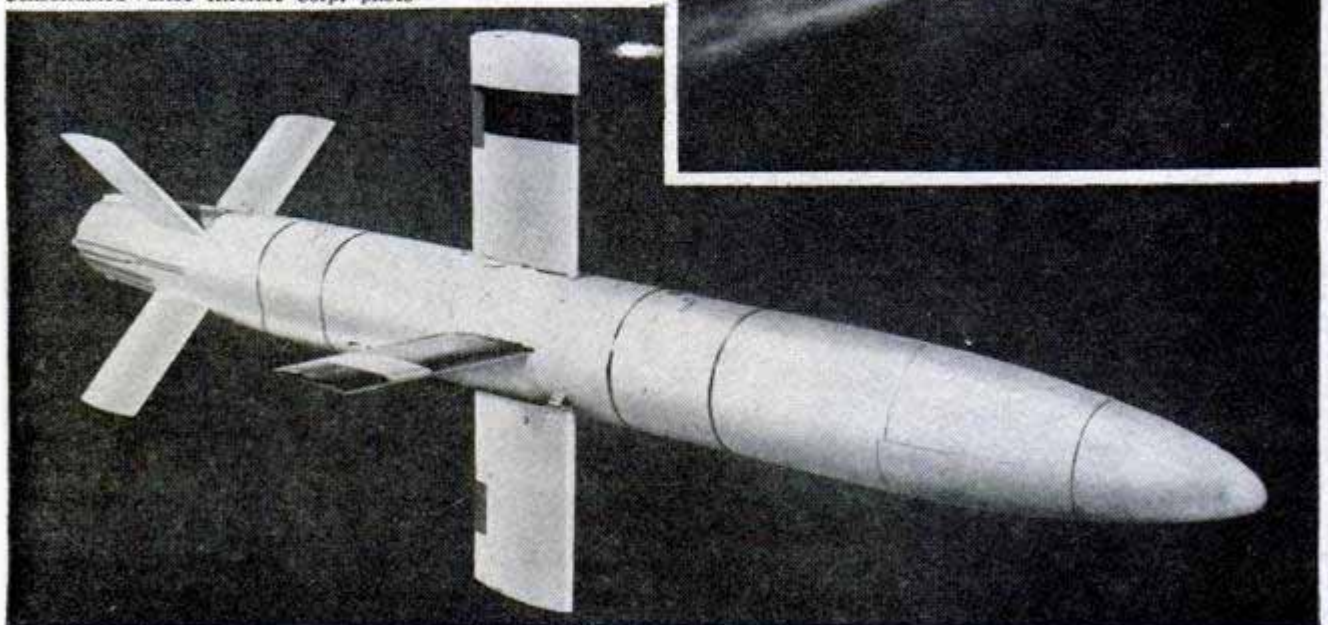
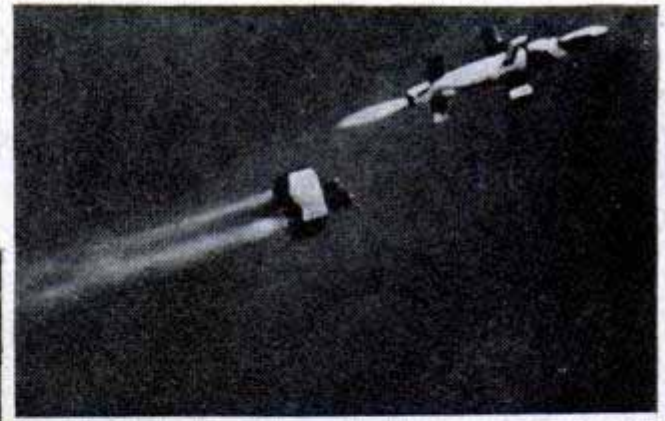
Submarine Launches Guided Missile

UNDERWATER craft took on new importance in top military strategy with the launching recently of a 7½ ton radio-controlled flying bomb, the "Loon," from a United States submarine in the Hawaiian Islands. The demonstration was part of a naval "war show" to illustrate how a submarine could enter enemy-held harbors and attack targets 200 miles from the coast. Although fired upon by the anti-aircraft guns of 75 warships, the missile escaped unscathed and finally disappeared over the horizon. Underwater boats are now being designed for seven different war roles.



Intercepting and destroying enemy planes before they can attack ship or shore targets is the job cut out for the Navy's newest guided missile. The Lark is operated by remote automatic control after launching from either shipboard or land. It has a liquid-fuel rocket motor and is aided by a twin-rocket booster assembly that drops away from it shortly after firing

Consolidated-Vultee Aircraft Corp. photo



DRY-LAND SUBMARINE SCHOOL

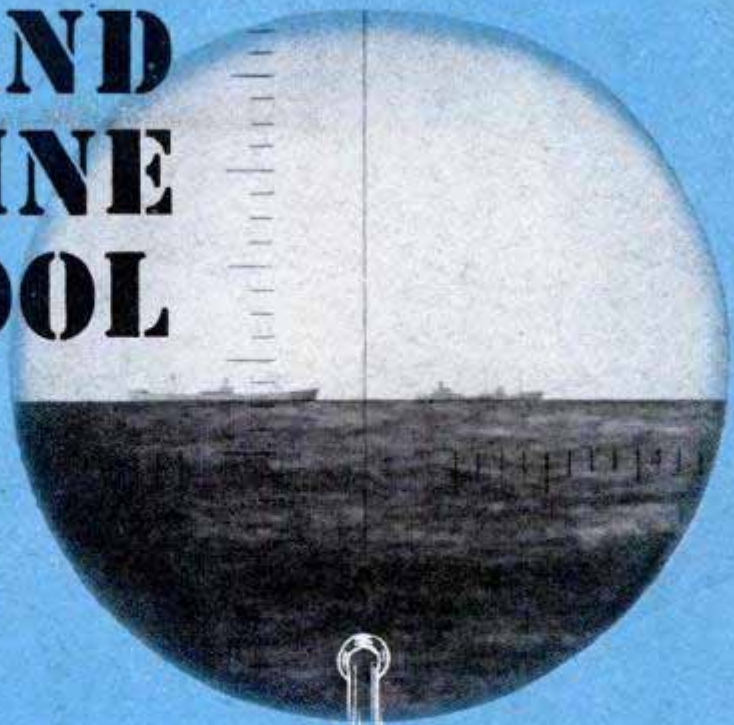
By Gorman McMullen

UP PERISCOPE!" Hovering over their instruments, the men in the conning tower of the submarine suddenly became tense. The underwater craft was in its most dangerous moment: It was abandoning its element of safety, full submersion beyond the sight of hostile craft, by raising its mechanical eye for a quick look for targets.

For critical seconds the periscope's feathery wake formed a telltale finger pointing out the submarine's location to the eyes of enemy ships or aircraft. But the operation couldn't be avoided. The periscope had to be raised above water so crew members could locate the target and send the torpedoes crashing into it.

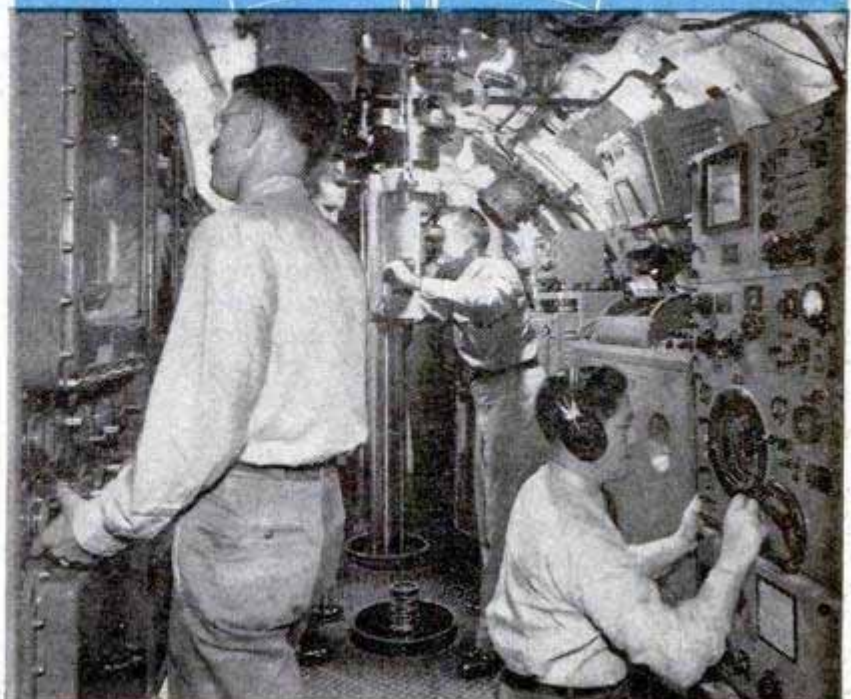
The number of gray hairs on Navy heads resulting from "sweating out" this moment in combat will never be known. But the Navy believes the scene need never occur again, because recently perfected instruments enable a submarine to locate surface ships while almost completely submerged. These radar and sound-wave instruments—coupled with increased speed, Schnorkel breathing devices and other improvements—have greatly stepped up the deadliness of submarines.

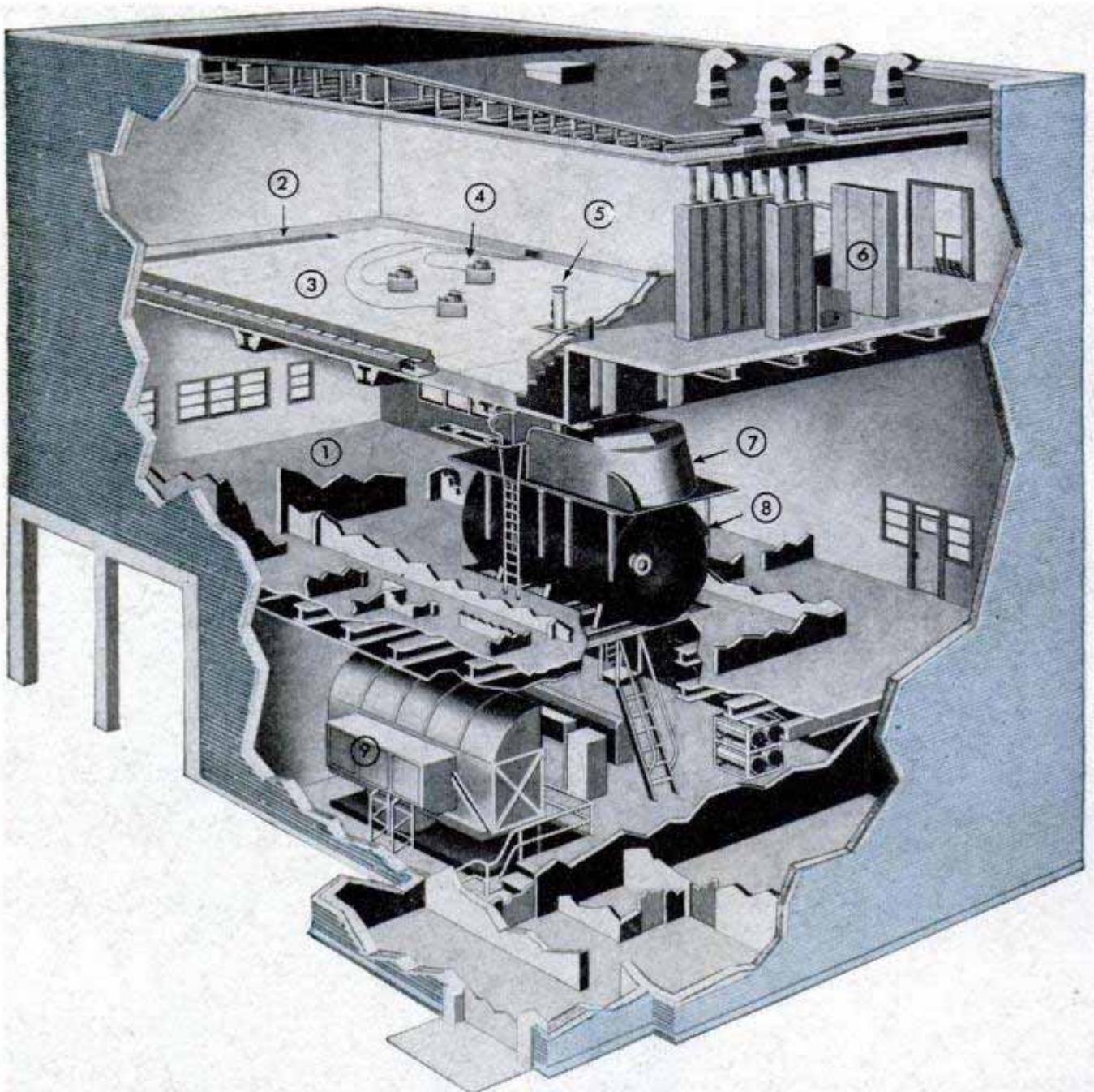
These technical advances created a need for more training in the teamwork that welds a handful of men and a jumble of instruments into one of the deadliest weapons of modern war. The Navy's answer is a three-story dry-land school where—thanks to



This is the view a submarine commander gets through a periscope as he follows a merchant-ship convoy on the "horizon"

Submarine crewmen in training man the conning-tower controls in the Submarine Attack Teacher at the New London sub school





U. S. Navy photos

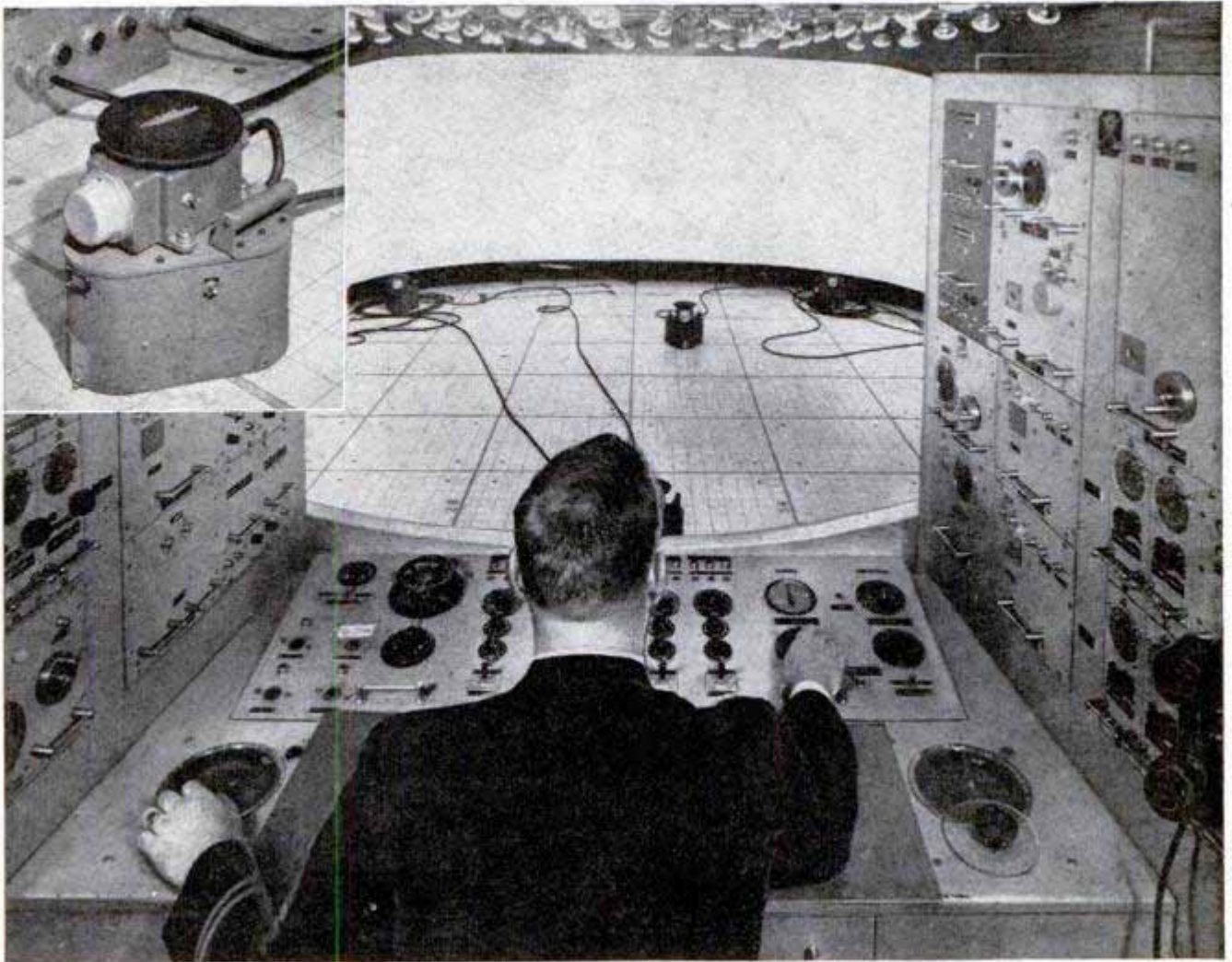
Cutaway view of the building housing the Submarine Attack Teacher at the New London school. Numbers designate the following: 1. Classroom; 2. Skyboard; 3. Target floor; 4. Model cars; 5. Periscope; 6. Computer rack and panels; 7. Forward bridge; 8. Conning tower, and 9. Submarine diving trainer. With this giant training device, future submarine crews are getting actual practice in underwater duty while on dry land

a network of mechanical brains and other engineering marvels—a submarine crew can synthetically take their craft to sea, submerge and practice with five surface ships any maneuvers which might be carried out afloat. Each man carries out the same duties with the same equipment he would at sea, with only a fraction of the time and expense actual undersea exercises would cost.

The Navy set up the first of these Submarine Attack Teachers in 1948 at New London, Conn. It was designed and built by the Special Devices Center, a branch of the Office of Naval Research, at Port Washington, Long Island. Improved models are now in use at New London and Mare Island, Calif.

Outside, these trainers look like any three-story brick factory. Inside, you see a complete conning tower, a bridge, and diving-control compartment. On the third floor, five model ships maneuver on the floor controlled by a training officer.

In the conning tower on the second floor the captain directs his craft. Move a control and the submarine's instruments, connected to high-speed computing machines, reflect the action as in an actual submarine. Standard hatches lead to the bridge above and the diving-control compartment below. Two periscopes, one operative and one dummy, are flanked by the helmsman's station with instruments and communication lines, radar and sound-wave equipment, torpedo gear, intercommunication

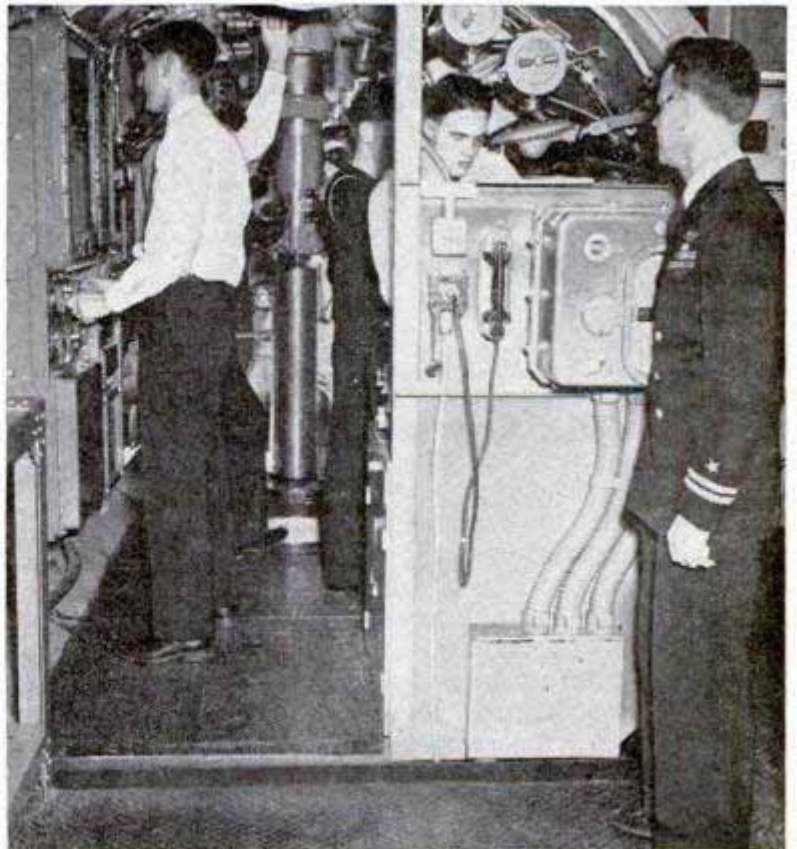


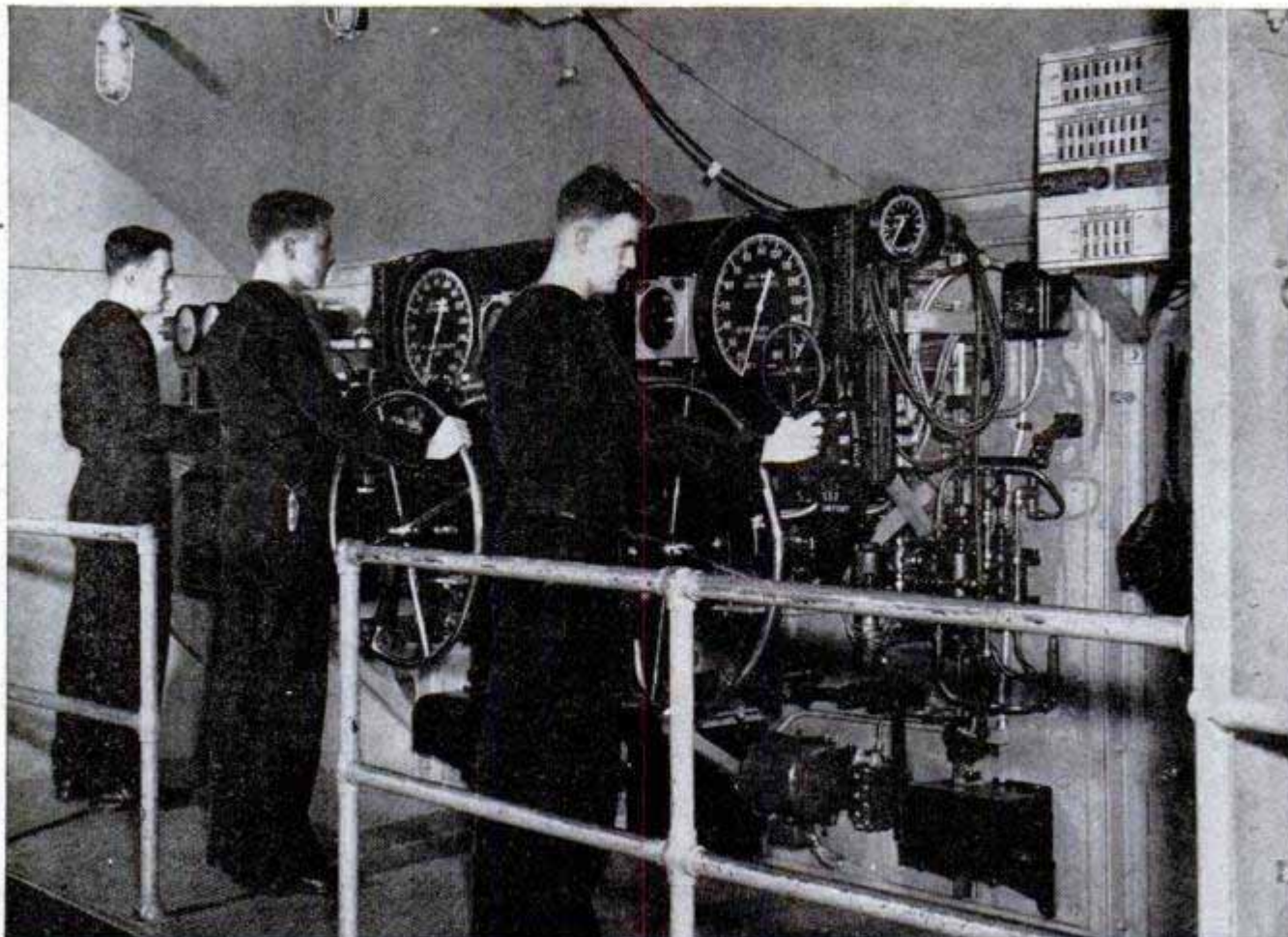
Above, instructor manipulates the target ships from his position at the console. Inset, top left, is a close-up of a model ship on the "crab" which maneuvers for the trainees. Crewmen see this ship through the periscope of the training device. Below, conning station and instructor's post inside the Submarine Attack Teacher

equipment and the intricate array of gadgets which make the eyes of landlubbers bulge.

The instructor checks the actions of officers and men as they maneuver their sub and make their attacks. His panel shows the positions and all statistics about the submarine and target vessels.

When the conning officer looks into his periscope, he views a seascape on which ships are plowing through the waters with bow waves standing out clearly and wakes trailing astern. The seascape is built into the optical system of the periscope, and the "sea" is the third-floor deck of the building. This deck, through which the periscope is raised, drops away gently from the periscope so that distant ships have a hull down appearance. The model ships, built to a scale of 1200 to 1, are mounted on automatically controlled cars which travel at speeds proportionate to the type of ship. The operator of the Trainer determines their course and speed. Since the simulated submarine cannot be moved, the





Above, sailors of the underwater fleet practice on the diving trainer. Right, a civilian technician puts together a model ship under a magnifying glass

movement of the model vessels varies to keep the correct distance and bearing from the submarine, depending on its simulated movements. Electric cables attached to the cars run to a computing mechanism, which keeps them traveling correctly. The model ships, which represent merchant vessels, destroyers, cruisers and aircraft carriers, "sail" on a 58 by 35-foot floor, constructed of polished terrazzo slabs. The floor is marked off into grid lines to facilitate computing. The floor provides an optical range of 16,000 yards in one direction, 7000 yards in all others. Radar range is limited to 30,000 yards. Lighting arrangements vary the seascape from bright daylight to night.

Four feet above the model-ship floor stands a battery of computers on the operator's platform, where problems are set up and their solution observed. By the flip of a switch, he makes the submarine react to the characteristics of the older fleet-type submarine or the newer high-speed "guppy" type. The surface vessels can be operated either as targets, or as submarine hunters, to give practice in evasive tactics.

The Diving Trainer, located on the first floor, simulates the control room of a submarine. It affords complete training facilities for diving crews, who operate the controls under directions from the conning



tower. The other operational room contains two standard torpedo-firing panels simulating the torpedo rooms of a submarine.

The Attack Teacher will never replace salt-water practice, but it has proved eminently satisfactory in bringing crews to a high degree of perfection before actually trying out at sea.



Fluorescent-Tube Disposal Device

Fluorescent tubes containing beryllium, a powder classified as a poison hazard, are disposed of safely by a device that breaks the burned-out tubes under water. Developed by the New York Department of Labor, the device consists of a long barrel, an anvil and plunger. The tube is inserted in the barrel, which is then closed by a lid on the top. The opposite end is placed in a bucket of water and the trigger pulled, breaking the fluorescent tube as the plunger crashes it against the anvil. The beryllium dust mixes with the water which is poured down a drain without danger.

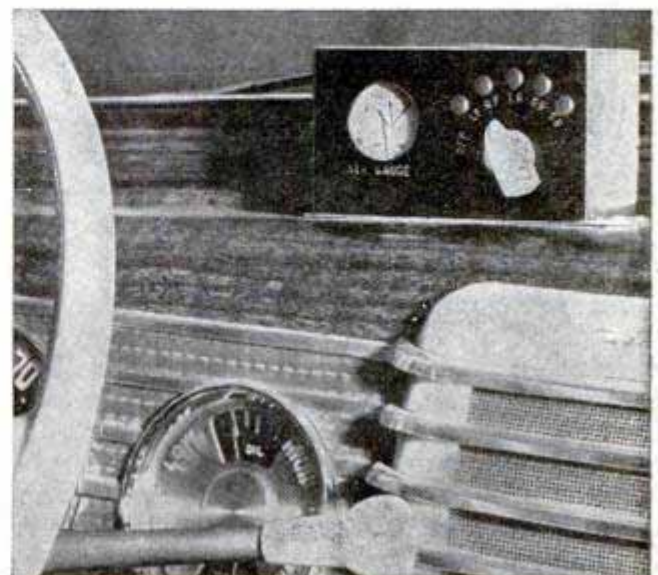
Dashboard Pressure Gauge Checks Tires Remotely

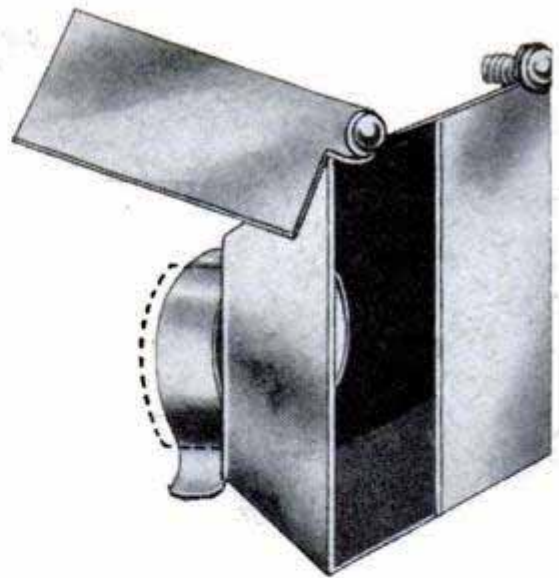
Motorists can check the air in their tires without stopping the car by means of a remote-controlled pressure gauge that mounts on the dashboard. By turning a convenient pointer to any of five positions, one for each tire including the spare, the motorist reads the exact air pressure on an adjacent gauge. An additional feature of the device is a warning system that flashes a red light on the panel when the pressure of any tire drops five pounds below safe operating pressure. The lights identify the troublesome tire and provide sufficient warning so the driver can stop his car before any damage is done.



Carton Tongs

Grocery clerks and others who have to handle heavy cardboard cartons and wooden boxes can eliminate back strain with a pair of tongs that permit lifting the cartons with one hand. Grippers of carbon steel hold the box securely but without damage. The upward pull on the handle forces the grippers inward so there is no possibility of slippage.

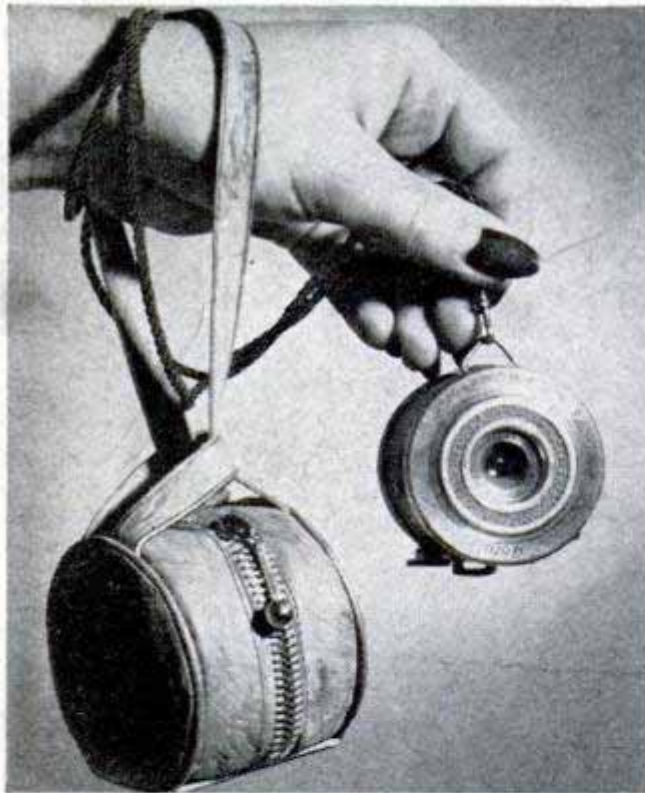




Trick Photo Effects Made With Shutter-Shade

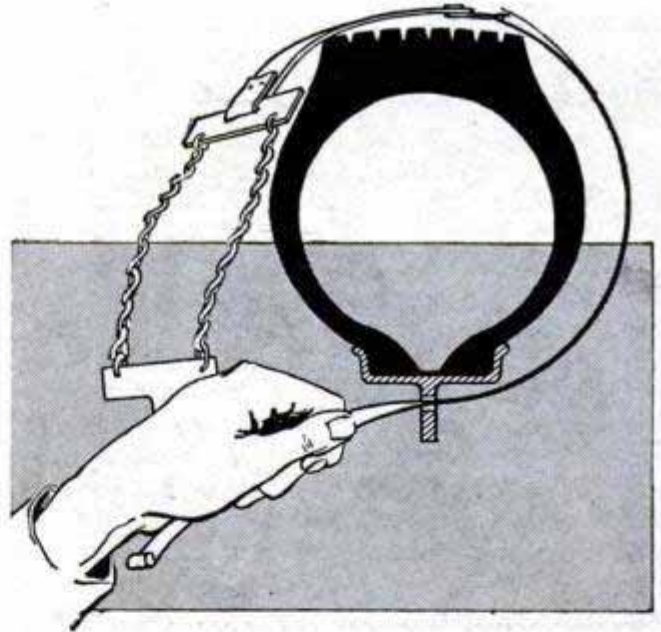
Double exposures are made scientifically for trick photographic effects with a lens shade that has two swinging shutters. With it you can photograph a person "talking" to himself. You simply close one shutter and snap the picture, then pose the subject

on the opposite side and re-expose the film with the first shutter open and the second closed. Many humorous effects can be produced in this manner. The two shutters can be swung open and the holder used as a lens shade, if desired.



Midget German Camera

Midget cameras make candid shots easy to get and a new midget from Germany is carried in a leather case on the wrist like a tiny handbag, always ready for action. The circular camera has an f:2.8 lens and shutter speeds up to $\frac{1}{200}$ second. The shutter has a built-in flash synchronizer. The 8-mm. film comes in special cartridges that hold 10 exposures.



Strap-On Chain Applier

Emergency tire chains, the ones that strap on through the slots in the wheels, go on quickly with the help of an applier that won't drop the strap as it is being pulled around the tire. Wire clips are attached to the end of each strap. The applier, formed of a wide spring-steel band, is pushed through the wheel slot until its hook end comes out over the top of the tire. The wire clip on the strap is then locked in the hook and the applier pulled back through the wheel slot until the chain is in the proper position over the tire. The chain strap is then buckled tight in the normal manner.



Despite the year's loss to rabbits of 15 acres of wheat, the homesteading McClymonds can still smile

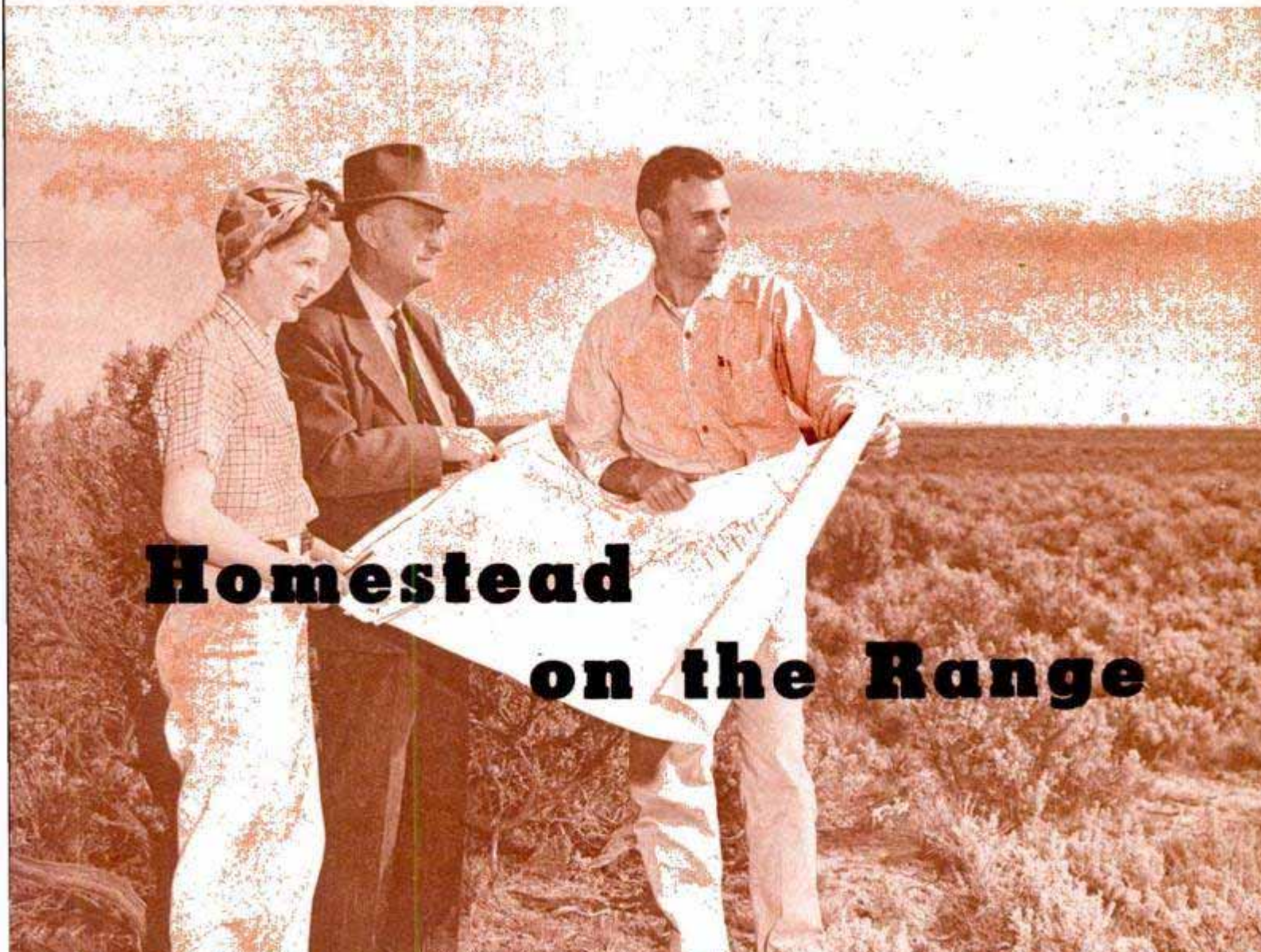
Below, J. S. Moore, superintendent of the Minidoka Project, shows two homesteaders their free acreage

Free land—the magic words that helped conquer our frontiers ring out once again. Occasionally, farm land on reclamation projects is available, but homesteading 1950 style is a science, not a gamble

By Rafe Gibbs

EVER CONSIDER homesteading? No, we're not talking to Grandpa, but to you. There's still free land to be had in the United States. It's in limited quantities, and the getting of it requires more than a fast horse to race out and stake your claim. But you do have a good gambling chance at a homestead, providing you can meet certain requirements.

Out in the Northwest, for instance, 75 farm units on federal reclamation projects were made available for homesteading during 1947 and 1948, with more to come. Thirty thousand persons from all over the United States requested applications for a chance at those 75 units. That sounds like tough odds, but additional facts don't make them so tough. Fewer than 4000 applications were returned for land drawings and



**Homestead
on the Range**



Water from a small reservoir behind a canvas dam is siphoned into the fields by lengths of plastic hose



Farmer adjusts nozzles in the aluminum pipe which carries irrigation water to a field of sweet peas

many of these didn't have a prayer for consideration.

Nothing pains the Bureau of Reclamation more than having a homesteader fail. Qualifications are thoroughly checked before a bureau official says:

"Okay, Mister, that hundred acres over there is yours. Hop to it."

Primarily, the successful applicant must have two years of full-time farm experience, or its equivalent, obtained after the age of 15, and capital assets of \$3000 or the equivalent in such assets as livestock, farm machinery and equipment which would be useful in developing and operating a new irrigated farm. Preference is given to veterans of World War II.

Back in Revolutionary days, to step up enlistments in the Continental Army, a bounty of land was offered, with the acreage depending on rank—1100 acres for a general, 500 for a colonel, 100 for a private. But today an ex-buck private is on an equal basis with an ex-general.

Now, before you start dashing off a letter to the Department of the Interior in Washington, D. C., asking about homestead opportunities, let's take a look at a typical project. The Hunt unit of the Minidoka Project in Southern Idaho is typical—and unusual. It is unusual because a lot of barracks from a Japanese evacuee camp were thrown in free with the land and the settlers have done interesting things with the buildings, but more about that later.

In June 1947, 43 World War II veterans

were awarded Minidoka farms, ranging from 60 to 100 acres.

"It was no land of milk and honey when we moved on it," said cowboy-hatted Eugene Kenner, who used to run cattle over Lava Hot Springs way in Idaho before the war. "Most of the project was covered by sagebrush, with two jack rabbits fighting for shade under each bush. The Japs had grubbed off some of the land for farming, but brush and weeds had snuck back in. Still, the land was ours, and there's something special about land that's free. 'Course we were assessed about \$100 an acre for irrigation-construction charges, but the land itself was free."

To those of you used to dry-land values, \$100 an acre may seem high for irrigation construction, but the figure for the land concerned is reasonable.

"Our first problem was getting homes ready," said Kenner.

And that's where the Japanese evacuee barracks—each 20 by 120 feet—came in. All homesteaders received two barracks, and how they utilized them was their own business. It cost from \$300 to \$600 to get the buildings moved onto the farm sites, but the buildings were worth many times that in lumber alone. Each contained about 15,000 board feet.

You wouldn't recognize some of the old barracks buildings today. With muscle—and money, varying from \$1000 to \$7500—the barracks have become homes of individualistic design.

Earl Mouton, former chief warrant officer in the Navy, for instance, rebuilt a barracks into an H-shaped house, with 20 feet in the center and 40 feet on the ends. What happened to the 20 feet left over? Built that into a garage. Mouton's other building was unscrambled into barns and sheds.

The interior of the Mouton house has been done in knotty pine. There's a friendly fireplace, too.

"I was in the Navy 23 years 7 months and 2 days," said Mouton, "and all the time I wanted a snug harbor of my own. Now, brother, I've got it."

Some of those who came on the project with the minimum of required funds are using the barracks as homes almost as is. But they're roomy!

A homesteader who will have a really different home is Harry Peterson. His barracks house burned down while he was out grubbing sagebrush and he lost everything, including his shirt. He had left the shirt in the house while he worked under the blazing sun. But, before the ashes of his home grew cold, Peterson started picking up rocks off his farm, and now he is building a new house out of them.

"I was one of the extra lucky ones," said ex-cattleman Kenner. "I won a surplus truck on a drawing. My grandfather homesteaded 80 acres over by Rupert, Idaho, in 1906. When he came onto the land all he had was a wagon, a slab of bacon, some flour and beans. But we still have to get in and dig just like Grandpa."

The modern homesteaders are indeed "digging" with the vigor of Grandpa, but they are progressing much faster and their chances of going broke are much less. Here is some more help that the moderns received which Grandpa never knew:

First off, the Minidoka land was carefully



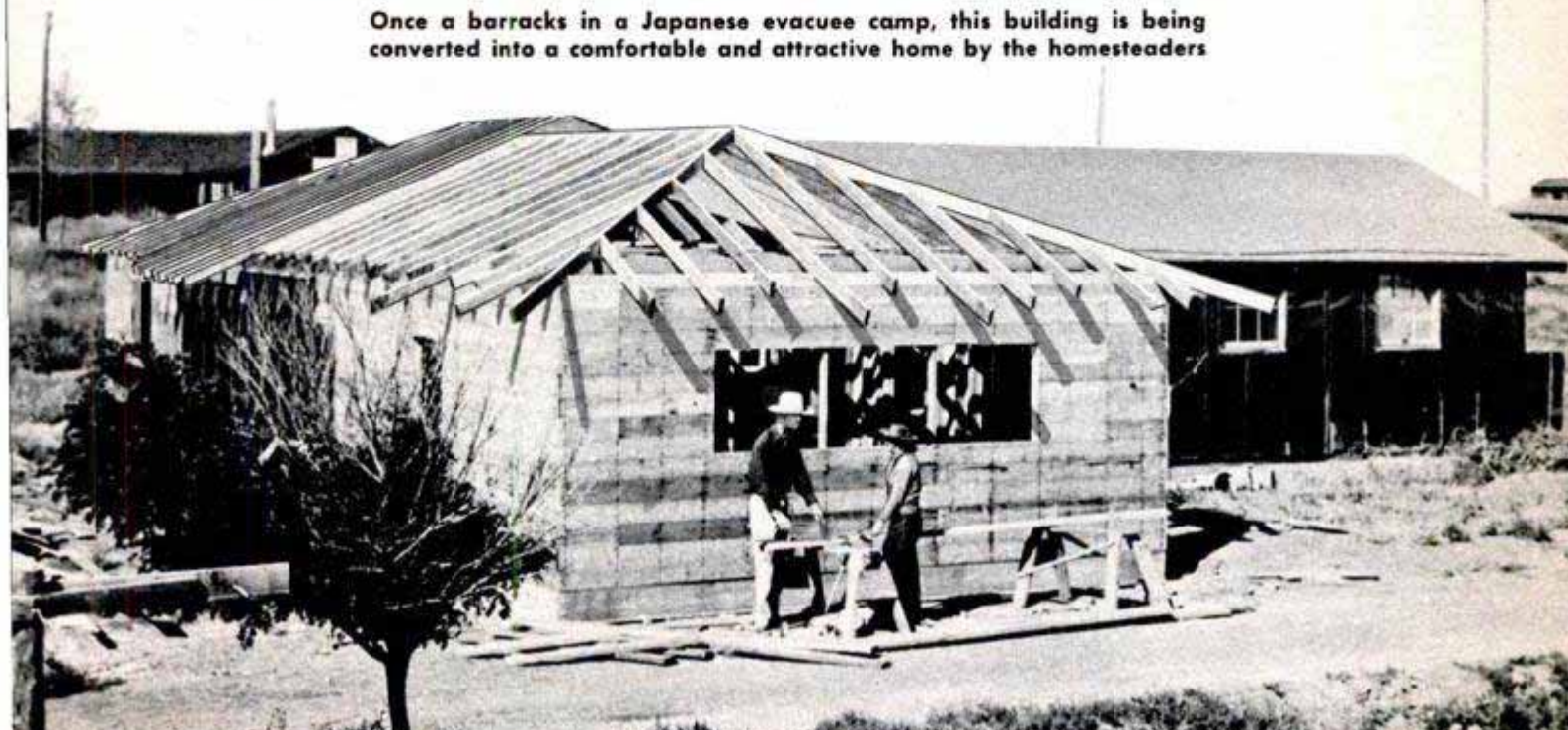
Mr. and Mrs. Marvin York, homesteaders, start work on the foundation of their future home in the West

analyzed by experts before it was allotted for homesteading. Not only did the homesteader know that the land was good, but he knew, before he ever grubbed a bush of sage, what crops would best grow on his particular plot.

Then a GI farm-training program was set up on the Minidoka Project. The homesteaders were taught the latest scientific methods for clearing the land, raising crops and livestock, marketing, financing and keeping books. For attending this school, the veterans received the regular GI subsistence payments. The monthly checks came in mighty nice while waiting for the land to start producing.

Always close at hand was Virgil Cross,

Once a barracks in a Japanese evacuee camp, this building is being converted into a comfortable and attractive home by the homesteaders





You'd never guess that this modern kitchen was once part of a barracks! Nor is it anything like the huts that were called home by homesteaders of yesteryear

The hardy folk who homesteaded years ago would be amazed at such items as Mrs. Earl Mouton's freezer



University of Idaho county extension agent. Cross continually dropped in to advise the homesteaders on crops adapted to the Minidoka area, on the time for planting, rate of seeding and sources of seed. If a homesteader suggested that he wanted to remodel a barracks into a dairy barn, Cross promptly whipped out a University of Idaho bulletin telling him just how to do it.

The Bureau of Reclamation also had a man on the job to give assistance to the homesteaders. O. V. Chenoweth, land-use specialist, was all over the project, helping lay out and level fields and install irrigation systems. Grandpa sometimes used to have to sight down his land over his thumb. On the Minidoka Project, Chenoweth was there with surveying equipment.

For necessary farm equipment, GI loans averaging \$2000 were extended by a bank at Jerome. The Farm Home Administration also made funds available for long-term loans. Implement companies at Jerome and Twin Falls gave the homesteaders a high priority on tractors.

As a result of all this help, crops—good ones—were produced on the land the first year, 1948. Take Kenner, for instance. He raised 42 acres of Lemhi wheat. Forty bushels to the acre (some farms produced 45). Gem barley went more than 50 bushels to the acre. Perfection peas, 20 sacks to the acre.

The land gave forth generously as expected, but there was the unexpected, too.

"I managed to get 50 acres cleared my first year, and planted it all to wheat," said William McClymonds, veteran from California. "I had a good crop of wheat—and jack rabbits. The rabbits got away with about 15 of the 50 acres of wheat."

Last winter, the homesteaders, with guns and poison bait, were death on rabbits.

McClymonds said he took up his homestead with the minimum of \$3000 in resources, and added:

"A man should really have \$5000."

McClymonds is a hard worker with an all-weather grin. He'll make it. Besides, he has plenty of inspiration — an attractive wife and two equally attractive children.

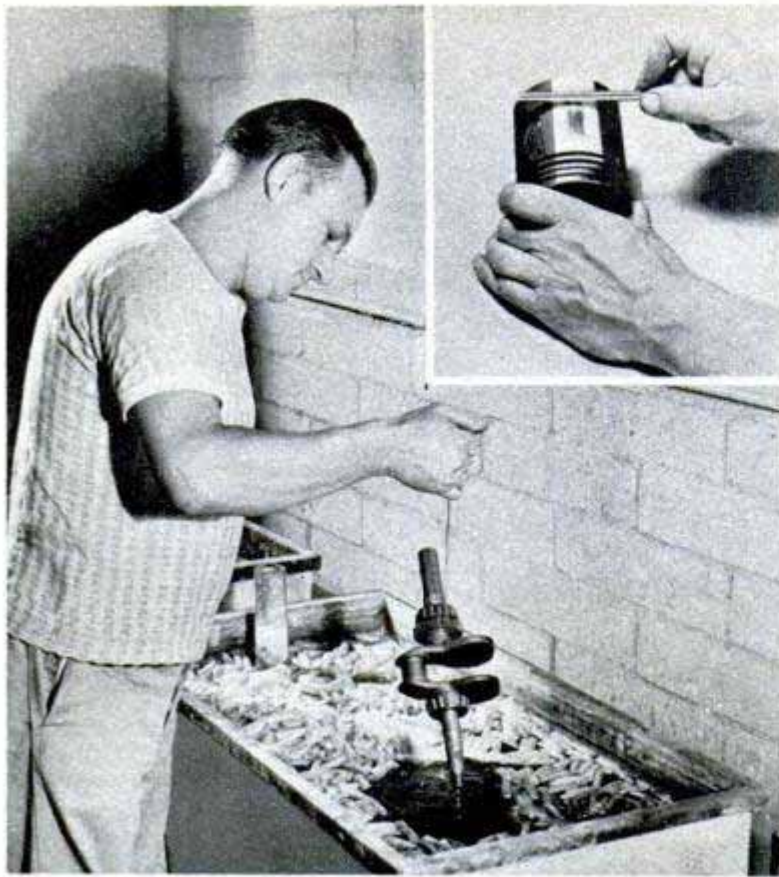
It used to be that it took the third generation to make good money on new land. On the Minidoka Project, it looks as if the first generation will accomplish that feat.



Less than a year before, this land was just sagebrush. Even without any special preparation with fertilizers, it yielded a good crop of potatoes

Below, a GI homesteader uses the equipment available at the Vocational agricultural School of the Minidoka Project to weld a brace on a scraper



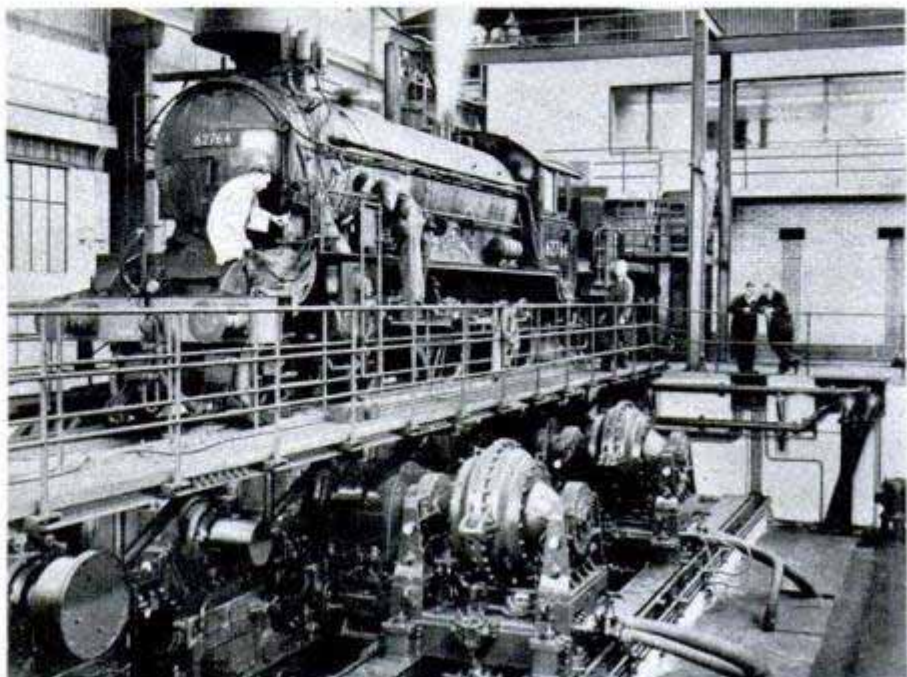
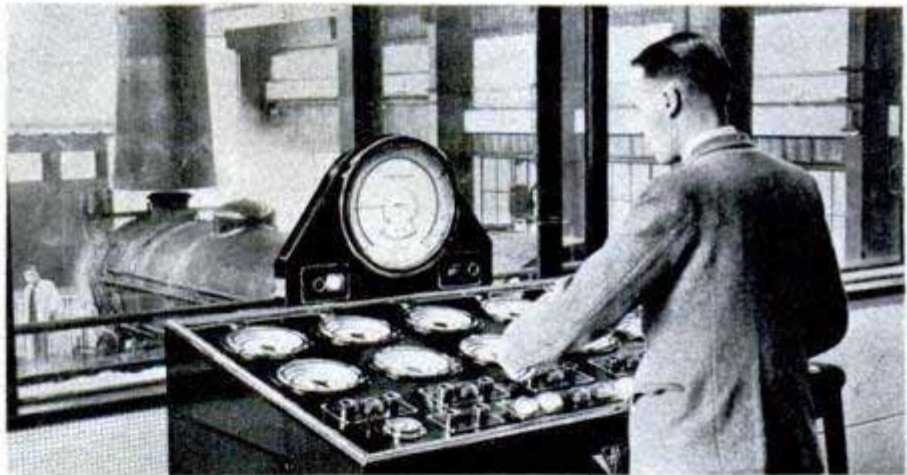


Graphite Coating For Engine Parts

Coating bearings and other friction surfaces of internal-combustion engines with a film of graphite increases life from 3 to 10 times. After a thorough cleaning, the parts are coated by dipping or spraying. The film is stable and unaffected by solvents or weather. In a test of graphite-coated pistons in an automobile engine, no evidence of piston scoring was found even after operation at high oil and water temperatures for 200 hours. Some graphite is absorbed by the pores of the metal to provide a reserve supply that replenishes the film as it is worn away. One treated piston was sandblasted clean on one side to remove all surface graphite, yet, when the area was rubbed by a metal bar, graphite soon worked to the surface to replace the film that had been removed.

Giant Treadmill Tests Locomotives

British locomotives are given test "runs" in an indoor testing station, said to be the most up-to-date in the world. The locomotive is supported on seven pairs of rollers. In treadmill fashion, the engine drives the rollers while technicians, in a sound-proof control room, determine the efficiency of the locomotive by watching a series of dials. One dial shows the speed and others show the amount of pull developed by each wheel. Although the test station doesn't eliminate the standard test runs over the right-of-way, it does permit controlled study of the engine's capabilities under a variety of loads.



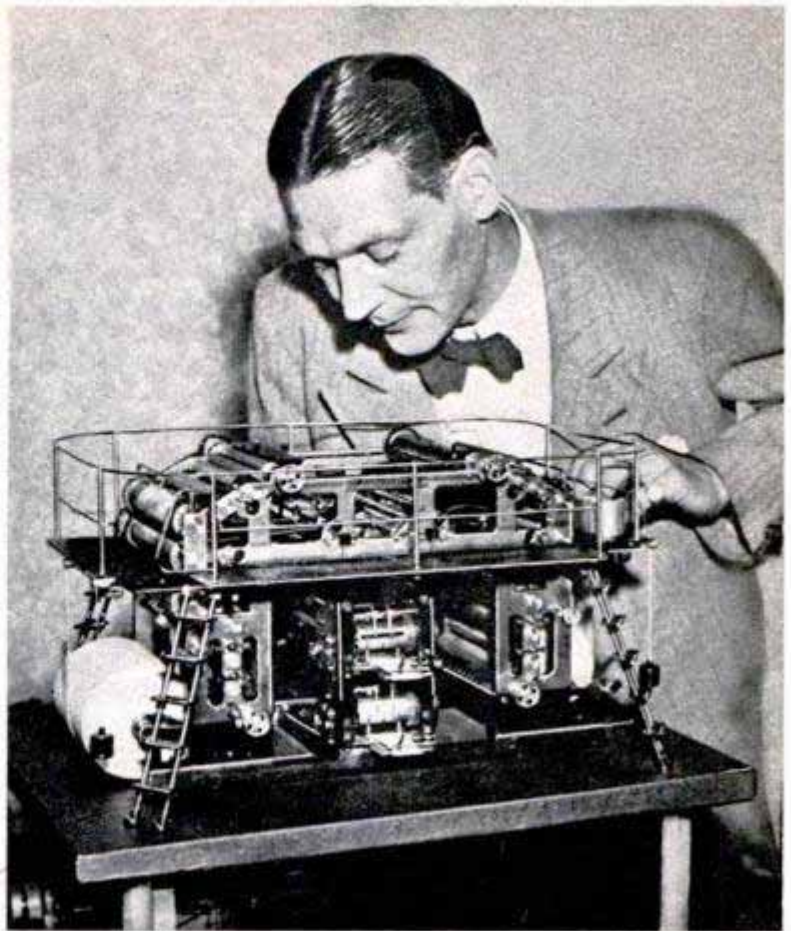
Information not given on articles listed in the index, frequently is contained in the WHERE-TO-FIND-IT INDEX, available at no charge from Bureau of Information, 200 E. Ontario St., Chicago 11

Model Rotary Press Prints Newspapers →

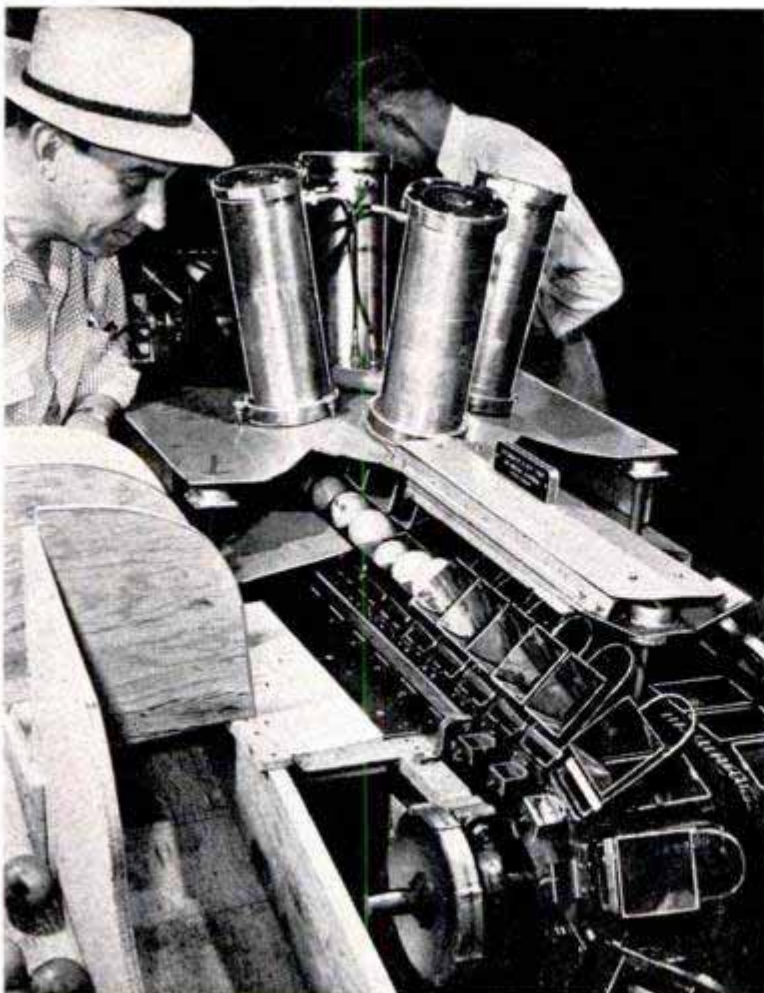
There are model-building hobbyists the world over and one of the more unusual is a German craftsman who built a working model of a giant rotary press similar to those used in the production of large newspapers. The tiny rotary press actually turns out 32-page newspapers with a page size of $1\frac{1}{2}$ by $2\frac{1}{2}$ inches. It took him 10 years to construct the model which is complete even to ladders and guard rails.

Resin Filter Permits Reuse Of Photo Wash Water

Field photo laboratories of the Army Signal Corps are relieved of the problem of finding large water supplies by a purification process that permits wash water to be used over and over again. In a typical field darkroom, about 3000 gallons of water are used in a day, but with the purification process only 10 gallons are necessary. The water, after it has washed the prints, is passed over thousands of tiny particles of synthetic resin which filter out silver and



other impurities. The resins are virtually indestructible and are rejuvenated by immersing them in washing soda.



X-Ray Orange Grader Detects Frost Damage

Frost-damaged oranges are automatically detected and rejected by an X-ray grading machine. Such damage is seldom apparent from the outside, so growers must be able to "see inside" the orange to eliminate damaged fruit. Two endless belts carry the oranges in individual cups through the machine. As the fruit enters, it passes in front of a size compensator which presets the X-ray tube for the size of the orange. The orange then passes over the X-ray tube and the frozen areas cast a shadow picture. These pictures are "observed" by four activating chambers which release the orange into one of three exit channels according to grade. About 36,000 oranges can be graded per hour by the machine.

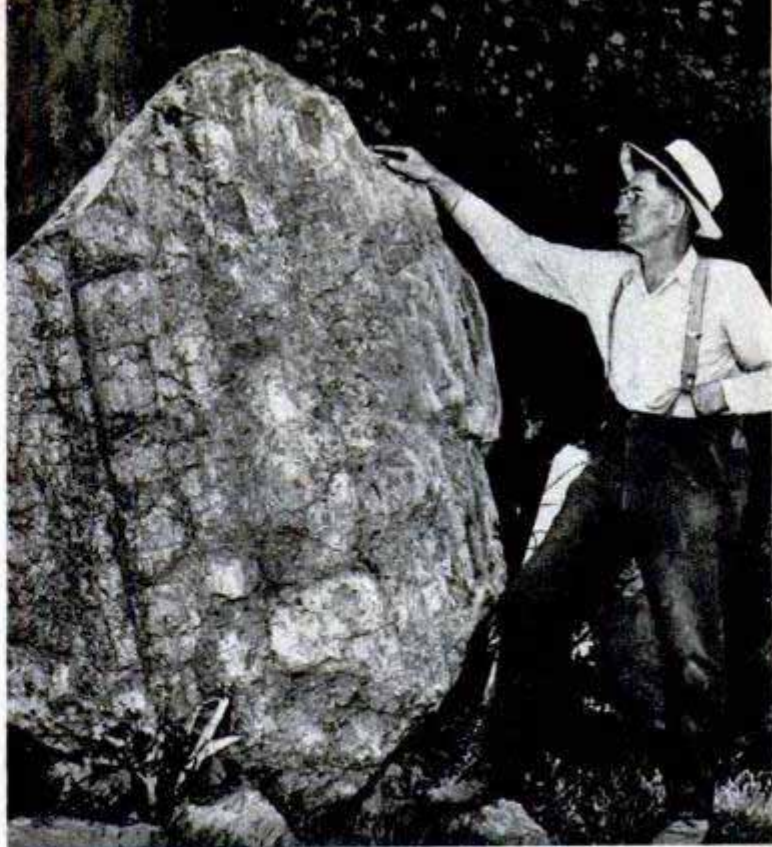
☛ There are 7,555,000 private and publicly owned trucks in the U.S. out of a world total of 15,038,000, according to the Automobile Manufacturers Association.

FOUR-ACRE ROCK GARDEN



A model of the Statue of Liberty stands on a base containing hundreds of radioactive-rock specimens

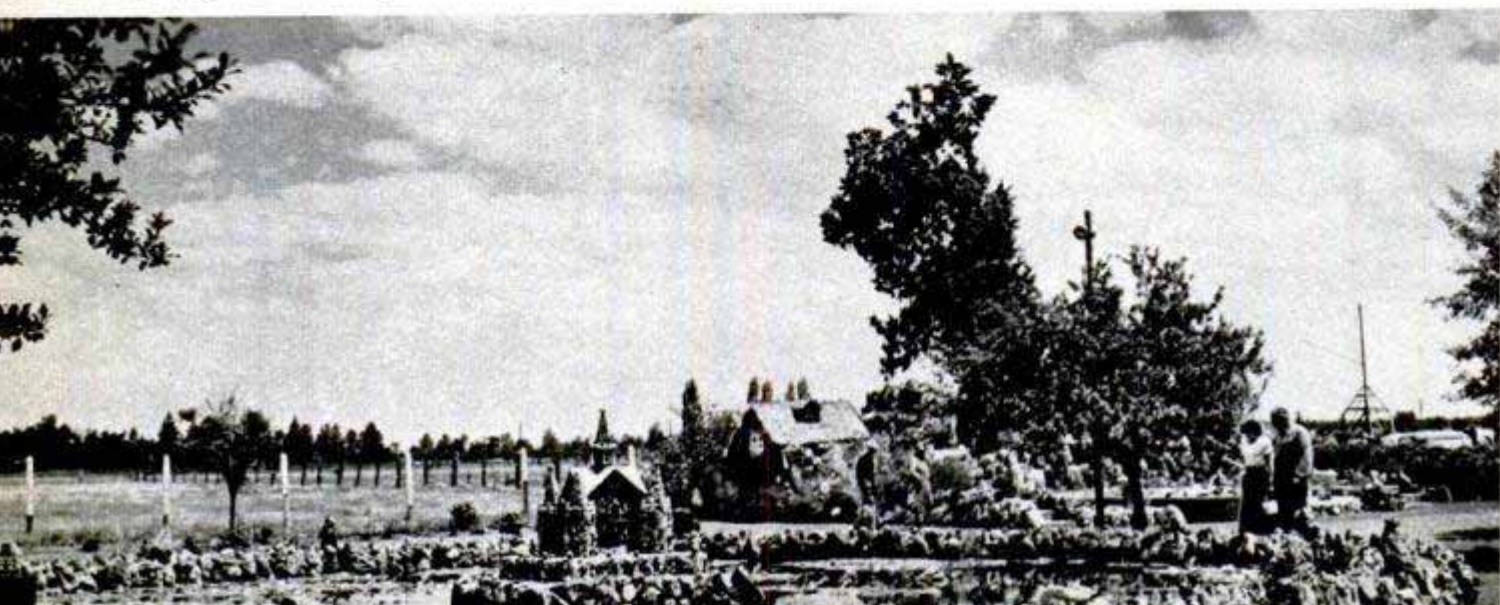
A lily-pond "moat" protects this spired castle. Now retired, Petersen devotes all his time to his hobby



Petersen stands beside a 3½-ton slab of petrified log



Fluorescent minerals, used in this model village, glow eerily under the rays of an ultraviolet lamp





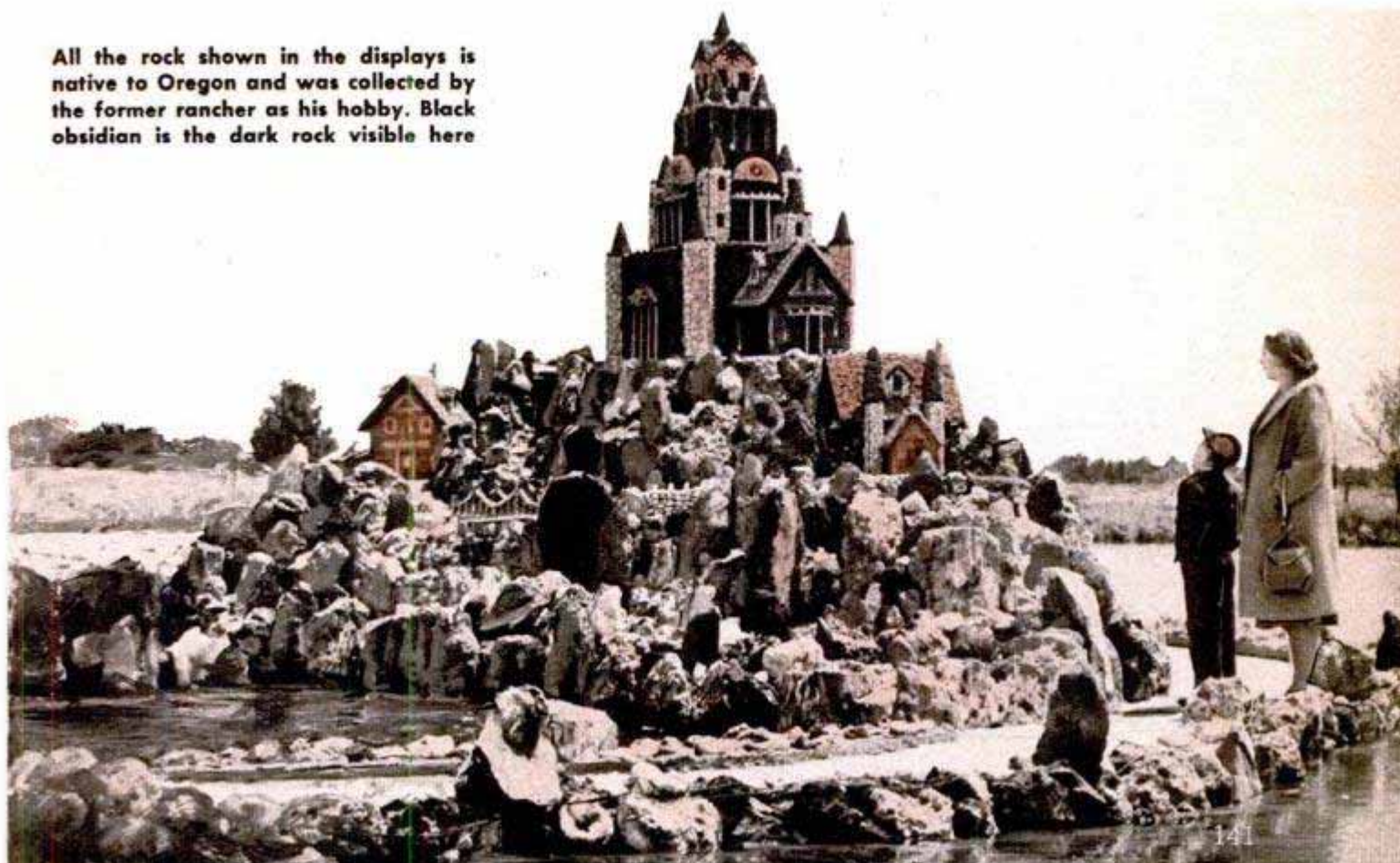
This house is a model of Petersen's family home in Denmark, which he left for a homestead in Oregon in 1905

STUBBORN juniper stumps that spotted the farmyard of Rasmus Petersen near Bend, Ore., were responsible for one of the most unusual geological "museums" in the country. Laboring with little success over the chore of removing the pesky roots, the Oregon amateur geologist decided to put his hobby to work and bury the roots under a rock garden of native stones. That was back in 1935.

Today, the former rancher, now retired,

has landscaped four acres around his home with more than a million pounds of multi-colored-rock specimens that he spotted in the fields and mountains of central Oregon. These specimens range from tiny chips of quartz to a 3½-ton section of petrified Sequoia log. Miniature castles, statues and other architectural designs, all built of rock, make the garden so attractive that 100,000 visitors stroll through it annually, admiring Petersen's handiwork.

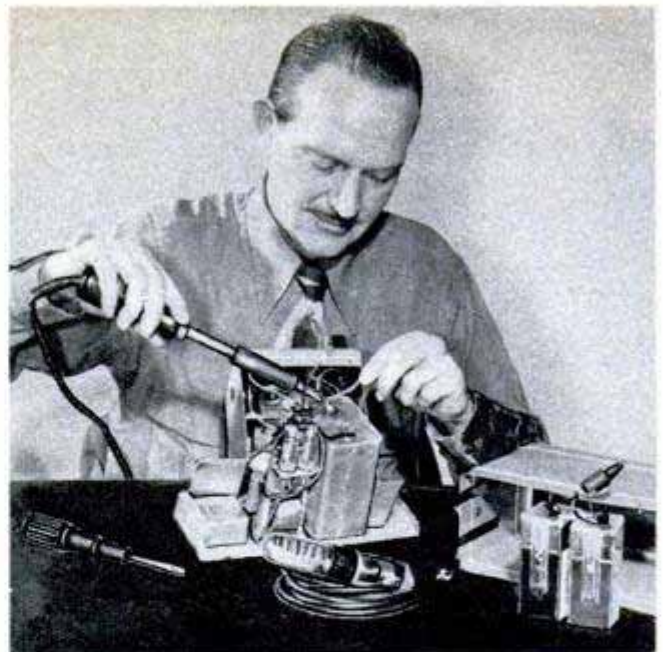
All the rock shown in the displays is native to Oregon and was collected by the former rancher as his hobby. Black obsidian is the dark rock visible here





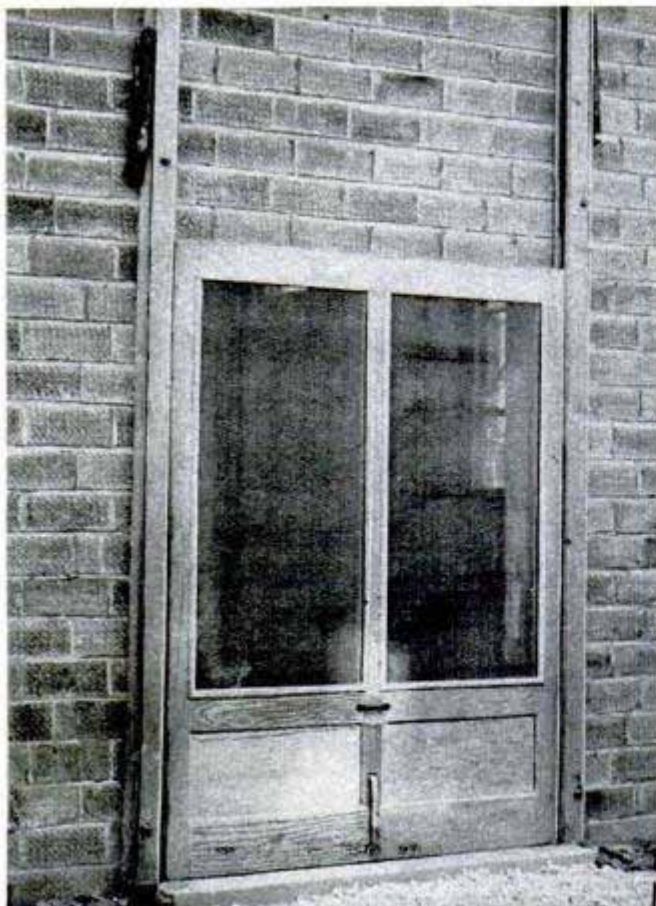
Speed-Light Kit

Photographers can put together their own speed lights with a kit that includes everything necessary for assembling an electronic flash unit. All difficult parts have



Above, with a screwdriver and soldering iron, you can assemble the kit in an hour. Left, powered by batteries, the speed light provides flash anywhere

been factory-wired. The only tools needed are a screwdriver and soldering iron. Even the solder is included and assembly takes less than an hour. The unit is powered by wet-cell batteries which are wired so they must be disconnected during charging, making it impossible to impress the higher charging voltages on the circuit and thus damage the unit. Space is provided in the case for a second condenser which can be added if more than one light is desired.



← Overhead Screen Door

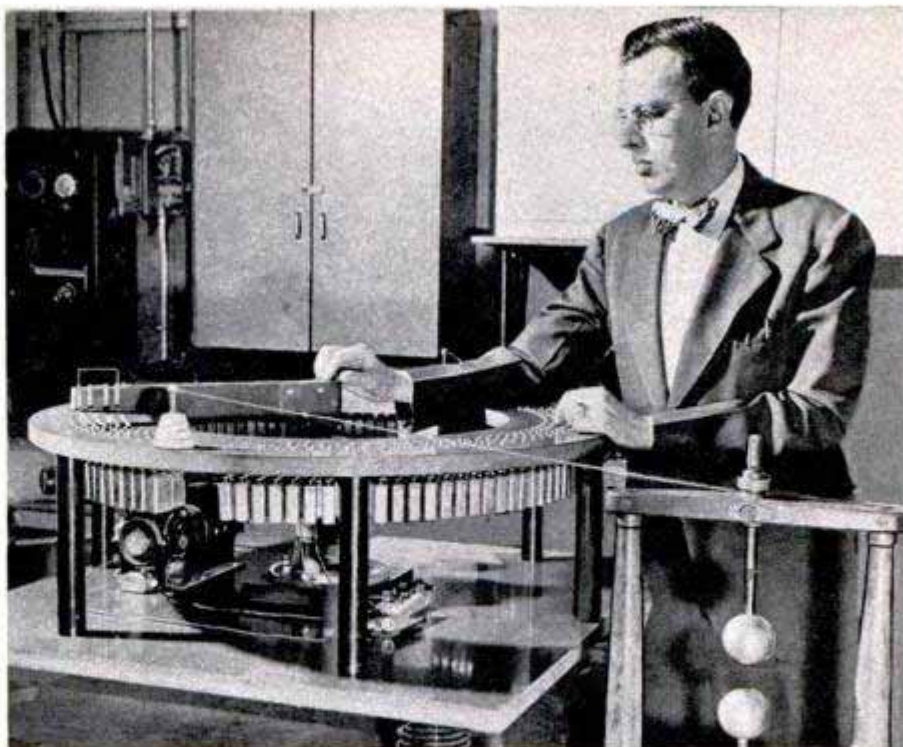
Trucks bringing in supplies to a food store can back up to an overhead-type screen door without interfering with its operation. The wide door slides up and down in tracks formed by wooden uprights. Several weights counterbalance the door to make it easier to lift.

Machine Tops Man

Working eight hours, an average man who is in good health can produce only $\frac{1}{4}$ horsepower. The amount of energy produced is equivalent to that obtained from burning a third of a pint of fuel oil. This amount of energy from a diesel engine would transport 396 bags of cement up a 100-foot hill. In terms of fuel, the energy produced by man in eight hours of labor is worth about two cents. However, man has one unique advantage over the machine—an efficient automatic control called a brain. These calculations are from a recent study by F. B. Shoemaker, consulting engineer of General Motors' Detroit Diesel Engine Division.

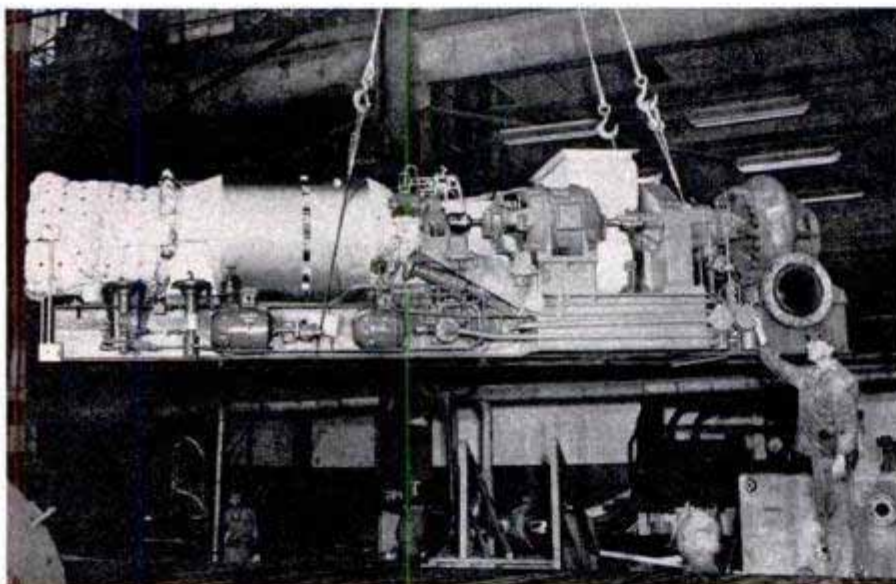
"Water Wheel" Boosts Voltage

Borrowing the principle of the water wheel, General Electric engineers have developed a voltage multiplier that increases the 1000-volt output of a small generator to 100,000 volts. As a water wheel develops power when its buckets fill with water, the multiplier builds up energy by "filling" 100 capacitors electrically through a sweeping arm with "finger tip" brushes. Discharging the capacitors releases a surge of electricity great enough to leap across a gap between two spheres.



Gas-Turbine Engine Pumps Pipe-Line Gas

Industry is making its first use of the aviation-developed jet engine as a practical source of power. A 2000-horsepower high-temperature gas turbine, built by Westinghouse, is helping to pump natural gas through a 22-inch pipe line connecting Monroe, La., and St. Louis, Mo. Operating on fuel oil, the unit has few moving parts and turns out more power per pound than other industrial power plants.

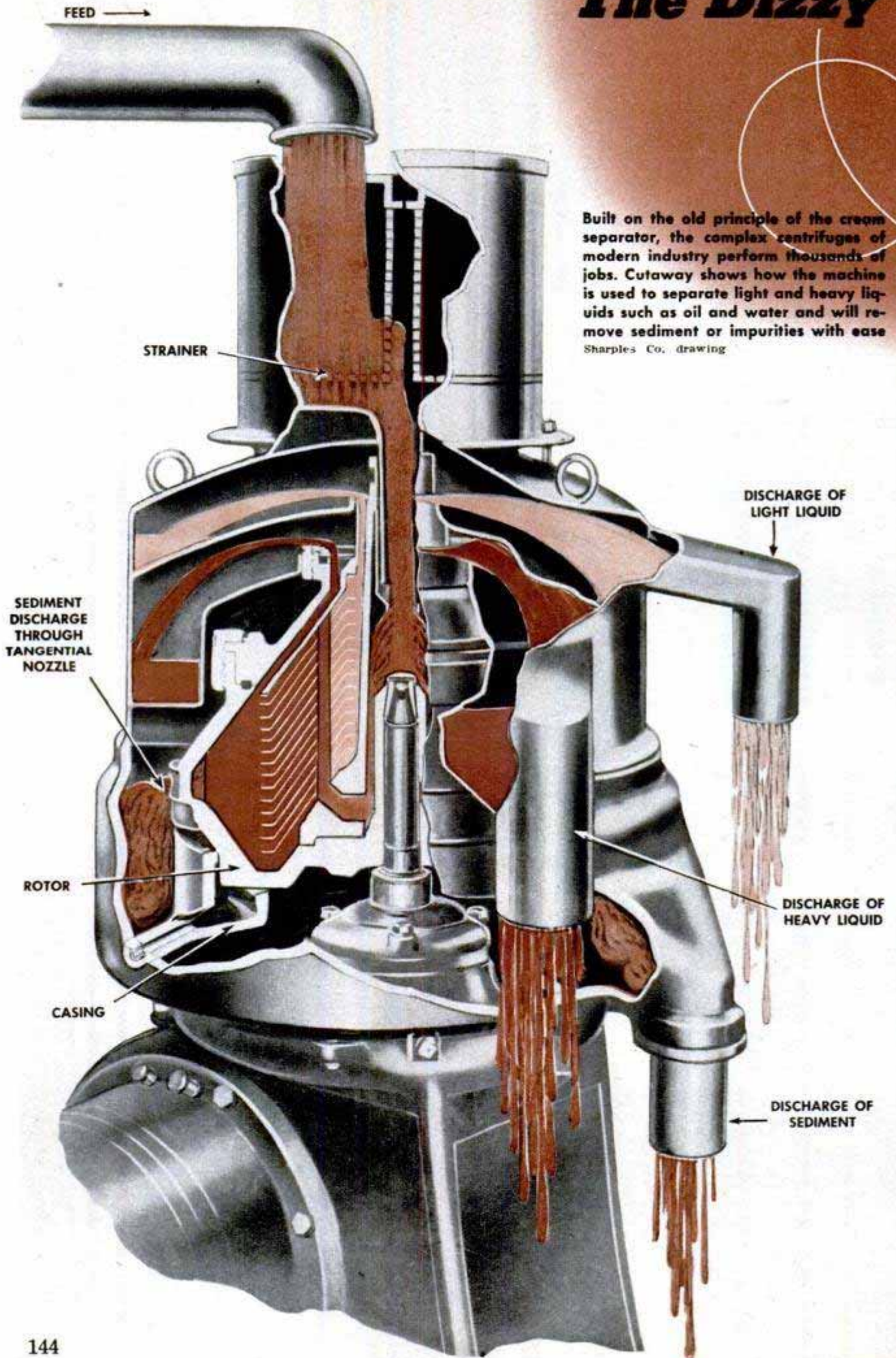


Cycle Salesman Tows His Wares

When Waymon Garner, Milwaukee motorcycle salesman, calls on prospective customers, naturally he goes by motorcycle and, with the help of a tow rig he designed, he takes a sample with him. A cradle, mounted on the rear of his three-wheeler, supports the front wheel of the towed machine. The wheel is locked in the cradle to prevent the towed cycle from bouncing loose when Garner travels over rough roads.



The Dizzy



Built on the old principle of the cream separator, the complex centrifuges of modern industry perform thousands of jobs. Cutaway shows how the machine is used to separate light and heavy liquids such as oil and water and will remove sediment or impurities with ease

Sharples Co. drawing

Merry-Go-Round of Industry

By J. D. Ratcliff

BUT FOR centrifugal force, history's greatest fight upset—David vs. Goliath—would have had a different outcome. Little David would have taken a terrific shellacking if centrifugal force hadn't imparted Sunday-punch velocity to the stone from his sling.

Today, centrifugal force is playing a major role in another battle—industry's fight against rising production costs. Applied by the centrifuge—industry's version of the cream separator—it is doing an enormous variety of jobs. It is providing a great variety of better and cheaper consumer goods—automobile finishes, floor waxes, kitchen flavorings—and is playing a heroic role in medical research. The centrifuge is among the most fascinating machines used by modern industry.

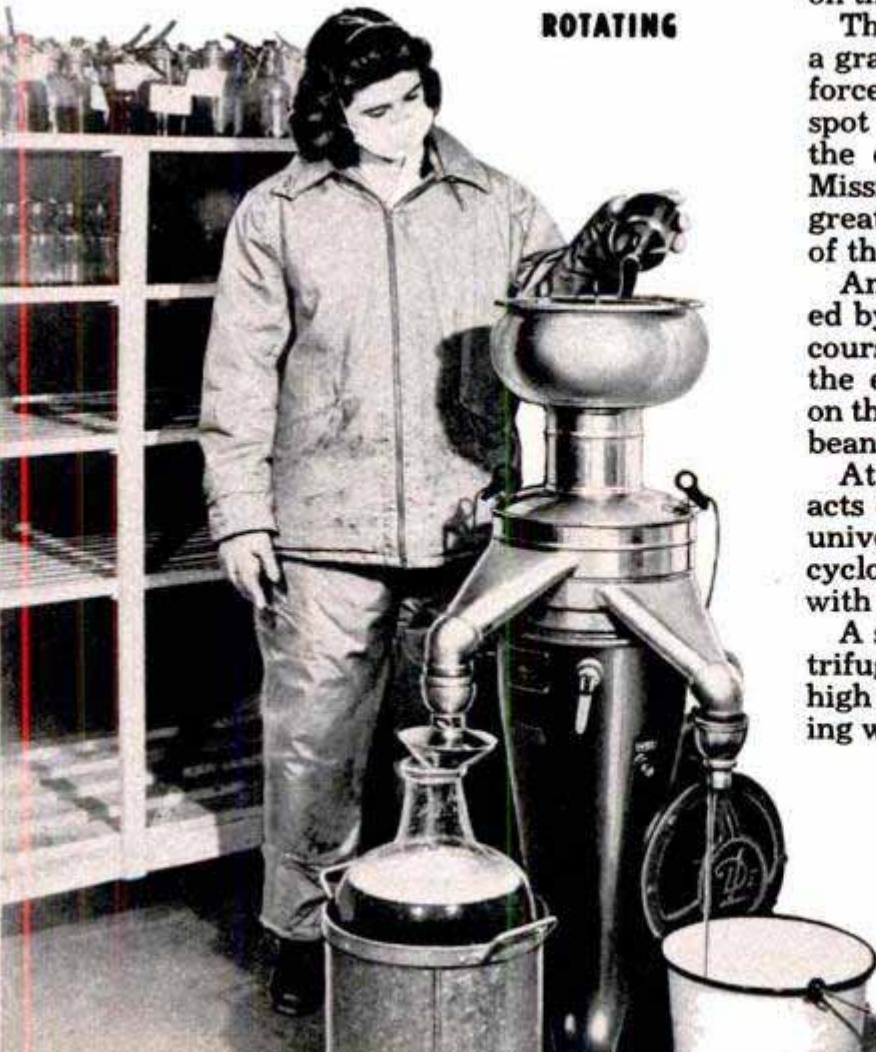
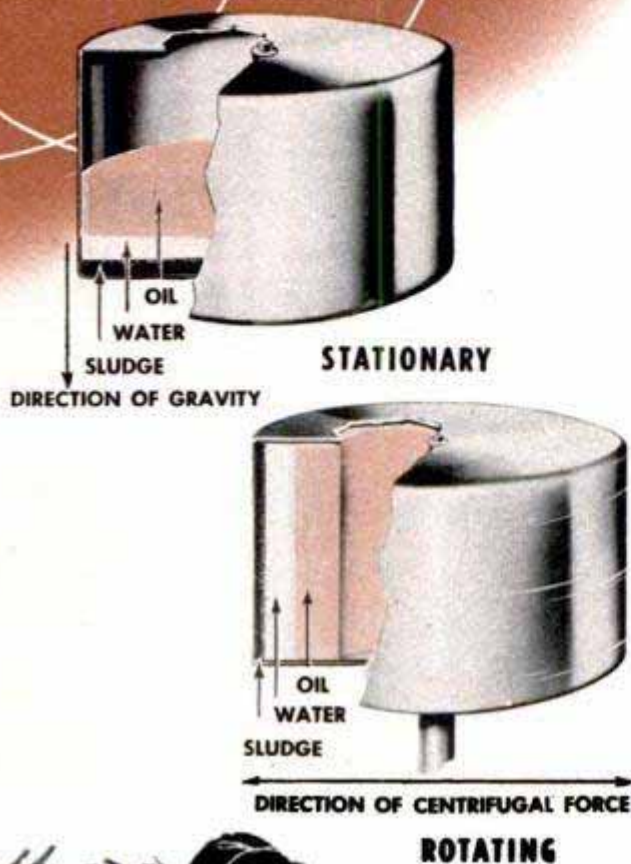
In a moment, we'll see more about the centrifuge, but first let's see something about centrifugal force. The most familiar example is provided by whirling a rock on the end of a string. The rock resists changing direction—as it must do constantly to remain on a circular path. It would like to fly off on a tangent. The resultant tension on the string is centrifugal force.

The earth whirling on its axis provides a grand-scale example of the effects of this force. Our globe is 30 miles fatter at the spot where the greatest force is applied: the equator. This same force causes the Mississippi to run uphill! The source of the great river is three miles nearer the center of the earth than its mouth.

An even bigger-scale example is provided by the planets, which are held on their courses by centrifugal force. But for this, the enormous gravitational pulls at work on them would scramble them together like beans in a beanbag.

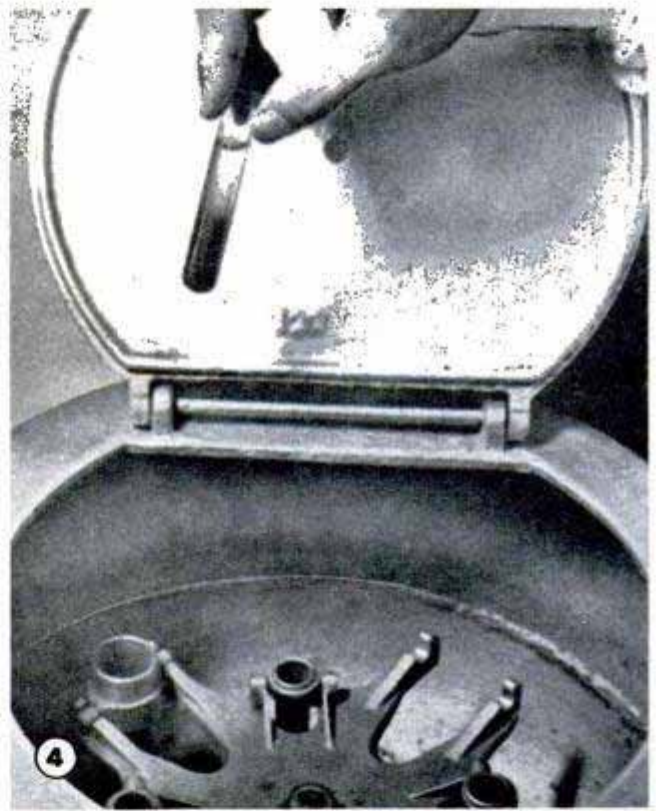
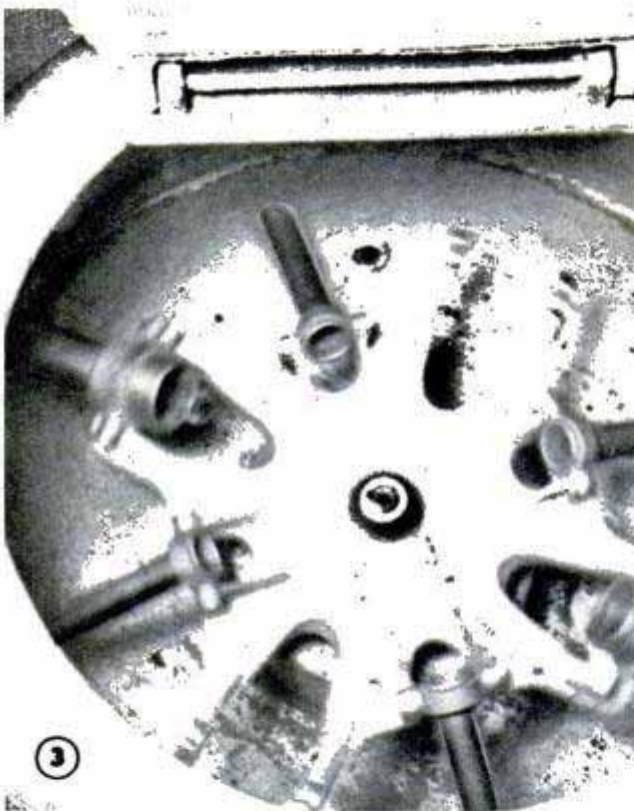
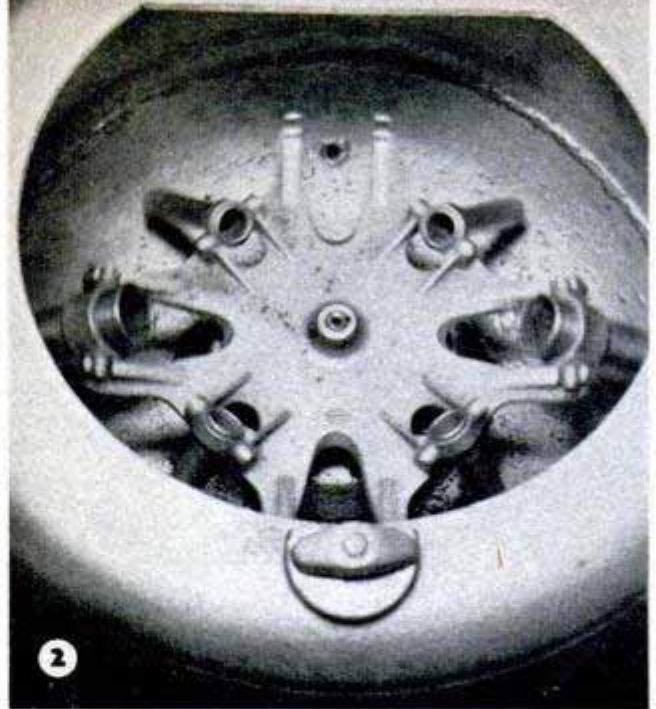
At the other extreme, centrifugal force acts on some of the tiniest particles in the universe. Atomic bullets are whirled in the cyclotron until they are hurled outward with multimillion-volt pressures.

A striking example of the powers of centrifugal force is provided by racing cars. At high speeds, drivers have no way of knowing whether they have flat tires—tires with



Sketches by Sharples Co.
Photo from De Laval Separator Co.

Centrifuge works like gravity—only it is much faster. When stationary (top), the natural forces form layers of sludge, oil and water. Other sketch shows rotating action. Left, separating plasma in blood



no air in them tend to maintain their shapes until speed drops below 60 miles per hour.

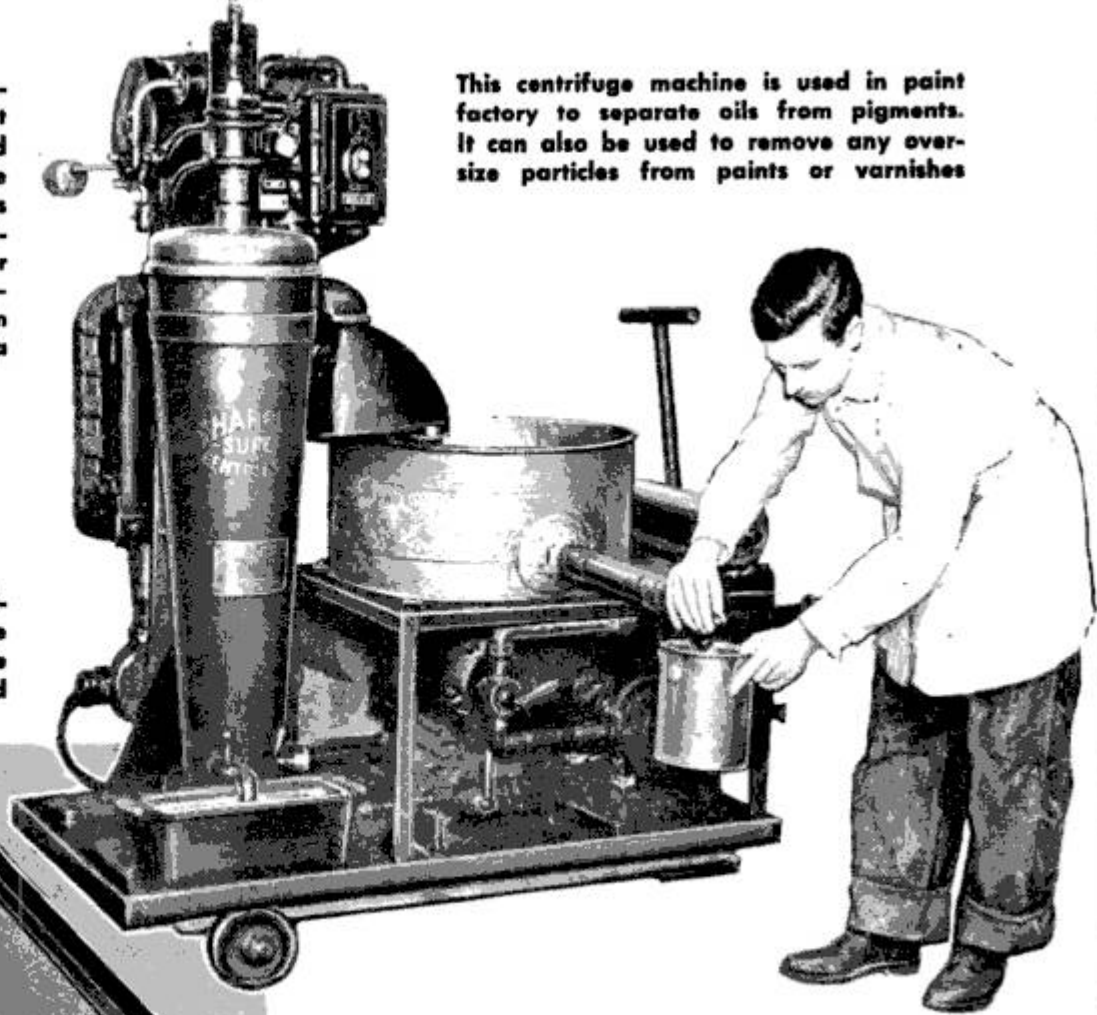
Although centrifugal pull is one of the basic forces of the universe, man made little effort to put it to work for him until the last century. Centrifugal pumps and centrifugal laundry driers were the first applications. The centrifuge in anything approaching its modern form wasn't born until 1875. That year Carl de Laval, Swedish inventor, pondered the problem of separating milk from cream. When whole milk was placed in bowls, it took gravity several hours to do the job—heavier milk settling to the bottom of the bowl, lighter cream rising to the top. But, De Laval, shrewd Swede that he was, reasoned that if whole milk were whirled fast enough, hundreds (even

thousands) of times the force of gravity would be applied. Heavier milk would be thrown to the outer rim of a whirling bowl, and cream would be stratified nearer the center. Spouts could be placed to draw off each one and separations could be achieved in seconds instead of hours. De Laval put his ideas to work, invented the separator.

Applications of De Laval's ideas outside the dairy industry were slow in coming and real mass-scale applications of the centrifuge didn't get under way until 1940. Since then more machines have been built and sold than in all the years that went before.

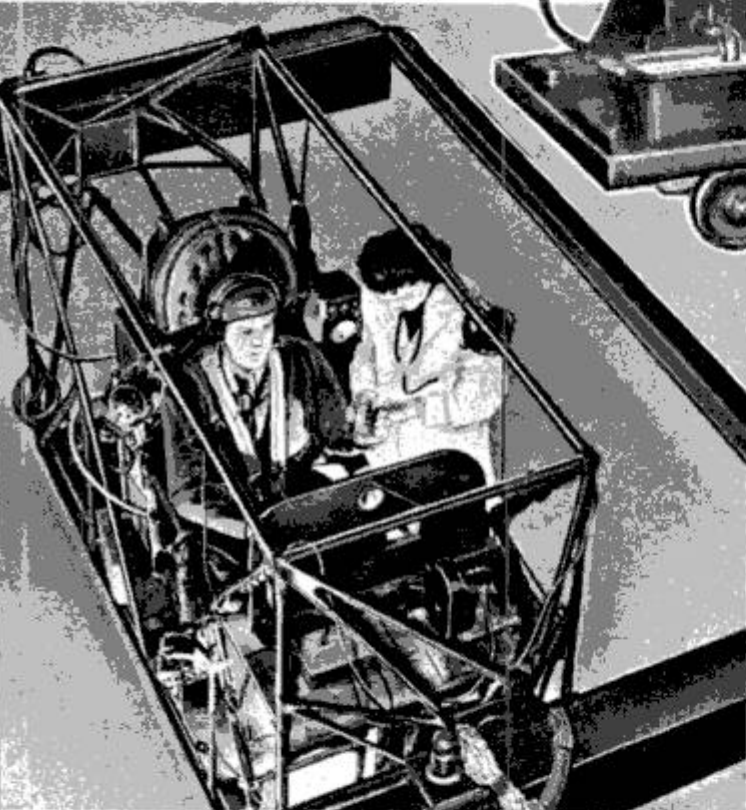
Today's machines range in size from small laboratory models, little larger than soda-fountain milk-shake mixers, to giant crystal driers which cost \$21,500. The lat-

← Old type of medical centrifuge shows how (1) test tubes of blood are inserted in hinged racks; (2) machine starts spinning; (3) the arms straighten out at 1500 revolutions per minute; (4) after 10 minutes the job is done—corpuscles are separated from the clear lightweight plasma
 Roland Harvey photos



This centrifuge machine is used in paint factory to separate oils from pigments. It can also be used to remove any over-size particles from paints or varnishes

U. S. Air Force uses centrifuge at Wright-Patterson base to whirl pilots around to see how many Gs they can stand



top scientist, who now heads that country's atomic research. Svedberg reasoned that a centrifuge which ran fast enough could apply any desired force and could, therefore, separate liquids which had never been separated before—the "tightest" emulsions, for example. The machine he built had a seven-inch rotor and was powered by an oil turbine. This machine reached a maximum speed of 160,000 revolutions per minute. For comparison, note that an electric fan whirls at about 1750 revolutions per minute; cream separators at about 7000. At the great speed Svedberg achieved, a one-pound weight exerted a force of 600 tons. The rim of the rotor achieved a speed of over 3000 miles an hour!

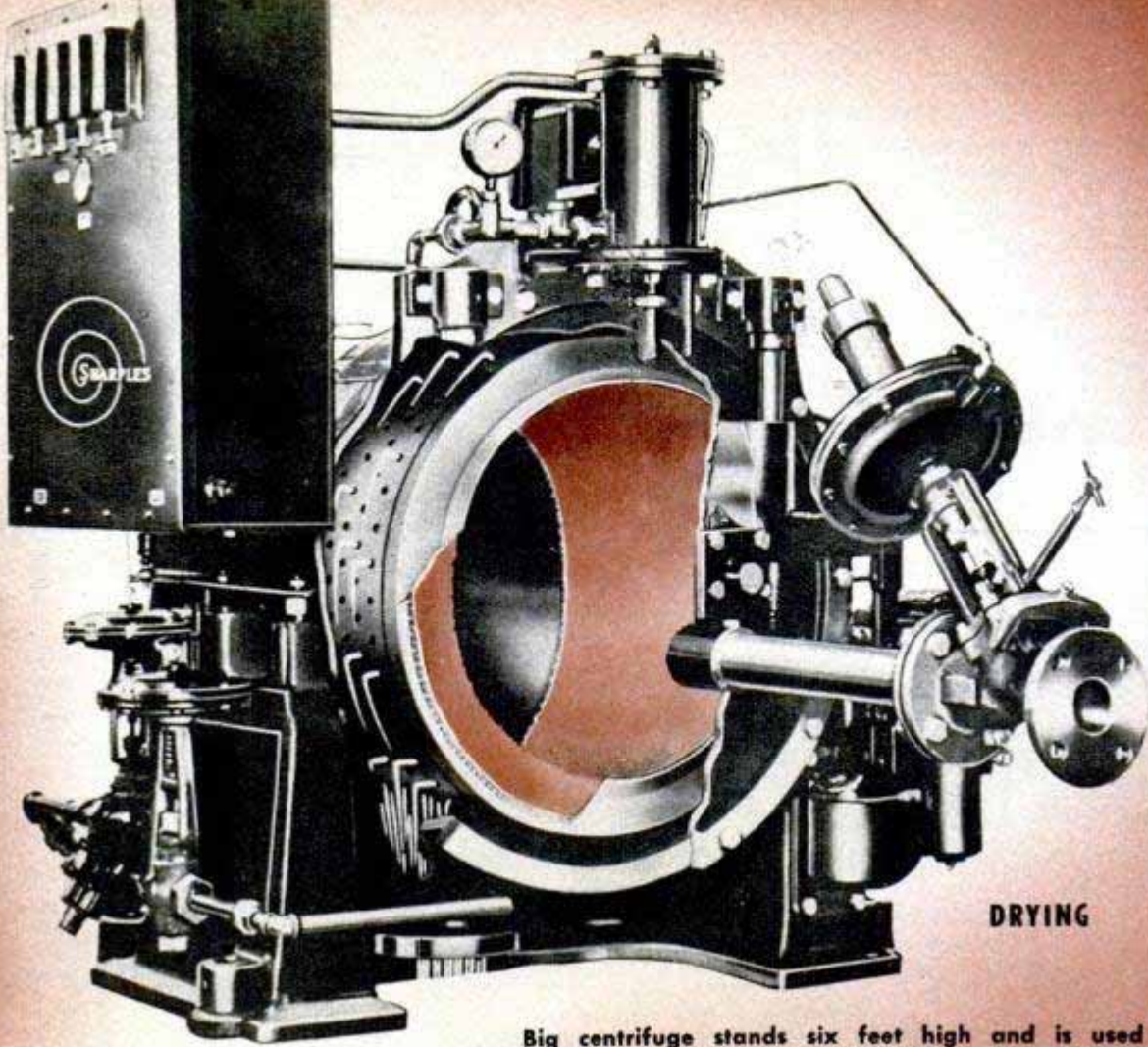
ter are used to whirl excess moisture from such substances as table salt; are able to handle up to five tons of materials per hour.

Whatever the size, centrifuges are built to finer tolerances than most watches—down to 1/10,000 inch. They have to be, since vibration would be disastrous at ultra speeds. Thus built to run with complete smoothness, centrifuges are among the quietest machines in industry—emitting no more than a faint whine.

Of all centrifuges built to date, the experimental models are the most fascinating. They whirl at stupendous speeds, generate stupendous forces. One of the first of these ultracentrifuges was built at the University of Upsala in Sweden by Dr. The Svedberg, Nobel prize man and Sweden's

For the better part, the far faster machines which followed were little better than tiny tops. The Sharples Corporation of Philadelphia built such a centrifuge which revolved at 1,200,000 revolutions per minute, generating a force 7.6 million times the pull of gravity. At this speed, a one-ounce weight would push outward with a force of 237 tons—the weight of a locomotive.

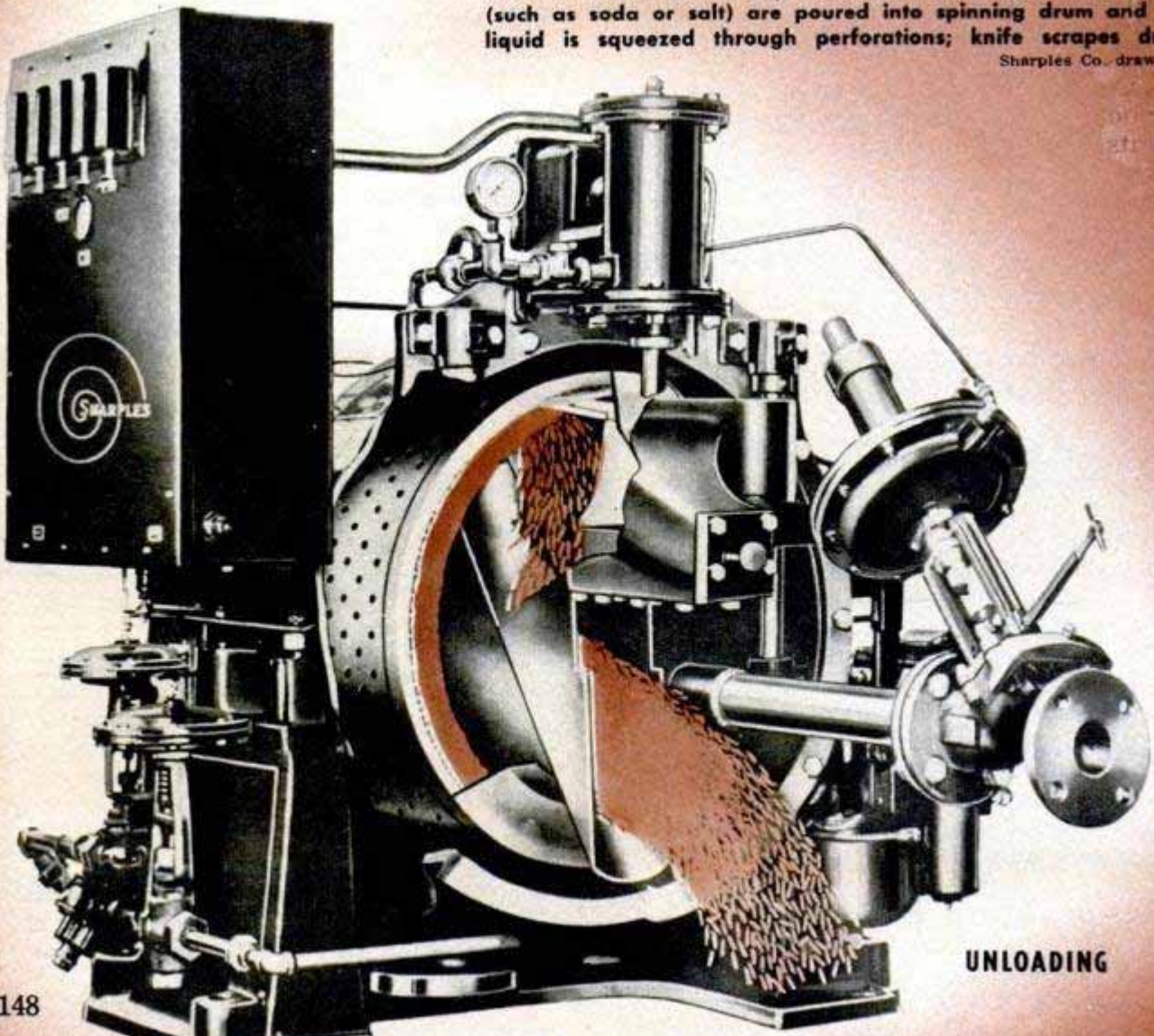
Even at this speed, the end was not in sight. Recently, Dr. Jesse Wakefield Beams, 49-year-old physicist of the University of Virginia magnetically suspended a tiny rotor in a high vacuum and managed to whirl it at 10 million revolutions per minutes—almost 166,000 revolutions per second! Beams didn't announce that he was seeking such



DRYING

Big centrifuge stands six feet high and is used for drying like an automatic washing-machine's "spin dry." Wet crystals (such as soda or salt) are poured into spinning drum and the liquid is squeezed through perforations; knife scrapes drum

Sharples Co. drawings



UNLOADING



Dr. Jesse W. Beams and his ultracentrifuge which whirls at 166,000 revolutions per second in a vacuum

super speeds as a means of separating isotopes, yet such an application appears to be feasible. It may one day be possible to separate uranium 235 from slightly heavier uranium 238 by this means, thereby cutting across the processes used at Oak Ridge.

Such speeds are well outside the requirements of industry. For most practical purposes, maximum centrifuge speeds of 50,000 revolutions per minute are sufficient in manufacturing processes. Machines turning at this rate exert forces up to 62,000

Centrifuge reclaims oil used in machining steel. The chips are saved and spun in simple centrifuge

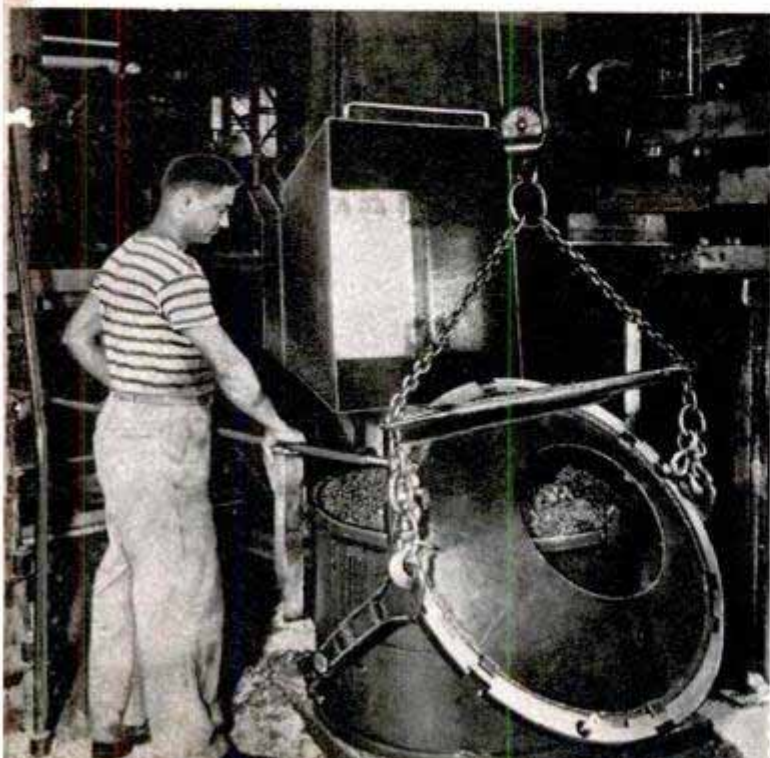
times gravity. The danger of explosion is always present. There are cases where centrifuges have flown apart, metal fragments ripping through walls and partitions like small artillery shells. The danger is greatest with super-speed laboratory machines, which are always protected with armor plate or concrete.

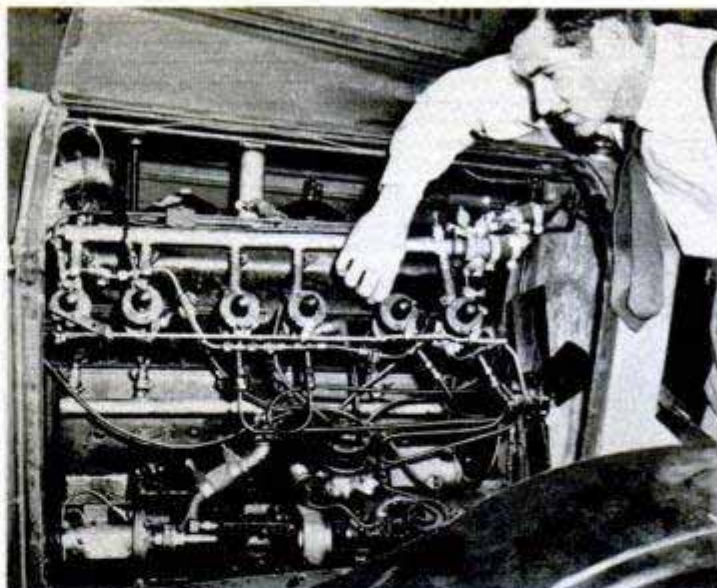
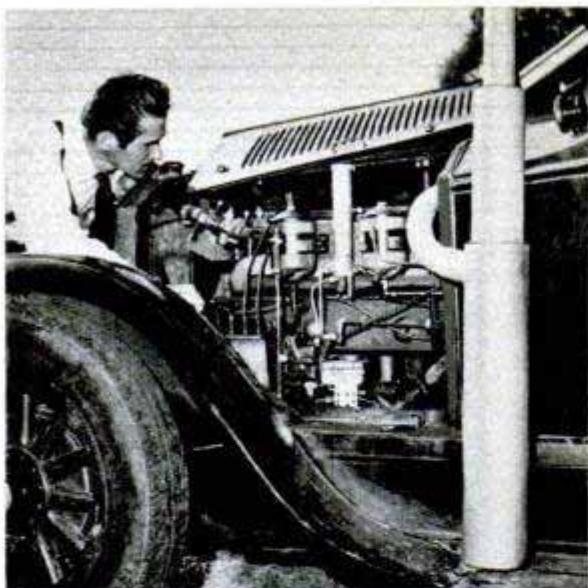
Makers of industrial machines have testing rooms with foot-thick reinforced concrete walls. In these rooms centrifuges are tested to 2½ times maximum working speeds. If they withstand this rigorous testing, the manufacturer assumes they are safe for industry. Hence, commercial centrifuges have only thin shells. The makers reason that if they do explode, a heavier shell would only break and make shrapnel.

Jobs for centrifuges fall into three main classifications: separation of immiscible fluids (such as oil and water); removal of solid particles from a liquid (such as removal of foreign matter which would make a lacquer cloudy); drying operations (such as removal of excess moisture from sugar or salt).

There are cases where centrifuges do all three of these jobs to produce a single product. Take a homely example—a stick of chewing gum. The centrifuge clarifies ink on the wrapper, purifies oil used in rolling the foil covering, removes jungle debris from the chicle, dries the sugar which is dusted on the gum.

(Continued to page 238)

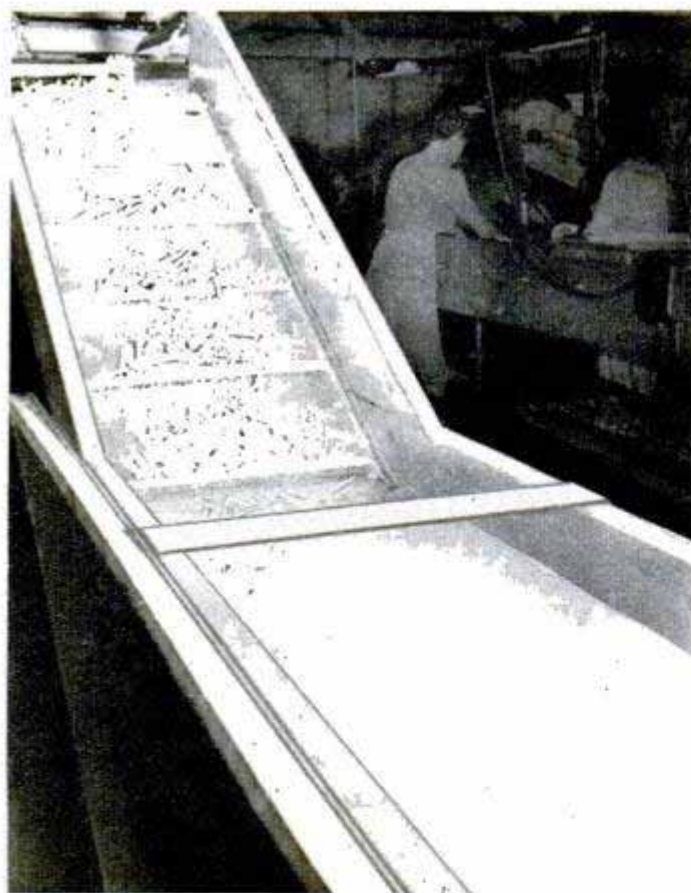




Injection Engine Burns Cheap Oil

Furnace or diesel oil can be used as fuel in a fuel-injection engine built by a Compton, Calif., inventor. The power plant has some of the characteristics of both a gasoline and a diesel engine. Ignition by spark plugs takes place in external, water-cooled combustion chambers, there being no com-

bustion chambers over the pistons. The intake is unthrottled and there is virtually no vacuum at any load, a factor which, the inventor says, reduces oil consumption to almost zero. Compression remains constant at about 200 pounds and acceleration is controlled by regulating the fuel injection. The experimental engine, a rebuilt stock model, is said to deliver 27 miles to a gallon with the cheap fuels.



No More KP Duty

Harried husbands who occasionally find themselves peeling potatoes in the kitchen have a new friend in Clyde Miller of Chicago, who plans soon to market spuds ready

for the pot. Miller has developed a solution which preserves peeled spuds for days. In his plant the potatoes are peeled, cut to size for boiling or French frying, treated in the solution and then packaged in transparent bags.

On the Trail of the Bat...

By Tom McHugh

FRED GREELEY and Dr. James Beer of the University of Wisconsin are working on a mystery which may prove more exciting than any Scotland Yard case. They are trying to find where more than one million bats vanish each winter.

Before dawn in subzero weather these men drive off in search of Wisconsin caves on their bat-banding expeditions.

Leaving the car, they plow through snow-covered fields seeking holes, from which thin vapor trails rise, indicating caves below. There the temperature remains about 42 degrees the year 'round.

Bats stream into these caves when cold weather cuts off their food supply of insects. In hibernation they pass the winter,

hanging upside down by their hind feet. In fact, one observer estimates that bats spend five sixths of their lives hanging head downward in the dark.

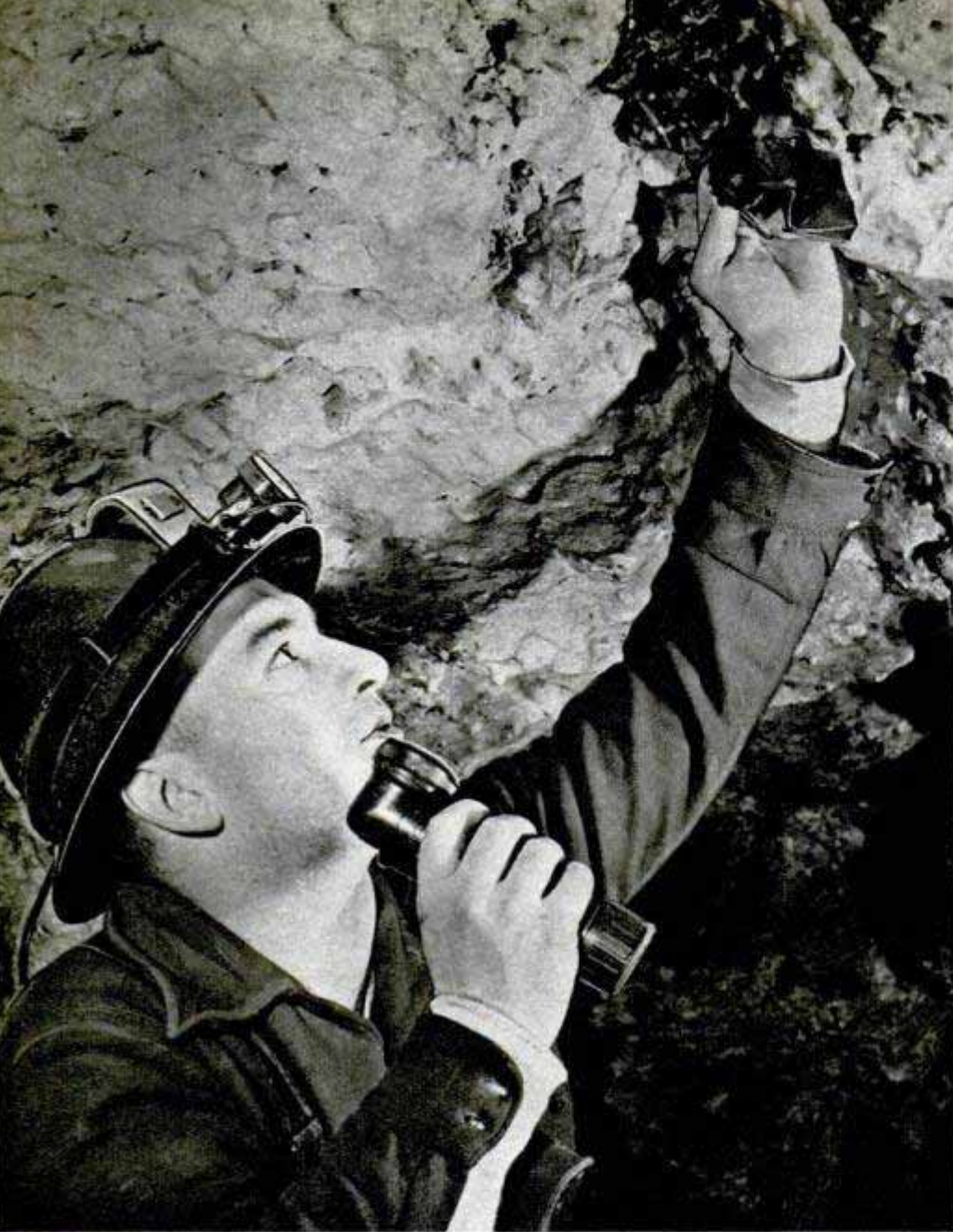
Inside such caves, Greeley and Beer rapidly pluck the bats from the walls and mark them with numbered aluminum bands. Should the bats be caught again, the zoologists are able to trace their travels.

They found an enormous discrepancy in the summer and winter bat populations. In winter, there are more than one million fewer bats in the caves than in summer. A search of caves in neighboring states failed to find the missing bats. Where did they go?

Naturalists know too little about the habits of the bats to answer this question.

Slithering along in snake fashion, a zoologist emerges from a low-ceiling cave with a bat for banding





Dr. James Beer picks a bat from a group crowded into a crevice in the cave ceiling. The hibernating mammals awake from their deep sleep when handled. Below, there are more than 50 bats inside this wire cage. Once banded, the bats are released and immediately resume their hibernation



Perhaps they hibernate in unsuspected retreats—retreats other than the large caves where they are normally found. In any case, Greeley and Beer, with 6500 bats banded, stand a good chance of solving this mystery.

But finding the missing bats is not their only problem. Equally baffling is the fact that winter colonies are composed mostly of males; only a few scattered females are ever present.

This is quite the opposite of summer colonies, where as many as 800 females are found together. Such large groups of female bats are referred to as "maternity wards," since it is here that they bear their young.

Zoologists also found that bats have an excellent homing instinct. They will return to the same cave winter after winter. Even if taken far away and released, bats find their way back. Released at sea, they have returned 36 miles to their home roost. Others released as far as 150 miles from their home cave eventually found their way back.

These instances of homing are in themselves quite remarkable. They become even more notable, however, if you consider that bats find their home in the dark with very poor eyesight, using a natural "radar" system known as sonar. The system uses the bats' high-pitched cries which sound, at close range, like the screech of fingernails on a blackboard. Close to the bat's mouth, the sound is about 100 times as intense as normal speech.

They find their home even though it may be no more than a hole in the ground scarcely two feet across. What unusual power of orientation makes this possible?



A band is clipped to the wing of this bat. Thus numbered, the bat can be identified if picked up again

Scientists believe that bats have a well developed kinesthetic sense. They find their cave much the same as we find objects in a dark room in our own home—we subconsciously keep track of our location by means of motions made.

Bats may also use a keen sense of smell. Some of them possess scent glands which emit a strong, musky odor. This odor, together with that from their droppings, could mark the cave.

Another theory is that bats find their way home by using obvious landmarks. This seems unlikely, since bats have poor eyesight and they make long flights only at night.

Since bats are seen only at night, people have formed many weird ideas about them. Bats are supposed to delight in flying into women's hair. Actually, that is one of the last places they would go.

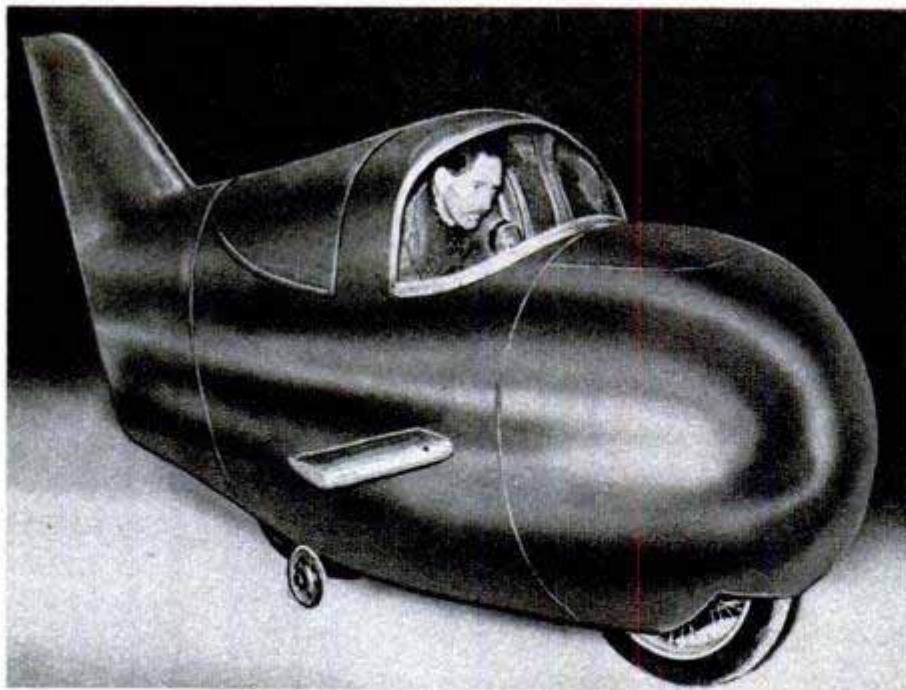
Another misconception is that bats carry bedbugs, lice and numerous other parasites. That may be partly true, but these parasites are quite particular and won't live on humans.

Nor do we have any blood-sucking bats in the U. S. These bats live only in the tropics, where they bite sleeping animals or men, then lap up blood from the wound.

These are some known facts about bats. There are many other facts still unknown. Scientists, like Beer and Greeley who are following the trail of the hibernating bats, will some day solve the mysteries of the winged mammals.

It is easy to see how this animal got its name. It's a long-eared bat



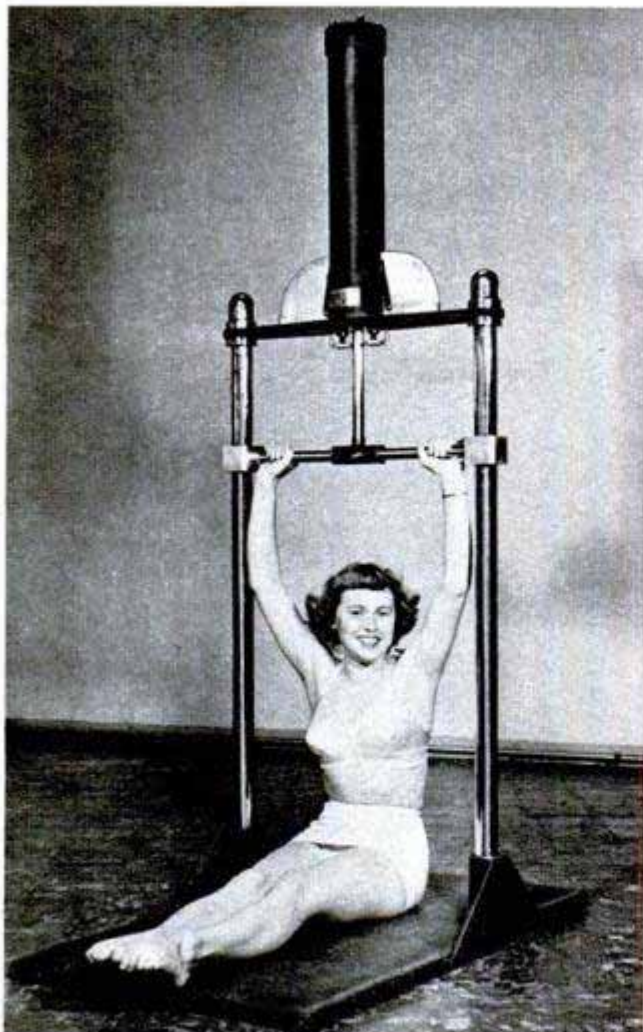


"Flying Egg"

Driver and machine are completely enclosed in the streamlined shell of a racing motorcycle with which Noel Pope, British speedster, hopes to set a new world speed record. Pope, who assisted in the design of the machine, will make his bid for the record in the United States. The machine is a supercharged twin-engine Brough Superior. With it, Pope hopes to exceed 200 miles an hour to break the German-held motorcycle speed record of 174 miles an hour.

Hydraulic Exerciser

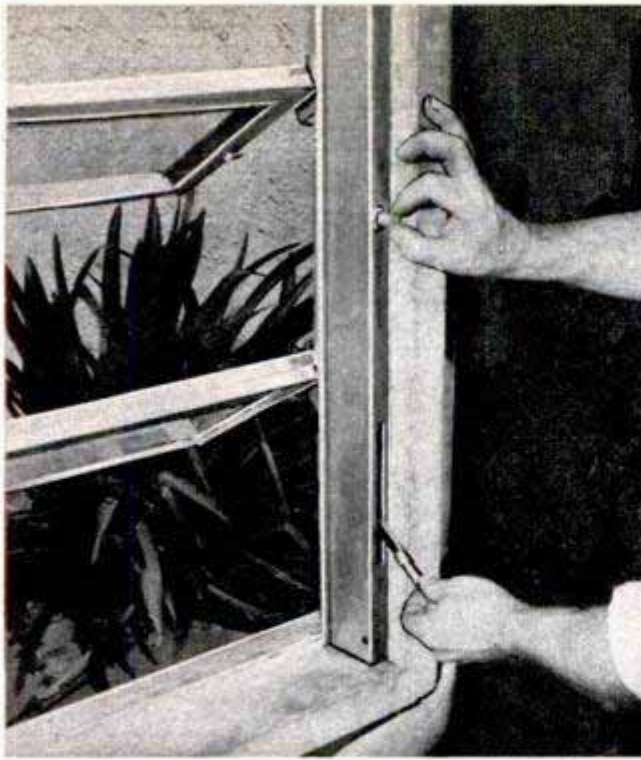
Hydraulic resistance does the work of heavy iron weights in a new exercising device. A plunger pushed by the user forces fluid through valves that can be adjusted to supply any desired amount of resistance. It takes less space than a set of weights and is safer since there is no danger of the user dropping it on himself.



Lamplighter With a 25-Mile "Reach"

By pressing his microphone button seven times in rapid sequence, a flyer 25 miles away can turn on runway lights at an unattended airport. Key to the new safety device is a control box at the field, with a series of radio tubes and two adjustment dials. No extra equipment is needed in the airplane. One of the dials sets the predetermined distance from which the landing lights can be operated and the other establishes the length of time they remain on. If a pilot uses up the light period, all he has to do is press his mike button seven times and the lights flash on again.





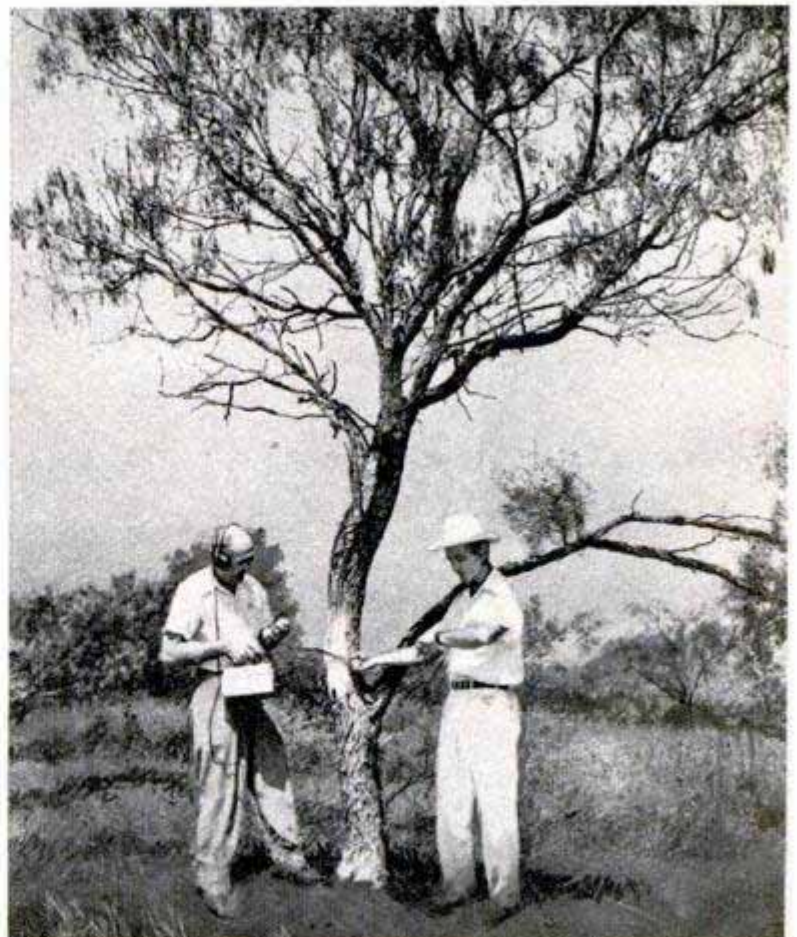
Rain Closes Windows

Homeowners off for a visit now can scoff at sudden storms—the rain itself will close new louver-type windows. As soon as eight ounces of water collect on the top panel, the window automatically swings shut. A wind of six miles an hour or more will

“button up” the house. The antiworry mechanism is a system of springs and balances built into the window frame. By turning a friction screw the homeowner can adjust the window so it will close entirely or only part way. A lever near the bottom of the frame raises all the panels of the window.

Radioactive Trees Test Effectiveness of Chemical

Isotope tracers are making ordinary mesquite trees radioactive in Texas. In an experiment to determine the effectiveness of a chemical designed to kill the hardy mesquite, the trees are checked periodically with a Geiger counter. By means of the tracers, scientists can follow the movement of the deadly chemical. The experiment showed that the preparation does work its way into the roots of the tree, thus assuring its destruction.



Germ Powder Emits Light

Doctors and scientists of Long Island College of Medicine have developed a new medical powder which emits its own light to kill germs. The powder, called heliogen, gives off ultraviolet rays, shorter than sun-tan rays and more effective in killing germs. In experiments, it was applied to the infected wounds of 22 persons, 20 of whom had failed to respond to sulfa drugs. In every case, the powder stopped the infection.

CAMERA WITH A ROVING EYE

BOTH THE AREA and speed of aerial photo reconnaissance are greatly increased by a new panoramic strip camera. Operating at altitudes as low as 10,000 feet, it produces, on a single negative, sharp pictures which otherwise could be made only at much higher altitudes.

The camera, using a wide-angle lens that is almost ball-shaped, is a development of the Air Force's Air Materiel Command and Boston University's Optical Research Laboratory.

As the exposure is be-

Left, shot from 10,000 feet above Cape Cod, this aerial photo includes: 1. Chatham; 2. Nantucket Sound; 3. Cape Cod Bay; 4. Hyannis airport; 5. Sandy Neck; 6. Barnstable; 7. Route 6; 8. Great Marshes, and 9. A glimpse of Buzzards Bay. Below, camera is mounted so it shoots through opening in the floor of the fuselage

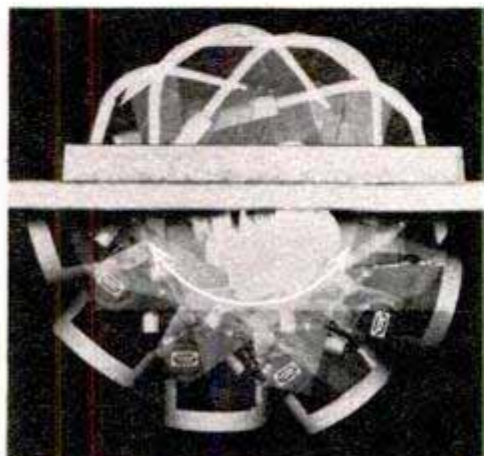
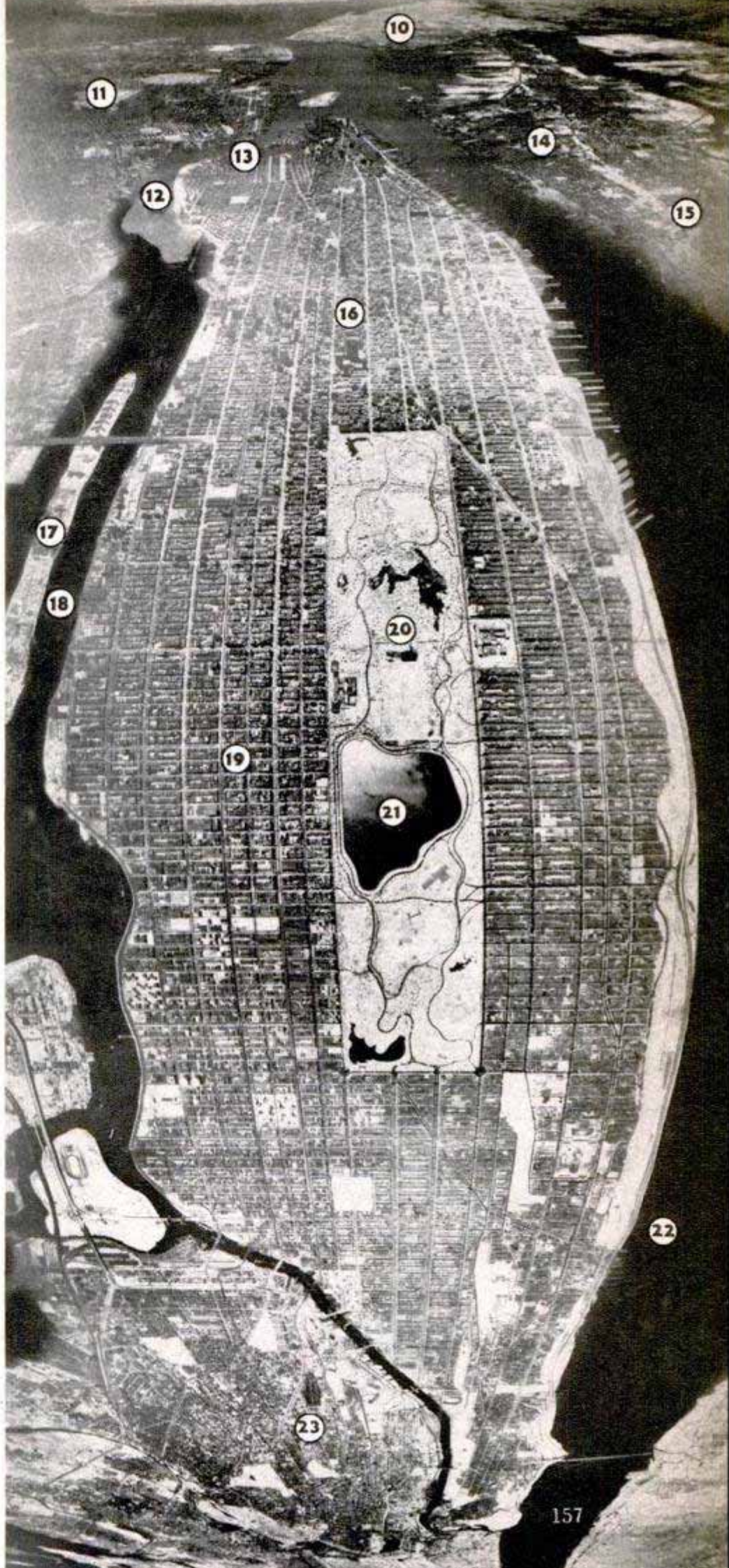


ing made, the camera swings in pendulum fashion at right angles to the line of flight at a speed of nine inches a second. There is no shutter; instead the film is drawn across a narrow slit and the moving image is "wiped" on as the film moves across the slit.

The resulting negative is 18.4 inches long and includes details from horizon to horizon. The distance covered varies with the plane's altitude—at 10,000 feet it is 260 miles, at 30,000 feet it is 450 miles.

Previously, some aerial panoramas were made by rolling the film across the lens of a stationary camera at a rate adjusted to the plane's ground speed. This method produces several types of distortion. Other aerial panoramas are made by piecing together many photos. The new camera takes the panorama in one exposure with virtually no distortion.

Right, this photo of New York includes: 10. Staten Island; 11. Brooklyn; 12. Manhattan Bridge; 13. Brooklyn Bridge; 14. Jersey City; 15. Hoboken; 16. The Empire State Building; 17. Welfare Island; 18. East River; 19. Manhattan; 20. Central Park; 21. The Reservoir; 22. Hudson River, and 23. The Bronx. Below, multiple exposure shows motion (arrow) of camera as the photo is taken





← Hand-Shaped Chair

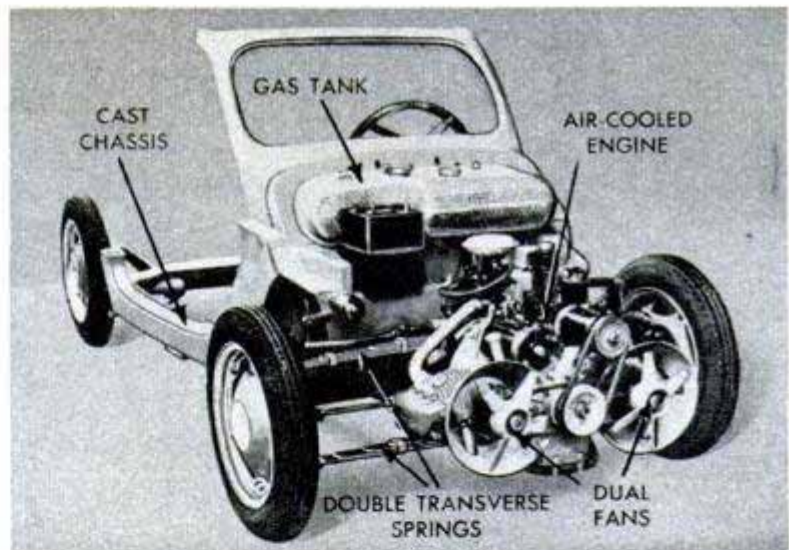
Displaying the clean, flowing lines of modern design a hand-shaped chair has a frame of walnut glued in sections. The continuous webbing, which supports foam-rubber cushions, is a lacing of plastic-covered wire. One of the student designs shown by the School of Art of the Chicago Art Institute, the chair was made by William Zdeblick.

Radar "Measuring Tape"

Distances between atoms can be measured by radar to an accuracy of $\frac{1}{100}$ of a millionth of an inch. Dr. A. H. Sharbaugh of General Electric says results 1000 times more accurate than is possible with the best optical instruments are achieved by shooting radar waves through the material under study and measuring the power remaining. The new application is expected to reveal valuable data about molecules.

Australian Automobile Has Front-Wheel Drive →

Front-wheel drive is featured on a two-door sedan which may soon be coming off an Australian assembly line if financing plans materialize. The twin-cylinder, four-stroke engine is air cooled with the help of two fans mounted behind the front grille. The wheels are aluminum and the longitudinal frame members are hollow, boxlike castings. Rear coil springs and front transverse springs provide independent suspension for all four wheels. The car is expected to sell for about \$1700.



Chemical Kills Hardy Weeds

Noxious grasses which have resisted weed killers now can be eradicated with a new chemical compound. The chemical is called TCA because it is a salt of trichloroacetic acid. It is said to be effective against such damaging weed pests as Johnson, Bermuda and quack grasses, and prickly pear cactus. Soil to which the weed killer is applied becomes sterile, but this condition lasts only a short time. The chemical should not be used on lawns.

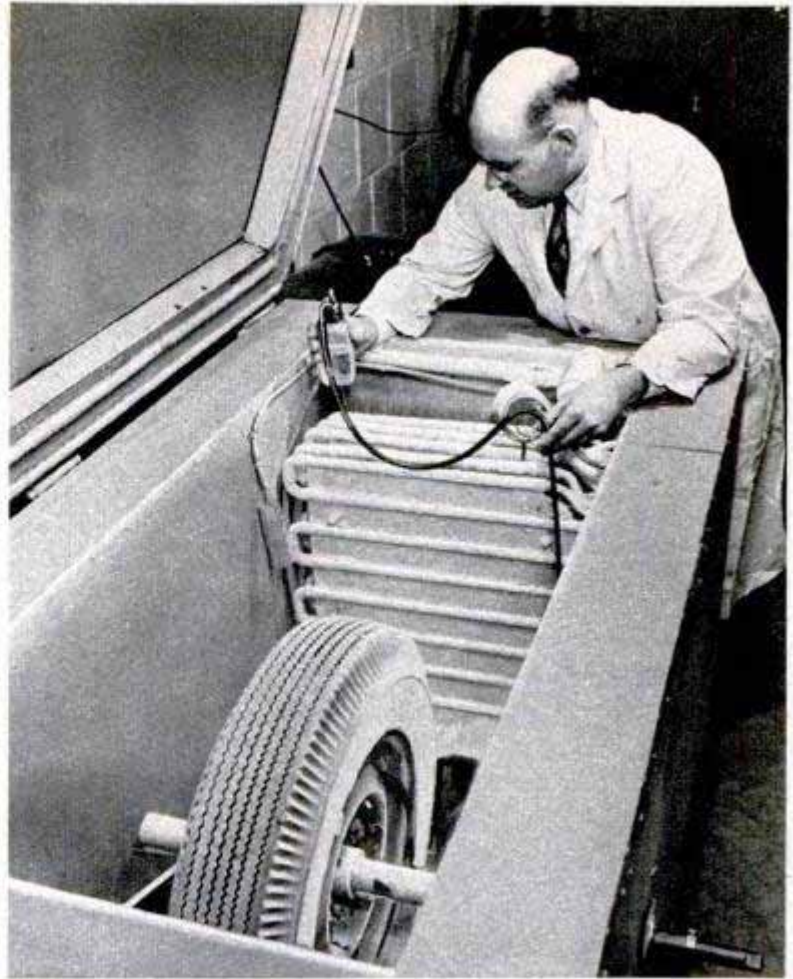


Arctic Tires →

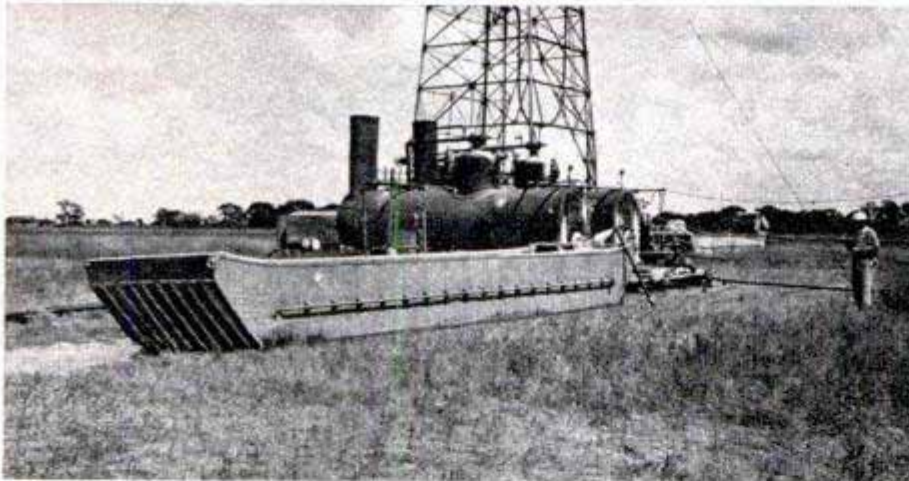
Tires made of a new synthetic rubber will bounce instead of shattering at 75 degrees below zero. This rubber was developed by Firestone for arctic operation where equipment has been immobilized by tires, hose, gaskets and belting freezing solid at temperatures of 60 degrees below zero. Tires would take on permanent flat spots when parked and treads would harden and chip. Mileage tests in Texas indicate the rubber will wear satisfactorily under normal highway driving conditions.

Balloon Tests Weather At 99,000-Foot Altitude

Accurate measurements of humidity and temperature at an altitude of 99,000 feet have been made for the first time with an instrument perfected at the University of Chicago. A plastic balloon carries the equipment into the stratosphere to altitudes about twice that at which accurate humidity measurements have been made previously. The new instrument uses a humidity-measuring technique called "dew point hygrometry," an old technique per-



fectured for balloon application by modern electronics. A radio transmitter sends the information back to earth during the flight.



Boats on Dry Land Store Drilling Mud

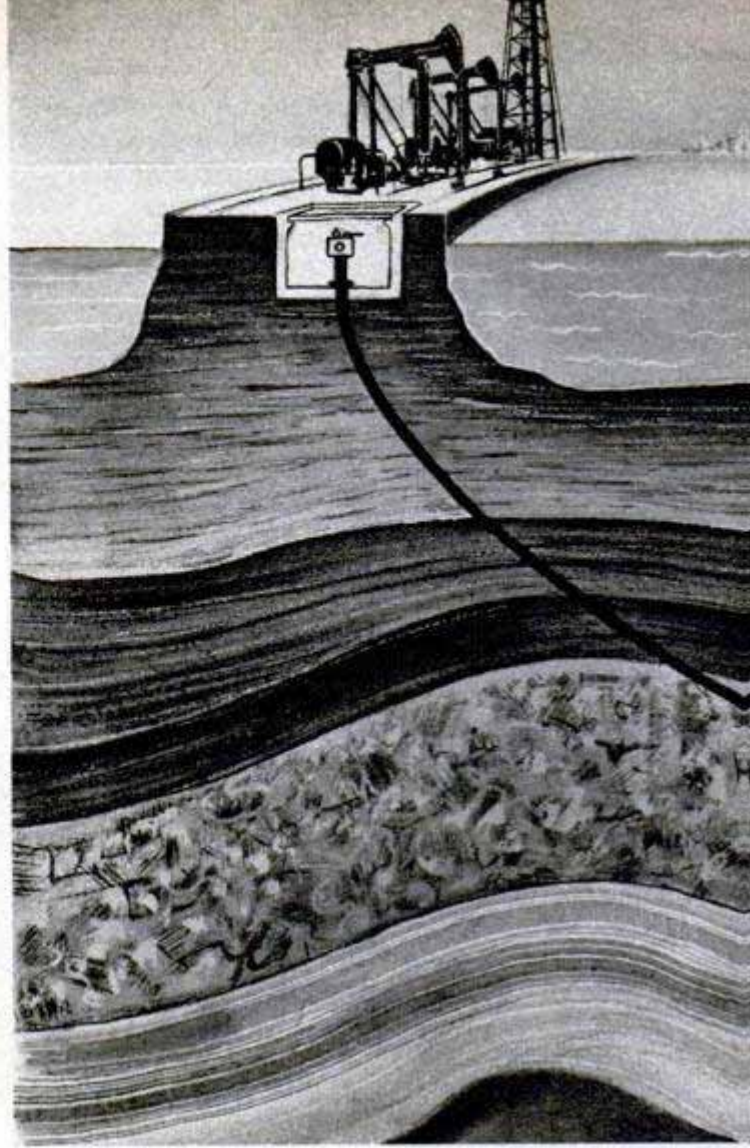
Surplus boats—the pontoons used by U. S. Engineers—are used by a Texas drilling contractor to hold water in instead of out. He fills the craft with drilling mud, the fluid pumped into oil wells to remove cuttings and cool the bit. The pontoons are towed to the site on a trailer, dragged off and filled with the fluid. When the job is completed they are emptied and again loaded on the trailers, where they serve as storage bins for pipe and drilling equipment.



☞ Widespread use of atomic energy may make it necessary to dispose of radioactive waste products by rocketing them to the moon, says an Australian scientist.



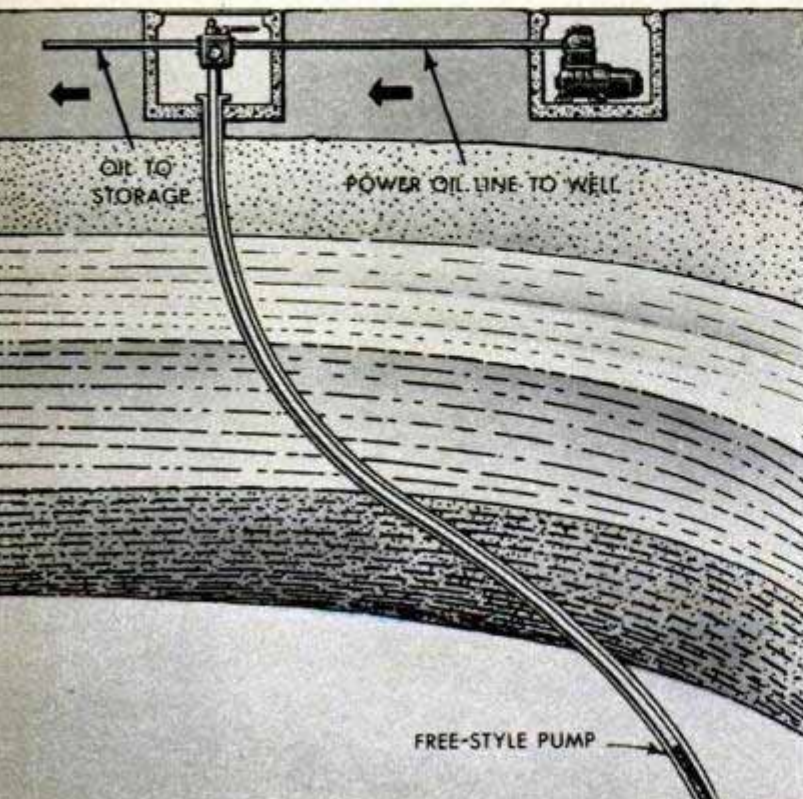
Row of pumps is removing oil from pool hundreds of feet away. Derrick on rails is drilling another well

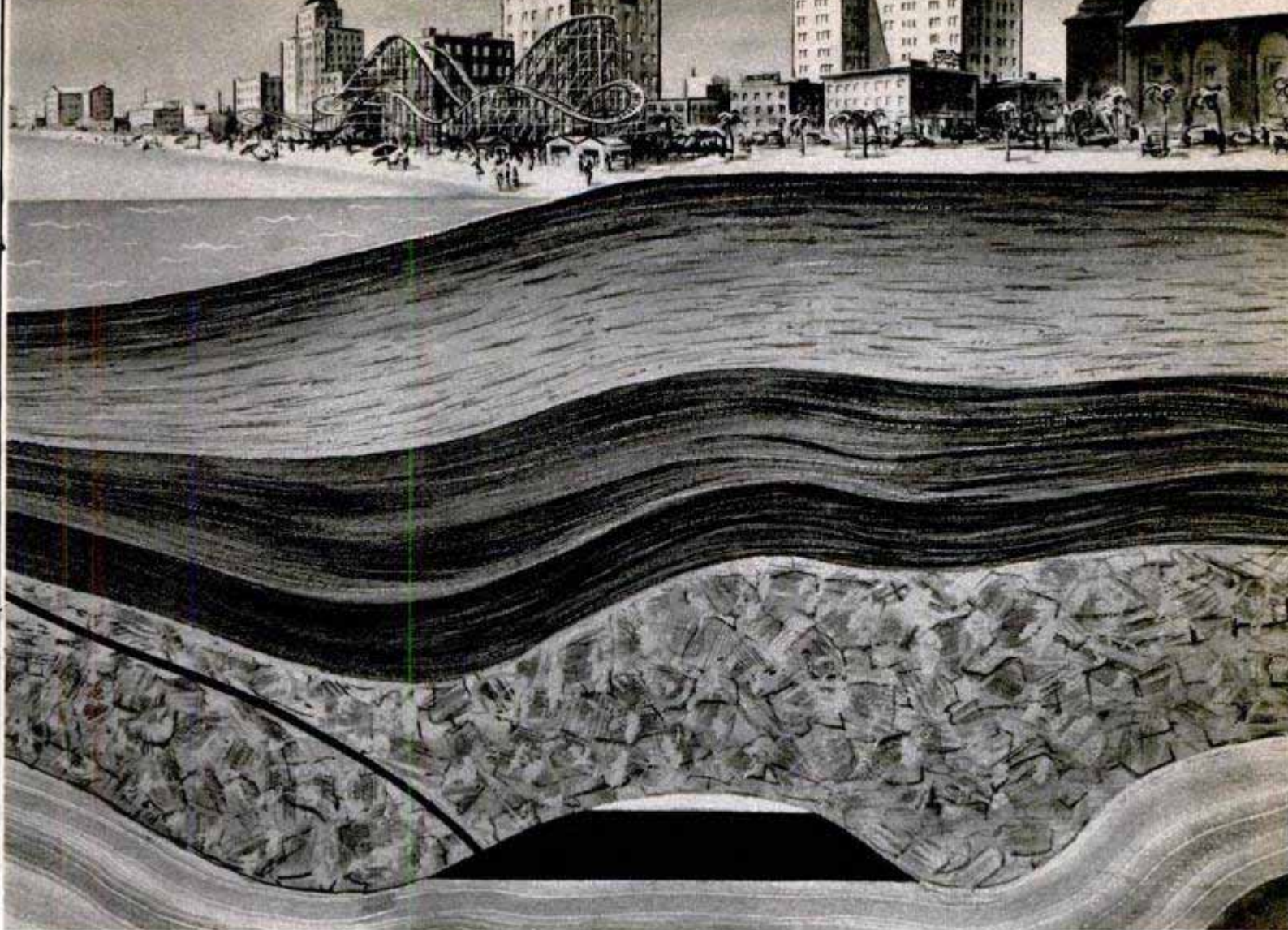


Oil Drillers Throw

Sketch shows free-style pump at bottom of well. Oil pumped into well drives pump, forcing new oil upward

Well below sign pumps oil from under harbor, beyond. Others reach as far as the sky line for oil deposits





Cutaway drawing shows how oil deposit under city of Long Beach is tapped by well that runs beneath the harbor, eliminating wells and derricks within city

Curves

THE OIL-COMPANY representative and the directional-drilling technician were standing at the edge of the city's industrial district. Near by was a residential area and beyond that they could see a tall building.

"Our community lease extends past that building," the representative was saying. "It's 4800 feet from here, almost a mile away, and oil sands are 5000 feet below the surface. Now, can you drill us a well from here that will tap the formation under that building?"

"Certainly," the technician told him. "That's not very difficult. We'll drill straight down for a couple of hundred feet and then bend the hole due north to miss the other slant wells that are out there. Halfway over we'll whipstock to the northwest and head straight toward the building, meanwhile continuing to go down at an angle of about 45 degrees.

"We can hit the oil zone at an angle or, if you prefer, we'll straighten the hole out

vertically as we reach the target. It will be a real slanted hole but its bottom will be within 10 feet or so of the spot you want."

Oil-field engineers used to complain that no well went straight down. A deep hole might wander several hundred feet from the vertical because of sloping underground formations and the flexibility of drill pipe, or it might describe a giant spiral. In extreme cases, a well might slant off to one side so much that it was finally tunneling parallel with the oil sands.

Today, the engineers not only can control the direction and slope of their holes, they drill crooked holes on purpose. Making oil wells deviate from the vertical has become an exact, scientific process. By means of it, productive formations can now be tapped that otherwise would be inaccessible or too costly to reach.

In the Gulf of Mexico, a dozen deep wells can now be drilled from a single artificial island. The holes radiate out to a dozen

different points in the underlying formation, saving the expense of additional well sites.

Similarly, a group of wells along an ocean beach can be drilled directionally to reach a formation that is thousands of feet offshore. An example of this is Southwest Exploration Company's 200 wells, spaced only 27 feet apart, on a bluff that overlooks the ocean at Huntington Beach, Calif. Each well slants off under the adjacent highway, a rail line and the beach, and taps its individual five-acre parcel of the offshore formation. Some of the wells extend 5000 feet offshore to a depth of 4400 feet.

When a well runs wild and craters or catches fire, it is now possible to drill a new well at a safe distance and slant it underground toward the runaway, capturing its flow and allowing it to be capped.

In mountainous country, an operator now often locates his rig in a convenient valley and drills directionally to reach a pool under a mountain. He saves the expense of building a road up to the top of a peak, hauling up his equipment and then drilling back down again.

In built-up business and residential areas in which drilling is prohibited, it is now usual to place a derrick inconspicuously at one side, if productive sands exist below and if leases are obtained from the property owners.

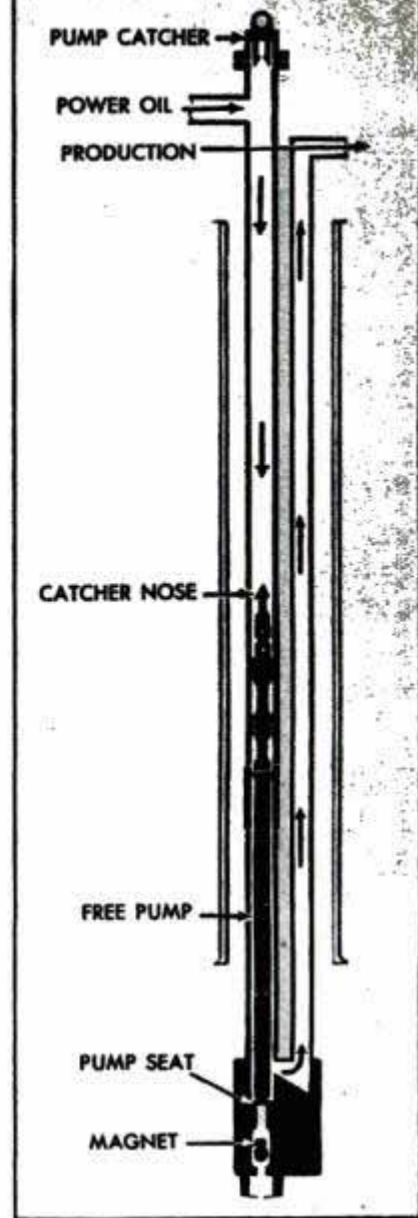
The present outstanding example of this technique is the new oil field in downtown Long Beach in California. No derricks are visible, but the wells are under the town, nevertheless.

One well taps the sands under an important street intersection, another is half a mile below the basement of a big garage, a third is getting oil from beneath a group of homes. In all, there are more than 150 producing wells that reach in under the city and the adjacent harbor.

All the wells are drilled from an industrial area on the far side of a flood-control channel. Here, in a single line and at 18-foot intervals are concentrated the wells that ordinarily would be spotted over hundreds of acres of ground.

It is, in fact, a portable oil field. The chief lessees mount their drilling derricks on skids or on wheels that roll on railroad tracks. After a well is drilled, the derrick is moved a few feet along its track to the next location. All that remains behind are the well-head equipment and a small pumping unit.

Some of the wellheads are underground in concrete vaults. Aside from the placards on the surface of the ground marking the



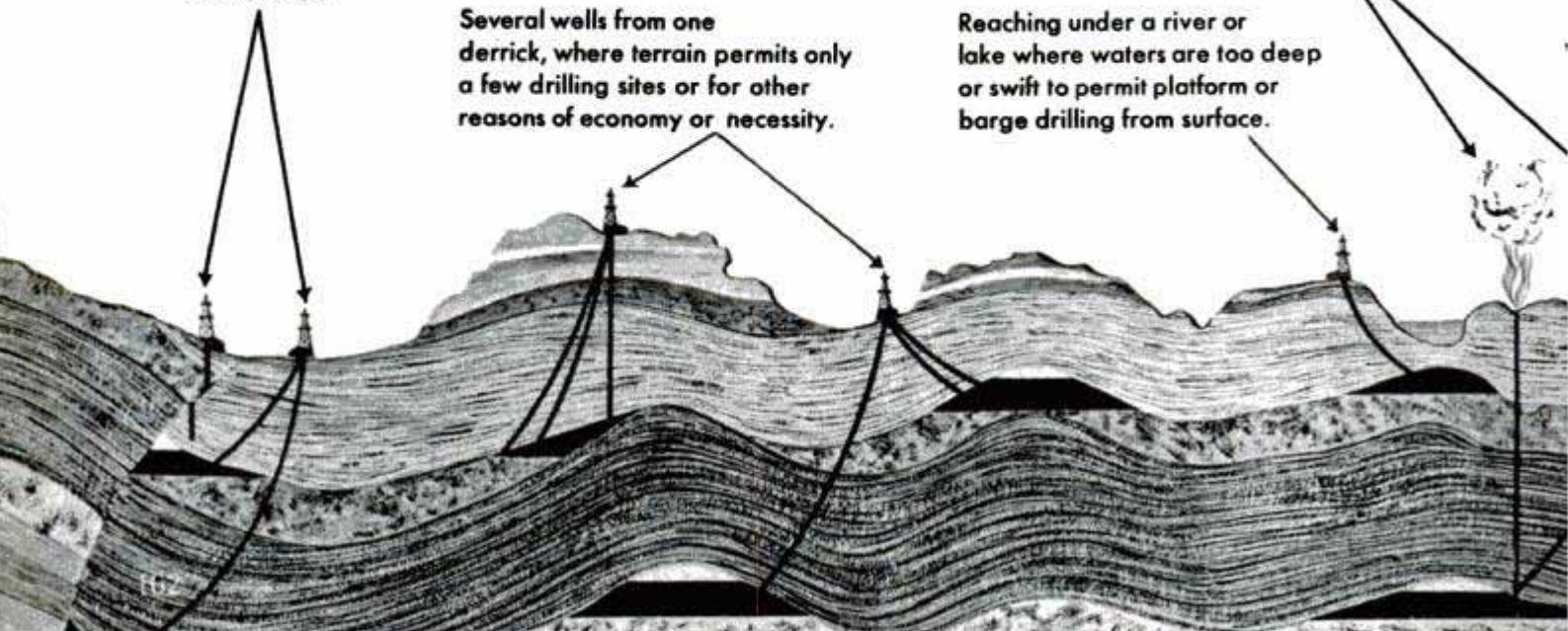
Free pump brings new oil up when the power oil is forced down. The magnet holds the check ball off seat. Below, some types of directional drilling

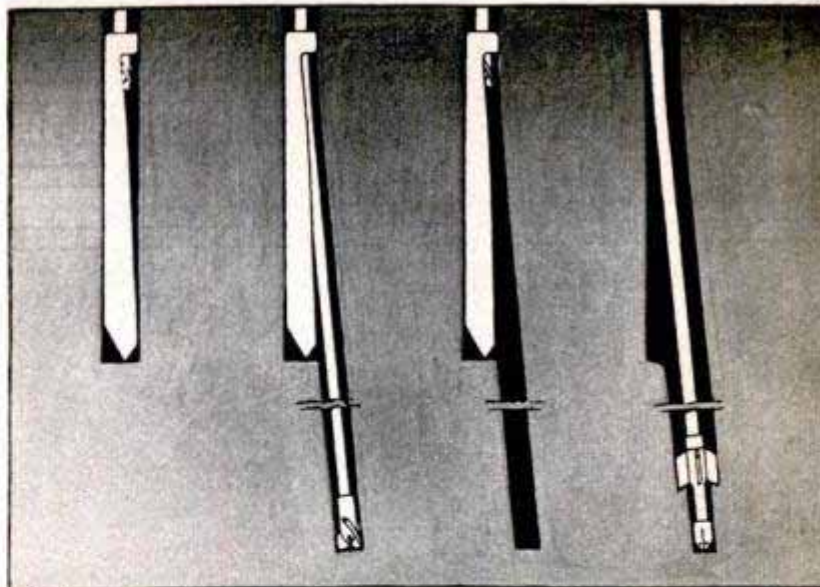
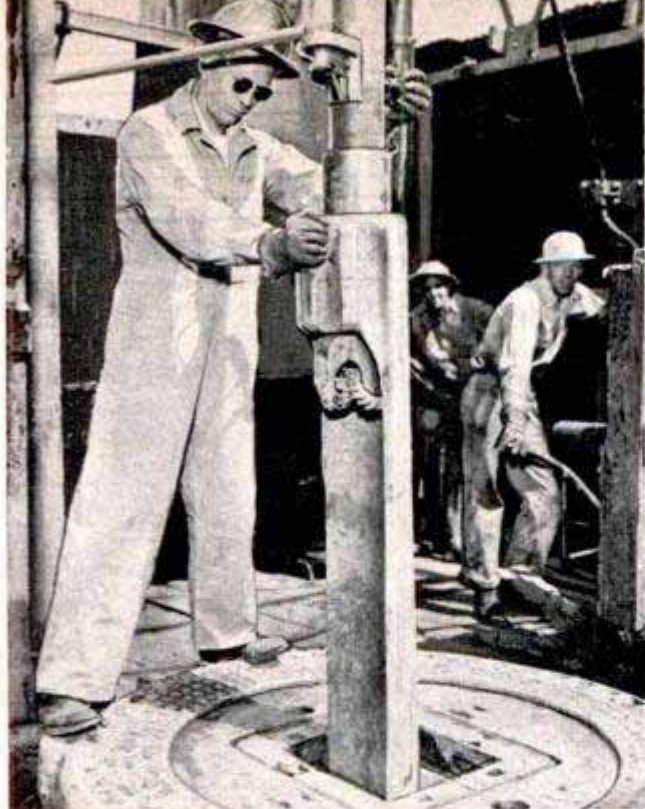
Avoiding a fault. Hole to the left has shifted, shearing off casing. Holes at the right go under the fault, reach oil at two levels

Several wells from one derrick, where terrain permits only a few drilling sites or for other reasons of economy or necessity.

Reaching under a river or lake where waters are too deep or swift to permit platform or barge drilling from surface.

Extinguishing an oil fire by drilling from a site some distance away and pumping in mud.





Above, drawings show, from left to right, how the whipstock enters hole and starts drill on slanting course. It is then withdrawn when the drill bit is removed. Finally, drill returns to bore new course

Left, an engineer guides the whipstock into a well

well locations, no one would suspect that he was standing on top of a busy, productive field.

The first tool pushers who attempted to drill directionally placed a few timbers under one side of their rotary tables in order to slant the bit and the drill pipe in the desired direction. That method is still used occasionally. However, modern directional drilling really got its start when a number of precision tools were developed by John Eastman, now head of the Eastman Oil Well Survey Companies that supervise much of the directional drilling in oil fields all over the world.

One of Eastman's devices is the removable whipstock, essentially a long steel

wedge held by a collar just above a small drilling bit. When this combination is lowered into the hole and drilling is resumed, the bit is deflected to one side by the wedge and the hole begins to slant. Instruments are used above ground to line up the whipstock in the desired direction. After a few feet of slant hole have been drilled, the combination is returned to the surface, removed and an ordinary drilling bit is sent down to widen the pilot hole and deepen it.

The driller has other items of equipment beside the whipstock to bend the hole. One is an elbow-jointed tool which is held straight by springs as it is lowered into the well. At the bottom, the elbow joint bends

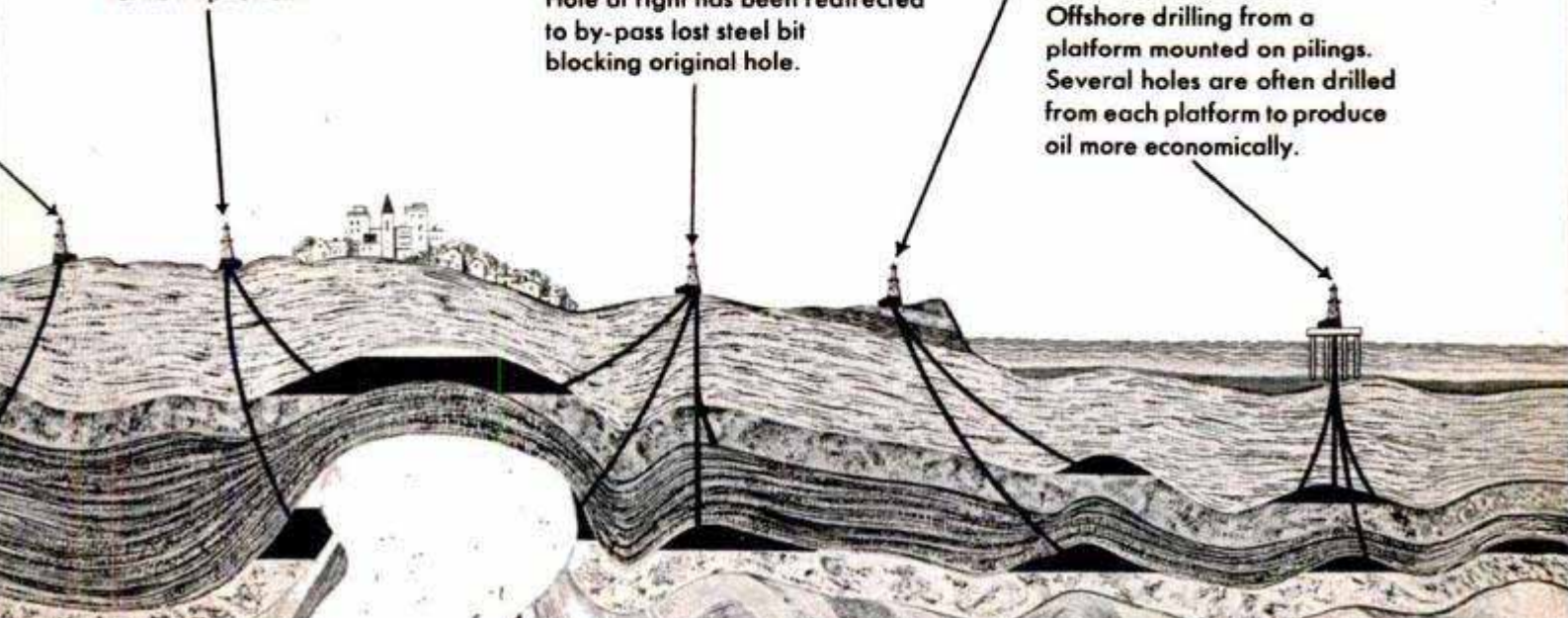
Drawing from Standard of California Bulletin

Undersea drilling from the shore. Curving holes reach both upper and lower oil formations from same location on the bluff.

Offshore drilling from a platform mounted on pilings. Several holes are often drilled from each platform to produce oil more economically.

Drilling under a city or other occupied place where vertical well site is impracticable. Deeper hole is reaching under the cap of a salt dome, which forms trap for oil.

First two holes reach under city and under salt dome. Hole at right has been redirected to by-pass lost steel bit blocking original hole.





Survey engineers check the time clock on a single-shot survey instrument which, when dropped in hole, records photographically the direction of the bore

Below, these wells, neatly arranged in rows along a highway near Huntington Beach, Calif., were all directionally drilled to tap oil under ocean, left

under drilling pressure and starts off at a slant. Still another curve-thrower is an off-center bit that automatically drills at an angle in sand or other soft formations. Another bit for soft stuff directs a stream of mud to one side through a special jet. Under high pressure, the mud hollows out the bottom at one side and the bit, following the line of least resistance, drills at an angle.

Another of Eastman's developments is the so-called single-shot survey instrument. This is contained in a nonmagnetic tube, about two inches in diameter and as long as 23 feet, that is lowered into the hole. There is a time clock inside the instrument that turns on a small interior lamp when bottom is reached and also operates a camera. The camera photographs the position of a small plumb bob in reference to a compass card. Hauled up to the surface and developed at once, the picture shows the inclination of the hole from the vertical and the direction in which it is headed.

With this information, the drilling crew can continue to put down their hole and guide it in the right direction or, if it is off course, they can tell how much correction they must apply.

There are numerous other directional tools and instruments available now, as well as other techniques, but the general method of drilling remains the same.

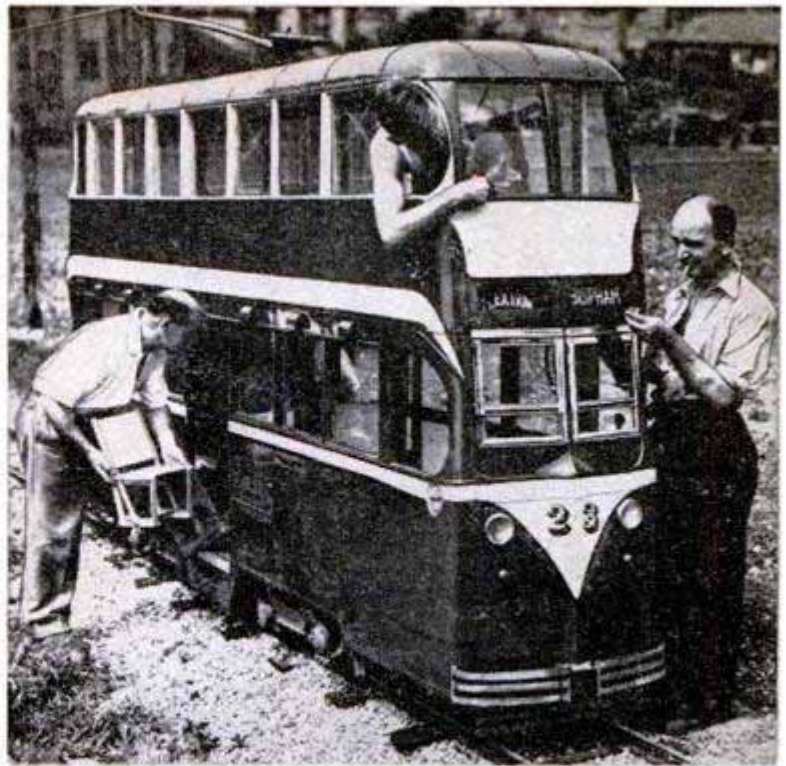
In a cluttered field like Long Beach, a directional job has to be carefully laid out on paper before drilling begins. Numerous factors are considered in plotting the course that the well must follow. Taken in account are the horizontal distance from the drilling rig to the target, the vertical depth that must be reached at the target, the safe curves to which the drill pipe may be bent en route and the angle at which the hole

(Continued to page 250)



Model Tram →

After a year's sparetime work, C. W. Lane has completed a tram line in his own back yard. Lane is an Englishman whose hobby is trams — British streetcars. His back-yard model seats 17 children, 10 on the top deck and seven below. A copy of a modern type, it runs on a 330-foot track and is powered by overhead electricity. It has an inside staircase and lights that really work.



Rust Preventive

One application of a new rust preventive will protect the chrome on automobile bodies up to a year, according to the manufacturer. Previously used by the steel industry to protect metals, the solution now is available for home use. It is a transparent, colorless coating which can be applied to any metal or plated surface to provide protection against rust, corrosion, pitting and

tarnish. It resists weather, heat, cold, grease and grit. The liquid can be applied by brushing, spraying or dipping.

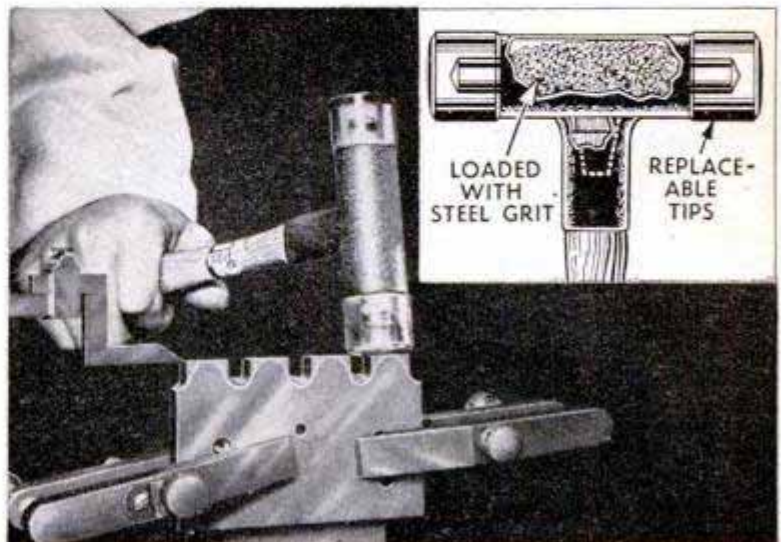


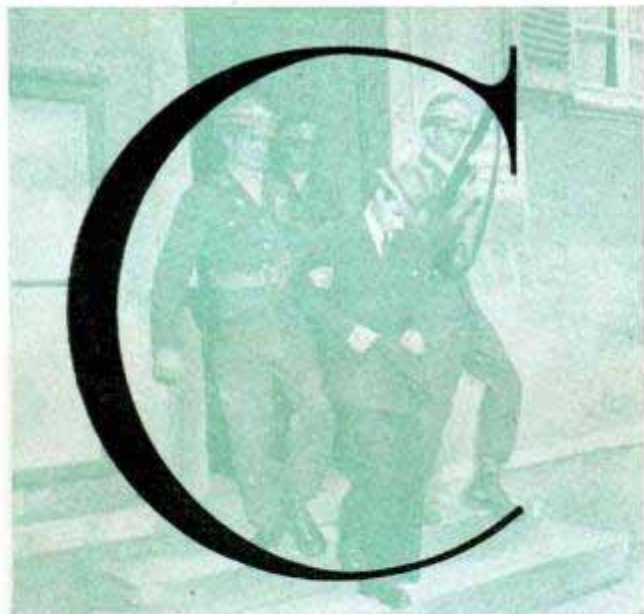
Barrage Balloons Store Grain Crop

Wheat farmers, unable to find storage space for another bumper crop, can solve the problem with surplus barrage balloons that serve as containers. The balloon will hold up to 2000 bushels or, if placed in a pit shaped to the balloon contours, the amount can be increased to 2400 bushels. Grain is dumped in by gravity flow or blown in by pressure.

"No Bounce" Hammer Has Plastic Tips

Hitting 30 percent harder than the ordinary hammer, a plastic-tipped hammer will not bounce or rebound when it strikes. The hollow head is loaded with steel grit that absorbs the rebound, giving a deadweight blow. Designed for use on machined and finished surfaces, setting-up work and soft metals, the hammer has tips of Tenite plastic that can be replaced when worn. Both heavy and light hammers are available equipped with the "no bounce" heads.





ONE NIGHT some months ago a mysterious dual murder took place in Nuremberg, Germany, within the United States Occupied Zone. An Army Jeep containing six GIs was passing through the downtown area when a shot rang out and killed two of the soldiers.

There wasn't a single clue and no sign of a suspect. An Army crime detective, Capt. Clark Nichols, member of the Criminal Investigation Division at Frankfurt, was consulted and he followed a simple plan.

First of all his ballistic and chemical-analysis equipment was flown to the scene of the crime. Rifles of Army units in the area were collected, tested and marked.

Ballistic studies began when autopsies of both victims showed that a bullet from a .30-caliber carbine had passed through the body of one soldier, killing him instantly. The slug then struck the other victim, who died soon afterward. The 87th rifle tested proved to be the murder weapon and it belonged to an Army private.

When confronted with this scientific evidence, the GI revealed the following facts in a signed confession: Before going on guard duty on the night of the shooting he had been drinking beer. Feeling a bit frisky, he fired three shots at a civilian running up a road. At his final shot an Army Jeep passed through the line of fire.

Thanks to the Army's ultramodern crime-detection methods this case was solved within a week.

Little known to the American public are the letters CID. That's because the Criminal Investigation Division, a segment of the Military Police under the Provost Marshal General, works in absolute secrecy. Its operations are worldwide; headquarters are in Washington, D.C., a training school is maintained at Camp Gordon, Ga., and two scientific crime laboratories are operating in Japan and Germany.

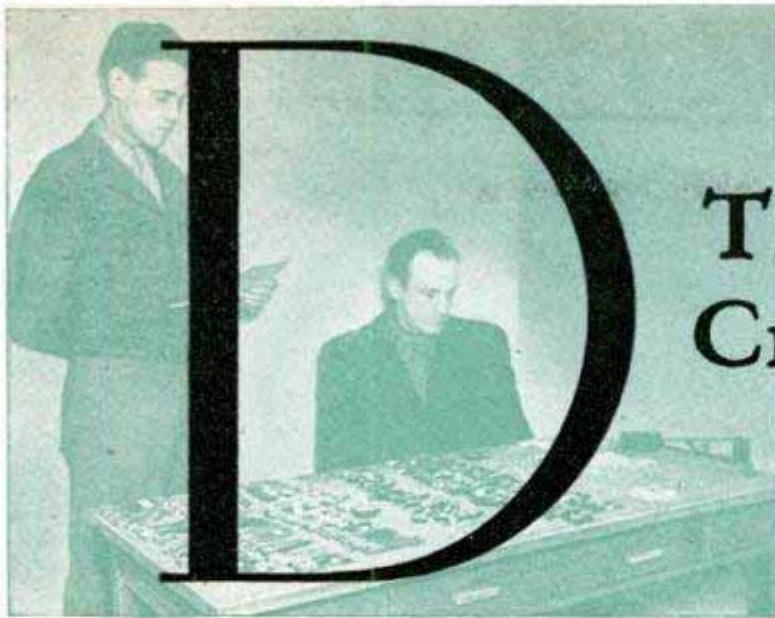


This agency, started early in World War II, uses the newest and most revolutionary crime-solving devices.

Army files overflow with cases solved by the ultramodern science of infrared photography. Very recently in occupied Japan, for instance, somebody was tapping a certain PX cash register of that precious green stuff and not a clue was found. For weeks every employee was secretly watched by day, and no one was seen to open the till. At night the manager was the last one on the job and he was thought to be above reproach. However, since he seemed to be the sole person who could be rifling the register, a trap was set. Army detectives fixed up a camera with an infrared bulb which operated only when the register was opened. One morning a week later the switch was found open. The camera had snapped a fine action shot of the PX manager with his hand in the till!

One of the cleverest soldiers who ever tried to outwit Uncle Sam, delivered mail for a CID detachment. According to CID agents, the man wrote a convincing letter on official CID stationery to a big tobacco company in the United States, pointing out that he, a CID official, had found cigarettes to be of great value in securing the services of informers to help solve Army crimes. In view of this fact, he explained, he was enclosing \$500 from a special fund for which he would expect to receive in the very near future a large quantity of cigarettes. He suggested this plan, he added, because the necessary operations would be delayed considerably if arrangements were made by the usual slow procedure used by the Army purchasing agents.

The company followed the plan, mailing the cigarettes in care of the CID detachment, and welcomed further transactions. Business boomed for the soldier. He found it easy to grab the packages without any of



The Army's Crime Bureau

By
Paul Twitchell

his associates seeing them since he received all the mail addressed to the CID detachment. Without bothering to pay customs assessments he peddled the cigarettes for fancy prices and soon had accumulated a couple thousand dollars. The tipoff to CID agents came in two ways: the large money orders he sent home, for which the man could offer no satisfactory explanation, and the fact the natives in his area were getting a large quantity of American cigarettes. When apprehended, he was all set to market penicillin and other drugs on the same illegal basis.

Often Army GIs are of considerable aid to the CID in solving crimes. Some months ago Sgt. Robert E. Bond of a transportation battalion in Berlin helped track down a gang of German tire and tool thieves.

Bond tipped off the CID that he had been approached by a certain German in the

Berlin Ordnance Depot and offered big money to drive a truck out of the depot to a garage in the American sector. The German had observed Bond working at the depot where he regularly picked up supplies for his unit. The German explained that Bond easily could get tires and tools off the official inventory by destroying tally-in and tally-out sheets. These, the German suggested, would be loaded into Bond's truck, driven to a garage in the Lankwitz section, then taken later into the Soviet sector for sale.

When Bond revealed the ingenious plan to CID authorities, he was advised to go right ahead with it. After furnishing secret agents with a description of the truck, the route to be used and the hour of departure, Bond drove out of the depot with the contraband cargo.

Two CID vehicles picked up the trail

Giant board in Tokyo CID laboratory shows all cases under investigation. Note emphasis on solving crimes by chemical analysis, lie detector and identifying types of blood



after a second German had joined Bond to direct him to the rendezvous point. When Bond reached his destination, CID agents were on hand to arrest the buyer and confiscate the truck. Bond also furnished the names of three other conspirators.

Then there's the weird story of a man we'll call Walter Rogers, who got used to the feel of folding money when he was a prosperous New Yorker before he became a draftee. When stationed in Asia some months ago as a member of the occupation forces, he wasn't so well heeled. One day he visited his buddy—call him Bill McElwain—in the hospital with an injury. Bill

had been figuring out possible ways of getting some quick cash and was about to give up when he noticed there was some penicillin lying around loose.

When Walter looked into the matter, a native translator offered him some money for illegal penicillin. The native scratched something on the dirt which looked like 50,000 and Walter returned to the hospital and told Bill he could get 50,000 yen a bottle for the drug. They figured it would be profitable to give 10,000 yen to get control of each bottle at the hospital and the profit on the transaction would net them a walloping 40,000 yen on each vial. This would

amount to over \$2500 at the official exchange rate of 15 yen to the dollar, or almost \$900, if figured at the black-market rate.

With dollar signs dancing in their eyes, the partners made a deal. Walter turned over 30,000 yen to Bill, who delivered to Walter three vials of penicillin. Walter went out to peddle the medicine.

But he got a rude awakening. The figure which the native had scratched in the dirt was not 50,000 after all, but 1500 and Walter walked away not 120,000 yen richer, but 25,500 yen in the red.

The two sad sacks decided the only way they could recoup their losses was to go into the penicillin business in a big way. They enlisted the services of three hospital noncoms as a source of the medicine and soon built up a thriving business. Within six months they had bought money orders at the black market rate of 45 to a dollar and sent home several thousand dollars each. Then the penicillin supply began to wane and one of the insiders at the hospital suggested that they sell morphine.

"Morphine!" said the horrified Walter. "I don't want to handle that stuff! That would mean trouble with the government."

What Walter didn't know was that he was already in trouble with the



CID agent fires suspected weapon into a tube filled with waste, which prevents any marks on bullet except those made by rifling. Below, new light tube gives a clear view of the inner surface of a pistol barrel



government. The hospital commander, finding his stocks of penicillin vanishing mysteriously, called in the CID. They quietly uncovered the black-market ring, some of whose members had already returned to the United States, and rounded up all the guilty parties. Today Walter, Bill and their hospital conspirators are serving terms.

Back in April 1947, the CID uncovered a bizarre tale of occupational gangsterism in Germany in which two AWOL soldiers and a German civilian masqueraded as Army officers and lived on the fat of the land. They meted out severe punishment to other AWOLs while covering up their own illegal activities. They also issued promotion orders for themselves.

Army detectives described the mobsters as: Private Andrew E. Jackson, scarfaced ringleader of the trio; Private Neil Rogers, a reform-school graduate, and Karl Buchheister, a German who spoke English well enough to have been booked the previous winter as an AWOL American soldier.

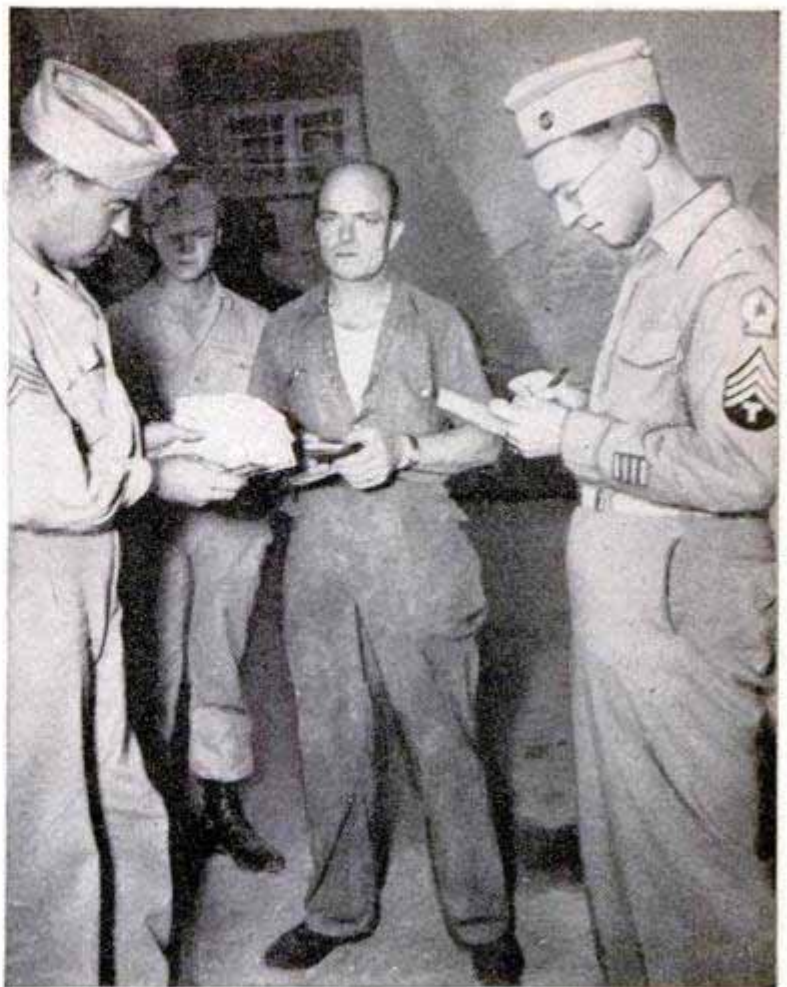
CID authorities arrested the gang in Mulheim, near Essen. Jackson was cornered in a German civilian's house where he was hiding and posing as an American officer. Rogers was arrested while visiting Buchheister's half-sister. The German was picked up in the local hospital, taking treatment for a minor injury.

As the Army detectives reconstructed the story, the three conspirators first met while confined in the Frankfurt stockade for GI prisoners. They escaped together in the late fall of '46 and for over a year roamed the British and American zones.

The CID picked up their trail the last week in March 1947. A footlocker belonging to an Army lieutenant in Hanau was rifled and in Wurzburg late that month a GI guard was knocked unconscious after he had given the trio highway instructions. His description of his assailants led to their final capture.

While fleeing the U. S. zone, the chiselers were halted by a constabulary patrol near Limburg. They weren't searched properly, according to agents, and promptly

(Continued to page 238)



Seized at last, this man gets personal introduction to work of CID. Money the agent is counting came from sale of stolen gas. Below, here's part of the loot uncovered by a 60-man raid in Korea. It includes cigarettes, watches, film, even golf clubs

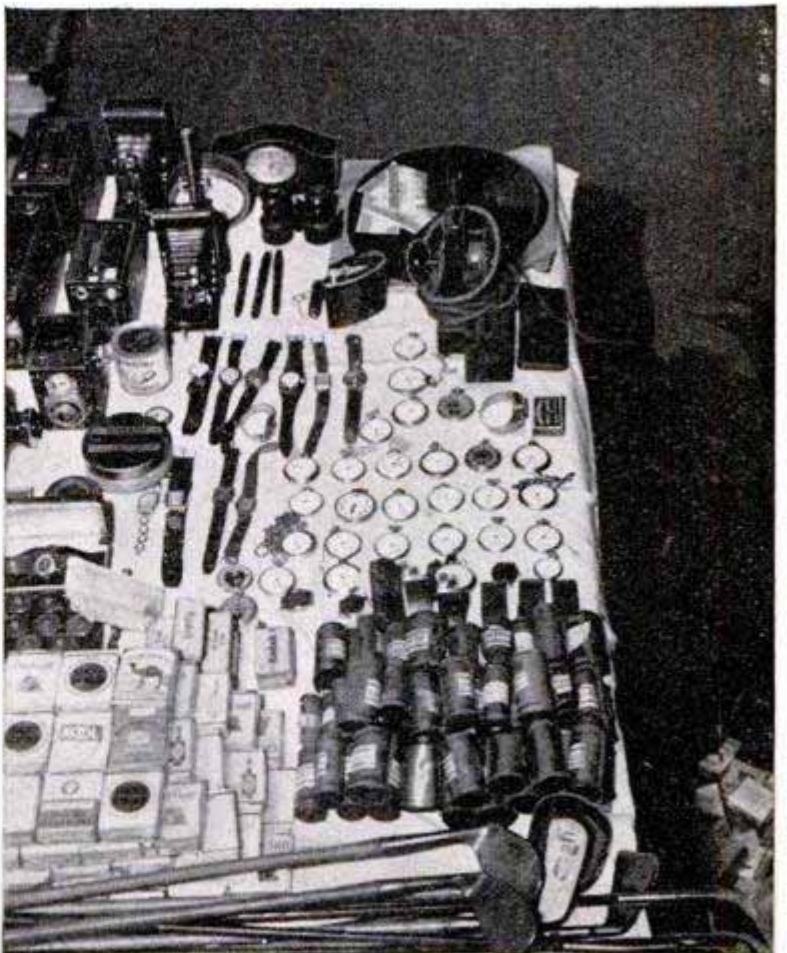




Image appearing on sensitive sheet tells you if the synchronizer is in adjustment. A—Shutter opens too soon; B—Perfect synchronization; C—Shutter is late



Heating With Paint →

ELECTRIC wall surfaces for room heating and warm electric rugs for underfoot are two proposed uses for a new "hot" paint that warms up to a predetermined temperature when connected to an electric outlet. Now, the paint is being used almost exclusively for anti-icing and other heating purposes on aircraft.

Sprayed over bomb-shackle hooks and attached to a source of current, the paint can maintain the metal at a temperature of 100 degrees even though the air temperature is minus 120 degrees, insuring positive release of the bombs. Applied to leading edges, antenna masts, propellers or jet-engine inlet fairings, the material prevents the formation of ice. It is being used to maintain hydraulic cylinders, gearboxes and other aircraft mechanisms at normal operational temperatures.

The paint is a thermosetting electrically conductive plastic material, gray in color, that may be sprayed, silk-screened or applied by other methods to virtually any surface. When applied to a nonconductor, such as cloth or wood, a wide electrode is attached to each end of the unit to insure equal heating or radiation from all parts of the surface. On a metal part, the metal itself may be used as one electrode, the second electrode being an electroplated metallic layer that is applied over the paint, permitting the current to flow through all portions of the paint.

On both conductors and nonconductors the heating area can be electrically insulated by applying, first, a coat of nonconductive insulating plastic material, then the conductive layer, and finally an additional coat of insulating material. The insulator has excellent abrasion resistance and all coatings are moderately flexible, permitting their use in carpets or clothing. The top insulating coat can be colored in any desired hue.

Depending on its application, the paint provides heat at up to 50 percent greater efficiency than do ordinary electrical units. It takes up virtually no space, weighs well under $\frac{1}{10}$ pound per square foot of surface and can be used with either alternating or direct current. When the correct formula is sprayed to the proper thickness, the coat can create and maintain any desired temperature from one degree above the base temperature to as high as 400 degrees.

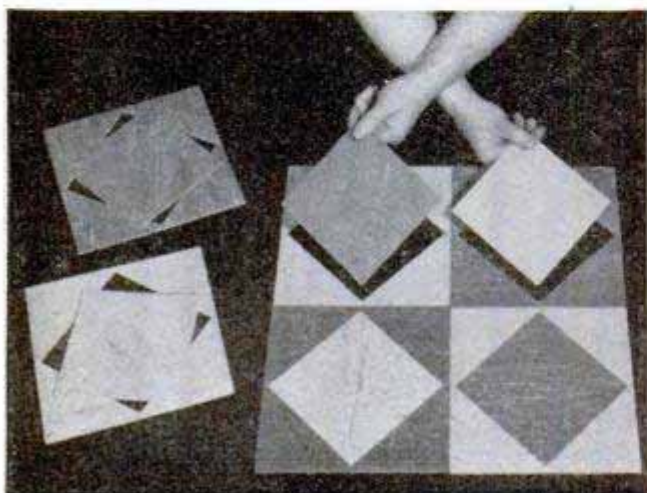
Worldwide air transportation of military medical patients, the bulk of whom have previously been moved by hospital ships and trains, has been taken over by the Military Air Transport Service.

Quick Test for Synchronizers

Flash guns are checked for synchronization right on the spot and without expensive equipment by a photosensitive sheet that requires no processing. The sensitive material is loaded in a film holder and a picture is taken of a flash bulb being fired by the synchronizer. Because the test sheet retains an image of the burning bulb for a short time, the photographer can see whether the shutter opened at the peak of the flash. No darkroom is required and the sheet can be used repeatedly since the image is retained only temporarily.

Tile With Cutout Center Provides Limitless Patterns

For endless pattern possibilities, a handy rubber floor tile is a square within a square. Measuring 9 by 9 inches, the tile has a 6 by 6-in. square cut out from the center at an angle. This bevel-cut center can be removed and replaced by another insert of a different color. To provide limitless patterns, the tile is available in 14 plain and marbled colors.





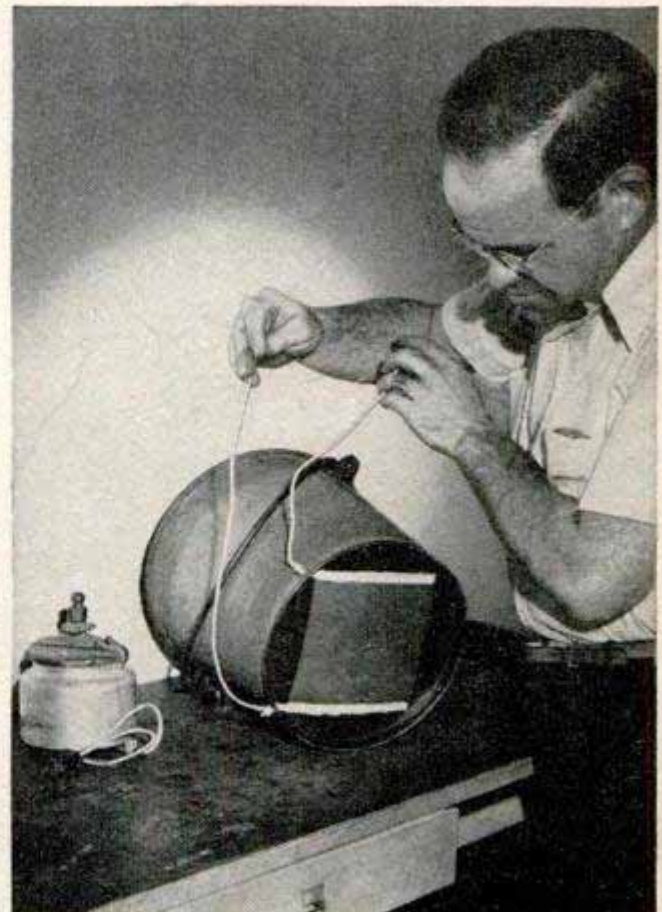
Covered with conductive paint, this panel, used in room-heating tests, keeps a surface temperature of 110 degrees. The paint can also be applied to walls

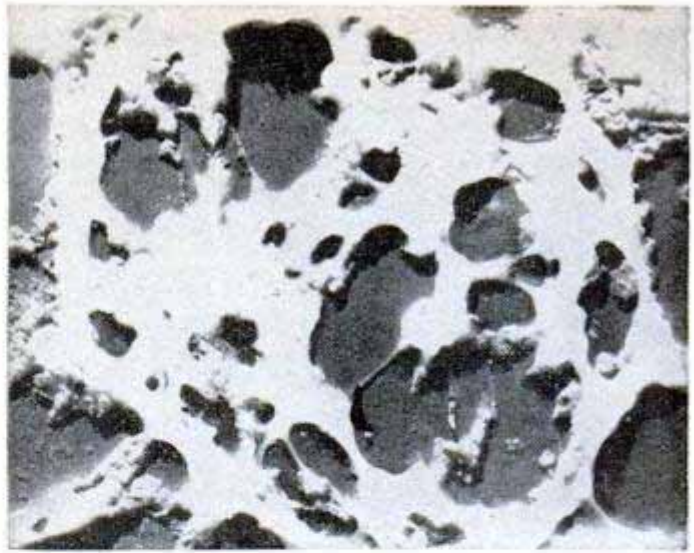
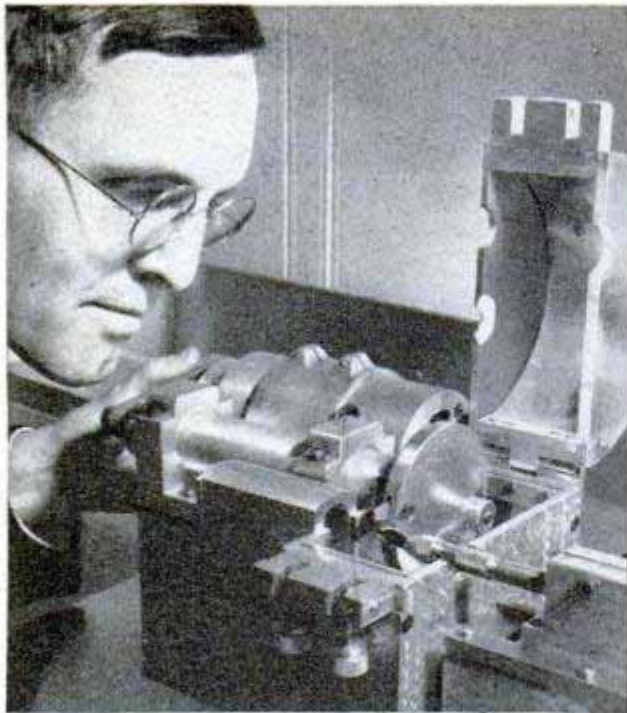
Below, conductive paint is sprayed on this plastic accessory cover for airplanes. It stops ice formation and keeps working parts at proper temperature



That cold floor is no excuse for staying in bed if you can step on an electric rug, containing a layer of the "hot" paint which is kept warm electrically

Below, the painted square on the bottom of the pail will warm liquids, replacing the immersion heater. Notice the electrodes at each end of painted area

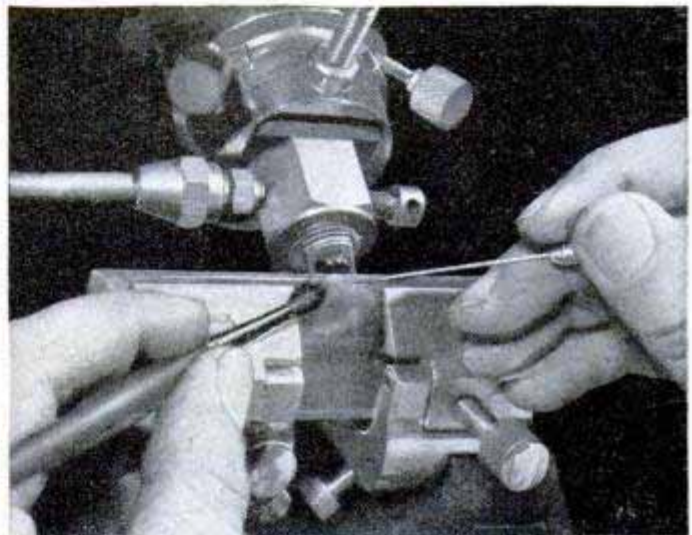




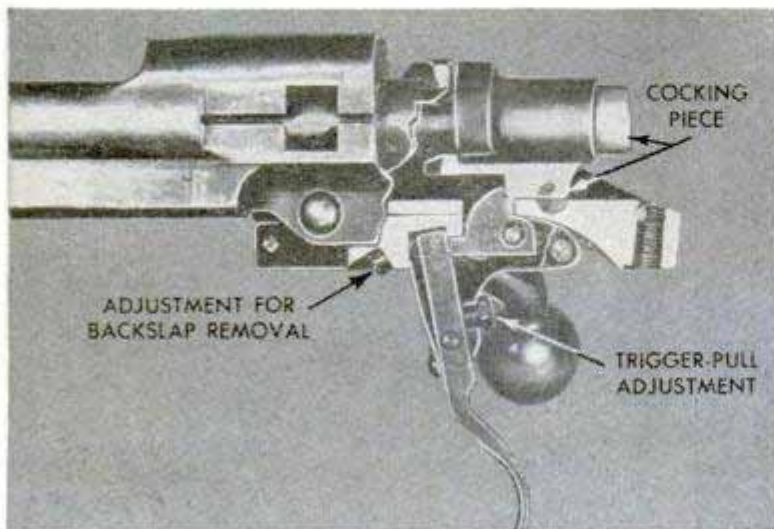
Left, blade of high-speed microtome is on the wheel in center of photo. Above, micrograph of section of frog's eye magnified about 25,000 times. Slice was cut on the expansion cutter, below, and picked up with the brush

Ultrathin Slices For Microscopic Study

Slices so thin that it would require hundreds of them to equal the thickness of a human hair are cut by two new instruments designed to provide scientists with tissue specimens for study under the electron microscope. One instrument, developed at the National Bureau of Standards, uses heat expansion to move the specimen against the knife blade. The specimen, embedded in plastic, is mounted in a hollow brass block that is chilled by the flow of carbon dioxide through it. This cooling contracts the block. When the carbon dioxide is cut off, the block gradually expands as it warms, advancing the specimen slowly against the knife blade. The second instrument, developed at General Electric, is a high-speed microtome that cuts shavings less than two millionths of an inch thick. The blade, mounted in a wheel, does not



touch the specimen, the cutting being done by a shock wave set up when the wheel is spun at speeds greater than that of sound. The sharpness of the blade is not of primary importance because the high-compression area in front of the blade actually does the cutting.



Trigger Conversion Unit For Military Rifles

Military rifles, such as the Enfield and Springfield, are given a crisp, target-rifle trigger release by a conversion unit that is simple to install. The mechanism also converts the Enfield to cock on opening. It provides a short pull that can be adjusted from three to six pounds. No alteration of the receiver is necessary.

☐ When starting a trans-Atlantic run, the Queen Elizabeth carries 1,630,000 gallons of fresh water.



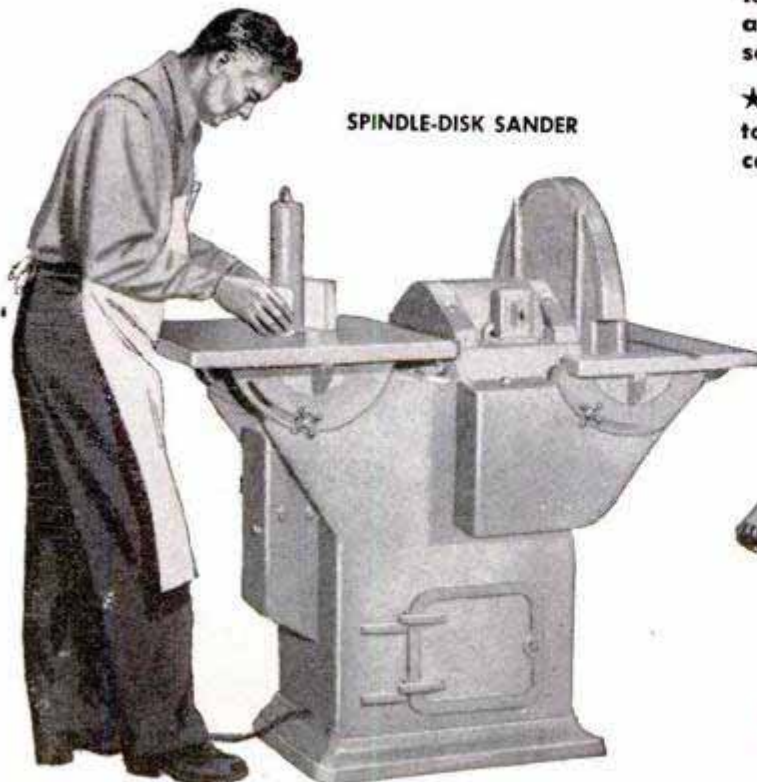
FUNCTIONAL FURNITURE

the **C**raftsman

★ Designed especially to extend our series on furniture construction to include pieces of all-around usefulness, these functional units are attractive and practical when used separately or in combination. Basic pieces are a chest, writing desk and table with combinations worked out as suggested in the sketches. Details on page 181

★ A good reason for the continuing popularity of leather tooling is that you can finish a useful and attractive project in one evening. We've selected a writing case, page 174, as an example

★ A special shop feature, page 224, tells how to build a combination spindle-disk sander of a capacity suitable for pattern and furniture shops

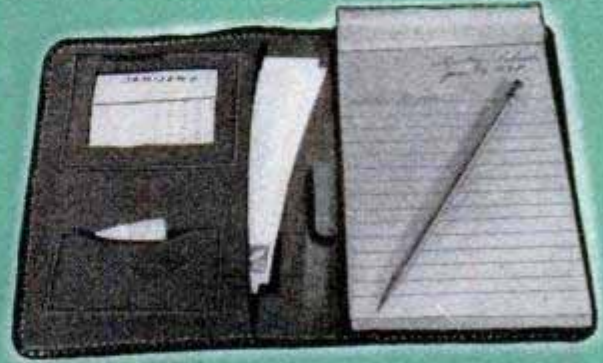
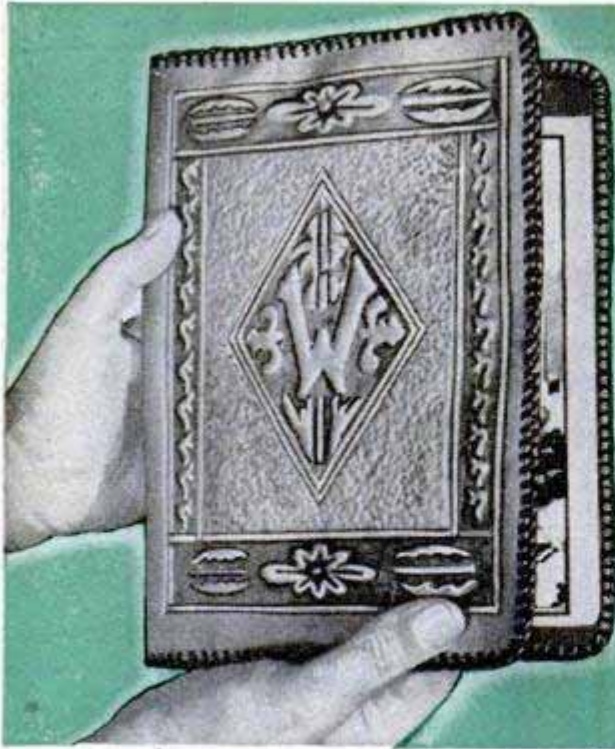


SPINDLE-DISK SANDER

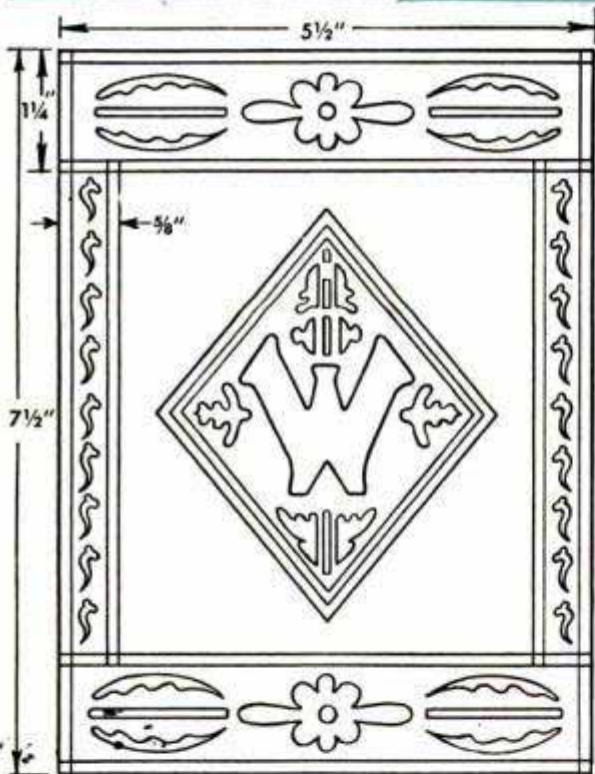


TOOLED-LEATHER WRITING CASE

Tooled-Leather WRITING CASE



By Elma Waltner



TOOLING DESIGN

A TOOLED-LEATHER writing case makes a handsome and handy accessory, especially for one who travels. This case contains pockets for everything needed, including a calendar. It was tooled in 5-oz. russet steerhide, although other leathers can be used. Steerhide tools nicely and the russet color takes on a rich glossy brown in the tooled areas which contrasts sharply with the lighter natural-colored areas. The case requires a piece of steerhide 9 x 13 in., which, when folded, makes a 6 x 9-in. case with a 1-in.-wide back. Lay out the design suggested at the left, or one of your own choice, on heavy paper, and draw your initial in the center. Almost any initial can be worked in the diamond shape.

Dampen the leather before tracing the pattern onto it. This may be done either on the flesh side or on the grain side, the important point being not to get the leather too wet. Leather that has been dampened too much

Below left, fasten the paper pattern to the leather with cellulose tape and trace the design with a blunt-pointed pencil. Then, deepen the impression in the leather with a tracing tool as in the photo at the right



1



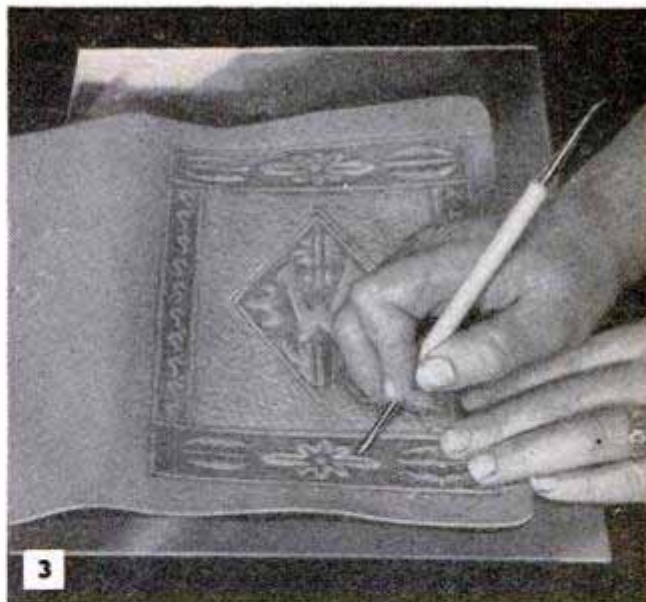
2

will not hold the tooled impression. When dampening the leather on the grain side, it is best to wet the entire piece and not just the area to be tooled. Otherwise, water-marks may result when the leather dries. To trace the pattern, center it on the grain, or face, side of the leather and fasten it with tabs of cellulose tape, Fig. 1. Do not let the adhesive stick to the face side, as it is apt to mark the leather. Instead, bring the tape around to the back or flesh side of the leather. Trace the pattern with a blunt pencil, applying light pressure. This will produce an impression in the dampened leather, which is further deepened by retracing the design directly on the leather with a regular tracing tool, Fig. 2.

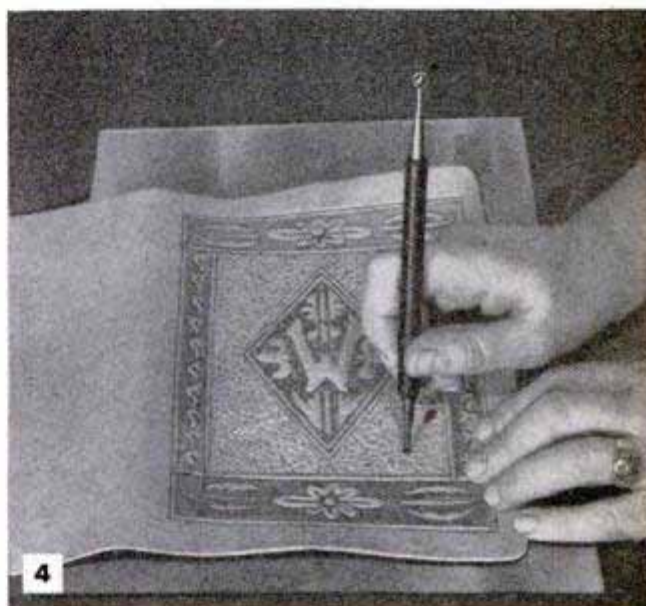
Tooling is done on a flat surface, such as a piece of glass. The background of both border and center designs is tooled down to leave the design in relief by rubbing it with the tool. This darkens the leather and makes it glossy, providing a pleasing contrast with the raised portions, Fig. 3. Next, the area surrounding the diamond shape is given a pebbled texture by stippling it with a roundnose tool, Fig. 4. This is done by holding the tool vertically and tapping the leather. If the tooling cannot be completed at one time, it will not harm the work if the leather dries. Simply redampen it when you resume work. Usually, the leather will remain sufficiently pliable for good tooling for several hours.

With the tooling completed, you are ready to add the lining and pockets. Fig. 6 gives the size of the lining and the positions of the various pockets. The lining is cut the same size as the cover of the case and the pockets are sewed to it by machine. Then the lining is machine-stitched to the cover, $\frac{1}{8}$ in. from the edges, using thread of a color which closely matches the leather of the case. The stitching is used to hold the edges of the two materials together while the lacing is applied around the edge to prevent shifting.

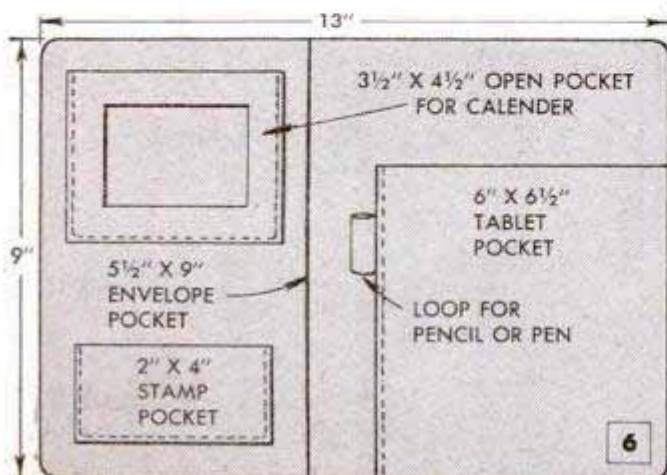
Holes for the lacing are punched through both leathers just inside the stitching line,

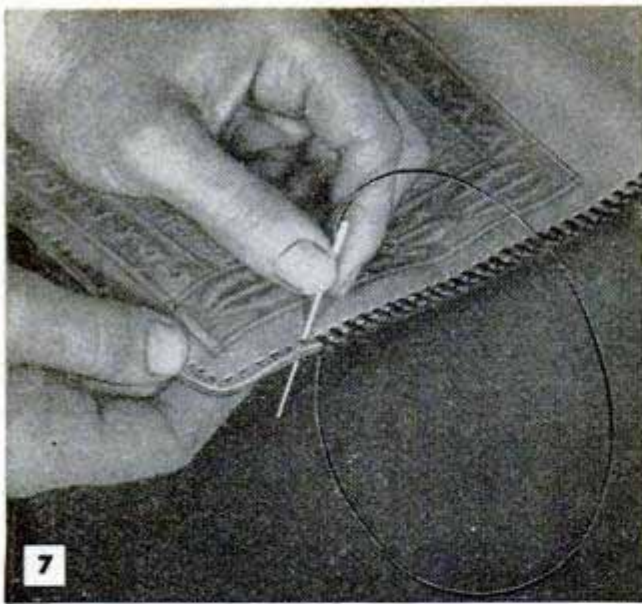


With the leather on a piece of glass, tool down the background areas. This operation darkens the leather

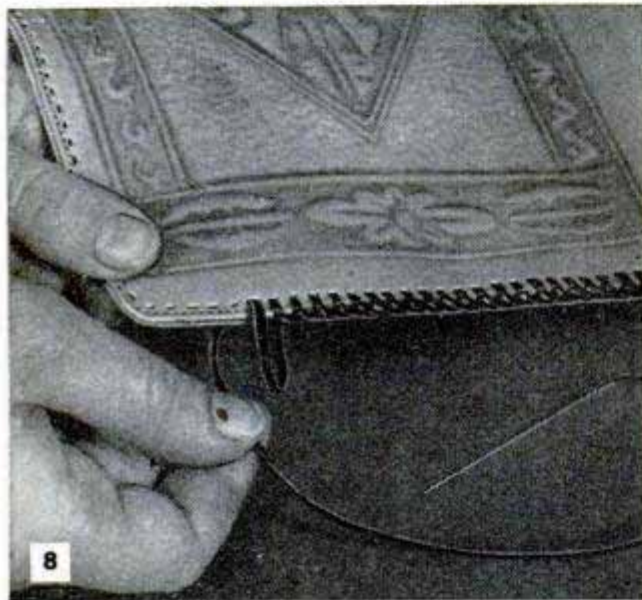


Above, a stipple effect is produced by tapping the leather with a roundnose tool, held vertically. Below, holes for a leather lacing are punched around the edge of the work with a special lacing awl made for the purpose. This is done on a hardwood block

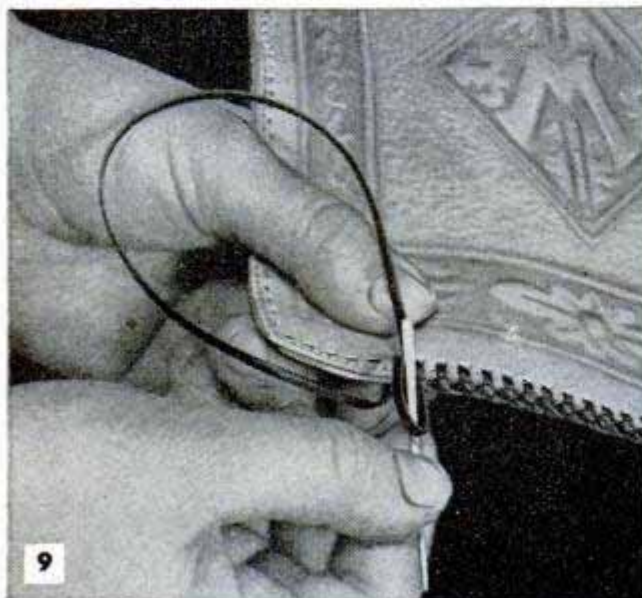




Using a regular lacing needle which has a split end, the lacing is pulled through the slits, front to back

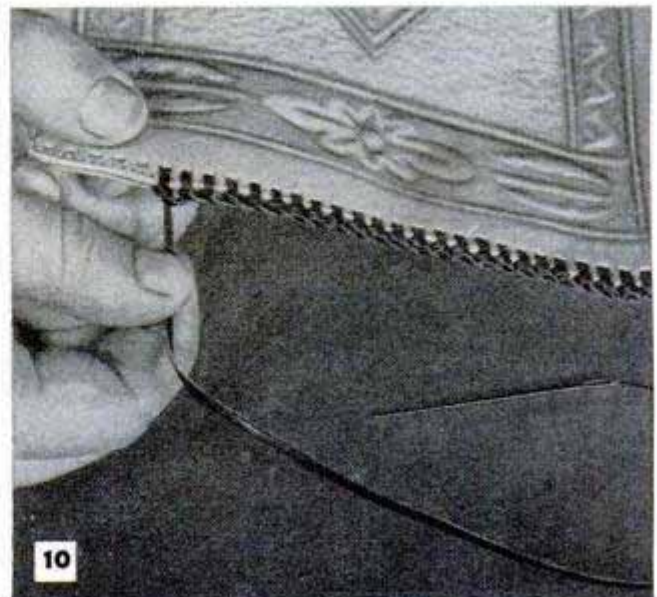


Above, first the lacing is pulled through until a small loop is formed. Then the needle is inserted through the loop, below, keeping the lacing to the left of itself. Finally, the lacing is drawn up tightly to form a knot, lower right. Repeat the steps



using a special pronged lacing awl to form a series of slits, as in Fig. 5. With the leather positioned on a hardwood block, punch the holes all around the edge. A split lacing needle is needed for threading the lacing through the slits. The skived end of the lacing is inserted in the needle and held in place with a drop of quick-setting cement. Use lengths of $\frac{1}{8}$ -in. lacing about 4 ft. long and begin as follows: Hold the case in the left hand with the tooled side toward you. Start the lacing in the center of the top edge and lace from left to right, inserting the needle from front to back, Fig. 7. Draw it through until only a small loop remains in front, Fig. 8, and then bring the lacing over the edge and through the loop as in Fig. 9. It is important that the lacing passes through the loop to the left of itself, as shown in the photos, and not to the right, otherwise it will not form correctly. Draw the first loop tightly against the edge of the leather and then pull the second loop down tightly to form the knot as in Fig. 10. Continue in this manner, watching that each knot is directly opposite the slit and that the lacing does not slant. Also, take care that the lacing does not twist. Placing the fingers of the left hand under leather and near the knot, as the latter is being drawn taut, will keep the edges of the leather from being stretched and pulled out of shape.

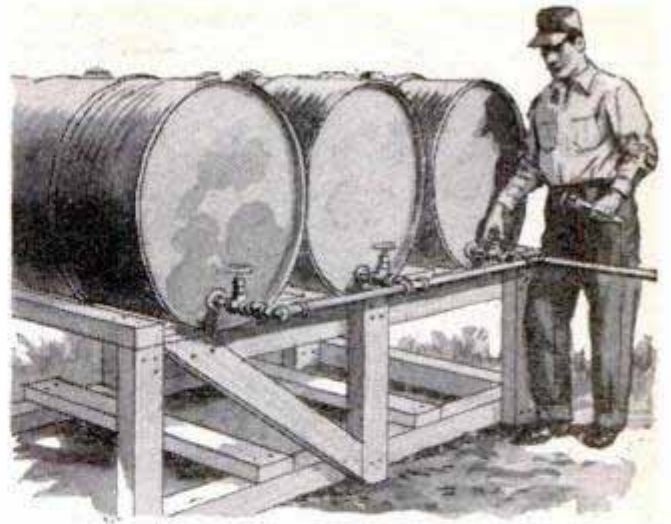
The lacing is joined by skiving the ends of the two pieces to bevel them and then cementing and lapping together. Ends at the start and finish of the lacing are tucked under several of the stitches and fastened with a drop of cement. Now, the completed lacing is placed on the edge of a hardwood block and tapped lightly with a mallet. This flattens the lacing to the approximate thickness of the case and slightly embeds it to keep the knots from shifting. Clean the finished case with saddle soap.



Small Oil Drums Linked Together Double for Large Storage Tank

Heating oil for the home or farm is more economical and convenient to use if it can be stored in sizable quantities and piped directly to the heating unit. However, if the cost of installing a large storage tank is prohibitive, several 55-gal. drums connected with pipe will serve the purpose. Each drum is fitted with a valve so oil can be fed from one drum at a time or all of them simultaneously.

A. M. Wettach, Mt. Pleasant, Iowa.



Paper Clip Forms Bookmark



A bookmark that won't fall out of place is had by pressing a paper clip over the page. Slip a folded piece of paper over the page before fastening the clip.

Match-Book Covers Level Furniture

Several match-book covers crisscrossed and closed so they are linked together provide a quick way of supporting a chair or table leg to level the piece of furniture. The stack of covers can be made any thickness and will not work from under the leg as readily as loose pieces of folded paper or cardboard.—Helen Lemberger, Chicago.

Clothespin Belt Holds Washcloths Within Easy Reach

When standing on a stepladder to wash windows or polish woodwork, you can keep both hands free and eliminate bending down to pick up cloths by hanging unused cloths from a clothespin belt. The belt is made by stringing several plastic spring-type clothespins on a length of cord and tying it around the waist.



Underspring Trap Concealed in Top of Stump Outsmarts Suspicious Fox

Here is a secret of experienced fox trappers that takes advantage of the animal's suspicious nature. An open glade including an old, rotten stump and a small tree or sapling about 50 to 70 feet from the stump should be selected as the site for the trap. This is not difficult to locate. Use a long cord to suspend a dead chicken, crow or other bird from a limb of the tree facing

the stump and scatter a few feathers on the ground below the bird. Then, conceal a No. 3 underspring trap in the top of the stump. When a passing fox notices the movement of the dead bird in the breeze he will be suspicious but also extremely curious. After circling the tree and finding nothing wrong, he usually will climb up on something to get a better view of the area. Eventually the fox will locate the stump which is an ideal place for him to view the bird, and when he jumps up on it, he is almost certain to spring the trap. To set the trap, carefully hollow out the top of the stump so there is just enough room for the trap. Wear leather gloves to avoid scent and carry away any excess wood so the fox does not become suspicious of the stump. Conceal the trap drag and chain below the trap, place a piece of clean wax paper over the open jaws of the set trap and crumble rotten wood over the top until the paper is no longer visible. The wax paper prevents the wood covering from sifting down and clogging the trap action.

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



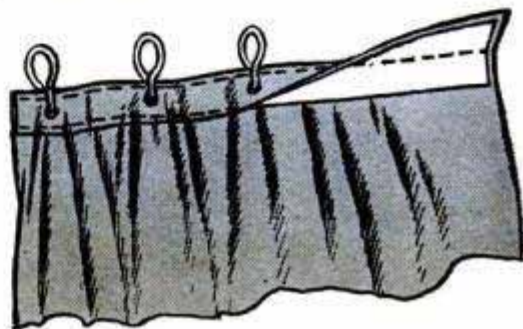


NO TIME IS WASTED in looking for sewing needles if one is kept with each spool of thread. Just press a short piece of crayon into the hole in the center of the spool and stick the needle into the crayon

TO PROTECT A WINDOW SHADE from damage while top sash is open and also to insure maximum ventilation, install a set of shade brackets a few inches lower than the regular ones. The shade can be mounted on these brackets whenever the upper sash is lowered



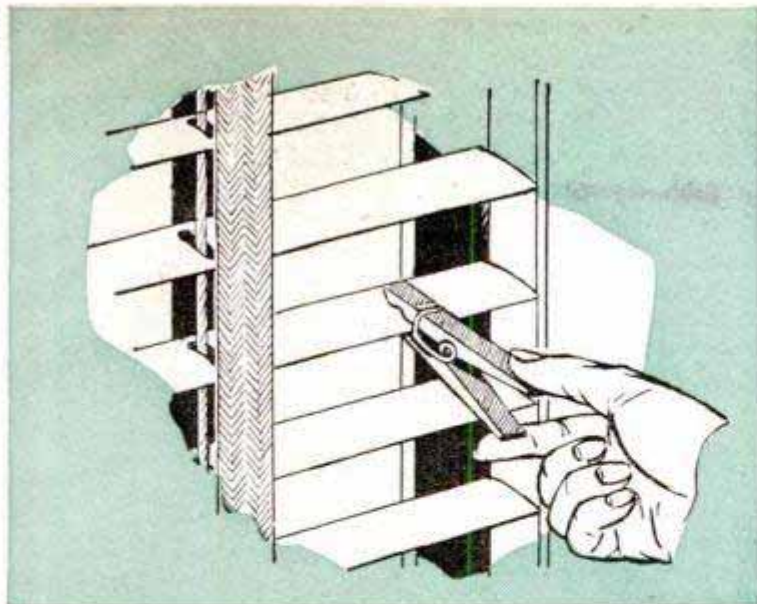
WHEN THREADING CURTAINS on a flat or round extension rod the cloth is apt to be torn by snagging on the joints. To prevent this, wrap the joints with cellulose tape so the curtain will slide over them. If the tape is covered by the curtains, the rod can be taped when fully extended and tape left in place



BEFORE INSTALLING RINGS on homemade plastic shower curtains it is a good idea to reinforce the top edge with a strip of adhesive tape. Cloth is folded over the tape and hemmed on the inner edge

RECIPES CLIPPED FROM NEWSPAPERS or magazines are held for easy reference by attaching them temporarily to side of a baking-powder can. Press the lid of the can over the clipping to hold it in place



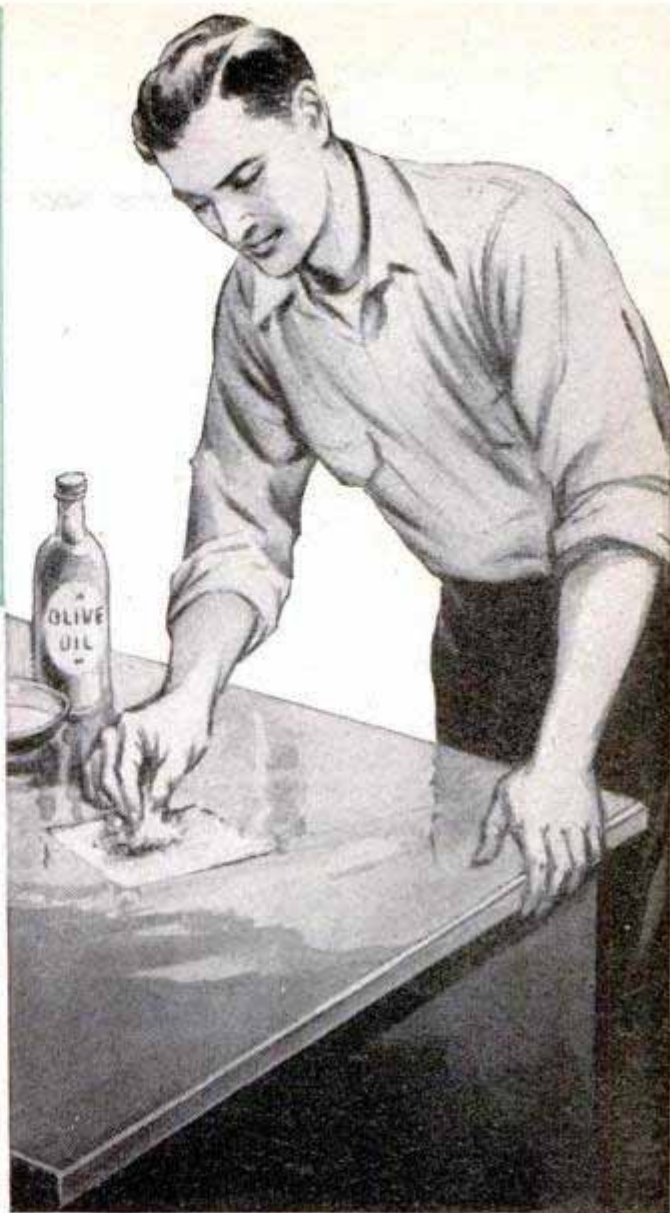


KEEP A SPRING-TYPE CLOTHESPIN handy when you are cleaning Venetian blinds. Then, if the telephone or doorbell rings, clip the pin to the slat being cleaned so you will know where to resume work

PAPER ADHERING TO VARNISH can be removed without damaging the finish by loosening it with olive oil. Apply the olive oil to the paper until it is thoroughly soaked, then pull the paper from the surface

SOLVING HOME PROBLEMS

DON'T WORRY ABOUT WATERING potted plants when you go on vacation. They may be watered for several weeks by placing each one in a large bowl and wedging two inverted quart-size bottles between the pot and bowl. The pot should be raised on blocks, if necessary, so the water barely touches the bottom



A STRIP OF CLOTH and some glue are the only items necessary to reset a loose picture-frame nail in a plastered wall. Wrap a narrow strip of cloth spirally around shank of the nail and dip it in the glue. Replace the nail in the hole and allow the glue to dry for a day or so before rehung the picture



Basement Windows Kept Cleaner With Concrete Splash Aprons

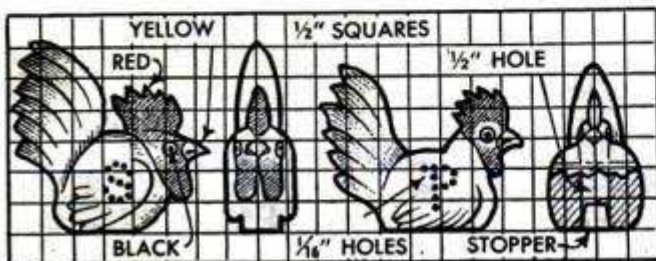


Finding that his ground-level basement windows were splashed with mud during heavy rains, one homeowner poured a concrete splash apron directly in front of each window. In addition to keeping mud from being splashed onto the glass, the aprons also add to the appearance of the house, as they provide an excellent place for setting flowerpots and boxes during the summer. The apron need not be more than 2 in. thick and can be poured directly on the ground, using a shallow wooden form. A space of $\frac{1}{4}$ in. should be left between the window sill and the apron. This space is filled with tar or asphalt emulsion after the concrete has hardened.

Walter E. Burton, Akron, Ohio.

Whittled Salt and Pepper Shakers Provide Novel Table Decoration

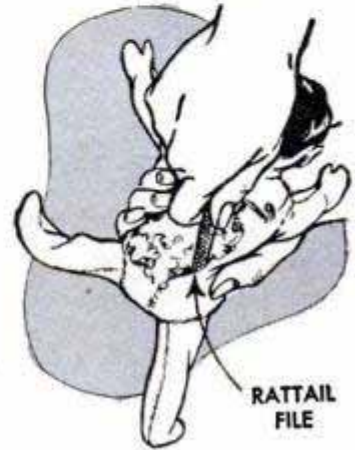
Quickly whittled from blocks of white pine, this rooster and hen are a pair of novel salt and pepper shakers that will be



right at home with the breakfast bacon and eggs. The birds are carved as shown in the squared pattern and a $\frac{1}{2}$ -in. hole, 1 in. deep, is drilled into the base of each figure. Then, $\frac{1}{16}$ -in. holes are drilled through one side of both the rooster and the hen to form the letters S and P. Corks are used to plug the $\frac{1}{2}$ -in. holes. On the original set, the heads of the birds were painted red and the beaks and eyes yellow. The bodies were coated with clear shellac and rubbed to a luster.—Wm. P. Kupka, Chelsea, Iowa.

Rattail File Aids Stuffing Toys

When stuffing dolls and toy animals, try using a rattail file to work the stuffing into the limbs. As the teeth of the file have a forward rake, the material will stay in place when the file is withdrawn.—Charles H. Hardy, Los Angeles, Calif.



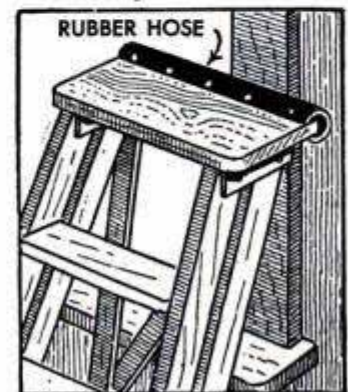
Concrete Laundry Tubs Repaired By Waterproof Crack Filler

If you want a long-lasting repair for cracked concrete laundry tubs, try filling the cracks with a waterproof paste made by mixing white paint or white lead in oil with dry portland cement. First, be sure that the tubs are dry and scrape any loose material from the cracks. Add the cement gradually to the paint, mixing continuously, until the mixture is of the consistency of fresh putty. Then fill the cracks by pressing in a liberal amount of the paste and smoothing off the excess with a heavy stroke of a putty knife. The paste will harden and the tubs will be ready for use within a couple of days. The repair, if made carefully, should last for many years.

E. S. Macgowan, Minneapolis, Minn.

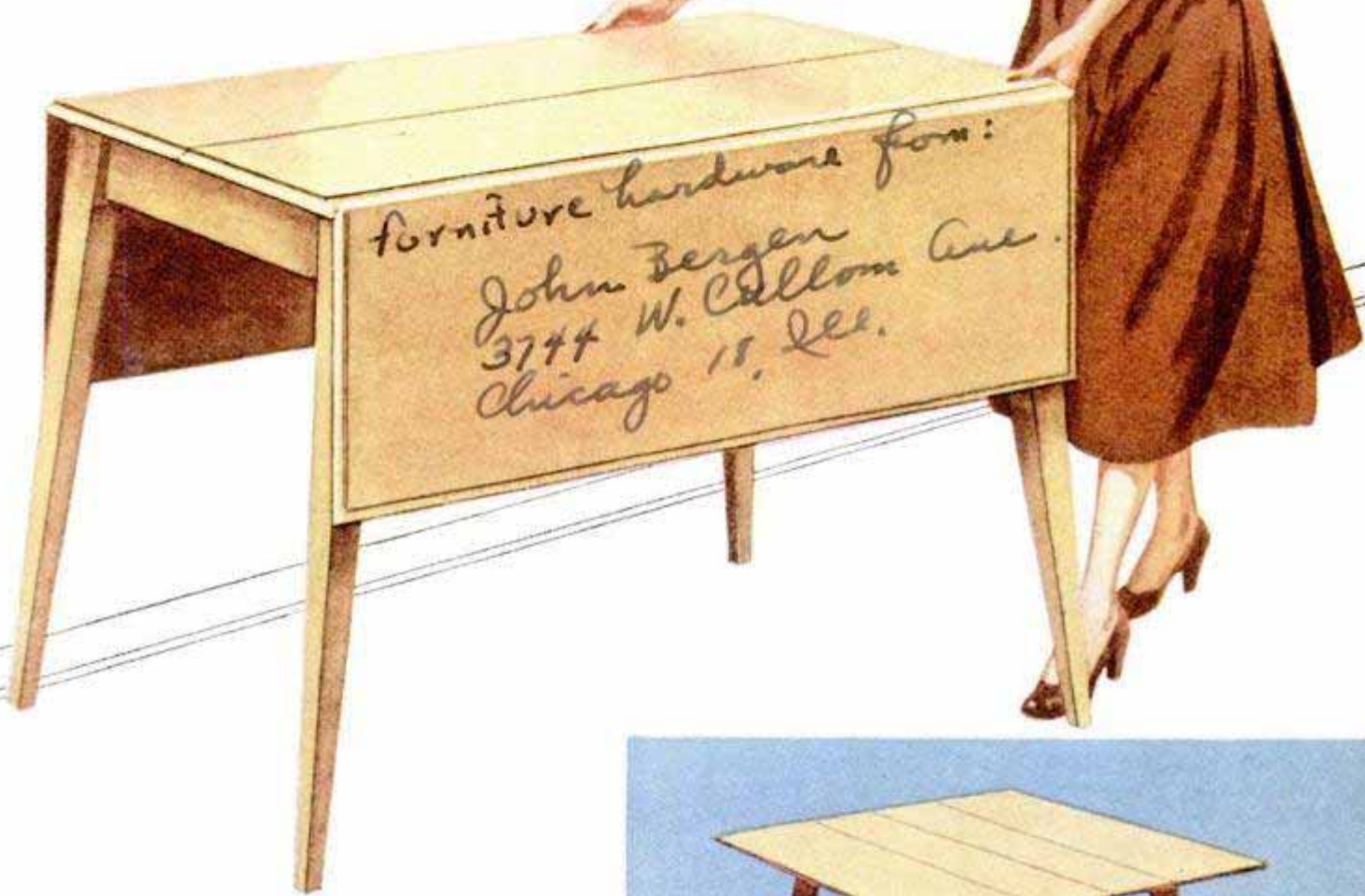
Rubber Bumper for Stepladder

To keep a stepladder from marring interior trim when it is leaned against it, attach a strip of garden hose over the rear edge of the top step. Just slit the hose lengthwise, notch if required, and nail it in place.



OCCASIONAL FURNITURE

Includes a drop-leaf table, made to order for a combination living-dining room, and a sectional wall ensemble, the units of which can be interchanged to form varied groupings



Story by Wayne C. Leckey

DESIGNED as companion pieces to harmonize with the dining and living-room furniture series presented in our issues of September and November 1949, these smart occasional pieces can be used to augment the other pieces or used by themselves in any particular arrangement you desire. The drop-leaf table pictured above is designed especially for a dining alcove where limited space does not permit room for even a dinette set. Such is the case in the latest trend toward eliminating a separate dining room in favor of a combination living-dining room. This table adequately fills the requirement for a piece that takes little space

JANUARY 1950



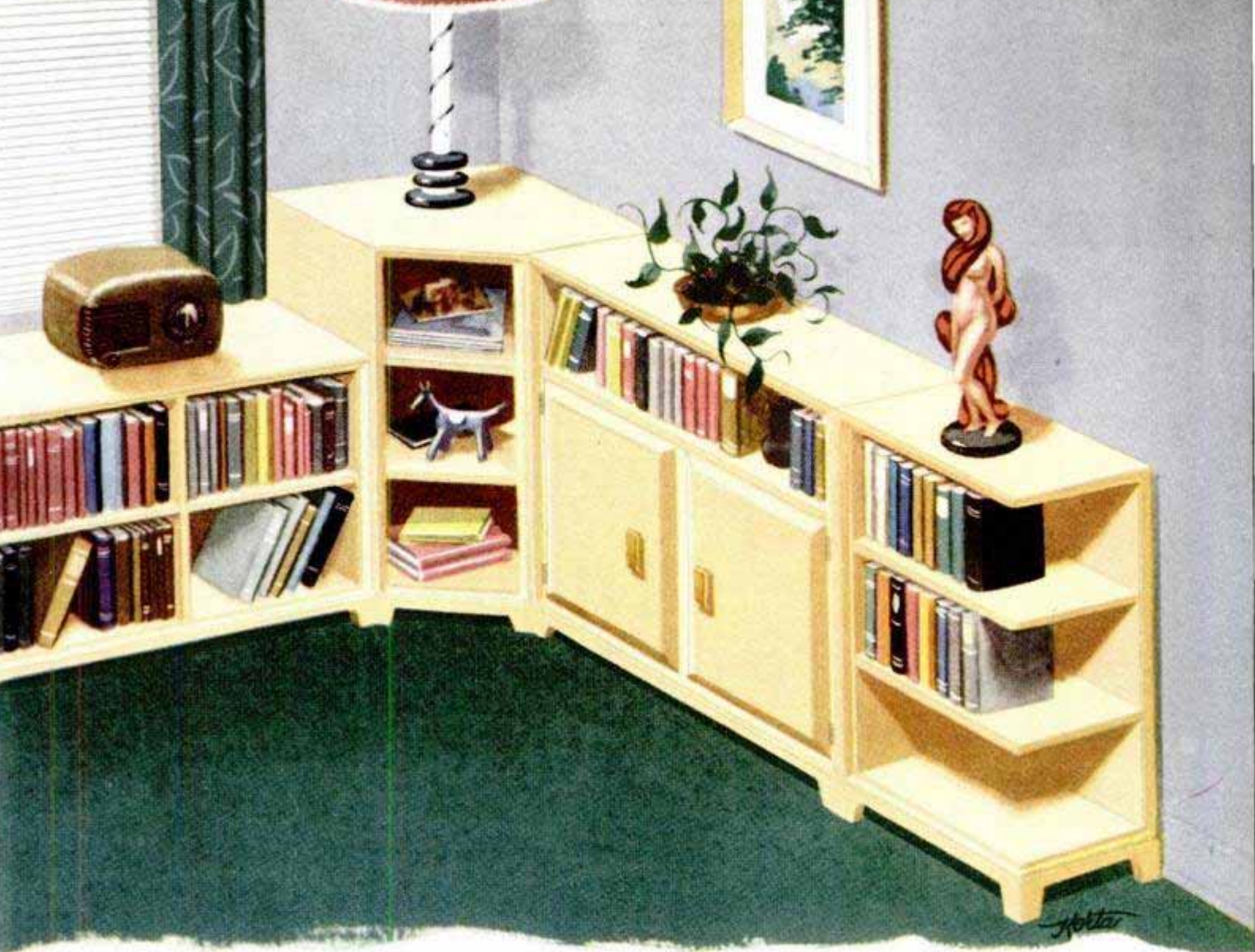


against the wall when not in use, and yet has big-table capacity when needed. To seat four persons comfortably, the leaves of the table are raised to a horizontal position and the whole top is rotated 90 deg. on a center pivot. In this position, the base of the table supports the drop leaves as shown in Fig. 1. Retractable brackets in each end of the table pull out to support the leaves when the table is fully extended. A lazy-tong mechanism, taking the place of the usual extension slide, extends to permit insertion of two extra leaves, Fig. 2, providing a top surface 40 x 74 in. Suitable dining chairs for the table can be made by following the plans presented in our September 1949 issue, which covers the construction of a complete dining-room suite. Actual construction of the table, detailed in Figs. 12, 13 and 14, will be explained later in the article.

The pieces of the functional wall ensemble pictured above are coordinated in size to fit together in a number of separate sectional arrangements in addition to the complete grouping shown. For example, the secretary, pictured in use at the bottom of

the opposite page, may be combined with an open-end bookcase at each side. Likewise, the three-shelf unit, with doors at the bottom, may be grouped in the same way. An attractive corner grouping is had by flanking the corner bookcase with end bookcases. Still another arrangement is to place the window unit between two end bookcases. These are but a few of the attractive arrangements that are possible with these sectional pieces. If desired, any one of the three basic units, namely, the secretary, three-drawer chest and two-door chest, may be used individually.

The secretary features a pull-out writing shelf which looks like a drawer when closed. The "drawer" front is hinged with special fixtures and lets down to become part of the writing surface. The secretary, like the others, is made primarily from plywood, with solid stock being used for the drawers, base and edging. The same edging, which is characteristic of all the pieces previously presented in our furniture series, also is used here to give a hopper-front effect and at the same time to conceal the laminations of the plywood. Figs. 3 and 4

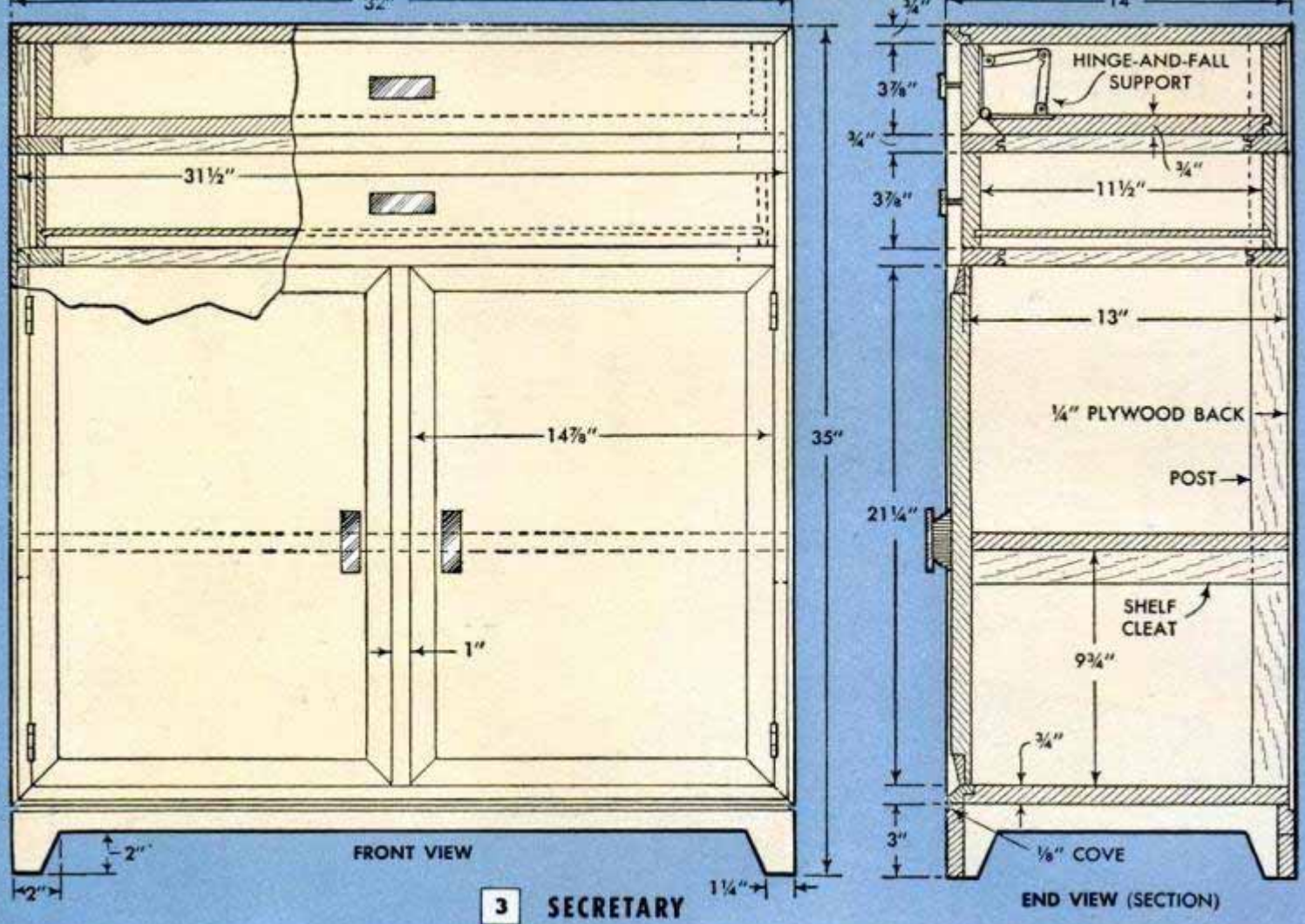


Styled by John Bergen, noted furniture designer

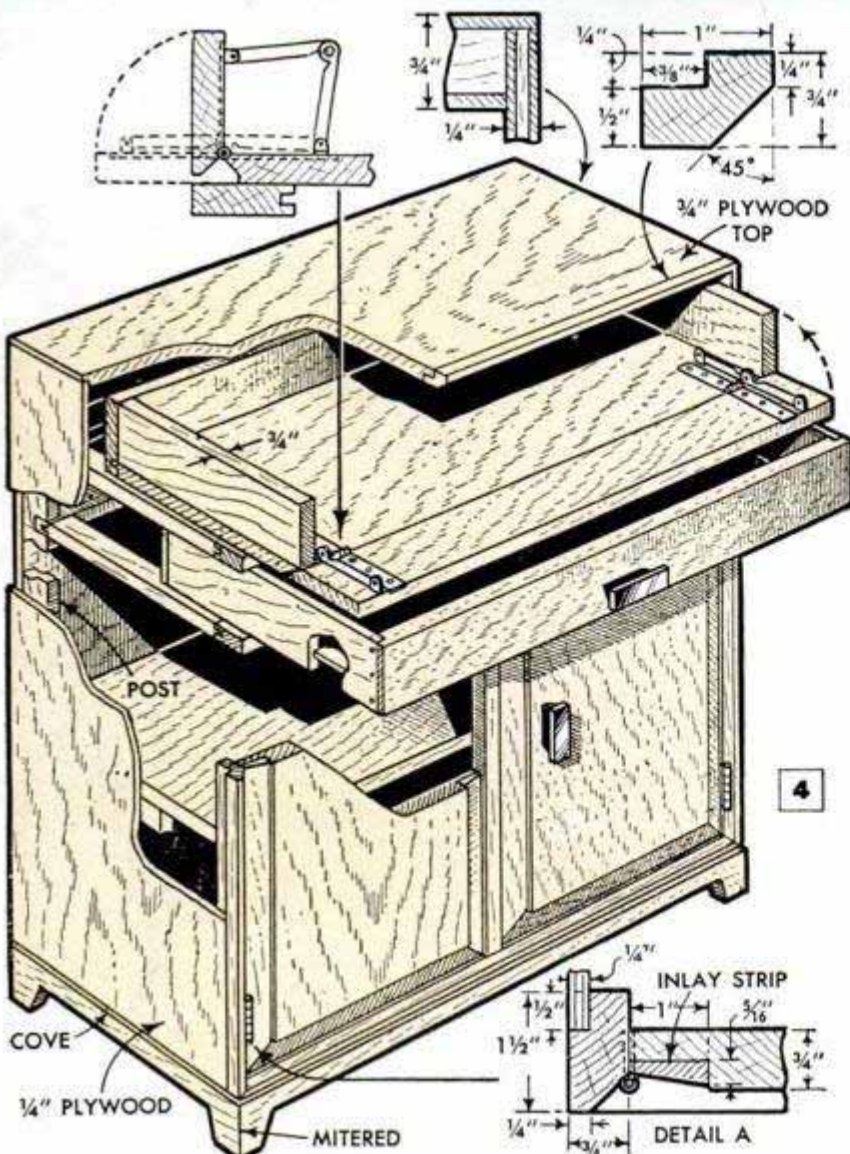
detail the construction of the secretary. In comparing its construction with that of the other pieces you will notice that much of the construction is duplicated. The bases are all the same, as are the drawers and, in most cases, even the manner in which the plywood panels are fitted. The exception is noted in the window, corner and end units which are designed to be flanked by other pieces. Here, the plywood is placed on the inside instead of the outside of the framework. Plywood, $\frac{1}{4}$ in. thick, is used to cover the sides and back of the secretary, while $\frac{3}{4}$ -in. plywood is used for the top.

Make the base assembly first. The members are mitered at all four corners, the rear member having a rabbet cut in the top edge to take the plywood back. A small, $\frac{1}{8}$ -in. cove is run along the top edges of the other pieces, which can be done either before or after gluing and nailing the base together. The hopper edging which frames the front of the





3 SECRETARY

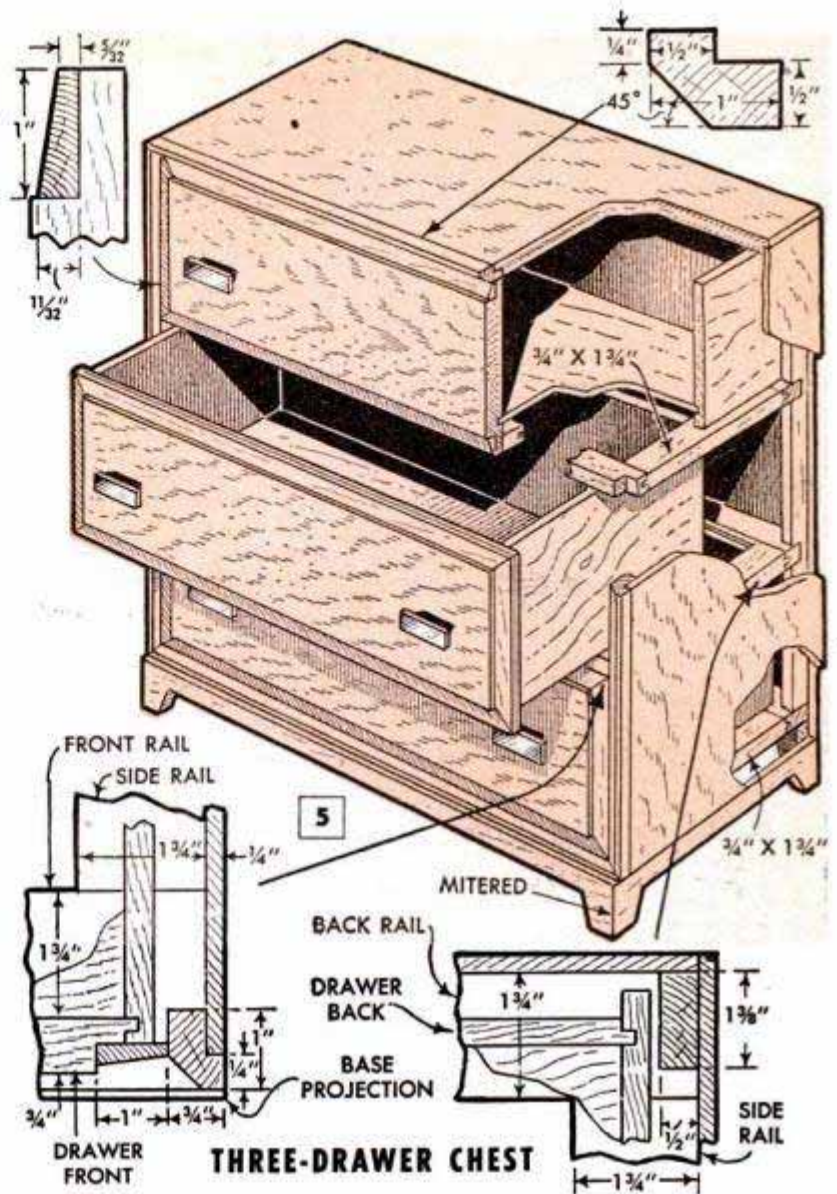


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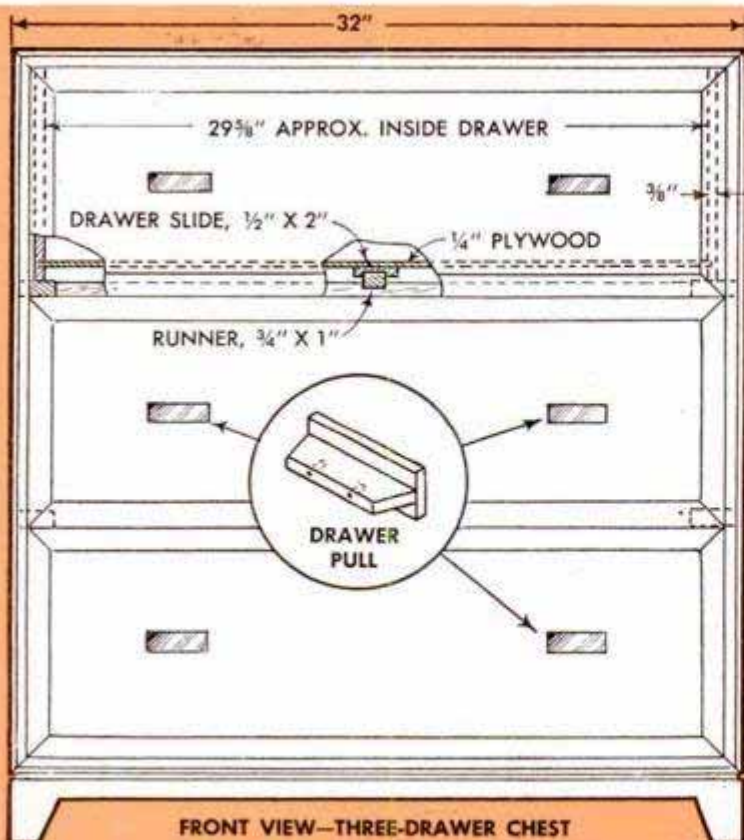
cabinet is shaped according to the sectional details included with the cutaway drawing, Fig. 4. The center and bottom shelves can be of plywood, or glued up from solid stock. These should be cut 31½ in. long and the front edge of the bottom shelf rabbeted for the hopper edging. Then the bottom shelf is glued and nailed to the base assembly. The ¾-in. top, including the edging, should have the same over-all measurements as the base. This is rabbeted on all four edges. Note at the ends that the rabbets are cut ¼ in. deep and to the thickness of the top ply of the wood. The top is supported at the rear corners by posts and at the front by the hopper edging. Frames for the drawer and writing shelf are typical open frames, being assembled from ¾ x 1¾-in. stock. Inner edges of the front and rear members are grooved to take tenons formed on the ends of the side members. The frames are fitted into notches cut in the rear posts and supported at the front by nailing into them through the edging rabbet. The ¼-in. side panels overlap the edge of the plywood back

and are cut to fit accurately in the rabbets of the top and in the edging strips. The writing shelf is made similarly to a drawer except that the front is hinged. Note in the sectional detail, Fig. 4, that the bottom edge of the front piece is beveled to match a similar cut made on the front edge of the shelf. A stop should be fitted in the underside of the top to prevent the shelf from being pulled all the way out, and a bullet friction catch installed to hold the drop front closed. Construction of the drawer is apparent from the drawing. Plywood is best for the two doors, but solid stock can be used. In producing the raised-panel effect in plywood, an inlay strip is used to conceal the plies as indicated in detail A, Fig. 4. The door and drawer handles pictured are made up special from $\frac{1}{4}$ -in. brass. Fig. 11 shows how these are soldered together T-shaped and then drilled and tapped for attaching with machine screws. The edges are rounded slightly with a fine file and then the brass is buffed to a high polish. A thin coat of clear lacquer will keep the handles bright.

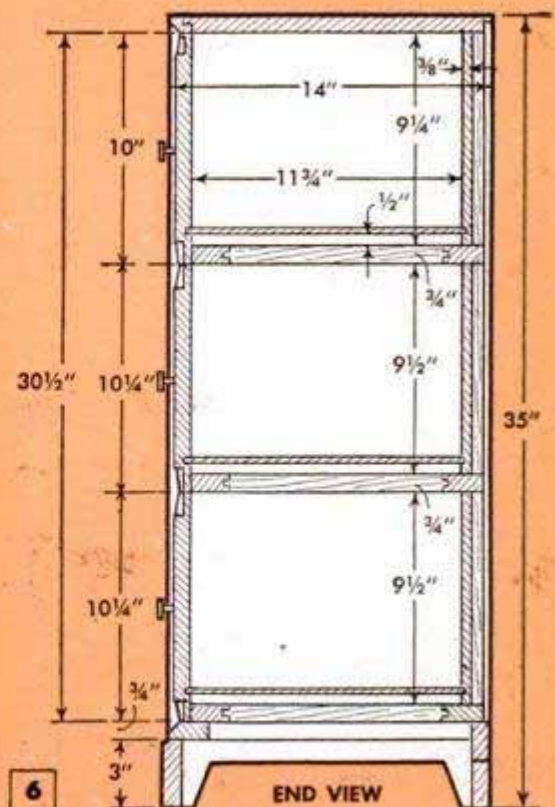
The three-drawer chest is



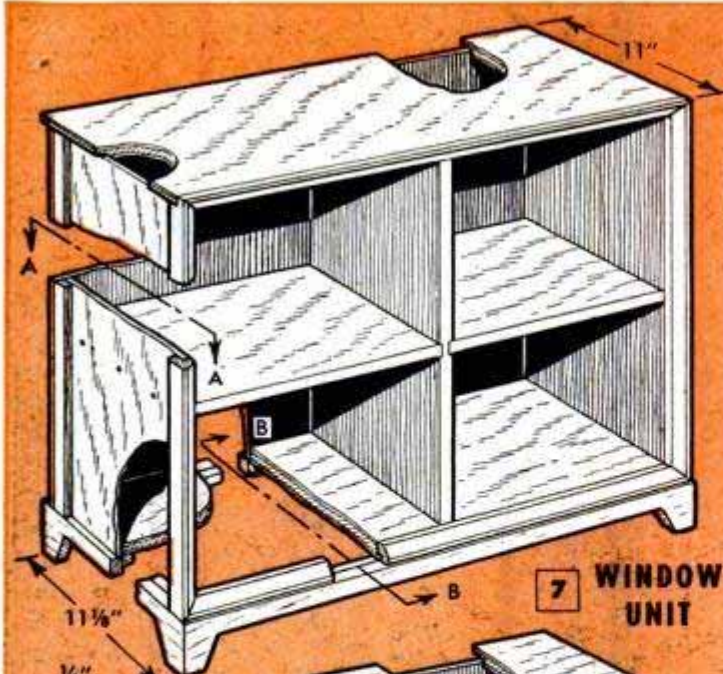
THREE-DRAWER CHEST



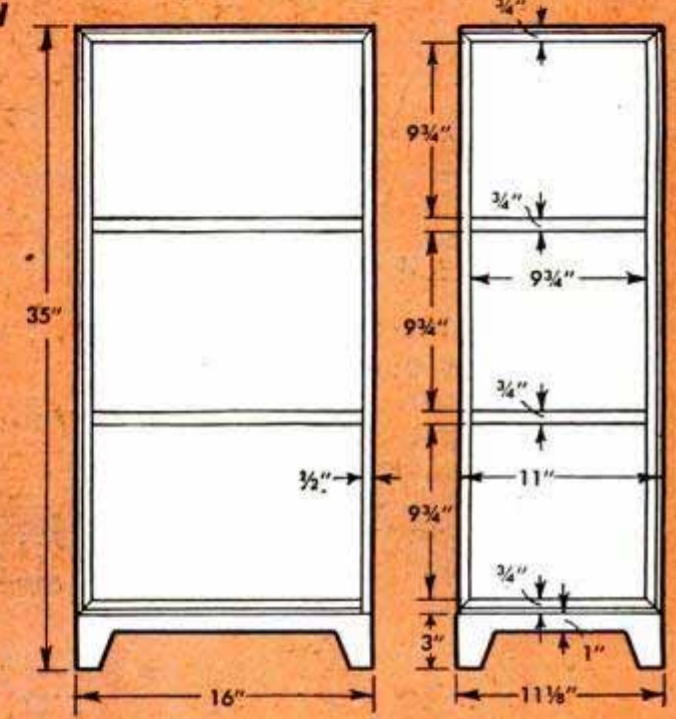
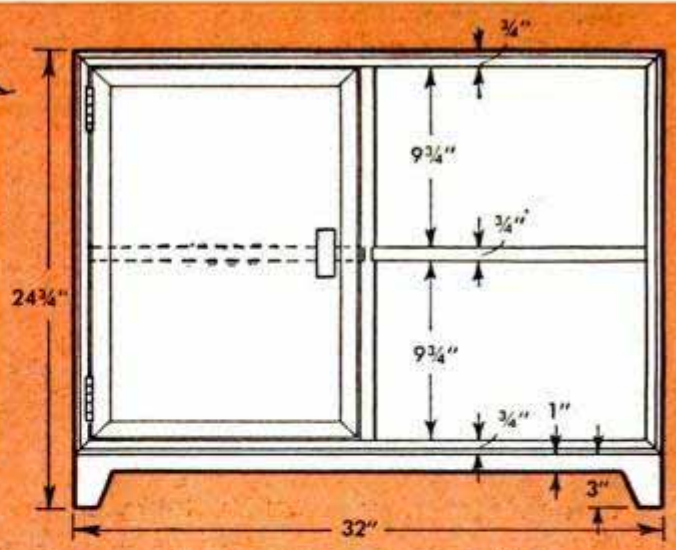
FRONT VIEW—THREE-DRAWER CHEST



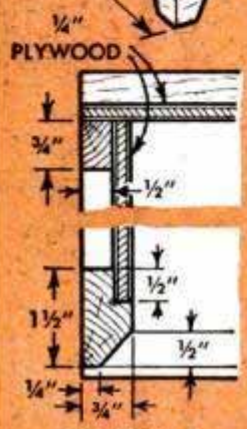
END VIEW



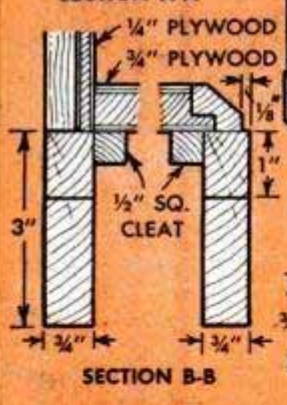
7 WINDOW UNIT



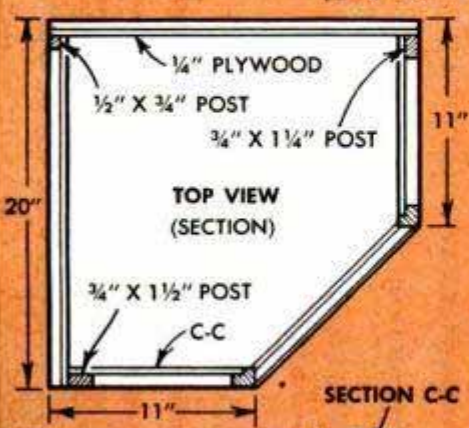
8 END UNIT



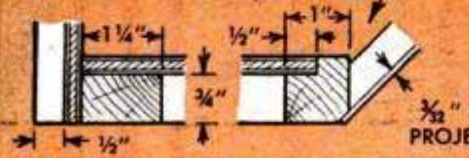
SECTION A-A



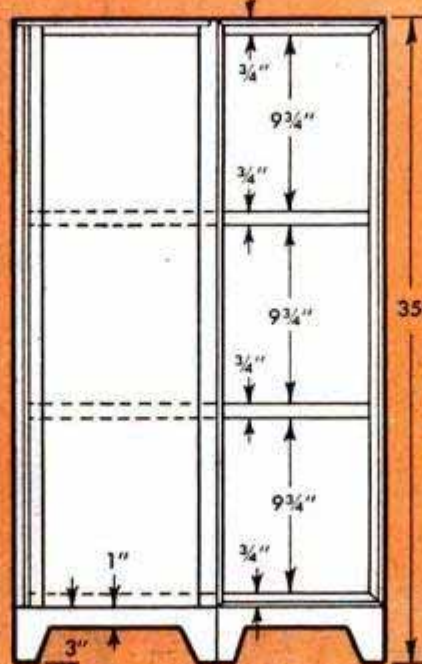
SECTION B-B



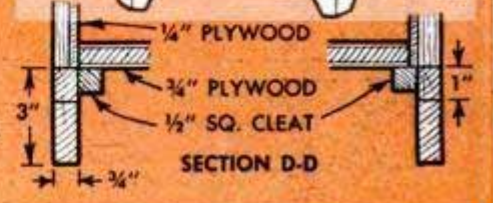
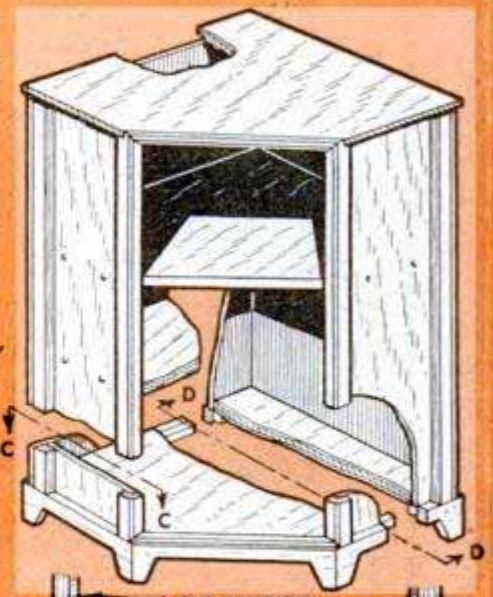
TOP VIEW (SECTION)



SECTION C-C



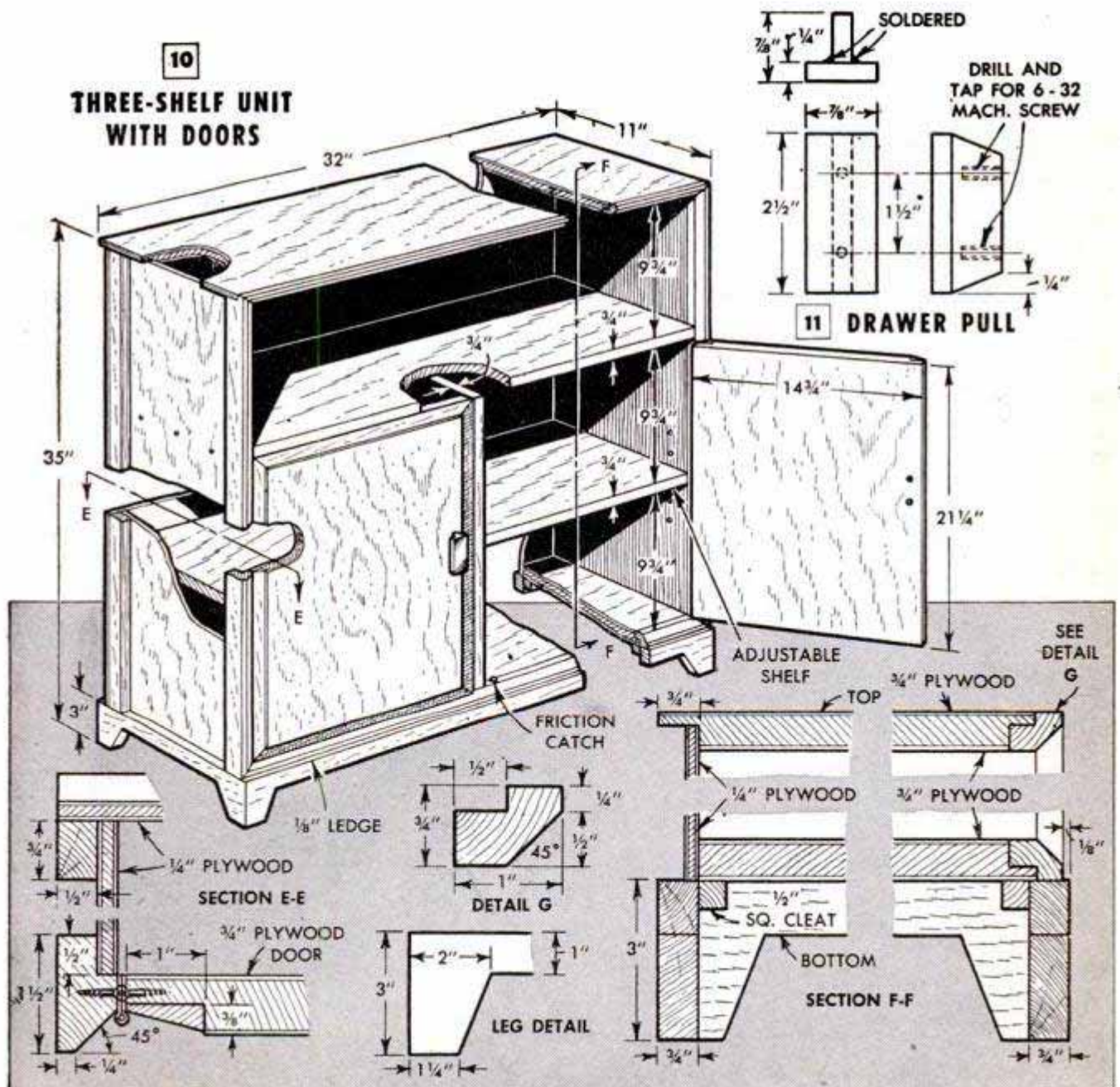
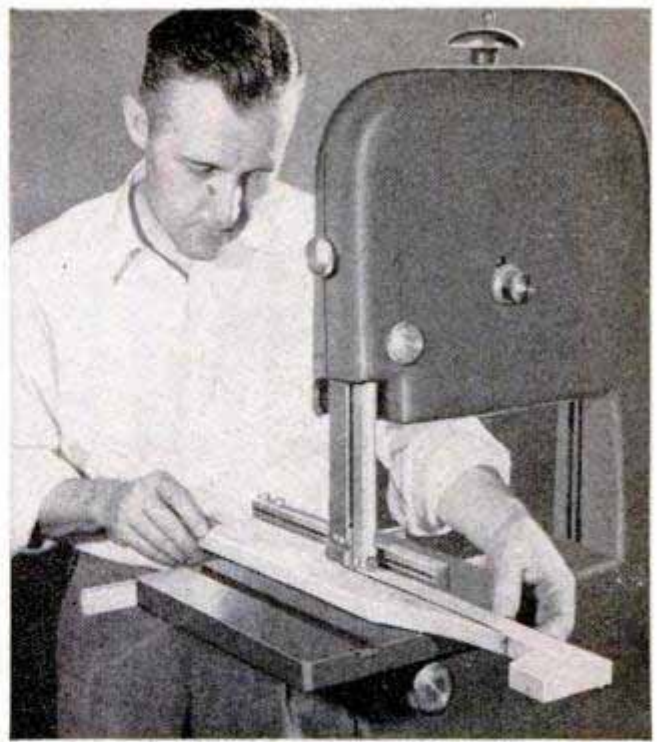
9 CORNER UNIT

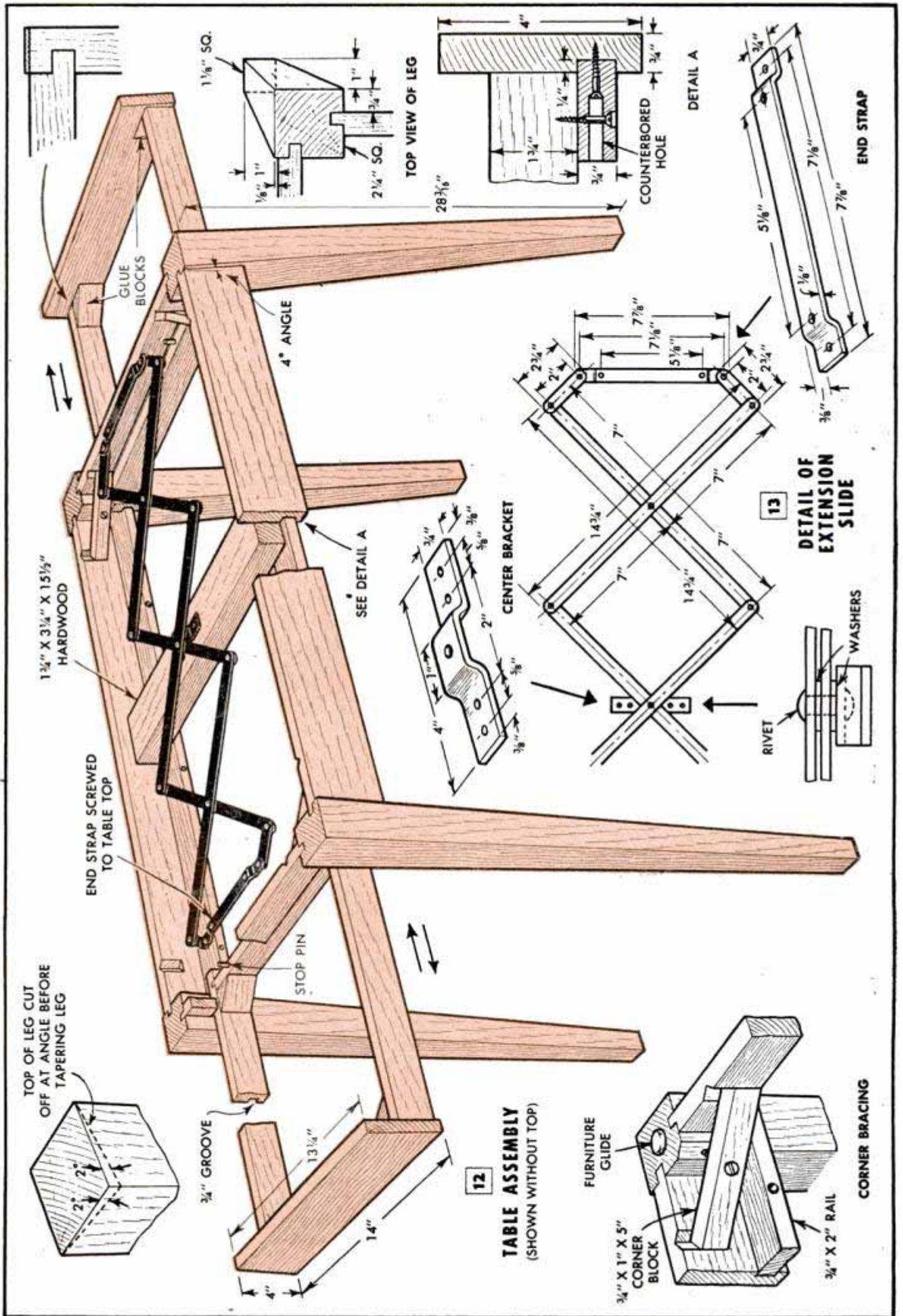


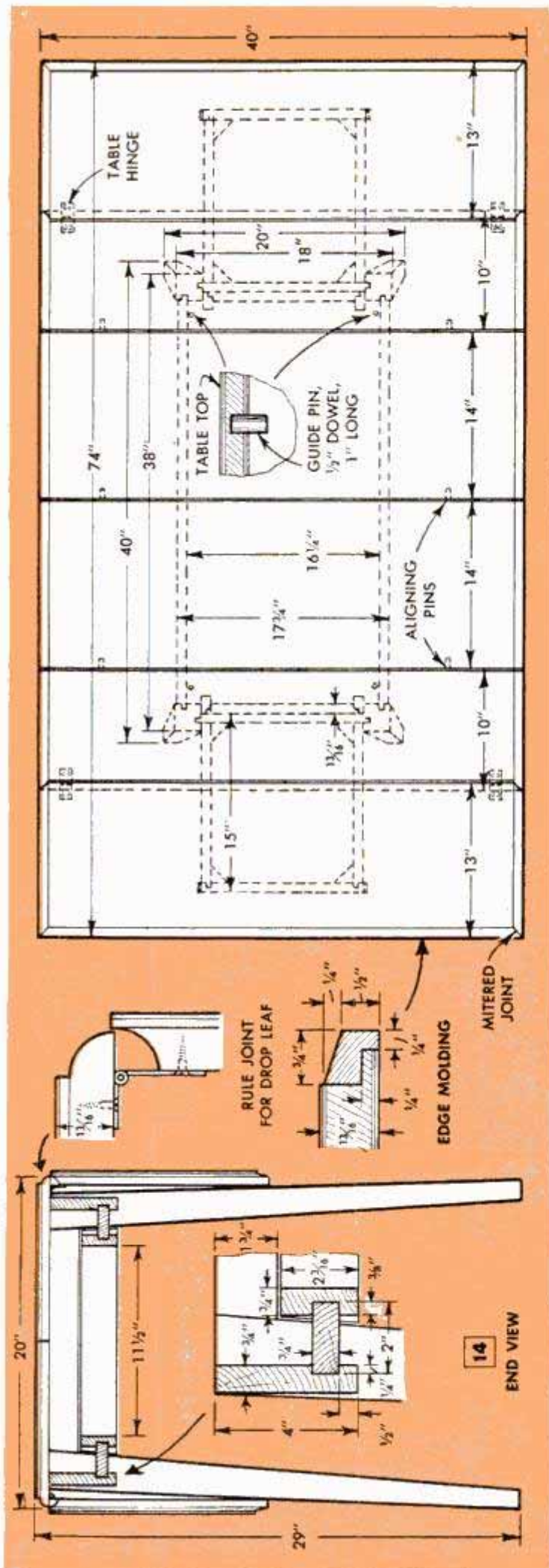
SECTION D-D

basically of the same construction. The cutaway drawing in Fig. 5 and the front and side views in Fig. 6 give the necessary details. Typical chest construction is employed with frames supporting each drawer. Hopper edging is applied as explained before and the drawer fronts are inlaid around the edges. The front view, Fig. 6, details the drawer runners. The strip nailed to the frame engages a wooden channel which is glued and bradded to the bottom of the drawer. This same type of runner is used for the drawer of the secretary. The lower details, Fig. 5, show plan views of the drawer at the front and rear corners.

Window, end and corner units, Figs. 7, 8 and 9, differ basically in construction in that the plywood side panels are placed on the inside of the cabinets instead of the outside. Whether this should be done on the sides of the corner unit depends upon the grouping arrangement. If placed next to the window unit as pictured on page 183,







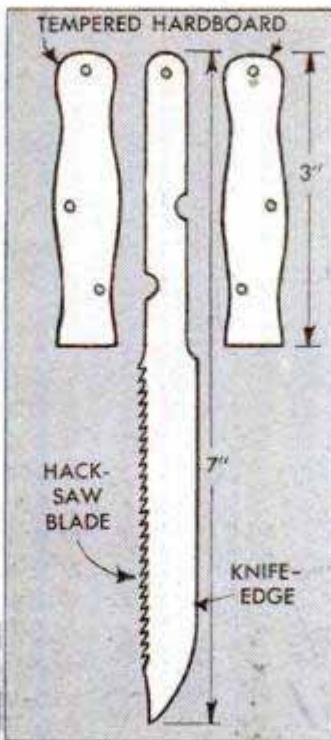
the plywood will have to be applied to the outside. Remember in cutting duplicate parts that the end units will have to be right and left-hand assemblies.

The three-shelf unit, shown fitted with doors in Fig. 10, can be made entirely open, in which case the partition is eliminated and the middle shelf brought out even with the one above it. The sectional details accompanying the cutaway drawing in Fig. 10 show how the 1/4-in.-plywood side panels fit in rabbets cut on the inner edge of the hopper edging.

The drop-leaf table, Figs. 12, 13 and 14, has flared, tapered legs which assume the correct slant by making a compound cut at the top and bottom. This is done before tapering the legs in one of two ways: Either set the miter gauge 2 deg. and tilt the saw table 2 deg., or, support the work horizontally on one corner and make the cut with the gauge set at 2 deg. and the table at 90 degs. Only the adjacent inner faces of each leg are tapered, as indicated in the top-view detail, Fig. 12. The leg tapers from a full 2 1/4-in. square at the top to 1 1/8 in. at the bottom. The two side aprons of the table are angle-cut to match the slant of the legs and the ends are rabbeted to fit open mortises cut in the tapered faces of the legs. Note in detail A that the side aprons are grooved along the lower edge to take strips on which the retractable end brackets slide. Half-width aprons are fitted across the ends of the table and then corner blocks are applied in the manner shown in the corner-bracing detail. Notice that a furniture glide is driven into the top of each leg to make the table top pivot easily. The pull-out brackets are made to slide under the end aprons and are corner-blocked for rigidity. A stop pin is provided at each side.

The lazy-tong extension slide is assembled from flat iron and riveted together as indicated in Fig. 13. This is pivoted to a center bracket which in turn is screwed to a hardwood center member installed between the side aprons. Each end of the extension slide is screwed to the underside of the two top leaves of the table. Fig. 14 shows an end view and a plan view of the table top including the two extra leaves. Outer edges of the plywood top are fitted with a mitered edge molding set in a rabbet, and a rule joint is run on the drop leaves for hinging them with regular drop-leaf hinges. When cutting the rule joints, be sure to allow sufficient clearance between the male and female members so that the joints will not bind after the finish has been applied to the surfaces. Note in the plan view that steel dowel pins forced in blind holes in the underside of the top align and guide the table top when extending it for inserting extra leaves.

Kitchen Knife Fashioned From Hacksaw Blade Handy for Peeling Vegetables and Sawing Bone



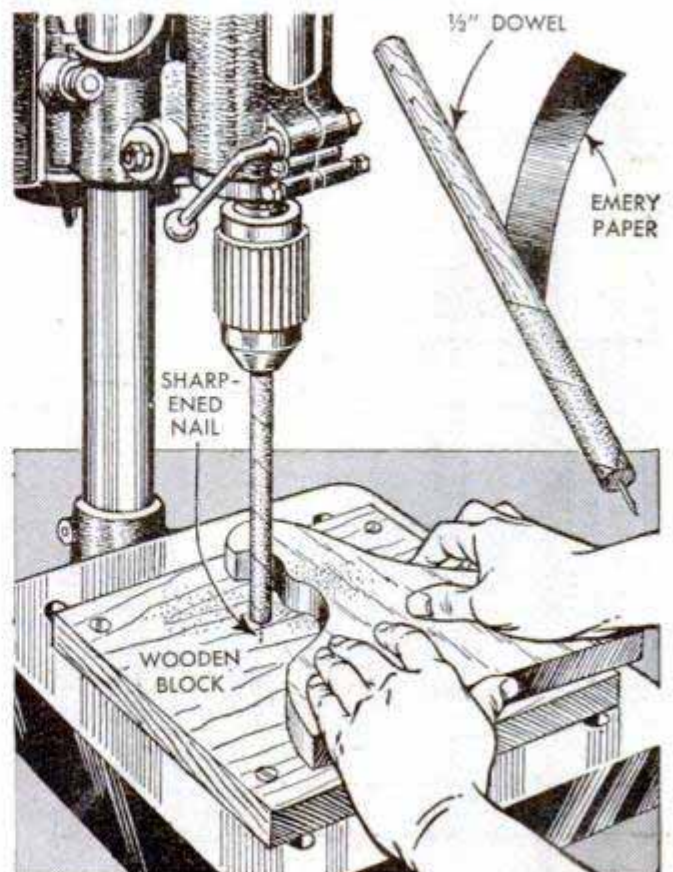
A real timesaver, this kitchen knife has both a keen cutting edge for vegetables or meat and a sharp, saw-tooth edge for bone and gristle. The knife is ground from a hacksaw blade and fitted with a handle of $\frac{1}{4}$ -in. tempered hardboard. A piece of hardboard is cut to fit each side of the blade and registering holes are drilled through both pieces to permit riveting them together. The edges of the hardboard are rounded and the ends of the rivets are ground flush with the handle. Finally, the crack between the handle sections is filled with plastic wood and the handle is shellacked.—J. Harley Hosack, Hartford, Conn.

Dowel Wound With Strip of Sandpaper Provides Efficient Spindle Sander

For removing saw marks and truing the edges of fine fretwork and small curved parts such as shelf brackets and ornamental scrolls, there's nothing quite as handy and efficient as a spindle sander chucked in a drill press. It is easy to make sanding spindles of varying radii by using ordinary dowels of different diameters up to $\frac{1}{2}$ in. Simply cut 6 to 8-in. lengths from the dowel rods, and drive a $1\frac{1}{4}$ -in. brad into one end of each length. Cut off the head of the brad and point the end. Then cut strips 1 in. wide and 8 to 11 in. long from fine emery cloth. Apply glue to the cloth back of each strip, wind it spirally around the dowel, and wind cord over the abrasive strip to hold it tightly in place until the glue sets. To use the spindle, insert the upper end in the drill-press chuck and tighten the jaws lightly. Clamp, or bolt, a square piece of

stock to the drill-press table and lower the spindle until the pointed brad is forced into the wood, then lock the spindle. The brad provides a bearing for the lower end of the sander. For sanding inside fretwork, just lower the sanding spindle within the area which is to be worked.

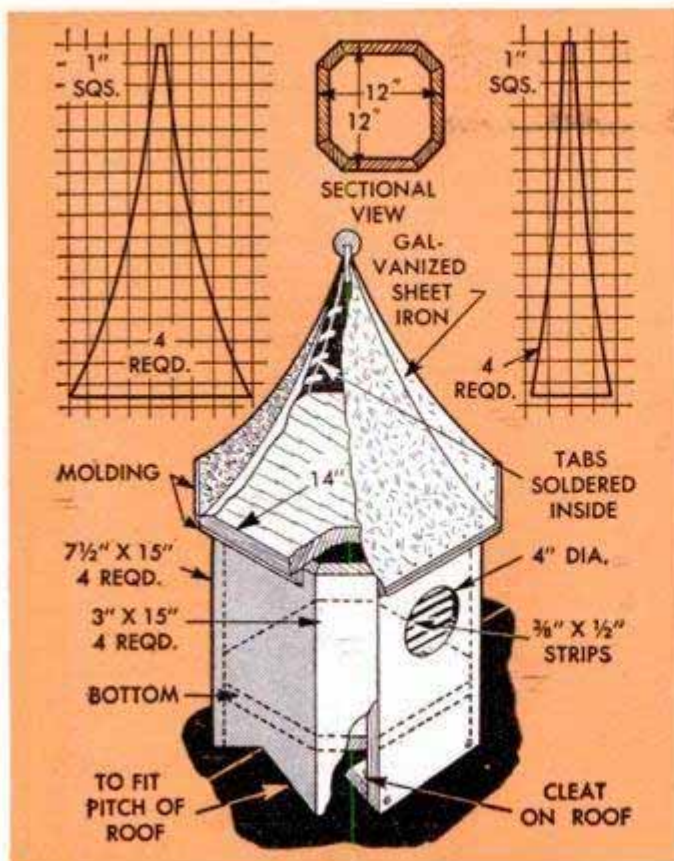
J. W. Jay, Palmyra, N. Y.



Asphalt Tile Cut in Saw Vise

After experiencing much difficulty in trying to cut asphalt tile to size with a saw, I did a faster and neater job by scoring the tile and breaking it off in a saw vise. After marking the tile, I clamped it in the vise with the edges of the jaws at the line. Then I scored each side of the tile, using the vise jaws as a straightedge, and broke the tile along the scores. Strips as narrow as $\frac{1}{4}$ in. can be cut in this way. If a saw vise is not available, extensions on a bench vise will do.—H. D. Wucher, Livingston, Calif.

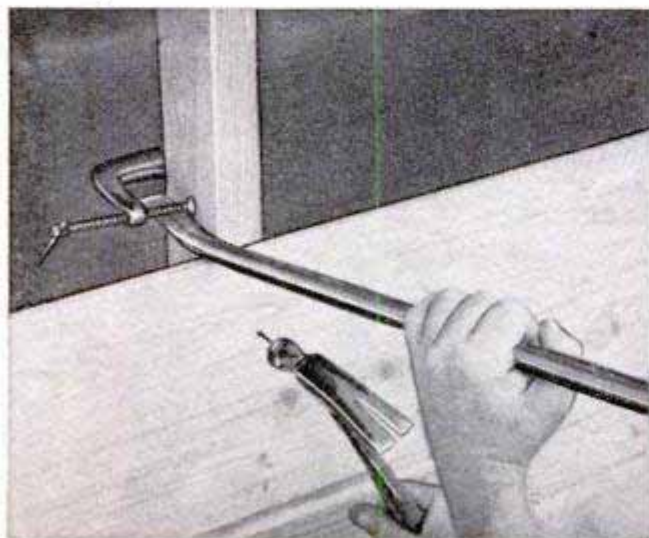
Eight-Sided Cupola Improves Garage Roof Lines



A cupola makes any gable-roofed garage easier to look at, for it "belongs," just as does a chimney on a house. As designed, this one is purely ornamental but, by making an opening in the roof on both sides of the ridge and flashing the joint around the bottom of the cupola when it is installed, it can be made to serve as a ventilator. If used as a ventilator, install two additional louvers. The cupola roof is made of sheet metal in the sloping "turret" type topped by a wooden ball. The crosshatched patterns show how to cut the roof parts and the cutaway view shows how the parts are joined by means of metal tabs sweat-sol-

dered across the joints. In the final assembly, the joints are seam-soldered to make them waterproof. Join the eight sides of the cupola with waterproof glue and clamp nails. Then nail a board over the top and shape it by sawing off the corners so that it overhangs the sides of the cupola 1 in. all around. Attach the roof to the board with small screws and finish with wood molding as shown. Cut the cupola sides to fit the roof pitch and attach to the ridge with cleats. Paint the body of the cupola to match the garage with the louvers in a contrasting color. The ball should be of the same color as the louvers.

Warped Boards Are Forced in Place by Using C-Clamp and Pry Bar



When laying flooring or applying siding or roofing, it is easy to force warped boards in place by using a C-clamp and a pry bar. The clamp is tightened to the opposite side of the stud or joist, as pictured, and the pry bar is hooked under it. The bar is pulled against the edge of the warped board to press the latter tightly against the preceding board, and the pressure is held while the warped board is nailed.

Charles Hedges, Clearwater, Fla.

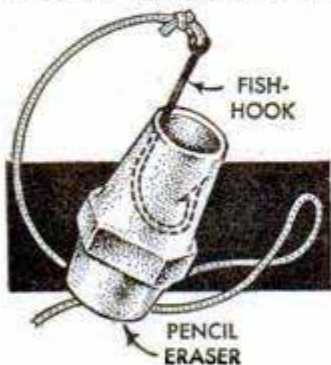
☐ To prevent nuts from freezing on bolts as a result of rusting, dip the threaded end of the bolt in shellac before turning on the nut. The latter may then be removed at any future time without difficulty.

Home Repairs Pipe Held Securely in Bench Vise To Facilitate Threading



When doing plumbing work in the home, a bench vise frequently is the only method of holding pipe for threading. However, the pipe is likely to slip when the vise is not equipped with pipe jaws. One homeowner solved this problem when threading long lengths of pipe by using a block of wood and a C-clamp to keep the pipe from twisting. The pipe is clamped in the vise near the end to be threaded and supported by the block which is placed near the edge of the bench. Then the free end of the pipe is drawn down and clamped to the far end of the bench with the C-clamp. The block of wood should be about the same height as the vise jaws and positioned as close to the center of the pipe as possible unless, of course, the pipe is longer than the bench.—G. E. Hendrickson, Argyle, Wis.

Pencil Erasers Sheathe Fishhooks



Fishhooks left on the line or carried in a pocket will not cause scratches or tear clothing if they are sheathed with erasers. The erasers are pliable enough to fit several hook sizes.

Safety Pin Locks Lunch Box

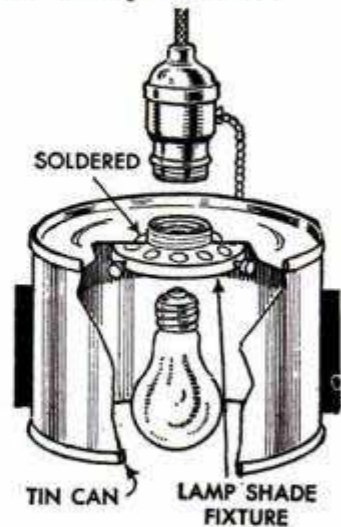
If the latches on your lunch box have a tendency to come open, resulting in an occasionally ruined lunch, lock them in the

closed position with safety pins. Just slip the arm of the pin through the lunch-box fastener so it keeps the latch from falling and then close the pin.

Victor H. Lamoy, Upper Jay, N. Y.

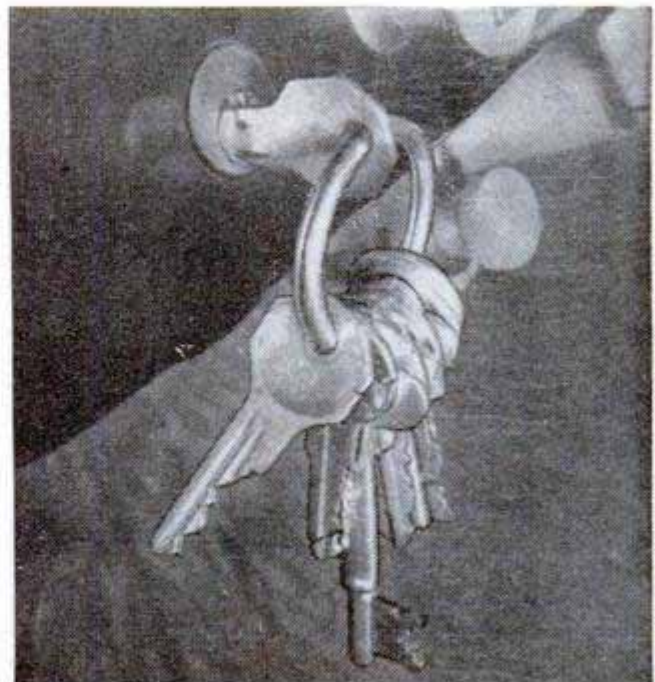
Coffee Can Forms Lamp Shade

Just the thing for an overhead shop light, this little shade is improvised from a 1-lb. coffee can and a standard lamp-shade fixture. A hole is cut in the bottom of the can and a fixture is soldered in place on the inside. Then, the shade is screwed onto the socket.



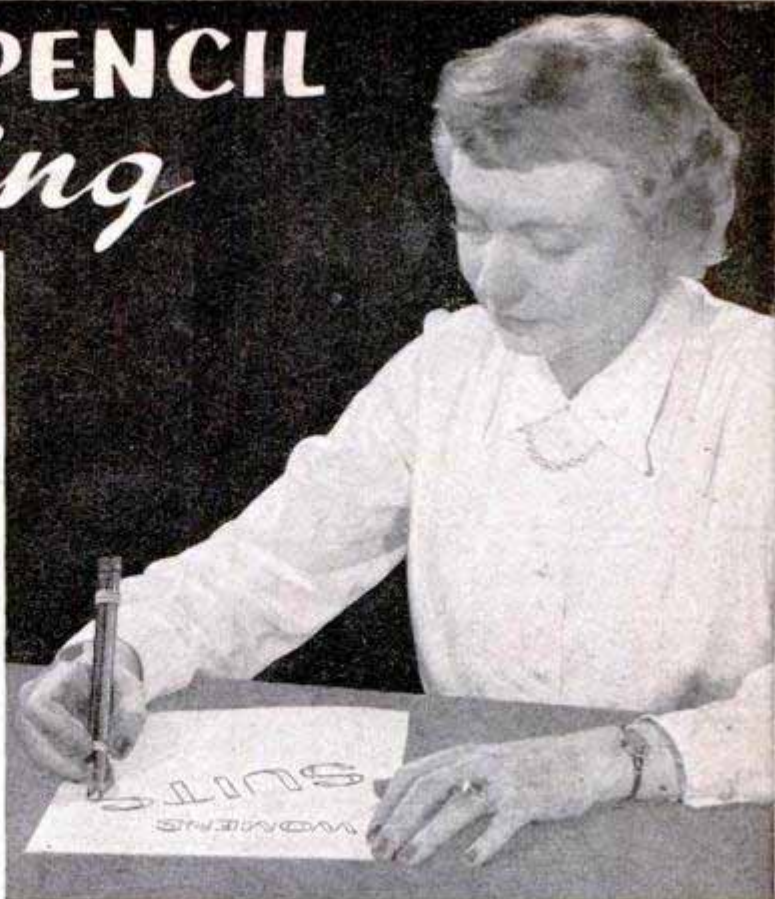
Preventing Ignition-Lock Trouble

The photograph illustrates a common reason for ignition-lock trouble—a heavy ring of keys dangling from the lock while the car is driven thousands of miles. In addition to damaging the lock itself, this practice causes a deep dent in the key which may result in the key failing to work in the car-door lock. It is easier on the ignition lock if you carry the key separately, keeping a spare one on the heavy ring if you like. At least twice a year, blow the dust out of the lock tumblers with compressed air. Then, dip the key in the finest graphite available and work the lubricant on the tumblers. This will insure dependable lock operation.—Ed Packer, Chicago.



DOUBLE-PENCIL *Lettering*

INDIVIDUALIZED sign and price-tag lettering, in definition almost equal to letterpress printing, can be done by anyone after a few minutes' practice. It's as easy as writing except that you use two pencils held side by side with rubber bands. Study the sample alphabet of outline letters at the bottom of the page and you'll see how it works. Note that most of the horizontal lines coincide while the vertical lines are made double. On some letters it is necessary to tilt the pencils so that only one point touches the paper. After outlining the letters, spaces between the lines can be blacked-in by inking with a small brush.



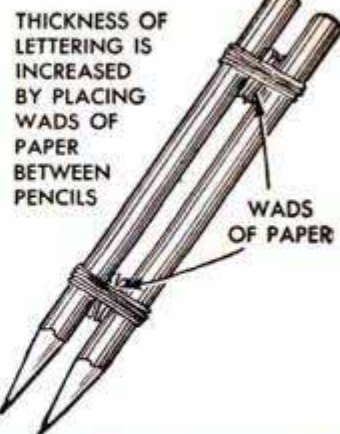
For exceptional neatness, use a ruler to make the vertical lines

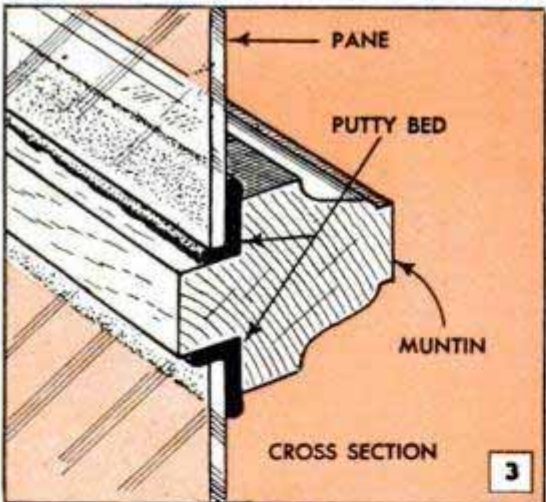
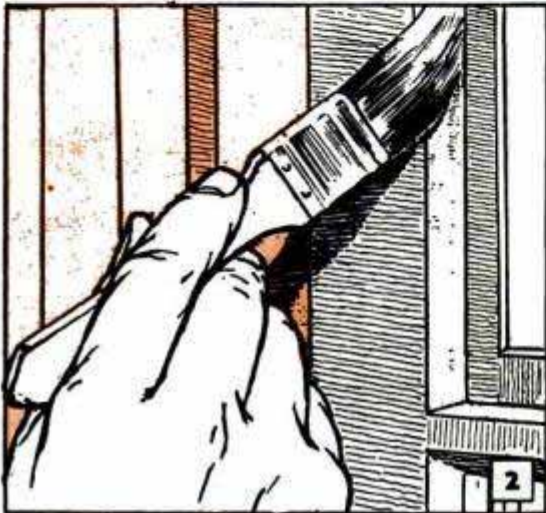
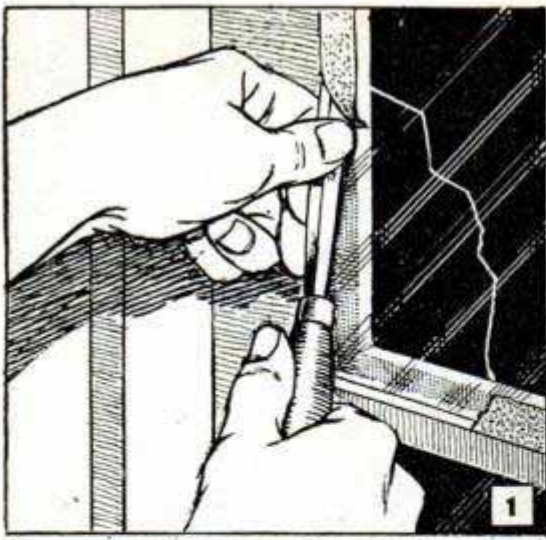


Distance between pencil points can be varied to suit the size of letters



Black-in spaces between lines to produce neat, bold-faced lettering





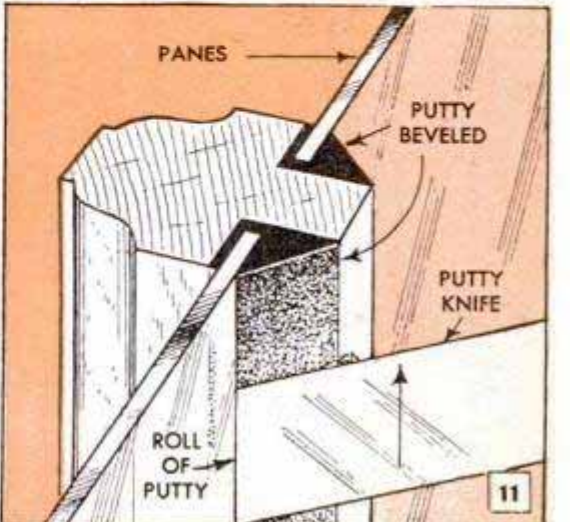
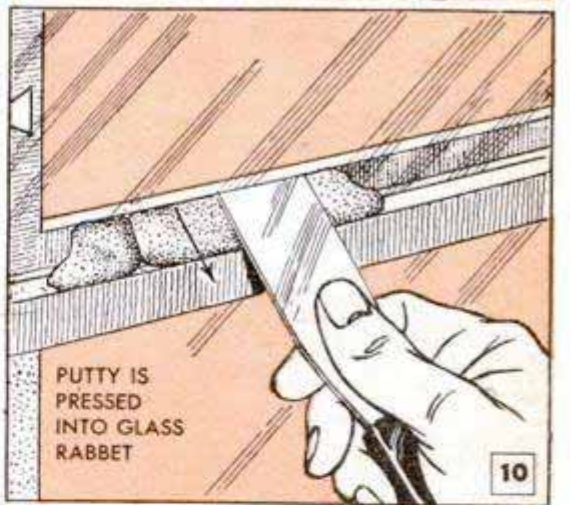
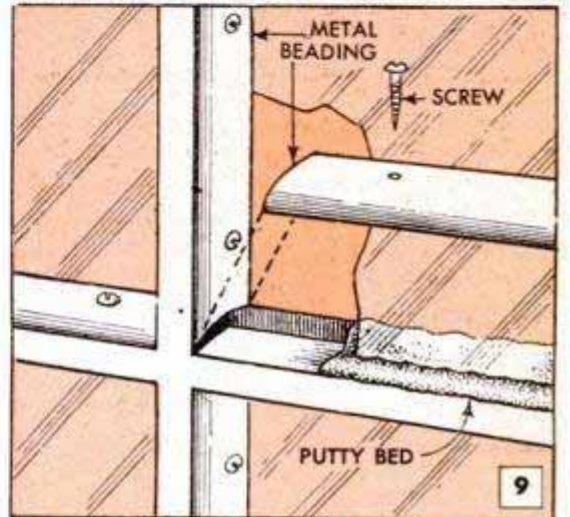
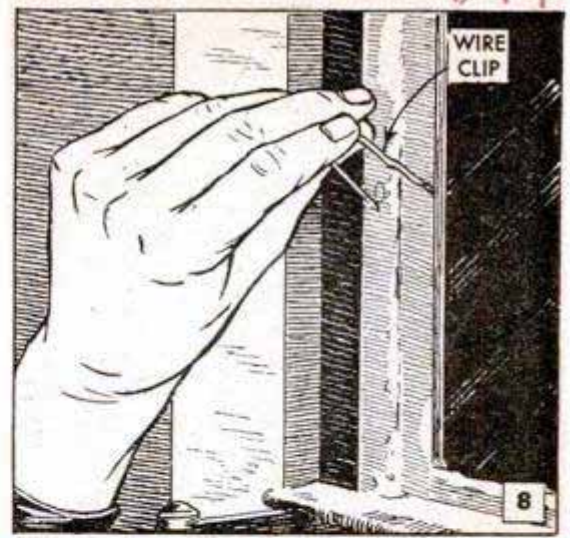
WINDOW

By E. R. Haan

IT'S AN easy matter to repair windows whether they're wood or metal, double-hung or casement, if you can determine what's wrong and apply effective remedies. Also, you can make substantial savings by replacing panes and sash cord yourself and fixing windows that stick or rattle.

Replacing broken panes: Measuring for a new windowpane and getting the repair materials can be done prior to removing the old glass and putty. The new pane should be about $\frac{1}{8}$ in. less over-all than the rabbeted opening in the sash. This allows a margin on each edge of the glass for irregularities and expansion. Precut panes are available in standard sizes at paint and hardware stores, or the dealer will cut the glass to suit. Ordinary window glass comes in two thicknesses—single strength (S.S.) for small panes not over 12 x 16 in. in size, and double strength (D.S.) for larger panes up to 36 x 48 in. The latter is used for all metal sash. There are three grades of window glass—AA, the best; A, intermediate, and B, least perfect. Always be sure to get the AA grade. Besides the glass, you will need glazier's putty. Dealers generally carry separate kinds of putty for wooden or metal sash. For wooden sash you will need No. 1 or No. 2 glazier's points. These are small, triangular pieces of sheet metal which hold the glass in place. Spring-wire clips are used to hold glass in metal sash, one end of each clip fitting in a hole in the sash while the other end bears against the edge of the glass.

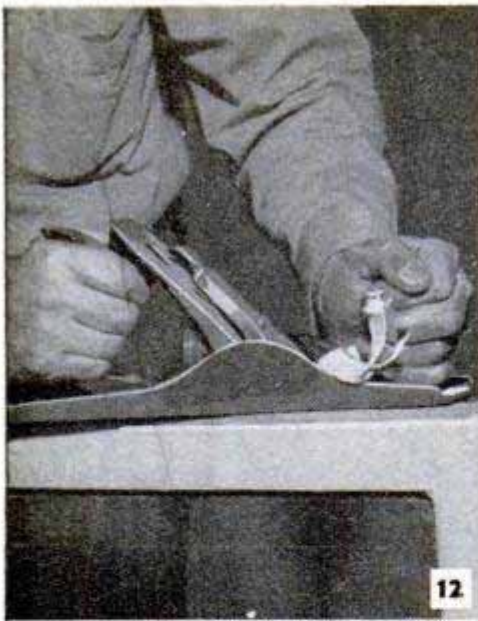
The first step in replacing a pane is to remove the old putty. Use a putty knife or a chisel, as in Fig. 1, and be careful not to cut into the sash. Also



UPKEEP

remove all broken pieces of glass and the old glazier's points or spring-wire clips. On wooden sash the cleaned rabbet is given a thin coat of paint or linseed oil, Fig. 2. After the paint or oil is dry, spread a thin layer of putty in the rabbet to "bed" the glass as in Fig. 3. Press the pane down against it carefully until the putty starts to ooze out. Then, on wooden sash, lay glazier's points on the glass and tap them into the wood with the flat side of a chisel as in Fig. 4. They should be spaced about 4 in. apart. Drive them in just deep enough to hold the glass securely. On most types of metal sash, spring-wire clips are used as in Fig. 8, but some types have metal beading bedded in putty and fastened with screws, as in Fig. 9. In this case, the beading is unscrewed and scraped clean of putty, and then simply relaid in putty and screwed in place again. After applying glazier's points or wire clips to hold panes in place, apply putty to the outside edge of the pane. The putty is pressed into the glass rabbet as shown in Fig. 10 and then beveled with the side of the putty knife, Figs. 7 and 11. After a few days the putty is painted, and the painting is repeated about every two years to prevent weathering. Loose sections of putty should be replaced, as it is important to keep the putty intact and painted. Otherwise, water seepage into the joints of muntins and rails of wooden sash will cause the wood to rot.

Double-hung windows: Both sashes of a double-hung window, Fig. 15, should work easily, yet without excessive play that permits rattling. In raising a stiff lower sash, don't push upward with the palms against the narrow check rail, as in Fig. 5, because this may result in loosening or



12



13



14

If waxing does not correct sticking sash, it may be necessary to reduce its width by planing. To remove sash, pry off stop bead on one side so sash can be swung outward. Use rag to protect casing as in center photo

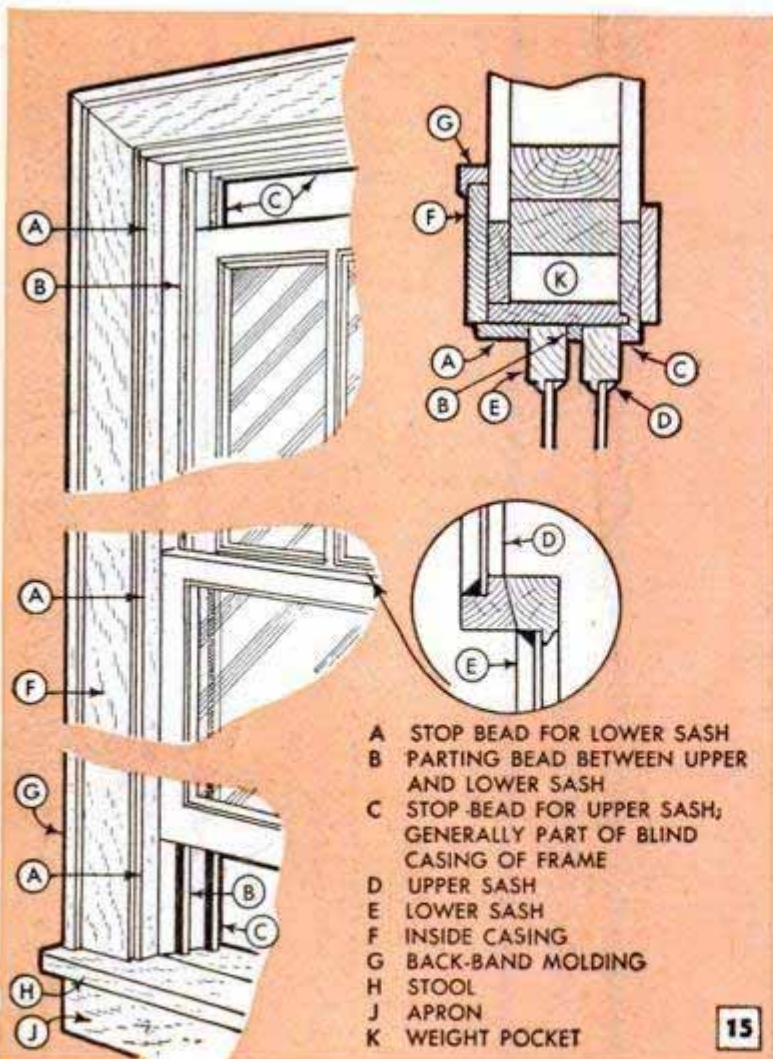
breaking the rail. Fig. 6 shows the proper method of pulling on the sash lifts. All average-sized windows should be provided with two sash lifts instead of only one at the center. This permits using both hands to distribute the pull uniformly.

On double-hung windows the most common causes of sticking are swelling of the

wood and sealing of the sash to the stops with paint or varnish. Frequently, sticking due to swelling is cured by applying wax, paraffin or stick graphite in the sash channels, but if the trouble persists the cause must be corrected. Find out if the sash fits too snugly between the stop and parting strips, or fits too tightly between the sides of the frame, or both.

Sometimes it is necessary to remove the sash and reduce its width by planing, as in Fig. 12. A lower sash is removed by first prying off the stop bead on one side, Fig. 13, so the sash can be swung out as in Fig. 14. Next, the sash cord is removed from the groove in the edge of the sash. The knot may have to be pried out, Fig. 16, after which the weight is lowered until the knot rests against the pulley. Then the sash is pulled away from the opposite channel, Fig. 17, to remove the sash cord on this side and let the weight down. Plane off a minimum amount of wood and check for fit after each cut. To remove the upper sash of a double-hung window, the lower sash must be removed first, and then the parting bead between the upper and lower sash is carefully pried out of the groove.

If tightness of a sash is caused by insufficient clearance for the sash between the stop and parting beads, a little dressing with a file or sandpaper held over a block often provides relief. If not, the stop or parting bead may have to be removed and dressed down with file, sandpaper or a block plane. The stop bead that retains the



15



16



17



18

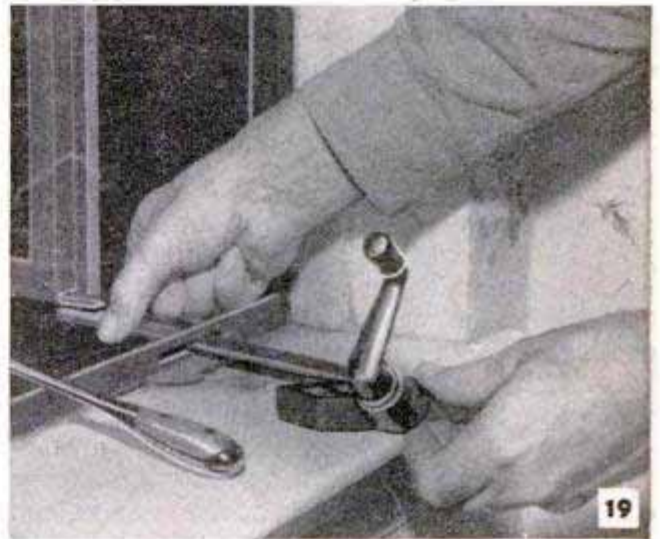
When one side of sash is free, remove cord and pull sash from opposite channel. Lower sash weights until knots rest against pulleys. Sticking caused by dried paint around sash can be corrected with point of sharp knife

lower sash can be shifted slightly to provide more clearance. When renailing it, the old nail holes should be avoided.

When sash and frame are stuck together by a film of dried paint, the film is cut by running the sharp point of a knife between the two as shown in Fig. 18. If the paint has run between the sash and frame it may be necessary to remove the sash so that the paint can be scraped or sandpapered. Another cause of tight sash may be that the window frames are thrown out of true by settling of the building. When moderate planing does not remedy the trouble, about the only alternative is to reset the frame so that it is plumb. This is a major undertaking similar to that described under the final paragraph entitled, "Replacing Wooden Sash and Frame."

Hard-to-work casement windows: When it is difficult to open and close wooden casement windows, the swelling of wood is often the cause. As a rule, light planing of each sash is the only sure remedy. Loose hinges, rusted hinges, or hinges out of alignment can make it difficult to open and close casement windows. Sticking also may result if the windows are closed after the sash and frame have been freshly painted. The framework of metal casement windows sometimes is forced out of true by settling of the building, making it almost impossible to open or close the sash. However, the fault may be in the closers which occasionally become hard to operate and require cleaning, oiling or adjusting. These devices usually are easy to remove, as shown in Fig. 19, and some of them are designed to operate without need of oiling. Oil the hinges periodically.

Rattling windows: On a double-hung window, rattling usually can be overcome



19

Crank-type openers on casement windows are easily removed for adjustment, above. Installing weather stripping in channel corrects rattling sash, below



20



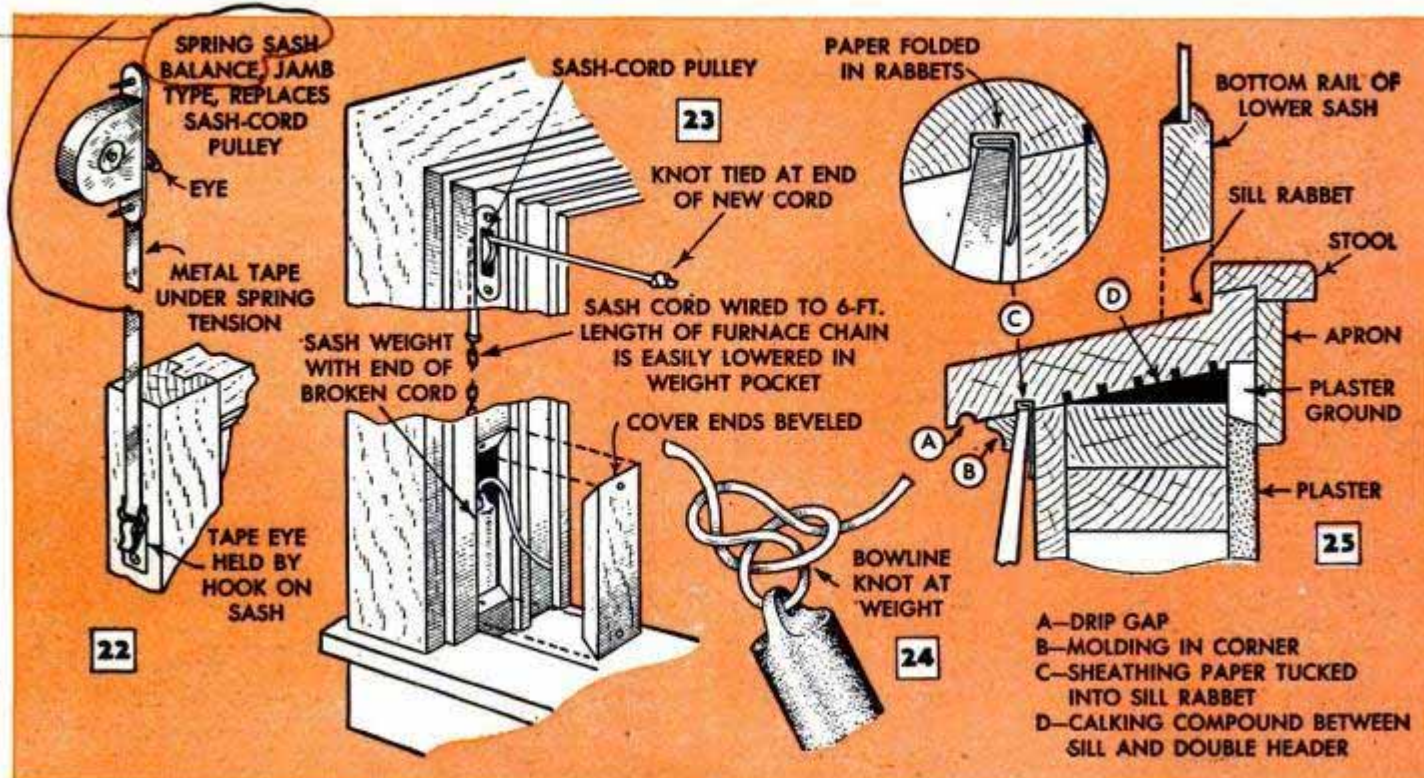
Counterweights may be replaced with spring-type sash balances. These are installed in slots for pulleys, and metal tape is attached to hook on edge of sash

by installation of flat spring-type weather stripping in each sash channel as shown in Fig. 20. Sometimes a pane will rattle in a sash if the putty is loose or does not seal the pane. On wooden casement windows, the openers are often responsible for rattling. If these cannot be adjusted, new non-rattling openers should be installed. Metal casement windows usually have crank-type openers that hold the sash open at any desired angle without tendency to rattle.

Replacing a sash cord: Breakage of a

sash cord in double-hung windows, or stretching of the cord so that the weight comes to rest before the window is open entirely, are other common troubles. Spring-type sash balances of many designs are now used instead of counterweights. The kind shown in Fig. 22 fits in the sash channel, replacing the sash-cord pulley, and can be installed easily as in Fig. 21. When sash cord is to be replaced, remove the sash in the manner previously described. Each sash has two counterweights that raise and lower in weight pockets, detail K of Fig. 15. To tie new sash cord to a weight, the latter must be removed from the pocket through an opening in the frame, Fig. 23. If the sash channels have weather stripping, this is first removed to reach the weight-pocket cover. It is sometimes difficult to locate this cover but careful inspection should show its position. Ends of both cover and opening are beveled to make it fit flush. The cord is replaced with a new one of the same length, making allowance for knots at both ends. Use No. 7 braided sash cord. Tie a knot at one end and then run a length of furnace chain over the pulley and use this to pull the sash cord through. The two are tied together with fine wire as shown in Fig. 23. Cut the broken cord from the weight, and tie the new one to the weight with a bowline knot as shown in Fig. 24. Set the weight in the pocket and insert the other end of the cord into the sash groove. Then replace the sash.

Leaky windows: Stains seen under a window sill often are caused by water driven into the joints during a driving rain-storm. A well-made window frame, such as the one shown in Fig. 25, which is the



see Thomas; Balance - Sash.

type used on frame construction, has adequate provisions to prevent the entrance of water. These antileak devices include a drip gap A, on the underside of the sill, molding B applied in the corner between the sill and the siding, asphalt sheathing paper tucked into the mortise cut in the underside of the sill to take the siding, as in detail C, and calking compound used generously to fill the space between the sill and the double header under the window as indicated by D. If a window sill has no drip gap, one can be cut by hand with a narrow gouge. This may be held on a block of wood to form an improvised rabbeting plane. A piece of molding, embedded in calking compound, also can be tacked into the corner, as in B, Fig. 25. In brick construction, where wood sills rest on bricks or stone, any space between the two should be calked.

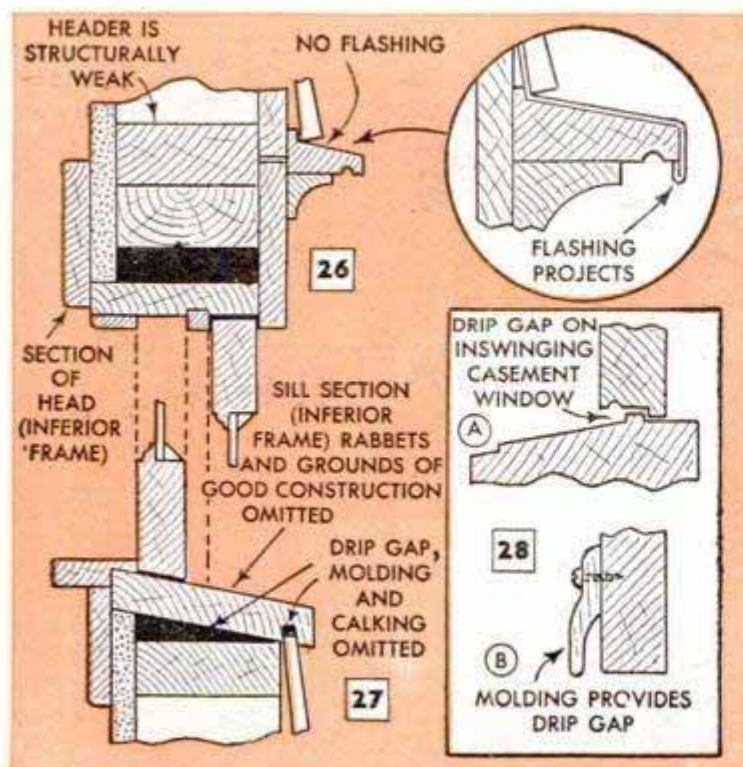
Figs. 26 and 27 show the cross-sectional views of the head and sill of an inferior window frame. Lack of sheet-metal flashing over the drip cap at the head, or a defective flashing, may be the cause of leakage. When installing new flashing, it should be allowed to extend over the edge of the drip cap as shown in the insert. Also, the pieces that comprise the double header in Fig. 26 should have been set on edge for greatest structural strength, instead of laid flat. The latter method is less resistant to sagging. Note also that in this inferior construction the top of the sill is not rabbeted to fit snugly against the bottom rail of the sash. Rabbeting at this point helps prevent the entrance of water in a driving rain. In addition, there is no drip gap on the sill and no molding or calking



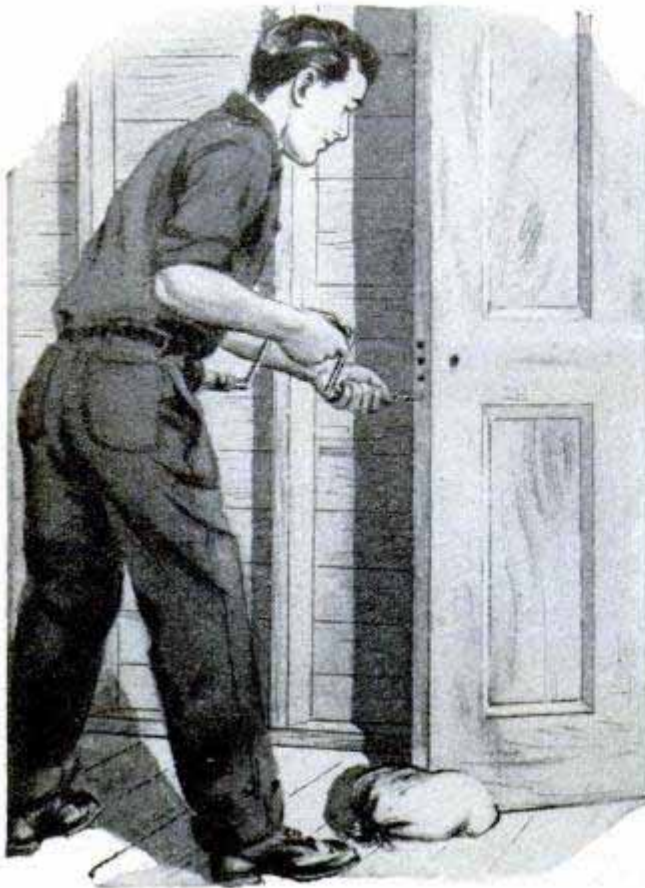
Outside joints between window frames and walls are calked to prevent leakage of air and moisture. Calking should be checked annually for tightness

under it. Sometimes, particularly with inswinging casement windows, which are likely to leak under the sash, a drip gap is cut in the lower edge of the sash, as shown in Fig. 28, A. An alternative measure is to provide a length of drip molding on the lower outside edge of the sash, as shown in Fig. 28, B. If molding is used, it is laid in calking compound before being fastened down with screws or nails. All joints between window frames and walls where leakage is possible should be calked, using a gun as shown in Fig. 29. Calking on windows should be checked annually to see if any of it has shrunk or pulled away, in which case it must be renewed.

Replacing wooden sash and frame: When the lower sash of a wooden window starts to decay at the bottom rail, about the only remedy is to replace the entire sash. Remove the old sash and install another one of the same size. When necessary to replace an entire frame and sash, first remove the old sash. Then take off the inside trim which includes the casing, stool and apron. Next, pry off the outside molding under the drip cap at the head, and under the sill. Follow this by removing the outside trim. Then it should be possible to loosen the frame by prying and hammering. A new frame, the same size as the old one, is slipped into place from the outside. Use a level to assure that the frame is perfectly plumb before nailing it in place. Small wooden blocks can be used to support the frame while nailing it. The outside trim is applied next, and then the inside trim.



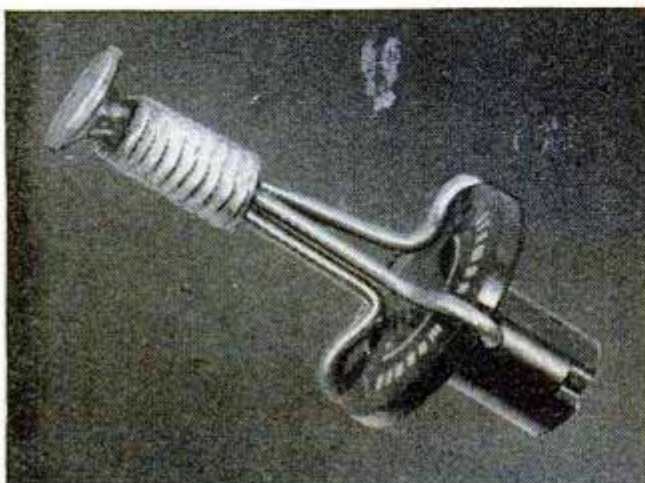
Door Held During Lock Fitting By Sand-Filled Sack



A cloth sack filled with sand or damp soil provides a convenient anchor to hold a new house or garage door steady when cutting the mortise for the lock. Any tightly woven bag, such as a sugar sack, will serve the purpose, and the idea is especially useful where a wooden wedge under the door would mar the finish of a hardwood floor.

Extension Handle on Car Heater Aids Turning Control Knob

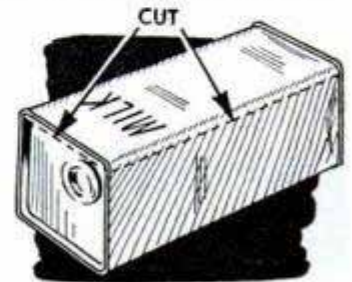
If your car is equipped with a gasoline-burning heater located so that the control knob is difficult to reach from the driver's seat, a short extension handle fastened to the knob will facilitate regulating the heat-



er. The extension can be made quickly from three lengths of heavy wire. Coathanger wire will do nicely. Measure the length of extension required and then cut the wire about 1½ in. longer. After removing the control knob from the heater, file three notches in the edge of the knob, making them about ⅛ in. deep and 120 deg. apart. Bend the ends of the three wires to grip the notches, as shown in the photo, and bind the wires together with heavy, soft copper wire, sweat-soldering it in place. A decorative knob or a plain washer is soldered to the end of the extension to serve as a handle.

Milk Carton Holds Patching Plaster

To save the trouble of cleaning hardened plaster from a pan or pail, mix small amounts of patching plaster in a quart-size milk carton. Cut one side from the carton as shown by the dotted lines in the drawing and discard the container after the job is finished.



J. Rafalow, Selden, N. Y.

Metal Clips Screwed to Toy Provide Wheel Mounts

Small wheels for toy trucks and trains are easy to assemble and remove if they are mounted with Fahnstock clips. The clips, which are obtainable in most radio-parts stores, are simply screwed to the underside of the toy. Escutcheon pins or nails are inserted through holes in the wheels to provide axles, washers being placed between the wheels and the clips.



R. W. Kainulainen, Spokane, Wash.

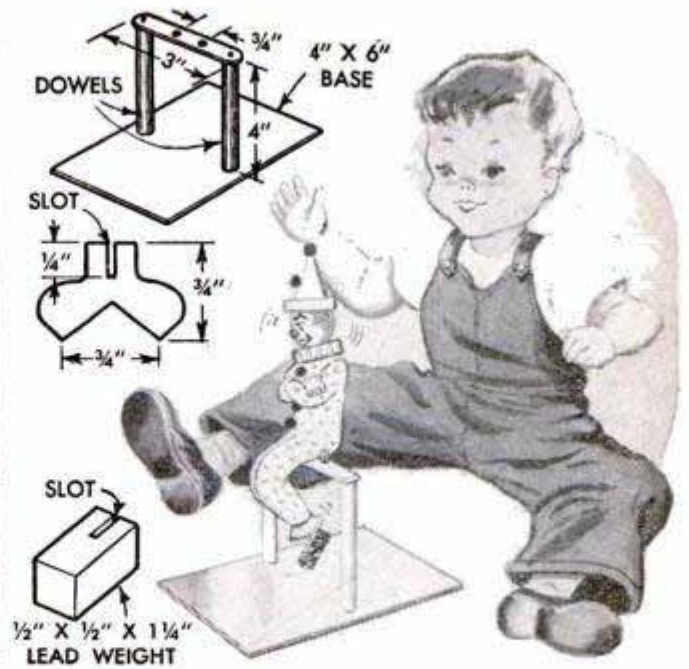
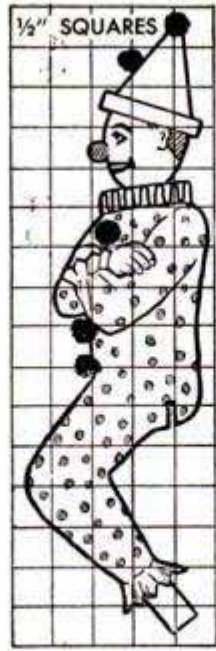
Clock Gears Used in Craftwork

Large gears taken from old alarm clocks are useful items for the home craftsman. Grinding or filing the teeth sharp and fitting the gear with a simple handle is a quick way of improvising a tool for serrating paper. The gears also form suitable hole spacers for leatherwork and decorating tools for homemade pottery.

Neal Houlahan, Glenshaw, Pa.

Weighted Toy Clown Swings Precariously on Rail

A flick of the finger starts this funny clown swinging merrily back and forth on his uncertain perch. To make the toy, cut the clown from sheet metal according to the squared pattern and paint it in bright colors. The base, which is a piece of plywood or sheet metal, supports two dowel uprights fastened with screws driven from the underside. A sheet-metal or plywood crossbar is attached between the uprights. If sheet metal is used for the crossbar, drill two holes for the sheet-metal pivot member or, if the bar is of plywood, countersink two depressions for the pivot and drive a small carpet tack in the bottom of each depression to reduce friction. Slot the pivot and the clown, as



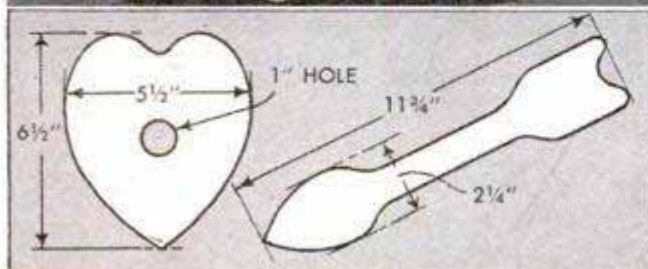
shown, and solder them together. Then, slot a lead weight and squeeze it tightly over the end of the clown's leg.

Rudolph G. Kopp, Milwaukee, Wis.

Wooden Arrow Inserted Through Heart Provides Bewildering Puzzle

It looks impossible but there it is—a solid wooden arrow with both head and tail $2\frac{1}{4}$ in. wide inserted through a 1-in. hole in a heart also cut from solid wood. It's a trick that will keep your friends guessing for some time. The secret is in using basswood which becomes resilient when soaked in water. First, cut out the arrow and heart from $\frac{1}{2}$ to $\frac{3}{8}$ -in. basswood as shown in the detail, making the shaft of the arrow slightly under 1 in. wide. Chamfer the edges of the arrowhead and hole slightly to facilitate pushing the arrow through. Then soak

the arrowhead in water for a few hours or overnight if desired, but no longer, as the basswood will turn black. Squeeze the arrowhead in the jaws of a vise, allowing the tip to extend slightly above the jaws, and by twisting and pressing firmly, work the heart down over the arrowhead. Raise the arrowhead up a little, squeeze in the vise again, and press the heart farther down, repeating the procedure until the arrowhead is completely through the hole in the heart. Do not use a mallet or hammer to force the parts together. Instead, work them together by hand. Soak the arrowhead in water to help it return to its original shape. Whittling rough chamfers along the edges of the heart and arrow will hide any bruises left on the wood. However, be careful not to change the diameter of the hole or the width of the arrowhead and tail. Should the $2\frac{1}{4}$ -in. width be too difficult to push through the 1-in. hole, trimming the arrow to a maximum width of 2 in. will give the desired effect more readily.—H. Simermeyer, New York City.

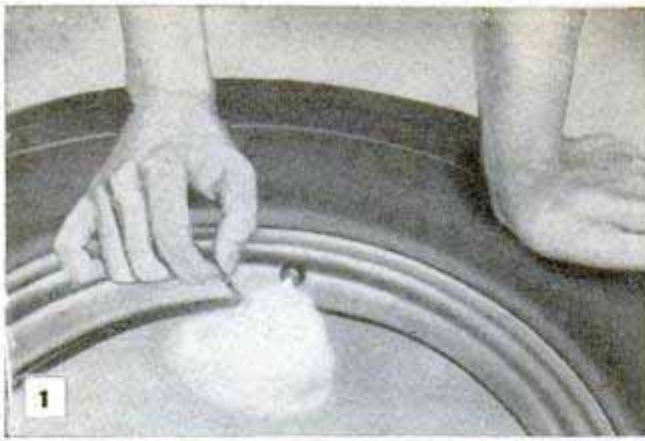


Removing Gum From Shoe Soles

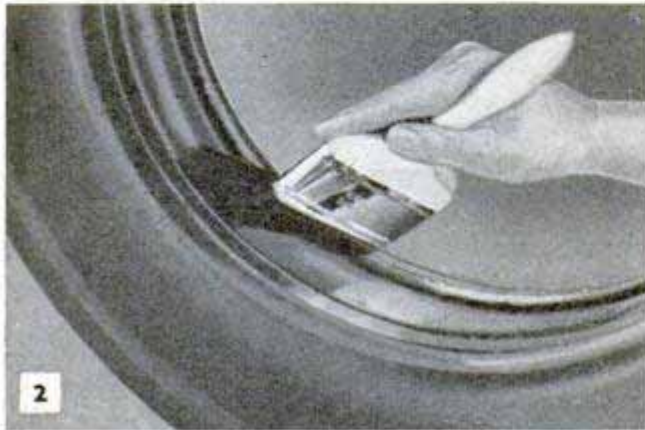
To clean chewing gum from the soles of shoes, first remove as much of the gum as possible with a wad of absorbent cotton soaked in hot water. Then, saturate another cotton wad with turpentine and briskly rub off the remaining gum.

TIRE CARE

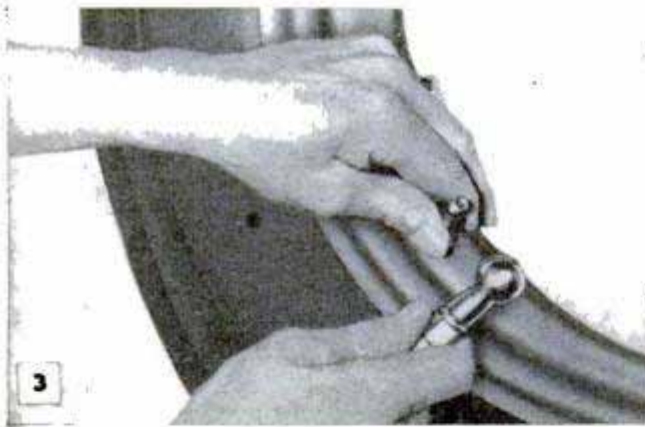
By Phil Ruskin



1 First step in removing a tire from the rim is to deflate tube completely by removing the valve core



2 Before remounting the tire, coat beads with a vegetable-oil soap. Do not use lubricating oil or grease

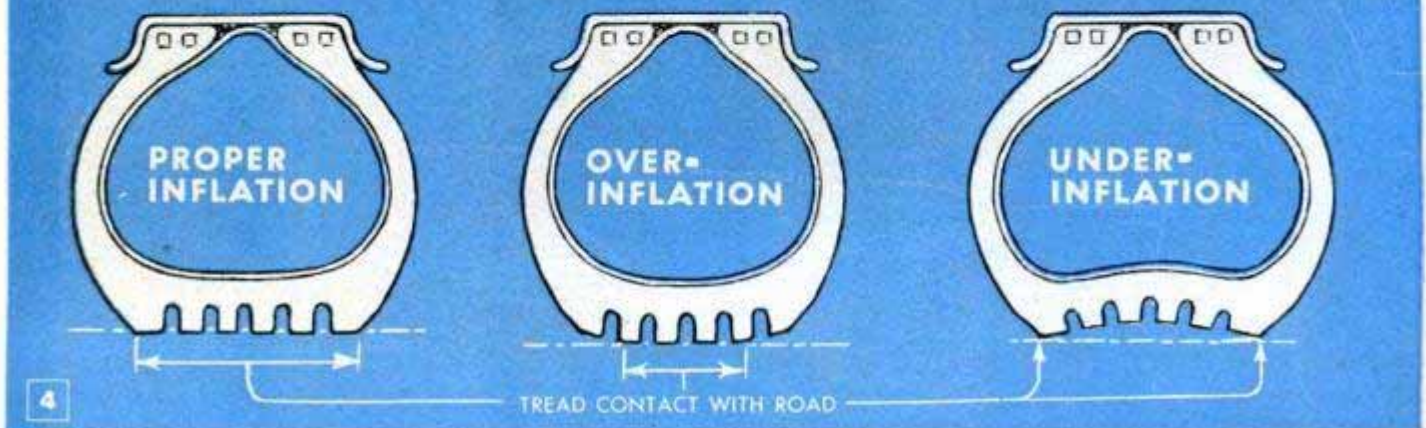


3 After remounting on the rim, inflate the tire to seat the beads tightly against the rim flanges

SUBSTANTIAL savings in yearly car operating costs can result from a careful inspection of your tires at regular intervals. Underinflation, neglect of minor damage and faulty wheel alignment are the common causes of excessive tread wear and early breakdown of casings and tubes. Careful drivers keep a close watch for improper tire inflation and make periodic examinations of the treads to discover embedded glass or nails and to locate and repair cuts, bruises and oil spots before they can do any real damage. The pay-off for these simple precautions comes in greatly increased tire mileage, maximum safety and the minimum of road trouble. Tires should be inflated at regular intervals to the exact pressure recommended by the manufacturer. To prevent slow deflation when on the road or when the car is standing in the garage, keep a careful check on the condition of the valve cores and caps, particularly on older tires. Renew valve cores that show any tendency to leak, and always be sure, after inflating the tires to the correct pressure, that the valve caps are screwed on snugly. Inspect the caps each time they are removed to see that the gaskets are in good condition.

It's no trick at all to dismount and remount a tire on a drop-center rim—if you know how. First of all, deflate the tube as low as possible by pressing on the valve stem with a small screwdriver or other pointed tool. Then deflate completely by removing the valve core, Fig. 1. Loosen the beads on both sides by inserting a tire tool under the edge of the rim and exerting downward pressure to force the bead into the drop center. Coat the casing beads with a vegetable-oil soap (never use lubricating oil) to make removal of the beads over the

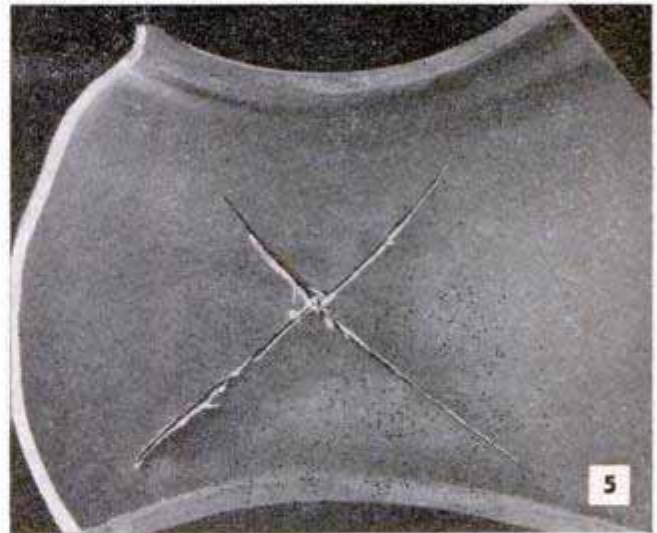
TO CHECK TIRE FOR CORRECT INFLATION, NOTE CONTACT OF TREAD WITH ROAD. ALSO NOTE THE RELATIVE AMOUNT OF BULGE OF TIRE SIDEWALLS. USE AIR GAUGE AND INFLATE TIRE TO EXACT PRESSURE RECOMMENDED BY THE CAR MANUFACTURER



MEANS LONG WEAR

rim flange easier, Fig. 2. Pry one bead over the flange, using two tire tools alternately. At this stage make certain that the valve body has been pressed out of the hole in the rim. Then turn the wheel over and force the other bead off the rim. To remount the casing and tube on the rim, inflate the tube slightly and insert in the casing. Position the tube so that the valve registers with the red dot on the sidewall. Place the casing and tube on the rim and insert the valve body through the hole in the rim. Then force one bead over the rim flange into the drop center. Be careful in this step that the tube is not pinched between the bead and the rim and damaged. Then force the other bead over the rim flange with tools. Inflate the tire slowly to center and seat it on the rim, Fig. 3. When the casing spreads under pressure and both beads seat firmly against the rim flanges, deflate the tube completely, then reinflate to the recommended pressure.

Fig. 4 shows graphically why proper inflation is of the greatest importance. Always test the tire pressure when the tires are cool. As shown in Fig. 4, overinflation causes rapid wear in the center of the tread. It places excessive strain on both casing beads and sidewalls and lessens the ability of the tire to resist cuts and snags and also breaks due to severe impact. An overinflated tire has less resiliency, and restricted tread contact with the road surface means reduced traction and less resistance to skidding. On the other hand, underinflation is the cause of excessive wear on the shoulders of the tread. When the car is driven at moderately high speeds the tires heat up fast and the excessive bending of the sidewalls at the point where the tread meets the road results in ply separation and rapid breakdown of the sidewalls. Figs. 5 and 6 show what happens when a small impact break is neglected.



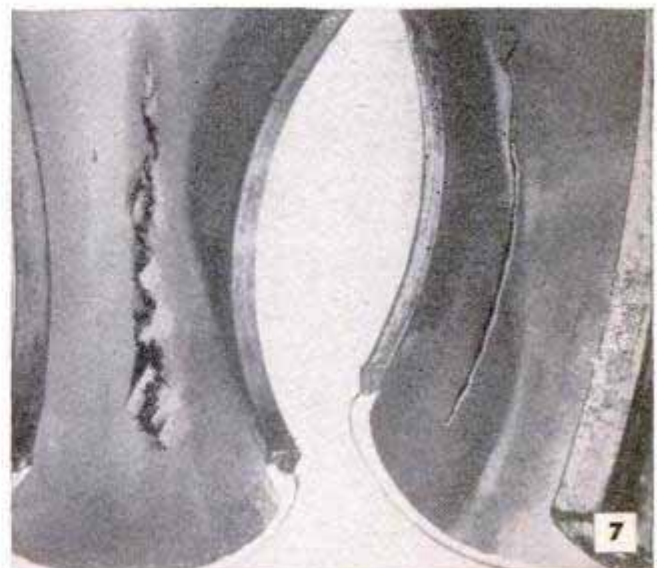
An impact break gradually enlarges to a crisscross pattern. At this stage the tire may "blow" any time



A bad blowout often tears away a portion of tread, exposing cords and making a major repair necessary



Small cuts won't cause immediate tire failure but in time dirt and water will work into the casing and will rot the cords, causing the plies to separate



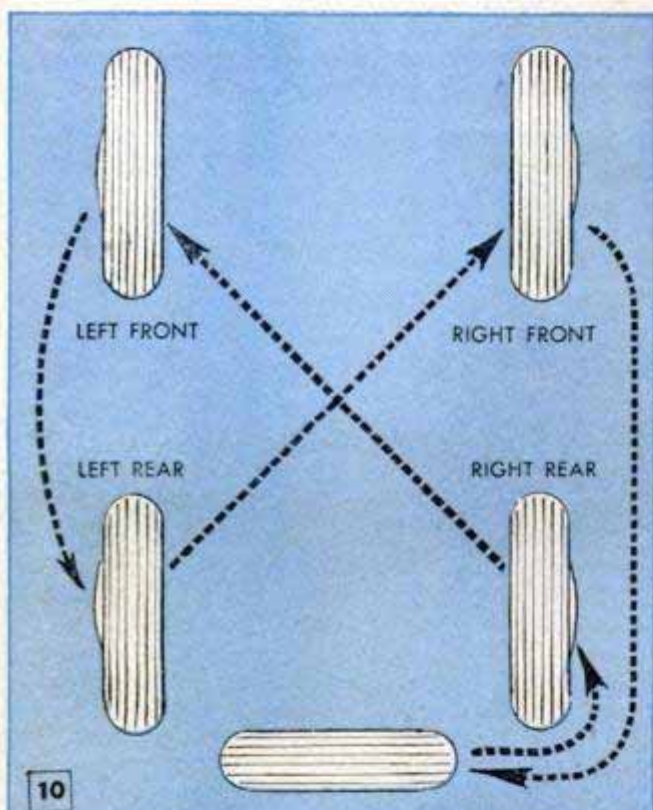
Running with soft tires causes long, irregular breaks in the tread and also in the sidewalls of the casing. Often casings in this condition are not worth repairing



Faulty wheel alignment, worn wheel bearings or a broken spring can result in uneven tread wear

A typical example of excessive wear on the tread shoulders due to underinflation. Note the ridged tread

Too much toe-in or faulty camber adjustment is the usual cause of rapid side wear of the tire tread



10

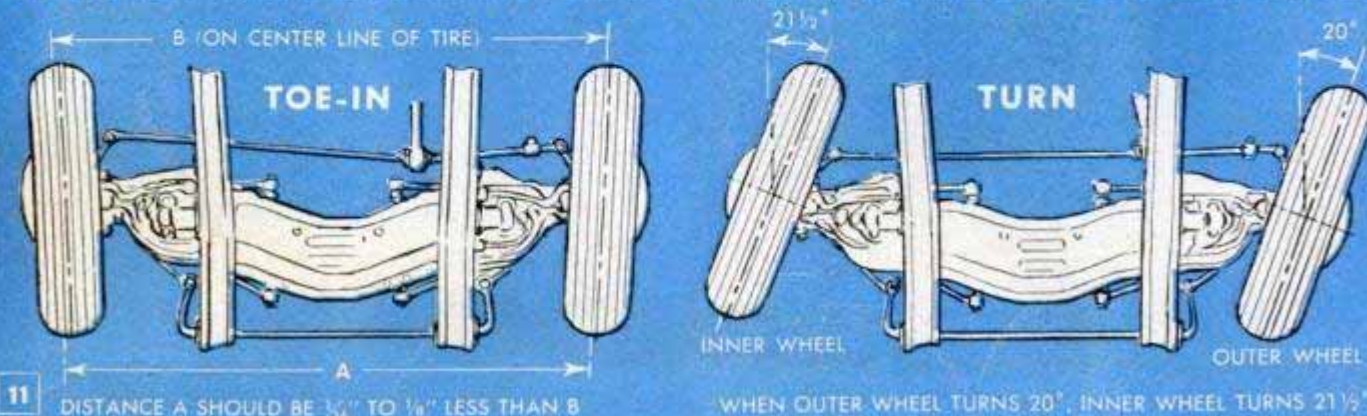
TIRES SHOULD BE SWITCHED AT LEAST TWICE A YEAR TO UTILIZE SPARE TIRE AND ALSO TO EVEN UP WEAR BY REVERSING DIRECTION OF ROTATION OF THE TIRES

The break gradually enlarges to the criss-cross form shown in Fig. 5. This pinches the tube, resulting in an eventual break. Air seeps through the break into the cord body, causing a bulge or "blister" to form. Sometimes the entire tread is blown off as in Fig. 6. In Fig. 7 the open casing at the left is a typical example of damage resulting from underinflation. The sidewall break shown at the right in Fig. 7 is another result of running with "soft" tires. Small cuts like that shown in Fig. 8 won't cause immediate tire failure, but in time dirt and water will work into the casing and rot the cords, causing ply separation.

Driving habits have a direct effect on tire mileage. Fast getaways, fast driving on the turns and squealing stops are especially ruinous to tires. Such practices not only grind rubber off the treads, but place severe strains on the entire structure of the casing and tube. The careful driver avoids bumping or scuffing against curbs when parking, driving rapidly over obstructions and driving at high speeds on rough pavement or unsurfaced roads.

The three views in Fig. 9 show what happens to tire treads when the car is driven

TYPICAL WHEEL-ALIGNMENT CHART SHOWING THE VARIOUS SETTINGS

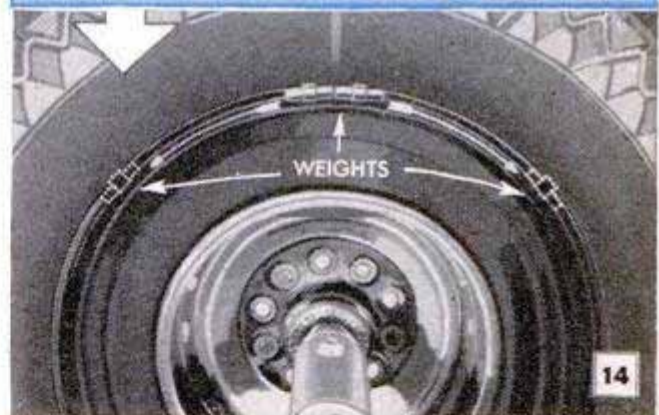
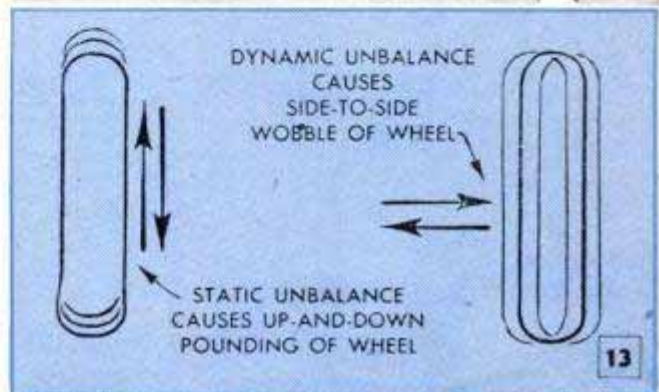
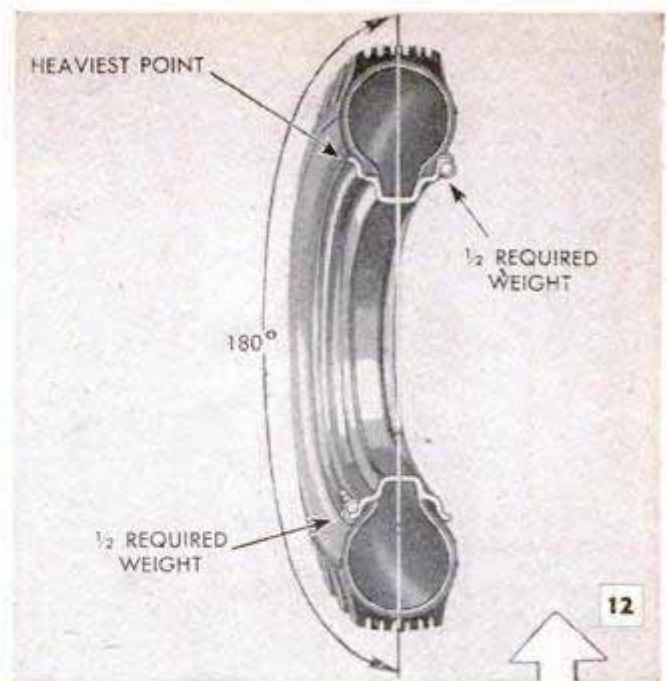


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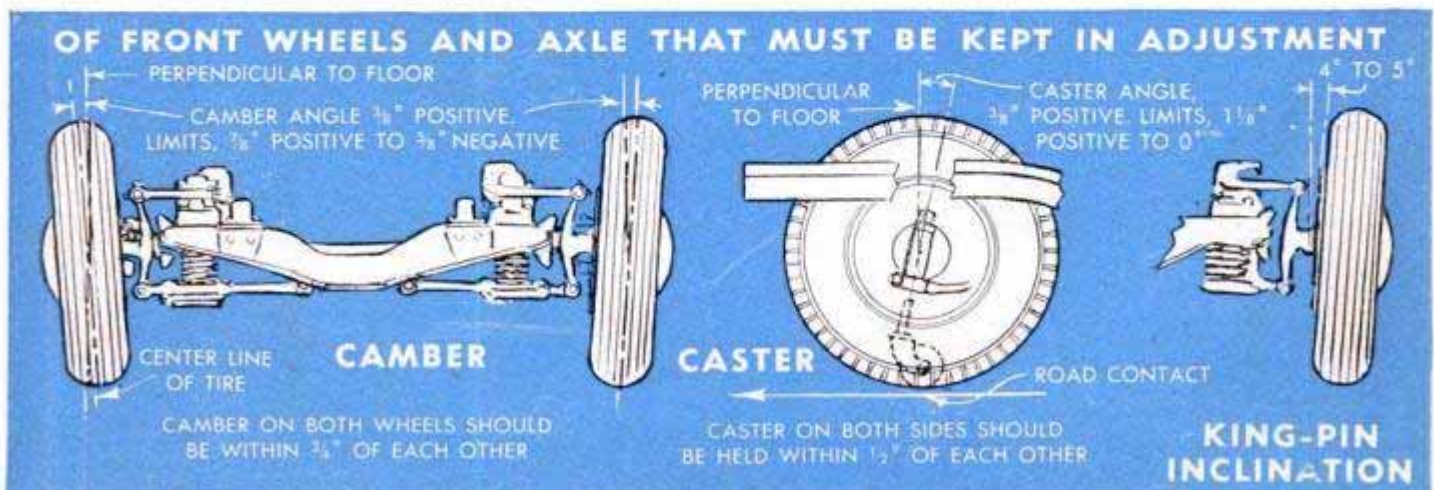
with faulty front-wheel adjustment. Worn wheel bearings, a bent axle, too much camber or caster and a broken or weak spring can cause the type of tread wear shown at the left. Wheel misalignment plus underinflation can cause the excessive wear on the shoulders of the tread as pictured in the center view. Faulty alignment plus too much camber is a cause of the excessive side wear on the tread shown in the right-hand view. Wheels should be aligned according to the general recommendations in Fig. 11 and the adjustment checked periodically. Also the tires should be switched regularly on the wheels as in the chart, Fig. 10. The condition of brakes, springs and shock absorbers affects tire wear materially. Brakes that grab on application, or that lock one wheel, will cause rapid tread wear on the tires that are affected. Keep the brakes correctly adjusted and shock absorbers and springs in good condition.

Static and dynamic wheel balance also figure in the mileage you get from your tires. Correct static balance eliminates pounding, Fig. 13, while dynamic balance prevents sidewise wobble, or "snaking," and keeps the wheel rolling in a straight path. Both static and dynamic unbalance are eliminated by the use of wheel weights, Figs. 12 and 14. Wheel balancing is a job for the service shop having equipment made especially for this purpose. After the wheels have been balanced by the use of weights, they should be checked periodically, as normal tire wear may shift the point of balance in time.

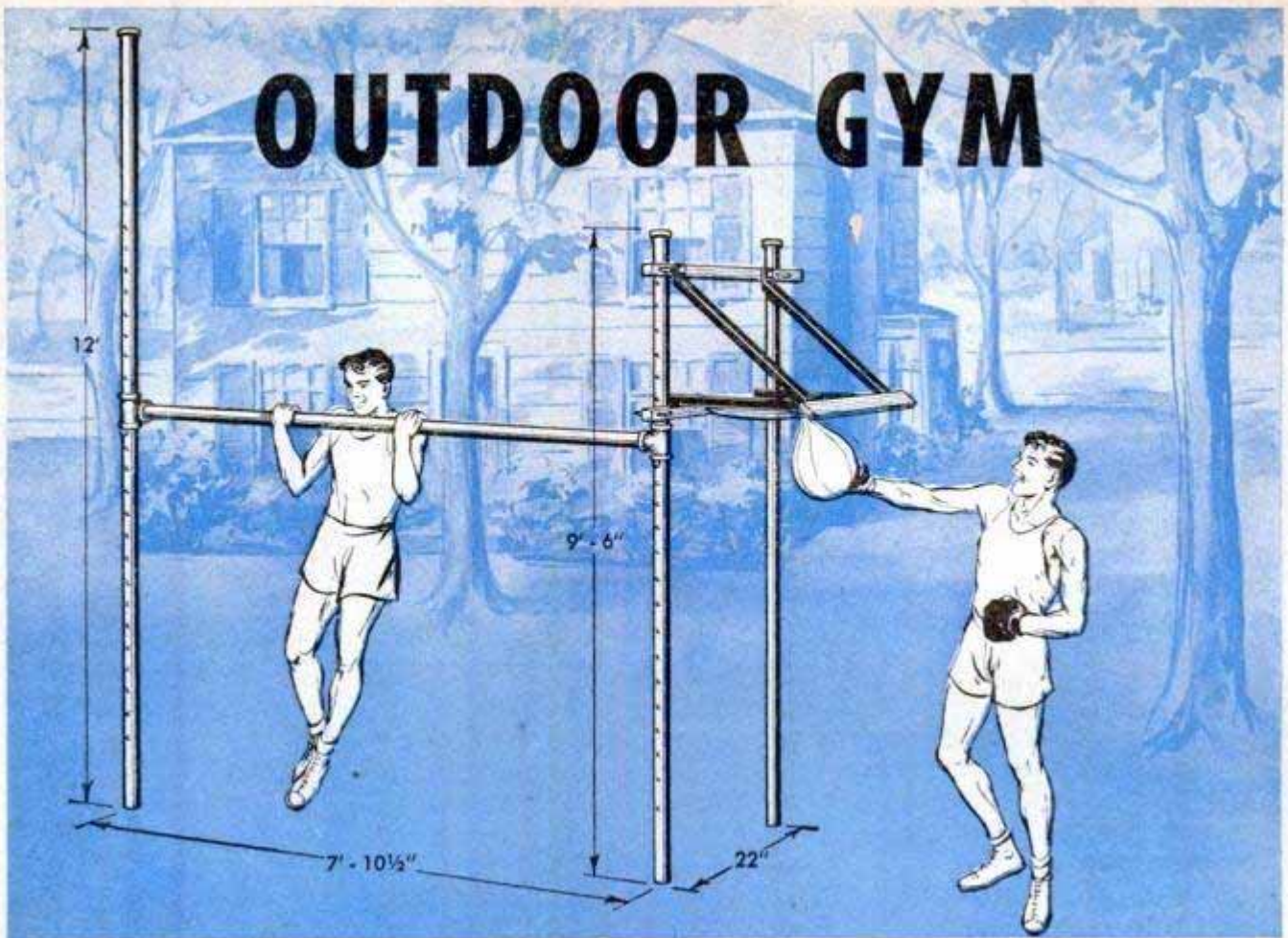
Retreading of tires can be recommended as an economical and safe practice when the casing is still in good condition, without any major breaks. If the job is correctly done, using good materials, the usable life of the casing can be extended as much as 50 percent. Minor cuts or breaks in the sidewalls and treads usually can be satisfactorily repaired by vulcanizing before the tire is retreaded. Always install a new tube in a retreaded casing, even though the old tube appears serviceable.



Wheels should be both statically and dynamically balanced to keep them rolling in a straight path and eliminate pounding and wobble, or "snaking"

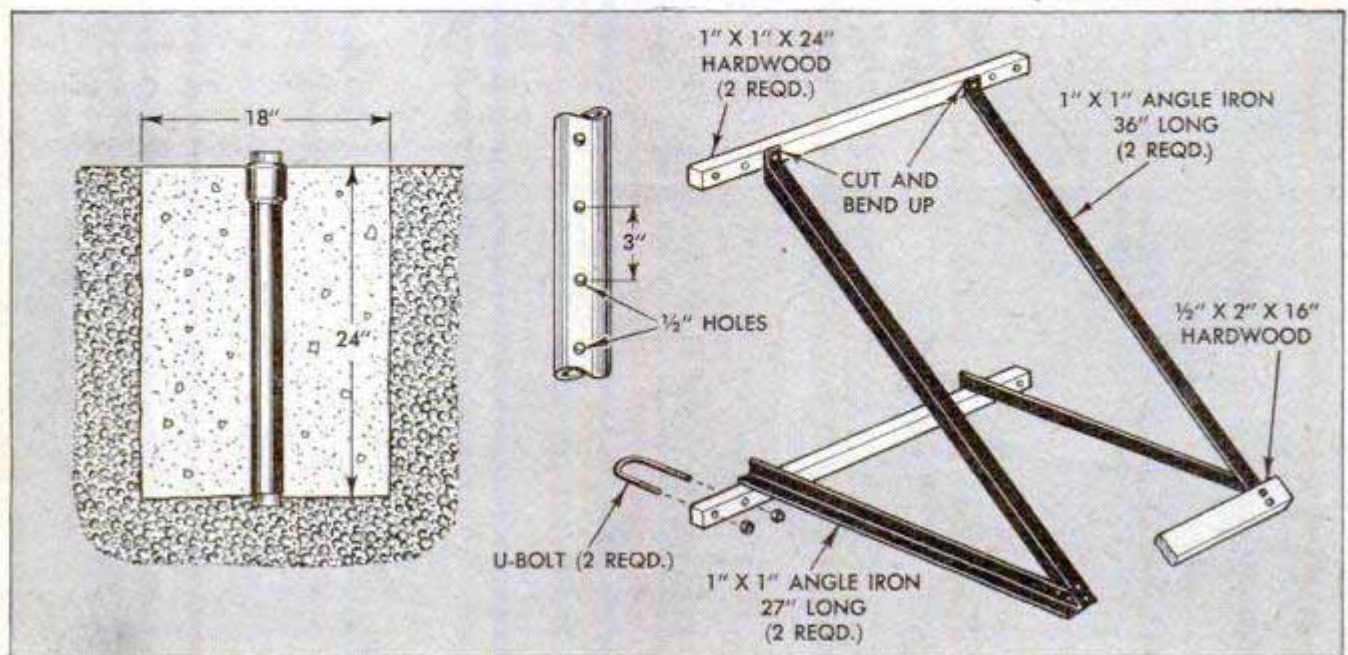
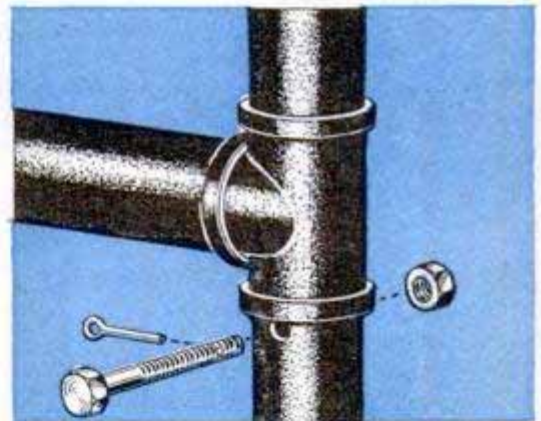


OUTDOOR GYM



By Thomas Trail

This simple, sturdy outdoor gym can be built in the yard with several pieces of pipe and a few fittings. Both the horizontal exercise bar and the support for the striking-bag platform are adjustable for height. Three uprights of 2-in. pipe, one of them a 12-ft. climbing bar, are anchored in concrete. A series of 1/2-in. holes are drilled in two of the uprights on 3-in. spacings, and each upright is screwed into a coupling on the upper end of the length of pipe which is embedded in concrete. Use 2 1/2-in. pipe tees with reducers on the ends of the 1 1/2-in. exercise bar. The detail at the right shows the assembly of a bolt which supports the bar at each end. The striking-bag frame, which is attached to the uprights with U-bolts, is detailed at the lower right

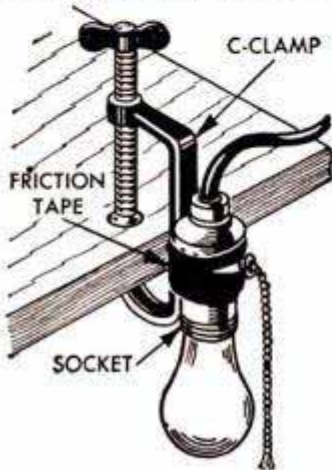


"Crazy Jug" Covered With Baubles Provides Interesting Novelty

Adorned with bits of colored glass, stones, shells and an assortment of trinkets, the "crazy jug" forms an eye-catching ornament for recreation room or patio. In addition, the youngsters will have hours of fun collecting the miscellany used to cover the jug. Most any type of jug or crock will do, and this is completely covered with a 1/2-in. layer of putty. After the decorations have been pressed into the putty, the jug is set in the sun to dry.



Light Socket Taped to C-Clamp Forms Portable Shop Lamp



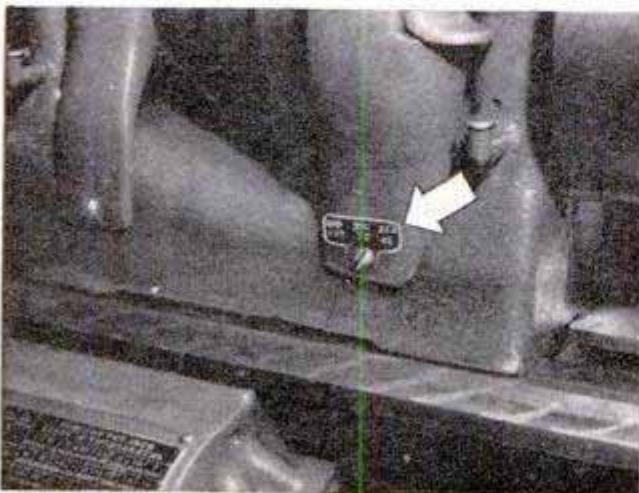
When regular workshop lighting is not bright enough for close work, additional light can be had by taping an extension-cord socket to a C-clamp and fastening the clamp to a convenient spot. Mounting the light in this way also is handy when working on

the car, repairing plumbing or doing other jobs where an extension lamp is necessary.
Herbert E. Fey, New Braunfels, Tex.

Table Listing Spindle Speeds Mounted on Lathe Headstock

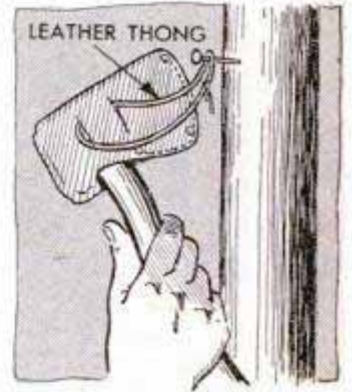
For turnings that require critical surface speeds, it is convenient to be able to determine the various spindle speeds of your lathe at a glance. This can be done by stamping the spindle speeds on a metal plate and fastening the plate to the headstock with one of the machine screws used to hold the cover in place.

Dwight Durkee, Jr., Cupertino, Calif.



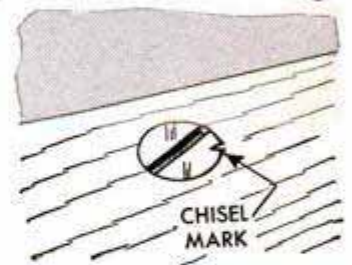
Take Care of Your Camp Ax

To keep a camp ax in the best condition, wipe it dry after using. Then oil the ax lightly and place it in its leather sheath. Stringing a leather thong or shoelace through the belt loop of the sheath will permit hanging the ax from a nail where it is out of the way. Before storing an ax for an extended period of time, always be sure to oil or grease the blade thoroughly and then wrap it in wax paper before placing in the sheath.—Willis O. C. Ellis, Washington C. H., Ohio.



Wood Screw Kept From Loosening

Upsetting the edge of a flat-headed wood screw with a cold chisel is the simplest and one of the most effective ways of locking the screw so that



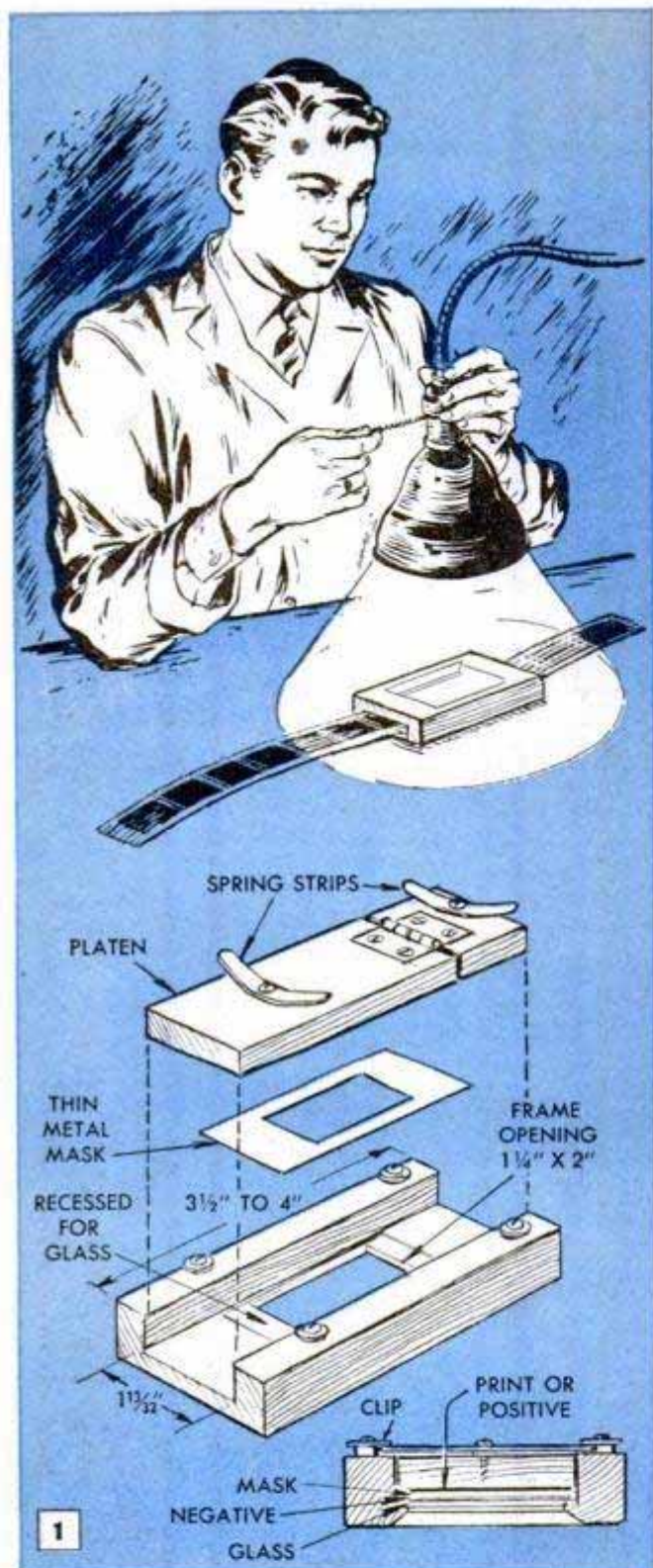
it will not work loose. However, before doing this, remember that some of the wood around the edge of the hole will be torn away if it is necessary to remove the screw.

❑ Instead of using pieces of absorbent cotton to powder the baby, use lamb's-wool powder puffs. They will stay soft no matter how often they are laundered.

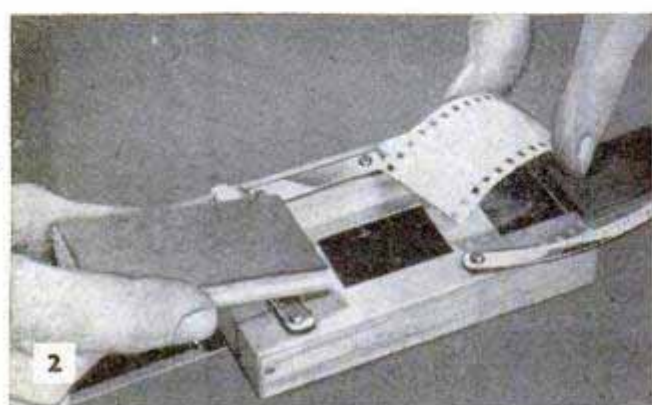
"Positive Negatives" for PROJECTION

Negatives from your black-and-white snapshots are copied on positive film, then projected like color transparencies

By Walter E. Burton



Exposure is the same as in making a print, except positive film is used instead of sensitized paper



YOU NEED NOT use color film to enjoy the thrill of seeing your snapshots projected on a screen. Black-and-white transparencies often are as satisfactory as colored ones, and generally are superior to plain prints. Negatives from 35-mm. up to the capacity of the slide projector can be made into positive transparencies by contact-printing them on film instead of paper.

Figs. 2 to 6 inclusive picture the steps in making a monochrome black-and-white transparency, using 35-mm. positive film. A printing frame like the one detailed in Fig. 1 is all you need, in addition to the usual developing equipment. The negative strip is inserted between a piece of glass and a metal mask, and the film is held in position by a hinged platen. If there is ample film to permit the end of the strip to be cut on a bias, less difficulty will be had in starting it through the frame. The positive pieces should be about 1/2 in. longer than the length of the frame opening.

Only a brief exposure is required in printing an average negative on positive film. One way to do this is to place the printing frame under a 40 or 60-watt lamp bulb as in Fig. 1, and switch the current on and off as quickly as possible. A few trials will enable you to judge the exposure time accurately. To lengthen the exposure period for better control in developing, move the light source farther away from the printing frame, or use a smaller bulb.

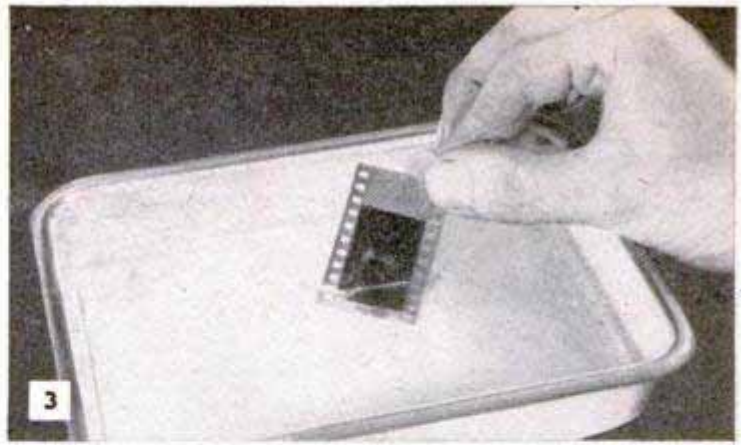
Suitable developer formulas for positive film are published by film manufacturers. However, any developer that is fairly vigorous will do, but a soft-working one should be avoided. When extreme contrast is desired, as in the case of line drawings, use a high-contrast solution such as a "title" developer. If the contrast is still too low, you can make the print on film especially designed for micro-copy work.

The exposed positive film is processed exactly like a paper print. It should be thoroughly fixed and washed for about 1/2 hour in running water. Wipe both surfaces of the film with a moist cellulose

sponge to remove water droplets and hang the film to dry, or lean each one against a glass tumbler. If after drying there are water spots on the back of the film, breathe on it and then wipe the surface with a clean handkerchief. Mount the transparencies between glass in the usual manner. With the picture held right side up, place a positioning dot in the lower left-hand corner, pasting it to the mask before binding. You can make these positioning dots from gummed stock, using a $\frac{1}{4}$ -in. paper punch. The dots serve as a guide in placing the slides upside down in the projector so that when viewed they will always be right side up on the screen. Each slide is inserted with the dot being in the upper right-hand corner.

Prints from negatives that are larger than 35-mm. film can be made on standard 2 x 2-in. lantern-slide plates. These are available in two grades, one for normal negatives and one for contrasty negatives. They are processed like positive film and may be printed either by contact or projection. Positive film is also made in standard sheet sizes. Film is mounted between two thin pieces of glass, whereas lantern slides are faced with only one piece of glass.

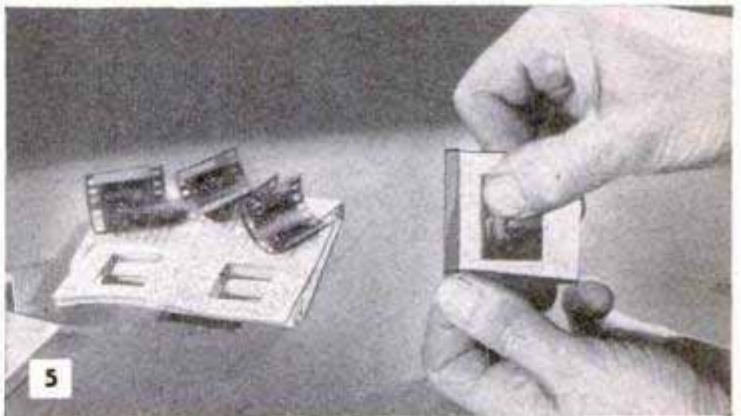
When black-and-white transparencies are projected they produce an image rich in detail and have a greater range of tone values than a paper print. With the aid of commercial photo stains and toners, you can further improve the qualities of the slides. Many standard toners will work equally well with both positive film and lantern-slide plates. Sepia tones may be produced on movie film by a sulphide toner, and on lantern-slide plates with a similar toner of slightly different composition. Although such toners can be had commercially in prepared form, formulas for mixing them are given in photo handbooks. The color should match the subject. For example, a summer landscape should be toned sepia while a snow or moonlight scene is best in blue. Toners change the color of the dark portions of the transparency by altering the silver particles, while photo stains alter the high lights by coloring the gelatin coating. By combining the two, slides of more than one color can be produced. Photo stains are a water-soluble dye in which the transparency is immersed for the desired density.



The exposed film is developed in the same manner as in the case of a photoprint, using a fairly vigorous developer



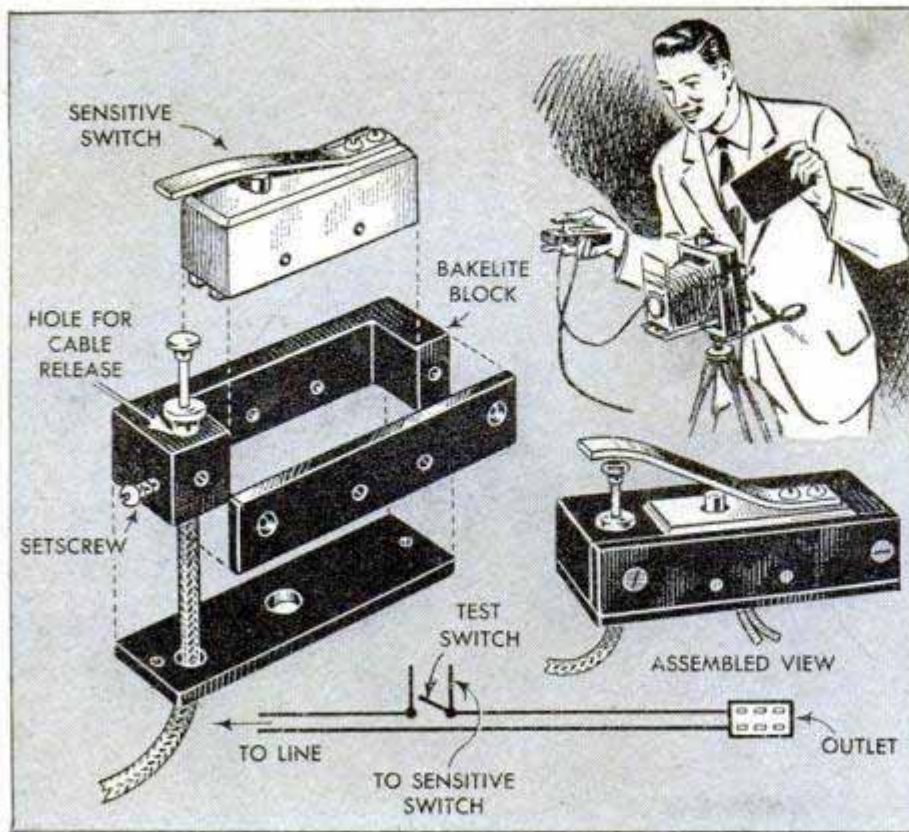
Placing the positive transparency in a ready-cut mask preparatory to mounting it between two 2 x 2-in. cover glasses



Above, binding the glasses together with gummed paper tape made for the purpose. Below, finished transparencies ready for projection. Dot in lower left-hand corner serves as a guide when inserting slide upside down in the projector



"Flash" Pictures From Photoflood Lamps Permitted by Hand-Held Synchronizer

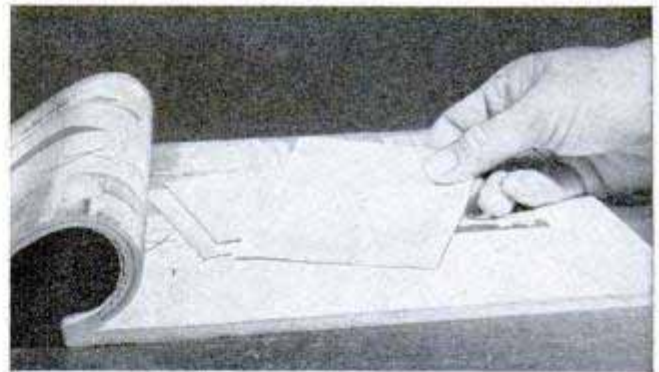


Especially useful when photographing children, this synchronizer for photoflood lamps gives a flash effect by allowing the lights to remain off until the shutter is released. A test switch wired in the circuit permits turning on the lights for focusing without releasing the shutter. The synchronizer consists of a sensitive switch set in a Bakelite housing. The cable release is mounted at one end of the housing so that when the lever of the sensitive switch is depressed the shutter will be released an instant after the switch is closed. Experiment to determine how far the cable-release button should extend above the housing. — Aaron Barnett, Chicago.

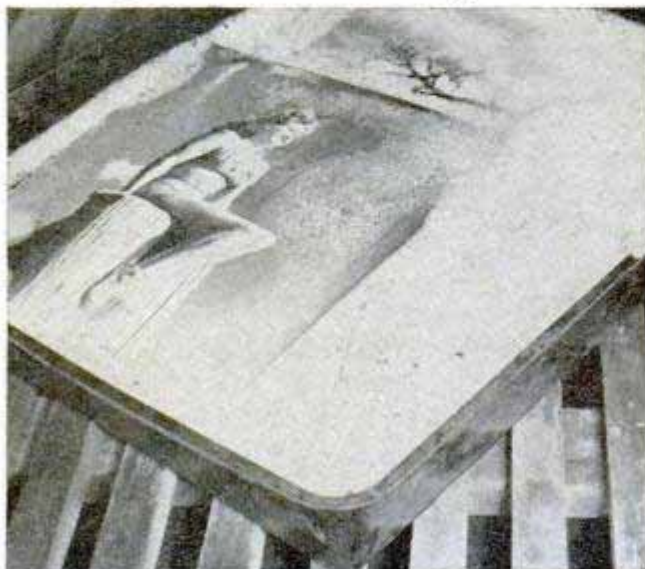
Photo Paper Held for Convenient Selection Between Pages of Magazine

When making a number of contact prints, the small sheets of paper can be held for easy selection by inserting them between the pages of a magazine. Using a magazine having a large page size and the type of binding that tends to remain open, slip a sheet of photo paper between the succeeding pages. Then, with the magazine closed, the paper is protected from light and, when needed, the sheets can be grasped more quickly than if kept in a box or an envelope.

Virginia Hanson, Santa Monica, Calif.



Adding Household Detergent to Final Wash Water Improves Glossy Prints



Household washing powder of the soapless-suds type can be used to improve the surface of glossy prints. Add $\frac{1}{2}$ teaspoonful of the detergent to the final wash water before immersing the prints. Washed in this way, the prints will have a minimum of pitting and drying rings when removed from the ferrotype tins.

Carrying Wet News Films

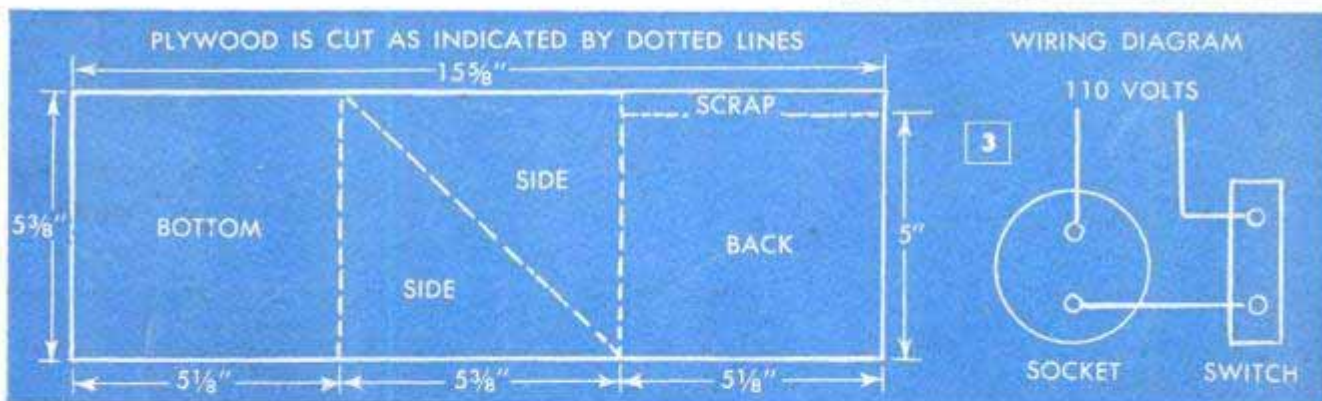
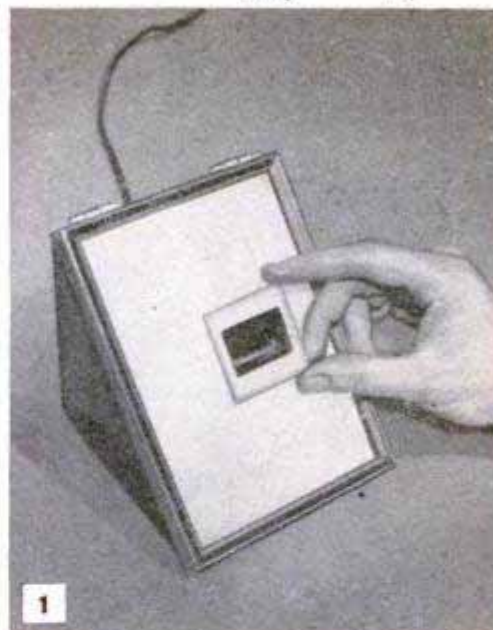
The amateur photographer who is fortunate enough to get an on-the-spot news shot can save precious time by rushing the negative to the newspaper while it is still wet. The negative is simply placed in a jar of cold water and the jar is tightly capped.

David Deutsch, Brooklyn, N. Y.

TRANSPARENCY VIEWER

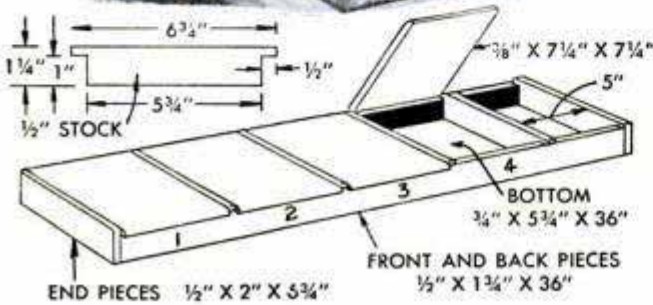
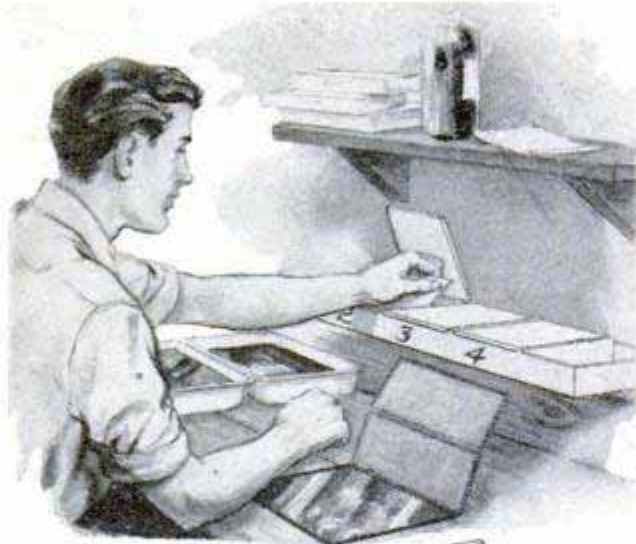
doubles as retouching stand

EVERY photographer needs this handy accessory for really serious work. It's simply a triangular box made from $\frac{1}{4}$ -in. plywood and fitted with a hinged picture frame containing a diffusing glass. The latter serves as a transparency viewer and also as a negative retouching easel. Fig. 1 shows the unit in use as a viewer and Fig. 2 pictures its convenience as a retouching stand. The left-hand view in Fig. 3 shows how to cut all the parts economically from one piece of plywood. First, join the parts to form the triangular box, Fig. 4, using glue and small brads. Drill four holes in the back panel, three $\frac{3}{4}$ -in. holes for ventilation and one $\frac{3}{8}$ -in. hole for the light cord. Then install a porcelain flush-type socket and a toggle switch, Fig. 5, and wire according to the diagram in Fig. 3. Next, obtain a 5 x 7-in. picture frame and a 5 x 7-in. diffusing glass, available at photo-supply stores, and fasten the glass in the frame with several small brads. Hinge the picture frame to the viewing box as in Fig. 6, using 1-in. butt hinges. Use a 7 $\frac{1}{2}$ -watt, inside-frosted lamp for illumination. This is sufficient for average work. The unit can be made somewhat more stable for negative retouching by driving four rubber-headed tacks into the bottom near the corners. The bottom also can be covered with a piece of $\frac{1}{8}$ -in. felt glued to the bare wood. If desired, the exposed wooden parts can be finished in the natural color of the wood with shellac and varnish, or the wood can be stained to match the finish on the picture frame.—James R. Oswald, Chicago.



U.I. '51

Handy Photo-Paper Dispenser Has Individual Compartments



Mounted on a wall with shelf brackets or merely set on the top of a darkroom table, this easily made paper dispenser will hold a large quantity of photo paper of several different grades or sizes. Made to the dimensions given, the dispenser includes four light-tight compartments for paper up to 5 x 7 in. plus a small tray for miscellaneous items. However, the number of compartments and their size can be varied to suit. The covers are hinged at the back with $\frac{1}{2}$ -in. brass butt hinges and they overhang the front of the dispensers $\frac{1}{2}$ in. to provide a finger grip for easy lifting. The inside of the unit is painted flat black and the outside a light color. Numbers to indicate the grade of paper may be painted on the front of each compartment. Be sure that the covers fit closely to prevent light leakage when a bright light is turned on, and store the paper face down in the dispenser.

Dick Hutchinson, El Monte, Calif.

Film Identified on Holder Slide



If you use several types of cut film in your camera, the film in each holder can be identified by writing the type and emulsion speed on the edge of the slide. This strip of

metal, which is usually aluminum, permits writing legibly with a pencil, and it can be erased readily when the film is changed.

Detergent Speeds Drying

Film will dry quickly and with fewer water spots, if it is first soaked in water containing a soapless detergent. Add just enough detergent to make the water sudsy and soak the film for only a minute or so.



Swabbing Insures Clean Negatives

Although water may look perfectly clean, it can leave a fine sediment on negatives, resulting in streaks, blotches and flattening of tones in the prints. To insure that the negatives are clean, use a sponge or a pad of cotton to swab off both sides of each negative while it is held under a stream of running water.

Reducing Dense Areas in Negative With Household Cleansing Powder

A paste consisting of household cleansing powder and alcohol forms an excellent medium for reducing the dense areas of a negative. Using a piece of cotton, rub the paste on the emulsion side of the negative until the denseness is reduced to the desired tone. Then, wash off the negative with alcohol. For working on small areas, wrap the cotton around the end of a matchstick or toothpick. Use alcohol for mixing the paste because, unlike water, it will not soften the emulsion on the negative.

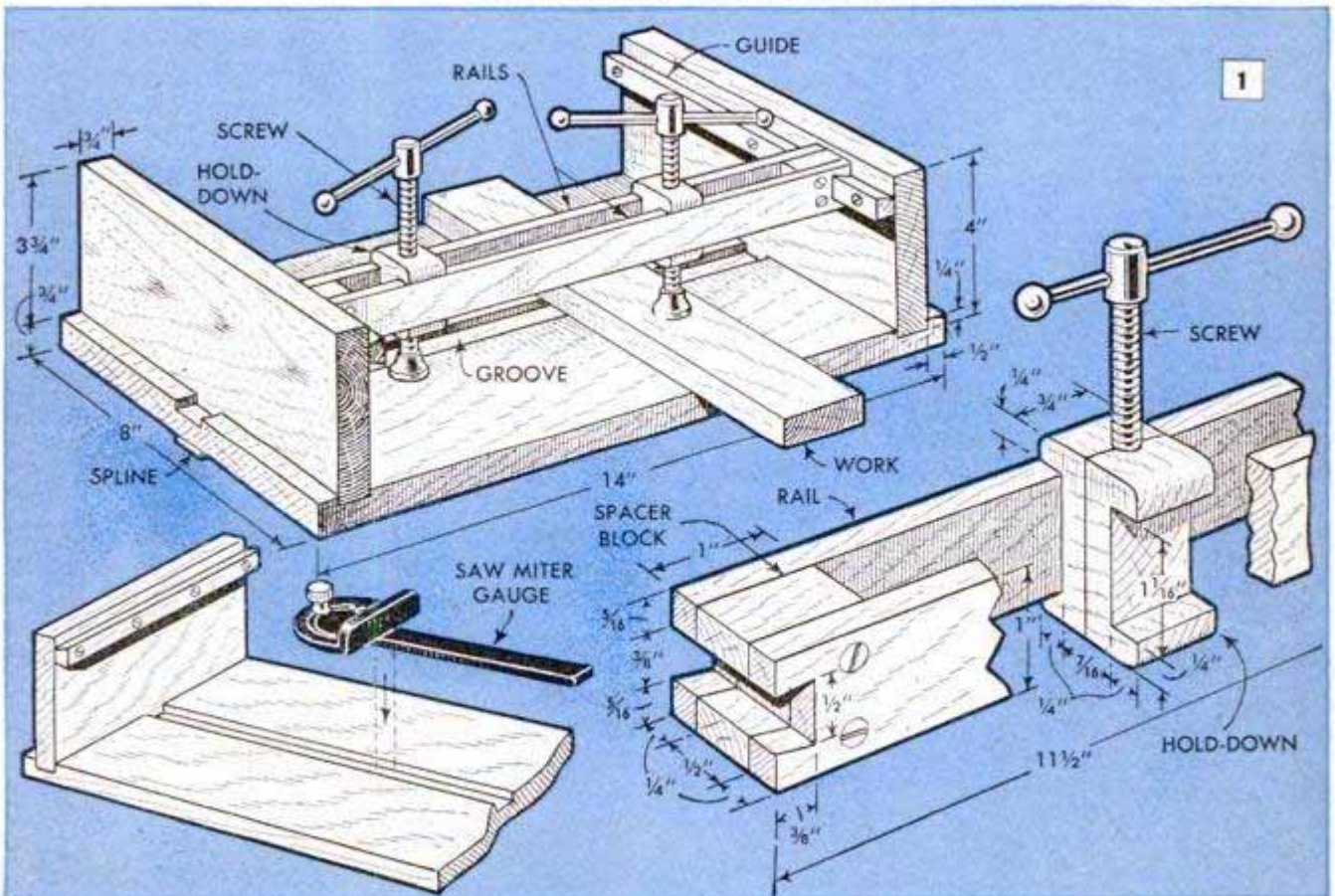
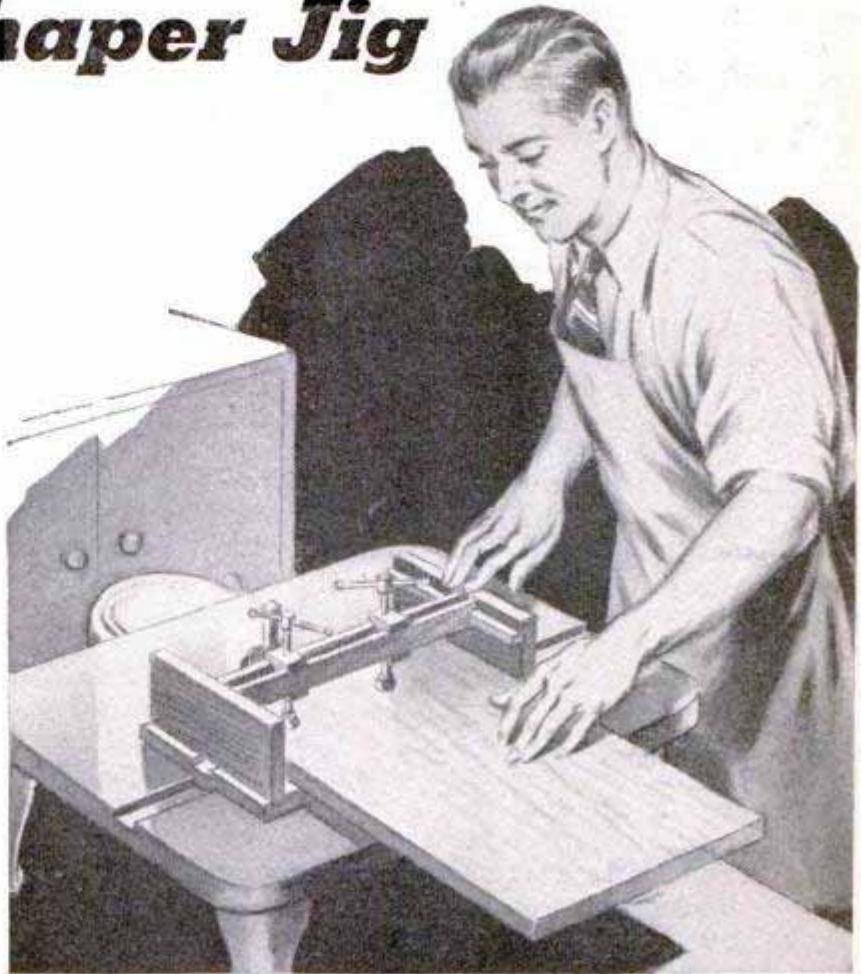


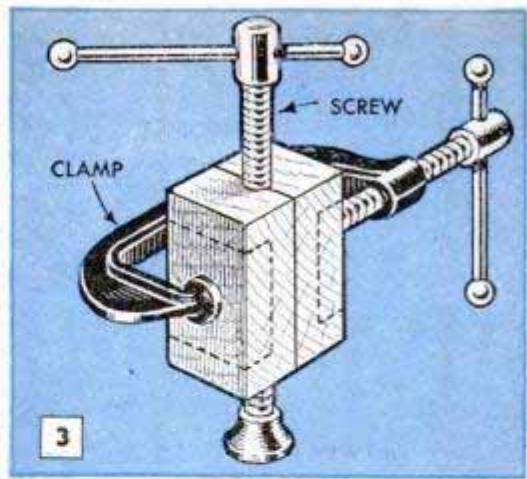
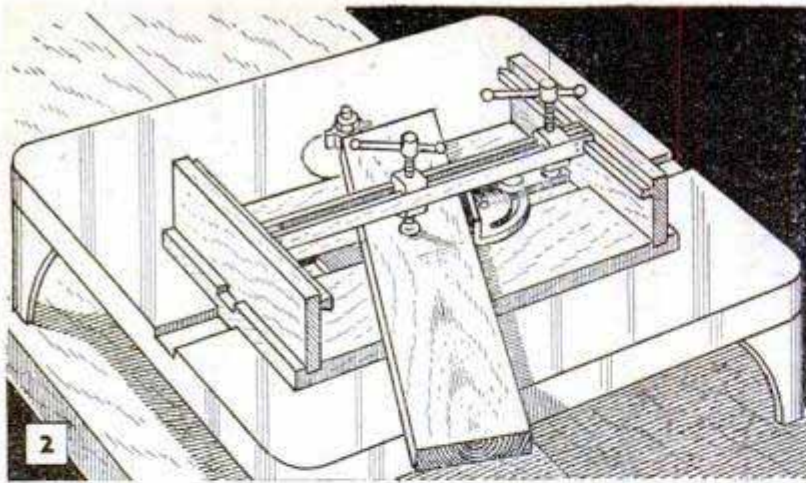
Rep. L.C.B. #141

Sliding Shaper Jig

By Roy Rogers

WHEN running a molding cut across the end grain on wide stock, it is difficult to hold the piece securely against the miter gauge with the hands alone, particularly on a small shaper table. Inaccurate work is likely to result because of the tendency of the stock to creep away from the cutters. This type of work is handled safely and accurately in the special jig detailed in Fig. 1. The jig consists of a base with two endpieces set in grooves and glued and screwed in place. Note that the base also is grooved lengthwise at the center, the width and depth of the groove being determined by the width and thickness of the miter-gauge spline. The miter gauge is

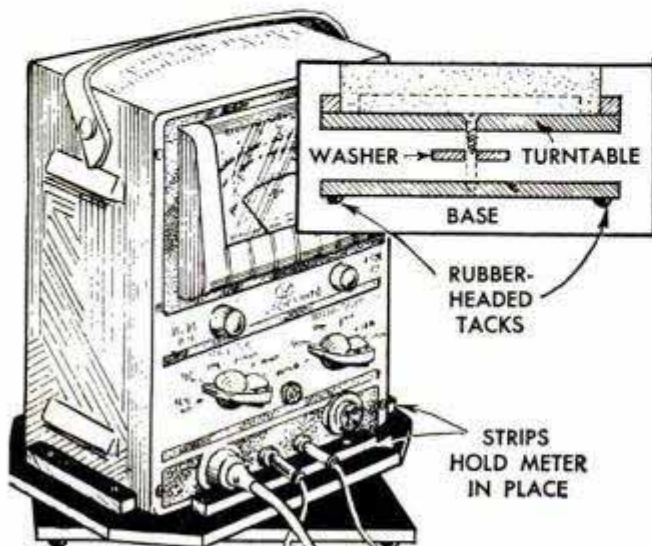




used to guide narrow pieces, as in Fig. 2, where the work is positioned at an angle so that a molding cut can be run across the end. A hardwood spline screwed to the bottom piece, as in Fig. 1, fits in the groove in the shaper table to guide the jig. Care must be taken when fitting this spline to make sure that it is located parallel with the inner edge of the bottom piece and also that it is positioned at right angles to the endpiece. Countersink the screws.

The hold-down screws are taken from old C-clamps. On most types of C-clamps it is only necessary to bend the tabs on the swiveling pad outward and the pad will slip easily off the ball end of the screw. Then the screw can be turned out of the clamp frame. These screws are then made to tap threads in hardwood hold-down blocks by turning them into tapholes drilled in the blocks, Figs. 1 and 3. Determine the size of the taphole required by measuring the diameter of the screw at the bottom of the threads. On certain types of C-clamps the screw can be removed only by cutting away the frame of the clamp. In this case, two blocks must be used to make each hold-down. First clamp the blocks together and drill the taphole. Then clamp the blocks together over the screw as in Fig. 3 and turn the screw back and forth

to form the threads. After the threads are cut in the wood in this manner, glue the blocks together with the screw in place as in Fig. 3. Next, notch the blocks to fit the side members of the sliding bar, as in the lower right-hand detail in Fig. 1. The hold-downs should slide easily when the two bars are assembled with spacer blocks as shown. Cut dovetail notches or grooves in the ends of the assembled unit. Then make dovetail slides from hardwood and screw these to the inner face of the endpieces. The dovetailed ends of the bar fit over these slides as shown in the assembly view in Fig. 1. Check the assembly for free movement along the full length of the dovetail slides. To use the jig, place it in position on the shaper table, locate the stock in line with the shaper cutters with one edge bearing against the rear endpiece and tighten either one or both of the hold-down screws to hold it firmly in position. Slide the jig slowly forward until the work has passed the shaper cutters. Then slide the jig off the table and remove the work before replacing the jig on the table. If the piece requires more than one pass to complete the cut, replace the jig, with the work still in place, on the forward edge of the table and adjust the shaper spindle before running the next cut.



Mounting Test Meter on Turntable Facilitates Reading Dial

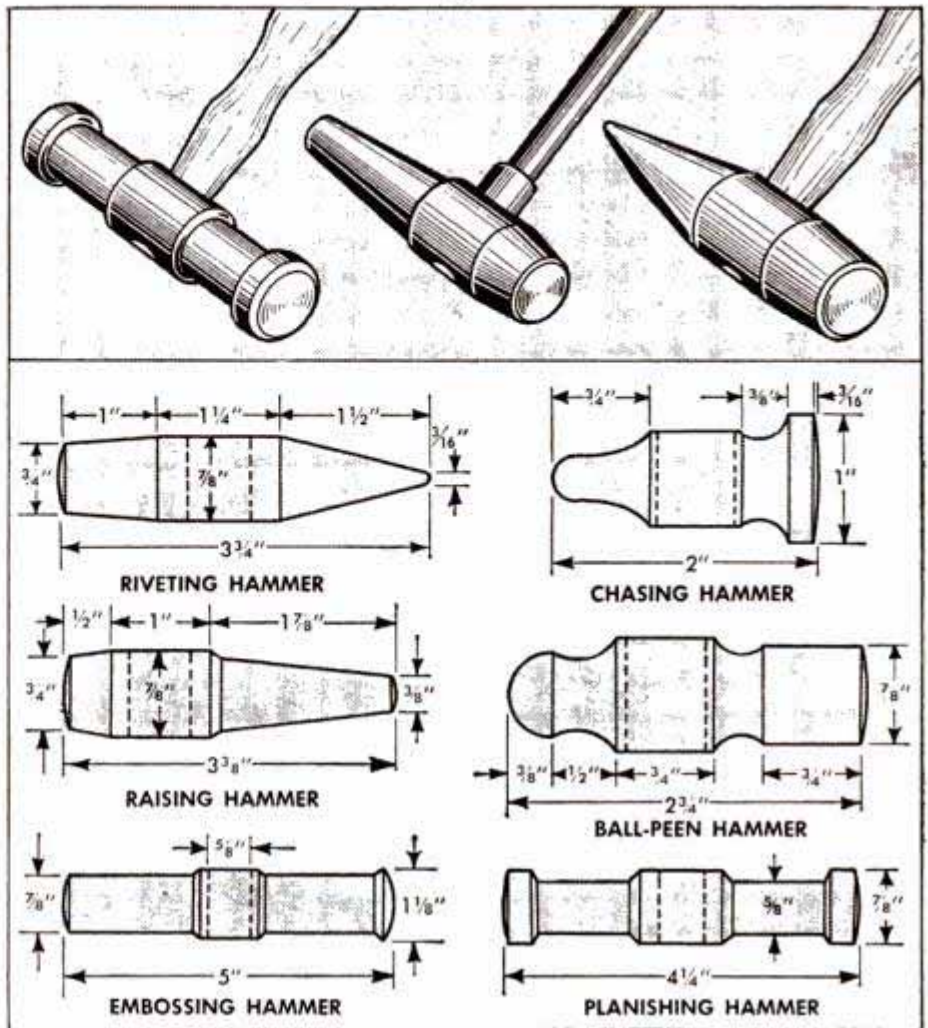
When mounted on this easily made turntable, a test meter can be swung so the dial is clearly seen from any position on the workbench. The table rotates on a wooden base from which it is separated by a 2-in.-square plywood "washer." A flat-headed screw driven through the turntable and washer and into the base serves as a pivot.

Robert Hertzberg, Jackson Heights, N. Y.

☐ To salvage a used sheet of carbon paper, hold it over a hot stove for a few minutes. The carbon will melt and flow over the worn areas so the sheet may be reused.

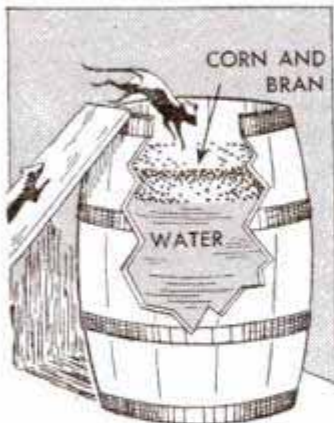
Needing a set of metal-working hammers but finding the cost too high to permit purchasing them, one craftsman economized by turning the half-dozen hammers shown from automobile rear axles. The axle shafts are sawed to convenient lengths, using a power hacksaw if available. The hammers are turned between centers until nearly completed and then they are chucked for finishing the faces to the proper contour. The holes for the handles are bored through the heads, positioning them on the drill-press table by means of a V-block. Two overlapping holes can be drilled to form an oblong hole for a wooden handle, the latter being purchased or reshaped from a broken handle. If steel rod is used for a handle, it should be threaded and the hole in the head tapped so the two parts can be screwed together. The rod may be lightened by boring it out, if desired, and knurled to afford a good gripping surface. If intended only for use on soft metal, the hammers do not have to be heat-treated.

Variety of Hammers for Working Soft Metals Turned Inexpensively From Automobile Axles



Final polishing is done with emery cloth and oil, and a coating of rust preventive is applied as soon as the hammer is completed.—D. C. Marshall, Manhattan, Kans.

Rats Attracted by Grain Camouflage Drown in Barrel Filled With Water



If you have a barn that is infested with rats, this water-filled barrel will get rid of them in a hurry. Using a clean barrel, fill it with bran to about three or four inches from the top. Then sprinkle some corn chop over the bran. Don't fill the barrel with water at this time. Lean a board against the side of the barrel so the rats are able to run up the board and eat the grain in the barrel. Allow the rats to feed on the grain for a week or so until they become familiar with the setup. Then, pour out the bran, replace it with water and pour a 6-in. layer of bran over the

water. Sprinkle corn chop over the layer of bran. The grain should be about the same distance from the top of the barrel as before. The rats, which are accustomed to jumping into the barrel to reach the grain, will continue to do so, except that now they will fall through the bran and be drowned in the water.

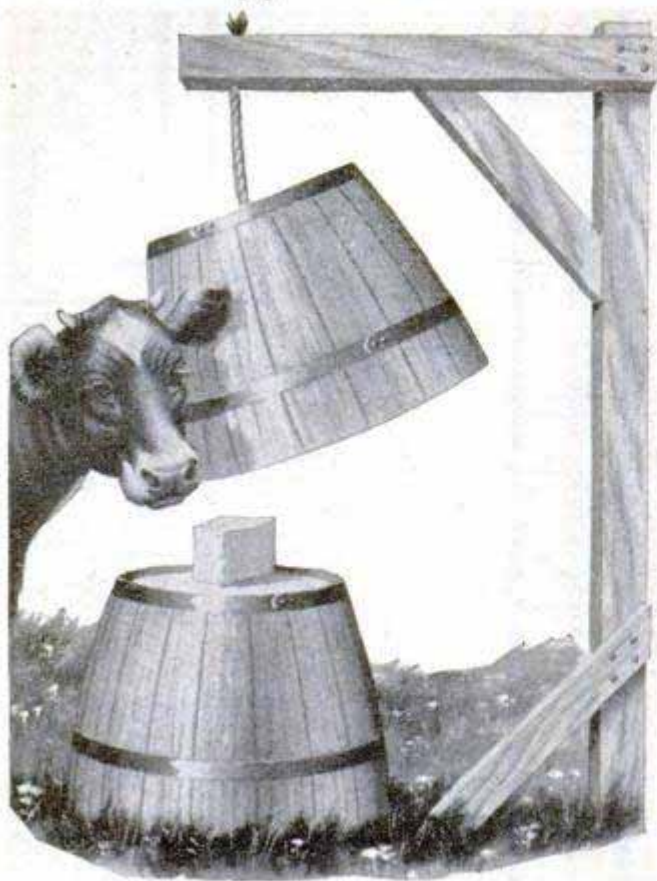
Bob Poulson, Los Angeles, Calif.

Storing Artists' Brushes

Before storing artists' brushes for long periods of time, wash them carefully in turpentine or other solvent and then immerse in lard oil for about 20 seconds. Work the oil well into the bristles, squeezing any surplus oil from the brush. Prior to using a brush stored in this way, rinse it thoroughly with turpentine so the lard oil does not retard drying of the paint.

Paul Will, Chicago.

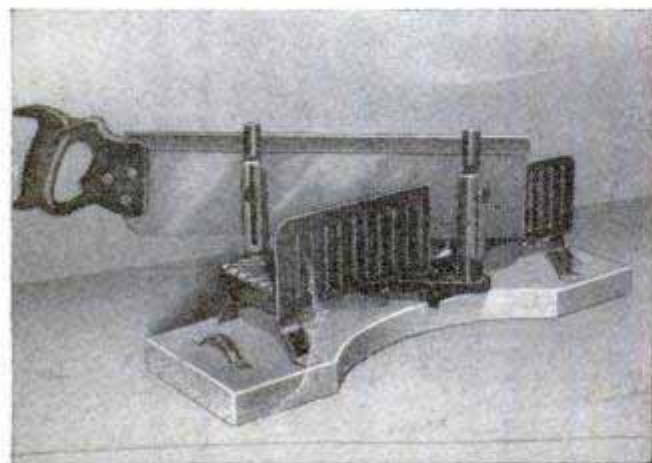
Barrel Canopy Protects Rock Salt



Rock salt kept outdoors for cattle will not be washed away by rain if it is protected with a barrel canopy. The barrel is sawed in two, and one half is placed on the ground to form a table. Then the other half is suspended with rope directly above the table to serve as a canopy. The cattle will nuzzle the canopy out of the way to reach the salt.

Miter-Box Base Prevents Clogging

By mounting his miter box on a subbase bandsawed from $1\frac{1}{16}$ -in. softwood, one carpenter eliminated the tendency of the saw to clog with sawdust and short trimmings from moldings which collect about the rear saw guide at the back of the box. The curved cutout in the subbase is centered so that it is directly below the saw guide as



illustrated. The miter box is attached to the base with screws. Two handles screwed to the base facilitate carrying the unit.

Grover Brinkman, Okawville, Ill.

Clock Spring Aids Drawing Arcs

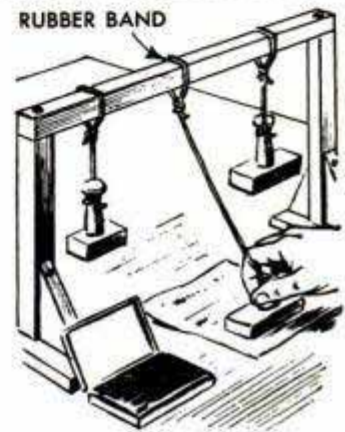
Curves and arcs of a wide variety of sizes can be drawn with the aid of a clock or watch spring. Take the mainspring from an old clock and place it in position on the paper. Then, attain the desired arc by varying the finger pressure along the edges of the spring.



Policarpo R. Bobon, Ilog, P. I.

Rubber-Stamp Rack Is Automatic

Especially handy where a number of different rubber stamps are used frequently, this novel rack automatically returns them to their proper position. The rack is merely a wooden crosspiece mounted on uprights or between two walls in the corner of an office or cashier's cage. Each stamp is hung from the crosspiece with a rubber band and, when needed, it is pulled down, inked and applied to the paper. As soon as the stamp is released, the rubber band pulls it back on the rack.



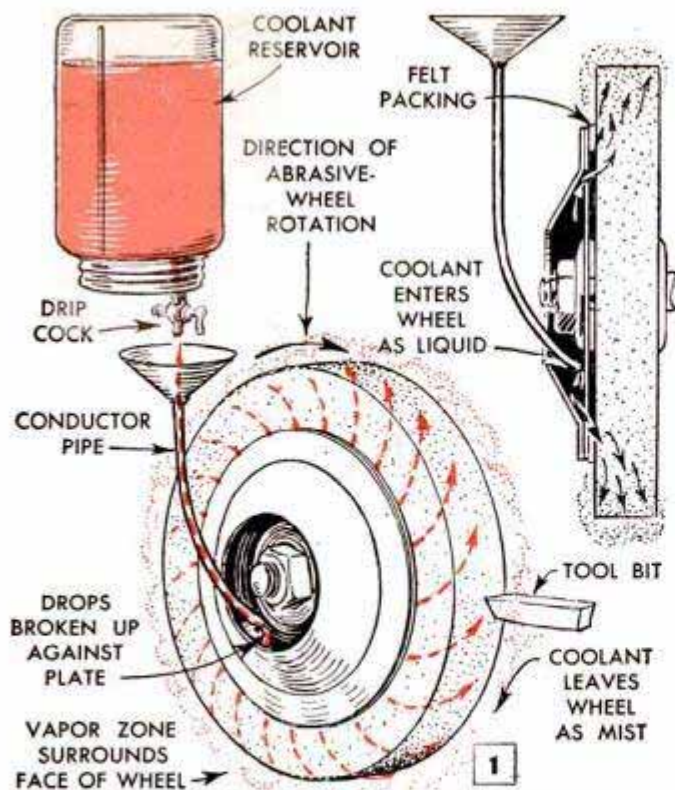
R. Lusignan, Montreal, Que., Can.

Quarter Round Saves Poultry Feed

To keep poultry from wasting feed by billing it out of a straight-sided wooden feeder, nail strips of quarter round to the inner edges of the sides of the feeder. The strips are nailed flat side downward so that they form lips



which make it difficult for the hens to waste the feed. Ordinarily, it is not necessary to attach pieces of quarter round to the ends of the feeder.



VAPOR-ZONE GRINDING

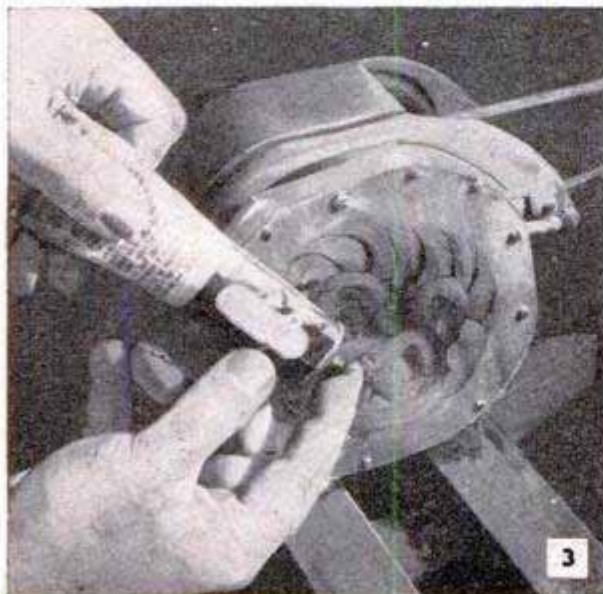
By Alexander Maxwell

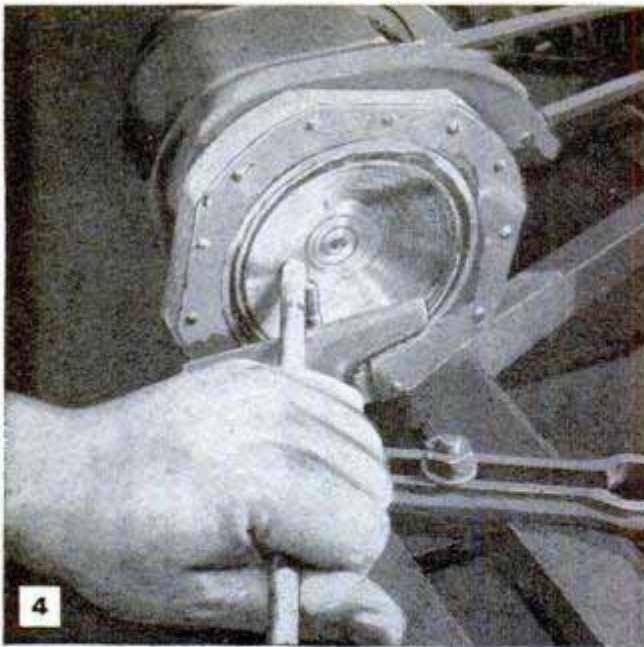
FITTING your bench grinder with a vapor-zone attachment transforms it from a run-of-the-mill shop tool to a highly efficient machine for putting keen, razor-sharp edges on both wood and metalworking tools. Simply by providing a zone of soap-oil vapor which rotates with the grinding wheel, tool-sharpening time is cut in half. As heat is continually dissipated from the cutting edge of the work, the tool remains cool even when heavy cuts are taken. The work can be held firmly with the fingers close to the cutting edge and sharpening completed without quenching in water. The coolant actually reaches the point of contact, burning of the feather edge being minimized as temperatures average 500 deg. cooler than in dry grinding. Danger of altering the work hardness is reduced. In addition, the wheel is washed constantly with less tendency to load, and grinding dust is precipitated in the form of paste.

The vapor-zone attachment operates by restricting the flow of coolant to the point where only an invisible spray emerges from the rim, or face, of the abrasive wheel, Fig. 1. Being light, the vapor is held near the rim by air currents, and whirls around with the wheel until it contacts an object thrust into the air stream. The mist then condenses into droplets, dampening the work but not getting it dripping wet. The most effective coolant, determined by experiment, consists of ½

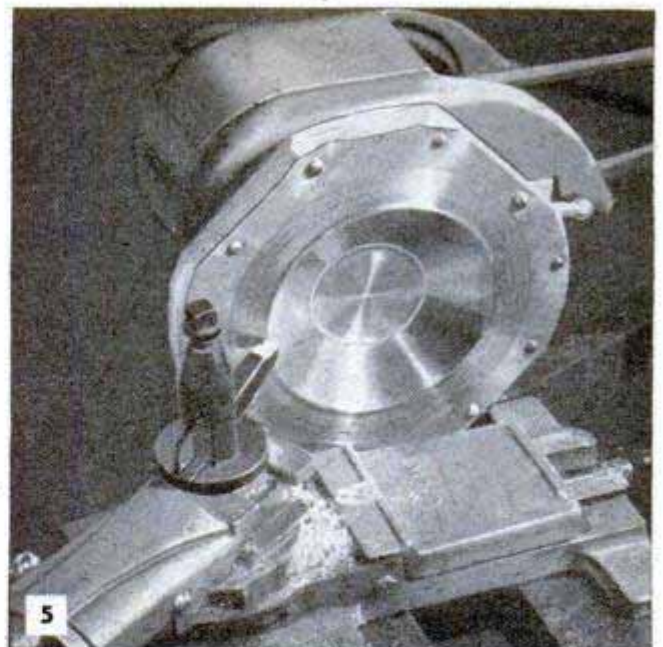


Distributor-cup form is dished-out, above, and brass is lubricated with graphite grease, below

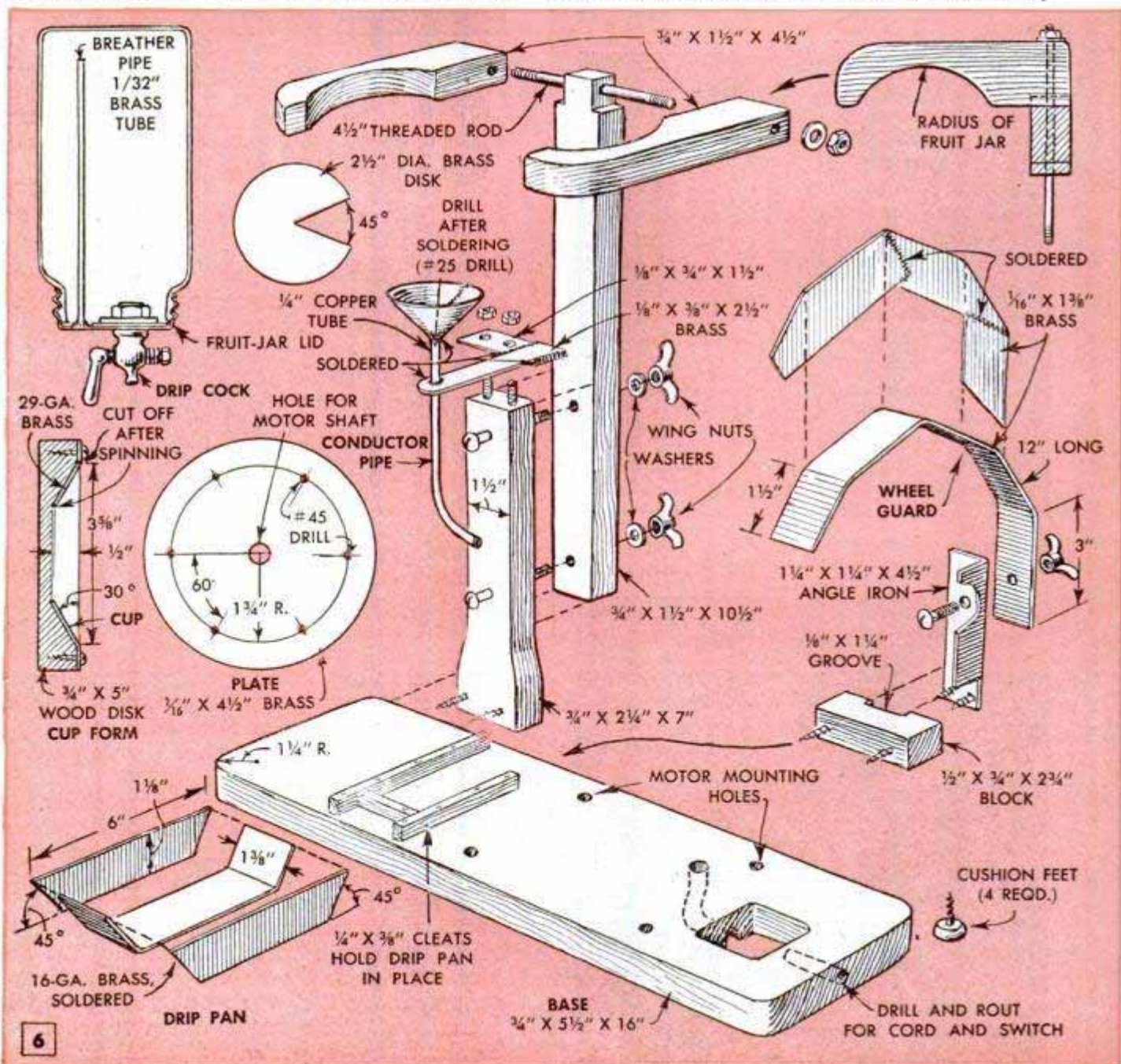




4 Pin clamped to tool rest steadies birch dowel for spinning distributor cup from blank of soft brass



5 Edge of distributor cup is scored on lathe. Then work is unfastened from form and waste cut away





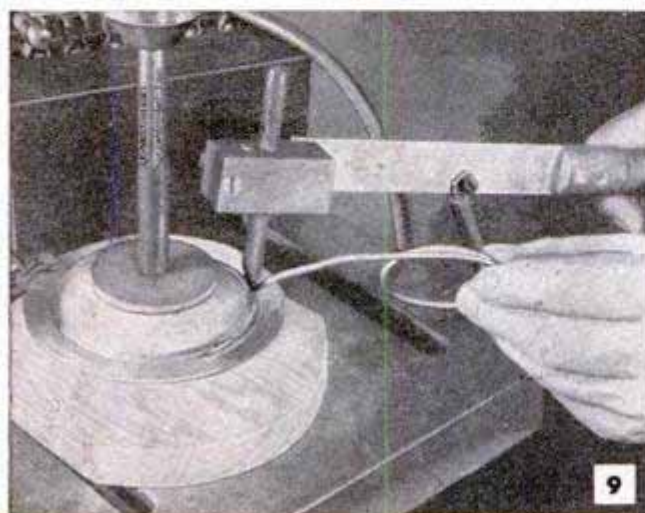
7

Rim of distributor cup is smoothed on emery cloth to assure watertight joint when soldered to brass plate

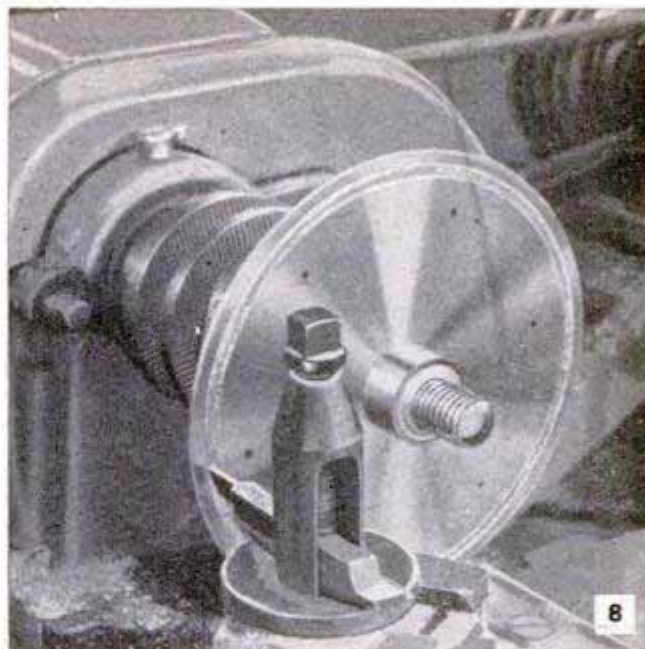
teaspoonful of soapless laundry powder dissolved in $\frac{1}{2}$ pint of cold water. To this is added as much vegetable cooking oil as will dissolve when stirred (about 6 or 8 drops) and a pinch of borax. A half pint of this coolant will last for an hour or so, cooling much more efficiently than an equal volume of pure water.

Begin construction of the unit by making the cup-shaped distributor disk which is assembled as in Fig. 1. The cup is spun from soft-drawn sheet brass, using a wooden form as shown in Figs. 2 and 6. The brass is screwed securely to the form and smeared with graphite grease, Fig. 3. Spinning is done with a length of $\frac{1}{2}$ -in. birch dowel, using a pin clamped to the tool rest as a fulcrum against which the dowel is held, Fig. 4. Running the lathe at high speed, start from the center of the work and slowly press the dowel downward and outward. Be gentle, as extreme pressure

Metal rod chucked in drill press holds disk against cup to provide pad center and clamp for soldering



9



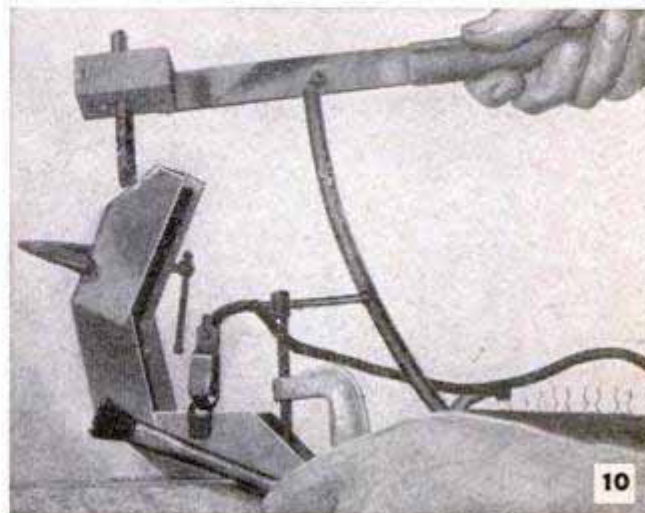
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After brass plate is cut out and drilled, a groove is turned near edge to receive ring of felt packing

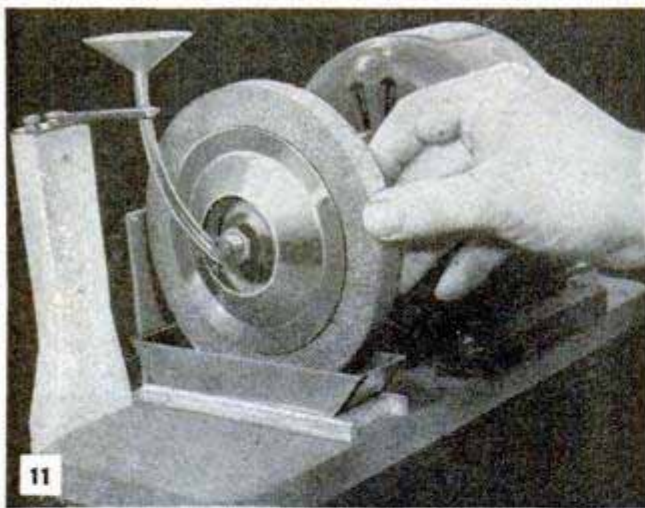
speeds hardening of the brass and may result in a spoiled cup. Continue the stroking action until the metal has "flowed" into the full contour of the form. Then cut away the center section, or bottom, of the cup and carefully score the edge, Fig. 5. Do not cut clear through, because the cup will be damaged when it pulls away. Unfasten the cup from the wooden form and cut along the scored line with tinner's snips. To assure a watertight joint when soldered to a brass plate, the rim of the cup must be lapped smooth on a sheet of fine emery cloth or a lapping plate as in Fig. 7. Cut out and drill the plate, Fig. 6, and true the edge on the lathe. Then turn a groove near the edge for the ring of felt packing, Fig. 8.

The cup and plate must be centered accurately before they are soldered together. This can be done by chucking a pad center in the drill press, using it to center and clamp the parts together. The pad center

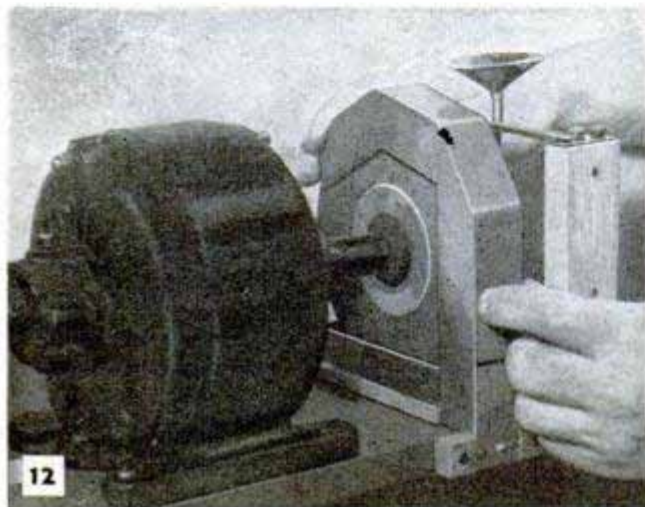
Carbon-arc soldering machine speeds work and small fiber brush spreads melted solder for neater joints



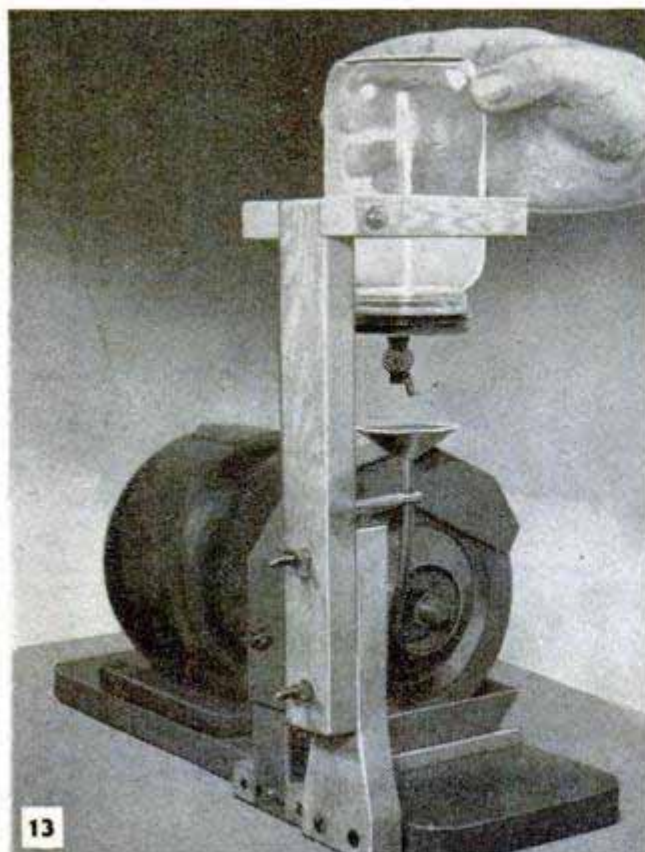
10



Drip pan fits directly under grinding wheel. End of conductor pipe is positioned close to brass plate



Wheel guard is attached with wing nut, above, and coolant container mounted on wooden clamp, below



is a length of steel rod with a disk fastened to or merely slipped under the free end. Coat the assembly with flux, tack-solder and then flow a wash of solder completely around the joint, Fig. 9. An inexpensive fiber brush, Fig. 10, may be dipped in flux and used to spread the melted solder, resulting in neater joints. If available, a carbon-arc soldering machine will do the job in a fraction of the time required for ordinary methods.

The base, uprights and jar clamp are made from hardwood as shown in Fig. 6, the radius of the clamping arms being determined by the size of the coolant container. A brass drip pan, held in place with wooden cleats, fits directly beneath the grinding wheel to catch the paste formed by the mixture of grinding dust and coolant. The construction of the conductor pipe is detailed in Fig. 6 and its assembly is illustrated in Figs. 1 and 11. The brass hanger supporting the pipe must be detachable, as it is necessary to remove the conductor pipe each time the grinding wheel is changed. For efficient distribution of the coolant, the end of the pipe must fit as closely to the plate as possible, Fig. 1. However, if a large-diameter retaining washer is used, consider this as part of the plate when checking the pipe length.

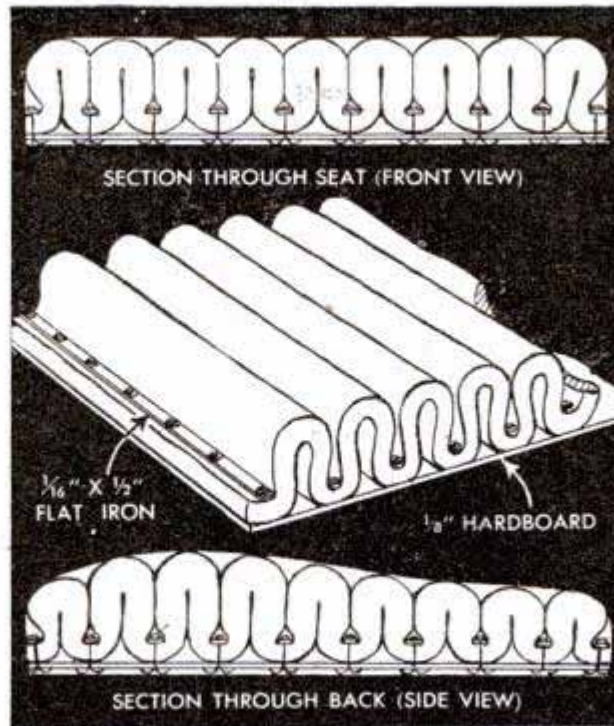
The detachable wheel guard, Figs. 6 and 12, must be substantial for maximum safety, so be sure that the soldered joints are strong. After tack-soldering the parts of the guard, flow solder along the joints. A good soldered joint flows all the way through and there should be a continuous fillet of solder along the inside of each joint.

An ordinary glass jar having a screw-type lid will do for the coolant receptacle. The lid is fitted with a drip cock and breather pipe as in Fig. 6, the drip cock being fastened with a stiffening washer and nut. Select a drip cock that turns easily so minute adjustments can be made. It is an excellent idea to keep two or more jars of coolant on hand. Then, as soon as one jar is empty, the cap can be screwed on the full one and the jar mounted in the clamp as in Fig. 13. Note that the clamp should hold the jar high enough so the drip cock can be regulated easily. Protect the completed unit by painting the parts with waterproof lacquer before assembly.

When using the vapor-zone attachment, allow the grinder to run for a few seconds after the coolant has been turned on and hold your finger close to the face of the wheel. Then, when your finger feels cool and droplets form on it, the grinder is ready for use. Experimenting will determine the proper flow of coolant for a particular job. However, one drop per second is about the average rate of flow.

Rough-riding Jeeps obtained from war surplus and being used on farms and in service stations can be made more comfortable by fitting them with foam-rubber seat cushions. Firm-quality foam rubber, 1 in. thick, is looped as shown in the details and mounted on a hardboard base with split brass paper fasteners. Note in the front view of the seat, upper detail, that the loops of rubber run from front to rear. The side view of the back, lower detail, shows how the rubber loops extend across the back and also illustrates how the size of the loops may be varied to form the desired contour. The base is marked off in a series of 2-in. squares and a $\frac{1}{8}$ -in. hole is drilled at each corner of the squares. These holes receive the ends of the brass fasteners which are first inserted through $\frac{1}{16}$ x $\frac{1}{2}$ -in. flat-iron anchor bars. Holes are drilled through the bars to register with the holes in the base and a bar is placed along the bottom of each rubber loop to keep the heads of the fasteners from working through the foam rubber. The

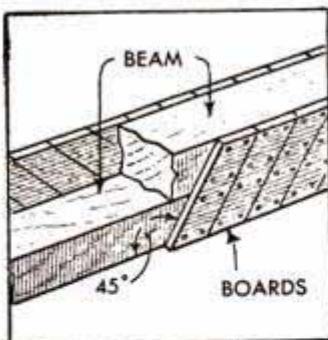
Jeep Seat Cushions of Looped Foam Rubber Absorb Road Shock for Comfortable Ride



rubber under the anchor bars should be compressed to one half its thickness. The cushions can be covered with fabric, plastic or leatherette, using the original seat covering from the Jeep if it is still in good condition. As this method of padding is simple to employ, it also may be used when building lawn furniture.

Louis H. Keding, La Grange, Ill.

Compound Girder to Support Heavy Load Improvised by Sheathing Beams



When timbers of sufficient size to support heavy loads are not available, compound girders consisting of two or more beams can be improvised to serve the purpose. The beams are laid

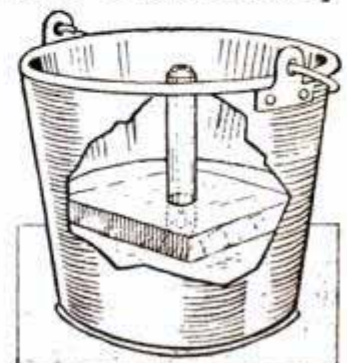
one on top of the other to attain the desired thickness and then sheathed with boards, preferably $1\frac{1}{4}$ in. thick. These boards are spiked at a 45-deg. angle along the sides of the girder, running in an opposite direction on each side. The sheathing counteracts shifting of the beams, and load tests reveal that the sheathing boards will split or the nails pull loose before the beams collapse under excessive loads.

John P. Arnold, Doylestown, Pa.

Nipple Floating on Milk Insures That Pail-Fed Calves Will Drink Slowly

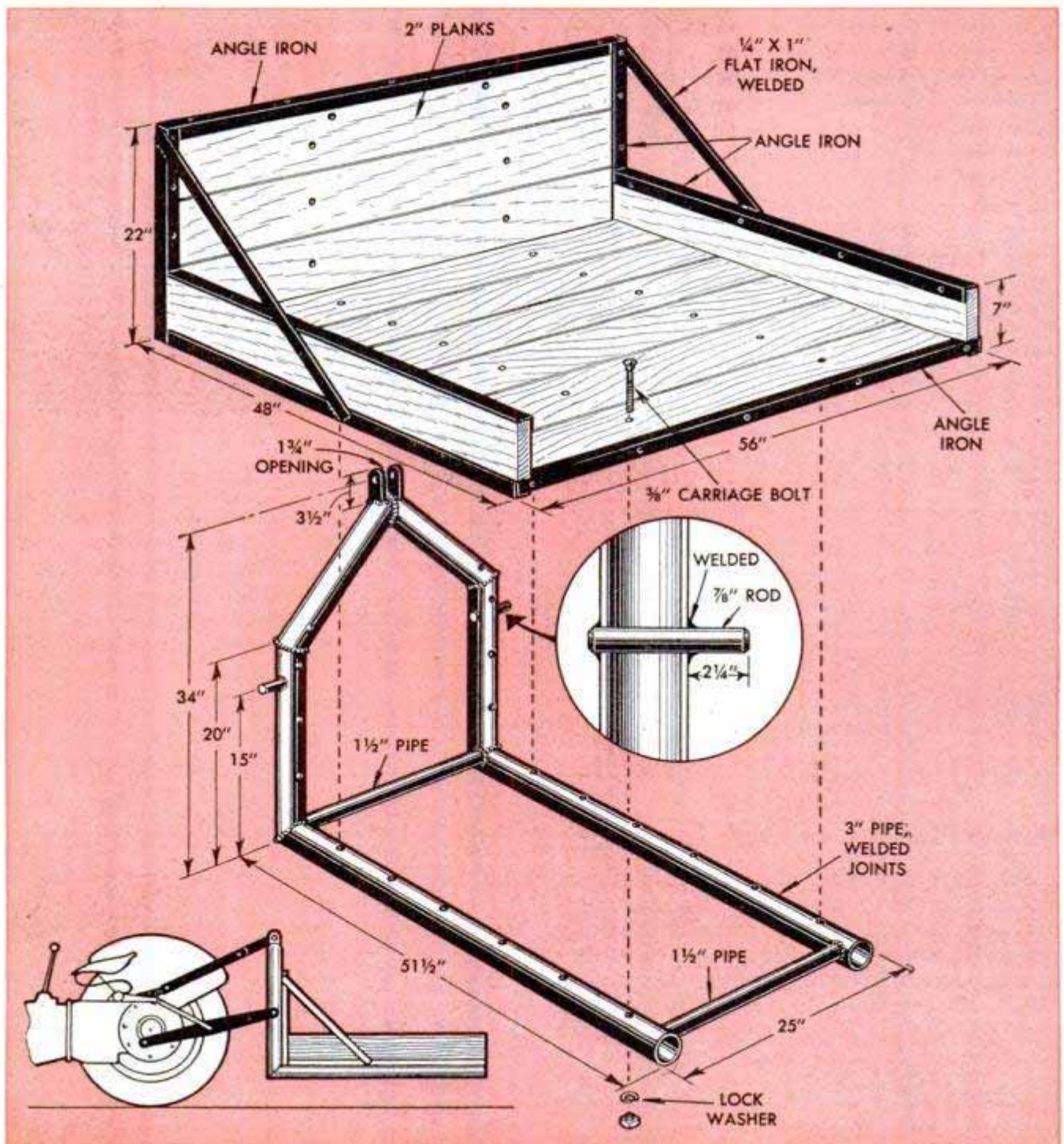
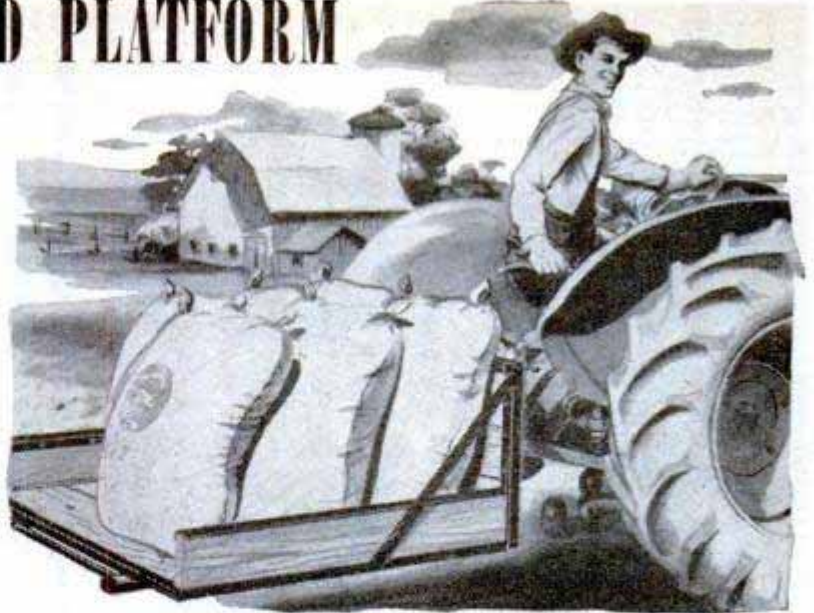
Floating in a pail of milk, this nipple forces a calf to drink slowly in a more natural manner and without wasting the daily ration. The nipple is a 6-in. length of rubber milking-machine tubing forced through a hole drilled in the center of a square piece of $\frac{3}{4}$ -in. board. Be sure that the square piece is cut to the proper size so that it will fit loosely in the pail. A wooden plug is pressed into the lower end of the tubing so that both are flush with the underside of

the board, and a $\frac{3}{16}$ -in. hole is drilled through the plug. The top end of the tubing should be tapered or rounded slightly so that it forms a nipple. — Clyde Zimmerman, Topeka, Kans.



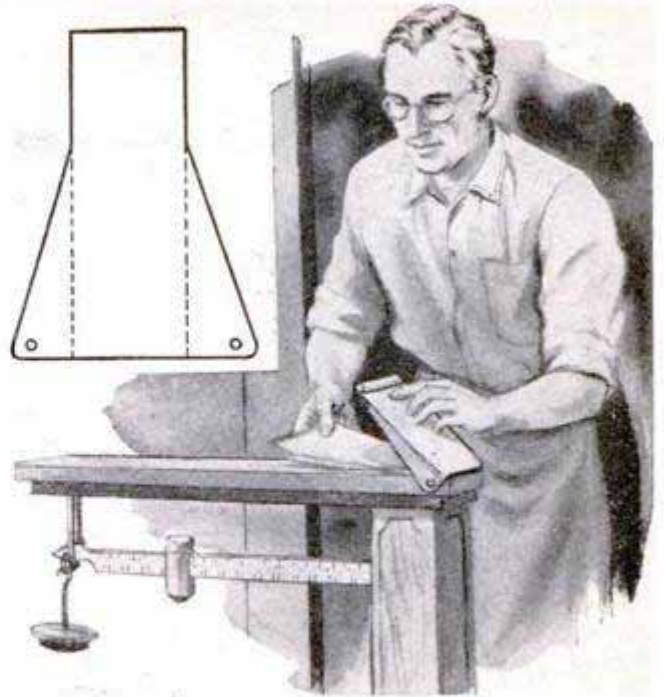
TRACTOR LOW-LOAD PLATFORM

FARMERS and poultrymen who own Ford tractors with hydraulic lifts will find daily use for this handy load platform. The platform is bolted to an underframe made from 3-in. pipe as in the details below. Sleeves in the ends of the tractor lift bars slip onto $\frac{7}{8}$ -in. pins welded into the vertical members of the pipe frame, and the free end of the hydraulic-control bar is pinned to a yoke on the frame. In the raised position the platform is carried about 8 in. above the ground.



Sheet-Metal Clip on Platform Scale Holds Weighing Slips and Pencil

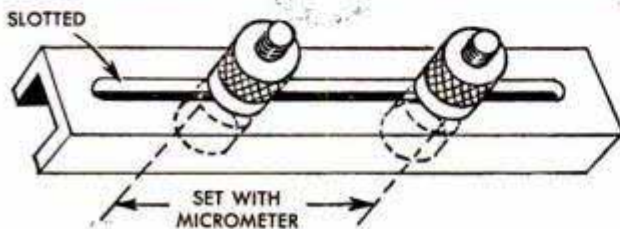
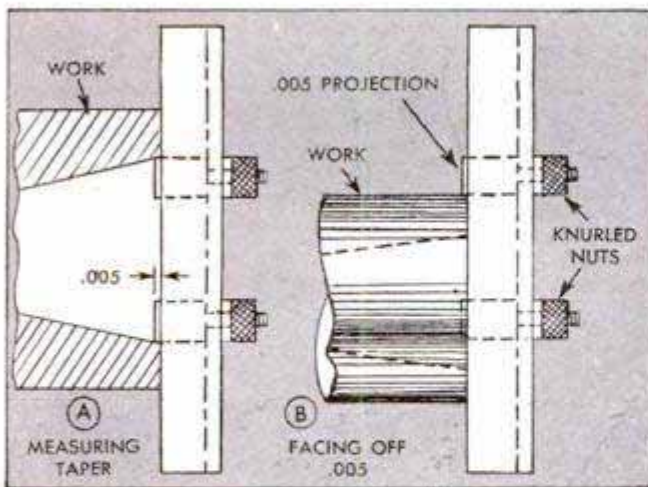
Weighing slips are prevented from blowing off the platform scale while weighing produce outdoors by one merchant who made a hinged holder of sheet metal to keep both the slips and a pencil handy. The sheet metal is cut and bent as indicated in the sketch and is attached to the wooden beam arm of the scale with two small nails. The free end of the sheet-metal clip is turned back to form a holder for the pencil.



Taper-Measuring Gauge for Lathe Assures Holes of Exact Diameter

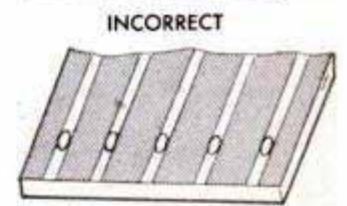
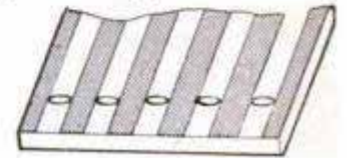
With this measuring gauge you can accurately "mike" a tapered hole to an exact diameter. The gauge consists of two movable buttons or studs in a slotted metal channel. The important point in making the gauge is to be sure that each button projects .005 in. above the channel. To check the diameter of a tapered hole turned to the approximate size, the buttons are first set the desired distance apart with a micrometer. Then the gauge is held against the work as in detail A. When the taper is turned to the point where there is no side play between the buttons and the side of the hole as the gauge is moved back and forth, the exact diameter desired is obtained by facing off the end of the work .005 in. To be sure that you remove just .005 in., the gauge is held against the work as in detail B. Then, when a trial cut, part way in from the edge, is deep enough to permit both button and channel to touch the work, the facing cut is completed to produce a hole of exact diameter.

H. Moore, Leeds, England.



Correct Punching Strengthens Belt

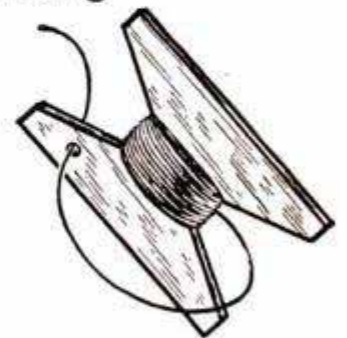
When lacing a belt, maximum strength is maintained if elliptical holes are punched parallel to the length of the belt as shown in the lower detail. Note, by comparing the shaded areas in the two drawings, that if the holes are punched with their length running across the belt considerably more material is removed from the cross section of the belt. The strength and pulling power of the belt is reduced in proportion to the amount of stressed material removed.



W. F. Schaphorst, Newark, N. J.

Chalk-Line Reel Drilled To Prevent Unwinding

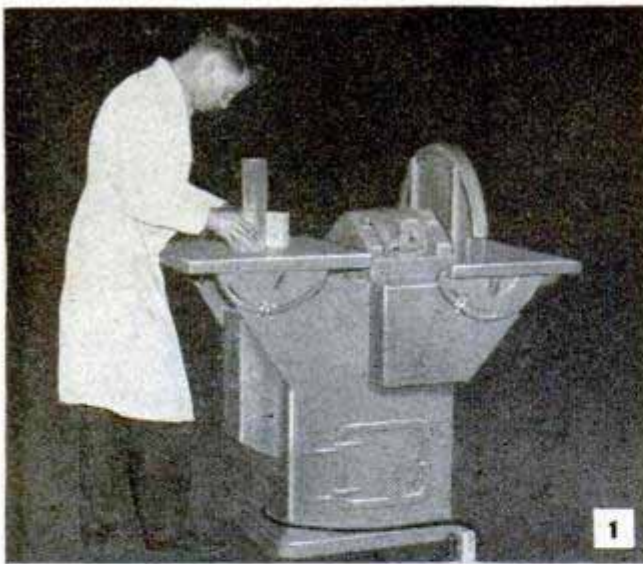
To prevent a mason's chalk-line reel from unwinding when the line is pulled taut and tied, drill a small hole through the reel and pass the line through it as shown in the illustration. When paying out the line, unwind as much as is needed by looping it over the opposite side of the reel and then pull it through the hole.



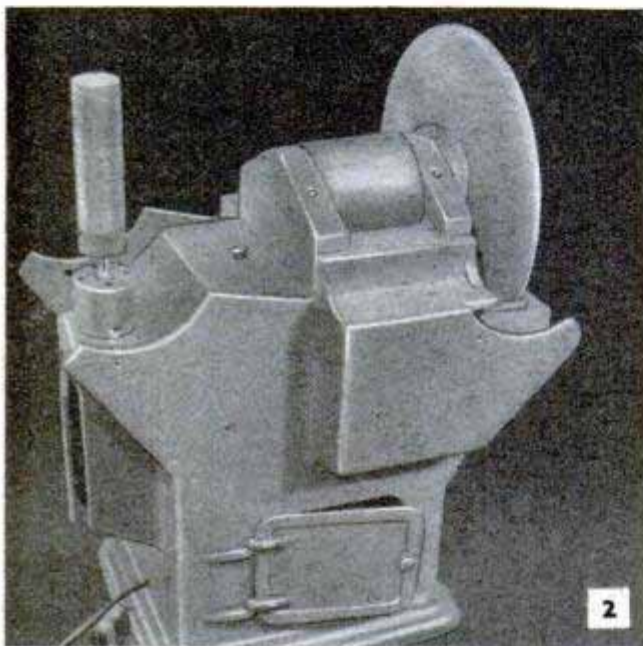
M. S. Hunter, Orangeburg, S. C.

Disk and Spindle **SANDER**

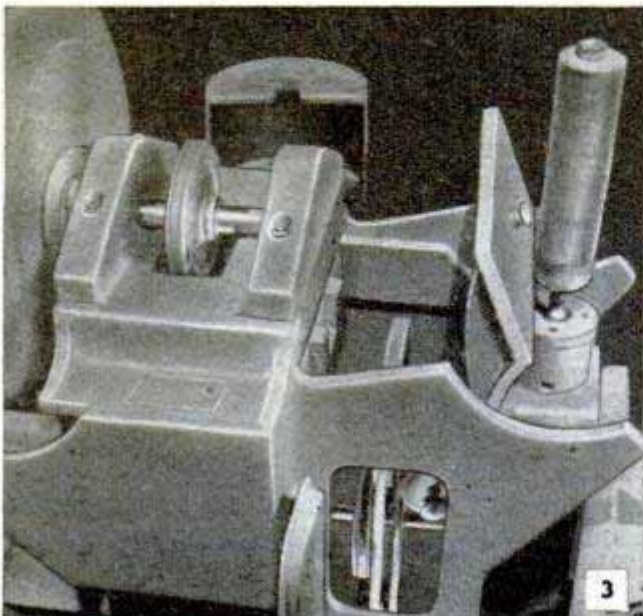
By R. Russell



Oscillating spindle sander plus large disk sander combine to form a versatile woodworking machine



Above, completed machine minus tilting tables. Note service doors for motor and oscillating mechanism. Below, removing dust covers and opening side door give access to both disk and spindle-sander pulleys

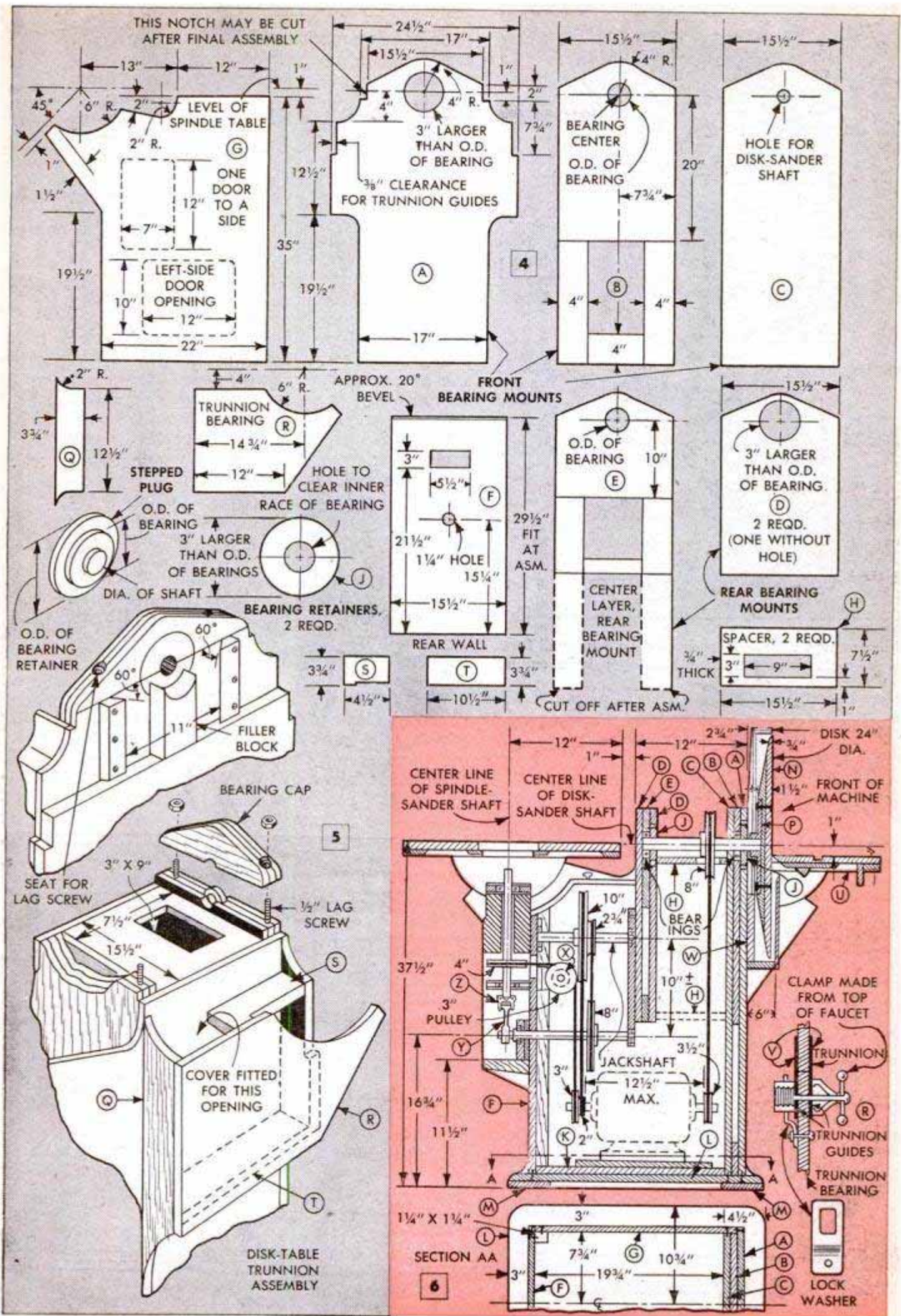


BUILT entirely of plywood, this combination disk and spindle sander provides a sturdy machine for the basement shop or small woodworking shop. The 24-in. disk with its tilting table will handle a wide variety of large work. The spindle sander, pictured in use in Fig. 1, oscillates, and this sander also is equipped with a tilting table. Both sanding units are driven by a 1-hp. double-shaft motor housed in the base of the sander.

Before beginning construction of the sander, it is a good idea to lay out the sectional detail, Fig. 6, full-size on heavy paper. All members are keyed to this detail. Proceed by roughing out the bearing mounts from $\frac{3}{4}$ -in. plywood, 7 ply, making them about 1 in. larger over-all than the finished dimensions, Fig. 4. Note part B is sandwiched between parts A and C to form the front bearing mount and part E is placed between two pieces cut from pattern D to form the rear bearing mount. Mark off the bearing centers and cut holes for the bearings in parts B and E. Standard ball bearings are used and should be a press fit in the holes. Holes 3 in. larger than the bearings are cut in part A and one of the parts D, the other member being left solid. Bearing retainers to fit into the holes in parts A and D are bandsawed from $\frac{3}{4}$ -in. plywood, and a stepped plug is turned to facilitate aligning the bearing mounts for gluing. Only B and C layers of the front bearing mount are glued together at this time. By cutting off the shaft projection from the stepped plug, the latter can now be used to align the sections of the rear bearing mount for gluing. All three layers of this mount are glued and clamped together and allowed to dry.

The two glued sections are placed one on top of the other and aligned with a stepped plug. Then the actual over-all dimensions are laid out from the bearing centers and the work cut to finished size, both front and rear sections being cut simultaneously. The outer layer of the front bearing wall, detail A, is then laid out and sawed separately. Note that the dimension at the base is $1\frac{1}{2}$ in. greater than the widths of the other layers so that a $\frac{3}{4}$ -in. rabbet is formed for the side panels when the three layers are glued together.

After section A has been aligned and glued to section B, the bearing retainers





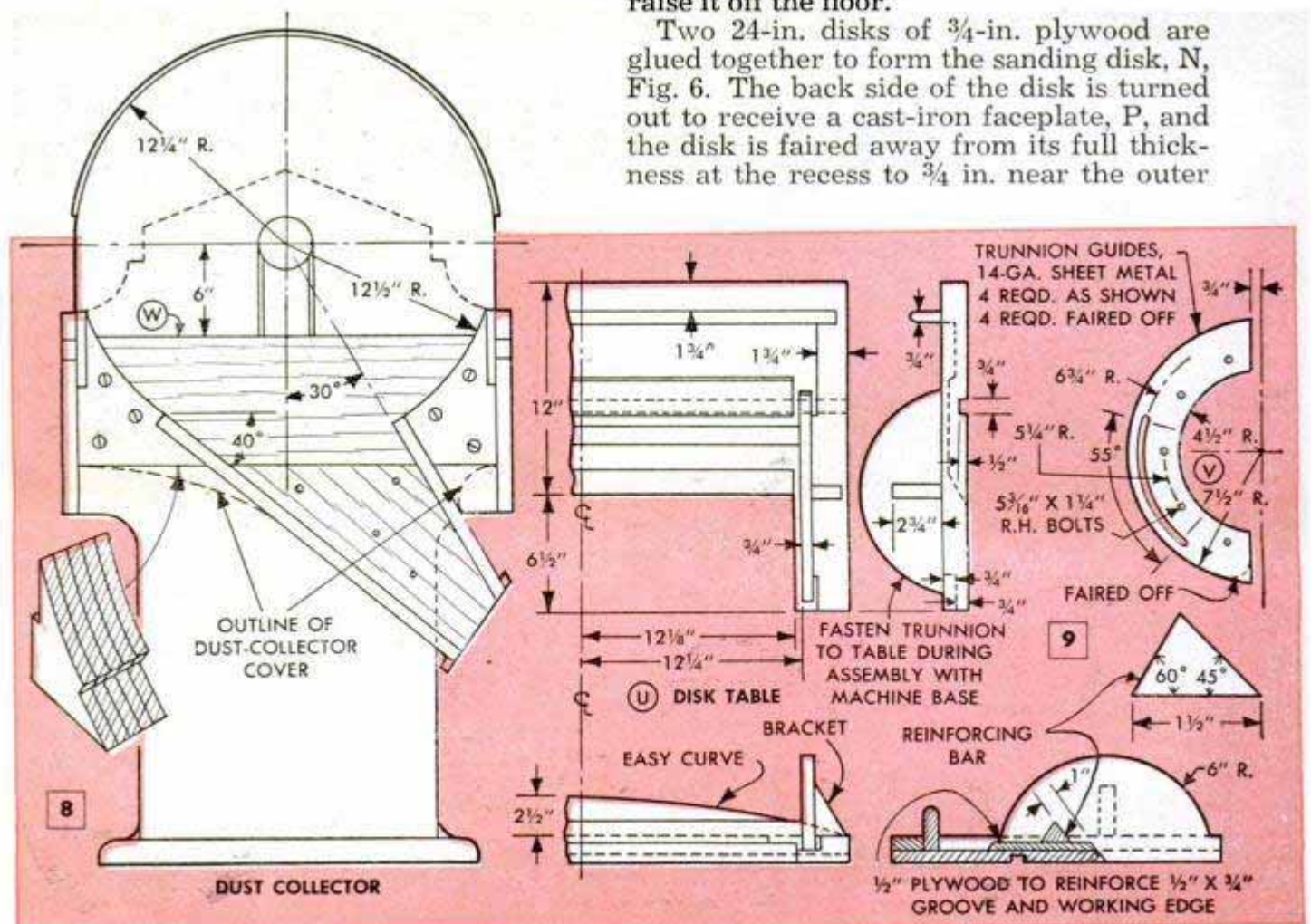
Idler pulleys mounted on detachable rear wall form right-angle drive for the oscillating spindle sander

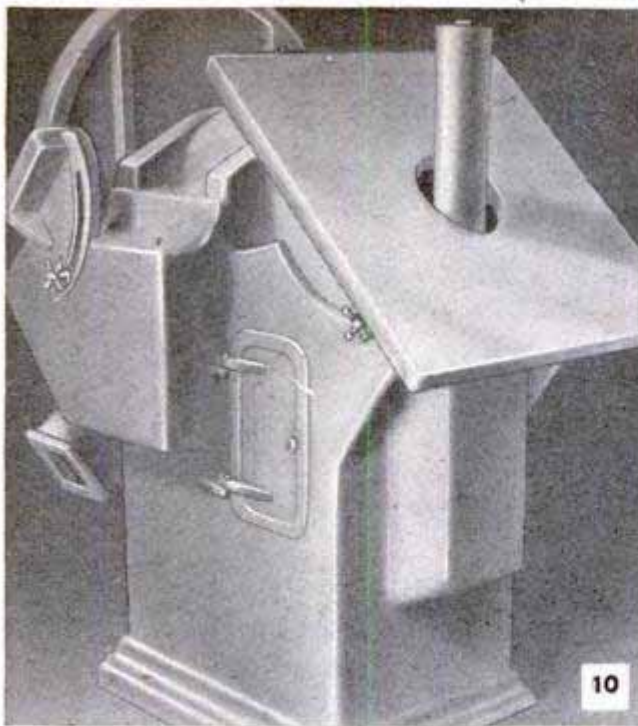
are screwed to the mounts. Then the top of each bearing mount is drilled for two $\frac{1}{2}$ -in. lag screws and cut off horizontally through the bearing center to form the bearing caps, Fig. 5. The holes in the caps are counter-bored for nuts and, after the lag screws are driven, their heads are cut off and threaded to receive the nuts. Hanger bolts can be used instead of lag screws.

The two side walls, detail G, are cut simultaneously from $\frac{3}{4}$ -in. plywood. The two trunnion bearings, R, the rear wall, F, the spacers, H, and associated parts can also be cut out at this time. As the spacers which fit between the bearing mounts serve to align the bearings, they must be squared accurately. Two of these are cut out, one being installed permanently at the top of the sander and the other being used only temporarily, as shown in Fig. 6. The latter spacer is knocked out after assembly.

The base of the sander consists of two main parts cut from $\frac{3}{4}$ -in. plywood—piece K which is $15\frac{1}{2} \times 19\frac{3}{4}$ in. and piece L which is $21\frac{1}{2} \times 27\frac{1}{4}$ in. When cutting piece K be especially careful to see that the corners are perfectly square, because any irregularity in this piece can throw the entire machine out of alignment. Piece K is screwed and glued to piece L which forms the lower member of the base. Cleats, M, Fig. 6, are cut from 1 x 6-in. stock and attached to the underside of piece L to raise it off the floor.

Two 24-in. disks of $\frac{3}{4}$ -in. plywood are glued together to form the sanding disk, N, Fig. 6. The back side of the disk is turned out to receive a cast-iron faceplate, P, and the disk is faired away from its full thickness at the recess to $\frac{3}{4}$ in. near the outer





Tables of spindle and disk sanders are shown tilted to maximum angle of 45 deg. Note trunnion clamps

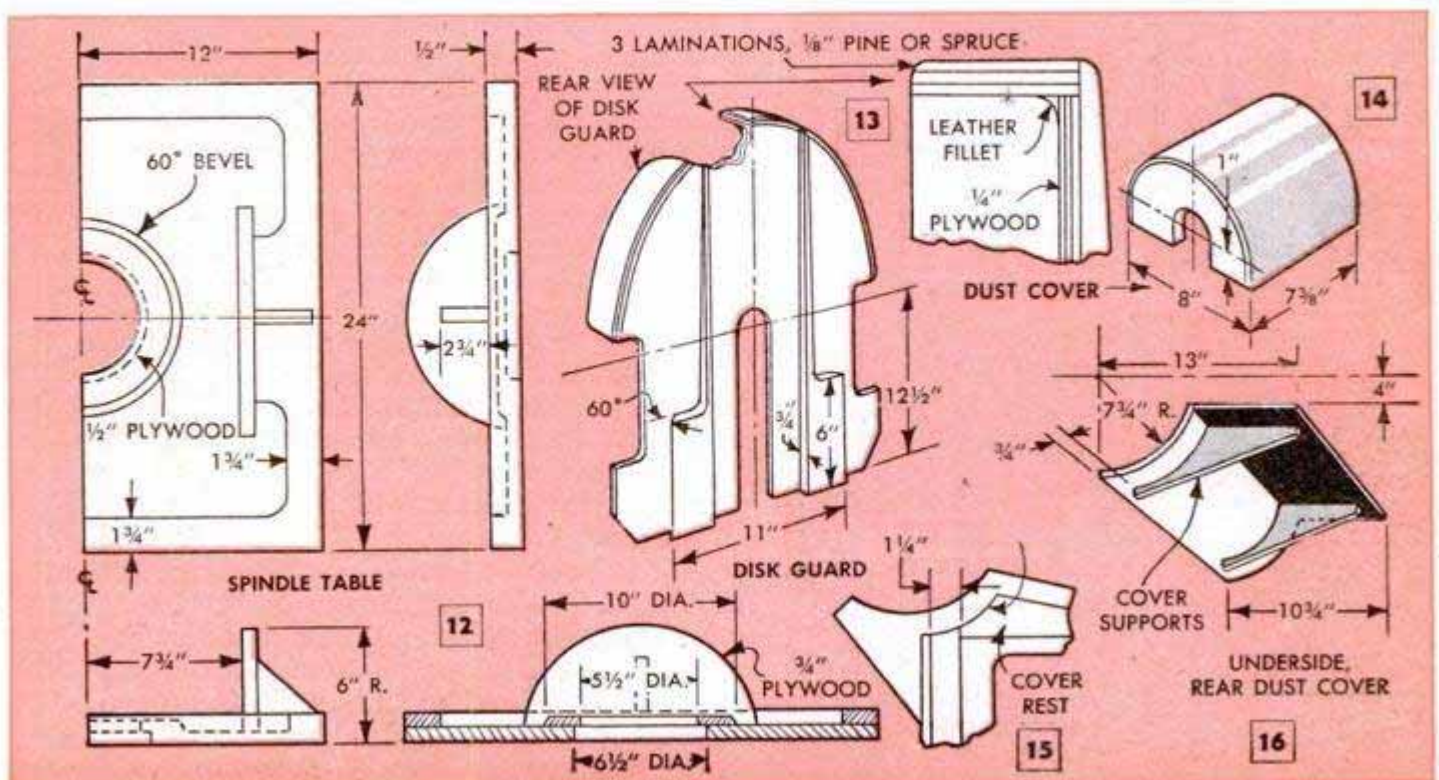


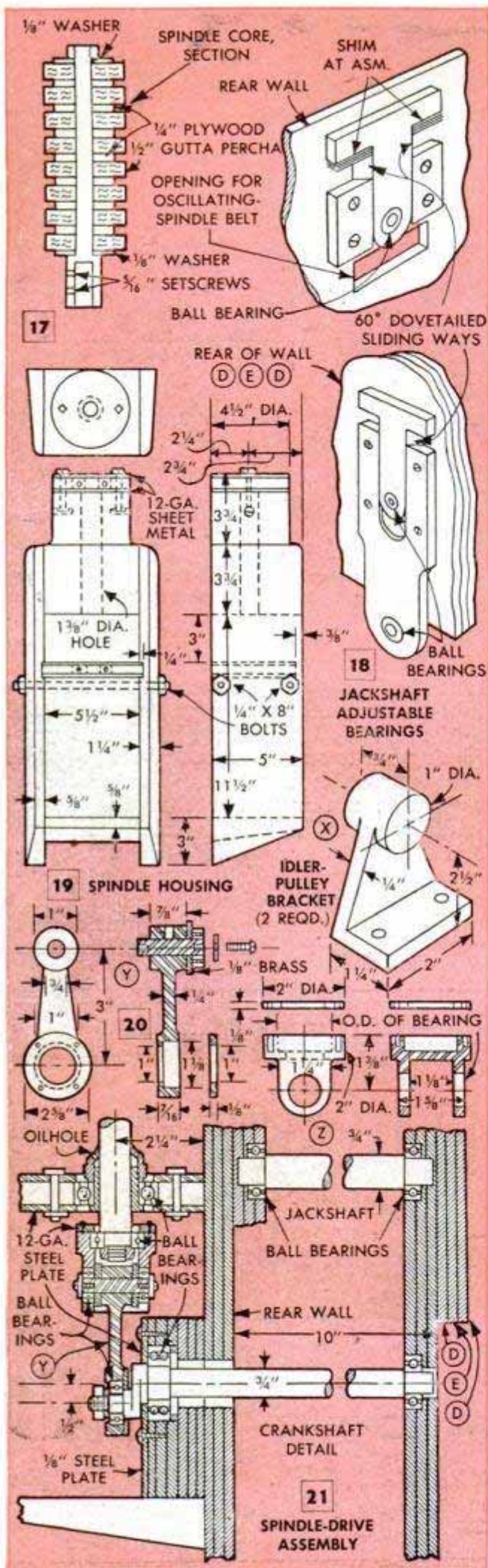
Table of disk sander is grooved for miter gauge and underside is reinforced with plywood and crossbar

edge. The hub of the faceplate is pinned to the shaft and the disk is attached with four elevator bolts in countersunk holes. The shaft size is determined by the bearings.

The machine is now ready for temporary assembly. To do this, fasten the front bearing wall against part K of the base with screws driven up from the underside as in Fig. 6. Install the 1¼-in.-square corner posts and set up the rear wall. Then the spacers, the side walls and the rear bearing wall are installed. When assembled, check the disk-sander shaft for alignment and make any necessary adjustments.

Make the plywood disk table, Fig. 9, detail U, the trunnions and the sheet-metal trunnion guides. Note that the top of the table is grooved for a miter gauge and the underside is fitted with a hardwood reinforcing bar to strengthen the working edge. Fit the trunnion bearings to the temporary assembly, making sure that the 3¾-in. width of parts Q, Fig. 5, is exactly the same as the overhang of the front section of the bearing mount, A, Fig. 4. After tightly drawing up all the joints of the machine, the disk table is fitted by fastening temporary strips on both sides of the trunnion





bearings and setting in the trunnions. The table should tilt without rocking but, if rocking does occur, it means that one of the trunnion bearings is out of line.

After the shaft and disk table have been perfectly aligned, the machine is ready for final assembly. Mark all the joint outlines, take the machine apart and then reassemble by gluing and screwing the parts together. However, do not glue the rear wall in place. Attach the sheet-metal guides to the disk-table trunnions and clamp them to the trunnion bearings with clamps made from the tops of faucets, detail R, Fig. 6.

To build the dust-collector chute, Figs. 8 and 11, first attach piece W, a 24 1/2-in. length of 1 x 10, to the front bearing mount between the trunnion bearings, as in Figs. 6 and 8. End blocks for the dust chute are built up in layers from scraps of plywood and bandsawed on a 12 1/2-in. radius. The blocks are fastened to piece W and then top and bottom pieces of the chute are fastened to them. The face side of the chute is covered with 1/4-in. plywood, fastened with screws to permit removal.

The disk guard is made as shown in Fig. 13 and is fitted with beveled mounting brackets to slide between the cleats shown in Fig. 5. Installation of the pulleys, belt and motor, as in Fig. 6, completes the disk-sander portion of the machine.

The spindle table, Figs. 10 and 12, is built similarly to the disk table. Sheet-metal guides and clamps are installed in the same way as for the disk-table trunnion. Fig. 14 shows construction of the disk-shaft dust cover, Fig. 16 construction of the rear dust cover and Fig. 15 the cover rest. Figs. 2 and 3 picture these covers in both the closed and open positions.

The housing for the spindle shaft and bearings shown in Fig. 10 is made of hardwood, as in Figs. 6 and 19, and fitted with an access door pictured in Fig. 2. The bearings are fitted in plywood retainers and held by sheet-metal plates. The spindle thrust-bearing housing and the connecting rod, Figs. 20 and 21, can be of welded steel or cast iron, the diameters being determined by the size of the ball races used. The crankshaft and jackshaft are mounted as shown in Fig. 21, and adjustable bearings for the jackshaft are made as detailed in Fig. 18. The two 3-in. idler pulleys for the right-angle drive, Figs. 6 and 7, are mounted on brackets detailed in Fig. 20.

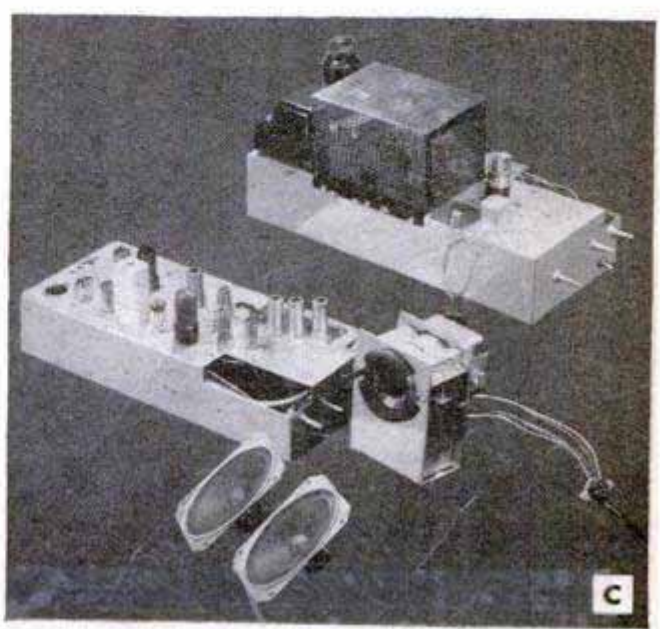
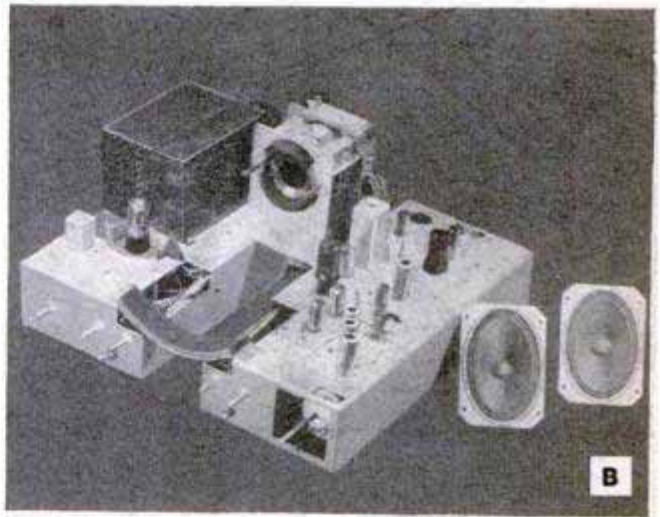
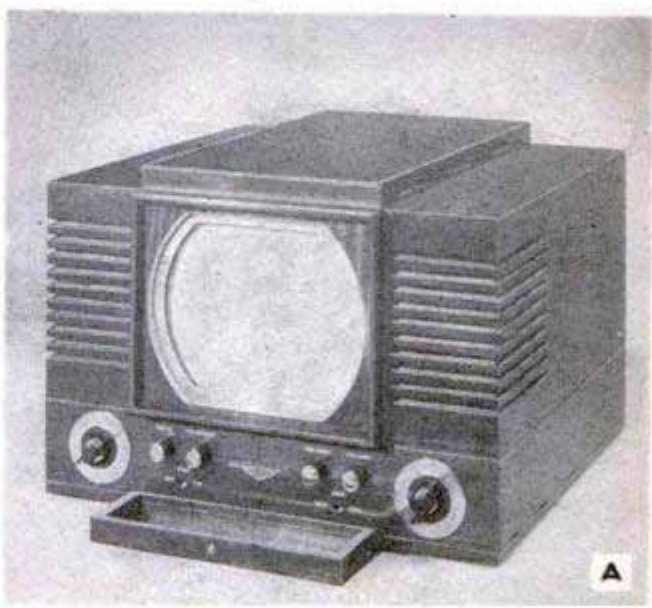
The spindle drum, Fig. 17, consists of disks of 1/4-in. plywood and 1/2-in. gutta percha, the latter being a sliding fit. These are fastened to a shaft with a nut and washer and the lower end of the shaft is bored to fit over the end of the oscillating drive shaft. The shaft is held in place with two 5/16-in. setscrews.

Radio Electronics

UTILITY TELEVISION TODAY

PRACTICAL applications of television in the home will be featured by many manufacturers in 1950. The table-model TV receiver shown in photo A employs two 6-in. loudspeakers to reproduce the FM sound in a realistic manner. This custom-made TV receiver employs a versatile chassis consisting of three basic units, the power-supply unit, R. F. chassis and deflection yoke assembly.

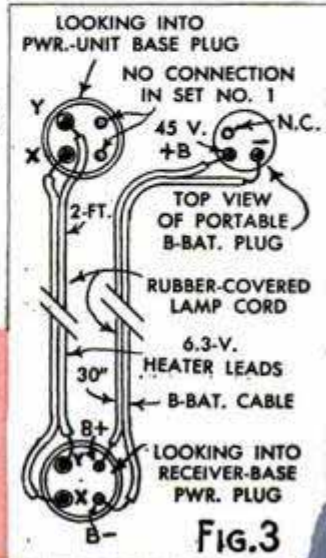
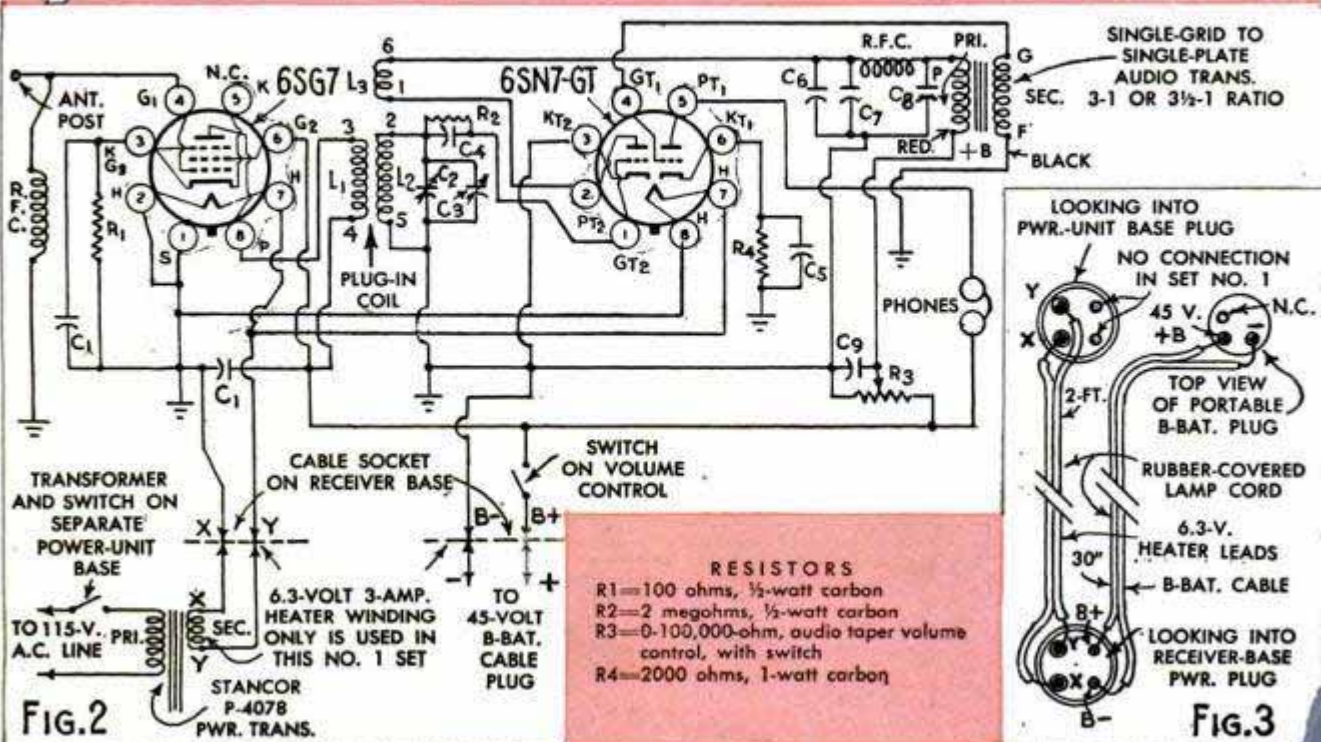
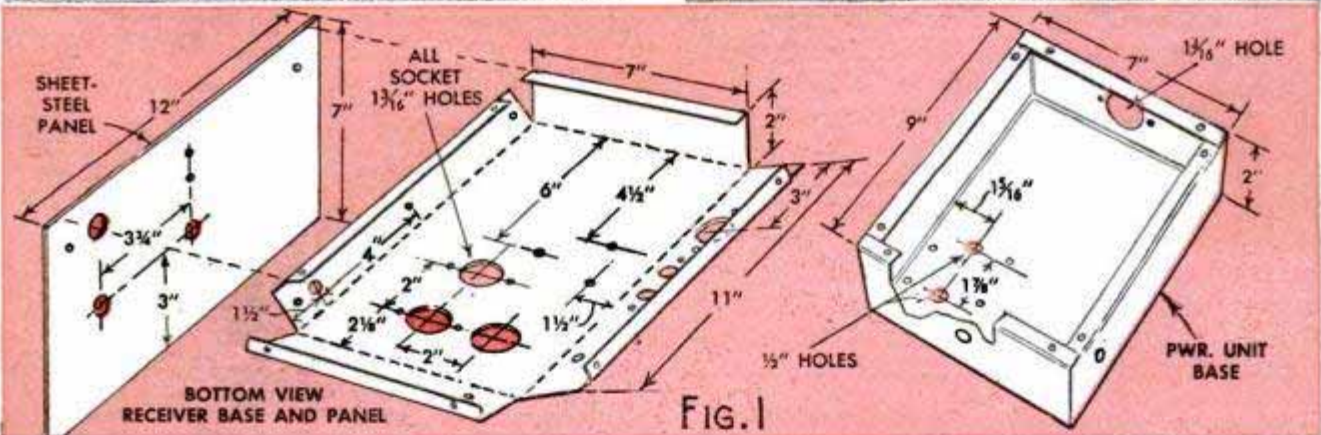
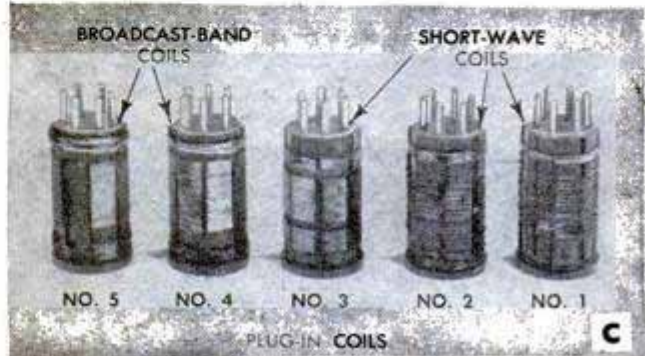
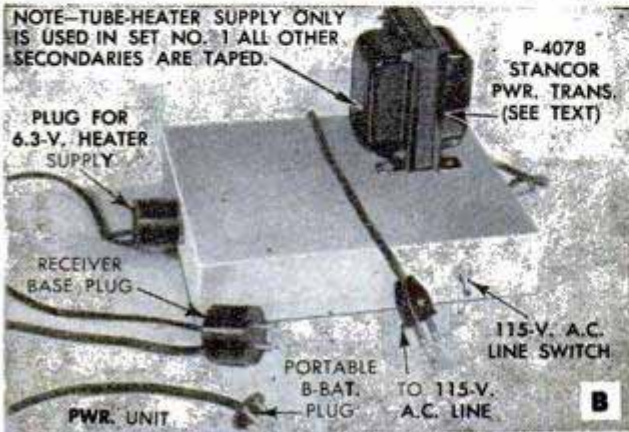
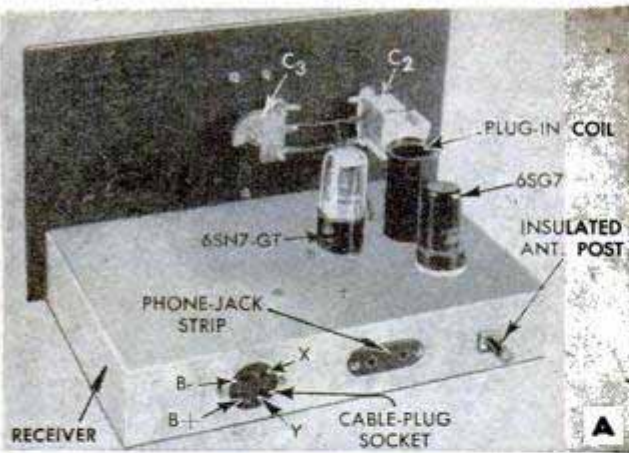
The manufacturer also makes the separate units and speakers available so that they can be assembled in special installations in any type of cabinet. They may be placed side by side, one above the other, etc., to conform with cabinet or console space. Photo B shows the assembled units without the TV picture tube, as they appear in a conventional cabinet; the separate units are illustrated in photo C. There is a choice of either a 10-in. or 12½-in. tube model. These units are completely wired, pretuned and tested; they are not construction kits. Photo D shows a kitchen television set in gleaming white, made by another manufacturer. It employs a 7-in. tube and is compact enough to fit on a kitchen shelf or cabinet, thus bringing TV right into the homemaker's work center.



No. 1 PROGRESSIVE ALL-WAVE

DISTANT short-wave stations as well as local broadcast-band programs can be tuned in with good volume and clarity with this specially designed progressive student set. Former progressive student sets have keenly interested beginners because they have made it possible to start out with a simple headphone receiver. Then without wasting parts, they can build a full-fledged, all-electric loudspeaker set at a later date.

This 1950 two-unit series is a little more elaborate than former ones but it is in keeping with the same idea, and it includes the

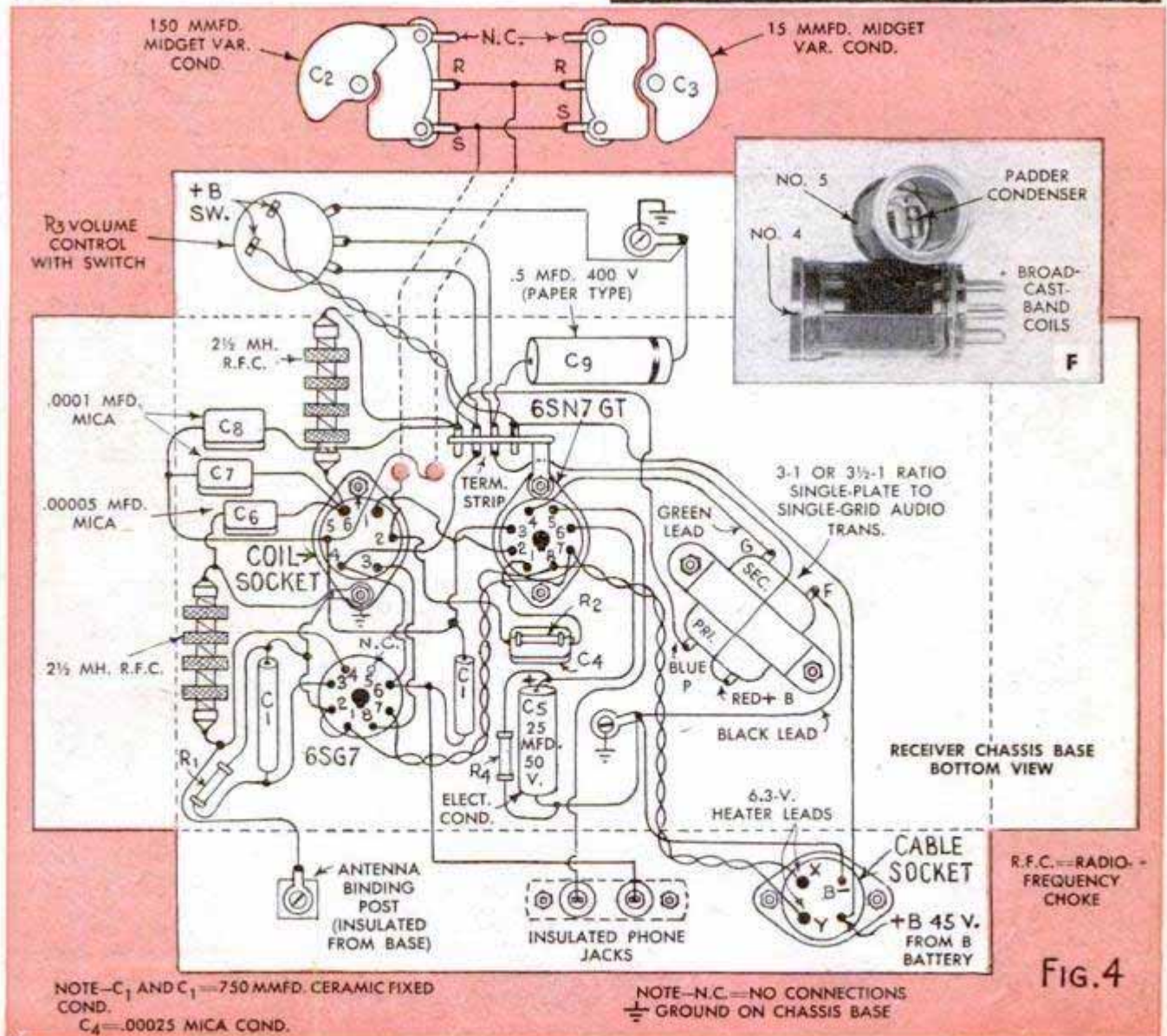
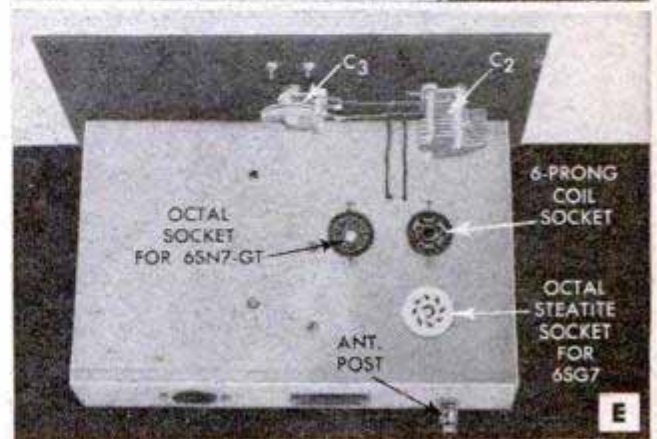


"OVERSEAS DXER" FOR STUDENTS

short-wave bands, and hand-wound coils requested by many builders of previous progressive student sets. The separate power unit plays a very small part in set No. 1 as only the 6.3-volt secondary winding on the power transformer is employed; tape the unused secondary leads carefully. This No. 1 set is complete in itself and should be carefully built and used by the beginner for some time until he is thoroughly familiar with its operation before converting it into the larger all-electric set which will appear in an early issue. Although only two tubes are used in this first set, they provide a radio-frequency stage, a detector, and one audio stage. The R. F. stage furnishes necessary extra sensitivity that will pull in foreign short-wave broadcasting stations with ease.

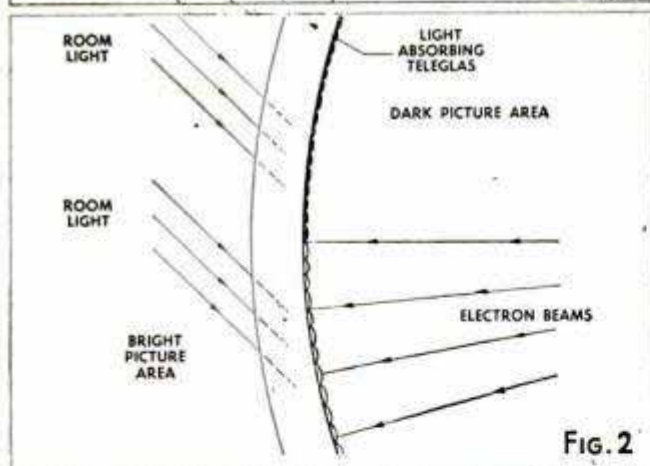
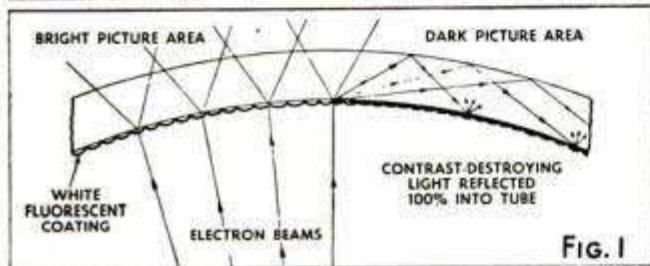
Photos A and B show the separate receiver and power unit; three of the plug-in coils illustrated in photo C are used to cover the short-wave bands from 1.6 to 15

(Continued to page 234)



"BLACK" TUBE FOR SHARP-CONTRAST TV PICTURES

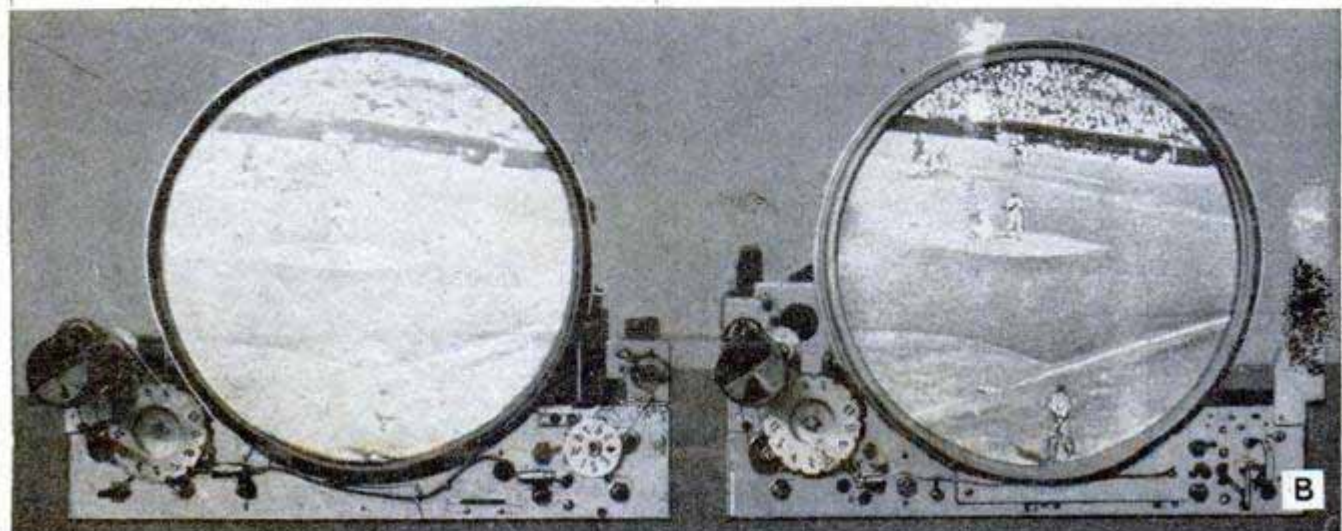
By F. L. Brittin



SPECIALLY designed glass known as "Teleglas" is now used in the faces of some metal picture tubes to provide contrast ratios, perfect image reproduction and relieve eyestrain. Developed by the Pittsburgh Glass Company engineers for TV-set manufacturers, it is claimed to make possible the maintenance of an approximate 33 to 1 contrast under widely varying conditions of room light.

A tube faceplate of this glass, held by the young lady in photo A, shows the lines on the dress under the area covered by the glass as compared with other dress areas. It acts as a filter to reduce the detrimental effects of room light, and to minimize halation, or glare.

Eye authorities are in general accord that the main threat of constant television viewing to the eyes comes from concentrating on an overbright image in a darkened room. They claim that the ideal solution is a not overly bright screen which must, however, have sufficient contrast to give a sharp picture in a lighted room. Two identical TV receivers are photographed on the same negative in photo B. The tube at the left has a conventional glass face while that to the right employs the new glass. A cross section of a cathode-ray tube face in Fig. 1 shows that light from the bright picture area striking the exterior tube-face surface at angles greater than 48 degrees is 100 percent reflected over into the dark area. Teleglas reduces the intensity of this unwanted light. The effect of room light on a TV picture is illustrated in Fig. 2. Black areas in the TV picture can be obtained only by an absence of light. Hence, it is essential that external light which might fall on the picture tube be kept to a minimum. The new glass accomplishes this by absorbing unwanted light.



Kodak ABC Photo-Lab Outfit—All the materials and equipment you need to start developing and printing your own pictures. \$7.58.

Kodak Negative Files—Protect individual negatives and negative strips. Index identifies negatives. \$2.25—\$3.25.

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Equipment

With the right Kodak equipment you can have a lot more fun in your darkroom. And you're likely to get better results, too.

Inspect these Kodak darkroom accessories at your dealer's. He can give you many useful tips in choosing the right equipment.

Eastman Kodak Company
Rochester 4, N. Y.

Prices include Federal Tax where applicable

Kodak Darkroom Apron
—Moisture-proof and lightweight. Long waist cord holds towel. Drip cuff at bottom protects shoes. Two sizes, \$2.25 and \$3.



Kodak Washing Assembly—Converts sink into circulating washer. Fresh water enters through hose; hypo-laden water drains through special stopper. \$2.25.



Kodak Utility Footswitch—Keeps both hands free while you're printing, enlarging, or inspecting negatives. \$10.

Kodak Studio Scales—Two-pan type. Weights furnished in avoirdupois or metric system. Mahogany-finish base. \$8.50.

Kodak
TRADE-MARK

Kodak Adjustable Safelight Lamp—Attach it to wall, shelf, or bench. Swing it through nearly a complete circle—it stays in any chosen position. \$7.58.



Kodak Automatic Tray Siphon—Puts fresh water in at top of tray, keeping prints agitated; siphons off chemically laden water. \$5.25.

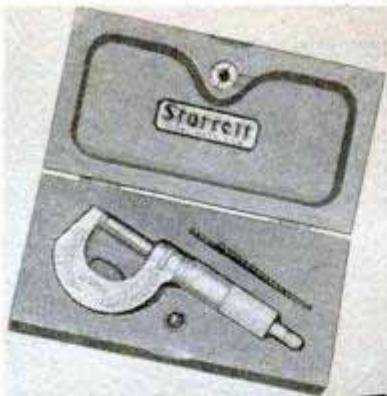


Kodak Senior Trimmer, No. 5
—Knife automatically returns to cutting position. Hardwood bed marked in 1/2-inch squares. \$12.



**STARRETT
"SATIN CHROME"
MICROMETERS**
Pioneered by Starrett

Satin Chrome Finish eliminates glare, resists rust and stains. Hi-Micro Mirror Finish on anvil and spindle faces—tapered frame—threads hardened and ground from solid—quick-reading figures—every thousandth numbered—many other big features at no extra cost. Furnished in handsome Sycamore case.



**Own These
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Make Your
Job Easier**

**STARRETT
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Eight handy tools in one. Hard precision ground steel blade—easy-reading fine graduations of 8ths, 16ths, 32nds, 64ths—stock and blade seat accurately ground—patented fast-action bolt—built-in level—hardened scribe. A Starrett invention, frequently copied—never equalled.



**STARRETT
STEEL TAPES**

Tough special steel tape ribbon—sharp, bright markings that stand out clear on no-glare black ground—quick-reading figures with foot number marked beside each inch—push-button handle—sturdy case—"Standard for Accuracy"—wide choice of lengths and styles.



SPECIAL OFFER—Only 10¢
50-Page "Tools and Rules" Book
"The Tools and Rules for Precision Measuring" tells how to make accuracy a habit, shows the methods skilled mechanics use. 100 pictures plus reference tables. Send only one dime. Address Dept. AP.



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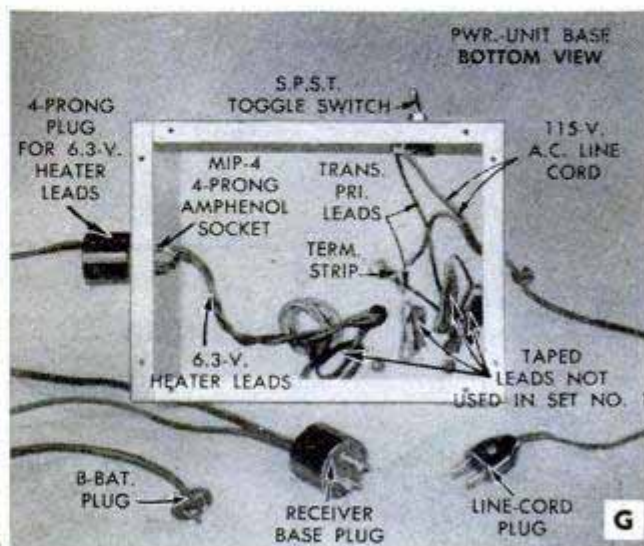
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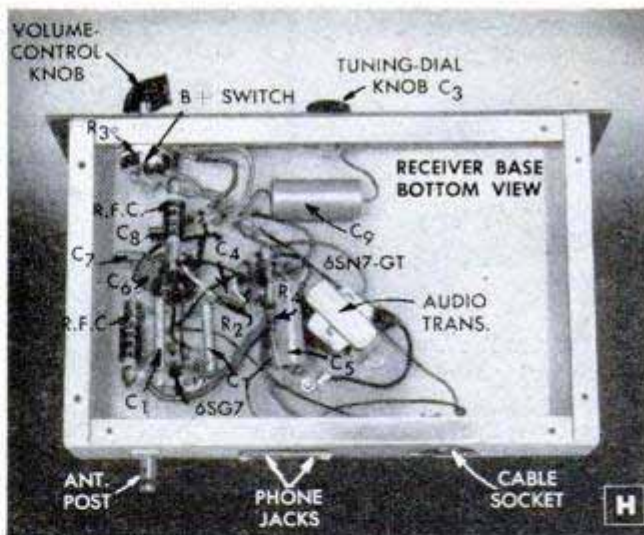
**No. 1 Progressive All-Wave
"Overseas DXer" for Students**

(Continued from page 231)

megacycles. The remaining two coils cover the standard broadcast band. Complete coil-winding details are given in Fig. 5 and the data chart. Winding the coils will take some time but it is easy to do if you follow



the dimensions and winding data given. As they will be used in both sets, wind them carefully. The coils may require some slight modification to insure smooth operations; coils L1 should be kept as small as possible and still have the detector oscillate. Panel and chassis details are given in Fig. 1; Fig.



2 is the complete schematic circuit diagram. The cable and plugs are shown pictorially in Fig. 3; the chassis base plugs are made from old 4-prong tube sockets. Note that prong X is on the ground side of the 6.3-volt tube-heater supply; check carefully to make certain that it connects to the X terminal in both chassis cable sockets. When wiring the twisted filament leads in the receiver as shown in pictorial wiring

(Continued to page 236)

A DOUBLE-BARRELED OPPORTUNITY TO

MAKE MONEY!



NEW HOMES



OLD HOMES

**No Schooling —
Steady Work**

Be Your Own Boss!

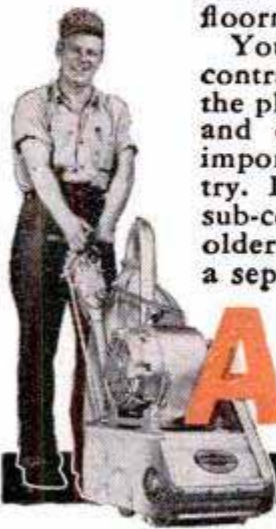
Another booming year is ahead in the building industry—and here's a double-barreled way for *you* to CASH IN!

Start your own business as a floor surfacing contractor with American Machines—and you will find hundreds of new and old homes are year 'round prospects for your services! No special schooling needed. No long waiting to get going in a business of your own. You can start sanding floors and make money as your own boss *the very first day* your machines arrive! Earnings of \$25 and more a day are not uncommon among men like yourself who have become floormen.

You'll be proud to be a floor surfacing contractor and take your place alongside the plumber, the electrician, the painter and other building craftsmen as an important cog in the construction industry. In new construction you work as a sub-contractor and when resurfacing older homes you will usually operate as a separate businessman.

The investment in floor sanding equipment is small. The overhead is low and you need no elaborate offices, workshop, storeroom or heavy trucking equipment. Many men operate from their own homes and use a regular passenger car to transport their equipment from job to job. Pleasant indoor work... steady the year 'round... prospects everywhere... and *you are your own boss*... a real opportunity for a man with ambition to get ahead and **MAKE MONEY!**

Send for "money-making" booklet entitled "Opportunities in Floor Surfacing"—use coupon and enclose 25c in coin or stamps to cover handling.



AMERICAN

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The American Floor Surfacing Machine Co., 535 So. St. Clair St., Toledo, Ohio,



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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Street _____

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FOR
SHALLOW
AND DEEP
WELLS

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Ejecto
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Sets new standards for pump engineering

Every mechanically minded man will appreciate the advanced engineering of the new Myers "HN" Series Ejecto Water System. You can study its many innovations in a free booklet now available—see for yourself why this latest Myers quality-built system sets new standards for pump performance. Mail coupon today for detailed literature on all Myers Ejecto and Reciprocating Types.



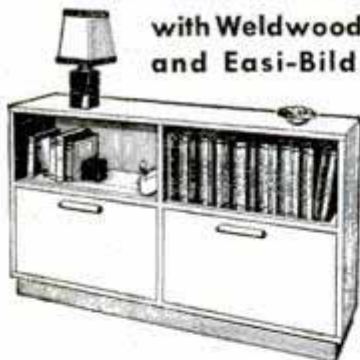
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Pattern for the Record and Book Cabinet, shown above, sells for 25¢. The Easi-Bild Pattern Book, illustrating 105 Build-It-Yourself projects, is only 20¢. Send for your copy now, and spend your winter months building home furnishings, toys, lawn furniture, gifts, etc.

*T.M. Easi-Bild Pattern Co.

UNITED STATES
PLYWOOD CORPORATION
Dept. P.M., P.O. Box 215, Pleasantville, N.Y.

COIL WINDING DATA

COIL	L1	L2	L3	
COIL 1	6-turns	10-turns	4-turns	All No. 26 Enam. Wire
COIL 2	8-turns	18-turns S.W. to 1 1/4"	8-turns	No. 26 Enam. Wire
COIL 3	L1 21-turns No. 26	L2 40-turns No. 26	L3 14-turns No. 30	
COIL 4	L1 50-turns	L2 85-turns	L3 40-turns	All No. 30 Enam. Wire
COIL 5	L1 60-turns	L2 100-turns	L3 50-turns	All No. 30 Enam. Wire

NOTE—S.W.—space-wound

In the two high-frequency short-wave coils No. 1 and No. 2, the "grid" winding (L2) is space-wound to the length specified; the "R.F." winding (L1) is wound between the turns of (L2). In the two broadcast-band coils No. 4 and No. 5, (L1) and (L3) are random-wound in order to get the specified number of turns on the standard plug-in coil forms. Coil dope is used on the random winding to hold it in place. In coils Nos. 3, 4 and 5, space L1, L2 and L3 about 1/8" apart. In the short-wave coils Nos. 1 and 2, space L3 1/8" from the combined L1 and L2 coils. Fixed padder condenser across coil L2 inside coil form No. 5 should be a silver-mica type. If 150 mmfd. is not available use a 50 mmfd. and a 100 mmfd. connected in parallel. No padder condenser is necessary in Coil No. 4.

All Coils Close-Wound Unless Otherwise Specified

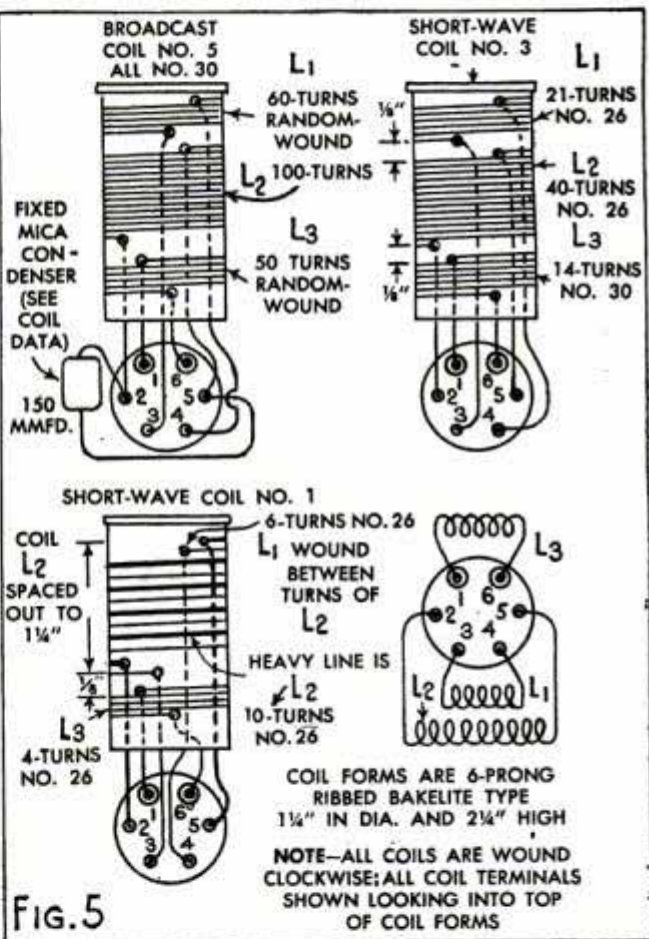


FIG. 5

diagram (see Fig. 4), make sure that the X lead goes to the grounded filament terminal on each tube socket, just as shown in Fig. 2. Underside views of the chassis bases appear in photos G and H. Note taped secondary leads in photo G. The complete operating assembly is illustrated in photo D. Detailed student material list R-885 for this No. 1 two-tube progressive set is available from Popular Mechanics Radio and Electronics department upon receipt of order in the postage.

Handy new **DUNLAP** Utility Drill Kit

OUR OWN TRADE MARK

Drills..Grinds..Sharpens..Sands..Polishes..Bufs!

Free!

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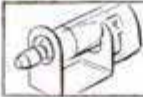
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Indispensable! Precision-built! Powerful enough to drive 1/4-in. bits in steel! 1/4-in. 3-jaw chuck. Triple reduction gears; aluminum alloy frame. 110-120-volt. 25 to 60-cycle. AC-DC motor; 6-ft. cord, plug; Underwriters' Labs. approved. 12 in. long. Complete with 10 high speed, 1/16 to 1/4-in. drill bits; 4-in. cloth buffing and 3-in. grinding wheels; 4 3/4-in. rubber sanding disc; 5 1/2-in. sheepskin polishing bonnet; 6 assorted sanding discs; disc template; paint mixer; adapter; drill side-handle; drill stand; in 12 3/4 x 6 1/4 x 6-in. handy steel storage and carrying case.



CRAFTSMAN METAL TURNING LATHE

REG. U.S. PAT. OFF.

Without Motor
\$39.50*
Cash
\$4.00 Down on Easy Terms
\$50.00 with 1/4-H.P. Motor*



* Lathe prices west of Mississippi River . . . slightly higher

America's lowest priced back-gearred, screw-cutting metal turning lathe!

Superb design! Strong, heavy, complete! Ideal for model making, tool room work, turning armatures and scores of small metal turning jobs! 6-in. swing; 12 1/2 in. between centers; 23-7/16-in. bed. 1/2 in. x 20-thread spindle. Removable No. 0 Morse taper centers in headstock and tailstock. 6 speeds: 120 to 1325 R.P.M. Feeds .0024, .0039, .0048 and .0078. With 8 threading gears (cuts threads 8 to 96 per in., right or left hand); two 60° centers; 1/4-in. tool bit; Allen wrench, 1/2-in. lathe dog; 4-in. face plate; 4-step motor- and 3-step machine pulleys; and 3/8 x 36-in. V-belt. Over-all length, 26 3/4 inches.

See these sensational power tools at your nearest Sears, Roebuck Retail Store TODAY!
Sears Easy Terms make it easier to own the tools you need NOW . . . pay while you use them!

CRAFTSMAN and **DUNLAP** Tools by **SEARS, ROEBUCK and CO.**
Famous for fine quality . . . precision performance . . . low price!

The Army's Crime Bureau

(Continued from page 169)

outwitted the patrolmen by pulling hidden revolvers. After tying up their victims, they stole their Jeep, helmets and weapons.

In this Jeep, another Jeep filched from Hochst and a private car stolen from Darmstadt, the party roamed the Mulheim area. They told the local British company commander they were on special assignment to pick up Army AWOLs.

Stamped orders, constabulary helmets and vehicles and the apparent efficiency of the trio persuaded the British to give them a private office, priority telephones, special rations and all the privileges of the garrison. Hardly had they set up "official quarters" when the German, posing as an American corporal, forged himself a promotion to sergeant so he could eat in the sergeants' mess.

Agents said the trio impressed the garrison personnel because they rode constant patrol looking for AWOLs, who incidentally were apprehended in large quantities, and maintained a rigid charge of quarters routine at night!

This clever adventure ended abruptly when two friends of the mobsters were arrested on other charges upon return to Frankfurt. They tipped the military and

the chiseling trio was apprehended and sentenced to imprisonment at hard labor.

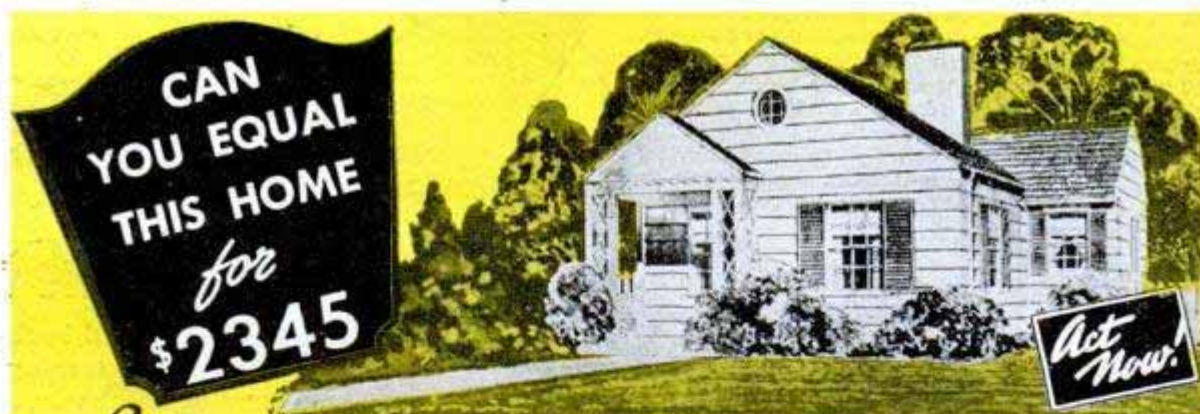
Is the CID worth-while, from the American taxpayer's viewpoint? Here's the Army's answer: Each CID agent not only recovers sufficient government property to cover his own yearly pay, retirement and transportation expenses, but he also returns a profit to Uncle Sam of \$2,659.28 per agent. These figures were worked out by the Provost Marshal's office on the basis of \$7,313,933 value of government property recovered in the last fiscal year.

The Dizzy Merry-Go-Round Of Industry

(Continued from page 149)

In many industries, the centrifuge vastly simplifies older production methods. Take, for example, collection of citrus oils—used in flavoring candy, cakes and the extracts on your kitchen shelf. This job was once a peasant industry in Sicily. Peasants would squeeze lemon and orange skins in tubs of water. Oil floated to the surface and was skimmed off. The yield indicates the tediousness of the task: a ton of orange peel yields 2 pounds of oil; a ton of grapefruit rind, ½ pound; a ton of lemon peel, 4 pounds.

(Continued to page 244)



Save 30% to 40% on Your New Home..

Shipped Direct from Our Mill

DON'T pay several hundred dollars more than necessary when you build a home! Buy direct from our mill at our low factory price. We ship you the lumber cut-to-fit, ready to erect. Paint, glass, hardware, nails, etc., all in-

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Dynamically balanced armature eliminates vibration • Oilless (oil-sealed) bearings • Patented automatic chuck lock pin • Snap-type sliding switch • Cord protector • Shockproof bakelite housing • Dust-filtered air-cooling system • Weighs 13 oz. • Plugs into any 110-120 V. AC outlet. Backed by over 13 years use in plants of General Electric • Ford • Remington Arms • Nash-Kelvinator • Westinghouse • Douglas Aircraft, etc. . . . plus a money-back Guarantee if not delighted after 5 days' trial.



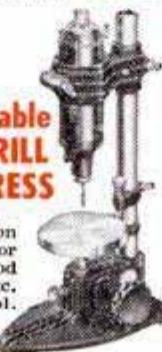
PRE-WAR PRICES STILL PREVAIL

MOTO-TOOL KIT No. 2, with 23 accessories including high-speed steel cutters and Model 2 Moto-Tool in natural finish hardwood case . . . **\$23.50**
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This 12" high, precision drill press is ideal for model making, wood carving, routing, etc. Utilizes No. 2 Moto-Tool.



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JUST GUIDE IT!

Only **\$5.85** with 3 saw blades

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Plans for making six useful, decorative projects packed with each Dremel Electric Coping Saw.

For men who harbor a hobby or do their own repair work . . . for boys who like to make things . . . no other tool will give so much pleasure and satisfaction in the home or workshop for the small amount of money invested as a Dremel Electric Coping Saw. It works in any direction . . . delivers 7,200 strokes per minute . . . so easily, there is no effort . . . so smoothly, work needs no sanding. Saws through 3/4" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only two moving parts, never needs oiling. Operates on 110-120 v. AC. Thousands and thousands of satisfied users.

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Say goodbye to hand sanding and polishing! This miracle machine is so easy to handle, a child can use it. Craftsmen and housewives find (1) As a sander, it takes the effort out of sanding walls, woodwork, furniture, workshop projects, etc. Its straight-line, (non-rotary) action will not burn or scratch surfaces. (2) As a polisher, it does a professional job on waxed surfaces of cars, furniture, etc. (3) As a massager, it's ideal for tired or sore muscles.

LOOK AT THESE DREMEL FEATURES

Dremel Sander delivers 14,400 strokes per min., weighs only 2 1/2 lbs. It's foolproof (has only two moving parts . . . never needs oiling). Dremel Sander operates on 110-120 Volt AC. Thousands and thousands of satisfied users prove its value.

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- Enclosed find \$2. Ship items checked below C. O. D. I'll pay postman balance plus postage and fee.
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Duraclean Dealers' businesses are built upon the solid foundation of a national organization with 19 years of Proven Success. Duraclean Service was established to improve cleaning methods for rugs and upholstery . . . to eliminate harsh machine scrubbing . . . to prevent shrinkage from soaking. Instead of floating surface soil down into upholstery and rugs, this amazing process actually removes it!

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1/4
PAGE

Better
Homes
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Gardens

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for Homemakers

As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.

Water From Copper Pipes Discolors Laundry

Q—We have copper water-supply pipes in our new house and we have found that white laundry left to soak overnight in the water turns a greenish color. What is the cause of this, and the remedy, if any?—P.D., Plainfield, N.J.

A—There are several possible causes of this trouble but we believe the most likely one is that soldering flux accumulated in the pipes when the joints were soldered. The action of the flux at the time of soldering might release copper compounds which would be carried along the pipes by the flow of water through them. These would, of course, dissolve slowly and could very well be the cause of the green discoloration you describe. However, if our interpretation is correct, the trouble should disappear in time, as water flowing through the pipes under pressure will soon wash out the flux deposits.



Roof-Deck Leaks

Q—I have an older style home which has a sheet-metal roof over a sun porch. During hard rains this roof leaks in several places. I have tried roofing cements but without success. Apparently the joints of the tin are soldered. Is there some way I can stop the leaks without putting on a completely new roof?—A.G., Lakewood, Ohio.

A—No doubt rust has eaten through the metal at points where the leaks occur. Whether or not it would pay to attempt a repair of the existing covering would depend on the general condition of the roof. If the metal is corroded over fairly large areas, then we would be doubtful about the value of a repair. Complete renewal of the covering would be advisable in this case. Special canvas is now commonly used as a covering on roof decks. This is much heavier than ordinary canvas and it must be laid in accordance with the manufacturer's instructions for satisfactory results. The old roof covering is removed before laying the canvas, of course. However, if your roof seems to be in fairly good condition and you wish to try repairing it, one suggestion would be to locate the openings in the covering, clean an area 6 to 8 in. square around each opening to the bare metal and

(Continued to page 242)

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HOME ASSEMBLED MIDGET AUTO



WORLD'S LOWEST PRICED AUTOMOBILE!

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Drive this car for as low as 50c per week. Precision built parts direct from factory with beautiful all steel body. Get all the facts on this amazing small auto — send 25c for detailed circular with large picture, 4 view drawings and price of all parts, or send \$1 (refunded first order) for this plus actual assembly book with 42 photos, drawings; blueprints of snow and ice conversions, information on mini-midget racing, etc.

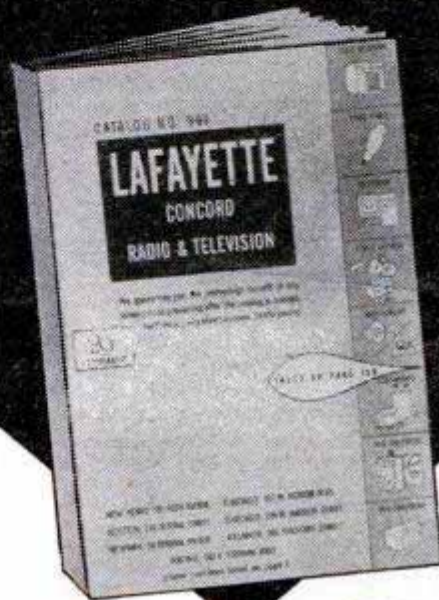
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No special skills or training needed. With our Ring Kit containing unfinished Sterling Silver ring and 2 or 3 initials, all materials needed and illustrated instructions, you can, in a few hours, make this beautiful heavy Sterling Silver ring for yourself, as a gift to someone special or for sale.

Send check or M.O. today with finger size and initials, or send 3c stamp for finger gauge.

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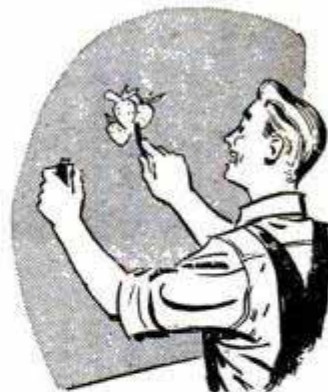
Makers of the Famous Whale & Viking Tools

apply a patch by sweat-soldering all four edges of the metal patch to the covering. With good soldering equipment this is quite easy to do, provided the metal is not so badly corroded that it cannot be properly cleaned in preparation for soldering. Clean the soldered joints thoroughly to remove all traces of the soldering flux before repainting.

Removing Decals

Q—I have a number of decorative decals on the kitchen walls. I have been told that these must be removed before the walls are repainted or else they will show through, spoiling the new paint job. Is this right, and, if so, how can I go about removing the decals without damaging the paint or plaster?

C.M., Dallas, Tex.



A—The decals should be removed before painting, as the slight irregularities of the raised pattern will show through two or more coats of paint. Also if the decal is loose over even a small portion of its total area, air or moisture may be entrapped while painting over it. This will later cause an unsightly blister. There are two methods of removing decals from a smooth surface such as a painted wall. One way is to cover the decal with a piece of dampened felt (there also is a specially treated felt available for this purpose) and allow it to remain overnight. The felt can be held in place with adhesive tape. At the end of this time the decal should peel off the surface quite easily. A faster method is to coat the decal with lacquer reducer or fingernail-polish remover. Apply either one with a small brush or a wad of cotton and be careful not to get any of the solvent on the painted wall as it softens paint quickly. A few seconds after application of the remover it should be possible to slide the decal off the wall without leaving any trace of discoloration. Wash the walls thoroughly before painting.

Noncoloring Finish

Q—How can I finish light wood in the natural color without changing the appearance of the grain or darkening it? Any clear shellac or varnish finish that I have applied to light-colored woods apparently darkens them for some reason. Isn't there some method of finishing these woods without changing the color so much?—J.D., Birmingham, Ala.



A—Ordinary clear finishes applied to light-colored wood appear to darken it because they change the light-reflecting properties of the surface. Although any finishing material will darken the common light woods to some extent, paste wax rubbed to a dull gloss probably will change the original color the least of any. Of course, to produce a satisfactory finish even on dense woods with wax alone would require several applications and considerable labor. Another base finishing material which colors the wood very little is that known to the trade as sanding sealer. This is a special product and is rarely used alone as a finish. It "builds" rapidly, even on softwoods such as pine, but when sanded lightly to cut the gloss the coating is hardly perceptible. A coat of flat lacquer sprayed over the sealer coat leaves the finished surface as nearly the color of unfinished wood as is possible to achieve with ordinary finishing materials. Of course, it should be remembered that any finished wood surface will darken as it ages. On grainy woods a clear finish will tend to emphasize the characteristic grain pattern.

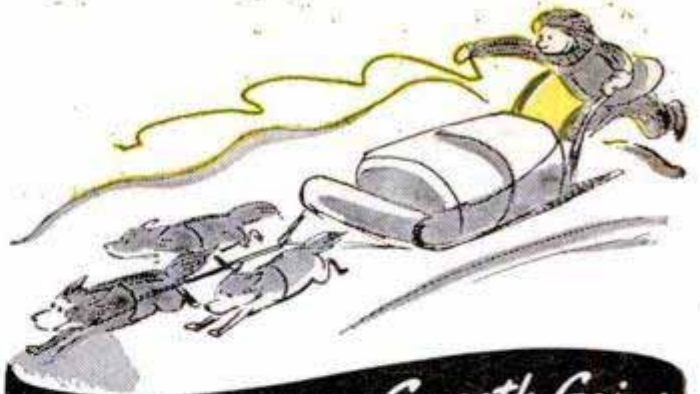
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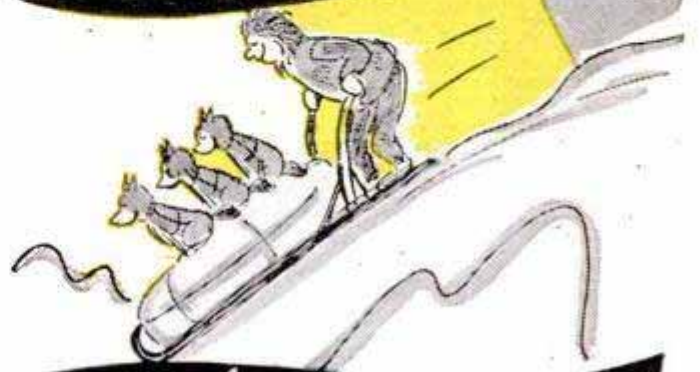
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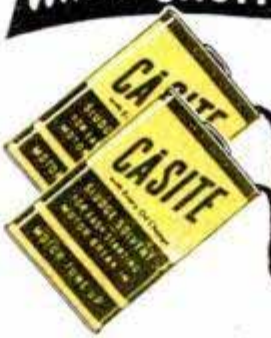
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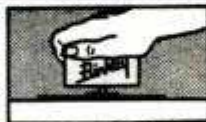
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The centrifuge deserves major credit for making winter driving possible. Remember the day when crankcase oil became so thick that it was often impossible to start engines? Wax, which solidified at low temperatures, was responsible. Centrifuges now remove this wax. Lubricating oil is diluted with naphtha, chilled to a point where wax solidifies. It is whirled out of the oil, and thereafter the oil flows in any weather.

To a great degree, you can thank the centrifuge for the excellent lacquers and varnishes that are on the market today. Some substances are too gummy to be filtered. Hence the problem arises of how to eliminate the impurities. The centrifuge is the answer. It plays a major role in clarifying glues, varnishes, lacquers, floor wax, latex and chicle.

The machine is similarly valuable in the fish-meal industry. Processors of pilchard, sardines, tuna wastes and other fish products want to extract as much valuable oil as possible before they sell fish meal as animal food or fertilizer. The ground fish is mixed with water, run through a centrifuge. Fish meal comes out one spout, water from another, oil from a third.

The centrifuge has hundreds of homely jobs. Take, for example, the one of cleaning grease in doughnut bakeries. Such bakeries use enormous amounts of fat, which represent a major item of expense. Used constantly, the fat soon becomes contaminated with burned particles of dough. Unless it is purified, it goes rancid. Cleaning this fat is a job tailor-made for the centrifuge. Dirty grease goes into the machine. Clean grease comes out one spout, blackened trash out another.

Cutting oils present a similar set of problems. In short time they are contaminated with metal fragments, condensed moisture, dirt and even fungi, which cause skin diseases. Unless they are purified, such oils must be discarded. Centrifuges do such an efficient job of cleaning that oils last almost indefinitely.

In many industries particle size of materials is a matter of supreme importance. This is true of clays to be used in fine china, lampblack which lengthens the life of auto tires, pigment for paints, graphite for pencils. It is particularly important in making inks for ball-point pens, where a slightly oversize particle would clog the minute

(Continued to page 246)

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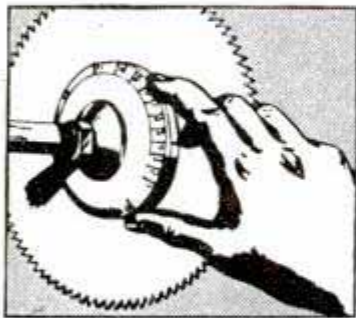
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Still another interesting use is in extraction of lanolin-grease—from sheep's wool. Lanolin, used in creams, soaps and ointments is valuable and wool processors want to recover every ounce possible. The water in which wool is scoured is sent through a centrifuge. Water comes out one spout, lanolin out another, dirt out a third. The machine is valuable in collecting another industrial by-product—yeast from beer. Excess yeast is used to enrich many human and animal foods.

Drying is the third big use of centrifuges. The simplest example is the rotary laundry drier, which spins most of the moisture out of washed clothes. The same principle is used throughout the chemical industry, particularly in the washing and drying of crystals—bicarbonate of soda, copper sulphate, aspirin, borax, table salt and a host of other products. Such machines operate continuously. As soon as moisture is whirled from one batch of material—by a force equal to 900 times the pull of gravity—a knife blade falls into position to scrape crystals from the spinning drum. Once this is discharged, another batch of material flows into the machine.

During the war, the country's two major centrifuge makers, Sharples of Philadelphia and De Laval of New York, were largely occupied by work for the Navy and the Maritime Commission. It was essential for our ships to have top-quality lubricating oils, and such oils weren't always available at various world outposts. Consequently, ships were equipped with their own oil-purifying centrifuges.

Without centrifuges it would have been virtually impossible to process gigantic amounts of blood into life-saving plasma, and blood albumin. The machine played a similarly heroic role in solving one of the most staggering problems ever handed industry—production of penicillin. In the manufacture of this glamorous drug, a solvent absorbs penicillin from liquor in big fermentation tanks where the mold grows. How to separate minute amounts of penicillin from thousands of gallons of valueless liquor? The centrifuge is the answer.

In research work, the centrifuge paved the way for an epochal laboratory achievement—the isolation of a virus. These microbes, which cause such diseases as infantile paralysis, yellow fever, the common cold and measles, are so small that they slip through the porcelain filters which trip up

(Continued to page 248)

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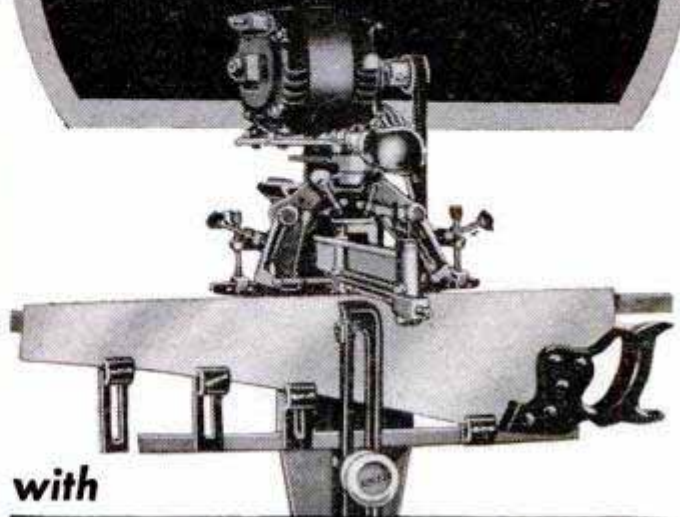
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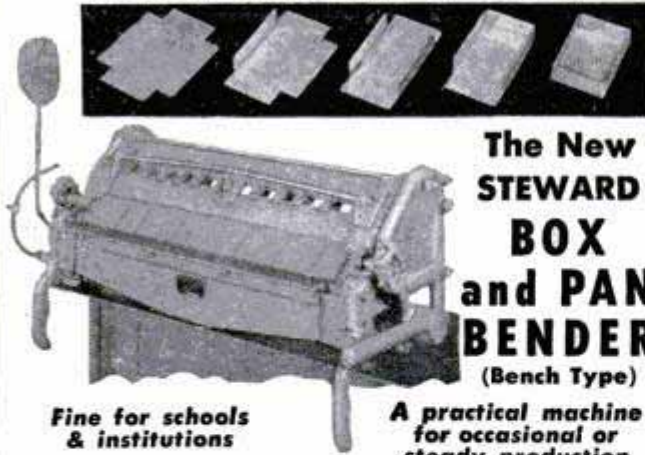
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**For Your Experimental, Hobby or Model Shop,
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**The New
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BENDER**
(Bench Type)

**Fine for schools
& institutions**

**A practical machine
for occasional or
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This handy machine makes special boxes, pans, trays, angles, channels, radio chassis, etc. from sheet metal up to 20 gauge, 24 inches long. A big feature of this compact but rugged Bender is seven fingers permitting fabrication of boxes bent on four sides . . . made of steel for maximum strength and light weight . . . with adjustments for quick and easy removal.

SPECIFICATIONS: Overall Bending Length 24"; Capacity, 20 gauge mild steel; Height, head open 5 1/2"; Back Gauge Range 1/2" to 9 1/4"; Depth of Fingers 2 1/2"; Net Weight 120 lbs.

STANDARD EQUIPMENT: Full set of seven fingers, 2 of 2"; 2 of 3 1/2"; 1 each of 3", 4", 6"; Gauge table with Gauging Bar and Apron Stop Gauge.

Price complete, ready for use

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"A gold bond written guarantee with every tire"

bacteria, so small that they are invisible under optical microscopes. Up until 1935 only indirect evidence indicated the existence of viruses. That year Dr. W. G. Stanley of the Rockefeller Institute for Medical Research pressed juice from tobacco plants sick with mosaic disease, a disease caused by a virus. He guessed that if he whirled this filtered juice fast enough, virus would be spun to the edge of the centrifuge. Calculations indicated that whirling at the rate of 25,000 revolutions per minute would exert a force on the virus 40,000 times that of gravity. This was enough to promote a separation, opening the way for isolation of absolutely pure virus.

It also opened the way for an attack on other virus diseases—notably yellow fever and influenza. Virus, which is the basis for a vaccine, is grown on the embryos in fertile eggs, since virus requires a diet of live tissue. Bacteria live on such "dead" foods as beef broth, agar and sugar.

Standard laboratory centrifuges are now available for such virus separations. Some ultrafast models whirl fast enough to produce centrifugal force 100,000 times that of gravity. They operate continuously. Fluid pressed from infected chick embryos goes in one end. Virus, in the form of a transparent jelly, comes out one spout, waste fluid out a second.

New uses for the centrifuge are opening up wherever the eye looks. One of the most fascinating of these uses has been on the horizon for some time. It is the separation of solid matter from sewage. At present, this is handled by running raw sewage into vast settling tanks where several days may be required for solid matter to settle out. This practice requires large tracts of land and inevitably depresses real-estate values in surrounding areas.

Tomorrow, this picture may be different. There is no reason why use of centrifuges wouldn't permit disposal plants to be located even in the center of cities. Trunk sewers would feed through centrifuges. A perfectly clear effluent would flow from them. Solid matter might be collected, sterilized and sold as commercial fertilizer. A number of cities are already collecting and selling deposits from settling tanks and centrifuges would enormously simplify this collection of valuable wastes. Such an approach would go a long way toward solving the critical fertilizer shortage the world faces today.

Thus, achievements of the centrifuge bulk larger each day. In many cases, the machine is doing jobs which could not be done by older methods. In others, it is enormously simplifying traditional techniques and cutting costs in the process.

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METAL GOODS CORPORATION

Dept. PM 5239 Brown Ave. St. Louis, Mo.

Oil Drillers Throw Curves

(Continued from page 164)

should pierce the formation. A master map that shows the courses of all the directionally drilled wells in the area is consulted so that the new well can cross safely over or under the ones in its path.

Drill pipe is made of the strongest steel obtainable and yet it is extremely flexible when several thousand feet of it have been connected together. It can be rotated even though it makes several vertical and horizontal changes of direction.

The procedure in drilling a slant hole is to avoid any abrupt angles and to build up a desired curve in a number of small steps. Thus a hole that is to be aimed, for a time, at 60 or 70 degrees from the vertical is normally started as a straight vertical hole. A few hundred feet down, it is whipstocked about four degrees to one side and from then on it is deflected an additional amount every 100 feet until the desired deflection has been obtained. The same whipstocking procedure is used to turn the hole horizontally when needed, as well as for returning it to a vertical path.

Directional drilling imposes no unusual strains on tools or drill pipe. When a slant well has to be pumped to extract its oil, however, wear on the sucker rods that lead from the wellhead down to the pump at the bottom often is excessive. The rods drag and scrape on the metal wall of the well casing. To avoid this, a "free" pump has been developed that has no mechanical connection with the surface.

The pump is something like a double-acting steam pump and is actuated by hydraulic pressure. It is contained in a tube two inches in diameter and seven feet long and is simply dropped down a pipe to the bottom of the well. Then the pipe is flooded with crude oil from the surface, pressure is applied to the oil and the pump begins to operate. The pump returns the "power" crude oil plus as much as 500 barrels of crude oil from the deposit to the surface per day, via a separate pipe. If the pump requires inspection or repairs, it can be returned to the surface by reversing the flow of oil in the two pipes. This forces the pumping unit up to the wellhead.

No matter whether an oil well is drilled straight down into the ground or is slanted off to one side, it sometimes gets into difficulties. The drill pipe may snap or twist off, leaving a few hundred or a few thousand feet of pipe buried in the hole. The walls of the hole may collapse, freezing the pipe so solidly that it can't be rotated or withdrawn.

(Continued to page 252)

Make Garden Masonry for Spare-Time Profits

Millions of homes can use these Ornamental products — urns, vases, flower boxes, bird baths, lawn seats, flagstones, etc. Easily made of sand and cement. Permanently glazed in a range of smart colors. Distinctive — attractive — quick selling.

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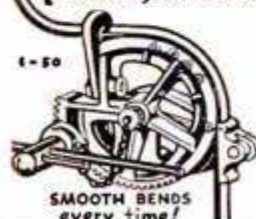
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Say You Saw It in Popular Mechanics

How Constipated People Can Be Kind to Themselves

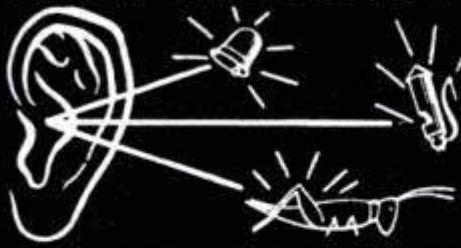
Thousands of people who suffer from chronic constipation have found an amazingly easy way to be kind to themselves. They don't whip their systems with harsh, painful cathartics. Instead, they turn to Nature's Remedy. For Nature's Remedy, NR tablets, is composed entirely of natural, vegetable laxatives—so gentle, most people take them at night because their sleep is not disturbed, yet regularity is accomplished the next morning.

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There are a dozen and one things that can happen to a well during drilling and the industry has many ingenious devices for "fishing" out tools and equipment lost or stuck below the surface. A "fishing" expert might be termed a surgeon who makes his diagnosis as far as two or three miles from the seat of the trouble, probes at long range with instruments of extreme delicacy even though they may weigh tons apiece and performs exacting cutting, lancing and measuring jobs without being able to see the "patient."

If the drill pipe twists off underground, he may drop an impression block of soft lead on the end of the pipe, then pull up the block to get a picture of the pipe location in reference to the hole. Once the pipe is located, he can lower a grabhook or a pair of giant tweezers into the hole and fish for the end of the pipe. Sometimes, acid is dumped into a well to eat out the formation and free a stuck drill pipe; sometimes oil is used instead to lubricate the drill pipe and allow it to be pulled free.

When a drill pipe seems irretrievably stuck, it is necessary to learn the exact point at which it binds in order to salvage all the drill pipe above that point. The task seems almost impossible but with a new magnetic detector the point can be determined within a foot or so.

The instrument consists of two powerful electromagnets that are held five feet apart by a rod containing a telescopic joint in its middle. It is lowered down inside the drill pipe to a test depth and the current is turned on, anchoring the two magnets to the drill pipe. Then the drill pipe is stretched by hauling up on it from the surface.

A sensitive device in the telescoping section of the instrument can measure and transmit to the wellhead a stretch of as little as .001 inch between the two magnets. If stretching is registered, the instrument is above the point at which the pipe is stuck; if the pipe doesn't stretch, then the instrument is below that point. After additional test depths have been tried, the instrument unerringly indicates the point at which the pipe is stuck.

One method of retrieving the pipe is to send down a cutting device to the correct depth and cut the pipe free, allowing it to be hauled up. The newest method is to lower a coil of primacord, the military explosive, to the point at which the pipe is stuck, and ignite it electrically. The resulting violent explosion springs the nearest joint in the drill pipe, loosening it and allowing it to be unscrewed from the surface. After that the pipe is hauled up without trouble.

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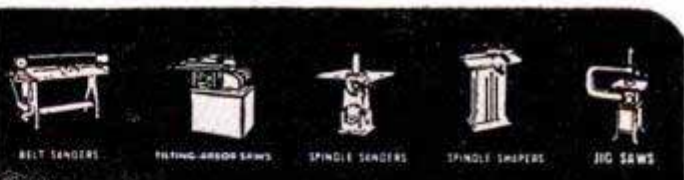
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By B. W. PELTON

Complete Step-by-Step Directions for making Every Type of Furniture —Including Built-in Conveniences and Home-remodeling Jobs

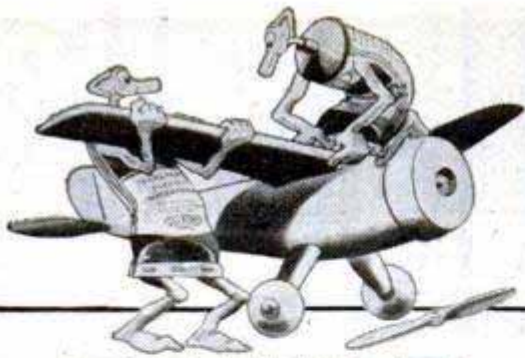
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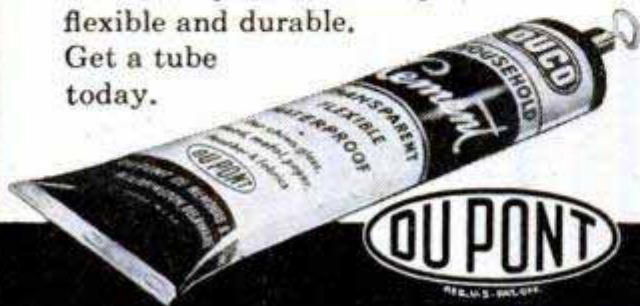
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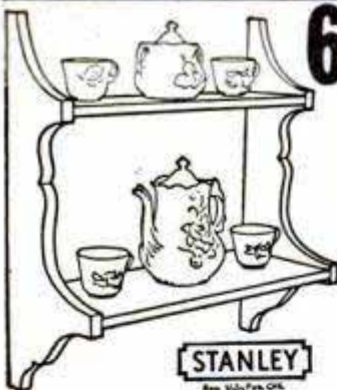
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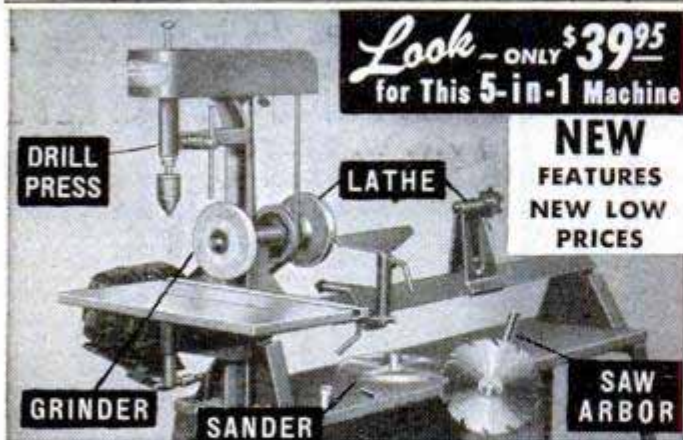


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A Half Century of Miracles

(Continued from page 85)

the way we utilize proteins and fat had to be revised. New sciences of physiology and nutrition are in the making. Some of the radioactive isotopes are already used in the treatment of cancer.

All these developments in atomic physics were the logical result of the discovery of the electron in the closing years of the 19th century. A hydrogen atom, lightest of all atoms, was 1840 times more massive than this electron. Evidently the atom was not the smallest indivisible unit of matter that the chemist had assumed. It was bombarded and bits of it studied.

In 1919 Rutherford inferred from the bits that an atom is like the solar system,



Radio's big impetus came in 1906, with invention of three-electrode vacuum tube by Lee De Forest, above

with a sunlike nucleus around which planetary electrons revolved. This conception has been considerably modified since, but the essential fact that the electron is both a particle of electricity and a particle of matter remains. A flash of lightning is a flash of electrons, a current in a wire, a flow of electrons. For all its dynamos, telephones and telegraphs the 19th century did not know what electricity was. The 20th century does know and defines it in terms of electrons.

Out of this new knowledge of the atom's structure came the branch of electrical engineering called "electronics." Electrons are harnessed in vacuum tubes. There are scores of such tubes, and they have 10,000 uses. They glow in every radio set. They pick up radio waves from a broadcasting station or from the sun and the Milky Way. They are the heart of radar, which makes it possible to detect distant planes in the air,

(Continued to page 256)

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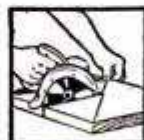
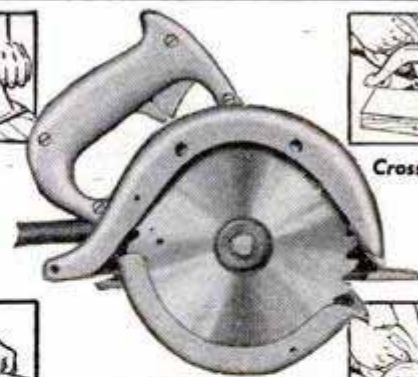
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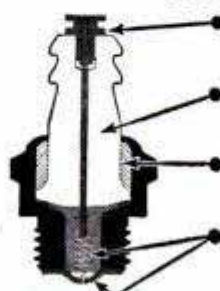
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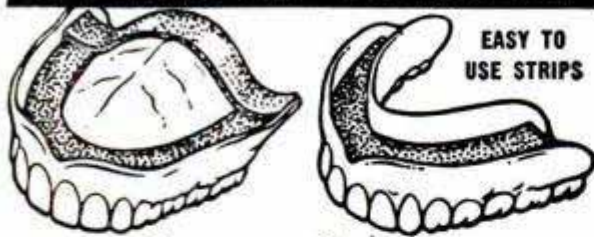
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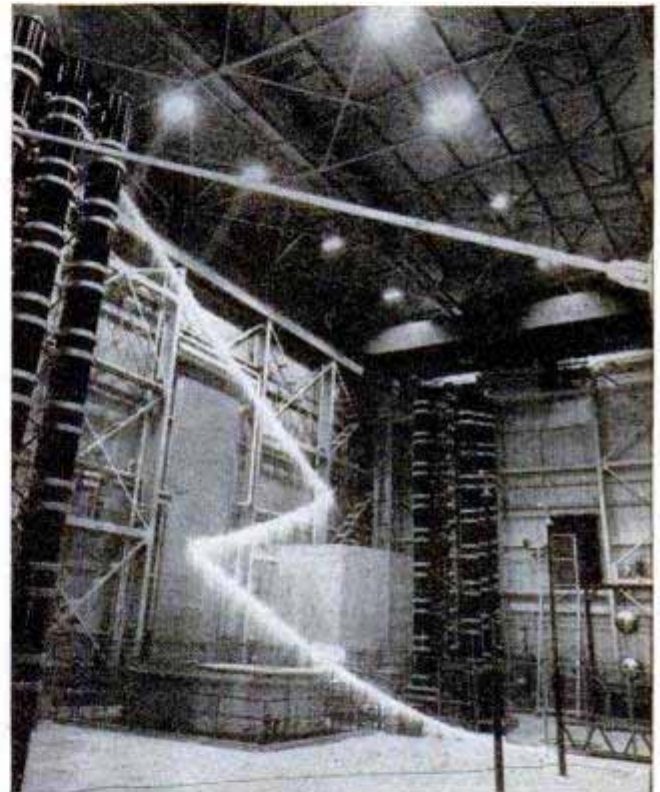
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A young man named Guglielmo Marconi had been sending messages through space by what was called "wireless" telegraphy



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(Continued to page 258)

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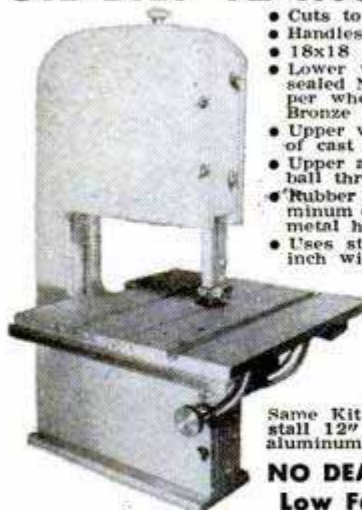
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to whom you are talking? This idea, the idea of television, is as old as the telephone. From telegraphy to television directly was too big a leap. First photographs had to be transmitted over wires. Prof. Alfred Korn was the first to do this (1904). In his process, and all other processes that followed, a photograph is scanned line by line with a beam of light. Photoelectric cells (electron tubes) translate the lights and shades in the lines into electric impulses and at the receiving end translate the electric impulses back into lines like the original. The process takes minutes. Television must



Today's television is credited to Vladimir Zworykin, who showed how beam of electrons could be utilized like a luminous brush to paint a picture in light

work in fractions of a second. Not only is there scanning but the lines are broken up into millions of dots, sent out as impulses, then reassembled. It is all so fast that the eye cannot follow the process.

The first man to build a practical television set was a young Scotsman, John Baird. That was in 1925. His mechanical principle is now as obsolete as the high-wheel bicycle. Today's television set must be credited largely to Vladimir Zworykin. He showed how a beam of electrons could be used like a luminous brush to paint a picture in light with flashlike rapidity.

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(Continued to page 260)

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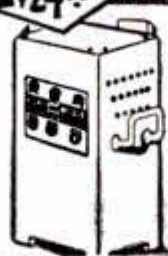
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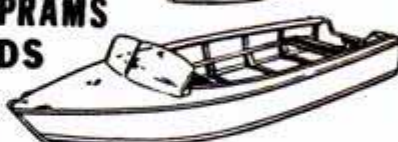


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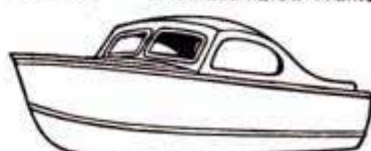
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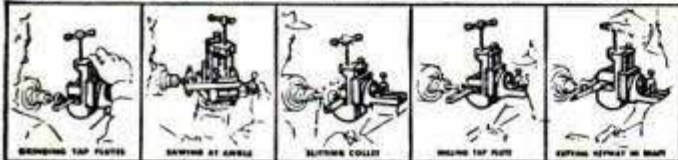
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PAGE DAIRY and FARM EQUIPMENT

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microscope is good only for magnifications of 5000 times, and the best perhaps for 10,000 or 15,000 times. Why can't the optical experts do better? Because when an object is smaller than a wave length of light it is lost, just as a rowboat is lost to view in the trough of two enormous waves. Something finer than a light wave must be used to magnify 30,000 to 50,000, even 100,000 times. That something is the electron. Already viruses have been seen in the electron microscope—something impossible with any combination of glass lenses. In the electron microscope, cancer cells are seen to have tentacles that sink into tissue, which helps to explain why malignant tumors destroy.

After the electron was discovered engineers began to understand what was happening inside an electric lamp. Edison made his filaments of carbon, after having tried metals unsuccessfully. Wonderful as his invention was it depended on the old principle that the hotter an object is the brighter it will glow. Tungsten will glow more brightly than carbon because it will stand more heating. But tungsten crumbles. Dr. W. D. Coolidge felted the particles together so that the metal could be drawn into a wire finer than hair. Thus was the tungsten-filament lamp born. But the bulb blackened, as all lamp bulbs do. Why? Tungsten boiled off the filament. How could boiling be stopped? By pressure. So Irving Langmuir converted the tungsten lamp into a sort of pressure cooker. He put in nitrogen or argon in the lamp under pressure. His gas-filled lamps have illuminated streets for decades.

But this was still the old principle of heating iron white hot to make it give off more light than when it is red hot. Imitate the stars—that was the right way. In the sun electrons are torn from atoms, and the stripped atoms rush about and try to make good their loss, succeeding for a moment and glowing in their excitement, only to be robbed again. The same principle is now applied in what are called gaseous discharge and fluorescent lamps. They glow on every Main Street.

Notice in all these developments of engines, airplanes, electronics and lamps the new command of science and engineering over the environment—over nature. But sometimes the scientist's chief purpose is to give nature a chance. That happens in medicine. No scientific physician imagines that he cures disease. He simply gives nature a chance.

The history of the vitamins is a case in point. As late as 1900 we talked of calories as if we were merely living engines that

(Continued to page 262)

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had to receive so much fuel in the form of food. Then came the discovery of vitamins, a word coined by Casimir Funk in 1910. Tables might groan with food, yet men might starve for lack of vitamins. Now physicians prescribe vitamins for what are called "deficiency diseases." In other words, nature is given a chance by putting into food what man has taken out of it by his method of processing, cooking and preserving it.

With hormones it is the same story. The name was coined in 1902 by two English physiologists, William M. Bayliss and Ernest H. Starling. Best known of the hormones is insulin, which was first extracted from the pancreas in 1921 by three Canadians, F. C. Banting, C. H. Best and J. B. Collip, and now keeps thousands of diabetics alive. There are a score or so of "ductless glands" in the body, and each of them secretes a hormone. If there is too little of a particular hormone, the results may be dire, as in diabetics. Again the physician administers a hormone to correct a deficiency and thus gives nature a chance to restore a body to health.

The whole trend in medicine is toward chemistry in this first half of the 20th century. Chemotherapy got its real start with Paul Ehrlich, the German pathologist who discovered in 1902 that salvarsan (introduced in 1910) is a cure for syphilis, and who, before that, had chemically dealt with African sleeping sickness and other infections. Now we have the sulfa drugs, the first of which was sulfanilamide, discovered in 1908 by P. Gelmo, and a whole series of "antibiotics," meaning chemical substances which arrest the growth of bacteria and which are derived from molds. The best known of these antibiotics are penicillin, accidentally discovered by Sir Alexander Fleming in 1928, and streptomycin, which came out of researches begun by Prof. S. A. Waksman at Rutgers long before Fleming appeared on the scene. The antibiotics have given the physician a firmer control of infectious diseases than was conceivable in 1900.

Synthetic chemistry as such began in the 19th century. By 1900 there were thousands of synthetic drugs, coal-tar dyes, perfumes and flavors. But clothes were still woven of threads that came from a plant or from an animal's back. Hilaire de Chardonnet had been making what we call rayon since 1891, but rayon was nothing but chemically converted cellulose. The first true synthetic fiber was nylon, introduced in 1938 by the Du Ponts, in accordance with a process devised by the late Wallace Carothers. Later came other real

(Continued from page 264)

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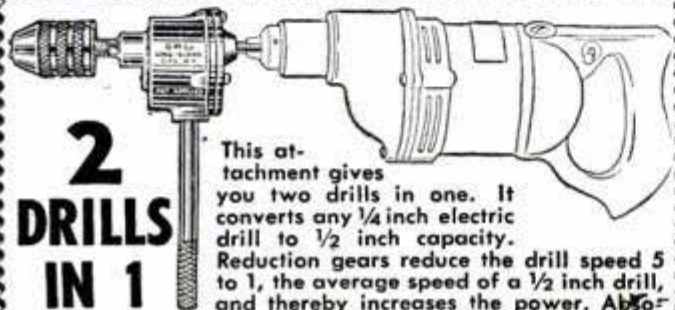
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In a sense both nylon and neoprene are what we now call plastics, all of which are synthetics. Celluloid was probably the first true plastic, and the 19th century used it to make billiard balls, keys for pianos, detachable collars and cuffs and toilet articles. The first of the modern series was bakelite, now Bakelite, which takes its name from its inventor Leo Baekeland.

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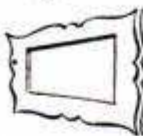
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(Continued from page 113)

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An aircraft is no good if its pilot can't control it and so part of Phase Two is to measure the forces that are needed to move the controls at various speeds. In the trans-sonic range, the air flowing past the control surfaces seems to take on the consistency of molasses and it becomes physically impossible to move the controls rapidly. This stiffness is a good thing. The pilot hasn't the strength to maneuver so violently that he builds up dangerous amount of G.

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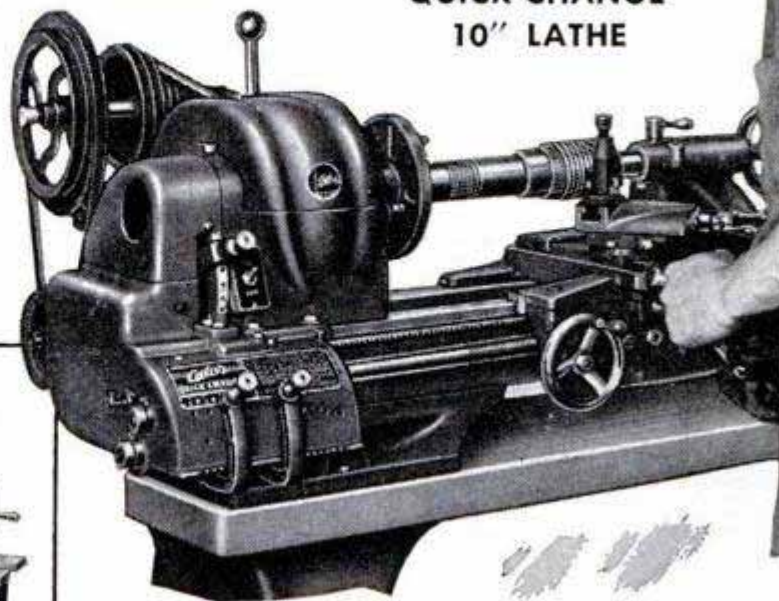
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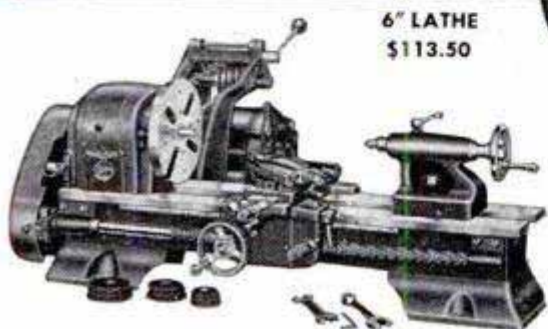
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Sander**



12" Wood Lathe.

FIX IT...



QUICK AS A WINK

Fills cracks and holes in wood, plaster, or almost any material. Savogran Crack Filler sets hard as stone. Savogran Wood Putty is easily tooled; contains real wood. Permanent, non-shrinking. Takes paint beautifully. Repairs furniture, floors, loose rungs, handles, knobs — 1001 uses. Big 1-lb. can only 35c where you buy paints.

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DEPT. 18, BOSTON 16, MASS.



CRACK FILLER
WOOD PUTTY

SAY YOU SAW IT IN POPULAR MECHANICS

Earns **\$100 a MONTH** in spare time

with **FOLEY LAWN MOWER SHARPENER**



"I did nearly \$100 worth of business in May, sharpening and repairing lawn mowers in my spare time"—says R. D. Fancett. "I figure I made \$100 a month," writes L. R. Michaletz. When you can sharpen 3 or 4 hand mowers an hour with the Foley Lawn Mower Sharpener, at \$1.50 to \$3.00, or 1 or 2 power mowers at \$5.00 to \$8.00 each—just figure out the possibilities for yourself! 99c out of every dollar you take in is profit.

How to Sharpen POWER MOWERS

FREE BOOK "HOW TO SHARPEN POWER MOWERS" shows just how to sharpen any make of power lawn mower with the Foley. Low prices, only \$98.50 to \$139.50—easy payments. Mail coupon today—we'll also send **FREE PLAN** telling how to start your own business without previous experience. No salesman will call.

SEND COUPON TODAY

FOLEY MFG. CO., 107-O Foley Bldg., Minneapolis 18, Minn. Send **FREE BOOK "How to Sharpen Power Mowers,"** and **FREE PLAN** on lawn mower sharpener business.

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The safe saw for children yet powerful, versatile enough for homeshops. Easily adjustable. Portable. Thousands in use. Plug in any 60 cycle, 110-120 volt AC outlet—and saw! Arm ADJUSTS to permit cutting ANY LENGTH

1/2" wood, 1/2" plywood, thin metal, plastics. Not a "lumber cutter" but for delicate, fine craftsmanship. No belts, gears, wheels.

Use for family projects or making money. The BASIC homeshop tool. Get yours now with **BUILT-IN MOTOR**, 3 blades, cord, plug, \$17.50. At Dealers! If he hasn't, send \$17.50 to factory, we'll ship saw postpaid. See Syncro products, pages 279, 285. (Dealers write!)



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Electric Jigsaw

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FREE TRIAL in your car famous GANE Air-Flow Needle

(Replaces present idle adjustment screw in your carburetor)
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Users report up to 4 EXTRA MILES PER GALLON—comment on SMOOTHER MOTOR, EASIER STARTING, FASTER PICK-UP, BETTER IDLING. (About 1/2 million now in use) However, needles DO NOT show improvement in SOME cars due to type or condition of motor. So try them FIRST for 10 days AT OUR EXPENSE. Check gas mileage and engine performance—if satisfied—send only \$1.50 per needle; (8 cyl. cars take 2) if not satisfied—return them—FAIR ENOUGH? Send card today with name, address, make of car and carburetor—Needles sent Postpaid.
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ENJOY SAFE — COMFORTABLE WINTER DRIVING WITH THE **SIMPLEX DIRECTIONAL SWITCH**

Here is a safe and comfortable way of signalling your intention to make a left or right turn. Flashes from 60 to 80 times per minute.
Kits furnished with all necessary material for perfect installation. No outside mounting of any kind. . . . uses your present parking and tail lights. Either of our two models fit most cars from 1942 to 1949.

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Specify year and make of car. Money back guarantee. Tested and Approved to meet SAE requirements.
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She'll enjoy your shop and
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You can start your home workshop with a Shopmaster Saber Saw, like the one pictured above. The cost is less than \$16.00. With it you can cross cut, rip, and do many other complicated sawing operations.

You can add to your shop at any time. All Shopmaster Tools are independent and designed to do specific work. Independent tools are always ready, and require little adjusting. Just flip the switch and you are ready to go. These uniform precision-built tools can be mounted together and powered with one motor if you wish, or can be independently powered.

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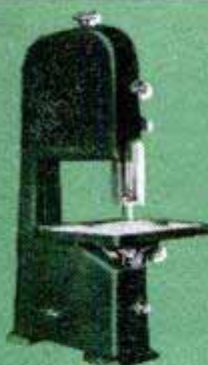
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12" Band Saw

\$68.95*

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Saber Saw \$15.75*



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15" Jig Saw \$24.95*



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17-JEWEL WRIST WATCH **\$16.95** PLUS \$1.70 TAX

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Sacrificed Because They're POST-War Surplus Luminous dial . . . sweep second hand . . . Super Accurate . . . Imported Swiss precision movement and case. You get these Men's New 5 Year Guaranteed Watches now for a small fraction of the original price. Don't delay! Order now . . . while they last.



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YOUR ANSWER TO SMALL ITEMS STORAGE at home, office, and shop (IDEAL GIFT, TOO)

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Stop searching, get a 32 or 64 drawer Jiffy to keep those small items that usually get mislaid. Spot welded steel, gray enamel finish, metal drawer guides. Dividers included with aluminum drawers make possible three compartments per drawer. Looks good anywhere. Send check or money order, please—no C. O. D.'s. Prices below. Your money refunded if not satisfied. Dealers write for quantity discount.

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32 Drawer Unit 6" Deep 12 3/4" Wide 15 1/4" High	Dividers and Index Cards Included One piece rustproof aluminum drawers for heavy service—good for work bench and industry use.	Suitable for most home uses. Heavy board kraft covered. Metal drawer pulls.
64 Drawer Unit 6" Deep 25 1/2" Wide 15 1/4" High	32 drawer - \$8.95 64 drawer - \$15.95	32 drawer \$5.95 64 drawer \$9.95
Drawer Size 1 1/4" Deep 2 3/4" Wide 6" Long	OHIO ORDERS ADD 3% SALES TAX Marproof Rubber Feet included with all cabinets	
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ELECTRIC SIREN **Fender Skirts for All Cars**



6 volt. Complete with push button . . . **\$10.95**



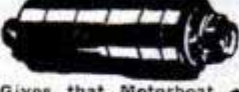
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 All Metal. Prime finish. Rubber heading prevents rattle.
 Easy to install. **\$12.95 PAIR**

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 Increases power. Reduces back pressure. Saves gas. **\$14.95**

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CRESCENT TOOLS
Give Wings to Work
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SPECIAL OFFER!
LOCK-STITCH SEWING AWL

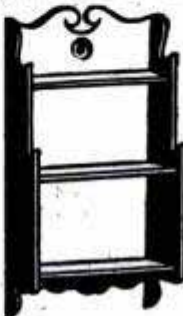
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Famous, patented lock-stitch sewing awl complete with needles, waxed thread and direction folder. Hundred uses—sewing, repairing leather goods, canvas, belting, harness, saddles, gun cases, awnings, golf bags. Extra needles and thread available. Satisfaction guaranteed or money back. Send currency, check or money order.
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WET GRINDER For all types of wet grinding carbide tools, glass, ceramics, gem and other stones. Ideal for general tool sharpening. Uses high speed grinding wheels 8" dia., 1" thick. Sealed ball bearings. Built-in water supply. Safety guards serve as splash shields. Underneath belt drive. \$26.50, less wheels and motor. Write for free literature—**VREELAND MFG. CO.**, 2020 S.W. Jefferson, Portland 1, Oregon.

10 SHELF PLANS
 NEW FULL SIZE

New, full size, easily built, beautiful wall shelf plans ready to trace on lumber, cut out and assemble. Corner and wall racks with 1 to 3 shelves. Stores charge about \$75.00 for these shelves. Make money selling them. Finest selection available. **PLUS BONUS** of 48 other novel cut-outs, Dutch Boys, Girls, Toys, etc., etc. **PLUS FREE** latest Handicraft Catalog. Send only \$1 to
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 3933 N. 28th St. Milwaukee 10, Wis.





BULL MORTISING KIT

Includes (a) Bull Mortising Adapter made of solid aluminum with double-shield ball bearings and (b) 1/4", 3/8" and 1/2" chisels with corresponding bits. Bull Chisels are made of highest quality steel and are designed specifically for use with 1/4" electric drill or drill press. Kit comes complete as pictured above and guaranteed, only..... **\$23.90**



Just chuck it in your drill—and watch the chips fly!

Now you can mortise on-the-job, now you can rout on-the-spot with the new Bull Mortising Adapter. This amazing new adapter can be attached in either drill or drill press in a matter of seconds, and it gives you a powerful, portable tool that really makes the chips fly!

NOTE: Bull Mortising Adapter and Bull Chisels and Bits are designed specifically for use in any 1/4" electric drill or any drill press; they should not be used with 3/8" or 1/2" electric drills.



BULL MORTISING ADAPTER
Large end chucks into drill or drill press; small end fits any 3/8" shank chisel..... **\$6.95**

ACCESSORIES FOR BULL MORTISING ADAPTER

CHISELS & BITS: Mortising chisels (1/4", 3/8" or 1/2" with bits), each **\$6.00**.
CHISELS ONLY: 1/4", 3/8" or 1/2", without bits, each **\$4.00**.
BITS ONLY: to be used with 1/4", 3/8" or 1/2" chisels, each **\$2.40**.



Chuck it in your drill—and you're a mighty handy guy!

Famous **BULL BUFFER** more than pays for itself the very first time you make your car, floors, boat, woodwork, furniture gleam like new! More than 100,000 home owners are now polishing and sanding the "Bull Buffer" way—the only easy, comfortable way to reach all surfaces, curved or flat. No skill necessary—anyone can polish like a professional or sand like an expert with Bull Buffer. Fits any drill or flexible shaft. **Exclusive swivel action** makes it easy to get to all those "tight places" that other polisher-sanders can't touch. Complete, with sheepskin bonnet and 2 sanding discs, only..... **\$9.95**

ORDER THESE ACCESSORIES FOR YOUR BULL BUFFER

(For use with the Bull Buffer only)

5 3/4" finest quality bark-tan sheepskin bonnet, **\$1.25**.

5 1/4" half-inch pile wool pad with rubberized back. Recommended when cleaning compound is used — will not mat down. **\$1.35**.

5" aluminum oxide production sanding discs (0000-000-00-0-1-212-3), 10c each. #4 open grit, 15c each.

1 1/2" Jacob hex key chuck. When attached to Bull Buffer, gives you angle-head drilling attachment. Increases 1/4" to 1/2" capacity, provides power for heavy drilling in wood or steel. **\$5.00**.

2 1/2" cup wire brush. Easily attached to Bull Buffer head. Removes paint, rust, scale, etc. right now. **\$1.75**.

Adapter B set, for high-speed sanding with Bull Buffer. By running Bull Buffer backwards this set doubles your drill speed. Complete, **\$2.00**.

Who wouldn't be a "handy guy" with these

NEW BULL TOOLS

for electric drill or drill press



NEW! Four different holes with One HOLE SAW!

Now you can cut 1", 1 1/2", 2", 2 1/2" holes with one hole saw—the new Bull Hole Saw that fits any 1/4" electric drill or drill press. Cuts cleanly through any 3/4" stock — wood, plastic, or metal. Complete, with arbor and 4 saws..... **\$4.95**



NEW AUTOMATIC SCREW DRIVER

Now you can get to all those "tight places" and drive screws in seconds where it used to take minutes by hand! The new Bull Driver fits any electric drill, drill press or flexible shaft. Automatically centers on screw groove; automatically disengages when screw is firmly home in wood or metal. Three models — take your choice and order today! Any model **\$4.95**

When ordering, specify model in either standard or Phillips. **MODEL A**—Self-centering model for driving screws up to a No. 14. **MODEL B**—Self-centering model for driving small machine screws. **MODEL C**—Without self-centering hood; long blade reaches those extra-deep counter-sunk jobs.

NEW PORTABLE DRUM SANDER

Uses Standard Sandpaper Sheets!



Now you can get to all those hard-to-reach places with the new Bull Drum Sander — a portable 2" drum sander that fits any electric drill (or drill press). **MOST ECONOMICAL** drum sander on the market because you cut your own strips out of ordinary sandpaper sheets instead of buying costly sanding sleeves! No wedges or screws necessary; new patented feature lets you insert and remove sanding strips at the flick of a finger! Complete..... **\$2.50**



NEW BULL ECONOMY KIT

Use your drill to polish and sand by direct drive with this low-cost kit that includes (a) direct-drive adapter that fits any drill, (b) 5" flexible rubber disc, (c) sheepskin bonnet, (d) 2 sanding discs, all for only..... **\$2.25**

TOMORROW'S TOOLS TODAY

AT YOUR DEALER OR SEND CASH, CHECK OR MONEY ORDER FOR PREPAID SHIPMENT, TO

BERTRAM C. ENGINEERING CO.

Dealers Write Today

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NEW LOWER PRICES ON CROSLY CARS!

Reductions up to \$105! And the 1950 Crosley cars have hundreds of improvements, many exclusive features such as Hydradisc (airplane type hydraulic) Brakes and Crosley engine with new CIBA (cast iron) Block and 8 to 1 compression ratio. Save with a new Crosley—costs less to buy, less to drive—up to 50 miles on a gallon of regular gasoline.

STATION WAGON
Price reduced \$105. Seats 4, or 2 with 1/4 ton load. All steel.



SEDAN DELUXE
Price reduced \$101. Speedline styling. Rich fabric upholstery. Seats 4, plus luggage.

CONVERTIBLE
Price reduced \$101. 4 passenger. Easy-to-handle top. Big luggage space.



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Price reduced \$51. A new thrill in motoring. America's own sports car. 2 passenger.

Crosley Trucks, both Panel Delivery and Pick-up have also been reduced—\$83 on each model! Driver agents wanted! Write for details.

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a FINE car

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STOP CHANGING MOTOR OIL!

End this needless waste and expense forever with



RECLAIMO Today's Most Advanced Oil RE-REFINING Filter

Continuously cleans and RE-REFINES motor oil as you drive (by utilizing motor heat)—keeps oil in high grade lubricating quality at all times! Proves conclusively that "Oil Does Not Wear Out Mechanically" as stated by U. S. Bureau of Standards, (Bulletin 86).

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- REMOVES SOLIDS (by filtration)
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Stable Viscosity ELIMINATES All Oil Changes
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Gas-Moisture Vapor Injector
Increases Mileage with Smoother Performance



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SANDING MADE EASY..

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with the Handy **SandDrum**
ALL-METAL DRUM

\$2.50 with adapter and 6 abrasives

Sold on positive money-back guarantee. Order Today.

EASY, QUICK MOUNTING. No locking key or wrenches needed. No cement, glues or wedges. Patented mounting method saves valuable time. Abrasive tightens while in use. Ideal for use on drill presses, grinder stands, electric drills, motor arbors, etc. Drum is 2" in diameter, 2" long. Adapter and drum head joined with 1/2/20 threads. Economical replacement strips cut from standard sheets.

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UTILITY TOOL CASE

specially designed for home-and-farm owners, craftsmen, radio and TV repairmen, fishermen, hunters, campers. Adopted by large utility companies for service men. Resists rust. Made of hard vulcanized fibre with reinforced corners, with removable tray and space for electric or large tools. Strong, durable, light! Solid, comfortable plastic handle. Full 8 inches wide; 9 inches high; two sizes:



17 inch (6 compartments) \$6.25 postpaid.

21 inch (8 compartments) \$6.50 postpaid.

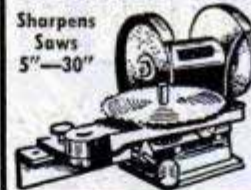
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INCREASE SAW SHARPENING PROFITS!

Sharpens Saws 5"—30"



REYNOLDS CIRCULAR SAW GRINDER
Produces top quality results in fraction of time usually necessary for reshaping, jointing, gumming and tooth forming. Any hook or pitch of tooth and depth of cut is quickly adjusted. Both hands are free to control position of saw while grinding. Write now for free circular!

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Unbreakable Fire-Safe Amber Hammer Proof Shock Proof

TOOL STEEL PRICED FROM \$c TO \$1.00 EACH

Ask Your Hardware Store for **FULLER'S** Unbreakable Amber Handle SCREW DRIVERS

America's most popular line of moderately-priced screw drivers! Wide range of sizes. **FULLER TOOL COMPANY, Inc.** 911 Fayette St. New York 59 World's largest makers of Amber-Handle Tools

GASOLINE DRIVEN ELECTRIC LIGHT & POWER MODEL PE7SU

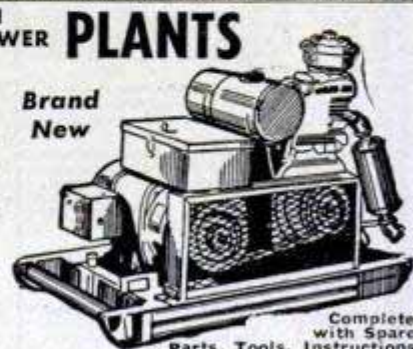
115 Volts, single phase, 2500 watt, A.C., 60 cycle. ENGINE: Briggs & Stratton, Air Cooled, 6 1/2 H.P. LELAND GENERATOR. Belt drive with guard, and Duplex Receptacle Mounted. NET WGT.: 310 lbs. GROSS SHIPPING WGT.: 441 lbs. SHIPPING SIZE: 36"x19"x26".

FULLY GUARANTEED

Mrs. List Price \$700.00

OUR PRICE \$295.00

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Brand New

Complete with Spare Parts, Tools, Instructions

Ideal for Farms, Cottages, Mills, Garages, Builders, Shops, Homes—will operate deep freeze, oil burner, pumps, saws, compressors, sound & radio systems & general lighting.

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LOGAN HEAVY DUTY HYDRAULIC CONTROL



VALVE BRAND NEW control valve with built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, 3/8" pipe thread connections. Overall dimen.: 12 1/2" H x 8 1/4" D x 8" W. Ship wt. 17 lbs. Govt. Acquisition Cost Over \$100.00. An Excellent Buy. F.O.B. Chicago.

(ITEM #37) **21.95**



HANNA Air Cylinder Brand New

Used for heavy duty industrial applications on shop air lines or with low pressure systems. With 100 lbs. of air pressure, will deliver 1900 lbs. pressure at the ram shaft. All steel construction. Adjustable cushions at both ends of cylinder. Shaft dia. 1 1/2". Foot mounting with clevis on ram shaft, 2 1/2" double-acting stroke; 5" bore, 40 1/2" overall length closed, 7" overall width. 89 1/2 lbs. net wt. Gov't. acq. cost \$101.85.

(ITEM #61) **39.50**
AN EXCELLENT VALUE for F.O.B. Chicago

HALE FIRE and IRRIGATION HIGH VOLUME

Centrifugal Pump

For Fire Protection, Irrigation, De-Watering, Industrial Uses, Farm Uses, Etc. PUMPS RATED 500 GALLONS PER MINUTE AT 275 FT. HEAD PRESSURE

Equipped with 1 1/2" diameter straight splined shaft for direct coupling drive; 4 1/2" threaded suction intake; two 2 1/2" threaded discharge outlets; Hale Pump Co. Model CP volute type; use any 4 or 5 cylinder gas engine direct coupled to pump; dimensions 21" x 24" x 28". Complete with full accessory kit including suction and pressure gauges, priming equipment, and instruction book. Ship. wt. 415 lbs. Gov't. acquisition cost \$425.00.

(ITEM #48) **149.50** F.O.B. Chicago

Hydraulic Control Valve

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders.



Brand new. Ship wt. 8 lbs. A \$38.00 value. postpaid **7.95**

ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston in any required position. Brand new. Ship. wt. 6 lbs. A \$60 value postpaid **10.95**

ITEM #28. A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand new. Ship. wt. 8 lbs. A \$75.00 value postpaid **14.95**

WAR SURPLUS BARGAINS!

115 Volt-60 Cycle A.C. LIGHT PLANT GENERATOR



(ITEM #67) **59.50** F.O.B. Chicago

IDEAL FOR: Home Lighting, Lodges, Stand-by Electricity, Running All AC Electrical Appliances including: Fans, Motors, Electric Razors, Refrigerators, Incubators, etc.

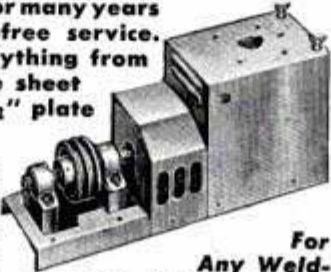
0-150 Voltmeter with Regulator; 1" diameter shaft with keyway for direct or belt drive, carried in two bearings, one bronze and one ball-thrust bearing, and packed separately to prevent damage to generator or shaft while in transit. Protection for emergencies to operate oil burner, stoker, freezer, water pump, and lights. These units, built to exacting Signal Corps specifications are the answer to your lighting needs. Shipping wt. 60 lbs.

AN OUTSTANDING VALUE **59.50** F.O.B. Chicago

NOW . . . It's Easy to Weld with this handy ARC WELDER

250 AMP. MODEL 252

Designed for many years of trouble-free service. Handles anything from light gauge sheet metal to 1/2" plate



(ITEM #65)

This precision engineered direct current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it.

The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over \$300.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc; handles 1/16" to 1/4" rods. Run welder at 2500 R.P.M. from drive pulley or power take-off of tractor, a 7 1/2 H.P. electric motor or a 10 H.P. gas engine. Use two V-belts, or flat belt (on pulley). Continuous welding rating—200 amps.; intermittent rating—250 amps.; 0-30 volts. Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 107 lbs. Only one or two jobs will pay for entire welder. F.O.B. Chicago **99.50**

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. (ITEM #66) F.O.B. Chicago **10.50**

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Model 6520 BRAND NEW. For double-acting pneumatic devices. Fine for operating air vises, presses, air machinery of many types. Heavy cast construction. Threaded for 1/2" pipe. Dimensions of valve body 8 1/2" L x 5 3/4" W x 7 1/2" H. Net Wt. 28 lbs. Gov't acquisition cost \$42.00. AN OUTSTANDING BUY AT F.O.B. Chicago **15.00**

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BRAND NEW . . . for operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1200 RPM in 1000 P.S.I. using 5 H.P. Has 3/8" pipe thread inlet, 3/8" pipe thread outlet. 3/4" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimensions: 7" L x 5 1/2" H x 5 1/2" W. A \$105.00 value. FOR ONLY **22.50** F.O.B. Chicago

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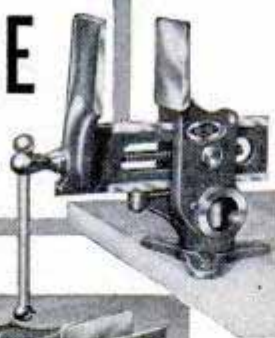


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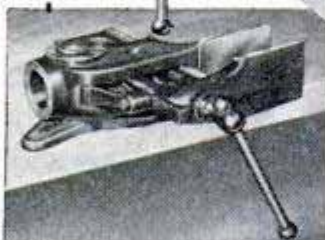
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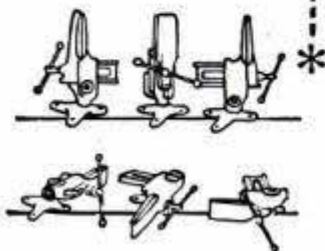


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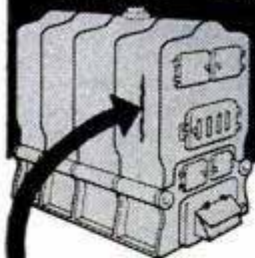
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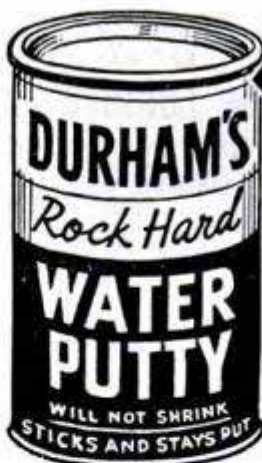
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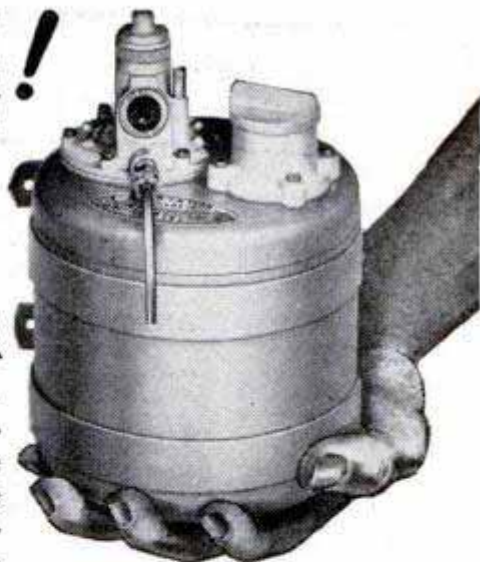
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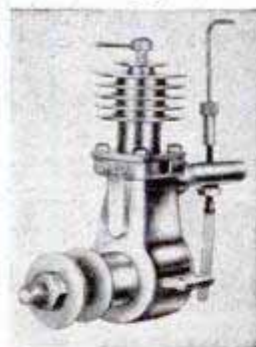
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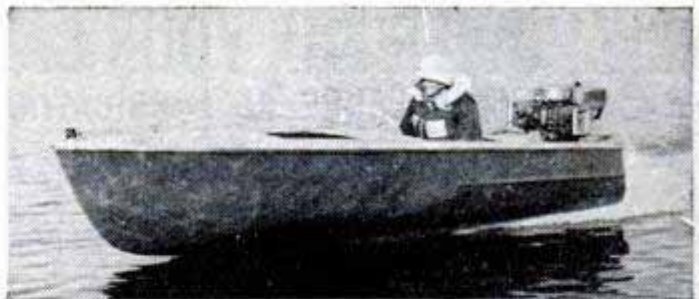
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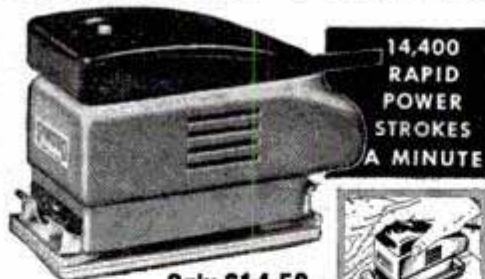
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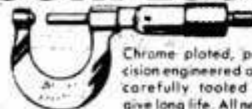
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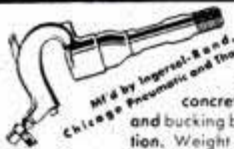
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Replaces splintered wood . . .
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Handles like putty . . . hardens into wood!

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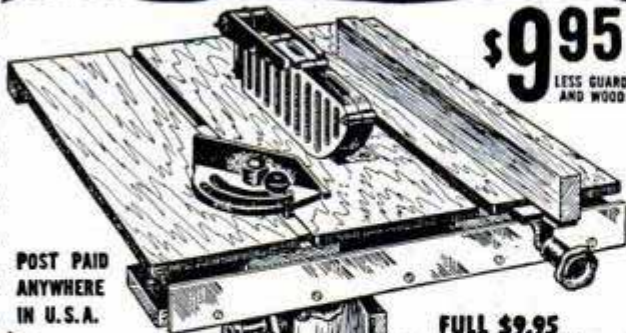
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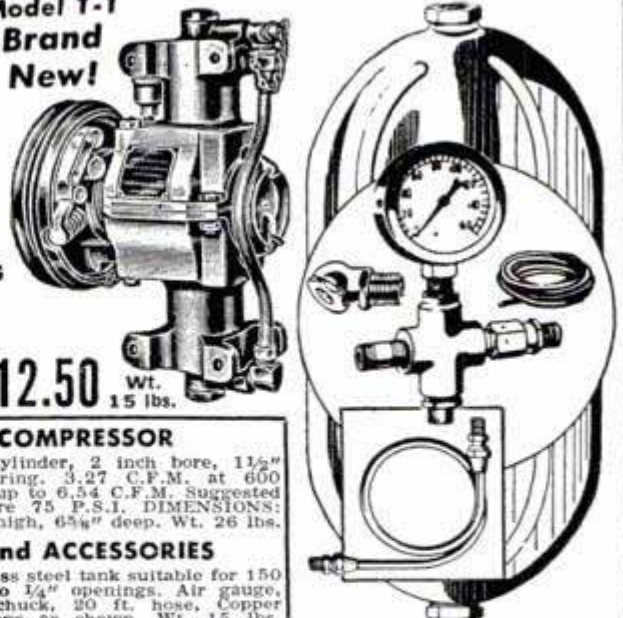
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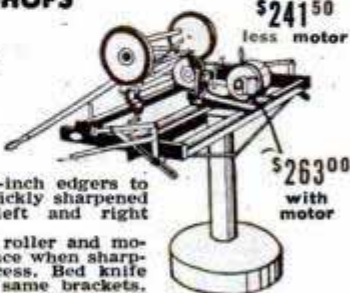
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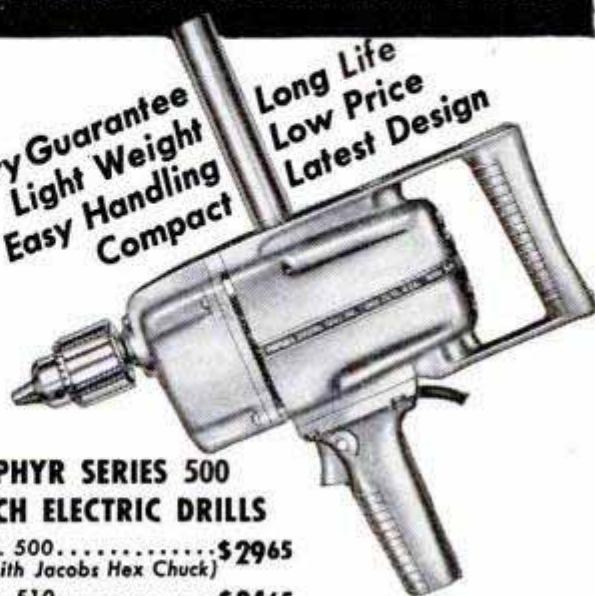
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(Less Motor)

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SPECIFICATIONS

TABLE SIZE..18x20
Total Height..12 1/2"
Size of Saw Blade
Furnished (8" blade
can be used)... 7"
Depth of Cut... 13 1/4"
Saw Arbor Shaft 1 1/2"
Bearings... Oil-Life
Saw Speed.....
4000 r.p.m.
Recommended
Motor Pulley... 5"

UNHEARD-OF VALUE! High-quality table saw that cuts to exact dimensions. Neither blade nor table tilts. All parts except saw blade and mechanical units made of specially-treated hardwood that is guaranteed against defect for one year! Metal parts cadmium-plated to prevent rust. Fence extends full length of table, can be used on either side of blade. Miter gauge graduated for 15°, 30°, 45° cutting. Complete, less motor, only \$14.95! Motors available. Get your order in today!

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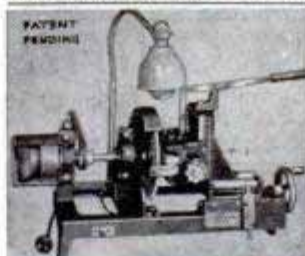
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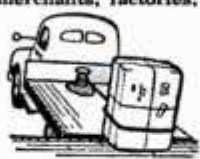
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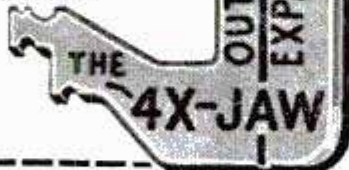
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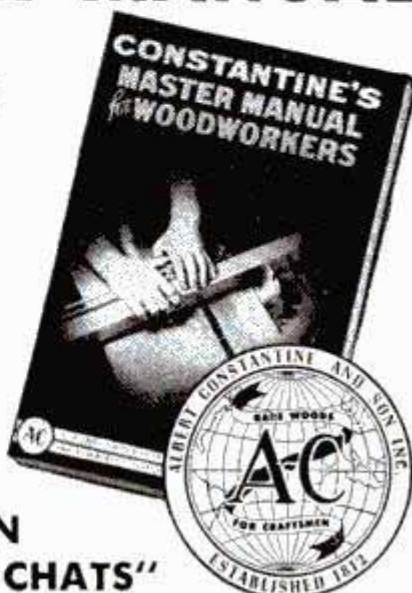
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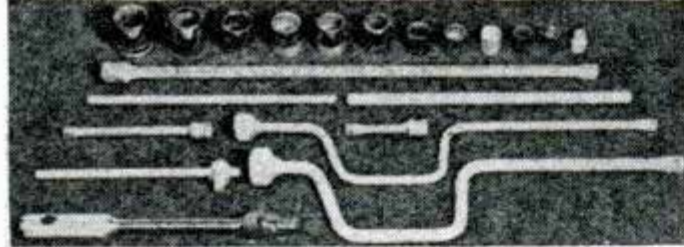
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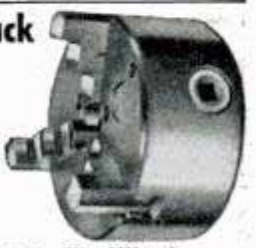


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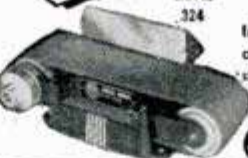
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Stationary and Portable

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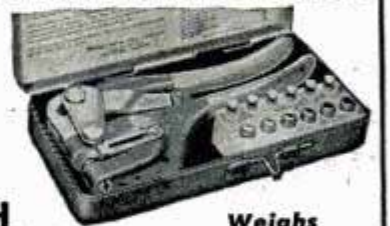
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THROAT DEPTH 2 inches
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Punches and Dies Furnished.
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Here's the 1/20 HP flexible-shaft tool built to do your shop work. It's not a cut-down or slowed-down industrial model, but a precision-built Dumore Hobby Tool which means more for your money.

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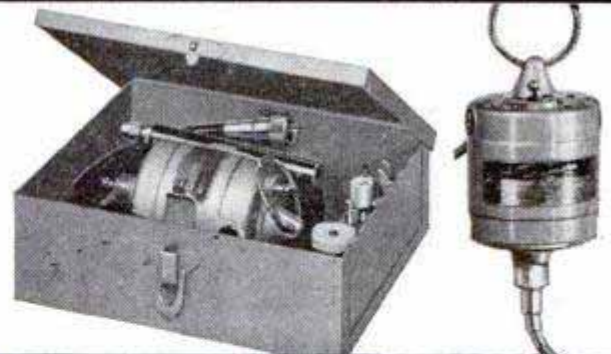
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DHF-1

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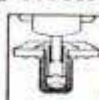
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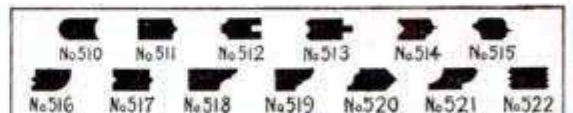
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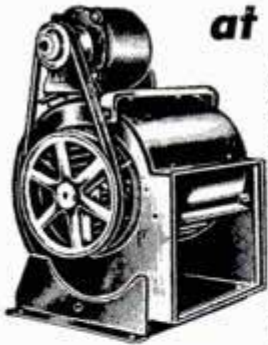
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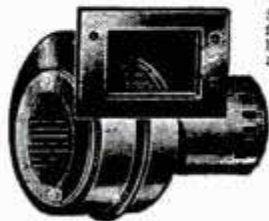
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Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft.

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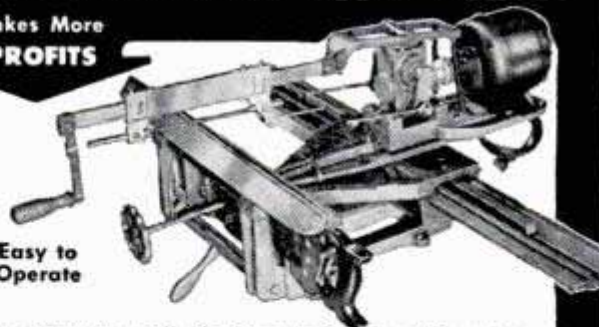
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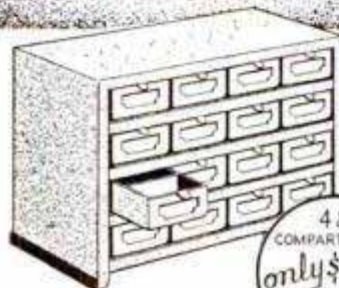
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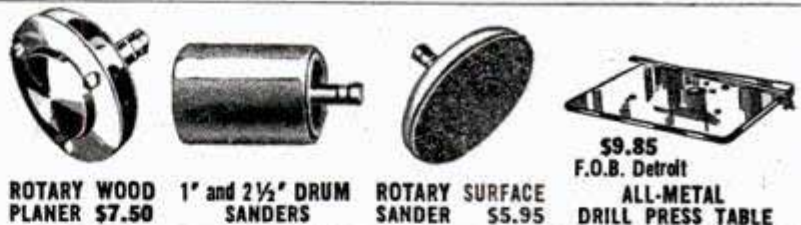
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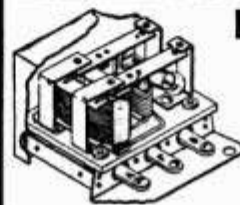
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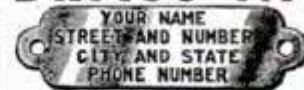
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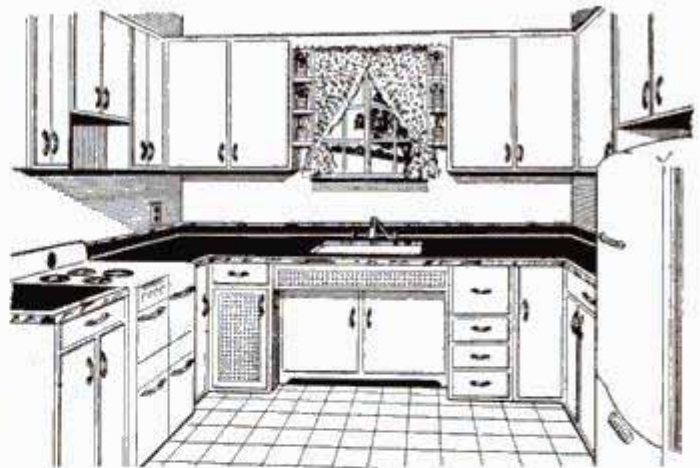
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	1,000	10,000	25,000	50,000	100,000	500,000
6-40	\$.25	\$.21	\$.19	\$.17	\$.15	\$.13
802	.31	.28	.25	.23	.21	.19
806						
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1/4-28	.39	.36	.33	.30	.27	.25
5/16-24	.64	.61	.58	.56	.54	.49
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K-5	1.250	.3120	.375	35¢
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K6AR-48	1-3/32	23/64	5/16	30¢
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3L24BM	7-3/32	4-23/32	1 1/8	7.50
209V	3-11/32	1-3/4	17/32	1.95
NEEDLE				
B-1616P	1-1/4	8"	1"	45¢
465972	1-5/8-1-27/32	9-16	1-1/4-1-1/8	35¢
ROD END (Thread 3/8 x 24)				
RE3M6A	3/16	2"	1/2"	35¢

NOTE: We have 168 other types and sizes of New Bearings in tremendous quantities!!

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6 in 1 HAMMER It Hammers. It pins and has four graduated screw drivers 5 1/2" to 7 7/8" which telescope into handle - A real household aid. **NEW ONLY 89¢**

NEW TARPS - HEAVY CANVAS Mildew & Flame Resistant. Cheap Outside Storage. They are Really Moving at These Prices. **\$3.95** 5' x 7' 16' x 32' **\$39.95** 8 1/2' x 10' **\$8.50** 16' x 22' **\$20.95** Rubberized Linen 7' x 11' NEW **\$5.95** Only 3 lb. light weight yet waterproof ideal for outside car storage.

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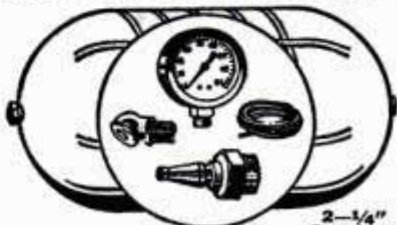
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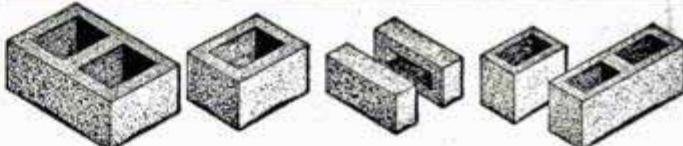
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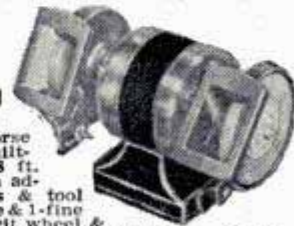
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Adjustable 4" Jaw opening Drop forged Auto type. Cod. Plated .89c Black 79c

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Suitable for adaption to hand welding units, portable and rural lighting, power plant on boats, etc

TYPE	AMPS	VOLTS	PRICE
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VOLTAGE REGULATOR for use with 24 to 32 volt DC generator. Complete with mounting base . . . \$6.75

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AMMETERS VOLTMETERS

-30 - 0 - 30	+	0 - 120	0-30 \$3.95
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10,000 in various popular makes, sizes, types, Cleco, Aero, Ingersol Rand, Chicago, Pneumatic, Buckeye, etc.

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Air Drill or Air Motor with 1 1/4" Jacobs chuck. \$17.95

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Provides an instantaneous source of tremendous power for almost any heavy work. Double action stroke. Delivers 3.0 cu. in. per cycle at 3000 PSI. Max. press. 5000 PSI. Built-in Reservoir cap. 2 1/2 qts. 3/8" pipe outlets. Has Pressure Release Valve. 7 1/2" dia. by 23 3/16" overall ht. Weight 15.2 lbs. A \$40.00 Value for...NEB \$15.95

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Self 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. - 0 to 1/3 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, Duplicate Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2-4" Spline Shafts for input & power take-off - Cost Gov't, approx. \$400. \$127.50

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1:1 bevel gear 1 1/2 to 1 reduction, size 7" x 6". A Lifetime Value. \$3.95
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ELECTRONIC TRANSMISSION GEAR TRAIN

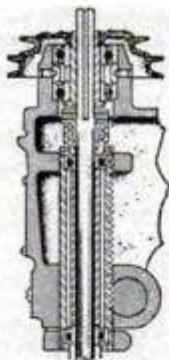
GT-1 Containing approx. 50 Bronze Spur & Pinion Gears ranging from 3/8" to 4" dia. 5 sets of 7 cluster gears, 2 complete worm & worm gear drive sets, 40 N.D. ball bearings from 1/2" to 1 1/2" dia. watch springs, bushings, posts, face plates, housings - Micro Switches, 2 miniature, controlled clutches, etc. 19 lbs Of Pleasure and profit. A Tremendous Gadget Mine. ONLY \$8.49
Gears in above train are all in multiple size and sequence with identical teeth ratio giving hundreds of ideal gear reduction combinations.

Order from this Ad. All sales final. All Prices F.O.B. Los Angeles, Pac by M.O. or Check. P.O.'s Accepted. from D & B. firms. 1/2 deposit with C.O.D.'s.

THE LARGEST FIRM OF ITS TYPE IN THE WORLD

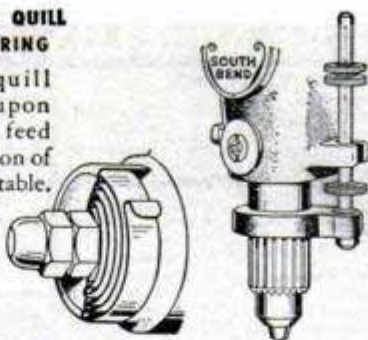
FOUR PRECISION BALL BEARINGS

Two on spindle, two on drive sleeve. Pre-lubricated and sealed precision type, no oiling required.



ADJUSTABLE QUILL RETURN SPRING

Retracts quill instantly upon release of feed lever. Tension of spring adjustable.



DEPTH GAUGE

Controls feed depth, length of return stroke, or locks spindle in any position. 16th graduations.

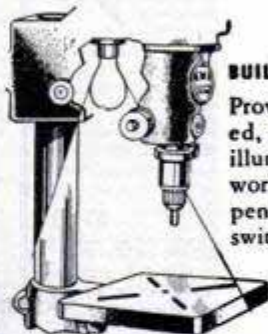
BELT TENSION RELEASE

Flip of lever removes tension from belt for easy speed changes. Proper belt tension maintained.



BUILT-IN LIGHT

Provides shielded, shadowless illumination on work area. Independent on-off switch is built-in.



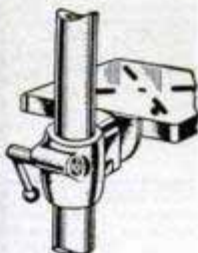
INTERCHANGEABLE SPINDLES

Spindles available to take No. 2 Morse taper shank tools, and for 1/2" straight shank tools, router bits, shaper cutters, etc.



TABLE LOCK

Double-plug binder securely locks table to column. Eliminates misalignment. Column bearing is NOT split.



QUILL BEARING ADJUSTMENT

Shoe-type take-up provides feather-touch tension and secure locking. Quill bearing is NOT split.



ONE-PIECE HEAD CASTING

Insures perfect alignment. Double-plug binder locks the head to column. Column bearing is NOT split.

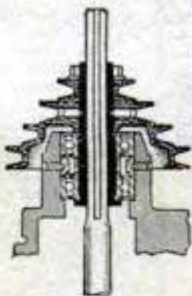


NEW!
SOUTH BEND
14" Drill Press



FREE-FLOATING SPINDLE

Design prevents misalignment, side thrust and whip. Precision splines in spindle and sleeve.



CAPACITIES — SPECIFICATIONS

CAPACITY
Maximum drill size in iron or steel—1/2".
Drills to center of 1 1/4" circle.
CHUCK
Capacity—0 to 3/8"
SPINDLE
Regular drill chuck type supplied.
Travel 4"

CHUCK TO BASE DISTANCE
Bench Model—17"
Floor Model—46 1/2"
SPINDLE SPEEDS
Four—655 to 4530 r.p.m.
TABLE SIZE
10" x 10". Tilts to any angle.

Bench Model **\$129³⁰**
Floor Model **\$144³⁰**

Prices, f.o.b. factory, include drill chuck and 1/3 h.p.; 115 or 230 v., 1 ph., 60 cycle motor and switch.

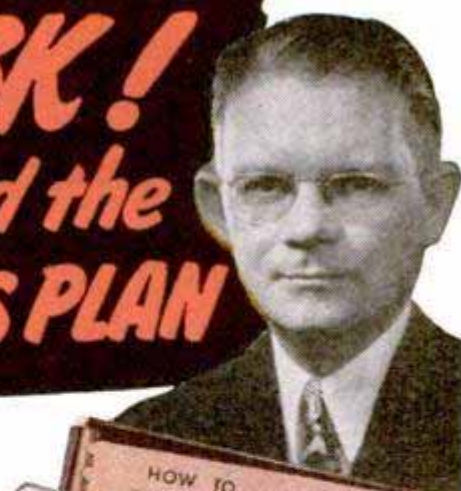


SOUTH BEND LATHE WORKS

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Printed by Popular Mechanics Company, Chicago, Ill., U. S. A.

NOW AT MY RISK!
 I want you to read the
WARNER SUCCESS PLAN



It shows you how to...

METALIZE BABY SHOES AND OTHER KEEPSAKES

- how you can start in spare time with your home as headquarters.
- how to build—step by step—to big profits and personal independence.

This is the famous Warner Success Plan—the Plan for Personal Success in your own fascinating business that many men, married couples credit with freeing them from the limits of a pay check and from the drudgery of a time clock.

It gives the exact step by step instructions for starting a business in spare time—without risking the job or steady pay. It shows with pictures, photographs, and drawings exactly how to Metalize Baby Shoes and other keepsakes. It shows how to get the orders coming in—how to expand—how to get others working for you—how to be SURE of at least twice your present pay before you give up your job for a life of personal independence.

15 Million Prospects

There are 15 MILLION pair of Baby Shoes in the country right now ready to be Metalized. Last year alone, more than THREE MILLION more babies were born.

There's not one of these mothers who doesn't want her baby's first shoes preserved forever. The Business is tremendous . . . and never ending.

The Warner Success Plan shows you how to turn this exciting opportunity into cash. Shows exactly how to prepare the shoes, how to put on them a coating of genuine *gold, silver, or bronze metal* by simple Warner Electroplating process. Shows how to get the business coming in, how to start in spare time, how to pyramid profits. Shows you how the whole family can have fun while building for an independent future. My own Shop here in Chicago does a Big Business by the very secrets I will now unfold to you.

Read The True Facts

Don't say "Yes" now. You must have ALL THE FACTS. Then decide. First, I want you to read the entire Plan—at my risk. After investigating—after discussing it with your family—then and only then do you decide whether to use the plan and make the small investment necessary to start.



\$5.00 An Hour PROFIT

Yes, even in spare time it is possible for a man to finish enough work to pay \$5.00 an hour for his time. Think what this can pyramid into when the family helps.

3c MAY START A FORTUNE

Today I want you to do only one thing. Send the coupon. Let me give you all the facts. Remember, what I send you does not cost you a cent beyond the postage you put on your letter to me. With an opportunity like this, a man who has a serious interest in his future MUST investigate. MAIL the COUPON TODAY and see for yourself why so many families have called the WARNER SUCCESS PLAN a "godsend".



WE SUPPLY ALL MATERIALS

You don't have to go "hunting" when Warner is behind you. We supply all materials, all mounts, chemicals, and metals. And you get the low prices made possible by our big quantity purchases and our own manufacture. You send for just what you need and never have any big investment tied up in stock.

MAKE 12 TIMES YOUR MATERIAL COSTS

Remember, the Warner Process is not a cheap imitation "PAINT" process. It is the genuine METALIZING through real Electroplating. And in spite of being the best, your materials cost so little that your profits are 12 Times your material cost. Then, when mothers order the shoes mounted as book-ends, as pictures, as ash-trays or pen sets, you make the BIG EXTRA PROFITS on the beautiful mounts.

WARNER-ELECTRIC CO.
 1512 Jarvis Avenue
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 Chicago 26, Illinois

DON'T SEND A PENNY JUST MAIL THIS COUPON TODAY!

Raymond E. Brandell, Mgr., WARNER ELECTRIC CO.
 1512 Jarvis Ave., Dept. 3-A, Chicago 26, Ill.

As long as it doesn't cost me a cent, I am willing to read the facts, investigate, then give you my decision. Send the facts by next mail. Everything you send now is FREE!

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Do Scores of Hard Jobs the Quick, Easy Way
COST Less TO BUY--COST Less

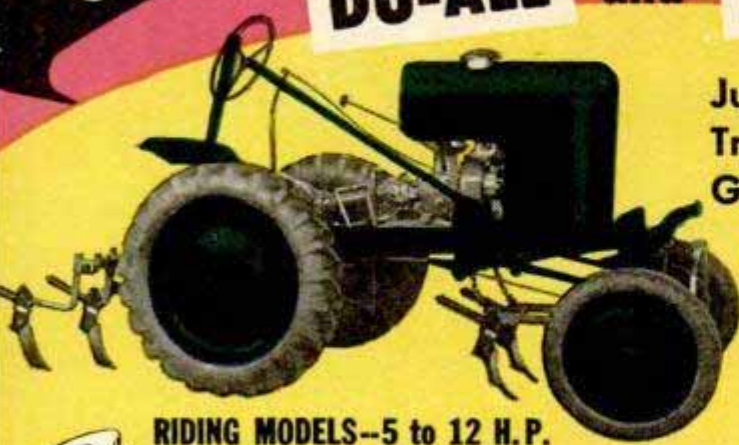
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WALKING MODELS

EASY TO OPERATE

1½ to 5 H.P.



In Use Throughout the Nation and in Many Foreign Lands... Saving TIME, MONEY and WORK!

Right now is the time to plan ahead... plan to do your work easier, in less time and at less cost this year. Plan to get a famous SHAW Tractor... the machine that does scores of hard jobs the quick, easy, better way! No other investment will pay you better dividends year after year.

TRIED AND PROVED RIGHT! For nearly a half-century SHAW Tractors have proved their value throughout the Nation and in foreign countries. They are built right... to do the job right... with quality materials and expert engineering. Equipped with high-grade air-cooled gasoline or oil engines. You get a full year guarantee against any defect in material or workmanship. They serve faithfully for many years.

LOW-COST DEPENDABLE WORKERS—SHAW Tractors have proved dependable, versatile, low-cost helpers on scores of jobs... ideal workers on small farms, in gardens, truck farms, nurseries, orchards, cemeteries, golf courses, poultry farms and estates. Great for plowing, cultivating, discing, seeding, harvesting, spraying, mowing; operate cutter bars and lawn mowers. Riding tractors with bulldozer also used in foundries and by building contractors for moving sand, dirt, etc. For power on belt jobs... sawing wood, pumping water, grinding feed and running belt machinery. First cost is low and low operating cost will surprise and please you.

EASY TO OPERATE—You'll find a SHAW "Peppy Pal" or "Du-All" Tractor just fitted to your needs... 1½ to 12 H.P. And you'll find that a SHAW will do things a big tractor can't. Easy to operate by elderly persons, boys and girls. Easy to change from one piece of equipment to another. We can supply many attachments at low prices.

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