

JULY 1957

35 CENTS

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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HILLER'S AERIAL SEDAN

—your flying car for 1967—page 74

Stand by for Satellite Take-Off!

Owners Report: OLDSMOBILE

HOW TO OUTSMART HOUSEBREAKERS

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Proof . . . AC Spark Plugs deliver full efficiency for recommended service life!

Location: thirty miles southeast of Phoenix, Arizona, somewhere among the Superstition Mountains. Weather: bright and clear. Temperature: a stifling 112 degrees.

This is a land of cactus, sun and swirling dust. In the heat of the summer, and in one of the most notorious heat belts within the continental limits, AC Spark Plug Division of General Motors sought out the hottest area and put AC Spark Plugs to the test . . . one of a series of tests under extreme climatic conditions to prove again that ACs are best for the kind of driving you do.

Hour after hour the desert tests went on—new ACs versus AC plugs after a normal lifetime of use. At last the tests are completed and final tabulations made. Here is one more proof that AC Spark Plugs, with normal servicing, will supply all the power you need, all the economy you could ask, right up to recommended lifetime limits.

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

JULY 1957

- 1 **SHELL-AND-INSULATOR DESIGN**—Both insulator and shell are designed to assure rapid heat dissipation.
- 2 **CONDUCTASEAL**—Only AC uses positive metal-ceramic seal to prevent compression leakage and power loss.
- 3 **HOT TIP**—AC Hot Tip design controls tip temperatures and cuts spark plug fouling to a minimum in all climates.



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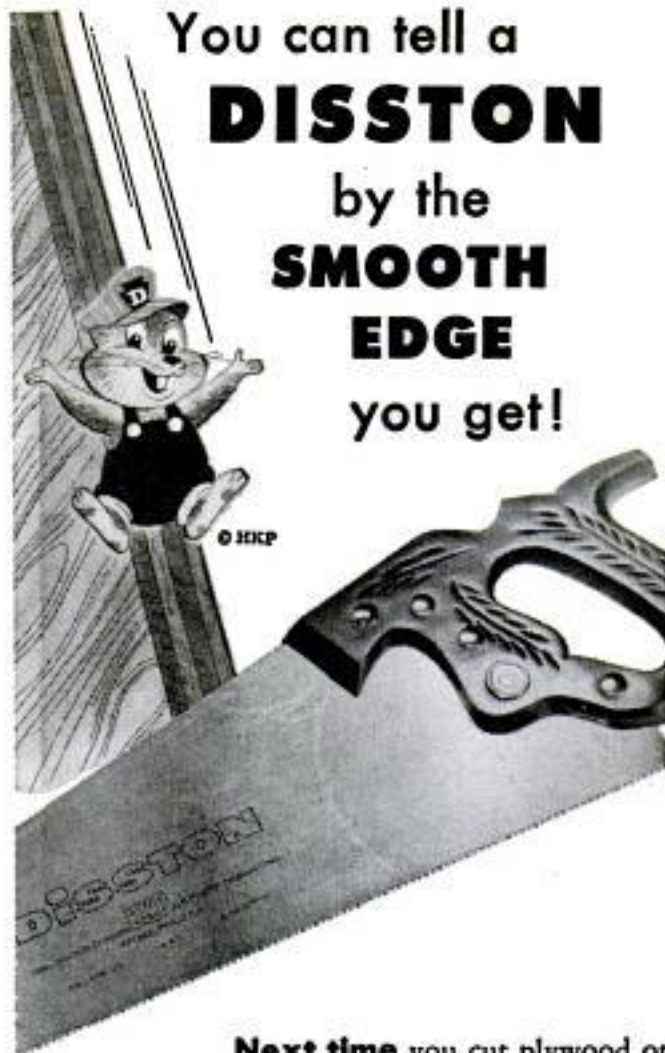
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**SMOOTH
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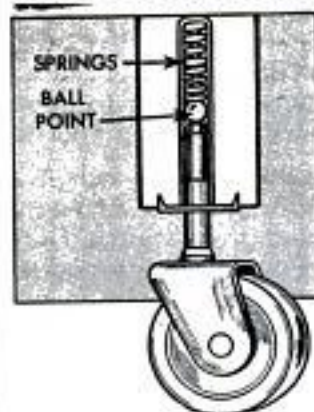
Star-Bladed Power Trowel Speeds Plaster Finishing

Smoothing plaster with this star-bladed power tool, reportedly, is three to four times faster than hand troweling. The six blades are arranged like petals of a flower, overlapping at the base. When spinning rapidly, they produce a smooth, circled surface which is troweled evenly as the machine is moved across the wall or ceiling. Water is sprayed onto the plaster from a hole in the shaft of the blades and the flow of water from a portable pressure tank is controlled by a valve near the blades.

New Clue to Radio Stars

Some radio stars, objects in the sky which appear to emit radio signals but can not be observed with optical telescopes, may be unusually turbulent masses of gas whose atoms have been highly ionized. This conclusion was announced by Drs. B. F. Burke and Merle A. Tuve, of the Carnegie Institution of Washington, after a study of similarities between radio stars and radio sources visible to optical telescopes.

Caster Eases Jolting TV Set



"Floating" casters ease jolts to TV sets that have to be moved. A special spring sits on a steel ball in the caster housing above the plastic wheel. This permits shock absorption and turning of wheel without marking the floor.

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Next Month...

FOR 12 YEARS a restaurant roof was a crashed, war-surplus DC-3. An enterprising firm bought it, fixed it up and it's flying again. This is one of many fascinating, true anecdotes in an August article, "The Saga of the DC-3," telling the story of the "gooney-bird" and how it refuses to die



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Vermiculite in Grill Spreads Heat Evenly

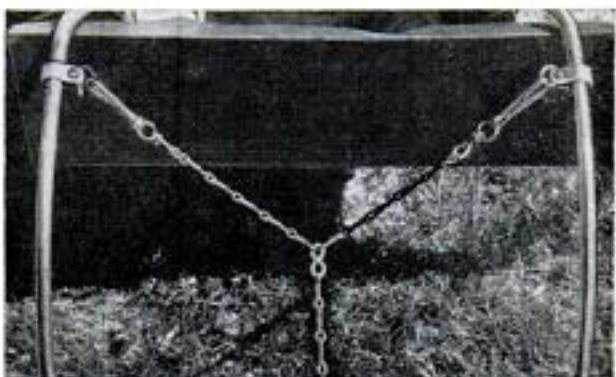
Vermiculite, a lightweight mineral used as an insulating material, now is being marketed as an aid to the back-yard chef. A layer of vermiculite is placed in the charcoal grill. It helps provide even heat for barbecuing, and absorbs grease drippings. Less fire-starting liquid is required, as the vermiculite acts as a wick. The mineral can be used repeatedly until it becomes filled with ash.

Jet Fires 114 Rockets

An Air Force F-100C Super Sabre jet fighter recently fired 114 rockets simultaneously at Eglin Air Force Base, Fla.

Power-Mower Chain Guide For Safe Grasscutting

Mowing grass on a steep terrace can be dangerous if your foot slips toward the whirling blades of a power mower. Such accidents can be averted by attaching a length of chain to the handle of the mower. A Y-shaped chain now available can be attached easily with U-clamps. On short terraces the operator can guide the mower from the top of a slope. On long terraces he can work from a safe distance.



POPULAR MECHANICS



X-RAY ON CHEVROLET

Roadability begins with "silk glove" steering

Nothing—not even performance—adds as much to solid driving pleasure as roadability. And roadability has its rock-bottom beginning with the silky, surgically precise steering that is Chevrolet's hallmark.

That's Ball-Race steering—a special system of steering in which a micro-polished spiral of steel ball bearings transmits your fingertip hint into turning motion—with sports car accuracy.

Chevrolet uses ball bearings because there's much less "drag" with *rolling*

friction than with the usual *sliding* friction. And we've taken extraordinary care in designing the Ball-Race system because, basically, nothing short of power steering can make the miles seem so fatigue free. Try it and you'll know why! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

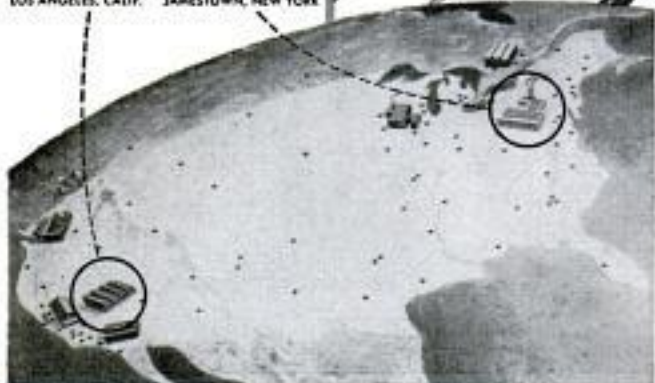




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ACROSS THE DESK



To the Editor:

The remarks about American cars in the March issue are interesting. I have a '54 Buick and think that 1954 was the best style year since the war. Since then styling has been going to the dogs.

What we really need is a good "do-it-yourself" car kit. I built my own 22-foot cruiser, so why not a car, too? It would eliminate that sloppy technological abomination, the assembly line, where so much good material is fouled up and where costs skyrocket. We see many interesting custom cars built by people who labor for months on the sheet-metal work. This is too much for the average guy. But the assembly of an automobile is within reach of anybody who has built a 22-foot cruiser, provided the car kit comes as the cruiser does, with the parts formed.

Henry Hilton,
Woodbridge, N. J.

To the Editor:

In your January PM, I noticed a picture of a three-wheel car. Thought you might be interested in another one made up from



three airplanes and one jet canopy, powered by a Continental 65-horsepower aircraft engine, and running on three wheels, skis or floats. On wheels it has been clocked at 115 miles per hour, on snow at 65 so far—haven't had the nerve to hold the throttle wide open. On water it will do better than 30. As you can see, it is licensed as a car. The canopy is raised by two hydraulic cylinders. I am building one now that has, in its present condition, reached a clocked speed over a measured mile of 147 miles per hour. Oh yes, it is steered by the feet with hydraulic brakes for the two rear wheels and a booster-powered steel plate dropping between the skis. The front wheel

(Continued to page 8)



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(Continued from page 6)

is replaced by a third, lighter ski which is used for steering.

William T. Rogers,
Billings, Mont.

Nylon-Lined Swimming Pool

An Indianapolis company offers a vinyl-coated nylon liner for swimming pools. Inexpensive concrete blocks frame the excavated area, the nylon liner is fitted into the pool bed, anchored at the top and filled with water—ready for swimming! The whole job can be done in about three days, says the manufacturer. A filter should be added. The liners are available in four sizes, and can be wiped clean with a cloth.

First Arctic Auto

In an old box in an abandoned Alaska cabin has just been found a remarkable photograph revealing an amazing journey of the first automobile ever to penetrate the Arctic, 57 years ago.

Its 12,000 mile journey there by steamer, rail and its own propulsion was a brilliant example of original advertising promotion by two French newspapers, the *Figaro*, and a new journal, *The Klondyke Review*.

This Arctic pioneer was a three-wheeled gasoline-driven automobile flying the French flag, and driven by E. J. de Lemare

to build up circulation of these two papers in Yukon and Alaska gold fields. The car went by steamer from Paris to New York, rail to San Francisco, steamer to Skagway.



From there it traveled several thousand miles over ice and snow.

Most difficult and thrilling moment was in April 1900 when the car was crossing Atlin Lake. The ice had commenced thawing. This placed the "burner" on the bottom of the car almost continually in water. On this record-making trip, repairs had to be made in the middle of the lake to the underside of the car. It being impossible

(Continued to page 10)

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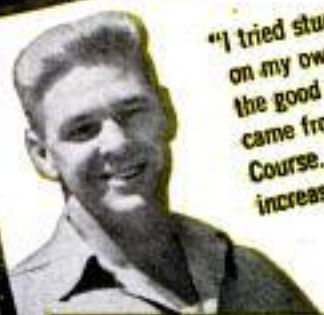
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(Continued from page 8)

to turn the machine over, a hole was cut in the thick ice the size of a man's body. The mechanic lay in this and the driver moved the car over him.

At the end of April 1900 this first car to penetrate arctic North America returned to make triumphal entry into Paris.

Francis Dickie,
Heriot Bay, B. C., Can.

To the Editor:

Henry White, high-school freshman of Phoenix, Ariz., decided he would look over the land as he rode his bicycle so he took parts of two bikes, turned over the frame of one, reversed the sprocket, welded a part of another bike on the seat section and welded a piece of bar in the front. This takes him off the ground about three or four feet and he considers it very safe and comfortable.



Henry F. Unger,
Phoenix, Ariz.

To the Editor:

I will begin this letter by stating that I have been a reader of *Popular Mechanics* since it was first published (1902) and I had the first volumes bound.

Now to my pet "peeve" . . . the story (March) of the frigate *Constitution*. In the first paragraph the *Constitution* is called a ship. Wrong, she was a frigate. The construction of the stern is far from correct and her masts were not banded, and the wheel was aft of the main mast.

When the *Constitution* was in Los Angeles harbor, I think about 1936, I had special permission from the Navy Department to photograph her from stern to stern and keel to topmast.

Now I will tell you why I was so interested. I recall that my great grandfather was a shipwright in the original construction and have in my possession a silver dollar he earned and my grandfather, my father and myself cut our first teeth on it. I was six years old and my father took me to see my first sailing ship . . . 80 years ago.

Theodore K. Hastings,
Los Angeles, Calif.

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I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my Winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things; of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—who you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life, is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept

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something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

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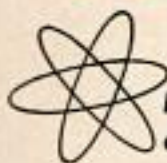
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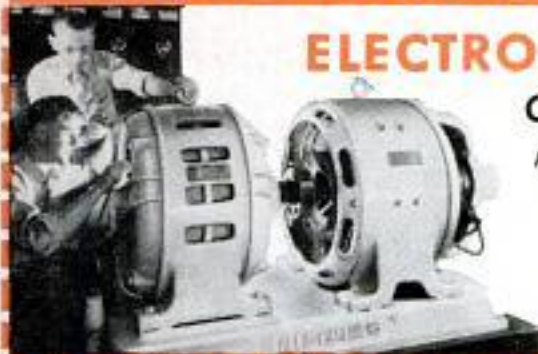
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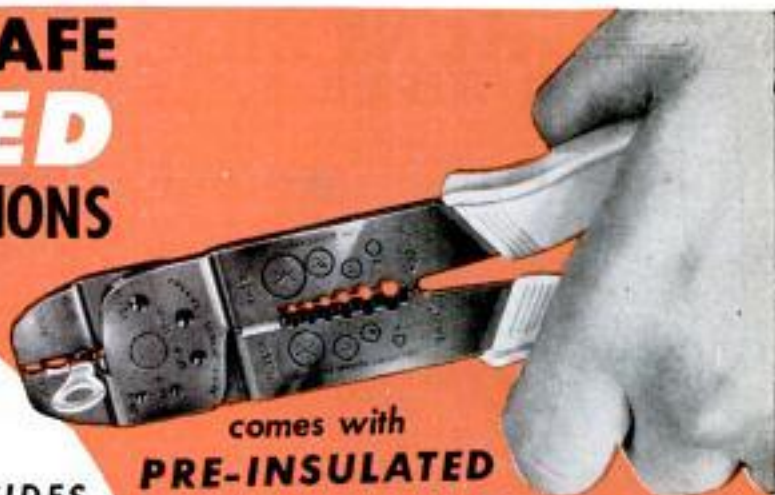
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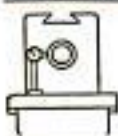
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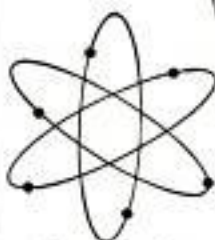
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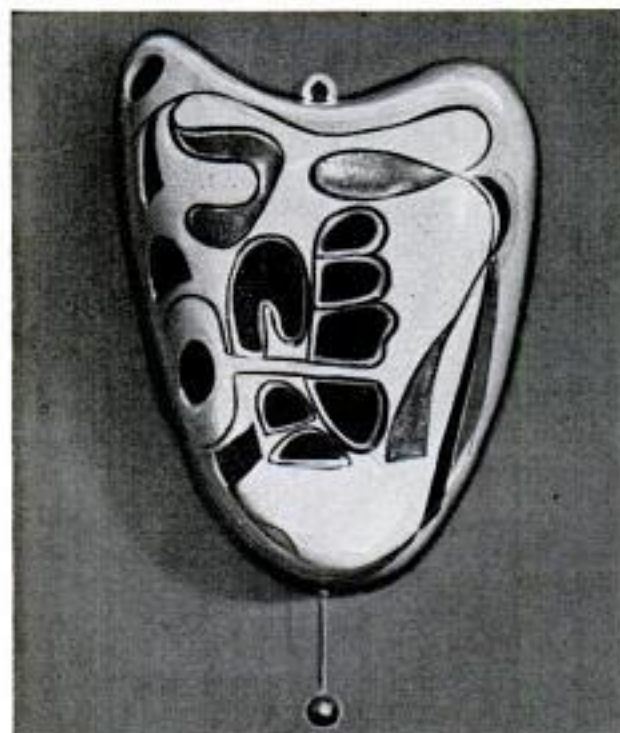
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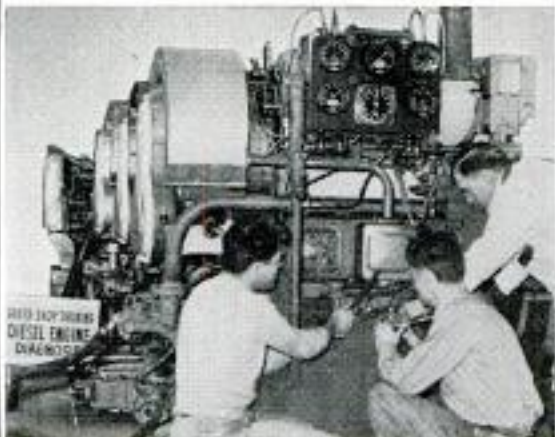
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5 MINT British colonies and 100 others 10¢ with approvals. Miller, 219 Fowler Ave., Jersey City 5, N. J.

FOREIGN Mission mixture 75¢ per 1000 stamps. Zaporowski, 4435 Allen, Philadelphia 37, Penna.

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IMPORT-Export! Mailorder opportunities. Details. Warner, Box 6, Fort Scott, Kansas.

SELL By mail. Tested methods. Alfano, 19 Pine Street, Closter 2, New Jersey.

MAILORDER. Free book. Shrager Advertising, 2 W. 46, New York City 38.

NEWEST Spare, full-time home business \$5 to \$10 hour possible. Paint with suede—The finish with touch and eye-appeal. Beautifully auto dashboards, signs, radios, toys, figurines, lamps—1001 others. Complete, step-by-step instructions sent for no-risk examination. Free details. Coast JY, Los Angeles 61.

MOTEL-Resort management—Qualify for hundreds fascinating, leisurely, well-paid executive openings. Learn at home. Free booklet. Motel Managers Training School N147C, 612 S. Berrano, Los Angeles 5.

AMAZING Earnings operating home sharpening service. Write George Page, 1820 Cleveland Ave., Niagara Falls 2, N. Y.

LEARN Professional TV servicing in one week! Fabulous new simplified system. No big expense. No studying. No tools or equipment. Spare, full time. Own your own big profit business! Save! Amazing but true! Free! Write, Electronic Engineering, Dept. AC-177, 1638 So. LaBrea, Los Angeles 19, California.

START A buying service, buy wholesale thousands nationally advertised products. Make big profits selling at sizable discounts. Postcard brings details. American Buyers, Hertel Station, Buffalo 16-C, New York.

START Your own business on credit. Your own boss. 1527 dealers sold \$5,000 to \$32,000 in 1936. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant profitable business backed by world-wide industry. Write Rawleigh's, Dept. G-U-PPM, Freeport, Ill.

PRINT Without a printing press! Amazing new method! Print colorful signs, banners, cards, posters, glassware; anything at home. Big profits. Money-making opportunity! We supply everything. Beautiful sample, home-business plan free! Write Screen-Print Company, JY, Los Angeles 61, California.

MAKE Extra money. Cash commissions. Everybody buys easy-to-sell advertising book matches. Union label. All sizes. Cuts for all businesses. Powerhouse selling kit free. Steady repeat business. No experience necessary. Superior Match Co., Dept. MX-787, 7528 S. Greenwood, Chicago 19.

INDUSTRIAL And institutional mail-order business. New, unexploited opportunity. Hermes Advertising, 152-C West 42, New York City 38.

GROW Expensive herbs for us! Big profits home-business of your own. Year around profitability! We supply everything necessary! Send for free rare seeds and revealing plan. National Herb Exchange, Dept. JY, Gardena, Calif.

60% PROFIT Cosmetics \$25 day up. Hire others. Samples, details. Studio Girl-Hollywood, Glendale, Calif., Dept. 1277H.

WE Establish you in your own mail order discount business. Catalogs, sales letters, etc., printed your name cost you nothing. No stock investment. We ship orders. Sell gifts, appliances, housewares, cookware, cutlery, dinnerware, silverware, jewelry, watches, etc., at big discounts. Catalog, details free. Topval Corp., Lindenhurst 618, N. Y.

WHOLESALE Catalog! Discounts to 80%! Clothing, appliances, tools, housewares, jewelry, etc.! Midwest, 2MP-136, Pontiac, Illinois.

MAKE Money growing miniature trees on your window sill. Free seed and plan. Miniature Nurseries, Dept. JY, Gardena, Calif.

HOME-Import mail order business—Import profitable items below wholesale. Experience and product investment unnecessary. Full, spare time. Famous world trader guides you. Free list "157 Imports," details. Mellinger, G707, Los Angeles 24.

"HOW To Start a Business" booklet sent free! If you know any trade, go into business for yourself! Learn the 9 easy steps to follow. We've guided 5,000 others to success. Revealing free booklet yours for the asking! Write! National Business Consultants. Office JY, Los Angeles 61, Calif.

WE Pay \$3.50 lb. Grow mushrooms. Cellar, shed and outdoors. Spare, full time, year round. We have over 25,000 customers. Free book. Washington Mushroom Ind., Dept. 172, 2954 Admiral Way, Seattle, Wash.

UNUSUAL Package of opportunities—Selling, mailorder. Magazines, catalogs, etc. \$1.00. Pickett, Mt. Airy, Maryland.

\$200.00 WEEKLY Reported! No selling. Free booklet. Franklin Credit, Roanoke, Virginia.

REVOLUTIONARY New dishwasher. Lightning seller. Ends dishwashing drudgery. Dishes gleam. Send no money. Just your name. Kristee 109, Akron, Ohio.

EARN \$10,000 Yearly raising Angora rabbit wool for us. Information 25¢ coin. American Angora Company, Malta 12, Montana.

FREE Literature of money making opportunities. Unique Trades, Box 5516, Chicago 80, Ill.

FREE! Complete mailorder business. Terrific profits! No investment. VitaMins, 4801PM Cedarvale, Wichita, Kans. 57.

CERAMIC Tile as an installer or sell to the do-it-yourself market. No investment. Order as needed. Write Norlin Co., 5515 North Ave., Chicago 39, Illinois.

FREE Catalog. Contains hundreds of businesses, farms and income properties throughout U.S., Canada. Specify type and location desired. Deal direct with owners. U. I. Buyers Digest, 1608 Hillhurst, Dept. PM-3, Los Angeles 27, Calif.

EARN \$10,000 A year and more in your spare time. For details write: Products, Box 607, Sheboygan, Wisconsin.

MANUFACTURE Thin, lightweight, concrete stone inexpensively from new, amazing, plastic mold. Exact detail and color of natural stone reproduced. Small investment, big profits. Sell homeowners, contractors, etc. Send \$1.00 for complete details, sample stone and mold. Superior, Dept. 102, 5645 Manchester, St. Louis 10, Mo.

\$200 PER DAY! Made operating stands, or concessions at fairs and carnivals. Write! Globe Sales Co., Macon, Georgia.

BOOK On culture crickets and earthworms. Excellent information free. Kean, Ladonia, Texas.

IMPORT Your own products in small lots. Start profitable mail order business using international drop shipment method. Capital unnecessary. Free details. Georgia Overseas Trading Co., Dept. W, 715 Persons Bldg., Macon, Ga.

FREE Cadillac, \$10,000 yearly. Cars, appliances wholesale. Strateway, 2114-E, Charlotte 1, N. C.

SELL And repair vacuum cleaners. Write for new free catalog. Easy to read, all cleaners and parts. Eder Vacuum Cleaner Co., Dept. 15U, 13345 Livernois, Detroit 38, Mich.

IMPORTS. List of 50 German and Japanese exporters, who will send samples of their products upon request. All correspond in English. Only \$1.00 postpaid. Henry Baasen Importer, Dept. CT-45, 328 Fullerton Ave., Chicago 14, Illinois.

YOUR Photo on stamps. No investment. No stock. Big profits. Free samples. Miniature Photostamps, Box 44-B, New York City 67.

MAKE \$6 To \$10 per hour sharpening saws and lawnmowers. Our Acme equipment used by thousands of successful shops throughout United States and Canada. Free literature. No obligation. Max Mfg. Co., 138 Stockton Ave., San Jose 26, Calif.

MAKE Chipped glass nameplates. Resilvering mirrors. Electroplating. Outfits furnished. John Sprinkle V60, Marion, Indiana.

NOW Buy in small lots direct from the importer. Gifts, purses, tools, everything for everybody. Current bulletin 25¢. Young's, Pleasantburg, 5102, Greenville, S. C.

MAKE \$46 From square foot plywood; jig saw necessary. Free information. Woodart, Bridgewater, Mass.

LIQUID Rubber. Make flexible molds. Free sample. Chaney, 1907-A East Road, Jacksonville 11, Florida.

BECOME Importer and mail order dealer. Greatest opportunity of today! Free details. International Associates, Dept. PM, Hyde Park National Bank Bldg., Chicago 13, Ill.

5000-WORD Report on opportunities in booming Mexico \$3.00. Joseph Weston, 715 Broadway, San Diego, California.

WANTED: Home producers, to be subcontractors. Cast plastic products for manufacturers in our clearing house service. Thousands of easily made items required. Cash in at home, without previous experience. Plastic Service Associates, Dept. T-PM, East Boston 28, Massachusetts.

COSTS 8¢—Retail \$1.00. Automotive product. You manufacture, distribute. Easy! Wilsons, Box 505, Princeton, W. Va.

"MAILORDER Laws and Regulations," explains necessary licenses, different taxes, legal requirements, etc., \$1.00. Tasker, 1603 Peach Street, Alexandria, Virginia.

MAIL Order advertising agency executive reveals sensational no-risk advertising and merchandise methods. Start in office or home; minimum capital; positive profits. Free details: Impact! 3407 Prospect Avenue, Dept. 11-7, Cleveland 15, Ohio.

NEW Products wholesale. Bargain close-outs. George Lucas, Bellevue 5, Wash.

MONEYMAKING OPPORTUNITIES

FREE Introduction copy to "New Horizons" for homeworkers. Shields Publication, Box 164A, Miami 38, Florida.

STEADY Income. Easy project. Tremendous demand. Yours for \$2.98. Betterworth, Vidor, Texas.

PRINTING Wholesale—Save 50%. Start brokerage. Elichs, 3035 Marvin(B), Toledo, Ohio.

"HOW To Win Prize Contests." Free information. National, 9128-P S.W. 26th, Portland 19, Oregon.

MAIL Order ideas, suggestions, methods. \$1.00. Box 4066, Wichita Falls, Texas.

DO It yourself. What? Repair TV, build furniture, make barbecue, plumbing repairs, build boats, do house wiring, remodel home, lay tile, modernize kitchen, repair home, and scores of other things you can do yourself. Books covering each subject, only 25¢. Send for descriptive list. It's free. Popular Mechanics Press, 200-LB East Ontario St., Chicago 11, Ill.

DIRECTORY! Where to obtain free merchandise, books, literature, other valuables! Directory, \$1.00. National, P.O. Box 606-L, Redwood City, Calif.

\$100.00 WEEKLY Spare time with a tape recorder! Proven facts free! Dixieland Publishers, Asheboro 2, N. C.

LEARN Technical metaphysics and insure your future. Easy, inexpensive correspondence course. Simplest method known. Diploma. Write: Premier College of Technical Metaphysics, 2532 McKenzie St., Vancouver 8, B. C., Canada.

BUY Wholesale! 30-80% discounts! Appliances, gifts, typewriters, tools, watches, sporting goods, jewelry, cameras, housewares, etc. Consolidated Distributors, Clifton 28, New Jersey.

THEY Hand him \$100! Free plan "Secret Journal Hidden Dollars." Work home! Publics, Oceanside, Calif.

HOTTEST Mail order plan ever! Sell photos, films, art novelties. Huge proven profits! Free details! Ampro, 429 South Western Ave., Dept. 1, Los Angeles 5, California.

ADS Running under this heading sell printing. Ask me for proof. I'll gladly send you amazing facts. Ask for Folder "P." F. W. Johnson, 200 E. Ontario St., Chicago 11, Ill.

AMAZING Successes through franchises! Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, 333 North Michigan, Chicago 1.

FREE Folio "\$5,000-\$45,000. Unlimited Vacations." No merchandise. Unknown! Work home, sparetime! Haylings, Carlsbad, Calif.

GENERAL Contest Bulletin. Lists contests monthly. Sample, 25¢. 1609 1/2 East 5th, Duluth, Minn.

READ Progressive Mailtrade, the magazine that tells how to make money by mail. Dime brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

RAISE Rabbits on \$500 month plan. Plenty markets. Free details. White's Rabbitry, Mount Pleasant, Michigan.

BIG Money raising, fishworms and crickets. Free literature. Carter Hatchery, Plains, Georgia.

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

SELL Titania gems. Far more brilliant than diamonds. Catalog 10¢. Diamonite, 2420-M 77th, Oakland 5, California.

VENDING Machines—No selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, Dept. 27, 715 Ensor Street, Baltimore 2, Maryland.

FREE Book "505 Odd, Successful Businesses." Work home. Pacific, Oceanside, Calif.

PRIZE Contests provide fabulous and confidential home income opportunities! Here's how and where to win your share! Send stamp! National Contest Bulletin, Box 2685-P, Miami 16, Florida.

YOU'LL Like goat milk! Profit and health with dairy goats. Booklet plus year's subscription monthly magazine: Special \$1. Dairy Goat Journal, Columbia, G-32, Missouri.

MAKE \$5,000 Yearly sparetime raising mink, chinchillas, nutria, etc. Free booklet reveals proved plans. Write Furs, 588 Mt. Pleasant Road, Toronto 1, Canada.

MAKE Top money collecting snakes, lizards, turtles, toads, frogs. We pay guaranteed prices. Details 25¢. Biological Exchange, Dept. 15b, Box 5302, El Paso, Tex.

WE Pay \$3.50 lb. Grow mushrooms. Cellar, shed and outdoors. Spare, full time, year round. We have over 25,000 customers. Free book. Washington Mushroom Ind., Dept. 173, 2954 Admiral Way, Seattle, Wash.

DOLLARS Every day! It's magical—You keep all the dollars. Setup free. Otto Miller, Box 583-W, Oshkosh, Wis.

TRAVEL Anywhere, fast, free. Send \$1.00 for Hitch-hikers Guide, R.F.D. #1, North Lawrence, Ohio.

JOIN The prosperity parade with a mail order bookshop in your own home. Valuable information free. Practical Publications, 3974-F Milwaukee, Chicago 41, Ill.

LEARN Profitable drapery making in your home. Free literature. VZ Sales, 123 E. Poplar, San Mateo, California.

MAKE Money, mailing sample business cards. Vosacek Printing, 4444PI Ute, San Diego 17, Calif.

READ Bargain Magazine! Keeps you informed on hundreds of sensational buys every month. Breath-taking, money-saving, money-making offers of merchandise as low as 10¢ and 25¢ on the dollar! 25¢ brings sample and special offer. Glass, Ellwood City, Penna.

60% PROFIT Cosmetics \$25 day up. Hire others. Samples, details. Studio Girl-Hollywood, Glendale, Calif., Dept. 1277H.

START A buying service, buy wholesale thousands nationally advertised products. Make big profits selling at sizable discounts. Postcard brings details. American Buyers, Hertel Station, Buffalo 16-D, New York.

"50 NEW Home-Business Ideas" booklet free. Coast Industries, B7C, Los Angeles 61.

EXECUTIVE Secrets revealed! Learn about business. How to earn profits—How to operate your own business. How to better yourself and your family's income. Taught by experts. Free details write, National Business Consultants, Office P7C, Los Angeles 61, Calif.

\$250.00 WEEK Spare time profit possible. Earn at home with new fascinating printing method. \$5 starts you, send no money now. Free confidential facts and valuable samples. Screen-Print, 27C, Los Angeles 61.

MAKE Money writing short paragraphs! No tedious study. I tell you what to write, where and how to sell; and supply list of editors buying from beginners. Many small checks add up quickly. Write to sell, right away. Send for free facts. Benson Barrett, Dept. C-27-G, 7464 Clark, Chicago 26.

MEN And women wanted to start home business in spare time with little table-top rubber stamp machine. Easy to earn up to \$9.80 an hour without previous experience. Full particulars free by mail. Send postcard to Roberts, 1512 Jarvis, Room CR-2-S, Chicago 26, Ill.

MEN—Women! Start money-making plastic laminating business at home in spare time. Material that costs 11¢ brings back \$2.58. No canvassing or selling but mail orders bring in \$20 a day. Write for full particulars free. Rush name on postcard to Warner, Room CL-2-S, 1512 Jarvis, Chicago 26, Ill.

"MAKE More money with less work." Your original exclusively created Sloganeers' slogan will produce results. Write Sloganeers, 235-Fifth Ave., No., St. Petersburg 1, Fla.

FORMULAS, PLANS, ETC.

LATE, Modern manufacturing formulas. List free. Moon Chemical, Martville, New York.

FORMULAS For latest money-making discoveries. New! Good! Valuable literature free! Miller, Chemist, 1517-D, Tampa, Florida.

FREE Formula catalog. Anything analyzed. Reasonable. Western Chemical, Salem, Oregon.

FORMULAS; All kinds, latest, best. Literature free. Kemixal, Park Ridge, Ill.

PRACTICAL Formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

EXPORT—IMPORT

IMPORTED Merchandise. Amazing savings on German, Japanese, and Swiss cameras, photographic, and optical goods; European firearms and accessories; Swiss, German watches; hi-fi and electronic equipment; etc. All famous names supplied in any quantity. Import direct and save! Write for details. International Import Service, 22-7M Oakland Square, Pittsburgh 13, Pennsylvania.

CHEMISTRY

ATOMOTRON, Model atom smasher, \$14.95. Raybaby cloud chamber, \$3.95. 3-in-1 electromagnet, \$14.95. Send 25¢ for literature. Atomic Laboratories, Inc., P. O. Box 343, Berkeley, Calif.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 25¢. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 20¢. Tracey Laboratories, Evanston, Illinois.

60 PAGE Booklets! "Beginners Chemistry," "Chemistry," "Physics," "Relativity," "Light," "Astronomy," "Electricity," "Radio," "Useful Tables," "Scientific Oddities," 10¢ each. Franks, 3121 South Racine, Chicago 8.

CHEMICAL Curiosities! Chemical puzzles! Chemical games! Chemical novelties! All only \$1.00. National, P.O. Box 606-L, Redwood City, Calif.

AMAZING New book of science. Experiments, formulas, and catalogue of laboratory supplies. Only 25¢. National Scientific Co., Dept. PM-7, 500 West Road, Lombard, Illinois.

PLASTICS

FIBERGLASS Patio sheets 58¢ sq. ft. Plexiglas 95¢ sq. ft. Liquid casting plastic \$1.95 qt. Send 10¢ for literature. United Plastics Products Co., Dept. 7, Roebling, N. J.

PLEXIGLAS, Square foot cost, 1/16", \$1.20; 1/8", \$1.52; 3/16", \$1.86; 1/4", \$2.21; 3/8", \$3.23; 1/2", \$4.36. Colors add 10%. Send 15¢ for postage. Aristocrat Plastics, 23-25 Sussex Avenue, Newark, N. J.

LEARN Plastics fabrication for spare time income. Low cost home training now available. Write for free booklet. Interstate Training Service, Dept. D-3, Portland 13, Ore.

FAMOUS Sculptor. Internal carvings to order. Edwin E. Pinkbeiner, 1621 N. Fredrick St., Burbank, Calif.

LAMINATING Supplies. Free price list. Solomonson, 46 Cornhill, Boston 8, Mass.

PLEXIGLAS, Fiberglass, polyester, epoxy, acetate, vinylite, styrofoam, acrylic. Instructive wholesale-retail catalog, free. Gem-O'-Lite, 3529 Cahuenga, North Hollywood, Calif.

BOXES, Plastic. Free list. Althor, 170 Bay 23 Street, Brooklyn, N.Y.

NEW Liquid casting plastic, clear, colors. Embed real flowers, coins, photos. New manual shows fine things you can make at home and sell at big profit. Send 25¢. Castolite, Dept. H-101, Woodstock, Illinois.

HELP WANTED

SMALL Southwest college with excellent research facilities is seeking the services of experienced instrument makers. Beginning salary range \$5000 to \$6000 per annum depending upon qualifications. Excellent climate for health seekers, outdoor recreating including hunting, fishing, swimming, and golf. Direct letter of application to Arthur P. Stanton, Personnel Manager, Campus Station, Socorro, New Mex., describing qualifications and salary requirements. Include recent photograph.

AGENTS WANTED

IF YOU want to earn money fast, I'll send you free sample stocking of newest stretch DuPont nylons to sell at only \$1 a pair. American Mills, Dept. 618, Indianapolis 7, Ind.

SHINE Shoes without polish. New invention. Lightning seller. Shoes gleam like mirror. Sample sent on trial. Kristee 67, Akron, Ohio.

WANT Extra cash? Send your name for money-making Christmas card and gift samples. Showing them to friends pays you as much as 50¢ to \$1.25 profit per item. \$150.00 easy! Samples on approval. \$1.25 gift offered free! Midwest, 1113 Washington, Dept. 487-H, St. Louis 1, Mo.

WHOLESALE—Handmade glass figurines. 4 samples and list \$1.40. Glass Figurines, 18724 Martha, Saratoga, Calif.

60% PROFIT Cosmetics \$25 day up. Hire others. Samples, details. Studio Girl-Hollywood, Glendale, Calif., Dept. 1277H.

BUY Wholesale thousands nationally advertised products at big discount. Free "Wholesale Plan." American Buyers, Hertel Station, Buffalo 16-A, N. Y.

AMAZING Greeting card assortment pays 85¢ cash profit on \$1.25. Make \$85.00 fast! Gift bonuses besides. Outstanding new Christmas cards, novelties, free imprint album. Samples on approval. Act fast, get golden egg banks free. Creative, 4401 Cermak, Dept. 512-G, Chicago 23.

FREE! Beautiful feather pictures, 200% profit! Apartado 9038, Mexico 1, D.F.

MAKE \$50-\$75-\$100 Again and again. Show friends New Idea Christmas, all occasion boxed assortments, gift wrappings. Profits to \$1.00 per box. Write for feature boxes on approval, 54 free personal Christmas card, stationery samples. Free catalog. Sensational free offer. New England Art Publishers, North Abington M-70, Mass.

AMAZING Profits. Easy seller. Abraham Lincoln's liquor license, bond, replica. Sample \$1. Outlet, Box 336, Lindenhurst, New York.

MEN-Women agents: Sensational new moneymakers—Beautifully hand-painted, plastic personalized photo enlargements, compacts, rings, bracelets, sockets, etc. Simply take orders, pocket 40% commission. We deliver and collect. Sales outfit free. Novelco, 3343 North Avenue, Chicago 47.

NEW Bathroom deodorizer. Hangs on wall. Banishes odors bathroom, kitchen. Lightning seller. Samples sent on trial. Kristee 68, Akron, Ohio.

MAKE \$50-\$300 Extra money fast. Show big value \$1.00-\$1.25 Christmas, everyday greeting card assortments, gift wrappings, costume jewelry, gifts, stationery. Profits to 100%. Cash bonus. Write for newest assortments on approval. Free gift offer. Free album name imprinted Christmas cards, catalog, details. Hedenkamp, 361 Broadway, Dept. PM-50, New York.

RUN Spare-time greeting card and gift shop at home. Show friends samples of our new 1957 Christmas and all occasion greeting cards and gifts. Take their orders and earn to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 70, Ferndale, Michigan.

\$10,000.00 AND UP yearly. Now earned by hundreds who sell heavy 3-ply stainless steel cookware, chinaware and cutlery. Opportunities for managers positions and higher earnings available. Age is no handicap. Write to: Sales Manager, P.O. Box 3038, South Bend 19, Ind.

JUMBO Profits selling slingshots to kids, stores. Buy wholesale. 50¢ for sample and information. Designed Products, P.O. Box 964-N, Concord, California.

IT'S Hot. New. Amazing miracle ash-tray. Automatically extinguishes fire. Free sample offer. Golden Gate, Box 222, Station A, Manchester, Conn.

MAKE Up to \$3.00 hourly selling cookware, appliances, dinnerware, silverware, cutlery, jewelry, watches, gifts, books, tableware, housewares. Satisfaction or money refunded. Free wholesale catalogue and details. L. G. Clark, P.O. Box 272, Greenville, Ohio.

WELL-Known importer seeks volume producing agents and distributors for fully guaranteed imported midjet radio, 3 1/4 x 5" - 4 tube superhet, weighs 14 oz. 2 1/2" speaker (interchangeable earphone), leather slipcase, strap, batteries. Sample on request. Enclose money order. \$18.50 complete. Extra set of batteries \$1.20. Albert International, 935 Broadway, New York 10, N. Y.

200% PROFIT. No-Kro stops battery and cable corrosion. Guaranteed. Whirlwind seller. Protected territories. Write No-Kro Company, Chanute, Kansas.

CALIFORNIA Sweet smelling heads. Sensational sellers. Particulars free. Mission, 2328-PM W. Pico, Los Angeles 6, California.

EXCLUSIVE Line of personal initialed buckles, belts, cap badges, 3,000 emblems, uniforms, shirts, caps, etc. Hook-Fast, Dept. PM, Roanoke, Virginia.

WHOLESALE Catalog! Clothing, linens, housewares. Write Bostonian, 14 Dock Sq., Boston 8, Mass.

AGENTS - 300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 1217-D West Newport, Chicago.

YOUR Ad in this space will get some good agents for you. Yes, I'll prove it. Write for Folder "A" right now P. W. Johnson, Classified Advertising Manager, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill.

GOLDMINE of 600 money makers. Copy free. Specialty Salesman Magazine, Desk 5-B, 307 N. Michigan, Chicago 1.

GOLD Or silver letters, numbers. Windows, doors, trucks. 1" to 6". 500% profits. Free samples. Atlas-T, 544 West 79th, Chicago 20.

PRINTING. Advertising salesmen—Excellent moneymaking sideline selling decalcomania name plates, small quantities. Automobile initials, sign letters. Free samples. Ralco, XL, Boston 19, Mass.

YOUR Own business—Used suits \$1.50, overcoats 65¢, maokinaws 35¢, shoes 12 1/2¢, ladies coats 30¢, dresses 15¢. Enormous profits. Catalog free. Nathan Portnoy Associates, 605-AA West 12th Place, Chicago 7.

EASY Handwork makes fast-selling articles. Sample free. Sunmade Company, Brockton 64, Massachusetts.

SELL Famous \$3 fire extinguishers. Past sales, liberal profits. Write Fire-Killer, Box 182, Hazleton, Penna.

BUY IT WHOLESALE

WHOLESALE Catalog! Discounts to 80%! Clothing, appliances, tools, housewares, jewelry, etc. Midwest, IMP-156, Pontiac, Illinois.

FREE Wholesale catalog. Gifts, appliances, housewares, cookware, cutlery, watches, dinnerware, silverware, jewelry, etc. Discounts to 80%. Topval Corp., Lindenhurst 424, N. Y.

BIG Multicolor wholesale catalog! Housewares, appliances, clothing, silverware, cookware, luggage, binoculars, radios, phonographs, cameras, recorders, projectors, typewriters, shavers, sporting goods, toys, tools, sewing machines, watches, jewelry. Name brands. Huge discounts. Just postcard: Selbyco, Decatur 153, Illinois.

BUY Your electrical supplies wholesale. Materials for any type of electrical installation. Includes fixtures. Free catalog. Bay Wholesale, P.O. Box 295, San Bruno, Calif.

BALL Pens. Full-view, liquid lead and three style retractables. Choice of 3 samples. 50¢. Quantity prices available. Nucleus, 2440 Amsterdam Ave., New York City 33.

BARGAINS, Joblots, closeouts. 2000 items. Tremendous savings, clothing, toys, gifts, jewelry, television, etc. 25¢ brings wholesale catalog, \$1.00 merchandise certificate included free. Reliable Jobbing, 311-B North Desplaines, Chicago.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin PMW, Covina, Calif.

USED And new watches \$2 up. Free list. Southern Watches, Gray, Georgia.

DIRECTORY! Where to obtain free merchandise, books, literature, other valuables! Directory, \$1.00. National, P.O. Box L-606, Redwood City, Calif.

SALESMEN—DISTRIBUTORS

AD Matches! Sell amazing designs—10, 20, 30, 40 and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PM-91, Chicago 32, Illinois.

WILL You wear new suits and topcoats without one penny cost and agree to show them to friends? You can make up to \$30.00 in a day even in spare time, without canvassing. J. C. Field & Son, Inc., Dept. K-1826, Harrison & Throop Sts., Chicago 7, Illinois.

FABULOUS Patented sewing machine air-conditioner \$1.00. Descriptive circular. Weidner, 131 West 45th, New York City.

CALENDARS. Advertising novelties, matches. All styles, including religious, varnished, 12 sheet, girls. Hundreds of advertising novelties, book matches, etc. Fleming Calendar Co., Sales Division, 6539 Cottage Grove, Chicago 37, Ill.

HANDICAPPED People. 18-30, Travel. Permanent jobs. Excellent pay. Transportation furnished. Advancement opportunities. Help Wanted, Box 4606, Kansas City 9, Missouri.

MAKE Extra money. Cash commissions. Everybody buys easy-to-sell advertising book matches. Union label. All sizes. Cuts for all businesses. Powerhouse selling kit free. Steady repeat business. No experience necessary. Superior Match Co., Dept. M-757, 7528 S. Greenwood, Chicago 19.

SOOTHING Health giving minerals from world famous Hot Springs, Arkansas. Arko, 202 W. Turnbull, Midwest City, Oklahoma.

EXTRA Cash for employed man. Up to \$3.25 hourly. Commission, bonus. No experience. Demonstrate patented Air Cushion Shoes. Samples supplied. Charles Chester Shoes, 741 Brockton, Mass.

MULTI Pocket auto briefcase. U. S. pat. pend. Carries maps, papers, sandwiches, etc. Hooks inside window. E-Z-Reach. Big seller with millions of prospects. Sample, particulars, Vinyl \$1.95, leatherette \$2.95. Money back guarantee. Grand Novelties Mfg., Box 103, Elkton, Md.

TRADING Stamp salesman! Large discount catalog firm recently inaugurated unique stamp feature into already nationally known business. Protected territory! Top commissions! Leads! Kroboth's, W. 1118 Grace, Spokane 17, Washington.

PROMISES With profit for you. Have you promised yourself a business of your own? Better-than-average income? A secure future? Turn these promises in your spare time into a permanent, profitable business of your own. Learn the facts today! No books. Contact: Belco Products Corporation, 544 South Mariposa Avenue, Los Angeles 5, California.

100% PROFIT Selling stock rubber stamps. Send \$1.00 for sample kit refundable. Grant Stamp Co., 63 Grant St., Buffalo 13, New York.

EXCLUSIVE "Trade-in sale" of old shoes sells new Air Cushion Shoes for you! Highest commission, bonus. Paid vacation. Samples supplied. Charles Chester Shoes, 740 Brockton, Massachusetts.

AGENTS, Distributors, 200% profit sell service stations, auto lots, etc. Spinners, whirlers, streamers, etc. Free sales kit. Robbins Manufacturing, Los Angeles 18, California.

AMAZING Insecticide line. Safe indoors, outdoors. Sells fast. Demonstrates. Great repeater. Wonderful profits. Distributors opportunity. Write Sayer Associates, 426P1 Portland Bldg., NW, Washington 5, D. C.

PROFIT; Selling 3 merchandise items; repeats, too. Sterling, Corona 68, N. Y.

TERRIFIC Profits in food supplement industry with old established company. Franchise distributors wanted. Organic Sea Products, 907 Harrison Street, San Francisco 7, California.

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the engine cools, condenses, mixes and reheats the exhaust, passing it off with a moisture content that is below maximum for producing fog. The manmade fog has been a problem to the Army in arctic areas.

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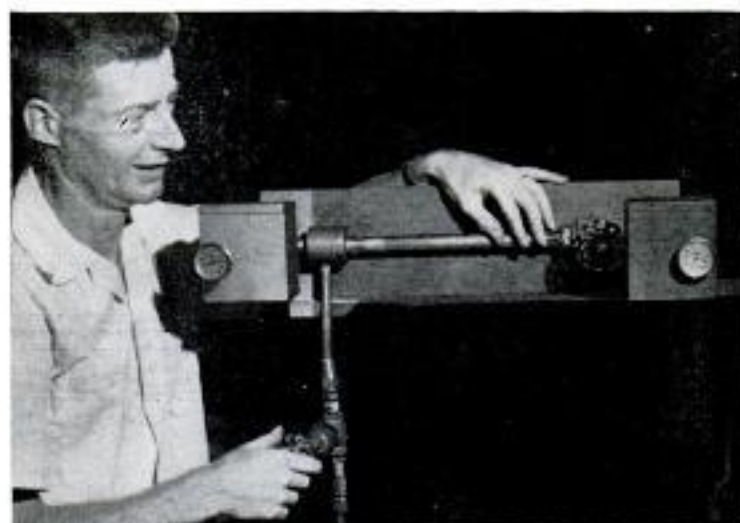
If you send compressed air up the stem of a T-shaped tube, hot air emerges from one tip and cold air from the other.

This puzzling phenomenon holds promise of providing inexpensive air conditioning for homes and cars. In one demonstration by physicists of the Southwest Research

Institute, air compressed to 100 pounds per square inch and with a temperature of 80 degrees is forced up the tee. A thermometer at one end of the cross tube shows that the air emerging there has a temperature of 116 degrees. Air emerging from the other end registers only 20 degrees.

Even the physicists don't know what happens inside the tube. They suggest that the incoming air sets up a vortex when it enters the cross tube, and the whirling action somehow creates the streams of hot and cold air.

At present the device is not as efficient as other ways of heating or cooling because of the cost of compressed air. However, physicists of the institute hope to learn the cause of the phenomenon. Once they find a satisfactory explanation, they reason, they may be able to increase the efficiency. Then you could cool or heat your car with a small air compressor.



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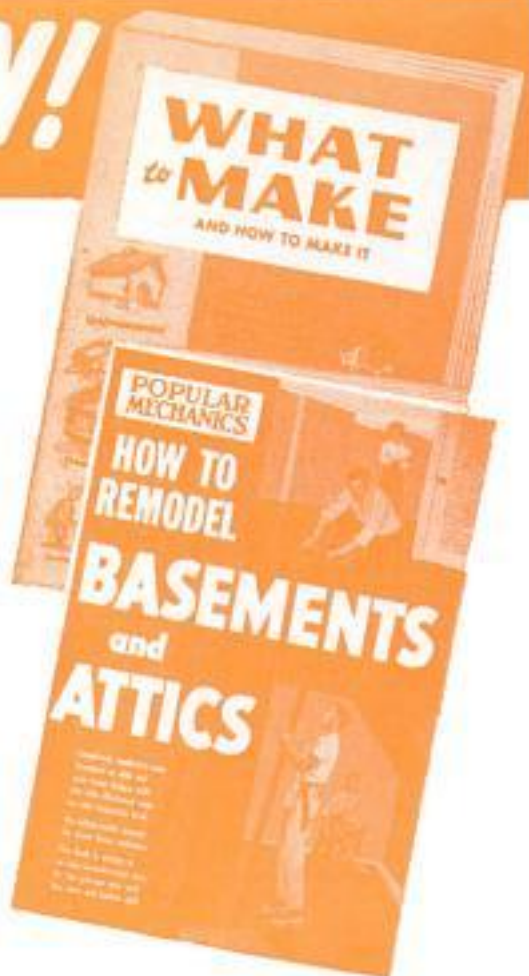
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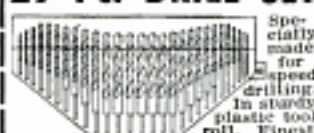
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Hedge-trimmer attachment operates smoothly with power supplied by vacuum cleaner via rotating unit



Above, floor-accessory set includes 6 $\frac{3}{4}$ -pound polishing base, waxing and polishing brushes, buffing pad

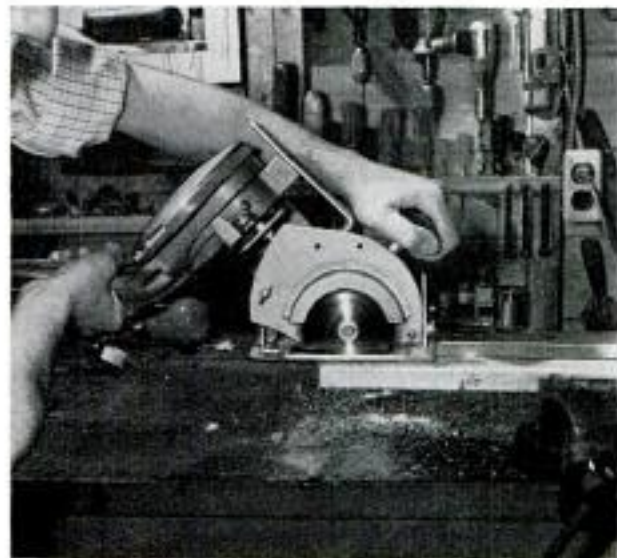
Power Unit Uses Vacuum Cleaner to Run Tools

AIR POWER may make the vacuum cleaner an indispensable aid to the do-it-yourselfer. One two-pound power unit goes onto the cleaner's suction air hose to become a portable rotating device. Attachments are available to adapt the cleaner as a tool for drilling holes, polishing the car, sawing and sanding wood, cleaning and waxing floors, trimming hedges, driving screws and doing many other household chores. For scrubbing the kitchen floor a 6 $\frac{3}{4}$ -pound, cast-iron polishing base, heavy enough to give the necessary push to clean or polish hard surfaces, fits over the new power unit. Brushes snap onto the base. Waxing and polishing brushes and a buffing pad are included in this particular floor-accessory set.



Attached to cleaner power unit, saw rips through plank. Kit includes drilling, sandpapering, buffing unit

Air from vacuum cleaner operates $\frac{1}{8}$ -inch drill on standard drill chuck (above), sands boat bow (below)
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Air-Conditioned Sidewalk Makes Shopping More Pleasant

Air-conditioned sidewalks keep prospective customers comfortable while they browse in North Towne Plaza, San Antonio, Tex. A glassed-in, roofed-over mall with year-round weather control eliminates the discomfort for buyers of going out into heat or cold to get from store to store. In this shopping center a terrazzo-tile walk 16 feet wide is closed in on the parking-area side with 3 by 10-foot glass panels in removable aluminum frames. The walk is roofed over with prefabricated decking, insulated with two inches of Pearlite and one half inch of white marble chips. Additional roof overhang holds down heat of the afternoon sun. Three sets of electric-eye doors open automatically at the approach of shoppers. Instead of traditional doors in shop fronts, large plate-glass panels slide open on tracks in the morning and are closed at the end of the day.



Carrier Corp., Syracuse, New York

Low Temperature Recorded

Scientists have recorded the lowest temperature ever observed at the South Pole—89 degrees below zero F. It is within one degree of the all-time world's record, recorded in northeastern Siberia in 1933, and exceeds by eight degrees the lowest in North America observed in the Yukon Territory of Canada in 1947.

Changing Molecules Fireproofs Fabrics

Flame-resistant cloth can now be produced by substituting bromine or iodine for some of the oxygen-hydrogen fragments in the cellulose molecules of rayon and cotton. The previous method of making fabrics fire-resistant required a chemical coating on the fibers. Scientists at the Textile Research Institute, Princeton, N. J., report that fabrics also can be made to resist afterglow by adding phosphorus to the cellulose molecules. Tests indicate the treated fabrics show no appreciable loss of strength and weigh only 10 to 12 percent more. Research workers plan to apply the technique of changing the molecule structure to cellulose building materials.

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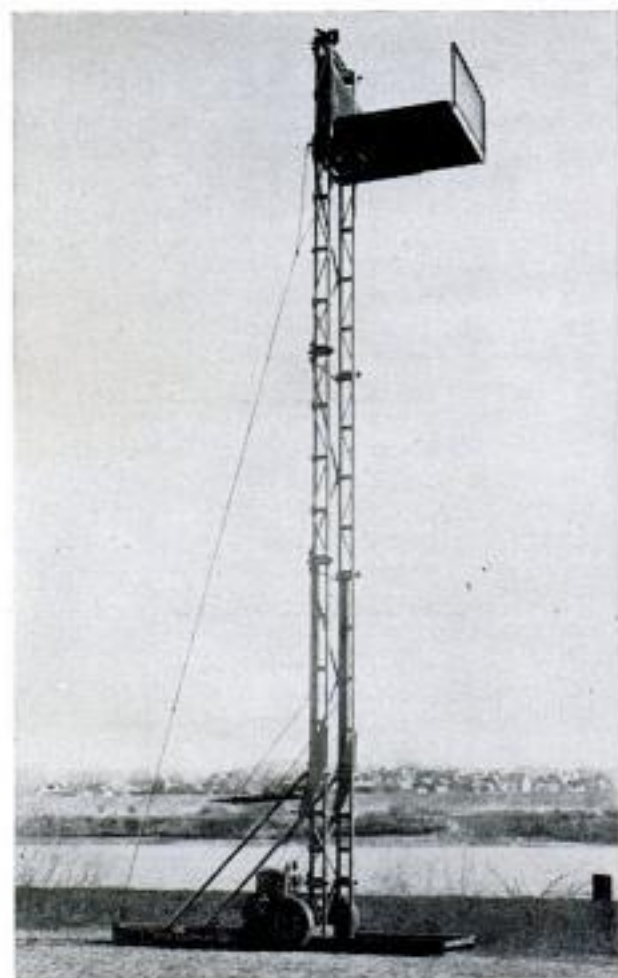
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NOTICE—It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. Except where otherwise indicated, this magazine has no information as to any unexpired patents in respect of the developments reported herein. In the event that commercial use is to be made of any of the developments reported herein, it is suggested that legal counsel be consulted to avoid liability for patent infringement. It is not the purpose of this magazine to encourage patent infringement but, as indicated, it is the intention of this magazine to report on the latest developments in the mechanical arts.

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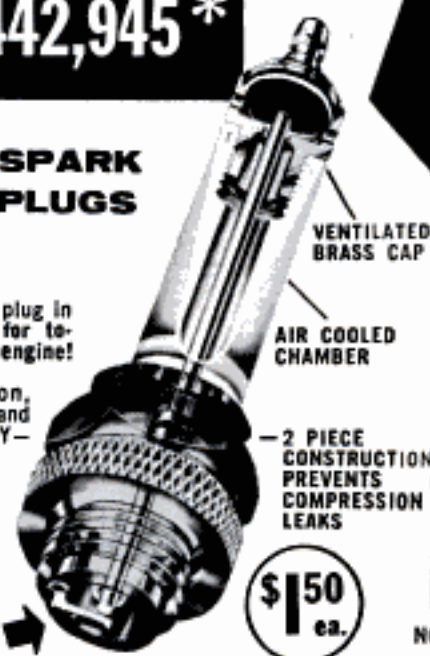
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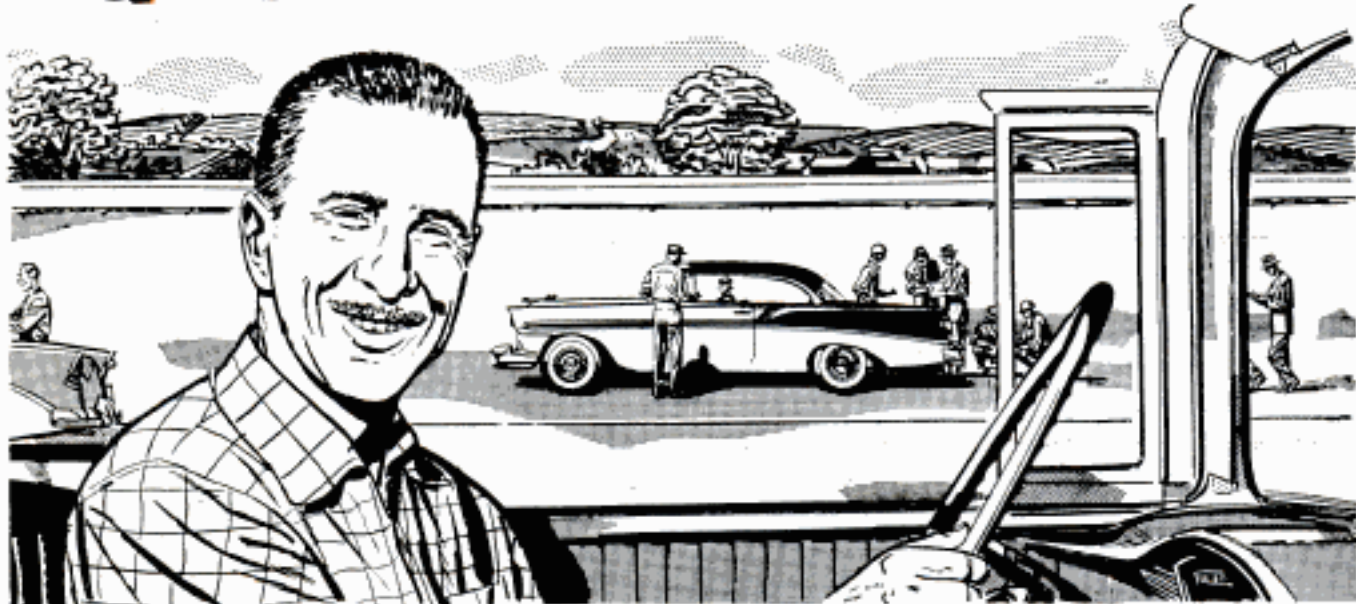
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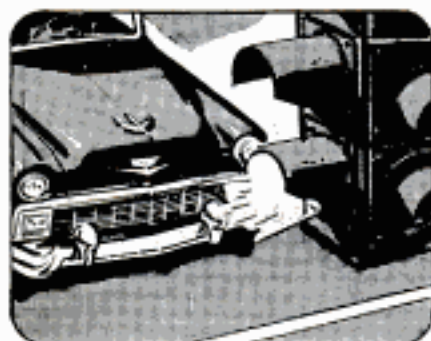
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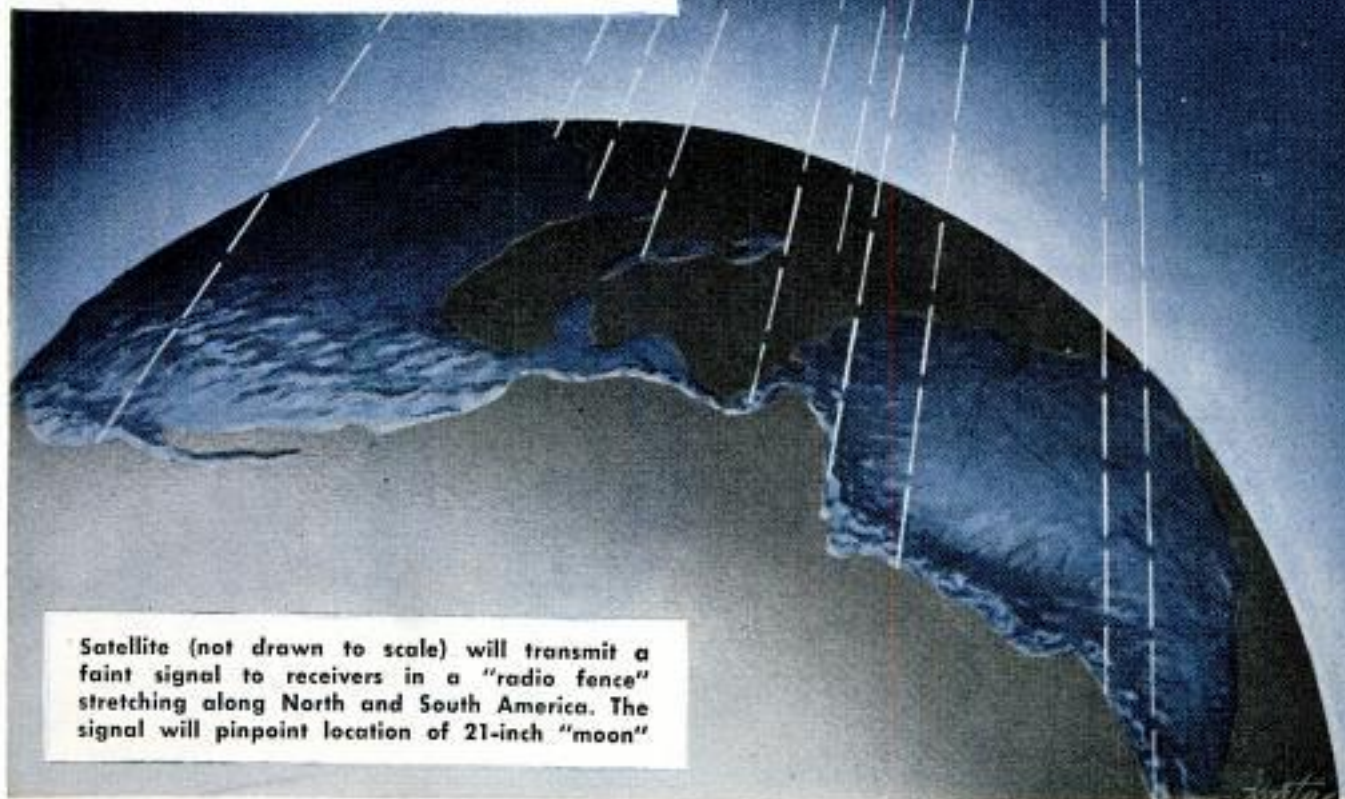
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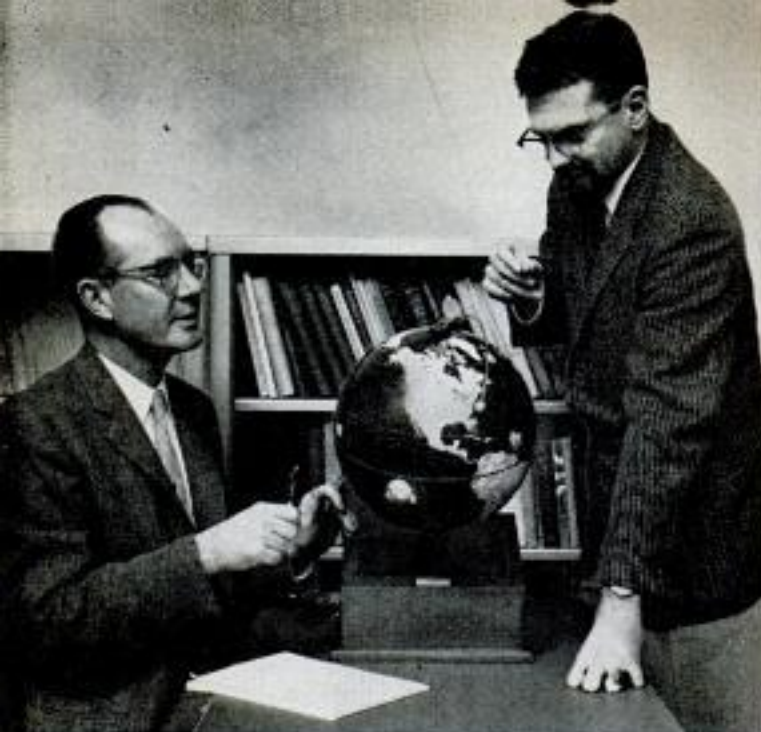
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Associate Director,
Smithsonian Astrophysical Observatory

IF A MAN COULD shrink to fly size and ride with the first artificial satellite, he'd have quite a view. Far below he'd see the earth—its plains, mountains and seas—through blue sky between the great cloud banks encasing our solar system's most beautiful planet.



Satellite (not drawn to scale) will transmit a faint signal to receivers in a "radio fence" stretching along North and South America. The signal will pinpoint location of 21-inch "moon"



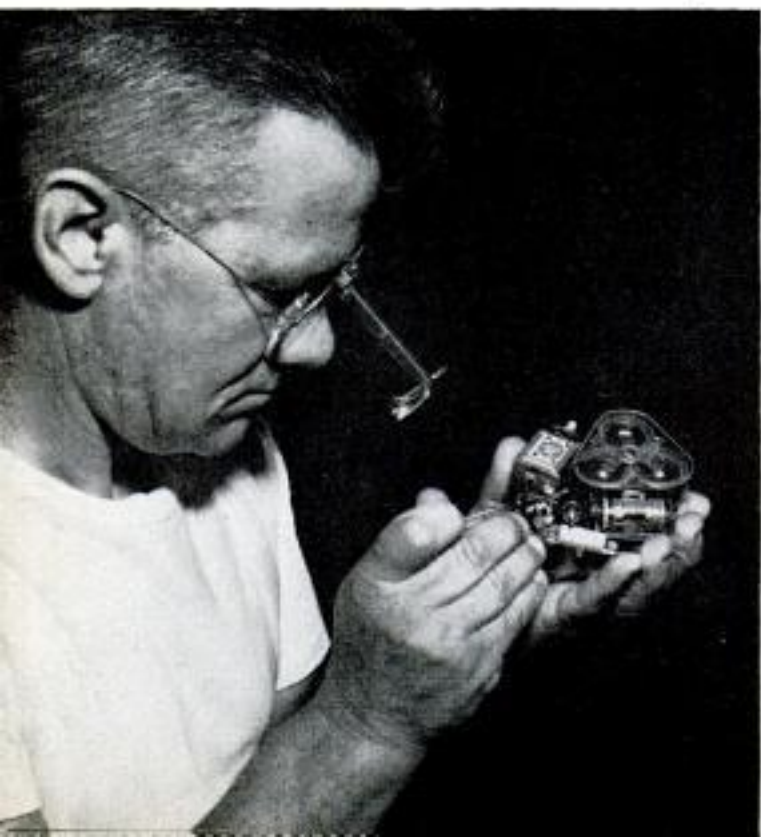
Co-authors Dr. Fred L. Whipple, left, and Dr. J. Allen Hynek discuss satellite's anticipated orbit

Earth's blue sky, making it unique and by far the most colorful of our planets, reaches only 10 or 20 miles above its surface. At 300 miles the air is so rare it shows no trace of blue scattered sunlight. The satellite rides in a paradox of night sky with its pattern of stars, planets and Milky Way—all in full daylight.

Originally, the target date for launching the 21-inch "moon" was September of this year. It is now believed that the satellite, part of the participation of the United States in the International Geophysical Year, will not be launched until next spring at the earliest.

Whenever it is launched, the dramatic

Engineer adjusts tiny gear in instrument which will collect information on outer limits of atmosphere



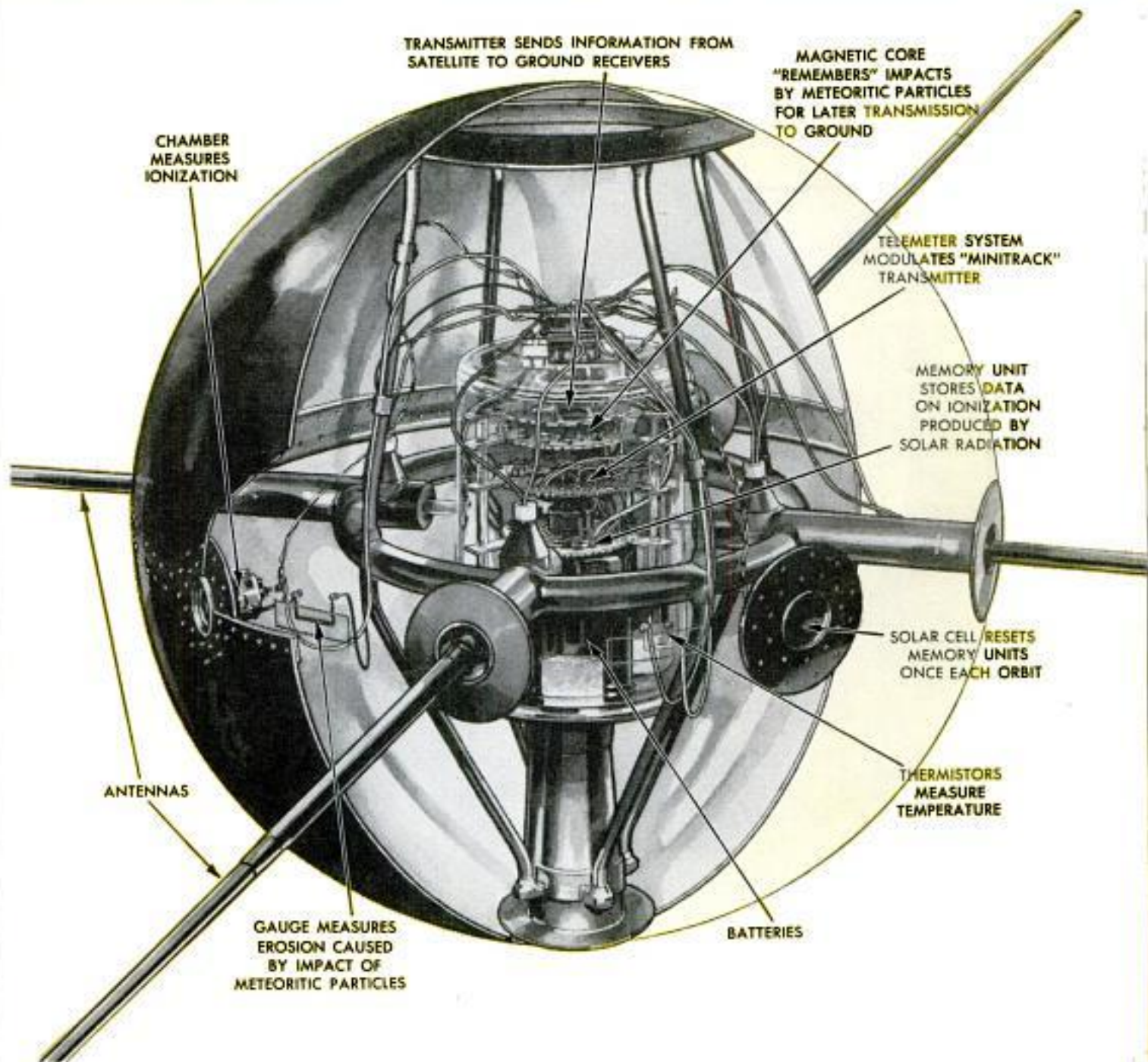
journey of the satellite will start with the firing of the rocket that takes it into space. To visualize the trip, you'll have to imagine riding in the cramped nose of an 11-ton, three-stage rocket, leaving the earth from Patrick Air Force Base at Cape Canaveral, Fla. In post-sunset darkness, the huge, pencil-like rocket stands 72 feet high against a star-studded sky, poised on a strange launching platform. Its ponderous first stage, almost four feet in diameter, appears graceful because of its incredible length. At "X minus one" every man will have disappeared into squat blockhouses. Then, with an unearthly roar, fire from the tail of the biggest rocket in history bends through a deflection tunnel beneath the platform and shoots across scorched ground. Along with it goes a hurricane of hissing steam from torrents of water drenching the lining of the steel tunnel to keep it from melting under the blast. For a moment, as though gathering itself for the Gargantuan effort, the monster seems to stand still, trembling atop its roaring exhaust. Then with indescribable power it moves upward, gathering speed. In seconds, it is a pin point of light disappearing in the sky.

Motor Pivots for Steering

No fins are needed to guide this epoch-making rocket. They were removed to reduce drag. Instead its big motor is mounted in gimbals, allowing it to pivot and direct its thrust for steering. Second and third stages are similarly rigged. Rising vertically under the powerful thrust of exploding liquid oxygen, ethyl alcohol, gasoline

Electronic package, heart of the satellite, is encased in plastic foam and slipped into the sphere





Drawing of the little manmade moon shows the parts and their functions. Radio will transmit data to the earth

and silicone oil, the massive first stage catapults the vehicle to 4000 miles per hour, lifting it 30 miles through the denser layers of atmosphere in 130 seconds. At this point, nitric acid and unsymmetrical dimethyl hydrazine burst into flaming reaction in the motor of stage two, carrying it up and away from the burned-out hulk of stage-one motor and tanks.

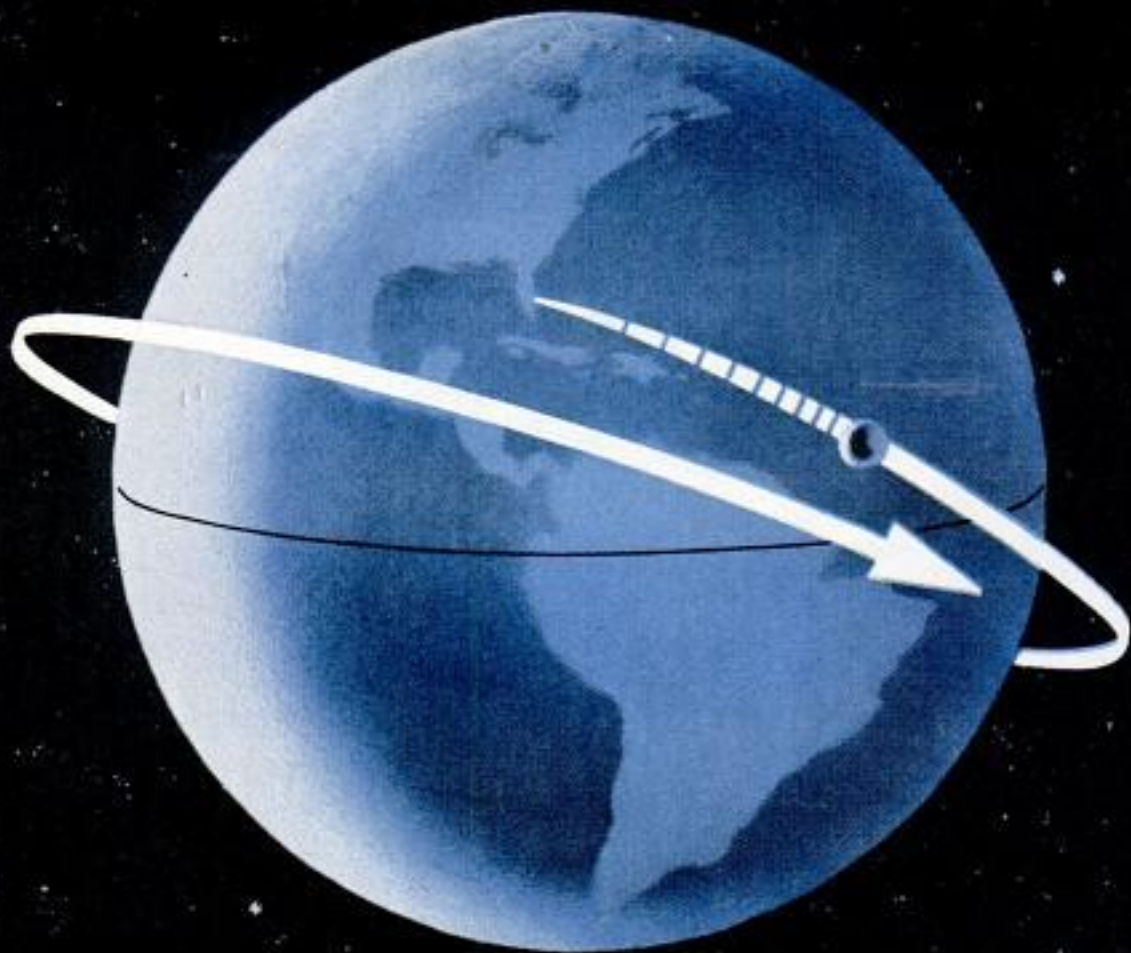
By the time the second stage burns its fuel, our satellite has risen more than 150 miles above the earth and is traveling nearly 10,000 miles per hour. The flight path is no longer vertical; it has been programmed into a more horizontal course by a gyroscopic guiding device in the second stage. We coast for about 40 seconds, the second-stage motor and fuel tanks still with us until an altitude of 300 miles is reached

and speed drops to 9000 miles per hour.

At this point the third stage takes over to provide spin and the final boost, shoving stage three horizontally into orbit at 18,000 miles per hour. Disengaging gently from the third-stage rocket by spring or small explosive charge, the tiny sphere slowly drifts away from this empty hulk, which tags along behind—a brother satellite.

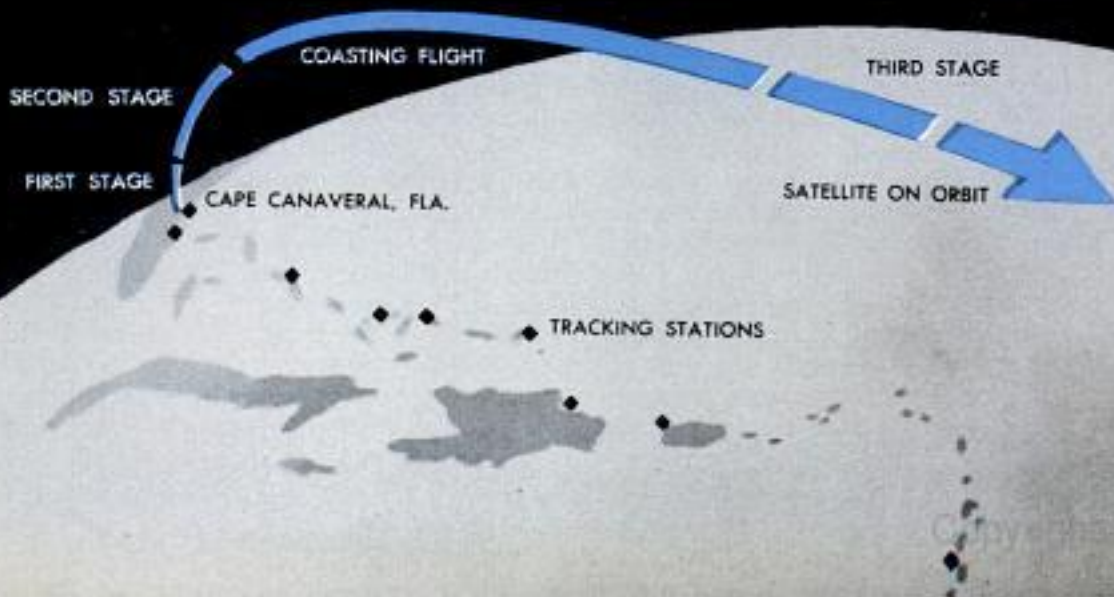
The 18,000 miles per hour is significant. At this speed the satellite falls toward earth at the same rate earth's surface curves away from it. Consequently, the satellite's distance from the earth remains about the same.

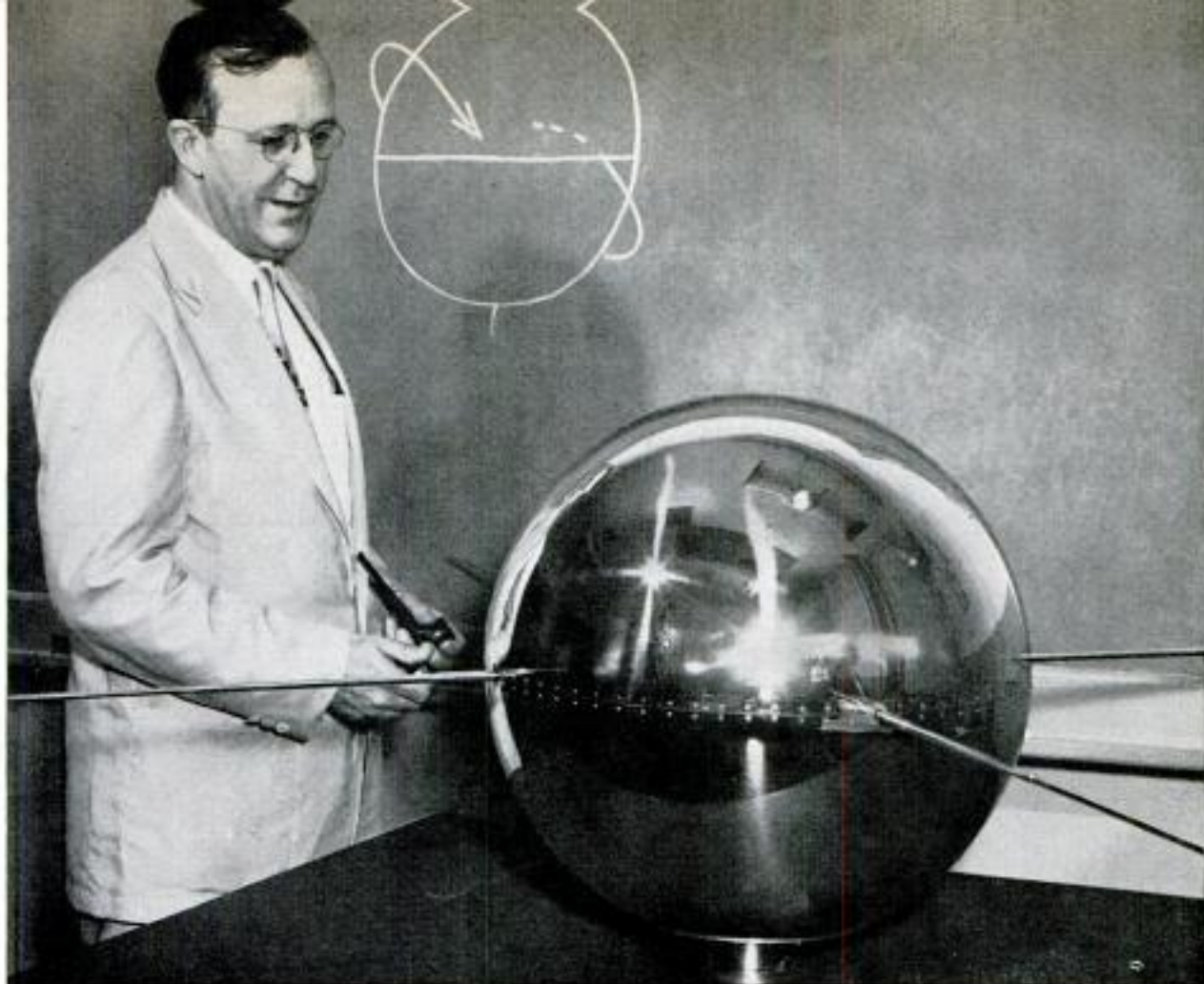
About 35 minutes after take-off the satellite is in orbit, approaching South Africa and dawn. From its height above the earth you would see the sun rise, illuminating



In relation to the earth, the satellite will not follow the same path on succeeding revolutions because the earth is turning inside the orbit. Also, its height above earth will vary from 300 to 800 miles

Drawing below shows size of the huge rocket in relation to the size of a man. Bottom, critical tracking job will occur during initial stages of launching, to determine its precise course for future observations





Dr. Hagen of Naval Research Laboratory examines full-scale model of satellite, complete with gold plating

the metal sphere and allowing watchers on the tip of South Africa to get first view of the tiny orb. Soaring over Madagascar, you'd see earth brightened by morning sun. During the next 50 minutes the baby moon will cross the Indian Ocean, Indonesia, then the far Pacific.

A "satellite day" is short. Slightly more than one hour after launching, the sphere circles most of the globe, passing sunset between Hawaii and San Francisco.

It approaches America near San Diego. From its vantage point, you'd see a broad expanse of the Pacific with the Canadian Rockies to the north. Southward lies Lower California and a sizable portion of Mexico. Toward the east glow the lights of Salt Lake City and Denver.

Visible Only at Twilight

Since the satellite shines only by reflected sunlight, it is visible to watchers on earth only at twilight. At night, shadowed by earth, it is invisible. In daytime it is lost in the glare of skylight. In 10 minutes the orb crosses the country.

Because the earth has turned during the first trip around, the satellite does not pass over its launching site, but considerably south of it—across Nicaragua. Although it is still launching night in Florida, it is the "second night" for the satellite. Aboard this

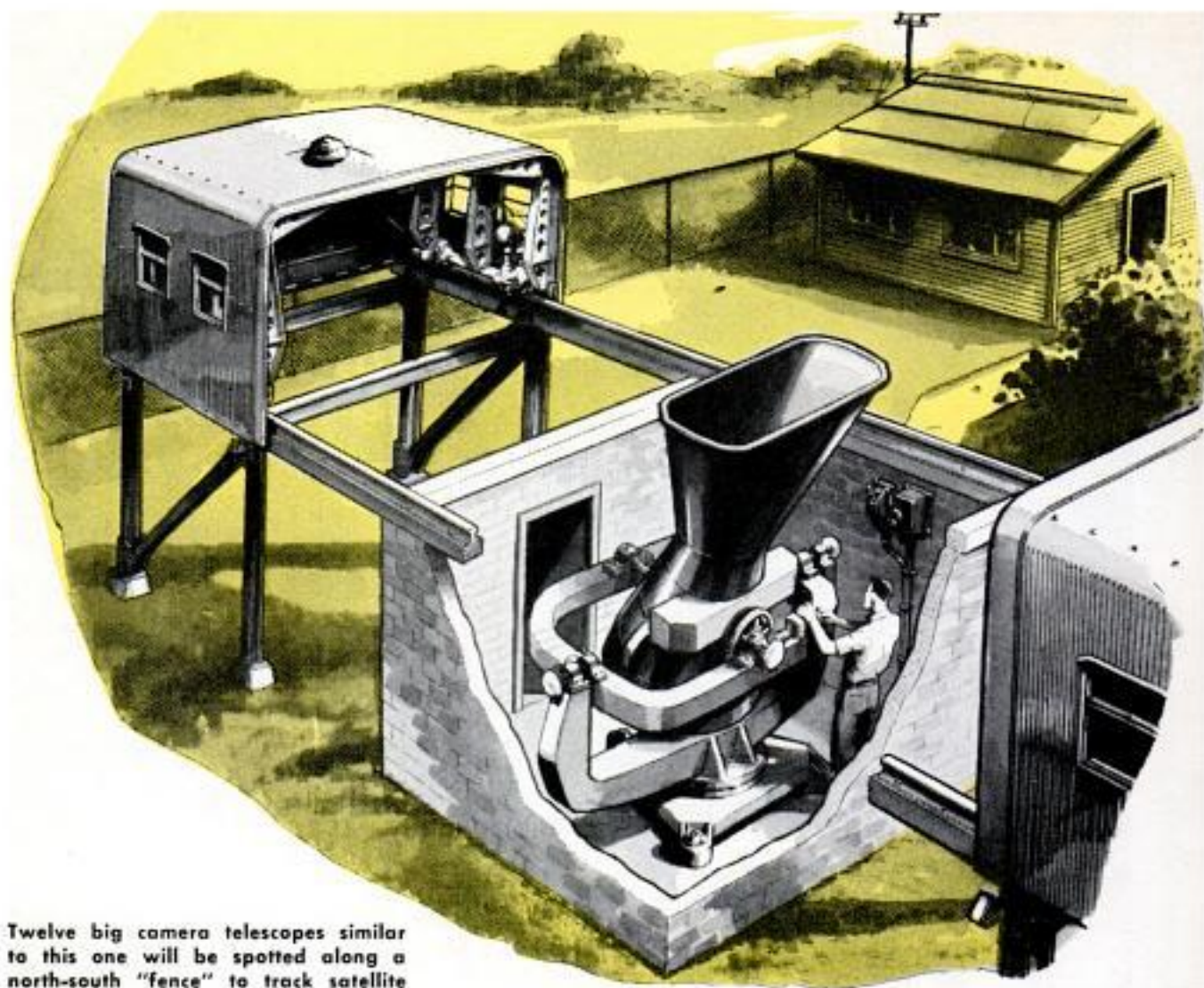
moon a full day is 100 minutes long; night less than 50 minutes.

During its ensuing trips, the satellite shows best at sunrise in Australia on its 11th, 12th and 13th revolutions. At sunset it shines over Tokyo on its 6th revolution, Hankow on the 7th, Tibet on the 8th, over Iran on the 9th, Syria on the 10th, Tripoli on the 11th, Spain on the 12th and the Azores on the 13th.

On the 14th revolution it arrives over the United States at sunset in Arkansas and above the eastern part of the country in late twilight. This is the first evening after the launching!

As twilight moves across the country, the orb's glitter is observed in the Midwest and Southwest areas—Arizona, New Mexico and California during revolutions 15, 16 and 17. With the 18th circling of the earth, night has fallen over the United States and the satellite will be invisible until next evening.

Evening appearance of our artificial moon over the United States does not last for many days, however, because the earth gyrates slowly around inside the baby moon's orbit, completing one gyration in about 60 days. Because of this, the zone of visibility at twilight slowly shifts southward, while the zone of morning visibility moves north. About 30 days after the launching, United States observers will see



Twelve big camera telescopes similar to this one will be spotted along a north-south "fence" to track satellite

the satellite in morning twilight, but it will be some 60 days before they see it in evening twilight again.

Elliptical Orbit

The satellite's orbit is elliptical, because launching speed must be made a little more than necessary for a circular path. As a result, the altitude of the satellite varies from 300 to about 800 miles.

At perigee (nearest point) over St. Louis, for instance, the view from the satellite would extend from Canada to the Gulf of Mexico and from the Rocky Mountains to the Atlantic Coast.

Many revolutions later when apogee (farthest point) occurs over St. Louis, the view would encompass the North American continent—from Hudson Bay nearly to Panama and from Pacific to Atlantic—if Earth's atmosphere were cloud-free. From the vantage point of the satellite there is an unparalleled view of the world's weather. In the 14 globe-girdling trips each day, the progress of storms could be easily noted in a manner impossible to chart on ordinary weather maps.

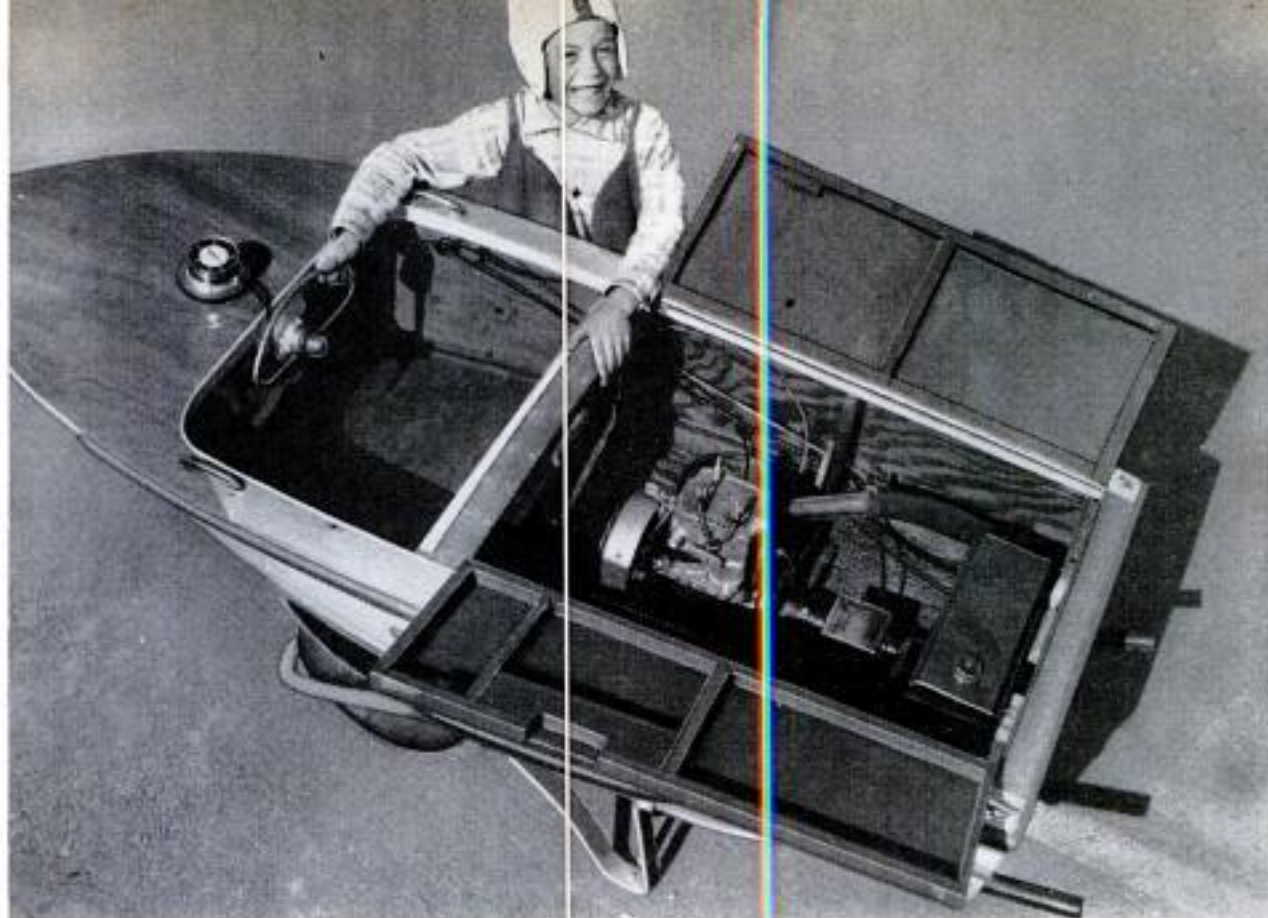
What data of scientific value can be obtained from observing the satellite from the earth?

First, we know that the earth is not spherical, but has a pronounced bulge around the equator. Such irregularities will cause the orbit to "regress," or gradually return to earth. By carefully observing the rate of regression, we can make a more accurate determination of the size and shape of our planet than has been possible heretofore. Similarly, the minute quantity of air at the satellite's altitude, though less than you'd find in the best manmade vacuum, is enough to produce a minute drag which will cause the orbit to change, and eventually lead the satellite down to earth. Observations of these orbital changes will give scientists a good determination of atmospheric density at such heights—something we don't yet know.

Challenge to Trackers

For the satellite to constitute a truly scientific vehicle, its orbit must be plotted with extreme care. Since it is a celestial

(Continued to page 216)

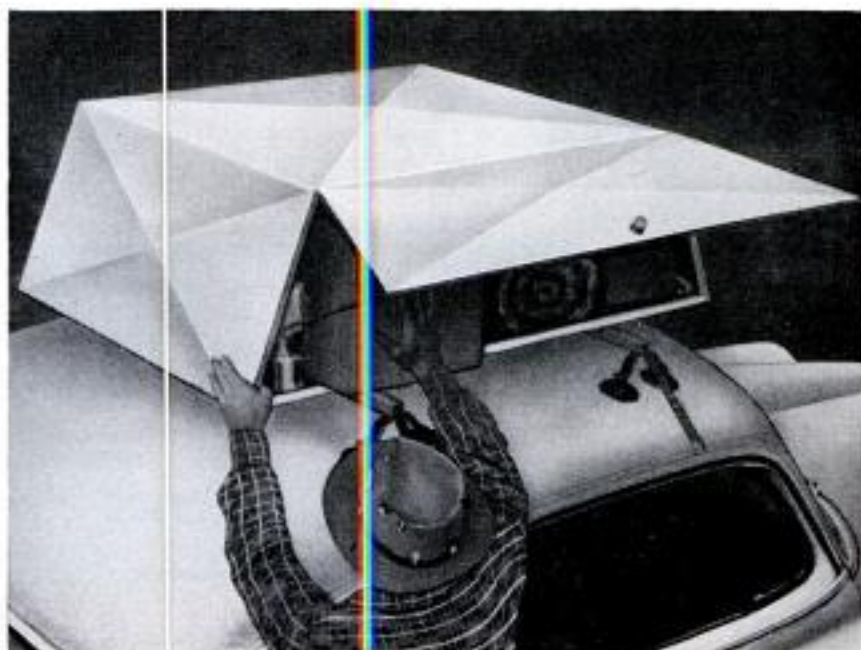


Pint-Sized Runabout

Proudest sailor afloat is a nine-year-old boy of Lakewood, Calif. The lad's father, H. R. Brakensiek, an aircraft worker, built his son a pint-sized inboard runabout that zips along at 30 miles per hour. The little craft is powered by a converted 7½-horsepower bilge pump. Weighing only 140 pounds, it is so small it can be moved on a wheelbarrow.

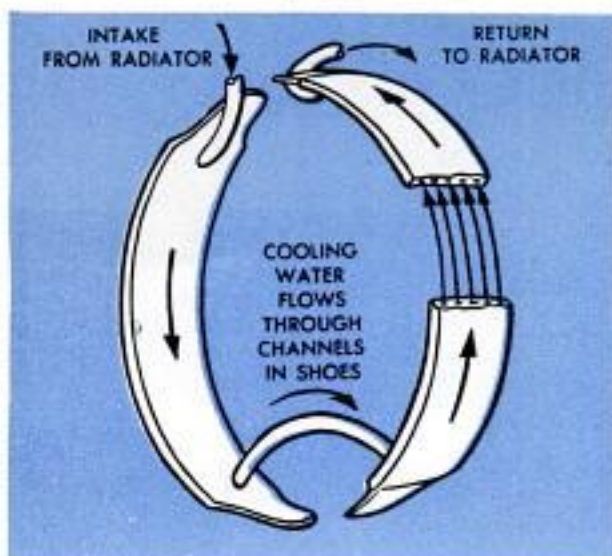
Metal Roof Rack Has Key Lock

Locked with a key, a metal roof carrier for cars keeps luggage and equipment secure from weather and thieves. Joints are rubber-sealed for complete water and dust protection. The frame of the carrier is steel, the panels are aluminum. Providing about 14 cubic feet of storage, it weighs 47 pounds. Only 16 inches high, it is designed for minimum wind resistance. The side-opening swing-up door permits convenient packing and unpacking.





Each shoe has a shiny copper lining fused to it. Frictional lining is bonded to the inside of the drum



Arrows show flow of cooling water through the shoes. Below, pipe at right extends through backing plate



RADIATOR WATER COOLS THE BRAKES

BRAKE FADE may be a worry of the past if a new water-cooled brake becomes standard on autos. The brake, developed by Raybestos, is cooled by radiator water.

Stopping a vehicle is principally a matter of getting rid of heat. Brakes convert the energy of the moving car into heat by the frictional action of the lining. As wheels get smaller and cars get heavier, heat dissipation becomes a serious problem.

Raybestos says it has the solution. Its system (which is said to cost about \$20 more than present systems) is three times as effective as conventional brakes in stopping cars from high speeds.

The cooling action also makes the linings last longer, says Raybestos. Tests indicate that the linings will be good for more than 100,000 miles or about three times the normal mileage.

Water is piped through a series of channels in the brake shoes. The heat is removed as fast as it develops. There is no frictional lining on the shoes themselves. Instead, a thin copper lining (an excellent heat conductor) is fused to the shoes and the frictional lining is bonded to the inner diameter of the drum.

Tubing, not unlike the tubing used in hydraulic-brake systems, carries the water from the radiator to each wheel.

ECONOMY IS in the air. More and more owners are watching the numbers on the gas pump spin around and asking: "How can I get more mileage?"

PM Owners Reports show that interest in gas economy has jumped sharply in recent months. This could mean that future buyers will demand more miles per gallon. If they do, what happens to industry plans?

Right now, everything points the opposite way—1958 engines will be bigger and thirstier in more luxurious cars. The public, Detroit feels, will not take an economy car. It insists on more car each year.

So small cars get bigger and more expensive to own and operate. This continuous upgrading inevitably leaves a void at the bottom—a void being filled today by imported cars.

Studebaker now hopes its Scotsman (a de-chromed Champion with an austerity rear end) will capitalize on the economy mood. Rambler's Canada-to-Mexico economy run was aimed at the same target. The big sales pitch for these two cars is miles per gallon, not ton-miles. (If you want to win an economy run based on ton miles just enter a heavily loaded truck—you'll win every time.)

Additional evidence of the economy mood is the fact that American Motors' Metropolitan is selling far more than expected. Sales of British economy cars are up 200 percent over last year. These are family cars, not sports cars.

In any case, some imported-car experts claim Detroit has itself in a squeeze. It couldn't make a living selling cars for \$1600 because it is set up for a \$3000 average sale. There is a tremendous overhead in this business that would have to go if sales dollars were cut in half.

Sculpture Versus Fins

Edsel is getting into the news more and more as announcement date nears. It will be out around September 1. Its two top lines will have only pillarless four-door sedans. Conventional four-door sedans will be available in its two lower-price models. Pushbuttons for the transmission are rumored to be in the steering-wheel hub.

Edsel's side treatment will feature some marked sculpturing, not unlike the Mercury treatment. It appears that both Ford and General Motors are going to let Chrysler ride the tailfins alone. Sculpturing seems to be the Big Two's answer, the theory being that you can only go so far with fins and Chrysler is there already!

The low car is here to stay although owners complain about the problems that result, especially the absence of legroom in the center of the front seat. Guesses are that 52 inches is about as low as cars will

Detroit Listening Post



By Art Railton

go. Lowest production cars for 1957 are about 54 inches high, so there is room for more lowering. Cars are now about as long as they will get, readers who are running out of garage will be glad to know.

We might as well correct a couple of errors. Now it appears that Chrysler will not have the Bendix fuel-injection system as reported here months back. Plans were set at that time, but it later developed that Bendix couldn't deliver in necessary volume. Chrysler is now turning to other injection suppliers, probably nonelectronic.

Metro Wagon?

The Metropolitan station wagon is back on the uncertain list again. The problem seems to be finances. There is little doubt that it would sell if American Motors could arrange suitable financing.

Electric door locks will be available on Chryslers for 1958. This is not an industry first as Packard had them just before the big switch to South Bend. All doors will lock from the driver's seat. For this convenience and safety you'll pay about \$45. No economy trend developing here!

Chrysler's trouble is all the other way. It is having difficulty selling its "economy" models. The expensive, luxurious lines are going great. Biggest gains of all are with Imperial. Plymouth's big sales are in the two top lines. Dodge alone is having difficulty with its most expensive models. And the low-price Windsor is not doing well at all compared with New Yorker gains.

All these facts seem to bear out Detroit's repeated claims that America will never settle for an austerity vehicle.

Yet how do you explain the striking success of the economy-type foreign cars which double sales each year? It can't be (or can it?) that what Detroit calls the "lunatic fringe" is increasing that fast!

If you'd like to bet on a long shot, watch the tiny bubble cars like the Isetta. Once their unbelievable convenience has been proved to American housewives there will be one in every suburban driveway.



YOUR

By
**Thomas E.
Stimson, Jr.**

A NEW KIND of flying machine is being designed that sounds like the answer to your desires for a personal aerial vehicle.

It is almost like a flying carpet. A good name for it might be the "flying fan." It uses the principle of the ducted fan, the same idea that is used by the flying platform.

Superficially this new machine, now being developed by Hiller Helicopters, will resemble an automobile although it will rest on short stilts. You'll be able to order a four-door model, a sports job or even a light-truck configuration.

To fly it, open the door and sit down behind the wheel. That button on the instrument panel operates the starter, and there's a faint whine and hum while you get the turbines up to speed.

See those two levers? The one on the left is the climb control. Push it up and leave it there. Now we are

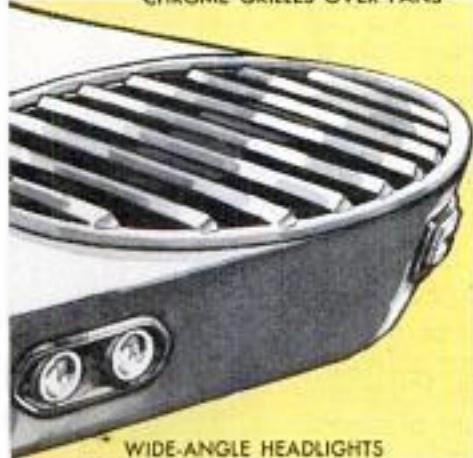
Principle of "flying fan" vehicles of future is same as that of flying platform, left, which gets lift from air forced through duct

FLIGHT ANGLE



FAN-POWERED CAR WILL FLY WITH NOSE SLIGHTLY TILTED DOWNWARD

CHROME GRILLES OVER FANS

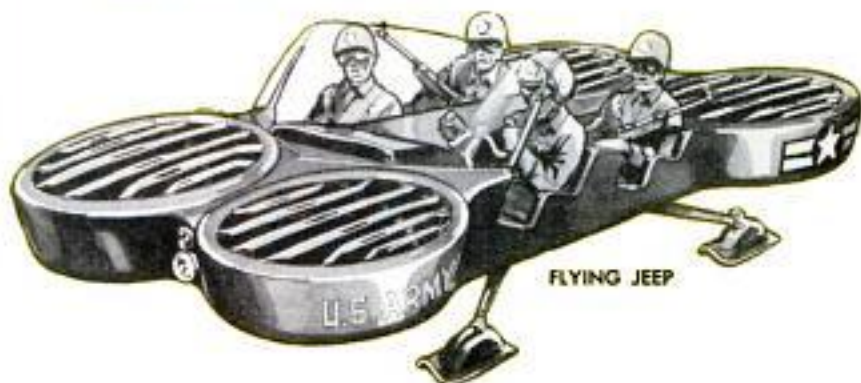


WIDE-ANGLE HEADLIGHTS

MILITARY USES



ABLE TO LAND ON ROUGH TERRAIN, ARMY VEHICLE COULD BE "RECON" CAR OR FLYING GUN PLATFORM



FLYING JEEP

AERIAL SEDAN FOR 1967

rising. Easy, isn't it? There's no big thrashing rotor overhead, no churning propellers. We just ascend with no apparent effort.

We are higher than the roof-tops now, so let's head across town. Turn the wheel to the right, in the direction we want to go. Now that second lever, push it ahead. Sure our nose dropped a bit. That's what the lever's for. It took some of the power off the front fans and tilted the machine. That's the way this thing flies. Air speed is up to 50 miles per hour already. If you want to stop in mid-air, just move the lever back again.

All this sounds too easy to be true, but the designers say this description is about right. They say the fans have most of the advantages and few of the disadvantages of ordinary helicopters. The fans will be easier to fly and should cost a lot less. It's too early to quote prices or delivery dates now: A rough guess is that in about 10 years you'll be able to buy a four-place fan for the price of a good car.

How can engineers be so sure about something that hasn't been flown yet, or even built?

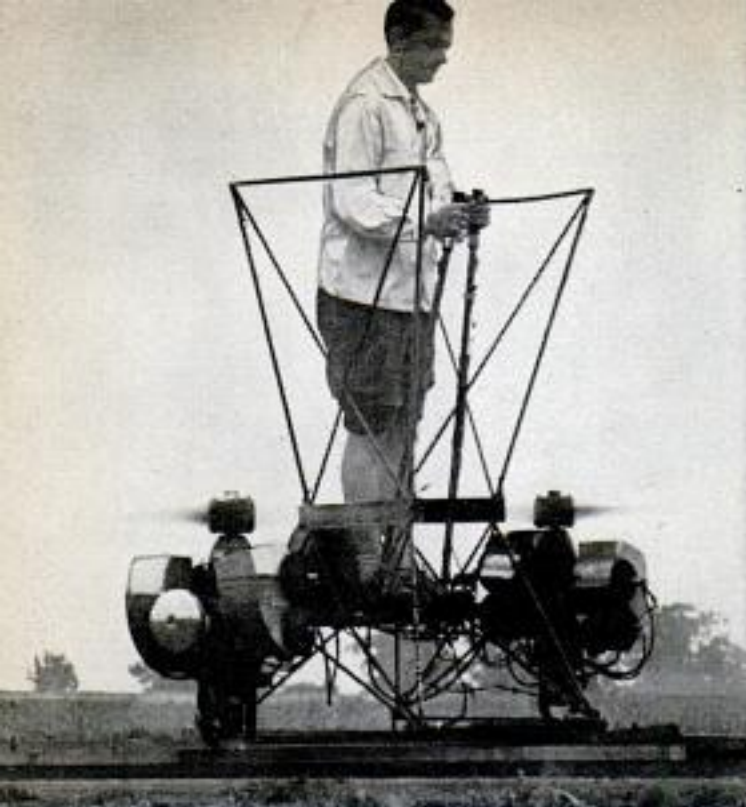
For one thing, the flying fan is nothing more than four ducted fans that are held together by a framework that supports the

engines and cabin. A ducted fan is a shroud or duct that is placed around a propeller. This duct has a wide flange or lip around its upper edge. When the propeller forces air downward through the duct, pressure above the lipped surface is reduced. An extraordinary amount of lift is obtained as compared to an unducted helicopter rotor.

The Hiller flying platform was the first practical vehicle to use the ducted-fan principle, and the platform has made scores of flights. Some of the early bugs have been worked out of it. A new and advanced model is under construction.

A multifan vehicle is an obvious improvement over a simple flying platform. The platform is maneuvered by the body movements of its operator. He leans in the direction he wants to travel. He depends on his sense of balance, something that could be unreliable at night or in a dense fog.

With four fans, controllability is materially increased. The vehicle is maneuvered by varying the revolutions per minute of the front or rear fans. With twin power plants, possibly automotive gas turbines of the type that has been demonstrated by Chrysler, there's little chance of a complete power failure. If one turbine fails, the other

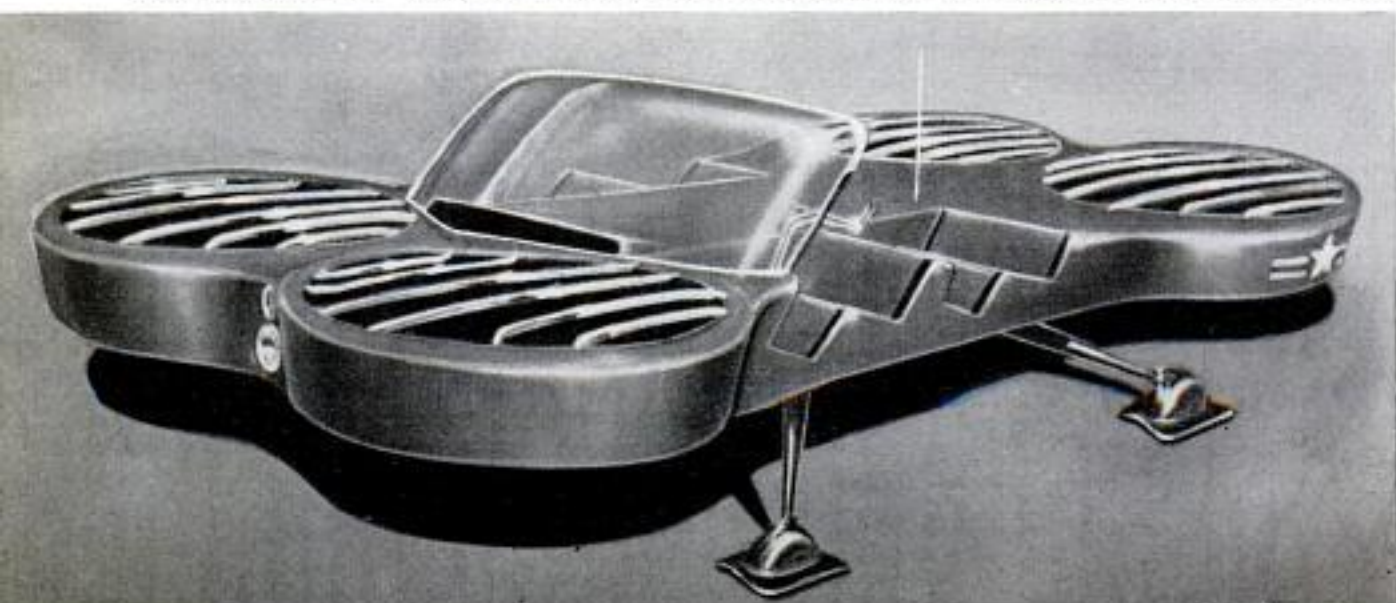


Original flying platform was this device which had two propellers to force air downward. This in turn led to concept of the shrouded or ducted platform



Close-up of first flying platform, above, shows it was something like two small helicopters. Putting duct around blades proved to be much more efficient

Hiller proposal for a "flying Jeep," below, would have four seats and cruising speed of 60 miles per hour



one would keep the vehicle sufficiently stable to permit an easy emergency landing.

Probably the first flying fan will be in the form of an aerial Jeep, an aircraft in which the Army is greatly interested. Hiller Helicopters has submitted a proposal for a four-fan Jeep. Basic engineering studies have been completed. Performance and costs have been closely estimated.

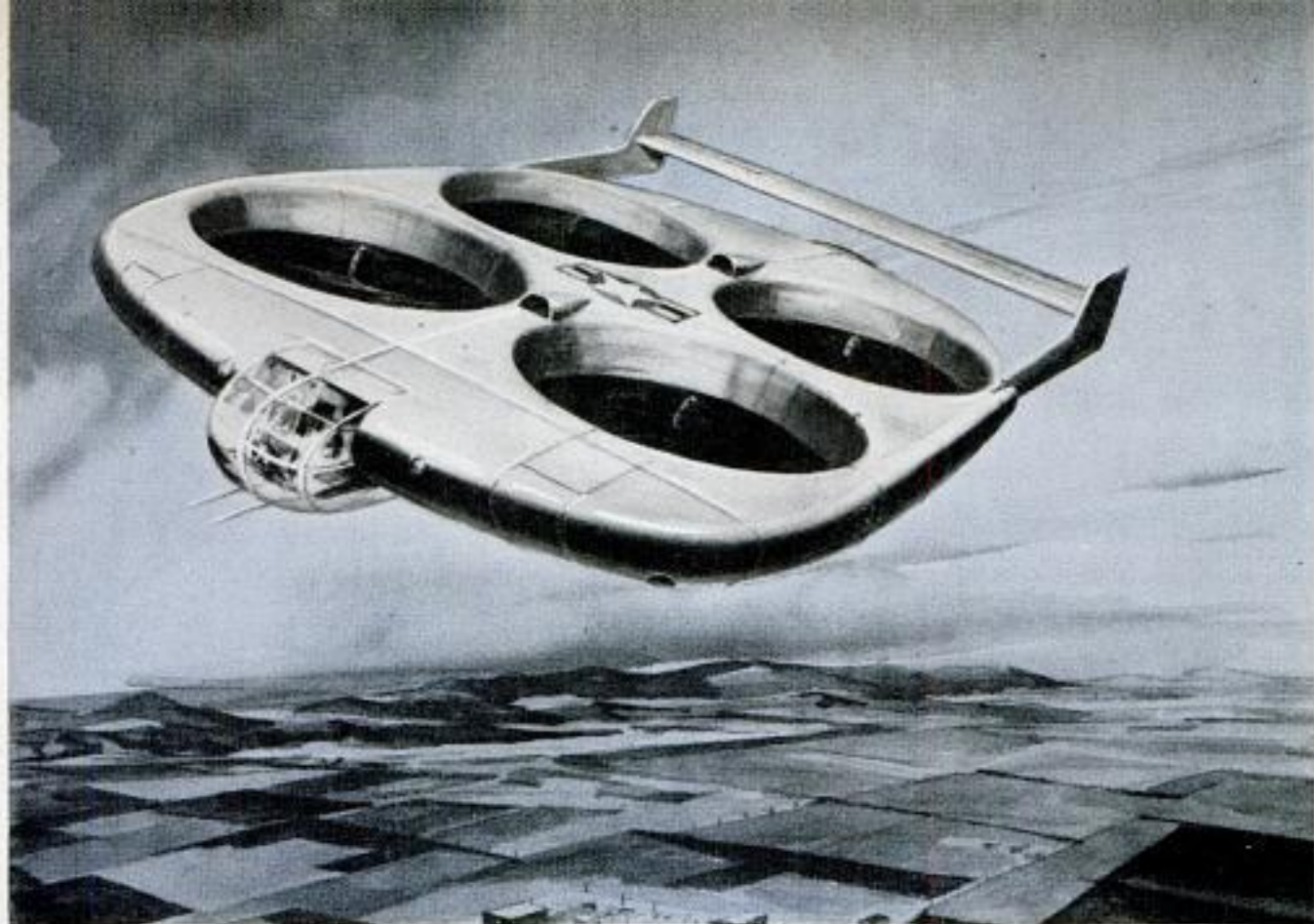
This Jeep-of-the-air would be capable of every job that an ordinary Jeep can do, with the advantage that it could travel across country with no need for roads. It would be able to land and take off from fairly steep hillsides. It could carry men and supplies, be used as an ambulance, or serve as a recon vehicle or even a flying gun platform.

Advantages Over a Copter

For this kind of service the flying fan has several major advantages over an ordinary helicopter. It can operate close to buildings or other obstructions. A helicopter taking off from alongside a building gets a rebound of air from the building that makes it very hard to control. And the flying fan can be operated around people in safety, with no chance that someone might accidentally walk into the whirling overhead rotor.

The Hiller engineers expect that eventually the ducted fan will become the basis for a whole family of special-purpose aircraft, the largest of which would be a "flying crane" that could lift enormous loads over short distances. The ducted fans look better for this job than do the huge helicopters that have been tried out in the past.

One of the Hiller proposals is a flying crane that would consist of four large fans, each about 15 feet in diameter. They would be bolted together in the form of a rough square to provide great lifting capacity. The gas-turbine power plant would be located in the center, with a bubblelike control cabin placed in front. Standing off the ground



Four large fans in a streamlined airfoil could be combined with jet engines for swift forward propulsion

on tall, stiltlike legs, there would be plenty of room below the crane for moving into place below it a heavy tractor, large truck or loaded cargo box.

Basically the ducted fan is not a very fast vehicle. In its present stage of development it is good for approximately 50 miles per hour. One hundred miles per hour may become possible in the future.

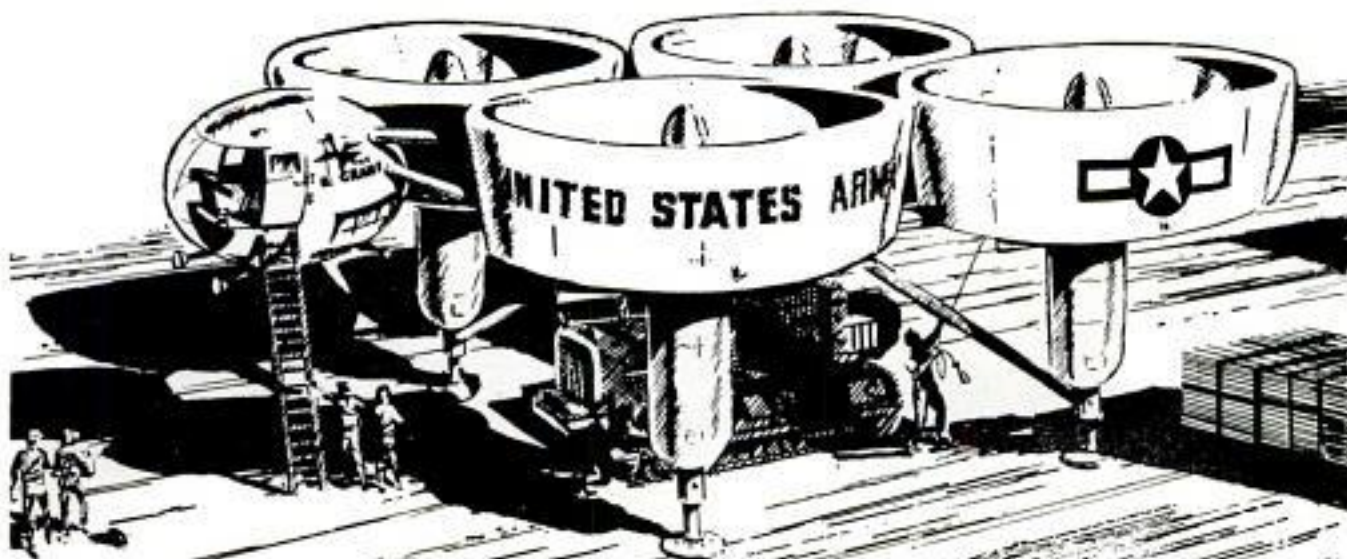
Possible Airborne Sentries

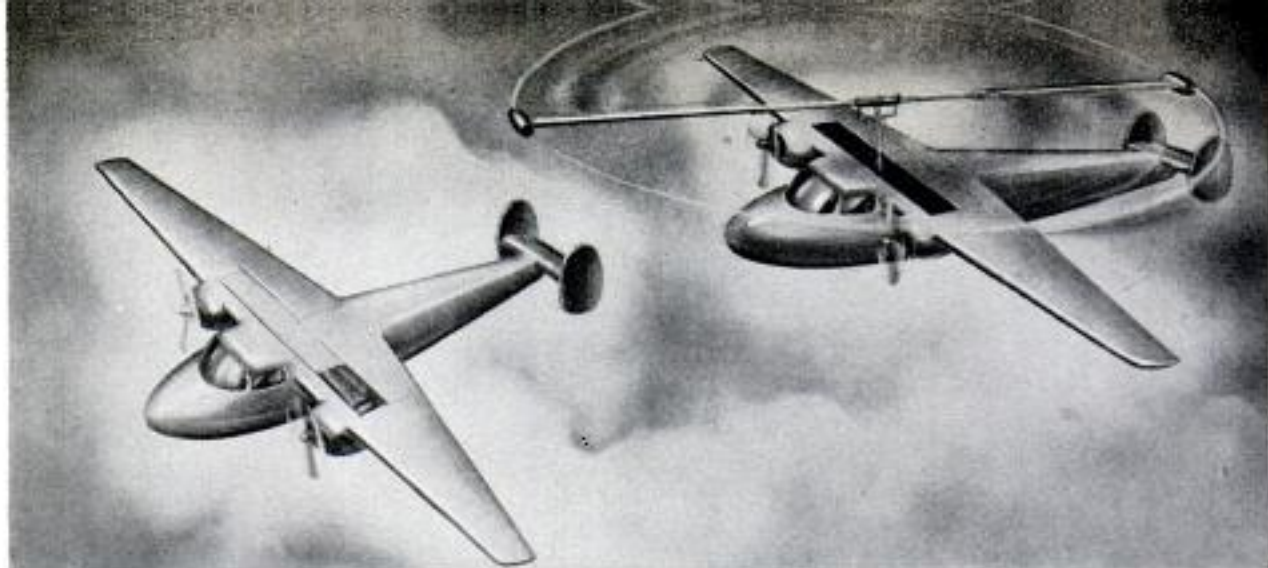
There's a chance that this kind of platform could be used for aerial sentry duty to guard national boundaries against intruding bombers. One suggestion is to install early warning radar equipment on one

big platform, with the second platform of the team loaded to capacity with guided missiles. Hovering at medium altitudes, such a team would be able to detect and destroy hostile aircraft while they were still a long way off.

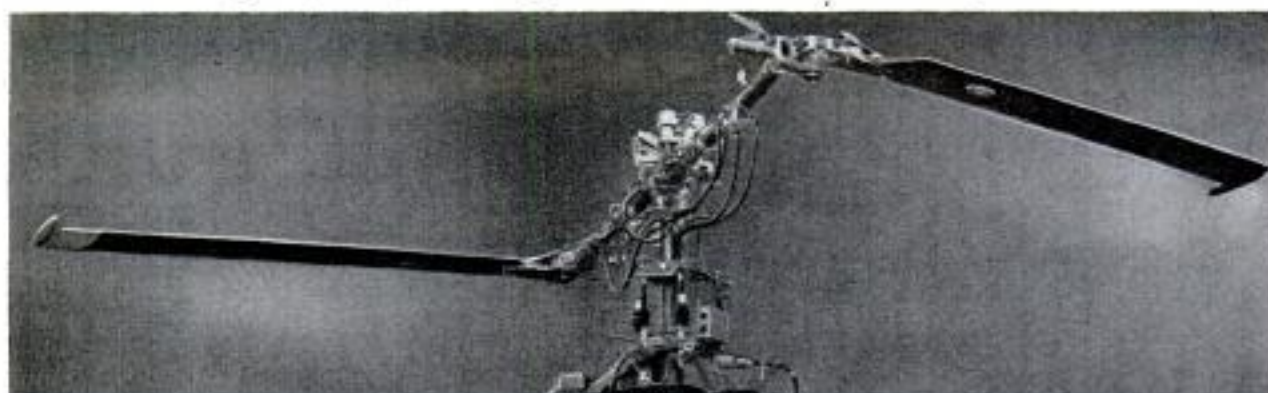
The ducted fan is not the only new idea that is being investigated for vertical-rising aircraft. One study Hiller has made is for a combination helicopter and airplane. This craft looks like an ordinary plane but has a large rotor overhead. The craft would use its rotor for taking off straight up, then as it began to use its main power plants to achieve forward speed, the rotor blades would fold and retract into the wing.

"Flying crane," below, has been proposed to U. S. Army for lifting trucks and tractors across rough terrain





Retractable rotor systems, above, are being studied as aid for vertical landing of conventional aircraft

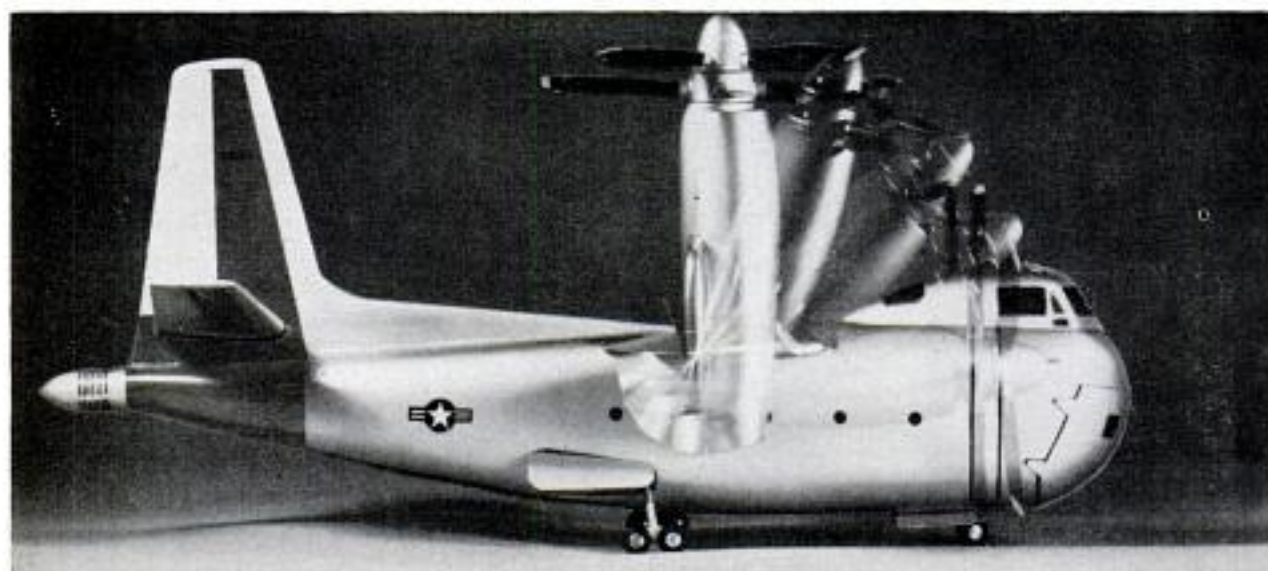


Folding rotor assembly being tested in the Hiller factory. Rotor-tip pods would hold ramjet engines

Now under construction at the Hiller factory in Palo Alto, Calif., is a transport plane with a tilting wing. For vertical take-offs the wing is rotated to a vertical position so that its twin turboprop power plants exert their thrust straight down. After take-off the pilot rotates the wing toward its normal angle, reducing the rate of climb and at the same time acquiring forward speed. Eventually, with its wing locked in the standard horizontal position, the plane flies just like any other airplane.

Vertical take-offs are not always necessary, and one of the advantages of the tilting-wing transport is that it can take off or land at any angle desired, depending on the length of the landing strip and the load that the plane is carrying. With a long runway, the plane would take off just like any other airplane. With a very short runway, the pilot would tilt the wing to get just the amount of lift he needed, and then take off in the short distance that was available to him. ★ ★ ★

Now under construction is a tilting-wing transport. For take-off, wing will turn to vertical position





Studebaker Scotsman Offers Gas Economy

Carrying a price tag of \$1776, the Studebaker Scotsman two-door sedan is aimed at the growing economy-car market. Basically a Champion, the Scotsman is devoid of chrome or brightwork and comes in three colors: gray, green or blue. Also available is a four-door sedan for \$1826 and a two-door station wagon for \$1995. These prices include federal taxes, dealer-handling

charges, heater, defroster and turn signals. The only extras are shipping charges to your city and local taxes, if any. The engine in all three models is the Champion six of 101 horsepower. The 3.54-to-1 rear axle is said to make possible as much as 29 miles per gallon of gas. Station wagons have a 4.10-to-1 rear axle. Scotsman models weigh 80 pounds less than Champions.

Television and Radio Team up to Operate Swedish Power Plant

Television's "eye" and radio's ability to trip switches are being teamed up in Sweden to operate an electric generating station by remote control. With the equipment, the hydroelectric plant will be com-

pletely operated from a station 11 miles away. The unusual feature of the installation is the control by radio, to direct a TV camera's field of view, change lenses and even start a windshield-wiper mechanism.

Shoulder Mount Steadies Fast Photos

Held and triggered like a submachine gun, a new high-speed movie camera enables Navy photographers to take steady slow-motion pictures of high-velocity operations. The sturdy shoulder mount eliminates the "jumpy" effect of former high-speed photos. The camera has a 400-foot film capacity and is equipped with through-the-lens sighting for both photography and tracking scope. Operating from battery or alternating current, the camera accommodates either 6 or 12-inch telephoto lenses.





Everybody's Going Sailing

TO THE AMATEUR SAILOR, life is at its peak when he can hear the wind pop open a gleaming sail, sniff the tang of pure air and feel the sudden spray as the lee rail dips into the water. Troubles are forgotten in the always new, always exciting game of taming wind and wave. It's a world of pure delight. To the landlubber, too, there's something infinitely appealing in the sight of a sleek boat gliding gracefully, silently through the water. *Why don't I try it sometime?* he thinks. And landlubbers by the thousands are trying it each

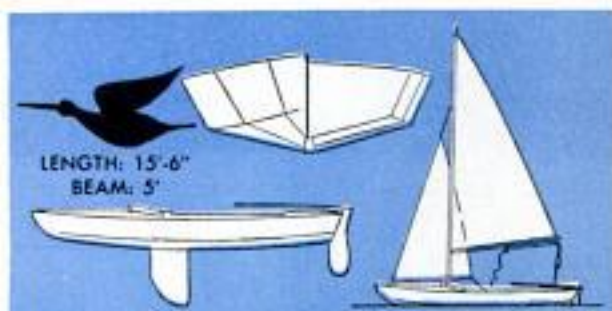
year. The boom on the mast is not the only boom in sail-boating. Today there are an estimated 575,000 sailboats in American waters. A majority are class boats; all boats in a class are built on the same lines. In a class-boat race, because the lines of the boats are the same (though finish and rigging may vary somewhat), victory usually belongs to the skillful skipper. Here we present details on four of the most popular of all classes. They're proven craft, found on waters throughout the world. Take your pick. See you offshore! ★★★



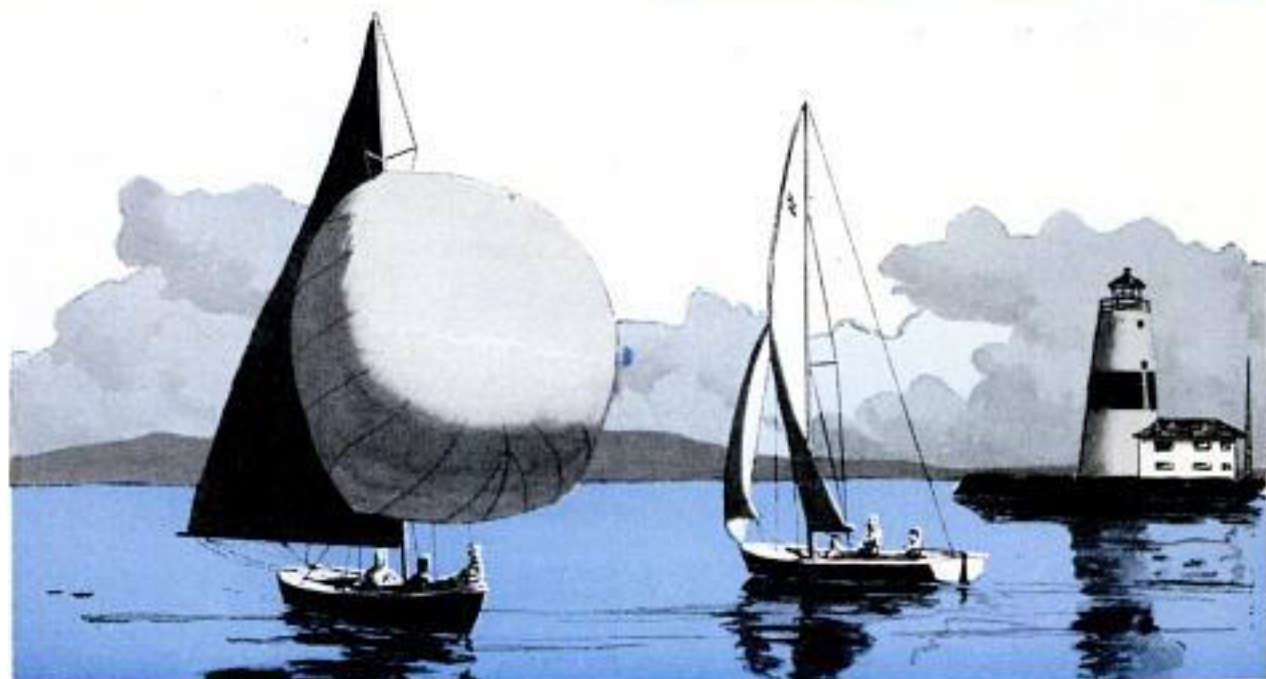
THE PENGUIN, a little sailing dinghy, is perhaps the best boat of all for the beginner, and the least expensive. She's easy to build, and kits of pre-cut parts are available. Despite her simplicity, the Penguin will give the novice sailor training in meeting most of the problems he'll encounter in larger boats. The Penguin weighs 200 pounds and can be carried atop a car. She'll carry three children or two adults. She has a hinged centerboard for stability, which can be retracted for greater speed when running with the wind. Small investment, lots of fun



THE SNIPE, shown running for home before an impending storm, has been called the world's most popular sailboat. Races for the world championship are held every two years. The Snipe is a sloop; that is, she has a jib in addition to her mainsail. Snipes, too, are available in kit form, or you can buy blue-printed plans. Three types of hulls are recognized: Planked, plywood and glass-fiber. The Snipe has either a hinged centerboard, or a dagger board that can be pulled up into the boat. Total sail area is 103 square feet. She's fast, easy to rig, easily transported on a trailer, a fine boat for sailors of any age



THE LIGHTNING is a top-notch sloop for both family sailing and racing. Her cockpit is large and protected by a coaming, making her a comfortable boat for just loafing along in the water. In addition to her regular sail area of 177.5 square feet, she carries a parachute spinnaker (shown in use below) for added speed downwind. An estimated 25 percent of the Lightnings are built by amateurs, but she's a fairly large boat for the beginner to tackle. Wide of beam, she's a stable boat especially good for family sailing. Trailer required. Carries up to eight





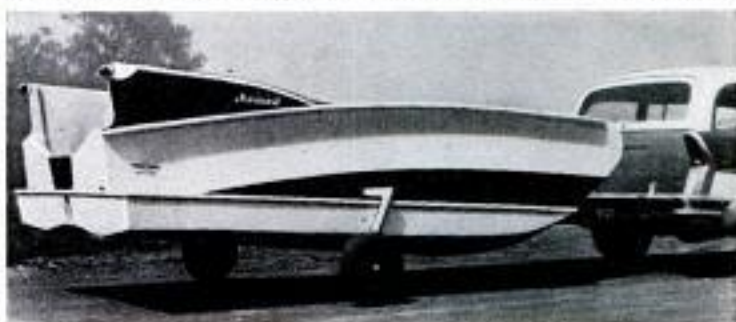
THE STAR, a fin-keel boat, is one of the oldest of the class boats and can be found throughout the world. Because of her beauty and exciting handling characteristics, she is preferred by some of the best of racing skippers over larger boats. Many sailors start out with smaller craft but end up with a Star as they become more adept. The Star has a total sail area of 281 square feet. Her fin is made of cast iron and weighs 890 pounds, so she is more difficult to transport than the other boats shown here. In heavy weather you'll be hiking over the lee rail, sailing's top thrill



Boat-Trailer Has Twin Hulls

FOR A REAL HYBRID, take a look at a craft which combines elements of a boat, a catamaran and a trailer. Basically the craft consists of two watertight pontoons fastened together and surmounted by a body. The two hulls are built of marine plywood covered with glass fiber. Two trailer wheels are installed on arms projecting downward from the sides of the boat. Up to 400 pounds of gear can be carried in the boat when it is rolling along the highway as a trailer. Once the boat is in the water, the wheels are pivoted up against the sides of the craft. Powered by a 30-horsepower motor, the boat will skim along on its twin hulls at 23 miles per hour. As a result of its unique hull design, the boat will virtually turn in its own length, 12 feet 9 inches. If the boat ships water, the water runs out two drain holes in the hulls. Thus bailing is eliminated and the boat can be washed by splashing water inside with a bucket or a hose. Also the boat is virtually impossible to sink. If one pontoon is punctured, the other will keep the craft afloat. If both hulls are punctured on the underside, air still will remain trapped inside the pontoons to support the craft. The total weight of the boat is 520 pounds. The boat seats five comfortably in its roomy cockpit.

Twin-hulled boat will virtually turn in its own length. Any water it ships automatically runs out drain holes in pontoons



Ashore, the boat becomes a trailer, with wheels pivoted down from the sides. Below, seats in cockpit will accommodate five



KEEPING UP WITH THE ATOM

TASTERS ARE TESTING tomorrow's food today in the booths shown at right. Constant though slow progress is being made in research to preserve food by irradiation. In the process, gamma rays are used to kill the bacteria which cause the spoilage of food.

However, irradiation may also affect the flavor of food. In this part of the research, expert taste testers take over. The ones shown here are members of a panel at American Can Company. Selected for their exceptionally good flavor perception, they have no strong food likes or dislikes.

Foods to be tested are unmarked, and it's up to the expert to rate the flavors of several samples, or to determine whether a sample has an off-flavor.

Want a job tasting these atomic-age foods? You must be in good health, free from worry, with a fast "taste recovery" and good "flavor memory." Which leaves one question unanswered: Who tests the taste-testers' tastes?

☆☆☆

SOVIET SCIENTISTS have tested the world's most powerful atom smasher. It is a huge synchrotron designed to achieve 10 billion electron volts of energy. In tests, it has accelerated protons to 8.3 billion electron volts, according to official announcements.

Prior to these tests, the world's largest



atom smasher was the six-billion-volt bevatron at the University of California.

According to a Soviet spokesman, the new machine will be used in studies of the atomic nucleus.

☆☆☆

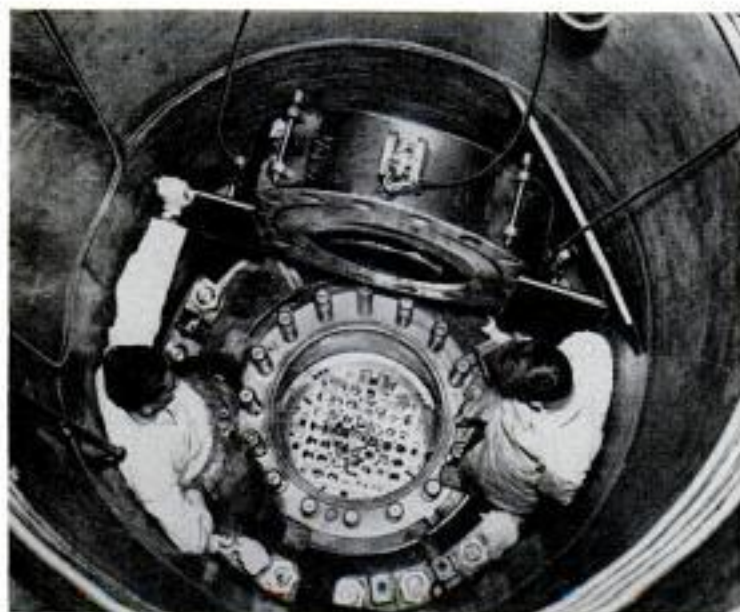
ARE WE RECEIVING too much X-ray energy from our television sets? A statement in Britain that viewers are receiving harmful amounts of radiation has created much controversy.

In this country, research by various agencies seems to indicate that viewers are not receiving harmful doses from well-constructed standard sets. A Massachusetts

Institute of Technology physicist points out that considerable X-ray energy is generated in a picture tube, but the set housing, the thickness of the picture tube and the protective glass reduce the intensity. He warns servicemen, however, that tubes tested outside their cabinets produce considerable amounts of X-ray energy.

☆☆☆

THE CORE STRUCTURE of the Army Package Power Reactor is shown at left. Fuel elements and control rods were slipped into the grid recently and the reactor went critical. Tests of the APPR are being watched with interest because the reactor is designed to provide electrical energy in remote areas.



After a wreck there's a big job to be done fast . . .

THE TRAIN THAT leaves its tracks plows up a lot of trouble. Tangled steel, demolished cars, upset engine, twisted and torn rails may mark the scene. The wreck is a giant jigsaw puzzle that apparently defies solution. But order comes to the scene fast, thanks to the experienced men and modern machinery that are always ready to move out on short notice to clean up after a wreck.

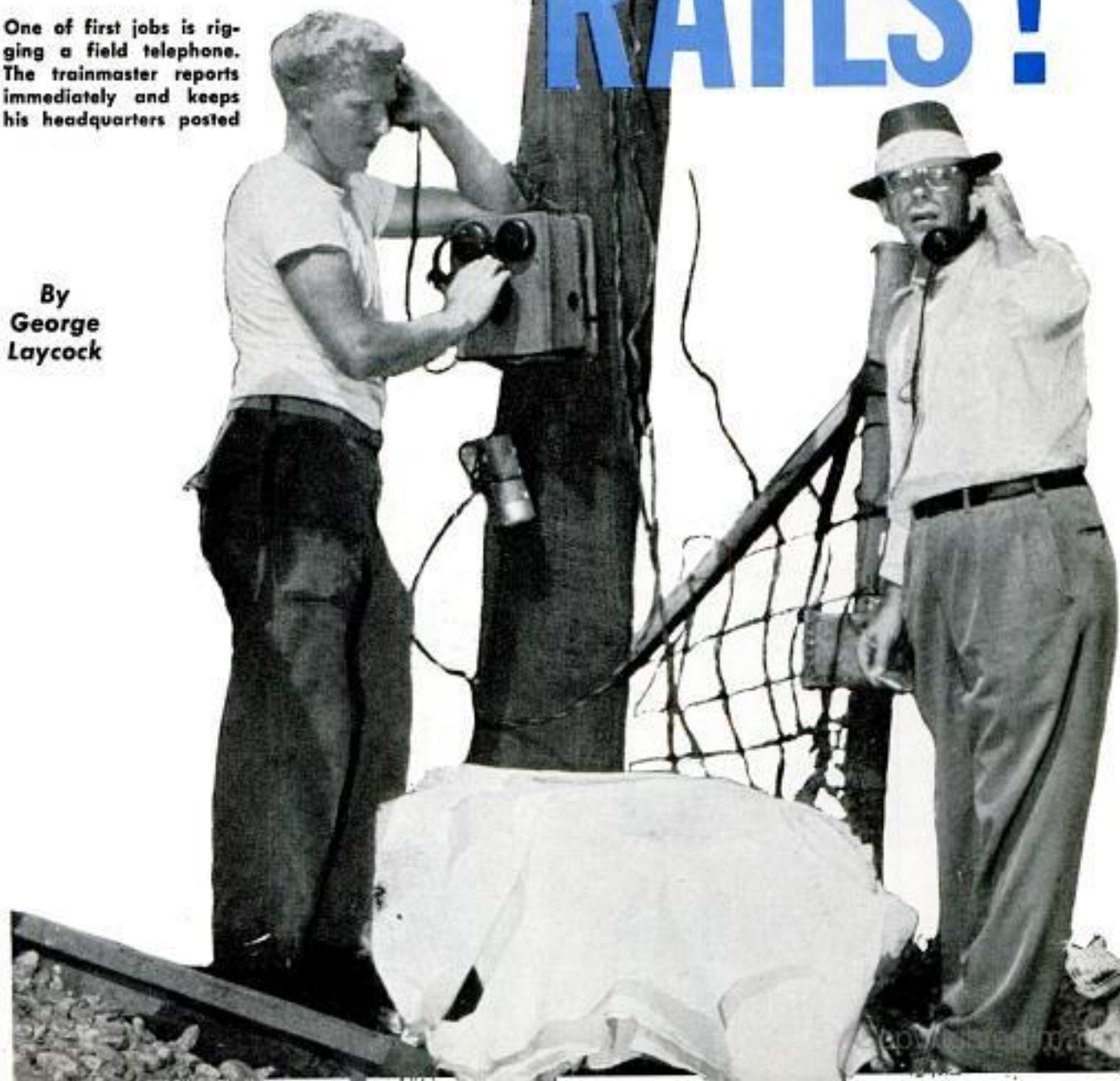
Some months ago a saboteur broke the switch lock off a small siding in central Ohio. The first train through opened the switch and seven cars slammed onto the siding, left the tracks and landed in soft earth.

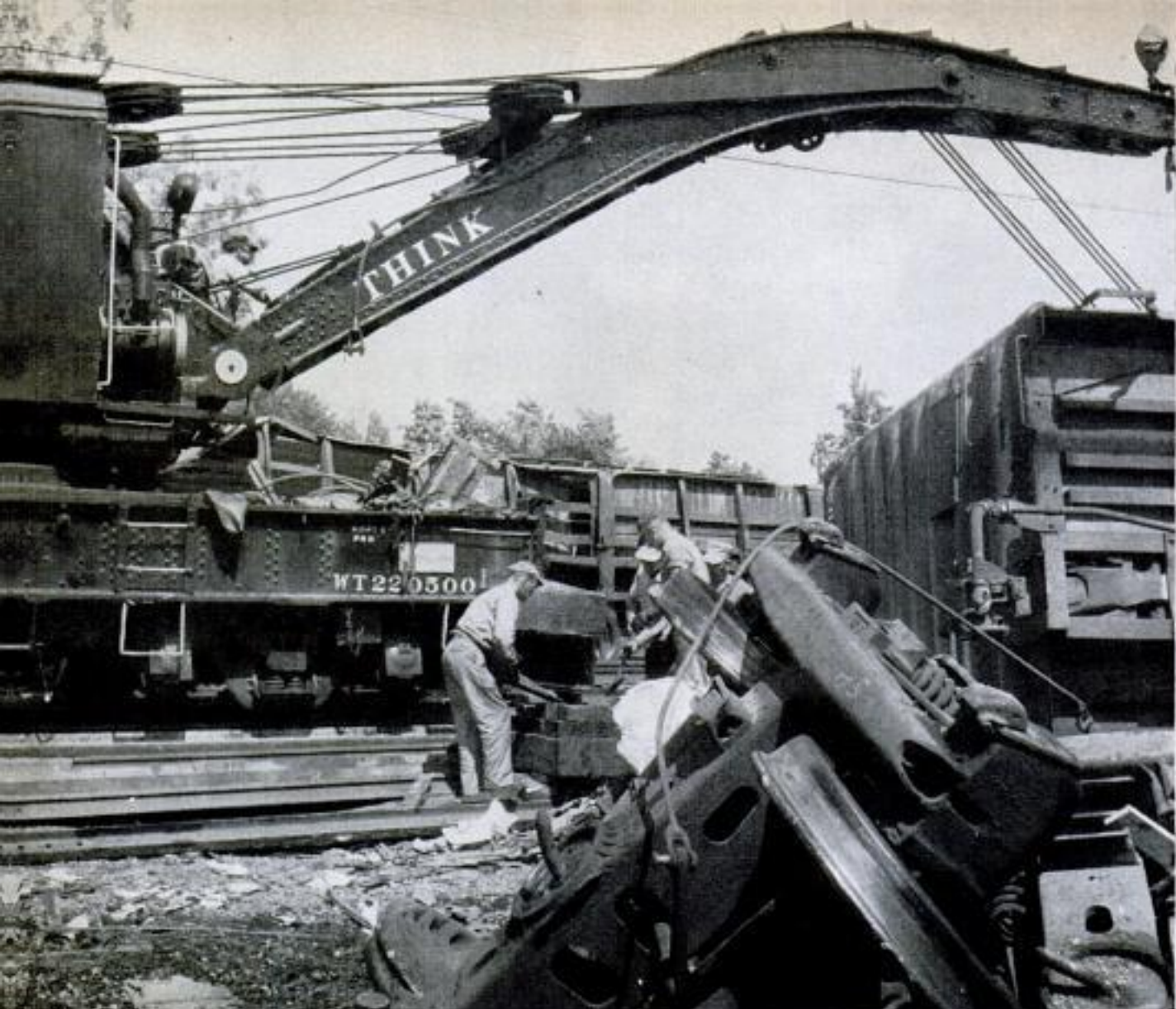
Within a short time a wreck crew was on its way to the scene from Columbus.

One of first jobs is rigging a field telephone. The trainmaster reports immediately and keeps his headquarters posted

CLEAR THE RAILS!

By
George
Laycock





Crane's boom dips into the tangled wreckage. It is the key tool, lifting the equipment piece by piece

Track-repair crew replaces the bent and broken rails as fast as the crane moves wreckage out of the way

Telephone pole, sheared off by a grain combine in the wreck, is snubbed back out of workmen's way



The tracks had been twisted and torn beneath the cars. The problem was what to do with the cars while the crews repaired the track. Here was added evidence of what wreck-crew superintendents mean when they say, "Every wreck has its own problems. Each wreck is a custom job."

The foreman solved this one in an unusual fashion. He instructed the crane operator to lift the cars one at a time, and while the cars were held off the ground the track crews laid new track. Then the cars were gently lowered onto the new rails.

Signals Flash a Warning

At the instant the wreck occurs and metal falls across the rails, the system's induction signals flash the danger warning up and down the track. All traffic from both directions stops.

Then a crew member from the wrecked train calls the nearest dispatcher either from a telephone on the train or from one of the phones spotted along the right of way. He describes the wreck thoroughly to the dispatcher.

The dispatcher sends out the nearest wreck crew. Then, if more men are needed, he begins to call in other wreck crews from more distant points. Other railroads may send crews to the scene, for railroads cooperate in clearing up after a serious train wreck. A supervisor gets to the scene as fast as possible. He sizes up the situation and begins to direct the clean-up operations. He keeps in constant contact with system headquarters, often on a field telephone set up at the scene.

The wreck train consists of engine, crane

and a few cars for men and equipment. The dispatcher sends out the first train crew available to take the wreck train to the scene.

On one of the larger Eastern railways a wreck crew consists of a wreck foreman, the train engineer, a power inspector and 10 ground crewmen. Usually these are shop workers who are also on call at any time for wreck-clearing duty. If the emergency comes during the work day it's fairly simple to gather up the crew and head for the scene. If the call comes at night the crewmen are called at their homes and they're expected to be at the shop ready to leave within a half hour.

Meanwhile the dispatcher has sent out the "maintenance of way" people who have the job of repairing tracks.

If the wrecked train was carrying passengers, other plans have been put into action as fast as possible. The railroad calls surrounding cities. Ambulances and doctors are dispatched to the scene. Police and firemen may be called out.

But more often the wrecked train is a freight and there are no serious injuries to anything but equipment. Here the big problem that faces the railroad men immediately is clearing the tracks. Regardless of how serious the wreck, other trains must go through with their freight, passengers and mail.

Mighty Muscles

One major piece of equipment for clearing the tracks is the crane. A modern crane is capable of lifting 250 tons; a machine with such muscles can simplify many a job. The first step often involves dragging

Crewmen quickly repair crossing sign. It must be ready for auto traffic when crossing is cleared





Track crew quickly lays brand-new ties and rails so other trains won't be bottled up by wreckage of this one

the wreckage aside so other trains will have clearance. The crane and perhaps a bulldozer accomplish this.

Howard Long, an executive in the traffic section of the Pennsylvania Railroad, in his long career has been out on so many wreck jobs that he no longer recalls the number.

"Some places are worse than others for clearing up a wreck," he says. "If you get a wreck in town or where there are many overhead power lines, you often have trouble moving your crane the way you want to." Usually the power company men are

There's nothing tidy about the way the wreckage is cleared. Trucks are simply pushed out of the way

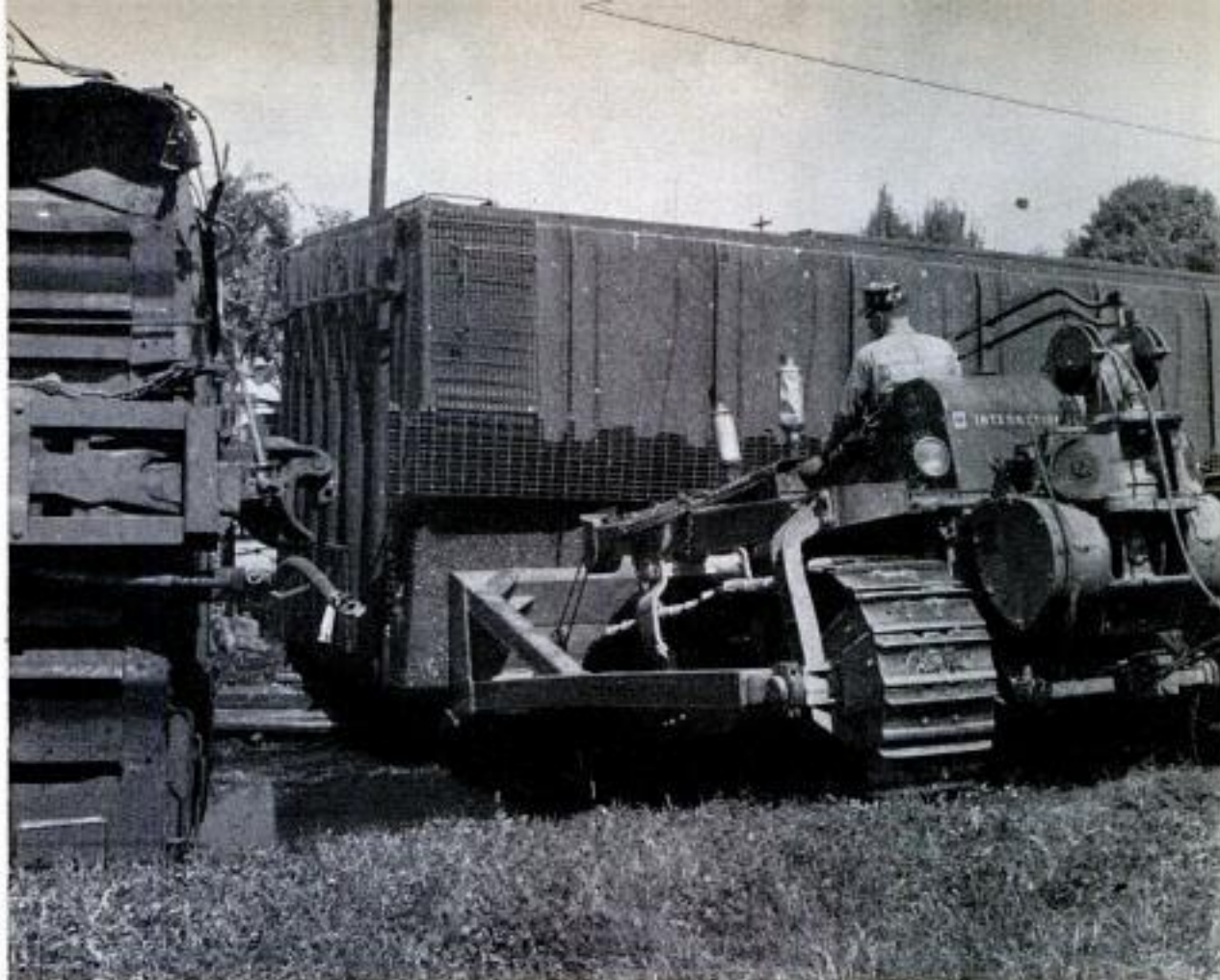
standing by to see that the wreck foreman doesn't hit one of the wires or stretch it too much.

Mountainside train wrecks present special problems. Cars and even engines may leave the track and roll down steep grades. There is always a risk when you start snaking a car back up a mountainside that instead of pulling the wrecked car up you'll send the crane downhill.

To prevent tipping over, the cranes are equipped with outriggers, steel arms that extend from the base of the crane. Each

Volunteers wash out the eyes of two workers. Chemical from a tank car irritated eyes in this wreck





Bulldozer shoves a wrecked freight car out of line of cars. Crane then will lift it free of the tracks

is blocked and wedged to broaden the crane's base.

Tunnels are a nightmare to the wreck crew. Workmen in cramped quarters must struggle to clear the tracks as fast as possible, for more often than not the tunnel is a vital link in the system.

Always after a wreck the railroad supervisors want to determine the cause of the accident. If the accident resulted from a collision it is almost always charged to human negligence. But the hotbox on the axle of a freight car still causes many

an accident. All railroad people working along the right of way are instructed to report smoking or flaming hotboxes on passing trains. If the hotbox trouble isn't caught in time the wheel may cut the end off the axle. The axle drops on the track, and shortly there's another call for the wreck crews.

You may seldom hear of the wreck crews. But every major railroad has them, well equipped and highly organized. Their assignment is to make order out of chaos—
★ ★ ★

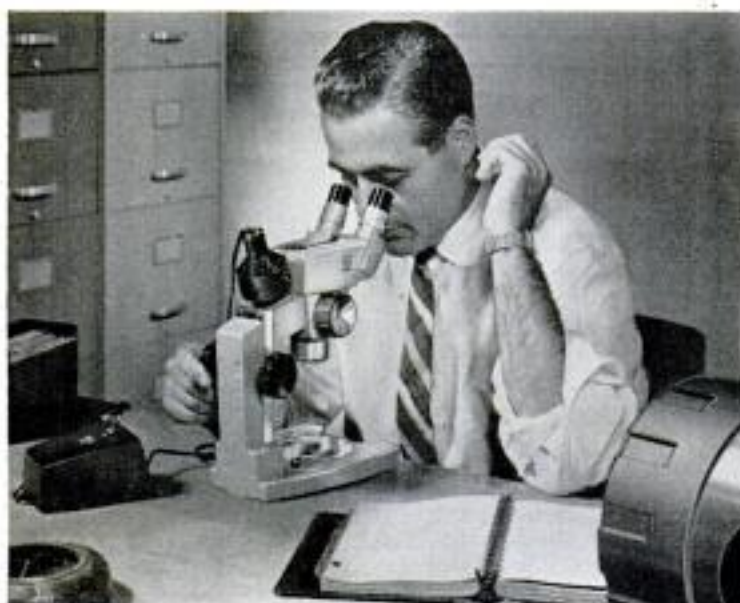
Local fire department hauled water for the steam boiler of the crane at this wreck. In such emergencies, nearby towns or cities cooperate by sending medical care, fire-fighting equipment and police protection





Carver Shapes Burl Into Huge Salad Bowl

Rodney D. Woodard, New Hampshire woodworking artisan, carved for 100 hours on a 200-pound birch burl to make the world's largest birch-burl salad bowl. A multi-grained growth on the trunk of a tree in northwestern Maine, the burl was 40 inches in diameter at the time he started to carve on it. Woodard shaped the wood into a bowl 33 inches in diameter, 9 inches in depth and 1½ inches thick. He also carved a bas-relief on the bowl's bottom to show a woodsman at work driving logs down the Androscoggin River in New England.



Dial on Microscope Selects Magnification

With this stereoscopic microscope, you can dial the desired magnification by rotating a chamber containing 16 corrected lenses. The microscope provides magnification from 3.5X to 80X and a three-dimensional view through dual eyepieces.



"Dog Tag" Sales Checks Aid Drive-In Operation

Metal sales checks, about the size of a serviceman's "dog tag," are used instead of paper slips at a Spokane, Wash., drive-in restaurant. The metal tabs cut costs, simplify handling and can't be blown off drive-in serving trays, according to M. J. Baker, operator of the eating place. The checks are made of pure nickel in five-cent denominations from five cents to five dollars and each check lists the sales tax on its surface. The sales checks are arranged on a wall rack near the cash register.

Not many years ago the prefabricated house was scorned in polite building-trade circles, as well as by zoning boards and the general public. After an uphill fight, the prefabs have won a place in the sun. Here's

How the Prefabs Got That **Custom Look**

By Wayne Whittaker



Courtesy of the Masonite Corporation

Frank Lloyd Wright, noted architect, gives his stamp of approval to the prefab idea with this new design

WHEN FRANK LLOYD WRIGHT, the unofficial dean of American architects, designed a house recently for a prefabricated home manufacturer it was big news to every builder in the country. To the prefabbers, this prestige plum was a highly important event.

Only a decade ago many an architect, noted or otherwise, would have scorned the job of designing a prefabricated house. Now in 1957, the man who has had the greatest influence on architecture for the last half century has lent his distinguished name and talent to the field of prefabri-

cated homes. The design is low and smart.

The Wright house and all it implies is a far cry from the days when hostile zoning boards relegated the prefab builders to undesirable locations outside city limits. The most that could be said for the prefab of 15 and 20 years ago was that it was cheap and a lot of house for the money. These low-cost houses seemed to be slapped together overnight. The public, unused to prefabricated techniques, leaped to the wrong conclusion that the houses were poorly constructed. Stylewise, the homes were miserable boxes strung in drab and

Donald Scholz calls this glass-walled home with pool his "Contemporary" model. It is a big prefab seller





Hodgson Houses, Inc., Dover, Mass.

This three-bedroom split level has 1074 square feet of floor area. The recreation room is in the basement

lookalike rows. "Tomorrow's slums," said the zoning board members.

Surprisingly enough, some of the early prefabs look better today than when they were built. The sturdy homes have been individualized with shutters, trellises, porches, garages, carports and good paint jobs of careful color selection. These early houses, largely, have upheld the promises of the builders in regard to durability. However, the complete lack of architectural style, poor site planning and the connotation of the word "cheap" with the early prefabs gave the industry an uphill problem with regard to public acceptance.

The prefab industry was a "depression child," the first company being organized in 1933. By 1946, only 37,500 prefabs were sold—most of them still nondescript in appearance. Last year, 94,791 of the homes were sold for a whopping \$1,098,010,414, according to the Prefabricated Home Manufacturers' Institute. One house out of every 10 single-family dwellings built in 1957 was a prefab. The prefabricated homes ranged in price from a few thousand dollars to \$100,000. Many were sold in the \$40,000 to \$50,000 bracket. Some of the houses won national mention for design and some of the mass projects won awards

for site planning, surprising the old-timers.

The prefab manufacturers confidently expect greater recognition this year. In addition to their low-cost homes, they are offering rambling ranch houses with open plan, family rooms, multiple baths, intriguing patios and outdoor-living areas. They are offering contemporary designs (modified modern) with low-pitched roofs and glass walls, wall-type ovens, air conditioning and swimming pools. They are offering two-story homes of traditional New England saltbox style and nostalgic colonial designs with modern interiors that include utility rooms and perimeter heating.

This year one of the big prefabbers proudly proclaims: "Our Luxury Line homes—\$15,000 to \$100,000—can be individualized in every luxurious detail. A special architectural service is available to help you fit the house to its natural setting and landscape it beautifully. Our low-cost homes—\$7500—can be built in 4½ days."

The ugly duckling of the housing industry was not transformed to a glamorous swan over night. Right after World War II there were many people who still didn't know what a prefabricated house was.

"We had to teach the public that a prefabricated house is made of parts assembled

The L-shape, Roman brick and vertical siding lend individuality to this five-room home. Kitchen is at front

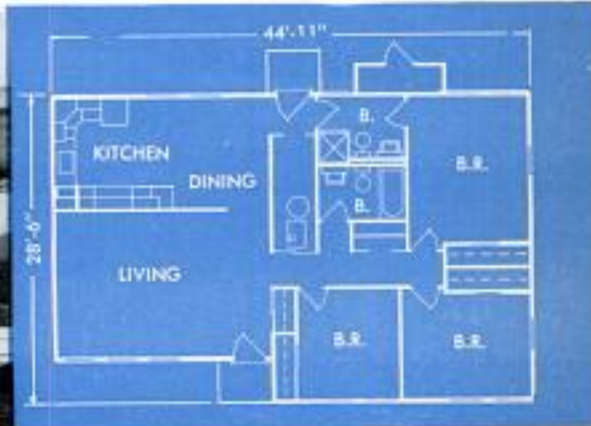
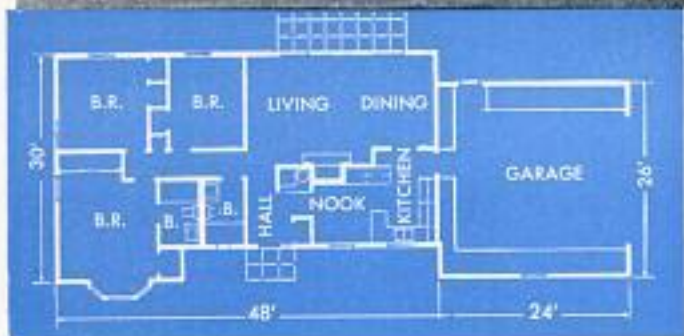
Barnschfeger Homes, Inc., Port Washington, Wis.





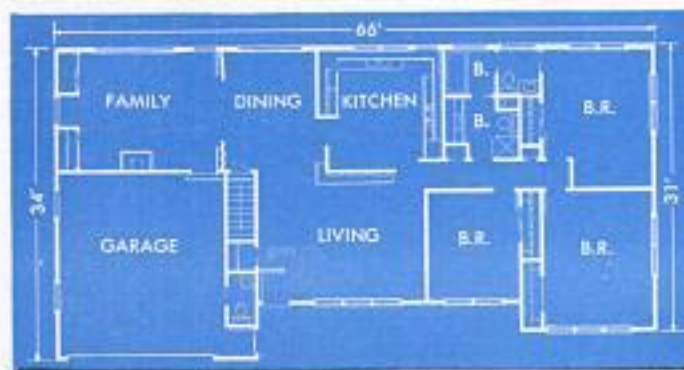
Scholz Homes, Inc., Toledo, Ohio.

This ranch home with colonial detail is built with variable floor plans (basic floor plan is at left). The owner of this house made a recreation room with big window out of garage



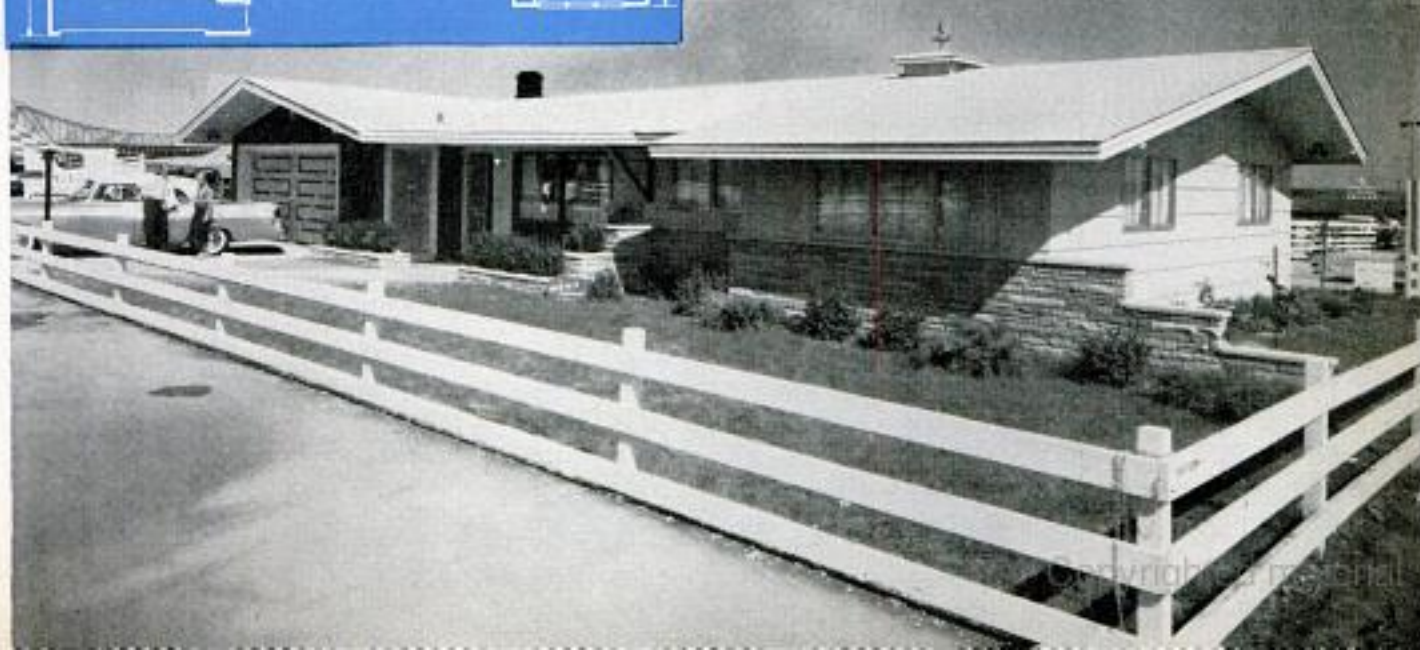
United States Steel Homes

Above, something new in prefabs is offered with this model which has steel roof trusses and steel-framed panels. Big windows and the low-pitched roof help give it a custom look



The home below won an award for both quality and design in competition with conventionally built houses. Custom features include stone trim, family room and an open plan within

W. G. Best Homes Co., Effingham, Ill





Modular Homes, Inc., Kirkwood, Mo.

This interior of attractive home at top of page shows effect of front window wall. It sells for \$15,000 without the lot. Below, two treatments of the same basic three-bedroom plan

Knox Corporation, Thomson, Ga.



at a factory for quick construction at the site," says one of the pioneers in the business. "These parts include wall panels, floors, roof trusses—in fact, all the main carpentry. Nowadays many prefabricators also supply the plumbing plus fixtures, heating and air-conditioning equipment, all sorts of built-ins including kitchen cabinets, also lighting fixtures, wallpaper, paint and rugs. Brick and stone are not included in the 'packages,' nor is the landscaping."

The prefab package (which fills a huge and scientifically packed truck) is transported to the waiting foundation of the building site at night so when the construction crew arrives in the morning there will be no delay. Some small houses are enclosed in a day and a half. There is no lost motion or costly delay waiting for some vital bit of material or job to be performed either at the prefab site or in the factory. A prefabricated house is said to save from 5 to 15 percent of the cost of an identical structure put up by conventional means. Fifteen percent of a \$20,000 house—\$3000—is a sum large enough to impress any family planning a home.

From the beginning, the prefabricators have stressed labor-saving in the assembly and construction of their houses. If you have any doubts on this score, all you have to do is visit a prefab factory or the site where a house is going up. Everything moves with speed and precision. In the factory, wall panels complete with insulation seem to be put together like magic. The place hums with the sound of busy power saws, nailing machines and every aid to mass production that engineers can devise.

The prefab manufacturers like to compare their product to the mass-produced automobile.

"Who has enough money to buy a custom-built car in this day and



age?" they ask. "The prefab house makes just as much sense as the mass-produced prefabricated car."

Before they could make this argument convincing, the prefabers had to do something about the design of their houses. Soon after World War II, one of the big prefabricators hired a well-known architect to tackle the problem. This architect came up with clean contemporary designs. Business boomed. Then the prefabber hired a color expert to plan color harmony, not only for the individual home but entire building projects. Sales zoomed even higher. Soon the prefab manufacturers were in a scramble—and still are—to lure some of the best names in the roster of the American Institute of Architects to their payrolls. Frank Lloyd Wright was preceded by Charles Goodman, Yamasaki, A. Quincy Jones, Frederick E. Emmons and others. Of the 300 firms now producing prefab homes, 75 percent employ registered architects. Donald J. Scholz, however, designs most of his own houses. The manufacturers give the public a choice of over 3000 models. These models are sold by 7000 builder-dealers.

Cuts Cost of Luxury Homes

Recently, the prefabricators have found that their methods are as adaptable to luxury homes as to low-cost models. After all, it is only reasonable that the economy of the basic units remains the same whether a house is 24 or 80 feet long. An Ohio doctor was on the verge of giving up the plan for his dream home when he discovered the cost by conventional building methods was prohibitive. Then he looked into prefabrication. He got his dream house for exactly \$52,000—far less than it would have cost with custom building. This doctor's acceptance of prefabrication—construction methods, styling and quality—is complete.

One of the biggest builder-deal-



National Homes Corporation, Lafayette, Ind.

Open plan of this house presents vista with fireplace in the background. Windows over fireplace add unusual custom look

ers in the Chicago area points with pride to the caliber of his buyers. They include many engineers, numerous architects and four mortgage officials. He points to the latter with special pride because there was a time when mortgage money for prefab buyers was hard to get.

One of the interesting results in the development of the prefabricated house is its impact on the entire housing field. This small segment of home building has forced many mass builders to adopt prefab money-saving ideas. These include the precutting of material in sheds right at the building

New England "saltbox" is the flavor of this house which has three bedrooms upstairs and a big family room on first floor

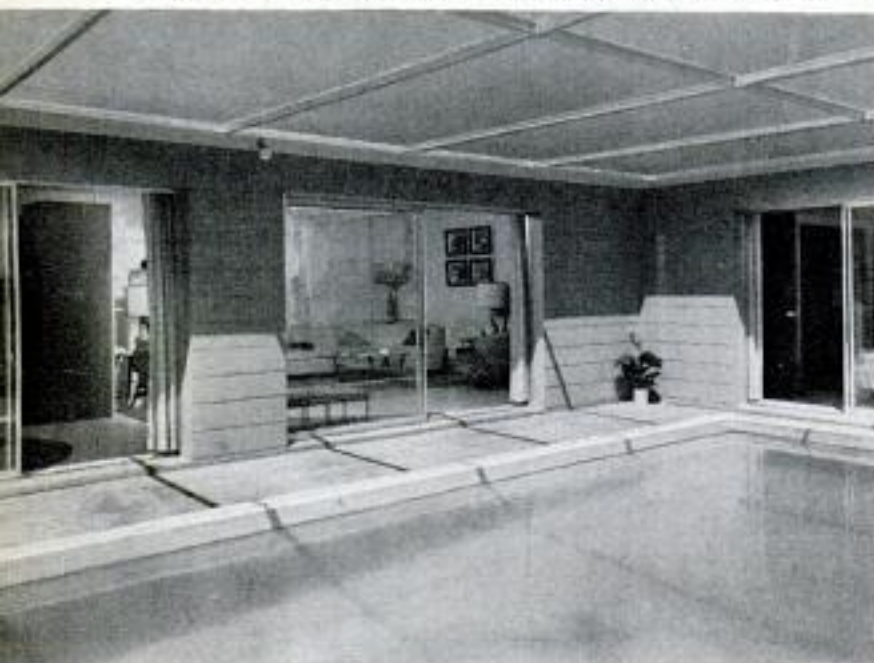
Midwest Houses, Inc., Mansfield, Ohio.





Scholz Homes, Inc.

High priced and colonial in design, this prestige prefab called "Monticello" is in \$35,000-\$50,000 range



site and the use of prefabricated components.

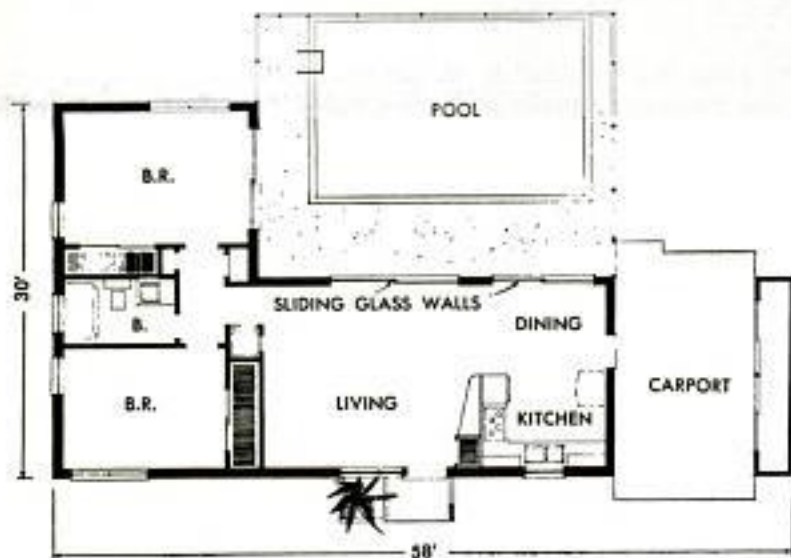
The prefabricators say "you ain't seen nothin' yet" when it comes to impact on housing in general. They freely predict that by 1970 half of the houses built will be prefabricated. Meanwhile, they are enlarging the scope of activities beyond the luxury house to motels, college dormitories and laboratories, churches, schools and public buildings long associated with conservative architecture and building methods.

"Prefabrication will play an increasingly important part in the fulfillment of the undiminished need for homes in this country," says George Price, veteran prefabricator and president of the Prefabricated Home Manufacturers' Institute. "This is because prefabrication has proved itself to be the most effective bulwark against constantly rising building costs that otherwise threaten to push the prices of new homes beyond the ability of a vast number of families."

To this, Conrad "Pat" Harness, executive vice-president of the institute, adds: "Prefab methods are a 20th century way of producing a 20th century house." ★ ★ ★

Screened pool is featured with this Florida prefab. The house is built of concrete blocks with two terrazzo floors. Price including the lot plus extras is \$12,950

Florida Builders, St. Petersburg.



I SHOOT THE WORKS

By Hugo Lizza

As told to James Joseph

A SBESTOS-SUITED, heart working hard, I brace behind the sandbagged control bunker, conscious as always of the crowd—the 85,000 jamming the black stands of Los Angeles' Coliseum. Or it might be any of a thousand stadiums and arenas scattered across country. Suddenly a voice pounds out of the night:

"You're on, Mr. Lizza!"

For the next 60 minutes I'm ringmaster, a pyromaniac with a license to play with fire.

Sweaty-fisted, I press the walkie-talkie's "speak" button.

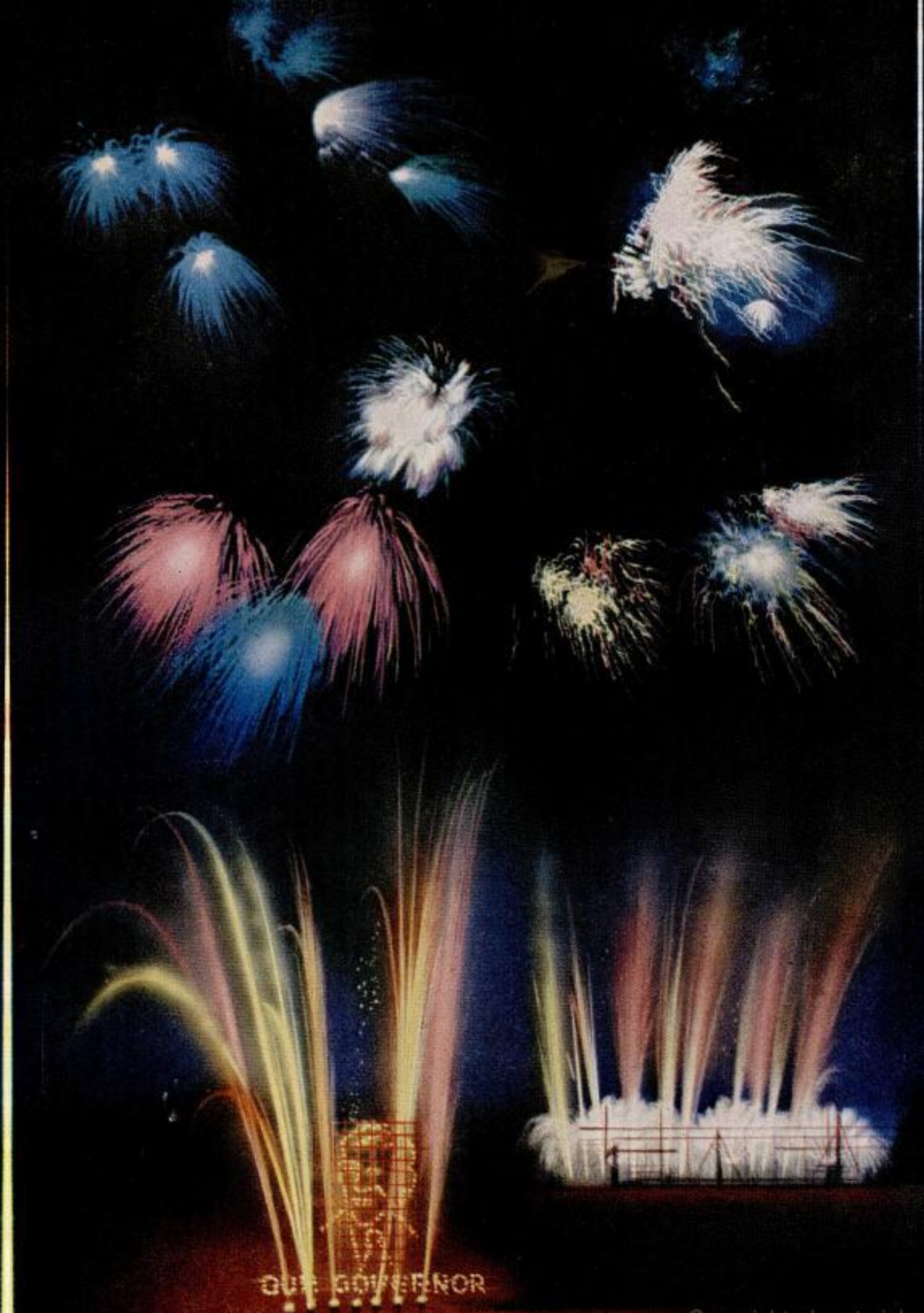
"Firing captains . . . ready?"

From across three acres of sets and high explosives, from the mortar entrenchments and rocket stations, crackles confirmation . . . "Ready to fire" . . . "Okay" . . . "Set and ready!"

Spread over the arena's vast blackness are 2000 blunt-nosed mortars, buried two thirds of their six-foot lengths in dirt, barricaded by 20 tons of sand and all within easy reloading of the powder magazines.

Behind the mortars loom two dozen sets—huge, building-high frameworks crafted from





OUR GOVERNOR



Surpassing colors of the rainbow, skyrocket and big aerial "bursts" light up the Fourth of July night sky (top of opposite page). Bombs are launched from mortar installations and a single bomb may contain 150 bursts released at split-second intervals. Beneath the aerial pyrotechnics is an incendiary portrait of "Our Governor" and the dazzling show opener. On this page is a panel of grand-finale color effects—fountains of flame which are reflected in a lake

20,000 feet of lumber and strengthened by steel. They're intricately fused and primed, their 30 miles of wrapped fuses run to remote firing stations. At each station crouches a triggerman, a rheostat at his finger tips, earphones snugged beneath his safety helmet.

An acre beyond, hidden by the stadium's lofty peristyles, waits the rocket crew, a dozen hand-picked men, each sheathed in asbestos. They're bossed by a firing chief, his back slung with a walkie-talkie. Close by my control post stands an observer, eyes probing the night, intent upon the mortars. His job: Spotting misfires.

Twenty tons of explosives await detonation, their colors and intensities as carefully compounded as those of a masterpiece. The artist paints with pigments; the fireworks designer with chemicals—dry pigments instead of wet. From grayish strontium-nitrate pellets come pyrotechnic reds; from barium and potassium chlorates, flaming greens; from slow-burning aluminum powder, the waterfall brilliance of Niagara. Modern firemakers, like their forefathers, keep secret their formulas. The chemicals? They're standard. The secret lies in the compounding, how one chemical's mixed with another and when.

Lingo of Pyrotechnics

There's also a nomenclature grown up around big-time fireworks. *Powders*, the explosive color etching every display; *fuses*, the intricate self-timers regulating a hundred different bursts; *boosters*, charges which keep pin wheels spinning; *lances*, the colored flares outlining the sets, literally drawing incendiary portraits. There are *parachutes*, too, which suspend explosives in mid-air.

During the next 60 minutes, \$20,000, perhaps \$30,000 worth of high explosives will go up in an artistic holocaust of flame and beauty. To the crowd, expectant in the stands, each flaming spectacle has a name . . . *Aerial Ballet* . . . *Devil Wheels* . . . *Battle of Midway* . . . *Niagara Falls*. And all etched in brilliant color against night's backdrop. To me they're just numbers . . . Set No. 1 . . . Set No. 2 . . . Numbers and seconds. Every shot's scheduled, timed to the second, regimented by radio and electrical impulse. Behind this pending holocaust stand four generations of craftsmanship—not to mention three hectic months of preparation and a half dozen dry-run rehearsals.

It's the spectacle that holds the crowd's attention. Aerial bursts. Thundering bombshells. Salvos of sky-rockets. It's a spectacular, all right, as breath-catching as a barrage along no man's land and almost as costly.

Few will notice, or even be aware of the three dozen men sweating over switches and fuses. For all eyes will be on the sky, on this, America's fieriest night of the year—Fourth of July.

As the last firing captain reports "set and ready," I tense.

Flashlight held close, I scan the firing order, the "sheet music" of big-time pyrotechnics. It's a score that's sometimes fast-paced, sometimes slow, as carefully composed as a ballad, as precisely arranged as any opera. As controller I'm a kind of symphony



Months of hard work precede the big show—here staple guns speed work of fusing elaborate set pieces

conductor. Fire and fantasy are my musicians. The mike is my baton.

The time watch's hand edges to 9 p.m. One second to go . . . half a second. . . .

"Fire aerials!" I rasp into the mike dangling from my neck. And the show is screaming skyward.

Three hundred feet to the south, the mortar chief slams his rheostat to first posi-

tion. Inside a steel-walled tube, a resistance wire bedded in black powder flares suddenly, igniting 1000 feet of tightly wrapped fuse. Fire races toward the mortar pits at 500 feet per second.

"Salooompp!" Two thousand lifting charges simultaneously explode in their tubes, hurling their bombs skyward, end-over-end. In quick succession come the

Below left, mortar chief in asbestos suit checks an aerial bomb. Right, Lizza with bombs and big set piece





Lizza checks wiring which will detonate this barrage of "candles." They are triggered from firing station

"breaks"—the dozen or more fountains of flames erupting from every bombshell, one break following the next at split-second intervals.

"Reload!" I bark. A dozen mortar men heft aerial bombs from the magazines, ram them down the still-hot throats of the firing tubes. They reach quickly—carefully—over

the sandbag barricades, barricades designed so that only a man's forearm lies exposed in the loading.

Quickening pace, I call, "Ready Set No. 1 . . . fire!" An acre away, across the thundering night, a set captain triggers his rheostat. "Sheesshh!" A half dozen fireworks destroyers flame against the night,

Colored flares called "lances" fastened to giant sets draw pictures in fire to form old and new favorites

FAVORITE DISPLAYS



OLD GLORY



NIAGARA FALLS



OUR PRESIDENT



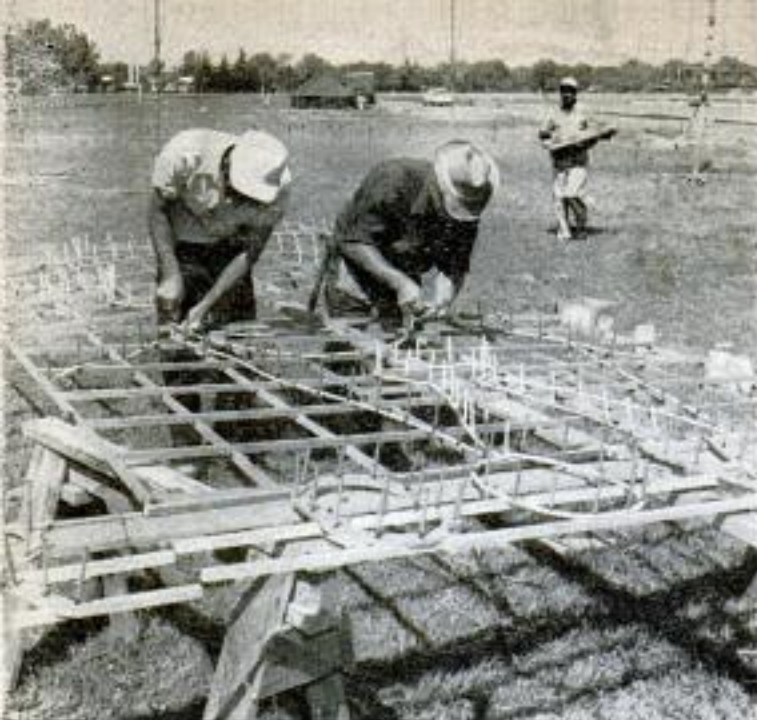
MILITARY HERO



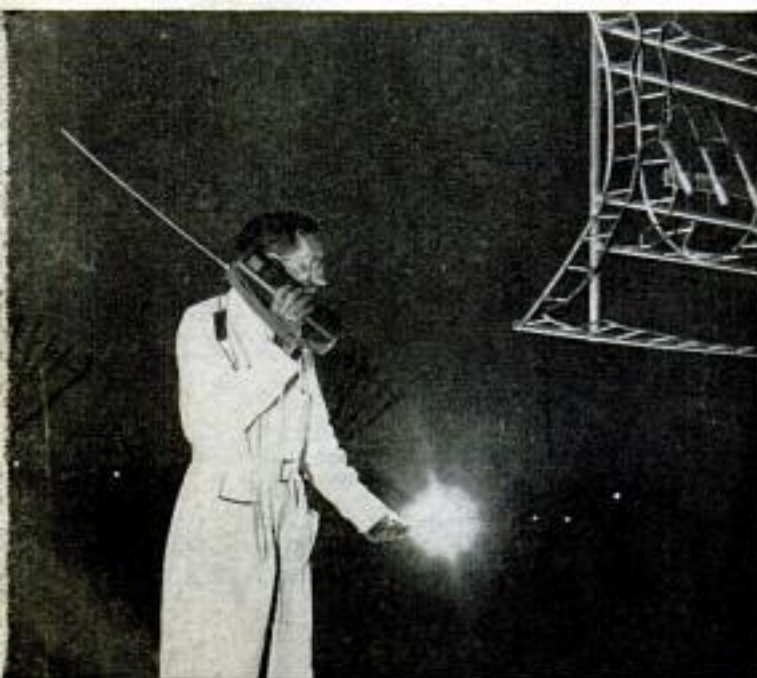
NAVAL BATTLE



CARTOON



Elaborate set piece takes shape in an open field. Black-powder fuses link hundreds of flares in set



Mortar chief gets walkie-talkie orders from Lizza and signals his assistants with a special flare. Below, workmen behind set pieces attend rocket emplacements controlled from the main firing station



their cannon ranging on the Japanese fleet. For three minutes the Battle of Midway rages—precisely three minutes, not 10 seconds longer. Suddenly, the enemy armada sinks into a sea of fireworks as the Americans hoist a triumphant Stars and Stripes.

"Skyrockets!" I order. The pace changes. Fast pace, slow, fast again. That's the controller's job—the showmanship which is his for 60 earsplitting minutes. It's the gasps he's after, the startled "oohhhs" drifting down from the stands. "Keep them on seat's edge," is the credo of big-time pyrotechnicians.

An hour later it's over, the last flare pot spent. My throat's raw from fumes and directing. My ears ring to the crescendo of aerial bombs. Vaguely, I'm conscious of engines straining as a hoist truck lifts mortar tubes free of their holes. A dozer Jeep follows behind, filling the craters. At the arena's far end a crane's at work, its riggers hauling down steel cables which but half an hour before supported two tons of explosives, the 5000 "candles" which had fountained into a stadiumwide Niagara Falls. The arena's earthen floor is strewn with bits of paper and dabs of twine—all that remains of \$30,000 worth of high explosives.

Plant Has 80 Buildings

Only three months before, the holocaust had begun to take shape among the 80 buildings snugged into a canyoned 1400 acres near Saugus, Calif. Here, closely guarded and engineered for safety, are the Golden State Fireworks Co., founded by my father, and its big brother, Bermite Powder Co. My father, Patrick Lizza, is probably the world's most successful and energetic pyromaniac. Four generations of Lizzas have, literally, been shooting the works. But the spectaculars we engineer today would have left great-grandfather Antonio Lizza gasping like any ordinary Fourth of July celebrant.

Grandfather Lizza never foresaw the bombshell—the aerial bursts which are the staple of today's big-time displays. Electrical firing devices were unheard of a century ago. The walkie-talkie, coordinating two dozen men at a half dozen firing stations? It hadn't been invented. Nor had special lead-in fuses which, with one igniting, simultaneously fire a whole set piece. Nor had engineering climaxed to the point where detonation was both positive and a veritable chain reaction—built-in time-delay fuses triggering upwards of 150 bursts from a single bombshell as it arcs through the night. And there weren't "moving" sets, their animated characters "walking"

(Continued to page 212)



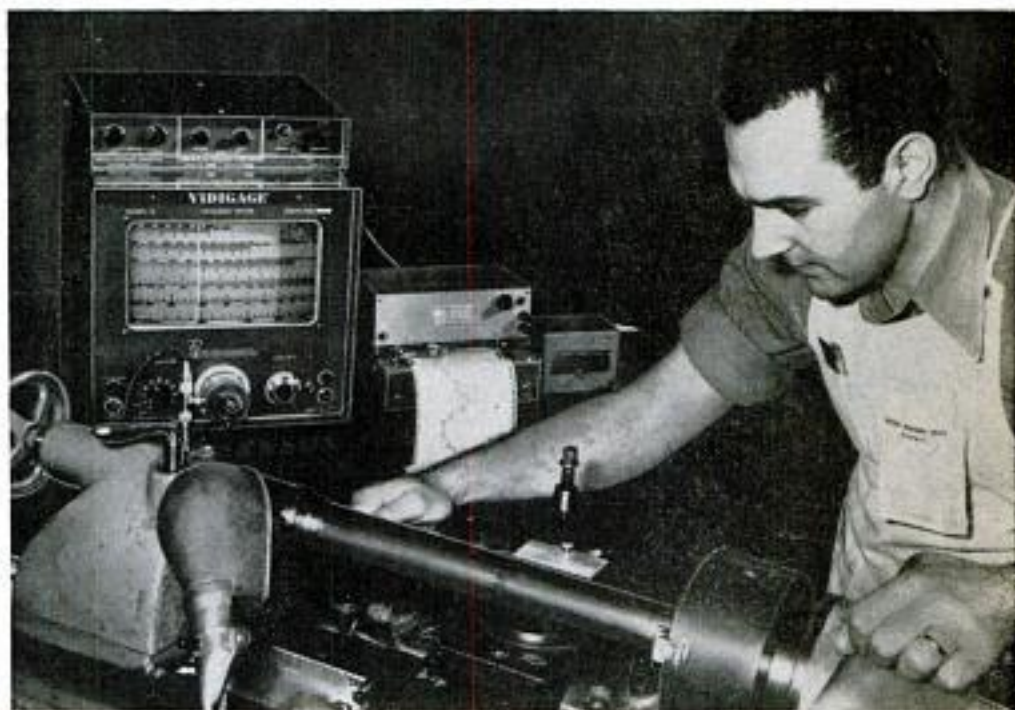
Aluminum Truck Bodies Reduce Dead Weight

Pay-load capacity is increased 10 to 15 percent with aluminum-alloy truck bodies, according to manufacturers. This dump-

body combination has a legal pay load of 51,470 pounds. Each body weighs 1400 pounds; aluminum wheels also cut weight.

Ultrasonic Gauge Tests Thickness

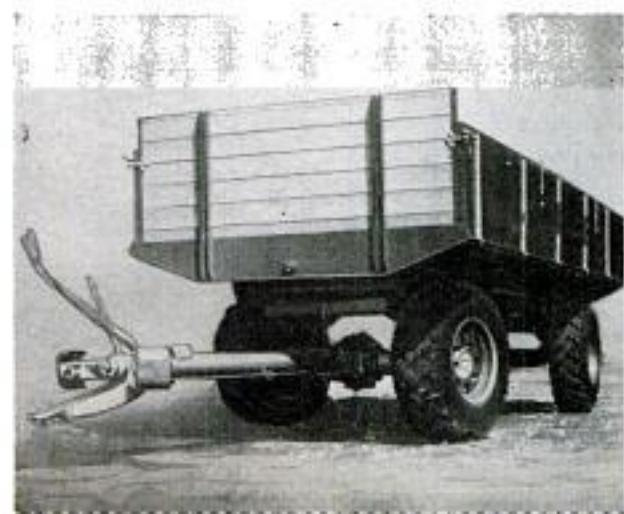
Changes in the thickness of metal and plastics as small as .05 percent can be detected by ultrasonic test equipment recently developed. The automatic thickness gauge can be wired to ring an alarm, flash a signal light or activate various kinds of compensating controls. Other circuits wired to the equipment convert the ultrasonic signals to readings on a strip-chart recorder, or make it possible to set high and low tolerances so material will be sorted as small, large or the correct size.



Power Take-off on Tractor Drives Trailer Wheels

It's almost impossible to bog down a German trailer that has its wheels powered from the power take-off of the tractor. A

two-jointed drive shaft connects the tractor and trailer to provide power to the trailer axle which is differential-equipped.





WHAT'S NEW FOR Your Home

TABLE TENNIS, anyone? This 5 by 9-foot table, left, folds in half for easy storage and rolls away on a set of four built-in ball-bearing casters. The top is five-ply, three-quarter-inch plywood with the court lines accurately striped on the playing surface

Brinktum, Inc., 710 N. Fourth St., Minneapolis, Minn.



FOOD MINCER uses five disk-shaped cutting blades which revolve and slice through meats, fish, fruits or vegetables. The palm-shaped holder also protects the fingers. The blades can be removed for cleaning

Competition Chemicals, Box 141, Iowa Falls, Iowa



CHALK MARKER for tacking dress material makes it easy to transfer pattern markings to the fabric. Built somewhat like a scissors, the tips are fitted with a device that automatically sharpens the chalk

Berwalt Co., 812 Huron Rd., Cleveland, Ohio

ALUMINUM HANDLE for milk carton will convert a conventional half-gallon container into an easy-to-handle pitcher. When not being used, the lightweight kitchen helper folds into a small space for storage

Specialty Sales Co., 801 1/2 Houston St., Arlington, Tex.



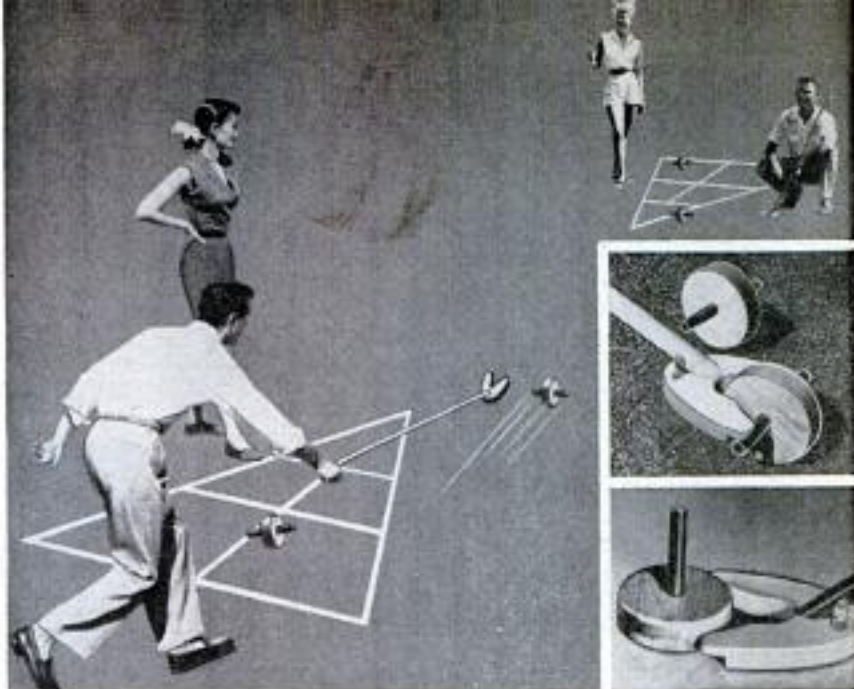
DECORATOR FABRIC FRONT for room air conditioners blends with the decor of the room and also conceals the control panel. You can replace the fabric with matching or contrasting material if you redecorate

Amana Refrigeration, Inc., Amana, Iowa



LAWN SHUFFLEBOARD game can be converted to conventional sliding deck shuffleboard in seconds. Puck is balanced to roll 75 feet for lawn games. Move peg, and puck slides for games on hard-surfaced courts. Set includes scoring courts, colored pucks, hardwood cues

Wamo Manufacturing Co.,
Dept. B, 835 El Monte St.,
San Gabriel, Calif.



ELECTRONIC AIR CLEANER removes germ-laden dirt, dust, pollen and smoke by attracting airborne particles to grounded plates. Some models can be connected to furnaces or to central air-conditioning units

Trion, Inc., Pittsburgh, Pa.

CHAIR LIFT can be installed in most multilevel homes without structural changes. Suitable for persons who cannot or prefer not to climb stairs, the lift does not interfere with ordinary use of the stairs

Sedgwick, 84 Eighth Ave., New York City



JULY 1957



ROUND ICE CUBES? Yes, this rubber tray is designed to freeze ice in either clear or colored balls, with or without fruit flavoring. For freezing lollipops, sticks can be inserted through the holes in the trays

Ena's Mailbox Shopper, Box 7005 DU, Denver 8, Colo.

CORD SHORTENER takes up the slack in long telephone or appliance cords. The excess cord is simply wrapped around the holder which can be tacked to the baseboard for semipermanent room installation

Robert Fales Co., 34F Talcott Ave., West Springfield, Mass.



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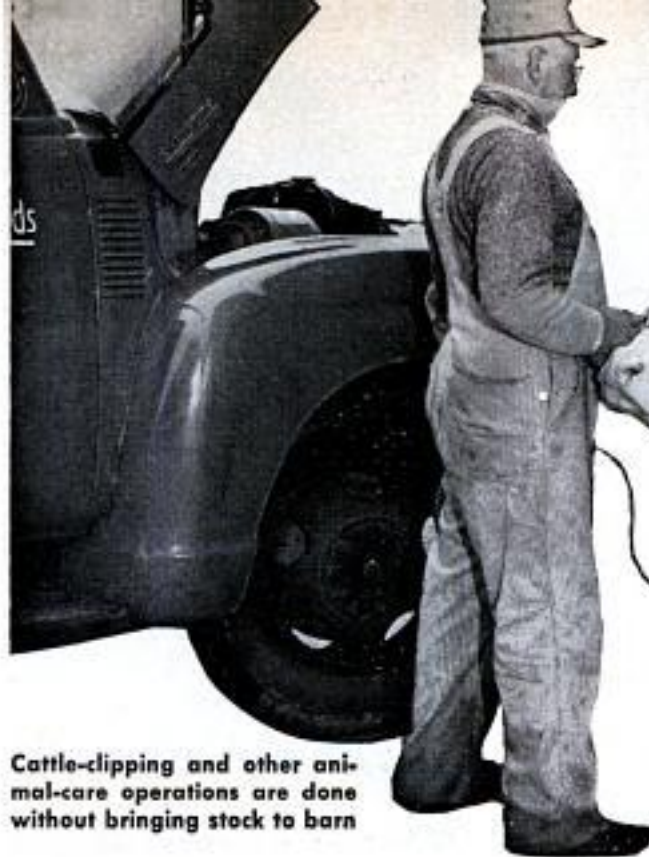
Just Drive Your Plane Downtown

If police don't have any objections, this amphibious aircraft—made by a manufacturer in Genoa, Italy—can also travel busy city streets. Cars and other types of vehicles merely move under the plane's wings



Flying Salvage Craft Works on Land or Sea

Tests conducted at the U. S. Naval Amphibious Base at San Diego, Calif., prove that the versatile helicopter can be used as a highly mobile salvage vehicle during amphibious landings. In the top photograph, a powerless, tracked LVT is hauled over loose sand and into the sea by a tandem-rotor H-21 helicopter. In the simulated-invasion problem, it was assumed that ordinary salvage vessels would be barred by reefs and shallow water. In another mock-invasion problem, left, the H-21 serves as a flying tugboat by towing a 3000-ton, 382-foot LST through the water at a speed of five knots. The helicopter's performance was reported better in many ways than that of a water-borne tug.



Cattle-clipping and other animal-care operations are done without bringing stock to barn



Utility Generator for Car

POWER TOOLS, appliances or emergency equipment operate from a 110-volt, alternating-current generator that hooks up to the engine of any truck or car. Called GenerAC, this generator and a small control box with hand throttle, on-off switch and voltmeter can be mounted with ease. A steady 3500 watts, or a temporary 6000 watts, are available; this power source also can start a two-horsepower motor. Outlets for 110, 220 or combination voltages may be installed in accessible locations. An electrical clutch prevents the generator from being run while the vehicle is driven.

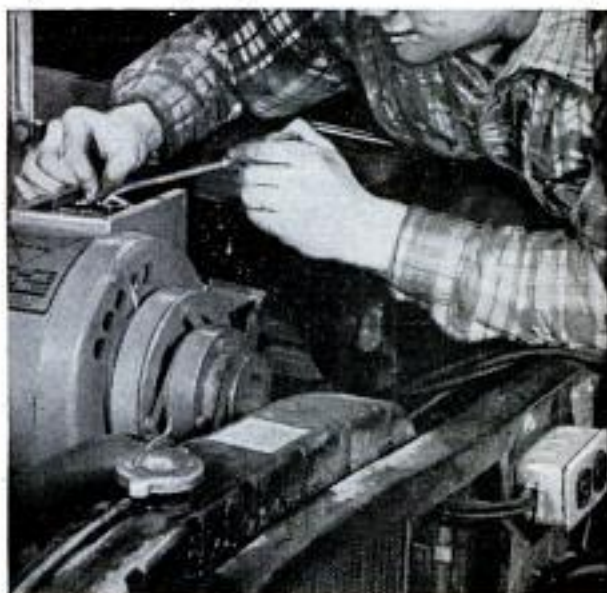
Handy man can use portable generator to power chain saw, below, or drive Sanders, drills, other tools



Above, on emergency vehicles this power source operates lights, rescue equipment, medical refrigerators



JULY 1957



Below, generator mounts under hood without removing crankshaft pulley or radiator. Outlet is at right

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Mystery Fuels for the Missile Age

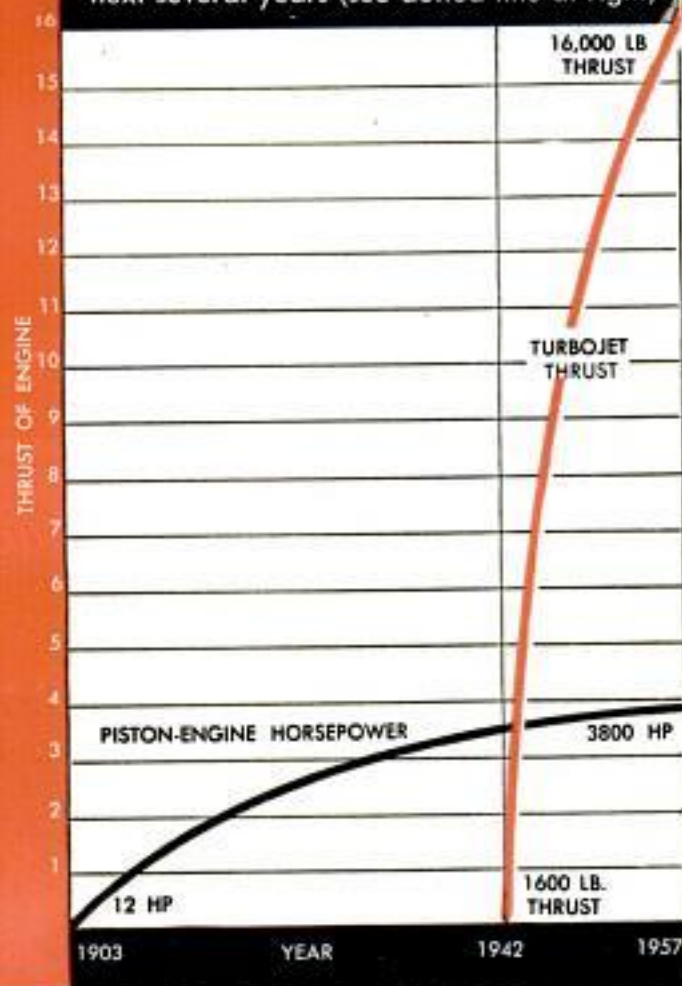


We're turning to metals and chemicals for the high-energy fuels essential to supersonic warplanes and missiles and the space vehicles of tomorrow

By
Thomas E. Stimson, Jr.

Courtesy of Aircraft Industries Association

Chart shows comparative thrust of piston engines versus turbojet-engine thrust up to 1957. With metal-chemical fuels, the curve of turbojet-engine thrust will rise in the next several years (see dotted line at right)



MILITARY AVIATION has turned to the chemistry books to find ways of making aircraft fly faster and farther.

Specifically, new fuels are being compounded that give an airplane the same superperformance that a tankful of nitromethane gives a hot-

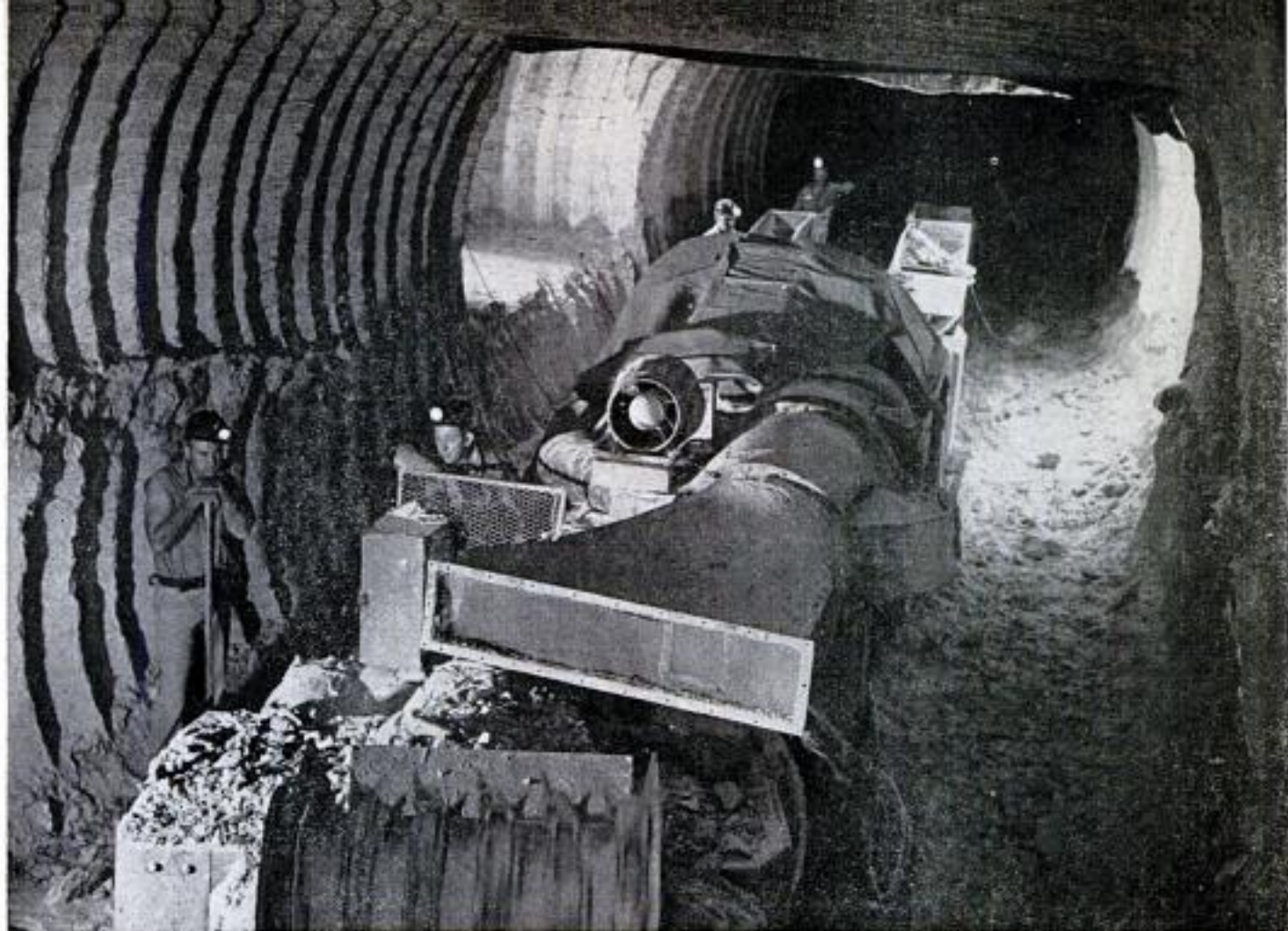
rodger's car.

"Some very remarkable propellants are being tested," a power-plant engineer says. "Some are metals. Others are so poisonous that a few whiffs of their vapor would kill you. A number are highly corrosive. Of course, fuels like these aren't practical unless we find ways of taming them. All of them are more potent than ordinary hydrocarbon fuels."

Curiously, the most satisfactory "zip" fuel found so far comes from the material from which borax is produced. Boron is one of the lightest elements. It is the basis of borax and boric acid and is widely used in enamels, in the glass industry and for producing a shiny surface on paper. Most of the world's supply is in the Death Valley region in California where it has been mined since the days of the 20-mule teams.

One group of boron chemicals known as boranes contains tremendous amounts of power in relation to its weight and bulk. A borane is a boron-hydrogen combination, and hydrogen burns with a greater heat of combustion per pound than any other pure material.

In a hydrocarbon, the hydrogen, a gas, is locked up with carbon, a solid. The resulting liquid contains around 18,000 BTUs per pound.



"Continuous miner" machine digs and loads borate ore, basis for a high-energy fuel, under California desert

In a borane, the hydrogen atoms are tied to boron atoms. This combination, also a liquid, contains something like 30,000 BTUs per pound, about a third more heat units (or power) than gasoline or kerosene.

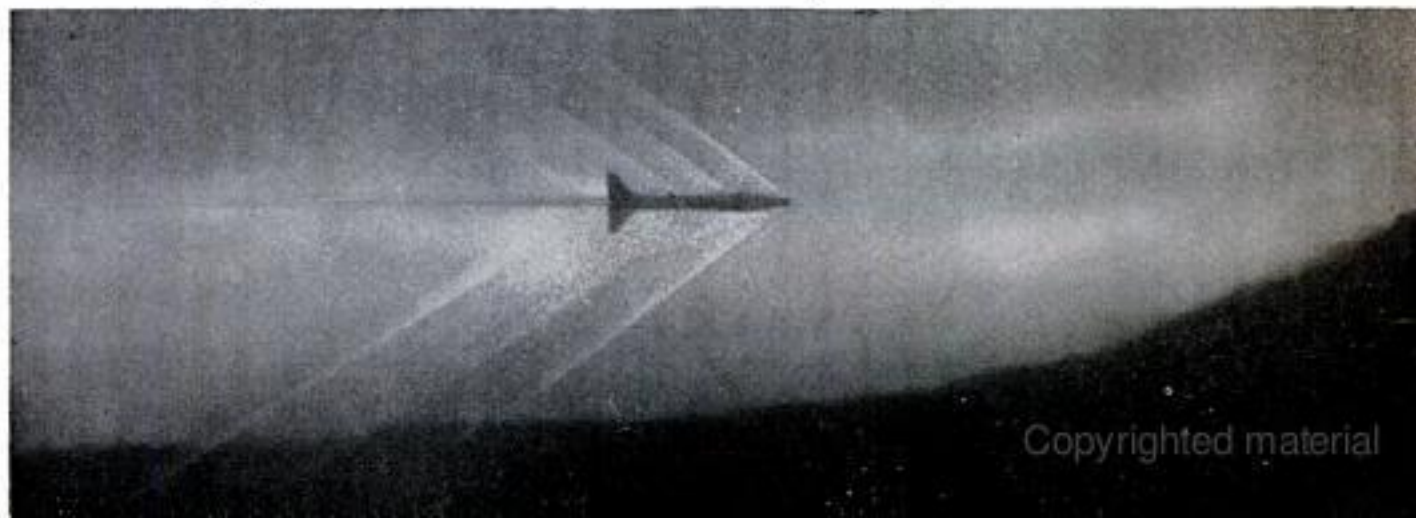
This means that in an airplane a borane can deliver a third more thrust than the same amount of JP-4 jet fuel. The ratio is actually better than that although the exact figure is a military secret.

With the extra power an airplane can fly faster at the same fuel-consumption rate or it can fly farther on the same amount of fuel. "These fuels literally deliver many more miles per gallon," a research chemist says. A borane burns efficiently at high altitudes where the air is so thin that ordinary fuels sputter and flame out.

Nevertheless, your service station isn't going to stock up on "superzip." These fuels would do more harm than good in present automobile engines. Their cost is many times that of gasoline. Besides, their products of combustion are poisonous to vegetation and possibly to humans and animals as well.

But their advantages for military aircraft and some missiles are so great that huge plants are being rushed to completion to produce them in vast quantities. This past spring ground was broken near Muskogee, Okla., for a \$38,000,000 plant in which Callery Chemical Company will produce "HiCal" for the Navy. This fuel is a combination of boron and hydrogen plus carbon. The carbon is added as a stabilizer. It

Honest John solid-propellant missile makes visible shock waves in supersonic flight at White Sands, N. Mex.





F-100 Super Sabre afterburner generates big exhaust flame on take-off. Chemical fuels will give more power

also contributes to the heat of combustion. A similar fuel is to be manufactured for the Air Force by Olin Mathieson at a \$26,000,000 plant now under construction at Niagara Falls.

It's an open secret that a borane will be used to power the world's first bomber designed from the start to operate on a chemical fuel. This plane, the WS-110, is intended to fly at 75,000-foot altitude and at three times the speed of sound. (WS means "weapons system" and may be replaced by the more conventional B for bomber when construction starts.) It is

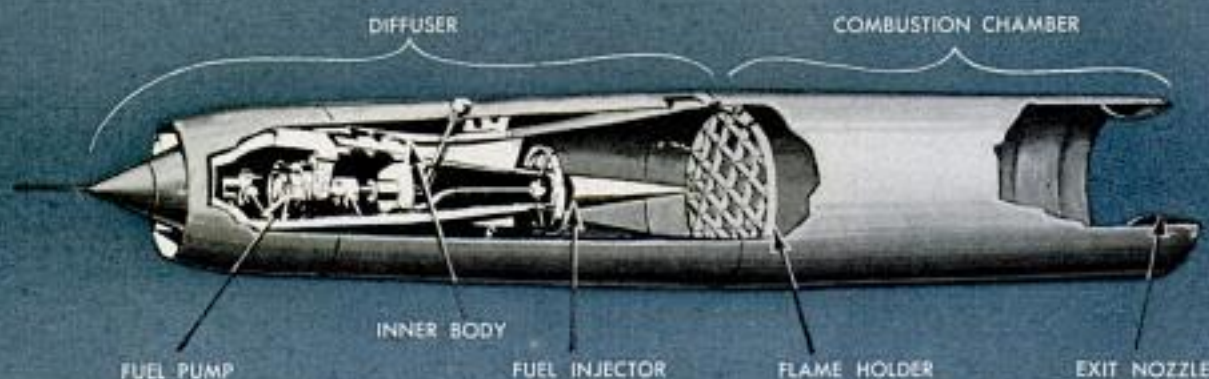
understood that the WS-110 will have a delta wing and that titanium will be used for 40 percent of its structure. North American and Boeing are making preliminary studies of the project. Long before the WS-110 is built, the present B-58 supersonic bomber and a number of other military aircraft may be re-engined to use the new exotic fuels.

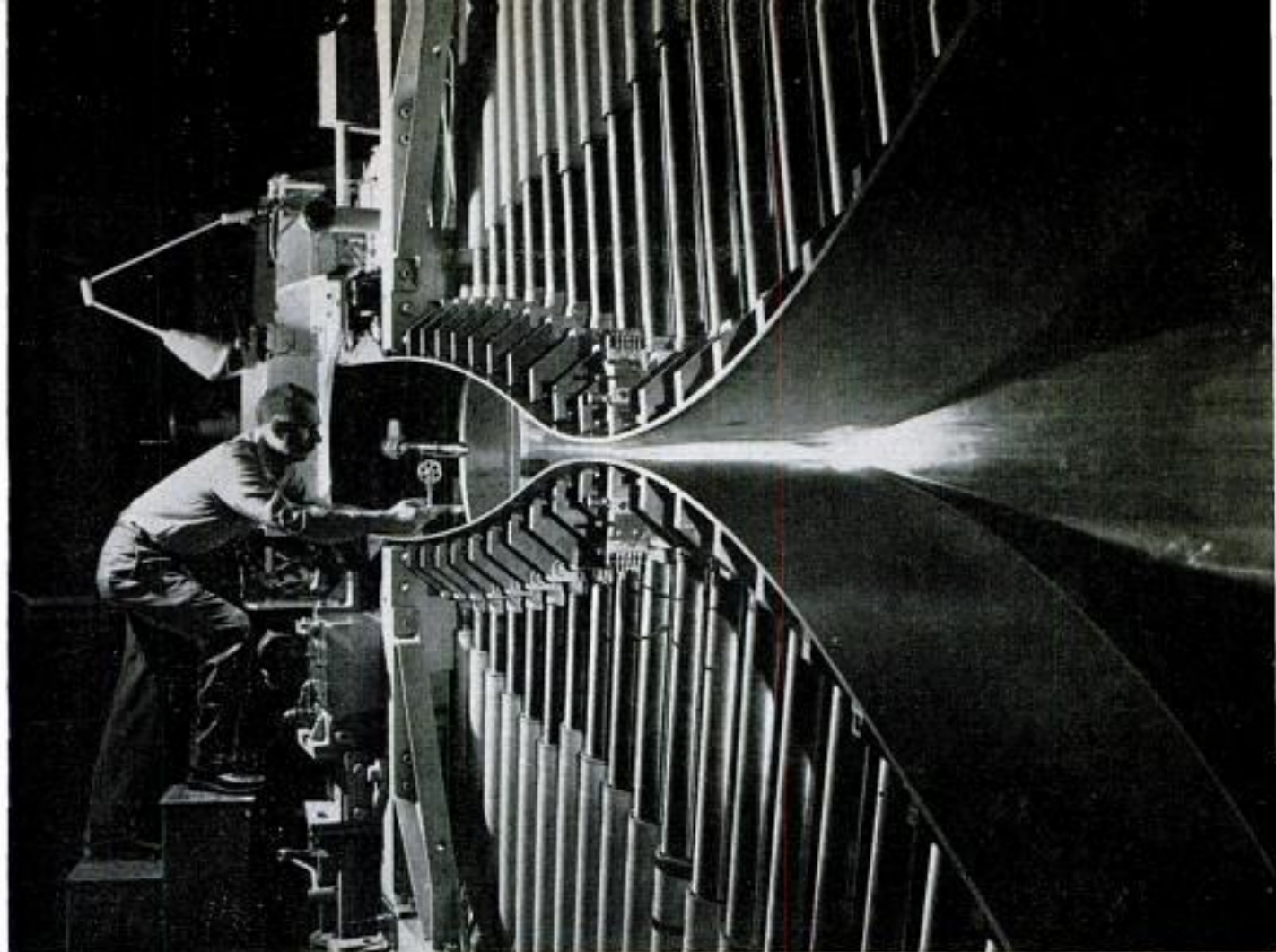
The boranes are not the only compounds being studied. Lithium is another light element and has some possibilities when hooked to hydrogen. Beryllium could be the basis of an excellent high-energy fuel

New high-performance exotic fuels are used in such missile engines as illustrated by this cutaway drawing

Courtesy of Ryan Aeronautical Co.

TYPICAL SUPERSONIC RAMJET ENGINE





Experimental model of missile at Caltech is rigged in 20-inch supersonic wind tunnel with variable throat

except that it doesn't exist in the vast tonnages needed. Nitromethane, the chemical that turns an automobile into a "bomb," can't compete with the other chemicals as an aircraft fuel. Its heat content is too low on a bulk basis.

One way of using a metal as fuel is to grind it into a fine powder, then mix it with ordinary jet kerosene on a fifty-fifty basis. Such a suspension is known as a slurry. The mixture contains more BTUs than a hydrocarbon fuel and can produce as much as 50 percent more thrust.

Powdered magnesium in JP-4 is one such slurry. Like many of the other exotic fuels it needs relatively little oxygen for combustion and is ideal for high-altitude flight. Aluminum slurry is another mixture with good characteristics. Boron is a poor slurry material because one of the products of its combustion is boron oxide. This forms a glasslike coating on the walls of the exhaust chamber and reduces thrust.

The slurries have one big handicap. They must be kept in constant agitation to prevent the metal particles from settling to the bottom. This calls for powerful stirring devices in the fuel tanks. Stronger fuel lines and pumps also are necessary. Abrasion is a big problem. There may be a way of eliminating some of this trouble: The

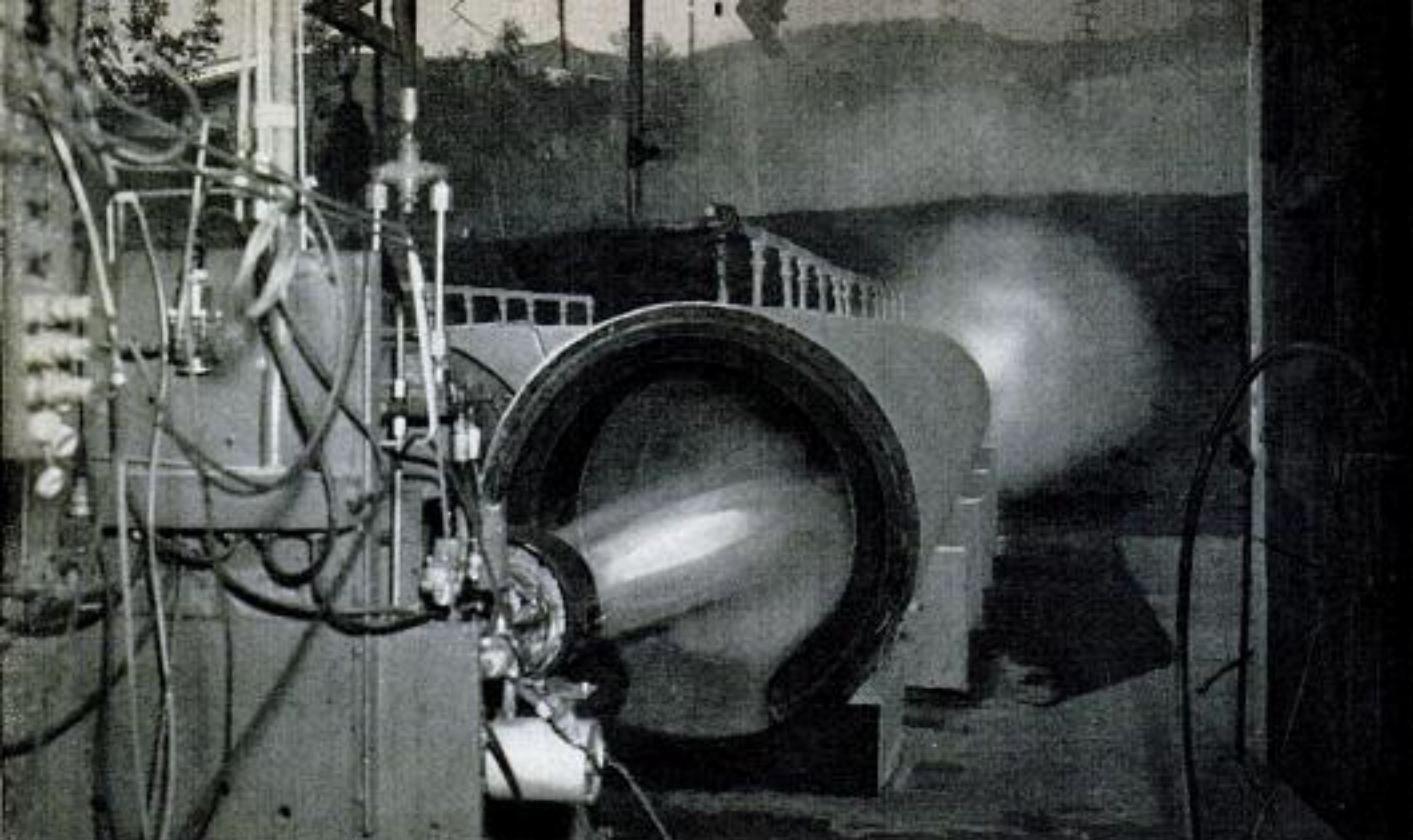
men who are studying slurries are seeking an additive which, when poured into a fuel, would keep heavy particles in suspension.

Some of the other new chemicals being studied are highly unstable; some are dangerously explosive. Thus, in the new gas-turbine-propellants laboratory that General Electric has just opened near Cincinnati, many of the tests are performed by remote control and are watched via explosionproof windows or closed-circuit TV.

Chart gives combustion-chamber temperatures for oxidizer-fuel combinations used or possible for rocket

Courtesy of Rocketdyne

COMBUSTION-CHAMBER TEMPERATURES FOR ROCKET MOTORS		
PROPELLANT COMBINATION	DEG. F.	ROCKET MOTOR
NITRIC ACID	AMMONIA	4220
OXYGEN	HYDROGEN	4500
HYDROGEN PEROXIDE	HYDRAZINE	4690
HYDROGEN PEROXIDE	GASOLINE	4830
NITRIC ACID	ANILINE	5100
FLUORINE	HYDROGEN	5100
NITRIC ACID	GASOLINE	5150
OXYGEN	HYDRAZINE	5370
OXYGEN	ALCOHOL	5560
OXYGEN	GASOLINE	5770
FLUORINE	AMMONIA	7224
FLUORINE	HYDRAZINE	7940

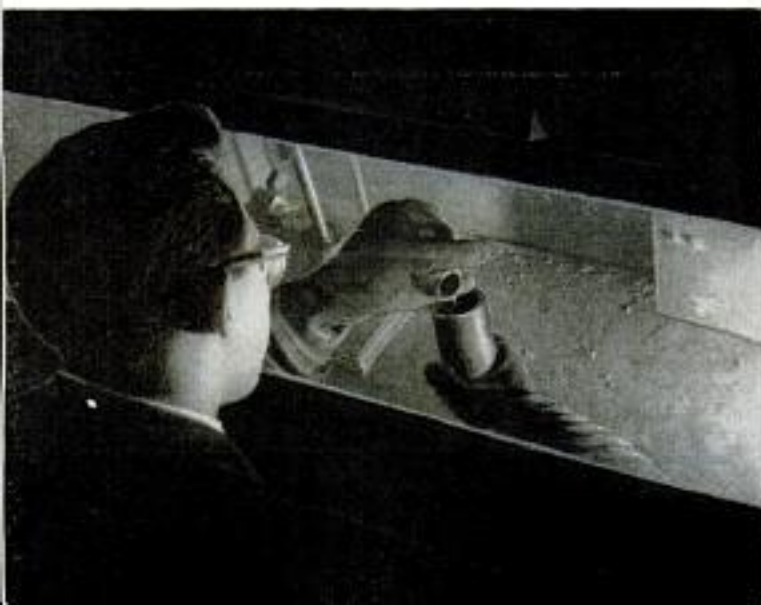


High-energy-propellant flame in experimental rocket motor is released into noise-suppression unit at Caltech

FUEL COMPARISONS

FUEL	BTU _s PER POUND
HYDROGEN	51,571
DIBORANE	31,370
BERYLLIUM	29,140
PENTABORANE	29,127
BORON	25,100
GASOLINE	18,800
KEROSENE	18,490
LITHIUM	18,460
CARBON	14,087
ALUMINUM	13,309
MAGNESIUM	10,639
TITANIUM	8,187

Above list shows heat content of fuels. Below, air-sensitive fuel is transferred to "bomb" for testing



Similarly, New York University has moved its jet and rocket-fuels laboratory to a fire and explosionproof building. Among other jet fuels being investigated at NYU is a group of monopropellants that formerly were considered suitable for rockets alone. Monopropellants contain their own oxidizer and don't need to take oxygen from the atmosphere for combustion. Some of the compounds under study include hydrazine, hydrogen peroxide and propyl nitrate.

Using a high-energy fuel is one way of getting around the basic inefficiency of present turbojet engines. Ordinary jet fuel burns at 2500 degrees F., a temperature that would soon turn an engine into junk except that the heat is dissipated rapidly. The jets operate on an air-rich mixture, an excess of air, simply to keep their temperatures down. In spite of all the research on new metal alloys and cermets, it isn't possible yet to operate a jet engine at higher and more efficient temperatures.

Until better metals are available, engineers are trying such engine refinements as "variable-geometry inlets," "convergent-divergent nozzles" and "Coke-bottle configurations" in efforts to produce more velocity at the tail pipe, thereby obtaining more thrust.

The new high-energy fuels suggest other engine modifications. The new propellants have better flame-holding characteristics; hence, combustion chambers can be shorter. This leads to other changes and the net result is a shorter, lighter engine. Not all

(Continued to page 226)



Two-Seat Jet Interceptor Gets First Test Flight

F-101B Voodoo, a long-range, supersonic jet plane designed for fast climb and high-altitude interception, has successfully completed its first test flight. Built by McDon-

nell Aircraft Corp., the plane has two Pratt and Whitney J-57 jet engines and carries pilot and radar observer. The F-101B is one of three in the Voodoo series.



You Can Have a Refrigerator in Your Car Trunk

Soon they'll put running water in cars and we won't need houses—that is, if the current trend keeps up. The newest auto convenience is an ice-making refrigerator

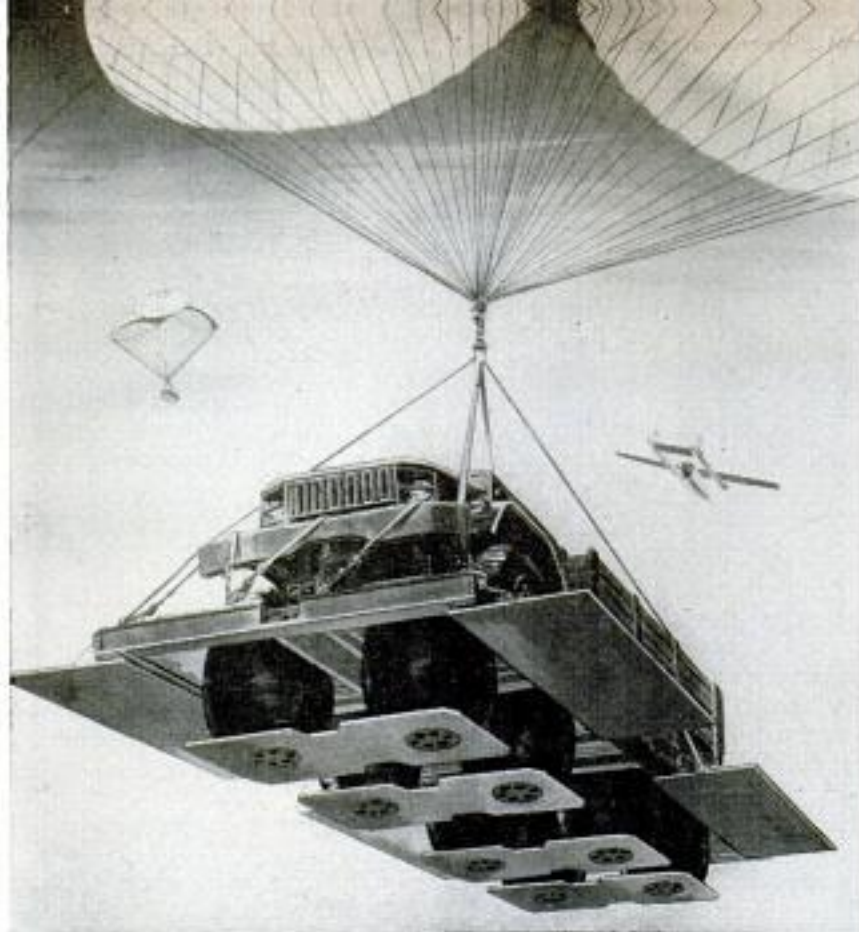
that is part of an air conditioner that mounts in the trunk. Another unit made by the same company fits neatly under the dash and is easily installed.

Swimmers Use Hands to Paddle Beach "Boats"

Fun for adults as well as children, a new small watercraft combines swimming and boating. The rider steps into a cockpit hole, picks up the craft and wades into the water.

He then sits down on a seat suspended beneath the cockpit and uses his hands as paddles. The child's version of the boat is four feet long, and will support 100 pounds.





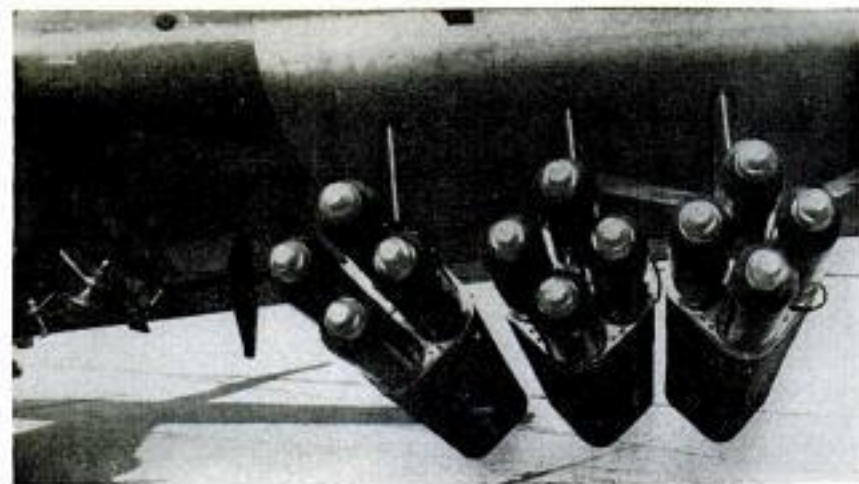
Aerial Platforms Drop Heavy Gear

Heavy fighting equipment—trucks, tanks and artillery—can be parachuted to troops on huge air-cushioned platforms. Each platform, made of magnesium, has a series of barrel-shaped nylon-and-rubber bags on its underside. When the platform is loaded into the transport plane, the bags are collapsed. As soon as the platform is ejected, uprushing air inflates them. Upon impact, the air is forced through diaphragms easing the load to the ground. The platforms are made in three sizes, the largest one 24 feet long.



Regular Motors Off, Jets Fly "Boxcar"

With both piston motors stopped, this Flying Boxcar flies 150 miles per hour powered by the two turbojet engines mounted on top of its fuselage. The jets were designed as auxiliary power if one piston engine should fail. When this was tried, their performance was so outstanding that the pilot turned off the other piston engine and the big 54,000-pound C-82 maintained its altitude and speed on the supplementary jet engines.



Rocket Missile Can Catch Jet

Newest rocket-propelled missile for the Navy is Zuni, an economical air-to-air or air-to-ground five-inch weapon that can overtake a jet plane. Costing only \$150 each, four of the folding-fin Zunis are carried in a detachable launching pod under an airplane's wing. They can be fired singly or in "ripples."



Fighter-Bomber Can Carry A-Bomb at Supersonic Speed

Nuclear bombs can be carried at supersonic speeds by the Republic F-105 Thunderchief, new fighter-bomber slated for peak production in late 1958. Powered

by the Pratt and Whitney J-75 engine, the F-105 features a cylindrical fuselage, sweptback wings, needle nose and a fin on the bottom of the fuselage near the tail.

First German Plane Since World War II

Short take-off and landing-space requirements are features of the first postwar German plane to be built. Designed by the German aviation pioneer, Claude Dornier, the four-place plane can take off in less than 300 feet, has a maximum and minimum speed of 158 and 37 miles per hour, and can climb an average of 1000 feet per minute to its top altitude of 20,000 feet.

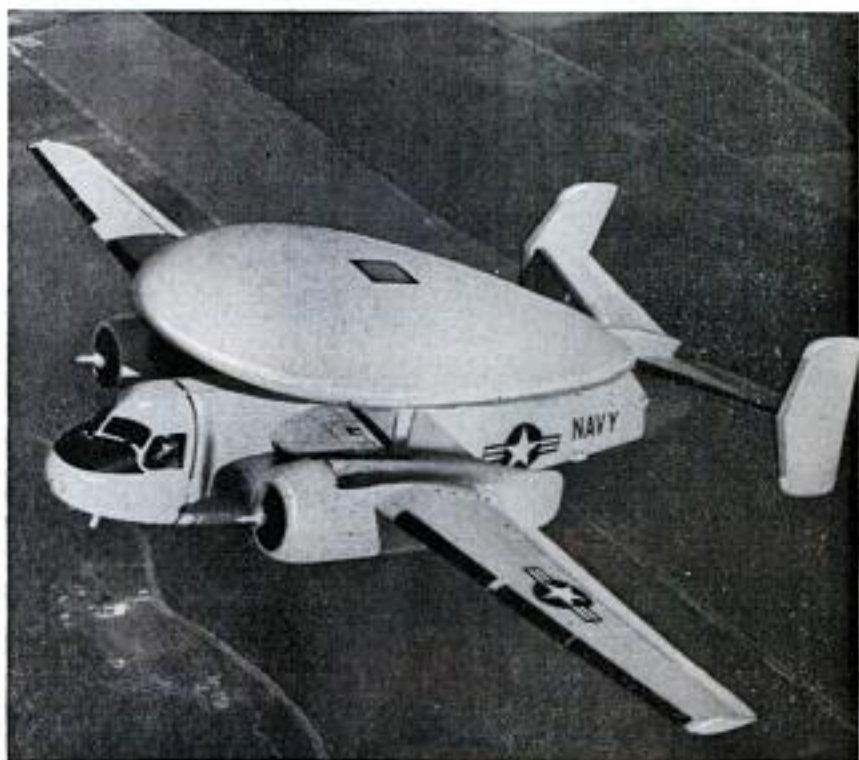


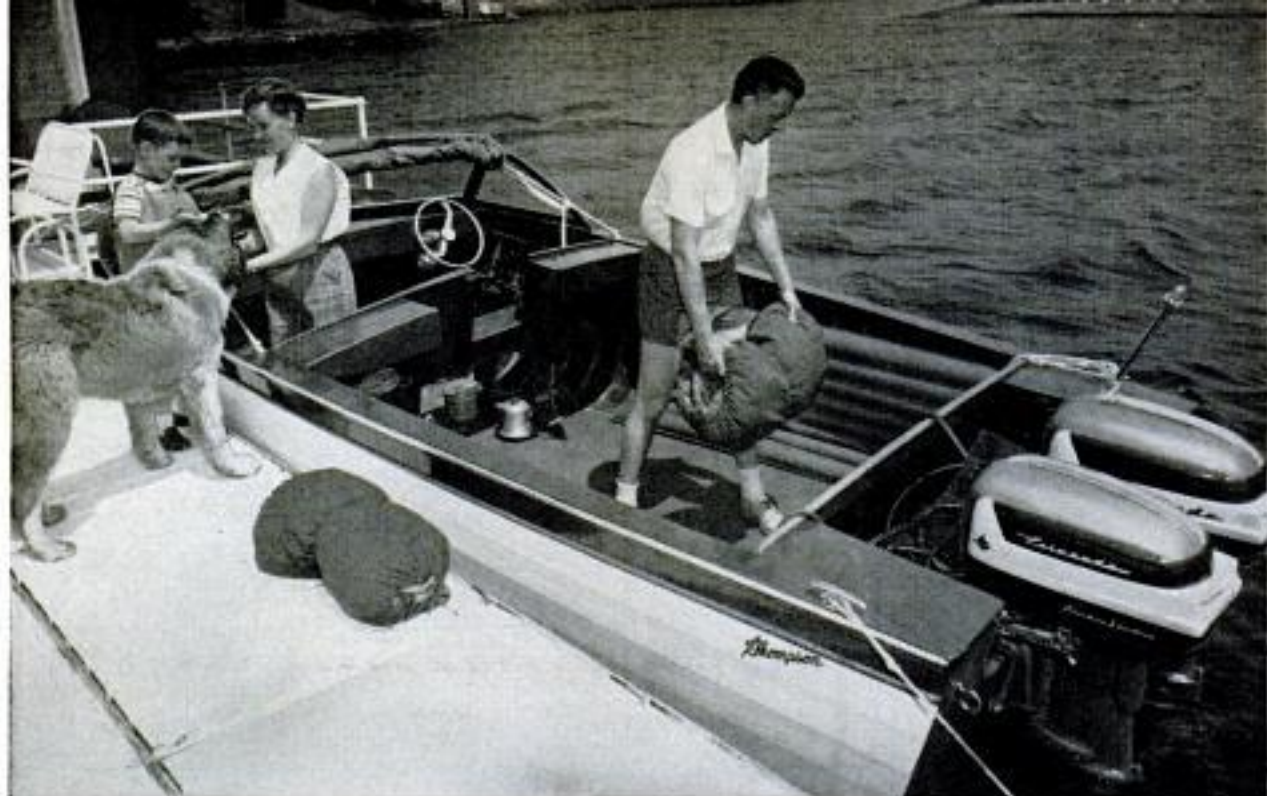
"Saucer Top" Plane To Warn Fleet

Long-range radar, its antenna housed in a saucer-shaped radome atop the carrier-based WF-2, will warn U.S. fleets of impending attacks by enemy air and sea forces. The Grumman plane also will control friendly task-force defense fighters.

Shell Cost Soars

Five-inch-caliber shells fired in World War II cost about \$100 per projectile. Today, one Navy Terrier guided missile, a modern substitute for a five-inch antiaircraft shell, costs about \$60,000 without its launcher.





Day cruising, increasingly popular family pastime, helps account for current boom in outboard boating

Our Outboard-Boat Boom

By Don Wharton

*24 Gramercy Park
New York City*

LAST YEAR Americans spent \$1,250,000,000 on boating—more than on any other recreation. They bought 275,000 boats and 600,000 outboard motors. When the war ended this country had two million pleasure craft; now it has more than six million. About half a million are sailboats, the rest powerboats—nine out of ten powered by the outboard motor. Last Labor Day the Coast Guard estimated that in the New York naval district alone a million persons

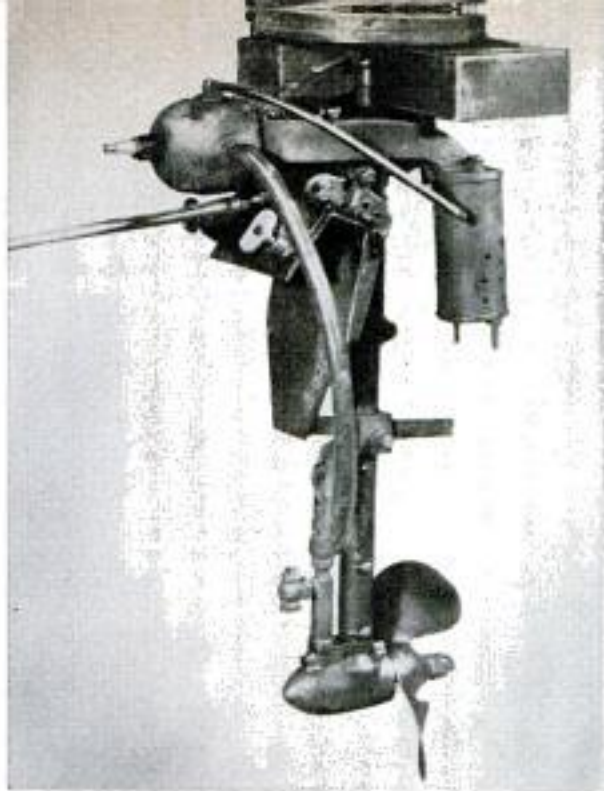
were on the water in their boats—mainly family boating. A financial publication estimates that every summer week end "... one in every eight families in the nation now goes down to the sea."

Trailers have come in for hauling boats overland, popularizing boating among families 50 to 100 miles from navigable water. Yacht clubs have been formed in such places as Wichita Falls, Tex., right in the dust bowl. Denver people are now trailing boats up to mountain lakes, Phoenix families trailing them down to the Gulf of California. In 1947, boat-trailer sales totaled only 3800. Last year they added up to 154,000.

The heart of the whole boating boom is the outboard motor—the old put-put which for years was the scorned, noisy, little wretch of the marine world. Its manufacture is the only industry I've encountered which was founded by a man and wife. The man was Ole Evinrude, born in Norway, brought to America when he was only five, raised on a small Wisconsin farm. His wife was Bess Cary, a little Milwaukee girl who on the death of her parents had to go to work at 15. Ole left the farm at 16, walked 20 miles to Madison, got a 50-cents-a-day job in an agricultural-implement plant. Later he worked in a Pittsburgh rolling mill and a Chicago toolworks. Then, moving to Milwaukee, he began making

The late Ole Evinrude, left, and S. F. Briggs, a business associate, examine a 1914-model motor





This is a 1909-model Evinrude motor. It developed one half horsepower, weighed 62 pounds, cost \$62

wood patterns for manufacturers to use in forming molds for iron castings.

Machinery fascinated him, particularly engines. He built a car around 1900, using four Harley-Davidson engines mounted on a frame he constructed of oak. But he couldn't get backers for his machine. Later he designed a gasoline engine, found a partner, went into the engine business. In six months the partnership broke up. Ole then figured that the budding automobile

First gearshift for outboard motors was pioneered on this 14-horsepower 1950-model Fastwin engine



JULY 1957

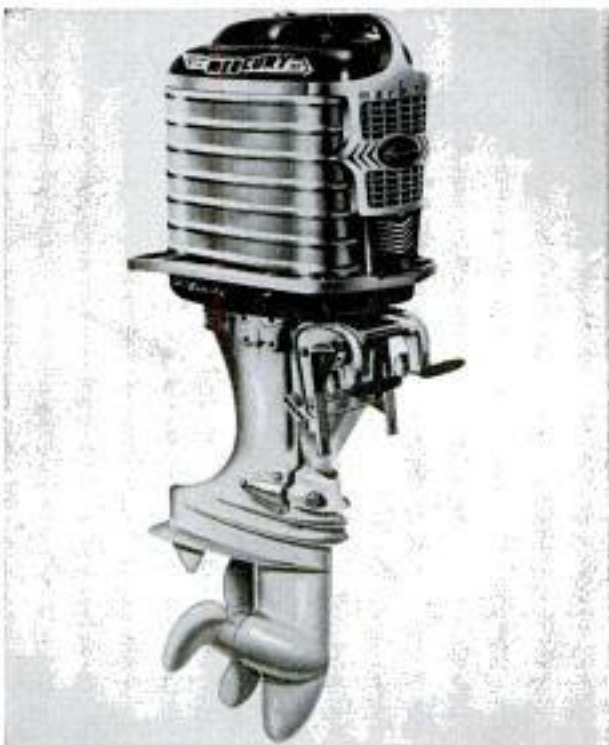


By 1929 outboard motors had come into their own. This four-cylinder Super Elto had 25 horsepower

industry needed a standard motor that could be installed in any horseless carriage. He teamed up with a retired furniture dealer, formed the Motor Car Power Equipment Company. It too failed—and again Ole went back to patternmaking in a shabby one-room rented shop heated by a potbellied stove. He was working there when he and Bess married in 1906.

Then, in spare time, in the basement of a rooming house, Ole began working on a

This Mercury Mark 75, rated at 60 horsepower, is the industry's first six-cylinder in-line outboard motor



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The rakish-styled Meteor has a glass-fiber hull, radio, leather bucket-seats, headlights and taillights

contraption destined to carry the Evinrude name around the world—a motor to be attached to the stern of a rowboat. There's a legend that Ole got the idea on a picnic when he had to row miles to get ice cream for Bess. Some say he got tired of rowing, some that the ice cream melted. Anyway, the idea wasn't new and his wasn't the first outboard motor. A Long Island firm had produced a few in 1896 and a French company had patented one as early as 1864. In 1907 a Detroit firm marketed a motor called the Waterman Porto. But Ole liked to build

Fifty-horsepower outboard motors moved storm boats of Allies across the Rhine River in World War II



for himself. He worked nights, swapped pattern jobs for parts, and in April, 1909, tested his first motor on the Kinnickinnic River, in a rented rowboat. While deck hands watched from big coal boats, the crude Evinrude motor pushed the rowboat along at five miles per hour. Ole made an improved model, loaned it to a friend one Sunday and soon had orders for 10 which he turned out when and as he could.

It would have all ended there, a spare-time operation, but for Bess Evinrude. She was only 24, frail, had her hands full with a two-year-old baby. Her only business experience was stenography and a little bookkeeping. But she was convinced that outboard motors could be developed into a real business, and for months she argued that with easygoing Ole. Then Bess wrote an ad, placed it in a Milwaukee paper, paid for it with money saved from her household funds. "Don't Row!" it said. "Throw the Oars Away!" She hoarded the replies until they made a big stack, then one evening showed the whole bunch to Ole.

Next, Bess set out to help him get capital. Banks, investment houses, businessmen weren't interested. But Bess found a tugboat owner, Christopher Meyer, who put up \$5000 for half interest in a new firm. Space was rented in a shabby red-brick factory building, secondhand machinery secured. While Ole handled production, Bess managed distribution, sales, advertising, bookkeeping. Bess had a keen business mind, much imagination. She hid her sex by signing all business letters "B. Evinrude." When she found orders dwindling in wintertime she began a hunt for new markets. She lined up an export company which introduced outboards to Scandinavia, shortly had enough orders to keep the factory busy the year 'round.

By 1913 there were 300 employees, Evinrude was an international word and Theo-



Scott-Atwater photo

Even youngsters can learn how to handle small boats properly with today's easy-to-operate outboard motors

dore Roosevelt was taking the outboards with him to Brazil for exploration of the River of Doubt. The Evinrudes sold out to Meyer for \$140,000 and began roaming the country, but Ole couldn't keep his mind off motors. In 1921 he came back with new designs: A two-cylinder outboard with less weight, more power. He tried to sell it to his old company but Meyer turned him down flatly. So he and Bess, with most of their money gone, again went into business together—"the perfect partners," someone called them.

They named the new motor Elto, coining the name from the first letters of the words Evinrude's Light Twin Outboard. The first year they lost \$10,500, then the Elto caught on, began outselling the Evinrude. By 1928, profits were nearly \$1000 a day. The next year Elto and Evinrude were merged in a firm ultimately called Outboard Marine, with Ole president and largest stockholder. Bess died in 1933 and Ole 14 months later.

Switch From Bikes to Boats

The second biggest push to the outboard industry came from three Johnson brothers, Lou, Harry and Clarence, who in 1921 found that their business—making a motor for bicycles—was flopping. They switched to an outboard motor, helped spark the drive for more power, and for outboard racing. The depression hit the Johnson company hard. In 1936 it, too, was taken over by Outboard Marine which today has three motor plants in the United States, one in Canada, another starting this year in Europe.

Outboard Marine is the "General Motors" of the industry, accounting for over half the total American volume. It has 7500 employees, makes both the Johnson and Evinrude motors, and has a third division producing outboards for mail-order houses and other firms. There are half-a-dozen well-known American makes now, includ-

ing Mercury, Scott-Atwater, West Bend, Champion and Oliver.

During the war, Johnson and Evinrude built 18,000 special outboards for the armed forces: Rugged, 50-horsepower units that saw service on most fighting fronts. Engineers used them to push pontoons into place quickly for bridges; the Navy dropped them from the air, along with rubber lifeboats, to bomber crews adrift at sea. The most spectacular employment came in Montgomery's massive crossing of the Rhine, when the first assault waves were carried in hundreds of storm boats powered by these outboards. Before the 9th Army moved up into position for the river crossing it checked personnel-record cards, found which men had given motorboating as a hobby, selected hundreds for special training at a German officers' swimming club near Maastricht. These men, for days before H-hour, were observed working over outboards in barns and under trees. The engineers even secured 1000 electric heating pads—to warm the motors for quick starting.

Longer Week Ends Boost Boating

After the war, social and economic changes in America began boosting outboard boating. Rising living standards were an influence, more and longer vacations, the five-day week and the whole trend from spectator to participation sports. Another big factor: Highways, parks and playgrounds were getting too crowded. Families turned to the water as the last frontier and outboards were changed to lure them. Electric starters became available, eliminating the business of pulling a cord, thus enabling wives and children to use the family boat when the husband was away. Gearshifts came in, boats could be started in neutral, reversed, more easily maneuvered. Separate fuel tanks made longer

(Continued to page 240)



Portable Baby Crib Easily Handled by One Person

Traveling on casters, a plywood baby crib can be handled by one person. The casters are on the ends of the legs, which

slide out. Then the two ends separate and the mattress, hinged bottom and safety guard all unfold to form the bed.

Homemade "Vacuum Sweeper" Collects Millions of Aphid Enemy

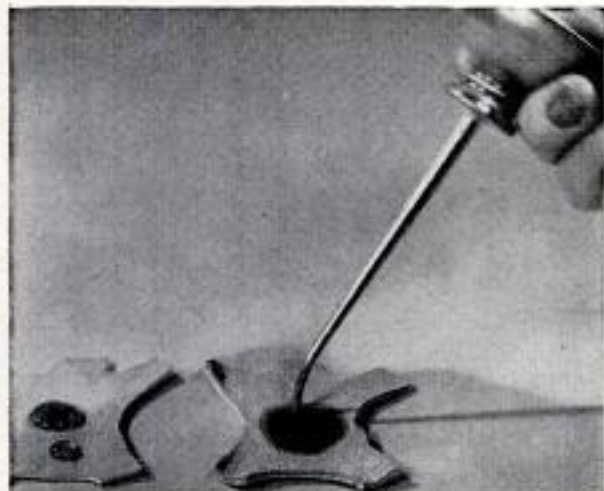
Fifty million parasite enemies of the spotted alfalfa aphid in California are "vacuumed" in a half hour by biologists

for redistribution to aphid-hit fields. A fan, mounted behind a truck, sucks parasites into canvas sacks through a wide scoop.



Moisture-Repellent Chemical Protects Clothing

Pouring oil on a sleeve (instead of the salad) without staining the cloth is now possible if the coat has been impregnated with a new fluoro-chemical. Fabric fibers coated with the chemical resist oil or water and the staining ingredients they carry. Because the treated fibers can't absorb oil or water, they form in beads on the cloth, as in the lower right photograph. The beads can easily be blotted. Even suede leather's natural "oil hunger" is made resistant by the chemical (see photograph below). Upholstery can be treated with it, too. A cleaning solvent such as carbon tetrachloride can be used to help remove stains without leaving a ring. The chemical is being used by some manufacturers of clothing, suede leather and furniture upholstery, and products treated with it will be available late this summer.



Economy Sports Car: The \$1600 Berkeley

Weighing 700 pounds (less than half as much as an MG or a Triumph), the British Berkeley sports car is sold in this country for about \$1600. The body is plastic. The engine, a two-cycle, two-cylinder air-cooled job, drives through the front wheels and,

thanks to the light weight, is said to yield as many as 70 miles on a gallon of gasoline. Cruising speed is about 70 miles per hour. Only 130 inches long and 42 inches high, the automobile has a surprising amount of headroom and luggage space.



OWNERS REPORT:



Here's What Oldsmobile Owners Like:

They like most its power and performance. Most of them bought Oldsmobile because of previous ownership, in fact 62.6 percent of them traded in Oldsmobiles when buying this 1957 model. An even higher percentage (69.4 percent) expect to buy Oldsmobile next time they buy a new car.

Here's What They Don't Like:

Their biggest complaint is that the Olds uses too much gasoline. Although Oldsmobile is certainly not sold as an economy car, only 6.9 percent of the owners say that they do not care about gas economy. Apparently, most owners, regardless of price class, are seriously concerned about economy.

What Is an Owners Report?

Each month *Popular Mechanics* sends questionnaires to 1000 owners, asking for frank and informed opinions of their cars. The Owners Report is a digest of their opinions and summarizes the experiences of hundreds of owners during millions of miles of driving.

NEXT MONTH: The 1957 Mercury

Owners in 39 states from coast to coast (shaded on map) tell you about their Oldsmobiles





Power to accelerate is what Oldsmobile owners like most. Some complain about the three-piece rear window

Power Is Oldsmobile's Top Feature, Say Owners From Coast to Coast

By Oldsmobile Owners

OLDSMOBILE IS STILL a "rocket," the PM survey shows. Owners of the 1957 Oldsmobile place power and performance at the top of the best-liked list.

Second best-liked feature is handling ease, followed by riding comfort and exterior styling in that order. Fifth on the list is roadability.

"Has tremendous power from a dead stop and a wonderful pickup at high speeds."—Indiana attorney.

"It has plenty of power. I believe the Rocket engine is responsible for the rise in Oldsmobile popularity. I like the speed, but I don't abuse it. It could have less speed and I would like it just as well."—Illinois salesman.

"It's a big car, yet it handles as well if not better than a smaller car."—New York owner.

"I like its ease of handling and its feeling of balance."—Wisconsin attorney.

"Olds is as easy riding as anyone could want."—Nebraska businessman.

"Just returned from a trip to Florida. Traveled about 500 miles a day. Car rode wonderfully, never tired from riding."—New York superintendent.

"It has eye appeal. Oldsmobile has not gone overboard in body styling."—Ohio elevator manager.

"Looks nice. Modern lines, but avoids extremes in fins."—Florida store owner.

"Holds the road well. Exceptionally good in cornering."—Washington foreman.

"When driving fast, the car is under my control at all times, even around curves. I have tried this at 70, so I should know."—Massachusetts electrical worker.

But They Complain, Too

Although Oldsmobile has the highest "Excellent" rating of any 1957 car to date (and, incidentally, the second lowest

Lowness is stylish, say owners, but at times like this, it is an accomplishment to get in or out gracefully

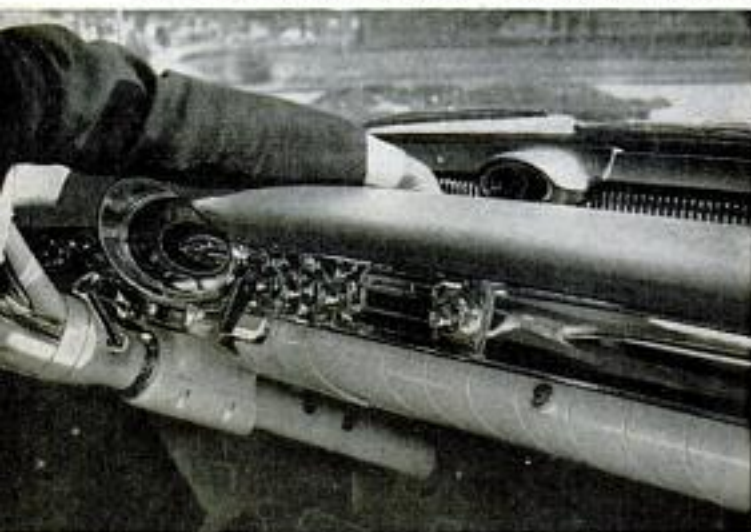




In a year of smallish glove boxes, Olds has one that is two feet long, but height and depth are restricted



Rare indeed is this example of poor assembly, but it did occur on the test car: incorrectly spelled name



Above, hand reaches into opening between dash and windshield. Some owners like this feature, others do not. Below, miniature jet planes on front fenders make it more difficult to wash and polish the car



"Poor" rating), it does have owners who complain. In fact, only 23.6 percent of the owners make no complaints at all and this is a comparatively small percentage.

What do Olds owners complain about? Tops on the list is poor gasoline economy. The owners like the fast, exciting performance, but they don't seem to like the lowered fuel economy that goes with it.

Second on the complaint list is poor assembly work; third is poor paint or chrome; fourth, body noises and rattles.

"When I first purchased the car it was getting only five to seven miles per gallon so they changed the rear end which did help a bit. It still uses too much."—Illinois radio engineer.

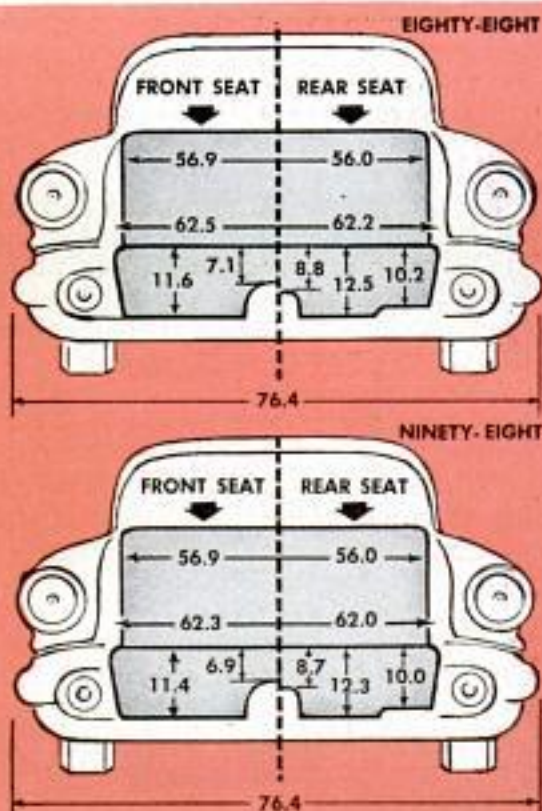
"I and many like me who travel 20,000 miles a year must pay through the nose for a comfortable ride. With gas more than 32 cents a gallon, I average about 9½ miles over-all."—California sales representative.

"Cars are not inspected properly. There were at least 25 faults. We are still trying to get corrected such faults as defective places in paint, car higher on one side than the other, one shock missing, and others. When one pays over \$5000 for a car I think he is entitled to a perfect machine."—California sales manager.

"Of the three Oldsmobiles I have owned,

(Continued to page 220)

Drawings show how the 88 and 98 differ. Virtually all the added length of the 98 is in rear overhang



THE OWNERS' OPINION OF THE OLDSMOBILE

Had trouble with engine?

No trouble	82.2%
Some trouble	14.7%
Considerable trouble	3.1%

What was engine trouble?

Carburetor	4.9%
Transmission	2.2%
Valve troubles	1.8%
Power steering	1.3%
Poor idle	1.3%

Performance

Would like faster acceleration?

Yes, would	14.4%
No, would not	74.0%
Undecided, no answer	11.6%

Would like more top speed?

Yes, would	5.1%
No, would not	88.4%
Undecided, no answer	26.5%

What is car's horsepower?

Knew horsepower	61.7%
Did not know it	38.3%

Have checked gasoline mileage?

Yes, have checked it	75.3%
No, have not	17.8%
Don't care about it	6.9%

Styling

Best-liked exterior feature?

Simple lines	18.1%
Grille, front bumper	16.7%
Low body	12.8%
Side trim	10.1%

Least-liked exterior feature?

3-piece rear window	15.4%
Front grille and bumper	7.0%
Wrap windshield	4.4%
Fender ornaments	4.0%

Best-liked interior feature?

Dash and instruments	23.8%
Upholstery	17.2%
Colors	6.2%

OVER-ALL RATING

Excellent Average Poor

75.0% 22.1% 2.9%

Least-liked interior feature?

Dashboard design	5.3%
Glove box	4.8%
Floor mats	4.8%

Miscellaneous

What car will buy next time?

Oldsmobile	69.6%
Other GM make	4.0%
Ford Motor make	1.8%
Chrysler Corp. make	5.7%
Other make	0.4%
Undecided	18.5%

How is dealer service?

Excellent	51.7%
Average	37.9%
Poor	10.4%

Would buy from him again?

Yes, would	41.4%
No, would not	13.5%
Undecided, no answer	45.1%

What make of car was traded?

Oldsmobile	62.6%
Other GM make	19.4%
Ford Motor make	7.5%
Chrysler Corp. make	2.2%
Other make	1.8%
No trade, no answer	6.5%

What about "strut" dashboard?

Like the design	69.9%
Don't like it	6.4%
See no advantage	23.7%

What about power-heater controls?

Like the controls	77.2%
Don't like them	9.1%
Undecided, no answer	13.7%
Had trouble with them	19.2%
Have had no trouble	80.8%

Why did they buy Olds?

Previous ownership	27.2%
Exterior styling	20.9%
Resale value	4.7%
Performance	5.2%

What should be changed?

Nothing at all	33.5%
Improve gas mileage	12.0%
Better heating system	5.8%
Easier to get in, out	5.8%
Front grille	4.7%
Rear-view mirror	4.7%

Best-Liked Features

Power, performance	44.0%
Handling ease	34.6%
Riding comfort	34.0%
Exterior styling	31.4%
Roadability, cornering	12.6%
Rocket engine	7.9%
Sturdy body	7.3%

Most-Frequent Complaints

No complaints at all	23.6%
Poor gasoline economy	23.6%
Poor assembly work	14.1%
Poor paint, chrome	12.6%
Body noises	9.4%
Hard to get in, out	8.4%
Heater operation	6.3%
Hydra-Matic	5.8%

Olds is very low

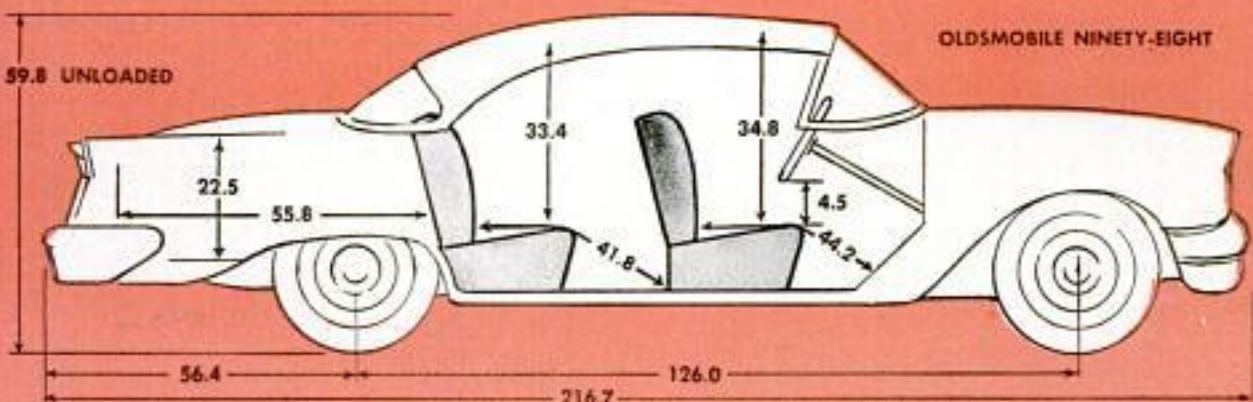
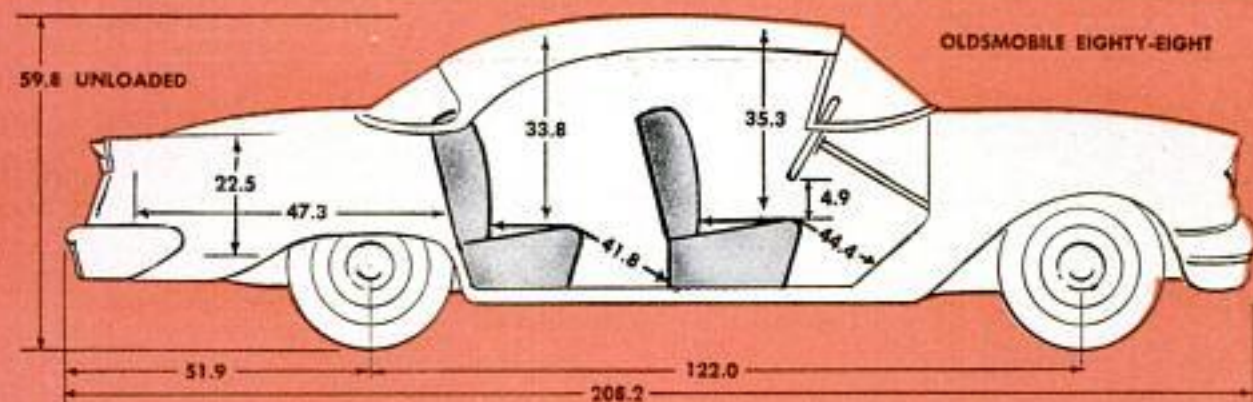
Like this lowness	81.4%
Don't like it	15.8%
No answer	2.8%

Olds is very long

Like this length	87.1%
Don't like it	6.2%
No answer	6.7%

Olds is very fast

Like this speed	87.4%
Don't like it	5.6%
It's not fast	0.9%
No answer	6.1%



An Engineer Analyzes the 1957 Oldsmobile

By Dale Kelly, SAE, Registered Professional Engineer

MODEL TESTED: Super 88 four-door sedan with J-2 carburetion (three two-barrel carburetors, two of which open at three-quarter throttle or beyond), dual exhausts, automatic transmission, power steering and power brakes.
Rear-axle ratio: 3.42 to 1. Wheelbase: 122.5

inches. Tires: 8.50 by 14. Weight: 4335 pounds with gas tank half full (57 percent on the front wheels, 43 percent on the rear).
Mileage on car at time of test: 400 miles.
Barometer: 29.10 inches. Temperature: 55 degrees F. Payload: 200 pounds.



ACCELERATION TIME FROM STANDING START IN SECONDS

	0 to 20	0 to 40	0 to 60	0 to 80	1/4 mile
Ignition timed for regular gasoline, 90 octane (Research)	2.7	6.6	10.7	18.5	18.6
Ignition timed for premium gasoline, 97 octane (Research)	2.4	6.1	10.2	17.5	18.2
Ignition timed for super fuel, 105 octane (Research)		5.9	10.0		

All acceleration runs made with transmission in "Drive" range.



FUEL ECONOMY IN MILES PER GALLON

	Steady 30 m.p.h.	Steady 50 m.p.h.	Steady 70 m.p.h.	Traffic Route
Ignition timed for regular gasoline, 90 octane (Research)	21.6	14.8	13.6	9.6
Ignition timed for premium gasoline, 97 octane (Research)	21.6	14.8	13.4	10.1

On the traffic route the car makes 10 full stops per mile and is driven fast enough to average 15 miles per hour.
Estimated average ANNUAL GASOLINE BILL: \$202 for 10,000 miles.



SPEEDOMETER ERROR (miles per hour)

Speedometer speed	20	30	40	50	60	70	80
True speed	22	31	39	48	58	69	80

ODOMETER ERROR

Odometer registered 104 miles when car traveled an actual 100 miles.



DRIVER'S VISION (for an average driver—5 feet 9 inches tall)

Distance at which part of road in front of car could be seen (A in sketch)	16 feet
Distance at which full width of road in front of car could be seen (B in sketch)	21 feet



GROUND CLEARANCE (unloaded car)

Radius of worst dip that could be crossed (solid line)	24 feet
Radius of worst hump that could be crossed (dotted line)	21 feet
Deepest rut car could be driven in	6.5 inches
Curb clearance for door opening	12.5 inches

MISCELLANEOUS

STEERING

Steering-wheel turns from straight ahead to steer outside front wheel in a circle with a 100-foot diameter: **0.85 turns.**

Diameter of the smallest circle in which the wheels could complete a circle (curb-to-curb): **43.25 feet.**

Diameter of the smallest circle in which the entire car could complete a circle (wall-to-wall): **45.5 feet.**

Steering-wheel turns, lock-to-lock: **4.4 turns.**
Steering-wheel diameter: **17.0 inches.**

TRUNK CAPACITY

Number of standard cartons (1 cubic foot each) that could be packed into trunk: **10 cartons.**

CENTER OF GRAVITY (unloaded car): **23.6 inches.**

WATER RESISTANCE

Fair. In the splash-pan test, brakes and ignition were not affected and no water entered the body. In high-pressure car wash, water came in around the right ventilator pane.

OBSERVATIONS

Instruments: Excessive chrome on instrument panel makes instruments hard to read. Worst offender is the chrome in the center of speedometer. Because the speedometer (and clock,

also) is elliptical instead of round, every five-mile-per-hour interval between 30 and 90 is compressed into 1/4 inch or less, further reducing readability. On the clock, 6:30 is easily misread as 7:30. The water-temperature gauge, like the ammeter and oil-pressure gauges, has been replaced by signal lights. A green "cold" light is supposed to go out when the water reaches 113 degrees F., and a red "hot" light comes on if the water reaches 232 degrees F. The 113-degree mark is too low for good engine life and the 232-degree mark is higher than is normal or safe.

Transmission: Hydra-Matic has a simple fluid coupling instead of a torque converter and torque multiplication is obtained with planetary gears, four ratios being available. Shifts from first to second and from third to fourth are made by filling an auxiliary fluid coupling and were almost imperceptible in the test car, but shifts from second to third are by mechanical clutch and were quite noticeable.

Headroom: Good in front, poor in rear.

General: Gas tank holds 20 gallons and could be filled at more than 15 gallons per minute when empty. Brake vacuum-reserve tank provided four to five full applications with engine dead. Parking brake held on a 14-percent grade.



Driving the 1957 Olds Super 88 Holiday

By Floyd Clymer

THE TEST CAR was a Super 88 four-door hardtop fitted with a 277-horsepower J-2 engine fed by the three two-barrel carburetors.

This car loafs along at 90 miles per hour without strain. Top speed by the speedometer was about 120 miles per hour which was about 10 percent on the high side (slightly more than the usual error).

There is the feel of a really heavy car. It might even be considered a little on the cumbersome side for certain kinds of driving. You cannot throw it into slides or corners as fast as some previous Oldsmobiles. The front end is extremely soft. It gives a very comfortable ride in normal straight-away driving and at moderate cornering speeds. In fast cornering, the car has good stability despite considerable roll.

The rear-seat ride is good. However, on sharp bumps or dips the rear end sometimes bottoms with a full passenger load. The front suspension has a considerably reduced front-end dive during braking.

The car is free of vibration and gives a smoother-than-average ride. There is a flexible coupling mounted in the base of the steering column to absorb road shocks before they reach the steering wheel. A constant slight drag on the steering wheel gives a simulated "feel of the road."

Few cars can touch the Super 88 when it comes to hill climbing or acceleration. Economy is not high, but it is not expected to be with a high-performance engine. All cars with high-performance equipment seem to be getting less mileage than in former years.

Brakes are probably satisfactory for normal driving, but they certainly could be improved for the hard driver or for regular driving in mountainous territory. The effective braking area of 191.7 square inches is not enough for such high performance and weight and is less than most other cars of about the same weight. I found considerable brake fading, especially when slowing down from high speeds or descending steep mountain curves.

The Hydra-Matic transmission (Olds calls its new version the Jetaway) has four forward speeds. A good feature is the downshift, available at any speed below 65 miles per hour by depressing the throttle part way (about halfway down). The "Super"

position ("S" on the quadrant) is good for city driving or in hills as it uses only three of the four speeds, locking out the top. Low can be used for braking on hills.

No squeaks or rattles developed in the solid-feeling body. The doors sound solid and tight. They open and close easily. Body rumble and wind noise at high speed are quite low. Olds is again using two metal strips to divide its rear window.

The driving position is comfortable. Cushions are well padded and have good springs. Nicely located armrests are built into each door and not merely bolted on. The interior of the body is luxuriously finished.

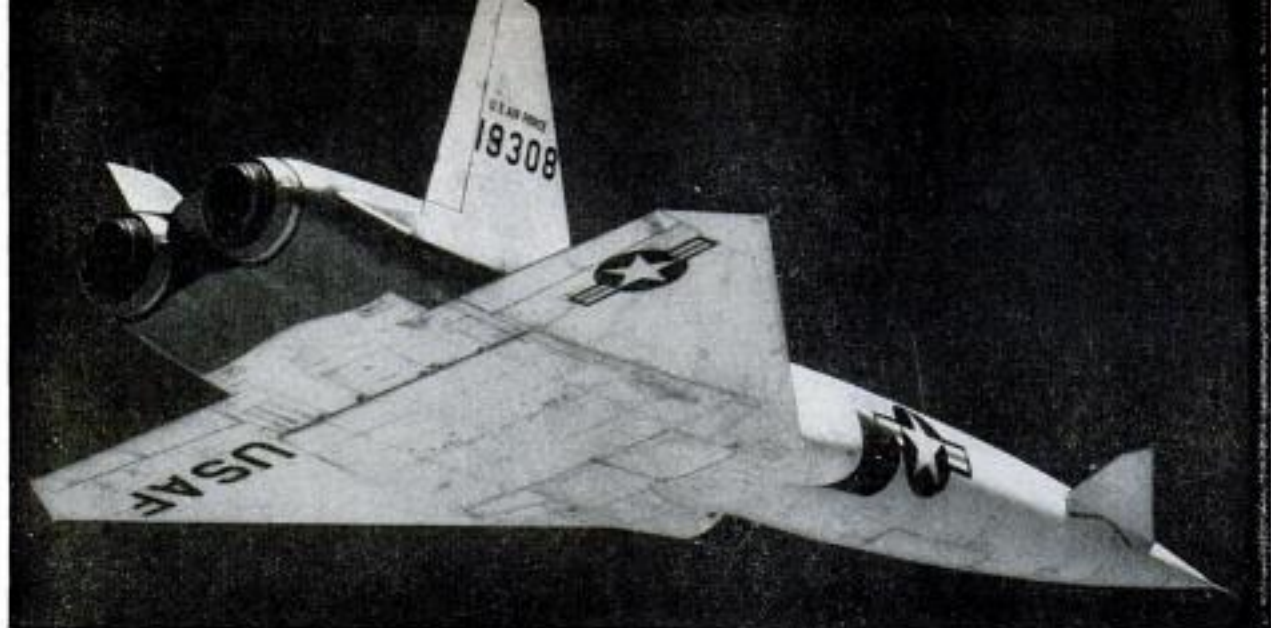
The relative locations of the throttle and brake pedals are good. The parking brake is operated by the left foot and is easily released by pulling on a small lever with the left hand. This parking-brake pedal is too high and seems to require more foot pressure than should be necessary. There are no ratchet graduations on the pedal travel and it must be pushed down as hard as possible before you feel it is in a securely locked position.

Several innovations have been designed into the new instrument panel. Power-assisted operation of both heating and ventilating systems is by push buttons. There is no need to move levers long distances to open and close vents. You merely press a button and engine vacuum does the work for you.

Warning lights are used instead of needles for generator, oil pressure and water temperature. I prefer the needles. One unusual feature is a green light that indicates that the engine is cold. This serves no purpose as the engine warms up so quickly that the light goes off in a minute or so after starting the engine.

Sun reflections are reduced by the padding atop the instrument panel. At the base of the windshield on top of the dash there is a wide slot which may be ornamental, but is a trap for small objects.

Bumpers are massive. The front one is too big and too low, being less than nine inches from the ground—even lower than bumpers on low sports cars. The rear bumper affords excellent protection and its lowest point is 14 inches above ground, which is ample clearance. ★ ★ ★



Engines and Landing Gear Bring Home Test Missile

Recovery of the U.S. Air Force X-10 unmanned test missile has been made possible by two turbojet engines and landing gear on the missile. At completion of a test, turbojets carry the craft to an airfield to alight on the landing gear. X-10 is test vehicle for the SM-64 Navaho surface-to-surface intercontinental missile



Navigation Ship Guides Missiles

Converted from a cargo craft, a new Navy vessel is being equipped with "the most fantastic array of navigation instruments ever assembled in a ship," according to the Navy. The vessel will provide navigational information for testing 1500-mile-range guided missiles. Precise navigation instruments determine the ship's position, true north, and the speed over the ground. A telescope equipped with a photo-electric cell is so sensitive that stars become visible in daylight. The telescope, regardless of rolling and pitching, will automatically align itself on a star. Instruments to be installed will be able to see the sun, moon and certain stars by detecting the radio signals they give off, making celestial navigation possible even when clouds cover the sky. Eventually the ship will locate position by radar.



"Star tracker" checks navigation even in daylight. Below, an officer inspects a graph recorded automatically by instruments



Powered Roller Packs Evenly

Power for these lawn rollers comes from a 2½-hp. engine. Biggest roller (below) weighs 1000 pounds loaded



Self-propelled, water-filled lawn rollers are easing tasks for the home gardener. A 2½-horsepower engine moves the roller at a constant speed forward or reverse to provide even packing. Forward-reverse engine transmission is controlled by one lever for instantaneous response under full load. The standard roller unit has a wide rear roller for balance and weighs 265 pounds empty and 610 pounds filled with ballast. Another model is equipped with an easy-turning rear caster, instead of the wide roller, for maneuverability; this roller assembly weighs 250 pounds empty and 595 pounds filled. The third model can be used from lawns to "hot top" paving and has two rollers and a seat for the operator; empty weight is 425 pounds; filled weight is 1000 pounds.

Heavy Boot Holds Prisoner

Prisoners hoping to run away while en route to another jail or to court may change their minds after wearing an 18-pound, lead-weighted boot. The device is used only on one foot and is locked with a chain around the small of the prisoner's leg to thwart removal.

Pistol Gives Wave-off Signal

Pilots flying faulty aircraft or making wrong approaches to landing strips can be waved off by a shot from remote-controlled Very pistol. Fired downfield in the flier's range of vision, this signal makes it possible to wave off a pilot in the final moments of his letdown, even after the control tower can no longer communicate with him. The device, developed by a noncommissioned Navy air officer, has been granted a United States patent.





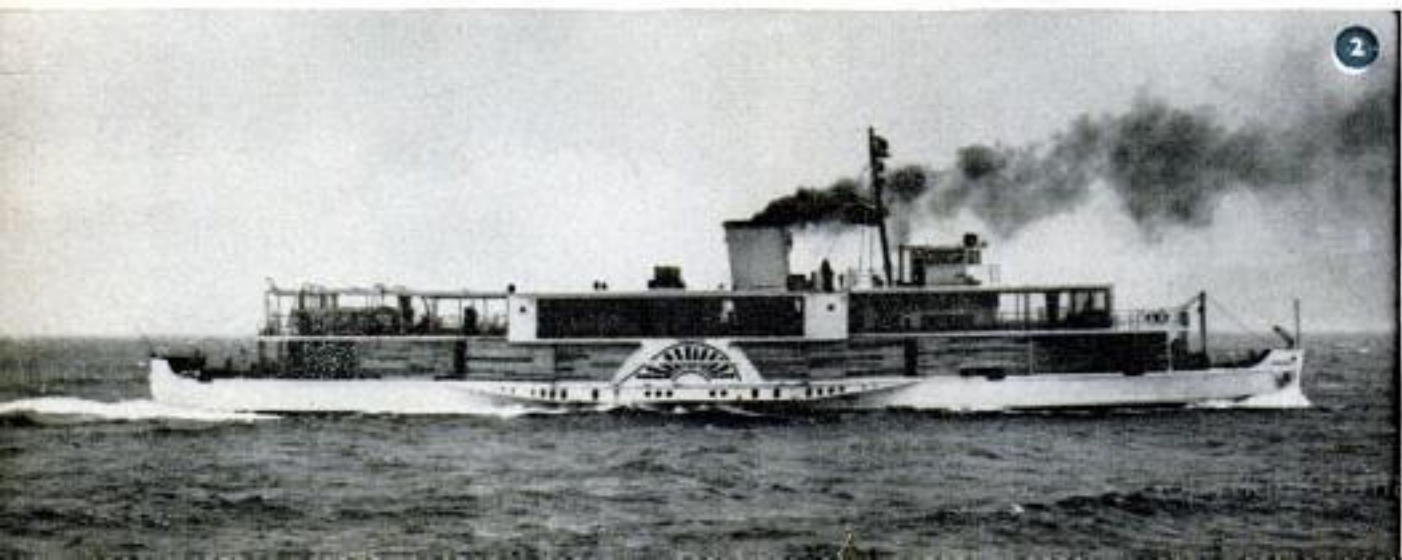
Queen Margaret, a ferry, battled mountainous seas for nine days in epic voyage around northern Scotland

"Broncobusters" of the High Seas

By John Kerr



Numbered routes on map show voyages of the craft shown in these photos. Below, the side-paddle steamer Yamuna, in a trip that lasted 81 days, was delivered to India where she is now at work on the River Ganges





Ferry leaves the River Clyde bound for Quebec. Intrepid "runners" will deliver almost anything that floats

FOR THREE HOURS the 289-ton diesel-electric auto-and-passenger ferry *Queen Margaret* had battled against the vicious tidal race of Scotland's notorious Pentland Firth, that rough and narrow channel which divides the mainland from the Orkney Islands to the north.

Captain MacDonald, master for the 700-mile delivery voyage from the Clyde on the west to the Firth of Forth on the east coast—only 40 miles as the sea gull flies—peered anxiously at the nearby rocky coastline, graveyard of many fine ships.

His sturdy eight-knot ferry, built by Denny's of Dumbarton, should do well in the Forth waters, he reflected. But exposed to deep-sea hazards she was a nautical nightmare. Her shallow draft of four feet gave little "grip" of turbulent waters, and the wind resistance offered by her suspended bridge and relatively high superstructure made accurate steering impossible.

Old Iron Becomes Ballast

Some 50 tons of old iron and rubble served as ballast to steady the *Queen Margaret* a little. But the 11-foot paddle sponsions which overlapped the hull to give her a 50-foot beam produced a bucking motion that was impossible to eliminate

even in a moderately rough seaway.

With the wind freshening from the north, she plowed through the 12-mile-long Pentland Firth, where the tidal stream runs at 7½ knots. Often she seemed to be making no headway at all. When MacDonald took another bearing of Dunnet Head, he found to his dismay that though he'd had the engines opened full out, he'd made exactly one mile in three hours.

Disaster Looms

As the tidal race slackened at last, Captain MacDonald relaxed for a moment. His relief was short-lived. Almost instantly, disaster loomed for the ferry. Duncansby Head was now abeam and the Pentland Firth astern. Ahead lay a leg of open sea. The wind was rapidly rising to gale force. Soon tremendous seas buffeted the laboring vessel. Plunging and rearing like a bronco trying to unseat its rider, she refused to answer her helm and wallowed helplessly. Snowstorms laced the gale and sea spume froze on the bucking decks.

Slowly, determinedly, MacDonald edged her south.

At last, six days out from the Clyde, a trawler appeared out of the turmoil. Sensing salvage, the skipper came close.

Small passenger vessel sailed from the River Clyde across the Atlantic, through Panama Canal, to Vancouver





Runners find life difficult aboard craft such as this, a ferry bound for river service in British Guiana

"Need any help?" he shouted across the heaving waters.

"Going the Forth way?" MacDonald queried back.

"Yes," came the answer. Gratefully, the *Queen Margaret* accepted the offer of a towline.

It was not to be so simple. All efforts to get a line aboard failed. Then darkness intervened.

When dawn broke the trawler was still standing by. Both vessels were 30 miles off course.

Success on Fifth Try

Again they tried to heave a line, and on the fifth attempt a rope was made fast between them and they headed into the gale. Twelve hours later they reached Aberdeen. This was the trawler's home port, but it lay 100 miles north of the Forth, the agreed destination, so the rescuer's subsequent claim for salvage failed.

It was 36 hours later, favored by calm weather, when the ferryboat finally berthed at her base—under her own power and in good shape, but nine days after she had chugged out of the Clyde.

That epic voyage took place 23 years ago, and the *Queen Margaret* is still in operation. In March of last year she was joined by a sister ferry, the *Sir William Wallace*.

Skipper for this voyage was another Captain MacDonald—Dugald MacDonald—who'd been mate on the *Queen Margaret's* delivery voyage in 1934.

This MacDonald comes from Tiree, one of Scotland's Hebridean islands, and knows the island-studded route around Scotland

like the back of his hand. Even so, he approached a voyage in such a "nautical conundrum" with trepidation and true Highland caution.

They had hardly left the Clyde before bad weather forced them to seek shelter for three days at Campbelton.

One Glimmer of Light

Then, sailing through the Sound of Islay on a Sunday evening, a combined seaway and tidal race made shelter imperative. Port Askaig, dark and deserted on a Sabbath, was their only hope. The black and rocky coast showed only one glimmer of light—which MacDonald figured came from a telephone booth perched on the cliff—and towards this he steered his vessel.

But for MacDonald's knowledge of the isles and islesmen the *Sir William* would have been lost then, for there was no light to pick a channel through the rocks and no sign of life ashore. Two blasts on the siren, however, brought quick assistance. The headlights of an automobile came jolting down the hillside towards the unlit jetty, and soon three men were dropping lighted matches to pinpoint a berth.

Yet another stop had to be made at Tobermory, on the Island of Mull; then fog patches appeared to cause some anxious moments as the ferry approached the sharp headlands of the Pentland Firth. There MacDonald was stopped by the tidal race inside the firth, and found shelter in slack-water under the lee of Stroma.

Fortunately, that was the end of the difficulties. The weather improved, and the *Sir William* reached port after a voyage of

(Continued to page 218)



German Hercules Flexes Mighty Muscles to "Defeat" Two Jeeps

With canvas straps and bath towels, Max Hartmann of Heidelberg, Germany, stood between two regulation Army Jeeps facing different directions and kept them from

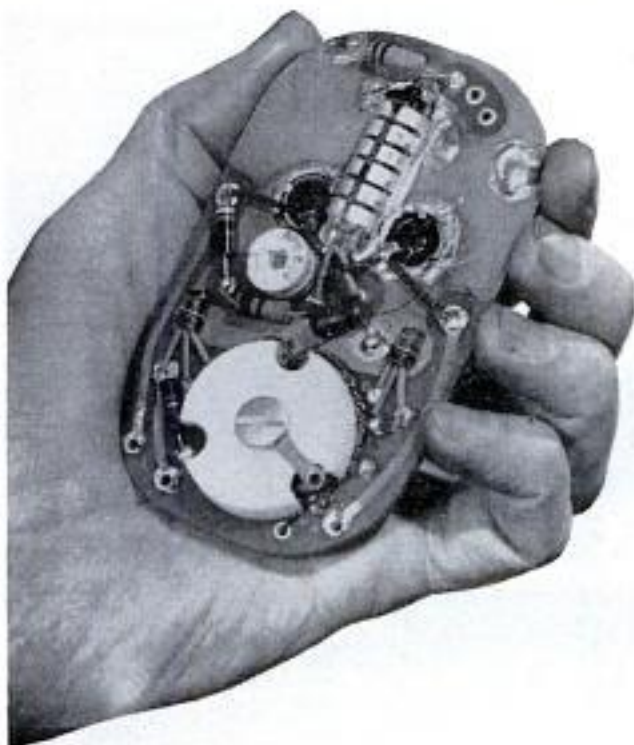
moving until he had released them. Drivers of both vehicles jammed accelerators to the floor in low gear without dislodging Hartmann or the vehicles from position.

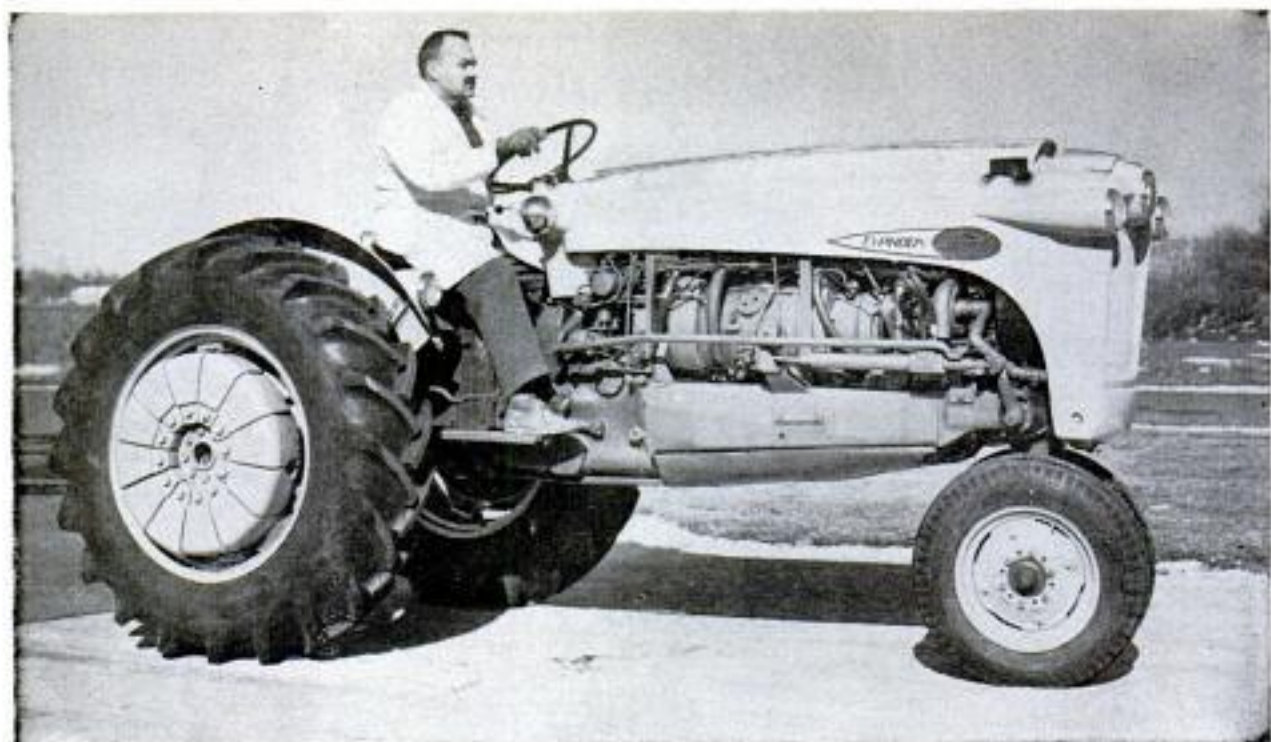
"Sardine Can" Transmitter Provides Emergency Communications

Transistors and printed circuits are the chief components of an ultra-high-frequency beacon transmitter built in a standard-size sardine can. This transmitter is capable of sending radio signals 25 miles

continuously for 24 hours. Designed for military emergency signaling and communications, the transmitter can be modified for voice or code operation at frequencies other than its present range.

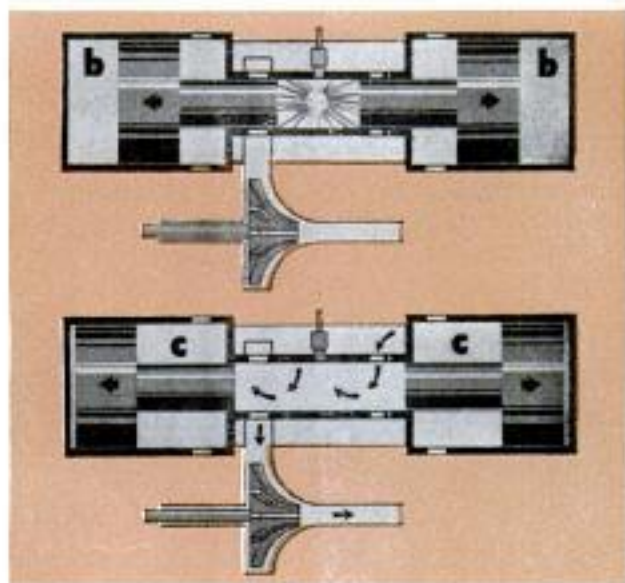
Below, two transistors and compact power transformer make up the power supply. Battery pack is separate unit. Below right, self-erecting, three-foot antenna





Free-Piston Turbine Powers Unique Tractor

Under test by the Ford Motor Company is an experimental tractor powered by a free-piston turbine engine. This is the first known installation of such an engine in a tractor. The engine will operate on a wide variety of inexpensive hydrocarbon fuels, and eliminates many of the moving parts of a conventional engine. The diagram at left shows a stroke of the two free-moving pistons. Forced outward by the burning gases, they compress air in the "bounce" cylinders (indicated at "b"). Air is drawn into the compression cylinders ("c") and mixes with the discharged gases to drive a turbine wheel.



Electronics Assembly Uses Belt Feeder

The machine at right is expected to boost the use of semiconductors in the electronics industry. Semiconductors, devices about the size of grains of rice that do the work of large vacuum tubes, previously had to be built into electronic circuits by laborious hand-assembly methods. Now the tiny electronic devices can be carried by the thousand in flexible belts, somewhat like belts of machine-gun bullets. The belts of precisely spaced semiconductors are fed into stapling machines that tack them into place in electronic circuits. With the production bottleneck eliminated, manufacturers say the use of semiconductors will be much more economical.

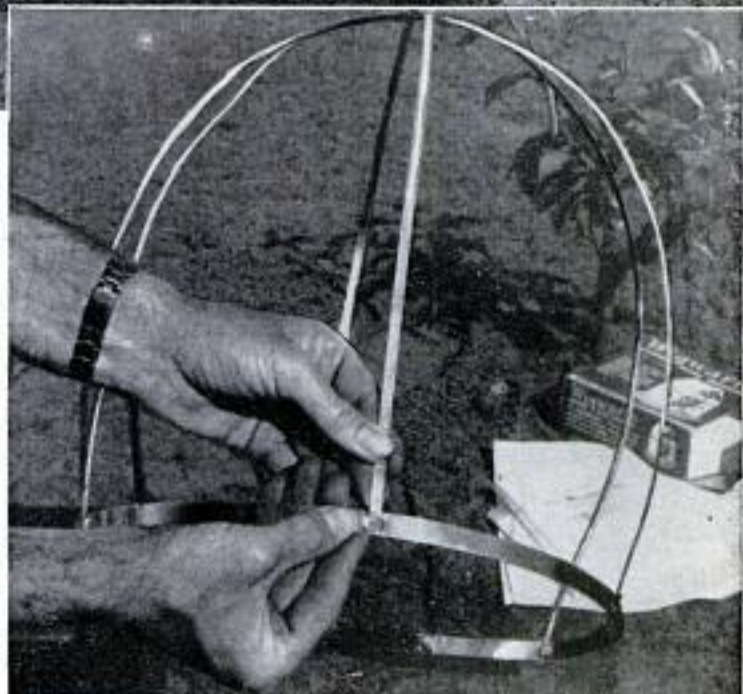


POPULAR MECHANICS



Plastic Plant Protector Has Adjustable Heat Vent

Polyethylene plant protectors, highly resistant to moisture, will maintain the high level of humidity required by young plants. Opaque white sides shade the plants from strong sunrays while the transparent surface permits the home gardener to watch the progress of growth. A vent on top can be closed when frost threatens, or opened to prevent an excessive buildup of heat. Large-size plant covers are available to protect broad-leaved evergreens against strong winds and snow, as well as low-level humidity during the winter months.



The polyethylene film is held in place by series of three aluminum ribs which lock into the sides of a base ring

British GM's Vauxhall Victor Is All New but Smaller

In America, General Motors cars get bigger, but the Vauxhall, GM's British-built car, is smaller this year. The new Victor is a four-seater powered by an economical (30 to 40 miles per gallon) four-cylinder overhead-valve engine of 92 cubic inches. But the new Victor is no midget, having a 98-inch wheelbase, only 17 inches less than the Chevrolet. Over-all length is 166½ inches—about 34 inches less than the Chevrolet. The American influence in styling is evident, including a wrap-around windshield, the first in England.





Spring Retrieves Lure

Snagged fishing lures can be dislodged by a new weighted spring. The coil spring is turned around the fishing line until the line is in the center. Then the dislodger is lowered on another line and bounced against the snagged lure to dislodge it.

Monorail Transports Materials

Standing in an electric-monorail lift bucket to demonstrate its size, a pretty German model shows how heavy construction materials are transported over long distances up a steep incline.



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Surgical Sniffer Developed

Aided by a resuscitator-anesthetizer that automatically adjusts to an animal's lung capacity, veterinarians perform singlehanded operations. The new instrument provides the precise respiration for pets that humans receive in surgery.

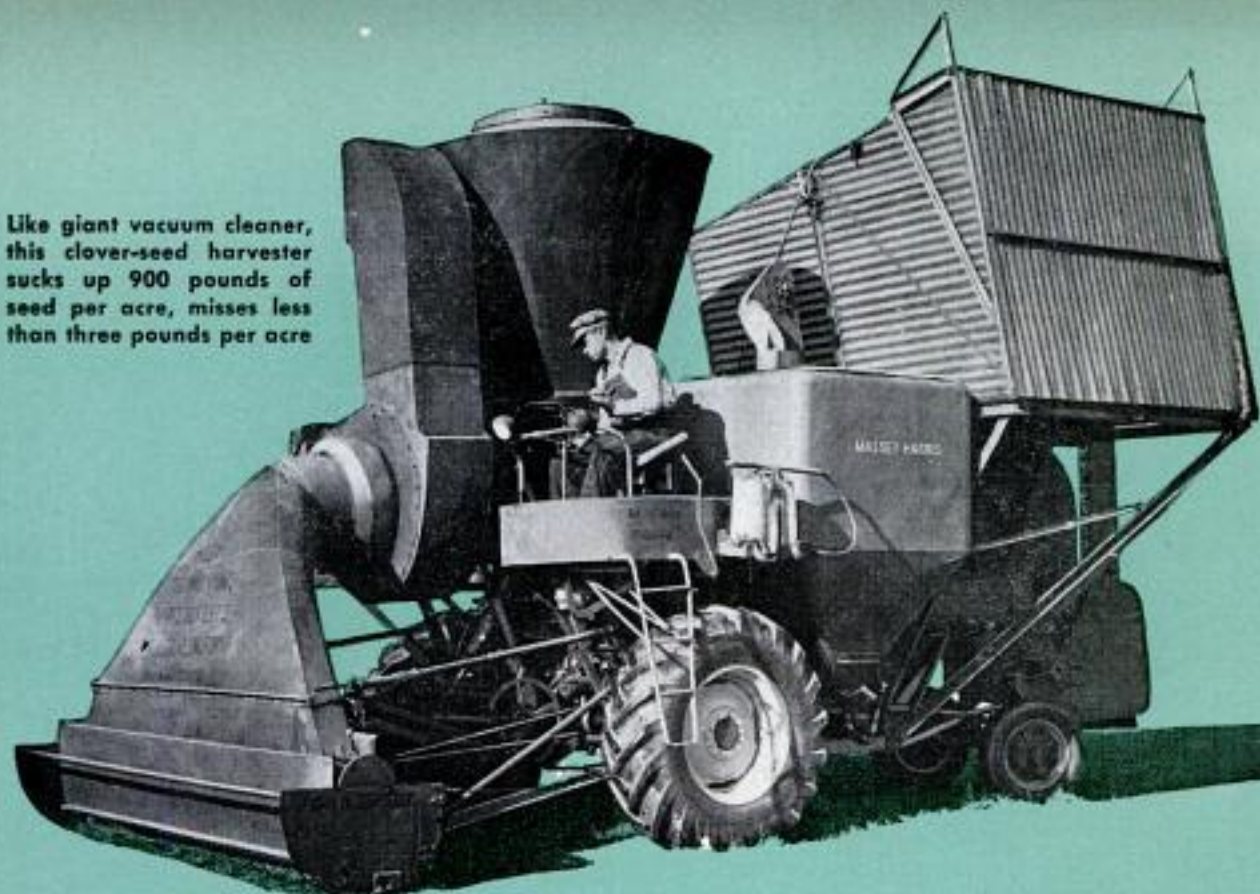
Weedless Lure

When a new fishing lure strikes weeds, the hooks are pushed upward to make the lure weedless. There are no guards and the hooks are always open, ready to receive a strike. The lures are available in two sizes.



POPULAR MECHANICS

Like giant vacuum cleaner, this clover-seed harvester sucks up 900 pounds of seed per acre, misses less than three pounds per acre



Air Is the Farmer's Hired Hand

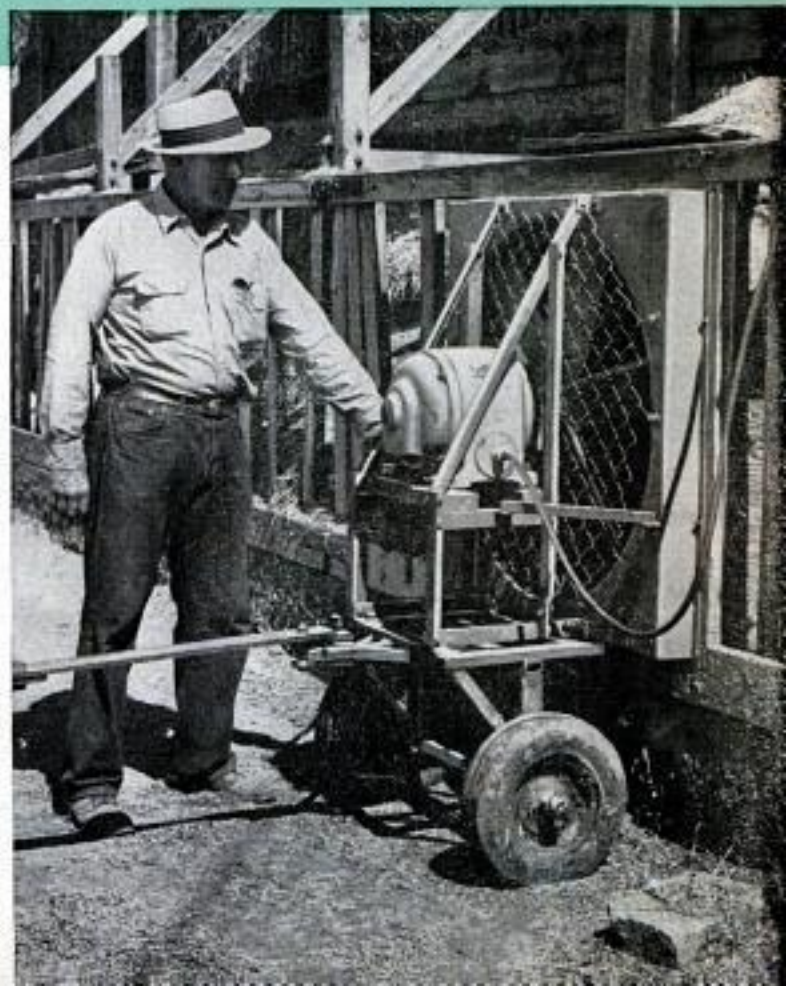
By F. Leland Elam

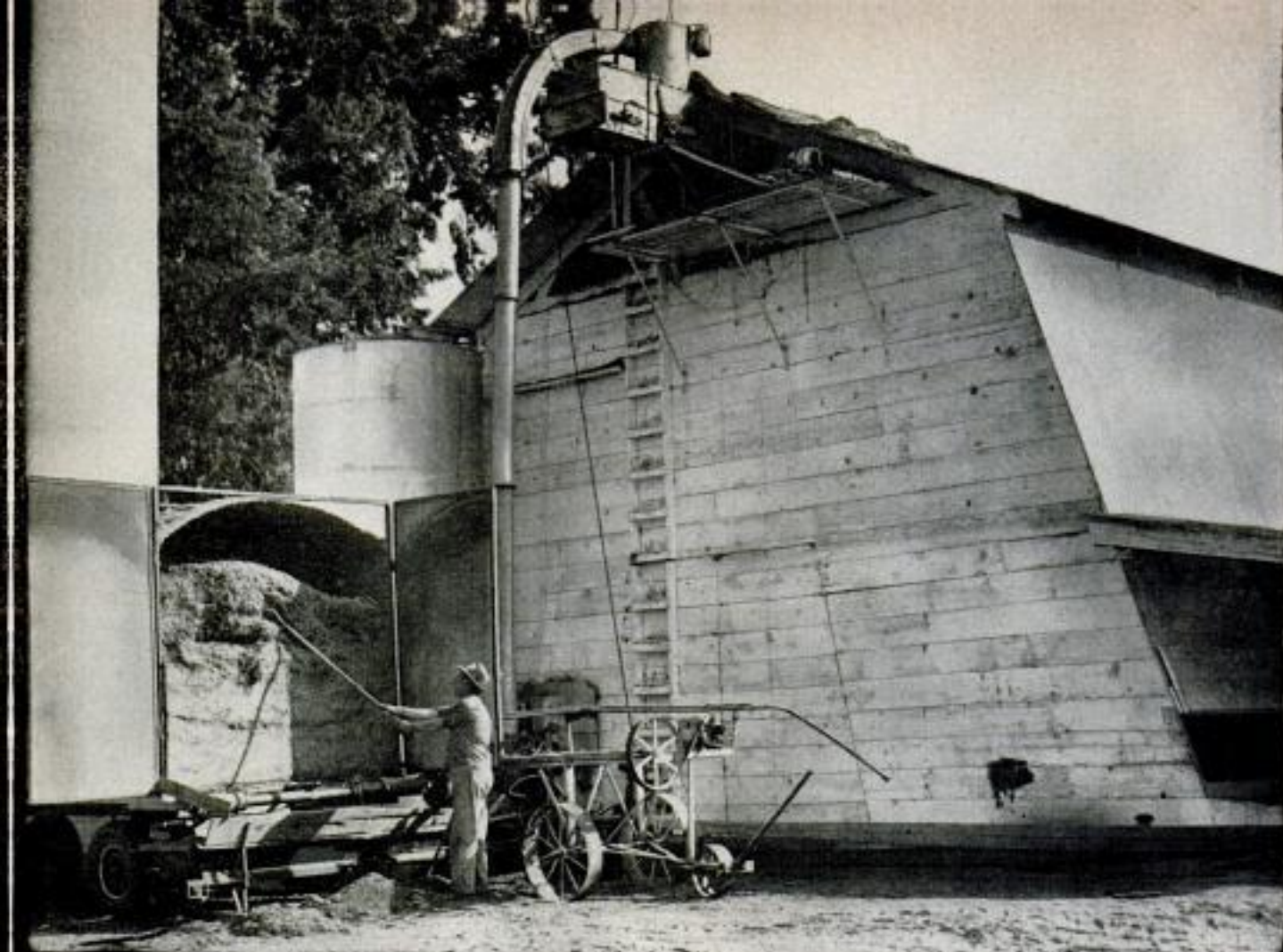
ABOUT 100 YEARS AGO it took one person on a farm to provide food and fiber for one person in a city. Thirty years ago, that ratio had been reduced to one to seven, and in 1955 it required only one farm hand to sustain 18 city dwellers.

The introduction of extensive mechanization has brought into the hands of farmers many "chore boys" that make it possible for them to plant, grow, harvest, store, feed and market their crops, livestock and poultry faster, and with less labor. This has been the major contributing factor in bringing about the spectacular change in the ratio.

Air is one of the chore boys the farmer has been able to harness and put into use in just about every conceivable phase of farm mechanization.

Portable electric fan blows dry air into chopped hay on the Wesley Sawyer farm at Waterford, Calif.





Blower system on Wesley Clark farm, at Hanford, Calif., automatically mixes chopped hay with molasses spray

He uses it under pressure, blows it with great force in a definitely directed manner or sets it to work on a suction or "airlift" basis. All three control methods are used to do a multitude of work tasks.

Air is a cheap means of power. It does away with expensive machinery. In many tasks it takes the place of equipment such as augers, elevators and hydraulic rams.

In California, a giant vacuum cleaner that uses a 32-inch fan to form the suction power, airlifts clover-seed plants into a harvest-

ing unit as a sickle bar cuts them loose from their roots, spits the seed onto a cleaning table and at the same time blows the dirt and plants away from the seed. So thorough is its action that its owner, Jack Brinkley of Elk Grove, finds it leaves only two to three pounds of seed on the ground while harvesting up to 900 pounds per acre.

"When it comes to handling chopped hay, even a big fork doesn't help much," Ward Watson, a Santa Rosa, Calif., dairyman comments. "It's just a disagreeable job to

Ray Fisher, of Lathrop, Calif., saves thousands of dollars with forced hot air in his turkey brooders



A 32-inch fan distributes dry air to six grain bins on Vinson Vanderford ranch at Yuba City, Calif.



handle chopped hay by hand." But he, as well as Harold Bontrager of Winfield, Iowa, have put air to work on their farms to eliminate the disagreeable job.

Watson solved his problem by rigging up a suction fan and hose that picks up hay like a giant vacuum cleaner. With this unit he mixes 500 pounds of chopped hay with 20 percent molasses in just 15 minutes. He can reach any area of the haymow with a six-inch pipe and hose, through which the hay is moved by an 18-inch centrifugal blower operated by a five-horsepower electric motor.

"I handle 18 tons of hay per hour," Bontrager says, "when taking it directly from the wagon and delivering it to the mow. The blower that forms the suction to lift the hay from the truck also blows it into the barn. It is operated by a belt from a tractor."

This forced flow of air has also been put to work moving concentrate feeds from a bulk-feed bin and delivering it to individual feed mangers at each stallion in the Elwin V. Gordon dairy barn at Marysville, Calif.

"It works like this," Gordon explains. "There is an electric-powered fan mounted above a feed receiving box on top of the bulk bin. It does all the lifting and distribution of the feed. Its first task is to lift the feed out of a delivery truck via a flexible hose and deposit it in the bin. When feeding time arrives, it's turned on. The action causes the air to be drawn through a four-inch pipeline that passes from the top of the tank through the barn to a controlled-flow outlet at the bottom of the tank. As the feed is airlifted along the pipe it drops into hoppers over the individual feeding mangers. Any feed that bypasses the hoppers drops back into the bulk bin via the feed receiving box under the fan."

Feed is released from

Harry Lechner, of Kirkwood, Wash., uses an old vacuum cleaner to clean out the watering troughs in his chicken house. The debris is collected in the milk can





Vacuum cleaner, above, pulls packaging bags tight against turkeys. Fans, below, keep eggs fresh by forcing air chilled to 50 degrees through baskets



each small manger hopper by turning a crank to deposit the desired amount in the manger. It takes only 40 minutes to fill 12 hoppers and the farmer goes on about other chores while this is being done.

The use of air in moving milk in the bulk operation at his Pocatello, Idaho, dairy has resulted in easier handling and less mechanical trouble for Thomas Rowland. The system is one in which a vacuum draws milk from the cows, carries it to the bulk tank and provides circulation. An air-pressure unit forces the milk from the tank to the truck that calls for it every day. The system eliminates the vacuum releaser found on most bulk systems. Vacuum from the milking machine works through the tank and milk can flow directly into it. It eliminates also a mechanical agitator inside the tank and milk pump mounted on the tanker truck. Milk has been held inside the sealed refrigerated unit five days without collecting oxidized flavor.

Ray Fisher, Lathrop, Calif., turkeyman, had to cut costs to stay in business. Hot-air brooding was his answer to the problem. Hot air flowing into brooding cages has taken the place of the usual gas or electric hover brooders. Air is heated by a gas burner. A blower distributes it through overhead pipes and ducts to 23 cages, each holding 300 turkeys. It comes out through a hover where the birds can find the heat they desire. The system has saved Fisher an average of \$500 on the cost of brooding each flock of 6900 birds—in medicine bills, labor and other operational costs.

Portable Air Supply

No task is too small for air to be used as the farmer's chore boy when it means the saving of labor and other expenses. Dairyman Wesley Clark, Hanford, Calif., has converted a small war-surplus oxygen tank into a unit that has multiple uses. He brazed an automobile-tube air stem and valve in one end of the tank. In the other he brazed an outlet onto which he could fasten a six-foot length of air hose. Air is forced into the tank from an air compressor via the auto tire valve. The tank holds 150 pounds of air pressure with safety.

"Being easy to carry, it offers excellent service in putting air into equipment tires which may go flat in the field," Clark explains. "Air from the tank induces air cushions into any of the three pressure systems on the ranch and saves time in blowing dirt from machinery that is to be repaired. It cost me less than \$5.00."

Glenn Culbertson of Acampo, Calif., has an easy way of getting oil out of a drum. Air from his shop compressor is forced into the drum through a small priming cock fitted into a small plug on top of the drum.

Five pounds' pressure is sufficient. The oil flows out through a long pipe curved at the top with a small valve near the mouth.

Air under pressure cleans dust and cobwebs out of the fryer-rearing houses of John Hamilton of Fresno, Calif., after each flock of chickens is sent to market. He built his own portable compressor and takes it to every corner of each room and forces air over the wall and ceiling surfaces, thus getting dirt out of the wood pores and cracks. This is a major sanitation procedure. He also uses it to produce air for spray painting.

The lives of newborn lambs are saved by forced air at the Allyn Tedmon ranch in Colorado. The lamb is placed in a wire-mesh cage. A fan drives air from an electric heater through the mesh and the lamb is soon dry and able to withstand chill winter temperatures.

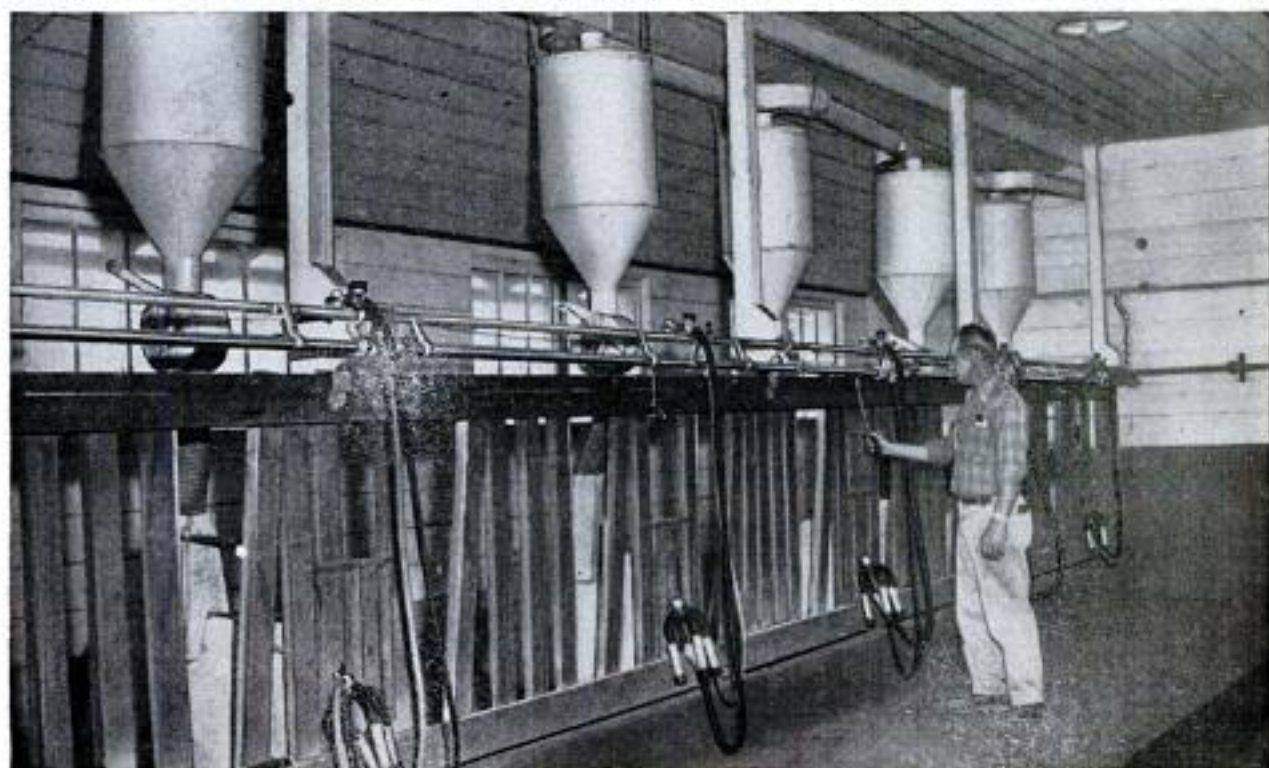
It takes just five pounds of air pressure to force fuel from a field-service

(Continued to page 230)



Time and labor-saving system on the Elwin V. Gordon ranch, at Marysville, Calif., distributes feed from this bulk tank to hoppers in barn

"Airlift" fills the individual hoppers over each stallion in 40 minutes while Gordon does other chores





Self-driven drills can be clamped on any square tool bar, permitting flexibility in the spacing of crop rows

Attachments Increase Versatility of Implements

FLEXIBILITY is the feature of two new farm implements. Individual drills, shown above, can be clamped to a tool bar to form a planter for both narrow and wide-row crops. Each drill is self-contained and self-driven, so it can be used on a front-mounted cultivator frame as well as a rear tool bar. Rows can be spaced as narrow as 13 inches. The individual John Deere drills will plant

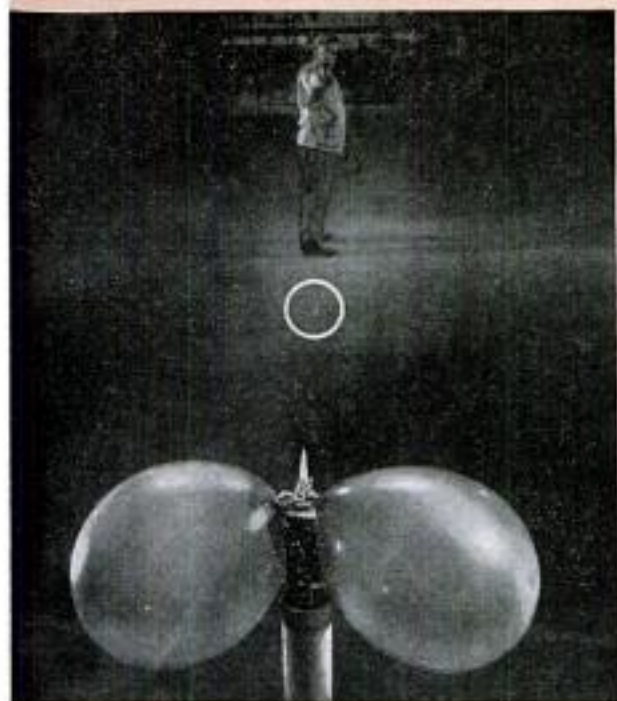
sugar beets, edible beans, soybeans, corn, sorghum and many vegetable seeds.

With the new attachment shown below, all John Deere corn planters can serve as liquid-fertilizer spreaders. The twin carrying tanks are mounted directly over the planter's wheels, and each tank holds enough fertilizer to apply approximately 250 pounds per row.

Twin-tank attachment is mounted on a corn planter, converting it into a liquid-fertilizer applicator



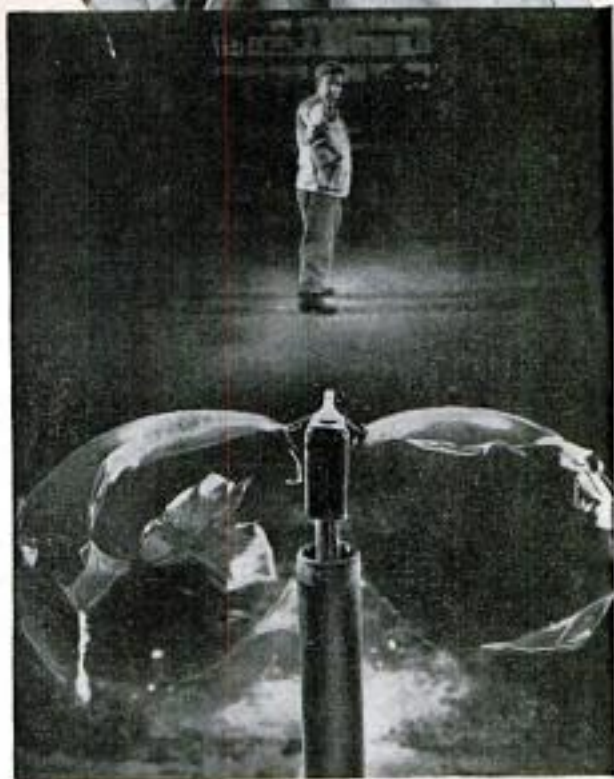
How to Split a Bullet



WITH ONE PISTOL SHOT M/Sgt. Huelet Benner can split a fired bullet in half and puncture two inflated balloons with the pieces. An ax blade is fixed with its edge pointed at Benner. Two filled balloons, one on each side, are placed by the blade. From 30 feet away Benner fires a shot from a .45-caliber pistol into the blade. The bullet splits. Each sliver of metal pierces and bursts a balloon. Benner is now an Army instructor at the United States Military Academy, West Point, N. Y.



JULY 1957

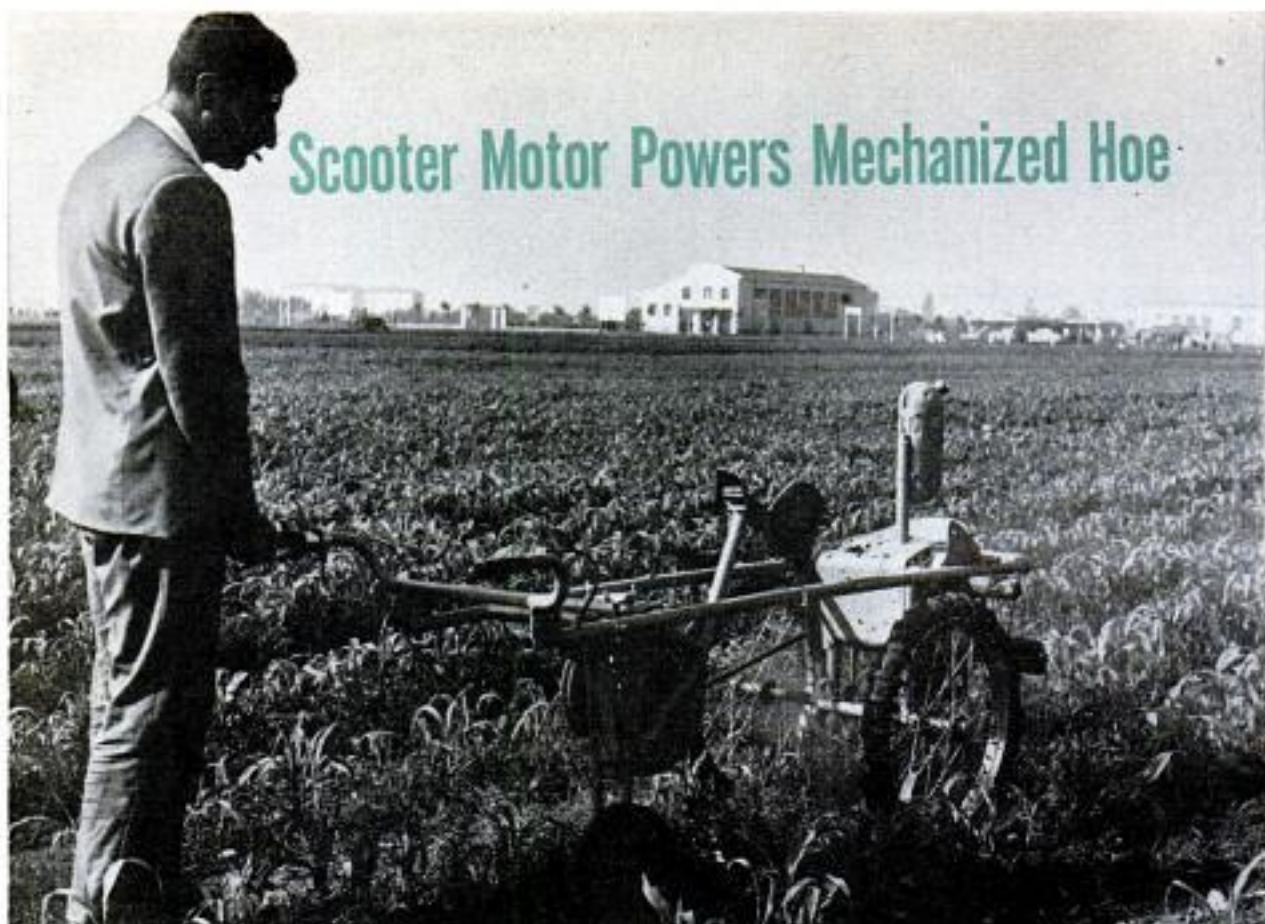


Top left above, bullet (in white circle) speeds toward ax blade. Camera, set up behind balloons to catch action at 1/10,000 second, was triggered electronically by the sound of the gun firing

Center right above, balloons burst simultaneously, as bullet hits ax blade and splits in half. Each half hits a balloon. Benner uses a soft-nosed bullet for this demonstration

Left, before performing stunt Benner ties inflated balloons on each side of an ax blade. See camera above balloons. Benner, 39, is a former American and Olympic pistol titlist

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Scooter Motor Powers Mechanized Hoe

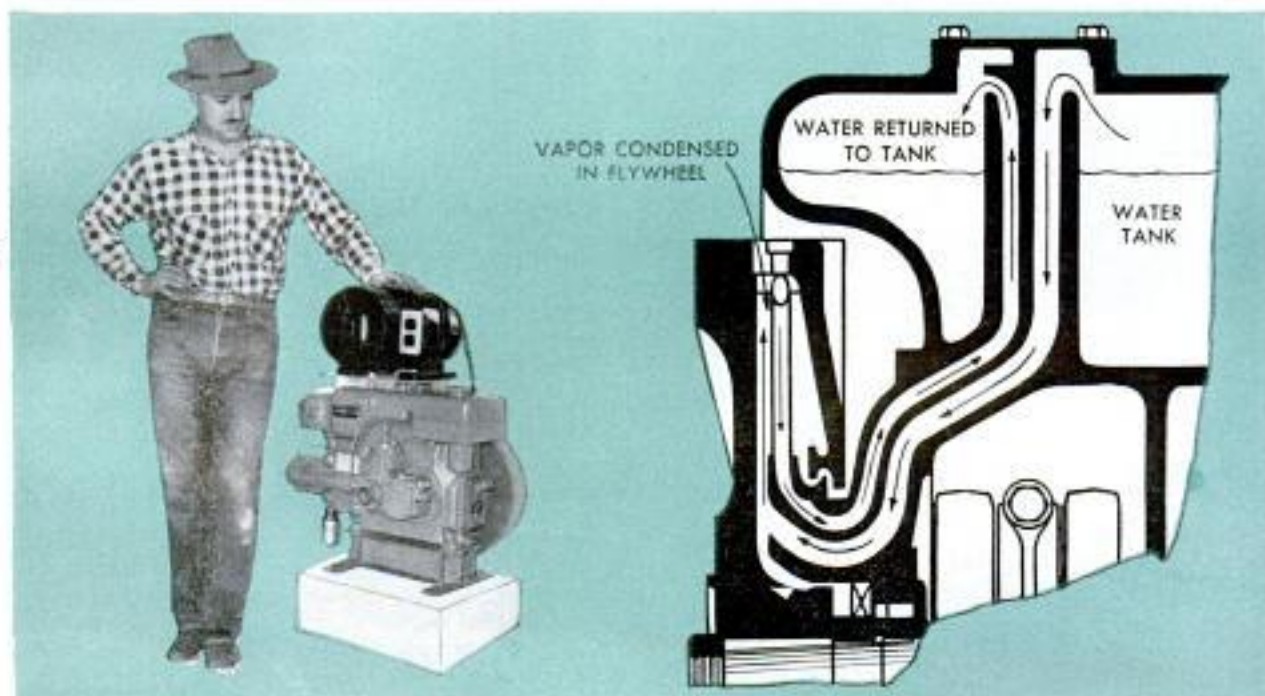
Bicycle and motor-scooter parts have been combined into a power tiller by an Italian manufacturer. The same engine that powers a popular brand of Italian motor

scooter not only powers the wheels of the little farm machine, but also the tilling blades. The mechanized hoe may replace horse-drawn plows on small Italian farms.

Miniature Generator Has Diesel Engine

Fuel costs are low in a miniature generator because the engine is a small diesel. Rated at six horsepower, the engine has an

unusual cooling system. The heat of the engine forms steam, which expands into the flywheel, where fins dissipate the heat.





TRANSISTOR RADIOS YOU CAN BUILD

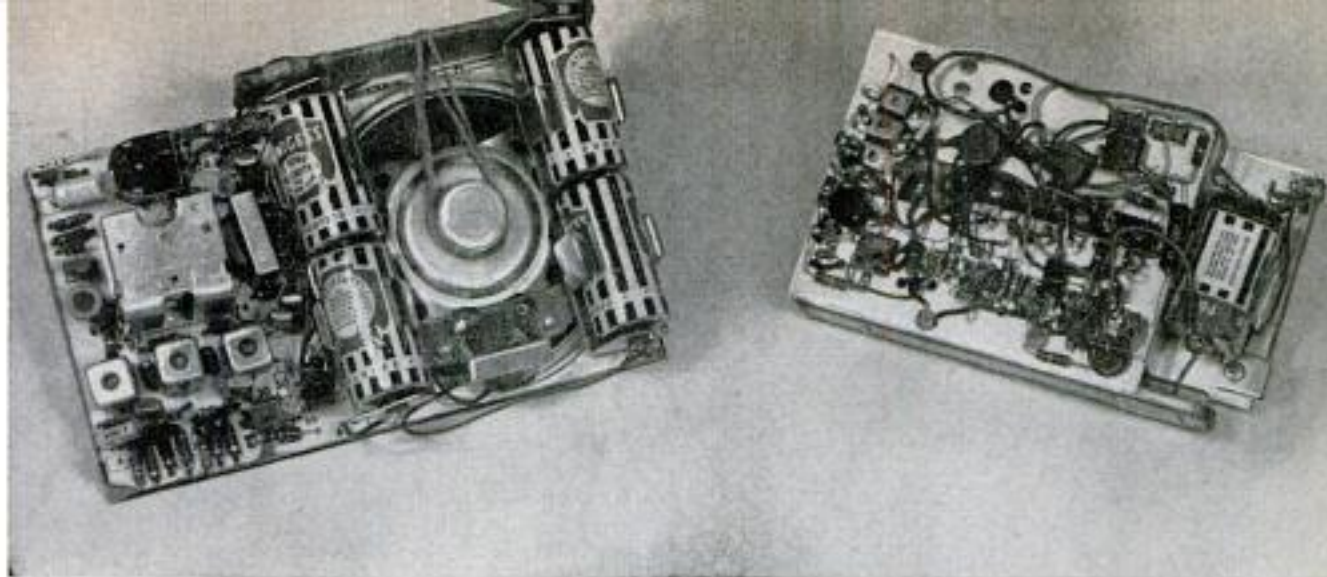
By Lothar Stern

THOSE AMAZING little transistor radios are literally "busting out all over." Not only in parks and on beaches where you would normally expect to see them, but also in railroad cars, automobiles and even in the home these little midgets are taking over from their larger vacuum-tube counterparts. Housewives carry them from room to room as they do their daily chores, children mount them on bicycles or take them along on hikes and camping trips and sports-minded individuals use them to tune in their favorite ball game while shoveling the snow or mowing the lawn. They fit into pocket or purse, use so little current that a single battery may last over a hundred hours and are rugged enough to withstand severe shock and vibrations.

But transistorization and miniaturization run high, and many attracted to the neat

appearance and small size of these little marvels are discouraged by the high price tags. Most radio hobbyists and experimenters, however, are lopping sizable chunks off these prices by devoting a few evenings toward putting together their own transistor portables.

Transistor-radio kits are available today from most leading radio-parts distributors. They range all the way from simple one-transistor sets to the more elaborate six-transistor units which compare favorably in performance and appearance to some of the best factory-assembled receivers. And construction is not difficult. The instruction manuals supplied with the kits give not only elaborate pictorial diagrams but also step-by-step assembly procedures which virtually eliminate the possibility of wiring errors by the careful builder.



Comparison of small-parts layout between printed circuit, left, and conventionally wired six-transistor radio

Some transistor-radio kits are supplied with printed-circuit chassis boards in which most of the actual wiring is already done. Others must be wired in the conventional manner, using hookup wire to interconnect the various parts. From the standpoint of final performance there is little difference between the two types. The printed-circuit units, however, require considerably less assembly time, while the more conventional ones are somewhat easier to service in the event of a possible wiring mistake or defective part. For either type, the only tools needed are a solder gun or pencil-type soldering iron, a pair of long-nose pliers, diagonal cutters and a set of screwdrivers.

Transistor Circuits

While transistors have been widely publicized as 20th-century electronic miracles and have, indeed, certain unique characteristics which make them far superior to vacuum tubes for special applications, the mere transistorization of a radio does not guarantee better performance than can be obtained with a vacuum-tube model. In fact, from the standpoint of sensitivity (the ability to pick up weak signals), selectivity (the ability to separate stations close together in the frequency band) and undistorted volume, it takes more transistors than tubes for comparable results. What, then, are transistor's special advantages?

Primarily, transistors require very little current, and only a low operating voltage, for proper performance. The sets illustrated schematically on page 146 all operate from inexpensive 9-volt batteries. Compare this with the battery packs of vacuum-tube portables* and it is evident that transistor radios cost far less to operate, particularly since a single set of transistor

* Vacuum-tube portables use two sets of batteries; the A-batteries ranging from 1.5 to 9 volts and the B-battery which usually has between 45 and 90 volts.

batteries will outlast several of the more expensive units used in vacuum-tube portable radios.

Secondly, transistor radios will give exceptionally long periods of trouble-free service. Transistors themselves do not wear out or burn out, and the low current and voltage requirements of transistor circuits greatly increase the life expectancy of the associated parts.

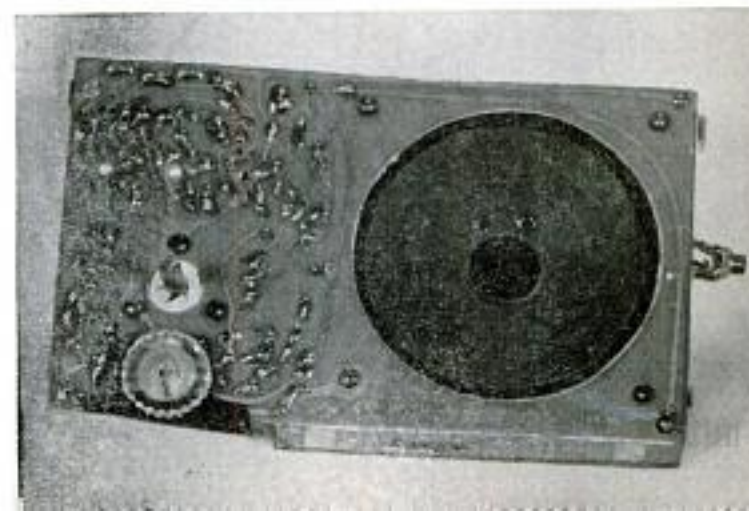
And, finally, the tiny physical size of transistors permits the design of receivers which are considerably smaller and lighter than conventional models.

Cost vs. Performance

Since transistors, particularly those suitable for r.f. circuits, are still relatively expensive, the cost of transistor radios rises rapidly as the number of transistors is increased. Simple one-transistor receivers are hardly capable of providing the type of performance to which we have become accustomed. Usually consisting of a diode detector followed by a stage of transistor amplification (in some cases the diode is omitted and the transistor serves as a combination detector-amplifier) these units require a long external antenna for satisfactory headphone reception, even on local stations. Yet their performance is much

(Continued to page 236)

Bottom of printed-circuit chassis is neat and clean but small iron and great care are needed to prevent solder shorts between closely spaced printed wires





Novel TV-Antenna Suspension

Balloon suspension of television antennas eliminates expensive towers and can greatly improve reception in extreme fringe areas. The balloon shown here, a target-type purchased from Army surplus, has a maximum diameter of 13 ft. It is inflated approximately half-size and is moored at an elevation of 100 ft. A four-way bridle of nylon secures the antenna to the balloon and the mooring line to the antenna. Nylon is also used for the mooring line and for the three guy lines which are fastened to the antenna extremities. The lead-in wire is tied to the mooring line



By Paul D. Smith
GRANITE FALLS,
WASH.

with nylon loops at 10-ft. intervals. Helium is recommended as an inflating gas wherever it is available. Though heavier than hydrogen, it is nonflammable and can be used with greater safety. The light Neoprene balloons must be handled with great care to avoid tearing. It is well to use a balloon size large enough so that it need be inflated only one half to two thirds its maximum size. To determine how much inflation is necessary, weigh the antenna assembly, including lead-in, guy and mooring lines before inflating the balloon. Then, with the balloon about half inflated, determine its lifting power with a spring scale. Continue the inflation process until the lift is about two or three pounds greater than the weight of the antenna system. Once aloft, the antenna is oriented by proper positioning of the guy lines. These should be spread about 120 degrees apart, thus guying the installation in every direction.



Record-It-Yourself TV

Playing back a previously recorded TV program, Antonio Rubbiani of Modena, Italy, tests his homemade device which reproduces both picture and sound. The invention records photographically the scanning lines of a TV picture on a Plexiglas disk which is then revolved under a powerful light by a turntable. A photocell gathers the light and transmits it to the set, producing the image. Rubbiani says the distortion apparent on the screen is caused by imperfect functioning of the electric motor that powers the turntable.

X-666

THE POPULAR MECHANICS

CRAFTSMAN

IF YOU WANT THRILLS and excitement on the water, this paddle board is for you. It will carry you along on the rushing crest of a breaker or let you skip through the wake of a speedboat towing you at full throttle. The board is equally good if you just want to paddle lazily around in a lake and sun-bathe. Safety, light weight and minimum maintenance are designed into the board to assure more fun and less work and worry. "Egg crate" construction is used to produce a board weighing one third less than a conventional type, with the added advantages of much greater strength and a one-third increase in weight-carrying capacity. A glass-fiber covering assures complete watertightness and minimum finishing problems.

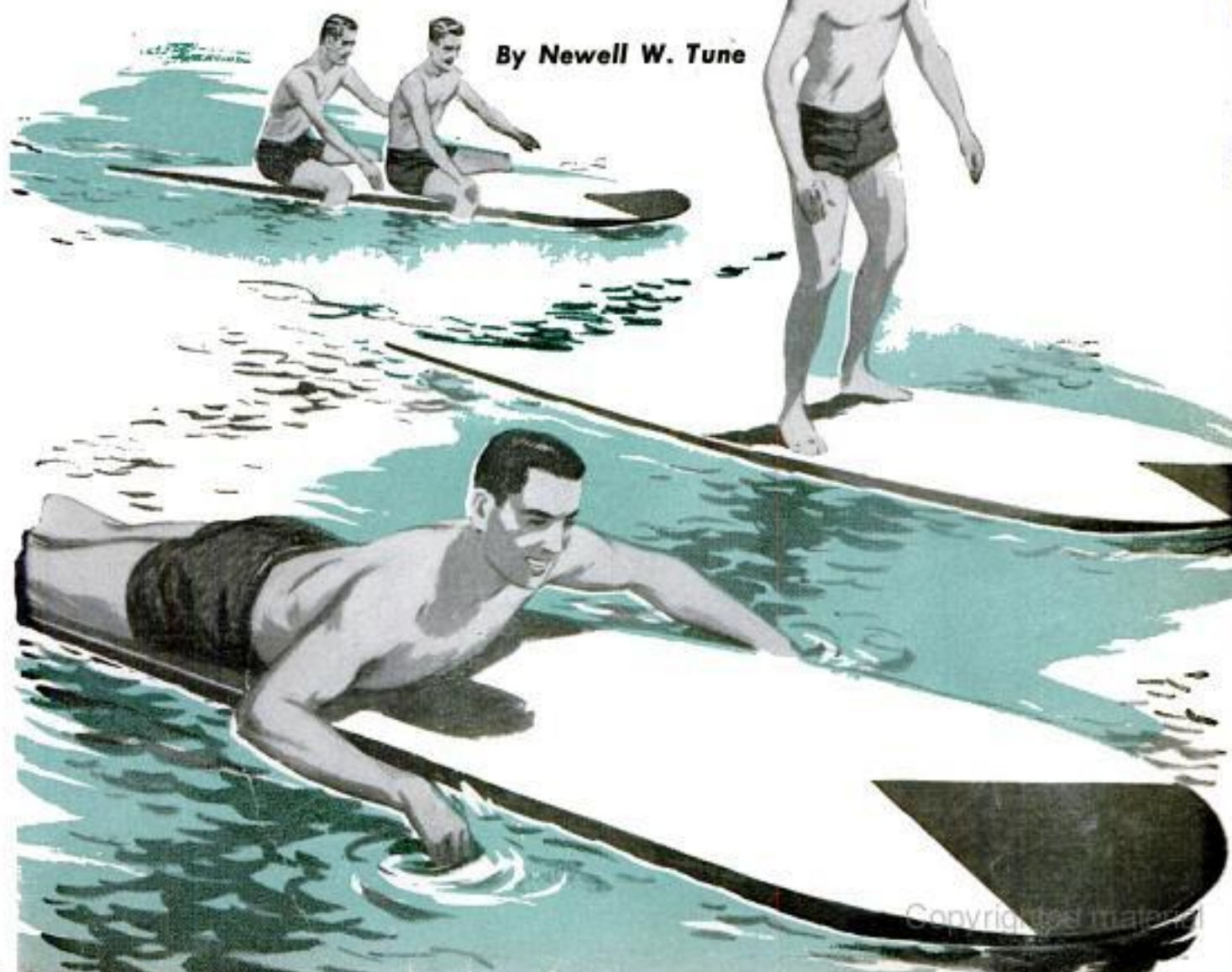
Tempered hardboard $\frac{1}{8}$ in. thick is used for all construction except the bow, which is made from solid stock and $\frac{1}{4}$ -in. plywood, and the stern block that also is solid stock. Mahogany is suggested for some

pieces made from solid stock, but since the finished paddle board is entirely covered, any good hardwood will do. Two 4 x 10-ft. sheets of hardboard are required in the construction of the board. Start by drawing the 29 ribs required on one sheet, using the dimensions shown in Fig. 1. Cut them out oversize with a handsaw, then trim to exact size on a table saw. Because of the need for accuracy when cutting the components of an egg-crate structure, a table saw is almost a necessity. However, an experienced craftsman, with much care, could do the job with a handsaw. Number each of the ribs, starting with No. 2. No. 1 is cut from wood. Cut a notch for the keel

WTM 59

"EGG CRATE" PADDLE BOARD *Is Light and Strong*

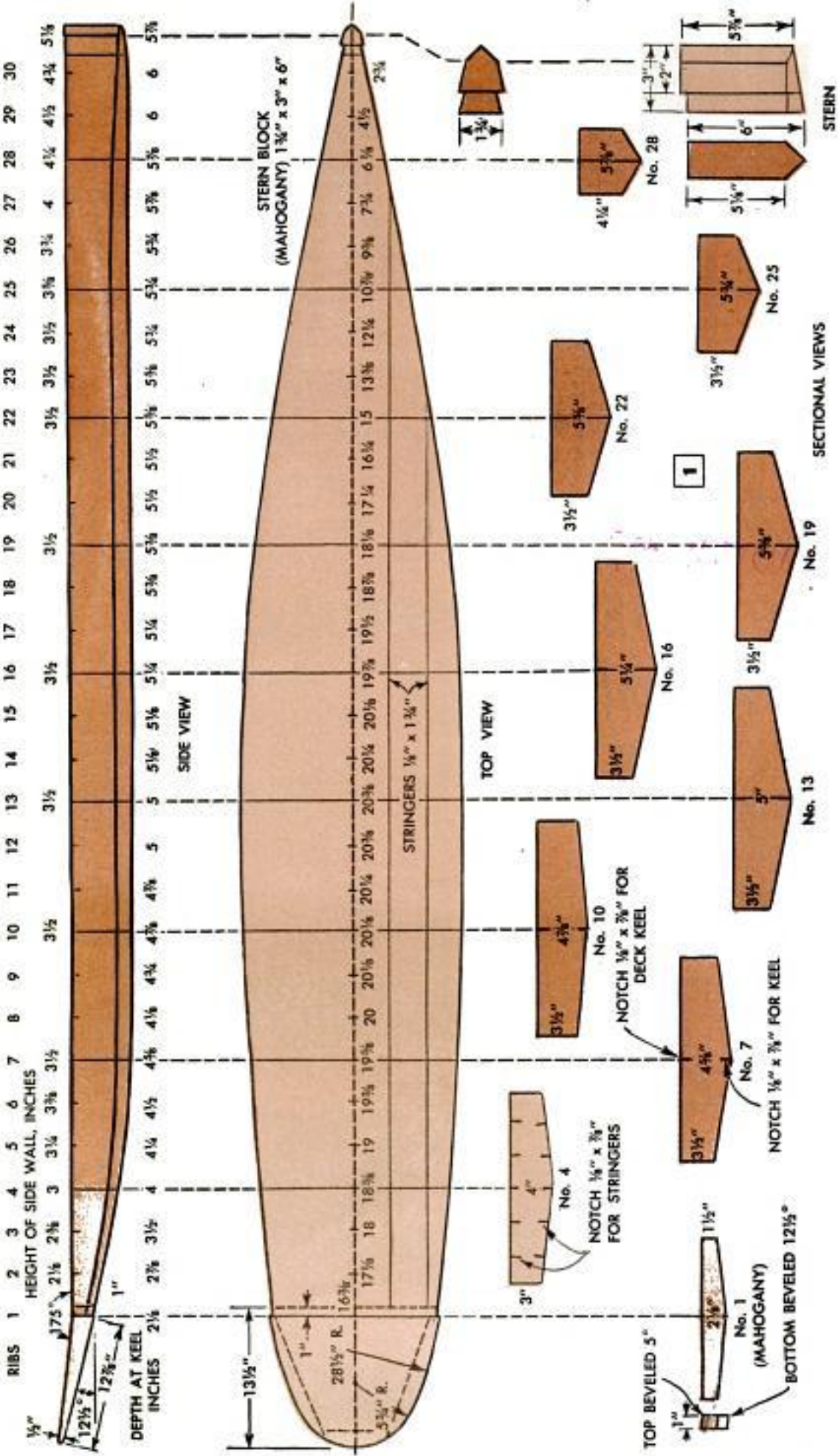
By Newell W. Tune

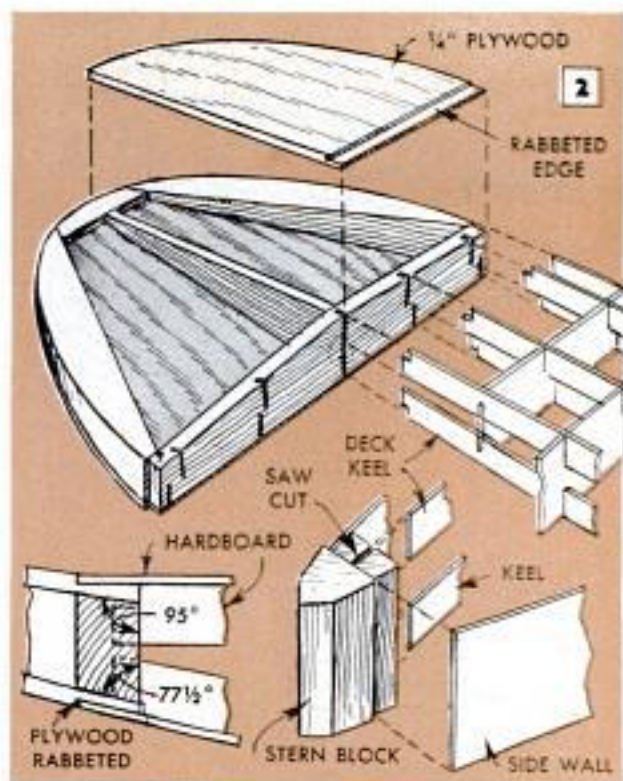


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FRESH-WATER PADDLE BOARD

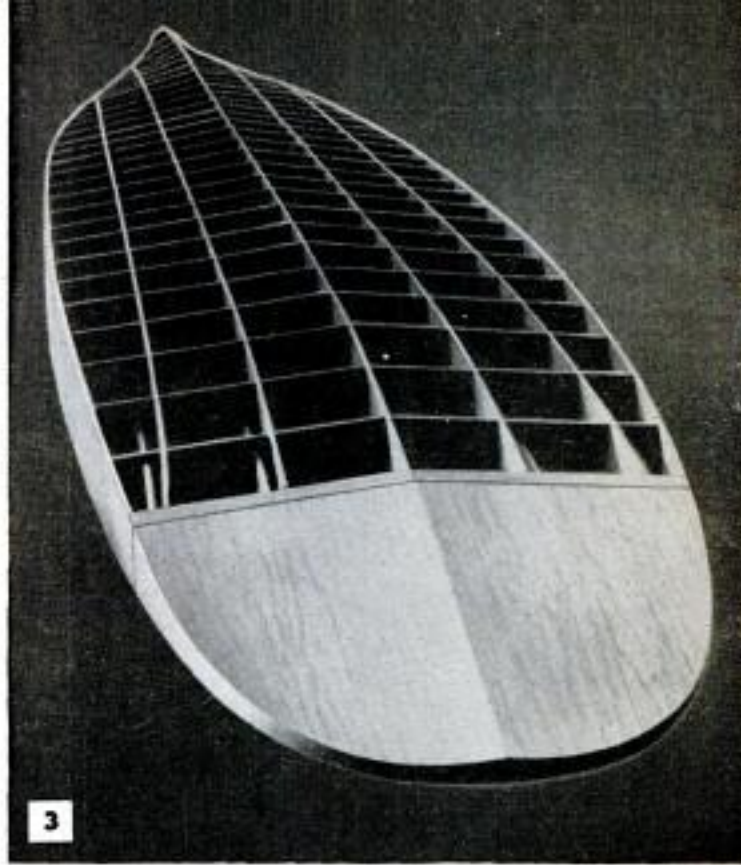
ALL MEASUREMENTS REFER TO SKELETON BEFORE ADDING EXTERIOR PLANKING, EXCEPT BOW AND STERN



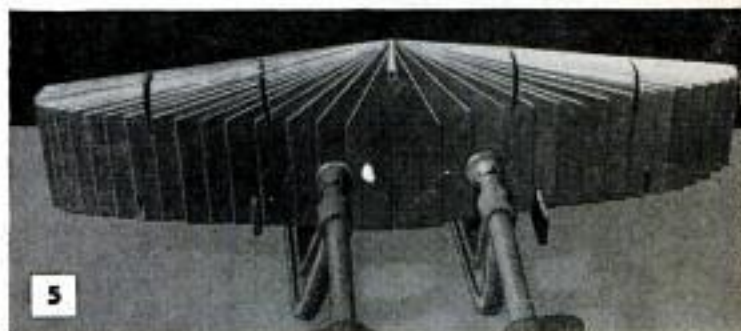


and deck keel in each rib, then stack the ribs and fit a strip of hardboard in both keel slots to keep the ribs aligned. Figs. 4 and 5 show the appearance of the stack from both bow and stern ends when it is clamped together. With the clamps in the position shown, cut slots for the bottom stringers. Because the ribs vary in height, cut the slots slightly deeper than $\frac{7}{8}$ in. so the cuts in the narrower ribs will be closer to the right depth, even though slots in the deeper ribs will be too deep. On most of the shallow ribs, the slots later will have to be deepened still further to provide a correct fit. Because of the irregular shape of the stacked ribs, a jig of some kind will have to be used to support the work squarely and permit sawing. Note, too, that the slats for the stringers are offset slightly to let them bypass at rib No. 1. Next, fit two clamps over the opposite edges of the ribs, remove the other two clamps, then saw the stringer slots in the top edges of the ribs. These slots can be cut to the correct depth, as the top of the paddle board is flat.

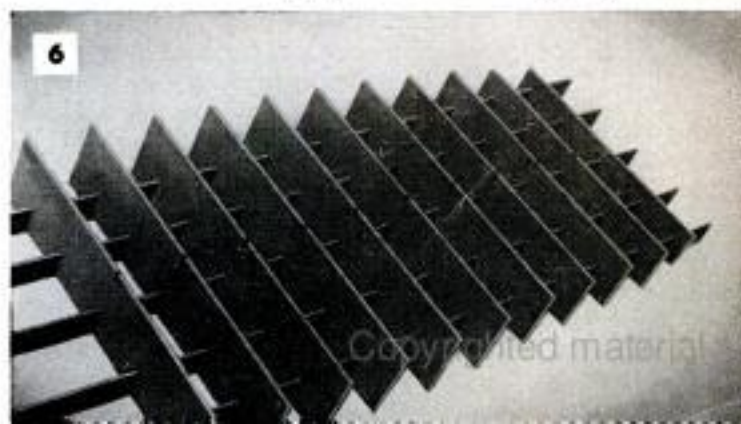
Now, cut all stringers and both keels $1\frac{3}{4}$ in. wide and make the keels $\frac{1}{4}$ in. longer. Clamp them in a stack and notch them every 4 in. to a depth of $\frac{7}{8}$ in. The keels and stringers can be test-fitted to make sure all notches are the correct depth, Fig. 6, before gluing is started. Use a good grade of waterproof glue and wipe the inside edges of all slots when assembling the egg crate. Install the deck keel and stringers first, then clamp in the stern block, detailed in Figs. 1 and 2. Turn the assembly upside down on a flat surface

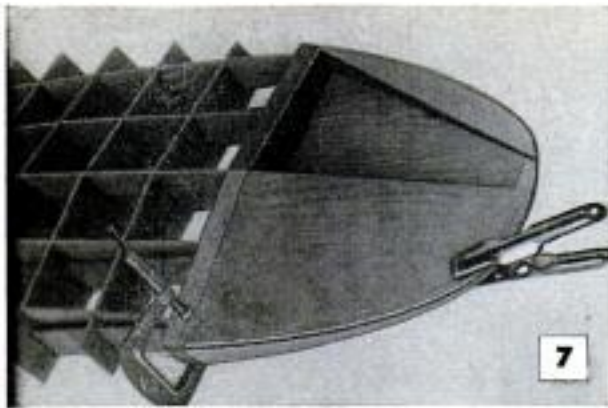


Above, bottom view of partly assembled hull shows bow, stern block, side walls and top deck in place



Above, top and bottom views of stacked and clamped ribs. Note strips of hardboard in keel slots to keep ribs aligned. Below, slotted ribs and stringers are trial-fitted to assure proper fit before gluing



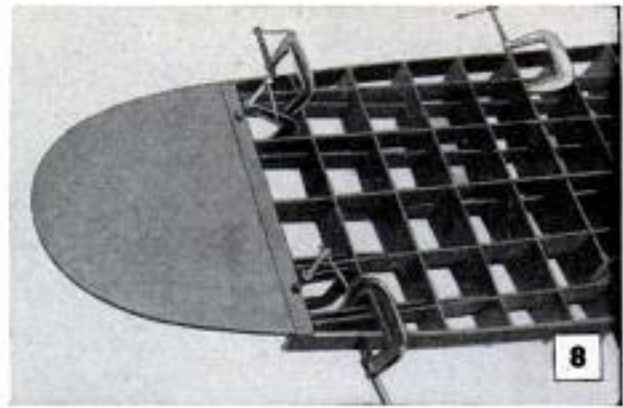


Rib No. 1 is cut from hardwood, slotted to accept ends of keels and stringers, then glued in place

and place weights on it to keep all pieces in proper alignment and contact. Make certain that the top edge of each stringer and the keel are flush with the tops of all ribs. After the glue has completely set, glue in the bottom stringers and keel, also placing weights on them to hold them in place until the glue sets.

Construction of the bow section of the paddle board, Fig. 2, starts with the making of rib No. 1, which is cut from hardwood. Note that the 2½-in. height of the rib is ¼ in. less than required at this point, to allow for the difference in the thickness of the ¼-in. plywood used to cover the bow, and the ⅛-in. hardboard used on the rest of the hull. A rabbet is cut in the plywood, as indicated, to accept the ends of the deck and bottom. The curved pieces of the bow frame are made according to the bow details in Figs. 1 and 2. Note that the bow frame is ¼ in. wider than No. 1 rib, where it attaches to the rib. This offset on each side allows for the ⅛-in.-hardboard sides and provides a flush joint at this point. As indicated in Fig. 2, a triangular-shaped center brace also is included in the bow section. The lower surface of this brace is beveled along each edge so that it will meet squarely with the two bottom pieces of plywood. Notches are cut in No. 1 rib to receive the top and bottom stringers and keels and it is glued in place. The bow pieces then are assembled and glued and the plywood top piece is glued and clamped in place, Fig. 8. When the glue has set, the bottom pieces of plywood are glued to the bow and clamped until the glue sets, Fig. 7.

The deck planking is next. Cut the deck from hardboard, making it ¼ in. oversize. Place the deck planking, bottom side up, on a flat surface, coat the top edges of all ribs and stringers with glue and invert the egg-crate assembly on the planking. Place weights on the assembly, making sure that all ribs and stringers contact the deck planking at all points. When the glue has set, cut two side pieces, making them ⅛ in.



Curved blocks for bow next are glued in place. Finally, plywood top and bottom are glued to assembly

too wide. Coat the edges of the rib ends with glue and clamp the side pieces in place, allowing the ⅛ in. extra material to project below the bottoms of the ribs. When the glue has set, plane the edges of the deck so they are flush with the sides as in Fig. 3. Now, cut the two halves of the bottom planking and coat the inner surfaces of the planking and all inside surfaces of the partially completed paddle board with marine spar varnish or a vapor-barrier sealer. The bottom planks now are glued on, one at a time. Clamp them tightly to the sides and use weights to assure that they contact all ribs and stringers. When the glue has set, drill holes in the ends of the deck, sides and bottom planking and drive wood screws through these pieces into the stern block and No. 1 rib. Plane and sand all corners of the paddle board so they are smooth and rounded.

Application of the glass-fiber cloth is the final step. Place the paddle board with the deck side up, fitting wedges under the bottom to keep the board steady. Cut a piece of glass-fiber cloth large enough to fit over the deck and down the sides. Paint the deck with polyester resin, leaving a dry strip ⅜ in. wide along both edges. Start at the bow with the cloth and press it into the resin on the deck. Immediately paint both sides of the paddle board with resin, as well as the untouched ⅜-in. strip on the edges of the deck. Pull the cloth down over the edges and press it into the resin on the sides. The cloth folds readily over the edges as it contacts the resin, something it would not do if it had been saturated with resin before being folded. The resin sets up so rapidly that the cloth would have become semirigid by now if the ⅜-in. strip had not been left dry along the deck edges.

After the resin has completely set, invert the paddle board and apply resin and glass cloth to the bottom, allowing it to overlap the sides, bow and stern. This provides a double thickness of cloth at bow and stern for added strength. ★ ★ ★

Know-How Fills the Creel



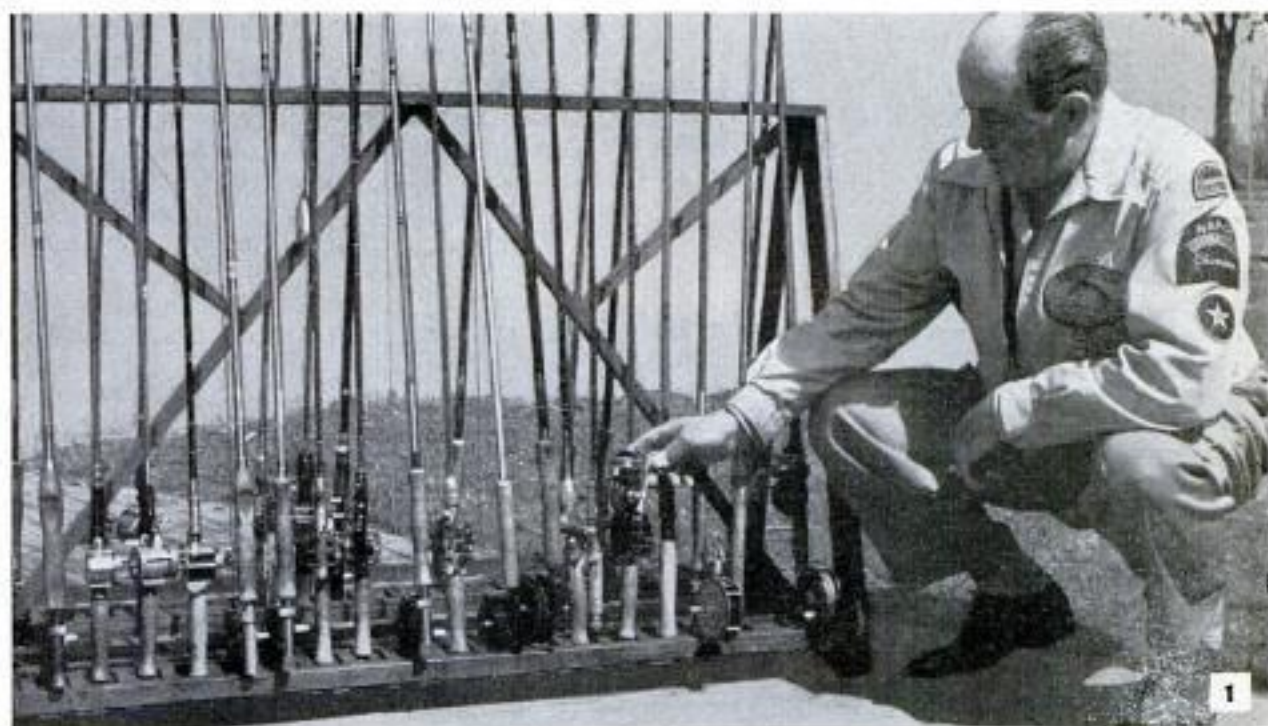
By Claude M. Kreider

HAVING A FULL CREEL at the end of a day of fishing often depends on the angler's skill with rod and reel. The skill, in turn, depends in large degree on the correct combination of rod, reel and line. If there is an organized casting club in your area, contact them for aid in increasing your casting skill. They usually have access to a park lake or swimming pool, and seeing the splash of the lure as it hits the water adds realism to casting practice which is

missing when you have to cast on dry land. Also, members of such a club can give you the benefit of their experience in choosing tackle best suited to your particular needs. And because they have a large variety of tackle, Fig. 1, you can learn for yourself the importance of using the correct line with a particular rod and reel.

However, if no club is available to you, a back-yard lawn will substitute for a body of water and an old bicycle tire can be

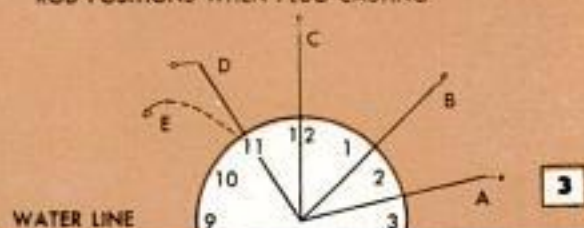
An organized casting club will have the tackle and facilities to aid in improving your casting skill





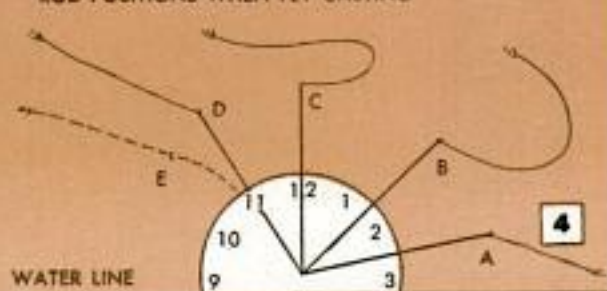
Upper reel is spinning type, the lower is for plug casting. When plug casting, thumb is held on reel spool as indicated to control accuracy of cast. No control is used on spinning reel, once line is released when forward cast is made

ROD POSITIONS WHEN PLUG CASTING



Above, rod positions for plug casting are indicated over a watch face to demonstrate various angles through which rod passes during back cast to D at 11:00 where rod flexes to E at 10:30, then picks up momentum for cast and follow-through

ROD POSITIONS WHEN FLY CASTING



The rod positions for fly casting are similar to those used in plug casting. Main difference lies in the fact that the weight of the extended line flexes fly rod to provide momentum for forward cast, while weight of lure flexes casting rod



The upper two reels are types of spinning reels, lower reels are two types used for plug casting

your target. The table, Fig. 8, will aid you in selecting the right line for your fishing rod.

Fly Casting and Tackle

Your fly rod can have a 7½ or 8-ft. length for small-stream trout fishing or a 9-ft. length for larger streams and lakes. For large trout and bass, when using fly or bug lures, a 9½-ft. rod weighing 6 oz. is best. A rod with just the right amount of backbone permits greater distance and better control when casting a fly, but only if the line matches the rod action. Most beginners use a line too light, and of the wrong type. In fly casting, the heavy mid-length of the line is always in the air beyond the rod, and its weight flexes the rod on the back cast to provide power on the forward cast. Tapered lines, Fig. 8, are recommended because they permit more accurate casting than constant-diameter lines. Line sizes vary .005 in. with each letter size. Thus, a double-taper line designated HDH will have a diameter of .025 in. at each end, tapering up to a mid-length diameter of .045 in. Torpedo-taper line in GBF size will have about 85 ft. of F running line, tapering up quickly to 15 or 20 ft. of B size, then down to a G tip to which a leader is attached.

The double-taper line is best for dry-fly casting; the torpedo for long casts, or where wet flies, bass bugs and small spinners are used. Use a large, bright fly for practice, with the point of the hook removed for safety. Start with about 30 ft. of line extended from the rod. Pick it up for a back cast by imparting a quick snap to the rod from a position about 2:30 on a watch dial, Fig. 4. Apply full power back through B and C and decrease to D. At this point you will feel a distinct pull on the line as the back cast straightens. Start the forward cast with a powerful snap to build momentum

in the line quickly. Apply power through C and B, at which point the rod speed is diminished to follow through to point A as the fly alights. After mastering the 30-ft. length of line, increase the length, pausing slightly longer at the finish of the back cast to permit the longer line to straighten. At about 50 ft. you will reach the practical limit of an ordinary cast. But where there is need for greater distance you still can shoot the line 12 to 15 ft. farther. Strip several coils of line from the reel and hold them in your left hand. Execute the pickup and back cast with the maximum amount of line you can handle in the air. Then, as the line straightens, add extra force to the forward drive. Release the coils just as the line straightens on the forward cast. This trick will send the fly under overhanging branches or ahead of you into water you cannot reach in waders.

Plug Casting

The weight of the plug or other lure flexes the rod in plug casting and thus permits the rod to develop its driving power. In this type of casting, careful thumbing of the reel is important, Figs. 2 and 6, as this is the only method of controlling the cast both for distance and accuracy. The casting rod can be glass fiber, bamboo or steel, and 5½ to 6 ft. is the best length. It should be fairly stiff through the lower two thirds of its length, with a rather flexible tip. The line may be silk or nylon, testing from 6 to 15 lb., depending on the size of the fish you expect to catch. The reel need not be expensive, but should have a free-running spool of the lightest weight to eliminate any possibility of a "flywheel" effect, which can cause overrunning and backlash. Also, the reel should be of the level-wind type to spool the line evenly when you retrieve, lower two reels, Fig. 5 and Fig. 7. Start with a target 35 to 40 ft. away. Grasp the rod easily with the hand in a natural position that puts the reel handle almost on top. Let your thumb



Photo illustrates how thumb is placed on the crossbar of casting reel so it can be used as brake on line. Thumb is used to slow unreeling line, then stop it when plug is above target. A calloused thumb is a definite aid for this



Illustrated above are three types of fly-rod reels of the nonautomatic type. Fly-rod reels are larger than plug-casting reels and are located below rod at rear of handle instead of on top of rod ahead of handle, as are plug-casting reels. Below, double-taper and torpedo-taper fly lines have varying diameters in over-all length



Rod Length	Rod Weight	Double Taper	Torpedo Taper
7½ ft.	3 to 3½ oz.	HEH	HOG
8 ft.	4 to 4½ oz.	HEH OR HDH	HCF
8½ ft.	4¾ to 5 oz.	HDH OR HCH	HCF OR GBF
9 ft.	5½ to 6 oz.	HCH OR GBG	GBF OR GAF
9½ ft.	6½ to 6¾ oz.	GBG	GAF

rest lightly over a crossbar on the reel, lightly touching the spool, Fig. 6. Start the cast with the plug about 3 in. from the rod tip. Keep your eyes on the target and slowly raise the rod tip to the "aiming position" A, about 2:30, Fig. 3. Increase rod speed lightly to B at 1:30, then snap back smartly to D where you will feel the pull of the plug, the rod tip flexing to E. Apply forward drive at once, carrying through to one o'clock, then diminish rod speed through B and follow through until the plug lands. Thumb pressure on the spool is lightened—but not entirely released—when the rod tip reaches vertical, then gradually applied to stop the plug at your point of aim. With an hour's practice you should be able to place half your casts within a 30-in. circle at 40 ft., and in another hour or two attain a smooth delivery up to 80 ft.

Spin Casting

Of the three types of casting, plug, fly and spin casting, the latter is the easiest to master. The spinning rod is light and whippy, permitting the use of many light lures too heavy for a fly rod and too light to develop the action of a conventional plug-casting rod. Also, the spinning reel releases its line spirally off a fixed spool, so there is no problem of backlash. Seven feet is a good length for a spinning rod, and the reel should hold about 100 yd. of line testing from 6 to 12 lb. for most fresh-water fish. For salt-water fishing, and larger fresh-water fish, the rod may be of the two-hand type with a long cork handle. In this case the reel will hold up to 200 yd. of heavier line.

The conventional spinning reel has a pickup bail, or finger, which you "cock" (set at the casting position) with the forefinger at the start of the cast, upper reels, Fig. 2 and Fig. 5. The cast is executed with the same motion as plug casting, but more slowly, due to the longer and more flexible rod. Your forefinger is used to hold the line against the rod grip until the moment of release when the rod is at a one o'clock position.

As with any sport, skill at casting requires practice. An hour or so several evenings a week, or on week ends when you cannot go fishing, can be well spent in improving your ability with rod and reel. The full creel of fish you bring home will be ample reward for your time. ★ ★ ★

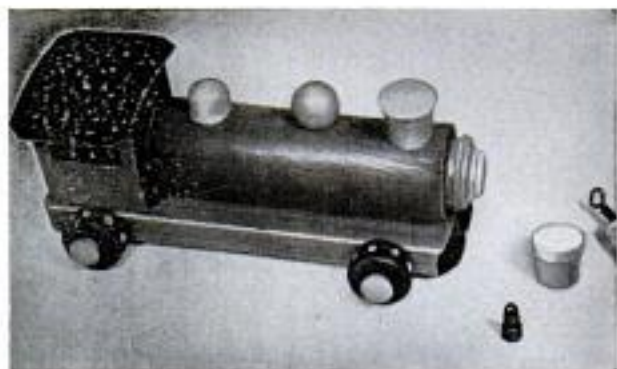


Hypodermic Needle Altered To One-Drop Oiler

For applying a trace of light oil to action parts of guns one gunsmith uses a hypodermic needle altered to suit his purpose. He buys needle units in various sizes, the smallest for light oil and the larger sizes for gun grease or cleaning fluid such as carbon tetrachloride. The sharp point of each needle is ground square across so that small drops of oil will be formed when the plunger is slightly depressed.

Colorful Accessories for Toys Made From Plastic Caps

Toys for toddlers can be made even more colorful by the addition of plastic-cap accessories. The cap from a hand-lotion bottle provided the smokestack for the locomotive pictured, while caps from other bottles provided boiler domes. Pill-bottle caps are cemented to the front of the boiler and toothpaste-tube caps hide the heads of the screws used for wheel axles.



Wet Cloth Refrigerates Fish

To prevent fresh trout from spoiling when cleaned and placed in the creel, one fisherman wraps each fish in a wet dish towel. Air entering through the porous sides of the creel evaporates the water, which cools the fish.

Thomas P. Ramirez, Fond du Lac, Wis.

Enlarging Drawings The Easy Way

Here is a simplified method of enlarging a drawing by laying it out in squares or rectangles. First, draw lines on all four sides to touch the outer extremities of the sketch. Then draw two diagonal lines within the box thus formed, and draw a vertical and horizontal line to bisect these lines where they cross, thus forming four divisions. If required, each of these divisions may be divided into four parts, and so on, depending on the detail of the sketch to be reproduced. Mark copy the same way.—Henning Nelms, Washington, D. C.

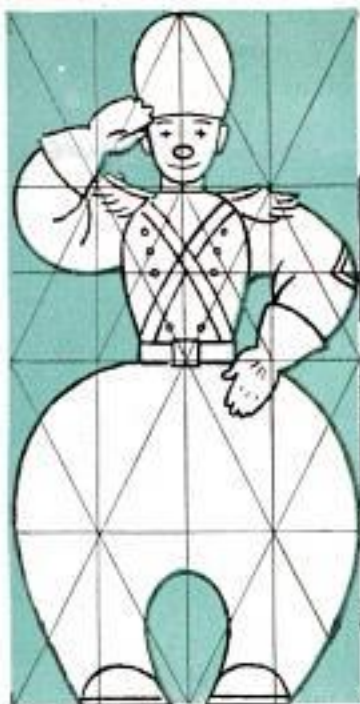


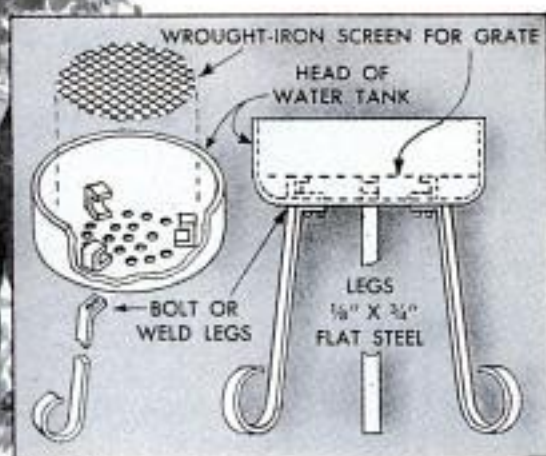
Photo Solutions Protected Against Damage by Air

Home photographers can use one of the two following methods to prevent spoilage of developing solution that is caused by the presence of air inside the bottle. The first method is to replace the liquid that is removed each time by dropping clean glass marbles into the bottle until the level of the solution is raised up into the neck, thus eliminating most of the air. A second method of protecting the solution is to distribute the liquid in a number of equal-size small bottles, each holding just enough solution for one session of print developing. By this latter method a gallon (128 fl. oz.) of stock solution will fill thirty-two 4-oz. bottles.

Car Battery Illuminates Trailer In Absence of Park Facilities

If you find it necessary to park your trailer where 110-volt electrical service is not available, your car battery may be used to operate one bulb inside the trailer. To do this, wire an extension-cord type of receptacle into the car-battery circuit, running one heavily insulated wire from the starter terminal where the battery terminal connects. Run a second wire from the receptacle to a bolt on the car frame. Mount the receptacle on the underside of the car trunk or bumper. This will enable you to plug the trailer circuit into the car-battery circuit easily. Use one 25-watt bulb of 6 or 12 volts, depending on your battery.

Clinton R. Hull, Santa Ana, Calif.



Midget Barbecue From Water Tank

When fired with charcoal this midget barbecue will cook as well as the larger ones. The fire bowl is the top of a hot-water tank. Three flat-steel legs support the unit. The grate is a wrought-iron screen supported on steel brackets. Several small holes drilled in the bottom of the fire bowl assure adequate draft. A welded-wire shelf provides a cooking surface.



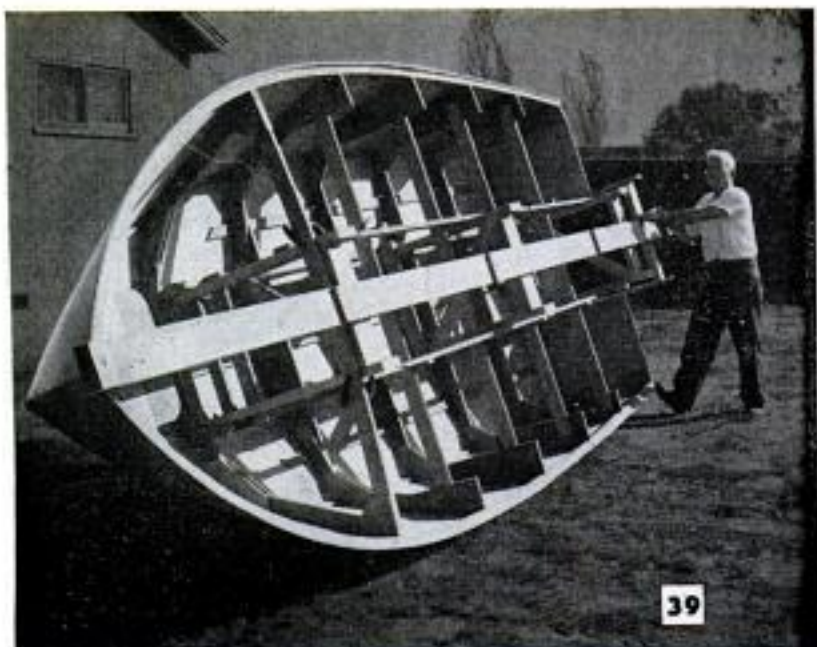
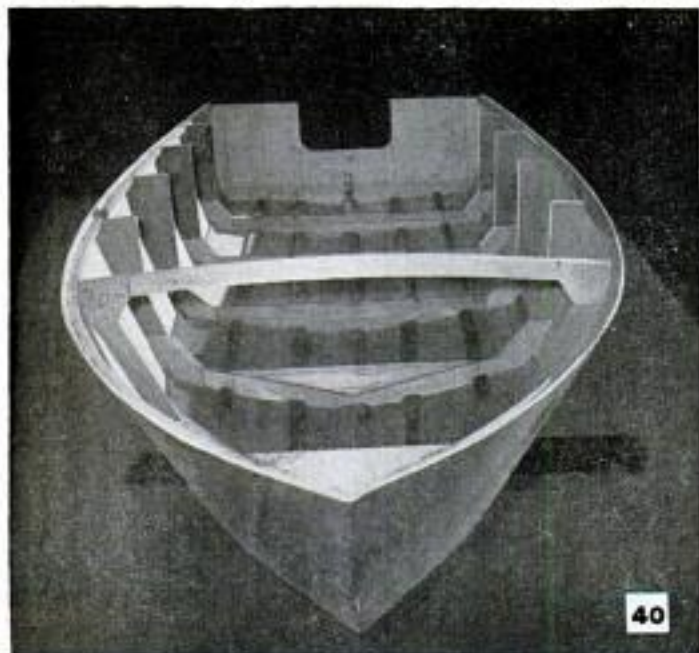
SEA KNIGHT

PART III

By **Glen L. Witt**,
Naval Architect

AT THIS STAGE of construction *Sea Knight* is completed right side up which means that before continuing, the hull and building form are turned over. This is done with the form in place as in Fig. 39, for the simple reason that it continues to brace the hull during the topsy-turvy operation. After the hull is right side up, the form is dismantled piece by piece and removed. Your boat should look like

Here is what your hull should look like when turned right side up and building form removed. Note frame deck beam



Hull is rolled over with building form in place so it remains braced during the operation. Use a pad to protect the planking

Fig. 40, with one deck beam in place. Since the lines of the hull are curved and thereby offer no reference plane from which to work in plumbing and squaring the cabin and interior fixtures, it is important that the hull be chocked and braced securely so that the setup level is again level both fore and aft, as well as athwartship. Use a level on the frames.

Carlings: The carlings are trim pieces that line both sides of the cockpit. They measure about 13 ft. long and fit between the transom and the deck beam on frame No. 5. Fig. 41 shows the carlings installed. They are ripped about 4 in. wide from 1-in. mahogany or oak and are screwed to the edges of the frames so the lower edges of the pieces are 2½ in. down from the top at the transom and the deck beam. In referring to the sectional frame drawings in Part II, you'll see that the carlings are even with the tops of the frames. This means that the tops of the carlings must be arched to match the deck contour. A long batten resting on the tops of the side frame members is used to mark them. You may find it necessary to either trim or shim the frames so the carlings are straight. Fasten with 2-in. No. 10 screws.

Intermediate deck beam: This beam is installed at a point 27 in. from beam No. 5 and serves to frame the forward end of the hatch. It assumes the same crown as the other beam and is cut from 1 x 3-in. oak or mahogany. You'll notice in the profile view, Fig. 46, that it rests on

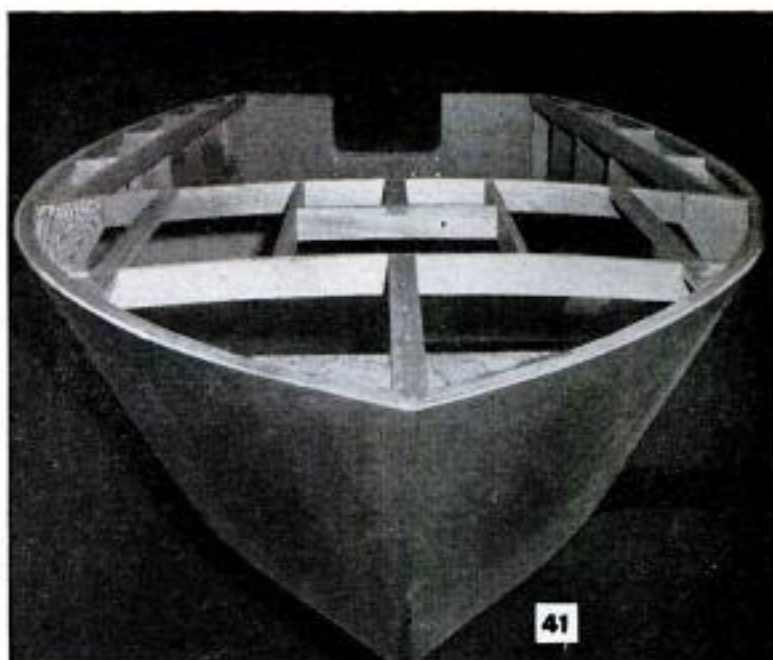
Here you see the carlings, deck beams and battens, and hatch framing installed ready for plywood decking

blocks at the sheer clamps and is fastened with 2-in. No. 10 screws.

Strongback: This member extends from beam No. 5 to the breasthook and is tapered at the forward end to lie flat against the slanting breasthook. It is applied in one length to assure trimness and is housed in notches cut in both deck beams. It serves as a backing for the deck-planking joint and is later cut away where it bridges the hatch opening. Fasten in place with glue and 2-in. No. 10 screws. Notches in both beams, 22 in. each side of the centerline, house two deck battens.

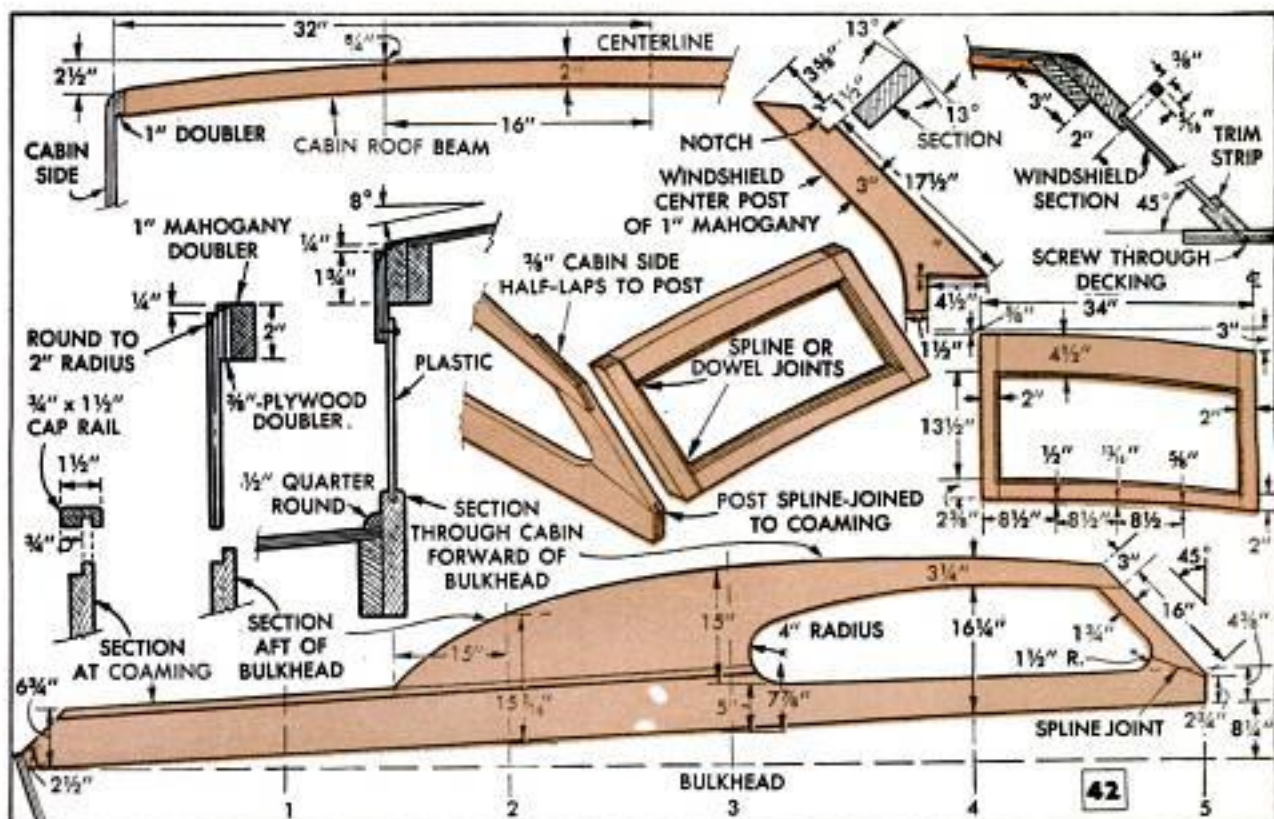
Hatch frame: The hatch is formed by separate framing members installed between the deck beams. These are crowned to coincide with the curvature of the beams, as well as the deck curvature fore to aft. The deck-framing plan shows the spacing of these members to form a 15 x 18-in. hatch.

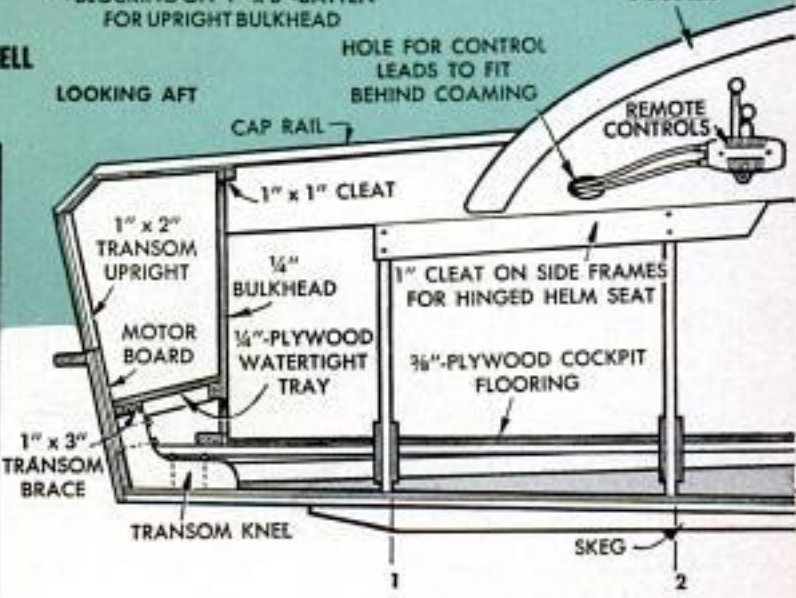
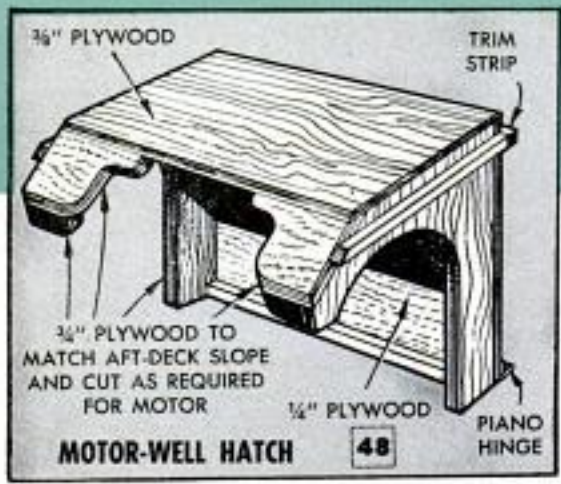
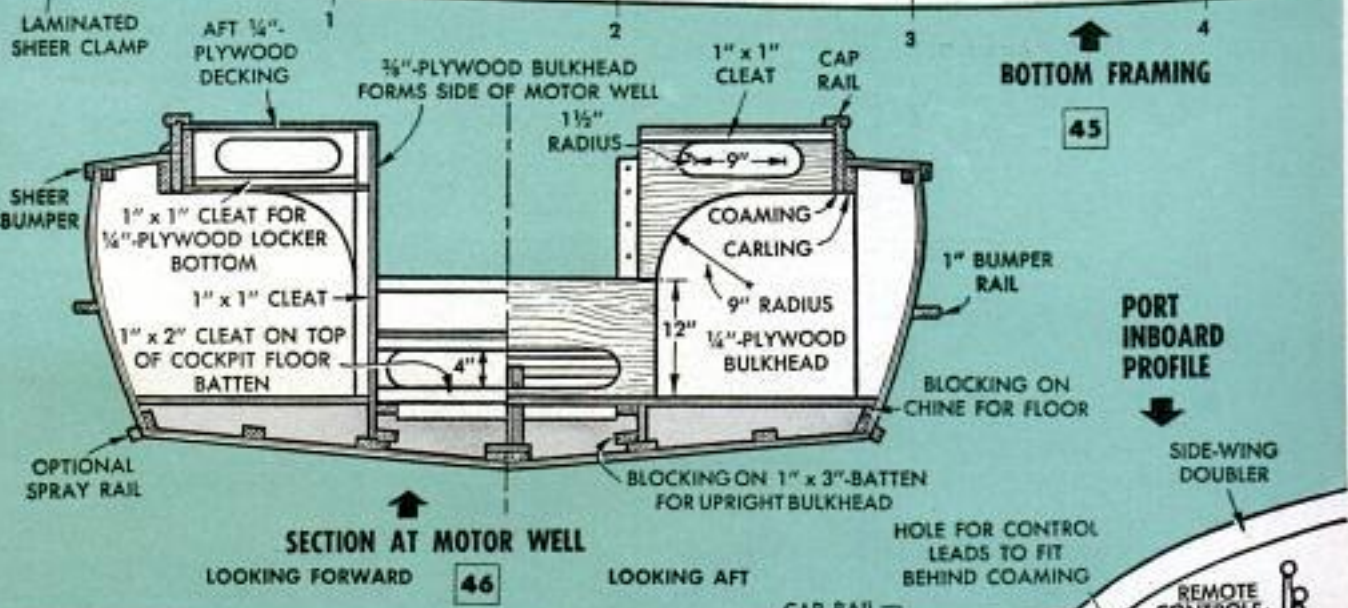
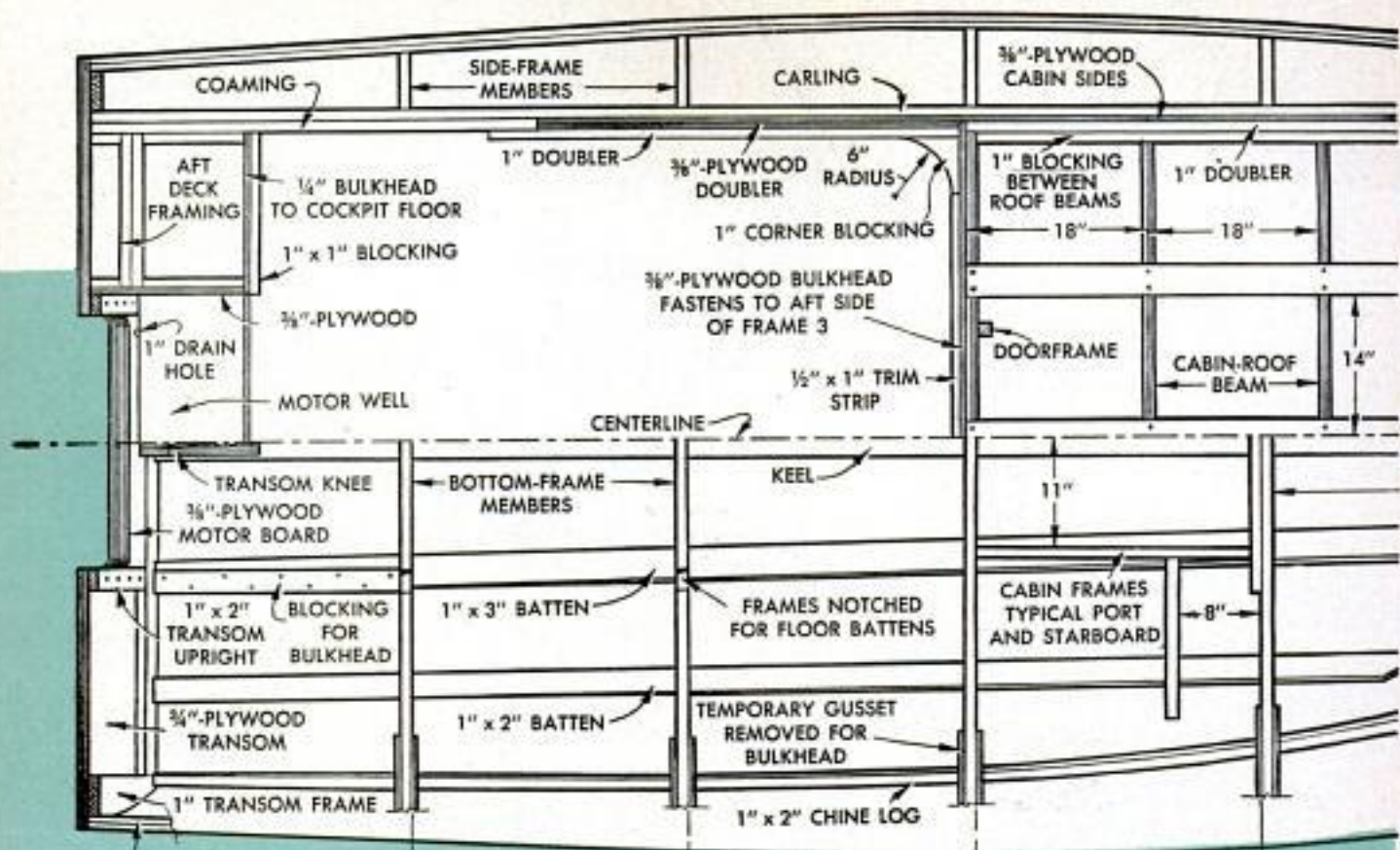
Decking: The edges of the side planking, sheer clamps, carlings, battens and strongback must be faired so the deck planking will lie flat on these members. The decking should be $\frac{3}{8}$ -in. exterior plywood, either AA or AB grade. The forward decking is

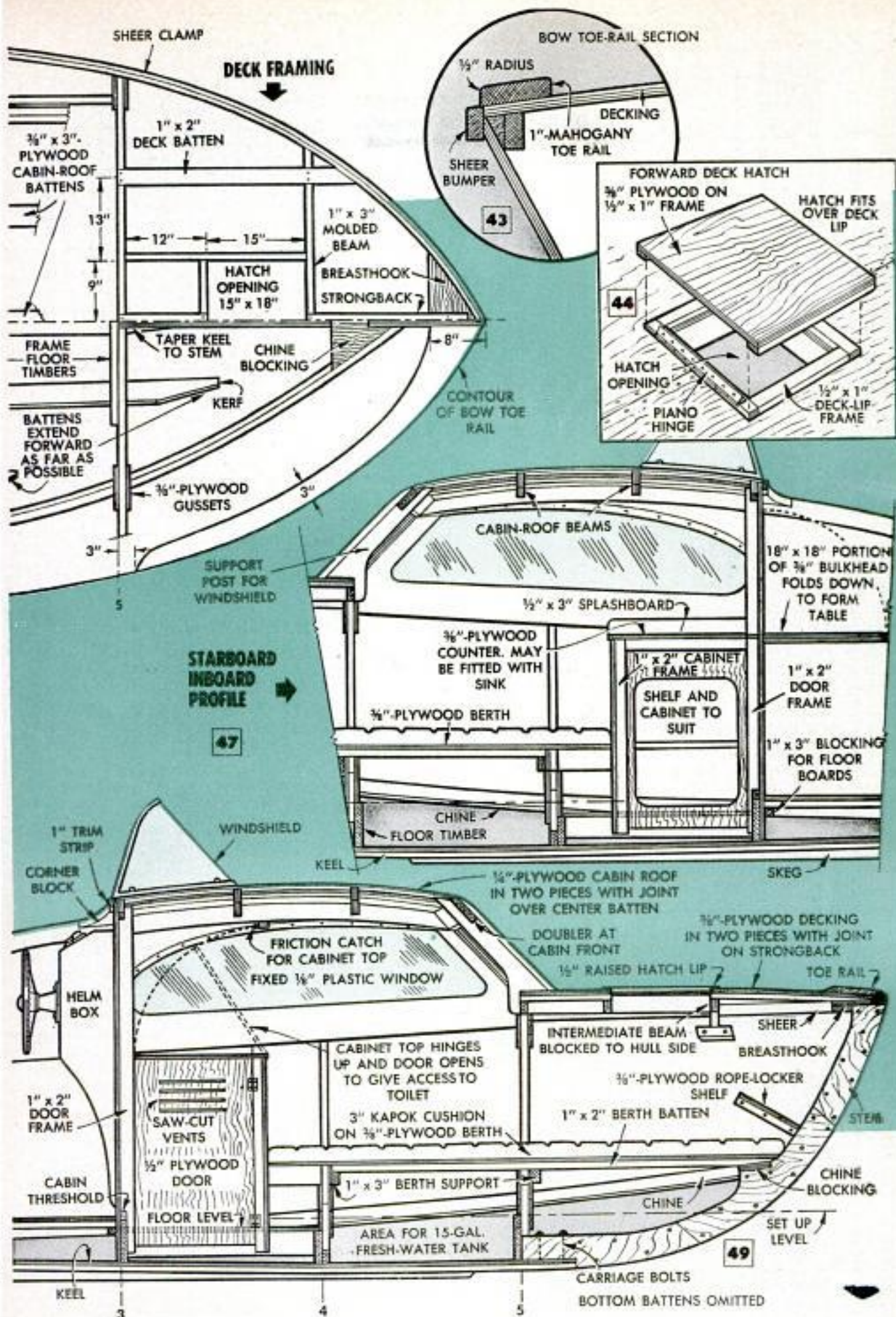


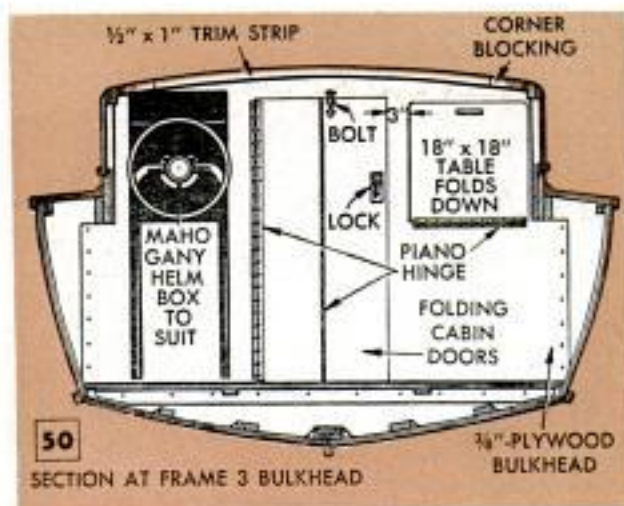
applied in two pieces with the joint falling on the center of the strongback. The side decking is applied in lengths as long as possible. Where joints must be made, the plywood is butted and backed with blocking. All decking is nailed at the outer edges with $1\frac{1}{4}$ -in. ring-type nails spaced 3 in. apart, whereas 1-in. nails are used in fastening it to the battens, beams and strongback. After fastening, the decking is planed to bring it flush with the side planking.

Cabin interior: The forward rope-locker shelf is positioned to suit the builder, keeping in mind that you'll need foot clearance



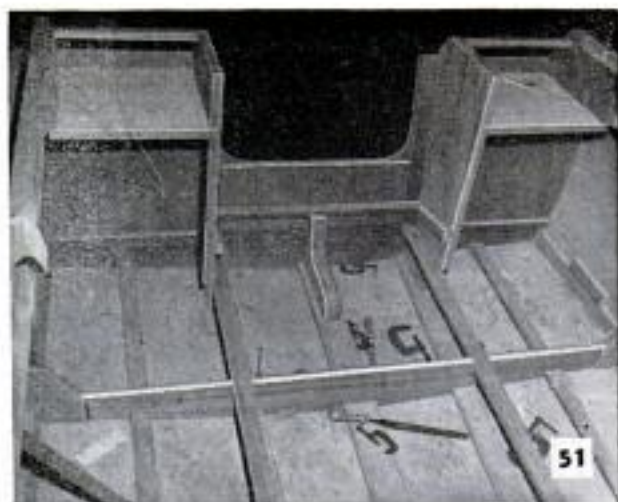






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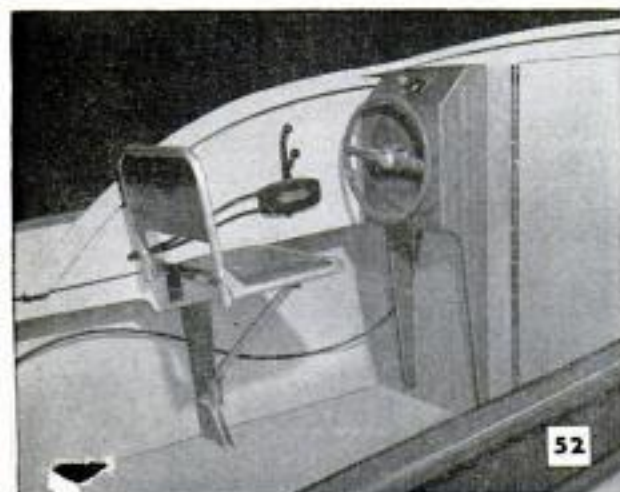
SECTION AT FRAME 3 BULKHEAD



51

below it for sleeping comfort. In Fig. 49 you can see that it is merely supported at a slant by cleats. The port and starboard cabinets are supported on members installed between frames Nos. 3 and 4 and are kept at the same height as the floor timber of frame No. 4. By studying the bottom-framing plan, Fig. 45, you'll see where these members are placed in relation to the centerline of the keel and frame No. 4. The pieces that are 8 in. from the frame extend outward as far as possible at the same height as the floor timber. The plywood sides of the cabinets, both port and starboard, are fastened to this member. Since the cabinet tops are 24 in. above the setup level, these sides must be fitted to this level. Where the cabinet sides join the side planking, they are fastened to 1 x 2-in. cleats which extend from the carlings down to the chines. On the forward side of the cabinet sides, 1 x 3-in. cleats are added 7½ in. above the setup level to support the aft ends of the plywood berth. Berth supports also are screwed to the forward sides of frames 4 and 5 at the 7½-in. level. See Figs. 31 and 35 in Part II. Both of these supports are notched at the center-

You can use a commercial helm seat or make one of plywood and pad it. Note motor-starter control



52

View looking aft toward transom shows partial completion of motor well and stern storage compartments

line to house a 1 x 2-in. batten that extends from frame No. 4 to the chine blocking at the stem. Additional blocking is installed between the frames at the juncture of the side planking to support the berth plywood at the outer edges, and two more 1 x 3-in. support blocks are installed parallel to the keel between the support at frame No. 4 and the cabinet sides. The ¾-in.-plywood berth covering is installed in two sections, letting the joint come on top of the 1 x 2-in. batten.

Cabin sides: The lower portion of the cabin sides, which actually is the coaming, is ¾-in. mahogany, while the upper part is ¾-in. exterior-grade fir plywood. A full-size paper pattern of the side, Fig. 42, over which each cabin side is assembled, will be needed before you start. The windshield end posts are doweled or splined to the coaming part and notched at the top to receive the plywood portion flush. The lower edge of the plywood fits a ¾-in. rabbet cut in the outside edge of the coaming. You'll notice that a ¼-in. groove is cut in the edge of the coaming, as well as the corner post, to receive a ¼-in.-plastic window. The assembled cabin sides are installed with the lower edges even with carlings. Use plenty of mastic between the cabin sides and the carlings and fasten with 1½-in. No. 8 screws, well staggered and 6 in. apart.

Bulkhead at frame No. 3: Now the temporary gussets can be removed from the aft side of frame No. 3 and a ¾-in. plywood

To Save Both Time and Work

If you wish, you can buy the patterns for the stem, frames, transom, breasthook and chine blocking already drawn full size. And, to further simplify construction, you can buy these parts in kit form accurately cut in mahogany from Glen-L, Marine Designs, P.O. Box 568, Compton, Calif.



Cabin sides and windshield have been added and beams installed to support plywood roof which is added next

bulkhead glued and nailed to the frame with $1\frac{1}{4}$ -in. ring nails spaced 4 in. apart. The top of this bulkhead is crowned to conform with the cabin roof and, as a doorway must be made in it, it is more practical to install the bulkhead in two sections. See Fig. 50. Two doublers are added to the top edges of the cabin sides aft of the bulkhead to help strengthen it. One is of $\frac{3}{8}$ -in. plywood, 2 in. wide, which is beveled 8 deg. and allowed to project $\frac{1}{4}$ in. above. The other is 1-in. mahogany which is applied over the other. The latter one sweeps down across the inside face of the coaming to serve as a brace. This you can see in the profile view in Fig. 49. Glue and then screw the doublers with $1\frac{1}{8}$ -in. No. 8 screws.

Cabin beams: The cabin-roof beams are cut from $\frac{3}{4}$ -in. plywood and kept 2 in. wide. Three of these are required and their exact lengths should be taken from the boat. Three $\frac{3}{8}$ x 3-in. notches are cut in each beam for plywood roof battens. Before the beams are installed, a 1-in. doubler of mahogany is added to the cabin sides forward of the bulkhead. This too, is beveled 8 deg. and allowed to project $\frac{1}{4}$ in. In gluing and screwing the doublers in place, keep the screws as low as possible so they will not interfere later when rounding the edges. The cabin beam at the bulkhead is installed first, gluing and nailing it directly to the plywood with 1-in. ring nails spaced 4 in. apart. A ledge cleat to support the cabin roof is applied to the face of each doubler in three sections. Like the doubler, it is cut to match the curvature of the cabin roof line and beveled 8 deg. After

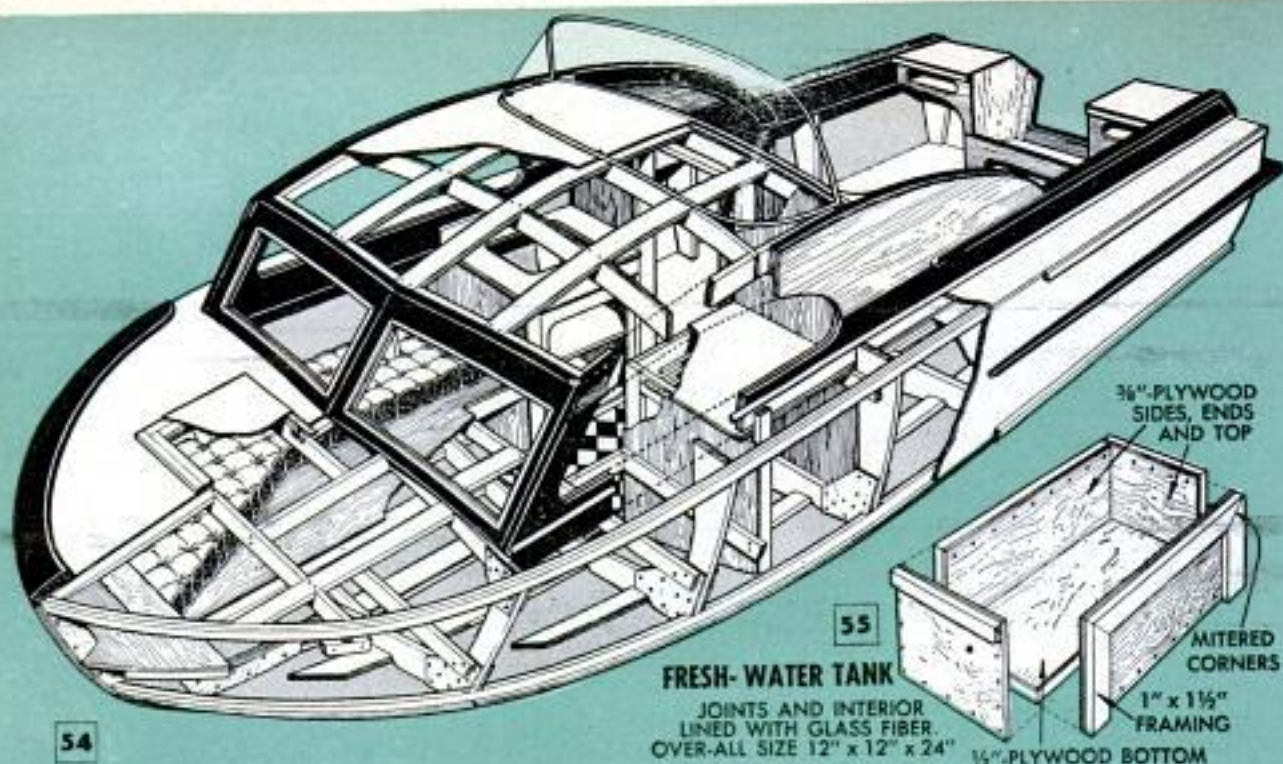
the first beam is installed, a section of ledge is added. Then the second beam is butted against the end of the ledge piece and fastened to it with screws. Then another section of ledge is added and another beam and so on.

Doorframe: The cabin doorway is framed on the forward side of the bulkhead with 1 x 2-in. mahogany strips that extend from the beam to the floor member. The strip on the starboard side of the doorway also serves as one frame for the door of the toilet enclosure. On the galley side, the $\frac{1}{4}$ -in.-plywood cabinet front is sandwiched between the 1 x 2-in. frame member and a 1 x 2-in. cabinet upright. Study Fig. 47.

Galley cabinet: The shelves in this cabinet are positioned to suit the builder. Cleats are used to support the plywood top and then a splashboard is fitted across the back to fill the gap between the cabin side and the cabinet. The cabinet top should be covered with linoleum or counter plastic. Like the galley cabinet, you already have two sides of the head (toilet compartment) completed. The front is merely a hinged panel of $\frac{1}{2}$ -in. plywood with saw-cut vents in the face. The hinged top of the head is $\frac{3}{8}$ -in. plywood and is held open with a friction catch attached to the cabin side.

Blueprints Available

Those who prefer to build *Sea Knight* from plans larger than the ones presented in the magazine may purchase a set of blueprints, 22 x 34 in., by writing Blueprint Department, *Popular Mechanics Magazine*, 200 E. Ontario St., Chicago 11.



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FRESH-WATER TANK

JOINTS AND INTERIOR
LINED WITH GLASS FIBER.
OVER-ALL SIZE 12" x 12" x 24"

3/8" PLYWOOD
SIDES, ENDS
AND TOP

MITERED
CORNERS1" x 1 1/2"
FRAMING

1/2" PLYWOOD BOTTOM

The bottom of the head should be covered with linoleum for ease in cleaning.

The cabin floor is sprung between the two inner battens and rests on the keel. It can be in one or two parts, and should be covered with linoleum or painted with a nonskid deck paint.

Front-windshield frame: Fig. 42 details the frame which is made up in two parts and supported at the center with a 1-in. mahogany post. This requires a certain amount of handwork to make it fit the curvature of the deck. It is best to make each half oversize so you will have extra stock for fitting, and to bevel the top edges after the framework is in place. A rabbet is run all around for the glass. Cover the screwheads with mahogany wood plugs. A ledge piece across the inside of the windshield at the top forms a rabbet for the cabin-roof plywood. The latter is both nailed and screwed in place after the roof battens are installed. Coat all contacting surfaces with glue and drive 1-in. ring nails around the edges of the roof. Then fasten it to the battens with 5/8-in. No. 5 screws, staggering and spacing them 4 in. apart.

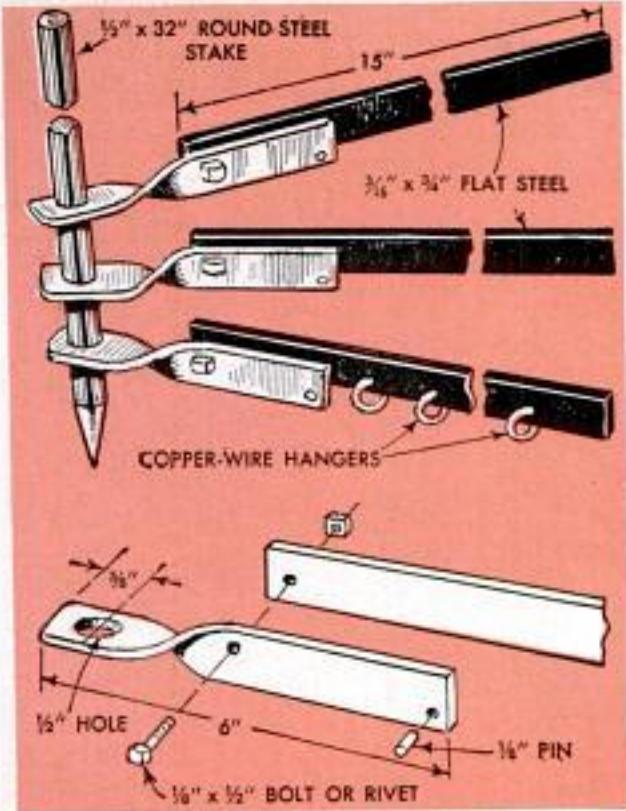
Cap rail: This is a grooved member that caps the rabbeted edge of the coaming and continues past the juncture of the cabin side to cover the joint. The cap rails are not permanently fastened until ready for the final trim. Then it is screwed down to the coaming with 1-in. No. 8 screws, spaced 12 in. apart, and to the cabin side with 3/4-in. ring nails 6 in. apart. A short cap rail is used to cover the slanting part of the

coaming at the transom. At the top corners of the open cockpit, corner blocking is fastened to the cabin sides and bulkhead with glue and two 2-in. No. 10 screws in each leg of the blocking.

Aft deck and motor well: This part of your cruiser will vary slightly with the motor used. As detailed, it worked out very satisfactorily for the 35-hp. Evinrude motor that was used. In studying the transom drawings in Figs. 46 and 51 you will see that 1 x 2-in. uprights are glued and screwed to the transom at each side of the motor cutout. The 1 x 3-in. transom brace which lies flat on top of the transom knee extends to the outside of the 1 x 2-in. uprights. This is glued and fastened to the knee with 2-in. No. 10 screws, as well as to the transom with screws from the outside. A 1 x 2-in. block on top of each 1 x 3-in. batten is installed between the transom and frame No. 1 to support the 3/8-in. motor-well side. The sides of the motor well fasten to the 1 x 2-in. uprights at the transom, to the 1 x 2-in. floor battens and to the blocking on the batten just described.

Motor-well bulkhead: This is cut from 1/4-in. plywood and is held by cleats fastened to the coaming and floor battens. Elongated openings to provide access to glove-compartment-type storage lockers are made both port and starboard and below the motor well for bilge inspection.

In a concluding article next month, the completion of the construction will be described and plans will be presented for building a winch-fitted trailer to transport your *Sea Knight*.



This Folding Grill Is Outdoor Cook's Delight

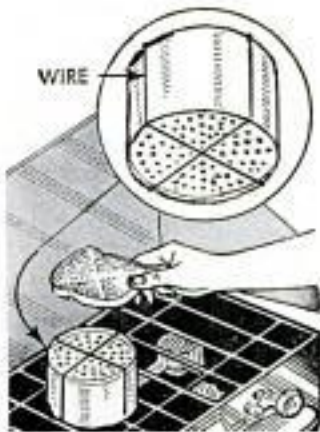
Outdoor enthusiasts who like food cooked over an open fire will find this collapsible stake-type grill a handy camping or picnicking accessory that can be set up in a few minutes and stowed compactly in a pack or car trunk. The unit consists of only four members—three flat steel arms and a round steel stake on which the arms pivot.

When using the grill, you need only drive the steel stake into the ground next to a fire and arrange the arms to accommodate the cooking utensils used, as shown in the photo. The lower arm is equipped with wire hangers for attaching steaks, bacon,

fish and other foods to be broiled. The large hole at the end of each arm, through which the stake is passed, should be made slightly larger than the diameter of the stake to permit positive jamming of the arm at any elevation desired. The 6-in. sections of the arms are twisted 90 deg. as shown in the detail above, and joined to the 15-in. sections by bolts or rivets that permit the latter sections to be folded against the stake when the unit is carried. A steel pin on the outer end of each short piece, serves as a stop when the arm is extended.—J. G. Wing, Santa Fe, N. Mex.

Coffee Can Used as Toaster

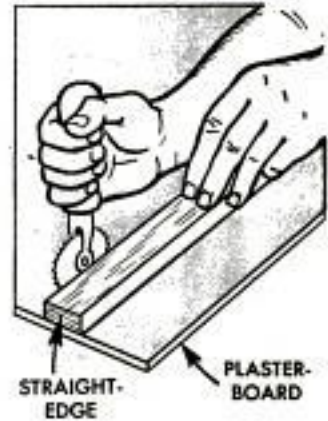
For a toaster that can be used with a portable gasoline stove, punch 25 to 30 small holes in the bottom of a 1-lb. coffee can and wrap two lengths of wire around the can as shown. When using the toaster, simply invert it over a lighted burner and place a slice of bread on the crossed wires.

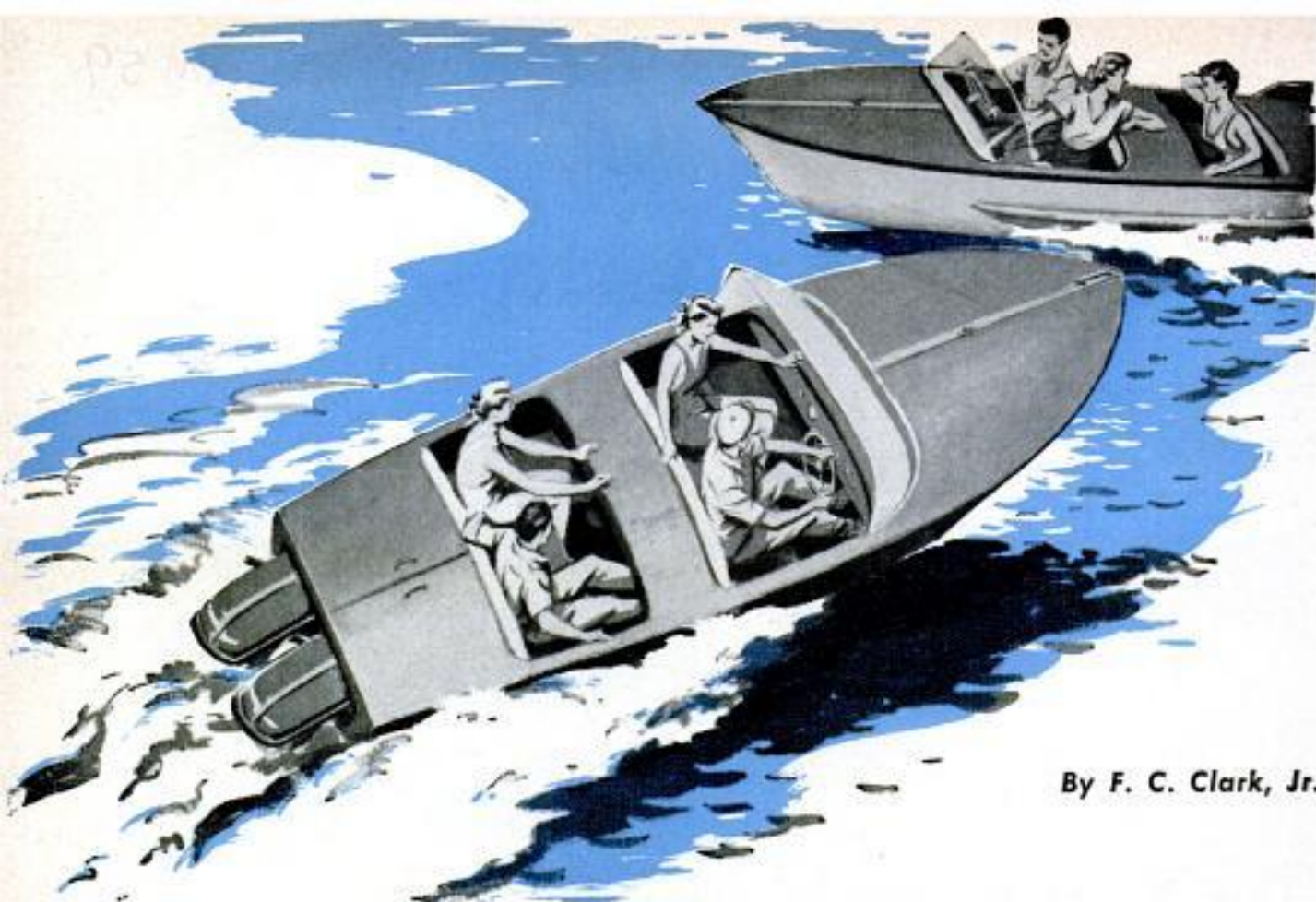


Clinton R. Hull, Santa Ana, Calif.

Rotary Knife Scores Plasterboard

You'll find a serrated rotary knife of the type used for trimming wall-paper better than an ordinary knife for scoring plasterboard prior to breaking it. Use of a rotary knife requires much less effort, since it "punches" through the paper overlay and avoids the friction against the blade when a straightedged knife cuts the plaster core.





By F. C. Clark, Jr.

You Can Steer Your Twin Outboards Like a Pro—

with this remote-control steering system, which has a tie-rod assembly that permits both motors to pivot as a unit, and a sprocket-and-chain assembly that responds instantly to the slightest turn of the wheel

HERE IS A REMOTE-CONTROL steering unit for twin outboards that you can adapt to your own boat for instant rudder response and a solid feel of the wheel when making tight turns in a race or to avoid a collision. The tie-rod assembly provides positive steering control similar to the type used on cars. The bicycle-sprocket-and-chain assembly is optional and is connected to the steering-wheel and tie-rod assembly as shown in the drawing and details. Conventional steering cables and pulleys may be used with the tiller-bar and tie-rod assemblies, but this non-rigid-type cable system may introduce lag or "soft" steering response, when cables stretch and clamps and other fittings vibrate loose as a result of use.

Using the sizes of sprockets shown, effortless steering, lock to lock, is assured with about $2\frac{1}{2}$ turns of the wheel. Any combination of sprocket sizes that will afford a favorable steering ratio may be used. The length of the tiller bar, cut from $\frac{1}{4}$ x $1\frac{1}{2}$ -in. flat steel, is determined by the dis-

tance from the transom to the bulkhead on which assemblies 1, 2 and 5 are mounted. Also, the lengths of the chains, the two shafts for the sprocket assemblies shown in details 1 and 2, and the steering drive shaft will depend upon the size and design of the hull in which the unit is installed.

For proper operation of the tiller-bar and tie-rod assemblies, it is necessary that the tiller bar pivot at a point that is in line with the pivot points of the motors and be equidistant from them as shown in details 3 and 4. Four complete ball joints installed on two lengths of $\frac{1}{4}$ -in. steel rod threaded on both ends, make up the tie-rod assembly, which is bolted to the tiller bar and to steering clamps on the steering brackets of the motors as shown in the photo. The slide, detail 2, is made of two $2\frac{1}{2}$ -in. lengths of steel angle welded together, with a bolt welded on the underside and three holes drilled and tapped in the top piece for screwing the bicycle chain to it. The 36-in. length of $\frac{1}{4}$ x $1\frac{1}{4}$ x $1\frac{1}{4}$ -in. steel angle used as a track for the slide, is of sufficient

length for most boats and is mounted on the forward side of the motor-compartment bulkhead. Also, the track, slide and sprocket assemblies may be mounted on the inside of the latter bulkhead, if there is room, or on either side of any other transverse member that is suitable.

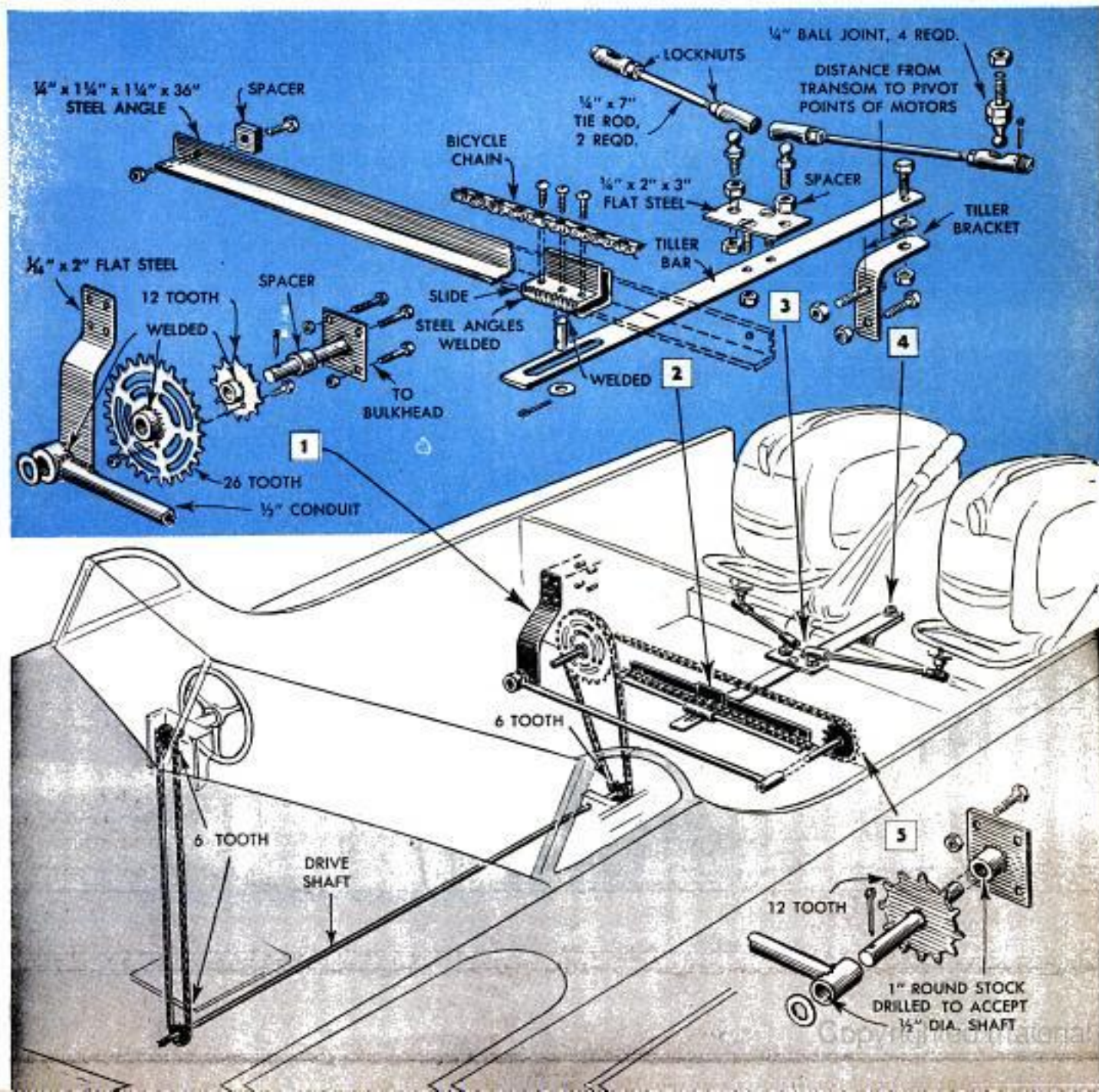
After mounting the tie-rod, tiller-bar and sprocket assemblies, the tiller bar is marked for cutting the slot that receives the bolt on the slide. This is done by moving the bar from port to starboard and outlining the position of the bolt on the bar at the ends of its swing in each direction.

Since the steering drive shaft turns quite slowly, it can be mounted in maple or oak bearing blocks drilled and cut to fit snugly over the shaft and with or without metal linings. The blocks can be screwed to the frames under the floor boards. Any type of steering wheel can be used, simply by mounting it on a shaft and attaching a sprocket as shown in the drawing. ★ ★ ★



Steering clamps of type shown permit secure attachment of tie-rod assembly to steering bars of motors and quick disconnecting when motors are removed

Except for tie-rod assembly, dimensions of structural members, shafts and chains are determined by design and size of boat in which steering gear is installed





Saw Fitted in Slotted Step Kept Handy on Ladder

To keep a handsaw close at hand, yet out of the way, when working from a step-ladder, fit the saw in a slot cut in the top step as indicated. The slot is made by boring two holes, then cutting between them with a keyhole saw.



Mirror and Magnifying Glass Help Find Particle in Eye

Simplify finding that bit of foreign matter in your eye by holding a magnifying glass between the eye and a mirror as shown. Rest your hand against the mirror to steady the magnifying glass, which still can be moved slightly for proper focus.

Low-Contrast Film Adapted for Line-Copy Work

When a contrasty negative for a line-copy job was needed by one photographer, and there was no process film available, he used panchromatic film and exposed it one stop under the indicated exposure for the shot. Next, the film was developed for twice the recommended time in DK60 de-

veloper, immersed in a stop bath, fixed and washed thoroughly. The film then was agitated in a dilute solution of rapid selenium toner for five min., after which it was washed in running tap water for 30 min. and hung up to dry.

Earle V. Leavitt, Knoxville, Tenn.

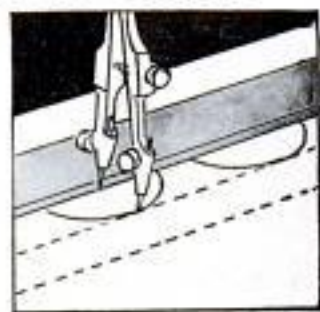
Inexpensive Birdbath Made From Household Items

This easily made birdbath consists of an aluminum pie plate, or a pot cover, that is nailed or screwed to one end of a length of broomstick or dowel, the lower end of which is sharpened to a point. Force the point of the stick into the ground and your birdbath is ready.

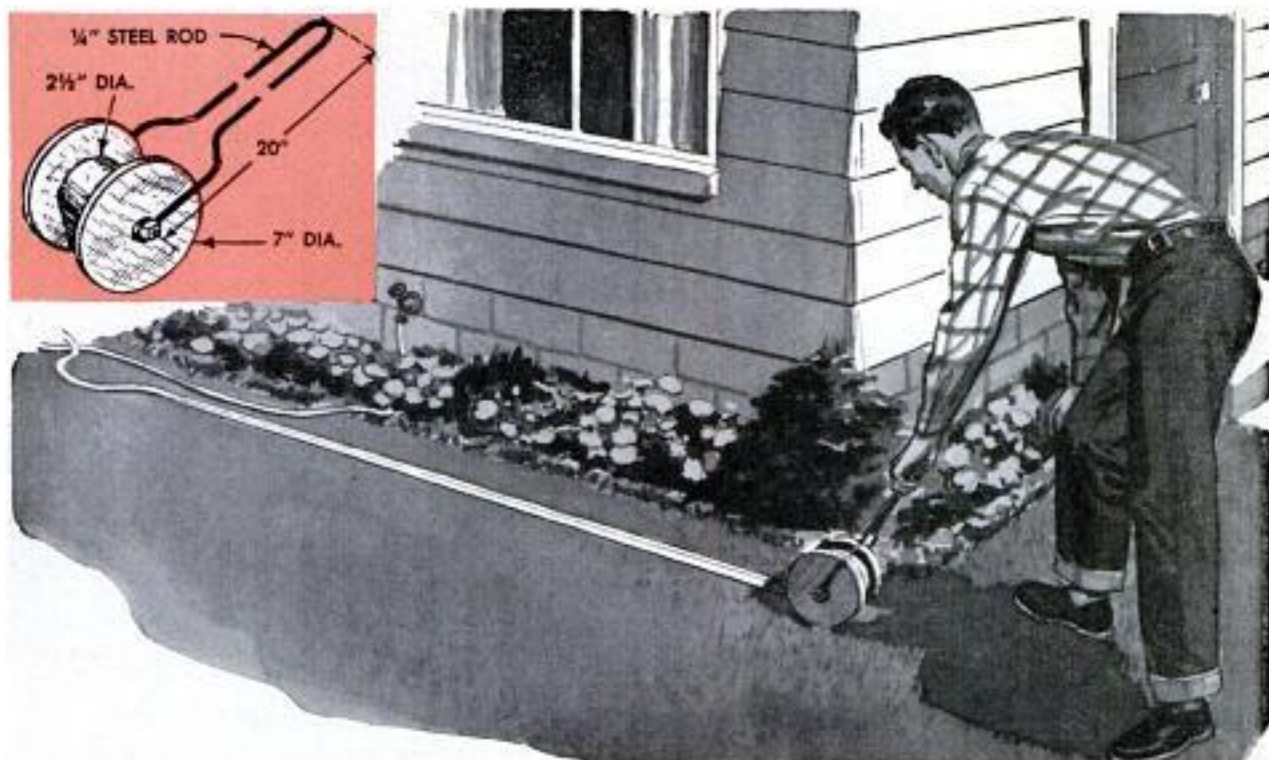


Parallel Lines Drawn Accurately By Scribing Arcs With Compass

Use a compass to assure that two lines are parallel to each other. Set the points of the compass at the distance required between the two lines, then place one leg on the original line and scribe two or more arcs. A line tangent to two or more arcs is parallel to first line.



Soaker Hose Rolled Into Position With Reel



No tangled soaker hose with this handy wooden reel that will pay out the hose just where you want it with little effort. Made of rot-resistant redwood, with a U-shaped steel handle mounted on the axle as shown in the detail, this reel can accommodate 25-ft. of hose and is easily pulled across the lawn or garden. Also, the handle permits convenient storage on a hook. If a hose

longer than 25 ft. is used, it is only necessary to install larger end pieces on the reel. Wood other than redwood may be used for the reel, but it should be well painted or treated with wood preservative. For convenient unrolling and rolling of the hose, the closed end is secured to the drum of the reel permanently.

W. G. Waggoner, Sacramento, Calif.

Egg Slicer Used for Cutting Flat Pieces of Ceramic Clay

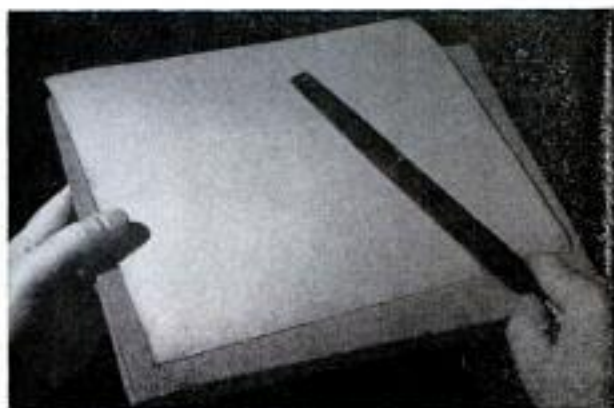
An egg slicer of the type shown is an excellent tool for cutting balls of clay into flat pieces of uniform thickness from which small articles such as buttons and brooches are made. When forming round objects, a length of thin-wall tubing is used like a cookie cutter. Cut surfaces are smoothed with a wet spatula.

Walter E. Burton, Akron, Ohio.



Coarse Sandpaper "Smoothed" For Use on Fine Work

When a fine grade of sandpaper is needed and only coarse is available, pass a mill file over the paper a few times. The file will knock off the points of the coarse abrasive grains so that the paper can be used for finer work. A piece of coarse paper that has been well used also will be dulled enough so that it can be used for finer work.—Ken Murray, Colon, Mich.





Hose Mounted on Masonry Wall Of Garage Protects Car Doors

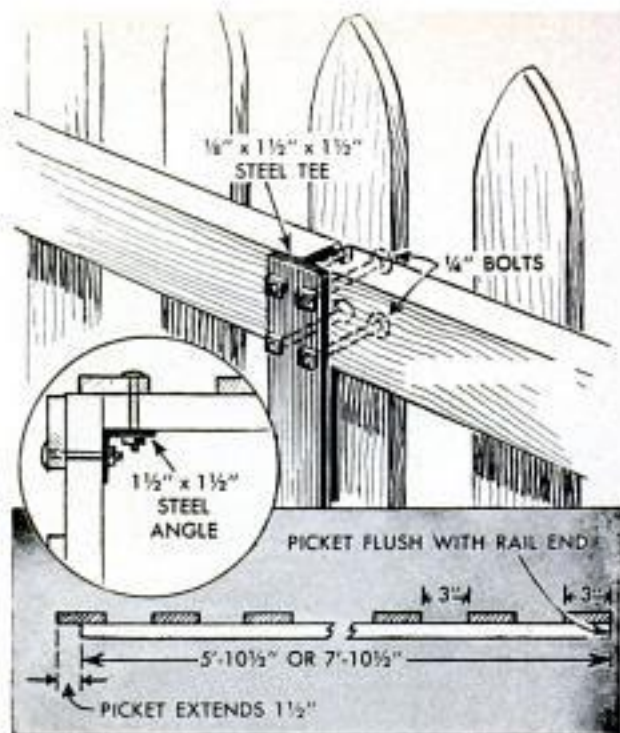
To avoid damaging the finish on his car doors when opening them in a narrow garage with unfinished masonry walls, one homeowner screwed a length of garden hose to a strip of wood anchored on the wall as shown. The protective strip is located at door-handle height and extends about 1 ft. in front and 1 ft. in the rear of the points of contact with the doors. Heads of the screws are inside the hose.

Magnet Hung Over Edge of Tumbler Holds Small Brushes off Bottom

To prevent damage to the bristles of small brushes, a small but strong magnet can be used to hold the brushes having steel ferrules off the bottom of tumbler filled with a solvent as shown. A number of brushes can be held in this manner merely by placing the steel ferrule in contact with the magnet at the desired height. Hook the magnet over the rim of the glass.



☐ A pillow case provides a good cover for a drawing while carrying it, especially if such a cover is needed only occasionally.

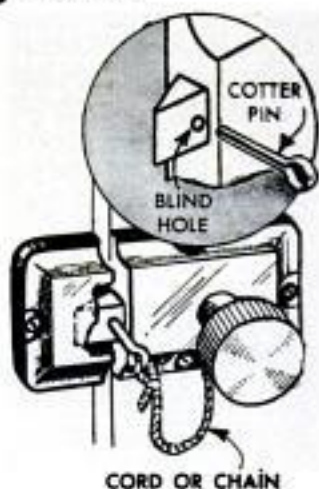


Picket Fence With Steel Posts Easy to Move and Lasts Longer

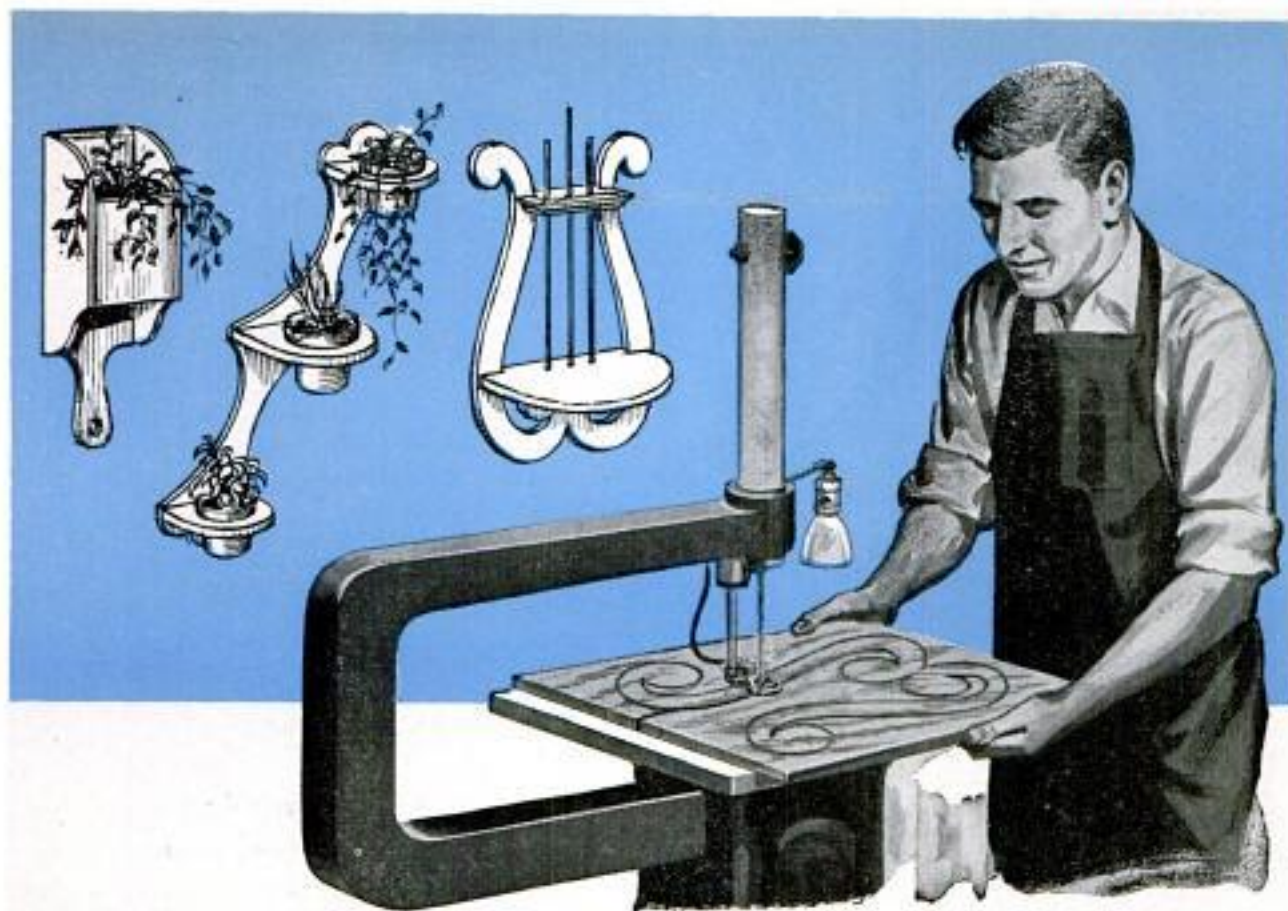
Picket fences with steel tees used as posts as shown, last longer and can be easily moved to new locations when changing the landscaping. A fence is made of sections 6 or 8 ft. long, consisting of 3-in. pickets nailed 3 in. apart on two 2 x 4 rails. Beginning and corner sections are constructed as shown in the top view and detail. All other sections are the same except that the picket on the right end, top view, is omitted.

Cotter Pin in Door-Latch Bolt Serves as Locking Device

A rim-type door latch not equipped with a pin that locks the latch, can be provided with a locking device in a somewhat similar manner by means of a cotter pin. To do this, a pin is slipped into a blind hole drilled in the bolt as shown. The legs of the cotter pin should be spread a little so that they will have to be forced together when inserting, which prevents the pin from working out.



☐ Before mixing cold shortening with an electric mixer, heat the blades in hot water and they are less likely to clog.

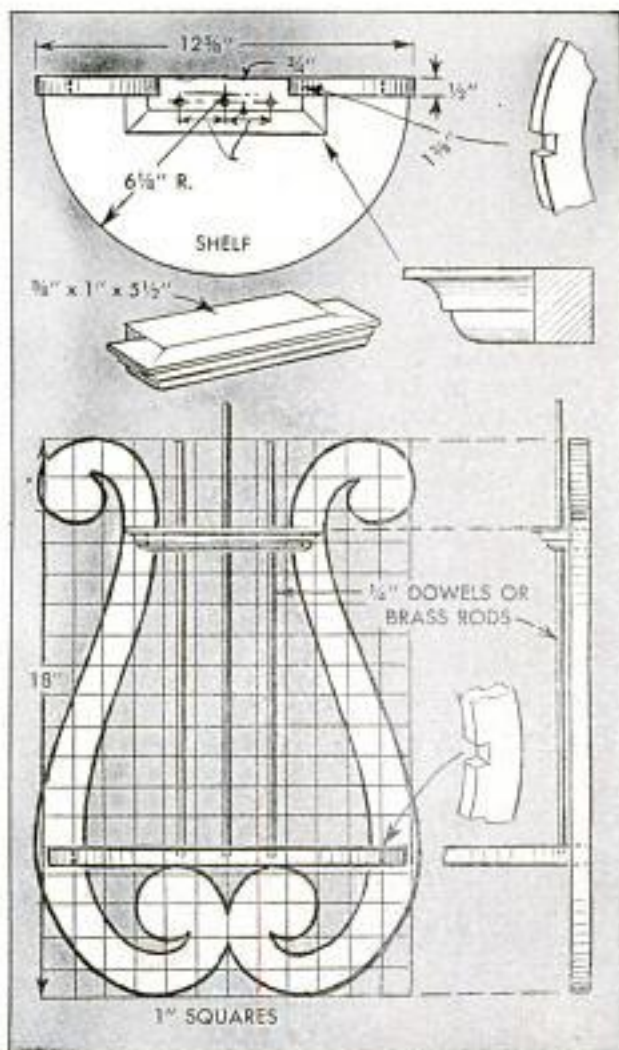


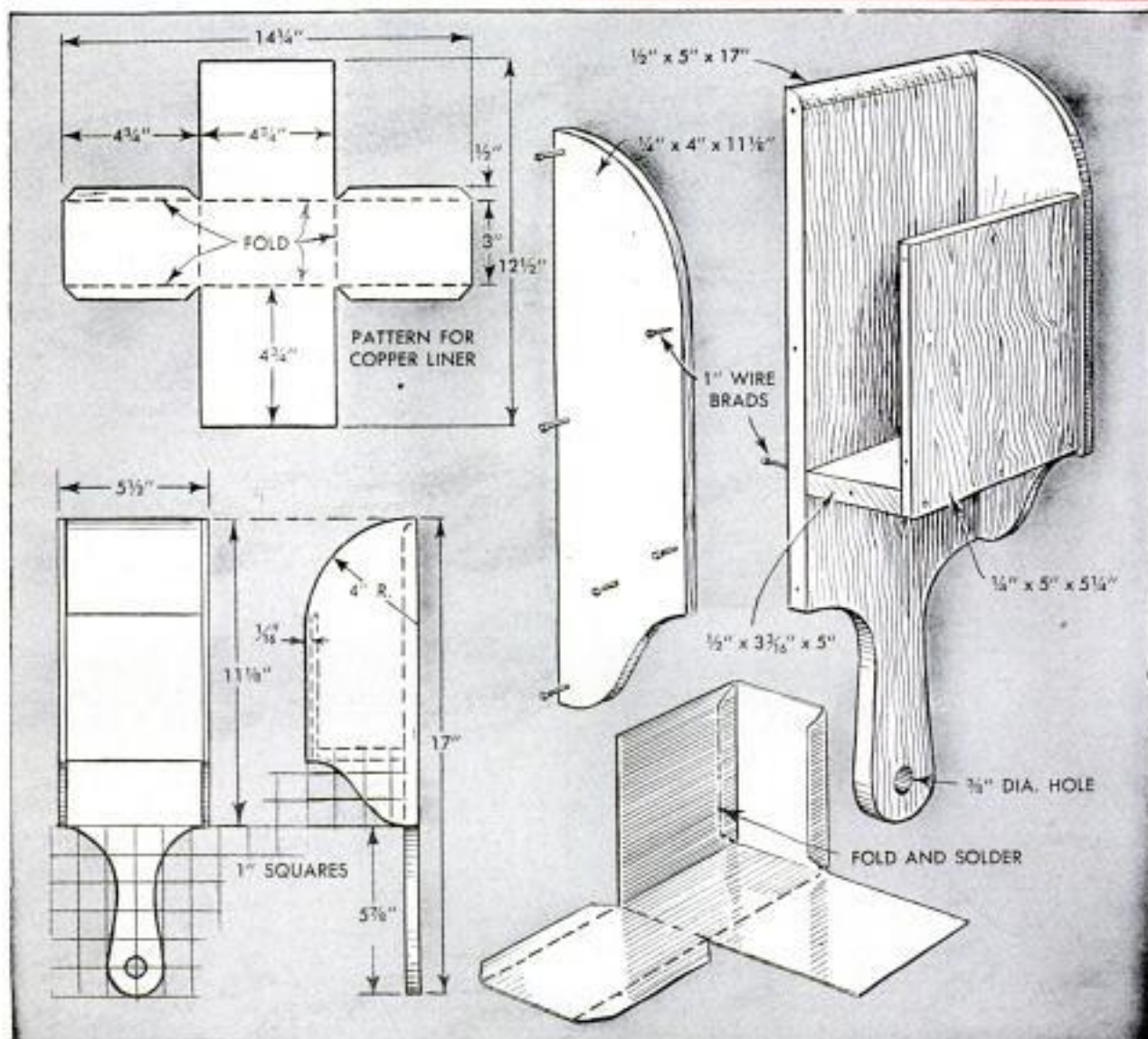
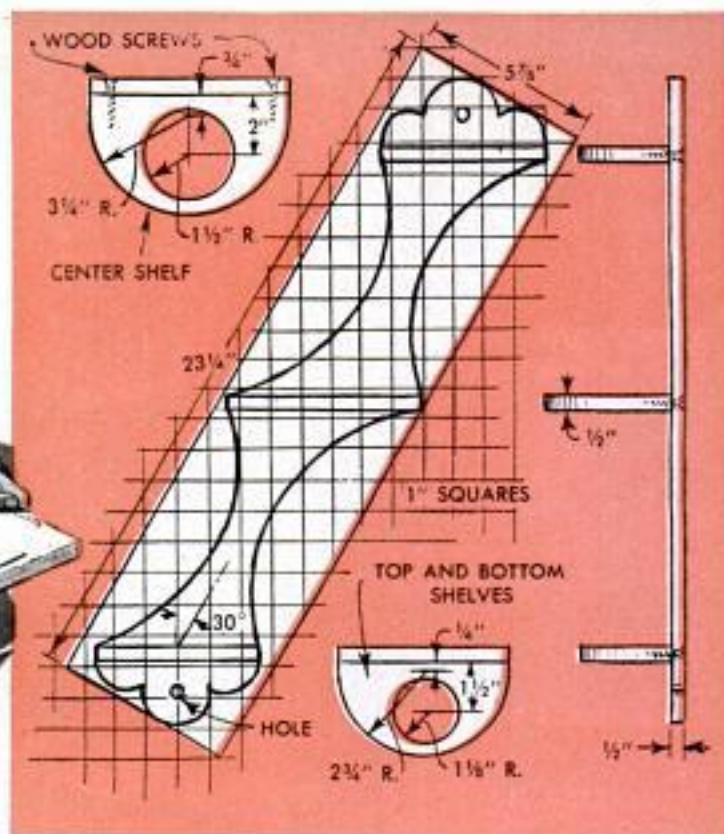
FOUR WALL PLANTERS for attractive display of your plants

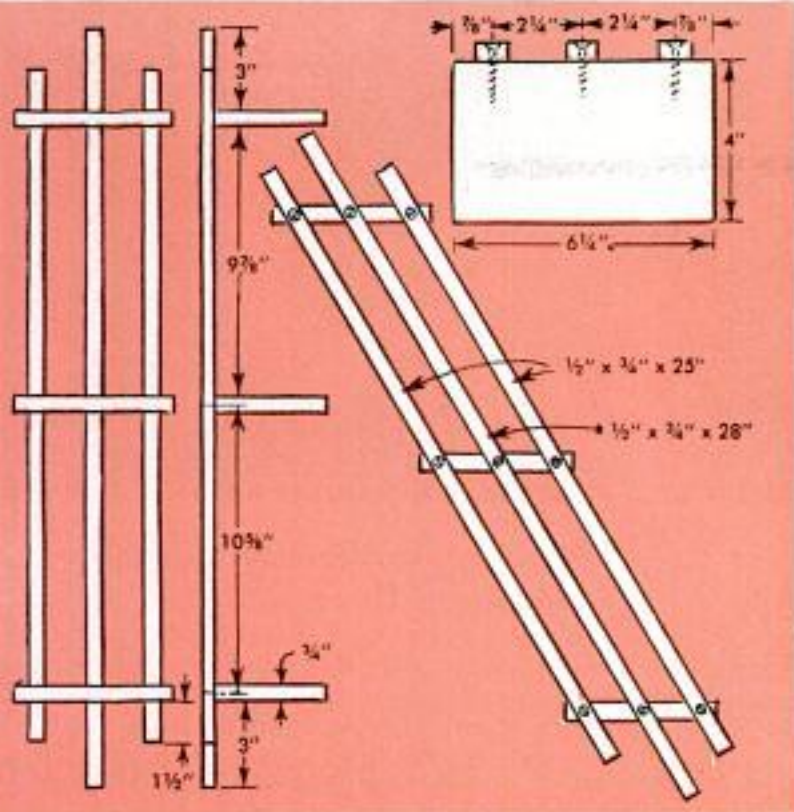
POTTED PLANTS grown indoors always are more attractive and more easily tended when they have their own special racks or shelves. And whether your taste and decor run to colonial, modern, classic or conventional, you will find a style of shelf or rack described in this article that will meet your needs. As with any job, power tools will reduce both the time and labor required to make the plant holders, but hand tools are entirely adequate.

Classic Lyre

The classic lyre shape of the shelf detailed on this page can be jigsawed from a single piece of plywood or cut from two pieces of solid stock. In the latter case, one half of the pattern is drawn on one piece of stock, which is placed over another and both pieces are jigsawed at one time. A dowel glued and fitted in blind holes at the point where the side scrolls join will hold the lyre together at the lower end, and the decorative cross piece near the top will hold the upper ends of the lyre in position. Adding the shelf and the vertical members, which can be $\frac{1}{4}$ -in. dowels or brass rods, will give rigidity and strength to the







finished shelf. Note that inside edges of the lyre scrolls are notched to accept the shelf and top cross piece, which adds both strength and neater appearance to the finished assembly.

Modern Design

Modern design is featured in the next shelf, which actually consists of three brackets arranged in steps. A hole is bored in each shelf to accommodate flowerpots, as indicated. The top and bottom shelves have a 2 1/4-in.-dia. hole, the center shelf has a 3-in.-dia. hole, so that the larger pot is located on the center shelf.

Again either plywood or solid stock can be used. If solid stock is used, a 2-ft. length of 1/2 x 6 is adequate for the back piece. For greater strength, 1-in. stock could be used. The three bracket shelves are butted against the back piece and fastened with glue and wood screws.

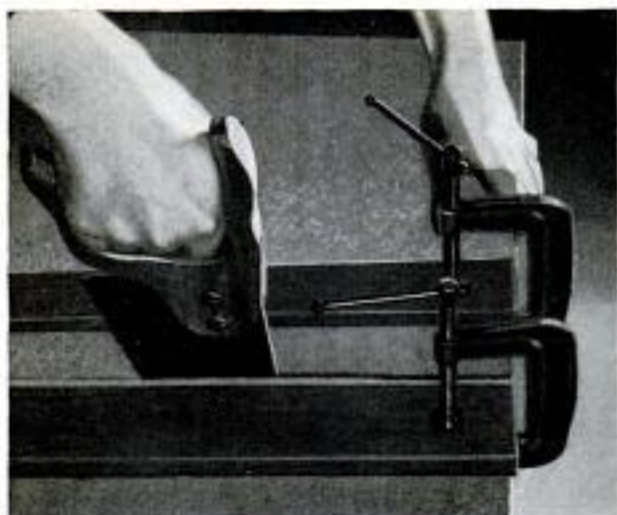
Early American or Colonial

Maple furniture and shining brass provide the decor which goes best with the "flour scoop" planter, but it will look well even in a modern kitchen. Extremely simple in design, only a few curves are required and these are shown on a pattern of 1-in. squares. The curves can be varied from the original for individuality, and both sides of the paddle-shaped back of the planter made identical by first drawing one half of the pattern on a folded sheet of paper and cutting it out to form a full

pattern. The unfolded pattern then can be traced on the stock with a pencil. The two curved sides of the scoop are clamped or nailed together temporarily and jigsawed at one time, to assure that they are the same size and shape. The scoop is designed to have flowers planted directly in it without need for a flowerpot, so a waterproof liner is required. Copper is the best metal to use for the liner, as it is bent easily as well as being rust-resistant. However, both brass and galvanized steel also can be used. Cut out the liner according to the detail, fold as indicated and solder it. The wooden portion of the planter may be made of maple, or pine can be used and stained maple. To blend with more modern decor, the planter might be enameled and a decal added for the final touch. Two holes must be drilled near the upper edge of the planter back to permit hanging or fastening it to the wall. They are not shown on the detail. The 3/8-in. hole in the handle is a touch of realism, but can be used to screw the handle to the wall, if that is necessary.

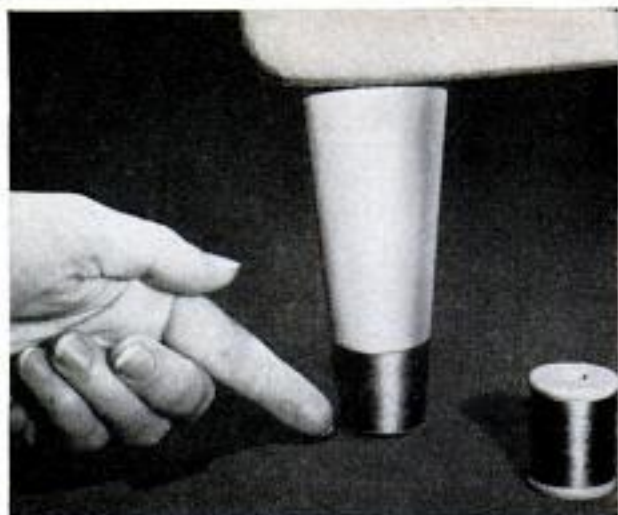
Trellis-Type Shelf

The last shelf is of more conventional design and is simple to make. It consists of two 25-in. lengths of 1/2 x 3/4-in. stock and one 28-in. length of the same material, that are used to form a vertical trellis to which three shelves are screwed. To provide an alternate design, the screws may be loosened and the back tipped at an angle, as indicated. ★ ★ ★



Wooden Strips Dampen Flutter When Sawing Wallboard

The tendency of wallboard to flutter when cutting it with a handsaw can be avoided by clamping two wooden strips at each side of the cut. Apply clamps at both ends of the strips. This stiffens the wallboard so that it cannot flutter with each stroke of the saw. Strips of 1 x 4 will do.

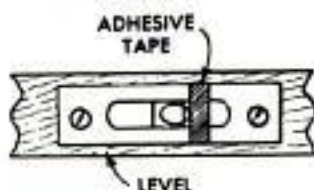


"Ferrules" for Furniture Legs Made From Thread

If you want to add something to the short, plain, round legs on furniture, try providing each with a thread "ferrule" at the bottom. Thread such as used on fishing rods is ideal and comes in many colors. Wind it tightly and closely and then coat it with clear shellac or lacquer.

Tape Guide on Level Vial Speeds Setting Sidewalk Forms

The job of setting sidewalk forms can be speeded up by using tape as a guide on the level vial. Position the tape so it centers the bubble when the forms are at correct pitch.



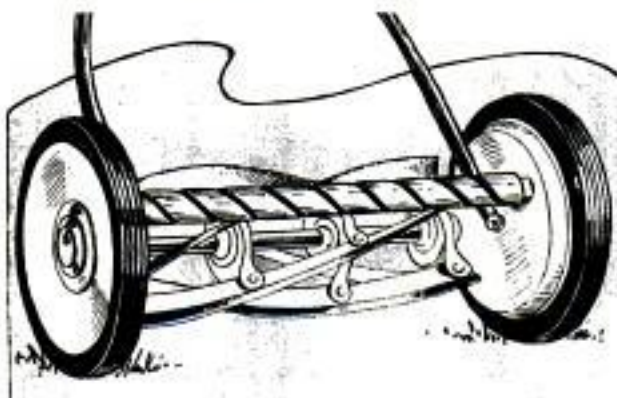
Altering Worn Eraser to Use It Effectively

Difficulty in using a circular-type eraser after it becomes worn on one side may be overcome by pinching the metal frame to grip the eraser. This holds the unworn part in place.



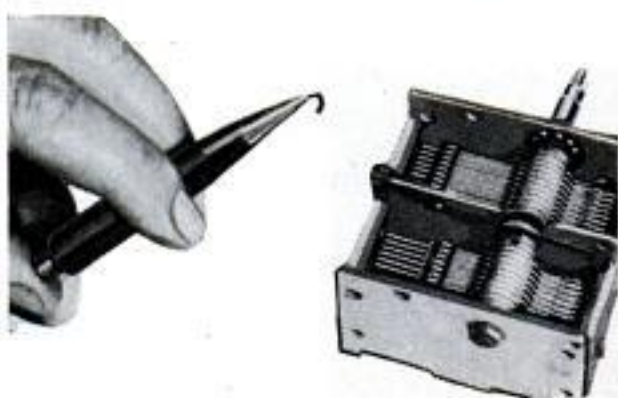
Rubber Bumper on Lawn Mower Protects Trees and Shrubs

By cutting a length of garden hose spirally, it can be "threaded" onto the crossbar of a lawn mower to serve as a bumper to protect trees and shrubs when mowing around them. The hose can be cut easily if a dowel is inserted in it.



Modified Mechanical Pencil Is Miniature Grease Gun

If you need a miniature grease gun for lubricating small mechanisms, one can be made from a mechanical pencil. Remove the mechanism, fill the barrel with grease, then make a plunger from a tightly packed ball of cotton and a length of dowel.





Avoid letting newspapers, magazines, handbills and mail accumulate at your entrance during an extended absence. Such "advertising" practically invites prowlers inside to strip the premises at their leisure

Outsmarting the Housebreaker

By Enno R. Haan

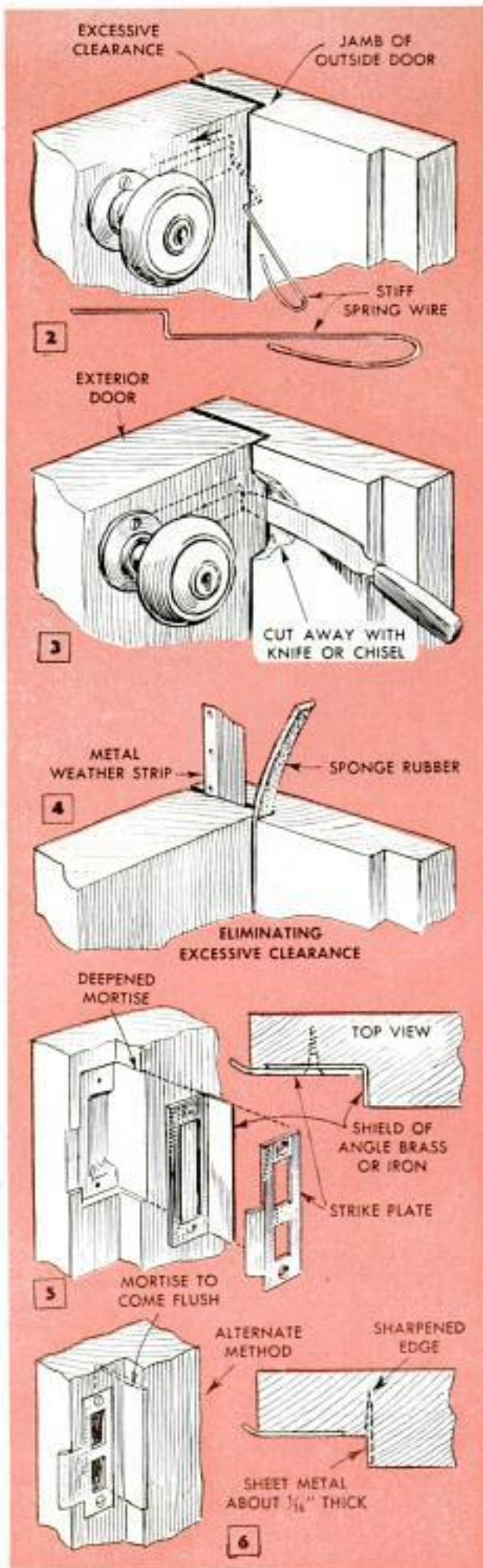
RETURNING TO FIND your home ransacked can take all the enjoyment out of a vacation or an evening out. Unfortunately, many persons actually invite such theft by advertising their absence without realizing it. The chances of having your home burglarized can be minimized by a few common-sense precautions.

First: Avoid telltale clues that advertise your absence and thus invite housebreakers, who usually prefer to work when occupants are gone. Second: Make provisions to mislead and confuse would-be intruders as they usually try to avoid needless complications, trouble and risk. Third: Lock all doors and windows whenever you leave and install additional fastening devices as may be necessary. The average housebreaker prefers places that are easy to enter. Fourth: Inform the police of your vacation absence so they can check up daily. Also ask neighbors to keep an eye on the place for any signs of activity. Fifth:

Leave your jewelry and other valuables in a bank safety-deposit box, in a burglar-proof safe or with trusted relatives or friends. Although these measures, or any others, do not make a home burglarproof, they are nevertheless effective deterrents. A burglar-alarm system may be installed also as an added preventive measure.

Lights, Shades and Radio

A dark house having the front entrance or porch light on as in Fig. 8 is a dead giveaway that the occupants are absent for the evening. A dimly lighted front hall or living room does not fool a smart prowler. A lighted bathroom is much more effective, but it's even better to have the house illuminated as usual. Most of the window shades and drapes should be open so that neighbors can notice the presence of an intruder. **Leaving your radio turned on during a few hours' absence does not cost much and suggests that someone is home,**



Old-time naive habit of "hiding" key under mat or in mailbox is like handing it to a burglar as he habitually checks these places first for easy entry

provided that the prowler cannot look into rooms completely. However, some rooms should not be entirely visible from the outside as this enables a prowler to check whether the house is unoccupied.

Clues of Absence at Doors

Accumulated newspapers, magazines, circulars, etc., at your front door and stuffed in the mailbox, Fig. 1, betray absence. Thus alerted, a prowler can move in with comparative safety. To prevent such evidence, have your newspaper deliveries discontinued during your absence and have the mail held at the post office or forwarded to you. Then ask a neighbor to pick up circulars and packages and remove "have called" signs sometimes hung on doorknobs.

An array of milk bottles at a back door is another urgent invitation to a prospective prowler. A note left for a milkman to discontinue milk may be read by someone else first. Use the telephone to cancel milk deliveries. Also avoid newspaper comments on a pending trip; no one will read this with greater personal interest than a housebreaker. Don't leave door keys under mats, Fig. 7, in mailboxes or other hiding spots for the convenience of other members of the family. These are the first places that prowlers investigate for easy entry. Have each member of the family carry a separate key without any address attached.

Making Door Latches Hard to Open

Many door latches can be opened easily by using a length of spring wire, as in Fig. 2, a thin knife blade or a screw driver. This will be more difficult to do if excessive clearance between the door and jamb is eliminated by installing weather stripping as shown in Fig. 4. However, leave the normal $\frac{1}{16}$ -in. clearance between the door and jamb to allow for expansion. Most outside doors have rabbeted doorjamb but it's easy to cut away some of the wood with a jackknife or chisel to permit inserting a thin blade as in Fig. 3, to pry the latch



8 Leaving an entrance lamp lighted, but the rest of the house dark and quiet when you're out for the evening, is another "polite" invitation to prowlers

loose. To prevent such jimmying, you can install a piece of angle brass or steel as in Fig. 5, or a piece of flat steel sharpened at one edge and driven into the jamb as in Fig. 6.

Interior doors sometimes serve as entrances to dwellings as, for example, the doors in the hallway of an apartment building that give access to the apartments; also the doors between houses and attached garages that are left open or unlocked. Inside doors generally have stop strips nailed or screwed to the jambs and these can be pried up to get at the door latch. To make such doors more foolproof, eliminate excessive clearance between the stop and door by relocating the stop strips. Then attach them more securely with ring-type drive nails, two or three of which should be located near the lock. You can also install shields as shown in Figs. 5 and 6.

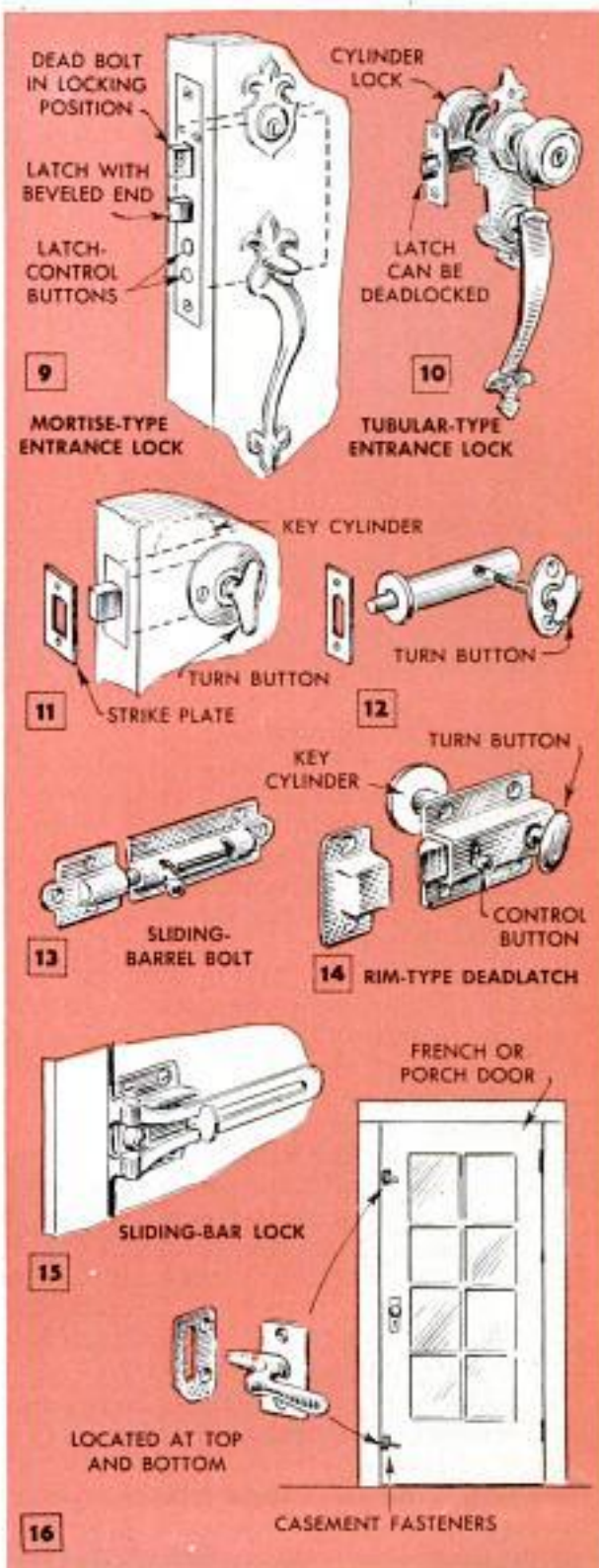
A crude but effective method of jimmying a door open is to insert the end of a crowbar, or similar tool, between the door and the jamb and apply brute force to disengage the latch from the striker plate. This method of entry can be made difficult by providing additional holding devices that do not respond to this action.

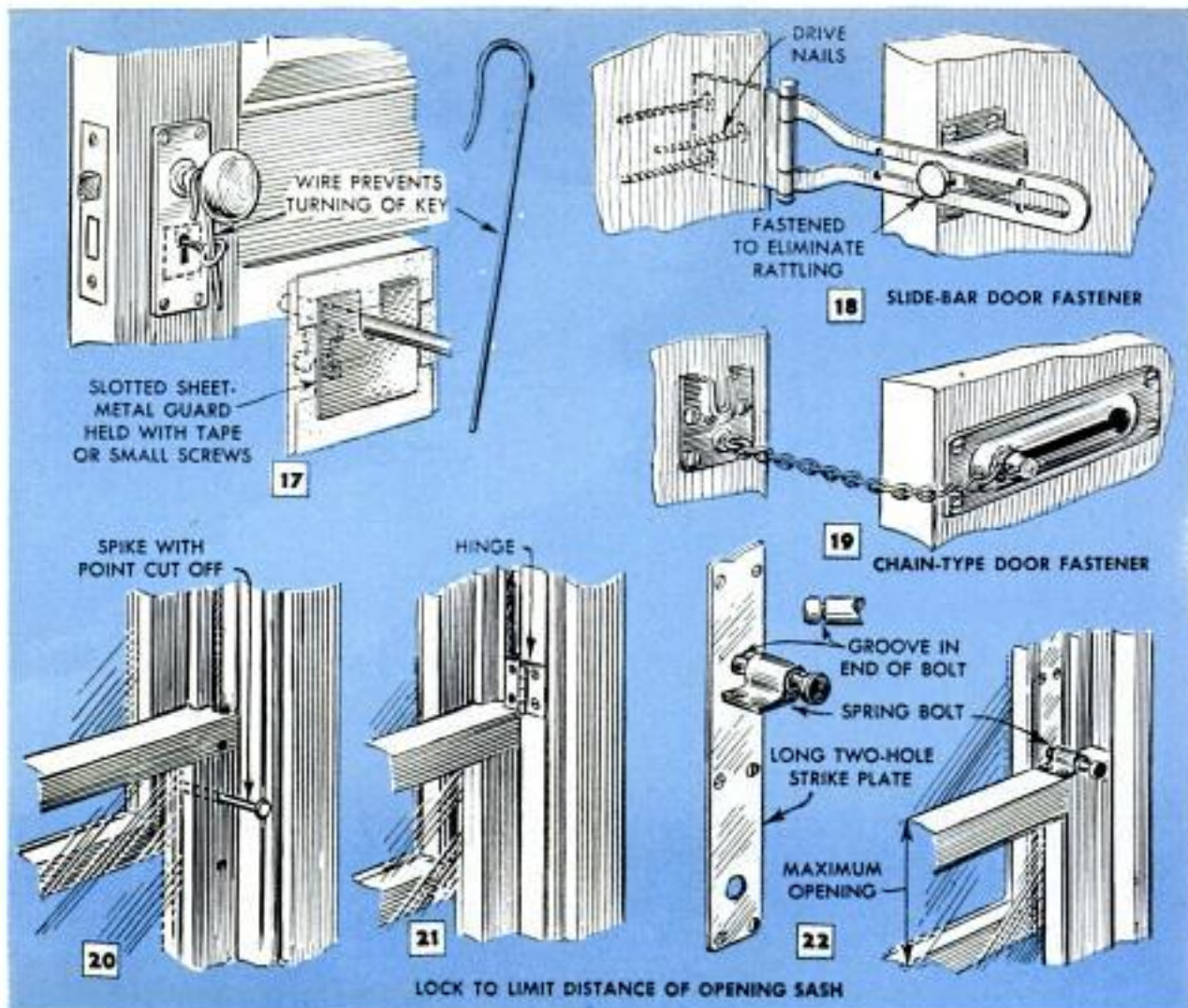
Install Locks Having Dead Bolts

Entrance doors should have foolproof cylinder locks equipped with dead bolts or dead latches. These cannot be pried open with a wire or knife like an ordinary latch. A dead bolt on a cylinder lock, such as the mortise-type entrance lock shown in Fig. 9, works independently of the doorknobs. The dead bolt can be opened or closed from the inside with a turn button and from the outside by means of the door key. Tubular-lock sets, such as shown in Fig. 10, have a latch only but this can be deadlocked to give the same security as a dead bolt.

Adding Auxiliary Fasteners

In many homes only the front entrance is provided with a tamperproof lock and





the other doors have locks of little or no security value. These doors should be provided with separate bolts or dead locks, or other auxiliary locking devices of equal effectiveness. A sliding bolt of the tubular type is least conspicuous as it is housed inside the door. It may be operated from the inside with a turn button and from the outside with a key, as the one shown in Fig. 11. A simpler style that is operated from the inside only is shown in Fig. 12. A barrel bolt, Fig. 13, or a rim-type latch may be operated from the inside and outside as the one shown in Fig. 14, or from the inside only. The kind that can be dead-locked offers maximum protection.

An alternate arrangement consists of a bar fastener of the kind shown in Fig. 15. For doors that open onto screened porches, patios or decks, extra security is gained by installing casement fasteners, Fig. 16, at both top and bottom of the doors.

Built-in milk and package boxes near kitchen-entrance doors may provide a means of intrusion even though they are themselves too small to permit entry. When not equipped with an adequate lock on the inside door, they can be opened and then

may permit manipulation of a wire hook to open the door. In some cases it is even possible to extend an arm through an open milk box and reach the lock of the door.

Practically no security whatever is offered by bit-key locks that are often found on back doors. Leaving the key in the lock on the inside offers no protection as it can be pushed out or gripped by a special tool and turned. About the only way to prevent the key from being turned is to hold it with a stiff-wire hook as shown in Fig. 17. To prevent the key from being pushed out, you can insert a slotted, sheet-metal guard under the keyhole escutcheon, or plate, as is also indicated in Fig. 17. Screen door hooks are no deterrent to a prowler as he simply slashes the screen to loosen the hook.

Locking Partly Opened Doors

Bar fasteners and chain fasteners, Figs. 19 and 20 that are commonly used to keep out intruders when a door is partly open, are installed so that a person outside cannot loosen them by reaching inside. Spirally grooved drive nails should be used to fasten parts that attach to the jamb. Or,

SHOULD READ 18 and 19

flat-headed wood screws can be used, the slots being filled with solder after installation, which prevents their easy removal with a screwdriver.

Secure Window Fasteners

When doors are hard to open, prowlers turn to windows that are not easily observed by neighbors. Double-hung windows—those having an upper and lower sash—can be locked effectively by means of the usual crescent-type sash locks installed at the parting rails. However, they provide no security when the sash are left partly open for ventilation. Therefore, it is advisable to fit windows with supplementary locks that limit the distance that the sash can be opened. Some of these locks can be opened easily from the outside with a length of wire or a flat blade. The homemade arrangement shown in Fig. 22 consists of a spring bolt which engages holes in a strike plate. The latter is screwed to the upright of the upper sash. It is difficult to open from the outside, particularly if the bolt has a groove at the end as shown in the detail. The groove should engage the edge of the strike plate automatically when either sash is opened the maximum distance. The reason for a long strike plate extending to the top of the sash is to prevent the sash from being marred by the bolt sliding over its surface. The bolt also enters the lower hole automatically when the window is closed, and thus assures a locked window even though the center lock may be forgotten. Figs. 20 and 21 show two other methods of locking partially opened windows.

Outswinging casement windows having crank-type adjusters cannot be opened easily when they are closed or slightly open—not far enough to permit inserting a heavy-wire tool or an arm to reach in and turn the crank. Casement windows that swing inward can be held by means of regular casement fasteners like doors as shown in Fig. 16, or by means of bar fasteners. The latter will hold the windows locked when they are completely closed or slightly open. Using chain locks or hooks and eyes for this purpose does not eliminate movement and rattle.

Hooked screens in front of windows offer no protection at all as it is so easy to slit them and then open the window. Basement windows are likely to be inadequately locked. Second-story windows often are accessible from the low roof or deck of a porch or garage, or by means of a ladder conveniently acquired by the prowler on the premises. With this in view, it's best to keep a ladder inside the house or in another locked building. ★ ★ ★



Small Flower Vase From Test Tube Fitted in Candleholder

For an attractive bud vase or holder for water-grown plants, such as philodendron, simply insert a test tube in a candleholder as shown. Also, the glass tube some brands of cigars are individually sealed in can be used for this purpose. If necessary, a rubber ring may be used to secure the bottom of the tube in the holder.

H. T. Gunderman, New York City.

Paper Cup for Mixing Paint Held in Plastic Container

A paper cup held in a small plastic container used for cheese spread provides a convenient paint-mix can for small paint jobs. The disposable paper cup eliminates some of the work of cleaning up and avoids having messy paint cans around the shop.



☞ Place a few pennies in a goldfish bowl to keep the green scum from forming.

Guide Strips on Sides of Roof Help Amateur Shingler



If you have trouble keeping the sides and lower edge of a roof straight and neat when applying shingles, try the following kink. Flush with one edge of a 1 x 2, nail a $\frac{3}{8}$ -in. lath or other wood strip, and then nail this assembly to the edge of the roof as indicated, allowing the 1 x 2 to project above the roof a distance at least equal to the thickness of the shingles to be applied. Apply the strips to both sides and the lower edge of the roof. The strips provide guides to keep the roof line straight and uniform, and the lath assures the correct overhang of shingles. Guide strips are later removed when the shingling is completed.

Walter L. White, Indianapolis, Ind.

Notched Shelf Holds Fishing Rods

To provide a handy place for storing casting rods in a cabin, just cut some notches in an existing shelf in the cabin. Height of the shelf is immaterial as the rods are supported against the line guides and can be set in the shelf at any height necessary to keep the lower end off the floor.—G. E. Hendrickson, Argyle, Wis.

Tin-Can Rack Provides Storage For Garden Tools

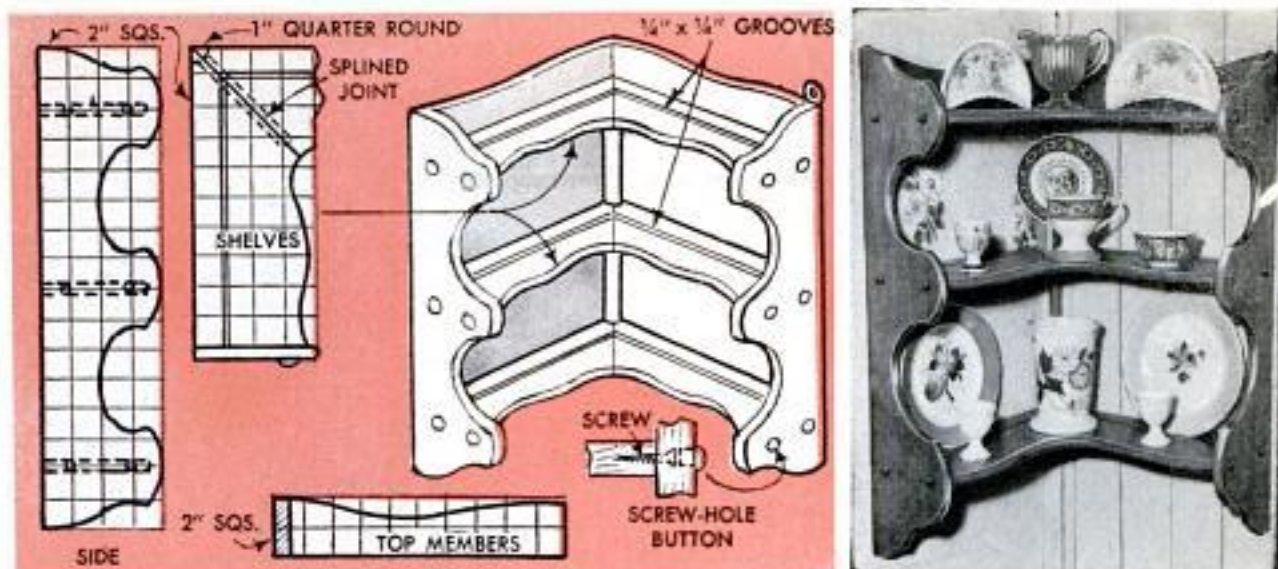
Two large tin cans having both ends removed and nailed to a stud in the garage or tool shed will provide a good rack for storing handled garden tools. Such a rack also is ideal for storing rod and pipe. Ideal, too, for clothesline props.

Stanley Clark, East Bradenton, Fla.



Locking Screw in Eyeglasses

Loss of tiny screws from a pair of eyeglasses with possible breakage of the lens, may be avoided by locking the screws in place. This can be done with a drop of auto-windshield sealer, which is available at most auto-supply stores. Be sure that the frame adjacent to the screw is clean and then apply a drop of the sealer with a toothpick. Contacting both the screw-head and the frame, the sealer prevents the screw from turning. This idea may also be used to hold small screws in assemblies where vibration has a tendency to loosen them.—Andy Vena, Philadelphia, Pa.



"Antique" Rack to Display Your Show Dishes

Antique dishes and bric-a-brac will be shown to better advantage if the display rack also is of antique design. This corner rack is ideal for the purpose. Made of $\frac{3}{4}$ -in. birch, the rack may be used without a back as shown in the photo, or it may be provided with one of $\frac{1}{4}$ -in. birch-faced plywood as indicated in the detail. If power tools are not available, $\frac{1}{4} \times \frac{1}{4}$ -in. cleats

may be substituted for the plate grooves in the shelves, and the splined center joints of the shelves can be assembled with corrugated fasteners driven in from the underside. Hangers at the outside corners are made of flat steel and mortised flush into the edges of the side pieces. Screw-hole buttons used to hide screw heads in these pieces are available at most lumberyards.

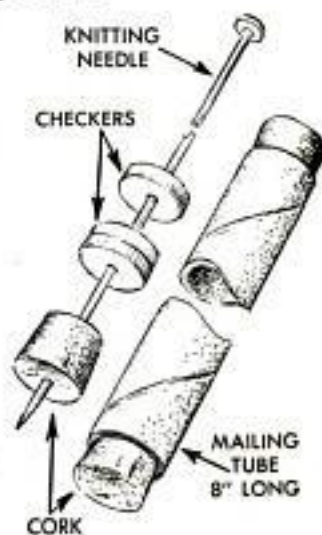


Support for Heavy Parade Flag Improved From Work Rubber

When his troop was called on to parade and there was only a minimum of equipment, one scoutmaster used a heavy work rubber to improvise a support for carrying a heavy flagstaff. The heel section of the rubber was cut away and the sole slotted to accept a belt. The toe of the rubber then provided a socket for the flagstaff.

Checkers Strung on Needle Stored in Mailing Tube

To prevent checkers from being mislaid when they are stored, drill a hole through the center of each and slip it over a knitting needle. Press a cork over the point of the needle to keep the checkers in place and then slip the assembly into a mailing tube, using another cork in the opposite end.



X501



DIVING FLOAT

For more enjoyable water sports, build your dock, diving float, launching ramp or boathouse on—

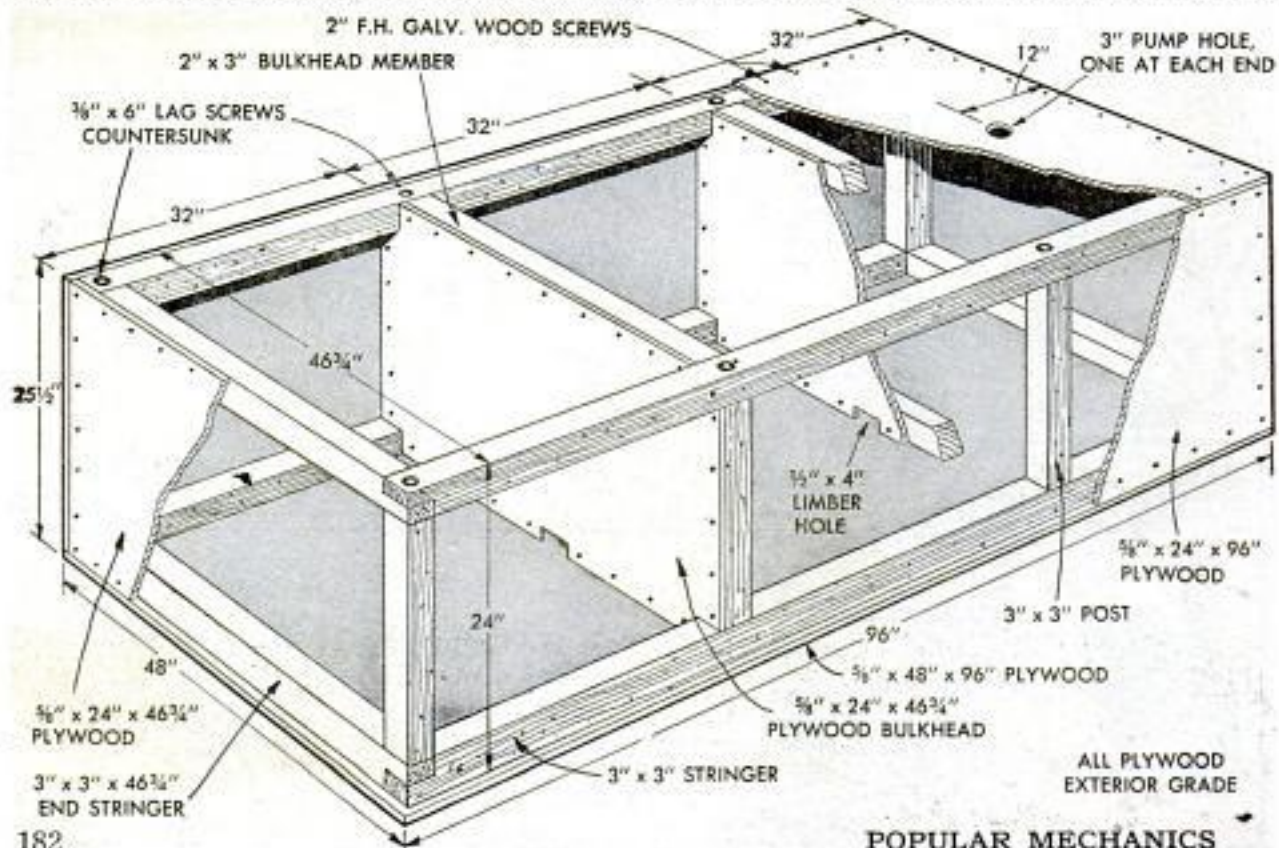
PLYWOOD PONTOONS

INEXPENSIVE, EASY-TO-BUILD pontoons are the answer to your problem if there is need to frequently rebuild a dock or other pile-supported marine facility because changes in the water level have made it unusable. A pontoon, such as the one

shown in the drawing, can be used as the basic unit upon which to float the structure desired, such as the ones illustrated.

Two of these pontoons with a platform nailed on top of them provide a diving float. A diving board and other equipment

Basic unit for floating ramp, boathouse, deck and diving float is plywood pontoon 8 ft. long and 4 ft. wide



can be added as necessary. In some cases, as when the pontoons are used for a dock or boat-launching ramp, the $\frac{5}{8}$ -in.-thick plywood tops serve as a dock. Additional decking is unnecessary.

Maximum buoyancy of one pontoon is 3650 lb. initially, but it can be ballasted with water to gain the desired depth. Only exterior-type fir plywood should be used for the pontoons. Three types of protection may be used to prevent deterioration of the plywood. Pontoons may be pressure-treated with creosote if a pressure-treating plant is located in the vicinity, or they may be covered with glass fiber, although the latter does not give the protection against decay that creosote treatment provides. The third type of protection involves painting the pontoons as you would the hull of a boat, using a good grade of marine paint. A final coat or two of anti-fouling paint below the water line will discourage marine growths.

A 3-in.-dia. hole cut in the top of each pontoon permits inserting a hand-operated bilge pump, obtainable at most marine-supply stores, for removing water should the pontoon leak. Although some taking on of water is to be expected at first, a well-constructed pontoon will stop leaking soon after it is launched. It is a good idea to paint the inside of the pontoons to reduce water absorption by the plywood. ★ ★ ★

Top of page, launching ramp is automatically raised or lowered as water level changes. It is secured to sea wall and two piles

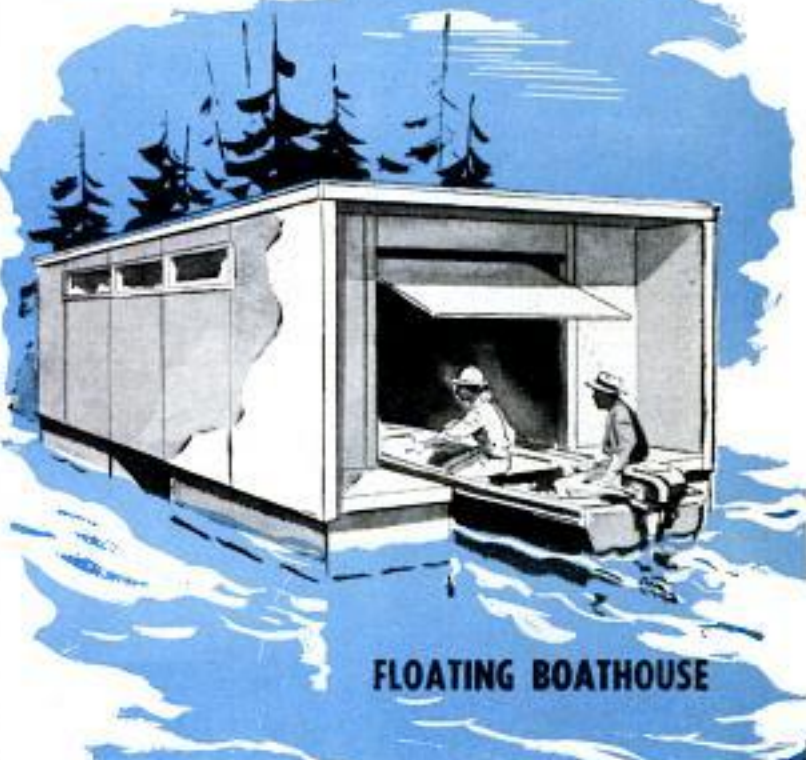
Center, floating boathouse anchored offshore because water is too shallow at landing. Overhead door permits easy entry of boat

Below, 2 x 4s bolted to pontoons permit dock held by unattached piles to rise and fall freely with changing water level

Information courtesy Douglas Fir Plywood Assn.



BOAT-LAUNCHING RAMP



FLOATING BOATHOUSE



PONTOON DOCK



Bag With Plywood in Bottom Keeps Fish Alive Longer

Burlap bags were found to do a better job of keeping the catch alive by one fisherman, when he inserted one bag within another and fastened a short length of marine plywood in the bottom of the inside bag. Without provision for keeping the sides of the bags extended when lifting them out of the water, the burlap tends to bind the gills of the fish and suffocate them. A 1 x 2-in. strip of wood nailed over the bottom seams of the bags, as shown in photo, holds the plywood in position. The plywood is slightly smaller than the bottom of the bag and the corners rounded to prevent tearing the burlap. Nails holding the two strips are clinched on the bottom.

Plant-Lined Creel Preserves Freshly Caught Fish

One method of keeping a catch fresh during a day's fishing is to drop the fish in a woven creel that has been lined with grass or other available plants and submerged in a cool area of a stream, or dropped over the side of a boat. Water-lily leaves, grass and stems or swamp moss are used to line the creel, and a few clean pebbles in the bottom keep the creel submerged, but with the top above the surface of the water. At

the end of the day's fishing, the catch should be cleaned, then repacked in the creel with fresh, moistened plants. The fish can be transported for a short distance when packed in this manner, but for longer trips the fish should be packed in ice or placed under refrigeration in a portable icebox of the type that can be stowed easily in the trunk of a car.

Ben C. Robinson, Newcomerstown, Ohio.



ADD THOUSANDS OF DOLLARS TO THE VALUE OF YOUR HOME...

New PM Book tells and shows how to handle power tools like an expert—and make valuable property improvements

A thorough knowledge of power tools and how to use them will enable you to perform hundreds of major and small projects around your home at *tremendous savings*, and *increase its value* significantly. Now, with the aid of a new Popular Mechanics book, "Getting Started with Power Tools", it's easy, fun, safe . . . and with no previous experience you'll be able to do more home remodeling and repair jobs, make beautiful furniture, toys and boats, or execute many other projects you may have wanted to do, but never could.

This remarkable book, in 160 pages of easy-to-understand text and scores of illustrations, shows you all about the interesting and profitable avocation of working with power tools. Special attention is given to the type of learning problems encountered by the novice, and each major type of power tool is clearly illustrated with captions showing all of its components. But this book is written for the skilled craftsman as well. It contains many helpful hints that will save time and money. It tells what you should look for in planning a power tool shop, and how to lay it out for greatest efficiency. It stresses safety procedures that will benefit even the practiced workman. And various attachments are shown that will convert one tool to multiple duty, thus saving on the total investment. Never before has a book on power tools been written for the home craftsman that provides as much basic information for the novice, and as many down-to-earth work hints for the expert, as "Getting Started with Power Tools". Order your copy today, with a money-back guarantee if not pleased. Send your check or money order to the address below in the amount of only..... **\$2.50**

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- Ch. 2—Installing power tools
- Ch. 3—Portable power tools
- Ch. 4—Operating the circular saw
- Ch. 5—Dado-head techniques
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- Ch. 7—Operating the bandsaw
- Ch. 8—How to use the jigsaw
- Ch. 9—Working with the wood lathe
- Ch. 10—Wood-shaper techniques
- Ch. 11—Fundamentals of the jointer

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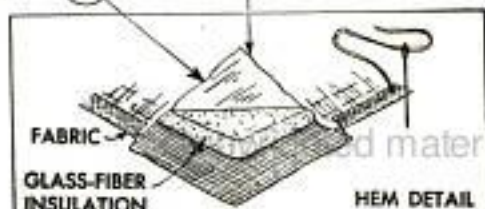
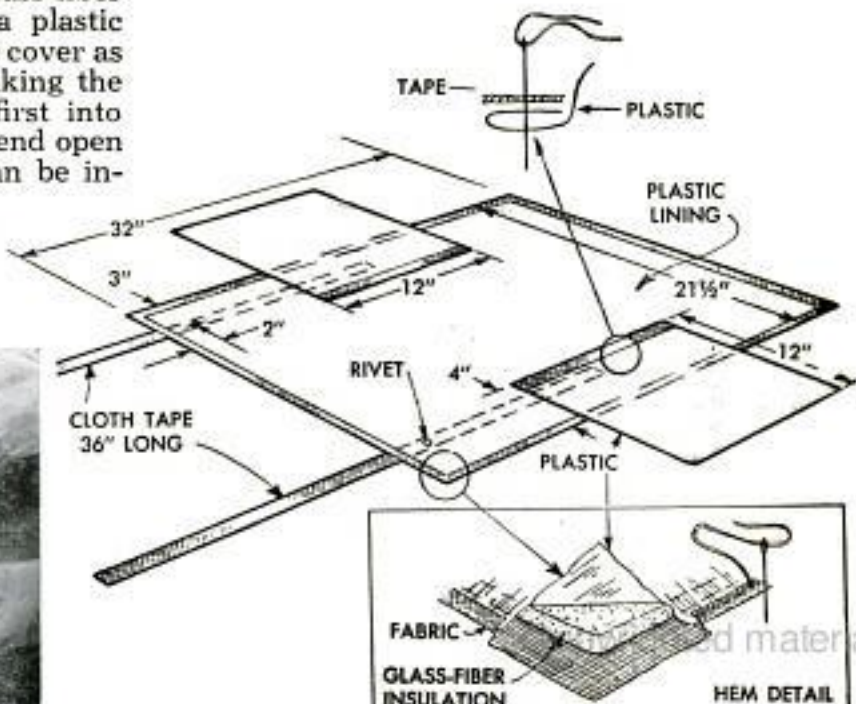
HANDY INSULATED FOOD BAG

WHEN TAKING ALONG food for a picnic or beach party, you can wrap steaks and other frozen foods in this glass-fiber insulated bag where they will remain frozen for hours. Also, the bag affords protection for photo supplies from extreme heat or cold, and glassware and other fragile objects wrapped in it are protected when carried in a truck or car.

The bag consists of a layer of glass-fiber insulation sandwiched between a plastic lining and a medium-weight fabric cover as shown in the drawing. When making the bag, the plastic lining is sewed first into the hem of the fabric leaving one end open so that the insulating material can be in-

serted. After inserting the insulation, the open end of the bag is sewed shut and the plastic flaps are stitched to the lining as shown in the detail. The flaps, when folded over articles being wrapped in the bag, hold them in place. Two cloth tapes, each 36 in. long, riveted to the back of the bag as shown in the photo at lower left, provide a means of tying the bag.

Two 36-in. lengths of $\frac{3}{8}$ -in. cloth tape are riveted to fabric cover on food bag to prevent ties from slipping off when rolled or folded bag is secured





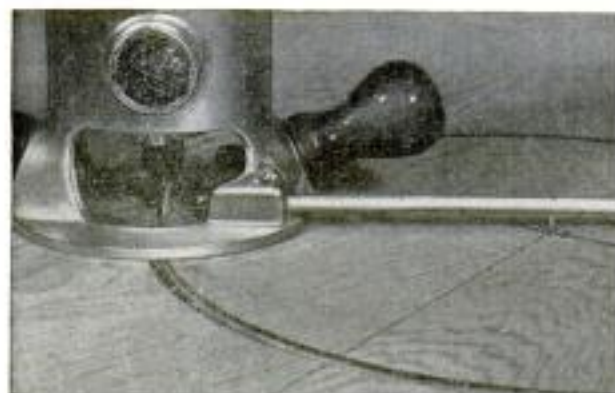
Broken Tiles Prevent Erosion On Sloping Lawn

Pieces of broken draitile were found by one homeowner to be excellent for holding the soil on sloping ground. The porous tile also serves as a "mulch" to retain moisture, which aids in the rapid growth of ivy and other ground cover suitable for binding the soil and preventing it from eroding. The curved pieces of tile are not moved easily and provide stepping stones when the ground is muddy. When soil is worked in around them, the tiles are not unsightly, and soon are covered with plants that conceal them completely. If desired, the tile pieces may be worked into a design.



Blowgun of Metal Tubing Fires Harmless "Darts"

Here is a blowgun any youngster can make that expels "darts" that are harmless. The gun itself is a 3-ft. length of $\frac{3}{4}$ -in. tubing. Steel, brass or aluminum can be used, although the latter is preferred because of its light weight. File and sand the ends of the tubing smooth, and clean the inside thoroughly. Darts for the gun are made by rolling cones of paper, obtained by tearing pages from a magazine that uses a slick, coated stock. Cellulose tape can be used to hold the cones together. Coat a small weight with glue and drop it inside the tip of the cone as indicated.—Perry and Brian Barnard, Los Angeles, Calif.



Circle-Cutting Attachment Improvised for Router

If the regular accessory is not available, a circle-cutting attachment for a portable router can be improvised from a length of $\frac{1}{4}$ -in. dowel slightly longer than the radius of the required circle. A nail is driven into the dowel near one end, and the other end is fitted into the accessory opening in the router base. The nail fits into a hole drilled in the center of the circle to be cut.

R. J. De Cristoforo, Los Altos, Calif.

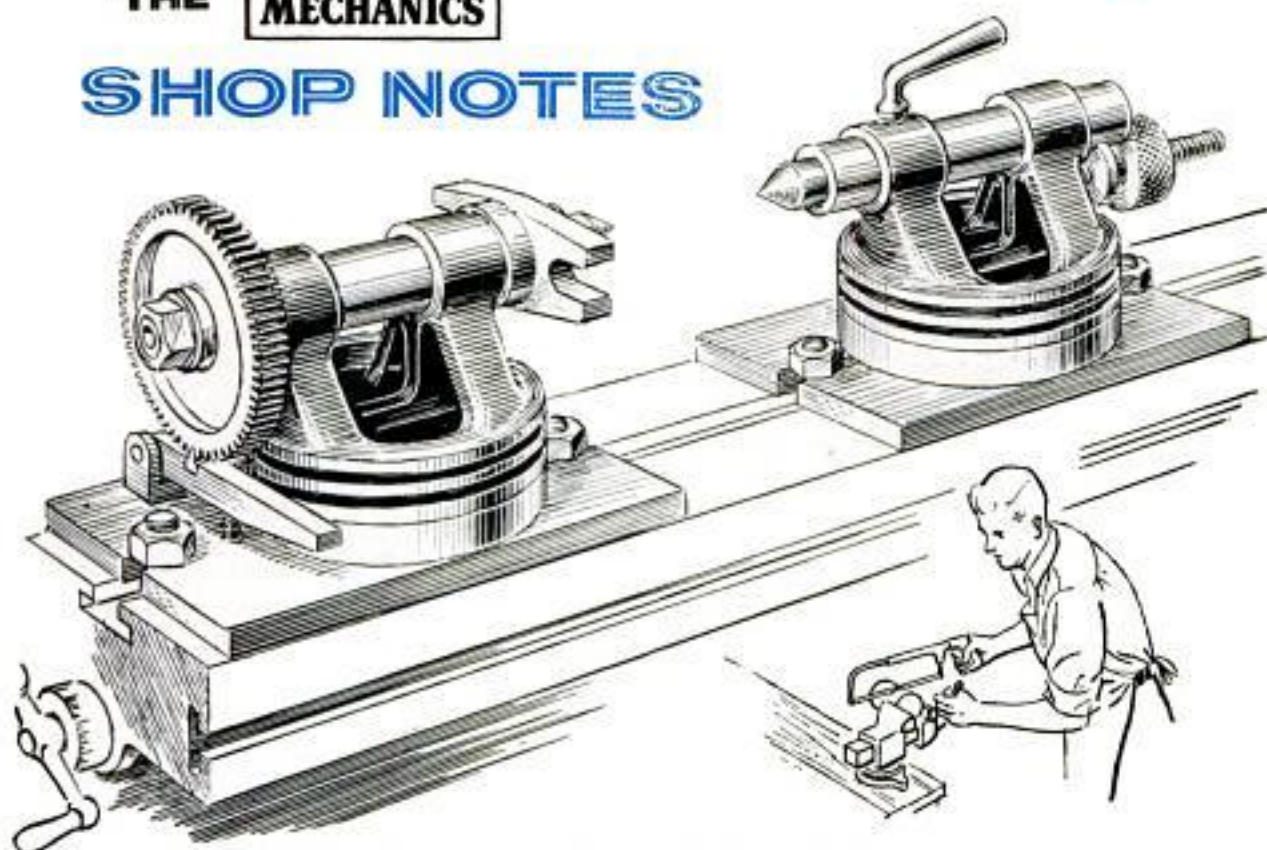
Clean Darkroom Equipment Assures Higher Quality Work

Thorough cleaning of darkroom equipment at regular intervals will assure improved quality of work and help prolong the useful life of the equipment. To keep film-developing tanks free of residue, first empty them, and then place 1 oz. of hypo in the bottom, sprinkle a little potassium ferrocyanide over the chemicals and add hot water. Allow time for the solution to loosen the residue in the tank, then rinse with warm water. Acetic acid,

or specially prepared cleaners, also can be used for this job. Film tanks may be cleaned with a solution of equal parts of hydrochloric acid and water. Apply it with a brush, then rinse the tanks thoroughly. Film hangers are cleaned in a developing tank containing acetic acid in a 28 percent solution, allowing them to soak for about 15 min. Rinse the hangers with water and place them in a solution of sodium carbonate and warm water for 10 min.

THE **POPULAR MECHANICS**
SHOP NOTES

SN 59



INDEX CENTERS—

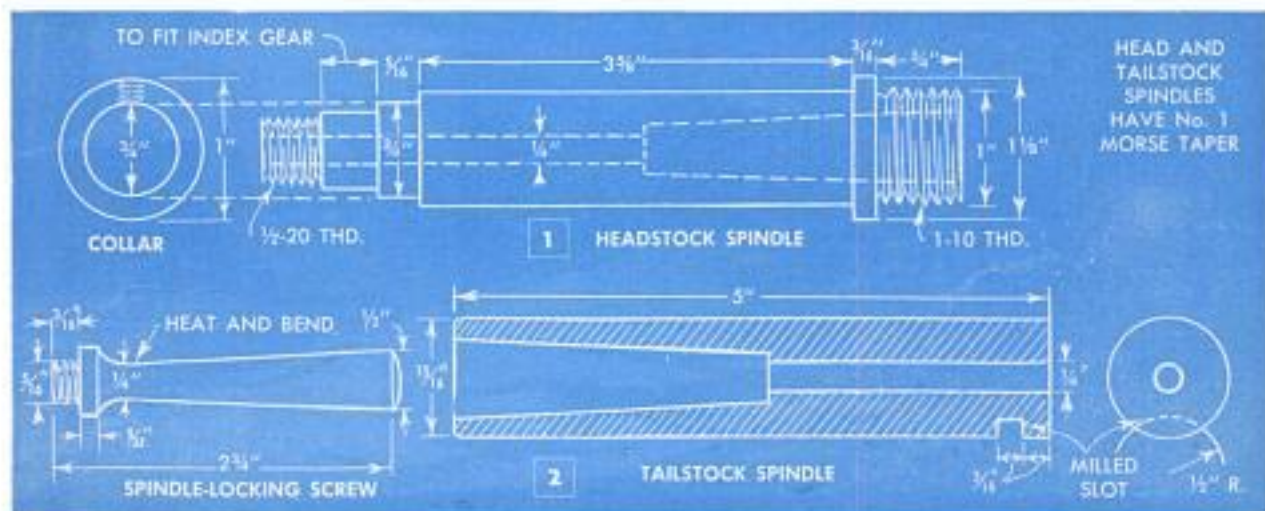
accurately space gear teeth and splines, and locate flats when squaring ends of round work

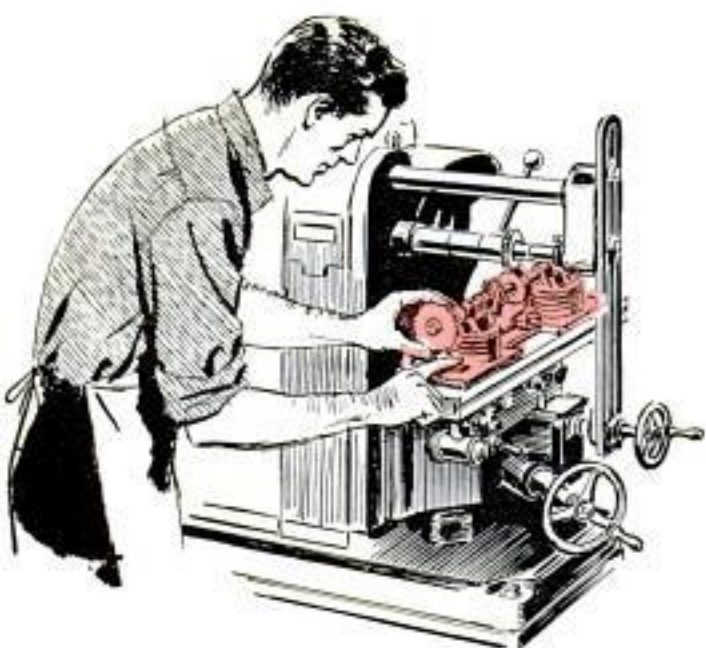
By C. W. Woodson

TWO DISCARDED PISTONS from a Buick auto engine serve as the head and tailstock of these shop-made indexing centers. As designed, the centers are intended for use on a milling machine, but of course they can be mounted on a special base for bench work. The first step is to face off the heads of the pistons so they will

seat on round subbases turned from $\frac{1}{2}$ -in. steel, Figs. 4 and 6. Mounted as in Fig. 4, the centers have a swing of about 5 in. After facing off, cut away the piston skirts, leaving only the wrist-pin bearings to serve as bearings for the spindles which carry the 60-deg. centers and indexing gear.

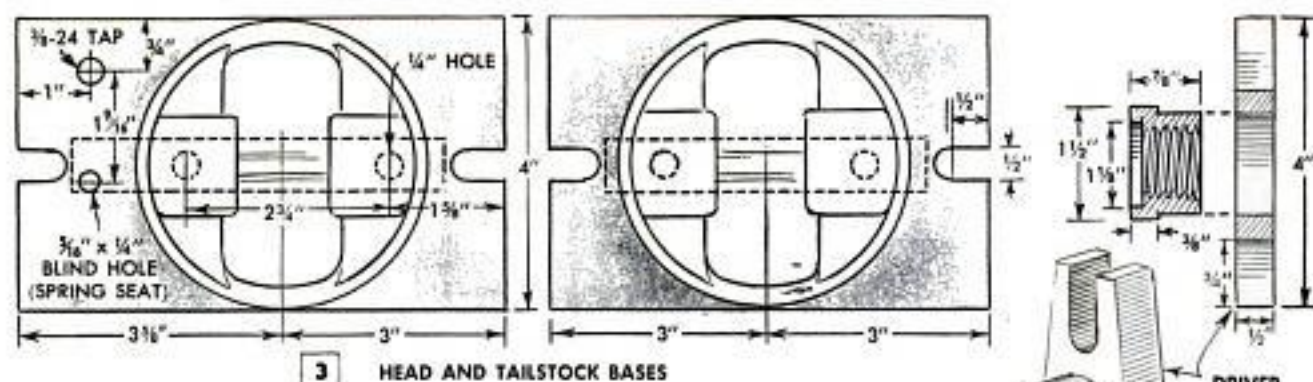
Figs. 1 and 2 detail the headstock and



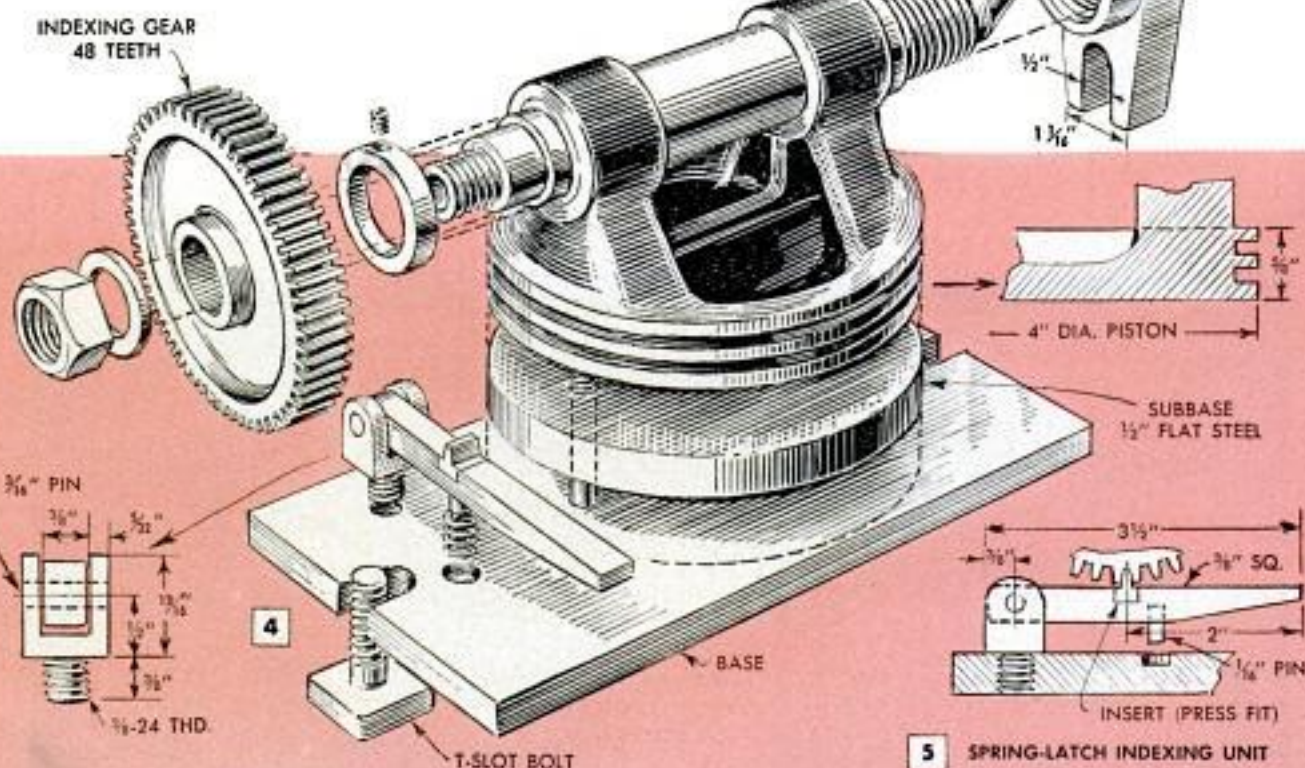


tail spindles. Note that these are machined with No. 1 Morse tapers and are drilled through longitudinally for $\frac{3}{16}$ -in. knockout rods. Both spindles normally are turned to $\frac{15}{16}$ in. in diameter, but check the inside diameters of the wrist-pin bearings before turning to final specification as there may be some variation. Head and tailstock bases are cut from $\frac{3}{8}$ -in. flat steel, Fig. 3. Both are the same width but note that the headstock base is $\frac{5}{8}$ in. longer to permit mounting the spring-latch indexing unit, Fig. 5. The guide bars, Figs. 3, 6 and 7, slide in the T-slots in the machine table. The width is given as $\frac{3}{4}$ in. but this may have to be varied. Registering holes are drilled through the guide bars, bases, subbases and into the pistons for $\frac{1}{4}$ -in. fillister-head screws, Fig. 7. The holes must be drilled in precise alignment with the axis of each spindle. Make a jig for this purpose.

The headstock is designed to utilize a standard 48-tooth gear wheel in place of a



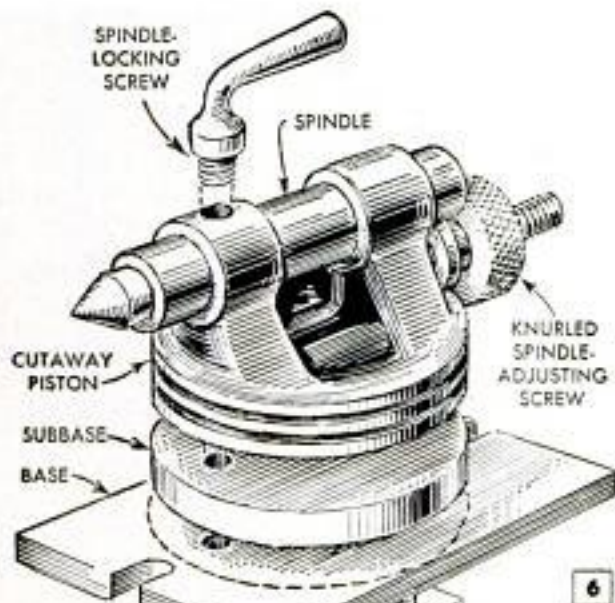
3 HEAD AND TAILSTOCK BASES



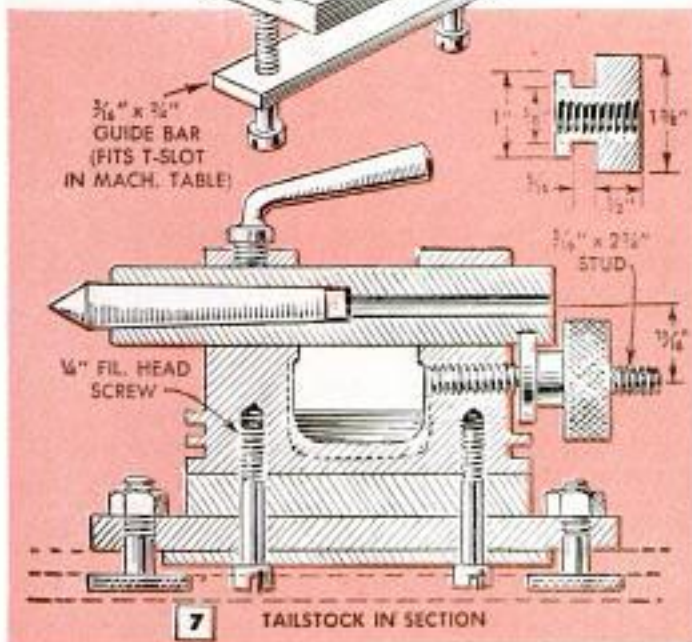
5 SPRING-LATCH INDEXING UNIT

regular indexing plate. The arm of the spring latch is fitted with an insert on which a matching gear tooth is filed, Fig. 5. This should engage to the full depth.

Note that the driver, Fig. 4, is fitted to a machined hub which is shouldered, recessed and threaded to fit the headstock spindle. This construction is not essential but it does save stock, as otherwise it would be necessary to machine the hub projection from the solid. In the best practice, the adjusting screw for the tailstock spindle, Figs. 6 and 7, would be turned from brass or a machining aluminum. In any case, the flange should be a close fit in the slot milled in the spindle, Fig. 2. The stud, Fig. 7, gives slightly more than an inch of spindle travel. It can, of course, be made longer if desired. After the units have been assembled, place them on the machine table, bolt down and check the centers for vertical and horizontal alignment. ★ ★ ★

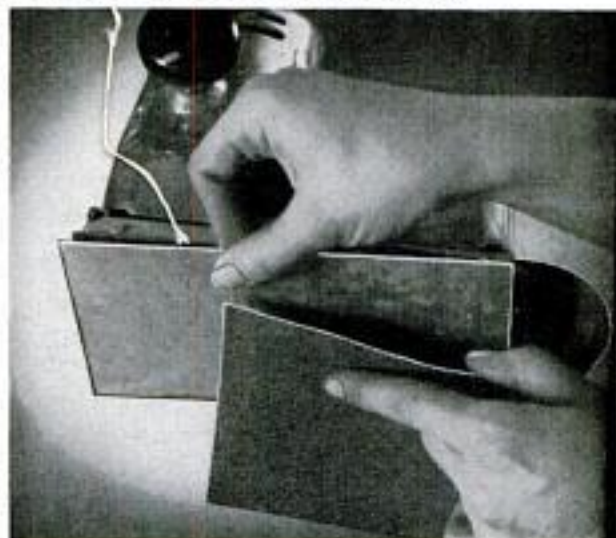


6



7 TAILSTOCK IN SECTION

Piece of Hardboard Under Paper Increases Sander Efficiency



When sanding rough surfaces with an orbital sander you can speed up the job by covering the soft pad of the sander with a firm material. A piece of sheet metal or hardboard fitted over the pad under the sandpaper as indicated will hold the paper flat so that it sands only the high spots, quickly cutting them down.

Henry V. Lucas, Inglewood, Calif.

Metal Spool Provides Storage For Several Extension Cords

Ask your hardware dealer to save one of the metal spools on which is wound the electric cord he purchases. Nailed or screwed to the wall of a workshop in a handy spot, the spool will provide storage for several extension cords.



Midget Electric Furnaces



1



Disassembled socket is shown with required strip of asbestos paper, resistance wire and connector wire

After wet asbestos paper, over which resistance wire is wound, is completely dry, socket is reassembled



WHETHER YOU HAVE a home workshop or a home laboratory, one of these two midget electric furnaces will prove invaluable where small amounts of clean, dependable heat are required. The first furnace, Fig. 1, actually is an "electric Bunsen burner," being designed primarily for heating test tubes, while the second, Fig. 7, is a crucible for melting metals, such as solder, for tinning the ends of wires.

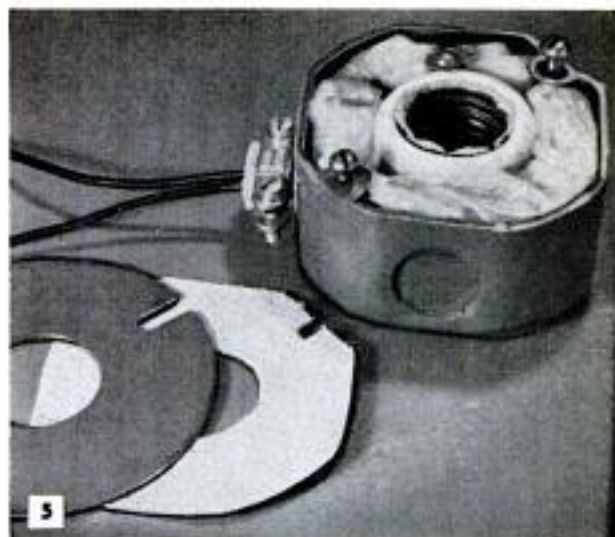
A transformer is required to modify current delivered to the furnaces, and on the original furnaces, the transformer is of the type provided with solder guns. Filament-type transformers, such as used in radio work, also can be used. Transformer output should be 8 to 10 amp. at 5 to 7 volts.

Heating elements for the furnaces are made from resistance wire of the type used in electric toasters and portable heaters. Replacement elements, consisting of coils of this wire, are available at electrical-supply stores. In the original furnaces, .020-in.-dia. wire was used.

The Bunsen burner, which develops about 250 deg. F., is made from a surface-mounted porcelain lamp socket. First, an 18-in. length of wire is connected between the transformer output terminals and the current is turned on to the transformer. If the wire will scorch paper after a 20-sec. contact, it is producing the correct



4 Lower end of wire is fastened to screw holding shell in socket. Upper end of wire connects to lead running to strip that is center contact of porcelain socket



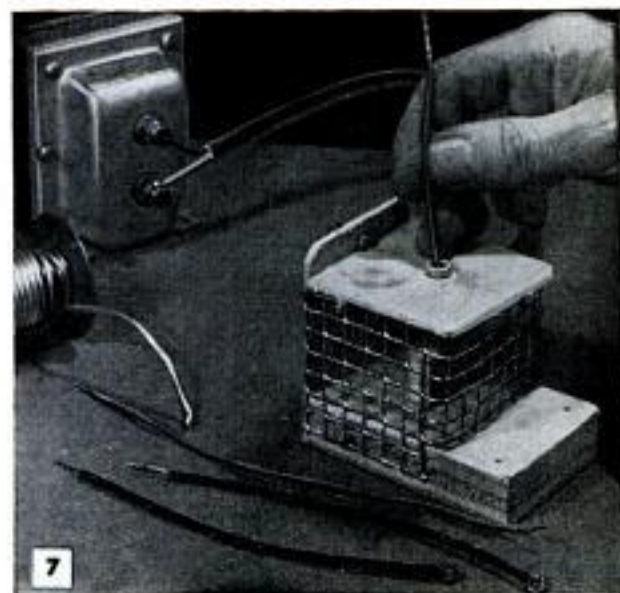
5 Porcelain socket is installed in 3-in. junction box, leads are run through connector and socket is packed with glass-fiber or asbestos insulation as indicated

heat. If not hot enough, shorten it 1 in. at a time until it does produce the right heat. Next, chip the sealing wax from the screw holes in the bottom of the porcelain socket, remove the screws and disassemble the socket, Fig. 2. Wrap a layer of wet asbestos paper around the threaded shell and wind the resistance wire over it, Fig. 3. Bend a hook in the starting end of the wire to fit the screw in the bottom of the shell. Bend a loop in the other end of the wire and connect it to a short piece of 14-ga. copper wire. Run the wire down the side of the socket and loop it under the screw in the metal strip that provides the center contact of the socket, Fig. 4. After the asbestos paper is dry, reassemble the socket and attach a pair of flexible leads to the socket terminals. Now, fit the socket in a 3-in. junction box, run the leads out through a connector and pack glass-fiber or asbestos insulation around the socket, Fig. 5. Finally, fit a standard cover, in which a $1\frac{1}{8}$ -in. hole has been cut, on the box.

The "solder melting" furnace, Fig. 7, is similar to the test-tube heater in construction. In the original unit, a 9-in. length of resistance wire was correct. The heat chamber of the furnace consists of a $3\frac{3}{8}$ -in. length of $\frac{3}{8}$ -in. tubing, one end of which is squeezed shut in a vise. Two thicknesses of sheet mica $1\frac{1}{4}$ in. wide are wrapped around the tube and the resistance wire is wound over it. The ends of the resistance wire are connected to 2-in. lengths of 14-ga. copper wire that are screwed to a $2\frac{1}{2}$ x $3\frac{5}{8}$ -in. sheet of $\frac{1}{8}$ -in. asbestos. The asbestos is nailed to the end of a $\frac{3}{4}$ x $2\frac{1}{2}$ x $3\frac{1}{2}$ -in. wooden block, the top of which is covered with asbestos paper. The heat chamber is supported on a $\frac{1}{2}$ x $\frac{3}{4}$ x $\frac{3}{4}$ -in. block of asbestos. A guard of hardware cloth is stapled to the base block, Fig. 7. ★ ★ ★



6 Above, crucible without hardware-cloth guard and asbestos top. Below, solder being melted in unit



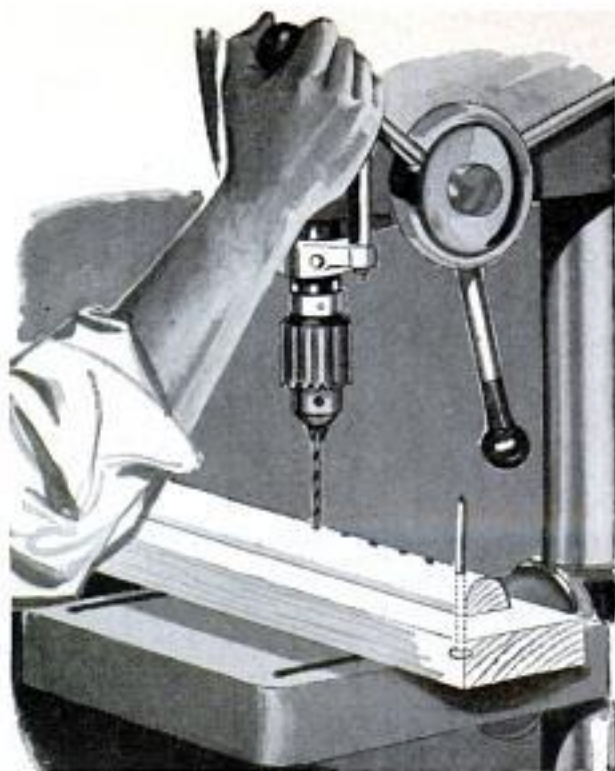
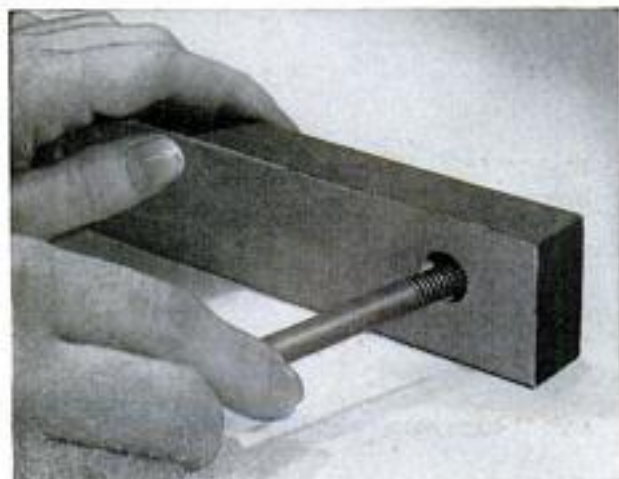


Workpieces Held With Dowels When Being Cut on Jigsaw

To hold a number of thin pieces of stock in alignment when sawing through to duplicate a pattern, stack the pieces and drill a small hole near each corner. Drive a short length of dowel into each hole. Lay out the pattern on the top piece. Pinned together in this way the stack can be sawed without any possibility of the pieces shifting. Always plan the pattern so the holes can be drilled and pinned in the waste area of the work.

Carriage Bolt Used as Rasp

When a wood rasp or round file is not at hand, a carriage bolt makes a good emergency substitute. Can be used for enlarging holes in hardwood, rounding corners or reducing thickness of small pieces. Threads cut freely with or across the grain.

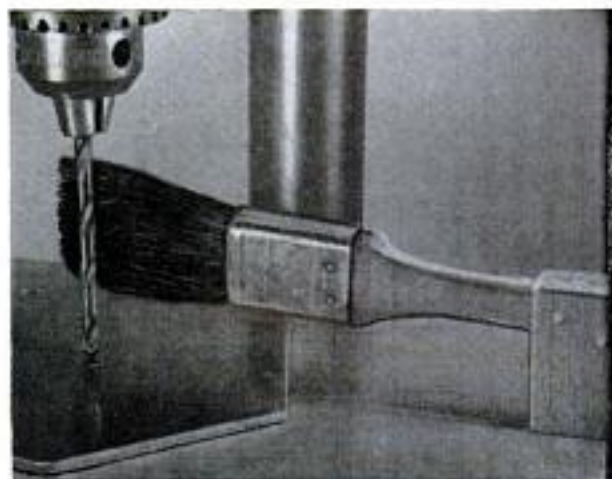


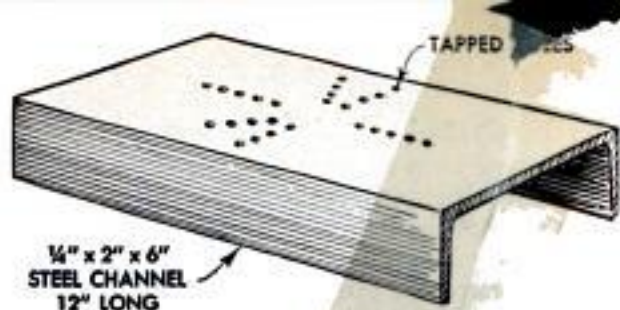
Jig Spaces Holes Uniformly When Drilling Half Rounds

Keeping a number of holes equally spaced when drilling dowels or half-rounds is no problem when this jig is used. It consists of a nail of the correct diameter driven into a board and allowed to project. Mark a center line on the stock and also mark location of the holes. Drill the first hole, then fit the workpiece over the nail. Then, advance the work one hole as each additional hole is drilled, slipping the work over the nail each time.

Drill Lubricated by Paintbrush

The time involved in the frequent use of an oil can when drilling metal can be saved by nailing a paintbrush to a block of wood and positioning it next to the drill as shown. The brush, saturated with oil, presses against the drill.

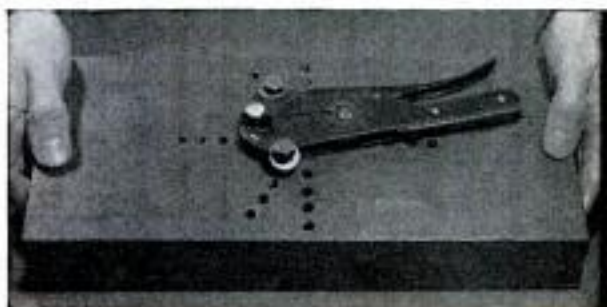




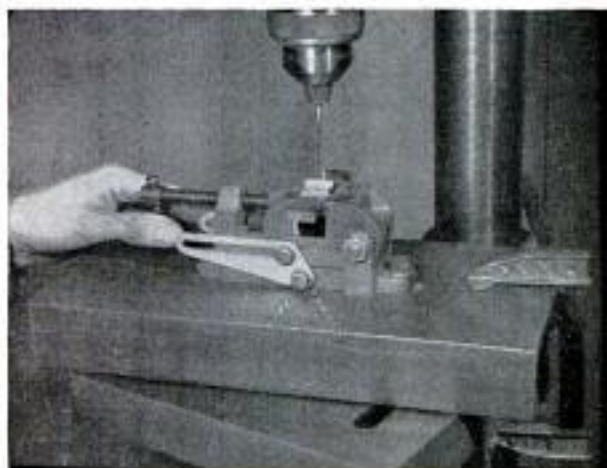
BENCH PLATE

holds work for filing, drilling, punch marking, layout and tapping

A bench plate is handy for holding work rigidly in position when several separate operations are to be carried out. This portable plate, made from a length of steel channel, will serve the purpose well where a high degree of accuracy is not required. Open ends make the plate easy to handle and permit the placement of C-clamps. A pattern of holes drilled and tapped in the web of the channel provides a means of fastening a vise to the plate or of clamping work directly to the web with strap clamps. A piece of channel of the length and sectional size given weighs about 9 lb. This weight is sufficient to give stability for light filing, layout and punching without the necessity of clamping the plate to the bench. An angle vise bolted to the plate facilitates handling work which calls for angular drilling or similar operations. Although the original plate pictured was used without finishing either the web or flanges, greater accuracy will be achieved by surface grinding the edges of the flanges and the web. This will better adapt the plate for use as a fixture on machine tables.



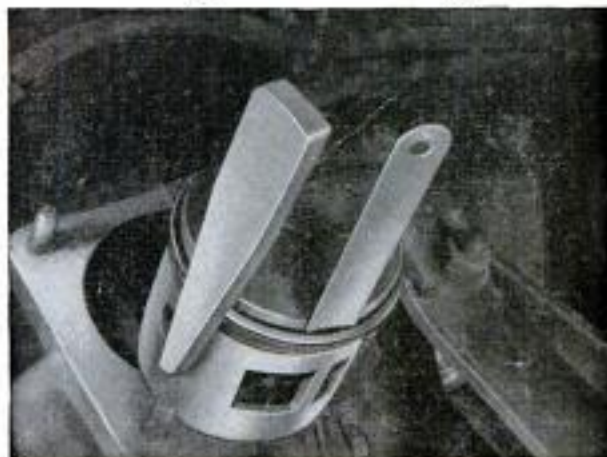
Above, top of plate showing hole pattern and clamping pliers held in place with capscrews. Below, plate and vise in use as holding fixture on drill press



Wedge With Long Taper Aids in Removing Piston Rings

When no conventional ring expander is at hand, piston rings can be removed by forcing the ends of each ring apart with a tapered wedge. The latter is improvised by filing long tapers on a length of flat steel. Press the ring into the groove at a point opposite the ends. While holding it in this position, force the wedge between the ends to expand the ring sufficiently to clear the groove. Then insert a feeler gauge and lift the ring clear.

Wood sheathing acts as a structural part of the wall of a home and provides maximum bracing when applied diagonally.



Make This

THIS CHEST OFFERS maximum tool storage in a minimum of space. It was originally designed to accommodate sets of wrenches and pliers assembled for special purposes. Constructed entirely of plywood with all exposed corners protected by aluminum angle it will withstand hard usage. The $\frac{1}{4}$ -in.-plywood sides are joined to end pieces of $\frac{1}{2}$ -in. plywood with staggered rows of screws driven through holes drilled in the aluminum angles. Note in the sectional view that the bottom panel fits inside the frame formed by the ends and side panels. Although $\frac{1}{4}$ -in. plywood is specified for the top panel, $\frac{1}{2}$ -in. plywood can be used. This will give somewhat greater strength, also prevent any possibility of breakage should the chest be used as an emergency support for a heavy weight or as a stool. Spacing of the sliding tool panels, shown in the sectional view, is optional. Perhaps the best way to determine spacings to suit the toolkit at hand is to lay the individual tools on a flat surface and measure the space required for those to be racked on each side of the individual panels. Special hangers for each tool are easily made from sheet metal and attached with screws or stove bolts. Finish in the natural color with spar varnish. ★ ★ ★

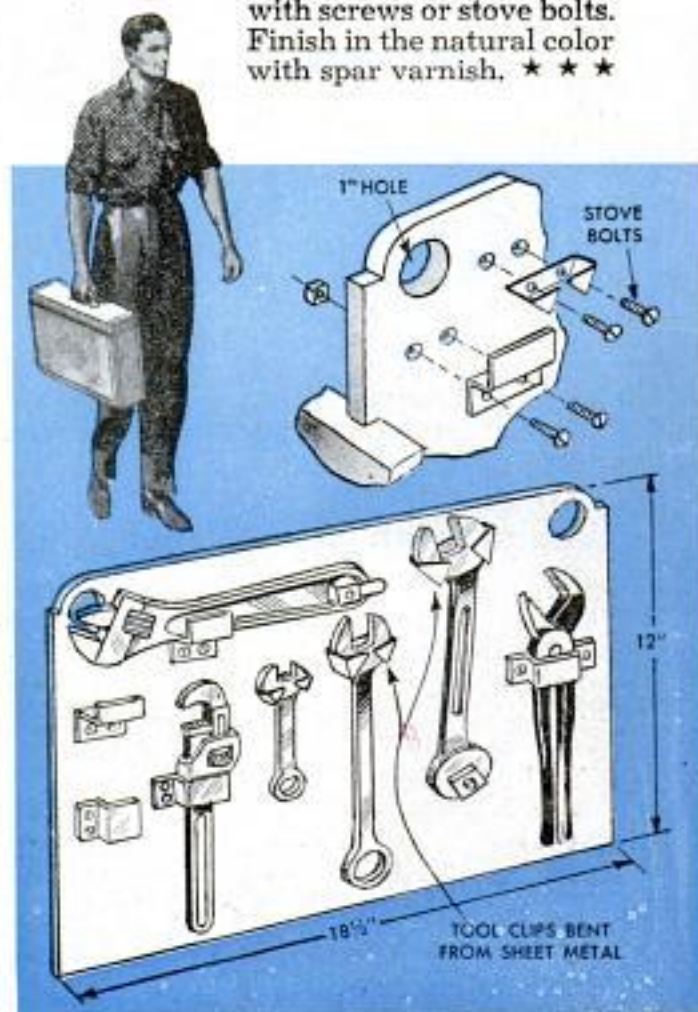


Strips Modify "Drive Block" For More Efficient Use

When applying tongue-and-groove flooring or drop siding to studding, it often is necessary to use a block and hammer to drive warped boards into place. The "drive block" can be made even more effective by nailing wooden pieces to each side to form a channel at the lower edge of the block. Besides making it easier to position the block on the edge of a board more quickly, the channel also permits the block to be left on the edge of a board while nailing is completed, so it is close at hand when next needed.

Brush Cleans T-Slots in Table

Cleaning metal chips from the T-slots of machine-tool tables is a simple job when a round bottle brush is used. Moderate pressure is used to force the brush down into the slot undercuts as indicated and pull out the chips.



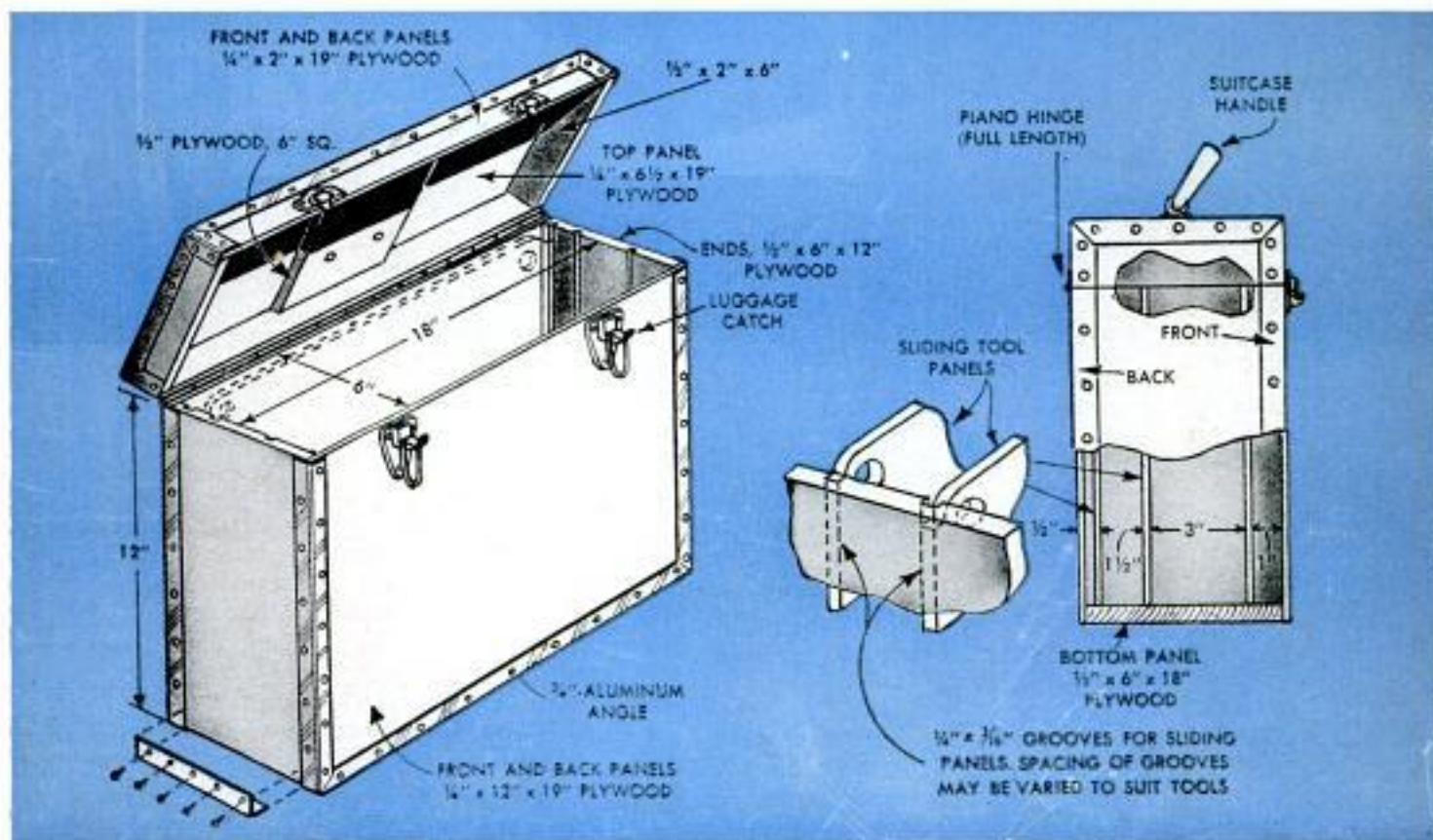
POPULAR MECHANICS

HANDY TOOL CHEST

Its sliding storage panels can be removed and taken to the job



Auto mechanics and men who service household appliances will find this tool chest a handy size to carry. Tool panels slide out for quick selection of the wrenches and pliers needed for the job. Regular toolbox locks can be substituted for the luggage catches specified. Smooth all exposed metal edges



Lumber Racked Between Joists in Basement Workshop



One solution to the space problem in the average basement workshop is an overhead lumber rack made by screwing hardwood cleats to the bottom edges of a pair of floor joists. When cutting the cleats to length, allow for equal projection of the ends beyond the pair of joists to which the cleats are attached. Then you can rack long strips, such as moldings, on the extended ends of the cleats without the necessity of sliding each piece into position endwise. Spacing of cleats should be about 36 in.

Roadside Stock-Loading Chute Helpful During Spring Thaw

Shipments for the spring markets are never delayed by soft ground or stubborn cattle on the farm of Millen F. Sandersfeld of Williamsburg, Iowa. In fact, cattle are practically in the truck before they know it with this special chute that allows loading from the road—just the thing for big semis during spring thaws. Wing gates lead the cattle into the chute which makes a slight bend so they cannot see the truck until they start up the ramp. If they try to turn or backtrack, a 2 x 4 is slipped through the chute behind them. A 2 x 8 on edge provides a "catwalk" up the outside of the chute.

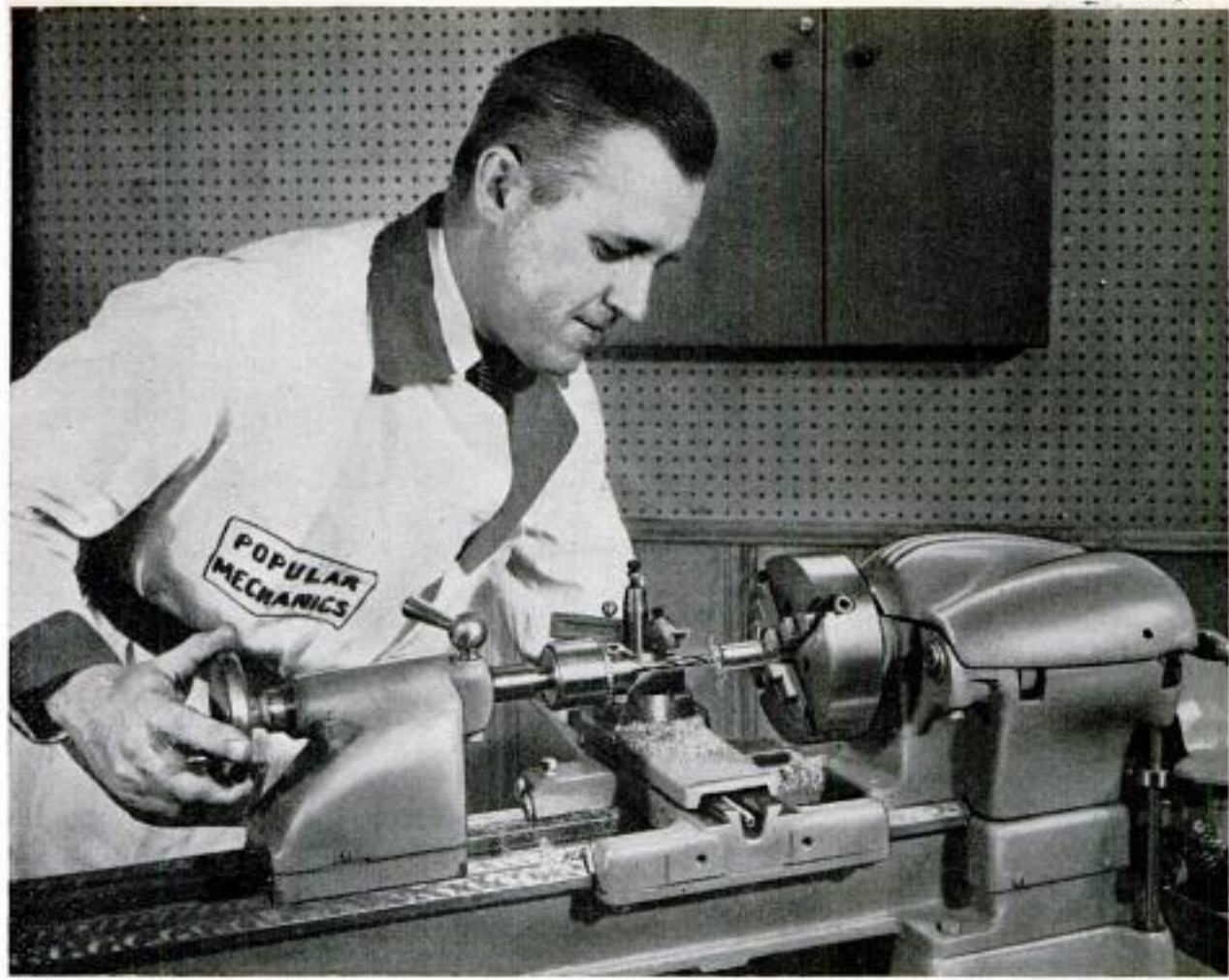
Concrete Poured From Mixer Directly Into Forms

To save one handling of concrete when pouring foundations and feed-lot slabs, one farmer mounted the mixer and a water tank on a trailer bed. With these two units there is room on the bed for bags of cement and $\frac{1}{2}$ yd. or more of aggregate. When pouring a foundation the trailer is backed into a position to bring the mixer directly over the form. When pouring a slab, concrete is dumped from the mixer into a chute, which carries the concrete to the desired point. The trailer is easily moved when one section of the wall or slab is finished.—C. F. Marley, Nokomis, Ill.



Correct Distributor Installation

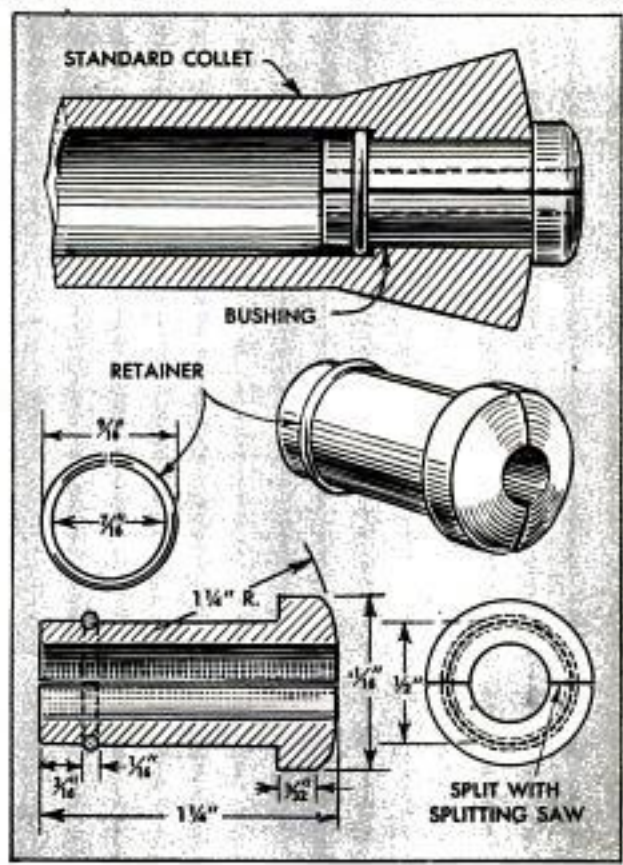
Correctly reinstalling a distributor in an automobile engine is no problem if the distributor is pictured as the face of a clock. Before removing the distributor, choose a point, preferably where the primary wire enters the distributor, as the 12 o'clock position. Note at what hour the clock "hand"—the rotor—points, and reposition it at the same hour when replacing the distributor in the engine.



Adapters Fit Standard Collets

WHEN ACCESSORY EQUIPMENT does not include a full set of collets the work range of those at hand can be extended with adapters. As an example, a 1/2-in. standard collet can be fitted with 3/8, 1/4 and 1/8-in. adapters, or bushings. This increases its range to four sizes. Carefully made, the accuracy of the adapters should very nearly equal that of the collet in which they are used. Adapters can be made from brass, bronze or machining aluminum. Drill and ream the center hole and finish all over. Machine the groove for the retainer, then cut through lengthwise on the center line. Slide the retainer in place in the groove, open the collet and insert the adapter. Then place the collet in the lathe spindle and tighten on a short length of drill rod of the same diameter as the hole reamed in the adapter. In some instances the retainer may prevent the adapter from closing fully. Should this occur, remove the adapter and file the ends of the retainer ring. Dimensions given are only approximations. Check the collet before machining the adapter to final dimensions.

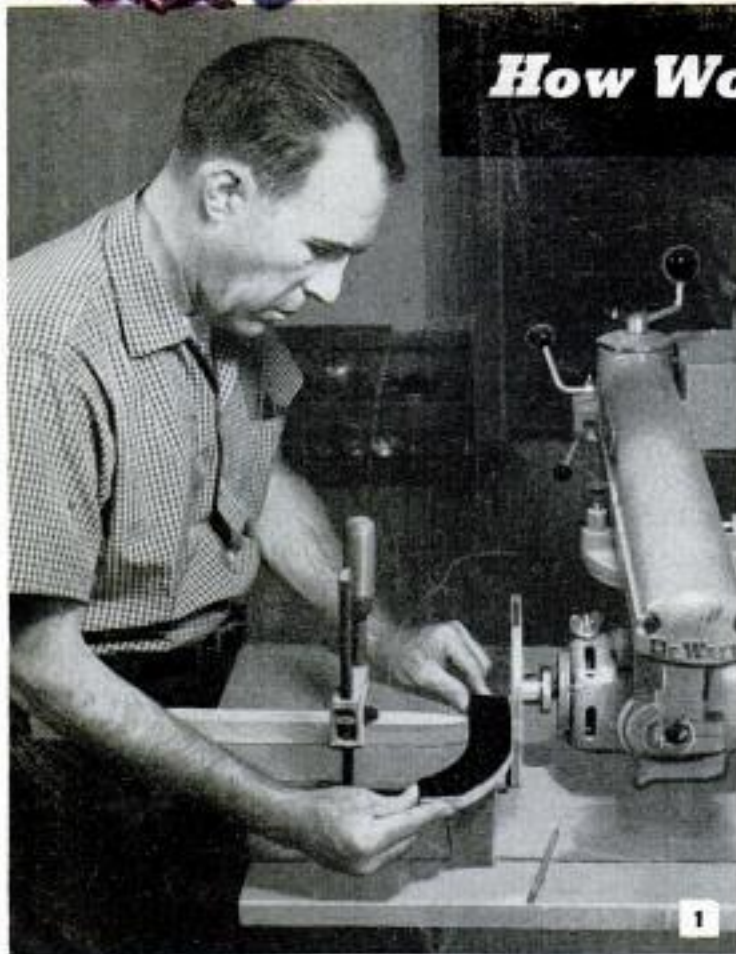
C. W. Woodson, Chicago.



X226

SN 59
P. 109

How Would You Do It?



1

1. Q—What jig assures that curved work is disk-sanded to uniform width?

A—Clamp a pointed jig block to the sander table at the required distance from the disk and pass the work between the block and the disk. The inside surface of the curve must be sanded beforehand, using a drum sander, or on the drum of a belt sander, if these tools are available

2. Q—How is sandpaper applied to the disk when using liquid adhesives?

A—Liquid adhesive must be applied to both disk and paper. When using a contact adhesive, locate the paper properly the first time, as it cannot be moved once it is in place. When using any adhesive, apply pressure to the full surface of the paper to assure complete adhesion



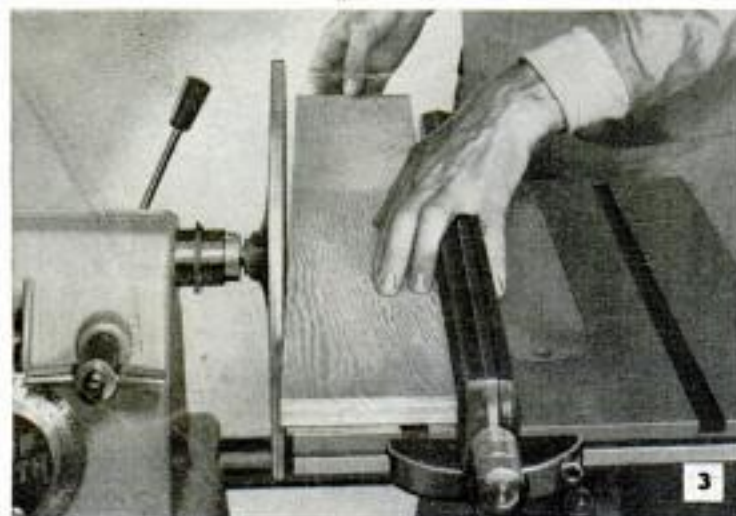
2

3. Q—Can a disk sander be used to "joint" the edge of stock to be glued?

A—Yes. Set the rip fence at a slight angle as shown in the photograph, so the stock is forced against the edge of disk when it is passed between the fence and the disk. Make several passes with the stock to make sure that the edge of the wood is absolutely true and smooth for gluing

4. Q—Stick adhesive requires that the disk be warmed. How is this done?

A—The use of friction is the easiest way to warm the disk. Simply hold a wooden block against the disk for a few moments to warm it, then apply the stick adhesive as shown. Using the block as indicated prevents the stick from becoming jammed between the rotating disk and the table



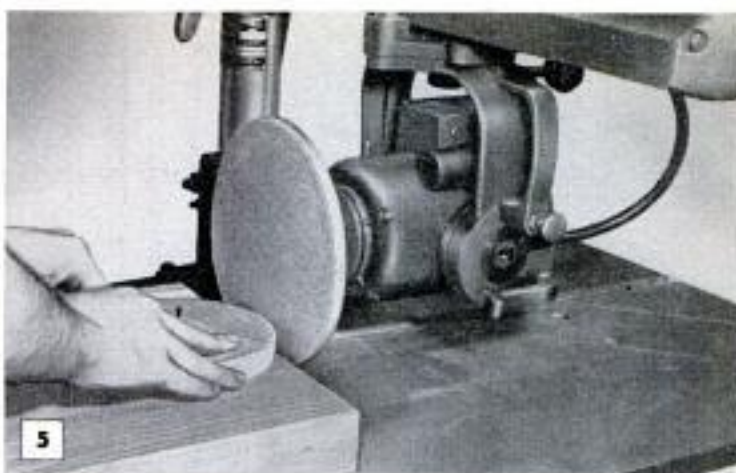
3



4

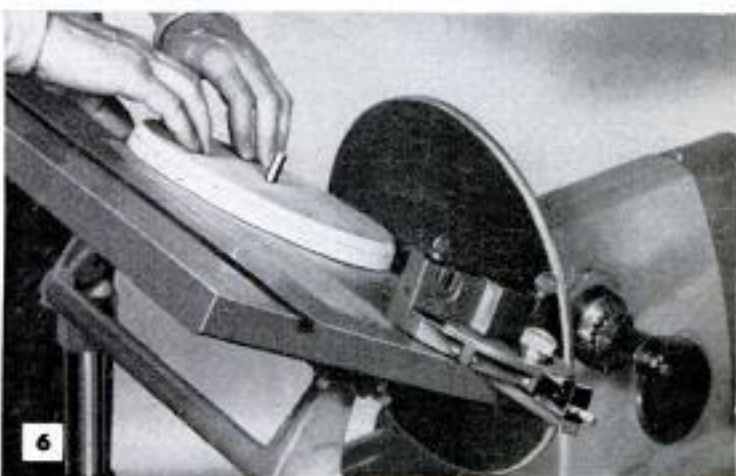
5. Q—How are wheels "turned" on sander without a jigsaw or bandsaw?

A—Use jig consisting of pivot pin in wood block. Draw wheel on stock, center-drill it and rough cut to shape with saw. Fit wheel on jig clamped to sander table and rotate it against sander, moving jig closer until wheel is correct diameter



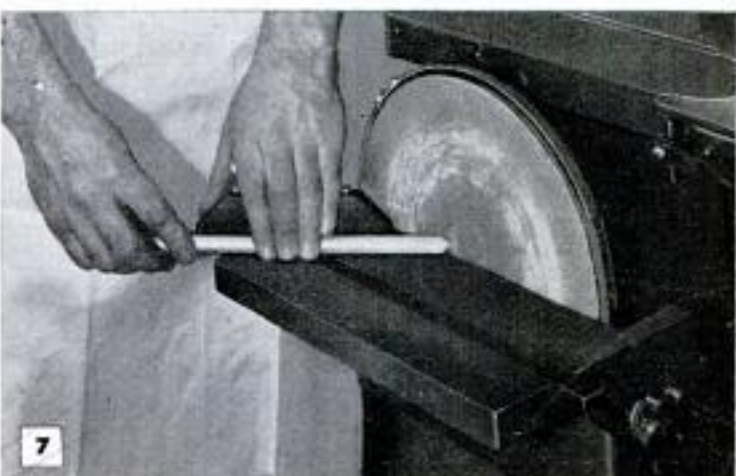
6. Q—What method is used for making an accurate chamfer on a wheel or disk?

A—On a conventional-type disk sander, use a jig such as described in the preceding answer, with the sander table tilted at correct angle. On some combination tools, a threaded pin can be screwed into the bar of the miter gauge to provide a pivot



7. Q—What is the quickest way to sand uniform points on a number of dowels?

A—Hold the dowels against a miter gauge to assure maintaining a uniform angle. If your sander is not equipped with a miter gauge, clamp a block of wood on the table instead. Push end of the dowel against the disk and rotate it slowly



8. Q—How can a disk sander be used to smooth the edges of an inside corner?

A—To sand the long edge of an inside corner, move the work across the face of the disk, stopping it just short of the disk rim. Next, slide the long edge directly into the disk, using either a clamped block or a miter gauge as shown

9. Q—What method is used to sand duplicate round corners on several pieces?

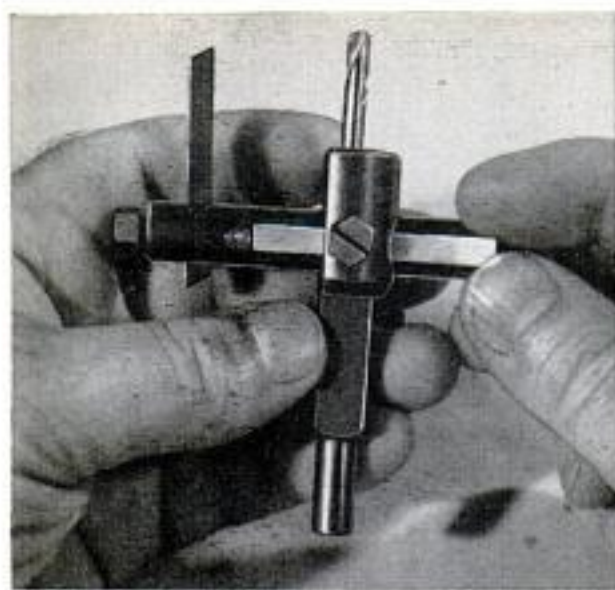
A—First, cut the corners of workpieces at a 45-deg. angle, making all cuts of uniform size. Then, sand angles into curves freehand. When several workpieces have been sanded, stack them and resand slightly to assure that curves are duplicated



SN 59
P. 73

4 SHOP KINKS

By C. W. Woodson



Metal Shim Under Setscrew Maintains Accuracy of Cutter

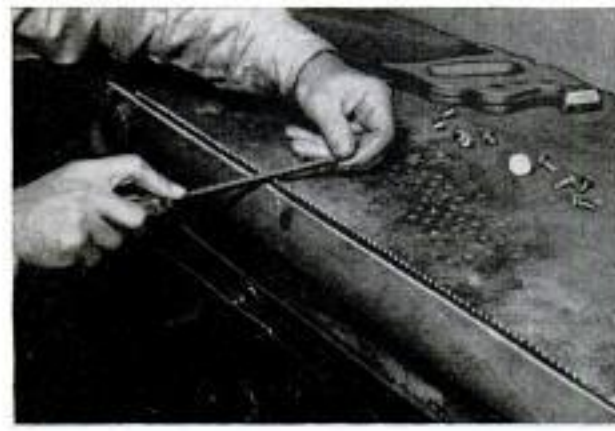
After a circle cutter has been in use for some time it may slip out of adjustment while a cut is being made because of damage to the extension bar by the setscrew. Avoid this by slipping a narrow strip of thin sheet metal under the setscrew as shown. Move the shim to a different position each time the setting is changed and replace it when it becomes deeply scored along its length by the screw.

Ken Murray, Colon, Mich.

Simple Clamp for Saw Filing

If you have only an occasional job of saw filing, try using a length of beveled siding, or any molding that reduces to a relatively thin edge, as a clamp. This can be screwed to the edge of the workbench or other suitable surface with the saw blade between as indicated. In most cases it is best to remove the saw handle and, of course, the blade is mounted so that the teeth project above the clamp. If some vibration persists, place a strip of felt, such as weather stripping, between the saw and clamp.

Michael Ligocki, Gary, Ind.



FIRST ONE, shown in the photo on the opposite page, is a test bar for checking alignment of lathe centers before setting up a job in the toolroom or school shop. Turn the bar from solid stock in a lathe with centers known to be in alignment. Mount in the lathe to be checked and run a light cut across both disks without moving the cross slide. Then mike the disks. If both show the same reading the centers are in line.

One way of laying out the job of squaring the end of a shaft is shown in steps 1, 2 and 3 in the left-hand detail, opposite page. It's fast and reasonably accurate.

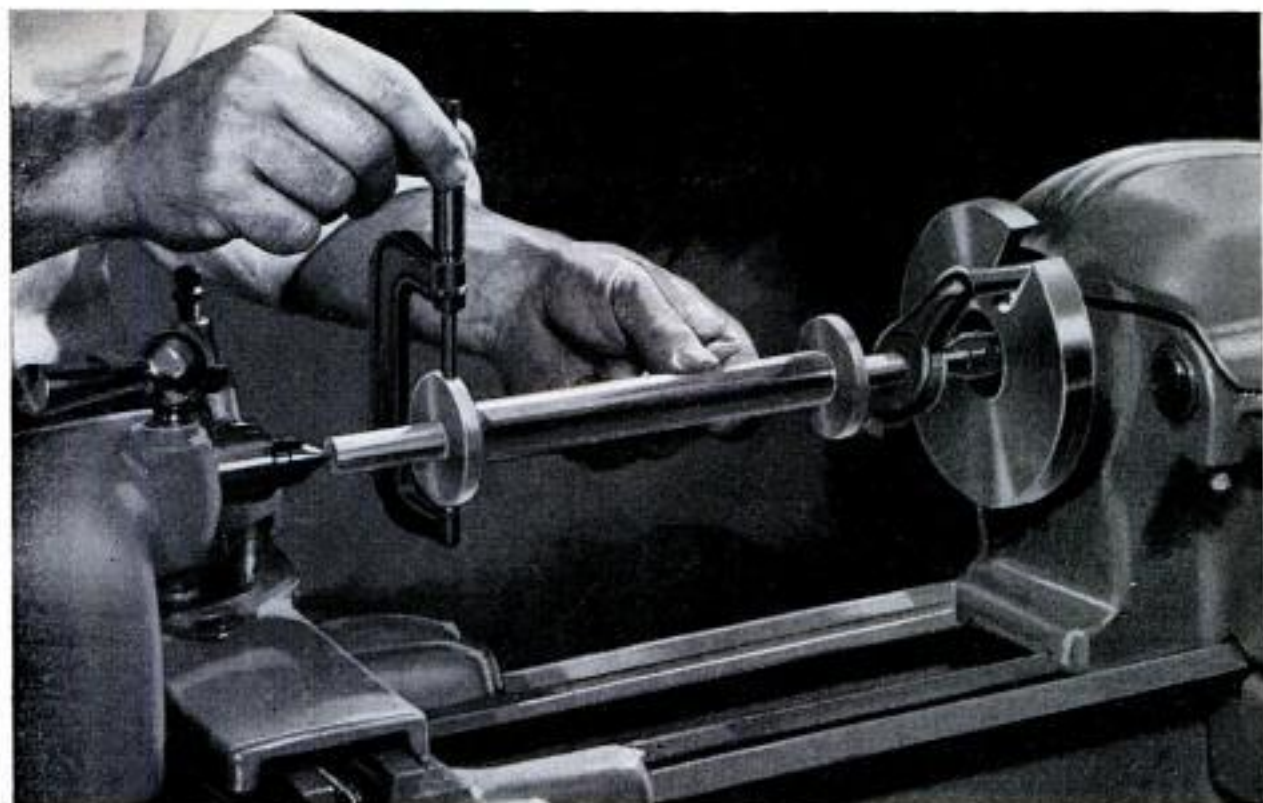
A shop gadget handy for scribing center lines on bar stock of rectangular cross section is shown in the right-hand details 1, 2 and 3 on the opposite page. Construction is clearly shown and you can make it to suit your own requirements.

The lower details, opposite page, show inside and outside chucks for holding thin metal disks. The outside chuck, details 1 and 2, holds the disk for facing only. Contracting jaws grip the outside of the disk. The inside chuck, details 3 and 4, has expanding jaws and permits work to be both trued and faced. ★ ★ ★

Roadside Weed Sprayer

Novel feature of this highway spray rig is the outrigger crow's-nest which carries the man handling the spray head directly over the road shoulder. This arrangement permits the truck to travel in the outside lane at a steady pace and still give the spray man ample time to cover the entire shoulder effectively.

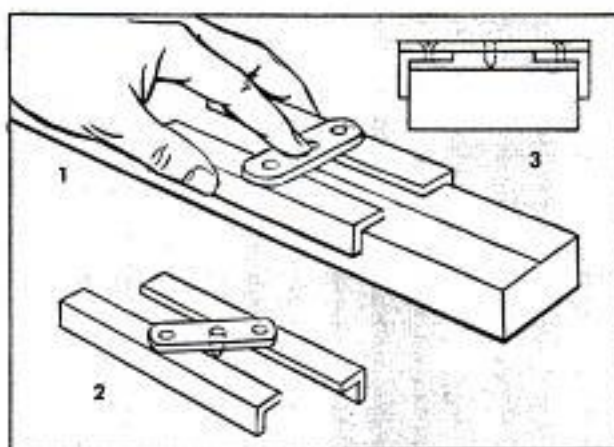
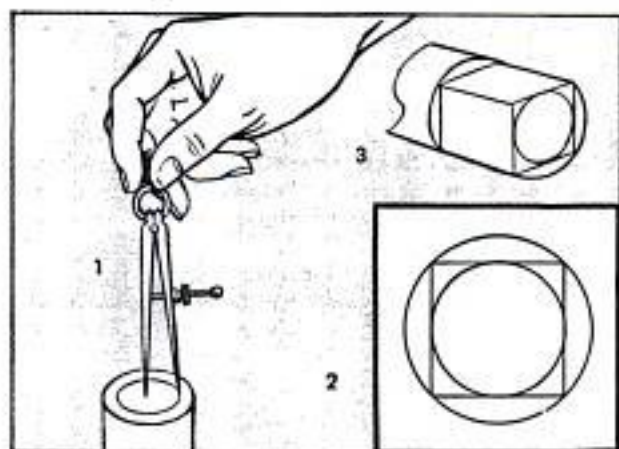




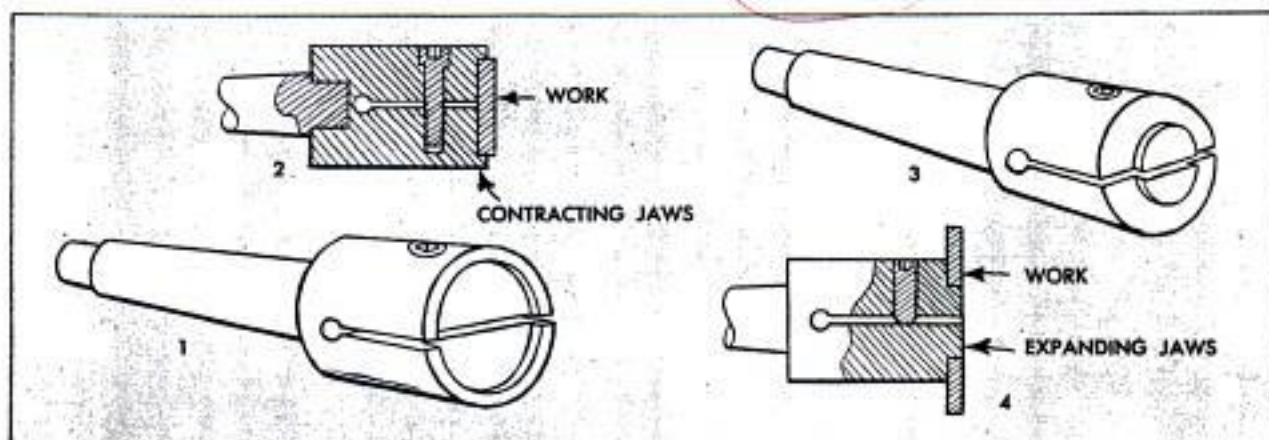
To check alignment of lathe centers, turn a test bar, run a light cut across disks. Then mike as pictured

Layout for squaring the end of shaft can be made with scriber after establishing center of shaft. Cuts are run tangent to the scribed lines as indicated

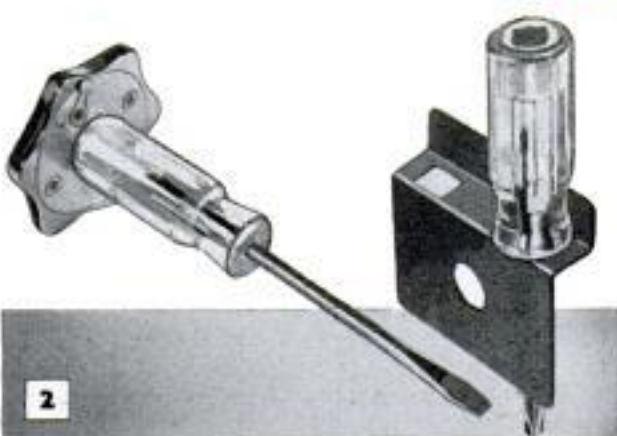
This handy gadget scores an accurate center line on bar stock in one stroke. Adjusts automatically for different widths of stock, either wood or metal



Inside and outside chucks for turning and facing thin metal disks are handy to have among the lathe accessories. To cover a wide range of work both inside and outside chucks should be made in several sizes



SHOPPING FOR TOOLS



1. PNEUMATIC NAILER can drive 60 nails per minute in sheathing, subflooring and roof boards. Also seats nails through sheet metal without predrilling. Takes cement-coated nails, box nails or common nails from 4 to 8d. Adapters are available for clinching nails or driving at an angle. Driving unit works within a radius of 15 ft. from the separate feeding unit Morgan Machine Co., Inc., 1230 University Ave., Rochester 7, N.Y.

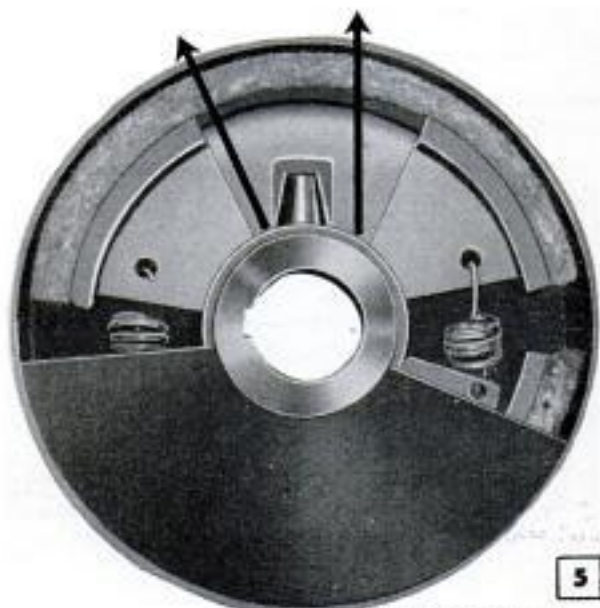
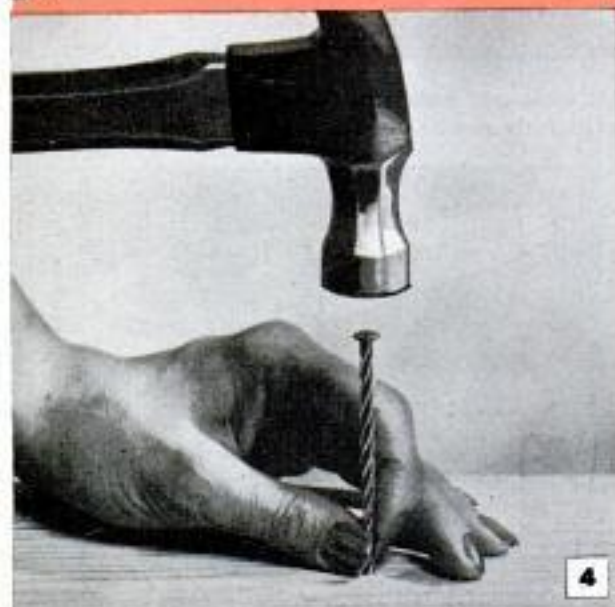


2. SCREWDRIVER has detachable palm-type ratchet driving unit which gives extra power for tightening or loosening wood or machine screws. Available as individual drivers or as a kit consisting of two drivers and a storage rack as pictured. Each driver is fitted with a special square socket to take the ratchet driving unit which is reversible for turning in or out

Kipton Industries, Box 21, Royersford, Pa.

3. TORQUE WRENCH performs as a precision nut runner with a smooth, constant torque having an accuracy range of 1 percent. Comes in three drive types giving precision, nonimpact torque from 6 to 300 in.-lb. Weight of the three drive types ranges from 5 $\frac{3}{4}$ to 6 $\frac{1}{4}$ lb. with a side-to-center distance of 1 $\frac{1}{4}$ in., this distance permitting use in hard-to-reach places

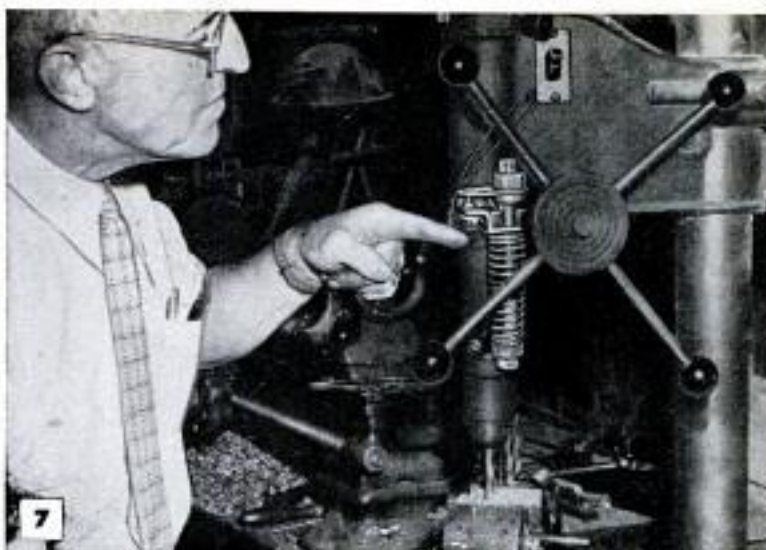
Swift Tools Corp., 3201 S. Prairie, Sioux Falls, S.D.



POPULAR MECHANICS



4. SPIRAL NAIL is said to cost less and hold better than the common wire nail. Shank, or body, of nail is deeply threaded, or fluted, throughout its full length. This gives it increased holding power, reduces splitting of wood, especially hardwood, and makes the nail easier to drive. Crest of thread is rounded, does not cut wood fibers when nail is driven
 Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa.



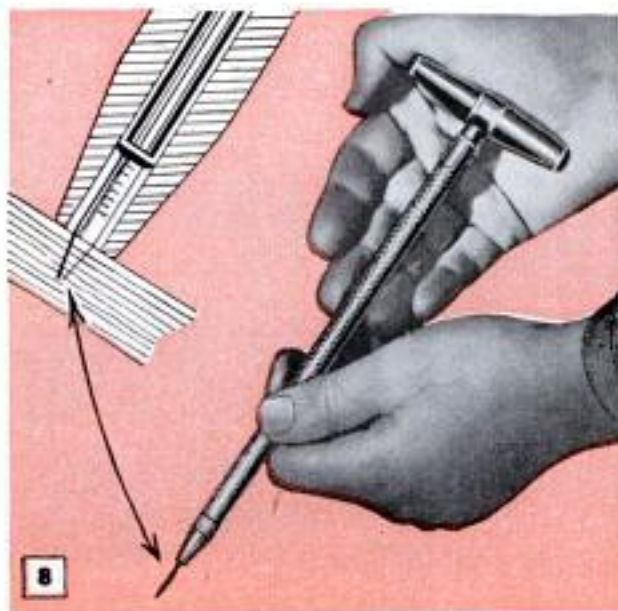
7. DRILL-PRESS ATTACHMENT provides automatic down-feed and shutoff in repetitive drilling operations. Adjustable depth stop automatically limits travel of the drill bit making it possible to drill blind holes of dependable uniformity in depth. Pressure is decreased as drill nears the end of the down-stroke, a feature that prevents burring through holes
 Diamond Tool Co., Box 32, South Haven, Mich.

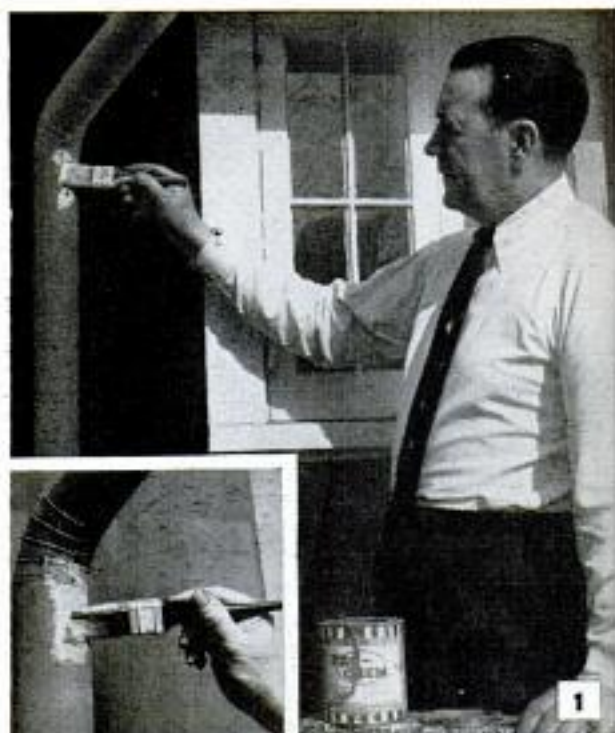
5. SELF-ENERGIZING CENTRIFUGAL CLUTCH combines centrifugal and lever action to force shoes against drum. This utilization of two forces gives smooth, positive engagement under heavy torque requirements. Shoes rest on a taper pin which exerts lever action. Floating shoes permit adjustment for misalignment. Used on chain saws, air conditioners, etc.
 E-Z Machine & Tool Wks., Beloit, Wis.

8. MAGNETIC DRIVER seats small nails and brads right where you want them. Body of tool houses a plunger with magnetic tip. Nail or brad is held in tapered tip, which is similar to drill chuck in shape, and is guided into wood as pressure is applied to handle. Fine for bradding glass-retaining strips in small doors, also in picture and mirror frames
 Carol Beatty Co., 7410 Santa Monica Blvd., Los Angeles 46, Calif.

6. ELECTROSTATIC FLOCKING KIT comes with generator, adhesive, stencil of alphabet letters, four colors of flock and an applicator. Makes a quick job of flocking the bases of ash trays, ceramic vases and figurines. Also is used to flock-embroider designs, monograms or initials on fabrics, such as sportswear, drapes, handkerchiefs, pillow cases, napkins
 Dennis E. Radford Co., 5620 Maywood Ave., Hammond, Ind.

9. DUAL-PURPOSE WRENCH features a novel sliding jaw having one side notched, the other smooth. Moving the sliding jaw forward against fixed jaw exposes smooth side, providing a quick-acting wrench for nut running. Sliding jaw back to original position gives the equivalent of two pipe jaws for a firm grip on pipe or thin-walled tubing
 St. L. Zak, Oberpfaffenhofen/Post, Weasling (Bavaria), South Germany, American Zone





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The Pro-Chem Co., Inc., 51 E. 42nd St., New York City 17

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Merimart, 2615 W. 21st St., Erie, Pa.



3. PENETRATING CONCRETE STAIN can be applied with a brush in the same manner as a penetrating wood stain. Complete concrete-staining kit contains the stain, an undercoater or toner and a final finish of wax. Two coats of stain usually are required. The other materials are one-coat applications. Comes in choice of nine colors with full instructions

Bohloff & Co., 918 N. Western Ave., Hollywood 29, Calif.

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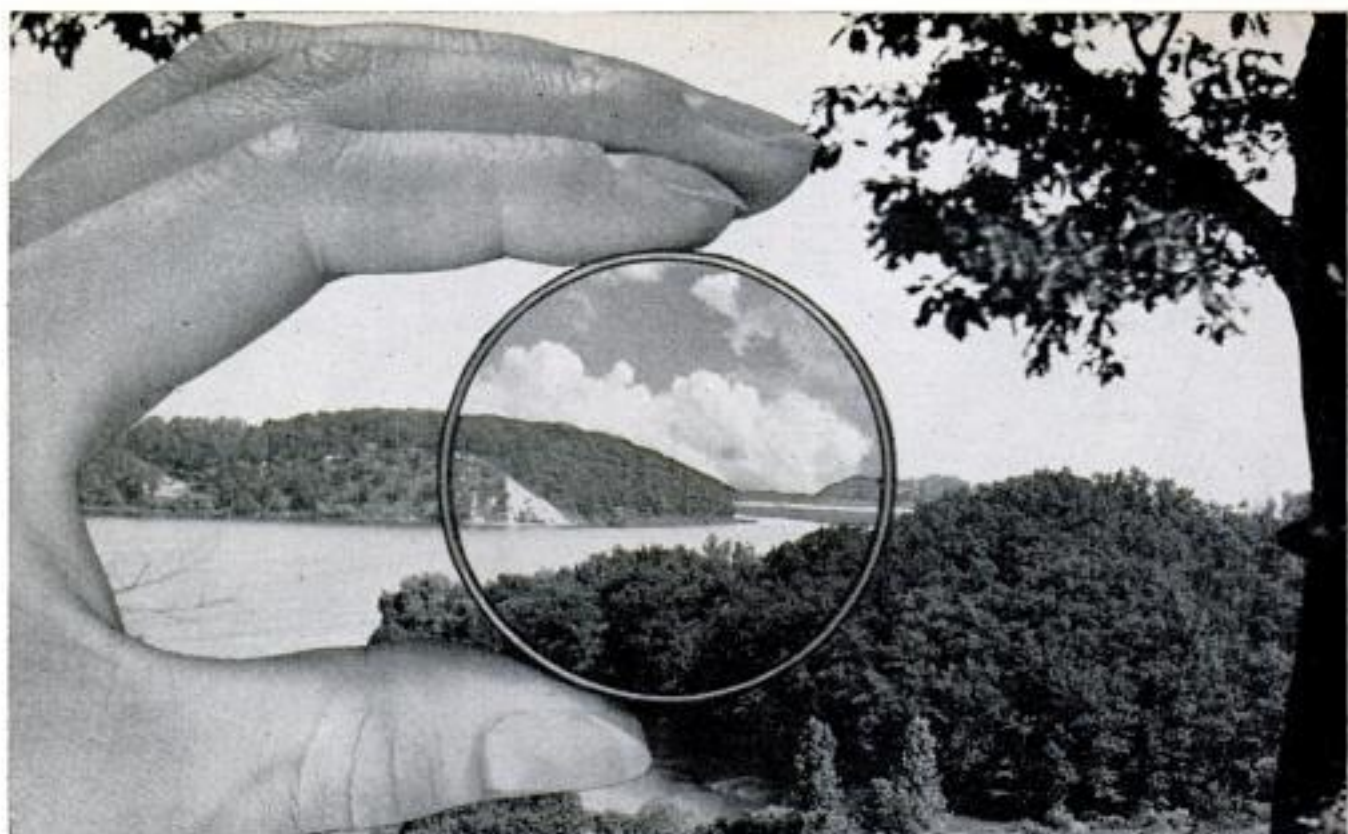
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Kodak Daylight Filter for Type F Color Films (No. 85C)—Adapts Type F (indoor) Kodachrome and Ektachrome Films for outdoor use.

Kodak Photoflood Filter, No. 80B (for Kodak Daylight Type Color Films)—Adapts Daylight Type Kodachrome and Ektachrome Films for use with photoflood lights.

Kodak Photoflash Filter, No. 80C (for Daylight Type Color Film)—Adapts Daylight Type Kodachrome and Ektachrome Films for indoor use with clear flash lamps.

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Kodak Wratten G Filter—Darkens sky and water . . . reduces atmospheric haze in landscape shots.

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Crack Filler

Q—Before painting plastered walls I've tried all kinds of crack fillers without much satisfaction, as you can always see the filler through the paint, which spoils the job entirely. Even two or three coats of a lighter color won't cover it. And how does one get crack filler into a corner to fill a fine crack? I've tried every tool I could think of. Any suggestions?—P. R., Ga.

A—Have you ever tried mixing the paint you are using with whiting (precipitated chalk) and using this mixture as a crack filler? However, most all crack fillers, patching plasters and the like which are made for the purpose work satisfactorily if handled correctly. It's the usual practice to clean out the crack, removing all loose material, then undercut the edges slightly so the new plaster, or filler, will key securely in place. When it is dry, sand it flush and coat with shellac to prevent absorption of the paint. Cracks having the edges offset should be sanded flush with the surface of the wall before filling. For filling fine cracks you can use a mixture of paint, of the same color as that used on the wall, and sufficient whiting to make a stiff, puttylike paste. Apply with a putty knife dipped in turpentine or any suitable paint solvent to prevent the mixture from sticking to the blade. Sand smooth after drying. To fill cracks in corners use the same mixture and apply with the index finger, which makes a perfect fillet.

Restoring Chairs

Q—I recently acquired several chairs to complete an old dining set. These apparently have been exposed to dampness for a long period of time which has caused the joints to loosen. Otherwise the chairs seem to be in fairly good condition and I'd like to put them back in first-class shape. But how does one go about it?

H. R., N. J.

A—You say the chairs are in good condition and from this we assume that no refinishing is involved. For a permanent repair the joints should be



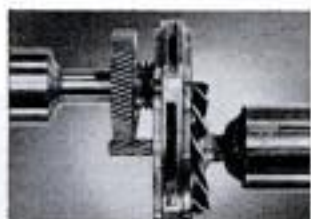
(Continued to page 210)

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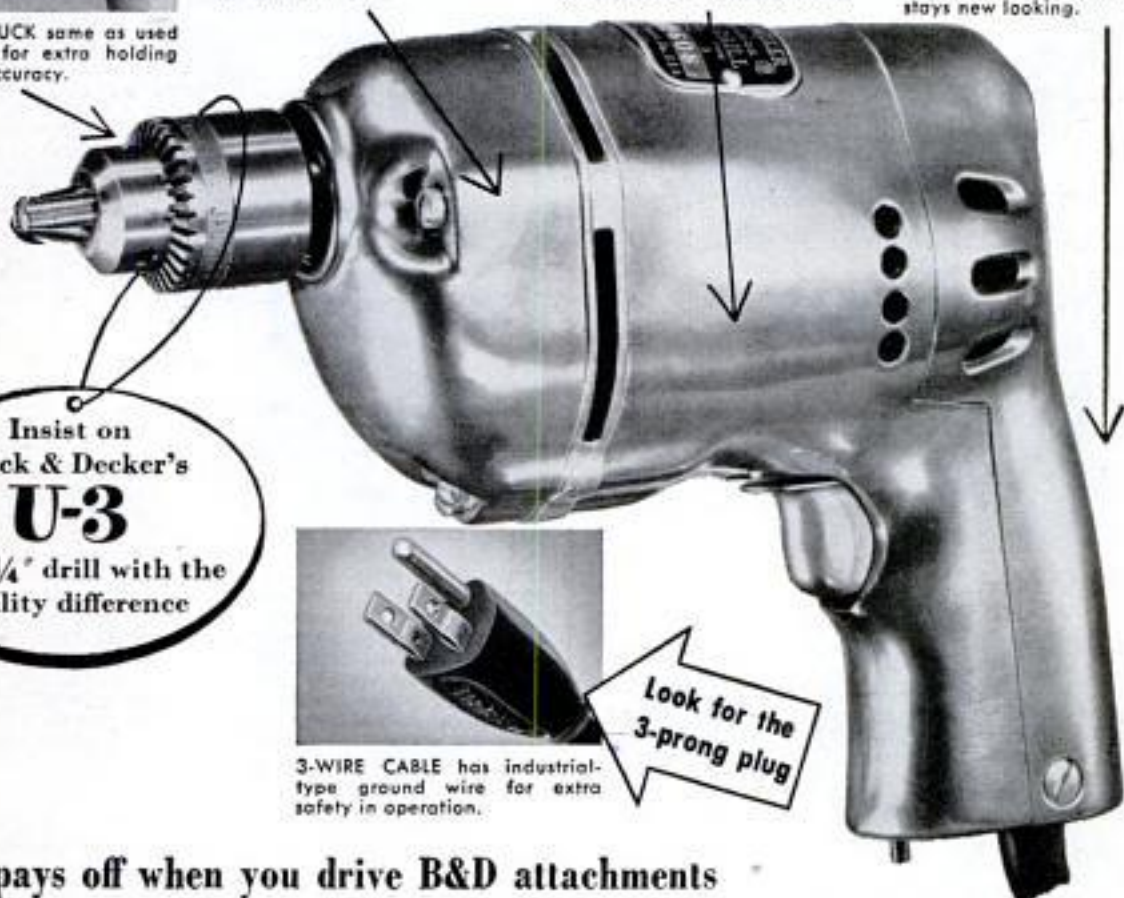
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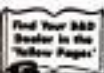
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SHERWIN-WILLIAMS HOUSE PAINT

(Continued from page 208)

opened and thoroughly cleaned to remove old glue and accumulated dust and grime. Usually it is possible to invert the chair, unscrew the corner braces and seat, if removable type, and then work the tenons out of the mortises by tapping the legs just below the rails and stretchers with a wooden mallet. Work carefully or you may split the wood at the mortises. Do a thorough job of cleaning away old glue but be careful not to enlarge the mortises or reduce the size of the tenons. Then "paint" the joining surfaces of the mortises and tenons with glue and reassemble with clamps. Another method which makes it unnecessary to disassemble the chair is to drill small holes through the back edges of the legs into the mortises and then force glue into the joints with a small glue gun made especially for the purpose. This method is satisfactory provided the joints are still in reasonably good condition. After forcing glue into the joints in the manner described, draw the joints tight with bar clamps or a band clamp and allow to dry thoroughly.



Summer Lawn Care

Q—When does one apply plant food to a lawn during the summer months to prevent "burning" the grass? I've been told that the best time is late in the evening after the dew falls, also that it is not advisable to apply any kind of fertilizer during July and August, but begin the applications again in September and continue at intervals until cold weather sets in. What is the correct procedure? — L. S., Ind.

A—A good lawn is the result of a regular maintenance schedule, just as is a golf green. Spring and fall applications of recommended fertilizers are good, but the spring applications do not as a rule furnish sufficient plant food to sustain growth at a high level during the summer months. Ordinarily the feeding schedule should begin early in the spring and carry through consistently until well along into the fall. This calls for regular applications of approved fertilizers at two, three or four-week intervals, whatever appears necessary to maintain growth at the desired level. Lawns on thin soils low in plant food and humus content may require steady applications on a two-week schedule, while lawns on heavier soils of greater moisture retentivity and higher fertility levels may be maintained throughout the season by 30-day applications.

Replacing Wood-Shingle Roof

Q—My home is roofed with wooden shingles. I do not know how old the roof is, but it's beginning to deteriorate as several small leaks have developed. My problem is whether to replace the old roof with new wooden shingles or reroof with composition shingles. I like the wooden shingles but I am afraid replacing them is going to be expensive. What is best?—J. P., N. Y.

A—You do not describe the condition of the roof other than saying that it is beginning to deteriorate and that small leaks have developed. It would hardly seem, from this description, that the entire roof is in a condition requiring immediate replacement. If the wooden shingles still lie reasonably flat, not turned up at the butts or cracked over large areas, they should give service for several years longer if repaired and further protected with a preservative. A good time to locate leaks is during a rainstorm. Remember that from the attic side, wooden shingles usually appear wet during a heavy rain but water does not drip from them unless there is an opening. Locate the points where the leaks occur and drive a small nail through the shingles so you can locate these points when you get up on the roof. Repair with new shingles. Then coat the roof with a creosote-base stain which is prepared for the purpose.

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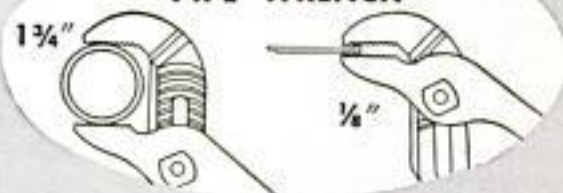


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CHAMPION DEPARTMENT TOOL Co. MEADVILLE, PA.

I Shoot the Works

(Continued from page 102)

across stage, life-like as their blood-and-bone counterparts.

This is the new science of pyrotechnics and nothing better illustrates it than the bombshell.

Consider the intricacy of a single big aerial bomb, packed with 60 or more small breaks, in a dozen colors following the main burst. Biggest mortar bombs are 48 inches long, 12 inches in diameter. To hurl them skyward you need a lifting charge—three or four pounds of black powder. The lifter packed beneath the bomb ignites first. The aerial shell, handmade as are all such complex explosives, is built up from tightly wrapped layers of sawdust, paper and powder, with as many as a dozen breaks to the layer. And each break is a different color, each mushrooming a different shape. As the bomb clears the mortar tube, the breaks must successively detach themselves from the mother bomb, and explode seconds later. Roughly, the biggest aeriels break every 200 milliseconds.

A Matter of Engineering

Visualize the engineering: The bomb's got to be hefty enough to withstand the terrific ballistic pressures of the lifting charge (so great that mortar tubes are welded from $\frac{3}{4}$ -inch steel). Each segment and every break must in turn survive the explosive "break away" of the next, igniting precisely in planned sequence.

The secret lies partly in the packing (compaction of sawdust and powder), partly in the delicate fusing (the fuse's length and density). What if something goes wrong, the slower-fused breaks igniting before the lifting charge?

This doesn't happen often, perhaps not once in a thousand displays. But it has happened while I've been ringmastering things.

We'd set up at the California State Fair, had laid out the mortars in a single line, the tubes 10 feet apart, as always.

Just before firing, I'd briefed the mortar chief.

"Soon as the swabbers have cleaned out the bores, reload. And if a bombshell hangs up in its tube," I'd cautioned, "get word to me fast. We'll isolate the tube, keep a hose on it until after the show."

That'd been our technique: Isolate the mortar, wet down around it, fill the tube with water and wait things out. A couple of hours later we'd remove the bomb, douse it with a fire hose as we cut it open. We'd wet the powder and bury what was left.

I'd called "Fire aeriels!" and watched as the mortars let go. Even with 2000 mortars coughing up bombs, you develop a sixth sense about misfires. Besides, bombshells trail a fuse as they go up. They're easily spotted, though not from the stands.

Suddenly I sensed that a tube close by hadn't let go. At the same moment the firing chief's voice crackled in my ear-phones, "Misfire! Tube No. 10!"

From the control point I saw the chief motioning the loaders away with hand signals because there's no hearing yourself think when bombshells let go. He'd no more than turned back to the magazine when one of the guys, confused I suppose, rammed a shell down the misfire and torched the fuse (we were lighting them manually that show).

I ducked, expecting the tube to blow to bits.

"Zoommmp!" With a deafening explosion both shells skittled skyward, blossoming with bursts as if nothing was wrong. Ever since then we've gotten rid of misfires—the smaller, four to six-inch-diameter ones—that way.

Maybe when the stadium lights flick on, you've noticed an unfired set standing among the debris. A misfire? Perhaps. But there's a much better explanation: Somebody missed a cue. Slip-ups happen occasionally during the frenzy of firing. If a piece isn't fired in its turn, we seldom get back to it.

Fireworks Are Fragile

What most people don't appreciate is the fragility of fireworks. It seems incredible that a flimsy package of paper and powder can rock a huge stadium and set onlookers to holding their ears.

The "gerondole," or "spin around," is both my father's most fragile creation and his most spectacular. Its one-million-candlepower burst is enough to bring daylight to the darkest stadium. Yet the gerondole's feather-light bamboo frame, hand-tied and shaped like a piepan, is so fragile it can scarcely support the weight of the 72 pushers ranged around its rim. Can't support them, that is, until its lifting charge hurls it into the night, simultaneously firing the pushers. That's when centrifugal force takes over. Spinning more than 500 revolutions per second, the gerondole's flimsy frame tauts like steel. And the spin around, fiery as a flying saucer, soars high above the crowd—one of the most spectacular and expensive of man-made meteors. About \$250 worth of powder and patience burn during its scant 15 seconds of life.

(Continued to page 214)

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Costliest and showiest of aerial bombardments short of war was a Lizza creation. VJ Day was but a week old and Los Angelesans wanted something big. They got it. That night we rocketed 3000 bombshells into the night in just 180 seconds, fired the four and eight-inch-diameter aerals from steel barrels, fused one to the other. That three minutes of pyrotechnics cost \$10,000. Those who watched gasped for breath. You'd have had to be there to get the impact.

A show like that requires miles of fragile fuses. Fuses are really timing devices. Their burning rate depends upon compaction—how tightly the explosive ingredients are packed—and upon the fuse's length and diameter. Basic ingredients are black powder blended with a binder—a high-melting-point wax which needs about 200 degrees F. to melt. The wax is the firemaker's "glue." It solidifies the millions of tiny grains of powder. Electronics can trigger a fuse, set it to burning. But only powder—and craftsmanship—can make it behave.

Fuses triggering elaborate set pieces are breathtakingly fast. A big bomb's fuses may burn a paltry half inch per second. In that same second, fire races along 500 feet of set fuses. Watching from the stands, it seems that a stadiumwide set fires instantaneously. It doesn't. Your eyes simply aren't fast enough to catch the igniting.

Set fuses look like coils of rope. Upwards of seven plies of cotton twine, 75 to 500 feet long, are dipped into a solution of black powder, allowed to dry, then threaded through light Manila tubing (typical diameters: 1/8 to 1/4 inch). It's "rope"—the lethal variety. Thousands of feet of the flammable stuff may go into a single set piece, crisscrossing thousands of lances—so the whole set seems to flare at once.

As controller, I worry about fuses, about electronic igniters, about the maze of sets and the blunt-nosed mortars spread before me across the arena.

Then, as my stop watch nudges 9 p.m., I brace behind the sandbagged control bunker, conscious always of the crowd—of you—huddling in the black stands.

Suddenly a voice sledges out of the night. "You're on, Mr. Lizza!"

I rasp into the mike dangling from my neck: "Fire aerals!"

And the show's screaming skyward—on this, America's fieriest night of the year, Fourth of July. ★ ★ ★

Submarines operating in World War II cost from \$5,000,000 to \$7,000,000 each. Today, nuclear-powered submarines require an outlay of \$45,000,000 to \$60,000,000 each.

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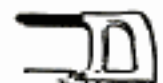
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Instantly.



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Tenite handle molded around steel
back for greatest strength...perfect
balance!

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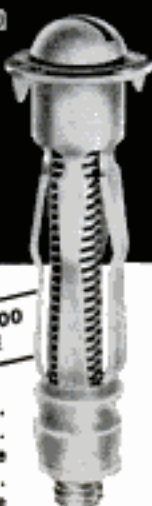


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Stand By for Satellite Take-off

(Continued from page 70)

body while aloft, standard astronomical methods can be used to observe it. But the tracking job will be a challenge because never have astronomers had to chart the position of such a rapidly changing celestial object.

Before precise observations can be made, the satellite's exact path on its first few revolutions must be quickly charted. This will be done in two interesting ways.

First, the sphere will carry its own transmitter, radiating a fraction of a watt. The miniature radio was designed and built by Naval Research Laboratory as a part of Project Vanguard headed by Dr. John Hagen. Its batteries will last two or three weeks. Nonetheless, NRL and the Army Engineers have designed special Minitrack receivers to form a "radio fence," extending from North America down into South America. If the satellite's radio operates, observers will have data to predict the orbit in its early stages.

Second, the satellite will be visible during twilight hours as a rapidly moving star of almost naked-eye magnitude, and can be picked up by simple optical instruments manned by amateur and semiprofessional sky watchers all over the world.

Satellite spying should become a popular sport, as well as an important scientific endeavor. Should the radio fail, these observers will prevent loss of the satellite to science. When the miniature radio batteries die and when the sphere's orbit grows erratic due to the forces working on it, visual observers will be the only ones who can chart its route. There is rich potential scientific information in these final stages.

Computers Will Calculate Orbit

As various teams across the country spot the satellite on successive revolutions through the creeping twilight zone, the time and location data from each will be telephoned to the Smithsonian Observatory's Satellite Computing Center in Cambridge, Mass. In minutes, electronic computers will plot the preliminary orbit. Before the satellite has completed many revolutions, its path will be sufficiently well-known to enable special photographic telescopes to be aimed accurately at succeeding orbital paths.

These photo observatories, especially established by the Smithsonian Astrophysical Observatory, will be in Florida, New Mexico, Hawaii, Japan, Australia, Dutch West Indies, Peru, Argentina, South Africa, Spain, Iran and India.

(Continued to page 224)

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Make Your Jobs Easier to Do

Exclusive Magnified Crystal Vision, free of shadows and reflections, makes Empire three times easier to read than other levels. Shock-absorbing mounts prevent damage by accidental fall. Unmovable adjustment guarantees accuracy. It's today's big buy in levels . . .

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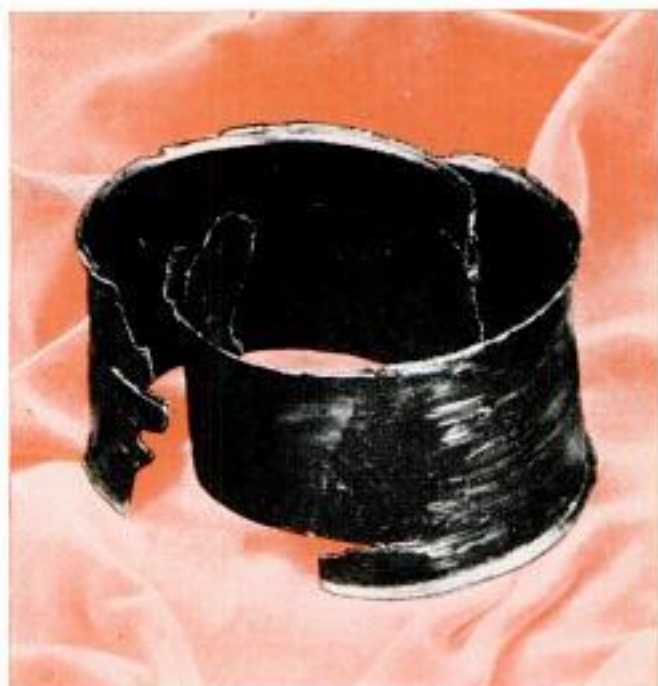
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What happens when you wait too long to replace engine bearings?

In addition to power and pick-up loss and carbon fouling the engine's "insides," driving with excessively worn bearings can cause costly crank-shaft damage—perhaps even replacement! When engine sluggishness and increased gas and oil bills signal worn bearings, to protect the shaft and to restore power, pep and economy, replace with Federal-Mogul main and con rod bearings—they are *engineered* for the job! *Ask your mechanic!*

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Mechanics Know . . .

that the black and red Federal-Mogul box identifies the service bearing line as modern as today's engines.

RESEARCH • DESIGN
METALLURGY • PRECISION
MANUFACTURING • SERVICE



"Broncobusters" of the High Seas

(Continued from page 132)

seven days. She went into service the following day.

Delivery of vessels of all types, from their port of launching to their new owners, is the responsibility of the "runners" or contracting firms.

One of the oldest of these is Abram's of Glasgow, the company which delivered both ferries. It was Henry Abram, son of the founder, who waited so anxiously for news of the *Queen Margaret*; it was his son, another Henry, who fretted until the *Sir William Wallace* docked safely. Between them, the three generations of Abrams have managed to deliver hundreds of ships, hulks, floating docks and other seaborne objects to all parts of the world.

"Weather is the taskmaster in this business," Henry Abram explains, "but each commission presents its own problems. It might be, for instance, the question of how to deliver a harbor tug with a 36-ton bunker capacity, burning eight tons of coal daily, across 6000 miles of ocean with bunkering ports 10 days and more apart."

Extra Bags of Coal

Abram, who is himself a Naval Reserve officer, was faced with this very problem recently, when he was charged with delivering three 113-ton, 90-foot-long tugs built in Britain to Cape Town, South Africa. He managed it by stowing extra bags of coal wherever possible aboard, and making arrangements to bunker at obscure points on the African coast which seldom see a ship.

One of Abram's longest voyages was that of the British-built 85-foot-long motor lighter *Meealong*. This was delivered at Palembang, Dutch East Indies, 8750 miles away, in 81 days. It traveled via Gibraltar, the Suez Canal, Aden and Colombo. Bad weather played havoc with the original schedule.

Dredgers Difficult to Deliver

Hoppers and dredgers of all types, whether self-propelled or towed out, are always difficult delivery assignments. Trawlers, on the other hand, being sturdy craft built to stand up to storm and stress, present few delivery difficulties. In 1952, the 133-ton *Dauntless Star*, built in Britain and sold to the Booth Fisheries Corporation, Chicago, was delivered at Halifax, Nova Scotia, in 25 days' steaming time.

The 625-ton pilot ship *Jean Mentelet*, built on the Clyde for the Suez Canal Company, was taken out to Port Said, via Malta, by Abram's in 14 days. Recently

a coaster sailed from Rotterdam for the West Indies completely bunkered, stored and manned by an Abram crew of runners six days after the delivery price was quoted.

Last Voyage

Delivery of ships on the last sad voyage to the shipbreaker's yard takes place frequently. Some must be taken even as far as Japan. In 1953 Abram's arranged for the towage of the burned-out hulk of the 20,000-ton *Empress of Canada*, submerged for 20 months in a Liverpool dock and raised after an epic salvage feat, to a breaker's yard in Spezia, Italy.

Yachts, powered by their own tall canvas, are occasionally delivered overseas. The auxiliary Bermudan cutter *Gulvain*, 55 feet long and with 1135 square feet of sail, was delivered to a Greek shipping tycoon in Bermuda after a splendid 30 days' Atlantic crossing, sailing by way of the Canary Islands.

The successful delivery of any ship depends greatly on the crew of runners engaged. Abram's draws on a pool of qualified officers and efficient crewmen, all prepared at a moment's notice to sail anywhere in anything that floats.

Good food and comfortable berths, the modern sailor's birthright, are not always possible in small craft doing a deep-sea safari. Canned and dehydrated foods and meat without bones are invaluable space savers.

Bread wrapped in waxed paper keeps fresh for about 10 days. Fresh water is always a problem in small ships on long voyages. Barricoes (wooden casks) of water are stowed away to augment limited tank capacities and canvas is stretched to catch the rains.

Small ships can now be equipped temporarily with short-wave radiotelephones capable of transmitting arrival messages or, in an emergency, the "Mayday" distress signal.

Cabled news of arrival is immediately phoned to waiting clients. Then, as a goodwill gesture, the crew's next of kin are informed.

Ship delivery is certainly a risky business requiring a high degree of skill. It gets few publicity fanfares. Yet, where small craft are concerned, it is as essential to shipbuilders as the mail service is to industry ashore. There are very few executives in this ulcer-provoking job—Mr. Abram hasn't had a holiday for three years—but fortunately there's always a good pool of runners ready to deliver anything that floats.

YES . . . Paint furniture, fence etc. — spray away the insects for outdoor living — these and scores of other jobs actually are fun with the portable Johnson **Red Head** Air Compressor. It's a powerful piece of equipment—not a play-thing. You can do a "professional" job with the Johnson **Red Head** Can pay for itself many times over.

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Do-it-Yourselfers . . . the "Red Head" puts the professional touch to all refinishing jobs, painting work and odd jobs around the house.

Boat Owners . . . the "Red Head" is the best spray machine made for hull painting, deck and cabin refinishing, handling insect spray.

Home Painters . . . the "Red Head" spray gun gives a flawless, smooth finish to exterior home surfaces and professional finishes on furniture.

Charcoal Chefs . . . A fast spraying with insecticides virtually eliminates annoying bugs and pests . . . means truly enjoyable outdoor meals and living.

Farmers . . . the "Red Head" used properly for barn fogging, machinery maintenance and painting saves you time, money and cost of extra personnel.

Gardeners . . . "Red Head" spraying is a most effective way to control insect pests.

Equestrians and Kennel Enthusiasts . . . the "Red Head" barn fogging process and sanitary spraying will insure the health and comfort of your animals.



\$44
LESS MOTOR

"Red Head" Compressor Kit includes: gun, 15 ft. air hose, tire chuck, fittings, 4" pulley on compressor, 26" V-belt, 3 1/2" pulley for mounting on 1/4 to 1/3 h.p. motor . . . weight less than 30 lbs. — easily portable.

CHECK THESE "RED HEAD" FEATURES

100% BALL BEARING and needle roller bearing construction.

PISTON-TYPE UNIT. Provides oil-free air. Built-in surge tank eliminates pulsations.

NYLON THRUST WASHER keeps shaft in alignment. Neoprene seal tested through thousands of hours of trouble-free operation.

LIGHTWEIGHT AND COMPACT. 14" long, 8" wide, 10" high. Weighs less than 30 lbs. with motor. Easy to carry to any location.

NO STORAGE TANK NEEDED. Delivers 3 1/2 cfm of free air and 50 psi pressure.

FORCED AIR INTERNAL COOLING. Aluminum die cast housing ribbed and reinforced for greater strength and maximum cooling.

GUARANTEED PERFORMANCE. Quality materials and advanced engineering. Simple, oilless, efficient.

• **FOR USE WITH** any 1725 rpm 1/4 h.p. or larger fractional horsepower electric motor. Power take-off or gas engine can also be used.

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MANUFACTURERS OF PNEUMATIC TEMPERATURE AND AIR CONDITIONING CONTROL SYSTEMS.

Power Is Oldsmobile's Top Feature, Say Owners From Coast to Coast

(Continued from page 124)

this is by far the least mechanically perfect. Many bugs were apparent in the car after only a few weeks of driving, such as poor printed circuit in the dash, poor shocks and an inadequately strengthened radiator for the high pressures involved."—Indiana Air Force man.

"I paid \$65 extra for my special paint. It is more metallic. It is showing through on the roof struts and not from polishing as it has not been polished, only washed."—Ohio union representative.

"Door glasses rattle."—Texas pastor.

"Has more rattles and squeaks than any car I've had and I've had 10 new cars since 1949."—Michigan attorney.

What About Styling?

Because Oldsmobile has been completely restyled for 1957 and because it retains much of the general appearance of previous years, we asked several specific questions about styling.

Oldsmobile has developed a reputation for clean, simple styling with a minimum of frills and it is not surprising that owners rank this characteristic tops on the list. On the don't-like list, the feature most frequently mentioned is the three-piece rear window. Here are quotations to illustrate the likes and dislikes in order of frequency of mention by the owners:

"I like its simplicity, its clean lines."—Illinois diemaker.

"The simple, but well-built design with no exaggerated fins."—Michigan sales manager.

"Modern front bumper and grille design."—Tennessee service manager.

"Low, streamlined."—Indiana salesman.

"I like the red stripe on the chrome side trim."—Wisconsin owner.

"Rear-window dividers cut down the vision through rear-view mirror."—Michigan state policeman.

"Front grille too hard to wash and polish."—Indiana plasterer.

"Wrap-around windshield makes it too hard to get in and out."—Oklahoma dentist.

"Chrome airplanes on front fenders collect extra dirt."—New York salesman.

Interior Likes, Dislikes

Strangely enough, the best-liked interior feature and the least-liked interior feature are the same: the dashboard. Oldsmobile has an unusual dashboard design this year. It is called a "strut mounted" dashboard. There is an opening between the base of

the windshield and the top of the dashboard. Here are the good and bad features of this design, as seen by the owners:

"Strut dash adds strength and gives good radio sound quality."—Missouri retailer.

"The design keeps the sun's rays from hitting me in the eye."—Texas farmer.

"Strut-mounted dash looks good but is a catchall. Everything goes over behind it."—Virginia contractor.

"Opening behind dash is strictly a dust catcher."—Mississippi businessman.

Here are more opinions on Oldsmobile interior design:

"Headlining is made so it can be washed."—New York clerk.

"Colors of interior are subdued. This is a safety factor."—Florida retailer.

"Glove pocket is long, but poor in depth. Should be deeper."—New Jersey university student.

"Floor mats are too hard to sweep."—Kansas night-club operator.

"Floor mat should be something you could wash."—California stage-property man.

More Best-Liked Features

"I like most the fine, quiet, durable and outstanding performance of its engine."—Illinois corporation executive.

"Sturdy construction."—New Jersey salesman.

"Hydra-Matic changes from first gear to second quickly and smoothly. Has a quick getaway."—Maryland well driller.

"Large window area."—Wisconsin retailer.

"Lots of vision."—Michigan farmer.

"I like the dual exhausts below the bumper, throwing fumes down instead of through bumper."—Nebraska contractor.

"As an auto mechanic, I prefer Olds to any other make due to its general accessibility."—New York mechanic.

"I like the heater controls—no levers to pull or knobs to turn. Just push the buttons."—Maryland foreman.

"My dealer service could not be beat."—New York fire chief.

More Complaints

"When you open the rear door, space is too narrow to get your feet out of the door."—Illinois retired farmer.

"Too low. Hurt my back getting in and out, as I am six feet tall."—Colorado salesman.

"Heater control does not work right. When not on Hot, it throws all cold air. No way to get warm air."—California owner.

"Heater vents vibrate at over 60 miles per hour."—California Navy man.

(Continued to page 222)

Here's a sound-conditioned fun room you can build yourself!



Kids should have a room where they can make all the noise they want. Parents should have a room, too — for their parties or hobbies. Even if you've never driven a nail before, you can build a sound-conditioned fun room for your family. It's easy to do, and costs less than you think.

On the ceiling, use Gold Bond Acoustamatic Tiles. They make rooms pleasantly quieter, are attractive and inexpensive. Both Regular and Random patterns (see above) have hundreds of perforations that literally soak up noise. Nail or staple tiles to wood strips applied right on your old ceiling. Their rich ivory-white finish beautifies any basement.

On the walls, use Gold Bond Gypsum Wallboard and Insulation Tiles. Tiles come in ivory-white and a random assortment of four lovely pastels, have interlocking edges that hide nails or staples. Wallboard goes up fast. Saw panels like wood, or

score with a knife, and snap. Finish with quick-drying Gold Bond Velvet Latex Paint. Job's done!

Want plans so you can start building? Write for free illustrated folder, "How to Remodel Your Basement," to National Gypsum Company, Dept. PM 77, Box 73, Buffalo 13, N. Y. Then see your local Gold Bond® dealer. He'll supply everything you need — including helpful advice.



NATIONAL GYPSUM COMPANY



"Jetaway is not as fast from a standing start as plain Hydra-Matic."—California steel worker.

"Some road ice struck the rod which operates the transmission control and I could not shift. The car could not even be towed. This important rod should be in a more protected location if the car is to be given such low clearance."—New Jersey dentist.

"When driving fast in rain, wipers fail to hold against the windshield."—Indiana farmer.

"Windshield-wiper mechanism uses cables that are too loose and result in poor window coverage."—California executive.

"Front fenders overlap front bumper and the wheels throw all the mud and road dirt over the chrome."—Illinois merchant.

"Window cranks are too low and work too hard."—New York distributor.

"Have to slam trunk lid almost through the rear end to close it."—Connecticut owner.

"Should move dimmer button two inches to the right as emergency-brake pedal is in the way."—New York engineer.

"Too much of the underside of the front fenders shows."—Ohio housewife.

General Comments on Industry

We ask the owners who take part in our Owners Reports to tell us what they think about the current trends in the automobile industry. Many of their comments are of unusual interest. While they do not necessarily apply to Oldsmobile, they are interesting enough, we feel, to be quoted. Here are some of them:

"Why have all cars gone overboard in horsepower? Power, power, power. Laws don't begin to allow the use of all the power so we use more gas for power we can't use. I'm not an engineer, but it all sounds pretty silly to me."—Massachusetts housewife.

"They have lowered the cars too much. It isn't as convenient getting in and out as the 1956 models."—Michigan assembler.

"My reaction to body styling of several of the 1957 cars is that changes are too drastic. I like more conservative styling. Also I think extreme fins and such add to the cost."—Texas business manager.

"I don't mind the lowness, but I do not like the windshield protruding in the way of getting into the car. It is also dangerous as to getting fingers caught in the door."—Michigan owner.

"I sell direct to homeowners. I would have bought another make which is more stylish, but it looks too much like a 'brag' car. Some people resent obvious prosperity and the big-shot appearance. The conserv-

ative lines of the Oldsmobile are the main reason for my buying it."—Missouri salesman.

"This car is air-conditioned which I have not used to date. There is some question in my mind as to the value of this in this part of the country. It may turn out to be more of an expense to maintain and operate than the advantage it offers."—Michigan salesman.

"If speedometers were more nearly correct, the highways would not be cluttered up with slow drivers. Also gas mileage would be different."—California retired owner.

And that is the assembled opinion of the Oldsmobile owners who took part in this month's Owners Report. For the engineering analysis of the car turn back to page 126. For a report of the way the car drives see page 127. ***

Swinging Wall Lamp Has Wide Radius

Blind workers are manufacturing a product they can never use. It's a suspension wall lamp with a swinging radius of eight feet. The frame is made of tubular aluminum with a black, gold or silver finish. One type of shade is triangular and the unit's cost is \$11.50 including parcel post and handling. The other model is a Japanese-parasol type costing \$12.50.



❑ Paper of synthetics such as nylon is planned for manufacture within a year.



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The heart of these stations is the Baker-Nunn Satellite Schmidt telescope. Basically the telescope is a Schmidt type, modified optically and mechanically for this tracking problem. It employs a 31-inch spherical mirror and three corrector plates, providing a 30-degree field of view, and stellar images of high quality. Continuous photographic film in the telescope mechanism records the path of the satellite across the sky in a series of pictures that may be as frequent as one per second.

Film Records Background Stars

Merely to photograph the satellite without respect to background stars would be interesting but meaningless. An ingenious drive mechanism enables the new telescope to track the satellite for a short time, then on the same film to record the star field, which acts as a celestial frame of reference for the satellite motion.

Clock timing, also recorded on film, pinpoints the passage of the sphere to an accuracy of $\frac{1}{1000}$ second. Radio time signals broadcast to all 12 stations simultaneously, for accurate calibration of the telescope clocks, make this remarkable tracking program possible.

As soon as the satellite has passed over a given station, the film will be processed on location, rough measurements made and transmitted to the computing center in Cambridge. This will serve as a rough check on orbit computations. Precise measurements will not be made until the film is received in Cambridge for analysis.

The scientific value of such records, besides furnishing data for predicting satellite positions, will yield a complete history of the satellite's changing orbit on successive journeys around the earth. These changes will enable scientists to determine the size and shape of the earth, to link the geodetic networks from continent to continent, and to measure the variation in density of the upper atmosphere of the earth.

The satellite will also carry instruments for measuring such things as cosmic rays, ultraviolet light from the sun, and the magnetic field of the earth.

It is intriguing to reflect that this tiny body will give us information about the upper atmosphere as well as conditions inside the earth, since its motion will be controlled by conditions in both places. Such information is not obtainable any other way. Our satellite may well be the forerunner of a new astronomical tool, as important in its unique role as was the telescope of Galileo in its role. It is fitting that this effort be an international cooperative effort.

What about future satellites? It seems

(Continued to page 228)



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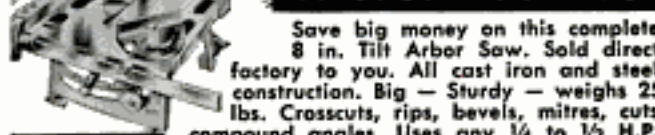
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Mystery Fuels for the Missile Age

(Continued from page 112)

the new fuels, incidentally, are suitable for turbojet use. Some are best when used in the afterburner; some are best in supersonic ramjet engines.

Other studies are being made to improve the operation of afterburners and ramjets. An afterburner requires a flame holder (usually a pair of V-shapes) to prevent the flame from being blown out by the hot gases rushing past. When the afterburner isn't in use, its flame holder is an obstacle that cuts down thrust. Recently, Stanford Research Institute came up with a solution: Turn the afterburner fuel nozzle around so that it faces forward. The nozzle sprays its fuel just as efficiently in the new position, serves as the flame holder and causes little turbulence.

"Screeching combustion" is another afterburner malady and this has been studied intensively at Caltech's Jet Propulsion Laboratory. In this phenomenon the usual low-pitched roar of an afterburner suddenly changes to a piercing whistle or screech. The screech is accompanied by a build-up of heat so intense that the afterburner can be destroyed. Schlieren spark photographs were made of the condition and the screech was found to be an oscillation of the flame, an instability produced by some air-fuel ratios in combination with certain flow rates and afterburner shapes. With this information it became possible to modify the afterburners so that screech doesn't occur.

Rocket Carries Own Oxidizer

The hunt for new jet fuels springs in part from a similar search that has been going on in the rocket field. A rocket carries its own oxidizer as well as fuel. One fairly reliable combination, used in the V-2s and the early Vikings, was liquid oxygen as the oxidizer and alcohol as the fuel. Since then many other combinations of propellants have been tried, including nitric acid and aniline, hydrogen peroxide and hydrazine, and nitric acid and ammonia.

As an indication of the present state of the art, the rocket that will loft the Vanguard satellite will use liquid oxygen and water-alcohol in its first stage, nitric acid and a special kind of hydrazine in its second stage, and a solid monopropellant in its third stage. Hydrazine is a nitrogen-hydrogen compound that is made by the reaction of chlorine with ammonia. The Vanguard hydrazine is called "unsymmetrical dimethyl-hydrazine and contains extra amounts of hydrogen plus some carbon atoms.

The theoretically best combination for rocket propulsion would be hydrogen as the fuel and fluorine as the oxidizer. This yields the highest heat of combustion, some 8100 degrees, producing more thrust than other propellants. But so far, engineers haven't been able to find a way of using the combination. Hydrogen gas has to be compressed into a liquid and requires heavy tankage. The liquid fluorine is so corrosive that it rapidly eats through all metals and most other substances. And the flame that this combination produces is so hot that no one has been able to design a rocket engine that could handle it.

John F. Tormey, chief of research for Rocketdyne, the rocket motor division of North American Aviation, estimates that present rocket fuels give 25 percent better performance than did earlier fuels. He adds that another 25 percent boost in power is possible before the energy barrier is reached, as far as chemical fuels are concerned. ★ ★ ★

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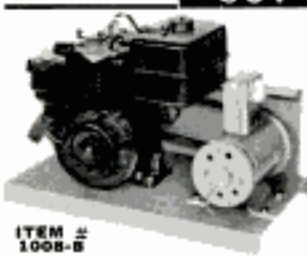
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almost certain that man's inventiveness and curiosity will demand that larger and better-equipped satellites be placed in orbit. These would be true satellites in that they would orbit the earth at altitudes up to 1000 miles, where lack of atmospheric drag would allow them to circle the earth for thousands of years.

TV Cameras in the Sky

Future satellites may have instrumentation undreamed of today. An era of satellites with radio powered by a nuclear power plant or solar batteries can be visualized in the foreseeable future. Such large satellites might carry television cameras aimed not only at the earth but at the skies, transmitting to permanent satellite observatories around the world a constant flow of cosmic information.

At the beginning of our article we whimsically anticipated the manned satellite by imagining ourselves in the 21-inch sphere during its initial revolutions. The end of such an imaginary junket would be little less spectacular than the beginning. After a few months to a year, the resistance of even rare atmosphere will exert a telling drag on the sphere. Slowly its orbit will shrink, carrying it closer to Earth, where air is more dense. The rate of spiraling will increase rapidly until at last the satellite plummets downward in a long arc at 18,000 miles per hour.

At this stage, you'd better get off—preferably with an asbestos parachute. Friction will heat the skin of the satellite rapidly above the melting point of any materials we can use. The tiny moon will glow like a shooting star and finally plunge to earth, a mangled handful of partially melted junk.

But its memory will persist through all history. Telemeter receivers, tracking cameras and visual observers will have preserved the scientific story of its record-breaking adventure. ★ ★ ★

Process Reduces Lines on TV

Those black horizontal lines across a television screen may soon be eliminated, according to scientists at the Westinghouse Research Laboratories. They have developed an experimental method of "wobbling" the electron beam vertically about 15,000,000 times per second as it scans the picture tube. This broadens the white lines which carry the picture information and narrows the distracting black lines between them. The improvement is possible through a slight change in the construction of picture tubes.

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Glenn Culbertson, Acampo, Calif., runs forced-air hose into oil drums and gets an even flow of oil

Air Is the Farmer's Hired Hand

(Continued from page 141)

rig to the tractor on the Raymond Morris ranch at Garden City, Kans. Air comes from a small tank which is filled by a shop compressor.

A hoverless brooding system gets chicks off to a good start with air bringing heat into the building from an oil-fired, home-type furnace and metal heating ducts on the Roy Heckenluber poultry ranch at Biglerville, Pa. Vertical heat ducts 10 inches above the floor supply an even flow and plenty of hot air at any desired temperature, thermostatically controlled.

"The handling of silage has always been a tremendous chore when no mechanical means has been available," Albert Helbig, an Illinois farmer reports. "I just couldn't put up with the tremendous amount of work I had to give out when unloading corn silage from the field chop wagon, so I mounted an auger in the bottom of a wagon. This auger moves the silage to a blower set on the outside of the wagon and airlifts it up a pipe and into the silo."

Air also comes into its own when chores are to be done around the hog ranch. There's no hand-carrying in the hog-feeding system of Bob Lynch, Marshall County, Ill. Air from a blower does all the feed handling, taking corn and supplement from a hammer mill and sending it as far as 80 feet to both indoor and outdoor feed pens.

Time control permits the rancher to do other chores while feeders are being filled.

Air Removes Water

Air is one of the principal means of drying hay, grains, and any other crops which must have moisture drawn from them. Ways and means of sending or drawing the air through the crops are many and quite varied.

One of the latest developments is the use of a Quonset-type building set on a concrete floor. Grains are piled in the building over tunnels made of steel mesh and covered with window screen so air can pass through but grain cannot fall into the tunnel.

John Wheeler of Courtland, Calif., in his building of this type has divided it into four sections with a powerful electric fan blowing air into a tunnel in each section and sending the air up through the corn.

Another method used in Quonset buildings is to run two tunnels the length of the building and connect them to a giant fan at one end. Air is fed through a series of air ducts that runs the length of the galvanized-iron walls, vents in each end of the building and in the uppermost part of the roof.

Circular steel tanks also have become quite important as drying units during the last two years, with thousands of them being put to that purpose. Tanks are set on a 20-inch-high wall of concrete blocks. Flooring is perforated so that when air is forced in under the floor it passes up through the grain and out a vent in the top of the tank. One fan takes care of six 1000-sack tanks, with air delivered via a main tunnel to ducts leading to each tank.

Joe Gruenthal of Live Oak, Calif., sets up each of his circular tanks as an individual drying unit, and has portable squirrel-cage-type fans, which he runs up to the opening under the tank floor. Each fan is equipped with a gas heater unit.

Cold Air for Small Grain

"Only cold air is used in drying small grains," Gruenthal explains. "If hot air is used it only moves the moisture into the top two feet of the tank where it condenses and refuses to move out. Cold air will take moisture on out without condensation. Hot air is used when corn is dried because the kernels of corn are large enough to let air pass around them without condensation."

Corn drying by air receives attention wherever corn is grown. In some sections of the United States, column-type air driers, such as the one on the Clarence Ragland farm in Ohio, are used extensively.

(Continued to page 232)

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Corn goes into two steel drying columns with an air space in between and air holes in the columns next to the air space. Hot air from a furnace is forced between the two drying columns, and moisture in a 180-bushel truckload of corn is reduced from 35 to 13 percent in eight hours. Such a batch drier can be eight feet high, 12 feet long, 54 inches wide. Drying chambers are 14 inches wide.

The tunnel system is also used for drying hay, either in the barn or in the outdoors. Such a unit is used by dairyman Wesley Sawyer, Waterford, Calif. The system calls for placing a four-foot-square tunnel made of wood the length of the building or outside stack, with laths covering the top and sides. Chimneylike plugs extend up from the tunnel. A fan is set at one end. As the hay is placed around the plugs they are moved upward leaving an opening in the hay through which air, forced from the tunnel, spreads out through the hay. Air also goes upward from the slat walls of the tunnel. Moisture content of hay is brought down to a safe level in less than 12 hours.

Hay Driers on Wheels

Portable hay-drying systems are common in some areas, such as the one on the University of Wisconsin farm. In this wagon drier, a duct spreads heated air beneath a slatted false bottom, quickly reducing moisture content. Heat comes from a portable heating unit that is attached to one end of the wagon. When the hay is dry a chain unloader dumps it into a unit which blows it to storage. This system cuts fire danger and there's no need to install a duct system.

How do you remove loose husks, silks and trash from corn when it is being placed for drying? With air of course. An air blast from a fan removes them on the R. J. Tweedy ranch at Mt. Pleasant, Iowa. On the William F. Renk and Sons ranch at Sun Prairie, Wis., forced air rips the husks off corn as the ears pass through corn-shredder rolls.

"Now," one farmer mused, "if someone will just invent a system that will harvest crops by air power when we push a button while sitting at home enjoying its many comforts..." ★★★

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Equipped with pairs of tin snips and needlenosed pliers, Lt. Thomas A. Shall-better of the Seattle, Wash., Army Terminal folds and curls tin cans into six-pointed stars. He then bolts together four or five layers, plus several lacerated lids, into a three-dimensional "sunburst" in the center of which he attaches a colorful piece of costume jewelry.

At least 10 tons daily are added to the earth's mass by the 200 million naked-eye meteors smashing into the earth's atmosphere, two Canadian scientists estimate.

Household and Auto Items Make Portable Trouble Light

Plumber's helper, bicycle-handle grip, and sealed-beam bulb form a trouble light that plugs into a cigarette lighter. Developed by Junior Achievement workers in Waukegan, Ill., the light has a 16-foot cord and uses either 12 or 6-volt bulbs.



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**HOME IS WHAT YOU MAKE IT—
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Transistor Radios You Can Build

(Continued from page 147)

better than that of ordinary crystal sets, and their low cost (between \$5 and \$7 including phones) and extreme simplicity make them ideally suited as first projects for the beginner.

Surprising improvement results from the use of two transistors in a reflex-type circuit which eliminates the need for an external antenna for local reception. Both the earphone and loudspeaker sets shown in the photograph employ a circuit similar to the one diagrammed at the top of page 146. The r.f. signal picked up by the antenna is amplified by the first transistor and detected by a crystal diode. The resulting audio is then fed back through a 5-mfd. capacitor and amplified by both the first and the second transistor before being applied to the earphone or speaker. In effect, therefore, these two-transistor sets provide three-transistor performance.

In most locations these simple receivers, which sell for about \$12 to \$15, give very satisfactory performance. Tone quality and volume of the speaker set are as good as or better than that of some more elaborate units, due to the large speaker and relatively large case. Selectivity, however, is somewhat limited with the result that a strong station may leak through and provide a slight amount of interference when the set is tuned to a weak station.

The center schematic is that of a modern superheterodyne radio circuit which is used in the pocket-sized three-transistor receiver shown in the photograph. The kit, which sells for about \$17, includes two high-frequency transistors, one used as an oscillator-mixer, the other as an i.f. amplifier, and an inexpensive low-frequency unit employed as an audio amplifier. The circuit, while lacking some refinements such as automatic volume control, is capable of excellent sensitivity and selectivity and provides more than adequate earphone volume on most stations.

Four-transistor circuits usually include an additional audio-amplifier stage for greater volume on weak stations. Prices range from about \$22 to \$30 including an optional, matching Leatherette case which may be omitted if you build your own.

The last schematic on page 146 is that of a representative six-transistor radio circuit, including the usual oscillator-mixer, two i.f. amplifiers, a diode detector, an audio amplifier and a push-pull output stage. While seemingly complex, even these sets are easy to put together by anyone possessing normal proficiency in the use of

a soldering iron and in the handling of miniature parts. Prealigned i.f. transformers simplify final adjustment to the point where little or no previous radio experience is needed to obtain proper operation.

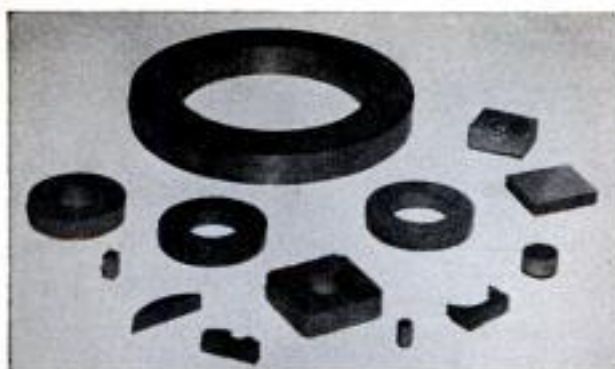
But don't expect high-fidelity tone quality. Modern science still hasn't learned how to pull bass notes out of a midget speaker in a pocket-sized enclosure and any claims of "big-set performance" are not likely to be realized. Yet, all other characteristics are entirely adequate and, at a cost of about \$33 (plus Leatherette case), these six-transistor kits are good values.

So thorough are the instruction manuals supplied with transistor-radio kits that most distributors offer a written guarantee to repair any nonoperating receiver for a very nominal service charge. The charges usually vary from \$1 to \$3, depending on the complexity of the kit, but to validate the guarantee the builder has the responsibility of completely wiring the set and using due care in following the manual. By working slowly and carefully checking each step, however, even a newcomer to the radio field is not likely to encounter any undue construction difficulties. ★ ★ ★

Plastic "Air Pocket" Bag Serves as Pump

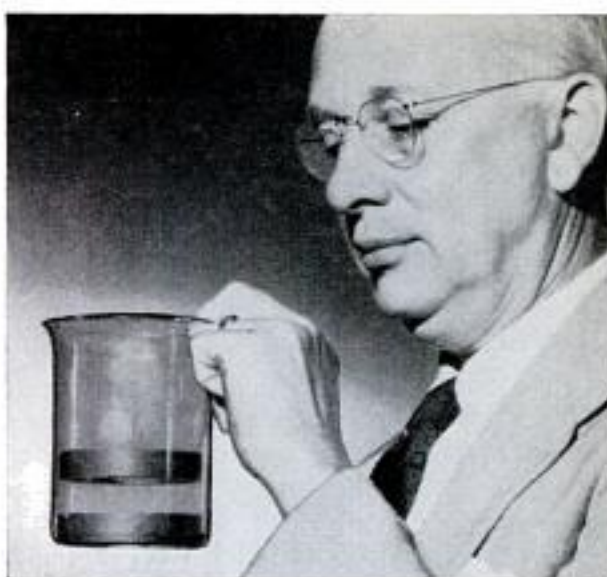
Body pressure on a plastic "air pocket" bag that has a special valve in its bottom may replace effort now needed to inflate air mattresses, wading pools and similar products. The bag is folded at the top, trapping enclosed air for transfer to the product being inflated.





North American Philips Company, Inc.,
100 E. 42nd St., New York City

Above, made from Ferroxdure, newly patented ceramic material which is readily molded, these parts will replace industrial use of nickel and cobalt-alloy magnets. Right, Dr. Frank Brockman of North American Philips Company, Inc., studies the repelling power of magnetized Ferroxdure rings



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Ceramic magnets—nonmetallic, electrically nonconductive and yet permanently magnetized—have been patented. Applications include use in refrigerator and cabinet-door latches, in loudspeaker and television yoke-focusing, in motors and generators, oil filters, rotating mechanical couplings, cushion-

ing devices and toys. Made without crucial materials, ceramic magnets are unaffected by external fields and are difficult to demagnetize. Compared with metal magnets, this substance is smaller, lighter, has longer effective life and gives improved performance and cost savings, its developers say.

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Who Invented the Electric Clock?

ELECTRIC CLOCKS (alarm, mantel and kitchen) have become a household necessity. Very few American homes are without these accurate and convenient instruments. In recent years they have become a domestic fixture. Apparently it has occurred to very few to wonder who gave us this dependable and entirely automatic timekeeping machine. A recent letter in a Chicago newspaper asking that question drew a surprising number of replies and surmises. That prompted the writer to investigate, by inquiry to various authorities.

On account of a number of opinions expressed that the first practical electric clock was made by a Frenchman, an inquiry was addressed to the Institut de Chronométrie at Besancon, France. The Institut promptly handed the inquiry to Marius Lavet, ingénieur, of Paris, and apparently, in their opinion, the supreme French authority on the subject.

Mr. Lavet replied:

"To my knowledge, this invention (the electric clock) is due to the Swiss engineer Thury, from Geneva, who realized in 1890 the first hours distribution through three-phase current transmitted by a special line of three conductors. The current was distributed by a little swivel engine (change-over switch) which transferred the power driven by a storage battery to a three-phase current of constant frequency. The Thury Swiss system is described . . . in a book written by A Favarger, *Electricity and Its Application to the Chronometrie*, published in 1924 by the Journal d'Horlogerie de Bijouterie à Neuchatel, Switzerland. Mr. H. E. Warren (from the General Electric Co., Telechron Department) stated at the International Convention of Electricity in Paris in 1932, that the first clock using alternating current had been done in 1916 in the Boston area by the Edison Electric Illuminating Co. The arms were controlled by a single-phase engine with automatic starter."

M. Lavet enclosed a short description of the Thury clock. From Mr. Jean-Pierre Savary of the Watchmakers of Switzerland Information Center, New York City, came the following:

"In 1830 the physicist Zamboni of Verona, Italy, constructed the first electric clock. This clock was presented in 1832 to the Art Society of Geneva, Switzerland. In Switzerland in 1860 a watchmaker called Hipp built one of the first electric clocks which could be used for practical purposes. Engineer Thury, of Geneva, built the first electric clock with a synchronous motor in 1899. In 1917 the American engineer, Warren, built the first electric clock with a synchronous motor in the U.S.A."

Other electric-clock experimenters mentioned by correspondents included Huygens, 1854; Farcot, also 1854 (reputed to have developed the Thury clock); Paul Lacour, 1846-1908, of Denmark, who was given a U. S. patent on an electric clock in 1878. There was also an electrical time-keeping device called the Bulle clock which, it is said, was operated by alternating current.

There are at least 12 books in English about clocks in general. They all discuss the electric clock but are inclined to be hazy about credit for origin. The following from Mr. Donald E. Stewart, an editor of the Encyclopedia Britannica, is definite, however. He said:

"The consensus seems to be that Henry E. Warren should be given credit for developing the first practical modern domestic (electric) clock. As early as 1878, however, Paul Lacour, who was born in Denmark, was awarded a U.S. patent for a synchronous clock motor on principles later applied by other inventors."

Now here is the American viewpoint on the subject, as presented by Mr. John W. Babb of the Clock and Timer Department, General Electric Telechron, Ashland, Mass.:

"The synchronous electric clock was not invented by a Frenchman, but by an American by the name of Henry E. Warren in 1916. The Warren Master Clock is used by electric utility companies to regulate the current. He (Warren) conceived the idea that a synchronous motor that follows the changing direction of alternating current could keep accurate time if the speed of the current were regulated. The term 'electric clock' must be broken down to include two basic types. First, there is the original type used since the advent of electricity, the simple magnet used to wind a spring-powered clock. This type has been replaced by the 'synchronous-motor clock.' Up to the time of the master clock, no synchronous motor could keep time. Synchronous timekeeping was suggested to Mr. Warren by an article in a technical journal describing a synchronous-motor clock exhibited at the Leipzig Fair in Germany in 1914, with the comment that 'of course, it did not keep time correctly because the frequency of the current was not controlled.' As a result of this, Mr. Warren developed his own self-starting synchronous motor and then the master clock so the motor could keep correct time."

Mr. Babb added that "the electric clock may be termed 'the fourth estate of electricity.' Previous to its development, electric power companies were able to furnish three services—heat, light and power—and now electric time has rapidly become a prominent fourth."

From the foregoing it may be gathered that invention, in this case, was definitely important, but that development of the invention to the point of making it practical for human use was equally vital. So, when that musical chime interrupts your slumber in the morning you can, whether you like to get up or not, thank Mr. Henry Warren for the service. And you might add a subdued cheer for Messrs. Thury and Lacour.

Charles Grant, Evanston, Ill.

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Typical family pose, taken 30 years ago, shows the late Ole Evinrude with son Ralph and Mrs. Evinrude

Our Outboard-Boat Boom

(Continued from page 119)

cruising possible and ended for many the dangerous practice of refilling the engine tank in open water.

Also, bigger motors were put on the market—25 horsepower, then 30, 35, 40—and even a 60-horsepower Mercury marketed by the growing Kiekhaefer company in Fond du Lac, Wis. The step-up in horsepower is startling. Outboards are now powering 21-foot cruisers with two bunks, and even some 25-foot outboard cruisers with four bunks. Many boatmen use outboards in pairs—clamping two on the stern of their boat. They get more power, also a second engine to come home on if one fails.

Meanwhile, three new kinds of boats have emerged: Glass-fiber boats which don't have to be painted, molded-plywood boats which are cheaper to make, and aluminum boats whose lightness makes them easily carried on car tops. More and more banks began financing boat and motor purchases. Kits, including knocked-down boat components, are on the market for people who want to build for themselves—everything from an eight-foot pram to a twenty-foot cabin cruiser. The result was over three million outboard sales in the past seven years. Last year's sales figure of 600,000 was more than twice all outboards marketed during Ole Evinrude's lifetime.

They Get Away From the Highway

Thousands of people own outboard motors without owning a boat—they put their motor in their trunk compartment, drive

along until they find a place they want to fish, rent a rowboat and clamp the motor on. Many families are buying an outboard boat instead of a second car. Others, instead of renting a cottage for week ends and vacations, put their money into a boat, spend spare time on cruising-camping trips. Often they discover a whole new world: solitude, islands they didn't know existed, little coves for swims and picnics, spectacular views never seen from highways. Some find their fun in short-haul runs, others take 1000 and 2000-mile cruises—for instance, Chicago to New York via lakes, rivers and canals, or all the way down the Mississippi.

Boating clubs have been organized in over 800 communities. They sponsor weekend and vacation cruises, with family boats traveling in company, tying up together at night. For instance, each July 30, members of a Bay City, Ore., club take a week's cruise together in the San Juan Islands. The nation's largest mass cruise is the Kissimmee Boat-a-Cade in Florida each October—321 boats last year. They start at Kissimmee Lake, go down the Kissimmee River and through other lakes to Lake Okeechobee. Participants from as many as 17 states bring in their boats by trailer.

Today, outboards enable families to take to the water in whatever style they can afford. You can get an eight-foot pram for \$90, attach a 3-horsepower outboard costing \$150, and make up to 12 miles per hour—good for teaching youngsters small-boat handling. A 16-foot runabout costing \$600 with an 18-horsepower outboard at \$400 is fine for fishing and family fun; if you want water skiing—one of the world's fastest-growing sports—with this runabout you can get a 30-horsepower outboard for \$550 and speed along at 25 miles per hour. Then, a 21-foot cruiser, complete with two bunks, toilet and a galley with sink and ice chest, costs around \$2500, plus \$500 to \$650 for a 30 to 40-horsepower outboard. With a pair of these you can cruise at 22 miles per hour.

Top Outboard Speeds

Incidentally, the fastest speed ever recorded by an outboard boat is 100.36 miles per hour. This record was set in 1954 on Italy's Lake Idrocalo by Massimo Leto di Prioli—one of three brothers who built their own motor. The fastest time of a boat powered by a stock outboard is 75.402 miles per hour—set in 1954 at DeLake, Ore., by Burt C. Ross, Jr. He used a hydroplane and a 40-horsepower Mercury. Last year there was outboard racing at 353 sanctioned regattas, plus informal racing at hundreds of boat clubs. By far the biggest race is the

(Continued to page 242)

Handy Nail Guide

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- Tells amount of nails per pound
- Tells right hammer to use



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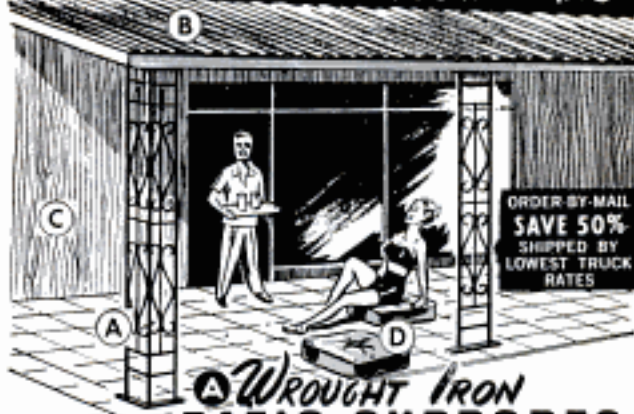


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COMPARES TO SAWS SELLING UP TO \$49.50 1998 Complete with 5-1/2" Blade

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Lifting today's high horsepower outboards or handling hundreds of tough hoisting jobs around marine basins, stores and repair shops, farms and construction projects — is easy with a 'Budget' Aluminum Chain Block. The ½-ton size weighs just 29 lbs. but lifts 500 lbs. with a hand chain pull of only 25 lbs.

The lightweight 'Budget' Aluminum Chain Block is a rugged one-man hoist, built to save time and money. Sealed housing protects mechanism from dirt and sand. Anti-friction bearings assure easy operation. "Full-jeweled" automatic brake provides positive load control. Sizes from ¼ to 10 tons. Priced \$199. Spark-resistant models available. Get details from your "Shaw-Box" Distributor or write us for Bulletins 405 and 415.



B7C-3



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354 W. BROADWAY MUSKEGON, MICHIGAN

88-mile run on Lake Winnebago, Wis. It drew 223 starters last year, but high winds whipped the lake into a froth and only 22 boats finished.

In the United States today, eight out of ten outboards are used for pleasure. But they do a lot of useful work around the globe. Fishermen were the first commercial users here, the first to buy exports to Scandinavia. In the past few years the outboard has revolutionized the fishing industry in some regions. In the Philippines and East Indies, fishermen who formerly couldn't venture far offshore now go out 20 miles. Some are bringing in two or three catches a day instead of one.

Filipinos use outboards on outrigger fishing boats. In South Panama, the Choco Indian clamps the motor to a large dugout canoe to transport bananas down jungle streams. Missionaries use outboards on the Amazon, Congo and scores of other rivers. Explorers have used them—from Roosevelt in Brazil in 1913 to a Spitzbergen expedition in 1956. Thirty medical and health teams in Colombia are equipped with outboards in order to reach roadless sections of the interior.

Even Newsboys Use Boats

On the Klamath River in California, outboards pull rafts of logs 250 feet long. In Ontario, huge rafts are assembled on some lakes, a piece of lumber nailed to a rear log, then an outboard clamped on—to push the raft to a paper mill. A steel company in Peru uses outboards on Lake Titicaca to move steam-shovel barges into position. On the open Honduras coast they have been employed for years as power for unloading freighters—the outboards bring the barges through the surf to the beach. One outboard made in England is standard equipment on many lifeboats.

Paris uses wooden barges propelled by outboards to clean its huge underground sewers. Last year the newspaper *France-Soir* began employing outboard boats to rush the latest edition to Saint-Cloud, Charenton and other suburbs. Four boats carry 80,000 papers a day, reducing costs and cutting delivery time in half.

Finland has more outboards per capita than any other European country. At Helsinki, every summer afternoon around four you can see hordes of business and professional men leaving the city in outboard boats for islands where they have family cottages. Docks, empty at night, are jammed each morning with several hundred boats apiece—a thrilling sight 75 years after Ole Evinrude, the emigrant boy, left Scandinavia for America. ★ ★ ★

PORTABLE LIGHT PLANTS

GIANT 2500 WATT PLANT

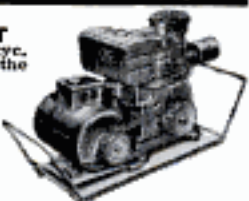
110-120 v. 60 cyc. AC. Absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 6 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 311) Wt. 210 lbs. Reg. price \$585. Special at..... **\$299.50**

Same plant with electric self starter (Item 312)..... **\$359.50**

Generator only and control box..... **\$169.50**

DUAL VOLTAGE 110-220 available on any of above models for \$28.00 additional.

We make every type and size of light plants — Write, giving us your requirements!



1000 Watt Belt Drive AC Generator

Lightweight portable generator. Will provide 1000 watts of 115 volt 60 cycle AC power for lights, saws, drills, etc. or other appliances requiring up to 1000 Watts. Operates at 3600 r.p.m.—drive with any gas engine, tractor or power take off. Can even be mounted on an automobile engine to operate off a fan belt. Complete with duplex receptacle, safety fuse and 4" pulley. Not recommended for heavy duty. Wt. 27 lbs. (Item 825) only... **\$79.50**

750 Watt Generator, similar to above. (Item 826)..... **\$59.00**

Heavy duty 1200 Watt Generator only. Wt. 50 lbs. (Item 45a).... **\$139.50**

Heavy duty 2500 Watt Generator only. Wt. 80 lbs. (Item 21a)..... **\$169.50**



Double Acting Hydraulic Cylinder

A powerful cylinder mfr'd. by Massey Harris which develops both a pushing and a pulling force. Will push 8,100 lbs. with a 1000 P.S.I. pump pressure. Cylinder is 3 3/4" O.D. with 6 1/2" stroke—standard heavy duty clevises on both ends. Has standard 1/2" pipe thread openings. Can be used for tilting buckets or blades, raising or lowering implements, hydraulic presses, etc. Can also be used as an air cylinder. (Item 802) Wt. 17 lbs. Reg. \$88. Special..... **\$14.95**

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24" stroke — 3" bore..... **\$7.50**

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COMPARE! This is the only compressor built with a **NO RUST** stainless steel tank. Safe up to 500 lbs. (Item 209) High pressure type (4 c.f.m.) Large type 2" bore compressor with built-in air filter. Master built with high strength alloys and precision bearings. Tank, 12"x24", 2100 cu. in. cap. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 50 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Don't take chances with used or surplus equipment. Our compressors are factory new and are guaranteed **SAFE**. Low factory prices. 1 1/2 HP Model (cap. 30 lbs.)..... **\$109.50**

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1 1/2 HP heavy duty model, Reg. Ind. motor & unloader switch (Item 209a)



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700 WATTS PUSH BUTTON START
115 v. 60 cyc. AC. Powered by a rugged 2 1/2 HP easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, refrigerator, brooder, emergency lights, etc. which require up to 500 watts. Ideal for television and radios. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24.) Wt. 75 lbs. Easily fits in car trunk. He prepared to storm knock-out power lines. Reg. \$475 value... **\$143.50**

1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output..... **\$199.50**

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Stainless steel tanks tested to 1000 P.S.I. Working pressure 500 P.S.I. Absolutely corrosion proof — will last indefinitely! Ideal for air, gases, chemicals, boozys, etc. 1/4" pipe thread openings each end.

2100 cubic inches (21 1/2" x 24")..... **\$16.95**

Wt. 20 lbs. (Item G-1)..... **\$12.95**

1000 cubic inches (8" x 18")..... **\$12.95**

Wt. 10 lbs. (Item F-1)..... **\$12.95**



SCREW-TYPE PRESS
A tremendously powerful press capable of exerting pine tons of pressure. Pays for itself straightening bent parts, or pushing out bearings and bushings. Ideal for manufacturing and assembly operations because of precise control. Massive 1 1/2" screw permits precise control over vertical travel. Extra heavy ribbed yoke has a throat 2 1/2" high; depth capacity for working to the center of an 1 1/2" diameter. Includes 8" x 15 1/2" vise-type table and two pushing arbors. Wt. 150 lbs. (Item 797). Reg. \$49.50. Special..... **\$149.50**

HYDRAULIC PRESS. Nine ton capacity. See June Pop. Mech's. ad for details on write Complete. Wt. 110 lbs. (Item 404)..... **\$68.50**

JET STEAM MASTER

Now, a super efficient portable steam generator that produces live steam at 100 lbs. pressure in 60 seconds from a cold start! Produces large volume of high pressure steam on 2 pints of fuel oil. Instantly cleans sticky grease, dirt, rust, old paint, etc. off implements and road machinery. Pays for itself in a few weeks. Sterilizes soil. Sterilizes as it cleans—kills equipment, etc. Fully automatic—oil fired with new, built-in lifetime bronze water circulating pump. Draws water from faucet or bucket. Simple and safe — anyone can use it; built-in safety valve. Complete with 12 ft. of hi-pressure steam hose and hose fitting efficiency steam gun that automatically mixes in soap solution if desired. Special factory price..... **\$349.50**

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Sturdy ball bearing winch—super tough aluminum alloy construction. Powered by an easy starting 2 1/2 HP Briggs gas engine thru gear reduction drive — it exerts up to 3000 lbs. of terrific force for hoisting materials or pulling. Combination gear and pulley reduction results in tremendous multiplication of engine power. Later pulley clutch arrangement and built-in drum brake (with ratchet hand lever) enables operator to back loads down gently and lock at any point desired. Drum handles 400 ft. of 3/8" cable or 600 ft. of 1/4" cable. Ideal for contractors, farm implement trailers and unlimited other uses! (Item 703) Wt. 125 lbs. Only..... **\$149.50**

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1500 WATT PLANT
115v. 60 cyc. AC Push Button Start. Powered by a 3 1/2 HP. Clinton engine. Combines big output with easy starting. Provides emergency power for operating any oil burner, sump pump, freezer, television, lights, communications systems, etc. which require up to 1500 watts. (Item 23). Wt. 110 lbs. Reg. \$475 value. Factory price... **\$239.50**



1750 Watt Plant Powered by 4.5 Briggs engine. Electric starting & battery charging built-in. Factory price... **\$279.50**

MASTER-LITE 2500 Watt Plant
110/120 v. 60 cyc. AC. A power plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Possesses a big 5.0 HP Briggs engine, etc. complete with all accessories. Includes control box, voltmeter, and handy plug-in power receptacle. An ideal plant for permanent or stand-by service. Wt. 225 lbs. Reg. \$665.00 (Item 21) Factory Price..... **\$329.50**



3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. \$780. Factory Price..... **\$379.50**

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Heavy duty and very flexible. Neoprene 14-2 cable. 20 year quality. Wt. 12 lbs. (Item 185) 100 ft. Complete with rubber plug and outlet. A terrific buy at only **\$8.95**

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20 ft. without fittings (818a)..... **\$4.15**

50 ft. (Item 592) with fittings..... **\$13.45**

100 ft. (Item 135) with fittings..... **\$28.95**

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100 ft. (Item 200)..... **\$12.95**

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Heavy duty, made by S. F. GOOBICH for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists—any operation requiring variable speed. Employs reliable "trochoid" planetary system. No hydraulic power losses. Infinite range, smooth operation, easy installation. 3 sizes: 1/2-1 hp, 36 lbs.; 1-2 hp, wt. 55 lbs.; 2-3 hp, wt. 105 lbs.; Reg. list \$228, \$252 and \$352. Our prices **\$79.50, \$89.50 and \$114.50**



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Now! a portable rugged, industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. Senior model made for years of trouble-free, continuous service. High capacity DC welding unit enables you to tackle any job with confidence—easily welds anything up to 2" plate using from 1/16" to 1/4" rods. Built-in stabilizer and cooling system makes arc easy to strike and hold. Dual control rheostat provides for heat soldering, brazing and welding from 30 to 500 amps. Complete with instructions, guarantee and brake V-belt or flat pulley. Easy to hook up and easy to operate.

WELDER ONLY — DUAL CONTROL MODEL. Same as above, but drive with your tractor, jeep or gas engine of 14 HP or more. (Item 35a) Wt. 110 lbs. \$450 value..... **\$119.50**

WELDER ONLY — INDUSTRIAL MODEL same as above but with ceramic rotary type rheostat providing 74 different heat settings for all types of welding (Item 35b)..... **\$139.50**

\$500.00 value..... **\$139.50**

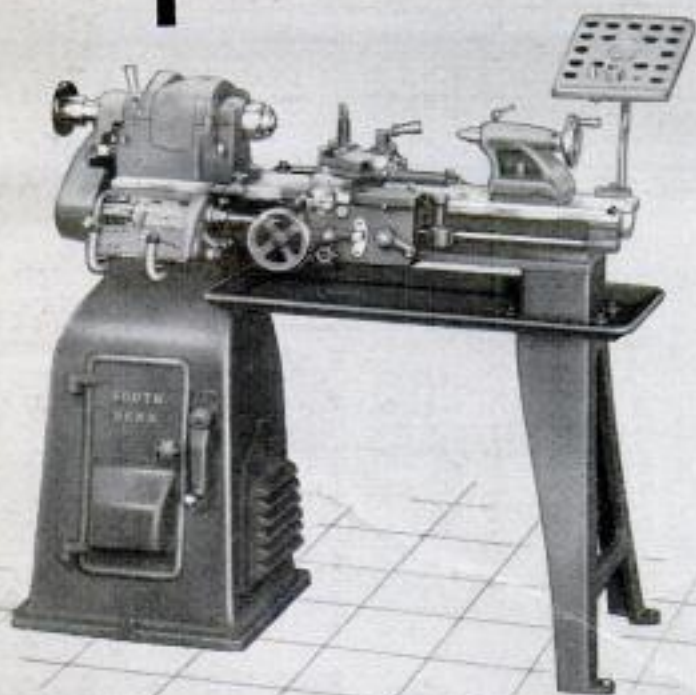
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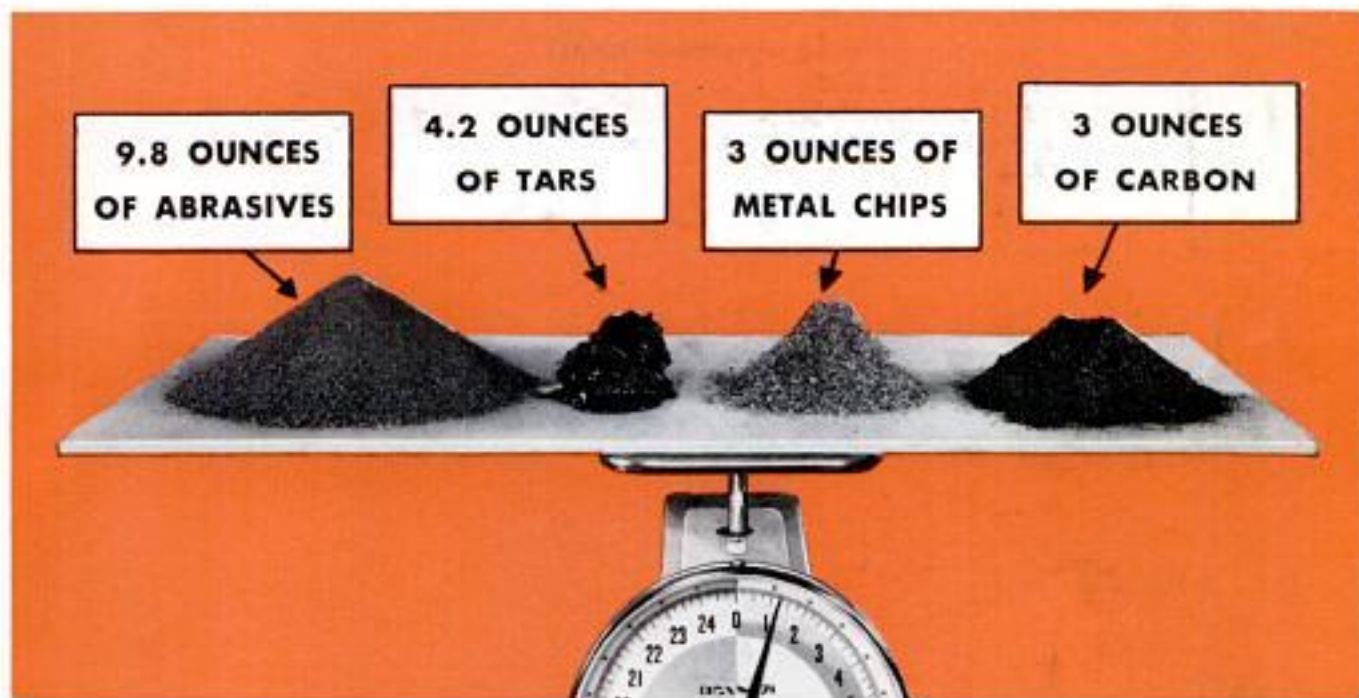
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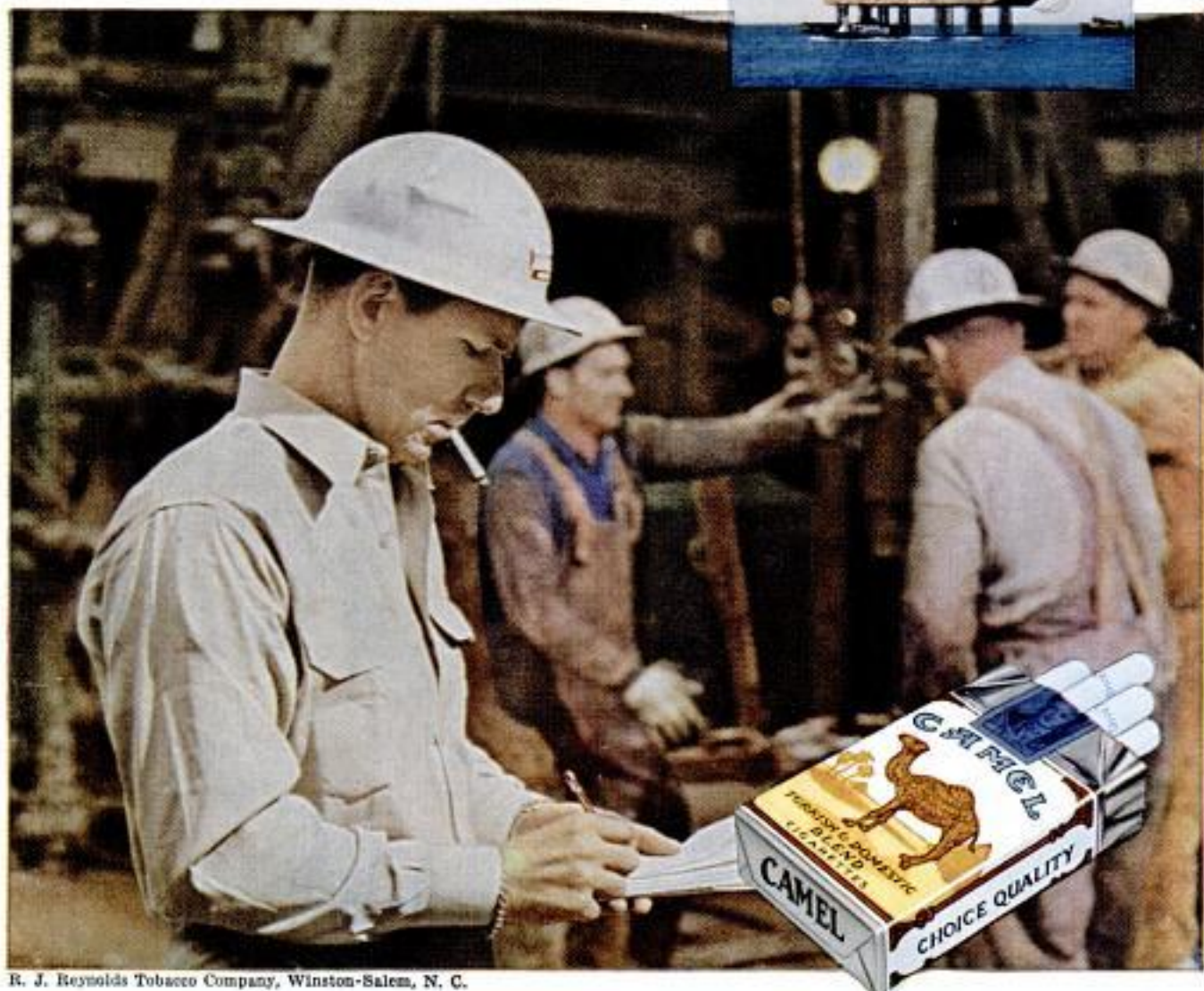


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