

Rambler and Ford Owners' Reports

POPULAR MECHANICS

MAR. 1963
35 CENTS

Hurricane Killers Learn Where to Aim
How Space Detectives Rate
the Red Moon Probes



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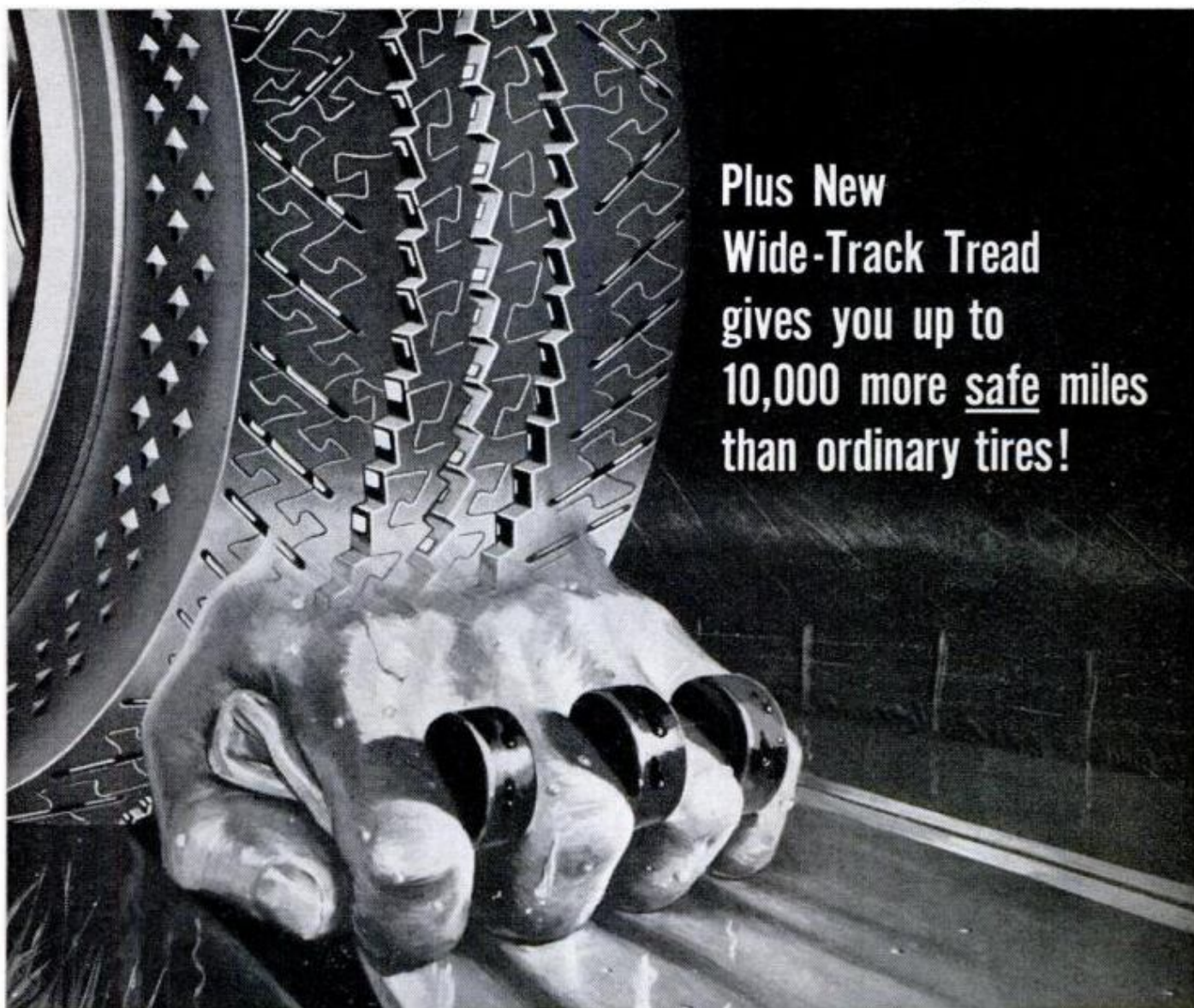
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'63 GALAXIE



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POPULAR MECHANICS®

MARCH 1963

VOL. 119

NO. 3

INTERNATIONAL EDITIONS • SPANISH • CARIBBEAN • FRENCH • PORTUGUESE

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NEXT MONTH—Sport Ballooning, newest thing in daredevil pastimes, is described by a *PM* editor who did it and takes you for an unforgettable ride. Also in April, Tempest and Dodge owners tell what they think of their new models. And look for complete plans for a cartop boat deck and a fat-tire wilderness bike

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BACKSTAGE at PM

Sometimes a cracking good story lies dormant for long periods of time simply because reporters may fail to follow up good leads.

One example is the exciting story on hurricane killers (page 114) by C. P. (Ken) Gilmore. Over a year ago, Ken clipped an item from a New York newspaper quoting a speech Dr. Francis Reichelderfer, Chief of the U.S. Weather Bureau, made before the National Press Club.

Dr. Reichelderfer said that we stand on the threshold of being able to control hurricanes. Newspapers reported his remarks but there apparently was no follow up. The next time he was in Washington, Ken Gilmore went to the Weather Bureau and asked for the facts.

He got a story that practically wrote itself. Bureau officials were amazed that no reporters had bothered to ask Dr. Reichelderfer to explain just how hurricanes might be tamed.

Here's a footnote to last month's *PM* article on how the work of our infrared aerial photography experts may have prevented war over Cuba.

Just a few days after we wrapped up the story, we lunched with George Michanowsky, explorer-president of the Amazonia Foundation. George had just returned from South America, where for several years he has done archaeological sleuthing with—you guessed it—infrared aerial photography!

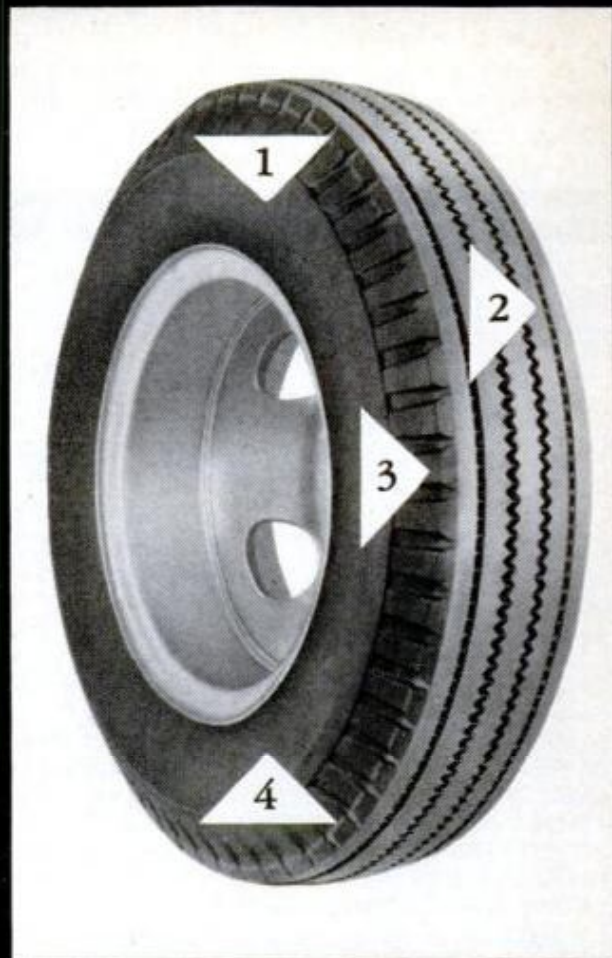
Because of the way infrared records foliage, objects such as ancient roads and ruins, never before visible from the air, pop out of infrared jungle photos.

This year, though, explorer Michanowsky tried a new experiment with his cameras. Acting on a hunch, he took pictures of great Andes mountain snowfields. Knowing that infrared is absorbed by "warm" areas, Michanowsky guessed that soggy snow—the treacherous kind which triggers avalanches—would show up darker.

It did. And, as a result, infrared photos may now become a vital key to forecasting the deadly avalanches.

The Editors

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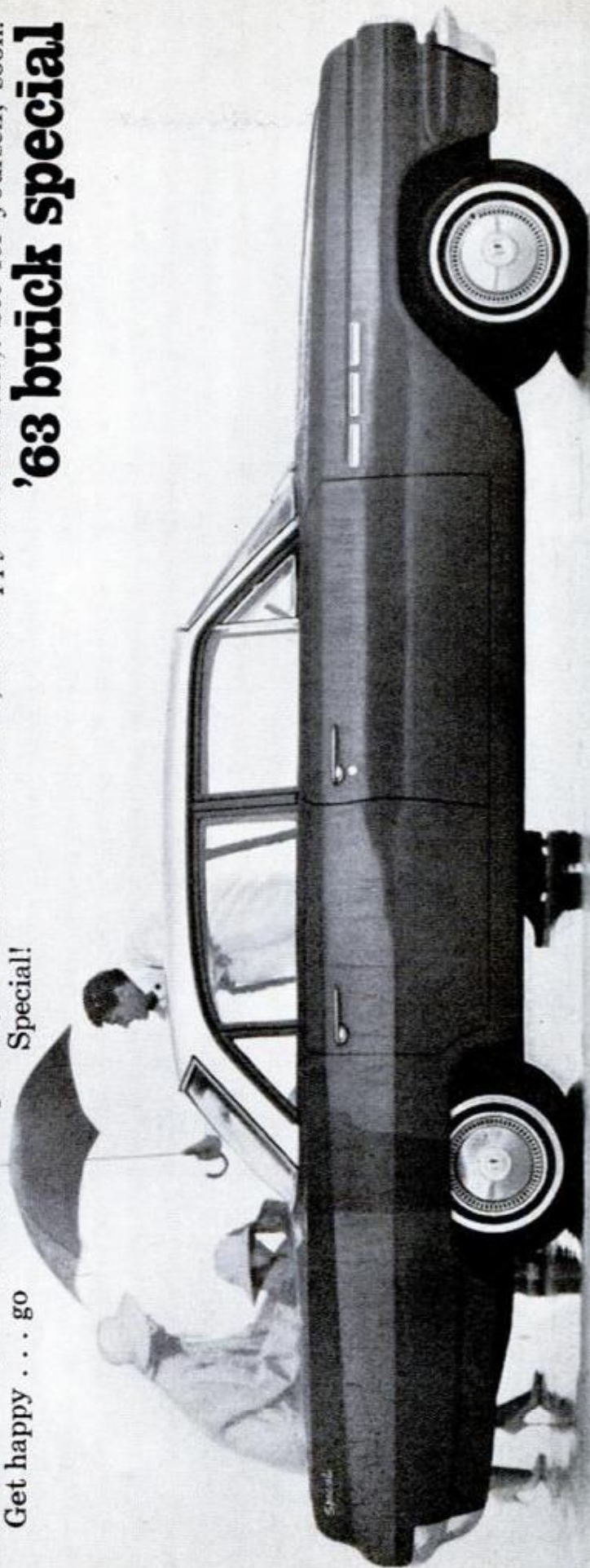
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last year's runaway popular success, is headed for even greater acclaim in '63, and for good reasons. Most obvious: its V-6 engine . . . nimble action with regular gas economy (more details below). Other reasons: Special silk-smooth transmission response. A low price. High trade-in value. Plenty of no-cost extras, such as rugged aluminum muffler, 6,000-mile lubed front suspension, new Delcotron generator. Plus: Special luxury and room (Stretch out, everybody. All Specials, V-6 or aluminum V-8, are *happy medium-size!*). See for yourself, soon. Get happy . . . go

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'63 buick special



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ALSO NEW FROM BUICK MOTOR DIVISION: BUICK LESABRE/WILDCAT/SKYLARK/ELECTRA 225/RIVIERA

Over the editor's desk

Negative Deer

Here's the display I constructed from the plans in your December issue (page 130). To give the scene some animation, the deer



supporting the one holding the bag has a head which oscillates in a "no-no" manner, powered by a small motor.

Agawam, Mass. F. L. BREVEGLIERI

I used your method to duplicate your Christmas cover scene of Santa and the three reindeer and it was so easy. I thought *Popular Mechanics* was a man's magazine, but I have found many wonderful things in it.

Austin, Tex. MRS. VAN REECE

My husband did the one of the Three Wise Men and the star in black paper. We then glued it to our mirror. It turned out beautifully.

Southgate, Mich. MRS. J. STROS

Instead of using plywood, I made the complete reindeer and Santa group out of 26-gauge sheet metal. The wind makes the metal move, giving it animation.

Saginaw, Mich. ROBERT FYLE

This is the first time I've made such an item from a magazine plan because I've never wanted to take the time to blow up a pattern on the old "square" method.

We added some silver sparkles to Santa's space capsule to make it glimmer a little.
Barrington, Ill. BRUCE G. POSEY

I have balked at doing many projects in the past because I am either too lazy or have not felt competent to do a "squared enlargement." However, I made the Santa Claus and reindeer using the Project-a-Plan, and we are extremely pleased with it.
Etobicoke, Ontario A. G. ELPHICK

I projected the pattern of the Nativity scene directly on the plywood and marked it with a felt marking pen.

Cresco, Iowa DAVID CORCORAN

A lot of nice comments came our way during the week before Christmas because of your idea in December *PM*. It also made the front page of the newspaper.

Ft. Madison, Iowa BOB MANKA

Car Coverage—Pro and Con

As a new subscriber to *PM*, let me congratulate you on your *Service Free '63 Cars?* and *Comfort-Convenience Index to the 1963s* (both Jan. '63 *PM*). The latter is the most important data about any car and I think everyone ought to be interested in the figures shown. I get *Automotive News* and *Motor Trend* regularly and this is the first time I have seen a table as comprehensive as yours. Keep it up.

Brooklyn, N.Y. J. GOLDMAN

In regard to *A Road Racing Pro Test Matches the Wilder Ones* (page 92, Jan. *PM*) in which the Corvette, Riviera, Avanti and Thunderbird were compared, I have many questions:

Why were these cars tested and compared with each other, as the Avanti and Corvette are different from each other and from the other two? Why were they tested under race conditions, when all but the Corvette are meant for *only* road use? Why was the steering of the Avanti classed as slow at 16:1 and the Corvette not at 17:1? Why isn't the Avanti a luxury car? Must luxury be feminine frilliness?

Anyone who slings these cars around on the road like Fitch and Whipple did, is crazy. So why the big deal about understeer or oversteer?

Bronx, N.Y. ROBERT FERBER
Ex-subscriber
(as of this article)

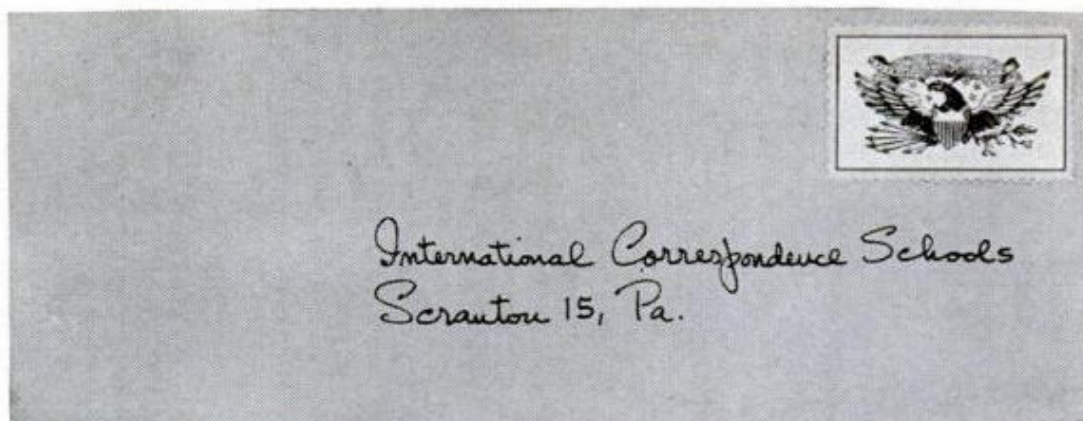
Hey, Bob—if you're still listenin'—here's why:

Yes, the cars are different, of course. We tested the four because they're all billed as "performance" cars and because of high reader interest.

They were tested at Lime Rock, which is

[\(Please turn to page 14\)](#)

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Thanks I. C. S. for successful career. "Your engineering course stood me in good stead throughout a rewarding government career. Without it, I could not have passed rigid Civil Service exams which qualified me for steady advancement, good pay and challenging overseas assignments!"—W. J. Eichorn, San Francisco, Cal.

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Carpenter-Builder
Carpentry & Millwork
House Planning
Lumber Dealer
Mason
Painting Contractor
Reading Arch. Blueprints
Reading Struct. Blueprints

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Amateur Artist
Commercial Art
Commercial Cartooning
Fashion Illustrating
Figure Drawing & Painting
Magazine Illustrating
Show Card & Sign Prod'n
Show Card Writing
Sign Painting & Designing
Sketching & Painting

AUTOMOTIVE

Auto Engine Tune-up
Automobile
Automobile Body Rebuilding and Refinishing
Automobile Electrical Technician
Automobile Technician
Diesel Engines

Diesel-Gas Motor Vehicle Engines
Gas Engines
Internal Combustion Engines

AVIATION

Aero-Engineering Technology
Aircraft & Engine Mechanic
Aircraft Mechanic
Aviation Engine Mechanic

BUSINESS

Business Administration
Business Correspondence
Business Law
Business Management & Marketing
Business Management & Production
Business Psychology
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Office Management
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Retail Business Management
Shorthand
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Typewriting

CHEMICAL

Analytical Chemistry
Chemical Engineering
Chemical Engineering Unit Operation
Chemical Laboratory Technician
Elements of Nuclear Energy
General Chemistry
Industrial Analytical Chemistry
Industrial Chemistry
Professional Engineer—Chemical

PULP AND PAPER

Paper Making
Pulp & Paper Engineering

Pulp & Paper Making
Pulp Making

CIVIL ENGINEERING

Bridge & Building Foreman
Civil Engineering
Construction Engineering
Highway Engineering
Mine Surveying & Mapping
Principles of Mapping
Principles of Surveying
Professional Engineer—Civil
Railroad Engineering
Roadmaster
Sanitary Engineering
Section Foreman
Sewage Plant Operator
Structural Engineering
Surveying and Mapping
Water Works Operator

DRAFTING

Aircraft Drafting
Architectural Drafting
Drafting & Machine Design
Electrical Drafting
Electrical Engineer Drafting
Electronic Drafting
Industrial Piping Drafting
Junior Mechanical Drafting
Mechanical Drafting
Sheet Metal Drafting
Structural Drafting

ELECTRICAL

Elec. Appliance Servicing
Electrical Contractor
Electrical Eng'g (Power Plant option—Electronic option)
Electrical Engineering Tech.
Electrical Instrument Tech.
Electric Motor Repairman
Illumination Eng'g Tech.
Industrial Electrical Techn.
Power-House Engineering
Power Line Design and Construction
Practical Electrician
Practical Lineman
Professional Engineer—Electrical
Reading Electrical Blueprints

HIGH SCHOOL

Good English
High School Business
High School College Prep (Arts)

High School College Prep (Engineering & Science)
High School General
High School Mathematics
High School Secretarial
Modern Letter Writing
Short Story Writing

LEADERSHIP

Industrial Foremanship
Industrial Supervision
Personnel-Labor Relations
Supervision

MATHEMATICS

Mathematics and Mechanics for Engineers
Mathematics and Physics for Engineers
Mathematics and Physics for Technicians

MECHANICAL

Industrial Engineering
Industrial Instrumentation
Junior Mechanical Engineering
Mechanical Engineering
Professional Engineer—Mechanical
Quality Control
Introductory Technical Writing

PETROLEUM

Natural Gas Production & Transmission
Oil Field Technology
Petroleum Production
Petroleum Prod'n Eng'g
Petroleum Refinery Operator
Petroleum Refining
Petroleum Technology

PLASTICS

Plastics Technician

PLUMBING, HEATING, AIR CONDITIONING

Air Conditioning
Air Conditioning with Draw'g
Air Conditioning Maintenance
Domestic Heating with Oil & Gas
Domestic Refrigeration
Heating & Air Conditioning with Drawing

Heating, Drawing & Estimat'g
Plumbing
Plumbing, Drawing & Estimating
Plumbing & Heating
Plumbing & Steamfitting
Practical Plumbing
Refrigeration
Refrigeration & Air Conditioning
Steamfitting

RAILROAD

Air Brake Equipment
Car Inspector & Air Brake
Diesel Electrician
Diesel Engineer & Fireman
Diesel Locomotive
Diesel Machinist
Railroad Administration
Railroad Car Repairer

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Real Estate Salesmanship
Retail Merchandising
Retail Selling
Sales Management
Salesmanship
Salesmanship & Sales Management

SHOP PRACTICE

Boilermaking
Electric Welding
Foundry Practice
Gas and Electric Welding
Gas Welding
Heat Treatment of Metals
Industrial Metallurgy
Machine Shop Inspection
Machine Shop Practice
Machine Shop Practice & Toolmaking
Metallurgical Engineering Technology
Physical Quality Control of Metals
Practical Millwrighting
Reading Shop Blueprints
Resistance Welding Technology
Rigging
Safety Engin'g Technology
Sheet Metal Worker
Tool Design
Tool Engineering Technology

Toolmaking
Welding Engineering
Technology

STEAM AND DIESEL POWER

Combustion Engineering
Power Plant Engineering
Stationary Building Eng'g
Stationary Diesel Eng'g
Stationary Diesel-Electric Engineering
Stationary Fireman
Stationary Steam Eng'g
Steam Engine Operation

TEXTILES

Carding and Spinning
Carding
Cotton Manufacturing
Cotton Warping & Weaving
Dyeing & Finishing
Hosiery and Circular Knitting
Loom Fixing
Spinning
Synthetic Fabric Manufacturing
Synthetic Throwing, Warping & Weaving
Textile Designing
Textile Engineering
Textile Mill Supervisor
Woolen Manufacturing
Worsted Manufacturing

TRAFFIC

Motor Traffic Management
Railroad Rate Clerk
Traffic Management

TV-RADIO-ELECTRONICS

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Radio Operating
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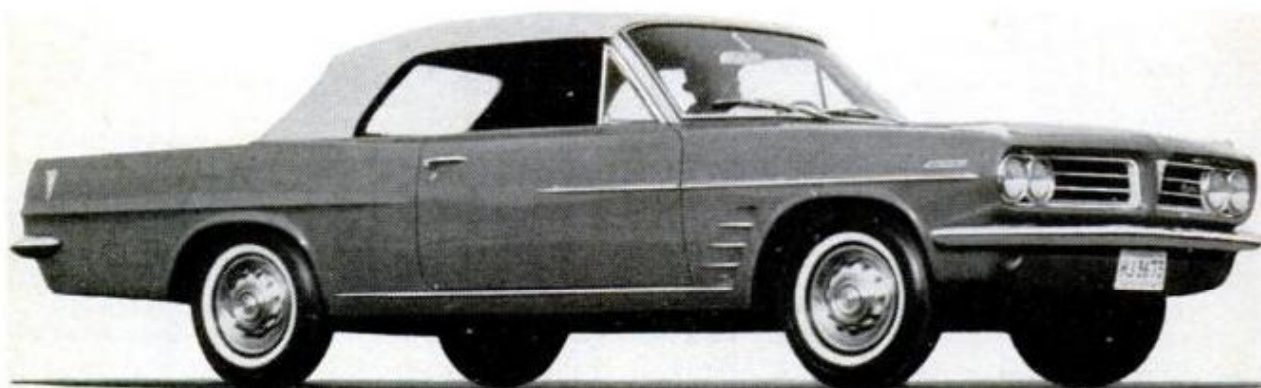
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a road-racing track, not an oval. And it's a far safer location for tests than a public road would be.

Unfortunately the ratio of a steering gear does not always guarantee parallel response of the car. You may turn Avanti's wheels quickly, but its heavy front end is reluctant to follow. Cowl shake, rattle, bottoming over railroad tracks and general feel and sound prevented Fitch from considering the test Avanti a luxury car.

And steering characteristics are important on the road as well as on a track; the cars were wrung out (as well as given normal over-the-road and fuel mileage tests) to bring out clearly any of their shortcomings.

John Fitch dwells on design features he feels have been "lifted" from European cars. But this was not the case with the Corvette Sting Ray rear suspension. The rear suspension of the 1948 Porsche-Cisitalia that John refers to as the predecessor of the Corvette . . . did not use an unsplined axle shaft as a control member. The only prototype of the Corvette suspension is the Chevrolet Experimental Research Vehicle (CERV-1), first shown in late 1960.

Detroit, Mich.

KARL E. LUDVIGSEN
General Motors Corp.

Contrary to what Mr. Fitch seems to believe, a Formula One automobile does not constitute the layman's opinion of the perfect family car. The average American does not want a fire-breathing, finely tuned, temperamental midget built only to win races.

Dudley, Mass. JOHN M. HARVANEK, III

You omitted one of the pioneers in the personal sports-speedster category — the Chrysler 300J.

Biggs AFB, Tex. PAUL B. JOHNSON

The 300J didn't come out until November, which was too late for these tests.

Prop-er Name

The first paragraph of *Germs from Outer Space* (page 124, Nov. PM) tells of a jet airliner landing at Washington National Airport. Then in paragraph four, I found this airliner to be a DC-4. Unless my 13 years of airline experience has gone for naught, I'm sure you'll find that the DC-4 is a piston-engine aircraft.

St. Paul, Minn. LAYTON N. BENNETT

As, indeed, it is.

Glass with Class

I would like to express my appreciation for the excellent article, *The Crazy Things They're Doing with Glass* (page 71, Dec.

PM). This is closely akin to my own field of specialization, metals and ceramics for high-temperature application, and lends an enjoyment of a highly competent presentation of a very complicated subject in popular form.

Tipp City, Ohio

EMIL R. BEAVER

Evaluator's Evaluation

The article *Thinking Factories* by S. David Pursglove (page 87, Nov. PM), is a notable piece of journalism. It portrays the role of military operations research with sustained interest and accuracy. Operations research is a difficult scientific specialty to explain, and military operations research doubly so because so much of our work must necessarily be classified.

Center of Naval Analyses
Arlington, Va. JOSEPH H. ENGEL
Director, Operations
Evaluation Group

Yup, It's Good Enough

In the article *World's Toughest Target Shoot* (page 114, Dec. PM), I object to the statement: "For a 50-meter rifle, those who don't want to pay Remington \$361.05 . . . can get an Anschutz for about \$240. This is good enough for the MTU, so it ought to be a fair shooting iron."

This "good enough" Anschutz rifle is the very weapon that enabled Gary Anderson to establish a new world record at the World Shooting Championships at Cairo in October, 1962.

More than 50 percent of the small-bore target marksmen reportedly also used the Anschutz Super Match target rifle. In the three-day tests, all four individual World Championships were set with the Anschutz rifle.

New York, N.Y. GERARD J. KLUYSKENS
President, Anschutz
of America Corporation

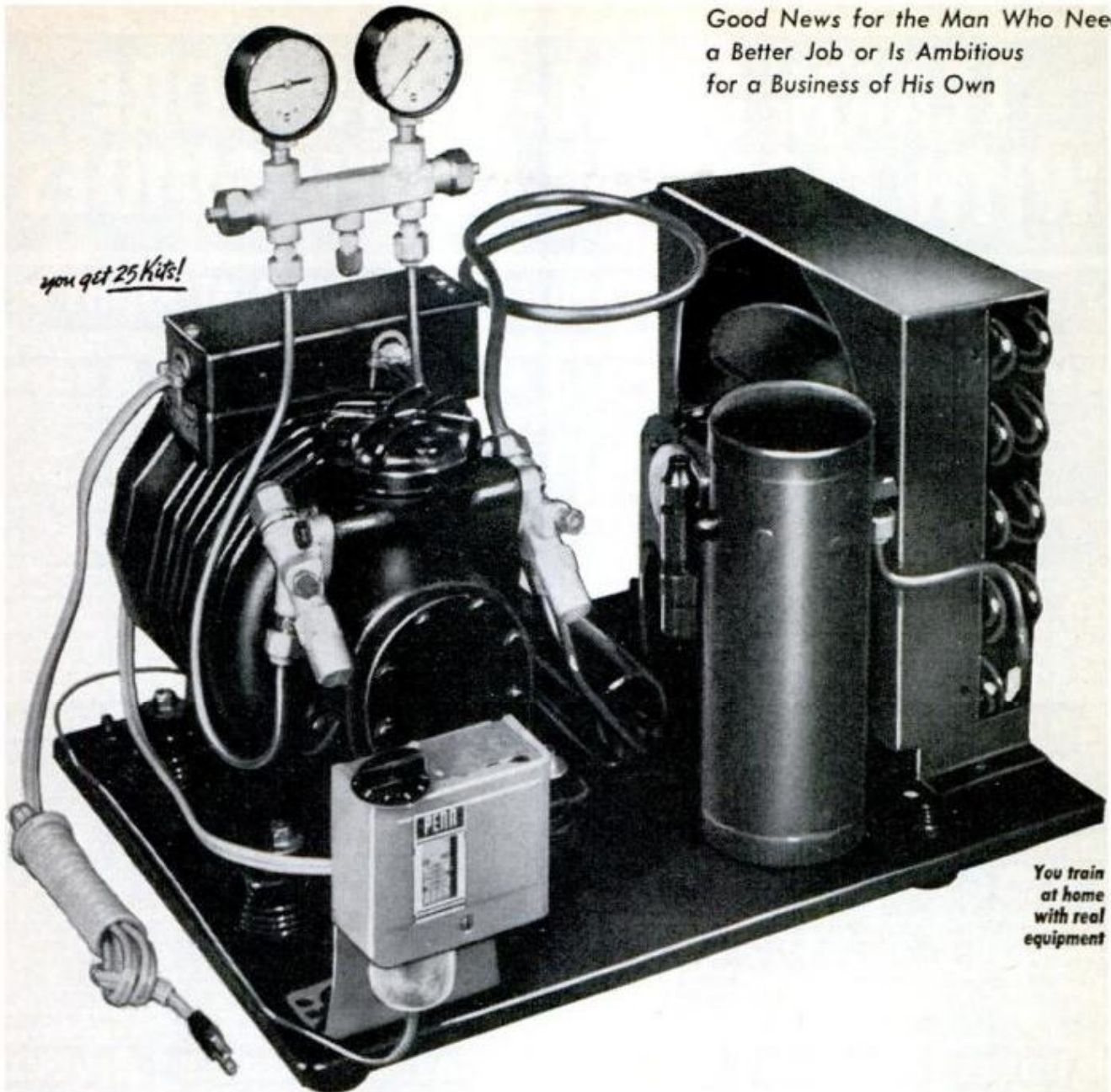
Flying Cloud

In the late 1920s my father built a model of the ship *Flying Cloud* from PM plans. He has now presented it to his grandson. The glue has all dried out, the spars and mast have been broken, and the rigging fell down. They have cleaned it up but are at a loss how to make new masts and rigging. It would make them both so happy to be able to see it restored.

Port Chester, N.Y. MRS. JEANNETTE CLAUSS

Happily for all, our files yielded clippings of the article, *Build This Model of Flying Cloud, a series that started in December, 1927, telling how to build a model of the speedy clipper. So things should soon be shipshape in Port Chester.*

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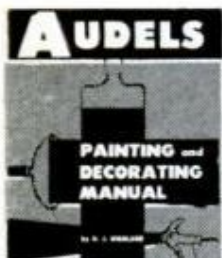
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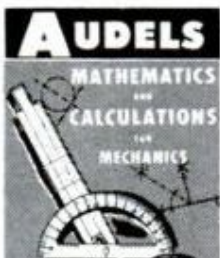
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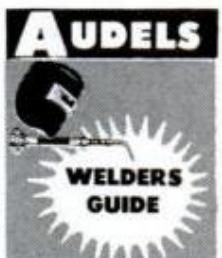
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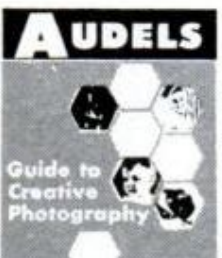
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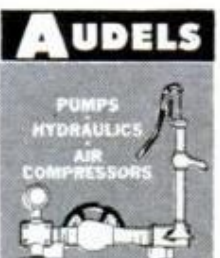
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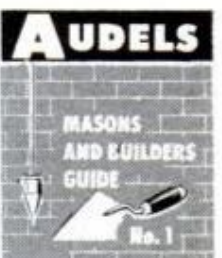
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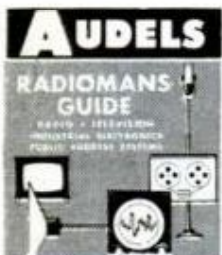
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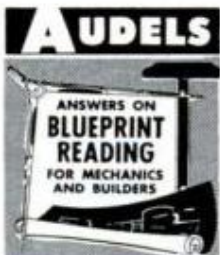
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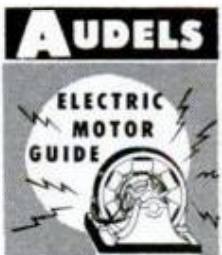
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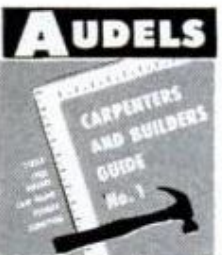
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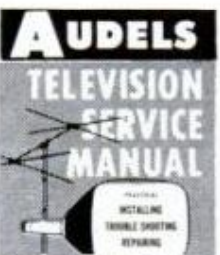
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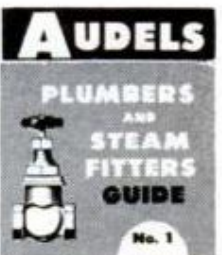
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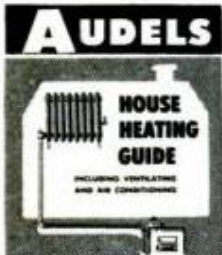
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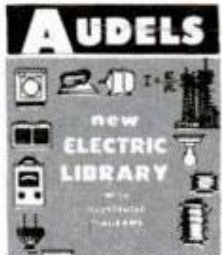
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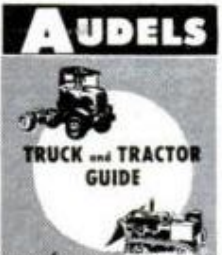
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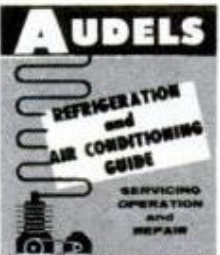
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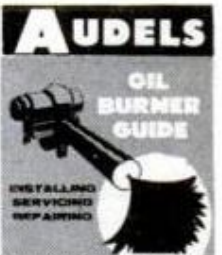
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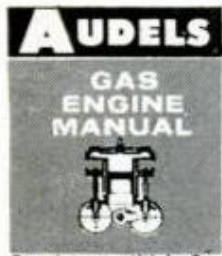
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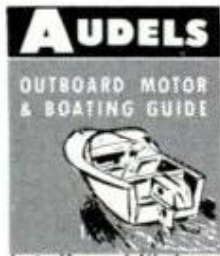
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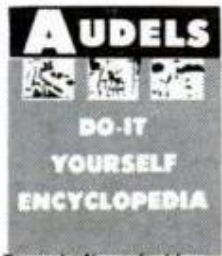
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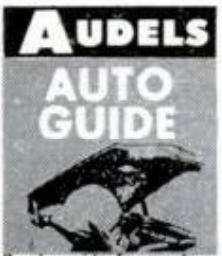
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Sidelights on aviation

New military aircraft designations handed down by the Department of Defense because congressmen (and others) were getting confused by the rash of symbols, are still pretty confusing.

Seems there's a conflict between two points of view. The Navy liked to group its aircraft according to manufacturers—the F4D, for instance, was the fourth (4) fighter (F) produced for the Navy by Douglas Aircraft (D). The Air Force preferred to use the next number in line—regardless of who made it.

Sometimes, however, the same manufacturer made the same plane for both services—and the confusion began. The venerable DC-3 commercial airliner was converted for military cargo by both the Air Force (C-47) and the Navy (R4D).

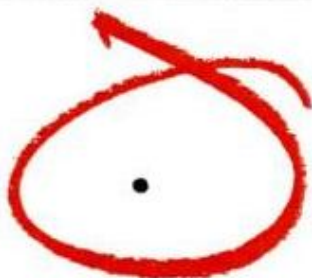
In the new designations, the Air Force system seems to have prevailed (the R4D is now the C-47 in the Navy, too). The Department of Defense mandate requires

that a letter designating the basic mission (A for attack, B for bomber, F for fighter, etc.) precede the model number. Another letter, designating a modified mission, if any, may precede both. An F-104 may become the RF-104 for reconnaissance.

Basically, most Air Force symbols remained intact, but the Navy's symbols lost the manufacturer identification (its A4D is now simply the A-4) and some of the planes received new numbers (the F4D mentioned above is now the F-6). There would have been duplications otherwise. The Navy had both an F4D and an F4H—the F4H became the new F-4, so the F4D jumped to the next open number and became the F-6.

When new planes are built they will follow the new system of symbols. The Air Force, however, will start all over at F-1 if and when a new fighter is built. It is already working on an F-111 and the numbers are getting too high. The Navy's new fighter, if there is one, will be the F-12. It already has an F-11 (the old F11F). If both services choose the same plane, however, they'll have to choose between calling it the F-1 or the F-12, and the conflict will start all over again.

Kevin V. Brown



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Messenger probes from intelligent beings in outer space might be in our own solar system right now, says a Stanford University radio astronomer. Prof. Ronald N. Bracewell says that man should be careful not to overlook unexplained radio signals from space; signals from other worlds could well be detected by radio monitors on earth, he thinks.

But, he says in a new book, *A Journey Through Space and the Atom*, the first contact is most likely to be made via computer probes from earth "talking" to computer probes from remote planets.

Never drink sea water—at sea or anywhere else. A team of international experts from the World Health Organization, researching survival techniques, finds that sea water causes diarrhea, drains fluids from the body because it overloads the system with salt, and can cause mental disturbances and even suicidal tendencies. Earlier investigations, including a study made by the French Navy, had indicated sea water was safe to drink.

A Turkish automobile mechanic in Istanbul has invented a device that automatically stops a car's engine when it runs low on oil. A dashboard light goes on to show the driver why his motor stopped.

Aphrodite may not have been so sexy after all. A new statue of the famous goddess of love was recently discovered in Turkey, and archaeologists describe it as a maternal symbol rather than a sensual one. Fully clothed, the statue is that of a rather stocky female—unlike such celebrated Aphrodites as the near-nude Venus de Milo. The statue dates from 100 A.D. Formerly part of a temple, it was later broken in half and was found built into the foundation of a building close to the temple—which had become a basilica.

Watching TV can cause convulsions. So say three British researchers who have reported 14 such cases among children in Britain. They blame it on the nature of

the TV picture itself, which is produced by flashing images in rapid succession onto a screen. Such "intermittent photic stimulation" is a well-known way of causing a convulsion akin to epilepsy. Similar reactions are experienced by some people who look directly into a fluorescent lamp, or look at the sun through the blades of a whirling fan.

Japan plans to strengthen its typhoon warning system by building the highest weather radar station in the world—atop 12,389-foot Mount Fujiyama.

An artificial voice-maker that fits into an upper dental plate has been invented by a British dental surgeon. Designed to restore speech to those who have lost the use of their vocal chords, it consists of an electro-magnetically vibrated diaphragm which is energized and controlled by a miniature battery and oscillator in the wearer's pocket.

A natural space "probe," which arrived on earth last August after a journey lasting some half a billion years, may yield important clues to the origin of the universe. The 19-pound object, looking like a black piece of dirty iron, is a meteorite that landed in the new African republic of the Upper Volta; it is only one of 40 meteorites in the world that have been recovered after a known time of descent. According to the Atomic Energy Commission, the meteorite may have been bombarded by cosmic rays during much of its travel; it is expected to contribute important data on deep space radiation.

Almost total protection against malaria has been achieved in laboratory tests by a new drug called C1501. Used on volunteers from federal prisons, it will now undergo extensive tests in the field.

Fishermen in Japan are going to try to talk fish and shrimp into being caught. After 10 years of research, government scientists say they've found a way to broadcast language used by sea life. Floating tape recorders have picked up fish talk and fishermen will rebroadcast selected tapes in an attempt to lure fish and shrimp into their nets.

Soviet scientists report they've listened to the heart functions of a star speed skater as he was winning a 500-meter race. A miniature radio transmitter, worn under the skater's hat, was connected by thin wires to sensors over the heart; the signals were picked up by a special re-

(Please turn to page 20)

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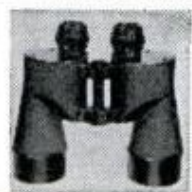


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(Continued from page 14)

ceiver near the rink. The transmitter weighed 3½ ounces.

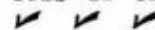


The healing power of Indian tribal dances will be studied by a team at Arizona State University. Navajo ceremonies will be examined in line with the modern theory that the mind makes the body ill—a principle the Navajo, whose religious life is based on healing, has accepted for generations. The scientists will study the attitudes of patients during the ceremonies, record techniques used, and see what happens to patients later.



Satellite tracking will enter a new era with the Goddard Space Flight Center's S-66 ionosphere beacon satellite—due to be sent aloft any day now. An experimental laser beam will be used to track the space craft from Wallops Station—the first time a laser will have been used for such a purpose. The light beam will be in the invisible infrared spectrum.

Potentially, the laser (light amplification by stimulated emission of radiation) can provide a tracking accuracy unobtainable with other techniques. Lasers will also eventually be used for telemetry transmission. The laser's tracking and command potential arises from the fact that light pulses from the ruby rod, passing through a lens system in a narrow beam, can be projected over long distances without loss of energy.



Sound waves may make some pharmaceutical drugs more effective.

Tests at the Illinois Institute of Technology indicate that waves at about 20 kilocycles may increase the permeability of cell membranes, and might thereby help control the rate at which drugs are absorbed into the cells.

High-frequency waves at about one megacycle can either inactivate or stimulate enzymes and hormones, researchers have discovered.



A British firm has developed a ladies' shoe with a small wheel at the end of the heel. Hoped-for result: Long-lasting heel wear, easier walking and an end to stiletto-holed carpets. The wheel revolves slowly with the wearer's walk in such a way that it presents a constantly changing rigid surface to the floor. The inventor says it doesn't skid and that it has been test-worn by ballroom dancers.

John P. McNeel

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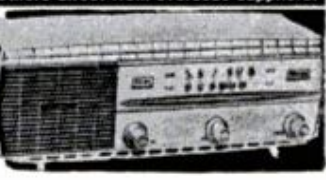


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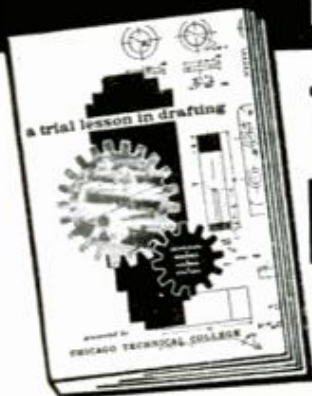
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First, let me introduce myself. I'm president of an Internationally famous company. Our name is known to millions throughout the U.S., Canada, Europe, South America, even in Africa. It has become famous partly through National advertising, but principally through the services given by men we have put into business for themselves under our Co-operative Plan.

These men were drawn from all walks of life. They were farmers, mechanics, truckers. They were office workers, retail clerks, house-to-house salesmen. They were professional men, railroad men, college graduates, teachers. Some had had only a grade school education.

They were young men who had worked for others for a few years; men retired or just about to retire; men of middle age who had family responsibilities. For years they had yearned to start independent businesses. But they didn't dare risk giving up their jobs and missing their pay checks—even for a few weeks. We showed them how to start their own businesses *in spare time*. Then, when their spare time profits approached or equalled their regular pay, they could quit their jobs with safety and give all their time to building their businesses still bigger.

Today, throughout the world there are many hundreds of such men that my company has put in business. They own their businesses outright. They are their own bosses. They "call the shots" on vacations, hours of work, hours of play and recreation.

Some of them run "one man" businesses. Based on the rates in our National Price Guide, they can make \$9.00 gross profit an hour on servicing they do themselves. A gross income of \$10,000 and upwards the first year is not too much to expect from a one unit operation—with no shop, no store, no rent, no inventory, and no equipment except that which we furnish.

Ward Whitbeck wrote "I have made as much as \$225 in one day." L. Lawson says: "In September, working alone, jobs totaled \$1,475.00." L. Canaday wrote: "\$1,571.00 in a single month." And G. Byers reported, "On one institutional job my charge was \$2,416.00—total expenses, \$814.00."

Other men have built organizations with from two to five men working for them. The owner merely writes up the orders, keeps the books, and does the banking. This increases the profit opportunity as the owner of a business can make as much as \$6.00 an hour on every hour his employees work—even after paying them a good hourly wage.

Ed Kramsky wrote, "In my second year I now have two assistants, a nice home,

and real security for my family." E. Davis reported "Gross income increased \$17,660 this year." Carl Smith wrote, "Earned \$650.00 in one week. Our volume is getting bigger all the time." And Mike Lyons made the statement, "... first calendar year \$40,000 gross income. Without headquarters constant help it would never have been possible."

What is this booming business? What does it take to get into it? Let me answer: We train, equip, and help finance men in one of the fastest growing service businesses known. We provide them with a Franchise which permits them to operate under our trade name—under our International Trade Marks, and our copyrights—using our methods, and our sales program. Each man benefits from a big national advertising campaign.

What do these men do? They perform six unique and urgently needed services in the homes of their customers. These are services that are needed and wanted by far more homes than we are now able to service. We haven't scratched the surface.

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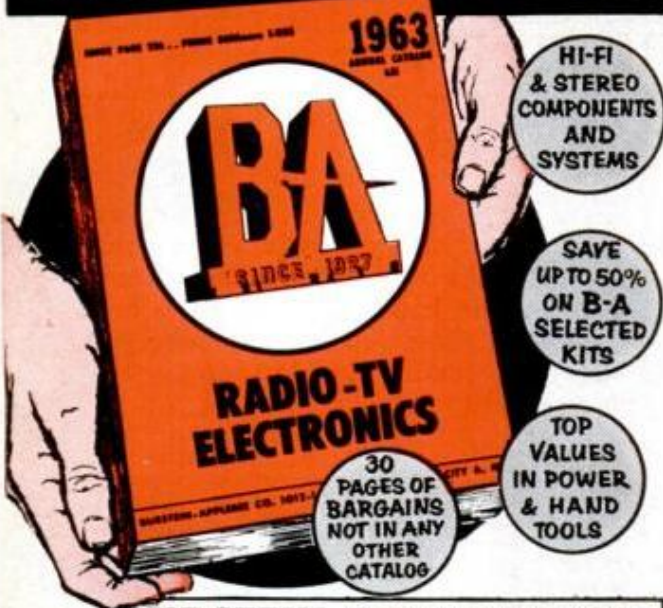
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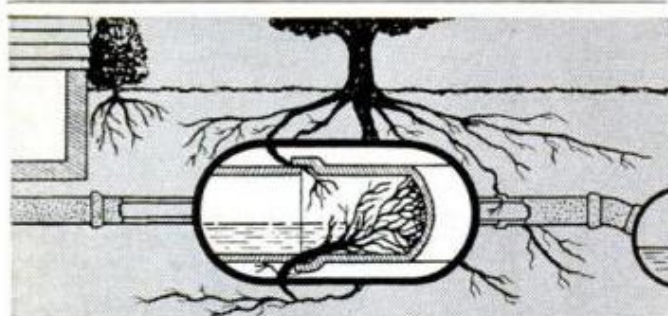
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The pattern of American living continues to change at a pace so rapid that it tends to confuse even the experts. It's now an accepted part of American life for a man to live in a half-dozen different cities during his lifetime . . . or to change homes several times as his need and location changes.

Within the very near future, this same pattern is going to become commonplace in another area—men will begin to change careers as readily as we now change employers. This is a part of the growth pattern of American industry; as improvements reduce the needed manpower in one occupation, a greater need seems to be automatically created in others.

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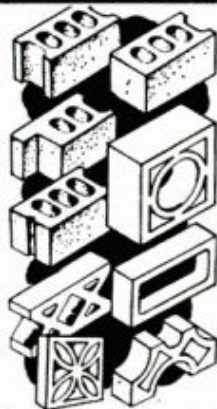
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A battery-operated spinning rod caught our attention, so we spent a weekend trying it. Made by Lectro-Matic Sports Inc., 11405 E. 7th Ave., Denver, Colo., it is a close faced reel built into a handle that contains three flashlight batteries. The rod is broken into two sections. While we still prefer the manually operated reel, the Lectro-Matic does work. There are two buttons on the reel, one for releasing the line for casting, the other for automatically reeling it in. The buttons became painful to operate after an hour, but the manufacturer reports that this has been remedied. The reel runs at a set speed, but slows down with the added weight of a fish. Priced at \$39.

While testing the Lectro-Matic, we also tried out a new lure designed by Kenny Magoon of Buckeye Bait Corp., Council Grove, Kans. Called Bug-N-Bass, it is a plastic replica of a largemouth bass fingerling chasing a bug that is mounted on a wire an inch ahead of the gaping mouth. A surface lure, it rests tail down in the water. A pop of the rod and the lure leaps after the bug, gills on the sides creating a realistic effect. We took two bass on the lure.

Game law violators are a scourge to legitimate sportsmen, but they have always been a part of the American scene. In 1646, the Rhode Island town of Portsmouth closed the "deere" hunting season from May to November and poachers were fined five pounds. This past season the Utah Dept. of Fish and Game reported 107 elk illegally killed, and Iowa game wardens report that many bow hunters are shooting deer with rifles, then inserting an arrow in the bullet hole.

Stuart James

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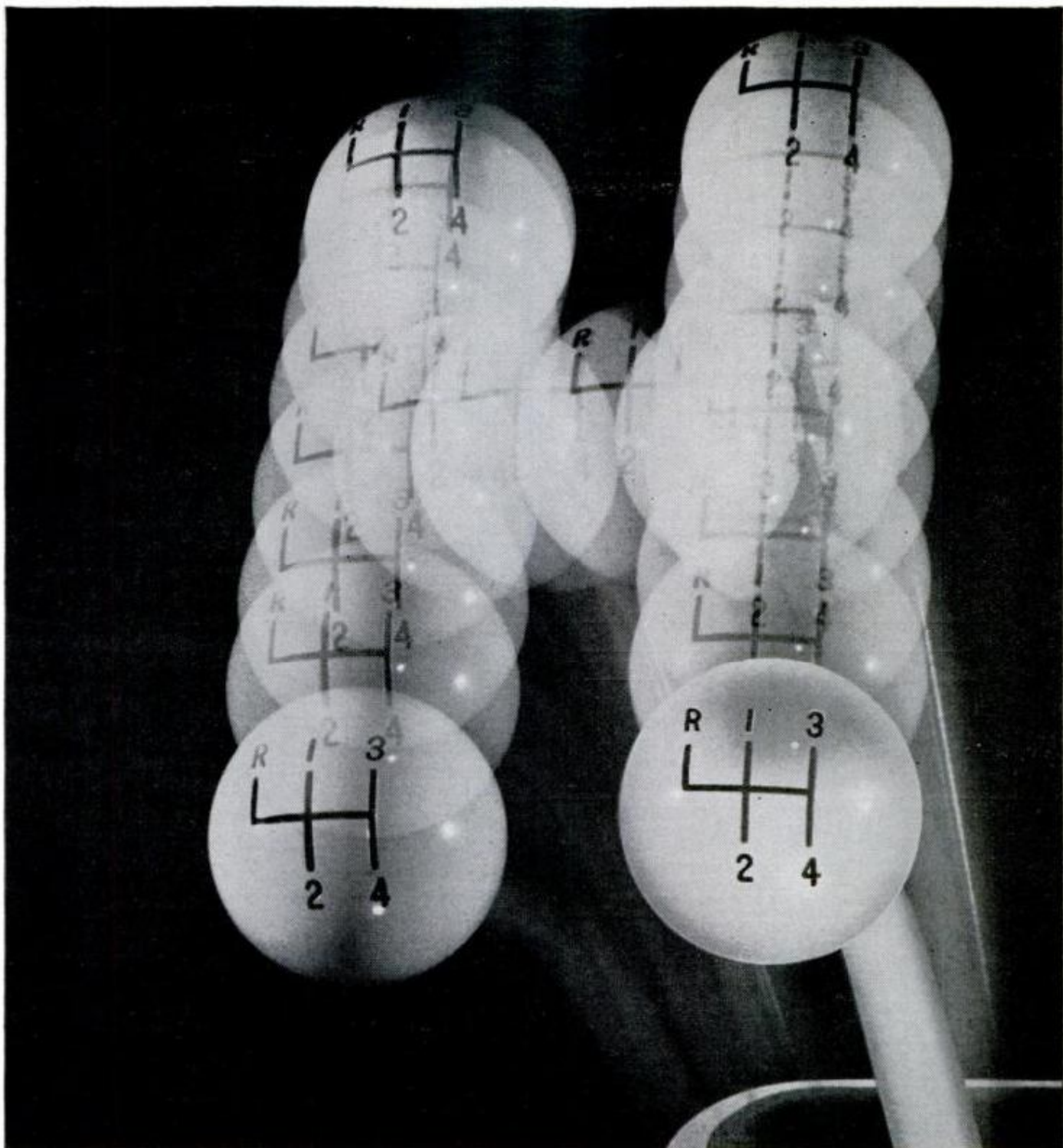
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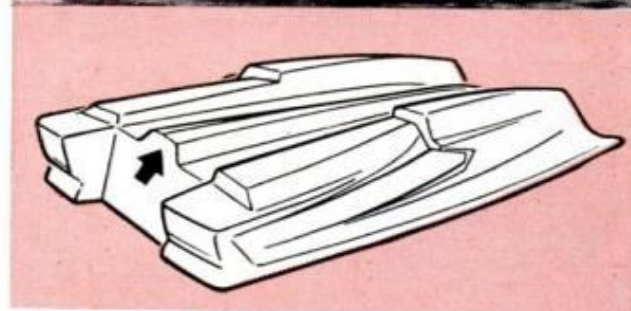
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Cat Runs on One Motor



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Latest in the company's series of radically different multihull designs, this new point-riding cat is a direct descendant of last year's Manta Ray.

Tunnel cavitation has always made it impractical to run a cat on one motor. However, the use of a spoiler in the center of the tunnel at the transom to deflect spray flow makes it possible for the prop of a center-mounted motor to get a bite.

Spoiler Not Widely Used

This spoiler idea isn't new, but it has never been widely used because of the drawbacks involved. When built into a normal cat hull, it not only adds extra wetted surface but decreases the efficiency of the tunnel's lifting effect.

To compensate for this, Custom Craft has stepped the hulls and used a tapered streamlined spoiler. The patented step design by H. Donald Canazzi features "breathers" which run up the side of the hull just aft of the forward step. These prevent the step surfaces from becoming vacuum-locked, and increase the boat's efficiency at low and intermediate speeds.

The new hull is available only in 15-ft. and 17-ft. runabout models this year, but Custom Craft already has other boats in the works which will utilize this patented hydroplane-catamaran design.

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Pentagon sidelights

By William R. Kreh

A real cool light to help guide planes ditching on the ocean at night is being tried out by the Coast Guard. The light is made by packing a substance called "chemi-luminescence" into two-by-two-foot squares that are covered with transparent plastic. Mixing water with the chemical causes it to glow. The substance neither flares nor flames nor produces heat, but simply produces a cool glow. The illumination isn't as strong as that in the battery-powered bulbs now used to mark ditch paths, but tests show that the larger lighted area—four square feet as compared to the virtual single point of a bulb—more than makes up for that. In addition, the new light gives pilots more depth perception in the dark.

Cold ships, quick starts. The Navy's worried about getting cold ships off to quick starts so it's going to install auxiliary gas-turbine engines in its antisubmarine destroyers. The turbine can be started with the push of a button, enabling the ship to get underway immediately even without any boilers fired up. And the extra power plant can be cut in later to give an antisub craft the added burst of speed it needs while chasing an enemy sub.

Olive or nose cone? One defense contractor mixes missiles and martinis without disrupting his production line. The firm turns out precision missile parts for the armed forces on one production line while nearby in the same building is another line that produces a precision mixer that allows dial-controlled amounts of gin and vermouth to flow into a waiting glass.

NOW they tell us! A recent survey by the Air Force showed that the safest position in World War II bombers was the ball-turret gunner's roost. Worst slot, as far as casualties were concerned, was the bombardier's compartment.

Amateur radio "hams" will have the chance to get surplus military communications gear at no cost except for shipping if they join the Navy's new Military Affiliate Radio System (MARS). Members will be taught Navy communications procedures

and will get enough practice through planned competition to keep "sharp." Anyone over 16 who has an FCC amateur's license is eligible to join. More information can be obtained from the Office of Naval Communications (Op-94), The Pentagon, Washington 25, D.C.

A glass "well" with no moving parts may some day be used to get fresh water from the sea. A Navy employee has patented his process for desalting water by forcing it into a glass or plastic sphere. The sphere is submerged in the ocean at about 800 feet. Pressure of about 360 pounds a square foot forces the water into the sphere through spaces between the molecules in the glass. On the way the sea water loses its iron and salt in what you might call the "reverse osmosis" process. The Navy's looking into the process to see if survival kits can be equipped with glass wells.

Crews by computers. By feeding a computer data about fear, love, anger and frustration, the Navy hopes to create "mathematical models" of mentally balanced crews for critical military missions. The Navy is studying how the effectiveness of groups is influenced by various combinations of individuals. High speed computers may eventually enable scientists to analyze crews with greater accuracy and efficiency than they can now. The analysis could be especially helpful in choosing crews for isolated radar stations or submarines. The study is called "Project Argus," meaning advanced research on groups under stress.

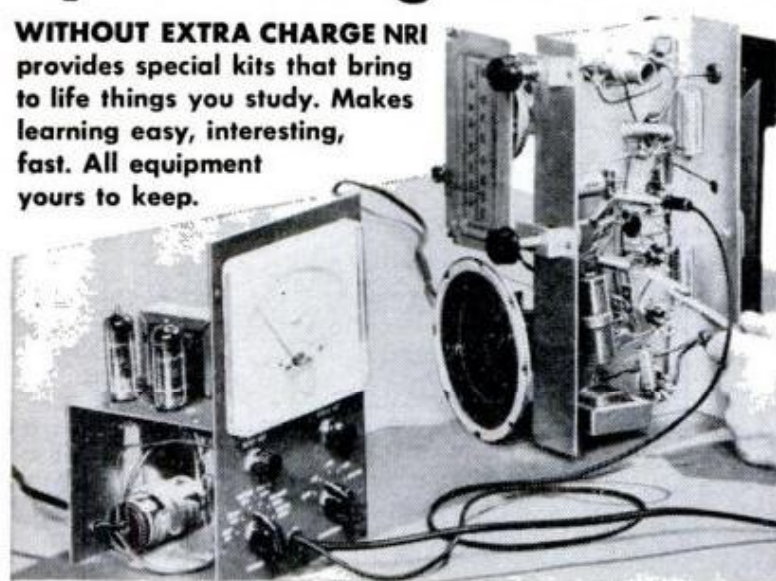
Blip burns. Navy researchers are trying to develop special clothing for men who must work within range of radar transmitters. Some of the new radars used on Navy ships are so powerful they're capable of inflicting deep body burns.

A tall fish tale. Staff Sergeant Daniel P. Swanson, assigned to a "Texas Tower" radar platform off the coast of Cape Cod, recently hooked a 42-pound *lophius piscatorius*, better known as an angler fish, from 80 feet up—the distance of the gap between ocean and tower platform. He caught the fish with a gadget called a "bear trap" which the airmen devised. The trap consists of a triangular-shaped steel bar with sharp prongs. Tied to a strong cord, the gadget is placed over the fishing line and down over the head of the hooked fish. A yank on the cord some 80 feet above catches the prongs behind the gills of the fish and permits it to be hoisted aboard without breaking the fishing line.

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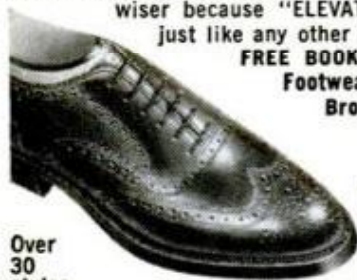
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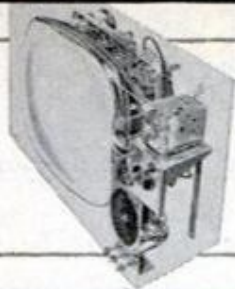
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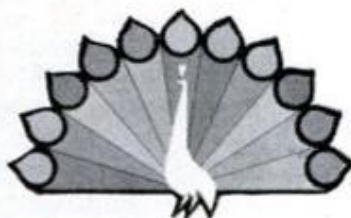


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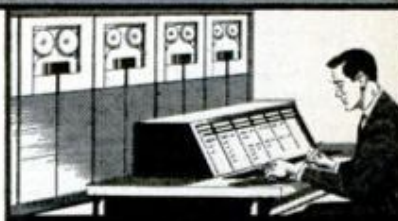
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By Jim Whipple



Big-Inch Engines Reaching Displacement Limit Ford Finds New Proving Ground—the Rally

As almost everyone must know by now, the horsepower race is on again. Piston displacements, rising like a July thermometer, for the moment are at the top of the tube with manufacturers agreed on a limit of seven liters or 430 cubic inches.

This means that "full-house" versions of these monsters will crest the 400-horsepower mark as compression ratios, valve timing, exhaust tuning and carburetion hop them up to the magic figure of one horsepower per cubic inch.

Agreement on a ceiling wasn't too hard to come by between **Ford, Chevrolet, Pontiac, Dodge, Plymouth and Mercury**—the big six in the "go, go for glory" group. The reason was simple. Having bored out to the limit of the water jacket and stroked to the limit of crank throws, they've just about run out of cylinder block space.

Before the recent agreement, Ford probably reached the high-water mark in displacement with a 483-cubic-inch behemoth mounted in a **Galaxie**. This job ran at Bonneville, hacking out about 500 horsepower while screaming through the time traps at better than 170 m.p.h.

Now that the contest is on in earnest from Dayton to Pomona, competitors will have to concentrate on engineering their power boosts instead of calling on the foundries for cylinders of ash-can dimensions. It's great news for motorists in search of more bounce to the ounce (of gas).

The limitation on size will result in engines that breathe more efficiently through bigger valves (in proportion to piston diameters). They'll be able to run faster, thanks to overhead camshafts which will permit more rapid action of light, short-stemmed valves.

Thus, these engines will generate lots of power at wide open throttle (5-6000 rpm) at the same time providing good part-throttle economy, thanks to the relatively small displacement (in relation to horsepower). Such small, high-revving engines have been the power formula in Europe where fuel is expensive and engines are taxed on displacement formulas.

In the U.S. however, with its Southwestern plains sloshing with petroleum, we've gone the route of bigger combustion cham-

bers (and gas tanks) in a quest for power.

Fame is the payoff of the performance race today just as it was five years ago or fifty years ago. A car that wins on the track makes out in the sales race, too.

Until this year drag strips and the stock car circuit were the only arenas where U.S. cars won fame and fortune. But for 1963, something new has been added—the group auto outing known as the rally.

Rallies are not pre-game pep festivals but keenly competitive contests of driving skill and automotive durability conducted on public roads. Here's how they work:

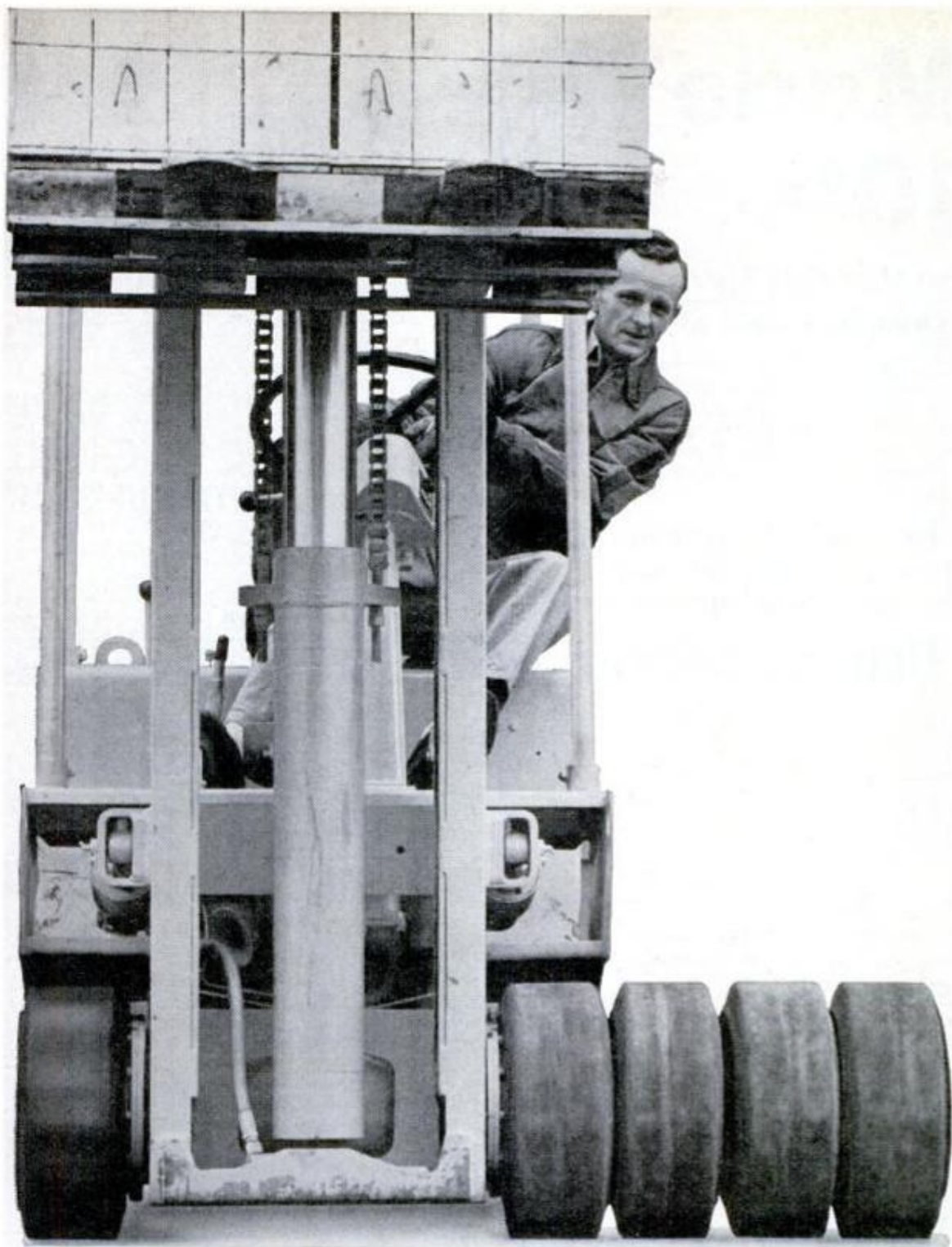
Two-person teams (driver and navigator) follow maps and instruction from one to another of a series of checkpoints, arriving within seconds of the prescribed time. It's easy to win if you don't miss a turn, if you're not delayed by traffic, if the weather remains clear, and if you can keep a perfect account of time and distance.

Toughest of them all is the 2000-mile, four-day Monte Carlo run through Europe in the winter. After a tortuous journey through snow-slick Alpine switchback roads that were a problem for Hannibal's elephants, the rally terminates in the city that bears his name. Those who've tried it say that the Monte can be as tough a contest on man and car as was ever devised.

Ford has taken a bold step this year and entered three teams in **Falcon Sprints** and they're the first U.S. manufacturer ever to do so. These cars were especially prepared (by Holman & Moody) versions of the new "flatback" hardtop V8s that Ford has brought out for midyear. They start out with 260-cubic-inch, 164-horsepower V8's coupled to four-speed synchromesh transmissions. Bendix-Dunlop disc brakes (front) and booster are added as well as beefed up suspensions, quick steering (12 to 1), Koni competition shocks and aluminum skid plates to protect the soft underbelly of engine and gearbox when the cars slither off the road.

As far as improving the breed in the area of better handling and roadability we don't think Ford could have picked a better event than the Monte Carlo Rally.

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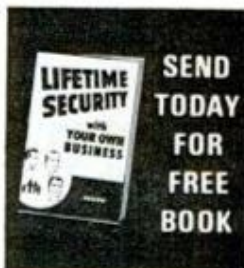
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Tune in on the inventors

By John P. McNeel

Spacemen should be able to move around freely in a state of weightlessness with a belt that won patent 3,066,887 for Wendell F. Moore of Youngstown, N.Y. It uses a gas propellant stored under high pressure in tubes around the user's waist. The tubes are connected to the control mechanism, and thrust is exerted by moving the control in the desired direction.

* * *

Tough steaks can be pounded into submission with a meat tenderizing attachment for electric mixers. It changes the rotary driving motion of the beaters into a back-and-forth vertical motion and won Edward L. Quiring, Minneapolis, Minn., patent 3,066,350.

* * *

A gyroscope system for controlling unmanned aircraft, such as gliders, won patent 3,066,895 (after a 17-year delay for security reasons) for Jacob Rabinow, Rockville, Md., and Harold K. Skramstad. Two gyroscopes, one to keep the craft horizontal, the other to maintain stability on the vertical axis, keep aircraft stable.

* * *

Fresh foods can be preserved longer by storing them in a partial-vacuum container designed for a compartment of the home refrigerator. Patent 3,067,588 for such a device went to Harland W. Whitmore, Grand Haven, Mich.

* * *

The amount of oxygen in a patient's blood can be measured with flexible optical probes consisting of bundles of tiny glass fibers. They are inserted into the body by means of hypodermic-type needles, and light readings are taken of the oxygen content. The probes won patents 3,068,739 and 3,068,742 for Dr. John W. Hicks, Jr., Fiskdale, Mass., and Dr. Michael E. Polyani, Webster, Mass.

* * *

A cup and saucer that won't drip, slip or tip is the aim of patent 3,067,904, granted to Dr. Malcolm L. Raymond, Johnstown, Pa. The design reverses the saucer's usual recessed circular center. Instead, the new saucer has a raised center, around which the cup fits. Liquids drain off the side of the cup without wetting the bottom.

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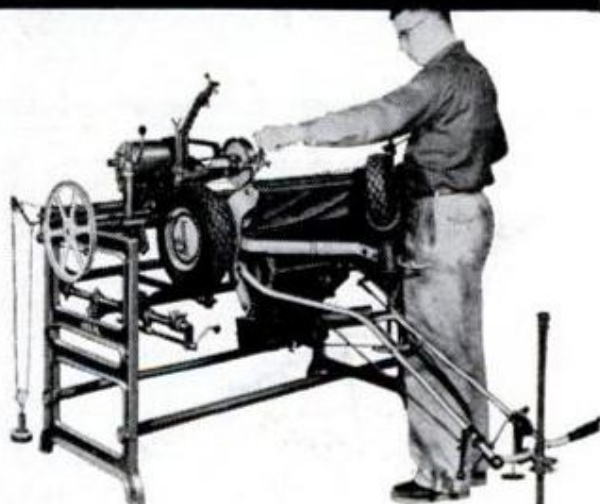
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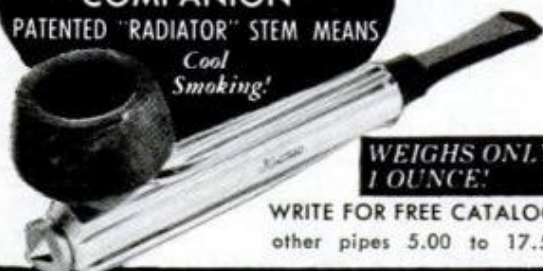
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Remember the Aero Willys?

An early American compact, born too soon, has finally found fame and fortune as Brazil's luxury car



EVER WONDER where the Willys went? The old Willys, that is.

Remember that square, sensible sedan from Toledo called the "Aero?" The one with the big letter "W" instead of a grille? It first appeared in 1952. *PM* did an owner's report on it in October 1953 (p. 53). After brief success, the Aero bowed out with the 1955 model which sported a new grille and a plummeting sales curve.

Today, in the U.S.A., most of the 1952-1955 Aero Willys are dodging the scrap heap and 19 out of 20 Americans would probably peg the Aero Willys as being as extinct as the Kissel, the Erskine or the Moon.

But south of the border in sunny Brazil, it's a different story. A totally restyled and re-engineered Aero Willys 2600 recently starred as the crown jewel in the national auto show in Sao Paulo, Brazil's industrial wonder city.

Recently *PM* road tested one of the first production-run 1963 Aero 2600s. It looks like a current U.S. compact or a king-sized import—next year's Volvo, perhaps.

Let's go back to Toledo for a moment and see what happened to the Aero of a decade ago before its reincarnation as a Latin luxury car.

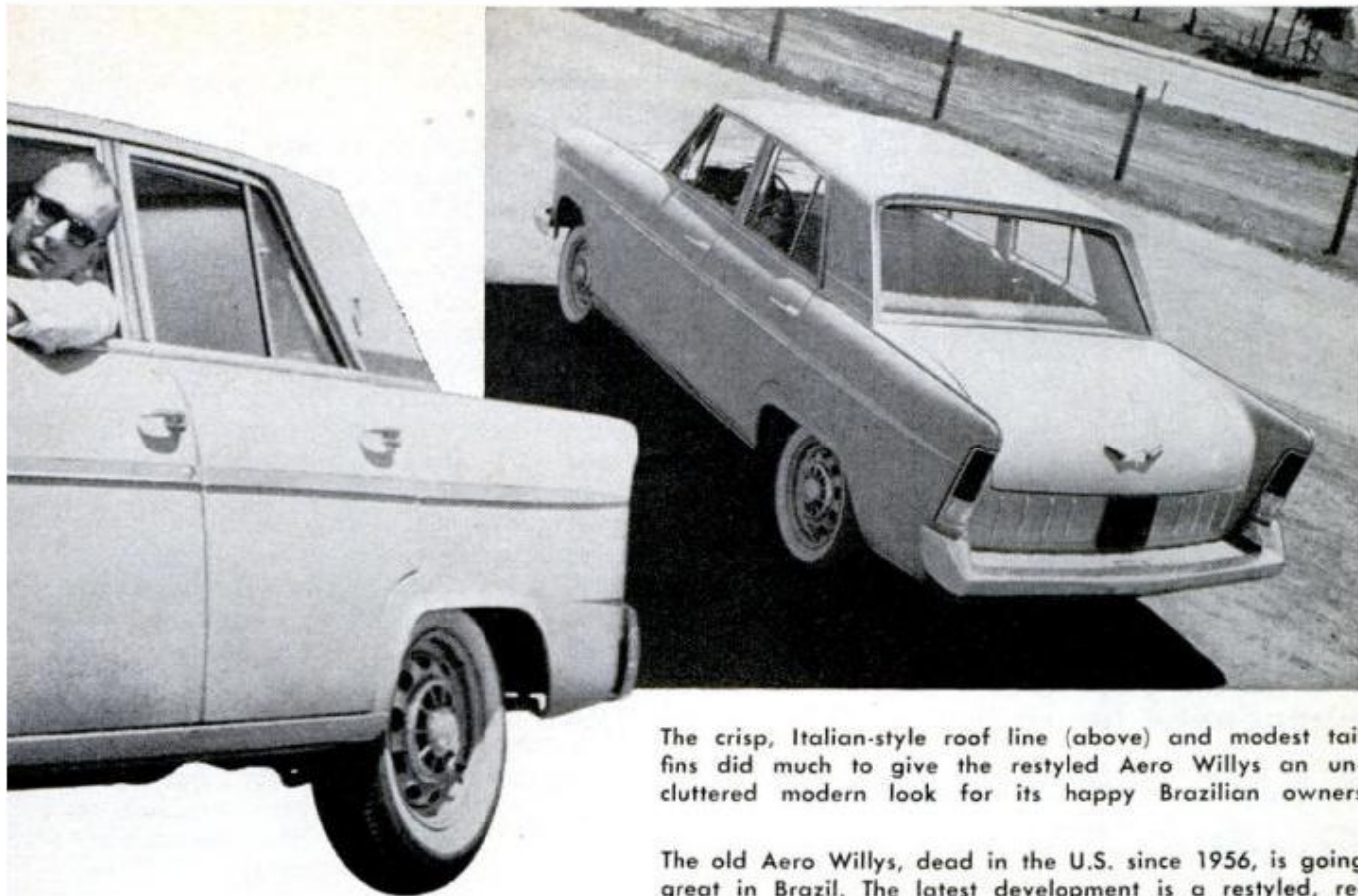
With a unit body 189 inches long and 72 inches wide, set on a wheelbase of 108

inches, and weighing but 2778 pounds, the old Willys fitted today's definition of a compact such as Rambler, Falcon, Chevy II. Like its contemporaries—Hudson's Jet, Studebaker's Champion and even the ocarina-shaped Rambler of that era—it was too little and too soon.

In those days, U.S. motorists only had eyes for cars that were longer, lower, wider, V8-engined and power assisted. America's love affair with leviathans lasted until 1958 when Rambler sparked the compact revolution. By that time, Willys had launched a Brazilian subsidiary to produce its profitable Jeep and Jeep station wagons. These were much sought after in Brazil where paved roads are largely concrete pie in the sky.

There is, however, a strong demand for new passenger cars in Brazil's larger cities and towns, where 1939 Chevrolets still limp along as taxicabs and an imported '62 Impala costs \$15,000 to \$17,000 new. So, quietly and craftily, Willys of Brazil brought their idle Aero tools and dies down from Toledo and set up shop. After all, the engines, transmissions and rear axles for Jeep station wagons had also served the Aero in the U.S.; why not in Brazil?

In March 1960 the first shiny Aero sedans started rolling off the line. Success



The crisp, Italian-style roof line (above) and modest tail fins did much to give the restyled Aero Willys an uncluttered modern look for its happy Brazilian owners

The old Aero Willys, dead in the U.S. since 1956, is going great in Brazil. The latest development is a restyled, re-engineered version, the 110-horsepower Aero Willys 2600

was immediate. Then, Willys of Brazil management decided the time had come to incorporate improvements and modifications into a new model, which they introduced at the auto show last November as the Aero Willys 2600.

Although the unit body hull and much of the external sheet metal is unchanged, former Willys owners would not recognize their dumpy darling. A thorough restyling job, by local talent in conjunction with U.S. designer Brooks Stevens, provided a handsome new grille and crisp, Italian-style roof and window area.

Hood, deck lid, cowl and lower doors were unchanged. Clever rework of fender dies added a lip around the wheel cutouts, a controversial eyeshade over the single head-lamps and a mild fin crowning the formerly bob-tailed rear fender. Result: a longer-looking body with a generally clean, modern appearance.

Inside, the Aero got a beauty treatment. Its high-backed, comfortable seats were given improved, firmer springs covered in nylon fabric trimmed with real leather. (For more money you get full leather upholstery, although the hot climate should make you think twice.) The instrument cluster has three big, white-on-black dials. All five necessary gauges are set in a panel of polished Brazilian hardwood.

They are surrounded by an ebony finished cowling that would put many Detroit products to shame. Carpets, however, are sturdy rubber, a concession to Brazil's muddy back roads.

The body itself is solid as a bank vault, thanks to a strategic beefing up of an already short and rigid structure.

Suspension is an ideal compromise for Brazil or any other area with similar roads. They range from smooth concrete down through Belgian block streets to country roads best described as "linked potholes." These *Barrachos*, as the Brazilians call the bomb-crater size chasms, can clean the suspension right out from under a conventional, softer-sprung car. The Aero 2600 rides free of sway and bounce, if a bit stiffly. Like its Toledo ancestor, it has independent coils in the front, leaf spring at the rear.

Steering is slow and harder than U.S. tastes would care to develop the muscles for. This is the only area where we find the car really wanting. Willys Chief Engineer Frank Erdman, however, assured us that lower-friction steering gear is in the works. There is no power steering, power braking or automatic transmission. Omission of the last item stems from the lack of automatic transmission service facilities.

[\(Please turn to page 58\)](#)

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Remember the Aero Willys?

(Continued from page 57)

Furthermore, Brazilians don't seem to miss the automatic.

Pedal pressure on brakes is firm, but it's reassuring to know that there are 176 square inches of lining ready to stop you.

Driving the 2600 is pleasant. Its firm suspension keeps you glued to the road (as long as it remains a road) while the reliable, cast-iron Six moves you with a surprisingly quiet smoothness and a minimum of gear shifting. This engine is an F-head with intake valves in the cylinder head and exhaust valves in the block. Bore and stroke are $3\frac{1}{8} \times 3\frac{1}{2}$ inches for a displacement of 161 cubic inches.

Horsepower is rated 110 at 4400 rpm, and with the 4.27-to-1 rear axle ratio you use lots of revs getting to top speed—about 80 miles per hour. Acceleration is on the languid side for U.S. tastes, with 60 m.p.h. coming up 22 seconds after a standing start.

The engine is beautifully balanced, however, so the high rpms needed to maintain a speed of 65 or 70 miles an hour create no annoying vibration. Exhaust noise is low.

Could It Stack Up in the States?

Fuel consumption is not as good as one might expect from a small engine in a 3100-lb. car. In traffic, driving at speeds of 30 to 50, we got about 14.7 miles per gallon. This reflects no discredit to Willys engineering. The slide rule boys are forced to keep the compression ratio to a low (and less efficient) 7.6 to 1. Reason: Brazilian gasoline, which comes from refineries unable to obtain higher octane ratings. Noise levels are low throughout the car and there's little vibration from any source. The firm, roomy, well-designed seats make a long trip comfortable if you like firm-sprung European standards.

How does the new Aero stack up against U.S. compact competition? Could it be sold at competitive prices in the U.S.? As far as roominess, appearance, solidity and high-quality workmanship are concerned, Willys would have few peers in its price bracket. But the very qualities that make it acceptable in bumpy Brazil might keep it from becoming a full-blown success in the boulevard-ride U.S.—stiff suspension, low compression engine, manual transmission. But there could, we feel, be a steady demand from taxi companies and people who live out where roads are rough and where durability counts more than a marshmallow ride. Only time will tell. ★★★

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SELL Champion, AC, Autolite spark plugs. Reconditioned, electroplated, guaranteed 10,000 miles. 100% profit. Free sample. Lee Plugs, 1608-A, Roberts, Houston 3, Texas.

AMAZING Manufacturing opportunity. Free list of manufacturing formulas. Presler Oil Company, Fostoria 3, Ohio.

MAKE Durable building plastic easily. Waterproof. Fireproof, economical. Bays Laboratory, Cedaredge, Colorado.

GOLD, Silver, platinum; refining, testing, make alloys, solders, etc. Learn wonderful business. Frank J. Herman, Metallurgist, 421 South Western, Los Angeles 5, California.

WORK At home packaging merchandise. Very profitable. No selling. Everything supplied. Details free. HBE, 1148-P West Grand, Chicago 22.

DRIVING Schools needed. Profitable. Free instruction by trade association. Nothing to sell. Driving School Association, 4935 Foster, Chicago 30, Illinois.

IMMEDIATE Profits with no capital or experience. Take orders for all magazine subscriptions. Friends and neighbors are your prospects. Write now for complete, free kit. McGregor Magazine Agency, Dept. AB-3, Mount Morris, Illinois.

SELL Products. Mailorder. 400% profit. Work home. Catalogue free. International, 6347 Parnell, Chicago 21, Illinois.

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

EARN \$10,000 Selling books by mail. Box 51-BY, Des Plaines, Ill.

HOME Producers needed desperately in exploding new plastics business. Sell us your spare time. No selling—most territories still open! Hurry, NPC, Box 23321-PD, Los Angeles 23.

BIG Catalog featuring candle molds, supplies, tools and equipment. Largest selection, lowest prices. Golden opportunity for big profits. Send 25¢ today. General Supplies, Dept. GX-352, Fallbrook, California.

MONEY Manufacturing, selling. Own brands. Andrews, East 3823 Liberty, Spokane 27, Wash.

PARKING And traffic line marking area franchise. No age limits. Full time, part time. Send dollar for brochure, instructions, lease equipment to National Traffic Control & Safety Co., P.O. Box 641, New Haven, Connecticut.

NEW Ideas increase mailorder profits. Free details. Thomson, P.O. Box 3554-A2, Austin 4, Texas.

MAILORDER! Several tested, proven, moneymaking opportunities. Everything furnished. Free particulars. Mann, 266-PM, Hillsdale, New Jersey.

AGENTS For fast selling national advertised items. Big profits, repeat orders. Write: Sales Director, International Fiberglass Corporation, 6537 Queens Blvd., Woodside 77, N.Y.

BECOME Tax consultant. Graduates earn \$1,000-\$3,000 every tax season preparing returns evenings. State approved. Union Institute, Lakewood X-2, N.J.

SEND Stamp, name, address. Get surprise, bargains. Sheill, Southfield 2, Michigan.

BIG Money—Operate your own fix-it shop. Service all household appliances; irons, fans, refrigerators, automatic washer-dryers, etc. Do house wiring, commercial wiring. Rewind motors of all sizes. Sharpen mowers, skates, saws. Buy needed spare parts wholesale. Free book. Christy Trades School, A-3603, 3214 W. Lawrence, Chicago 25.

\$15.00 An Hour possible in new home manufacturing business. Spare or full time. Amazing velvet-spray transforms hundreds of old items into money-making products. Write for samples, free "50 Business Opportunities Booklet." Craft Industries, Dept. JN-3, Los Angeles 61.

MAKE Extra money. Big steady earnings, repeat business. Sell advertising book matches, full or part time. New 1963 line. Show glamour girls, colorama, tenorama; dozens more. All sizes. Free master outfit, sales helps, leads, no experience necessary, no investment. Write today. Superior Match, Dept. MX-363, 7530 Greenwood, Chicago 19, Ill.

EXPORT-Import opportunity, profitable, world-wide mail-order business from home, without capital; or travel abroad. Established world trader ships instructions for no-risk examination. Experience unnecessary. Free details. Mellinger, J703, Los Angeles 25.

PROFITABLE Mail order opportunities. Nelson, Box 1512P, Long Beach 1, Calif.

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 TV Systems, Dept. N-3, 1038 So. La Brea, Los Angeles 19.

DOLLS! Dolls! Dolls! We teach you to make, repair, dress and sell. Study at home. Earn while learning. Free booklet. Doll Hospital School, Studio MC-33, 11826 San Vicente Blvd., Los Angeles 49, Calif.

MURAL Artists needed! No experience required, earn \$10-\$15 per hour! Amazing "Project-A-Mural" method. Project pattern slides, trace-off, paint for color guide. Professional results guaranteed! Huge demand from homes, bars, restaurants, offices, etc. Sell \$100 murals for pennies in paint. Free success plan. Associated Muralists, Dept. E3C, 500 Plumas, Reno, Nevada.

LEARN Landscaping and plant growing. Start a profitable business part or full time. Free information without obligation. Lifetime Career Schools, Dept. MC-33, 11826 San Vicente Blvd., Los Angeles 49, Calif.

LEARN Sewing machine repairing. To \$125 weekly. Sparetime. Supplies. Add to present business. Write today! Taylor Service, Box 484, Cupertino, Calif.

MAIL-ORDER. Secrets! Secrets! Mail order success revealed by internationally famous expert who discovered how to make home business fortunes. Beginners! Get free copy "How to Make Money in Mail Order." Discloses free advertising, profitable product, everything! No obligation. Write Mallico, 1554 Sepulveda, Dept. J703, Los Angeles 25.

TELEPHONE For profit spare time! Home-business information; revealing details about joining nationwide organization. Write: Telephone Contactors, Dept. N3, 1038 So. LaBrea, Los Angeles 19.

LIQUID Rubber, plaques, figurines, plastercraft supplies. Sample, details free. Lavin Novelties, Box 296-E, Leavittsburg, Ohio.

MAIL-ORDER Success even for beginners. Details free. Handy House, 214 Main, Hackensack, N. J.

MINIMUM \$320 monthly very easy. No selling, canvassing or competition. County your choice exclusive territory. Pay franchise out of profits. Educated semiretired preferred. Franken, 915 S. Grattan, Los Angeles 15, California.

OPERATE Restaurant or diner. Free booklet reveals profitable plan. Write Restaurant Business School, Dept. EC33, 1920 Sunnyside, Chicago 40, Illinois.

REPAIR Hydraulic Jacks. Easy, profitable. Write: Hydraulics, 3000 Mountain, El Paso, Texas.

BIG Money. Operate your own fix-it shop. Service all household appliances: irons, fans, refrigerators, automatic washer-dryers, etc. Know how they work, what goes wrong, and how to fix them. Learn how to do house wiring, commercial wiring, rewind motors of all sizes, sharpen mowers, skates, saws. How to get business, buy spare parts wholesale. What to charge for your work. Free book. Christy Trades School, A-3703, 3214 W. Lawrence, Chicago 25.

PROFITS In mail order? Of course! Else, why all these ads? Priceless information, \$2.00. Moneymaker, 722-P3 East Silver Spring, Milwaukee 17, Wisconsin.

PACKAGE At home for profit! We supply everything. No selling. Free home business details. HPC, 807-BH Sunset Blvd., Los Angeles 12.

TIN-CANS, Newspapers, sawdust. 200 uses. Instructions \$1.00. Charles, 42-AF, Norwood, Ohio.

IMPORT For dimes, export for dollars. Represent manufacturers. No investment, no experience necessary. Details 10¢. Benko, Box 188-A, New York 21.

OPPORTUNITIES. Profitable, repeating, home business magazine, 50¢. Vista-PM, 1230 Purcell Ave., Cincinnati 5, Ohio.

OPERATE Mailorder bookshop. Details, stamp. Ballard, PM-1834, Edgeland, Louisville 4, Ky.

WE'LL Train, furnish equipment and supplies to double your investment. Car lots potential customers. No shop needed. Paint Associates, Inc., 5506 North Meridian, Wichita, Kansas.

LIQUID Molding rubber, free information, Chaney's, 5415-A San Jose Blvd., Jacksonville 7, Fla.

MIDWEST Chemical Co. home dealer plan offers large profits to men or women. No investment needed. No experience necessary. 1442 I-LD Griswold, Detroit 26.

BIG profit! Learn to operate auto and iron salvage yard. Box 806, Mason City, Iowa.

BIG Profits. Hand-crafted jewelry business. Free details. LPS, Dept. 133, 1706 Argon, Mesa, Arizona.

OPERATE Successful mail order business of your own. Write Ormiston's, Stockport, Ohio.

MAKE Money at home by mail, full time, spare time, without capital. Write Mid America Sales, Box 597-B, Topeka, Kansas.

LOVE Pays! Bronze, pearl, electroplate baby shoes. Start on credit. Free booklet. Box 5036A, Inglewood, California.

"STARTING, Managing Your Own Business." Book, \$1.00. Ward's, Box 341, Vernal, Utah.

"39 TIPS for Greater Mailorder Profits". Hints on postal regulations, selecting a firm name, pricing, testing at low cost, copy, envelopes, idea bank, sales letters, etc. Send 25¢. Graham, 2952 Marlboro Road, Oceanside 14, New York.

\$10.00 IN An hour spare time at home possible with amazing "Magic Wonder Method" invisible reweaving. Details free. IRI, Dept. P-1, 8411 La Mesa Blvd., La Mesa, Calif.

SELL Champion, AC, Auto-Lite spark plugs. Factory rebuilt, Electroplated. Guaranteed 10,000 miles. 100% profit. Free sample. Scientific Company, Box FM-5066, San Antonio 1, Texas.

FANTASTIC Mails! Opportunities, bargains, magazines, offers, surprises! 50¢ yearly. Dunne's, Washington 7, D.C.

MAKE Small fortune with "Floating-Henryburgers." Over 60 million sold. P.O. Box 936, Wichita, Kansas.

EARN Money at home mailing postcards to new mothers. Westley, Box 27, Western Springs 3, Illinois.

RAISE Nightcrawlers, redworms, indoors, basement, garage. Three Oaks Ranch, Dresden, Tenn.

MADE \$10,000.00 Typing at home. Guaranteed proof. Amazing information. 15¢. Lenore Feigen, 30-C Washington, Oak Park, Ill. Dept. PM.

I Make money every week by mailorder! Helped others. Will guide you. Webster, 2038-39 Mockingbird, Columbia 4, South Carolina.

"BOOK of 1,000 Practical Ideas." Where to buy it, where to sell it, how to do it, how to make it, thrift hints, new ideas, money making and saving tips for everybody. Only \$3.00 in postal m.o. One year's consultation service included. Stanley Husar, P.O. Box 1025, Lorain, Ohio.

MOLD Statuary, pottery, tiles, novelties—5¢ materials makes dollar sellers! Particulars free. Marbleizing Service, Edwardsville, Illinois.

EARTHWORM Growers needed! Big money! Free information. California Bait Co., 10416 Fair Oaks Boulevard, Fair Oaks, California.

SHOW This ad to an inventor you know who has product, preferably for general consumer market, either new idea or big improvement on existing product. We may be interested in marketing product, possibly financing mass-production, with fine royalty arrangement for him. We're large, well-established, highly-rated firm with big nationwide organization of salesmen eager for new products they can demonstrate, sell to public. Have inventor write, tell us what invention does, who needs it, why people will buy it. If interested, we'll contact him fast. Write: Ed. Frank, 114 East 32nd, Dept. G-100E, New York 16.

EARN Money—minor house repairs, full time, part time. 4017 Marks Place, Fort Worth, Texas.

STARTING a mail order business? Write for information. Buller's, 429 White St., Springfield, Mass.

BUILD Mail fortune, easy! Fascinating! Books, Box 3131, London, Canada.

MAKE Profitable men's-women's wear. Sample free. Sunmade, Brockton 64, Massachusetts.

PROFIT With Popular Mechanics' subscription plan. No investment, no experience needed. Earnings begin immediately when you obtain subscriptions for Popular Mechanics, Good Housekeeping and others. High commissions, bonus. No experience needed. Deal directly with the publisher. Write Popular Mechanics, Room 3B, 250 West 55th St., New York 19, N. Y.

MONEYMAKING OPPORTUNITIES

GOOD Income. Be own boss. Be independent. New fantastic system teaches in minutes. 25¢ for instructions. Variety Advertising Company, 1219 Douglas St., Dept. 143, Alton, Illinois.

RETIRE In ten years! Good business income. Send \$2.00 to: Booklet, 675 North Hamilton, Pomona, California.

CASH In on booming baby market. Popular baby items ideal for mailorder, door-to-door or party plan selling. Profit-making details and sample envelope stuffers free. Rutward, 109, Bryant, Columbia Station, Ohio.

MONEY-Making mailorder business! Literature free. Conner, 3530 S. Atlanta Road, Smyrna, Georgia.

FABULOUS Profits raising fishworms. Picture folder free. Excello, Kosciusko 6, Mississippi.

REPAIR Hydraulic Jacks. Easy, profitable. Write: Hydraulics, 3000 Mountain, El Paso, Texas.

PAINT Signs for yourself, others. Easy with our letter patterns, sign kits. Also "popular raised letters". Paulow, Crystal Falls, Michigan.

BIG Mails. Replete with opportunities and where to buy bargains, only 25¢. Anthony Matzkewitz, 125 Thames Street, Brooklyn 37, N.Y.

MAILORDER Dealers. Imported cuckoo clocks, wholesale. Wide variety. Profitable details 25¢. Atlas, Box 6581, Richmond 30, Va.

BECOME A notary public. Win extra income, prestige, business contacts. Details free. Stationers Exchange, Box 617-P, Kilgore, Texas.

YOUR Own, easy-to-start, home mailorder business, sparetime. Fascinating; profitable! Information free. Alfano, 19-PM, Pine, Closter, New Jersey.

MAILORDER Profits and pitfalls. Free details. Box 63-PB, Bellwood, Illinois.

SHELLCRAFT, Fascinating hobby or profitable home business. Make and sell wall plaques, lamps, ash trays, candy dishes, costume jewelry, handbag decorations. Write for most complete shellcraft instruction manual ever published. Send \$1.00 refunded first order shellcraft supplies. Plasticraft, Dept. SP, 624 N.W. 8th Avenue, Fort Lauderdale, Florida.

RAISE Redworms. Big demand. Free literature, Hall Redworms, Hilton, Ga.

\$1000.00 PROFIT Possible per sale showing our quality aluminum siding on your home. Details free. Aluminum Industries, Dept. PM-3, Kansas City 11, Mo.

MONEY Earned easily, with my valuable, instructive booklet "How To" identify, purchase, restore, refinish and sell antique furniture for cash. Full of trade secrets for professional craftsmanship. Large profits in your own business. Supply limited. Only two dollars. Check or money order. "Old Antiquer", 6619½ Livingston Ave. North, St. Petersburg 3, Florida. Dept. A.

TWO Deals. 500 ways to earn money. Exclusive deal from manufacturer. Hilbor Products, 650 Pierce, Gary, Indiana.

MAKE Money! Start a private campground. \$1.00 for information. Sandy's Campground, RD 7, Mercer, Pa.

FREE! The perfect, no-investment mailorder plan. Stamped self-addressed envelope appreciated. Oakwood, Philadelphia 26.

OPERATE Home art studio. \$5.00-\$10.00 or more hour possible! Advertising agencies, magazines, stores (over 40 big fields) large buyers of free-lance art and cartoons. We show you how. Sell by mail. Fascinating home study system. Free book. Write to Continental Schools, Dept E-96, 4201 So. Broadway, Los Angeles 37, California.

MAKE Money gathering wild roots, herbs, weeds, leaves, tree seeds, flowers, plants! Over 200 varieties! Buyers listed for all you can ship! Easy! Pleasant! World wide! Get free book! Rush 25¢. Allain: 69-P Hollis, Worcester 10, Mass.

FREE Book: "609 Unusual, Successful Businesses." Box 1001-FW, Evanston, Illinois.

SUCCESS In slenderizing. Send \$3.00 book "How to Operate Slenderizing Salon." Free equipment catalog. Arnold Co., Knox, Indiana.

FREE Advertising for mailorder items. Branvold, 5718 Troost, North Hollywood, California.

LEARN The secrets of repairing junk batteries, generators, starters, profitable, easy, at home. Free particulars. Batterymen, Prunedale Station, Salinas, Calif.

PHYSICAL Culture and massage pays big profits. Learn at home. Free catalog. Write National Institute, Dept. A-1, 874 N. Wabash, Chicago 11, Ill.

VENDING Machines. No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, 715 PMM Erisor Street, Baltimore 2, Maryland.

IT'S True. You can succeed in mail order our easy way. Details free. Worldwide. Box 4026, Station H, Columbus, Ohio.

EARN \$240.00 a month at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1532 Howard, Chicago 26, Ill.

EASY To start rubber stamp business at home in spare time. Make up to \$9.80 an hour without experience. Facts free. Write Roberts, 1512 Jarvis, Room CR-2-A, Chicago 26.

SEASHELLS. Shellcraft and jewelry supplies. Wholesale catalog 25¢, refunded on first order. Our 29th year. Florida Supply House, Box 847M, Bradenton, Fla.

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-A, 1512 Jarvis, Chicago 26, Ill.

BIG Profits in figurines, lawn ornaments. World's best liquid rubber for molds. Sample and catalogue free. W. Wooley, Peoria, Illinois.

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

MAKE Big easy profits making costume jewelry at home in spare time! Quick, easy to make, easier to sell! Details free; Don-Bar, 2934 W. Fullerton, Dept. A-203, Chicago 47, Illinois.

WE Purchase items you make at home for us. Enclose stamp for details. Wolfe Specialties, Box 171, Center Line, Mich.

HOME Mailorder "manufacturing." Everything supplied. Clenso Products, 184 Oakview, Winnipeg 15, Manitoba.

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

MAKE Plastic novelties for extra income. Low cost home training now available. Write for free booklet. Interstate Training Service, Dept. D-3, Portland 12, Oregon.

BAKE New greaseless doughnuts in kitchen. Sell stores. Free recipes. Melvin, 3605 South 15th, Minneapolis 7, Minn.

CIGARETTES—Make 20 plain or filter-
tip for 9¢. Facts free. Moberly, Box 4012, Owensboro, Kentucky.

MINK Raising information free. Complete. Lake Superior Mink Farm, Superior, E.E.1, Wisconsin.

EARN Money raising fishworms for us! Write: Oakhaven—59, Cedar Hill, Texas.

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

AMAZING Successes through franchises! Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, MP-528, 333 North Michigan, Chicago 1.

EXPORT — IMPORT

SAMPLE German export publication plus valuable worldwide exporters lists—50¢ stamps. Burke Associates, Manchester 1, Mass.

BUY Wholesale from 1000 U.S., foreign sources. Import! Drop-ship! Free details. Mashburn's, Enka, North Carolina.

POSTPAID from Holland. Clocks, dolls, lamps, Delftware plates, etc. Illustrated list, 20¢. Melco, Box 69, Edwardsville, Illinois.

JAPAN: Mail order catalogue business information, dolls, kimonoes, etc., \$1.00; Trade Directory, 3000 firms listed \$3.00; Japan Tour Guide \$1.00; Send cash. Clarence Yamagata, 814 Togin Bldg., Marunouchi, Tokyo.

SCIENCE & CHEMISTRY

ROCKETS! New illustrated catalog of rocket kits, supplies, engines, chemicals, 25¢. Central Rocket Company, Div. 89, Waupaca, Wis.

ROCKETS—Plans: construction, propellant. \$1.00. Deluxe \$2.00. Rocketry, Box 2533-A, Wilmington, Delaware.

EXPERIMENTER'S Handbook free with bigger catalogue, 25¢. Hagenow Laboratories, Manitowoc, Wisconsin.

ROCKETS: New illustrated catalog 25¢. Single and multistage kits, cones, engines, launchers, trackers, technical information, etc. Fast service. Estes Industries, Penrose 7, Colorado.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 35¢. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 25¢. Tracey Laboratories, Evanston, Illinois.

UNUSUAL Chemistry books, courses, kits! Rare chemicals, cheap! Catalog 25¢. NSC, Box 11133, Palo Alto, Calif.

MICROSCOPES, Accessories, prepared slides, supplies, etc. Free brochure. New England Science Service, P.O. Box 315, Peterborough, New Hampshire.

ROCKET Supplies. 1963 list 25¢. Mervin Hill Company, Seward, Pennsylvania.

CHEMICALS, Apparatus, Biology. Catalogue 25¢. Mid-States Scientific, 7053 N. Clark, Chicago, Ill.

AMAZING New book of science experiments, formulas, and catalogue of laboratory supplies. Only 35¢. National Scientific Co., 13 S. Park Avenue, Dept. PM-3, Lombard, Illinois.

CATALOG 35¢. \$3.00 kit free with substantial order. Laboratory Sales, Box 161-A, Brighton 35, Mass.

CHEMISTRY Set—apparatus catalog \$1.00. Catalog 25¢. Labcraft, 137 Oakland Avenue, Methuen, Massachusetts.

FREE—Pair of chemical resistant polyethylene gloves with catalog. Low priced chemicals, biologicals, and apparatus. New illustrated catalog only 35¢. Dover Chemical, 35-24 31 St., Astoria 6, New York. Open all day Saturday.

PLASTICS

PLASTIC Embedders. We have everything you need. Moulds, miniature findings, etc. Catalog 25¢. David Co., 20 Garden St., Providence 3, R.I.

NEW! Plastic vacuum forming machines. Hobby. Easy. Profitable. Details. Burr, 7645 Oakland, Kalamazoo, Mich.

PLASTIC And supplies for laminating. Colamco, 12 Center, New Haven 10, Conn.

BOXES, Plastic. 200 sizes. Free list. Althor, 2301 Benson Ave., Brooklyn, N. Y.

NEW Liquid casting plastic, clear, colors. Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks, "How to Cast Liquid Plastics" and "How to Make Extra Money at Home." Castolite, Dept. C-101, Woodstock, Illinois.

MAKE Your own embedded plastic charms: Excellent beginners' kit includes detailed instructions, clear liquid plastic, catalyst, jewelry fittings and all necessary supplies for making small charms. \$1.95 postpaid. Craft Service, 341 University Ave., Rochester 7, N. Y.

NATCOL Resins are best for casting and laminating. Catalog 25¢. Natcol Plastics, Box 227, Redlands 3, California.

COLORFUL Liquid plastic. Sample products. Details. Bryan, 1133 Barry Ave., Los Angeles 49, Cal.

FORMULAS, PLANS, ETC.

CALCULATE Radiation protection of any shelter, 50¢. Kearns, Box 71, Sunny-mead, Calif.

10,000 MODERN Moneymaking formulas. Details free. Harvey's, 1402-PMC, Englewood, Colorado.

MONEY Making formulas. List free. B & H, Box 425, Glendale, California.

50¢ PER Gallon. Amazing paint thinner, brush rinser, etc. Better than turpentine. No evaporation. Used by experienced painters. Information \$2.00. Satisfaction guaranteed. Hurry! Bayer Publications, 938 Betty Avenue, Neenah, Wisconsin.

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

FORMULAS—All kinds. Amazing big catalog, 10¢. Kemixal, Park Ridge, Ill.

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

LABORATORY Tested formulas. Box 81, Station B, Calgary, Alberta, Canada.

AGENTS WANTED

MEN! Show wife this amazing offer! Famous nationally advertised Hollywood cosmetics pay 60%. Make \$25 day up. Hire others. For free samples, details, write Studio Girl, Glendale, California. Dept. 23733.

EXOTIC Earrings! Details free. Pair \$1.00. OHGA, PM-434, Sigakenkusatu, Japan.

SELL Greeting cards. Make extra money. All occasion assortments, Easter; stationery, gifts, wrappings, toys, jewelry. Experience unnecessary. Salable samples on approval. Free catalog. Free gift offer. Bonus plan. Write Hedenkamp, 361 Broadway, Dept. PM-85, New York.

NEW "Magic knife" slices frozen foods, even bone—pays up to 100% profit! Rush postcard for free double-your-money details, special starting assortment discount offers. Dale, Dept. L-602, 4333 N. Pulaski, Chicago 41, Ill.

MAKE Most extra cash with world's biggest line everyday greeting card assortments, gifts. Introduce friends, neighbors, to over 150 assortments, 500 big money-makers. Pocket up to 100% profit plus big cash bonus. Free giant color catalog: samples on approval. Write Arrow Greetings, 513 Fourth Ave., S., Dept. 83-B, Minneapolis, Minn.

BUSINESS Kit free! Postcard puts you in business! Complete line 230 shoe styles, jackets! New discoveries pay big commissions. No investment. Send for free kit. Mason, Chippewa Falls, K-456, Wisconsin.

SHOW Demonstrator shoes on your feet to 10, and 6 will buy on sight because of discount price, beauty, and one year unconditional guarantee. You'll see! From \$1.99 to \$5.59, none higher. Many other discount bargains. Discount clubs spreading like wildfire. You'll actually take business away from discount stores. Rush shoe size. Perfect-World Co., Dept. 220, Cincinnati 15, Ohio.

EARN Big money introducing amazing Color-V. Makes ordinary TV show in beautiful colors. Low \$2.98 price. Sells like hot-cakes. Free details. Excellent Buys, Dept. PM-4, 34 E. 12th NYC.

EXTRA Cash plenty! Show 'em and you'll sell 'em—sensationally beautiful, handpainted plastic photo enlargements, personalized compacts, costume jewelry. Take orders—collect 40% commission. Self-selling sales kit free. Novelco, 3343 North Avenue, Chicago 47.

WILL You test new items in your home? Surprisingly big pay. Latest conveniences for home, car. Send no money. Just your name. Kristee 131, Akron, Ohio.

AGENTS Make big profits from battery operated razor. Perfect shaver for travelers, salesmen and campers. Free details. Cambridge, 1060 Haddon Ave., Camden 3, N.J.

YOUR Name and house number in reflective letters plus details on big profits, for 25 cents. Highlight, 352-C Stewart, Turtle Creek, Penna.

RAISED Letterheads, envelopes, cards. L&D Press, 159-m Jeanette, Inwood, L.I., N.Y.

EARN \$50 Weekly in sparetime. New unusual way to earn extra money in your spare-time—no investment necessary! No sales experience needed. Get merchandise on credit. Work your own hours! If you'd like complete details on how to earn money this interesting way, write Greetings Unlimited, Park Square, Room 3-702 St. Paul, Minnesota.

NOW! \$195. Commission one order! Date-carton books pay 100% repeated profits. Pyramid your income. Represent most popular humorous advertising. Free book. Happy Publications, 6340 Coldwater, North Hollywood 4, California.

MAKE Money selling ties, readyknits, tie kerchiefs. Free catalog. Philips Neckwear, 22 West 22nd, New York.

SENSATIONAL Commissions, bonuses writing orders for guaranteed hosiery for entire family. Money-making outfit free. Billera, 38 Circle, Syosset, New York.

SELL Champion, AC, autolite spark plugs. Reconditioned, electroplated, guaranteed 10,000 miles. 100% profit. Free sample. Lee Plugs, 1608-E, Roberts, Houston 3, Texas.

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

FREE Sample. Beautiful curios! Sell on sight! Apartado 9036, Mexico City.

YOUR Own business—Used suits \$1.50; overcoats 65¢; mackinaws 35¢; shoes 12½¢; ladies' coats 30¢; dresses 15¢. Enormous profits. Catalog free. Nathan Portnoy Associates, 2109-AA Roosevelt Road, Chicago 8, Ill.

BUY IT WHOLESALE

POWER Tools. Belt sanders, Zipp saws, electric planes. Write: Carpenter Wholesale, Box 127, Three Forks, Montana.

BARGAINS! Closeouts! 4 catalogs yearly—\$1.00. Reavis, Box 1134-PM, Lufkin, Texas.

BARGAINS Buy wholesale and save free catalog. D. H. Frey, Westview Estates, Greencastle, Penna.

BARGAINS: Jewelry, appliances, wedding gifts. Catalog 25¢. Ronaldo, P.O. Box 295, Allentown, Penna.

350,000 BARGAINS! Free merchandise! Write: Goldmine, 240-PA, Planetarium Station, New York City 24.

100,000 PRODUCTS Wholesale! Terrific bargains! Wholesalers, 1265-MR Broadway, New York 1, N. Y.

AMAZING Wholesale directory available. Details free. Enterprise, 434 Temple, Fredonia, New York.

OVERHEAD Door parts. Wholesale prices. List. Door Supply, 101 County Street, Somerset, Massachusetts.

BARGAINS! Buy wholesale! Save money! Free catalog! Norris, 273-AX Merrick Road, Lynbrook, N. Y.

FREE! Name brands catalog! Your own high profit business. Sell name brands, full or part time. No inventory, no investment. More than 2,000 name brand items: lowest wholesale prices. Watches, jewelry, cameras, hi-fi, stereo radios-phonos, appliances, housewares, hardware, power tools, luggage, musical instruments, garden equipment, sporting goods, toys, many others. 8 floors of name brands. Million dollar inventory. Orders shipped complete in 24 hours! Send for free, beautifully illustrated catalog now! Separate wholesale price list. H. B. Davis Corp., Dept. PM. 145 W. 15 St., New York 11, N. Y.

NEW Deluxe below wholesale catalog. Automobile catalog and others. Furniture, clothing, housewares, appliances, refrigerators, freezers, washers, dryers, television, radios, luggage, binoculars, hi-fi, stereo, phonographs, recorders, cameras, projectors, musical instruments, sporting goods, toys, tools, typewriters, watches, jewelry. Huge discounts on thousands of name brand items. For free specimen list of actual factory prices—postcard: Selbyco, Decatur 15, Illinois.

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

USED And new watches \$2 up. Free list. Southern Watches, 5-PM So. Wabash, Chicago 3.

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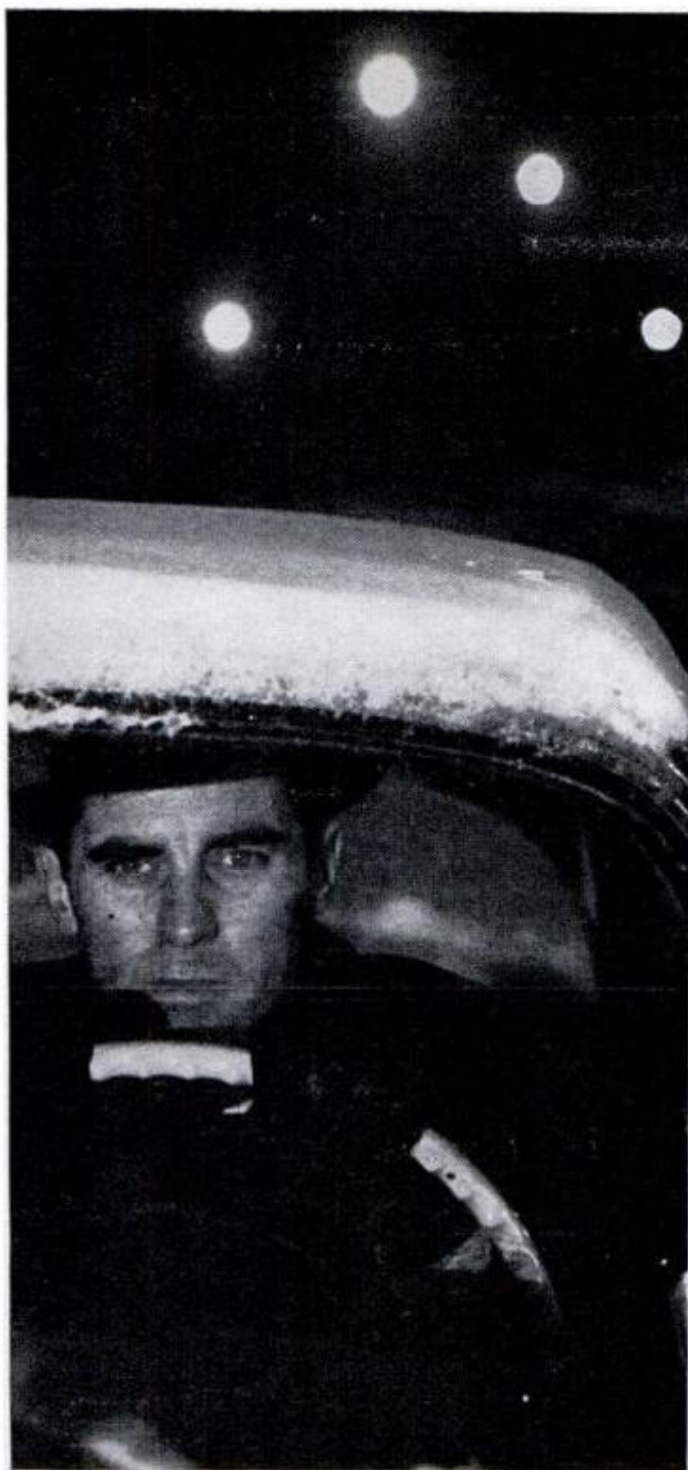
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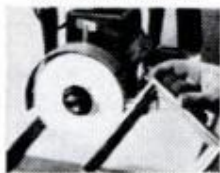
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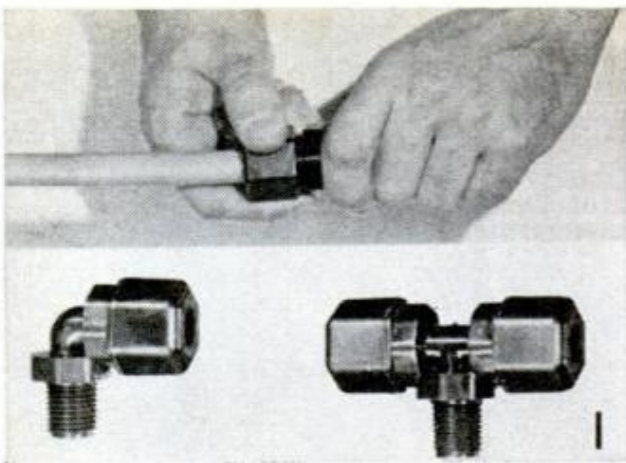
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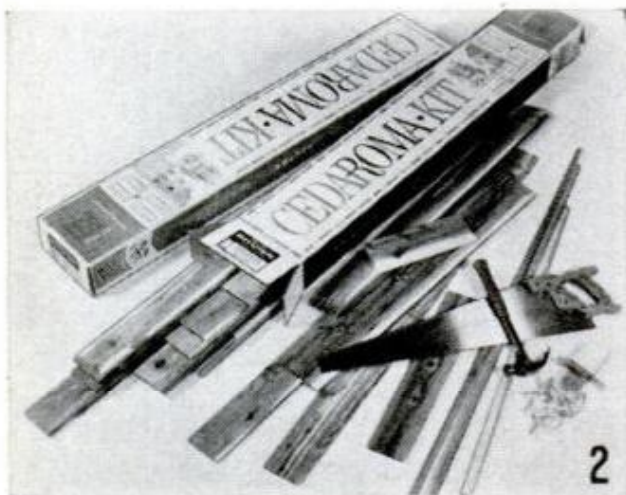
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1. PLASTIC FITTINGS can be installed in seconds on plastic, copper or aluminum tubing of up to $\frac{3}{8}$ in. outside diameter. No clamps, liquid joining or special tools are needed as the tubing is simply inserted into the fittings and the cap is then hand-tightened. Fittings include male and female connectors, unions, elbows and tees. D & G Plastics Co., Kent, Ohio



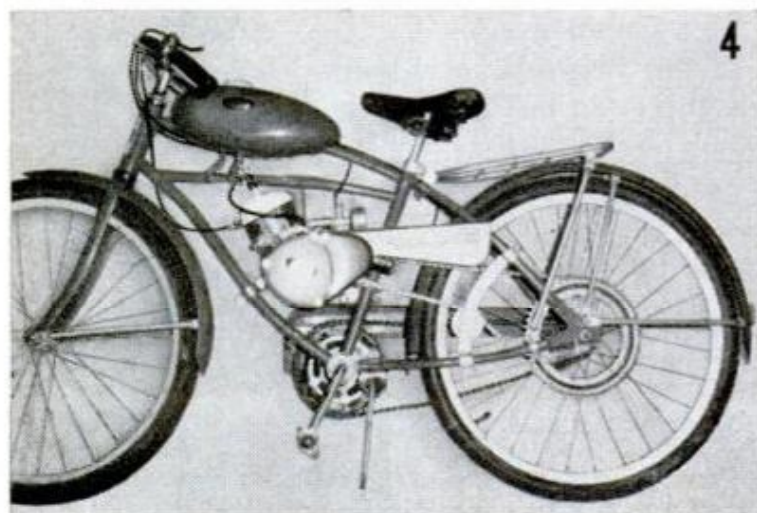
2. CEDAROMA KIT contains enough tongue-and-grooved, end-matched wood to cover 25 sq. ft. of wall area. Special nails, dipped in a bonderized paint the same color as the cedar, eliminate the need for countersinking and using wood filler. The only tools needed to install a cedar-lined closet are a hammer, a saw and a square. George C. Brown Co., Greensboro, N.C.



3. CHEMICAL VULCANIZING of tears in rubber, canvas or fabric articles is easy with Duro waterproof, plastic-rubber compound. Available in black or white, it molds into any shape, dries quickly but still remains pliable enough that the mend is not likely to open up again. Price is \$1 for a 4-oz. tube. Woodhill Chemical Co., 1390 E. 34 St., Cleveland 14, Ohio

4. BICYCLE ENGINE kit contains a TAS 50 "Feather" 1-cylinder, 2-h.p. air-cooled engine, a $\frac{3}{4}$ -gal. gasoline tank, drive and control units. Can be assembled and mounted within the frame of any bicycle in one hour. Weighing 17 lbs., the engine provides a top speed of 34 m.p.h. Kit sells for \$97.50. Wil-Gard Specialties, Inc., 4014 W. Parker Ave., Chicago 39, Ill.

5. CARPET AND RUG stains caused by coffee, liquor, juices and many other products in everyday home use can be removed with squeeze-spray odorless, non-toxic, non-flammable Stain-Ex. Harmless to fibers and skin, it leaves no ring although no rinsing is required after use. Price is \$1.20. Positive Products Laboratories, 28-11 Astoria Blvd., L.I. City 2, N.Y.





You supply the cargo...



Ford supplies the wagons (more than anybody else in the business)

Nobody else gives you this wide a choice (15 models! 4 sizes!). Nobody else makes 'em this carefree (routine service is needed only twice a year or every 6,000 miles!). Here's the lively line-up:

Full-Size Fords—4 beautiful models including the distinguished Country Squire. Attic-size room...a ride like velvet. Swing-Away

steering wheel and deep-foam bucket seats, optional.

Middleweight Fairlanes—all-new for '63. They carry like the big ones, cost like some compacts.

Compact Falcons—they're big on gas economy, low on price. Over 7 ft. of flat, usable loadspace. Power-operated rear window standard in Falcon Squire.

Big Club Wagons—They handle twice the cargo of full-size wagons—yet cost less than some compacts! Can carry 8—can be equipped to sleep 4!

*Except Station Bus and Club Wagons



America's longest, liveliest
line of wagons

FORD
FALCON • FAIRLANE • FORD

Talk about wagons...your Ford Dealer has more to talk about



NEW FROM OUTBOARD MARINE...

**THE BEST THING THAT'S
HAPPENED TO WATER IN YEARS!**

Until OMC Boats came along, nobody ever made such a concerted effort to engineer out all the exasperations of boat ownership; to engineer in all the travel comfort, dependable performance, uncomplicated operation and ease of maintenance of the family car!

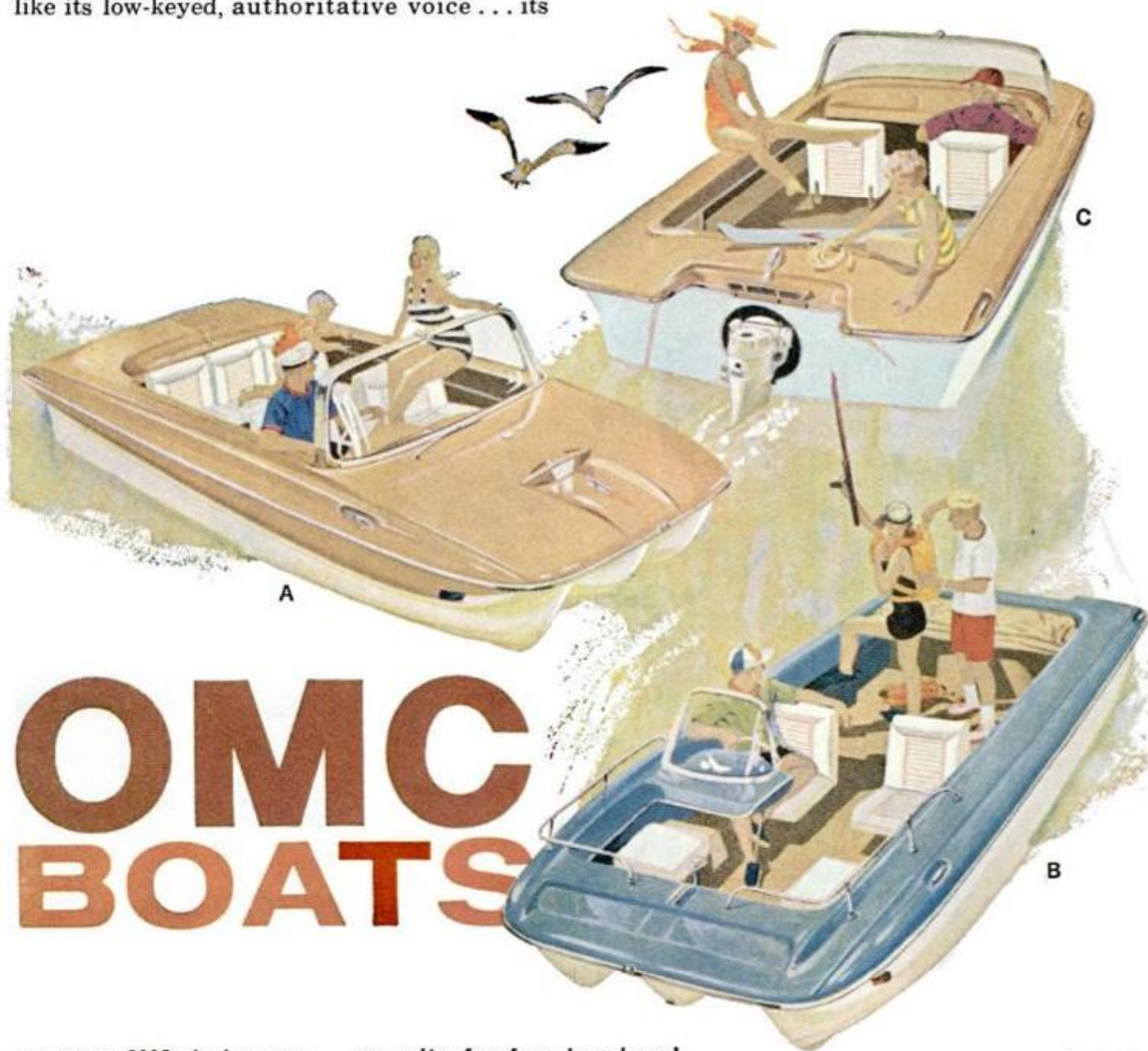
It's a new idea in boating, starting with a unique hull that resists tipping no matter how tight the turn, how lopsided the load... with the speed characteristics of a 3-point hydro plus twin sponson displacement smoothing the ride... with stability and handling ease even a novice can appreciate.

Tucked in the stern is the 88 hp OMC 488 stern drive — a V-4 with 4-barrel carburetor. You'll like its low-keyed, authoritative voice... its

eagerness to get up and claw water when you lean on the throttle. (*The fabulous OMC 17 Dual Deluxe has TWO of these sweethearts — each with its own running system — for a sizzling 176 horsepower!*)

And boating was never easier! No extras to buy, no complex get-ready, no toilsome maintenance. Your big difficulty will be deciding which of OMC's 5 brilliant models suits you best — and prices are much lower than rumor (or the boats themselves) would lead you to expect. See your OMC dealer!

Opposite: OMC 17 Dual Deluxe. A. OMC 17 Deluxe. B. OMC 17 Seasport. C. OMC 17 Custom.



OMC BOATS

see your OMC dealer now... or write for free brochure!

©1963, OMC BOATS, Dept. PM-3, A Division of Outboard Marine Corporation
Waukegan, Illinois. In Canada: Peterborough, Ontario. Patents pending.



OMC 17 Deluxe. First Award Winner, Marine Interior Design Competition, Sponsored by American Institute of Interior Designers and Popular Boating.

Get Lucky

the taste to start with...the taste to stay with



The taste of a Lucky spoils you for other cigarettes. This famous taste is the best reason to start with Luckies...the big reason why Lucky smokers stay Lucky smokers. How about you? Get the taste you'll stay with. Get the fine-tobacco taste of Lucky Strike.

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HOW SPACE DETECTIVES RATE RUSSIA'S MOON PROBES



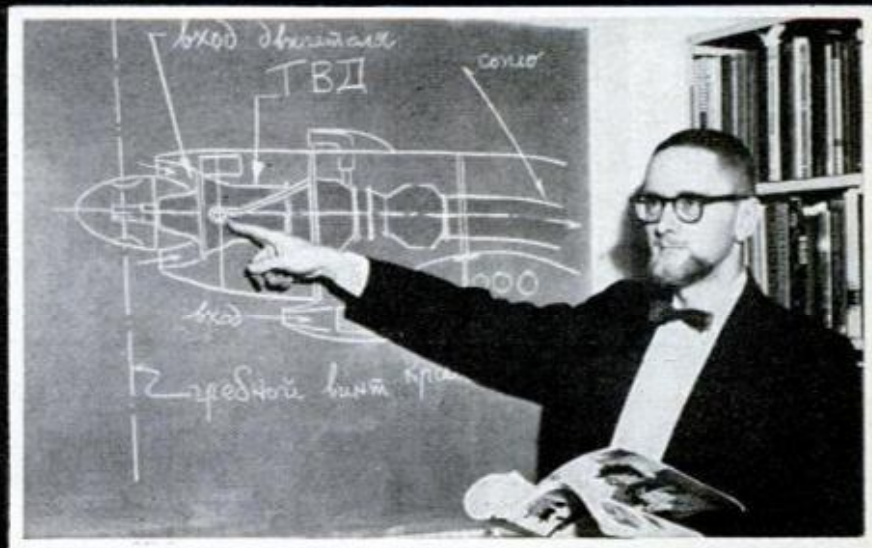
By S. David Pursglove

WHAT DO AMERICAN EXPERTS KNOW about the super-secret Russian space program? How soon will the Soviets land a space vehicle on the moon?

Thanks to a dedicated group of U.S. "space detectives," who work on their own time, we know a great deal more than the Russians would like us to know. Here are a few revealing facts about Soviet space vehicles these men have deduced:

- A Russian space ship fires 550 pounds of solid propellant to slow itself for re-entry into the earth's atmosphere.
- A parachute 59 feet in diameter lowers the manned spacecraft to the ground at just under 30 feet per second.

Led by physicist Donald J. Ritchie, a group of "space detectives" use computers and scientific savvy to crack the secrets of Soviet space capabilities. From bits and pieces of information, they've created composites of possible Russian moon probe vehicles, above, which are described in this article.



- The space vehicles, called Vostoks, land on a target 500 miles in diameter, usually near the center.

- When the Russians launch one of their manned satellites, they have a 43-percent chance of getting it into a perfect orbit.

- The Russians can use their existing launching rockets to send a man around the moon and back by sending just seven Vostok-size pay loads into an earth orbit and there building the moon rocket. To land on the moon and return, 33 launches would be needed.

The Russians have not handed us these facts—at least not directly or willingly. Our space sleuths have had to dig them out, piece by piece. Thanks to them, we now know what the Vostoks and other satellites and weapons look like, how they are built, how they perform and what the Russians are likely to do with them next.

The space detectives are reputable scientists who for nearly a decade have been dissecting the Russian space and missile program. They don't do this work for the government or for industry. They want the freedom to discuss their results openly.

These men piece together bits of information dropped at international meetings and screen out planted misinformation. They analyze contradictory statements in Soviet publications. They evaluate each new Russian space feat. Sometimes they spot new satellites, parts of rockets or shadowy hints of missiles in photographs.

Often, the space detectives work only with the slim data that tracking stations are able to collect on satellite flights. Sometimes, pure mathematical analysis can confirm conclusions drawn from photos. And later photographic evidence is a double check on the data cranked slowly,

item by item, from electronic computers.

One space sleuth who uses all these methods is Donald J. Ritchie. At the Bendix Corporation's Southfield, Mich., Research Laboratories Division, mathematician-physicist Ritchie is the assistant department head of the new Technology Department. His official duties run the spectrum from radiation weapons to arms control programs. But he is not paid to analyze Vostoks. He does that on his own.

Shortly after the first manned satellite, Vostok 1, orbited on April 12, 1961, Ritchie met with three Southfield colleagues: R. W. Duncan, G. A. Cornell and W. H. Gruber.

"Let's analyze the Vostok," he suggested. "Let's see what makes it tick."

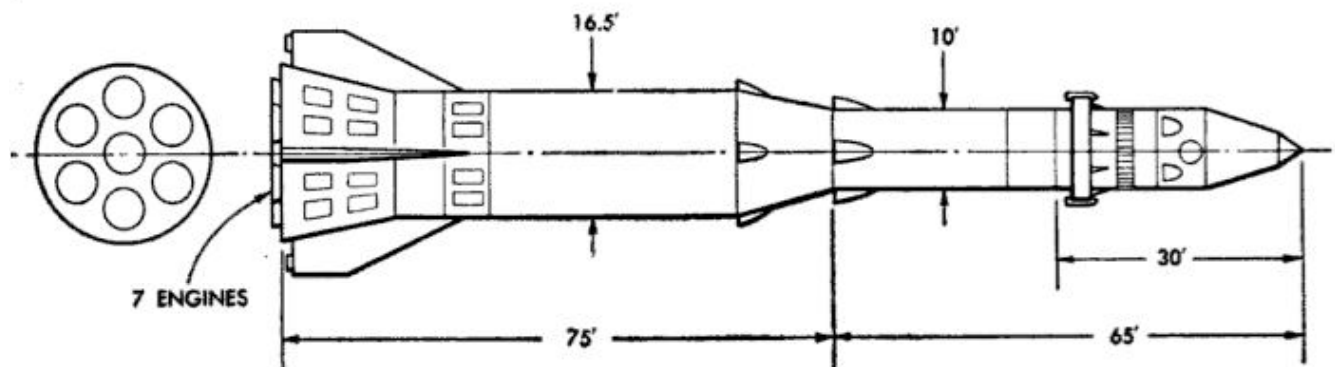
"How?" he was asked. "Where do we start?" We don't know anything about it."

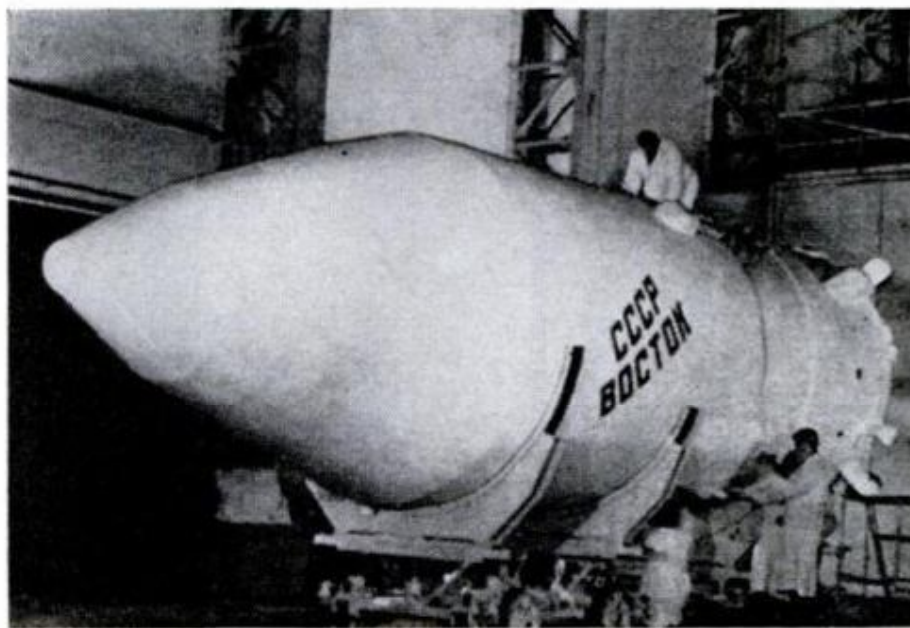
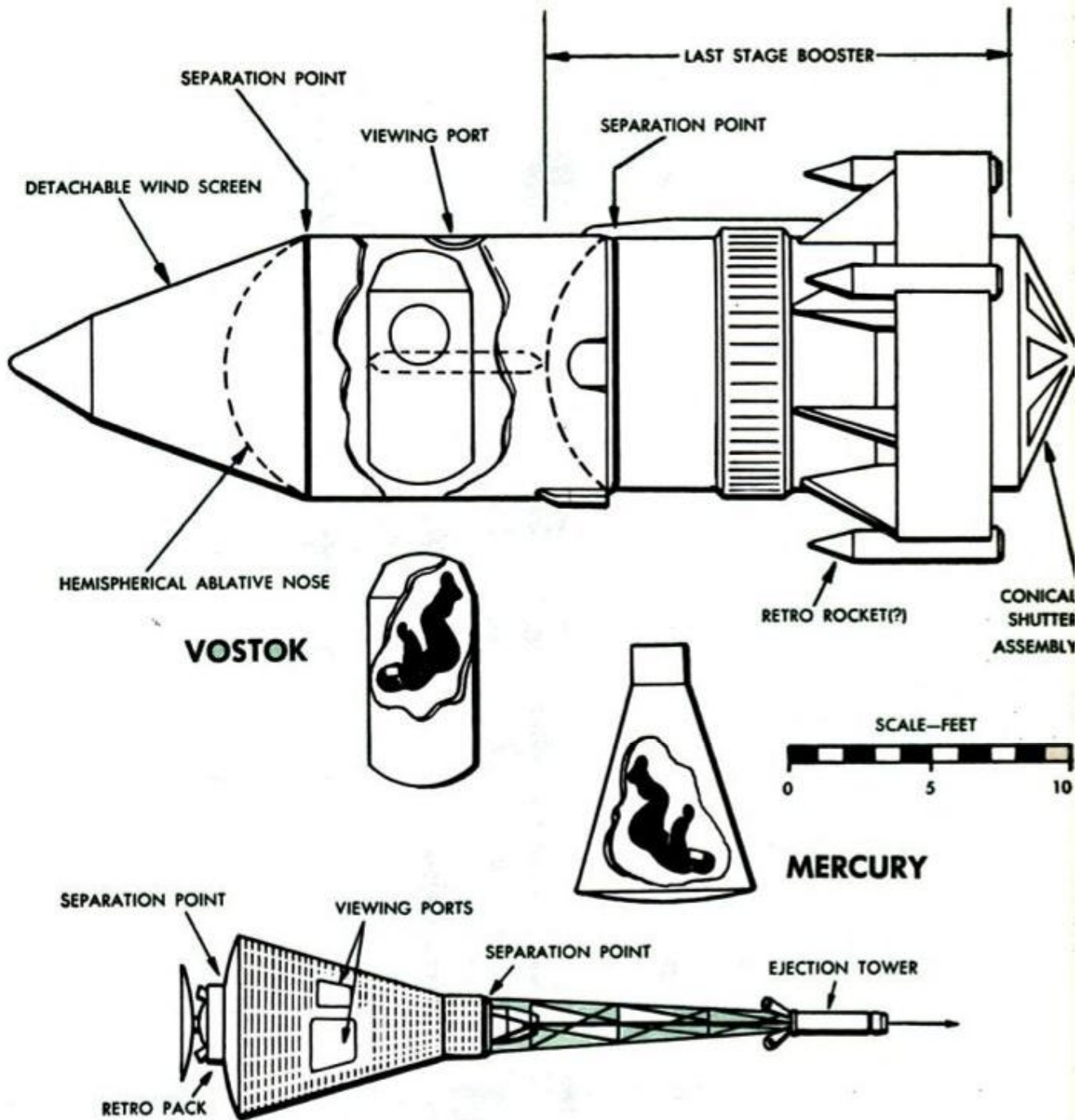
The Art of Space Detecting

"We know enough for a start," Ritchie pointed out. "We have the perigee. We have the apogee. We have the take-off time. We know where it was in orbit at all times and we have the landing time. Those facts have to fit laws of nature that are the same for Russia as they are for the U.S. With a computer analysis, we should even be able to draw a picture of what a Vostok looks like." The others grinned. Why not?

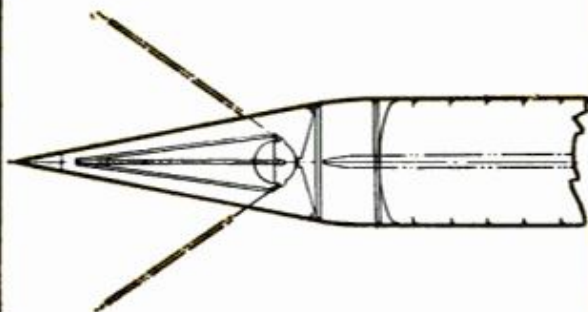
They started by plotting Vostok's exact orbit. They knew that high point (apogee) was 203 miles, its low point (perigee) 112.4 miles. Calculations based on the earth's radius (approximately 4000 miles), showed that the orbit was nearly a perfect circle. The slight difference between the actual orbit, and what Ritchie assumed to be the goal, a perfect circle, later helped him to determine the launching accuracy

VOSTOK 2 with its rocket booster probably looks much like this drawing by Ritchie; engineering and mathematical calculations gave him its dimensions

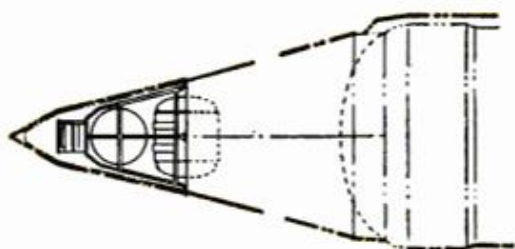




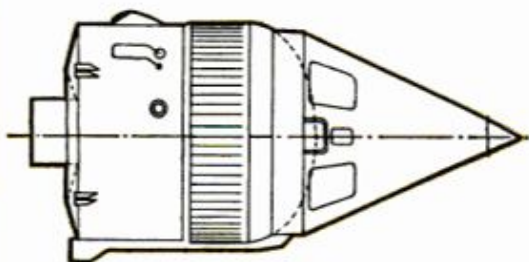
THE VOSTOKS (left, and top drawing above) are much bigger and heavier than Mercury components (bottom drawing) but their pilot capsules are roughly the same size. The sides of the Mercury cabin (at right in center of drawing) slope inward to avoid heat during re-entry



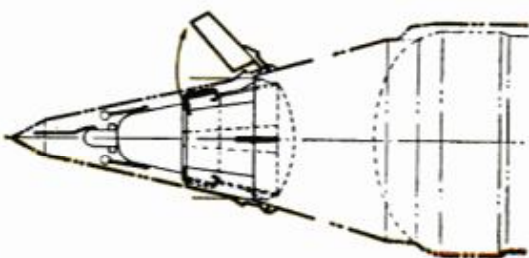
SPUTNIK I capsule went up in the nose of a T-1 rocket on October 4, 1957. Drawings of Red capsules were made by Don Ritchie



SPUTNIK II carried the first space traveler, a dog. Capsule dimensions were carefully calculated from scanty data available



LUNIK III, a model of which was exhibited in 1959, gave Ritchie clues to Vostok II dimensions; photos confirmed findings



SPUTNIK III has what appears to be an opening for catapulting an ejection seat. Drawings are one-fortieth of full scale

of Russia's big liquid fuel booster rocket.

Knowing the orbit, the mathematicians were able to calculate the exact speed and angle at which the Vostok was injected into its flight path.

With these facts established, the men turned their attention to re-entry. Engineering data told them that such a vehicle would have to enter the atmosphere at about a 3.5 degree angle to the "top" of the atmosphere, some 60 miles above sea level. A sharper re-entry angle would cause the craft to enter the dense air too rapidly and burn up; a lesser angle would cause Vostok to "skip off the roof" of the atmosphere and sail out into space.

To hit this angle, the retro-rockets would have to slow the ship at a rate of at least 440, and not more than 733 feet per second. A safe deceleration rate seemed to be about 587 feet per second. This helped in estimating thrust of the braking retro-rockets and the length of time they acted.

The estimates were plugged into equations and fed into a computer. The results were compared with the nearest set of figures that any rocketry engineer would try to achieve for the known conditions. The differences told the mathematicians just how accurate the braking system is (within five percent).

Another error analysis showed that timing of the signal to de-orbit was not critical. A 17-second error would mean only an 81-mile shift in the recovery zone on the ground. The retro-rocket propellant, apparently, is a fairly standard product; thus, 553 pounds of it firing for exactly three seconds would put Vostok into its proper re-entry trajectory.

An analysis of the trajectory showed that the ship uses a single application of

EJECTION SEATS, which space sleuths spotted in pictures of the Vostok, won't be used in U. S. space vehicles until Project Gemini becomes operational



braking power; the braking thrust is not applied in spurts. This indicates that solid propellants are probably used for braking Vostok; a start-stop-start system generally uses a liquid propellant.

The deceleration figures also revealed the G-forces acting on the cosmonaut's body. These were high enough to confirm the earlier supposition that the pilot lies on his back in a cabin that has to be turned around between blast-off and re-entry.

It was fairly simple to calculate a heating profile from the trajectory and make an educated guess as to the structural materials. The profile showed that Vostok probably has very little internal cooling. This means that most of the re-entry heat probably is absorbed by an ablative material and the kind of shock wave that is created by a blunt shield rather than a pointed nose. This is the way it's done with Mercury capsules, but with a major difference that was discovered later.

How was Vostok eased to a landing after entering the atmosphere? Complete re-entry required about 30 minutes for a ship of its known weight, velocity and trajectory. Safety considerations place a 30-foot-per-second limit on the speed at which such a vessel could hit the ground. The scientists figured that recovery should begin at about 23,000 feet altitude; a parachute 2750 square feet in area, or 59 feet in diameter, would do the trick.

Before they had finished with Vostok, the space sleuths not only knew how the spaceship operated; they also knew all the ways in which it might fail to operate, and what would happen in the event of various errors. An error in re-entry speed of not more than 25 feet per second, Ritchie reasoned, would be permissible.

FROM CLUES gleaned in frames from Red newsreels, like the one below, our experts determined that the cosmonauts' cabin was inside a sealed capsule



MARCH 1963

And Vostok's orientation at the re-entry signal must be accurate within 0.75 degree.

"These are the limits of permitted error," Ritchie told his team. "Now, what size of target do the Russians need if such a ship is going to hit it 95 times out of 100?"

The investigators picked, arbitrarily, several impact area sizes that seemed reasonable for this size ship. Working backward from these target sizes, they found the sets of errors that could be tolerated by each. Finally, they found a target size that was close to Ritchie's specifications. Once in the right ball park, they were able to refine their equations for the computer. Here's what it said:

A re-entering Vostok can hit an area 500 miles in diameter 95 percent of the time.

What percentage of the time Vostoks can hit the center could not be calculated, but they can succeed most of the time.

Questions Bring Answers

"What about launching?" Ritchie asked. "What's the chance of a perfect orbit?"

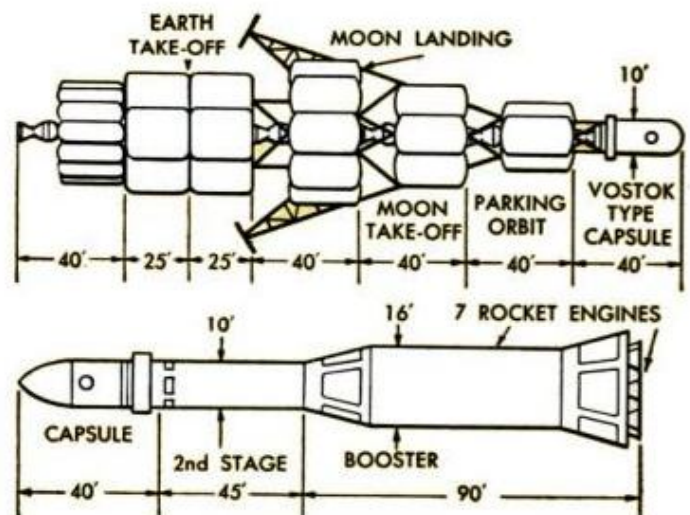
The scientists went back to accuracy figures on perfect circle orbits and orbits actually achieved. The differences showed that the maximum permissible error in speed on injection into orbit is 100 feet per second. The angle had to be accurate within 0.45 degree. Any launch that met these limits could be considered "perfect."

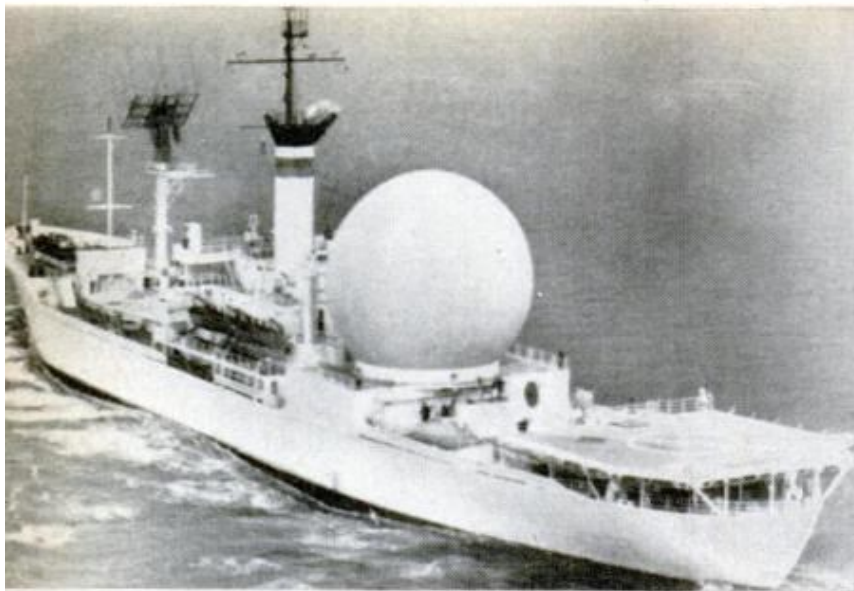
Computer analysis indicated that the Russians can expect to achieve a "perfect" orbit 43 percent of the time.

Ritchie's teammates have moved on to other fields, but he still devotes all of his non-workday energies to analyzing Soviet space and military rocket programs. However, he is not alone. There are perhaps a

[\(Please turn to page 228\)](#)

A MOON LANDING VEHICLE, top, could be assembled in space with 33 payloads in booster, below. Voyage around the moon would require only seven launches





Satellite Watcher at Sea

Perched like a huge golf ball on a tee, a new seagoing satellite communications terminal, mounted on the deck of the USNS *Kingsport*, was unveiled recently at the Philadelphia Naval Base. The 53-foot inflatable plastic radome contains antennas for tracking satellites, as well as ship to shore radio. The rebuilt Victory-type cargo ship is equipped with a helicopter landing platform aft.

The communications terminal is the fourth such system (and the first seagoing one) to be put into service—all for use by the Army in testing space-communications.

They're Closing In, Kids

Teachers who dread scoring test papers should welcome the Grademaster, a new electronic scoring machine developed by Electronics for Education, Inc., Kensington, Md. It automatically grades 150 papers in 30 minutes, with wrong answers marked and the total number of incorrect answers printed on each page. Special answer sheets are required for use in the machine. They are available from the manufacturer.



One-of-a-Kind Fishing Boat

With a tractor inner tube attached to a metal frame, Jack Potts of Paola, Kans., fishes in water that is too deep for wading but unhandy for a boat. Iron pipes comprise the framework of the homemade craft. It is equipped with a metal tractor seat, metal brackets for rods and a tray for his tackle box. He wears rubber waders to keep dry while fishing and carries two small paddles for propulsion.



POPULAR MECHANICS



Air-Rescue Trainer

The fuselage of a crashed helicopter was salvaged at Stead Air Force Base in Nevada and turned into a training stand to teach downed airmen how to be rescued with a helicopter sling.

Pilots learn how to don the sling, and helicopter crewmen get lessons in how to operate a hoist.

A Matter of Taste

A man's taste buds may have something to do with the fact that he's got high blood pressure. In reporting this theory, three Johns Hopkins researchers said that high blood pressure patients eat more salt than a healthy person, apparently because they can't taste it as well. High salt intake may even cause their blood condition.

In taste tests, 20 patients with high blood pressure and 20 healthy persons were given cups containing distilled water, salt solutions and sugar solutions. The group with high blood pressure needed salt concentrations two to 16 times greater than the healthy group to tell which cups contained salt. No differences in taste requirements were reported for sugar solutions.

Solar Distillery

Moisture in the soil, distilled by heat from the sun, can provide water for areas not served by water lines. A system developed in Japan uses plastic "greenhouses" to trap solar heat, which distills water from the soil by evaporation. The water is collected in pipes and stored in reservoirs.

A square meter (a meter is 39.37 inches) of soil yields one liter (about one quart) of water daily. Necaquarius equipment is sold by Nippon Electric Co.



Giant Aerator for Rivers

Joining the battle against river pollution, a floating aerator puts five tons of fresh oxygen into a river every day.

A pair of 10-foot aerating cones are rotated at the water's surface by two diesel engines. As the water is thrown off the periphery of the cones it takes fresh oxygen from the air. It was built by Yeomans Brothers, Melrose Park, Ill.



PM OWNERS REPORT
A Nationwide Survey Based on
909,048 Owner-Driven Miles

Owners Like Rambler's Handling, Thrift, Complain of Wind Whistle

Boldface comments by Jim Whipple,
PM's Automotive Editor

This includes low repair costs, higher trade-in as well as good fuel mileage. As owners tell it, Rambler is a regular → piggy bank on wheels

To appreciate this, get five friends and sit in other compacts of → Rambler's length; Rambler is as big as any, bigger than most

RAMBLER OWNERS, it seems, are no ordinary breed. They are a practical and thrifty group who look on their motor cars as proof of their good sense, rather than as impressive symbols of their personal affluence.

Although they appreciate the styling of Rambler's brand-new body, some 67.8 per cent stated that their purchase of a 1963 Rambler was most influenced by a desire for economy. Perhaps the many ministers, farmers, government workers, school teachers and retired people among them help to explain the emphasis on thrift.

The second-ranking influence to buy, mentioned by 48.7 per cent of all owners, was size, indicating an appreciation of Rambler's exemplary combination of compact exterior dimensions with roomy interiors for the passengers.

OWNERS LIKE

Handling Ease
Comfortable Ride
Fuel Economy

DISLIKE

Excessive Wind Noise
Catchy Horn Ring
Sunken Floor Well



SPARE LIES flat at the right, taking up space on the trunk floor. Low lip makes it easy to lift luggage into the trunk. Bumper has little room to flex before effect of an impact reaches the body sheet metal

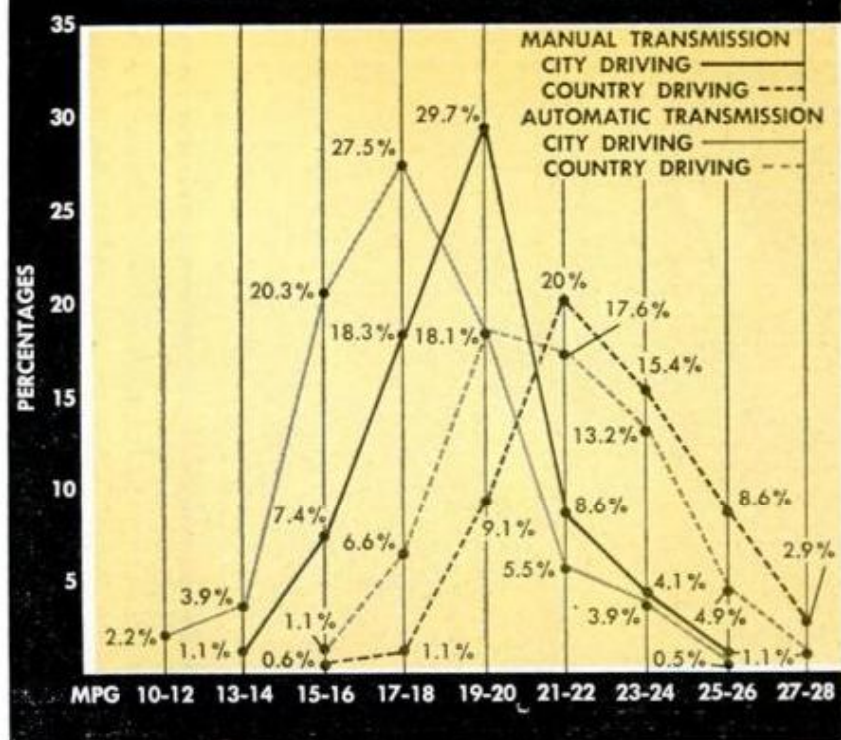


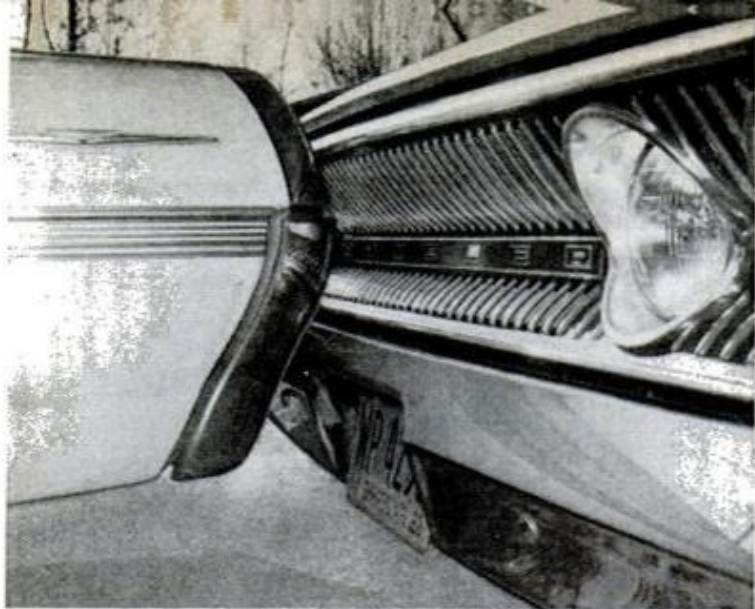
REAR DOOR opening is cut back to ease entry and exit. Owners reported they like the roof line and lower Rambler silhouette, but many also complained about the floor well, 5½ inches down below the rear door sill



MOST OWNERS of automatic-transmission Ramblers get close to the fuel economy enjoyed by their manual-shift cousins in similar driving

WHAT MILEAGE DO RAMBLER OWNERS GET?





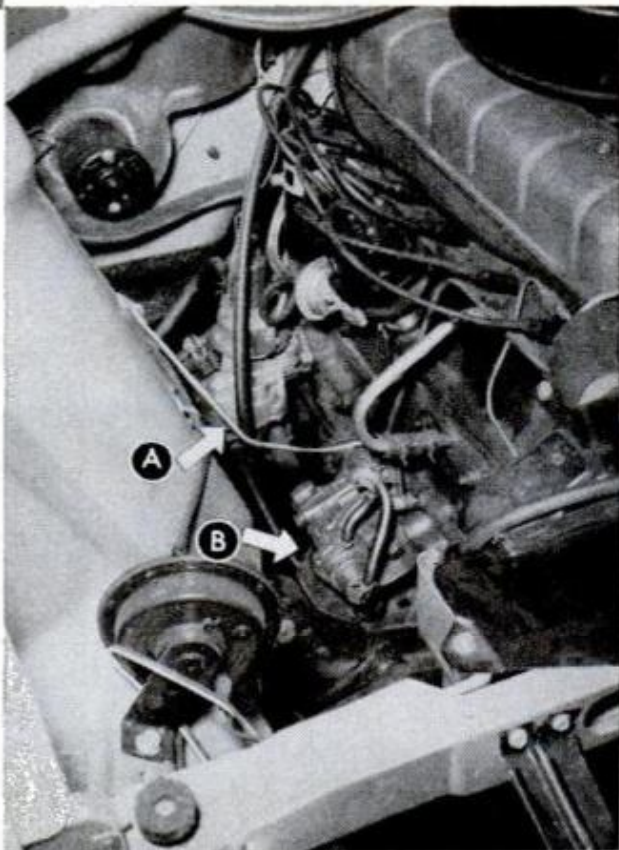
CONCAVE GRILLE with inset headlights was fourth among the styling features Rambler owners liked. They also noted clean smooth lines. But the grille is uncomfortably close to the front bumper, leaving it vulnerable to accidental damage when drivers park by the braille system



LARGE CUTOUTS around the rear wheels make attaching chains comparatively simple. Just lay the chains out, back over one end, and pull the free end up over the tire. Some owners, however, reported they were unhappy with Rambler's change from 15-inch to 14-inch wheels for the 1963s

A FRACTION of an inch of movement at the shift lever operates an electric switch to dump pressure that kept the clutch engaged. But the shift throw is long from first to second

E-STICK is Rambler's name for its automatic clutch system. As the engine's speed drops, the clutch spring operates through the servo unit (A) to overcome the remaining oil pressure from the pump (B) and disengage the clutch. Thus you can stop the car without killing the engine



Rambler owners are more responsive than the average group of PM owners surveyed. They're quick to spot design flaws and production faults, equally ready to praise the virtues of their cars. For example, 28 per cent mentioned Rambler's long-time feature, reclining seats, as a best-liked feature, while the car's below-average trunk space drew fire on the list of Least-Liked interior features.

Rambler's reputation for economy will not be tarnished by the new model as a large percentage of owners—some 61.9 per cent—felt that fuel mileage was as good as expected. That's even better than the 57.5 per cent who felt the same way about their 1962 Ramblers in last year's report (March 1962, PM p. 98).

To check fuel consumption, PM ran steady-speed fuel tests on a series 550 Classic four-door with E-Stick and single-barrel, 127-horsepower engine.

Our results were: 28.2 miles per gallon at 30 m.p.h.; 25.1 at 40 m.p.h.; 22.1 at 50 m.p.h.; 20.4 at 60 m.p.h. and 17.8 miles per gallon at 70 m.p.h.

Over-all mileage was 20.8 miles per gallon.

In spite of the special problems that come with putting an all-new car into production, the '63 Rambler was generally rated higher than last year's by owners. Here's how the percentages compare:

	1962	1963
Excellent	61%	63.3%
Good	32.4%	31.1%
Fair	3.5%	4.2%
Poor	3.1%	1.7%

The five features Rambler owners like best, in the order in which they were most often mentioned, were as follows:

"It has the handling and riding qualities of cars 1000 pounds heavier."—North Dakota prison officer.

"Drives and handles as well as an Olds or Pontiac, of

[\(Please turn to page 242\)](#)

Rambler was reduced two inches in length while wheelbase went up four inches, moving rear wheels back as bumper came forward. Something had to give and it was the trunk

We were running in quite cold weather in city, suburban and turnpike driving. So over-all mileage is quite respectable

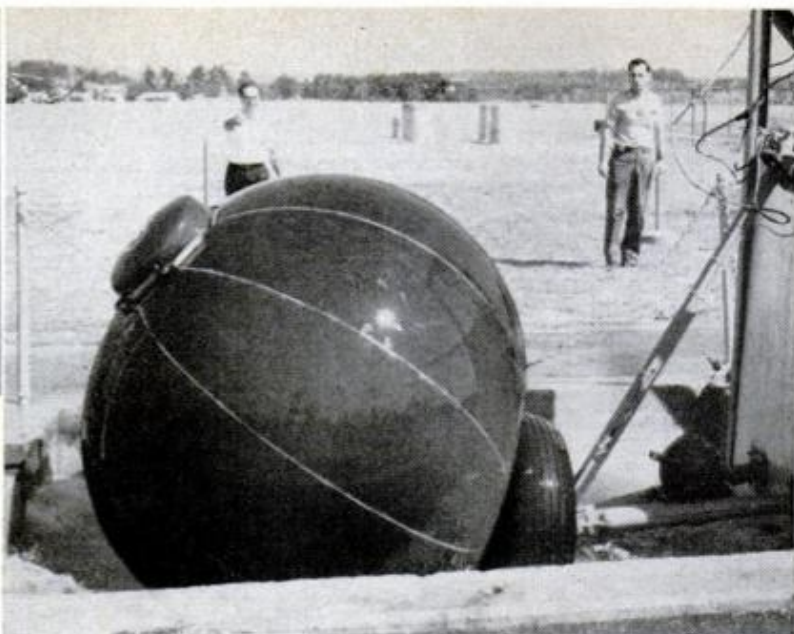
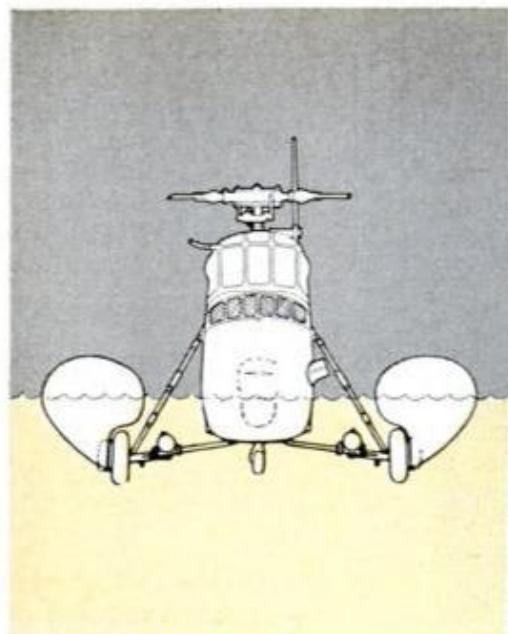
SUMMARY OF OWNERS REPORT



- Satisfied with automatic economy?**
 - About as expected59.4%
 - Better16.6
 - Not as good24.0
- Satisfied with manual economy?**
 - About as expected64.0
 - Better20.0
 - Not as good16.0
- Best liked features**
 - Handling ease52.9
 - Riding Comfort29.4
 - Economical27.5
 - Styling27.2
 - Roominess18.2
 - Easy to park11.5
 - Visibility11.2
 - Power, performance10.6
 - Compact size9.0
 - Solid, rattle-free body8.4
- Most frequent complaints**
 - Excessive wind noise34.7
 - Horn ring catches sleeves11.2
 - Sunken floor well10.1
 - Doors hard to close8.7
 - Reduction to 14-inch wheels7.0
 - Poor gasoline economy3.6
 - Glass windows fit poorly3.4
 - No gear selector light3.4
 - Rattles and squeaks2.8
 - Hard to get in and out2.8

- Had mechanical trouble**
 - No trouble72.3%
 - Yes, had trouble27.7
- What was trouble?**
 - Thermostat5.3
 - Carburetor4.5
 - Oil leak3.1
 - Clutch, clutch pedal2.0
- Best liked exterior styling**
 - Curved glass windows17.6
 - Clean, smooth, streamlined styling12.6
 - Simple, functional lines7.0
 - Grille5.6
 - Lowered silhouette4.2
 - Roof line3.9
- Least-liked exterior features**
 - Curved glass windows4.2
 - Grille3.6
 - Door latches2.0
 - Tail lights1.7
 - Vent windows1.7
 - Trunk, rear deck1.7
- Best-liked interior features**
 - Reclining seats28.0
 - Seats10.9
 - Dashboard10.1
 - Upholstery7.8
 - Headliner7.3
 - Bucket seats5.3

- Least-liked interior features**
 - Transmission hump5.6%
 - Ashtrays3.4
 - Small trunk space2.2
 - Carpeting2.0
- Decision to buy Rambler based on**
 - Economy67.8
 - Size48.7
 - Style46.2
 - Owned Rambler before45.1
 - Comfort38.4
- Consider buying another compact car?**
 - Did not consider56.6
 - Did consider43.4
- What make of other car**
 - Chevy II30.3
 - Ford or Falcon24.6
 - Valiant10.3
 - Tempest7.1
- Is Rambler only car in family?**
 - Yes, it is68.6
 - No, it is not31.4
- How is dealer service?**
 - Excellent61.7
 - Average32.3
 - Poor6.0
- Would you buy another Rambler?**
 - Yes, would buy85.2
 - No, would not buy3.6
 - Undecided, don't know11.2



Pop-Out Balloons Float Helicopter in Emergency Ditchings

Like oversize bubblegum bubbles, two giant balloons automatically inflate from recesses in the main wheels of a helicopter to keep the craft afloat in ditchings.

The twin floats are carried deflated in the hub caps. When the wheels touch the

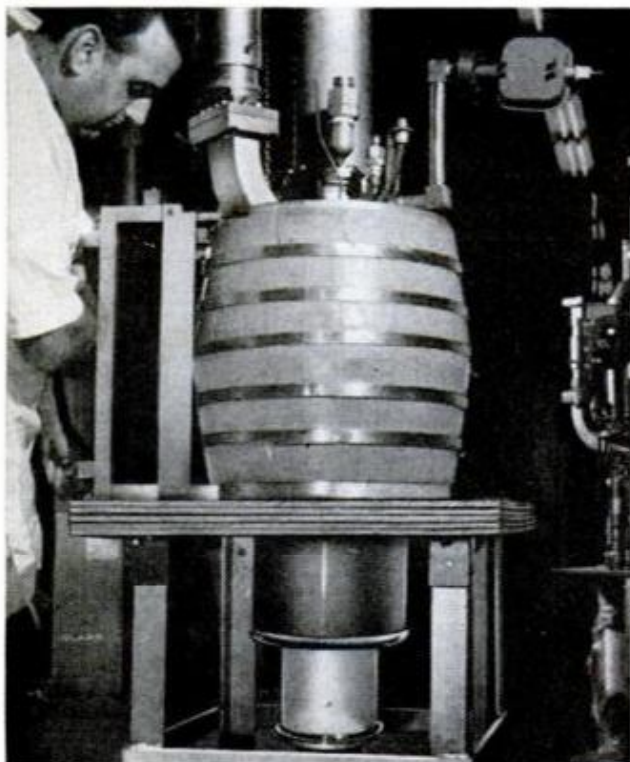
water, submersion valves trigger gas generators which explode the balloons to 5½ feet in diameter. A permanently inflated float is installed in the tail cone to give the helicopter three-point flotation. The system was designed for the Sikorsky S-58.

"Beer Keg" Magnet

Looking like a keg of the sudsy, this powerful magnet is used to focus electron beams through amplifier tubes. The Sperry Rand device provides tremendous power (up to 22,000,000 watts) and is smaller (20 to 25 percent) than ordinary electromagnets. It will make atom smashers and missile radar networks easier and cheaper to build, according to the manufacturer.

Self-Sealing Oxygen Mask

Pressure from the flow of oxygen inflates a cuff on an oxygen mask and forces it up against the face, forming a leakproof seal and eliminating adjustments. The oxygen then passes through perforations on the inside of the cuff and is breathed by the patient. The mask is thrown away after one use. It's a product of Chemetron Corp., 840 N. Michigan Ave., Chicago, Ill.





Great Lakes Surveyor

Forty-five-foot catamaran hulls that displace only 30 inches of water and twin water-jet propulsion units are the major features of the newest U.S. Army Engineer Lake Survey vessel, the *Johnson*.

Designed specifically for shallow-water hydrographic soundings, the twin hulls with 390 square feet of deck space reduce roll, pitch and yaw.

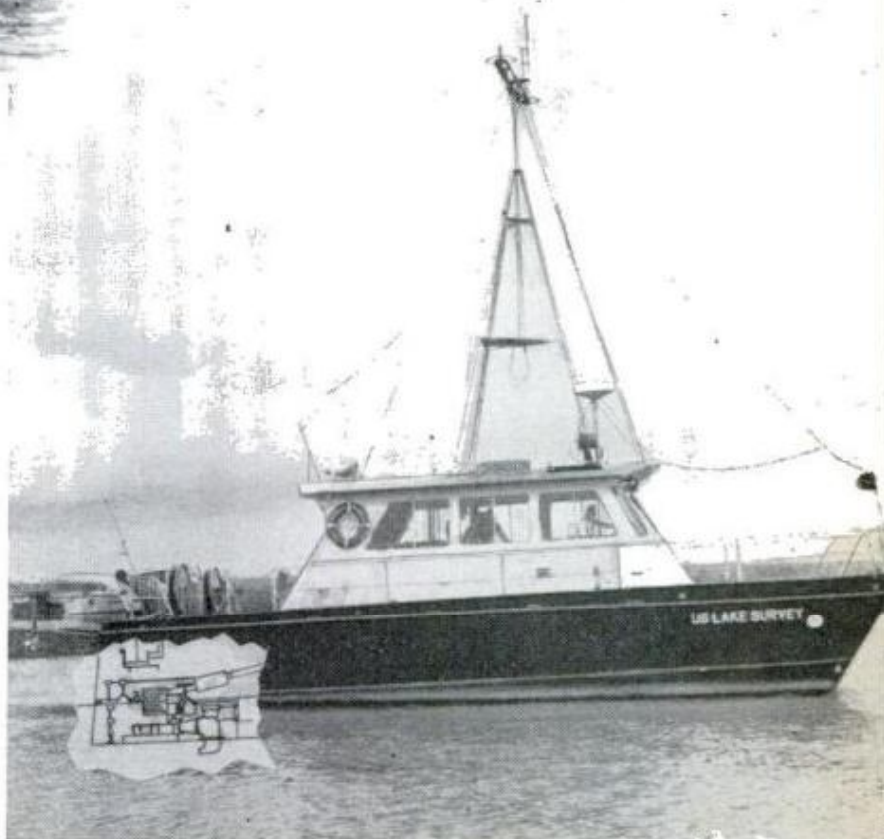
The water-jet units are operated off twin diesel engines. To power the extensive survey electrical system, two marine generators operate directly off the engines. The *Johnson* is also equipped with gyrocompass, spherical magnetic compass, radar, depth recorder, electronic positioning system, power capstan, wire sweep equipment and FM radio.

MARCH 1963



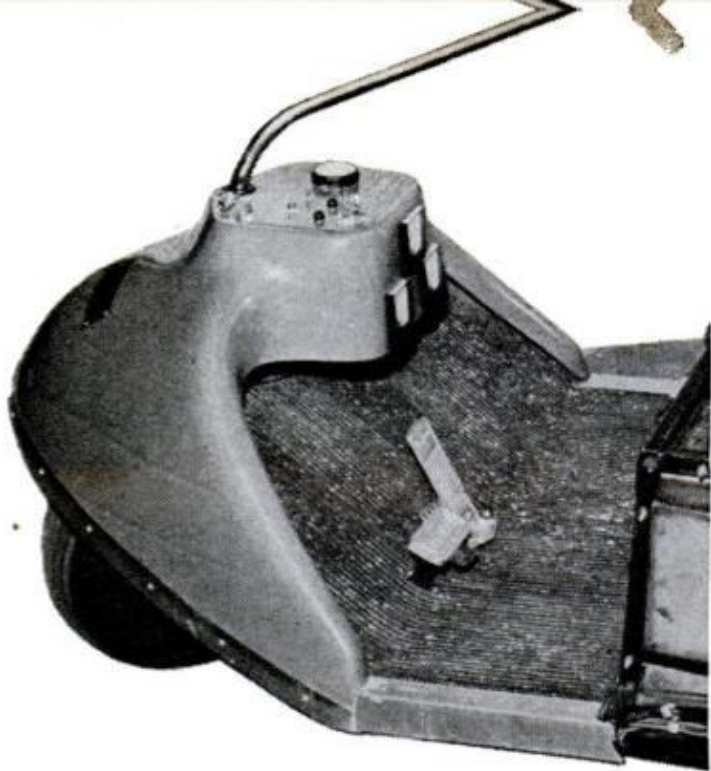
New Look in Bicycles

Easy disassembly for stowing, small (16-inch) wheels for rapid acceleration and rubber suspension for a soft ride are features of Alex Moulton's new bicycle. The British bike was recently pedaled 25 miles at an average speed of 26 m.p.h.

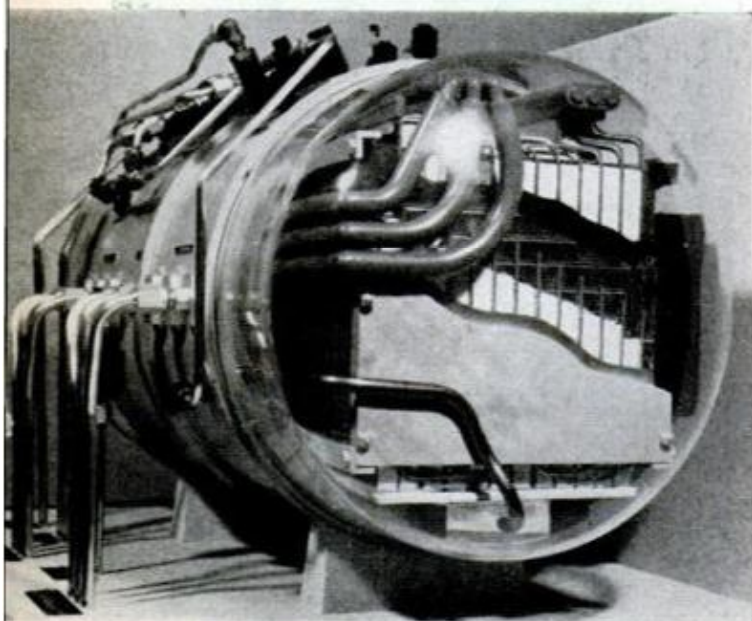


FUEL CELLS: Electricity in a Promising New Package

By Len Buckwalter and Bill Francois

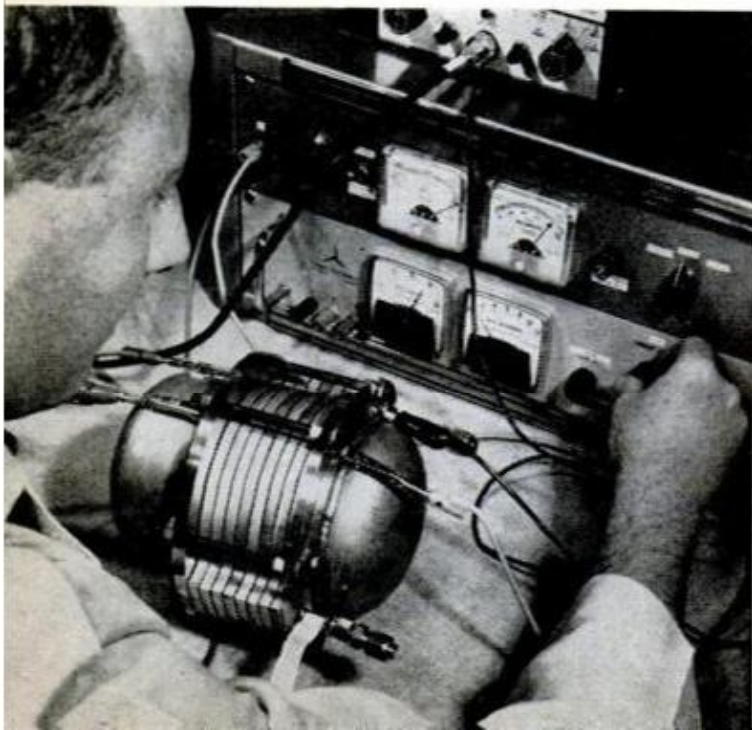


GOLF CART is powered by 60 Allis-Chalmers fuel cells. They replace the batteries that originally powered the unit. The cells deliver 3000 watts of electricity, use tanks of hydrazine and oxygen as fuel



CUTAWAY VIEW shows interior of GE fuel cell. It is an electric generator and a source of drinking water

HYDROX FUEL CELL developed by Electro-Optical Systems has nearly limitless life for use in spacecraft



WHIZZING AROUND a track at Chrysler is a scaled-down automobile whose engine spews neither noise nor smoggy exhaust.

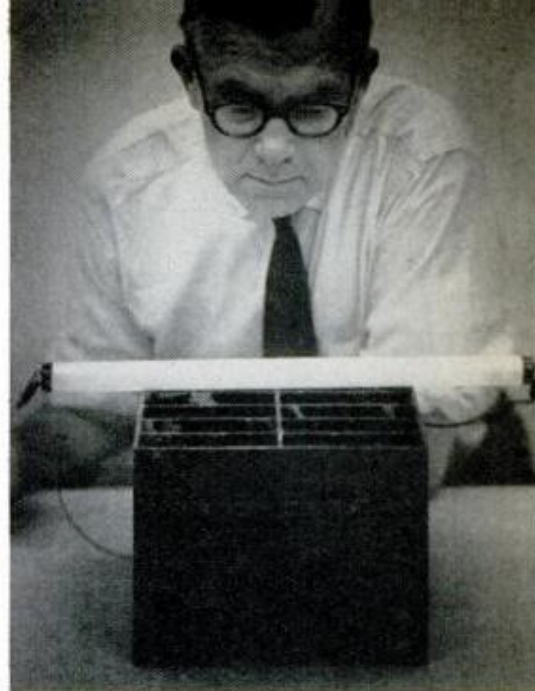
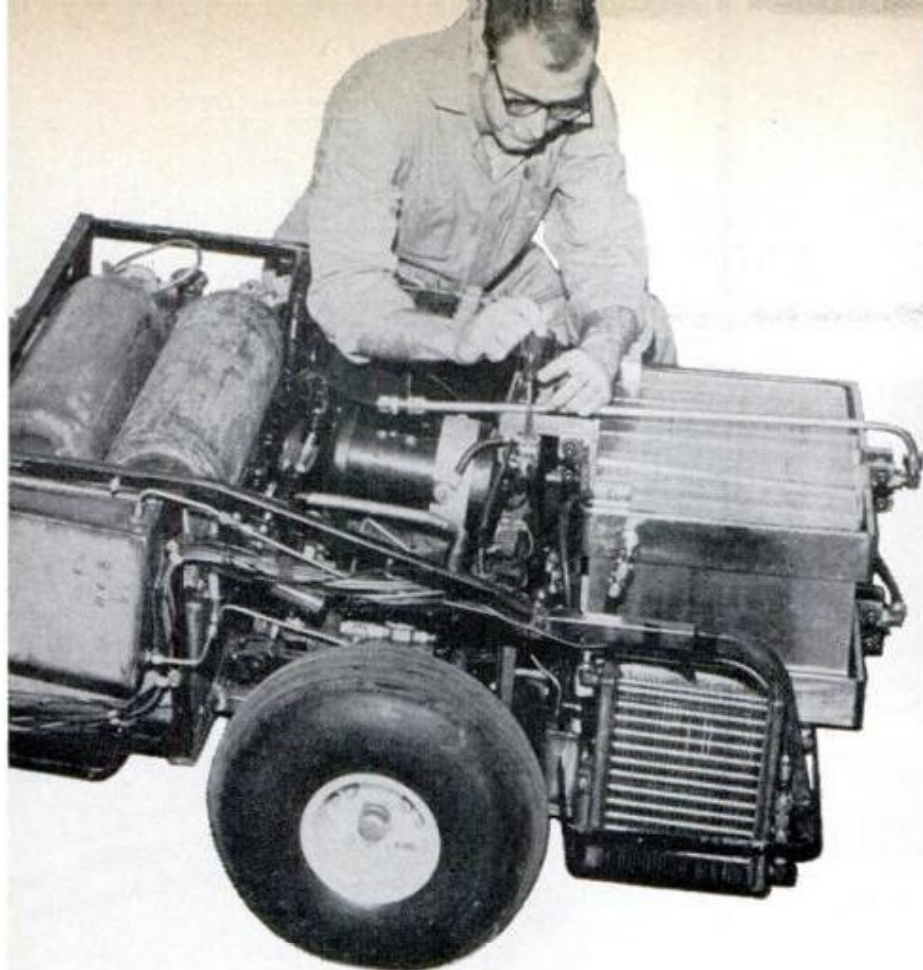
An engineless two and one half-ton tractor from Allis-Chalmers recently purred its way into the Smithsonian Institution.

In complete silence, a couple of G.I.'s operate their field radar without the giveaway sound of a gas generator to warn an enemy of their presence.

These are just three samples of what's happening in the fast-moving field of fuel cells. In each case the power push is provided by a neat electrical package operating on an entirely new principle. So promising are present-day fuel cells that big corporations, to the tune of \$30,000,000 this year, are scrambling to turn out a welter of pilot models. Even now, operational fuel cells are ready to ride into orbit aboard the Gemini and Apollo manned spacecraft. And the civilian market is being assayed by everyone from auto makers to oil companies probing the fuel cell potential.

Ever since man began generating electricity, his effort has been plagued by inefficiency. In a big power plant the conversion of coal to electric watts is a three-step process: burn fuel to create heat, make steam with the heat, then drive a turbine with the steam. Works fine, but more than half the energy locked in the fuel is wasted. Engineers have to live with troublesome

POPULAR MECHANICS



BACTERIA CELL looks much like a standard lead-acid type battery. Here it is being used to flash an ordinary fluorescent lamp. The cell requires no recharging; just add water and nutrient to keep it going

combustion that drives efficiency down to a meager 40 percent.

The fuel cell neatly detours the heating step. By converting fuel *directly* into electricity, efficiency balloons up into the 80 percent region.

That's only part of the story. When size and weight are figured, the fuel cell puts out about twice the power of nickel-cadmium batteries. The comparisons are even more impressive against the ponderous lead-acid storage battery.

To be sure, the fuel cell is not quite ready to displace your flashlight battery or go under your automobile's hood—not today, anyway. But a look at what the scientists already *are* producing is interesting and promising.

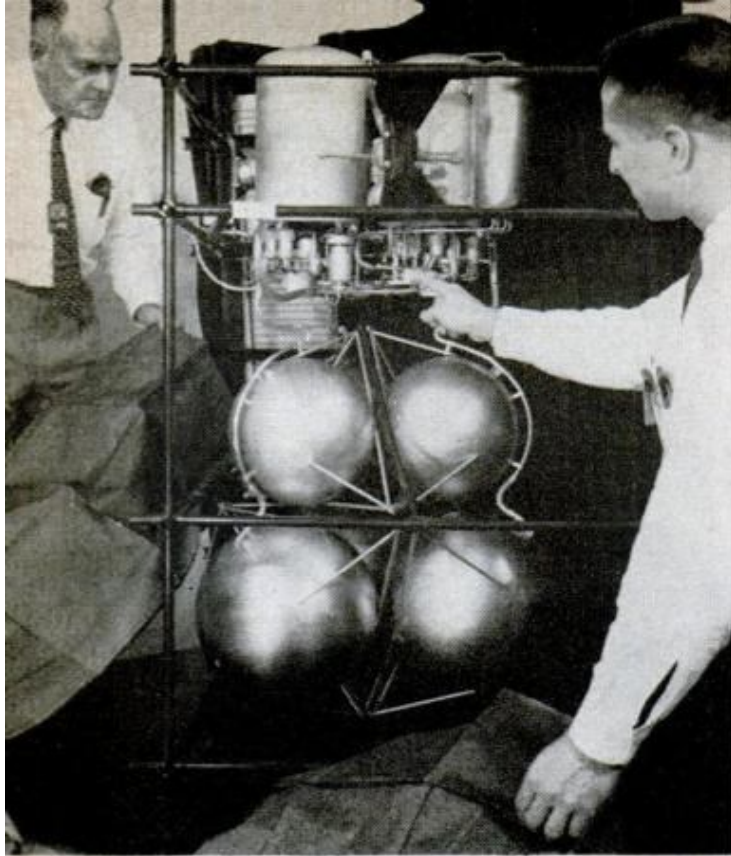
You may have watched a fuel cell operate in *reverse* in a high-school chemistry class. It's the classic experiment in which the instructor demonstrates that water consists of hydrogen and oxygen. As he passes an electric current through the water, its molecules absorb energy and break apart. If you reverse that process to bring oxygen and hydrogen together by adding a chemical catalyst that makes the gases combine, you wind up with water. That is the basis of the fuel cell. Not only does water appear, but electrical energy is released in the process. Curiously, heat is not a factor. The process from fuel to watts is direct and efficient.

This deceptively simple reaction represents the most advanced type of fuel cell today. It's the kind that will ride with the astronauts next year, providing power—and an "exhaust" of drinkable water.

What's holding up the unit for mass civilian markets? Chiefly, it's the cost of purified hydrogen. Cost is not a deterrent in military and space programs, where small size and light weight make the fuel cell powerfully attractive. In one special application, 55 pounds of fuel cell supplants a half ton of storage battery. In the market place, however, the device must be judged on a dollars-per-watt basis. If you watch your TV for an hour the cost of electricity is apt to be less than a penny. If you used a fuel cell in its present state of development, it would be more like a dime per hour.

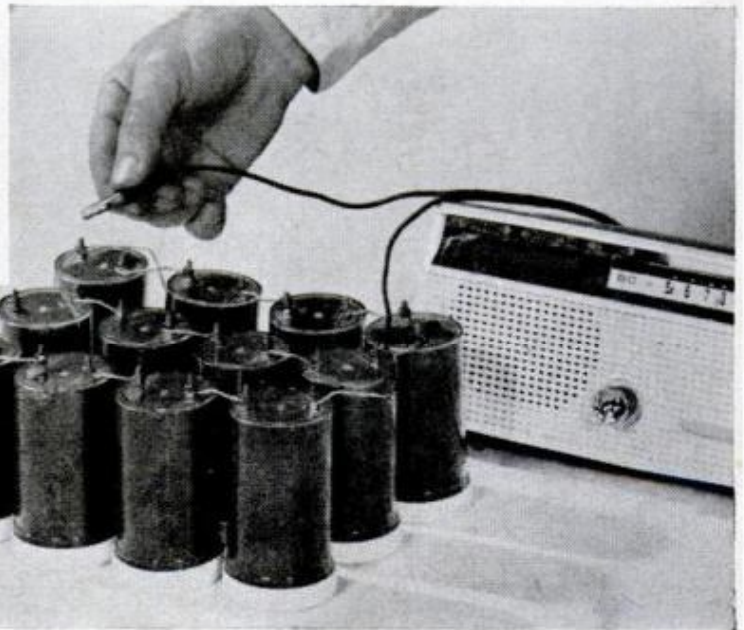
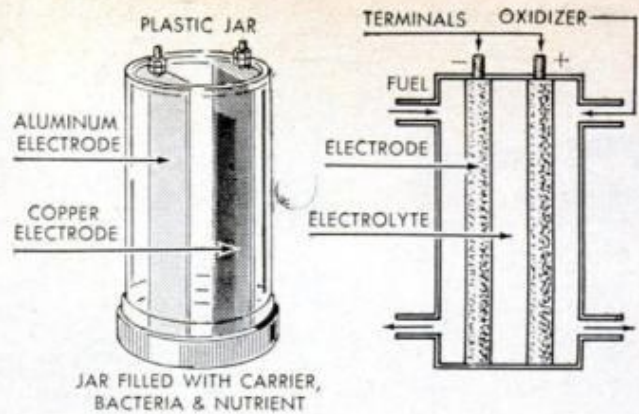
There's plenty of cause for optimism, however, in a rash of new designs that may slash fuel costs. The Redox (from reduction and oxidation) cell, for example, can deliver power with cheaper, impure hydrogen. Another major assault shapes up as the hydrocarbon cell. Instead of filling tanks with hydrogen and oxygen, the supply is gasoline, kerosene or some other hydrocarbon.

The cell behaves like a miniature refinery. It "cracks" fuel into useful gases which are then turned into electricity in normal fuel-cell fashion. The problem in



HYDROGEN-OXYGEN fuel cell, above, is made by Pratt & Whitney. To its right are the two fuel cells: the bacteria cell (left); hydrogen cell (right)

TRANSISTOR RADIO is powered by bacteria cells wired in series from a kit produced by Electron Molecule Research. Their bigger unit is shown on previous page



this approach is the heat needed for the cracking process; the fuel cell produces none of its own. Early models ran at 1000°F., but present units are down to 150°F. If cracking can be done at room temperature, some of the predictions on the fuel-cell automobile could bear fruit.

Scientists state that the answer now lies in finding the right catalyst to unlock hydrocarbon energy efficiently within the fuel cell. Other cheap substances like ammonia and alcohol also await a better understanding of these mysterious agents that activate chemical reactions.

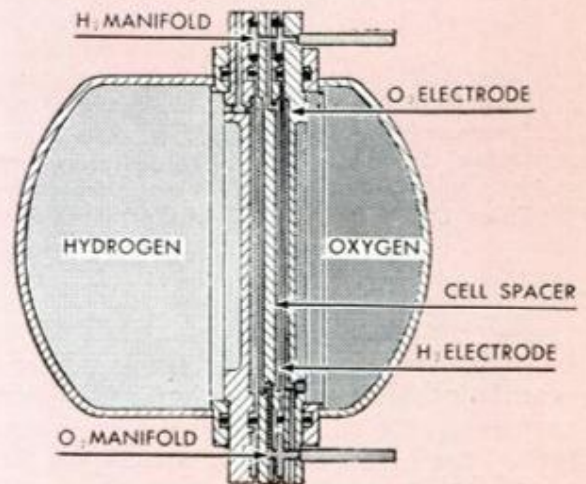
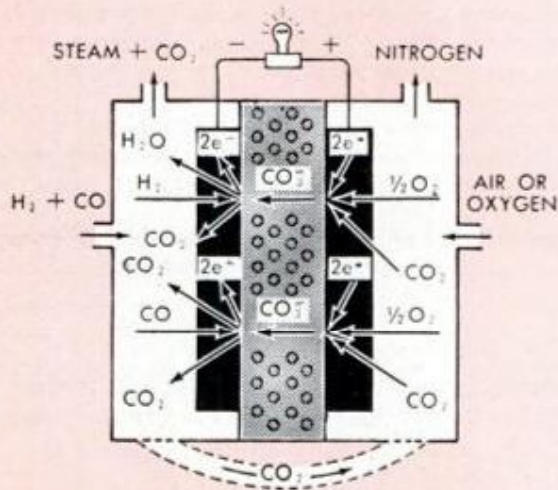
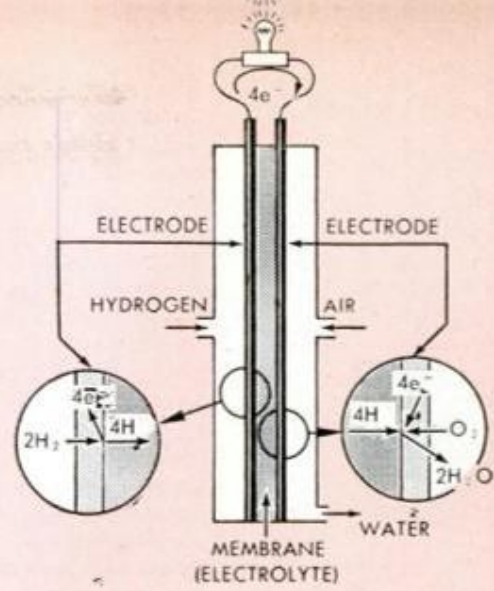
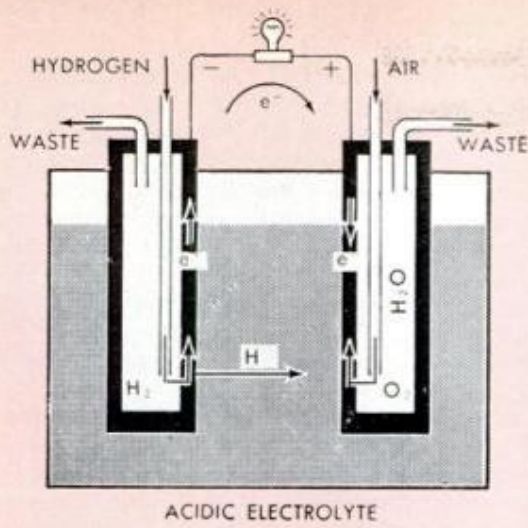
No one will go out on a limb at this time with definite dates for widespread application of the fuel cell. But in light of whirlwind developments over the past few years, we can attempt a rough timetable. From now until 1965, military-space projects will surely dominate the picture. Operational fuel cells will tend to be used where compact lightweight power (and not costs) are critical. From 1965 to 1970, they should enter a limited number of mobile applications, where large vehicles

are used to travel for short distances.

The Navy, for example, has awarded a contract for the development of a fuel-cell submarine. Aside from quiet operation, such a sub could perform limited-range missions where the higher cost of nuclear power is not justified. According to GE, the sub's propulsion system is now practical with known fuel-cell techniques.

As for automobiles and other general uses, researchers cautiously suggest 1970 as a year to watch. The implications of a fuel-cell car are startling. Efficiency would be about three times that of today's gas engine. Small electric motors driven by fuel cells would apply torque directly to the wheels. Transmission, radiator and bulky engine compartments are entirely eliminated. Brake shoes, drums and hydraulic cylinders give way to electrodynamic braking, a feature peculiar to electric-drive systems (now used in trains). Idling, warmup time, exhaust fumes and vibration all would be eliminated by fuel-cell power.

The most dramatic idea to date is the



INSIDE WORKINGS of major fuel cell types. Top left: hydrogen-oxygen cell. Top right: cell with membrane electrolyte. Lower left: Fuel cell with molten salt electrolyte. Lower right: Regenerative type cell

BELOW-FREEZING TEST of 30-watt GE fuel cell being evaluated by the U.S. Army, used for heating arctic clothing



CHANDLER RSCH
SECTION 108 APR 60

What's Happening in Fuel Cells?

Allis-Chalmers

Demonstrated full-size tractor powered by 1008 fuel cells. Building light-weight aluminum H-O models, three times better than earlier units. Trying ammonia as cheap fuel source. May market cell-powered fork-lift truck.

Autolife

Some success with hydrocarbon cells. Now trying for room-temperature operation. Working on a single-feed cell with alkali metal and liquid ammonia; can produce twice usual voltages at subzero temperatures. A research outfit sponsored by 46 corporations to conduct 5-year investigation in fuel cells.

Battelle Institute

Demonstrated auto and other lab models operating on H-O cells. Investigating alcohol as cheap fuel source.

Chrysler

Developing portable devices, such as warning light powered by bio fuel cell. Puts out kit for home experiments.

**Electron Molecule
Research**

Investigating low-temperature hydrocarbon cells. Fuel is ethane propane or ethylene. Sees potential use as individual home power plant.

Esso

Developed 2000-watt unit for Gemini space capsule. A unit for Air Force project destined for 30-day orbit. Designing sub propulsion equipment. Latest GE fuel cells double output of earlier models.

General Electric Corp.

Bio fuel cells (see text)

**General Scientific Corp.
General Motors Corp.**

Operating thermally regenerative cells. This type needs heat source but is 10 times smaller than others. Needs no refueling for years. Metal fuel breaks down, then recomposes repeatedly. Unit is being teamed with nuclear reactor which serves as heat source.

Pratt & Whitney

Building H-O cell unit to power Apollo; three-man moon flight.

**Sonotone and Electro-
Optical Systems**

Two companies working jointly on bio and H-O cells. Have lab model that uses sugar as fuel. Seeking artificial or natural enzymes to extract energy from waste matter.

Union Carbide

Built "Silent Sentry" for portable army radar. Developing highly porous carbon to provide great surface area, and thus high output, in small cells.

biological fuel cell. And here is where the scientists behave like alchemists about to turn lead into gold. It's no secret that perfectly harmless bacteria attack all kinds of offal—sewage, sawdust, garbage—with a prodigious amount of chemical activity. The process is similar to that which goes on in the human stomach. Enzymes are produced to break down substances into simpler, digestible form. If the chemical output of the germs can be harnessed in fuel cells, the power potential is staggering. Sea water, for example, contains a nearly limitless supply of microorganisms and waste matter.

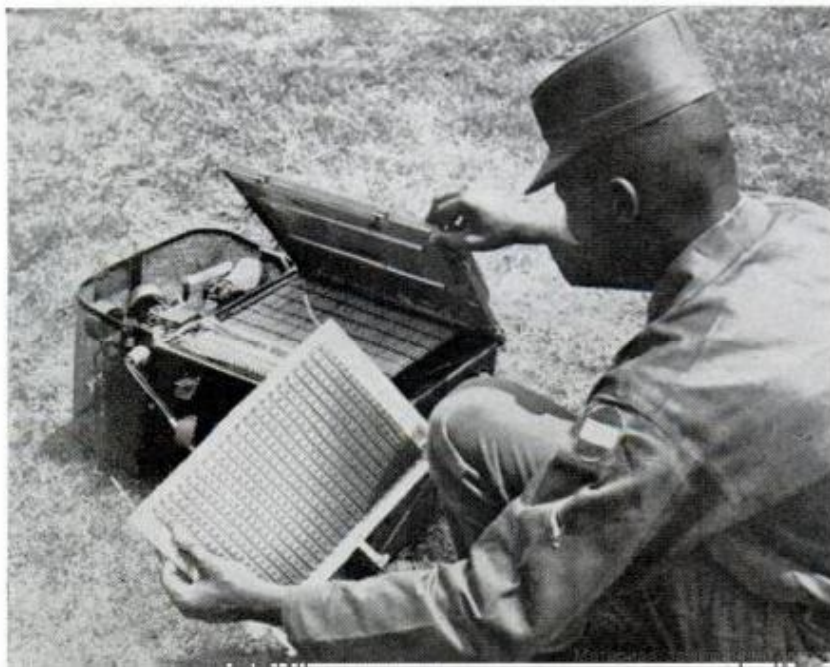
Like its predecessors, the bio fuel cell has descended from pie-in-the-sky to real

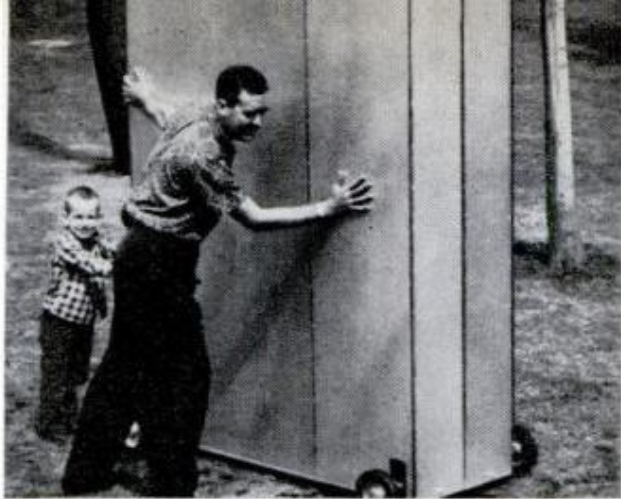
working units. Drs. Frederick Sisler and Robert Sarbacher of General Scientific Corp. have already demonstrated a working model. Their cell drives a boat that propels itself in a tank of sea water on power derived from bacterial action. An even more practical project is the Navy's navigational buoy that dips electrodes into the ocean to snare "free" power.

Precisely how a biological fuel cell works is still a matter of some conjecture. Nevertheless, its effects can be observed on a tabletop at home. With a kit marketed by Electron Molecule Research, anyone can set up a simple experiment to measure the output of a single cell. A small amount

[\(Please turn to page 206\)](#)

AIR-BREATHING fuel cell by GE is used to power military field radar and radio equipment noiselessly





Roll Out the Patio

Any spot in the yard becomes a patio in a matter of minutes with a folding aluminum shelter that can be wheeled about.

A compact boxlike structure when stored, Roll-O-Patio opens into a 10-foot wide shelter featuring a fold-up sun roof of colorful canvas on a tubular aluminum frame. Tables and benches fold out from the wall which is also equipped with shelf space. A built-in barbecue, screen enclosure and built-in folding chaise are available accessories at extra cost.

Made by Roll-O-Camp, Inc., Milford, Conn., the portable patio comes in the completed basic model for about \$400, and a do-it-yourself kit for about \$300.

MARCH 1963



Movable Column for Mower

Easy access to the operator's seat of a new riding mower is given by a steering column that moves out of the way. Another unusual feature of the Toro machine is a safety seat that stops the engine when the driver leaves his seat. Price: \$370 to \$425.

Pets Ride High

An adjustable platform over the rear auto seat keeps the family pet safely away from the driver, and allows it to ride sitting, standing or lying down. It is priced at \$9.95 by Pooch Perch, Hot Springs, Ark.



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POPULAR MECHANICS OWNERS REPORT
A Nationwide Survey Based on
975,856 Owner-Driven Miles

Ride and Pep Please Ford Galaxie Owners More Than Fuel Mileage



Boldface comments by Jim Whipple, PM's Auto Editor

SINCE THE LAST Owners Report on Ford (*PM*, August 1961, p. 92), the Division has been jumping. Major change was the spin off of Fairlane into a standard-size "super compact." This move left the former top-of-the-line Galaxie standing—like the cheese in the nursery song—alone. So in 1962 Galaxie was fissioned into a "standard" and a "deluxe" series: Galaxie and Galaxie 500.

Although the new automotive cousins compare to the previous Fairlane 500 and Galaxie of 1961, there has been an upgrading of trim and equipment, along with a full house of optional V8 engines running up to 427 cubic inches.

Ford continues to offer the 223-cubic-inch six-cylinder engine on the Galaxie, but acceptance has proved to be a low eight percent of the new Galaxie buyers.

This is a part of the move to lure some of the big car buyers down from medium-price field →

This engine is miscast pulling a 3700-lb. car →

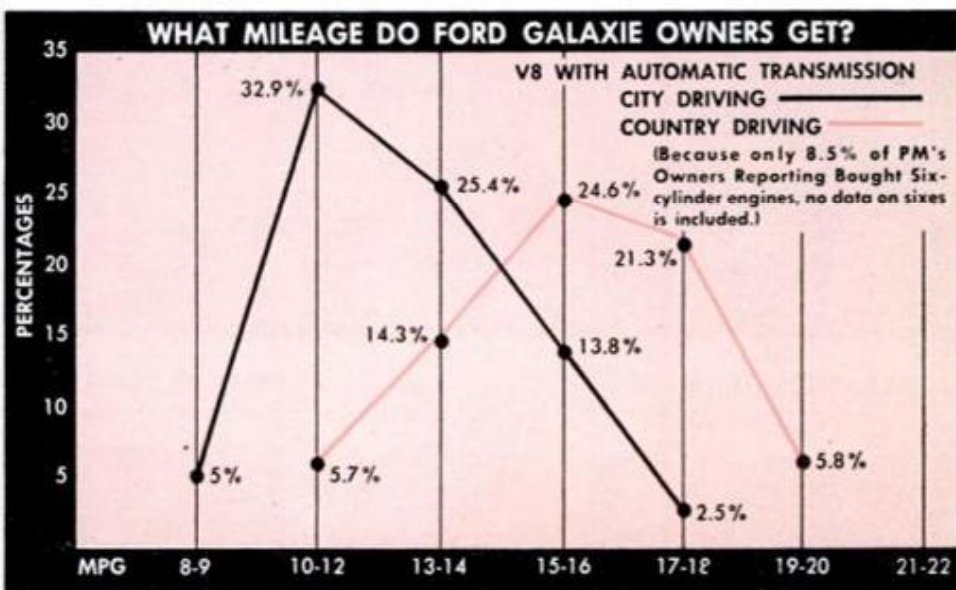
OWNERS LIKE . . .
Big-car ride, handling ease
Clean styling
Brisk performance

DISLIKE . . .
Low gasoline mileage
Poor workmanship
Suspension sagging



GALAXIE OWNERS paid tribute to the good vision through the car's windshield. They liked the smaller 16-inch steering wheel used with optional power steering

WHILE THE LARGEST group of Galaxie owners reported getting 15 to 18 m.p.g. on long trips, city economy for most dropped all the way to 10 to 12 m.p.g.



Ford's new "anti-harsh" suspension, providing for horizontal as well as vertical shock absorption at the wheels, proved its worth when some 45.9 percent of all owners reporting put Riding Comfort as the feature they liked best. Second best-like was Handling Ease with 39.8 percent.

In 1961 owners of the large Ford played it just the other way with Handling Ease first at 40.3 and Riding Comfort second with 33.3 percent.

Chief complaint in 1963—as in 1961—was Poor Fuel Mileage. Significantly, though, the complaint percentage has dropped from 14.1 percent to 7.3 percent. Second largest complaint registered by owners on the 1963 Ford was Poor Workmanship—4.6 percent. This represents a commendable shrinkage from the 7.9 percent of 1961 owners who made Poor Workmanship their first complaint.

PM checked out the constant-speed fuel consumption of the Galaxie 500 test car with these results:

- 18.8 miles per gallon at 30 m.p.h.
- 17.8 miles per gallon at 40 m.p.h.
- 17.0 miles per gallon at 50 m.p.h.
- 16.1 miles per gallon at 60 m.p.h.
- 15.4 miles per gallon at 70 m.p.h.

To sum things up: 1963 Galaxie owners are generally

Ford made a smart move
← putting a plush ride on a traditionally low-priced car

← This complaint drop probably reflects buyers' acceptance of the facts of life—you can't ride big and pay small

← The battle of quality control is the one that Ford wants most to win



THE SPARE, located far forward, steals little from the available luggage space but some owners said the shallow trunk was too small for a car of the Galaxie's size



OWNERS were generally pleased by the Galaxie's balanced, conservative styling and praised the protection offered by big wrap-around bumpers

DOORS WERE a major source of owners' complaints, with many reporting poor fit, rattles and leaks

POPULAR T-BIRD roof line also gives good rear seat head room, adequate for a 6-foot-plus PM car tester



pleased with their cars. A creditable 65.7 percent felt that the Galaxie was Excellent while 25.5 percent rated the car as Good. A moderate number totalling 6.1 percent rated their car Fair while the 2.7 percent who said their cars were Poor is no higher than average.

Starting from the top we have, in order of frequency mentioned, the five features that most owners liked best.

"The ride I get is out of this world! It's like riding in a cloud!"—Kentucky farmer.

"The \$10,000,000 Ford spent on the ride is no gimmick—my '63 handles and rides better than any of the new cars I've driven including the 'big boys!'"—New York salesman.

"It rides and handles much smoother than the Fords I have had in the past."—Iowa sales representative.

"The car rides beautifully over gravel country roads, which I have to drive much of the time; it drives over gravel as if it's hard surface!"—Minnesota salesman.

"It has a really smooth ride."—Ohio factory worker.

"I like its riding ease; it is very comfortable and not tiring on long trips."—New Hampshire teacher.

"The handling of the car is much better than any car I've owned, and I've had an Olds, a Cadillac and a Buick."—New Jersey painter.

"It handles so smoothly with each touch of the wheel."—New Jersey government employee.

"I like the easy handling in traffic and on the open road."—Kansas doorman.

"My '63 Ford handles much better than the '62 Ford I formerly owned."—Minneapolis realtor.

"It handles like a dream on the highway."—Wisconsin restaurant manager.

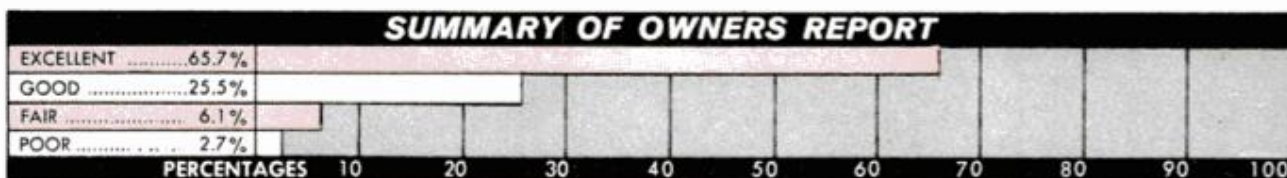
"I like the soft-pedaled, attractive T-Bird styling."—Texas retired oil worker.

The traveling man is right; ← Ford's compliance suspension gives a really Grade-A ride

This is where the longer ← wheelbase and extra cost should pay off in a car—happily they do so on the '63 Ford

Ford's power-steering is a good compromise between ← instant response and total road feel

(Please turn to page 236)



Fuel Economy	Other full-size cars considered	Least-liked interior style features
About as expected52.7%	Chevrolet46.4%	Glove compartment 6.4%
Better than expected 15.7	Pontiac12.4	Transmission hump 4.2
Not as good as expected31.6	Another Ford model 9.8	Ash trays (location) 3.0
Best-liked features	Oldsmobile 6.5	Clock (location) 2.7
Riding Comfort45.9	Consider buying a compact?	Seats 2.1
Handling ease39.8	No, did not consider87.8	Is Ford only car in the family?
Styling28.6	Yes, did consider12.2	Yes, it is57.4
Power, performance23.4	Compact make considered	No, it is not42.6
Interior design 9.7	Ford Falcon52.5	Make of other car
Quiet riding and running 9.4	Comet12.5	Another Ford16.7
Roadability 8.2	Chevy II 7.5	Other Ford Motor make 9.3
Visibility 7.0	Best-liked exterior style features	Chevrolet11.5
Solid, rattle-free body 6.4	Tail lights13.1	Other General Motors make 9.3
Roominess 4.8	Roof line12.2	Plymouth 2.1
Most-frequent complaints	Rear end 7.6	Galaxie decision based on:
Poor gasoline mileage 7.3	Thunderbird styling 5.8	Previous Ford ownership66.3
Poor workmanship 4.6	Simple, uncluttered, clean look5.5	Style48.6
Water leaks 4.2	Chrome trim 4.8	Performance36.7
Fit at doors, windows 3.0	Grille 3.9	Economy29.5
Had mechanical trouble?	Least-liked exterior style features	Size26.8
No trouble73.2	Grille 9.4	How is dealer service?
Yes, had trouble26.8	Rear end, rear fenders 3.6	Excellent60.9
What was trouble?	Trunk 3.0	Average31.1
Carburetor 3.6	Chrome trim 2.4	Poor 8.0
Automatic transmission 3.3	Best-liked interior style features	Would you buy from him again?
Power steering 3.0	Dashboard, instrument lights19.8	Yes73.0
Faulty wiring 2.4	Upholstery12.8	No 8.8
Automatic choke 1.5	Comfortable seats 9.7	Undecided18.2
Consider another full-size car?	Bucket seats 9.4	Would you buy another Ford?
No, did not consider53.5	Door handles 8.2	Yes87.9
Yes, did consider46.5	Crank vent windows 6.4	No 4.3

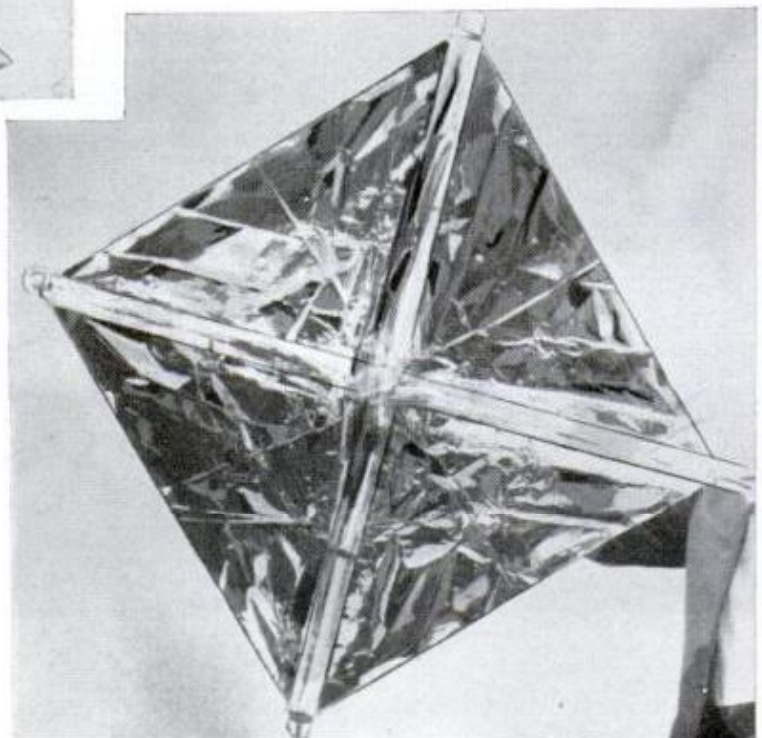


Three Puffs to Safety

Finding downed spacemen will be an easier task with an aluminized mylar reflector now being tested by the National Aeronautics and Space Administration. The pocket-sized packet (top) weighs seven ounces. It can be quickly inflated with three puffs.

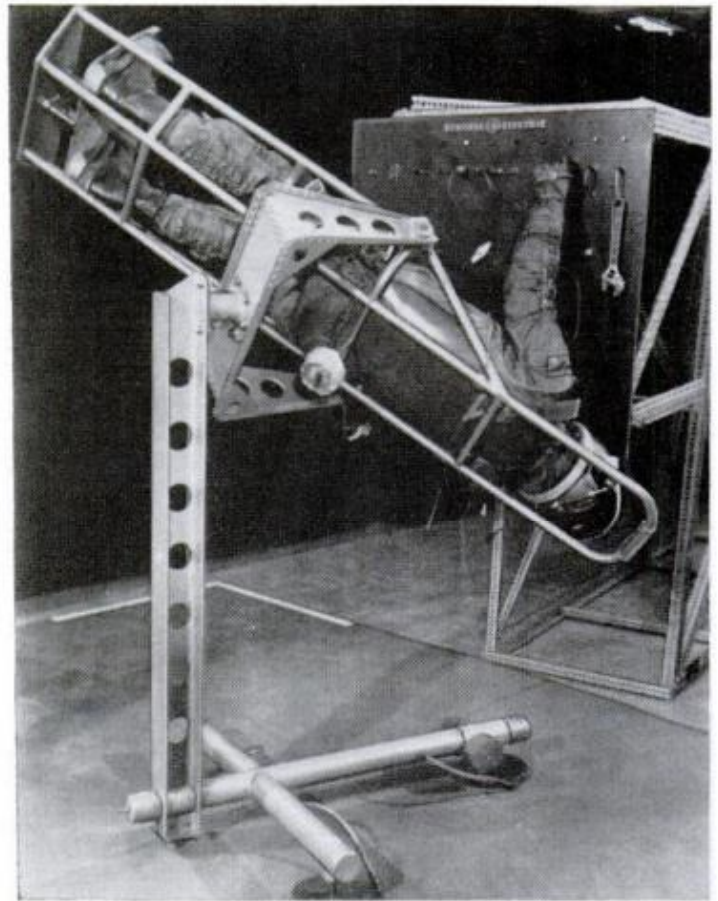
Three vinyl tubes unfold and inflate to provide a supporting framework for the 32-square-inch aluminized mylar (right).

Tests in the Atlantic indicate that the reflector can be pinpointed by aircraft radar up to 48 miles. The bags are made by Geophysics Corporation of America, Anoka, Minnesota.



Tightening a Nut in Space

To test space repair tools and methods, General Electric designed the Spaceworker. Riding on air bearings, it turns or moves away at the slightest movement. (Turning a wrench in a state of weightlessness is difficult and fatiguing.) Findings indicate that ordinary tools can be used in space—with proper bracing.



Rises to an Emergency

Maintaining communications and radar links after an area has been hit by nuclear bombs may be done by an inflatable radome-antenna system.

Developed by Goodyear, the aluminized, inflatable antenna housing would rise out of the ground and inflate itself at a signal from a distant command post.

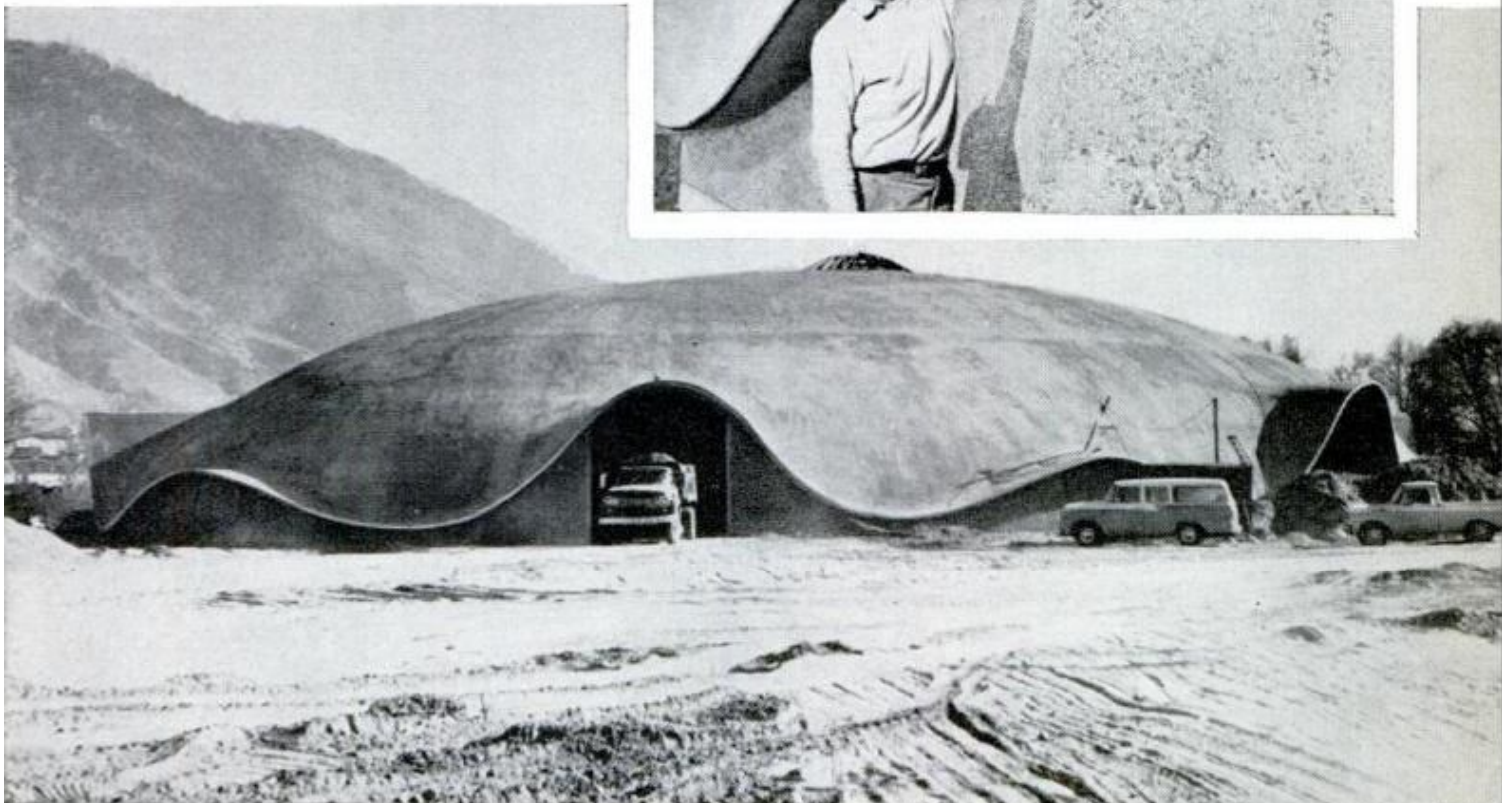


Dome Built on Dirt

You don't need forms or scaffolding to pour concrete for this type of shell building—if you have plenty of dirt fill handy.

The earth fill of this Utah skating rink was bulldozed into place and carefully molded to the desired shape of the building. Steel reinforcing rods were laid in concentric patterns on the fill and the concrete sprayed on under heavy pressure.

When the shell hardened, the fill was removed by scoop and truck (top and below). The only concrete poured into a form was for the footing walls and the retaining shelf, to which the workman is pointing. The building measures 160 by 240 feet; it contains 300 spectator seats, a cafeteria and a skating arena.

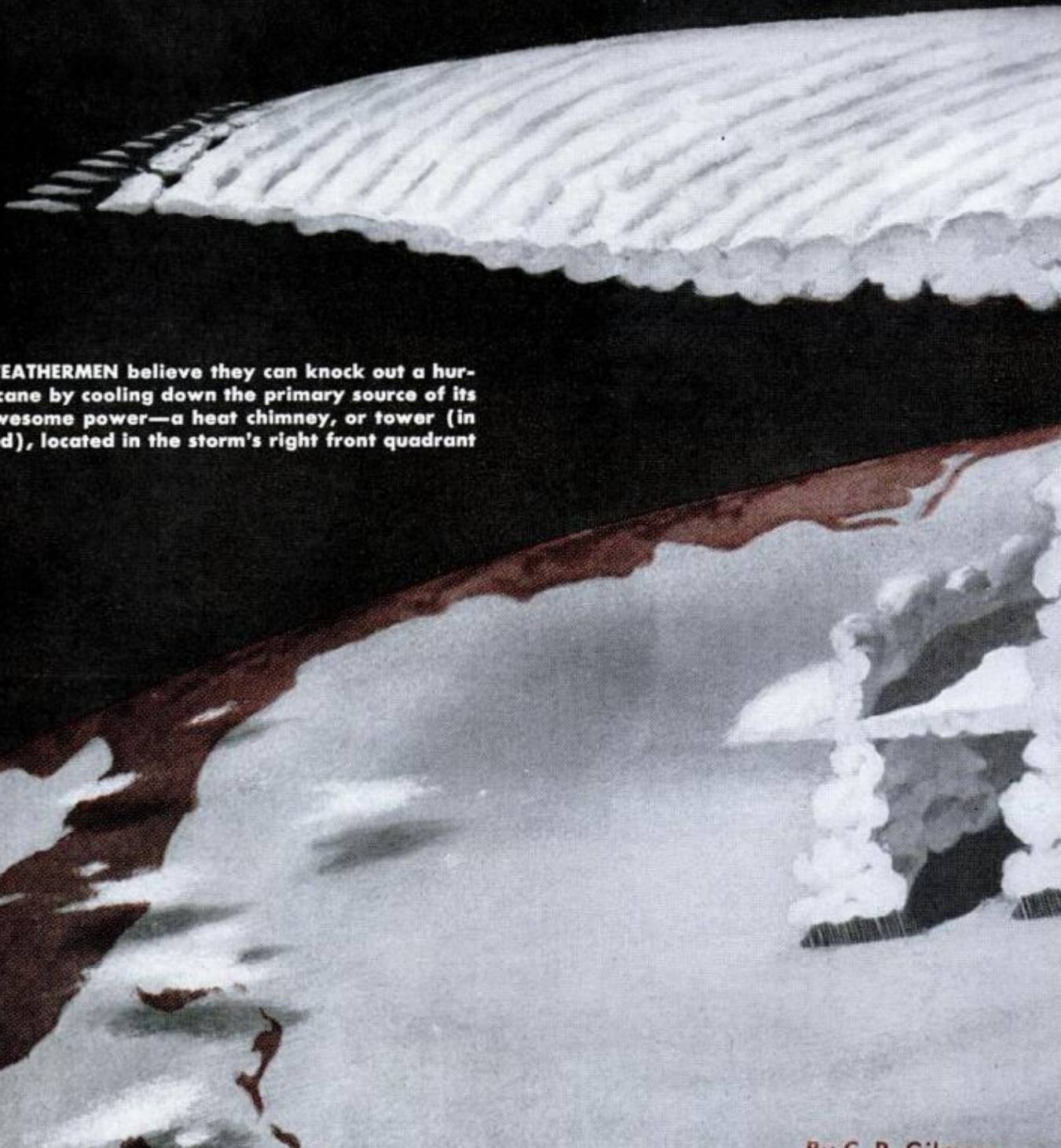


HURRICANE KILLERS

THE MORNING of September 16, 1961, was blustery and gray as a Navy A3D took off from an airport not far from San Juan, Puerto Rico, flew out over the Atlantic, and into the swirling, frenzied heart of Hurricane Esther. As the aircraft sliced through the turbulent air near the storm's eye, it spewed

some 100 pounds of silver iodide crystals into the hovering clouds.

Dr. Robert Simpson, chief of the Weather Bureau's Severe Storm Section, told meteorologists about the event in Washington later. "Nothing cataclysmic happened," he said. "But there were interesting changes observed."



WEATHERMEN believe they can knock out a hurricane by cooling down the primary source of its awesome power—a heat chimney, or tower (in red), located in the storm's right front quadrant

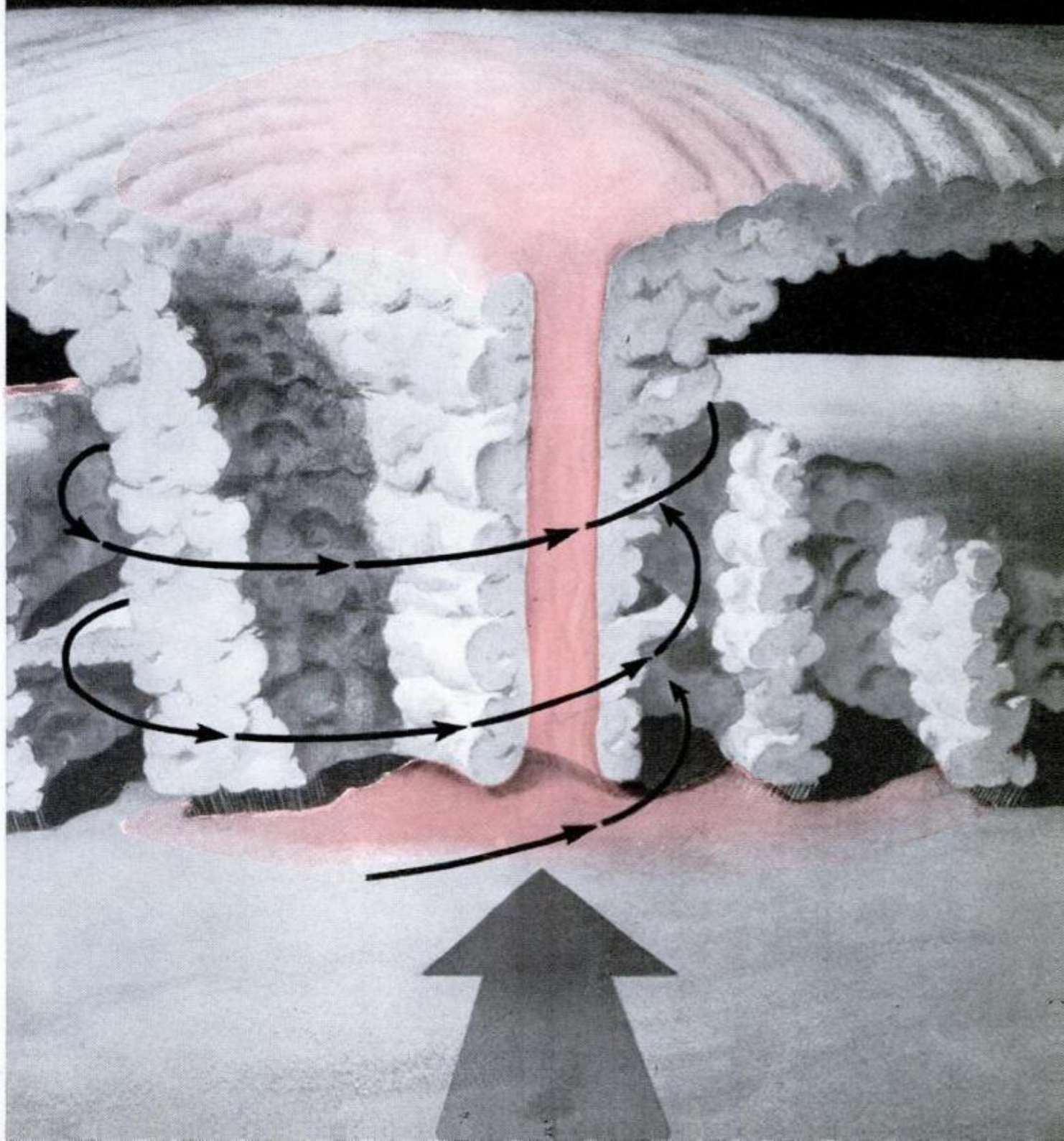
By C. P. Gilmore

LEARN WHERE TO AIM

Yet this operation, described in the ultra-cautious terms scientists use, may turn out to be the most important meteorological event since the Flood. For in spite of its outwardly unspectacular results, the experiment near Esther's core has put us "on the threshold of control"—as the Weather

Bureau chief, Dr. Francis Reichelderfer, put it—of one of nature's most destructive forces. In other words, we're about to lick hurricanes.

The chain of events that led up to this meteorological landmark began in the late 1940s. Simpson, fascinated by hurricanes for years, began hitching

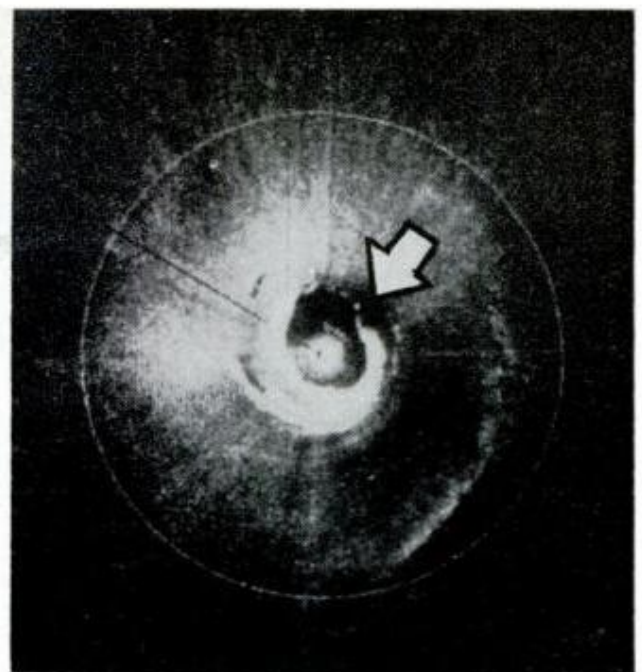
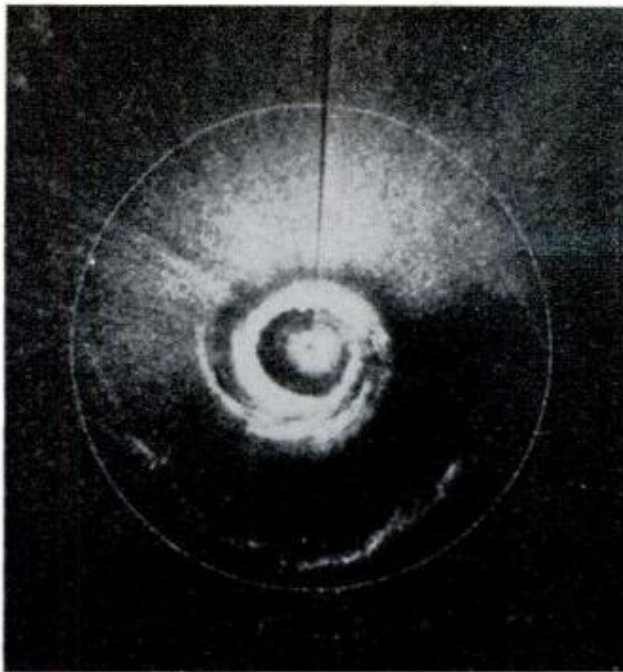




THE EYE OF A HURRICANE is relatively calm, with serene surface clouds and bright sunlight. Eye of 1961's Hurricane Esther measured 40 miles across

DESTRUCTIVE STORMS like this hurricane smashing into Miami Beach, Fla., have been under intensive study since four storms hit the U.S. coast in 1954





SILVER IODIDE crystals knocked hole (dark area, center of photo on right) in Hurricane Esther's heat tower. Photo at left shows storm before it was seeded

rides into them on Air Force and Navy reconnaissance planes, trying to learn something about the then-dimly-understood storms. In 1951, while in charge of the Weather Bureau's Pacific operation, he rode with the Air Force into the raging center of Typhoon Marge (a typhoon is a Pacific hurricane), one of the most vicious storms on record.

"As we got closer," said Simpson in a description he wrote later for *Scientific American*, "the winds grew stronger. Two hundred miles from the center they reached hurricane force [75 miles an hour], and in another 50 miles they had increased to 100 m.p.h. From here on we could no longer see the surface, for the cloud cover now engulfed the plane completely. Only the spiral pattern of the squall lines on the radar screen enabled us to keep headed toward the storm center. Soon the edge of the rainless eye became visible on the screen. The plane flew through bursts of torrential rain and several turbulent bumps. Then, suddenly, we were in dazzling sunlight and bright, blue sky."

Then Simpson noticed a strange thing. "Around us was an awesome display. Marge's eye was a clear space 40 miles in diameter surrounded by a coliseum of clouds whose walls on one side rose vertically and on the other were banked like the galleries of a great opera house."

For some four and a half hours Simpson cruised around in the eye and puzzled over the fact that the clouds on one side were vertical, on the other, slanted. All meteorology textbooks, he knew, pictured

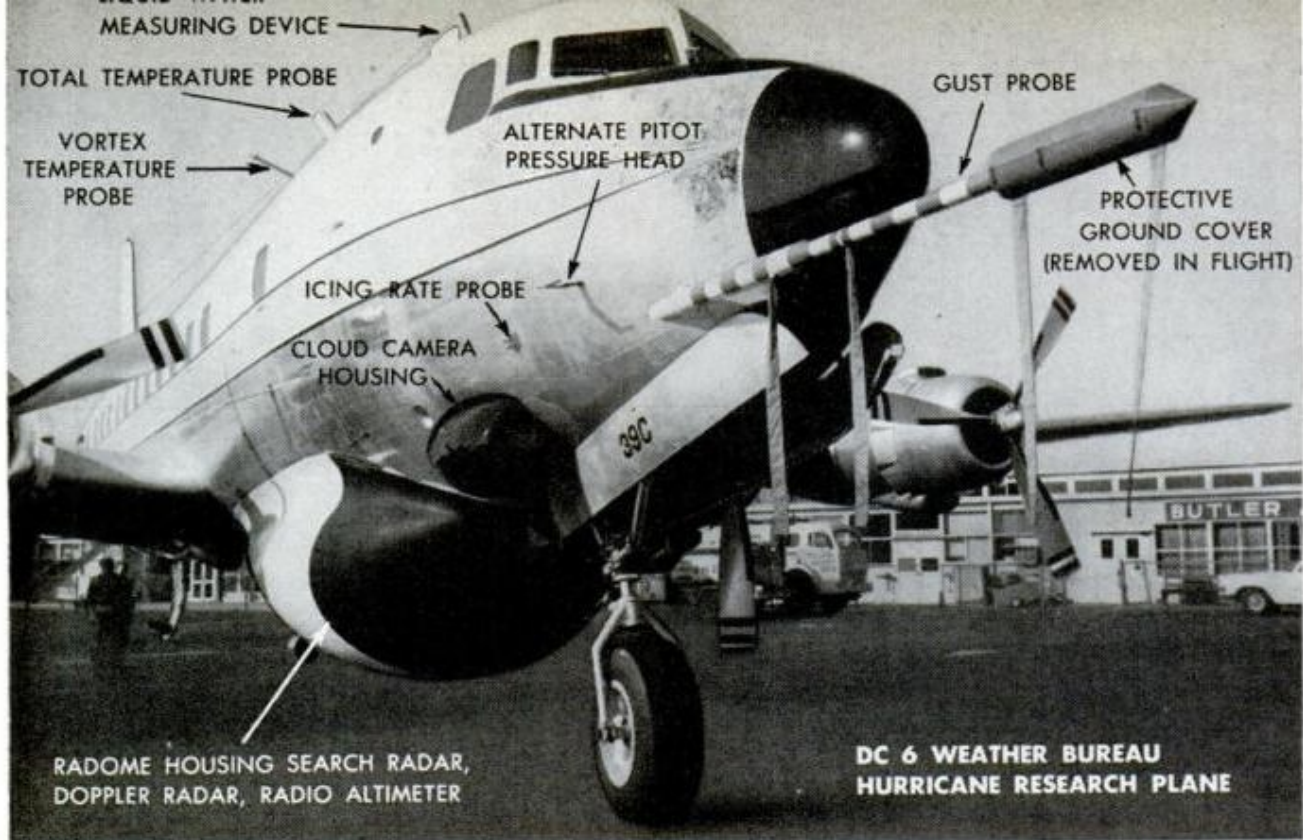
the hurricane as a perfectly symmetrical spiral of rising air around a central core. Then why the slant? For that matter, why did the spiraling bands of rain squalls always stick out much farther on one side than the other—a well known, but ignored, fact—if the whole thing were symmetrical?

The suspicion began to grow in Simpson's mind that perhaps the classical model of a hurricane was all wet. But if so, what *really* was going on in those walls? There simply wasn't enough data to make an intelligent guess.

For the next five years, Simpson rode into hurricanes every chance he got. Stationed in Washington, he'd scurry down to Florida and scramble aboard every Air Force plane headed out on hurricane hunter duty. "I'd sit on a parachute and ride the nosewheel well in B-29s and B-50s, look over the pilot's shoulder, and snap pictures furiously," he said. "And then when we got into the critical radial run through the storm, I'd record changes in temperature, heat values, and so on, and make notes as fast as I could write. The data I got this way gave me a lot of clues, a lot of ideas."

Principal idea growing in Simpson's mind was this: Not only was the storm not symmetrical, but most of its driving force came from a rapidly rising column of air on the storm's right front quadrant. But his supporting data was still fragmentary.

Then, in 1954, came Simpson's first real opportunity. That year, four violent ladies—Carol, Edna, Florence and Hazel—



HEAVILY INSTRUMENTED weather research planes probe the centers of vicious tropical storms, recording wind velocity, temperature, pressure, other factors

smashed into the U. S., trailing death and devastation. Congress demanded action, telling the Weather Bureau to get busy and do something about hurricanes.

Bureau Chief Reichelderfer called in Simpson, asked if he had any ideas. He did. "We threw away all restraints," said Simpson later, "and designed what amounted to the most massive research program the Weather Bureau had ever undertaken."

In 1956, proceeding according to the blueprint, the bureau set up the National Hurricane Research Project (NHRP) in Miami. With the cooperation of the Air Force, NHRP scientists started sending planes equipped with continuous recorders crisscrossing through every storm. The hurricane probes came back loaded with millions of observations from each storm—detailed information on pressure, rain, temperature, wind, at various points throughout the storm's structure. Gobs of such data were fed to computers, which began laboriously drawing out in fantastic detail the intricate picture of what goes on inside a tropical storm.

A hurricane, NHRP researchers knew, is a vast heat engine. Huge quantities of warm, moist air sweep in from the surrounding sea, rise in the vicinity of the eye, condense, and release rain. Just as evaporating water cools the surrounding air by absorbing heat, condensing water releases *heat*—the latent heat of condensation. The heat, released in the storm's

upper reaches, rises rapidly, sucking in more warm air from below and increasing the storm's fury.

The new and significant thing that NHRP scientists learned was that as much as 95 per cent of this latent heat—and thus 95 per cent of the power driving the storm's heat engine—was released in a small sector in the right front quadrant of the eye.

Simpson and his associates put together a plan of attack. One airplane, they figured, could cover with ease the small, but important, area driving the storm. So long as they had been thinking in terms of treating the whole storm, a hundred planes couldn't have done it.

Near the top of the storm, they knew, was a great deal of suspended water—tiny droplets dancing on the updraft, too small to fall out as rain. The temperature in this area—some 45,000 feet above the sea—is about 50 degrees below zero. The droplets, then, were obviously supercooled. But they were not freezing out.

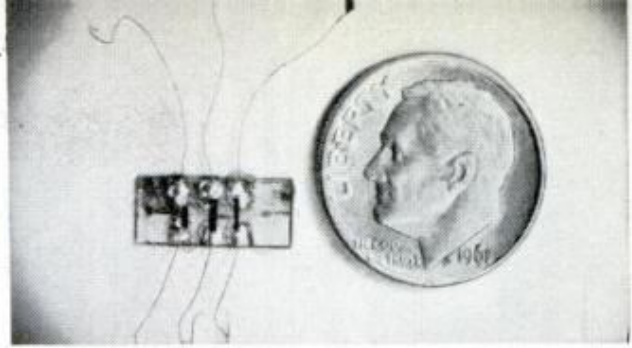
The plan was simple. Get this supercooled water to freeze, somehow. This would release the latent heat of fusion (water to ice), warming up the very top of the storm-driving chimney. Weighing less, the warmer air in the chimney would expand slightly, and its barometric pressure would drop.

The force that causes severe winds in a hurricane is the sharp change in pres-

(Please turn to page 224)

Tiny Instruments Explore Mars

Smaller than a dime, a battery of three low-temperature bolometers will soon be sent by balloon 80,000 feet above the earth to examine the surface of Mars. Supersensitive to infrared heat, the bolometer detects radiation signals of infinitesimal strength and may detect presence of life-sustaining substances.



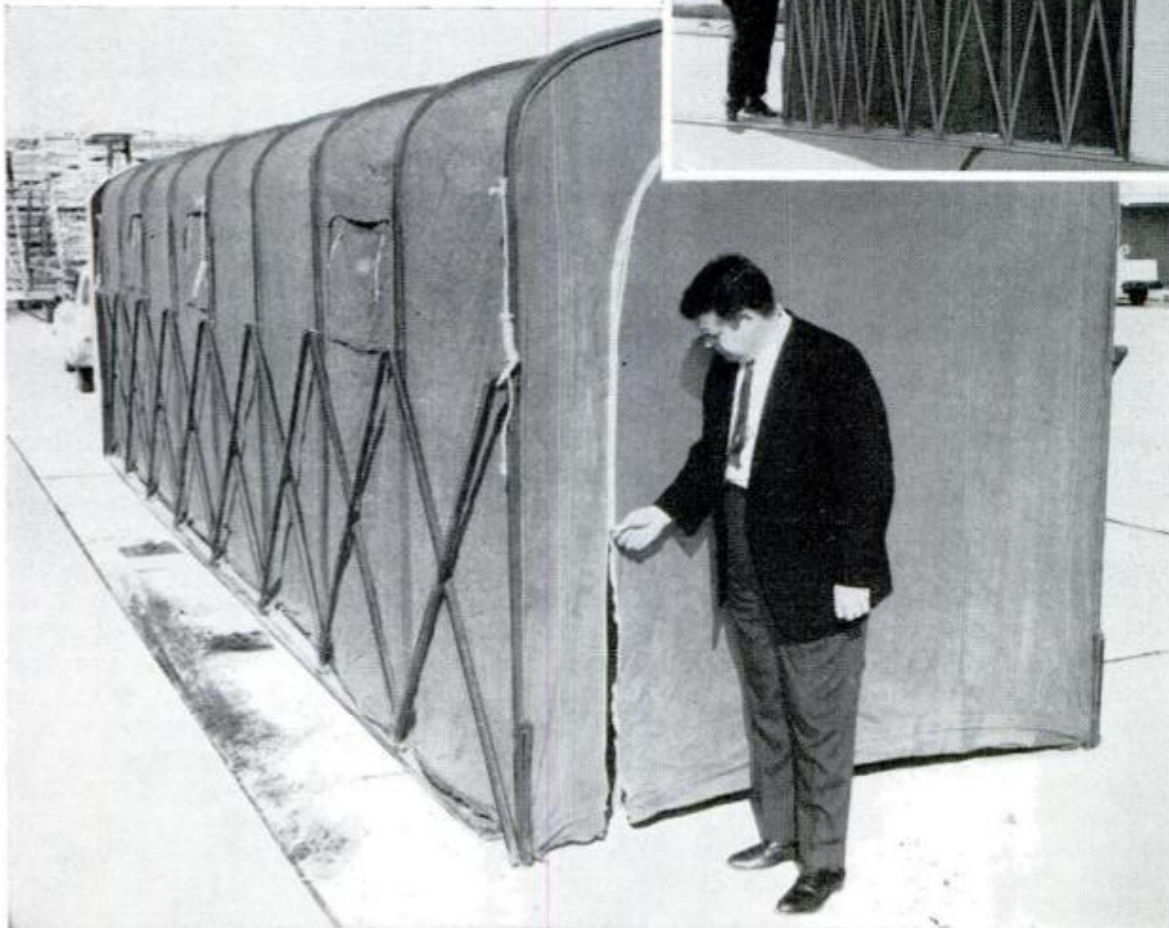
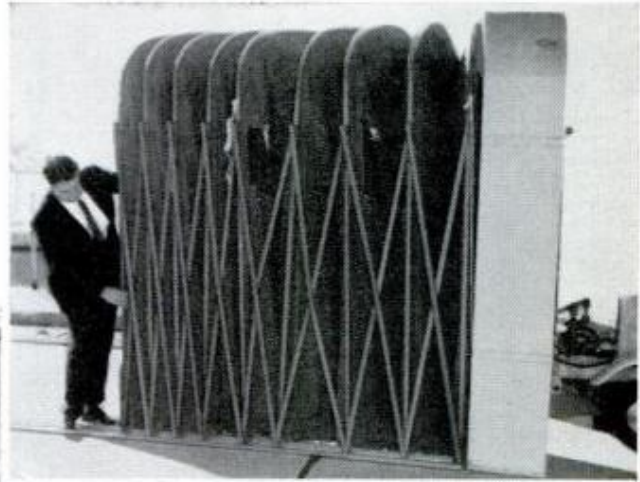
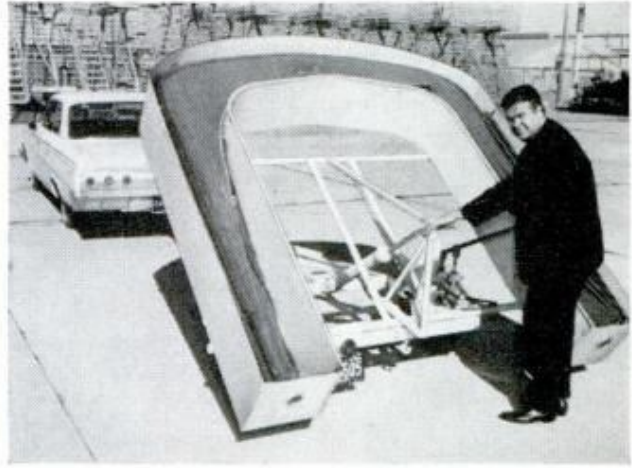
Accordion Tent

Light enough to be hauled on an auto trailer, a collapsible tent can be set up in five minutes by one man.

Nine horseshoe-shaped steel beams are connected by expanding (and collapsing) crossarms. The beams, which have casters, are rolled out on jointed steel rails which can be laid over any kind of terrain, hard or soft. They can then be tied down, if necessary in high winds, by guy ropes.

The tent weighs about 340 pounds and is encased for traveling in a specially designed U-shaped trailer bed 11 inches deep. The bed can be tilted to an upright position for unfolding the tent by a hydraulic pump.

The maker, Phil Cummins, a Texas oil field fire-fighter, built the tent for use at camp sites. He just got tired of the manual labor involved in setting up a conventional tent with poles, stakes and ropes, he said. "Doors" of the tent zip shut.



HIS COLLECTION of butterflies got so large that Max Richter had to open a museum to house it in 1953. The museum is in East Durham, N.Y., near his butterfly farm



ATTACUS ATLAS, a rare species of moth grown by only a few, is one raised by Mr. Richter

Butterfly Farmer

MAX RICHTER earns his living doing the thing he loves best: Breeding and selling butterflies.

On his farm at East Durham, N.Y., Mr. Richter produces thousands of eggs, caterpillars, pupae, chrysalises and adult butterflies, most of which he sells to museums, laboratories and private collectors around the country.

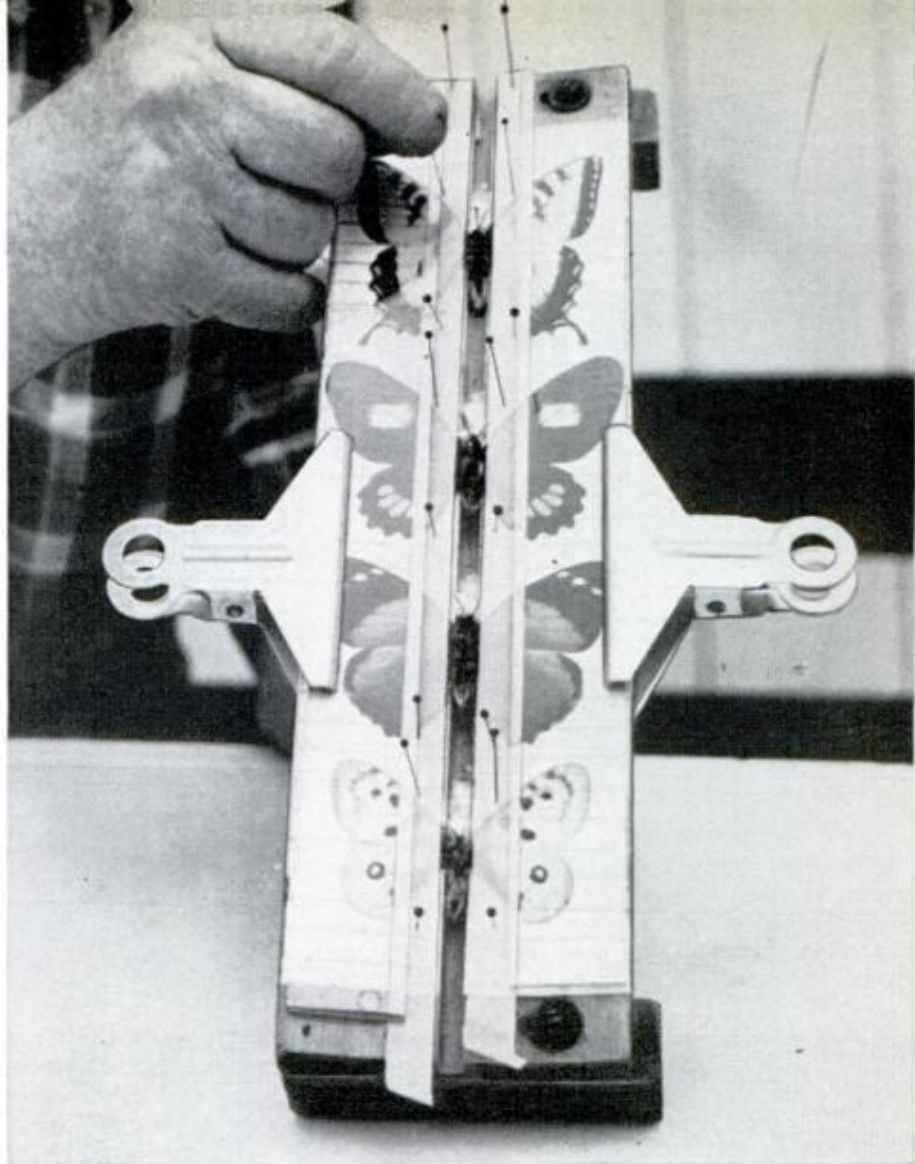
Spring and summer are his busiest seasons. To start the life cycle moving, female butterflies are tied to mosquito netting and hung from trees to attract the male butterflies in the surrounding area. Later, Mr. Richter collects the eggs and moves them to a safe place for hatching.

Once the larvae, or caterpillars, have

hatched out, they are placed on tree branches and plants where they eat heavily, shed several skins, and develop into pupae, or chrysalises. They are then collected in paper bags and transferred to wooden sheds for protection from the elements. The growing cycle is complete when the adult butterfly emerges from the chrysalis.

Born in Germany, Mr. Richter has raised butterflies in East Durham for the past 30 years. He has had little or no scientific training, but many scientists visit him to learn his secrets of butterfly breeding.

He raises many rare types, including the *Attacus atlas* moth, noted for its large wing span and golden brown hues.



SPREADING FRAME made by Mr. Richter is used to spread butterflies for mounting. They are clamped to the frame under glass and hung up to dry

CATERPILLARS are collected from tree branches in large bags as soon as they reach the pupa stage

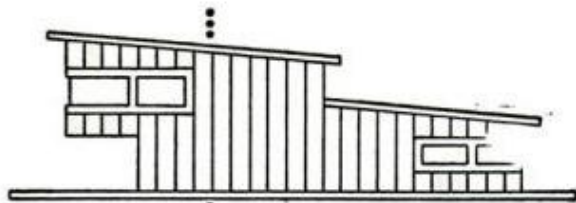


MARCH 1963

STRINGS OF PUPAE are kept in wooden sheds for protection. Here they incubate, emerge as butterflies

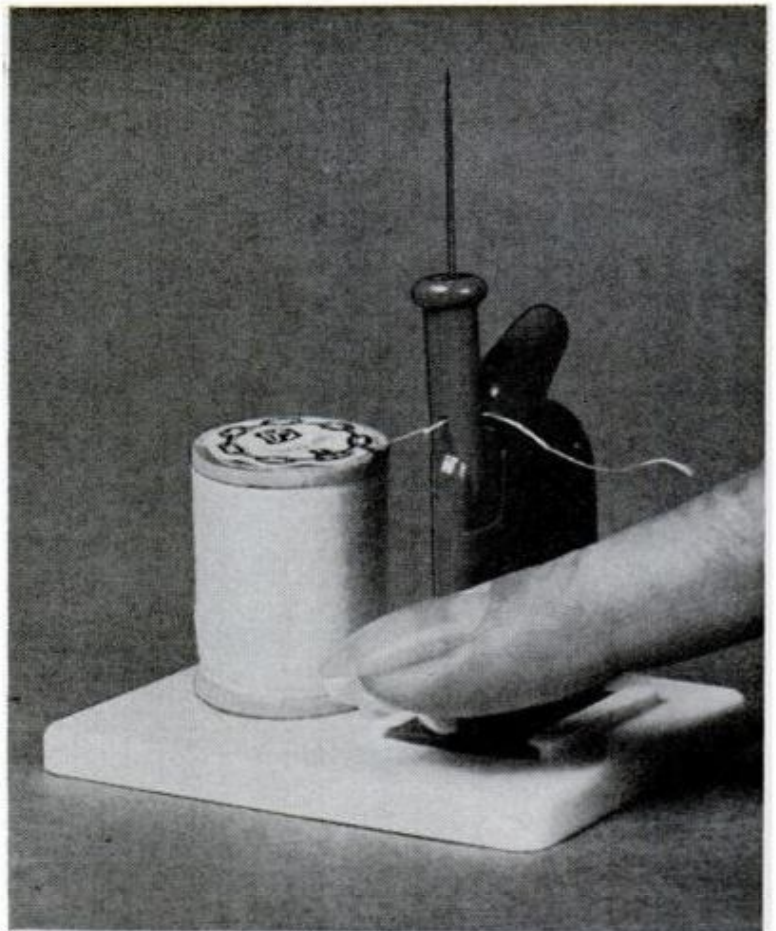


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NEW FOR YOUR HOME

AUTOMATIC NEEDLE THREADER eliminates eye strain. Needle is threaded by dropping it in threader and pressing button. Price of \$1 includes one dozen No. 6 needles and spool of thread. Foreign Trade Unlimited, 311 Ferry St., Pontiac, Mich.

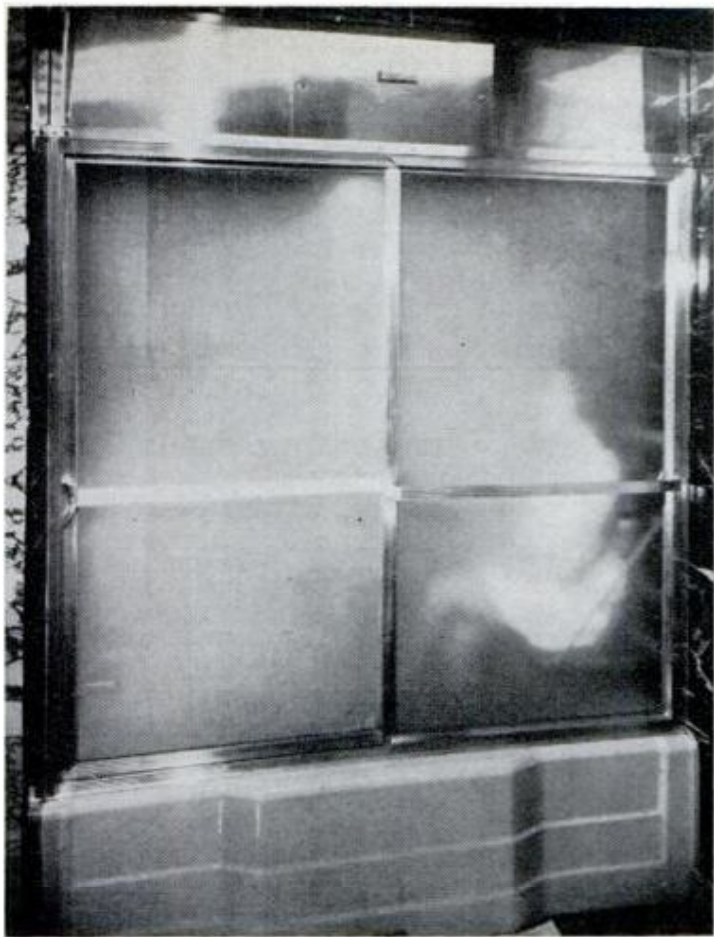


CHIMNEY LAMP, shaped like an early American oil lamp, is an incandescent bulb that serves as a porch or post light outdoors. Indoors, the bulb can be used in table and floor lamps. It has a life of 3000 hours. It's made by Sylvania, 370 3rd Ave., New York 17



LUMINOUS BATHROOM CEILING comes in one package, partly pre-assembled and ready to install, with fan, heater, night light. Panels are plastic egg-crate design. Cost: \$195 for 5 by 7-foot bathroom. Emerson Electric Co., 8100 Florissant, St. Louis 36, Md.





STEAM BATH unit is completely assembled with built-in interior light, moisture and vapor-proof sliding doors. Can be installed in any bath tub or stall shower; wires and pipes are concealed above false ceiling. Made by Thermasol, 702 E. 12 St., New York



CRIB BLANKET HOLDER keeps blanket secure and evenly spread. The one-piece, plastic holder loops around the crib pole and clips to blanket with garter-like fastener. Cost is \$1 per set of six. Westland Plastics, 800 N. Mitchell Rd., Newbury Park, Calif.

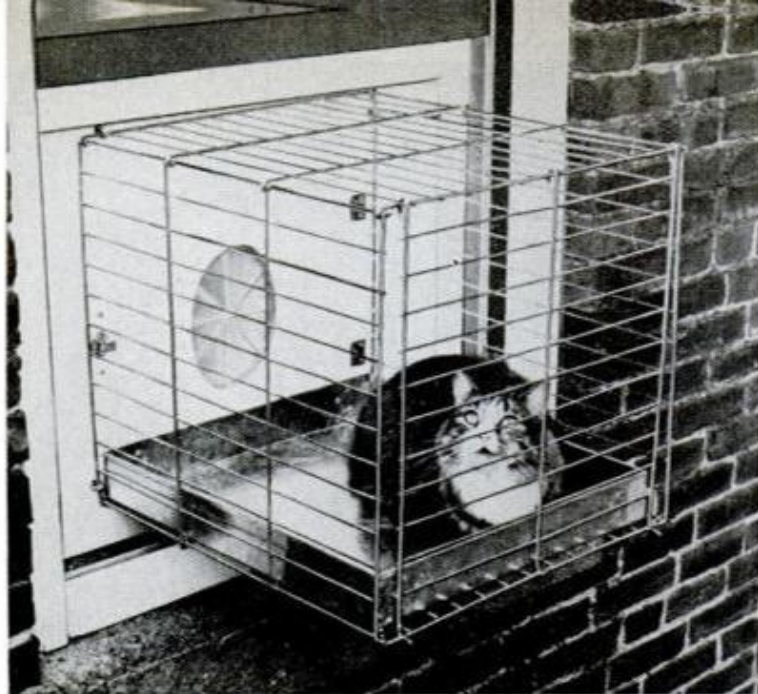
NEON BULB clips on phone to illuminate the entire dial for making calls at night. It does not interfere with dialing and plugs into any household outlet. Available from Panda Products, 1200 Niagara, R 55, Buffalo 13, New York, the dial light costs \$2.50



MARCH 1963



KING-SIZE MAIL SLOT receives newspapers, magazines, photos without bending or crushing. The aluminum slot has a 2½ by 12½-inch opening and a self-closing flap. Costs \$5.95; made by Barney Gardner Bldg. Specialties, 506 N. Prior Ave., St. Paul 4, Minn.

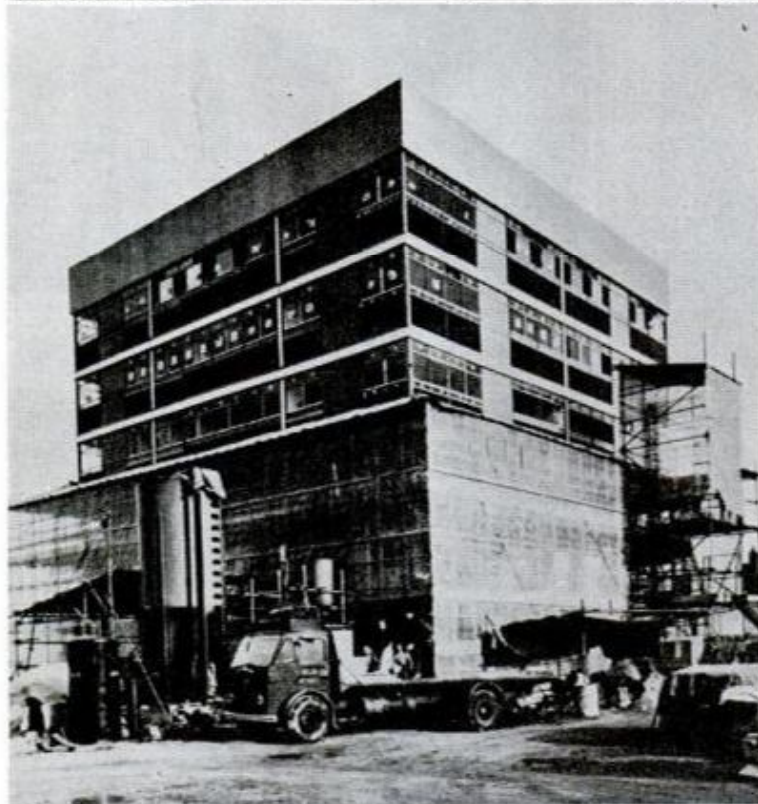


Terrace for Tabby

Apartment-dwelling cats may take the afternoon sun at their leisure in an outdoor cage that is attached to a window.

A flexible opening allows the cat to come and go as he pleases, and sturdy metal construction assures his safety. Named FlexPort, the window cage is sold by Turen, Inc., Danvers, Mass. Price is \$78.

If a woman's weight is 120 pounds on earth, statisticians estimate that she would weigh 19 pounds on the moon, 102 on Venus and 317 on Jupiter.

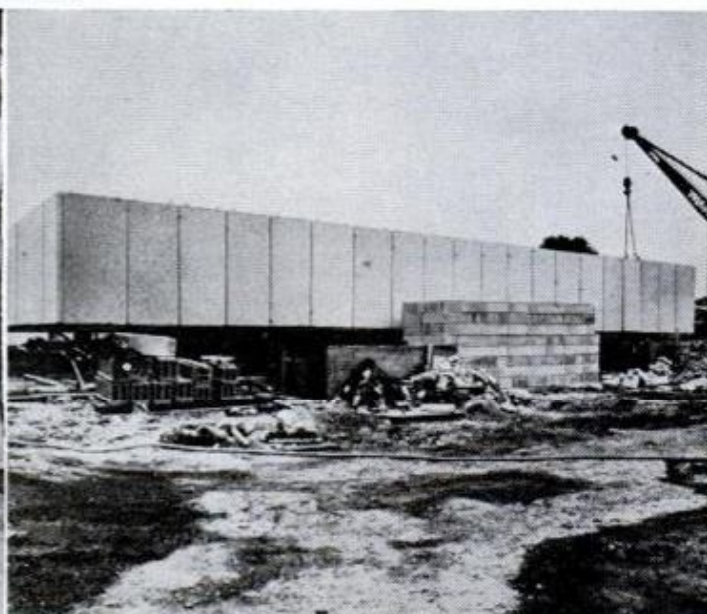


They Start at the Top

Applying a revolutionary concept in construction, a British firm is building from the top down.

Beginning in a basement well in which are installed 40 hydraulic jacks (lower left photo), the parapet and roof structure are built in place, then jacked up. The top story is then built on the ground (lower right photo) and jacked up to make room for the next story—the entire 17-story building being constructed at ground level and gradually raised. Seven stories are up in the photo at left.

Consisting of a hollow core for elevators and stairs and 15-foot cantilevered floor beams, each floor is completed in only two weeks and raised in three days. Finishing, plumbing and electricity are carried on at various levels on an assembly-line basis.





Infrared Heater-Cooker

For warming hot dogs or cold "dogs," a propane-burning infrared stove doubles as a portable cooker and heater.

The heater-stove produces infrared radiation by burning small quantities of propane gas on a perforated ceramic mat. Made by Hupp Corp., Cleveland, Ohio, it sells for less than \$20.

Arsenal on Foot

Twin bandoleers studded with plastic cups have been adopted by the Army to turn the infantry soldier into a walking arsenal. Shock resistant and impervious to extreme temperatures, each plastic cup carries a 40-mm. grenade.

MARCH 1963

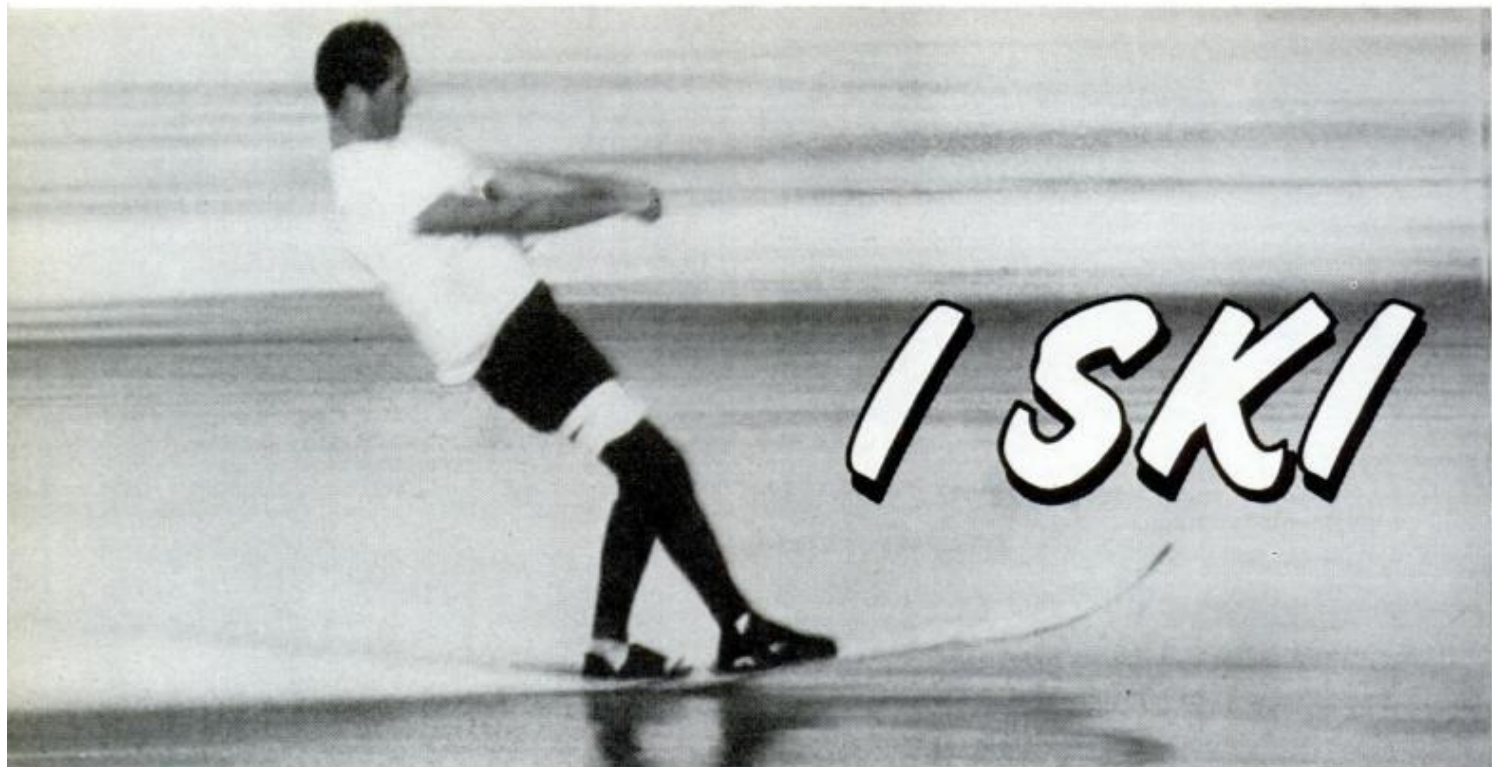


Bad Weather on Demand

Hazardous aircraft landing conditions are created on demand in an enclosed 800-foot fog chamber built by the University of California to test new methods of lighting runways. A model cockpit rides on the ceiling of the hangarlike building to simulate landing on fog-bound runways and test visibility with experimental lighting.



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By Harold "Butch" Peterson, APBA Champion . . .

WATER SKIING at 106 miles an hour is like coming out of the chute on a wild bucking bronco that you don't dare get off.

The wind cuts your face and pummels your stomach. You lean into a protective crouch. Your wrists and arms tell you that you're being dragged by 900 powerful horses, and even on smooth water the ski feels like a demented massage machine.

At 60 miles an hour you forget about being graceful. You don't smile the big photogenic smile because you can't. As you move up to 65, then 80, then 95 miles an hour, you feel more and more as though you're glued to a strip of carpet that someone is trying to yank out from under you.

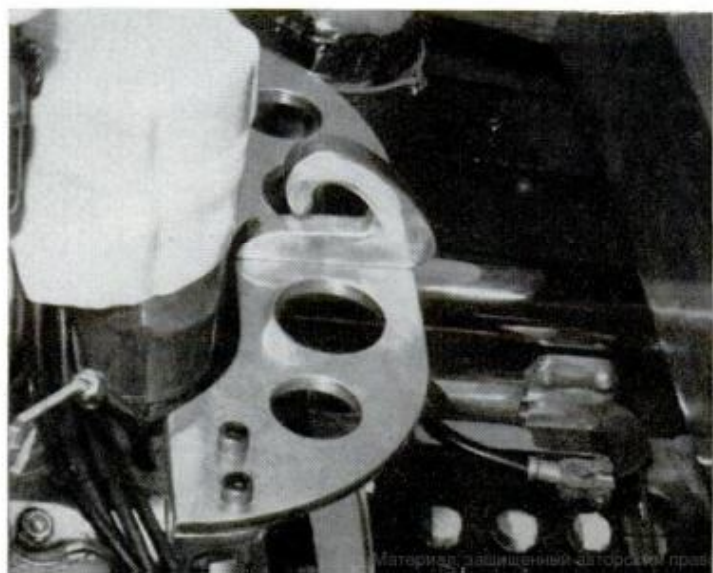
CROUCHING AND BRACING muscle-weary legs to keep up the point of the ski, speed skier is buffeted by wind that cuts the face and pummels the stomach

The only way you can keep the forward end of the ski out in front where it belongs is by bracing your legs so hard you think the muscles are about to burst.

Everything around you is gray and blurred, like the picture on a TV set that needs a new tube, but even at 106 m.p.h., you can still see. This is fortunate, because if the tow-boat swerves, slows, or stops unexpectedly, you have less than a second to figure out and execute a maneuver that will keep you from flying into the stern with enough impact to break every bone in your body.

I've spent most of my life on snow skis and slalom skis, and there's no doubt in my mind that for all-out, flat-out excite-

CUSTOM SKI-TOW ATTACHMENT for 150-foot tow-line is engineered for top speed skiing. Made of steel, it is bolted to engine mounts for greater stability



106 MPH

... as told to Jack Speirs

ment, nothing comes close to speed skiing.

Speed skiing takes very little in the way of practice, but it does take stamina, strength, and plenty of experience at low-speed skiing. It also takes judgment, on the part of both the skier and the tow-boat pilot.

All the top speed-skiing competition events are run on courses approved by the American Power Boat Association, but these can be anything from short straightaways to 50-mile 'round-the-islands tours, and water conditions can be anything from glassy to choppy. Since even a small ripple on the water makes fast skiing feel like a ride on a super-stoked jackhammer, the skier's worst enemy is an eager-beaver

boat pilot who has more regard for the trophy than for the skier's skin. Actually, the object of speed skiing is to get the best possible time *under the existing conditions*. Sometimes this is no more than 70 m.p.h. At other times—like on June 18, 1960, when I was lucky enough to set the 106-m.p.h. record that still stands in the APBA ledgers—the speed is limited only by the equipment.

This, of course, means mostly a fast boat—the faster the better. The top-running skiers usually ride behind the same many-horsed monsters that go 150 m.p.h. in the quarter-mile drags. There are, in fact, people who claim that the only reason

[\(Please turn to page 216\)](#)

TOWING A SKIER at 70 miles an hour, a sharp-turning boat produces a "crack-the-whip" effect, pushing the skier's speed up to more than 100 miles an hour

SKIMMING OVER THE WATER at more than 100 miles an hour, the speed skier crouches and holds on against forces that make rigid ski-tip whip into blur



Wet Quarter Mile Tops 152 M.P.H.

HOW THE DRAGSTERS DO IT

By Jack Speirs

TWENTY THOUSAND PEOPLE gathered recently to watch an eight-second show and came away with the satisfaction of having received their money's worth.

Seated at the controls of *Golden Thing*, Chuck Gireth guided the special-design racing boat into a marked course at the Marine Stadium in Long Beach, Calif., and idled down, his foot poised to throttle the growling 900-horsepower engine, his eyes glued to the red light which was part of the starting device.

The light flashed to green. Gireth jammed his foot to the floor and the exhaust pipes, which had been bubbling placidly under the water's surface, blasted a gaping hole in the water that was made even bigger by the sudden catapulting of the boat. By the time the water had recovered and the hole filled, the show was practically over.

In those few seconds *Golden Thing* had covered 1320 feet of water, and scarcely touched it. The big supercharged Chrysler engine had kicked the boat up onto its prop hub, held it practically airborne for

200 feet, allowed it to level off onto a water-rattling plane, and then sent it howling through the timing lights at the end of the quarter-mile course at a speed of 152.8 miles per hour.

A few minutes later Gireth repeated the performance in the back-up run required by the American Power Boat Association for an official record time. *The Golden Thing* thus became the new holder of the world's record in the addict-making sport of boat dragging.

Drag racing is the most exciting new gimmick to appear in the boating field since big horsepower. It's the simplest form of high-speed competition, and the safest. Like the land drags of automotive hot rodders, all it takes is a quarter-mile straightaway, a couple of contenders, and an accurate timing device.

"Eliminators" Win

The boats run in pairs. They start from a rolling idle, accelerate as hard as possible through the first 188 feet of the quarter-mile course, blast through the elec-

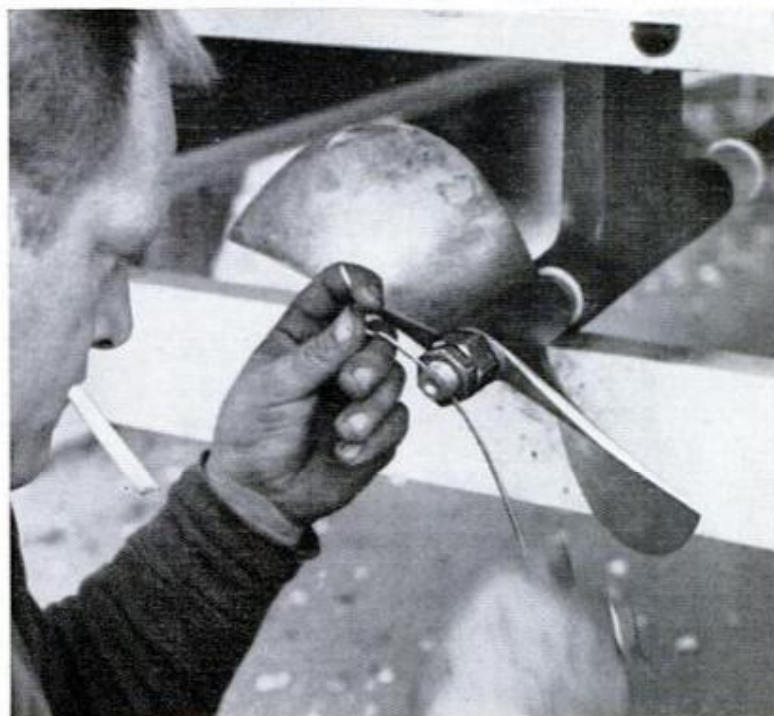
PRACTICALLY AIRBORNE the first 200 feet, the super-powered dragster roars away for the quarter-mile test





SUDDEN ACCELERATION of 900-horsepower engine literally drives the stern up under the bow of the boat and causes a back flip

TYPICAL PROPELLER on a drag speedster has a small diameter and deep pitch, two factors necessary for high-speed performance





FULLY PLANED at 152.8 miles per hour, V-drive *Golden Thing* blurs across water to set new world's record

tronic beams of timing traps spaced over the last 132 feet, and then shut off. The best of the two boats is the "eliminator" of that match; and the gold-plated trophy goes to the "top eliminator" of the day—the fastest *accelerating* boat.

Bluebird Would Be a Dodo

There are actually a lot of boats that will go faster than many top dragsters, but they take longer to do it. For example, Donald Campbell's 260-m.p.h. *Bluebird* would be a dodo at the drags; any 40-horse outboard would pluck it clean.

The moment of truth in dragging—and most of the fun—is in the first few seconds of acceleration. The object is to hold the straightest possible course in order to hit top speed fast. But even a boat is likely to react in weird and improbable ways when it gets all its power at once—particularly if it's an outboard. With the propeller behind the boat, with the weight of the motor hanging at the back, and with one of the pilot's hands committed to the throttle instead of steadying the wheel, a high-thrust, high-torque outboard will take off as though it's heading for outer space instead of the timing traps.

It hits the water with a perpendicular slam, and even when it levels off it tends to drop into a yawing, sliding, tooth-rattling plane that takes the long way around to the end of the course. Nevertheless, with a lot of experience, a driver with quick reflexes and sensitive hands can get some very efficient dragging out of an outboard. The current *outboard* record (these things change fast) is held by the well-known Florida hydro racer Chuck

Mersereaux at a speed of 91.09 m.p.h.

The nation's top dragging events are sanctioned by the American Power Boat Association, and the object of most of the rules is to give all boats, inboard and outboard alike, fair competition. The chief means of accomplishing this end is the practice of holding preliminary qualifying runs for top speed, so that the pair of boats pitted against one another in a given elimination run will be more or less matched in terms of drag potential.

"Not that this takes the competition out of the event itself," says Kenneth Wade of the APBA. "Drag boat classes are broken down into five-m.p.h. brackets. We have a 35-to-40 class, a 40-to-45 class, and so on. But this is top speed, and even a pair of boats that wind out to exactly the same limit don't necessarily accelerate at the same rate. A cruiser in the 40-to-45 class, for example, might have a top speed of 44 m.p.h. and need most of the 1320 feet to get it—whereas a runabout might just be good for 41, but all at once. In dragging, the runabout would probably beat the cruiser."

Pressed Peach Pit Power

In addition to speed classifications, drag boats are also broken down into classifications according to type: inboards and outboards; blown and unblown; gas and "fuel"—the latter, in the vernacular of the dragsters, being any power-stoker that's neither gas nor solid propellant, from pressed peach-pits to nitro-methane.

These neatly segregated slots make it possible for anybody to play, even with one or two powerful outboards. Chuck Mer-



BARELY TOUCHING THE WATER, a dragster driven by two 100-horsepower outboards tries for speed record

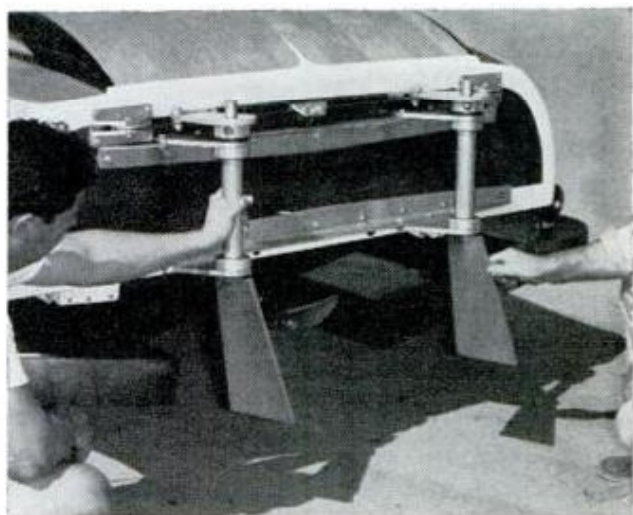
sereaux's record boat, for example, is powered by nothing more terrifying than a pair of Mercury 1000s. It's still possible for a novice to enter a drag race just to find out what his craft will do under maximum urging.

But as the competition categories indicate, dragging goes far beyond the aims of the novice. Most of the dragsters have always run fast inboards equipped with big, marine-converted automobile engines. With today's superchargers, special fuels, and batteries of carburetors, all well-established elements of the game, a dragster must persuade a stock engine to produce 900 to 1000 horsepower before he casts covetous eyes at the APBA record book.

It's a truism in the drag fraternity that "the bigger they come, the hotter they ball," and the really horrendous boats are built around engines like the mammoth '57-'58 Chrysler New Yorker. However, in the more languid dragsters—SK (for Ski Runabout) class racing runabouts that turn "only" 90 to 120 m.p.h.—the engine is usually something like a Corvette or Bonneville that hasn't actually been hopped up but merely marine-converted. What this means is that it has specially designed water-cooled manifolds and carburetor tilt shims to compensate for the motor's front-down mounting. But whether the engine is stock or custom-built, the manner of transmitting engine r.p.m. to prop r.p.m. is almost universal: via a V-drive unit operating off the engine's crank end.

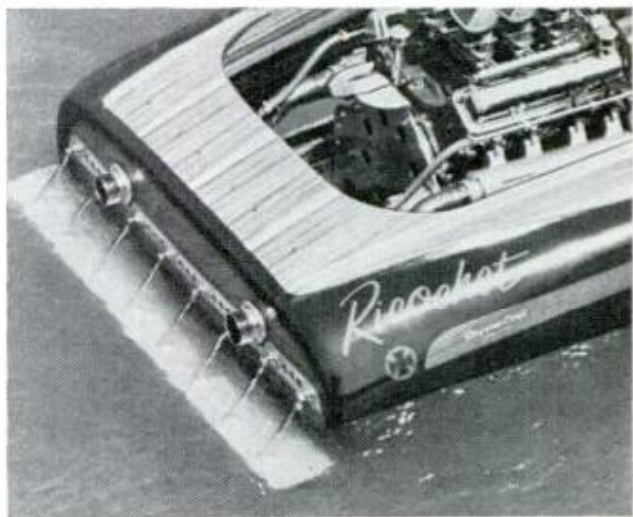
Next to sheer madness, the V-drive has probably contributed more to dragging than anything else. What it does is to allow

(Please turn to page 203)



CONTROL IS DIFFICULT at high speeds since drivers use one hand for wheel and the other for throttle, so one builder is experimenting with dual rudders

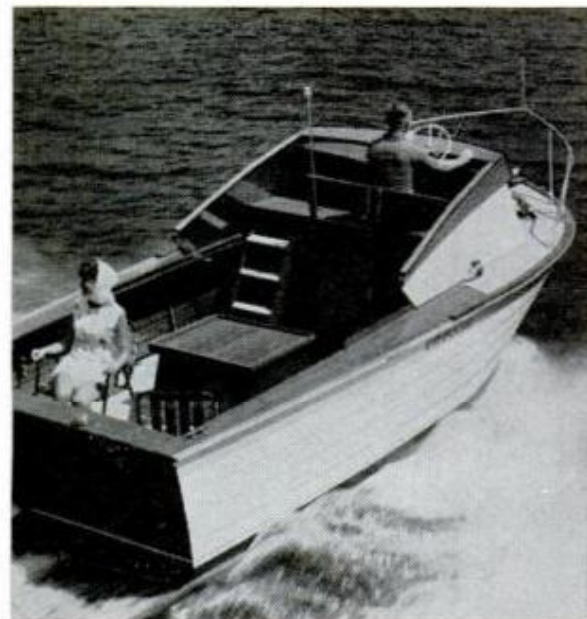
PLANING PLATES attached to the stern of the boat assist in faster planing action. The battery of turnbuckles is used to make hairline adjustment





SPEED AND SAFETY in one 12-ft. fiberglass package, *Slalom* has 6-ft. beam for stability, flat-V bottom for minimum wetted surface. Complete with aluminum mast, dacron sail, rudder and centerboard, it sells for \$612.50 from Slalom Sailboats, Inc., 4130 Lee Rd., Cleveland 28, Ohio

RAISED BRIDGE of Trojan's 20-ft. *Martinique* offers helmsman excellent visibility while retaining low profile, takes little space from either cockpit or cabin. Powered by 100-hp. Interceptor, lapstrake hull has white oak frames, teak planking on foredeck and is trimmed in solid mahogany



BOATING BULLETINS

NEW TRENDS • NEW PRODUCTS

AFTER a decade of revolutionary change, 1963's emphasis on simple product improvement may not seem too exciting, but it makes this a banner year for the man who is actually in the market for a new boat or motor.

He'll get a better engineered product with most of the bugs ironed out.

Outboards appear to have run into a size (and marketing) barrier at the 100-horsepower level. Mercury's introduction of that big black 1000 last year signaled the end of the clamp-on horsepower race, and this year the trend is toward coaxing more power per pound from existing

LATEST ENTRY in the marine jet field is an old-line pump manufacturer, Jacuzzi Bros. Inc., Richmond, Calif. Their unit features a kickup rudder enabling the boat to be steered even when motor isn't running





MODIFIED CAT HULL of this 12-ft. fiberglass fisherman has three longitudinal runners for more stable ride, weighs 110 lbs. Selling for under \$200, it's made by Molded Fiber Glass Boat Co., Union City, Pa.



ULTRA-LIGHT 8-ft. all-plastic car-topper weighs 45 lbs., can carry over 500 lbs. Craft accommodates outboards up to 5½ hp. or special sail kit. Columbia Plastics Corp., Los Angeles, Calif., makes it

42-FOOT HOUSEBOAT powered by twin stern drives mounted in pontoons is equipped with gas refrigerator, hot-and-cold pressure water system. Without stern drives, it's priced at \$8900 f.o.b. Carri-Craft factory in Berlin, Wis.



25-FOOT DEEP-V CRUISER is smallest direct descendent of the original Moppie, provides complete cruising facilities for four. Prices: \$10,945 with twin Volvo 100s; \$11,145 with Mer-Cruiser 110s, f.o.b. Bertram's Miami plant



motors, while making them still more reliable. The few new-from-the-block-out motors seem designed to fill out manufacturers' lines.

Apparently taking a cue from Detroit, Johnson and Evinrude have extended their warranties against motor defects to two years, another indication of the direction in which the whole industry seems to be moving. You'll be hearing "the Volkswagen approach" mentioned more and more often in outboard showrooms.

While OMC has announced plans to withdraw its Gale outboard line at the close of the '63 season, the company will continue to back Gale's two-year warranty through Johnson and Evinrude dealer organizations.

Race-Tuned Outboards

Scott's two new competition engines are obviously exceptions to this conservative trend. Using essentially the same powerhead as the big 75, the FS 590 and FS 630 feature selective gear ratios, an external rotary valve and individually tuned carburetors. Operating up in the 5800-6400-r.p.m. range, they run on aviation gas, but can be modified to use alcohol. Incidentally, Scott admits that these transom-burners aren't designed for skiing, cruising or other humdrum activities.

While exact sales figures on stern drives

FOLDING FISHERMAN with square stern is 12 ft. long, takes motors up to 5 hp. Made of rubber-treated canvas on spring-steel frame, it's from Kalamazoo Canvas Boat Co., 432 Harrison St., Kalamazoo, Mich.



aren't available, word at the boat shows is that they're steadily gaining in popularity, especially on the larger 20-ft.-and-up boats. Ten years ago a practical stern drive hadn't even been perfected; today this system is well on the way to taking over an important segment of the market. Shows how short a time it takes for a good idea to progress from the inventor's drawing board to the showroom and the marketplace.

Aluminum Versus Iron Engines

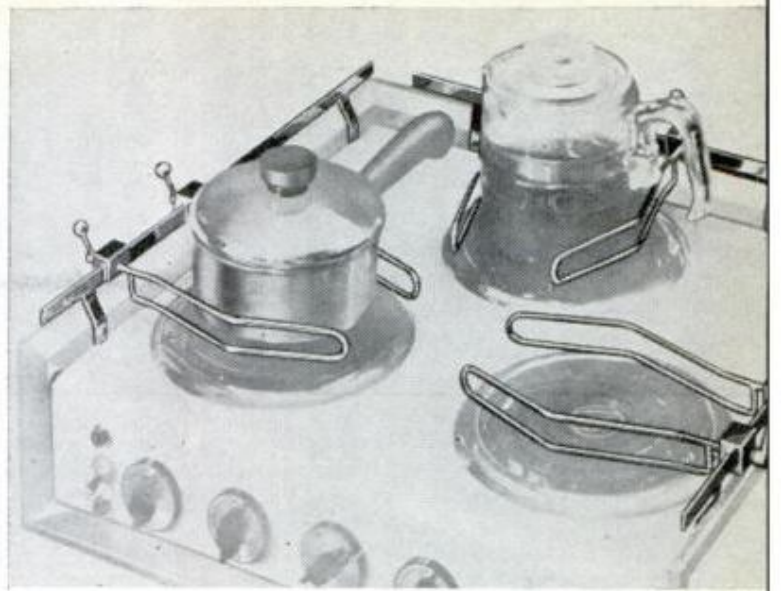
The marine-engine picture is strongly dependent on engineering developments in Detroit and the auto capitals of Europe. One of GM's most recent gambles, the aluminum engine, failed to make a hit with the auto-buying public, but many people thought that it would go over big in the more weight-conscious marine market.

Aluminum blocks seem to have caught on, but aren't running away with the market. According to Stokes Marine Supply, one of the country's larger marine equipment distributors, sales of the Buick 155-hp. aluminum V8 just about match those of the company's two top-selling iron V8s in this power range, the 145-hp. Chevrolet and 145-hp. Ford.

While there isn't anything radically new in marine engines today, there could be something interesting lurking just over

WALK-THROUGH WINDSHIELD hatch on '63 Lone Star boats allows easier anchoring, docking and loading. Center windshield section slides down under hatch cover which moves forward. Both pieces latch watertight



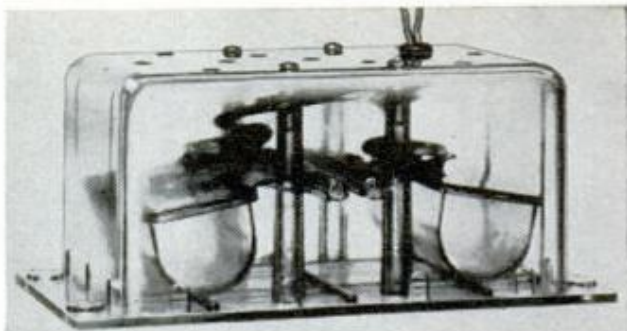


ADJUSTABLE SEA RAILS for galley stoves hold pots firmly. Kit shown sells for \$23.95 from Pan Pacific Mfg. Corp., 2053 E. 38th St., Los Angeles 58, Calif.

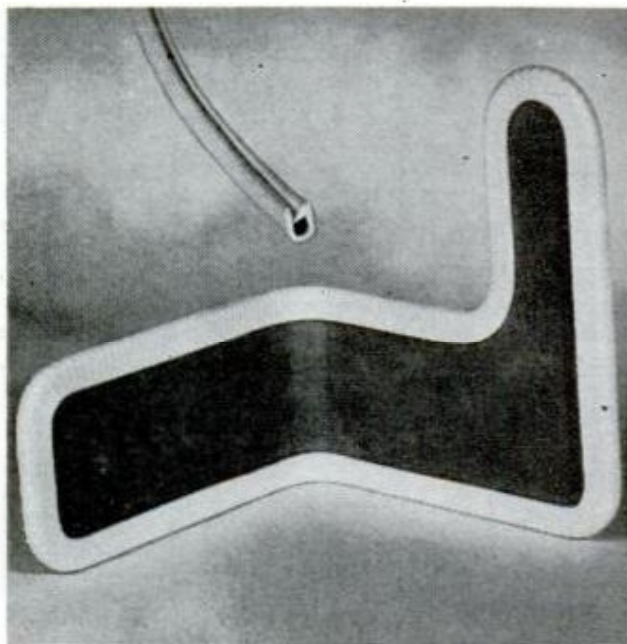
TAPED BUTTED SEAMS of Ratsey's new "Laminair" sails offer less skin friction, smoother air flow than regular seams which are overlapped and stitched

OMC's SEASPORT, open-cockpit version of that three-point hull, has bow tonneau cover, sells for \$2995. An optional camping top offers stand-up headroom





BILGE WATER ALARM mounts at high bilge water line, consists of two floats equipped with mercury switches enclosed in a box. It sells for \$29.95 from Phipps' Water Alarm, 6517 N. Commercial, Portland, Ore.



the horizon. Someone in Europe has already dropped a Wankel engine into a runabout (see p. 138), and the tiny rotary engine, during its initial try-outs, didn't seem to get seasick.

Gas Turbine Inboard

Also, don't give up hope on the small-craft turbine yet. Outboard Marine Corp. has developed a 150-hp. twin-spool gas turbine stern-drive package for the Navy, and will deliver three of these units this year for testing on personnel boats. The use of twin regenerators makes possible a specific fuel rate of .5 lbs. per b.h.p. per hour, which compares favorably with today's auto engines. Furthermore, this is no watchmaker's wonder; all structural parts are designed for high-production die casting.

How about the new boats? Well, with the exception of those pictured here and CustomCraft's four-point cat (see p. 32), the general outlook seems to be "last year, but more so," meaning more Deep-Vs and multi-hull designs.

Speaking of Deep-Vs, Dick Bertram



PORTABLE TANK-BASIN holds 5 gal. of water and is equipped with built-in pump, faucet, drain and stopper. Made by Plastic Products Corp., 1365 Mercer St., Seattle 11, Wash., it has a \$19.95 price tag

SLIP-ON MOLDING for covering exposed edges on fibreglas boats requires no fasteners or adhesives, can be bent to $\frac{3}{4}$ -in. radius. It's produced by Standard Products Co., 2130 W. 110th St., Cleveland 2, Ohio

recently lashed out at latecomers in this field who have capitalized on the success of his Hunt-designed *Moppie*. "What was new in the now famous *Moppie* was a carefully calculated set of ratios, such as the angle of the V (deadrise), the shape and size of the new longitudinal steps, the lifting of the chines above water, the relationship of length to beam, and the often overlooked but critical radius of the rounded keel."

Chancy Love Affair

There isn't room to include his complete statement here, but it boils down to cautioning you against falling in love with a boat simply because you like the looks and it carries that magic Deep-V label. Test it in the water, compare it with similar hulls, *then* make up your mind.

Finally, if you really want to dress up the cockpit of your small cruiser, how about a typewriter-size precision radar unit with a 7-in. picture tube? Raytheon's Model 1900 uses hardly more power than two light bulbs, and you can pick it up for only \$2120. ★★



Plastic-Foam Catamaran

Built of polystyrene foam and powered by a 190-horsepower airplane engine, a two-passenger homemade catamaran can skim the water at 60 miles per hour.

At high speeds air is rammed into the enclosure formed by a wing-type deck and the two hulls, creating a static pressure that raises the craft in the water. At top speed the stern draws only five inches. Designed by Norman Dickinson of Hartford, Conn., the 26-foot "ram-wing" craft is steered by a rudder acting on propeller slipstream.



Boat Wings over the Water

British aeronautic students designed and built a sail shaped like an aircraft wing to prove that principles of flight could be applied to sailing.

Mounted on a short, swiveling mast that fits into a metal tripod, the "wing-sail" has flaps and tailplane. Direction is controlled by cables to the flaps and tailplane which weathercock the wing into the chosen angle of incidence to the wind. Successfully tested, the 15-foot-long sail equals the performance of much larger sail areas.



Rotary Engines Take to Water

WHEN NEWS of the Wankel rotary engine first leaked out to the public, it put a gleam in the eyes of boaters all over the world. More efficient than the familiar reciprocating internal combustion design, this revolutionary little 88-pound engine had an output of 43 horsepower at full throttle. It just begged to be put into a boat.

Sure enough, two European companies have come out with marine applications for the Wankel. Swiss Waser dockyard company previewed a prototype NSU/Wankel-powered jet runabout at the International Boat Exhibition, Friedrichshafen, Lake of Constance, Germany. With throttle wide open, the undersize engine rams 240 gallons per minute through the Starjet unit to which it is mated. Translated into thrust, this is 1000 lbs.—not bad for an 88-lb. flyweight that isn't much larger than a bread box.

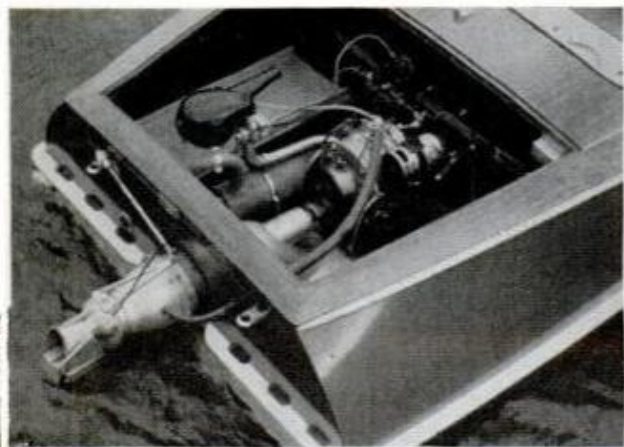
The second sea-going Wankel, a smaller 21-hp. model, nestles inside a 6½-ft. ski

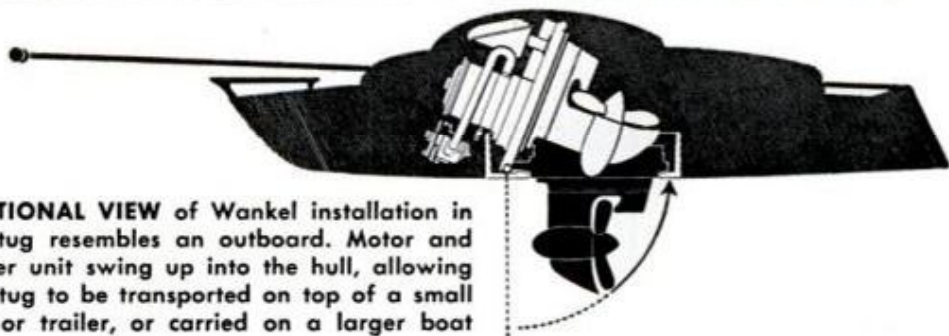
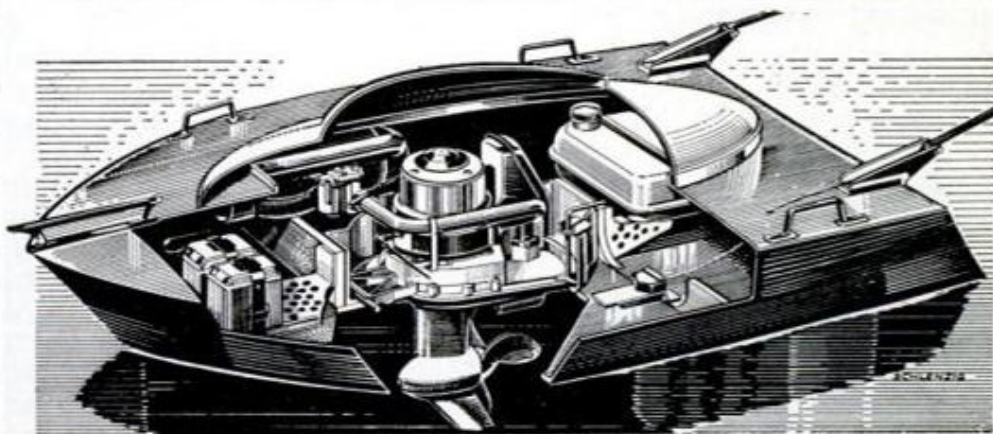
tug. Produced by the Skicraft Company, Hamburg, Germany, this remote-controlled boat is started, stopped and steered from a handle-bar-equipped box mounted on the ends of two 8¼-ft. swiveling rods. As a safety feature, it includes an automatic ignition cutout which shuts off the engine when the skier releases his grip on the handle bars. Thus, when the skier takes a tumble the tug will coast to a stop within a short distance.

Steering the tug involves a combination of swinging the leading rods and shifting your body weight. With such a short towing "line," it's possible to take very tight curves at high speeds. Top speed is 28 m.p.h. and even when running flat-out, the 9.15-cu. in. engine consumes only one gallon of gasoline per hour.

Skicraft put this little tug into production on Oct. 1 of last year, and it sells on the German market for about \$700. So far, no export plans have been announced by the company.

COMPACT AND LIGHTWEIGHT, the Wankel requires no valves, springs, camshafts, pistons or connecting rods. Instead of cylinders and pistons, it has a single combustion chamber shaped something like a jelly bean. A rotor resembling an equilateral triangle with the sides bowed out makes an eccentric orbit inside this chamber so that its three corners are always in contact with the walls of the chamber. The three cavities formed between the sides of the rotor and chamber walls act as moving "cylinders"





SECTIONAL VIEW of Wankel installation in ski tug resembles an outboard. Motor and lower unit swing up into the hull, allowing the tug to be transported on top of a small car or trailer, or carried on a larger boat



Low-Cost

Auxiliary Fuel Tank For Your Outboard

By Keith F. Hildebrand

IF YOU'RE AN AVERAGE BOATER, one or two standard six-gallon outboard fuel tanks offer sufficient fuel capacity for most of your boating activities—skiing, fishing, skin diving, etc. But how about those once-a-season trips which require greater cruising range? Most people just take along extra cans of fuel and pour it into the outboard tanks as required, but in a moving boat this is both an awkward and potentially dangerous operation.

For less than half the cost of an out-

CONNECTOR UNIT may be fitted to jeep can by drilling and tapping a 2-in. pipe plug for $\frac{1}{4}$ -in. thread



board fuel tank, you can buy a jeep-type gas can and equip it with a removable fuel-hose connector cap. With such a cap, you can connect the fuel hose from the motor directly to your spare cruising tank, thus avoiding the difficulties involved in transferring fuel from one container to another. And when the jeep can isn't being used as a cruising tank, just replace the fuel-hose connector cap with the regular cap and you have a spare gas can.

The heart of this conversion, the fuel-hose connector unit, may be obtained from your local outboard dealer. Montgomery Ward's Outdoor Sports catalog lists such a unit designed for use with all Outboard Marine Corp. motors (Johnson, Evinrude, etc.) for \$2.95. A standard compression fitting that fits $\frac{5}{16}$ -in. O.D. copper tubing is included with the connector, so all you need to convert any container into an extra fuel tank is a means of fastening the end of the hose connector in the opening of the container and a length of tubing which will reach to the bottom.

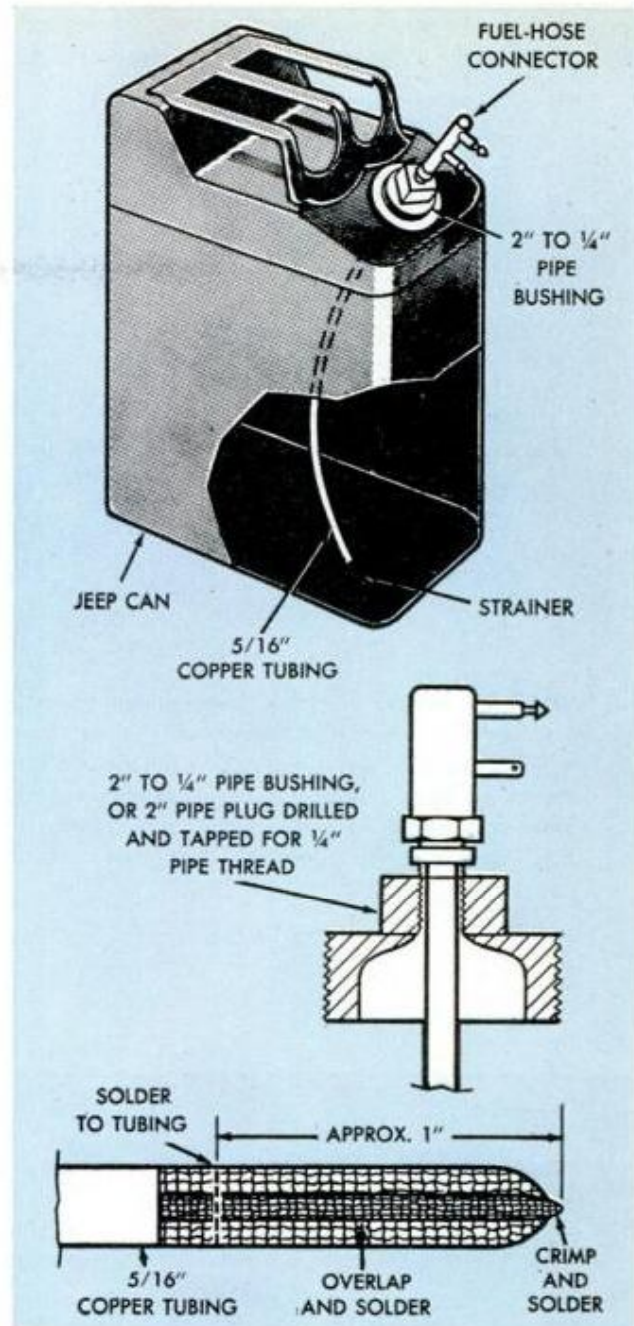
Since the threaded opening in a five-gallon jeep can is a 2-in. pipe thread, you can either use a 2-in. to $\frac{1}{4}$ -in. reducer or (as illustrated) a drilled and tapped 2-in. pipe plug to fit the fuel hose connection to the can. Fasten the compression fitting to the copper tubing, then thread it into the pipe bushing.



JEEP CRUISING TANKS are less stable than regular tanks and must be securely mounted to prevent overturning. Author installed his in wells cut in deck

The bushing need only be threaded in hand tight, since the can isn't pressurized. Also, don't turn the hose connector too tightly into the bushing until you have checked how far the bushing will screw into the opening in the jeep can, as this may have to be adjusted later in order to orient the unit in regard to the fuel hose.

To complete the connector cap, make a strainer from a piece of fine brass screen, following the diagram at right, and solder it over the end of the copper tube. One such cap can be used with several jeep cans by switching it from can to can while running on one of the regular tanks.



First Aid for a Rough-Idling Outboard

When you suddenly realize one day that your outboard's powerful purr has turned into an irregular caterwauling, don't start worrying about a complete overhaul until you've checked out these easily corrected causes of rough idle:

- Stale fuel mixture
- Fuel not mixed properly
- Fuel lines kinked or pinched
- Spark plugs fouled or improperly gapped
- Carburetor or mag out of sync
- Carburetor settings incorrect

If you still haven't found the source of trouble after checking these, go on to

some of the less common possibilities:

- Look for a bent gear or exhaust housing
- Check points and timing
- Check reeds for flat contact with reed plate
- Clean oil drain screen in reed plate base
- Inspect carburetor needle and seat and float valve
- Check for dirt in coil

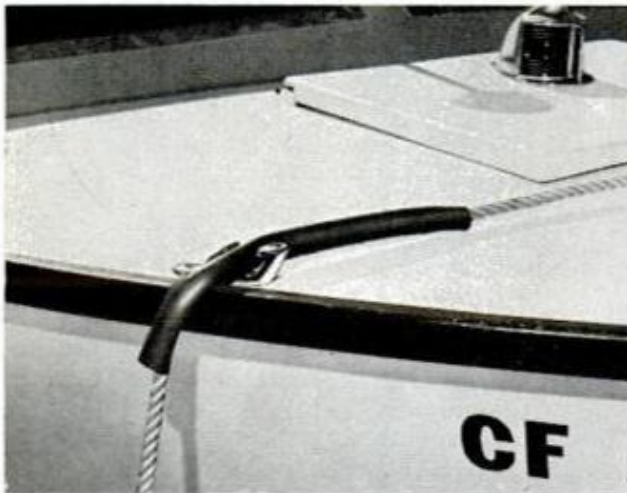
If there is a great fluctuation in rpm at idle, there's a good chance that you'll find sticking piston rings or scored cylinder walls at the root of this.



BOATING SHORT CUTS

NO GOOD MECHANIC likes to work with a rusty tool, but it's almost inevitable that tools carried aboard a boat will rust in a short time because of the ever-present moisture. To protect your tools from moisture, wrap each one snugly in that clinging transparent plastic sandwich wrap

HOLES OR TEARS in canvas boating equipment—boat covers, convertible tops, duffel bags, even sails—can easily be repaired with inexpensive iron-on patches. These are available in several colors and sizes, so finding the right patch for each special job shouldn't be too difficult



CHAFING GUARDS for your anchor, bumper and mooring lines will protect both the lines and the surrounding paintwork. Make them from the inner tubes used on racing bikes. Most bicycle repair shops will be glad to give you worn or blown out tubes from which guards can be cut

IF YOUR CRUISER won't fit into your garage because the windshield is too high, take off the permanent mounting brackets and replace with quick-change bronze bolts and wing nuts. Use rubber molding under the edge, and drill holes for the mounting bolts about 10 in. apart



POPULAR MECHANICS

STRAP WEBBING on canopies and life jackets often becomes frayed at the ends. To correct this condition and prevent it from recurring, cut off the frayed portion of the strap and coat the first inch of material above this cut with white glue to hold strands of webbing in place



IF YOU NEED an oversize funnel when working around your boat, try cutting the bottom out of a large plastic bottle or jug, such as those in which bleach is sold. Put the cap back on and the funnel becomes an emergency bailing bucket which will come in handy in rough weather

ANOTHER USE for those large plastic bleach bottles? Try them as marker buoys. Just attach one end of a length of light line to the handle and tie the other end to a weight. Such buoys cost almost nothing, but come in very handy for marking anchorages or good night fishing spots

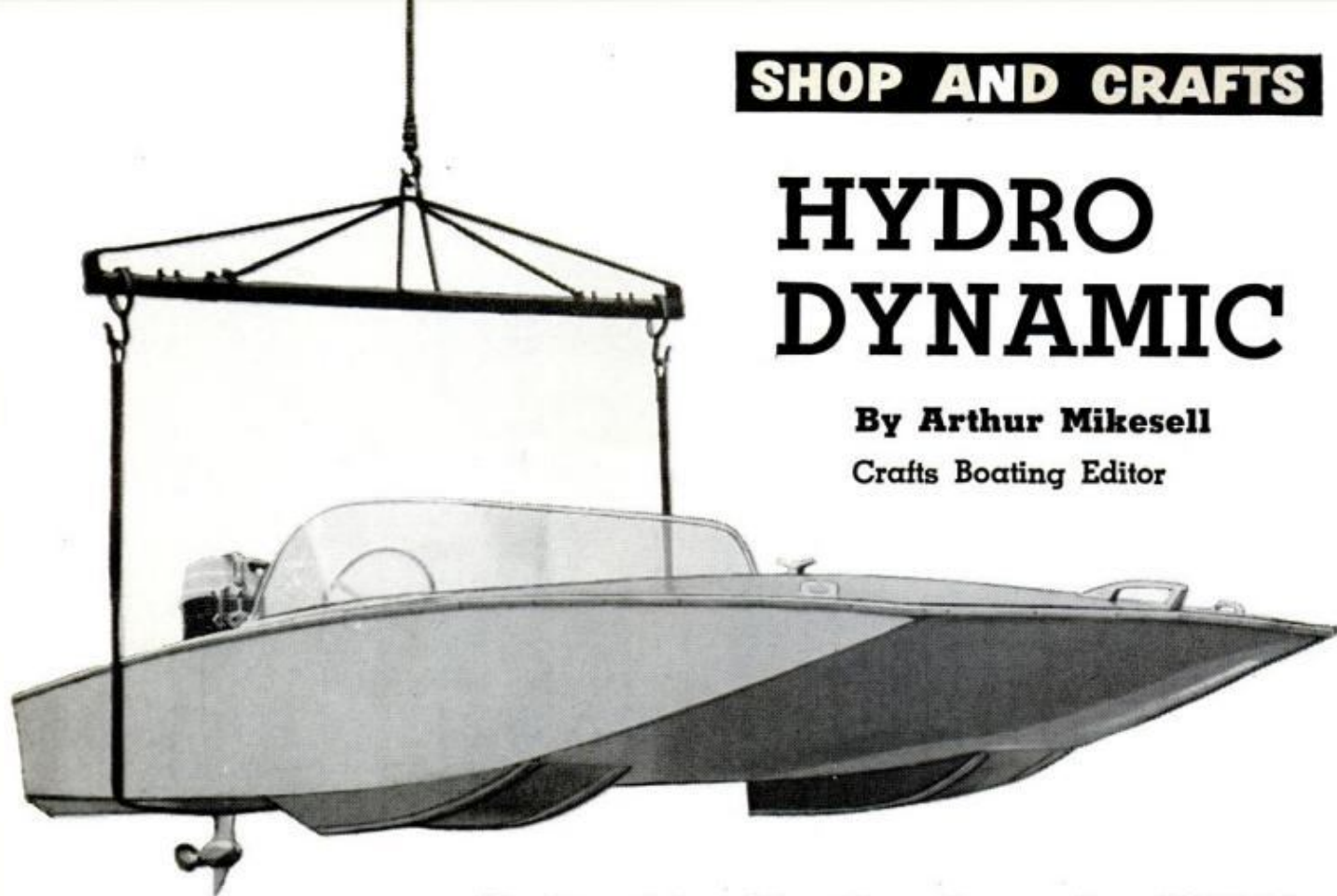


NEXT TIME YOU PAINT your boat, wrap a piece of wax paper or aluminum foil around the bottom of the paint can and secure it with a rubber band or length of string. This not only stops paint from running down the side of the can and leaving stains, but prevents scratching deck

HYDRO DYNAMIC

By Arthur Mikesell

Crafts Boating Editor



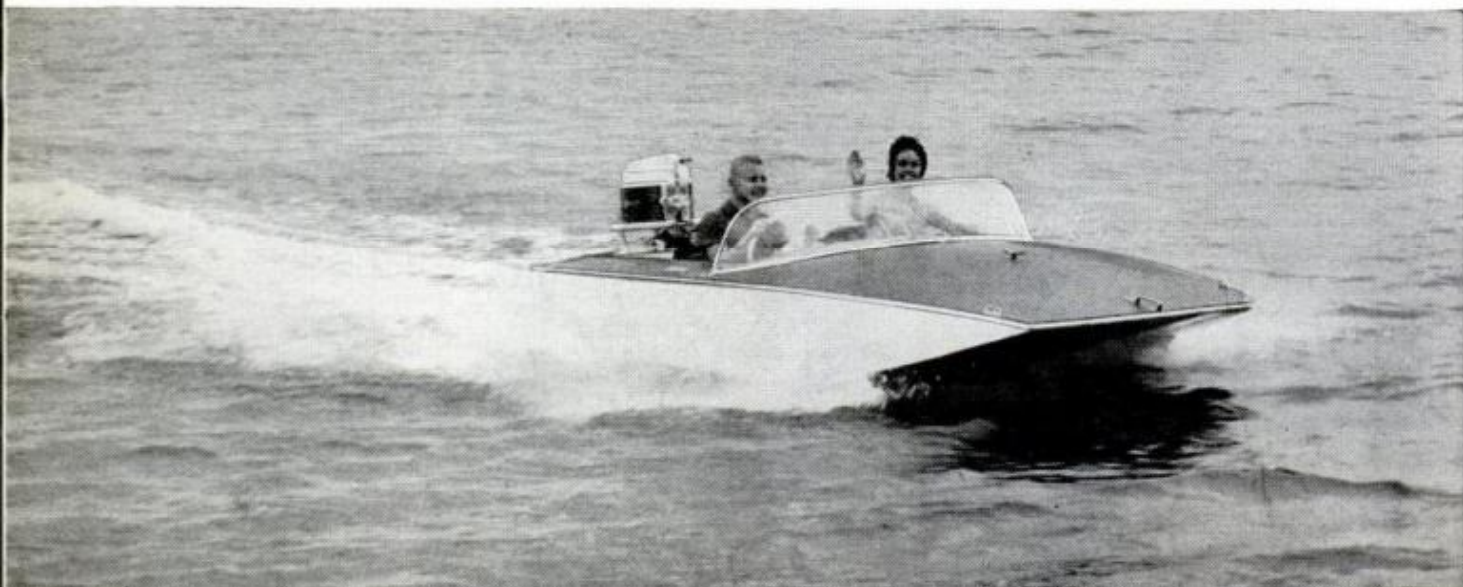
Designed by Alan Scott (remember PM-38?), this crisply modern three-point runabout seats four and can top 50 mph with a 65-hp motor. A thrill to drive, you can build it for less than \$75

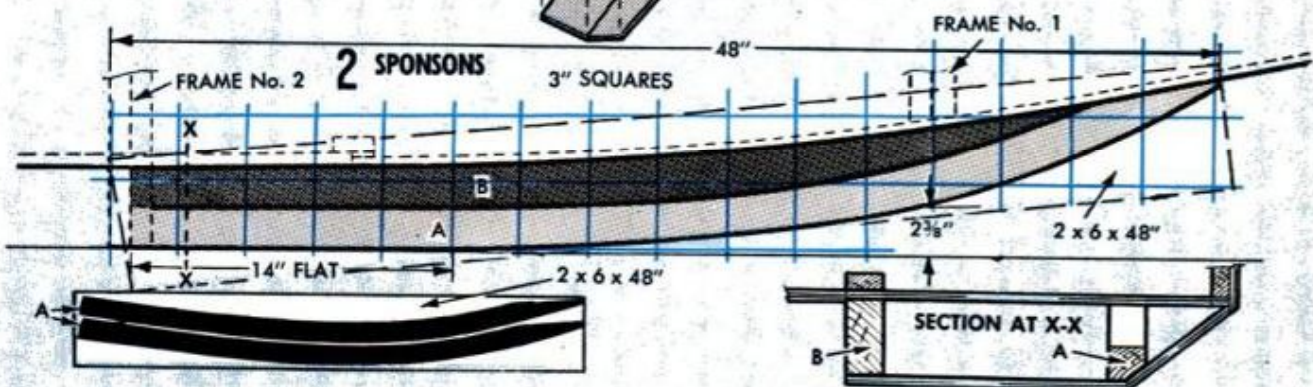
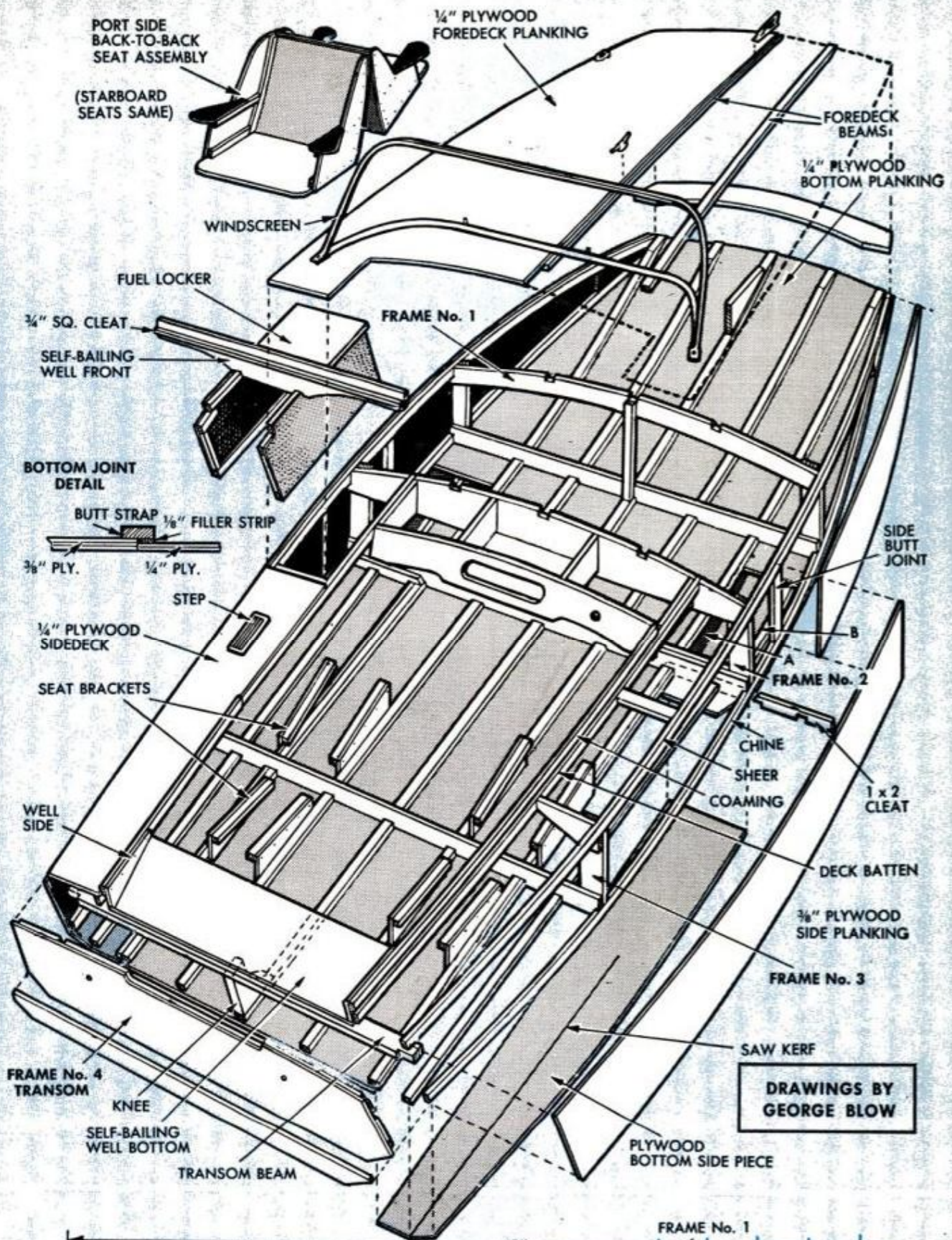
UP TO NOW, the amateur boat builder who was interested in a hydroplane had to be content with an ultra-light, temperamental racing hull designed to carry only one or two people.

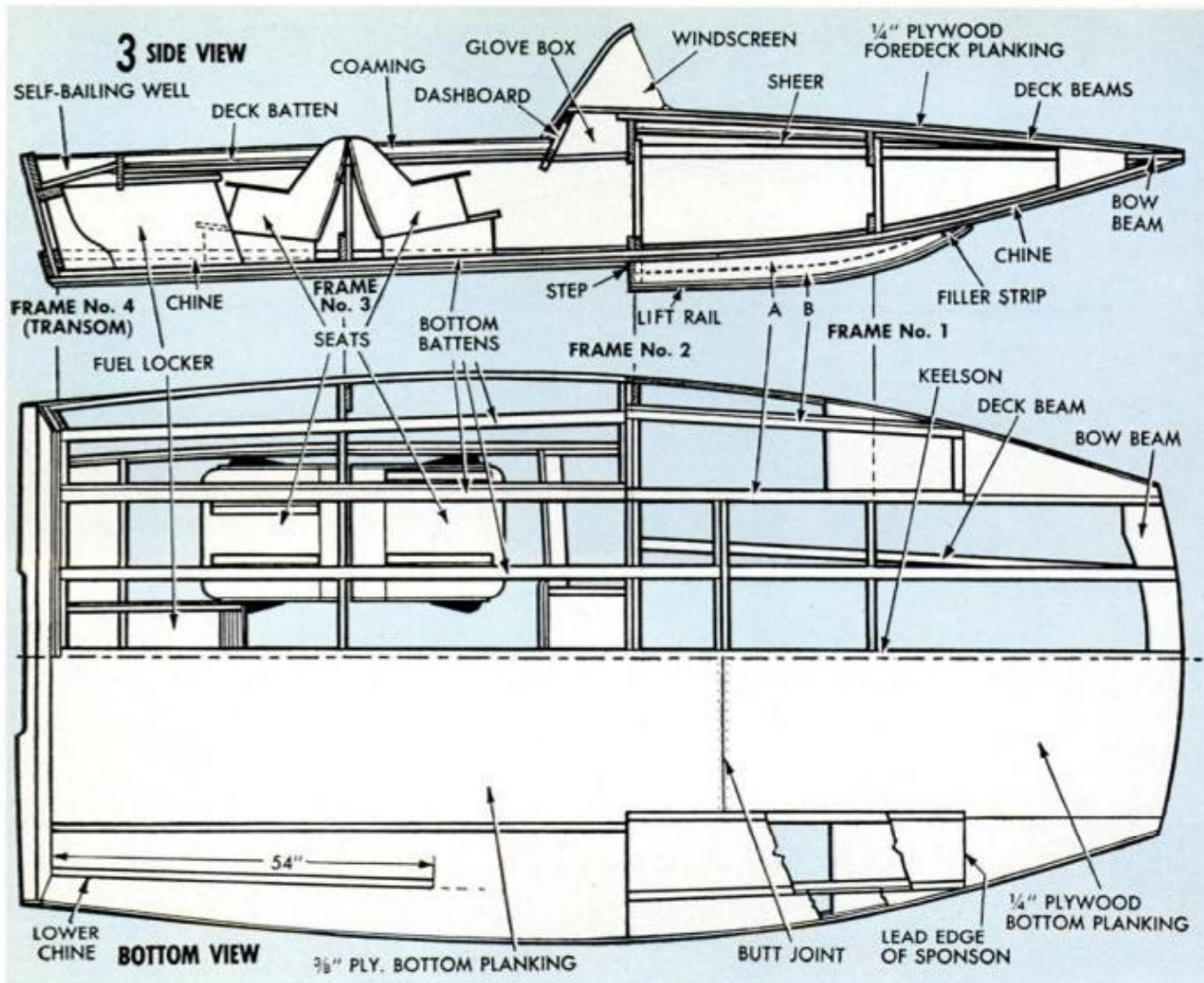
In spite of recent breakthroughs by boat manufacturers in taming the race-bred, three-point hydroplane for more general use, build-it-yourself plans for a true recreational three-pointer just weren't available. Thus, we decided that PM's project boat for this spring should be a recreational hydroplane.

Remembering the success of *PM-38*, we called in Alan Scott to design this boat. These were the requirements we gave him: An easy-to-build three-point plywood runabout approximately 14 ft. long for use with a motor in the 45 to 65-hp range; a clean modern topside design, featuring a roomy cockpit with seating for four; and the capacity to operate efficiently while towing a skier. Altogether, this was a pretty tall order, but three months later we received the plans for *Hydro Dynamic*, and it turned out to be a

SLEEK AND SASSY, this modern three-pointer combines the excitement of a racer with runabout versatility





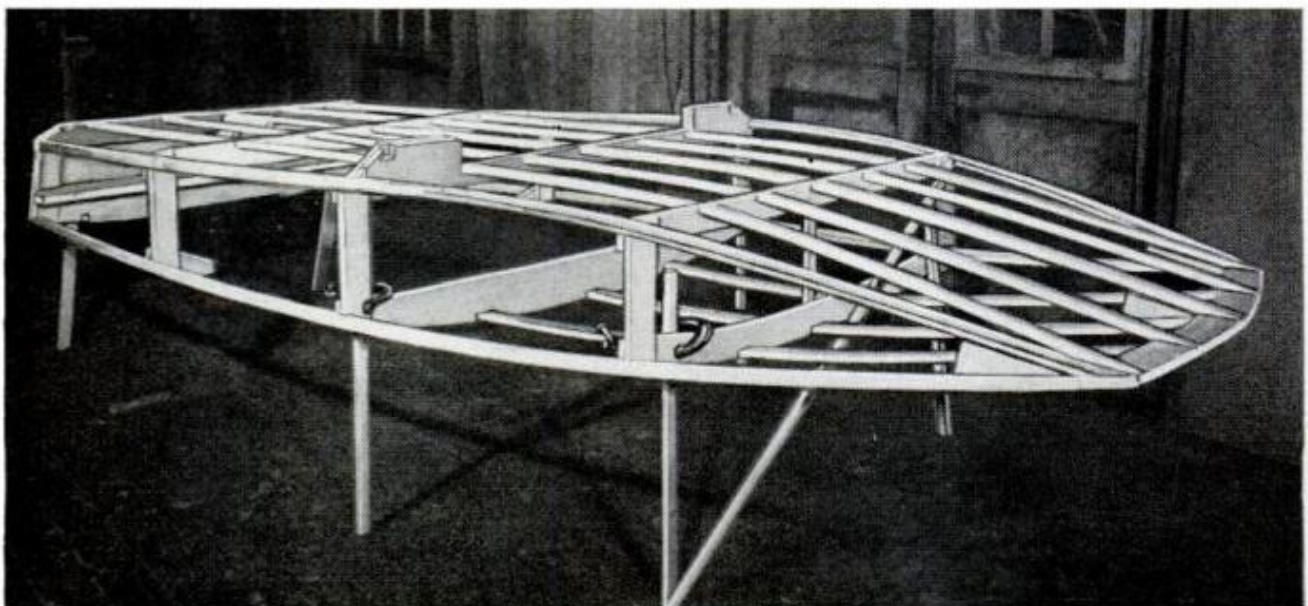


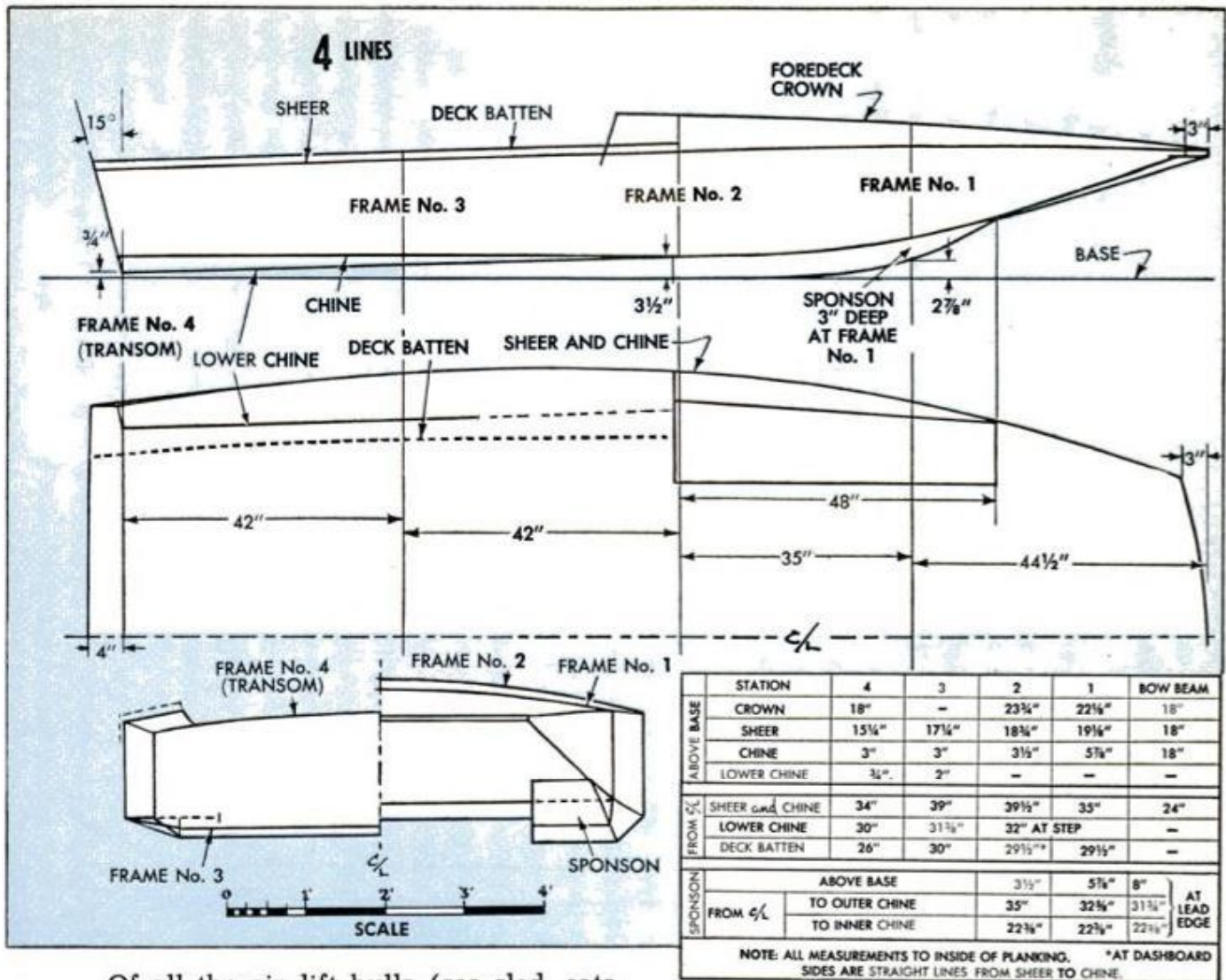
rousing success on all of these counts.

If you've never driven a three-pointer, then you've missed one of the biggest thrills in boating. Let your imagination go, and slip into the driver's seat of *Hydro Dynamic* for a test run. As you ease the throttle lever forward, the boat comes smoothly up on a plane just like any normal planing hull. But continue to ad-

vance the throttle and *Hydro Dynamic* suddenly climbs to her points with an effect like cutting in the afterburner on an F-104. The boat seems to be flying over the water rather than skimming along the surface, and you feel that almost imperceptible "walking" action, found only in three-pointers, as the sponsons slide from wave to wave.

NO BUILDING FORM is required, but temporary legs which support frame should be securely attached to floor





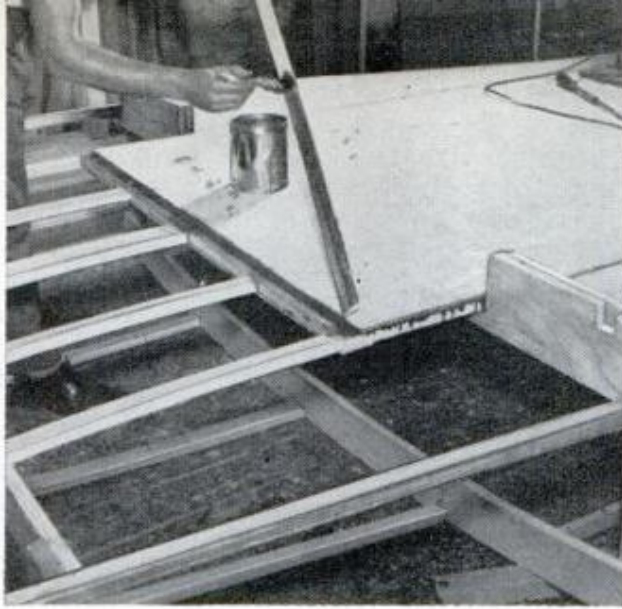
Of all the air-lift hulls (sea sled, catamaran, etc.), the hydroplane design is the most sensitive to weight. Since this boat is designed for general recreational use rather than flat-out racing, the sponsons were made wide and flat, with a rather deep entrance. This may not be the most efficient design for racing speeds but it brings the boat up on its points sooner and provides support for a heavier load, enabling you to enjoy the advantages of three-point ride while towing a skier or carrying extra passengers.

But a word about materials before we go on to the construction of *Hydro Dynamic*. The hull of the pilot model was planked with AA exterior fir plywood. Naturally, solid-core marine plywood can be substituted here, but it will raise the cost of the boat substantially. Likewise, fir was used for all frames, battens and other structural members, but mahogany has a better strength-to-weight ratio and would make the boat somewhat lighter. However, mahogany is more expensive.

All joints are both glued and screwed, and all exterior fastenings should be countersunk slightly and concealed with wood putty. While cadmium-plated steel screws are specified in the materials list,

BOTTOM SIDE PLANKING aft of sponsons must be slit to form inner chine. Lift rail will cover this joint





FOR FLUSH JOINT between $\frac{3}{8}$ -in. aft bottom planking and $\frac{1}{4}$ -in. forward bottom planking, glue a $\frac{1}{8}$ -in.-thick batten over the butt straps at this joint

come in a variety of colors. As for the vinyl-coated deck fabric (Du Pont, Nautolex or similar), it won't scruff, crack or peel and is easy to keep clean. We used a teak pattern, but it comes in a number of other patterns and colors.

Before you begin building *Hydro Dynamic*, make sure that you understand every construction step. Study the drawings—particularly the exploded view on p. 145—until you know the whole boat like the back of your hand. Then, after “building the boat in your head,” begin the actual construction by cutting out and assembling the frames.

While most of the side and bottom members of each frame are simply straight pieces of 1 x 4 stock, Fig. 5, the transom, top beams and bow beam must be cut to a curve. To avoid errors, make full-size paper patterns of each one, using the grid system to scale the drawings up to actual size.

You can make a handy tracing tool for transferring these patterns to the wood by salvaging a gear from a discarded alarm clock and mounting it on a nail between the legs of a wooden clothespin. Tape or tack the paper over the wood, run this tool around the edge of the pattern and you'll produce a neatly dotted outline of the frame member on the stock.

Begin with frame 4, the transom. This is made up of an inner frame faced with $\frac{1}{2}$ -in. plywood and reinforced with a 2 x 4 cross beam. A 1 x 4 running across the bottom on the outside provides additional strength. Since the keelson, bottom battens, sheer battens, etc., will all be notched into the inner framing and butted to the plywood, cut these notches before mounting the frame members. Then fasten the framing to the plywood with glue and

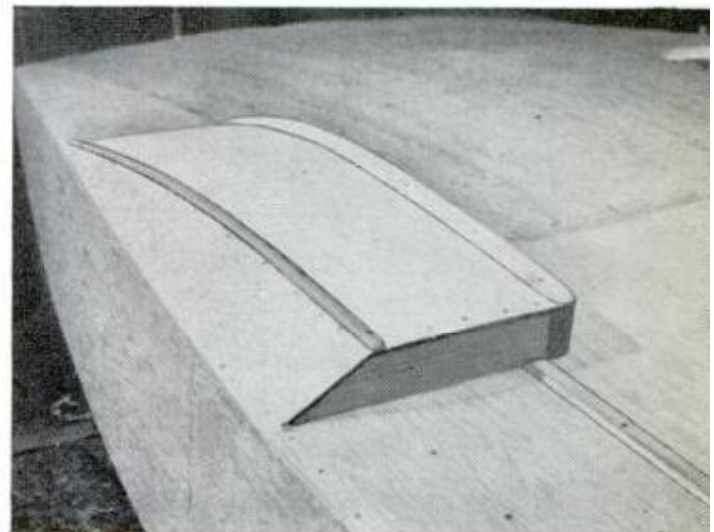


AFTER SECURING aft edge of bottom bow planking, clamp fore end to bow beam and add other fastenings. Outside bow planking notches to center section



SPONSON FRAMING will require a considerable amount of fairing. To save time, you might cut this bevel oversize with a saw, then finish it with rasp

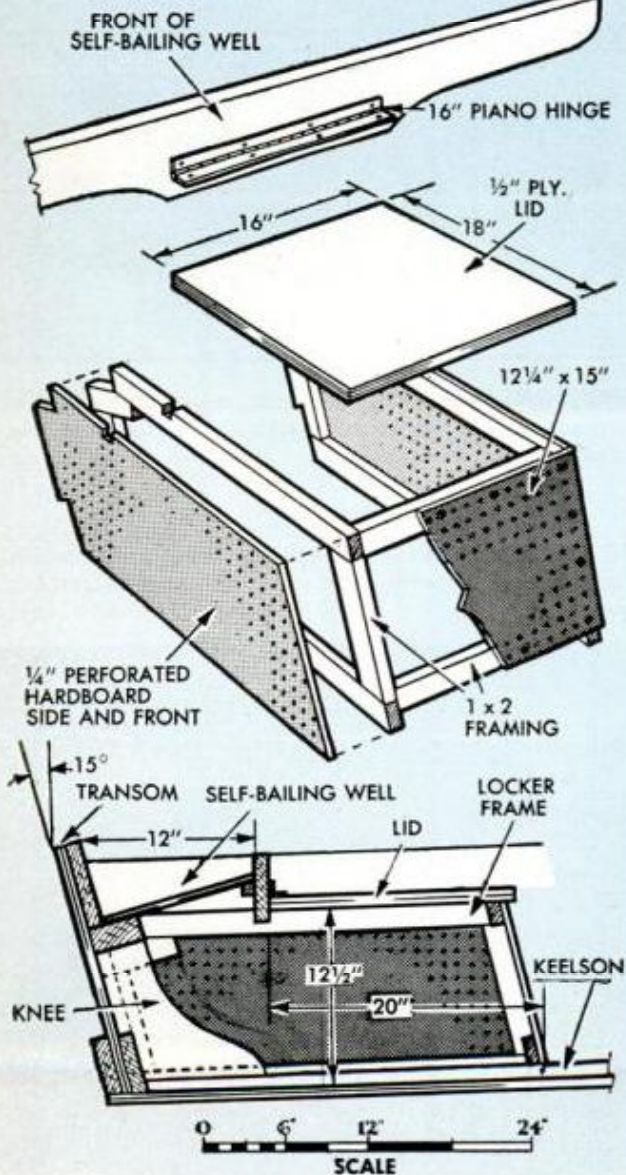
COMPLETED SPONSON includes two rails which slant inward, providing a slight “tunnel effect” to gain additional lift. Round the ends as shown here





BUCKET SEATS are framed with light battens obtained by cutting 1 x 2 stock in half on a circular saw

6 FUEL LOCKER



1¼-in. No.-8 f.h. wood screws spaced 2 in. apart. After assembling the transom, cut out the transom knee, Fig 5, and mount it on the transom. Note that it must be notched to fit over the the bottom framing member.

Next, cut and assemble frame 3, using three 1½-in. No.-8 f.h. wood screws at each corner joint. The dashboard mounts on supports running aft from frame 2. While you may cut out these pieces now, installation will be easier if you wait until the hull is turned.

Frame 2, the step frame, is somewhat more complicated. The bottom cross-member must be made double thickness since it also acts as framing for the sponsons. The forward thickness fits between the two side framing pieces and is notched for the outer sponson framing member, "A" in Fig. 2. The aft thickness runs the full width of the boat and isn't notched. Thus, the notches in the forward thickness must be cut before it is secured to the aft thickness. Use glue and 1½-in. No.-8 f.h. wood screws to mount it.

You'll have to add a 1 x 2 cleat on the aft surface of the bottom crossmember of frame 2 to serve as a nailing strip for the ¼-in.-plywood bottom planking. This cleat must be notched to accept the two outer bottom battens before securing it to frame 2. Be sure to make the inner notch large enough to accommodate not only the batten but the nailing strip which runs along its outer edge and butts to the aft surface of frame 2. After cutting notches, secure the cleats with glue and 1¼-in. No.-8 f.h. wood screws.

Assemble frame 1 as shown, cut out the bow beam, and you are ready to begin framing the hull. Although no complex building form is required, you should have a stable, level nailing platform on which to assemble the hull.

You will note from the photo on page 146 that the frames are supported on legs above the building floor. Since we built *Hydro Dynamic* in a shop with a wood floor, it was no problem to toenail these legs directly to the floor. However, if you plan to build the boat in a concrete-floored garage, assemble a skeleton building platform from scrap lumber and attach the legs to this. Use C-clamps or screws to mount these temporary legs on the frames.

Once all four frames are supported at the proper height and correct distance apart, Fig. 4, install the 1 x 2 keelson using glue and two 1¾-in. No.-8 f.h. wood screws per joint. Next, mount the sheer battens on the frame, securing each joint with glue and two 1¾-in. No.-8 f.h. wood screws. Note that these must be attached

to the outer ends of the curved bow beam.

The chine battens go on next. They must be curved rather sharply from frame 2 forward to the bow beam, so in order to make the bending easier we suggest that you slit this portion by running it through a circular saw. After slitting, fasten the chine batten to frames 2, 3 and 4 using glue and one 1 $\frac{3}{4}$ -in. No.-8 f.h. wood screw per joint. However, don't fasten it to frame 1 yet. Instead, bend this slit forward portion through the notch in frame 1 so that the end meets the joint between the sheer batten and bow beam.

Trim the end of the slit batten to fit flush against the sheer batten, then fill the slit with glue and clamp the chine batten in place. When the glue has hardened, secure it to frame 1 and the bow beam, then fasten it in place with glue and screws. A reinforcing block is required at this joint, too, though it shouldn't be installed until after the center deck beam is in place.

Mount the bottom battens next, trimming the end of each to fit against the bow beam. Secure them with glue and one 1 $\frac{3}{4}$ -in. No.-8 f.h. wood screw at each joint.

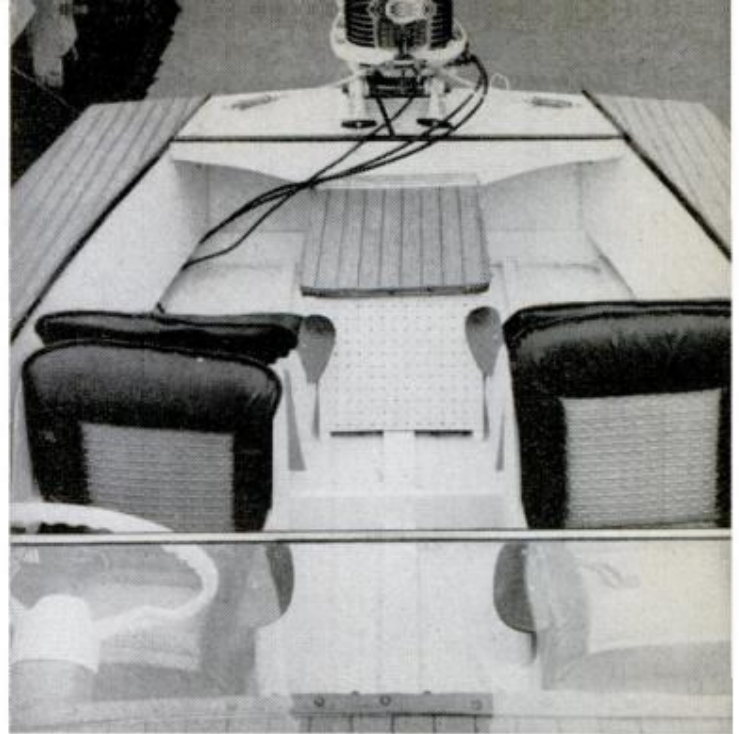
Before fairing the frame and beginning the job of planking, you might mount the three foredeck beams. While the operation isn't absolutely necessary at this point in the construction, these beams will make the hull slightly more rigid, thus providing extra insurance against pulling it out of alignment when planking.

Since most of the hull surface is flat, the frame will require a minimum of fairing. Remove the temporary legs which have supported the hull thus far and place the hull on the floor. Then fair all framing surfaces until they will mate evenly and smoothly with the plywood planking.

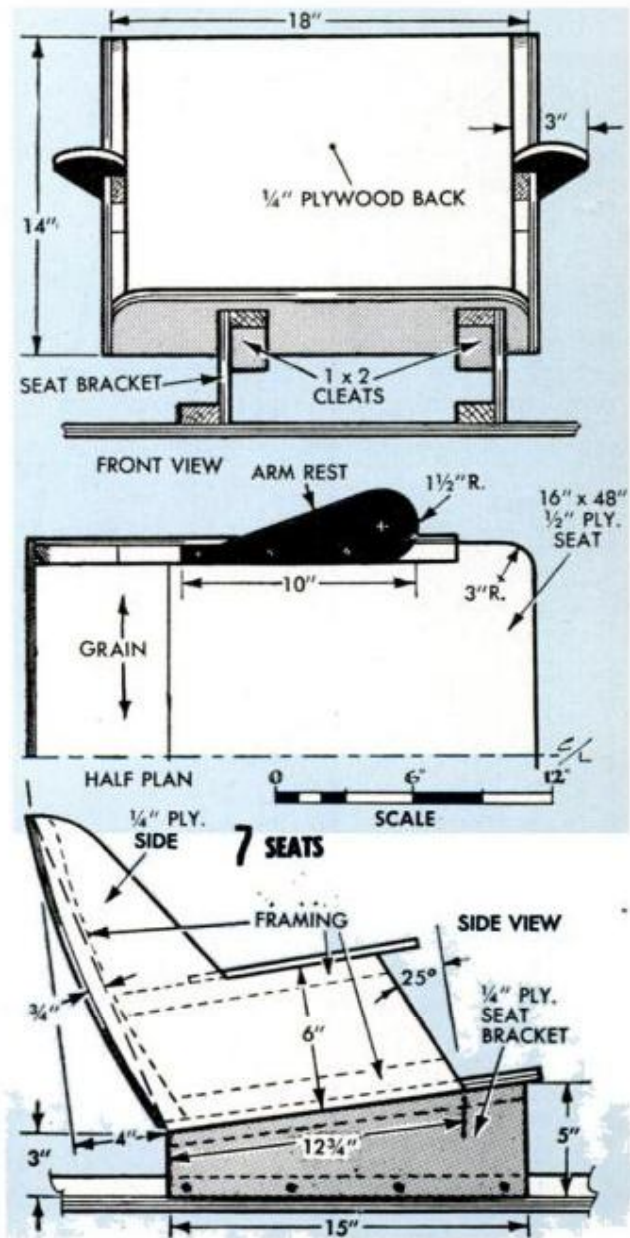
Begin planking with the 4 x 8-ft. panel of $\frac{3}{8}$ -in. plywood. Place this in position on the frame and attach it temporarily with four 1-in. No.-8 f.h. screws. Then crawl underneath and mark the location of all framing members on the plywood. Also mark the location of the forward edge, so you will know where to install the 1 x 2 butt straps which reinforce that planking joint.

Next, remove the panel and predrill holes about 2 in. apart for 1-in. No.-8 f.h. wood screws, using a double row of screws along the transom. After installing the butt straps between the bottom battens, coat mating surfaces with glue, apply calking compound to transom edge and secure the panel to the frame.

Once the $\frac{3}{8}$ -in. panel is installed, you can mount the nailing strips along each side of it. Made by cutting a 1 x 2 down



BACK-TO-BACK seating takes advantage of every inch of space with rear legroom extending under well





TOWING A SKIER, *Hydro Dynamic* speeds over water staying well up on her points with a 45-hp motor

the middle, these strips are attached to the two bottom battens and elevated slightly so as to bring the 1/4-in. planking up flush with the 3/8-in. planking.

In order to achieve the bend necessary to form the inner chines, you'll have to make a 54-in. saw cut in the two outside sections of aft planking, Fig. 3. Secure these two sections as you did the center panel, using a double row of screws along the 54-in. slit.

The forward bottom planking is also 1/4-in. plywood, so glue a 1/8 x 1-in. batten along the fore edge of the 3/8-in. planking to bring it up to the proper height. After securing the 4 x 6-ft. center section of planking, make paper patterns of the two

4-ft. outer sections and mount these. Before you start on the sponsons, install the side planking, following the same procedure used in planking the bottom.

Each sponson is framed with two longitudinal side pieces cut from 2 x 6 stock, Fig. 2. After mounting these framing members, add a tapered filler block at the fore end to serve as a nailing strip for the planking. Then cut out the 1/4-in. sponson planking, bevel the fore edge to fit flush against the bottom planking and secure with 1-in. No.-8 f.h. wood screws and glue.

Before turning the hull over, install the eight lift rails. Those on the sponsons should slant toward the center of the

(Please turn to page 214)

MATERIALS LIST

LUMBER

1 pc. 1 x 2 x 14'
4 pcs. 1 x 2 x 14'
2 pcs. 1 x 2 x 7'
2 pcs. 1 x 2 x 14'
2 pcs. 1 x 2 x 14'
3 pcs. 1 x 2 x 8'
2 pcs. 1 x 2 x 10'
1 pc. 1 x 2 x 7'
2 pcs. 1 x 2 x 12'
1 pc. 1 x 4 x 8'
1 pc. 1 x 4 x 6'
1 pc. 1 x 4 x 12'
1 pc. 1 x 4 x 8'
1 pc. 1 x 4 x 10'
2 pcs. 1 x 6 x 7'
1 pc. 1 x 6 x 6'
1 pc. 1 x 6 x 5'
1 pc. 1 x 6 x 6'
1 pc. 1 x 8 x 4'
1 pc. 1 x 8 x 4'

Keelson
Bottom battens
Bottom battens
Sheer battens
Chine battens
Deck beams
Deck battens, seat framing
Fuel locker framing
Planking nailing strips
Transom framing
Outside transom framing
Frame 3
Frame 2
Frame 1
Frame 2
Frame 1
Self-bailing well
Transom framing
Bow beam
Dashboard brackets

1 pc. 1 x 8 x 7'
1 pc. 2 x 4 x 6'
1 pc. 2 x 6 x 4'
1 pc. 2 x 6 x 8'
2 pcs. 1/2" x 1 1/4" x 7'
6 pcs. 1/2" x 1 1/4" x 5'

Transom beam
Frame 2
Sponson framing
Sponson framing
Lift rails
Lift rails

PLYWOOD

1 pc. 3/8" x 4' x 8'
1 pc. 1/2" x 3' x 6'
6 pcs. 1/4" x 4' x 8'

Bottom planking
Transom, fuel-locker lid,
self-bailing well bottom
Planking, seats, etc.

FASTENINGS, MISC.

6 gross—1" No. 8 f.h. woodscrews
6 dozen—1 1/2" No. 8 f.h. woodscrews
1 gross—3/4" No. 8 f.h. woodscrews
2 lbs.—waterproof glue (Weldwood, or similar)
1 pt.—caulking compound (Stay-Tite, or similar)

TUNING THE TRANSOM

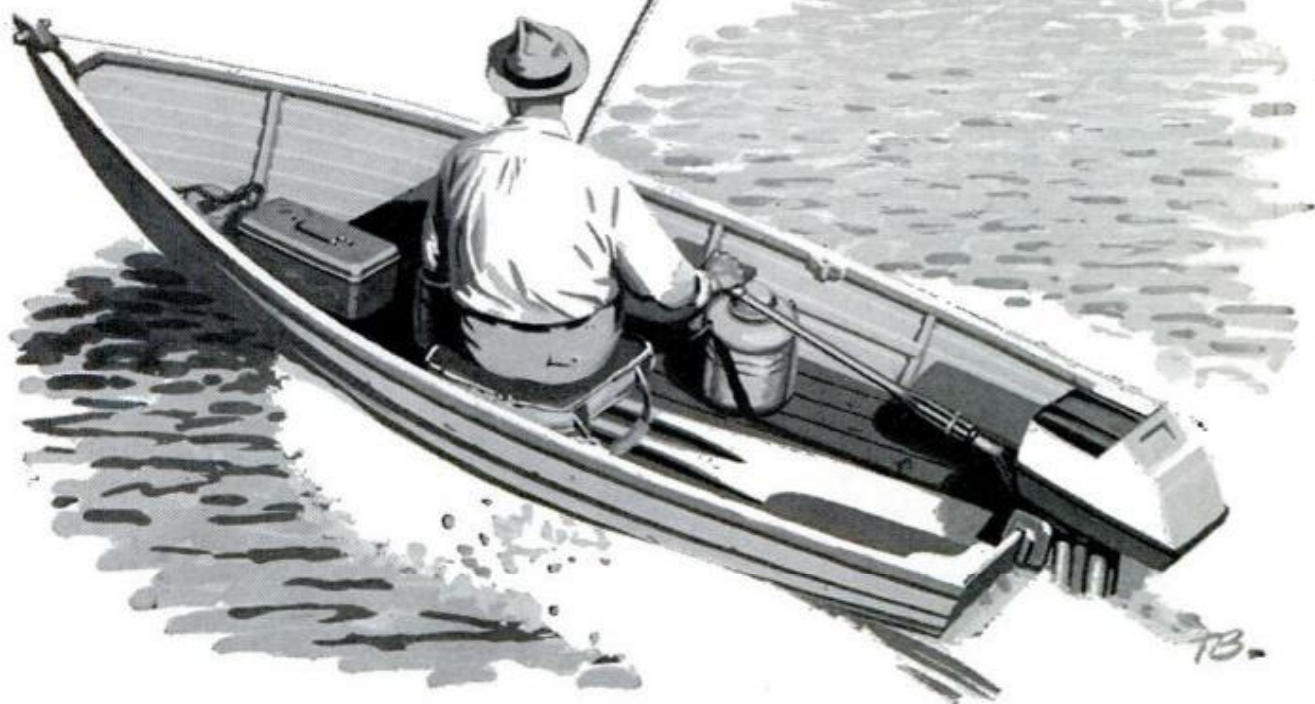
To get the best performance from this 375-lb. hydroplane, insert a series of 1/8-in. shims under the motor clamps, one at a time, until it begins to cavitate when wide open. Then remove one shim. On test runs, best results were obtained with #3 tilt-pin setting.

Hydro Dynamic was tested with Mercury's 450 and 650 motors. The smaller motor, turning a #48-32178A1 15-in. Merc prop, pushed it to 44 mph; the larger one yielded 53 mph. All runs were made in a slight chop (ideal water for this boat), and speeds were checked with Truspeed racing speedometer.

PLANS AVAILABLE

If you prefer to work from larger drawings than those included here, you may obtain a set of plans on 22 x 30-in. sheets by sending \$3.50 to Popular Mechanics Blueprint Dept., 740 N. Rush St., Chicago 11, Ill.

Up-Front Steering For Small Outboards



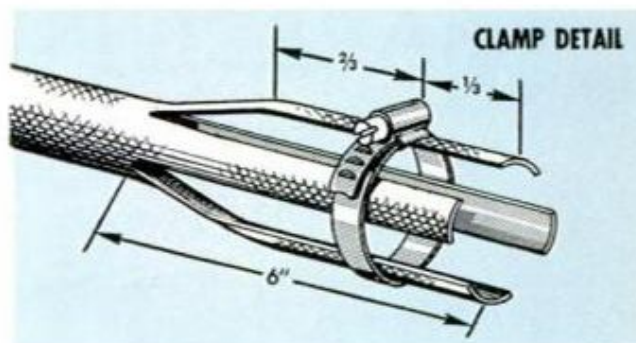
ANYONE WHO HAS gone out fishing alone in a 10 or 12-ft. boat is well acquainted with the trim problems involved.

Such boats are too small for normal remote control, so you have to sit near the transom in order to operate the motor. This concentration of weight at the stern pushes the bow high in the air, resulting in improper planing and wasted fuel.

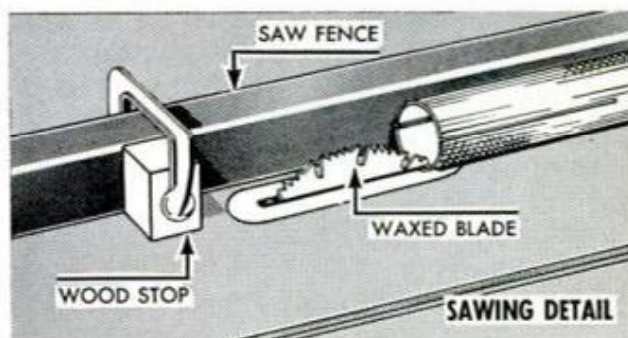
You can lick this trim problem by making an extension for the control handle of your fishing motor which will allow you to run the boat from the center seat. Using a hack saw or circular saw, make four cuts at 90 deg. to each other in one end of a length of 1-in. embossed aluminum tubing. (To reduce binding, coat the saw blade with paraffin.)

Flare out each of the four straps thus formed, as shown in the drawing, and slip this end of the tubing over the control handle of your motor. Wrap the handle first with rubber cut from an inner tube to protect it. Next, slide an adjustable hose clamp over the flared end of the tubing and tighten it. After making sure that the tubing is in line with the handle and the clamp is well-seated, mark the location of the clamp. Finally, rivet the clamp to one of the straps, slip a bicycle grip over the other end of the tubing, and your "remote control" is ready for use.—*Don Mathesins*

ADJUSTABLE CLAMP must be riveted to one of the straps so that it will stay in place when extension handle is removed from the motor. Locate it about one third of the way in from end of expanded straps



IF SLOTS ARE CUT on a circular saw, clamp a stop block to the saw fence so that all cuts will be of equal length. Be sure to wear safety glasses to protect your eyes from flying particles of aluminum





BARREL FULL OF BIRDS

These eighteen apartments built in a barrel should say "welcome" to every purple martin that flies past in search of a nesting site

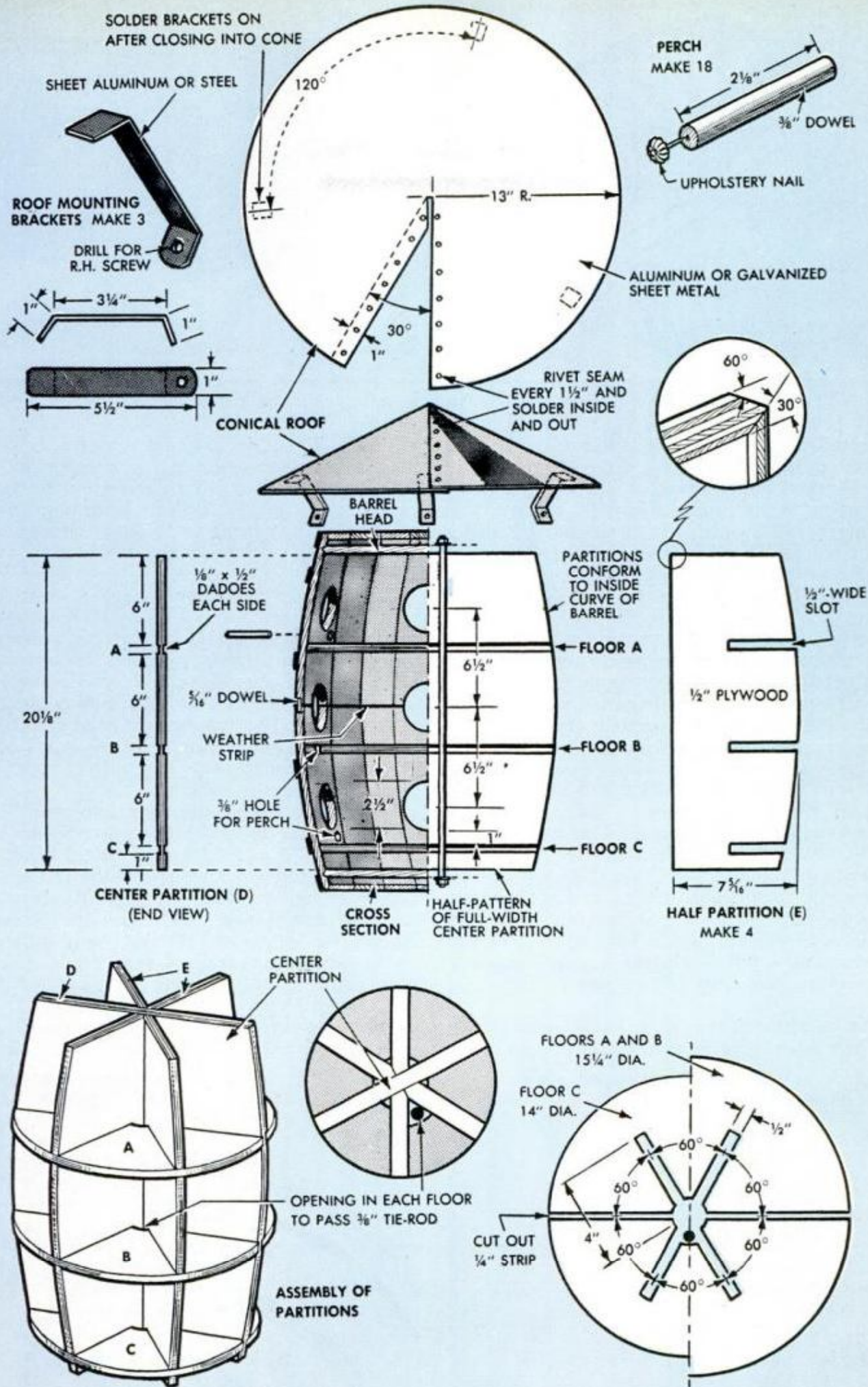
By Manly Banister

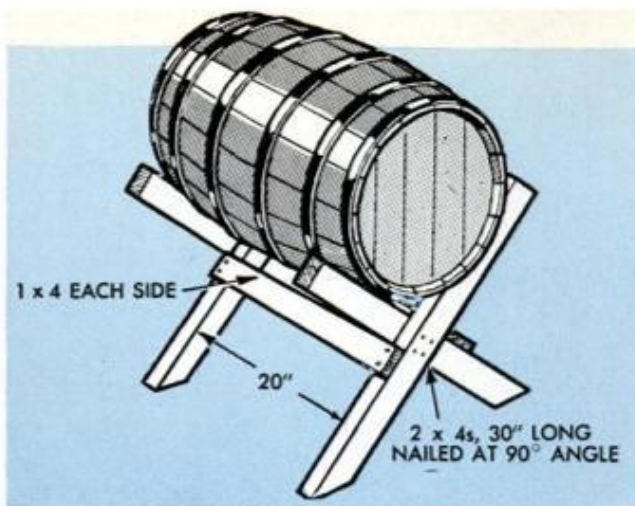
YOU WON'T BE LONG hanging out a "no vacancy" sign when you get this martin apartment house set on the peak of your garage or atop a pole in a sunny, open area.

You can locate the barrel near your house (but not closer than fifty feet) so that you can enjoy the melodious chatter and flashing wings of a house-nesting colony all spring and summer. But remember that the house must be located in the open, never under or near large trees. Purple martins are graceful, acrobatic flyers and they like lots of wing room. Once they're home, though, they don't mind crowding. They're natural-born apartment-dwellers,

with no interest in private bungalows.

The barrel used for the original pictured above was a paraffin-lined oak keg intended for vinegar or wine. A plain fir barrel would do as well. It might not look as handsome to you, but martins don't choose by appearance. It'll be less trouble, because the oak keg's thick paraffin lining had to be scraped out. Don't use an old whiskey barrel: martins probably won't like the smell—or the charred inside. The dimensions of the barrel you get should be checked very closely before you cut any stock; the partition assembly detailed on page 155 may not fit. It was designed for a typical 15-gallon cask. Your barrel should





YOU'LL NEED a buck this size to support a 15-gallon barrel for the three operations shown on this page

have both heads, but if it doesn't, you can cut additional plywood disks.

First step is to make a barrel buck like that in the drawing above to support the barrel while you sand it smooth between the hoops, bore the holes and then cut it in half with your saber saw. Locate the holes so they're 1 in. above the floor levels. For the perches, drill $\frac{3}{8}$ -in. holes 1-in. below each entrance port. On the barrel shown, the top and bottom rows of perches were offset to avoid drilling through the bands.

The center barrel bands are nailed or screwed to each stave to make sure the barrel won't fall apart when it's cut in two. The lower half of the barrel is weather-stripped with an adhesive-backed felt strip. Finally, drill two $\frac{5}{16}$ -in. holes 180 degrees apart and centered on the edge of the lower half of the barrel. Drill to a depth of about $\frac{3}{4}$ -in. Then, using dowel centers, locate and drill registering holes in the edge of the upper half of the barrel. Glue dowels in the bottom pair of holes, trimming them to project about $\frac{3}{8}$ -in. and rounding the ends. These dowels serve as

CUT 18 ENTRANCES with hole saw, spacing them evenly around circumference. Nail bands to each stave



156



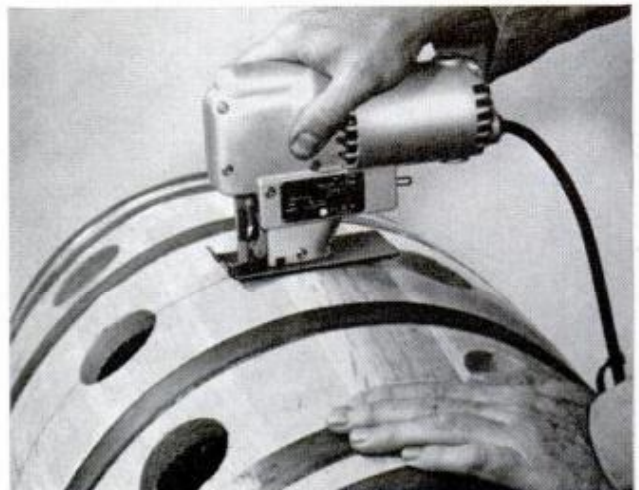
SAND KEG smooth between bands with orbital sander or by hand. Use a rasp between the end bands

aligners. Then, in the final assembly of the partition-and-floor structure the half floors are glued into the dados cut in the center partition, D. Before fastening any of these parts permanently together, do a trial assembly. Some hard work may be necessary for a good fit.

Cut perches and drive in place with a spot of glue on the end of each. Let each dowel project about $1\frac{1}{2}$ in. After attaching the roof to the barrel (bending the brackets slightly if necessary to level the top), finish the barrel all over with two coats of spar varnish. If aluminum is used for the top, it need not be finished. Galvanized sheet metal can be sprayed with a couple of coats of aluminum paint.

If you want to set the barrel on top of a garage or shed, you'll have to design a platform to fit over the roof ridge. Whatever mounting you use, check the purple-martin return date for your locality (usually late April) and don't raise the house before, as sparrows, starlings and other undesirables may take over. You'll find them hard tenants to evict. ★★★

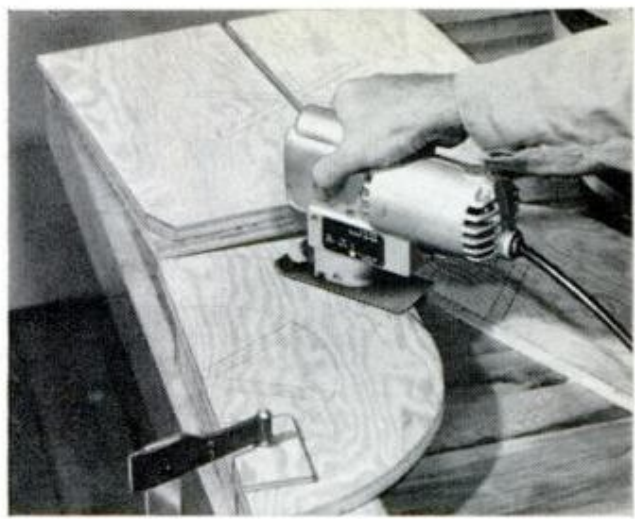
INSERT SABER-SAW blade in one of center holes and cut barrel in half on largest circumference line



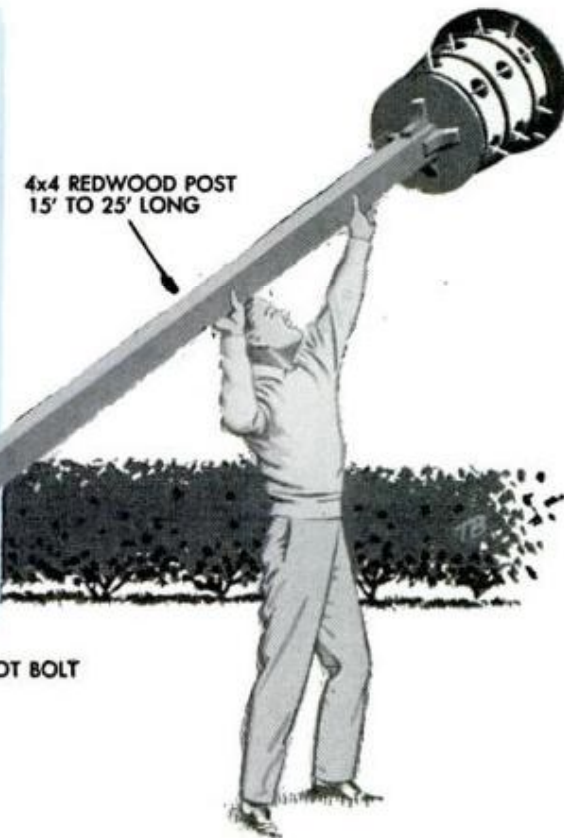
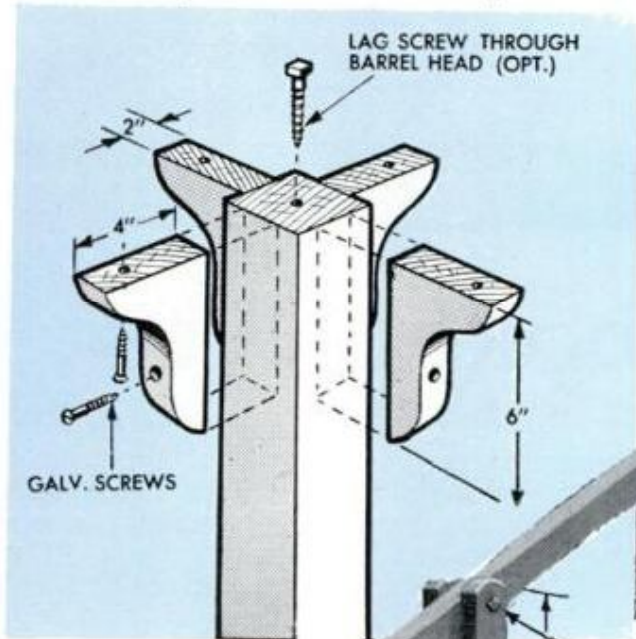
POPULAR MECHANICS



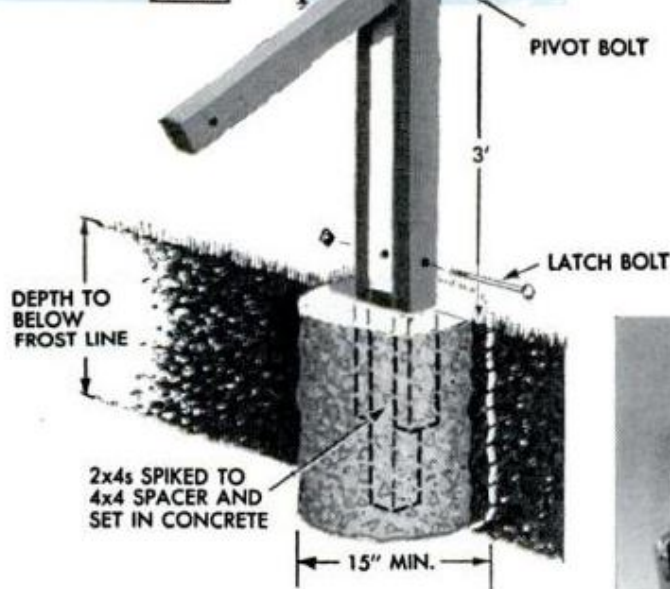
WEATHERSTRIP lower half of keg with adhesive-backed felt strip. Notch felt to obtain easy fit on curve



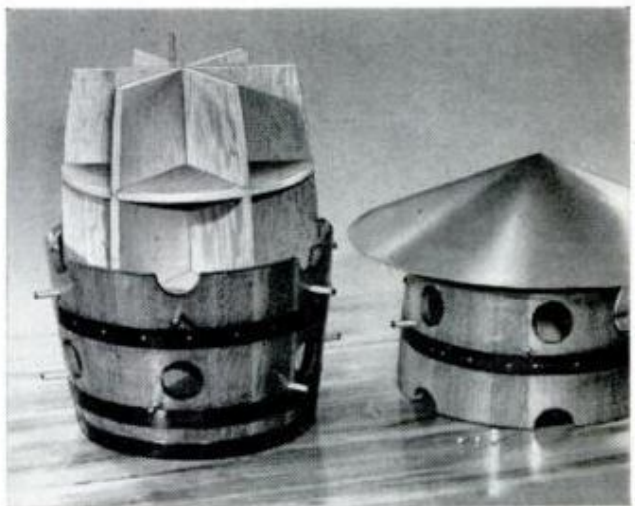
CUT FLOORS with saber saw. Lay out circles, then cut out the center strip, stack halves, and trim contour

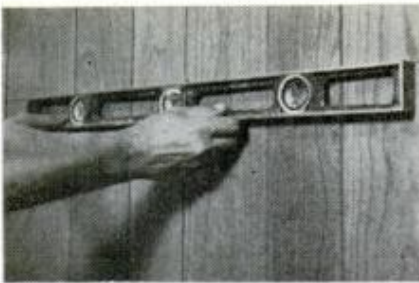


4x4 REDWOOD POST
15' TO 25' LONG



PIVOTING POST makes maintenance a snap. At end of nesting season, you just lower the barrel and detach tie rod so you can lift off top half (right). Then partition assembly pulls out for cleaning. If you store barrel indoors till next martin return-date, you foil such unwanted squatters as starlings and sparrows





FIRST MARK a horizontal center line on the wall for each shelf at desired height above the floor

THEN BORE holes through the wall into the studs for the rod supports, being careful to hold the drill level



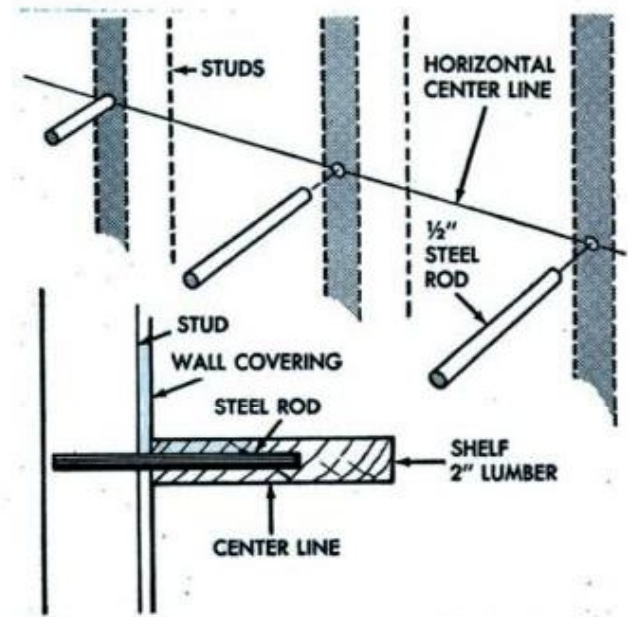
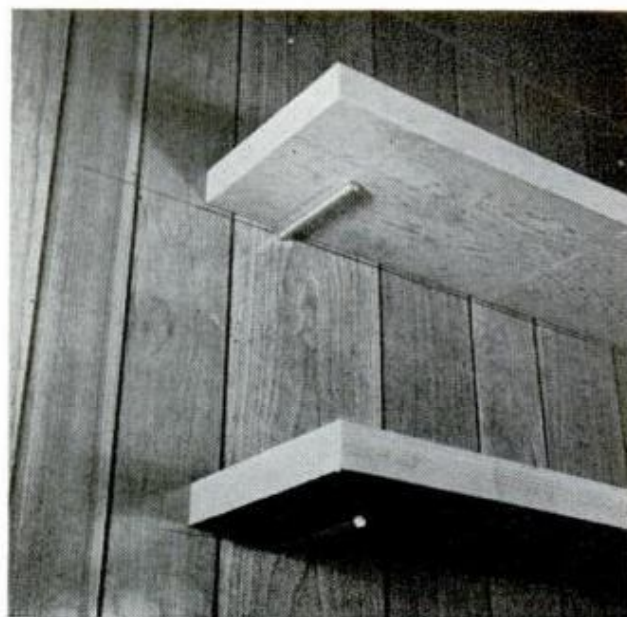
Floating Bookshelves

WITH NO VISIBLE MEANS of support, you are apt to wonder what's holding them up. Actually, these "floating" planks are quite shelf-sufficient and will hold their weight in books without fear of falling.

What magic, pray tell? The shelves are simply edge-drilled to slip over $\frac{1}{2}$ -in. steel rods projecting from holes drilled through the wall into the wall studs.

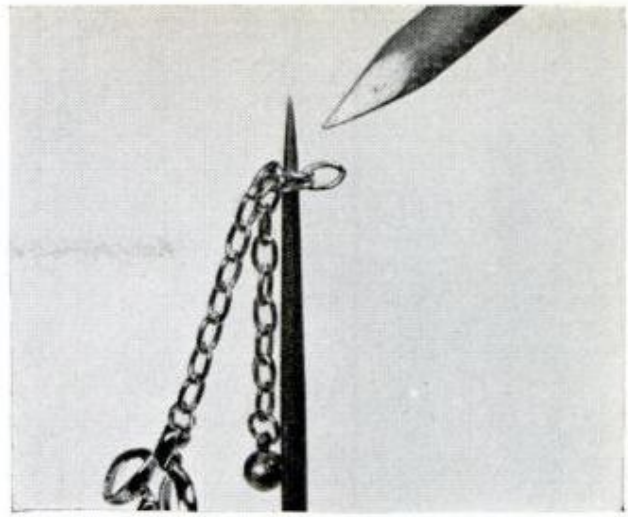
Despite the care needed to bore the holes true so the shelves and rods will register, it's actually a fast way to erect wall shelves and a most attractive one.

First, with the aid of a level, draw horizontal lines on the wall at the heights where you want the shelves. Then, after locating the first stud by tapping the wall with a hammer to get the solid sound that indicates a stud, measure across the wall at 16-in. intervals to spot the centers of the other studs. Drill $\frac{1}{2}$ -in. holes 3 in. deep in each stud where the lines intersect, drive in the steel rods and mark the shelves for registering holes in the edges by resting them on the rods as shown in the photo.—*R. J. DeCristoforo*



Soldering Stake

Jewelers, hobbyists and others who have need to solder links in repairing watch or purse chains or chain necklaces will find that an ice pick or a sharp scriber makes a good soldering stake. You lock the pick or scriber upright in the vise. Then you fold the chain back on itself, holding the two links joining the defective link between the thumb and finger. Drop these over the point of the pick, leaving the faulty link projecting as pictured, in position for soldering with a pencil-type iron. The binding action of the two links holds the one rigidly in position.—*Bil Toman*



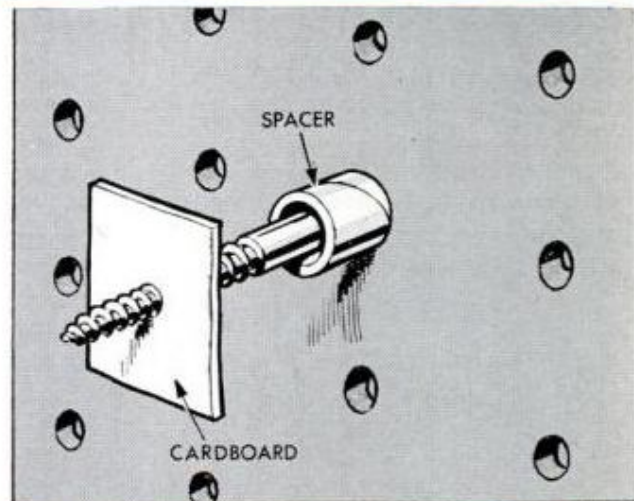
Sorted Sweepings

When you clean up your workshop there are likely to be a few nails, maybe a screw or two, also filings and metal chips among the sweepings in the dustpan. Sorting these from the wood shavings is no job for the hobbyist with limited shop time. But you can sort the sweepings automatically simply by cementing a row of small permanent magnets to the bottom of the pan. When you dump the pan gently into the container, the metal sweepings will be clinging to the magnets.—*Frank Shore*



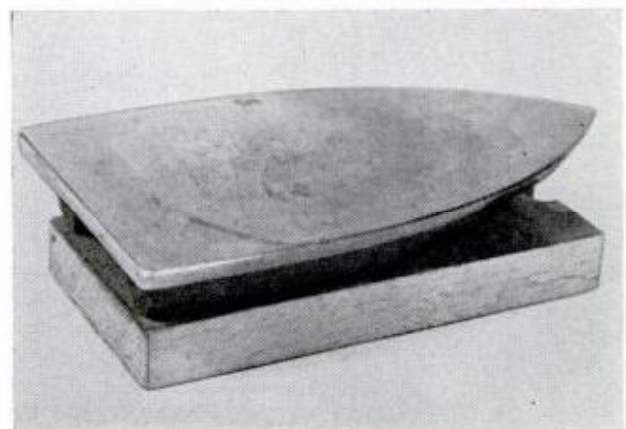
Spacer Retainer

Those tricky little spacers you use when hanging perforated panels—how to keep 'em in position while you juggle the panel into place and get a few screws tightened? To make the job really easy and at the same time keep everything under control, insert the screws, slip the spacers over them and turn a small square of light cardboard down on each screw, the full length of the thread. Then position the panel, turn in the screws and you've got it—no crawling around on the floor hunting spacers.—*William G. Waggoner*



Bench Anvil

An excellent bench anvil, not too heavy and not too light, can be made from the shoe, or sole, of a discarded electric iron. On some older-type irons the sole plate is a casting having extended sides, or ribs, that serve as a frame for the outer housing and provide space within which the electrical parts are assembled. This type makes the best anvil, as it is just the right heft. Screw it to a block of about the same overall size to serve as a base and you have a handy tool for bench work.—*Jack Eisner*



GO FLY A KITE

These four novel designs make the most of March winds. There's also a variation on this box kite that you can control just like a model plane



BAT-WINGED TRIANGULAR BOX KITE is so dependable a flyer it's been used to tow strings across chasms to start construction of suspension bridges. It's been called a war kite since it hauled battle observers aloft

FLOATING HOOP KITE is popular with the ladies if it has printed-plastic covering and tassel tail



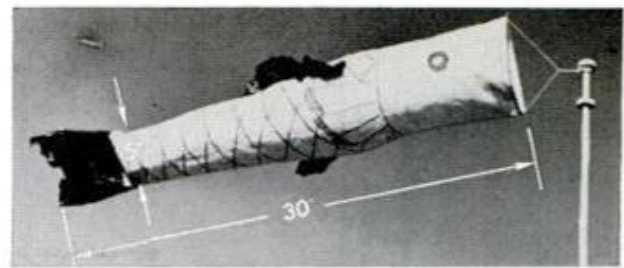
By Willard and Elma Waltner

WHO STARTED the whole thing? Legend has it that the first kite-flyer was Archytas, a Greek philosopher and friend of Plato, 400 years before the birth of Christ. Others credit the ancient Chinese general Hao Sin with the idea.

However, kites were in existence long before either of these men lived. The earliest travelers to Malaya reported that natives flew large leaves and worshipped them as gods. There's evidence, too, that the Egyptians flew kites centuries before Cleopatra.

Kites have not been merely playthings, but have served man in practical ways. Polynesians still use them for fishing. Ancient Chinese flew them as signaling devices during wartime. A kite laid the first line of the bridge that now spans Niagara's gorge, and until recently the U.S. Weather Bureau sent kites high into the upper air to record temperature, wind velocity and humidity. America's most famous kite-flier, Ben Franklin, put one

FISH WIND VANE (right) is a pole kite—popular in the Orient. Cloth is whip-stitched to a reed hoop to form gaping mouth. Ring, tied into bridle string, lets fish swing to show way wind is blowing



up in the midst of a thunderstorm in 1792 to prove that lightning was electricity.

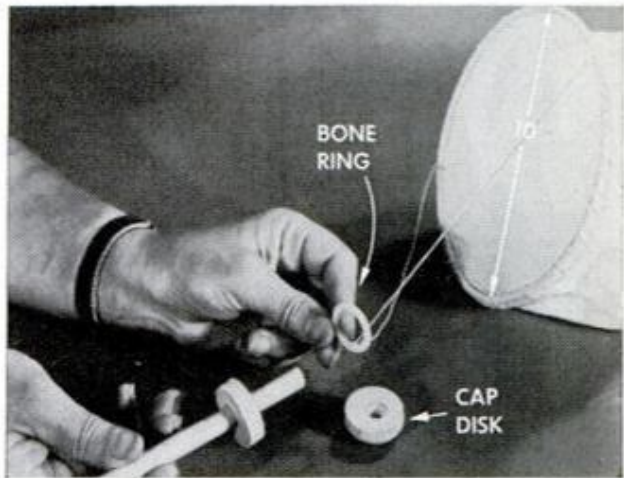
Most of us, though, simply accept the principles of what makes a kite fly without giving much thought to air current, lift, wind drag—or how we might put all this to work for us. We just enjoy the thrill of a high flyer's tug on the line.

And the thrill's double when you've made the kite yourself. Materials are easy to come by. For the sticks, a strong, light wood with a straight grain is best; it can be soft pine, spruce, basswood or redwood. Sticks $\frac{3}{8}$ x $\frac{3}{16}$ in. are suitable for most kites except very large ones that require heavier frames.

The covering material is usually paper. Ordinary brown wrapping paper is fine. Lightweight cloth, such as silk or nylon, is less likely to tear, if you don't mind the extra cost. Some plastics work well—an old shower curtain makes a strong, colorful covering. Plastic should be fastened to the framework with masking or freezer tape. Paper is attached by spreading glue on the top surface of the sticks and laying the framework onto the paper, smoothed out face-down on a flat surface. Cut the paper at least $\frac{1}{2}$ in. larger than the kite's outline on all sides. Apply glue to this projection and lap it back around the frame or outline string.

String is needed both for flying and building the kite. For flight lines, the larger the kite, the stronger the string must be. Mason's chalk line is fine.

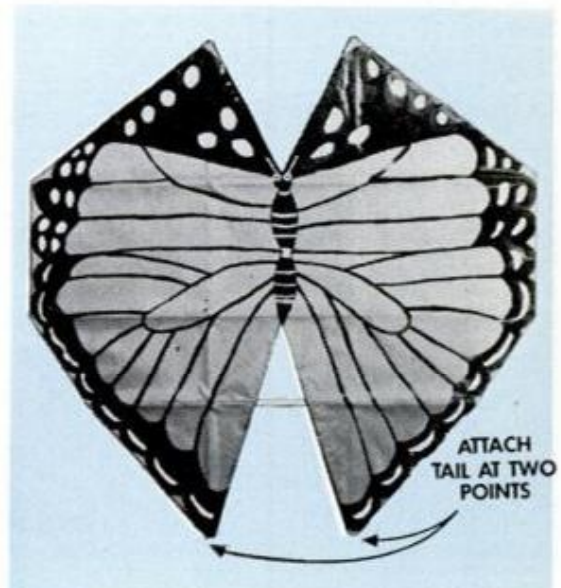
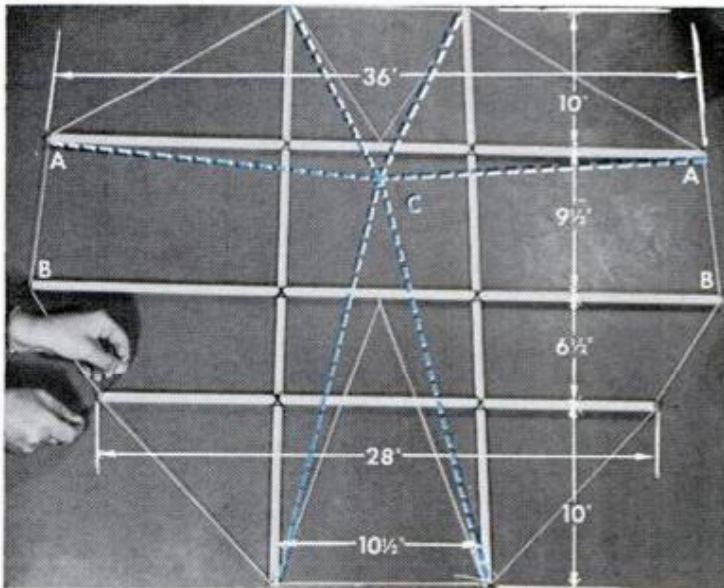
Rigid lashing of the frame is essential.

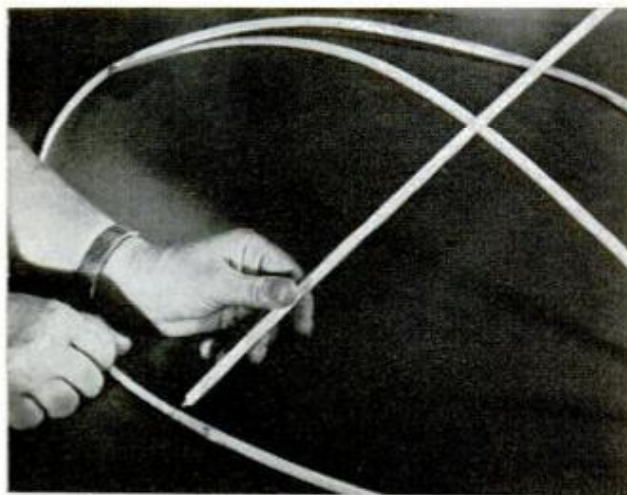
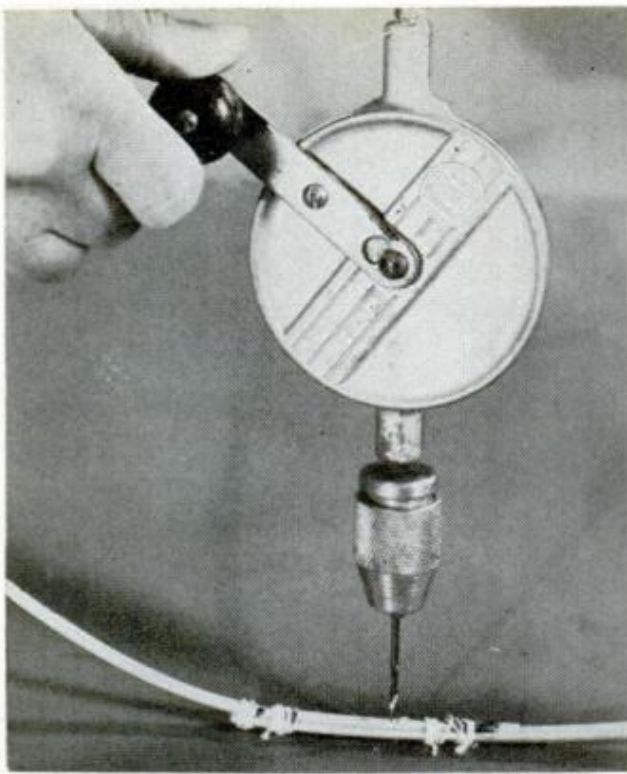


After crossing the sticks at the desired angle lash diagonally both ways, forming an X. Many turns of thread do a better job than a few turns of heavier cord.

A common misconception about kite-flying is that you need a strong wind. Actually, kites fly best in a light, steady breeze of from 8 to 15 mph. Launching a kite is easier if you have help, as in the photo at the top of the left-hand page. The helper, downwind about 50 to 100 feet from the stringholder, raises the kite until he feels it being lifted by the wind. A light upward toss should launch it without your having to dash away with the string. A well-balanced kite will climb steadily as string is gradually paid out.

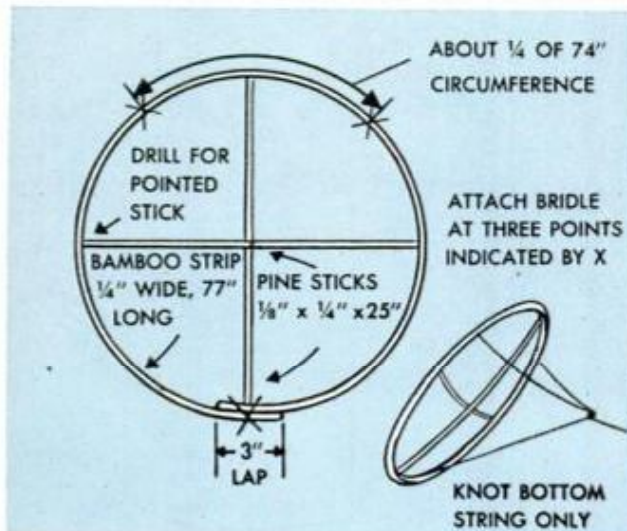
BUTTERFLY KITE is flat stick frame with outline string tied around notched ends. Frame is bowed by strings run between points A-A and B-B, then tied together at center. Dotted color lines show how bridle strings are attached. Flight string is tied at point C, which should be 15 to 19 in. from kite's painted face





FORM THE HOOP by lapping ends of $\frac{1}{4}$ -in.-wide bamboo strip 77 in. long. At center of lap (top photo) drill one of four socket holes for pointed-end cross sticks. These will bow when inserted (second photo)

LASH STICKS at center and cut circle from plastic curtain material—big enough so edge can be folded back around hoop (right). Apply tape at four cross-stick points, then at mid-points between to stretch cover

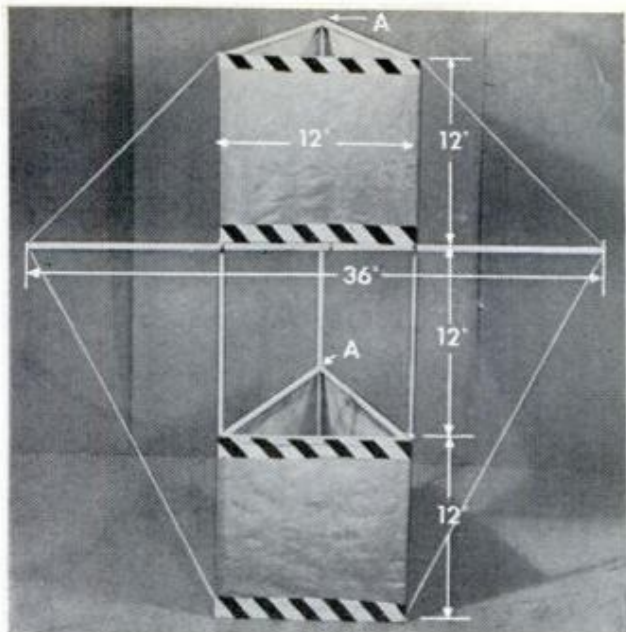


If a kite won't rise in a good breeze, it's probably too heavy for its surface area. A kite usually flies best if the bridle is adjusted so the kite's at an angle of 30 to 40 degrees from horizontal. Most kites need a tail for balance. The only one of the designs shown here that will fly its best without one is the box kite. An effective tail can be made of light material; it's not the weight but the bulk and surface that give the balance. Accordion-pleated sheets of typing paper, cinched at their center to make them fan out, work very well. So do scraps of plastic or cloth. A good tail may be made of pieces about $1\frac{1}{2}$ in. wide, tied to cord about every 5 or 6 in. The stronger the wind, the more tail is needed to balance the kite. Tails are attached at the kite's lowest point. In the case of the butterfly kite, a second string is required to center a tail between the two points.

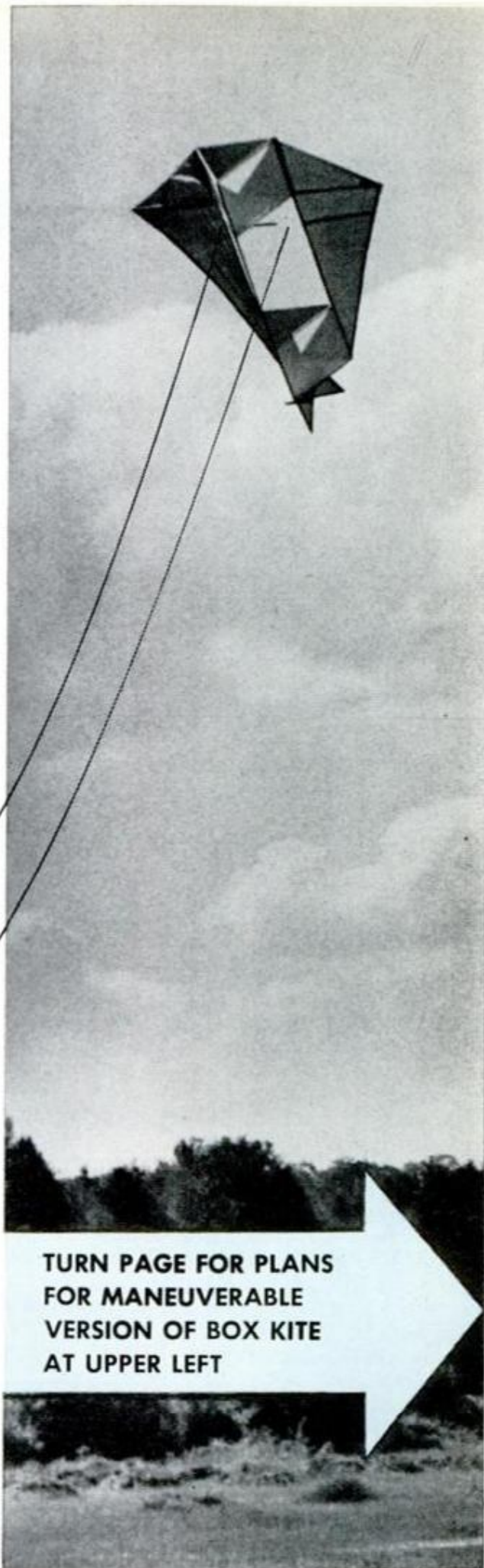
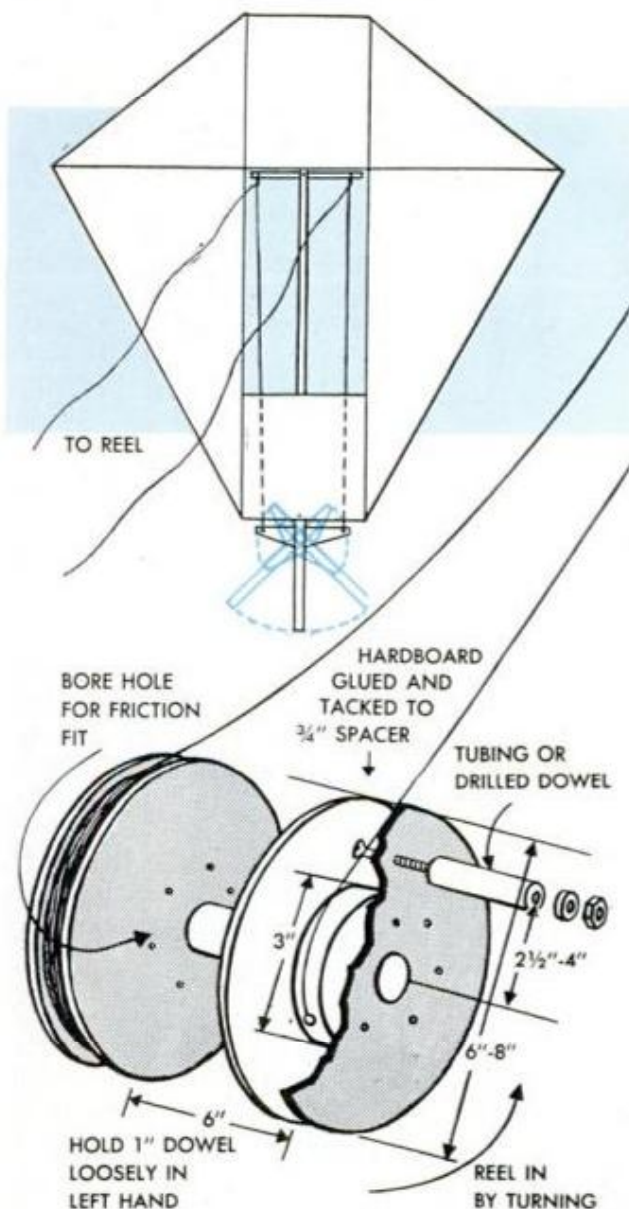
The floating hoop kite differs from the others presented in that its outline is formed by bamboo. Since you'll need a strip 77 in. long, you'll probably have to join two shorter pieces by tapering, lapping and gluing the ends; let the glue set under clamping pressure. Also glue (and lash) the 3-in. lap that brings the strip into a hoop. After stretching the plastic covering by taping at eight equidistant points, tape all around the frame.

The Chinese Fish kite is a wind sock, so needs no body frame. In the Orient, such kites are carried in holiday processions at the top of long poles. Cut the two pieces of the body from cloth, draw the simple markings with crayons and set the color by placing the cloth between two layers of paper and pressing with a warm iron. Lay the two pieces together, right side in. Cut fins of plastic cloth and lay them between the two body pieces. Stitch along the top and bottom, leaving the ends

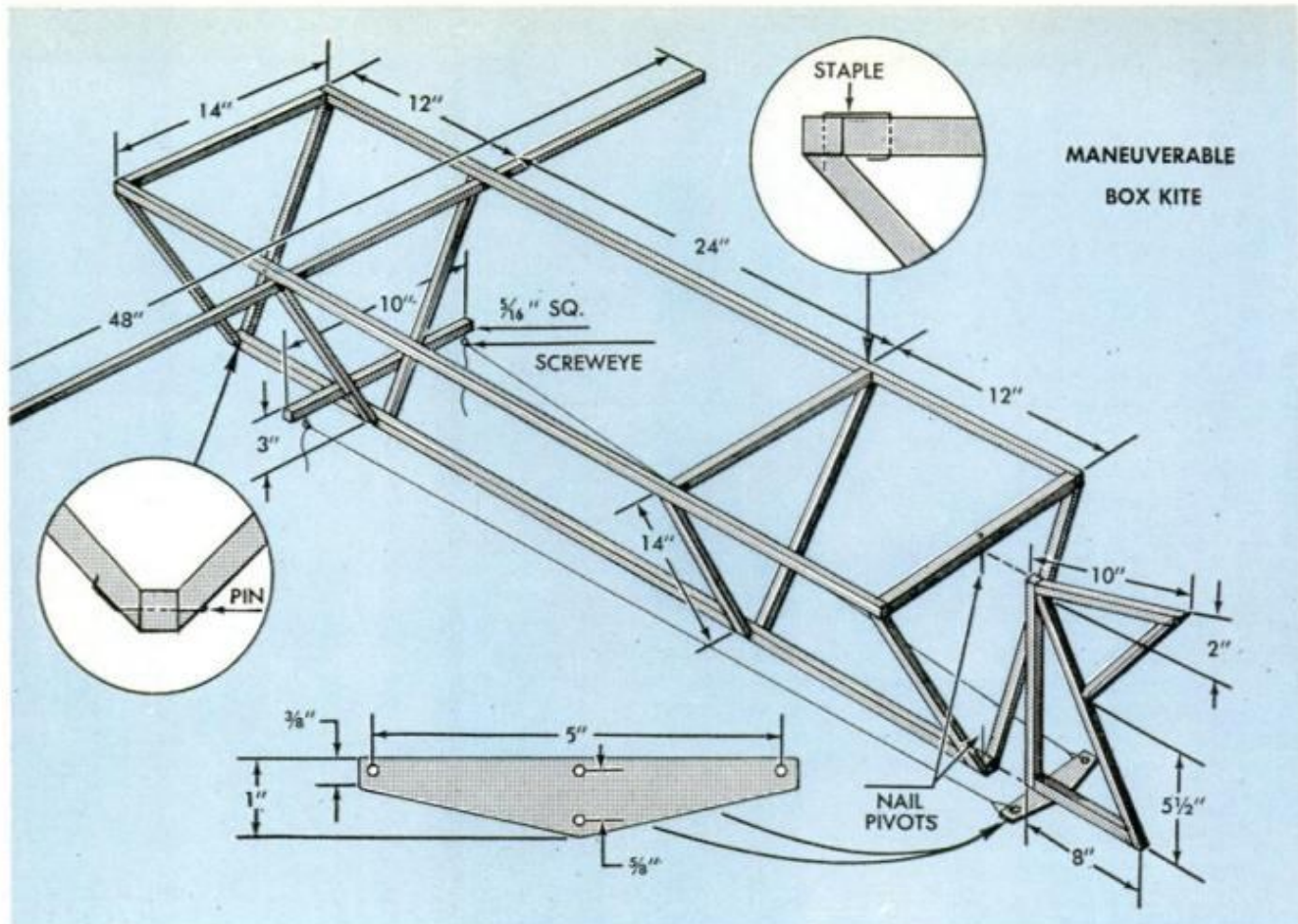




AFTER COVERING BODY of box kite at top and bottom, leaving center section open, fasten string to form outline of bat wings and cover these separately. Attach bridle at points A. Diagram below shows how rudder version is controlled by lines from ground



TURN PAGE FOR PLANS FOR MANEUVERABLE VERSION OF BOX KITE AT UPPER LEFT



MANEUVERABLE VERSION of triangular box kite is by Roy L. Clough, Jr. Frame dimensions differ from those given on preceding page for conventional type, but main feature of this design is fish-tail rudder at rear

open. Turn right-side-out and stitch the basket-reed hoop inside the large end. Attach the bridle at top and bottom seams and tie it to a bone ring large enough to turn freely on the pole you've selected.

Since the framework for the box kite can't be lashed, use a good grade of wood glue in the assembly. Fasten paper around the two end triangles, leaving the center section open. Then, glue the cross stick at right angles and lash the joints where it crosses the body sticks.

Plans for the maneuverable version, at the top of the page, call for the glued joints to be reinforced with staples and pins because this frame will be subjected to unusual movement in flight. Once you learn how to twist the double reel to pivot the rudder right or left, you can send the kite plummeting all over the sky or swooping in lazy figure-eights against the clouds. The fact that it can be guided (plus its load-carrying abilities) means you can even put it to practical use. It'll carry a small camera aloft for aerial photography—or a sheaf of circulars for your next church bazaar, to be released when a separate trigger line is tugged from the ground.

For the covering, use the heaviest grade of model-airplane tissue, or light cloth such as handkerchief silk or cambric.

Rubber cement is best for attaching since it won't shrink or pull anything out of shape. The rudder is covered on one side only. Its control horn is fastened to the bottom stick with glue and small airplane bolts, and is set back from the leading edge to permit free pivot action.

When launching the kite, let it gain some altitude before you attempt to control its flight. The two flight strings are tied to opposite ends of the control horn and run through screw eyes turned into the bottom edge of the lower crossbar which is nailed and glued to the second V-frame. The opposite ends of these lines are tacked to the core disks of the reel spools. When the lines are taut, merely twisting this double reel swings the rudder right or left.

The kite can also be flown in a conventional way, from a single string. You don't even have to tie down the rudder—just remove its control lines and let it swing free.

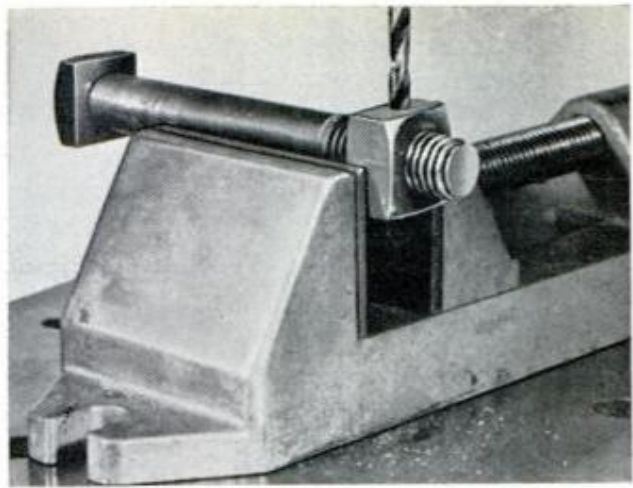
Designer Roy Clough test-flew this model in New Hampshire, to let us know how high the kite would climb on a single string. He'd paid out 1000 feet of line when the string broke. "Far as I know," he says, "it's still going."

Anybody seen a travel-worn box kite with a flapping rudder? ★★★

SHOP SHORT CUTS

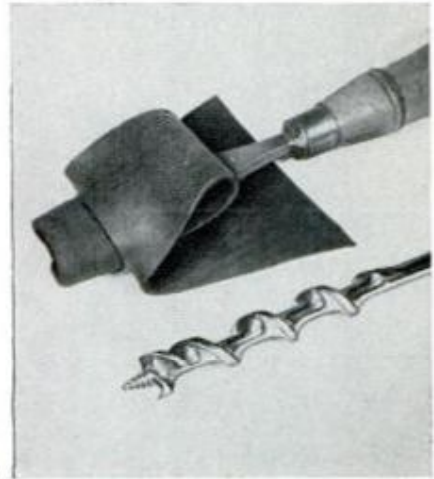
Cross Hole

If you try to drill a cross hole through the threaded end of a bolt or through a threaded rod there's going to be trouble. But if you run a nut on the threads and drill through the nut, it's as easy as drilling a transverse hole through a piece of square stock. Of course, you have to make sure the rod or bolt is at right angles to the drill and that the nut is securely locked in the vise.—*H. Hanscom*



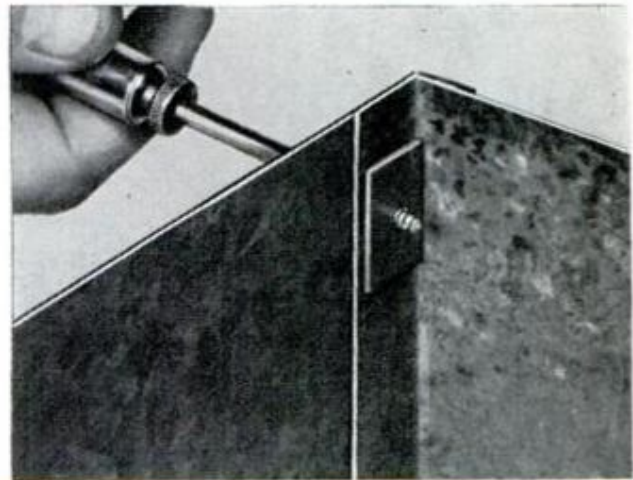
Tool Wraps

Chisel-edge guards are easily made by cutting a keyhole-shaped strip from an inner tube. Slit the strip in the position indicated. Lay the blade of the tool with the edge centered in the round portion. Fold the round section in from three sides, then bring the free end, or flap, around and press the fold through the slit to hold the wrap in position over the edge. For a 1/2-in. chisel the keyhole shape should be 6 in. long. For a 1-in. chisel, make it 1-in. longer and proportionally larger.



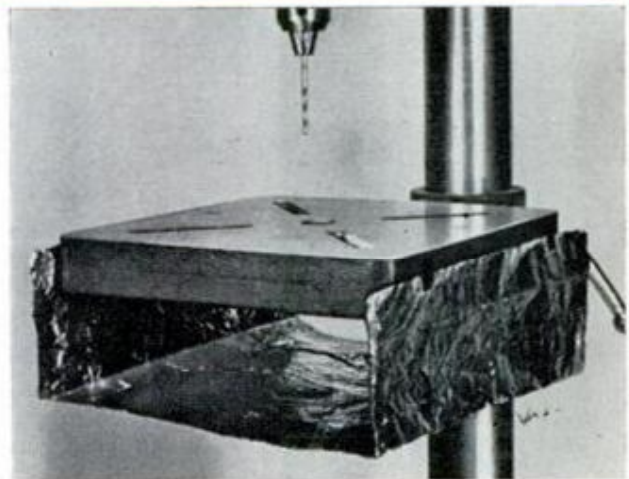
Extra Bite

Ordinary sheet-metal screws won't take in stock that's a gauge too thin to hold the threads. The metal will break at the edges of the hole, permitting the threads on the screw to pull through as it is tightened. But there's no need to discard the work. Spot the holes with a light punch mark and then solder a tab of heavier stock at these points. Drill the specified hole through the work-piece and the tab. The extra bite will permit drawing the screw to the required tension.—*Herbert Y. Moon*



Chip Catcher

You can keep metal chips off the floor and prevent damage to drill points, accidentally dropped through the hole in the center of the drill-press table, by taping a piece of heavy aluminum foil to the table in the manner pictured. After the material has been taped in place, depress the center of the foil slightly so that oil and chips will tend to work toward the center. If your drill press has a tilting table, the foil should be shaped to clear the locking pin in the column collar.—*R. Hanscom*

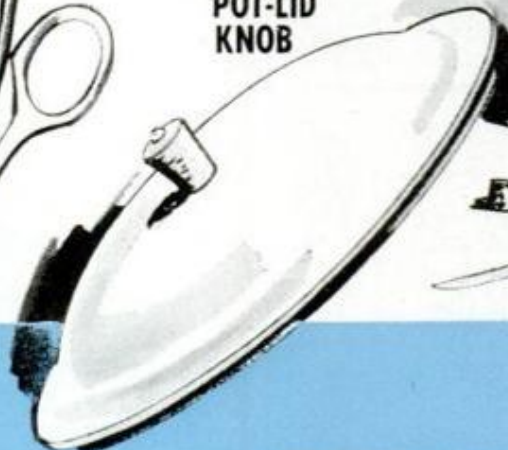


CORKING GOOD

SIX DIFFERENT IDEAS for making use of corks besides bottle stoppers. For some of these nothing will serve as well as corks so keep a box or drawer handy for making a collection. It's more than likely you'll find some practical use for every one



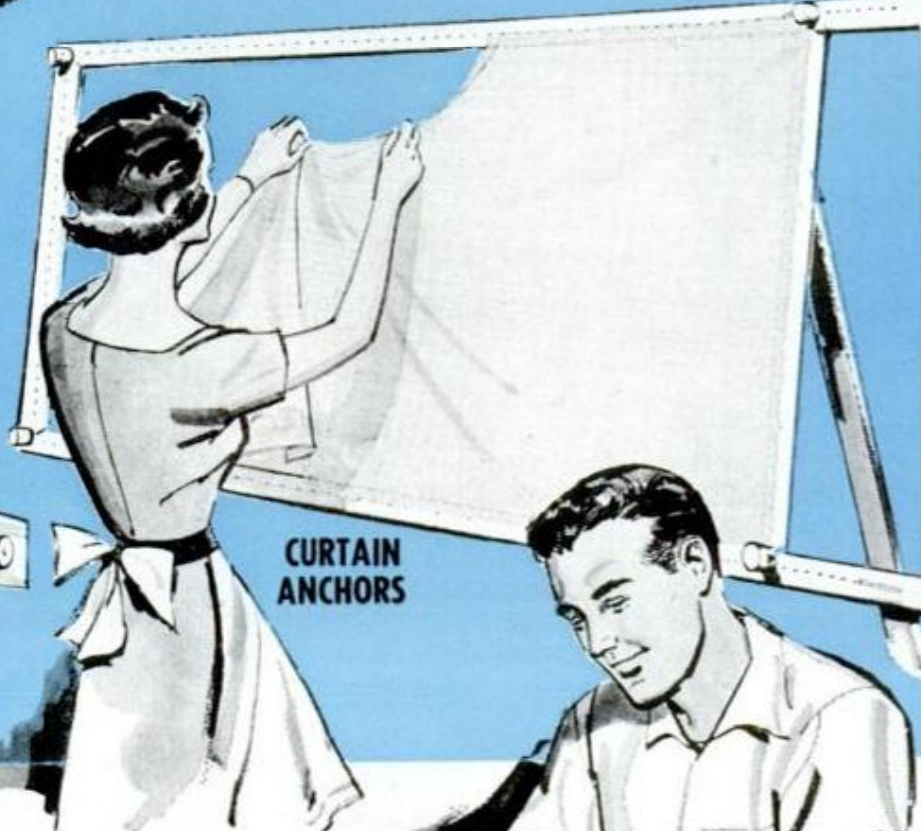
POT-LID
KNOB



SCOURING PAD



SHARP-POINT
SAFEGUARDS



CURTAIN
ANCHORS



PADDED COAT HOOKS

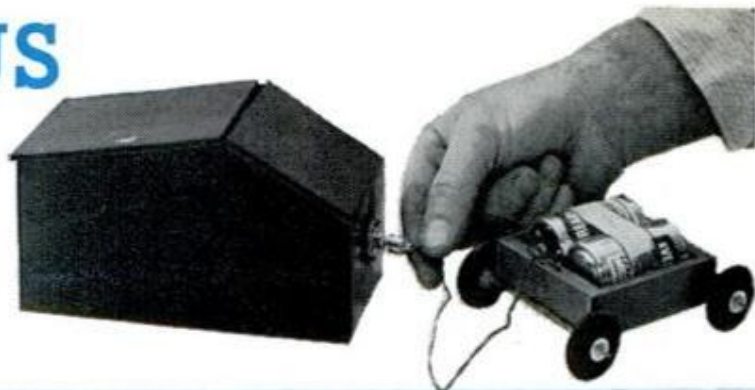


NON-MAR FEET

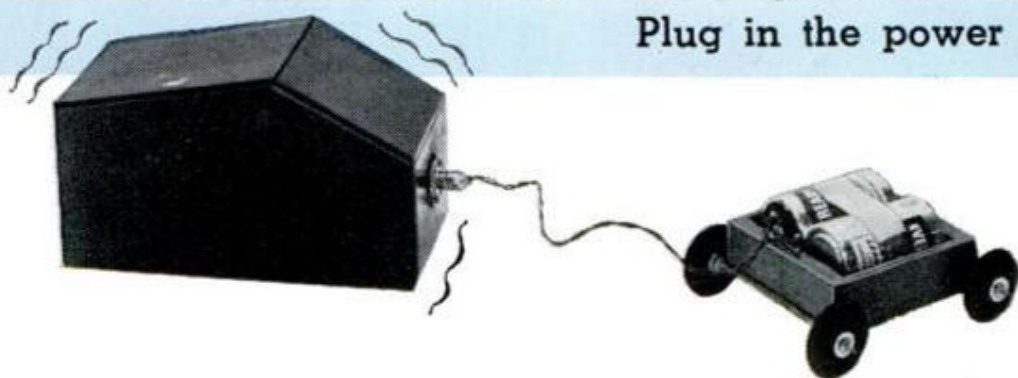
POPULAR MECHANICS

MYSTERIOUS WALKING BOX

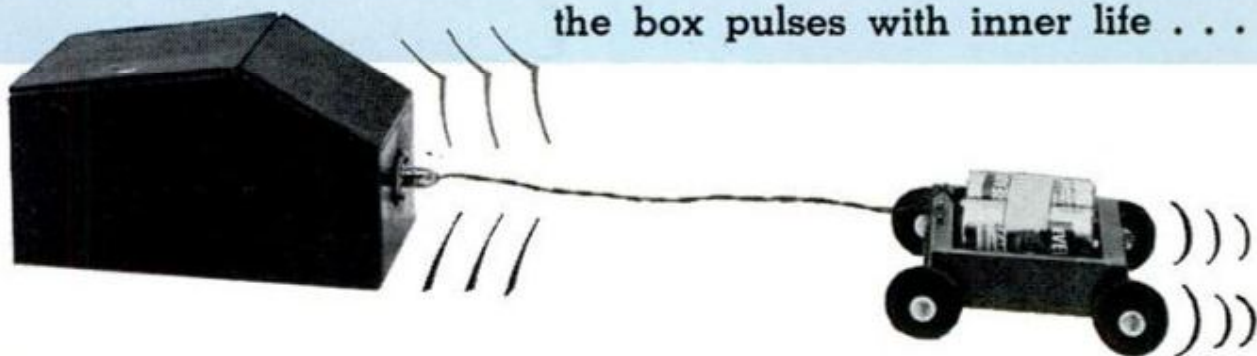
By Roy L. Clough, Jr.



Plug in the power . . .



the box pulses with inner life . . .



. . . and is on its way, tugging the wagon behind

THERE IT SITS: a little black box that has no wheels, treads, or air jets to push with. Its bottom is smooth and flat. It seems a most unlikely prime mover—but just let a curious friend plug in the cable from its little red battery wagon, and away it goes, chuffing like a sewing machine and towing its power supply.

If your puzzled friend puts his finger in front of it, the box nudges the finger along with a steady, pulsating thrust. Odder still, if he pushes it gently, he discovers that the box resists being urged along faster than it wants to go. If friend pushes it backward, he hears the driving mechanism labor in protest.

"Does the box run only on a flat surface?" your friend demands. In reply, you tilt the table under it to form a grade up to five percent. Undaunted, the box pumps onward and upward.

"Okay, okay!" says friend, impatiently: "What makes it go?"

Your reply can again be wordless. Just hand him this magazine, opened to the following page.

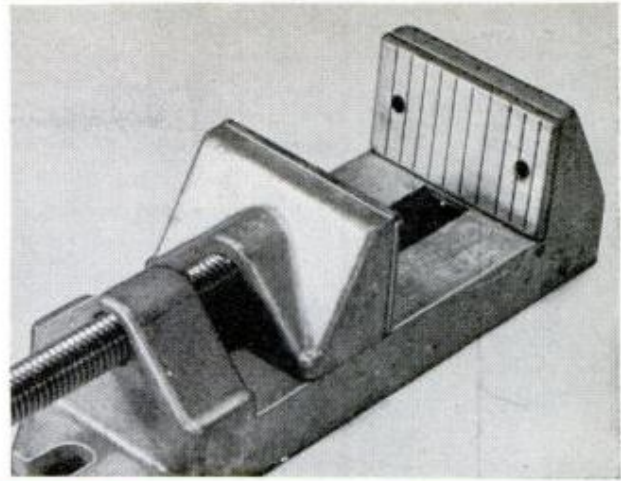
But before you do, see if *you* can solve the mystery with these additional clues:

The box moves because it contains a source of thrust that is independent of its exterior. This thrust operates in both directions, but pushes a bit harder forward than it does backward.

That's right: action with modified reaction, in that part of the reaction is taken up by the acceleration of the earth's gravity field. It's not a "bootstraps" drive, however. Equal amounts of energy are expended in both directions: the equation balances. But the energy is removed suddenly in the forward direction and more slowly in the reactive direction. As a propulsion system it is utterly impractical. The test? Suspend the box, or place it on wheels. It won't budge an inch! Got your solution? Turn the page.

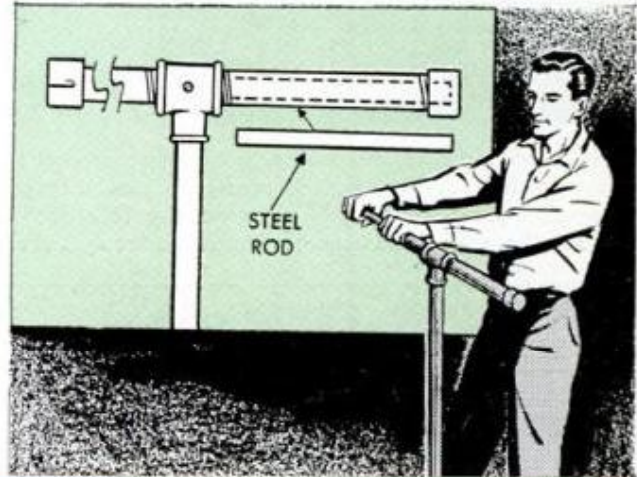
Vise Marks Speed Work

Aligning work at right angles to the table of your drill press can be done quickly and accurately without the need for checking with a square. Simply pencil vertical marks on the jaws of the drill-press vise, using a square to true them, and then scribe the marks with a sharp tool. The scribed grooves should then be coated with bright paint so they can be seen clearly for ready reference. Spacing the marks at set intervals will aid in measuring some types of work.



Auger Handle Extension

When digging holes in hard or gravel-filled soil an extension for the handle of your posthole auger will ease the job by providing more leverage as you apply force. Get a rod or pipe of a diameter and length that will allow it to be stored inside the auger handle when not in use. In this way, the ends of the handle can be capped or plugged to prevent possible injury to the hands from the rough pipe edge, yet the extension is readily available if a job requires added leverage for turning.



Extra "Oil Stone"

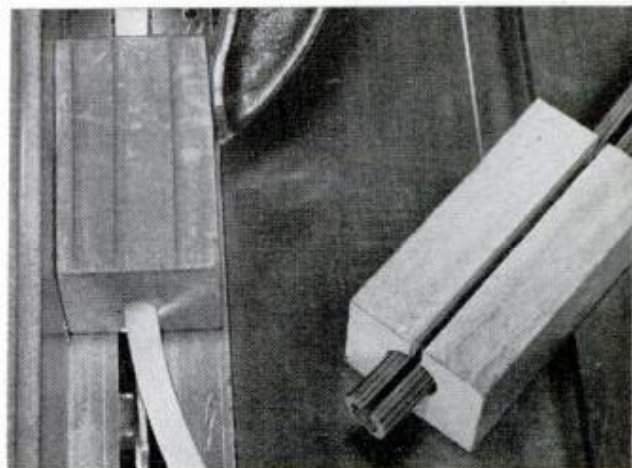
Ever find your regular carborundum oil stone broken or chipped after carrying it around with other tools? Make yourself a non-breakable extra one by gluing a piece of emery cloth to a $\frac{1}{2} \times 3 \times 5\frac{1}{2}$ -in. plywood block with rubber cement. Use a fine grade of emery cloth on one side of the block and a coarser grade on the reverse side. The rubber cement makes it easy to remove the emery cloth for replacement when it becomes worn and glazed.—R. Hanscom



Hose-Slitting Jig

When you have a long length of rubber or plastic tubing to slit, you can do it as fast as you can feed the tubing through the saw with this simple jig. Drill a hole through a scrap wood block, making it slightly larger than the outside diameter of the tubing. Then center the hole lengthwise over the saw blade and cut a kerf through one side of the hole. Clamp the jig to the saw fence and feed the hose through the hole in the block, raising the blade just high enough to cut through the tubing.

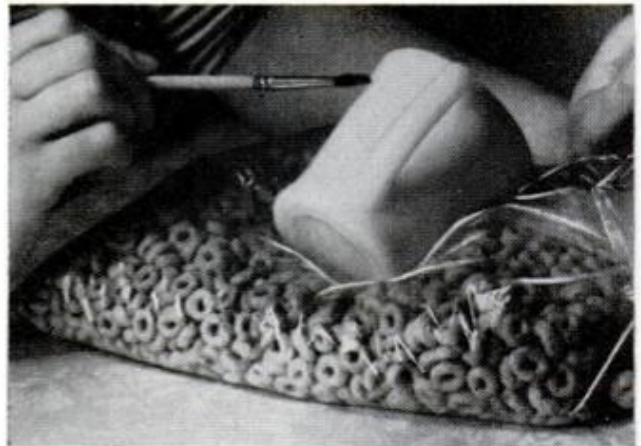
—Jerry Thompson



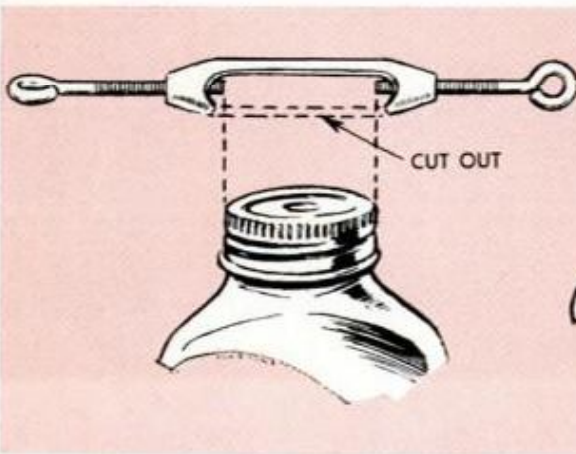
Solving HOME PROBLEMS



ONE SURE WAY to start a nail in a place too high to reach with both hands is to press the nail through a small square of foil. Then wrap the foil tightly around the poll of the hammer in the manner pictured

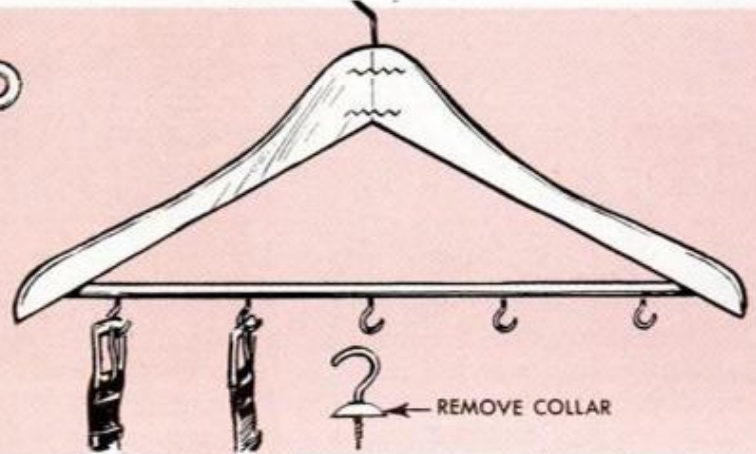


HOBBYCRAFTERS who paint china or other objects difficult to hold in working position will find that a plastic bag filled with beans, breakfast food, or other particle material is just the thing for a solid support



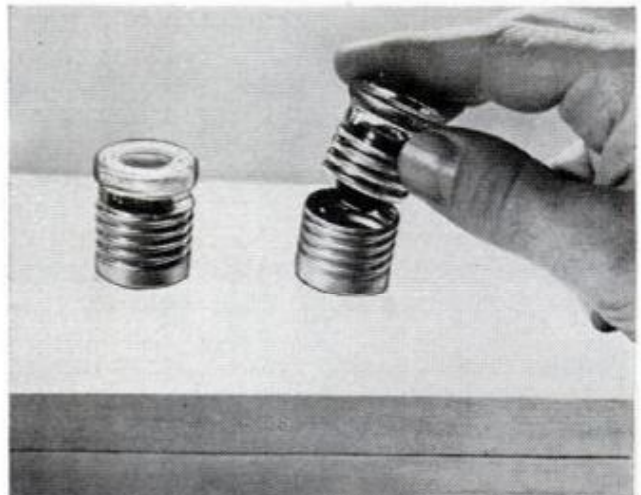
A TURNBUCKLE of the right reach makes a good wrench for those stubborn screw-type jar lids. Cut away one "buckle" as shown by dotted lines, drop over cap and tighten screweyes. Turn and off comes lid

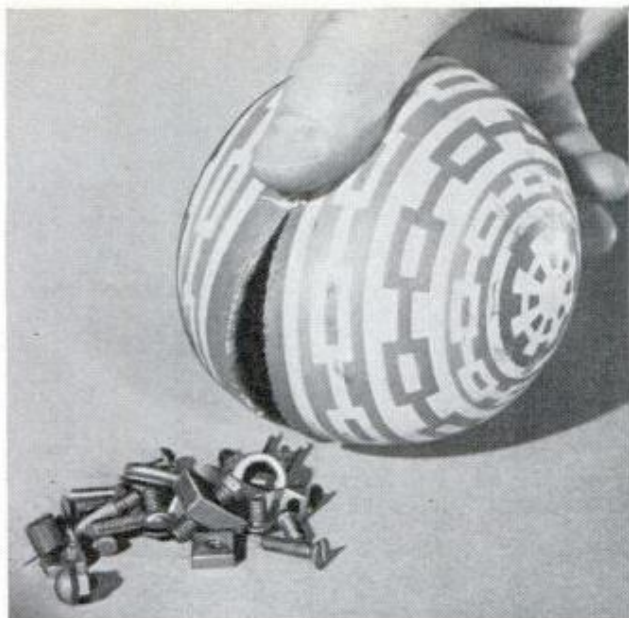
HOW TO remove and replace a single floor tile? It's easy when you heat damaged tile with infrared lamp until adhesive is softened. Use setup pictured, adjusting lamp reflector about 2 in. above tile



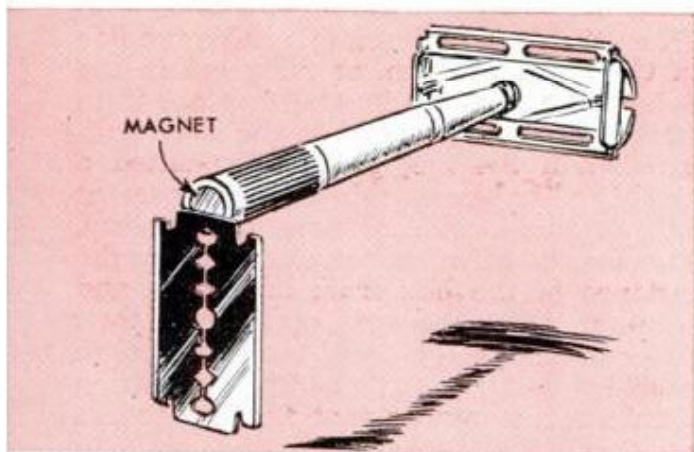
BELTS ARE always at hand when you hang them from the pants bar of a wooden garment hanger. Remove collars from several cup hangers, drill small spaced holes in bar, turn hooks in and hang belts by buckles

WHEN A FUSE blows you're lucky if you can lay hands on a replacement without searching. There'll be no problem if you screw socket shells to a board, turn new fuses into shells and hang near entrance box



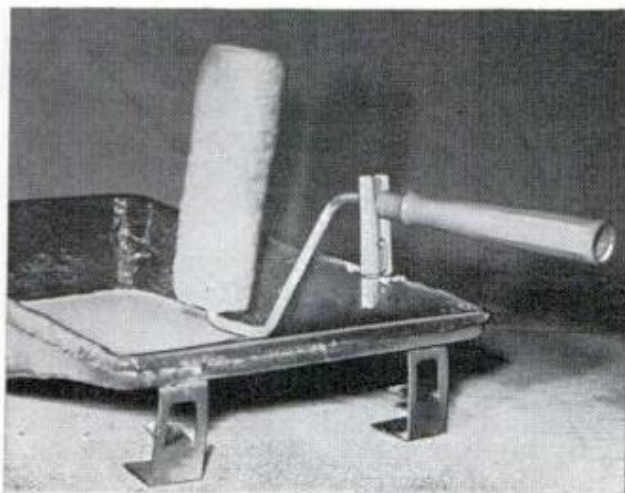


SLIT A HOLLOW rubber ball about one fourth the way around the circumference at center and you have a non-spill container for storage of small parts, bolts, nuts and such. Squeeze to open; release to close



HAVE YOU ever tried to pick up a razor blade from the floor and got a painful cut? Don't try it. Instead, wedge a round or square magnet into the hollow end of the razor handle. Then there's no problem

WHEN IT'S TIME for lunch or a coffee break don't lay the paint roller in the pan. The nap will flatten and you'll get a corrugated pattern on the wall or ceiling. Support roller on end with clothespin as pictured



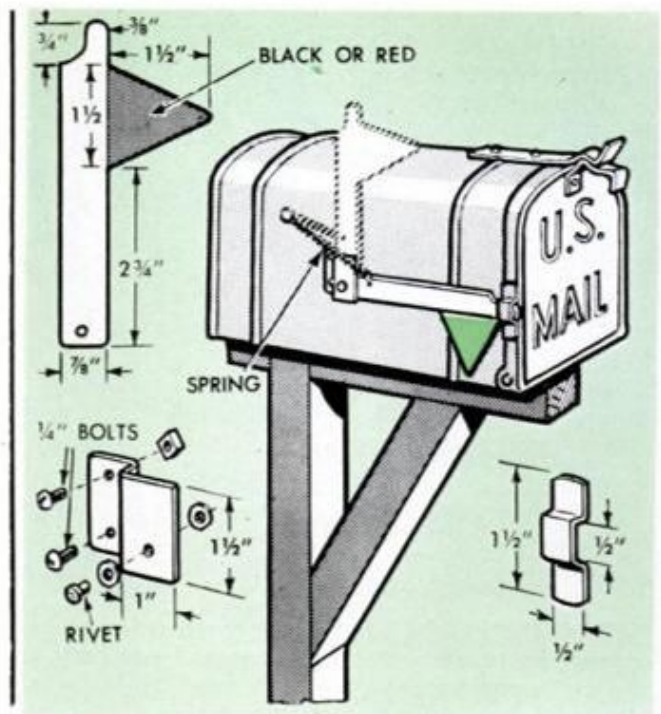
MARCH 1963



WORKING A HOSE around a flower bed to reach a new sprinkling area can mean a lot of backtracking if you are to avoid damage to plants. Fill a pail with water and let pail serve as a portable fender for the garden hose

171

Pop-Up Flag Signals the Arrival of Rural Mail



When your carrier drops the lid, or door, of your rural mailbox this flag automatically pops up to indicate that the mail has been delivered. It can save you many a trip on a rainy or snowy day, only to find the box empty. The indicator does not in any way interfere with opening the box or inserting bulky mail or packages, and it works in any weather. The detail shows how it's made and how it works. A piece of flat steel, 1/16 in. or thicker, bent to an S-shape serves as a pivot and stop for the flag. A strip of sheet metal bent to a shallow U-shape with attachment projections is welded or screwed to the flange of the door.

When the door is closed this holds the flag in the down position, as indicated in the detail. The flag and its staff are cut from fairly heavy sheet metal to the sizes indicated, and the flag proper is painted a bright red or black, whichever color seems best to suit local conditions of visibility. This can be affected, for example, by the distance of the box from the house and whether it's in the open or under a tree. After attaching the parts to the box, you probably will have to do a little hand fitting with a file to assure that the flag works positively and easily. Paint all parts to prevent rusting.—Charles D. Neal

That Little Old Wine Maker Can Use Toy Balloons



When making fruit wine, a special stop tube with water seal must be fitted in the neck of the jar to allow gases produced during fermentation to escape. Since these tubes project above the cork, there is a danger of breakage. A better and cheaper method of sealing the jars against air entry is to tie a toy balloon over the neck of each jar. The satisfactory progress of fermentation is indicated by the inflation of the balloon. If the wine should not ferment, it will be obvious at a glance.

In many areas of the country, wine-making is illegal. Thus, it is strongly suggested that you consult your local law officers and the Bureau of Internal Revenue before starting such a project. They will inform you of the regulations which apply in your particular case.

—Charles A. Oldroyd

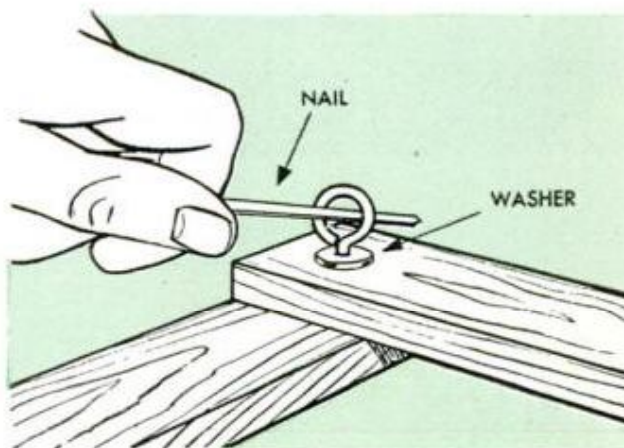
It Isn't So

That's what you'll say when you try this stunt, it just isn't so. But there it is, a hole through the palm of your hand. You bring about this illusion by looking fixedly through a short length of paper tubing with one eye, the other eye directed at the center of the palm of your hand. You can even see objects in the background quite clearly through that hole in your hand! But even though your eyes may be rated perfect, or nearly so, don't prolong the illusion for lengthy periods. Take a frequent break. And if you have any serious eye defects—or some not so serious—it may not be wise to try this stunt.



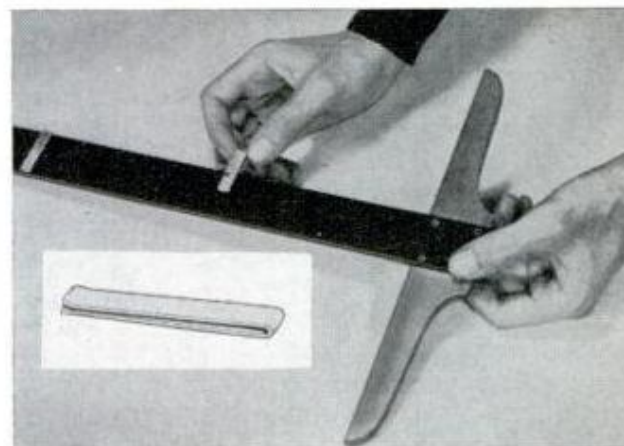
Subs for Thumbscrews

Often in experimental work you need to set up an assembly temporarily for testing or checking. When the parts are of wood you can substitute screw eyes and washers for small bolts, thumbscrews or ordinary wood screws. The eye of the screw eye permits quick disassembly and re-assembly either by the thumbs or a nail. Drill a clearance hole in one piece and a shank-size hole in the joining piece and draw together with the screw eye and washer as detailed.—*W. F. Schaphorst*



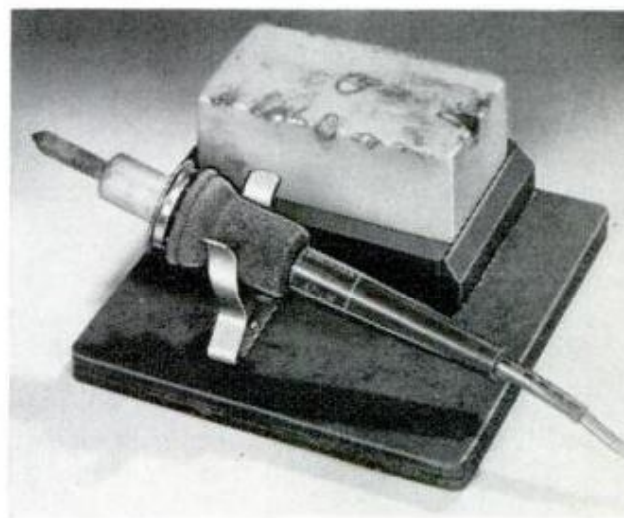
T-Square on Runners

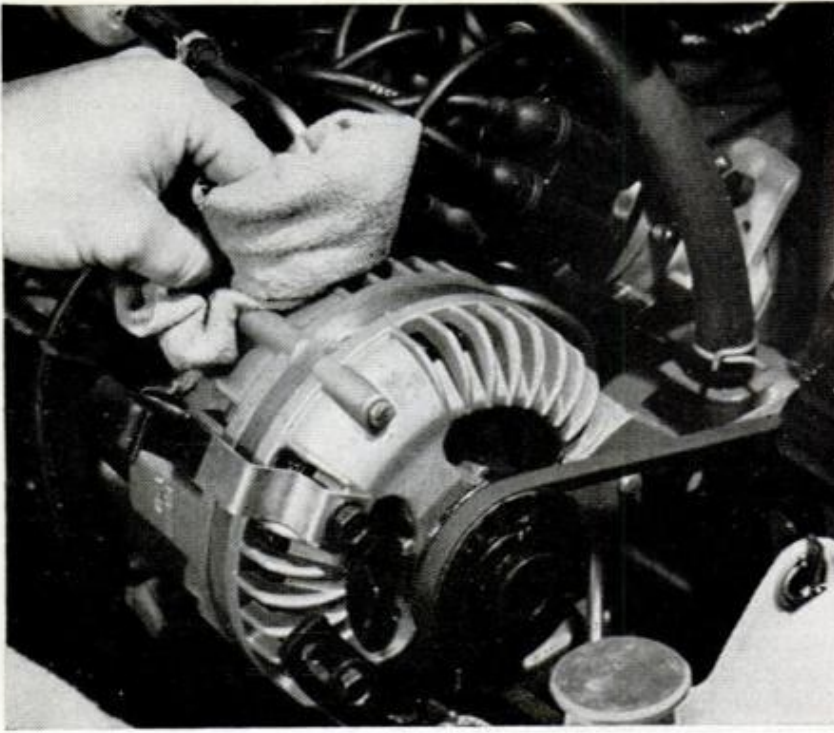
Smudged pencil drawings are one of the everyday problems of artists and draftsmen. The smudges are caused by moving the blade of the T-square over the penciled work and they are always difficult to erase neatly without erasing part of the drawing. One way to prevent these smudges when it comes to ruling a series of horizontal lines is to fit polished sheet-metal clips over the blade of the T-square to serve as runners. Spaced on the blade so that they do not pass over any part of the drawing, the runners raise the blade clear of the surface.



Always at Hand

When working intermittently on a diversified soldering job you need a safe keeper for the iron, or copper. Also you need to have that block of sal-ammoniac always handy, as a small copper tip is difficult to keep clean. To solve both problems one tinkerer made this handy caddy which holds the iron and the sal-ammoniac block. It consists of a base of $\frac{3}{8}$ -in. plywood, a holder, or well, for the block made by tacking $\frac{3}{8}$ -in. strips to the base, and a spring-steel tool clip which holds the iron.—*Frank Fritz*





Something new under the hood! On most '63 cars, the long-familiar generator has been replaced by a new current-making device you should learn to pamper

GETTING TO KNOW YOUR ALTERNATOR

By Morton J. Schultz

MOST AMERICAN CARS of '63 have been equipped with what may appear to be, at first glance, a new device for producing electricity. It's an AC alternator, and it will no doubt replace that ancient powerhouse—the generator—in all cars within a year or two.

Actually, alternators have been around since World War II and in wide use for some years in police cars, trucks, and cars equipped with telephones and two-way radios. In 1961, Chrysler Corporation put alternators in all of its passenger cars, marking the introduction of this unit to the general automotive public. Now, in 1963, alternators have replaced generators on all General Motors cars, with the exception of Corvair, and on the Mercury, Lincoln, Thunderbird, Rambler Ambassador and Studebaker.

You may even have an alternator on a passenger car that dates back before 1961; separate-purchase alternators are easily adaptable to all automobiles originally manufactured with generators.

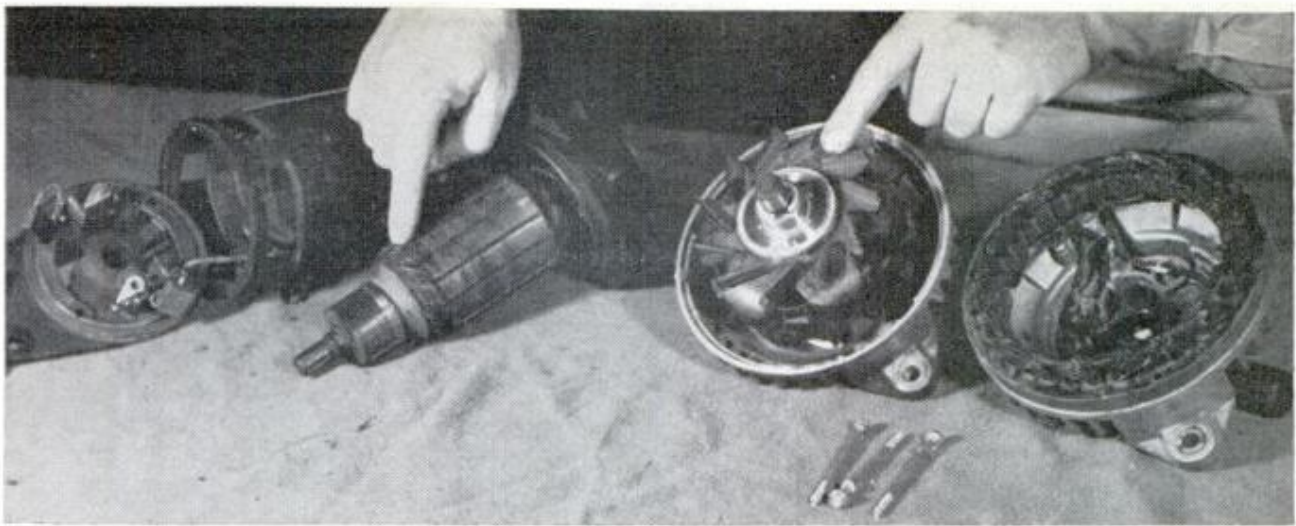
The big advantage of alternators, besides being lighter, smaller, and a more reliable source of electric power than the generator, is that they keep batteries fully

charged under all driving conditions, including idle. This means that you can park your car, keep the engine idling and operate a number of electric accessories, such as the radio, heater or air conditioner, without having to worry about discharging the battery. However, there is an accessory load at idle when the alternator will not be able to produce enough current to keep the battery fully charged. When this load is reached, the car's ammeter or alternator troublelight will flash discharge, as on any generator-equipped car.

The alternator and generator do the *same* job. They convert mechanical energy to electrical energy. Furthermore, they *both* produce alternating current and convert this to the direct current needed by a battery and automotive accessories. In other words, the direct current that leaves both the alternator and generator is exactly the same.

All alternators consist of a stator and a rotor, shown separated in photo at top of next page. These differ from a generator's field coil and armature principally in their *method* of converting AC to DC.

In generators, brushes are used to pick alternating current off a commutator, con-



ROTOR OF ALTERNATOR (pointed out with left hand) does same job as generator's armature (right hand). Other half of alternator assembly is stator lying at far right. It corresponds to generator field coil

verting that current to direct. Alternators, however, employ silicon rectifiers, or diodes. (Don't be confused by the fact that alternators also contain brushes, since they are used for a different purpose than in a generator. Alternator brushes supply field current to the rotor by contacting two slip rings mounted concentrically on the rotor shaft.)

A rectifier is a chemical disk that changes alternating current to direct current since it permits current to flow in one direction only. In other words, the rectifiers used in alternators have a low resistance to the flow of electrical current in one direction and a high resistance to the flow of electrical current in the other direction.

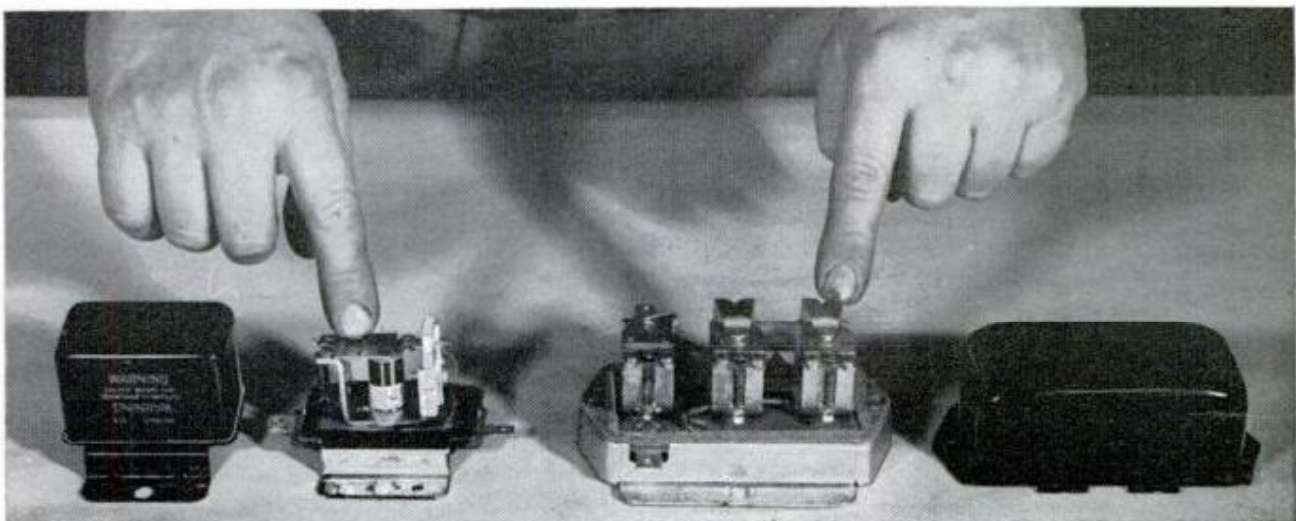
This low resistance allows current to flow from the alternator to the battery, but the rectifiers' high resistance prevents a return flow from the battery to the alternator when battery current exceeds alternator output, as when the engine idles.

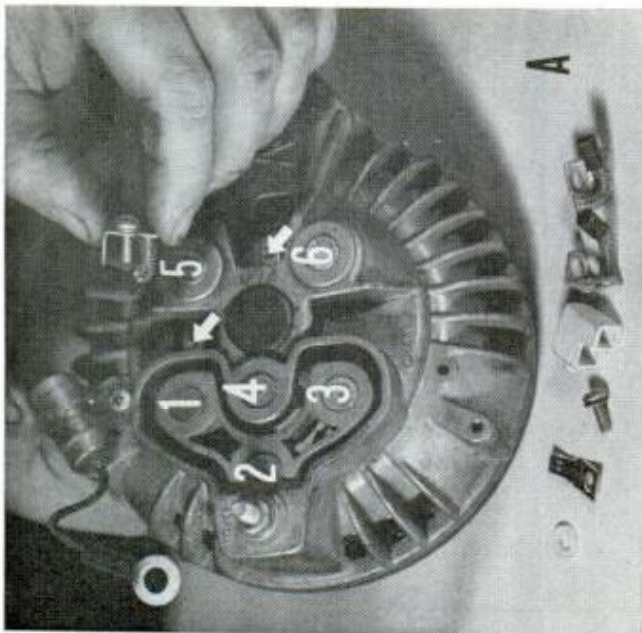
Both alternator and generator have regulator units, shown below, but the make-up of these differs in one important aspect—the absence of a circuit breaker (the cut-out relay) in the alternator regulator.

In the generator regulator, the cut-out relay connects and disconnects the generator and battery at the proper time. When generator voltage is higher than battery voltage, such as when the engine is accelerating, the points of the cut-out relay close magnetically, causing current to flow from the generator to the battery. When current in the *battery* is higher than in the *generator*, such as when the engine is idling, the points open. If the points remained closed, the current would flow back into the generator, causing discharge of the battery and possible damage to the generator.

The alternator is self-rectifying, providing a constant, steady flow of current to the battery with no return flow. That's

ALTERNATOR REGULATOR (left) has simple one-piece construction, in contrast to three-unit regulator from a typical generator. The one part that's the same in both is voltage regulator which is being pointed out





ALTERNATOR REPAIRS in chart include: (A) Replacing brushes—a lot easier than same job on a generator; they spring out when unscrewed from their sockets (arrows). Numbers are to show this is a six-rectifier alternator. (B) Replacing stator—just pry from case; (C) Replacing rotor—use pulley tool. In each photo, new parts are ready nearby

TROUBLE-SHOOTING CHART

WHAT'S WRONG	HOW TO TELL	PROBABLE CAUSE	HOW TO CURE IT
Alternator fails to charge	Ammeter, troublelight glows red on idle or acceleration Dead battery	<i>Fan Belt:</i> Loose Broken <i>Alternator:</i> Brushes sticking Broken stator winding Broken wire in field winding Defective rectifiers Loose connection Worn brushes Worn slip rings <i>Regulator:</i> Loose connection Burned or pitted points	Tighten Replace Replace brushes (Photo A) Replace alternator or stator (Photo B) Replace alternator or rotor (Photo C) Replace rectifiers Tighten all connections and terminals Replace brushes Replace rotor Tighten all connections Replace regulator
Unsteady low charging rate	Ammeter troublelight flickers "on" and "off," especially at low engine speed and idle Rundown battery	<i>Fan belt:</i> Loose <i>Battery:</i> High resistance at terminal posts Poor ground connection <i>Alternator:</i> Loose connection Resistance in charging circuit Poor brush contact Open stator windings	Tighten Remove and check condition of cables; clean terminals Tighten ground connection or replace cable Tighten connections Tighten connections Replace brushes and check condition of slip rings Replace stator

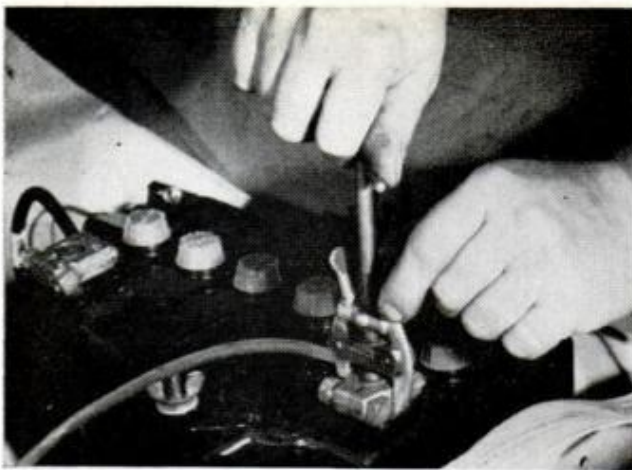
Low voltage output	<p>Ammeter troublelight flickers "on" and "off" at all speeds Rundown battery</p>	<p><i>Alternator:</i> Resistance in charging circuit Grounded stator Shorted rectifier <i>Regulator:</i> Faulty regulator Low regulator setting</p>	<p>Tighten all connections Replace stator Replace rectifier Test regulator, replace if necessary Adjust regulator</p>
Excessive charging rate	<p>Battery uses excessive amount of electrolyte Excessive amount of acid salts on battery top and hold-down parts</p>	<p>Regulator set too high Regulator contact points stuck Open windings in regulator Poor regulator ground</p>	<p>Adjust regulator Replace regulator Replace regulator Remove regulator, clean mounting surface. Tighten mounting screws and ground wire</p>
Noisy alternator	<p>Noise</p>	<p>Loose mounting bolts or base Improper belt alignment</p> <p>Loose drive pulley Worn shaft bearings Sprung rotor shaft Bent rotor fan blades Open or shorted rectifier Open or shorted windings in stator and rubbing rotor poles</p>	<p>Tighten mounting bolts or replace damaged bolts Make necessary corrections to mounting base attachment. Also make sure alternator is correct one for your car</p> <p>Tighten pulley Replace bearings or replace alternator Replace rotor Straighten blades or replace rotor Replace rectifier Replace alternator</p>
Oxidized regulator points	<p>Battery uses excessive amount of electrolyte Excessive amount of acid salts on battery top and hold-down parts</p>	<p><i>Regulator:</i> Poor ground connection Improper air gap setting High voltage setting</p> <p><i>Alternator:</i> Shorted field windings in rotor pole</p>	<p>Tighten ground connection and clean mounting surface Adjust regulator air gap Adjust regulator voltage Replace rotor</p>
Burned voltage regulator points	<p>Battery uses excessive electrolyte Excessive acid salts on battery top and hold-down parts</p>	<p><i>Regulator:</i> Setting too high <i>Alternator:</i> Shorted field windings in rotor pole</p>	<p>Lower voltage regulator setting Replace rotor</p>
Burned coil winding in voltage regulator	<p>Battery uses excessive electrolyte Excessive acid salts on battery top and hold-down parts</p>	<p>Regulator voltage setting too high</p>	<p>Adjust or replace regulator, depending on extent of damage</p>
Voltage regulator points stuck closed	<p>Rundown battery</p>	<p>Poor ground connection between alternator and voltage regulator</p>	<p>Replace regulator, making sure new one is well-grounded</p>

WHAT'S WRONG

HOW TO TELL

PROBABLE CAUSE

HOW TO CURE IT



CAUTION

Before making any test meter connections (as shown in photos on these two pages) disconnect the ground battery cable after making sure ignition switch is off. Failure to do this may damage alternator if meter leads are hooked up incorrectly

why it allows the battery to maintain a full charge, even at low and idle speeds.

Both the generator regulator and alternator regulator contain a voltage regulator unit that limits the amount of voltage the generator or alternator can produce at any one time. This is needed to prevent an excessive flow of current to the battery, and to keep the alternator or generator from burning itself up.

Regardless of the type of alternator system on your car—Chrysler, Delco-Remy "Delcotron," Electric Autolite "Prestolite" or Motorola—troubleshooting and testing are basically the same.

Anyone equipped to test and service generators can easily do the same with an alternator. (Some mechanics even contend that alternator trouble shooting and service are easier. They claim that replacing parts in an alternator is a lot simpler.) When trouble shooting and testing, keep in mind one fact—that in order for an alternator to produce electricity, it must have normal field current, and the stator circuits and rectifiers must function.

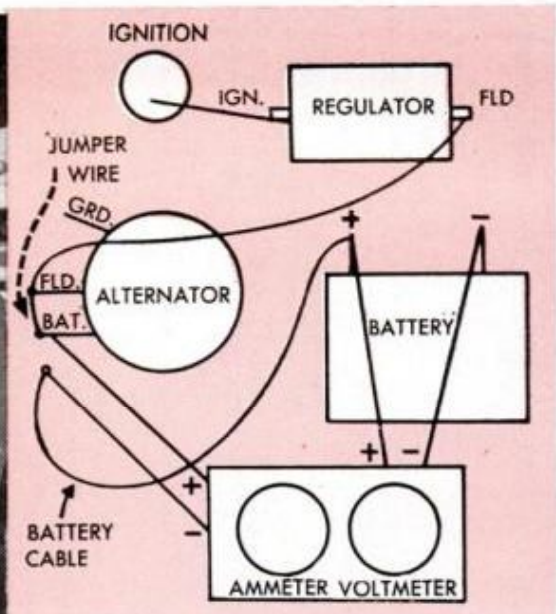
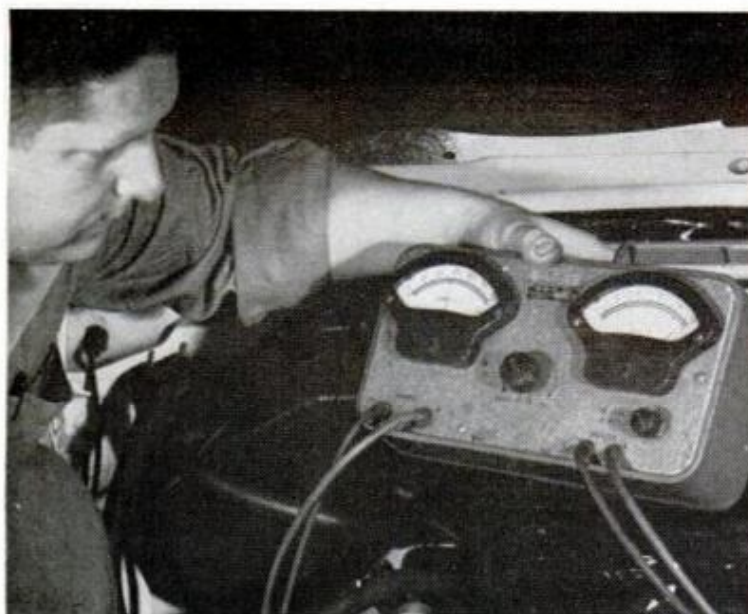
As you can see by the trouble-shooting chart on the preceding pages, nine types of malfunction can occur in an electrical system charged by an alternator. These malfunctions are centered in four areas: the alternator itself, the alternator regulator, the battery and the fan belt.

There are only two periodic tests needed to make sure the alternator and alternator regulator are operating properly and not developing a malfunction: the current output test and the voltage regulator test.

Before conducting either of these tests, the battery should be checked with a hydrometer or voltmeter. If less than $\frac{3}{4}$ charged, it should be removed and charged or a new battery installed. Unless the battery is nearly or fully charged, test results will not be accurate.

To perform the current output test (photo and diagram at the bottom of this page), first disconnect the cable connected to the battery (BAT) terminal of the alternator. Connect the positive lead of an ammeter to the BAT terminal of the alternator, and the negative lead of the am-

CURRENT OUTPUT TEST tells you overall condition of charging system. When hooked up as shown in sketch, ammeter reading shows condition of alternator and voltmeter reading shows condition of alternator regulator



TEST ALTERNATOR REGULATOR independently by throwing a jumper wire between regulator's ignition and field terminals and hooking voltmeter to battery

meter to the cable end you disconnected at the alternator's BAT terminal. (All cars to date that have alternator systems are negative grounded.) Now, connect a jumper wire between the BAT and field (FLD) terminals at the alternator. (The third terminal you see there is the ground.)

In line with the caution at the top of the page, the battery ground cable was disconnected before you began. It must now be reconnected to the negative battery post. Hook up the voltmeter with its positive lead going to the battery's positive post and its negative lead going to the battery's negative post.

Turn on the car's lights, radio, and other electrical accessories for a few minutes with the ignition off. This drains the battery sufficiently, so the alternator will operate at peak output, providing a truer test reading.

Start the engine. The ammeter should read the number of amps at which the alternator is rated—in today's cars, anywhere from 30 to 40 amps. If not, there is a malfunction in the alternator, and the unit should be removed from the car for trouble shooting.

The voltmeter should read about 14.2 to 15 volts for a 12-volt charging system, and 7 to 7.5 volts for a 6-volt charging system. If not, the voltage regulator unit needs an adjustment.

If you wish to test the regulator without checking the alternator (photo above) simply connect a jumper wire from the field terminal of the regulator to its igni-



tion (IGN) terminal. Hook the negative lead of the voltmeter to the battery's negative post and the positive lead of the voltmeter to the battery's positive post, then start the engine.

Since most alternators are equipped with pre-lubricated bearings, they require no periodic lubricating service. However, at regular periods—every 5000 miles or so—the outside of the alternator should be wiped clean as shown on page 174. Check dirt accumulation that could obstruct the flow of air.

In testing or trouble shooting the alternator, there are certain precautions that must be observed which are unlike those involved in checking a generator:

(Please turn to page 218)

WITH ALTERNATOR OFF CAR, check condition of rectifiers with special tool or ammeter calibrated in one-amp scale. When touched with probe (left) each should read at least 1¼ amps. Rectifiers are wired together on inside of stator case. To replace faulty one, clip wires and knock it out with punch. Solder wires of new one

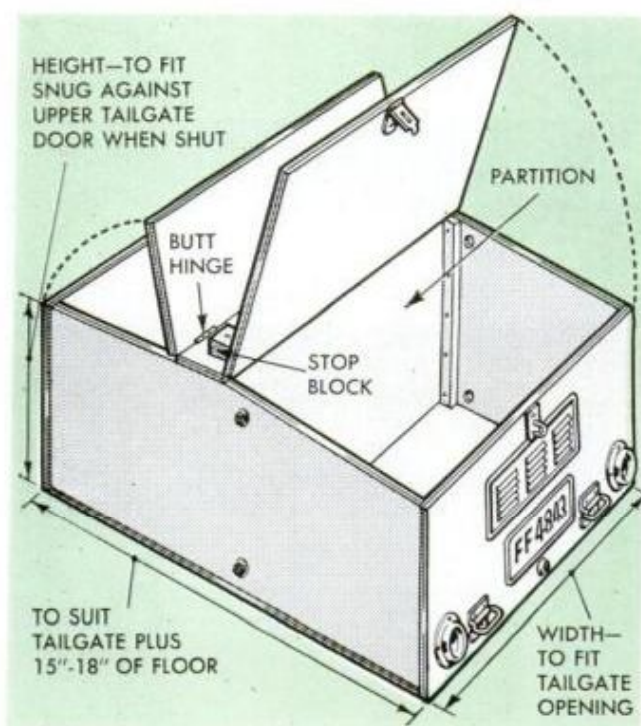
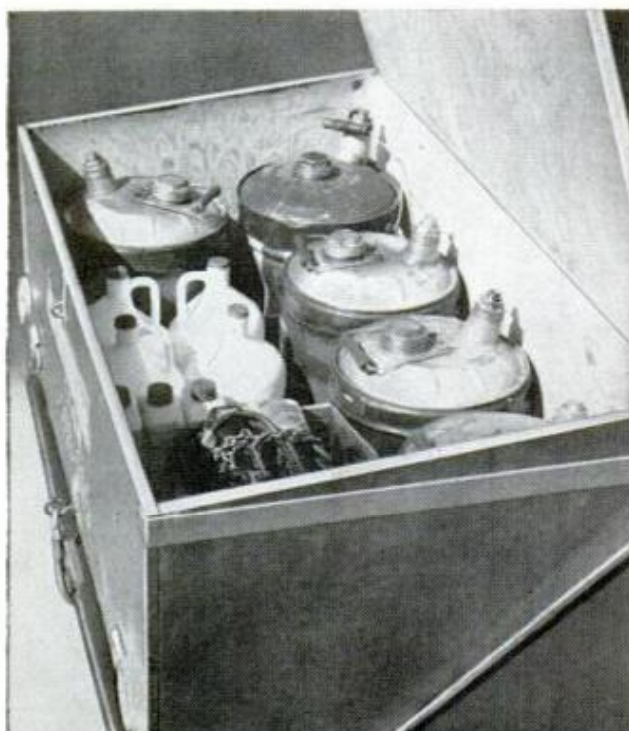


Tailgate Box Increases Storage in Station Wagon



IDEAL FOR HAULING camping gear, as well as extra cans of gasoline and outboard-motor oil, this two-compartment box can be built from $\frac{1}{2}$ -in. plywood to a size that will fit the wasted tailgate space of any station wagon. The rear compartment is vented, as shown, so that fumes from the stored gasoline will not seep into the station wagon or front compartment

which opens from inside the vehicle. Stop blocks atop the box keep it from sliding backward once the upper tailgate door is closed flush with the box top. A snubbing cable hooked to the box and rear bumper is fitted with a compression spring and turnbuckle to keep the box and tailgate from bouncing. Chest handles aid removal of the box.—Dr. William J. Jahoda

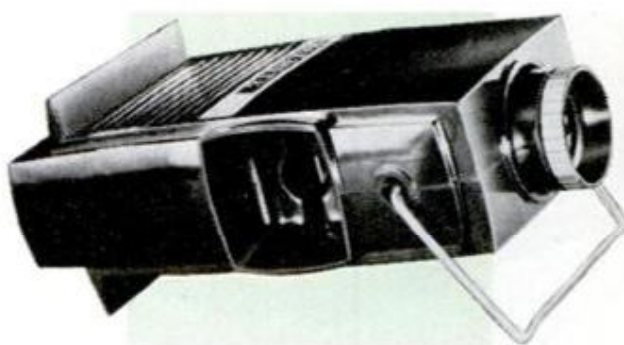


NEW FOR SHUTTERBUGS NEW

KONICA FP single-lens reflex camera features complete interchangeability of lenses available in focal lengths from 35 through 800 mm. With a 52-mm. f:1.4 lens it is priced at \$229.95. With 52-mm. f:1.8 lens, \$199.95. Case costs \$16.95. Flash attachments and other accessories are available. Konica Camera Corporation, 404 Park Ave., S., New York 16, N.Y.



BALMITE 50 slide projector is housed in a plastic case measuring 4 x 5 x 9½ in. and weighs only 2 lb. Operating on a 50-watt lamp, it has no moving parts. Slides are inserted manually, each new slide ejecting the previous one. Casts a 40 x 40-in. image from 9½ ft. away or operates as close as 2 ft. Less than \$15. Bausch & Lomb, Rochester 2, N.Y.



ROLL-A-WAY DARKROOM is a walnut-veneered cabinet that can also be used as a tea caddy or rolling buffet. It measures 48 x 20 x 36 in., including legs and casters, and the interior is fitted to hold necessary darkroom accessories such as an enlarger, trays, chemicals, tongs and timer. Priced at \$31.95. Durst, Inc., 37-14 48 Avenue, L.I. City 1, N.Y.





BLACK-AND-WHITE NEGATIVES of extreme contrast are made by simple process of projecting or printing color transparencies directly on high-contrast film



WOODCUTS

By Marguerite Johnson

STRIKING IMITATIONS of woodcuts and etchings such as shown here can be made by anyone with ordinary dark-room equipment. The method is extremely simple as color transparencies are "printed" on high-contrast film which then is processed by a special developer to make a negative from which you produce prints in the usual way. The film and developer are Kodalith Ortho Type 3 (sheet film), and Kodalith Fine-Line developer, or equivalents in other makes.

Transparencies can be "printed" on this film either by contact of the transparency placed directly on the film for exposure, or by using an enlarger. In the latter case the film is placed on the enlarger easel just





FROM COLOR TRANSPARENCIES

like paper being printed. Using an enlarger permits cropping undesired portions and enlarging the essential part of a picture. The negative is made to a size that will fit in the negative carrier of the enlarger for producing subsequent paper prints. You can either cut the film to this size first and then expose it, or you can project the transparency on the film, and trim it to size after processing. This high-contrast film can be handled in a red safelight, having a Wratten Series 1A filter.

As the colors of transparencies often are misleading in respect to the grey tones that they produce when transformed into black-and-white negatives, it will be helpful to view the transparencies with a monochromatic filter such as a Wratten No. 90. Generally, simple subjects without clut-

tered backgrounds are the best for producing good woodcut and etching effects. Because exposures are long on this film, you will have time for burning-in or dodging. To eliminate the effects of stray light from the enlarger during exposure, wrap a cloth around the housing.

Using the developer at 68 deg. F., put the exposed film in the tray with the emulsion side up and agitate the developer until the image appears faintly, which takes about 20 seconds. Then press the film by its edges against the tray bottom, ceasing agitation and allowing development to continue until the image is satisfactory, which takes from 1½ to 2½ minutes.

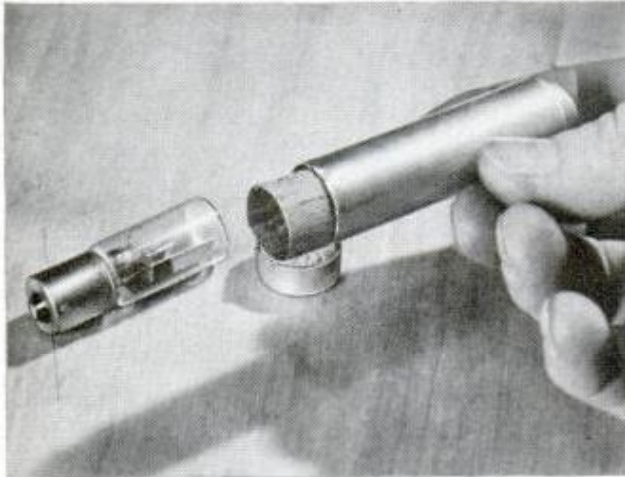
From the negative you make prints in the usual way. Normally, good results are obtained with No. 2 paper.



FOR CAMERA BUGS

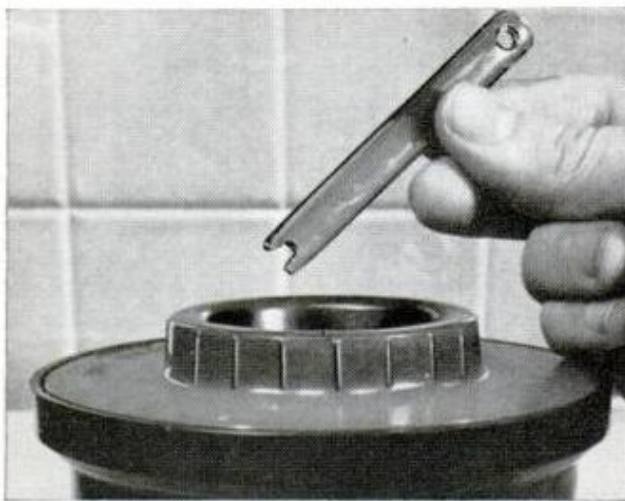
Camera Bag Strap Holder

It is annoying to have the strap of your camera bag slip off your shoulder when walking, but the use of an ordinary pin-type drapery hook will take care of the problem perfectly. Simply insert the hooked pin in the shoulder of your coat or jacket with the curved end of the hook outward, toward your arm. Bend the hook a bit so that the strap is less likely to slip out if it becomes necessary for you to raise your arm.—*William Swallow*



Flash Tube Protector

Photoelectric tubes of the type used in slave flash units are delicate objects and cannot stand rough handling. They can be safely stored or carried in aluminum containers used to protect the more expensive brands of cigars against crushing. Cut the container to fit the length of the photo tube, allowing enough space to permit small pieces of sponge rubber to be inserted at each end. Retain the thin wood liners that come with the cigar containers to provide additional protection for the fragile tubes.—*Frank P. Fritz*



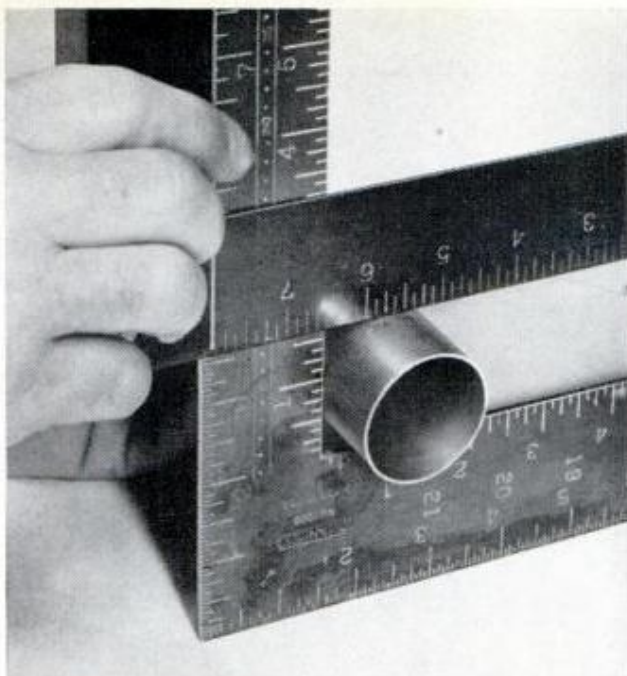
Emergency Agitator Handle

If you mislay or break the agitator handle for the reel of your roll-film developing tank, an old toothbrush will come to the rescue and serve as a good substitute. Simply cut a section from the toothbrush handle long enough to suit the particular tank. Then file a notch in one end of the plastic handle so it will fit over the cross web of the tank reel. The hole in the other end of the handle will let you hang it on a nail for safe keeping. Intermittent agitation during developing is important and you should not consider using a tank which is without a means of rotating the reel.



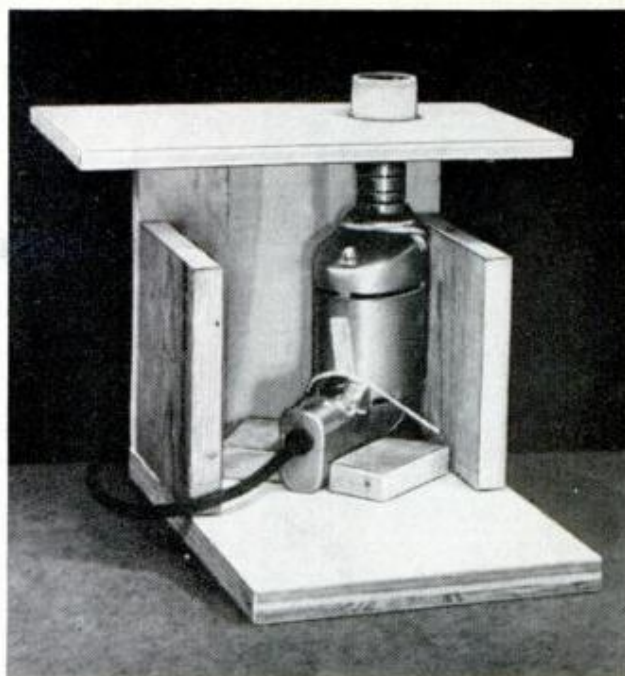
Film-Pack Developing Aid

Photographers who only occasionally use a film pack in their press cameras may not have the proper hangers for developing the negatives. Since cut-film hangers are unsatisfactory for the job, I devised a simple method of developing them. I fastened each negative to a small cork with a thumbtack. The weight of the film holds it under the solution in the tank but the cork will float and keep it from slipping to the bottom. Bob the cork up and down during the developing, fixing and washing processes.—*Wayne C. Floyd*



Squares Measure Pipe

One method of measuring the outside diameter of a pipe quickly and accurately involves the use of two squares to form a gauge. Simply slip the pipe into the angle of a steel framing square, then rest another square on top of it so that the legs are parallel with those of the first. You will be able to read the outside diameter of the pipe from the vertical scale of the first square. The second square may be another framing square, a try square or simply a piece of scrap lumber or cardboard containing a right angle since no scale is required on this one.—*E. M. Harman*



Spindle Sander in a Jiffy

When using a drum sander attachment with your portable electric drill, you can often do a better job by running the work over the drum rather than vice versa. This improvised table made of scrap 1-in. lumber held together with flatheaded wood screws supports the drill firmly in an upright position, leaving both hands free to hold the work. Just run two pieces of cord through holes in the sides and tie the drill in place. Cut the top from $\frac{3}{8}$ -in. plywood and add a 2-in.-dia. hole centered over the drill chuck to accept the sanding drum.—*Robert C. Cutchshaw*

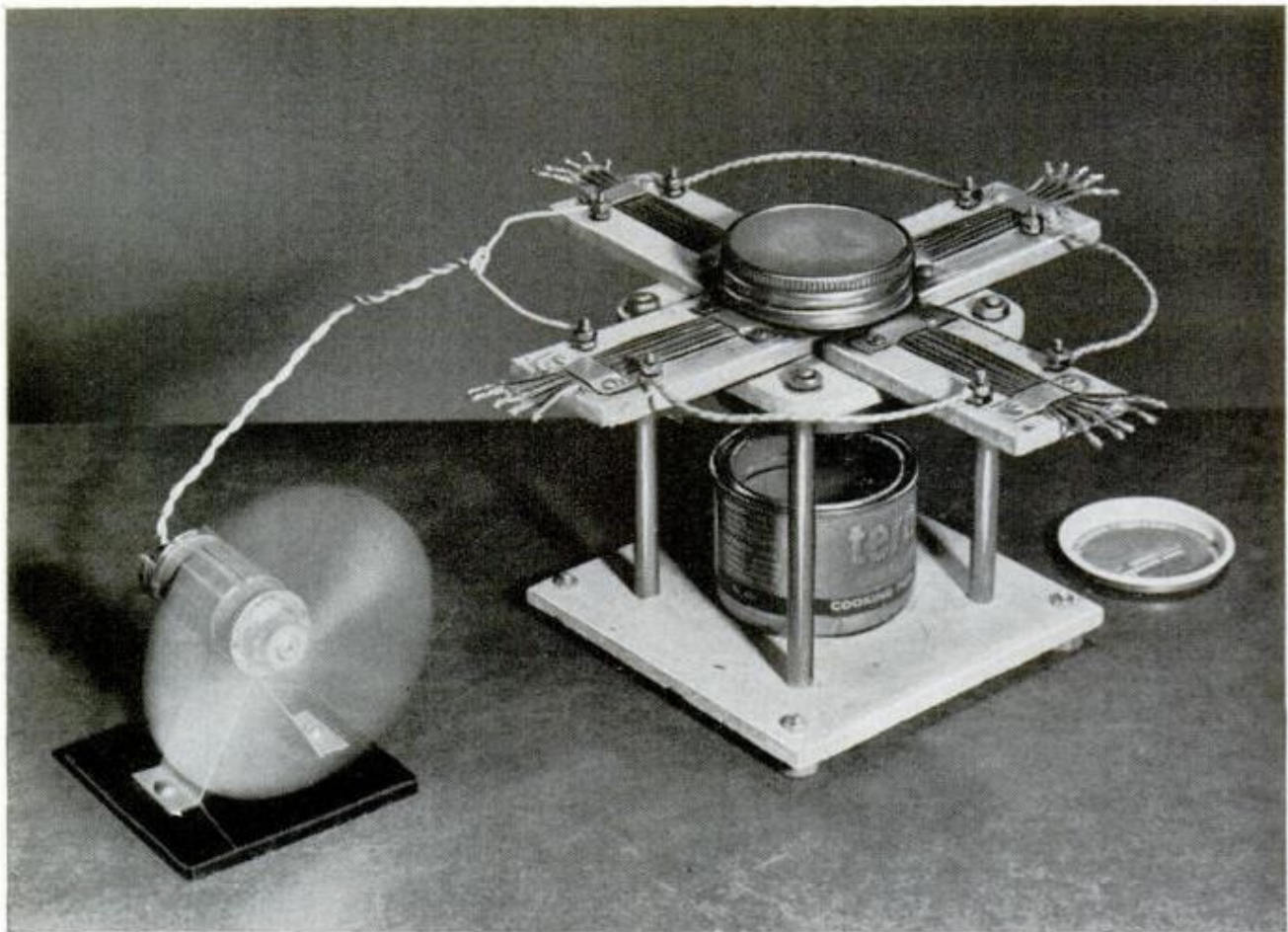
COMING UP NEXT . . .

SPORTSMAN'S SCOOTER. If you have a yen to get out into the backcountry but don't like hiking, be sure to pick up the April issue. It tells you how to build a rugged off-trail scooter that just dates on rough terrain. Powered by a 2½-hp. 4-cycle engine, this pack vehicle is ideal for toting camping gear, or simply taking a load off a tired fisherman's feet.

HOT-DIP GALVANIZING. A thick coating of zinc is one of the best barriers to rust ever discovered. Next month, PM shows you how to do your own galvanizing at home, using easy-to-obtain materials and relatively inexpensive equipment. Don't miss this one.

BICYCLE BUILT FOR TWO. For less than \$10 you can turn two standard bikes into an eye-catching tandem that will give the whole family hours of fun and healthful exercise. Trim your waistline without trimming your pocketbook. It's all in the April issue.

CARVING WITH A FLY CUTTER. Add that special custom touch to any of your furniture projects by decorating them with rich carvings. You don't have to be a woodcarver. Just use a fly cutter in your drill press, and you'll turn out carvings that a professional would envy.



NO, IT'S NOT PLUGGED IN! A thermoelectric battery converts canned heat into power to run this tiny fan

Fun with a Homemade THERMOPILE

By Harold P. Strand

WE'RE ALL FAMILIAR with everyday demonstrations of electricity converted into heat—the common hot-plate and scorched insulation are examples. But fewer of us have actually watched the *reverse* process of heat being converted into a practical source of electric power.

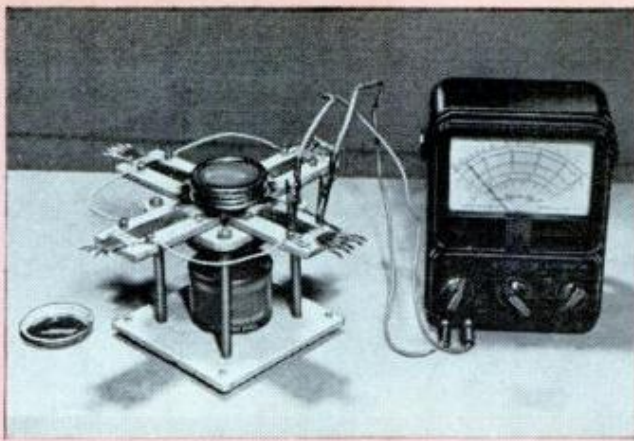
Here are plans for a simple thermoelectric battery—or thermopile—that generates enough electricity to set a fan whirling. It's fun to build, and makes an ideal Science Fair project.

A German professor named T. J. Seebeck is credited with the discovery, in 1821, that when the junction of two dissimilar metallic conductors is heated, an electric current is produced. Over the years since, this phenomenon has been explored by many experimenters, with the result that a number of thermoelectric batteries have been developed for generating small amounts of electricity.

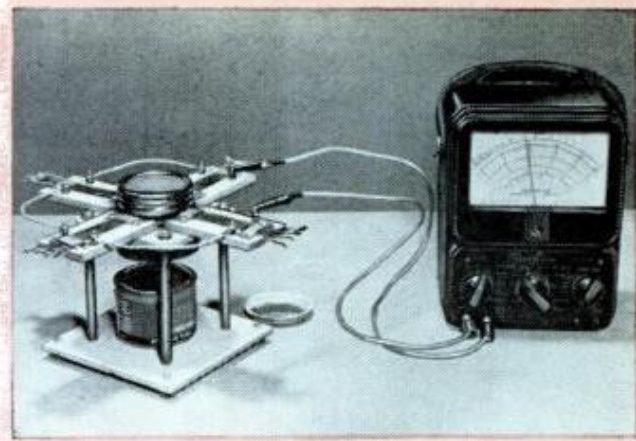
Thermocouples, used today in industry for measuring temperatures, were also a result of Seebeck's discovery. However, as a source of practical power, the "Seebeck Effect" has remained relatively inefficient.

Recently, modern laboratories have taken renewed interest in this system of obtaining electricity without moving parts. Improvements have been made through the use of semi-conductors and new techniques which may eventually result in an efficiency comparable to that achieved by currently-used methods of generating electricity. There is now every indication that further research may lead to exciting developments in this field.

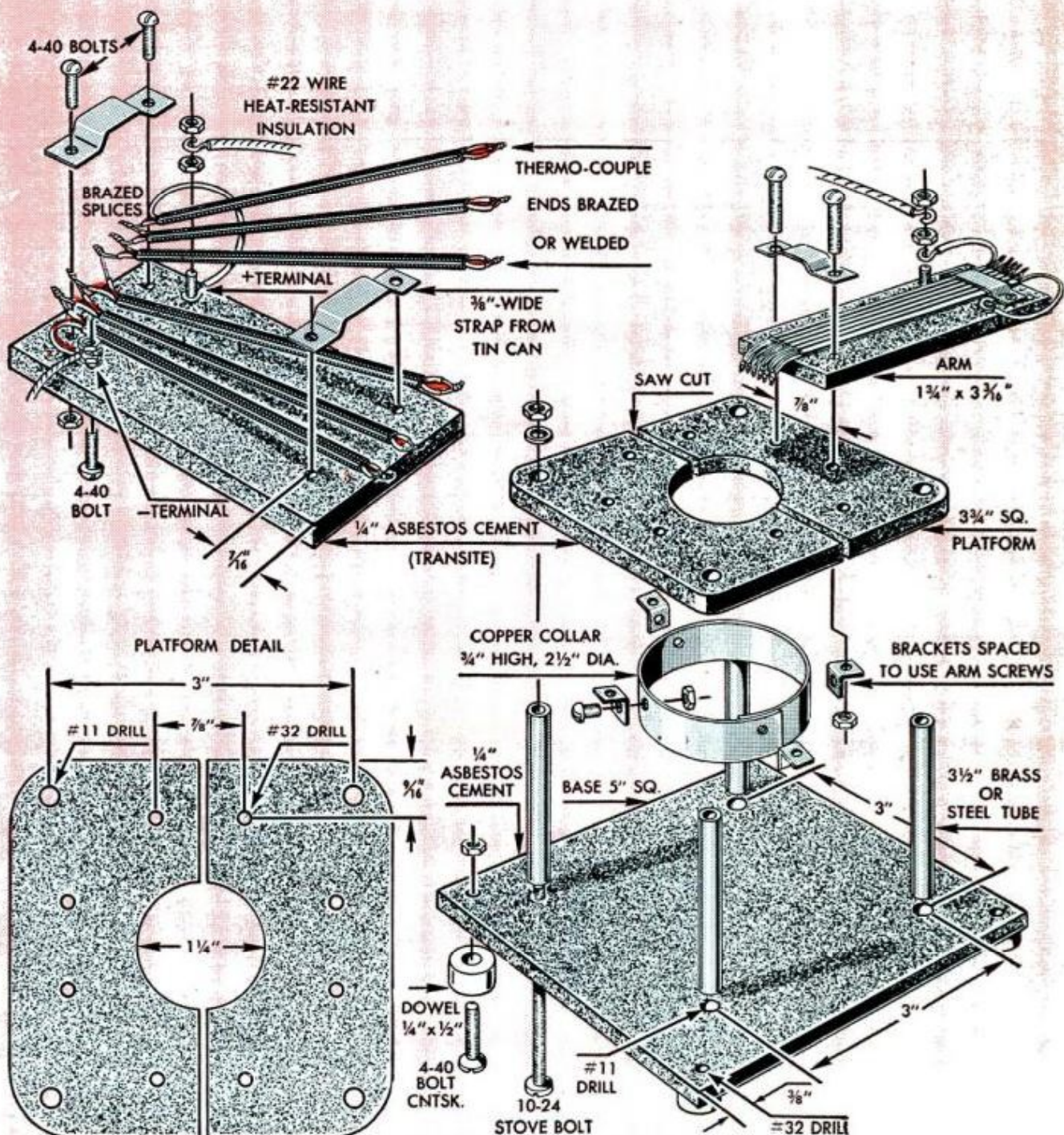
Unfortunately, semi-conductors of a type suitable for thermoelectric experimenting by amateurs are not readily available in a form easily handled without laboratory experience and equipment. However, we can conduct some very interesting experiments with thermocouple

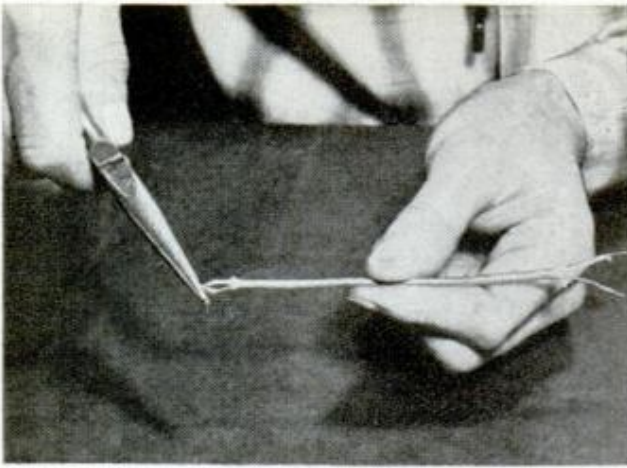


VOLTAGE TEST AT EACH ARM shows output of .25 volts. Such individual checks determine if voltage is about the same at each arm. A lower reading at one arm indicates one or more junctions are badly brazed or welded, making high-resistance joints



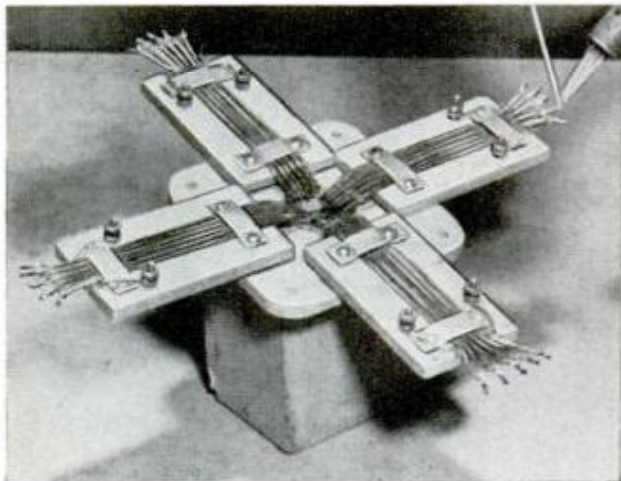
ATTACH TEST LEADS to output terminals when all four arms are connected in series. The reading now is about .9 volt—the total output of the thermopile. Use a DC milliammeter (not shown) to test for current output. Should be about 170 milliamperes



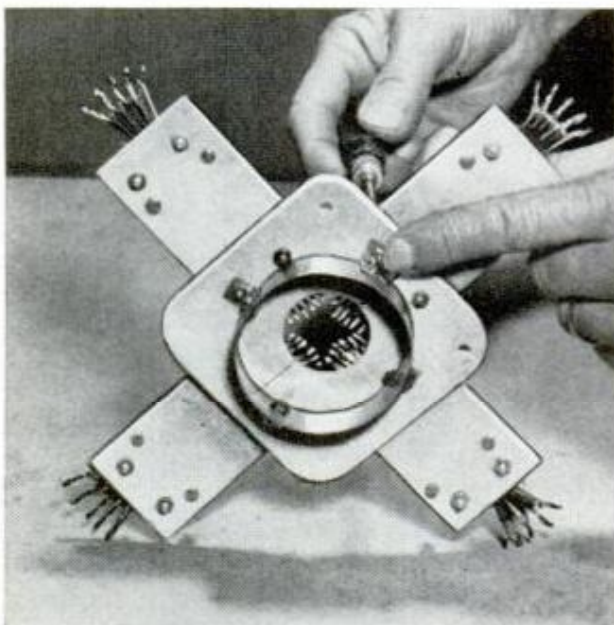


INDIVIDUAL THERMOCOUPLE is cut to $4\frac{3}{4}$ in. and bared wires at one end are joined with several tight twists. This will be hot junction at center of thermopile and must be brazed or—preferably—welded

OPPOSITE ENDS are twisted after thermocouples are anchored to arms. Here, adjacent thermocouples are joined in series and the twists are silver-solder brazed with propane torch set for red heat (right)



COPPER COLLAR is attached to underside by brackets fastened with one of two bolts used to join each arm. Collar keeps heat within area of hot junctions



wire that can be easily obtained and worked. A thermocouple is a junction of two dissimilar metals and when the junction is heated, a small voltage will be developed. When a number of thermocouples are connected in a series, we have a thermoelectric battery or thermopile. There are several different kinds of thermocouple wire available. These include iron-and-constantan, chromel-and-alumel, chromel-and-copel, chromel-and-constantan. These double wires may be bare, or insulated with a heat-proof glass material. The junction of the wires can be either brazed or welded, but welding is preferable—especially for the hot junction.

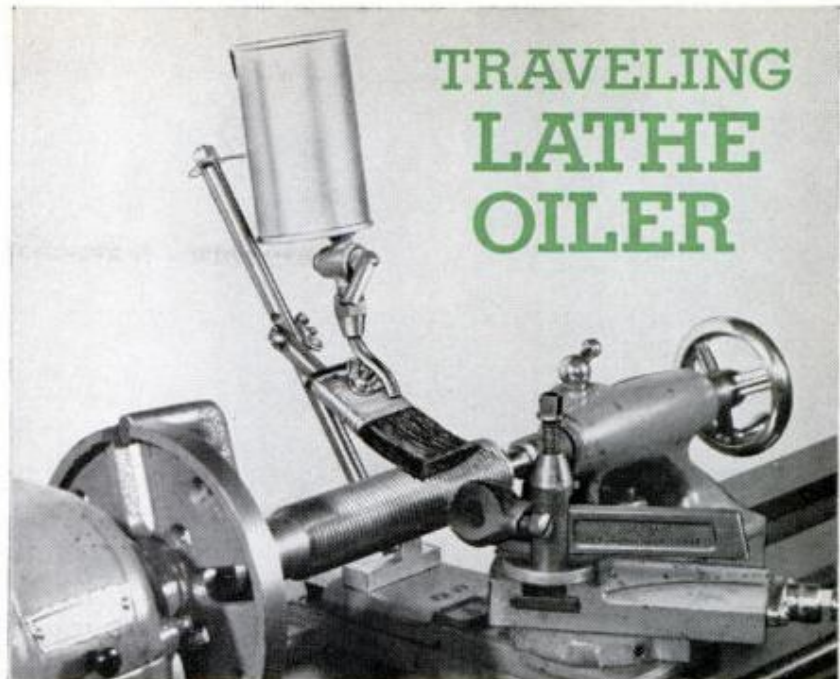
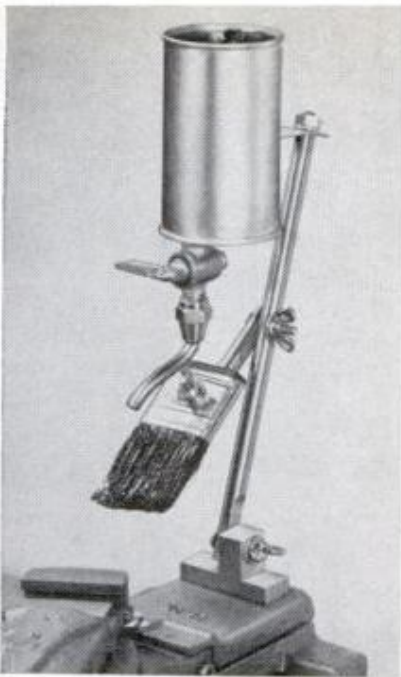
The thermoelectric battery shown here uses insulated iron-and-constantan thermocouples in a very simple design that could be duplicated by most home experimenters or science students. It is constructed entirely of fireproof materials for safety. The heat source is a container of canned heat. This inexpensive commercial product is a form of solidified alcohol that burns with a safe, clean, hot flame. The maximum voltage developed will be just under 1 volt—enough to operate a small motor with an attached fan as a visual demonstration of the phenomenon of thermoelectricity. The motor pictured is an Aristo-Rev, available at most hobby shops. It has ball bearings and special low friction brushes so it will operate on a voltage as low as .5 volt. It will run as long as heat is applied to the hot junctions of the battery.

The general design of the thermal battery can be seen in the photos at left. Four groups of six thermocouples each are bracketed to asbestos-cement (Transite) arms with the hot junctions projecting into an opening at the center. The cold junctions are series splices made at the outer ends. Wire is used to connect the four arms in series at terminals provided, giving a total of 24 series-connected thermocouples.

You'll need about 10 ft. of No. 20 iron-constantan thermocouple wire, in a twin cable with glass braid insulation, and about $3\frac{1}{2}$ ft. of No. 22 or 24 stranded wire to connect the binding posts. This wire should have heat-resisting insulation as enough heat may radiate from the flame to soften plastic insulation.

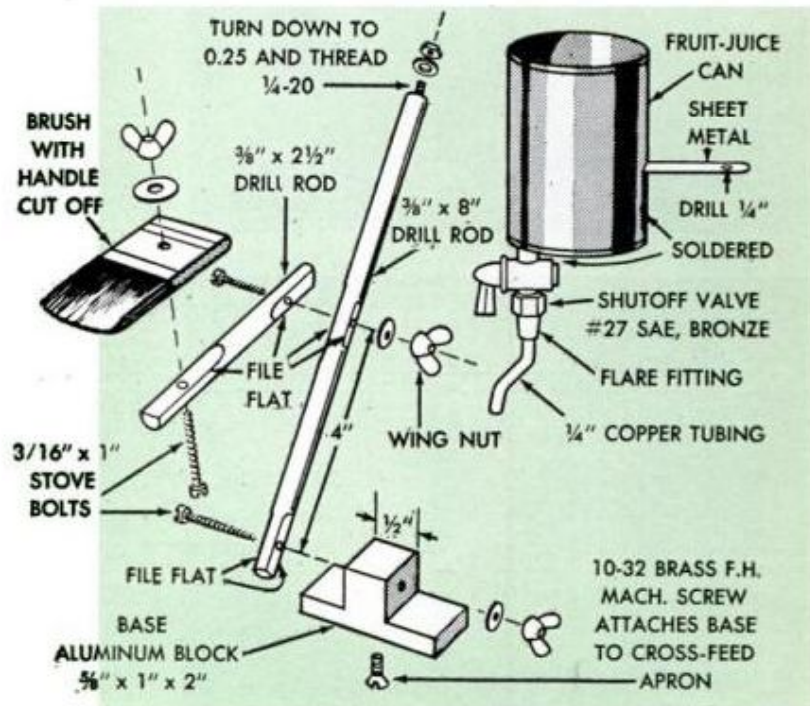
The center platform is elevated from a Transite base on stilts consisting of bolts through pieces of tubing. This provides space to slip in the container of canned heat. The cover seen on top, in the photo on page 186, is a screw cap from a small jar; it's placed over the opening to help confine the heat.

(Please turn to page 208)



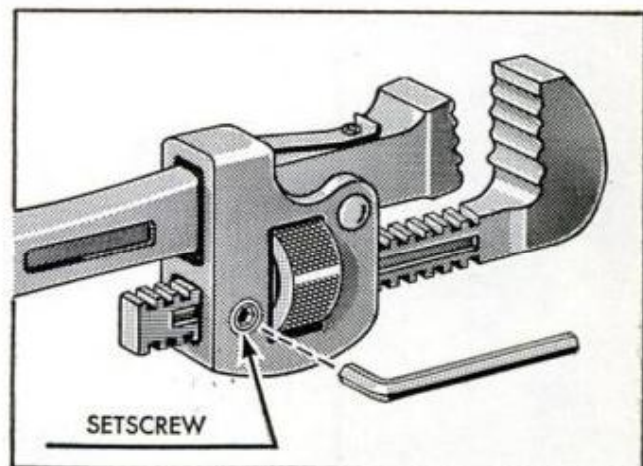
ONLY ONE screw is needed to attach the oiler to the cross-feed screw guard. Countersink the screw head

TO CUT clean sharp threads in steel, or machine a long workpiece between centers, you need a steady application of cutting oil to lubricate the lathe tool and dissipate heat. Where the volume of work does not warrant the outlay for a coolant pump, this simple setup is the next best thing. The photos above and the detail at the right tell you everything you need to know to make the unit and adapt it to your lathe. It travels with the carriage and applies oil in a steady, uniform film flowing from the brush. Catch the excess that drips from the work on waxed paper.



Setscrew Locks Jaw to Widen Use of Pipe Wrench

Moveable jaws of pipe wrenches are not only pivoted so they will lock on to pipe or any other round work, they also are fitted loosely so that they are easily adjusted. But if you have need to use the wrench on square or hexagonal stock or as a pipe vise, then a socket setscrew turned into the pivoted housing carrying the nut and threaded arm of the jaw is an advantage. The hole drilled and tapped for the screw should register with the flute in the side of the arm. Then when the screw is tightened the jaw is locked rigidly in the housing, enabling you to use the wrench as a holding vise and also on work of irregular shape.—David Simpson



SHOP SHORT CUTS

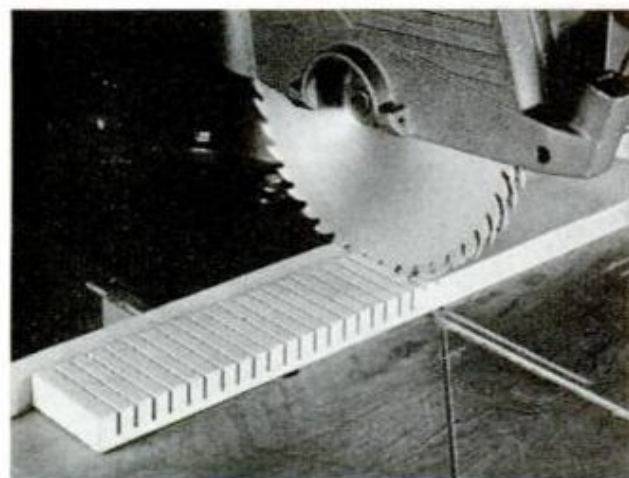
Guaranteed Accurate

Positive spacing of radial holes through wooden dowels or metal tubing is a fast, repeat operation with this jig. The photo pictures the setup. The dowel is held in a shallow V-cut near the end of the block, which is clamped to the drill-press table with the center-to-center distance between the drill bit and nail equal to the spacing required. After drilling the initial hole you use the nail as a spacer.



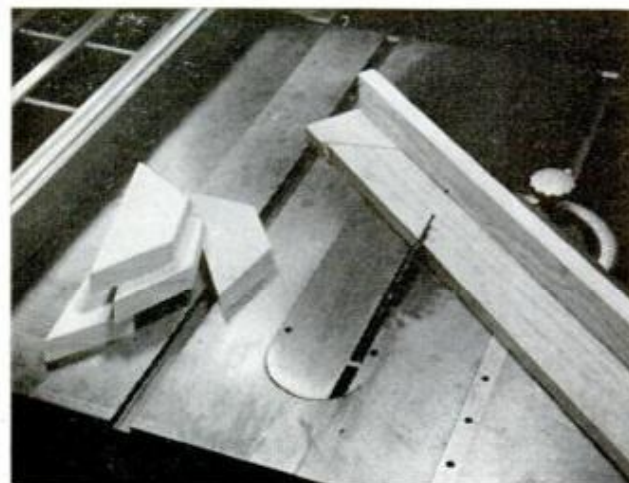
Flexible Rule

Ruling a scribed line accurately around a length of tubing is done easily by using a hose clamp as the "ruler." Slip the clamp over the tubing and locate it with one edge at the point where you want the scribed line. As you tighten the clamp move the band back and forth slightly to make sure it seats accurately. Then scribe along one edge of the clamp band all the way around as pictured. Then loosen the clamp, slide it off and cut the tubing on the line. Or, if you're careful, you can omit the scribed line and use the clamp band as the guide.



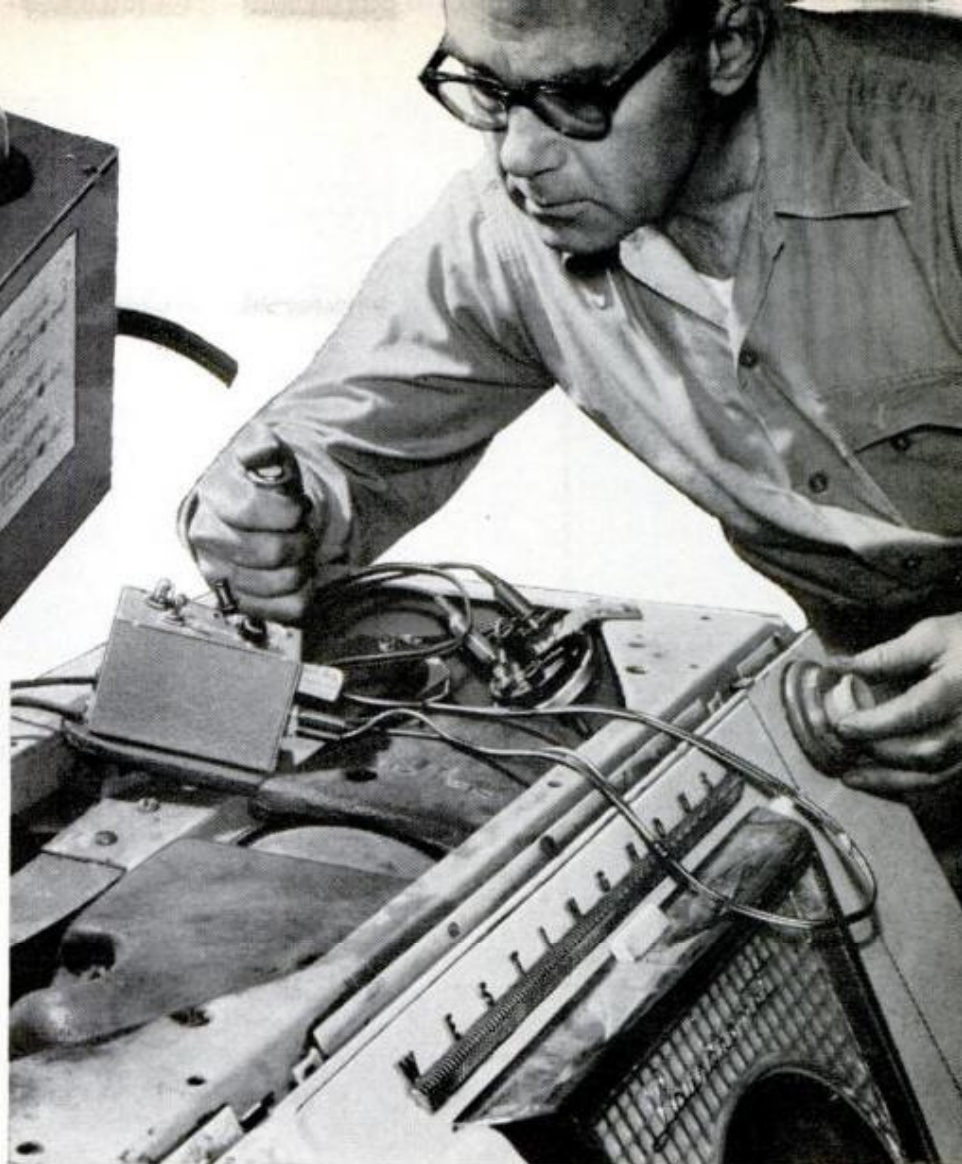
Spaced Kerfs

Spaced saw kerfs in a length of stock, which is to be bent without steaming, can be cut just twice as fast by using two blades of the same diameter on the arbor of your radial saw. Using washers of varying thickness between the blades, you can get almost any spacing that the length of the arbor will permit. Make sure before you start the saw that the blades clear the guard and that they run true. A small nail inserted in a hole drilled through the sawtable fence will help in spacing the dual cuts accurately.—R. J. DeCristoforo



Flip-Over Miters

This jig enables you to cut miters at any angle simply by flipping the stock over for each successive pass. First, make arbor and miter-gauge settings to give the compound angle you want. Then make the initial cut about 3 in. from the end of one of the pieces to be mitered. Attach this cutoff to the end of a 1 x 2 and screw the latter to the miter gauge in a position to give the length of mitered strip you need. To make the second cut, just slide the stock along the gauge until the mitered end contacts the mitered end of the stop. To make the third cut, turn the stock over.



CURRENT CHECK of washer's water-level control (pressure switch) tells whether current is coming through timer. After attaching clips, turn machine on, snap tester switch to position No. 1 (above) and press push button. For this operation, don't plug tester into a power supply

HOT-SERIES TEST BOX

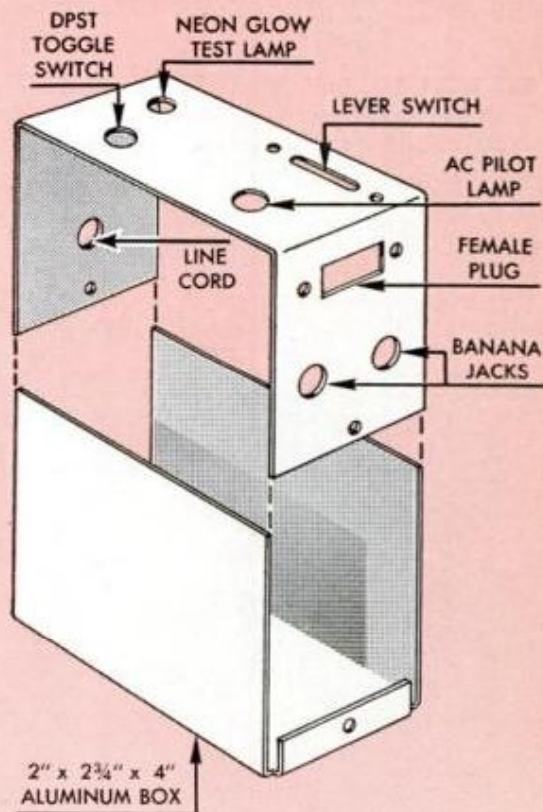
By Frank P. Fritz

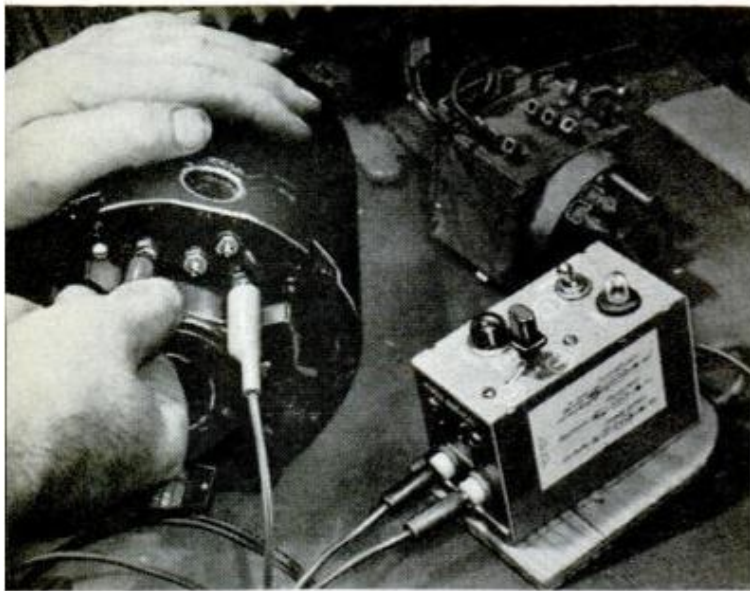
FRUSTRATED when home appliances or electric motors quit dead on you? Build yourself this nifty little tester and you'll be able to diagnose the trouble and know what repairs or new parts are needed to put them in working order.

You'll also be able to check if current is being supplied to motor leads, wall outlets or timer contacts. And you'll have a bench power supply with controls.

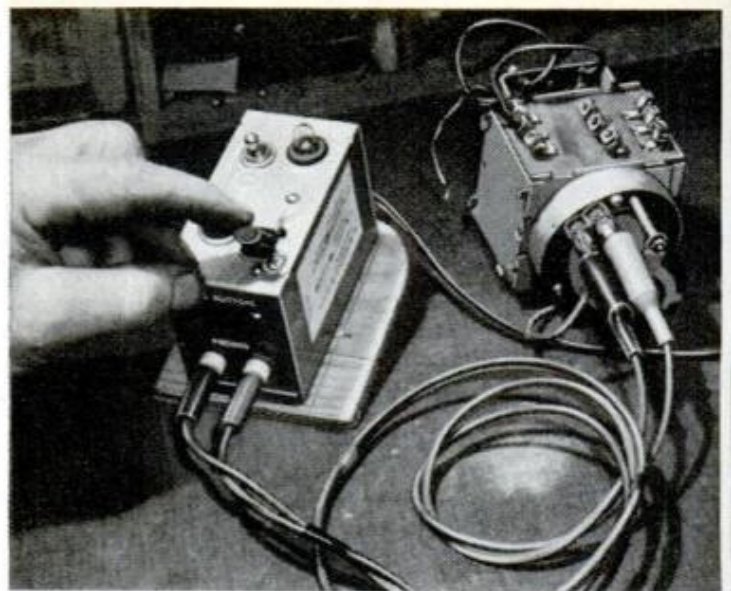
It's hard to believe that so compact and simple a unit can replace a bulky, expensive, vulnerable vommeter—or three separate test cords. But though the test box has only three functions—current check, continuity (series) check and controlled power supply—it can track down nearly 90 per cent of all motor malfunctions.

All materials needed for its assembly





WHEN CHECKING CONTINUITY of motor windings, switch is at Position 2. If test lamp glows, switch to 3 to apply power to check if motor will run. If motor runs only when motor shaft is turned, starter is faulty

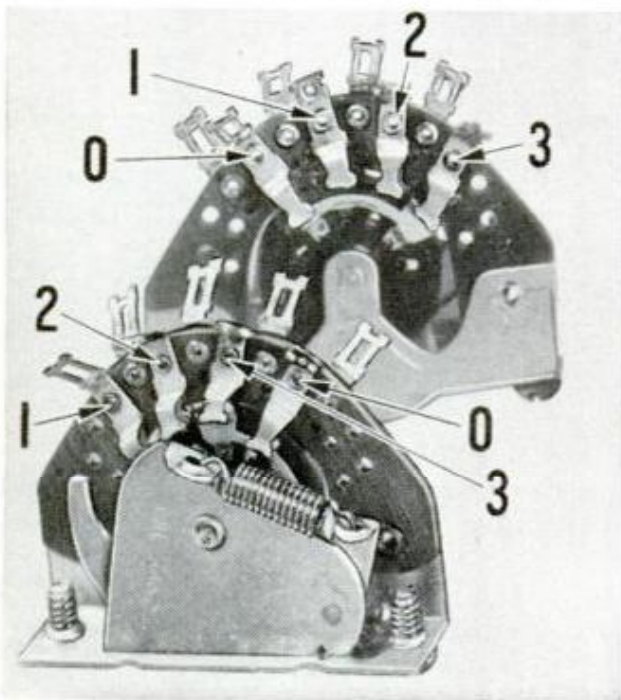


WASHING-MACHINE TIMER MOTOR can also be series-checked with switch on Position 2. In photo above, series check has just been made and switch is being set on No. 3 to check the escapement gear

are available at radio supply houses. They shouldn't run over \$6, including the Centralab non-shorting lever switch, a DPST line-cord switch, two NE 51 H neon glow lamps and two Dialco lamp sockets: a red cap No. 931 (for the pilot light) and a miniature bayonet socket No. 707—plus a type 102 interlocking chassis case and all the banana plugs and alligator clips you need.

1. To check if current is being supplied—as at wall outlets, or through the contacts on timers, toasters, motor

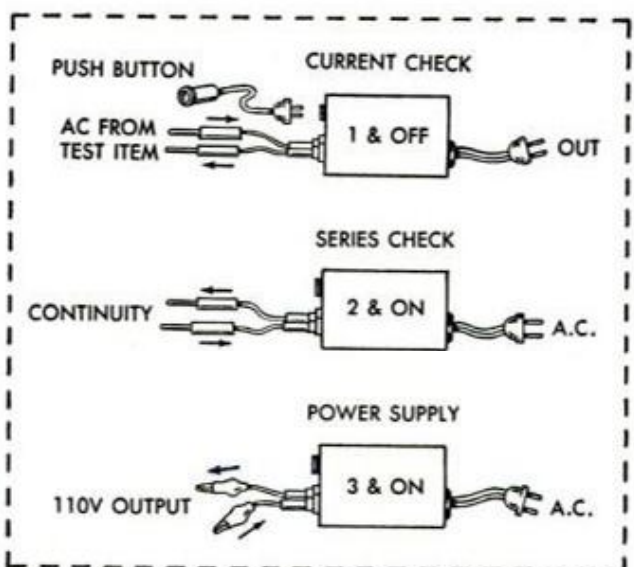
SET NEXT TO MIRROR to show both sides at once, switch's three positions become clear. "O" represents pole toward line. No. 1 is the open position



leads and the like—cut off the power to the item to be tested. (If it's a motor, unplug its line cord.) Attach alligator clips to the motor contacts and put the test-box switch in the No. 1 position. Now, restore power to the item being tested and press the tester's push button. If the test lamp glows, current is being supplied to the machine or outlet as the case may be.

2. For continuity testing, put the switch in No. 2 position. When the test box is plugged into a wall outlet, the pilot light will glow red, and probes are used to test for broken wires, open contacts in timers, and defective fuses, solenoids, bulbs and flash lamps. When testing an appliance, turn its switch on after discon-

CLIP OUT the diagram below and glue to side of tester box to prevent error in use. Figures refer to position of lever switch; "off" or "on" to line switch

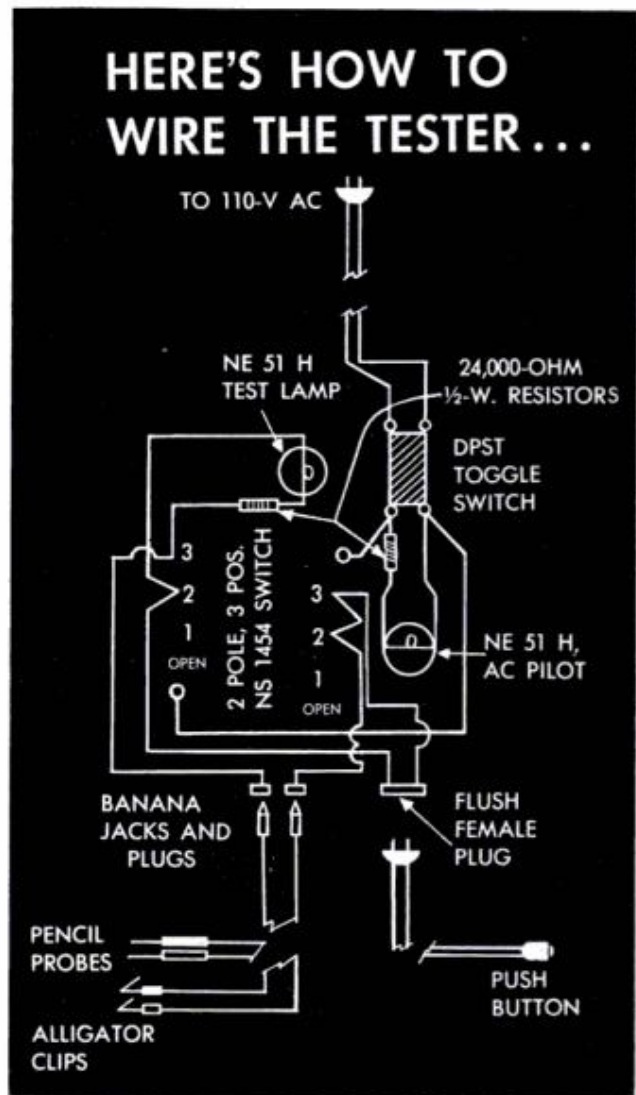


necting its cord. To test the cord itself, touch a probe to one contact at each end. If the test lamp glows, you've established that one wire in the cord is unbroken, and you can move the probes to the other two contacts. If the lamp fails to glow, try moving one probe to the other contact at that end. If the lamp still doesn't light, a wire is broken or a connection is loose.

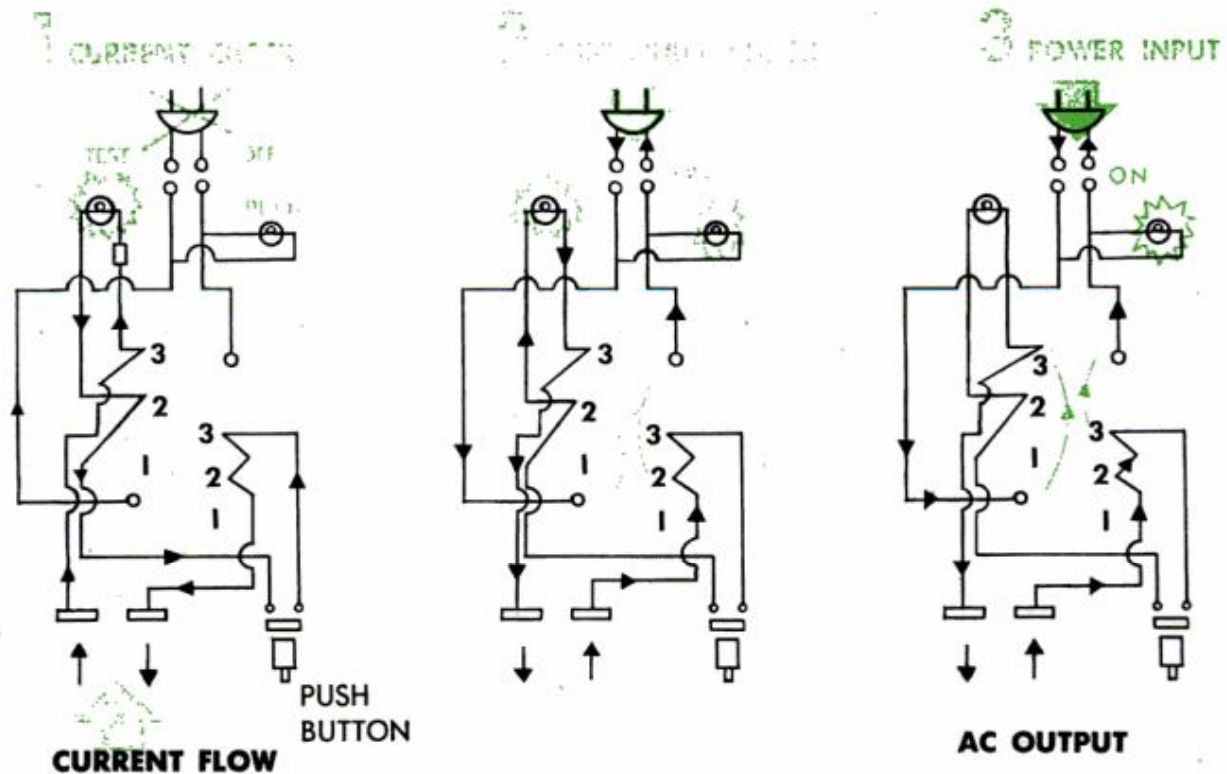
You can test a household bulb or flash lamp by merely touching one probe to the base and the other to the side. The test lamp will glow if current is passing through the filament properly, though of course the test box won't pass enough current to light or flash the bulb.

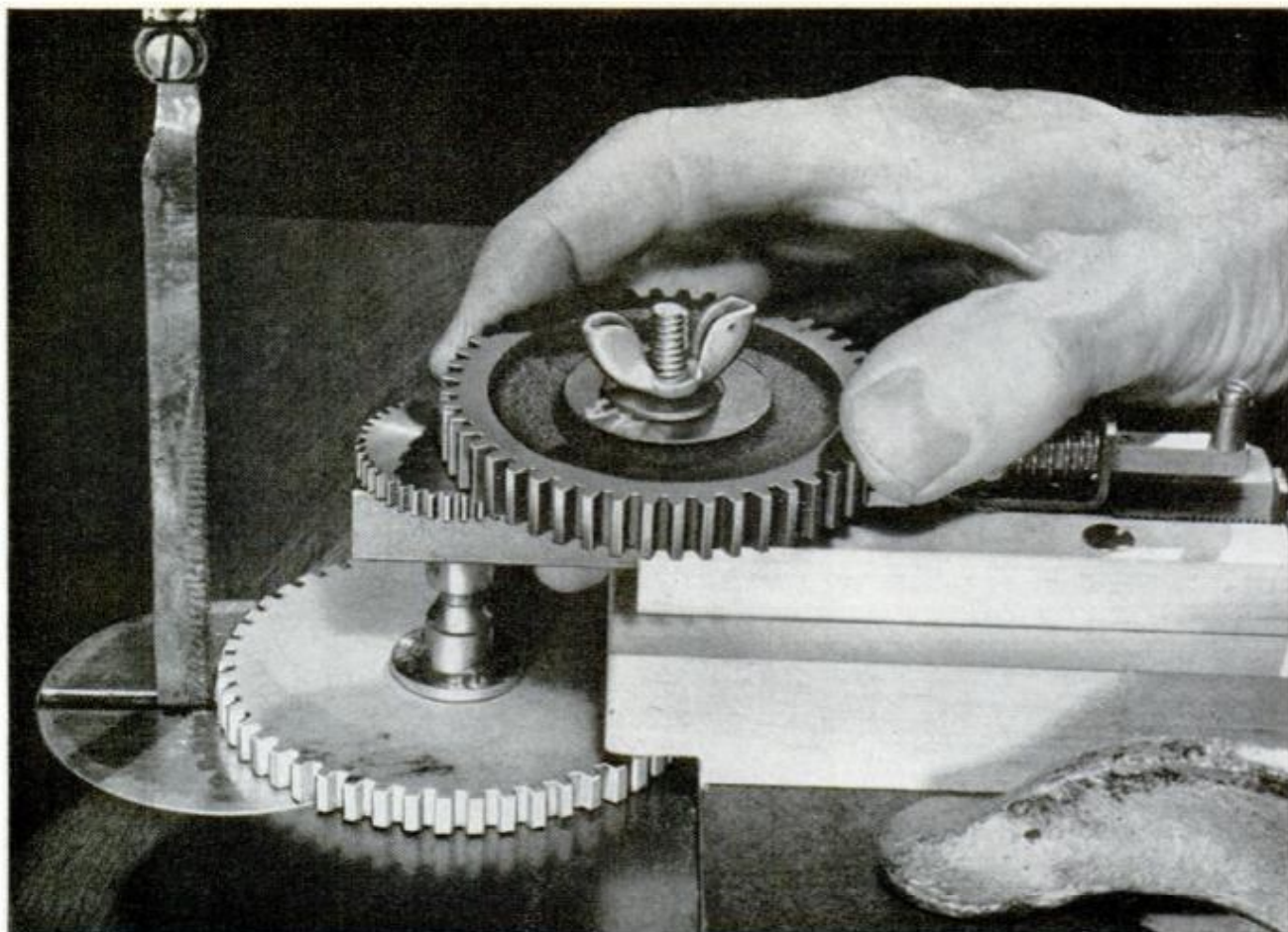
3. With the switch in the third position, plugging the test box into a wall outlet gives you a hot line, with controls, for bench testing. Combining functions 2 and 3 gives the tester a dual purpose. With the switch at No. 2, current is supplied to the probes or alligator clips for a series check as described above. If both lamps glow, the motor's continuity is okay and you can flip the switch to the No. 3 position to supply current to operate the motor—without risking further damage to it. For this double function, attach the tester's alligator clips to the plug prongs of the appliance or to the motor leads. If the item doesn't function under this set-up, it needs further checking and repair.

A bonus function of the tester is that,
[\(Please turn to page 222\)](#)



...AND HOW THE THREE SWITCH POSITIONS CHANGE THE FUNCTION OF THE TESTER





PRECISION INDEXER FOR YOUR JIGSAW

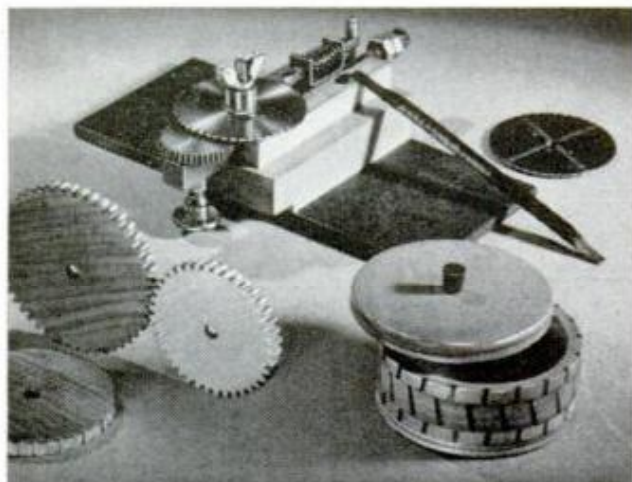
By Walter E. Burton

THIS ATTACHMENT lets you cut equally spaced slots and notches to identical depths for gears or decorative disks.

It will guide disks up to 4-in. in diameter (wood, hardboard, plastic or metal) against a blade, file or special cutter in your jigsaw and space the kerfs or notches

evenly around the edge to a pre-set depth. The indexer can also handle square, hexagon or other polygon shapes of various thicknesses. Disks or rings whose edges are shaped with the attachment can be glued together or mounted to form such articles as trays, boxes, lamp bases and furniture pulls. Contours or grooves cut in the disk edges make possible inlay patterns or carved effects difficult to achieve by other methods.

The indexer consists of a notched index disk or a spur gear used as an index plate, a latch for locking the index disk at various positions, and a shaft on which the work blank is mounted and whose movement is controlled by the index plate. To provide blade clearance, the index shaft is separate from the work-holding shaft, the two being coupled by a pair of identical

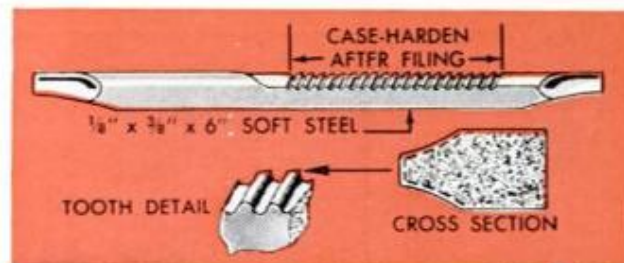


WORK YOU CAN DO with the indexer and accessories (background) includes decorative notched-and-fluted edge of disk at lower left, perfectly-meshing wood gears, and angled inlay grooves in jewel box

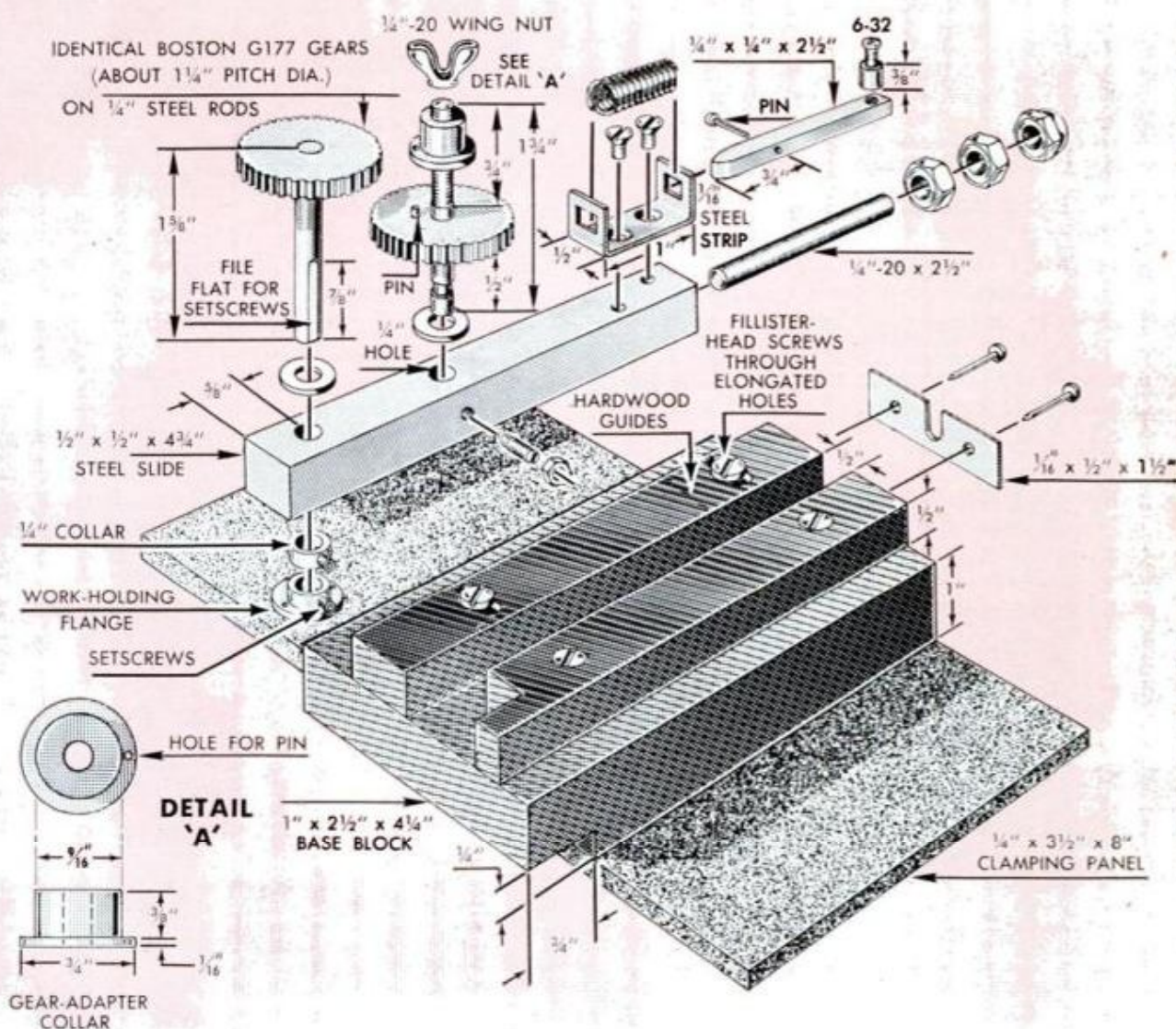
spur gears. All of this is mounted on a metal bar that can be moved smoothly back and forth in a channel formed by hardwood guides mounted on a hardwood base. To eliminate play, one of these guides is screwed to the base block through elongated holes for sideways adjustment. The other is notched to provide clearance for the locking-screw nut.

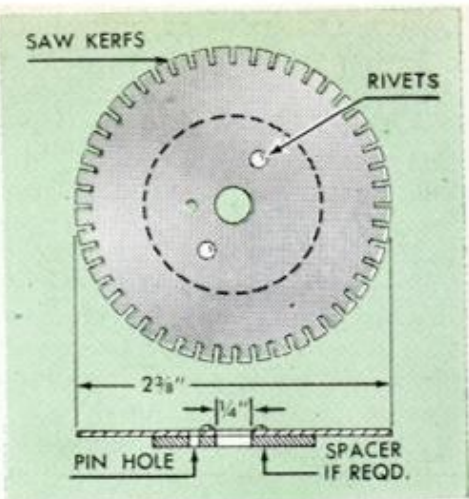
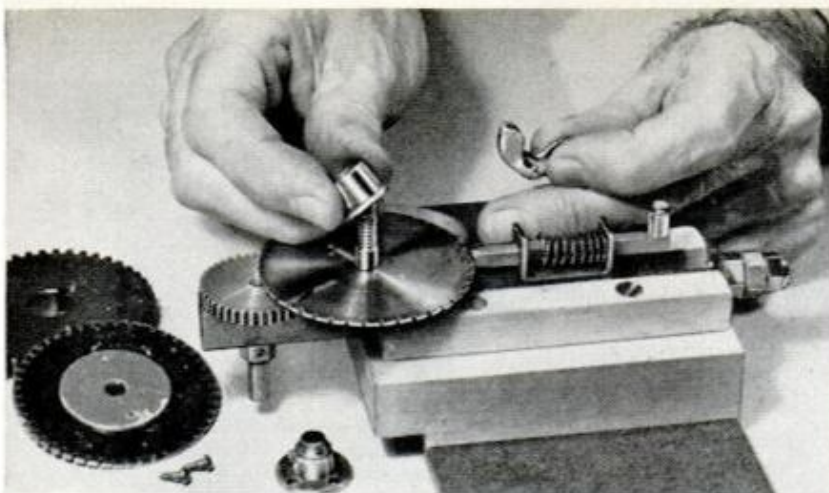
The work-holding shaft is a steel rod soldered into a small spur gear so as to form its axle. At the opposite end, a flange is attached by means of a setscrew. Flange dimensions aren't critical, but the widest diameter should be about $\frac{7}{8}$ in. Three or four small screw holes are provided to fasten the work blank to this flange. A thin washer between gear and bar provides gear-edge clearance.

Near the unthreaded end of the index-plate shaft is a shallow groove to receive a locking screw that holds this shaft in its hole in the sliding bar. The distance between the two shaft holes is such that the gears will mesh snugly without binding. Projecting $\frac{1}{16}$ in. above the top surface of the index-shaft gear and spaced about $\frac{3}{16}$ -in. from the shaft, is a small pin that



CUSTOM-MADE CUTTER makes fast work of wooden gears. Before filing teeth (sketch), bevel bar with file, and finish shaping with scraper made of tool steel





SPECIAL INDEXING DISK—where existing spur gear won't serve—is seated on shaft as shown, left. Lathe-gear collar serves as spacer between thin steel plate and locking nut. Kerfs can be cut using this indexer, with lathe gears as temporary indexing plates. A good starting set would be disks with 48, 56 and 60 kerfs

engages holes in the index plates and the lathe-gear-adaptor collar, to insure against shifting if the wing nut is loose.

The gear-adaptor collar is a simple flanged collar used to mount a lathe-change gear as an index plate (top photo, page 194). Collar dimensions in Detail A, page 195, are for gears with $\frac{9}{16}$ -in. holes. Preferably the collar should be provided with a key or pin to engage the slot in the gear hole. Its flange is drilled to fit the spur-gear pin. When a thin index plate is used in place of the thicker gear, this adapter collar is placed on top to span the unthreaded portion of the shaft. This also keeps the collar handy and prevents it from straying when not in normal use.

The latch is a square steel bar sliding in a U-shaped holder made by bending a steel strip as shown. The bar slides in holes drilled with a $\frac{1}{4}$ -in. bit and filed square. A coil compression spring operates between one end of the holder and a pin (small nail) in a hole drilled crosswise

through the latch bar. The latch handle is a short length of brass tube bolted on near the back end. The other end of the bar is filed wedge-shaped and preferably hardened. The latch is mounted so that when its tip engages a notch in a $2\frac{1}{2}$ -in. index plate, the coil spring is slight compressed.

To limit slide movement toward the jig-saw blade, a threaded $\frac{1}{4}$ -in. rod extends from the latch end of the slide and is equipped with several nuts, the first of which strikes against a notched metal stop plate fastened across the guide strip. The second is a lock nut. A cap nut on the end is an optional feature that keeps you from gouging your palm on the projecting rod.

The base block is undercut to provide clearance for large-diameter blanks. This block is fastened with screws to a hard-board panel which can be gripped readily by a C-clamp on each side, to anchor the indexer to the saw table.

Although lathe-change or similar gears [\(Please turn to page 234\)](#)

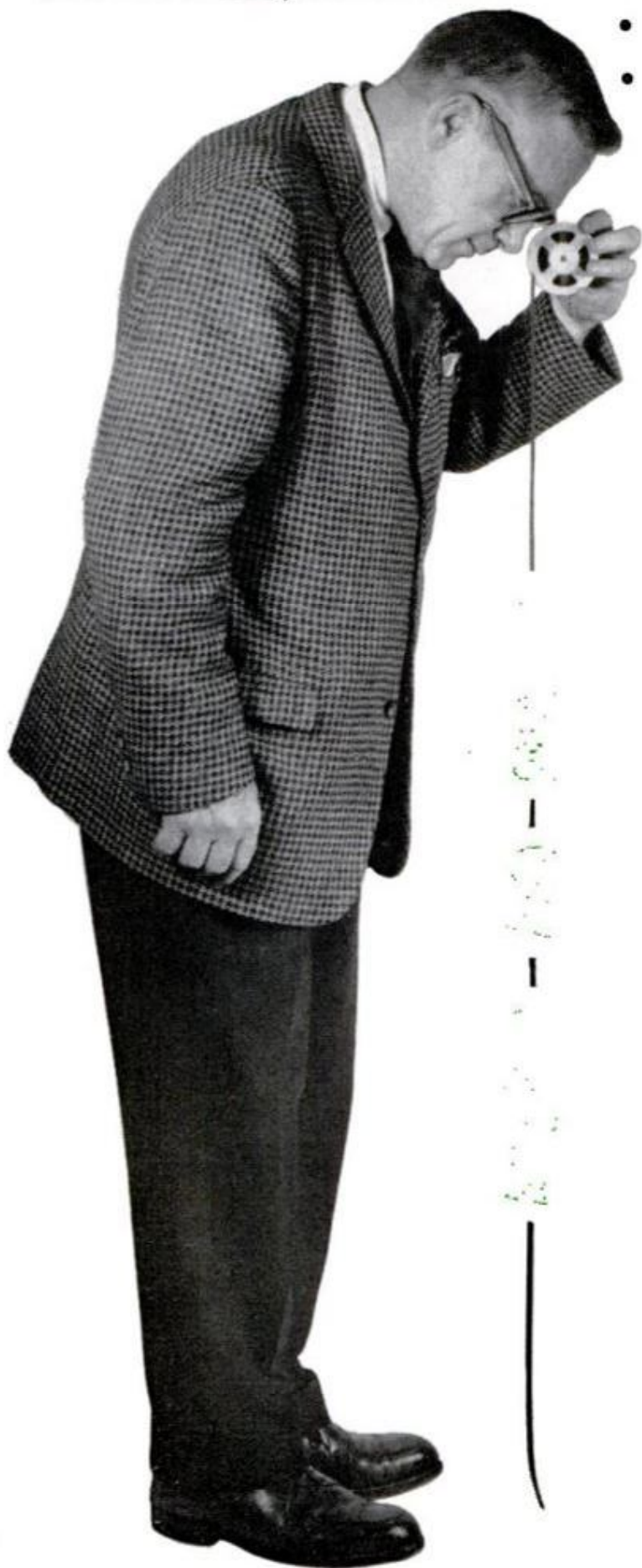
DECORATIVE EDGING is easy with indexer to give equal spacing of alternate v-notches and flutes. Former are cut with triangular file, latter with rat-tail, chucked in jigsaw. Finger pressure minimizes bounce

WIDE KERFS are cut with two blades clamped side-by-side in jig saw. Slant was achieved by tilting table. With kerfs filled with plastic steel, this disk became part of jewel box shown on opening page





- What You Should Know About It
- How to Find The Kind You Need



IF THE LAST REEL of tape you bought skittered past the recording head at an odd angle, shedding flakes as it went, your machine may be ready for the repair shop.

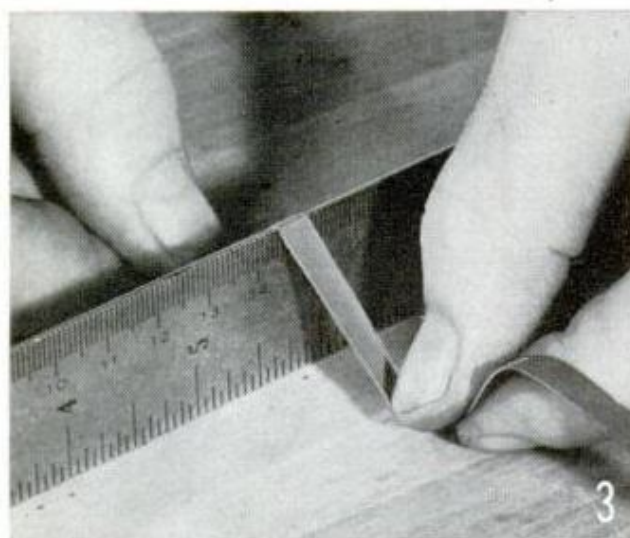
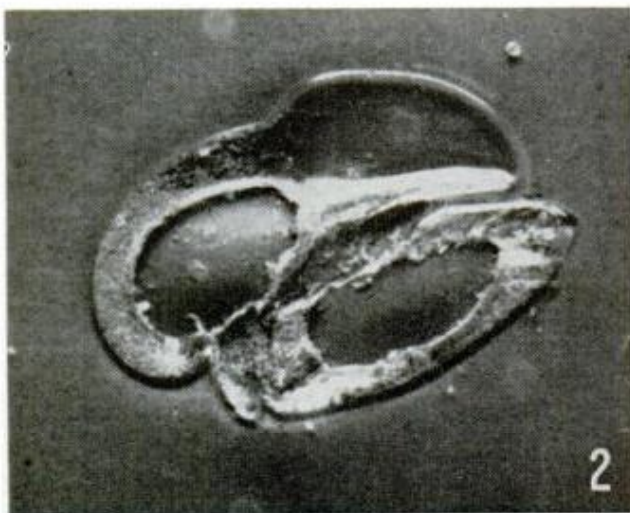
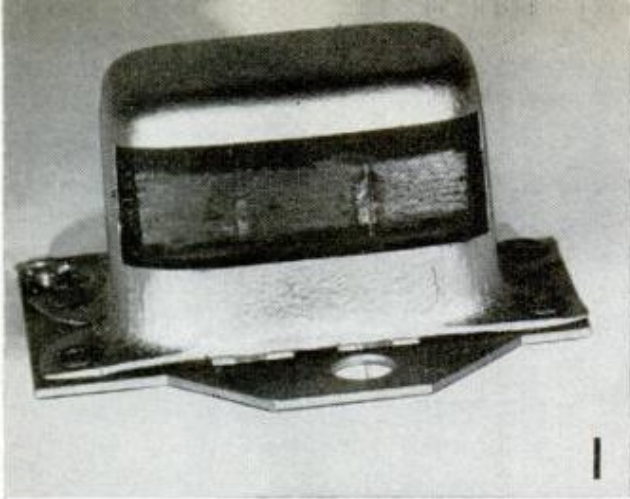
But too often the real culprit goes unsuspected. It's tape—a product of considerable precision. Whether you get good performance depends on three factors: the manufacturer, the type of tape and you, the user.

A lot of complex technology during tape manufacture is aimed at a single result. The tape must glide across the heads, never losing intimate contact. With uncanny accuracy, a plastic backing (the tape's shiny side) must be coated with an incredibly smooth layer of iron oxide. Anything short of this creates a hill-and-valley surface that takes on the characteristics of sandpaper. (Two revealing tests you can make on coatings are shown in photos.)

Badly coated tape is responsible for a potful of evils. Aside from wearing out heads prematurely, it plays havoc with frequency response. Low-pitch sounds distort in the "valleys" since they need the full oxide depth. High tones drop out when a "hill" comes along and holds the tape a few thousandths-inch from the head. In really bad cases the oxide flakes onto the head damaging perfect tapes played later.

Tape quality depends surprisingly little on the producer's choice of raw materials. Nearly all manufacturers use acetate or Mylar as the base material. Iron oxide is the magnetic coating. Reputable firms place great stock in techniques and quality control to turn out a uniform product. Consider the slitting process. As shown in the photo, it's in the final step of manufacture that a wide roll of tape is slit into standard $\frac{1}{4}$ -inch widths. If the cutting edges of the rotary knives are not perfect, the tape emerges with a

DROP A LENGTH of tape from reel to detect "skew," curl or cupping, as described in text



1. EXTREME EXAMPLE of how bad tape can ruin head. Once smooth and shiny, head is now clogged and roughened by oxide particles shed from tape

2. MICROPHOTO OF TAPE coating reveals uneven deposit, chief cause of poor tape. Blob of oxide can prevent close contact or break off in machine

3. SIMPLE TEST of coating on acetate tape is done on metal edge. Few, if any, particles should flake away when dull side of tape is rubbed

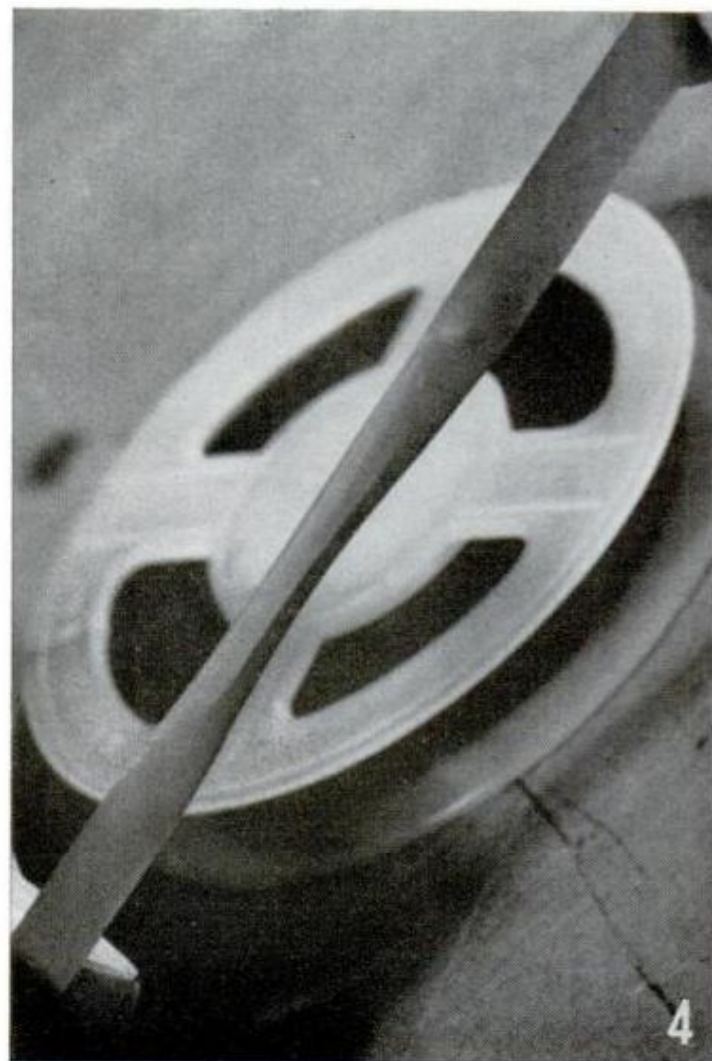
4. TEST OF POLYESTER tape is done by stretching section of tape, as shown. If it is properly coated, particles of iron oxide will not flake off during test

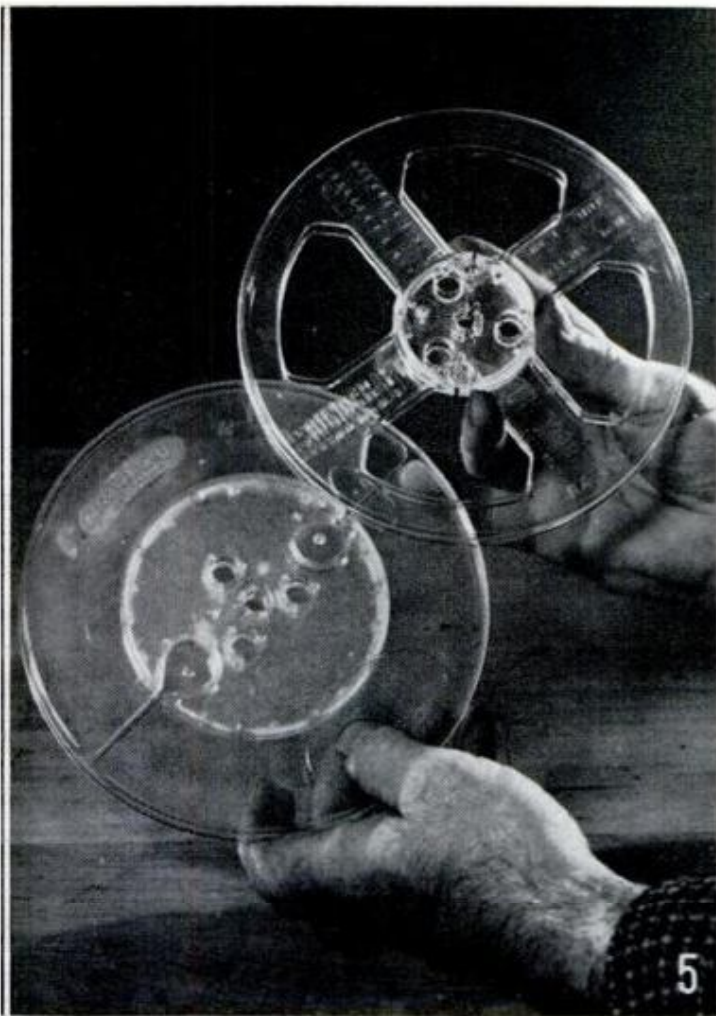
toothy edge. On your machine fine burrs break off and foul the heads. They trigger the same kind of deterioration in frequency response and head condition as poorly coated tape. Make this another checkpoint in evaluating tape—examination of both edges should reveal extreme smoothness.

Shoddy tape slitting introduces another problem you can spot. It's "skew," which results from an uneven knife cut. Such tape delivers poor quality since it rides past the heads in slightly diagonal fashion. It takes just a moment to check for "skew," as shown in the photo on page 197.

Cupping and curling are two more signs of poor engineering. These deformations are caused by temperature and humidity changes. Tape can behave like a bi-metal thermostat; its two layers—oxide and backing—expand at different rates and the stress pulls everything out of shape.

What about so-called "bargain" tapes? Prices on the unbranded product are attractive, but these items are a gamble. Such merchandise flows from several sources; end runs which the manufacturer won't guarantee, re-slitting operations which cannibalize used computer and video tapes and splice jobs of odd lots. Some prove suitable, others might be



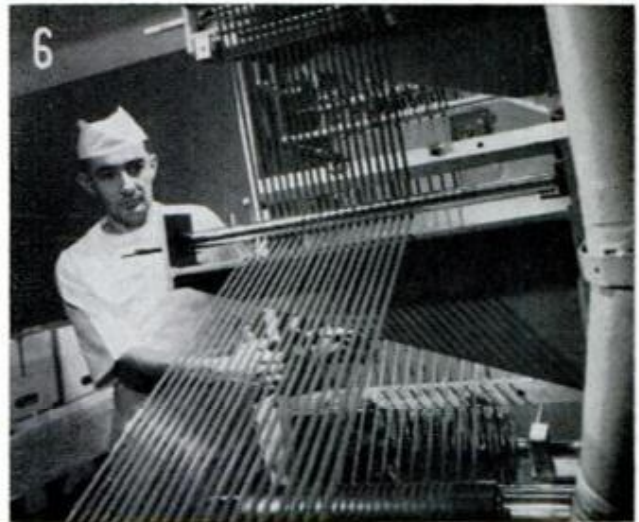


5. LARGE FINGER HOLE in reel (lower left) makes threading somewhat easier. Same reel, however, may warp in time due to slit from the rim to the hub

6. SLITTING PROCESS at factory cuts tape into familiar ¼-inch width. Poor quality control in this step causes tape "skew" or rough edges on the tape

7. ANY POINT of tape contact must be kept scrupulously clean. Left to right: rubber roller, metal post, tape heads, pressure pads and tape guides

8. NEW TO THE FIELD is "sandwich" tape. Ultrathin .005-mil plastic keeps oxide from touching head, preventing wear when tape is played constantly

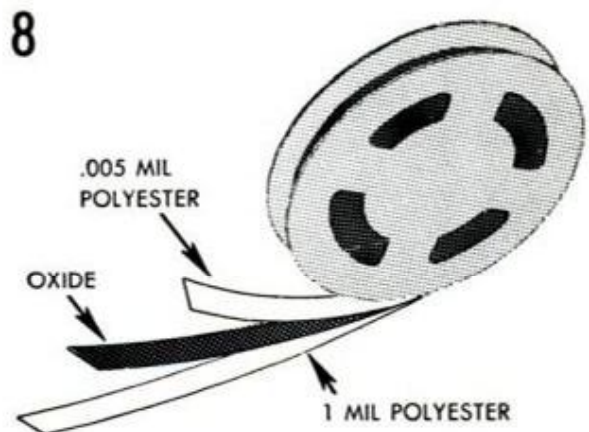


stretched, scratched or bear other signs of damage. Although they are erased they could contain objectionable noise levels. If you still want to speculate on the "white box," stick to non-critical applications like voice, dictation, etc. Just be certain to check the oxide coating as described.

The prospective buyer of tape is confronted with an array of sizes and styles. Choosing among them introduces the second major factor—tape type. Price differences exist, but don't make the mistake of buying the most expensive kind in the hope of improving the sound of your machine. Cheap or expensive, the output of a reputable manufacturer usually sounds the same on a home-type recorder. (This assumes that the tape has none of the basic defects described earlier.) However, there are big differences just as important as fidelity—playing time, strength and lasting qualities. Here's how they add up:

Acetate, 1.5-mil. This is standard tape. It's economical, lasts long when not subjected to wide variation in temperature and humidity. If you're a purist with a sharp ear you might want 1.5-mil tape (the thickest type) for its low "print through" qualities. It has the least tendency to transfer sound from one tape layer to the next.

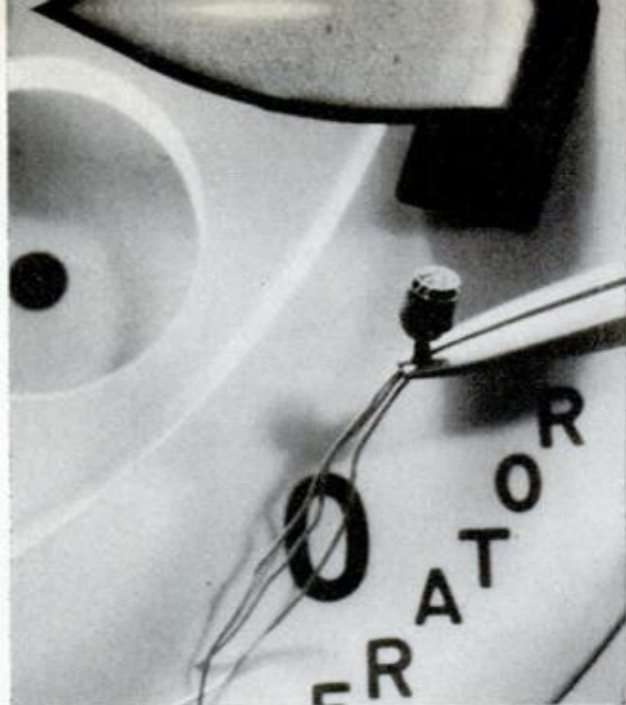
[\(Please turn to page 212\)](#)



NEW IN

ELECTRONICS

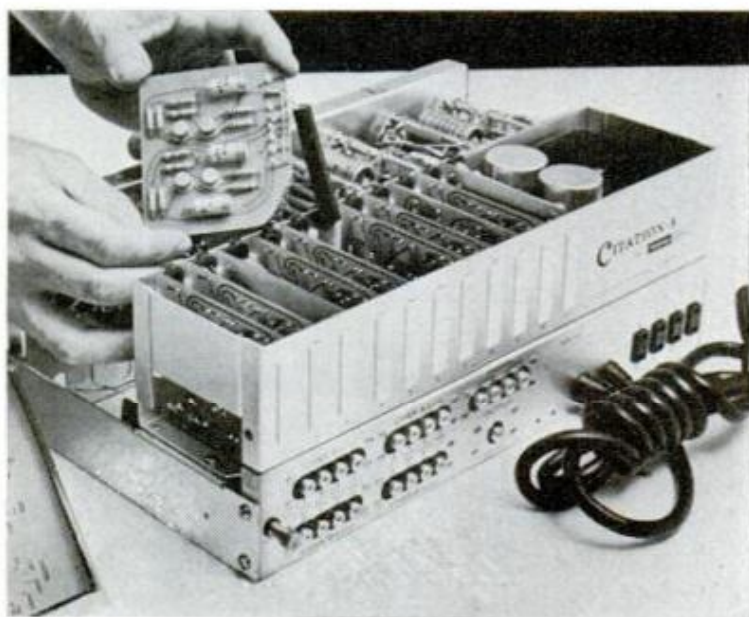
SPY MICROPHONE could get lost in a pile of paper clips. It's really a special kind of transistor. A miniature metal disk at the top picks up vibrations and sounds, then injects them into the transistor via a diamond stylus. The transistor amplifies these signals and can be connected to an amplifier input. This unit was developed by Raytheon. A similar unit has also been announced by Bell Telephone Laboratories



TINY TAPE RECORDER easily sits in the palm of your hand—it's only 5 x 3½ x 2 inches. The TR-401 Pockette is battery powered making it completely portable and weighs only 1½ pounds. Not for hi-fi recording, but excellent for voice recordings of all types. \$59.95 from Craig-Panorama Inc., Los Angeles 16, Calif. It slips right into a suit jacket pocket



PICTURE-FRAME CABINET conceals an 8-inch high-fidelity extension speaker behind your favorite photograph. It can be easily connected to any radio, TV, or phonograph and you can stand it up on a desk or table or hang it on a wall. Comes with 25 feet of hookup cable and is sold by Sears Roebuck for \$19.95. A table-top version is also available



FLAT FREQUENCY RESPONSE from 1 cycle to 1 megacycle is one unique feature of the Harman-Kardon Citation A. This top-quality stereo preamp takes advantage of computer and missile printed-circuit techniques to insure stability of its al-transistor circuitry. One of the 11 printed-circuit cards in the unit has been pulled out for inspection. The unit is available as a kit for \$250 and completely wired and ready to connect into your high-fidelity system for \$350



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more taste through the filter...and L&M's filter is the modern filter — *all white*, inside and outside—so only pure white touches your lips.

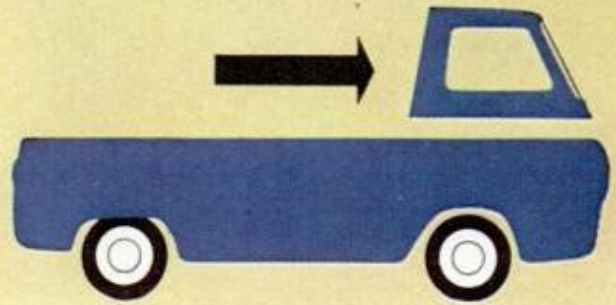
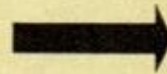


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WHAT A PICKUP!



What a pickup you'd have
if you could...



move the cab forward so
you could see the road better
and have more loadspace...



put a cover on the load area
to keep out the weather
and prevent theft...



put double doors at the
back and side for easy
load handling, and...

... keep the cost of all these wonderful improvements below \$100.



'63 ECONOLINE offers 204 cu. ft. of protected loadspace; long, low, flat floor; $\frac{3}{4}$ -ton payloads. New options include double doors on left side; windows all around!

You can! An Econoline Van gives pickup owners all these advantages—at a price within \$100 of most pickups! And the money Econoline saves on gas and upkeep soon pays for the difference!

FORD ECONOLINE VAN

PRODUCTS OF  MOTOR COMPANY

POPULAR MECHANICS

Drag-Boating at 152 m.p.h.

(Continued from page 131)

both the prop and the engine to be mounted at the stern. The stern-mounted engine is an important ingredient in drag racing.

Even Experts Back Flip

The weight at the rear helps prevent prop thrust from kicking the boat into a series of forward flips, but a danger is that it also encourages backflips. When the power suddenly goes on, the nose of the boat rises high above the water, and the over-eager prop, held in the water by the weight of the motor, literally runs the stern underneath the bow. Even in the hands of an expert driver there is always the possibility of a drag boat doing a back flip. The real value of V-drive is that it allows the propeller shaft to be set at an angle that gives the propeller the optimum angle of attack, a necessity for high speeds.

V-drive units come in a variety of capacities. Some are in-and-outer shifts, with no reverse; others have forward, neutral and reverse; and others, the kind used in boats that don't pretend to have any purpose but dragging, are direct drives—that is, they have nothing but forward gears. The ratios vary; *The Golden Thing*, for example, has a Halibrand V-drive that operates on a 66-percent overdrive. This means that when the *Thing's* big engine is rapping around 7000 r.p.m., its 12 by 18 propeller is turning over something like 12,000 r.p.m. And it happens instantly. The torque figures on a perfectly tuned drag engine are extremely high.

V-Drive Problems

But like most innovations that solve a problem, a V-drive creates one that is peculiar to super-speed dragsters. It derives from the placement of the torque unit, far forward in the boat, where double shafts have to reach for it; the drive shaft from the engine and the prop shaft that runs back through the hull to its place under the rear-mounted engine. This arrangement gives a dragster a condition that's something like the driveline in an automobile, without the tunnel. A dragster pilot sits with *two* high-speed shafts less than a foot from his legs and little more than a foot from his midsection. If one of these shafts should let go during a hot run, the parts would whip around like a wet noodle in a high-speed drill.

The answer to this threat is a V-drive "cage"—a sturdy metal cross member with cutouts through which the two shafts pass. It's located amidships, practically beside the driver. It's a neat solution to the problem, but it also illustrates a point that's as

true of boat dragging as it is of any kind of racing: the higher the speed, the more you need extra equipment; the more equipment, the more weight; the more weight, the more horsepower you need to overcome it. Beyond a certain point, the cost of every additional m.p.h. begins to multiply and re-multiply. Mersereaux's 91.09 m.p.h., for example, is about two-thirds of the inboard drag record, but it was set with about one-fifth of the horsepower—and at about one-third the cost. Financially, speeds like the outboard record are more or less in the reach of anybody's dollar, but the supercharged V-drives call for an unusual combination of speed-blinded courage and a thick wallet. Added to the cost of an extraordinary power plant is the need for an extraordinary hull.

Kidney Collapser

In the early days of boat dragging the hot boats were racing runabouts or SK hulls, and occasionally you'd see the dedicated kidney-collapser known as the cracker box. In terms of design, these were essentially the same as today's middle-upper-class dragsters, characterized by flat aft planing surface, shallow forward vee, and a long-raked, needle-nosed bow. This design is fine for a desultory dragster that doubles as a family-type ski-boat and runabout, but it's no more suited to top-level dragging than a stock T-Bird is for the automotive equivalent. And just as the rail jobs and slingshots took over the land drags, the "stretched" hydroplane has come to be the accepted drag design.

The hydroplane itself is the fastest of all hulls. Basically, it's no more than a pair of narrow sponsons with a flat-bottomed boat body slung between and above them. At speed, the entire assembly rises to ride on the sponsons, creating a "tunnel" of air between the hull and the water—and eliminating most of the "wetted" area and its speed-cutting friction. Once a hydro gets up on its sponsons, no conventional hull can get anywhere near it. But the hydro is a notoriously slow starter; it has to be nursed up onto the surface. An uninhibited application of power to a dormant hydro can cause an on-the-spot backflip.

An SK hull, on the other hand, will leap to the top instantly and with relative stability because of its wide aft planing area. But once it levels off in a plane, the broad surface that put it there becomes a friction-prone area that speed-minded purists find intolerable. The "stretched" hydro is a clever combination of both types. It's a hydro up front, a runabout aft. In a run, the runabout section serves its entire function during the first second and the first

(Please turn to page 204)



**GOOD
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!**

They are when you install a Sealed Power KromeX ring set with Stainless Steel oil rings.

It's easy as can be. Only three pieces—no shims, no gauges, no fussing with an "A" or "B" set. Sealed Power's proven end-abutment design means no groove depth problems.

Once in, you've installed real oil control, oil control that lasts. And lasts. Longer than you'd think possible.

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Furthermore, Sealed Power electropolishes this premium alloy. So it's smooth, shiny and slick, so deposits don't have a chance to build up.

For good ring jobs the easy way, just ask for Sealed Power KromeX with Stainless Steel oil rings. It's that easy. Sealed Power Corp., Muskegon, Mich.

Sealed Power Stainless Steel
oil rings stop oil pumping

Drag-Boating at 152 m.p.h.

(Continued from page 203)

few hundred feet. From then on, the sponsons carry the weight; the aft runabout portion is entirely clear of the water—clear of drag, and cleared for dragging.

In the brackets above 125 m.p.h., the "stretched" hydro—or the hydrobout-run-a-plane, as designers Rich Hallett and Jack Williams call it—has the field pretty much to itself. *The Golden Thing* is the fastest of their creations so far, but practically nobody, including Hallett and Williams, thinks that a 200-m.p.h. hull is very far in the future.

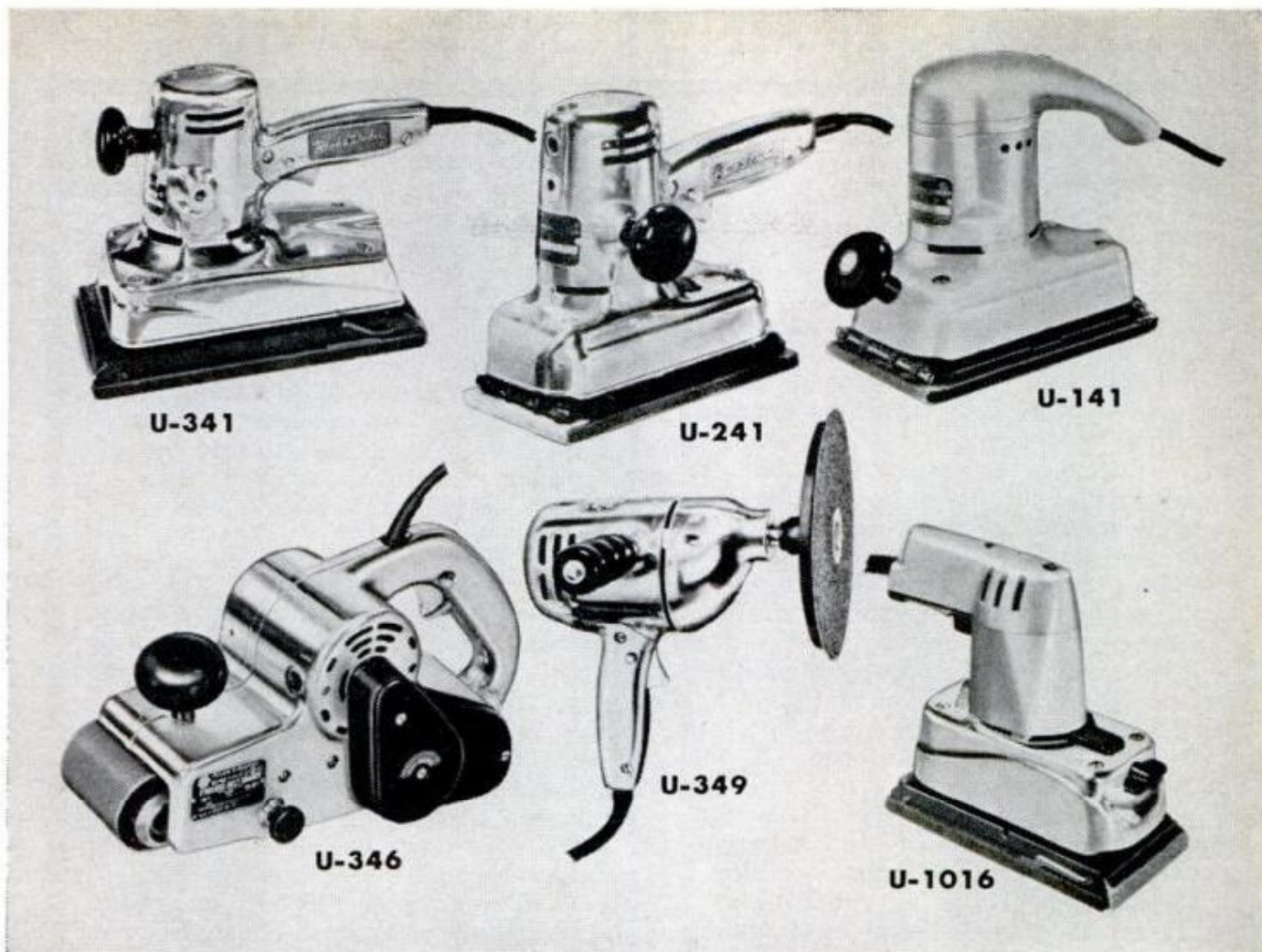
You can have a 100-m.p.h. family-ski-dragster if you want it. Raysoncraft Boats are built in Gardena, Calif., but distributed nationally—and they hold the world's record for open course speed, a 78 m.p.h. average for five miles. Spico Boats of Bakersfield, same type, same distribution, hold the top drag time in the unblown gas class, 98.63 m.p.h. Both Spico and Raysoncraft make boats that will give you a near-100 m.p.h. ride with unblown, unmodified engines—plus as much luxury as runabouts ever get.

It's also possible to build a do-it-yourself dragster. Between Glen L. Marine Designs of Bellflower, Calif., and its sister company Glenwood Marine Equipment of Gardena, Calif., you can get a drag boat plan or frame kit, plus all the equipment needed to turn an abandoned auto engine into a marine-converted powerhouse.

Any one of these family-type waterheaters will allow you to out-run 99 percent of the boats in the country. Of course, there's the remaining one percent, the record breakers, that will make you gargle. However, the consolation is in the cost. *Golden Thing*, for example, represents a \$10,000 investment simply standing still, and its operating cost is somewhere between \$200 and \$500 per quarter mile, which must be some kind of record even when it doesn't set a record. A good part of the money goes for special fuel; the rest would cover replacements for various fused-together parts. Rudy Ramos of Raysoncraft Boats is the owner of *Golden Thing*, and he takes all this in stride.

"After all," he says cheerfully, "we might be able to get as many as 10 or 12 runs out of it before we have to rebuild it."

This is the attitude it takes to own a dyed-in-the-wool go-for-broke dragster. To someone that doesn't have it, *Golden Thing* is just a \$10,000 boat that won't even take you fishing. But that's probably the same man who drove to Yellowstone to look at Old Faithful, watched it perform and said, "Is that all it does?" ★★★



IF YOU APPRECIATE FINE TOOLS . . . WE'VE GOT YOUR NUMBER

To some men, sanding means a block of wood and a piece of sandpaper. But, to the man who knows and respects good power tools, sanding means a Black & Decker Sander. He knows that every B&D Sander has a quality Black & Decker-built motor, durable construction, and the latest operating features. The finishing sanders are gear driven and each can be converted to dustless sanding with a Dust-Collecting Attachment. There's a Dust-Less Kit for the Belt Sanders, too.

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CLINIC FOR HOMEOWNERS

Let Your Pool Freeze

Q—I'm planning to build a swimming pool this coming spring and I'm bothered much about what to do with it during the winter which follows. Some tell me to let it freeze; others advise that it should always be drained. What is your advice?—L.G., Ill.

*A—*Although there is some difference of opinion and varying experiences in handling cold-weather pool problems, it seems to be quite generally agreed that a swimming pool should be left filled over winter, especially in areas where the average frost line just about equals the median depth of the pool. The reason is, mainly, that when the water in the pool freezes the frost pressure on the wall will be more nearly equalized; there will be less all-over movement and less likelihood of damage to the wall. This has been the general experience of pool owners in cold-weather localities. In the northern tier of states where mid-winter cold is more severe, swimming pools are sometimes "cribbed", or lined, with softwood (pine or cedar) logs 8 to 10 in. in diameter and cut to short lengths so that they can be more conveniently stacked along the walls and lashed in place. When the water in the pool freezes the softwood logs tend to act as an expansion strip, absorbing and equalizing the pressures exerted against the wall by deep frost.

Condensation in Crawl Space

Q—The four corners of the crawl space under my new home accumulate moisture in such quantities that beads of water drip from the floor boards and joists. Originally there were three vents installed. I have installed two more, but still there is dampness present. To prevent further damage, what can I do now?—E.R., New York.

*A—*Yours is a common problem. Basically the cause is a variation in temperature in the space under the floor which is just sufficient to bring the moisture in the air to the dew point. Condensate then forms on any exposed surface, in this case the subfloor, the joists and the foundation walls above grade. The one remedy which seems to be almost universally effective—and it is not easy to carry out in most crawl spaces—is to cover the earth inside the foundation with a plastic membrane, sealed mois-

ture-tight at the joints and at the walls where the plastic is carried up the wall from 3 to 8 in. The earth fill under the floor should be leveled and stones, building debris and soil lumps, or clods, should be broken up to provide a reasonably level surface over which to lay the plastic sheets. These should be lapped at least 5 in. at each joint and cemented with roofing cement or a similar material made for the purpose. This procedure usually cures the trouble entirely or at least minimizes it to such an extent that it is no longer damaging.

Cleaning Paintbrushes

Q—Just how does one clean a paintbrush to prevent the paint from working up to the base of the bristles and hardening, thus gradually rendering the brush useless? I've tried every solvent I can find but still I can't get brushes sufficiently clean to prevent paint from hardening at the "heel".—H.N., Calif.

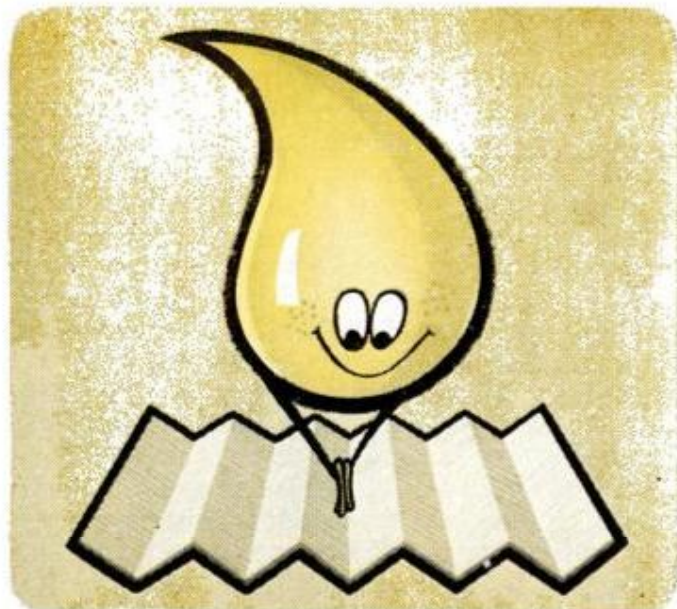
*A—*No ordinary paintbrush will last indefinitely and those that are used in overhead work, such as painting ceilings and soffits, are comparatively short lived. The reason, of course, is the tendency you have mentioned, that of the paint slowly collecting at the base of the bristles and hardening between usings. It is impossible to entirely prevent this tendency, but there are several tricks you can use after cleaning in solvent to extend the useable life of a good brush. All modern paints, both exterior and interior oil-base paints, set quite fast and because of this it is necessary to clean the brush immediately after you have finished with it. There are a number of good brush cleaners available but one of the fastest acting is lacquer reducer, or thinner. Do a thorough job of cleaning in the solvent, then take the brush by the handle and give it several sharp, downward strokes. Next, holding the handle between the palms of the hands, spin the brush several times. There also are several chemical "brush keepers" available which are said to keep a paintbrush soft and useable for months in storage. Ask your paint dealer.

As a service to Popular Mechanics readers in solving the hundreds of problems pertaining to a home—inside or out—you are invited to present your problems to The Clinic Editor for his helpful advice. Address your questions to The Clinic Editor, Popular Mechanics Magazine, 575 Lexington Ave., New York 22, N.Y.

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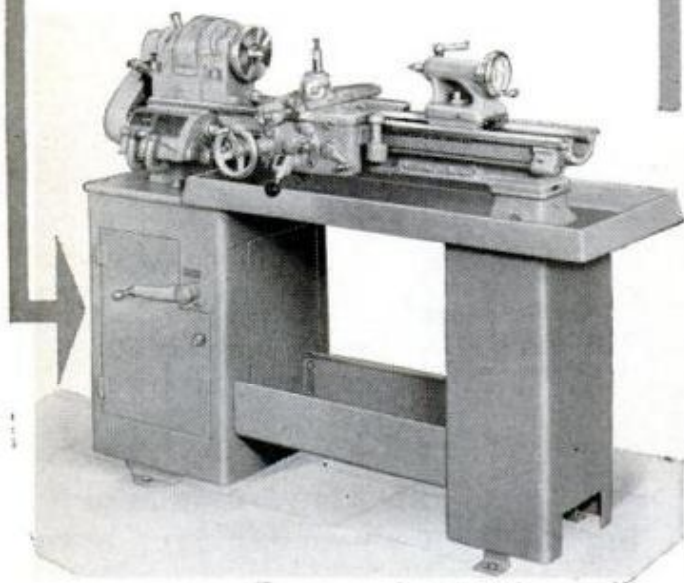


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Homemade Thermopile

(Continued from page 188)

The cold-junction splices are made by twisting together the red wire from one thermocouple and the white from the thermocouple next to it. The white wire is the iron, and will be positive, the red is the negative wire. To braze these splices, flow silver solder well between the turns of the wires. A suitable flux for brazing should be applied at the time of heating. The outside wires of each group are connected to the binding posts.

Welding is preferable for the hot junctions. Use an oxyacetylene torch set just high enough to melt and flow the two metals together with a small ball at the end. If you lack this equipment, proper brazing with a propane torch will suffice.

All four arms are identical to the one pulled apart for detailing in the sketch. The platform to which these are bolted has a 1¼-in.-diameter hole to admit heat to the hot junctions. This opening can be made by marking out a circle and drilling a series of small holes inside the line. The center piece can be carefully broken out and a half round file used to dress it round and smooth. The piece is then cut through the center to make two halves. This is done because the heat will otherwise cause an expansion that would crack the material. When mounting the four arms, adjust the positions and distance that the thermocouples are extending into the opening so that they are uniformly placed in the opening and the ends do not touch.

A collar is required at the underside to help confine the heat; this is easily made from a piece of .025-or-.030-in. sheet copper, with angle brackets of the same material for attachment. Each arm of these brackets should measure about ¾-in. square.

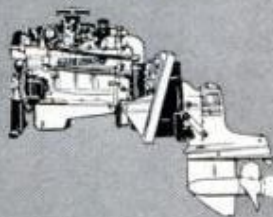
All materials except the brazing equipment can be obtained from Linwood Products Co., Box 186, Wollaston 70, Mass., in a kit complete with motor, for \$15.95, postpaid in the U. S. ★★★

Locating Outlet Holes

What's a quick and accurate way to transfer the location of electrical outlet boxes when applying dry-wall panels to a frame wall? Try this: trim the wallboard or paneling to fit its space, then rub powdered graphite on the edges of the box before you press the panel in place. Lift the panel from the wall and cut out the box outline on the back surface. For material with a dark-colored back face, substitute ordinary chalk in place of the graphite.—*Wm. Waggoner*

POPULAR MECHANICS

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What more can we say?

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STERN DRIVE POWER PACKAGES

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Promising Fuel Cells

(Continued from page 106)

of "nutrient" (representing waste matter) is placed in a plastic jar containing copper and aluminum electrodes. The bacteria inhabit a grainy "carrier" that fills the jar from top to bottom. With a meter and load resistor connected across its output terminals, a cell tested in *Popular Mechanics* lab indicated power of about .0001 watt. Most significant was that this small, but measurable output held steady for 10 straight days. There was no sign of tapering off at the end of the trial. For greater power, a number of these cells were connected in series to run a transistor radio as well as a flashing fluorescent lamp.

For competitive reasons, the reactions in the bio fuel cell are still shrouded in secrecy—or simply not fully understood. Speculation about the cell just described places it in the bio "galvanic" class. With its metal electrodes, the unit appears to follow the principle that dissimilar metals immersed in acid generate electricity.

Results with Vinegar

The same cell—minus the bacteria—was filled with vinegar (a mild acid). The meter read the same output but dropped down in a few minutes. A process of polarization had occurred which coated the electrodes against further action, but the test proved this unit to be galvanic in action—in short an ordinary acid battery using bacteria to produce the electrolyte. Apparently, the bacteria, in decomposing organic matter, are more proficient than household vinegar.

Today, the fuel cell hovers between the basic research and hardware stage. Costly but effective units are here now. The big-scale applications await breakthroughs in new catalysts, knowledge of enzymes and low-cost fuel. We're not ready, as one scientist suggests, to convert the Black Sea into a vast fuel cell to electrify parts of Europe and Asia.

But we are out of the dream stage. ★★

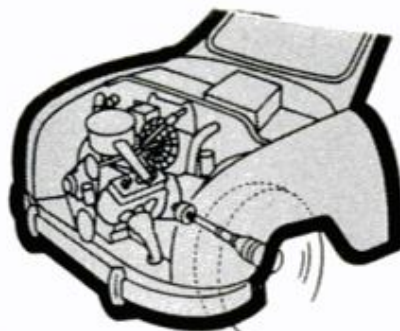
Does the Moon Cause Rain?

Weather Bureau records show a striking correlation between the phases of the moon and rainfall in the United States.

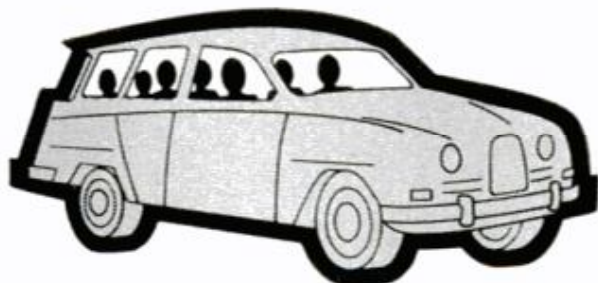
Heavy rains have tended to occur on the third and fifth days after a new moon and after a full moon, according to three scientists who have been studying the records.

They say the reason for the correlation is not clear, and warn against basing any weather predictions on the position of the moon. However, their research may eventually reveal the moon's effect on rain.

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SAAB WAGON PERFORMANCE is the envy of many sedans. Reasons: Simple, effective engine—a quiet, three-cylinder, two-stroke valveless unit—produces all the power of a conventional "6." At high speeds, it operates with gas turbine-like efficiency, yet delivers from 30 to 35 miles per gallon. Front wheel drive; eliminates sway, minimizes skidding, and optimizes over-all stability. Front wheels pull the rest of the car firmly and effortless—around curves and corners, over mud, ice, and snow.

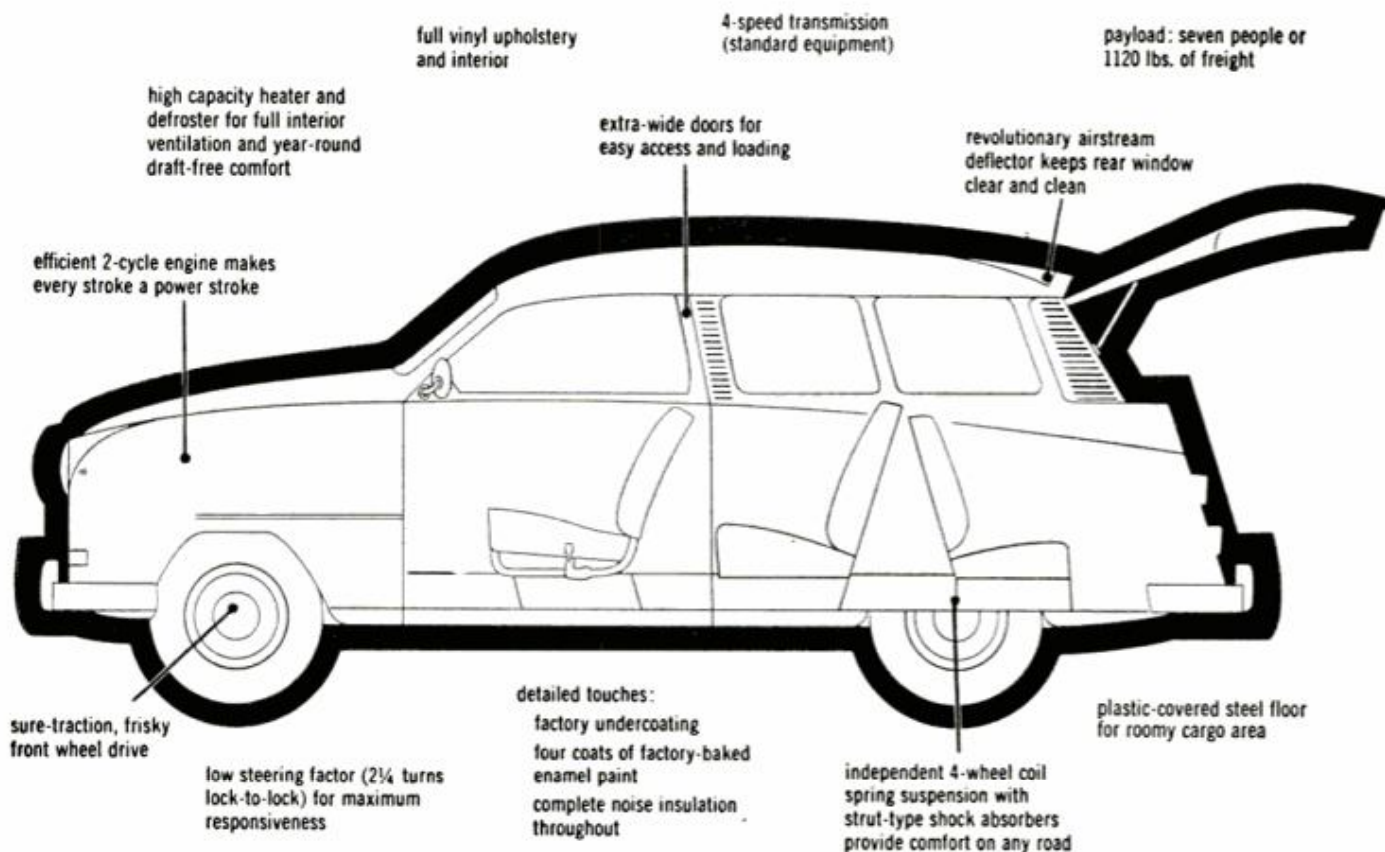


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that it has a 24,000-mile/24-month written warranty*



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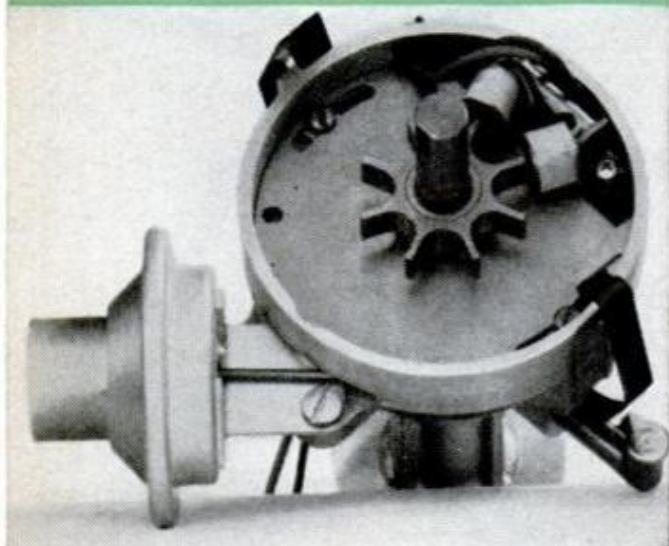


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MARCH 1963

211

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Tips on Tape

(Continued from page 199)

Disadvantage of 1.5-mil tape: shortest playing time of all.

Acetate, 1-mil. Similar to above, but offers 50 percent more playing time on same size reel. Thinner base of 1-mil calls for gentler handling. If the transport mechanism of your recorder jolts tape during fast speed or direction changes, tape is more apt to snap. However, you can virtually eliminate this problem by careful operation. One tip: pause before switching from fast forward to reverse.

Mylar. This is the deluxe stuff, sometimes referred to as "polyester" base tape. Like the less expensive acetate it's made in 1.5- and 1-mil style for comparable playing times. The big difference is in lasting quality. Mylar will not crack or become brittle. Thus, if you want to record the kids' first words for playback years later, Mylar might be worth the extra cost. You won't need a sealed container for storage.

Mylar is durable enough to be made in the superthin .5-mil thickness which yields double the playing time of 1.5-mil size.

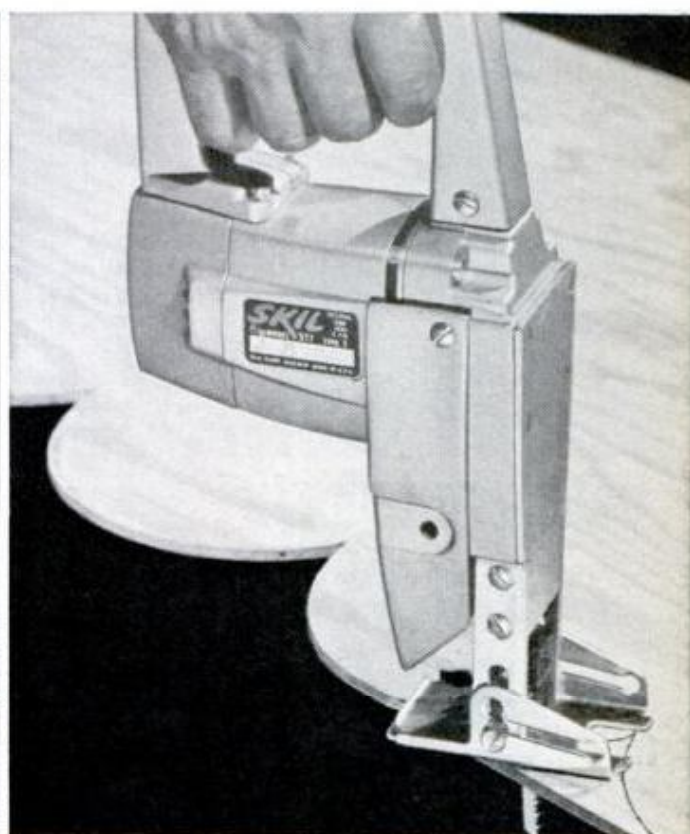
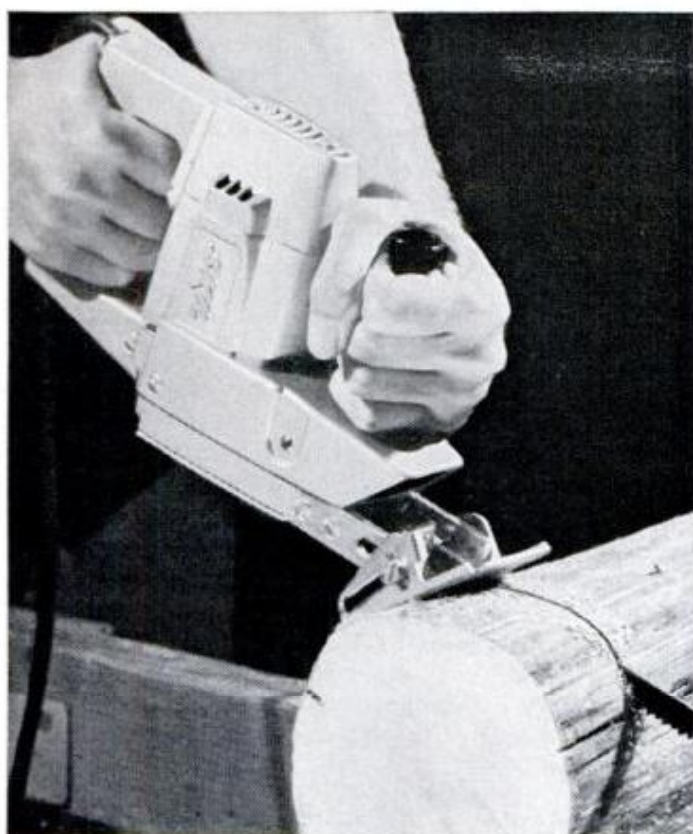
On the debit side, Mylar tends to stretch, rather than form a clean, easily spliced, break when mishandled. This could cause a momentary pitch error in music as the stretched portion passes over the heads. Gentle handling is a rule for .5-mil Mylar. Stretch is minimized in a newer Mylar "tensitized" tape.

No matter how good your recording tape, its quality is short-lived if you ignore care. Too often is heard the lament "the tape sounded good when new, but now it's muddy—no high tones." Much of this is traceable to insufficient cleaning and demagnetization. Keep tape heads free of foreign matter with a swab stick dipped in alcohol. Regular cleaning works wonders for fidelity and staves off wear.

Another bugaboo often overlooked is demagnetization. Though tape heads operate with fast-moving magnetic fields, heads themselves should retain no residual magnetism. But it does accumulate, especially if you've recorded at excessively high levels. It can be ruinous. Fresh tape crossing a magnetized head is recorded with noise and hiss. Demagnetization is a simple process, performed in a few seconds with a three- or four-dollar gadget made for the purpose. Do it at least once a month.

Other tips: Tapes last longer if rewound immediately after playing (to ease off the wind-up tension). Don't stack tape boxes atop each other, store them on edge. Seal acetate tape in airtight containers, particularly if there's wide variation in humidity. Finally, keep tape heads clean! ★★★

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It's a coping saw, hacksaw, scroll saw, jig saw, crosscut saw and rip saw that'll make you twice the craftsman you ever thought you were! You can buy it at better hardware and lumber dealers everywhere. Priced under \$50 (slightly higher in Canada).



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PM's Hydro Dynamic

(Continued from page 152)

sponsons, while those on the aft planking slant toward the center of the boat. Taper and round the fore ends of the two rails covering the 54-in. slits at the inner chines. Use calking compound and 1-in. No. 8 f.h. screws to mount all rails. Finally, mask all fastenings, fiberglass the seams, and give the bottom at least three coats of paint. Then turn the hull over, resting it on a padded surface so as not to mar the finish or the bottom of the hull.

Add the deck beams and battens, if you haven't already done so, then mount the dashboard and add the perforated hardboard bottom to the glovebox. After fairing the deck framing, install the deck planking and the basic hull is complete.

For appearance, the cockpit of the pilot model was lined with ¼-in. perforated hardboard. This does add a certain amount of extra weight, and can be omitted if desired. However, if you wish to do this, attach light 1 x 1 nailing strips to the bottom of the boat and secure the hardboard to these and the deck battens. Then conceal the upper edges under the rounded coaming strips.

Next, make the four seats, Fig. 7, and mount them on ¼-in. plywood brackets attached to the bottom battens. The self-bailing well and fuel locker, Fig. 6, will complete the boat. If you wish, drill ½-in. holes at the corners of the well to allow water to drain out. The fuel locker is a simple box construction of perforated hardboard framed with 1 x 2s. If you require more space, make the locker longer so that it runs between the rear seats. Finally, paint the interior of the cockpit, install the vinyl-coated deck fabric and the boat is complete and ready for the water. ★★★

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A "stored telexray" system, developed by an Australian surgical team for use in setting broken bones, drastically reduces X-ray exposure time for patients and doctors alike.

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TRACTOR DIVISION

Studebaker

C O R P O R A T I O N

5703 GRAVELY LANE
DUNBAR, WEST VIRGINIA

I Ski 106 M.P.H.

(Continued from page 127)

speed skiing was invented was that it was the only other excuse for drag boats. However, a 900-horse hot rod isn't really mandatory equipment. Any boat fast enough to get a skier up to 50 or 60 m.p.h. will at least make him one of the slow ones in the fast group.

About the only other special equipment a speed skier needs is a tow rope that's at least 150 feet long (twice as long as the standard 75-footer, because when you're skiing twice as fast as usual you need twice as much room for emergency maneuvers), and a good ski. Like the trick skier, the speed skier uses a single stick, one that takes a hard, toothy bite into the water but generates as little friction as possible. The shape that gets the job done best is one that has plenty of built-in "rocker" or curvature, so that only a small part of the ski is actually in contact with the water. On my 106-m.p.h. ride, for example, only about a 3 by 5-inch area on the back of the ski actually stayed wetted.

Cake Pan Grease?

Most of the really fast skiers today use a formica ski. I'm conservative and prefer wood. Also, I leave it alone. Lots of skiers use varnish, wax or liquid soap to get a super-slick finish on the bottom, and one skier I know even daubed his ski with bakery pan grease. However, it's my theory that a tiny amount of drag—the amount you get with a bottom that's so smooth that you can't feel any irregularities—gives about the right amount of traction for the best control.

But even the skiers in the "don't do it yourself" school do make their own bindings. This is because a binding on a speed ski should fit so well that when your foot goes into it the combination of ski, binding and foot should feel like a single unit—just like your own leg, only long. Bindings are usually cut out of quarter-inch rubber, a hard grade for the flat parts of the heel and sole, a softer, more flexible grade for the parts that rub against ankles and in-steps. When you install the bindings on the ski, you match the location to fit your own stance. On a speed ski, your strongest leg—the one you kick with, if you play football—goes to the rear. This is the leg that does most of the hard work when you're braced so that you can keep the nose of the ski up.

Once you're out on the water, up on the ski and being pulled by a boat that's built to set records for a half-mile around, there's not really very much you can do but hang on, sit back, brace yourself and

relax as much as possible. Naturally, you stay alert for signals from the observer in the boat, and give him some yourself if you think you're in over your head.

However, you can and should find the best niche to ride in. The wake of a boat fans out in a rolling "vee" that's cut down the middle by the line of the prop wash. On either side of this line is a buffer zone of smooth, slick water that's easy and fast to ride in. When the wind is hitting you from the left, you'd settle into the trough on the right of the prop wash; with the wind on the right, get into the left-hand trough.

And if you have to get off, you have to do it right. Once your feet get wet they'll slide out of the bindings easily, even when these are custom-made and tight as a tick. If you have to fall, the best way to do it is to jettison the ski. If it hits the water at an angle, with your leg still attached to it, nobody can help you but Blue Cross and a hip-to-ankle cast. So if you can, slide free of the ski, get your arms and legs close to your body and roll into the water as unobtrusively as possible. It's much easier to avoid serious injuries in speed skiing than in snow skiing, and this is probably one big reason for the popularity of the sport.

Whatever the reason, speed skiing is becoming one of the leading competition sports in the coastal U.S., and there's no doubt that the speed record will be challenged this spring. The boat that hauled me at 106 m.p.h. is a Rich Hallet hydro with a top speed of about 138 m.p.h. Drag boats are now hitting 150 m.p.h. with regularity, and when the drag record goes up, the ski record isn't far behind. ★★

Glass Tints Itself

Glass that automatically tints itself blue in sunlight and then returns to clearness when removed from sunlight may be available in the near future.

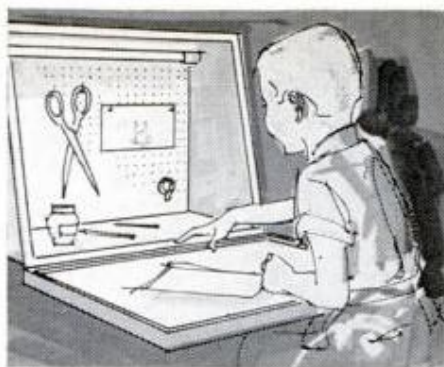
Recent research at the Climax Molybdenum Co., Detroit, Mich., has shown that molybdenum compounds in a plastic turn blue if placed in a beam of light. The original color is restored when the light is removed.

Presently, experiments are being conducted by glass manufacturers using photo-sensitive molybdenum and tungsten which are added directly to the glass or are placed in an organic layer between two glass sheets.

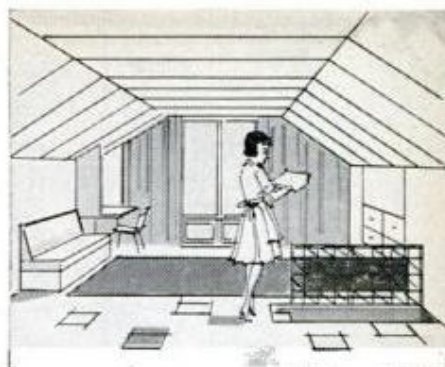
The new glass would be used in store windows, glass-walled office buildings, automobile windshields and space vehicles if the experiments prove successful.



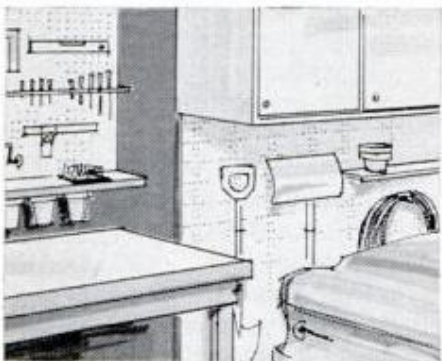
1. Fences of distinctive design



2. Wall desk with optional chalkboard front



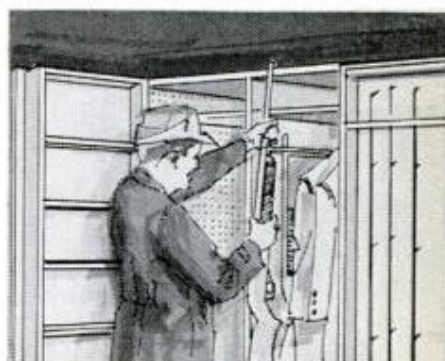
3. Remodeled attic



4. Garage interior remodeling



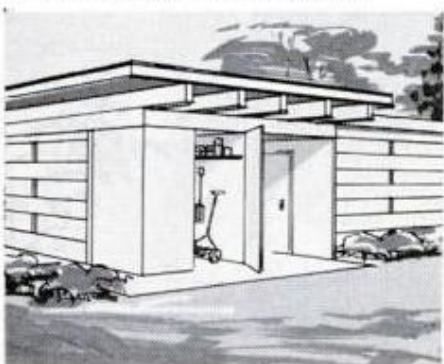
5. Picnic table and benches, lawn chair



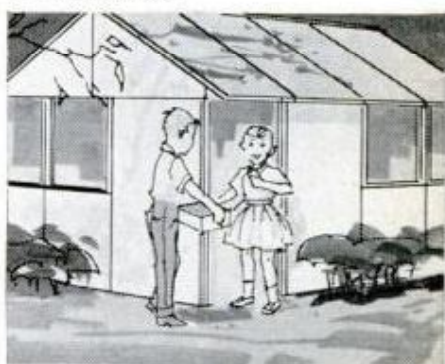
6. The sportsrobe



7. Room divider with desk and wardrobe



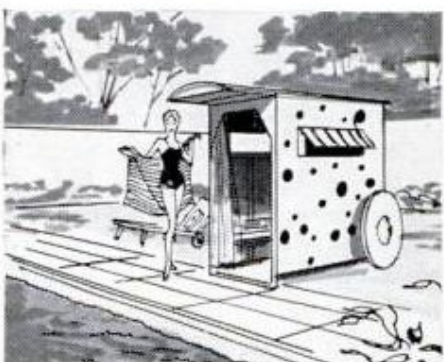
8. Woven carport wall with tool room



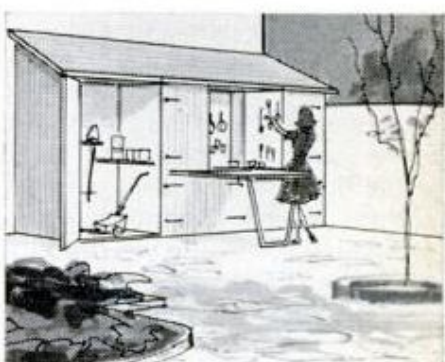
9. Playhouse plan for children



10. Home entertainment center
Family leisure hi-fi center



11. Roll-away cabana



12. Outdoor living room

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All About Alternators

(Continued from page 179)

1 Make sure battery connections are correct when hooking them up, to prevent damage to the rectifiers. If you disconnect your battery cables, check them with a voltmeter to determine battery polarity before hooking them up again. Any reverse in cables—a negative cable put on a positive post or vice versa—can send a flow of electrons back into the alternator, damaging it.

2 Try to avoid the use of a booster battery to start your alternator-equipped car. If the booster is improperly connected, even for a few seconds, electrons will flow back into the alternator, damaging it. If you must use a booster battery, make doubly sure of the connections (plus to plus, minus to minus) before hooking it up.

3 If you use a fast battery charger, disconnect the battery ground cable before making the hook up. Never use the fast charger as a booster for starting the vehicle—a wrong connection could damage the alternator.

4 The field circuit between the alternator and alternator regulator must never be grounded. Grounding of the field terminal of either the alternator or regulator will damage the regulator.

5 Grounding of the alternator output terminal will damage the alternator. This is true even when the system is not in operation since, on most systems, no circuit breaker is used and battery voltage is applied to the alternator output terminal at all times.

6 The alternator must not be operated on open circuit with the field winding energized. This will cause alternator voltage to be extremely high and may damage the rectifiers.

7 Never attempt to polarize an alternator as you would a generator. No polarization is required and any attempt to do so may result in damage to the alternator, regulator or circuits.

8 Care should be taken when adjusting the voltage regulator to prevent a short circuit from occurring between the voltage regulator relay and the regulator base. The tool you use to make the adjustment should be insulated by tape or with a plastic sleeve.

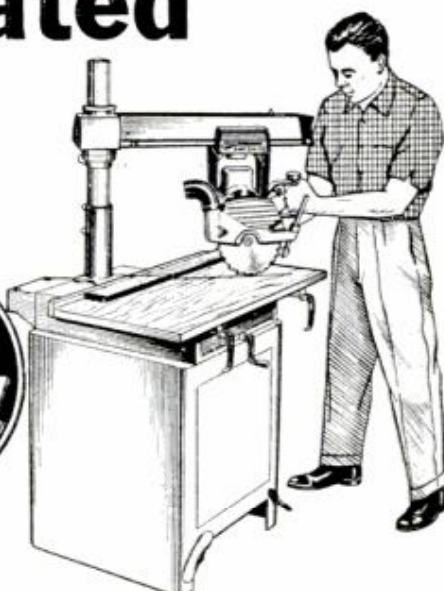
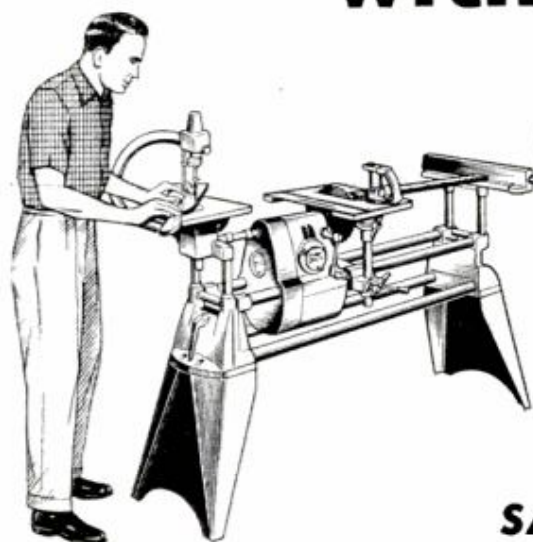
9 Care should be taken not to spill oil into the air passages of the alternator when servicing the engine.

10 Always turn the ignition switch off when performing work on the alternator. Bear in mind that it is, after all, a power plant. ★★★

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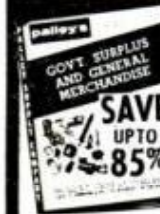
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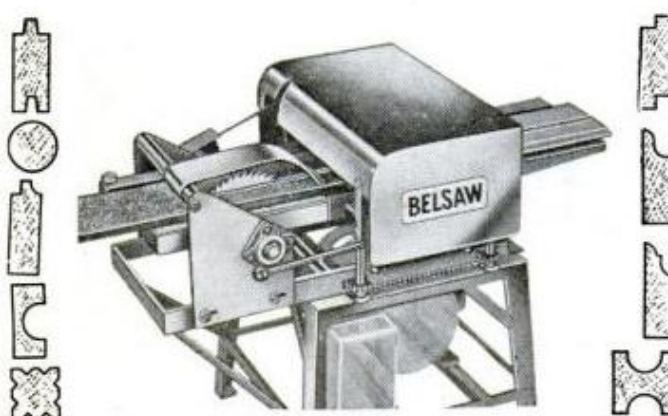


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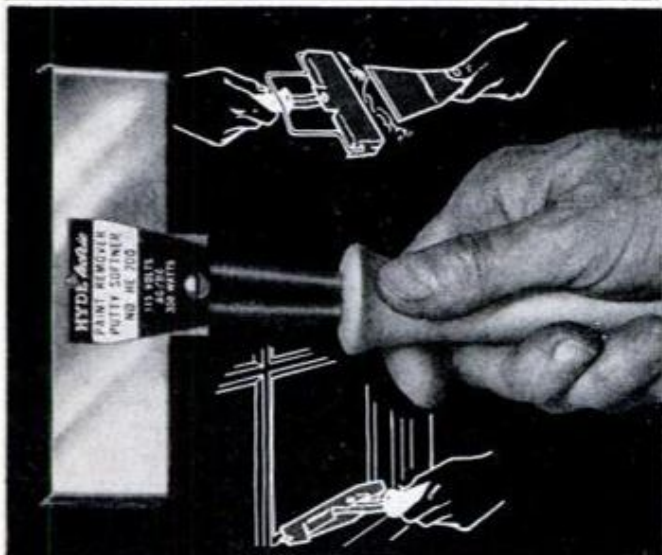
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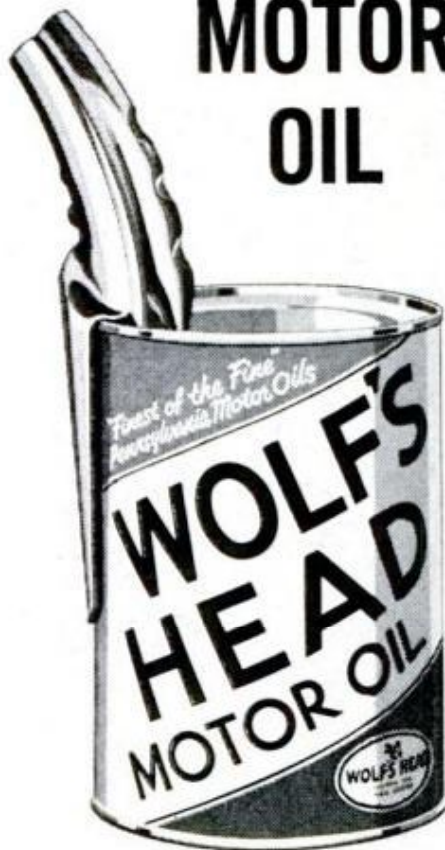
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Hot-Series Test Box

(Continued from page 193)

with the switch in either 2 or 3 position, it will also tell you whether the current supply is AC or DC—a valuable check in some localities which may be wired for either. If the current's AC, both elements of the neon pilot-light filament will glow. If it's DC, only one element will glow.

As with expensive vommmeters, human error can damage the instrument. Thus, the item being tested should always be disconnected from its power source. The three-position switch on the test box should always be set at 1 or 2, with the line switch off, *before* plugging in the tester's line cord or attaching the test probes. Serious damage will result, however, only if the test box at Position 1 is plugged in while probes are connected to a machine that's also plugged in and turned on. Pressing the push button in such a case would result in a direct short—and would blow a fuse.

The neon glow lamp, with a 24,000-ohm resistor in series through the test probes, prevents shock. The probes may be touched without harm—*except* when the tester's switch is in No. 3 position. As a precaution, don't handle the probes at all at this setting; you might let the live tips brush against one another or—worse still—might grasp one with each hand.

Before using it to test other items, you'll want to be sure the test box itself is functioning properly. Switch it to No. 2 (continuity check) position and plug it into a wall outlet. The pilot light will glow if current is being supplied to the box. Touch the probes together: if the test lamp glows, the box is okay for continuity checks.

Next, unplug the box and switch to No. 1 (current check) position. Insert the probes into the outlet and depress the pushbutton: the test lamp should glow. If not, check that circuit's fuse. ★★★

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miles between major
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Like Mohammed, they went to the mountain—Colorado's Bartlett Mountain. More molybdenite is mined there than in the rest of the world combined. And from molybdenite comes the amazing "moly" grease that helps extend chassis lubrication intervals for Ford-built cars. This grease sticks tenaciously to metal, stands up under extreme pressure and resists moisture, pounding and squeezing. It's slicker than skates on ice!

New, improved seals were developed. Bushings, bearings and washers of many materials were investigated. Slippery synthetics, like nylon and teflon, were used in new ways. It took time. And ingenuity. But the effort paid off when Ford Motor Company was first to offer chassis lubrication good for 30,000 miles or two years—whichever came first (now up to 100,000 miles—or three years—for Thunderbird).

Engineering leadership like this also provides other quality achievements: self-adjusting brakes, use of rust-resistant galvanized steel for vital underbody parts, durable 4-coat baked-enamel finish.

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Hurricane Killers

(Continued from page 118)

sure over a relatively small area. The eye, of course, is at a very low barometric pressure, but go outward into the swirling vortex and the pressure rises rapidly. Air rushing from the high pressure to the extremely low pressure area directly adjacent creates savage hurricane winds. To slow them down, either raise the pressure of the eye or lower the pressure of the area immediately surrounding it. One way or another, reduce the pressure difference.

If Simpson and his scientists could lighten the column over the chimney, they figured, the pressure difference would be lessened, the wind would slow down somewhat, and in so doing, spread out into a larger, gentler storm.

Nuclei for Freezing

How to start the process in the first place? Meteorologists suspected the reason the water wasn't freezing was that it had no freezing nuclei—tiny particles in the atmosphere—to condense around. Since ice has a crystalline structure, the best freezing nuclei would be particles of ice; the new crystals could fit perfectly onto those already frozen, like pieces of

a jigsaw puzzle falling together. But spraying tons of ice around the sky is a tough job. Fortunately, silver iodide crystals, far easier to make and distribute, are so similar to ice crystals in size and shape that water can't tell the difference. It freezes around silver iodide crystals about as well as it does on ice.

The test, then, would consist of seeding supercooled water in the upper reaches of the hurricane's chimney with silver iodide crystals. The only thing now was to wait for the right hurricane.

Esther showed up in the early days of September, 1961. By the 16th, she had grown into a mature storm and was in a good position for seeding, some 350 miles north of San Juan, Puerto Rico, 1000 miles east of the Florida coast. A task force from Project Stormfury—a joint Weather Bureau-Navy effort to find a way to kill hurricanes—took off and flew into the storm. The group included a Navy WV3, an Air Force U-2 and four planes from the Weather Bureau's Flight Facility; two DC-6s, a B-57 and a B-26. A Navy A3D was elected to drop the silver iodide. All the craft were fitted out to observe what happened.

On the observation planes, two types of radar were used, a low-frequency 10-

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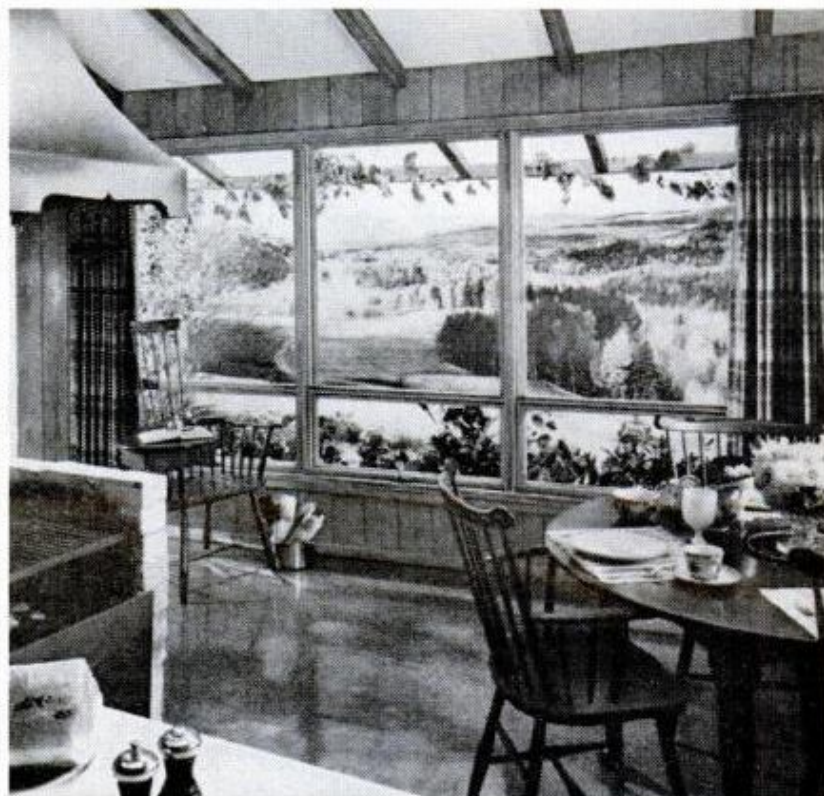
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centimeter wave length rig in one plane, and a high-frequency, three-centimeter one in the other. The high-frequency set could "see" both water droplets and ice particles equally well. Even if the seeded droplets changed to ice—the object of the experiment—no change was expected on this radar screen.

Proof of success would really show on the low-frequency set. On this wave length, only the water droplets would show, but not ice.

When the planes got to Esther's eye, conditions were excellent. Simpson gave the word for the A3D to start up its silver iodide generators and make a pass through the chimney.

The results were dramatic. Within minutes, a huge section of the forward wall of the hurricane abruptly disappeared on the low-frequency screen. When the water droplets froze, the front simply vanished from the screen.

To the jubilant weathermen, this was ample proof that a way to lick a hurricane had been found.

At the same time, observation planes flying through the seeded area reported another sharp change. Heavy icing, which had been noted through the entire area of the storm, indicated that large quanti-

ties of supercooled liquid water were present. But now, where the seeding had taken place, there was no icing.

Effect on Hurricane

The effect on the hurricane itself was also marked. Maximum wind velocity in the critical seeded area dropped a startling 10 percent.

Scientists calculated later that probably some 400 cubic miles of water-laden clouds containing somewhere between one and five grams of water per cubic meter had been converted to ice within a 40-minute period. This reaction, at a very minimum, released energy in the form of latent heat of fusion equal to approximately eight 20-kiloton atom bombs. This amounts to less than one-tenth of one percent of the energy released naturally by the hurricane itself during the same period. But, triggered at the right time and place, this relatively minor jimmyming with the storm's works had a powerful effect.

Within about two hours, with no further seeding, the hole closed and winds picked up speed to the previous level. But weathermen are now confident that repeated seedings could reduce wind in-

(Please turn to page 226)

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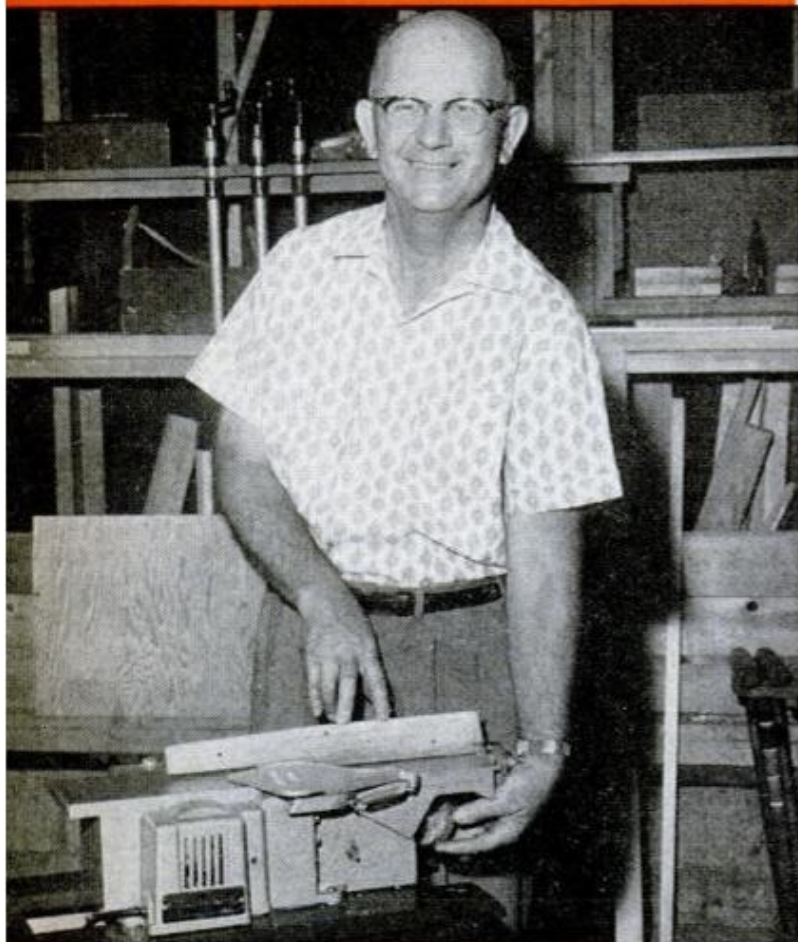
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Hurricane Killers

(Continued from page 225)

tensity by 10 percent, then another 10 percent, and another, and another until it falls below the danger level. Simpson estimates the job might take 12 hours.

"What's the next step?" I asked the tall, graying storm chaser in his Washington office a few months ago.

"We'll repeat the experiment at least two more times in exactly the same way to make sure we get precisely the same results," he answered. "If we do, we'd be in a position to go into large-scale seeding. With repeated seedings we'd hope to spread a hurricane out and reduce its maximum winds from maybe 110 knots to 60 or even 50 knots. A 60-knot blow is no worse than a good winter storm; it doesn't kill anyone. It blows down a few trees, maybe, but not much more.

"We had hoped to work toward this goal this year, but it was a disappointing season. We didn't have a single hurricane suitable for seeding."

Year Is Disappointing

This year's experience was especially disappointing because the hurricane killers were really loaded for bear. Last summer, a team of Navy scientists under the direction of Dr. Pierre St. Amand of the China Lake, Calif., Naval Station, had developed a system for even more efficient cloud seeding. Under the plan, a Navy plane would fly through the chimney, drop small, disposable silver iodide generators automatically out of the bomb bay doors at rates up to four per second. Each one, as it tumbles down through the clouds, leaves a plume of silver iodide crystals completely through the layers from top to bottom. Said Simpson, "It should completely saturate the clouds with silver iodide." In the Esther seeding, some 100 pounds of silver iodide were dropped in the chimney. With the Navy's new gadget, hurricane fighters calculate they'll deposit some 1300 pounds during a similar pass.

While the wily hurricanes didn't cooperate this year, it's a pretty safe bet that the capricious ladies won't outfox the hurricane hunters much longer. Simpson declared his personal vendetta on the tropical twisters in 1919, when a great storm hit his home town of Corpus Christi, Tex., killing 250 and forcing him to swim three blocks to high ground to save his own life.

He's been after hurricanes ever since. And the delay of a year or two, with victory almost in sight, isn't going to stop him now. ★★★




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Rating Russia's Moon Probes

(Continued from page 93)

dozen other space sleuths doing similar work in the U.S. At the top are four with whom Ritchie consults frequently.

F. J. Krieger makes official studies for the RAND Corp., the Air Force-supported "think factory" at Santa Monica, Calif. Russian-born Dr. Albert Parry heads the Russian studies program at Colgate University. C. L. Zakhartchenko, a private consultant in Washington, often helps the Navy in evaluating Russian missiles; other times he advises the Aerospace Information Division of the Library of Congress. Alfred J. Zaehring, a North American Aviation propellant expert, was studying the Russian space program at a time when few people knew they had one.

A few other space detectives have to remain anonymous. One used the photo-detail approach to evaluate the huge second Vostok. That ship carried Gherman Titov through 17½ orbits beginning August 6, 1961. The Russians filmed part of that flight and part of the training activities surrounding their manned space flight program. The anonymous expert, who is an engineer for a large aerospace company, viewed the film. Here is what he saw:

- A stubby cylinder with one pointed end, a large ring at the other end and a line around the girth. Four rocketlike cylinders were mounted on the ring.
- The nose, partly hidden by a detachable cone, was covered by a metal cap.
- A pair of control fins mounted backward to the apparent direction of travel.
- A ring of rectangular ports girdling the ship near the rear.
- Opening and closing rear shutters.

Interior views showed that the ship is much roomier than a Mercury capsule. There is at least one porthole for direct viewing of the earth.

Not shown in the film, but clearly seen in newspaper photographs of the same ship, was a large hatch-covered hole in the side of the body.

The most significant clue was the set of control fins. The landing accuracy and some of the Russians' own guarded statements had indicated that some Vostoks could be controlled to some degree in the atmosphere. These fins primarily adjust the angle of descent; they're probably cooled by a liquid coolant.

The reverse mounting of the fins confirmed that the cabin re-enters backward and the pilot is on his back facing the nose.

A separation line indicated that the rear of the craft separates from the front. This confirmed what was already known about

the way Sputnik 4 split into sections in a well-publicized space accident in 1960. The large hole in the side of the body obviously is an emergency escape hatch for catapulting an ejection seat. It is in the forward half of the ship, revealing the location of the pilot's cabin and indicating the position of the heat shield and retro-rockets. Such positioning proved that the retro-rockets are strapped on over the heat shield, as they are on Mercury capsules, and drop off after firing.

The Russians later admitted the presence of the ejection seat.

The aft portion, the engineer reasoned, is the instrument and guidance section. This is confirmed by the ring of rectangular ports designed to release atmospheric pressure from the unpressurized section as the ship climbs to higher altitudes. Shutters in the tail permit radiation cooling of communications gear, power supplies and other equipment in that section.

Mysterious Ring

The anonymous sleuth was especially impressed by the large ring at the rear of the ship. It is used in place of tail fins to keep the craft on a stable course after launch but before separating. Four small rockets separate the aft section from the cabin. The nose cone is fired away from the ship at the same time.

The metal cap near the nose protects a glass porthole during launch and re-entry.

From these calculations, the cabin appears to resemble a metal cylinder with rounded ends. The Russian news agency, Tass, released a photograph of Titov "preparing for one of the training flights he made before his successful orbital flight." The size and shape of the craft he is entering, and the location of the porthole cover, correspond to the cabin configuration derived by our engineer.

Vostok cabin sides are subjected to much more re-entry punishment than the sides of a Mercury capsule, but the Russians can afford it. They have a booster rocket hefty enough to permit heavy insulation for the pilot's protection. On re-entry, the Vostok's blunt heat shield creates a very hot thermal shock wave that rolls up the sides of the cabin. The walls of the Mercury capsule slope inward to avoid heat.

In analyzing Vostok 2, Donald Ritchie derived some dimensions from a display model of a moon exploration satellite—Lunik 3—that the Russians exhibited in New York in 1959. The diameter of this satellite was given as 10 feet, a measurement that also fitted the Vostok. Ritchie studied the crude photos the Russians re-

(Please turn to page 230)



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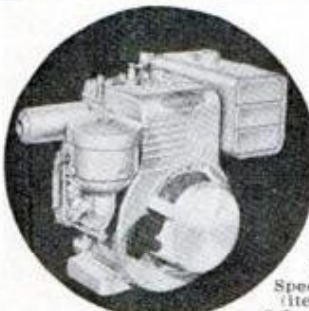
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Rating Russia's Moon Probes

(Continued from page 228)

leased on the Vostoks. He saw that the rear end of the Vostok, minus the stabilizing ring, was identical to the rear of the Lunik 3.

A Soviet air show at Tsushino gave Ritchie a clue to the Vostok's length. The outline of the craft was clearly visible in a photograph of a helicopter carrying either a Vostok or an excellent model. Precision dividers told Ritchie the length was three times the diameter, or 30 feet.

Mercury capsules, with escape tower and retro-pack, are 26 feet long and 74½ inches in diameter at the heat shield.

When *Popular Mechanics* reached Ritchie following the dual flights of Nikolayev and Popovich in Vostoks 3 and 4, he already had studied them enough to know that the ships were apparently the same as Vostok 2. Rocket expert Wernher von Braun confirmed this opinion.

Russia's Next Move

U.S. space experts generally agree that the Russians are building a larger booster rocket and a bigger pilot cabin for the expected moon trip. However, they also agree that the present booster and a modified Vostok could make the trip around the moon and return to earth. The question is: What kind of voyage do they contemplate?

The 14,000-pound Vostok seems to be the Russians' present basic pay load, and Ritchie assumes it is the craft they'll use. Beginning with the recovery point on earth and working backward, Ritchie calculated the rocket weight and power necessary to deliver a Vostok from the moon to an earth orbit; the booster needed to raise the Vostok and its sustainer rocket from the moon's surface; the rocket needed to lower Vostok, the sustaining rocket and the moon launch booster onto the moon's surface; and the rocket needed to deliver the whole system to the moon from an earth orbit where it would be built.

To assemble the required rocket in a parking orbit, he calculated that the Russians would have to launch 33 major components into space. Thirty-three launches, all directed to a tiny rendezvous in space!

The task sounds impossible. But the next best feat—sending a man around the moon and back without landing—is much easier. For a circumlunar flight, Ritchie calculated that the Russians need to launch only seven pay loads toward an orbital rendezvous where the spaceship would be built.

Viewed against the Nikolayev and Popovich flights, this is what Washington expects the Russians will do. ★★★



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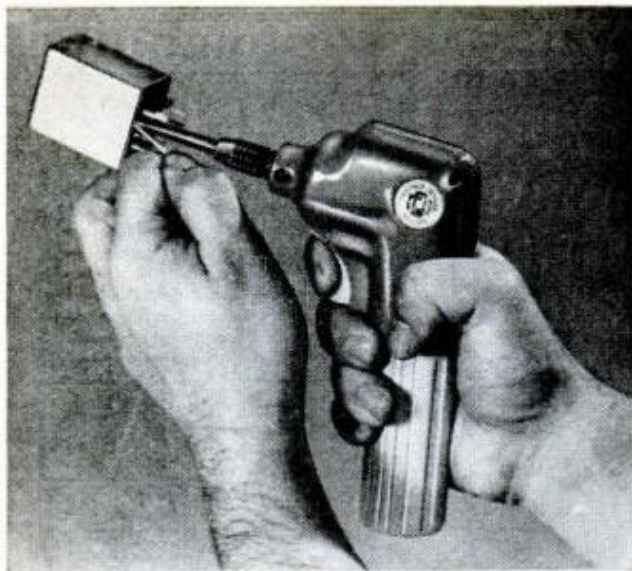
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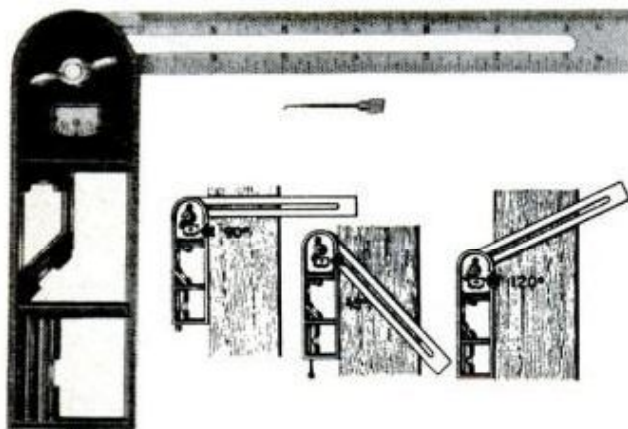
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PORTABLE WIRE-WRAP tool, at left, can make approximately 4000 solderless electrical connections with 24-ga. wire on one charge of its nickel-cadmium battery. Can be equipped to wrap 22 to 32-ga. wire. The built-in charger uses 110-volt, 60-cycle current to recharge the battery in 14 to 16 hours. A product of Gardner-Denver Company, Quincy, Ill.

UNIVERSAL SQUARE includes a scribe, horizontal, vertical and 45-deg. bubble-levels, as shown in drawings. It can be used as a bevel-square, a graduated scale (arrows) showing angle settings of the blade ranging from 0 to 270 deg. The 7-in. blade is marked in inches and centimeters. Price \$2. Carolyn Creations Co., Box 2042, New York 1, N.Y.



THROWAWAY RAZOR-BLADE knife. Handle of folded sheet steel is partially covered with plastic cord. Priced at 3 cents (\$6 for 200), it is inexpensive enough to discard when the blade becomes dull, eliminating the time and cost of sharpening. The 2-in. blade is covered except for a 1/8-in. strip above the cutting edge. Edmund Scientific Co., Barrington, N.J.

EZ-SHARP electric-powered saw sharpener at lower left handles circular blades of 4 to 24-in. diameter, including carbide-tipped type. An available accessory holds the blade stationary so each tooth automatically receives the same degree of set, eliminating guesswork. Priced at \$95.50. Easysharp Corp., 900 Monroe Ave., N.W., Grand Rapids 2, Mich.



THUMB-TACK HOLDER (below) has a built-in magnetic tip that holds a tack in place for insertion while pressure is exerted on the amber-colored plastic handle. The handle is hollow, providing storage for 36 tacks. The magnet can be used to pick up pins, paper clips, needles or other small metal objects. \$1 from Hollis Co., 1133 Broadway, New York 10, N.Y.



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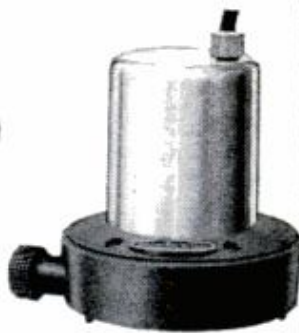
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Indexer for Jig Saw

(Continued from page 196)

may be used for index plates, special disks can be made. Those in the photos were cut from electrical junction-box covers, 3/64 in. thick; the notches are slitting-saw kerfs 1/16 in. deep. When this indexer was assembled, the lower surface of the latch bar turned out to be slightly higher than the top surface of the index-shaft gear. So each index plate was equipped with a 1/16-in.-thick spacer disk to raise it into full engagement with the latch tip.

For shaping gear teeth and making other special cuts, you can custom-make blades to fit your jigsaw, as shown in the opening photo and detailed at the top of page 195. This particular soft-steel bar was first filed roughly to the desired contour, then shaped with a scraper made from 1/16-in. tool steel. A spur gear was used as a filing template to shape the V-notch at the scraper's business end.

By sliding the work-holding flange up its filed shaft, you can mount disks up to about 3/8 in. thick. For thicker pieces, a shim—such as a rectangle of hardboard—is placed into proper position between the clamping panel and the saw table.

Preparing the Disks

Here's the recommended routine for preparing work disks: Rough out the disk on the jigsaw, or with a circle cutter in the drill press, and bore a 1/4-in. center hole. Place the disk over a 1/4-in. pin in a board clamped to a disk-sander table and revolve the disk against the sander until it has a uniform radius.

Now fasten the work-holding flange to the disk blank with small screws while a 1/4-in. rod extends through the center hole of each. Then lower the forward shaft of the indexer into the flange socket and tighten the setscrew. If you wish to avoid screw holes in the face of the blank, glue on a small disk that's already attached to the flange, placing paper between the disks so the joint can later be split apart.

The indexer is normally mounted with its slide in line with the jigsaw blade or file. But by mounting it for tangential cuts, the work can be converted into a polygon, star, or other shape.

Use of the blade guard and hold-down is advisable where possible. For clarity, they were omitted in the photo. ★★★

To keep paper handy at the work-bench for project sketches, mount a roll between paper-towel brackets. Left-over wallpaper would be ideal. Use the back of the paper and clip off each sketch as it's completed.

—Richard Wathen



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MIDGET MOTORS CORP., Athens 1, Ohio

Owners Report—Galaxie

(Continued from page 111)

"It handles beautifully in traffic."—New Jersey clergyman.

"The styling feature I like is the Thunderbird rear."—New Jersey policeman.

"I like the over-all style inside and out!"—Massachusetts electronics worker.

"To me it has better styling than other makes in the same price range."—Ohio foreman.

"I like the roof and trunk styling especially."—Texas surveyor.

That T-Bird roofline has been a gold mine for Ford. It gives a look of distinction without the way-out effect of fins.

"Good power for a six-cylinder car."—New York fireman.

"I like its all-around performance; my Ford is drag-raced every Sunday and I've won two trophies so far."—Massachusetts truck driver.

Acceleration paid off for Ford 30 years ago with the first V8. It seems that it still does.

"It has plenty of pep for a six-cylinder car."—New York salesman.

"The back-rest is not tiresome; it's at the correct angle."—Washington truck driver.

"My Ford has especially nice appearance both inside and out."—New Jersey maintenance engineer.

"The interior appointments are nice. The dash lighting is pleasing and gauges are easily scanned."—Connecticut office manager.

"It allows one to sit in a relaxed position while driving."—Indiana bank clerk.

"I like the interior in both its style and the quality of workmanship, also the crank vents, steering column, tasteful use of chrome, curved sun visors and ribbed upholstery."—New York sales engineer.

Plusses must be balanced by minuses. Here, in the order mentioned most frequently, are the top complaints voiced by owners numbering one through five.

"It isn't broken in yet, and uses too much gas. It might do better later on—I hope!"—Ohio farmer.

"Have had very poor gas mileage—only 10-11 miles per gallon in the city!"—New Jersey machinist.

"The gas mileage is poor—only 14 miles per gallon over-all."—Minnesota trucker.

"Gas mileage should be a little better when fully broken in at about 6000 or 7000 miles; it's 14 miles per gallon now."—New Jersey engineer.

We hope he's right, but when you ask for performance in a heavy car, 15-17 miles per gallon will be about all you can expect.

"Poor mileage and lack of power from the 260-V8 engine. My 1956 Fairlane with Thunderbird engine was more powerful after 60,000 miles and gave 17.4 miles per gallon."—New York auditor.

Yes, but it was a lighter car with a larger, more powerful engine.

"It doesn't get enough miles to a gallon of gas (12½)."—Kentucky co-op manager.

"Very shabby workmanship and dealer service indifferent."—New Jersey salesman.

"Workmanship on body was poor—took two days in garage to straighten out. Car should never have been allowed to leave factory or dealer."—New York govt. employee.

"I think that all car manufacturers should spend more time inspecting the cars before they leave the factory."—Minnesota maintenance man.

So they should, but if they did, cars would cost more and we wonder if the public would pony up the difference.

"I have found loose and left-out bolts, screws, etc. Poor fits of mating parts also indicate poor quality control."—Michigan cost analyst.

"Extremely shoddy quality-control; a few examples include discolored chrome, a poorly-fitted top, water leakage due to poor sealing, pitting mouldings."—Ohio systems analyst.

"The body sheet metal looks like ocean waves and the paint looks like orange peel."—Georgia construction foreman.

"Many parts were not put together well; i.e., the brake handle broke off, car leaked around top, mufflers rattled, car steered hard after 3000 miles."—Missouri minister.

Ford Galaxie is now sized and priced so that it must compete with cars on which there are few problems like the Reverend's.

"I found small annoyances such as speedometer not functioning, oil leak, broken clock."—New Jersey housewife.

"There are leaks around the windshield, various rattles, windows don't close properly and the top doesn't bolt to the windshield header as well as it should."—New Jersey electronics technician.

"The trunk leaks and water comes through from underneath."—Georgia manufacturer's representative.

Water leaks draw some of the most irritated responses among all our automotive surveys.

"I have had carburetor trouble."—New Jersey policeman.

"At first the automatic choke gave much trouble and gas consumption was exces-

sive. Fixed now and runs fine."—New York realtor.

Many hard-starting and excessive gas consumption problems may be traced to the automatic choke.

"The wiring caught fire and burnt off."—Tennessee service-station owner.

"The gas line to carburetor broke."—New Jersey truck driver.

"The transmission bands slipped and I had no passing gear."—Michigan laborer.

"The automatic transmission doesn't shift as smoothly as my previous car, a Buick."—New York teacher.

"I have had trouble with the transmission oil seal."—Michigan Ford factory maintenance man.

Back on the positive side we have the second group of best-like features in order of frequency mentioned six through ten.

"The quiet ride matches that of a Cadillac."—Maryland clerk.

"Well-insulated against road noise with a minimum of sound from the wind."—California accountant.

Ford has made tremendous strides in this direction on the '63 Galaxie.

"I like the nearly sound-proof body."—Missouri retired man.

"I like the way it handles on rough roads and curves."—Minnesota businessman.

"I like the car and roadability, especially on gravel roads."—Minnesota salesman representative.

"Handles well, runs quietly and it holds the road on fast driving and curves."—California insurance agent.

"It's got stability around curves!"—New York power foreman.

Galaxie's inherent chassis roadability is good, but shock absorber control could well be firmer for curving roads.

"Better vision due to higher seats."—North Carolina farmer.

"I like the terrific feeling of quietness and solidness of the entire car."—Minnesota salesman.

"Absolutely no rattles! And we especially like the way the doors close."—Indiana farmer.

"The car has tight construction, and handles like one piece of machinery."—Georgia credit counselor.

PM's test Galaxie had very little trace of rattle or squeak on rough roads.

"The seats are large and roomy with plenty of leg room."—Missouri farmer.

"My Ford is easy to get in and out of."—North Carolina auto finance operator.

Again, the accent is on the negative, with owner complaints six through ten

listed in order of frequency.

"I have had troubles with the power steering."—New York plumber.

"Power steering is too light for high-speed driving; should have more feeling of normal steering."—New York tool and die maker.

"My car has power steering, yet there is not much feel of the wheel when traveling fast."—Ohio shoemaker.

Galaxie power steering seemed pretty good on PM's test car, but there was room for improved feedback of road feel.

"My power steering leaked."—Michigan printer.

"I don't like the way they've hung the back doors—they're a dust trap. Dealer has had to correct the front doors."—Kansas farmer.

"Doors don't close by themselves as one gets out; there are two stops that seem to hold them open."—North Carolina teacher.

Ideal solution would be a trigger-controlled hold-open catch that would release when you gripped the handle.

"The car does not seem airtight, and on cold evenings we have drafts."—New Jersey housewife.

On PM's Galaxie there was some air leakage around the upper door frame.

"The doors are too hard to shut; I usually have to slam them two or three times."—Ohio store manager.

"The left door leaks in rainy weather thus wetting front seat when door is open."—New Jersey mechanical engineer.

"Paint job on my car is bad and body is pitted around back window."—Ohio assembler.

"There is not enough road-to-frame clearance and rear springs are too soft; 100 lbs. of mud on the rear end doesn't give much fender clearance."—Kansas rural mail carrier.

Here comes that old devil compromise again! If you make springs soft enough for a plush ride, they aren't stiff enough to support any extra passengers or luggage.

"The rear springs should be stiffer, also front springs to eliminate sway on curves and prevent bottoming on rough roads."—Missouri real estate broker.

"Weak spring system in rear for heavy loads (mostly caused by great rear overhang.)"—Kentucky sales engineer.

"Doors do not close evenly and they rattle."—New York businessman.

Back on the bright side we have the final batch of best-liked features from 11 through 16 in the order most frequently mentioned by Galaxie owners.

[\(Please turn to page 238\)](#)

Owners Report—Galaxie

(Continued from page 237)

"I like the economy of my V8—18 miles per gallon over-all!"—New Jersey machinist.

"I like its economy of six-cylinder operation."—Minnesota dairy farmer.

It's great if you're not in a hurry.

"Smaller steering wheel gives adequate room for driver."—Maryland engineer.

"You feel the road when you steer, yet it handles with a minimum of attention."—California credit manager.

"It handles very nicely with smaller diameter steering wheel."—Massachusetts machinist.

The new, 16-inch diameter is a definite improvement, but only with power steering.

"Of the many Fords I have owned, this is the best constructed, quietest and smoothest—really a refined car! Even the wheels are properly balanced and the interior is a quality job."—Illinois insurance agent.

If they all came through like his car, Ford's sales problems would soon be solved.

"It is quality-built with good attention to detail; everything works smoothly."—Massachusetts executive.

See, it can happen here!

"The body is tight with no rattles."—Michigan foreman.

"I feel that the workmanship is very good for an early-production car."—Oklahoma businessman."

"Quality comparable or better than Buick or Olds at a fraction of the price."—Missouri trailer park owner.

"I like the longer period of time between oil changes and grease jobs."—Indiana grocer.

This feature won't really come into its own until he's owned the car for a trouble-free, grease-free year or so.

"I like the freedom from mechanical maintenance."—Minnesota physician.

"I like the 6000-mile oil change, 3000-mile chassis lube, and 24,000-mile or 24-month guarantee."—Minnesota farmer.

"Wonderful new front suspension—seems softer!"—Indiana engineer.

"I like the new cushion-link suspension which makes the car ride much better."—Kentucky store manager.

"New front end suspension much smoother."—New Jersey salesman representative.

"I like the big car feel and weight (approximately 4200 lbs.)."—Kentucky meter reader.

"It gives you a 'big car' feeling and per-

formance."—Georgia private detective.

We wind up with the last group of owner complaints on the list numbering 11 through 16 in order of mention.

"I have had electrical trouble—something seems to run the battery down."—Michigan secretary.

"Factory inspection not entirely reliable; when car was delivered it had a short in wiring."—Wisconsin retired executive.

"Never had a Ford yet that had a tight body—always a rattle somewhere."—Texas bookkeeper.

"There is a shake and vibration period at high speed (70-80 m.p.h.)."—Michigan automotive engineer. (Ford!)

Honest criticism from the home office itself.

"There were several minor rattles, slightly annoying, but easily fixed."—Michigan student.

"Service is lousy; car not worth its price; Ford doesn't stand in back of its guarantee."—New Jersey student.

"Every time I buy a new Ford in some other town, they don't want to take care of it. They tell me to take it back where I got it."—California theatre manager.

"I cannot get the dealer to service the car as he promised when I bought it."—Kentucky mail clerk.

Dealers like his should be stamped out.

"Return to the 1000-mile inspection."—Ohio tax collector.

"The small, standard V8 (260 cubic inch) lacks power on pickup, and I have difficulty maintaining turnpike speed limit when going up a grade."—New Jersey salesman.

Wonder how many sample cases he's carrying?

"It doesn't get good gas mileage nor does it display the pep it should have with the 220-horsepower engine."—Georgia aircraft technician.

"Very slow pickup because of six-cylinder engine."—New York routeman.

"I would like to see an insulating grommet around door-lock rod to prevent rattle."—Nebraska attorney.

These trifles can be as vastly irritating as a lone mosquito in your bedroom after you've turned off the light.

"Annoying rattles from door-lock buttons which need washers or something."—Massachusetts salesman.

"No complaints except for wind noise on ventilator windows."—New York oil plant supervisor.

That wraps up the verdict on what a representative group of owners think of their 1963 Ford Galaxies after a group total of 975,856 miles. ★★

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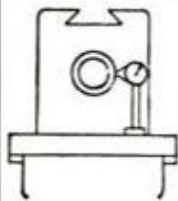
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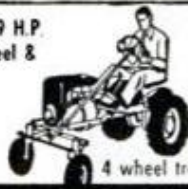


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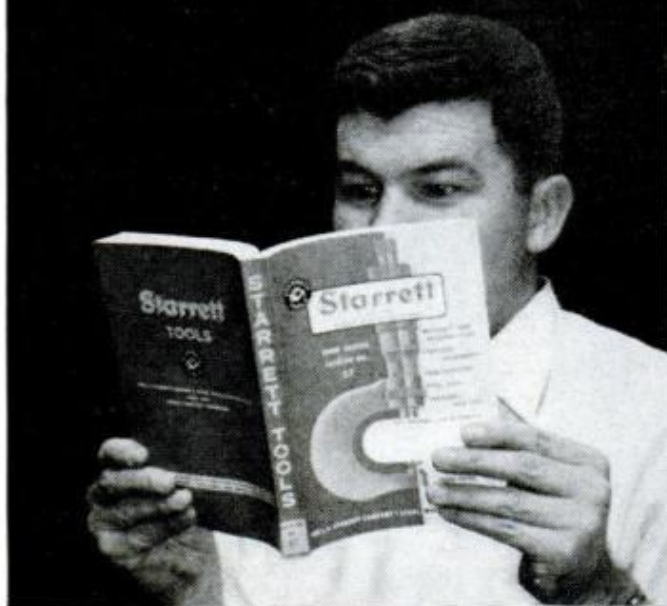
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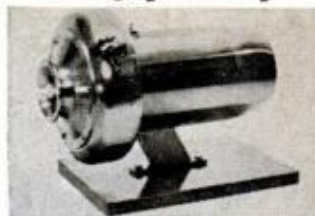
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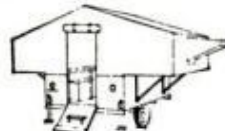
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BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



Owners Report—Rambler

(Continued from page 99)

which I have owned several in the past."
—Pennsylvania executive.

PM's testers felt that Rambler handles as well as its competitors and stays on course as well as most big cars. Steering, however, is a bit slow.

"I like its easy handling on gravel and rough roads."—South Dakota rural mail carrier.

"Better ride due to the longer wheel base (112 inches)."—Pennsylvania engineer.

"I like its large-car comfort and feeling."—South Carolina line rigger.

"I'm on my feet all day, yet after a 12-mile drive home from work, I feel thoroughly rested!"—Florida supervisor.

The ride is great, we'll admit, but we'd pick the reclining seat on the passenger's side for a real rest.

"The ride is better than on earlier models."—Ohio electrician.

"It is the most inexpensive car I have ever had to maintain and operate."—Pennsylvania entertainer.

"I like the economy for a full, family-sized car."—Nebraska manager.

Rambler's new body compares favorably with so-called "full-sized, lower-priced" cars. Its trunk space does not.

"I like the shape and style of the 1963 Rambler; the curved windows are a wonderful feature."—Arkansas minister.

"It has the economy of operation that Rambler is noted for, plus competitive styling this year."—Delaware meterman.

The new styling seems to have hit the target dead center. It's different enough, but not too different, and we don't think that people will tire of it very soon.

"The Rambler no longer looks 'boxy!'"
—Virginia housewife.

"Practical for our family needs, both roomy and yet not cumbersome."—Florida salesman.

"I am able to haul six adults without anyone in the back seat being cramped."
—Pennsylvania post office employee.

Heading the list of complaints for Rambler owners were these five points, listed in order of frequency mentioned.

"The curved windows are nice to look at, but seem to cause the wind to sound very loud at about 60 miles per hour."—Illinois serviceman.

"At high speed (55 to 65 miles per hour) the wind causes some severe noise

inside the car."—Florida insurance agent.

"Terrific wind noise around all doors and windows."—Illinois tool grinder.

"I can feel and hear the wind blowing in."—Rhode Island teacher.

Sound sources are hard to trace without scientific instruments. We're not at all sure that curved windows create any more noise than flat ones. But the noise is there.

"The horn ring often catches in coat sleeves and blows the horn embarrassingly."—Rhode Island retired man.

"The horn needs to be situated differently as it's too easily hit by one's elbow and blows when it shouldn't."—Idaho salesman.

"The segment that blows the horn catches sleeves on it and thus blows at most inopportune times."—New Hampshire trucker.

Possibly, Rambler engineers work with their sleeves rolled up and never hooked the horn ring. But everybody else has.

"I don't like the low floor level as you can't sweep it easily."—Nebraska laborer.

"Lowered floor makes entry and exit more difficult."—Florida retired man.

"My wife does not like the fact that she must step down to get in and up to get out, although all new cars seem to be this way."—Virginia government worker.

The Virginian is right on both counts; flat floors are preferable, but space and weight-saving unit construction, like Rambler's, makes the high, box-section sills necessary.

"Doors do not close smoothly and quietly."—Pennsylvania government employee.

"The doors just don't shut completely, so it isn't airtight."—Ohio truck driver.

"Doors do not close and latch as easily as they should."—Vermont machinist.

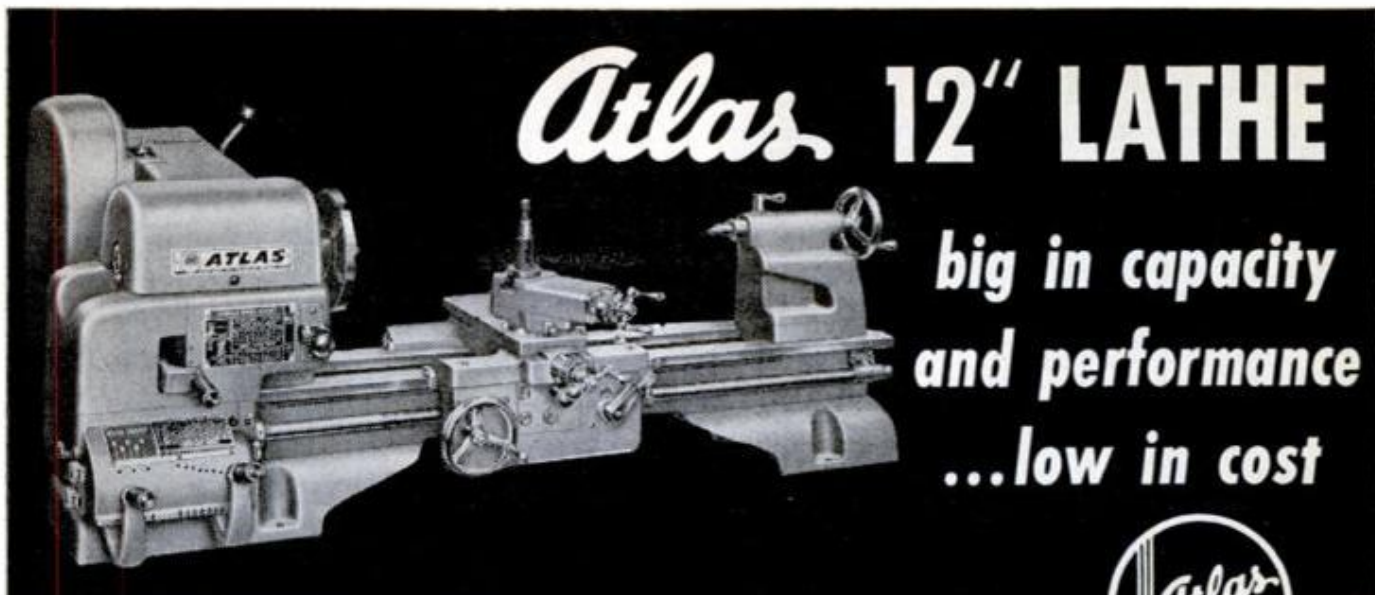
PM's test Rambler had a front door that tended to bounce away from firm latching position. This is one of the problems of early production of a brand-new car—you don't know how every part will work out in mass production until you mass-produce some.

"I would like to see a return to 15-inch wheels so that I would have more clearance on country roads."—North Dakota minister.

"Its 14-inch wheels do not roll over rough roads as well as they did on my two earlier Rambler American wagons."—Virginia mechanic.

Theoretically, he's right, of course. A smaller diameter wheel will drop further into the same-sized pothole than a larger one, but so many other factors such as weight

(Please turn to page 244)



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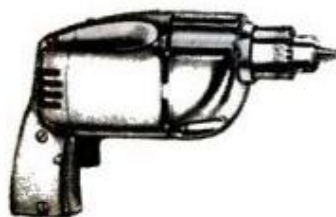
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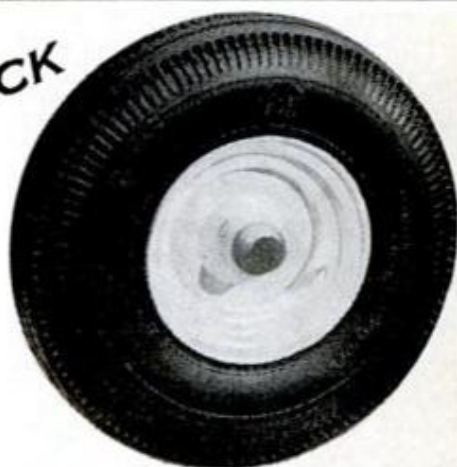
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Owners Report—Rambler

(Continued from page 242)

and wheelbase enter into this evaluation, that it would seem difficult to pinpoint a one-inch difference in wheel size.

On the happier side, here are items six through ten on the owners' list of favorable points.

"It's easy to park and turn around because it's not as long as other cars."—Nebraska laborer.

"I like its short turning radius."—Virginia credit manager.

In spite of the increase in wheelbase from 108 to 112 inches, Rambler managed to reduce its turning circle from 37.5 to 37 feet curb-to-curb.

"Has ability to park in places too small for larger cars."—Rhode Island government employee.

"It's an easy car for a woman both to drive and park."—Colorado secretary.

"It has good all-around visibility."—Pennsylvania lab technician.

"The curved windows clear rain off much easier than straight windows."—Pennsylvania merchant.

They also make slimmer door cross-sections possible, and that puts more room inside the car without enlarging the outside.

"The feature I like is the lower hood to give better visibility."—North Dakota professor.

"It's got plenty of 'snap' and 'get-up-and-go!'"—Minnesota insurance agent.

Rambler Classic's performance won't take your breath away, but neither will it maroon you out there in the passing lane.

"Smoothest power ever with the most wonderful performance at all times!"—South Dakota therapist.

"It is compact for parking, yet there's just as much room inside as in bigger autos."—Florida citrus grower.

"Plenty of room inside and less exterior waste space."—Rhode Island engineer.

"I like it because it's an in-between car, neither too big nor too small."—Arkansas policeman.

American Motors was one of the first to discover that a healthy slice of U.S. car buyers wanted this type of car, and we'll bet that Rambler will be the last to join the trend toward "super" compacts.

"Completely rattle-free and well-made."—Illinois salesman.

Now we present more complaints. Listed in order of their frequency, here are numbers six through ten on the dark side.

"The thermostat stuck shut."—West Virginia tractor driver.

"Thermostat stuck and boiled out the anti-freeze."—Nebraska farmer.

In our opinion, the thermostat is important enough to warrant pre-installation tests.

"I've had trouble with the carburetor."—Arkansas farmer.

"I was told to expect 17 to 19 miles per gallon with automatic transmission, and I'm still expecting, for I only get 15.3 miles per gallon."—Arkansas construction man.

His car is out of tune, or else he hasn't told us about the house trailer he's pulling.

"The rear window in our station wagon flutters like a leaf in the breeze unless it's rolled all the way up."—West Virginia aircraft worker.

"Windows don't fit tight, and thus leak."—Pennsylvania engineer.

Once again, the problems of early production of a totally new body.

"Not enough light on gear selector."—Maryland minister.

"There is no light nor indicator on steering wheel."—Florida retired man.

For the final list of features Rambler owners praised, here are numbers 11 through 16.

"It steers as if it were power-equipped."—Florida electrician.

Rambler steering is light and easy, but requires six full turns from full right to full left. This is pretty slow going.

"Holds the road very well at 75 miles per hour, especially on curves."—Arkansas grocer.

In our opinion, Rambler is a very roadable car—on smooth pavement—but when lightly loaded and cornering on washboard surfaces, the rear wheels are inclined to slide.

"Corners very well at high speed."—Ohio maintenance man.

"No wind disturbances when passing buses or big trucks."—Ohio machinist.

"The Rambler holds the road exceptionally well for a compact car and rides very smoothly."—Minnesota insurance salesman.

"Its braking system is every bit as good as having power brakes."—Illinois boiler operator.

Agreed. Few, if any, owners will need power assist.

"I like the double safety brake system."—Florida male nurse.

(Please turn to page 246)

ELECTRIC WELD - BRAZE & CUT

REPAIR MOST EVERYTHING MADE OF METAL

Home Appliances, Auto parts, Make and repair



lawn chairs, tables, ornamental iron work, gates, wagons, etc. Solder, heat, bend, and straighten, with terrific heat from arc torch. Cut and weld up to 1/4" steel plate. A million uses for Home, auto, farm, inventors, factories, etc. Works

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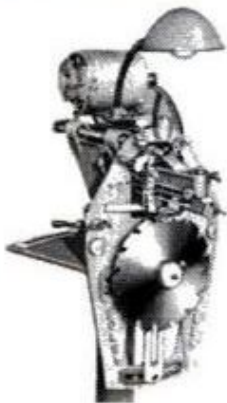


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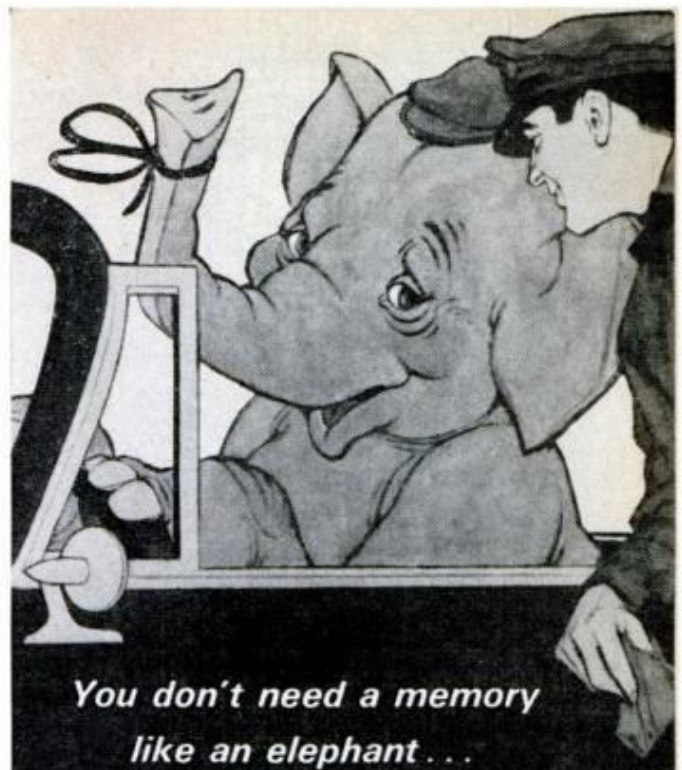
Have you ever thought about owning and operating at home a little business that you could work at when you felt like it? Not a big shop with high rent, overhead, and a payroll to worry about, but a small one-man business you could handle yourself in spare time? With the Foley Automatic Saw Filer you can quickly set yourself up in a business like that. All around you there are hundreds, even thousands of saws in daily use—saws that must be sharpened regularly.

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MARCH 1963



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like an elephant...

If you forget to
change oil
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Not being elephants, people are apt to forget. That's why we build *protection reserve* into Pennzoil Z-7, so it will go on protecting even if you forget to change oil when you should. Use Pennzoil Z-7 always, and ask for it even if you don't see it displayed. Pennzoil, Oil City 61, Pa.

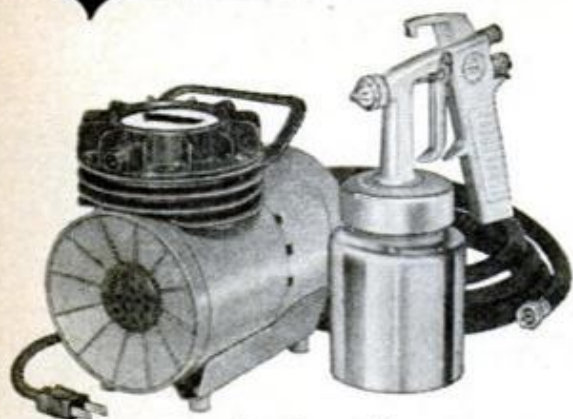
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Available at Hardware, Building, Lumber and Stationery Dealers Everywhere.
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Owners Report—Rambler

(Continued from page 244)

"I like most the quiet, efficient engine."
—Florida naval officer.

"It has a wonderful heating and air-conditioning system."—Ohio furniture worker.

"Well put-together for a lower-priced car."—Minnesota businessman.

Generally, we'll go along with this. PM's test car was a Classic 550, the lowest line, and with exception of door rattles, it was sound as a nut.

To complete the rundown, here are owner complaints numbers 11 through 16 for the '63 Rambler:

"It isn't as easy to get in and out of as previous models were."—Rural mail carrier.

"The doors appear to be harder to close than GM makes."—Florida engineer.

This problem is different from the door latch mentioned above. His car is probably sealed so tightly, that air trapped inside resists closing of the door.

"It was poorly put together on assembly and I had to plug up holes in the dash with cotton."—Nebraska soil engineer.

"Workmanship on body does not compare favorably with 1959 Rambler."—New Hampshire housewife.

He could be right: PM didn't poll Rambler owners in '59. But the percentage mentioning poor workmanship dropped from 5.1 on the 1962 Rambler to 2.8 this year.

"Not enough road clearance for unpaved country roads."—Pennsylvania house painter.

Few 1963 cars have more clearance than Rambler, but for some it still isn't enough. American Motors should option 16-inch wheels for these trailblazers.

"I find that there is less road clearance, as I do a lot of hunting on dirt roads."—New Hampshire construction worker.

"I liked the pushbutton transmission much better."—Minnesota fireman.

"The pushbutton shift was much easier than the lever they have now."—Rhode Island physician.

"I would rather have pushbutton transmission again."—Virginia salesman.

You can't win 'em all! In years past, some owners found the pushbuttons wanting.

Those are the reactions from the most thorough car testers of all—the owners—based on 909,048 miles of driving through all kinds of conditions. ★★★

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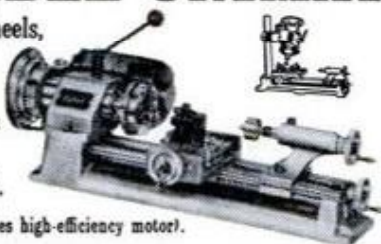
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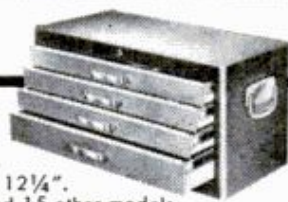
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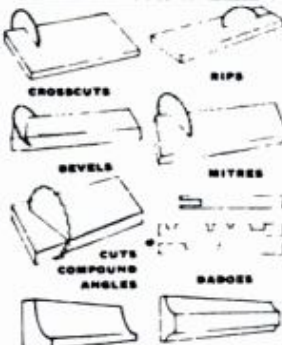


KIT INCLUDES:

- Complete blade carrying mechanism with depth of cut control
- Ground spindle with saw flanges
- Pre-oiled bearings
- Angle of tilt control
- Mitre gauge
- Motor mount assembly
- Attractive steel front control panel
- All needed brackets, screws nuts, bolts
- ABC assembly plans
- Patterns for sturdy base, massive 20" x 24" table
- Full instructions

UNCONDITIONAL 10 YR. GUARANTEE

**GUARANTEED TO DO THE
WORK OF \$50 BENCH SAWS**



MAKES COVE MAKES MOULDING

SAVE BIG MONEY ON HOME IMPROVEMENTS, SHELVES, CLOSETS, FURNITURE, TOYS

Put together in jig time. All you need are household tools. 1/2 sheet 3/4" plywood for table and base. Revolutionary new patents. Table stays level, blade tilts. Motor mount takes standard 1/4 h.p. or larger motor, keeps belt tight; full power, perfect alignment any angle. Blade tilts, locks securely any angle to 50°; raises, lowers 0"-2 1/4". Takes standard 8" blade, dadoe heads, cutters, etc. (not incl.).

IT'S FUN! IT'S EASY! Save big money when you buy, save big money when you use. Use for 10 days. Put through most rugged tests. If not satisfied, return for full refund.

**6" SWING
3-FT. LATHE**

\$9.85
f.o.b. factory

Optional Faceplate
for turning bowls,
trays, lamp bases,
rosettes, etc.
\$2.50



Complete as shown

DOES THE WORK OF \$40 UNITS—Sturdy all cast iron power tool turns wood or plastics with the precision and speed of machines selling for 4 times as much. Tubular steel bed, ball thrust cup center, spur center, T-Rest assembly, lever action tail stock, 2 speed pulley. Fits any motor.
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FULL 22" LONG, 4 1/8" JOINTER-PLANER

\$19.95
F.O.B. Factory

Complete as shown

100% precision ground cast iron and steel.



DOES WORK OF \$60 UNITS

Now, at little more than a hand tool price, a guaranteed professional quality precision machine which does same work as skilled hand planing . . . much faster, more accurately. Make accurate glue joints; rabbeting cuts for doors, window frames, table drawers; square taper cuts for chair legs; accurate beveling.

• Precision ground cast iron tables, adjustable for depth of cut • Rigid cast iron base • New patent-pending design holds clearance between knives and tables at any depth • Rabbet depth 3/8" • Hardened, ground high speed steel knives • Patent-pending fence adjustable to any position, any angle 0°-50° • Patent pending lift-off guard (nothing to loosen!) • Balanced steel cutter head.
UNCONDITIONAL 10-YEAR GUARANTEE.

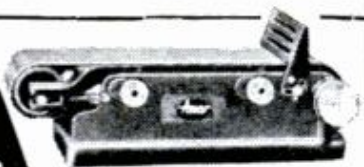
**PROVED BY
MORE THAN
500,000
USERS**

**4" BELT
BENCH SANDER**

\$19.95
F.O.B. Factory

Complete as shown.

Precision sanding performance of \$80 units



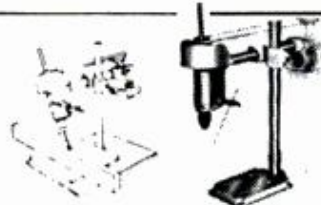
Perfect results every time for flat, curved and bevelled surfaces. Rugged cast iron construction with 4 1/4" x 10 3/4" supporting surface. 4" belt. Adjustable trackage . . . adjustable tension takes belts from 34" to 36" lengths. Smooth-running bearings are chatter-free. Bevel sanding guide adjusts to 60° angle. One sanding belt and 2" machine pulley included. Takes 1/4 hp. or larger motor.
UNCONDITIONAL 10-YEAR GUARANTEE.

**32" RADIAL
DRILL PRESS**

\$29.95
F.O.B. Factory

1/2" Cap. Gear Chuck Inc. Shipping Wt. 30 lbs.

DOES WORK OF \$90 UNITS . . . AND A GREAT DEAL MORE



Industrial quality precision machine with all features of standard drill press, many extras. Head raises, lowers. Greatly increased depth of throat. Can be pre-set to any angle or position for on-or-off table drilling . . . even horizontal drilling. All cast iron and steel. **UNCONDITIONAL 10 YEAR GUARANTEE**

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Please send me the units checked. Payment in full enclosed \$ or \$3 deposit each item enclosed, balance C.O.D. I must be fully satisfied or will return unit within 10 days for full refund. No questions asked.

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| <input type="checkbox"/> 8" Saw Kit \$9.95 | <input type="checkbox"/> Lathe & Faceplate \$12.35 |
| <input type="checkbox"/> Lathe \$9.85 | <input type="checkbox"/> Drill Press \$29.95 |
| <input type="checkbox"/> 4" Belt Sander \$19.95 | |

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10 DAY MONEY BACK GUARANTEE

You must be satisfied or money refunded.
AMERICAN MACHINE & TOOL COMPANY
Dept. PM-33, Royersford, Pa.



"stick 'em up, pardner!"

... and stick 'em for good with the new **DURO-PLASTIC** 2 for 1 combination offer \$1.49 value ... only \$1.00!

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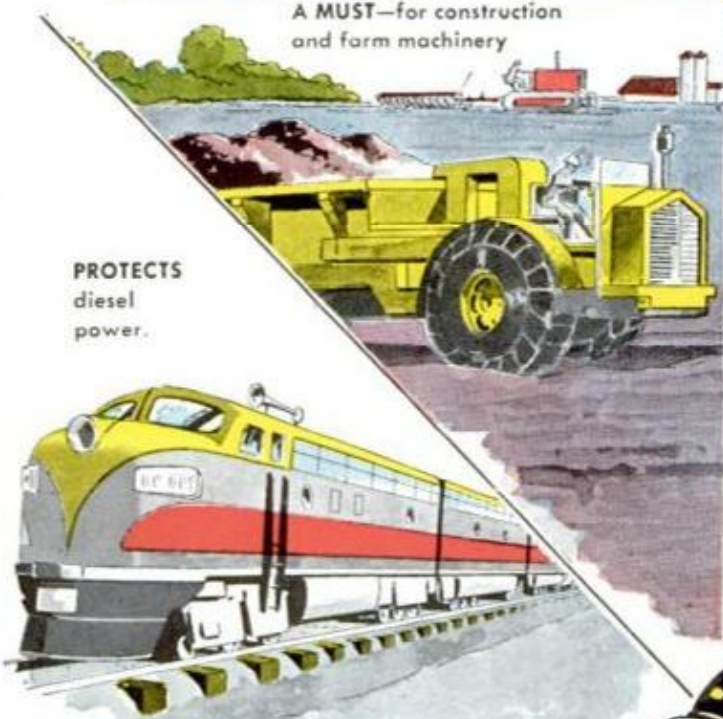
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