

Galaxie & Impala — first feedback from owners!

POPULAR MECHANICS

MAR. 1966
35 CENTS

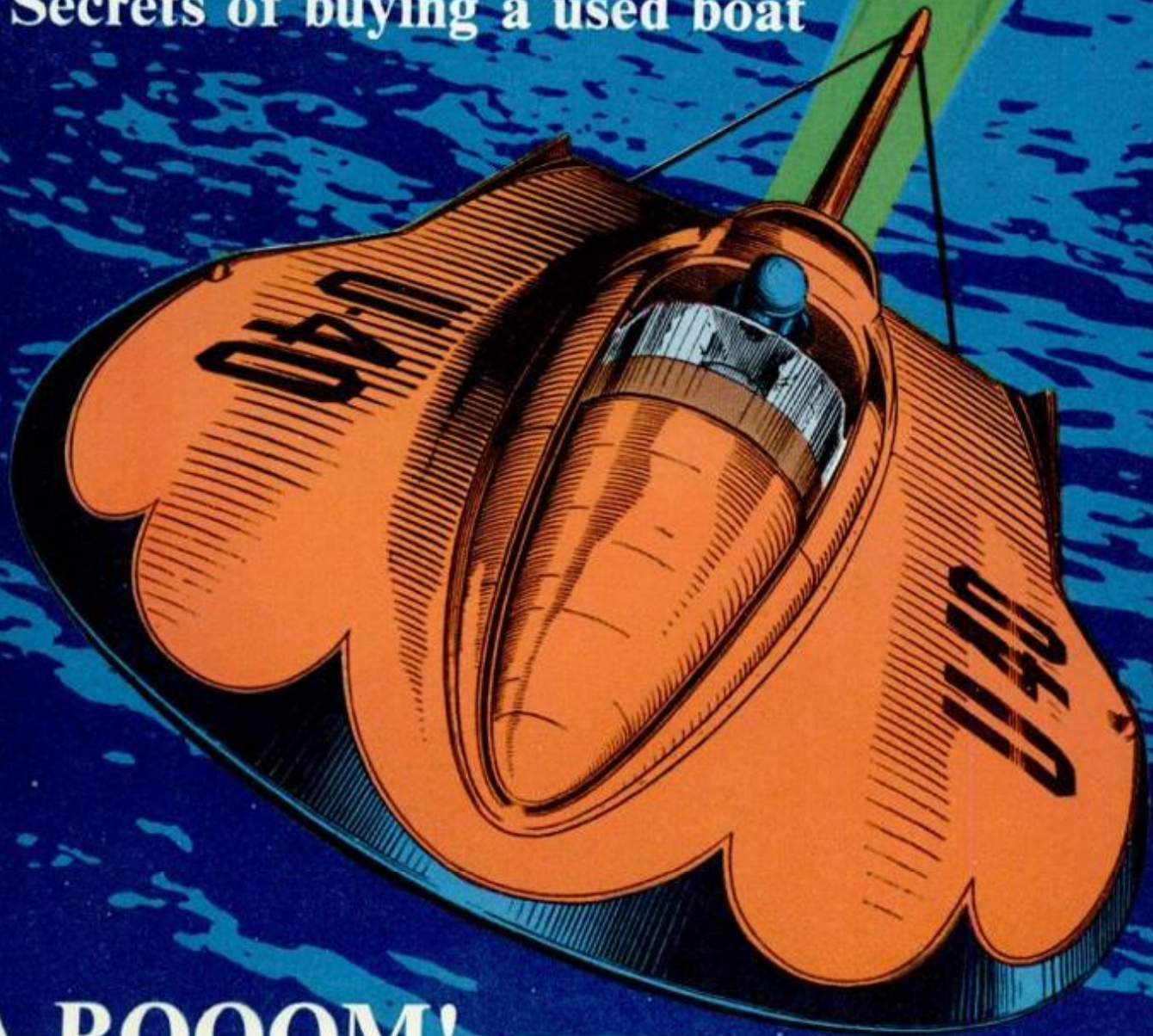
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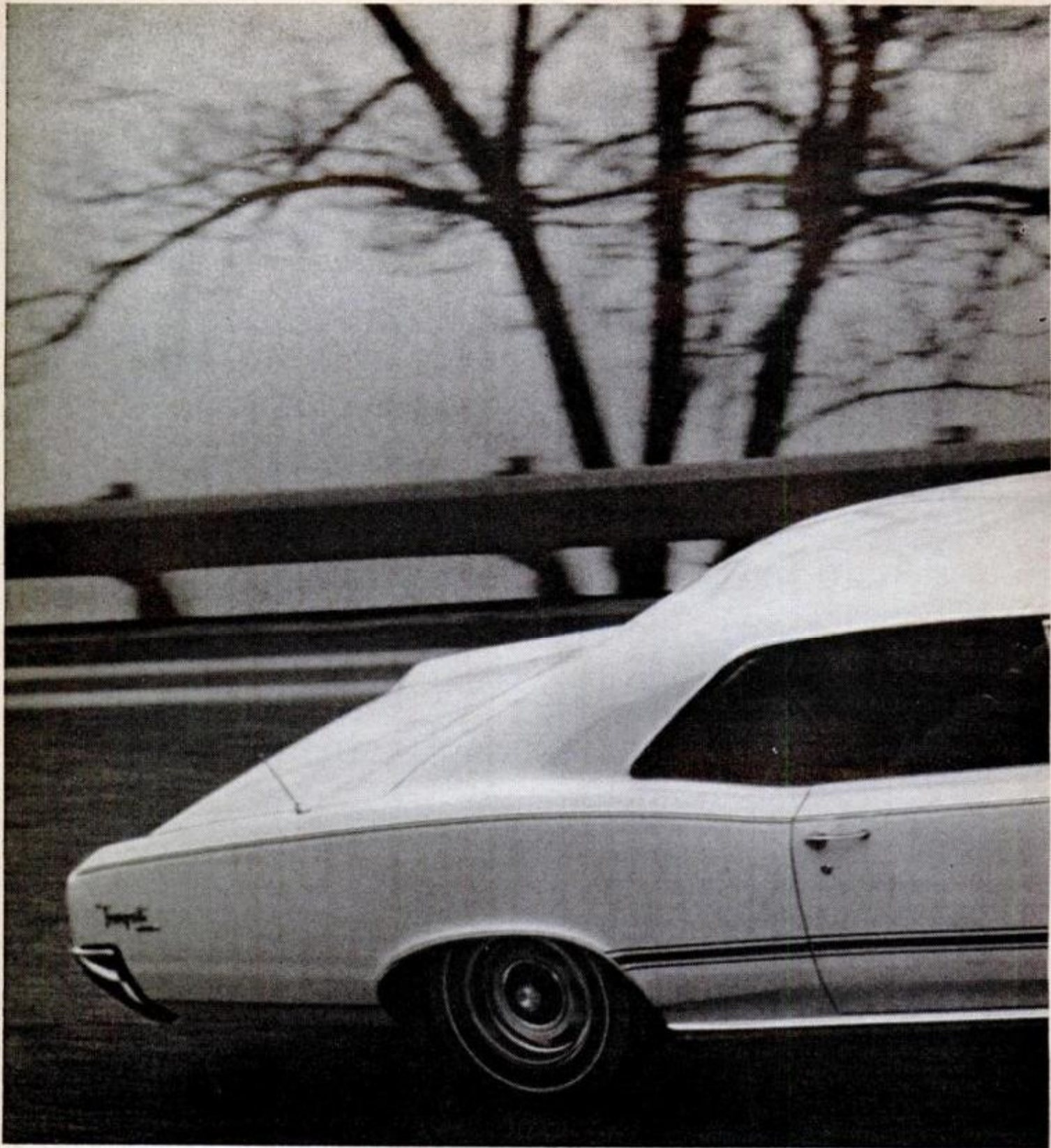
Acceleration tests at the famous Sebring Race Track proved how much the brand of spark plug can affect engine performance! In 49 cases out of 50, Chevrolets performed better with Champion spark plugs than with the plugs that originally come in Chevies. Other tests proved Champions gave better gas mileage, too! No wonder Champions are first choice with engine experts the world over!



HERE'S HOW THE TESTS WERE CONDUCTED • 50 brand-new Chevrolets (including Corvairs, Chevy IIs and Chevelles) were used in each test. • All spark plugs used were brand-new. • Nationwide Consumer Testing Institute—an independent company—conducted both tests. • All results were certified by the United States Auto Club. • Acceleration tests were run from a standing start with professional drivers at the wheel. • All runs were timed electronically. • Gas mileage tests were made on ultra-precise dynamometers. **RESULTS: 49 out of 50 Chevies accelerated faster with Champion—48 out of 50 gave better gas mileage!**



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Pontiac will send you five, ready-to-frame 26" x 11½" color reproductions of the famous GTO, 2+2 and new OHC Six—plus full factory specs on all three, plus five GTO emblem decals. Send 25¢ (35¢ outside USA) to: Wide-Track Tigers, P. O. Box 888H, 196 Wide-Track Blvd., Pontiac, Michigan 48053. (No stamps please.)

3 Wide-Track Tigers—GTO, 2+2 and new OHC Six

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MARCH 1966



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LETTERS

TO THE EDITOR

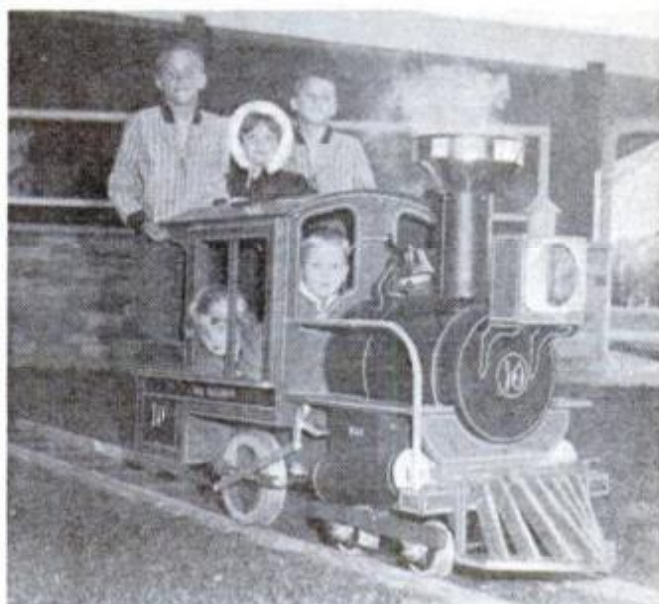
Lucid Antimatter

Congratulations on the *Way-Out World of Antimatter* (page 98, Dec. PM). It is lucid, complete, accurate and most enjoyable. It is the first comprehensive article on antimatter that has been written.

Upton, N.Y. ROBERT H. MASTERSON
Asst. Information Officer
Brookhaven National Lab.

10-Passenger Engine

My husband built the *Backyard & Bird-bath* train (page 118, Aug. PM) from the



plans in your magazine. He completed it in four weeks of spare time.

Incidentally, the numeral 10 on the engine is for our 10 children.

Mosinee, Wis. MRS. GENE OSOWSKI

No End to End-Loading

The picture of the *End-Loading Freight Car* (page 119, Dec. PM) brought back memories. Actually the West German Federal Railway is just a bit late with the auto boxcar you showed. I was unloading cars like that on the CC&O Railroad in Johnson City, Tenn., back in 1929 when I was 16 years old.

Howard, R.I. DEFOREST ROSENBALM

Not Stupid

I disagree with R. G. Schiff whose letter appeared in your December *Letters to the Editor*. It is not a "stupid law" about discharging firearms in city limits. They aren't strict enough with the firearms laws

(Please turn to page 10)

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MERCURY announces the first major

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NOW — Preignition, even with highly leaded fuel, is unheard — and unheard of!

NOW — Engine efficiency and reliability are dramatically increased!

NOW — High-powered engines idle like fishing motors!

Thunderbolt—a super-power electronic ignition . . . the first semiconductor capacitor discharge system offered to the public as standard equipment on an internal combustion engine.

Thunderbolt ignition was invented and developed by Kiekhaefer engineers. It is a complete, fully integrated system that makes use of space-age, solid-state materials and technology to produce dramatically increased spark plug life and engine performance. New **Thunderbolt** ignition is available today as standard equipment on two new 6-cylinder Mercurys, the Merc 1100SS and the Merc 950SS.

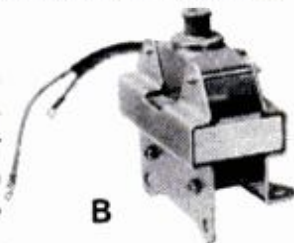
HOW DOES THE THUNDERBOLT SYSTEM WORK?

Thunderbolt ignition is so named because its spark voltage impact far surpasses that of a conventional ignition system—and because it produces this voltage in mere millionths of a second, many times faster than a conventional system does. In **Thunderbolt** ignition, the battery's 12 volts are converted to a far higher voltage level than in a conventional coil-and-battery system.

This augmented voltage is charged into a large capacitor (condenser). Contact points, carrying only a small amount of switching current, trigger the semiconductor electronic control (A), sending the stored charge into a specially designed low-inductance ignition transformer (B). This unique step-up transformer multiplies the voltage hundreds of times, producing a "Thunderbolt" of a spark! And the output is essentially constant over a wide



A



B

range of battery voltage, from 4 to 30 volts—virtually no low battery problems ever!

FIRE YOUR ENGINE WITH LIGHTNING SPEED AND POWER

Thunderbolt's "concentrated instant ignition" snaps the engine to maximum performance; a single crack from **Thunderbolt** exceeds the energy of several ordinary ignition sparks.

In conventional ignition systems, voltage build-up at the plug is so slow relatively that much is lost by leakage across any conductive deposits which bridge the electrodes or by moisture in the distributor cap or on the high-voltage wiring. **Thunderbolt** ignition builds up a full spark plug voltage with lightning speed, forcing the plug to fire so quickly that practically no energy loss occurs through leakage. Thus, **Thunderbolt** ignition can fire plugs that are "fouled" by conventional ignition standards. And, because the triggering current required to discharge the capacitor is so small, points are not nearly so subject to pitting and burning. The result is a degree of dependability, durability and performance never before approached in an outboard motor ignition system . . . and a new standard of two-cycle performance.

THE POLAR-GAP SPARK PLUG

An integral part of the new **Thunderbolt** ignition system is Mercury's new Polar-Gap spark plug. Polar-Gap is a very "cold" spark plug: operating temperature of the electrodes and ceramic insulator is 800 to 1000 degrees colder than conventional plugs. This means that the Polar-Gap plug does not glow red hot in the combustion chamber as do conventional spark plugs. Consequently, deposits from the use of leaded fuels do not reach preignition temperature levels. The center electrode (C) receives the high voltage from the coil. A ceramic insulator (D) forms the gap, and a large mass of metal (E) forms an outer ring, which is the other electrode. The spark travels from the center electrode to the outer electrode. Spark arcing area is considerably greater than that of the conventional plug—Polar-Gaps have a 360° electrode gap. This reduces the rate of electrode





breakthrough in outboard ignition in 50 years...



erosion, partially accounting for the greatly increased life of the Polar-Gap plug.

Thunderbolt ignition and Polar-Gap plugs go together—it takes Mercury ignition to fire Polar-Gap plugs. New *Thunderbolt* ignition gives them a super spark and vastly improves the idle.

Forget fouling—Thunderbolt's higher voltage spark just about eliminates low speed

wet fouling or carbon fouling, while the very low operating temperature of the Polar-Gap plug ends fouling caused by lead deposits from automotive fuels. In comparison, experience has indicated that some competitors' high-horsepower outboards using conventional spark plugs require replacement every 10 to 12 hours of full throttle operation on leaded automotive fuels.

RADIO INTERFERENCE REDUCED

Radio interference is greatly reduced with *Thunderbolt* ignition because only a single spark is produced. With a conventional system, several sparks in rapid succession are often produced. This increases radio interference and shortens spark plug life. *Thunderbolt* brings you a bonus of minimum interference with your electronic equipment.

KIEKHAEFER PIONEERING

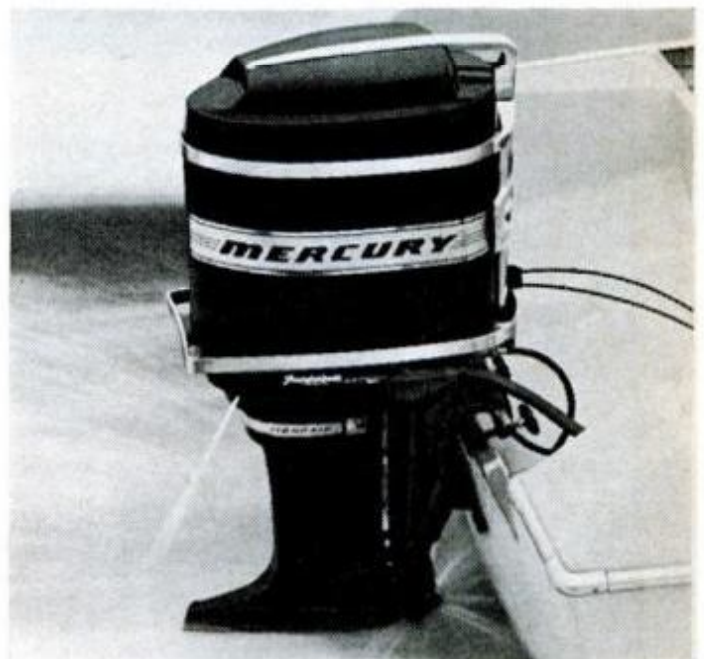
In preparing the way for production of the *Thunderbolt* ignition system, Mercury first moved towards perfecting dielectric properties in plastics for distributors, rotors, and other components. These have been in production on Mercury outboards for several years, although only this year they are being hailed by some auto manufacturers as "new developments." A feature of the *Thunderbolt* system is the new higher-dielectric non-carbon-tracking distributor.

The roots of the capacitor discharge system go back to Mercury's World War II experience in producing thousands of military engines. High costs and critical material shortages discouraged application of this advanced ignition principle to civilian production at that time. With further development of the art, today's vastly superior system has been arrived at with only a modest increase in price.



THUNDERBOLT: EXCLUSIVE ON THE NEW MERCS 1100SS AND 950SS

New *Thunderbolt* ignition makes the new Mercs 1100SS and 950SS the most advanced outboards ever manufactured, offering performance, dependability and economy never before experienced in any high-horsepower outboard.



"We are proud to add *Thunderbolt* ignition to more than 80 outboard industry 'firsts' pioneered by Mercury since 1939. With this new system, you will enjoy a degree of spark plug life, engine performance and reliability never before possible in an outboard motor. *Thunderbolt* ignition is another example of our determination to give you the most performance, dependability and pleasure for your boating dollar."

W. Kiekhaefer
President



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LETTERS continued

now. Wax shooting can be very dangerous if you do not know what you are doing.
Gretna, La. RAYMOND B. PHILLIPS, JR.

Excellent Sport Fisher

With its ample cockpit and stability, *Sports Sled* (page 144, March 1964 PM) is proving an excellent boat for Puget Sound sport fishing.

The boat, begun in March, was completed in late August. Modifications to the



plan have included forward controls, walk-through seats, windshield, rub and spray rails, and brass-on-oak outer keel strips.

It has been an enjoyable (and not too difficult) first effort for me at such a project.

Olympia, Wash.

RAY FOUNTAIN

Gutter Guard

We'd like to commend you on your fine article *Is Your Run-Off System Doing Its Job* (page 158, Nov. PM) and to thank you for including our Gutter Screen. We take exception, however, to your statement that "aluminum guards should only be used on aluminum gutters." Both our company and Alcoa (from whom we get our aluminum) have made extensive studies that prove without a doubt that our aluminum screen will have no ill effects on galvanized gutter.

Metalex Corp. LEONARD M. SANDBERG,
Libertyville, Ill. Sales Manager

Matter of fact, we checked out this very point with Alcoa before running the article. They replied: "There is obvious danger of corrosive reaction if aluminum gutter screen is used with bare metal gutter of another material. If galvanized or copper gutter is painted, there should be no problem." Maybe they don't read their own research reports? Anyway, thanks for all the evidence you enclosed; it seems pretty conclusive that your product may be used on any gutter, painted or not.

THE EDITORS



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of money in your own business*

... "made
\$1200⁰⁰
on one job"

Some make more, some less...

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MARVIN SIMPSON, Utah
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EMMET FREMONT, Colorado
"It's amazing what the Wall Deterger will do. I'm more than satisfied."

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BY JOHN F. PEARSON
SCIENCE
WORLDWIDE

More bacteria, including some disease-producing strains, survive on laundry washed in cold water than in either hot or warm water. This was established recently by Department of Agriculture scientists in tests of new cold-water detergents that are on the market. They advise adding a disinfectant to the tub of laundry.

Does a bird listen to the sound it makes? Yes, says a University of California scientist who has deafened baby birds and then compared the development of their song with that of normal birds reared in isolation. Deafening affects both the syllables of the song as well as the pattern of its delivery.

Add postage stamps, envelopes, labels and other gummed papers to the list of things that are bad for you. According to a scientist at the University of Edinburgh (Scotland), bacteria and viruses can live in the gum. He suggests incorporating a bacterial deterrent such as chlorinated water in the gum preparation.

Bombarding faded photographs with neutrons from a nuclear reactor will restore them. The technique was developed by Eugene Ostroff, curator of photography at the Smithsonian Institution, who worked with photos so deteriorated they bore no visible image.

The neutrons strike the particles of silver, which compose the photographic image, converting them into radioactive isotopes. A sheet of X-ray film is then placed in contact with the photo and becomes exposed to the radioactive image. Developed, the X-ray film produces a clearly restored copy of the original.

A wild-growing plant in Spain shows promise as a potential domestic crop for producing a valuable industrial oil, according to the Department of Agriculture. Seeds of the plant, *Euphorbia lagascae*, are rich in epoxy fatty acids, now made synthetically for use in plastics, paints and other industrial products.

The coral reefs of the Midway Islands are at least 25 million years old. So say University of Hawaii researchers who drilled two deep holes (one to a depth of 1600 feet) through coral, layers of sedi-

mentary rock and, finally, basalt—a volcanic rock whose flows provided the foundations upon which the islands were formed.

They're feeding licorice to cattle at Pennsylvania State University. It's not that the cows have developed a sweet tooth, but veterinarians there have found that the licorice root contains as much nourishment as timothy hay—and that's after the licorice extract has been obtained. For years, people in agriculture have sought a good use for the tons of root that remain after processing.

Talk, talk, talk. How much time do people actually spend talking? Careful measurements show, says a Temple University anthropologist, that it's only for a total of 10 to 11 minutes daily. He says the standard spoken sentence lasts but two and a half seconds. "We do far more communicating with body movements, with our eyes and eyebrows, facial expressions, hands and shoulders."

Hearing loss and heart disease appear to be related, say two New York physicians who studied a series of cases. They found that loss of hearing in the high frequencies in children and young adults closely parallels early changes in the cardiovascular system.

First of its kind is a new graduate course at Stanford that will cover the "science and technology of contained and cratering nuclear explosions." The purpose is to train civil engineers in the ins and outs (and ups) of digging canals and enlarging harbors with nuclear explosives. The announcement of the course states that students will not set off any blasts but may visit sites of old explosions.

Computers are for the younger set. That's what a survey of scientists at the Brookhaven National Laboratory (N.Y.) indicates. The chaps over 40, most of whom were well into their careers before the computer came along, tend to use the machines less than their younger colleagues. It was also found that medical and biological researchers don't go in for as many computer-assisted studies as do physicists.

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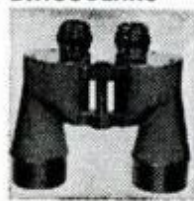
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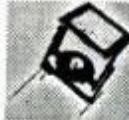
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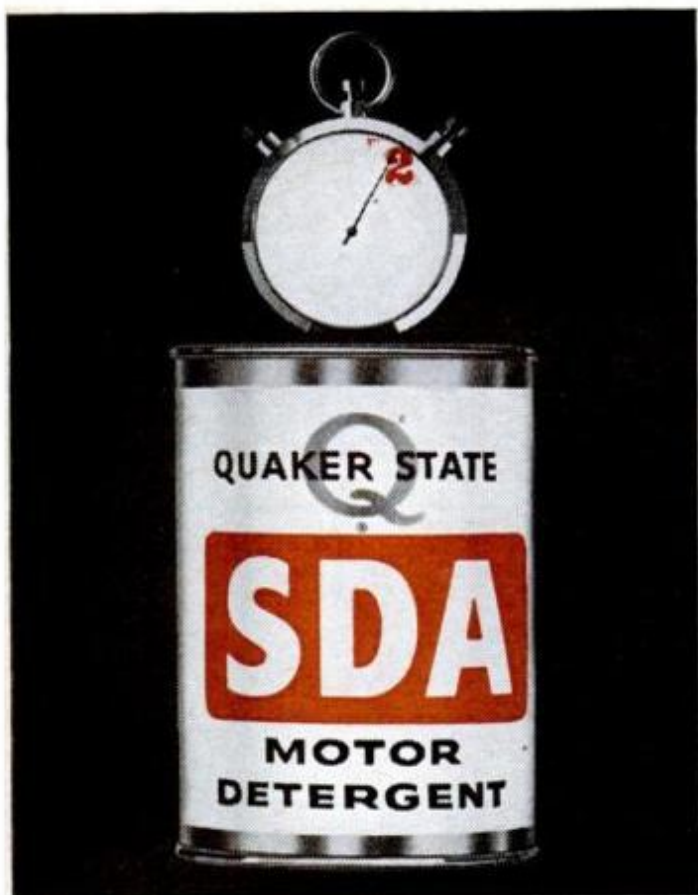
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Science Worldwide

(Continued from page 12)

Air sacs in the porpoise's head appear to be the secret of the mammal's amazing sonar system, according to a Navy scientist who says that when the porpoise wishes to "echo-locate," it forces air into sacs in its head, closes some valves and forces air past them. This causes clicking sounds, which are made up of both high and low frequency waves. The clicks are beamed in a cone shape by two horn-shaped sacs in the forepart of the animal's head.

While sending signals, (the porpoise sweeps its head from side to side in a scanning motion. Low-frequency echoes from an object in its path are received by the animal through its ears and other parts of the head. High-frequency echo signals are picked up in the animal's jaws. Navy experiments are aimed at trying to imitate both the mixture of frequencies and focusing the beam.

* * *

Air-Force scientists are studying the effects of nuclear explosions with a new laboratory device which creates a pulse of power equivalent to all the power generated by 10 Grand Coulee dams.

Called an ultrafast, pulsed power system, the device can generate 20-billion watts of power in a pulse lasting only 50 billionths of a second. Scientists are using the device to stimulate and study light output, plasma production, shock waves and other effects associated with nuclear explosions.

* * *

Ancient Temples Are Reclaimed

Five stone temples of the Mayan civilization are being restored by Guatemala as heritages from the past.

The ruined Tikal temples, 1000 to 2000 years old, are being recovered from lush tropical forests. Excavation of the eight-square-mile ceremonial area (once inhabited by 25,000 Mayans) north of Guatemala City began in 1957 as an archeological project by the University of Pennsylvania. One chief problem has been protection of limestone facades of the 200-foot-high temples from erosion by humidity as they are uncovered. The Guatemalan Government is contributing \$860,000 for repairing the work.

Highly developed, the Mayan culture endured for about 3500 years before Spanish conquistadores destroyed it; during thriving centuries, Mayans built temple cities throughout the area known as Guatemala, Yucatan and parts of Mexico and Honduras.

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BY KEVIN V. BROWN
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PM's man in Europe, Richard Thomas, heard about one produced in South Africa that is selling as fast as it comes off the assembly line and sent this report: "It operates on a four-cylinder, 70-hp McCulloch engine which drives a two-bladed push propeller and, by means of a flexible transmission shaft, a 20-foot, two-bladed overhead rotor. It weighs 325 pounds, with a useful load of 225 pounds. It can take off within 90 feet and land within six. It maintains level flight as slowly as 18 mph with a top of 100 mph, cruising at 70.

"Called the Minicopter, it has been favored by doctors and medical aides in the South African bush country. Controls are simple and include, in addition to the usual aircraft controls, a cyclic-control column and rotor speed-up lever. Cockpit can be enclosed in bad weather.

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No word, however, on whether it might be available in the United States.



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FROM THE PATENT OFFICE

NEW INVENTIONS

BY M. J. PEDERSEN

Satellite servicing got a boost in the right direction with a patent that promises to provide—at one-tenth the weight required by present systems—the enormous power needed by an orbiting space station housing “repairmen.” In brief, these high voltages would be obtained by interposing materials with a high di-electric constant between metal sheets constituting the space vehicle’s exterior. In effect, many separate capacitors would be formed. Patent 3,204,889 went to Robert J. Schwinghamer, Huntsville, Ala.

Another space-oriented patent proposes to utilize the energy of charged particles in the ionosphere to obtain electrical power. By placing one gold and one platinum electrode on opposite sides of the satellite, part of the payload would be powered by the DC electricity produced between the two electrodes. Patent 3,205,-

413 was awarded to Dr. Donald E. Anderson, University of Minnesota.

Chuzzzz-chingzzzz-chingadazzzz is not the familiar sound of an old steam engine rolling down the tracks. It’s the latest sound in modern jazz bands, emanating from a cymbal accessory that earned patent 3,215,020 for Ralph C. Kester Jr., South Bend, Ind. Fitted over and attached to a cymbal, the device consists of a ring with double discs spaced at intervals along the circumference.

Underwater wireless communications system for divers was awarded patent 3,210,723 to Luigi Martelli and Carlos Reinberg, Genoa, Italy. A combination mouthpiece, amplifier and sound converter is contained in a single package small enough to be carried easily by the diver.

A cheaper alarm system uses normal telephone circuits to relay emergency signals by codes. When mechanical sensing devices are tipped, the telephone cuts its regular service temporarily and emergency messages are flashed to the central office. Fred B. Crowson, Brooklyn, N.Y., and Walter S. Michel, Forest Hills, N.Y., received patent 3,206,551.

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QUESTIONS ANSWERED

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Driveway blues

After repeated efforts (all unsuccessful) to patch a number of cracks and holes in my asphalt driveway, I'm about ready to throw in the sponge. Can you help me out?
—L.D., S. Dak.

Sure. First of all, throwing in the sponge won't help. The stuff to use in patching asphalt, is available in hardware stores for just such jobs. Cut out and sweep away all loose material so that you have a clean, solid base in the crack or pothole. Cut the sides straight up and down. Flush out the area with water, then let dry. Finally pack in the asphalt and tamp it down hard so the patch is level with the rest of the driveway.

Deflating wallpaper

In our dining room, an area of wallpaper about a foot square has developed a noticeable bulge that balloons out from the wall about half an inch at the center. Is there some way to paste it flat to the wall again?—Mrs. H.deQ., Kans.

This is a fairly common failure of wallpaper, due usually to moisture penetrating the wall. Use a sponge to soak the area with warm water until the paper is soft. Then cut across the blister with a very sharp razor blade. Carefully separate the edges enough to permit you to insert your finger behind the paper. Then use your finger to apply a thin mix of wallpaper paste on the underside of the paper. Finish by pressing the paper against the wall with a clean, damp cloth or sponge. If the edges overlap a bit, you can trim them—or just let 'em be.

Warped door won't latch

We bought an old house recently and, after we'd moved in, discovered that the kitchen door was so warped we couldn't latch it. The house purchase will keep us poor for at least the next year, so I'd like to avoid the expense now of having a new door installed, if possible. Perhaps you can suggest a fix-it solution for this problem.
—J.B., Ark.

If the door is warped on the hinge side, try installing a third hinge midway between the top and bottom hinges. If it's warped on the latch side, pry up the stop bead on the latch side of the door frame,

(Please turn to page 24)

TOM McCAHILL SAYS:

"Good Appliance Repairmen are Scarce as Edsel Dealers!"

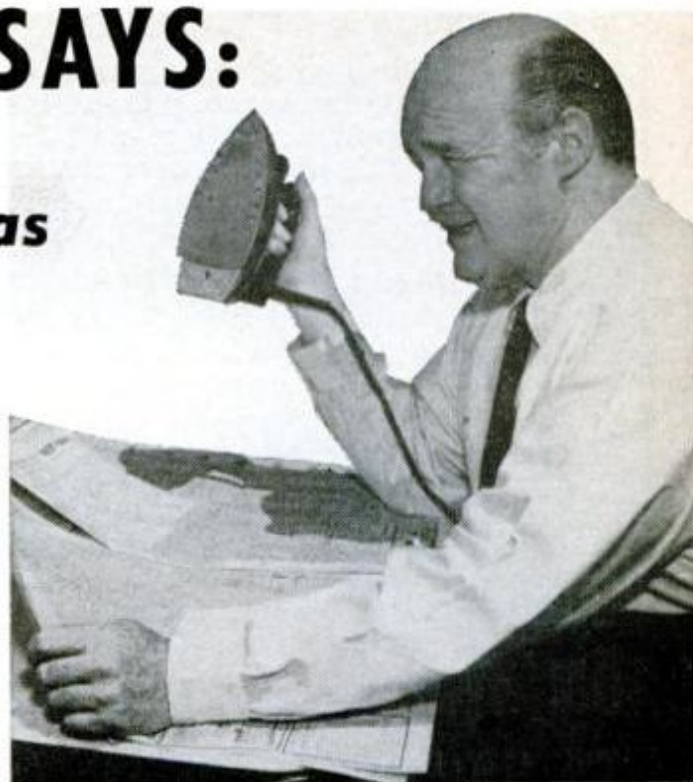
I don't think anything disturbs me as much as trying to find an appliance repairman . . . and finding out I'll have to wait my turn because he has more business than he can handle.

With over 400 million Appliances now in use, and more coming every year, there just are not enough repairmen around to take care of every Mrs. Jones who wants a broken Appliance mended in a hurry! And that's why a smart guy could really clean up in the Appliance repair field.

Some years back, almost anyone could do a fast repair on an iron or toaster with a bit of fancy tinkering. But today's complicated Appliances call for a special brand of know-how the average Joe doesn't have without training. Appliances are loaded with thermostat controls, solenoids, and special devices. Unless a repairman has a working knowledge of these parts, he won't even get to first base.

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NRI is one of the biggest and best schools in the field, and has been around since 1914. They have a staff of 150 people in Washington, D.C., who are equipped to guide you through



the easy course with expert and personal instruction.

Take it from Tom . . . this is one of the easiest and most rewarding fields a guy can enter today. You don't need a college education, you don't even need to know the first thing about Electrical Appliances when you begin your training.

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HOMEOWNERS' CLINIC

(Continued from page 22)

then close the door and use a pencil to draw a line on the frame along the inside edge of the door. When you re-nail the stop bead along this line, the door should latch.

A table of many colors

Upon removing the old finish from what I thought was a maple table, I discovered instead that the piece consists of several woods—some light, some dark. I want to give the whole table a uniform maple finish. How the heck can this be done?

—H.S., N.Y.

In the past, such furniture was often made from several hardwoods, including birch, maple, gumwood and even poplar. The piece would then be finished with a varnish stain and possibly a toner, both applied by spraying. You can do the same thing by spraying on a maple varnish stain. First remove the old finish and sand the wood smooth. Then spray on the stain, let dry and sand. Repeat with two more coats, sanding lightly between coats. Use a near-mist spray so you can more easily

control the application and better match the light and dark woods. Smooth the last coat with very fine steel wool.

Patching gouged paneling

My basement room has walls finished with painted insulating planks—a type of patterned softboard with V-joints. One plank has been badly damaged by gouging. Must I remove this plank and replace it with a new one, or can it be repaired?

—N.E., Ill.

If the plank is only gouged or dented—not broken—try repairing it with some wood putty, the powdered type that mixes with water to make a paste. Clean out all loose material from the gouges, then use a putty knife to lay the putty into each depression, slightly over-filling the holes. Wipe excess putty from the edge of the holes with a damp cloth. Now, before the putty sets, take a piece of leftover planking (if you're lucky enough to have some) and press its patterned surface to the face of the soft patch. This will simulate the original pattern, rather than leaving a conspicuous bare spot. When the putty is thoroughly dry, paint the patches to match the rest of the panel.

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WHAT'S NEW OUTDOORS

BY STUART JAMES

Mulligatawny means pepper water.

Now that's the sort of statement that always snares me when I'm rambling through a new cookbook, and the next thing I know I'm in the kitchen rattling pots and pans. I've put in a lot of kitchen time the past month, because I received a cookbook for game that is loaded with snares.

Here's another one. *Moose chop suey*. That resulted in a long distance call to a friend who always has moose meat in his freezer, and an air express bill that made me gasp. But it was delicious.

And this, on the opening page about game birds. "*Golden Bridge, New York, for pheasants—and the thrill of the first pheasant I ever bagged—the hills of Hunterdon County, New Jersey, for rabbit and grouse—Wading River along the Jersey shore for ducks . . .*" I know that country and next thing I'm in the closet knocking the mud off my boots.

Geraldine Steindler is the cause of all this. Stoeger Arms Corp., 55 Ruta Court, South Hackensack, N.J., has just published her *Shooter's Bible Cookbook* (\$3.95). It's good reading and excellent eating. Mrs. Steindler has an original approach in the writing and in the kitchen.

Here's a recipe for "Clay Bird," for instance, that made me wish I'd made that duck-hunting trip down to the Toms River area of New Jersey:

"Find yourself some good sticky clay—nothing else will do, so if that's not available, forget it till next time. Dig a pit and build a good fire that will burn down to lasting coals. Stuff a cleaned, but unplucked, duck with apple and/or onion and a piece of celery, fasten the openings closed and fold the feathers over to keep out the clay. Then plaster the bird liberally with clay—the sticky overcoat should be at least an inch thick, if not more. Scrape aside some of the coals, set the bird in the coals and pile others on top. Seal the pit and forget about it until you're ready to eat. Dig the bird out carefully, knock off the hardened clay (the feathers will come too) and start eating!"

If that's not enough to make you want to rush out and get Gerry's cookbook, how about this line: "Moose nose is a great delicacy with the Telegraph Creek Indians."

Like I said, when she starts off like that it's hard to resist.



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"Do it with a computer," somebody suggested. We did. Had an independent testing company use a portable computer that could be moved from one Pickup to another. Six bump-sensing devices at different points within the cab fed data to the computer as the Pickups ran over different kinds of roads at different speeds. Result? You can bet our electronic genius had an instant answer. It said that our Pickup had a better ride than any of the four other makes.

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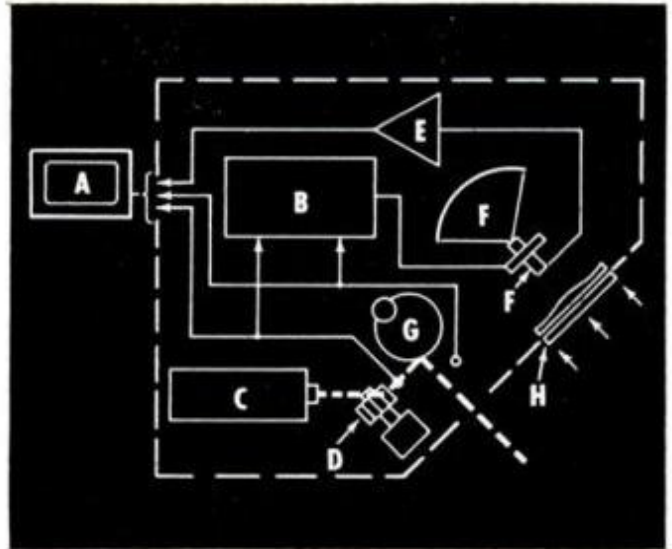


FORD/66

Laser TV Sees in Pitch Dark



PILOT'S EYE VIEW of laser "radar" in use might be something like this. The painted runway limits stand out clearly against the ground on radar screen



INSIDE the laser TV receiver circuit. Black diagram sections are: A—monitor; B—deflection circuits; C—laser; D—line scanner; E—preamp; F—receiver optics; G—frame scanner; H—spike filter



TURN ON THE LIGHTS and you can see what you're photographing. TV screen picture remains unchanged as room lighting does not affect either the laser transmitter or the reflected-energy receiver



LASER IN ACTION doesn't light up the darkened room, but does produce fully-lighted picture on the TV. Laser scans the subject so rapidly and in such fine segments that its light can't be seen

SCANNED BY hair-thin lines of red laser light moving so quickly as to be invisible, subjects in complete darkness appear on a TV screen as if photographed in normal daylight. Intensity of the scanning beam is kept well below the level that might endanger the human eye.

The laboratory system, developed by Perkin-Elmer, combines a laser light transmitter and a reflected-energy receiver in one compact package. Pictures produced this way are said to be equal to standard TV reception.

Intended uses for the new system include spot TV news reporting, where a camera not requiring an additional light source would simplify things.

The laser "radar" could also become an all-weather landing aid for aircraft. Runways or helicopter landing pads would be marked off with reflective paint or tape. Laser beam would let the pilot spot them on "radar" screen from altitudes of several hundred feet, in complete darkness.

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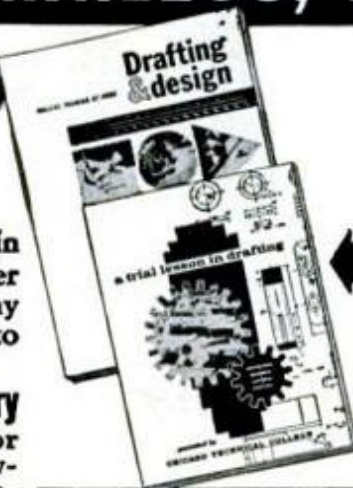
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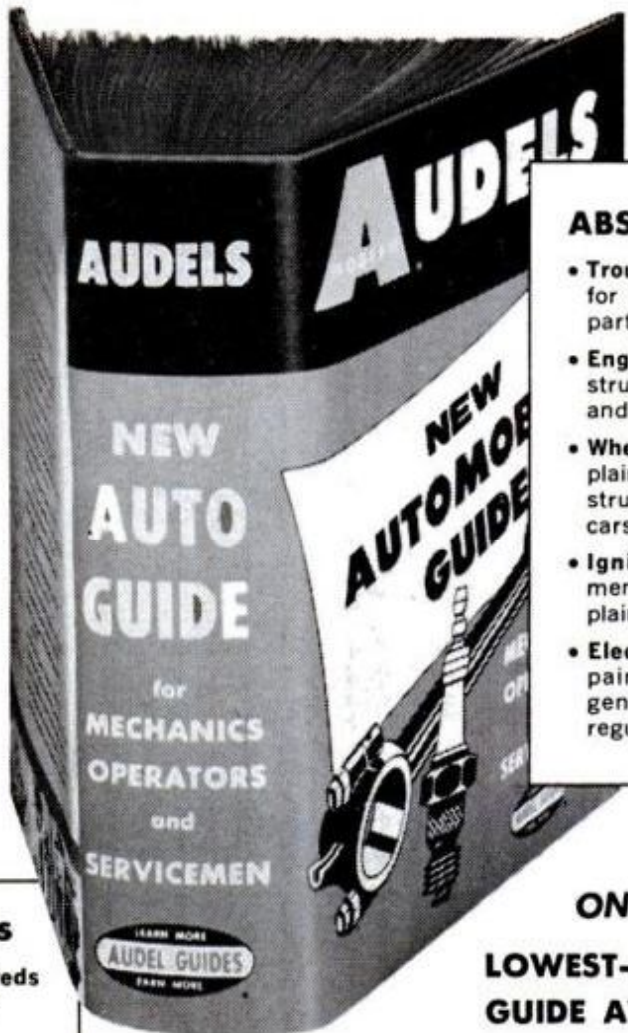
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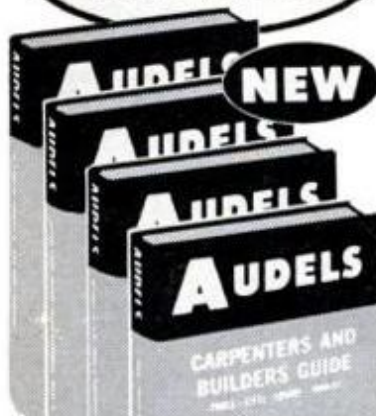
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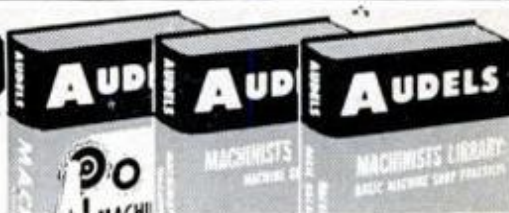


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DETROIT LISTENING POST

BY JIM DUNNE

Oops—Back up on Ford's 385 cu. in. V8. We said last month that Ford would introduce it in their full size cars, next fall. Well, we jumped the gun. The engine is in the works, but the change-over required for tooling up such a high production item will delay it beyond the 1967 model introduction time. Ford insiders say it won't be available until 1968, but they're so excited about its lightweight design I'm betting it will be introduced early next Spring as a half-year model. Lincoln will use the same basic block but bore it out to 462 cubic inches—exactly the same displacement Lincoln now offers. The big Lincoln version is definitely set for 1968 models.

Chrysler Corp.'s new safe door handles . . . aren't. In fact, they are proving dangerous. They work all right, no trouble there. But taxicab drivers find that passengers are mistaking them for ashtrays, a potentially deadly error. In the dark, fares pull the handles out, thinking they are opening an ash tray cover. Pop! There goes the door. And—if the driver is turning a corner at the time—there goes his fare. Next time you ride a Chrysler Corp. cab ask the driver his reaction to the handles. And when you go to New York, check the door handles of Chrysler Corp. cabs. The little yellow sign says DOOR HANDLE. Now you know why it's there. Cab drivers say Chrysler is investigating, and probably will make a change for cabs only. In the family car, handles are safer; passengers are used to the new designs.

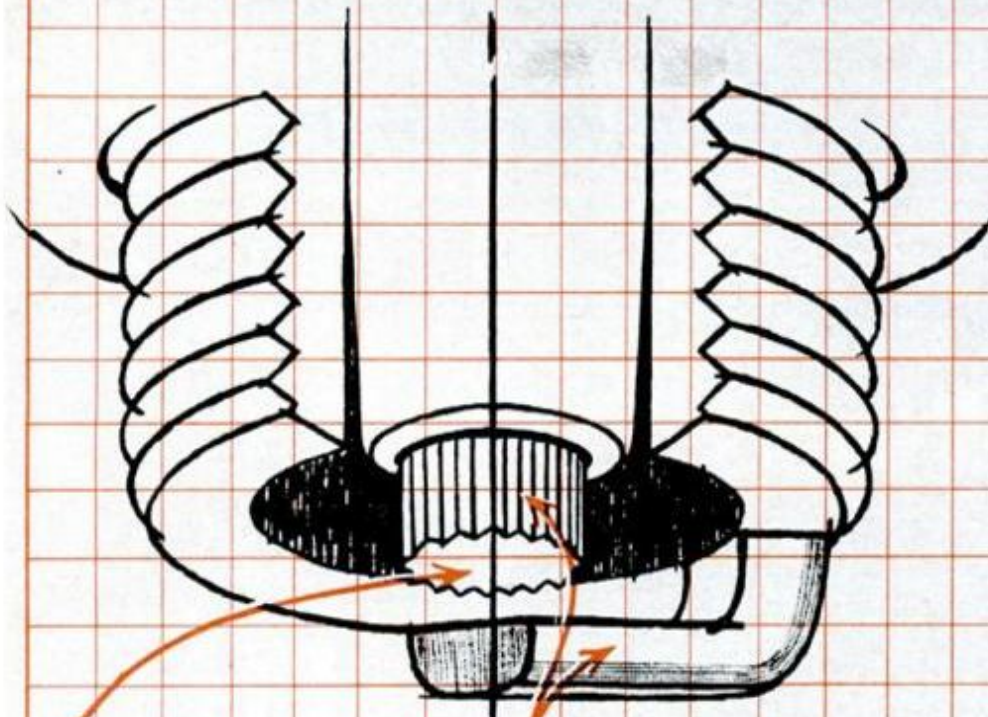
Turbine talk is revving up. No matter what the other automakers say, Chrysler is not the only company trying to put a turbine in a passenger car. Ford and Pontiac privately admit to turbine work aimed strictly for passenger car use. In each case, the passenger car turbine borrows heavily from the designs these companies have been working on for commercial and military vehicles. Ford's work of late has been concentrated on putting a turbine engine in a Thunderbird. The company uses a new model T-Bird body that looks no different from a production car. But the characteristic vacuum cleaner whine of the turbine wheel under the hood of the test car is unmistakable. So, even though Ford has not made a decision on a small turbine for cars, development and testing continue. Why a turbine in a T-Bird? It's all a matter of money. If the turbine is ever produced, it will cost a premium to own, and that makes it too expensive for low price car buyers.

Vehement denials from Buick follow all the talk of front-drive cars. Buick sent letters out to the press saying they are happy with the Riviera the way it is now, and that demand for the car is higher than ever. What the letters didn't say, but what they meant was: no front drive for Buick in the foreseeable future. Speculation first started on Buick's use of front drive about a year ago when it was learned that Olds' Toronado would share the same body with Riviera. At that time information was circulated that Buick was given first choice for bringing out a front-drive vehicle. But Buick decided to stick with the conventional drive setup in Riviera, and has not changed its mind since then—so they insist.

V12 engines for luxury cars has been under development for some time, though little has been said about it. Fantastic, you say? Hold on for just a minute. The V12 design has its backers. Engine designers are looking for a cost breakthrough. The present V8 has been refined well past the over-design point and any big improvements now produce minor benefits compared to the costs involved. That's why auto people are looking at turbines, rotary engines and V12s. The V12 offers smoothness you can't build into a V8, no question about that. It furnishes power at peak levels through a wider range of engine rpm, and that's a big plus. It doesn't take up much more room either, as long as cubic inches remain about the same. We don't know whether Cadillac

(Please turn to page 34)

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**FIRE-RING
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(Continued from page 32)

(which intends to introduce a front drive model next year—page 30, Feb. '66 PM) has a go-ahead on the V12 program yet. But we do know that Ford is planning such an engine for racing (Indianapolis?).

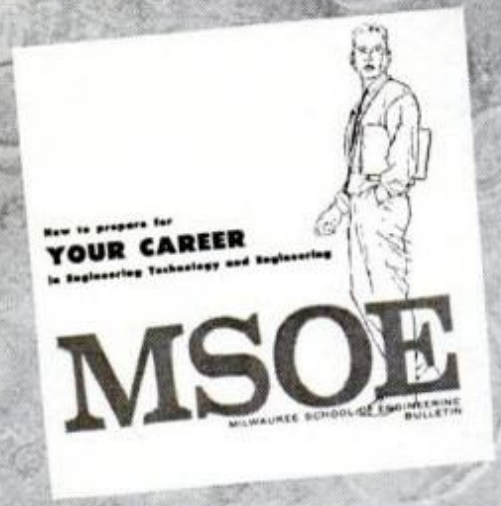
Ford's overhead-cam engine may or may not be acceptable to racing associations, but it will probably be available to the public in restricted numbers by this time next year. And the reason is not just to qualify it for stock car racing. Pontiac looms as a potent threat to Ford's monopoly of OHC V8s, and the word is that the Grand Prix will have one next year. The only holdback is the experience Pontiac had with its new OHC Six. Production problems with the Six delayed deliveries for months after last fall's introduction. What Pontiac engineers learned from that experience may cause them to be more cautious with the V8. Pontiac management was overruled by GM big brass on their proposed two-seat sports car, and they feel they should have something new to offer in their cars, and with their great sales record, they'll get it.

Chrysler's answer to Mustang, Panther, Cougar? Word around Detroit has it that Plymouth will concentrate on the Barracuda as its entry in the low-priced sports car field. Barracuda, under the proposed plan, will get radically different styling from the regular Valiant line, not just a new roof and grille. That way the Barracuda name will be retained in the Plymouth lineup.

No-vent front window design is being rushed by Ford for its 1967 Galaxie and Mercury big car line. Competition is forcing the move. GM got the jump on the rest of the industry this year by eliminating vent windows on Riviera and Toronado, and now it looks as though the big Caddys, Olds and Buick will get the same new treatment this fall. Ford's rush is to avoid being left behind in the high volume market. T-Bird, of course, will have no vent windows.

American Motors plans a new posh image. Their 1967 lineup of cars will go a long way toward changing that company's "economy" pitch. They are lower, longer, sleeker—more like the popular GM and Ford intermediate models. Styling is all new on the Ambassador and Classic series, the bread and butter cars of AM's future. Company bigwigs, who got their first glimpse last December, exude confidence over the company's future. That image lag AM blames for its sales dive should be just a bad memory by this time next year, they hope.

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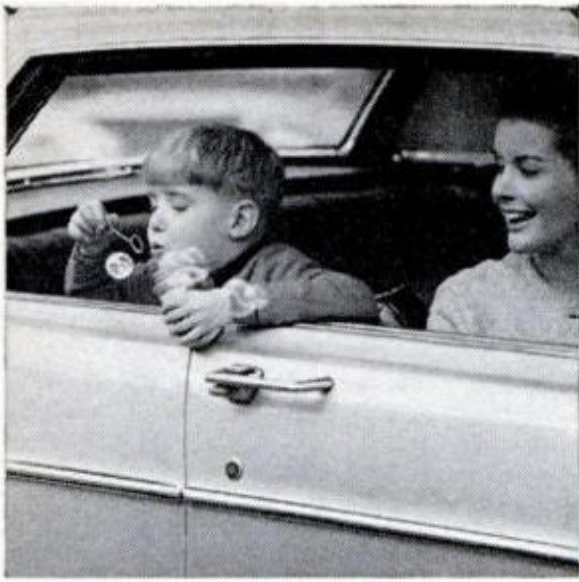
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NEWS FROM THE
MILITARY

BY WILLIAM R. KREH

Beer cans and GI ingenuity helped get an Air Force jet back into action in Vietnam. The plane, an RF-101, suffered flak damage that peppered one wing flap with fist-sized holes. Air Force mechanics didn't have enough metal of the proper thickness, so they used empty beer cans from their trash barrel. They cut out the tops and bottoms, straightened the cans and riveted them in place. The makeshift repair job enabled the plane to be flown to Taiwan for permanent repairs.

An **"ice suit"** may sound like a hockey player's uniform, but it's not—it's the Navy's name for a new sonar system which makes it safer for submarines to cruise under the polar ice cap. It consists of one sonar looking straight ahead, one looking ahead and up, one looking straight up and one straight down.

With this "suit," a submarine helmsman can know how far he is from the bottom and from the ice above. He can be warned of ice columns protruding down from the surface and he can find "polynyas"—areas of thin ice through which he can crack to surface his craft.

Slime time. Coastguardsmen often snatch buoys out of the water and clean them, but rarely have they saved the scrapings. But now five Coast Guard tenders operating out of New York City are carrying two-quart jars on their rounds, and the crews solemnly scrape into them the slime from the undersides of buoys. The scrapings, labeled with the buoy of origin, are sent to the science department of the Newark (N.J.) Museum, which is studying the effects of the amount of the salt in the water on certain kinds of marine organisms.

Junked cars by the hundreds are being dumped in the Mississippi River by Army engineers. The old cars are piled along four dikes jutting out into the river near Vicksburg, Miss., to help catch driftwood, debris, sand and sediment. As the muddy barrier builds up, water is diverted, thus deepening the river's main channel. At some dikes the engineers are using the bulk method of dumping the cars, while in other places, the cars are cabled together to form a vertical screen. A survey will later be made of the two methods to decide whether to use them in other areas.

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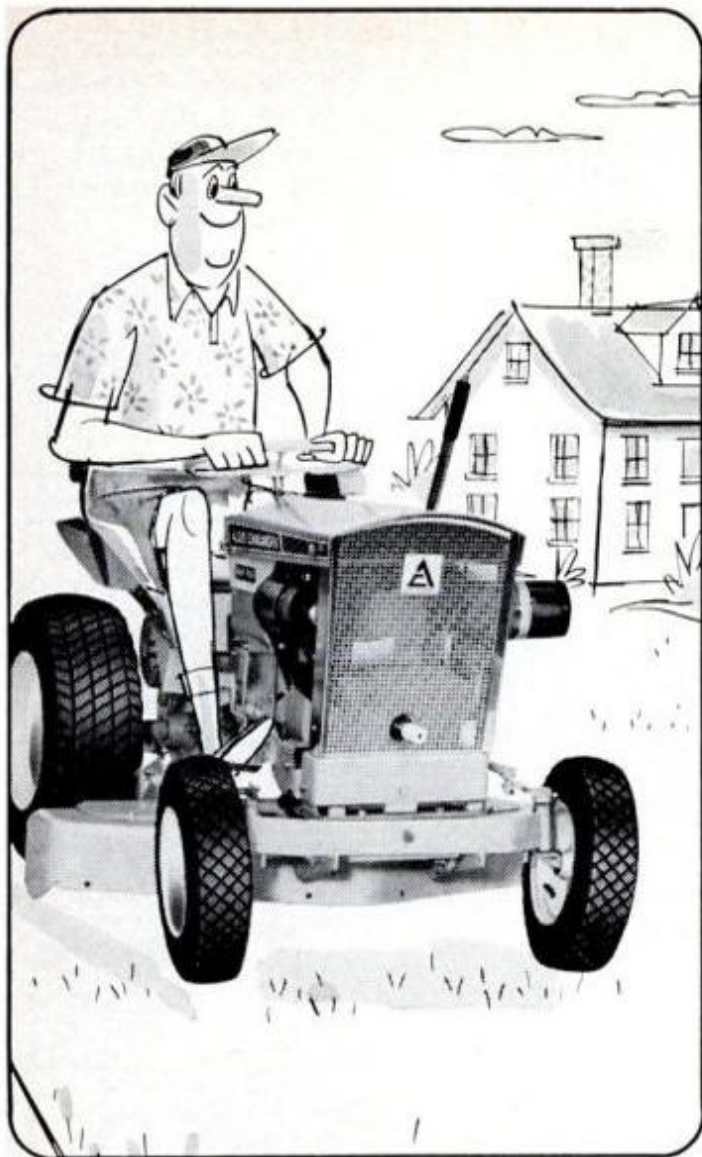
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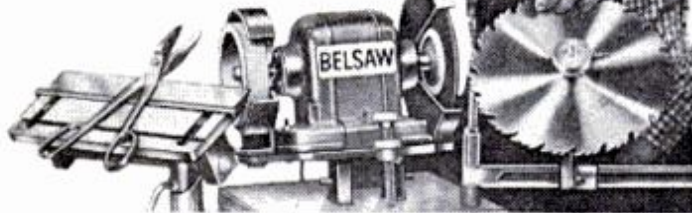
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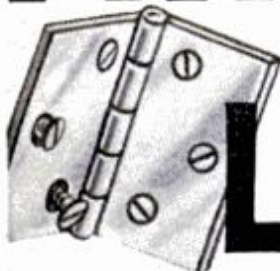
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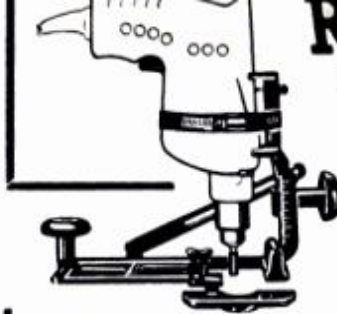
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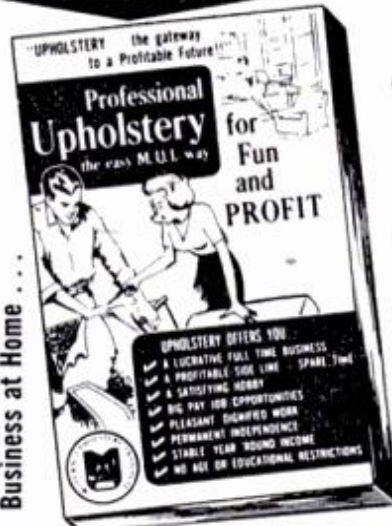


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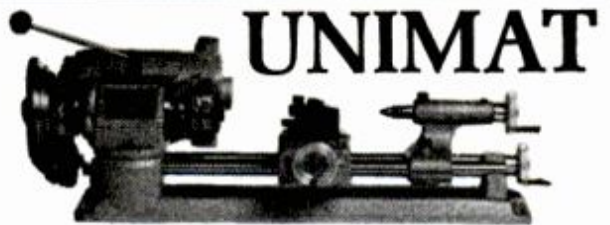
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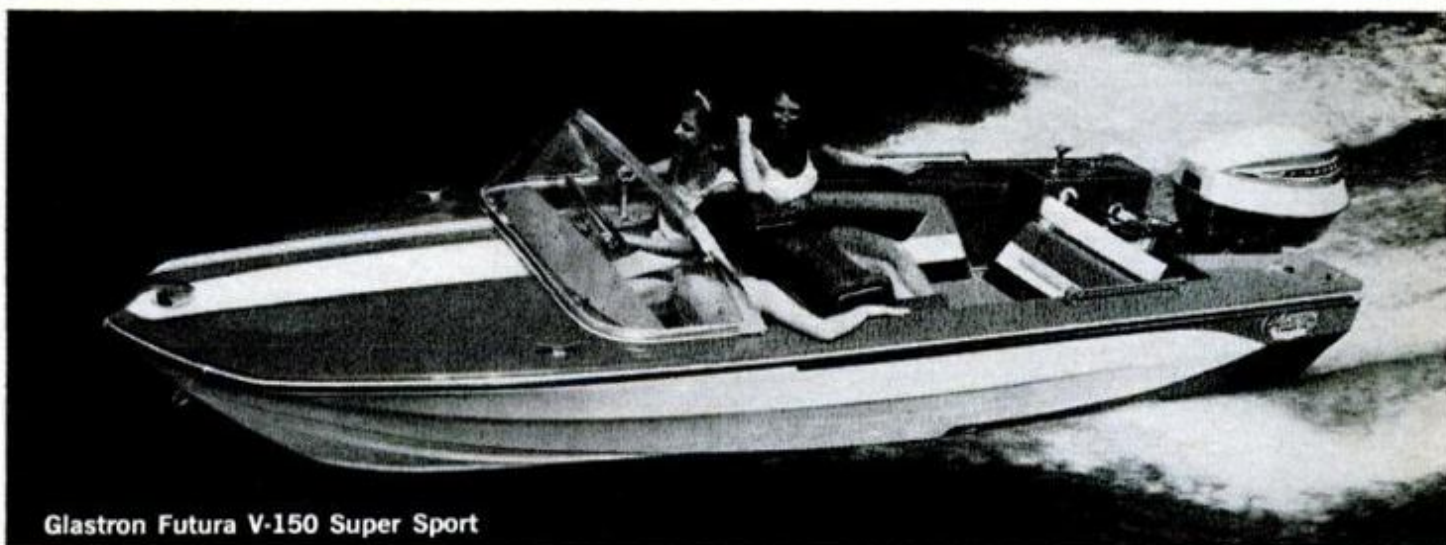
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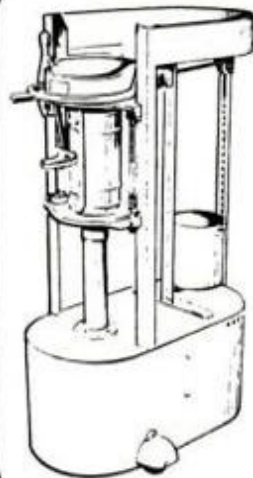
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PM Picks a Winner in its Suburba-Car Contest



▲ **The Prize**—The IIT-designed chassis featured on our November cover, complete with battery, Honda engine and tires—ready to drive away

The Judges—Decision in Detroit! L-R: Ford's Gene Bordinat; PM's design consultant, Frank Jacoby; Wayne Leckey; GM's Bill Mitchell

The Winner:

N. K. Niemi
5051 E. Eastwood Circle
Cincinnati, Ohio 45227

THE FLOW STARTED as soon as our November issue went into circulation with its contest announcement. Many of the earliest entries were impulsive sketches (often quite imaginative) from young readers. Some of these came in batches of 20 to 40, indicating that art and mechanical drawing instructors had assigned the contest as a class project. But as the December 20th deadline approached, entries became more and more sophisticated, and included many elaborate presentations complete with professional-looking color renderings and construction details. Many contestants even compiled thorough cost estimates. And although submission of a model was not required, we got 40—made of balsa, paper, leather, plaster, or carved blocks.

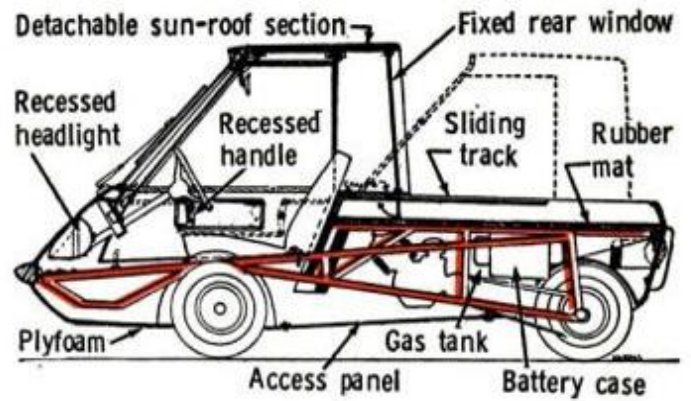
By Christmas, the Shop and Crafts offices were heaped high with entries of every size and shape, swelling to a total of 1262 separate envelopes mailing tubes, packets, cartons and crates. Postmarks ranged across all 50 states (with heaviest

concentration in California) and ten foreign countries, from Nicaragua to Turkey (with nearly forty from France alone).

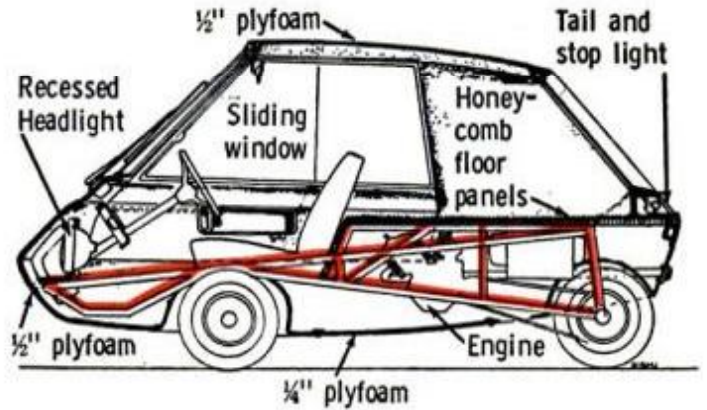
The final days of '65 were painful ones for the editors who tackled the initial winnowing. In long hours of preliminary judging, worthy designs had to be discarded because of their similarity to others that were more thoroughly worked out or because they were impractical to build. Finally, the entries were narrowed down to 25 which were flown to Detroit for final judging by the vice president in charge of design at GM and Ford—the two men who pretty much determine what most cars on the road look like (see photo above).

The winning entry consists of three variations of a basic design, and PM will be eager to see which Mr. Niemi decides to build on the prize chassis that's now on its way to him. Complete plans for this chassis, along with photos of other top entries and names of the other 24 finalists, will appear next month.

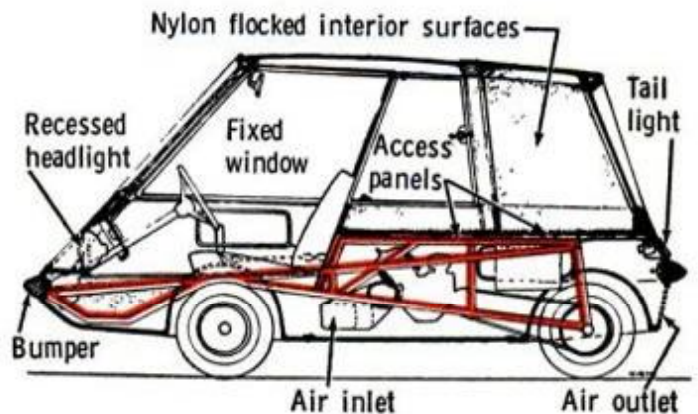
THE WINNING ENTRY



UTILITY VERSION features cab top that slides back and door that drops down for easy entry. Cab has fixed rear window, vinyl side curtains, detachable "sun roof" section. Bed of pick-up is covered with rubber mat, and recessed so you don't need tailgate. Note air intake.



SPORT VERSION alters shape to form two-seat pod of fibreglassed Plyfoam. Entry doors now are hinged, with rear half of window fixed, front half sliding in track for ventilation. Interior is nylon flocked, with carpet on generous platform for hauling groceries and packages.



COMMUTER VERSION returns to first profile, but adds panel-back to create compact station wagon. Note roll bar incorporated into Plyfoam shell. Forward roof is covered with vinyl. Fixed side window swings with door, has vent behind it. Air outlet is through rear louvers.

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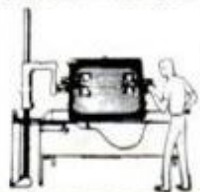


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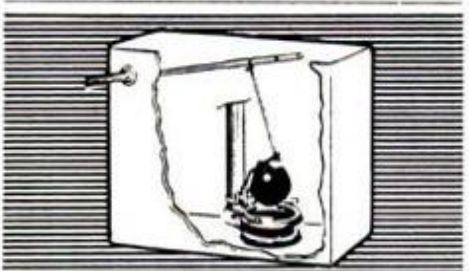


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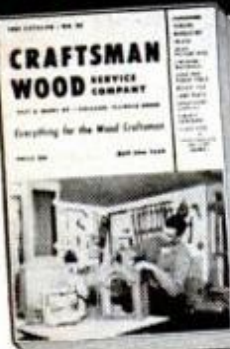
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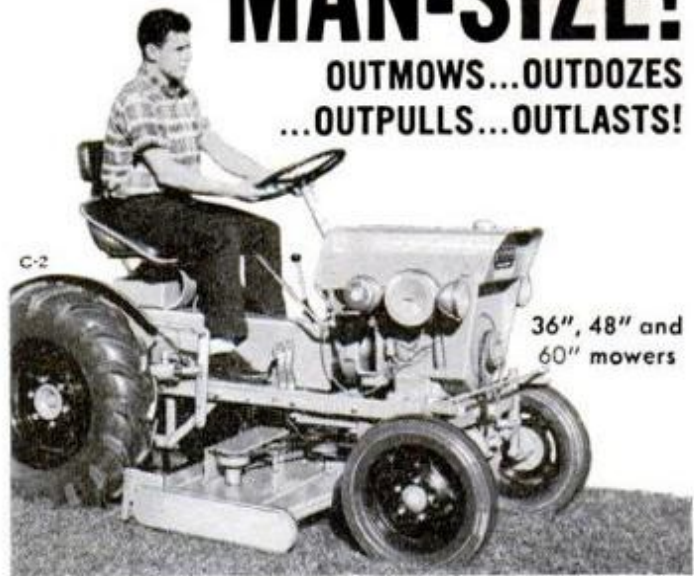
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BY CREIGHTON PEET

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The biggest demand is for A & P mechanics—which means airframe and powerplane maintenance men. Every airline has its own mechanics in every airport of any size, and at the big repair and overhaul bases such as those in Kansas City, Tulsa and San Francisco, hundreds of men earn from around \$3.20 to \$3.52 an

hour, with inspectors coming close to \$3.75. Men working for foreign airlines in the United States usually get \$4 or more, but chances of promotion are poor.

On the other hand, promotion chances for smart A & P men working for a domestic airline are good. They can become supervisors on the job and move up into office and executive posts. Salaries here run from around \$600 to \$1,000 a month. Another thing is that maintenance crews are on duty 24 hours a day, 7 days a week, and there is often an 18-cents-per-hour wage differential, so pay can add up.

An aircraft mechanic is a very important man. He can't do a half-good job. For this reason the Federal Aviation Agency conducts written and oral examinations to make sure a mechanic knows his stuff before he gets a mechanic's certificate in either airframe or powerplant work. These exams are practical. Before a man can take them he must show either

JOB TITLE	CURRENT NATIONAL		STATES WITH HIGHEST DEMAND					
	DEMAND	3-MONTH TREND						
Chemists, Biological	20	Slight drop	N.J. 7	Penn. 2	Ohio 2	Ill. 2	Minn. 2	
Chemists, Organic	47	Slight drop	N.J. 10	Penn. 3	Ala. 11	Minn. 3	Cal. 2	
Chemists, Inorganic	16	Demand doubled	N.Y. 5	Md. 1	N.C. 1	Penn. 1	Ohio 2	
Engineers, Metall.	61	Good increase	N.Y. 6	D.C. 5	S.C. 10	Ind. 6	Cal. 9	
Engineers, Civil	441	Some decline	Conn. 32	D.C. 67	Ohio 34	Cal. 69	Wash. 39	
Engrs. Elect. & Electron	1013	Good increase	Conn. 47	N.Y. 83	Md. 58	Fla. 125	Cal. 289	
Engineers, Industrial	410	Demand steady	Conn. 26	N.J. 31	Fla. 33	Ohio 58	Cal. 40	
Engineers, Mechanical	1272	Still booming	Conn. 67	Penn. 79	Ala. 90	Ohio 109	Cal. 211	
Engineers, Aero.	485	Some drop	Fla. 49	Ohio 41	Md. 60	Cal. 178	Wash. 120	
Engineers, Mining	12	Slight increase	D.C. 3	Penn. 3	Fla. 1	Co'o. 1	Cal. 2	
Natural Scientists	135	Good increase	N.Y. 6	D.C. 30	Ohio 5	Cal. 11	Wash. 51	
Draftsmen, Arch.	106	Some little drop	Mass. 7	Fla. 7	Ohio 30	Cal. 20	Wash. 9	
Draftsmen, Electrical	118	Some little drop	Mass. 9	Fla. 6	Ill. 5	Mo. 20	Cal. 67	
Draftsmen, Mechanical	264	Some little drop	Penn. 38	Ohio 40	Wis. 43	Cal. 47	Wash. 11	
Draftsmen, all other	331	Slight drop	Conn. 37	Mass. 38	Mo. 41	Cal. 69	Wash. 35	
Tool Designers	94	Slight drop	Conn. 6	Vt. 6	Ill. 13	Cal. 13	Wash. 30	
Lab. Tech. & Assistants	108	Very good increase	Mass. 7	N.Y. 10	Va. 11	Ky. 9	Ill. 6	
Sports Instr. & Officials	126	Very good increase	Maine 4	Vt. 40	Penn. 13	Mich. 32	Cal. 15	
Surveyors	18	Small drop	Conn. 3	Mass. 5	N.C. 2	Fla. 1	Ill. 1	
Techs. Eng'g & Phys. Sci.	642	Demand doubled	Ala. 78	Fla. 43	Ohio 121	Cal. 123	Wash. 183	
Tool Planners	31	Demand tripled	N.Y. 3	Ohio 20	Ind. 7	Iowa 1	—	
Systems Engineers	24	Demand steady	N.Y. 4	N.C. 1	Ill. 4	Ind. 2	Mo. 10	
Programmers	362	Very good increase	N.J. 48	D.C. 15	Ohio 19	Cal. 118	Wash. 80	
Systems Analysts	77	Some little drop	Conn. 5	N.J. 19	N.Y. 7	Cal. 14	Wash. 8	
Inspectors Pub. Service	8	Some little drop	Md. 1	Cal. 2	Wash. 5	—	—	

PM's Career Barometer Chart, above, gives the actual number of men currently needed for specific jobs. "Current Demand" figures are true as of our closing date. Check this chart each month and it will tell you where your talents are needed, and how badly. For names of actual employers represented by these listings, contact the state employment agency in the cap-

ital city of the state indicated. Mention that you saw this in **POPULAR MECHANICS**.

Today, with proper schooling, you can qualify for many of the job categories shown. For a list of accredited correspondence and residence schools, write to **POPULAR MECHANICS' Information Bureau, 575 Lexington Ave., N.Y. 10022**.

a graduation certificate from a certified mechanics' school or documentary evidence he has had at least 18 months of practical experience with the procedures, materials and tools used in the rating he's applying for (either airframe or powerplant). To take the exams for both ratings, he must have had 30 months of actual experience "concurrently performing both airframe and powerplant duties."

While a man can work as a mechanic in an airline shop without a certificate, everything he does must be double checked by a certificated mechanic.

There are, in continental United States and Hawaii 69 certified mechanic schools recognized by the FAA. Circular No. 147-2 listing these schools can be had free from the FAA, Distribution Section H Q-438, Washington, D.C. 20553. In a few big cities, such as New York and Chicago, there are free city high schools which provide acceptable preparation, but enrollment in most of these schools is not easy and only residents are eligible.

The many private schools in all parts of the country charge around \$400 per trimester (15 weeks) for full-time instruction in a wide range of technical subjects. Some of these schools also have courses in aviation management and airport management. To get a job as a mechanic with an airline you must be over 18 and have completed your military requirement.

An A & P certificate doesn't mark the end of training. Airlines have training departments. Foremen and supervisors are sent regularly to factory schools to learn about modifications on models of existing airliners.

How to start pilot training

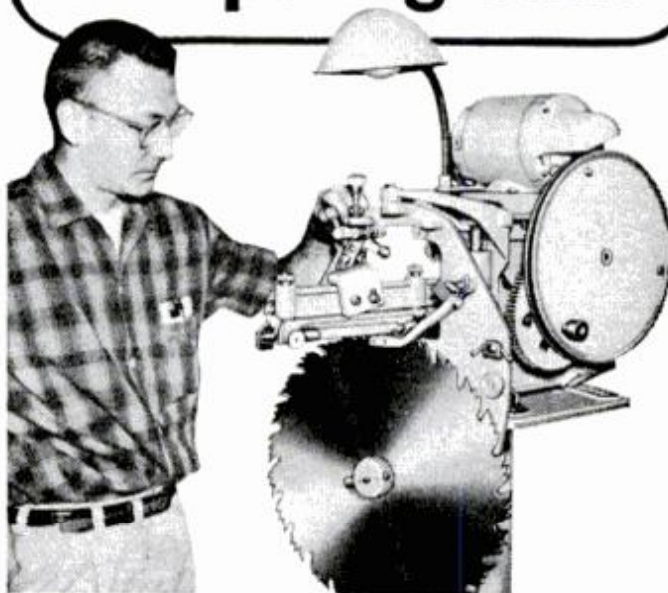
Getting to be a pilot is more complicated, although the airlines suggest the best way for a young fellow to get into this work is to join a small local flying club, trading maintenance work for flying instruction. This helps to meet one of the primary requirements for most airlines—500 hours of flying time. A college education or a certain amount of military flying experience are also necessary. All airlines use the Stanine test to determine whether a man is fitted to be a pilot. The FAA also issues several types of pilot certificates, needed before a man can fly.

Deutsch & Shea, Inc., which keeps track of the volume of job advertising for engineers and technical people in newspapers and trade magazines, reports that on their index, the demand this last November was 8.6 points higher than for October, and 84.1 points above Nov. 1964. Further, indications are there will be a still higher demand this year. ★★★

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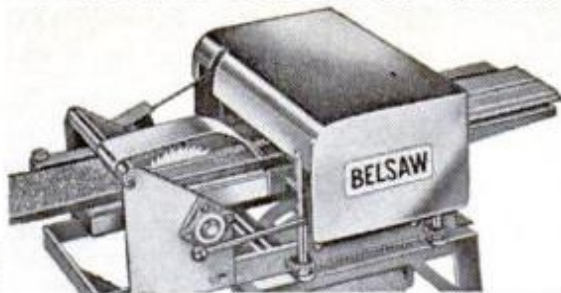
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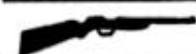
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HAVE Successful, home mailorder business! Celebrated professional tells "How!" Gain independence, security. Live better! Exciting details Free! Unicis, Box 735-PE, Norwalk, Conn. 06852.

SEASHELLS. Shellcraft and jewelry supplies. Wholesale catalog 25¢, refunded first order. Our 32nd year. Florida Supply House, Box 847M, Bradenton, Fla.

CIGARETTES—Make 20 plain or filter-tip for 10¢. Facts free. Moberly, Box 922, Owensboro, Kentucky.

EARN Big commissions full or part time. Show America's largest line low priced business printing and advertising specialties plus big catalog union label political advertising items. Calendars in season. Big free sales kit samples hundreds items used daily by businessmen and political candidates. Merchandise bonuses for you. Free gifts for customers. Build profitable repeat business. Start now. National Press, Dept. 147, North Chicago, Ill.

FREE. 206 Easy ways to make money taking orders for exciting new products—spare time. Send name, age for 5 months free subscription Opportunity Magazine, 850 N. Dearborn, Dept. 17-AM, Chicago.

QUICK Money by mail working with us. Details free. Worldwide, 694 Kerr St., Columbus, Ohio.

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TURN Spare time into cash. Complete plan, \$2.00. Details, 10¢. C & H, Box 5037D, Santa Ana, California 92704.

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MASTER Watchmaking at home. Free sample lesson. Chicago School, Dept. YBA, Fox River Grove, Illinois 60021.

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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.

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I MADE \$50 day in my Ad Market. Helped launch others. Free details. Ad Market, Harlingen 4, Texas.

EXCITING Way to cash in on your ideas. Details free. Bobrow, 75 Ocean Avenue, Brooklyn, N. Y. 11225.

MAKE Money zip-coding mailing lists at home. Information free. Automated Mail, Dept. 123, Stamford, Connecticut 06904.

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MAKE Extra money in your spare time by making old shoes look like new. Easy method of recovering. Send \$1.00 for complete instructions to HSS, Box 81, Dayton View Station, Dayton, Ohio 45406.

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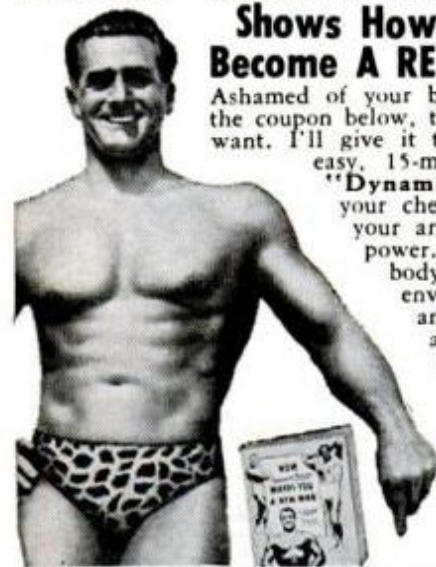
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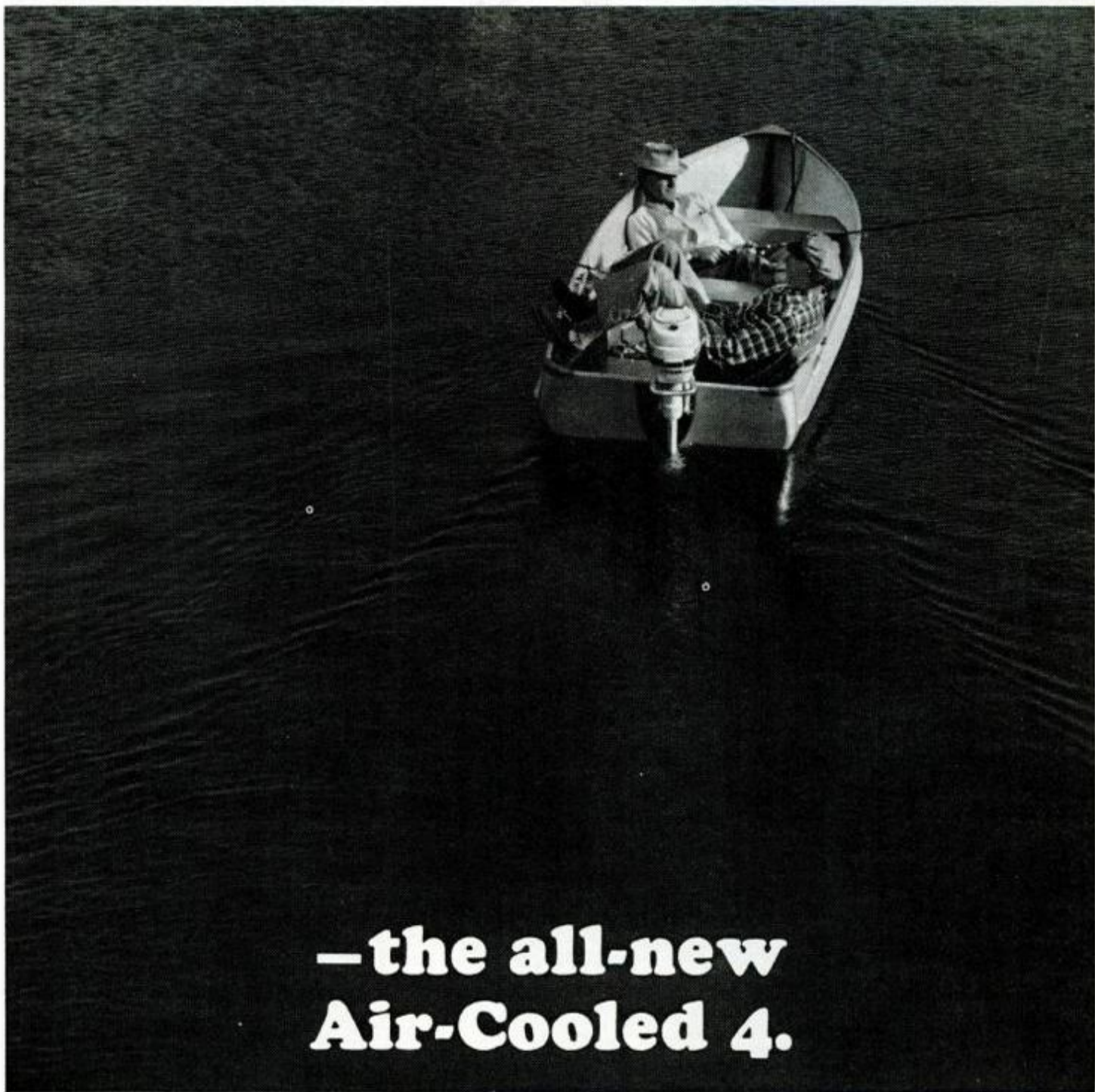
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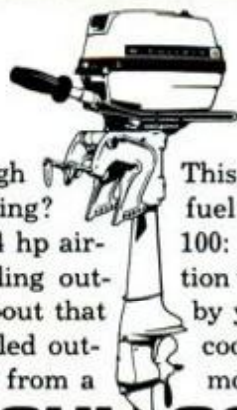
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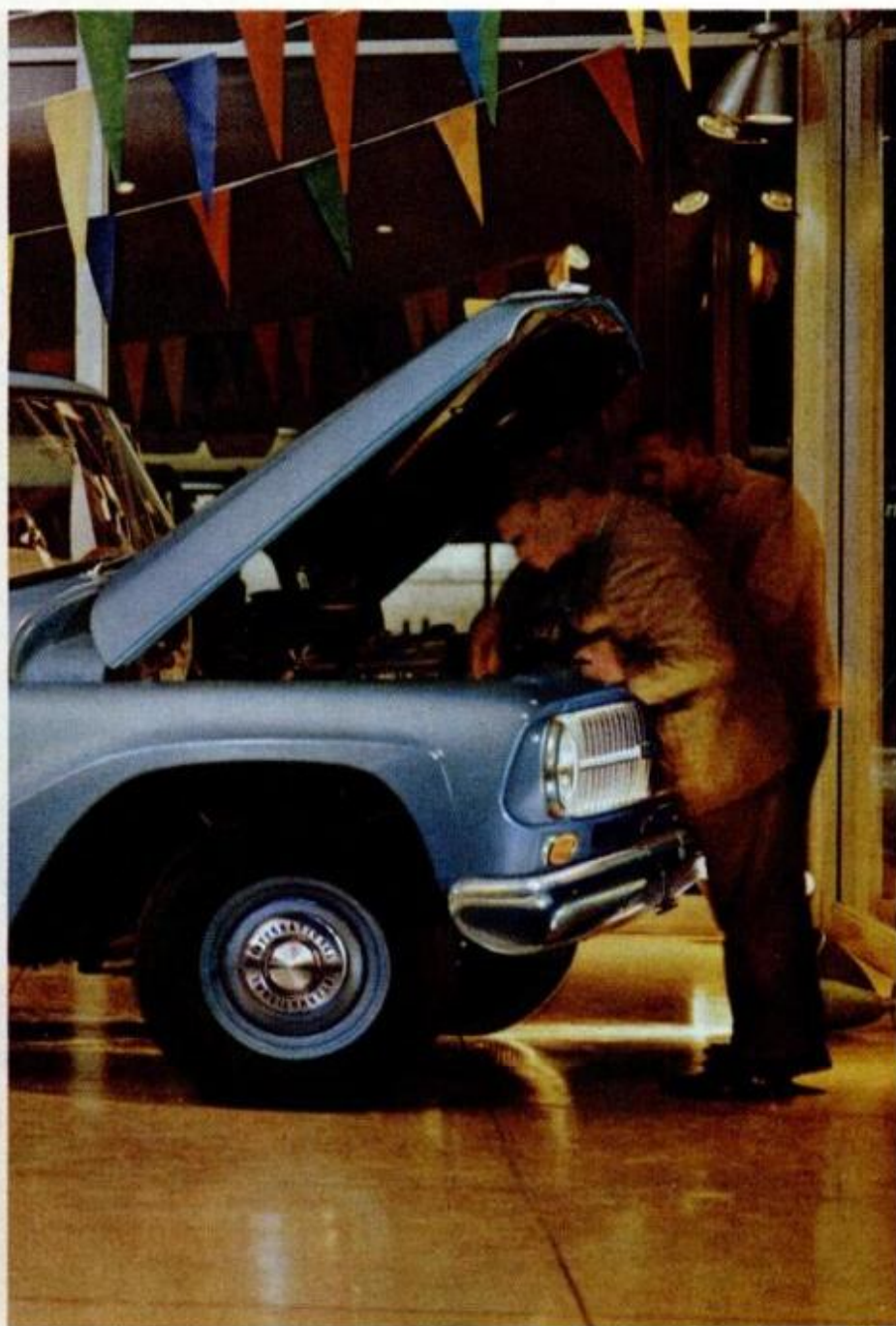


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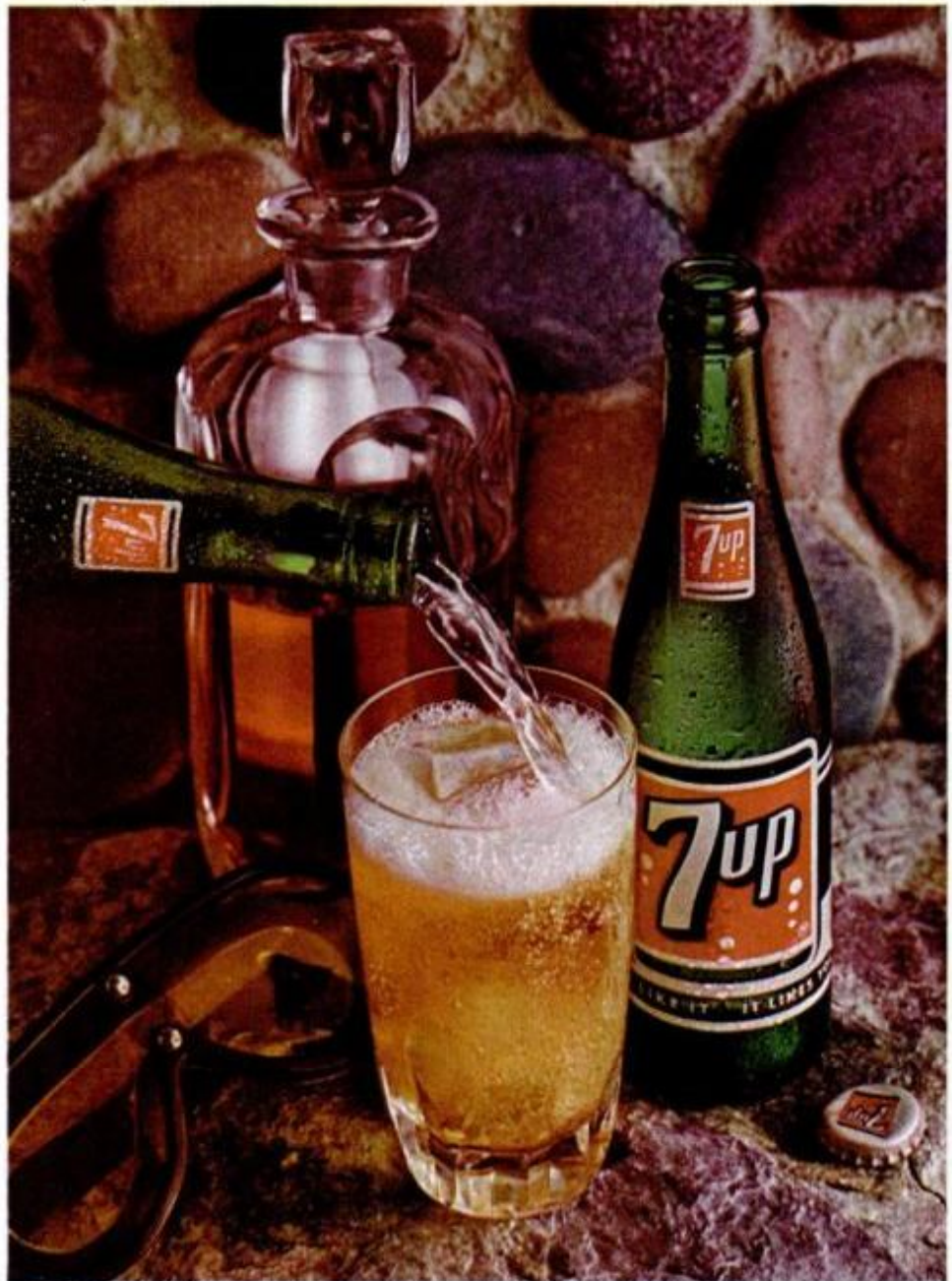
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EDITOR'S PAGE

Our Suburbia-Car avalanche, which should have subsided after the Dec. 20 deadline for entries, was still tumbling down the mail chute on Jan. 14, when this page went to press. All told, 1,262 readers had submitted body designs for the chassis; everything from professionally drafted blueprints to freehand con-

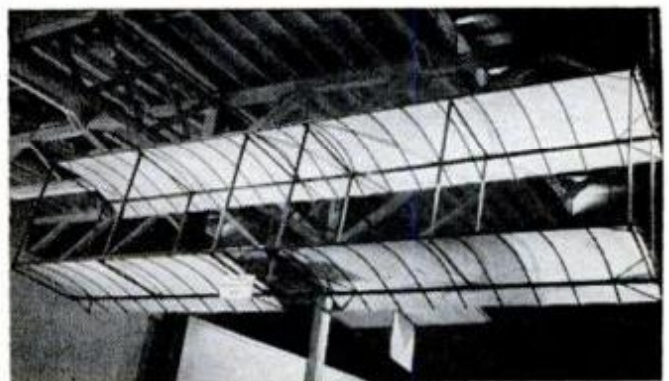


cepts in crayon on brown wrapping paper! More than 40 precisely executed models lined the tables and shelves in the Crafts Department. The outcome of it all is detailed on page 56 of this issue—all except for Crafts Editor Wayne Leckey. He's still "outcoming" from under the debris.

Where did the smoke come from which issued from the stack of the backyard "Tootle" on our 1965 August cover? We're still getting queries on it. Cliff Hicks, our midwest editor who handled the project, explains as follows: "A pan of hot water was placed in the milk-strainer stack and a piece of dry ice was dropped into it. Result: real cool smoke."

Good projects never die. They wind up on monuments and in museums. Recently, John E. Boykin, whose photos appear regularly on these pages, was hiking along Albatross and Maple Sts. in San Diego when he saw a monument he hadn't noticed before. The plaque, dedicated to Waldo Waterman and "The Early Birds" (an organization of aviation pioneers), marked the 50th anniversary of Waterman's first flight down a canyon at this spot on July 1, 1909. Boykin, his professional nose sniffing story scent, went hunting for Waterman and he soon located the 71-year-old gentleman (right). It was a good story. Mr. Waterman's memorable

flight was made, it developed, at the age of 15. "I flew down the slopes of that San Diego canyon," he told John, "in a glider I built from plans in Popular Mechanics (PM, April, 1909—Ed.). It was the first flight in the San Diego area of a manned heavier-than-air machine. The youth of America were thrilled with the idea of flying . . . This how-to article in PM was an outlet for myself and hundreds of other adventurous young men. The article did much to insure the future of aviation in America. Most of the Early Birds got their first taste of flying in this home-built glider." Waterman, amazingly vigorous and active, still holds and uses the oldest commercial flying license in the country. He's just built a reproduction of a 1911 Curtiss pusher, named Bluebird, which he flies at Early Bird meets and special occasions. It's the latest in a long line of exotic Waterman-built craft. He built and flew the first tricycle-landing-gear flying wing in 1932. Another creation of his boasted variable dihedral. He designed and built six "Arrow-biles"—flying machines that converted to automobiles. He produced a flying boat of his own design and one of the first small air-cooled aircraft engines. A number of his creations have ended up in national air museums—including two of his PM gliders, like the one shown below.



Electronic eyes are

The government now has a tax
that's quick to spot frauds as

IN ATLANTA, a brash citizen who filed 17 federal income tax returns for refunds was arrested by T-men for his criminal impudence. In Newark, N.J., a frantic taxpayer called his local Internal Revenue Service office: "Please, is it too late to change my returns—I clean forgot to include my dividends." And in Wilmington, Del., a mechanic was amazed to receive a \$44 check from the government for overpayment on his taxes that he hadn't figured he deserved.

What these people had in common was exposure to the fantastic revolutionary operation called ADP (Automatic Data Processing) by which the IRS is making

sure you're law-abiding or get what's legitimately coming to you in refunds. It's hailed as an "epic adventure" opening a new era in tax collecting. For you, it's the moment of fiscal truth as you buckle down this month for your annual agonizing ritual of making out your tax returns.

Our IRS has the formidable job each year of processing a half-billion pieces of paper like yours and converting them into \$12.2 billion in revenue. Now it's mostly done through computers, magnetic tape and sundry other hardware. Automatically, chiselers are trapped, inadvertent errors and omissions discovered, arithmetic verified, vulnerable returns spotted for



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watching your tax returns

collector you can't fool—a big computer system well as honest mistakes. Here's how it works.

By THEODORE IRWIN

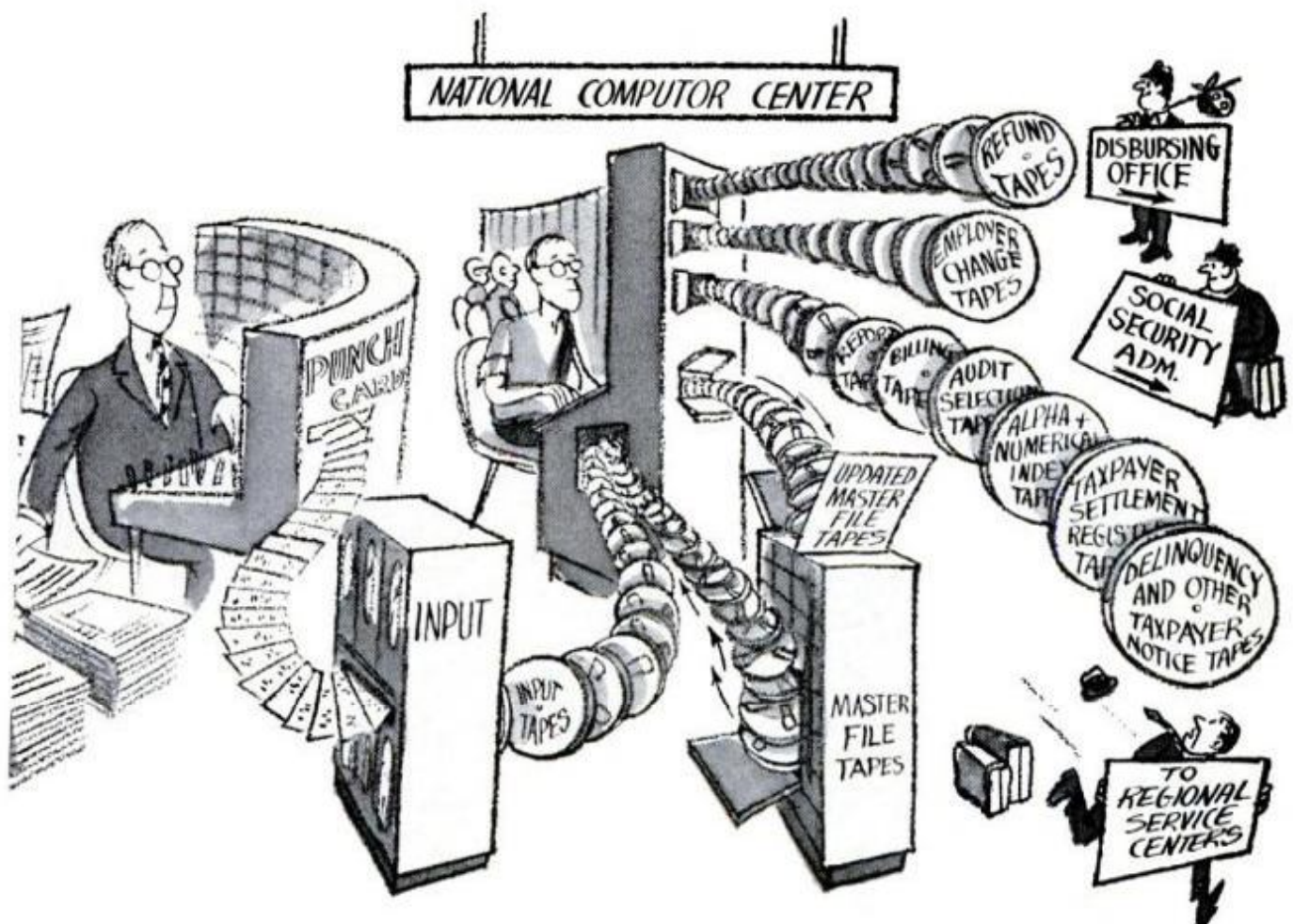
audit and your current tax status determined by pushbutton in a few minutes. Big Brother ADP has its multiple electronic eyes on you.

Want to know how it affects you personally? Curious how your moonlighting income is known to IRS or whether you'll be tapped for an audit? Stay with me as we tackle the nationwide interlocking jigsaw puzzle of ADP.

First, a quick overview. In most areas, you mail your tortured document to your local District Office (one of 58 in the nation). Here, all that generally happens is that the envelope is opened, your name and address examined for legibility and

your payment deposited. Your return then goes to the regional Service Center (there are seven of them) where it undergoes a variety of mechanical massages, ending up as a half-inch on magnetic tape. This tape is shipped to the National Computer Center in Martinsburg, W.Va., to be posted to your master file. An output tape from Martinsburg, showing your tax standing, shoots back to the Service Center, which may send you a bill or notice, ominous or otherwise.

The big action, I was told, is in the Service Centers. For a hard look at the guts of the system, I undertook a safari in the mechanized jungles of the now



fully automated Philadelphia Service Center, which serves—or cleans out—26 million citizens in the Middle Atlantic Region (N.J., Pa., Del., Md., Va. and the District of Columbia).

Sprawling in the midst of placid meadows on the outskirts of Philadelphia, the tax-processing plant is about the size of four football fields. To the uninitiated, your return seems to be kicked around like a football in the whirring and clacking labyrinths. Besides machines, some 2600 humans (mostly female) inhabit the plant at the season's peak, working day, night and graveyard shifts.

Start with the cavernous Control and Services Department, which receives batches of returns from the districts. Here, they're coded, edited and "perfected" by human brain and hands—deft examiners or analysts. On marital status, for example, they jot down code "1" for single, "2" for joint return, "3" for marital filing separately. Glancing through the returns for completeness and accuracy, the coders make sure that figures on page 1 are substantiated by those on page 2, that Schedule B is attached if indicated, and so on.

If your late return is accepted, you're marked "R," meaning reasonable cause. If not, a programmed computer will figure out the penalty and interest. Taxpayers offer some ingenious excuses. One wrote that making out his return "made

me sick." Another said he was "under the influence of tranquilizers." Among the letters sometimes attached to returns was this message: "I understand that President Johnson has declared war on poverty. Where do I surrender?"

The coding completed, your return starts going through the ADP gauntlet. Key-punch operators at IBM 24s transcribe the coded return to punch cards. The cards move to data processing, where computers "sense" the 80 holes, converting the tax information to magnetic tape. Mistakes discovered by the computer are listed on error registers, then forwarded to an error resolution branch for correction.

To a benighted taxpayer like myself, the stuff on tape was gobbledygook, like "MFT," "OBL" and "yymm." I did learn that "Entity Freeze" had nothing to do with refrigeration; it means that the return was waiting for more dope about the citizen's name and Social Security number. "MFT," not at all mighty fine tobacco, stands for master file tax; "OBL," for outstanding balance list—what you owe. I still haven't discovered what's meant by "yymm"; probably a gremlin in the tape.

Reels of tape, each with information from some 200,000 punch cards, are sent to Martinsburg, which has been collecting tax information from all over the nation for its master files on businesses and individuals. By law, all companies paying dividends and wages, and banks paying interest, must report their payments. These and millions of other "transactions" end up at the National Computer Center, the hub of ADP.

So the tape of your tax return is pumped into, or posted to, your updated master file. Softly whirring, a computer searches its electronic memory to cross-check your financial holdings, earnings and deductions, then prints out acceptance or rejection of your return. Business and individual files are cross-referred. If you "neglected" to include some income or "forgot" to file a return, the master file will holler foul.





Martinsburg is where Uncle Sam can catch tax-dodgers like the woman who kept stocks in her maiden name, omitting her dividend income when she and her husband filed a joint return. Now she'd be caught by her Social Security or identity number, which companies must include in reporting dividend payments.

The Martinsburg computers also produce output tapes, showing what you owe (if anything), whether a refund is due you, or if there's any discrepancy or odd characteristic about your returns. For indexes of returns and payments there's a device called Digiprint, which reads information directly from tape onto a microfilm print at the rate of 1½ million lines an hour. These microfilms are sent to Philadelphia and other Service Centers for answering taxpayers' "how come?"

Letters pouring out of Philadelphia elicit some surprising responses. One taxpayer, who noted the sale of a second-hand truck, received a letter asking him to "advise the disposition of the vehicle." His reply: "If this truck had a disposition, it was mean and ornery."

Answering another inquiry letter, a tavern owner insisted that the expenses of running his car were a legitimate business deduction. "How else," he asked, "can I get the drunks home?"

Without such interruptions, the entire processing of an average return, from the day it's dropped into a mailbox, takes four to six weeks.

You won't get cleared promptly if you're a Problem. You're a common Problem, for instance, if you don't supply full information or you're one of the 350,000

in the Middle Atlantic Region who puts down a wrong Social Security number. Your number is validated against the Social Security Administration tape at Martinsburg. If your name and number don't match, you'll certainly be hearing from IRS. I was told of one truckdriver who had his Social Security number carefully tattooed on his arm so he'd never, never lose it. Turned out he'd given the tattoo artist one wrong digit.

Seeing double

Currently, I heard about the case of two women in New Jersey who have the same name and identical Social Security numbers. Who is getting credit for what and who is paying whose taxes? Wheels are turning in Philadelphia, Martinsburg and Baltimore, the Social Security headquarters. So far, the mystery hasn't been solved. A very, very rare situation, I was assured.

Far more frequently, taxpayers are too tired to sign their returns. Remember, you can't get a refund without your signature; IRS only sends back your papers for your John Hancock. To avoid another delay, don't forget to attach your W-2 form to your returns.

You'll be happy to learn that all those IRS machines occasionally have a heart of gold. Many people entitled to credits don't include them in their returns or otherwise fail to take full advantage of their legal rights. Some forget their pensions, others overlook prior year credits, loss carry-overs or extra allowance for



the aged. Computers pick these up and credit the taxpayer.

At least half a million people entitled to refunds move each year without leaving a forwarding address. The computers' memory credits them on the master file in Martinsburg. If you've used the wrong tax table in figuring what you owe (such as "head of family" instead of "joint husband-wife") the kindly machines tell which is cheaper for you and IRS notifies you how you can save money.

Maybe you expect a \$100 refund but to your puzzled delight you get a check for \$120. You sit tight. A few days later, you'll probably receive a "computer's notice" explaining the windfall. Thousands of such cases occur every year.

What are your chances of being audited—called in for an examination? Last year, 3,000,000 returns—about 4 percent—were tapped. Under ADP, machines now have built-in audit criteria, what IRS would like to scrutinize in a return that could be off base. These criteria are decided by the audit division in Washington on the basis of what's apt to give the most yield. Among the criteria covered are entertainment expenses, real estate taxes, contributions, gross income dependents and travel expenses.

Machines reveal who has gone too far in deductions, which returns are out of line. What drops out in the screening are "potential audits" and perhaps one out of three of these taxpayers will be actually called in. By the end of this year (1966), *every* return in the U.S. will be checked by machine for a potential audit.

Don't forget to remember

In specific situations, ADP is alert to catch the forgetful and the fraud. Suppose you hold down two jobs but report income from only one. Remember, your employers have to file W-2s (wage documents) with IRS. Those W-2s go to Martinsburg, where they're posted to your master file. A tape comes back to Philadelphia (or other Service Center) saying that you failed to mention one income. Out goes a bill to you, including interest at 6 percent. A further slap on the wrist is that thereafter you may become a good customer for IRS, to be audited each year.

The same goes for stock dividends and bank interest, reported by companies and

banks. The Atlanta Service Center alone has thus far chalked up over \$8,500,000 in increased revenue from mathematical verifications, amended and delinquent returns.

Let's say you didn't file any return last year. The Service Center receives a tape from Martinsburg, which has matched up '65 returns to '64s. You're delinquent, so expect a letter from Uncle Sam.

Think you can get away with not reporting cash rent you receive on an upstairs apartment in your house? One too-smart taxpayer was caught when he deducted for depreciation on his house—which isn't admissible unless there's an income from it. Otherwise you could be picked up on your net worth. A classic case is the citizen with a \$80,000 home, two Cadillacs and a reported income of only \$7000—a particularly glaring target for an audit to be authorized.

Overdoing the dependents

Such "abnormal patterns" are familiar to IRS. A man with a wife and two kids, earning \$3,500 a year, who says he's the chief support of two parents in another home, apparently can't afford those dependents on his income.

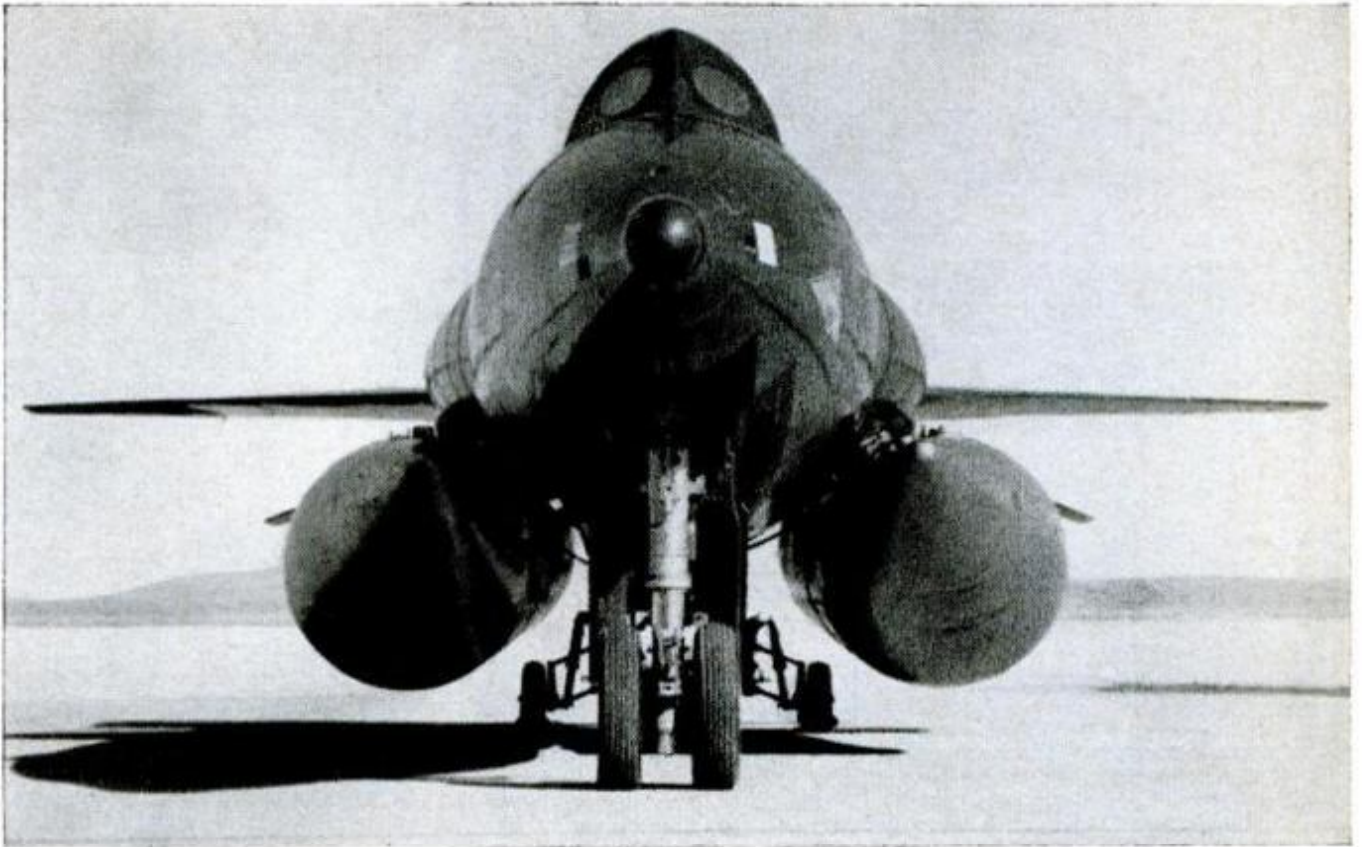
On deductions for sales taxes, there's criteria for a family of four based on income; go off the beam, claim too much, show an abnormal pattern and you'll be clobbered.

Of course, ADP is not infallible. You go out to a business lunch, the other fellow picks up the \$22 tab but you report the \$22 as your own entertainment expense. ADP can't tell you've cheated unless you're audited for other glaring or suspicious deductions. Then IRS may check with your companion to see who actually paid for the lunch.

On tips to waiters and cabbies, IRS may use the net worth criteria but generally Uncle Sam's attitude is, "Let your conscience be your guide." Farm income is also hard to pin down. And IRS is fully aware of such characters as band leaders who pay a musician \$50 a night but give him a W-2 for only \$25.

Details like potential audit criteria are still being refined as ADP moves toward completing the gigantic job of national coverage. As of January 1 of this year (1966), five of the regional Service Cen-

(Please turn to page 232)



5000-mph aircraft. The X-15 will try to set new speed records by adding external fuel tanks, shown here. Tanks will give it full minute more burning time and get speed up above 5000-mph mark. Tanks will be jettisoned and dropped by parachute.



Bomb buster. No toy, this miniature tank is used by Montreal police to investigate and dispose of any potentially dangerous package by remote control while the operator keeps a safe distance. It can move up close, relay any ticking sounds to the operator's headset, take Polaroid pictures and return to the operator, or pick up the package and transport it to an unhabitated area for disposal. Wet-cell motorcycle batteries power the four motors—two to drive the vehicle and two to operate the arm mechanism.



Weekend refrigerator. Designed for boats, a refrigerator keeps ice cubes and frozen food for 48 hours without power. It uses the eutectic principle of storing a "charge of cold" that is released when it is disconnected from outside power. General Thermetics, Farmingdale, New York.

Feedback from the

Yes, it is quiet, say the owners. And ranking even higher in the best-liked features are Ford's handling, ride and styling



QUIETNESS, HANDLING, RIDE: Washboard roads quickly prove the three top-ranked features of the big Ford. But after 544,000 owner-driven miles, poor workmanship and low gas mileage were biggest gripes

FORD'S SALES TALK for the past couple of years has it that its 1966 Galaxie is quieter than the most expensive cars on the road. Quieter than a Rolls Royce. And Ford owners agree.

The Ford owners we polled for their reactions to the 1966 Galaxie named the quietness of the ride as the best-liked feature. Almost four out of ten favored it. These owners speak from the experience of driving new Fords more than 544,000 miles. They report from all over the United States.

Their responses show that the Ford is far quieter than it was last year when only 22 percent praised quietness. Next best liked are ride (36.5 percent), handling (36.0 percent), and styling (29.8 percent) which incidentally remain in the same order as they were last year, but collectively drop down one notch.

Ford's noisy ads about quietness for the past couple of years have made

Ford Pros

An estimator from Westmont, Ill., describes his favorable reaction to the Ford just like they say it in the ads. "It's quieter than a Rolls Royce, great trunk space." Not fresh and original, but it tells the story. Other owners were more precise.

"Rides beautifully. Plenty of room inside, and not a noise or rattle in it."—New Jersey bus driver.

He's obviously unmarried.

"Well insulated from engine compartment. No engine noise."—Connecticut research engineer.

"It has less road noise than any car in its class."—Ohio farmer.

Some drivers confuse quietness with smoothness of ride, but most were savvy enough to spot the difference.

"Ford has excellent roadability. Stable at 60-70 mph."—Illinois engineer.

"Just a small amount of effort is required to drive at normal speeds."—Virginia foreman.

"Ride is comfortable, like that of a heavy car."—Maine contractor.

You call 3500 pounds light?

(Please turn to page 226)

owners: 1966 Galaxie

Biggest gripe among Ford owners is workmanship. Next, they complain about gas mileage and location of the ashtray



INSTRUMENT PANEL LAYOUT boosted interior design to fifth best feature, ashtray was third least-liked



FLATNESS OF FORD RIDE is apparent in this turning maneuver. Popularity of wagon tailgate startling

customers hear things in their cars that they never heard before. This year, Ford engineers had to give the heater blower and windshield wipers extra attention. Their muted noises were even further muffled, as the buyers' reactions confirm.

Biggest gripe among Ford owners was poor workmanship. Many said dealers didn't catch bugs before delivery. Next was gas mileage (almost one out of eight expected better), jumping that complaint from the sixth most common last year to almost the top spot this year. Actually, gas consumption was about the same as last year's 13 mpg in the city, 16 on trips and an overall average of 14.2. Ford feels the need for more economy. This year's 7 Litre engine—as an example—has compromised high horsepower for economy. It is interesting to note that Ford drivers' gas consumption is almost identical to that reported by Chevrolet owners this year; but the Chevy owners don't seem to mind as much.

Ford Gripes

Some of the complaints were right to the point.

"Ford doesn't make a car that is economical or efficient enough."—Virginia engineer.

"Possibly a thorough tuneup would improve gas mileage."—Maryland engineer.

On a new car?

Other complaints were more elaborate.

"My car was delivered to me in terrible condition. The fuel line broke twice and the rear wheel was out of circumference one inch. That caused a terrific vibration.

They had to align the front end, put in a new drive shaft and also new rear shock absorbers. Their advertisement on a quiet ride is a big joke."—Iowa contractor.

"Glove compartment required pry to open. While washing car I cut my finger on piece of chrome that was loose and had a sharp edge. The car also leaks when it rains."—New Hampshire homemaker.

"Parking light lenses fog up, doors don't align properly, bumpers were replaced because of stains from poor plating and the new ones have similar stains, the hood

(Please turn to page 226)

Feedback from the

Best feature of the car is its handling, say the owners. Next qualities listed on the happy side are its styling and ride



AIRBORNE OVER ROUGH BACK ROADS, our test car remained stable and well insulated from harshness. This year, shocks are changed internally and angled differently, and frame members are heftier, more rigid

RIDE, STYLE AND HANDLING—those are the features Chevy owners say they like best in their 1966 models. Last year styling rated Number One; this year it slipped to third place in early returns—then crept to a scant second.

What this signifies is *not* that Chevy owners like this year's styling less—but that they are exhibiting a remarkable astuteness in picking up the factory changes on the '66s. On certain models in the full size line, frame, suspension and shock absorbers were modified this year to produce a softer, yet more stable ride. This makes for a solid feel in maneuvering situations, especially on corners, and a surprising number of owners spotted it.

Impala Pros

"It's easy to handle. No sway with the wind or on curves."—New Jersey chef.

"Stable on ice; pulls through snow well."—North Dakota engineer.

"Big-car feel."—South Carolina salesman.

"Perfect styling."—Delaware factory worker.

He may be prejudiced. He works for GM.

"I've had more compliments on this car's sharp looks than any of my previous 12 Chevies."—Connecticut salesman.

"Nice roof line."—South Carolina superintendent.

He's talking about the 2-door hardtop.

"I like the coil-spring ride."—West Virginia shipper.

Chevies are big cars, so you can expect a good number of compliments on interior roominess and comfort. This feature was the fourth best liked, up from seventh spot last year. Power and performance ranked fifth. A surprise was the praise heaped on the bucket seats by nearly 10 percent of the owners. Here's how the comments go:

"I rode in both the Ford and the Chev. The comfort was in the Chev."—New Hampshire salesman.

"Like the way you sit up."—Ohio welder.

(Please turn to page 230)

owners: 1966 Impala

Poor rear-window visibility brought the most cries of dismay. Next in the dislikes were carburetor troubles and wind noise



JUST 1.5 PERCENT PRAISED TRUNK, though roomy, easy to load. Boy and dog found it comfortable



GOOD SEAT ADJUSTMENT gives just-right legroom for either Mutt or Jeff. Instruments are easy to read

On the minus side, almost 14 percent of the owners had some gripe about the condition of the car on delivery. Specific complaints came under the heading of workmanship—a category involving many small annoyances: poor door fit, missing screws on the dashboard, poor dealer preparation and misalignment of body parts.

A rash of squawks came from under the hood; one out of ten owners who listed such complaints griped about the carburetor and other fuel mixture components.

Here, with comments by the editor, are the remarks of Chevrolet owners after 637,578 miles of personal driving:

Impala Gripes

Chevy owners were most vehement about poor rear-window visibility (in sedans as well as hardtops).

"The rear window is too high for me to see my rear fenders. This makes it hard to park or back up."—Maine insurance agent.

"There is a blind spot between the rear and side windows."—Montana teacher.

The stylists won this round over the safety engineers.

Next came carburetor troubles and that old bugaboo: wind noise.

"I had a hesitation in acceleration that was corrected by replacement of the

carburetor pump."—Maryland salesman.

"I've had trouble with my automatic choke. I'd like to see it changed."—North Carolina manager.

"Vent windows make too much noise in any position. They can't even be cracked open."—Illinois truck driver.

With cars getting quieter, even a zephyr can begin to sound like a hurricane.

"Side mirror noise is as if window leaked air."—West Virginia storekeeper.

Poor fit of doors and windows got enough mentions to rate its own fourth-place category among gripes. And next came overall sloppy workmanship. Some

(Please turn to page 230)

what's your

Are you a fishing expert? Do you trust to pure luck, or do you really know what you're doing? With the help of veteran fisherman, Dick Kotis, we worked up some typical fishing situations to test your know-how. How would you fish them?



It is a warm spring day. You are fishing from a boat in a quiet lagoon. There are two partially submerged logs where fish could be lurking. The water temperature is in the low 60s. The sun is dropping behind the horizon. What type of lure would you use to fish these logs and how would you use it?

1

partially submerged logs where fish could be lurking. The water temperature is in the low 60s.

The sun is dropping behind the horizon. What type of lure would you use to fish these logs and how would you use it?



It is early morning. The sun has just come up and there is not a breath of air moving. You are in a very quiet lagoon that is filled with lily pads. You are in a boat and you are facing the sun in the east. How would you fish this lagoon for largemouth bass and what type of lure would you try first?

2

You are in a very quiet lagoon that is filled with lily pads. You are in a boat and you are facing the sun in the east. How would you fish this lagoon for largemouth bass and what type of lure would you try first?



It is the month of April and it has been an unusually cool month, and the water is still cold. You are drifting down a rapidly flowing stream in a canoe and you're fishing for trout. You are approaching a rocky point that juts out into the stream. How would you fish this projecting point?

3

rapidly flowing stream in a canoe and you're fishing for trout. You are approaching a rocky point that juts out into the stream. How would you fish this projecting point?

fishing IQ?

Got your answers down? Okay, now you can pit your skill against a panel of recognized experts. We gave the same test to two dozen fishermen who test lures for a major manufacturer, and you'll find the majority answers on page 210.

You are fishing for bass and decide to try an area where a steep bank plunges into deep water. It has been very cold. The water temperature is in the high 40s and the day is dark and overcast. How would you fish the steep bank, what type of lure would you use and what would its color be?

4



You are wading a swift-running narrow stream fishing for brook trout and come upon a huge boulder in the middle of the stream. The weather has been warm and it is late afternoon. A hatch of millers has just started to break the surface. How would you fish the area surrounding the boulder?

5



You are in a skiff, fishing a long lagoon where there are a number of moored boats and docks and quite a bit of boat traffic. The day is warm, the water temperature is in the middle 60s, it is the middle of the afternoon and there is a slight breeze. How would you fish this area and with what lure?

6



The new Miss B!

Ron has a new girl this season, a 3-ton rear-engine beauty with sophisticated curves and a 170-mph yen to be '66 champion

By RON MUSSON, world champion driver, unlimited hydroplanes

UNLIMITED HYDROPLANES are the world's fastest and largest competition powerboats, and this year I'm driving a brand-new one of radical design.

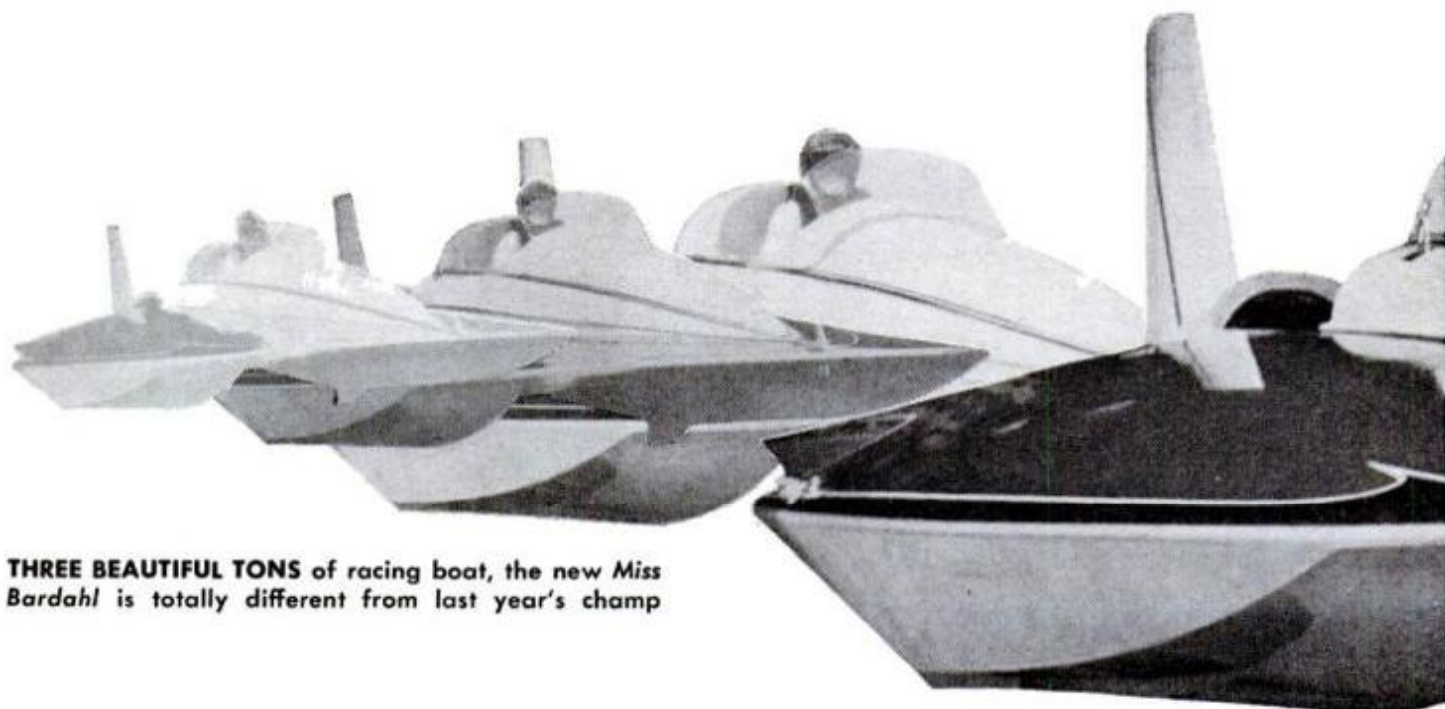
Some people think the new *Miss Bardahl* is too far out, too extreme. I disagree. In its first trials on Lake Washington early this year the boat felt smooth and sure. Since then I've been working it up to faster and faster speeds.

This is a sport that's full of contradictions. The unlimiteds are the elite of racing, yet it's a brutal, punishing sport that's hard on the drivers and even harder on their boats. Last year the existing *Miss Bardahl* won \$47,875 in prize money, yet we spent close to twice that amount to win the purses. For a powerplant we use a sturdy, reliable Rolls Royce engine that weighs a full ton, yet we run it so close to the ragged edge that we usually change engines after two heats, say about every 30 miles of competition. An unlimited charges down the straight-away at upwards of 170 mph, comparable to the top speeds at Indianapolis, and yet we average no more than 110-115 mph around an oval three-mile course.

That last sentence spells out the reason for the new boat. The old *Miss Bardahl* won the Gold Cup and the national championship for the last three years in a row, yet like all other conventional unlimiteds her speed drops to around 90 mph in a turn. We wanted a boat that could go through a turn at 100 mph or more.

To get it, Ole Bardahl commissioned Ron Jones to design the world's fastest unlimited hydroplane. Ron is the son of the brilliant Ted Jones who designed the famous *Slo-mo-shun* unlimiteds, and Ron has taken up where his father left off.

The new hull is designed to go into a turn faster without mushing down and to come out of the turn faster. It's also designed not to "kite"—that is, if the nose rises up, the tail should rise also. Otherwise the boat could flip over on its back or begin a porpoising motion that could end in a nose-first dive that would



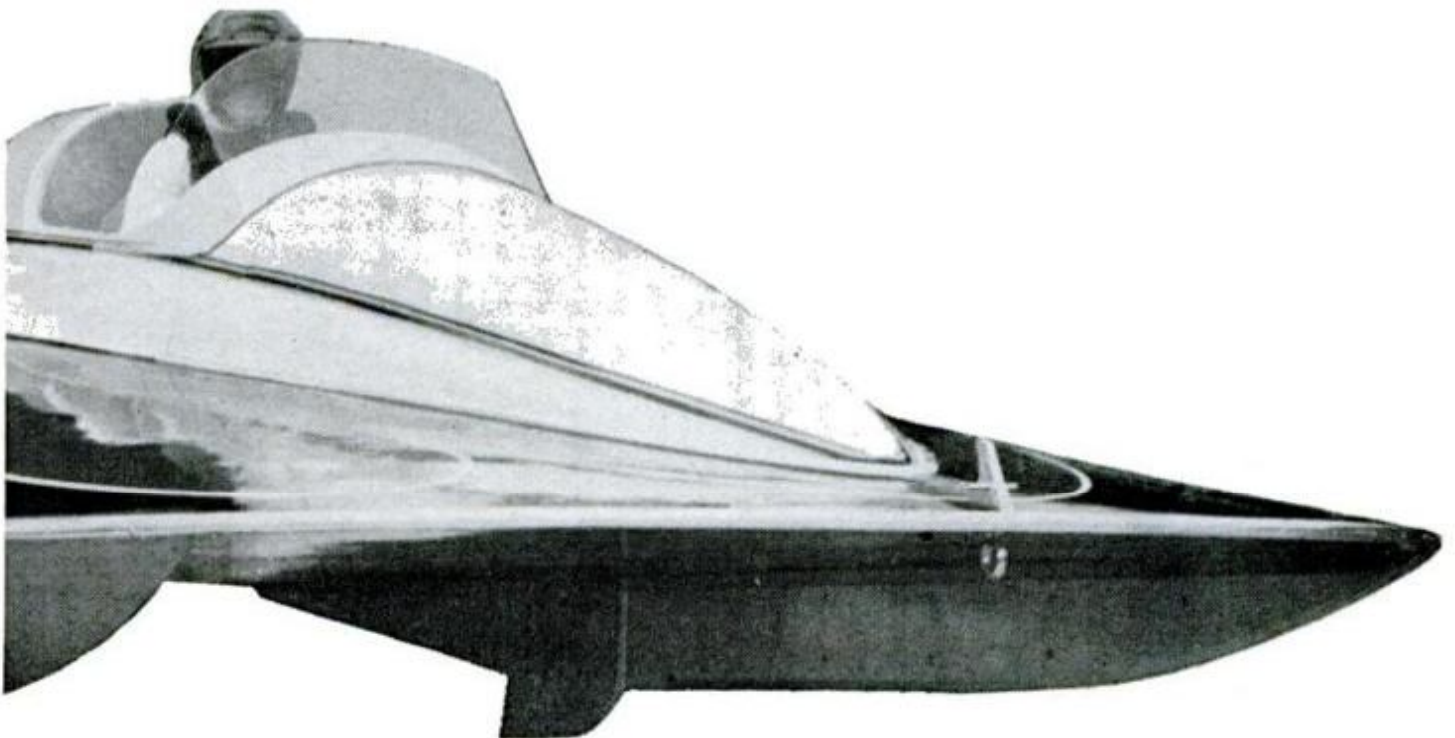
THREE BEAUTIFUL TONS of racing boat, the new *Miss Bardahl* is totally different from last year's champ



BIG ROLLS engine is swung into place for installation. It'll be covered with a streamlined canopy



OLD MISS B, national unlimited champion for the last three years, had engine up front and exposed





WEARING HIS TRADEMARK, a fluorescent red helmet, Ron Musson poses in the cockpit of new boat. Driving uniform includes flameproof suit, lifejacket

shatter it into matchsticks. (Driving technique comes into this, too. If I back off the throttle too fast, the tail could dig in and the nose rise. We'd be airborne.)

To obtain this paragon (and we don't know that we have it yet) Ron Jones blended a great deal of hydrodynamic and aerodynamic design into a boat that is 32 feet long and weighs over three tons.

The biggest change that he made was to move the engine aft where it can sit lower in the hull. This allows a lower profile and it also lowers the center of gravity, which all by itself allows faster speeds in the turns. Most of the other changes were made simply to keep the boat fast and stable in spite of the changed engine location.

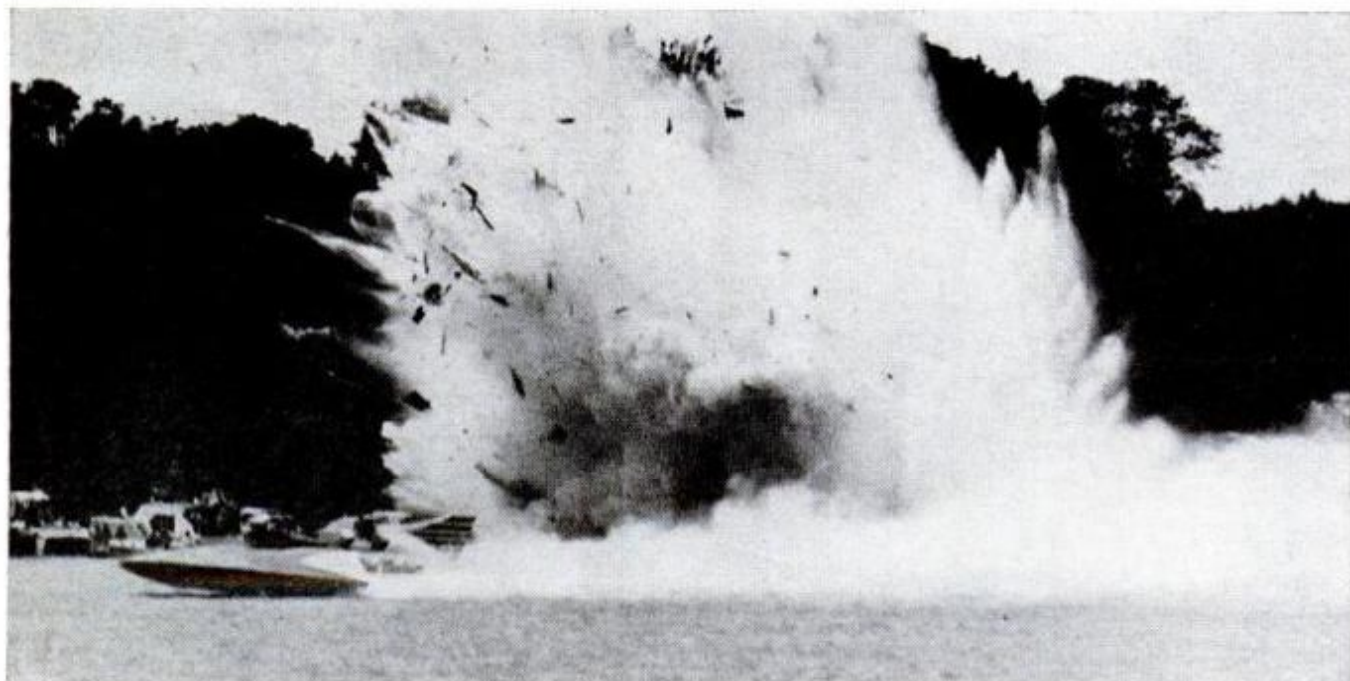
The deck is curved fore and aft, and from side to side, to create maximum aerodynamic lift. The cowling that houses the cockpit and the engine, similarly, starts at the nose and extends all the way back to the vertical stabilizer, to provide a clean air flow and contribute to lift. The afterplane (the portion of the hull that extends aft of the sponsons) is widened to nine feet to increase the lift.

In most unlimiteds the vertical stabilizer or air fin creates quite a bit of drag. For our new boat, Jim Raisbeck, a Seattle aerodynamicist, made use of a NASA airfoil section to design a stabilizer of minimum drag.

The outboard sponsons of a hydroplane are deeper than the rest of the hull. In effect they create a tunnel, and the air that flows through this tunnel helps lift the hull up out of water. The flat bottom of the new boat is rockered just a bit at about the halfway point to help retain this air under the afterplane.

The engine is placed so far back that for the first time in unlimited racing we are using a V-drive. The engine drives a gear box located just behind the cockpit, and the propeller shaft extends aft from the gear box. The big gears and their housing weigh 350 pounds, and the gear box has its own self-contained oil supply and its own water-cooling system. These are vitally necessary, for the gears have a ratio of 1 to 3, and they turn the propeller shaft at up to 12,600 rpm.

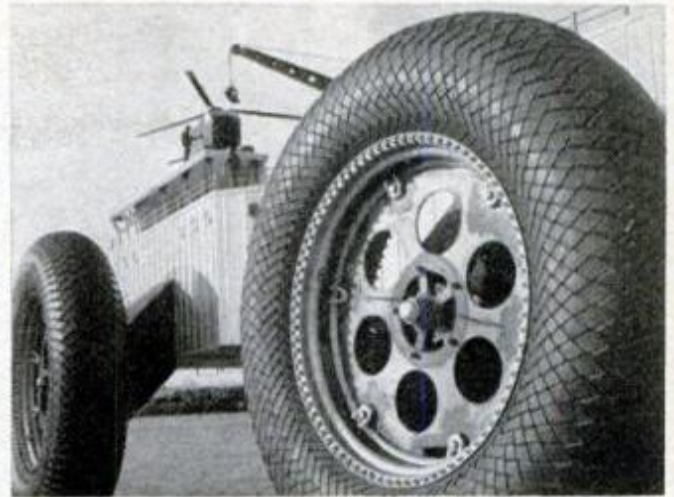
(Please turn to page 228)



UNLIMITED RACING can be spectacularly hazardous. This boat became airborne, then crashed and exploded



Joyriding swimmers and lifeguards may be towed at up to 5 mph by this motorized float called the "Polliwog." A small instrument panel contains recoil starter, throttle and choke. Steering is accomplished by leaning on handlebars into the desired direction. Priced at \$229, it is manufactured by La Habra Plastics Engineering Co., La Habra, Calif. 90631.



Engineers' dream. Tires 50 feet tall make practicable huge, building-size overland vehicles which could carry personnel, living and sleeping quarters and necessary equipment into remote areas for geological exploration. As developed by Goodyear, the technique involves making the tires in separate strips which are woven together at the site.



Water by the "bag." Hunters, fisherman and weekend cottagers may find extra convenience in this half-gallon paper package of spring water. The top of its sterile plastic lining is a pouring spout that closes when tucked in a cover slot. It's unharmed by freezing, according to the packagers, Glenwood-Inglewood Co., Glenwood at Thomas, Minneapolis, Minn.



From scale model to full size, this homespun craftsman is an expert at building and rebuilding spinning wheels

By WILLARD AND ELMA WALTNER

A MAN IN MASSACHUSETTS has a broken spinning wheel, a family heirloom, and he wants it repaired. In California a woman wants a new spinning wheel to spin wool from the hair of her angora rabbits and another woman in Missouri wants a machine built around a wheel and treadle, the sole remains of a treasured antique.

Like dozens of others, these people ultimately find their way to Freeman, S.D., and E. J. Waltner, an 82-year-old craftsman who is known as the "Doctor of Spinning Wheels."

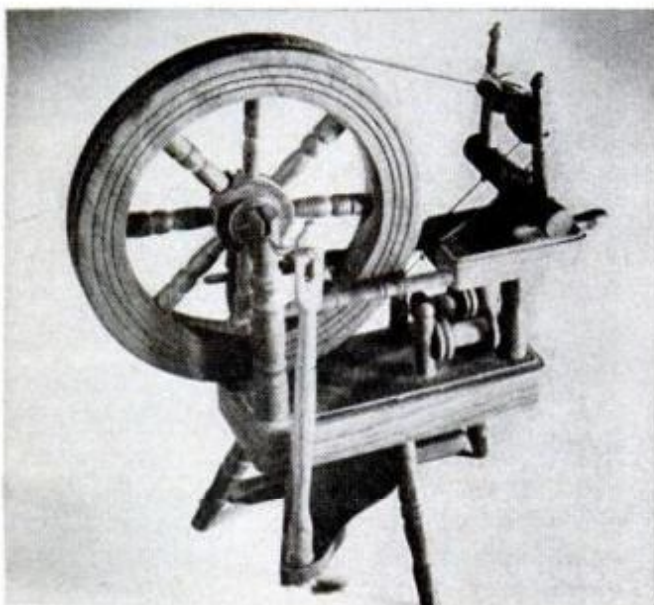
More a hobby than a profession, the construction of spinning wheels began for Waltner when he embarked on a project to handcraft a quarter-size working model of an original. That was 20 years ago, and since then he has become a master artist.

With the exception of the platform, pitman and treadle, the wooden parts of a spinning wheel—full size or miniature—are fashioned on a wood lathe.

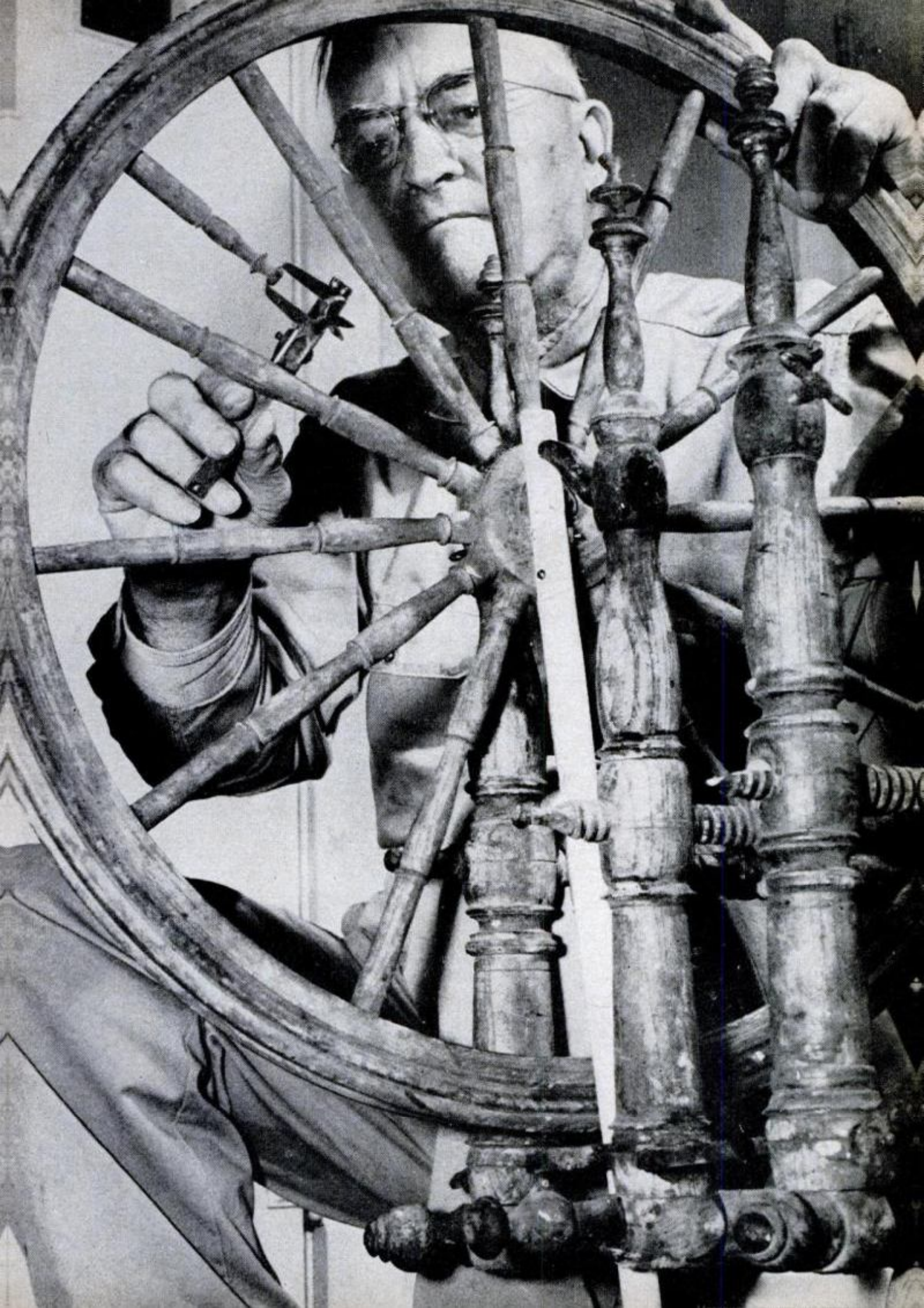
Precision is a crucial factor in the operation of a spinning wheel, and assembly of the parts—particularly the miniatures—is a painstaking task.

In most models the large wheel runs on the axle that hangs in slots in the two upright posts. The slightest difference in the depth of the slots will cant the axle and the wheel will bind, causing the string belts to run off their narrow tracks. A similar problem will develop if the grooves in the spools on which the belts run are not perfectly aligned with the belt recess in the wheel rim.

Duplicating parts which no longer exist is a problem in restoration, but when a



SCANDINAVIAN MODEL has a rack for holding spools, and all parts are parallel. E. J. Waltner (opposite) takes a measurement on a decorative spoke in preparation for a completely authentic restoration





DOCTOR DISPLAYS the offspring with the parent, a quarter-size detailed reproduction of the Russian flax wheel that was used by Waltner's grandmother



TRACING A TREADLE, Waltner works on a double-wheel model. This rare antique was just junk when it arrived at the "clinic" for a complete rebuilding



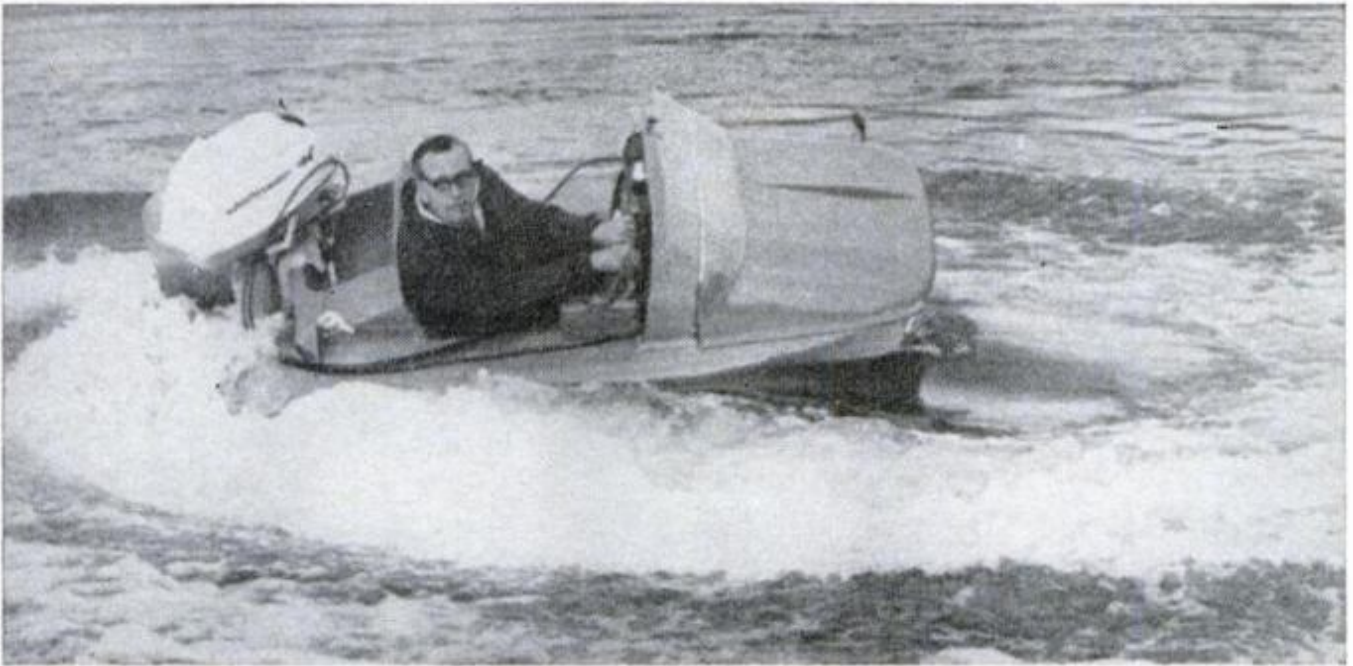
DEVOTION TO DETAIL is a major factor in creating a scale model where all the parts and fittings must be fashioned by hand to a fraction of an inch

miniature is involved, the solutions require uncanny ingenuity. Belt tighteners, for instance, are two pieces of wood that require inside and outside threads. To accomplish this in a miniature, Waltner simply screws a stove bolt into the wood to make the inside threads, and then works the nut over another part to create the corresponding outside thread.

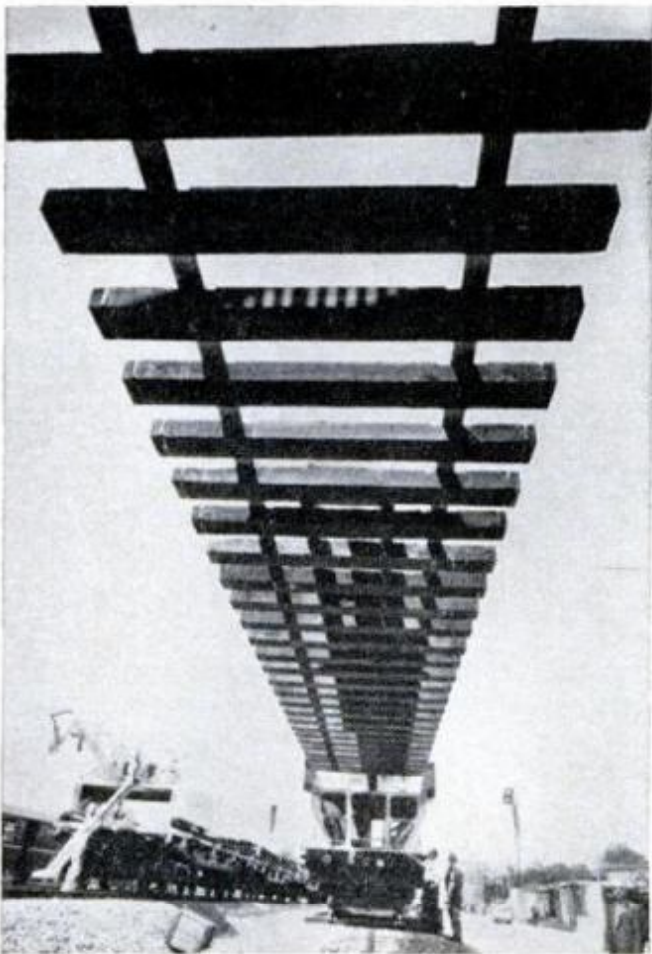
A finishing nail serves as a crankshaft and axle. It is bent to form the crank which engages the pitman. Clipped off to the proper length and flattened with a hammer, it can be forced through the hub to engage the wheel without slippage.

The tip of an ice pick supplies the spindle for a model of the Colonial Wool Wheel, but Waltner has also used a nail with the head clipped off and the shank ground to the proper taper, and the results have been equally good.

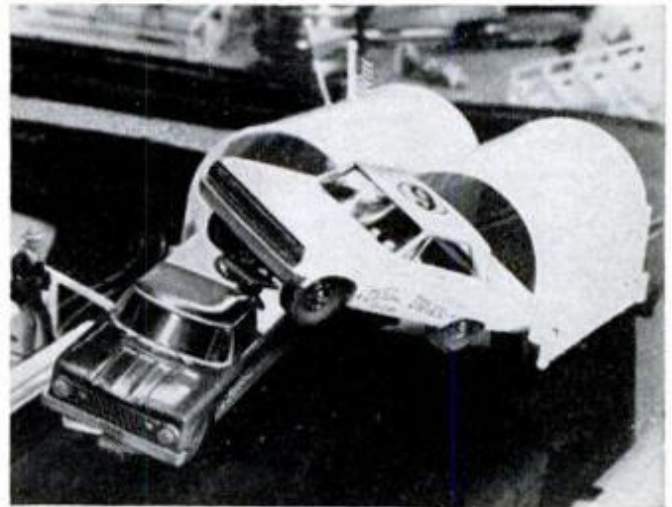
Over the years Waltner has collected parts, drawings and photos, and from these he has worked out scale blueprints for a wide variety of models. With this vast store of highly specialized knowledge, he is able to take a wheel—all that remains of a precious antique—pinpoint its origin and then painstakingly bring it back to life. Another successful surgery. ★★★



Miniature torpedo is the newest thing in prime haulers for water skiers. The tiny craft weighs 136 pounds minus outboard. Frank Costin, who recently left his position as a Welsh aircraft designer, invented it. Cost? \$840 f.o.b. Llanberris, Wales.

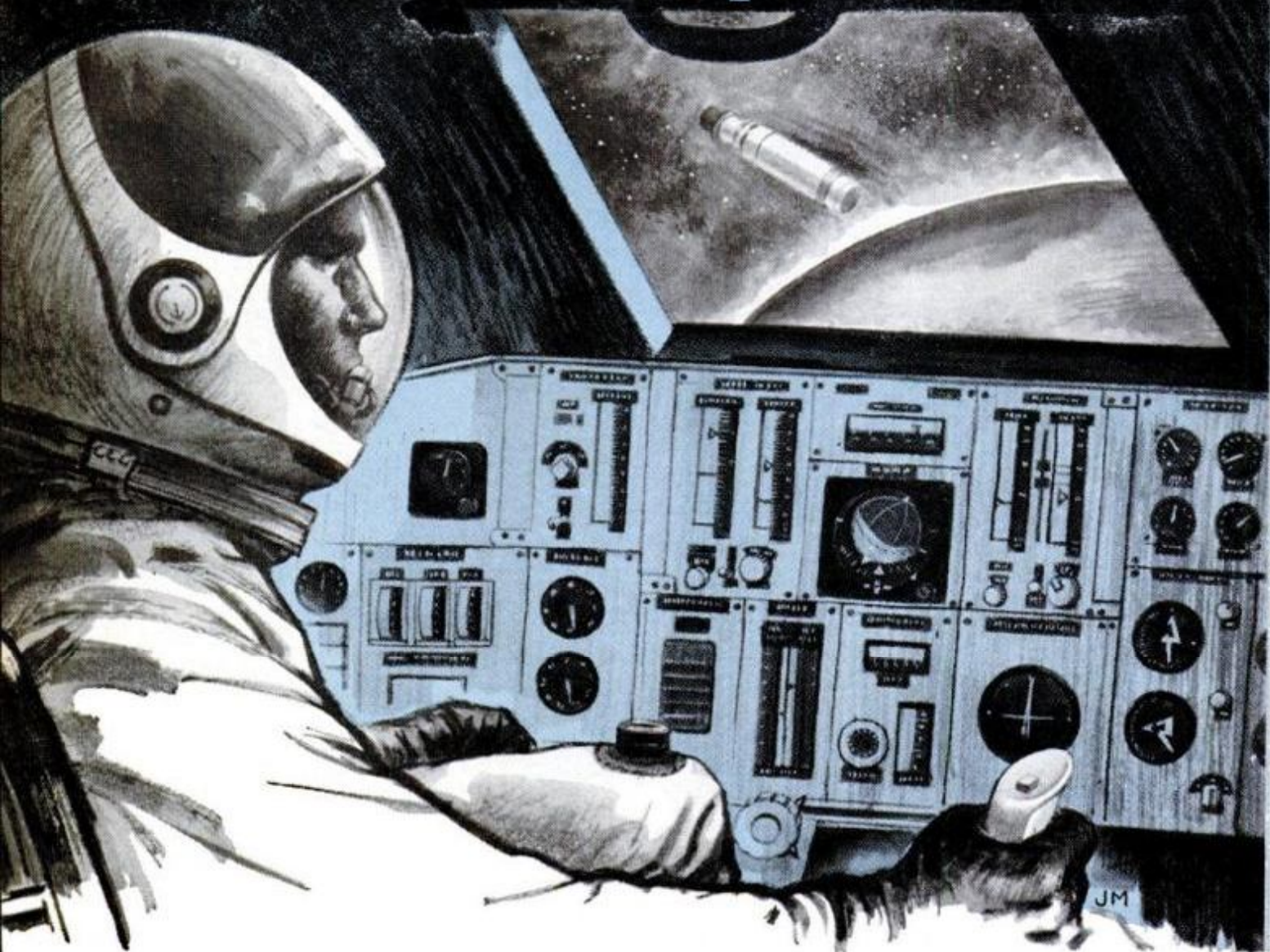


Instant railroad track squirts from this West German machine like toothpaste from a tube. The wheeled vehicle spews some 650 feet of finished track in 50-foot section along a prepared roadbed every hour.



Scaled-down thrills on a new road-racing set simulate the stunts staged at thrill driver events. Pistol-grip controls "race" both a Dodge 440 Coronet and Sweptline truck. Cars go up ramps on two wheels, "spin the clown," land on all fours and keep going. They leap from ramp to ramp and race on. Equipment includes cannon-jump ramps, straight and zig-zag track, risers, stacking bricks and a power pack. Eldon Industries makes the Thrill Driver's set.

I Docked in 'Space'



In a game that will send a heavy-handed throttle jockey whirling helplessly around his target or shooting off into the black void of space, PM's aviation editor flies the Gemini spacecraft to an Agena rendezvous—without leaving the ground.

By Kevin V. Brown

THERE IT WAS out in front of me, tilted up and to the left. The sun's harsh light bathed one side in total whiteness, and the vast emptiness of the universe painted the other side almost black. Stars blinked in the distance.

I studied the Agena a moment or two through my window to make sure I was staying with it, then checked the closing-rate indicator on my instrument panel. It read zero, so I was ready to maneuver my Gemini spacecraft.

I jogged the translation handle to the

left and flicked up the thumb-button. My spacecraft jarred slightly and I could hear the "shhhh-shhhh" of the reaction controls. Slowly almost imperceptibly, the tail of the Agena appeared to come down.

"A little more left," I said, jogging the translator again. "Shhhh-shhhh" went the controls. The Agena began coming right, but now the tail was below me on the left.

"Oops, too much up," I said and pushed the thumb button down a couple of squirts. Too late; it was dropping out of

sight below me. I moved the rotational handle in my right hand for the first time, rotating it forward to pitch down. Soon the Agena appeared in my window again with Earth behind it. I was looking almost straight down and the Agena was moving off to the right.

"Oh, Lord," I thought, "let's settle this thing down."

I jogged the translator right and rolled the rotator right too, to keep the satellite in my window.

"You're using too much fuel," my headset crackled. "Better close in on it."

That was the ground controller.

"Roger," I replied meekly.

The Agena was moving up and to my left now, but it was almost dead center in my window, so I jogged the translator forward until the indicator read five feet per second closing rate.

Now the Agena seemed to speed up its movements. It was still moving up and left, so I flicked up the thumb-button, moved the translator left again, and pitched up and yawed left.

Man, it really started moving now. I let go of the translation handle and just concentrated on keeping the bloody thing in sight with the rotational handle. Pitch down, now, and a little right yaw, or better yet, do both with a right roll.

"You're closing too fast" ground control rasped.

Now everything was spinning. When I took my hands off all controls in desperation, the Earth was rolling above me, the Agena was out of sight and I was completely lost in space.



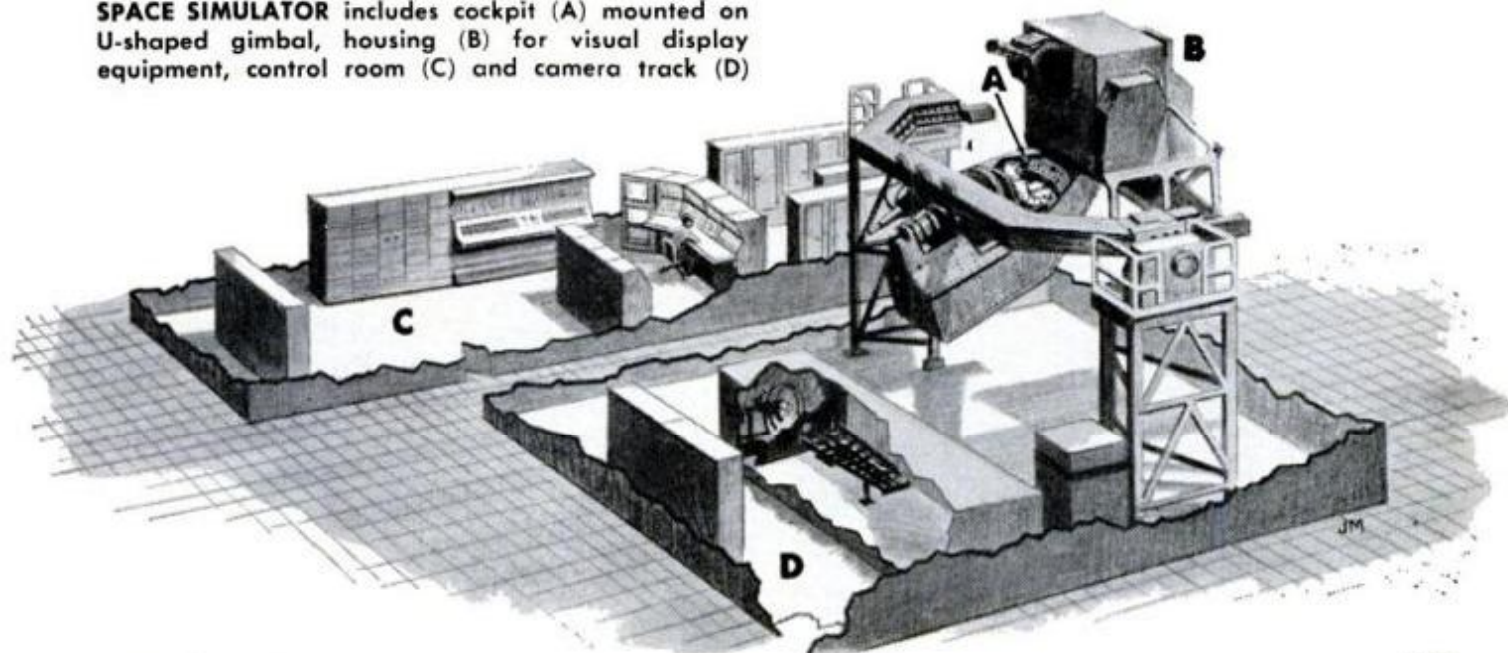
AUTHOR prepares for "space" flight. He reported chasing Agena target all over sky, finally docking with it after about 10 futile, slapstick attempts

But not really. I was actually sitting in one of the most sophisticated pieces of equipment ever designed for training astronauts, and I had never left the ground.

The T-27 space-flight simulator, designed by Link, the same outfit that designed the old Link Trainer of World War II fame, is located in the Space Pilot's School at Edwards Air Force Base in California. I had asked permission to fly the same kind of a rendezvous docking mission that the aborted Gemini VI was scheduled to fly last Fall, and Gemini VIII was due to fly this month. (The Gemini VI and VII mission ultimately flown in December was just a rendezvous without the docking.)

"Let's try it again," my genial ground

SPACE SIMULATOR includes cockpit (A) mounted on U-shaped gimbal, housing (B) for visual display equipment, control room (C) and camera track (D)



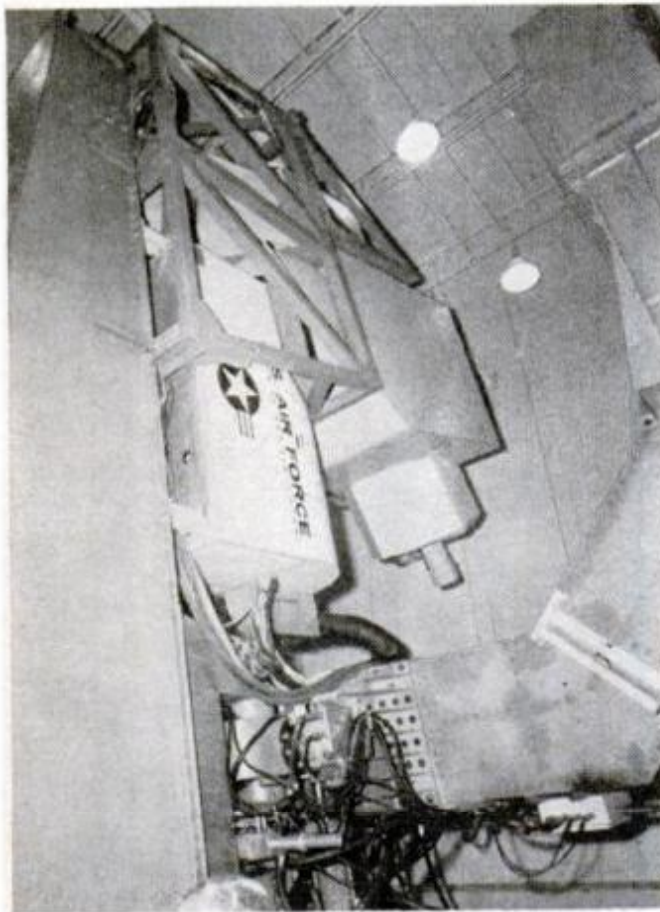
“And stay off that rotational handle until you get in close. You were flying orbits around the Agena.”

“Roger,” I said in my best Casper Milquetoast fashion. And, with a couple of razz-ma-tazz moves on his controls, he whooshed the Agena out to where it was the first time—about 3000 feet off, up and to the left.

“Okay, old buddy,” I said to myself encouragingly, “Let’s do it right this time.”

Reviewing my mistakes I figured I had overcorrected on each move or had not erased the corrections soon enough, or both. After initially getting in phase with the Agena, flying the identical orbit with it—flying formation, really—each time I put my craft into motion it would stay in motion until I put in a reverse correction. If I moved left I would keep going left—forever—even though power was on only momentarily. Newton’s law, remember: “Bodies in motion tend to stay in motion. . . .” So the same amount of right correction had to be put in to stop it. And, in order to line up properly with the Agena, it had to be put in at the right time.

“Smaller adjustments this time,” I said



SIMULATOR COCKPIT points straight up, rotating pilot onto his back. In darkened cockpit it gives the illusion of G-forces encountered in launches

to myself, and erase them sooner. I nudged the translator left again and, as soon as it started moving, I nudged it back right. Fine. It moved a bit and stopped. Once more, and once more again. Fine. I was lined up under it now.

Okay, let’s move up. A flick up on the thumb-button, and a flick down. Another one. That’s about it. Now let’s move forward. I nudged the translator forward, and my spacecraft jogged with a “shhhh-shhhh” sound until I was closing at about five feet per second. The closer I got the more I could see I was still off a shade. The Agena was moving down and right.

“Slow down,” I said, “and stay off that rotational handle.” I pulled back on the translator until I was going away from it at two or three feet per second. Too much. I got the closing rate back to zero, but the Agena was still falling down and right out of sight.

“Don’t rotate!” I thought. “Use the translator.” I checked the closing indicator again. Still zero. “Okay, now get it back in front of you. A little right, then left. A little down, then up. Not enough. Once more on each. Ah, here it comes. A little more right, then hold it. Good.”

Now we can move forward again, and not so fast. I got it up to two feet per second, but the same thing happened. The Agena, as it grew larger, moved up and to the right. The tendency to rotate into it was great but I held off and just tried to slow again. Too late. The Agena slid by me and I lost it again.

But the controller was encouraging. “Much better,” he said. “A little more finesse and you’ll have it.”

I got it lined up right on about the tenth try—after a little practice I found I could eyeball it better—closed slower, and took my time with the corrections. It wasn’t until I got within a few hundred feet and it became obvious that I was heading right for it, that I made corrections with the rotational handle. These were just minor adjustments to send the nose of my spacecraft right into the receiving end of the Agena.

It was so neat, in fact, that I flew the last few feet hands off. And, the last bit of realism built into the simulator, there was a “thump” sound when I hit.

Major John Prodan, the Air Force man in charge of the simulator, threw open the hatch and greeted me with a cheery,

"Very nice. You might make an astronaut yet."

Before he let me go, however, he explained some of the things I did right and wrong. I pretty well knew what the two handles were for, but how and when to use them was the problem. The translation handle, in my left hand, was like a throttle—push it forward and pull it back for forward and reverse, or side to side for side to side movements. The thumb-button flicked up and down for—what else?—up and down.

The rotational handle in the right hand, controlled, not the craft's motion, but its attitude. On rolling the handle forward the nose pitched down, but the spacecraft kept traveling in the same direction. It's not like an airplane where, if you pitch down, the aircraft is going to go down. The rotational handle also could turn the nose right and left, or roll it around in a slow roll. That's what happened when I ended up on my back with the Earth above me.

The whole point is that one handle controls motion; the other, attitude.

"Your problem," Prodan told me affably, leaning over my shoulder, "was that you were trying to control your motion with both handles. It gets very confusing. If you just change your attitude to keep the target in sight you think you're changing the direction of your motion but you're not. You ended up flying loops around the Agena."

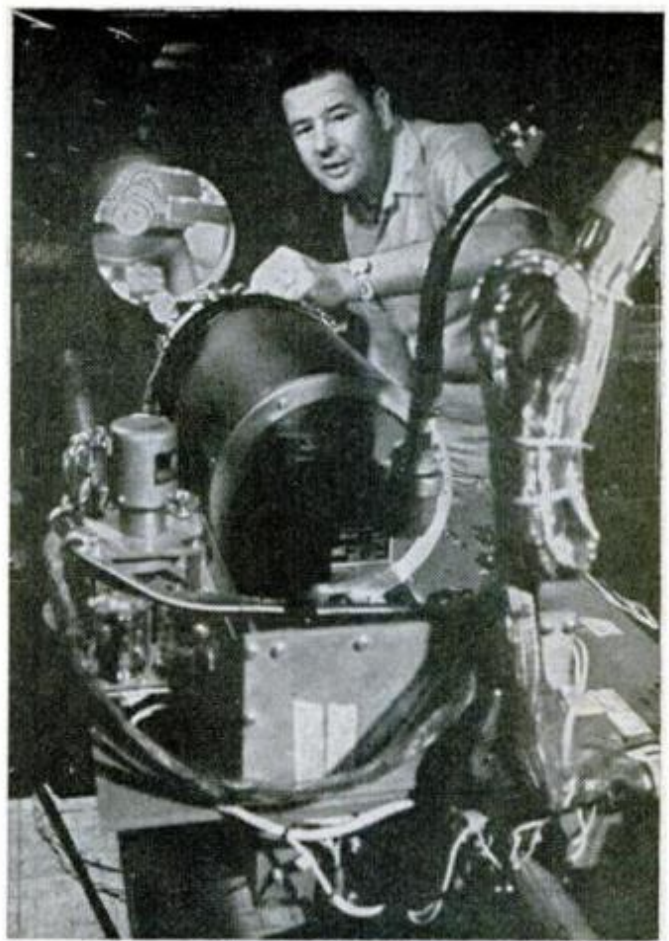
He patted me on the back. "Come on out, and I'll show you how the simulator works." It was strange returning to the world of reality. The simulated ride was quite realistic.

I climbed out and went down on the elevator with him. On the ground, he pointed up at the huge U-shaped gimbal that holds the cockpit.

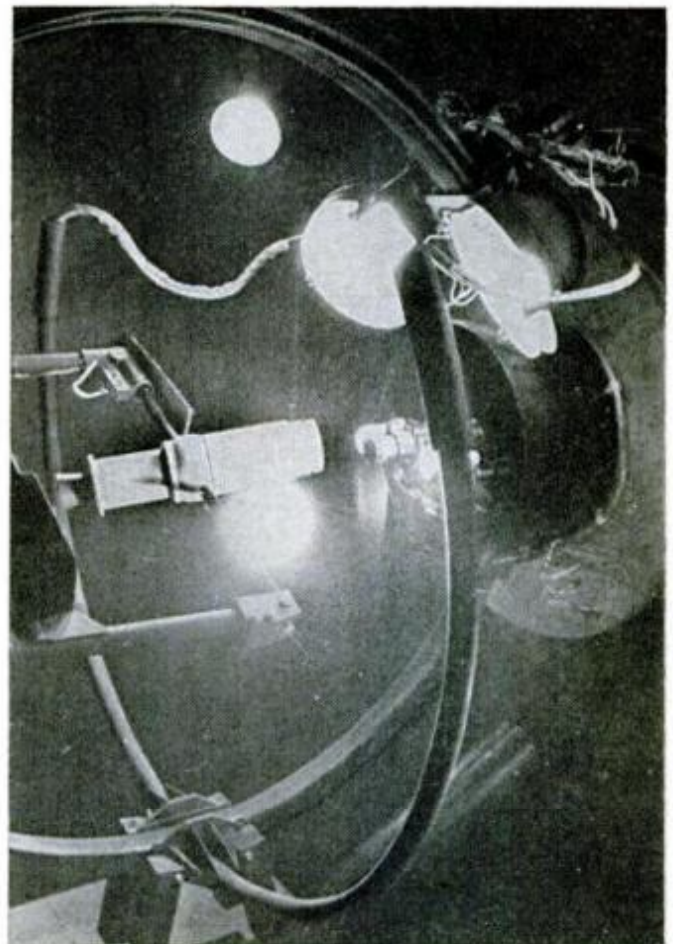
"We can turn this so you're on your back or hanging on the straps," he said. "It gives the illusion of G-forces during acceleration or deceleration. We can also jog it slightly or shake it violently to simulate other motions. Of course, appropriate sounds are synchronized with all of them. About the only thing we can't simulate is weightlessness."

He pointed to a housing in front of the cockpit. "The 'sky' and the 'stars' are in there. It's just a black sphere with various-sized ball bearings imbedded in it. We

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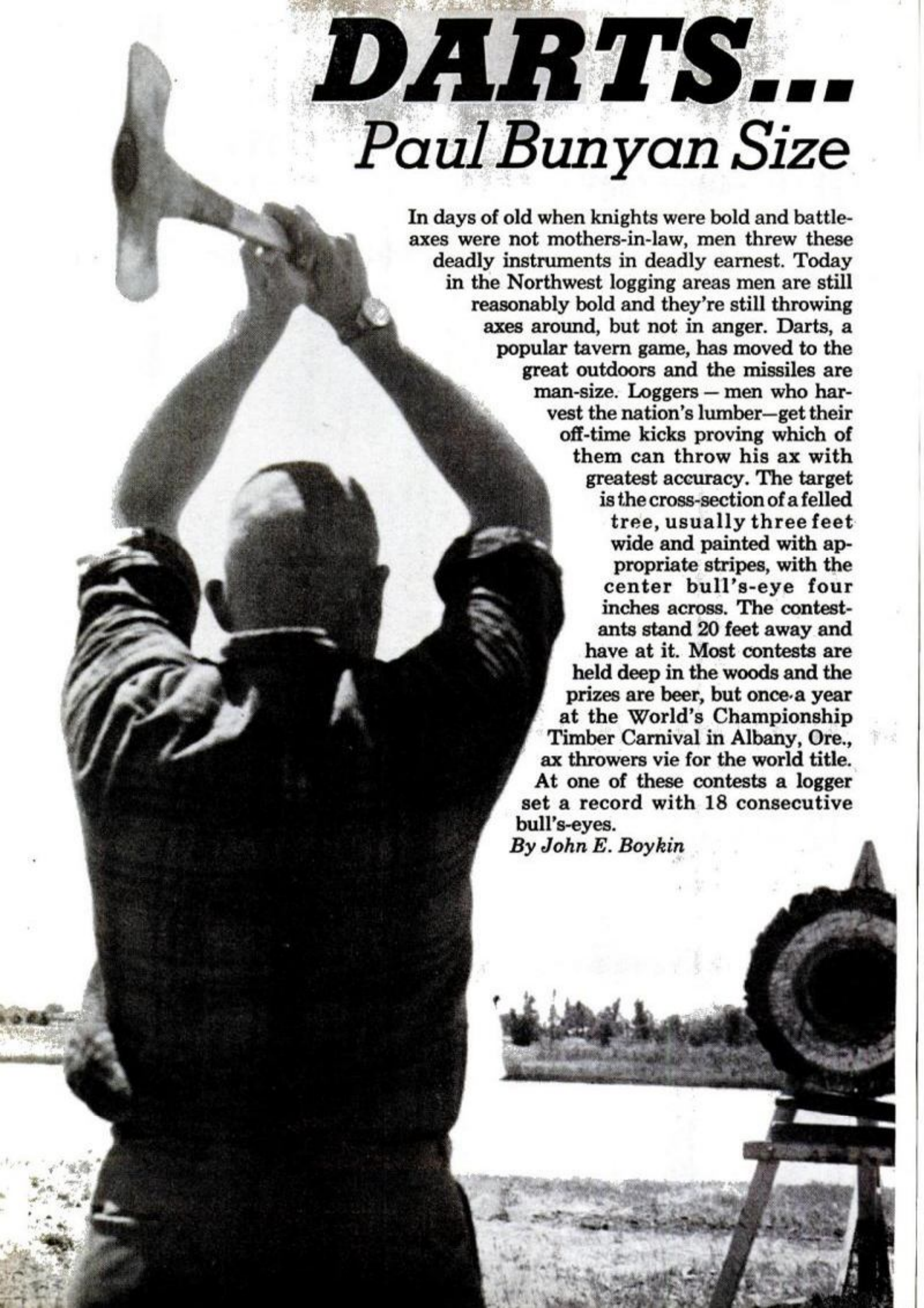
MAJOR PRODAN adjusts closed-circuit camera. Mounted on track, it points to Agena in background, and sends visual display to window in simulator cockpit



AGENA MODEL, about eight inches long, is mounted on three gimbals, allowing it to rotate in any direction. Harsh lights simulate sunlight in space

DARTS...

Paul Bunyan Size



In days of old when knights were bold and battle-axes were not mothers-in-law, men threw these deadly instruments in deadly earnest. Today in the Northwest logging areas men are still reasonably bold and they're still throwing axes around, but not in anger. Darts, a popular tavern game, has moved to the great outdoors and the missiles are man-size. Loggers — men who harvest the nation's lumber—get their off-time kicks proving which of them can throw his ax with greatest accuracy. The target is the cross-section of a felled tree, usually three feet wide and painted with appropriate stripes, with the center bull's-eye four inches across. The contestants stand 20 feet away and have at it. Most contests are held deep in the woods and the prizes are beer, but once a year at the World's Championship Timber Carnival in Albany, Ore., ax throwers vie for the world title. At one of these contests a logger set a record with 18 consecutive bull's-eyes.

By John E. Boykin



SWISH! Five-pound ax flies through air in eccentric circle, usually making one complete revolution before hitting the target—if it hits



BULL'S-EYE! Good hit ends up with one cutting edge of double bit wedged deep in wood. Target is held together with iron bands



SPLASH! Some contests add spice by placing beer can in bull's-eye. When ax hits home accurately, beer sprays in all directions



EACH LOGGER, like ball player, has his own stance. Some use two-handed overhead style (left) and others one-handed stride (above). Some contests use point system—five points for a bull's-eye—and others are man-to-man elimination tourneys, with three throws each

CAUTION!

BY JOSEPH N. BELL

SOMEONE SHOULD HAVE WARNED THE PRINCESS. During her recent U.S. visit, a campus tour at the famed California Institute of Technology in Pasadena was included in Princess Margaret's itinerary. She was told of the 11 Nobel Prize winners the school had produced, of the number of men it had contributed to our space program and other scientific fields, and of the high intellectual level of the students and faculty.

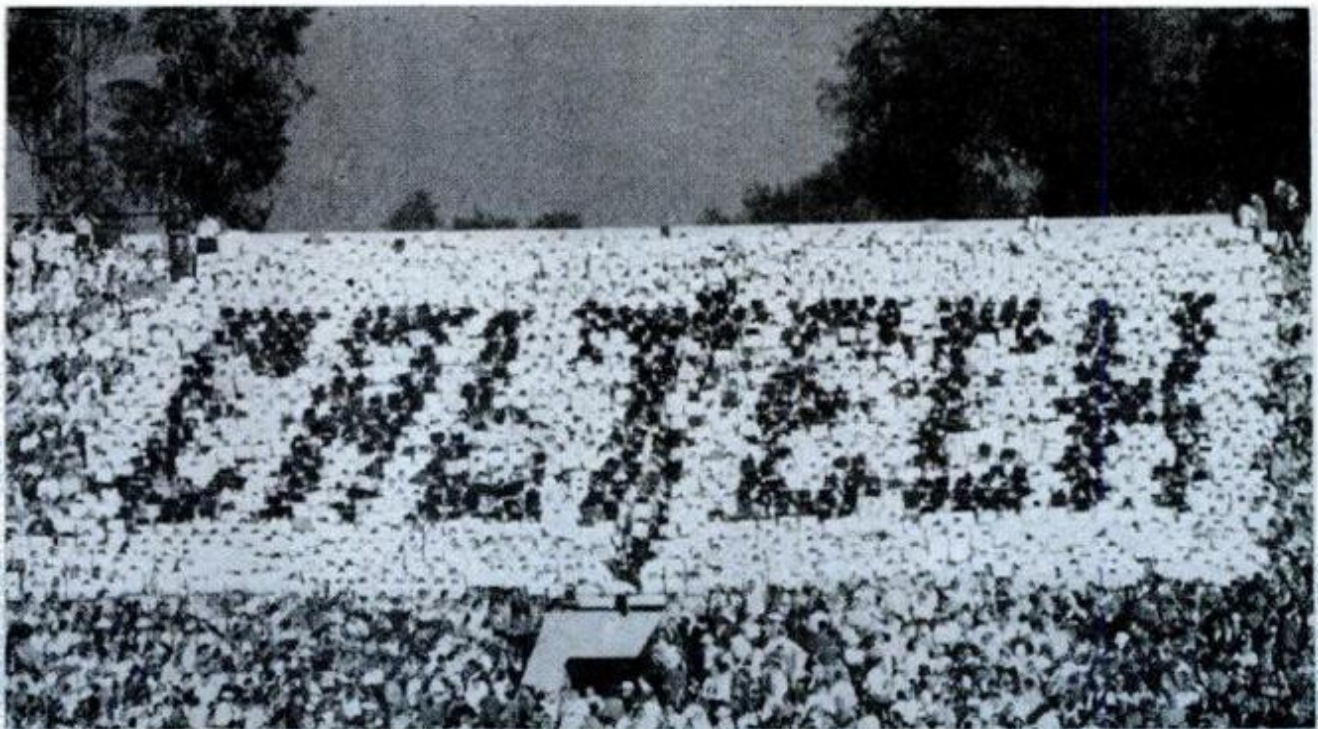
No one told her of the high level of campus high jinks.

Too late. As she strolled leisurely along a tree-lined walk, surrounded by faculty guides and several hundred students and onlookers, up popped a manhole cover in front



PRINCESS MARGARET and Lord Snowden laugh appreciatively as Caltech student is hauled ignominiously from manhole after failing to snap their picture

No low forms of high jinks for these high-IQ Caltech students—they've brought off some of the all-time classic campus capers



CLASSIC CAPER was pulled off at 1961 Rose Bowl game. Caltech students rigged cards of Washington's cheering section to spell out their name as millions watched on television and officials looked on in dismay

GENIUS AT PLAY

MARCH 1966

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DITCH DAY offers greatest opportunities for campus capers. With seniors gone, undergraduates turn room upside down

of her and out jumped a young man in shirt sleeves.

There were a few startled gasps before the security officers and police rushed over and grabbed him. He quickly explained that he was just trying to get a picture. He had been hiding with his camera in the manhole for 30 minutes, standing on a hot-water main the whole time. Lord Snowden, a former photographer himself, intervened and the student was released.

Security officers remained grim-faced but the incident brought smiles of recog-

nition to members of the faculty and some of the students. Others shrugged and said, "Just routine."

It wasn't that the young man failed to get his picture but there was so little scientific imagination involved. Caltech's intellectual giants take their humor seriously and their efforts don't always have to be successful to be admired. Take the incident that happened last year: A contractor preparing to pour concrete for the foundation of a new dormitory was unnerved by the discovery of a black metal box, bristling with wires, partly hidden in the trench. It looked like a bomb and the contractor fished it out gingerly, placed it on the lawn—and called higher authority. The dean who was summoned, being wise in the ways of the Caltech inmates, opened the box brusquely. It contained a loudspeaker and several yards of loose chain. A dozen wires, broken off by the contractor, dangled limply. Had he traced them, he would have found that they ran underground to a transmitter in the basement of an adjacent dormitory.

While a group of disappointed students watched morosely from the sidelines, the foundation was poured devoid of the black box. "What a pity," the dean said later. "Just imagine, we might have had a new dormitory with built-in ghosts. We *never* would have found those chains or that speaker!"

Thus does genius sometimes fall victim to the callow in our midst. And genius abounds at Caltech, America's most cerebral seat of learning, with its Nobel laureates



WOOD SHAVINGS fill another senior's room hip high. Biggest problem is figuring way to get into room, then doing something cerebral once they get in



TARDY SENIOR didn't get off campus on time and pays the penalty. He is tied to tree on Ditch Day, while mayhem goes on around him



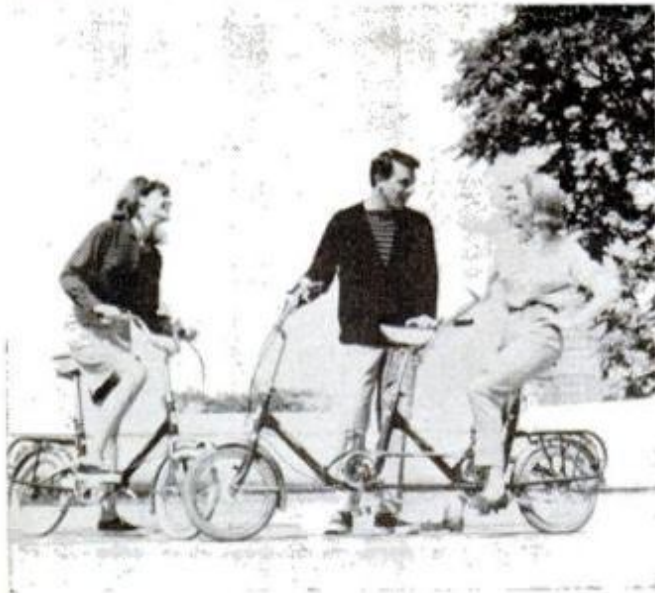
eates and an honest reputation as the most difficult school in the nation for undergraduates to gain admittance. But Caltech is not so much a school as a research center for the broadening of human knowledge, pursued in an atmosphere of free scientific creativity probably unparalleled anywhere else in the world. It is small, with an undergraduate student body of about 700, some 550 graduate students, and a fantastically talented faculty of 500 of the nation's top scientists—about half of whom actually teach classes.

But even this relatively tiny collection of scientific brains has to blow off steam occasionally and when that happens at Caltech, it's likely to be a real gasser.

Probably the best known example—at least if measured by the number of people who saw it happen—was the colossal stunt now hallowed in legend at Caltech as the Great Rose Bowl Hoax.

During the half-time intermission of the '61 Rose Bowl game between Washington and Minnesota, the Washington cheer-

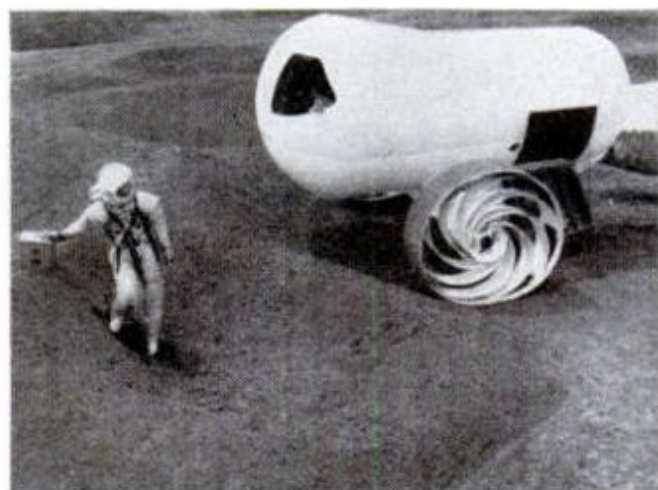
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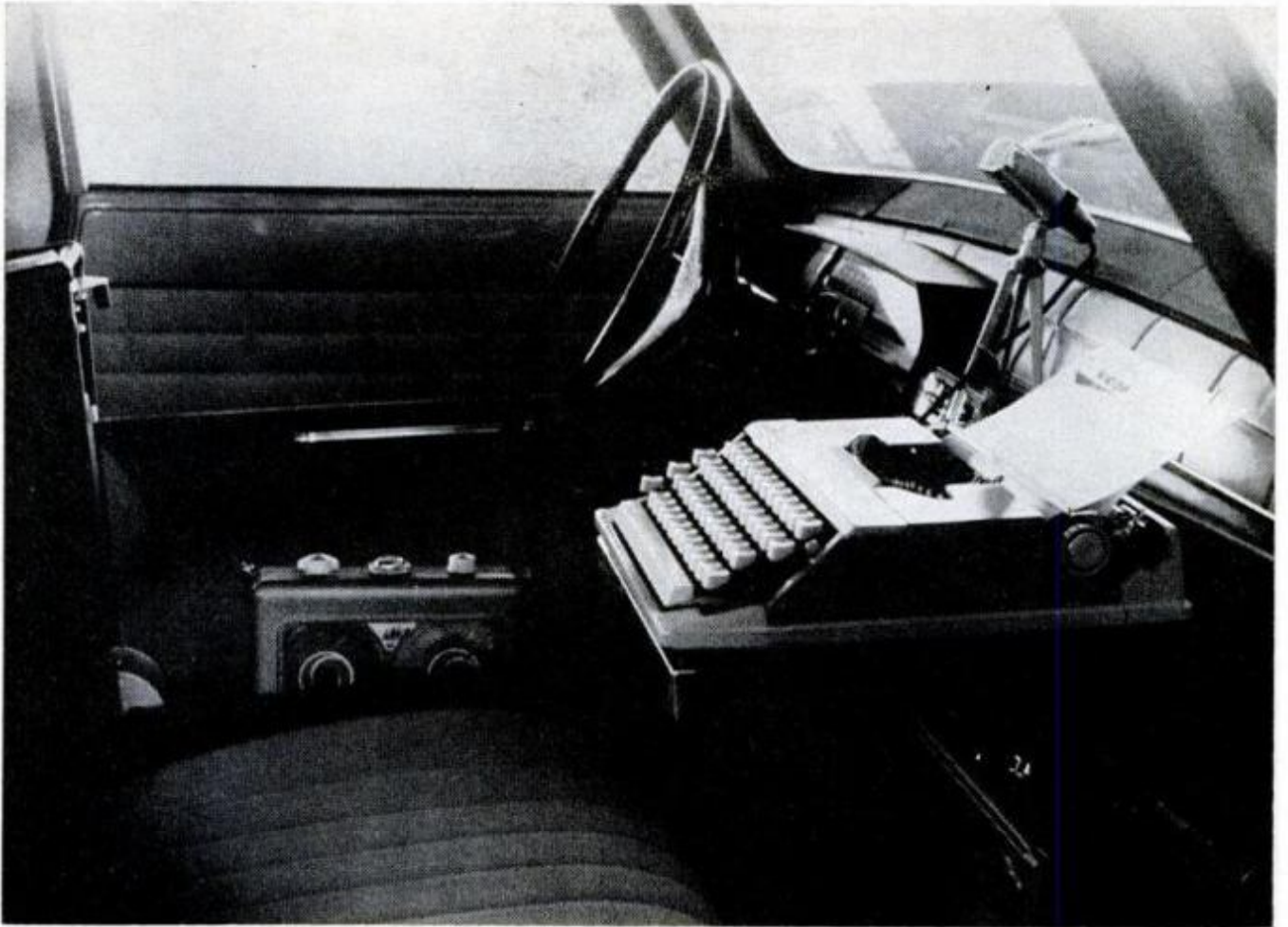
Stowaway bicycle is an import from Italy that folds up for carrying in a car or boat, then unfolds for cycling. Folded, its size is 29½ by 23 by 12 inches. Opening it for riding takes just 30 seconds, according to the manufacturer. Seat and handlebars may be set at any height for children or adults. The Graziella bike sells for \$99.50; in tandem style, price is \$167.50. It's available from Abercrombie & Fitch, Madison Ave. and 45th St., New York.



You don't see many of these around. In fact, the bow-guitar (bogenguitarre) being played by Erich Ferstl of Munich, Germany may be the only playable one in existence. His guitar was made in the 1930s from a 100-year-old design. The sound of the instrument, which has three sound openings, is described as harplike.



Men on the moon may one day rely on a vehicle like this to get around. The two-section, wheeled vehicle—called a mobile base simulator—is being developed by Grumman. Here it lumbers around at five mph on moonlike craters made of cinders and coal dust.



There's hardly anything missing in this "car of the well-organized man"—a special version of the Renault 16. Equipment includes a foldaway typewriter, table, tape recorder, telephone, four-band radio receiver, and a complete refreshment bar (with glassware, tongs, spoons, ice, stirrers, shakers and refreshments). About all that the owner has to furnish is a secretary to operate the typewriter and something like \$3000 to \$3500 to buy the car.

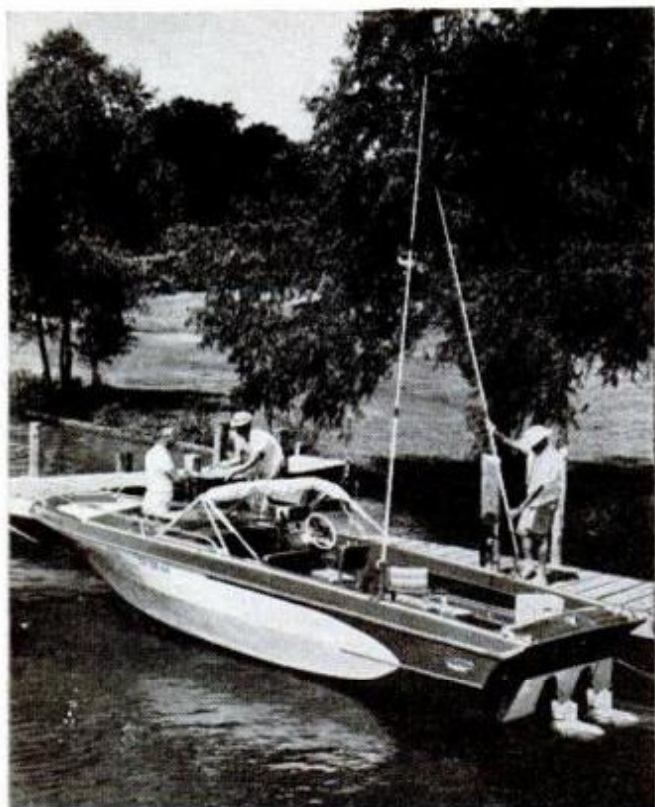


Water Witch doesn't ride on a broom, but she does sweep harbors clean of floating trash with the scoop "broom" on her bow. The Witch is a 20-foot steel barge with mesh scoops attached to two seven-foot tentacles that are hydraulically controlled. The scoop is 10 feet wide and 4 feet deep. Shown at work in Manchester, England, the Water Witch is the invention of Frank Caddick of Britain.

'66 Boats: It's a



SOMETHING NEW from Starcraft for 1966 is this novel camping top for its 14-foot Explorer Deluxe. Unusual in such a small boat, it offers plenty of headroom plus a clear view all around. The boat itself is a lapstrake fiberglass trihedral hull which comes in two-tone "Avocado Green" and sells for \$499



SLEEK AND SPACIOUS, Glastron's new Caribbean V-234 at 23½ feet is the biggest boat yet from Big G. That forward cabin has two big 6-foot, 5-inch bunks

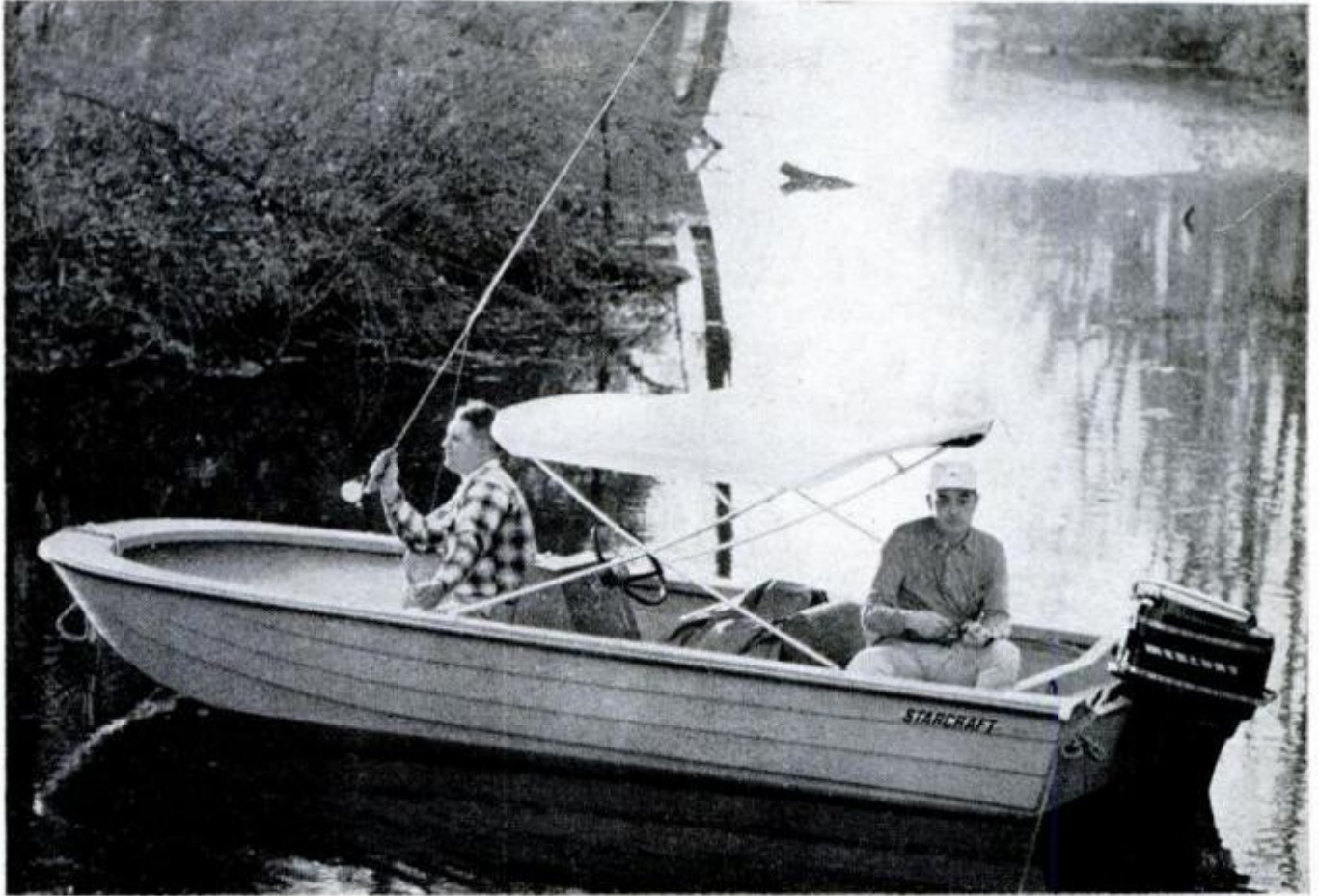
IF YOU'RE ONE of those people who wait until Detroit has worked all the bugs out of a new design before buying a car, this is the year to buy your boat.

It's like the middle year in GM's three-year model runs—few wild novelties, almost no really new concepts, but lots of quality, design refinement and value.

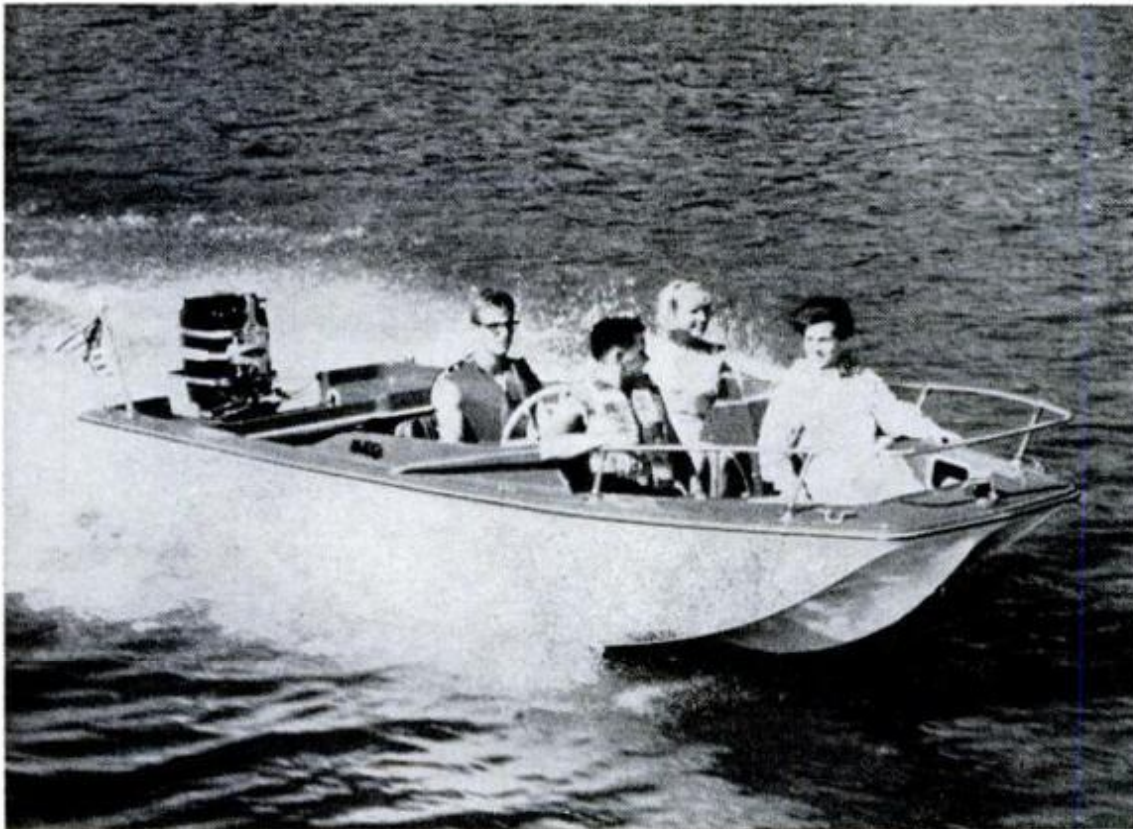
After the design revolution of the past half-dozen years this may seem a bit tame. For a while, every year has seen a hoard of radically new boats bursting onto the market. Bertram's Deep-Vs and the ones that followed, all those multi-bowed descendants of the cathedral hull, the wide-open runabouts (which someone suggested be called "whalers" as a tribute to the boat that started it all)—there were so many new developments tumbling out in quick succession that both buyers and manufacturers had a hard time keeping up. This is catch-up year.

The designs that didn't work have generally been scrapped. Those that caught on have been modified, refined and are

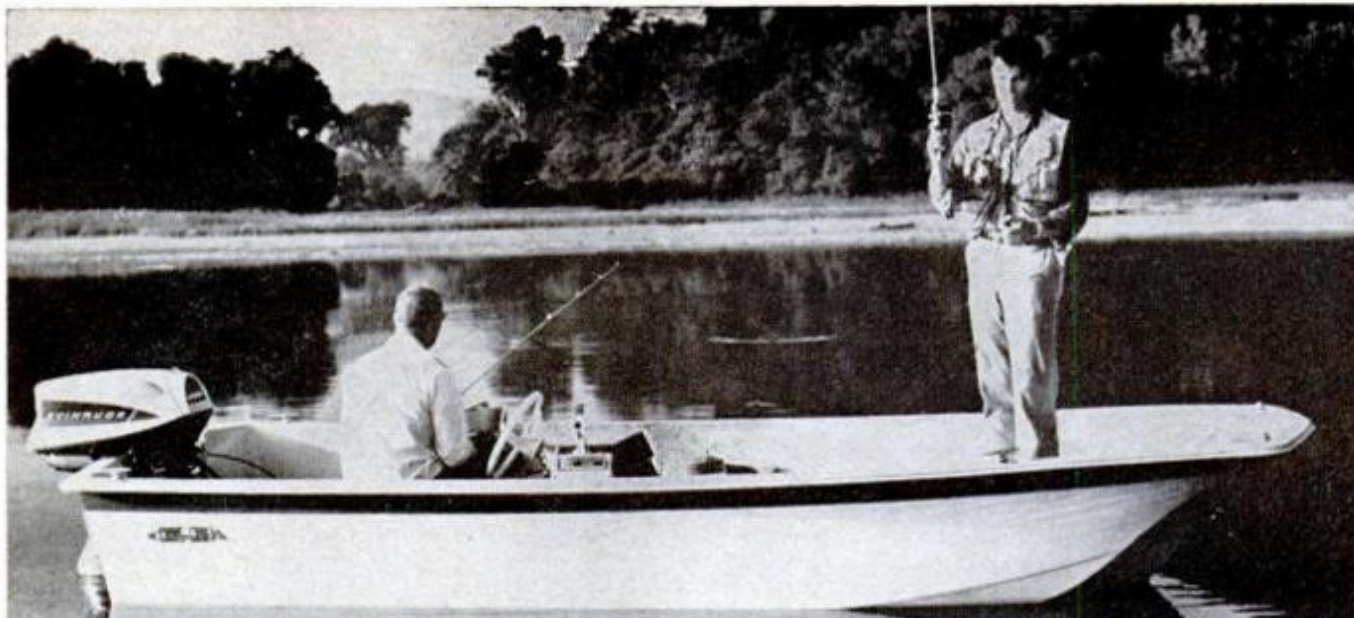
Catch-Up Year



WITH RUNNING TOP only, the Explorer has lots of action room for two fishermen with a spot of shade if the sun gets too hot. Starcraft's other developments this year include new windshields, streamlined cabin profiles on cruisers, new colors and styling, plus a number of new models, but no radical departures



EXTRA SEATING up front instead of a foredeck makes MFG's 16-foot Beachcomber seem larger than conventional runabout of this size. Rated for motors up to 65 hp. Sells for \$1095



CHRIS-CRAFT Corsair's 15-foot Castaway is basically a new cockpit approach for the Jolly Boat hull. Instead of a "bridge station," it has a full 14 feet of open cockpit with two athwartship mahogany seats. A steering console is optional. The hull features full foam flotation and is rated for engines to 60 hp

better than ever. And the boats shown here are just a small sample of the tremendous variety available today.

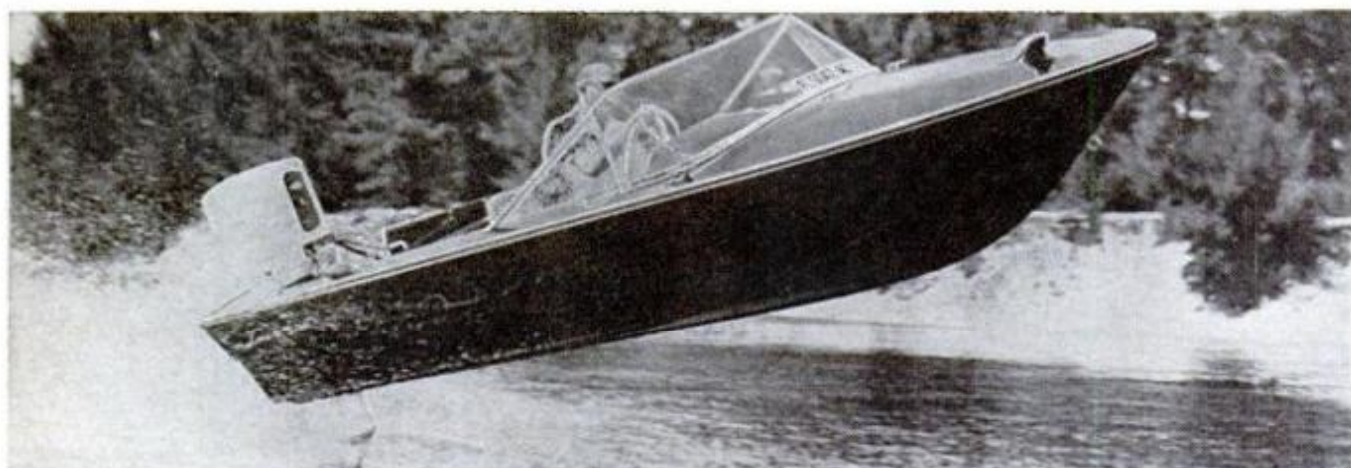
The boating industry is growing up. A lot of the money from the current boating boom has been poured back into businesses, much of it for new plants.

A few months back, I flew out to Texas to visit Chrysler's Lone Star plant in Plano and Glastron's plant in Austin. Both were big, efficient production-line operations. Traveler has just put up a new, modern plant; Kiekhaefer is in the midst of a long-term building program. And there are many more.

What's all this mean to you? As Henry Ford taught the auto industry, volume production makes it possible to put out a consistently good product at a lower cost. Ultimately, this means more bargains for you in the showroom.—*Art Mikesell*



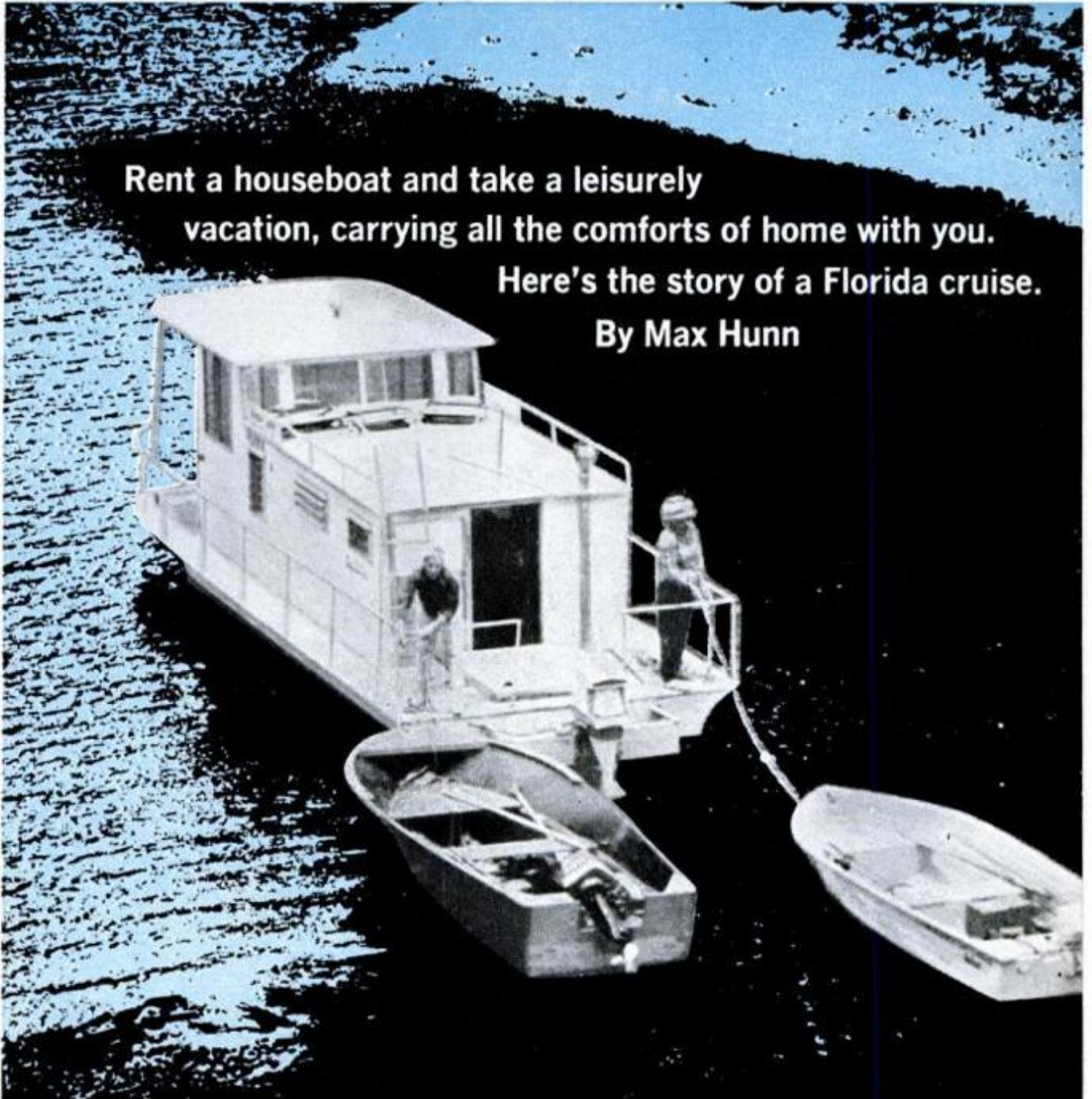
THOMPSON'S 11-foot Take-A-Long fishing boat looks like a streamlined john-boat, weighs 110 pounds. It's molded from Royalex (foam encased in hard rubber)



CHRYSLER LONE STAR has added a number of features to its 15½-foot Mustang, will also sell a stern-drive version this year with MerCruiser's compact 60-hp package. Luxury touches on the '66 Mustang include nonskid marine carpeting, upholstered side panels, between-seats storage console and a wood-grain dash

floating down the river in a house

Rent a houseboat and take a leisurely vacation, carrying all the comforts of home with you. Here's the story of a Florida cruise.
By Max Hunn



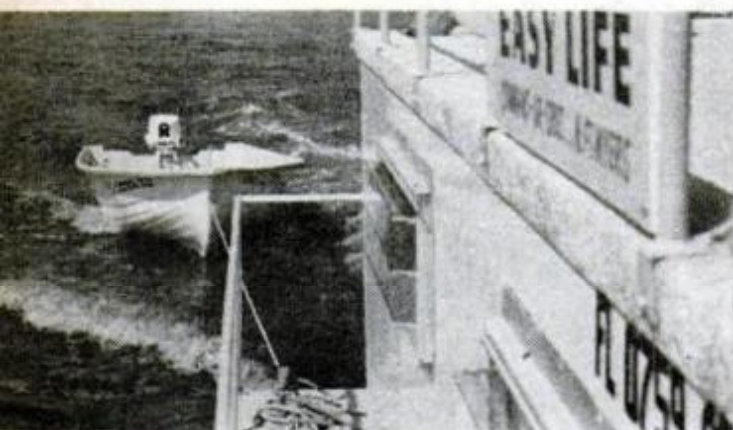
OUR UNUSUAL CRUISE began when Cal Stone and I heard they had some rental houseboats in Fort Myers, Fla. Houseboat renting, increasing in popularity around the country, had been slow starting in Florida.

Intrigued by the idea of cruising on a floating motel, we planned a trip with our wives to Lake Hicpochee, 50 miles or so up the Caloosahatchee River. We had other ideas, too. Being fishermen and never averse to seeking black bass, it was a perfect setup. Our wives could relax in a floating home and we could get in some casting. We towed a pair of skiffs for this and for exploring small creeks too shallow for the boat.

Upon sighting our floating home, any idea it would resemble a shantyboat of Mississippi River fame vanished. It was a compact beauty, a 28-foot, fiberglass boat with a 55-hp outboard motor. Electric starting and remote



U-DRIVE-IT HOUSEBOATS let you float where you like and dock where you please, with all the pleasures of a cruise and all the comforts of home right there



TWO SKIFFS were towed along for miscellaneous use—fishing, for instance. Also, they towed houseboat off sandbars when it was anchored in low-tide area



LIVING QUARTERS, below cockpit, included small galley and dinette and four bunks. Two-burner alcohol stove, sink and icebox provided for meals

controls permitted operation from the helmsman's station with 360° visibility.

Gear aboard, we headed up the Caloosahatchee, floating along at a leisurely 8 or 9 mph—about like Huck Finn on the Mississippi. Anyone operating a houseboat should follow marked channels for the slow-moving craft aren't designed for quick maneuvering.

While Cal and I manned the bridge, our wives, Mary and Kit, stowed the gear and indulged in woman talk. Their galley had a small icebox, sink (fresh water piped to a faucet from built-in tanks), a two-burner alcohol stove and cupboards. Opposite the galley was a four-seat dinette and aft were four bunks, the top two folding up during the day. A small head with a marine toilet and basin was at the rear.

Dusk was falling when we anchored in the sheltered mouth of a creek near Alma. Here we learned two lessons. Never anchor a houseboat at dusk and know your tide.

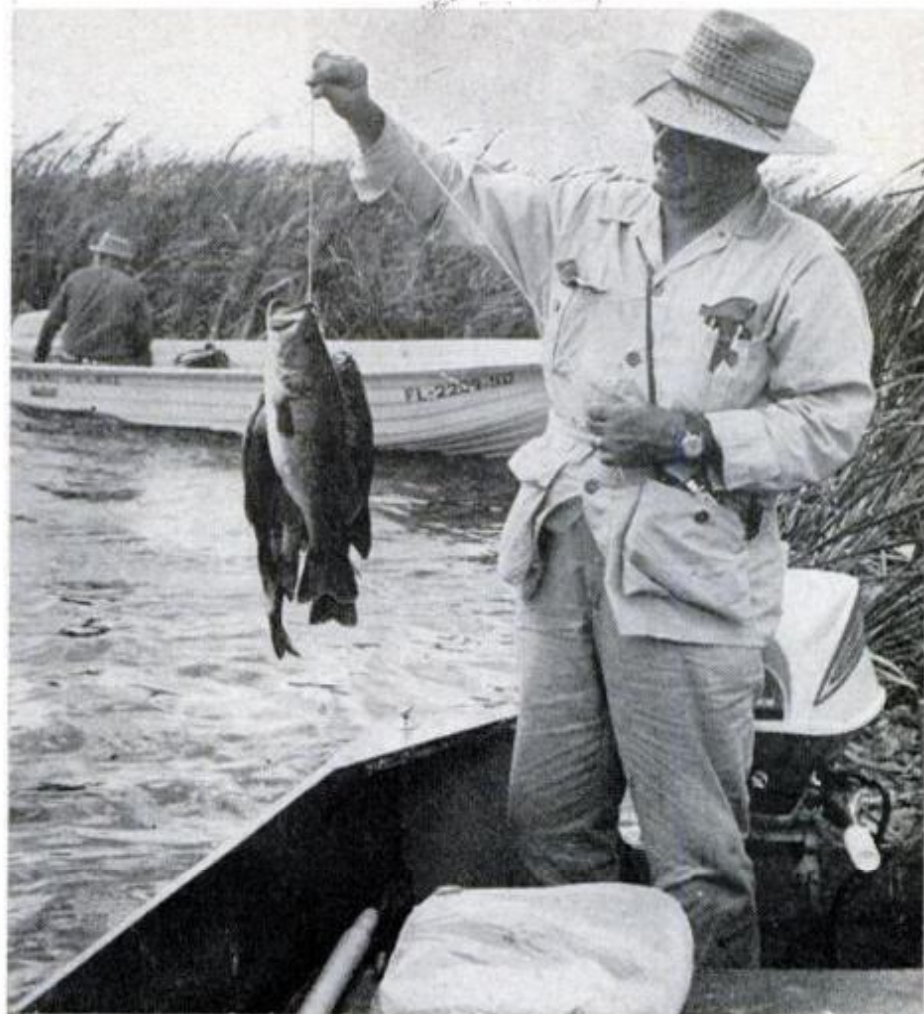
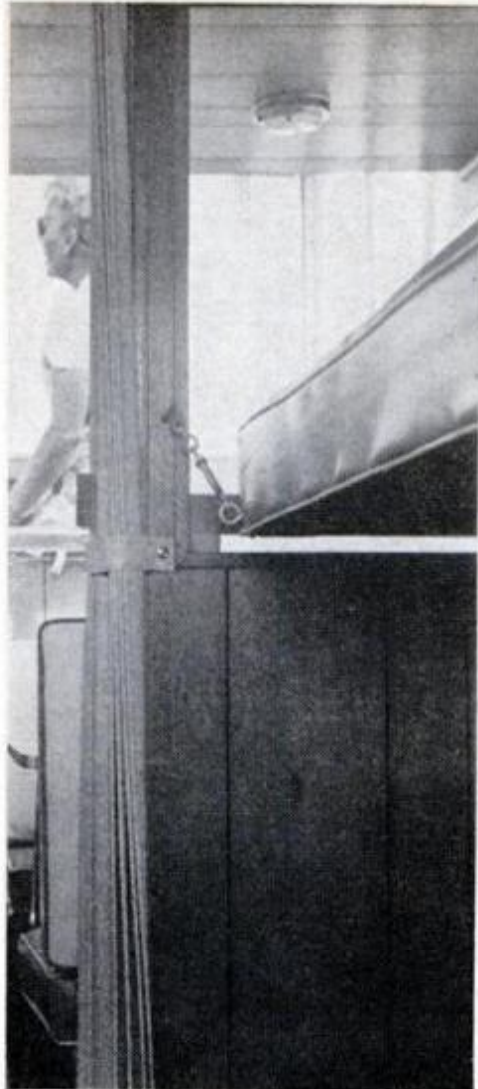
Early next morning—you don't sleep

late on a houseboat—we found the falling tide had left us on a sandbar. But it was a simple task to pull free with the skiffs.

We passed the picturesque shores near La Belle—cabbage palms drooping gracefully over the water and thick woods lining the banks—then used the municipal docks and went ashore. La Belle is a sleepy cattle town, once dependent on river traffic and still without a railroad. We headed for the Trading Post, a 19th-century emporium stocked with everything from cowboy boots to frozen food.

Back on the river, we approached the Ortona Locks about 1 p.m. and, with the light green, slowly entered the lock chamber where the tender tossed us lines and explained how to handle them. Water entered the chamber and we were raised about 10 feet to the upper level.

Here the Caloosahatchee is different. Spoil banks line each shore—left when the river was straightened 30 years ago—but we could see cattle ranges with hump-



MAN'S DELIGHT, a string of fresh-caught fish. While not the end of houseboating, it's one of the more pleasant ways to get out where the fish are and bring the home along, too—far away from the maddening crowds

backed brahmas and crossbred cattle grazing. It was an empty land—no houses, no sign of human habitation, just flat range.

Egrets spooked ahead of us, one flock forming a startlingly white picture against the sky's dark blue. We encountered our first boat along this stretch. A motor sailer, it passed us quickly and its passengers peered curiously at our strange craft.

We reached Lake Hicpochee in late afternoon and spent two hours of fruitless, windswept fishing. Before sundown, we anchored for the night and relaxed with a steak dinner miles from nowhere.

Next morning, the largemouth black bass were biting. Despite the thick weed beds, we boated five good-size lunkers, while losing another five when they fouled in the grass.

At noon we were under way again for the 50-mile return. The trip back always seems shorter but it was different, locking to the lower level and drifting downstream.

Our plans called for skiff exploration of

Telegraph Creek, a famous local waterway, but we had trouble locating it. Noting a creek on a chart and finding it are two different things. We had to dock one night without success, then send an exploratory party in a skiff next day. They found it and brought back some lovely color slides. We docked on the fourth day at Fort Myers, completing the most leisurely 100-mile cruise imaginable.

Houseboating is like no other boating. Rentals range from \$165 to \$250 a week for a 28 to 40-foot craft with everything furnished except gasoline, food and your personal equipment. They're now available on lakes and rivers in Tennessee, Kentucky, Indiana, Iowa, Minnesota, Texas, Virginia, New Jersey, Wisconsin and Georgia. On Georgia's Lake Lanier, in fact, there's an annual houseboat race.

Houseboating is a delightful, relaxing form of recreation, free from the frenetic hurry-scurry of modern life.

Why don't you try it?

★★★

HOW TO BUY A GOOD USED BOAT

If you're a canny shopper, the spring boom in 'pre-owned' boats offers a top opportunity to get the biggest value for your boating dollar.

BY FRED CLARK JR.

IT'S STILL POSSIBLE today to get stung when buying a used boat, but you have to make a real effort. Hurry into a deal before someone beats you to that "steal," don't ask for advice, choose off-brand gear that's no longer being made and you'll have an excellent chance of ending up with a big, juicy lemon.

The smart buyer does his homework before he starts touring the lots and checking the classified ads. If he's not sure of the type of boat he wants, he bums rides with friends, tries out rental boats, takes every chance he can get to familiarize himself with boats he *might* want to buy.

He also checks out the price picture on new boats. For instance, most newsstands carry *Boat Owners Buyers Guide*, which sells for a buck. It lists prices of virtually all current boats and motors. A couple of evenings with this, plus a few visits to dealers' showrooms to look over the new boats, and you're better equipped to judge the value of a used boat. You'll sometimes find a price variation of as much as 50 percent between stripped and deluxe versions of the same basic boat.

The big depreciation bite comes in the first year—up to 25 or even 33 percent of list price. After this it drops back to between 7 and 10 percent of list until the halfway mark is reached. From then on it's primarily condition that sets the tab.

Once you have a line on the market and know what you want, you're ready to shop the classifieds, private owners and dealers.

Each season, people find good buys in gas stations, used car lots and from private owners. You just have to work a little harder checking title and condition, since guarantees can't be as meaningful here as they would be from a dealer. Most of the tricky ones, the boats that would hardly be worth fixing up, change hands on direct deals. That's not to say that all dealers' boats are in perfect shape, of course, but the professional will generally shun a clunker, or junk it for parts.

A dealer usually offers a fair value, good protection and some sort of guarantee. Occasionally, when pressed for space, he'll really wheel and deal.

You've probably already made up your mind about materials—fiberglass, wood

of aluminum—so instead of wasting time going over the old pros and cons, let's look at the different types of boats.

Canoes and Cartoppers. When you are checking one of these boats, always stand off and take a good look from both sides and both ends. If the lines aren't fair and smooth flowing, look further to find out why.

Lightweight aluminum canoes and cartoppers may show dents due to handling. If the price is attractive, however, try the boat on the water to see whether performance is affected or whether there are any leaks.

A neglected canvas-covered boat can often be put back in shape, if you're willing to spend time on repairs. Be sure the price is right, however, and if there are quite a few cracked ribs, better look elsewhere. Cracks in the cover may be superficial, the result of too many thick coats of paint.

Runabouts and Large Utilities. The most popular boats made today are the 14 to 18-foot planing hulls, so you should have a large selection to choose from. As with a smaller boat, stand off and check the hull fore and aft, all around, for fair, continuous lines. It's the most impor-

tant feature to check, for though a great deal of money goes into upholstery and trim, the condition of the hull bottom determines performance.

Go over the transom closely. This structural member takes a lot of punishment because it has to transmit the power of the engine to the hull. Get a friend to pull and tug on the engine while you keep an eye on the corners, where the transom mates with the hull. There should be no cracks or movement here.

If the boat is on a trailer, note the location of the rear rollers or bolsters. They should be set to support the transom itself and, thus, the weight of the engine. If they're forward of the transom, the load can cause a concave "hook" in the bottom which does terrible things to performance. The same goes for a hump, or "rocker."

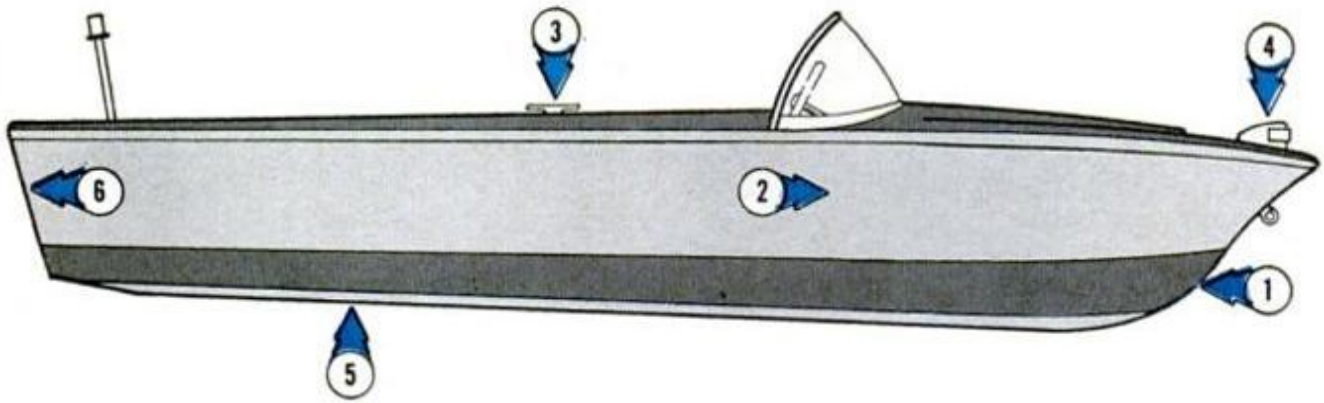
At speed, planing boats ride on the last third of their bottoms, and if this surface isn't straight, the boat will porpoise and buck. Some boats which have perfectly straight planing platforms while sitting in the water will develop a hook when power is applied (a good reason for taking a demonstration ride before buying).

Demonstration Ride. Once you have

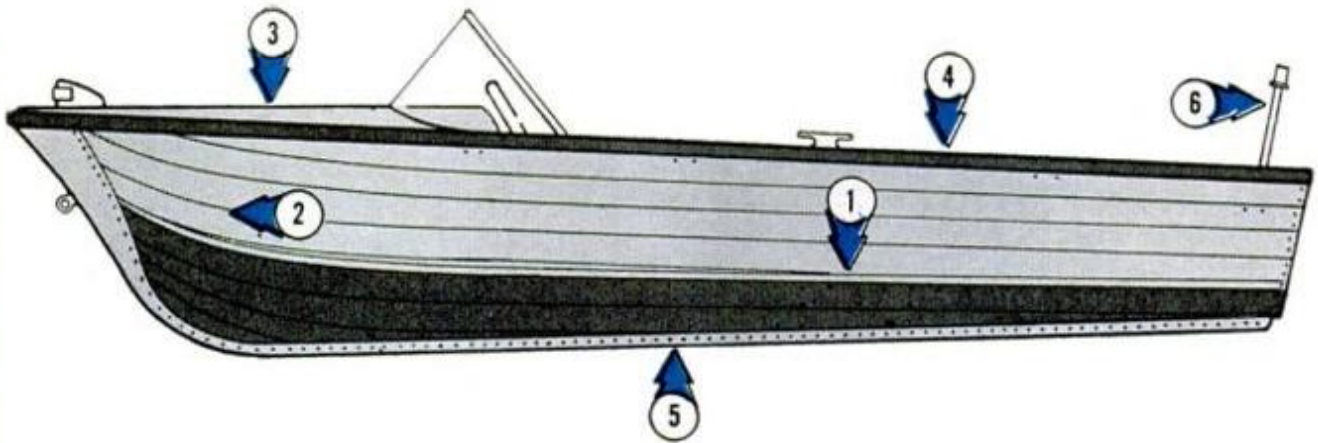
SHOPPING THE LOTS can be a pleasant experience if you know exactly what to look for and what to pay



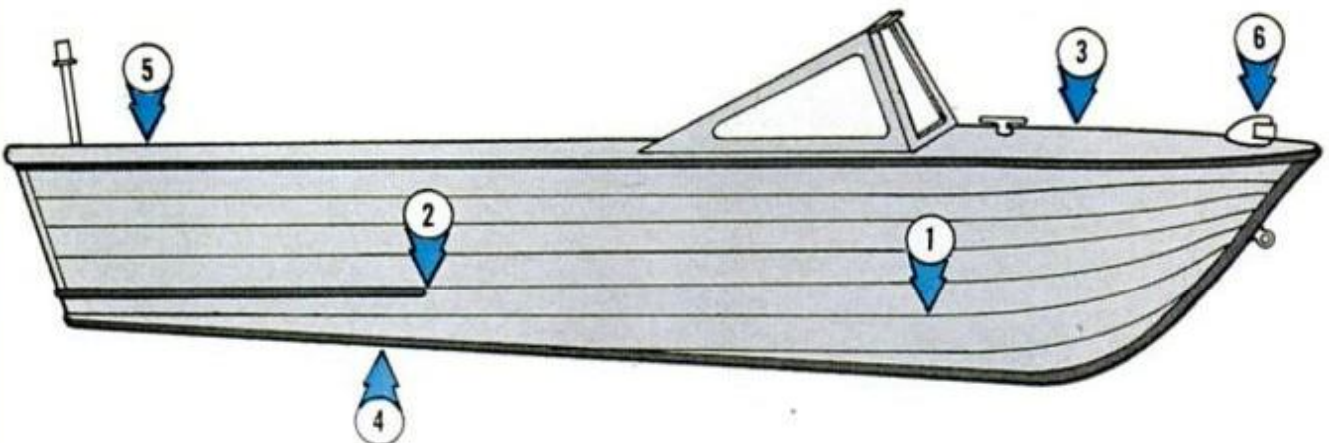
FIBERGLASS BOATS



ALUMINUM BOATS



WOODEN BOATS



1. Examine the hull for gouges or deep scratches which will require filling. If any are particularly bad, look further to make sure they don't involve structural damage.

2. Go over the gel coat for crazing or fading, indicating the need for a paint job.

3. Make sure the fittings are all tight and well braced.

4. Check the running lights and equipment to make sure they conform with local regulations. If anything is missing, remember that you're going to have to replace it, so keep this in mind when talking price.

5. Stand off and examine the lines. If the boat is on a trailer, check position of rollers to see that they support transom correctly.

6. Look for cracks at joints and connections—chines, keel, transom, stem.

1. Go over all seams carefully for loose or missing rivets, particularly below the waterline.

2. Examine any dents carefully. With today's nonhardening seam fillers, however, even a dented seam may be nothing but a cosmetic problem. Double check such dents for leakage when the boat's in the water, just to play it safe.

3. If it's painted, check the condition of the finish. Is a paint job indicated? Incidentally, unpainted aluminum boats often show a white powder deposit. Don't worry about this, it's just a surface condition and can be removed.

4. Check out the flotation. If the boat has air tanks, make sure they're sound and tight. If foam, it should be in good condition and securely in place.

5. Look at the lines to see if the hull is fair and true, free of hooks or rockers.

6. Check the equipment against what's required.

1. If plywood, look for delamination, particularly on edges of strakes.

2. Are all joints and seams tight? If you find a leak, it could mean anything from a simple recaulking job to replacing fastenings, planks or even ribs. Find the cause.

3. How's the finish? Repainting a wood boat isn't a particularly difficult job, but on the other hand, few people look upon it as recreation.

4. Check the lines to see that the hull hasn't been deformed by improper storage.

5. Okay, you've been waiting for this one—check poorly ventilated areas for dry rot. But don't use a knife or ice pick. Tap any suspicious areas with a hammer. Rotted wood is softer and sounds deader when hit. If you find what seems like rot, call in an expert.

6. Check the equipment, lights and fittings.

found a boat that interested you, arrange for an on-the-water demonstration. If you're buying the trailer as a part of a package deal, this will give you a chance to check that out, too. Is there a good arch on the springs? Is the axle straight? Flat springs or an axle that could be bent mean trouble.

Observe how the engine starts, idles and runs when opened up. You can't expect perfection in used iron, but on the other hand, you don't want the serious, expensive kind of trouble, either. If an engine starts easily, idles reasonably smoothly, and will take off in high gear, you shouldn't have too much to worry about.

Let the owner or dealer drive the boat at first, while you prowl around looking at the fuel tank and lines, and generally getting a passenger's feel of the boat. Then give her a whirl yourself.

Try normal turns, jumping the wake and tightening the turns gradually. The boat should turn smoothly and steadily. Remember that round-bilge boats will bank more sharply than hard-chine designs. And an unbalanced ride or extreme squatting during acceleration might easily be corrected with a set of inexpensive planing plates.

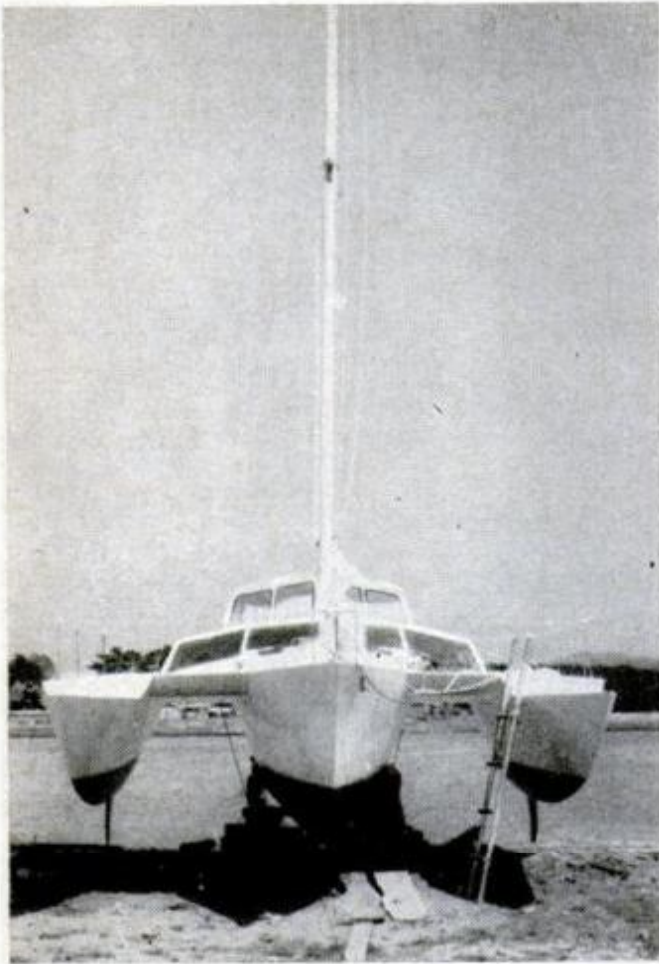
See a pro for final check

If the boat looks good, runs smoothly and doesn't take water, you're ready for the final check, which means professional help.

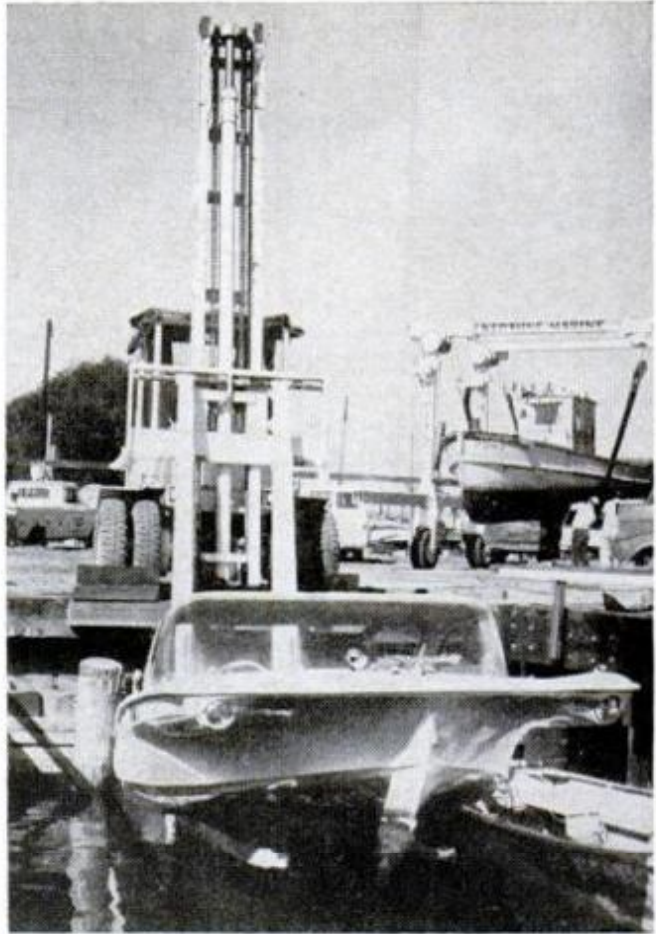
We've bought and sold a lot of boats ourselves, and we've never objected to a buyer's satisfying himself that a boat is in good shape. But on the other hand, we don't allow anyone who answers an ad to start cutting up our boat or dismantling our engine. If a person is interested enough to hire a service man with the right tools, gaskets and know-how, he's welcome to look at our dome, skirts and rings. The same goes for the hull. The ten, fifteen or even twenty-five bucks you might waste on a rig you turn down could turn out to be the best insurance money you ever spent.

You can't expect a perfect boat from the used-boat market. After all, you're getting from one third to two thirds off the original price, and something has to give. A professional will take this into consideration, while steering you away

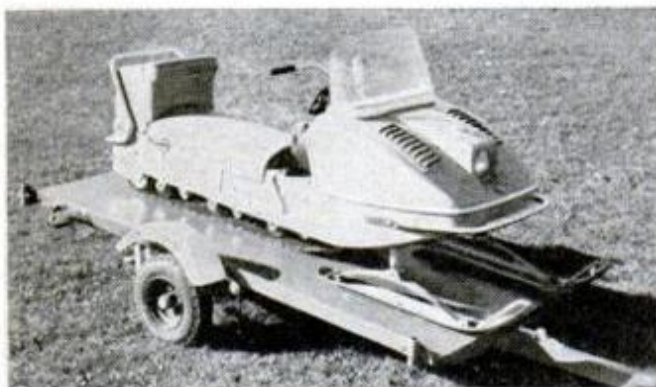
(Please turn to page 216)



Three hulls for 15 people. A new 35-foot trimaran recently built in Japan by an American businessman has berths for six, but will hold 15 for day sailing. The boat is made of plywood covered with fiberglass. Equipped with a galley and head, the craft will be exported to the United States. Its cost in Yokohama is \$9000.



Boating's on the upswing, at least when it comes to launching and dry-docking at the Brooklyn Marina. A forklift designed for the marina lifts boats out of the water (top photo) and deposits them on racks up to three stories high—and returns them to the water just as easily. The lift can handle up to four tons. It takes one operator just five minutes to launch or retrieve a boat.



Snowmobile or boat—it doesn't matter what the load is with this adaptable trailer. With the addition of a winch stand, rollers and carpeted bunkers, the utility trailer becomes a boat trailer. A swing-away tongue allows loading from front or rear. The Gator Suburbia is made by Gator Trailers Corp., 1925 E. Beaver St., Jacksonville, Fla.



"Gear down and locked" may become as appropriate to trailering as it is to flying if many trailer owners go amphibious with a new pontoon attachment. The pontoons, which are carried over the roof for road travel, can be made ready for the water in just 10 minutes, according to the manufacturer. A hydraulic system lowers the pontoons to the side for launching, then raises the trailer higher between the pontoons. A 15-foot trailer will convert to a craft 22 feet long and 11½ feet wide, furnishing complete walk-around decks. Power is supplied by an outboard carried on the aft deck. Controls are on the forward deck. The pontoon attachment is made by Trail-or-Floats Co., 4242 N. Alberta St., Portland, Ore.

CYPRESS GARDENS DRIVER TELLS: **How to rig your ski boat**

The boat can make the difference in tournament skiing and any boat can be adapted for top efficiency.

By **Ed 'Haddy' Rehling**

SHOW DRIVER Ed Rehling pilots the perfect boat, a runabout specially equipped for hauling skiers



TOWING A WATER SKIER into a ramp jump in competition is like playing a critical game of high-speed crack-the-whip. Getting the skier into position for the long outside swing, and then achieving just the right speed for his crossover and approach to the ramp, are things that collect extra points. Extra equipment and rigging are important.

Now, it's a fact that just about any outboard runabout can serve as an excellent tow boat. The hull must be in good condition, of course, and you need an engine powerful enough to do the job but, over and above that, it is the extra rigging that makes the difference.

My personal choice of boat for show driving is a 17-foot Crosby tournament special. It's powered by twin Johnson V-90 Golden Meteors. Since this boat is often called upon for unusual precision performance, it has been expertly rigged by our mechanical crew, but the average ski fan can alter and set up regular runabouts so they're similar to our tournament rigs.

Pick a proper prop

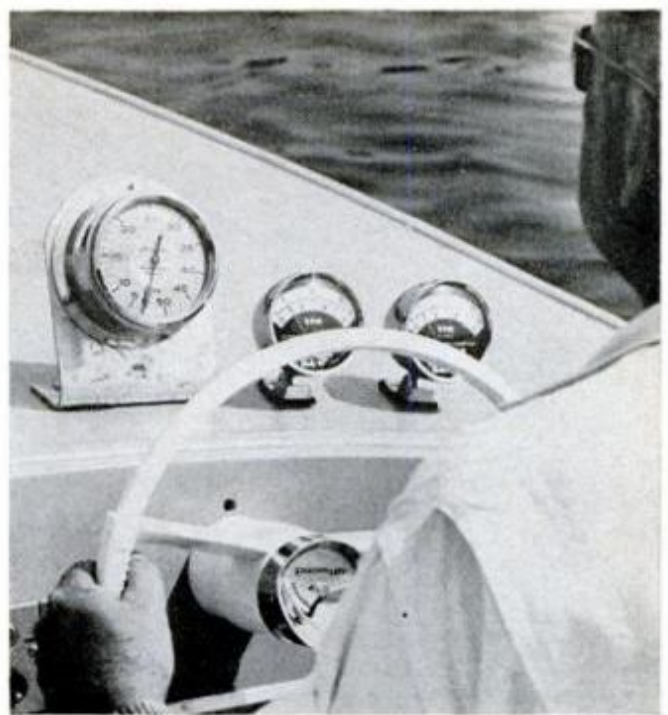
The place to start is at the business end of the engine—the propeller. A prop that will deliver quick takeoff punch and maintain a power grip on the water at high speeds is essential. In 99 cases out of 100, the prop used for Sunday cruising will not be right for group skiing or towing advanced skiers.

It's equally important that the engine be mounted at the correct height on the transom (rely on boat manufacturer's recommendations) and the angle of engine be right. It isn't hard to find the best angle by experimenting with the engine running in various "notches."

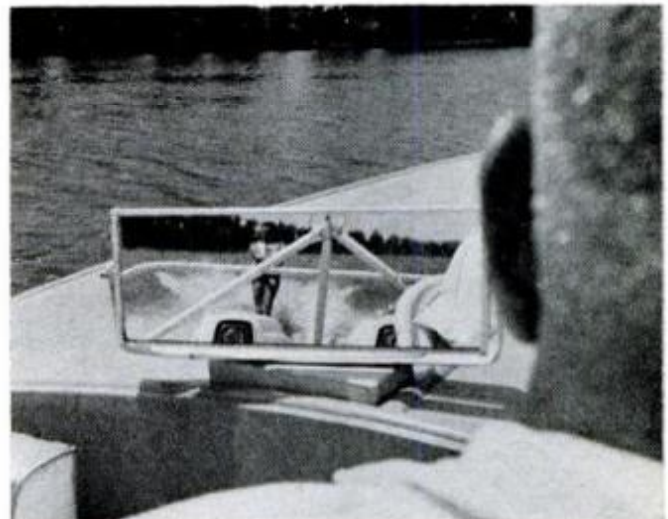
Invest in a good quality speedometer and tachometer to help the driver maintain a constant speed and power for the skier in tow. Dials should be large and easy to read. Most important: mount them in clear view of the driver so a flick of the eyes will give him a full report. Put them up high and directly in front of the driver.

A wide mirror is another essential and nothing does the job better than a big truck mirror. Bolt it down tight to the dash so there's no vibration.

Some conventional boat seats don't provide enough back support over long hours of ski-tow driving. An Army surplus airplane seat, with a generous coating of



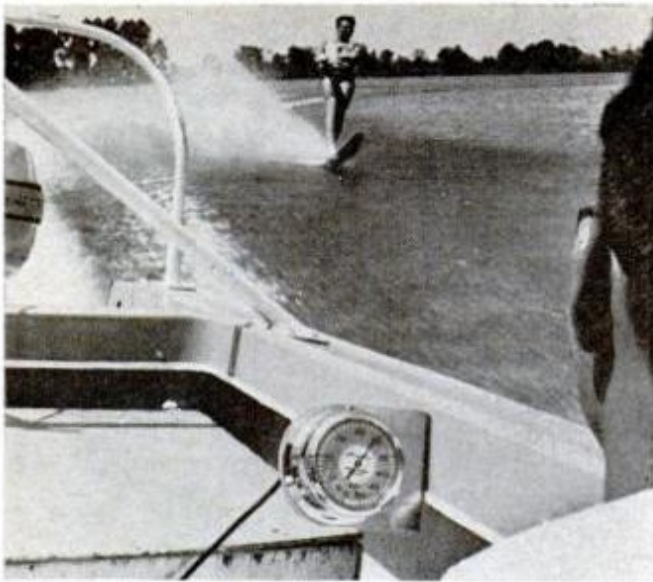
SPEEDOMETER and tachometer dials are easy to read



LARGE TRUCK MIRROR is perfect for the ski boat



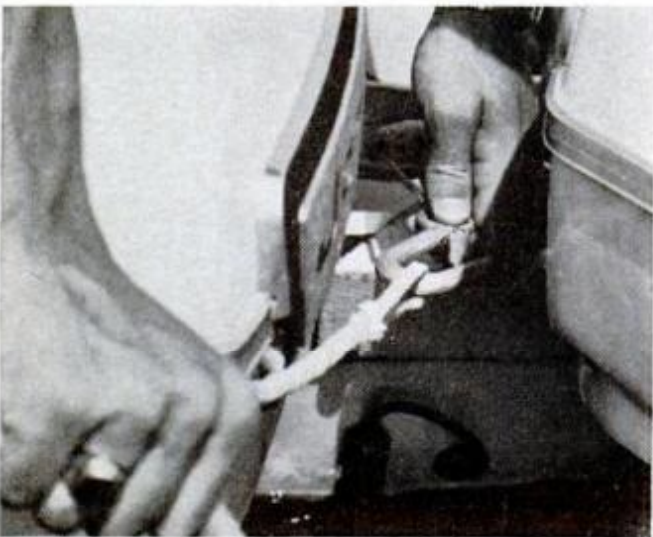
SURPLUS AIRPLANE SEAT gives driver added stability



SECOND SPEEDOMETER mounted in rear for observer



PLYON should be ahead of engines and the guide bar



TOW LINE HOOK for towing pyramids is mounted low

foam rubber, makes a functional if not pretty driver's seat.

Another sturdy seat, for the observer, should be facing aft and located up front across from the driver for quick communication. A second speedometer should be affixed to the gunwale for the observer.

An important accessory is the tow bar or "pylon." You can construct a good one of three pieces of 1-inch pipe welded together at the top, with two "legs" bolted to the top of the gunwales or on each side of the floor and the third brace bolted aft to the floor or transom. Weld a hook and ring to the top to attach lines.

The pylon should be ahead of the engines so the rig pushes the skiers. Pylon height must be between 3 and 5 feet from the water to conform with AWSA rules. Another rounded pipe bar should go above the engines, parallel with the transom, to keep lines from getting tangled with the power.

Attach one strong line-hook low (between the engines on twin rigs, on a low bridle on single engine rigs) for pulling heavy loads such as a pyramid of skiers.

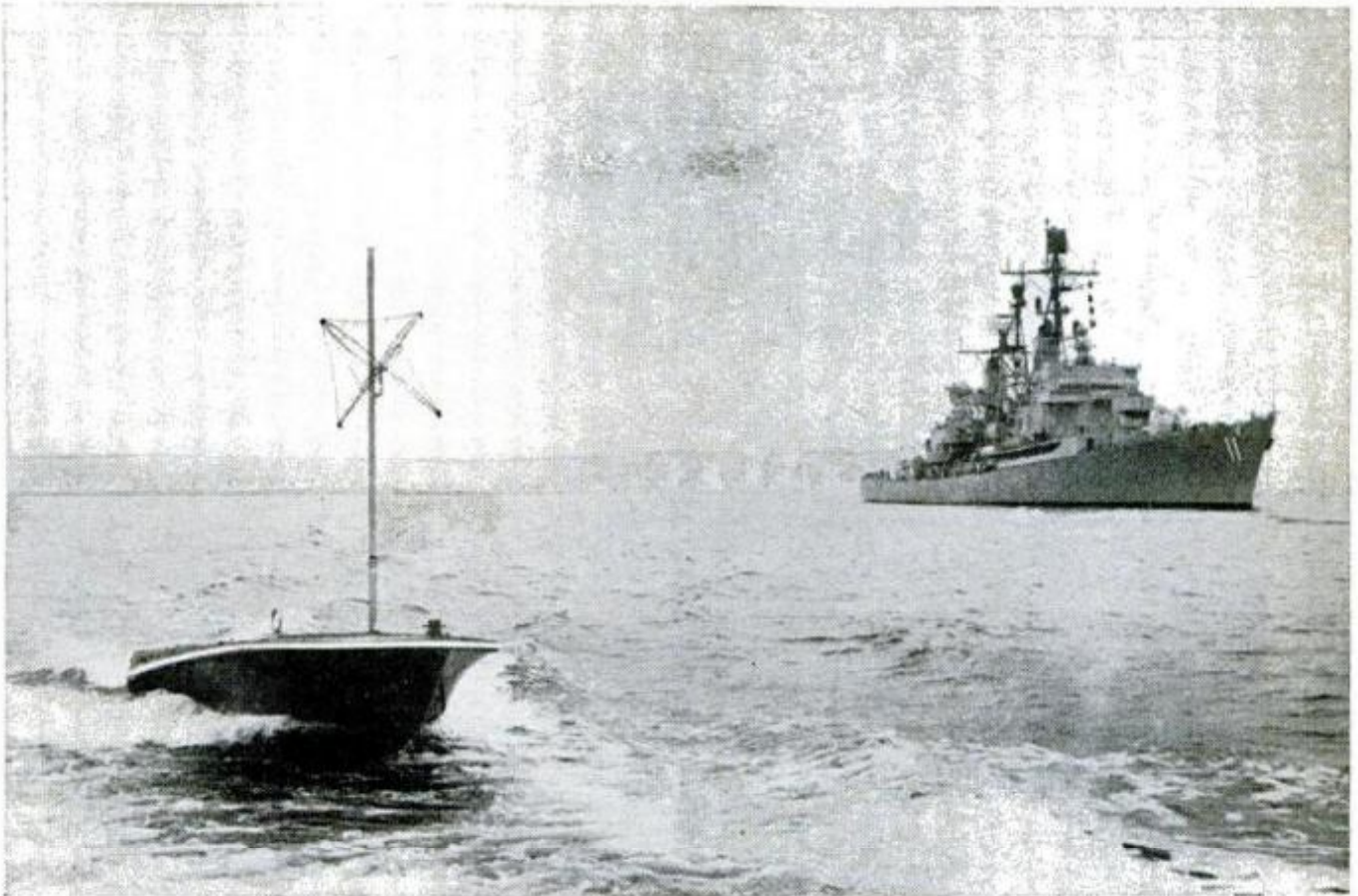
Balance fuel tanks

Place fuel tanks on each side of the boat for balance and keep them as far forward as possible. Lock the fuel cans in place with boxes bolted to the floor or heavy straps or shock cord.

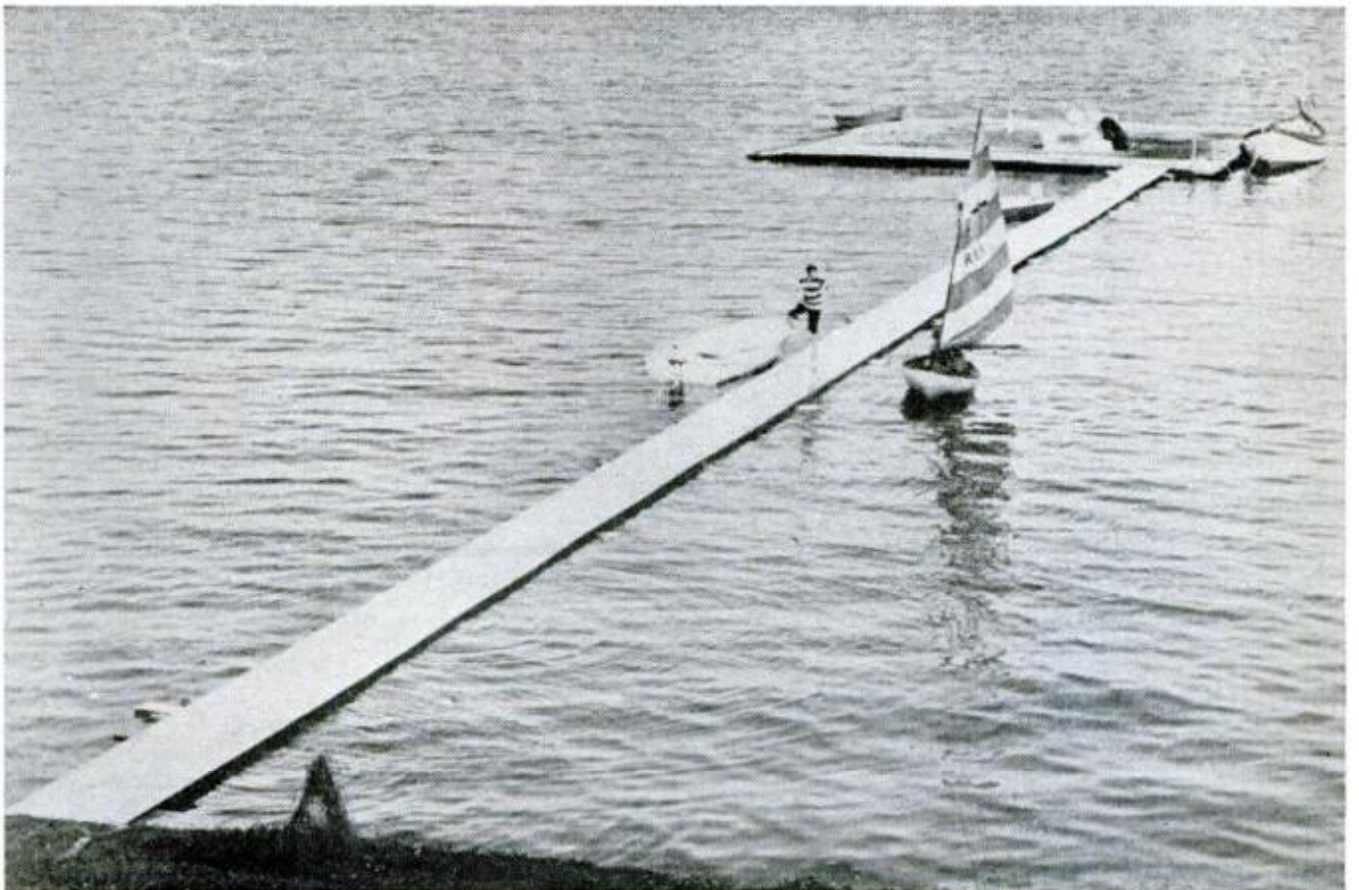
Rid the boat of unnecessary "gingerbread." Some drivers prefer no windshield but I'm comfortable either way.

It's good to have one handy storage bin to keep judges' flags, a first aid kit (always keep one in the boat) and other miscellany. A boarding ladder is one accessory necessary on a ski rig. Exhausted skiers like steps leading into the boat!

It takes a lot of practice for a boat driver and a skier to function as a team, but if your boat is well-rigged, the hull is kept clean and the engines are tuned to perfection, the battle is two-thirds won. The remainder depends on how you develop individual skills, a matter of total dedication and practice. You'll spend long hours, and your ears will burn from what dunked and bruised skiers say about you, yet there is no other way to develop the fine edge and perfect timing required for competition driving. But if you have the right rig and you persevere there will be a day when point-conscious skiers clamor to have you behind the wheel. ★ ★ ★



"Birdcage" ping targets, used for years on the Greenland and Antarctic ice caps as trailfinders for blizzard-blinded Sno-cats, have a new role. Perched on unmanned Ryan Firefish boats, they simulate "enemy" PTs. U.S. ships practice on them with radar "guns."



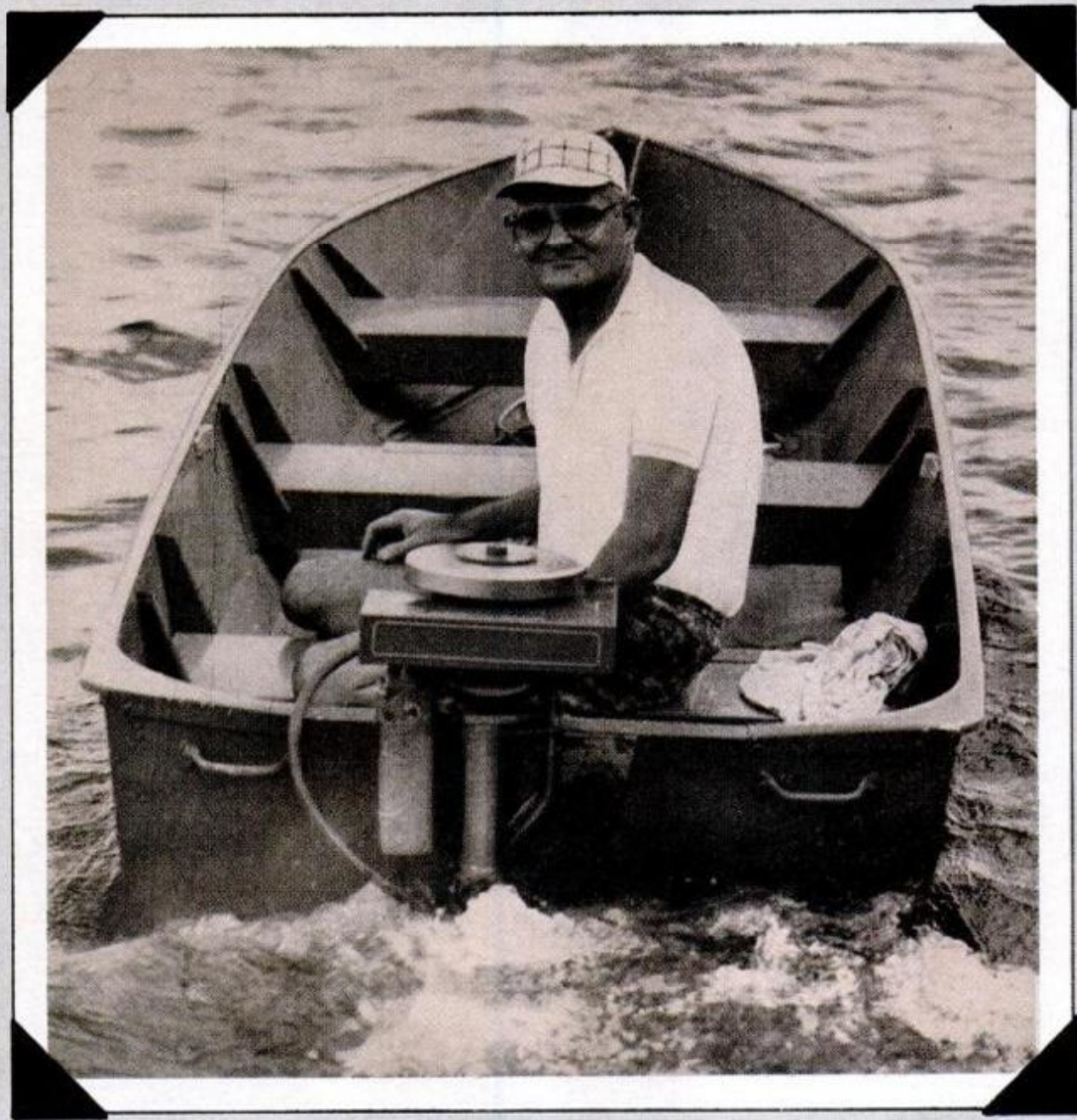
Endless plywood is what it took to fill a special order for this one-piece floating walkway. The 200-foot-long "panel" of $\frac{3}{4}$ -inch plywood was made by Georgia-Pacific for two Puget Sound families as a path to their dock float. It was floated from factory to site.

antique outboards

Ancient motors, some a half horsepower strong and
BY Ken Warner

CONTRARY TO THE BELIEF OF MOST MUSCULAR TEEN-AGERS, the outboard motor predates both the bikini and water skis. As you may recall, there actually was a time when kickers of modest power served primarily to make life a bit easier for the avid fisherman.

If such a motor is taking up corner space in your basement or garage, don't consign it to the junk pile. There may still be plenty of life in it. And it might even be a sought-after antique. You can find that out soon enough



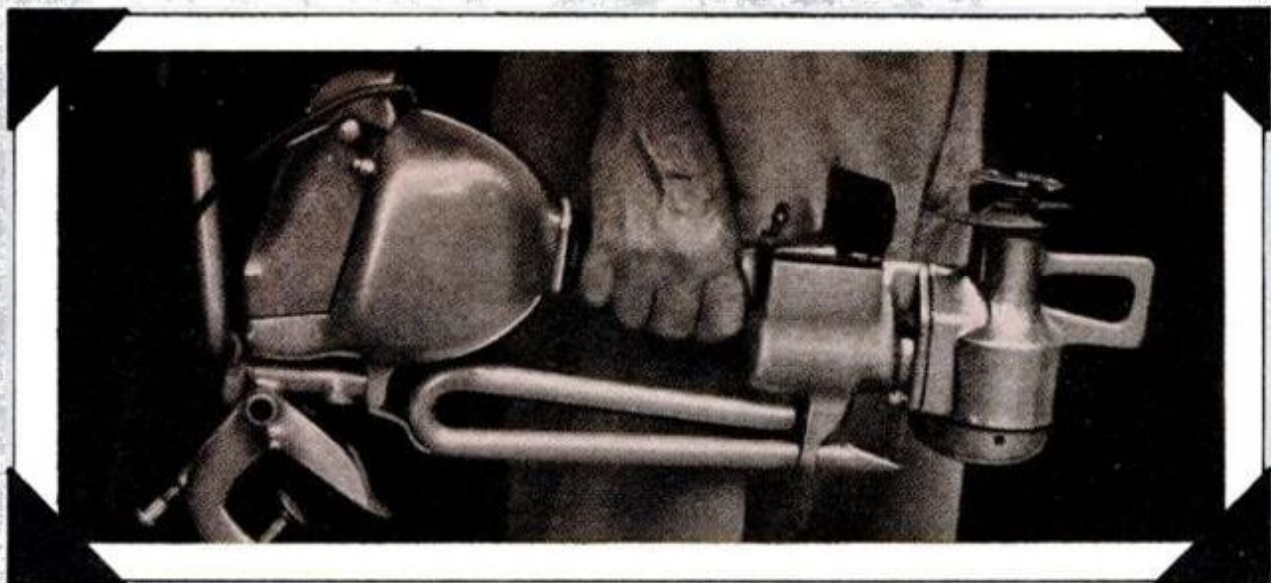
EXPERT ON WHAT MAKES OLD KICKERS KICK is J. Frank Johnston, who's restored more than 125 of them. The motor smartly pushing Johnston's 14-foot fishing skiff is a half-century-old Evinrude

too frisky to retire

others 50 years old, are still pushing boats around

by checking with The Antique Outboard Motor Club, an organization "dedicated to the preservation and restoration of old outboard motors."

If you're wondering how old an antique motor has to be, the cut-off date is 1942. Any outboard made prior to that year qualifies. But the motor most likely to quicken the pulse of the average AOMC member is one made in 1909. The day that it hit the market—and it was the first commercially successful outboard—is warmly thought of as the "day Ole threw away the



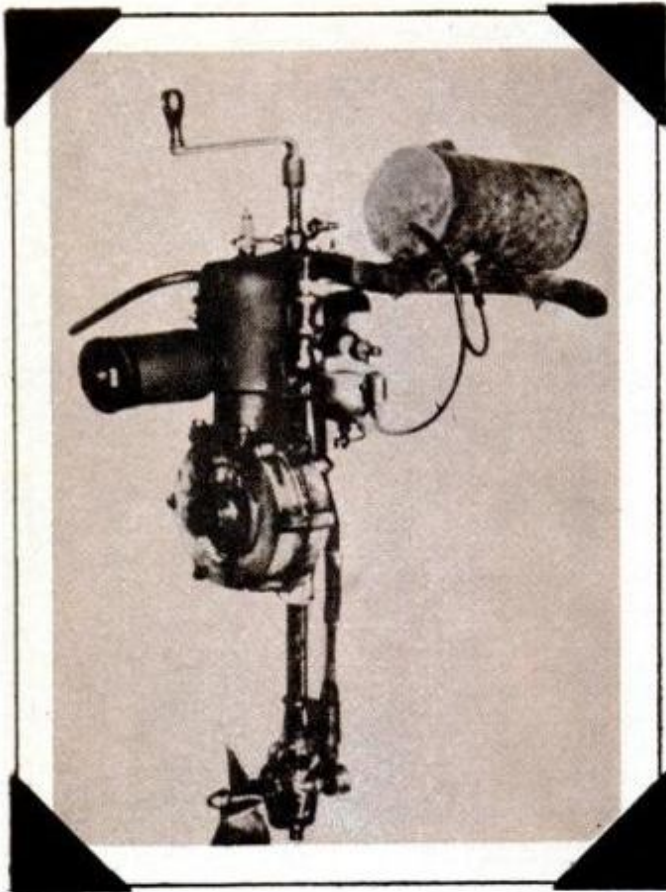
ODD CONFIGURATION PUT MOST of 2.1 Troller under water. Cylinder and sparkplug are just above lower housing; prop is mounted on end of driveshaft. The motor is started by winding the prop



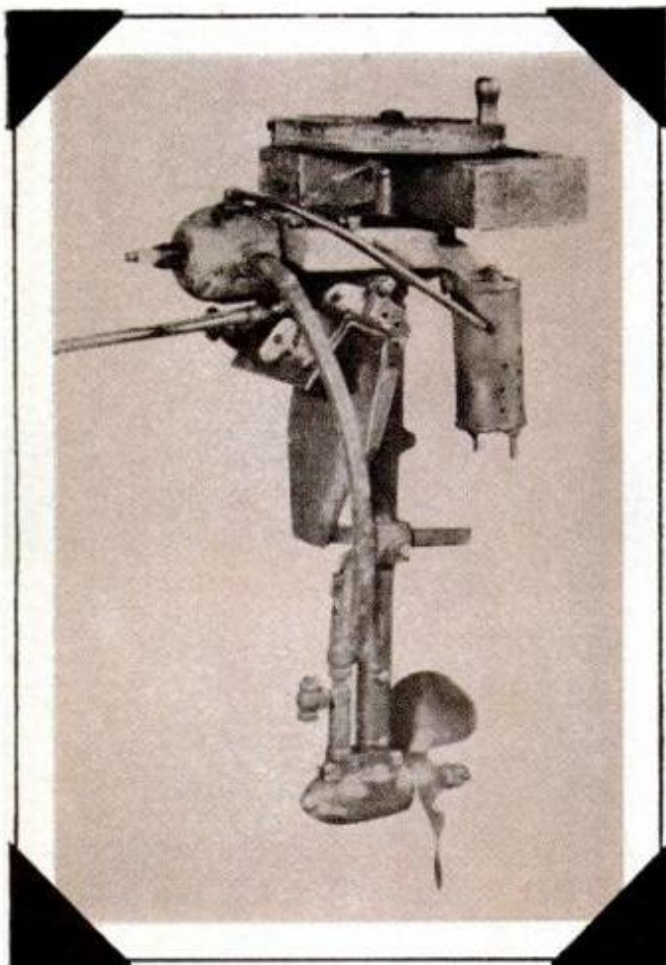
MOST OLD COILS will work if undamaged, according to Johnston. This one was made 42 years ago



THE 1922 JOHNSON next to George D. Ralph, testing another motor, belonged to mobster Al Capone



MOTOR THAT MADE AMERICANS "throw away the oars." Ole Evinrude put it on market in 1909



IDENTIFICATION IS LACKING on this one, but buffs suspect it's a prototype Waterman Porto

cars. The chap referred to is Ole Evinrude. In April, 1909, the Milwaukee machinist rented a rowboat for 50 cents, attached his new kicker to the transom and putt-putted up the Kinnickinnie River at a jaunty five mph.

Ole's one-hp engine wasn't the first on the market. In 1905 Cameron B. Waterman of Detroit introduced a two-hp job, but it didn't catch on. And back in 1893 William Steinway, son of the famous German-American piano maker, displayed a detachable machine on Lake Michigan. It's said that this contraption created a smoke screen thick enough to drive spectators away and Mr. Steinway back to the piano business.

All told there have been some 70 American companies making outboards at one time or another. Names like Koban, Elto, Johnson, Lockwood-Ash and Caille loom large in the development of the engine.

In 1959 George D. Ralph and other aficionados in Florida organized the first antique outboard club. Last year the club was reorganized under the leadership of David R. Reinhartsen of Madison, Wis., a 27-year-old candidate for a PhD in electrical engineering. He has a collection of 30 old motors.

But the champ collector probably is J. Frank Johnston of Gainesville, Fla. He has completely restored and still owns some 125 motors. About 50 of them are on display at the Carriage Cavalcade, an attraction in the resort town of Silver Springs, Fla. The rest are racked row on row in a sheet-metal building on his property.

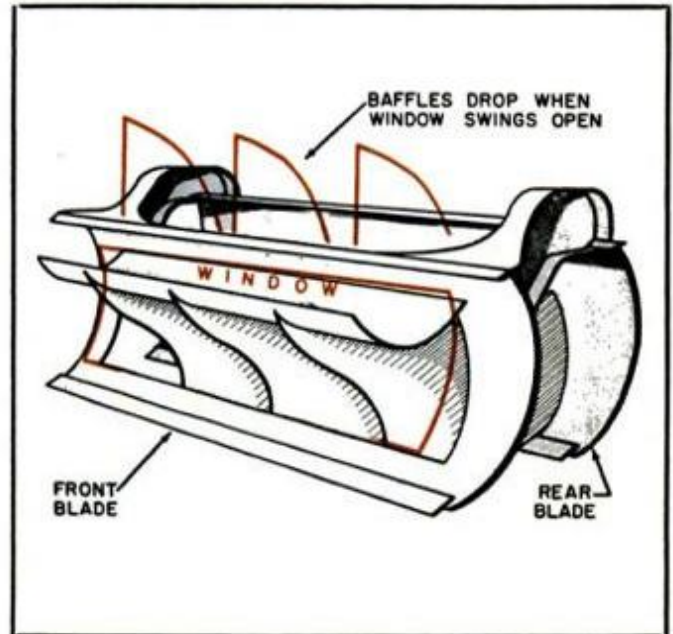
What to look for

When Frank Johnston sets out to work over a motor, he doesn't fool around. He takes it carefully apart, down to the last little bolt. He cleans and taps out each threaded hole. He cleans and polishes by hand before buffing. When he has reassembled a motor, it looks as though it had had loving care since it was first made.

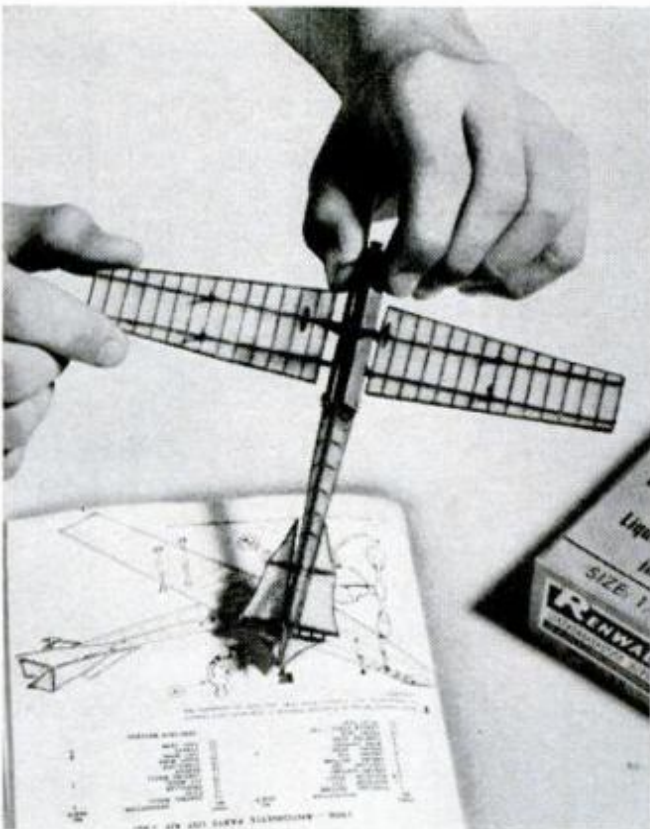
He has a four-item checklist for judging a rig:

1. Is the motor all there? Are any major parts broken or visibly deteriorated?

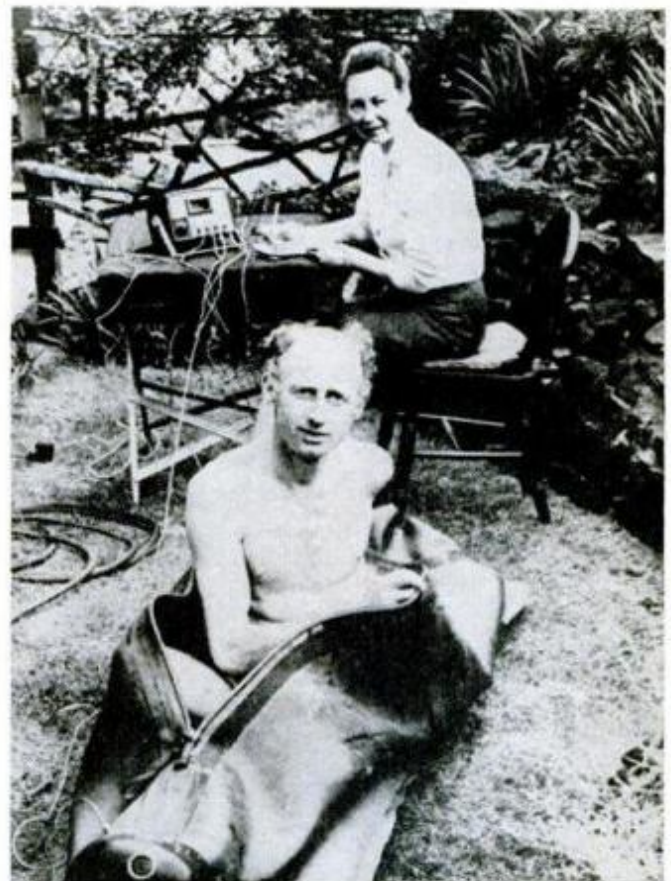
2. Is the lower end good? This is a difficult replacement to make with any [\(Please turn to page 218\)](#)



No snow-blocked driveways after this plow goes by—that's the promise of the inventor, Cyril Astill of Deep River, Ont. The plow has two blades, one behind the other. The front blade pushes snow aside until the machine reaches a driveway. A "window" on the front blade then swings up dropping baffles behind it that trap snow until the plow is past the drive. Closing the window causes the baffles to rise—and the trapped snow slides out to one side.



Like old times. The plane is a 1/72 scale model of the 1908 Antoinette, one of Renwal's Fabulous Flying Machine series which feature a new covering technique called Aero-skin. Paper is used over the ribbed-out wing, fuselage or tail sections; the paper is saturated with modeling cement to bond it to the ribs. A two-plane kit costs \$1.



Life-saving bathtub. A quick, hot bath for an injured mountain climber or cave explorer can mean the difference between life and death, claims Donald Robinson of Yorkshire, England. He is shown demonstrating his survival bag, which can be carried by rescue teams who use it to raise the body temperature of injured climbers.

AT 11:30 P.M. of gale-force service, the traditional 36-foot Coast Guard motor lifeboat is being replaced by a 44-foot, 400-hp rescue craft that operates like a streamlined cork.

Slamming through 30-foot waves or crunching over a sand bar, the new boat has proven itself not only more seaworthy than its predecessor, but it has a built-in self-righting ability that makes it absolutely impossible to capsize.

Self-righting systems are not new, but past models have always used a system of pipes and valves to shift water ballast, and these systems often foul up or suffer damage in heavy seas. This has been eliminated in the new boat by shaping the hull and distributing weight in such a way that it is totally unstable when it is upside down and simply flips right side up.

This is aided by a lightweight aluminum superstructure over the heavy steel hull, a forward passenger station and aft litter station that are watertight and airtight compartments, and a center-line fuel tank that is shaped slightly like an inverted "V" so that it presents an unstable free surface when the boat is capsized.



UNSINKABLE, HIGH-

Coastal waters are safer, thanks to the Coast Guard's latest 44-foot



CALM BEFORE THE STORM. Making a test run, the new 44-foot motor lifeboat makes 15 knots in a calm sea. But its element is the storm, and it has weathered 30-foot waves to prove itself indestructible



Extra framing and welded steel construction make the motor lifeboat far more rugged than a conventional craft, and it has heavy plate protection at the bow and amidships to absorb the punishment from ice, sand bars and grounding.

It also has a towing bit situated almost amidships to give better control for regular or side towing.

A fully integrated control and steering station brings steering and speed under control of one man safely strapped in front of a fathometer and radar.

Built at a cost of \$115,000 at the U.S. Coast Guard shipyard near Baltimore, the new lifeboat has a range of 150 miles at a speed of 15 knots. Twin screws and rudders are within the outline of the midship section so the boat can ground from nearly any direction and get underway again under its own power.

After a thorough beating in the notoriously rough waters of Yaquina Bay off the coast of Oregon, the boat was described as: "The most remarkable piece of equipment to bolster the operational capabilities of the Coast Guard since the development of the 52-foot motor lifeboat." ★ ★ ★

POWERED RESCUE

motor lifeboat which combines speed, stability and rugged efficiency

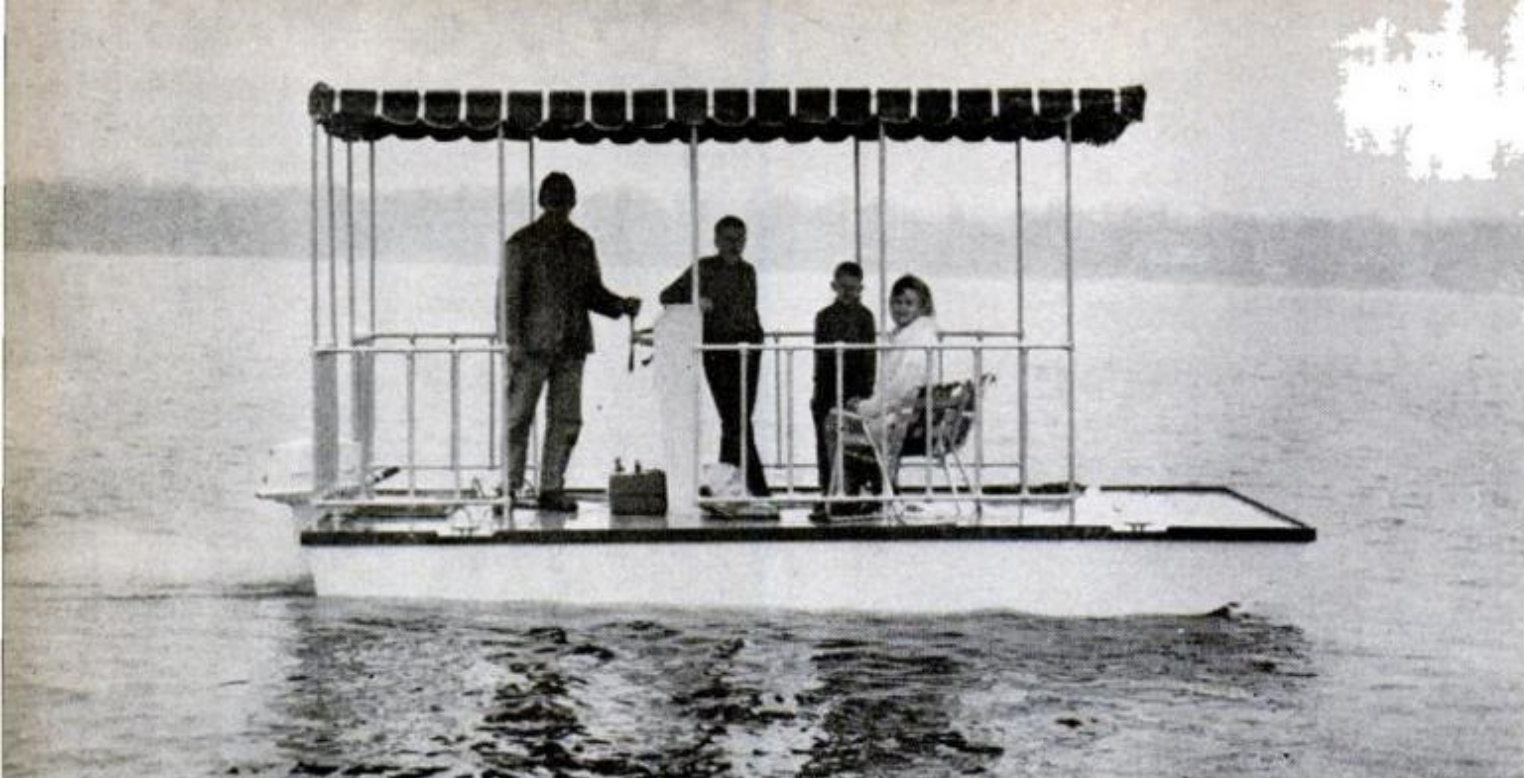


FIRST TIME in Coast Guard history, the helmsman is strapped to a seat where he also handles throttle

MARCH 1966



A GRAND OLD TUB, the 36-foot motor lifeboat has served 90 years, creating a legend of gallantry



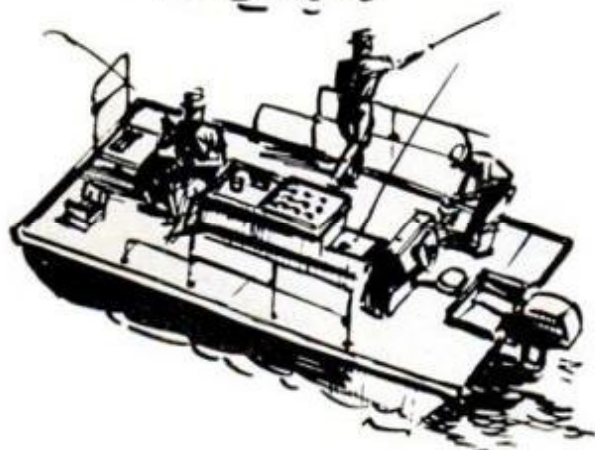
PM'S PLATFORM BOAT

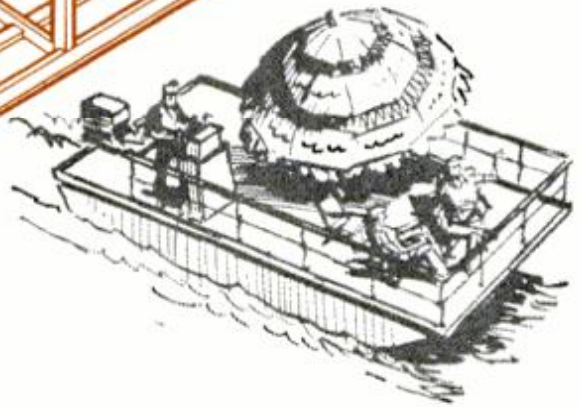
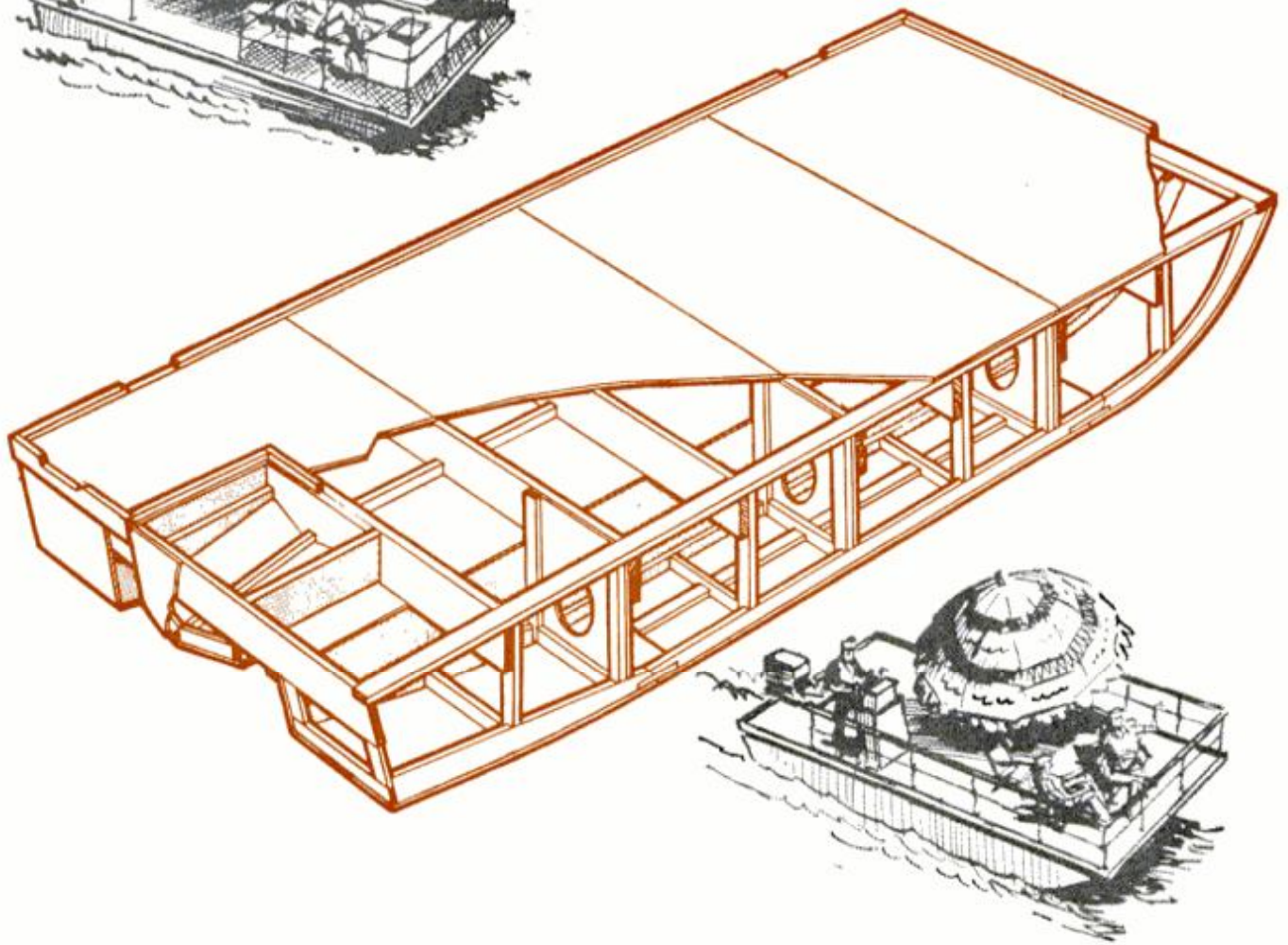
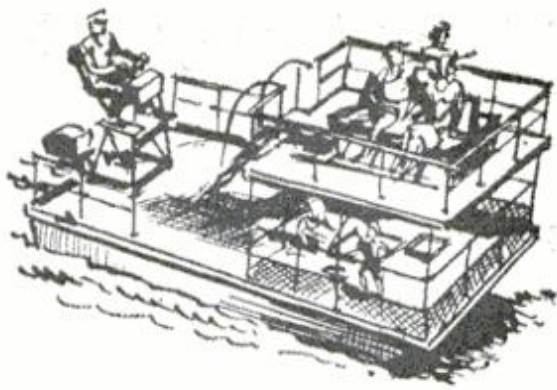
By Art Mikesell

You can build any kind of floating fun on top of it. We give you plans for the pontoons and deck—you take it from there



START WITH THIS easy-to-build pontoon platform and you'll have no trouble turning out a customized boat exactly suited to your needs. It's a big, roomy craft offering plenty of space for installing all the features you'd like to see in a boat.





Of course, no pontoon boat is designed for towing skiers or running in really rough water, so don't try to turn it into an SK or deep-V. (Actually, this one plugs along at a stately 8 mph or so.) But outside of these limitations, this type of hull is one of the most practical choices for general use on small lakes and rivers.

Turn it into a floating picnic pavilion, with seats, table and storage space for coolers and hampers. Or, a powered fishing dock with live bait and catch wells, underdeck rod storage, fish finder and anything else necessary. Or, even a deluxe swimming station that can be moved anywhere on the lake, complete with diving tower, swimming slide and colorful dressing tents.

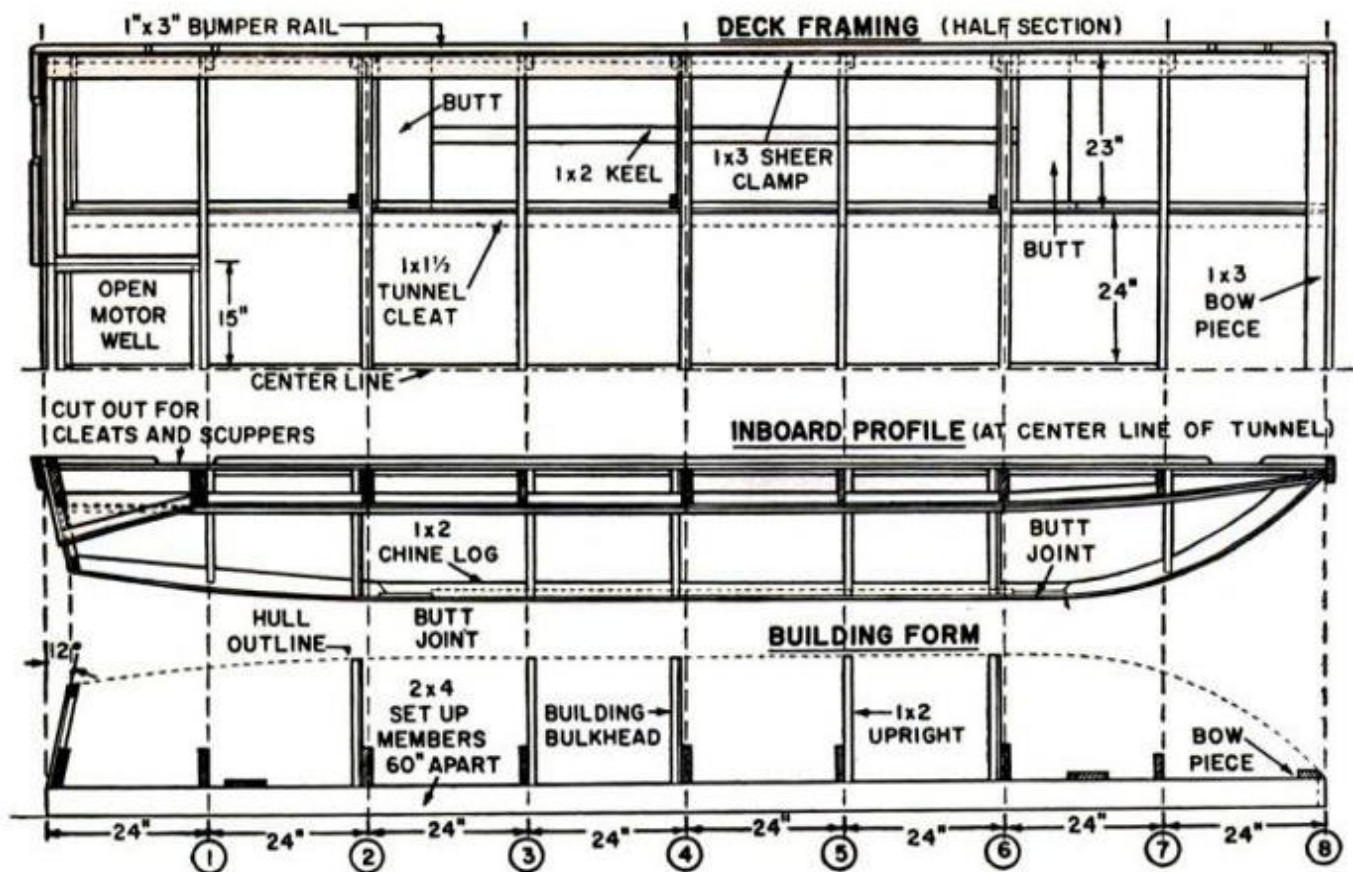
If you want to trailer the boat, you'll have to alter the dimensions of the pontoons. While the width falls within that permitted by regulation, the spacing between pontoons (48 in.) is too narrow to fit on a pontoon trailer, most of which re-

quire from 50 to 54 in. The 4-ft. spacing was decided upon to take advantage of stock plywood panel size and economize on materials.

By building the pontoons slightly narrower and widening the tunnel, the boat can be tailored to fit any pontoon trailer. Since it normally draws only about 4 in., the slight increase in draft caused by narrowing the pontoons shouldn't cause any problems.

General specifications. Douglas fir is satisfactory for the framing, so long as it's first grade and free of knots and shakes. For a slightly stronger boat, use white oak, Philippine mahogany or Sitka spruce. Likewise, exterior-grade plywood is satisfactory in all cases, though marine-grade will result in a stronger construction. You also have some leeway in choosing the quality plywood to be used at different locations. For example, AC panels could be used for decking with the C face down.

All joints should be glued, as well as

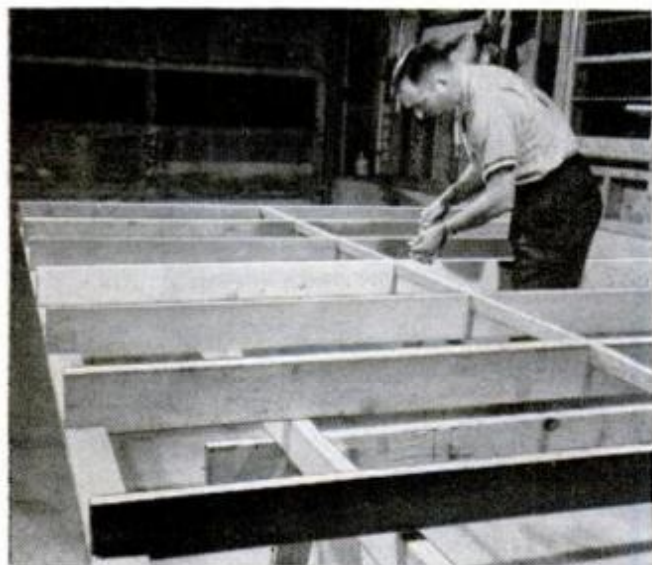


screwed or nailed. If you plan to fiberglass the hull, a hard-setting glue (resorcinol or urea-resin type) should be used. If not, however, select a mastic or flexible, water-type glue for all underwater junctions.

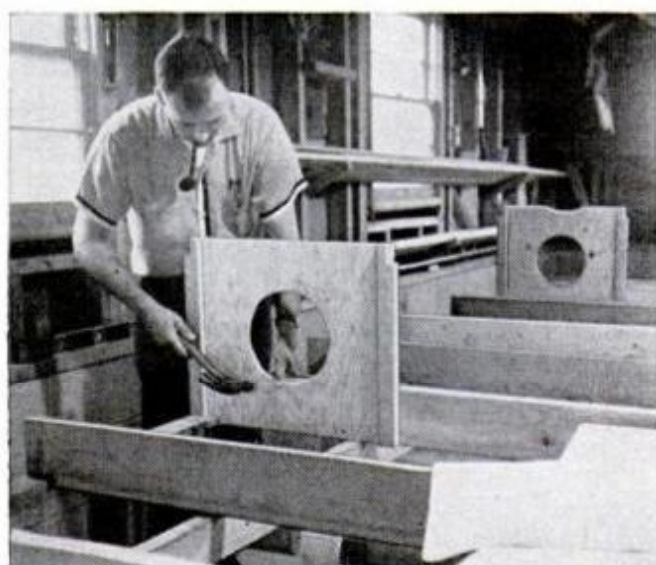
All fastenings should be either of bronze or hot-dipped galvanized iron. The latter are quite adequate here, and are less expensive. Incidentally, all nails should be the annular-ring type.

Review the plans and text carefully before you begin construction.

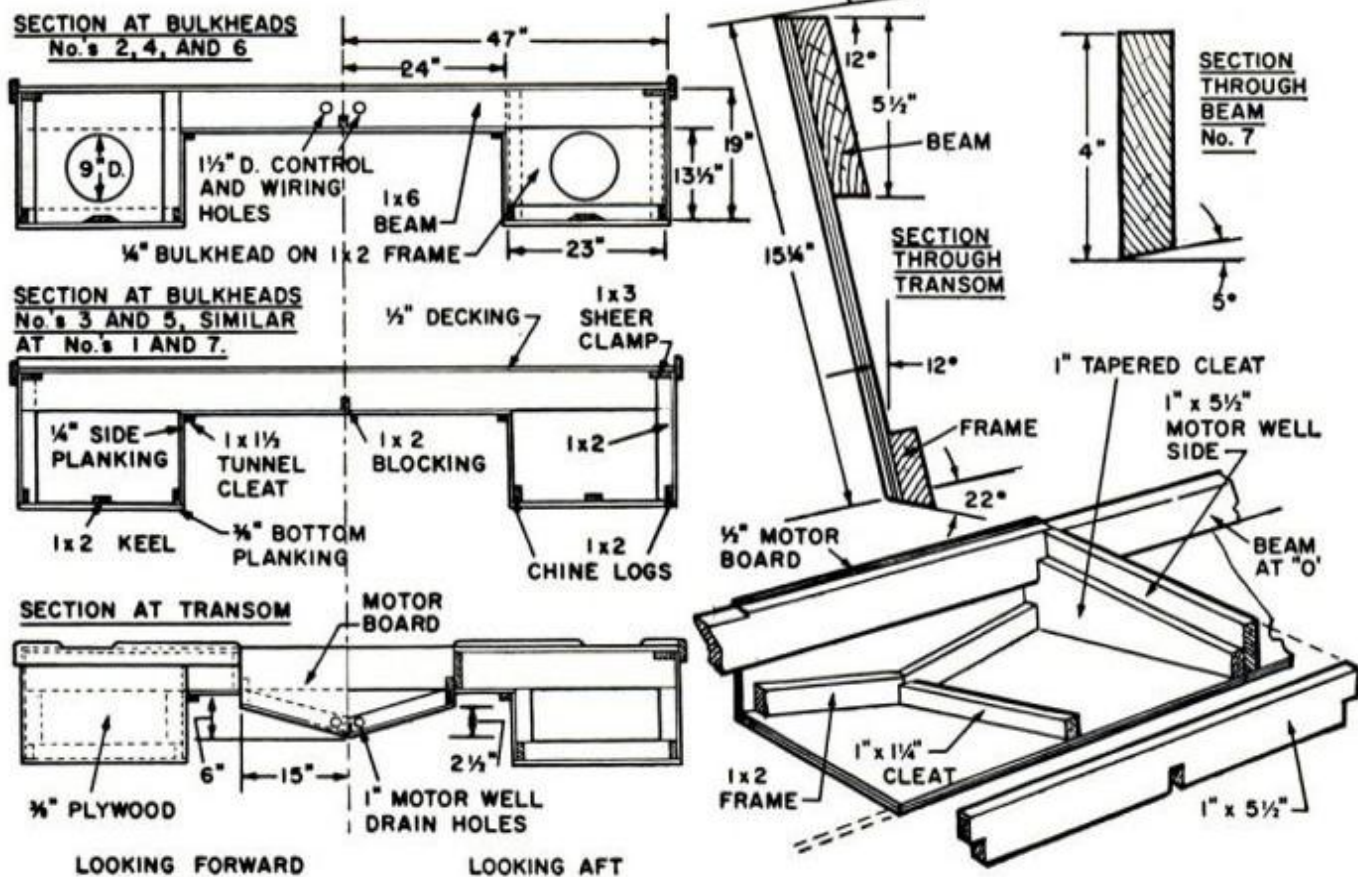
Building bulkheads. The three building bulkheads each consist of two 1/4-in. plywood bulkheads framed with 1 x 2 stock and fastened to a 2 x 6 beam. As shown in the photos, lightening holes may be cut in each of the bulkheads to reduce the weight of the boat. Limbers (drainage holes) should be cut adjacent to the keel notch to allow any bilge water to drain aft where it can be removed through drain plugs installed in the transom or pumped out, gaining access through small hatches set flush with the deck near the transom.



BUILDING FORM is actually just two 2 x 4 set-up rails on which the basic framing pieces are mounted



PLYWOOD BULKHEADS mounted on the 2 x 6 beams make up three building bulkheads spaced 4 ft. apart



Note that two types of bulkheads may be used at bulkhead No. 4, depending on whether the side planking is a continuous 16-ft. panel (usually available only on special order) or two butt-joined, 8-ft. panels. If the planking is butt-joined, you'll have to make allowance in the bulkheads for the thickness of the $\frac{3}{8}$ -in. butt blocks that will mate to the side of the bulkhead and extend 8 in. on either side of the planking joint.

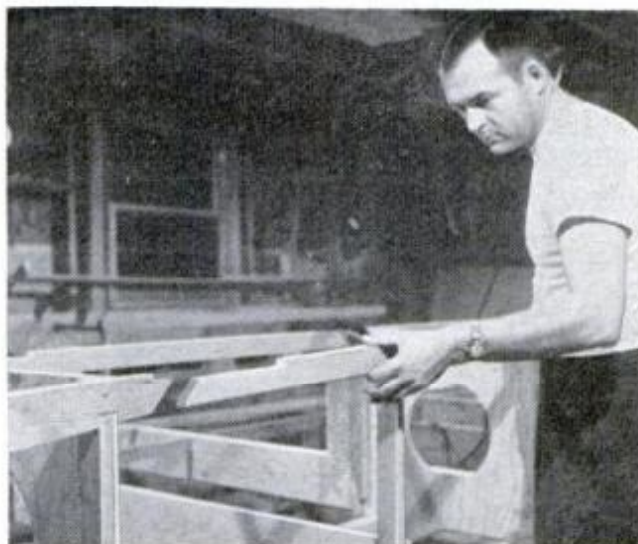
Beams. At stations 1, 3, 5 and 7, use 1 x 6 beams with uprights at their outer ex-

terminities in place of full bulkheads. Note that the beam at No. 7 must be trimmed and bevelled to mate with the $\frac{1}{4}$ -in. plywood tunnel planking.

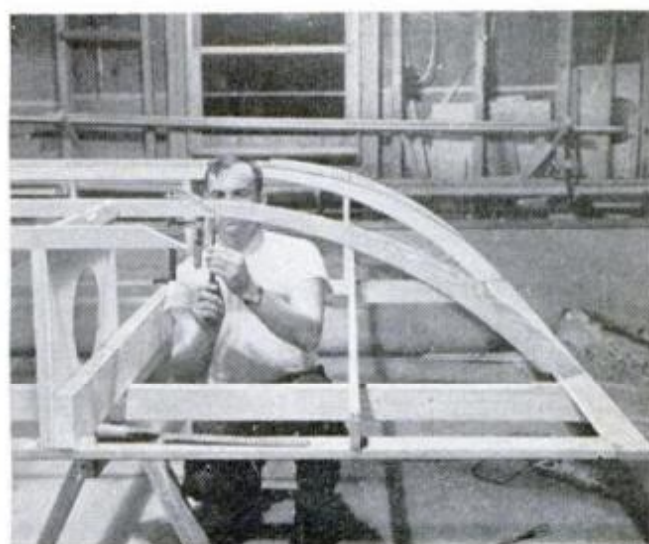
The uprights at Nos. 1 and 7 may be left long for cutting to size later during assembly of the side planking, or may be left out temporarily and installed after the planking is in place.

Cut notches in the beams for the sheer clamp and in the uprights for the chine log.

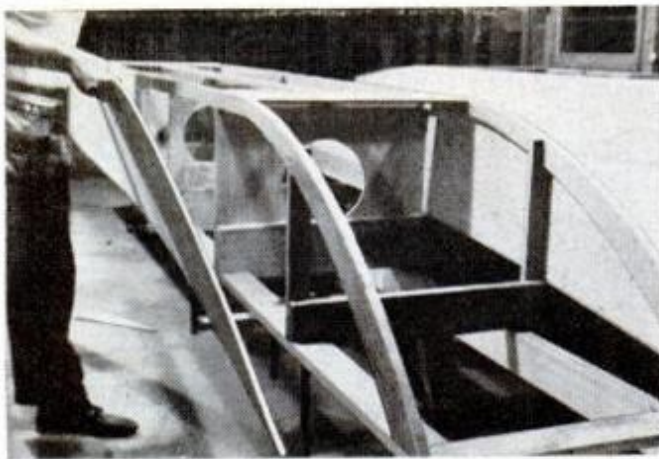
Transom. The transom is constructed in much the same way as the bulkheads. It's



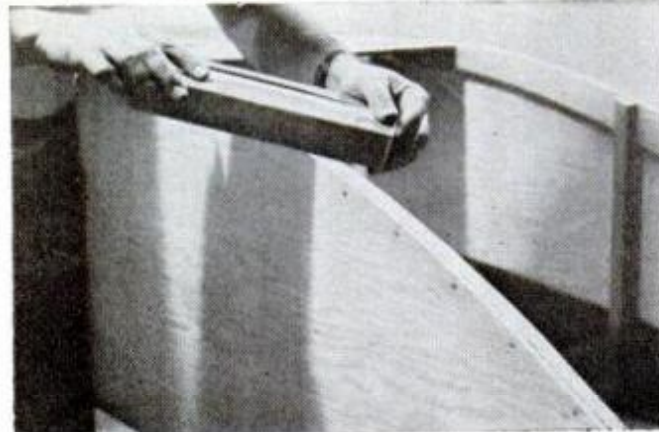
CHINE LOG JOINTS fall under joints in bottom planking and must be notched for $\frac{3}{8}$ -in. butt plates



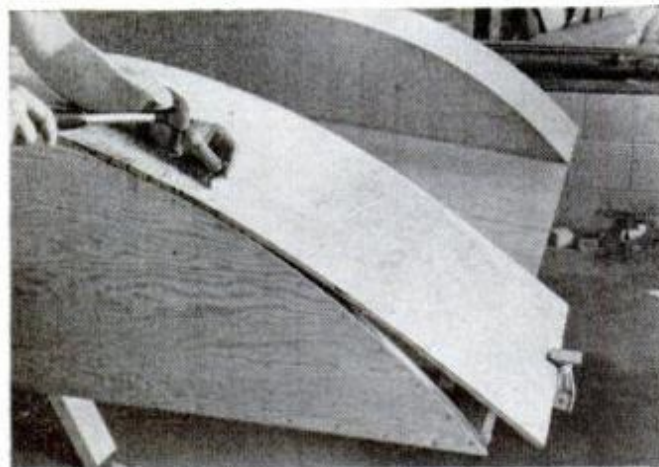
STEM CURVE is a 4-ft. 6-in. radius which may be cut from 1 x 6 stock or laminated from $\frac{1}{2}$ -in. plywood



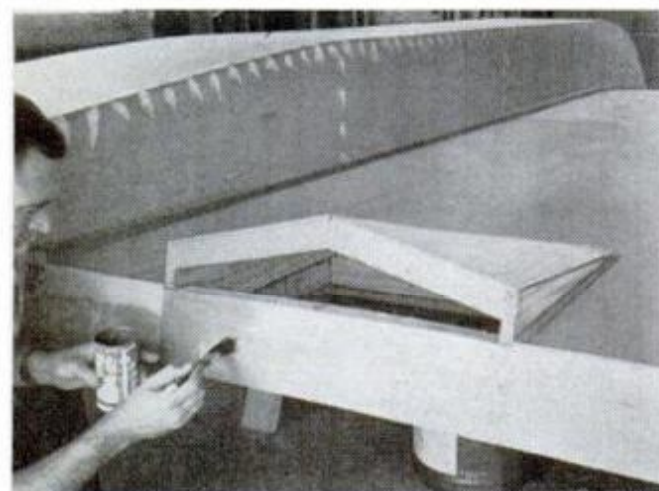
ALL FOUR PIECES of side planking have the same curve, so after one is laid out it can be used as pattern



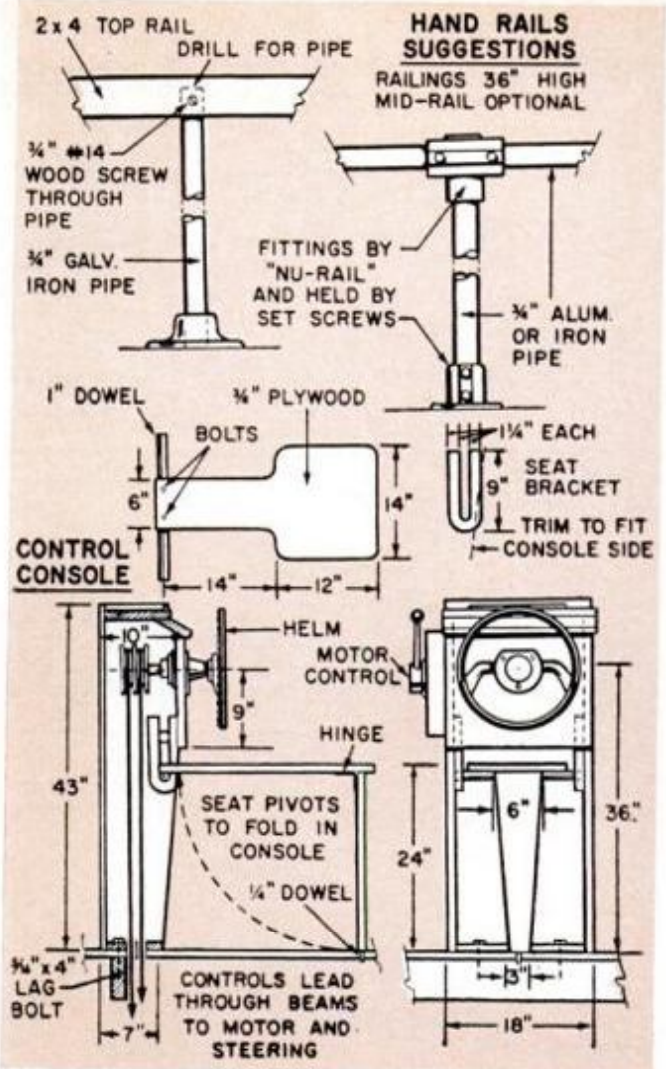
AFTER MOUNTING the side planking, sand the edges flush with framing so bottom planking mates tightly



WHEN NAILING forward section of bottom planking, begin at aft end and work down the curve of stem



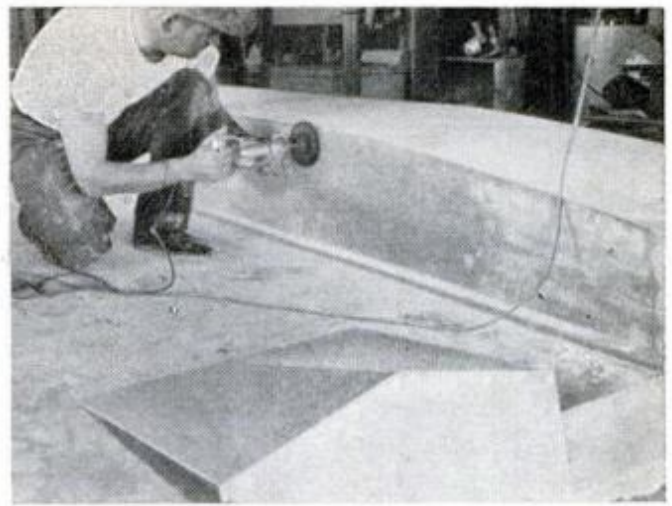
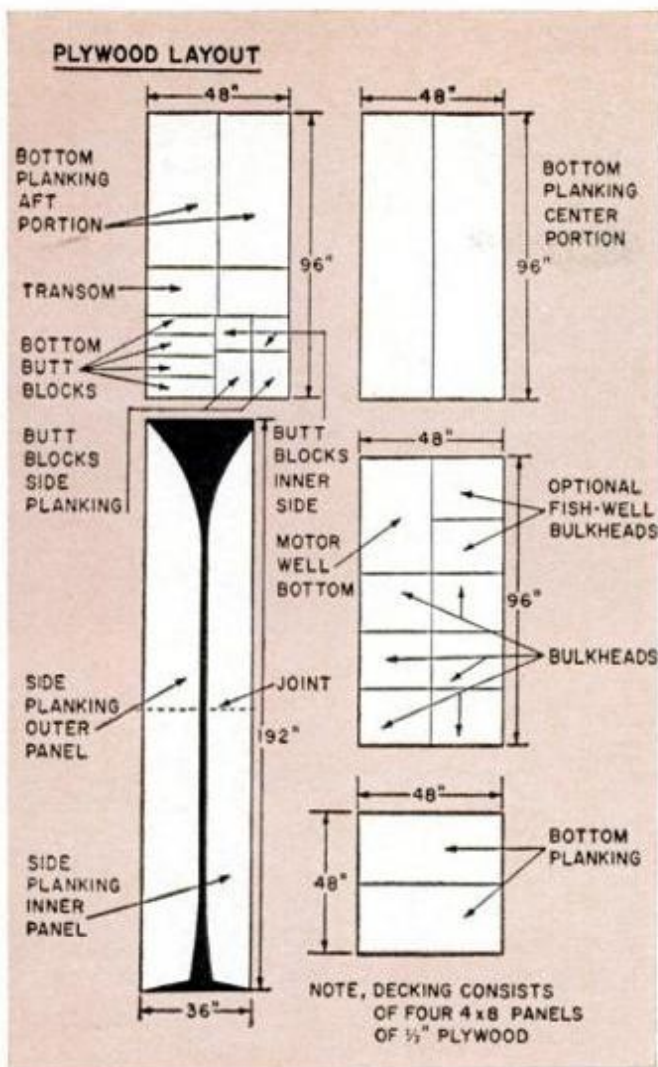
MOTOR BOARD cut from 1/2-in. plywood is mounted on the outside of transom frame and goes on last



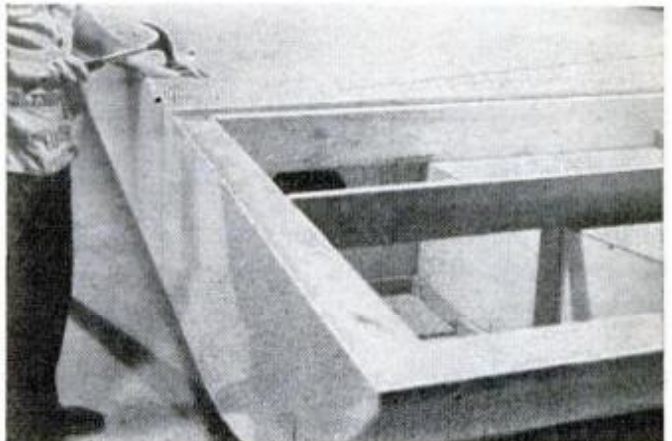
framed on the inside surface, with notches for the sheer clamp and chine log in the frame only and not extending through the plywood transom. Since the transom is set at an angle of 12°, the beam that connects the two bulkheads should be beveled 12° where it must mate with the tunnel and deck planking.

Building form. The hull is intended to be constructed bottom-side-up on a building form consisting of two 2 x 4 setup members spaced 5 ft. apart. These may be fastened directly to the floor or raised to a more convenient working level by mounting them on saw horses, as shown in the photos. In any case, they should be level lengthwise and athwartships, and held securely in position to prevent movement.

The bulkheads and beams are mounted on this form, spaced as shown and centered horizontally. The transom must be accurately spaced from the No. 2 frame on the hull center line and braced at an angle of 12°. The 1 x 3 bow piece should also be positioned on the form, as shown in the building-form drawing. Fasten all these framing members securely to the form and



FIBERGLASS HULL before turning it over (Dyneel was used here), then flip the hull and apply the decking



to one another to prevent movement during construction, since it's imperative that they remain vertical, accurately centered and properly spaced.

Avoid moving the form during construction. If you do so accidentally, however, retrue the structure before you continue.

Sheer clamps and stiffening. The 1 x 3 sheer clamps fit into notches at each of the beams and butt to the bow piece. Fasten with two 1½-in. No. 8 screws at each joint.

To stiffen the structure, notch a length of 1 x 2 vertically into the bottom of beams No. 1 through 7 along the center line. Secure it in place with 1½-in. No. 8 screws driven angularly into the beams.

Motor-well frame. In building the prototype, a width of 24 in. between longitudinals was used. While this is adequate for many small motors, the spacing was extended to 30 in. on the plans to accept larger motors and to provide more room for hooking up the steering and remote-control cables. The 1 x 6 longitudinals extend from the transom to beam No. 1, with 1 x 6 blocking on the beam acting as a spreader.

The motor well itself is in the shape of a V when viewed from the stern. Two cleats cut from 1-in. stock extend 1½ in. below the tunnel planking at the transom and must be tapered to be flush with the tunnel planking at No. 1. Fasten these cleats to the longitudinals with 1½-in. No. 8 screws.

The motor board can be cut from ½-in. plywood (not included in the materials list) or laminated from ¼-in. plywood. Add 1 x 2 blocking along the bottom edges for attaching the bottom planking, then mount the motor board on the beam and install the center bottom cleat which runs from the transom board to the beam at No. 1. Fair this framing but don't install the plywood planking until after the tunnel has been planked.

Tunnel planking. To provide a flush mating surface for the tunnel planking, bevel the bow piece and any beams which might require it. Two 4 x 8-ft. panels of ¼-in. plywood are used to plank the main part of the tunnel. The motor-well area is also planked with ¼-in. plywood, cut to fit. Coat the mating surfaces of the

(Please turn to page 220)

Pour Your Own Pitch Block

By E. G. Sandrock

IT DOESN'T TAKE MUCH to knock a propeller out of pitch—running over a submerged log or clipping a rock will usually do it—and even a minor pitch error means a drop in efficiency. You pay for it in performance and fuel dollars.

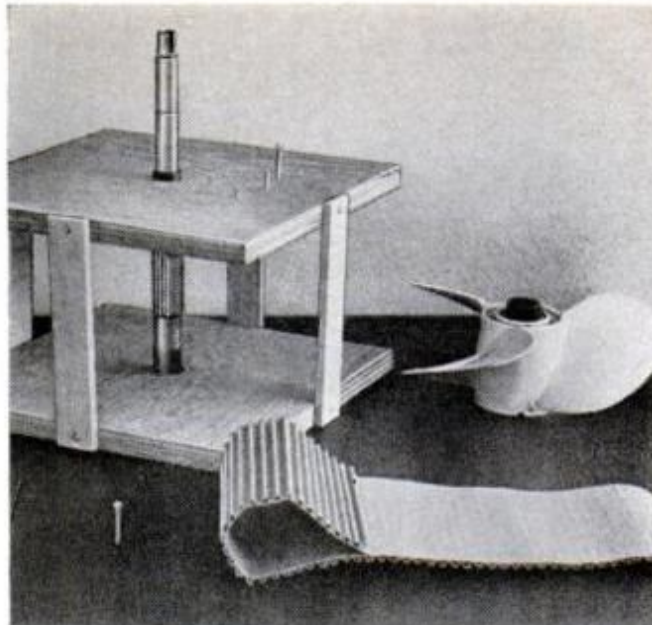
The problem is that an improper pitch isn't always obvious to the eye. And here's where a pitch block comes in.

For every propeller made, there is a form which mates perfectly against any blade of that propeller so long as it's in the proper pitch. An out-of-pitch propeller won't mate correctly against this form. Marine shops use these pitch blocks to check their work when bringing damaged propellers back to their proper pitch. They aren't available to the general public.

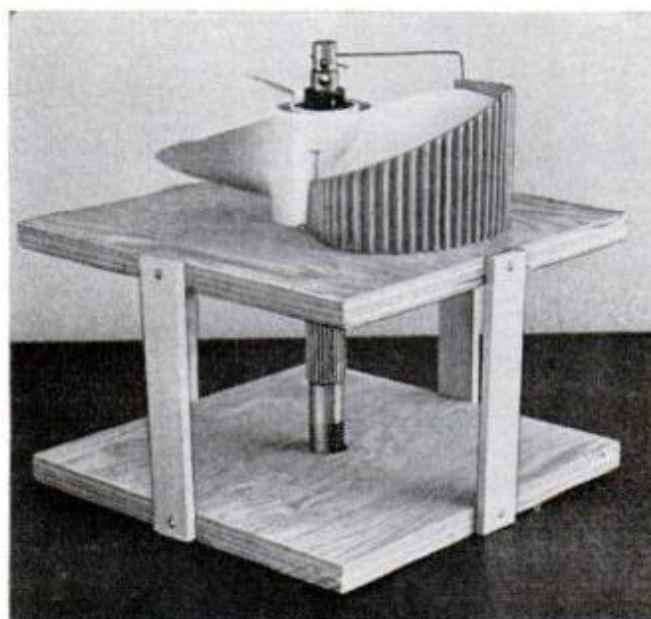
While we don't recommend that you attempt to repair your own prop, it's relatively easy to make a pitch block for checking the condition of your prop so you'll know when to take it in for repair. Construction is detailed in the photos at right.

One piece of $\frac{3}{4}$ -in. plywood serves as the base. Begin by drilling a blind hole in the center of this piece the same size as the bearing end of the propeller shaft. In the second piece of plywood, drill a hole the size of the bearing area on the shaft just ahead of the propeller. These serve to align the propeller shaft with the pitch form.

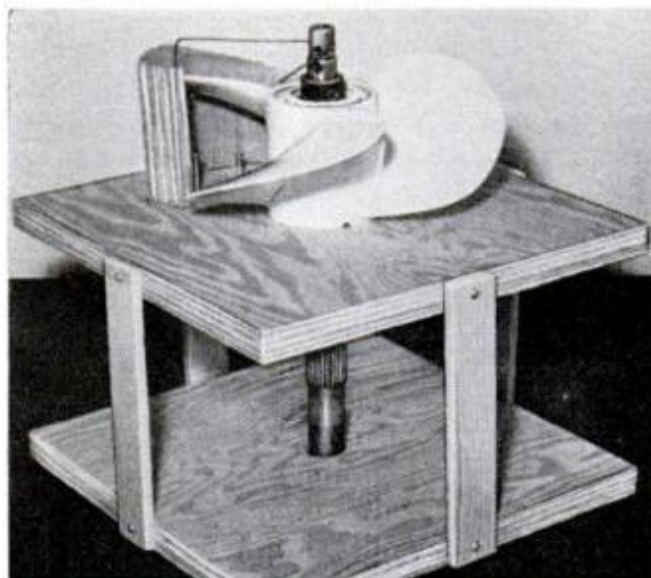
Next, seat the shaft in the base, slip the other piece of plywood over it, and while supporting this piece near the top of the shaft with one hand place the propeller on the shaft as far as it will go. Then raise the upper piece just enough to lift the prop



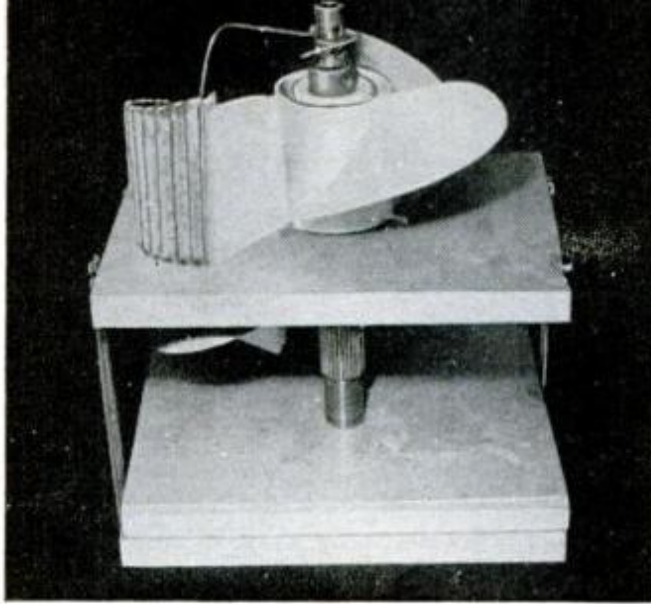
1 SET UP BASE structure as shown, centering the shaft in both the upper and lower pieces



2 MOLD IS FORMED by wrapping corrugated paper around blade and anchoring it in place

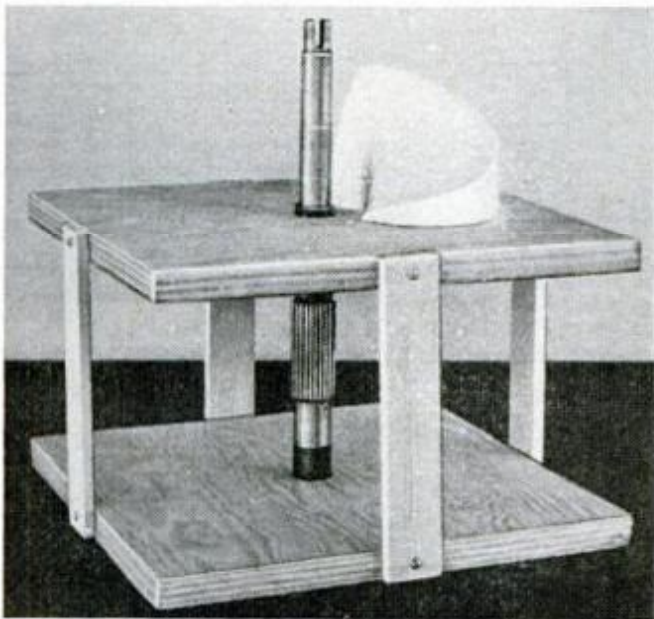


3 TO FILL MOLD, tip the base on its side so that the open end is up and ladle in plaster



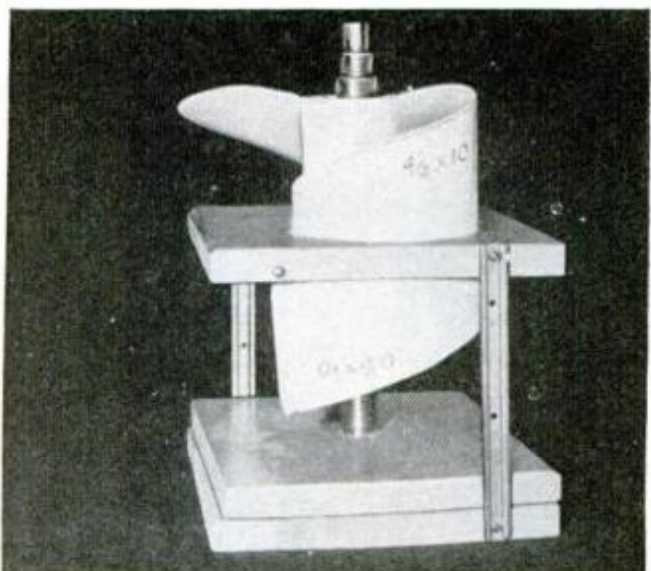
ALLOW PLASTER to set up hard enough so it won't sag before turning it upright again

4



STRIP AWAY the corrugated paper, pry the propeller up, trim and the block is complete

5



TWO BLOCKS can be molded on one piece of plywood if you use two different pitch props

6

on the shoulder on the shaft. The four supports should be installed to hold the upper piece at this height.

With the propeller in place, draw an outline of one blade on the top to use in positioning the three anchor screws. These will secure the form to the plywood.

Some propellers have notches in the forward edge of the hub which can be useful in the molding process. If yours has such a notch, select a screw with a head diameter that just fits into this slot and drive it into the board in a location to keep the propeller from turning while the mold is being made.

To accomplish the same thing with propellers which don't have slots, simply drive two screws into the board, one on either side of a blade which isn't being used to cast the mold.

To mold the block, position the corrugated cardboard as shown, smooth side in, with one end snug against the hub of the prop. At the hub end, it's held in place by driving a nail down through the next-to-the-last corrugation into the plywood. The wide end is anchored with a length of coathanger wire which passes through a hole drilled in the plywood, up through one corrugation, and is then bent to a right angle so it can be wrapped around the shaft.

After mixing the plaster, tip the unit on its side so that the opening is on top and ladle the plaster into it with a large spoon. Stir the plaster often while filling the cavity to eliminate any air pockets. Once the cavity is filled, support the unit in this position until the plaster sets up hard enough so it won't sag, then place it upright again, remove the corrugated board and pry the propeller from the base.

Where needed, trim the casting with a sharp knife (before the plaster becomes bone-dry, if possible). After trying the prop and checking all clearances, give the whole unit a coat of aluminum paint to protect the plaster and dress it up a bit.

MATERIALS LIST

- | | |
|--------|--|
| 2 pcs. | 3/4" x 12" x 12" plywood |
| 4 pcs. | 1/4" x 1 1/4" x 10" battens |
| 1 pc. | 40d nail |
| 1 pc. | coathanger wire (about 12") |
| 1 pc. | 4" x 12" corrugated paper, smooth one side only (shellac smooth side so it won't absorb moisture from plaster) |
| 5 lbs. | molding plaster or plaster of paris |
| 1 pc. | propeller shaft (try your marine dealer for a discarded one) |
| 1 pc. | propeller, proper pitch |

BARGAIN BOAT HORN

By R. J. Capotosto

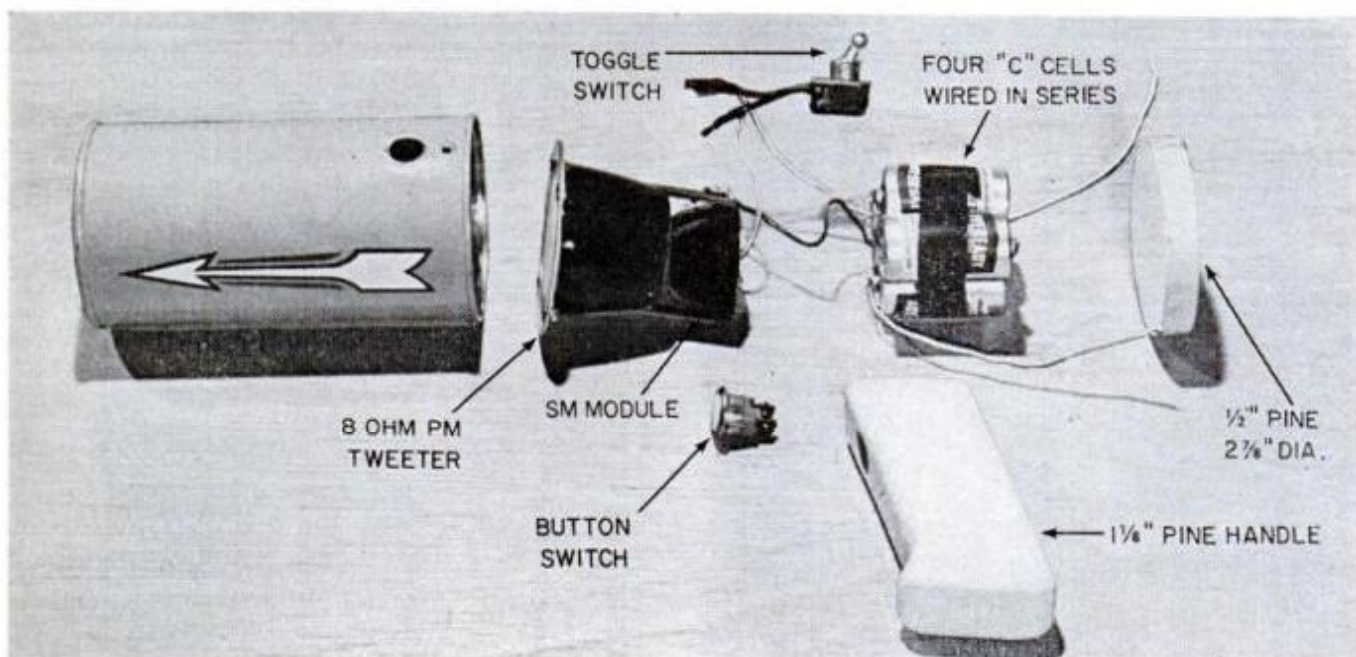


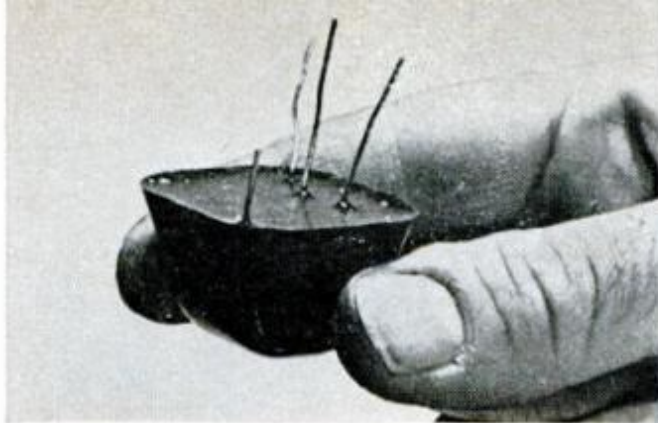
COMPACT ENOUGH to stow almost anywhere, this low-cost boat horn sounds off like a screaming giant at the push of a button. Basically, it's just a small speaker fitted in a tin can and driven by a transistorized module small as an ice cube.

Original specs for the module call for a 6-v. lantern battery, but to cut down the weight and size, four "C" batteries were used instead. The cells are taped to-

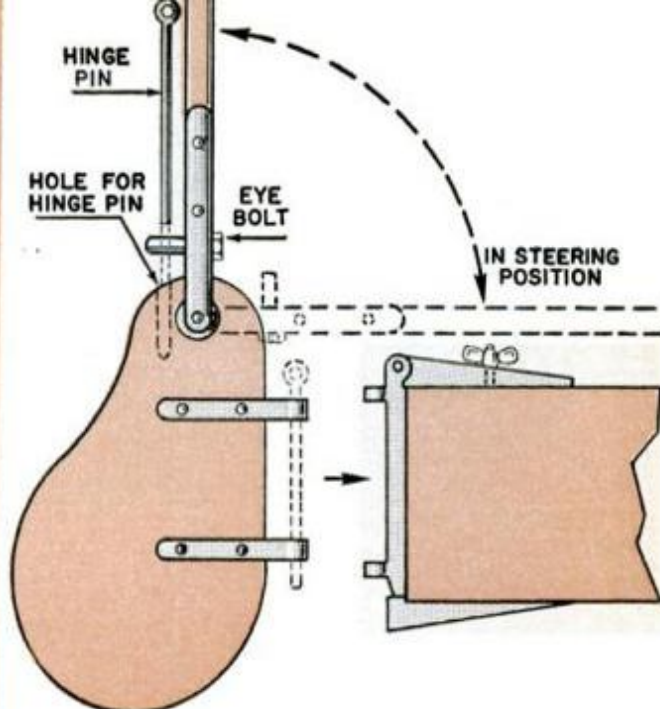
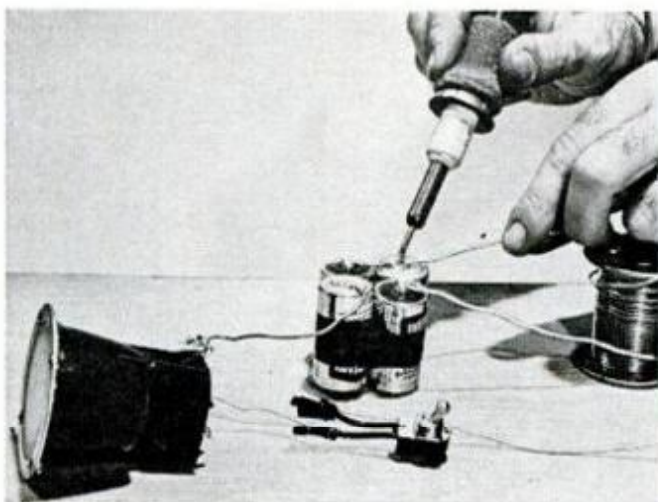
gether and the leads soldered as shown. To further miniaturize the unit, the module is taped piggy-back to the speaker housing. A toggle switch turns the power on, after which the horn can be activated by pressing the button.

The solid-state module is available from The Armor Co., Box 103, Station A, Flushing, N.Y. 11358. It sells for \$3.50 plus 25 cents for postage and handling.



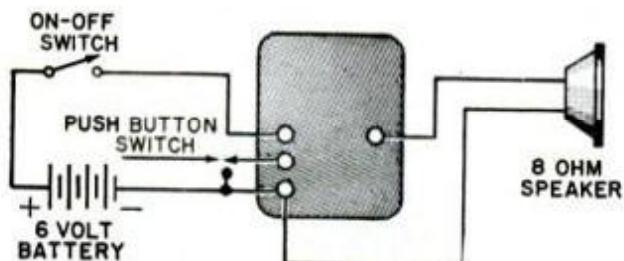
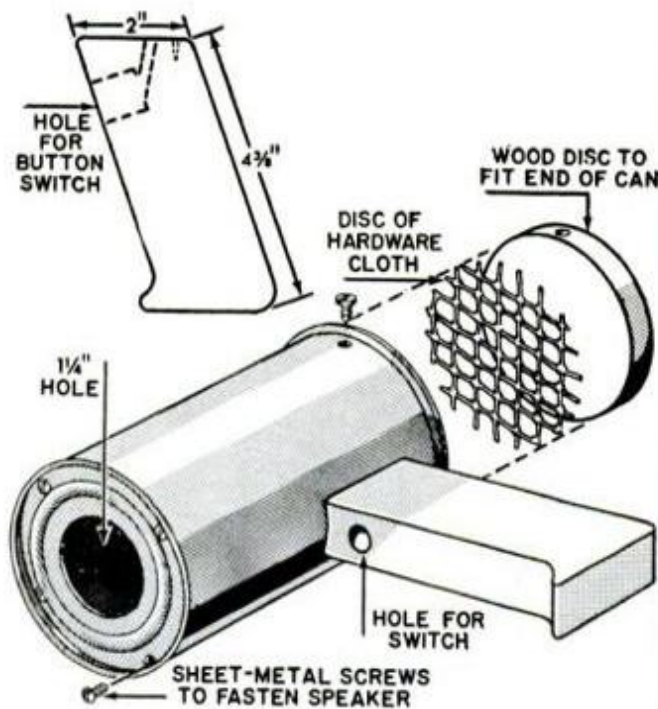


SMALL MODULE, above, is connected to four "C" cells wired in series by soldering leads as shown below

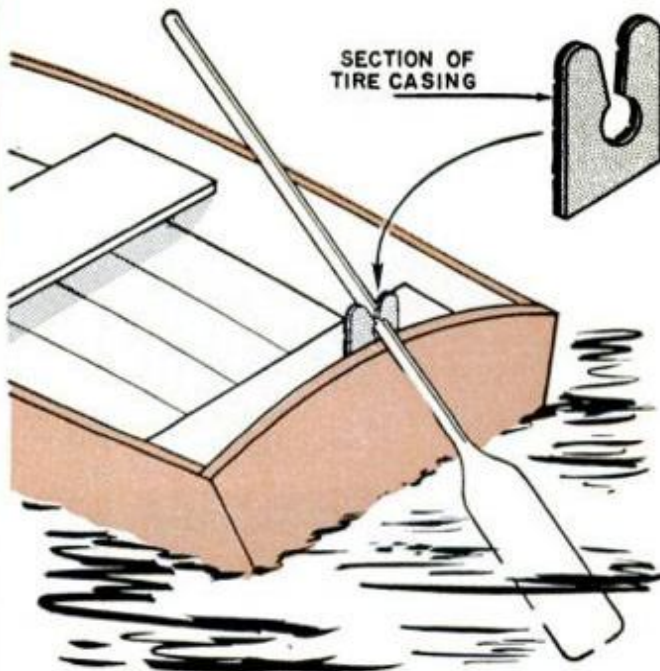


Paddle for Sailboard

You can't carry a paddle aboard a sailboard but by drilling a hole in the top of the rudder for the rudder hinge pin and installing a brass eye bolt on the tiller, the rudder can be converted into a paddle.—William S. Hughes



WIRING DIAGRAM



Silent Sculling Oarlock

To make a simple and noiseless oarlock for sculling, cut a section from a discarded tire casing, as shown, and notch it to fit your paddle. Mount it on the inside of the transom and you'll be able to sneak up on the fish every time.

Stow-Aboard Tool Kit For Outboards

Don't let a breakdown catch you up a creek without so much as a screwdriver. The right tool can have you running again in no time

BY HENRY B. NOTROM

IT'S BOUND TO HAPPEN. No matter how carefully you maintain your motor, something is almost sure to go haywire when you're out on the water, even if it's only a sheared pin. And when this occurs, you ought to have enough tools aboard to make on-the-spot repairs that will get you home.

Of course your kit needn't include everything listed on the opposite page. The point is you should have a well-thought-out selection of tools aboard your boat at all times, instead of relying on an old screwdriver and an extra shear pin.

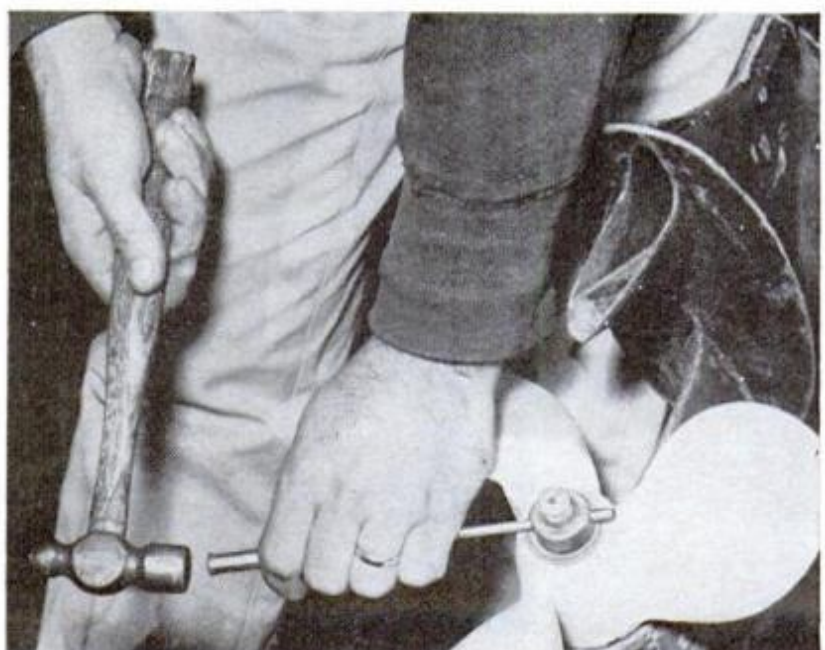
A fiberglass tackle box makes a great place to stow your tools. It's light, inexpensive and won't rust. If you want to do the job up right, lash it down with shock

cord in a convenient place in the cockpit.

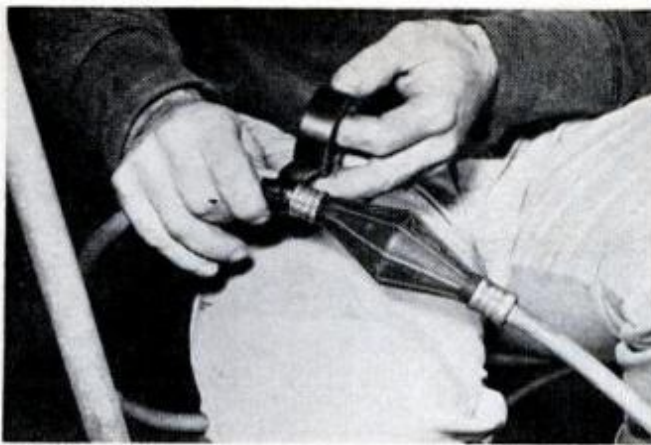
Another thing to keep in mind is that those tools will be exposed to a lot more moisture than they would if they were sitting in the drawer of your workbench, so be sure to give each one a thin coat of light oil to prevent rusting. For extra insurance, wrap each individually in a sheet of that clinging-type plastic wrap.

Keep all the small items like shear pins and cotter pins, in a plastic sandwich bag so they'll be easy to find. Most marine sparkplugs come encased in a waterproof blister pack, and it's a good idea to leave them in the original package until you're ready to install them. Wrap the fuel-pump diaphragm in plastic wrap.

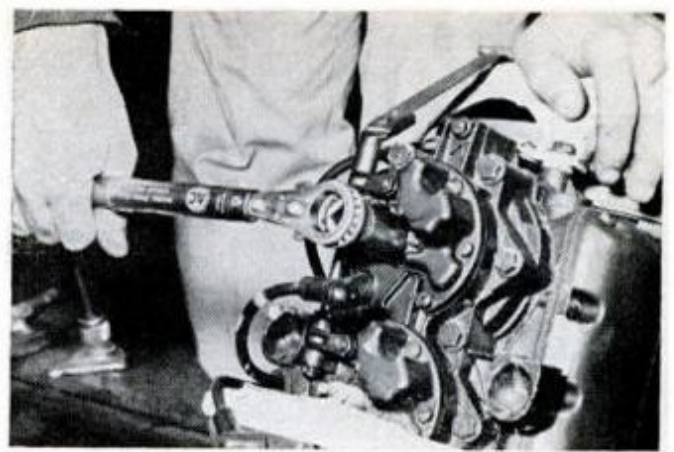
There are two items which aren't men-



CHANGING A PROP isn't any complicated mechanical operation, but it can be next to impossible if you don't have those few necessary tools on board. If you don't believe it, try it sometime with your bare hands












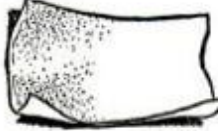






IT MAY NOT BE an electrical problem, but a leaky fuel line can easily be sealed with plastic electrical tape, if you have a roll handy in your kit, of course



TROUBLESHOOTING an outboard often requires the removal of a plug. The reversible ratchet with a deep-drive socket shown here does it in a hurry

Tools you'll want to have on board

Items	Comments	Items	Comments
	A <i>hammer</i> comes in handy on even the simplest jobs, like changing a prop or replacing a shear pin. You don't need a sledge — an 8-oz. ball-peen will do. A solid <i>punch</i> (3/4-in. taper) or <i>ice pick</i> is also useful. And <i>pliers</i> , by all means, either thin-nose, combination or adjustable.		Spare <i>sparkplugs</i> can mean the difference between top performance and putt-putt.
	To pull plugs, you'll need a <i>sparkplug wrench</i> . A 6- or 12-point box works fine. Or get a reversible ratchet with 6- or 12-point deep-drive socket.		Chances are you won't need it, but carry a <i>spare fuel-pump diaphragm</i> just in case.
	You're bound to run into a situation requiring a <i>screwdriver</i> , and a standard medium-sized head (3/8 in.) is a good compromise. If you don't have one, you're sure to need it, so toss in a Phillips-type, too.		Probably there isn't anything more frustrating than to lose your <i>ignition key</i> . Carry a spare.
	An <i>adjustable wrench</i> is absolutely necessary. Get one that opens to 2 in.		A roll of 1-in. <i>plastic electrical tape</i> can patch leaky gas lines or parted wires.
	Carry a <i>pocketknife</i> for cutting tape and make sure it's sharp.		Throw in a coil of No. 16 <i>solid-strand wire</i> . It's great for splicing steering lines.
	A <i>flashlight</i> is a lifesaver for dark corners and dark evenings.		Use <i>crocus cloth</i> to remove corrosion from plug terminals, battery posts and terminals.
	Have at least two <i>spare shear pins</i> and <i>cotter pins</i> in your tool kit.		Rags are fine for cleaning up (and rattleproofing your tool kit).
			Lack of <i>fuel</i> is one of the most common causes of engine failure. Carry a spare can plus <i>extra oil</i> .
			A <i>paddle</i> may not be very powerful, but it will move the boat. Have one aboard.

tioned in the list—a spare prop and a first-aid kit designed for boat use. The prop can be wrapped in a piece of canvas to protect the blades and stowed in an underseat compartment or at any other location where you won't be tripping over it all the time. A number of companies make

storage blocks to hold an extra prop, and since these can be mounted almost anywhere in the cockpit, you might try one.

Finally, the first-aid kit. Like some of the tools listed, you may never use it, but you'd be out of luck if you did need it and it wasn't aboard. ★★★

On-board troubleshooting chart

Trouble	Probable Cause	Cure	Trouble	Probable Cause	Cure
Plenty of revs but no push	A sheared pin	Replace the pin		Damaged fuel-pump diaphragm	Remove housing cover, replace diaphragm
Wheel moves but the boat won't steer	Steering line snapped	Splice the line with No. 16 wire	Engine floods and won't start, or starts but stalls (check for a wet plug)	Choke stuck closed	Open it by hand
Engine isn't getting fuel	No fuel in tank	Fill the tank		Carburetor float stuck	Tap float chamber sharply with handle of screwdriver
	Loose tank cap	Tighten the cap	Engine isn't getting spark (ground plug against head and rev engine; if it's getting spark, you'll hear it snapping)	Plugs shot	Replace
	Fuel valve closed	Open it		Break in plug wire	Tape the break
	Kink in fuel line	Straighten the line		Corrosion on plug terminals or battery posts and terminals	Rub it clean with crocus cloth
	Break in fuel line (usually near a connection)	Tape up the break		Foul-up in the magneto	Reach for the paddle
	Fuel filter clogged	Remove the filter and run without it (but only in an emergency)			
	Air leak around fuel-pump housing	Tighten up screws			

OUTBOARD CLINIC

Nervous Fishing Motor

My 1957 10-hp Scott-Atwater simply won't idle down for a smooth shift or trolling speed. Turning the idle mixture screw does nothing, and the motor's just been tuned. Is this the nature of the beast?—W.C.S., N.Y.

What's often overlooked in trying to lick this problem is a low-speed pick-up jet. That's a brass plug-like thing you'll find in the carburetor. I suggest you take it out, clean it, reinstall it and try again. It should idle down.

Lark with a Leak

My '61 Evinrude Lark is acting mighty strange. Give it full power and it bogs down slowly to rev up; open the cowl door and it takes off on you. I've replaced points, plugs and coil, and even over-

hauled the carburetor, but no dice. What's going on?—B.E., Ga.

I'd bet you have an exhaust leak in that engine somewhere. Check beneath the powerhead and around the gear-shift linkage cover.

Reluctant Chicken

I have a 1955 Johnson that refuses to stay in forward gear. What's the cause, and can I tackle it myself?—W.P.W., Ore.

That's no spring chicken you've got, so I'd suspect a worn forward gear and/or a worn shift dog. It's a rough job; unless you want to experiment, I'd take it to a Johnson mechanic.

Any Questions?

For a personal reply to questions concerning repairing your outboard motor, write to Outboard Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Please enclose 25 cents in coin to cover postage and handling.

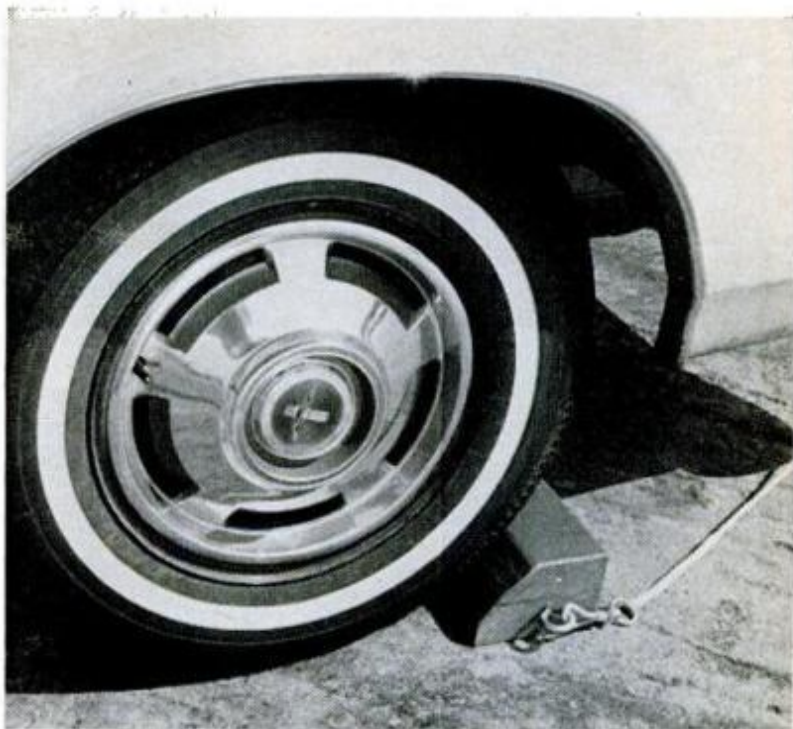
"Stone-Age" Emergency Brake

OLD-FASHIONED though the idea may be, blocking a rear wheel is still the best insurance against accidentally launching your car along with your boat.

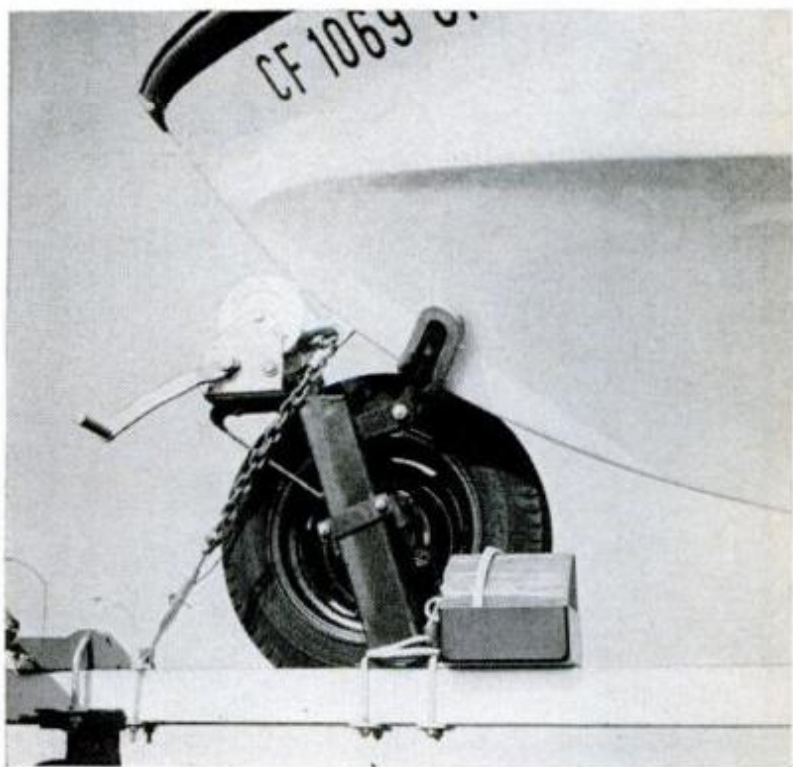
The easy-to-make wheel block shown here stows neatly in a box mounted on the trailer tongue, so it's always handy when you need it. An automatic retrieving line pulls it out of the way of the trailer wheels when you drive back up the ramp.

You can make the whole thing in an hour or so. The block itself is simply an 8-in. length of 4 x 6 stock with one edge cut back to form a wedge. A small piece of ribbed rubber matting glued to the bottom prevents it from sliding. Drive a 1½-in. screw eye into the end grain of the block and either tie or splice the retrieving line to the eye. (You may wish to use a harness snap here, so that the block can be removed and used with another car.) Attach the other end of the line to the winch stand.

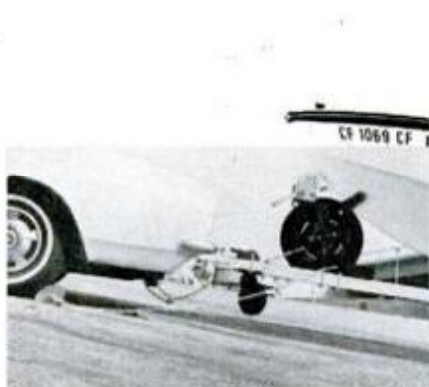
If you can't find a metal box the right size, make up a wooden one from the materials in your scrap box. A coat of paint and you're done.—Patrick Perrett



HARNES SNAP on line lets you remove the block and lend it to someone else—after you're back on level ground, of course



WHEN NOT IN USE, block rides in a box mounted on the trailer tongue. Retrieving line is wound around block and winch stand



RETRIEVING LINE should be just long enough to reach from the trailer winch stand to the rear wheels

Add the Charm of a Cupola



More than just a decoration, a louvered cupola serves a mighty useful purpose in venting the attic of your garage.

WHETHER PERCHED ATOP your garage or your house, there's something about a cupola, with its ornamental wrought-iron weathervane, that adds a touch of character and charm like nothing else. What's more, it can be functional as well. Placed over an opening in the roof, it will serve to ventilate attic space. Heat trapped under the roof on a sweltering day is able to escape through the louvers, making the area considerably cooler.

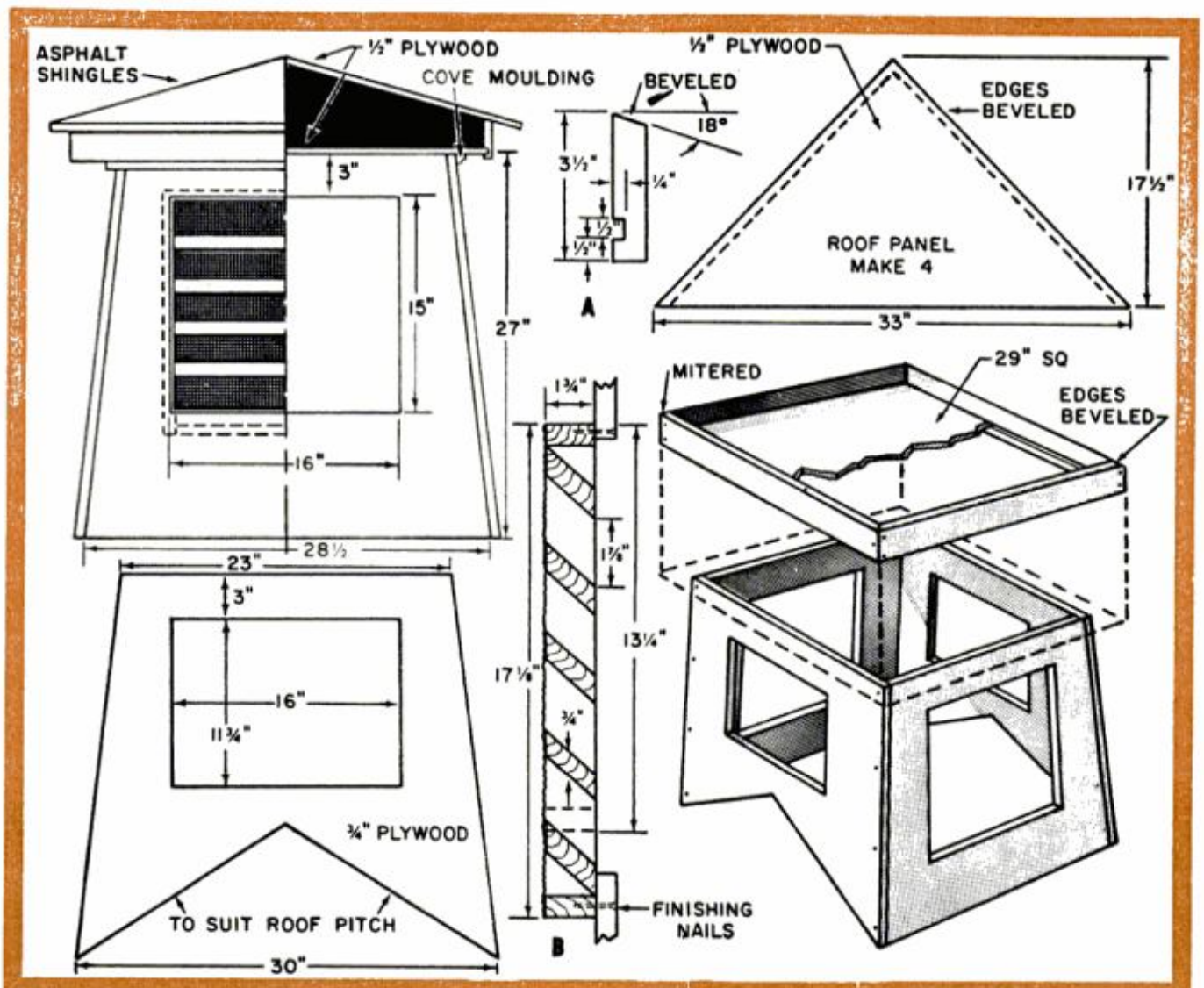
You have a choice here of three designs, two with hip roofs and one a gable. If you like the low-pitch design shown at the left, the details below indicate how it's made. Most of it is of exterior plywood of $\frac{1}{2}$ to $\frac{3}{4}$ -in. thickness (the louvers and roof trim are 1-in. lumber). Matching sides are made in pairs, and sides that lap are made $1\frac{1}{2}$ in. wider so the assembly will be 30 in. square at the base. You'll notice that the openings for the end louvers are con-

structed smaller because of the ridge cut.

The panel which forms the base of the roof assembly is cut 29 in. square and is centered and nailed to the side members. Then 1 x 4 trim pieces, grooved and beveled as shown in detail A, are mitered at the corners to fit over the panel's edges. The four triangular roof sections are beveled to fit tight at the hips. Regular asphalt shingles are applied with roofing cement and the ridges covered with scraps.

The louvers are made in pairs, too, two having four slats and two five slats. These are assembled separately and covered on the back with wire screen before being fastened to the inside of the four openings.

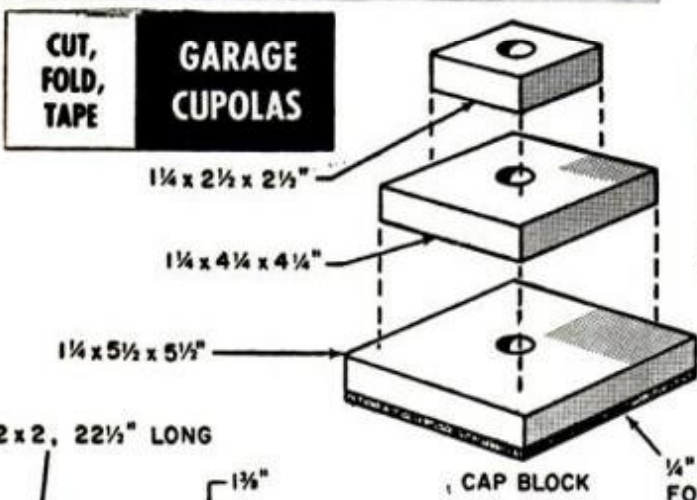
Screws driven up through the roof boards are used to anchor the cupola over the roof opening. Metal flashing and roofing compound are used, of course, to seal it against rain. A trap door will block off cold air and drifting snow in winter.



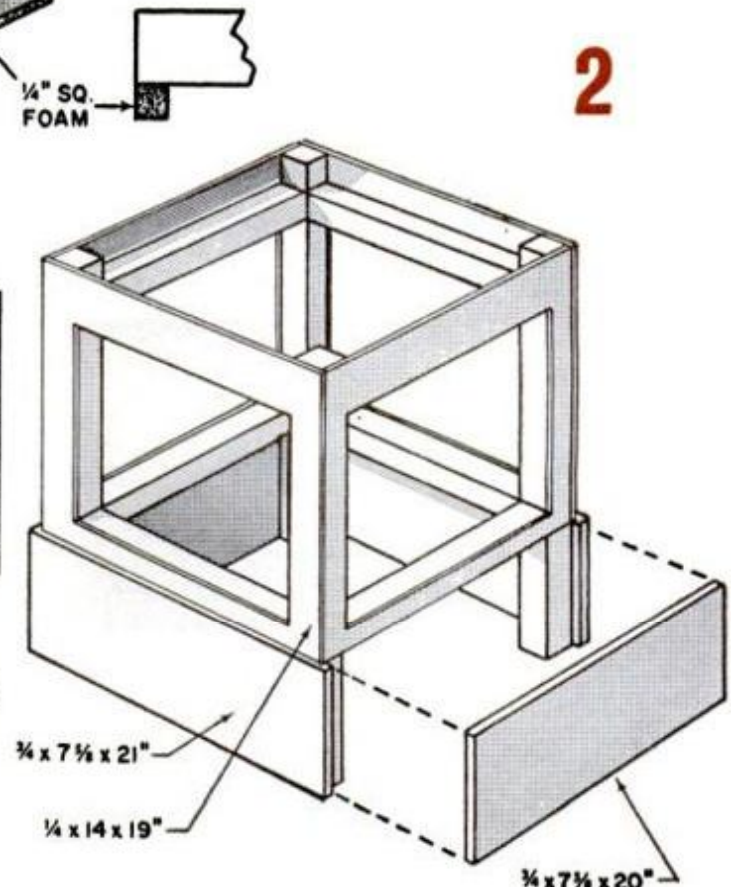
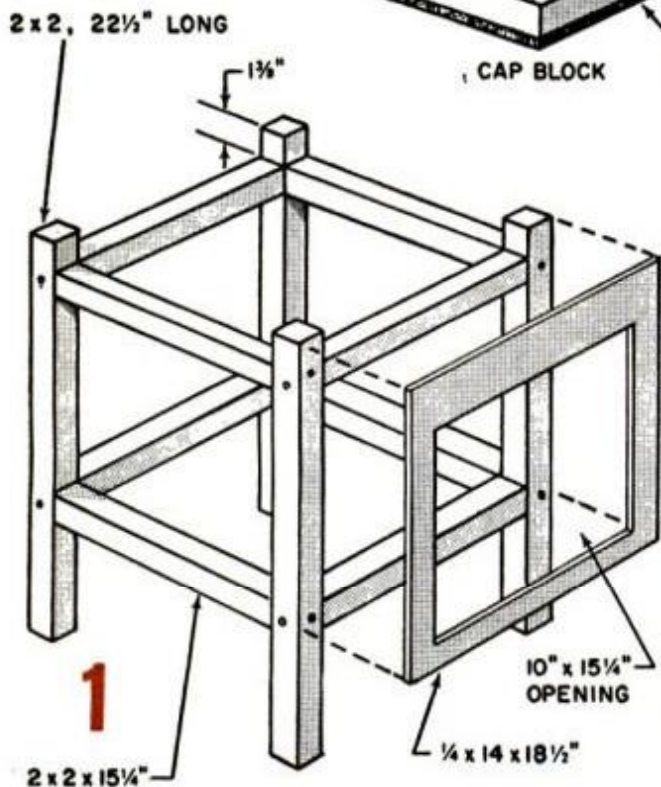


This attractive cupola is built around a framework of 2 x 2s which is covered with a facing of 1/4-in. plywood and a skirt of 1 x 12s. In building any of the three cupolas, you have to know the pitch of the roof so it can be made to straddle the ridge. This requires crawling up on the roof and making a template by placing two scrap pieces together scissor-fashion over the ridge and holding with a C-clamp or a couple of screws. Unless the roof is unusually steep, the 1 x 12s should provide ample depth for notching the skirt. If not, then you may have to go to 1 x 14s, or possibly cut these parts from 3/4-in. plywood.

Construction is clearly shown in the four sequence steps shown below. Once the 2 x 2 framework is assembled with glue and 20d nails, it's covered first with the plywood cutouts which form the louver openings, then with the 1 x 12 skirt boards. In each case, the pieces are lapped at the corners and fastened with water-



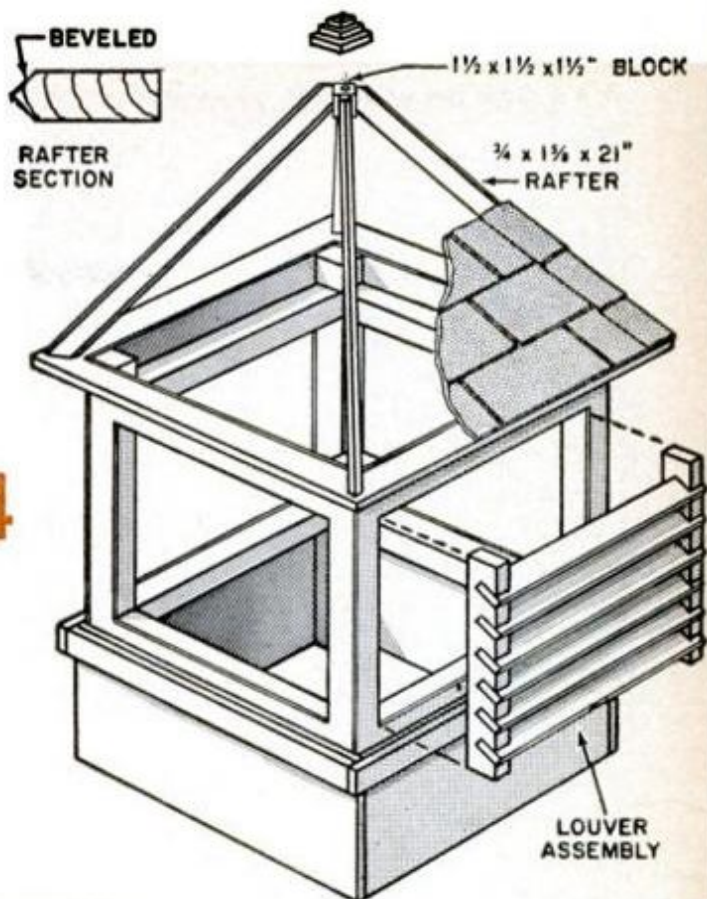
There is a full-size pattern available for this cupola and you can get one by sending \$1.00 to Steve Ellingson, Popular Mechanics Pattern Dept., Box 2383, Van Nuys, Calif.



proof glue and finishing nails.

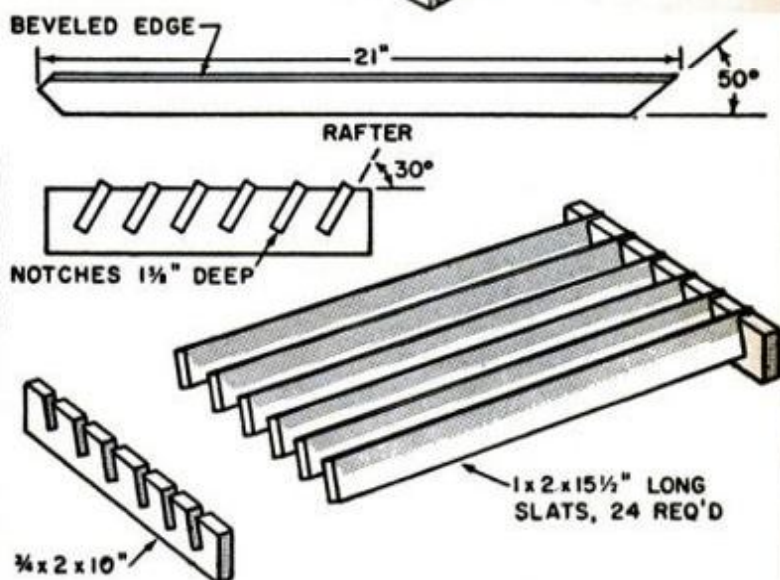
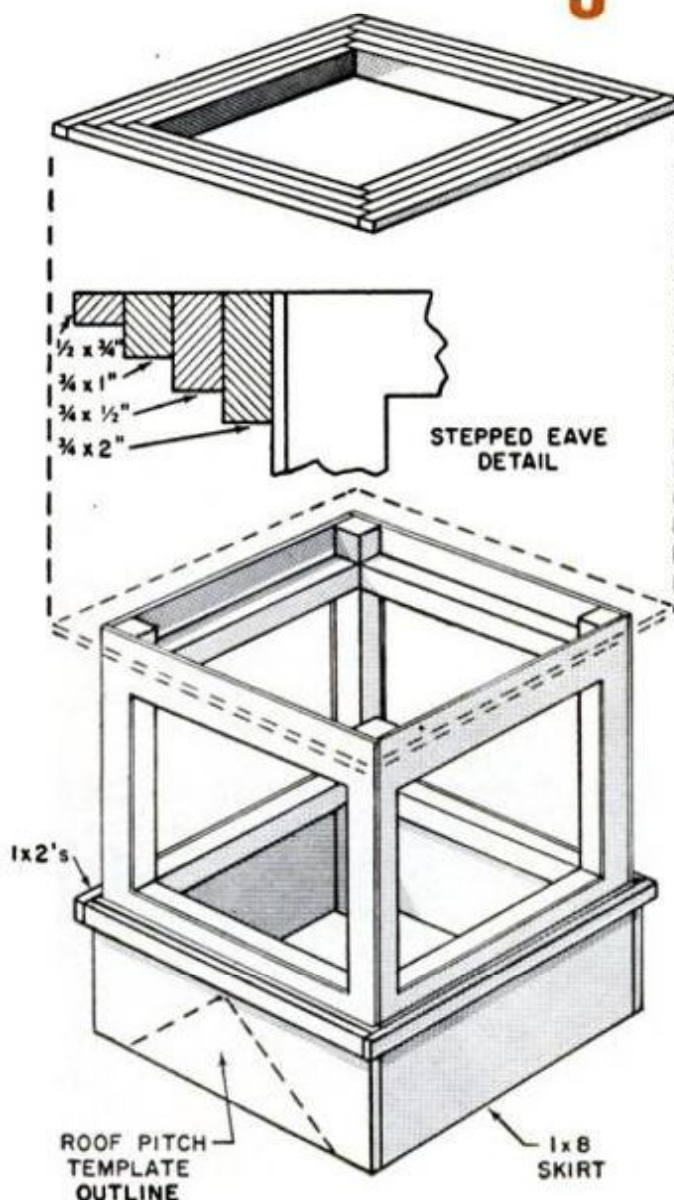
The stepped overhang is built-up of four separate widths, starting with 2-in. strips and adding progressively smaller ones of 1½, 1 and ½ in. to the four sides. The chamfered hip rafters are joined to a wood block at the peak which in turn is bored to receive the particular weathervane selected. Screws in counterbored holes at both ends of the rafters are used to anchor them to the block at the top and to the stepped overhang around the eaves.

The slats of the louvers are 1 x 2s which rest in slanting notches cut in uprights of ¾-in plywood. Here all four louvers are made the same overall size to slip flush in the openings, and are secured to the posts at each side with screws. After shingling the roof with regular four-in-one asphalt shingles and then covering the four hips with shingle scraps, the cupola is completed by adding the top pediment which consists of three 1¼-in.-thick pine blocks of diminishing size.

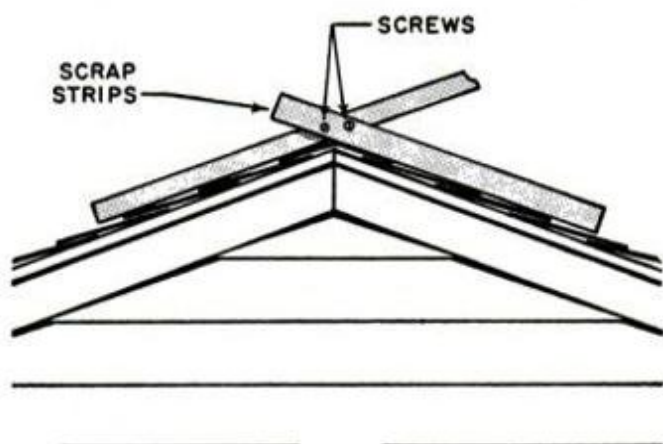


4

3



ALL FOUR LOUVERS are made alike by notching the side members to take six 1 x 2 slats at a 30 deg. slant

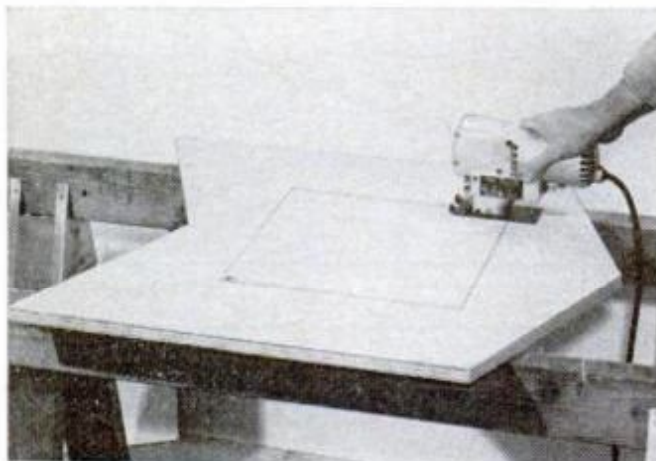
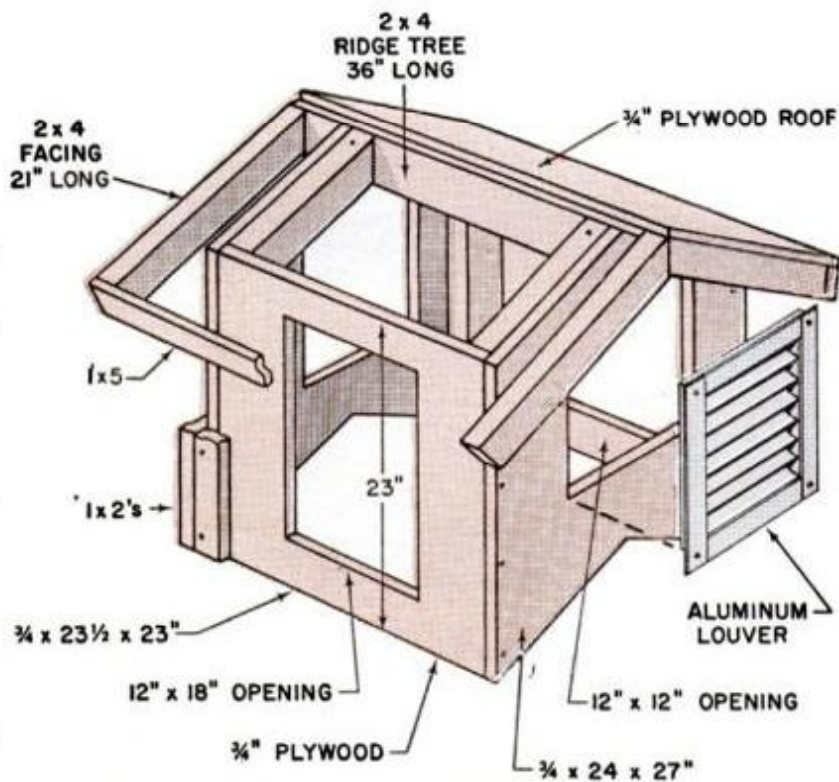
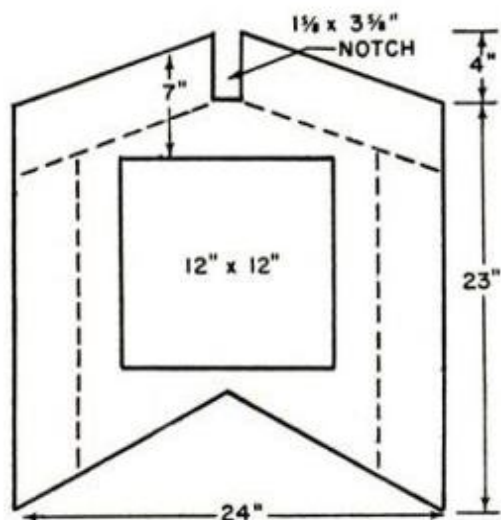
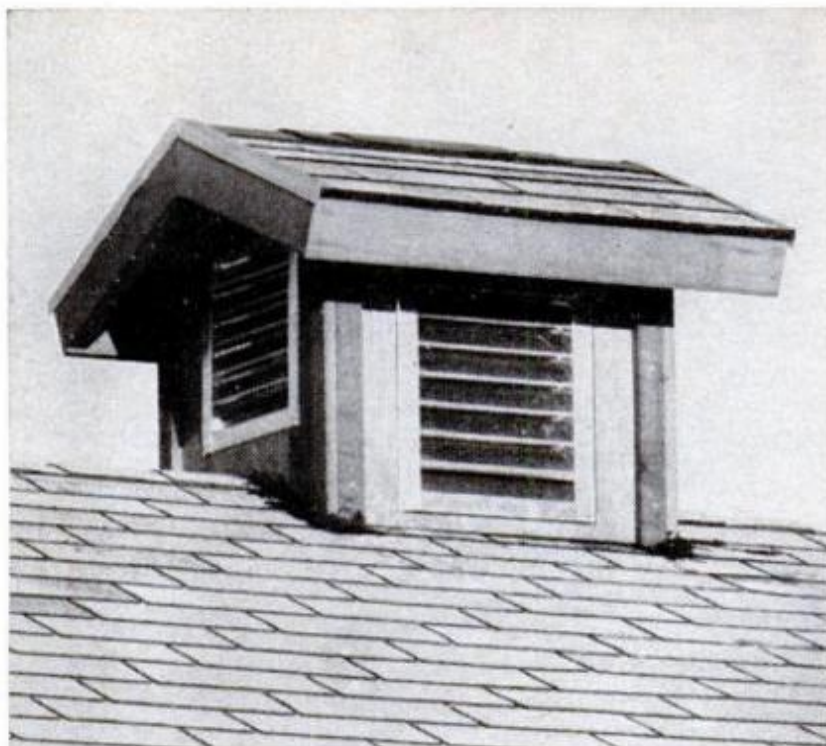


THE EASIEST WAY to make a template of your roof pitch is to place two strips scissor-fashion over the ridge and hold in place with a couple screws

This gable-roof cupola, built to withstand Oregon gales, sits astraddle the ridge of *PM's* Patio-Garage (see page 136, April '65 *PM*). Simplest of all three to build, it makes use of standard aluminum louvers.

You can get all the plywood parts from a 4 x 8-ft. sheet. The rest is 2 x 4s and 1 x 2s. The ends of the cupola are backed with 2 x 4s to provide solid nailing for the side and roof panels. A 2 x 4 is also used for the roof tree, as well as for the roof end facings.

In mounting the completed cupola over the opening in the roof, first add a liberal coating of asbestos roof cement to the bottom edges and then use 16d galvanized nails to toe-nail these in place. A 36-in. long asphalt shingle is just the right length for the roof. It will take ten to cover it. ★★★

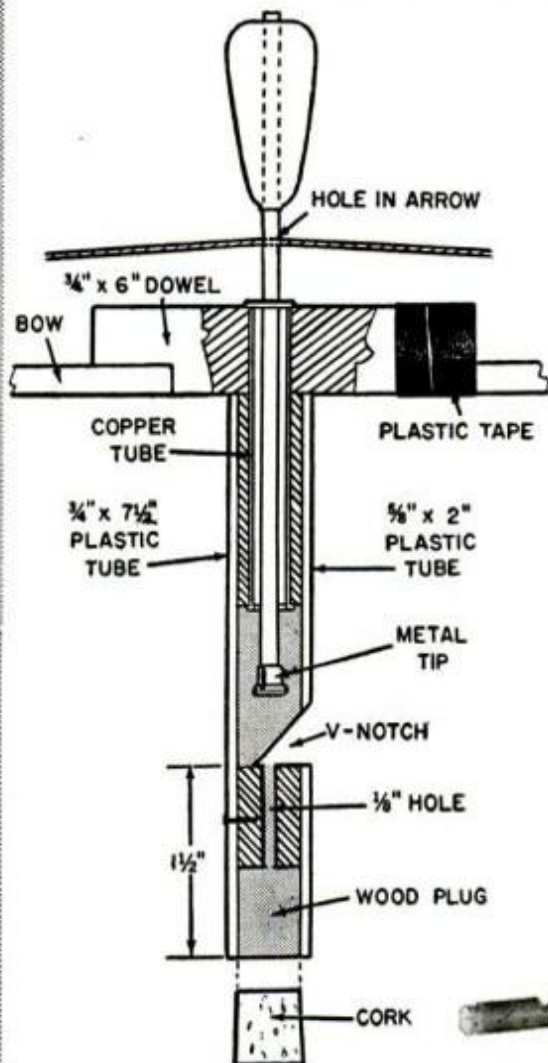


OPENINGS FOR ALUMINUM LOUVERS are a fast job with a saber saw, once you bore a starting hole. Lowering wood over rotating blade is another way



NAILING LOUVERS IN PLACE must be done before adding roof since overhang would interfere. Either aluminum nails or screws can be used to fasten them

Up-dated bow fires caps and corks



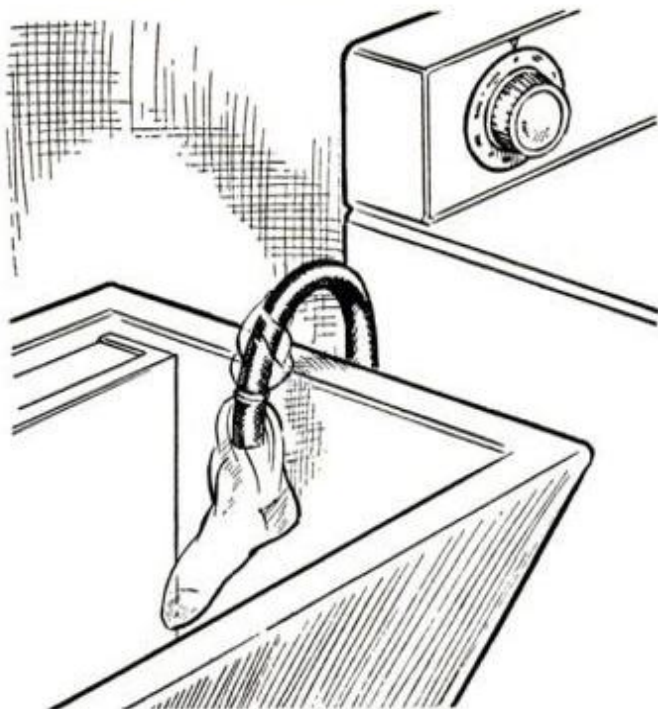
INDIAN BRAVES will have a 50-50 chance against settler's muskets if their bows fire corks with a bang. As complete a switch as a rifle which fires arrows, this clever conversion has the arrow fire a cap which in turn propels the cork. The detail shows how a section of the bow from a toy archery set is cut away and the ends rejoined to a notched dowel. The dowel is drilled for a length of metal tubing large enough to provide a sliding fit for the arrow. Crimped at each end, it locks in place a plastic tube which slips over it. A second length of tubing, which is the barrel, is pressed over the first length. To fire the cork, a cap is placed against a piece of dowel plugging the end of the barrel.—*Ralph L. Phillips*



SOLVING HOME PROBLEMS



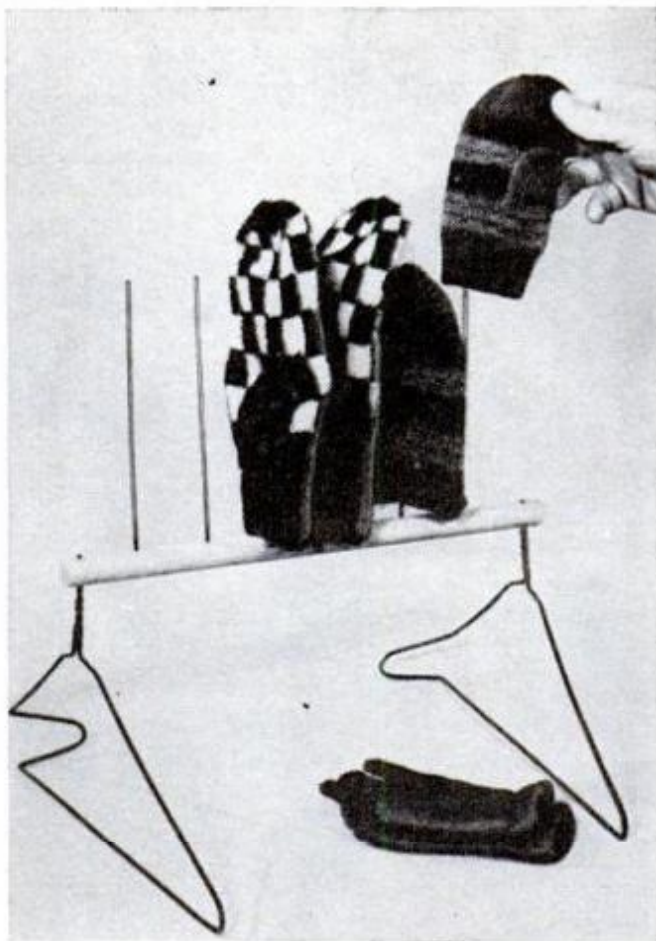
FLIP-SIDE STICKER, attached to the "Side 1" label of each of your multiple-selection records, tells you what's on other side. This lets you locate the selection you want by quickly leafing through a stack



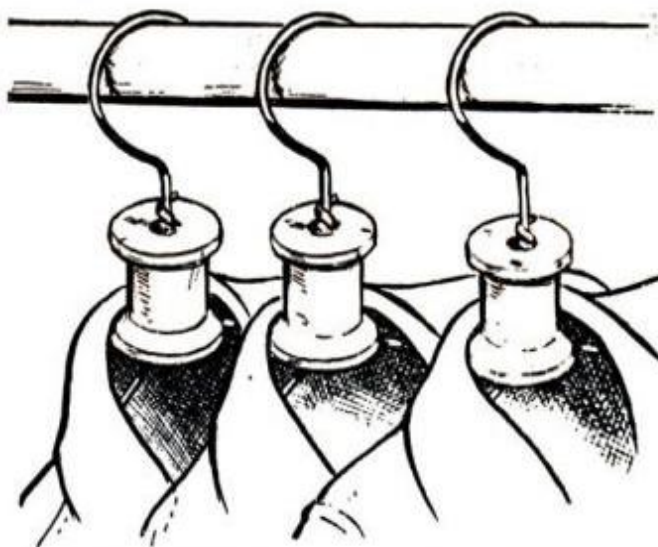
LAUNDRY TUB DRAINS can be clogged by lint drained from your automatic washer. To prevent this, slip an old nylon stocking on the hose end and snap on a rubber band. The fine mesh filters the lint out



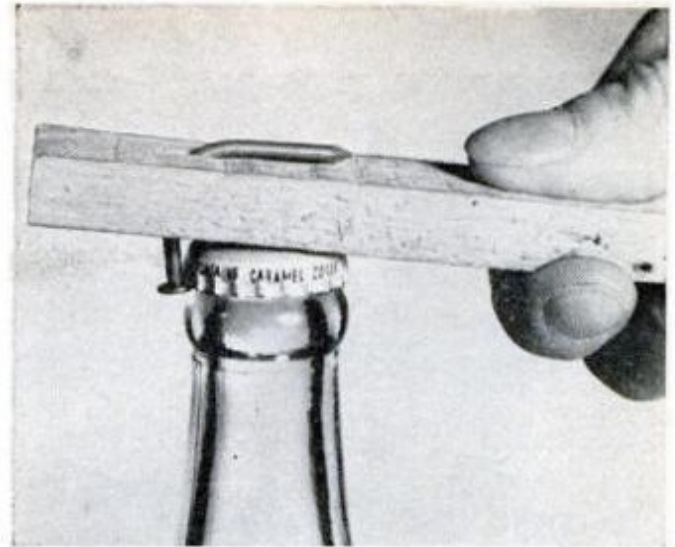
WHISK SMUDGES OFF wood-paneled walls with baby oil on a soft cloth or cotton. Especially effective for wiping off jelly handprints and crayon sketches, the treatment also tones down mars and scratches



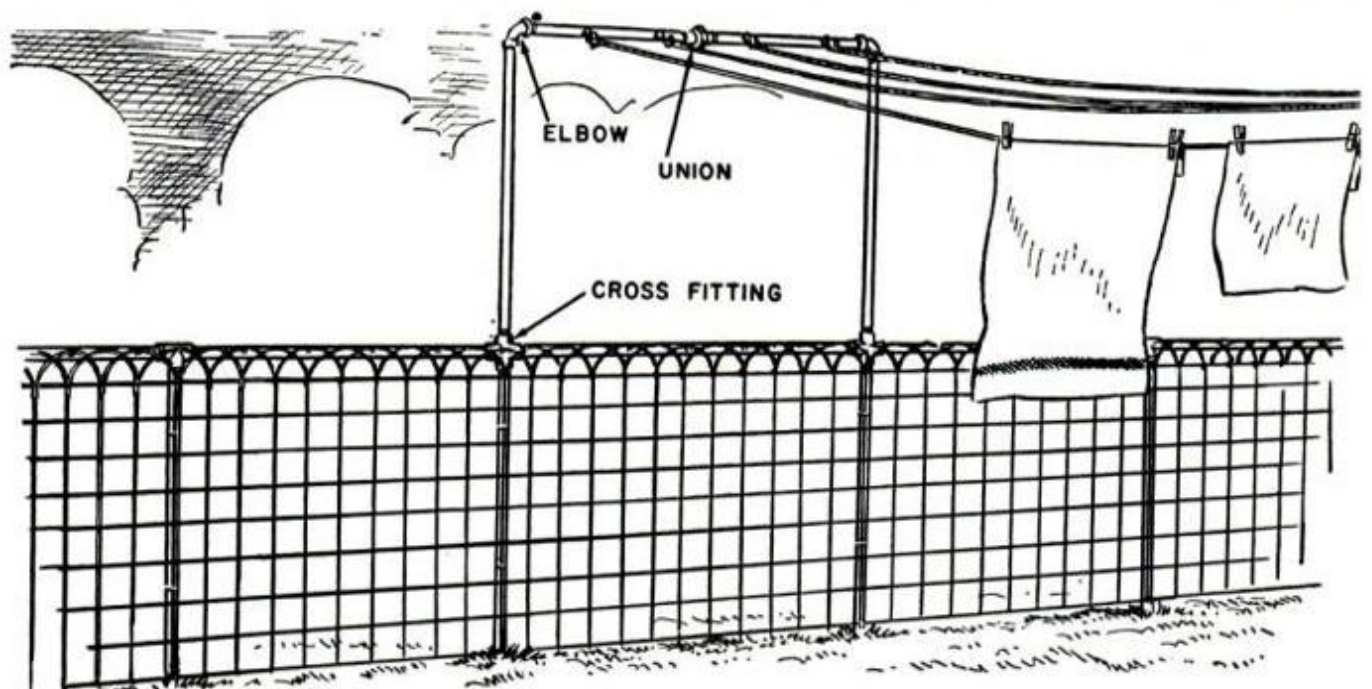
SOGGY MITTENS dry quickly on this rack, especially if set on a hot-air register. You need a dowel and a few wire coat hangers, several of which are cut into straight lengths for prongs spaced across the top



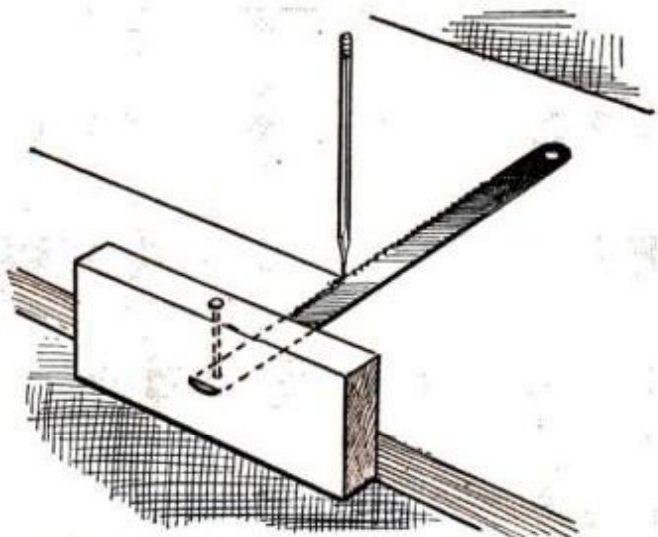
TANGLE-FREE HANGERS are yours if you save wooden spoons, slip one over the straightened hook of each wire hanger, then reshape the hook. Spools also add weight to keep empty hangers from jumping off rod



EMERGENCY BOTTLE OPENER is just a nail driven through a strong stick so that its head projects about $\frac{1}{2}$ in. and its point is clinched. The larger the nail's head, the easier to hook the bottlecap



PLANNING A PIPE-RAIL FENCE around the back yard? Think ahead—do you need a clothesline here? It's a simple matter to provide for an extra section by using cross fittings instead of tees at chosen points

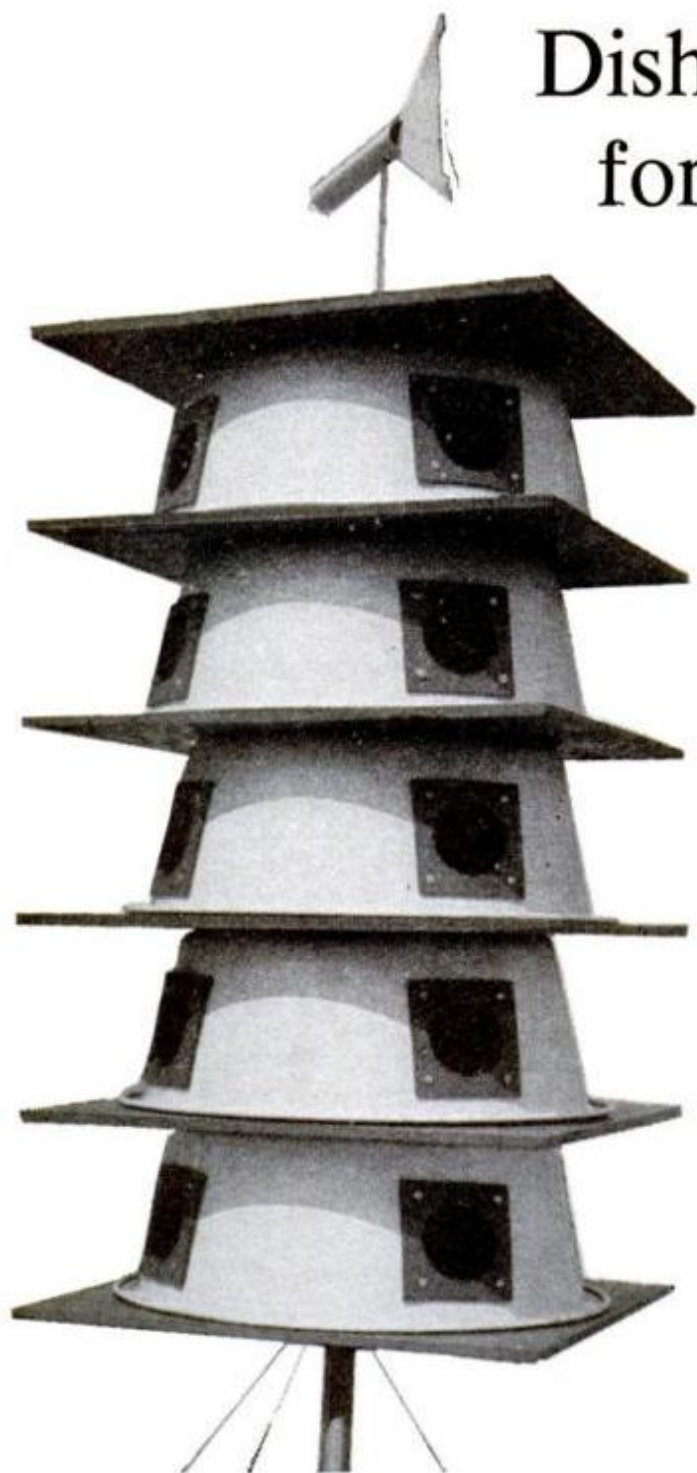


SCRAP-MADE MARKING GAUGE consists of a section of hacksaw blade anchored in a slot through a wood block. The teeth provide a wide selection of notches that hold a pencil or scratch awl right on target



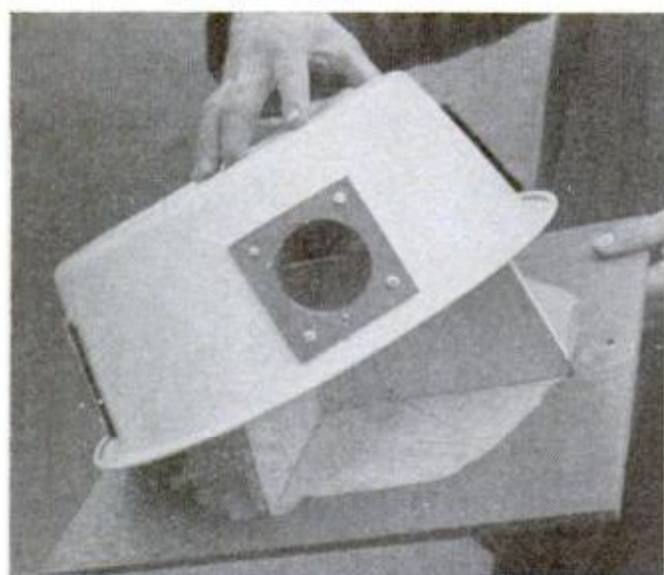
WHEN THE FAT'S ON THE FIRE you can keep it from splattering all over the stove and walls. Just sprinkle salt in the frying pan until the action calms. You'll want salt in the gravy, later, anyway

Dish-Pan Apartments for Mosquito Eaters

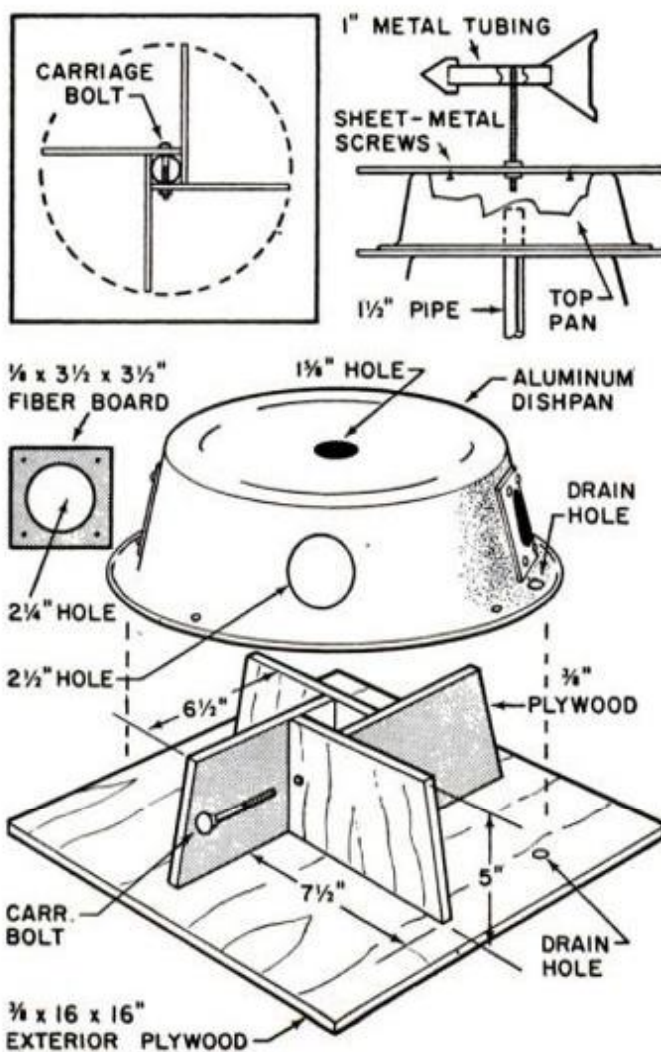


The sky is the limit when building this high-rise martin house—you can keep on stacking as many dish-pan units as you want since each one simply slides down over the pole like the layers of a cake. Each aluminum pan is divided into four apartments by inner walls which are nailed together like a paddle wheel to provide a central well for the supporting pole. The removable pans make for easy cleaning of the apartments.

Except for the penthouse apartment, a pipe hole is cut in the bottom of each pan, in addition to four entrance holes in the sides. These can be cut neatly with duckbill tinsnips. Sharp edges are covered with squares of hardboard having smaller holes. Each pan is attached to its plywood base with sheet-metal screws through the rim. An extra hole through both rim and plywood will serve as a drainhole. A 1½-in. TV mast makes a fine pole, letting the house rest on the guy-wire collar. A weathervane tops it off. —Kenneth W. Nightenhelser



NEAT TWO-TONE PAINT JOB is done by painting pans (white) and plywood platforms (green) before assembling. Hardboard entrance covers are applied last



Trouble Testers for Photographers

BY FRANK P. FRITZ



Batteries, plugs, cords, sockets, shutters, lamps, flash guns—no matter which one you suspect, you can zero in on the trouble in a hurry with these easy-to-use test boxes

FAILURE TO GET QUALITY pictures in single or multiple photography may be due to faulty equipment. Troubles can originate at the batteries, plugs, cords, sockets, shutters, flash lamp or flash gun. To avoid malfunctions all equipment should be checked out before shooting.

The first two testing units described herein can be used to check out practically any piece of electrical photo equipment. The first unit is a self-contained, two-meter box and used independently of any other testing equipment, while the second, a simpler unit, must be used in conjunction with a volt-ohmmeter (VOM). The advantage of the latter unit is that it eliminates the clumsiness involved in handling the relatively large clips or pin probes common to the VOM. Teamed with

the VOM, this unit will check "shorts" and or continuity in all cords, plugs, sockets, shutters, flash lamps and guns.

The third unit is a continuity tester designed for use in the field.

This article will restrict itself to a description of the construction of the self-contained unit only since the accompanying diagrams and photographs of the VOM and field units are self-explanatory.

Building the self-contained unit

The tools you'll need include chassis punches, nibblers and reamers. Lay out the panel as shown in the upper diagram on page 173, allowing ample room for all components. Prick-punch the centers and mark the finished hole sizes.

After all holes and openings are made and the parts fitted, mount the "SHORTED

PLUGS" first. Complete all the sides, including the 1½-in. battery clip. Use extruded fiber washers to mount the insulated machine screws on the top panel. Mount the banana jacks in like manner.

The test lamp is mounted through a rubber grommet having a ½-in. hole as shown. Add the push-button switch and the bent-prong male plug labeled LAMPS. Follow with the rotary switch, the voltmeter and the milliammeter. Note that the phone and phono-pin jacks on the "SHORTS" test panel (on left side of box) *must* be insulated from the case to prevent "SHORTS."

The shutter-flash plug is mounted directly on the top side of the cabinet. It may be necessary to carry a wire from

the center post of the ASA jacks in order to "short" them to the case.

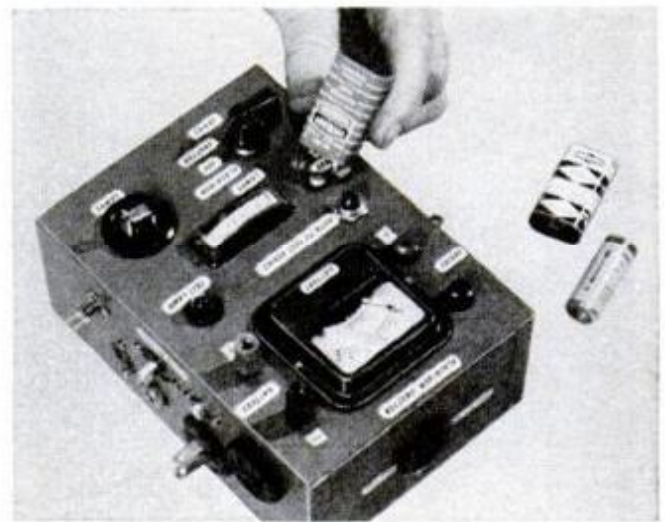
Following the wiring diagram, use single-strand insulated wire of different colors to facilitate tracing the circuit. Insulate all bare wires to prevent contact with chassis and other components.

Wire the rotary switch using the nuts shown. Solder all connections. Note the polarity of the voltmeter—plus (+) and minus (—)—and mark the banana jacks and machine-screw heads accordingly. If the needle jumps to the left when checking the flash gun, reverse the male plug.

If, when checking the batteries, the needle on the dial moves to the left, the polarity may be wrong due to incorrect wiring, incorrect positioning of the batt-



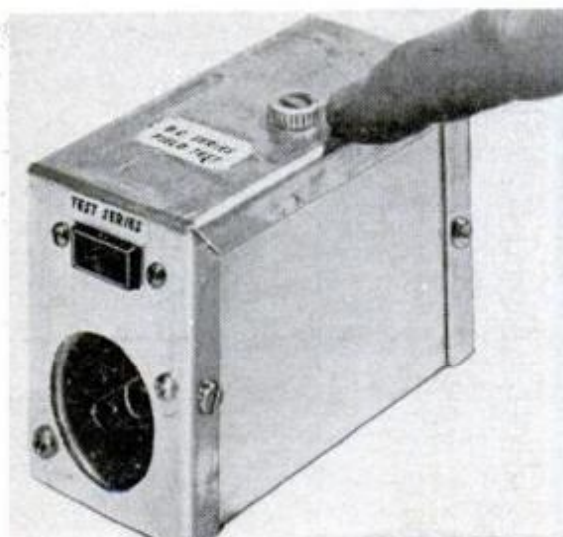
WITH ROTARY SWITCH SET at "lamps", all types of bulbs can be tested, both flash and incandescent



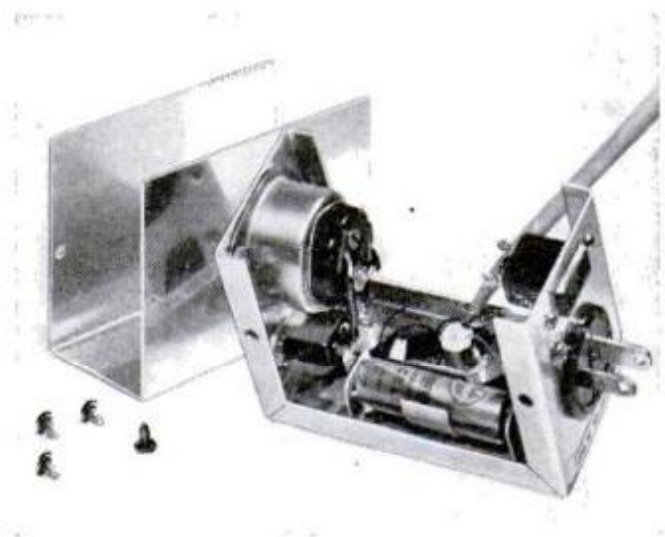
WHEN TESTING BATTERIES on the self-contained unit, meter reading tells quickly if cells are good

The third unit, a field test box, can be built by following the diagram at far right. This unit is for testing series flash circuits, cords, shutter contacts and flash

lamps on the job. The addition of test probes fitted to a male plug makes it a universal continuity tester. In testing shutter contacts, the meter needle movement



MALE PLUG OF FIELD TESTER is recessed to prevent shorts which would drain battery. Note tiny meter



HERE'S HOW COMPONENTS FIT inside small aluminum box. Pointer indicates position of miniature meter

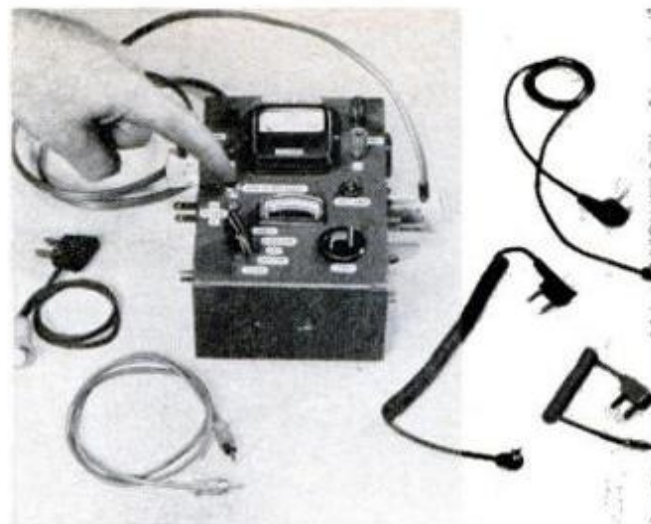
tery poles on the bolt heads, or reversed plus (+) and minus (-) symbols on the case.

The d.c. voltmeter should be of the type to test the largest voltage battery used in your work, with built-in resistance to give a true test under load conditions.

Finally, label the meter as illustrated in the top, right photo, page 172.

Testing with the VOM unit

Remove the pencil probes from the VOM wires and replace them with banana plugs of the same color. With the addition of banana-plug connector jacks, pencil probes and alligator clips may be added as required for other tests. Insert

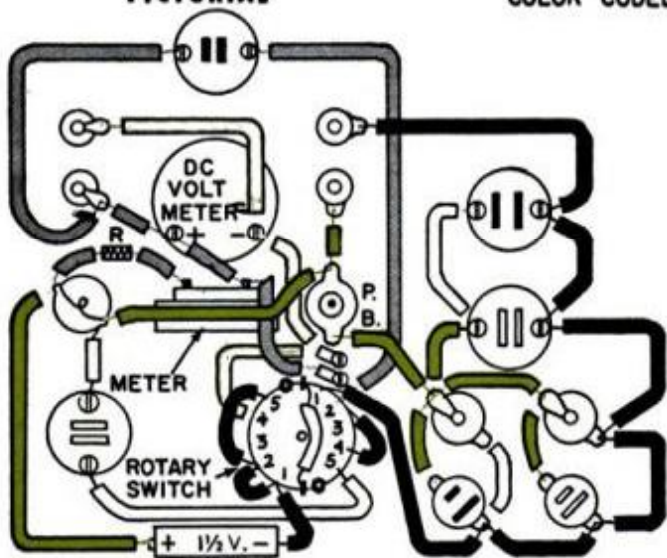


EXTENSION AND FLASHGUN CORDS are tested by plugging into unit and pressing the pushbutton

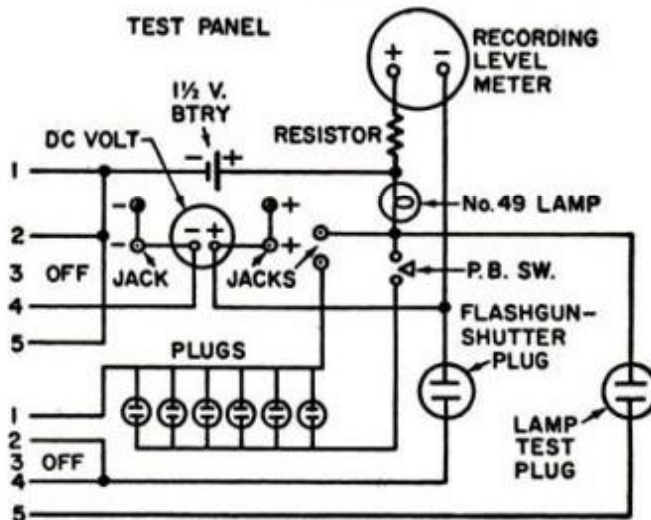
TWO METER TEST BOX

COLOR CODED WITH TWO METERS

PICTORIAL



SCHEMATIC

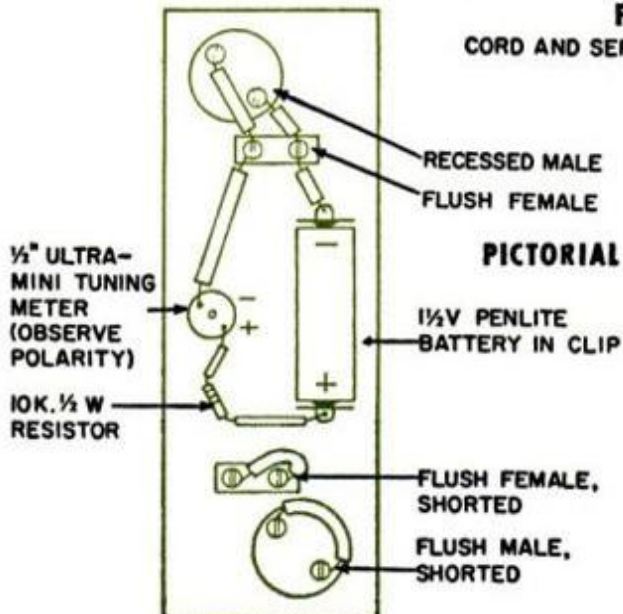


will be slight with Groflex flash shutters; very pronounced with Ilex flash shutters. The two-piece box is small (2x2 3/4x4 in.) and light in weight since it's made of

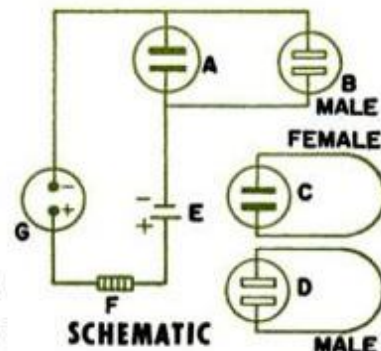
aluminum. The tiny 1/2-in.-dia. meter is very sensitive and consumes little current. Its 1 1/2-v. penlight battery will last nearly its shelf life—one year.

FIELD TEST BOX

CORD AND SERIES-FLASH CIRCUIT TESTER



- A FLUSH FEMALE
- B RECESSED FEMALE
- C SHORTED FEMALE
- D FLUSH MALE
- E 1 V. PENLITE BATTERY IN CLIP
- F 10K. 1-W. RESISTOR
- G ULTRAMINI TUNING METER (LAFAYETTE NO TM 27)



- A FLASH CIRCUIT TEST
- A FLASH CORDS
- A EXTENSION CORDS
- B DOUBLE FEMALE CORD
- A PROBES
- A SHUTTER CONTACTS
- B FLASH LAMPS

the proper plugs from the VOM into the matching jacks on the test panel. Set the VOM on OHMS to test for continuity (series) and for lamp testing. The male plug with the bent prong connects directly to the VOM, and lamps may be checked by placing the base of the lamp on the bent prong while at the same time touching the side of the lamp base to the upright prong. If the needle on the VOM jumps, the lamp is good.

To test batteries, set the VOM on d.c. volts. Remove the positive banana plug from the panel. With the battery's base (-) on the bent prong of the male plug, touch the positive (+) pole of the battery with the positive probe of the VOM. Use both probes from the VOM to check other types of batteries.

To check shutters, set the VOM on OHMS. Insert the male plug of the flash shutter cord in the female plug on the top side. Cock and trip the shutter as you watch the needle on the VOM. The needle will jump if the shutter contacts are good.

To test for short circuits, set the VOM on OHMS. Insert a female plug in the "SHORTS" plug on the side panel and, while twisting the cord at the plug, press the push-button. If the meter needle jumps, there is a short. Check the other end of the cord in the same manner. Let this plug remain and insert the other end of the cord in its matching plug on the "SHORTED" side of the panel. Press the bush-button. If the circuit is complete, the needle of the VOM will jump, indicating a good circuit.

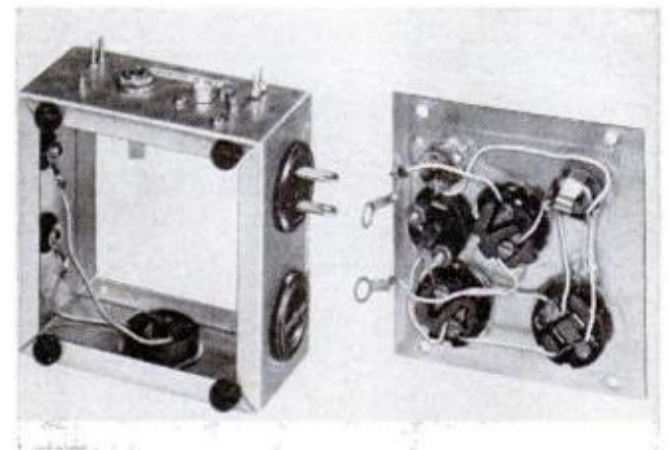
Follow this procedure for all cords and [\(Please turn to page 209\)](#)



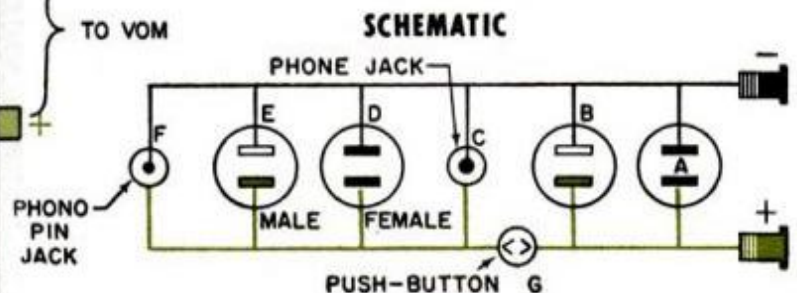
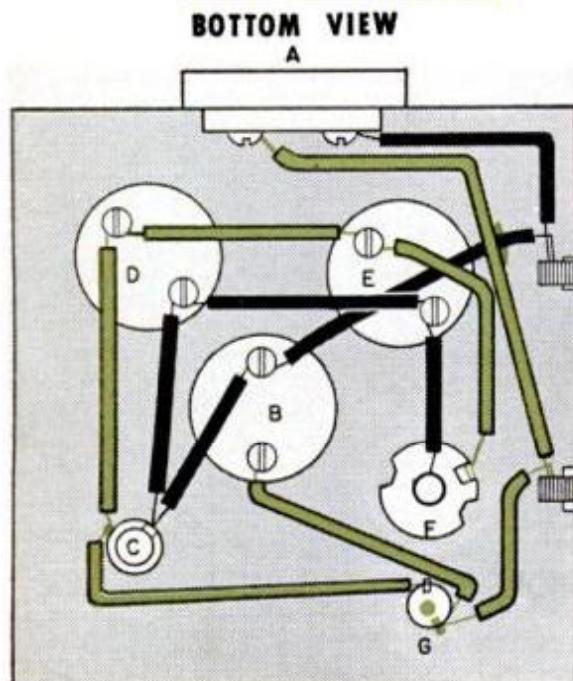
SUPPLEMENTARY TEST BOX, plugged into the VOM, is being used to check B. C. or D-size flash cells



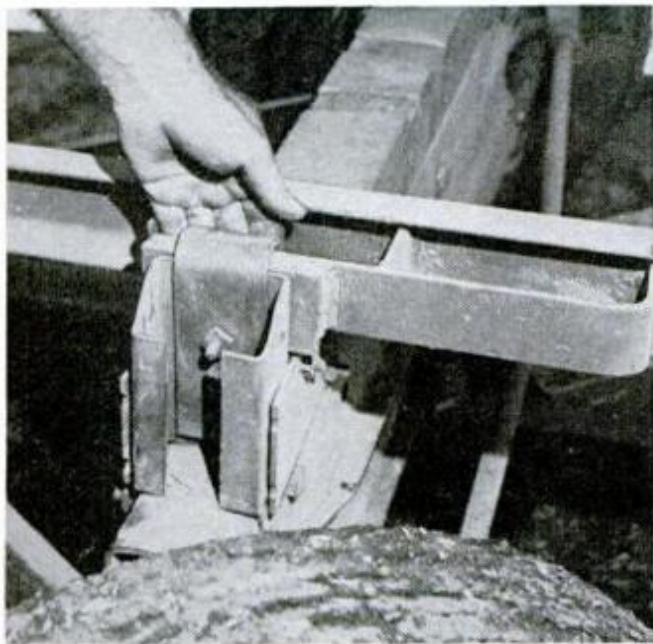
HERE IS THE COMPLETED supplementary test box showing location of all components properly identified



THIS IS WHAT THE TEST BOX LOOKS LIKE when fully wired. Cover is held on with sheet-metal screws



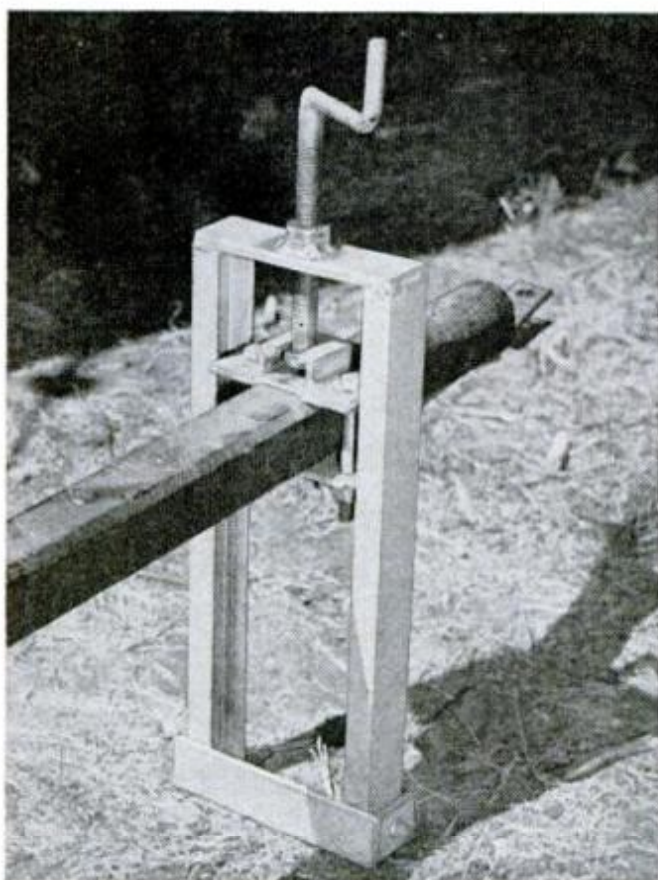
FARM TIMESAVERS



UNLOADING PROBLEM? This simple bolster hook will prevent a hydraulically operated wagon box from shifting on the rails when in the hoisted position for unloading cargo. Just bolt J-shaped pieces of flat steel tightly to the stake housings. Four of these on a wagon will make the box immobile

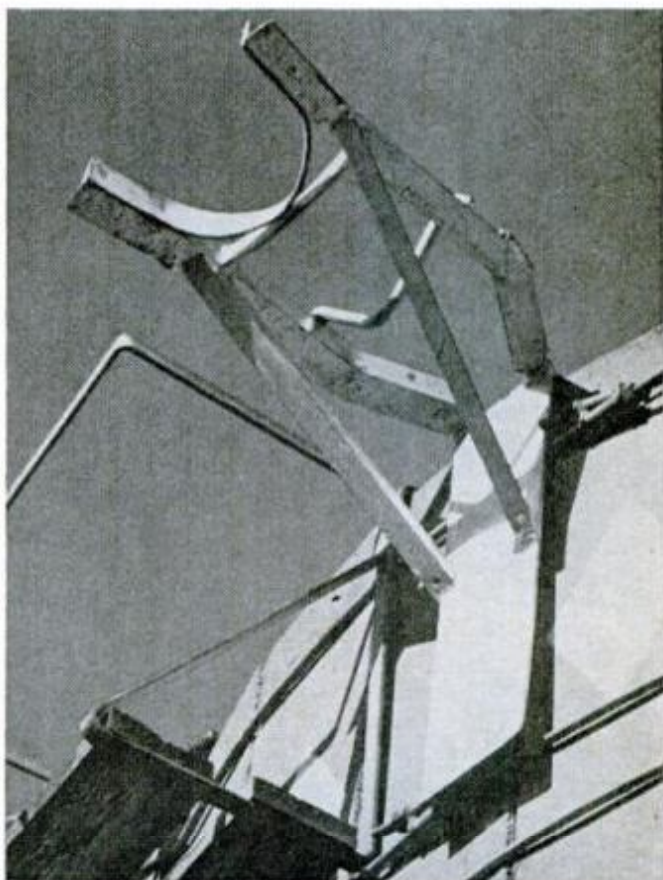


CLIMBING ABOARD a tractor is easier on the shins when a step is added just in back of the rear wheels. The tread is cut from deck plate, then reinforced by turning down the edges. The mounting bracket is a length of angle iron cut away along one side so it can be bent at right angles for the step plate



ONE-MAN HITCHING of a heavy farm implement to a tractor is possible with this welded jack. The frame is channel and angle iron bolted to a base which can be removed to slip the jack from the tongue. The clamp-on lifting bracket is left attached to the tongue so it's always there for unhitching the implement

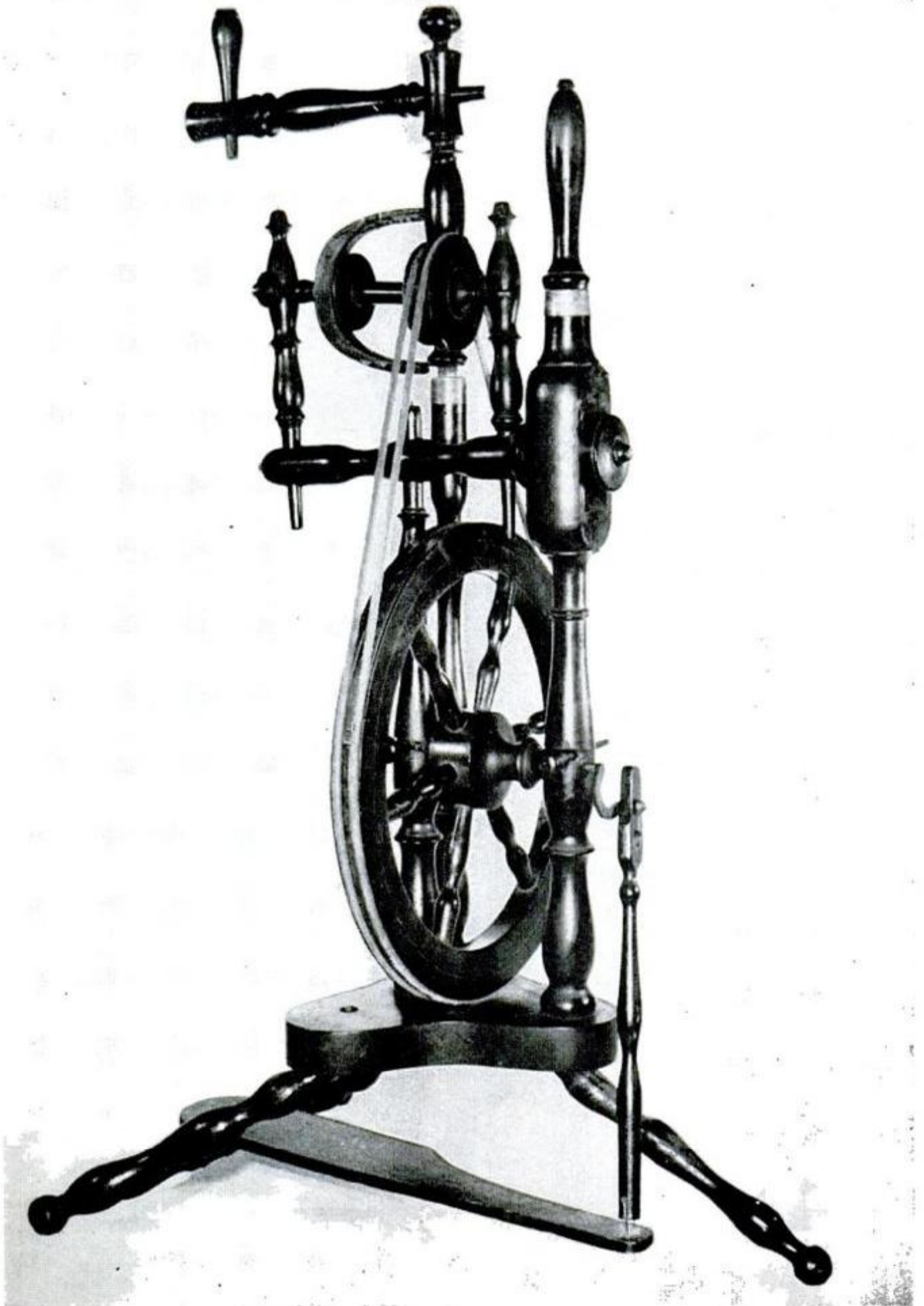
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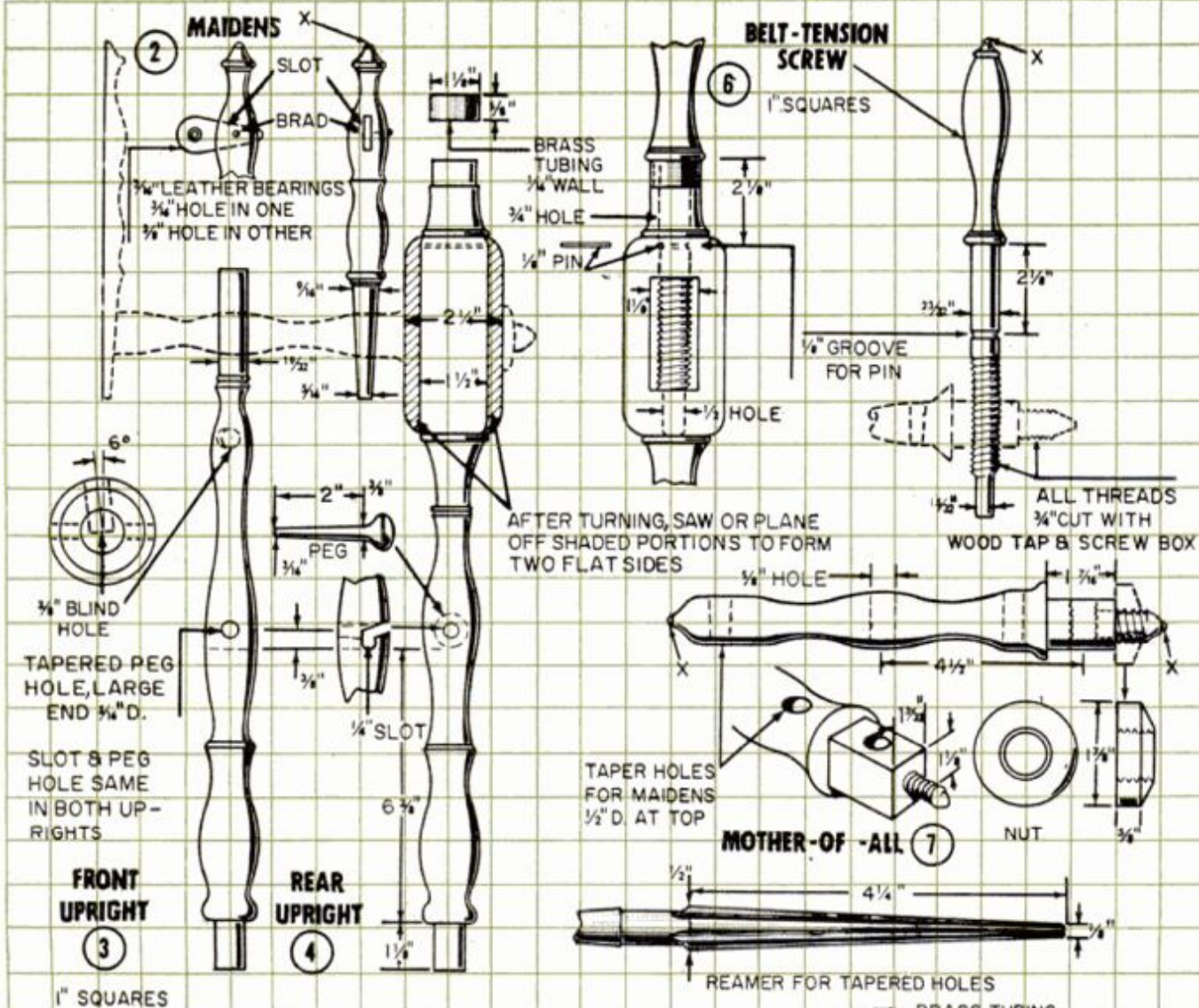


STANDOFF SILO BRACKET, welded to a saddle of steel plates, fits over silo rim to safely cradle a silage blower pipe when it's hoisted in position. A rod welded across the bracket permits a rope and hay pulley to be hooked to it for hoisting the pipe. The pipe is finally lashed to the cradle of the bracket

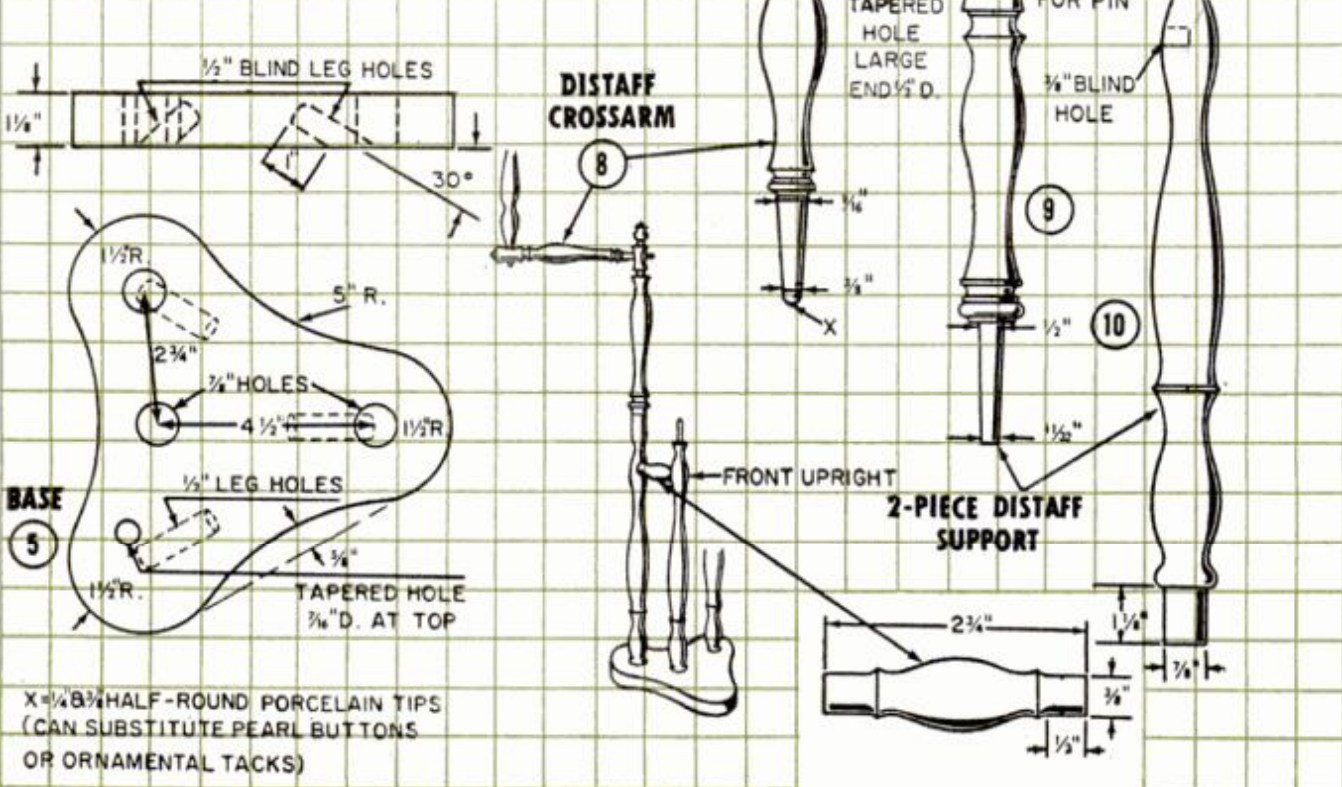
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Reproduce this Prized





CUT, FOLD, TAPE **SPINNING WHEEL**

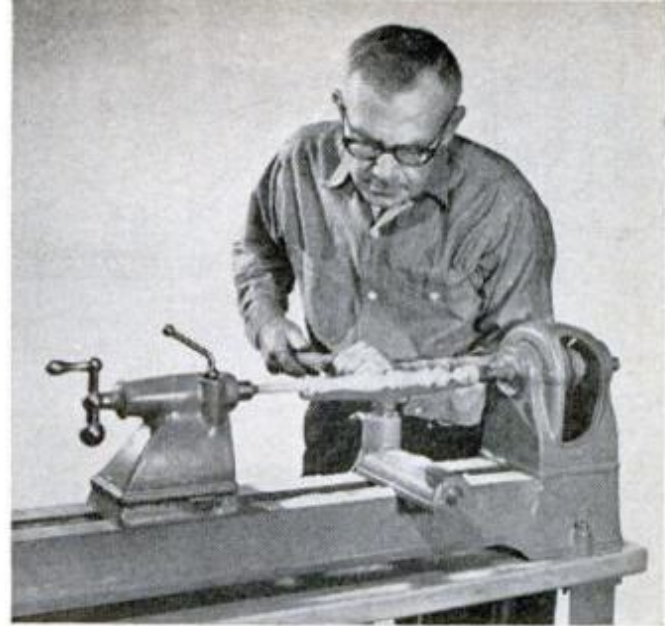


skill to fascinated friends and neighbors.

Your job should start with a study of the keyed drawing on page 181, to familiarize yourself with what individual parts are called. Great-great-grandma got pretty cute, sometimes, when putting *names* to items encountered in everyday chores. Thus the horizontal bar (Key No. 7) that positions the spinning mechanism (11) is a "mother-of-all." Sprouting from this are two posts called "maidens" (2); bridging these is the spindle—a solid-steel axle, hollowed at one end to form an eye through which the raw fibers pass. The fibers emerge at a side hole and are twisted by the horseshoe-shaped "flyer," which then guides the string onto the bobbin. The flyer is pinned to the spindle, so its rate of revolution is controlled by the larger of the two whorls, which is actually a V-pulley fastened to the spindle with a setscrew. A smaller-diameter whorl is turned onto an end of the one-piece bobbin. The difference in diameter is important: Since both whorls are spun by means of a belt (called a driving band) that passes around the rim of the wheel, the bobbin spins slightly faster than the flyer, keeping the thread taut for neat, snarl-free winding. Tension is kept on the belt by means of an adjustment screw (6) that lets you inch the mother-of-all farther from the wheel as the belt stretches.

The speed of the wheel is, of course, controlled by the treadle (15). The up-and-down action of the treadle is converted to the rotary spin of the wheel by means of yet another quaintly-named member—the footman. This is simply a stick (13) that connects the treadle to an offset crank on the end of the axle.

Now that we know how the main parts relate to one another, let's start construction. All wooden members should be made of a close-grain hardwood such as maple. The wheel rim consists of four band-sawed segments splined—or doweled—together. Splining is easiest, since the splines can be driven in position after the spokes have been assembled to the rim segments and hub. Use a relatively slow-setting glue so you can complete the entire assembly before it hardens. A rope around the rim, applied like a tourniquet, keeps the segments butted tightly while you clamp the wheel between two sheets of $\frac{3}{4}$ -in. plywood. When set, mount the hub in your lathe to true the rim and cut the two grooves for the driving band.



Then drive in the axle so it fits tightly, extending the right amount on each side.

Now, begin work on the frame itself, starting with the base and working up, but attaching the legs and treadle last. Make a full-size paper pattern of the base (5) for tracing its shape and the hole locations. Bore the holes for the uprights and the tapered socket for the distaff when it's not in use. (No distaff is needed when spinning wool.) After gluing the uprights in place, prepare for boring the sloping blind leg sockets by cutting a small notch with a chisel, to form a seat for the bit. This boring is done with the uprights installed because the leg sockets notch into the ends of the rear upright and distaff support. All tapered holes, incidentally, are made with a taper reamer.

The front and rear uprights support both the wheel and the mother-of-all. They have L-shaped notches cut in them that let you slip the wheel in place. The bearing seat for the axle is a bit to one side of the center line to conserve more of the uprights' cross section, for strength. The axle is anchored with tapered pegs. Drill and ream the peg holes before you drill the bearing seat and cut the notches.

A blind hole near the top of the front upright takes a short brace that adds rigidity to the distaff support. The upper end of this upright passes through the mother-of-all and lets it move up and down. The nearly-square end of the mother-of-all must be a sliding fit in the slot of the rear upright. To cut this slot, you must first turn the $2\frac{1}{4}$ -in. section of the upright on the lathe, then saw or plane two parallel flats to reduce the thickness to $1\frac{1}{2}$ -in. After forming the slot, equip

the top end of the upright with a brass reinforcing ring, then bore a centered $\frac{3}{4}$ -in. hole down from the top and into the slot. Now, improvise a sleeve with a $\frac{1}{8}$ -in. wall to fit this hole and serve as a guide for the auger while you drill a $\frac{1}{2}$ -in. hole at the opposite end of the slot. This hole forms a seat for the belt-tension screw. The screw itself does not travel—it merely revolves, and is locked in place with a $\frac{1}{8}$ -in. steel pin that fits a groove above the threaded portion of the screw.

To cut the threads, you should have a screwbox and wood tap, but if these aren't available, you can do the job on a metal-turning lathe equipped for thread cutting.

There are three holes through the mother-of-all—a straight center one that's a sliding fit on the front upright and two tapered sockets for the maidens. The threaded extension on the square section can be a dowel, threaded part way. Glue the unthreaded end into a centered hole; then bore and tap the hole through which the belt-tension screw turns. A round, wooden nut snugs the mother-of-all to the rear upright after adjustment.

The maidens are identical, and are fitted with leather bearings in tapered slots, to take the spindle. Secure each bearing with a brad, but leave the head projecting enough to permit removal if the leather wears out and must be replaced. The maidens themselves remain removable from the mother-of-all.

The lower part of the distaff support (10) is glued in its base socket. A tapered hole in the top end takes the upper part (9). This not only permits removal, but lets the operator turn the distaff for best positioning while spinning flax. A brass ring reinforces the wood around this socket. Both the crossarm (8) and top section (12) also fit into tapered sockets.

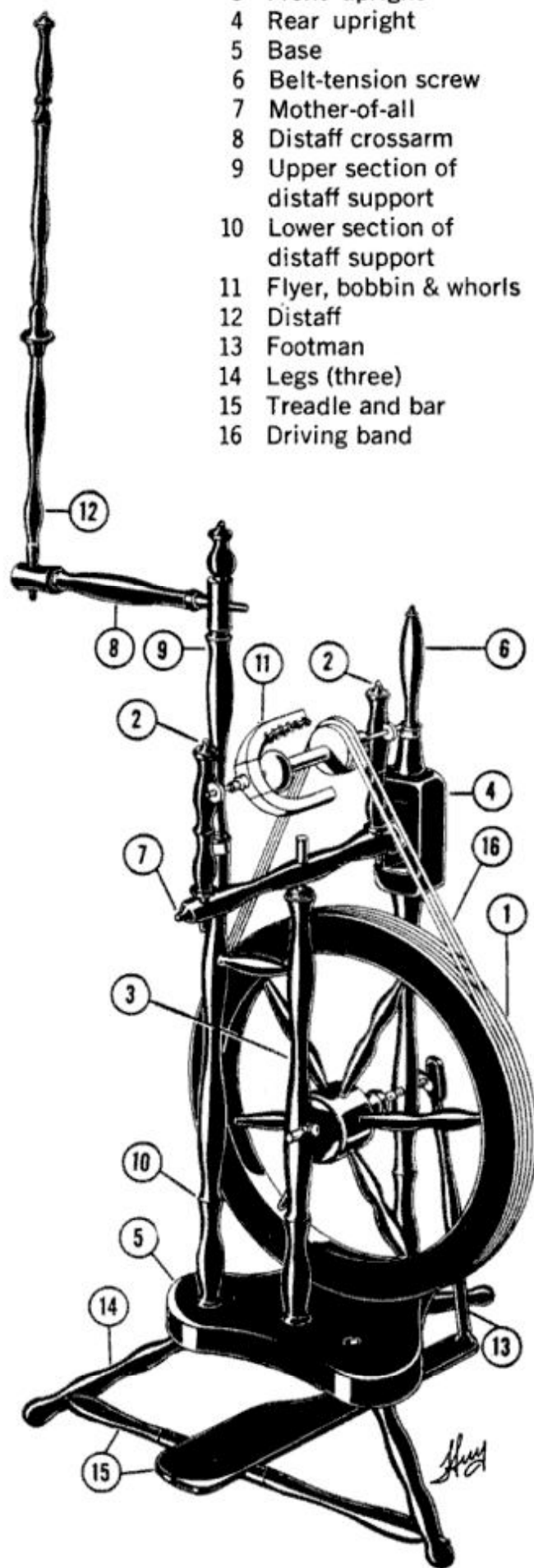
The thread-guiding hooks on the flyer arms are screwhooks bent to the shape indicated and turned into pilot holes to prevent splitting.

Note the step-down from $\frac{1}{4}$ in. to $\frac{3}{16}$ in. on the spindle. This comes at the end of the bobbin whorl and bears against the end of the brass bushing inside the flyer whorl, thus preventing friction between the two. The feeding hole at the spindle's opposite end is drilled and reamed to a funnel shape. A second hole

(Please turn to page 218)

PARTS

- 1 Wheel
- 2 Maidens (two)
- 3 Front upright
- 4 Rear upright
- 5 Base
- 6 Belt-tension screw
- 7 Mother-of-all
- 8 Distaff crossarm
- 9 Upper section of distaff support
- 10 Lower section of distaff support
- 11 Flyer, bobbin & whorls
- 12 Distaff
- 13 Footman
- 14 Legs (three)
- 15 Treadle and bar
- 16 Driving band



Your project becomes more than ornamental if your wife learns How To Work A Spinning Wheel

If you build the wheel on the previous pages, you'll own more than a decorative period piece: it's a functional machine for spinning thread from grain and animal fibers. To help you put your wheel to work, PM asked experts how to master the art

"YOU CAN'T TELL ANYONE how to spin," said the lady in the gathered dustcap. Which was discouraging, since that was the story we'd made the long trip to get. Old Sturbridge Village, the 200-acre "museum" of Early American life, located in central Massachusetts, had *seemed* the logical place to learn about spinning. It might be described as a rural Yankee version of Williamsburg, Va.—except that unlike that famous Colonial *reconstruc-*

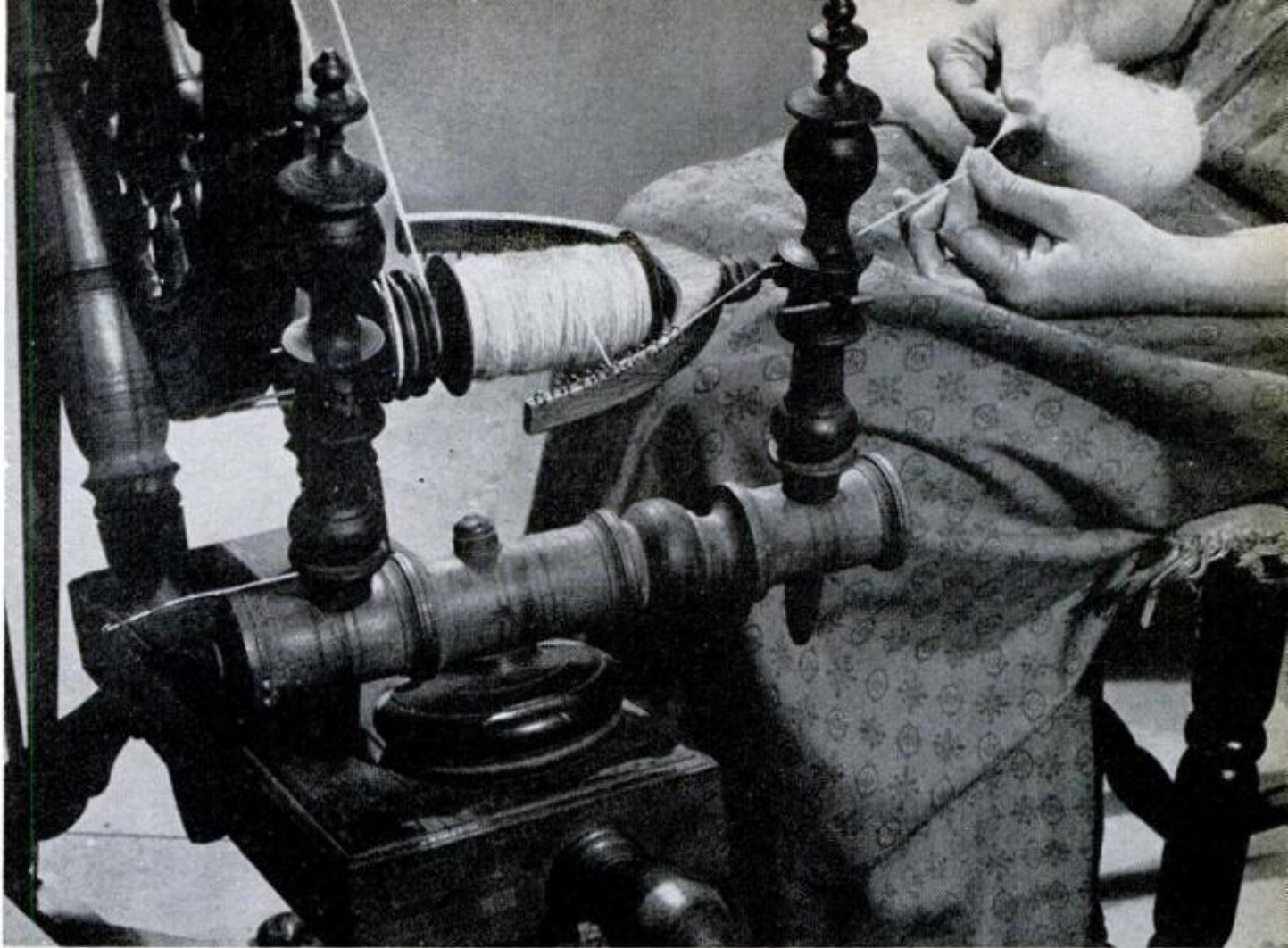
tion, the Village is made up of over 35 *original* buildings, gathered from 18th-Century sites all over New England. Many of these buildings house live demonstrations of such homely tasks as candle-dipping, broom-making and blacksmithing, and the Mashapaug house, on the Village Green, is a textile museum, crowded with looms and spinning wheels.

The lady in the dustcap seated herself at a handsome treadle wheel, fished a fluffy "card" of fleece from the basket beside her and, draping it across her lap, began to tease one end of it out into yarn. This she tied to the free end of a string already wound on the bobbin and fed out through the spindle.

"You never completely empty a bobbin," she explained. "It's just too much of a chore to try to thread this hand-twisted yarn through the spindle; so you always leave a bit of the last batch wound on, or else tie on a string long enough to do *this*." And she plucked up enough old thread to catch over the outer-most hook on one arm of the flyer.

Now she gave the wheel one deft spin with her right hand, matched the treadle rhythm with her foot, and continued to draw out the fleece, rolling it into a loose twist with her thumb and forefinger as it was tugged toward the spindle (see photo above, right). When the winding had piled up





WHILE WHEEL TURNS, you must keep pace by drawing random fibers (wool, here) into rough twist with fingers, feeding smoothly into spindle's eye. Whirling flyer gives finish twist while it guides thread onto bobbin

enough in the one spot on the spindle, she stopped the wheel and flicked the thread over the next hook.

"The thread doesn't distribute itself evenly along the bobbin, of course, so the flyer has this row of hooks. You just keep moving the thread down the row as the bobbin fills, then start back up."

"But why hooks on *both* arms?" we asked.

"Never found anyone to explain that. You couldn't use both rows at once. But our forebears liked symmetry in all things, and it *does* keep the flyer in balance."

We bent low over the wheel rim to examine the driving band. It was a woven, flat cord that looked vaguely familiar. "Is this special band hard to get?" we asked. "Not around here!" she laughed; "It's candlewicking from the demonstration across the Green." It was tied on in one con-

(Please turn to page 224)



Fixing Stripped Plug Holes

The last time my '61 Olds was in for a tuneup the mechanic managed to strip two of the plug holes while installing new spark plugs. Now I get leaks from these cylinders. I would appreciate your advice as to the least expensive way of repairing this damage.—Teodors Metra, Forestville, Conn.

Take the car into your local Oldsmobile garage and have them bore out the damaged holes and insert 14mm threaded sleeves to accept the plugs. These will stop the leaks.

Explosive Distributor

I have an 8-cylinder '57 Plymouth as my second car. It's a good little car except that every so often it produces an explosion in the distributor which is severe enough to break the rotor and knock the distributor cap out of place. What causes this and how do I correct the trouble?—Fred Schlenz, Morton, Pa.

The trouble is caused by a distributor vacuum advance unit diaphragm which has gone bad. It literally sucks gas from the intake manifold into the distributor, then—*bang!* Your best bet is to replace the vacuum advance unit or—if you have the type with a removable diaphragm—replace the diaphragm.

Seeks Automotive Shower Curtain

I like my air fresh, even in the winter. That means I like to open the vent windows of my '64 Chevy Impala Sport Coupe—at least a little—rain or shine. Trouble is, when it's raining, water blows inside the car. Question: Is there any way I can get the air—without the water?—Edwin H. White, Clinton, Iowa.

You're smart, Ed. No matter what the weather its always a good idea to keep fresh air circulating throughout the car. Driving while closed up tight can lead to drowsiness, and this can cut your reaction time way down, even put you to sleep.

Okay, about that rain. Pay a visit to you nearest foreign-car dealer or auto parts shop. Side-window deflectors are available and are widely used by owners of foreign jobs. I'm sure you won't have much difficulty finding some to fit your Chevy. You don't have to drill to install 'em either; they clamp on.

We Didn't Say It

I tried to get a service bulletin you cited in your Feb., 1965, column by writing the company. I was politely, but firmly told by Mercury that it doesn't issue these to the public. Stop giving out false information.—Signed: Perturbed.

We never said the average Joe can get service bulletins. Service bulletins are confidential and go only to dealers and other authorized parties—not to the general public. We tell you what they are however, as well as what they cover, so you can quote book and verse to your dealer, who may have forgotten that he has the tidbit in his files.

He'd Supercharge a Hawk

I've become the proud owner of a supercharger from a '57 Studebaker Golden Hawk. I'd like to install it on my '61 Hawk. Do you advise this? If so, what's involved?—George W. Pfeiffer, Riverdale, Md.

I'll answer the second question first, then you'll be able to answer the first one yourself. To make this installation you'll need the following parts:

A new drive pulley; a new water manifold; a new fuel pump; a new idler; a new pressure chamber housing; a new 2-barrel carburetor (if your Hawk is now equipped with a 4-barrel carb); and a new drive belt. The last item—at \$5—is the cheapest. Hope this answers your question(s).

Seeks Lemon-Aid

I bought a lemon. Probably I have no one to blame but myself. The seller swore that the car in question—a '63 Chrysler—

"ran like a top." He blamed the car's obvious pinging on regular gas and said it would clear up with a couple of tankfuls of premium. Well, it hasn't. Okay, Doctor, now what do I do?—Sam Moscoa, Tampa, Fla.

Several things can cause pinging, but if that engine is a 300J, the first thing I'd do is check out the basic ignition timing. Approximately six or seven months after this particular car hit the market the factory changed the timing specification to $12\frac{1}{2}^{\circ}$ BTDC. Your car may have been one of the models that preceded this change in spec. Make this change in timing now and you may get rid of your pinging problem.

Cranking a Cold Ford

My '63 Ford V8 cranks beautifully when it's warm, but has a helluva time kicking

off after it's stood in the cold four or five hours. Yeah—it's been checked.—Sid Metlock, Wilmington, Del.

Sid, your problem may be in the way you're trying to start it. Ford has issued a starting procedure for all '63 Ford V8s (except T-Bird) that differs from the one in your owner's manual. Here 'tis:

Press the accelerator pedal all the way to the floor *three times*, then release it. This sets the automatic choke and results in a rich fuel mixture for starting this car—which doesn't seem to like cold weather. Now turn the key and crank the engine until it starts. Release the key and let the engine operate by itself for about 10 seconds. Depress the accelerator pedal slightly, then release it to reduce engine idle speed—and you *should* be merrily on your way. If not, the engine's not properly tuned, whatever you've been told.

Service Tips

● **IT'S QUITE POSSIBLE** that you may be putting too much fluid in the Powerglide transmission of your 1965 Corvair, even though the fluid level doesn't show above the full mark of the dipstick. To make sure, measure the distance between the full mark on the dipstick and the top surface of the vent cap. It should be $2\frac{1}{16}$ in. If it proves to be more than $\frac{1}{8}$ in. short, straighten out the lower accordion fold in the stick as much as you must to get the $2\frac{1}{16}$ -in. dimension.

● **DON'T BE CONCERNED** if the generator indicator light comes on when you brighten up the dashlights on your '65 Olds. It's nothing but a plain old light leak inside the instrument cluster. The sponge seal inside the case isn't positioned properly and allows light to leak through to the generator light indicator. To correct this trouble, remove the bulb above the GEN indicator from the rear of the cluster and use a small amount of body sealer to seal the inside bottom edge of the hole between the separator and the back of the cluster.

● **GOOD FOR YOU, Dodge!** More than a few Dodge owners have been complaining loud and long about wind noise (and Dodge hasn't been the only offender). Now the "Dodge Boys" have issued a Technical Service Bulletin to all their shops which describes the correctives for this problem. The Bulletin is TSB D65-107. It's a dandy.

Each month Auto Clinic answers your questions on car repair. For a personal reply, please enclose 25 cents in coin to cover mailing and handling. Address questions to Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022.

What you should know about

PART I

Armed with these basic facts on wheel servicing, you'll be able to make sure your mechanic does the job right

LOCAL "SPECIALISTS" in wheel alignment are giving Detroit engineers the jitters. It seems that there's too much individual interpretation of alignment specifications going on. Caster, camber, toe-in and toe-out are being altered to meet individual theories of what they ought to be. The concern of the engineers is justified, because deviations from these specifications can lead to serious problems, including unnecessary wear and tear on parts which can jeopardize safety.

You, as an individual car owner, can't do your own wheel-alignment work—not unless you're prepared to spend thousands of dollars for an alignment rack. Wheel alignment is a job for a garage specializing in this work. The purpose of this article—and next month's follow-up on

wheel balance—is to make you as "book knowledgeable" about wheel alignment as the guy who's going to do the job. Armed with the inside info on wheel alignment, there's no law that says you can't stick around and unobtrusively "monitor" the mechanic, making sure the job is done according to specs.

How to spot trouble

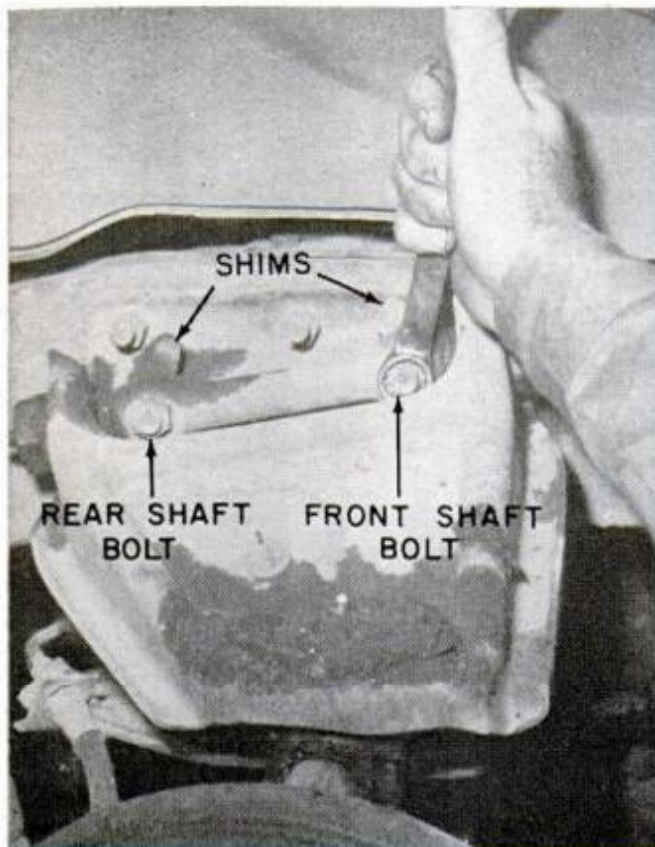
First off, how do you tell whether your wheels *need* aligning? Or do you conscientiously follow the manufacturer's recommendations and have alignment checked every six months? (Oh, *sure* you do!) Checking caster, camber, toe-in and toe-out twice a year will cost you a few dollars but it can save you a \$30 tire or two and will help extend the life of important front-end parts.

There are certain driving conditions which should make you suspect that alignment has gone out of whack. These are—

- A tendency of the car to pull to one side when you remove your hands from the wheel.
- Any front-end shimmy or vibration.
- A tendency of the car to wander or weave, requiring constant steering.
- Excessive tire squeal when cornering.
- Failure of the rear wheels to track with the front wheels.

Admittedly, any of the above conditions might be traced to other causes. Steering problems and premature tire wear, for example, could result from bad brakes, weak springs, badly adjusted front-wheel bearings, bad shock absorbers, a bent frame and even improper tire inflation. The only way to find out if it is wheel alignment that's at fault is to have the alignment checked.

The complete troubleshooter's wheel-alignment checklist on page 189 shows what constitutes a thorough wheel-align-



HERE, PROPER CAMBER AND CASTER are obtained by adding or subtracting shims at upper control arm shaft

wheel alignment

By Morton J. Schultz



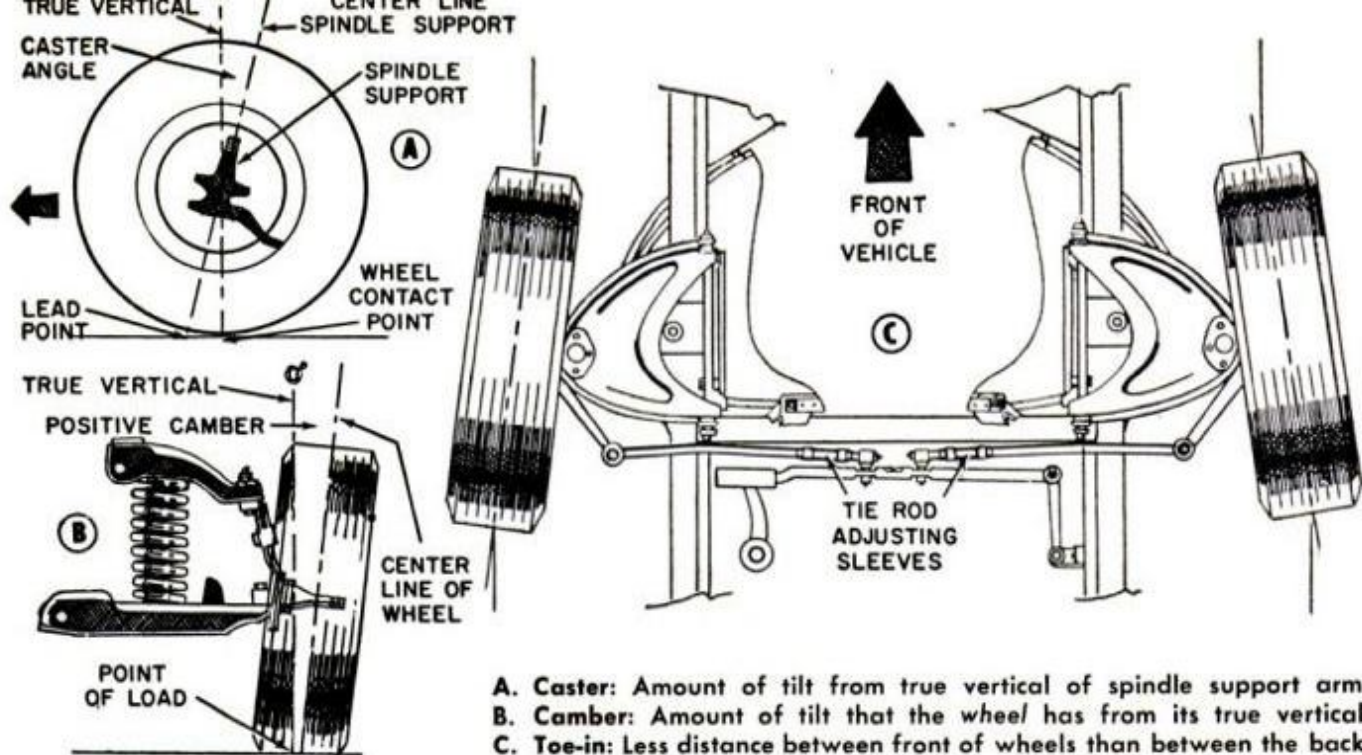
WITH WHEELS STRAIGHT AHEAD, a magnetic gauge attached to wheel is used to check camber angle

ment check. Listed are the procedures that manufacturers of wheel-alignment equipment recommend for all cars with independent suspension (the majority). In any case, basically the same checklist would be followed for a conventional axle design, except that an additional

check would be made of the axle itself.

All tests are made with the car level and at curb weight; that is, with the spare tire in place, a normal load of water, fuel and oil aboard, but with no passengers or other load.

Since it would take a book to detail



A. Caster: Amount of tilt from true vertical of spindle support arm
 B. Camber: Amount of tilt that the wheel has from its true vertical
 C. Toe-in: Less distance between front of wheels than between the back

each of the checks listed, we'll concentrate on the five tests which concern the car's geometry and are of major importance to alignment.

What is wheel alignment?

Wheel alignment is the correct relative position of the four wheels to obtain a true, free-rolling movement over the road without scuffing, dragging or slipping.

Five different angles determine wheel alignment: camber; caster, toe-in; turning radius (toe-out on turns); and steering axis inclination. These angles are purposely designed into your car to properly distribute weight on moving parts and to facilitate steering. Remember:

Properly aligned front wheels are never straight; they're at a slight angle top-to-bottom.

Now let's take a look at each of these five critical angles and discuss, briefly, how they should be checked.

Camber. This refers to the outward (or inward) tilt of a wheel at the top. It is measured in degrees which represent the amount the center line of the wheel is tilted from true vertical.

If wheels tilt outward at the top, that's positive camber. Inward tilt at the top is negative camber.

Manufacturer's specifications denote whether the wheels of a particular car should be set for *positive* or *negative* camber by the letters *P* or *N*, or by the symbols $+$ or $-$. Where neither letter nor symbol is indicated in the specs, positive camber is called for.

This specification usually provides two figures: a *desired camber* and a *limit*. For example, camber specifications for the 1965 Corvair call for a desired angle of $+1^\circ$. However, any angle between $+1\frac{1}{2}$ and $+1\frac{1}{2}$ is acceptable; this means $+\frac{1}{2}^\circ$ to $+1\frac{1}{2}^\circ$ from true vertical.

With your car's camber correctly set, the road contact of the tire is brought more nearly under the point of load. Thus easier steering results because the weight of the car is borne by the inner wheel bearing and spindle. Also, tire wear is held to a minimum.

When camber is incorrectly set, exces-



CASTER CHECK: Wheel is turned out 20° , then in 20° . The gauge reading should match manufacturer's specs

sive load is put on ball joints and wheel bearings, the vehicle will pull to one side and there will be excessive wear on one or the other side of the tire tread, depending on whether the camber is thrown out of kilter negatively or positively. If there's too much negative camber, tire tread will wear on the inside; too much positive camber will wear down the tread on the outside.

Depending on the car you have, adjusting camber is done by adding or subtracting shims or by turning self-contained eccentric bolts. The same type of procedure applies to caster adjustment.

To adjust caster and camber on a 1961-through-1965 Olds F-85, for example, you shim at the upper control-arm shaft attaching points.

Adding (or subtracting) shims at the front location changes caster toward negative (or positive) with practically no change to camber.

Adding (or subtracting) shims at the rear location changes caster toward positive (or negative) and camber toward negative (or positive).

Adding (or subtracting) equal shims at both front and rear locations won't change caster, but will change camber toward negative (or positive).

On the other hand, in changing caster and camber on 1958-through-1965 Plymouths and Valiants you adjust the upper control-arm attaching bolt and cam assemblies.

Caster. Caster refers to the backward or forward tilt of the kingpin or spindle support arm at the top of the wheel. It is a directional control angle that is measured in degrees and indicates to what extent the center line of the spindle support arm is tilted from true vertical.

Backward tilt of the spindle support arm at the top is positive caster. Forward tilt of the spindle support arm at the top is negative caster. Manufacturer's specifications designate negative or positive caster in the same way they do negative or positive camber; that is, with letters or symbols.

Caster determines directional control of the car by causing the front wheels to maintain a straight-ahead position, or to return to a straight position from a turn. Caster also helps to offset the natural crown of the road.

The car's straight-ahead position is

In-Shop Checks

1. Check toe-in, front and rear wheels, by driving across a scuff gauge.
2. Spin front and rear wheels on floor jack to check for high-speed shimmy, bent wheels, out-of-round tires and defective wheel bearings.
3. Check headlight intensity and direction with headlight tester.
4. With car on rack, check air pressure in all tires.
5. Check front and rear springs for sag and general condition. If they're torsion bar type, check height against manufacturer's specs. Check shock absorbers.
6. Jack up front wheels. Check for worn or loose tie-rod ends, idler arm and drag link; check for steering-gear cross-shaft looseness and steering gear-to-frame tightness.
7. Check steering gear for roughness and sticking on turns.
8. Check for worn upper and lower pins and bushings, kingpins or ball joints.
9. Check toe-in and tracking of each wheel, using sight tubes and rear wheel targets.
10. Check camber, caster, steering axis inclination and turning radius.

Corrections That Might Be Needed

1. Correct body-frame alignment.
2. Correct rear housing alignment.
3. Correct front suspension knee alignment.
4. Replace worn parts.
5. Balance wheels.
6. Correct caster and camber.
7. If turning radius does not meet specifications, check for a bent steering arm.
8. Adjust steering gear.
9. Adjust steering wheel to a true straight-ahead position.
10. Adjust tie-rods so wheels are straight ahead.

Road Test (vital for a complete job)

1. Drive on a level road to check if car tends to pull to one side.
2. At about 45 mph on a hard-surfaced road, check vehicle for steering stability and wander.
3. Check for shimmy at high speed.
4. If front wheels are out-of-balance, the steering wheel will have a rapid shimmy. If rear wheels are out-of-balance, undue vibration will show up in the rear view mirror and gear shift lever.
5. If, at high speed, the car has a road tramp caused by dead or weak shock absorbers and/or springs, the fenders will appear to "walk" and the hood will vibrate. The steering wheel will have a slow shake.

Symptoms and Causes of Wheel-Alignment Trouble

Trouble	Probable Causes		
	Camber	Caster	Toe-In
Excessive tire wear	Incorrect		Incorrect
Pulling to one side	Unequal	Unequal	
Wander or weave		Not enough	Incorrect
Hard steering		Too much	
Excessive road shock		Too much	
Low-speed shimmy		Too much	

maintained by tilting the spindle support arm so that it projects the center line of the support arm ahead and establishes a lead point ahead of the point of contact of the wheel. This compares to the ability of kids to ride their bikes straight and true without touching the handlebars.

The Bear Manufacturing Co., one of the leading producers of wheel-alignment equipment, emphasizes that caster *must* stay within the range of the carmaker's specifications. However, the company does recommend that about $\frac{1}{2}^\circ$ more positive caster be provided the right front wheel than the left front wheel to compensate for the effects of road crown.

Excessive caster will cause a car to pull toward the side having the least amount of caster; it can also cause hard steering, road shock and shimmy. Too little caster will cause the car to wander and weave.

Toe-in and toe-out. Toe-in describes the shorter distance between the front of the front wheels and that distance sep-

arating the rear of the front wheels. Conversely, toe-out (not to be confused with turning radius—i.e., toe-out on turns) describes the greater distance between the front of the front wheels and the rear of the front wheels. Got it?

By the way, toe-in and toe-out apply to the rear wheels as well; they should be checked also. Usually excessive toe-in or toe-out of the rear wheels indicates a bent rear housing, though in some cars with independent suspension it could just indicate the need for adjustment.

Toe-in is the most critical angle affecting tire wear. It is measured in inches. Its purpose is to compensate for widened tolerances in the steering linkage. If the car is toeing-in, tire wear starts to show up as a feather-edged scuff across the face of both front tires. Too much toe-in can also result in wear appearing on the outside of the right front tire only. On the other hand, too much toe-out will result in wear appearing on the inside of the left front tire only.

Toe-in and toe-out are adjusted by turning the tie-rod adjusting sleeves until the measurement taken at the front of the wheels falls within manufacturer's specifications.

The trouble chart at the top of this page lists some of the problems created by faulty camber, caster and toe-in.

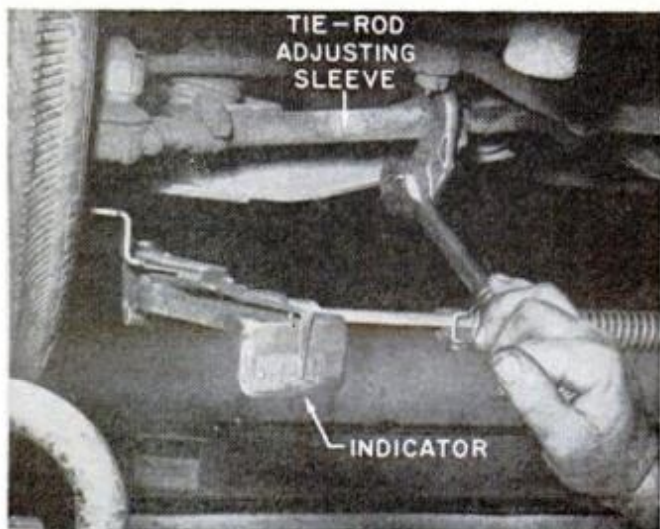
At this point, let's leave the rest of the discussion of wheel alignment (specifically, *turning radius* and *steering axis inclination*) until next month when we'll wrap up the package with a good look-see at wheel balance.

We've made big noise all through this article about manufacturer's specifications and the need to know what they are when you go to have an alignment job done. The natural question is: "Where do I get 'em?" Okay, these specs are available from any of the following sources:

1. Auto repair manuals such as *Motor* (250 West 55th St., New York, N.Y. 10019). Also, most libraries stock copies of this and similar publications.

2. Your car's manufacturer. A letter sent to its customer service department, requesting the wheel-alignment specifications should bring results.

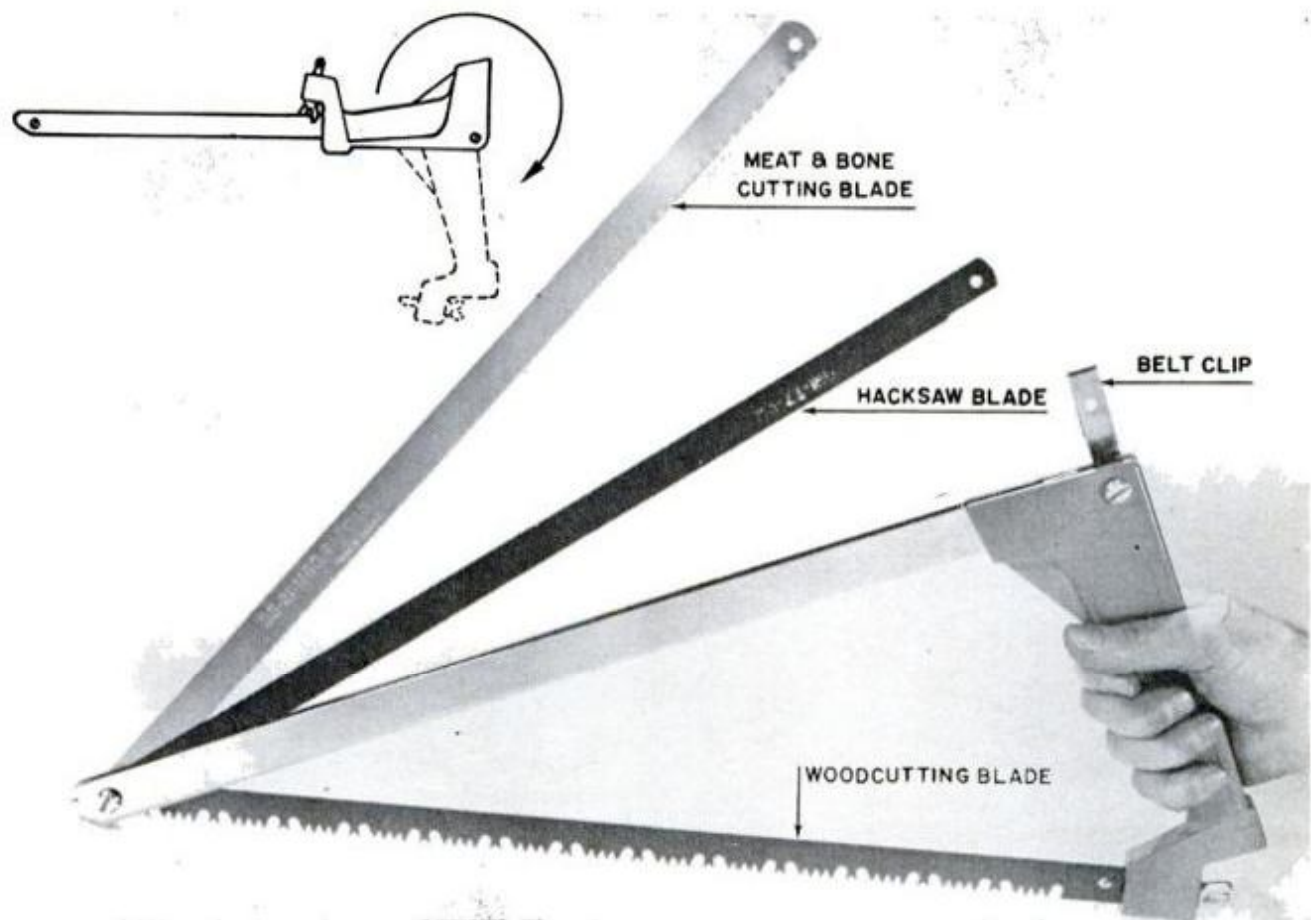
3. If you've got a buddy working in a dealership or garage, he probably can get them for you from the reference materials he keeps on hand. ★★



TOE GAUGE (between wheels) shows if wheels toe in or out. Adjustment is via tie-rod adjusting sleeve

SHOPPING FOR TOOLS

BY RICHARD HOWE



You get 3-saws-in-1 with the Safold Deluxe Traveling Saw: a hacksaw blade, woodcutting blade, and meat and bone-cutting blade. When not in use, blades nest in channel of saw's backbone; they fit in place in seconds for sawing. A belt clip for carrying the saw is included. Price: \$9.95. A product of Savage, Inc., Elverson, Pa.



Superior balance that eliminates "nose heaviness" is the outstanding feature of the new Series 15 pneumatic hand drill recently introduced by Cleco Tools, of Reed Roller Bit Co., Houston, Tex. Designed primarily for industrial use, the drill also can be used as a nutrunner, sander, wire brush machine or as a tapping machine.

MARCH 1966



Meet the B&C clamp fixture, a novel tool that enables you to make a clamp from any unthreaded length of $\frac{1}{2}$ -in. or $\frac{3}{4}$ -in. pipe. A toothed cam assures holding; a cam lever releases the jaw. A set screw secures the fixed jaw to the pipe. Available for $\frac{1}{2}$ -in. and $\frac{3}{4}$ -in. pipe. \$3.24 and \$3.88. Brink & Cotton Mfg. Co., Bridgeport, Conn.

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Make Yourself a Shrink Plate

By Walter E. Burton

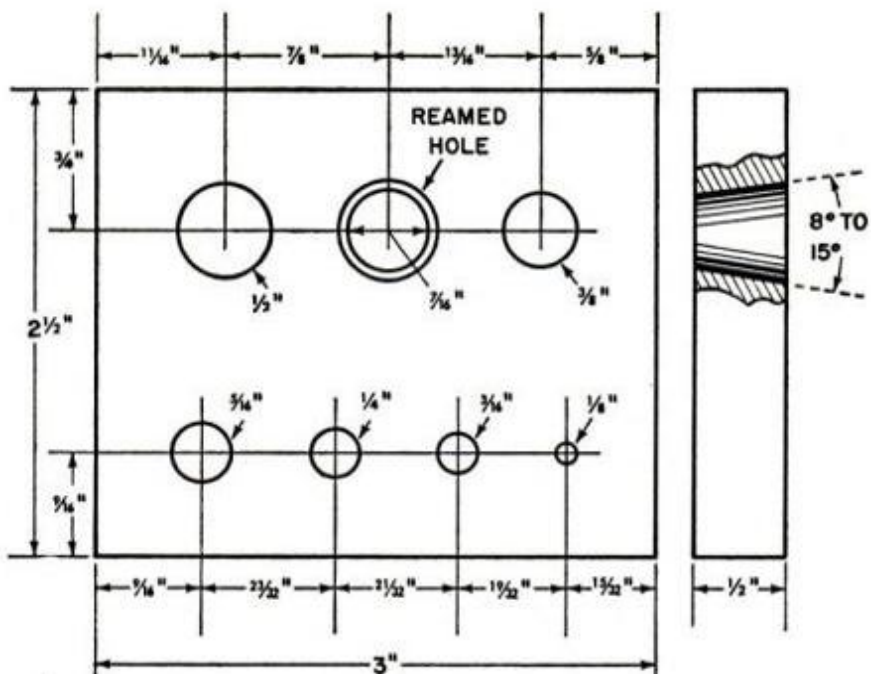
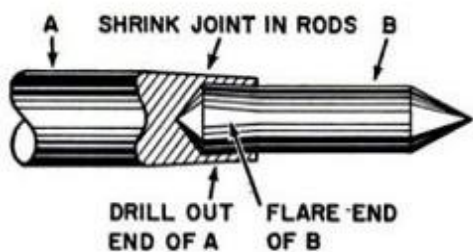
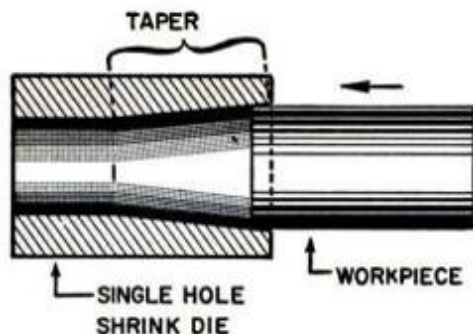
PUTTING THE SQUEEZE on metal with a "swiss-cheese" die is an old trick clock-makers have used for years when they wanted to reduce in size the ends of shafts and tubes. Called a shrink plate, it's nothing more than a block of steel full of tapered holes of different diameters. Here's how it works:

Say you want to slim down the end of a brass tube so it can be joined to another tube in a lap joint. All you do is apply a little oil to the right size hole in the plate, place the tube in it and proceed to shrink the end by either smacking it with a soft-faced mallet or squeezing it between the jaws of a vise.

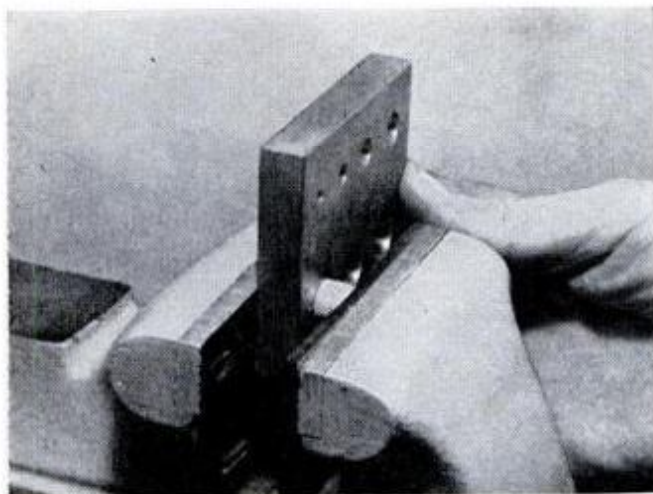
Shrink plates can be made in any convenient size and shape. In fact, if you have a lathe, you can make a single-hole die by simply chucking a steel blank and taper-boring it. For normal home-shop use the plate need not be hardened. Lay it out as shown above, right, and work up to maximum hole diameter with progressively larger drills. Then ream to final size. After reaming, smooth each hole with abrasive cloth wrapped around the reamer and chamfer them slightly.



EXAMPLES OF WORK include (left to right) aluminum body of center punch shrunk around hardened shank, copper tube of embossing tool shrunk around steel ball, and two types of ferrule. At far right is the single-hole die used to shrink a disk into the end of the tube lying next to it



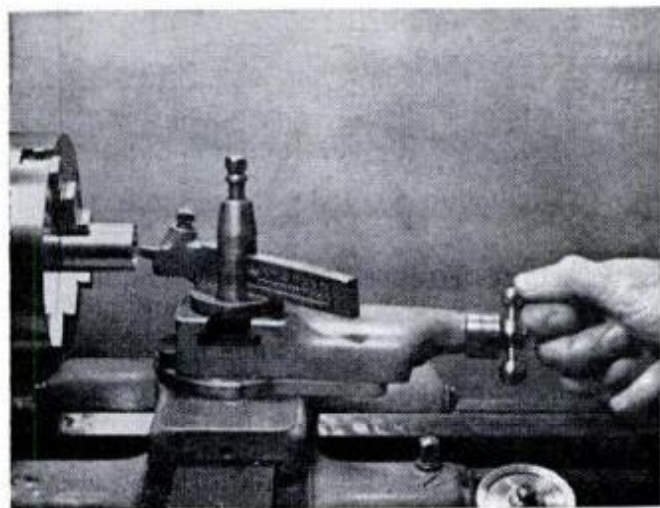
HOLE DIAMETERS SHOWN ARE BEFORE REAMING



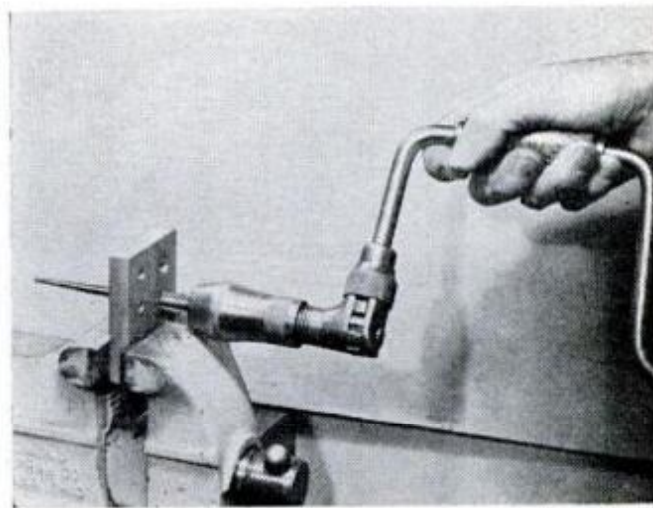
WHEN WORKPIECE IS SHORT, it can be squeezed into the tapered hole by placing both plate and work between the jaws of a bench vise. Because of close control of pressure and alignment, neat job results



TO SHRINK THE END of a tube, place the shrink plate on a solid surface, apply a little oil to the hole to be used and strike the tube with a mallet. End will be neatly tapered when tube is removed from hole



SINGLE-HOLE DIE IS MADE by lathe-boring a tapered hole in a cylindrical blank. Taper is formed by feeding the bit with the compound rest set at 5°. Taper need not extend full length of the die



AFTER EACH HOLE IS DRILLED with progressively larger drills, it is tapered from top to bottom. Here a brace is used to ream the larger holes, a taper-pin reamer will do for small ones. Use cutting oil

Add an Electric Brake to Your Saw

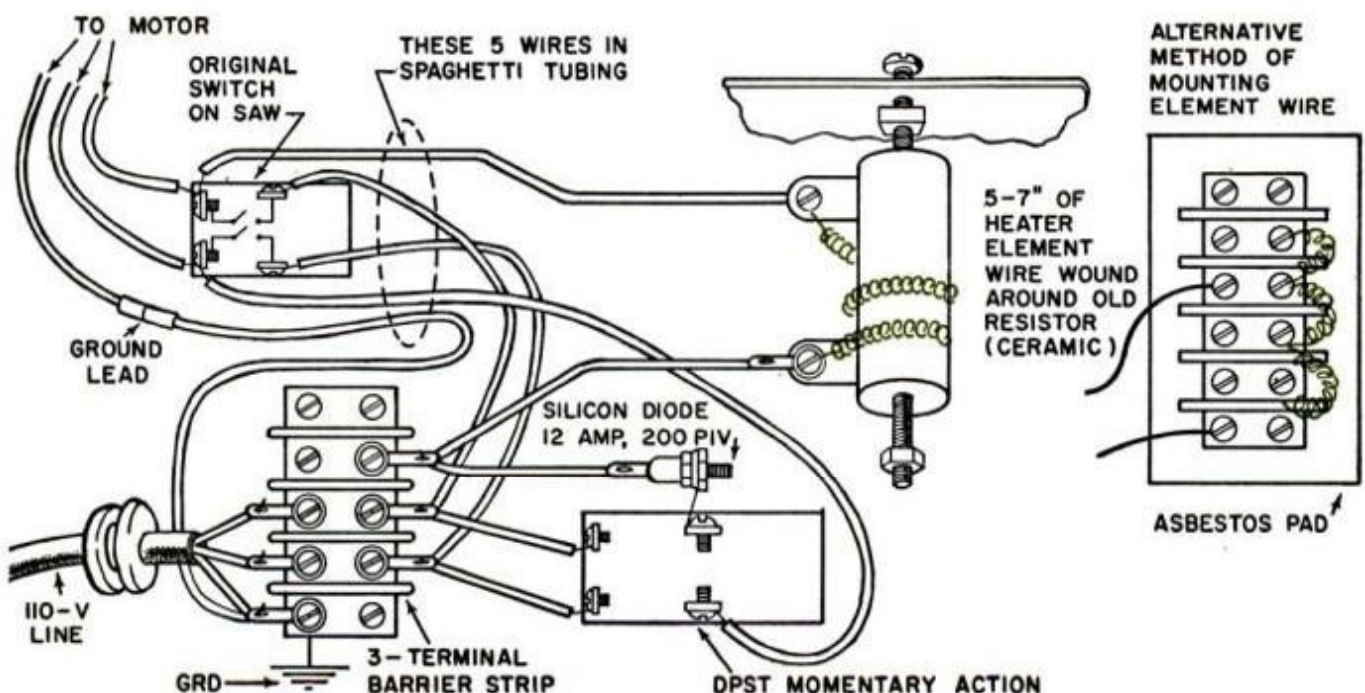
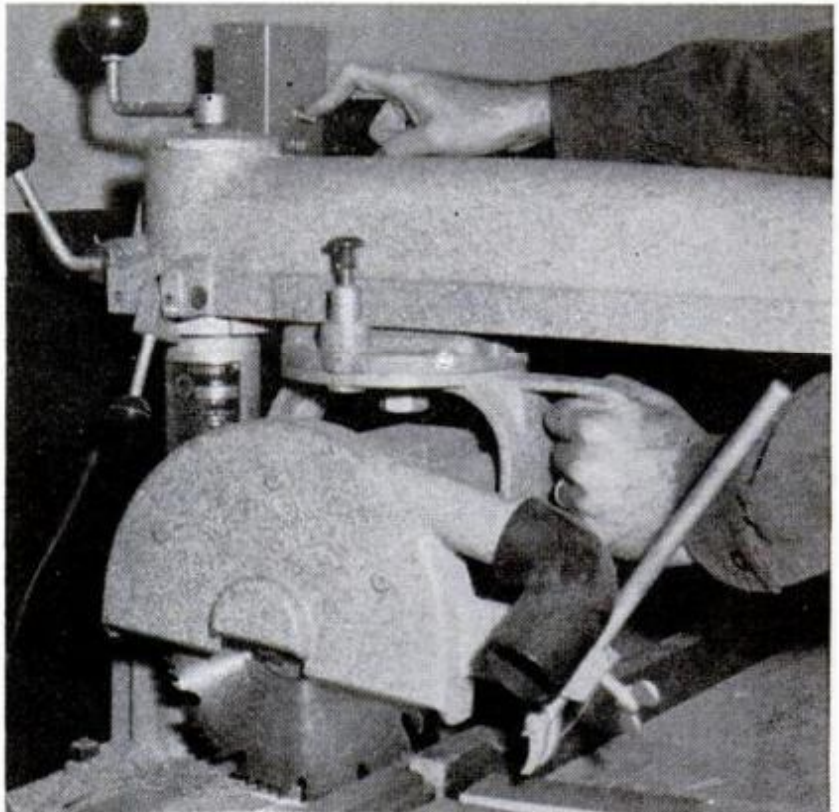
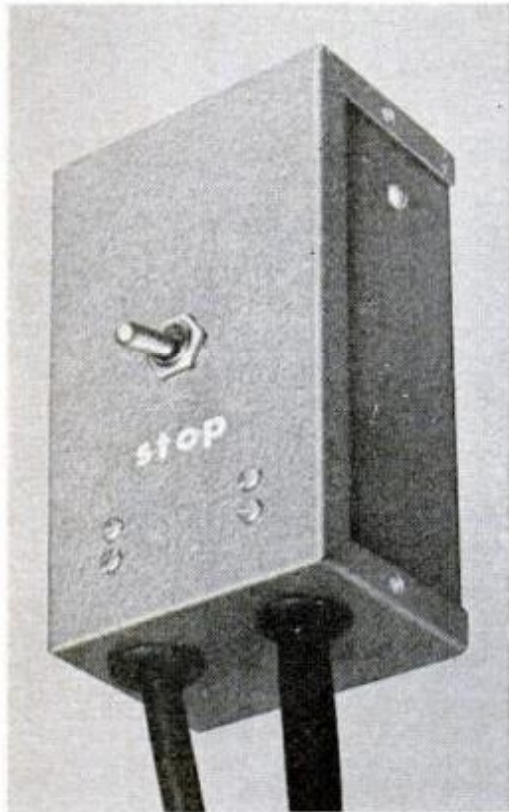
WAITING IMPATIENTLY for the blade of your radial-arm saw to coast to a stop can be for the birds. Not only is this a waste of time, but a coasting blade can be a source of injury. So, there are two reasons why you should take the time to add this electric brake to your saw.

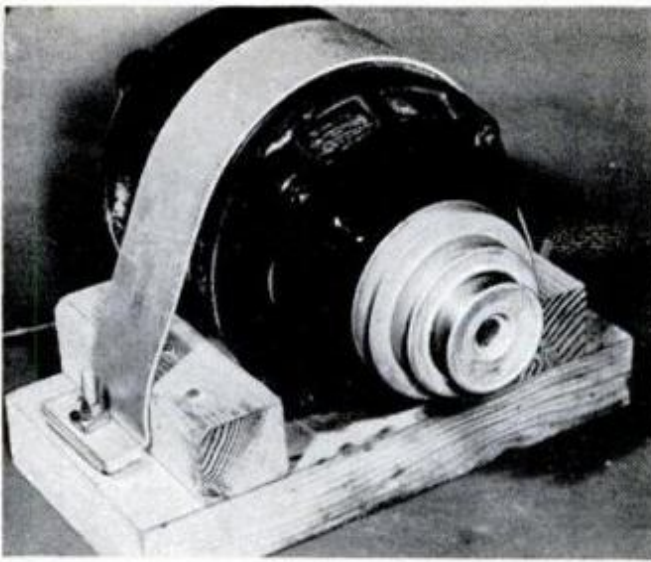
Here's how it works: After the saw's motor is shut off, the brake button is pressed. This puts a silicon rectifier and a resistor in series with the motor's leads and the line, which in turn converts AC to

DC. Direct current added to the fields of the motor causes the armature to slow down, and the more DC you induce, the quicker the motor will come to a stop.

The unit shown places about 12 amp of DC current to the fields, which is safe against overload on motors ranging from 1/2 to 1 1/2 hp. The brake cannot be used on DC or small universal motors.

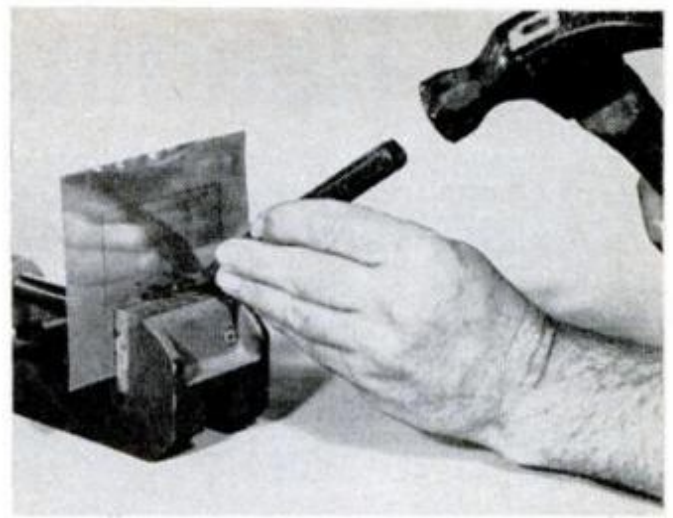
All components tuck neatly in a Minibox measuring only 2 1/8 x 3 x 5 1/4 in. You *(Please turn to page 214)*





Improved Motor Cradle

Your scrap box probably contains the necessary materials to make a base for any small motor not equipped with integral mounting legs. Use a short piece of 2 x 6 for the base itself, and cradle the motor with two pieces of 2 x 2 stock. Any strip of sheet metal can serve as a hold-down strap, but if you don't have a scrap on hand, it's easy to cut a strap from aluminum sheet. Remember to counter-sink the heads of the hold-down bolts.



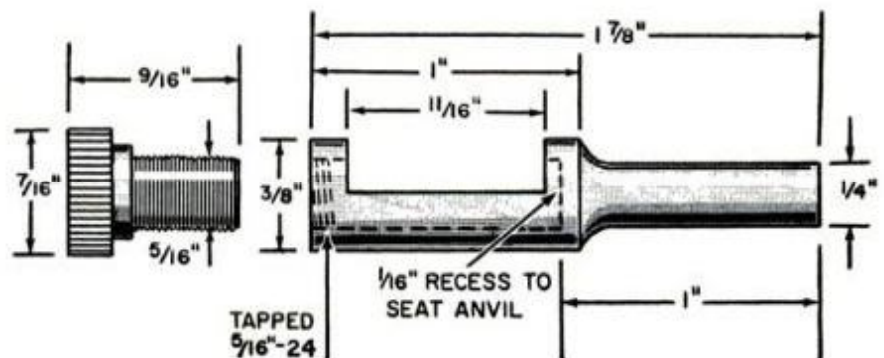
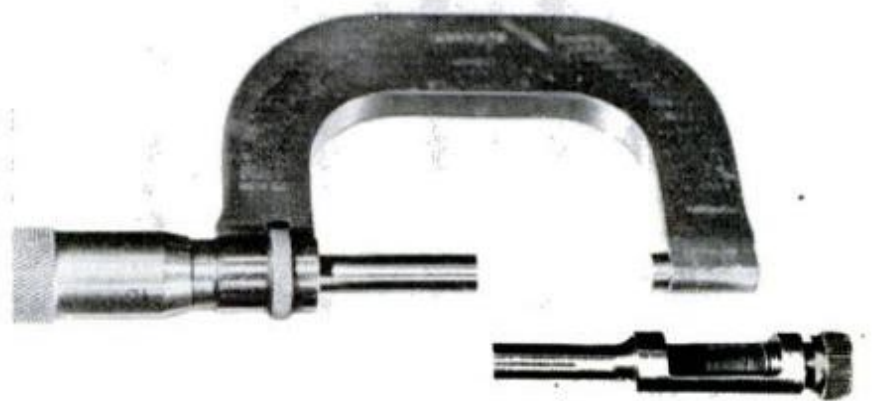
Making Inside Cuts

Here's a simple method of cutting small, straight-edged openings in sheet metal that gives you a clean edge every time. After scribing the opening, clamp the sheet in your vise with one straight side of the outline flush with the top of the jaws and the cutout section protruding above. A sharp chisel tapped lightly with a hammer will provide the necessary shearing action for a clean cut. Cut each edge in this manner.—*Gilbert C. Close*

Slip-On Attachment Extends Range of Micrometer

Slip this handy attachment over the anvil of a 1 to 2-in. micrometer and it will read from zero. Start with $\frac{3}{8}$ -in. mild steel chucked in a universal chuck and turn the $\frac{1}{4}$ -in. end. Then reverse it end for end in the chuck and bore the $\frac{1}{4}$ -in. hole $1\frac{1}{8}$ in. deep. The bottom of the hole must be recessed $\frac{1}{16}$ in. as shown to seat the anvil. Finish up by tapping the open end, filing the slot and turning and knurling the locking screw. Carefully lap the end of the screw until the mike reads about .002 above zero, then case-harden the fixture with Kasenit compound and finally polish and lap until the micrometer registers exactly zero.

—*John Wilson*



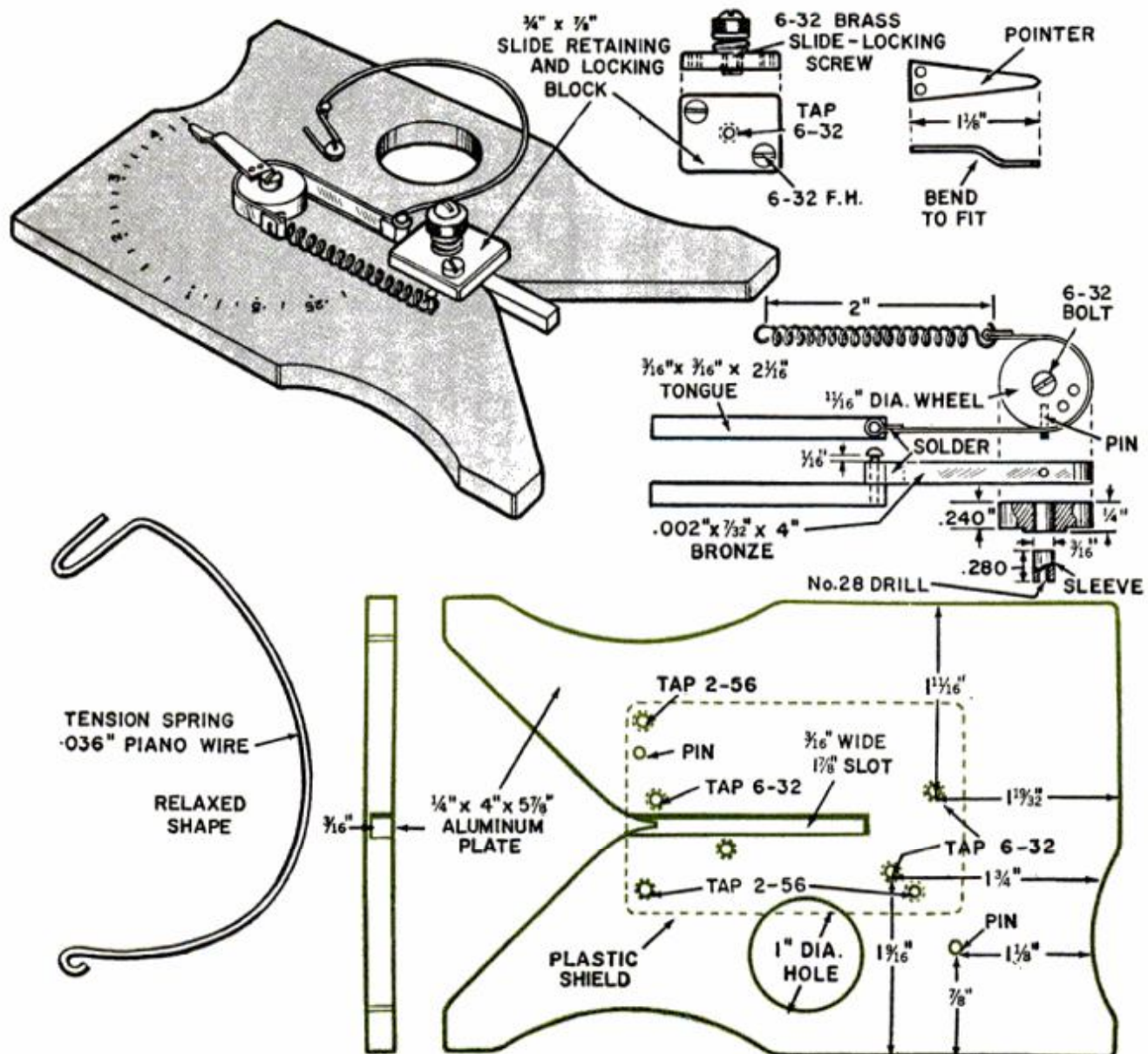
Self-Reading O.D. Shop Gauge

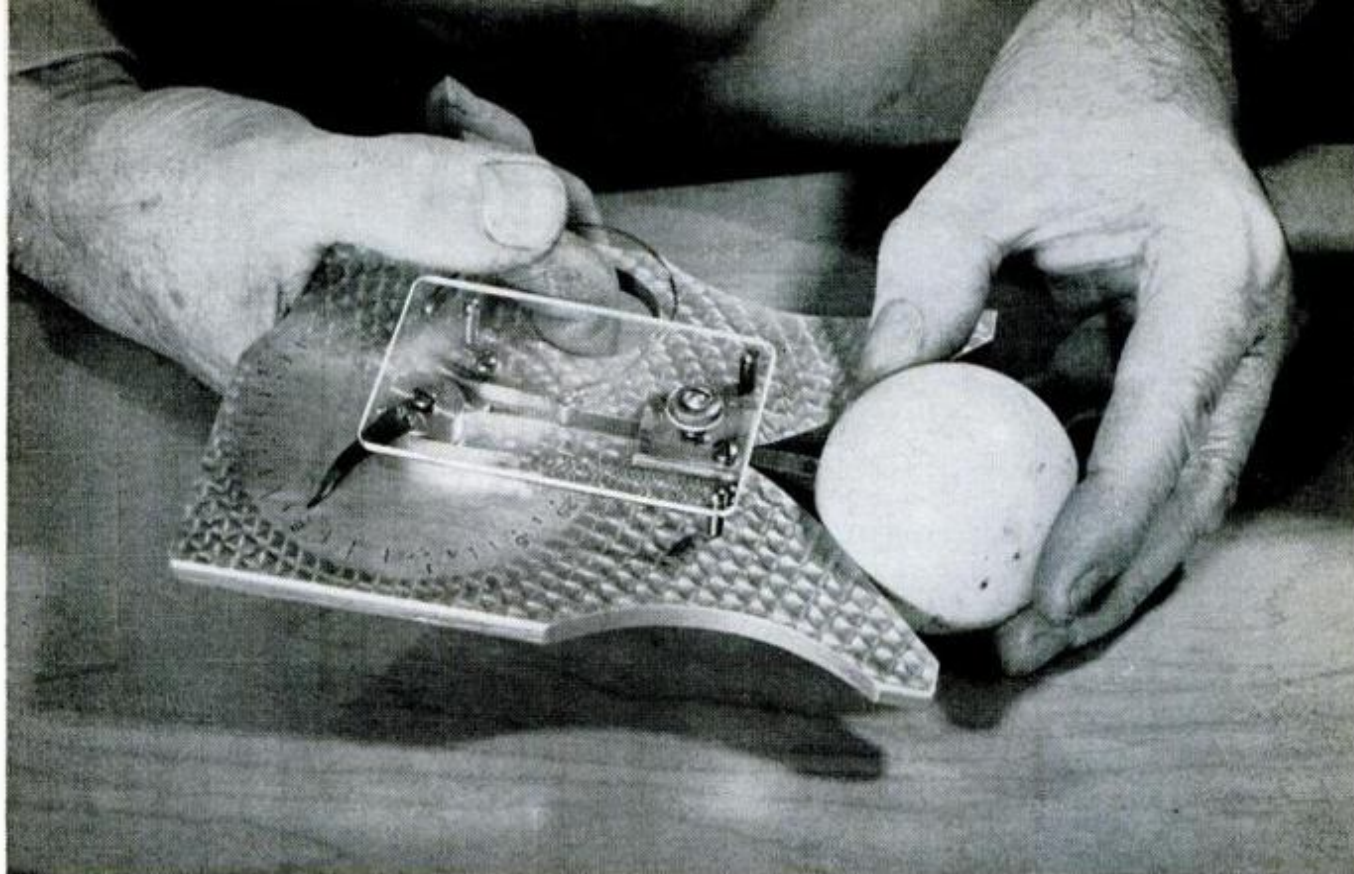
It's as accurate as a machinist's caliper and gives an instant reading even when workpiece is rotating

BY WALTER E. BURTON

YOU GRIP IT like a pistol and thrust its gaping mouth across pipes, shafts, cylinders, balls—anything with a circular cross-section. Its spring-loaded tongue retracts, pivoting a pointer around a calibrated scale to tell you the exact outside diameter of the workpiece. The gauge shown has a capacity from $\frac{1}{4}$ to

$4\frac{1}{2}$ in. Its accuracy is comparable to that of calipers and machinists' steel rules—and it's much quicker to read. Unlike calipers and most other gauges, it can be used to measure a shaft that's spinning—which can save you a lot of time at your lathe. You just apply a bit of oil to the spot you want to measure, touch





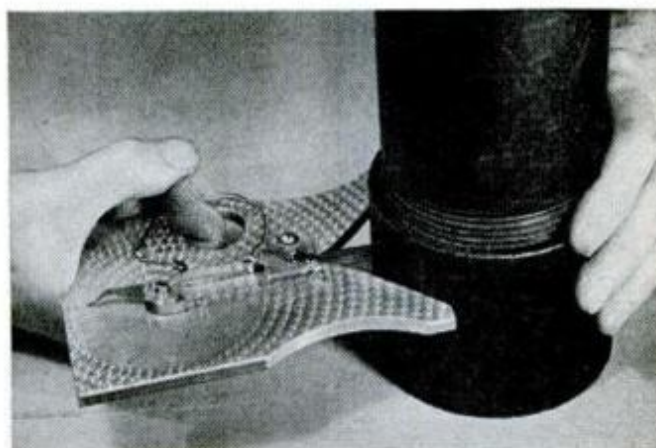
the gauge to it and tighten the slide-lock bolt to hold the reading.

The gauge is quite simple to make. The body can be $\frac{1}{4}$ in. aluminum, as indicated, or you can substitute sheet steel or a husky plastic (such as phenol formaldehyde resin). The V-notch mouth is a 90° angle for about two-thirds its depth, at which point its sides curve to provide a more acute angle; this spreads the scale somewhat for smaller diameters. Actually, the notch angle isn't critical, but shouldn't be much greater than 90° for a reasonable tongue movement. The sides of the notch must be square with the body faces.

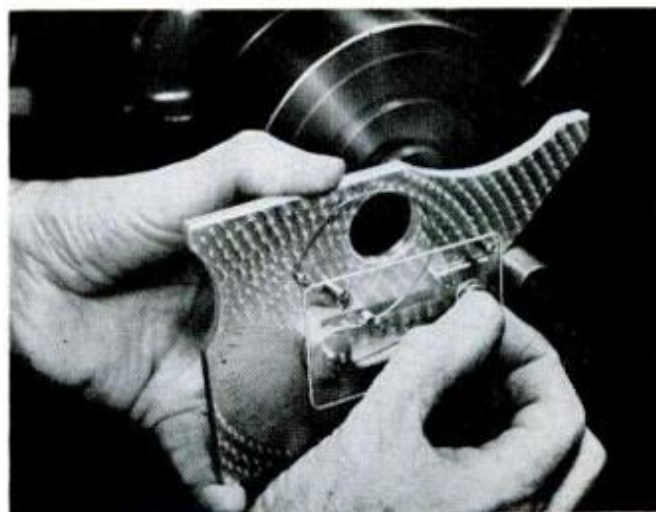
The other contours of the body are for ease of handling. Position the 1-in. finger hole at the best spot for your grip.

The tongue is a $\frac{3}{16}$ -in.-sq. steel bar (key stock is fine) sliding in a slip-fit channel that extends back from the apex of the V-notch. If you don't have access to milling equipment, you can cut a $\frac{3}{16}$ -in. slot *through* the body and then install a back-up plate. The top retainer, in any case, is a rectangle of brass, with a thumb-screw tapped at its center to lock the tongue in position. A coil compression spring under the knurled screwhead prevents loss when it's not tightened.

The sliding tongue activates a thin metal belt that wraps 180° around the



YOU GET INSTANT READING of outside diameter of a small ball (top) or a 4-in. pipe coupling (above)



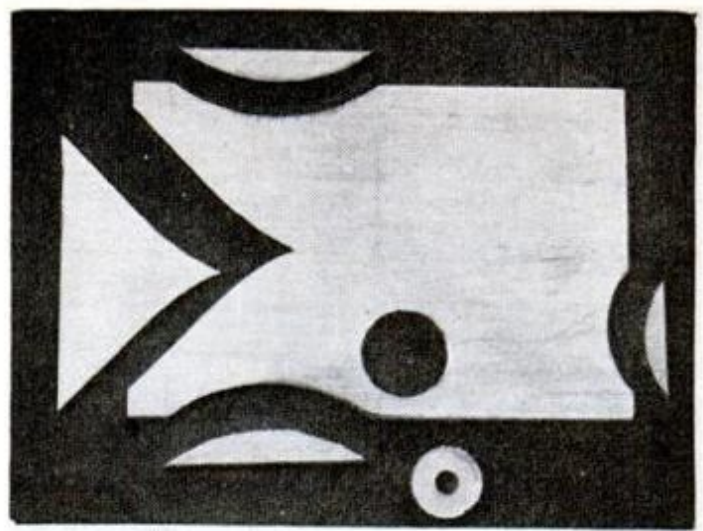
EVEN ROTATING SHAFTS can be measured. Just snug slide-lock bolt so gauge can be removed for reading

brass disc to which the pointer is fixed. Bronze shim stock (.001 or .002 in.) makes a durable belt. A loop at one end grasps a brass escutcheon pin in the tongue. The other end is doubled back $\frac{1}{8}$ in., soldered, and pierced with a small hole so a light coil spring can be hooked into it. This keeps the belt taut. A smaller pin (made from a brass nail) projects about $\frac{1}{8}$ in. from the disc through a hole in the belt to prevent slippage.

A second, stronger spring—made from piano wire—pushes against the pin in the tongue to which the belt is hooked. Adjust this spring to hold the tongue fully extended when the gauge is not in use.

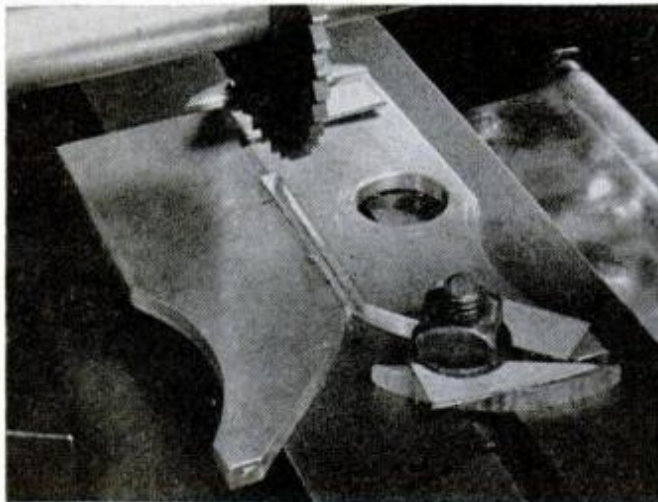
When attaching the sheet-metal pointer to the disc (with screws or solder) position it with respect to the edge pin so that the entire scale will be in the clear.

The easiest way to calibrate the scale is to press the gauge against truly-round cylinders of known diameters and mark the various pointer positions. The scale shown is marked for quarter inches above

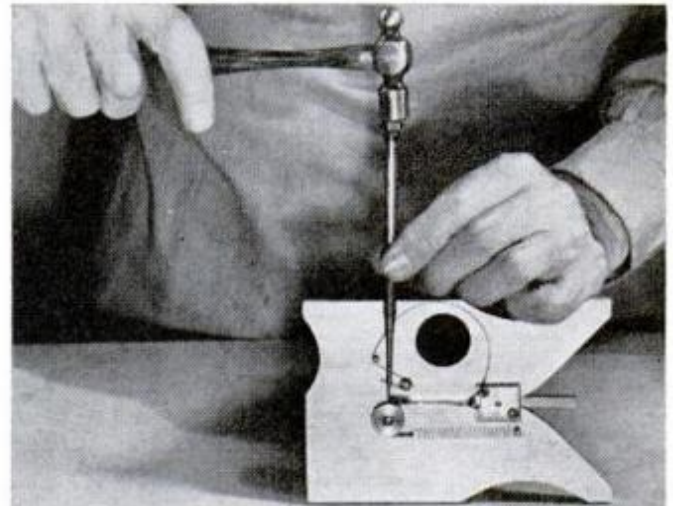


VERY LITTLE WASTE results when you jigsaw the body from aluminum plate. Hole was cut with hole saw

1 in. and eighth inches below. If you don't have an assortment of known diameters, use circles drawn on paper. Carefully align mouth and tongue-tip with each in turn, marking pointer positions as you go. To make scale permanent, punch these lines and stamp numerals. ★★★



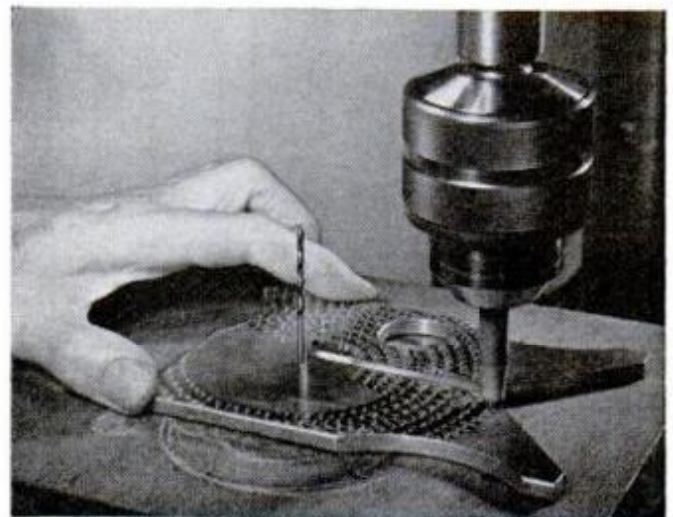
SLIDE CHANNEL can be milled as shown, cut with an end mill, or sliced all the way through with saw



PIN IN POINTER DISC must engage belt hole throughout pointer movement, so spot its socket carefully



TEMPORARY PUNCH MARKS and penciled scale of calibrating operation will be engraved and stamped



FOR DECORATIVE PATTERN, pivot body for rings of marks made by drill-chucked pencil-type ink eraser

Two surefire ways to fish for wiring snakes

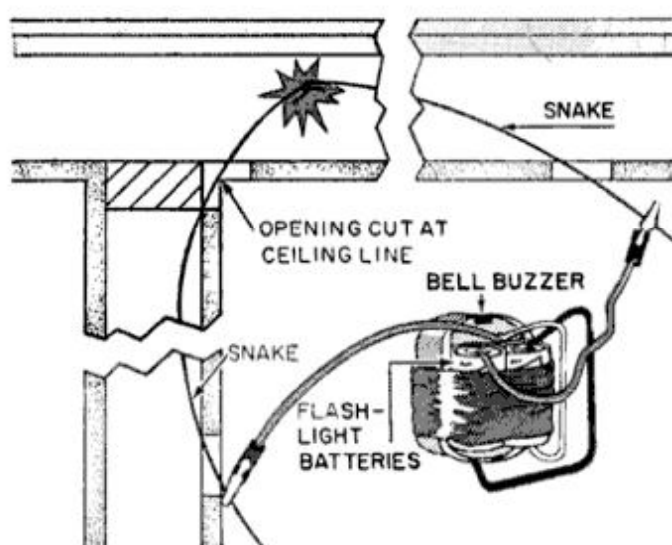
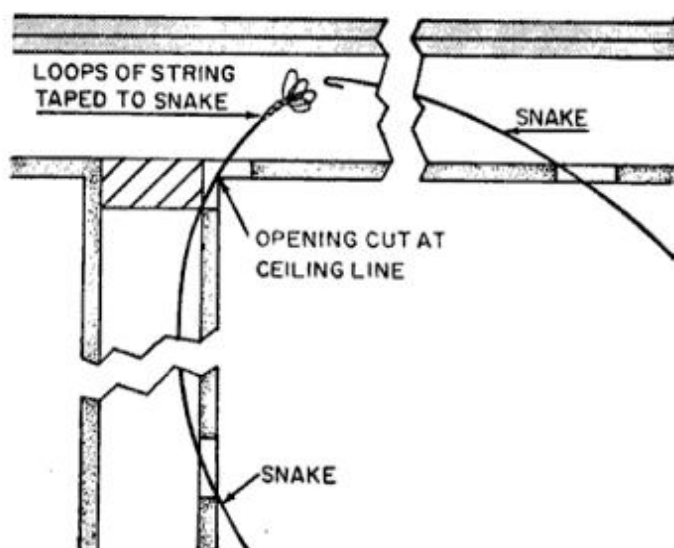
BLINDLY PROBING for the end of a snake with the end of another can be a frustrating thing for the homeowner when fishing a new BX cable through existing walls. But here are two methods used with great success by a pro.

As to first getting the snake past the top wall plate, the easiest way is to simply cut a narrow slot in the plaster at the ceiling line. Notching the 2 x 4 plate a bit will make room for the cable, and when in place, the slot is simply plastered over.

Since many "hooks" on a wire snake are better than just one, the first method shows how loops of string taped to the end of one snake offers greater chance of catching hold with the flailing end of the other snake. The string loops interfere in no way with poking the snake through narrow openings, and tend to spread like a fan.

The second method makes use of a door buzzer to tip you off when you are getting "warm" in probing for the hidden snake. Fitted with bell-wire leads clipped to the ends of the snakes, the buzzer sounds off when the two snakes touch. Knowing you are in contact lets you then twist the one snake to align and engage the hook ends. Two batteries are taped and wired to the back of the buzzer as shown.

—Joseph Braunstein



NEXT MONTH IN SHOP AND CRAFTS

MAKING ROOM FOR SUMMER. If limited backyard space makes you feel like a "fish in a bowl" during cookouts, you may find that some of the patio hideaways in the April issue offer answers to your problem. One includes a clever roll-out bar, sandwich counter and hi-fi cabinet that will let you make use of the secluded area at the rear of your garage.

DRILL-PRESS SANDER. An accessory that puts all other sanders to shame, this excellent homemade spindle sander is supported at both ends to solve the problem of side thrust. Its table rides the drill-press column to make use of the entire abrasive sleeve.

SUBURBA-CAR CHASSIS PLANS. Whether they won or not, many readers who entered our recent Suburba-Car body-design contest were eager to build the car. We are happy to announce that PM readers will find complete plans for building the chassis for this exciting runabout. It's your baby from the chassis up—which lets you add the prize-winning body or your very own custom design.

RUSTIC GARDEN FURNITURE. If you can only see firewood in a tree that must come down, you'll think differently when you see what attractive rustic furniture you can make for your lawn and garden from its hefty limbs and trunk. Ranging from garden benches and planters to tables and chairs, all the pieces become simple weekend projects when you rent or borrow a chain saw.

ELECTRONIC IGNITION TAKES TO THE WATER



By Murray Gellman

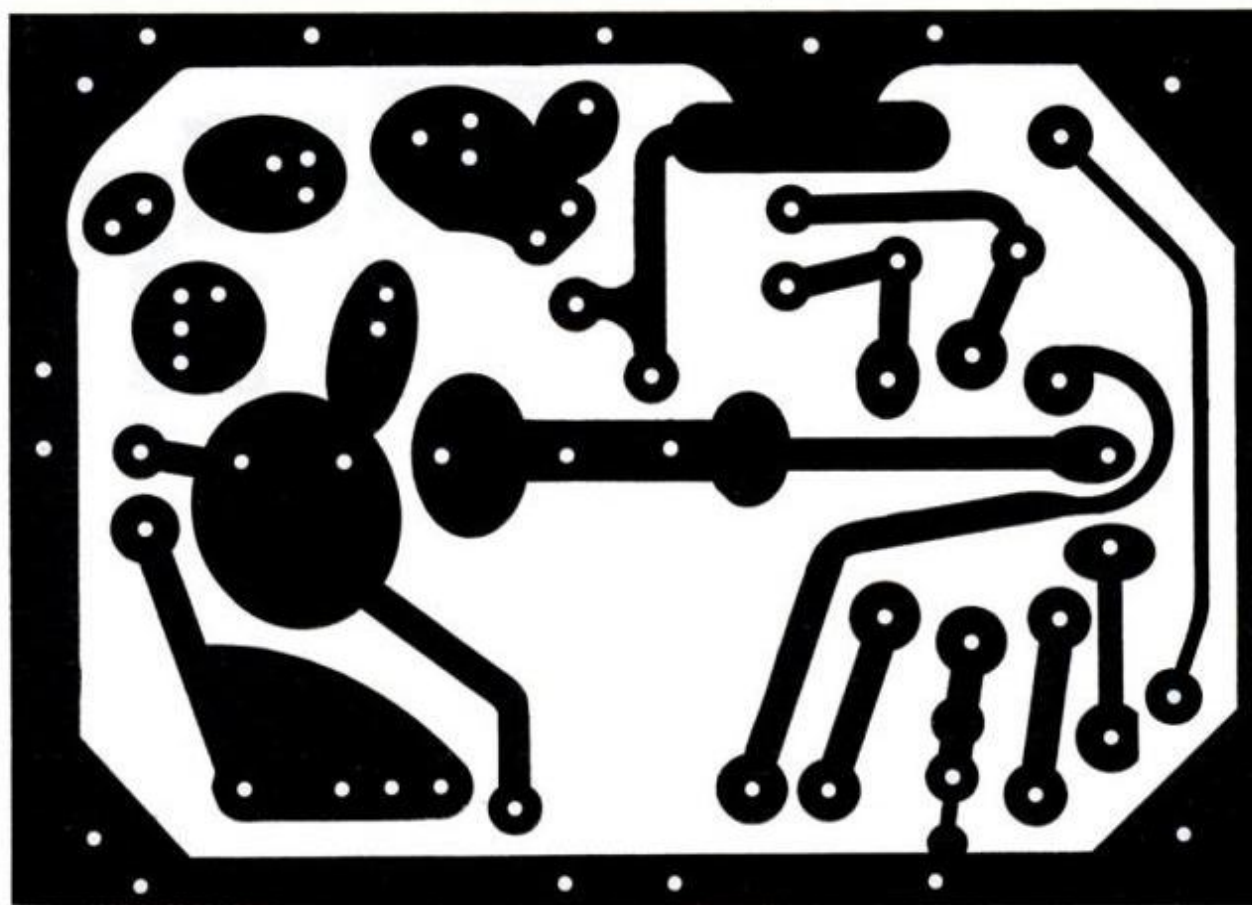
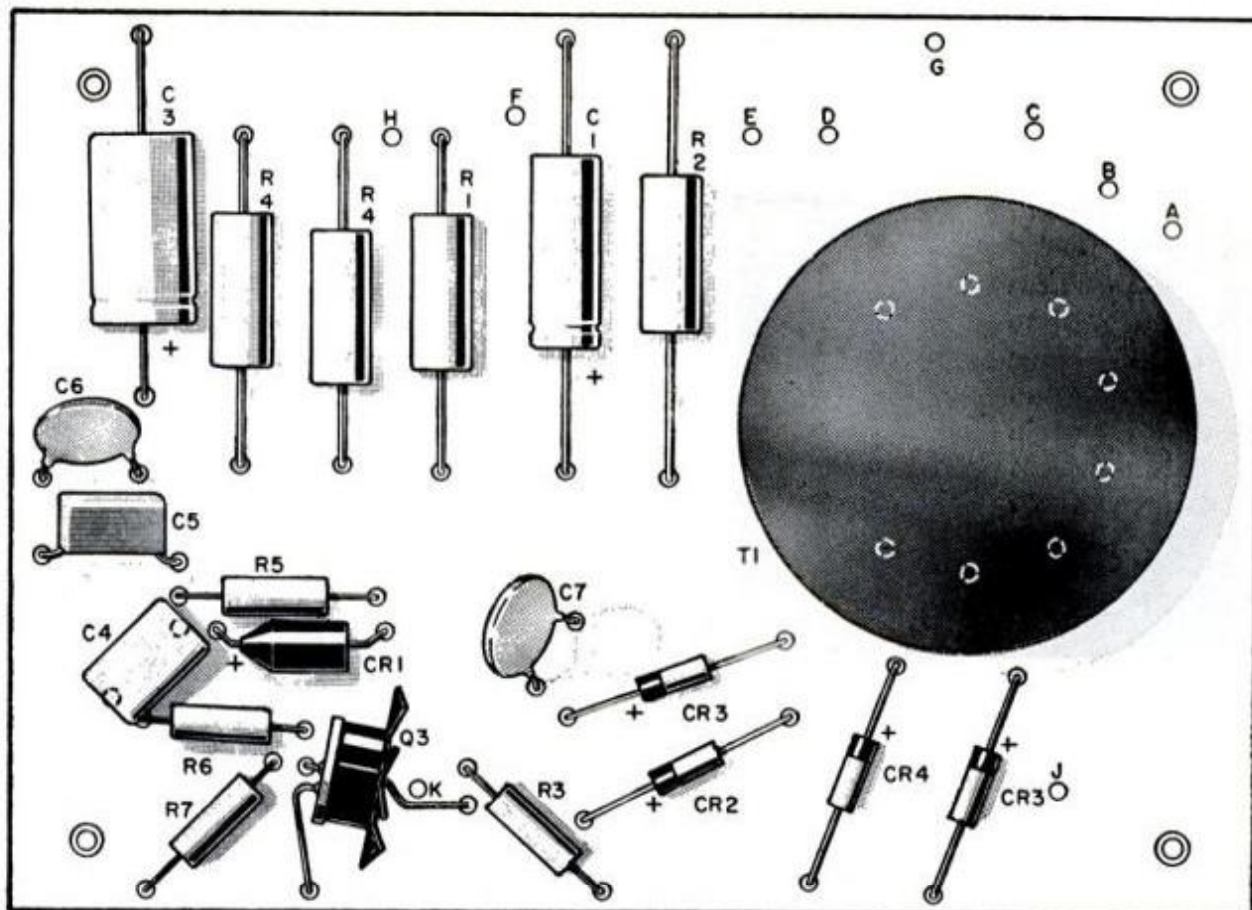
You can add this capacitive discharge system to your inboard motor now. You will get years of smoother operation

THE ULTIMATE IGNITION SYSTEM for yachts, speedboats and runabouts with inboard motors is an electronic capacitive discharge system. I have designed just such a unit, which I call the "Maraner."

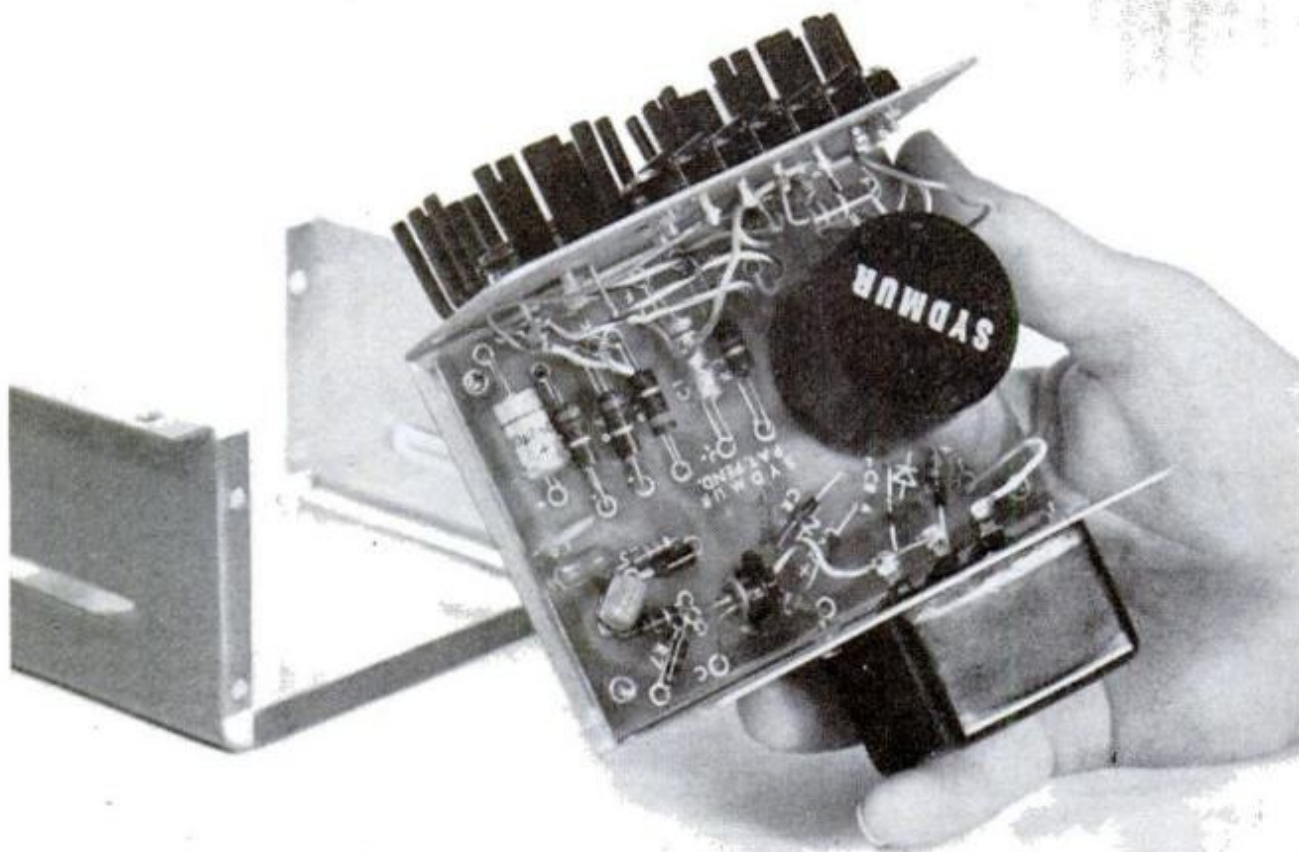
It has been tried in several boats and has proven itself. Points and plugs were used for two complete seasons. Even though the boat was used for trolling and water skiing, the points are still in perfect condition, although they can use a swipe or two with a burnishing tool to clean off oxidation. Firing tips of the sparkplugs are also in good condition, but the plug bodies have rusted badly so they will probably have to be replaced.

The Maraner offers several advantages over conventional ignition systems or ordinary transistor systems:

- Improved gasoline consumption (in one instance this was as great as 10 percent as indicated by a flow meter).
- Faster acceleration.
- Smoother throttle response.
- Less than 1 amp. of input current compared to 10 amps. or more for transistor systems (at 600 rpm for trolling).
- Higher output power (125 milliwatt seconds).



COMPLETE PRINTED CIRCUIT BOARD DETAILS are shown in these two diagrams. At top is component side of board showing location of each part when soldered into circuit. Follow this layout even if you don't use a circuit board. At bottom is wiring side of the board. Both diagrams are actual size



GUTS OF THE SYSTEM are visible once the case cover has been removed. Note the roomy appearance of the unit. At the same time you'll see it is small enough to tuck away in most inboard engine compartments

PARTS LIST

Resistors:

R1—10 ohms, 2 watts **R2**—1000 ohms, 1 watt
R3—680K, 1 watt **R4**—28 ohms, 4 watts
R5—1800 ohms, ½ watt **R6**—27 ohms, ½ watt
R7—100 ohms, ½ watt **R8**—1000 ohms, ½ watt

Capacitors:

C1—4 mfd., 50 v. **C2**—2 mfd., 600 v.
C3—80 mfd., 25 v. **C4**—0.22 mfd., 25 v.
C5—0.15 mfd., 25 v. **C6**—.02 mfd., 100 v.
C7—.01 mfd., 600 v.

Q1—2N1100 **Q2**—2N1100 **Q3**—MCR 1605-6

CR1—1N463 **CR2, CR3, CR4, CR5**—1N2615

T1—Transformer: SPC-35-12 for 12-v. system, or SPC-35-6 for 6-v. system. (\$14.95 from Sydmur, Box 25, Midwood Station, Brooklyn, N. Y. 11230)

Heat sinks—Augat 9001G1 or equivalent (2)

Barrier strip, 5 terminals

Case. 5 x 4 x 3 in. aluminum chassis box
 Printed circuit board and mounting studs,
 (\$3.50 from Sydmur. Address above.)

- Increased horsepower.
- Use of original ignition coil.
- Premature or multiple firing caused by contact bounce is eliminated by special memory circuit.
- Reduced radio ignition noise.

Building your system is comparatively easy. You can make your own circuit board from the diagrams, use a piece of fiberglass and wire from point to point or buy a ready-made board (see parts list).

With the circuit board, wiring should take about an hour.

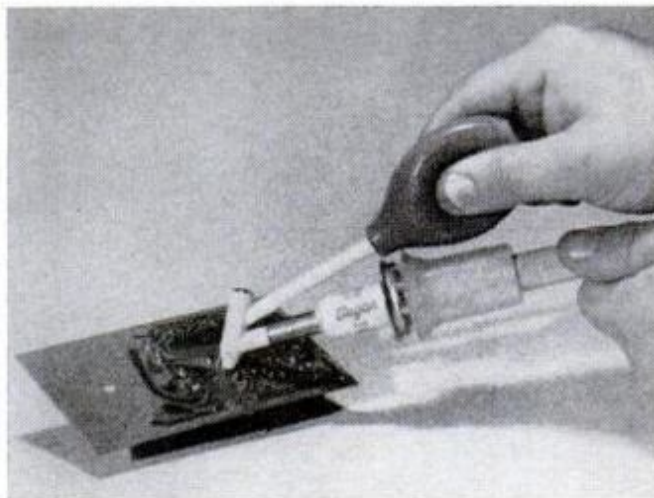
Make certain that rectifiers, diode, transistors and the silicon-controlled-rectifier (SCR) are properly polarized. If not, you're bound to burn them out.

Capacitor C2 is an oil-filled unit. Mylar or paper units cannot be used to replace it. This capacitor is really worked, being charged and discharged 16,000 times a minute when an eight-cylinder engine is running at 2000 rpm. For better cooling, mount it outside the case and paint it black.

NEW IN ELECTRONICS



Drive to the tune of taped music after you install a Porta-Tape player in your car. Plays through your existing car radio—you don't add speakers in the doors. Installs in 15 minutes, plays monaural only. Tape cartridges are equal to LP records in content. \$69.95 from Telepro Industries Inc., Cherry Hill, N. J.



Desolder circuit boards fast with the new Ungar desoldering iron. Squeeze the bulb, apply the iron. When solder is hot, release the bulb. Solder disappears and the part is free to be removed or replaced. This is one tool that the electronics man won't want to be without. Ungar Electric Tools Inc., Hawthorne, Calif.



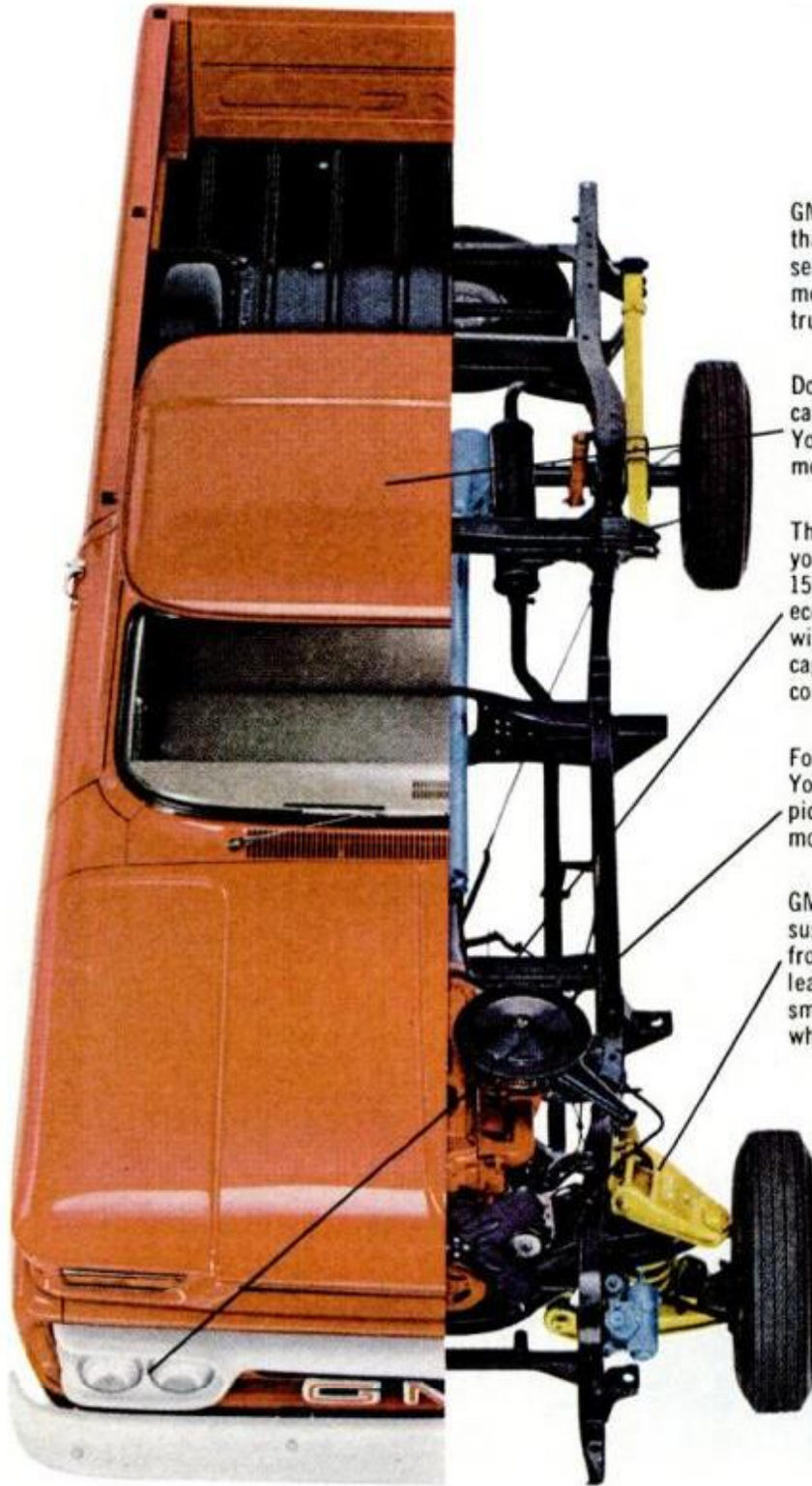
Dream of a tape recorder is a pleasure to use. It has two speeds, $3\frac{3}{4}$ and $1\frac{7}{8}$, capstan drive, of course. All-transistor circuit requires four flashlight batteries for power. Use it at parties, for vacation soundshots, a living diary or anything else you can think of. It will run for an hour at $1\frac{7}{8}$ ips with a 300-ft. reel of tape. There's even a neon level indicator. It's a General Electric model M-8000 and carries a \$39.95 price tag.



Need more CB range? The Knight C-577 audio compressor/preamplifier will give it to you. Connects between mike and transmitter. Boosts modulation percentage to provide greater peak power. Transistor circuit draws minimum current, delivers 26 db gain at 1 kc. Has separate and adjustable compression and output level controls. Switches in and out of circuit as desired. \$19.95, battery 27 cents additional, Allied Radio, Chicago, Ill.

The price of this GMC pickup is \$49* more than others. There's one reason.

We build it better.



GMC . . . three important letters that stand for built, sold and serviced by truck people. Which means you get a lot more truck for your dollar.

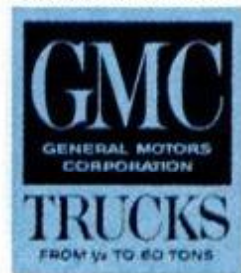
Double-wall construction in the cab—not just one wall. You get a stronger, quieter, more secure truck.

The new in-line six engine gives you more power this year—155 horses. Powerful, yet economical. And plenty tough with more cooling and lubricating capacity than most other competitive engines.

Four headlamps. You'll notice that most other pickups offer only two. A lot more truck. That's GMC.

GMC offers a proven total suspension system of independent front coil springs and progressive leaf rear springs. You get a smooth, secure ride no matter what the load conditions.

*Based on manufacturers' suggested retail prices, the GMC 1-6 model pictured above is never priced more than \$49 over comparable competitive base models. Often the difference is less.



BRAND-NEW

NOW—A BIG, BEAUTIFUL LINE OF OUTBOARDS

CHRYSLER 105

Want *top power*? Try Chrysler's spectacular 105 (*most powerful outboard ever certified by O. B. C.**). It puts out more than 25 hp. in each of its four mighty cylinders. Packed with premium-quality features: V-reed intake valves, hydraulic shock absorbers, full-length silencing, optional remote controls and power-tilt. Try it! You'll never be happy with less!

*Outboard Boating Club of America—official reporting agency for Boating Industry Association.

CHRYSLER 75

Seventy-five horses of dependable power for action-packed boating fun. New in engineering design, beautifully new in styling. Long-life, "million dollar" baked-enamel finish in snow-white and royal gold. Develops a full 25 horsepower per cylinder, for more power, less weight. Same quality features of Chrysler 105. Hydraulic shock absorbers optional.



BRAND: CHRYSLER

FROM THE POWER PEOPLE...THE CHRYSLER CREW

CHRYSLER 50

Here's the two-cylinder outboard that delivers a full fifty horsepower. Light weight, of course, for unusually economical operation. Yet it has the rugged dependability you're looking for. Perfect ski-power for light cruisers and runabouts—you name it. This superb Chrysler outboard is known for its endurance and record-breaking performance the world over.



Here's big news in boating . . . a complete power line of slick, quick outboards, styled and engineered in the Chrysler tradition of leadership. Brand? Chrysler! Reputation? Quality!

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Before you buy *any* outboard, get the story on America's brand-new brand in outboarding: *Chrysler*, built by the power people. See your nearby Chrysler Outboard dealer today (his name is in your Yellow Pages, under "Outboard Motors"). Chrysler Outboard Corporation, Hartford, Wisconsin.



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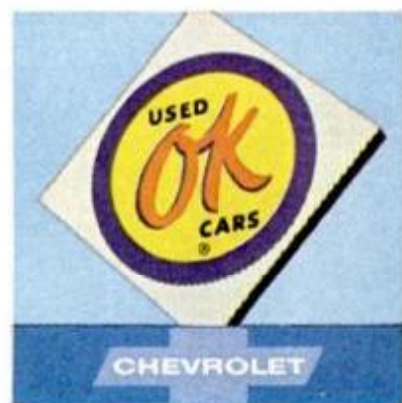
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Chevrolet Division of General Motors, Detroit, Michigan.



Get a No. 1 Buy from a No. 1 Guy—Your Chevy Dealer.

Photo Trouble Tester

(Continued from page 174)

plugs, including flash-shutter cords. If the needle does not move, there is either a loose wire at the plug or a broken wire in the line. Use the pencil probe and an alligator clip to check each wire.

To check flashguns, insert the flash-cord plug of the gun in the female outlet on the top side of the test unit. Set the VOM on D.C. VOLTS, then press the pushbutton on the gun. The voltmeter needle will jump if the circuit is okay.

The same tests can be run with the self-contained unit as with the VOM unit. This self-contained tester uses a single-gang, two-pole, five-position switch with one position for each function. However, the pushbutton is used *only* in the "SERIES" position for testing cords and plugs. Note that there is a separate plug for shutter and flashgun testing.

The SERIES test probes may be used to check continuity in other equipment such as motors, timers, washers, toasters and other appliances—while they're disconnected, of course. ★★★

MATERIALS LIST

No. Reqd.	VOM supplementary tester Item
1	Aluminum box, 2" x 4" x 4"
2	Amphenol flush-mount female plugs
2	Amphenol flush-mount male plugs
1	Pushbutton switch
2	Phono-pin jacks
2	Phone jacks
2	Banana jacks, insulated; one red, one black
4	Shutter flash jacks and bi-posts
1	Battery clip

No. Reqd.	Self-contained tester Item
1	Aluminum box, 3" x 5" x 7"
3	Amphenol flush-mount female plugs
3	Amphenol flush-mount male plugs
1	Pushbutton switch
1	D.C. voltmeter 0-25 (H) Shurite 950 #MT 210
1	Emico Model 13 edgewise meter, 0-100 ma.
1	Resistor—15 ohm, 1/2 watt
2	Phono-pin jacks
2	Phone jacks
2	Banana jacks red and black
4	Shutter flash jacks, 6 at 50¢ each
1	Simple-gang, nonshorting 2 pole, 5 position rotary switch
1	Battery clip
1	Min. bay. base pilot clamp #49—2 V. .06 amp.
1	Dialco min.bay. pilot light socket
1	Bottom plate
1	1/2" grommet, #10

Important: Do not use any other volt lamp for flash lamp testing. Must be 2 V. with .06 amp. current draw

NEW! GUMOUT PCV Valve Cleaner

Heads off engine trouble fast!



Positive Crankcase Ventilation valves, now standard on most cars and trucks, *must* be cleaned regularly to maintain proper idling, acceleration, fuel economy. Without cleaning, gas consumption soars, oil is contaminated, engine parts rust and corrode.

Just a few squirts of GUMOUT PCV VALVE CLEANER flush out the crankcase ventilation valve quickly and thoroughly. Exclusive probe applicator gets right into the valve—gets dirt out. Regular use prevents trouble, keeps engines running smoothly.

Buy GUMOUT PCV VALVE CLEANER at your auto supply store. Price is \$1.49. If your store doesn't have it, order directly from:

GUMOUT DIVISION

Pennsylvania Refining Company, Cleveland, Ohio 44104

EASY TO USE! Disconnect crankcase side of PCV Valve. Insert probe applicator, squirt a little cleaner into the valve while working plunger back and forth. Let soak for a few minutes, then start engine and flush valve with a few more squirts.



WHAT'S YOUR FISHING I.Q.?

(Continued from page 105)

One hundred fishermen will have a hundred different ways to fish each situation. This was a fairly general opinion when we started this angling quiz, but oddly enough, when we received the answers from our group of fishing experts, they mostly agreed with only slight variations. The following answers are the consensus of the majority.

1. Use a top water lure. Start with red and white, then try a frog color, and as the sun goes down switch to a darker color. Come in from the shady side of the logs. Cast and retrieve parallel to shore. Use short casts so the line can be easily controlled. Drop the lure right next to the log, let it lie for a minute or two, then give it two or three quick pops, and retrieve it slowly.

2. Face the sun. A bait-casting outfit is preferred because the casts can be pinpointed. Use a frog-finish surface lure with weedless hooks. Look for the holes and channels. Overcast the holes so the bait lands on the pads beyond. Let the bait rest for a minute, then skip it into the water. Let it rest again until all the ripples are gone. Retrieve it slowly, dragging it over the lily pads and, at the next open spot, skip it into the water, letting it rest again before repeating the retrieve. If the pockets of open water are large enough, use a floating diving lure. After you skip it off a pad into the water let it rest a minute, then give it a fast retrieve to make it dive deep. Reel in a few feet, then stop and let it wriggle to the surface. Rest it, twitch it, then start the fast retrieve again. You should then cast the shoreline with a weedless popper trailing a piece of pork rind off the rear hooks.

3. It would be best to beach the canoe and fish from the shore, because the canoe would take you past the point too quickly, and if you're using a fly rod it would be difficult to get accuracy from a moving platform. Fish from the downstream side of the rocks. Use dark gray or brown wet flies, cast upstream and let the fly drift down with the current, keeping it as close as possible to where the current meets the eddy water. You can also use streamers and bucktails and fish them the same way. If you're using a light spinning outfit, use a small, shallow-running spinner. Let the spinner sink near the bottom, working the eddies in and around the rocks, and be prepared to lose a lot of hardware.

4. Starting at the upstream edge of the bank, about 50 to 75 feet from the shore, let the current move the boat slowly

downstream. The water temperature indicates that the fish will be sluggish and deep, so your bait should be a bottom bumper, a lead-head jig, a spoon or a deep-lipped bottom lure. Cast ahead of the boat, downstream and parallel to the bank. Give the bait time to get to the bottom and then retrieve it very slowly. When you have drifted past the bank, take the boat back upstream, move in about 15 feet and repeat the drift. On the final pass, place the lure right up to the bank and retrieve very slowly, letting it drop off any ledges that might exist. A dark-colored bait would be most effective at this depth, and on the final pass you might add a black pork rind eel and plastic worm to the trailing hooks. (While the majority called for dark lures, many experts preferred yellow or red and white.)

5. Most fly fishermen, noting that the angler in the drawing is fishing downstream, would scoff at this idea, but this is a perfectly acceptable method of fishing a fast-moving stream. It is important that you stick in one place and let the current do the work. Using an artificial miller or a wet fly that most resembles a miller, place your bait as close to the boulder as possible so that the current will carry it around the edge of the rock and into the calm water where the trout will be lurking. With a dry fly, use an eight to nine-foot leader to eliminate drag from the line, and float it just outside the pocket at the rear of the boulder for a natural drift. If you're using spinning gear, use a small spinner, cast downstream and then bring it up through the calm water behind the boulder. An important adjunct to success in this situation is to study how the trout are taking the millers. If they're surface feeding, then the dry fly technique would be most effective. If they're picking off the hatch as they rise to the surface, then the wet fly or artificial miller would be best. For best results the wet fly or miller should be twitched and drawn toward the surface to mimic the natural bait, a maneuver requiring skill in fast water.

6. Don't bother. Since there are severe penalties (unjust!) for laying underwater mines to clear out the water skiers and speed merchants, the next best thing would be to repair to the nearest watering hole and swap fish stories until the sun and the breeze goes down. With the lagoon quieted, you should row or drift around the docks and piling, casting your bait into the dark, protected spots. A quiet, unhurried technique is needed. In early evening a medium deep-running lure would be best in bright colors, but as it gets dark a black surface lure will be the most effective.

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100hp more than you need? Choose from two new 80hp models (Electramatic and Electric) both with the same new tuned exhaust as the V-100. Or, there are two new, economy V-60's (one high-speed model, one high-

thrust for houseboats.) *Fuel economy? Wonderful!* On regular grade fuel! The new V-100, for example, uses no more fuel than 2-cycle outboards of substantially less horsepower—in fact, we'd like you to compare it with *any* 4-cycle outboard, inboard or stern drive. Remember, too, all of these engines use a 50 to 1 gas-oil mix. This not only dramatically length-

ens engine life, it saves you enough on oil in one year to pay for your oil the next. In all,

there are 16 new models in 10 power classes. For the right engine to fit your boating needs, see your Johnson dealer. He's in the Yellow Pages. P.S. Johnson

also makes a full line of Johnson Boats and the new Johnson Skee-Horse snowmobiles.

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shine a light on it and they blink like stars. The target is in here."

We went to a small room—two rooms, actually—behind the huge simulator chamber. In the smallest of them, a model of the Agena, about eight inches long, was mounted on three gimbals allowing it to rotate in any direction. It was bathed in harsh light and, with the gimbals and the rest of the room painted black, it stood out. In fact, when I saw it in the simulator, I saw no trace of the gimbals. The Agena just seemed to be floating lazily in space.

"The cameras are in here," Prodan said, motioning me into the next room. "We use one for distant maneuvers and the other for closing."

Camera effects startling

The closing camera was mounted on a track. Prodan got on the intercom and asked the men in the control room to put the simulator through some maneuvers. I watched as the camera moved toward the round opening where the Agena was going into some gymnastics. A closed-circuit television system, plus mirrors, projects the maneuvers to the window in the simulator. While the simulator is doing its few jogs and you get the "shhhh-shhhh" sounds, the camera and the model Agena are doing most of the work. The illusion in the cockpit, with the stars blinking in the background, however, is quite startling and, except for the problem of weightlessness, is amazingly realistic.

My experience at Edwards gave me an insight into the problems of docking, and they are considerable. Take the aborted Gemini VI mission. If the target Agena (which fell into the Atlantic Ocean after liftoff) had actually gone into orbit, the Gemini would have three main maneuvers to go through: lift off, rendezvous and docking. I did only the docking with the target already lined up for me and, while that, too, is a problem the first two phases are probably more so.

The liftoff has to be timed just so. It's like shooting at birds; you have to aim the gun just right or you'll miss. After the Agena goes into orbit the Earth has rotated slightly so the Gemini launch pad at Cape Kennedy is no longer in the same place it was when the Agena took off. Gemini's orbit will be slightly different than Agena's. So Gemini's liftoff is timed so its orbit will be reasonably in phase with Agena's. The area of time during which this is possible is called a "win-

and from day to day.

If Gemini lifts off within this window, it will be sent into an orbit below and somewhat behind the Agena. Its orbit will also crisscross the Agena's orbit slightly because of the Earth's rotation. To get into the same plane, Gemini will either adjust the direction with the Titan booster during liftoff, or make a dogleg maneuver itself after going in orbit.

Once in orbit, it will circularize the orbit. Most launches throw satellites into elliptical orbits. When it completes the maneuver, it will be in orbit about 145 miles above the Earth with the Agena about 160 miles.

Now it is flying in the same plane below and behind the Agena—catching up with it slowly because it is in a smaller orbit—and it is ready for the rendezvous maneuvers. This phase, too, is tricky, because if it overshoots it could fly right out into space. Gemini makes its transfer maneuver so that it will end up not behind the Agena, but in front of it. And when it gets there, it speeds up again or it would fall back to its original orbit altitude. The larger orbit requires different speeds than the smaller ones.

Then the docking maneuvers begin. Space people say they will be accomplished easier flying in front of, but facing, the target, than trying to catch up from behind. The target Agena, of course, is stabilized with the docking end facing toward the Gemini.

Docking a 'real ball'

As a rank amateur in the space simulator I could appreciate both the difficulty of the rendezvous and docking maneuvers and the ability of the men who will eventually have to perform them. After some practice, I came reasonably close to flying a good mission, but the astronauts should do infinitely better.

In the first place, they have more training, but, more important, they can take advantage of their instruments, especially their radar and computer. I had a panel full of dials in front of me in the simulator but I understood hardly any of them and probably would have ignored them, even if I did understand them. The fascination of watching that target in the window is too absorbing to bother with technical niceties.

Also, I was all alone. In a real Gemini mission, there are two astronauts. One can read the instruments while the other gets his kicks eyeballing the target. I can assure you, he'll have a ball.

Chasing a target through space is the greatest thing since Irish coffee. ★★★

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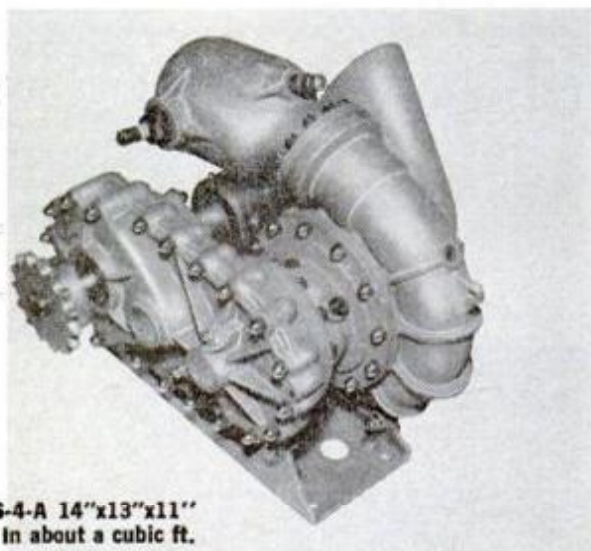
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should watch to see that no connections touch when the cover goes on, and plan to locate the glowing ceramic resistor so there is ample space around it. There's no need to worry about which end of the silicon rectifier is cathode or anode for it works equally well even when installed in reverse position.

The resistor, which you make, is nothing more than a 7-in. length of 1/4-in. heater-element wire (B & S 20-ga. 1.1 ohm), wound around a 1/2 x 3-in. high-value ceramic resistor. If you have trouble finding this, you can use a piece of ceramic from a lead-in insulator. Attach the ends of the element wire to the original terminals of the resistor, but do not solder them; either use lock washers or crimp-on lugs.

The silicon rectifier does not need a massive heat sink for occasional operation if you use one having the rating indicated. This hookup will work nicely with a heavy copper wire and spade lug as your heat sink. Since rectifiers have two current ratings (continuous and peak), watch out for "bargain" units in which the 12-amp. rating actually turns out to be the peak (1 cycle) rating. Such units will literally explode when subjected to 12 amps. for even a few seconds.

To install the brake, disconnect the line cord to the motor and rewire it as a line cord to the Minibox, following the diagram and making sure that you connect the ground wire to the box itself. Now fish the five wires from the box to the saw's motor through a 36-in. length of spaghetti tubing and attach the leads as shown in the diagram. The important thing is not to reverse leads 3 and 4 to the motor switch; if you do, you will blow a fuse as soon as you switch on the motor.

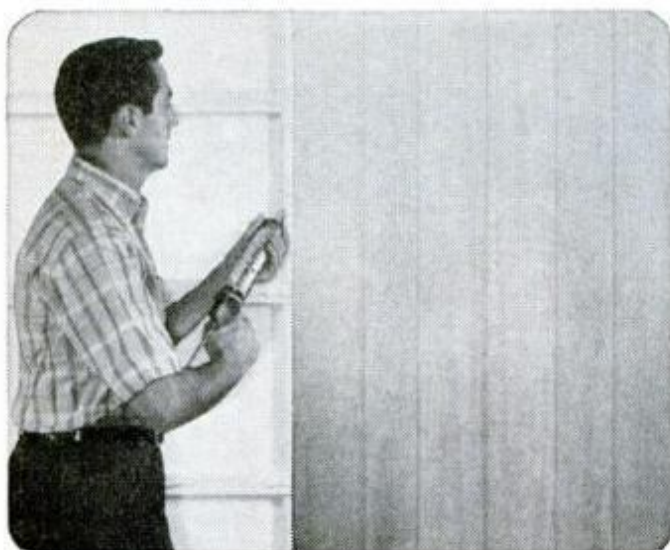
Test the completed brake with the blade securely tightened on the mandrel. Note the number of seconds it takes for the blade to coast to a stop. If *more* than eight seconds, keep shortening the length of the resistance wire, but don't try for a quicker stop as sudden braking action could loosen the saw blade.—Dr. John D. Griffith

Parts List

- 1—2 1/8 x 3 x 5 1/4" Bud Minibox
- 1—Silicon diode, 12 amp. 200 P.i.v.
- 1—7" length of 1/4" coil, B & S 20-ga. heater element wire (1.1 ohm/inch)
- 1—D.p.s.t. toggle switch; off, momentary on
- 1—Barrier strip, 3-terminal
- Assorted hardware, grommets

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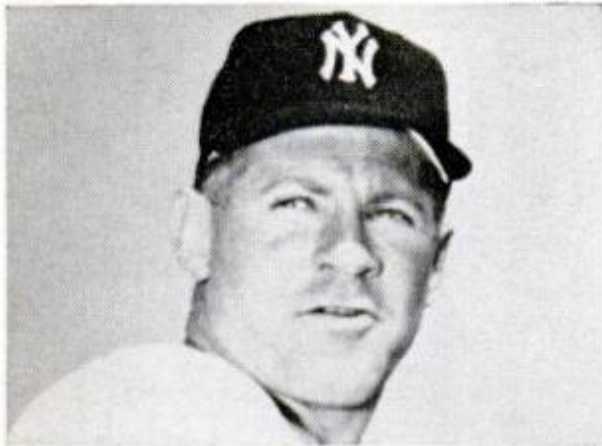
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by Whitey Ford

The famous Major League pitcher who holds the most World Series records tells what happened when he decided smoking was not good for his physical fitness.

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HOW TO BUY A GOOD USED BOAT (Continued from page 135)

from boats that have serious undercover problems.

How about the big boats? For our money, anything over 18 feet should be a survey proposition as soon as you locate a suitable boat within your price range. There's just too much detail and too much expense involved for the average buyer to take a chance on a direct buy in this category, spend a few bucks and consider it insurance.

Take houseboats, for instance. There are checks for rust on steel hulls or pontoons, fatigue and cracked welds on aluminum. You have to check the exterior and roof for leaks, sags and unfair lines. Black stains on the interior panels almost invariably spell l-e-a-k-y r-o-o-f, which require further inspection by an expert to make sure that the interior framing hasn't rotted.

Then comes the test ride. All houseboats tend to sail around in a wind to some degree, but some are so unstable they're hardly safe, while others show surprisingly good control when the going is tough.

A weekend rental will help you to determine whether a particular layout is functionally suited to your needs, and will also give you a chance to check all the mechanics—water system, head, shower, windows, stove, power plant and generator. But when you come right down to the checkbook, you really need the expert knowledge of a surveyor, a professional hired to play on your side.

Buying a name. Few families can put enough hours on a pleasure boat to wear it out. They get the urge for a larger boat, a different material, a new design, or possibly their present boat just needs a lot of work and so they decide to trade. The volume sellers get most of this trade-in business.

You'll pay more for the Glastrons, Glasspars, Lone Stars, Penn Yans, Thompsens and all the other excellent name-brand boats. In our opinion, the slight overwrite for a name-brand boat is money well spent. You'll usually get it back when you sell or trade. And sell or trade-up you probably will, if you're like most boating enthusiasts.

The used boat market is active, there are plenty of bargains available. A little savvy, some common sense, plus professional help at the right time, and you can pick up a serviceable rig for a fraction of the original cost. If you keep it in good shape you might even use it for a couple of years and get out whole!

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PM3

(Continued from page 144)

outboard motor of older manufacture.

3. Is the gas tank undented, uncracked? Repairs here are tough.

4. Is the inside, as seen through a freeze plug opening, plugged with rust?

Johnston checks the inside only if an engine meets the first three requirements. Motors used in salt water, he finds, are often in bad interior shape. Ordinarily, he scraps a rusted engine for parts. But if it's a real collector's item he removes rust with a charcoal-fire baking, followed by air blasts through the freeze plug openings.

There's little that's really new in outboards, says Johnston. He points out that variable-pitch props, reverse gears, submerged power heads and other 1965-type features can be found on antiques. He even has literature from the 1930s on an inboard-outboard rig.

When he finishes with an engine, it runs like new, too. Johnston regularly uses half a dozen of his restored jobs.

But it isn't always smooth sailing for antique enthusiasts. Chris Owen, a Wisconsin buff, reports these two untoward experiences:

"I was approaching a dock to refuel my 1928 Elto Quad. The noise of the motor was deafening, so loud that it apparently had unnerved several people on the dock. They were shouting and pointing at me.

"I reached back to cut the engine—and my hand sizzled. The motor was on fire!"

Owen hopped into the shallow water, put all his weight on one side of the boat and sank it.

On the loud side

He also is the proud owner of a 1928 Evinrude Speeditwin. "At the beginning of last summer," he explains, "the Speeditwin was the most outstanding motor on the lake. The game warden, among others, thought so. The trouble was that it had open exhausts because I couldn't locate a muffler. A friend of mine said it sounded like a B-17 winding up on the runway.

"First day on the lake I couldn't resist seeing how fast the old rig would go. I was thundering along when I noticed a white runabout pull up behind. I figured he wanted to race, so I poured the coal on.

"We'd covered several hundred yards when it dawned on me: The white boat was the patrol! When he pulled up alongside, he looked pretty annoyed. "All

right, wise guy," he said, "where's the muffler?"

After a second run-in with the same official, Owen tamed the engine with an underwater exhaust. "It made the motor sound more like a DC-3. After that, the warden just gave me dirty looks."

As men like Chris Owen, George Ralph and Frank Johnston demonstrate, the collecting of outboards has one big advantage over, say, delft china, postage stamps or coins: When the workaday world becomes too oppressive, the collector of old kickers can hitch one to the back of a boat and putt-putt away from it all, powered by a chunk of history that he's preserved.

If you have a yen for this sort of thing, contact The Antique Outboard Motor Club, 308G Eagle Heights, Madison 5, Wis. The club supplies members with leads on sources of spare parts, information from old manuals and tips on making repairs. In short, it functions as a clearinghouse of information. Annual dues are \$5, including a subscription to *The Antique Outboarder*, club magazine. You don't even have to own an outboard to qualify as a member. That's how broad-minded these buffs are. ★ ★ ★

REPRODUCE THIS ANTIQUE

(Continued from page 181)

of the same size meets it at an angle through the side of the spindle. This entire path must have perfectly smooth walls; you can achieve this by pulling a narrow twist of emery cloth back and forth through it.

With the wheel and spindle assembly complete, you're ready to add the three identical legs to the base. Shallow V-grooves cut along the leg tenons will let surplus glue ooze out when the legs are driven in place. After turning the treadle bar, carefully drill the front legs and the ends of the bar to take lengths of $\frac{3}{16}$ -in. steel rod. These pivots must be a sliding fit in the leg holes but a drive fit in the ends of the bar.

When tying the footman to the end of the treadle with a rawhide thong, adjust it so the end of the treadle won't strike the floor at the bottom of the stroke, or the base at the top of the stroke. You may even have to shorten the footman a bit to get proper clearance. Exact dimensions of the footman, treadle and treadle bar depend on the slope of the legs.

You will find it easier to apply a finish to the individual turnings while they're still in the lathe. The original wheel is stained very dark, then waxed. ★ ★ ★

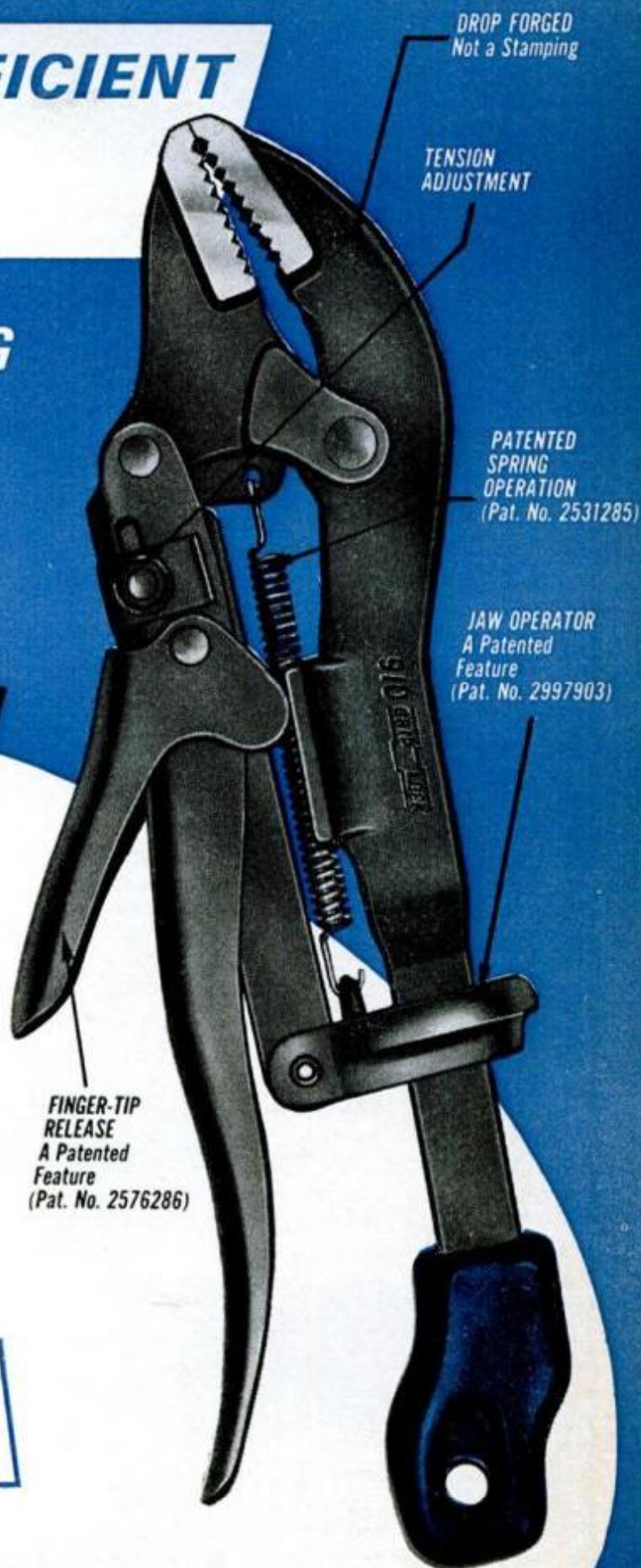
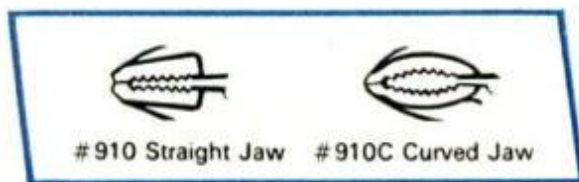
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frame with glue and fasten the planking in place by driving 1-in. nails 3 in. apart around the edges of the panels and 6 in. apart along the other framing members.

Side planking and chine logs. If you wish, the chine logs and stem may be pre-assembled to the inner and outer side planking before these pieces of plywood are secured to the frames. To do this, lay out the stem curve at one end and spring a batten between stations 0 and 2 to determine the curve at the stern end. Once you have laid out both curves on a side panel, use this as a template to cut the stern and bow members. Since the contours are identical, you may saw all of these at the same time.

Fasten the stem at the bow piece and uprights with 1½-in. No. 8 screws. Along the sheer, fasten the side planking with 1-in. nails spaced 3 in. apart. At the transom, use the same size nails spaced 2 in. apart. While you don't have to fasten the side planking at each bulkhead, it's desirable to secure the inside runner planking at bulkheads where it makes a junction with the tunnel planking.

Tunnel cleats. The 1 x 2 tunnel cleats cover the junction between the side and tunnel planking and are on the outside of the hull. If possible, fasten these from the inside, driving 1-in. nails from the underside of the tunnel planking and from the inside of the runner planking, spacing them 3 in. apart. Use 1½-in. No. 8 screws to attach to each beam.

Keel. The 1 x 2 keel is notched into the bulkheads and extends between the two butt blocks used to reinforce the joints in the bottom planking. Secure to each bulkhead with 1½-in. No. 8 screws.

Bottom planking. The entire bottom runner surface must be faired for the bottom planking. If the chine has been fitted to the side planking carefully, little, if any, fairing should be required along this area. The bow piece will have to be beveled to accommodate the bottom planking, however.

In the forward section, the grain of the ¾-in. plywood bottom planking runs athwartship, extending the width of a 4-ft. sheet to butt-join just forward of station No. 6 with the main bottom planking where the grain runs lengthwise. This 8-ft. main section of bottom planking runs aft to where it butt-joins with the stern portion of the planking. Make the butt blocks from ¾-in. plywood a minimum of 8 in. wide, fastening them with two rows of ¾-in. No. 8 screws spaced 2 in. apart on either side of the joint. Fasten

the bottom planking with 1¼-in. nails spaced 3 in. apart along the outer edges and 6 in. apart along the keel.

Motor-well area. The bottom of the motor well is made up of two pieces of ¼-in. plywood, one on either side of the centerline. Fasten these in place with 1-in. nails as you did the tunnel planking, after coating the frame surfaces liberally with glue.

At this point, the hull is ready to be turned right side up. To avoid turning the boat once again to finish it, however, take time out to sand and finish the bottom before you continue construction. (The prototype was covered with Dynel reinforced with resin, a process similar to fiberglassing but considerably easier because of the stretchable nature of the fabric. Complete instructions for applying Dynel or fiberglass may be obtained from the dealer from whom you purchase the material.)

Since the hull could be wracked at this stage, block it at bulkheads Nos. 2 and 6 and level it both lengthwise and athwartships. This makes sure it will remain level until the decking can be applied.

Decking. The decking consists of four panels of ½-in. plywood laid athwartships. Before installing it, fair all upper surfaces so it will lie flat on the framing and coat all mating areas with glue. Then fasten it in place with 1¼-in. nails spaced 4 in. apart along outer edges and 6 in. apart along inner framing members.

Before nailing the decking in place, however, decide where you wish to locate the control console and drill the necessary lead holes in the beams for steering and control cables. Also, any special storage ideas for utilizing space in the pontoons or wing deck should be considered at this time.

For instance, if you wish to locate fuel tanks and battery in the pontoons, it's easier to install plywood mounting plates and hold-down straps before the decking is in place. Hatches and provisions for ventilation can be taken care of afterward. The same goes for live bait or catch wells in the pontoons, or a rod storage rack in the wing deck. You might even consider filling this wing section with planks of Styrofoam, which would provide an extra 1000 lbs. of reserve buoyancy and make the fully loaded boat virtually unsinkable.

Bumper rail. The 1 x 3 bumper rail extends around the deck and projects 1 in. above the surface. Fasten it with 1½-in. No. 8 screws spaced 6 in. apart and countersunk so that they can be concealed with wood plugs.

Control console. Actually, the shape and location of the control console as de-

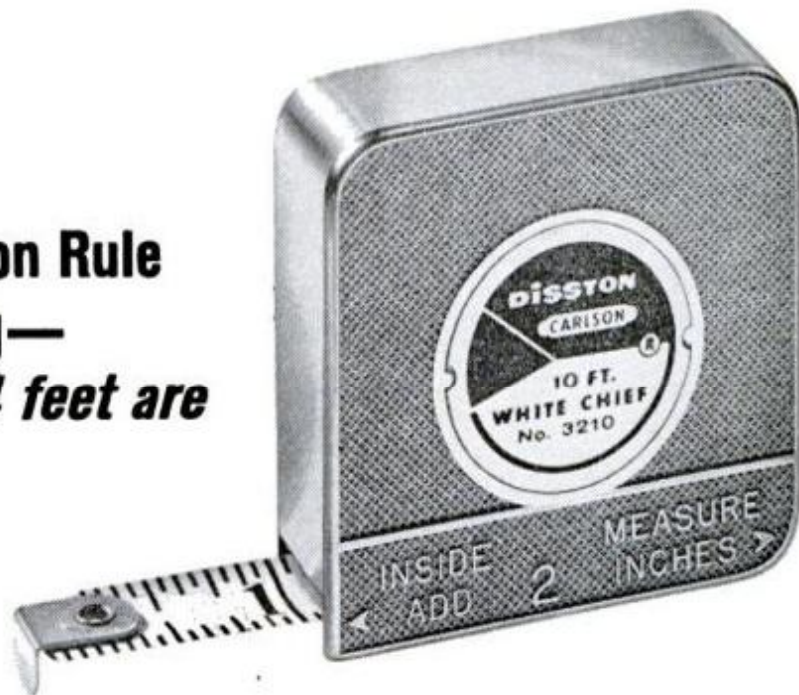
(Please turn to page 222)

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PORTER

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PM'S PLATFORM BOAT

(Continued from page 220)

tailed here is entirely optional. Any shape console may be used and it could just as well be mounted almost anywhere along the center line of the boat. It's up to you.

As shown in the plan, the console features a swing-out seat with a folding leg. The seat is hinged to the leg, and the leg is equipped with a 1/4-in. dowel which fits into a hole drilled in the deck. Controls are mounted on the side, and control cables and steering lines are led beneath the deck back to the motor area.

Painting. If you fiberglass the deck, be sure to select paint compatible with the resin used. If you omit this, give the plywood a couple of coats of paint to hide the grain. Sand between coats and finish off with a good nonskid deck paint.

Incidentally, if the boat is to be left in the water, all interior surfaces should be coated with a rot preventative ("Cupri-nol" or similar) before the decking is applied. You may wish to consider this even though you plan to store the boat on a trailer during the season rather than leaving it in the water.

All areas to be left natural should be filled, stained and given three to five coats of good marine varnish, sanding between coats.

Fittings. Lights, cleats and other fittings are matters of personal taste, so long as they satisfy regulations in your area. As shown in the photograph at the beginning of this article, the prototype was outfitted with DIY aluminum railings assembled with NuRail fittings, and a canvas top stretched over aluminum bows. Such features are purely optional.

From the deck up, it's your baby! ★ ★ ★

FASTENING SCHEDULE

Item	Size	Type	Spacing or No.
Frame to bulkheads	1"		
Beams to bulkheads and transom	1"	Nails	3" apart
Beams to uprights	1 1/2" No. 8	Nails	3" apart
Side planking to chine logs and stems	1"	Screws	2 ea. joint
Chine logs to bulkhead and transom frame	1 1/2" No. 8	Nails	2" apart
Sheer clamp to beams	1 1/2" No. 8	Screws	1 ea.
Bow piece to stem	1 1/2" No. 8	Screws	1 ea. joint
Keel to bulkheads	1 1/2" No. 8	Screws	2 ea. joint
Tunnel vertical blocking to beams	1 1/2" No. 8	Screws	1 ea. joint
Side planking to sheer	1"	Screws	1 ea. joint
Bottom planking at outer edges	1 1/4"	Nails	3" apart
Bottom planking along keel	1 1/4"	Nails	3" apart
Tunnel and side planking at tunnel cleat	1"	Nails	6" apart
Decking at outer edges	1 1/4"	Nails	3" apart
Decking at inner edges	1 1/4"	Nails	4" apart
Bumper rail to hull	1 1/2" No. 8	Screws	6" apart

MATERIALS LIST

LUMBER No. Req'd.	Size*	Use
4	1 x 6—4'	Stem
2	1 x 2—8'	Keel
4	1 x 2—10'	Chine log
4	1 x 3—4'	Sawn chine from Nos. 0 to 2
2	1 x 3—16'	Sheer clamp
2	1 x 1 1/2—16'	Tunnel cleat
1	1 x 2—12'	Vertical blocking for tunnel
4	1 x 6—8'	Athwartship beams (Nos. 1, 3, 5, 7)
3	2 x 6—8'	Bulkhead beams (Nos. 2, 4, 6)
1	1 x 3—8'	Bow piece
1	2 x 8—8'	Transom beam (thickness may vary with motor)
3	1 x 3—16'	Bumper rail
8	1 x 2—19'	Side uprights (Nos. 1, 3, 5, 7)
3	1 x 2—12'	Bulkhead frames

* All sizes above are nominal, or "lumberyard size," rather than actual size. Dimensions allow for cutting to length.

PLYWOOD

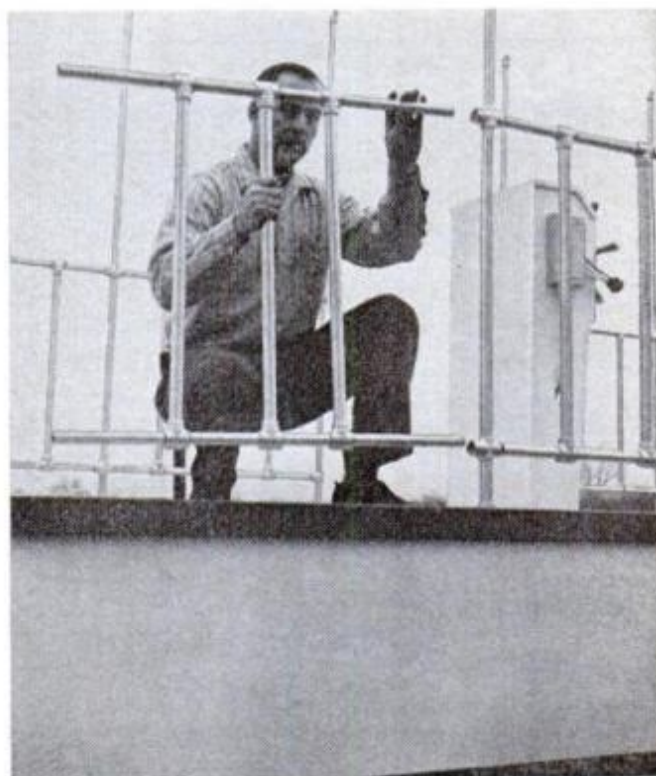
2	1/4" x 3' x 16'	Side planking
1	3/8" x 4' x 8'	Bottom planking (center portion)
1	3/8" x 4' x 8'	Bottom planking (forward portion)
1	3/8" x 4' x 8'	Bottom planking (aft portion, misc.)
2	1/4" x 4' x 8'	Tunnel planking
1	1/4" x 4' x 8'	Bulkheads
4	1/2" x 4' x 8'	Deck

FASTENINGS

Nails: annular-thread, bronze or Monel		
3 1/2 lbs.	1"	No. 12
2 1/2 lbs.	1 1/4"	No. 12
FH Screws: hot-dipped, galvanized or bronze		
1 gross	1 1/2"	No. 8

GLUE

Plastic resin (5 lbs.) or resorcinol (1 gal.)



ON THE PROTOTYPE, the rails and top bows were made from aluminum assembled with NuRail fittings

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tinuous band, crossing itself to form a double loop (one for each whorl). Using it for this job seemed a stroke of modern Yankee ingenuity, but if *your* access to candlewicking is more limited, you can run your wheel with two separate round leather belts of the type used on sewing machines.

The wheel was spinning again; when it had sucked up one card of fleece, our demonstrator simply twisted a new card onto the tail end and went on spinning. The basket she fished the wool from had two carders laid picturesquely on top. These are just boards with wire teeth, used to organize and fluff up the fibers of the washed wool until it resembles cotton.

"All spinning really does is straighten out a tangle of short natural fibers by staggering and overlapping them and binding them tightly together for strength. There's no limit to the *length* of thread you could spin, of course. At least, not with wool. Wool fibers have a natural affinity for one another—they *stick*, so it's easy to just twist on another rolag of fleece." The lady stopped her wheel and rose. "Flax, now, is another matter," she said.

"Yes, how about flax?" we asked. "When you see the stuff growing, it seems like an unlikely source for cloth. Is much flax spun today?"

Taming the flax

We got a withering look. "You've heard of linen?" We sheepishly followed the lady across the room and examined some seeded stalks.

To get at the long and tough fibers of the inner bark, the outer shell must be husked off. A batch of these fibers is combed, loosely tied and is then usually wound onto a "birdcage"—a hollow bent-stave form that revolves at the top of a distaff. (Our vertical wheel has no birdcage. Apparently, flax would be spiraled down the long distaff itself.) At any rate, flax is never held in the lap like fleece, because spinning it into thread is trickier, as the lady now demonstrated on a wheel in another room. A flax-loaded wheel will always have a water-dish near it, for these tough, stiffer fibers must be moistened to make them cling together. As your wheel spins, you keep gathering fibers with one hand, intermixing from different parts of the spiral to stagger the lengths, then giving an initial twist with the moistened thumb and forefinger of the other hand while feeding the crude thread

toward the spindle's eye. From that point on, the action is identical to that for wool—or cotton—or angora fur!

And when the bobbin's filled—what do you do with the thread? Is it actually usable?

"Of course!" the lady assured us. "What we spin here at the Village is used in the weaving demonstrations. To prepare the spooled thread for the loom, we first convert it into a skein by winding it on a niddy-noddy."

Now, like we said before, great-great-grandma could get pretty cute: a niddy-noddy is a simple wooden frame that, with a bit of elbow action, lets you quickly wind a spoolful of yarn into a loose skein of the type henpecked husbands patiently hold across stiffened hands. The skein can then be dropped over a "swift"—that expanding-frame reel that shows in the background of the wool-spinning photo—until such time as it's ready for dyeing and rolling up on a bobbin for the loom.

Nonprofit, but fun

Our demonstrator was busy again at the original wheel. "Hand-spinning isn't something you'd do for profit. The price you'd have to ask for a single spool of thread would make any buyer grateful for the Industrial Revolution. But it's fun, and it puts you in touch with your ancestors far better than a Ouija board. I recommend it to anyone with a wheel at home, but I always admit I can't *tell* anyone how to spin. They can only learn through practice at their own wheel. The basic technique couldn't be simpler, but it *does* require co-ordination and concentration.

The best way to start in is simply to treadle an unthreaded wheel until you've mastered smoothness of rotation and control of the speed. If you get the wheel turning too *fast*, you can't feed the fibers quick and smooth enough and—" she didn't have to tell us—it happened: the yarn snapped clean at her fingers and was sucked on through the spindle.

"You see?" she sighed. "If folks didn't *pester* you. . ." And we left her poking into the spindle with her little wire hook.

—Alfred W. Lees

Lipstick for Sheep

Sheepishness among sheep in New Zealand is a probability if the N.Z. Dept. of Agriculture goes through with its plan to make them wear lipstick. This scheme grows out of the need to find a new means of identification to replace the old method of liquid branding, which was banned as of Oct. 1.



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Ford Pros

(Continued from page 100)

Auto people have long recognized the impact styling has on car sales. This year's Ford, with completely new sheet metal, owes a lot of its success to styling appeal. Though styling ranks fourth among most liked features of the 1966 Galaxie, it was named by 30.2 percent of owners.

"I like the clean, smooth, chromeless look."—Chicago comptroller.

A few owners called for more chrome.

"Body style and overall, they are as pretty as any on the road. The colors are good too."—Ohio toolmaker.

A big gap exists between styling and the next most mentioned feature. Only 19.4 percent cited interior comfort and design. Power and performance (18.7 percent) followed close behind.

"I am 6-2½ and I have ample head clearance, excellent vision, leg and shoulder room."—Connecticut designer.

"I have lots of kneeroom when my wife drives."—Illinois supervisor.

"It has all the power I can use. And I have the Six."—New Jersey retiree.

"The lively V8 engine is what I like most."—Illinois technician.

(Please turn to page 227)

Ford Gripes

(Continued from page 101)

vibrates excessively at higher speeds and body work is poor."—Illinois painter.

"This is my seventh Ford and this year Ford threw quality control out the window. Screws were not put in and air leaks throughout the car."—Illinois manager.

... and then the depression came.

For a car that wins so much praise for quietness, the Ford drew complaints about wind noise from one in thirteen. And Ford is just going to have to do something about the location of its ashtray. Its size and distance from the driver were repeatedly (11.1 percent) singled out for gripes.

"Can't seem to correct wind noise around windows and windshield."—South Carolina salesman.

"That ashtray is too small."—South Dakota foreman.

"Radio is too far to the left and ashtray too far to the right. It takes your eyes off the road too much when reaching for the tray."—Ohio farmer.

"Lack of ashtray light caused a carpet burn when I missed the ashtray at night."—Maryland engineer.

Some owners complained of mechanical
(Please turn to page 227)

Summary of Ford Owners' Reports

Excellent 59.5% Good 31.4% Fair 6.5% Poor 2.8%

Fuel economy		
About as expected	54.5%	
Better	13.7	
Not as good	31.8	
Best-liked features		
Quietness	39.0	
Ride	36.5	
Handling	36.0	
Styling and color	29.8	
Interior comfort and design	19.4	
Power, performance	18.3	
Power steering and brakes	10.6	
Safety features	5.8	
Wagon tailgate	5.3	
Visibility	3.8	
Specific complaints		
Workmanship	20.2	
Gas mileage	14.1	
Front ashtray location	11.1	
Wind noise	7.6	
Handling	5.6	
Instrument panel	5.1	
Head and legroom	4.0	
General rattling	3.5	
Suspension	3.0	
Rain leaks	2.5	
Dealer service	2.5	
Oil consumption	2.0	
Best-liked exterior features		
Styling	39.8	
Clean lines	15.7	
Wagon tailgate	12.6	
Taillights	10.0	
Wagon air deflectors	4.7	
Side styling	4.7	
Least-liked exterior features		
Front-end styling	8.9%	
Back window shape	8.9	
No trim to protect doors	7.1	
Rear-end styling	7.1	
Taillights	7.1	
Best-liked interior features		
Upholstery, seats	33.5	
Instrument panel	31.3	
Roominess	16.8	
Soft trim	8.4	
Least-liked interior features		
Ashtray and lighter location	31.3	
Lights, instead of gauges	9.8	
Seats	7.2	
Glove compartment size	6.5	
Radio location	5.2	
No light on gear selector	3.3	
Decision to buy most influenced by		
Past experience with Ford	45.6	
Price, trade-in value	32.2	
Styling	27.6	
Dealer and service	19.8	
Ride handling	11.5	
Word of mouth, reputation	6.5	
Quietness	4.1	
Consider buying a different car?		
Yes	51.4	
Other make considered		
Chevrolet	22.7	
Plymouth	8.9	
Pontiac	8.0	
Buick	5.3	
Dodge	5.3	
Oldsmobile	4.9	
Mercury	3.6	
Rambler	1.8%	
Is Ford family's only car?		
Yes	59.8	
Make of family's other car		
Another Ford	25.4	
Chevrolet	7.1	
Dodge	1.8	
Buick	1.8	
Oldsmobile	1.3	
Plymouth	1.3	
Volkswagen	1.3	
Make of car traded in		
Ford	64.3	
Chevrolet	11.9	
Pontiac	4.3	
Oldsmobile	1.9	
Volkswagen	1.4	
Mercury	1.4	
Buick	1.0	
How is dealer's service?		
Excellent	53.8	
Average	39.2	
Poor	7.0	
Would you buy another Ford?		
Yes	94.0	
No	6.0	
What changes would you like?		
Location of front ashtray	13.5	
Better gas mileage	10.0	
Better workmanship	9.4	
Lights, not gauges on instrument panel	6.4	
Suspended gas pedal	3.5	
Suspension	3.5	
Body styling	3.5	
Spare tire location	2.9	

(Continued from page 226)

Two surprises showed up in the last four best-liked features in the top ten list. Five percent of all respondents—that's more than half of the wagon owners—praised the two-way wagon tailgate. Ford feels its tailgate is partly responsible for the more than doubled wagon sales during the second month it was on the market. Also surprising was praise for safety items, comments heard too infrequently to record in last year's report. Specifically, the flasher system came in for most praise.

"I like the improved power steering and better brakes."—Ohio farmer.

"I like the safety features, especially the rear seat belts."—Ohio engineer.

Great for holding down kiddies too.

"Hood and trunk slope down for good closeup visibility."—Connecticut engineer.

"I can see clearly all around; no blind spots."—Ohio press operator.

"I use my wagon for newspaper delivery. It handles well with oversize tires and that new tailgate is a welcome addition."—Ohio teacher.

Ford Gripes

(Continued from page 226)

breakdowns in the carburetor and power steering system.

"The secondary throttle plate in my carburetor had blurred edges and jammed in the carburetor bore."—Ohio machinist.

"There's a hesitation on acceleration."—Nebraska state trooper.

Slow warmup was another complaint.

"The Six doesn't have the guts I expected on a long hill."—Illinois supervisor.

"Car is sluggish. My 250-hp V8 does not have the pep of my '64's."—New Jersey salesman.

"Dash lights are very poor. I can hardly read gauges at night."—Colorado farmer.

"With your hands on top of the steering wheel you can't see any instruments."—Illinois construction worker.

"Engine instruments would be appreciated instead of lights. Especially the oil pressure and water temperature."—Connecticut engineer.

He's our kind of people. Usually by the time the idiot light goes on, it's too late.

"Power steering leaks fluid."—West Virginia restaurant owner.



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Nicholson File Company, Providence, Rhode Island
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NICHOLSON



THE NEW MISS B!

(Continued from page 108)

The usual unlimited's propeller shaft is supported under water by a vertical strut attached to the hull, and this strut creates a lot of resistance when the boat is sliding through a turn. Jones designed a V-strut that is something like a small hydrofoil for the new boat. It gives a small amount of lift to the stern all the way through a turn.

Most unlimited hydroplanes use a propeller that has neutral or negative lift. For the new boat we are trying propellers that have positive lift designed into them, again as a way of compensating for the aft location of the heavy engine.

With all these changes from orthodox design you can understand why a lot of people in the game are shaking their heads and saying "The boat's too radical."

The new hull is built of aircraft-grade maple plywood on oak frames, with a glassed skin. The bottom is clad with aluminum sheet, as thick as one quarter inch on the inner runners of the sponsons.

Aside from the usual instruments the cockpit has a row of lights to warn me if the oil pressure drops or if some part of the engine overheats. The lights are a big help, since it's hard to study the instruments during competition.

Stopwatch is important instrument

One important cockpit instrument is the stopwatch. I like to cross the starting line at 160 mph the instant the starting gun is fired, and I also like to be in the first lane, nearest the buoys that mark the course. Some of the other fast drivers also like the first lane, and they also like to cross the line wide open. The stopwatch helps me decide when to turn toward the line and when to start building up speed.

I wear a fireproof suit, a life jacket and a crash helmet, but no safety harness. It's best to be thrown clear if the boat flips or gets into other trouble. I use a foot throttle that's hinged at the center instead of at the bottom. This helps anchor my heel while using the toe for control. It's a help in rough water that tends to bounce your foot off the throttle. And it helps me to back off instantly if the boat becomes airborne. Otherwise the engine speed might climb to 5000 rpm, with a subsequent twisting off of the shaft or propeller when the boat hits solid water again.

Keeping an unlimited hydro in competition requires a lot of engines, and we have nearly two dozen in storage. All are used, war-surplus 12-cylinder Rolls Royce aircraft engines about 20 years old. They are watercooled and supercharged. Originally

they developed 1800 hp at 3000 rpm. After being torn down, re-worked and balanced, and with water injection, they develop about 2850 hp at 4200 rpm.

As a safety precaution we usually use one and a half engines during a race. That is, we change engines at the end of the second heat. Leo Vanden Berg and his four-man crew have made an engine change in as little as 17 minutes. The old engine undergoes partial tear-down and inspection, including Magnafluxing.

Between the first and second heats we lift the boat out of water and spray a fluorescent dye over the propeller, the shaft and some engine parts, then examine the parts under an ultra violet light. This reveals any hairline cracks that might be developing. All these precautions pay off. In the last two and a half years we've run 57 heats in competition without an engine failure. Of course, the (plug!) Bardahl additive that we use in the fuel and oil helped in setting this reliability record.

The unlimited hydros take part in about 10 APBA-sanctioned races per season, from June through October. An average of 15 boats travel the full race circuit; six might be considered the top contenders.

Each race is on a different course, and each course has its own problems for which the boats have to be set up differently. There are different currents, different wave reflections from the beach at each location. At Seattle we race on fresh water at sea level, at San Diego we run on salt water that's light and buoyant. We lose horsepower at Lake Tahoe because of its 7000-foot elevation and the coldness of its water, so we set up the hull differently, use a special propeller and go into the turns harder than usual.

I think the Detroit course is the toughest of all. There's a wide turn at one end, a narrow turn in rough water at the other end. Plus the river current. You could say that the winner at Detroit is usually the boat with the best combination of acceleration and speed that lets it get through the narrow turn faster than its competition. Yet it takes a different combination at Madison, Wis., because of the long straight-aways and the tight turns.

All the hours of preliminary trials that we are putting on the new boat this spring, and all the hours of studying the motion pictures that we make of each run, are only the beginning. We really won't know how well the new *Miss Bardahl* performs until we try it in the churned-up "competition" waters of a few races. But right now Ole Bardahl, Ron Jones, and my crew and I think we have a real surprise in store for all the other unlimited hydro teams. ★★★

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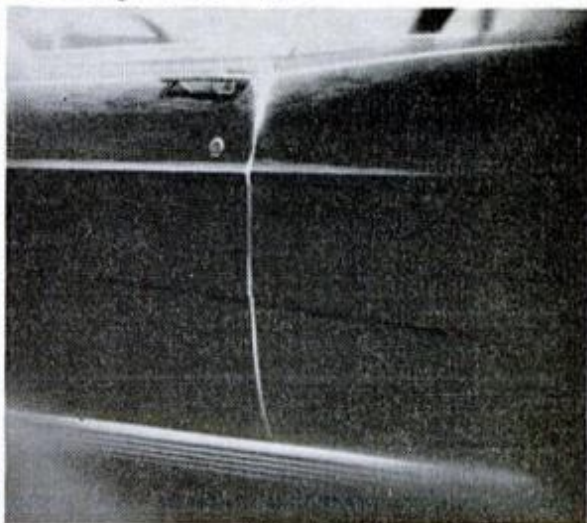
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You'll get the most for your driving pleasure from your Ford Dealer.

Impala Pros

(Continued from page 102)

"There's room for my legs, and I'm 6-2."—Illinois retired.

"Even with the automatic transmission my Chevrolet has a lot of snap."—Minnesota highway employee.

"Zip."—Iowa priest.

"Seats are soft, relaxing, like being on a cloud."—New Hampshire salesman.

This year the buckets have a new contour, more padding, higher seat backs. They fit like a sitzmark in the snow.

Chevy's economy came in next. And the power steering impressed the owners to the extent that they voted it No. 8.

Chevrolet hasn't talked quietness as much as Ford, so this feature ranks only ninth with Chevy owners—in spite of the fact that Chevrolet designers added fiberglass blankets, jute and dumdum to the firewall and floorpan and under footwell in the back seat. Finally, Chevy owners discovered that sturdiness of construction still is a big factor in buying.

"It's a poor man's big car. It's dependable. Never have major repairs. Does the job if you don't abuse it. You just change oil, don't add it."—Illinois messenger.

"Power steering is vastly improved over that of the '65 I traded in."—Illinois race-track employee.

Actually, it hasn't changed.

"Engine is quiet."—Connecticut retired.

"The body seems tighter than those of my previous Chevrolets."—Iowa retired.

Impala Gripes

(Continued from page 103)

of these problems may sound amusing—unless they're on your car.

"Doors don't fit properly. One window opens gradually while car is in motion."—New Jersey salesman.

"Eight small screws were missing from the dash."—Connecticut plumber.

Paint, gas mileage and transmission woes follow in that order.

"Paint is thin in spots and has runs."—New York lawyer.

Acrylic paints are tricky to apply. But once on, they give the best finish of all.

"Too much gas."—New Jersey doctor.

"Transmission didn't shift out of low. Had a new transmission installed, and it's fine."—Rhode Island optometrist.

"I don't like the Powerglide. I prefer three speeds."—Maryland salesman.

The two-speed is being phased out. By next year the three-speed Turbo Hydramatic should be the standard automatic.

Leaks ranked ninth; bad dealer service and suspension complaints tied for tenth.

"Interior and trunk get wet during a hard rain."—Michigan butcher.

"I didn't buy locally because of poor service on my '65. I drive 80 miles for service."—North Dakota office manager.

"Hard ride. My '39 rode better."—Illinois truck driver.

This lad must have forgotten to put the tires on his car. He's pretty lonesome with that complaint.

Summary of Owners' Report

Excellent .55.5% Good35.9% Fair6.9% Poor1.7%

Best-liked features:			
Handling	36.2%	Assembly	5.6%
Styling	31.7	Gauges instead of lights	5.0
Ride	30.8	Ashtray location	3.9
Interior design	24.1	Transmission	3.9
Performance	23.6	Gas mileage	3.9
Seats	9.8	Car traded in:	
Economy of operation	6.3	Chevrolet	71.5
Power steering	5.8	None	11.4
Quietness	3.6	Ford	6.3
Construction	3.1	Oldsmobile	2.9
Least-liked features:		Pontiac	2.5
Rear visibility	11.6	Dealer service:	
Carburetor	9.6	Excellent	52.7
Wind noise	9.4	Average	36.6
Fit of windows, doors	8.6	Poor	10.7
Workmanship	7.7	Buy from dealer again?	
Paint	5.6	Yes	87.6
Gas mileage	5.1	No	12.4
Transmission	5.0	Buy another Chevrolet?	
Water leaks	2.6	Yes	93.3
Suspension	2.1	No	7.7
Dealer service	2.1	Bought Chevrolet	
Most like to see changed:		because of:	
Rear visibility	15.6	Past experience	50.8
		Price or trade-in	33.8
		Styling	25.0%
		Dealer and service	14.2
		Type of transmission:	
		Three-speed manual	8.9
		Four-speed manual	6.1
		Automatic	85.0
		Type of engine:	
		Six	7.5
		V8	92.5
		Considered buying:	
		No other car	63.4
		Ford	13.6
		Pontiac	7.6
		Decided against it	
		because of:	
		Trade-in	24.6
		Price	20.8
		Styling	20.8
		Other car owned?	
		Yes	41.7
		No	58.3
		Make of other car:	
		Chevrolet	28.5
		Ford	5.6
		Oldsmobile	4.0

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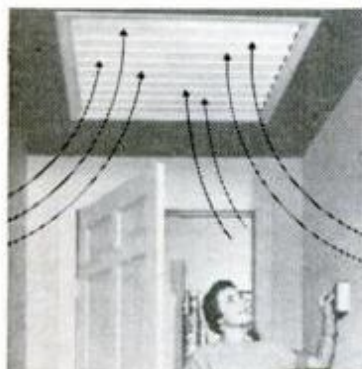
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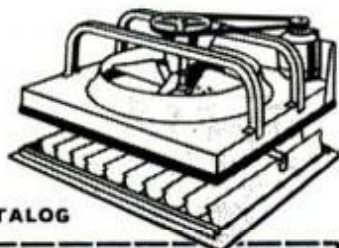


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2 for \$59.50
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Same engine with 12 volt start and battery charging. Item 1059A

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Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start—3/8" std. shaft.

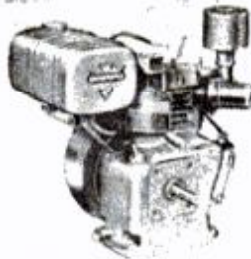
Item 1107 34.95
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3 1/2 h.p. Clinton—39.95

A big engine with big power. Model 406, 4 cycle, rope start, 3/4" std. shaft.

Item 406 39.95
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ELECTRONIC EYES

(Continued from page 98)

ters — Atlanta, Philadelphia, Cincinnati, Ogden (Utah) and Austin (Texas)—were processing both business and individual returns through Martinsburg. The other two Service Centers have been handling only business returns. By next year (1967) ADP in the Midwest (Kansas City, Mo.) and North Atlantic (Lawrence, Mass.) regions will include individual returns.

Then we'll have a "solid match" on everyone's return for the entire nation. You won't be able to alibi that you filed in some other region.

Note, too, that if you live in the Middle Atlantic or Southeast regions and expect a refund, you can mail your returns directly to the Philadelphia or Atlanta Service Centers, instead of to your local district.

Still another development: IRS used to pay the money on a refund and audit later. Now, through ADP, thousands of returns are first picked out for more information, particularly on such items as questionable dependents. If the taxpayer comes through this test, he gets his refund.

Come clean—or else

Speaking of dependents, a cabdriver once listed "Mary Ann" as a dependent—she turned out to be his pet cocker spaniel. After admitting his mistake, the IRS told him: "As far as the government is concerned, a confession now has only spiritual value." The penalty invoked: 60 days in jail.

To keep out of jail, the experts in Philadelphia advise us all to "clean your slate of past errors and omissions"—or ADP will get you. Some citizens have been made somewhat unhappy by it. One man, annoyed at the way the machines interpreted his returns, wrote in:

"Would you please take my problem away from the machine now in charge of it and give it to a human being who will rectify the error or enlighten me as to what the problem is, or both?"

No electronic monster, however, will completely replace the inquisitive human mind. Not long ago, a tax examiner noticed that a woman deducted \$50 for a bathing suit torn from her by ocean surf. Sensing something phony, the revenue clerk checked the taxpayer's previous returns—and discovered that for two years the same claim had been made for a \$40 bathing suit similarly lost in the ocean. The deduction was disallowed. ★★



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What makes a car a car is styling, performance, ride and handling. Only when they're all tuned together is the car a Buick.

Like this '66 Skylark Gran Sport.

As a matter of fact, it's what miserable traffic looks like to the tuned car. And twisty, winding roads. And a "ROAD UNDER CONSTRUCTION," too. For the tuned car makes a habit of making unwelcome sights disappear.

Which makes the tuned car a most welcome sight indeed.

The Skylark Gran Sport—one of the tuned cars. The Skylark GS in the picture is, like every tuned car, a beautiful blend of styling, performance, ride and handling. Which means it rides as smoothly as it performs. (A suspension designed specifically for the GS sees to the ride. A 325-hp Wildcat V-8 sees to the performing.) And it handles as briskly and responsively as you'd expect a car that looks like this to handle. (Alas, some cars don't live up to the way they look. The tuned car always does.)

How the tuned car works its wonders. If you're intent on making mountains evaporate, you've got to get out of the test lab, we say. So we do a lot of our product develop-

ment out in the real world, on real roads, where real people drive.

All this means you aren't likely to run into a driving situation that we haven't already seen. And *that* means the tuned car is tuned to your kind of driving.

Tuned safety equipment, even. Built and blended into every Buick are padded sun visors and a padded dash. Two-speed electric wipers and windshield washers. A shatter resistant mirror inside and a rear-view mirror outside. Back-up lights. And seat belts all around, which we exhort you—nay, plead with you—to buckle on. (Is there nothing we won't do to make sure you're in fit shape to come back for more Buicks? Nothing.)

How to turn your country into tuned car country. The only thing standing between you and the tuned car is your Buick dealer. And an easier obstacle to surmount you've never met.

Unless you count mountains.
Wouldn't you really rather have a Buick?

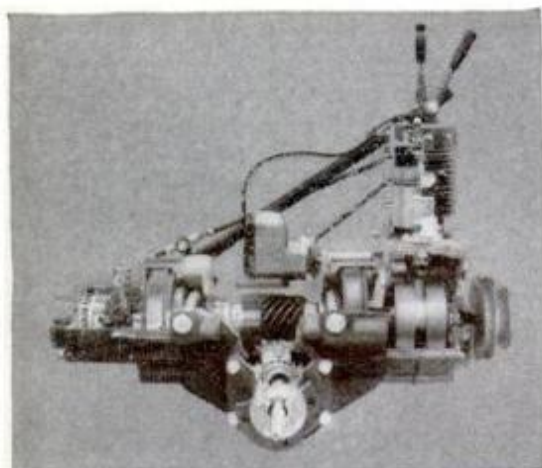
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ing section was scheduled to put on an exhibition of card stunts in which several thousand students would spell out words and create pictures.

This fact was publicized in the Los Angeles newspapers and read by a group of 14 Caltech students temporarily immobilized over the Christmas holidays. Bored and looking for action, they became bemused with the challenge of trying to figure out some means of putting Caltech in the Rose Bowl. The stunt began to take shape in a series of bull sessions that became progressively more enthusiastic as the details fell into place.

'Reporter' got the facts

A phone call to Rose Bowl headquarters turned up the information that the Washington card section members would arrive on Dec. 29 and would be staying in dormitories at Long Beach State College. One of the 14 was on hand, posing as a newspaper reporter, to greet the Washingtonians. He sought an interview with the card-demonstration director, and found him carefully filing away the directions that would be distributed to the card section participants on New Year's Day. The director was flattered at being interviewed and obligingly told the pseudo reporter in great detail exactly how the card stunts were done. The "reporter" took careful notes—including the director's room number and the location of the 2232 direction sheets. He also discovered the director's dinner hour and while he was eating, the "reporter" re-entered through an adjoining room and "borrowed" one of the direction sheets.

Armed with a knowledge of how the card tricks were managed and a sample direction sheet, the Caltech students set out—through mathematical computation—to refigure the card patterns for three of the stunts. They worked at it all night, then took their newly computed directions to a local printer who ran off 2300 copies for them on a rush order. Two days later, the entire Washington contingent toured Disneyland. While they were gone, several of the Caltech plotters broke into the director's room for the second time and substituted their newly printed directions for his. The color of the paper was not identical; plotters could only hope that it wouldn't be noticed.

It wasn't. Halfway into the performance at the game the following day, the card section was supposed to come up, loud and clear with "WASHINGTON." Instead, etched unmistakably in sharp black-

down. A husky dog—the Washington mascot—was due next. Instead, up came a beaver—the symbol of Caltech. The card director tried once more. When "Huskies" came up spelled backward the whole performance collapsed in chaos. The Caltech plotters—watching on TV—felt a warm glow of accomplishment.

"We just did it," recalls one, "to see if it could be done."

It was probably the most ambitious gag ever pulled by college students—and it was done with such finesse that the mystery might never have been solved had not the 14 culprits come forward of their own volition. Not even the geniuses at Caltech could bypass human longing to be identified with such a master stunt.

But the Rose Bowl hoaxers were seeking more than recognition for themselves. They also wanted the stunt identified with their dormitory. The centers of social activity at Caltech are the seven student dormitories (called "houses") which compete zealously against one another.

Genius sometimes errs

Occasionally one of these ambitious projects will backfire—with near disastrous results. Last year, the students in one house built a river on their patio, on which they planned to float a real houseboat as an appropriate setting for a Dixieland band. They used sandbags to hold the water. But the night before the dance—while most of the geniuses were asleep—the water began seeping, then pouring into the dormitory. By morning, the patio was bone dry and the dormitory was a miniature lake, several feet deep in places.

There's a day specifically set aside at Caltech for way-out stunts, and students have been known to plan for it several years ahead. Called Ditch Day, it takes place on some indeterminate morning in April or May (the exact date is set secretly by the seniors each year) when the entire senior class drifts quietly off the campus. By the rules of the Ditch Day game—scrupulously observed—the underclassmen then have until sundown to break into the seniors' rooms and devise some sort of diabolical torture. The challenge to the seniors is to barricade their rooms in such a way that they can't be violated. Brute force is not permissible; the underclassmen must get into the rooms without breaking any walls, windows or doors. There are three other inflexible rules: Private property can't be destroyed or damaged (closets and drawers are never touched); the physical plant can't be endangered in any

way; and any resultant damage has to be repaired or paid for by those causing it.

This still leaves plenty of latitude. Seniors *must* clear out on Ditch Day; if found on campus, they can be legally tied to a tree. There is also a built-in Achilles heel for the seniors, who must devise some means of getting back into their rooms when they return. If the underclassmen can figure out the device, they can activate it prematurely and get in themselves.

Good job commands respect

Senior George Radke two years ago, for example, braced doors, windows and closets with portable dance floor sections installed an unpickable lock, and double-secured his door with stainless steel screwed into the frame. He got out through the transom, and a brace fell into place behind him. The bracing bar was hooked to a rope secured to a pulley; resting on the rope was a cold soldering iron, wired to a timer. By pushing a knife blade through the door at a spot only he knew, Radke could short a pair of wires, activate the timer, heat the soldering iron, burn the rope, release the pulley and get back in through the transom. The invaders figured out Radke's defense through a ceiling peephole, poked in a lighted candle on a fishpole, burned the rope and broke into the room.

"It was such a beautiful job, though," recalls an admiring underclassman, "that we didn't do anything to his room."

This is the exception. Usually they do something. In one instance, the underclassmen reassembled the room upside down, bolting all the furniture to the ceiling. ("We couldn't figure out what to do with a goldfish bowl.") Another senior's doorway was carefully plastered up and the entire wall painted. When he returned home, his room had simply disappeared. Another senior found a polyethylene sheet on his floor and the room two feet deep in water stocked with goldfish. Another gleefully spotted a trap that would have upended a bucket of water on his head. He removed the bucket, dumped the water in his washbasin, then watched it pour out onto his feet where the underclassmen—anticipating his action—had thoughtfully removed the drain.

In recent years, the underclassmen have refined their techniques to devise a torture to fit the victim. In years past, seniors have returned to find such *objets d'art* as automobiles and cement mixers, in full operating condition, and huge

weather balloons filled with water in their rooms. But today's underclassmen regard these mechanical stunts as old hat.

Present stunts—on Ditch Day and otherwise — tend to be more subtle in keeping with Caltech's present image as a science-oriented institution. Thus the walls of the room of a hi-fi bug were coated with paste and covered with cotton; an athlete returned home to find a playground equipped with sand, slide and swings in his room; one who liked to talk endlessly (and hollowly) about his prowess with women returned to find his room converted to a bordello, complete with girl imported for the occasion. The underclassmen locked him in the room and monitored the ensuing pursuit by means of planted microphones connected to loudspeakers outside. The senior finally fled through a window.

Completely successful defenses are unusual; hence they are remembered with great admiration bordering on awe. One senior deliberately left no means of re-entrance to his room. The underclassmen spent all day drilling through a steel plate he had bolted over his door. He returned just as they broke into the room, thanked them, and left them stunned. Another senior rigged a motor in his room to activate a metal bar on a coded radio signal. This complex mechanism could be transmitted through a telephone outlet outside the dormitory building. The underclassmen figured out the circuit through a hole in the ceiling, activated it, got into the room, programmed a new code into the system, then relocked the door. When the senior returned, he boasted to an admiring group of underclassmen about the impregnability of his defense. Then he "demonstrated" to them how the door could be opened. Nothing happened. It took him all night and well into the following day to stumble on the new code.

Bluffed by tough hombre

One of the infrequent seniors to come out on top in this cerebral contest was a rough, tough ranch kid who told the underclassmen flatly he didn't want anything done to his room and to prove he meant business, he left a shotgun pointed at the door and wired to go off if anyone tried to enter. Reconnaissance through a ceiling vent verified his story, and the invaders were effectively frightened off. When the senior returned, he guffawed at the timidity of the underclassmen. He told them the gun was old, rusty and incapable of firing—and threw open the door to prove it. There was a tremendous explosion, and the senior fell, clutching

(Please turn to page 242)

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his chest. The effect was sensational. The door was actually wired to a massive fire-cracker which exploded when it was opened. The chest-clutching was an improvisation to heighten the scene.

"He won by bluff," an admiring sophomore told me.

Such intellectual horseplay is not limited to Ditch Day or scheduled social events. It's likely to break out at any time that the students—seeking some sort of psychological breather from the intense academic load they carry—begin to look around them with a reflective eye.

One night, a group of Caltech students with a junker piano on their hands staged a carefully planned riot in the center of Hollywood in which a pack of leather-jacketed toughs smashed the piano of a group of hymn-singing missionaries before an awed audience of passers-by who clogged the streets long enough for the disguised students to slip away when the police arrived.

"We try to be careful, though, about our off-campus image," an earnest sophomore confided to me, "but we're merciless to each other."

Faculty horns in the act

Playing intellectual games isn't by any means limited to the students at Caltech. The faculty members play, too, but their games are likely to be somewhat more sophisticated. Physics professor Richard Feynman—an authentic genius and Nobel Prize winner—was once on hand in Caltech's jet propulsion laboratory when a high-speed electronic computer had been set up to calculate the orbit from radio reports. As a mental exercise, Feynman decided he would race the computer with pencil and paper. Feynman and the machine finished in a dead heat, and the professor's results were completely accurate. Feynman is also a master at breaking lock and safe combinations, and he once threw the Los Alamos testing laboratories into utter consternation during the super-secret days of World War II by making the rounds of the safes there in which classified material was stored and then leaving "Guess Who?" notes inside them.

Feynman's former associate on the Caltech faculty, Dr. Linus Pauling, also indulged his whimsy in frequent intellectual games, some with startling results. He once attended a technical conference at which the need for development of a specific type of measuring device was discussed. The problem was tucked away

Pauling got on a plane to return home and was unable to sleep, he turned to it as a mental exercise. By the time he landed, he had thought his way back through the problem. He phoned the solution back to the conference from the airport and it later became known as the Pauling Oxygen Meter.

Occasionally, student whimsy will turn into similar constructive channels. A few years ago, a Caltech graduate student named Don Glaser was sitting pensively in a Pasadena bar watching the bubbles busily effervescing in his glass of beer. He began idly tracing their path, then found himself—with quickening interest—wondering what caused the bubbles to form in the first place.

He decided to find out. It took him several years, and he had moved to the University of Michigan when he finally completed work on his "bubble chamber"—a device in which Glaser built up pressure on a superheated liquid by bombarding it with atom particles. When he released the pressure, he could photograph the bubble tracks of the particles as they sped through the chamber. Glaser's efforts turned into a brilliant new method of examining some fundamental particles that form the basis of matter. His curiosity led, finally, to a Nobel prize.

The one place where Caltech's intellectual brilliance hasn't paid off very rapidly is on the football field. Every once in a while, there's a modest triumph—like the Caltech tackle (and physics major) who refigured his angle of attack so he could foul up the opposition blocking assignments. But such flashes of genius seldom win games, and at Caltech a season with two victories is a rousing success.

Football more than brains

The football coach (a former big-timer named Bert LaBrucherie, who once took UCLA to the Rose Bowl) never has to worry about whether or not his bright-eyed proteges understand his chalk talks.

"My players," he notes wistfully, "probably have the highest IQ average of any team in the country, but judging by our record, this proves plainly that football is more than a game of brains."

There is, however, some comfort in knowing that the men who will be mapping out our nuclear defenses and plotting our scientific progress in the years ahead are so liberally endowed with sensitivity, creative imagination and—best of all—a sense of humor.

"Besides," as one Caltech intellectual pointed out earnestly, "it's a good way to get rid of our hostilities." ★★★

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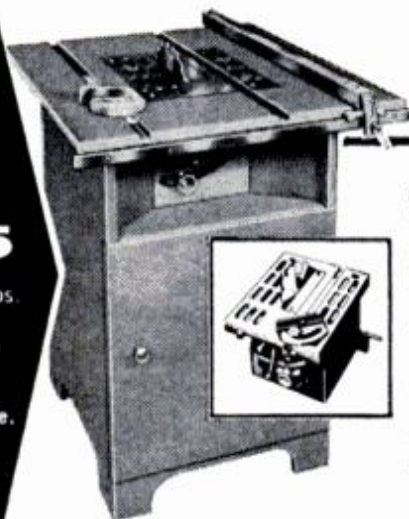
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REVOLUTIONARY PATENTS DECREASE COSTS, INCREASE EFFICIENCY Full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Parts made, assembled, tested and packed right in our own factories, shipped direct... save store profits.

DOES WORK OF \$75 BENCH SAW as is. Converts easily to equal any \$300 floor model cabinet units! Crosscuts, rips, mitres, cuts compound angles, dadoes, makes coves and mouldings. FREE CABINET BASE PLANS

Use as portable bench saw as received (inset photo)... or transform easily and inexpensively into floor model (as shown) guar. to do work of floor models costing \$300. FREE plans... sheet of 3/4" plywood and 3-4 hours are all you'll need. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, pullout sawdust bin, tool storage compartment. 10-YEAR FULL SERVICE GUARANTEE *

BLADE TILTS... TABLE STAYS LEVEL

• Locks securely at any angle to 50°, raises, lowers 0"-2 1/4" • Patented tilt mechanism, accurate etched scale • Patented motor mount takes std. 1/4 h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power • Takes std. blade, saw insert removes to take dado heads, cutters, etc. (not incl.) • Accurate mitre gauge assembly • Ground spindle • Enclosed steel base • "Compo" bearings • Accessories available at factory prices • RIP FENCE, if desired for easier work alignment: Std. size (for bench saw) \$3.50; larger fence (for cabinet base, as ill'd.) \$4.50.

6" SWING
3-FT. LATHE

\$985

f.o.b. factory

Optional Faceplate for turning bows, 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.

10-YEAR FULL SERVICE GUARANTEE *

FULL 22" LONG, 4 1/2"
JOINTER-PLANER

\$1995

F.O.B. Factory Complete as shown

100% precision ground cast iron and steel.

UNCONDITIONAL
10-DAY
MONEY BACK
GUARANTEE

You must be fully satisfied. If not, return in 10 days, freight collect. Money refunded in full, no questions asked.



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.

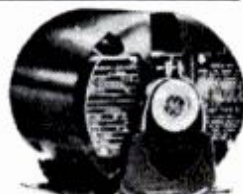
10-YEAR FULL SERVICE GUARANTEE *

OR
1/2 HP
ELECTRIC MOTOR

SPECIAL AMCO PRICE (when purchased with any unit in this ad)

\$1295

f.o.b. factory if purchased separately, \$18.95



SPECIAL LIMITED TIME ONLY

Brand new factory-fresh motors for use with any of the units on this page. Limited quantity purchase... first come, first served. Wt.: 17 lbs.

FULL SERVICE 1-YEAR WARRANTY Otherwise, as described below *

MAIL COUPON TODAY!

AMERICAN MACHINE & TOOL CO., PM-36, Royersford, Pa.

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.
 8" Power Saw at \$14.95 Jointer-Planer at \$19.95
 Standard Rip Fence #354 at \$3.50 Lathe at \$9.85
 Long Rip Fence #354C at \$4.50 Drill Press at \$29.95
1/2 hp GE Motor: \$12.95 (purchased with other item)
 \$18.95 (if purchased separately)

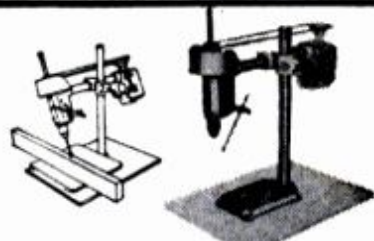
NAME
ADDRESS
CITY ZONE/ZIP STATE

32" RADIAL
DRILL PRESS

\$2995

F.O.B. Factory 1/2" Cap. Jacob's 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.

10-YEAR FULL SERVICE GUARANTEE *

* 10-YEAR FULL SERVICE GUARANTEE Any part or parts of any AMCO power tool which may become inoperative for any reason within ten years after the purchase date will be repaired or replaced by the factory without cost to the purchaser. Your only cost: for postage.