

IN COLOR! COMPLETE GUIDE TO RACING-CAR CLASSES

# POPULAR MECHANICS

MAR. 1967  
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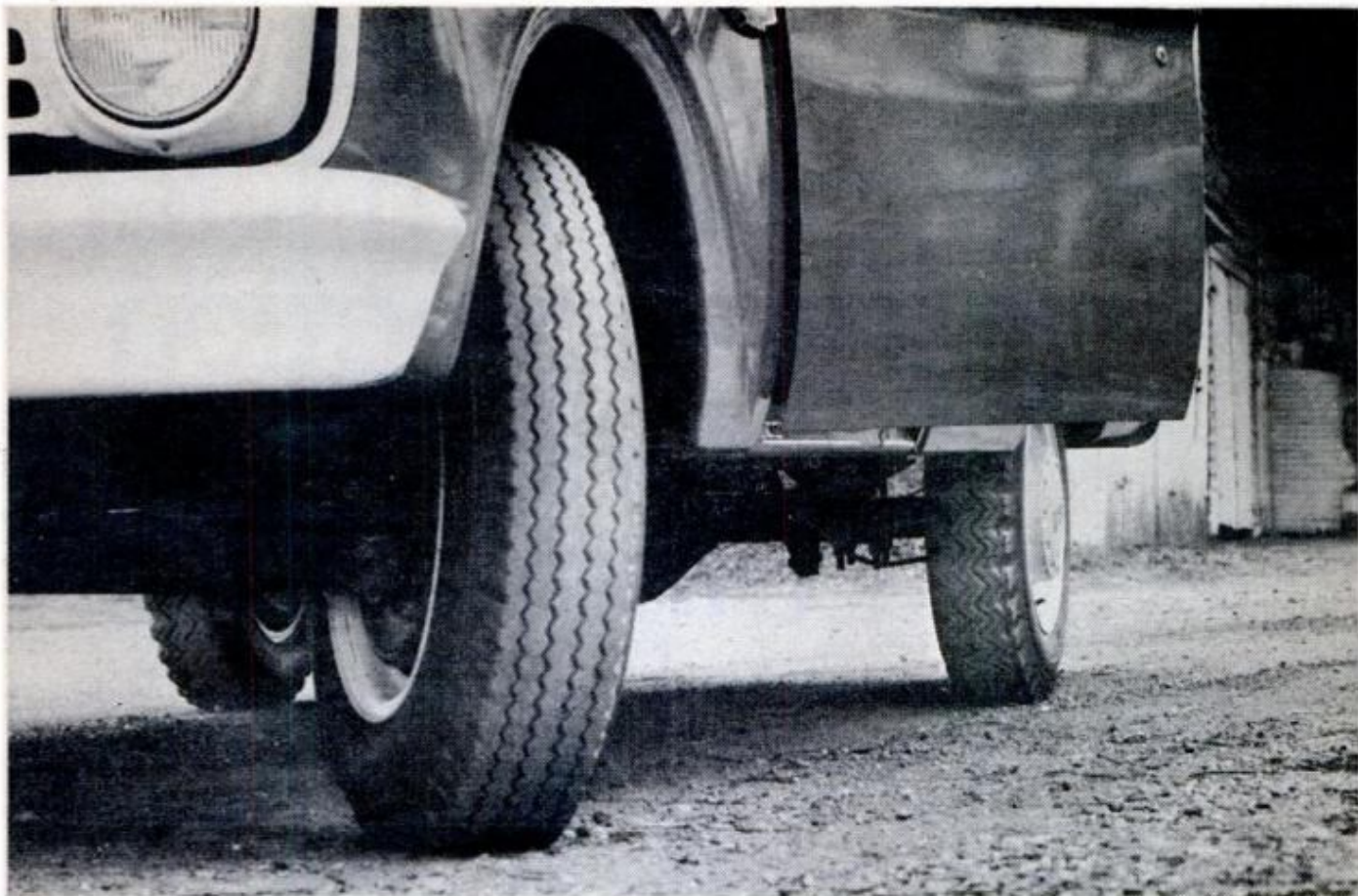
Schafner



*Only Miller High Life could put  
the Champagne of Bottle Beer in cans*







## **This nylon truck tire costs you no more than a car tire.**

Haul big loads—on paved or gravel roads—with Firestone's Transport nylon cord truck tire. It's got everything you need in a hard-working truck tire. For mileage: our exclusive, long wearing Sup-R-Tuf rubber compounds. For traction: a deep, non-skid tread. Patterned to stop and go in the roughest weather. For heavy loads: a rugged Shock-Fortified nylon cord body . . . 6-ply load capacity. As for price, lower than most passenger car tires. Firestone's Transport nylon cord truck tire. Easy terms. Get them both at your Firestone Dealer or Store.

Transport<sup>®</sup>, Sup-R-Tuf<sup>®</sup>

# **Firestone**

## **TRANSPORT NYLON CORD TRUCK TIRE**



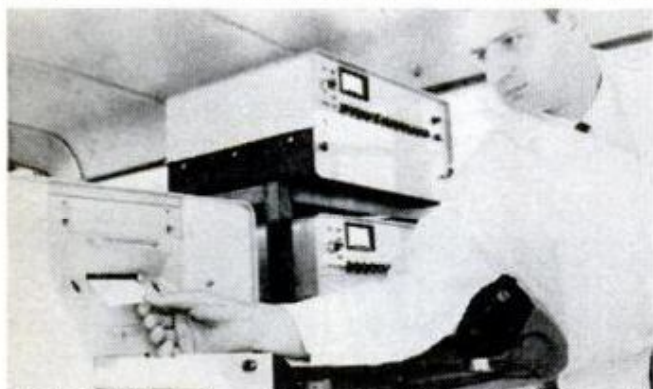
# Radioactive tracer tests prove Fram filters give more protection against engine wear than any other oil filter.

Modern oil filters have one important job. To prevent engine wear. Fram is the only filter manufacturer using radioactive tracers to evaluate engine wear. This space age test proves that for whatever the distance between filter changes — 4,000, 6,000 or even 8,000 miles — Fram gives the best engine protection of any oil filter in the world. Here's how we know this fact.

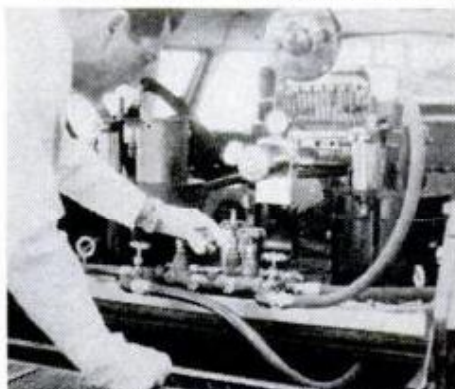
Engine parts are placed in a nuclear reactor where they're bombarded to make them radioactive. Then

these "hot" parts are put in a car engine and run under all kinds of driving conditions. Using sensitive electronic instruments, Fram scientists then precisely measure the ability of an oil filter design to prevent engine wear.

That's how all Fram filters are designed... and tested against all other major filter brands. This is the way we make sure Fram filters give more protection against engine wear than any other oil filter. This is why you should ask for Fram performance-proven filters.

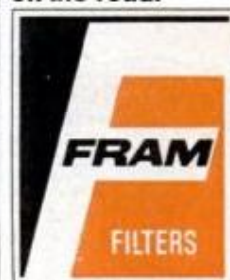


Electronic instruments count atoms of metal worn from engine parts.



Oil filter installation in Fram radioactive test car.

**They work  
on the track.  
They work  
on the road.**





# The how-to-glue chart.

Type of Material	Glue For General Usage (In Order of Preference)	Glue For Maximum Waterproof Durability (Boats, Exterior Construction, etc.)
All general gluing of hard and softwoods	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Glue-All	Elmer's Waterproof Glue
Particle and chip boards to wood	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Contact Cement Elmer's Glue-All	Elmer's Waterproof Glue
Plywood to decorative plastic laminates	Elmer's Casein Glue Elmer's Contact Cement Elmer's Plastic Resin Glue	Elmer's Waterproof Glue
Laminating heavy framing members	Elmer's Casein Glue	Elmer's Waterproof Glue
Veneering, inlays, cabinetwork	Elmer's Plastic Resin Glue (extended) Elmer's Glue-All (small jobs)	Elmer's Plastic Resin Glue
Bonding oily woods (teak, pitch pine, osage, yew, etc.)	Elmer's Casein Glue—sponge surface with dilute caustic soda one hour before gluing	Elmer's Waterproof Glue
End-wood joints, mitered joints, scarf joints	Elmer's Glue-All Elmer's Plastic Resin Glue (heavy mix)	Elmer's Waterproof Glue
Loose-fitting joints, relatively rough surfaces	Elmer's Glue-All Elmer's Casein Glue (heavy mix)	Elmer's Waterproof Glue
Doweling	Elmer's Plastic Resin Glue Elmer's Glue-All	Elmer's Waterproof Glue
Hardboard to ply- wood, wood or itself	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Glue-All Elmer's Contact Cement	Elmer's Waterproof Glue
Gluing porous mate- rials—linoleum, can- vas, etc. to wood	Elmer's Plastic Resin Glue Elmer's Casein Glue Elmer's Contact Cement	Elmer's Waterproof Glue
Gluing plastics, metal foil, etc. to wood	Elmer's Casein Glue (sand both surfaces)	Elmer's Contact Cement
Gluing non-porous materials— glass, metal, iron, aluminum, bronze, brass, etc.	Elmer's Epoxy Glue	Elmer's Epoxy Glue

**There's an ELMER'S Glue for every job you do.**

Here's a handy guide for making sure you're using the right glue. Stick-it on your workshop wall. (With Elmer's, of course.) And you'll never have a sticky problem.





# POPULAR MECHANICS

INTERNATIONAL EDITIONS: AUSTRALIAN, SPANISH, CARIBBEAN, FRENCH, DUTCH, PORTUGUESE, DANISH, SWEDISH

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Cover Painting by Howard Schafer

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PM Owners' Reports on the Chrysler Newport and the AMC Rebel. The buyers of these two '67 cars have definite opinions of them—pro and con. PM tells what they have to say.

Gee-Whiz Vacation Guide for the PM Man. What is there for *you* to see when you're traveling? Here's a roundup of colorful, action-packed vacation attractions.



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Rear Load-Levelers are combination heavy-duty shock absorbers and variable rate springs that prevent bottoming on bumps, swaying

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**FREE Monroe racing decal! Identical to ones used on Indianapolis "500" racing cars. Send a self-addressed, stamped envelope to Monroe Auto Equipment Company, Sales Promotion Dept., Monroe, Mich. 48161.**

Monroe Auto Equipment Co., Sales Promotion Dept.  
Send me two racing decals. I have enclosed a stamped, self-addressed envelope.

Name \_\_\_\_\_

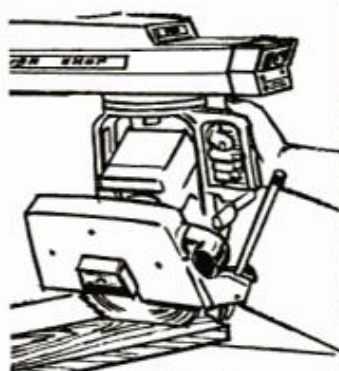
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# LETTERS

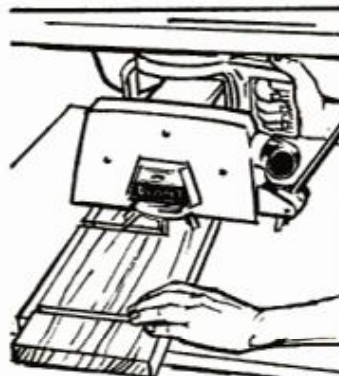
TO THE EDITOR



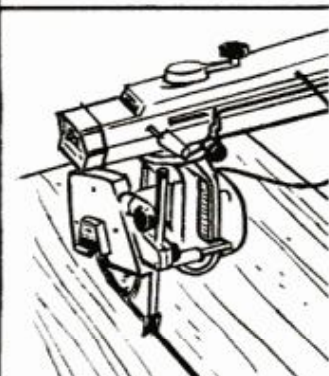
**It's a snap** to set your saw for any cut. Bevels, miters, even combination bevel-miters, in one pass.



**Designs are easy** with a shaper. Cut rabbets, molding. DeWalt shapers give 50% more shapes.



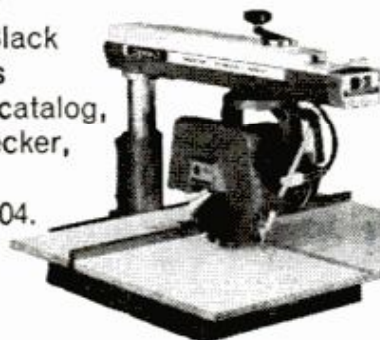
**With new "Quick-Set" Dado**, just dial the width you want and dado, rabbet, plough, flute, scallop.



**Cut wide panels.** Big table top gives extra support for accurate ripping beyond center of 4' x 8' panels.

## What can you do with wood? Anything ... when you own a DeWalt.

It's "operations unlimited" when you own a DeWalt Power Shop by Black & Decker. With accessories, a DeWalt is 14 tools in one! You can saw, size, bore, joint, dado, shape, cut curves, rout, grind, buff, sand, polish...and do it all like an expert, even if you've never worked with wood before. You'll find DeWalts for as little as \$129, along with a full line of accessories, at Black & Decker dealers everywhere. For catalog, write Black & Decker, Dept. C-037Y, Towson, Md. 21204.



### Surprise her with new hose

As safety committeeman in a large oil refinery, I was pleased to see *Kill That Fire* (page 102, Jan. PM). The article was informative and well written.

While the newer dry chemical fire extinguishers rated for Class A-B-C fires are certainly worth having around the home, the old-fashioned garden hose connected to a water tap is still the best insurance against a Class A type fire—which most home fires are.

My advice for the home: Keep a permanently connected length of hose long enough to reach any area likely to be a fire hazard. Keep a container of baking soda near the stove in the kitchen, and make sure your wife knows how to use it. Finally, install the newer dry chemical extinguishers rated for Class A-B-C fires in problem areas, and, again, be sure your wife knows how to use them.

Toledo, Ohio **LOWELL P. AMOS**

### How's your toe-in?

Just read *Too Dangerous to Drive* (page 99, Jan. PM). Sounds more like a Gestapo action than an inspection procedure. Also, those sharp-eyed civil servants failed to give a second glance at the most vital and important safety device in the operation of a motor vehicle—the device that gets in and out of the driver's seat. Buckingham, Va. **C. W. WILSON**

*But how would a guy feel being hauled off with a "Condemned" sticker plastered on his chest?*

Washingtonians *do* get their headlights adjusted right before inspection. The tolerance allowed is unrealistically tight. Like the man says, a parking tap or a chuck-hole throws them off. Such an unrealistic approach causes loss of respect for the inspection.

Washington, D.C. **JOE MULSTON**

### Wait'll he tries 21

There are quite a few excellent ideas in *20 Ways to Go in Snow* (page 87, Jan. PM), but I found a partial fault in one of them.


I would not advise plowing your way through deep snow unless you have one of the late-model cars with PCV. In an older

*(Please turn to page 8)*




# WHO ELSE WANTS A BIG RAISE IN PAY?

"My salary has increased 400% as a direct result of my LaSalle studies"



Rudolph Urbatis,  
Port Chester, N.Y.

"Salary more than doubled since enrolling"



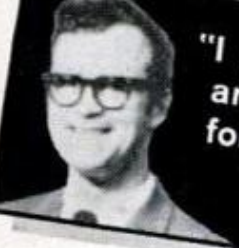
William T. Black,  
Canoga Park, Calif.

"Income has increased 100 per cent since graduation"



James L. Yonning,  
Manhattan, Kansas

"I now earn three and a half times my former pay"



Robert Fisher,  
Holbrook, Ariz.

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Address.....County.....

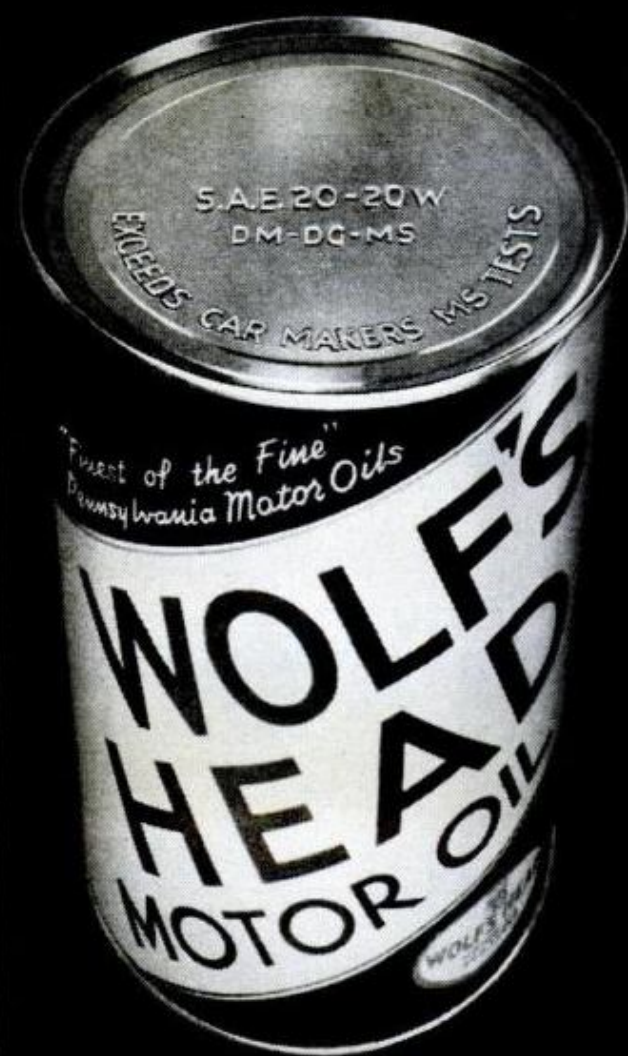
City & State.....Zip No.....

Occupation.....Working Hours.....A.M.....P.M.

321



**Buy your oil  
the way  
you bought  
your car.  
Carefully.**



the Uncommon Motor Oil  
100% Pure Pennsylvania  
Wolf's Head Oil Refining Co.  
Oil City, Pa.

## LETTERS

*(Continued from page 6)*

car, snow will become packed in the breather tube under the car. The plugged tube will cause pressure to build up inside the crankcase, forcing oil to blow out of the oil filler cap. In the newer cars, there is no road-draft tube to become clogged.  
Broomall, Pa.                      ROBERT S. FRATINI

The article is excellent . . . an excellent addition to our safety program. I am safety officer for this unit of 200 enlisted men and 19 officers.  
Langley AFB, Va. 1ST LT. ROBERT L. HAASE

It should be titled *20 Ways to Get Your Neck Broken*. I doubt that the F-85 would even break through the four-foot bank of snow shoved in the drive by the plow. And if the author had everything in that car that he claims, he couldn't see whether he was coming or going. Further—when he says that "if it was safe to accelerate to 40 at the bottom"—if it was safe, he has no problem anyway.  
Lineville, Iowa                      GENE M. CANNON

*That author is a big disappointment. He hasn't even found one way to break his neck, and he's still driving in snow.*

### Too bold for boulders

I enjoyed *3 for the Trail* (page 140, Jan. PM). The article was informative, and the tests would show a bike's true color. However, you should have captioned the pictures: *How not to dress for trail riding*. Your test crew wasn't dressed for street riding safety, yet you had them riding among boulders large enough to kill a properly attired rider. Any safety minded trail rider will wear a helmet, goggles, special protective clothing, gloves and boots.  
Chesapeake, Ohio                      WILLIAM J. SMITH

*We'll buy your argument; we're generally of the armor-plate school ourselves. (We wear shin guards to square dances.)*

### Remembering Pearl Harbor

*So You Don't Remember Pearl Harbor?* (page 84, Dec. PM) is one of the most truthful and to-the-point articles I have ever read.  
Oakland, Calif.                      WILLIAM L. MARTIN

Being a former member of the Fifth Special Forces Group and now having kin in Vietnam, I can't tell you how gratifying a story like this is to me.  
Hatboro, Pa.                      MICHAEL D. POKRINCHAK





TURN SIX AT RIVERSIDE

**SHELBY  
MUSTANG  
GT 350**

American. SCCA Class B production sports car champion in 1965 and 1966. Body style: two-door fastback. Engine: Ford overhead valve V8. Bore and stroke: 4" x 2.87". Displacement: 289 cu. in. Compression ratio: 10.5 to 1. Brake horsepower: 306 @ 6000 rpm. Torque: 329 lbs.-ft. @ 4200 rpm. Induction and exhaust: special free-breathing Shelby design. Transmission: 4-speed synchromesh. Suspension: independent coil spring, front; semielliptic leaf spring, rear. Shelby-modified for 30% less cornering roll. Brakes: disc, front; air-cooled drum, rear. Steering ratio: 16 to 1. Wheelbase: 108". Overall length: 186.6". Weight: 2723 lbs.

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speaks a  
performance  
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its own

This One



T05Y-46G-8QGF

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...the spark behind the total performance company...





BY JOHN F. PEARSON  
**SCIENCE**  
WORLDWIDE

**SMOKERS SHOULD EXERCISE.** A study of 55,000 New York City men shows that "inactive" smokers suffered 7.39 heart attacks per 1000 over an 18-month period, while smokers who exercised moderately had a rate of 5.36 per 1000. In addition, the physically active men's chances of surviving were found to be much greater. Active nonsmokers made out best of all. They suffered only 2.52 attacks per 1000.

**A CHEMICALLY HEATED BLANKET** for outdoor sleeping in extremely cold weather has been invented by an Army scientist. It contains a chemical sandwiched between two layers of plastic that reacts with air after a seal is punctured. Temperatures up to 100° F. are maintained for 8 to 12 hours. After use, the blanket can be recharged for more cozy snoozing under the stars.

**WIND-TUNNEL TESTS** of a model of the stadium to be built for the 1972 Olympics in West Germany are being carried out in an aeronautical research center in Sweden. Purpose is to make sure the proposed design will provide good conditions for discus, javelin and other events, which can be markedly affected by crosswinds and gusts.

**BIGGEST METEORITE** yet found in Australia was recently discovered in the western region of the country. It fell in two pieces, weighing roughly 6 and 12 tons, and is composed of a nickel-iron alloy. Scientists estimate that the meteorite is "probably thousands and possibly hundreds of thousands of years" old. World-wide, it is the eleventh largest discovered to date.

**HARD ROCK CAN BE CRUMBLED** with a laser beam. That capability was recently demonstrated by two students at the Massachusetts Institute of Technology. Faculty researchers think the discovery could lead to a major breakthrough in hard-rock excavation work and in boring through rock masses for future highway and rail tunnels.

**RABBITS WITH A HABIT.** Russian researchers report success in getting rabbits addicted to cigarettes, some smoking as many as nine a day. The animals wear

special masks in order to inhale the smoke.

Normally, rabbits don't like cigarettes. But once hooked, say the Soviet scientists, the animals become nervous when their weeds are late in arriving. The experiment is connected with research into the effects of smoking on breathing.

**SATURN'S TENTH MOON**, recently discovered by a French astronomer, may have been sighted by Naval Observatory scientists from a station near Flagstaff, Ariz. Confirmation couldn't be definite because observation conditions weren't good.

However, the new moon is thought to be 150 miles in diameter and orbiting the planet once every 18 hours. It is also thought to be the closest of the 10 moons, only about 50,000 miles from the big planet. At that distance, say astronomers, the satellite is in danger of being pulled apart by Saturn's powerful gravitational forces.

**GO-GO DANCERS AND EYESTRAIN.**

An unexpected occupational hazard came to light when the New Jersey Health Department was informed that a number of go-go gals complained of recurrent eye aches. The trouble was traced to ultraviolet floodlights used to produce a glowing effect on costumes. Exposure to too much ultraviolet can be harmful, the nightclub operators were told, and they corrected the problem by redirecting the lights.

**BIG SELLER IN HONG KONG**, says a Department of Agriculture scientist, is a soft drink made with a soybean extract base. Rich in protein, it beefs up a generally skimpy diet. Food experts are now trying to interest American soft-drink makers in developing similar protein beverages that might tickle palates in other nutrition-poor areas.

**SOME VERY FAT PEOPLE** are better off that way—at least psychologically. A study of 30 grossly overweight men by a Northwestern University psychiatrist revealed that they tended to use their bulk to dominate other persons, to protect themselves against working too hard, and to ward off the advances of amorous females. Slimmed down, many exhibited signs of psychic difficulty. They regained their emotional equilibrium by packing on the fat again.

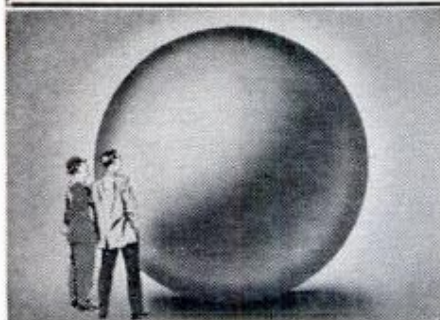


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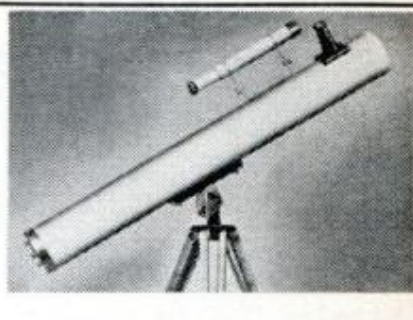
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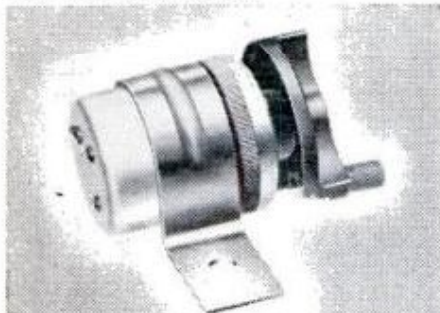
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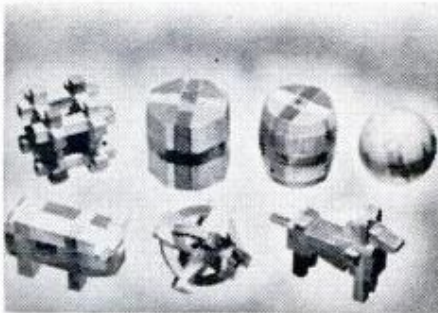
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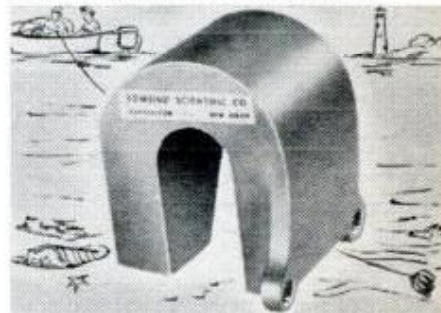
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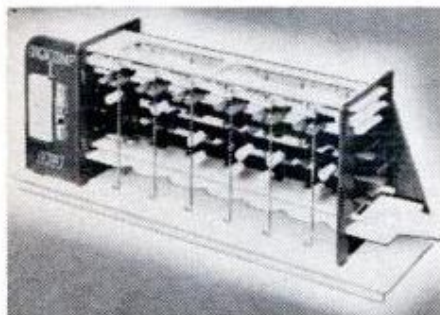
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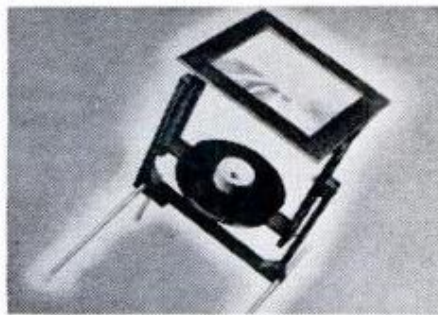
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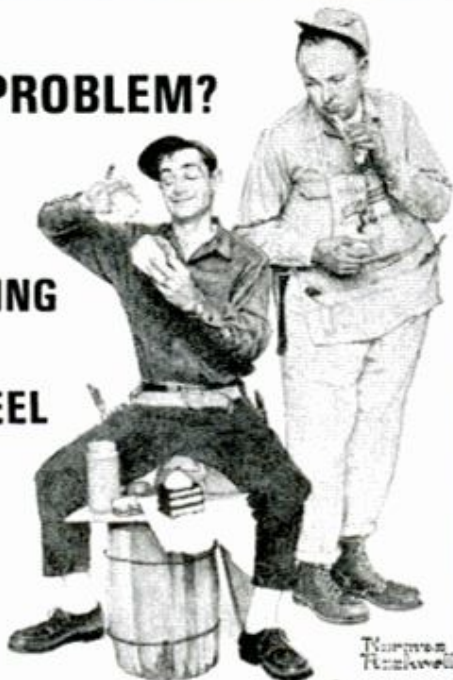
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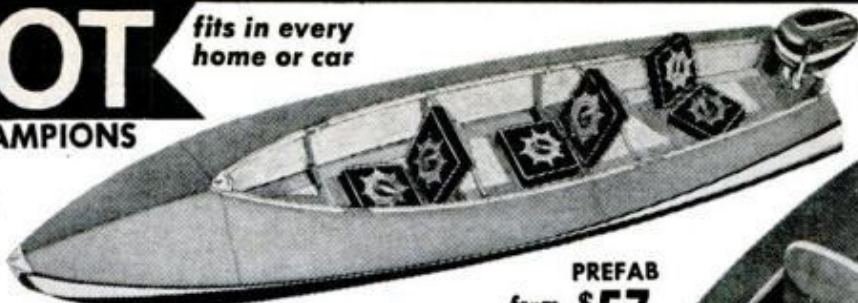
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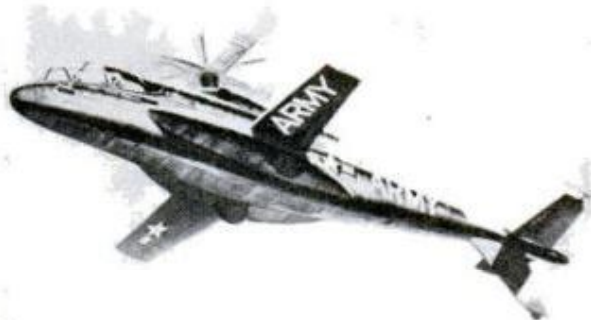


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But the simplicity of a rigid-rotor system still appealed to the designers and, recently, one such design won an Army contract for an armed helicopter for Vietnam. Basically, stronger blades and an auxiliary control gyroscope overcame the disadvantages of rigid rotors, and offered the advantages of greater stability and much greater speed. The lost motion of the hinged rotors has been translated into forward thrust.

The Army winner, the Lockheed Aphis, will do 250 mph. An ancestor, the XH-51, holds the world record of 272 mph. A Sikorsky design, using twin counter-rotating rotors, may do 350 mph.

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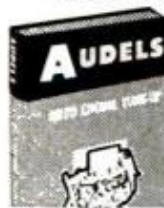
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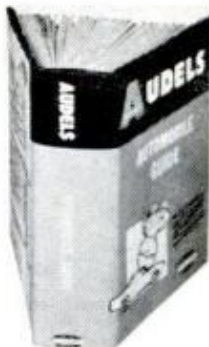
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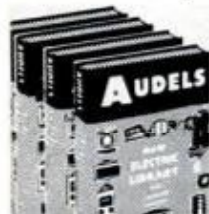
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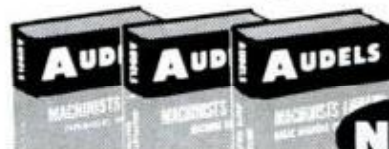
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**Q.** *How can I increase the horsepower of my 289 CID Mustang?*—George Foster, South Yarmouth, Mass.

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soon will have our Gurney-Weslake heads and engine kits available in both street and all-out competition form.

**Q.** *I read somewhere that racing fans in this country don't appreciate real driving skill, that all they want are thrills. Do you think this is true?*—Del Munsen, Passaic, N.J.

**A.** No I don't. That's the same as saying real driving skill isn't thrilling, and that's ridiculous. Of course, it's exciting to see an accident, if it isn't too bad, but I think most fans would much prefer to see a race pitting the top drivers in all-out competition than an accident.

**Q.** *Are you going to go into drag racing?*—Tommy Rivers, Encinco, Calif.

**A.** My first automotive competition was drag racing, and I've always had a soft spot for it. If I can possibly fit it into my schedule, I intend to attempt the drags again this year. More than anything I just want to get a feel for it myself even though I wouldn't expect to win. Also, I would like to see how our 289 Ford-based Gurney-Weslake engine does in drag competition.

**Q.** *Does increasing tire pressure 3 or 4 pounds above recommended pressure really make a car more stable? Doesn't it push the middle of the tread out so that the tire becomes rounded and wears unevenly?*—Mark Ryburn, Charlotte, N.C.

**A.** For some reason, car manufacturers are always recommending tire pressures that to my way of thinking are too soft. I suppose this is to give a softer ride, but it also gives you more sway. If you want to do some businesslike motoring, rather than floating down the boulevard, I think you'll find more

*(Please turn to page 24)*



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## DRIVIN' WITH DAN

*(Continued from page 22)*

stability and safety in higher tire pressures. As far as increased pressure pushing out the middle of the tread, it does, but brisk cornering with lower pressures will wear out the sidewalls. It's a compromise, and you really should adjust your pressures to suit the kind of driving you intend to do.

**Q.** *If you were buying a sports-type car equipped with high-performance V8, four-speed transmission and special handling kit, which would you pick: Mustang GT, Camaro SS, or Barracuda?—Henry La Montague Jr., Chicopee, Mass.*

**A.** It's a difficult choice. I suggest you go drive them and draw your own conclusions. I would tend to look for the best combination of light weight and performance options available. You might also keep a close eye on the Trans-American Sedan Series races this year and see how the various cars of this type stack up in competition with each other.

**Q.** *Dr. Howard A. Rusk, the famous specialist in physical medicine and rehabilitation, takes a dim view of motorcycles. He agrees that you meet the nicest people on a motorcycle, but he says they often turn out to be doctors, nurses and undertakers. I understand that you ride a motorcycle to relax. Are you scared?—Bill Mulligan, Braintree, Mass.*

**A.** 'Cycle riding is great therapy for me. I try to maintain respect for the machine. It requires 100-percent concentration. I don't enjoy falling off. However, I feel the danger is in the rider, not the motorcycle. It certainly has less a mind of its own than, for instance, a horse. But then Dr. Rusk may not be high on horses, either.

**Q.** *Would you like a chance to drive Craig Breedlove's "Spirit of America"?—Johnny Price, Salt Lake City.*

**A.** It would be a tremendous experience, but I wouldn't want to try it without a lot of study and preparation.

**Q.** *I read where a guy in Spokane bought a "street" version of the Ford GT40, the car you set the lap record with at Le Mans. How does his car differ from the racing version, what does it cost and how do you get one?—H. P. Black, Salt Lake City.*

**A.** A few street versions of the GT40 were built and are in private ownership, although I understand none are available at the moment. These cars were powered by a 289 CID street-version engine, equipped with fuel gauges, key ignition, door locks, leather upholstery, a grill and better (for street use) detailing than the racing versions. The price quoted was \$18,250. If they again become available, it would likely be through Shelby American in Los Angeles or Ford Div., Ford Motor Co., in Dearborn, Mich.

**Q.** *What kind of fuel would you recommend for stock-car races such as Darlington, Charlotte and Daytona?—George Offenburg, Auburn, N.Y.*

**A.** Unfortunately the rules limit the kind of fuel these cars are allowed to use to premium-grade pump gasoline. I think any of the large oil companies are capable of making a fuel good enough for stock-car competition, so I would hesitate to recommend any particular brand. I would suggest you look elsewhere for performance improvements, if that's what you're after.

**Q.** *What address would I use to contact someone at your All-American Racers camp?—Bryan Heineman, New York City.*

**A.** All-American Racers' headquarters is 2334 South Broadway, Santa Ana, Calif. Anglo-American racers, or our Formula I team, is located at Harbour Road, Rye, Sussex, England.

**Q.** *We are interested in a '67 Volvo station wagon. Have you had any experience with it? Is it worth \$3000? That seems like a lot for a compact-class car. Our primary concerns are safety, durability, minimum of repairs, economy, good resale. And is the Volvo here to stay?—Charles Benham, Grand Rapids, Mich.*

**A.** I am familiar with Volvos, but not with the station wagon. Don't forget that some of the \$3000 you mention is import duty. I would rate the Volvo as good on safety, high on durability. This is mostly due to their building the same car with minor changes for quite a few years, although their new "144" has real advances as PM reported in March. Economy should be about average. I can't comment on resale. That's out of my line. And, yes, in my opinion, Volvo is here to stay.



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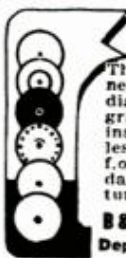
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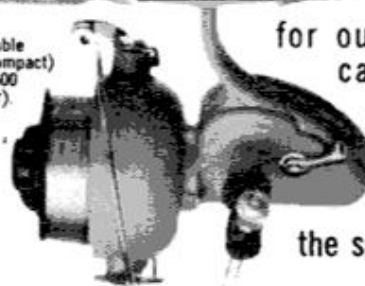
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DETROIT

# LISTENING POST

BY BOB IRVIN

**AMERICAN MOTORS CONFIRMS** it is working on a new car designed to compete in price with the well-known imports. The car is patterned after the Cavalier experimental model that uses interchangeable body panels, the idea being to reduce tooling and manufacturing costs. Slightly smaller than the present American, the car has been scheduled for a 1969 introduction. No tooling orders have been let, however, because of uncertainty over what federal auto safety standards will be required by then. If the standards are going to be changed yearly, AMC feels it couldn't build the car because the entire cost-saving concept is based on foregoing regular styling changes.

Speaking of AMC, the company finally has an entry in the so-called "supercar" field. They're offering their 280-hp V8 in the compact American sedan, which weighs about 2800 pounds. This gives the car an impressive 10-to-1 power/weight ratio, meaning it can really scoot.

**A CAR WITH CENTER DRIVE** is being studied by one of Detroit's Big Three. Steering wheel and controls are located over the transmission tunnel. This helps frontal vision, but cuts down the lateral view on the left. Solution here was to replace door sheet metal with Plexiglas, an admitted compromise arrangement. Center-drive cars have been suggested by several auto-industry critics, but this working model indicates definite limitations to the idea.

**CHRYSLER'S TURBINE-POWERED CARS** have been quietly disposed of, presumably closing out what many industry observers deemed a good (if somewhat splashy) effort. Forty of the 50 experimental passenger cars were destroyed under terms of an agreement allowing the Italian-built models to be imported duty-free as research beds for Chrysler's turbine engines. Of the remaining 10, six have been given to museums in Washington, Los Angeles, St. Louis, Detroit, Dearborn and Reno, two are being kept by Chrysler for engineering and research work, and two have been earmarked by Chrysler for "historical usage."

**MAKING CARS MORE THEFTPROOF** has Detroit designers pouring over data and drawings. Behind the effort is a marked increase in auto thefts in recent years. Not much is out yet, but one company is said to be considering a return to the old Ford system of a steering wheel lock. Ah, progress!

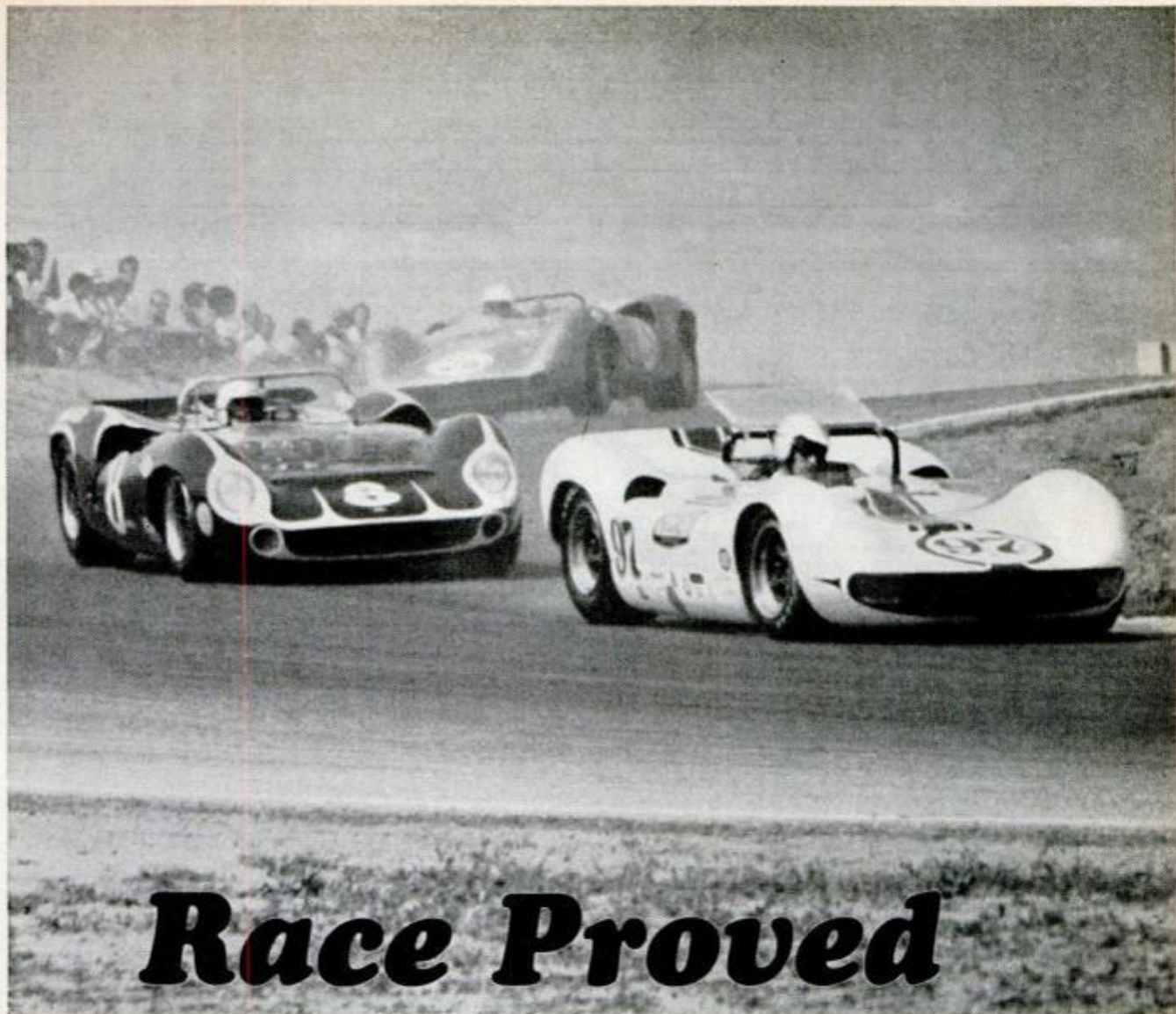
**FORD'S ROLLING MOTION DOOR LOCK** system may be in for some changes. The vacuum-operated locks are only supposed to work when the car is in motion at more than eight mph. But many owners have complained that the doors locked while their cars were going through a car wash—and with the keys inside! Again, ah, progress!

**WAYS TO IMPROVE DEALER SERVICE** are being studied by auto makers. Under special scrutiny, in view of the Federal Trade Commission's investigation of auto guarantees, are service situations covered by new-car warranties. Overnight pickup and delivery service is being tested by one company in two metropolitan areas. The idea is to make an evening pickup of a car that needs servicing, fix it while the owner sleeps, and have it back before morning.

**LASER BEAMS** as a sort of "onboard radar" system are still many years in the future, say auto engineers, many of whom spoke out in the wake of the recent big publicity splash made by both General Electric and Radio Corporation of America. The engineers claim a lot of cost-cutting and development work will have to be done before a laser

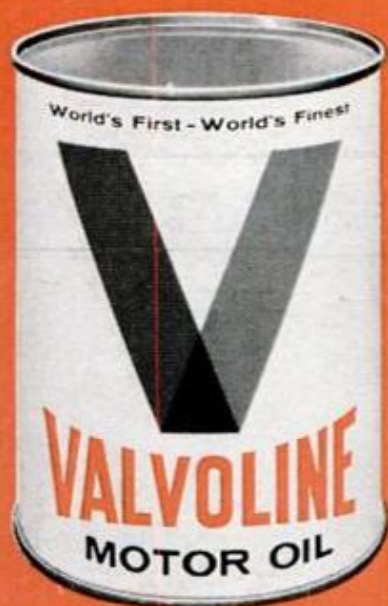
*(Please turn to page 32)*





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## DETROIT LISTENING POST

*(Continued from page 30)*

could be linked to a system to stop a car automatically if it got too close to the one in front. What's likely in the immediate future in the way of automotive electronics is the use of solid-state devices to measure cooling-system water temperature and engine-oil levels.

"I'M SORRY, SIR, but would you please get this car off the road!" a Detroit traffic cop told a Ford vice president recently. "You're not breaking the law, but you are something of a traffic hazard." Seems the exec was driving the Ford Mark III, an \$18,000 "street" version of the sports racing car that went on sale last year. The car is a real traffic-stopper, as the expressway patrol cop found out. Lincoln-Mercury's Mark X, scheduled for 1969, may be a luxury version of the same car.

A "VIDEO POD" MAST mounted on a Mustang is being studied by Ford engineers in an effort to cut down on the incidence of chain-reaction collisions and at the same time improve a driver's rear vision. The anti-collision part of the device involves installing warning lights atop a mast mounted on the Mustang's roof. When a driver hits the brakes, the lights flash red and are visible by several cars in back, thus providing what amounts to an early warning system. The "video pod" term is used because built into its base is a wide-angle rearview mirror hooked up to a periscope—the idea being a broader field of vision in an aft direction.

The pod is shaped like a delta wing, has the warning red lights on its trailing edge and a white running light mounted across the leading edge to advise other drivers of the car's approach. The entire scheme is strictly experimental, not planned for immediate production.

One idea—a rear view periscope—had to be abandoned because of mast vibration.



**HIGH SPEED, HIGH PRICE** sum up the latest from Pininfarina. Dino fastback reportedly does over 150 mph, but there's no word on f.o.b. anywhere, U.S.A.



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Yet hundreds are quietly developing a second source of income—an extra income right now for their spare hours; and a business that can be quickly expanded if it were ever necessary to look to it for complete support.

These "little" home businesses are little only in the sense that they require little capital to start and run, and they require little time on the part of the owner. The margins of profit in some of them are so fantastic as to be almost unbelievable—far greater than those usually enjoyed by big investment manufacturing.

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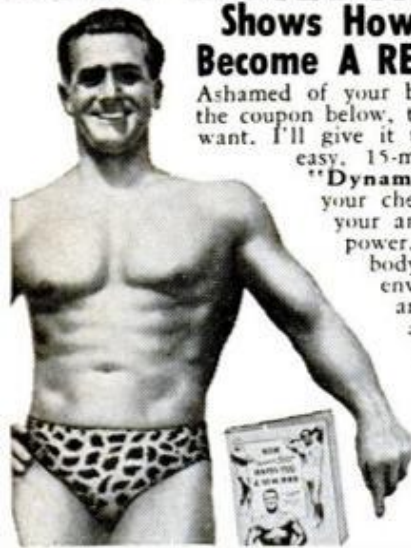
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# SOLUTIONS FOR MECHANICAL HEADACHES

# AUTOMOBILE CLINIC

BY MORT SCHULTZ

## Melody in oil

*My 1965 Chevy Chevelle is singing a new song: "Drip On, Drip On—No Hope In My Heart." The reason is a persistent oil leak from the rear of the engine. The rear main bearing seal, pan and valve cover gaskets have been replaced twice. Any suggestions to add to this torch song?—Warren Lucas, Indian Head, Md.*

Here's a chorus to try: Take it back to the Chevy shop and this time have them play a tune on the bearing clearance. Make sure the bearing isn't too loose. Nothing will knock the bejeepers out of a seal faster than sloppy bearings.

## Button, button . . .

*Oh, ancient philosopher, please philosophize on this one which no one's solved. It's that gearshift selector button atop the ball of the automatic shift lever in the center console of my '63 F-85 Olds Cutlass. It sticks down, especially when the selector is moved to Park or Reverse position. The selector has been apart three times, and the trouble doesn't lie in the spring unit. So where, pray tell, does it lie?—L. D. Eaton, St. Louis, Mo.*

The cause could be the manual rod which has gone out of adjustment, a sticking or binding neutral safety switch, a worn button, or a detent spring that has lost tension. I'm assuming, of course, that the linkage already has been cleaned and lubricated.

## Pulsing Beetle brakes

*When making a slow or fast stop with my 1966 Volkswagen, I get an occasional heavy pulsation through the brake pedal. The VW dealer has tried everything, including new drums, and any and all types of linings. He'd really like to get us straightened out, but he's at a dead end. Help show us the way.—John Mariola, Akron, Ohio*

Here's the word straight from VW on this one: That pulsating is basically what is called terminal velocity. It comes on from about 10 mph on down, and the trouble usually happens when a drum or drums go out of round.

What causes the out-of-roundness?

There are a couple of theories. One says that it will go out of round when the handbrake is set with the drum hot. Another is that it occurs when you splash through a puddle with the drum hot.

VW states that this has no effect on braking action and you shouldn't worry about it. One thing that might help relieve the pulsating when it happens again is to rotate your wheels two screws and then torque the bolts up with a torque wrench to exact specification.

## A bad sport

*I can't believe the automatic transmission is to blame, because my '65 Plymouth Sport Fury is relatively new. But sometimes it doesn't want to shift into third, and at the same time it winds up to 25 mph before it shifts into second. It happens most often when I go over railroad crossings or a bumpy road. The garage couldn't do a thing for me. Can you?—Anthony Szelpal, Champaign, Ill.*

I hope so. I see several ordinary reasons for the trouble and one extraordinary one:

1. Maybe the control cable needs adjusting, oil level is down, oil filter is plugged up or throttle linkage needs attention.

2. It could have happened that a stone or dirt or some other object got stuck around the throttle arm of the transmission. It may have fallen into the right position, got wedged there and now prevents correct shifting.

## A hot cat

*My 1966 Sunbeam Tiger overheats when the temperature goes over 80° F. I've tried running with and without the thermostat. No dice—this kitten really gets hot. Any suggestions?—Luke Gloutney, Montreal, Canada*

Put the thermostat back where it belongs and get in touch with a Chrysler-Rootes dealer. The problem is a relatively large engine having little room beneath the hood. Hot running is characteristic of the vehicle. A solution, however, is to have the expansion tank enlarged by a radiator shop. This will give the car more cooling. Since the car's still under war-

*(Please turn to page 42)*



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## AUTOMOBILE CLINIC

*(Continued from page 38)*

ranty, the dealer is responsible. But once the job's done, this Tiger should go like a cool cat.

### A belt in the midsection

*One of these days, my T-Bird with air conditioning is going to flap away because of a loose belt. When the engine reaches around 25 to 30 mph, the belt that runs the compressor starts to flap wildly and makes a loud noise. Tightening the belt helps some, but doesn't stop the flexing or noise. I've tried new belts—no help. The trouble existed from the day I got this otherwise fine car.—E. Crabbill, Hammond, Ind.*

You don't have to worry about the car flapping away. It won't happen, but you will have to put up with the flexing and noise, I'm afraid. These cars were all that way until 1965 when an idler pulley was added. That's a long belt and it flaps. The only suggestion I can offer is to keep it as tight as possible.

### A change for the worse

*Catch this one, Mort. My '65 F-85 Olds was running great until I had the front*

*end properly aligned. At 5000 miles, the front tires started showing heavy wear on the inside. Since then, a light drumming sound can be heard. There's also a light vibration through the steering wheel and gas pedal. The dealer has rechecked the front end, wheel bearings, brake shoes, etc. Is it possible that proper wheel alignment has caused a change for the worse in a quiet and smooth-running car?—E. L. Barent, Natrona Heights, Pa.*

It's possible that those worn tires, coupled with a proper alignment, are causing the trouble. If the inside edges of the tires have worn to a sawtooth edge, the alignment may now be causing the tires to ride up on those treads. This could cause the noise and other nonsense. Here's a suggestion: switch the tires and see what happens.

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**Note:** The great reader response to Auto Clinic has resulted in a considerable backlog of letters. However, the recent introduction of a new, faster method for handling this mail will soon help speed back the answers to your inquiries. In the meantime, please be patient. Your letter is being researched and will be answered at the earliest possible date. Thanks for your patience.

---

## Service Tips

- **OWNERS OF 1965 OLDSMOBILES WITH TURBO HYDRA-MATIC** may be having a transmission problem. If you have oil blowing out the breather and don't know why, chances are you had a *Jetaway* dipstick inadvertently put into the car at assembly. This dipstick is about 3¾" shorter than the **Turbo Hydra-Matic** dipstick. When installed in the car with **Turbo Hydra-Matic**, with oil at the "add" mark, the transmission is about three quarts over full. This will cause the blow-off. So, replace with the correct stick (part No. 386328) and drain excess oil from the transmission.
- **1966 DODGE DART OWNERS** with 273 engines and four-barrel carburetors can get something new. A new sparkplug has been developed and released for this high-performance engine. It's a Champion, N10Y, which supersedes the N9Y that went into the car when it was first produced. Gives better performance, you know, so why not jog down to your Dodge dealer and pick 'em up.
- **IF YOUR 1966, 6-CYLINDER PLYMOUTH'S OIL PRESSURE INDICATOR LIGHT** is giving you fits by staying on too long or indefinitely, indicating a loss of oil pressure, you can now fix it. The problem's been traced to the oil filter standpipe valve. If it sticks in the closed position, you'll have a complete loss of oil pressure. If it sticks in the closed position, the oil-pressure light will stay on longer than normal when the engine is started after standing overnight. The problem requires replacement of the standpipe assembly (part No. 2402607).

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Each month Auto Clinic answers questions on car repair. For a personal reply, send 50 cents in coin to cover mailing and handling. Write Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. One question per letter, please.

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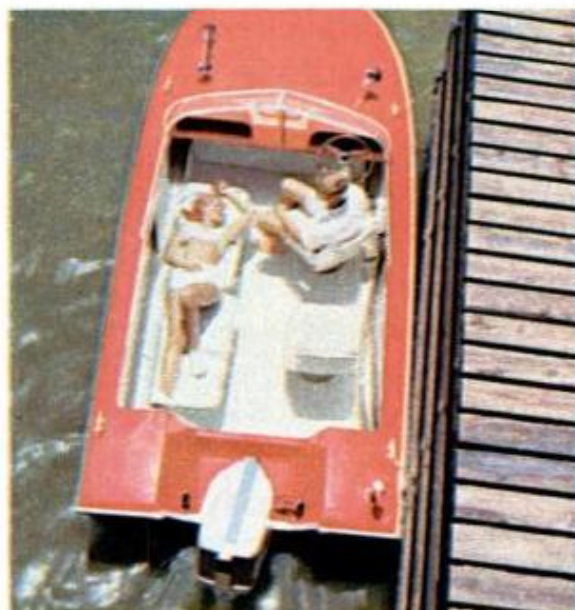
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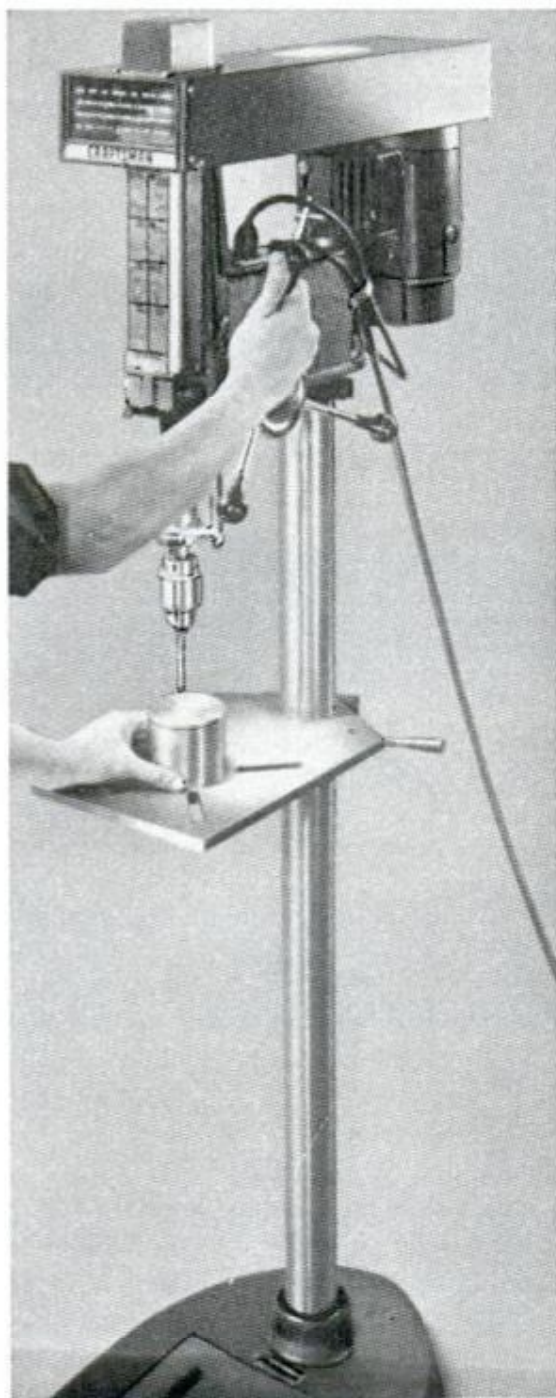
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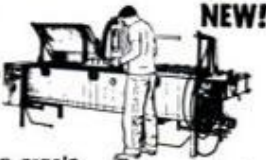
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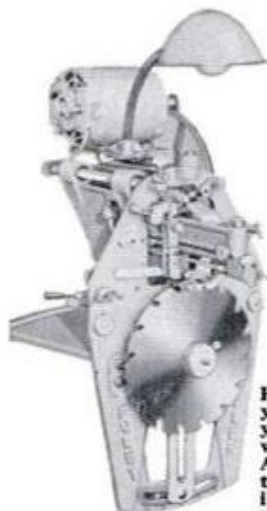
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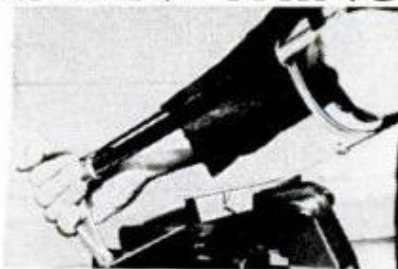


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**FREE** "Franchise Profit Letter" tells how unique NFR service is helping thousands seeking profitable businesses. Write today. National Franchise Reports, W-528, 333 North Michigan, Chicago 60601.

**OPERATE** Home mailorder business. Voicec Printing, 4444AI Ute, San Diego, Calif. 92117.

**PIANO** Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. GI Approved. Information free. Empire School of Piano Tuning, Box 327, Shenandoah Station, Miami, Florida 33145.

**EARN** Big money invisibly reweaving damaged garments at home. Free information. Eastern Reweaving, PM-72, Main, Hempstead, New York 11551.

**START** Own Import-Mailorder Business with \$10. DonKar, 1914A La Cana, Hacienda Heights, Calif. 91745.

**HUGE** Profits! Mail order importing. Free information. ITIS-PM-2, Box 454, Hollywood, Calif. 90028.

**BOOKKEEPERS** Earn \$1000.00 month. Operate simplified Bookkeeping tax service. Universal, Box 664-M, Springfield, Missouri.

**DOLLS!** DOLLS! You learn to make, repair, dress and sell dolls. Study at home. Fascinating hobby, profitable business. Certificate awarded. FREE booklet. Doll Hospital School, Dept. A-113, 2251 Barry Avenue, Los Angeles, California 90064.

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**SELL** Advertising book matches. Write us today; we put you in business by return mail, handling complete line ad book matches in demand by every business right in your town! No investment; everything furnished free! Top commissions daily! Superior Match, Dept. MX-367, 7530 S. Greenwood, Chicago 19, Ill. 60619.

**COPUBLISH** "Mail Sale Advertiser," leading mailorder paper. Copy and details 25¢. Vanroy Shirk, Lebanon, Pa. 17042.

**BAKE** New greaseless doughnuts in kitchen. Stores buy output. Start spare time. Profit 29¢ dozen. Small appliance. Free recipes. Montgomery Ray, Waseca, Minnesota 56093.

**RAISE** Rabbits for us on \$500 month plan. Free details. White's Rabbitry, Mt. Vernon, Ohio 43050.

**READ** Progressive Mailtrade, the magazine that tells how to make money by mail. Quarter brings sample and special offer. Mailtrade, P.O. Box 357, Sheboygan, Wis. 53082.

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**MAILORDER** Catalogs. No inventory required. Discounts 40% up, postpaid. Send 25¢ for 32 page sample catalog, featuring 150 unusual, fast-moving products and complete details. Satisfaction guaranteed. Gaylords, North Adams 7, Mass.

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**BIG MONEY MAKER!** Custom Furniture Upholstery plus Auto Trim, Slip Covers, Drapes. Tremendous spare-full time earnings. Men, women, all ages. No experience required. We furnish everything! Easy Home Instruction, Tools, Supplies to build roomful of beautiful furniture yours to keep-sell! Send for Big FREE Illustrated Book, Modern Upholstery Institute, Box 899-JX, Orange, Calif. 92669.

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**BURGLAR** Alarm Profits! Free manual. Alarms, Box 99, Uleta, Florida 33164.

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LEARN SPEEDOMETER Repair. Make good money. Instrument School, Box 5319, Tulsa 4, Okla.

WORLD'S Largest wholesale supply. Buy from 8753 American, European, Japanese wholesalers. Hongkong clothes, 123 dropship catalogues, Rockbottom prices, Automobiles. Free details. International Buyers, 216-MM West Jackson, Chicago, Illinois 60606.

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COMPLETE Mail order facts, \$2.00. E. White, 179 E. Norman Ln., PMI, Wheeling, Illinois 60090.

MORTGAGE Brokerage. Profitable! Free facts. CMC, Box 99, Uleta, Florida 33164.

BIG Profit! Learn salvage yard business. Box 806, Mason City, Iowa 50401.

SENSATIONAL "Talking Labels." Mail-order dealers wanted. Samples absolutely free. Neil H. Tasker, Shamokin, Pennsylvania 17872.

GUARD Your Checks—"Complete Bank Kit" \$1.00. Goodall, 68-N Joost, San Francisco 94131.

GET Into Own "Instruction Manuscript" mailorder business! New concept copy, resell service! Fantastic Profits!! Garen's, Huron, Ohio 44839.

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MAKE Money from old tires. Operators clearing \$600 weekly. Equipment costs \$1000. Get facts. S & S Patents, Inc., 3911 N. Damon, Chicago 60618.

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GIANT Mail, Folio, magazines, opportunities, merchandise, 35¢. Daufeldt, Atalissa, Iowa 52720.

HOW To make money in Mail Order Imports. Fabulous new method. Send \$1.00. Frymer, 383 Grand Street, New York N.Y. 10002.

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PAINT Signs without brush. County territories. Big Eye Industries, 120 Fourth, Monon, Indiana 47959.

MAKE \$46 from square foot plywood: jig saw or bandsaw necessary. Free details. Woodar, Bridgewater, Mass. 02324.

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FORTUNES Unlimited! Free booklet gives 12 rules for financial success. Lincoln Service, Dept. Y, Pekin, Illinois

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HOW To Make money writing short paragraphs. Information free. Barrett, Dept. C-27-N1, 6216 N. Clark, Chicago 60626.

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-CM, Chicago 60610.

AMAZING Successes through franchises! Become exclusive franchise holder in your territory. Information rushed. National Franchise Reports, WP-528, 333 North Michigan, Chicago 60601.

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INDEPENDENCE—New Sales Program. Details \$2.00. Cecil, 4781-A Northeast 27 Ave., Ft. Lauderdale, Fla. 33308.

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ZIP - CODE DIRECTORIES (Certified) and Postpaid \$1.00. DIRECTORIES, Box 708-M, Brownsville, Texas 78520.

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BIG Money from paper scraps. Jackson, Box 7149, Oakland, California 94061.

CHIP Newspaper items, \$2.00 each. Details free. Lily, 42 Davidsons, Hinesville, Ga. 31313.

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**BIG Money** raising fishworms and crickets. Free literature. Carter Wormery, Plains, Georgia 31780.

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**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-CA, Chicago 60610.

**WANT TO MAKE UP TO \$100 A WEEK** spare time, and get free shoes for life, too? No investment. Rush card for free details. **MASON SHOES**, K-572, Chippewa Falls, Wisc. 54729.

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MARCH 1967

Материал, защищенный авторским правом 69



# WHAT'S NEW **OUTDOORS** BY DAN FALES

**ODDEST MAIL-ORDER CATALOG** I've received is from L. N. Wight, Bolsters Mills, Me. He specializes in falconry equipment and some of his items left me guessing. I don't know what a nine-inch Jesse is, but I'm sure that a falconer requires two of them because they sell in pairs for 35 cents. I can't imagine what an imping needle is for. Wight's appended note—"I now offer a trap to use on either large or small hawks, sparrow hawks, by adding a small mouse cage to put inside trap to keep mice from chewing the nylon loops"—tells quite a bit about how one goes about trapping a hawk. But remember some hawks are protected by law. He offers a pamphlet on how to catch and train hawks and falcons for \$1.50.

**MANY OUTDOORSMEN** railed against this column when it supported the \$7 annual use fee for federal recreation areas. But now, a year and a half later, the program has proven a great success and is a major factor in a long-range program for the acquisition and development of recreation areas.

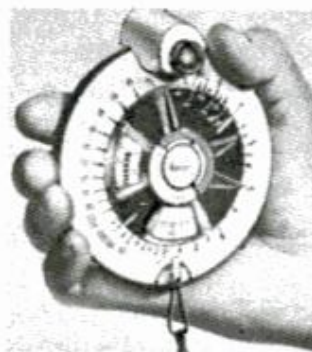
A recent report from the Bureau of Outdoor Recreation shows that together with receipts from motorboat fuel taxes and the sale of surplus federal real property, the use fees have made \$109,828,000 available for state needs on a dollar-for-dollar matching basis and \$44,738,000 to acquire new lands for national forests, national parks and national wildlife refuges. There are 240 state projects underway, and an additional 132 have been approved. The Forest Service purchased 158,800 acres of recreation land and the National Park Service bought 91,600 acres.

**LOVE POTION** for fish is being marketed by Torrence Aldred of Charlotte, N.C. Contained in a small plastic tube that attaches to a fishing line just above the hook, the potion is a mixture of saps from herbs native to Iran and Afghanistan, a recipe Aldred got from his granddaddy many years ago and has been using with personal success all his life. This piscatorial aphrodisiac is released into the water through tiny holes in the container. According to Aldred, when a fish gets a whiff of this stuff he says, WOW! (which, incidentally, is the name of the product), and flings himself onto the hook. Just in

case you don't believe all of this, you can get the story direct from Aldred at T & G Industries, Box 1294, Charlotte, N.C.

**TRAILER CAMPERS**, who are still grumbling about crowded campgrounds all over the country and are making their plans for next season, might want to consider a tour of western ghost towns. This can be fun. A friend remembers two years ago when he was touring the Western states with a Land Rover, an Apache tent trailer and his two kids. He pulled into a ghost town in southern Nevada about 11:00 p.m., and opened the camper right in the middle of the main street. He didn't get much sleep because the kids would bolt upright about every half hour and ask, "What was that?" But it was fun. For \$1 you can get a ghost-town directory listing 340 sites in 10 states from Pierce Publishing Co., Box 5221, Abilene, Tex.

**WEEKEND SAILORS**, golfers and hunters can all find a use for the Ordco range finder, a navigational aid conceived by Dr. Luis Alvarez, inventor of the ground approach system to land aircraft in thick weather. Just four inches in diameter and weighing less than five ounces, the hand-held Ordco measures



distance to any-size object in yards, statute miles or nautical miles. It is priced at \$18.50 from Davis Instruments Corp., Box 1543, Oakland, Calif.

**IT'S AMAZING**, but few people understand that hunters and fishermen, alone, have paid for the protection, preservation and development of wildlife. Fish and game departments, which manage all wildlife in the 50 states, are almost totally financed by the sale of hunting and fishing licenses. Anything that affects sales, affects department operations and, in turn, wildlife. Many people are surprised to learn that wildlife enjoyed by the nonsporting public is a direct result of sportsmen's money, not public tax funds.



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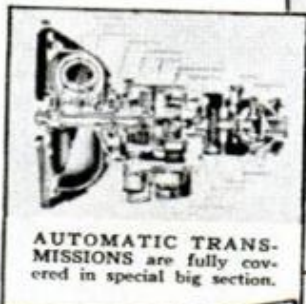
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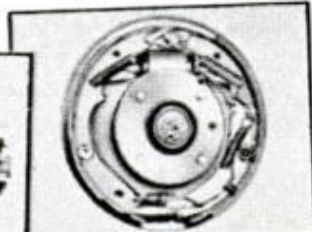
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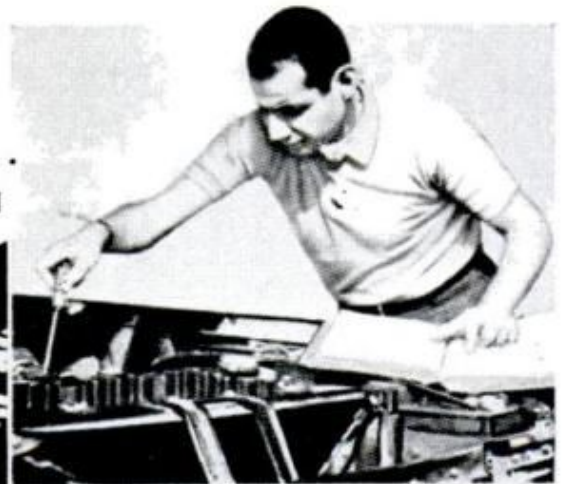


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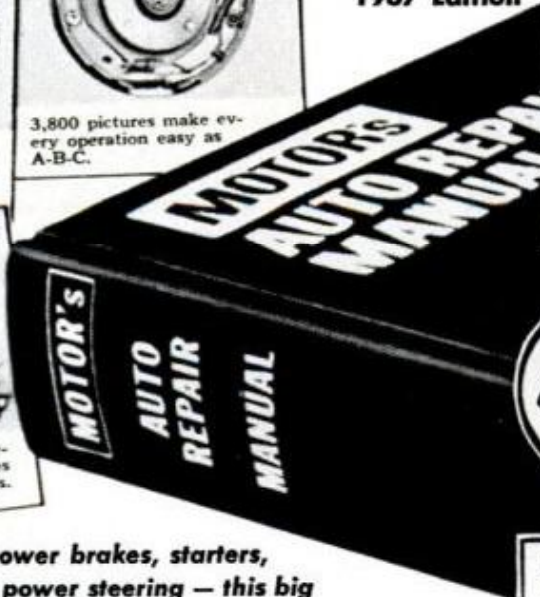


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# Chevrolet warrants all its high-performance engines for 5 years or 50,000 miles.

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We trust every engine we build. That's why we give our high-performance jobs the same 5-year 50,000-mile power train warranty we offer on all our other engines. Here it is:

*Chevrolet . . . warrants the power train components specifically described as the cylinder block and head and all internal engine parts, intake manifold, transmission case and all internal parts, torque converter, propeller shaft and universal joints, differential, axle shafts and rear wheel bearings on any such Vehicle, manufactured or supplied by it to be free from defects in material and workmanship under normal use and service for 5 years or until it has been driven for 50,000 miles after such delivery, whichever occurs first.*

*As an express condition of this warranty, once every 6 months the owner is required to furnish an authorized Chevrolet Dealer evidence that the engine oil, oil filter, carburetor air filter, and positive crankcase ventilator valve (and*

*automatic transmission oil and transmission band if so equipped) have been serviced in accordance with Chevrolet's required maintenance schedule as stated in the applicable Chevrolet Owner Protection Plan booklet, and have the Dealer certify in such booklet (1) that he has received such evidence, and (2) the then current indicated mileage on the odometer.*

*Chevrolet's obligation under this warranty is limited to repairing or replacing any part or parts which are returned to an authorized Chevrolet Dealer at such Dealer's place of business and which examination shall disclose to Chevrolet's reasonable satisfaction to have been thus defective. The repair or replacement of defective parts under this warranty will be made by such Dealer without charge for parts and labor.*

*The provisions of this warranty shall not apply to any Vehicle which has been subject to misuse, negligence, alteration or accident, or which shall have been repaired outside of an authorized Chevrolet Dealer's place of business in any way so as, in the reasonable judgment of Chevrolet, to affect adversely its performance and reliability, nor to normal maintenance services (such as engine tune-up, fuel system cleaning, carbon or sludge removal, brake and clutch adjustments and wheel alignment and balancing) and the replacement of service items (such as spark plugs, ignition points, positive crankcase ventilator valves, filters and brake and clutch lining) made in connection with such services, nor to normal deterioration of soft trim and appearance items due to wear and exposure.*

*This warranty is expressly in lieu of any other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose, and of any other obligations or liability on the part of Chevrolet, and Chevrolet neither assumes nor authorizes any other person to assume for it any other liability in connection with such Vehicle.*

**Enough said.**





# HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

## Plotting a garden

*I want to plot a small garden in a sunny place in my lawn, about 8x20 ft. Problem is how to lift the sod and what to do with it. I'll need spare moments of several days just to lift the sod. How can I keep it alive for that length of time? And how do I "replant" it? Please outline a procedure to get me started right.—I.E., Ohio.*

Your query about how to keep the sod "alive" would indicate that you have a place, or places, for it in your lawn. If so, the first step is to outline the size of the plot, using the garden hose, a length of rope or anything similar which is suitable. Then cut down along the hose or rope with a spade to a depth of 3 in. or so. Next, cut the sod into squares of a foot or less within the area, cutting straight down to a depth of 3 in. or more. Lift the squares with a shovel—the edge being sharpened so that it cuts cleanly—then stack them and dampen with the hose.

Replant the squares in any bare, or near bare, areas in the lawn by excavating to the depth of the squares and placing each square in the depression, pressing down firmly. Keep the replants wetted with the hose. Fill the excavation of the garden plot with black earth a little over full and then spade the area to a depth of 8-10 in., mixing in peat moss, sheep manure and a small amount of a complete commercial fertilizer in, say, a 5-10-20 proportion. Wet the newly spaded area to settle the soil. When dry, rake well to pulverize the soil, then plant whatever is desired in vegetables or flowers.

## Picket-fence headache

*I have a picket fence to paint, both sides. There are 184 pickets, each 2½ in. wide and spaced about 2¾ in. apart. Although my good neighbors have granted me permission to work on their side, I'd like to do the job from my side to avoid their flowerbeds and shrubbery along the fence. Can you suggest a method for doing this?—G.H., Va.*

It's going to take some doing. You'll have to do the job by stages. You can work with a long-handled roller, but you can't reach the lower ends of the pickets

or lower edges of the horizontal supports. It's important that these parts be painted also. Probably the best way is to remove every other picket. This will enable you to reach through between the remaining pickets, paint the back face of each one full length, and also reach the lower edges of the horizontals.

Putty the nail holes, paint the back face of each of the pickets removed, then drill two new holes for screws in each. Replace removed pickets as you go but leave the screws loose, so there is a little space between the painted back faces and horizontals to permit the paint to dry. Use aluminum screws or sheet-metal screws with binder heads. When you paint the face (your side) of the removed pickets, paint the screw heads also.

## Removing ceiling tile

*I need to remove two tiles from a ceiling and replace them with new ones. How do I get the old ones out and install the new?—C.N., Utah*

If the tiles are bradded to furring strips and not cemented, first locate the strips by pressing a pin or tapping a small nail through the tile along the edges. Once the strips have been located, sharpen a blade of your pocketknife to as near a razor edge as possible and cut along adjacent edges of the tiles to be removed, cutting the tongues between the furring strips. Then cut through the tiles at the center and pull the halves out. Be especially careful not to damage the edges of the tile remaining.

To replace with new tiles, remove cut tongues of the old, cut off one tongue of each new one and slip in place over a bead or spots of cement placed on the furring strips. If you finish with slight openings showing between the new tiles and those adjacent, fill with Spackle, scraping any excess out of the V-joints to conceal the replacement.

## Cabinet-door bumpers

*My metal kitchen cabinets are quite old and the rubber door bumpers have long since deteriorated. New ones are no longer available, it seems. Are there any substitutes?—N.D., Kans.*

A number of small squares cut from electrician's plastic tape and "stacked" one atop the other might do it, or perhaps better, cut round discs from ⅛-in. sheet cork and stick these in place with household cement. You can cut neat discs from sheet cork by using a short length of very thin walled tubing as a round cutter.



# New GRAVELY Convertible Tractor makes tough jobs easy...simple jobs a pleasure!

Here's the power partner you've always wanted . . . the Gravelly Convertible that gives you the best of *both worlds*. Now you sit back and ride through those big lawn areas . . . in command all the way. Your all-gear, no-belt drive gives you instant control, and that new Gravelly engine gives you power to spare. Four speeds forward, four reverse . . . without clutching. Safe, comfortable, almost indestructible!

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**Four-season performance...** with your choice from 39 attachments that give you power to mow, plow, blow snow, haul or do any other lawn and garden job — better! For as low as \$27.07 a month\*, you can own the new Gravelly Convertible with 40" mower! See your Gravelly dealer for exact price in your area. Send for our FREE CATALOG. Write now: Gravelly, 5703 Gravelly Lane, Dunbar, W. Va. 25064.

*\*After minimum down payment*

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**Studebaker**  
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**The newest in compact tractors  
from the oldest compact tractor  
manufacturer—1917-1967**



COMMERCIAL-10



CONVERTIBLE

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**Walking  
Versatility**

**Riding  
Convenience**





## Look what we did for an encore!

Among boats, Sea-Foil® Reveler was last year's favorite blonde. Now our 16-foot golden girl is an even bigger show-stopper. We gave her a rakish new reverse-curve windshield that matches the sweep of her deck . . . folds down flat for full-breeze riding . . . banishes glare with



Shock absorbing Sea-Foil hull is smooth and stable over chop, through fast turns, across wakes. Smooth all the way, no huge after-wave to annoy others.

new Sunscreen™ tinted safety glass. We raised the sides to give Reveler the prettiest profile in boating while improving passenger comfort and safety. We improved the contour seats to give you firm, easy-riding support. So go ahead and applaud! Catch Reveler's act at your Johnson Boats Dealer. Power choices include a 155-hp V-6 and a 120-hp straight 4. See the 200-hp 19'1" Surfer and the 90-hp 14'9" Caprice too. Write for free catalog — Johnson Motors, Waukegan, Illinois 60085, Dept. PM-B2.

**Johnson** 

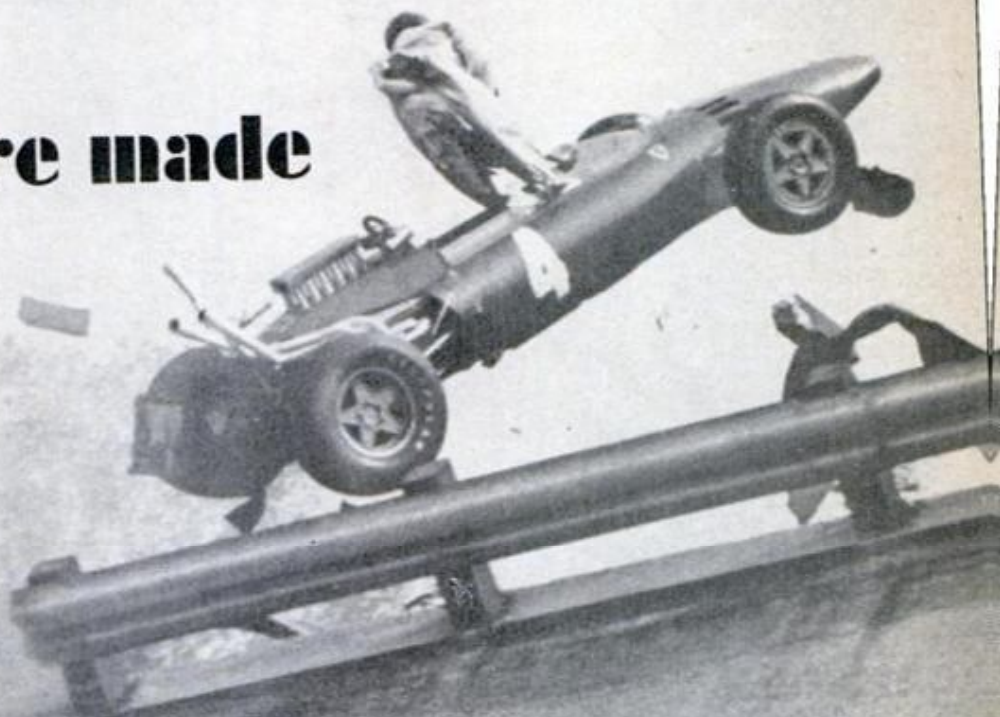
*First in dependability • Sea-Foil boats, Sea-Horse motors, Air-Buoy skin-diving gear, Skee-Horse snowmobiles • Division Outboard Marine Corporation*



# those great pictures in 'Grand Prix' —how they were made

by RICHARD  
DEMPEWOLFF

**REALISM** is the word in "Grand Prix." To get this shot, the F-1 car was fired by an air cannon at 120 mph. Driver is a dummy



*Cars shot from cannon, cameras mounted in helmets—these and other far-out film feats helped ingenious Johnny Stephens shoot the most exciting racing scenes ever photographed*

**D**ICING and jockeying for position, half a dozen three-liter Formula 1 bullets chorused a downshifting whine as they poured into the curve at "La Source," on Belgium's grand prix course at Spa. When they roared up the hill beyond, something was wrong with the music. The off-key member wasn't hard to spot. It was right in the middle of the cluster, gaining on the whole bunch. It looked like an inverted bathtub on wheels, sprouting antennas like cattails in a swamp, and bristling with odd-shaped gear on pipe-mounted platforms fore,

aft and even on the sides. Underneath all the plumbing was a Ford 350 GT, going like the hammers.

To add to the confusion, the chug of helicopter fans intruded on the acoustics as a jet chopper moved in over the maneuvering cars at helmet-top level—doing about 110 mph. The chopper's whole side had been removed. Sitting in the gaping hole was a man, legs dangling over the side, wearing earphones, a pair of mikes and holding a movie camera that sported a lens about the size of a bazooka. He talked into one mike and

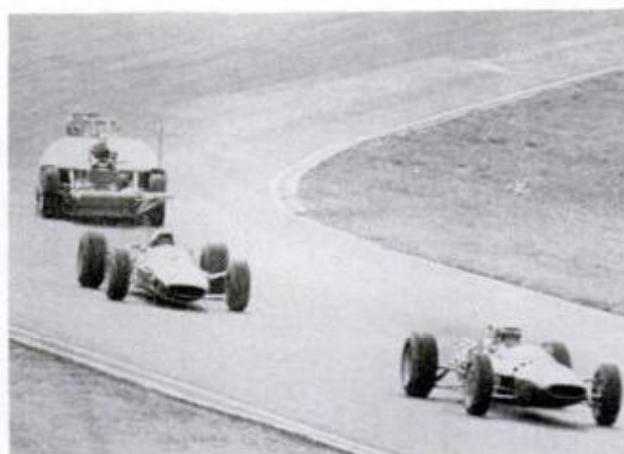


then the other, operating his camera meanwhile.

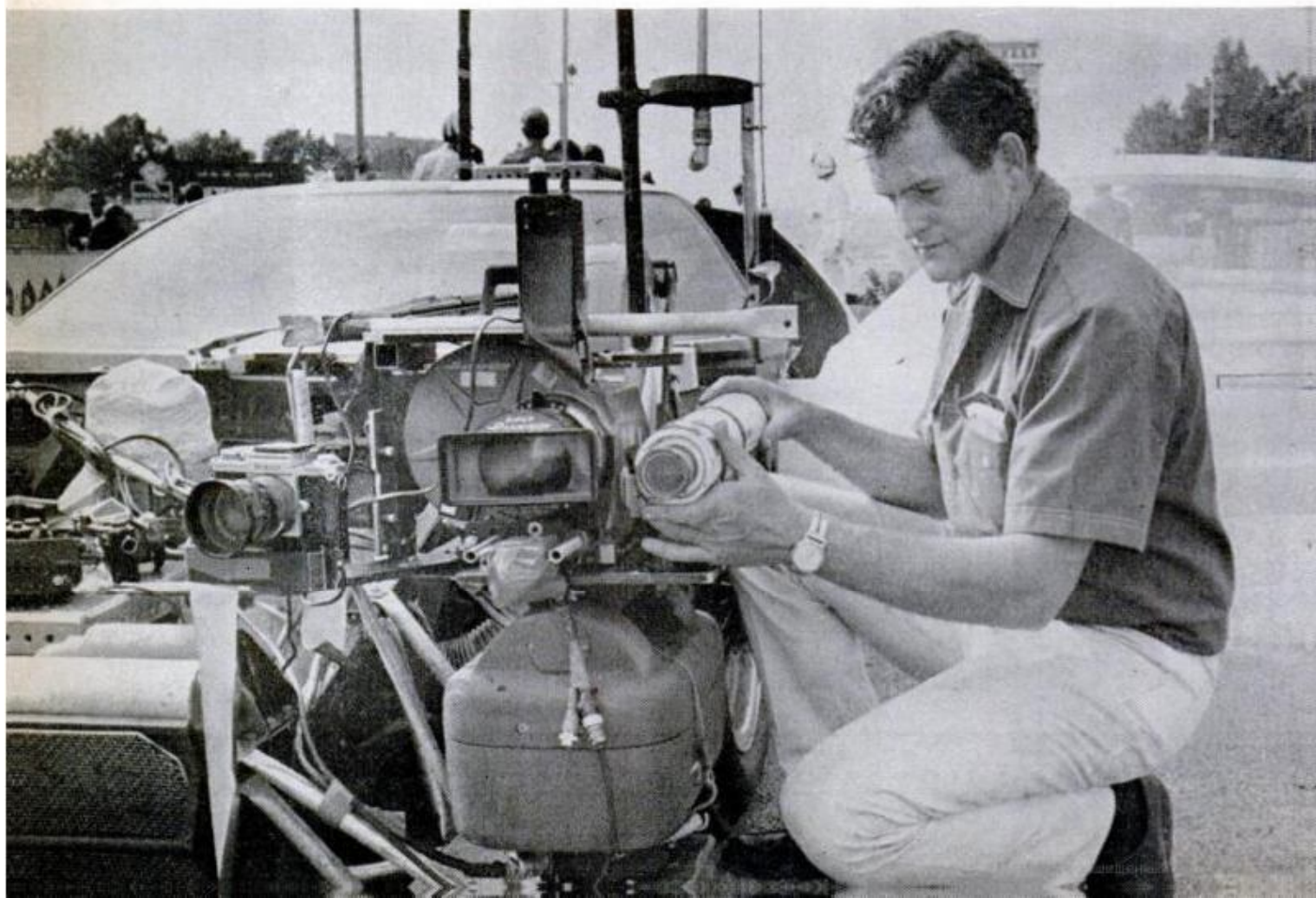
The man was John Stephens, 31-year-old electronic-camera operator for MGM's *Grand Prix* production company. The whole wild scene was typical of what happened last summer all over the grand prix circuits, when Stephens and Director John Frankenheimer put their heads together to devise a brand-new way to photograph grand prix cars in action.

The result puts every viewer behind

the wheel of a Formula 1 powerhouse, roaring along at speeds up to 140 mph. The noise is in your ears. Camera eyes are driver eyes—your eyes—watching exhaust stacks dead ahead, wheels spinning alongside at eye level, instrument needles swinging through rpms. You see your own hand on the shift stick, your own foot hitting the clutch and playing the brake pedal entering corners. You see road and wildly dodging cars whirl around you in spin-outs. You even ride the cockpit of a car



**BRISTLING FORD GT CAMERA CAR** boasted five radio-controlled camera mounts, TV remote monitor plus three-way radio. Below, Johnny Stephens loads forward side mount; above left, he mans cockpit. Above right, his rig chases Garner and Bedford as they dice for lead. Forward camera will pan broadside as he moves up





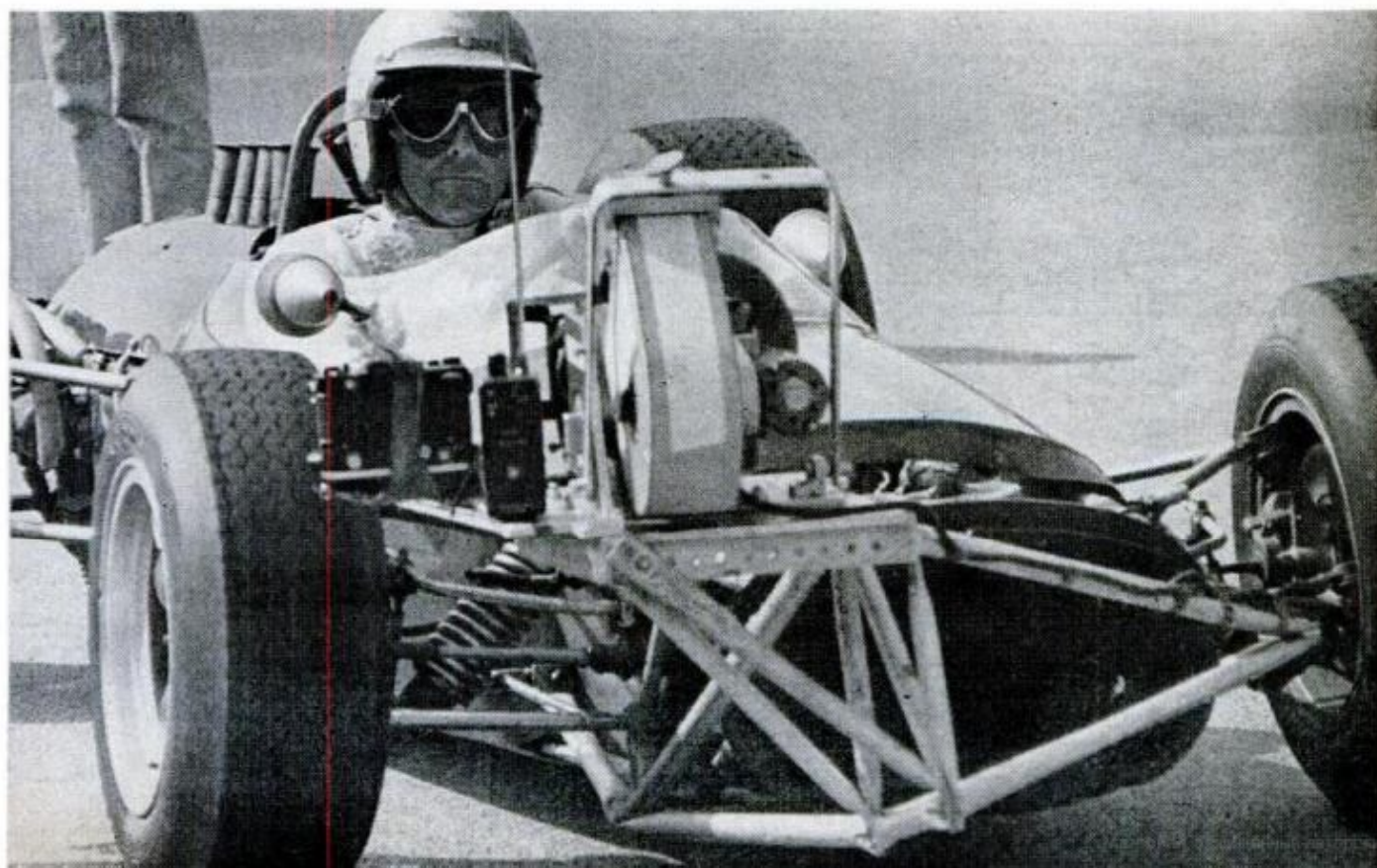
through the hay bales to disaster. And those are only samples of the vicarious thrills.

It began two years ago when Frankenheimer was invited to a grand prix race in Italy. The young director promptly decided that the high-speed excitement should be documented in a film story for posterity. But it had to be a totally realistic movie—no phony “process” shots or stunt doubles. The four leading actors chosen for the picture—James Garner, Yves Montand, Brian Bedford and Antonio Sabato—were sent to Carroll Shelby’s race driving school in Riverside, Calif., and Jim Russell’s school in Snetterton, England, so they could do their own driving.

All of them became highly qualified in a remarkably short time. But photographing these new Formula 1 drivers in action was something else again. Frankenheimer remembered Stephens, a young photographer long on ingenuity. In an earlier Frankenheimer picture, *Seconds*, Stephens had put a torso camera harness on Rock

Hudson for a scene in Grand Central Station. The camera, focused on Hudson’s face, went with him everywhere, recording his expressions and the swirling, unaware crowds around him. No one figured out how it was done. Stephens has gone off ski jumps and schussed down forested slopes with cameras lashed to his ski tips or to a fantastic shoulder harness from which the lens peered over his head as though it were the skier’s eyes. In skydiving pictures, he’d fastened cameras to his

**HELICOPTER SHOTS** provided dramatic variety on long shots of actual grand prix races, also enabled Stephens to get close-ups from above as his feet clipped treetops. From chopper he could even control cameras on racing-car mounts, like one below, aimed at the face of Jack Brabham doing 120 mph







**YOU'RE THE DRIVER** when Johnny Stephens' helmet cameras ride with Formula 1 pilot Bob Bondurant

helmet and parachuted from airplanes.

"How would you photograph racing cars at 150 mph?" Frankenheimer asked him.

"From another racing car on the track," Stephens told him.

Frankenheimer agreed. Stephen's basic camera car became a Ford 350 GT, solid and capable of pacing most of the formula cars. On it went five camera mounts—one on each side, fore, aft and one in the center through the roof. Bill Frick, technical consultant, built similar mounts for the Formula 1 cars—front, side and behind the

cockpit for over-the-shoulder shots, that could be attached or detached in minutes. A manufacturer of optical trackers for missile sites produced electrical tilt and pan heads for the mounts. A missile-control manufacturer came up with a radio-control system that would operate the electrical camera heads remotely.

Panavision developed special electronic-focusing wide-angle lenses, with glass shields to protect them from kicked-up pebbles and rain. But their masterpiece was an electronic control box about the size of a shoe carton, with a five-inch Sony monitor bringing in signals from a TV camera that could be mounted right beside any movie-camera lens.

"Sitting beside the GT driver, with this system in my lap, while we paced the racing formula cars," says Stephens, "my toggle switch controls would radio the camera wherever it was, telling it to pan, tilt this way or that, change focus, and give me a footage count. The Sony screen gave me a constant picture of what the camera was seeing out there—whether it was on a GT mount or on one of the cars in the race.

**SIDE CAMERA MOUNT** on the formula racing cars had 360° pan potential plus four-way tilt, radio controlled from pacing Ford GT or helicopter overhead. It enabled Stephens to get dramatic sequences, starting with a close-up of a spinning wheel, then panning the lens toward the driver's face





"In Monte Carlo," Stephens recalls, "Frankenheimer wanted many shots of the F-1s dicing, with me working my cameras from the GT right in their midst. . . . Here comes Montand, for instance. I touch my fingertip controls, dip my side mount to get his spinning wheels, pan to his tense face as he comes alongside and we dolly along at 120 mph, a few feet apart. There's no other way to get such spectacular shots."

The same remote system could be used by Stephens from the helicopter, radioing orders to a camera on the GT or a racing car below. Or Frankenheimer could be on the monitor down below, while Stephens was shooting zoom sequences of the cars from the chopper.

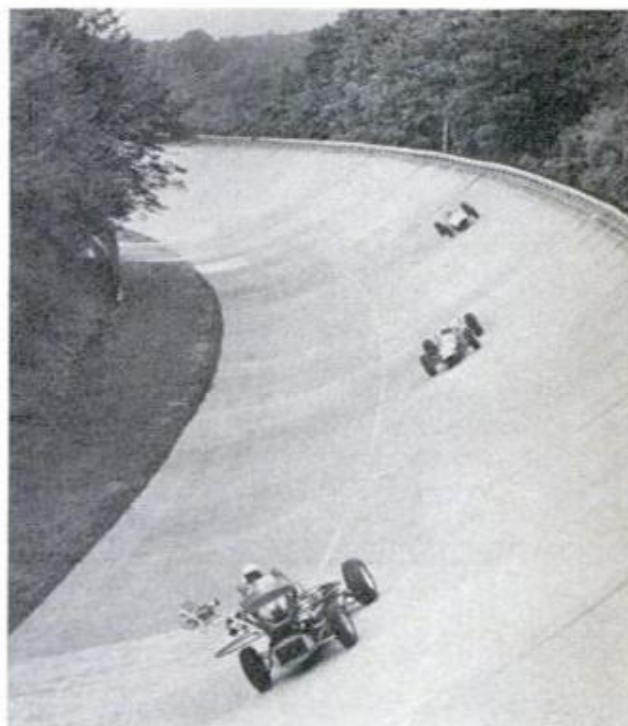
"Communication was essential," Stephens points out, "So in addition to everything else, I had a three-way-radio tie-up with the racing driver, the director and the chopper pilot.

"Here's how it worked: Let's say I'm in the chopper, shooting at a car racing along the track at 140 mph. 'Okay,' says John over the radio, 'You're in sharp—now zoom wide—you're looking good . . .' I tell the

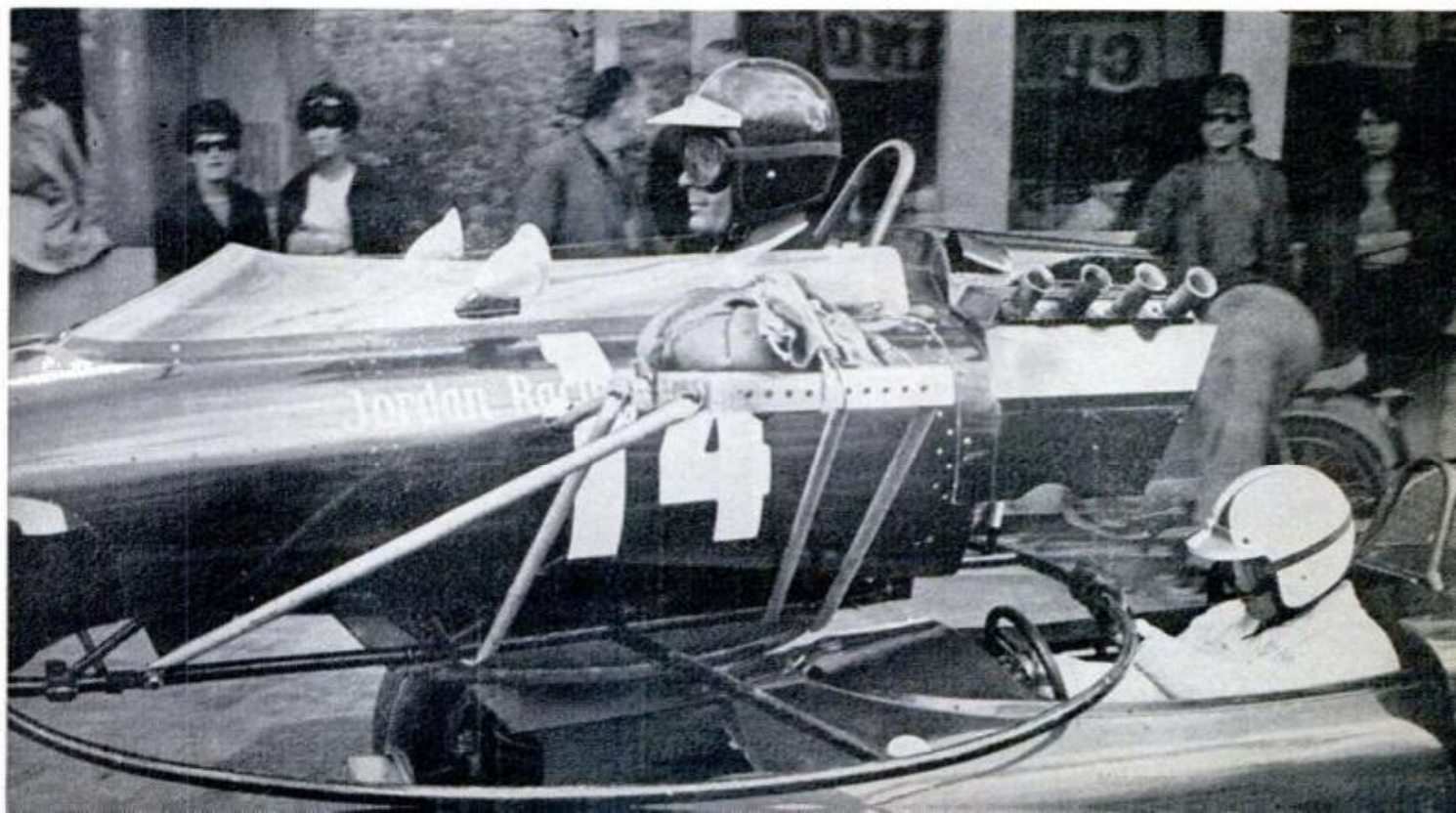
driver of the car below, through my right-hand mike, to slow it a little. I'm halfway through my zoom . . . 'Okay, you're on it,' Frankenheimer snaps, 'now pull away.' I tell the pilot, through my left-hand mike, to fall off. We do, and it's in the can."

Early in the film, at the Monte Carlo Grand Prix, there's a sequence in which Garner has trouble with his BRM gearbox. The wheels lock. A car

*(Please turn to page 200)*



**WILDEST CONTRAPTION** built by special-effects man Milt Rice for getting impossible shots was swiveling cockpit atop another Formula 1 car. As rig raced down the course, GT alongside could shoot the start of simulated spin-out as cockpit swiveled. It was used in Garner sequence, below; Montand sequence, above.





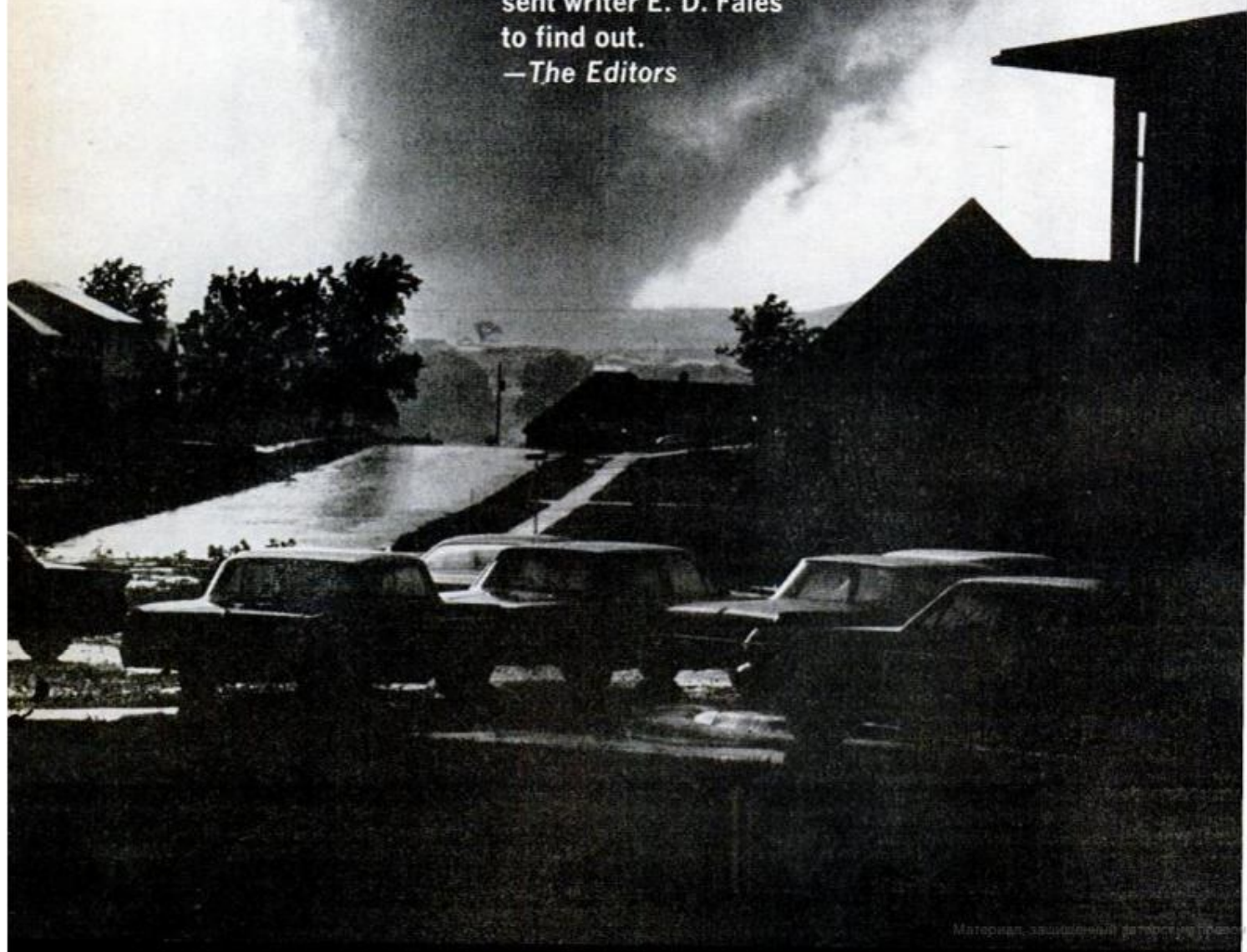
# Twenty-two minutes over Topeka...

The season for tornadoes is now beginning. And as our population spreads out, the peril is growing. Last year 42 states were hit by more than 800 tornadoes, the most vicious storms on earth. No force short of an A-bomb is so deadly. Cities hit in recent years include Worcester, Flint, Dallas, Grand Rapids, Cleveland, Macon, St. Louis, Fargo and Chicago.

Today cities and towns are growing where tornadoes used to roar across empty fields. As a result new precautions need to be taken—in your town and everywhere.

What is it like to be hit by a tornado? After the most destructive tornado in history blasted Topeka, Kans., last June, PM Editor Bob Crossley [who used to live in Topeka] sent writer E. D. Fales to find out.

—The Editors





The tornado that hit the Kansas capital could have been the worst disaster in U.S. history. Maybe it was luck that so few were killed, but communications, planning and plain old battlefield bravery had a lot to do with it. Here's the dramatic story, plus tips that could save your life

By E. D. FALES JR.

**O**N A WINDY AFTERNOON LAST JUNE a former Special Forces paratrooper named Jesse Taylor was driving east on Interstate 70 toward Topeka, Kans.

About 5:00 p.m. a wind sprang up. His Buick darted from side to side. He fought to control it, then slowed. Black rain clouds were crossing the road from the south. "I'd never seen clouds so fast and so low," he says.

This certainly didn't look like a tornado, although the U.S. Weather Bureau had been warning Kansas all day of twisters. Yet Taylor knew it was something bad and he worried about his family in Topeka. Then he remembered that he had always heard tornadoes could never hit the capital city. An old Indian legend said that Burnett's Mound, a 200-foot hill at the southwest corner of the city, would turn them aside.

Reassured by the legend, Taylor soon drove out of the windy area, stopped worrying, and got home safely.

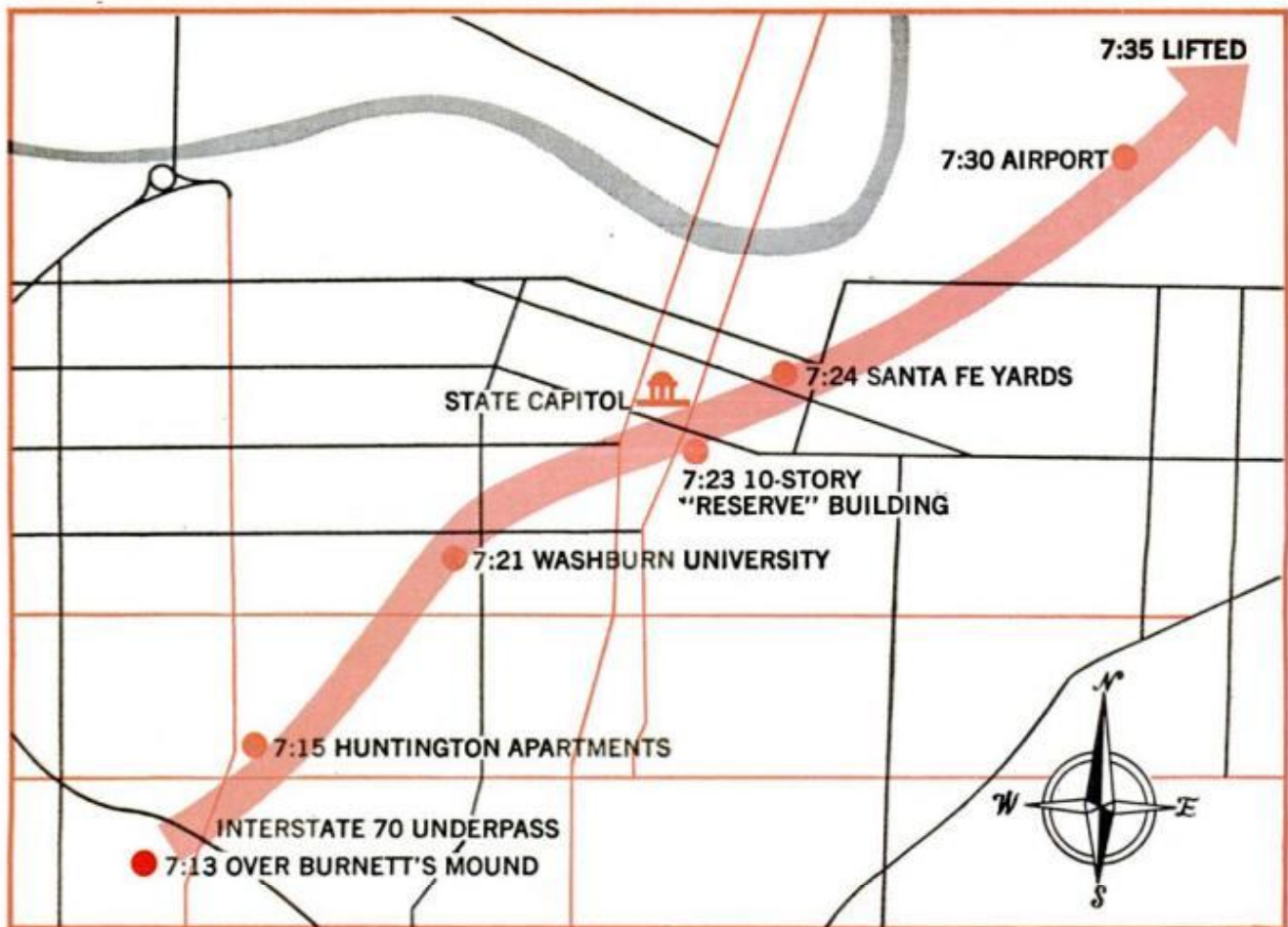
An hour later a welder, John Meinholdt, watching the sky west of Topeka, saw a curious black cloud sitting on the prairie. Meinholdt had seen long, slim tornado funnels, and this squat monster was no funnel. He radioed the U.S. Weather Bureau at Topeka Airport. The Bureau replied that it had an "intense storm cell" on its radar, but had not identified it as a tornado—yet.

But Meinholdt, a Civil Defense storm-watcher, continued on

**THIS WAS NEW RESIDENTIAL AREA** in southwest Topeka. Mound where the tornado was first seen is at left  
Photos: Perry Riddle (left), Rich Clarkson (below), both of Topeka Capital-Journal







alert. The cloud stood like a building block, holding up the heavens. At 6:50 the Weather Bureau line to police headquarters warned: "HEAVY THUNDERSTORMS MOVING INTO WESTERN EDGE TOPEKA AREA. THESE WILL LIKELY CONTAIN HARD RAIN WHICH WILL AFFECT HIGHWAY TRAVEL. STRONGER CELLS WILL POSSIBLY PRODUCE HAIL AND MAY CONTAIN STRONG WINDS . . ."

**NINETEEN-YEAR-OLD RICK DOUGLASS**, WREN newscaster, warned Topekans to take cover before tornado caught him and caked him with blood and mud. Map at top of page shows path of twister across city  
 Photo by Delmar Schmidt, Topeka Capital-Journal





Minutes later, from Police HQ, five patrol cars fanned out to five good vantage points, to watch. And word came: A photographer for WIBW-TV had seen a tornado near Auburn, 15 miles west. WIBW at once advised Topekans to take cover.

One of the police cars sent to watch was driven by crew-cut Patrolman Dave Hathaway, an ex-GI. Hathaway was ordered to drive to the top of Burnett's Mound. He found it scary and lonesome. Below, to the northeast, lay thousands of pleasant homes, the new Huntington apartment complex, and Washburn University. Five miles northeast the downtown skyline included a 10-story prairie skyscraper at 10th and Kansas and nearby the green dome of the state capitol. West of the Mound, sitting on rolling farmland, was that cloud. Hathaway thought: "No tornado could be *that* big."

A tornado, he knew, is a whirlwind that hangs like a rope. It packs a terrible spinning punch. Though it may be as small as three feet across at the ground, big ones run 300 to 1200 feet across at their tops.

At 7:02 Hathaway saw something else. High in the cloud a beckoning finger poked down, wagged twice, then drew back up and vanished. Then it reappeared, beckoned again, and once more withdrew.

Tornadoes play strange tricks that frighten even men of science. They appear to scheme and to have evil minds. A meteorologist calls them "those damned things." And although an enormous research program is under way, no one knows what they really are. It suddenly occurred to Hathaway that he had seen a tornado born—perhaps a tornado within a tornado. He alerted police headquarters. Sirens sounded.

Then, as if angry at being discovered, the black mass moved toward him. Hathaway radioed a last report. According to the official record, he said he was "changing location." Actually what he shouted was, "I'm getting the hell out."

About this time two young men, Jim Russell and Tom Lux, were driving toward a friend's house to play bridge. They came to an Interstate 470 underpass and saw a police-

*High in the cloud  
a beckoning finger  
poked down . . .*

*Then, as if angry  
at being discovered,  
the black mass  
moved toward him.*

## **8** WAYS TO SURVIVE A TORNADO (Based on what Topekans did)

- Hide in a basement away from the side chimney may fall. Lie close to base of wall.
- If no better place to hide, try bathroom, preferably an inner, windowless one.
- Get in a bathtub; pull a mattress over you.
- Put on a heavy winter coat to cushion the flying glass and "shrapnel."
- Roll up in a rug.
- Pull anything strong—such as a thick parka hood—over your head. Secure it.
- Get under a steel desk, a heavy table or a bed.
- Best of all, of course, get in a real storm cellar. This is the only 100-percent protection.



*"I couldn't breathe. I heard Tom say, 'Oh God, we're going to be killed.'"*

man waving his arms like mad, stopping cars. It was Officer Hathaway. Two cars nearly hit him. "We thought it was a traffic check," Russell says. "Then he shouted: 'Run for it!' We saw a cloud coming up the road. I couldn't breathe. I heard Tom say, 'Oh God, we're going to be killed.'" They ran up the dirt slope in the underpass and hid in the cave-like recess under the bridge. Other cars skidded to a stop. There was a crash. Two had collided. More people ran up including a turnpike trooper, Harold Tuttle, and his wife. They hurled themselves protectively on two little children who had taken refuge there.

At 7:14 like a bomb blast the storm exploded through the underpass.

Earlier, at 6:50 p.m. when the Weather Bureau warned of the storm, Topeka's four radio stations along with WIBW-TV, had broadcast an alert. At former Gov. Alf. M. Landon's radio station, WREN, curious electronic beeps began sounding over the evening programs. These bell-notes are a familiar warning to people in tornado country.

When Officer Hathaway sighted the funnel at 7:02, a more frightening warning went out. The wail of city sirens was broadcast live, and a voice repeated in doomsday tones: "THIS IS . . . A . . . TORNADO . . . ALERT." Thousands ran for basements.

*The whole black sky to the west was spinning like a gigantic electric drill.*

Meanwhile, at 7:00, 19-year-old newscaster Rick Douglass, had left WREN in a radio-equipped Chevy II wagon hoping to reach the Mound for a live broadcast. He did not know that a twister was coming up the west side of the hill. Turning on headlights, and putting wipers at high speed, he fought past traffic jams then saw the dark mound. A sign greeted him grimly: "Welcome to Skyline Drive."

But above it the sky turned terribly black. Douglass wanted to turn around. Yet he began the half-mile climb. At 7:10 he radioed his station: "Now climbing the Mound."

Douglass took comfort in the thought he would find others on top. But when he got there, Officer Hathaway was gone, and he was all alone. And then he saw the whole black sky to the west, spinning like a gigantic electric drill. Clouds of brown dirt were being thrown out of the storm.

He was puzzled by a strong smell of ranch stables. Then the trees on the hill all bent one way. Two fenceboards jumped off the prairie, danced toward the storm, and disappeared behind it.

*"If you aren't already in a safe shelter, get there quick."*

"When they came around a second time," Douglass says, "it dawned on me that I was watching a monster revolving storm. I was appalled by its size. This was a *super-tornado*."

The wind shrilled into the wagon through the door cracks. He tacked around and hurtled back down the zigzag road. Grabbing his mike he broadcast: "Ladies and gentlemen, I am driving like mad down the Mound followed by the biggest tornado I ever saw. It is coming straight downtown. *If you aren't already in a safe shelter, get there quick.*"

He took a right turn racetrack style, starting wide then





Photo by Mike Worswick

**MASSIVE STONE BUILDINGS** on campus of Washburn University fared little better than nearby ranch houses. A 300-pound chunk of rock was carried by wind to roof of municipal auditorium two miles away

tightening in. The wind lifted his rear wheels. He was shouting. "This thing is *gigantic*. It's a half-mile wide and it's going right through town!"

Then he apologized. "I'm coming to a sharp turn. I've got to drop the mike to steer." He began steering lock-to-lock to hold the road. An automobile floated up over the hill and landed by the road. Douglass never saw it.

He passed a lone house belonging to a minister. He turned on his red flasher and laid on his horn, hoping people in the house would see and hear. Then he gave the Chevy II everything. Even going downhill, he felt it lurch into passing gear. At the bottom he nearly lost the road. Then he saw the Interstate 470 underpass and raced for it, his car trailing a plume of spray.

The time was 7:13 under the bridge when he stopped. He found Officer Hathaway there stopping cars. People were scrambling up the bank. "It's going to be a bad one," Hathaway called. "There goes a house." Douglass jumped out in time to see the minister's house go straight up, turning slowly. When he figured it was 20 stories high it exploded into confetti. He heard Hathaway shout, his voice rising: "*And there go more houses. Now THEY'RE GONE. ALL GONE.*"

He tried to run up the slope with Hathaway to join the others. He had a glimpse of the officer standing and bracing himself, his hands pressed overhead against the bridge. Then Douglass, who weighs 280 pounds, felt the wind lift his feet. He slipped back just as the storm exploded into the underpass. He felt himself rolling over and over. The storm was taking him away. Houses by the hundreds started blowing to bits. The most damaging tornado in history—and one of the strangest—was tearing apart a city of

*(Please turn to page 232)*

*"This is gigantic. It's a half-mile wide and it's going right through town!"*

*When the house was 20 stories in the air it exploded like confetti.*



PM OWNERS REPORT



# BUICK GS400



**HANDLING, STYLING AND POWER** are at the top of the list of praise from the men who own 'em. Top on list of dislikes are too-low gas mileage, workmanship not up to owner's standards, and oil burning

**I** SUPPOSE I'll get used to it, but I doubt it. For some reason or another I find it difficult to adjust to the fact that youngsters 18 and 19 these days own and drive cars costing thousands of dollars. I keep thinking back to a summer's caddying from which I scrounged \$25 to have for my very own what must have then been the world's most beat-up Model A.

Take the Buick G.S. 400. It lists at \$3019 f.o.b. the factory. Add freight, flooring charges, a dealer's profit—

right away the price has climbed a couple of hundred or more. Add a few options and accessories and we're talking about figures nudging \$4000. Yet 52.9 percent of the G.S. 400 owners replying to PM's survey reported their ages as being between 15 and 29! It's enough to make a guy start scouting the old soldiers homes for future accommodations.

My middle-aged peevishness aside, it would appear that these "juvenile" sugar daddies have—in the G.S. 400—



**Buick owning is a habit: Over 50 percent of owners had a first Buick before buying their G.S. 400. Aside from a few complaints, biggest regret of owners was not ordering air-conditioning, stereo tape player and tilting steering wheel!**

By **BILL KILPATRICK**,  
Automotive Editor

**OWNERS LIKE**

Handling ...57.4%  
Styling .....45.5  
Power .....37.6

**OWNERS DISLIKE**

Gas mileage.17.6%  
Workman-  
ship .....16.2  
Burns oil ...10.8

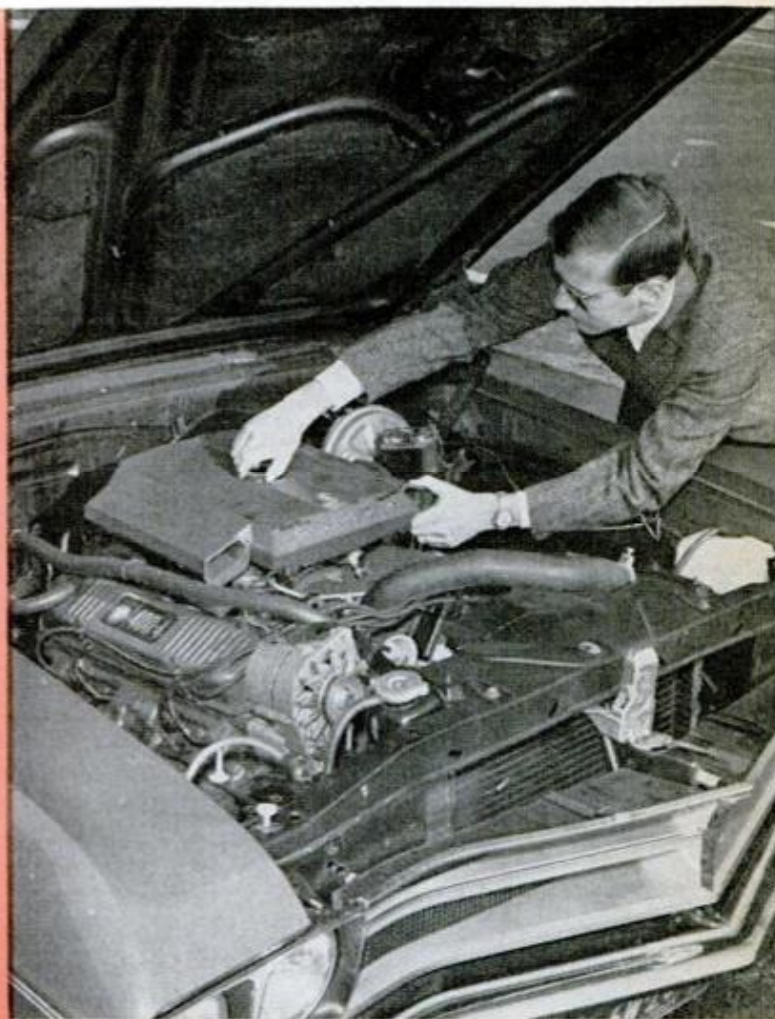
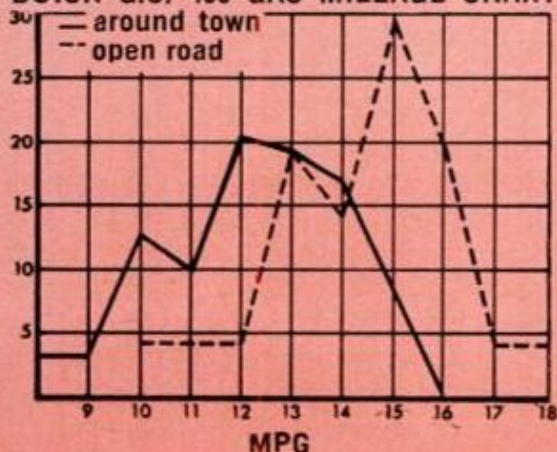
**WHY OWNERS PICKED BUICK**

Sporty style.51.4%  
Past experi-  
ence .....18.7  
Power .....14.0

**WHAT OWNERS WANT CHANGED**

Larger  
engine ....5.1%  
Styling .....5.1  
Transmission 3.8

**BUICK G.S. 400 GAS MILEAGE CHART**



**SPORTY STYLE OF G.S.400**, Buick's entry in the sport market, was biggest reason (51.4 percent) for purchase of car. The only engine available, the big 400-cu.-in. V8 isn't big enough for 5.1 percent of owners

bought themselves an automobile with which, in general, they are very much pleased. In our survey they gave high FMRs (frequency-of-mention ratings) to such attributes as handling (57.4 percent), styling (45.5 percent), power (37.6 percent) and performance (23.8 percent).

Topping the list of gripes was one that would seem to give lie to the idea of devil-may-care, youthful affluence. The kids complain about poor gas mileage, giving it an FMR of 17.6 percent.

This would seem to indicate that while the budget may be able to handle the payments, it groans with every stop at the gas pump. Also, the young owners seemingly aren't too happy with what they consider poor and/or indifferent workmanship, affording it an FMR of 16.2 percent. To this last figure can be added gripes about the car having a poor finish (9.5 percent) and assorted rattles and squeaks (8.1 percent).

But overall, the average G.S. 400 owner is a happy one. Typical of the





**DRIVER COMFORT** rated excellent. All controls—including the 4-way flasher—are within easy reach

raves for the car is this one from a 19-year-old apprentice tool and die maker from Illinois:

"The car is just great. It's quick off the line, has a lot of top end, stays glued to the road, and gets admiring looks from people wherever I go."

This young man should meet an equally young Massachusetts machinist who, while expressing overall pleasure with his purchase, nevertheless complained:

"Quality control in assembly of the car is poor. For example, the front bumper was off-center, the shift linkage was incorrectly adjusted, the clutch linkage was set up wrong, there were several cotter pins missing, the clock doesn't work, there's a short in the headlights, a couple of headlamp plugs were loose, and there's a short in the cigaret-lighter circuit."

In that the G.S. 400 is available with but one engine—the 400-cu.-in. 4-bbl. 340-hp V8—a number of owners said they'd like to see Buick offer more power options. One owner, a Missouri refrigeration engineer, said he'd like to have the big 430-cu.-in. engine (available in the Wildcat, Electra, Riviera) in his G.S. 400. On the other hand, many owners said they thought the car had more power than was needed.

A big 76.4 percent of the G.S. 400 owners replying to our questionnaire reported having automatic transmissions. The



**TRUNK COMPARTMENT**, large for sports-type car, has V-shaped opening for easier loading and unloading

console-mounted automatic was reported by 46.2 percent, the column-mounted automatic by 30.2 percent. The 4-speed manual was reported by 21.7 percent, the 3-speed manual by 1.9 percent.

A summary of the likes, dislikes, opinions, and general driving and ownership experiences of G.S. 400 owners taking part in *PM's* survey appears on the opposite page. Again, percentages listed reflect the frequency with which owners mentioned specific items. The summary is based on 403,591 miles of both local and cross-country driving. Keep in mind that most of those answering our questionnaire had owned their G.S. 400s for little more than a month or so.

Comments pertaining to owner likes and dislikes are listed below in order of frequency mentioned. The boldface asides are mine.

Right out in front of the rave parade are praises for the way the G.S. 400 handles, a big plus affording a big FMR of 57.4 percent.

"Car has wonderful cornering and road-holding ability and handles easily."—Ohio auto mechanic.

"Feel I have complete control of the car at all times."—Kentucky clerk.

"Holds the road, yet rides as comfortably as the Electra."—Illinois insurance salesman.

Next, owners like the way the car looks, affording styling an FMR of 45.5 percent.





**TYPICAL PARKING SITUATION** shows how front hood of G.S. 400 gets dented while denting car ahead

"Everyone says it's the best looking car they've seen."—Michigan student.

"Very stylish and sporty. Takes off like a tom cat."—Mississippi, retired.

► This man refutes the youth business. He's in his early 70s.

"Like those hood ducts."—Maryland draftsman.

Owners like the car's power, too.



**FRONT SEAT BACKREST RELEASE** is safety feature that owners find easy to use when it becomes habit

"Like the idea of knowing the power is there if I need it."—Michigan machine operator.

"I do a lot of driving, and having the power there when I need it is just great."—Massachusetts truck driver.

"Enough on hand to get you out of tight places."—Georgia engineer.

*(Please turn to page 222)*

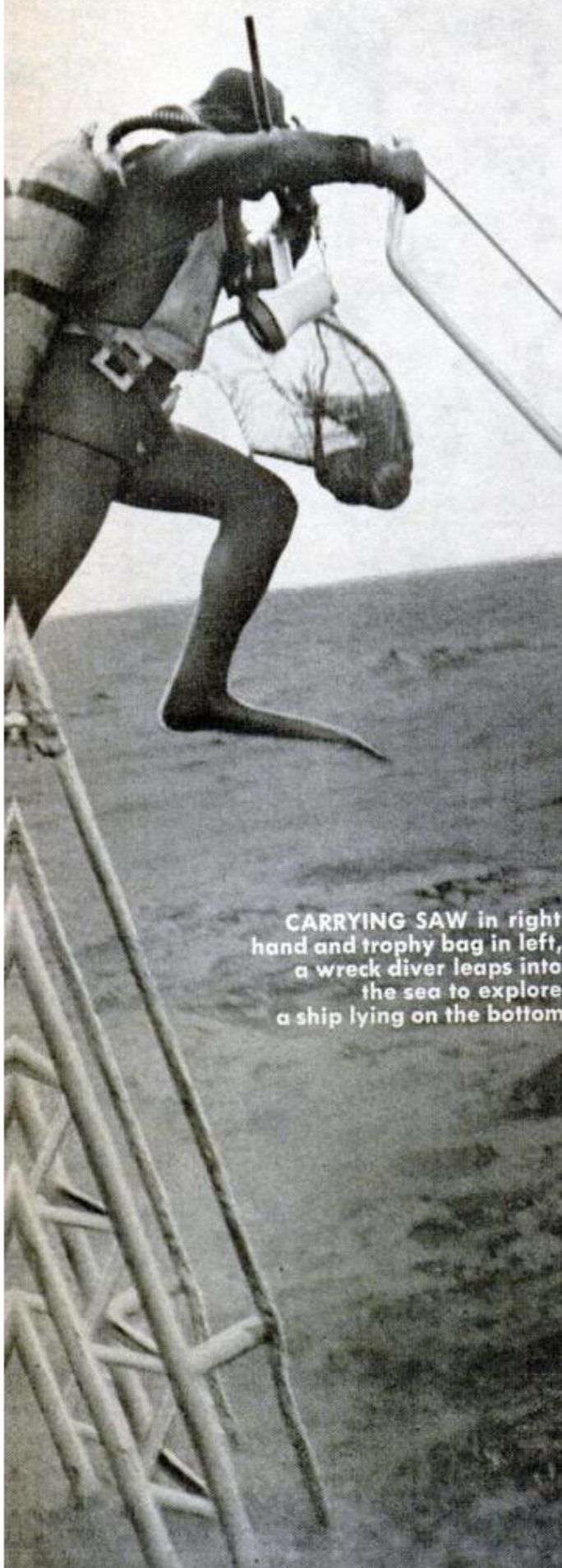
## Summary of G.S. 400 Owners' Reports\*

<b>Total Miles Driven</b> .....	403,591	<b>Column automatic</b> .....	30.2	<b>Other cars owned?</b>	
<b>Average mpg</b> .....	12.9	<b>4-speed manual</b> .....	21.7	Buick .....	53.1
<b>Specific Likes:</b>		<b>3-speed manual</b> .....	1.9	Chevrolet .....	18.8
Handling .....	57.4%	<b>Had mechanical troubles?</b>		Cadillac .....	9.4
Styling .....	45.5	No .....	51.9	Oldsmobile .....	7.8
Power .....	37.4	Yes .....	48.1	Ford .....	6.3
Performance .....	23.8	<b>What kind of trouble?</b>		Chevy pickup .....	6.3
Ride .....	21.8	Oil leak/burns oil .....	19.2	Dodge .....	4.7
Comfort .....	20.8	Transmission (various ill) .....	13.5	Plymouth .....	4.7
Pickup .....	20.8	Clutch (various ill) .....	11.5	<b>What options/accessories?</b>	
Wide tires .....	14.9	Power steering .....	11.5	Power steering .....	71.2
Cornering .....	11.9	Speedometer .....	11.5	Radio .....	51.7
Brakes .....	9.9	Carburetor .....	9.6	Power brakes .....	48.3
<b>Specific Dislikes:</b>		Automatic choke .....	7.7	Positraction .....	40.2
Poor mileage .....	17.6	<b>Dealer service satisfactory?</b>		Tinted glass .....	36.8
Workmanship .....	16.2	Yes .....	72.3	Airconditioning .....	32.2
Burns oil .....	10.8	No .....	27.7	Wide tires .....	20.7
Finish .....	9.5	<b>Why the G.S. 400?</b>		Vinyl top .....	20.7
Rattles .....	8.1	Sporty style .....	51.4	Chrome wire wheels .....	20.7
Dealer service .....	8.1	Past experience .....	18.7	Tachometer .....	14.9
Rear seat room .....	6.8	Power .....	14.0	Bucket seats .....	13.8
Ride .....	6.8	Engine/transmission .....	13.1	Magnesium wheels .....	12.6
Bright light indicator .....	5.7	Buick name .....	12.1	Power windows .....	12.6
Idiot lights .....	5.5	Size .....	10.3	Tilt steering wheel .....	10.3
<b>Model:</b>		Price/trade-in .....	8.4	Outside mirror (remote) .....	9.2
Two-door hardtop .....	73.3	"Different" .....	7.5	Speed "alert" .....	9.2
Convertible .....	16.2	<b>Is G.S. 400 your only car?</b>		<b>Age distribution of owners:</b>	
"Thin pillar" coupe .....	10.5	No .....	60.4	15-29 .....	52.9
<b>Transmission:</b>		Yes .....	39.6	30-50 .....	24.1
Console automatic .....	46.2			50 plus .....	23.0

\*Where applicable percentages may not equal 100 percent due to rounding and/or insufficient sample.



# THEY DIVE FOR WRECKS



CARRYING SAW in right hand and trophy bag in left, a wreck diver leaps into the sea to explore a ship lying on the bottom

Searching sunken ships—from barges to giant ocean liners—is a brand-new hobby for a curious breed of sportsmen. Danger and excitement fill the water as each hulk is found

By JAMES R. BERRY

LOADED WITH HAPPY VACATIONERS, the liner *Shalom* slipped out of New York harbor at 10:00 p.m. and headed for the Caribbean. At the same moment, the Norwegian freighter *Stolt Dagali* thudded toward New York through a sea curtained by fog. The two met on Thanksgiving morning at 2:00 a.m., 22 miles off the New Jersey coast. To shrieks of ripping steel, the *Shalom* sliced through the *Stolt Dagali* like a chisel. The *Shalom* limped back to New York. The *Dagali*'s forward section was towed to port—the aft section sank.

The tragedy was the most important news of Thanksgiving Day, 1964. And to a group of adventurous wreck divers it offered a rare chance to dive on a freshly sunken ship.

Before daylight the next morning, a





**IT'S ANOTHER WORLD** under the sea where time seems to stand still and everything is in slow motion



**SHARKS** don't scare many wreck divers, but divers have tremendous respect for them when in numbers  
**MARCH 1967**



**STERN SECTION** of the *Stolt Dagali* is easily identified by the large "S" that actually seems to glow





**NOT A PINT**, but a freighter named *Pinta* that sank in 1963. This wreck is very popular because the ship sank with almost every nut and bolt intact

handful of these divers were in a boat, equipped with a depth recorder, searching for the *Dagali*. Minutes after spotting the freighter, they were swimming through the hulk, now sealed in the eerie silence and hazy gloom of 120 feet of water. They would dive for a month before making a grim discovery.

The *Dagali* is just one of scores of wrecks being reconnoitered today in this growing underwater sport. So far, these amateur wreck divers have no formal association or name, but hundreds can be found diving off both coasts—and even in inland rivers and lakes. Along the Northeast Coast, there's one loosely knit group of 75. Though they are scattered, one bond brings them together—an ardent passion for exploring sunken ships. Many are so lured by these wrecks that they dive summer and winter. Some travel hundreds of miles to spend 15 exciting minutes inside a gloomy hulk.

"You're in an alien world," says Mike DeCamp, a lanky 39-year-old New Jersey science teacher. "You follow a line down and down as darkness closes in with each foot you descend. Suddenly, your surroundings brighten: a ghostly light is reflected off the bottom. Then through the gloom you see the towering outline of a wreck. Sometimes masses of codfish swim over it like a

living waterfall or a dropping curtain.

"These ships were floating communities. Exploring them is like wandering through lost cities," DeCamp says.

Shipwrecks are plentiful. About 4000 lie scattered over the East Coast's continental shelf, a shallow ledge sweeping out 50 to 100 miles from shore. Thousands of other wrecks litter the Pacific Coast and the bottom of the Great Lakes. Fascinating wrecks recently have been found in smaller lakes, too.

These ships range from giant battlewagons to stubby barges, from graceful wooden schooners to enormous passenger liners. Hundreds lie in water less than 120 feet deep, easily reached by these experienced divers. Other hundreds lie between 120 and 250 feet—the limit for wreck divers. "But only a few divers have the skill to go below 150 feet," says George Hoffman, 32, a husky, genial elevator maintenance man.

Along with the sheer pleasure of exploring, there's always the hope of finding money, equipment or even such souvenirs as a ship's name boards. On recent trips, sports divers have brought up pearl-handled toothbrushes, ship's bells, silver-plated doorknobs and brass porthole frames. Sometimes such booty can be picked up easily. But often it has to be yanked, pried, sawed or hammered free.

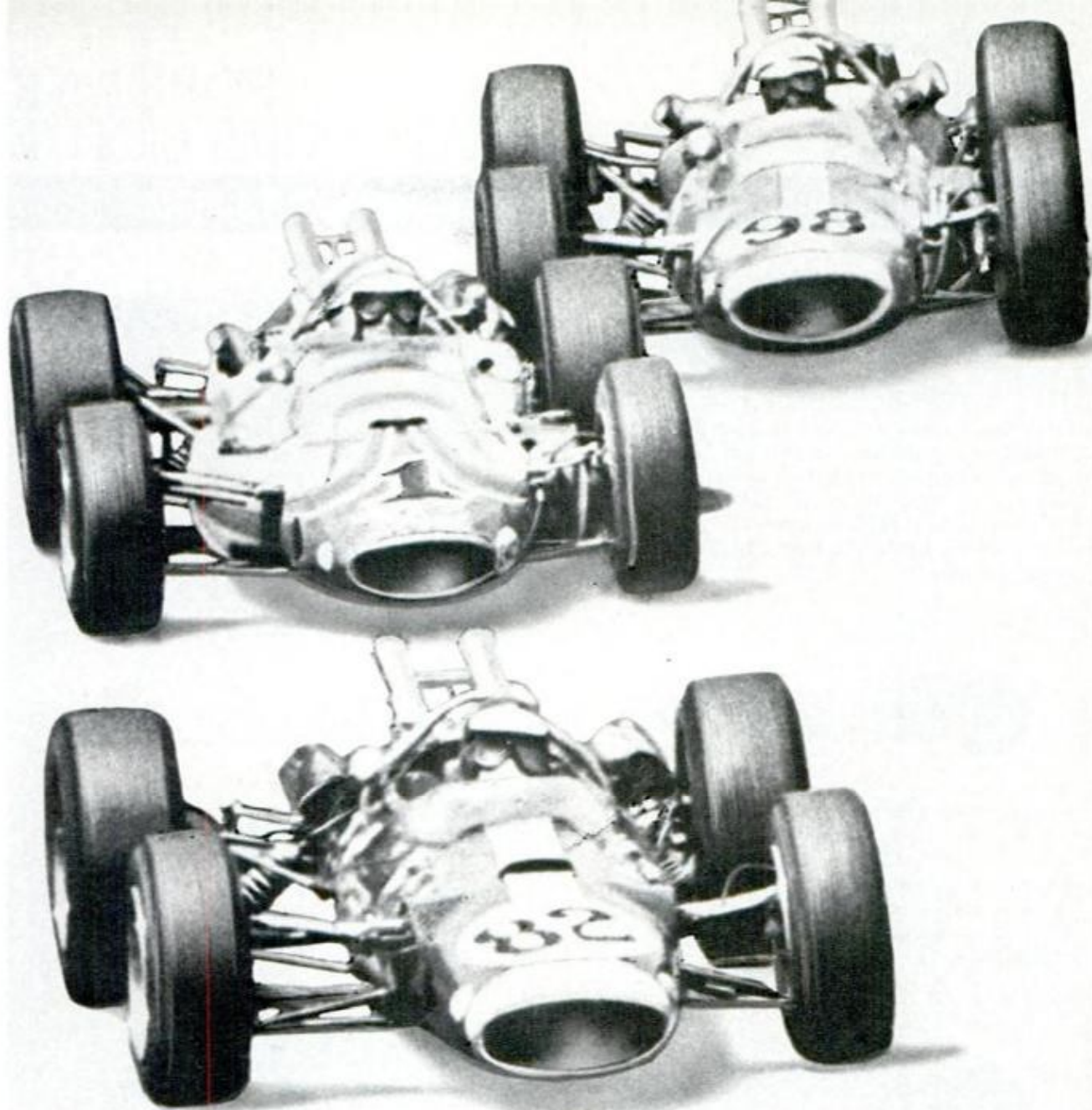
#### **Tools for divers**

On a recent trip to the *Dagali*, divers—in their skintight black rubber suits—splashed from a hired boat clutching hacksaws, pinchbars, hammers and other tools. "We'll pry loose anything not welded down," says Hoffman. "My house is festooned with trophies." Legally, it's all for the taking.

When the divers surfaced 20 minutes later, their fishnet trophy bags were stuffed with marine hardware, lamp shades, silverware, dishes and the like. After a few hours' rest, to allow slow discharge of nitrogen from their blood, they made another dive. This was short, only 10 minutes, to avoid a dangerous

*(Please turn to page 228)*





## A RACEWATCHERS GUIDE TO COMPETITION CARS



EVERY DAY, everywhere—on tracks large and small, on courses straight and flat or winding over rolling countryside—the high-pitched whine or throaty roar of race cars in action can be heard issuing their tantalizing challenges to the men who build them and drive them. Big cars, little cars, special cars, clunkers and cars whose workings and delicacy rival the finest watches—

all add up to one of the world's most thrilling sports . . . *auto racing!* The maze of cars and classes can be confusing, and it's no reflection on your mechanical savvy if you aren't too sure just how Formula I differs from Formula II. To help you recognize the major types of competition cars and increase your racewatching enjoyment, *PM* worked with famed auto artist Dale Gustafson in preparing the following guide to the cars and the racing rules.





# POPULAR RACEWATCHERS GUIDE

## FORMULA



### FORMULA I (GRAND PRIX)

Powered by 183 cu. in. 8 to 16-cyl. engines cranking out an unsupercharged 325 to 400 hp on pump gas, cars have 5 or 6-speed gearbox, wheelbase between 90-96 in., must weigh at least 1100 lbs., can go 190 mph. Contenders: Brabham, Lotus, BRM, Ferrari, Eagle, Lola.



### FORMULA II

Lighter, lower-powered version of Formula I, engines cannot have over 6 cyls. displacing between 1300-1600 cc and must originate from production-type cars. In Formula II, chassis must weigh at least 924 lbs. Cars are very maneuverable, can hit speeds of over 150 mph.



### FORMULA III

An international class similar to Formulas I and II. Cars weigh but 880 lbs. and must have single-carburetor, pushrod production engines of no more than 4 cyls., displacing under 1000 cc. Cars in this class can hit speeds of 140 mph, make outstanding racing driver trainers.



### FORMULA VEE

An American idea that has attained worldwide popularity, Formula Vee makes low-cost racing possible by requiring stock Volkswagen engine, transmission, suspension, brakes. F/Vees weigh only 825 lbs., are built for around \$2000 by specialty outfits, will hit over 100 mph.

## GRAND TOURING



### SPORTS PROTOTYPE (OVER TWO LITERS)

These so-called "Le Mans-type" cars, most powerful of 13 FIA international classes, run under strict rules, primarily in long distance, high speed events. The Ford GT Mk. II (above) can go at speeds of over 225 mph, weighs 2400 lbs. Its main competitors: Ferrari, Chaparral, Mercury.



### SPORTS PROTOTYPE (UNDER TWO LITERS)

Smaller "Le Mans-type" cars are also governed by strict FIA rules, also compete primarily in long-distance, high-speed races. Engines have less displacement, cars less overall weight. Porsche 906 (above) gets 200 hp from a flat 8, can go 165 mph. Ferrari Dino is in same class.



### GRAND TOURING

Cars in this class are suitable for high-speed touring as well as for competition. Rules specify that at least 500 must have been built. Engine size is the principal factor in determining competitive slots. Cars in this class are built by Ferrari, Jaguar, Lotus, Porsche and several others.



### TOURING SEDAN (GROUP TWO)

FIA rules permit all cars with minimum of 1000 production. But U.S. SCCA sedan racing limits engines to 305 cu. in., wheelbases to maximum of 116 in. Called "sedans," cars like Mustang, Camaro, Barracuda, Dart, Cougar, Cortina, Mini-Minor, smaller Alfas are eligible, go 150 mph.



# MECHANICS TO COMPETITION CARS



## STOCK



### NASCAR GRAND NATIONAL STOCK CAR

Limited to American sedans not over two years old, must weigh at least 3500 lbs. with 9.36 lbs. per cu. in. of engine displacement. Maximum engine for all cars—standards and intermediates—430 cu. in. Hemi engines permitted 1 4-bbl. carb., wedge-heads 2. Cars lap Daytona at 180 mph.



### MODIFIED

No limit on engine displacement. Late Model Modifieds ('56-'64) must have engine and body of same make. Modifieds ('35-'64) can have engine of one make in body of another. Events mostly on short tracks, but Late Model cars run 300-miler at Daytona, hit 165 mph speeds.



### SPORTSMAN

Sportsman ('35-'64) can mix engines and bodies when engine is under 335 cu. in. Late Model Sportsman ('55-'64) engines must be same make as bodies, range from 335 to 440 cu. in., depending on make. No hemis except when competing against Late Model Modifieds on big tracks.



### SUPER-MODIFIED

A popular independent class in which just about anything goes. However, cars must use American engines and must have roof cages. Some sprints (right) are convertible to this class. Chassis are usually lightweight tubular, engines big fuel-injected V8s. Run on 1/2-mile dirt tracks.

## CHAMPIONSHIP



### USAC CHAMPIONSHIP (INDIANAPOLIS)

Rules limit special OHC racing engines to 256 cu. in., production engines to 305 cu. in. If supercharged, OHCs are limited to 170, others to 203. Using exotic fuels, engines can crank out up to 550 hp, move approximately 1250-lb. cars down the straightaways at speeds of over 200 mph.



### USAC CHAMPIONSHIP (DIRT)

Although power limits are same as above, cars often look like old-fashioned Indy racers. They could run at Indy, but are set up for dirt tracks, usually 1-mile. Chassis is heavier than Indy cars, driver sits higher. Short tracks hold top speeds down to 140 mph.



### SPRINT CAR

Smaller versions of above, sprint cars run on 1/2-mile dirt tracks. Power normally comes from 305-cu.-in., fuel-injected Chevrolet V8s, or 256-cu.-in., 4-cyl. Meyer-Drakes. Sprints weigh about 1400 lbs., are extremely fast, difficult to handle, and considered rather "hairy" by many drivers.



### MIDGET (COMPACT SPRINT)

Smallest of the USAC racers, the mighty mites are scaled-down versions of the championship/sprint concept. Usual engines are 110 cu. in. Meyer-Drakes, or adaptations of 150 cu. in. GM aluminum block. Wheelbase is held to a maximum of 76 in. Cars run on 1/4 and 1/2-mile oval tracks.





# POPULAR RACEWATCHERS GUIDE

## FIA RULES

The Federation Internationale de l'Automobile is the worldwide governing body for auto racing. Its special committee, the CSI (Commission Sportive Internationale) has a membership representing 12 of the nations of the world interested in motor racing. American interests on the CSI are served by ACCUS (Automobile Competition Committee of the United States), whose members come from the United States Automobile Club (USAC), the National Assn. for Stock Car Auto Racing (NASCAR), the Sports Car Club of America (SCCA), and the National Hot Rod Assn. (NHRA).

Through its member nations, the FIA establishes rules for all major international racing classes (Formula I, II, etc.), schedules all international races (Grand Prix races counting for the World's Driving Championship, etc.), and administers various international performance records, including the famous world Land Speed Record.

Although much racing is held outside the precincts of the FIA and its member clubs, no races on a truly international level can be organized without the approval of this worldwide body. The FIA racing classes include three groups of single-seat, open-wheel cars (Formula I, II and III); four groups of touring, grand touring and sports cars; two classes of special touring and prototype sports cars, and a category for special, all-out sports/racing cars (Group 7). Other classes for establishing international speed and endurance records (against the clock only) are also set by the FIA.

The FIA acts as a catalyst for international racing, permitting an interchange of cars and drivers from all nations and FIA-member racing associations running under uniform rules. Probably the most important single class of international racing is the FIA's Grand Prix, or Formula I, run in a series of annual races to establish the World's Driving Champion.

## USAC RULES

The United States Auto Club governs most of the important oval-track races for single-seat, open-wheel cars in the United States. The most famous of these events is the Indianapolis 500, part of a series of races called the "Championship Trail," run annually over one-mile and larger ovals to determine the National Driving Champion.

USAC Championship cars (sometimes known as Indy cars) are the most powerful single-seat track cars in the world, though they are closely rivaled by the club's second most important competitive type—the well-known sprint cars. These fast and often dangerous machines run on dirt and paved half-mile speedways, primarily in the east, midwest and Pacific coast areas, and provide a major source of racing talent for Indianapolis and the overall Championship Trail. Not all sprint-car racing is sanctioned by USAC, and important races for this type of car are run by groups such as the International Motor Contest Assn., the California Racing Assn., and the United Racing Club. However, the best drivers generally gravitate toward the USAC sprint division for a year or two of seasoning before taking a crack at Indy. Other independent sprint-car races, which have no sanctioning group behind them, are run on small tracks around the nation.

The same situation exists in midget car (sometimes called "compact sprints") racing. The most important races are sanctioned by USAC, but there are other organizations (notably the American Racing Drivers Club) that also run midget races. USAC also sanctions certain stock-car races. For this type of racing, however, the largest and most important governing body is NASCAR.



# MECHANICS TO COMPETITION CARS



## NASCAR RULES

The National Assn. for Stock Car Auto Racing (NASCAR) is the primary organization for stock-car competition and runs this type of racing's most prestigious annual event—the Daytona 500. Other stock-car events are run by USAC, the International Motor Contest Assn., the Automobile Racing Club of America, and a number of regional groups.

NASCAR, however, remains stock-car racing's "big time," its series of "Grand National" races determining the NASCAR Driving Champion. NASCAR also sanctions events for Sportsman, Modified, Late Model Modified, Limited Sportsman and Hobby race cars, plus all forms of drag racing.

## SCCA RULES

Based on a membership of amateur automotive enthusiasts, the Sports Car Club of America sanctions two distinct types of road racing competition in the United States.

Its primary function is to support over 1000 races annually for its great bulk of amateur competitors, who race for nothing but pleasure and trophies. On the other hand, SCCA has increased its importance on the racing scene in recent years by backing several FIA-listed race series for professional drivers and the world's finest Group 7 racing cars. These series include the United States Road Racing Championship and the newly instituted Canadian-American Challenge Cup, which, in its inaugural year in 1966, attracted the top cars and drivers from around the globe.

The SCCA is also backing the new Trans-American Sedan Championship series, which offers professional racing for FIA Group 2 touring sedans in the United States.

## NHRA RULES

The National Hot Rod Assn. sponsors more than 2000 drag races across the nation each year and is therefore the most important sanctioning body in this fast-growing segment of the auto-racing world. In addition to NHRA, the American Hot Rod Assn. and NASCAR sanction drag racing, but all operate with similar classes and rules to those established by the older and more prestigious NHRA.

Although it runs many major events around the nation, NHRA's most important race is held annually at the Indianapolis Raceway Park drag strip, where the "Nationals" take place and over 1200 top drag racers enter championship competition.

### GET THESE CARS ON A HANDSOME FULL-COLOR WALL CHART

All 32 racing cars shown in this month's PM have been reproduced in a big, beautifully printed color chart, suitable for framing. A great conversation piece and argument settler for your den, shop or garage. On heavy paper, 35 x 23 inches. \$1.50 each postpaid.



Popular Mechanics, 575 Lexington Ave.,  
New York, N.Y. 10022.

Please send me \_\_\_\_\_ copies of PM'S RACE-WATCHERS GUIDE TO COMPETITION CARS. Enclosed find \$1.50 for each.

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# POPULAR RACEWATCHERS GUIDE

## SPORTS



### GROUP 7 (SPORTS/RACING)

World's fastest sports cars fit this category. Overall rules require a full body, at least two seats and two doors. Rules place no limit on weight. Transmissions can be either automatic or manual. Fairly liberal rules permit innovations such as the airfoil shown above on an open-bodied Chaparral.



### PRODUCTION SPORTS CAR

For competition in 8 classes ("A" through "H") the Sports Car Club of America gives cognizance to 122 "marques" of production sports cars. "A" is the fastest class, "H" the slowest. Cars vary widely in overall size, speed potential, run most often in regional and national amateur events.



### MODIFIED (SPORTS/RACING)

The SCCA recognizes 6 classes of modified sports cars, the rules being similar to those applied to Group 7. Variations are minor (e.g., cars in this category must have windshields). Car above is in Class F Modified—an Elva chassis with a 4-cyl., 175-hp Porsche engine, can go 145 mph.



### GYMKHANA CAR

Not a racing machine in the usual sense, a car of this type is meant for competition against a clock, usually on a very tight, pylon-marked course. Competitive classes are based on engine displacement. Cars must be small, maneuverable. Typical such car is shown above, a Lotus Mk. 7.

## DRAG



### AA/FUEL DRAGSTER

The sky's the limit here. Most "cars" in this highly specialized form of drag competition go VOOOM on nitro-burning, supercharged Detroit engines producing up to 1500 hp! Called "rails" (sometimes "slingshots"), they weigh about 1200 lbs., hit speeds of 230 mph in standing 1/4-mile.



### "FUNNY CAR"

One of the newest and most popular drag-racing classes, no rules govern "funny cars" except that a stock-appearing (generally lightweight fiberglass) body be used. Chassis is tubular, very light. Engines are usually V8s that are either blown or fuel-injected. Speeds hit 170.



### ALTERED ROADSTER

Cars run in one of several "competition" drag racing classes based on engine size and weight of vehicle, whether or not gasoline or special fuel is used. Some classes allow supercharging. A stock-appearing body must be used. Cars can reach 160 mph in 1/4-mile from standing start.



### STOCK CAR

American or foreign passenger cars are run in 25 classes established on basis of advertised hp to vehicle weight. Classes are further split by separating automatic, manual transmissions. Few powerplant modifications are allowed on anything other than factory experimental cars.



# MECHANICS TO COMPETITION CARS



## RECORD



### UNLIMITED RECORD CAR (JET-POWERED)

Fastest cars in the world strive for the Land Speed Record (LSR), set by Craig Breedlove and his "Spirit of America" (above) at 600.601 mph. Cars of this type can weigh up to 4 tons, have no drive trains, are powered by pure jet engines. Future LSR cars may have controlled rocket power.



### UNLIMITED RECORD CAR (WHEEL-DRIVEN)

Until a special class was established for jet cars, only those driven or powered through the wheels qualified for the LSR. The wheel-driven record is presently held by the Summers Bros.' "Goldenrod" at 409.277 mph. Car is powered by 4 Plymouth "Hemi" engines driving all 4 wheels.



### SCTA STREAMLINER

The Southern California Timing Assn. (SCTA) sanctions and runs (usually at the Bonneville Salt Flats) a series of class races for these muscular giants, most of which are powered by big, highly-needled U.S.-built V8s. A number of these cars hold international records in smaller engine classes.



### SCTA ROADSTER

An offspring of the original hot rods that ran on salt and desert flats 30 years ago, these SCTA roadsters (also called "highboys") compete in classes based mainly on engine size. Cars must use stock bodies. Bigger classes permit superchargers. Fastest cars can hit 200 mph.

## SPECIAL



### JET DRAGSTER

A true "outlaw" class unrecognized by any major sanctioning body, these jet-powered "rods" are popular for drag strip exhibition runs, often "hit the traps" at speeds up to 250 mph. They are pure jets, actually little more than light, tiny 4-wheeled bodies built around an engine.



### KART

The smallest, but far from the tamest form of competition car, twin-engine karts can attain speeds of over 100 mph, have been known to lap some road courses faster than smaller sports cars. Karts are divided into classes based on power displacement and overall configuration.



### THREE-QUARTER MIDGET

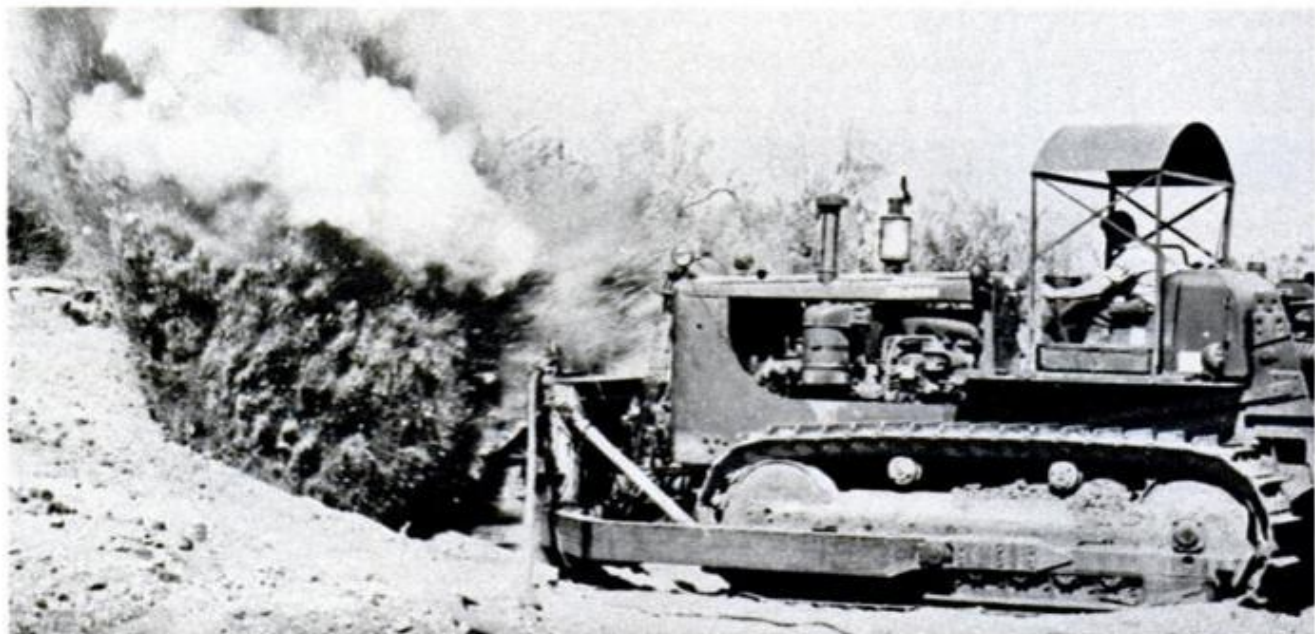
A scaled-down version of the USAC midget, cars compete on 1/4 to 1/10-mile oval tracks (sometimes indoors), are powered by 750-cc small car and motorcycle engines. Even smaller Micro-Midgets are similar, but are limited to 250-cc engine displacement. Most of these use modified "bike" engines.



### RALLY CAR

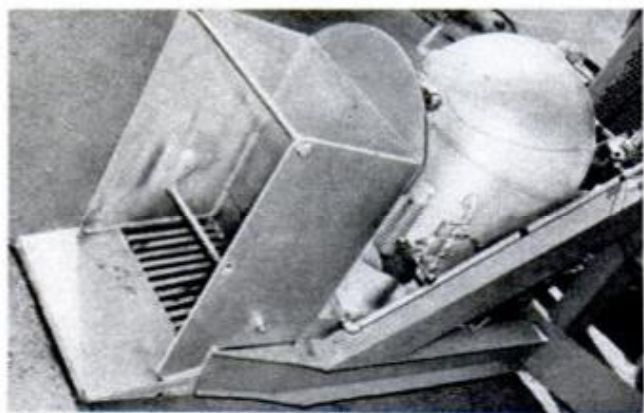
Typical European rally car competes under FIA Group 1 or Group 2 rules. Cars are specially equipped with extra headlights, tires, and so on for high-speed driving in adverse weather. Mini-Cooper (shown above) makes good rally car because front-drive provides snow/mud traction.





## Earth blaster

Instead of moving earth by brute force, a new bulldozer attachment uses the combustion of gases to literally blow the earth out of the way. The device (right) consists of a combustion chamber in which compressed air and fuel are mixed and ignited, and, with the tractor moving constantly forward, the earth acts as a piston and is blown loose in a continuing series of explosions. The new earth mover was developed by South-West Research Institute, San Antonio, Tex.



## Robot baby sitter

With a TV camera for eyes, radio receivers for ears and speakers for his mouth, a remotely controlled robot can perform a variety of jobs while its British owner watches, listens and speaks from his home.

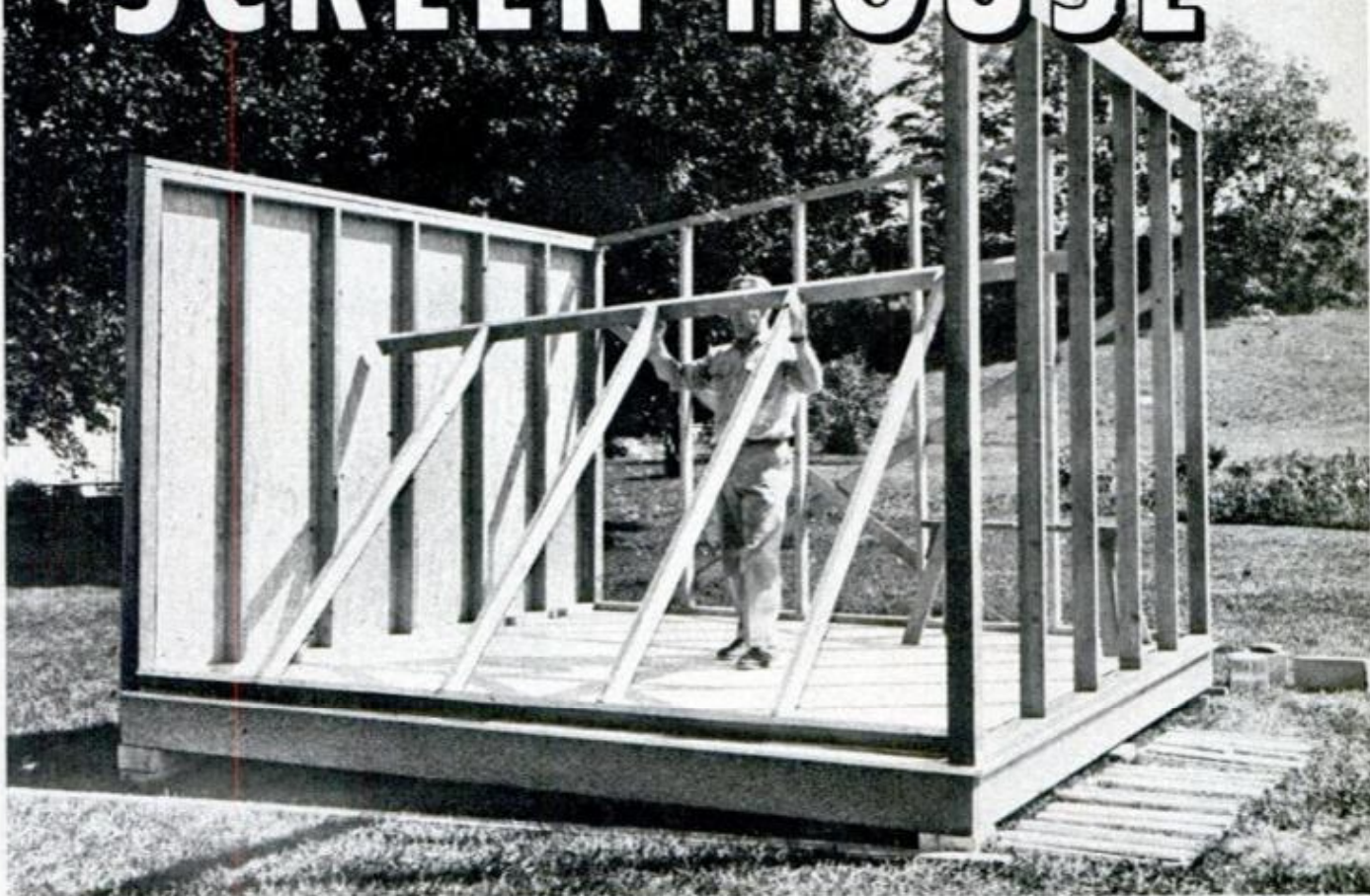


## Sandbagged Bluebird

With a new, heavy engine in the *Bluebird*, Donald Campbell used sandbags lashed to the craft's stern as temporary trim in test runs. Unfortunately, in a speed-record attempt in January, the *Bluebird* crashed, killing Campbell.



# BUILD YOURSELF A SCREEN HOUSE



**UP GOES SECOND SIDE WALL.** Top plate has been spiked to studs. Wide stud opening is made to suit door

**Pest-free, noise-free hideaway where you can get away from it all to enjoy summer evenings in solid comfort**

By **WAYNE C. LECKEY**

*Technical art by Barry A. Wiedenkiller*

**AN ATTRACTIVE ADDITION** to your back yard, a screen house is something the whole family will enjoy

**L**IKE ANYTHING, you can have too much togetherness. The time comes when you'd love to have a place remote from the house where you could go to unwind, to get away from teenage ruckus, to have a few hours of peace and quiet.

Your patio isn't the answer. Mosquitoes, if not a shower, will soon drive you in. Darkness will call a halt to reading and, most important, you're really not off by yourself.

What you need is a back-yard screen house! A place where you can steal away from airconditioning and enjoy the zephyr breezes of a summer's night; where you can spend an evening





## BUILD YOURSELF A SCREEN HOUSE



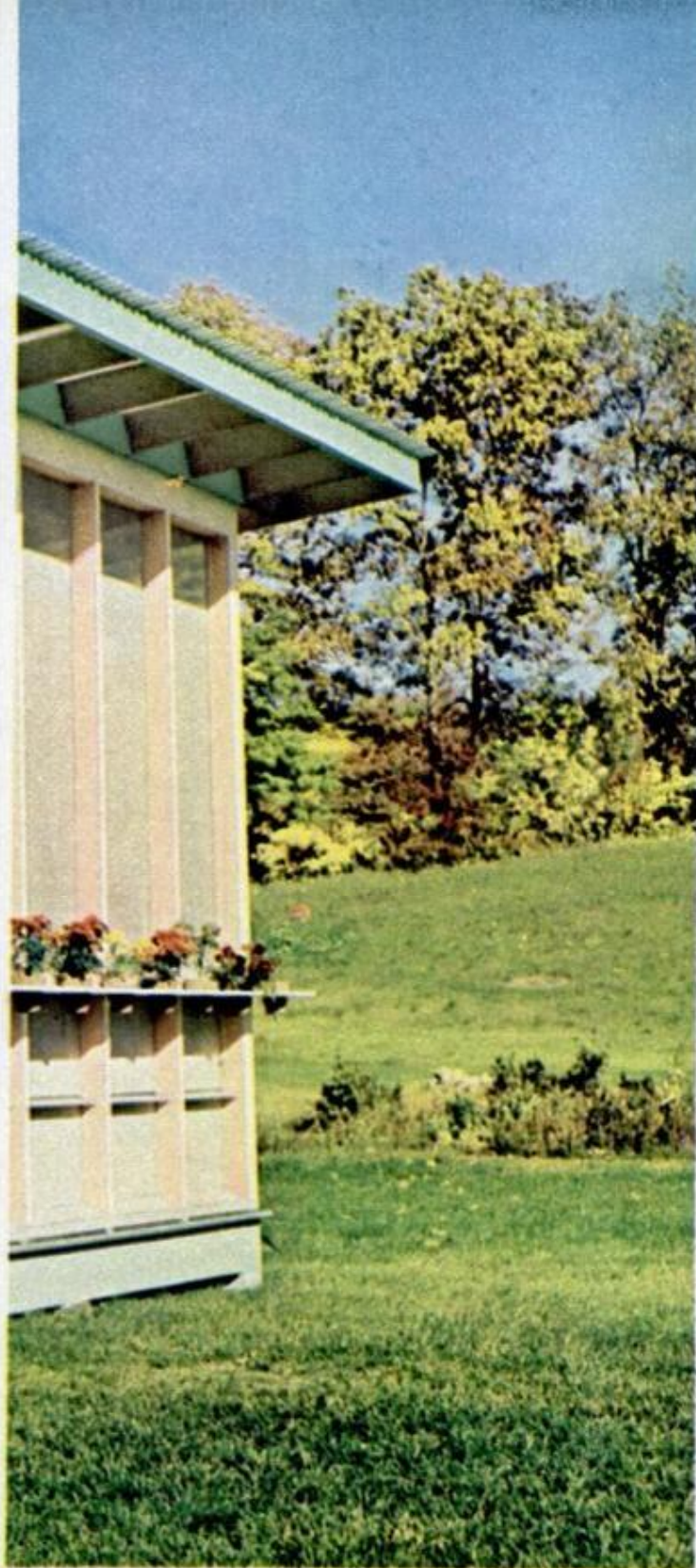
of baseball on TV, or have the fellows in for beer and bridge. Build a house like this and we'll guarantee you'll have the time of your life.

Of course, a screen house need not be put off limits to the rest of the family. The kids will find it a wonderful playhouse. Mom can throw a tea for a foursome. And since it's a permanent structure, it makes a dandy place to store bulky out-of-season items during the winter, like patio furniture, the kids'

bikes and various lawn and garden tools.

The screen house you see here in beautiful color-rotol was designed for *Popular Mechanics* by Jerry Geerlings, A.I.A., noted New Canaan, Conn., architect. It measures approximately 12 ft. square, has floor-to-ceiling cupboards across the back where you can chuck things away for the night, built-in benches around three sides which are wide enough to serve as bunks for sleeping out, and there are seven caster-fitted bins that roll out from un-





Color photos by Frank P. Fritz

**SIX TWIN-DOOR CUPBOARDS** provide storage galore for bedding, cushions, a set of second-best dishes, books, records—you name it (top photo). Fitted with locks, the doors keep contents safe from petty thieves

**BUILT-IN BENCHES** on three sides and fitted with foam-rubber cushions double as bunks for youngster sleep-outs (center photo). Pull-out bins under the benches give even more storage for toys, books, magazines

**WHILE BENCHES PROVIDE SEATS**, there's still ample floor space for a card table and four chairs (bottom photo). Cupboards afford safe and dry storage for table and chairs when clearing deck for other use

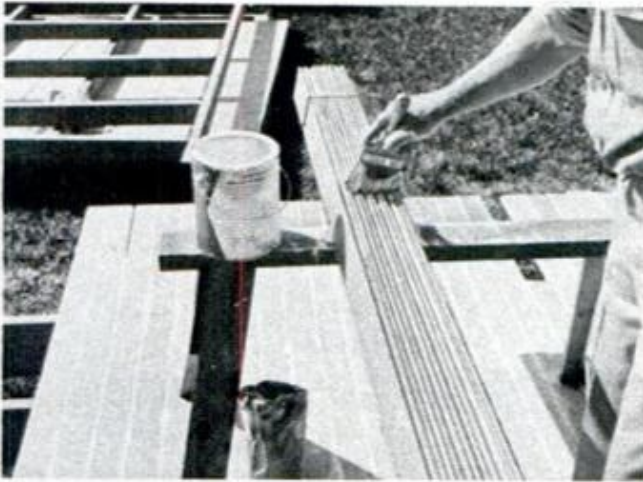
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**WHITE-LEAD PAINT** applied to tongue-and-groove edges of boards will make durable watertight floor



**FLOORBOARDS ARE NAILED** to joists while painted edges are wet. Standard 12-ft. boards are just right

der the benches to provide additional storage for a multitude of things. A flower-pot shelf around the outside helps make the house plain pretty.

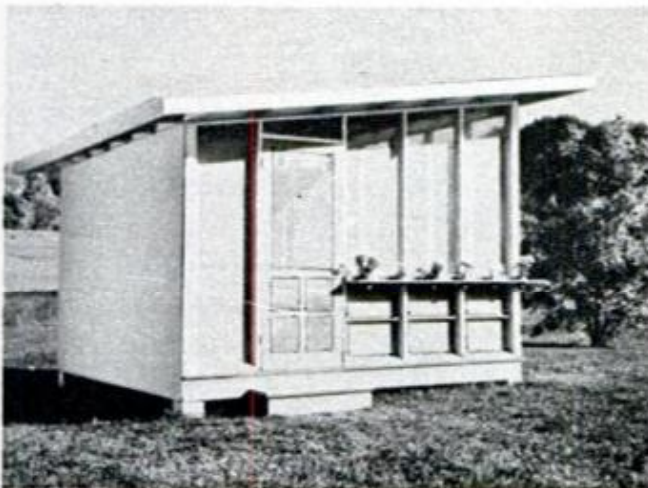
To make sure that it would go together as well as it did on paper, we built it, putting our cabinetmaker, Bud Johnson, to work as a carpenter. As you can see, it turned out beautifully. We used white fiberglass on the roof to brighten the interior. We used aluminum wire screen on three sides so it would last a good while. We slanted the floor and benches so that water would not collect, and we screened the drain vents so the bugs couldn't come in. Except for the back, the house was built sort of inside out, in that the studs were purposely left exposed their full length as a design feature. It turned out that it actually simplified construction.

Basically, the rough framing is little more than that of a lean-to shed. You start out as if building a porch floor, set-

ting joist members on concrete-block piers to raise the house up off the ground. The 2x8 joists (16 in. on centers) are spiked to 2x10s across the ends, then a second 2x10 is slapped against the first as a doubler. Overall size of the floor framing should be about 11 ft. 10½ in. square so that standard 12-ft. flooring will overhang the edge ¾ in. all around. There's no waste this way. You'll wind up with a good watertight floor if you take time to coat the edges of the boards with white-lead paint and lay them wet.

Now for the walls: Frame and raise the back wall first. You can even cover it with the three sheets of plywood while it's flat on the floor. The corner studs (posts) are 4x4s, the others are 2x4s, 24 in. on centers. There's a 2x4 plate across the bottom and a 4x6 plate across the top. Note that all four corner posts actually rest on the floor. This whole back wall can be raised in one complete assembly

*(Please turn to page 226)*

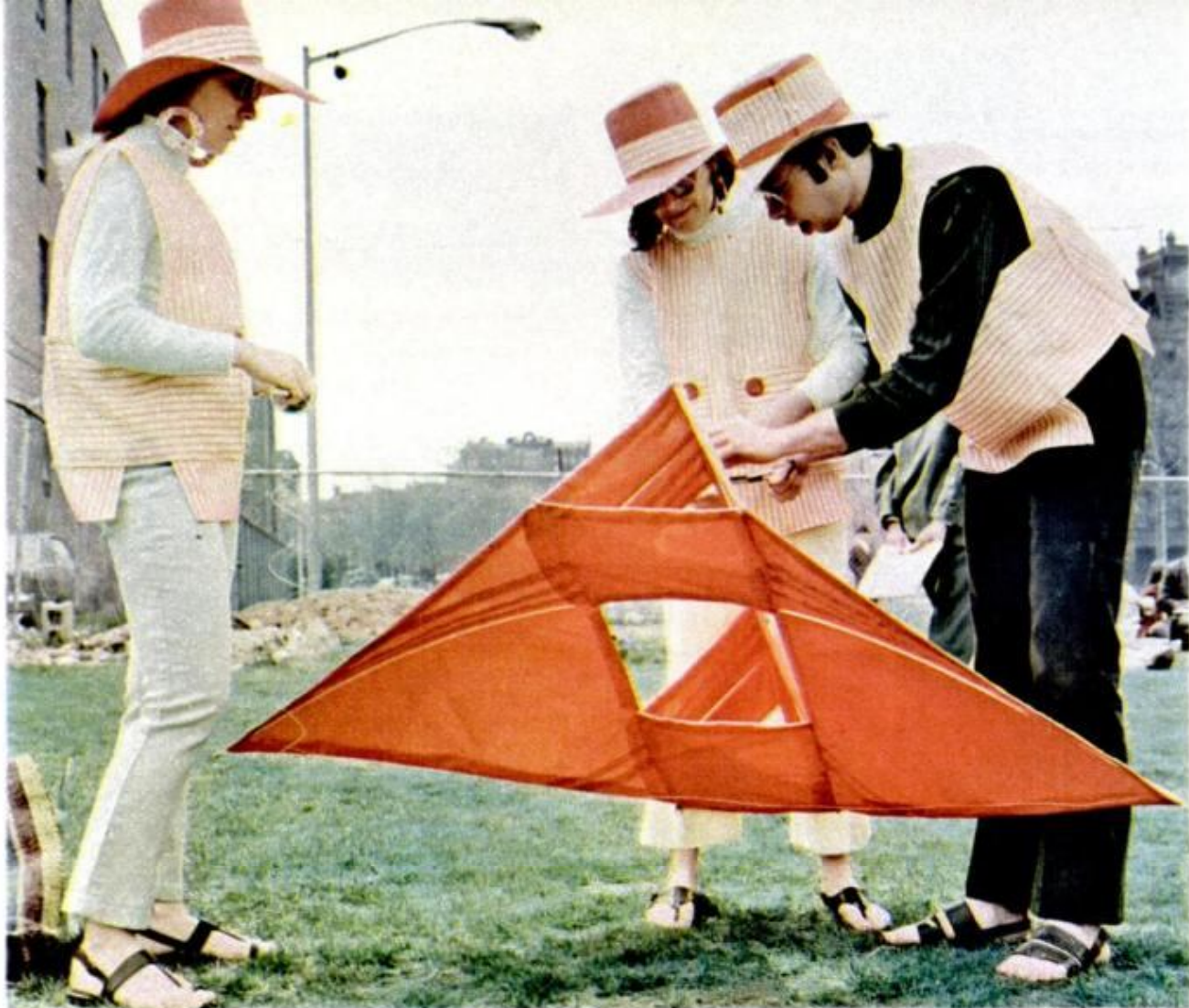


**REAR AND ENDS** of back wall are covered with exterior plywood to form roomy floor-to-ceiling cupboards



**BACK WALL**, plywood and all, is raised as complete section, spiked to floor, plumbed and then braced





**TOGETHERNESS AWARD** went to three interior design students who decorated their exteriors to match the kite. Irene Grabowich, Judith Kovis and Lauder Bowden here make final adjustments prior to prize-winning flight



**GRAND PRIZE** was won for both performance and looks by nine-foot tetrahedron of industrial-design team



**HIGH VOTE** went to triangular prism kite by architectural students Donald Szyplski and Roger Spencer

**POPULAR MECHANICS**

Материал, защищенный авторским правом



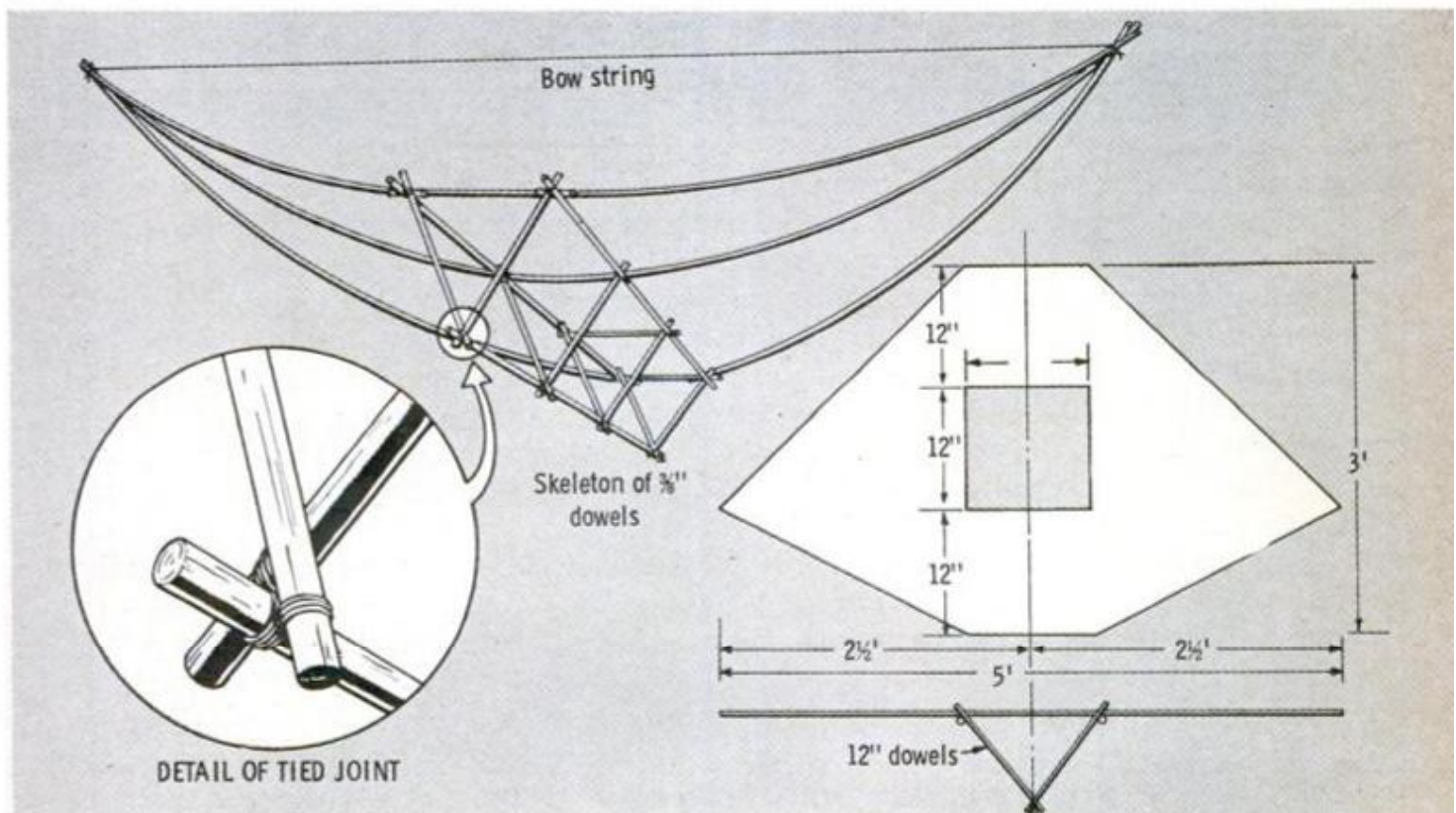
# Prize-winning kites

The annual kite carnival at Brooklyn's Pratt Institute boasts a skyful of way-out designs. We got you plans for three flight-tested winners

By AL LEES

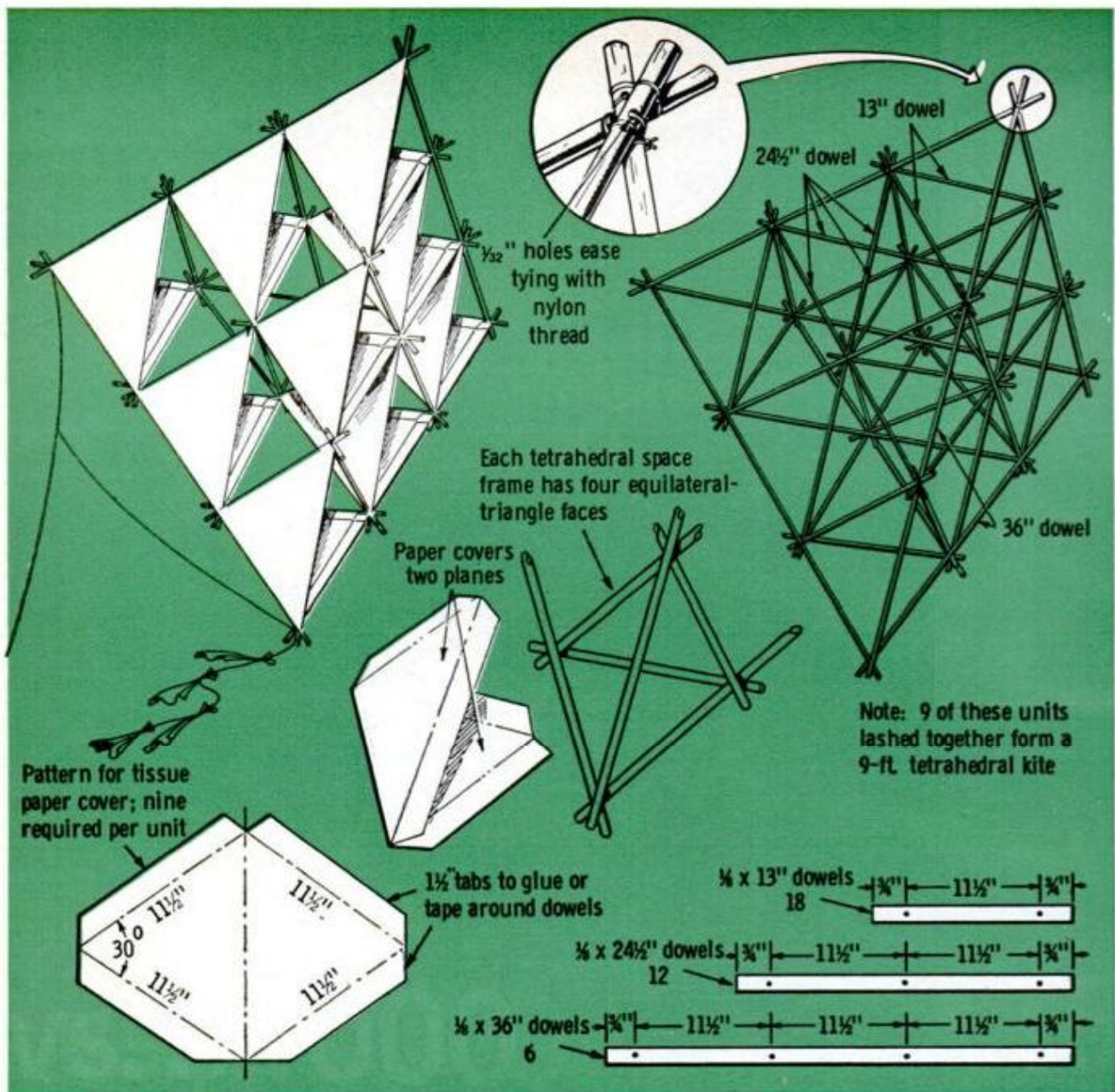


**I**T'S MORE THAN A COLLEGE ROMP, each spring, when the architecture school of Brooklyn's Pratt Institute sponsors a campus kite-flying contest. Though some students embellish the affair with kooky costumes, and trot out "constructions" that are downright frivolous, the purpose behind this annual competition is a serious one. Students are instructed to "design, build and fly a kite which is



**DOWEL CONSTRUCTION** of kite shown in top color photo, and in sketch above, is relatively simple; joints are wrapped and wing is bowed with a stout cord. Skeleton is covered with organdy cut to pattern above





structurally sound, aerodynamically correct and beautiful in the air." To comply, each entrant must tackle all steps in a practical design project: research, plans-sketching, construction, testing. He must concern himself with strength-to-weight ratios, to select the lightest functional materials; stress problems, to determine proper structure and joinery, and esthetics.

The result of all this is a festival of form and color. Admittedly, some of the wilder flights of fancy never get off the ground, but there are always a good number of highly original designs that soar above the carnival atmosphere to put a new twist in aerodynamic principles.

We know from your letters that *PM*

readers are always looking for unusual kite plans, so we studied the 1966 event with the idea of presenting several prize-winning designs for you to duplicate. Three of the design teams—two of them were prize-winners—sketched plans especially for this article.

All three designs are based on standard dowel lengths, though for the triangular prism kite, right, the longest dowel you need in the smaller (3/16-in.) diameter is 32 in. The heavier core-grid construction calls for 4 and 6-ft. lengths. To avoid sleeve-joining (fastening dowels end-to-end by means of short lengths of tubing) you may prefer to hunt down dowels that are longer than the common 3-ft. length.

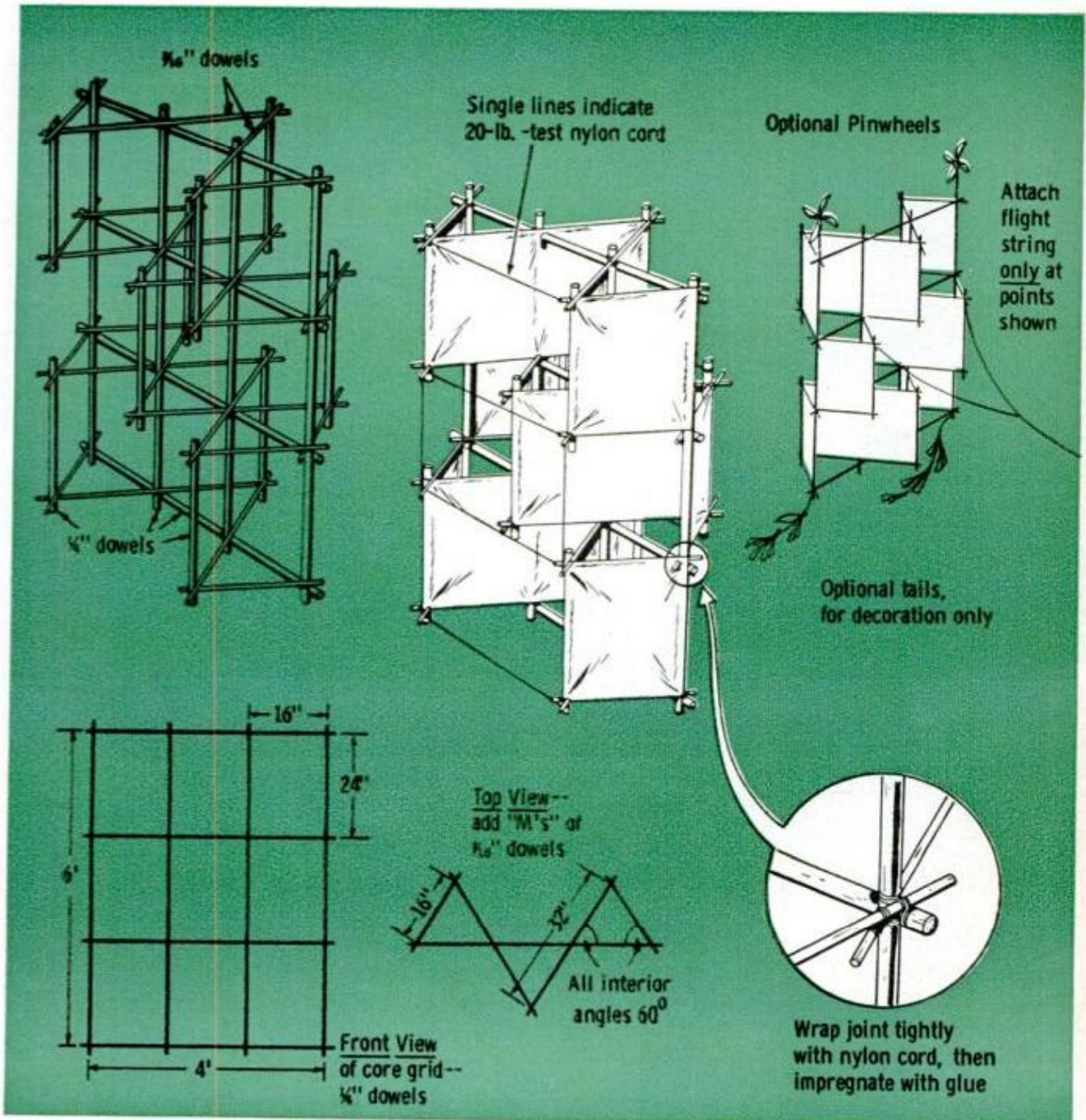
Most dramatic of the kites at last



May's event was a giant three-faced pyramid of dowels and tissue paper that flew point-down. The industrial design team, headed by architectural student Edwin Taylor, first built a unit measuring 3 ft. per side, made up of tetrahedral "space frames" having four equilateral-triangle "faces." Only two of these faces are covered on each unit—with an envelope of paper folded around one rib. (It's this folded edge that faces the wind.) The team supplied us plans for the 3-ft. unit, but they actually built eight more just like it and lashed them into that mammoth 9-footer seen in the color photo. Small wonder they copped grand prize! ★ ★ ★



**DESPITE INFORMALITY**, competition is soberly judged and records of flight conditions are posted (above) so concessions can be made for relative performance







**Clock watcher's radio**

Though it looks like a giant wristwatch that fits around your middle, it doesn't tell time. That dial is for tuning a radio inside the "watch" case. The unusual belt-radio is a product of Japan.



**Calm cow keeps cool**

Calmly enduring a harness, plastic tent and respirometer, this patient cow is helping U.S. Department of Agriculture scientists to determine how to counteract the loss in milk output that occurs in hot, humid weather.



**Silt stopper**

Fitted to the mouth of a canteen, a new filter system makes the silt-heavy water of the jungles more potable for soldiers. A pair of filters remove particles larger than 10 microns. The device is a development of the Army's Limited War Laboratory, Aberdeen, Md.



**Three-cycle power**

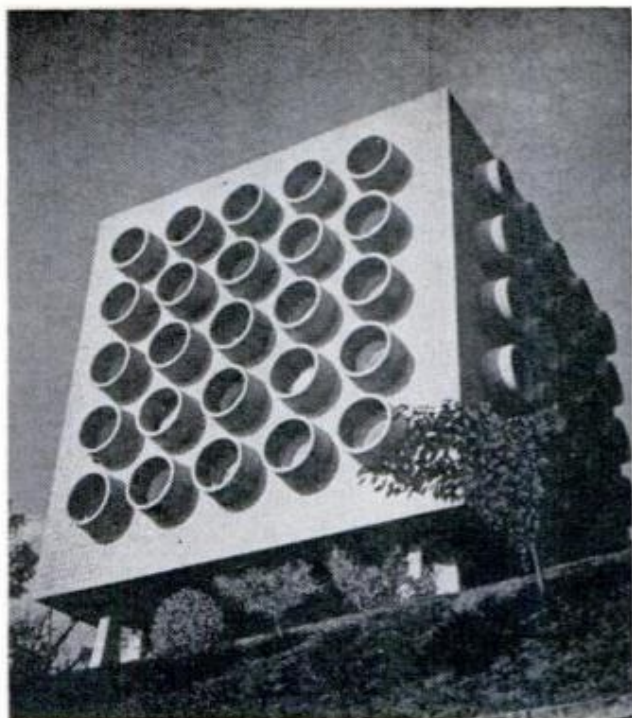
Three motorcycle engines—one for hover power and two for thrust—drive a do-it-yourself British ground-effect machine. The craft was built from the first amateur hovercraft kit to be sold in Britain.



**Tin-can Cong spotter**

A helicopter landing light inserted in a tin can and connected to a battery makes a Viet-cong spotter for Marine Cpl. C. C. Justus. He improvised the light when he became aware of the great number of flares required every night to light his security area.





## Well rounded outlook in a square house

There's no lack of daylight in a house recently built in Japan with 100 porthole-shaped windows set in rows in its square sides. But if the owner wants to see even more of the outdoors, he can push a button and a section of the ceiling opens to allow him a view of the stars at night. The unusual house is completely airconditioned. Neighbors reportedly refer to the home as a "space station."



## Young cyclist

Not long out of his baby buggy, this two-year-old youngster now zooms around at 10 mph in a tiny motorcycle built for him by his father. Another lad goes along in the sidecar. The builder is Graham Farr, a mechanic from Camberley, England.

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## Full of memories

Woven on an automatic loom, this plated wire "cloth" is a new type of computer memory. Data is stored magnetically at the intersections of the wires. Its advantages are that it is fast, small, and lightweight, while it uses very little power and generates no heat.





RODGER WARD TESTS  
***Two 'Champagne' Cars***  
**\$15,000 vs. \$4000**

*For the man whose tastes in automotive bubbly run to the imported, but whose budget is strictly domestic, the retired two-time Indianapolis champion reports Mercury's new Cougar XR7 can give the Aston Martin DB-6 a run for its money*

*By Rodger Ward*

**IN THE ASTON MARTIN,** I found a good bit of oversteer, especially during hard, high-speed cornering



**IN THE COUGAR,** I found slight understeer that may have penalized possibility of faster lap speeds





**F**OR A CAR BUFF LIKE ME, it was a dream assignment: Take Mercury's new XR7-390 GT, a pampered product of a Detroit assembly line, and wring it out against a fine hand-crafted Aston Martin DB-6. And in Las Vegas at the Stardust International Raceway! Who could refuse?

Ford's Lincoln-Mercury Div. had fashioned its new beauty for both luxury and performance. So convinced were the engineers and designers that they had come up with something truly special, they dared a head-on "shoot out" with what is recognized as one of the world's best high-speed tourers.

All that remained to prove their contention was to have an impartial driver conduct the tests and an impartial publication print the results. Enter *Popular Mechanics* and me.

To a lot of people the Aston Martin

The car I tested had such nice touches as black leather seats, an electrically heated rear window to melt ice or snow, a five-speed gearbox, a control to soften or stiffen the suspension, disc brakes and a hydraulic jack. It even had a switch to change from the usual electric horn to a powerful air horn. It had airconditioning, a fire extinguisher and safety harnesses.

No more than 15 or 20 Aston Martins are built per week, and each is virtually built by hand. The car lists at \$15,400 on the East Coast.

On the other hand, the Cougar comes off an assembly line. Production has been about 4000 per week. The XR7-390 GT model, even when loaded with every available extra to make it as comparable as possible with the Aston Martin, lists at \$4450.

(The loaded Cougar includes such extras as the performance package with the big engine, oval tires, power disc brakes in front, limited slip differential, manual four-speed transmission, power steering, swing-away steering wheel, airconditioning, a luxury interior with hardwood instrument panel.)

Both cars are two-door, four-place vehicles. The Cougar is somewhat longer (190 vs. 180 inches), has a longer wheelbase (111 vs. 101 inches) and a wider tread (58 vs. 54 inches). Each has comparable inside room.

Horsepower is similar, although the engines certainly are not. The Aston's double-overhead-cam, six-cylinder Vantage engine has an aluminum block and head and is fitted with three Weber carburetors. The engine has a displacement of 3995 cc (244 cu. in.) and a compression ratio of 8.9 to 1. It develops 325 hp at 5750 rpm. Torque is 290 lbs.-ft. at 4500 rpm.

The Cougar's conventional pushrod V8 has a cast-iron block and heads, and one Holley four-barrel carburetor. Displacement is 390 cu. in., compression ratio is 10.5 to 1. The engine develops 320 hp at 4800 rpm. Torque is 427 lbs.-ft. at 3200 rpm.

At Las Vegas the Mercury people



**TEST DRIVING** such as this sure beats the grind at Indianapolis. It was great having the track to myself

is the world's finest high-performance GT. It has even been called a "VGT," for *Very Grand Tourer*! It has an aluminum alloy body wrapped around a tubular steel frame. Its streamlined shape flows back to a lipped-up spoiler on the tail, designed to increase its roadholding ability at high speeds.



told me I needn't bother with any acceleration trials; they already had run them for me. Sure enough, their figures gave the Cougar the edge! I decided to run my own trials, anyway.

First we ran the two cars down the straightaway side by side, comparing speedometers. Both read the same at each speed. Then I took out the Aston with Tom Stimson, *PM's* western editor, beside me and holding the clock.

From a standing start we reached 30 mph in 3.2 seconds (The figures Mercury had given me were 3.6 seconds.). We ran the 0-to-60 in 8.1 seconds (the chart 8.4 seconds). On the 0-to-90 runs we averaged a flat 16 seconds vs. the 16.7 seconds on the chart. The car obviously was faster than indicated.

Next, in the Cougar, we did the 0-to-30 in 2.2 seconds (the chart showed 3 seconds). On the 0-to-60s we averaged 6.1 seconds vs. the chart's 6.8 seconds, and on the 0-to-90s we averaged 13.5 seconds vs. the chart's 13.6 seconds. This in spite of a bad rear-wheel hop that the Cougar had while trying to get off the line in a hurry. The rear suspension on our test car was too soft to keep the wheels on the ground during a full-power getaway. The car performed best when I fed power less severely.

Perhaps the difference between the two sets of figures was a difference in drivers, road conditions and possibly the weather. Even my figures, however, showed the Cougar accelerating faster.

While running practice laps on the tough, three-mile Stardust course, I found the Aston had quite a bit of oversteer, typical of many European cars, while the Cougar had a slight amount of understeer. This penalized it later.

The Aston's engine had a slight tendency to stutter at around 2000 rpm, then it ran clean and really came on strong from 3500 rpm up, performance typical of this design of engine. The Cougar's engine wasn't running too well at 4000 rpm and up, possibly because of carburetion. The car had been hastily driven 2400 miles to Las Vegas in order to meet *PM's* deadline, then



**PM WESTERN EDITOR TOM STIMSON** and I confer on test procedures before bombing off in Cougar at

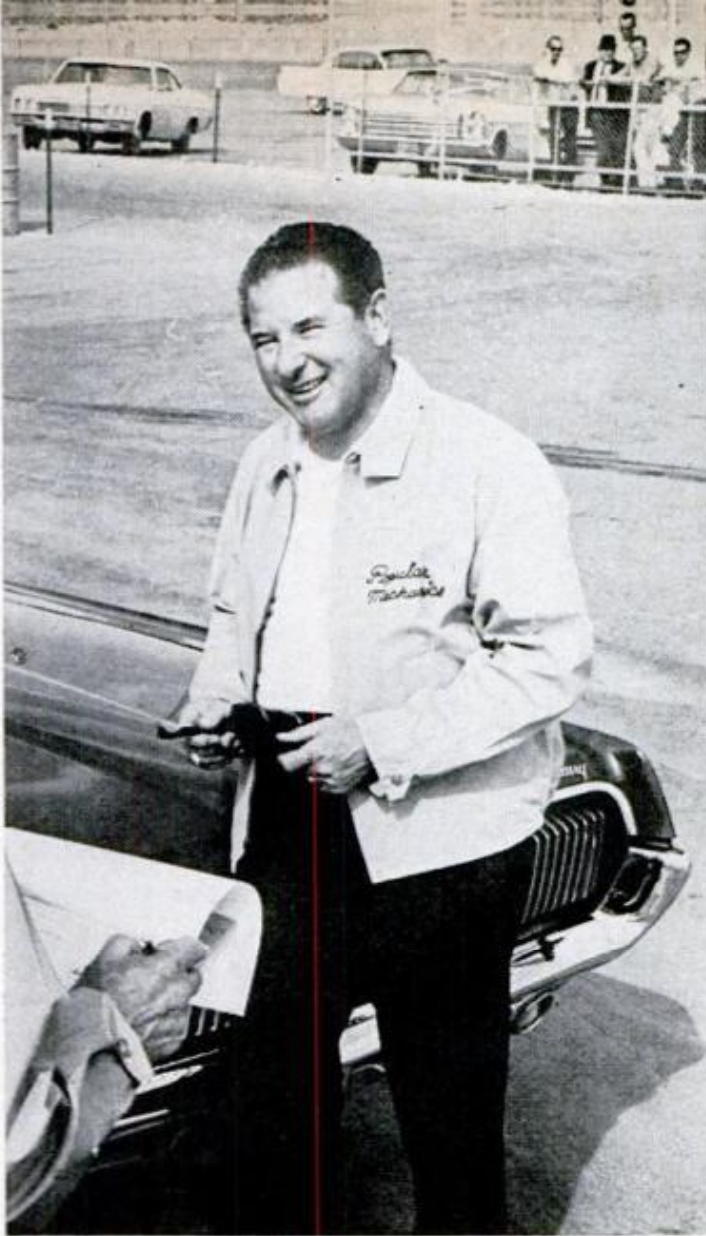
**COUGAR XR7-390 GT** offers manual four-speed shift, power steering, swing-away wheel, luxury interior



**POPULAR MECHANICS**

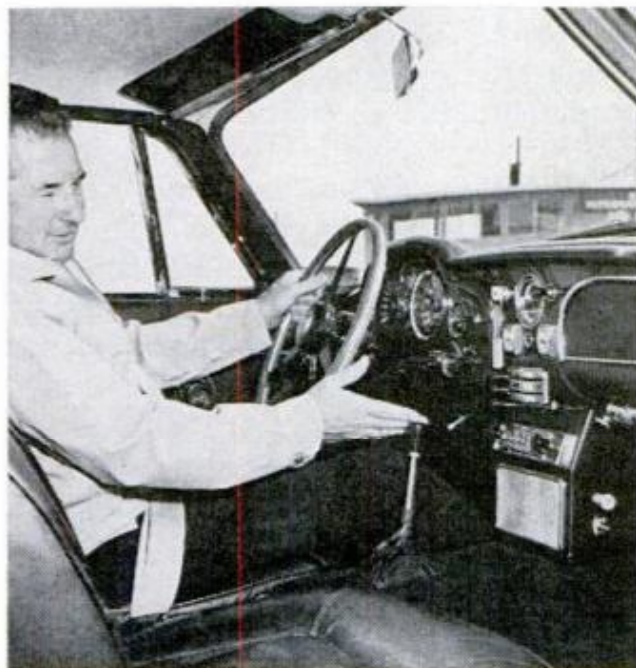
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Las Vegas' Stardust International Raceway. Stimson said I drove as if "retirement" was all in my mind

**ASTON MARTIN DB-6** offers manual five-speed shift, luxury touches, gadgets as standard equipment



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had been given a quick—and possibly incomplete—tune-up.

I ran each car around the track three times against the clock. Average lap times: Aston Martin—2 minutes, 15.5 seconds (79.70 mph). Cougar—2 minutes, 20.5 seconds (76.87 mph).

Yet I think I could have picked up much of the five seconds I lost in the Cougar if the car had been prepared differently. There was just enough understeer to keep me from getting set up in the corners so I could really hustle. A few slight adjustments to gather up the understeer would have given the car the handling qualities I needed to make full use of its power on this "busy" kind of track. The car definitely has all the power it needs. Braking on each car was excellent.

When I finished on the track I tried both cars on dusty desert trails for road handling and cornering and I found no significant difference between them.

Anyone who can afford to drive an Aston Martin is bound to enjoy its luxury features. It's a compact car and gives a driver a feeling of solid construction. Its short-throw manual transmission is a masterpiece compared to a production transmission in regard to the amount of movement needed to get the shifting done and the certainty that you've reached the right gear. The Aston didn't have power steering, although it's available as an option.

I found the Cougar to be as comfortable as the Aston and its equal in ease of driving. The Mercury product is a good looking, attractive car. One of its good features is the way it can be tailored to the purchaser by means of its many options. Certainly "Bill Sports-car" would buy the performance package with its slightly stiffer suspension (and possibly wish it was stiffer than it is), while the average buyer can forego the performance options.

To sum it up: for performance and luxury, I'd say the Cougar is a car for the man who aspires to own an Aston Martin but hasn't got the pocketbook for it!

★★★





ARTICULATED UNITS of TASC make it extremely flexible, able to drive over radically undulating terrain

## Boy, If It Could Only Fly!

Despite its imposing military handle—a Tactical Articulated Swimmable Carrier—we found this new multipurpose “thing” an off-road delight

By **BILL KILPATRICK**, PM Auto Editor

Technical Art by *Inkcraft*

**YOU COULD SAY** Chevrolet's new “double-jointed” military vehicle is sort of handsome in a purposefully ugly way. Or, you could say it's just plain funny-looking. You could even say it *has* to be an engineering nightmare. But you can't say it isn't one of the most rugged, versatile rigs ever built, and you can't say it isn't an absolute ball to drive.

Chevy calls it TASC (for Tactical Articulated Swimmable Carrier). Yet the name tells only part of the story. Sure, TASC can swim, but it can also crawl up a 60-plus-percent grade, climb over a 21-inch vertical step, bound over foot-high rocks, plow through heavy bush country, zip down an open road at a brisk 55 mph, and do just about everything but stand on its ear and fly.

I drove TASC at the General Motors

Proving Ground near Milford, Mich. With me was GM senior project engineer Ed Etnyre, who said the idea of TASC was to design for military use a low-cost, lightweight, amphibious vehicle offering what he termed “exceptional off-road mobility.” After driving TASC over some pretty wild terrain—including a pond—I'd say the “off-road mobility” requirement has been more than met.

Powered by a 283-cu.-in., 160-hp V8 (capable of operating on 83-octane military grade fuel) linked to Chevy's Powerglide automatic transmission, TASC's really unique feature is its flexible three-module design. The three modules, or sections, include a two-wheeled driver's cab, a center engine, transmission and accessory unit, and a two-wheeled rear payload compart-





**BIG TIRES ACT LIKE PADDLEWHEELS** to drive TASC on water. Vehicle "swims" with 11-inch free board ment adaptable as a cargo, troop or weapon carrier, a reconnaissance vehicle, or a battle-zone ambulance. TASC can lug payloads weighing up to 3000 pounds.

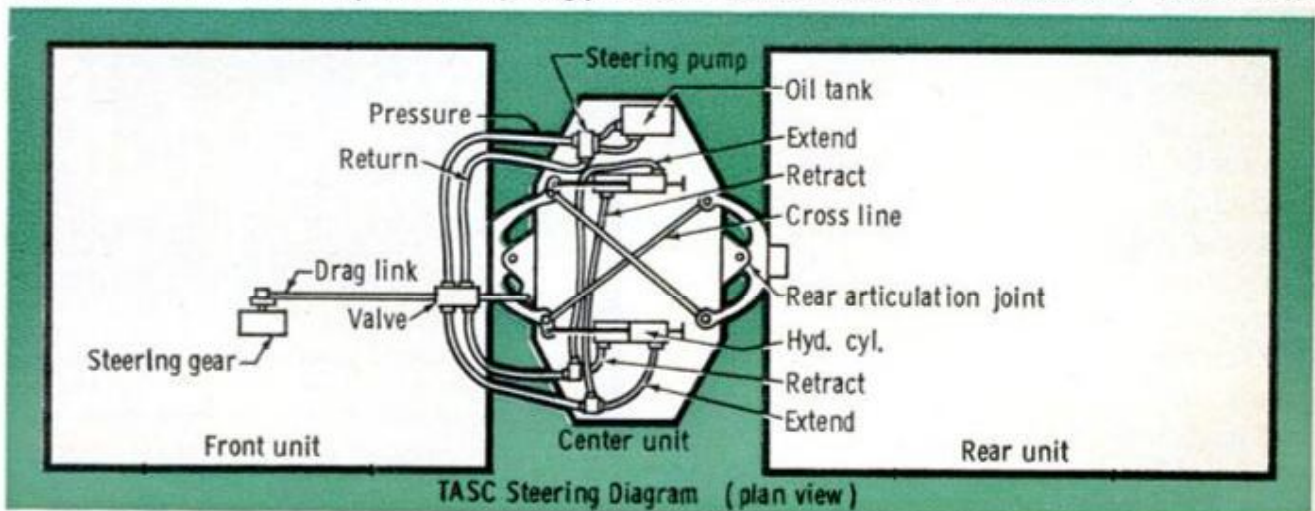
TASC's special trick is its power-assisted steering (see diagram). Two steering pivots are located equidistant from the axles (both standard GM truck rear axles) and connected with cross links. The pivots steer simultaneously and in synchronization. The power-assist is provided by hydraulic cylinders reacting between front and rear sections. Hence, the wheels don't steer, just track.

TASC swims thanks to watertight compartments and big, low-pressure, heavy-ribbed tires that—in four-wheel drive—act as paddlewheels. Speed on water is three to five mph. Any water slopover is bailed out of the engine transmission compartment via two bilge pumps switched on and off by the driver.

When you examine TASC, you find no trace of a rudder for operation in water. That's because rudder action—as with land steering—is due to the pivot action of the modules.

A great rig. Too bad it can't take off and fly. ★★★

**UNIQUE STEERING SYSTEM** provides surprisingly accurate control. TASC can be turned in a 36-foot circle





**I** FLEW A KART at a speed in excess of 150 mph!" asserted Jack McClure of Tampa, Fla., one of the country's leading jet-kart drivers. "I was hitting about 155 mph when the front end of the kart raised up, then the rear wheels followed and I suddenly realized I was flying. I cut the engines off and the machine started to settle back to the track."

The vehicle that McClure was driving when this takeoff occurred was one of the new powerful little Formula J karts. These little bombs are powered by tiny reaction engines built by Turbonique, Inc., Orlando, Fla. Most of them are seen on drag strips in the southern part of this country. A number of wheel-powered turbine karts, powered by Turbonique's Microturbo engine, are also beginning to be seen on the tracks.

C. E. Middlebrooks of Turbonique Inc. says that wheel-driven jet karts become light or airborne on the front end around 130 mph where the pure



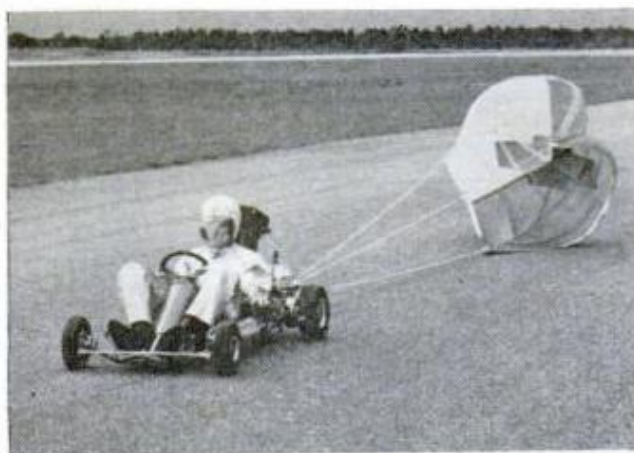
**TINY JET KART** jumps out in front of Tommy Ivo and his 200-mph dragster. McClure, driving, almost beat big machine

## KARTS WITH ROCKET

jets are good for another 30 mph before "lifting off." The "aerodynamic barrier" keeps kart speed down. Incidentally, this also happens with other types of vehicles. A VW powered with an 850-hp turbo engine will take off at 160 mph.

The engine used on most of the jet karts is the Turbonique Model T-16-A which has a thrust of 185 pounds. The engine burns a monopropellant fuel, available through Turbonique, called Thermolene.

Turbonique builds the karts complete, or supplies the engines and components separately. The equipment necessary for powering a twin-jet kart runs a little over \$1200. ★★★



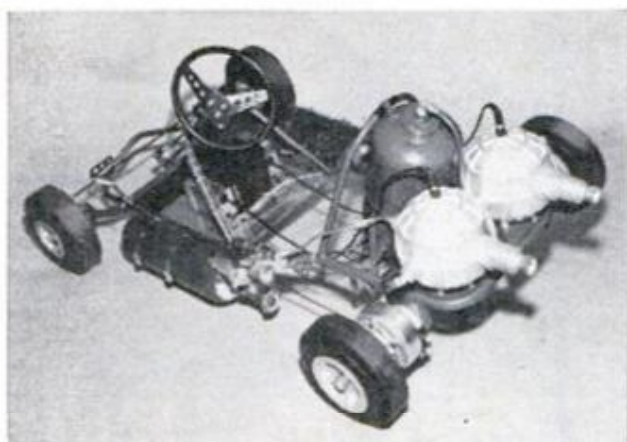
**POPPING HIS CHUTE**, Jack McClure slows his kart from 150 mph to a lower speed so he can use the kart's small disc brakes for final deceleration



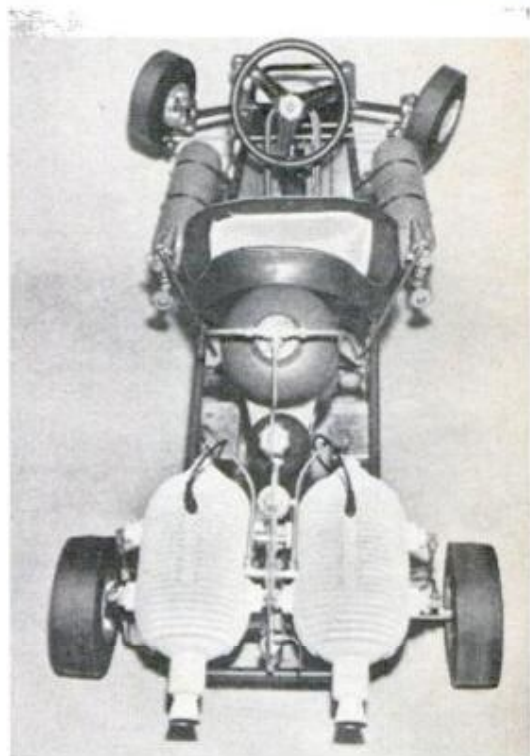


**WHEEL-DRIVEN VERSION** of kart is tied down and weighted for static test. Turbonique engine puts 45 hp to wheels

# POWER

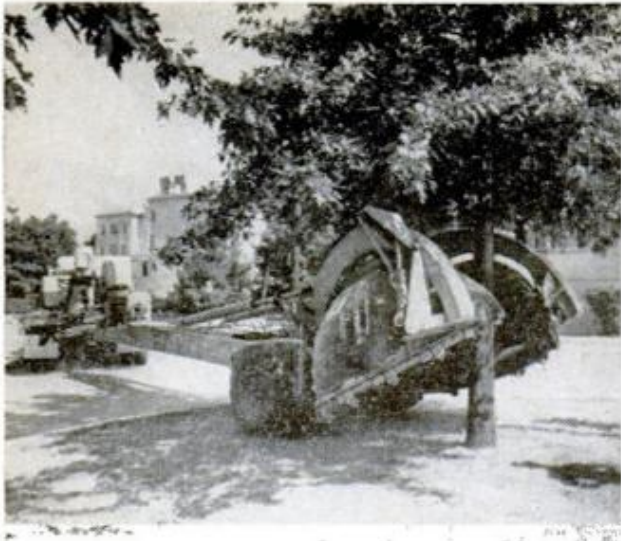


**THERMOLENE FUEL TANK** between engines is pressurized by nitrogen carried in one of cylinders on chassis. Other cylinder contains oxygen to start jets.



**KART** with extended wheelbase, being modified for its 370-lb.-thrust engines, will be streamlined, equipped with high-speed tires





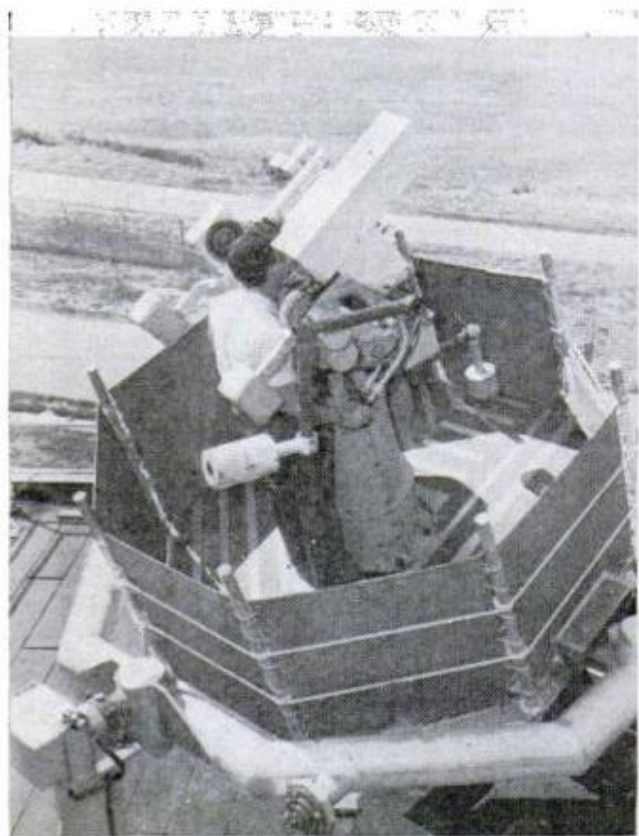
## Tree mover picks tree up here . . .

Each half of the giant clamshell scoop on this tree-transplanting machine has chain-saw teeth that chew under the roots of a tree in a uniform ball-like pattern. When the two cutters meet under the tree, the machine lifts the seven-foot ball of earth, the roots and the tree itself out of the ground. Then the tree is ready for transplanting almost anywhere. The machine, called the Pow-R-Tree Mover by its maker, the Harry Vermeer Manufacturing Co. of Pella, Iowa, can do all of these chores itself—the digging, the transporting and the trans-



## High-level competitor

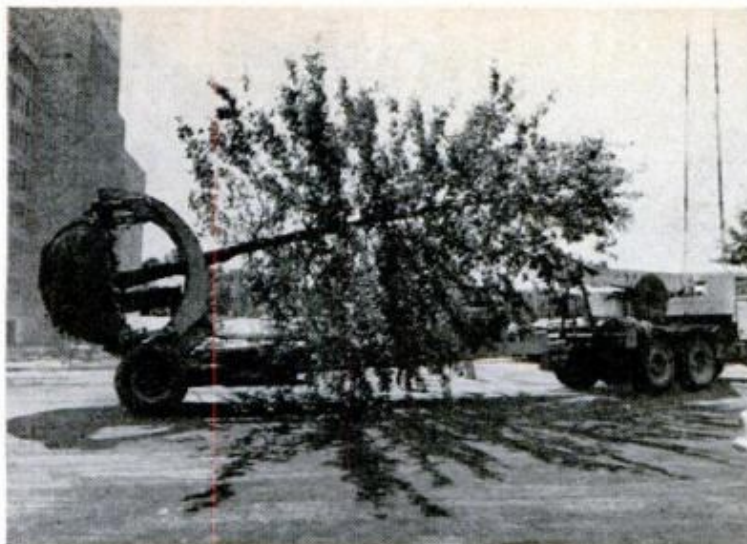
Preparing for the Mexico City Olympics, where track and field events will be run in the thin air at 7500 feet above sea level, British runners are testing their stamina with oxygen measuring devices carried in an auto as they do their daily workouts.



## High seas on dry land

Simulated heavy seas toss this "battle station" to and fro during a study of means by which engineers can make firing from an unstable ship's deck easier. Operated by electric motors, the platform is installed at the Johns Hopkins University physics laboratory.





### **. . . and gently plants it over yonder**

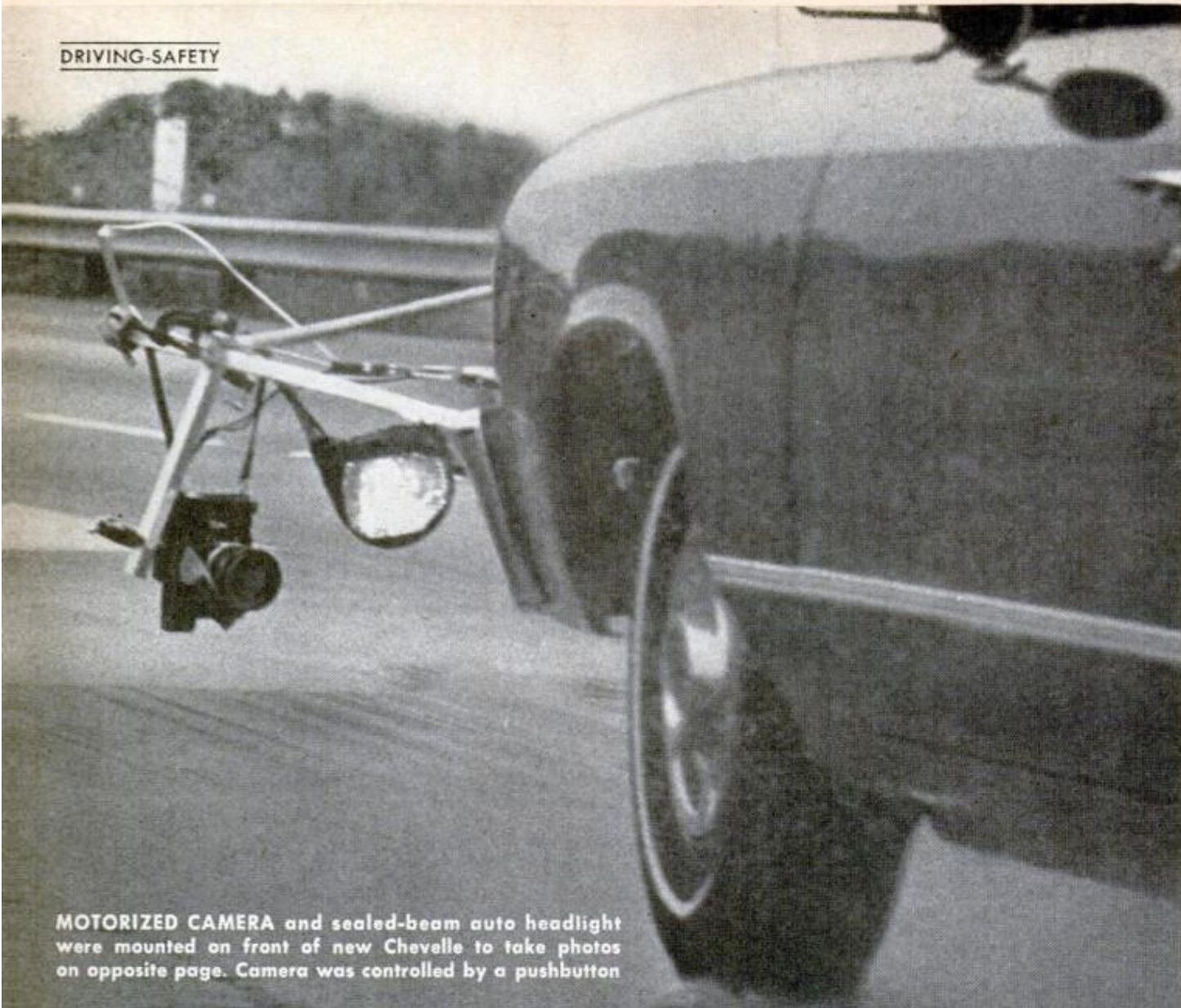
planting. The ball of earth, plus the tree, may weigh as much as 6000 pounds and the saving in manpower may be as much as the difference between one hour's work for the machine and eight hours' work for a crew of tree diggers. The pictures show the machine moving into place, clamping its jaws around the tree while the chain saws go to work, lifting the tree and its roots to the horizontal position for transport, then dropping it into place at its new site. (In many cases, the new site is prepared beforehand by the same machine.)



### **Omnibus stadium for Montreal's Expo 67**

Called a "permanent-temporary" structure, a \$3-million-plus stadium has been built near the main entrance of Expo 67 at Montreal to handle spectacles of all kinds. Major sports events, military demonstrations and horse pageants are among the programs announced. The stadium, sponsored by five major Canadian automobile manufacturers, is expected to seat about 25,000 people. Made of precast concrete, the stadium can be removed from its site and erected again elsewhere.





MOTORIZED CAMERA and sealed-beam auto headlight were mounted on front of new Chevelle to take photos on opposite page. Camera was controlled by a pushbutton

# Farewell to Wet-Weather Skids

Because certain strips of California highway are really groovy, auto-skidding accidents have been sharply reduced

By JONATHAN ROOT

Photos by Peter Breinig

**B**Y SAWING LONGITUDINAL GROOVES in its freeway and expressway pavements, the California State Div. of Highways is stopping wet-weather skidding accidents caused by tire hydroplaning. The grooving technique is an outgrowth of experiments by the British Ministry of Aviation and several years of research by the U.S. National Aeronautics and Space Administration. It has proven so successful in California that it has been adopted by at least two other states, and it may become the standard method throughout the country for preventing the rash of car crashes that



make up the major portion of accident reports across the nation whenever and wherever it rains.

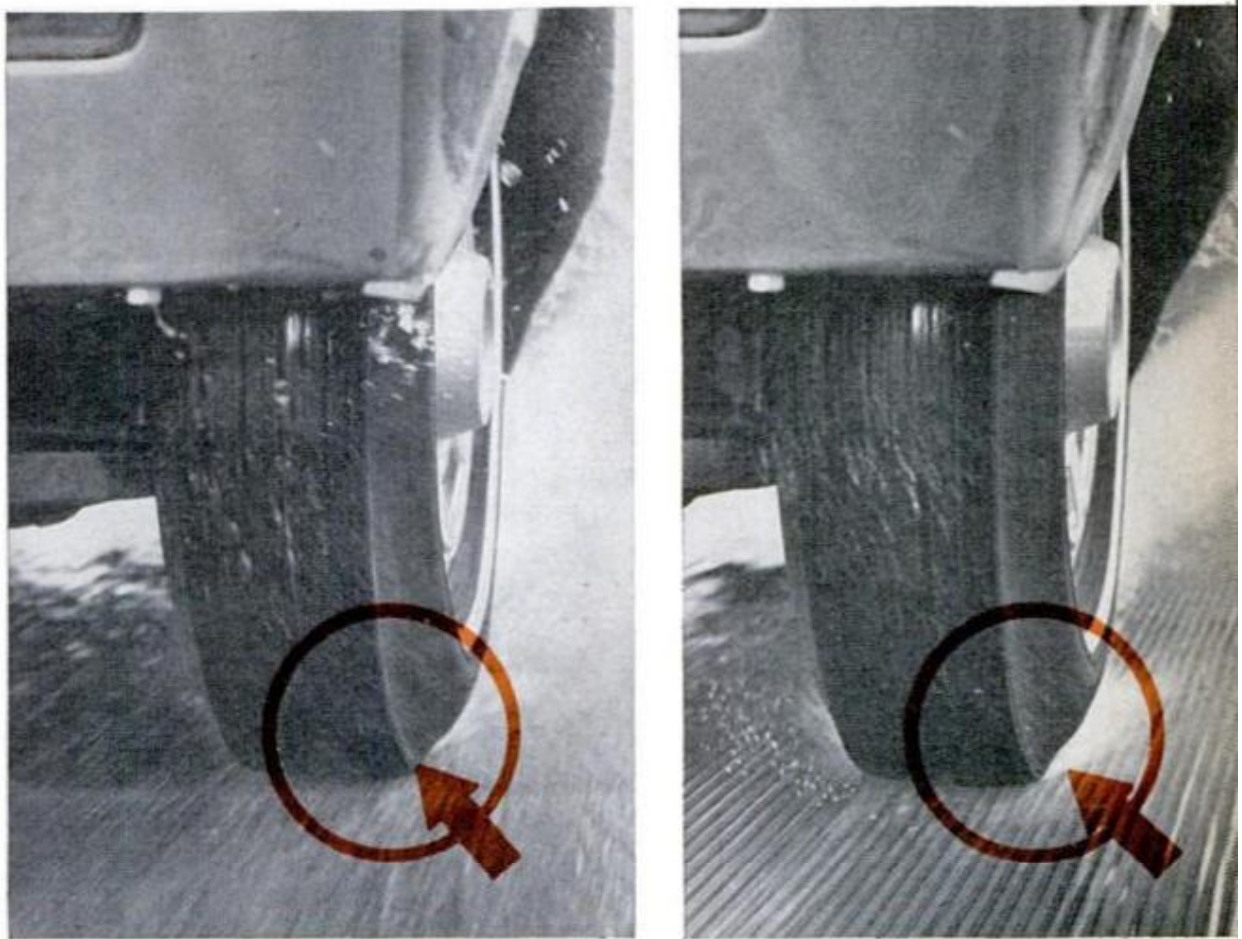
California grooved two crash-plagued sections of highway experimentally three years ago, and there have been no skidding accidents at either location since.

Although it was Britain that first tried pavement grooving (to increase the friction coefficient of military airfield runways), it was NASA that uncovered the now-familiar phenomenon of tire hydroplaning and exposed a large number of misconceptions, both popular and professional, about tire design.

Pneumatic tires do not merely slide on the pavement lubricant provided by water, they water-ski—rising off the pavement on a wedge of water trapped between the pavement surface and the footprint of the tire. The solution, NASA found, is either to get rid of the water or design a tire that will penetrate it.

Tires with circumferentially ribbed tread are less prone to hydroplaning than tires with patterned tread, especially if the ribs have been "siped"—tiny transverse cuts across the rib tread, NASA discovered. The ribbed tread provides escape channels for the trapped water, as do grooves in the pavement, and the "siped" sections of the tread provide high-pressure points which tend to penetrate the water.

California engineers decided to try pavement grooving in 1963, not long after NASA published its first report on hydroplaning



**NEW TIRE STARTS TO HYDROPLANE** (left) at 65 mph on smooth pavement covered by about .5-in. of water. Note that tire's bow wave has diminished and receded back midway in the footprint, indicating that buildup of water pressure is lifting tire off pavement. Still going 65 mph (right), tire enters section of grooved pavement, relieving pressure and enabling bow wave to return to front of footprint. Water forced into grooves helps tire retain traction



#### HOW TO AVOID THE DANGER OF YOUR AUTO HYDROPLANING ON WET PAVEMENT:

1. Determine the hydroplaning speed of your car's tires by multiplying the square root of the tire pressure by 10.3. Stay below this speed on wet pavement, especially if your tire tread is worn.
2. Equip your car with tires whose treads have been ribbed circumferentially, rather than patterned, and which have been "siped"—tiny transverse cuts in the rib.
3. Add a margin of safety during wet weather by increasing tire pressure 10 pounds per square inch above the specified pressure. The greater the tire pressure, the higher the speed at which hydroplaning can occur.
4. Remember that a tire can hydroplane on as little as 4/100ths of an inch of water, a depth bound to occur on highways during normal rainfall.
5. Remember, too, that once a tire hydroplanes, even when the car is traveling in a straight line, you can lose all control. A crosswind of no more than 10 mph can send a hydroplaning car into an unrecoverable spin.

research. NASA engineers found that any inflated tire will hydroplane, losing all directional and braking control, if it is unable to displace the water through which it is passing.

In short, if the depth of the water exceeds the depth of the tire tread, the tire can hydroplane. Average tread depth on a new tire is about  $\frac{1}{16}$ ths of an inch. Water depth in front of a tire varies with the texture and drain slope of the pavement, the speed and pressure of the tire, and whether or not—and at what speed—a crosswind exists. A crosswind of as little as 10 mph can pile up water to a hazardous depth, and it can also blow a hydroplaning auto hopelessly out of control.

Fortunately, tire hydroplaning is foreseeable and the speed at which it will occur is predictable. The key to it is the dynamic pressure of the piling-up water balanced against the air pressure within the tire. NASA expressed it with this somewhat empirical equation: The square root of the tire pressure multiplied by 10.3 will give the speed in mph at which a given tire will hydroplane.

For example, most modern auto tires carry between 18 and 30 pounds of air pressure. Taking 25 pounds as an average, the square root of 25 is five and multiplied by 10.3 it equals 51.5 mph.

The final factor in this scary phenomenon, NASA learned, is the size of the tire footprint. The larger the footprint, the more efficiently the tire will hydroplane.

These last two conclusions of the NASA research—tire pressure and footprint area—tended to support highway engineers' observations that the incidence of wet pavement skidding auto accidents had increased markedly since the introduction by Detroit of low-pressure, low-profile (softer and fatter) tires in the interest of motoring comfort. "Tires used to carry as much as 40 pounds pressure and this—plus lower posted speed limits—kept most cars out of hydroplaning range," says Blair Geddes, one of the California district traffic engineers who pioneered the highway grooving.

What Geddes is saying is that a tire at 40 pounds pressure will not hydroplane under 60 mph, and posted speed limits in most states only recently exceeded this.

California's decision to try pavement grooving was somewhat arbitrary. Hydroplaning theories were not then widely known.

"It was our feeling that we could increase the friction coefficient of the pavement and give tires something to hang onto, so to speak," said John Beaton, who heads the highway division's research department.

Among the first locations grooved at Geddes' direction was a 1200-foot gentle (six percent) downhill curve on Interstate 80, just east of the 7000-foot-high summit of Donner Pass in the Sierra Nevada Mountains.

Although the surface of this four-lane divided highway was relatively



To determine the speed at which your car tires can hydroplane, multiply 10.3 by square root of the air pressure. Hydroplaning speeds for the most common auto tire pressures are shown below:

TIRE PRESSURE (PSI)	SQUARE ROOT OF PRESSURE	HYDRO-PLANING SPEED (MPH)
16	4	41
18	4.2	43
20	4.4	45
22	4.6	47
24	4.8	49
26	5.09	52
28	5.2	54
30	5.4	56

new and adequately banked, and its friction coefficient well above required minimums (.25), there had been 11 wet-weather skidding accidents at that location over the preceding three years. Since the pavement was grooved in 1963, this type of accident has ceased.

Similarly heartening results were obtained in Southern California. G. L. Russell, the district traffic engineer for the Los Angeles area, decided to try it out on the Golden State Expressway, also a divided four lanes, just south of the town of Gorman. Over a two-year period, there had been nine crashes attributable to cars skidding out of control on wet pavement. One person had been killed and 15 injured. Since the pavement was grooved, there have been no wet-weather accidents. Russell has since applied the technique to several accident-prone freeway locations in and around Los Angeles.

California and NASA soon became acquainted with each other's efforts and have been busily exchanging engineering reports, for NASA seeks a solution to the problems attendant on aircraft—especially high-speed jets—landing on rainy runways. The agency is investigating pavement grooving, both transverse and longitudinal, and in the meantime has discovered another antihydroplaning device, applicable to aircraft if not to autos—an air jet directly in front of the tire, blowing the water aside.

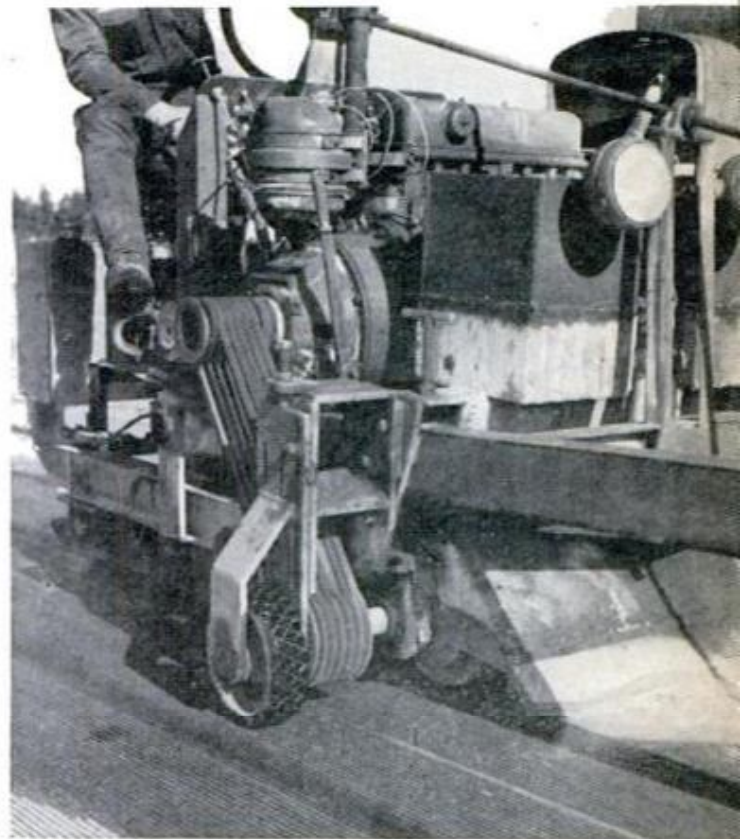
NASA's research was triggered specifically by the near-crash of a Boeing

707 departing a slush-covered runway at New York's John F. Kennedy (then Idlewild) Airport in 1959. The aircraft had reached critical speed, just shy of rotation and takeoff, and refused to go any faster. The pilot finally yanked it free and the ship staggered into the air—barely. Walter Horne, assistant to the chief of NASA's Landing and Impact Branch, remembers the incident vividly.

"We thought at first that we had a serious operational bug that might ground all the jets," he said, "and then we began to think about the possibility of tire hydroplaning."

Several years earlier, a NASA engineer named Harrin Eziaslav had discovered that a tire revolving at high speed on a continuous moving belt would stop turning when water was introduced between the tire and the belt. This, it turned out, is characteristic of tire hydroplaning, the apparent result of drag induced by the displacement of the water, a force sufficient to

*(Please turn to page 210)*



**PAVEMENT IS GROOVED** via special diamond-tipped circular saw blades that cut an 18-in. swath 1/8-in. deep in concrete, go 1/4-in. deep in softer asphalt





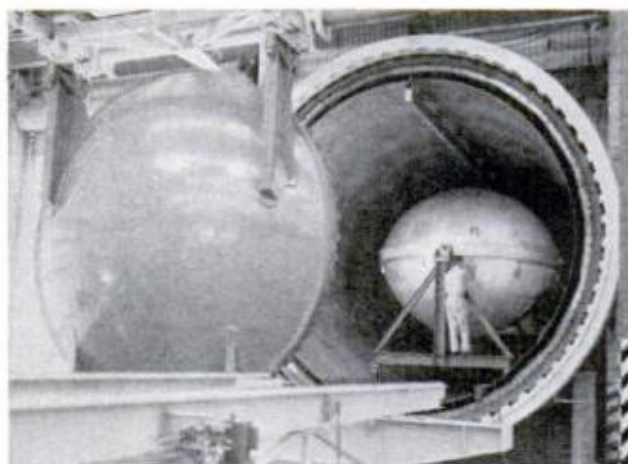
## Air Force jet gets a nose job for space work

One of a fleet of eight C-135s to get their noses altered to accommodate electronic equipment, this four-engine jet will soon be sticking its bulbous proboscis into the space program. The nose houses, among other things, a huge parabolic dish antenna to scan for spacecraft. The planes will fill in communications gaps between spacecraft and ground stations.



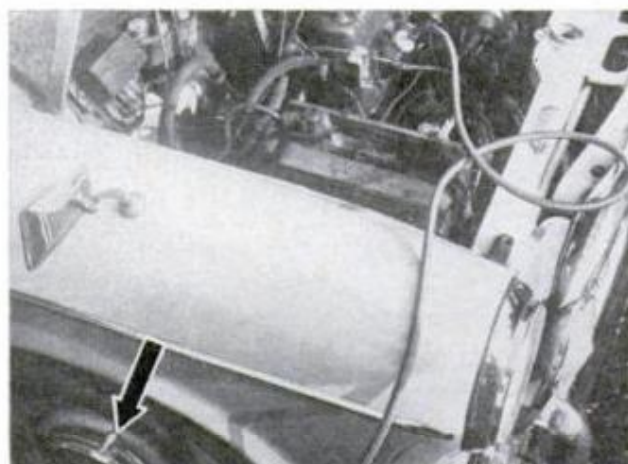
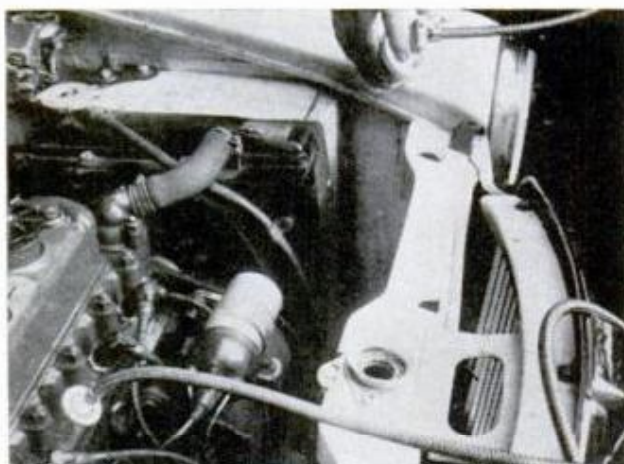
## Homemade dozer

Made from odds and ends, this midget tractor is powered by a five-hp gas engine that drives the tracks (old tractor tires). Either a blade or a bucket can be attached. Robert Albrecht of Athens, Wis., made it.



## King-size pressure cooker

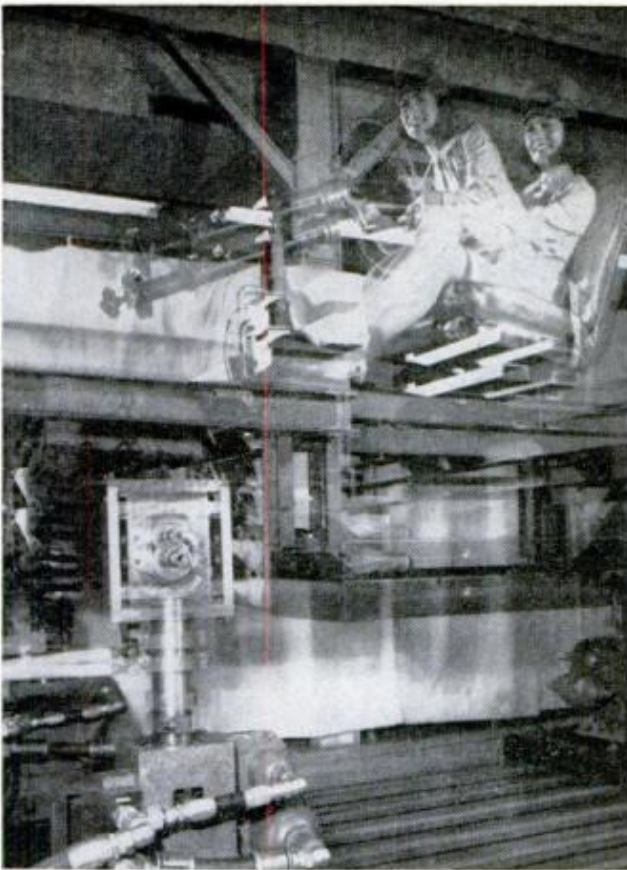
Custom-made for the Marshall Space Flight Center, this giant pressure cooker provides controlled atmosphere, heat and pressure to help bond adhesives used in making honey-comb panels for missiles.



## Engine compression operates spray gun or tire pump

Screwed into a sparkplug hole in an automobile engine, an English-made device uses the engine compression to provide pressure to operate either a paint spray can (left) or blow up flat tires (right). A special cut-off valve prevents the normal fuel-air mixture in the cylinder from being sucked into the hose.





## B-b-bump s-s-simulator

All the bumps and bounces from cobble stones, pot holes or gravel roads can be reproduced on this hydraulic road simulator which is used to test experimental automobile chassis. Magnetic tapes of road surfaces are fed into the machine which then jostles the frame.



## Real bell ringer

When the pet cat began scratching the front door, signaling she wanted to be let in, her English owner rigged a special doorbell for her. Now the cat comes home after a night on the town and just rings for attention. It gets to be a bit much, however, when she comes home at 2:00 a.m.



## Low-priced helicopter

Made to sell at \$12,000, this two-place helicopter features rubber-mounted rotor blades and V-belt drive which, the maker claims, reduce manufacturing costs and eliminate vibration and lubrication. Developed by Scheutzw Helicopter Corp. of Berea, Ohio, it has a top speed of 85 mph.



## Student hovercraft

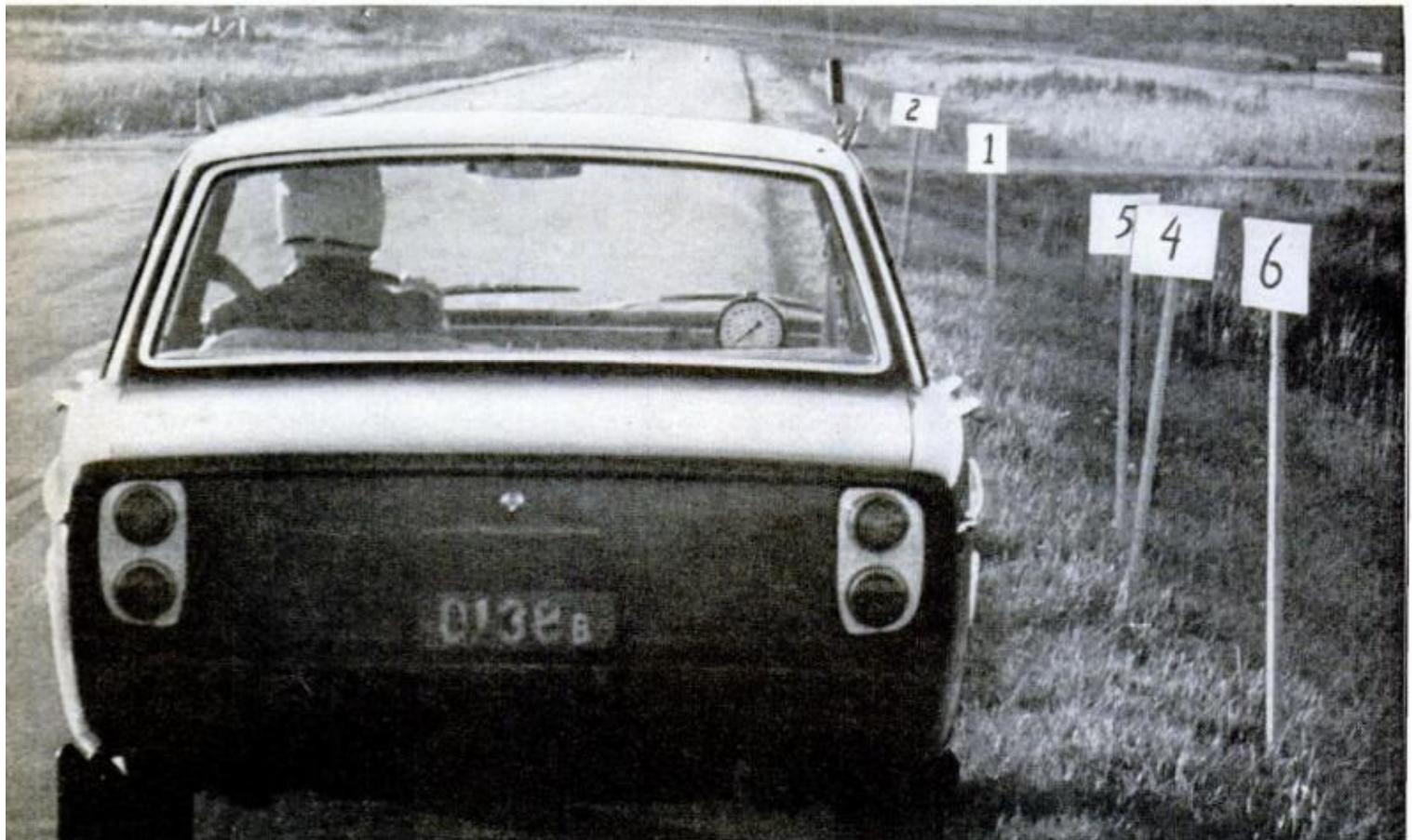
Made as a shop project by five engineering students in Ford of Britain Training School, this aluminum-covered hovercraft was built in one year for about \$5500. It's powered by a half-ton diesel truck engine and is held aloft by twin fans pushing out 42,000 cubic feet of air per minute.



VOLVO'S NEW 144 HAS DISCS BOTH FRONT AND REAR AND A BRAKE SYSTEM THAT GUARANTEES STOPPING POWER

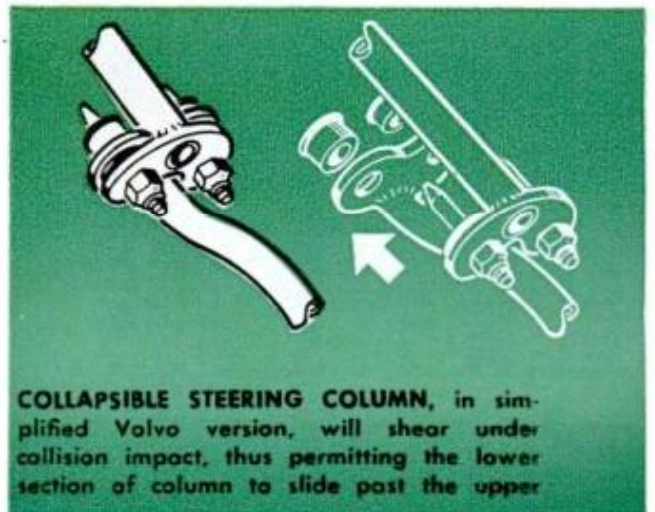
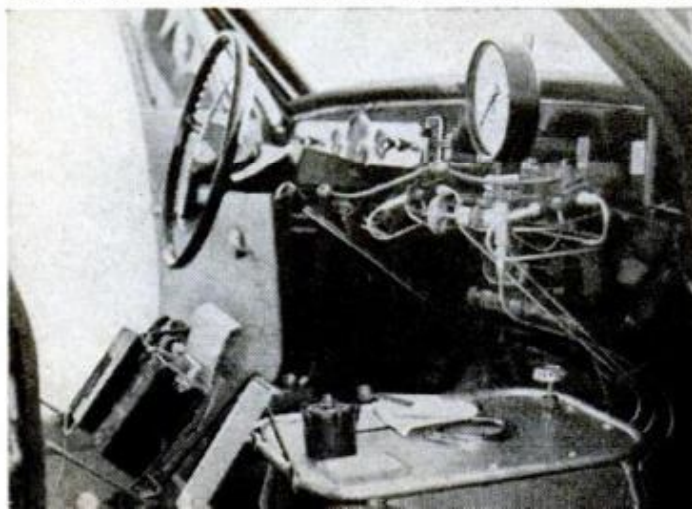
# Why can't American cars have

By Robert P. Crossley



**MARKERS SHOW STOPPING DISTANCES** of test car using various brake combinations applied steadily at 45 mph. Farthest, No. 2, shows distance with rear brakes only. No. 1 marks where car stopped using only front brakes. Nearest, No. 6, shows effectiveness of four brakes. No. 4 indicates distance with brakes working on two fronts and one rear, provided by either half of Volvo's dual system. No. 5 is same three wheels in panic stop. On missing No. 3, panic stop with rear brakes only, car spun off road

**INTRICATE SWITCHOVERS** within easy reach permit the test driver to select various combinations of brakes



**COLLAPSIBLE STEERING COLUMN**, in simplified Volvo version, will shear under collision impact, thus permitting the lower section of column to slide past the upper



BACK PLUS A FAIL-SAFE  
ON AT LEAST 3 WHEELS

# brakes like these?



PM EDITOR Bob Crossley liked way 144 took bumps on proving ground in Sweden

**T**HE BLACK SEDAN came down the straightaway at a precise 45 mph. As it crossed a white line the driver slammed on his brakes—or what was left of them. One half of the car's dual braking system had been disconnected for the test. Without the least swerve, the sedan came to a smooth halt only a few yards farther down the road from where it stopped when all four brakes were functioning.

This time, although half of its system was not working, it still had brakes on *three wheels*—both front wheels where it counts most, and one rear wheel.

Minutes earlier, with only the two rear wheels braking, as might happen on Detroit's new dual systems, the same car had careened across the test track in a wild spin.

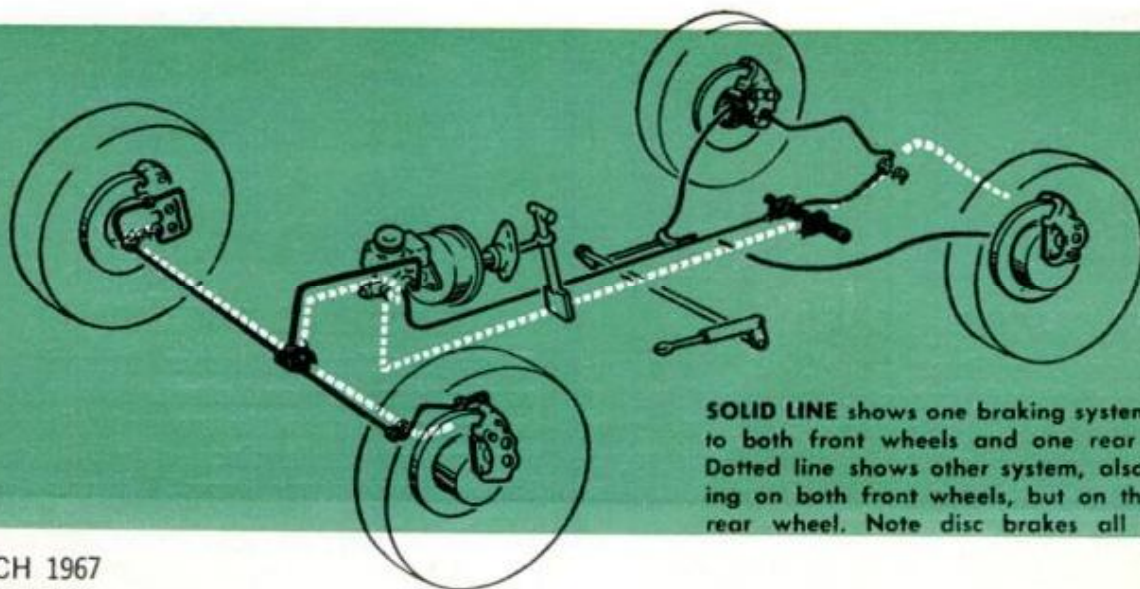
The car was a Volvo 144, a smartly styled new compact which the Swedish company will unveil in this country next month. It has, quite probably, the best brakes in the world.

When U.S. carmakers are starting to offer disc brakes as front-wheel options on high-performance and sporty models, Volvo goes all the way and puts them on all four wheels of a family car. Volvo says four-wheel discs cut icy stops in half compared with cars having discs front and drums rear.

Volvo's real "brake-through," though, is in the engineering of its dual "fail-safe" system. Instead of one brake cylinder connected to the front wheels and another to the rear wheels, as on U.S. cars, Volvo's system is designed so that you *always* have two front brakes and one in the rear. The importance of this is evident when you realize that front wheels generally supply 70 percent of a car's braking and rear wheels only 30 percent. With two fronts always teamed with at least one rear, the efficiency is never less than 80 percent.

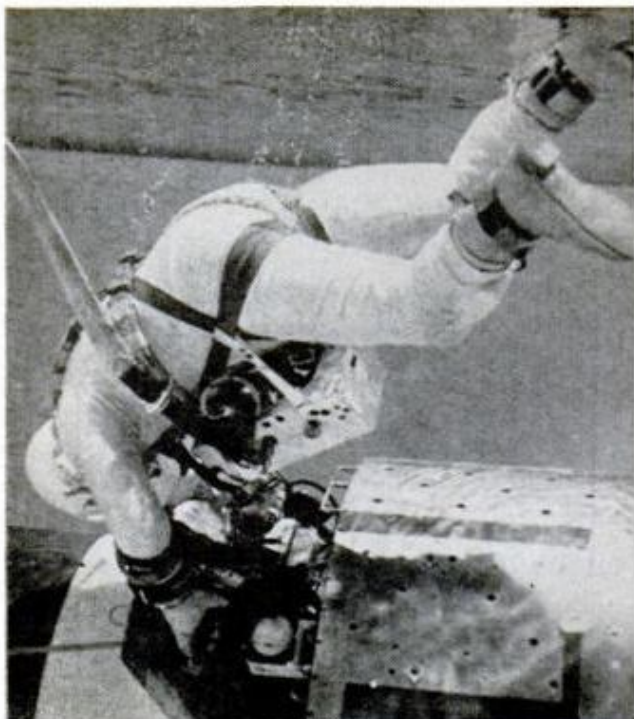
I had a chance to test the 144 last October at the Volvo proving ground near

*(Please turn to page 224)*



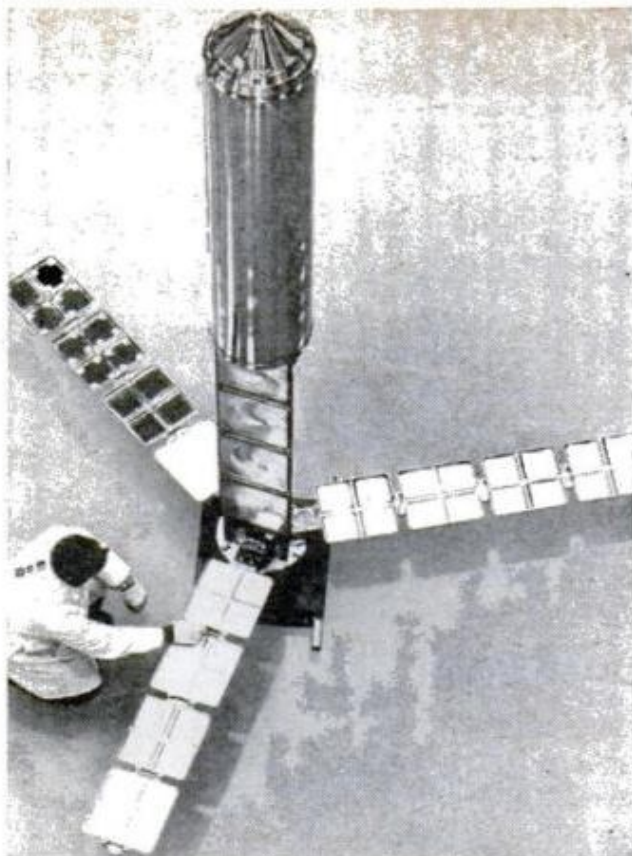
**SOLID LINE** shows one braking system going to both front wheels and one rear wheel. Dotted line shows other system, also working on both front wheels, but on the other rear wheel. Note disc brakes all around





### Work down to work up

This aquanaut is actually astronaut Edwin (Buzz) Aldrin, space walker of the Gemini 12 success. He feels that the best way on earth to simulate the weightlessness of space is to walk and work under water.



### Dusty Luster

"Luster" is a space vehicle that collects micrometeoroids and other space dust, then returns to earth by parachute. The arms extend for three minutes when Luster gets into space. Then they fold back into the body and are covered by a nose cone before descent.



### New rescue jacket

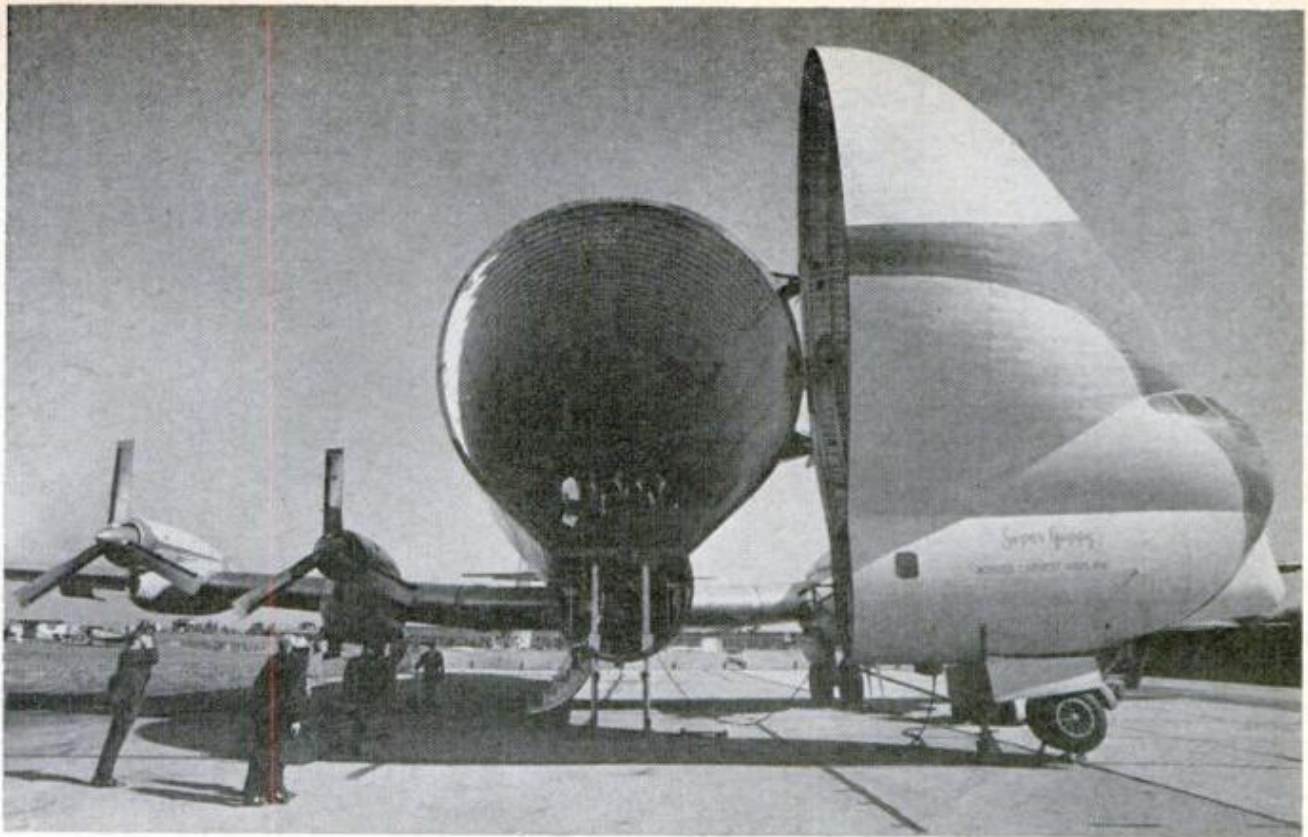
A Royal Air Force flyer floats in an undamaged life jacket after ejecting from a supersonic jet. Inflatable jacket, made of Terylene and nylon, is designed to withstand the wind blast of a bailout. The jacket also has a radio homing device.



### Comfortable combo

Designer Kenneth Isaacs dreamed up this combination bed and chair. Now you can be in bed more than the normal third of your lifetime with this piece of novel furniture. But you will never know if it was the bed-chair or the book that put you to sleep.





## Stratocruiser fattens up for rockets

Called Super Guppy, this modified Boeing Stratocruiser is big enough to fly some of NASA's largest space rockets. The giant plane, designed by Aero Spacelines, Inc., is 141 feet long, 26 feet in diameter and can carry 45,000 pounds of rocket in 50,000 square feet of space.



## Modern Art?

No. It's a new antenna for communicating with satellites. The Circular Polarized Loop Vee, designed by Electronic Communications, Inc., will be mounted on airplanes for direct communications with space vehicles.

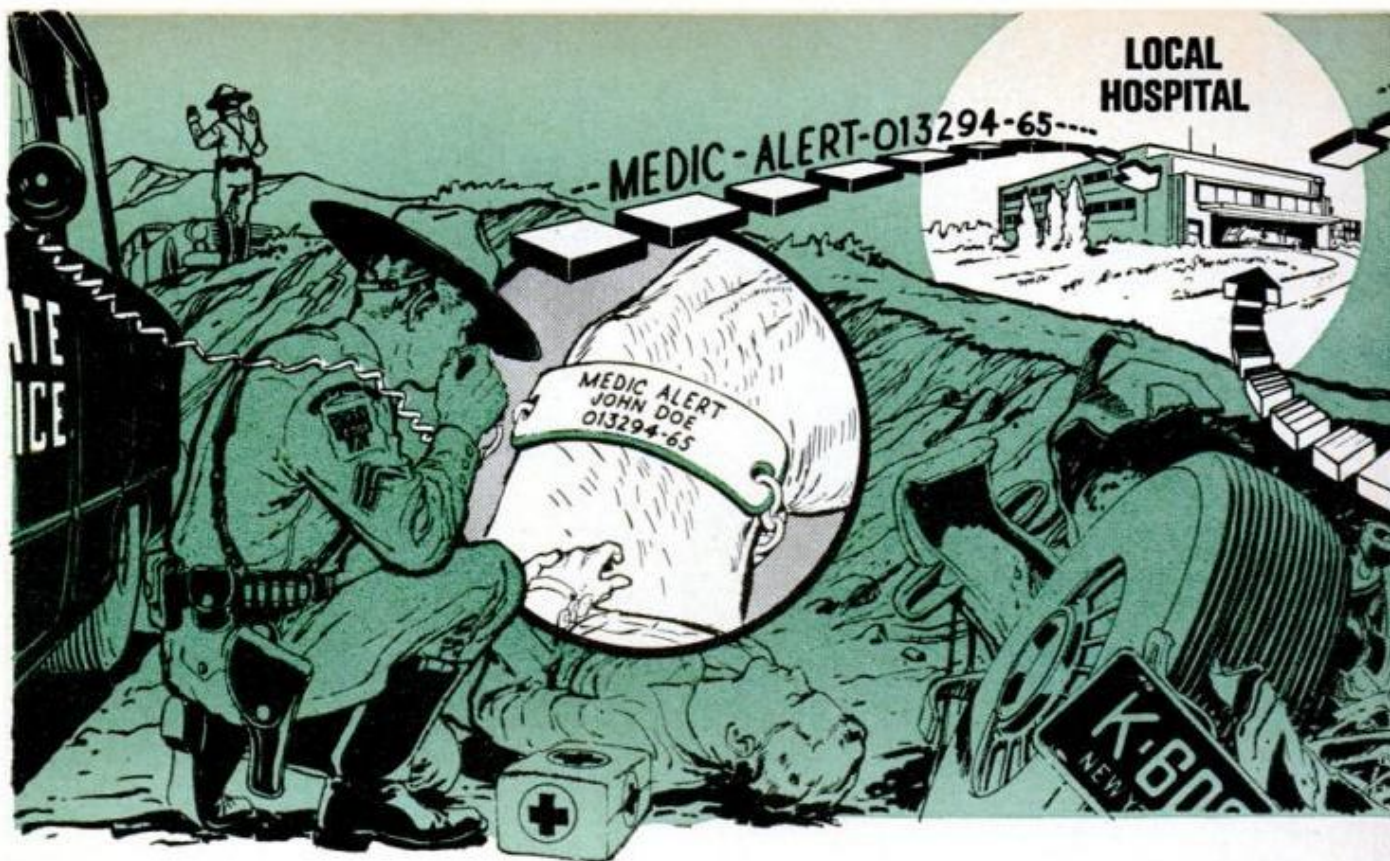
MARCH 1967



## Look, ma, no hands

Two different gnomons (upright pointers)—one for winter and one for summer—keep this new German sundial within 15 seconds of indicating correct time the year round. The inventor is engineer Martin Bernhardt (shown).





# Computers... They Supply Answers When Your Doctor Needs to Know

Even though you're hundreds of miles from home, a doctor who doesn't know you pushes a button, reads your medical history flashed by computer and—in minutes—is ready with vital aid

By KENNETH N. ANDERSON

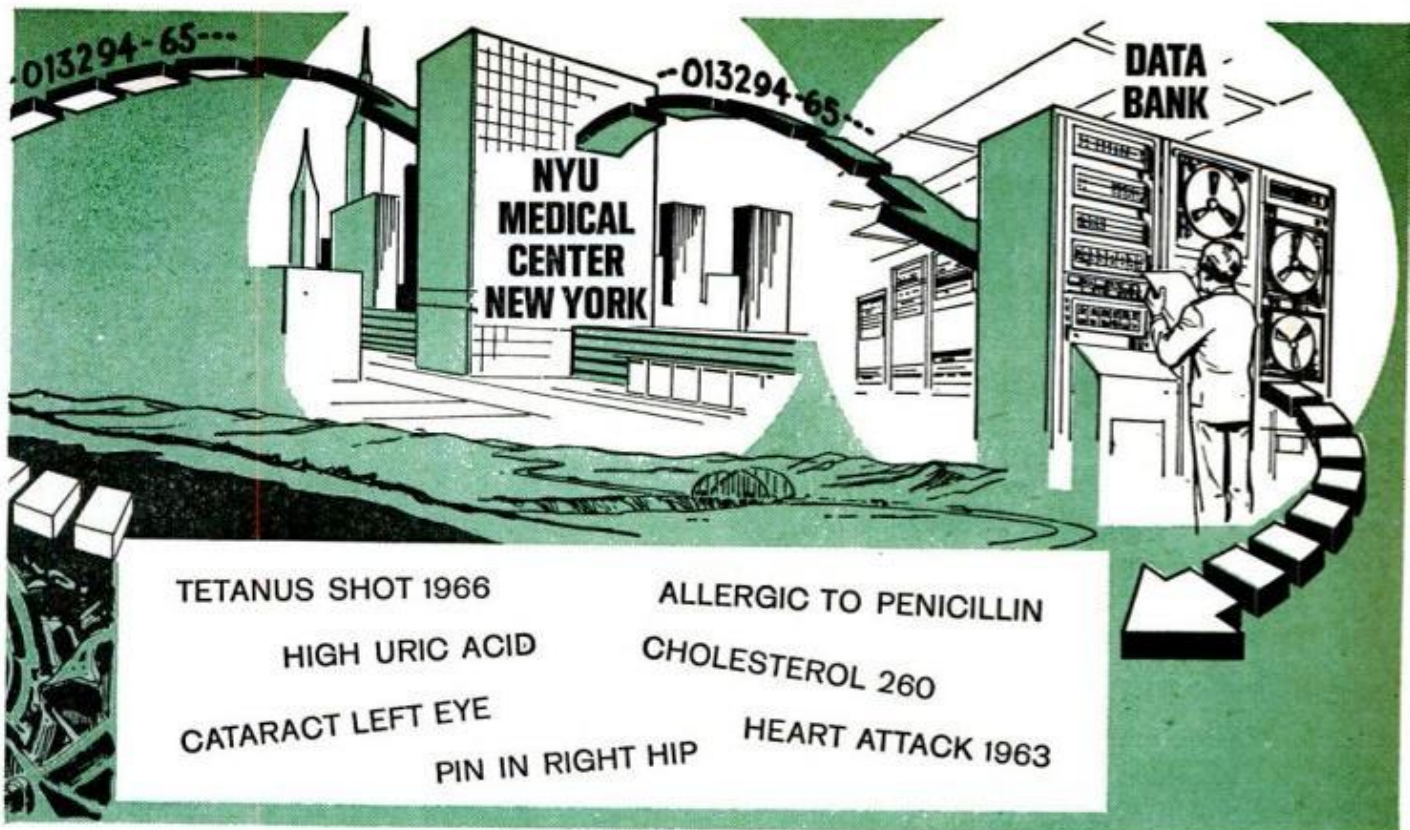
Illustration by Charles Kramer

A CAR HEADED WEST on the Ohio Turnpike begins to pass another on the rain-slicked paving outside of Cleveland, but the driver suddenly collapses. The car veers off the road to the left and rolls over in the divider strip. When the police arrive, they know only that the car has New York license plates and the injured driver

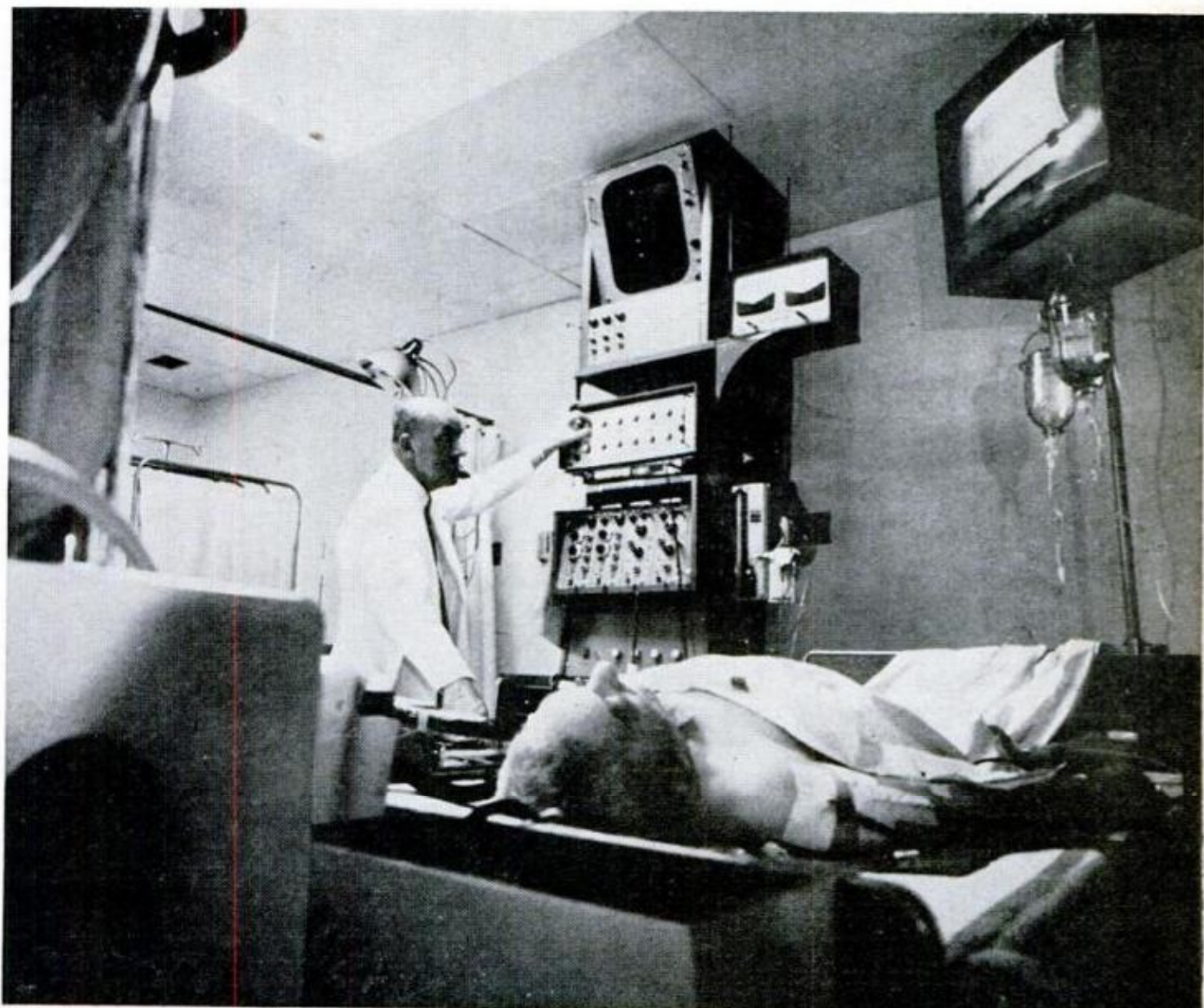
is unconscious and bleeding severely.

This kind of accident could occur today; it's happened many times on many highways. What makes this accident different is that the driver is wearing a medic-alert bracelet with a series of letters and numbers beneath his name. One of the officers radios a hospital and reads the information to





**MEDIC-ALERT BRACELET** on accident victim's wrist (left) is key to electronic processes revealing patient's medical history to emergency-room doctor. Below: shock-research unit projects readout on screen (right)







**RADIATION SCANNER**, placed over patient by doctor, records all radioisotope data on magnetic tape for computer processing in Mayo-IBM system



**SURGICAL MONITOR** at St. Mary's Hospital, Rochester,

an attendant, who reaches for a telephone dial on a nearby console and feeds the information into a circuit.

A second officer aims a portable television camera toward the accident victim, then zooms in on a part of the face at the request of a doctor who is studying the condition of the driver on a TV monitor in the emergency ward.

An ambulance helicopter lands in the median strip. An electronic sphygmomanometer is placed on the victim's arm to get blood pressure; other portable diagnostic devices are ready if needed. Within minutes after the first police call, the driver is airborne, and before the helicopter lands on the hos-

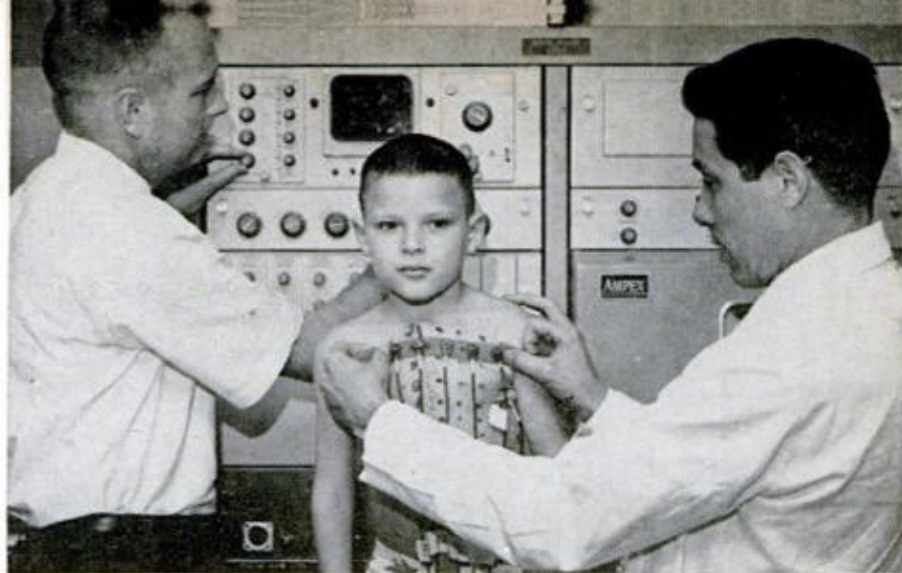
pital roof the doctors on duty probably will know more about the victim than the average doctor today knows about his own patients.

This is not just a dream of the future. Every aspect of such emergency medical care is available today and is gradually being adopted by government and private hospitals. The code on the medic-alert bracelet, for example, is the key to the patient's complete medical history, stored in a memory unit of a computer data center. By dialing the data bank, a teletypewriter in the hospital—eventually any hospital—will print out everything known about the patient from his childhood diseases to





Minn., tells patient's condition on video screen on wall



CHILDREN'S HEART AILMENTS have been diagnosed in Duke University test. Surface electric voltage on body is recorded, fed to computer



HEART RHYTHMS are recorded by experimental bedside electronic unit



KNEE MOTION can be recorded, processed by computer, diagnosed

his latest electrocardiogram and blood chemistry.

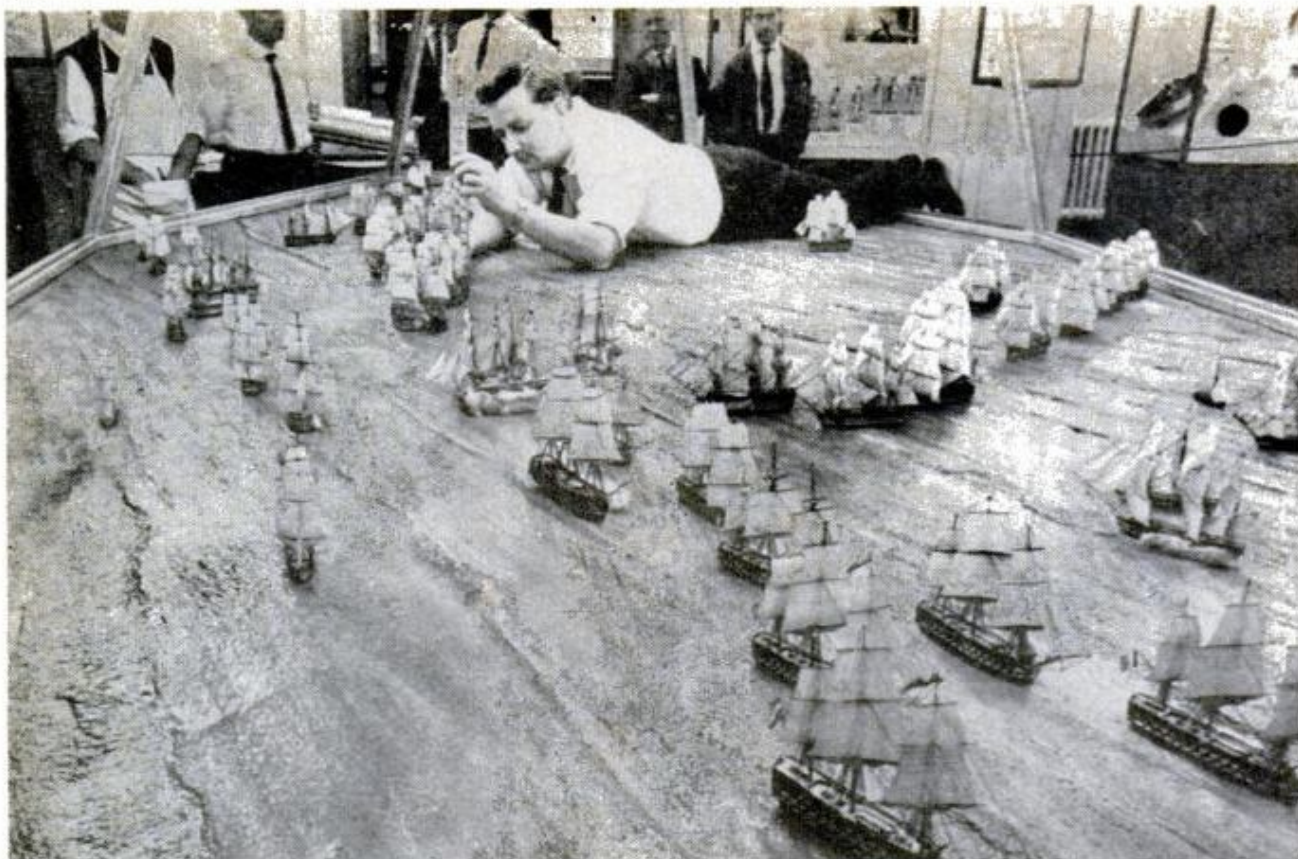
The portable TV camera designed to help highway accident victims already has been used by French police, permitting a physician far from the scene to view the condition of the patient on a screen so the doctor can advise emergency treatment or supervise by remote control the careful removal of the patient. Portable electronic instruments to monitor blood pressure, heart rate, and other physiological factors have evolved from aerospace medical research. The helicopter ambulance has become well established as a fast way of evacuating patients in Vietnam.

The use of computerized diagnostic and record units and medical monitoring systems is well beyond the dream stage. The University of Missouri Medical Center, for example, has in service a complex of an IBM 1410 computer and IBM 1092 data transmission terminals which:

- evaluates laboratory tests for accuracy and content;
- automatically reports the results of tests to the nurse's station of the patient's floor;
- stores in an electronic memory all information contained in the tests;
- has the capability of making any part

*(Please turn to page 216)*





## Battle of Trafalgar recreated in miniature

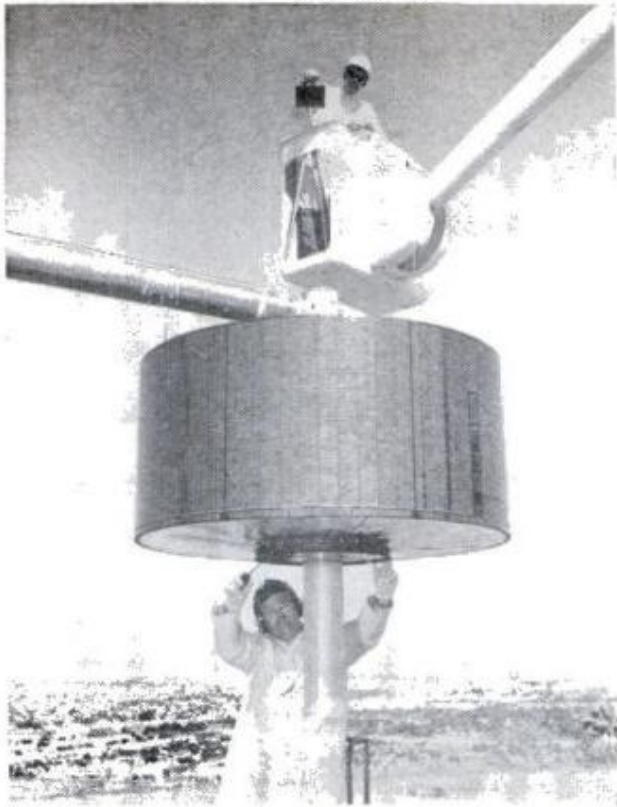
To observe the anniversary of the famous Battle of Trafalgar, 73 models of some of the ships that participated were put on display at a marine museum in Portsmouth, England. In the original battle off Cape Trafalgar, Spain, in 1805, Admiral Horatio Nelson of the British Navy outmaneuvered and outfought the combined forces of the French and Spanish fleets, capturing or destroying about 60 percent of their ships. It was a significant victory during the Napoleonic campaigns.



## Swimming pool for race horses

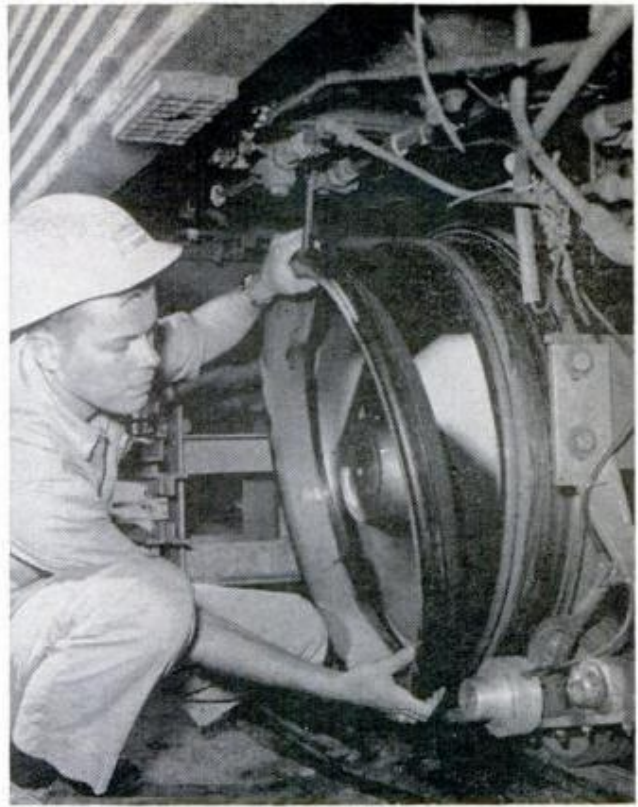
"It massages strained ligaments and tendons, and helps build powerful lungs and settle down nervous dispositions." That, at least, is the explanation of the owner of a 92,000-gallon fresh-water tank which caters to ailing thoroughbreds. Horse trainers all over the United States send their racing horses to the farm near Chula Vista, Calif., where a month in the pool equals two months of workouts on the track, and the horses love it. "If we delay them at all, they start pawing and whinnying," reports the pool manager.





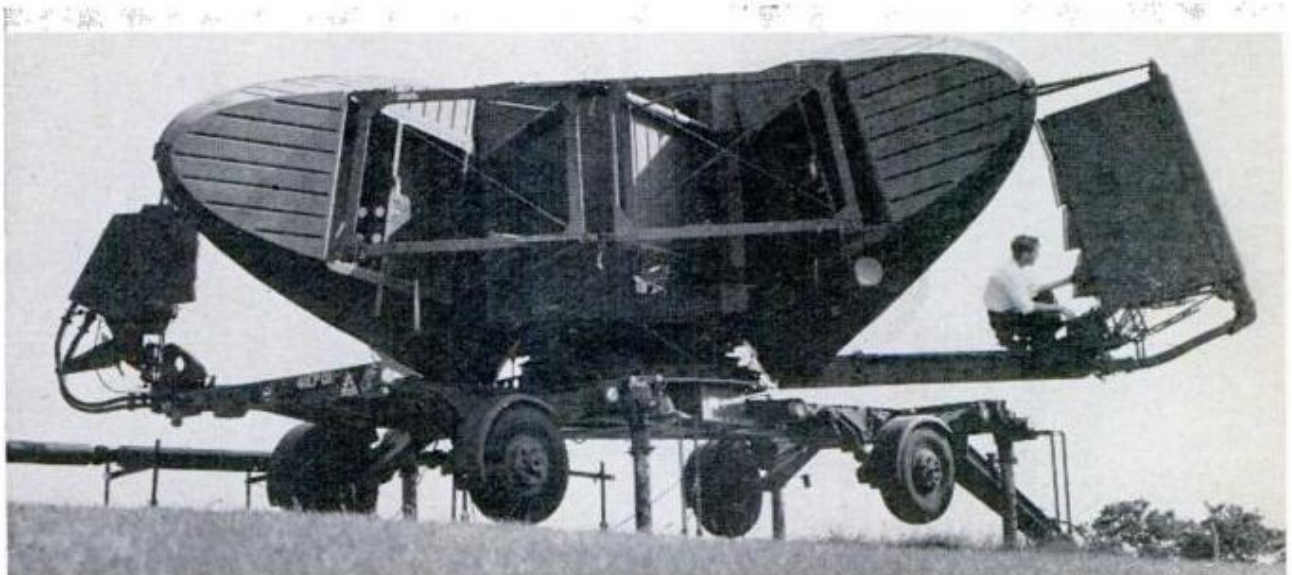
## New Comsat satellite

Bigger and more powerful than Early Bird, a new Comsat satellite is tested before being launched into orbit to provide a space relay for ground communications, including commercial television. One of four to be built by Hughes Aircraft, the spacecraft will link two-thirds of the world. They will also provide communications for the Apollo astronauts.



## Wheels lose their squeals

Bonded to a steel ring and fitted to wheels of transit cars, a new material reduces annoying noise both inside and outside commuter cars and trains, and virtually eliminates the squeal of wheels on rail curves. Called "Deadbeat," the polymer-based elastomeric damping material is manufactured by the B. F. Goodrich Co.



## Mobile radar for ground-controlled interception

Designed to travel across the roughest terrain and be fully operational within two hours, a powerful new radar system can be used for early warning or air-traffic control. It includes both surveillance and height-finding radar, controlled from a central operations vehicle. Together, the units with generators and support equipment form a self-contained convoy. Designed and built by the Marconi Co., the equipment was unveiled recently at the Farnborough Air Show in England, where it is shown being prepared for operation.

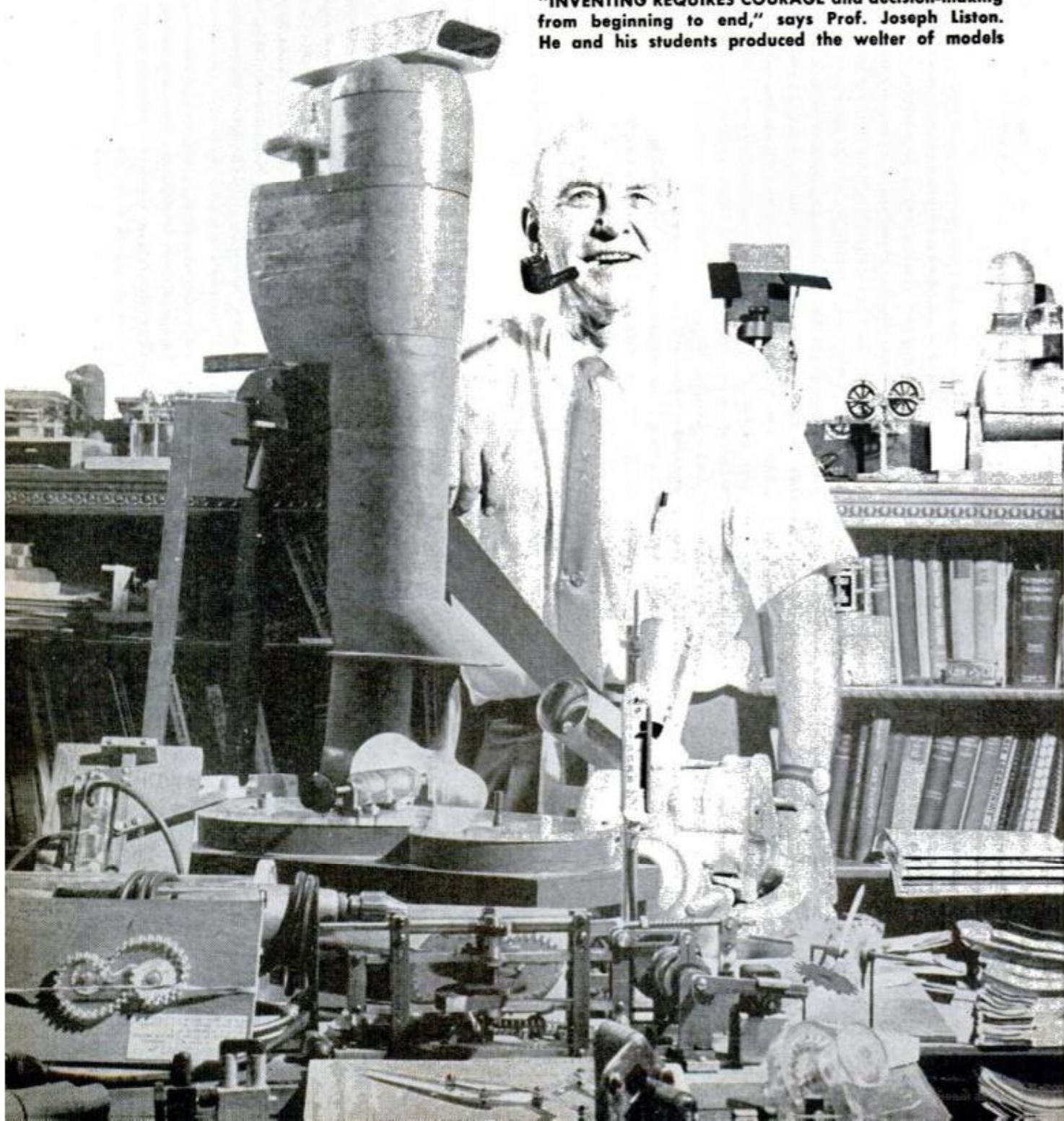


By  
JOHN F. PEARSON

# Who said you can't teach inventing?

Inventing is not a mysterious process, says Professor Joseph Liston of Purdue University. He should know. Already some students in his special course on how it's done have produced ideas with commercial possibilities

"INVENTING REQUIRES COURAGE and decision-making from beginning to end," says Prof. Joseph Liston. He and his students produced the welter of models





**M**UST YOU BE A GENIUS to be an inventor, or is it enough to have good intelligence and be able to get more "mileage" out of your know-how and imagination than the average guy?

Each semester about 20 fourth-year engineering students at Purdue University answer that question for themselves. In the process, recent classes have produced a variety of potentially valuable inventions. Here are some:

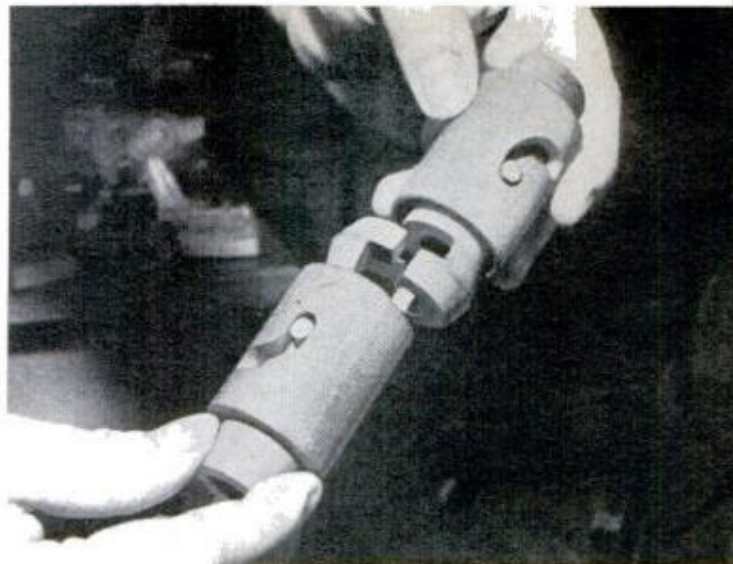
- An electronic combination lock.
- A variable-intensity auto brake-light that shows the degree of urgency to following cars when brakes are applied.
- An automatic feed for soldering guns.
- A pressure-sensitive coating that can be painted on obstetrical forceps to show the doctor when they are pressing too hard on a baby's head.
- A device to improve cold-weather starting of cars.
- A new racing-car suspension.
- A carbon monoxide alarm device.
- An improved method for helping the blind to read.

At the start of the half-year course—it's officially called "Creative Engineering Synthesis" and is probably the only one of its kind in the country—the instructor tells the students:

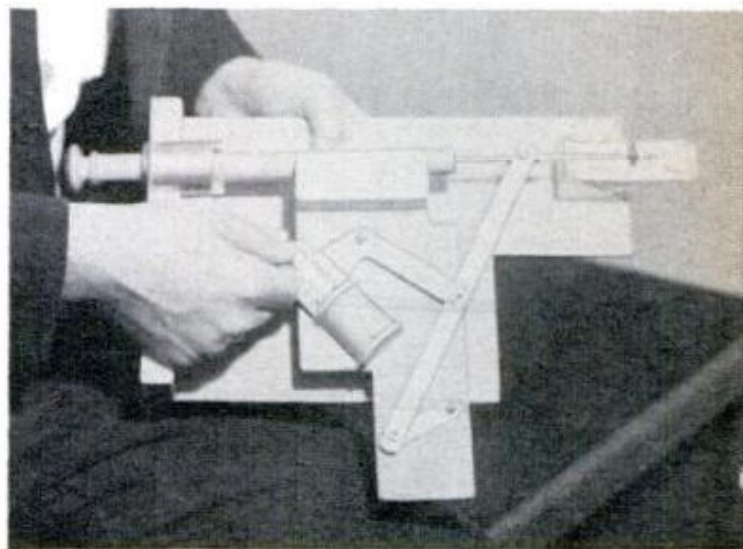
"You will have to dispel from your mind the widely held notion that invention is a kind of occult art and that inventors are a breed apart, rare and gifted individuals. You will have to put aside the aura of superstition with which many people still regard inventors and make yourself really believe that deliberate creativeness is possible."

The man lowering the boom on these misconceptions is a bald, pipe-smoking professor of aeronautical engineering named Joseph Liston. A consultant to industry and a successful inventor himself, he has long been concerned with the problems of bringing out the creative talents of engineers. His present course, gradually

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**PROBLEM GIVEN CLASS:** Design a universal coupling to replace male-female fittings on garden hoses. This model of one such coupling was the result

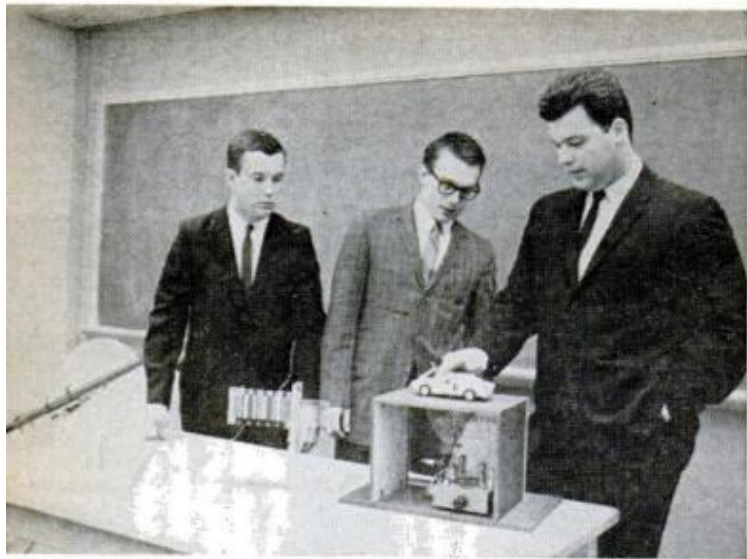


**WORKING MODEL** demonstrates student's invention of an automatic fuel mixture control for aircraft. Device responds to changes in atmospheric pressure



**DEVICE ATTACHED TO DRILL** converts rotary to linear motion by means of rotating weights. Linear motion can be stopped without stalling rotary motion





**RADIO BURGLAR ALARM** for cars is under inspection. Also seen are angle of attack indicator for light aircraft (left) and electronic lock (center)

evolving from others dating back to 1954, is a response to a growing need for engineers adept at "imagineering."

The usual engineering courses, Prof. Liston explains, entail learning known facts and procedures; a student's recall ability is the key to success. Experimentation and "blue sky" thinking are discouraged. As a result, engineers tend not to be creators. Not long ago, one large industrial company evaluated the 6000 engineers on its payroll and found that no more than 30 could be classed as innovators. Contrast those figures with Prof. Liston's results: one-third of his students usually produce sound inventions.

"It takes courage to be an inventor," he says. "The process involves decision-making from beginning to end."

The course meets twice a week, but students do most of their work on their own time. They usually work alone, though sometimes two may team up on an especially complex project.

For many, the toughest part is deciding what to invent. The professor advises them to deliberately look for a need that isn't being met by products now available. Bigger, heavier cars, he points out, created a need for power steering. Prof. Liston gives this as one of the important rules for success in inventing: "Be eternally curious and

alert to possible future needs for new products."

Once a project is selected, the professor says, the instructor must step carefully. Many students procrastinate at this stage. Used to being told in detail what to do, they hope that if they delay long enough the instructor will step in and do the planning for them.

If the instructor falls for this ploy, the student merely functions as a helper and learns little. But if the instructor is too curt in refusing to help in planning, the student may get sore.

"It's essential," Prof. Liston explains, "to retain a student's respect and good will while insisting that he do the thinking, deciding and planning."

Once the need is selected, there are other steps the student or any inventor, for that matter, must follow. Here are some of the main ones:

- Define the problem. "Specifications indicating the goals that must be reached are necessary guides focusing the mind on possible ways to satisfy the need."
- Search through back copies of the *Official Gazette* of the U.S. Patent Of-



**THINKING BEHIND** invention shown in these three photos is that better way to propel boats is by side-to-side fishtail action than by the usual rotary prop



fice for inventions that may pertain to your need. The *Gazette*, which is issued weekly, can be found in most big libraries. A good procedure, points out Prof. Liston, is to start with the latest issue and work back. Since recent patents often cite prior patents relating to the same area of interest, the reverse direction helps to avoid blind hunting.

● Make 3-D drawings and models of the project. "This is like writing down the steps in a long mathematical analysis. It helps to hold the various pieces of the idea in focus and provides a feedback stimulus for further ideas."

For some reason, many students fail to recognize the value of this. But they usually see the light when they find it next to impossible to explain their ideas only using words and formulas. Some come around when they note that the class laggards are those who haven't been using 3-D sketches.

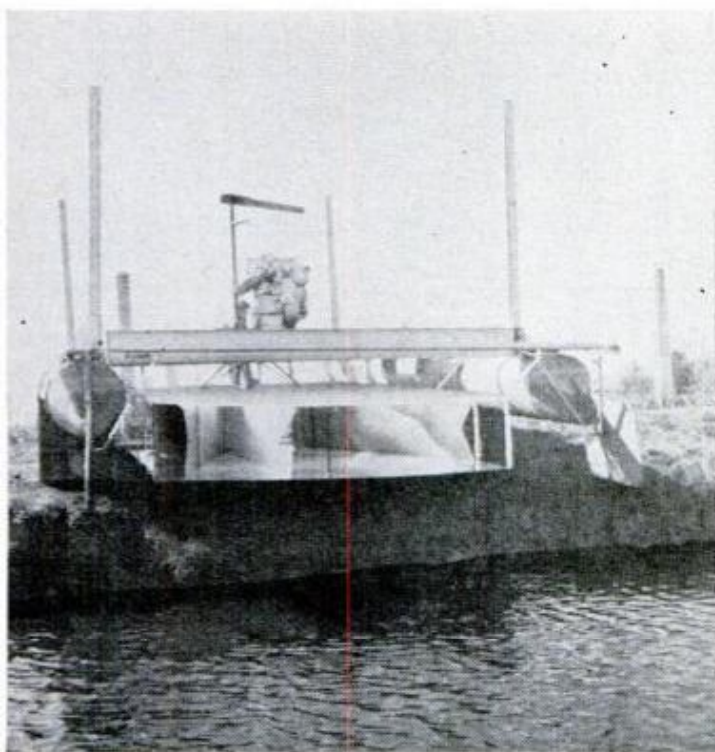
Students in one of Prof. Liston's earlier courses, when class members worked in teams, learned these lessons the hard way. "They found that layouts and some simple wood or card-

board models and mock-ups were exceedingly helpful in fitting engine parts together," he recalls. "Usually, this became most forcefully apparent when, as frequently happened, they found a lot of component planning had to be modified or re-done because adjacent components were not compatible.

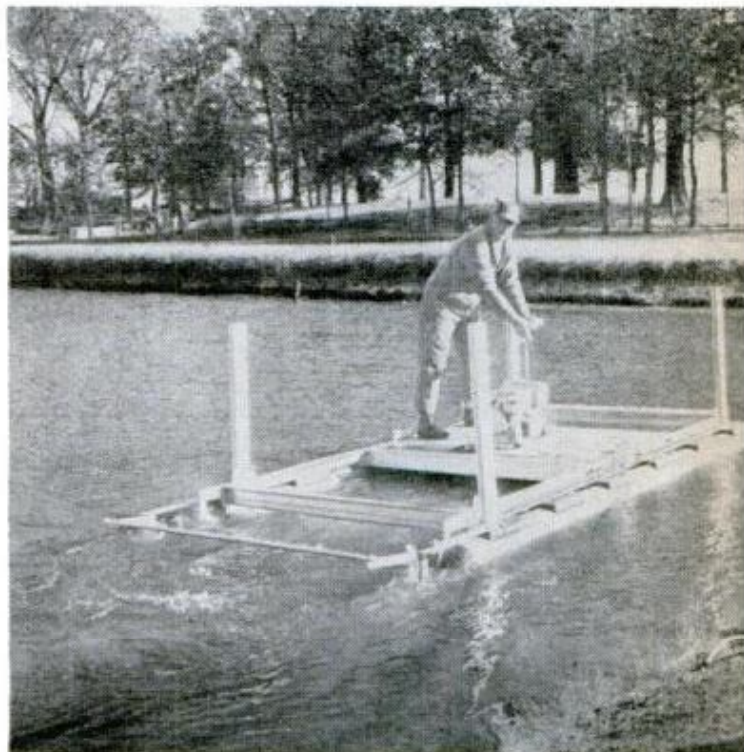
"In one instance, one group of students found that, after much detail design, their proposed pistons and connecting rods would not assemble. The axial length of the small end of the con-rod was greater than the distance between the piston bosses. When this embarrassing situation was pointed out by placing the con-rod drawing over that of the piston, all student resistance to making assembly drawings and visualization mock-ups collapsed in a hurry. But it seems necessary for students to experience this sort of thing before they will believe it can happen to them."

Motivation is a strong factor in successful inventing, and the hopes for financial gain provide the greatest

*(Please turn to page 204)*



**DOUBLE FINS** in a plexiglass channel are seen at rear of raft. They change pattern of undulations, according to load and speed, for maximum efficiency



**FINS IN ACTION.** They produce a flow of water that engineers describe as "laminar" in contrast to vortex flow produced by the conventional rotating prop





### Sliding bartender

In one German bar, the beverage dispenser no longer sends beer glasses slipping down the bar from tap to customer. The bartender sits comfortably while an electric motor powers his chair over the distance.



### An eye for a spy

For those who want to photograph and view from a high angle, there's this ingenious invention. The camera "eye" is aimed to match view through periscope. Shutter-release extension cable operates the camera.



### Dorothy is the name

A new Japanese amphibious vehicle uses four rotating screw drums for propulsion. Dorothy, as it's called, can work and travel on water, mud, soft snow and sand. On hard surfaces, all drums rotate in the same direction, driving the vehicle sideways. On soft surfaces, drums on one side rotate opposite those on the other, driving Dorothy forward. Cranes and other equipment can be mounted on the amphib, developed by Ishikawajima-Harima Industries.





## Rocket sprouts wings to come home again

This piece of German hardware will be used to take readings at high altitude. Released from plane, the rocket will climb to 50 miles then extend triangular wings and slowly glide to earth. The wings allow maneuverability, permitting a ground pilot to land it wherever he wishes by remote control. It's called a "repatriable" rocket because it can return to its launching area. The slanting nose extension is equipped with measuring devices. The rocket is being developed by the Dornier Factories at Langenargen, Germany.



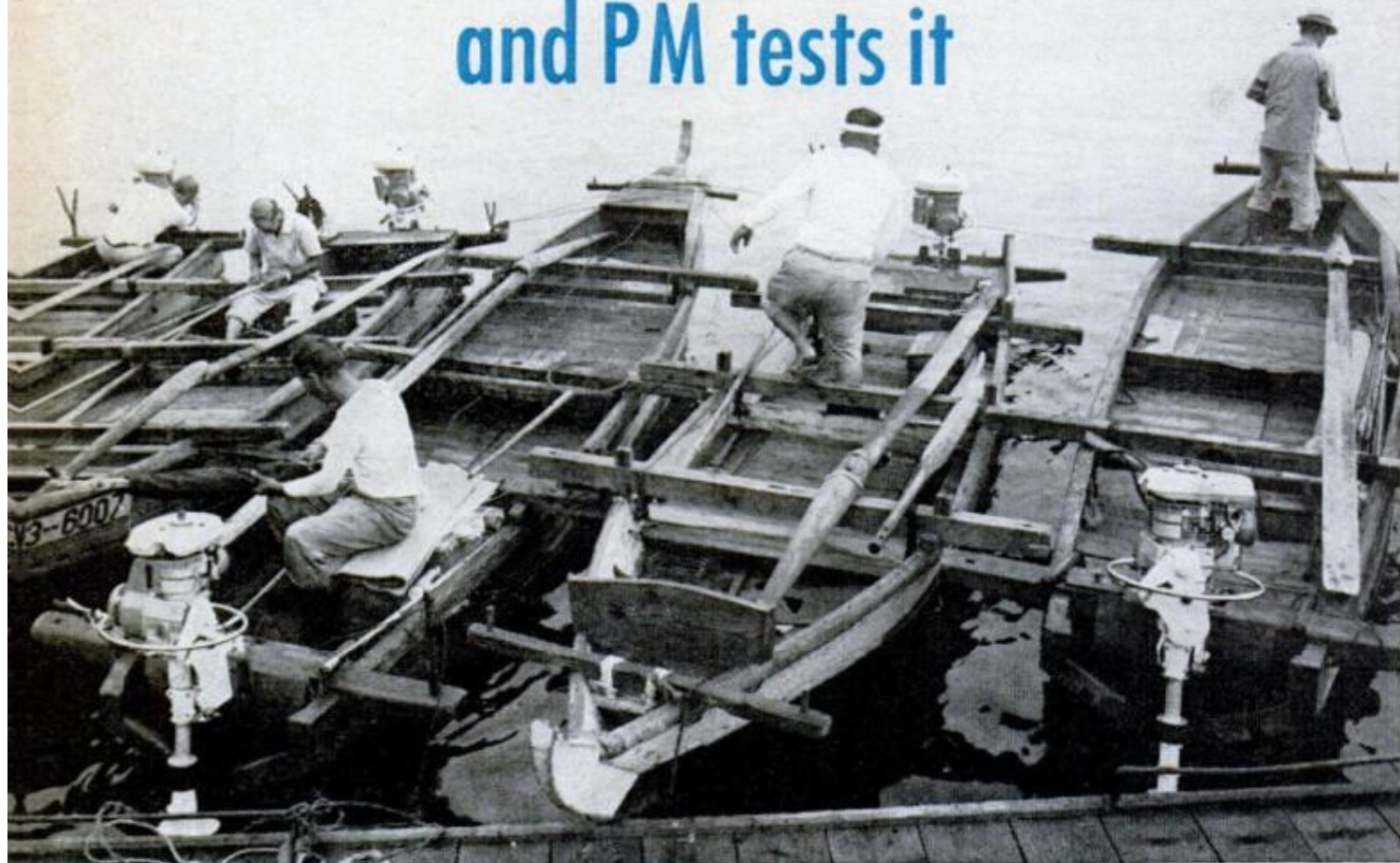
## Prop without a prop

In Williamsburg, Va., this stage prop is pulled by an underwater rope across Lake Matoaka during the first act of *The Common Glory*—a re-enactment of the Battle of Yorktown. The craft floats on four airplane wing tanks and rides ashore on four scooter wheels. In the drama, she is the frigate *Alzaark*.





# Now Honda's got an outboard and PM tests it



You can't buy it in the States, but we thought you'd be interested in just how this ingenious Nipponese four-cycle stacks up against U.S. motors

By ART MIKESELL, Boating Editor

Technical illustration by Donald Evans



**HEAVY HONDA** weighs as much as a Johnson 20 and is a lot more cumbersome to install on a small boat



**STARTER ON SIDE** makes locking catch necessary to prevent motor from spinning when cord is pulled



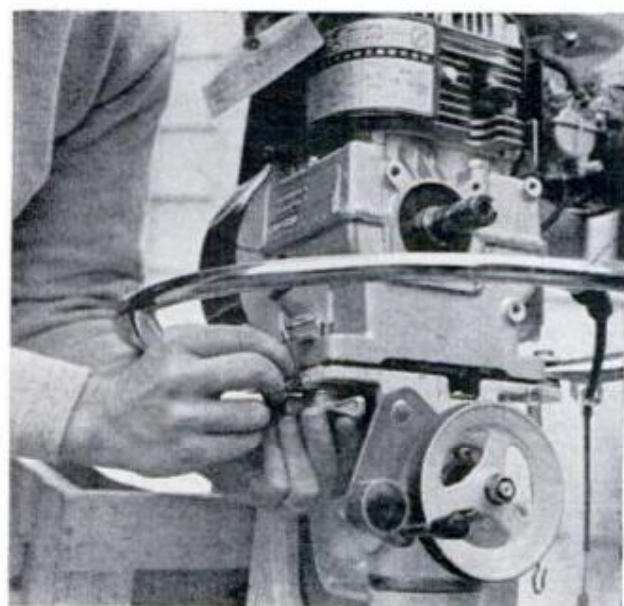


**ENGINE BOLTS** on lower unit, can easily be removed and used separately as power source for machinery

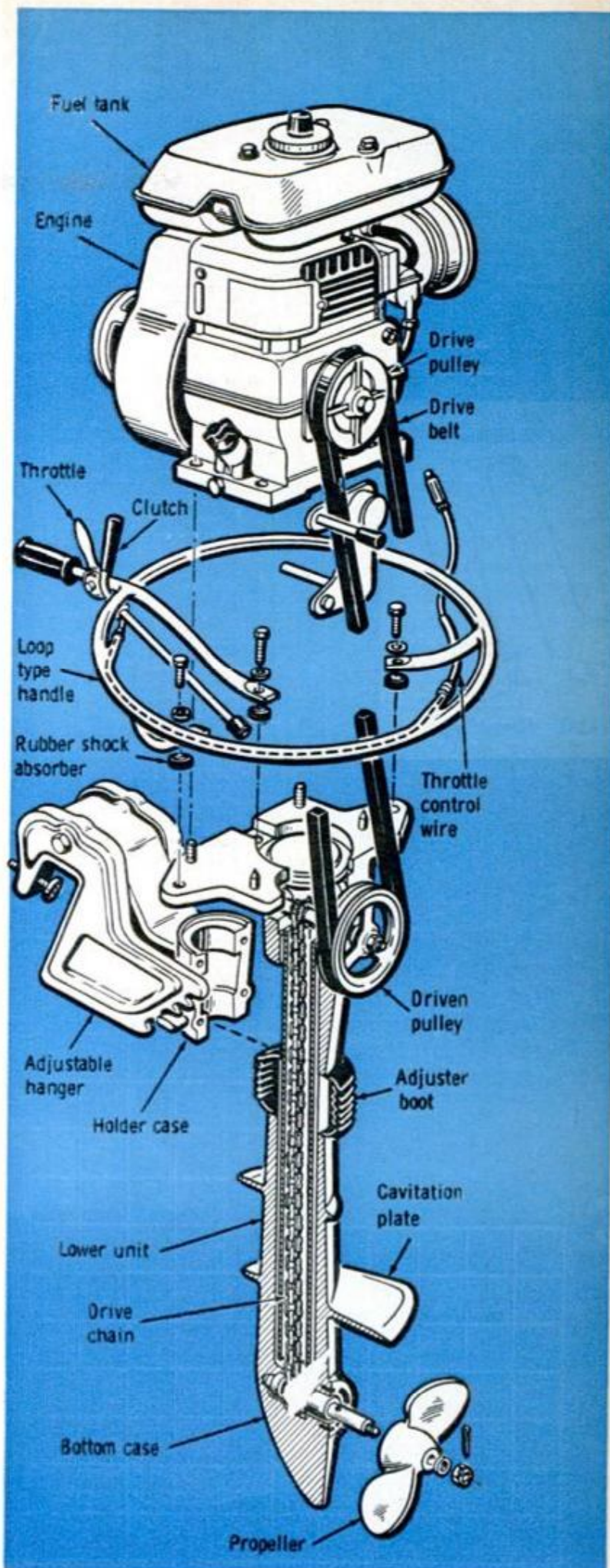
**T**HE FIRST NEWS I had of Honda's GB-30 came from a free-lance writer who had just returned from Tokyo. He suggested it might be a good *News Brief*.

According to the photos and fact sheet, it was a wild engineering package—a one-cylinder, four-cycle fishing motor with chain-belt drive, tension clutch and forced-air cooling, “just right for any of the duties outboard motors are asked to perform . . . offshore commercial fishing, river ferries, small cargo boats and lighters, seaweed and pearl farming . . . adaptable to every task.” It was strictly for the Asian market, with no plans for export to the United States.

When I showed all this to Bob Crossley,



**MOUNTING BOLTS** are wing-type with nuts held in hinged wire brackets so they're impossible to lose







**TRIM MAY NOT BE IDEAL** here, but it was the best I could achieve without a tiller extension. The Honda isn't really designed for use on a light planing hull. It belongs on heavier, displacement-type work boats

he decided that it was worth covering in greater depth. "In fact," he said, "why don't you try to get one and run a test on it." So I started trying.

Honda of America, the company's U.S. subsidiary, was eager to help but didn't have a GB-30 on hand because it wasn't in the U.S. line of Honda products. They could send me a shop manual on it, but for the engine itself, I'd have to try Japan.

The Tokyo Honda people were nothing if not polite. Yes, they had hundreds of GB-30s lying around, but unfortunately it would be impossible to sell one to *PM*. You see, *PM* was in Honda of America territory, so I would have to deal through that office. I explained that Honda of America didn't handle this particular product. They sympathized. There *did* seem to be a problem, but possibly if I tried Honda in Los Angeles. . . .

I ended up by wiring 41,000 yen to our Japanese correspondent, who drove over to his local Honda dealer and bought one off the shelf. It arrived a week later via air freight, but when I uncrated it I found that the fun was just beginning. The motor had been shipped knocked-down in the original factory crates and the as-

sembly instructions were given in Japanese.

Luckily, the job wasn't too complicated, and there were a few diagrams, scattered among the maze of cryptic characters. The ease with which this was accomplished backs up one of Honda's main selling points for the GB-30 in the Asian market: the powerhead is easily demountable so it can be used as a power source for generators, pumps or other machinery.

Incidentally, the nonmarine version of this engine, the G-30, is available here. It features a standard base mounting and is interchangeable with other horizontal-crankshaft small engines.

Once the Honda was ready to go, I headed for the harbor where a borrowed 12-ft. aluminum cartopper was waiting. For comparison, I brought along a Johnson 3-hp motor.

Propping the Honda upright, I filled the oil sump (1.2 pints) and the lower-unit sprocket case (.35 pint), then stepped gingerly into the light, bobbing boat. About five seconds of balancing act and another fact about the Honda became blindingly clear—it's a big, heavy, cumbersome motor that is portable only in

*(Please turn to page 213)*

### Honda GB-30 vs. Johnson 3

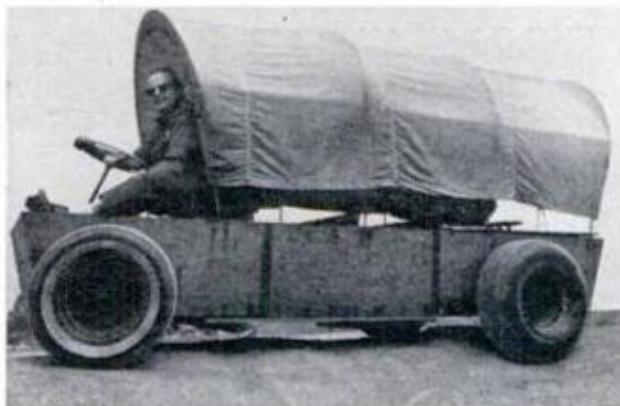
	HONDA	JOHNSON		HONDA	JOHNSON
Motor type	4-cycle	2-cycle	Shift	360° steering	360° steering
Cylinders	1	2	Ignition	flywheel magneto	flywheel magneto
Hp rating	3/3400 rpm	3/4000 rpm	Fuel capacity	1.2 gal.	1.2 gal.
Displacement	10.39 cu. in.	5.28 cu. in.	Drive line	belt/chain	gear
Bore & stroke	2.60 x 1.97"	1-9/16 x 1 3/8"	Standard prop	7.9 x 5.5"	8 x 4.5"
Starting	manual	manual	Weight	77 lbs.	37 lbs.
Cooling	forced air	air			





## Surfboard breaks apart for travel

To answer complaints by surfers that their boards were too bulky to carry on private aircraft to where the waves are, a California inventor created a sectioned surfboard. The three sections are cut in a deep "V" with slots in one portion accommodating extensions from the other section. One pin, slipped into place at each joint, holds the sections together. Two-unit boards are made for juniors, and current one-piece boards can be sectioned.



## Covered Volkswagen

Well, it's no wagon train, but it's at least a wagon car. A Long Beach, Calif., dune-buggy enthusiast put a wooden body and canvas top on a standard Volkswagen chassis. The vehicle carries up to six people (on wooden bench seats) on rough-country trips.

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## Outboard ash-can boat

Anglo-American relations may have reached their zenith recently when a British water lover rigged three English ash cans on a platform with an American-made 20-hp engine to demonstrate something or other about English ash cans and American engines.

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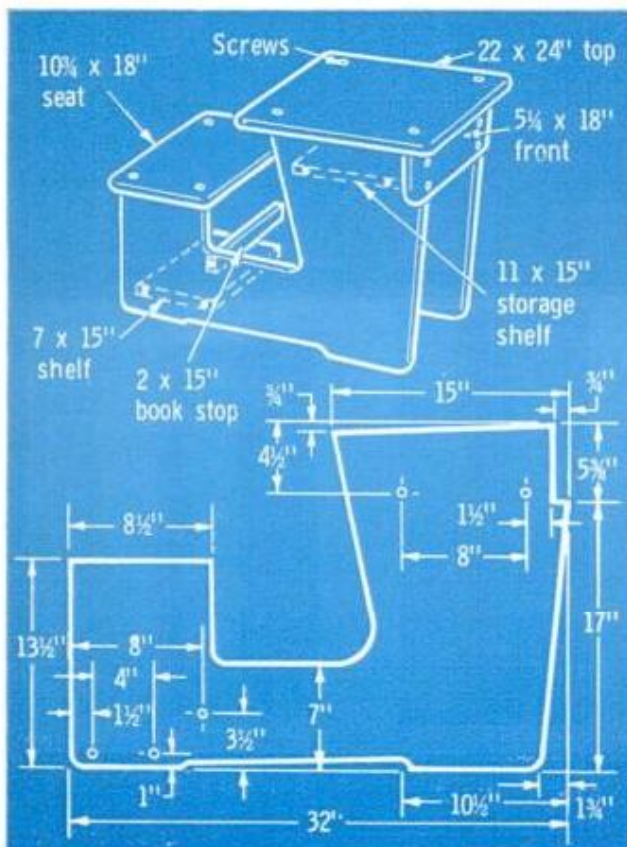


# FIVE WEEKEND PROJECTS



1. CHILD'S PLYWOOD DESK
2. COCKTAIL TABLE
3. PLATE HOLDER
4. TRAVELING BOOKCASE
5. LAUNDRY SORTER

Technical illustrations by Donald Evans



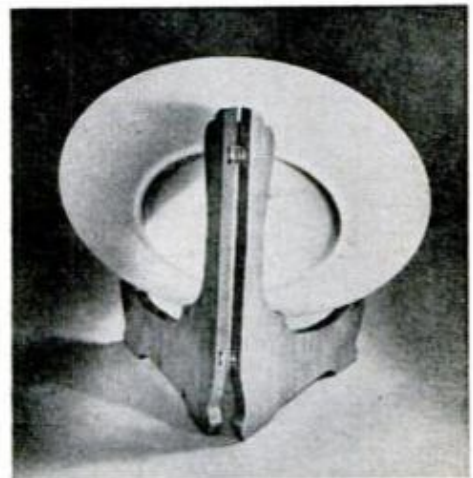
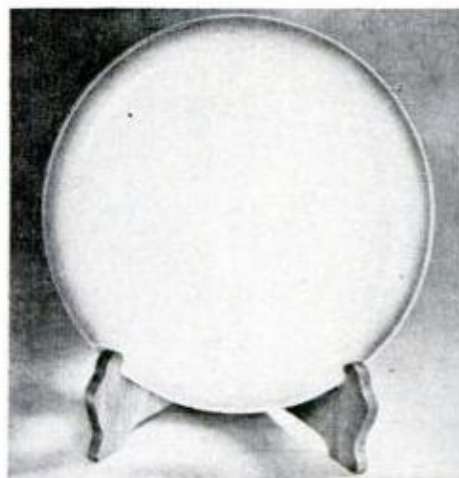
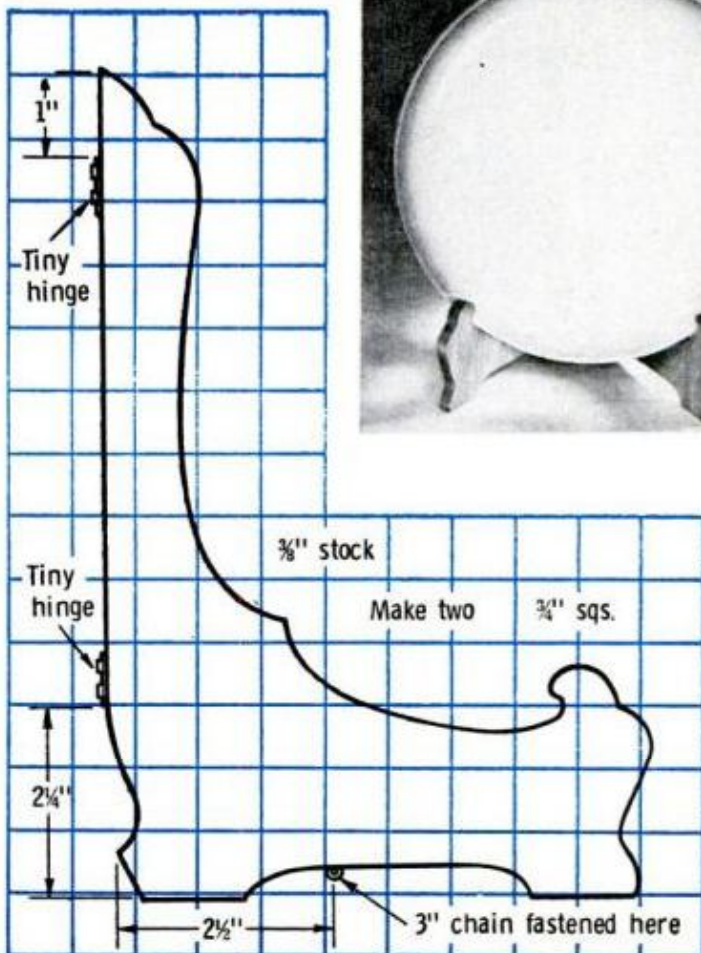
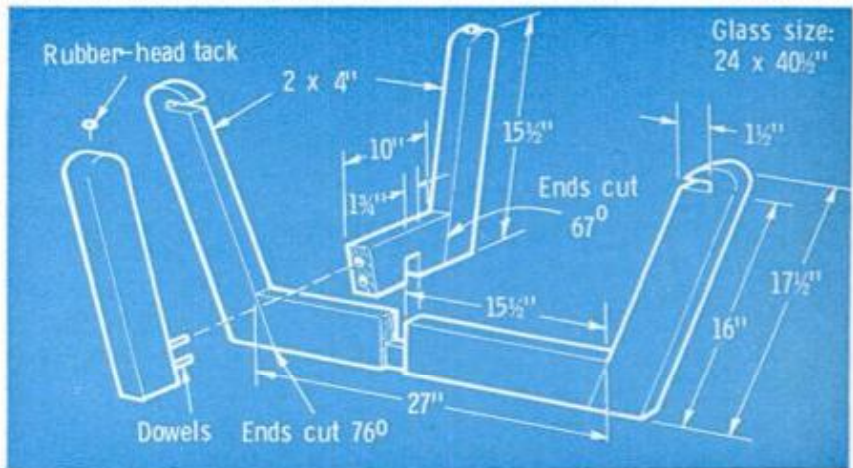
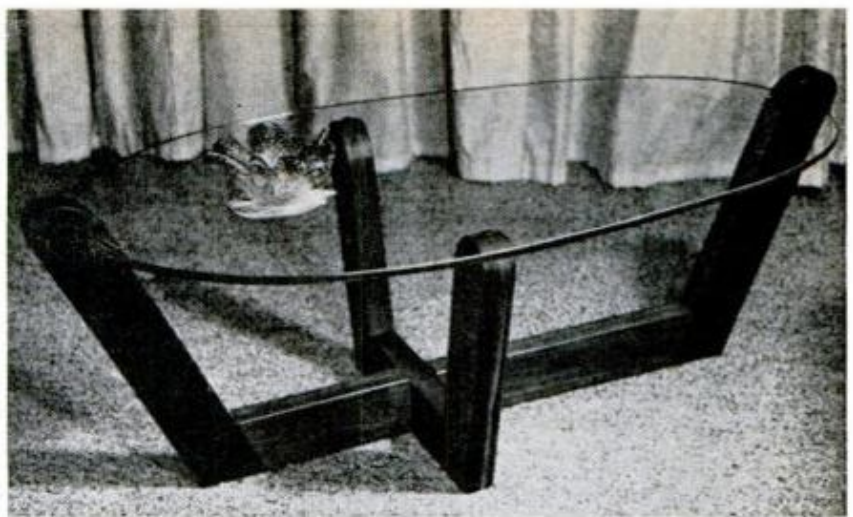
**1 CHILD'S PLYWOOD DESK.** Here's a dandy little homework desk that has a built-in bookshelf under the seat. You can cut all parts from a 4x4-ft. sheet of 3/4-in. plywood. Arrange the patterns so that the "D" plywood faces will be inside when assembled. Drill and countersink the five 3/16-in. clearance holes on each side piece and the four on the let-in front piece. If you intend to use a natural finish, countersink deeply and use a plug cutter on scrap to obtain plugs. Otherwise, plan to set the screws 1/16 in. below the surface and fill with wood putty. Sand and assemble the parts with 1 1/2-in. No. 8 flathead screws. Clamp the sides with the book and storage shelves, book stop and frontpiece, then drill 1/8-in. pilot holes centered in the plywood edges. Next, position the seat and top and attach with screws in the same way. If you wish, hinge the top for better access to the storage shelf.—*E. J. Holgate*



## 2 COCKTAIL TABLE.

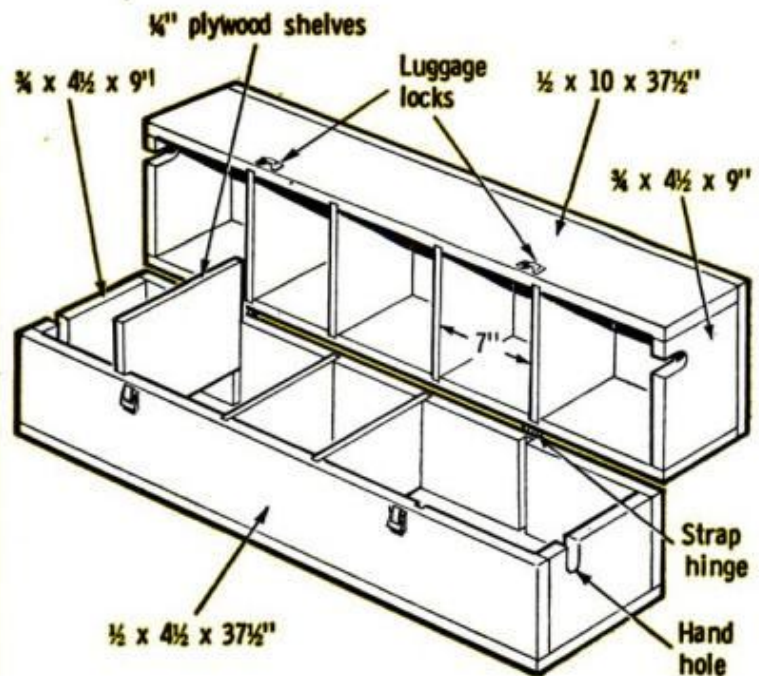
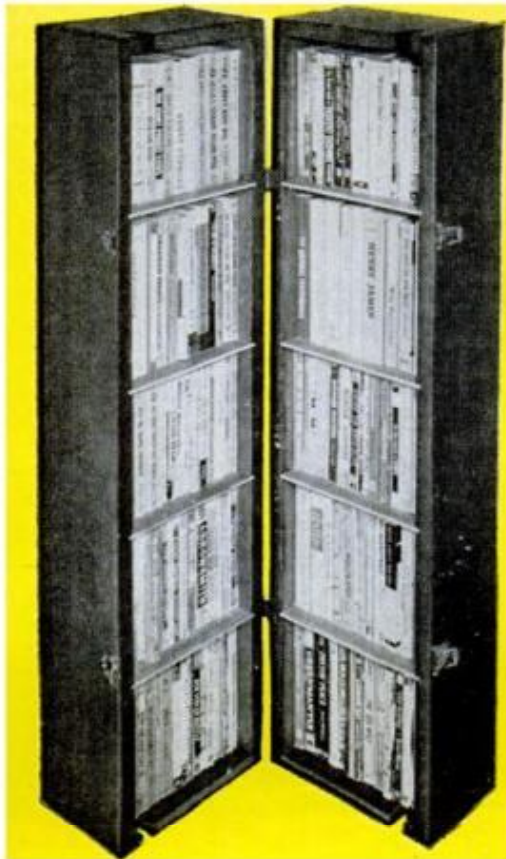
You start with a  $\frac{7}{16}$ -in. ovoid plate glass. This one is 24 in. at its widest and  $40\frac{1}{4}$  in. at its longest, a fragment of a larger table. Buying a piece about this size will cost about \$40. Glue up 1x4 walnut for the leg members, matching grain and color, then joint and cut as shown. Saw  $\frac{1}{2} \times 1\frac{1}{2}$ -in. slots in the end legs to be parallel to the floor. They should be  $\frac{1}{8}$  in. above the finished side legs. Dado and chisel a half-lap in the longest cross-piece for a snug fit on its mate. Rout each side below the dado  $\frac{1}{8}$  in. and make the half-lap in crosspiece  $\frac{1}{4}$  in. narrower. Dowel and glue all leg joints. Rubber-head tacks driven into the tops of the two short legs will provide adequate bumpers on which the glass can rest.

—Len Samuels

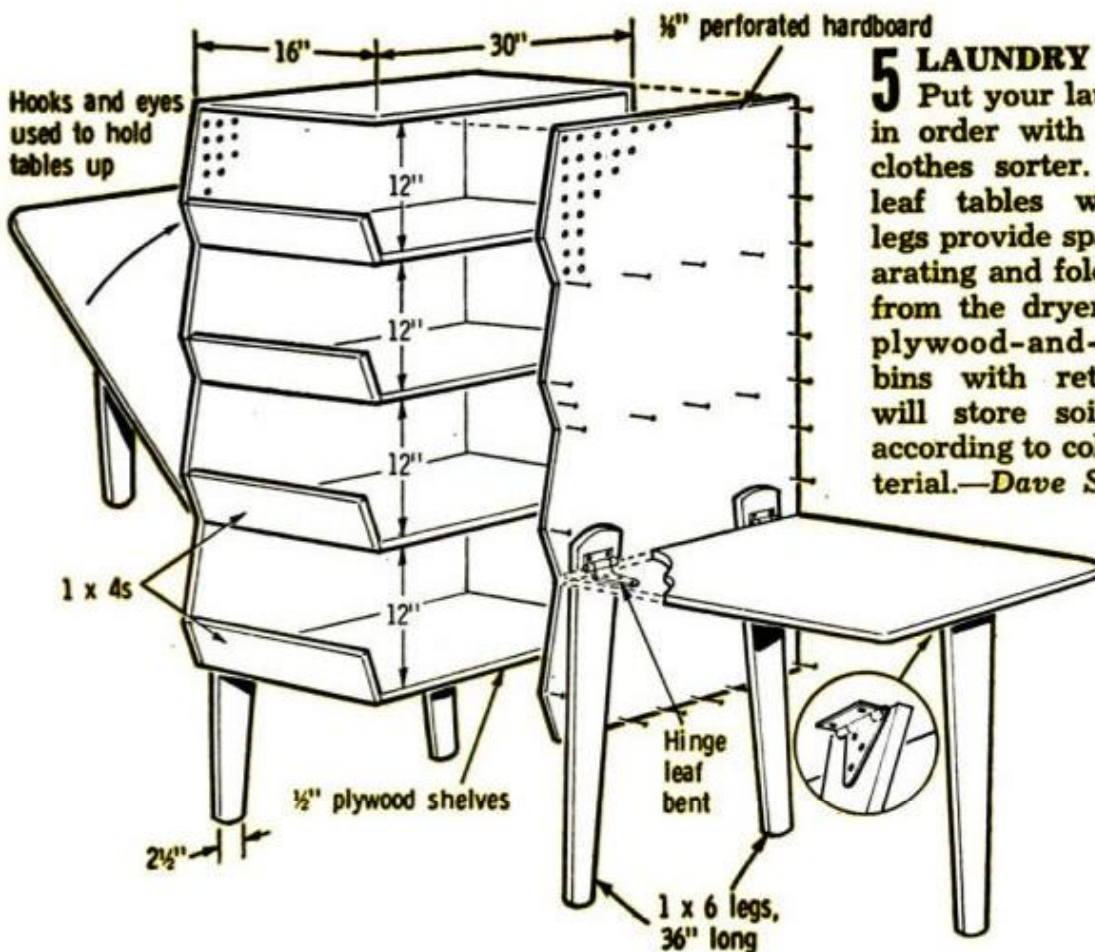


**3 PLATE HOLDER.** You can display a piece of your fine china or a favorite commemorative plate with this hardwood stand. It's designed for a 10-in. or larger plate. First, transfer the scroll pattern to two pieces of  $\frac{3}{8}$ -in. hardwood stock and then tack them together through the waste portions. Jigsaw the shapes, sand and finish. Line up the pieces again and mount small butt hinges. To prevent the stand from opening too far, fasten a 3-in. length of small-link chain with brads.—Willard and Elma Waltner





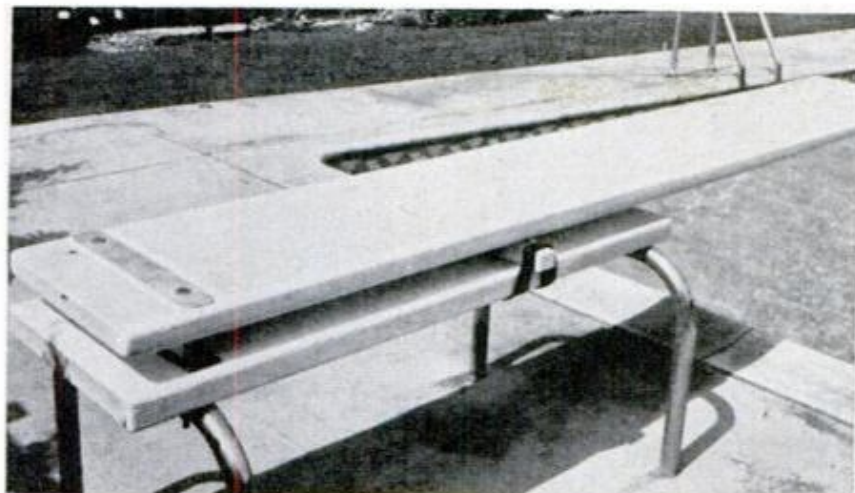
**4 TRAVELING BOOKCASE.** Your reference copies of *Popular Mechanics* or favorite paperbacks need not stay behind when you take off for the summer. Build two plywood boxes with shelves spaced to suit, hinge along one edge and add latches along the other. Cutouts at both ends form built-in handles.—*L. A. Harlow*



**5 LAUNDRY SORTER.** Put your laundry room in order with this handy clothes sorter. The drop-leaf tables with hinged legs provide space for separating and folding clothes from the dryer, while the plywood-and-hardboard bins with retaining lips will store soiled clothes according to color and material.—*Dave Swartwout*

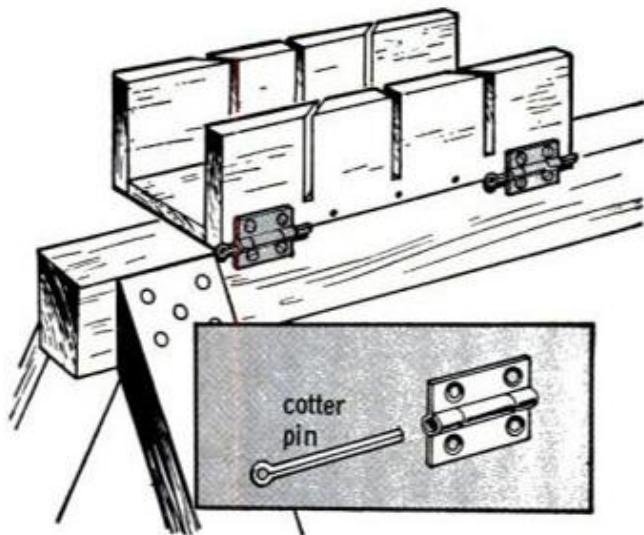
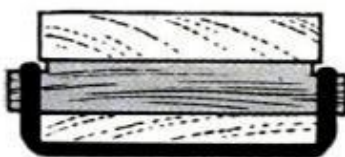


# HINTS FROM READERS



## Better diving board

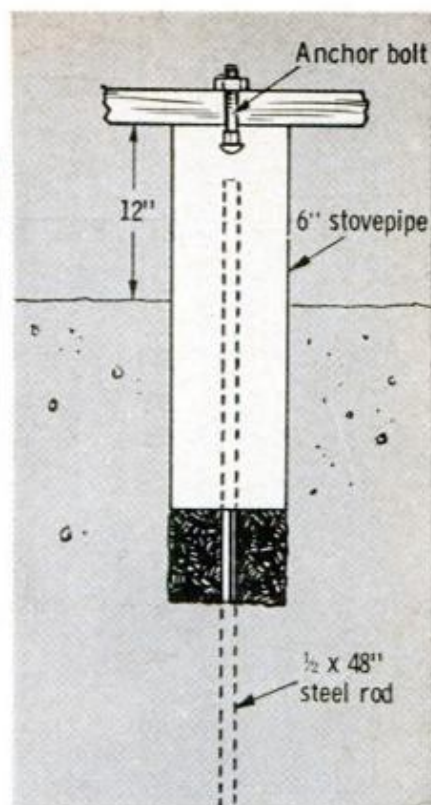
Save money when replacing your diving board by making an adjustable fulcrum. Cut off the old board just ahead of the permanent fulcrum so that it will act as a platform. Cut a 2x4 scrap to board width and another one 4 in. longer. Bore  $\frac{1}{2}$ -in. holes in shorter 2x4 to match those in rear of the new board. Install it between the board and platform with two  $\frac{1}{2}$ x10-in. bolts as shown. Slide longer 2x4 under board to point where fulcrum is wanted and secure it with a bicycle inner tube looped over ends as in detail.—Ken Willard



## Miterbox stays put

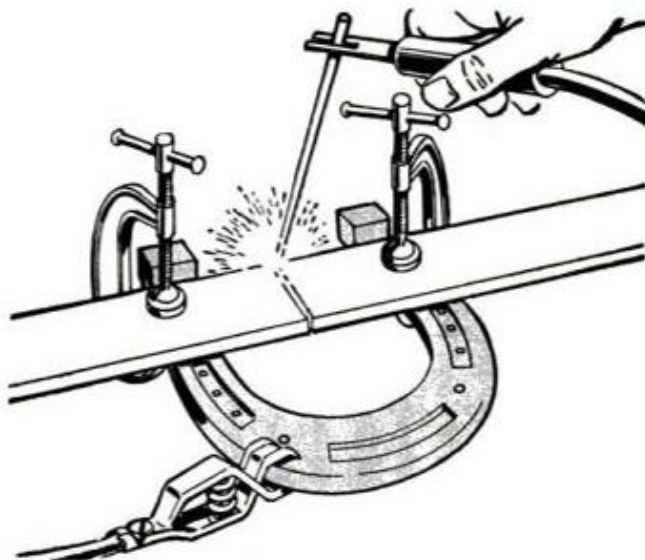
With this setup you can fix your miterbox to a sawhorse or workbench, yet easily remove it. Simply mount loose-pin butt hinges on box and horse or replace pins in standard butts with cotter pins. This way, you don't have to clamp the box or keep it mounted.—Wilfred Beaver

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## Pier forms

Stovepipe sections make ideal forms for foundation piers for sheds. Center reinforcing rod in post hole, place pipe over rod and fill with concrete. Top with anchor bolt.—E.B. Tichenor



## Lucky welding trick

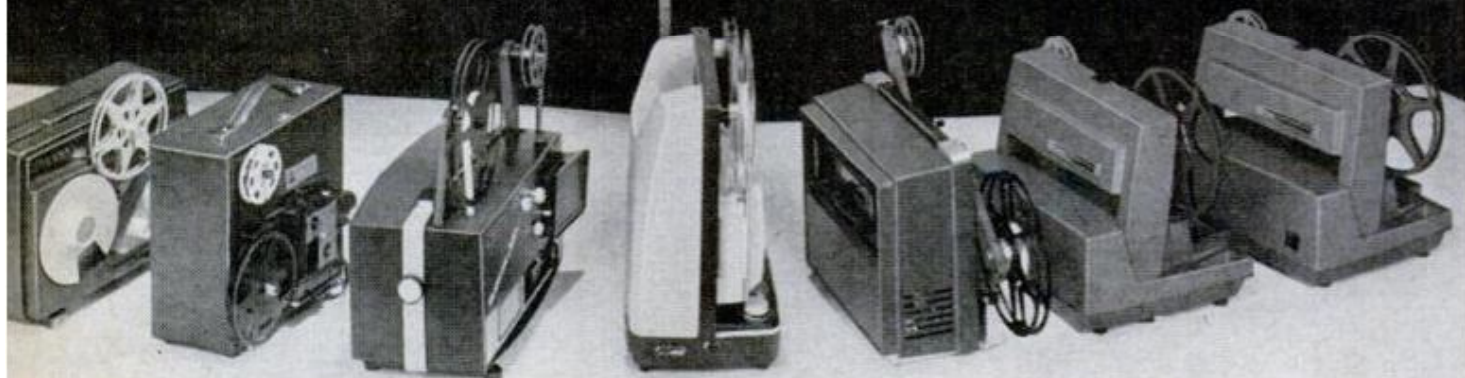
When welding small butt joints, it's often hard to hold the pieces together for a good weld and provide a grounding circuit for an arc welder. A clever way is to secure the pieces with C-clamps to a large iron horseshoe. Then the weld can be made easily.—Victor H. Lamoy

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# Projectors that bridge the 8-mm gap

By LEONARD SAMUELS

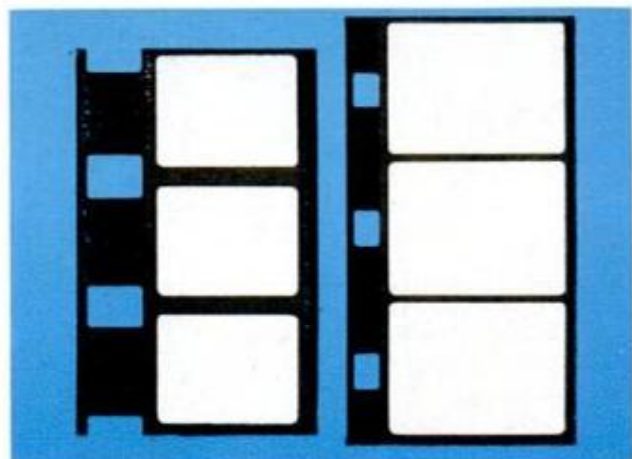


Today, all amateur movie equipment is being designed around Super 8 film. But you aren't stuck with old 8-mm movies. Here's a comparison of seven projectors that span the eras of regular 8 and the big-format film.

**SUPER 8 FILM** is here to stay, but if you're a moviemaker from way back or expect to inherit some old 8-mm family movies, you won't have to double up on your equipment: The seven projectors that *PM* tested have a capability for showing both regular 8-mm movies and the Super 8 format.

You'll find a wide choice among them, for they vary all over the lot in features, price and weight; however, you won't find all you want in one projector.

The most feature-laden machine is also the most expensive and the heaviest: the Dejur-Amsco Versatile, available as the



**FILM FORMATS** (shown enlarged handled by projectors are regular 8-mm (left) and Super 8, with smaller sprocket holes and a larger, more brilliant image

POPULAR MECHANICS



PT-90 and the PT-99. They are the same except for a viewing-editing screen on the 99. It's one of three projectors that are able to handle 8-mm and Super 8 spliced on the same reel. The film will run up to the splice and stop—without jumping. When the format-selection lever is moved, the film continues through.

The manufacturer hedges on its own capability, though, in suggesting that a piece of white leader be spliced between the films for safety. A good idea in any event, but in testing, I found that even a crude film-to-film splice presented no problem.

Bell & Howell's Autoload 456 also has a stop-and-go splice capability, but B&H's solution to the tearing hazard is to notch the film alternately on both sides of the splice. This also worked well.

Whereas the format-selector switch changes both the position of the pull-down claw and the aperture mask on most projectors, the switch on Keystone's Auto-Instant K-560 only alters the aperture. Its pull-down is positioned to coincide with the slight overlap of the sprocket holes from both formats. As a result, spliced 8-mm and Super 8 film flows through as if there were no change. The operator has only to switch the mask.

Every manufacturer, however, stresses the format differences in his manual to prevent damage to the film. Honeywell and Kodak go to greatest lengths to prevent accidental switching. To change formats, the lamphouse cover must be swung open on the Elmo FP8-C (a new, slow-motion model), a pair of sprocket shoes opened and the proper, color-coded sprocket pushed into position. Here, it's the sprockets that move instead of the

claw. The slow-motion operation on the four that had it was quite bright enough, particularly on the Honeywell, with its speeded-up rotary shutter.

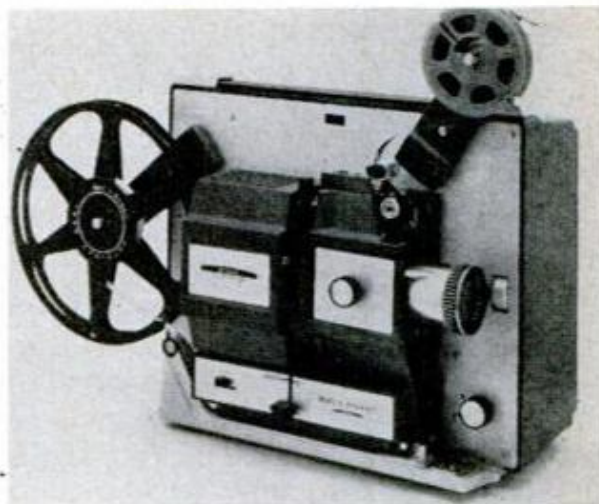
For the Kodak M80 and M95, which are virtually identical in construction, the lamphouse cover must be removed and a switch turned.

Except for these machines, format selection is at the control panel and simple to effect. Bell & Howell's design locks the format switch when running.

All but two of the projectors require (and came with) supply-reel-hub adapters for Super 8. Dejur and Honeywell machines have concentric spring-loaded spindles which will accept both reel types.

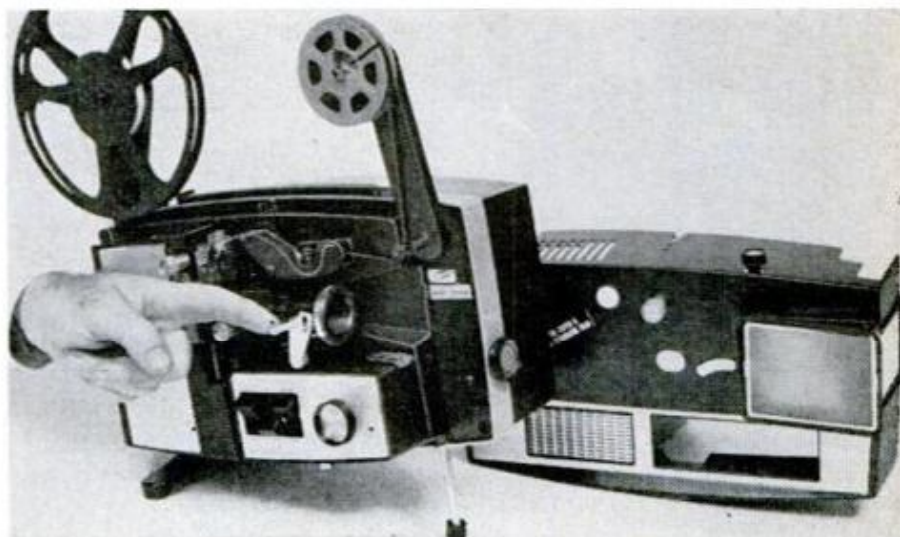
If you're an active moviemaker who likes to edit and splice his films, you'll want the 400-ft.-reel capacity of five of the projectors (25-30 minutes running time). The inexpensive Kodak M65 and

FILE FLAG  
OPPOSITE SIDE



**BELL & HOWELL** has a quiet, single-speed machine. The take-up-reel arm must be raised for rewinding

**DEJUR'S PROJECTOR** has an easy-to-operate zoom lever in the controls area. All controls are accessible through the viewer cover (far right) supplied with the PT-99 model





recessed into the body of the projector, giving it an attractive appearance, but fishing for the film end prior to rewinding is annoying.

The Dejur, Honeywell and more expensive Kodaks have variable-speed controls, but the first two have no indication of the actual speed being used to permit matching it to camera speed. The omission is deliberate, because the speeds cannot be relied upon as accurate with local line-voltage variations. Complete accuracy would require a voltage regulator, which none of these projectors have because of cost and weight. Still, some calibration would have been useful.

The Kodak models boast three forward and reverse speeds, but the switches on both were stiff and the speed positions placed so close as to make it difficult to set normal speed in either direction.

All of the projectors permitted reversing except Kodak M65. It also lacked provision for still projection or varying speed. Though not as versatile as any of the others and primitive in its packaging (its case is plywood with a crinkle-paper cover), at its price, the M65 doesn't really take a back seat to any of them:

It sports an automatic-rewind feature that works like a charm. At the end of a film's first run, you attach a metal clip to the film and slip it into the supply reel's hub. At the end of the next run, the tug on the end of the film trips the rewind

the Keystone are limited to 200-ft. reels. Keystone's take-up reel is neatly

	Bell & Howell Autoload 456
List price	\$149.95; zoom—\$169.95
Weight in pounds	15.12
Lens supplied	f/1.5 1" (25.4 mm)
Other lenses	f/1.5 19-32 mm zoom
Projection lamp	150-w. DJL
Automatic threading	✓
Film transport	Sprocketless
Variable speed	No
Reversing	✓
Power rewind	✓
Still projection	✓
Slow motion	No
Framing control	✓
Focus control	✓
Elevation control	✓
Takeup reel supplied	✓
Supply-reel hub	Adapter
Reel capacity in feet	400
Separate lamp & motor control	✓
Room-light receptacle	No
Film trimmer	✓
Viewer or screen	No
Line-cord length in feet	7
Lubrication needed	No

switch to send the film back through the film channel at high speed. None of the other projectors had this convenience.

Unlike most projectors, and particularly those in this group, the M65 uses a tilting optical system for projector elevation. It's more convenient than lifting the machine and releasing a foot.

Surprisingly, the quietest of these projectors also was the M65. None were really quiet—it might involve quite some design effort and added cost to insulate—but the M65 tone was at a very comfortable level. Bell & Howell's was the



**HONEYWELL'S ELMO**, the only sprocket machine in the group, hides its format selector under the lamphouse cover. It's available with or without slow motion



**KEYSTONE'S COMPACT UNIT** features a single slide switch for forward, still, reverse and rewind functions. Its recessed, 200-ft. takeup reel and enclosed film channel make for virtually foolproof automatic threading, but complicate rewind



Dejur-Amsco Versatile PT 90-99	Honeywell Elmo FP8-C	Keystone Auto- Instant K-560	Kodak Instamatic M65	Kodak Instamatic M80	Kodak Instamatic M95
PT 90: \$219.95 PT 99: \$244.95	\$199.50; zoom—\$219.50	Under \$130	Under \$100	Under \$200; zoom—under \$220	Under \$225; 22 mm—under \$210; zoom—under \$230
PT 90: 22/PT 99: 24	17.4	11.5	9.25	15	17
f/1.4 15-25 mm zoom	f/1.3 25 mm	f/1.3 20 mm	f/1.5 22 mm	f/1.5 22 mm	f/1.0 28 mm
None	f/1.3 20-32 mm zoom	None	None	f/1.5 20-32 mm zoom	f/1.5 22 mm; f/1.5 20-32 mm zoom
150-w. 21.5-v. DEF	150-w. 21.5-v. DCA	250-w. DMH	250-w. DFN or DFC	150-w. DNE	150-w. 21.5-v. DNF
✓	✓	✓	✓	✓	✓
Sprocketless	Sprockets	Sprocketless	Sprocketless	Sprocketless	Sprocketless
✓ continuous	✓ continuous	No	No	✓ 3 fwd., 3 rev.	✓ 3 fwd., 3 rev.
✓	✓	✓	No	✓ 3 rev. speeds	✓ 3 rev. speeds
✓	✓	✓	✓ Automatic	✓	✓
✓	✓	✓	No	✓	✓
✓ 6-9 f.p.s.	✓ 6-9 f.p.s.	No	No	✓ 6 f.p.s.	✓ 6 f.p.s.
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓ lens tilts	✓	✓
✓	✓	✓	✓	✓	✓
Dual	Dual	Adapter	Adapter	Adapter	Adapter
400	400	200	200	400	400
✓ also linked	✓ lamp automatic	✓	No	✓	✓
✓	None	None	None	None	✓
✓	✓	✓ in cover	None	✓	✓
✓ viewer on PT 99	None	✓ acc. viewer	✓ cover screen	None	None
7	8	6½	8	8½	8½
No	Motor only	No	No	No	No

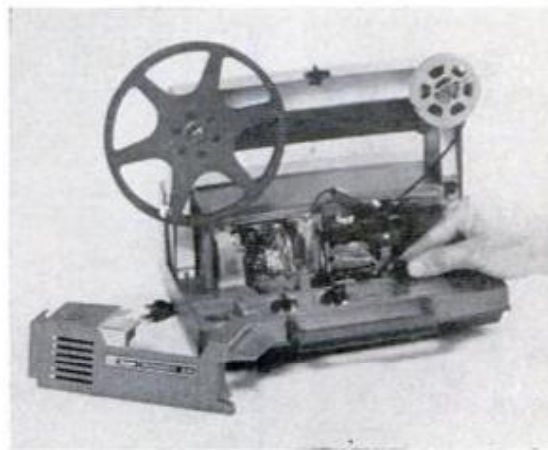
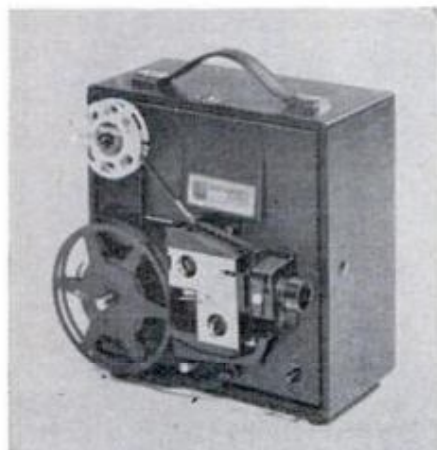
second quietest, with a low-key motor-fan tone.

The noisiest was the Dejur-Amsco, which produced an annoying whine on top of the fan and linkage noises. The Kodak M80 was almost its equal, but at a lower pitch. Since the M80 and M95 are built the same and the latter had a more tolerable mid-range buzz, the M80 noise must have been just a question of the sample tested.

Quite different was Keystone's tone—a loud, low-pitched roar of fan and motor. Honeywell's Elmo was middling, linkage noise being the only disquieting factor.

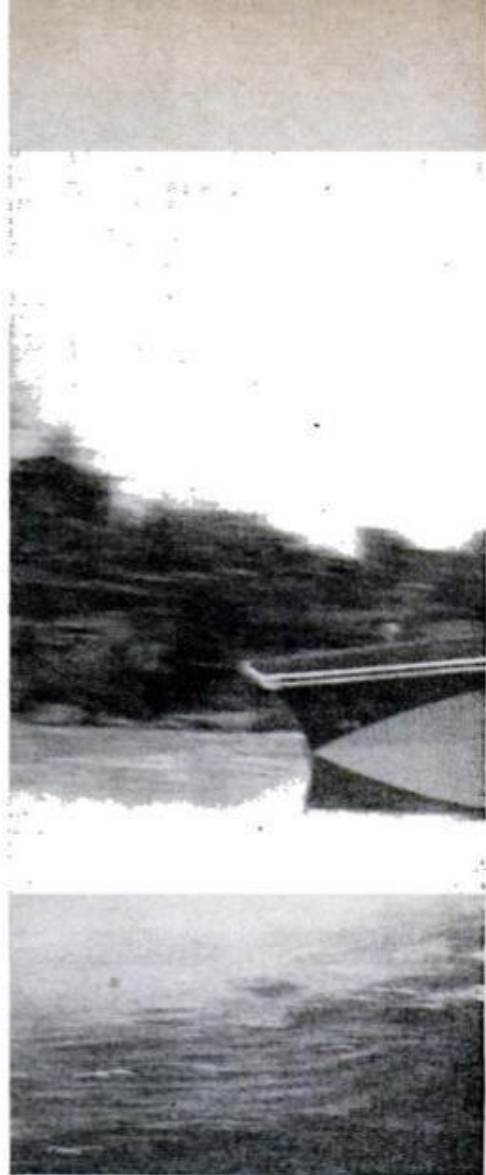
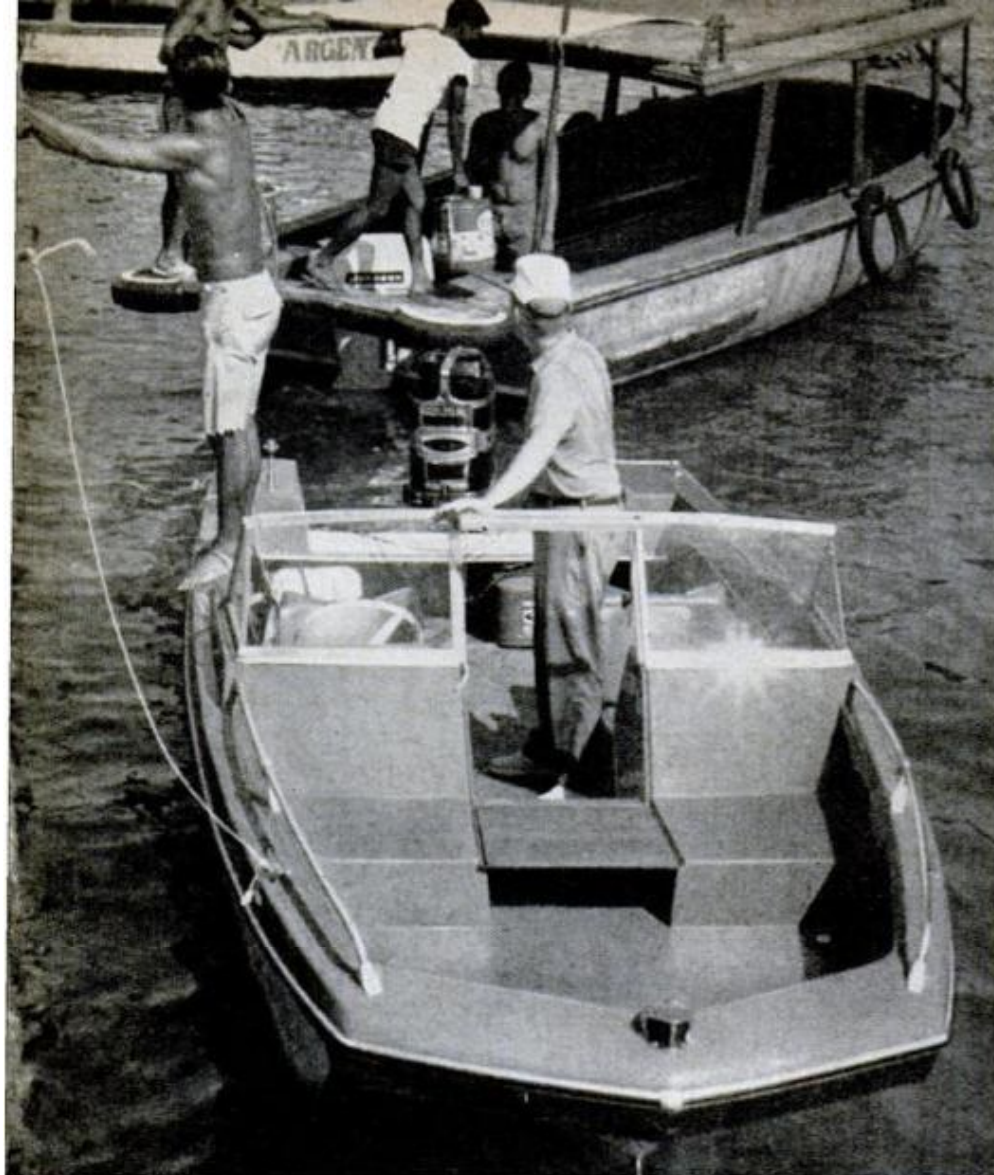
Except for the Keystone and the M65, all were equipped with, or offered, a zoom lens. This feature is primarily for setting up, whereby you can fill the screen without moving screen or machine. Dejur's zoom is the easiest to use, having a zoom lever. The least convenient was Honeywell's, which, like the others, requires turning the front of the lens, but which provided scant room for a grip.

It's a mixed bag of combinations and recombinations of features and conveniences—but you do have a wide choice among them. ★★★



KODAK'S BEVY includes the not-so-glamorous-looking M65 (left above) that boasts automatic rewind and tilting optical system and the modern-styled, all-in-one cases of the M80 and M95. These two are identical except for lamp, lens options and room-light receptacle. A change in film format requires removal of the lamphouse cover, and a single switch on the control panel handles all speeds and stills





**GLASS-BOTTOM BOATS**, like one aft of Swinger, look old and worn, but sport bright paint jobs. Many are powered by new U.S. outboards

## DATELINE:

# PM Tests Glastron's

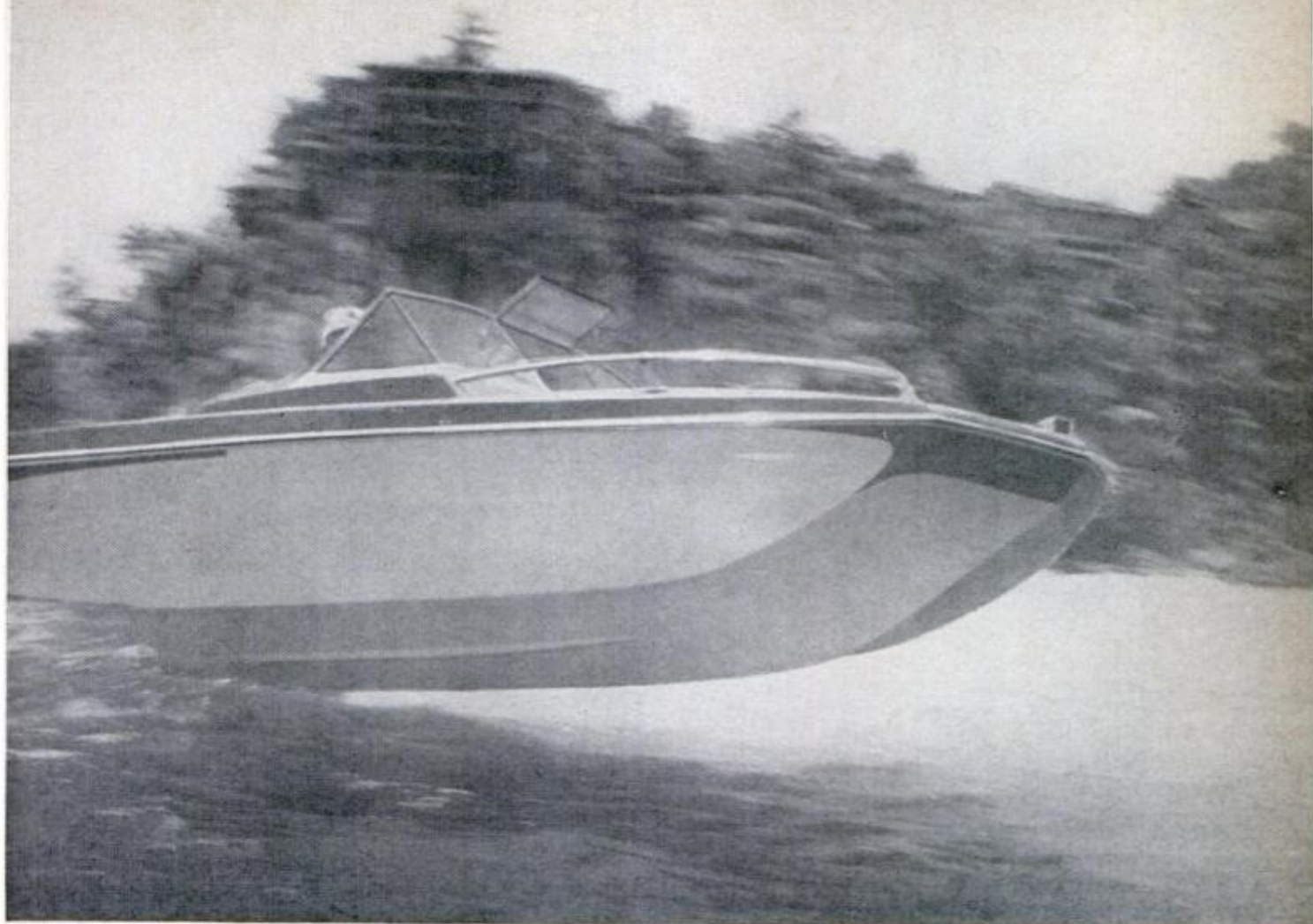
By Art Mikesell  
*Boating Editor*

The whole thing was perfect—palm trees, great stretches of sandy beach, the bluest water you ever saw and an exciting boat to test. Here's what happened.

**O**UR JET BROKE OUT of the mountain mist and swung wide over the mouth of the bay to give everyone a gull's-eye view of Acapulco. It was right off a souvenir postcard.

Picture a deep blue harbor notched into lush green coastal mountains, pastel buildings clustered along a blinding white beach, all shimmering in the hot sun of a tropical afternoon. This was the technicolor setting for PM's "Swinger" test.





"SWINGERING" OVER WAVES off Roqueta Island, I found that the boat had a stable solid feel. Speed here was about 35 mph. Top is around 40

## ACAPULCO

# New 'Swinger'



It all began some weeks before in New York when I received an invitation from the Glastron people to attend their annual dealer meeting in Acapulco. One of the first Swingers off the line would be available for testing at that time.

This opportunity to combine a promising boat test with a chance to talk with leading dealers from all over the country was too good to miss.

The morning after we arrived, I left the

Caleta Hotel early and walked over to Morning Beach where a Swinger was rocking gently at anchor near a fleet of ancient-looking, glass-bottom boats. It was like a Jag XKE nosed up next to a bunch of donkey carts. I waded out to take a closer look.

In profile, the Swinger has that long-hood look of a powerful roadster. The windshield is set farther back than you would expect and the modified Glastron





**THE**



**MAIN TEST RUN** shown on the map, above right, began at Morning Beach, above left, and covered many different water conditions. Little Mouth, between Roqueta Island and Las Playas, was a combination of moderate rollers and surface chop stirred up by the wind. In Great Mouth, the rollers were somewhat larger, but there was no chop. Up in the most protected part of the bay there were no rollers, but the wind kicked up quite a chop. On the way back, I checked out the water near Roqueta, hoping to find millpond conditions. However, it was about the same as that on the mainland side of the channel

**FORWARD COCKPIT** of the Swinger, left, is a roomy 25.6 sq. ft. of flat floor. Center panel swings down and rests in grooves in the edges of the seat boxes

**BOTTOM CONFIGURATION**, right, is a relatively deep V with flat wedge along the keel. Note that the sponsons are extremely shallow at the transom end

“spear” treatment of the two-tone gel coat further emphasizes the long, lean lines.

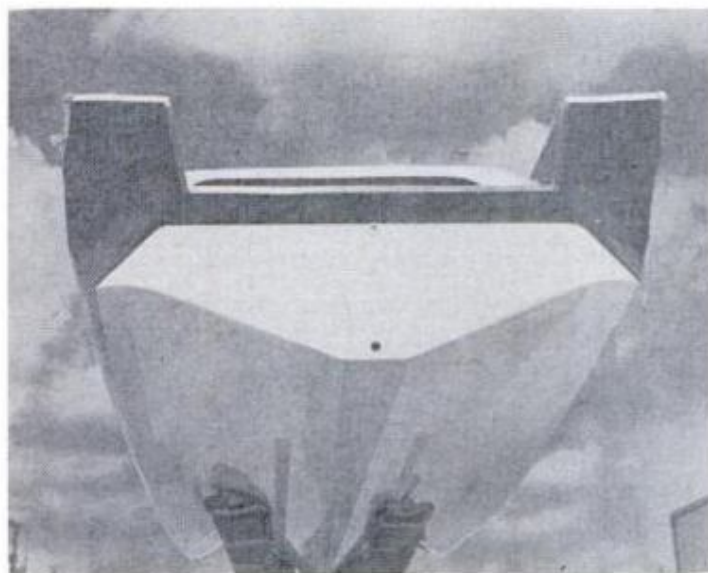
This windshield location puts the passenger load back where it should be for this hull. Being farther back from the bottom curves of the bow, it also allows more front-seat legroom. Finally, it leaves room for a forward cockpit large enough to be useful—25.6 sq. ft. to be exact.

Unlike some of the foxhole foredecks around today, this forward cockpit is a well-thought-out and practical addition to the boat. The floor is flat all the way across. You can actually move around a little without worrying about falling overboard. It's even self-bailing.

The box seats on either side of the walk-through are strictly flat surfaces for taking a load off your feet for a couple of minutes. There's no pretense of increasing the nominal seating capacity, though two or three kids could ride up there (and probably will want to) when cruising.

Incidentally, the walk-through seals tight when the bottom panel is swung up and the windshield closed. I'm told that on all future models the center section of the windshield will swing over on the passenger side rather than go up like an awning. A clear opening is definitely an advantage (I bumped my head only once, but that was enough)





The model I tested was a 17-ft. outboard equipped with a 95-hp Merc. The same hull is also available with 120-hp stern drive and a slightly modified version of the Swinger bottom is found on the 15-ft. Sportster, a stripped-down economy outboard with a different interior.

I started the motor and eased the Swinger out through the cluster of anchored boats into the channel between Roqueta Island and the mainland. Called "Little Mouth," it's somewhat more sheltered than "Great Mouth," the main entrance to the bay. Still, the water was a messy combination of good-sized rollers and surface chop stirred up by the wind.

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## GLASTRON SWINGERS

	V-156	V-176	V-177
Length	15' 1½"	17' 4"	17' 4"
Beam	72"	84"	84"
Transom Width	67¾"	76"	76"
Depth	32"	39½"	39½"
Transom Height	Long shaft	Long shaft	31"
Construction	Fiberglass	Fiberglass	Fiberglass
Approx. Weight	600 lbs.	826 lbs.	1480 lbs.
Power	Outboard	Outboard	Stern drive
Max. OBC Hp	85	140	140
Fuel Tank	—	—	18 gal.
Seating	Two sleeper	Two sleeper	Two sleeper & two buckets at stern
Color:			
Hull Deck	Avocado-white Avocado	Jade-white Jade	Blue-white Blue
Price	\$1099	\$1399	\$3489
Soft Top	\$69.50	\$93.50	\$93.50
Side Rear Curt.	\$70.50	\$81.50	\$81.50
Complete Soft Top	\$140	\$175	\$175

Once clear, I poured on the coal, was planing almost immediately and airborne soon after. The next couple minutes were spent playing offshore racer with the hull out of the water half the time. Then I stopped fighting the rollers and cut back to two-thirds throttle.

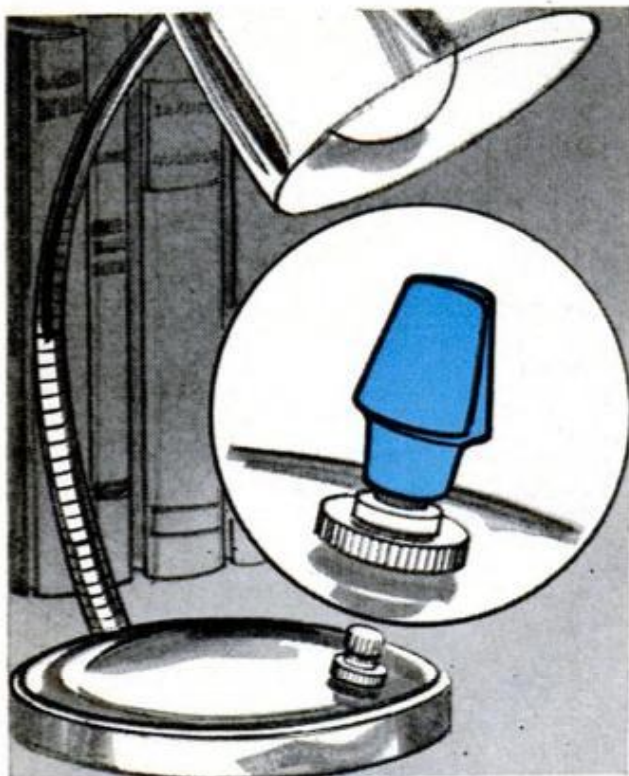
Through it all, the windshield remained dry and I didn't feel a drop of spray. Handling was excellent. The boat always felt completely under control, never on the ragged edge of doing something unexpected.

When I headed out into "Great Mouth," the rollers were bigger but the Swinger

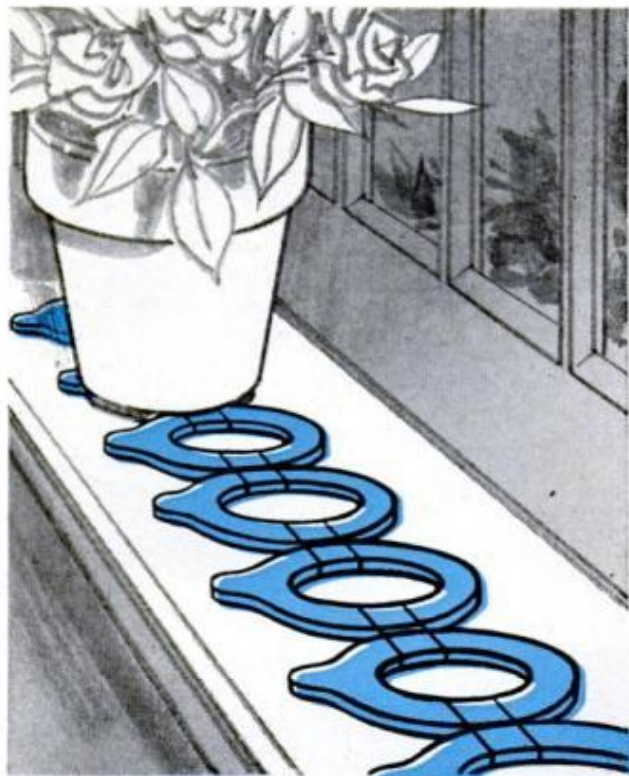
*(Please turn to page 194)*



# Solving home problems



**EASY-GRIP SWITCH** for a desk lamp is just a wedge-type pencil eraser pushed down over the regular switch. This not only makes it easier to turn the lamp on and off, but keeps an eraser always handy



**WINDOW-SILL MAT** lets you put small potted plants on the sill for a sunbath without worrying about staining or scratching the finish. Simply tape jar rubbers together to form a foldable chain, as shown



**TO STORE HOSE NEATLY**, knot the ends of a 20-in. length of heavy cord to form a loop and use this to hang the coiled hose from a nail. Connect the coupling halves and slip the nozzle over nail nearby



**"DRIP-PROOF" TEAPOT SPOUT** can be made by wrapping it with a colorful pipe cleaner just below the tip. It will absorb those few drops which otherwise run down spout and stain a clean tablecloth

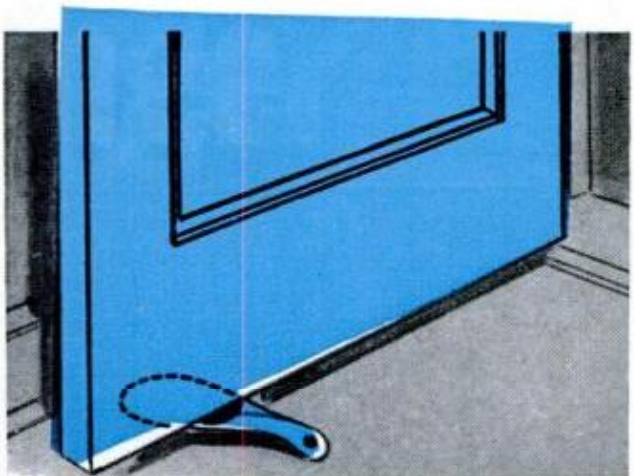




**WHEN WORKING RAPIDLY** to staple a great many programs or other papers, you'll find that some of the staples aren't firmly clinched. Slip a thimble on your finger and you can finish the job in no time



**IF YOU FIND** that you seldom use that bulky metropolitan telephone directory, slip it over a coathanger and hang it in the back of the closet. It's handy when needed, yet takes up no valuable shelf space



**TO IMPROVE A DOORSTOP** when none is available, try slipping a shoehorn under the door. Its upward slant will accommodate almost any door. For extra height, you can bend up the end with pliers

MARCH 1967



**LOOKING FOR A MOLD** in which to cast decorative stepping stones for the lawn? Buy a hog feed pan. Besides having sloping sides which make it easy to dump the casting, its fluted edges add pretty look



**ARTIST'S BRUSHES** can be cleaned, shaped and dried faster if a V-shaped notch is cut in the rim of the plastic or paper tumbler used to hold water or other cleaning fluid. Just pull the brush through the notch



# Your STEERING LINKAGE...

## How to Troubleshoot An Overlooked Troublemaker

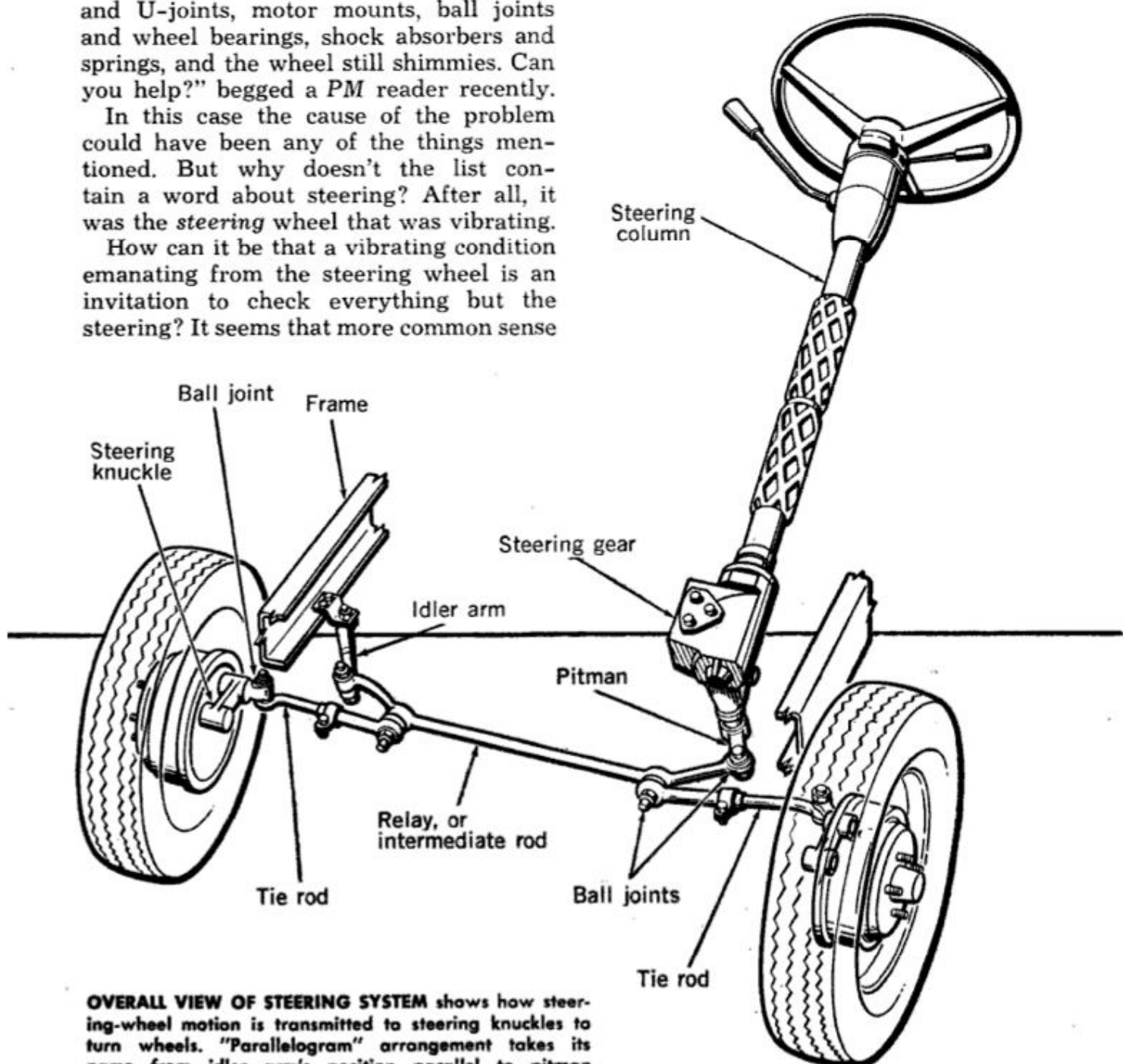
"I HAVE A BAD SHIMMY in my steering wheel, I've spent a fortune buying new tires and checking front-end alignment, wheel balance, drive shaft alignment and U-joints, motor mounts, ball joints and wheel bearings, shock absorbers and springs, and the wheel still shimmies. Can you help?" begged a *PM* reader recently.

In this case the cause of the problem could have been any of the things mentioned. But why doesn't the list contain a word about steering? After all, it was the steering wheel that was vibrating.

How can it be that a vibrating condition emanating from the steering wheel is an invitation to check everything but the steering? It seems that more common sense

By Morton J. Schultz

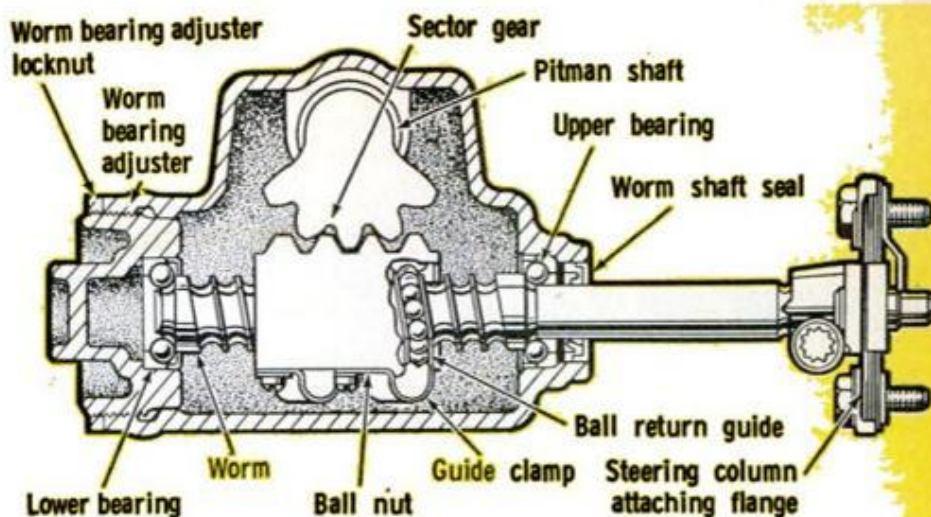
Technical illustrations by Don Evans



**OVERALL VIEW OF STEERING SYSTEM** shows how steering-wheel motion is transmitted to steering knuckles to turn wheels. "Parallelogram" arrangement takes its name from idler arm's position parallel to pitman



**CROSS SECTION** of steering gear shows how steering column couples to worm shaft which is bearing-mounted in gearbox. As worm shaft turns, ball-nut moves up and down the shaft, meshing with sector. Sector is part of pitman shaft which turns and imparts motion to relay and tie rods which connect to steering knuckles



should be a troubleshooting ingredient.

The steering system seems to be a mystery to many people. But a close look at your car's front end will separate the steering elements from the myriad of suspension, antisway devices and other front-end members that confuse your view of what's happening up front.

Elements of steering—beyond the familiar steering wheel—are steering shaft or column, steering gear and steering linkage. When you add a power-assist unit to your steering, things get a bit more complicated, so we'll ignore it for now. The steering column, which transmits the movement of the steering wheel to the steering gear, can also be dismissed lightly to get to the first important steering element—the steering gear.

Basically, the steering gear consists of

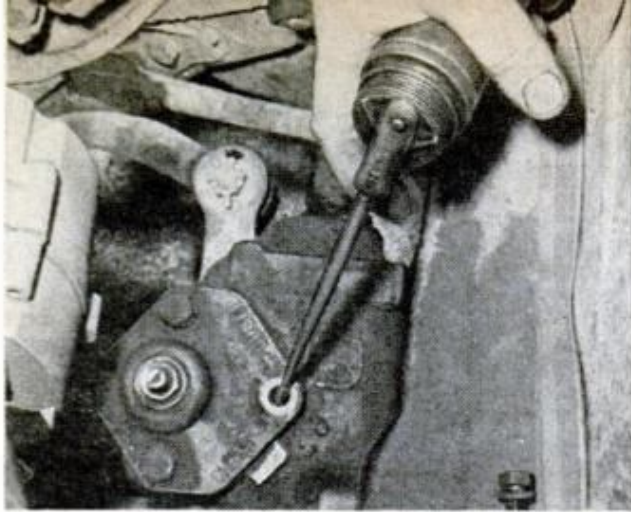
a worm or screw at the lower end of the steering shaft that drives a mating gear, called the sector, which in turn drives the pitman (or sector) shaft. The sector shaft is the first element in the steering linkage setup.

Over the years, there have been many types of steering-gear designs—worm and sector, worm and roller, cam and lever, to name a few. But, regardless, basic steering gears have really changed little over the years. The only changes, really, have been toward a more efficient design. The most recent innovation, for example, is a gear called the recirculating ball type. Since the middle 1950s, most cars have adopted it. The only exception I can think of is Chrysler which has used a worm and roller-gear type after 1960.

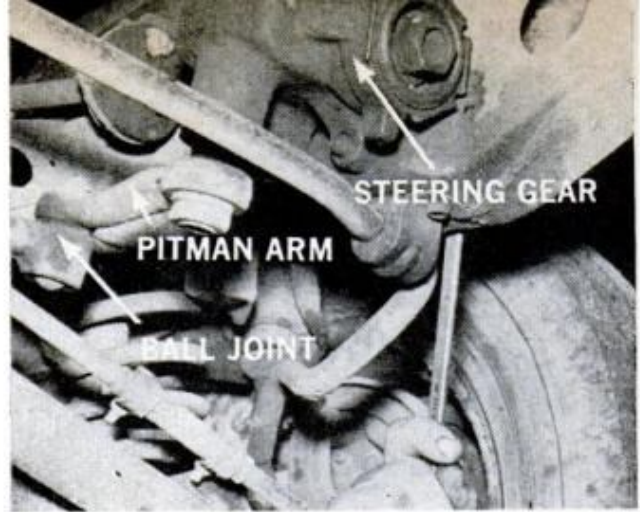
The recirculating ball setup is thought

PROBLEMS ORIGINATING IN STEERING SYSTEM				
Symptoms	Possible Causes			
	Lack of Lubrication	Steering Gear Out of Adjustment	Loose Steering Gear Mountings	Looseness in Steering Linkage
Stiff steering	●	●		
Loose steering		●	●	●
Shimmy		●	●	●
Jerky steering	●	●	●	●
Rattle in steering	●	●	●	●
Side-to-side wander		●	●	●
Tire squeal on turn				●
Binding, poor recovery	●	●		





**STEERING-GEAR LUBRICANT** must be checked periodically and filled when necessary. Lack of lubrication will lead to hard or jerky and noisy steering



**ATTACHING BOLTS** must be kept tight. Before troubleshooting the steering system, always check these bolts which secure gearbox to frame of car

to be the most efficient, because it greatly reduces friction, giving easier steering and longer gear life. Because of its universality, we'll concentrate on this one.

The worm on the lower end of the steering shaft engages and drives a ball nut by means of a series of circulating, steel ball bearings. These bearings circulate in the spiral grooves provided by the screw threads of the worm and ball nut. Friction between the balls and the grooves as the shaft turns causes the balls to move through the assembly.

The ball nut as such does not rotate. Instead, it moves up and down on the steering shaft. It has a set of straight-sided gear teeth (called the rack) that engage the sector gear of the pitman shaft. As the ball nut moves up and down, engaging the teeth of the sector gear, it causes the pitman shaft to turn and transmit motion through the steering linkage to the wheels.

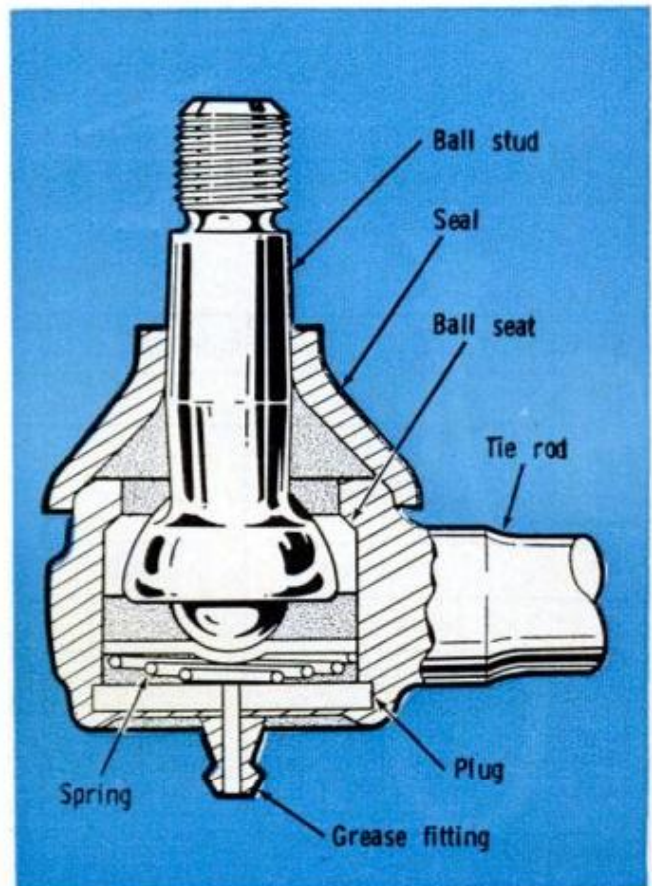
The recirculating-ball steering gear is used both in cars having manual steering and power-assist steering.

Several types of steering linkage have been used throughout the years. Today, though, most cars employ what's called the parallelogram system as illustrated on page 164. The distinguishing part of this system is the idler arm, which is mounted in a bracket on the side of the car opposite from the steering gear. It is connected to the pitman arm (or sector shaft arm) by a relay or intermediate rod. The pitman arm, in turn, is connected to the pitman shaft. As the shaft moves, the pitman arm moves and transmits motion to the rest of the steering linkage.

Connections between the pitman arm and relay rod, between the idler arm and

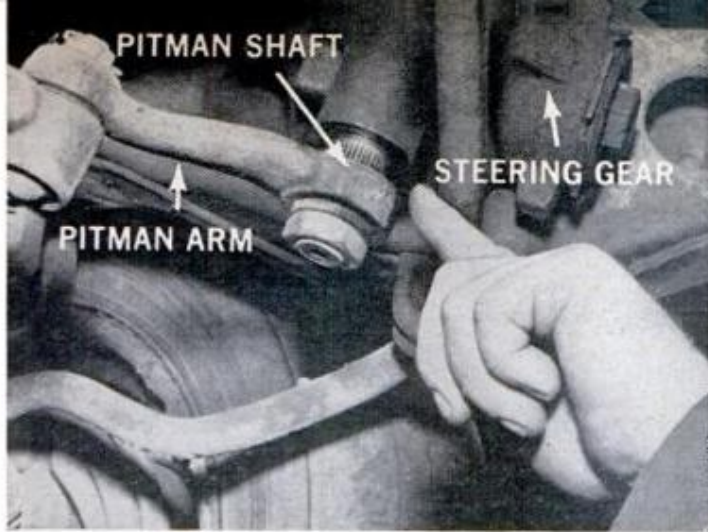
relay rod, and between the relay rod and tie rods are usually made by means of prelubricated ball joints that are similar in principle to suspension ball joints. Some of these joints are permanently lubricated. Others are fitted with removable plugs that allow insertion of grease fittings for lubrication.

Connections between tie rods and steering-knuckle steering arms, on the other hand, are often threaded and clamped

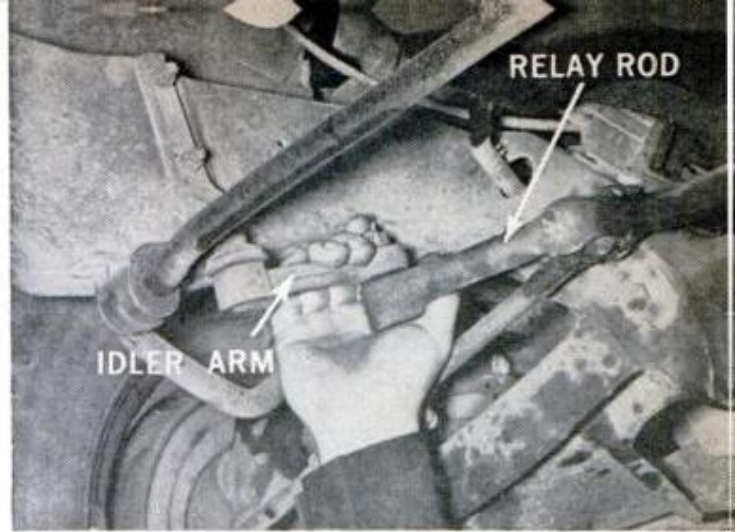


**BALL JOINTS AT TIE-ROD ENDS** have provision for lubrication through a grease fitting in some cars; others are sealed and no lubrication is specified





**PITMAN SHAFT SHOWS EXCESSIVE LUBRICANT** when seals or bushings in steering gear are ruptured. In this case, the gear must be overhauled



**IDLER ARM LOOSENESS** is easily checked. As shown here, one end of the idler arm is secured to frame on passenger side of the car and carries relay rod

sleeves that allow you to make necessary front-wheel toe-in adjustments.

There are many ways in which a problem in the steering setup can make itself known. These problems occur in both manual and power-steering systems. Of course, additional troubles can show up with power steering because of the power assist unit. The accompanying chart shows what could be causing troubles in conventional steering systems. Before trouble-

shooting, however, always make sure tire pressure is correct.

When a problem crops up that may have lack of lubrication as its cause, the solution, of course, is grease. But what do you grease? The lubrication chart appearing in your car owner's or service manual is the best guide, but here are a few notes.

Every steering gear has a way for you to check lubricant level. Remove the plug  
*(Please turn to page 190)*

### COMMON POWER-STEERING COMPLAINTS

Problem	Possible Cause	Solution
<b>Hard steering</b>	Tight steering adjustment	Adjust steering mechanism.
	Loose or worn pump belt	Replace belt if worn. If not, adjust to manufacturer's specifications.
	Low oil level in reservoir	Bring oil level to full, using Type A automatic transmission fluid. Check for leaks in lines and connections.
	Leaks in system	Examine for leakage in power-steering hose and around connections. Replace where necessary.
	Dirt in system	Flush out system and replace with clean fluid. Be sure to bleed system of air after oil change.
	Lack of chassis lubrications; improper tire inflation	Perform lube job and check tires.
	Pressure line is about to fail	Check power-steering lines for sponginess, checking and cracking. Replace where necessary.
<b>Increased effort required on quick turns</b>	Air in power-steering system	Fill reservoir and bleed all air from system. Check for leaks in power-steering lines and connections.
<b>Clunking sound in power-steering</b>	Looseness in steering system	Check steering linkage.
<b>Looseness in steering wheel</b>	Leaks in power-steering lines	Check lines and connections.
<b>Kickback of wheel</b>	Looseness in linkage	Check linkage and replace worn parts.
	Air in system	Examine lines and connections for leaks. Replace where necessary. Bleed system of air.
<b>Noisy power-steering system</b>	Fault usually lies in power-steering lines	Examine lines for checking, cracking and sponginess. Replace as necessary.
<b>Noise after completing a turn</b>	Dirt in system	Flush out system and replace with clean fluid. Bleed system of air after oil change.



# 'Plant' a Rug and Forget the Weeds

WILL YOUR VEGETABLE GARDEN go to pot while you're away on vacation? Are you weary of hoeing instead of fishing? No need for it if you turn to rug gardening.

With rug gardening, you plant it and forget it, for it will take care of itself. No weeds can compete with your plants, so there's no need for cultivation that may damage roots. Occasional rains on top of the retained spring thaw provide all of the water the plants need. Unlike plastic, the rug permits water to soak in and fewer insects find this exposed environment to their liking. The rug also keeps the ground warmer and brings you a bountiful harvest earlier in the season. And when you go to harvest the fruit, you'll find it and yourself cleaner—both will be atop a soil-less carpet, free of weeds.

The method is simplicity itself. Don't bother with spading. In the early spring, just spread out an old rug, or the felt padding that underlays carpeting, where you want the bed. Place it nap side down for the best appearance. Leave it there until planting weather arrives. By then, all weeds and grasses will have been smothered and turned to humus in the darkness.

Under this cover, the saturated spring earth will retain its moisture as a reserve for the summer.

When spring tugs you outdoors, your plants and seed should be at hand. Cut out 5-in. squares at the appropriate planting distances, dig the holes and plant. Then water them once. That's it, unless you have an extremely dry summer; then soak well occasionally and watch 'em grow.—*John Krill*



**VIGOROUS MELONS** are a response to rug gardening. The technique keeps them clean, seals the moisture in and traps heat, promoting rapid, sturdy growth

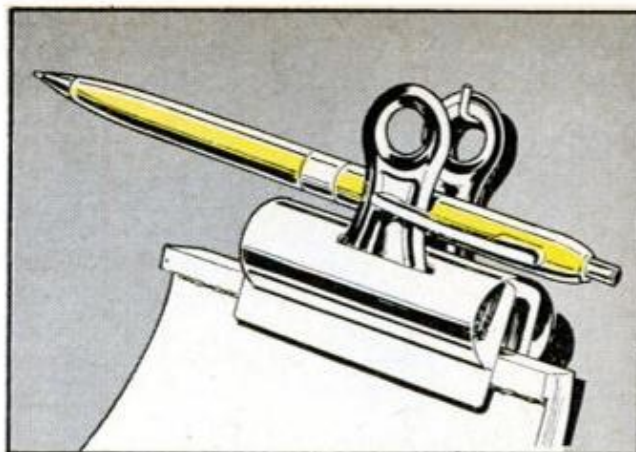


**SPREAD YOUR CARPET ANYWHERE** and you'll improve plant growth with the least effort on your part. The merits of the technique include prevention of weed growth and conservation of moisture and your time

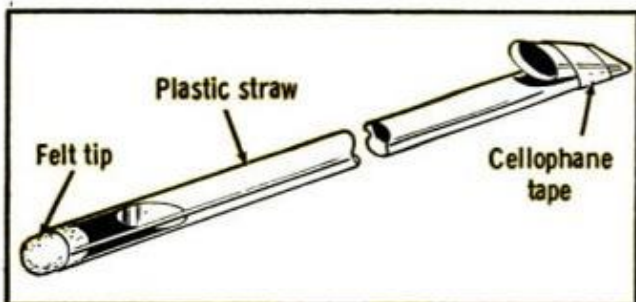


# HINTS FROM READERS

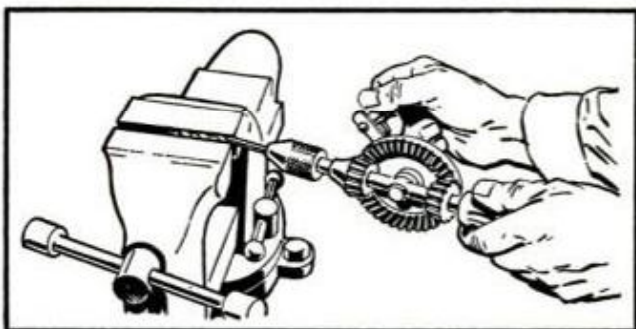
**MEMO PAD AND PENCIL** won't wander, just as you need them in the shop, if you keep them together with a large paper clamp, as shown at right. Any pencil or marker with a pocket clip can be snapped onto the thumbpiece, and the clip hung from a cup hook screwed into your tool-board or workbench.—*G. E. Hendrickson*



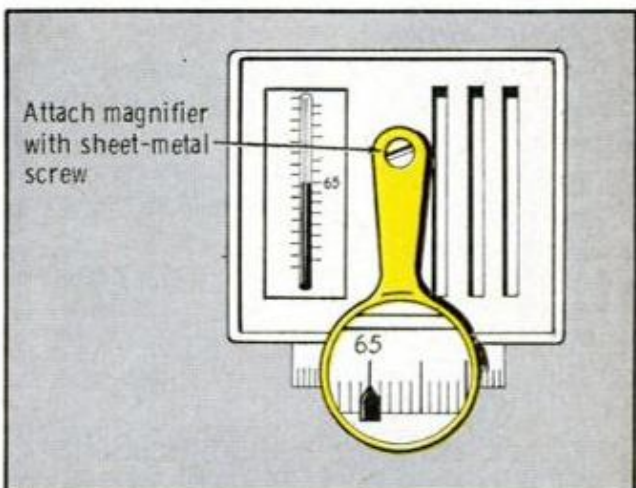
**CHILD'S FELT MARKERS** are easy to make from large plastic drinking straws. Insert a felt tip (oilcup wicking is ideal) in the straw, fill the straw with marking ink, bend back the end of the straw and secure with cellophane tape. Make a set, using straws of colors to match the ink inside.—*Joseph Braunstein*



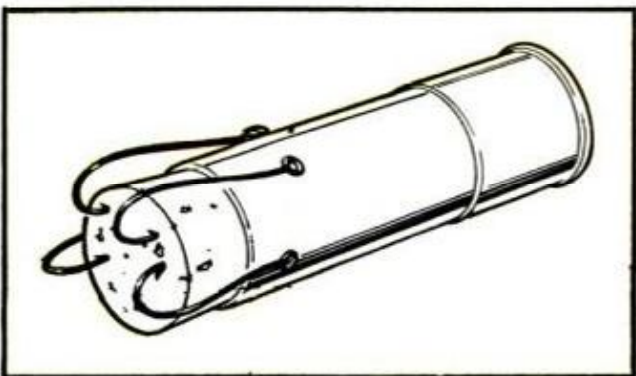
**A TINY TWIST DRILL** can be straightened quickly if you chuck it in a hand drill and then snug a metal-jaw vise on it just enough to let it still turn. Grasp the hand drill firmly enough to put a little side pressure on the bit and crank it slowly without letting it shift up or down in the vise jaws. A few turns will straighten it.—*H. Mullen*



**THERMOSTAT SQUINT** is a common winter complaint. The markings on the temperature scale are often too small to read, especially when the thermostat is located in an inconspicuous and dimly-lit spot. You can add an inexpensive plastic magnifier by removing the thermostat cover and drilling a hole in it for a self-tapping screw which is passed through the magnifier's handle. Make sure that the screw's point doesn't protrude far enough inside to interfere with the mechanism.—*Thomas Trail*

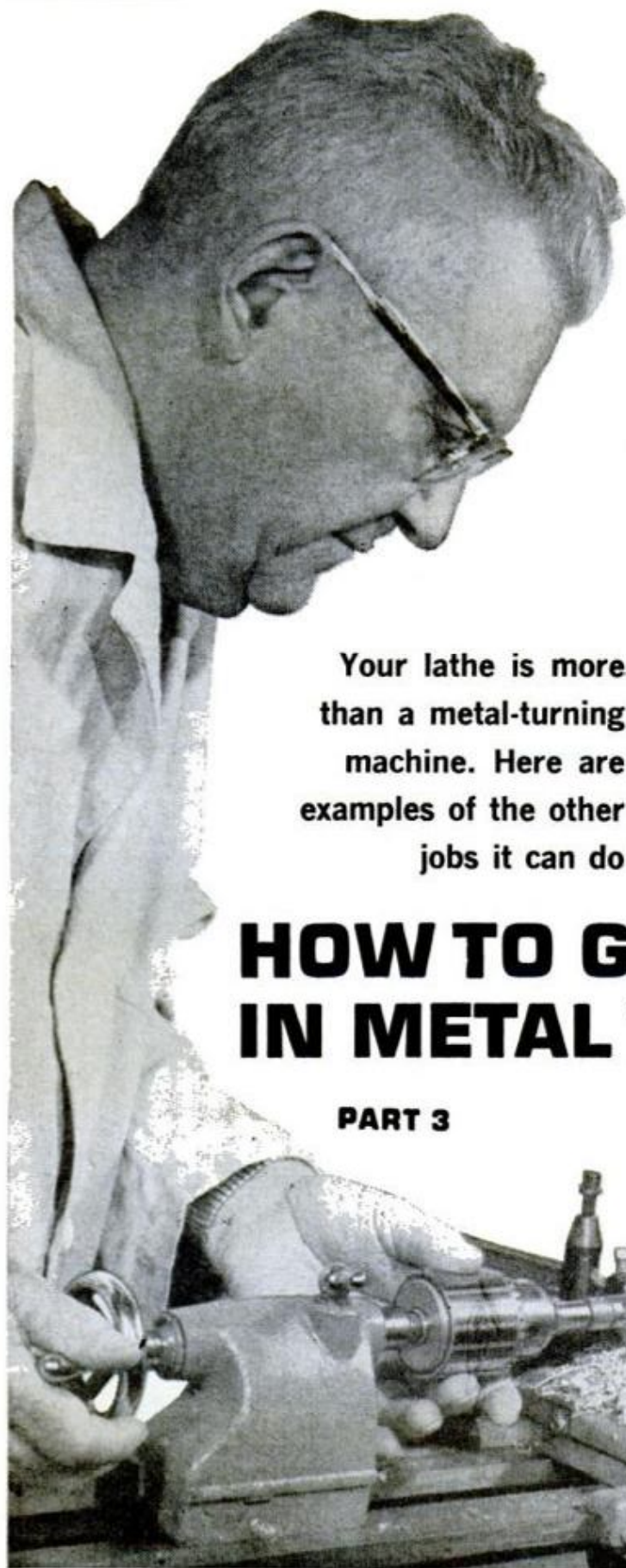


**POCKET YOUR FISHHOOKS** and sinkers to keep a supply handy no matter how far you roam from your tackle box. You can do it safely and keep the supply in order for immediate selection with the help of an empty shotgun shell. Slip the sinkers inside the shell and cap the end with a cork. Now, embed the points of hooks firmly in the cork as shown at right.

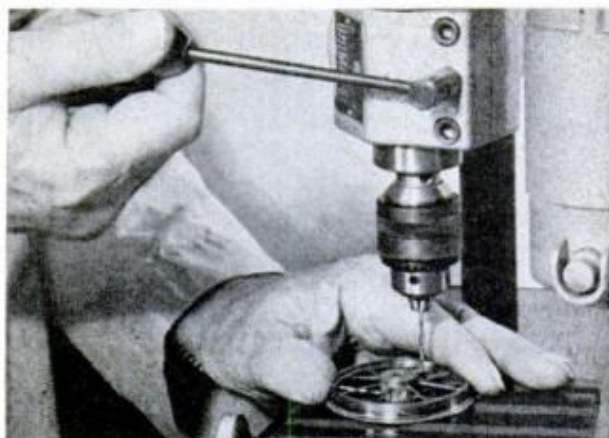


—*G. E. Hendrickson*

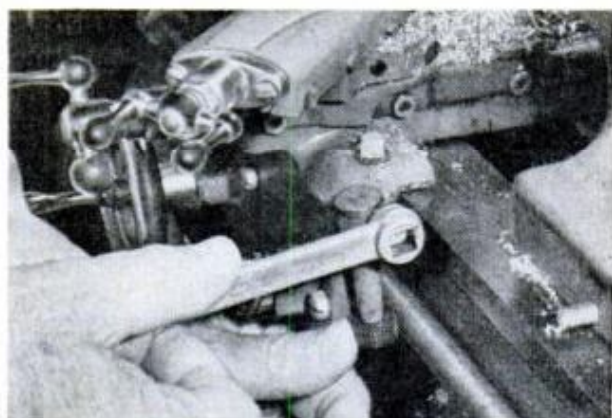




**SENSITIVE DRILLING** can be done on small lathe with headstock clamped to vertical column that's an accessory with some makes



**FIRST STEP** in thread cutting is to engage dial with lead screw (below). Dial saves returning carriage with lead screw, each pass

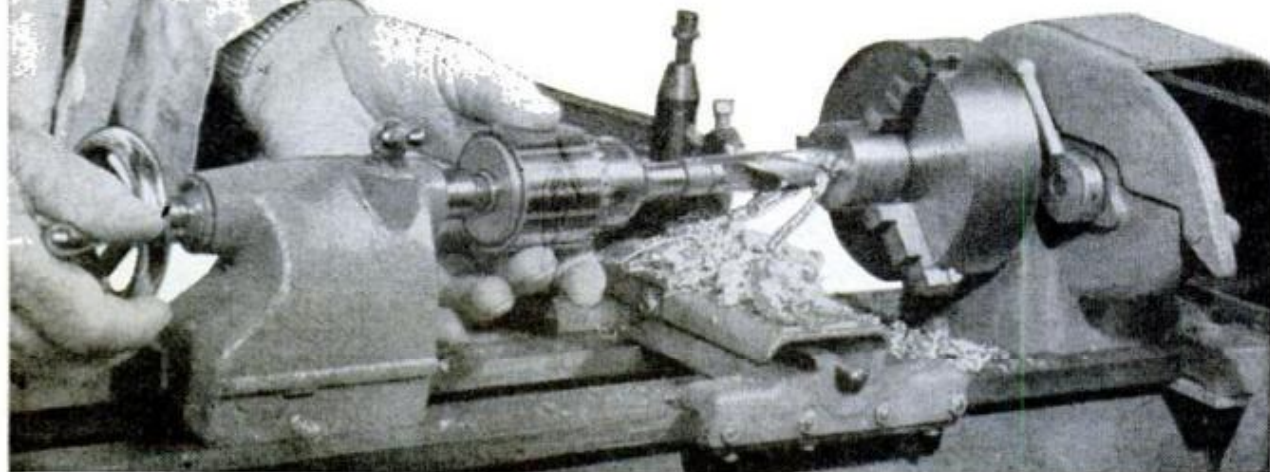


Your lathe is more than a metal-turning machine. Here are examples of the other jobs it can do

## HOW TO GET STARTED IN METAL TURNING

**PART 3**

**BY W. CLYDE LAMMEY**



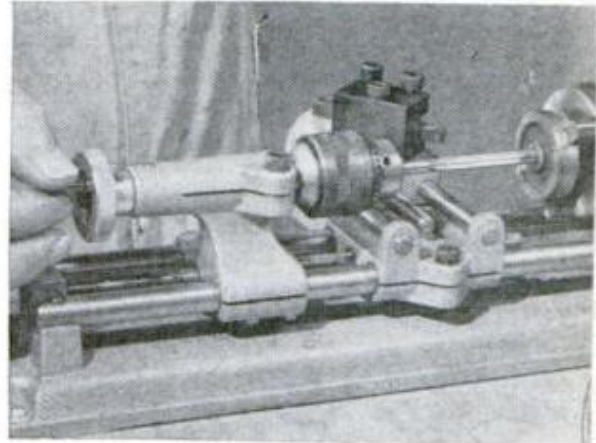
**TO DRILL HOLE** with a  $\frac{1}{8}$ -in. twist drill in a small lathe, center work in three-jaw universal chuck as shown above. A small-diameter pilot hole serves as guide for larger bit. Use a light, uniform feed



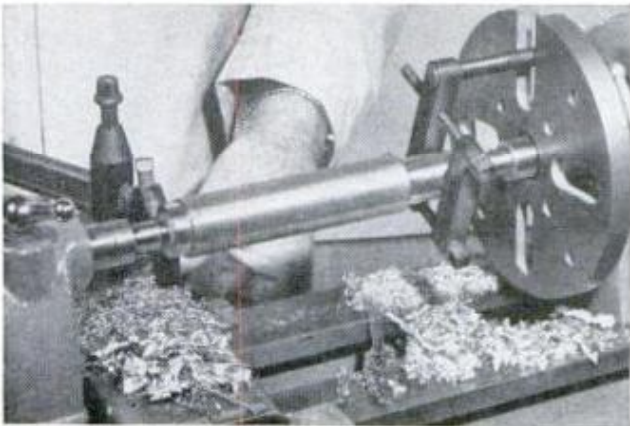
**FINISH BORING** of off-center job (below) shows it's often best to drill large-sized holes undersized, then finish to required diameter with boring tool



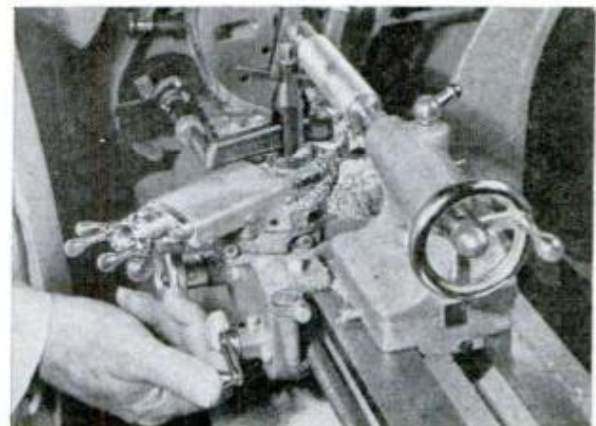
**DRILL AND REAM**, say the specs, so first you drill undersize hole, then go through with reamer —backing off a bit at intervals to clear chips



**AT END OF PASS** disengage half nuts from lead screw and return carriage by hand to starting point, with point of cutting tool clearing threaded section



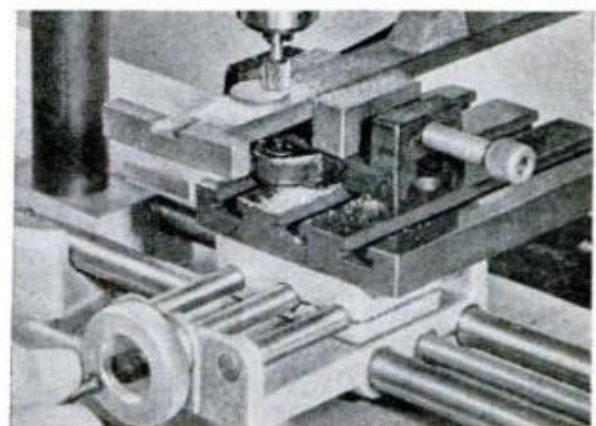
**FOR NEXT PASS**, in-feed tool given amount on cross-feed dial and re-engage half nuts on lead screw as original mark on thread dial passes mark



**IN HAND TAPPING**, main problem is to get tap started straight and true. Setup below utilizes lathe as accurate support for tap wrench and workpiece



**CONVERT LATHE** to vertical mill with accessory vise, column and table. In setup below, both the cross and longitudinal feeds are utilized



**THE MANY EXTRA JOBS** your metal lathe can do, in addition to all the standard metal-turning operations covered in the January and February installments, take up this third and final part of our story. Even the small machines can be set up to do such work as drilling, reaming, milling, thread-cutting, knurling and turning tapers. And, you can turn the harder woods by replacing the 60° centers with the spur and cup centers and substituting a short metal bar for the toolholder. You just swing the toolpost so that the bar is parallel with the workpiece.

Drilling is perhaps the most common "side" operation done on a metal lathe. On



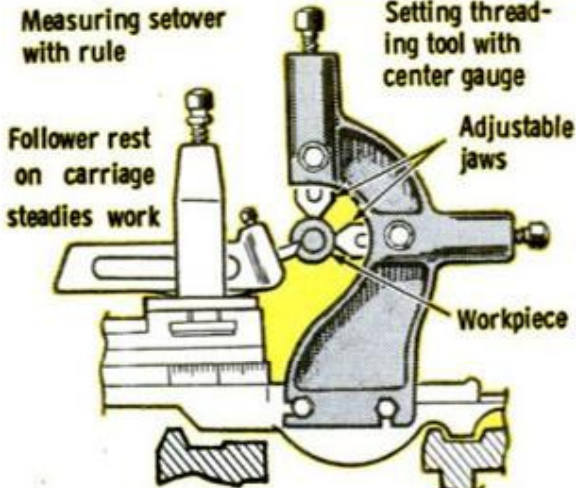


At same amount of setover, taper varies with length of workpiece



Measuring setover with rule

Setting threading tool with center gauge



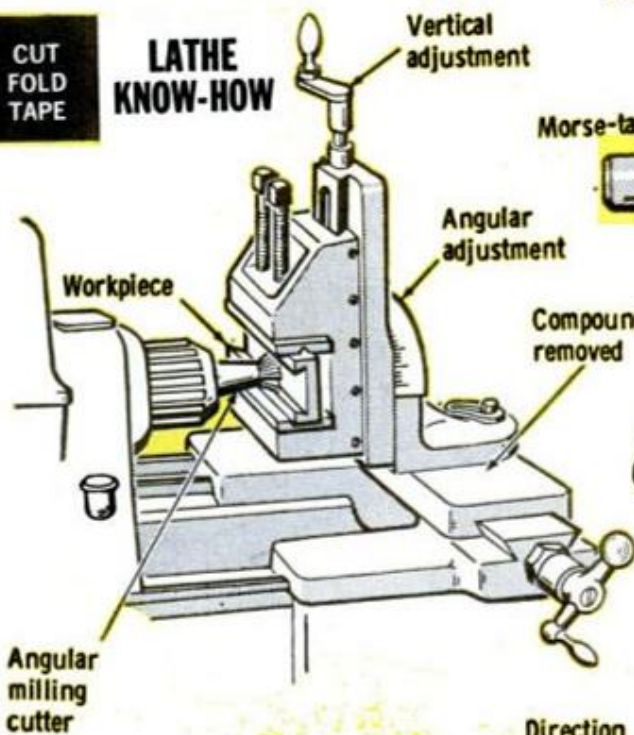
Follower rest on carriage steadies work

Adjustable jaws

Workpiece

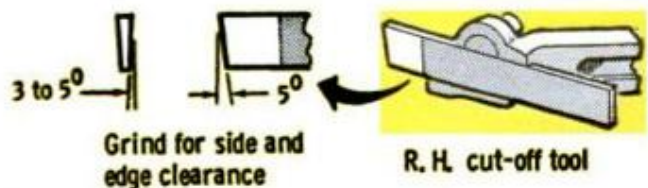
**CUT FOLD TAPE**

**LATHE KNOW-HOW**



Milling accessory

Note -- this accessory is available for nearly all small lathes; to attach, just remove compound and bolt it on carriage



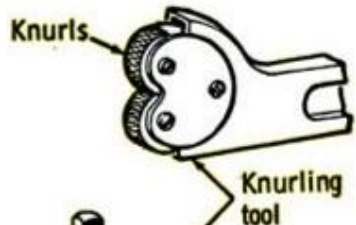
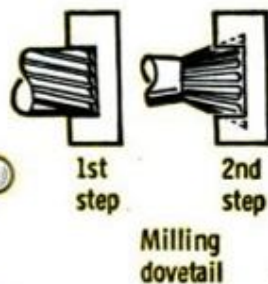
Morse-taper shank



Arbor with chuck for keyway cutter

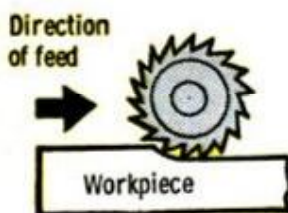


Screw arbor

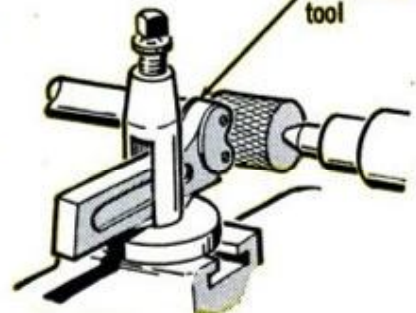


Knurls

Knurling tool



Technical art by Barry A. Wiedenkiller



Knurling setup

a small lathe you can use drill bits from needle size to 1/2 in. or more as the tailstock, fitted with a precision drill chuck, gives an extremely sensitive feed.

When drilling the larger diameters, it's advisable to run in a pilot hole first, using a small-diameter bit that you are sure is perfectly straight and correctly ground. The hole will serve as a guide for the larger bit. Ordinarily the pilot hole should not be more than one fourth the diameter of the larger hole—sometimes, less is preferable. Before drilling either hole, make sure the tailstock quill (or sleeve) taper is clean, with no chips or grime. Also wipe the tapered drill shank and place a drop of very light oil on it before inserting it.

You won't need a lubricant to drill most nonferrous metals and cast iron, but when drilling steel an occasional drop of light oil will result in a smoother job and prevent undue heating. When the finish hole is to be of large diameter, it's often best to drill



undersize and then finish to the required diameter with a boring tool.

Work specs frequently call for reaming to final size. In any case, if you are working to close limits it's well to follow through with this step. Drill the hole slightly undersize—about  $\frac{1}{64}$  in. in the larger sizes—then go through with a straight reamer of the final diameter desired. This will give you a smooth, true hole of exact diameter as long as you don't remove the work from the chuck between the two operations.

### Thread-cutting methods

Accurate screw threads can be cut on a lathe equipped with a lead screw. The cutting tool must be ground with a  $60^\circ$  point and the compound turned  $29^\circ$  to the right for cutting the common external threads. The tool must be set at right angles to the axis of the workpiece. If you have a center gauge, use it to obtain an accurate setting as detailed in the third sketch on page 172. Also, the cutting tool must be set exactly on the center line, or axis, of the workpiece to produce the best work. Somewhere on your lathe—usually on the inside of the gear cover or on the quick-change gearbox—you'll see an index chart listing the correct change gears to use in the train to cut a given number of threads per inch.

Diagrams on the change-gear lathe will show position of the change gears for cutting any thread within the lathe's capacity. With the gear train arranged to cut the thread desired, center-drill the workpiece and mount it between centers. Drive with a dog as in the left center threading photo on page 171. Usually it is desirable, when the lathe carriage has no threading stop, to run in a shallow groove with a cut-off tool at the finish end of the thread to provide clearance for backing off the threading tool at the end of the cut.

### How Threading dial works

On the simple threading dial you'll see four (some have eight) equally spaced marks. All pass a single witness mark as the dial slowly rotates. To start any even-numbered thread, such as 12 or 24 per inch, with the lathe running, engage the half nuts just as the rotating zero mark coincides with the witness mark.

After the first scoring cut, back off the tool, disengage the half nuts, return the carriage to the starting point by hand and re-engage the half nuts as the *same*

mark used previously on the rotating dial

Normally the common threads—even finer ones—should be cut in several passes, feeding the tool in from  $\frac{1}{64}$  to  $\frac{1}{32}$  in. at each pass, the depth depending on the thread size.

Cutting an internal thread requires much the same procedure as does the external thread, except that the feed is toward you, and you use a different type of threading tool. Also, there must be clearance in the bore for backing off the tool, and the compound is set  $29^\circ$  to the left instead of the right.

Milling, tapping, knurling, taper turning and cutting off are less frequently encountered, yet all can be done on a metal-turning lathe with available accessories. The main problem in hand tapping is getting the tap started accurately. The lower left photo on page 171 shows how; you use the lathe as a support for the work and tap wrench.

### Knurling and taper turning

A considerable range of accurate milling operations can be done with accessories shown in the photos and sketches. Knurling, which provides that neat gripping surface on small screws and other hand-turned parts, is done with the special tool sketched at near left. To knurl any small part, you first turn it to diameter, chuck it (or mount it between centers), set the knurling tool on center in the toolpost and run up to the work. Apply enough pressure to score the work surface and make the first pass, using the lead-screw feed. Then, just before the knurling "wheels" clear the work surface, reverse the lead screw, turn up the cross-feed screw slightly to apply more pressure and allow knurls to feed back in a reverse pass. Continue until the knurl is cut in to the desired depth.

On small lathes without a taper-turning attachment, tapers may be formed by setting over the tailstock. A machinist's handbook (check your library) will give formulas for taper per foot to any degree.

Long workpieces to be turned to small diameters between centers tend to spring away from the cutting tool. To prevent this you'll need a follower rest, one type of which is sketched on page 172. The cutting-off tool is useful mainly when a number of pieces are to be duplicated. It must be set exactly at right angles to the workpiece and precisely on center. Don't try this on work supported at both ends. ★ ★ ★



## EXCITING NEW PRODUCTS



EVERYTHING YOU NEED to reproduce the Shaker kitchen cabinet (left) comes in one handy package

### Classic furniture kits

Rounding up materials for any project can mean a lot of chasing around to buy all the items required. But with Sears' new line of Craftsman Original Furniture Kits everything is provided—including wood veneers or solid woods and plywoods, screws, nails or dowel pins, glue, finishing materials, plus a detailed plan and a short history of the piece.

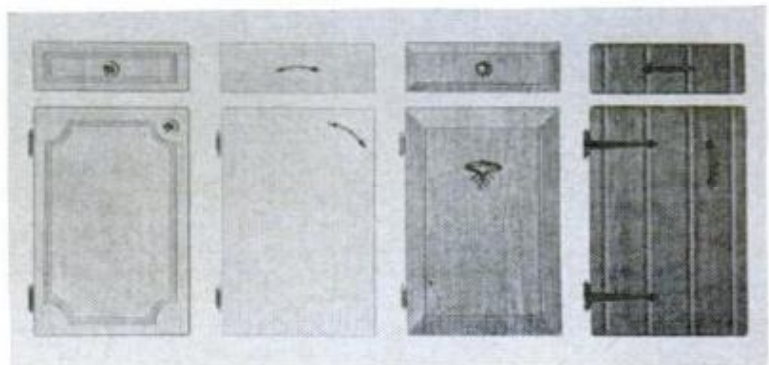
You have a choice of four classic designs: a Shaker kitchen cabinet (above) a 16th century Chippendale chest (right) and a Shaker oval table. All are true reproductions of originals on display in American museums and authentically reproduced from materials and plans in the kits.

The chest is a classic example of true English Chippendale and today is a prized collector's item. The chair is of Moorish origin and designed to be made of white oak, maple and pine.



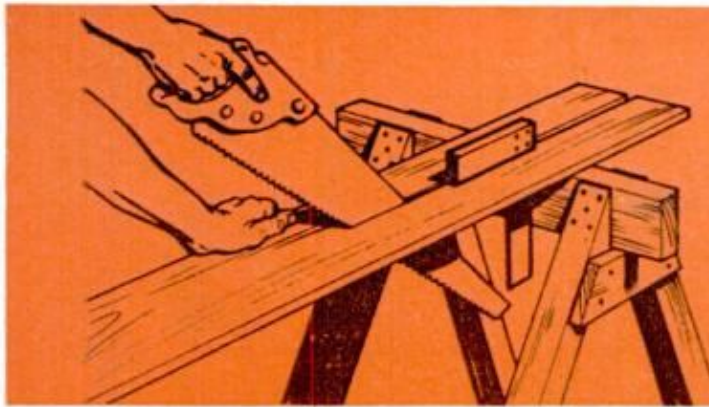
### Sculptured cabinet doors come complete, ready to hang

Smart cabinet doors and drawer fronts featuring all the sculptured detailing of much higher priced products are being produced by Emenee Mfg. Co. of Gillespie, Ill., through a unique process. The desired design is molded in wood-grained plastic, which is then laminated to a warp-resistant wood core. Called Formwood, they're available in standard drawer and door sizes, ready to install.

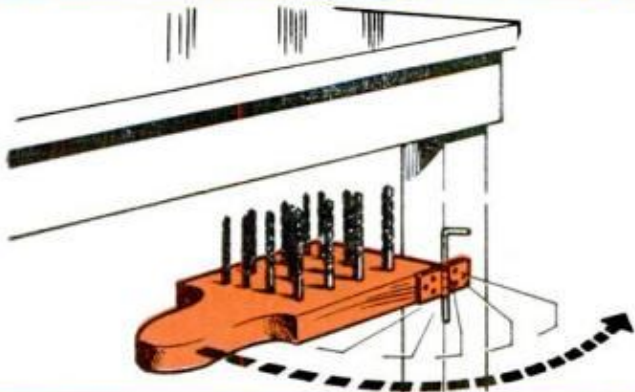




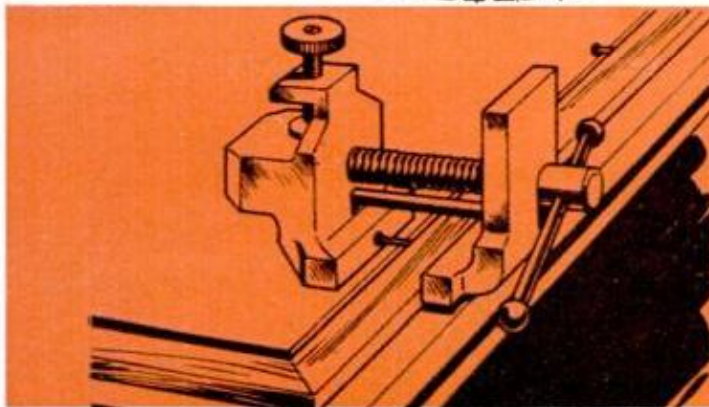
## HINTS FROM READERS



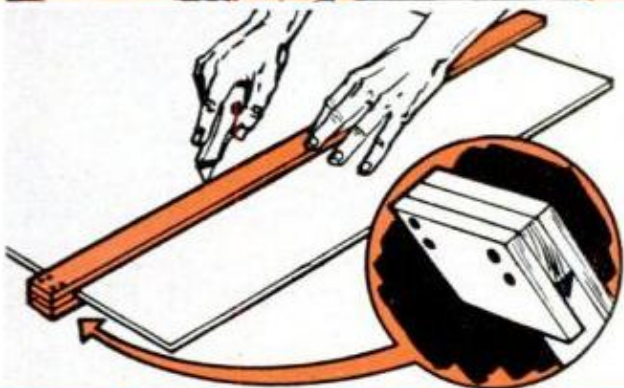
**TRY-SQUARE RIPPING WEDGE** is ideal to keep a handsaw from binding in long cuts. Just slip the square's blade in the kerf behind the saw and move it along as you cut. The thicker handle rides the face of the work and prevents the square from dropping through. Since you've just used it to lay out the cut, it's right at hand.



**SWING-OUT DRILL CADDY** can be made from a scrap of 2x6 lumber, band-sawed to the shape of a square paddle. Using the drills you wish to store at the workbench, bore a  $\frac{3}{4}$ -in.-deep socket for each, then hinge the paddle so it swings back out of the way. A removable pin lets you tote the caddy to a job site.



**SMALL VISE DRIVES BRADS** in tricky places where you can't get at them with a tack hammer—such as the back of a picture frame. You risk knocking the miters apart or cracking the glass if you pound brads in here, but if you press in the tip, then apply the vise as shown, you can sink a brad easily.—*Frank Shore*



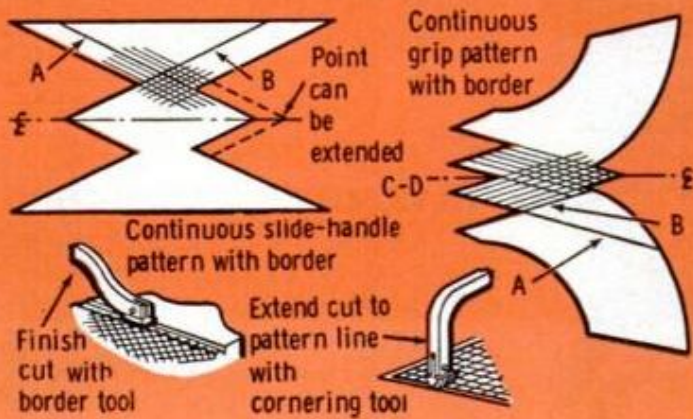
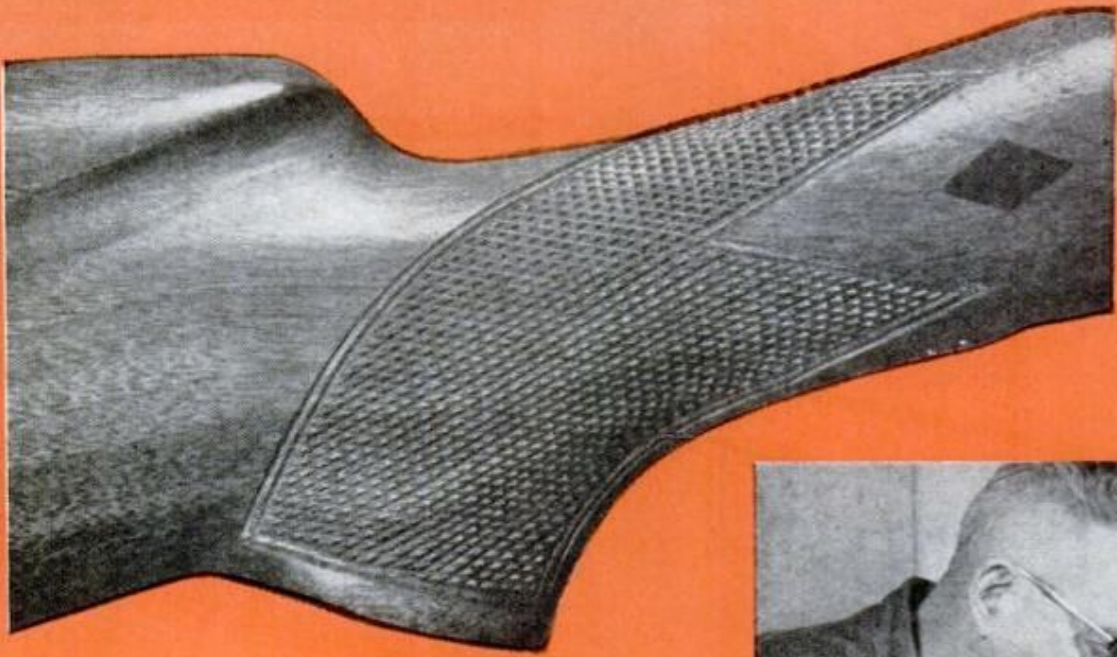
**STRAIGHTEDGE WITH HOOK END** catches the far edge of any large panel and prevents slippage as you scribe along it. This is especially helpful when cutting plasterboard, since a straying knife can ruin the whole sheet. Form the hook by tacking on plywood through a spacer the same thickness as the panel.



**IMPROVISE A PRICK PUNCH** by inserting a nail through a bottle cork, as shown at left. You can grip the cork easily for accurate placement of the nail tip, and your fingers are insulated from the sting of the blow. The cork also prevents loss of the nail and makes it easy to fish out of a pocket.—*G. E. Hendrickson*



# Checker Your Own



**MACHINE JOB** takes fewer passes than hand-tooling. Note that checkering is

**Checkering—as simple or elaborate as you choose—turns a standard gun into a beautiful custom piece**

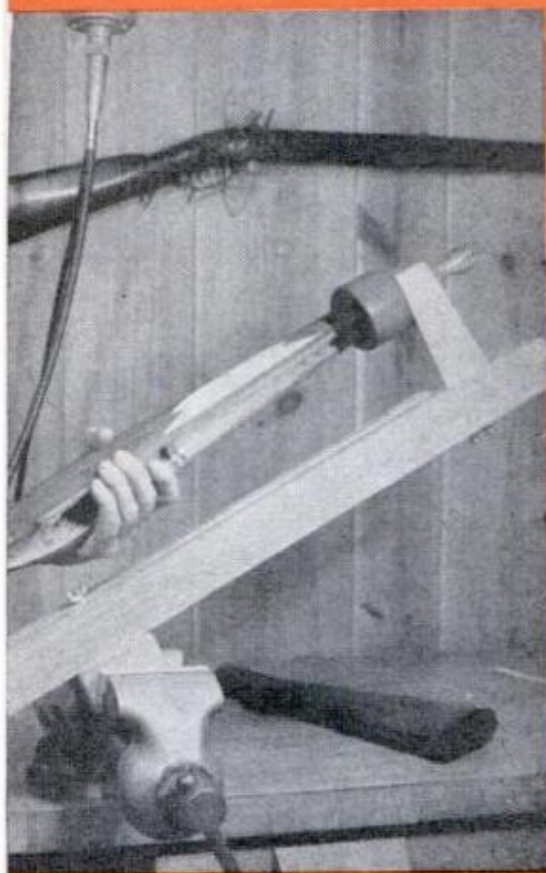
**F**IRST-RATE hand checkering on a shotgun or rifle stock is the mark of a master craftsman. Yet it's easier to do than you might think. It simply takes time and an extra measure of care.

Probably the most common type of checkering is a simple point pattern consisting of individual panels on each side of the grip and forearm. More involved are patterns in which checkering is carried over the top of the grip, or tang, and around the bottom of the forearm.

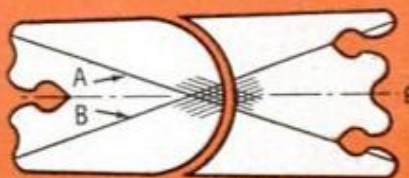


# Gunstock

By W. CLYDE LAMMEY



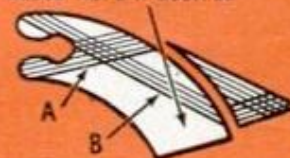
being done on one-piece rifle stock that was completely finished beforehand



Fleur-de-Lis pattern without border



Fleur-de-Lis may be added here if desired



Background tool  
Small nail



Plain checkering is useful as well as decorative, since it is an aid in gripping the gun. More elaborate patterns tend to be more decorative than utilitarian and may include relief carvings, standing scrolls and almost any other form that might suit personal fancy.

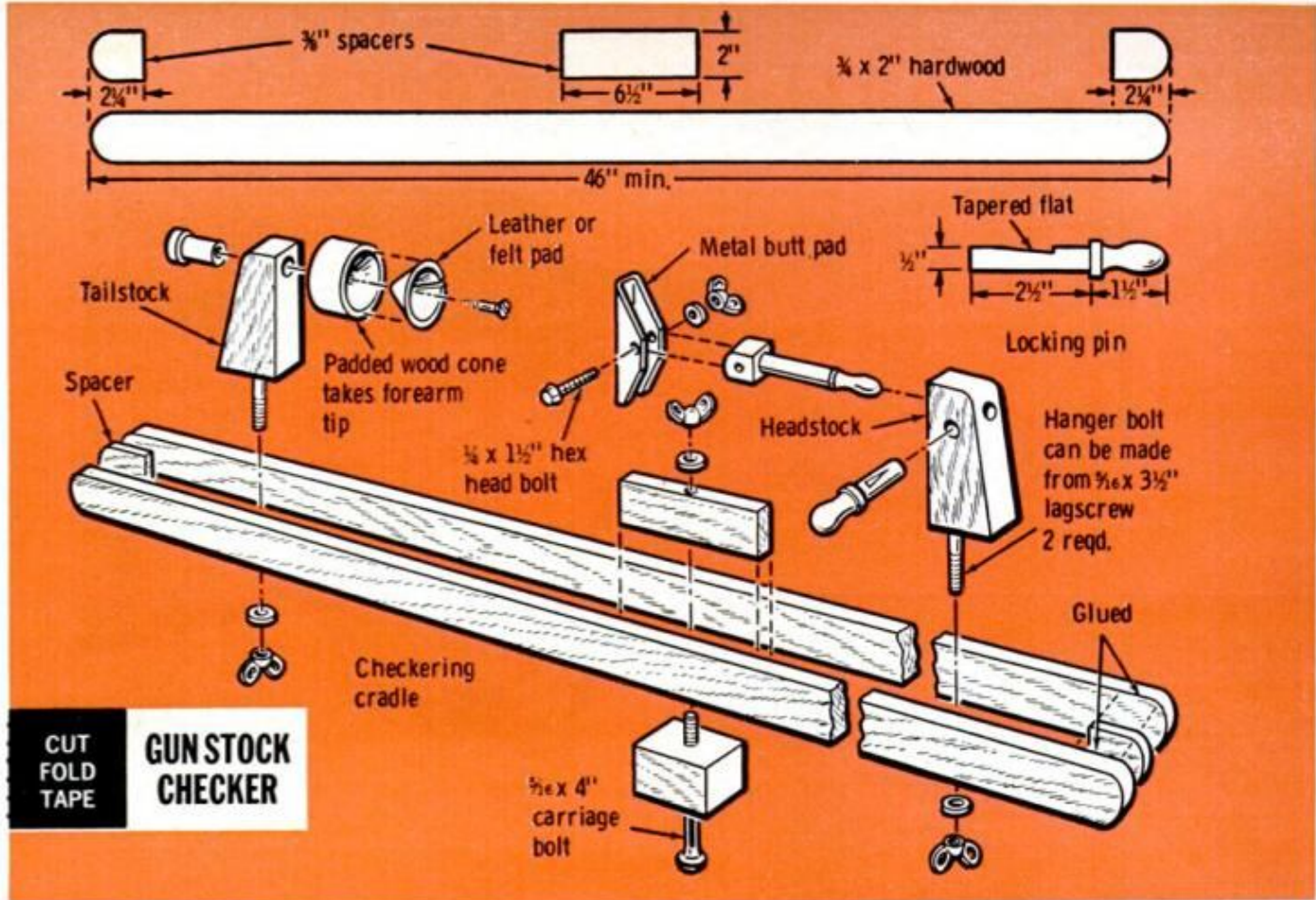
The hand tools you need are simple and inexpensive. The "cutters" are actually tiny files, or rasps, with specially shaped teeth that cut quickly and smoothly. Being heat-treated, they keep a sharp edge

for many hours of work. Another type, preferred by some gunsmiths, has integral cutting teeth. Details A, B and C on page 179 show three common types.

To do common checkering without a border you need a scoring cutter and a spacing cutter, also detailed on page 179. Spacers are available to cut from 16 to 32 lines per inch. With tools B and C, you need only one handle, since the cutters are detachable and interchangeable.

If you prefer checkering with a border,

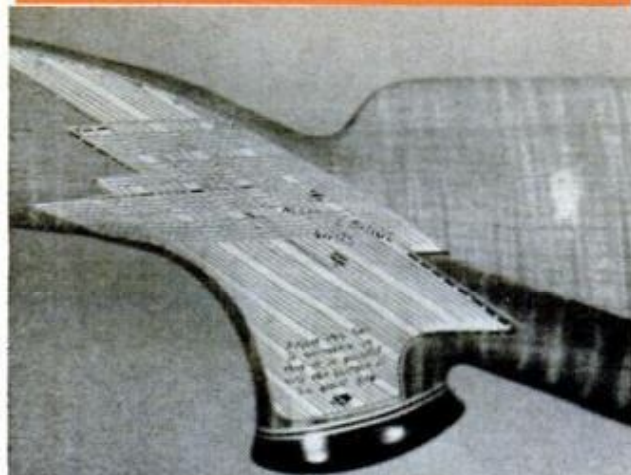




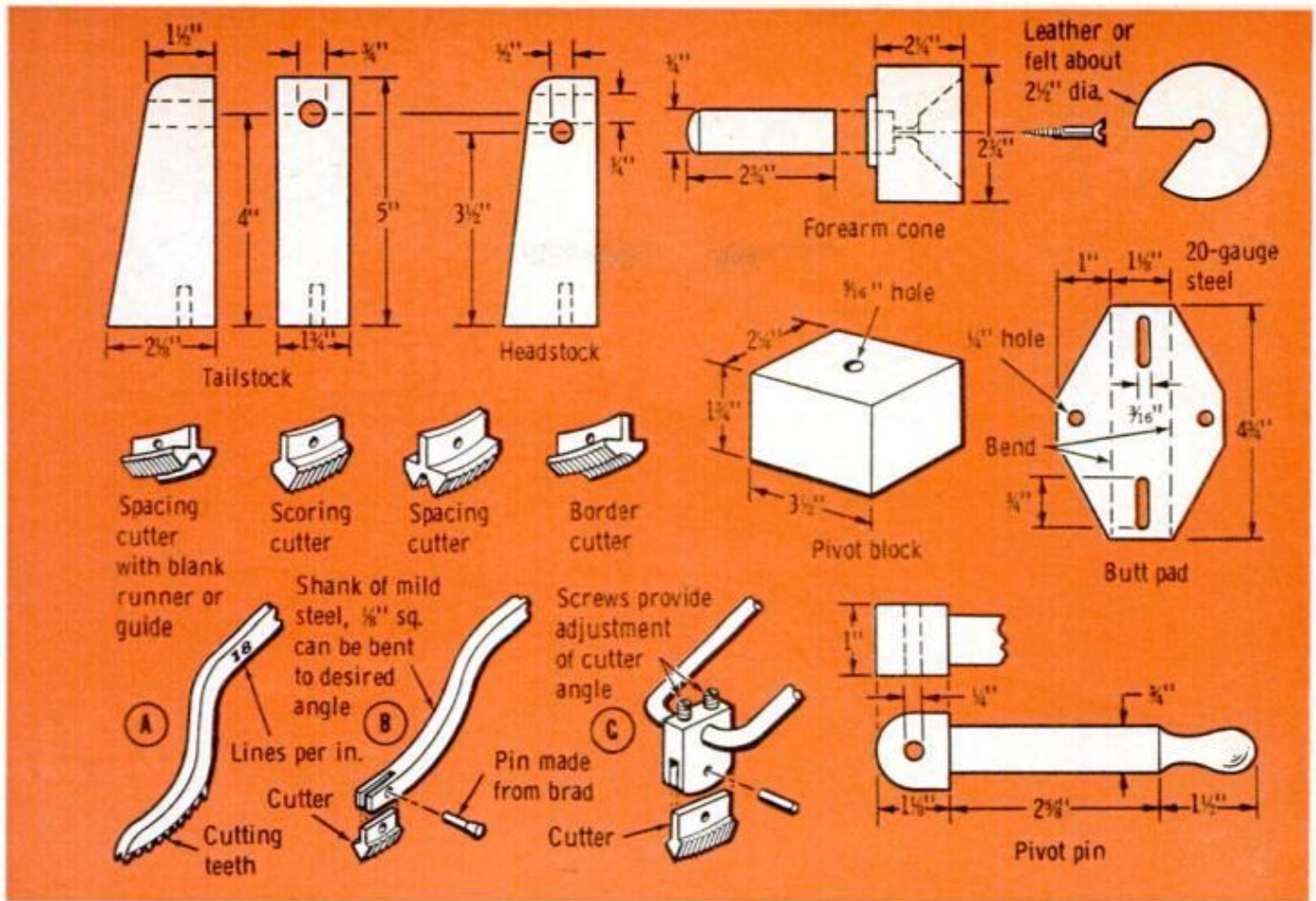
**DECAL PATTERN** is cut away with wheel (above) controlled by foot switch. Cheekpiece (partly scored, below) has full skip-line-pattern decal



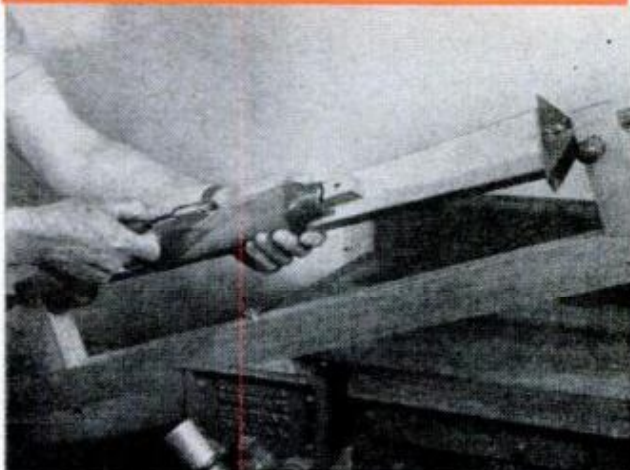
**FREEHAND OUTLINE** of grip pattern is easy to pencil. To hold front of pump-gun stock, use fitting below; screw other end to metal butt pad







**CRADLING STOCK** of old side-by-side double shotgun requires this mounting, while matching forearm needs special holder shown below

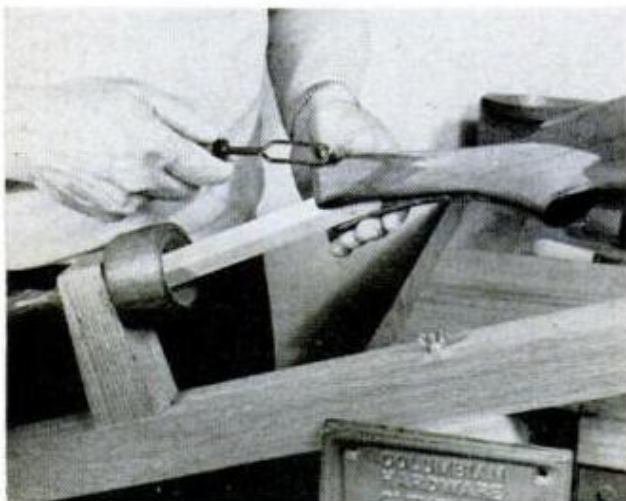
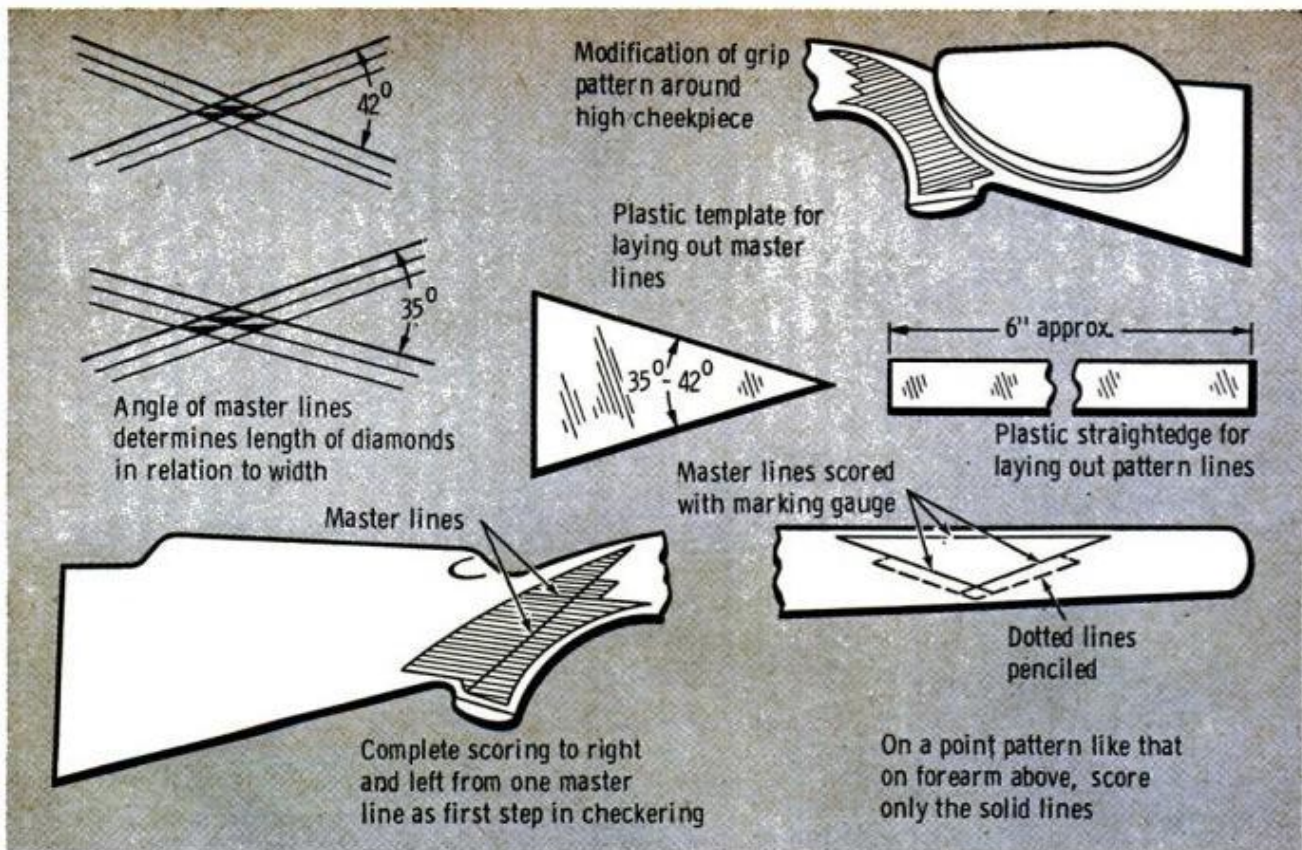


you need the border cutter, which cuts a bead-shaped border around the pattern after the checkering has been cut to full depth. Another tool, the skip-line spacer (not detailed), is identical with the ordinary spacer except that the cutters, or files, are spaced to skip two or more lines when scoring, giving the skip-line pattern shown at the far left. The spacer is also available with a blank runner, or guide, which has no cutting teeth. It comes both right and left so you can work each way from a master line, or score. You also need a stiff-bristle brush to clean the scores frequently. A toothbrush is perfect.

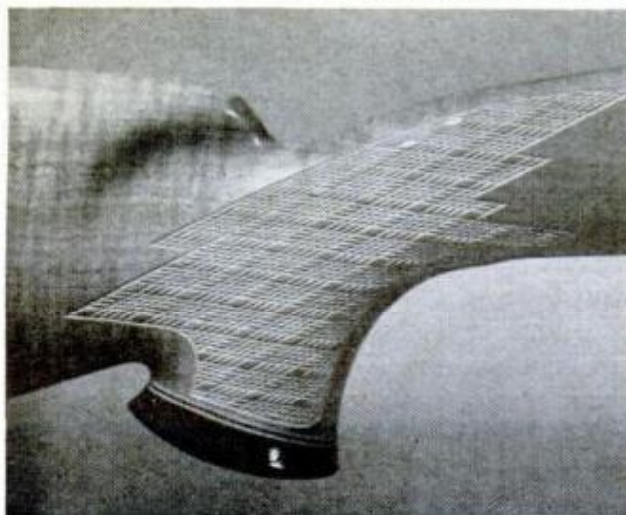
Next, you need a cradle to hold the stock firmly in almost any position, yet permit it to be turned a full 360° at any angle. Gunsmiths usually make their own cradles to suit their own needs, but the plans on the facing page are typical. Designed to be locked in a bench vice, this cradle can be both tilted and swiveled. The turnings detailed on two of the parts are not essential, but if you don't have a wood lathe, you can have a friend or a cabinet shop turn the forearm cone.

To place a one-piece rifle stock in the cradle, insert the end of the forearm in





**SLIDE HANDLE** of pump gun is supported with two-piece holder. Photo above shows last step—cutting border around pattern, shown below



the cone, bring up the "headstock" and insert the buttplate screws (the buttplate having been removed, of course) through the slots in the metal butt pad. Tighten the screws lightly. Then tighten both the head and tailstock wingnuts and you're in business.

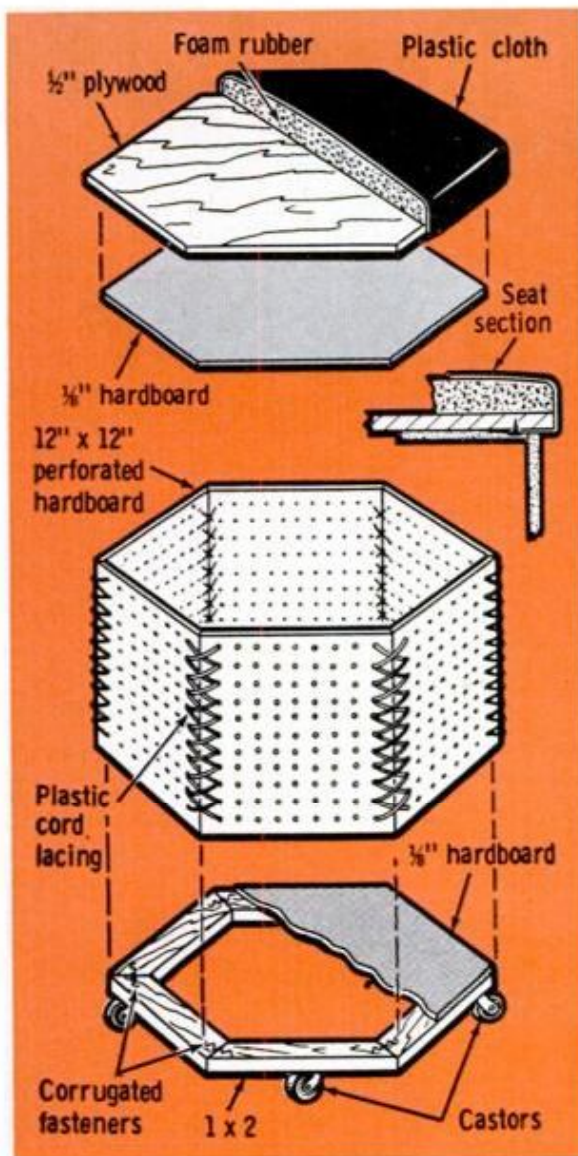
First, get the feel of the checkering tool. Cut a V-shaped template from thin, rigid, plastic as sketched above, with an included angle ranging anywhere from 35 to 42°. Notice in an adjacent detail how the angle of the master lines changes the length of the checkers, or diamonds. Use this template to lay off a couple of master lines on a small piece of walnut, extending them past their intersection. Then score the wood lightly with your scoring cutter, making sure the cutter follows the line precisely. Do the same with the intersecting line.

Next, interchange the scoring cutter for the spacer and place one cutter of the spacer in the score you've just made. Move the spacer along the score and make a second score adjacent to the first, making sure that the one cutter of the spacer follows the first score. Cut several scores in this fashion. Then move the spacer to the second master score (which was the master line) and proceed as you

*(Please turn to page 210)*



# Hexagon hassock doubles as toy box



**SIMPLICITY'S THE KEY** to this double-duty piece of furniture for a child's room or the family den. If the side panels are cut from prefinished Peg-Board, no holes need be drilled for the lacing, and there's no painting to do after assembly.

Cut two identical hexagons from  $\frac{1}{8}$ -in. hardboard to fit inside the laced panels. Attach mitered 1x2s to one to provide a means of attaching four casters. Use the other as a pattern for the lift-off seat by cutting a plywood hexagon  $\frac{3}{4}$  in. larger on all sides; after upholstering, glue this "template" on the underside to keep the lid securely centered on the hassock.

## NEXT MONTH IN SHOP AND CRAFTS

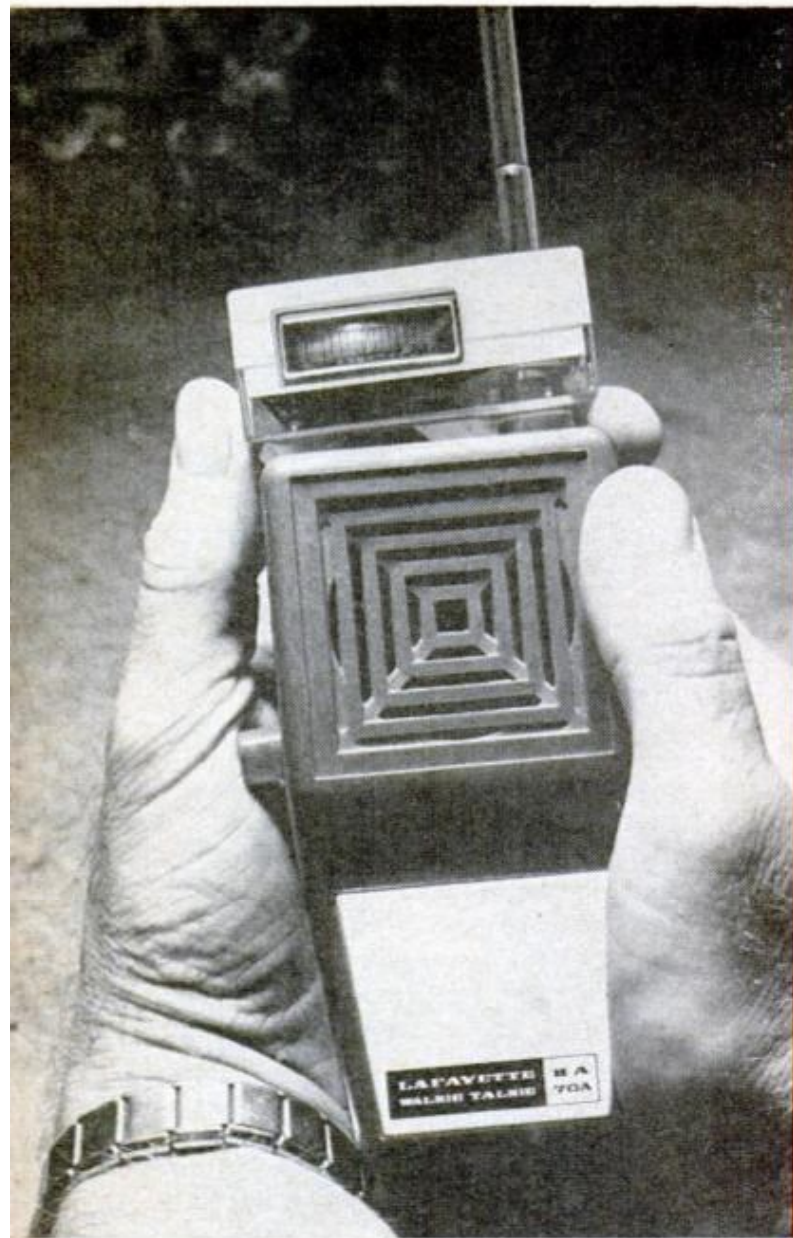
**STUPID QUESTIONS ABOUT BAG MIXES.** Going into a store and asking for dry mix is like asking for ice cream—both come in a variety of "flavors." In the case of bag mixes, there's mortar mix, sand mix and concrete mix and you can't use one kind for all jobs. Knowing what to ask for will avoid grief when you find a clerk who neither knows nor cares. This informative craft feature puts you wise as to what to use when setting a post, tuckpointing a chimney or patching a wall, answers "stupid" questions that everyone asks in using these ready-mixed products.

**WEEKEND PROJECTS FOR YOUR WEEKEND HOME.** Making your second home as convenient as your first one will give you twice the enjoyment from those weekends at the lake. You'll be eager to browse through the hatful of ideas we have for improving your vacation home for the summer ahead.

**BUILD PM's "JUMPER" SAILBOARD.** While it's small (and easy to build), this 13½-footer is a giant of a boat in the fun department. Two weekends and you'll be ready for summer sailing. Has 78 sq. ft. of sail and a plywood hull. You'll find complete plans in the April issue.

**SQUEEZING MORE OUT OF YOUR PLIER-WRENCH.** This versatile tool can do more jobs around the shop than you'd suspect—and there are special types you may not know about. PM's Toolsson, next month, demonstrates many bonus uses.





# Pocket CB Meter

You can wire a field-strength meter for your walkie-talkies with just a handful of components

By Homer L. Davidson

**H**OW CAN YOU TELL if the small transmitter in your walkie-talkie is actually transmitting? What if you're a quarter or half mile away from another walkie-talkie and you're not receiving—what then? The answer is very simple: Just build this small Citizens Band field-strength meter.

You can always check walkie-talkie units when close together by simply talking back and forth, but suppose you are out of sight and trying to communicate? Then you don't know if your transmitter is working or not. Your batteries might be down or you might have trouble within the unit. In any event, just slip this pocket CB meter over the telescoping antenna and take a signal check.

Only a handful of components is used in constructing the meter. A pickup coil which you wind yourself picks the signal

off the walkie-talkie antenna; a fixed crystal diode rectifies the RF signal and the amount of signal is shown on the face of the small, flat-type panel meter. This unit fits over the telescoping antenna of the walkie-talkie.

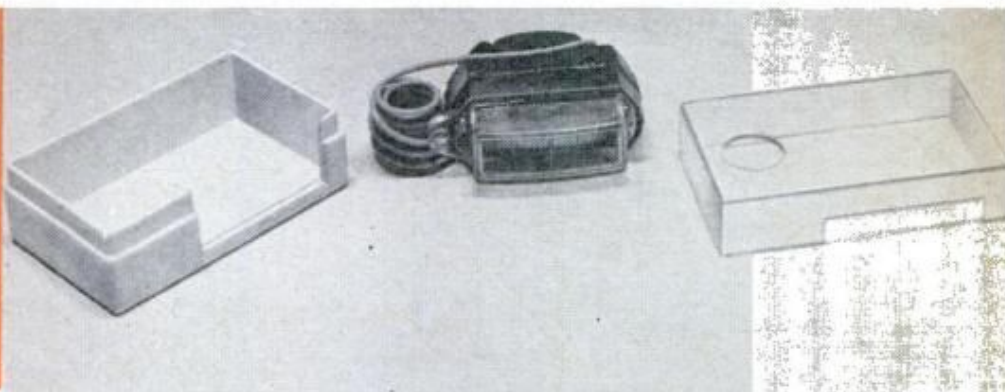
A 36-in. length of covered No. 22 solid hookup wire is wound around a  $\frac{3}{8}$  in.-dia. form for the pickup coil. The inside hole of the coil must let the button on the telescoping antenna rod pass through it. You should end up with about 20 turns of wire for the coil. Wind each turn tightly and do not space the windings. After ten turns, close-wound, double up the last ten turns in a second layer. Let the wire protrude  $\frac{1}{2}$  in. from one end of the coil and 2 in. at the other. The small end will solder directly to one terminal on the small meter, while the longer one will lie across the top of the meter. Solder the latter end



**SMALL-PENCIL** soldering iron is suggested for tight wiring around the meter terminals. Here, one lead of C1 and coil L1 are wired to a meter terminal. Diode CR1 on left is wired between L1 and other terminal



**WIRED COMPONENTS** make compact package which must be housed in small plastic case. Both halves of this case are cut to mount meter, then drilled to allow the walkie-talkie antenna to go through pickup coil L1



**POLARITY OF METER** can be ignored when wiring since it is the center-null type and reads in either direction. When completed unit is secured to top of walkie-talkie; you can use it to keep tabs on battery strength



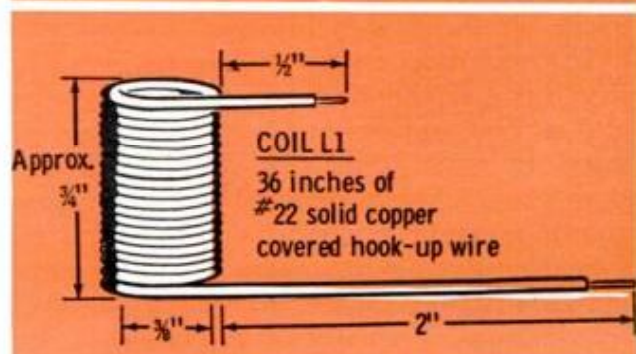
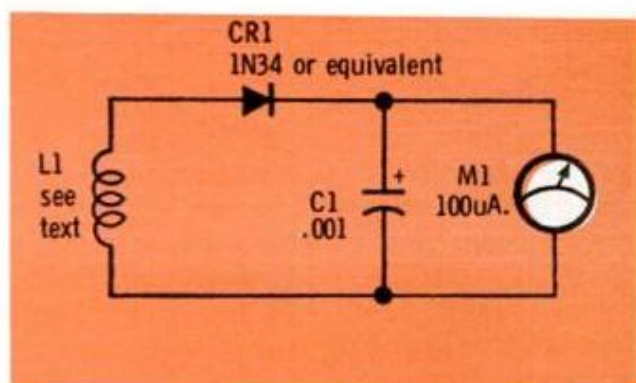
to the crystal diode, CR1. With No. 22 wire, coil L1, is self-supporting and will stay in place.

Solder and tie all parts to the small 100- $\mu$ A meter. Place the coil tightly against the meter case and solder in place. Keep all parts tightly together to make the meter as compact as possible. Run the leads of C1 across the meter terminals.

Meter polarity connections are not critical. The meter is a center-scale, balanced type so the reading can be pulled to either side of the center scale. A \$2.50 meter, it was originally designed for stereo balancing or receiver tuning.

The plastic case I used came from a discarded phono-cartridge box. Any type box is okay as long as it isn't metal. Cut out a slotted opening in the case for the plastic meter face. Also cut a matching slot in

*(Please turn to page 214)*





# Heathkit/ Magnecord 1020 stereo tape recorder



**A** TAPE RECORDER KIT in itself is news, since there are only three or four such kits on the market. When the kit is a Magnecord 1020 packaged by the Heath Co. (Heath calls it the AD-16), the event is enough to make the most demanding audiophile sit up and take notice.

The Magnecord 1020 is a professional-quality instrument with four-track stereo heads. It's a two-speed machine:  $7\frac{1}{2}$  and  $3\frac{3}{4}$  inches per second. It has a tested frequency response that is nothing short of incredible when compared to the usual "home" type tape recorders. Typical lab results show the high-frequency response down only 5 decibels at 30,000 cycles at the  $7\frac{1}{2}$ -inch speed.

The construction manual has a heft like a volume of the *Encyclopedia Britannica*, and a first impression is that the actual building will take considerably longer than the 25 hours claimed by the maker. Heath is right about the time required, even though this is no semikit. It's a complete construction job, including the electronics and mechanical assembly of the

transport. (Let's make a note here: Although the Heath Co. terms this machine a "recorder," it is actually what most of us call a "deck"—that is, it requires a stereo amplifier and speakers for playback.)

Actual construction is divided into three major phases. In part one, the main electronics circuit board and smaller assemblies go together. Placing parts and soldering the main circuit board is the most time-consuming part of the job. By the time it's finished, it's crammed full of closely packed parts and transistors.

Along with the assembly manual, Heath includes another booklet—a *Kit Builders Guide*. New kit builders should study it carefully because it is here that techniques, such as soldering transistors, are given. One transistor—just one—ruined by overheating can prove quite aggravating. Since transistor sockets are not used in the electronics and there's no room to attach heat dissipators on the transistor leads when soldering them, make sure you follow the simple rules for low-heat soldering.

The first assembly step is attaching a small circuit board to the pushbutton switch assembly. Switches and controls are mounted directly on a large printed-circuit board. And connecting wires are attached to conveniently located snap-on clips on the board.

Another well appreciated feature of this kit is the way Heath has prepared the shielded cables. Any experienced kit builder will tell you that the shielded coaxial cables are the most aggravating and time-consuming part of assembly. Very often, they must be cut to length, and their outer plastic insulation stripped off for about  $1\frac{1}{2}$  inches from the end. Then there's the laborious job of unraveling the shield braid. A sharp-pointed tool is needed for this, and it often buries itself in your thumb instead of the braid.

Interconnections between different subassemblies are made with a factory-prepared wire harness, with wires numbered for identification and the ends terminating in those wire clips once again.

The main chassis assembly involves the hefty parts: large oil-filled capacitors, beefy ceramic power resistors, a.c. power cord, miscellaneous jacks and the wire harness. This section is the quickest to assemble. The main circuit board, the



pushbutton switch assembly, and the control panel all will slide easily into place.

Construction now turns to mechanical assembly, which is probably the easiest part of the entire project. First out of the packing case is the main support plate, a large rectangular casting that represents an awful lot of work at the factory. It is an intricately cast and machined piece that you'd half expect to find in a pop art exhibition and would most definitely find in any professional recorder in a broadcast studio or in a Cape Kennedy blockhouse. Once you've gotten over admiring the casting and realizing that with such a backbone for the transport, the kit you've bought actually is worth the \$400 you spent, it's back to work.

The mechanical parts look small and repetitious, and you'd best keep turning back to the fold-out page with the hardware illustrations on it, or you'll live in constant dread that you're using the wrong spring bolt or washer and won't have it when you need it later.

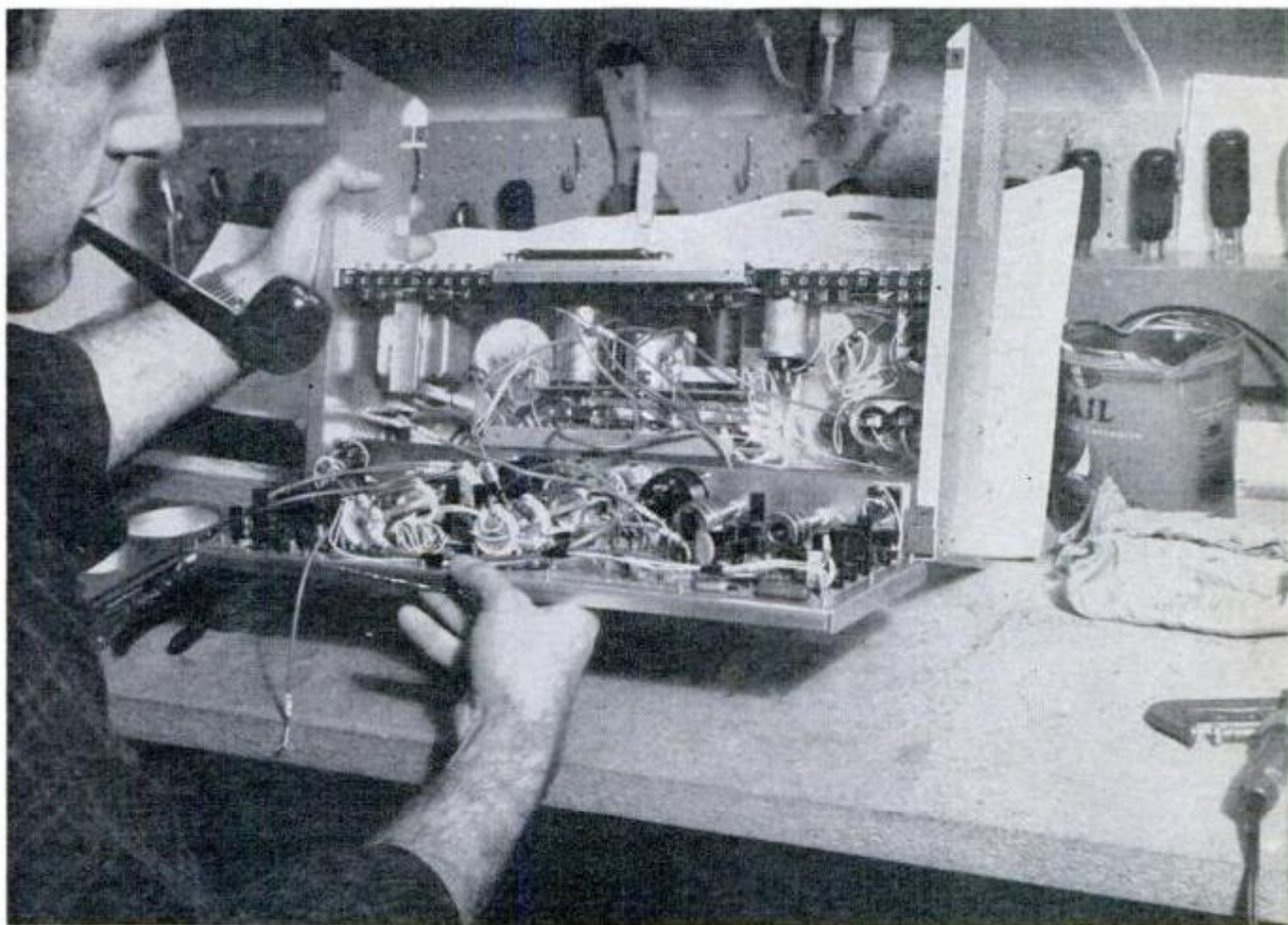
Actual mechanical assembly is quite simple, since this is not a belt-and-pulley type of machine. There are three motors.

Three large solenoids control the various lever actions. As a result, the only belts are those driving the capstan flywheel and the digital index counter. *A note of caution:* take it easy on the solenoids' solder terminals. We broke the wire to the coil on one and discovered it only after the machine was completely assembled and in the first stages of testing. Fortunately, it was possible to repair.

Another note of caution in the mechanical assembly section: Read each assembly step through entirely before starting it. Very often, there are several interrelated operations to be performed, and it's very easy to miss one of them. You can really make trouble for yourself, since some of the pressure-mounted parts are very difficult to remove once they're installed.

Final assembly steps go quickly. On the machine we built, a test reel of tape checked out fine until the last seconds of the rewind, when the tape started to climb out of its guide slot and threatened to spill all over. Actually, it is physically impossible to spill, since the break arm

*(Please turn to page 197)*



**THE RECORDER ELECTRONICS**, with its 21 transistors and 4 diodes, is completely solid state. An impressive feature of the transport is its solenoid-operated, differential-band brakes. All operational modes—power on/off, stop, rewind, record, safety, cue, play and fast forward—are effortlessly pushbutton controlled



# Circuit boards for your projects

Ubiquitous building blocks for your electronics experiments—whether you are novice or professional—are printed-circuit boards and modules



**CIRCUIT BOARD** mounts components of relaxation oscillator that comprises Eicocraft "Mystifier Kit"

IN THE EVOLUTION of construction techniques used in electronics technology, we have seen the old 3D rat's nest of wiring give way to the two-dimensional circuit board.

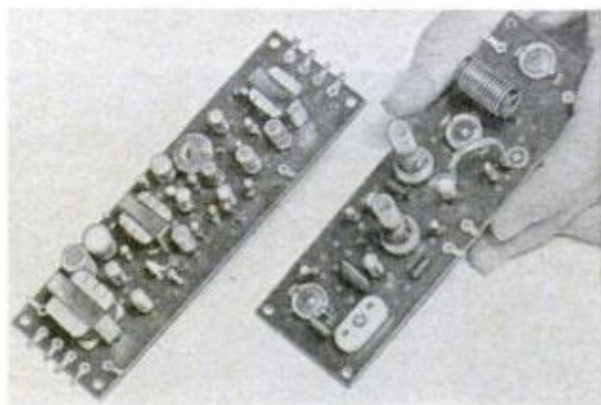
Perfection of the printed-circuit art started by revolutionizing commercial and military electronics, making possible, for example, modular construction techniques where a whole circuit is packaged on a board that can be pulled out and another substituted. If you're a home experimenter, you can choose from a proliferation of circuit boards which make for speedy assembly of complicated circuits.



**PRINTED CIRCUIT MATERIALS** are part of Kepro's kit that enables you to etch boards to your own specs

You also have the advantage over your predecessors in having access to a score of inexpensive "learn-while-you-build" circuit-board projects. Each of EICO's Eicocraft solid-state kits enables you to build one of many functional projects such as sirens, code oscillators, intercoms, and metronomes. These kits range in price from \$2.50 to \$9.95. Each one is designed around a circuit board on which all components are wired. Knight-Kit's and Heathkit's beginner kits are also based on the practical approach to learning. In addition to building a working circuit (or even a complete radio), you learn the operation of amplifiers, multivibrators, photoconductive devices and other seeming "mysteries" of electronics.

These "beginners kits" are clearly directed to you electronics neophytes who can—if you're not careful—make your



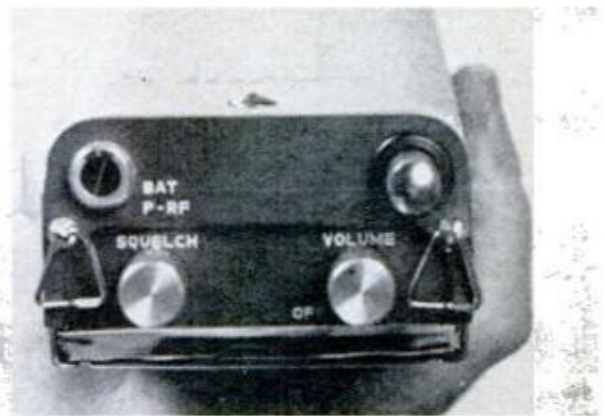
**AUDIO AMPLIFIER, CB TRANSMITTER** are two complete modules available from Round Hill Associates

first mistakes on basic inexpensive projects. But once you've wired one circuit board you can go on to a more complicated kit and zap it together without a hitch.

If you're a more advanced experimenter who wants to work from the ground up to lay out a project of your own design, there's everything from "etch-your-own" kits such as Kepro's, shown here, to Veroboard which is construction board copper-clad with parallel perforated strips. The strips serve to connect components or, when opened with a spot-face cutter, to make innumerable circuit configurations possible. Using Veroboard is an excellent way to "breadboard" a project for testing and checkout.—*Bill Hartford*



# NEW IN ELECTRONICS



## High-power CB walkie-talkie

A full five watts in a hand-held CB transceiver is one of the features of Lafayette Radio's Dyna-Com 5. It has provision for 3-channel operation and comes with crystals for channel 10. Volume and squelch controls and RF and battery-condition indicators are on the top of the \$99.95 Citizens Band unit.



## Safety control for power tools

Power tools that come in contact with grounded metal objects are automatically shut off by Shur-Stop. It'll save pipes, conduit and, perhaps, your life if you hit a high-voltage line. It's \$67.50 from RKO, Inc.



## Marine safety flare

A transistor circuit pulses this waterproof safety flare at one brilliant flash per second. It's visible for miles and a replaceable battery gives 15 hours of continuous use. It's \$14.95 from the Guest Corp.



## Pocket tape recorder

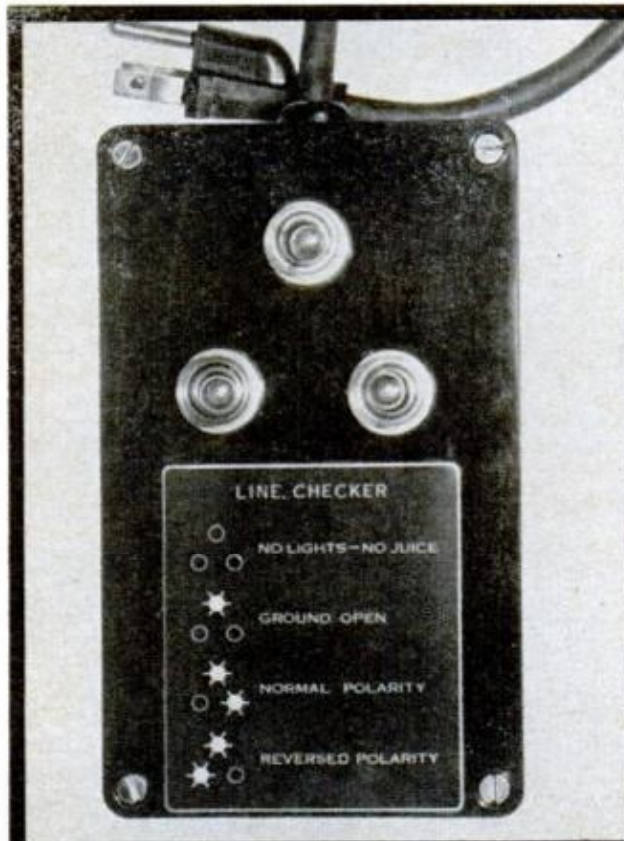
An integrated circuit that acts as a three-stage amplifier keeps the weight of this tape recorder and dictating machine to 13 ounces and its size a lot smaller than a breadbox. Dubbed the "Versatile III" by DeJur-Grundig, it has a combination microphone and speaker. Recorder operates 15 hours on 3 penlight batteries and plays 45 minutes with quarter-inch tape. Price is \$75.75.



# Three-wire socket checker

This simple and inexpensive device checks 3-wire outlets for presence of voltage, for correct polarity and for an effective ground connection

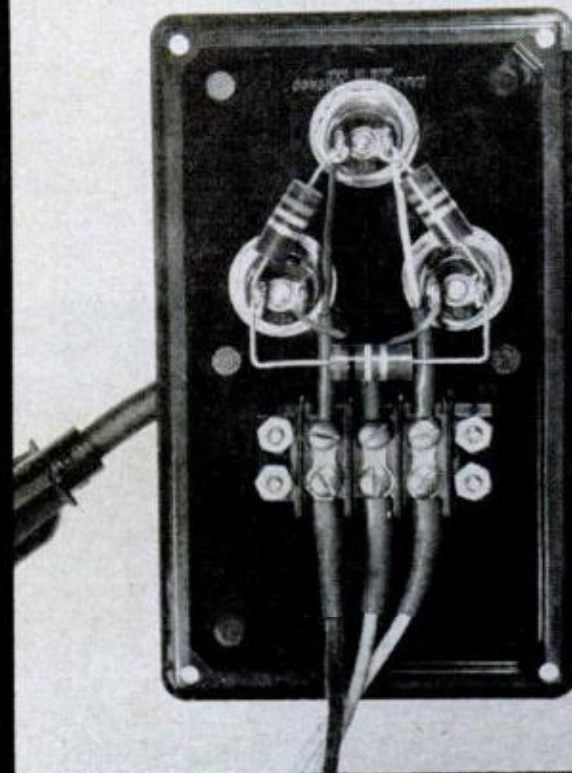
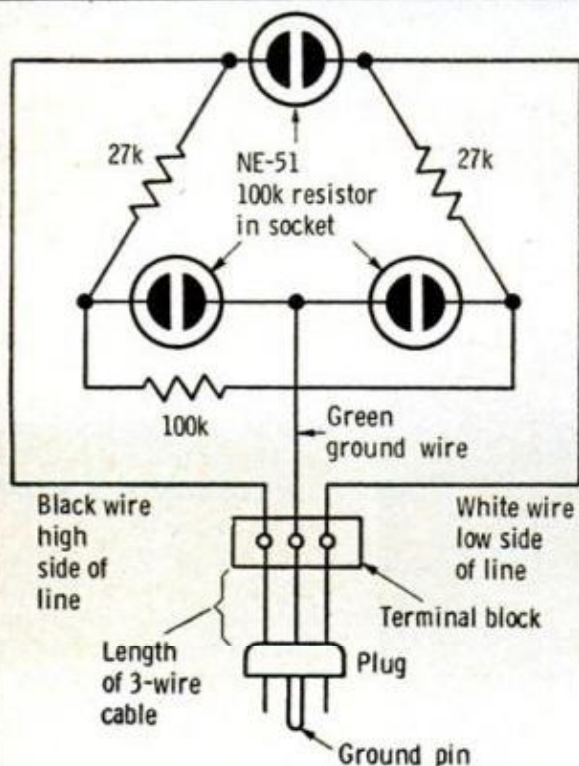
By RONALD L. IVES



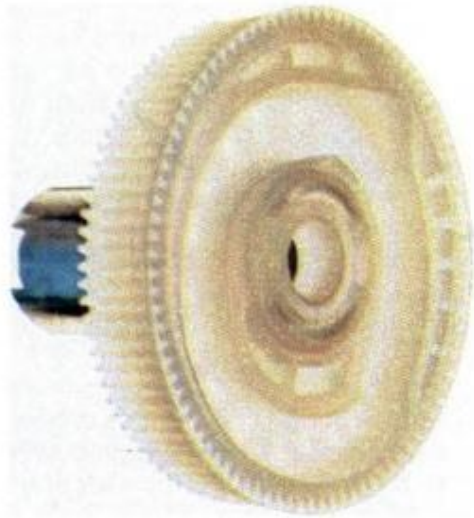
MY FIRST BOSS gave me the best advice I ever had: "Never assume anything!" And this holds, no matter what your job. In electrical work, assuming you've got a good ground just because you're using a three-wire socket can cost you your life.

When this unit is plugged into 115 or 220 volts, the neon lights tell you if you've got power, if the ground connection is effective, and if polarity is correct (if polarity is reversed, your electrician hasn't been doing his job.)

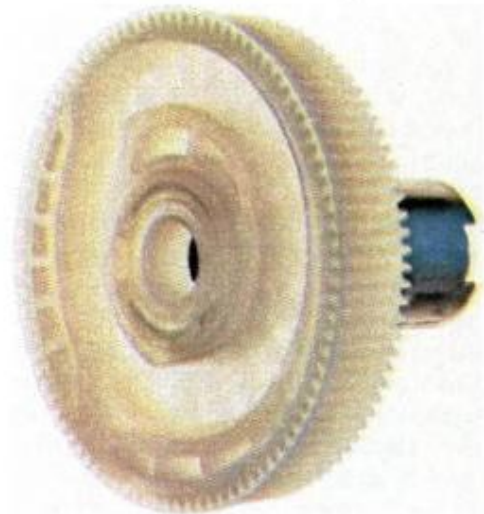
The schematic diagram shows all components which are mounted on the cover of a bakelite instrument case. Triangular arrangement of neons in the schematic is the same as in the rear view of the unit shown below. ★ ★ ★







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## YOUR STEERING LINKAGE

(Continued from page 167)

to check lubricant level. Remove the plug and make sure lubricant is at the level of the filler-plug hole. In most cars, this service should be performed once every six months. Check your book to determine which grease to use.

Although every car has a steering gear that needs an occasional greasing, not every one has a steering linkage which needs lubricating. For example, Dodge says that the steering ball joints in its 1965 cars should be inspected for damage to make sure seals haven't ruptured and, if the part is damaged or worn, replaced. No provision is made for greasing.

On the other hand, Ford and Mercury make provision for greasing the linkage in their 1966 cars. Although the service must be done according to the service guide (once every 36,000 miles for Ford), if a problem arises which signifies lack of lubrication, grease it and see if it helps.

To lube, wipe dust from around the lubrication plugs. Remove the plugs and install grease fittings. Apply the recommended grease to each linkage fitting with a pressure gun.

Before getting to steering-gear adjustment or overhaul of the steering gear, as the case may be, note that many problems could be caused by loose steering-gear mountings. Check tightness on all mounting bolts first.

### Steering-gear parts check

To check the steering gear for parts replacement, overhaul or adjustment, jack the car up and follow this procedure:

1. Turn the left front wheel to its extreme travel position. Slowly move the front wheel back through its travel. Note if there is any roughness or jumping of the wheel; action must be smooth. If not, there is probably a gouge or pitting on the worm gear, ball nut or both. The steering gear will have to be removed from the car and taken apart for overhaul.

2. Take a good look at the pitman arm and the end of the pitman shaft. Is there excess grease which indicates leaking from the steering gear? If so, a shaft grease seal is probably damaged and must be replaced.

3. Finally turn the left front wheel slowly through its straight-ahead position. A slight drag or tightness should be felt. If not, the steering gear requires adjustment.

Most of today's steering gears require two adjustments: worm bearing preload adjustment, and sector and ball-nut adjustment. The worm bearing adjustment is made first. Adjusting isn't difficult, but

it requires use of a couple of special tools and specs for the particular car.

The two most critical parts of the steering linkage to check for looseness and wear are the tie-rod ends and the idler arm. Tie-rod ends are ball-stud connections. When they wear, they are a direct cause of scuffed tires, wander and weaving of the car, and excessive play and looseness in the steering wheel. Bad tie-rod ends make for an unsafe vehicle and should be replaced immediately.

The easiest and one of the best ways to check for a bad tie rod is work each tie rod up and down by hand. A worn tie rod is indicated when the ball stud moves vertically or laterally in its socket.

### Idler arm checks

A loose or worn idler arm causes sloppiness in the steering linkage, permitting front wheels to move laterally, independent of steering-wheel movement. A loose or worn idler arm also affects directly the toe-in adjustment and will keep a setting from being properly maintained. So, what you may be blaming on toe-in that won't stay put could, in fact, be a bad idler arm.

To check for looseness in the idler arm, jack up the car at each front wheel and move the arm up and down by hand. Any play calls for replacement of the idler arm. (By the way, with some cars, Chevrolet, for example, you have to bump the front wheels against the stop position to observe any vertical movement of the idler arm.)

Power-assisted steering is deserving of a story in itself, but briefly, it is a system that uses fluid under pressure as an actuating medium. The fluid is supplied by an engine-driven hydraulic pump that continually circulates the fluid.

Most power-assisted systems use the steering shaft-worm recirculating ball feature. However, the ball-nut is usually replaced by a piston with a rack section that engages the sector gear of the pitman shaft. Fluid under pressure forces the piston to move and turn the pitman. Power-assisted steering problems and possible causes and cures are indicated in the accompanying chart. ★ ★ ★

### No gravity, no fire

Fears about fires in pure-oxygen spacecraft atmospheres have been partly calmed by the discovery that without gravity many fires will put themselves out.

Without gravity, nothing is "lighter than air," so there are no convection currents; the combustion products simply blanket the flame, suffocating it.

The discovery was made at the NASA Manned Spacecraft Center, Houston.



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## PM TESTS GLASTRON'S SWINGER

(Continued from page 161)

took them in stride. The ride was easy and stable, with no abrupt pitching or rolling.

Rounding the point of the peninsula, I followed the coastline toward the sheltered downtown side of the bay where there was just a light chop. I put the boat through tight turns and figure eights, then tried acceleration to a plane from a dead stop and running from trolling speed to flat out. In all these, performance was smooth and quick.

This is one of the few boats I've run in which it's almost impossible to detect the exact point where the hull slips over on plane. The Swinger runs almost perfectly level throughout, with no discernible bow climb. And it gets up in a hurry.

Just why it does all these things so well is a bit complex to explain. In designing the hull, the aim was to produce a tri-hull based on Glastron's race-proven Aqua-Lift deep-V. The sponsons had to provide the desired stability at rest and at low speeds, while adding the minimum of drag at high speeds. Thus, they're relatively shallow and raked sharply at the bow. At speed, the boat runs almost entirely on the center hull.

It's a good, solid design concept, but I think that the main reason the Swinger has such an excellent blend of stability and speed is the fact that the design went through six months of trial-and-error refinement on the water before Glastron felt it was ready for production.

For instance, the very bottom of the center V was flattened to produce a long narrow triangle of horizontal planing surface. It pushes the boat up on plane faster, with no appreciable effect on ride or handling at speed. The sponsons were raked a little more at the stern to eliminate a slight cavitation problem on turns. A little bit here, a little bit there, and when the boat went into production it was as nearly bug-free as possible.

I was mentally writing this up as I ran along the Acapulco waterfront, past empty docks where the big charter fishing boats would tie up in the late afternoon.

All in all, I think the Swinger is a fine boat and a quality value for the price. The only fault I could find was with storage arrangements, and this is mainly personal opinion. The troughs on either side of the cockpit are roomy enough. You can even shove a pair of skis up forward inside the sponsons. Still I'd like to see some easily accessible dry storage somewhere, even if it were only a glove box.

Acapulco? It was as much fun as the Swinger. That's saying quite a bit. ★★★



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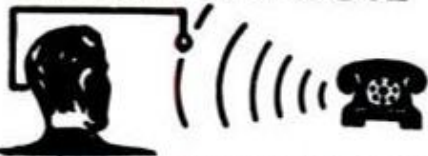
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# Simplicity

Simplicity Manufacturing Company, Inc., 6729 Spring St., Port Washington, Wis.



# Chevy pickups become family affairs



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You could call it a second car with a dual personality. On the one hand it's built to take to any task. With a pickup box that is built a better way to eliminate all of the exposed joints. So it won't catch a bad case of corrosion on wet days. And with a new touch in tailgates too—it opens with a simple one-hand operation.

The other side of Chevy's character is this. It's newly styled to please for commuting, camping or what have you. Dress it all the way up with bucket seats, carpeting and a choice of automatic transmissions if you wish. But even beyond the looks, the new Chevy Fleetside rides and handles like a passenger car. Makes it a real pleasure for everyone in the family to drive. Stop by your Chevy dealer's soon. . . . Chevrolet Division of General Motors, Detroit, Michigan.



*a brand new breed!*



## STEREO TAPE RECORDER

(Continued from page 185)

lever stops the whole shebang on a dime the instant the tape does something wrong—an excellent feature. A little adjustment (stretching) of the tape break arm return spring took out the stiffness and thereafter there was no trouble. This is one alteration, however, that's not in the book and should only be done with care if you seem to have the same difficulty I did.

A test recording revealed another difficulty—and emphasized that you can't be careful enough; the left channel VU meter wasn't working. A visual check of the printed-circuit board showed that we had neglected to attach a wire clip—the one from the left VU meter.

One touchy part of construction is head alignment and associated adjustments. Of course, this is even more difficult when the builder's on the last lap and anxious to set reels a spinning.

The size with reel overhang is about average for custom deck installation, and most stereo equipment cabinets will accommodate the machine. Remember to allow for the 8¼-inch diameter reels available from Magnecord. These oversize reels will hold 50 percent more tape than the seven-inch size and may become a popular stock item soon.

Special features abound in this tape deck. It has two three-conductor jacks for stereo headphone monitoring. Since it has three separate heads (record, playback and erase), it's possible to monitor a tape while it's being recorded, to see if the recording is taking properly. A flip of a front panel switch, and you're monitoring the source instead of the tape.

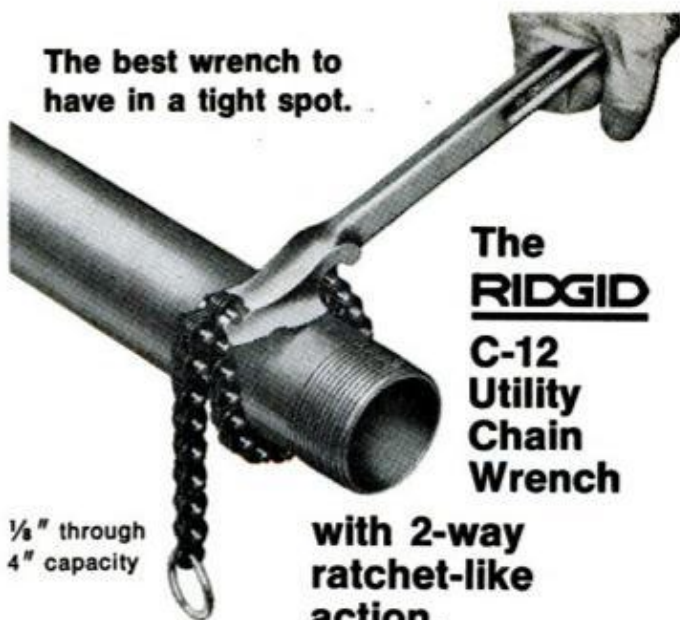
There's an empty space in the head assembly with room for one more head when needed. Presumably a half-track head could be installed for those rare occasions when half-track recording or playback is called for, or possibly an eight-track head for "roll-your-own" stereopack cartridges.

Another feature is the built-in mixer. The recorder can mix two inputs for each channel—one from the microphone input and one from the auxiliary input at the rear. By connecting a mike to the rear, it becomes a microphone mixer.

All in all, the Heathkit-Magnecord alliance has given us a high-quality machine, both in performance and ease of construction, and at a great savings over the original wired Magnecord unit. It is a machine for the tape enthusiast, the perfectionist, and the professional.

—Walter Salm

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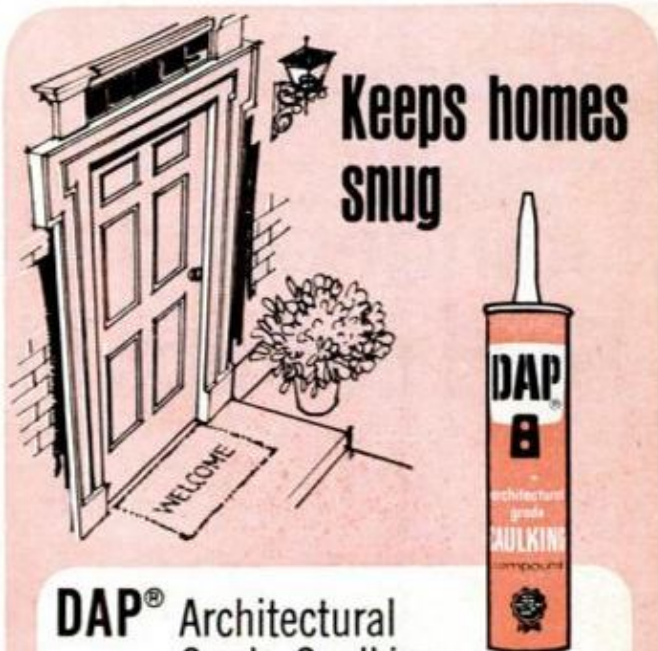
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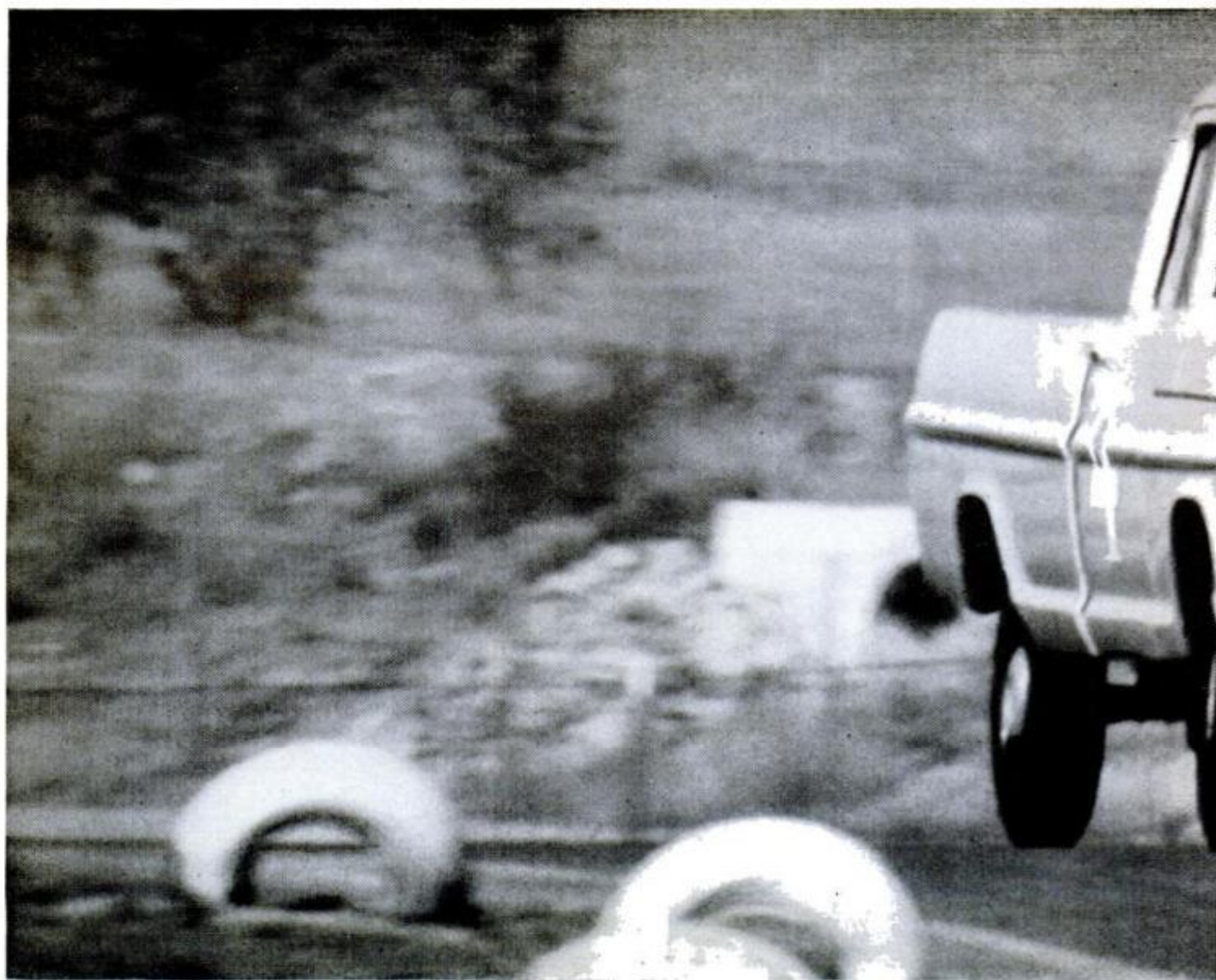


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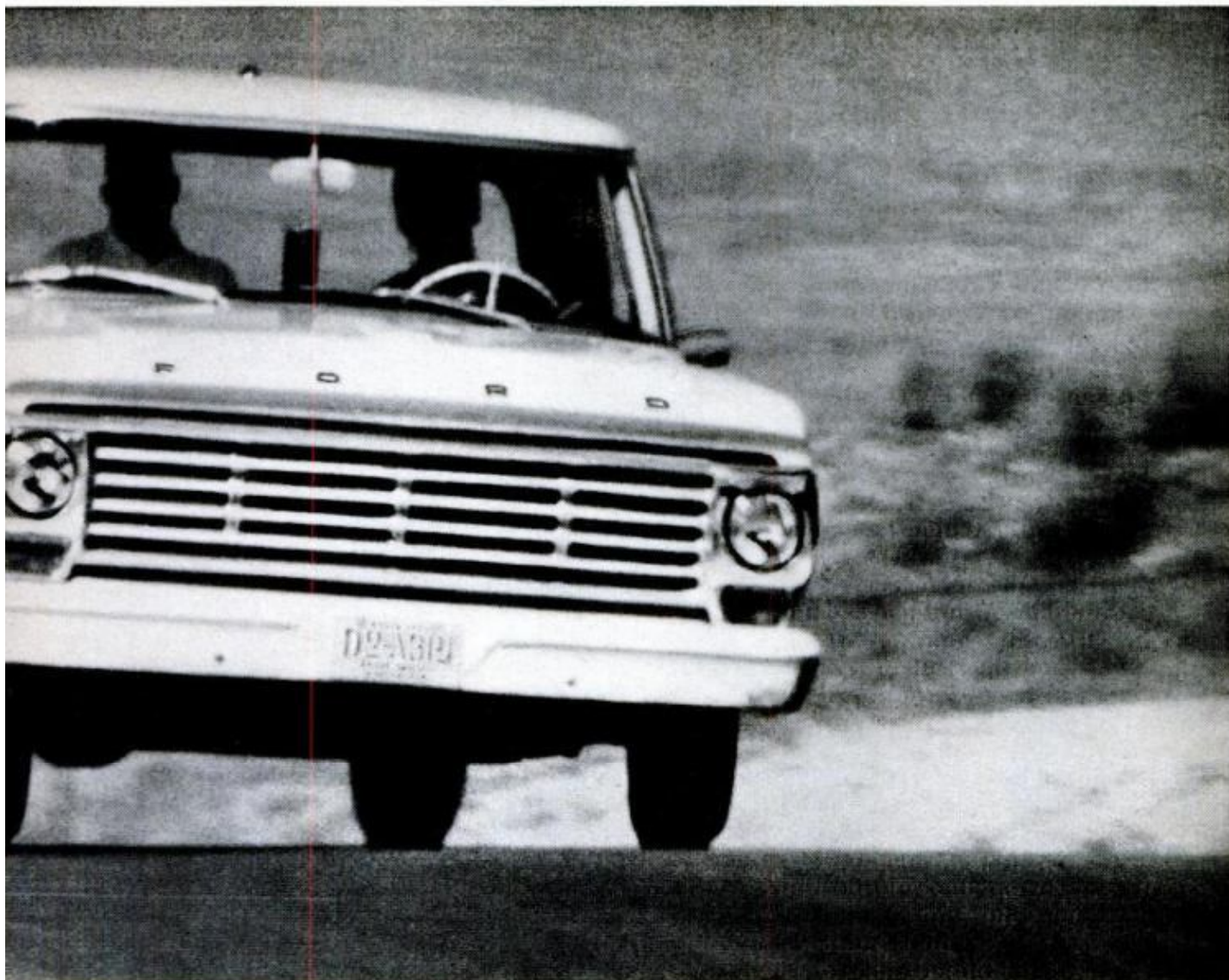
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## GREAT PICTURES IN 'GRAND PRIX'

(Continued from page 81)

following behind shoots halfway up a cliff wall to avoid him and crashes in flames. Garner locks wheels with Brian Bedford and they both go spinning at 120 mph—Garner shooting through the hay bales, over the breakwater and into the sea. Five cameras in hazardous spots were all activated from the helicopter for that entire sequence. What's more, Frankheimer wanted a special point of view, as seen by Garner, throughout the sequence. The audience is in Garner's seat as he "loses it"; they "feel" the car begin to spin against the background, they see the instrument needles wobbling at high rpms and high heat, they explode through a hay bale, plunge into the water. On wide screen, it's a heart-stopper.

### Car on top of a car

To shoot such "you are there" spin-outs at rocketing speed, Milt Rice, MGM's special effects expert, built a fantastic rig. On top of a regular formula car, he mounted a cockpit section of—in this case—Garner's BRM on a motorized swivel. The entire device, with Garner manning the second-story cockpit, could barrel down the road at 120 mph, while broadside shots from the GT roof camera showed the cockpit begin to spin against a whizzing background. Later, the camera replaced Garner in the cockpit to complete the spin sequence—with the *spectator* peering through the windshield.

Naturally, this wild contraption did not go through the hay with a man driving the bottom half. Milt Rice built another device, known around the lot as "Big Blue," to handle the problem. Big Blue is a cannon, powered by nitrogen at 2000 pounds-per-square-inch pressure. It fires racing cars from the end of a four-foot piston that fits a special sleeve socket welded to the car frame. In that four-foot shove, Big Blue can wham a formula racer from standstill to 120 mph. For the breakwater calamity, Rice rigged the wobbly needles on the dash of the victim car. Frankheimer designed a special skydiver camera with shockproof, watertight case and mounted it in the driver's seat. The car was hung on Big Blue's ram. At a given signal, the camera was started remotely, Big Blue went off with a resonant *whuump!*, and the BRM shot across the track, through the bales and into the briny at a cool 100 mph, its diving "driver" camera grinding away footage of everything out front. Edited and spliced into place, the entire sequence—from the instant of trouble to the big splash—con-

sumes less than 10 seconds. But it's the busiest 10 seconds any movie audience ever experienced.

"The car that climbed the cliff wall was also fired from Big Blue," says Stephens. "So was Montand's car when it goes through the guard rail on the banked turn at Monza. Big Blue made everything cut and dried. Cars went where they were supposed to go when needed. We'd place our remote controlled cameras where we wanted them, and knew how every second of a sequence would come out."

The idea of using helicopters paid off, though they posed some problems. The worst: 110-mph choppers couldn't keep up with 140-mph cars. At Monaco, Stephens didn't even try. "Too many buildings, and the streets were tight," he explains. But as he followed the cars toward the famous tunnels, he used the zoom increase on his camera. In the film, it looks as though the camera is following them right into the tunnel. "The pilot waited until the last second before pulling up and away," explains Stephens. "It was one of those great accidental shots."

The Belgian grand prix track at Spa is one of the fastest in the world. But here, Frankheimer wanted close-ups from the chopper. Stephens and the jet helicopter pilot—a talented fellow with guts, named Schumont—caught them going up a long hill through fields and woods where they were slowed to 100 mph. "We could get within 40 or 50 feet and, with my long lenses, I could fill a frame with a driver's face," says Stephens. Drivers complained bitterly about the windy bluster from the fans. Garner stormed into the canteen one noon, muttering: "That \_\_\_\_\_ was seven feet over my helmet on one pass today, blowing my car all over the highway. Next time I'll brake right out of the picture."

### Hedgehopping the hard way

But Stephens was getting pictures. "Sure we were hedgehopping," he says with a grin. "I'd yell to Schumont to move in, and he *would*. We didn't even 'hop' every time a hedge came up. My dangling feet kept clipping the tops of trees."

At Spa, disaster turned into some of the best pictures in the movie. "The actual Grand Prix races had to be filmed to show real crowds and real cars in competition," explains Stephens. "On race day at Spa, Phil Hill had a camera on the nose of his 2½-liter McLaren. It had no rain cover. If it fell off we were dead. It was taped like a mummy. It shot straight ahead for a whole lap. On that first lap the cars roared into a cloudburst and half the en-

(Please turn to page 202)





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## GREAT PICTURES IN 'GRAND PRIX'

(Continued from page 200)

tries piled up or spun out in chaos. Jimmie Clarke's Lotus never got up the hill. They were waving the rest through. Phil's was the last car, and he got some spectacular pictures of the spin-outs. I was in the chopper that day. We followed the cars around the bend, looking for Bob Bondurant who was driving Garner's white "Japanese" car, which was to figure heavily in this sequence. Then we hit rain. I couldn't see a thing through the open hatch. I was soaked. We ran the loop. No white car. On the second circuit we saw it—teetering on a cliff edge—no driver in sight. Another car was overturned, a mess of garbled wheels and tin. Then we got lucky. It rained the rest of the week, so we did retakes with the white car running. I put a watertight plastic hood on the GT, using my electric monitor. Got great close-ups of Garner pacing in the rain—side by side with us—throwing a rooster tail 200 feet high. Terrific."

### Temperamental camera

Not everything was peaches. In Milano Stephens figured his luck had run out. "I was in the GT with the controls on my

lap, pacing Montand. The camera was on his car's side mount, panning to pick up his wheels, then face, then arms and hands. Started great. He was passing some cars, a formula car moved up close and I saw the camera jittering as it panned. The other car's plugs were on the same frequency as my signal! We put depressors on the plugs and tried again. This time the camera wouldn't obey the controls at all. A bad alternator on the GT was goofing it up."

Drivers grumbled about a number of problems. "Driving a Formula 1 vehicle with 44 pounds of camera anchored to a forward mount on one side, with a big round black eye peering at you throughout the race is damn disconcerting—and it didn't help stability," observed Garner. "There was a tendency to plough heavily on the corners at speeds as low as 6200 rpms. Without the gear, I was up to 6800 on the same curves, flat as a board. And at Spa, it was birds! All kinds. They kept ricocheting off the windscreen. I fully expected to have my head taken off either by them or by Johnny Stephens' leafy feet dangling from that blasted helicopter."

But for all the grief, even the actor-drivers and the pros are crowing about the finished job and their part in it. ★★★

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## CAN'T TEACH INVENTING?

(Continued from page 143)

incentive. "While prospect of a good grade will stimulate most students," observes the professor, "seldom will it alone motivate a student to exert utmost effort."

"He continues to feel he is striving for a limited reward that requires some effort but no all-out assault. Probably the surest way to achieve maximum self-motivation is for the student to select a real problem and try to invent a product that, in solving a real need, could produce a sizable economic reward."

A number of the inventions produced by the Purdue students have attracted commercial interest. Some of them: the electronic lock (mentioned earlier) which literally has millions of possible combinations; a fluid amplifying device; a boat propeller that works like a fishtail.

If a device shows promise, Prof. Liston will encourage the student to make an invention disclosure, patent search and application. A disclosure, he explains, is a precise description of an invention that is signed, dated and witnessed. It is the inventor's first formal declaration of what he's developed and is an important document when it comes time for him to apply

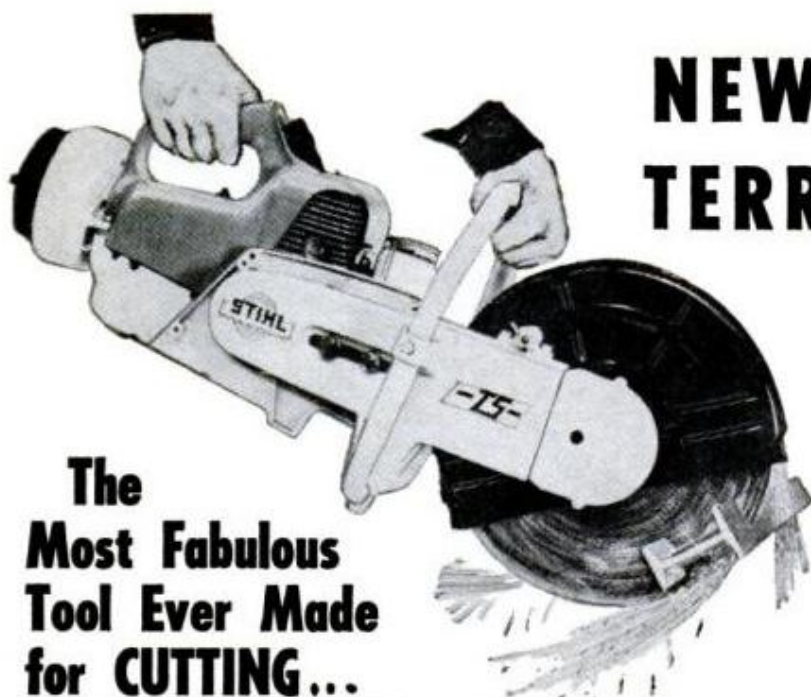
for a patent. (Prof. Liston has 59 formal disclosures to his credit in addition to several patents.)

At the end of the term, the student reports on his project to an audience consisting of fellow students, members of the faculty and representatives from industry. Using a working model and other visual aids, the student tries to sell his idea.

"The faculty members tend to ask academic questions," states Prof. Liston, "and the people from industry get into the economics of the thing. They want to know *how much*. It's a real business experience for the student."

Much of what Prof. Liston has learned through the years is contained between the covers of a book he wrote in collaboration with a colleague, Prof. Paul E. Stanley. It's titled *Creative Product Evolvement* and is published by Balt Publishers, West Lafayette, Ind.

He's written other things, too. As I prepared to leave his office at the end of an interview, he thrust a piece of paper at me. He puffed on his pipe, his eyes twinkling, as I read: "Beware if your job's all routine./For freedom from thinking, that's keen./But one day, the smart smart boys/With their 'lectronic toys/Might for you substitute a machine." ★★★



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## CHECKER YOUR GUNSTOCK

(Continued from page 180)

did before. This will lay off the spacing.

Now change back to the scoring cutter and make a light pass, not more than  $\frac{1}{64}$  in. deep, on all the scored lines. Deepen each scored line by successive passes until the points of the diamonds are sharp to the touch. That's all there is to it.

But you've been working on a flat surface. Now you must try your newly acquired skills on curved surfaces such as those on the gunstock grip and forearm. On the curved surface you'll need to set an even closer watch to prevent the scoring cutter from straying when making that first score on both master lines.

First, lay out the pattern that establishes the limits of the checkered area on the grip and forearm. Decal patterns are available for both grip and forearm in various designs from simple point to more elaborate layouts. Once the decal is in place on grip and forearm, you have the layout ready-made, including the border lines and the master lines. The scoring and spacing tools cut *through* the decal.

If you prefer, it's quite easy to lay off the simple point patterns freehand—especially on the grip, where a paper or thin cardboard pattern won't take the reverse curves. Use a soft lead pencil or, better, a china marking pencil. Work carefully, erasing here and there, until you get true curves and accurate points.

### Guide for pattern line

The straight pattern line down the inside of a grip can be laid off accurately with a narrow plastic straightedge made as sketched on page 180. Then mark off the master lines with the point template you've made. Score the master lines, then space both ways from the master lines with the spacing cutter.

*Now a few precautions:* If the scoring cutter strays slightly, stop immediately and correct the irregularity by pressing lightly, with a right or left finger, on the tool as you move it along the score. Make sure the score is back into line before you proceed; even on the simplest point pattern, an irregularity will "gain" as you go.

The sample pattern shown (with photos of the finished design) on page 176 is for continuous, or "wrap-around" checkering on the tang and slide handle of a pump shotgun with a two-piece stock. Lines A and B are the master lines, although on the grip, some gunsmiths would use lines C and D as masters. (These are the lines that cross on the centerline to form the central valley between the points.)

The photos and pattern on page 177

show a fancy *fleur-de-lis* motif with bands of standing wood between the checkered panels and relieved "flowers." Here, on both the grip and forearm, lines A and B are the master lines.

Keep in mind that you're checkering a pattern without a border. Score the border lines very lightly. Then, after the checkers (diamonds) are formed to full depth and are sharp to the touch, go around the scored border lines, deepening them to the same depth as the vees between diamonds.

Be extra careful that the tool doesn't run past the pattern line and nick or score the wood. These tiny nicks and digs are almost impossible to eliminate unless you resort to the border tool, which may not be desirable. A cornering tool helps in running the scores to the line without a runover into or past the border score.

Machine checkering as illustrated is much faster than handwork, since diamonds can be brought to a point with as little as two passes (although in the finer checkering it is best to make three or four passes to finish). Gunsmiths often use the machine to speed the job and finish up with a pass of the fine scoring cutter.

Although gunstocks can be checkered before finishing, it's a common practice to completely finish the stock before checkering, then coat it with a linseed-oil preparation. ★★★

## WET-WEATHER SKIDS

(Continued from page 127)

hold back a Boeing 707 trying to take off.

Horne and his colleagues pursued the problem from that point and have spent the years since rolling tires along a test track at NASA's Langley Test Center in Hampton, Va. The track is surfaced with a variety of textures (including glass that enabled engineers to photograph from beneath the behavior of tires in water).

As a result of NASA's research and California's pioneering, at least two other states—Texas and Georgia—have begun highway grooving programs.

To serrate California's pavement, engineers use a diesel-powered, water-cooled, diamond-tipped gang saw invented by Concut, Inc., a Los Angeles masonry sawing firm. The saw blades are rigged to cut an 18-inch swath of grooves  $\frac{3}{16}$ ths of an inch wide,  $\frac{3}{8}$ ths of an inch apart, and  $\frac{1}{8}$ th of an inch deep ( $\frac{1}{4}$  inch deep in asphalt, which tends to break down more easily). The grooves have no noticeable effect on the riding qualities of an auto.

The cost of pavement grooving is less than one cent per square foot, which makes it cheap as well as effective. ★★★





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**SHOOT a 3/8"**

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Use wooden dowel or cuticle stick to clean larger grooves.



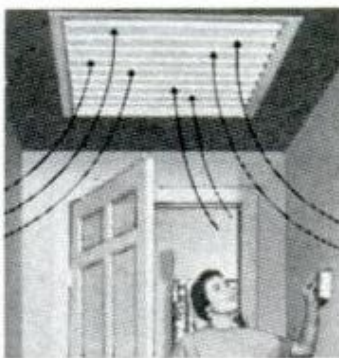
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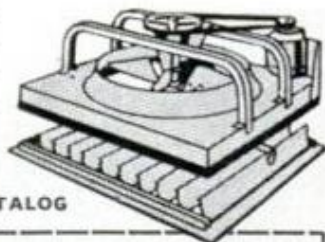
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## HONDA'S OUTBOARD

(Continued from page 148)

the loosest sense of the word. It was a tossup whether I'd pitch it over the side or drop it through the bottom of the boat.

Luck prevailed, though, and I finally got it on the transom and gassed up. But then I couldn't start the damn thing. Thinking that something might have been bounced out of adjustment in transit, I struggled back to shore with the motor and drove over to the nearest outboard dealer, GB-30 shop manual in hand.

After gee-whizzing around it for a while ("Only 3 hp? You're kidding!"), he checked it out, played with the choke, gave the cord half a dozen good yanks and it roared into life. Back at the harbor, I muscled the motor onto the transom again and it started perfectly. Incidentally, the first thing you notice when the motor starts is that you're face-to-face with the exhaust opening. After a while, you learn to turn your head.

To put the Honda in gear, you push a clutch lever which engages a tension pulley used to stretch the belt and convey power from engine to the upper sprocket shaft. I did this and eased the boat out into the channel.

One feature which I found a little hard to get used to was the centrifugal-type governor which keeps engine rpm constant regardless of load fluctuation. If the prop starts to cavitate in a sharp turn, the governor instantly throttles back until you get a solid bite again. If rpm drops because of increased load, the reverse happens. It's adjustable.

Cooling is by fan blades on the magneto flywheel, with a shroud directing air around the cylinder and head. It seemed to work fine, with no evidence of overheating.

On the other hand, noise level was a little high for anyone accustomed to an underwater exhaust.

For the heck of it, I tried three speed runs with each motor. Except for one slow run with the Honda, each covered the short course within a second or two of a minute and 20 seconds.

Actually, it's almost impossible to compare the two. The Johnson is light, compact and features much more sophisticated engineering. The Honda is simpler, heavier, yet undoubtedly more economical to manufacture (especially when the same engine is sold for other uses) and to operate. Basically, it's a work motor.

But if you were a Japanese seaweed farmer, you'd think your shiny new Honda GB-30 was the greatest thing since sukiyaki. And you'd be right. ★ ★ ★

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**POCKET CB METER**

(Continued from page 183)

the top lid of the box. Use a hacksaw for the downward and upward cuts. Then take a pocketknife and, with the help of a straightedge, scribe a line across the two cut slots. The plastic cut can now be snapped out cleanly. Drill a 1/2-in. hole through top and bottom of the plastic case for the walkie-talkie antenna.

A rubber seal or rubber adhesive sealant can be used to hold the wired components in the case. First line up the pickup coil over the bottom 1/2-in. hole in the case; then hold the halves of the case together, using plastic cement.

Test your CB meter by placing it over the telescoping antenna of a small three-transistor walkie-talkie. The one shown here is a Lafayette HA-70A. Turn the receiver switch on and press to talk. The meter hand should move two or three divisions. Larger CB units of greater milliwatt output will make the meter pointer hit the peg. If you will use the meter only for small three-transistor walkie-talkies and desire a greater reading, add five more turns on coil L1. A greater reading can also be obtained when the antenna is collapsed to about 2 in. All power output from the small transmitter is concentrated in these 2 in. and a higher meter reading is obtained.

You can add a rubber suction cup to the bottom of the pocket meter if you desire to hold it on top of the walkie-talkie for a constant check on output. This also keeps check on your batteries. ★★★

**PARTS LIST**

- C1—.001 µf disc capacitor
- CR1—1N34, 1N56 or equiv. diode
- L1—Pickup coil, 36 in. of covered No. 22 solid hookup wire wound on 3/8-inch diameter form
- M1—100µa balance meter (Lafayette 99C5034 or equiv.)
- Misc.—Plastic case, cement, solder

**'Kiss and tell' missile**

"Kiss and tell" might become common among Air Defense Command pilots. That's the nickname given a target scoring device now being tested. Officially known as BIDOPS, the system works on a sound-frequency basis. When a missile is fired it emits a high-frequency sound that changes pitch as it closes in on the target drone, which is equipped with another device to "hear" that sound. The sound is at its highest pitch when the missile is at the correct distance to deliver its "kiss" of destruction. Then, as it moves away from the target, the sound waves begin to fade. Recorded frequency waves "tell" whether a hit or a miss occurred.





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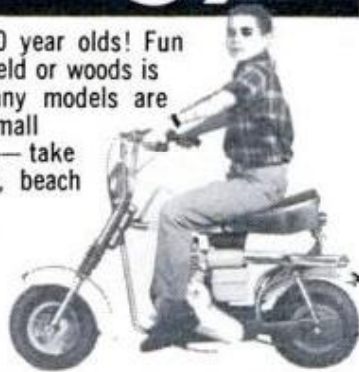
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## COMPUTERS HELP YOUR DOCTOR

*(Continued from page 137)*

of the accumulated data instantly available for statistical, diagnostic or research purposes.

The Mayo Clinic at Rochester, Minn., is establishing a computer system that will record details of a patient's medical history, lab tests and other information from the hour the patient checks in.

New York University has received a \$2,300,000 grant from the Department of Health, Education and Welfare to establish in 1967 a patient data bank. The initial cataloging of health information will be concentrated in the Pediatric Dept. of the Bellevue Hospital Center in Manhattan. Later, it will be expanded to include other children in the New York area. Eventually, the data bank will catalog medical details of both children and adults through much, if not all, of the United States, according to present plans. And the information about a patient will be available to any authorized doctor in the nation who dials a long distance number and gives the patient's identifying code.

Once the data bank has received information about a patient's childhood diseases, blood chemistry, and so on, it will be immediately available in the event the person is, for example, stricken by a heart attack, or appendicitis, while hundreds of miles from his home base. Any hospital equipped with the computer-readout equipment could dial into the data bank.

According to Edwin Kraus, director of computer systems for the N.Y.U. Medical Center, the gobbledygook of computer language will be eliminated from the data bank. A new system, called Narrative Data Analysis programming, will be used—meaning that medical information will be recorded in complete sentences of the English language.

### **Computer also keeps records**

Besides being able to call up an accurate, readable written record of a patient within a very few minutes, there are other benefits. One is that the doctor is relieved of the time-consuming chore of record keeping. The magazine, *Medical Times*, recently reported that a doctor may spend 15 or more hours a week writing records. At station desks of most hospitals, there frequently is a crowd of doctors, residents, interns, nurses and lab technicians writing on charts and filling out forms—all of which must be collated as part of the individual patients' records. By turning over to the computer the record-keeping chores, medical personnel have more time for care of patients.

Another benefit is that diagnosis of diseases, as well as the most favorable kinds of treatment, can be enhanced by organization of information about ailments. With hundreds of thousands of cases of a disease recorded in a data bank, medical researchers can learn more about the disease by having the computer analyze signs and symptoms. For example, exactly what constitutes bronchial pneumonia? What sort of track record does penicillin have in treating the disease? At the present time, a doctor may see but a few cases each year and may have to depend upon his memory in making a diagnosis.

But a computer can sift out details of every case reported in the past year, or past decade, and forecast the outcome of the various types of treatment available.

### **Sometimes they goof**

However, computers, like humans, can make mistakes. The physician must make the final decision, and accept the computer as a usually reliable expert consultant. Dr. Frederick Schwartz of the American Medical Assn.'s Council on Aging recently described a goof made by a computer that prescribed high carbohydrate meals for a group of patients who tested positive for diabetes. The patients were eating the wrong foods for three days before the error was discovered.

On the other hand, the Rand Corp. of Santa Monica, Calif., staged a blind competition between a computer and a team of physicians and chemists working on the same problems in a surgical laboratory at the University of California. Although there were a number of "discrepancies" in the results of more than a thousand analyses of human blood, in no instance was the computer wrong.

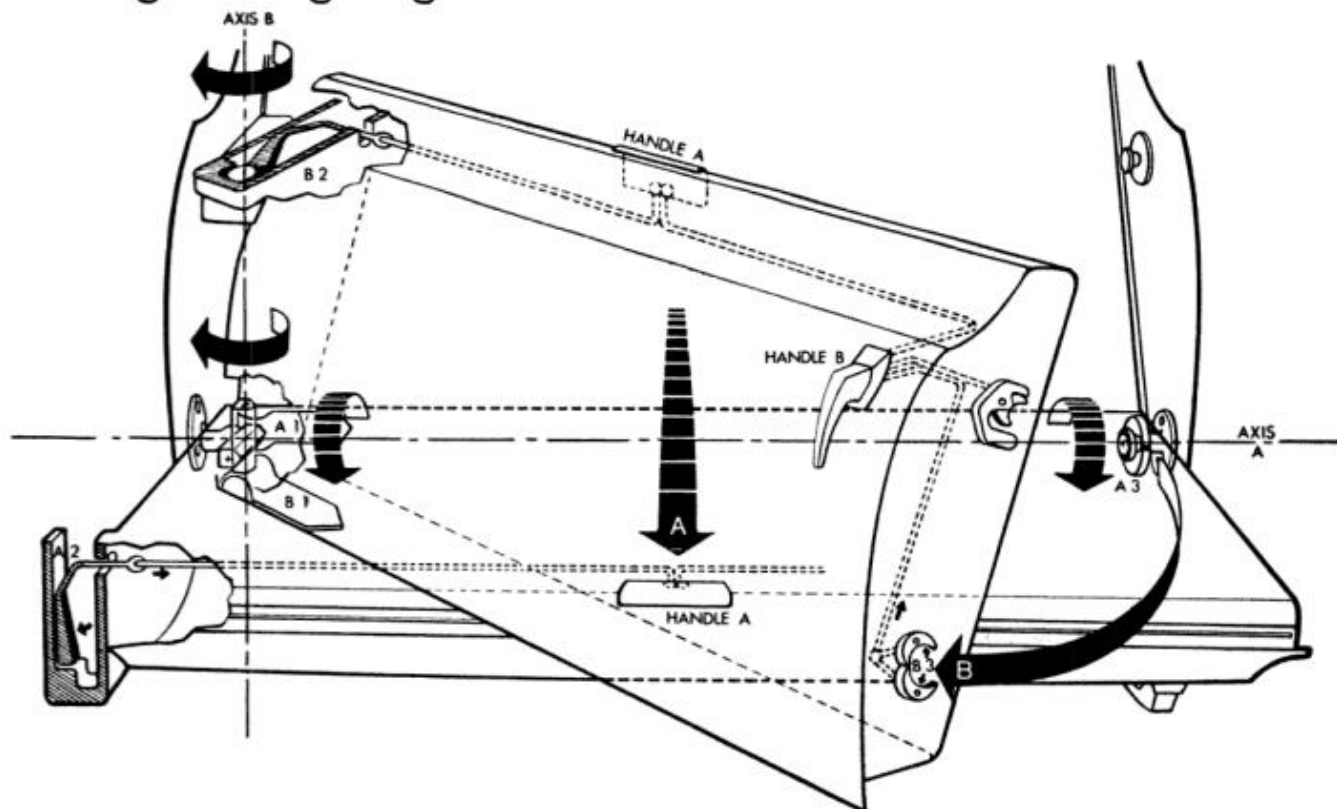
In fact, the computer discovered a phenomenon that had been overlooked by generations of doctors. Using information from a mathematical model of human blood, the computer predicted that when salt was added to the blood, carbon dioxide would disappear from the lungs and appear in the blood, producing a condition known as acidosis. The startled medical scientists anesthetized a dog and a spirometer was attached to its respiratory system. It was injected with saline solution and the sudden absorption of carbon dioxide by the blood was recorded—just as the computer had calculated.

Computers, of course, do not digest any and all information fed into them. The information must be presented in a rather precise and systematic way. And the computer must be told what to do with the information. But it can be instructed to

*(Please turn to page 218)*



## New Engineering Magic:



# Ford's better ideas bring out the best in wagons

It took Ford engineers to devise the Magic Doorgate which lets you swing it out like a door, or down like a tailgate — whichever way you want, whenever you like.

**Secret of the Magic Doorgate**, which is available on all Ford station wagons, rests in its three ingenious hinges that work two ways.

At the lower left of the Doorgate (faced from the rear) is a double hinge with pins on both horizontal "A" and vertical "B" axes.

At the upper left of the Doorgate, a second hinge permits the gate to swing like a door on the vertical axis "B," while at lower right a "bear hug" latch (similar to that used on Ford car doors) forms the other end of the horizontal axis "A."



**To use it as a tailgate** the center release handle is pulled and the hinge at the upper left corner of the Doorgate releases from its pin, the upper right latch releases and the Doorgate swings down hinged on axis "A."



**To use it as a door**, you turn the handle at upper right corner. This releases *both* upper and lower latches (on the *right hand* side of the Doorgate) from their pins.

This permits the Doorgate to swing out like a door on vertical axis "B." An interlock between handles "A" and "B" permits gate to work on only one axis at a time.

**Other better ideas** that go into Ford wagons are: a push-button actuated latch for folding second seats that eliminates finger-bending struggle; a dual-facing rear seat (on Ford wagons) that seats up to four children, and a roomy under-floor luggage compartment that's lockable (on Ford and Fairlane wagons) to keep your valuables safely out of sight.

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## COMPUTERS HELP YOUR DOCTOR

*(Continued from page 216)*

work within certain limits of data and to reject abnormal or unusual bits of information it finds while sifting through a myriad of medical records.

In the area of kidney diseases, an IBM 7090, analyzing facts from cases of 400 patients with pyelonephritis, revealed that doctors have been dealing with four different diseases instead of one. The disease, a bacterial infection of the kidney, had confused doctors for years because the symptoms would come and go, some patients had pain while others felt no pain, and evidence of the disease was found in autopsies performed on persons who appeared to have died of other causes. The revealing study was made at Columbia-Presbyterian Medical Center in New York by using the computer to sort through some 32,000 items of information about pyelonephritis. Without computers, it is doubtful that medical scientists would have been able to solve the kidney disease riddle.

### **Computer helps locate tumors**

At the Mayo Clinic, an IBM 7040 computer is used to locate tumors and cancerous tissue in body organs, capturing and improving the data obtained from radioisotope scanners just as a computer is used to improve pictures of the moon received from space probes. The patient receives a dose of medicine containing a mildly radioactive tracer which is absorbed more readily by malignant tissue cells than normal cells. The body area is then scanned by a radiation detector and the data are recorded directly on magnetic tape for computer processing.

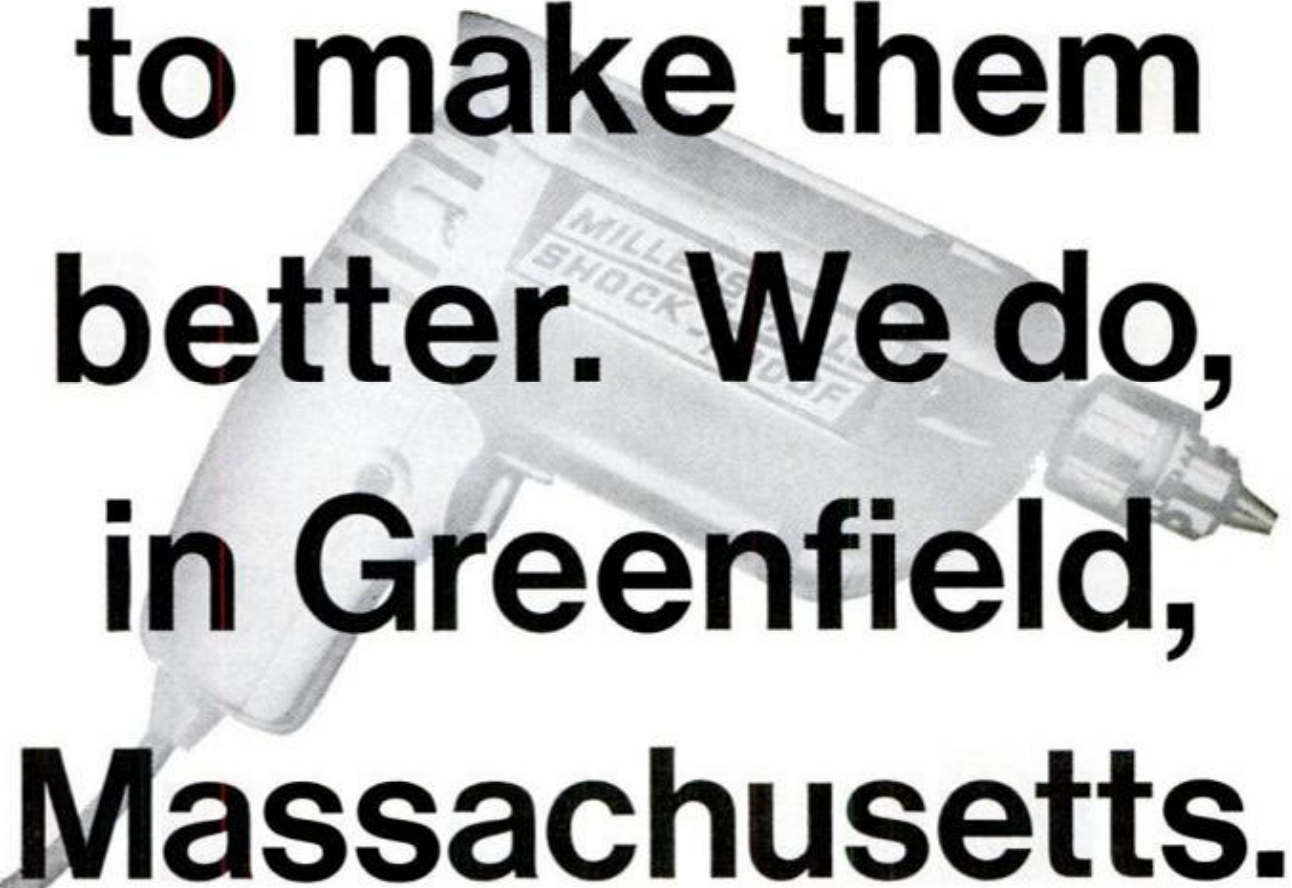
According to Dr. W. Newlon Tauxe, the Mayo radiologists can see "many more things on a computer-processed scan than we can on a film record." Besides improving the clarity of the image, the computer can be programmed to compensate for the rapid decay rate of isotopes that doctors prefer to use because they produce a high level of radiation for a brief time and are less dangerous to the patient. Also, the computer is able to eliminate false zero readings, correct for ragged edges in the picture, eliminate background "noise" of natural radiation, and can plot paths of equal radiation, much like the lines on a contour map.

The University of Missouri Medical Center performs a half-million laboratory tests each year and the computer system relieves the lab personnel of a tremendous amount of detail work, while at the same

*(Please turn to page 220)*



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## COMPUTERS HELP YOUR DOCTOR

(Continued from page 218)

time it helps to concentrate medical care where it is most needed. The computer evaluates newly completed tests to include such factors as age, race, sex, previous patient diagnosis, relation of new test results to earlier ones, accepted normal range of values, relation to results of similar tests at the medical center, and biological properties of bacteria and antibiotics, where they are involved.

The computer's memory already contains records of all patients handled by the hospital since 1955, data on 50,000 tissue specimens in a surgical pathology file, a tumor registration file of all patients treated for abnormal tissue growths, a file of physicians' interpretations of all X-rays taken there since 1955, a file of 60,000 electrocardiograms coded by 105 categories and a computerized version of the American Medical Assn.'s *Current Medical Terminology*, an encyclopedia of diseases by symptoms, origins and so on.

Several hospitals, including Massachusetts General, Long Beach Memorial and New Jersey's Monmouth Medical Center, are starting computerized drug-ordering systems. At Massachusetts General, the doctor's orders for medications are fed into the computer by writing them out on a teletypewriter terminal. The computer is programmed to check the spellings of drug names, size of the drug dosage, and other factors. If there is a possible error in the prescription, the computer feeds back a challenge on the teletypewriter.

### Mapping the heart

At Duke University, a computer was used recently to solve the medical problem of a single child. The tot had the symptoms of severe heart trouble but a more conclusive diagnosis was needed before surgery could be undertaken to save its life. A computer was fed taped recordings of 250 electrocardiograms taken from all parts of the child's body. Within 20 minutes the computer had analyzed the EKGs and produced a contour map which showed the electrical function of the heart.

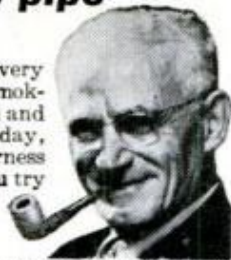
In one area, it showed, there was no electrical current being generated by the contraction of heart muscle. It was the lower part of the left side of the heart. An opaque liquid was injected into the heart through a blood vessel leading to that organ and an X-ray was taken. The study showed that one of the arteries supplying blood to the heart was on the wrong side. Knowing exactly where to go, the doctors corrected the defect by surgery, and the child is recovering. ★★



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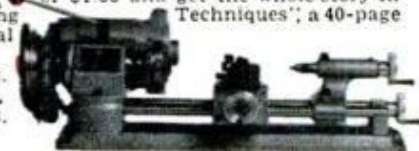
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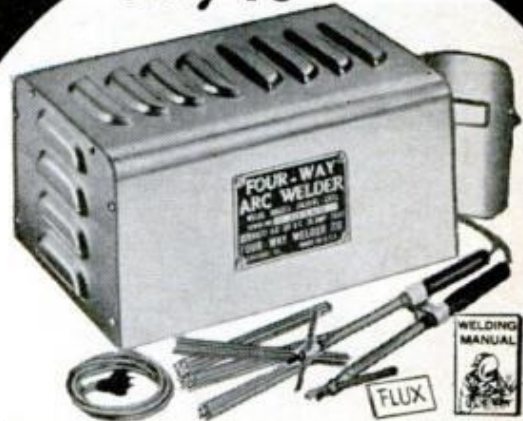
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## BUICK GS400

(Continued from page 91)

There's probably a fine line, at best, between praises for such things as power, performance and pickup. Yet many owners refer specifically to each category:

"Everything is put into this car to make it a true high performer for all but a race driver."—Wisconsin student.

"The car has never faltered at sustained speeds in excess of 80-90 mph."—Army officer, Texas.

► It isn't the car I'm worried about. It's you. What happens if you falter?

G.S. 400 owners also seem to like the way the car rides.

"Very smooth."—Illinois mover.

"Rides well despite heavy-duty suspension."—Indiana physician.

On the other side of the coin—the gripe side—it should be pointed out that, while many owners had complaints both major and minor, almost 25 percent of those replying to our questionnaire had no complaints at all. But those who did were quite definite. Leading the gripe list with an FMR of 17.6 percent were complaints about poor gas mileage.

"Granted, car is new, but I'm only getting 5½ mpg."—Pennsylvania salesman.

"Could get better mileage."—Oklahoma aircraft assembler.

► He reports 9-10 mpg in town, 14-15 mpg on open highways. Sort of hate to tell him this is about as good as things are going to get.

Next on the complaint list (and a regular in these pages) are gripes about poor workmanship. As a sort of summary, read this young Kentucky salesman's bleat:

"To begin, after just two weeks and 1000 miles, my car lost 3½ quarts of oil. The front carpet had a hole in it, there was a broken gas gauge, broken rear speaker switch, bent bumper, the front wheels were out of balance, one of the shocks was loose, paint on the back half of the car was oversprayed. Car was like this the day I bought it, except for the oil problem that took place two weeks later."

► He goes on to report that everything got squared away eventually, including a new paint job. But not until his father got on the phone and called Buick headquarters and raised the roof. Meanwhile, the young fellow was without a car for 10 days. Now, everybody's happy. Still, this seems to be doing it the hard way.

Some of the most bitter owner comments concerned dealer service. Again, however, keep in mind that most G.S. 400 owners reported being very satisfied. But those who had gripes griped.

(Please turn to page 226)



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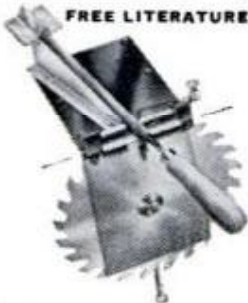
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## VOLVO'S NEW 144

(Continued from page 131)

Gothenburg, then drive it clear across Sweden—315 miles—to Stockholm. With twin SU carburetors, Volvo's already proven B-18 108.5-cu.-in., four-cylinder engine with a 10 to 1 compression ratio puts out an efficient 115 hp to make the 144 fairly lively. Going through the gears with the four-speed stick shift, I clocked 60 mph in 12.1 seconds. The 144 will also be offered with an automatic transmission made by Borg-Warner. The manual I drove also had an overdrive, but this may not be offered in America.

On Sweden's winding two-lane highways, handling is important, and the 144's tendency to understeer a bit makes the curves easier to take.

The first manufacturer in the world to make three-point safety belts standard, Volvo may today be just about the safest car on the road. Along with the discs and three-wheel dual braking system, the 144 comes with a roll bar under the roof, rear-window defrosters and a two-part steering column which gives way under impact. A connecting unit between the two sections of the column breaks when you smack into something hard.

Sweden's roads weren't as bad as they say in the Volvo ads, but the company has obviously made a fetish of durability. Sills are galvanized to prevent rust and the air intake feeds cool air into them to keep them dry. The anodized aluminum bumpers carry a center strip of hard rubber to make it easy on pedestrians.

The odometer goes up to a million before turning back to zero. No one keeps a Volvo that long, but so many Swedes drove past the 100,000 mark (in kilometers) and were trading cars in with 25,000 or 50,000 showing instead of 125,000 or 150,000 that dealers asked that something be done.

The 144 is almost the same overall size as a Corvair or a Rambler American, although its wheelbase is 102.4 inches compared with Corvair's 108 and American's 106. Somehow Volvo has managed to provide amazing room in the passenger compartment. I could ride in either front or back seat with a hat on. Legroom was fantastic in front, and a 6-inch clearance under the front seats gives extra toerom in back. A knob on the front seats lets you adjust the seat back for firmness, and a lever permits the seats to go all the way back to form a bed, Rambler-style.

As a four-door sedan with four-speed manual transmission, the 144 will sell for about \$3,200 in this country—a "best buy" for anyone who values durability and superb engineering over brute power. ★ ★ ★



November 18, 1966.

Dear Sarge:

I don't know exactly how to say it, but the fact is, I'm glad to be back in the Air Force. Why? Well, let's just say I found out the hard way that Air Force pay, privileges, medical care travel — they all add up — and compare very favorably with civilian life. Not only that, but when you think about all the other things — how much satisfaction I got from my job — the fact that I learned a useful skill — all my friends and buddies too — I didn't get all that in civilian life.

And I couldn't figure out how I was going to get retirement income (in the Air Force I don't have to worry about that either).

Besides I know I'm serving my country — and you can't beat that for living a worthwhile life.

I'm glad I re-enlisted.  
All my best to your family  
Jim.

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PM



## BUICK GS400

*(Continued from page 222)*

"The guy won't even return my phone calls. It has been two months and he still hasn't installed the radio I ordered."—Pennsylvania marketing representative.

"You have to fight the seller for everything, particularly things covered by the warranty."—New York, retired.

But regardless of the specifics, the impression you get through reading all the completed questionnaires is that the G.S. 400 is a spiffy and frisky package in all, perhaps even deserving of this praise heaped upon it by a Missouri technician:

"I like everything about my car, from top to bottom—the red stripe tires, the chrome wheels, the color, vinyl top, engine, airconditioning, power steering, tinted glass—everything."

And he's 21. Humph! I think I'd better call the nearest Veterans Administration hospital and see if there's a bed available. My ego hurts. ★ ★ ★

## SCREEN HOUSE

*(Continued from page 107)*

with help. Spike it to the floor, plumb it and brace it.

Frame and raise the front wall next. It's taller than the back wall and has only four studs which are simply equally spaced. The 4x4 posts are the same, so is the 4x6 top plate, but here the wall is set on ¼-in. hardboard shims which form a drainage slot along the entire wall. Cut the shims about 2 in. wide and place them under each stud. Spike the plate to the floor, toenail the posts, plumb and brace.

We deviated from the plan a bit when we installed the side walls by adding a 2x4 top plate. This seemed advisable to give more support to the outer roof rafters. This plate is not shown on the plan. The side studs are spaced equally, too, and the door opening is framed to suit a standard 2x6 or 2x8 screen door.

Nine 2x6 rafters, 24 in. on centers, are needed. Seven of them rest directly on the wall framing. The outriggers are supported in space by additional 2x6s which cap the ends and extend 24 in. at each end, and by stub rafters which jut out from the side walls every 24 in. The 24-in. spacing of the main rafters is just right for 26-in. panels of corrugated fiberglass. Sixteen 8-ft. panels cover the roof nicely with no cutting.

The three screened walls are boxed in behind the benches with ¾-in. exterior plywood cut in two separate panels. One seals off the space below the seat, the other forms the seat back. Rip enough

strips 16¼ in. wide to fill in the two side walls. Then rip strips ¼ in. narrower for the front wall to clear the drainage slot at the floor. Nail the strips to the studs and the corner posts.

Next run a 1x4 cleat around the three walls 12⅝ in. up from the floor, nailing through the plywood and into each stud. Now, assemble ten identical L-shape bench legs from 2x4s, making them 16¾ in. at the front and slanting the tops ½ in. Rest the legs on the 1x4 cleats, in line with the studs, and toenail them to the latter and to the floor.

Cut the seat panels from ¾-in. plywood and notch them about 2 in. deep to fit around each stud. Rip the plywood seat backs 17¼ in. wide. Hike the panels ¼ in. above the seats to provide a continuous drainage slot and nail the panels to the studs. Add the 11-in.-wide flowerpot shelf all around the outside by notching the boards so they will fit around the studs and butt against the seat backs. Nail in place after cutting the 5-in. holes for the pots. Finally, notch 2x6s around the same studs and pitch them like a sill, letting them rest on the pot shelves. The seat backs lap the sill members along the inside, as does the wire screen which is later stapled to the sill members. The benches are completed by making the seven roll-out storage bins to fit the spaces below them.

Vertical dividers, plus a fixed horizontal shelf 36 in. up from the floor, divide the rear wall into six roomy cupboards which, in turn, are fitted with double doors. Adjustable inner shelves provide storage galore.

The aluminum screen wire is stapled to the inside edges of the studs, to one face of the corner posts, to the top plates and to the sill members along the tops of the seats. Apply the wire to the side walls first, letting it run past and lap the posts about 1 in. Then apply it to the front wall, making a right-angle bend in the wire at the posts so it can lap the side wire. Regular lattice stock is used as molding to cover the stapled edges of the wire.

Paint your screen house in gay, lively colors and apply a couple of coats of good porch and deck paint to the floor. Make the drain slots bugproof by folding narrow strips of screen wire double and wedging them in place. ★ ★ ★

### PLANS AVAILABLE

In some areas you may need a building permit to erect a permanent screen house like this which means a plan is required to submit to local authorities. To obtain a plan, send \$1.50 to Popular Mechanics, 575 Lexington Ave., New York, N. Y. 10022

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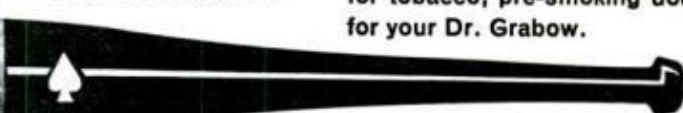
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## THEY DIVE FOR WRECKS

(Continued from page 94)

nitrogen build-up. The best prize this trip was a lobster three feet long.

By tradition, the first diver to surface with a souvenir keeps it. "I once worked for 35 minutes unscrewing a porthole before I had to surface," says DeCamp. "While I was resting above, someone else finished the job in five minutes and surfaced with it. I was mad as hell, but it belonged to him."

Every diver hopes at least once in a lifetime to make a haul of cash or gems. And sometimes it happens—but not often. "These wrecks just don't plummet to the bottom," says Carl Shoemaker, a steady wreck diver from Bethel, Pa. "Generally, there's enough warning for passengers and crew to collect cash, jewels and other valuables before abandoning ship. We find the leftovers. The biggest haul in our group so far has been \$70 found in an old wallet."

Even when cash is discovered, it's not always what it seems. "Once I surfaced with a small tin box and found inside several \$100 Brazilian bills and some \$1 Panamanian bills," says DeCamp. "At last, I thought I'd found some real cash. I gave the \$1 bills away and kept the Brazilian C-notes. Later, I discovered the C-notes were worth only 27 cents each, while the \$1 bills were collector items worth \$1.25 each. It's hard to get rich wreck diving."

Sometimes these sport divers come across valuable metals. Last year, a diver descended to scout the *Mohawk*, a big cruise ship that sank in 80 feet off New Jersey in 1935. This wreck had been searched before. But a recent storm had worked away years of sand deposits—revealing a small treasure of tin ingots. The scout and several other sport divers salvaged \$4000 worth.

"That money just about covered each man's expenses for a summer of diving," says DeCamp. "There's always the hope you'll run into something bigger. But the sport's real appeal is meandering through wrecks while currents gently billow curtains out of portholes and cause doors to open and close softly as if the places were haunted."

### Grim discovery

DeCamp was diving on the *Dagali* a month after she sank when his buddy motioned to a porthole. DeCamp looked, spotted something white and grabbed hold. It was the end of someone's footless leg—a *Dagali* stewardess who had been missing. The corpse was turned over to Norwegian authorities.

One problem for sport divers has been lack of boats and captains. Divers generally don't own a well-equipped boat for offshore diving because of the expense. And charter skippers are often wary of these sport divers. First, wrecks are good fishing grounds and captains don't want too many people to find their favorite spot. Second, some claim that divers scare away fish.

"This just isn't so," says Hoffman. "When you're down there, you often have to reach out and push the fish away from you—they're that curious. We don't scare them at all, and some captains are beginning to realize this."

Most of all, captains fear fatal accidents among divers. So far, these fears have been groundless.

### Danger present

But wreck diving does have its hazards. Among the most dangerous: getting lost.

"One day," Shoemaker says, "my buddy and I swam along a narrow corridor and down into the engine room of a wreck. Somehow, silt jammed my air regulator and I began losing air—fast. We hurried back along the corridor, but couldn't find an exit! We were trapped. Nowhere could we find a doorway out. I knew that I, at least, was in trouble."

Air steadily hissed from Shoemaker's tank. The pair groped high and low for anything that resembled a door. Their movements dislodged silt so thick that their lantern rays penetrated less than three feet. "If we had panicked," Shoemaker says, "it would have been the end." To save air, he took a breath only once in every 30 seconds.

Suddenly, a faint patch of light shown below. Shoemaker probed through the silt. It was an open door where no door should have been. "Then we realized," he says, "the door was right *under* us. In our excitement, we'd become disoriented and had forgotten the ship was on its side."

To top it all, as the two friends left the ship, Shoemaker's tanks got tangled in wires and ropes. When they surfaced, Shoemaker had averted catastrophe by four minutes. That's how much air he had left.

Another danger is underwater cave-in. Few sports divers risk swimming through a ship that has been on her side or upside down for many years. Rusting decks and machinery supports sometimes give way at the slightest jar. One such ship that divers avoid is the U.S.S. *San Diego*, sunk by a German torpedo during World War I. She lies upside down off the East Coast. Her holds are full of coal and some day

(Please turn to page 230)





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## THEY DIVE FOR WRECKS

(Continued from page 228)

it's going to come down in an avalanche.

Sharks, surprisingly, worry some wreck divers the least. "Oh, they come around and sniff at us sometimes," says Hoffman. "Then they wander on. Besides, you rarely see many of them unless there's blood in the water." Other divers take sharks more seriously. Nevertheless, some consider the danger so slight that they don't even carry shark billies. These are poles used to ward off sharks.

### Divers help correct charts

Sport divers actually serve a useful purpose. Often they confirm—or refute—the existence of wrecks that could be dangerous to shipping. Wrecks are marked on charts. But charts often are inaccurate. "When the *Dagali* went down," says DeCamp, "the *Shalom* radioed one position, the *Dagali* another, and the Coast Guard a third." Sport divers now claim that they were all miles off the mark. Charts marking the wreck may be corrected because of sport divers' efforts.

In 1964, a party-boat captain ran his depth recorder over a spot about seven miles east of Block Island where fishing was better than usual. He picked up echoes of a wreck 135 feet deep with the configuration of a submarine. Investigation indicated that the wreck might be the U.S.S. *Bass*, reported scuttled in the area by the Navy. But when a crew of sport divers explored the site they found a mystery. The vessel was a submarine, but there was evidence that it was *not* the *Bass*.

"Our photographs of the conning tower and measurements don't match with the official description of the *Bass*," says DeCamp. "In addition, the sub rests lightly in the water as if it still had air in it. A scuttled ship would be heavier."

### Information scarce

DeCamp and his group checked the builders of the *Bass* for more details to match with their own. They were told that pictures and plans of the sub no longer exist. And they found the Navy had clamped down on all information about the *Bass*. "A sub called the U.S.S. *El Dorado* left New London, Conn., during World War II and was never heard of again," says DeCamp. "It's possible this is it. Maybe someone goofed and doesn't want the story of the *El Dorado* released." Sport divers plan more trips to verify the sub's name. They are intrigued by this mystery and will continue to investigate even if they have to blow out a bulkhead with dynamite to get in. ★ ★ ★





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## 22 MINUTES OVER TOPEKA

(Continued from page 87)

130,000. Some houses rolled like tumbleweeds.

Officer Hathaway now lay unconscious, a hole torn in his head. Young Rick Douglass, rolling over and over, felt the wind lift him again. He tried to dig in with his fingernails, but the whole earth was moving. There was nothing to hold. There was no grass where he rolled—only gravel—yet his fingernails were full of green grass blown there by wind explosion. For a quarter-mile he rolled. Gravel penetrated his skin like bullets. A long splinter was fired through his face. Then he lost consciousness. When his body stopped rolling it looked like a mummy in a hard casing of mud. His head looked pointed.

In the next 21 minutes the tornado bulldozed a path for eight miles, from the southwest corner of Topeka to the northeast. The path ranged from four blocks to half-a-mile wide—exactly as young Douglass had warned.

At 7:15 the Huntington apartments—a new two-story complex housing 300 people—exploded. Walls came down. Thousands of pieces of lumber and brick went straight up. One man stood outdoors defiantly. "You people get all shook up by these winds," he said. His trousers began to flap. An instant later he vanished.

The tornado then plowed through two more miles of homes, moving northeast. At 7:21 it bore down on the campus of Washburn University, leveling pine trees and buildings with stone walls three feet thick. Fifty people left a recital in the chapel and ran for the basement. "Go to southwest corner!" someone shouted. That's supposed to be the safe corner, since tornadoes usually come from the southwest. Then walls came apart like paper. The "safe" southwest corner filled with tons of stone.

### A steel dome disappears

The wind was estimated as high as 400 mph. It lifted the steel dome—25 feet across—from the university observatory. The dome, weighing tons, took off like a flying saucer. It has never been found. Some tornadoes drive straws into wood. This one drove straws into stone. It flew a 300-pound rock two miles then put it gently on the roof of the city auditorium.

Next, the wind bore down on a garage where 70 buses—every one in town—had been run for protection. Suddenly the barn was gone. Ten-ton buses flew past each other in mid-air, like airplanes. The whole fleet was shattered.

A copper sheet was torn from the state

capitol dome just outside the main path of the storm. Dozens of buildings exploded, and acres of new-car lots were devastated. At 7:23 the twister blasted the 10-story National Reserve Life Insurance building. The steel-framed tower rocked, while its insides came vomiting out. Moving on, the wind ripped into a residential area, overturned freight cars in the Santa Fe yards, roared into another group of homes, then at 7:29 raced for the airport.

A pilot could not have steered it more accurately. Like a jet, it steered for Runway 4, swept the length of the field, took off again. It passed 250 feet from the Weather Bureau and for a few seconds the barometer recorded a startling loss of about 50 pounds per square foot in air pressure. The tornado lifted at 7:35 after 22 minutes of staggering destruction.

### 1600 homes smashed

Not since the San Francisco earthquake 60 years ago has an American city been so ravaged. Over 1600 homes blew away or were horribly smashed. Chief of Police Dana Hummer, dodging flying furniture, looked down from his hilltop home over a crumbling city, was sure thousands must be dead. He ran to his car radio to activate a disaster plan. Mayor Charles W. Wright Jr., frantically driving back from a suburb, felt his car being tossed, saw wires sparking in the streets like machine guns. Screams came from homes. Fire trucks, serving as ambulances, found themselves running on flat tires. The streets were full of nails. Over 10,000 cars had been piled in heaps.

And suddenly—silence. At dark, 65 miles away, a piece of paper fluttered down from the sky. A farmer picked it up. It was a tax receipt from the Huntington Apartments.

If the tornado had struck late at night when people were asleep, 5000 Topekans could have died. As it was, 22 miles of wreckage—eight within the city—produced only 550 hurt and, miraculously, only 17 deaths. Fourteen of the dead were in the eight-mile swath cut through Topeka. The other three were outside the city.

How did the others survive—especially since many homes had no basements and few had storm shelters?

And what happened to Rick Douglass, Officer Hathaway and the others in the underpass? Was the bridge a safe place?

It was—in a way. Those able to wedge tight on top of the dirt bank (and on the concrete abutment it covered) were battered, but lived. Officer Hathaway was given up for dead when he was taken to a hospital, but he survived. Rick Doug-



lass was also taken to a hospital, unknown to friends who came to look for him. He, too, lived. But his body was unbelievably peppered with stones. Both he and Hathaway were later honored as heroes for service to their city.

In the Huntington apartments, only 100 went to the underground storm shelter.

The other 200 flung themselves under beds, into closets, on the floor against inside walls—or into bathrooms. Those on the second floor ran downstairs. Astonishingly, first-floor bathrooms proved safe. When the second floors blew away, and lower walls fell, the small inner bathrooms, with small doors and no windows, held together almost like storm shelters. Bathroom piping helped. Small doors kept debris out. While adjacent rooms were ripped wide open, most bathrooms were not even scratched inside. Closets were almost as good. As a result, in the whole shattered complex the only person killed was the man who stood outdoors and defied the storm.

In homes built on slabs, people wisely ran to neighbors' basements. One group ran to a tomblike workroom in a cemetery. In basements they lay close to outside walls and chose the side the wind was coming from—away from their falling chimneys. The old rule "Choose the 'safe' southwest corner" did not always work, though. For homes on the path's edge, the wind came from the east, or the west. (Tornadoes rotate counterclockwise).

#### Saved by an error

What saved the 50 people in the university chapel basement was somebody's error. The 50 refugees *thought* they were in the southwest corner. Actually they had run to the southeast corner. Thus not one was killed when falling stone filled the southwest end of the basement. In a large stone building, then, the safest corner may be the one *away* from the wind. Heavy walls falling on the windy side may actually break the wind and help support walls on the downwind side.

Many people, lying on floors, hid under mattresses which took the shrapnel-shock of flying debris. To understand what this shock is, you should walk through smashed homes as I did. Every inch of wall was splashed and cut by glass. Floors were littered with glass spears and bullets.

In some homes people jumped into their cars, locked the doors and lay on the seats or floors. This saved the lives of ex-paratrooper Jesse Taylor and his family. They ran to their basement garage and huddled in their Ford wagon. They watched the house float away, but they were unhurt.

(Please turn to page 234)

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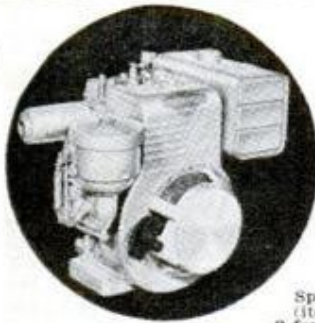
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## 22 MINUTES OVER TOPEKA

(Continued from page 233)

But the main lesson Topeka learned was the value of tornado warnings.

If your town is in a thunderstorm area and has no watchers, you should see to it this spring, when tornadoes start whirling, that such a watch is set up. Weather Bureau tornado alerts are not enough. Your town needs to know when a funnel is actually seen.

When a tornado comes, you may want to jump in your car—as many Topekans did—and run away. But don't make the mistake some did. Start early. Those who waited found streets hopelessly jammed.

And suppose a tornado strikes at night—when radios are off? Funnels usually are spotted on Weather Bureau radars—but how would you know? Your town needs sirens and a special storm signal (so you won't think you're hearing a fire alarm). But you also need volunteer wardens to go through the streets with car sirens and horns. City sirens are not enough. Many Topekans never heard them: The wind blew the sound away.

The biggest lesson: Never underestimate a tornado alert. Topeka thought it was safe—but it wasn't. That's a lesson your town may have to learn—the hard way—unless you get a storm-warning system started. It's up to you. In the final analysis, it was *early warnings* that saved 5000 Topekans. ★★★

## More Tornado Lessons from Topeka

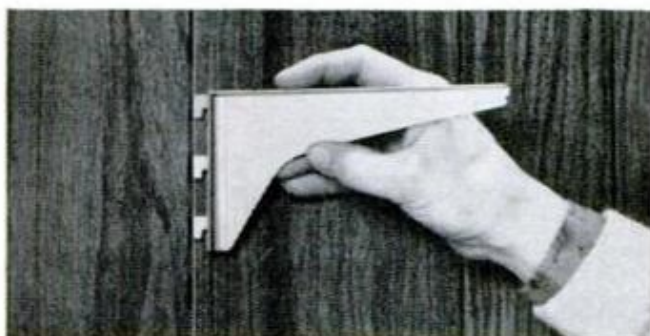
- Floors often remained intact over basements when well built—that is, when bolted into poured-concrete foundations.
- Partly exposed basements often crumbled; so did cinder-block walls.
- Even though second-story walls and roofs blew away, first-story walls stood firm when topped by 2x10 wooden joists. In the big Huntington Apartments, even though small steel I-beams twisted and fell, not a single first-floor 2x10 fir ceiling joist broke. These in turn helped hold walls up. What helped was the fact that joists were cut to over-run the walls by four feet (to support second-story porches) and were firmly anchored at center of building. Thus, even if walls shook, the joists did not fall in.
- In a car it may help to lower a window on the lee side a little to relieve air pressure and save other windows which help hold back pulverizing jets of mud.
- Empty swimming pools offered poor shelter. They filled with lumber, bricks.
- In bad thunderstorm areas storm shelters should be designed into all homes.
- Police should have a pushbutton way to instant-alert all schools and hospitals by radio if winds knock down phone lines.



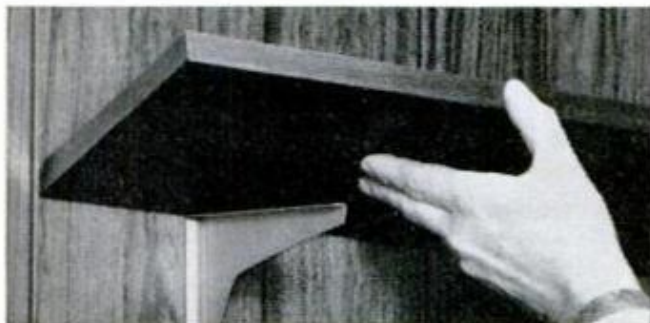


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QUALITY   
POWER TOOLS

**DIRECT FACTORY OFFER AND 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, packed right in our own factories shipped direct... save store profits.

**ENDORSED BY AMERICA'S TOP MAGAZINES...** Here is what the editors say:

"A good bit of sound—imaginative—engineering." Popular Science; "(saw) boasts many features of bigger brothers." Popular Mechanics; "Amazingly versatile." Workbench; "Highly substantial construction, sturdy enough for production line use."

Industrial Woodworking. And Workbench awarded these tools their coveted "Work Tested" Seal.

**OVER A MILLION USERS** confirm their precision, versatility and rugged performance.

**\*10-YEAR FULL SERVICE GUARANTEE...** Any part or parts of any AMCO power tool (except motor) 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.

**UNCONDITIONAL  
10-DAY MONEY  
BACK  
GUARANTEE**

You must be fully satisfied. If not, return in 10 days, freight collect. Money promptly refunded in full.



## 8" TILT ARBOR POWER SAW

**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.

**\$14.95** f.o.b. factory. Wt. 25 lbs. Includes completely assembled cast iron and steel 8" saw with ground cast iron table... less blade. RIP FENCE, if desired, for easier work alignment, \$3.50 add'l.

**SAW BLADE TILTS... TABLE STAYS LEVEL**

Locks securely at any angle up to 50°, raises, lowers 0"-2 3/4". 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 dadoe heads, cutters, etc. (not incl.). Accurate mitre gauge assembly. Ground spindle. Enclosed steel base. "Compo" bearings. Accres. Std. size (for bench saw) \$3.50; larger fence (for cabinet base, as ill'd.) \$4.50.

**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... all you'll need are a sheet of 3/4" plywood and 3-4 hours. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, tool storage compartment.

**10-YEAR FULL SERVICE GUARANTEE\***

## 6" SWING 3-FOOT LATHE



Optional faceplate for turning bowls, trays, lamp bases, rosettes, etc. \$2.50. **\$985** f.o.b. factory Wt. 14 lbs.

Set of 3 high speed turning chisels, \$4.95 add'l.

**DOES THE WORK OF \$40 UNITS...** with same precision and speed. Turns wood, plastic. Sturdy cast iron with 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\***

## PRECISION 4" x 36" BELT SANDER

f.o.b. factory. Wt. 15 lbs.

**\$14.95** †Disc Sander attachment incl. disc bracket, ground cast table (tilts 0-45°): \$7.95 add'l.

**DOES WORK OF \$50 SANDERS...** The world's most talented belt sander. Heavy cast sander incl. 4" x 36" sanding belt, V-pulley drive, multi-purpose drive spindle. Changes from horizontal to vertical sanding in secs. Uses 1/2 hp or larger motor.

**10-YEAR FULL SERVICE GUARANTEE\***



Mitre gage: \$1.95 add'l.

## FULL 22" JOINTER-PLANER LONG, 4 1/8"

**\$19.95**



f.o.b. factory. Wt.: 19 lbs. Complete as shown.

100% precision ground cast iron and steel.

**DOES THE WORK OF \$60 UNITS...** Professional power planing at a hand tool price. Make faster, more accurate joints, rabbetts, bevels for windows, doors, drawers, square tapered legs—Adjustable precision ground cast iron tables. Patent-pending design holds knife to table clearances at any depth. Rabbett depth 3/8". Fence adjustable 0°-50°. Hardened, ground hi-speed steel knives. Dual cutter guards. Balanced cutter head.

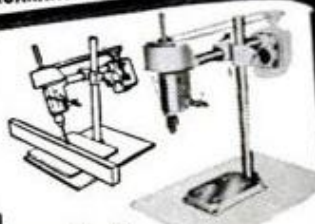
**10-YEAR FULL SERVICE GUARANTEE\***

## 32" RADIAL DRILL PRESS

All cast iron and steel  
f.o.b. factory **\$29.95**  
Wt. 30 lbs.

1/2" cap. Jacob's chuck incl.

**DOES WORK OF \$90 UNITS...** and much more. Industrial quality precision unit with all standard features, many extras. Head raises, lowers. Depth of throat up to 16". Pre-set to any angle for on-or-off table drilling, even horizontal drilling. **10-YEAR FULL SERVICE GUARANTEE.\***



**BRAND NEW**  **1/2 H.P. MOTOR... \$14.80**

F.O.B. FACTORY

FOR ANY OF ABOVE MACHINES. WT. 17 LBS. PURCHASED SEPARATELY, \$18.95



# Isle Royale... Evinrude Country



## ...the perfect place for a pair of "18's"

Like to catch lake trout on light spinning tackle in mid-Summer? You can at Isle Royale, a wilderness island in Lake Superior, where lunker trout cruise the icy waters of the offshore reefs from June to September. But come prepared for rugged fishing for this is Evinrude Country.

Seems like the trout always hit best when the big lake is rough and that's when you really appreciate the dependability of Evinrude's famous 18 hp Fastwin... in fact, a pair of them makes good sense. They double your round-trip insurance... get you to the good fishing faster... and save on fuel when you cut out one engine to troll with the other.



Fastwin's thermostat-controlled engine makes it ideal for these cold waters. It warms up fast and cruises and trolls at a constant temperature. Its high-voltage magneto gives it a hot spark for quick starts. Its rubber slip-clutch propeller is a nice feature to have when you misjudge the depth of water over a reef.

A pair of Fastwins makes a fast, doubly dependable, economical-to-operate rig that's also easy to handle on the road or in the water. That's why Fastwins are so popular in Evinrude Country.

Why not double your fishing fun with a pair of 18's?

See the Fastwin and other fishing motors from 3 to 100 hp at your Evinrude dealer (listed in the Yellow Pages). Free catalog. Write Evinrude Motors, 4131 N. 27th St., Milwaukee, Wisconsin 53216.

**EVINRUDE**  
first in  outboards  
DIVISION OF OUTBOARD MARINE CORP





## I, shy, sly Sylvie Shaw, am a flavor grabber.

How could this happen to a nice girl like me?

Blame it on that cute Mr. Finney in accounting. You know. Wavy hair. Blue eyes. Always smoking L&M cigarettes.

Well, one day while passing Mr. Finney's desk, I grab one of his L&M's. It's good! Not sharp. Not flat. But a good round flavor you don't get in any other filter cigarette.

Later, I grab another one!

I, Sylvie Shaw, am a flavor grabber. My conscience pangs. I run down and buy my own L&M's. I figure, and rightly, when you grab hold of an L&M, you grab hold of flavor.

Now my L&M's are missing. Could that sweet, friendly Muriel Robbins in research be a flavor grabber?