

POPULAR MECHANICS

MAR. 1969
50 CENTS

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The Wonderful Artificial
Limb That Obeys
Commands

What's the Truth About Your Auto Warranty?

EXCLUSIVE!

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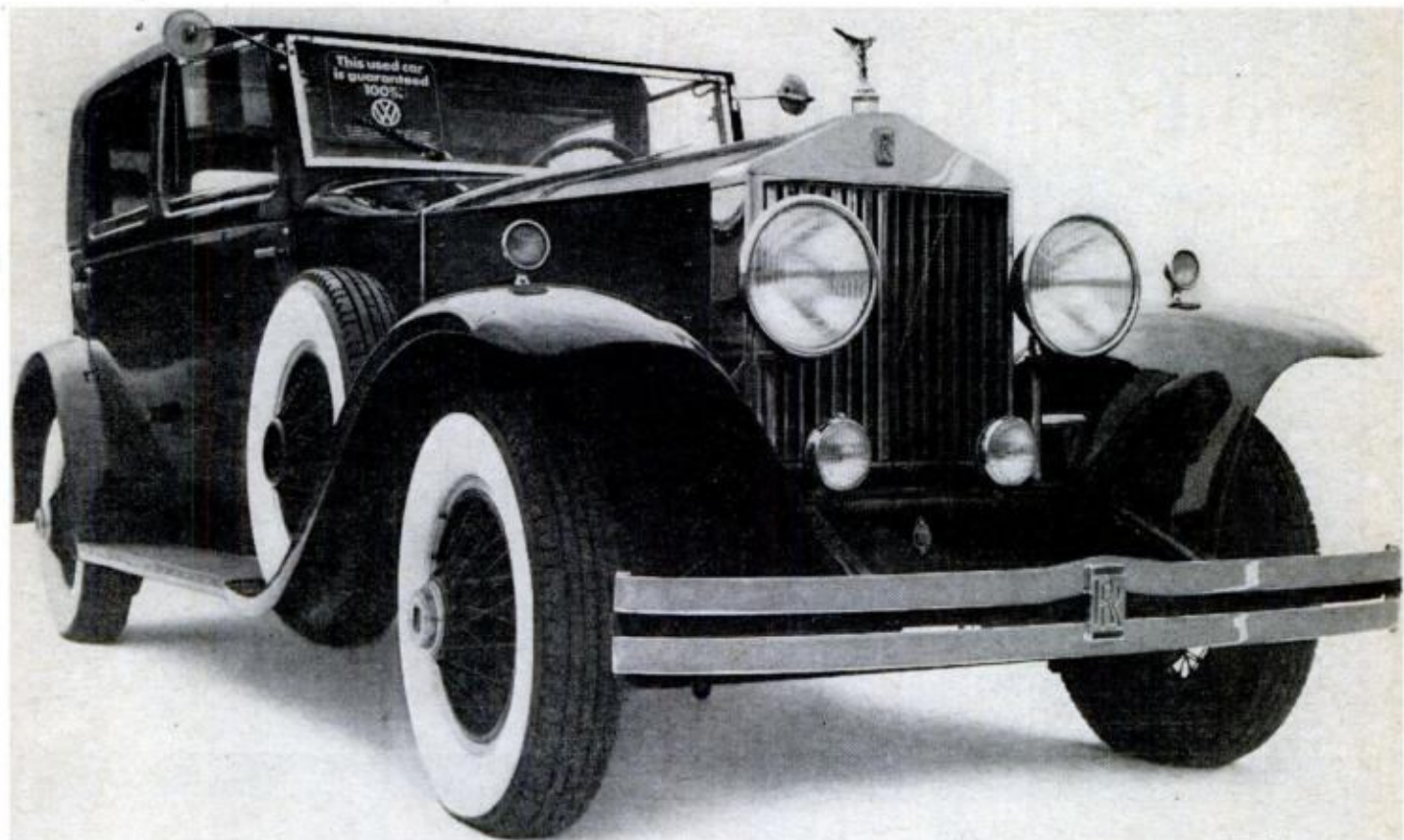
Dan Gurney Answers Your Questions on Racing and Driving • Auto Clinic

How to Have More Fun With a Cassette Recorder

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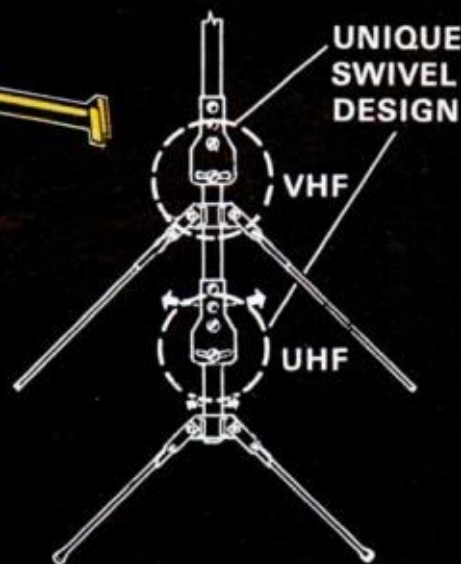


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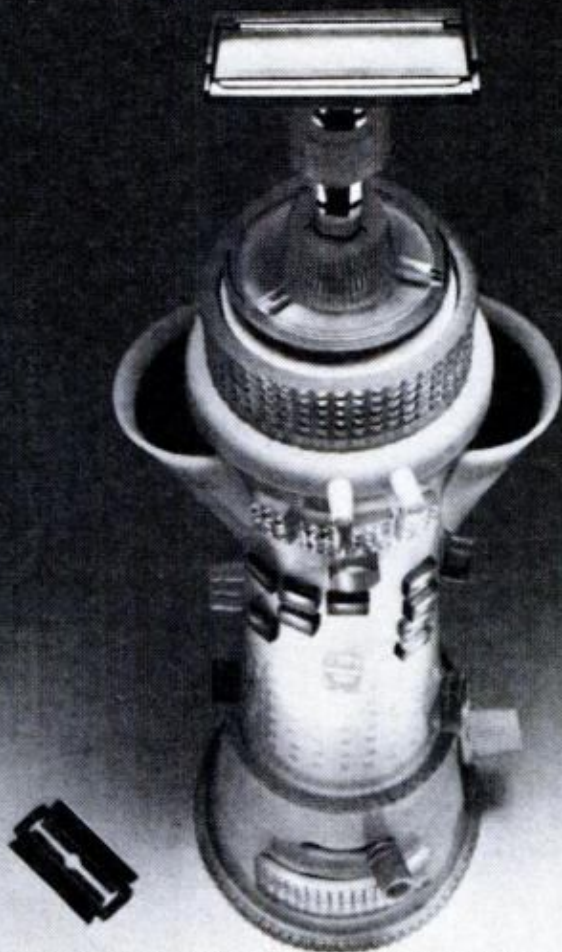
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It'll probably make its own lather and automatically change angles.

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But even with all these improvements, the most important thing about the razor can't change.

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A few years ago you might have tried an electric shaver and been disappointed.

But that was a few years ago. Today we're shaving like it's the year 2000. Now.



Norelco
you can't get any closer.

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What Caused the Torrey Canyon Disaster? Incredible last hour of the supertanker.
What Owners Think of Grand Prix and Ford XL. Two more exclusive PM Owners Reports.

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MARCH 1969

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LETTERS

TO THE EDITOR

Now we learn our ABCs

You are mistaken in terming the A-26 the "Marauder" in *They're Putting the Old Birds Back Into Battle* (page 92, Jan. PM).

The Marauder was the Martin B-26. The airplane pictured in your article is the Douglas A-26 Invader. Both were twin-engine medium bombers, and both were used in Europe and other theaters during World War II. The Martin B-26 was the earlier of the two. Over 5000 were built. After the war, the B-26 was retired and the A-26 was redesignated B-26. It was used in Korea. I worked on and flew in both.

ANCHORAGE, ALASKA

JACK WOODS

The two World War II throttle jockeys who edited that copy have hung up their white scarves in embarrassment. "But after all," they moan, "we drove single-engine planes."

Seeing in the dark

I am a sniper in Vietnam. I have carried a Starlight Scope in the field for six months.

I just got through reading *How the Army Learned to See in the Dark* (page 79, Jan. PM). The article tells a great deal about the intensifying of a small amount of light by the scope. But there's also some nonsense. You cannot see if the clouds are low and blocking the stars and moon. You cannot see if the foliage is thick and overhanging. If you are in clear terrain and the stars are out with the moon shining, you still cannot see over 300 meters. And the scope does not transform the scene into razor clearness.

3RD MARINE REGT. PFC. OTIS J. USSERY

The article does stress the fact that there must be some light available—otherwise there's nothing to intensify. However, since most of us have experienced the "de-intensification" of specifications that takes place between optimum test conditions and field conditions, we feel a Marine sniper has a well-earned right to sound off.

"Fiber optics," it says on page 224 . . . "the invention of Dr. A.C.S. Van Heel, of the University of Delft, in the Netherlands in 1948."

The first publication in a scientific journal on the principle of fiber optics and

(Continued on page 8)

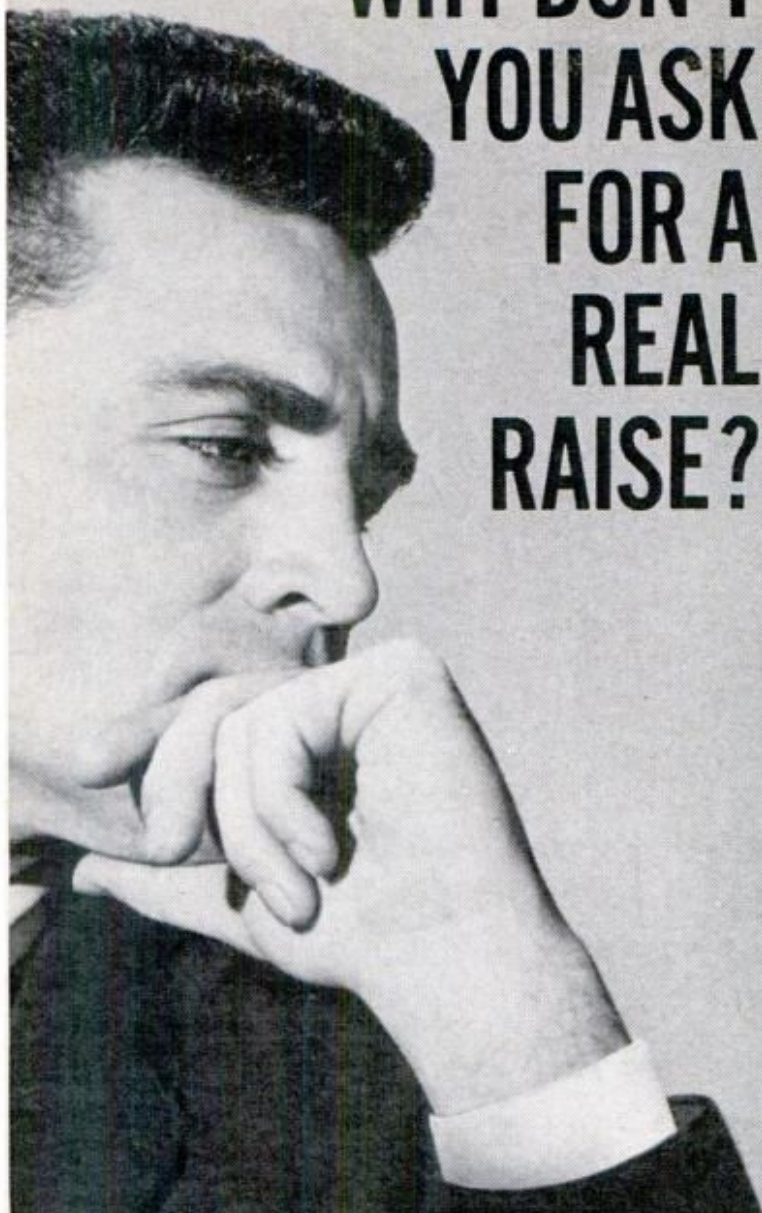
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*Lights easy—
takes its own good
time about burning.*





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Exceeds car makers'
warranty requirements.

LETTERS

(Continued from page 6)

of an image transmitted by a flexible, bent fiber bundle was my paper. *Biigsame optische Geräte (Flexible Optical Instruments)* published in *Zeitschrift für Instrumentenkunde* 50:579 in 1930 in Berlin. After I had completed the work reported in that paper, I learned of two earlier publications, both in 1928 in *British Patent Specifications*.

I don't doubt that Dr. Van Heel discovered fiber optics independently and without knowledge of earlier work. So did I. The earliest inventor seems to be John Logie Baird of London, who, in the late '20's, must have been an employee of Television Limited.

I know of no publication on the subject in a scientific journal before my paper of 1930.

HARLINGEN, TEX. HEINRICH LAMM, MD, FACS

No place for regality

Regarding *When Radiators Were Regal* (page 110, Jan. PM), I guess California was rather quick to decide that radiator ornaments were a safety hazard. Back in 1939, Section 27601 of the Motor Vehicle Code was passed prohibiting radiator ornaments which extended or protruded "to the front of the face of the radiator grille."

SOUTH SAN FRANCISCO DAVE BARRY

Was it nationwide?

I was intrigued by *Glacier Park's Great Grizzly Bear Mystery* (page 82, Nov. PM).

The same evening at midnight in Fort Dodge, which would be about 11:00 p.m. in Glacier National Park, several of our neighbors were struck by the peculiar behavior of our dogs. I had returned from the hospital, and my own police dog, who is exceptionally well-behaved, was acting in a most unnatural manner. He was extremely excited, was running back and forth in the house, bumping into the walls, and whimpering. Shortly thereafter, he ran through a screened-in porch and leaped directly through the screen enclosure, joining several other dogs in nearby woods in excited, aimless barking. This behavior lasted for an hour or more and disturbed the neighbors considerably. I was unable to get him back into the house.

The next day I was surprised to hear of the behavior of the grizzly bears in Glacier Park at about the same time.

I wonder if some meteorologic condition might have triggered this behavior and I wonder if there were other similar occurrences in the country.

FORT DODGE, IOWA HERBERT KERSTEN, MD

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Peter J. Strikwerda of New York State: "Yesterday I did a 60' x 12' 1-year-old trailer. I hope this is a good beginning in this area, because it was accomplished with ease and resulted in a great sense of satisfaction when I saw the trailer glistening. You can imagine the dirt, grime and film that had accumulated in one year. Now I would like to get 3 more machines."

David J. Paradise of Massachusetts: "Just two years ago my wife and I returned to Mass. from Arizona. We were broke. I got a job in a factory and then read about Merlite Presto Shine. Then presto, I got my dealership and started making money as they said. Today I have a steady flow of customers, and we now own our own home with an acre of land."

Pedro Ramirez of Puerto Rico: "As a Merlite Presto Shine Dealer, I do Simoniz wax jobs on aircraft on a contract basis. Already I have steady business contracts totaling \$500.00 a month. Recently a domestic airline signed a contract for me to do their 12-passenger Beechcrafts at \$75.00 per plane per month, and a plane takes me only 5 hours to do."

Steven Schorr of Long Island, N.Y.: "I am 15 years old and in junior high school. My dad will let me do only 10 cars on a weekend, although I could do a lot more, if I didn't have to do homework. Even so, I make about \$50.00 a weekend, which will go to my college education. This summer I've lined up 2 beach clubs, and 2 of my friends to do the work for me."

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DETROIT

LISTENING POST

BY BILL KILPATRICK

HOTTEST CONVERSATION TOPIC in town is speculation on how the public will take to next month's introduction of the first of Detroit's subcompacts—Ford's Maverick, due April 1. The entire industry, from manufacturers down to the smallest dealer, is holding its breath. Reason for the anxiety? If the car's sporty look and a-bit-under-\$2000 price attract buyers in big numbers, it could cut seriously into sales of Ford's Falcon and Mustang, to say nothing of the British-made Cortina. Also, if the car strikes buyer fancy, it could murder Ford dealers' late-model used-car sales. Ford's experience with the Maverick will serve as a marketing guideline for GM, AMC and Chrysler when each introduces its own subcompact. Auto men speculate that subcompacts, if successful, will make it at the expense of an established market. The original idea was to clobber the imports, but now many observers think the ultimate victims will be the lower ends of existing car lines—Falcon, Nova, Valiant and so on. They reason that imports sell to a certain type of buyer, and that nothing Detroit can or will produce will win such buyers over.

THE CHEVY-FORD WAR, always Page One, will be expanded on the racing front in coming months. Although still giving lip service to GM's ban on racing, Chevy is readying a number of high-performance units designed to be anything but losers, particularly on major-league stock-car tracks. The thought is that if "someone" wants to use the engines for such purposes, nobody at Chevy or GM is going to nix their sale. Chevy is already nudging Ford in the racing-power department. Its engines have been showing up on more and more starting grids, and have dominated the prestigious Can-Am circuit. Ford, however, has no intention to roll over and play dead; a source deep inside the Dearborn complex told us the company has "a bomb" plus backup hardware ready in the wings should Chevy or any other GM division (Pontiac? Olds?) show signs of becoming an even tougher contender.

A CLOAK 'N' DAGGER ATMOSPHERE worthy of the Kremlin surrounds Chrysler's new turbine program. Like the Kremlin, everybody knows it's there, but few know what's going on inside. Gossip has it that the engine around which the program is centered is a little over half as big as Chrysler's original turbine (officially "retired" a few years back), yet almost twice as powerful. Chrysler, in the past never reluctant to talk turbines, has slammed a lid of secrecy on the entire project. Speculation is that Chrysler is on to something big, is playing its cards close to the vest 'til appropriate patents are issued. This could be the first turbine program to stay alive and result in passenger-car hardware.

A POSSIBLE WEAPON in the battle against air pollution is Liquefied Natural Gas (LNG), a Dr. Wizard-ish lab wonder made by lowering the temperature of natural gas to minus 258°F. Two '68 Ford Fairlane V8s, adapted by the San Diego Gas & Electric Co. to burn LNG rather than gasoline, recently completed six-month road tests. Each car covered more than 50,000 miles. At the start of the tests, exhaust emissions for the two LNG cars were 118 parts per million (p.p.m.) of hydrocarbons, 0.17 percent carbon monoxide. When the tests finished, hydrocarbons were down to 93 p.p.m., carbon monoxide up to 0.21 percent. Maximum allowable emissions under present California standards, for example, are 275 p.p.m. hydrocarbons, 1.5 percent carbon monoxide. A gasoline-burning car equipped with the auto industry's present exhaust emission controls will—after some 50,000 miles—average 240 p.p.m. hydrocarbons, 1.2 percent monoxide.

For the tests the LNG cars were fitted with 21-gallon cryogenic fuel tanks installed in the trunks, coils of copper tubing to act as vaporizers to change the LNG back to

(Please turn to page 16)

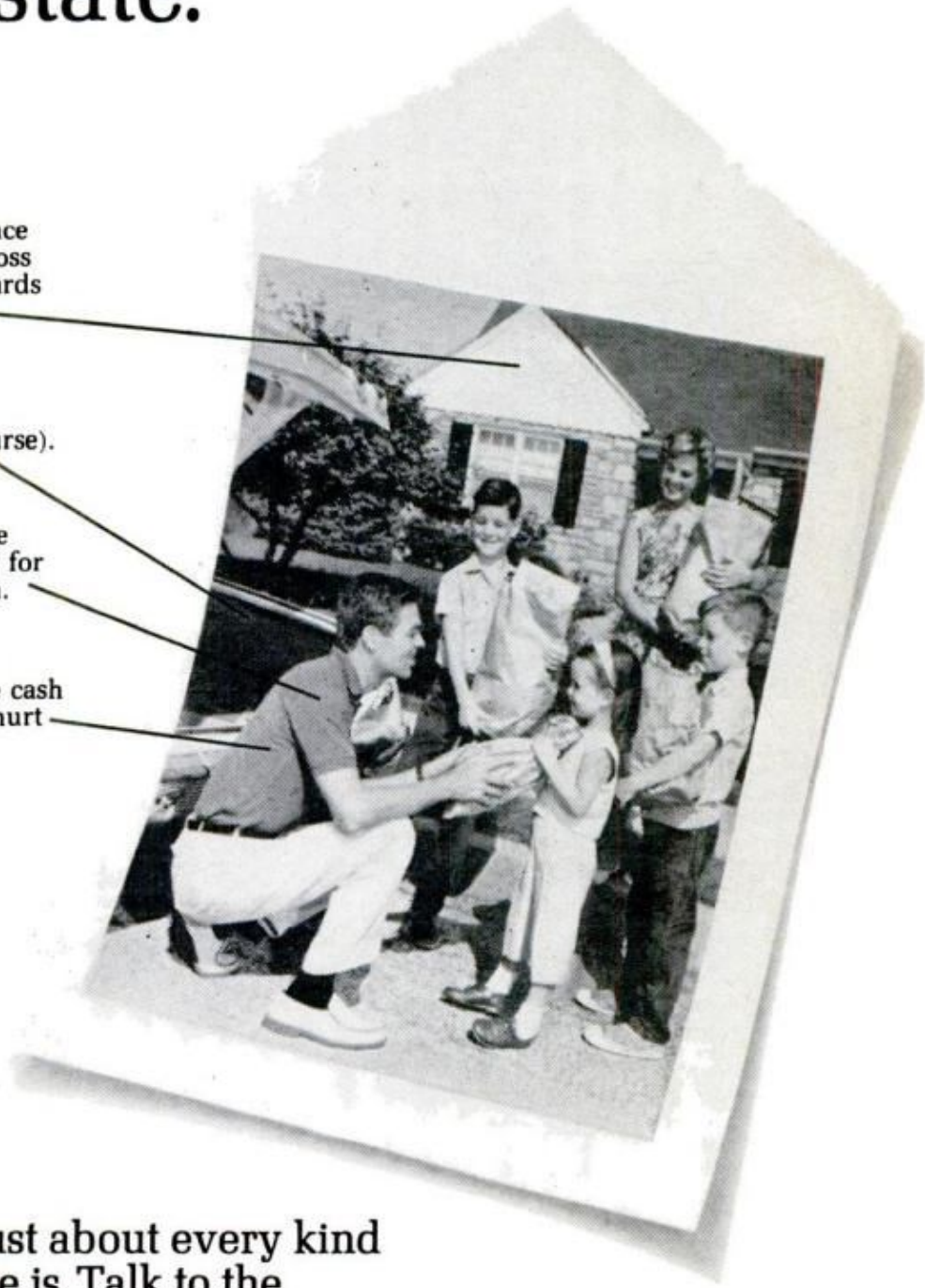
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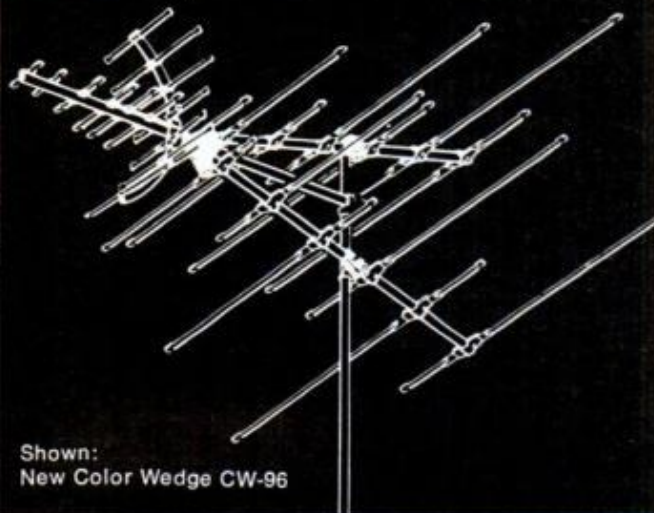
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DETROIT LISTENING POST

(Continued from page 12)

natural gas, a special gas regulator and carburetor. Cylinder heads were milled to increase compression ratios to 11 to 1, and a special cam installed to facilitate more complete combustion. Fuel consumption for the cars averaged 14 mpg at 40 mph. Performance of an LNG car compares to that of a conventional car in every way with the exception of a slight and very brief lag in hard acceleration.

A NEW PONTIAC, an orange-red fire-breather called The Judge (presumably of "Here come de . . ." fame) puts the division right back in the muscle-car sweepstakes, a field it pretty much pioneered five years ago with the first GTO. Pontiac officials admit competition had not only closed the gap, but in certain instances passed 'em by. Now however, Pontiac prexy John De Lorean feels The Judge—previewed to the press, including



PM Editor Bob Crossley, at Riverside in December—is the opener in a new round of supercar performance.

Essentially an even-more-beefed-up GTO, and *not* a "plain" job like Plymouth's Roadrunner, The Judge gets its added power from either of two ram-air packages, one cranking out a standard 366 hp, the other an optional 370. Both are based on General Motors' 400-cu.-in. V8. In addition to its special paint job and unique decor theme, The Judge features a 60-in. "floating" airfoil mounted over the rear deck (see photo). In wind-tunnel tests, it's said to exert enough pressure at high speeds to improve road-holding.

LOOK FOR CAR PRICES to go up by early summer at the latest. Reason? Automakers will make the new polyester-fiberglass, bias-belted tires standard equipment on most of their production. The new tires will add between \$40 and \$50 to the price of the average car. Pay-off for buyers will be greater safety, longer tread life, much improved traction, particularly in wet going. ★★

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Science Worldwide

BY JOHN F. PEARSON

Run for your health—and hearing. That conclusion can be drawn from the results of recent research at Purdue University. Seventy male staff members, ranging in age from 23 to 56, were given physicals that included hearing tests before embarking on a four-month exercise regimen calling for stiff workouts, including a lot of running, three times weekly. Tested again at the end of the course, many men showed a gain in hearing acuity, in some cases a dramatic gain. Improvement was attributed to a reduction in levels of cholesterol, a waxy substance that clogs veins and arteries, and may reduce hearing ability by collecting in blood vessels of connective tissue inside the ear. The Purdue investigators say hearing tests might be used to help spot potential heart risks.

Bad news for crawling insects comes from the University of California at Los Angeles, where a researcher has discovered that a derivative of coconut oil causes bugs to develop without legs or antennae. It also halts wing development in roaches and keeps their eggs from hatching, and turns carpet beetles into albinos that starve to death. The coconut-oil derivative, reported to be harmless to humans, may lead to a new type of pesticide.

An underwater battery, said to be capable of operating 20,000 feet deep for as long as five years, has been invented by a Lockheed Electronics Co. engineer. It uses a magnesium core surrounded by steel wool. Seawater serves as the electrolyte. The battery can produce up to one watt of electricity, says the inventor, enough to power underwater beacons or acoustic devices.

The discovery of ammonia in interstellar space—the first relatively complex molecular compound definitely identified in the vast unknown—was announced by scientists at the University of California in Berkeley. Using a new 20-foot radio telescope, they detected the molecules—showing as distinctive ammonia “lines” in the microwave spectrum—in a cloud of dust and gases in the center of the Milky Way Galaxy. One significant aspect of the discovery: Ammonia substances have been proposed as chemical ancestors of organic compounds and, therefore, as necessary steps toward the origin of life.

By bombarding human blood cells with high-energy ions, British researchers have successfully peeled away, atom by atom, the outer membrane and revealed an inner structure that cannot normally be seen with even the most powerful microscope. The method—called ion etching—has disclosed an orderly network of filaments dotted by irregular beading, a kind of structural frame for the cell. The technique can be used to study virtually every type of cell, including cancer cells, say the scientists.

Major changes in the world's climate will result if air pollution is not checked. That warning comes from Reid A. Bryson, a University of Wisconsin climatologist, who explains that atmospheric temperatures have shown a cooling trend since 1940. Major cause: smoke, dust and other pollutants dumped into an already overburdened atmosphere. Rural areas as well as cities generate turbidity. There are millions of square miles of rural land (eroded areas, deserts) with at least a seasonal smoke or dust problem, and winds carry the polluted air to all regions of the world. Long-term effects of pollution can't be predicted, says the Wisconsin scientist, but it is inconceivable that a major change in our climate would be beneficial.

Two new small research submarines have been launched in Groton, Conn. They each weigh in at 21 tons and each is capable of operating 6500 feet down, which puts them within reach of 16 percent of the ocean floor. One of the subs, the *Turtle*, will be assigned to the Navy's Underwater Test and Evaluation Center in the Bahamas. The other, the *Sea Cliff*, will be operated for the Office of Naval Research by the Woods Hole Oceanographic Institution at Woods Hole, Mass.

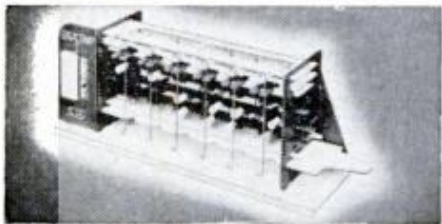
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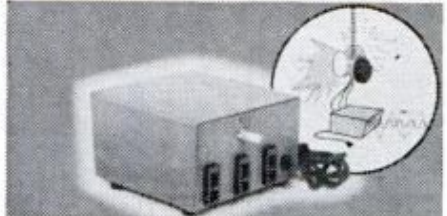
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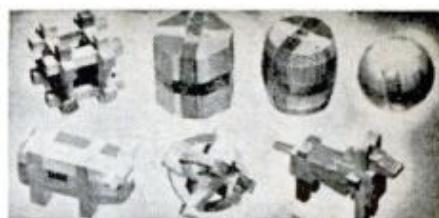
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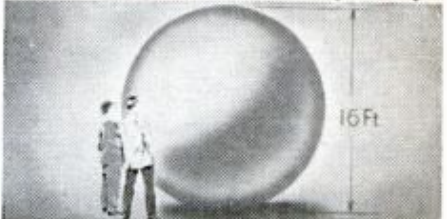
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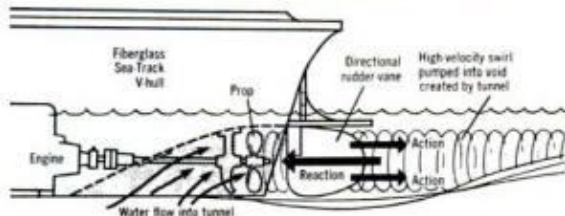
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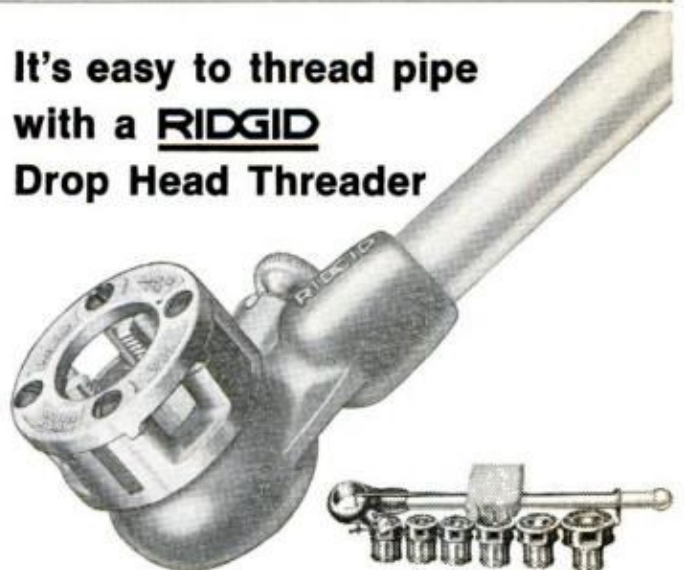
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New Racing Outboards

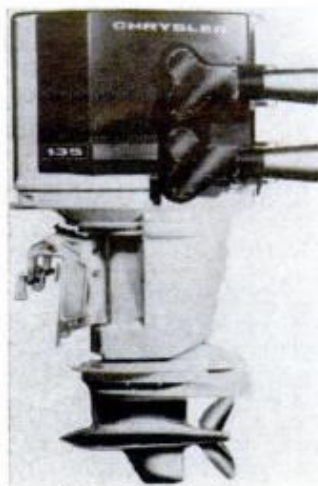
CLASHING in a revival of the outboard horsepower race, Chrysler and Mercury made new-motor news at the National Boat Show in New York. Chrysler announced a new 135-hp model. Then Mercury uncovered a new line of high-horsepower motors topped by a 140-hp giant, boostable to 155-hp by using exhaust stacks.

You'll see both Chrysler and Mercury outboards on racing circuit this summer.

Mercury not only announced the 140-hp model, designated Merc 1250 Super BP, but announced the Merc 1000 Super BP. There's no horsepower rating for this motor as yet, though it's said to be considerably higher than the standard Merc 1000, which is 100 hp.

Don't confuse both of Merc's new motors with the standard Merc 1250 (125 hp.) and Merc 1000. The new motors use a different block which has Mercury's Direct Charging scavenging system with the new piston configuration now used in the Merc 800. Both BP models are in-line sixes.

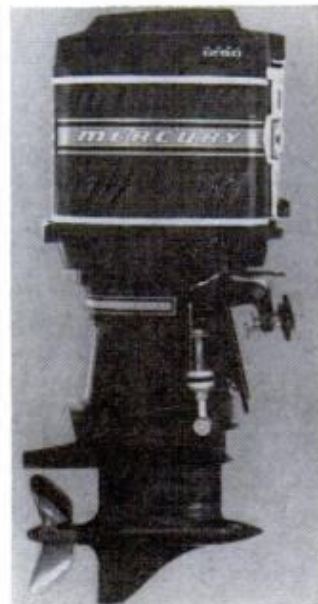
Chrysler's new 135-hp motor takes advantage of tuned exhaust stacks plus higher compression (from 170 to 180 p.s.i.) to get the high horsepower. The block is the same as that used in Chrysler's 85-hp and 105-hp motors. The new motor has four cylinders and a displacement of 96.55 cu. in. It develops 135 hp at 5400 rpm. Of course, the block has been modified and the cylinder walls have been strengthened with steel bands. The direct-flow exhaust system makes use of a new mani-



fold, water-cooled header, polished-aluminum header cover and stainless-steel stacks. Exhaust movement through the leg of the motor is eliminated, and no thermostat is used.

The hp race is back.

—Dan Fales



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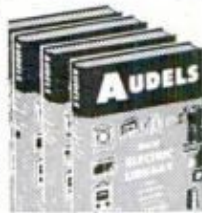
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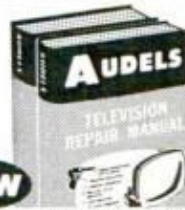
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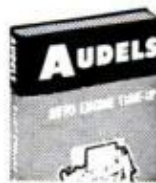
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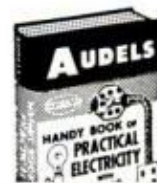
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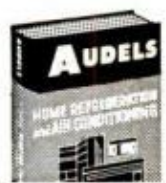
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LOOKING AHEAD to another crack at the Indy "500," Dan Gurney is planning to enter two Eagle cars this spring. Up to now, he's built 20 Eagles for Indianapolis racing. Last year they placed one-two-four

Q. A neighbor of mine says it's harmful to let the motor idle on a cold morning in order to warm up the car before starting out. What can it harm?—R. P. Stewart, Delmar, N.Y.

A. This is an age-old question. I suppose that some automobile companies know the answer to it, but I don't. It is important to get oil to the moving metal surfaces that are in contact. Some of this depends upon the slinging action of rotating and reciprocating parts. As to just what speed is best, your guess is as good as mine. If you have an automatic choke, it can sometimes cause an over-rich mixture which doesn't burn completely and then washes the oil off the cylinder walls, causing accelerated wear. On the other hand, the moving parts in an engine rattle around more when they are cold because they have not yet expanded to their full size.

Q. I saw you drive in the International Grand Prix. I wondered if the wings on the back of the cars slowed them down at all, and if not, why don't they use them at Indy?—Edward Gundersen, Windsor Locks, Conn.

A. Yes, they do slow them down some on the straights. However, they seem to help in cornering, acceleration and braking by "glu-

ing" the wheels to the ground without adding a lot of weight. And lap times actually improve with their proper use. They are allowed at Indy and USAC races in the vestigial form of "spoilers." Wings are considered "dangerous" by USAC because they might come off the car in an accident and enter the grandstands.


Q. What is the fastest engine in a production Mustang, and in a Camaro? Which is the fastest car?—Mike Reif, McGraw, N.Y.

A. The 427 Cobra Jet in the Mustang, and the 427 Chevy high-performance engine. I think they are very closely matched. The Camaro is considered possibly faster because of its shape. However, with the '69 Mustang shape, I think it may have the edge over the Camaro.

Q. I have two-ply tires on my '68 Chrysler. Even though I've had the whole car undercoated, I still get road noises. Would four-ply tires eliminate this? What suggestions do you have?—R. J. James, Forest Grove, Ore.

A. Ear plugs are my first reaction, but I know that doesn't really solve the problem. Maybe you could experiment by changing air
(Please turn to page 30)

Report from Daytona: winners of the 1969 Union/Pure Oil Performance Trials!

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Ford Fairlane 500 won Class 6 (Intermediate 8-cyl.)	19.823	189.1	10.80
Plymouth Valiant Signet ... won Class 7 (Compact 6-cyl.)	23.170	192.8	15.30
Dodge Charger R/T won Class 8 (Sport Intermediate)	14.939	190.4	5.565
Plymouth Barracuda won Class 9 (Sport Compact)	19.897	194.6	10.03

* in feet † in seconds

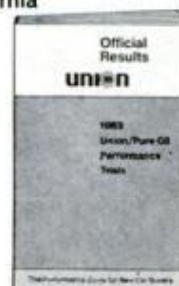
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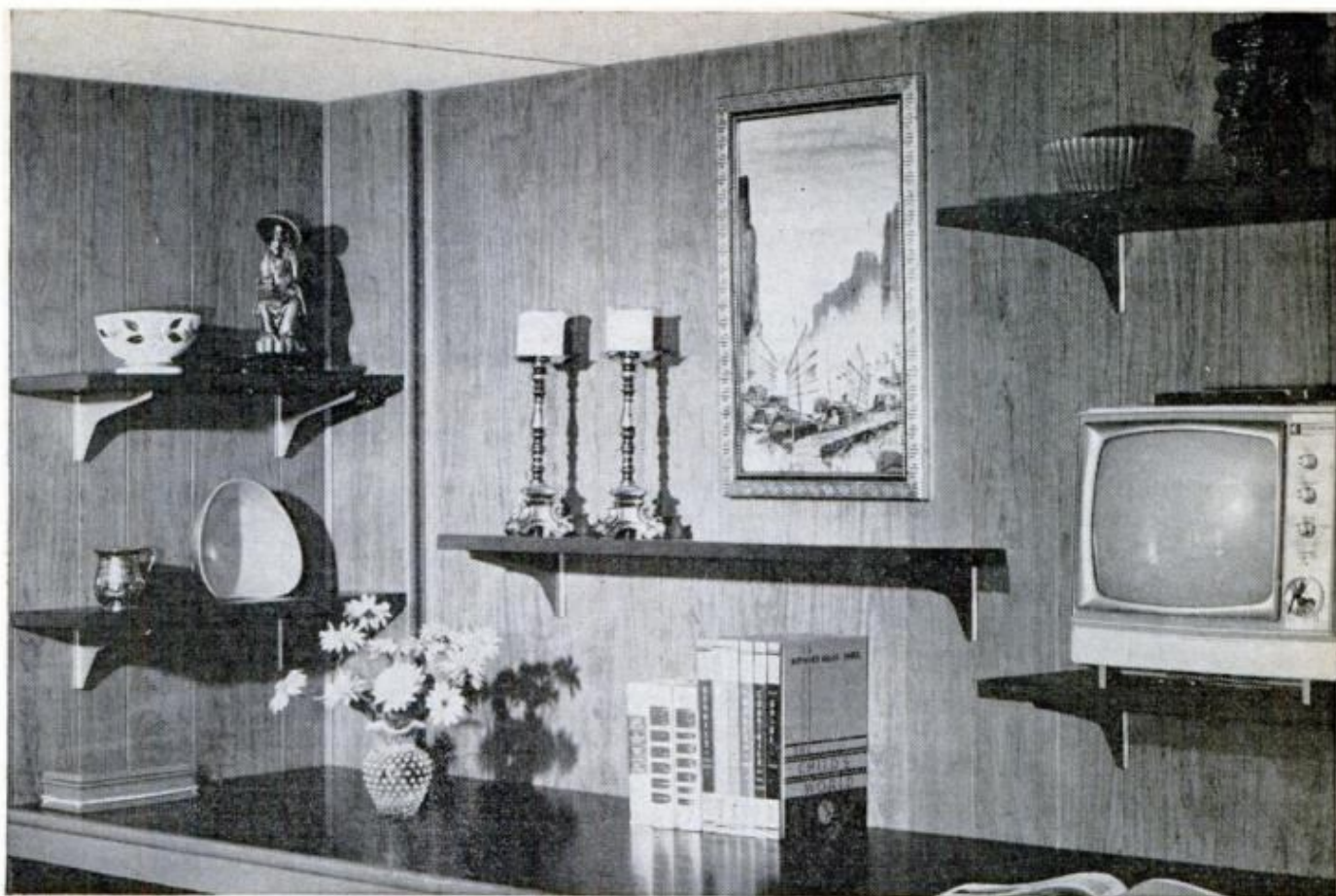
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DRIVIN' WITH DAN

(Continued from page 26)

pressure in your tires. Also, go to your Chrysler dealer and drive a similar model with different tires to see if there is any difference. I suspect the tires, but I don't think four-ply are any quieter than two-ply.

Q. When a car is on the track at Le Mans or in the Indy 500 for the first time, does it need to be "blown out"?—Joe Edward, Muncie, Ind.

A. Ideally, no. But, frequently an engine requires a warm-heat-range sparkplug during warm-up, then when the engine is up to running temperature, colder racing plugs are installed for the hard running. Many engines must be blown out if they have been warmed up on cold-heat-range sparkplugs.

Q. Has the Ford J car finished a race yet, and if so, who was the driver? What type engine did it have and what was top speed?—John Parsons, Deerfield, Ill.

A. I am weak on all the statistics, but I believe that the J car was destroyed in a testing accident. The car, a rolling electronic laboratory, had a 427-cu.-in. Ford wedge engine. Top speed was approximately 200 mph. It never raced, but it was the fore-runner of the Le Mans-winning Fords.

Q. I've seen both stock-car and Indy-car races. Which is easier and safer to drive?—Dennis Johnson, Madison, Wis.

A. That is virtually impossible to answer. Statistically speaking, stock cars are safer. I would say that neither one is easy to drive. It boils down more to a matter of the other drivers in the race than what kind of car you are in.

Q. How tight should your seat belts be when racing?—Bill Clark, Colfax, W. Va.

A. They should be as tight as possible without hindering your movements, or stopping blood circulation. In event of an accident, the tighter the better. By careful positioning of the anchoring points, a belt can be kept quite snug without loss of comfort.

Q. My friend says a Firebird 400 could take a Corvette and a Chevelle. What is your opinion?—Bill Findiesen, Grand Isle, Vt.

A. My first question is, what sort of race are we talking about? It is possible that he is right, and also possible that he is wrong. That's what racing is all about!

Q. How do your Eagles differ from A. J. Foyt's Coyotes?—Rob Beary, Belleville, Ill.

A. They differ in almost every detail, even though they are basically the same. A.J.'s Coyotes are small and clean aerodynamically. They are light, and they use quite a bit of antidive, antisquat suspension geometry. The Eagle is straightforward and simple, with a bit more aerodynamic down force incorporated in the body shape. They are light and strong, have won a lot of races and, if you're interested, we build them for sale.

Q. Why don't you race all sanctioned events in the championship division of USAC? Wouldn't you make more money? Isn't it safer than Grand Prix racing?—Richard Eby, Argos, Ind.

A. I might make more money, but I believe the risks are higher on the ovals. It seems to me as though too many drivers are victims of getting involved in someone else's mistakes. As far as safety is concerned, I would say that the risks are about even. I have given up Grand Prix racing for 1969, incidentally, and I plan to race in all the USAC Road Races as well as all of the Can-Am series.

Q. Is racing a full-time living, or do racers have additional occupations? Also, where can I get information on becoming a race-car driver?—Richard Rosenfeld, Rockville Centre, N.Y.

A. If you are winning, then yes, it is a full-time living. Conversely, if you want to win consistently, you must spend a lot of time at it. I would say that most "big name" drivers have other forms of income, but they depend on their racing as the foundation of everything else. I would write the racing organizations, such as USAC, SCCA, NASCAR, and ask for their help in answering your last question. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 88).

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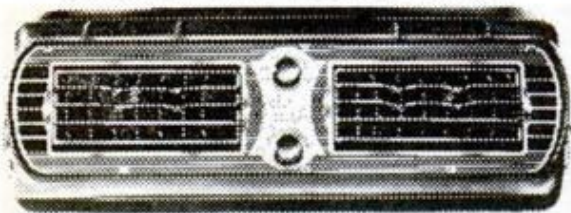
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Mystik Colored Plastic Tape	comes in 9 popular colors; tear resistant; flexible, conforms to irregular surfaces.	mend garden hose, plastic swimming pools, inflatable plastic toys and colored vinyl upholstery.
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BY DAN FALES

BRAND NEW from Winchester is a 10-model line of air rifles and air pistols—eight pellet rifles, two pellet pistols.

Winchester decided to get into the air gun business to carve out a section of the market between the powder-burning firearms and the BB guns.

All of Winchester's new air guns are single-shot, recoilless and noiseless. The new Precision line of air rifles and pistols covers the broadest range of weights, preferences and prices. These run from the Model 416 (just below) for \$15.95 through the top-of-the-line Model 333 (middle) for \$169.95 to the Model 353 pistol (bottom) for \$29.95.



Six of the eight rifles are in the popular .177-cal. while the remaining two are chambered for the .22-cal. pellet. The Model 353 pistol comes in .177 or .22 while the Model 363 competitive air pistol comes in .177 only.

Model 416 is a good choice for youngsters just learning the pleasures and responsibilities of shooting. This air rifle weighs 2¾ pounds and is 33 inches overall. From this model on up the rifles get heavier and longer up to the supertarget Model 333 used in competitive grade shoots.

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TOM McCAHILL SAYS:

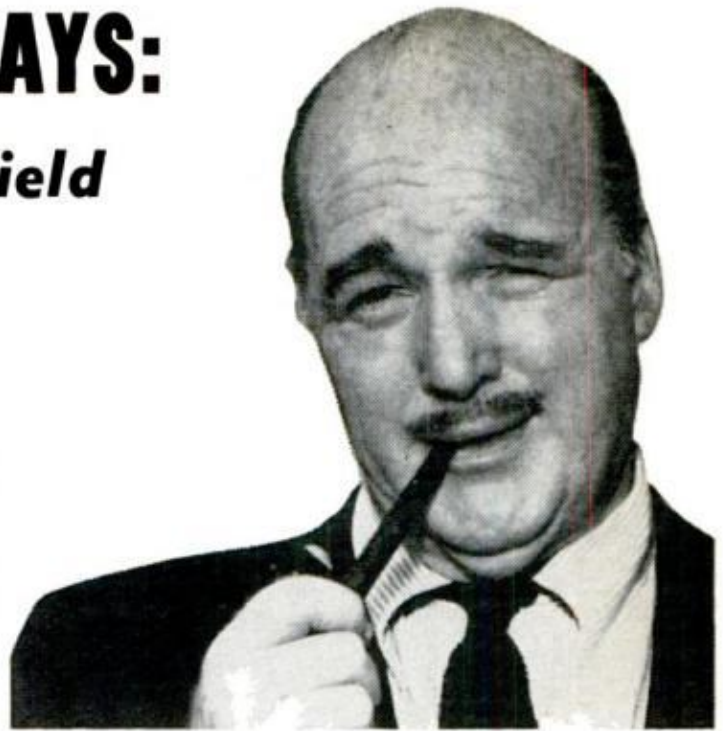
"The appliance repair field is so uncrowded it's almost lonely!"

Someone once said that if you build a better mousetrap, the world will beat a path to your door. In the home appliance business, a lot of enterprising companies have gotten rich peddling a list of handy electrical gadgets for the home longer than Wilt Chamberlain's arm. The trouble is, the dozen or more appliances in the average American home can go on the fritz, and men with the proper training to do repairs are as scarce as knee-length skirts on teen-agers.

Good Appliance Repairmen are a rare breed these days. Those with a little ambition are booked so solidly you can wait days to get somebody to fix a balky refrigerator or cantankerous toaster. Sometimes, you have to settle for a bum job from a guy who had no business calling himself an Appliance Repairman in the first place.

This brings me to my point. If you want to make money in a field that's begging for trained technicians, there's a fine, low-cost home-study plan available that teaches you how to handle every type of Appliance repair in detail—including refrigeration, air conditioners, and even small gas engines. The course was prepared by the instructors at National Radio Institute. This is the oldest and largest home-study school in the Electronics/Electrical fields with more than fifty years' experience training men like yourself for new careers or spare-time or full-time businesses of their own.

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The best advice I can give you is to clip the coupon below and send for the NRI Appliance Training Catalog. It's free, and there's no obligation. NRI doesn't employ salesmen, so nobody will be knocking at your door. All it will cost you is a postage stamp. Take it from Uncle Tom, the Appliance Repair field needs good men. Now.

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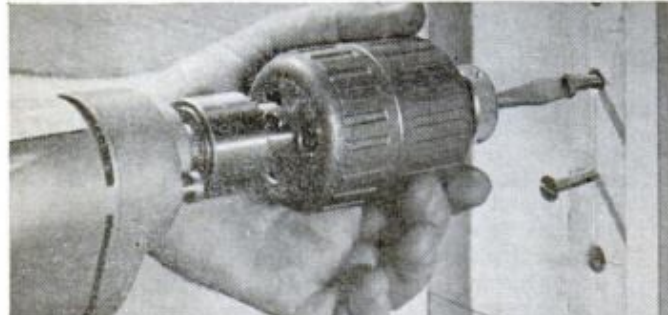
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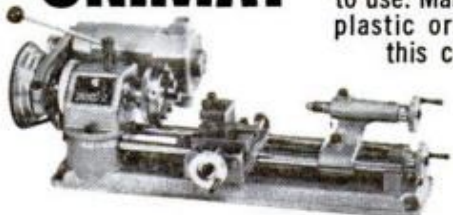
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NEWS BRIEFS



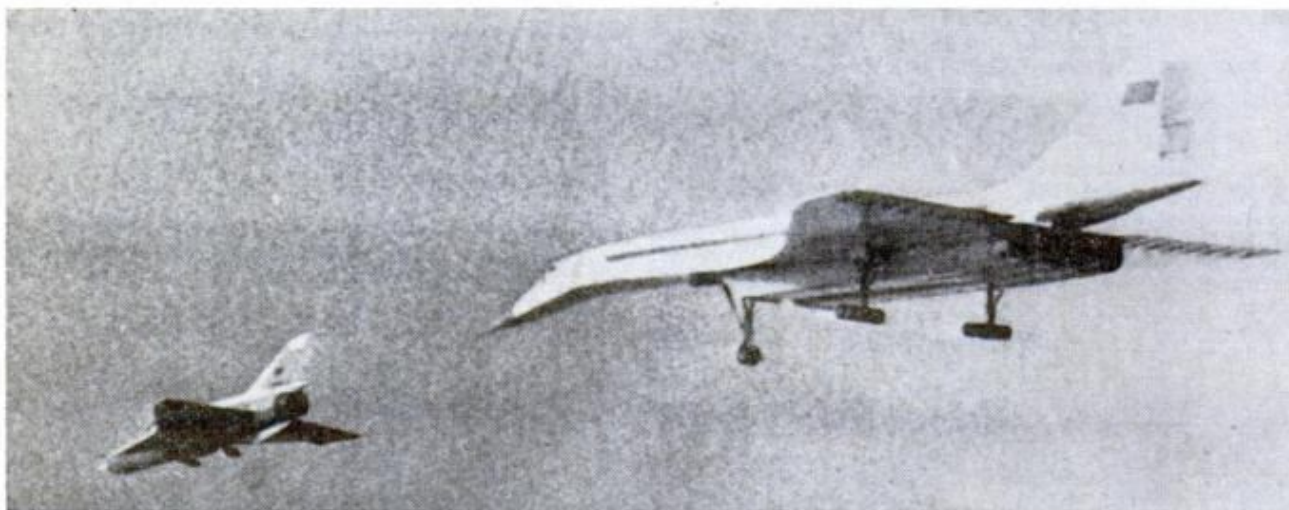
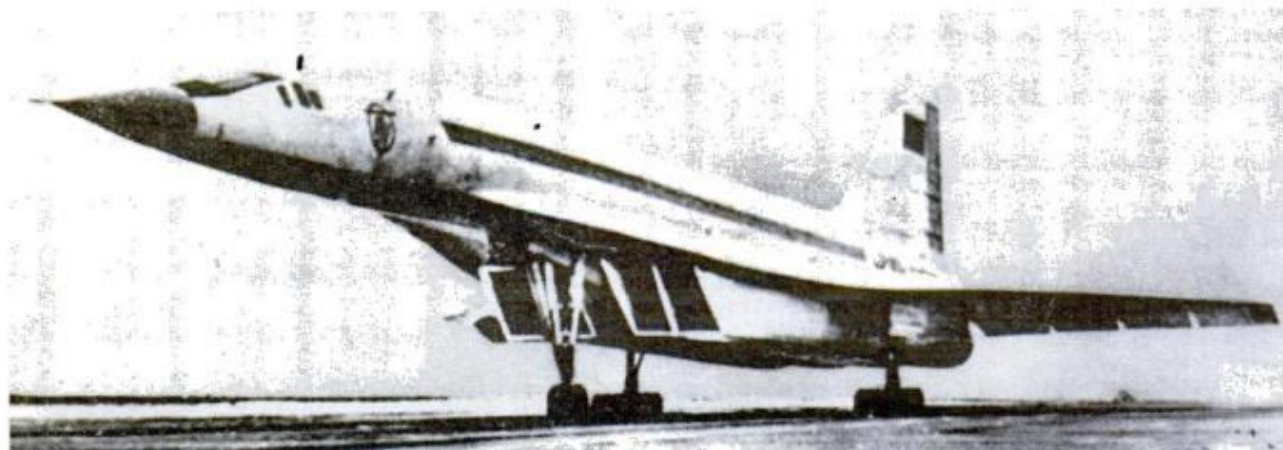
Cops glow in the dark

Six flashing amber lights—three in front and three in back—offer great nighttime visibility to policemen wearing a new British shoulder harness. The lights are inside clear plastic tubing and are powered by batteries carried in a metal box.



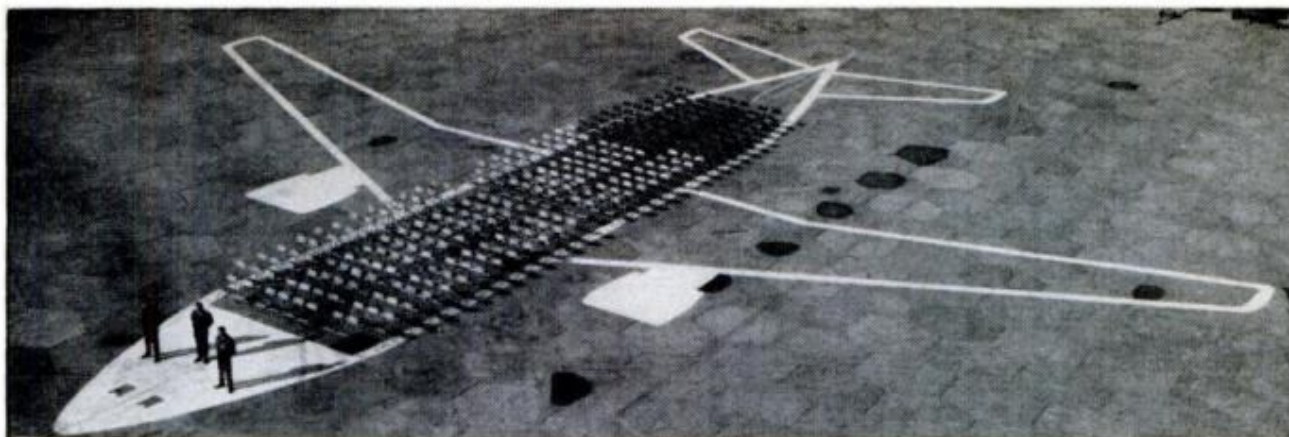
Keys to computer

A new Honeywell solid-state keyboard, set up in a home or office like a typewriter, can communicate to a centralized computer by means of a printed circuit encoding board (shown in the girl's hands) that fits underneath the Micro Switch keyboard.



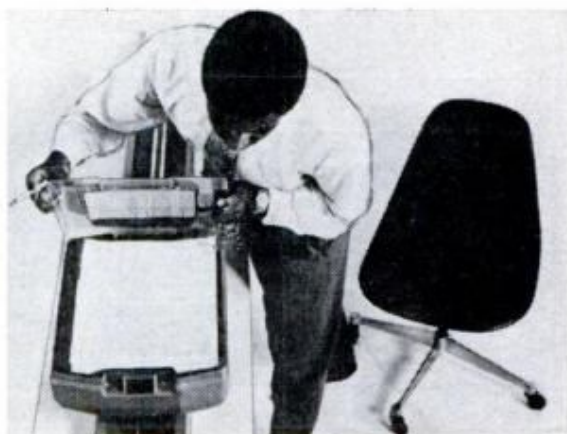
Russia is first to get a supersonic transport into the air

The Soviet Union test flew its supersonic TU144 airliner from a Moscow airport on Dec. 31, thus becoming the first nation to fly an SST. The Anglo-French Concorde is scheduled to fly early in 1969 (see *You, Too, Can Break the Sound Barrier*, page 111, March '68 PM), and the U.S. SST is still in design stage. The Russian plane is built to fly 1550 mph, carry 120 passengers and cruise 4000 miles. The top photo shows the TU144 on the ground; in the lower photo, guided by a fighter plane, it comes in for a landing with its nose down for maximum visibility from the cockpit. All systems were tested in the maiden flight.



French-British-German Airbus will have space for 345

Outlined on a hangar apron at Toulouse is Sud Aviation's giant new A-300 Airbus, a medium-range, twin-jet aircraft that will carry up to 345 passengers. It's scheduled to go into service late in 1972. Cooperating with Sud in construction of the plane are Deutsche Airbus and Hawker Siddeley Aviation. Twin Rolls-Royce RB-207 engines, each with a takeoff thrust of 57,500 pounds, will allow a maximum takeoff weight of 308,650 pounds.



'Model railroad' for offices

Operating much like a model railroad, Mosler's new Telelift system utilizes attaché-case-size, self-propelled electric cars to convey items from office to office within a building or from building to building.



Russian hydrofoil in Britain

On a recent visit to England, the Russian Kometa hydrofoil boat passed under the Tower Bridge over the Thames. The 120-foot, 100-seat craft reached a speed of 35 knots during a demonstration run.



Chipper on a boom

Shown chipping away a city street during construction of a subway in Hanover is a new German "hydro-chisel" operating from a truck-mounted boom. The hydraulically operated machine delivers 580 blows per minute.



Underground water search

Helping the Indian government to locate underground sources of water in the state of Madras are technicians of the UN Groundwater Investigation Project, who are shown doing an electrical depth probe of the earth.

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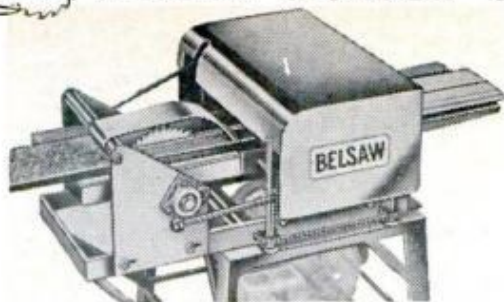


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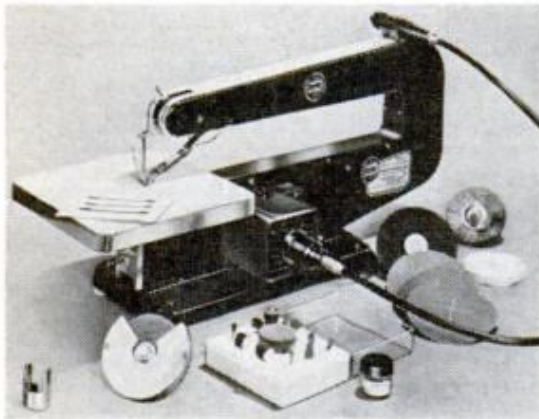


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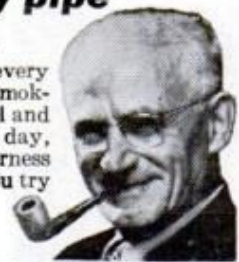
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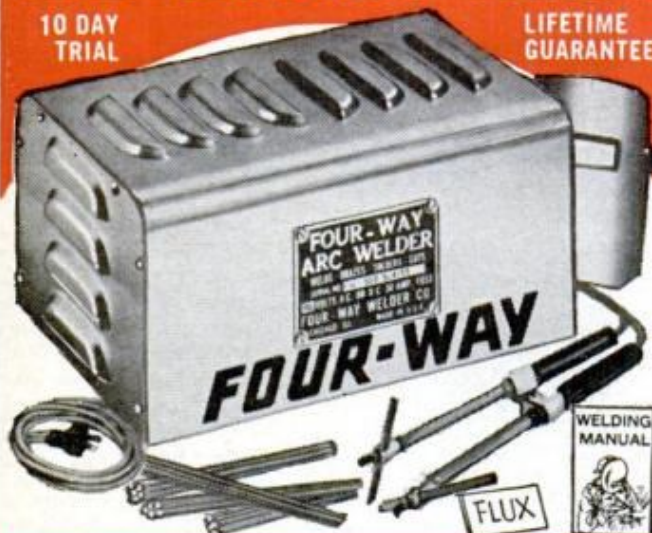


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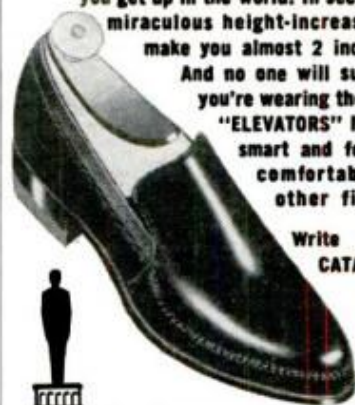
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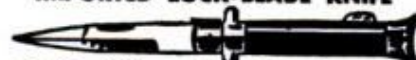
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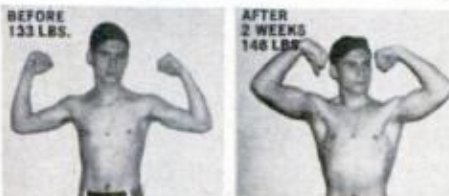
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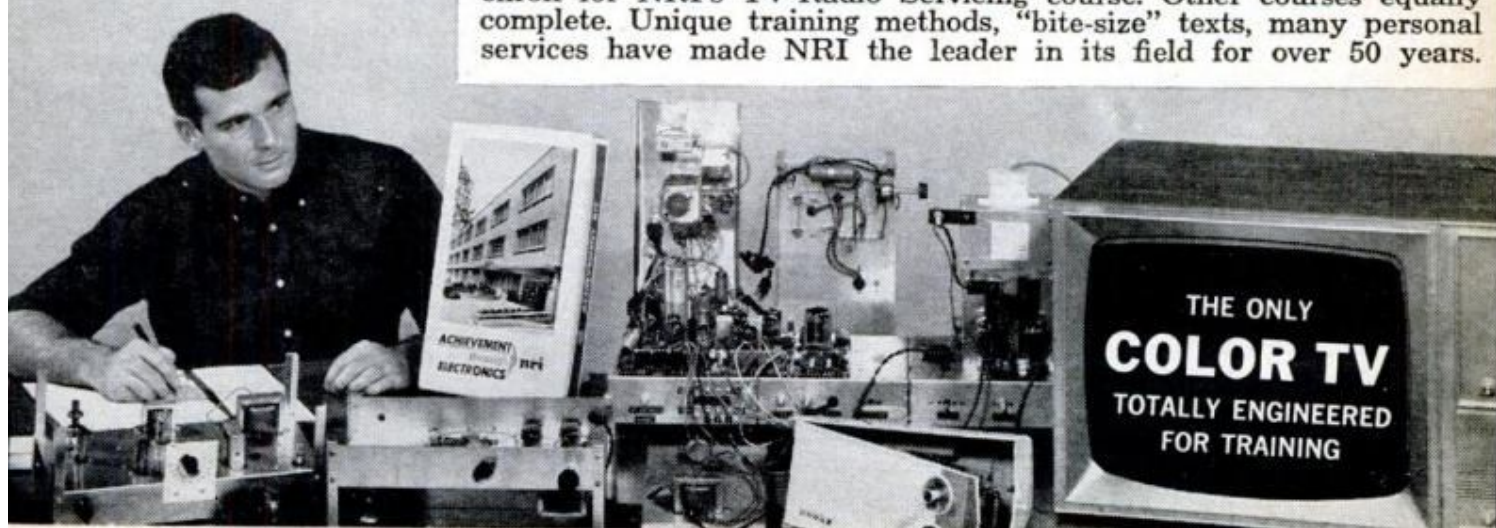
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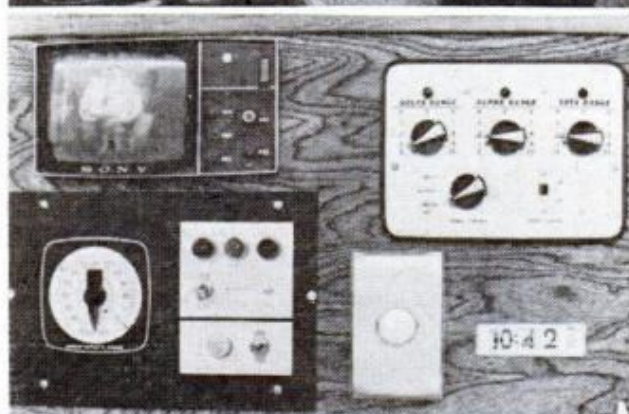
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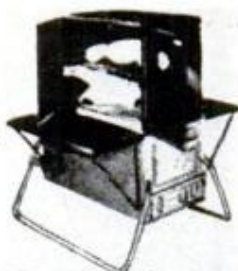
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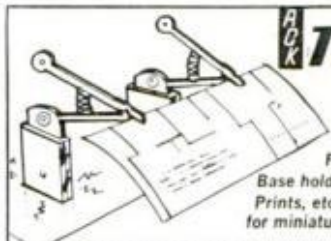
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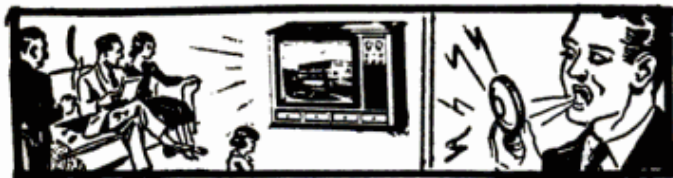
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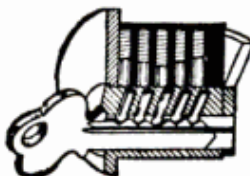
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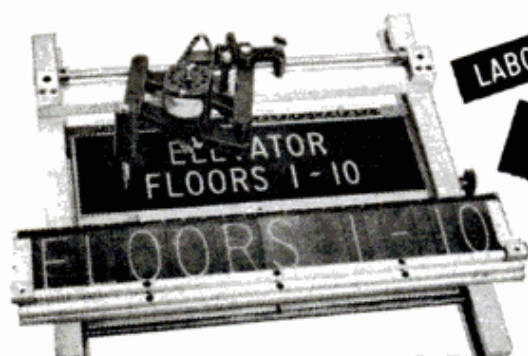
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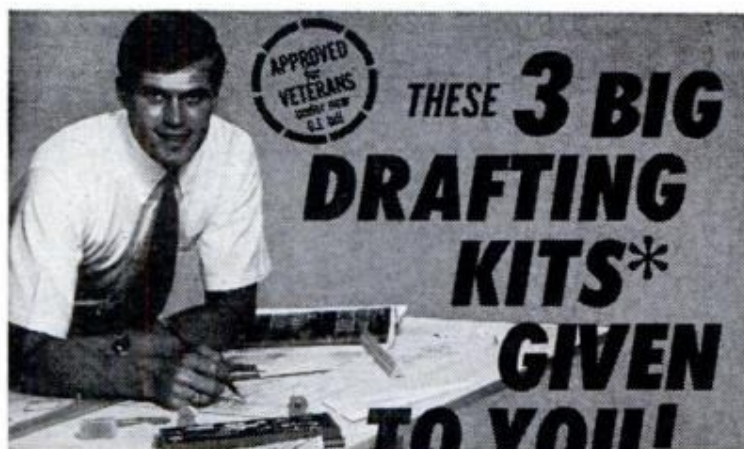
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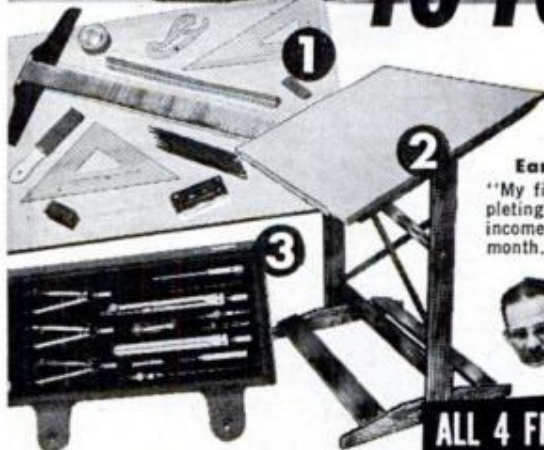
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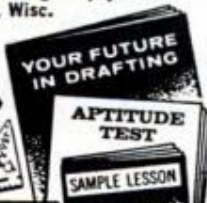


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MARCH 1969

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85

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ACTION

SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Too much beauty treatment

I decided to doll up the interior of my car and used auto polish on the trim on the instrument cluster and armrests. I completely rubbed away the chrome finish on one piece before I got the message. What can I do to restore the finish?—Jim Round, Madison, Wis.

There's not much you can do except replace the trim piece. However, thanks for giving me the chance to bring this into the open. The trim pieces in today's cars are chrome-finished plastic. They won't withstand polishes with silicone or other abrasive elements in them. If you want them to look good, wipe dirt off with a damp cloth or sponge. Then, buff the piece with a soft, dry cloth.

Airing the problem

About a year ago, I had an air conditioner and new tires installed in my 1968 Fairline XL. Since then, I get vibration at 60-70 mph. I've replaced the tires, had several wheel-balance and front-end jobs done, and have had new shocks and ball joints installed. The vibration continues. Why?—Barry E. Callaway, Sahuarita, Ariz.

Because you're probably looking for a solution in the wrong place. I think the place you'd best start considering is the air conditioner—not tires and front end. You probably have a loose compressor, loose belt or a misaligned idle and compressor pulley setup. Check by disconnecting the compressor belt and driving the car. Lack of vibration at 60-70 mph means you've found the trouble.

Loose rod

Four weeks after I got my 1967 Chevrolet Caprice, a push rod let go. A new one was installed. Two months later, it happened again and was repaired. This morning the same thing happened on the same bank. The car's well taken care of and I'm too old to be a hot-rodder. I don't know what's wrong. Do you?—S.L. Adams, Dorchester, Mass.

Obviously, for some reason, the rocker-arm studs aren't holding. I suggest you

take the car back to the dealer and have him install rocker-arm stud pins to add strength to the assembly. Then, pray. If your prayers aren't answered and the car's still under warranty, get nasty until the factory sends a man down to straighten the trouble out once and for all.

Half a breakdown

I have a 1959 Renault Dauphine that's driving my mechanic crazy. It runs like a top except for one "minor" thing that's sending him into a straitjacket. When it reaches 40 mph, it starts breaking down in two cylinders. He's put in new plugs, points, coil and has rebuilt the carburetor. What now?—Jim Bowles, Pottsville, Ark.

Try checking inside the distributor. You may have a worn lobe. If not, try inside the engine. Could be broken valve springs.

Brazen burrs

This is regarding "Overlooking the Obvious" in the Sept. '68 Auto Clinic in which you tell Elmer Gifford that two things would cause loss of rear axle lubricant—a bad pinion seal or a plugged vent valve. I ran across a third thing with my Chevy which may be of help. To find the reason for my losing rear end lubricant, we pulled the plate and found heavy burrs around each bolt hole. The studs tightened on the burrs, but no pressure was put on the gasket, resulting in insufficient sealing. We ground the burrs off, and everything's fine.—William G. Waltz, Bloomington, Ill.

Thanks, Bill.

Bang, bang!

What's causing my 1967 GTO to detonate badly at speeds of 48 to 60 mph after the engine gets hot? Distributor's okay, timing is on the spot, and I use premium fuel. The car's used mainly for town driving with periodic short trips.—D.B. Probyn, Morton, Ill.

I think that last sentence answers the question. I'll bet a doughnut to a noodle that carbon's built up in the engine. When

(Please turn to page 90)



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AUTOMOBILE CLINIC

(Continued from page 88)

it gets hot, it causes fuel to ignite prematurely. This car's made to run. Get it on the highway and open it up for a couple of hours at least once a week.

Give 'em air

Can you tell me why the tires of my 1967 Thunderbird wear excessively on the inner and outer edges and not as much in the center? I've had the front end aligned and I maintain the recommended pressure—26 lbs. in front and 24 lbs. in rear. The dealer says this tire pressure is insufficient; how can that be?—W.A. Ehrman, Glendale, Calif.

From your description of how the tires are wearing, it sure sounds as if they are underinflated. Don't let this "recommended" business become a hard, fast rule. I would try increasing the pressure to about 30 lbs. in all four tires.

Window cleaning

My Oldsmobile has an oily film over the inside surfaces of its glass. What's best for cleaning it off?—Jack Hill, Philadelphia, Pa.

Try a commercial ammoniated window cleaner and a clean cloth or paper towel. In cars that are trimmed in vinyl, which causes this haze, the film will probably reappear frequently. So, keep a good supply of that window cleaner available.

Stuck plug

I've got a sparkplug stuck in the engine of my 1963 Volkswagen. I'm afraid to force it since I may strip the thread in the seat. What can I try?—Adrian Parsegian, Bethesda, Md.

Warm up the engine to operating temperature, and then "quick freeze" the plug with dry ice or a shot from a dry chemical fire extinguisher. This might cause the plug to "shrink" in relation to the block and allow you to work it out. In trying to get the plug out, turn it back and forth in case there's any foreign matter caught around the thread; that is, don't keep turning it in one direction. Should you

have to force the plug or otherwise damage the thread, you will need a threaded insert to install a new plug.

Hard start

I have a 1963 Buick Special that stalls frequently in the morning before it warms up. Starting is no problem. What can I do?—T. Ramakrishna Rao, Irvine, Calif.

Check the automatic choke to make sure it's working properly, and set the carburetor float to correct level. If okay, set the carburetor fast idle to 750 rpm. That will stop the trouble.

Service Tips

● **1969 Chrysler, Imperial, Plymouth or Dodge owners.** Check your airconditioner coolant hose. If not supported, it can abrade itself against the muffler bracket. If the hose doesn't have a plastic strap supporting it to the fender-to-cowl-panel strut member, tape it to the strut with electrician's tape.

● **Continental Mark III owners** may notice that their engine temperature gauges are reading abnormally high ($\frac{3}{4}$ to $\frac{7}{8}$). A 2.2-ohm resistor should be installed in the temperature sending-wire harness by the dealer. He'll find the procedure outlined in Service Bulletin 7 (6/17/68).

● **1969 Chrysler Imperial owners** may be bugged by headlight doors banging after the lights have been turned off and doors have shut. The problem is with the counterbalance springs. Service Bulletin 69-8-1 (10/23/68) tells your Chrysler mechanic how to fix it.

● **Oldsmobile** warns that incorrect sparkplug torque will lead to preignition and shortening of plug life because of higher temperatures. It also points out that correct torque cannot be obtained without a torque wrench. Be sure to have your plugs torqued to the spec recommended by the manufacturer.

● **Some 1969 Cougars** were delivered with faulty jacks. Check yours. If the letter A is stamped on the jack handle, it's probably a bad one, which you should return to your dealer for a new handle (part No. C5ZZ—17032—C). The good handle doesn't have an identifying letter stamped on it. ★★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Letters cannot be answered individually, but problems of general interest will be published in the column.



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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Squeaky plywood subfloor

I have plywood subfloors under wall-to-wall carpeting (upstairs and down). The floors squeak in spots, mostly downstairs. How can I stop the squeaks without tearing up the house?—D.L., Del.

I'll assume you can reach the subfloor downstairs between the joists. Sometimes the squeaks are due to slightly "started" nails that have not been driven all the way down, or nails that have missed the joists. But as a rule the squeaks originate at the joints. As the floor is walked on, the plywood springs slightly, just enough to cause slight movement at the meeting edges.

To eliminate the squeaks, first locate the points where the squeaks appear to originate. Then rip strips from 1/2-in. plywood about 1 to 1 1/2-in. wide and 4 to 6-in. long. Drill these for a couple of wood screws near the ends, spread glue on one face of the strips and screw them to the underside of the floor across the joints. Two to three strips across each joint in the area of a squeak should do it.

Upstairs is something else. Here you either live with the squeaks or you take up the carpeting and drive coated nails spaced 2 to 3 in. along the squeaky joint. Small coated nails tend to "grip" the edges and prevent the movement that causes the squeaks. Should you discover any nails that have missed the joists, or nails that have split off a corner of a joist with the point projecting, bend the points upward and hammer them down tightly.

Cleaning new trim

My new house has unfinished pine trim around windows and doors that is fingerprinted and discolored in places. I want to stain the trim in "old pine" but how do I remove the discolorations? I don't want to wet the wood.—W.E., Pa.

Wetting will do no harm if you don't overdo it. A clean cloth wrung out damp-dry in a mild soap solution should get the fingerprints and other surface discolorations. Fine steel wool will loosen any embedded dirt so that it can be wiped away. Discolorations that won't yield to this

treatment can usually be eliminated with a solvent, but keep in mind that common solvents are highly flammable. Be careful!

Once the prints and other discolorations are removed it's wise to go over all trim to be stained with fine sandpaper or fine steel wool to prepare a smooth base for the stain. Although trim is generally presanded it often is not as smooth as necessary for a stain finish. Be sure the wood is thoroughly dry before staining, and keep your wiping cloth handy as the stain will "take" more rapidly on some areas than others, even on the same piece. Unless such places are wiped soon after applying stain you may get a splotchy, uneven job.

Tarnished brass and copper

I have a beat-up old copper teakettle and a pair of modern candlesticks that have become badly tarnished. I've tried several cleaners but they just don't do the job I'd like. Is there an old or secret remedy I could use?—I.D., Colo.

Did you follow the instructions to the letter when you used the cleaners? Several good commercial "brighteners" for both brass and copper should work for you. I also wonder if by "tarnish" you are referring to this condition or whether you mean the "green rust," or verdigris, that forms on these metals and requires more vigorous methods of removal. If oxidation has reached the stage of pitting of the surface, complete removal is practically impossible with any ordinary means, especially if the metal is thin (that is, sheet metal rather than a casting).

One "secret" method—I suppose it might be called old—is to rub the surface with a mixture of vinegar and salt, or drop a goodly pinch of salt on a slice of lemon and rub this on the affected surfaces. Rinse and dry the metal immediately. If the green rust is present, the only recourse is wire-brushing and buffing. This would have to be done by a shop equipped to handle such work.

Non-sprout grapefruit plant

About a month ago I planted grapefruit seeds in 4-in. clay pots, but they haven't sprouted. I dried the seeds after taking them from the fruit. Could this be the reason?—R.H., Ariz.

I don't think so. Give them more time—often these seeds take a couple of months to sprout. Keep the soil damp but not too wet and keep the pots in the sun most of the day. After the seedlings appear, water them, but only sparingly. ★★★

Firestone announces new SUP-R-BELT TIRE.

Twice the tire— twice the mileage.

Built with polyester and fiberglass.

It's like getting two tires in one. Built with a polyester cord body. Strong. Resilient. Reinforced with two fiberglass belts. They circle the tire. Keep the tread rolling ahead, not rubbing from side to side. Result: Up to twice the mileage

from a regular-ply wide tire. And it's a Firestone Wide Oval. The design that changed the shape of tires for good. Firestone Sup-R-Belt Wide Oval. Twice the tire. Twice the mileage. That's Tirepower. Exclusively from Firestone.

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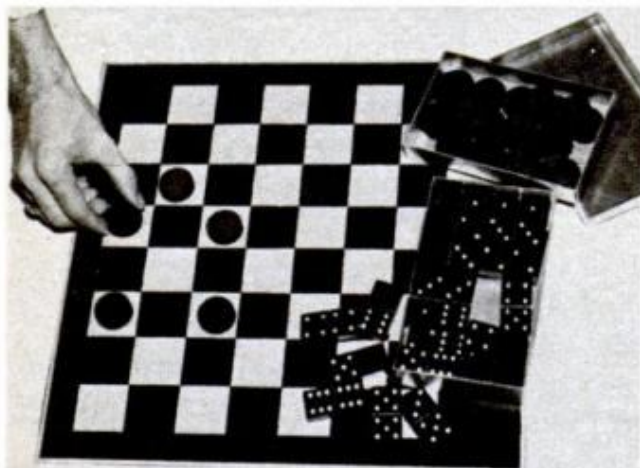
Like getting two tires in one.
Two body plies of polyester cord.
Two belts of fiberglass.
Twice the mileage.
Twice the tire.

Firestone

High-Performance Tirepower

BY KEVIN V. BROWN
AVIATION
 JETSTREAM

AIR FORCE TECHNICIANS may have created the first recreation-time activity for spacemen. The Air Force, with its Manned Orbital Laboratory (MOL) program, has been in the space business for



MAGNETIC PIECES of aluminum for dominoes and checkers are fireproof and unfloatable for spacemen

some years, testing volunteers in its high-altitude chambers for long periods.

One of the discoveries is that, no matter how much the test subjects are given to do, they always have time—or take time—for recreation. It becomes a problem—on space flights—of what kind of recreation can be indulged in while weightless.

Technicians at Brooks Air Force Base, where most simulated space tests are conducted, also had to keep in mind that they couldn't create anything flammable.

They started with the usual games played by small groups of two or more—cards, checkers, chess, dominoes—and found methods for making them both magnetic (so they wouldn't float around the spacecraft) and fireproof by creating them from aluminum and inserting small amounts of magnetic material in each.

Five-card stud, anyone?

THERE'S NOTHING NEW in aviation. Not much, anyway.

One of the most recent aircraft to be certified by the Federal Aviation Agency for commercial service is one of the first aircraft to be used in commercial service: the old Ford Tri-Motor which was flying for hire in 1926, even before the FAA came into being. ★ ★ ★



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"When you're out of Schlitz,
you're out of beer."



Just tune
to Channel 2.
If it turns up
white, head for
the cellar!

NOW YOU CAN 'SEE' TORNADOES ON TV

By HENRY and VERA
BRADSHAW

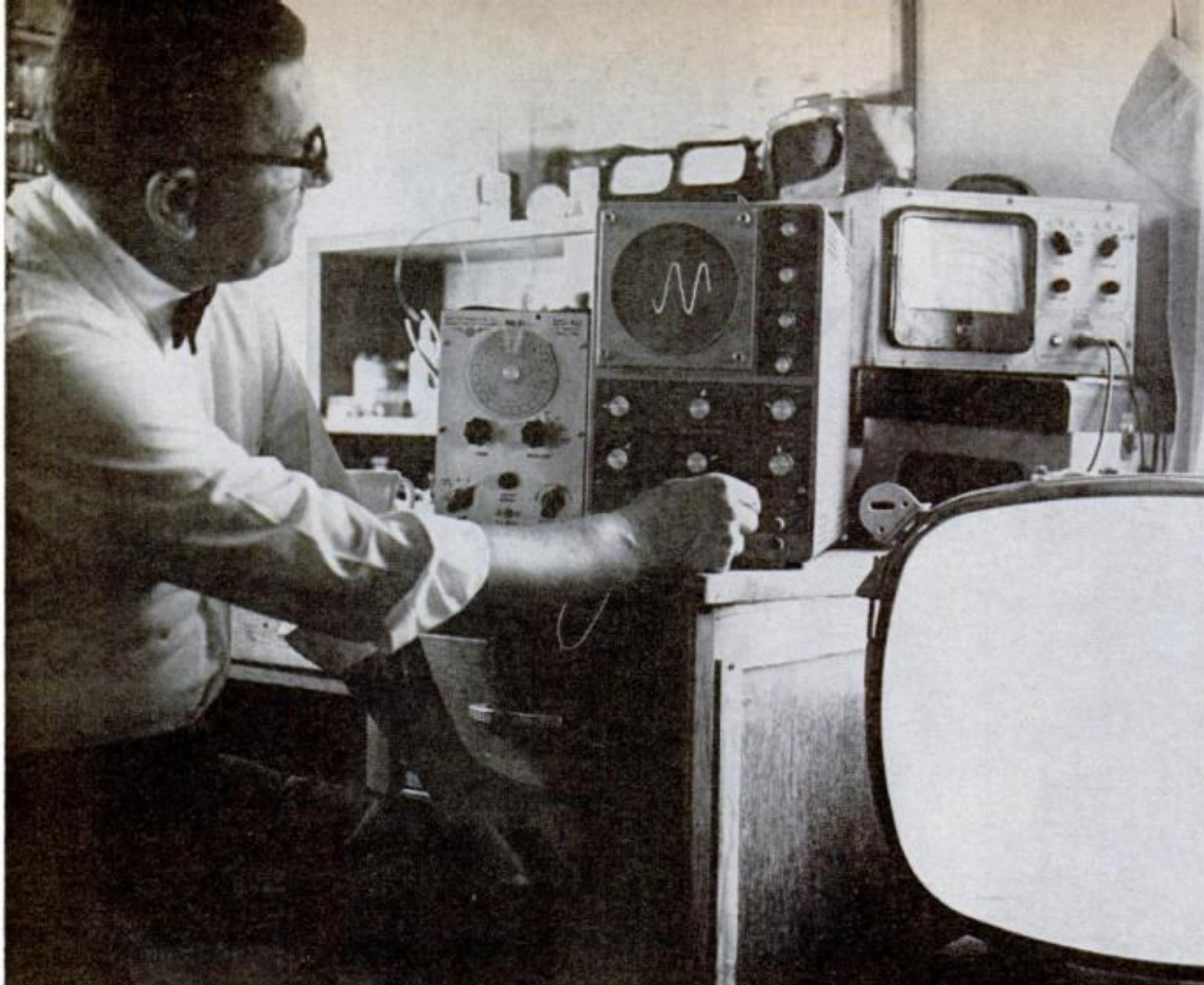
Illustrations by
Herb Mott

CLOUDS WERE DARK. Lightning was zigzagging wildly in the skies. But outside of the threat of a probable thunderstorm, it was a normal, quiet, September Sunday afternoon in the little Dutch tulip town of Orange City, Iowa. Businesses were closed; families, home from church, were having their traditional get-togethers. There was no hint that this tranquility would soon be broken and the town strewn with wrecked homes, uprooted trees and downed power lines.

Norman Boonstra, a chemist, and his wife, were watching a TV portrayal of Hamlet on Channel 14. But during commercials, Boonstra, noting the light-



HERB
MOTT



DISCOVERER OF TV TORNADO WARNING method, Newton Weller, West Des Moines, Iowa, experiments with oscilloscope for long-range tracking of tornadoes and electrical storms. TV method is limited to 20-mile radius and Weller emphasizes "white screen" warning may appear when tornado is as little as five miles away

ning and out of curiosity, would switch to Channel 2, darken the screen and observe the lightning flashes on it. He found this intriguing. He was doing this because he had read a story that morning in the *Sunday Des Moines Register and Tribune* about Newton Weller, who claimed anyone with a TV could tune in a tornado or severe storm.

Each time Boonstra turned from Hamlet to Channel 2, he noted the lightning was becoming more severe, and bands were wider and stayed longer on the screen. Then, suddenly, he and his wife were shocked to see the dark screen light up and turn white—the signal, according to Weller, that a tornado was near.

"The screen went white—completely white," says Boonstra. The Boonstras did not go to the basement. "Because," he explains, "I just didn't know how much stock to put in this white-screen

thing and I was more interested in Hamlet. It must have been about 20 minutes later that I heard the siren—the long blast that is our tornado warning. The wife and I made a mad dash to the basement carrying the portable TV, but the power was off and I couldn't use it—I wanted to see if the screen was still white on Channel 2."

Boonstra's house began to get a peppering. Boonstra says he foolishly sprinted back upstairs. Through a window, he saw debris flying by and he watched, almost stunned, as a patio roof across the street lifted like an airplane and sailed away. Then he saw the tornado moving toward him—the tornado he had seen before and hadn't believed.

Luckily, the vicious, whirling funnel skipped around Boonstra's house. But much of Orange City, a town of 3000, did not fare as well. Before the tornado completed its horrible bulldozing, it

... no doubt about it: Boonstra had tuned in a tornado ...

had done \$1¼-million damage, and left people homeless and bewildered.

There was no doubt about it: Boonstra had tuned in a tornado on his TV set and gotten a 20-minute warning that it was on its way. So had many others in Orange City and neighboring towns that day. But because they did not have the conventional weather warning, all disregarded the TV tornado warning. But never again! To a person they vow that whenever they see a white screen on Channel 2, they will alert the town and get their families to safety.

This system, which can be used anywhere, is considered one of the most dramatic breakthroughs in weather forecasting—it could well save your life.

Called the Weller Method after its discoverer, Newton Weller, of West Des Moines, it merely requires a slight adjustment in tuning Channel 2. Turn on your TV, dial Channel 13, darken

the screen to the threshold of blackness, then switch to Channel 2. Now, if your screen is stark white, or turns white after being black like Channel 13, head for shelter—quick! A tornado is within 20 miles of you, or possibly closer. If lightning flashes (horizontal white streaks across your screen) become wide bands and linger, a dangerous storm is in the offing and you should get to safety immediately.

Dr. James M. Quigg, state climatologist for Missouri, regards the Weller Method as the possible "missing link" in the chain of tornado detection. One link is radar by which only 50 percent of tornadoes can be detected and these in such a broad territorial area that it cannot be accurately predicted if or where they will strike. Another is an oscilloscope, which can track a tornado but ordinarily, not pinpoint it. With Weller's Method, there is no guessing. A tornado funnel can be positively

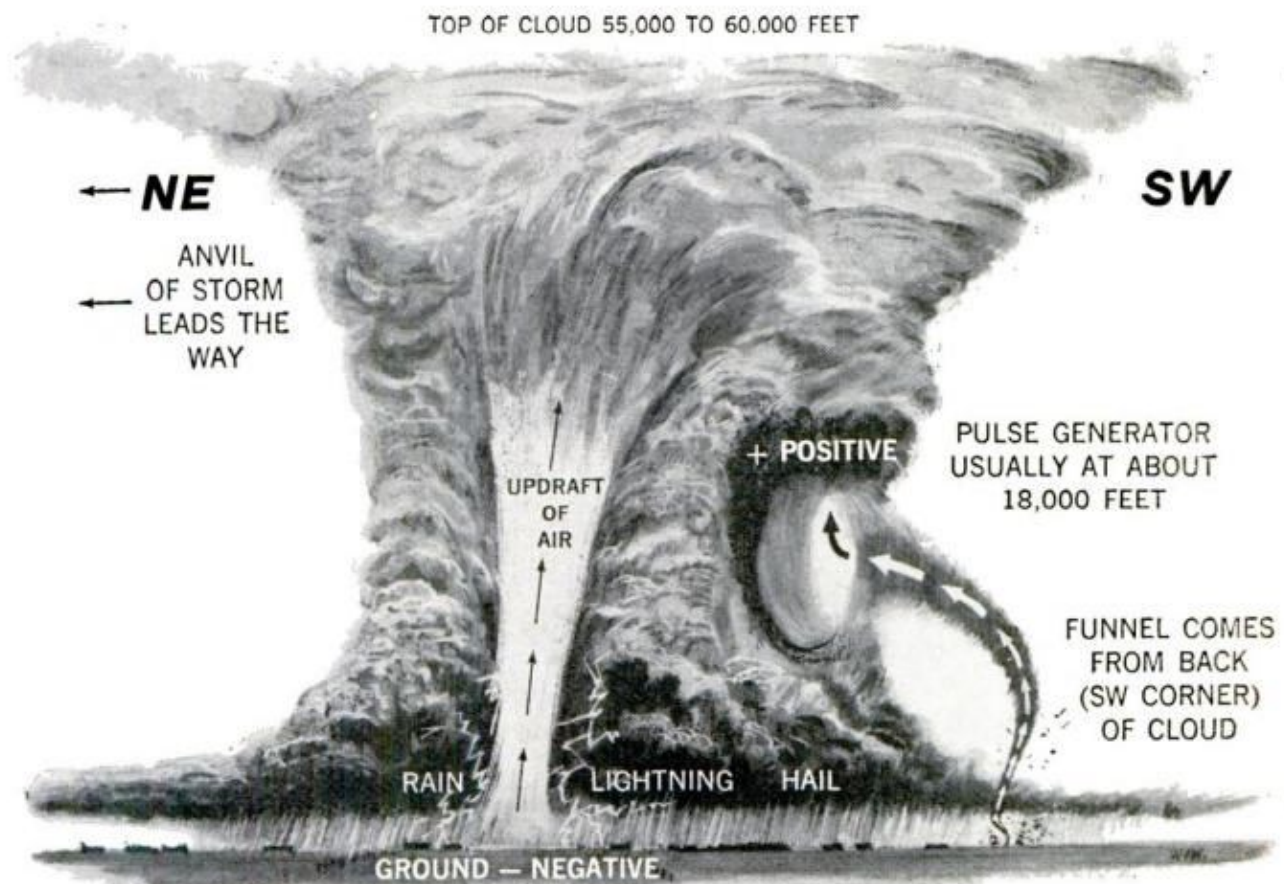


DIAGRAM OF TORNADO CLOUD shows how funnel simulates vacuum diode. Vacuum is created by air swirling at high speed and oxygen being burned in funnel by "positive going" electricity rising to pulse generator

identified near the area about to be clobbered.

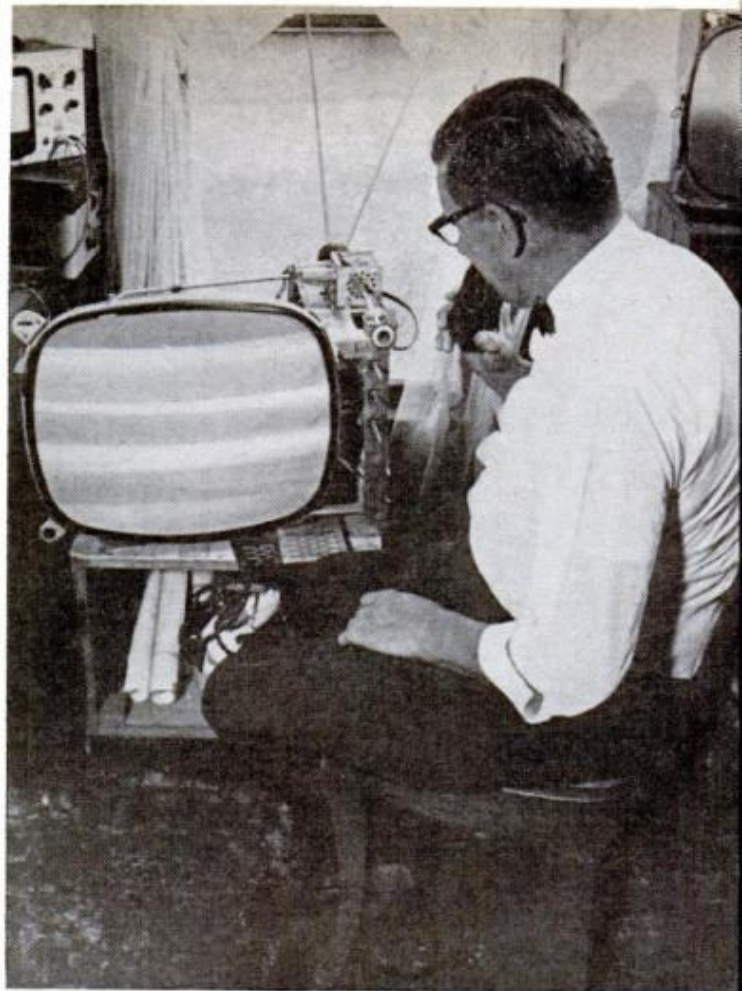
Weller discovered that the 55-mega-cycle band (Channel 2), is the nearest TV has to the electrical frequency of the pulse of a tornado. The pulse generator—Mother Nature's own device for setting up an electrical flow—creates the voltage that triggers Channel 2. If you want it scientifically, the pulse generator is a spiraling force of lightning revolving around a vacuum core. It sits high in the thunderhead, about 18,000 feet and, if you could see it, would look much like a faraway satellite flashing tiny bluish-purple rays. There is no thunder because the funnel is a vacuum chamber. The funnel then, which descends from the pulse generator to the ground, becomes much like a vacuum diode tube. In a tornado, pulses flow from the ground to the pulse generator in the cloud above. This gargantuan vacuum tube, a phenomenon of nature, makes the system work.

Weller made his discovery three years ago, but kept it secret until he had tested it over and over again. (One of his few confidants was Paul Waite, Iowa climatologist for the U.S. Weather Bureau, who was sure Weller had made a great discovery and was at his elbow with assistance and encouragement.) When Weller was positive his method was foolproof, he contacted news media, and the story broke in the *Des Moines Register and Tribune* on Sunday, Sept. 22, 1968.

"Surely," Weller says, reflectively, "Someone up there was looking over my shoulder. The announcement couldn't have been more timely."

At 5:10 p.m., the very day the story broke, the tornado hit Orange City and gave the Weller Method the supreme test—that of people actually seeing a tornado on their TV screens.

Another family having this surprising experience was that of Willard Van Steenwyk, living in the opposite end of town from the Boonstras. A going-away party was in progress for young



WHITE BANDS ON TV in Weller's laboratory are "lightning flashes" you see during electrical storm—simulated by using an unfiltered walkie-talkie

Mr. and Mrs. James Bolluyt, about to join the Peace Corps. Among the 16 adults present were Mr. and Mrs. George Vogel. A fire truck sped by with its beeper going—Orange City's tornado alert. But no one at the Van Steenwyks was alarmed.

"Hey—fellow in the morning paper claims you can see a tornado on TV," James Bolluyt remarked banteringly. "Let's try." The TV set was turned to Channel 2 and darkened, as everyone watched skeptically.

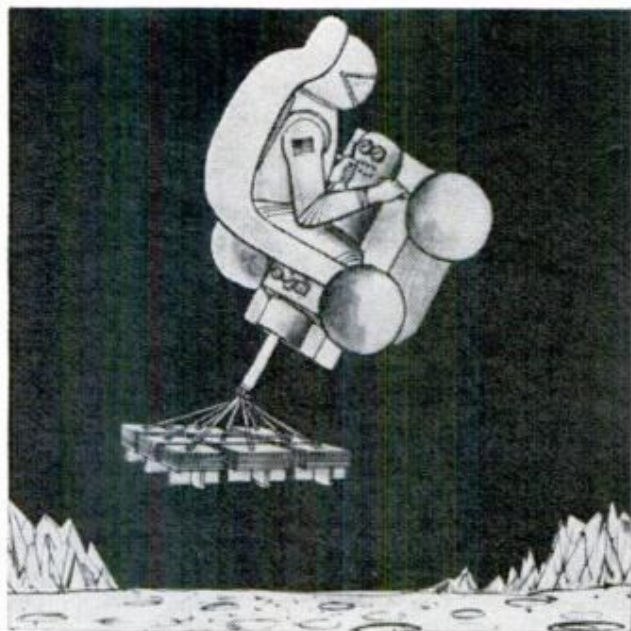
"But just like the fellow said," Van Steenwyk recalls, "we saw the horizontal streaks of lightning—ours in color, because we have color TV. All of a sudden that screen lit up—it was ghostly white. We couldn't believe it. Thought something was wrong with the TV and we turned the knob away down trying to get the brightness off, but it wouldn't go—it stayed white. We

(Please turn to page 225)



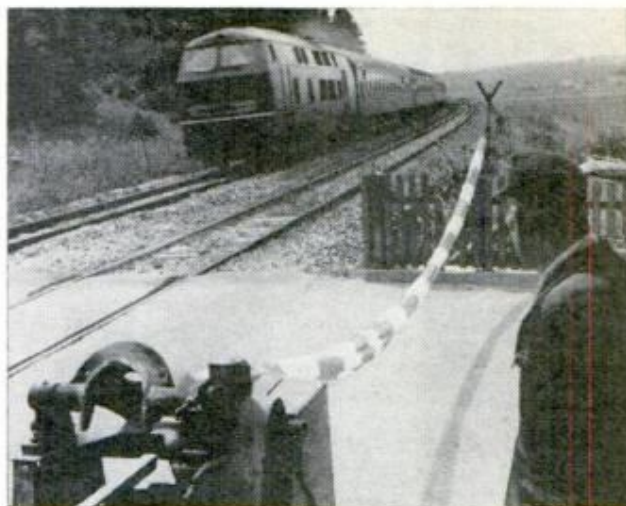
Plastic recaps

A German engineer has invented a plastic recapping strip for old tires, which, he says, can be mounted on the worn tires in just a few minutes at a service station.



Lunar leaper

A lunar pogo stick is being designed at Stanford University. It will take advantage of the moon's weak gravity to hop across the rugged moonscape in 50-foot jumps. Gyroscopes will keep the astronaut upright, and compressed gas in globes will fuel the mechanism at about 10 miles to the gallon.



Gate is real stopper

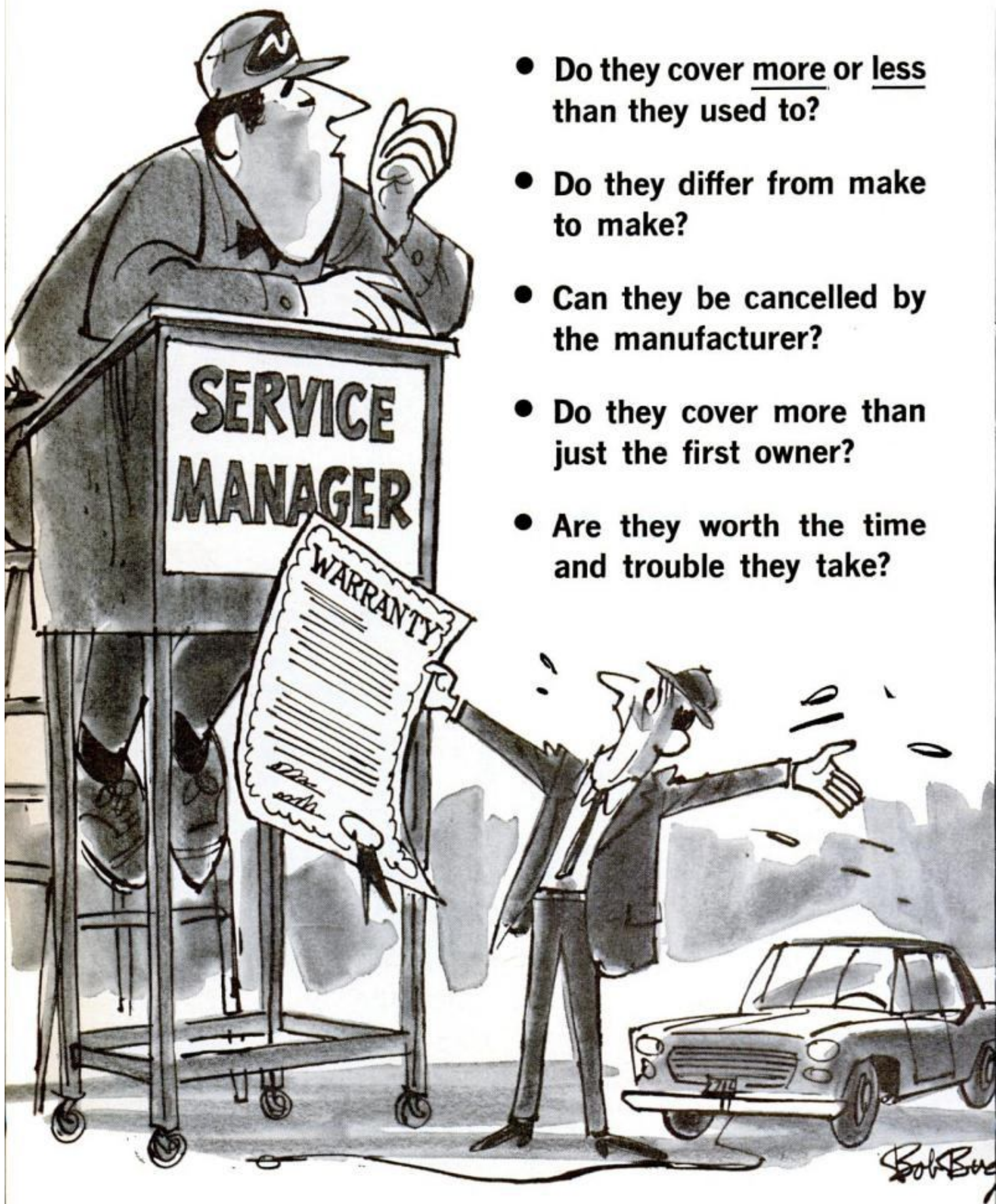
Becoming impatient when the bureaucracy of the German Railway system moved too slowly to replace damaged railroad crossing gates, crossing attendant Leo Beckmann solved his problem in an ingenious fashion. He made a gate of old Christmas decorations.



Copies in color

The first copying machine to reproduce color originals in full color is the "Color-in-Color" copier produced by the 3M Co. It requires no silver and utilizes dry reproduction technology to make an 8½ by 11-inch color image in one minute. Cost of each copy will be about 50 cents, which includes the machine costs. The copier will be available this year, according to 3M.

What's With the New



- Do they cover more or less than they used to?
- Do they differ from make to make?
- Can they be cancelled by the manufacturer?
- Do they cover more than just the first owner?
- Are they worth the time and trouble they take?

Auto Warranties?

By CURT CUTTER

THE GREAT LEAP BACKWARD on automobile warranties was announced last fall with the introduction of the 1969 cars.

Shrunken, simplified and standardized though they now are, these guarantees against defective parts and workmanship have settled down on a realistic basis and should prove valuable in the years to come for every buyer of a new car as well as for the first person who buys it as a used car.

The revised 1969 warranties on all General Motors, Ford Motor Co., Chrysler Corp. and American Motors cars cover:

- The entire car for 12 months or 12,000 miles, whichever comes first, for the first owner.
- The power train for five years or 50,000 miles, whichever comes first, for the first owner.
- The entire car for the unexpired portion of the 12 months or 12,000 miles, and the power train for the unexpired portion of the five years or 50,000 miles for the second owner, but not for the third or subsequent owners.

However, second owners must pay \$25 to have the warranties transferred to themselves at a dealership selling their make of car. Part of this fee goes for an inspection to make sure that the used car is worthy of a warranty. This registration must be done within 30 days or 1000 miles after the car has been sold.

In addition, if you're a second owner you must pay a \$25 deductible fee for each power-train claim after the 12-month-or-12,000-mile period ends.

Each manufacturer lists at least a half-dozen items of required maintenance if the warranty is to be kept valid. Only Chrysler now demands that owners have this maintenance certified or validated annually at one of its deal-

erships. GM and Ford used to require validation, but now—along with AMC—authorize their dealers to determine if, when free warranty work is requested, scheduled maintenance service has been performed.

Said one Chevrolet service manager, "If a man comes in after 10,000 miles and needs a valve job, and we find his engine full of sludge, the claim will be refused. Likewise, if he comes in with worn ball joints on a car that obviously has not been properly lubricated, his claim will not be honored.

"In other words, the manufacturer has authorized us to play this by ear. Any person who properly and reasonably maintains his car will get his full and fair warranty protection."

What's covered

From the motorists' standpoint, the Great Leap Backward on the 1969 warranties is that the guarantee against all defective parts and workmanship has been reduced from 24 months or 24,000 miles to 12 months or 12,000 miles, whichever comes first. Buyers of GM, Ford and AMC cars have received 24-and-24 warranties since the '63s were introduced. Chrysler Corp. introduced similar coverage with its 1967 cars. At the same time, the other three makers first began matching Chrysler's 5-and-50 power train warranty.

In addition, all four companies have reduced the warranty coverage on three components that were formerly included with the power train. For 1969, the suspensions, steering systems and wheels are guaranteed only for 12,000 miles or 12 months. They used to be warranted for five years or 50,000 miles.

All makers now more or less agree that the power train consists of engine block and head, internal engine parts,

Cutback on '69 warranties reduces car value at least \$40

water pump, intake manifold, transmission case, internal transmission parts, torque converter, driveshaft, universal joints, rear axle and differential.

The other major change in the 1969 and 1968 warranties is that they have gradually limited all protection to the new-car buyer and to the first person who buys the car from him. Ford and Chrysler made this change on their 1968 cars. GM and AMC followed suit for the 1969s. Practically all earlier warranties covered a car for all owners until its warranty expired.

According to Paul Rand Dixon, Federal Trade Commission chairman, the cutback on the 1969 warranties has reduced each new car's value at least \$40. The FTC has also issued a staff report based on a study started three years ago, that severely criticized the automakers for their warranties, for the quality of their cars and for their dealer service.

Attributing many of the problems to the industry's increase in production from six million to nine million cars a year, the report said the warranty performance of the manufacturers and the dealers was not up to the levels implied by the warranties.

Citing 3000 letters of complaint the FTC received about warranties, the report stated, "A majority of the writers complained that the dealer had refused to perform as required under the warranty, that defects in their cars were not corrected, and that manufacturers' representatives, when contacted, had failed to assure satisfaction."

Warranties more valuable

Nevertheless, these new warranties, which have become more or less standardized from company to company, and which hopefully will become more stabilized in the future, may well be more valuable to the consumer if only because much of the confusion that has surrounded warranties for many years

has been removed. Thus, for the first time since the Lincoln Continental started the "warranty race" in 1961, all warranties on new U.S. cars will remain substantially the same for the next several model years.

Full usage of the warranty by many owners has been restricted in the past because of confusion stemming from the wide variety of warranties offered and by frequent warranty changes made by the manufacturers. As automakers jockeyed to stay competitive with one another, or to practice a little one-upsmanship, some alterations in warranty clauses were even made in the middle of model years.

Although each carmaker has a slightly different list of maintenance requirements, each generally includes oil and filter changes, suspension lubrication, inspection and replacement of air-cleaner elements, positive crankcase ventilation valve inspection, and periodic replacement of transmission fluid and engine coolant.

Chrysler wants validation

To receive full warranty coverage on Chrysler Corp. cars, both first and second owners (if there is a second owner) must submit a validation form to Chrysler annually on the anniversary date of the delivery of the car to the first owner. Both owners must furnish evidence to a Chrysler Corp. dealer that all required maintenance services were performed at proper intervals. The dealer then must certify on a validation form supplied by the manufacturer that he is satisfied maintenance schedules have been met and that a car's mileage is true. Finally, the owner must mail the form to Chrysler.

It's important that this validation procedure be asked for by the vehicle owner, since most dealers will not volunteer the information. And make no mistake, no warranty claim will be honored without proper validation. All

companies insist that their warranties are invalid if there is any evidence the odometer has been tampered with. They insist on knowing a car's true mileage. If a car has been used by the manufacturer or a dealer (as a "demo," for example), the warranty begins when the car was first put into service, regardless of by whom.

Generally, the manufacturers also will invalidate warranties on all cars that have participated in competitive racing, have been modified for racing or other purposes, have been obviously misused and neglected, or that have been serviced with substandard parts or oil.

The auto companies assume no responsibility for (1) routine maintenance such as oil changes, tune-up, front-end alignment, wheel balancing, replacement of sparkplugs and oil filters, (2) repairs made necessary by accident, and (3) repairs dictated by normal deterioration of hoses, belts, upholstery, soft trim or appearance items because of wear or exposure.

Batteries, tires covered

Batteries are fully guaranteed for the first 12,000 miles or 12 months by the regular car warranty. Replacement in this period is made with no charge. Also, there is an additional 24-month warranty period in which the car owner is given credit toward a new battery in proportion to the number of months remaining in the overall 36-month guarantee.

All tires are covered by the tire manufacturer's guarantee. It's generally assumed that these original-equipment tires are warranted for the life of the original tread. Tire companies also make adjustments in proportion to the expected remaining life of the tire.

During the life of the original tread, and to the first purchaser, new tires are guaranteed against road-hazard failures such as blowouts, fabric breaks, bruises and snags that may make a tire unusable. However, this guarantee is not protection against punctures, run-

ning flat, fire, wrecks, chain cuts, or irregular wear and abuse.

A frequent cause of disputes between car owners and dealers revolves about the applicability of the warranty to leaks and squeaks in a new car. The companies generally will authorize fixing these problems if the car is brought in within the first 4000 to 6000 miles, depending on the manufacturer.

Paint damage is another bone of contention. The deliberately vague rule of most carmakers is that the buyer should call any paint or appearance imperfection to the attention of his dealer "without undue delay."

As a rule, special high-performance cars either have limited warranties or are excluded from warranty coverage.

Motorists with warranty claims are strongly urged to return to their selling dealer. Dealers other than the seller usually do not care for "outside" warranty work, and the selling dealer supposedly has the most incentive and the greatest responsibility to do the work and do it right.

However, if an owner moves, or if he is touring in another section of the continent, most dealers in the United States or Canada will perform warranty service, particularly if a motorist explains his situation. U.S. and Canadian warranties usually provide the same coverage.

Auto warranties have changed many times since the day in 1960 when Ford Motor Co. announced that the 1961 Lincoln was so well built it felt it could extend the traditional 90-day or 4000-mile warranty to 12 months or 12,000 miles.

Coverage proved costly

For its 1963 cars, Chrysler kept the same 12-and-12 contract for the entire car, but added a five-year and 50,000-mile guarantee for the power train. At this same time, the other makers began offering a 24-and-24 warranty for the whole car. But Chryslers' 5-and-50 power-train coverage was just too strong a

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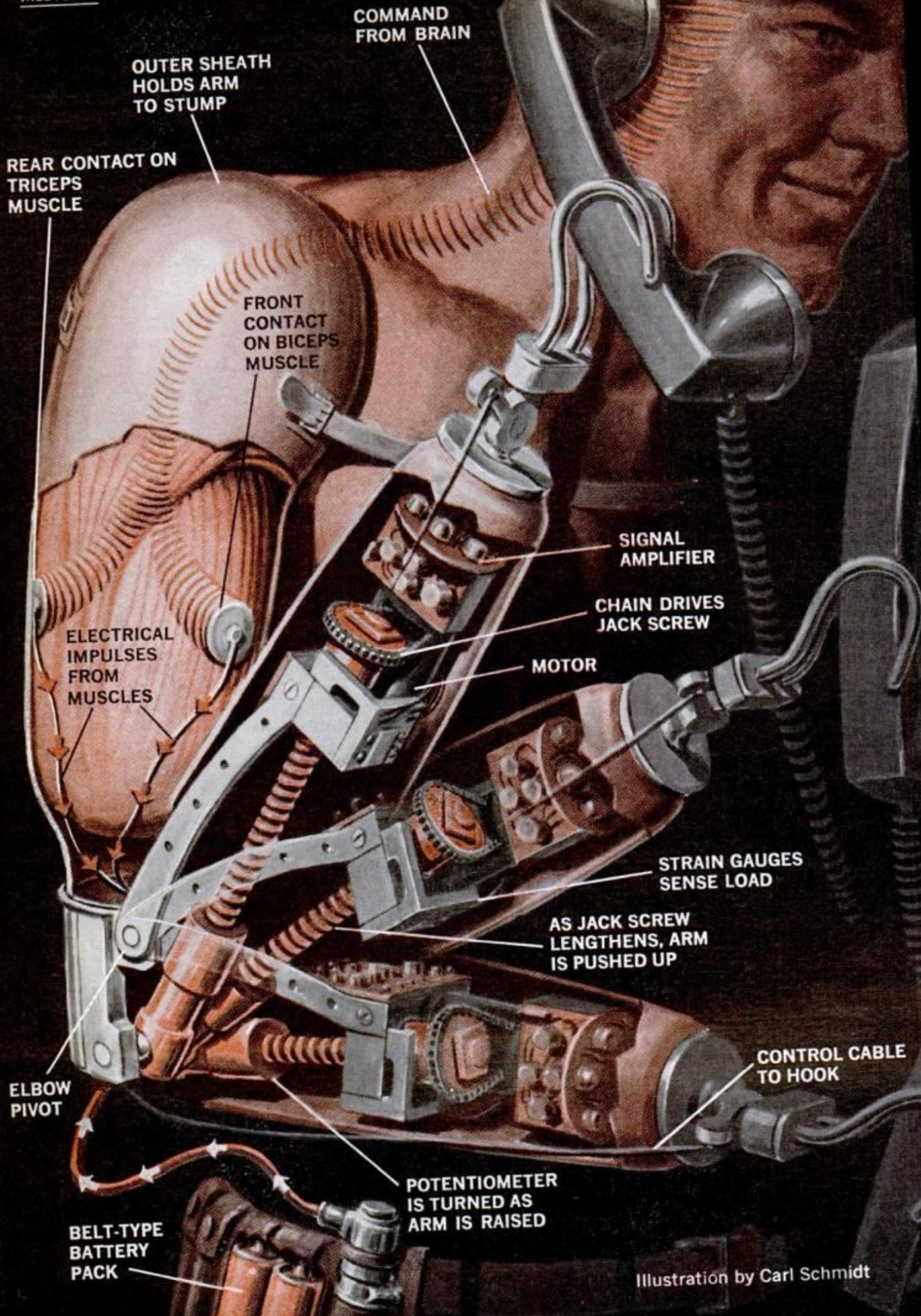


Illustration by Carl Schmidt

THE AMAZING 'BOSTON ARM'

An ingenious new artificial limb taps the body's own electrical impulses to respond like a real one

By ARTHUR S. FREESE

THE MAN BELOW is picking up a telephone with an artificial arm controlled by his thoughts alone. If he "wills" the arm up, it comes up; if he "wills" it down, it will straighten out. For all practical purposes, he controls the mechanical limb in the same way he would a real one—by command signals from the brain that tell the body's muscles what to do.

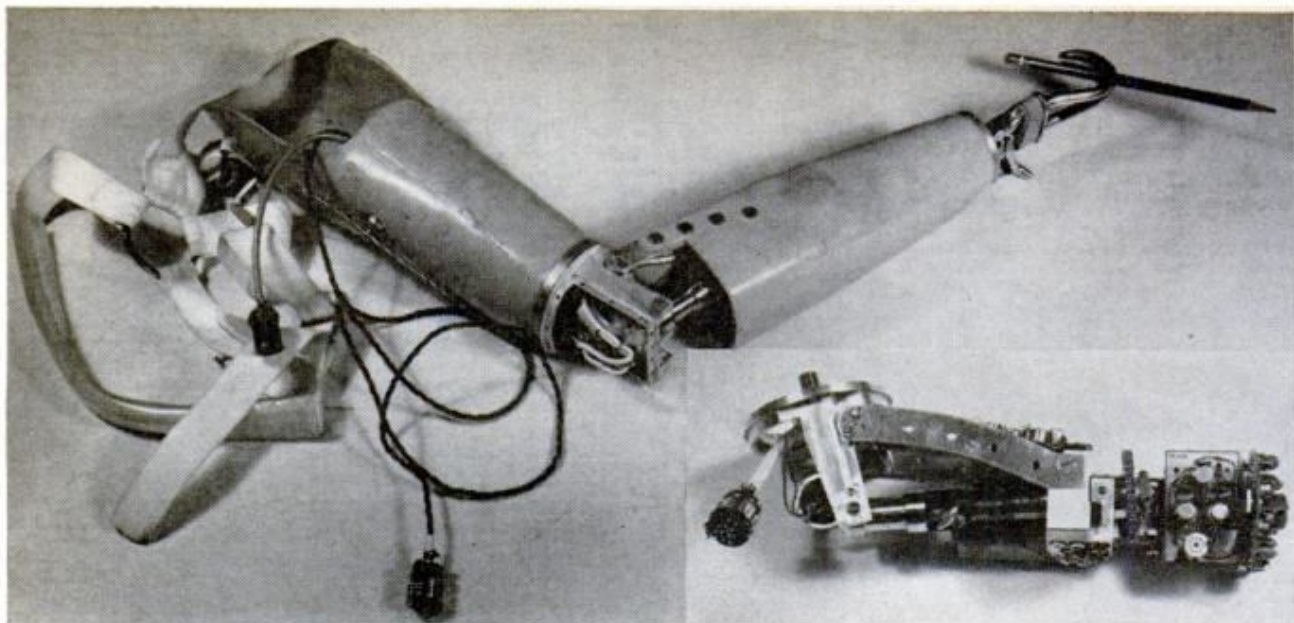
This amazing device, developed in Boston by a team of doctors, engineers and electronic experts, has become known as the "Boston Arm." It brings new life and hope to hundreds of thousands of upper-arm amputees—those who have had an arm removed below the shoulder. So long as some of the original arm muscle is still intact, the

new arm will work. What it does is use the electrical energy generated by the old severed muscles in the stump to move a mechanical linkage substituting for the lost arm.

Using the new artificial limb, an amputee can pick up a cup of water and drink it, answer the telephone, move objects in any direction, even lift a 10-pound weight. This is only the beginning, too, because a basic breakthrough has been made—otherwise useless muscles can now perform important tasks. If severed muscles in an arm stump can move a hand to answer the telephone, other muscles in the body may be harnessed to let a

CUTAWAY shows how ingeniously simple screw jack arrangement raises and lowers arm like a car jack. Tiny motor turns screw according to electrical signals from real muscles—the greater the muscle voltage, the faster the arm moves. Strain gauges measure weight on arm so user can tell how heavy a load he is picking up. Potentiometer at elbow pivot senses speed of movement by its changing resistance





IN COMPLETED ARM, the mechanical and electronic components are encased in a flesh-colored fiberglass sheath covering all but the elbow pivot. Upper-arm section is slipped over the amputee's stump and held by shoulder straps. Inset photo at right shows motor, jack screw and electronic control circuitry that are hidden inside the forearm section



PICKING UP A BOX with two hands, one real and one artificial, an amputee shows how the mechanical device is so sensitive he can easily balance the weight between the two to keep the box level. The amount of muscle tension required to lift the box is determined by strain gauges inside the device

legless person walk or a paralytic victim move.

These exciting possibilities come from the new ultrasophisticated technology of bioengineering—literally combining human and mechanical functions into single living systems. Dr. Melvin J. Glimcher, professor of orthopedic surgery at Harvard University, is a principal developer of the new prosthesis—artificial replacement—along with Prof. Robert W. Mann of the Massachusetts Institute of Technology and the National Academy of Sciences.

Their work comes at an important time for thousands of amputees returning from the Vietnamese War, plus the estimated 1500 or so amputees produced annually in this country through auto and other accidents. Doctors working in rehabilitation centers have long been aware that many amputees are reluctant to use the older type of replacement arm. Operated by a complex system of cables and harnesses, it not only is limited in what it can do, but it requires a series of difficult and embarrassing contortions to make it work.

The new Boston Arm works smoothly and naturally. Except for its hook, it might well pass as a normal arm. Eventually, it may be possible to replace the hook with an artificial hand having movable fingers for an even



WITH ELECTRICAL CONTACTS strapped to his arm, author Arthur Freese shows how anyone can operate the artificial limb after only a few minutes' prac-

tice. As he tenses muscles to raise his own arm, test arm clamped to bench begins to rise, too. Mechanical arm follows every move the real arm makes

more realistic appearance. Because the arm works like a real one, little training is required to learn to use it.

To see the Boston Arm, I visited the Liberty Mutual Insurance Co.'s Research Center in Hopkinton, Mass., 25 miles from Boston. I was ushered into a crowded room that looked more like a radio repair shop than a medical research laboratory. The walls and benchtops were jammed with electronic gear, including the TV-like eye of an oscilloscope.

Cord Ohlenbusch, an electrical engineer, and David Russell, a mechanical engineer, had been commissioned by Liberty Mutual to handle the actual construction of the experimental arm under the guidance of Dr. Glimcher, Prof. Mann and Dr. Allen L. Cudworth, director of the Liberty Mutual Research Center. Within two years, they had come up with a practical, working model—the remarkable device that now lay before me on a table.

In the late 1950s, the British and Russians devised an artificial hand controlled by electrical signals from resid-

ual muscles in the forearm. It was, however, merely a simple “go-no go” affair in which the hand—a two-part pincher—could only be opened or closed with no control over strength or speed.

Dr. Glimcher set out to develop a better system. One mathematician he consulted was Dr. Norbert Wiener who in 1948 had introduced his now-famous theory of cybernetics—the study of automatic control and communication processes in both machines and living creatures. This broad new science seeks to find common grounds in operations as diverse as your nervous system and an electronic computer.

Just as the power steering in your car amplifies the force of your hands and transmits it to the wheels, the idea gradually evolved that an electro-mechanical system could be used to amplify the power of once-useless muscles and transmit it to an artificial extension. What happens is this. When you tense a muscle, it generates a tiny electrical current, barely a few thousandths of a volt. The harder you contract the

. . . I was amazed to find that I could control the arm perfectly . . .

muscle, the more voltage it produces.

The Liberty Mutual researchers discovered they could tape electrodes over the biceps and triceps muscles in an amputee's arm stump, feed the signals to an oscilloscope, and actually watch the muscle action on the screen. As the amputee tightened his muscles as if to raise his arm, the blips on the screen would sharpen into peaks, then subside as the amputee relaxed.

In the Boston Arm, these minute muscle voltages, known as electromyographic or EMG signals, are amplified and used to control a small, high-speed motor inside the artificial extension. The 7800-rpm motor turns a threaded shaft that works like the screw in an automobile jack. When the amputee tightens his stump muscles, electrodes taped to his skin pick off the EMG signals and feed them to an electronic circuit that switches on the motor. The jackscrew starts turning, slowly pushing up the artificial extension, an aluminum frame pivoted at the elbow.

The harder the amputee works his muscles, the more EMG voltage is generated and the faster the arm comes up—just as a real arm would. The actual power source for the motor is a rechargeable battery pack worn at the waist. The tiny muscle voltage merely acts as a control signal.

But this is only part of the story. If all the arm did was turn on when an amputee flexed his muscles, it would simply fly up with a bang, incapable of being precisely controlled. The Liberty Mutual researchers found they needed to give the amputee a way of sensing how much weight the arm was picking up and how fast it was moving—in other words, it had to have the “feel” of a real arm.

This is where the Boston Arm is truly ingenious. Its secret lies in the

principle of feedback—the technique of feeding back part of a resulting reaction to control the initial action. A governor on an engine is a good example. As the engine turns faster, its own speed is used to trip a control that slows it down.

In the arm, strain gauges in the drive linkage measure the load on the hook, producing a negative feedback voltage in proportion to the weight. Since this is a negative voltage, it is, in effect, subtracted from the positive muscle voltage. The muscles must, therefore, work that much harder to overcome the negative feedback voltage and pick up the load. It takes twice as much muscle effort to lift a four-pound load than a two-pound load. In this way, the amputee can tell how much weight he is lifting.

As the arm comes up and the strain on it lessens, the negative feedback voltage automatically decreases, telling the amputee that he doesn't have to work so hard and can ease off. At the same time, a potentiometer located at the pivot point in the elbow is rotated as the arm is raised. The potentiometer is a variable resistor, just like the volume control on a radio. As it is turned, its resistance varies according to the position of the arm and how fast it accelerates. The faster the arm moves, the greater the rate of change in resistance.

This, too, produces a negative feedback voltage that must be overcome by the positive muscle voltage. Thus, if the arm is already moving fast, generating a large negative voltage, the amputee would really have to work to overcome this and speed up the arm even more. This keeps the arm from being raised too fast accidentally.

As the amputee relaxes his muscles, the positive voltage decreases and the motor slows down. At the point where the negative feedback voltage becomes greater than the positive muscle voltage, the polarity of current to the motor is reversed and the motor starts to

(Please turn to page 231)



It's a Doppelganger special—for just \$24,000

Built for the upcoming space-exploration film, *Doppelganger*, this sleek 44-inch-high car was constructed around a Ford chassis and engine. Its top speed is about 140 mph.



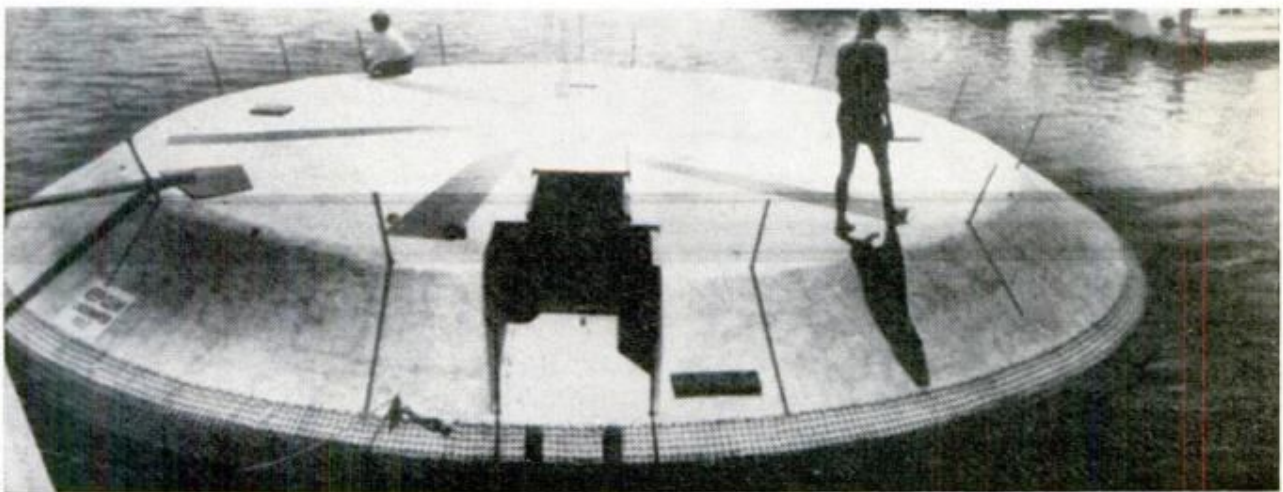
Motorized rescue

Gas-powered and mounted on a single tail wheel from a Lancaster bomber, the "Ulls-water Fellbouncer" is a motorized stretcher used to transport injured mountain climbers.



100 mph standing still

David Spry of the British ski-bob team gets the feel of traveling 100 mph downhill just standing still in a wind tunnel at the College of Aeronautics at Cranfield.

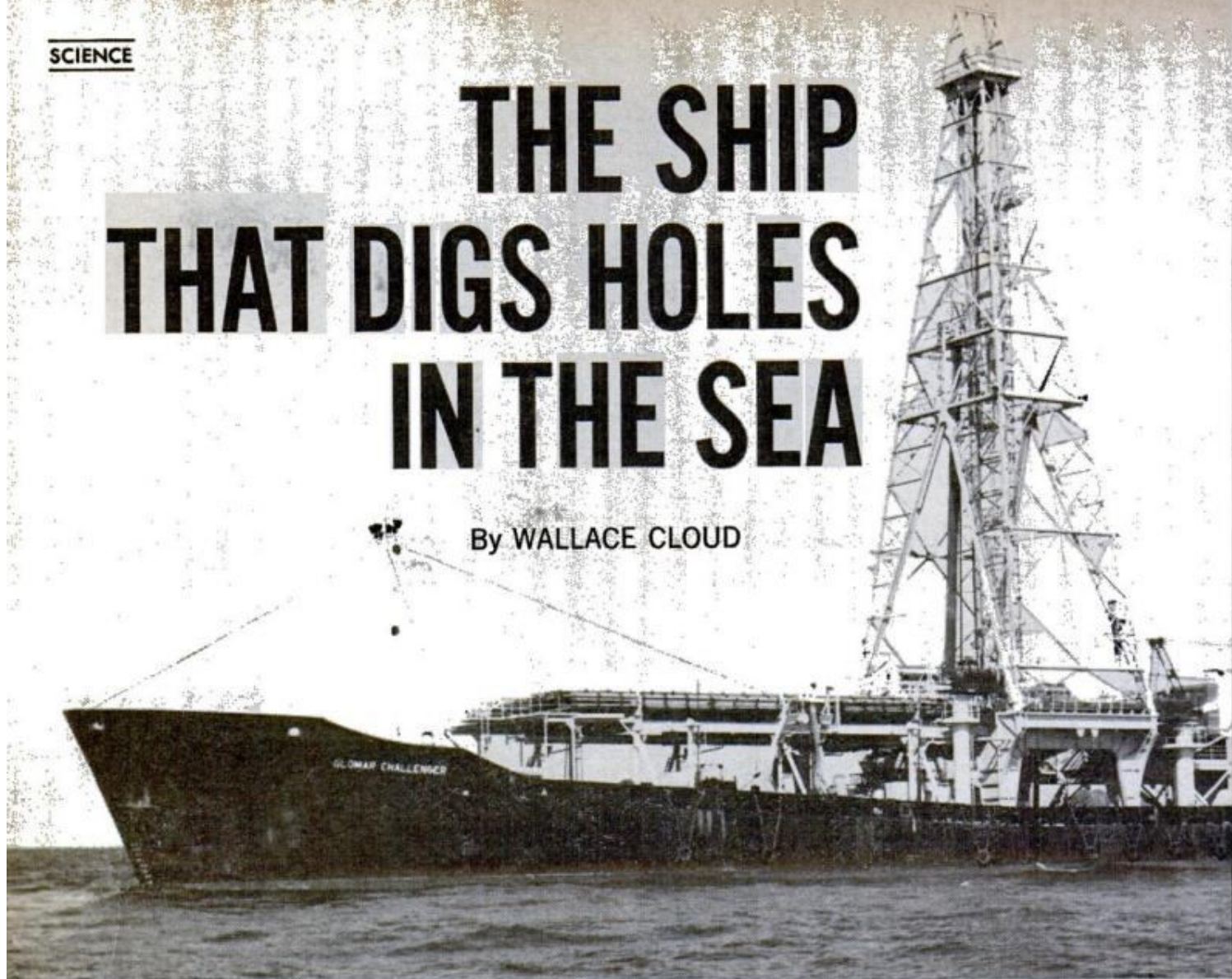


Yachtsman to sail around world in 'Top Secret'

California yachtsman C. M. Christensen plans to sail this fiberglass saucer around the world. It reportedly rides on foils, but beyond that, details—like its name—are *Top Secret*.

THE SHIP THAT DIGS HOLES IN THE SEA

By WALLACE CLOUD



Glomar Challenger has dug its drills deeper into the ocean floor than anything before to bring up samples that may unravel the mysteries of the Earth's underwater crust

IT WASN'T LIKE BEING on a ship, more like a floating island." That's what Dr. J. Lamar Worzel, of Columbia University's Lamont Geological Observatory, said about his three months aboard the *Glomar Challenger*. The ship's stabilizing system, he explained, is so good that she rolls no more than 6° in a rough sea; other research vessels often roll as much as 30°. Dr. Worzel was one of the chief scientists during the first leg of the drilling ship's current 18-month round-the-world voyage of oceanographic discovery.

The *Glomar Challenger*, first ship

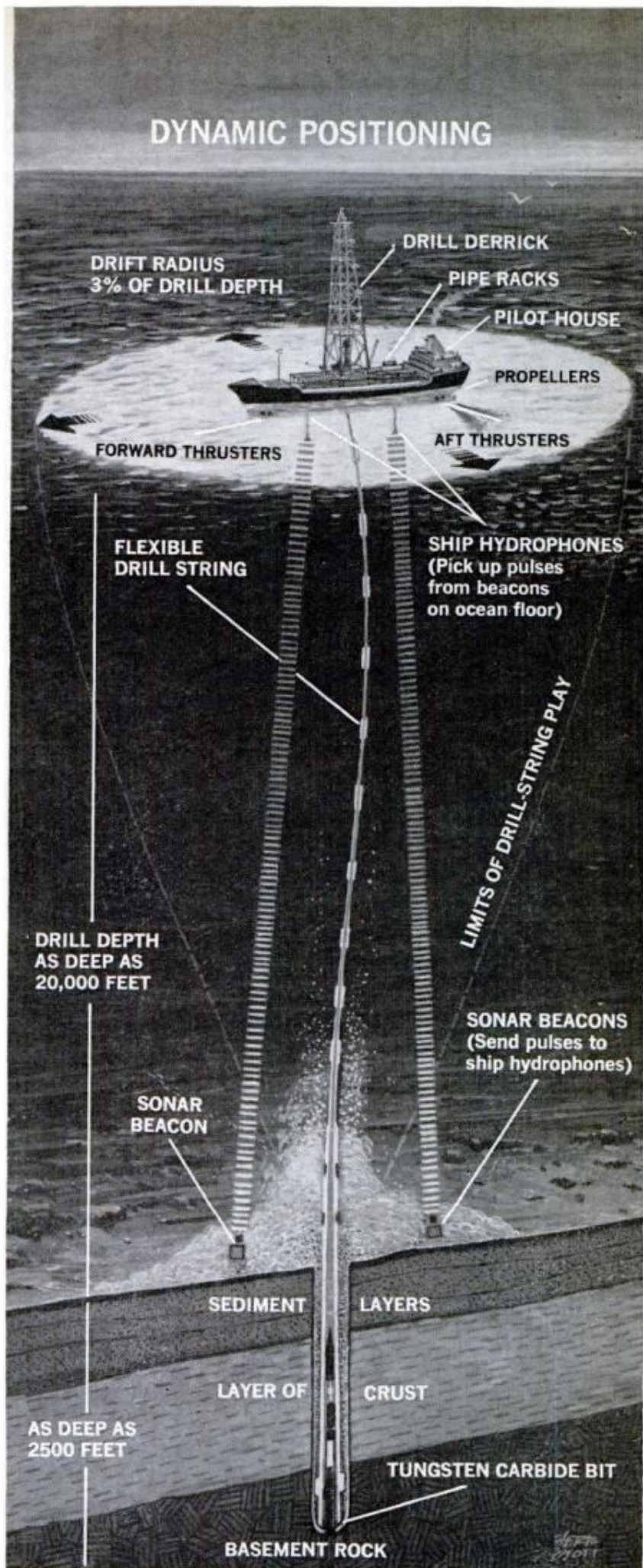
able to drill into the sea floor and retrieve samples, or cores, of rock in water down to 20,000 feet deep, has already produced some surprises. Most sensational was the discovery of oil under 11,720 feet of water in the Gulf of Mexico, midway between Louisiana and Yucatan. Dr. Worzel was cautious, but the find vindicated his theory that the mysterious bumps distributed widely under the Gulf of Mexico, known as the Sigsbee Knolls, are really salt domes, often associated with oil fields on land. And it was the first time anyone had struck oil in the deep ocean. (All offshore oil wells so far are



A FLOATING DOUGHNUT, *Glomar Challenger* rides in deep seas with hole in middle to drop up to three miles of drilling pipe to ocean floor

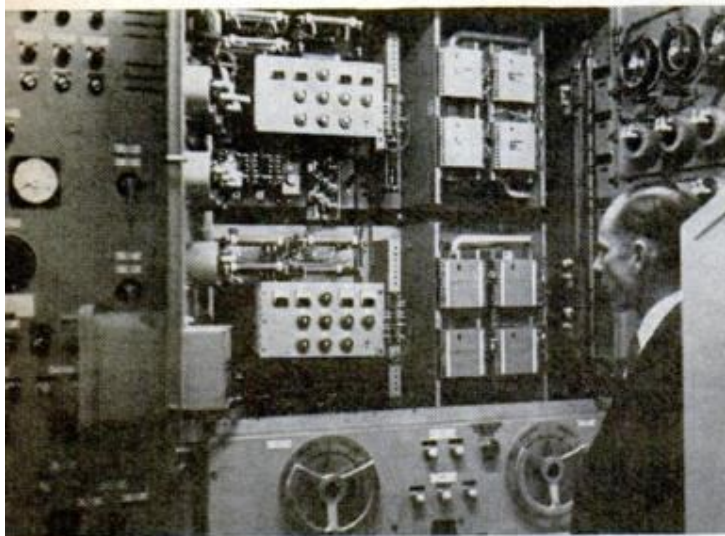
DYNAMIC POSITIONING enables ship to station itself over preselected site and stay there within 3° radius, even though drill hole may be 20,000 feet below. Sonar-beacon signals, picked up by ship hydrophones, are interpreted by on-board computers, which automatically maneuver ship through normal propellers and four "tunnel thrusters" for sideways movement. *Challenger*, which will make 18-month around-the-world exploration of ocean floor, is currently on Atlantic leg of voyage. Deepest drilling on first leg was in 17,600 feet of water; deepest penetration into ocean floor was 2500 feet

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DRILL RIG towers above deck. Crown block rides between two guide beams and supports drill string



COMPUTER ROOM controls ship over drill site, interpreting signals from beacons on ocean floor



SHIP'S ROUTE through Atlantic Ocean included leg in Gulf of Mexico where oil was discovered at depth of nearly 12,000 feet, deepest oil strike in history

found in depths of less than 1000 feet.

The oceanographic expedition is not primarily aimed at discovering oil. The Deep Sea Drilling Project is a \$12.6-million effort, sponsored by the U.S. National Science Foundation, to find out more about the early history of the earth by drilling into compressed ocean-floor sediments laid down millions of years ago. Until now there has been no way to probe very deep into those sediment layers, but the *Glomar Challenger* can penetrate more than 2500 feet into sea-floor rock. Deepest drilling on the first leg was in 17,600 feet of water. The deepest core came from 2528 feet below the sea floor.

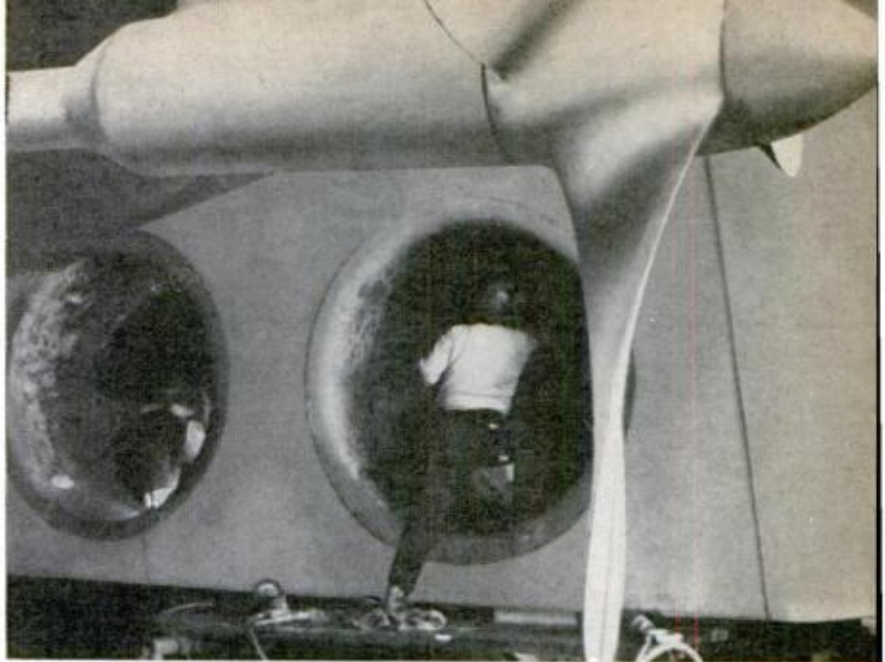
The unique 400-foot-long, 12.5-knot ship was designed by Global Marine Inc., its owner and operator. Scientific work on the project is being carried out jointly by the Scripps Institution of Oceanography of the University of California, the Institute of Marine Science of the University of Miami, the Woods Hole Oceanographic Institution in Massachusetts, and the Lamont Observatory, under the management of Scripps.

The design of the *Glomar Challenger* appears to have solved some of the major problems of deep-ocean drilling. The most important problem was to keep the ship standing still during drilling. Anchoring in water three or four miles deep is not feasible. So a "dynamic positioning" system was devised.

At the drill site, sonar beacons are dropped to the bottom, where they continuously emit high-frequency sound pulses. The signals are picked up by hydrophones—underwater microphones—beneath the ship, and a computer takes over, maneuvering the ship to home on the signals. This is done accurately with the aid of "tunnel thrusters"—four propellers in tunnels that run straight across the ship, two in the *Challenger's* bow and two in her stern skeg. Each produces 17,000 pounds of thrust. They enable the vessel to move sideways, or to turn with-



DRILL BIT is at bottom of drill string. Hole is plugged during drilling, unplugged when the core is to be taken up



TUNNEL THRUSTERS, located fore and aft, control ship's lateral movements over drill site. Two propellers are also synchronized to control forward and reverse movements of ship

out steerage way. The thrusters are used in combination with the ship's main propellers to hold the ship steady while drilling.

At the end of the first leg of her voyage, the *Glomar Challenger* was brought into the Bethlehem Steel Corp. shipyard in Hoboken, N.J., and placed in drydock for a few days. I visited the ship there.

Jack Reed of Global Marine, the *Challenger's* manager, explained that accuracy of the positioning system is such that it keeps the ship inside a circle with a radius that is three percent of the water depth at the drilling site. For example, if the water is 10,000 feet deep, the ship will not drift more than 300 feet off the drill hole. The drill string is flexible enough to bend that much and keep operating.

In the *Glomar Challenger's* engine room, Reed showed me the bewildering panels of electrical switching gear that control the thrusters and propulsion motors under command of the computer in the deckhouse above. Ten big Caterpillar diesel engines drive generators that supply power to General Electric 750-hp motors of the type used in diesel-electric locomotives. To drive each of the ship's main propellers, three of these motors are ganged

on a single shaft. Each of the four thrusters has its own 750-hp electric motor. During drilling operations, the same diesel generators also supply the power for the drilling machinery.

The drill rig is the most obvious thing about the *Glomar Challenger* when you first see the ship. Its derrick towers 142 feet above the drilling platform that is built over the vessel's main deck—a total of nearly 200 feet above the water line.

Forward of the derrick is the racker that carries 24,000 feet of the 5-inch pipe that is used to make up the drill string; another 14,000 feet of drill pipe is stored in holds below deck. The pipe is carried and handled in "triples"—three 30-foot lengths screwed together. Under the derrick is the drilling floor where the ship's roughnecks operate the drilling machinery—big winches that hoist up the stands of pipe that are joined to reach down to the ocean floor, the "power sub" or hydraulic drive unit that is attached to the top of the drill string to turn it and the drill bit that bites into the bottom rock, the pumps that force seawater down the drill pipe to lubricate the bit and flush out the drill hole.

Up in the derrick is the crown block,

(Please turn to page 236)

A Reality at Last:

THE FAMILY AUTOGYRO



TWO-PLACE GYROPLANE cruises at 120 mph, has a 300-mile range with a load of 550 pounds, including two passengers. Single rotor spins freely; forward motion comes from pusher prop between twin booms

By **ROBERT ZIMMERMAN**

THE AUTOGYRO IS CHURNING back into the sky. The McCulloch Aircraft Corp., El Segundo, Calif., calls its stubby two-seater the J-2 Gyroplane.

The Gyroplane takes off with a run of about 40 feet, climbs at 1000 feet per minute and cruises at 120 miles per hour. The pilot can throttle down to 30 miles per hour and maintain altitude and control with no fear of stalling. He can land at an incredible 28 miles per hour to roll to a quick, braked stop.

The J-2 carries a price tag of \$15,950—about half that of a light helicopter. McCulloch instructors claim a pilot can solo after eight hours.

Unlike a helicopter, an autogyro needs forward speed to keep flying. A conventional propeller pulls or pushes the aircraft along, with its unpowered rotor tilted slightly backward to catch the airstream like a windmill. The air-



UP AND AWAY in 40 feet, J-2 climbs 1000 feet per minute. Stub "wings"—not needed for lift—hold fuel



EASILY TRAILERABLE by removing the rotor, the J-2 weighs only 900 pounds, can be loaded by two men

stream keeps the pitched blades spinning and produces lift.

New light metals and advances in design have drastically reduced the weight of rotors and made them stronger, and the 180-hp Lycoming engine that drives a pusher-propeller in the new Gyroplane weighs half as much as a comparable engine did in the 1930s. The J-2's takeoff weight is just under 1500 pounds.

Pilot and passenger sit side by side in the Gyroplane cabin, just ahead of the engine. A control stick tilts the angle of the rotor for banking, climbing and descent, while foot pedals move the twin rudders.

After starting the engine, the pilot raises a clutch lever and power is supplied to the rotor. When the rotor speed reaches 520 rpm he releases the lever, which simultaneously frees the rotor and changes blade pitch to a 5° angle. Once disengaged, the rotor gets no more power from the engine. Now power is applied to the pusher-prop and the Gyroplane moves through its short takeoff roll.

In the event of a power failure, the autorotating blades allow a fully controlled descent. The worst that could happen would be an unscheduled landing and possible low-speed collision with an obstacle. ★★ ★



PUSHER PROP provides forward motion that keeps rotor spinning. J-2 then flies like fixed-wing craft

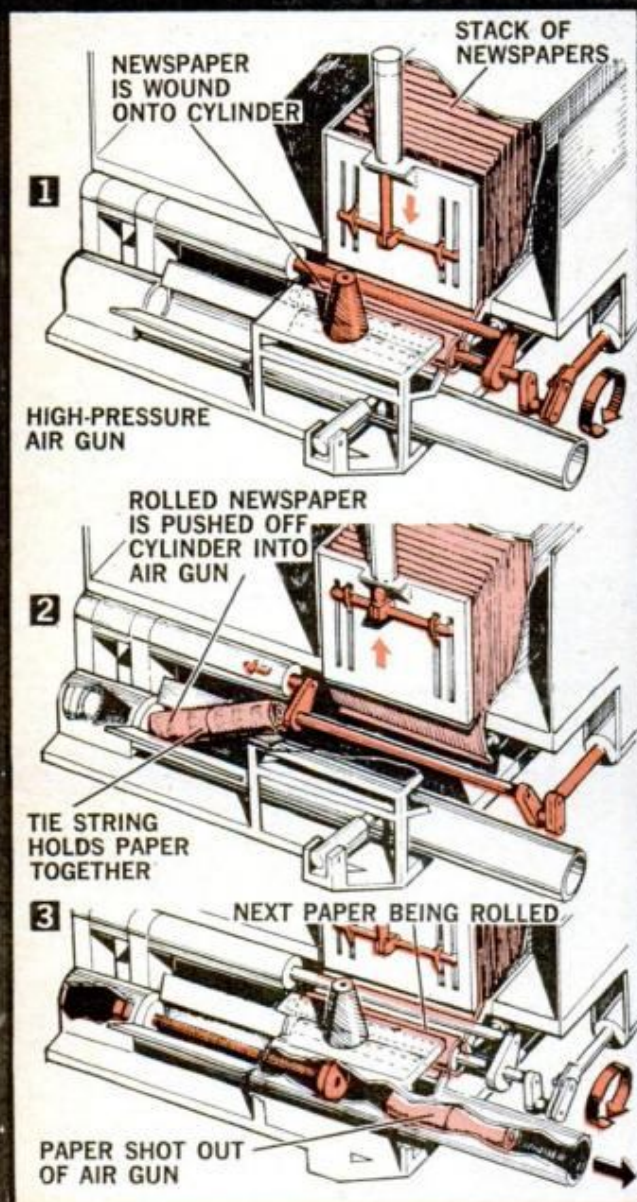


GYROPLANE LEAPS OFF at 30 mph when blade is tilted 5°. Stubby craft is virtually spin-and-stallproof

Just patented

PM'S PICK OF THE NEW INVENTIONS

Prepared in cooperation with Roger S. Shashoua, Director, International Inventors Association, Inc.

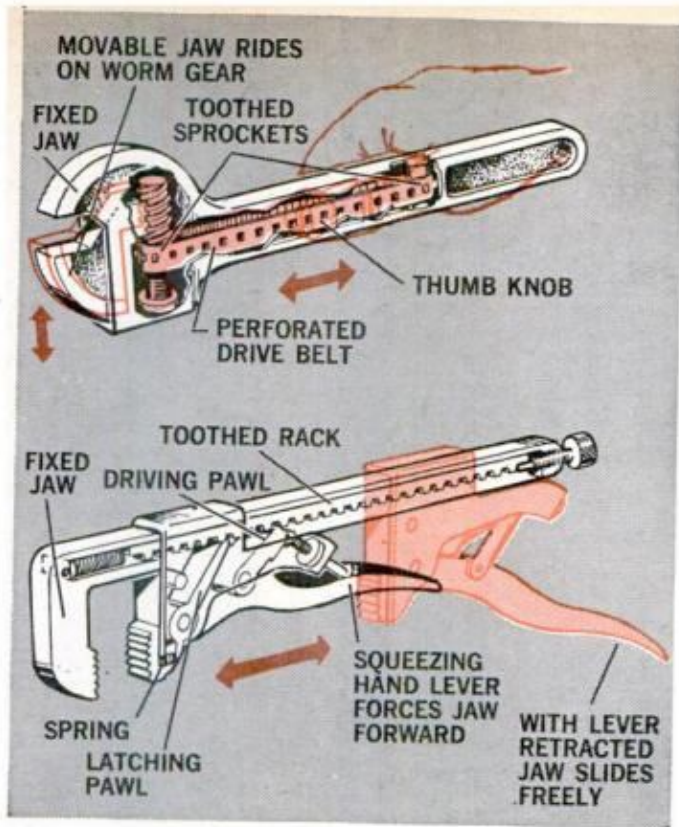


1. THIS MECHANICAL NEWSBOY shoots your daily newspaper onto the front lawn at the touch of a button. The truck carries a supply of papers in a spring-loaded stack. As it cruises slowly along the street, the papers are fed one by one onto a rotating cylinder where they're wound and tied into rolls. Each roll then slides off the cylinder and drops automatically into a powerful air gun. At each house, the driver fires the gun, propelling a neatly rolled newspaper practically to your doorstep

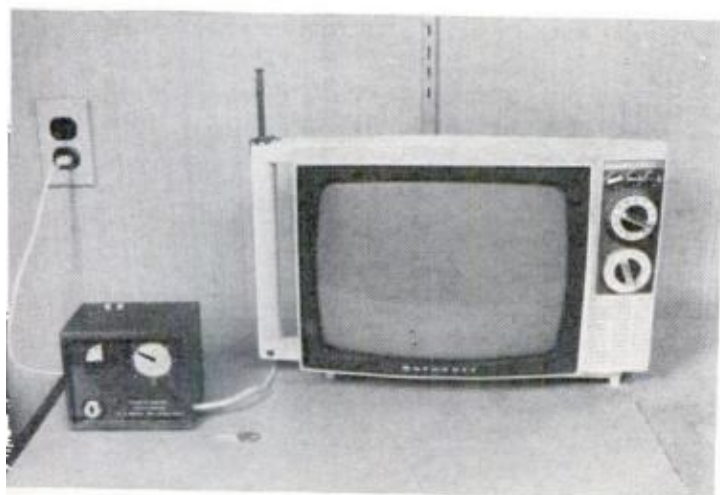


2. YOUR DOG WON'T GO HUNGRY when he's all alone with the delayed-action feeder at left. You fill it with food, close the hinged lid, and set a dial to the desired feeding time—up to 12 hours ahead. At the preset time, the lid pops open and your dog eats, even if you can't be home. For foods that require water to be added, there's a 16-ounce reservoir in the lid. As the lid tilts up, the water runs automatically into the food bowl

Inventors of the items shown on these pages are as follows: 1. John L. Powell, Jr., 2823 Walnut St., and Marion L. Mayo, Oak Hill Rd., both of Texarkana, Tex. (No. 3,375,635); 2. Pet-O-Matic, 1805 Flower St., Glendale, Calif.; 3. top wrench) Kenneth F. Halls, Broomfield, Colo. (No. 3,368,432) and (bottom wrench) John Legrande, 419 Jackson Ave.,



3. A FLICK OF THE FINGER is all it takes to tighten the two fast-acting wrenches above. In the adjustable wrench at top, the worm gear is rotated by a thumb knob on a tiny drive belt. All you do is slide the knob forward until the jaws lock on the work. The jaws can't loosen until the knob is retracted to unwind the worm. In the pipe wrench at bottom, the movable jaw is free to slide along the frame so you can quickly push it up against the work regardless of the size. Squeezing the hand lever then forces a pawl into a toothed rack, driving the jaw forward to lock it tightly on the work.

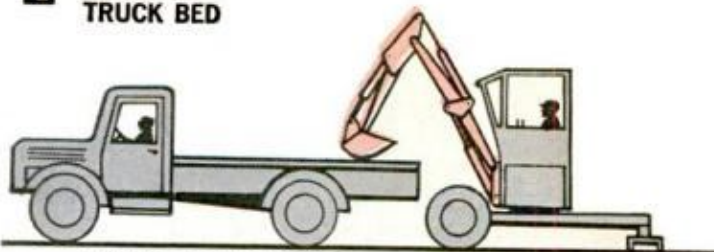


4. WANT TO RATION your youngsters' TV viewing? The timer control shown at left above can be set for the total viewing time you permit each day, say two hours. Children can watch any combination of programs that add up to two hours. At that point, power to the set is cut off and won't come back on until the next day. A special key permits Mom and Dad to override the control for their own viewing.

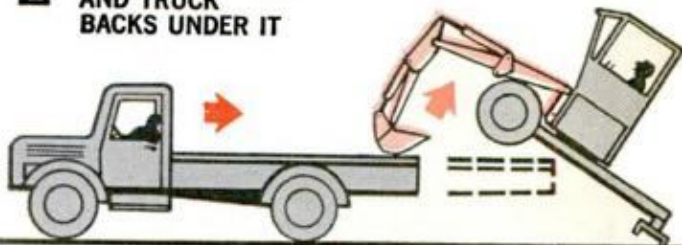
Westwood, N. J. (No. 3,354,755); 4. D. G. Noiles, 114 Elm Place, New Canaan, Conn.; 5. Ernst Menzi AG, Schweiz, Switzerland. Anyone interested in bringing new inventions to the attention of Roger Shashoua can reach him at the International Inventors Assn., Inc., 680 Fifth Ave., New York 10019.

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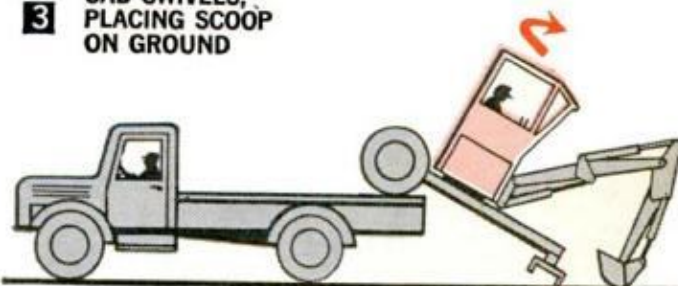
1 SCOOP PRESSES DOWN ON TRUCK BED



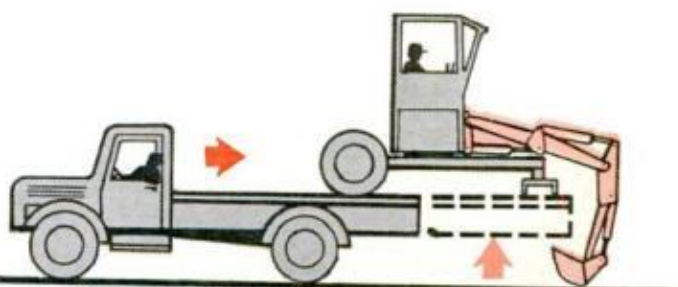
2 HYDRAULIC PISTONS RAISE FRONT END, AND TRUCK BACKS UNDER IT



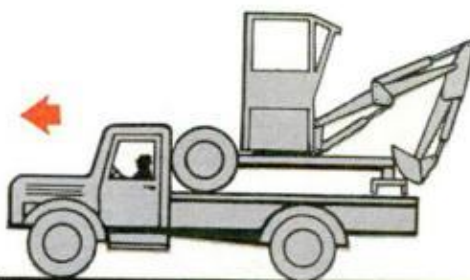
3 CAB SWIVELS, PLACING SCOOP ON GROUND



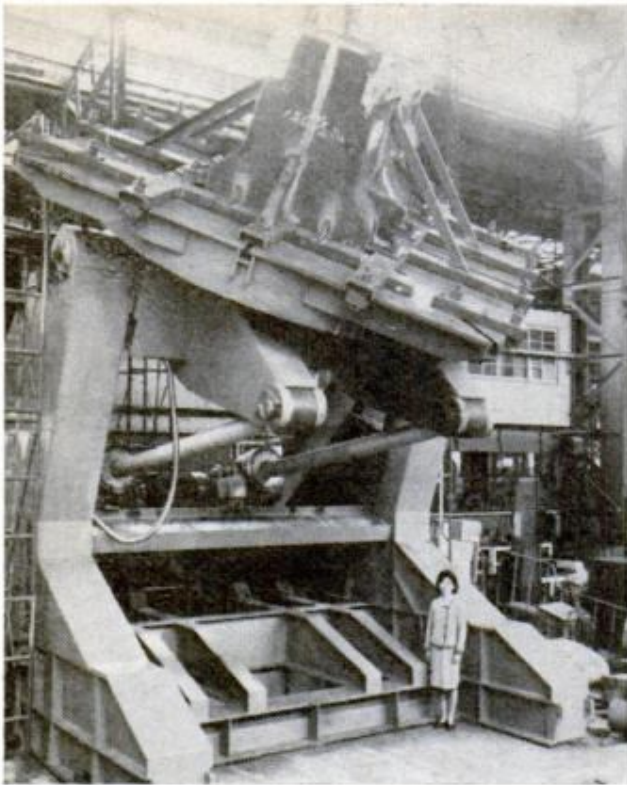
4 REAR END COMES UP AND TRUCK BACKS UNDER IT



5 SCOOP IS RAISED READY FOR TRAVEL

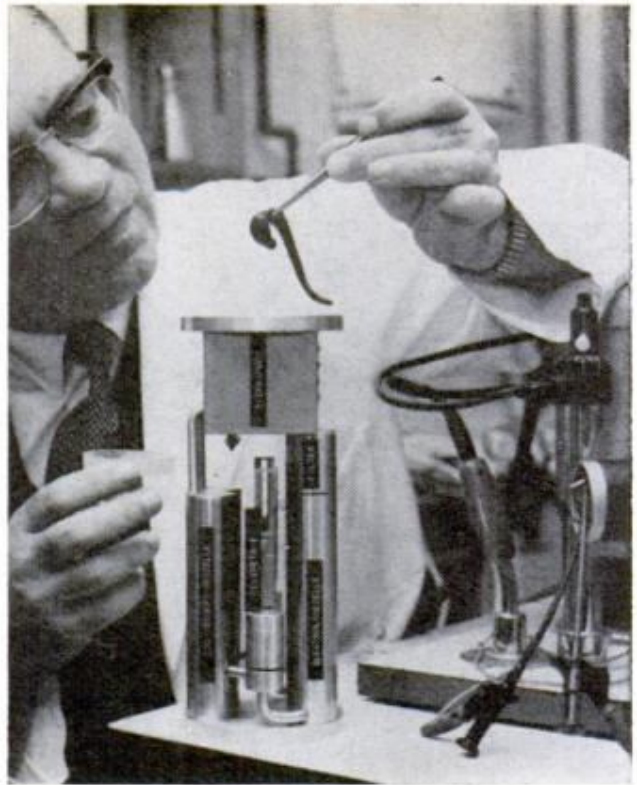


5. LOOKING ALMOST ALIVE, the unusual trench digger above doesn't need any help climbing aboard its carrier truck when it's ready to leave a job. Using its hydraulic scoop like a giant mechanical arm, it lifts first one end, then the other end, onto the truck bed, doing all the work itself. By reversing the procedure, it can also get itself off the truck bed when it's delivered to a new location.



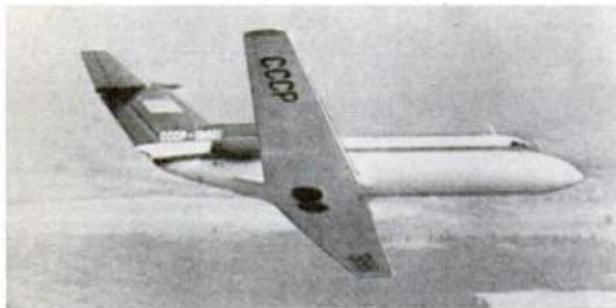
100-ton tipper

World's largest welding positioner, built by Kobe Steel, Ltd., will hold an object up to 100 tons in weight, rotating and tilting it to increase welding efficiency.



Wiggly astronauts

Germany's first astronauts will be four leeches; they'll circle the Earth for a year supplying information about living in space. They can live over a year without food.



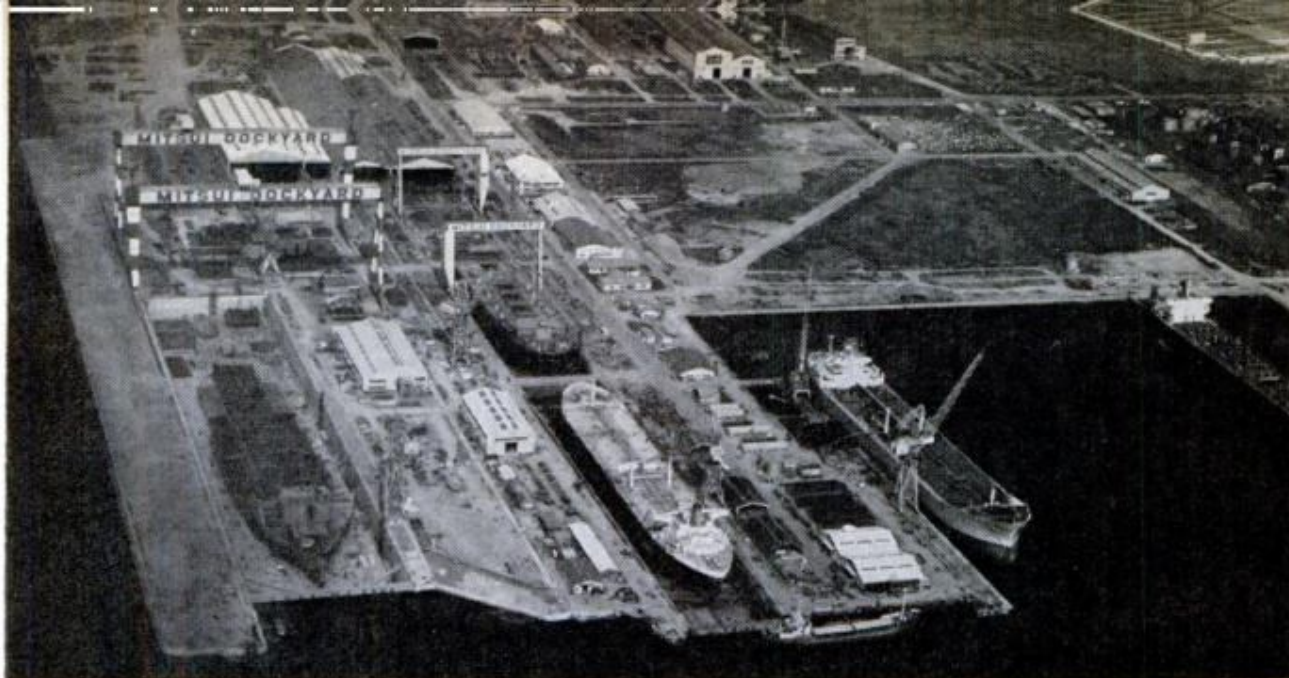
New Soviet jet

A new Soviet light jet transport plane, dubbed the JAK-40, is shown here in a turn during evaluation trials. The new craft has rear-mounted engines and looks similar to transport aircraft in use in Western countries.

Houseboat that really looks like a house

Appropriately enough, the craft below was built by an English firm called Floating Homes, Ltd. The 18-ton structure has a large balcony bedroom, a replica-stone fireplace and is fully insulated with double-glazed windows. It's to be used as a showpiece for a designer of floating homes. The craft is shown here being towed along the Thames River by a powerboat.





Giant ships come from world's largest drydock

Mitsui Shipyard in Japan boasts the largest drydock in the world. The dock (left foreground) is 1217 feet long, 218 feet wide and about 38 feet deep. Photo shows a ship under construction.



Speedy mailboxes

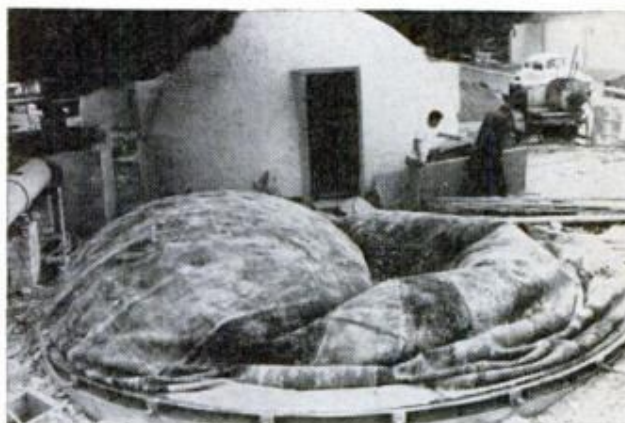
New mailboxes in England feature quick unloading. The postman pulls a lever and the accumulated mail slides into his mailbag.

MARCH 1969



River Kwai in Switzerland

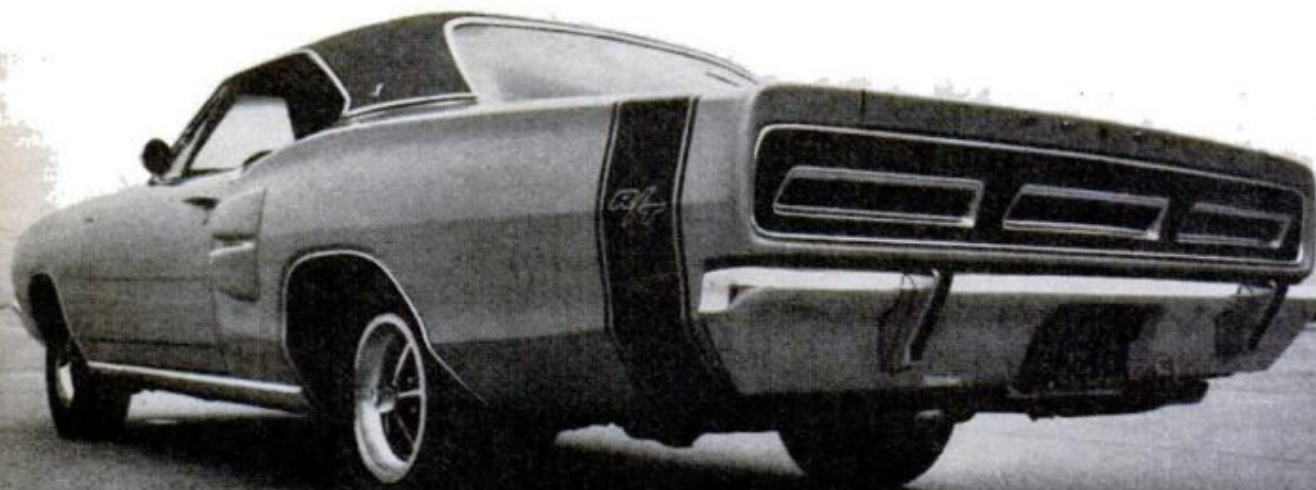
A Swiss hotel manager became so interested in the film *Bridge on the River Kwai* that he built a duplicate model of the famed bridge.



One-day housing

An Israeli firm has developed an igloo-shaped house to go up in a day. Five layers of material are sprayed on an inflated form.

117



With a Whiz—and a Whistle

BY BILL HARTFORD, Technical Auto Editor

Photos by Irving Dolin

WHAT WHIZZES down the road with pipes a-humming and buzzes through turns with bumblebee stripes a-blur?

To one out of six Coronet owners, it's their Super Bee or R T.

What whistles down the road with air a-leaking?

To another one out of six annoyed owners, it's their Coronet, regardless of whether it's a Super Bee, R/T, Deluxe, 440 or 500.

A quick quiz to be sure, but an accurate reflection of the results of an extensive survey of Coronet owners nationwide. They like handling; they like style; some don't like the wind noise and passenger compartment sealing and insulation; and a couple didn't like being interrogated by *PM*:

"My time is worth \$10 an hour," quips a Hoosier. Says a busy New Yorker: "Due to the pressure of paperwork, we must insist on a five-dollar charge to answer a questionnaire—sorry, you can't pick our brains for free!"

► If you read our letter, you'd know you lost out on a free copy of this issue of *PM*, which at 50 cents and based on five minutes of your time would be equivalent to \$6 an hour! Too bad.

We'll never know what they like and dislike about their car; we can only guess. But if they are "typical" owners of "typical" Coronets as defined by our survey results, we can guess with some certainty.

Topping the list of why owners chose a Coronet in the first place, is "good deal." The good deal includes, of course, price.

► Deluxe Six, two-door sedan starts at \$2537, convertible R/T (with automatic transmission standard) starts at \$3643.

With the optional equipment owners indicate, they paid close to or well over the price the average American pays for a car—about \$3200. But, for one thing, owners feel they've got a lot of car: "I wanted a full-size car," explains a New York computer programmer. And an Ohio letter carrier says he "formerly owned a compact car and wanted a full-size one."



CORONET COMFORT is high on the list of owners' likes. Most owners have 440 model and over 90 percent have automatic transmission. Four-speed Hurst shifter (above), puts the Super Bee R/T through the gears

► The Coronet isn't a "full-size" or so-called "standard-size" car, but an intermediate—the largest intermediate in the industry, however.

Another factor implicit in the "good deal" is the reception owners received at their dealer.

"Treated me like a king and gave me the best deal I ever heard of."—Alabama salesman.

"There was no sales pressure and I got a very fair deal."—Kansas railroad man.

"Top courtesy, no high pressure, very fair in dealing. All in all, our Williamsport Dodge dealers are square shooters."—Pennsylvania engine test leader.

Such comments reveal that owners of 1969 Coronets have a somewhat better than average relationship with their dealers.

In several cases, the salesman was the reason a Coronet was sold: "Primarily the courtesy of the salesman," admits an Illinois utility company man. "I like the people who sell them," says a self-employed Ohio man, and "I like the dealer and sales staff," compliments a Virginia service station owner.

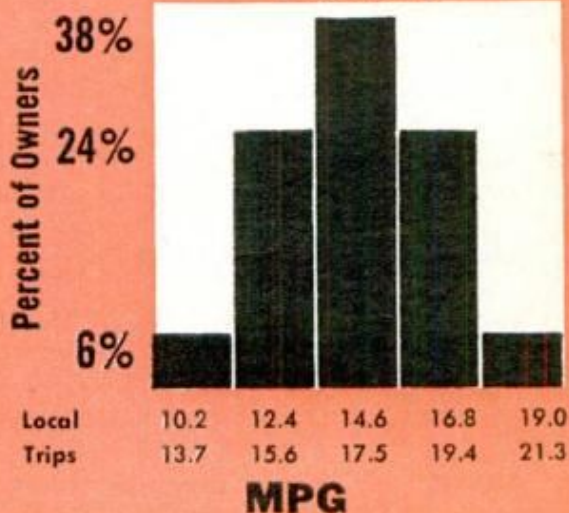
Service, too, is hailed by owners. A North Carolina construction foreman "changed to Chrysler products in 1966 because of the service," and he's still

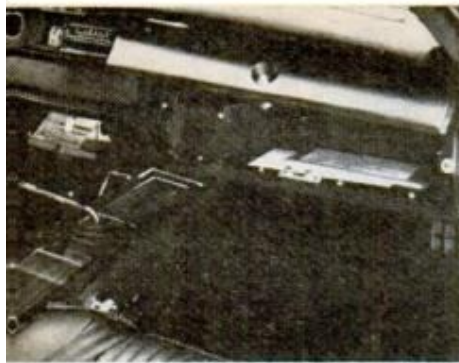


HANDLING impresses owners most. As on all Chrysler cars, wishbones and torsion bars suspend front end. Ram air scoops are detailed on the next page

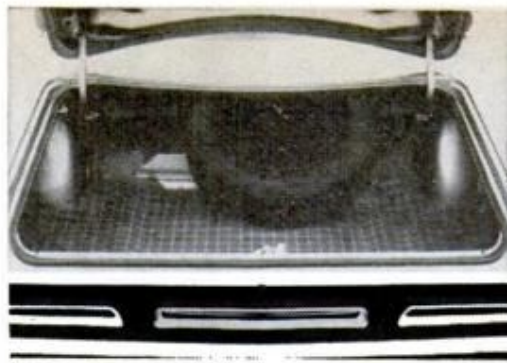
CORONET FUEL MILEAGE CHART

318 cu. in. V8





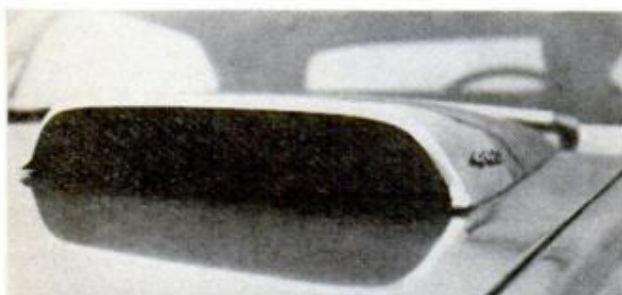
GLOVE BOX LID, with its top hinge, is annoying to owners



TRUNK SIZE is ample; only the height of the lid opening is criticized by owners



INSTRUMENT PANEL impeccably laid out, is liked by most



AIR GRABBER hood scoops duct-cool air to carb when engine compartment breathing is closed off. Some thought power boost would be more noticeable



REAR VISIBILITY is good, back seat comfort is average for intermediate, head restraint is too hard

satisfied. A Massachusetts water plant operator is happy with service but still sensitive to incidences of workmanship faults that originate with the manufacturer: "They cause hard feelings between customer and dealer when actually the factory is to blame."

► At a time when automobile sales and service operations are being investigated on the federal level, Coronet owners who are satisfied with their car and dealer should be doubly happy.

Whether in the shop or on the road, it's not all easy going for some owners. A Massachusetts buyer found his dashboard out of alignment and also attributes "severe wind leaks" to poor workmanship. An Illinois grocer has noticed "excessive air whistle on the driver-side door," and a Wisconsin insurance rep's biggest complaint is "road and wind noise, needs more sound-deadening." "Car is noisy inside," to a Missouri clerk, "and the chrome trim doesn't fit snug against the body." An articulate Montana electronics technician complains of wind noise and door and window fit—"too many gaps." Interestingly he adds: "If it weren't for the local dealer's outstanding service, I would definitely consider a different make of car."

Coincidentally, three rural mail carriers, from Missouri, Louisiana and New York, and all Coronet fans, wouldn't consider another make of car. Their comments sound like paid testimonials: "No trouble at all with about 275 stops and starts per day," "nominal maintenance," "good service from fair and honest dealer," "best car for my work." Their minor complaints

Summary of 1969 Dodge Coronet Owners Reports*

Total miles driven	680,103
Average miles per gallon	
318-cu.-in. V3, local driving	14.6
long trips	17.5
383-cu.-in. V8, local driving	12.3
long trips	15.6
440-cu.-in. V8, local driving	10.9
long trips	14.6
225-cu.-in. Six, 426-cu.-in. V8: not available.	
Specific likes:	
Handling	41.9%
Style	32.9
Comfort	26.4
Economy	24.6
Performance	20.4
Ride	16.8
Power	7.8
Specific Dislikes:	
Wind noise	16.6%
Economy	6.6
Workmanship	7.9
Brakes	5.8
Tire quality	5.8
Handling	5.0
What changes would you like?	
Better workmanship	12.8%
Glove compartment door	8.8
Styling	8.0
Seat height	5.6
More headroom	4.8
Gauges, not idiot lights	4.8
Model:	
Coronet Deluxe	9.2%

440	51.6
500	22.3
Super Bee	13.0
R/T	3.8
Body style:	
2-door coupe	4.3%
2-door sedan	4.9
2-door hardtop	53.0
4-door sedan	26.5
Station wagon	9.7
Convertible	1.6
Engine:	
225-cu.-in. Six	5.0%
318-cu.-in. V8	63.5
383-cu.-in. V8	23.8
426-cu.-in. V8	0.6
440-cu.-in. V8	7.2
Transmission:	
Automatic	90.3%
3-speed manual	4.3
4-speed manual	5.4
Had any mechanical trouble?	
Yes	53.3%
No	46.7
What kind of trouble?	
Transmission	18.3%
Brakes	14.6
Carburetor	9.8
Electrical	8.5
Window action	7.3
Dealer repair satisfactory?	
Yes	76.5%
No	23.5

Why the Coronet?	
"Good deal"	35.2%
Styling	26.8
Economy	17.9
Reputation	12.9
Size	12.3
Is the Coronet your only car?	
Yes	50.0%
No	50.0
Other cars owned:	
Dodge	29.4%
Ford	13.7
Chevrolet	10.8
Pontiac	9.8
Plymouth	8.8
Volkswagen	6.9
What options/accessories?	
Only power steering	68.8%
Radio	50.9
Airconditioning	29.5
Both power steering and brakes	19.9
Vinyl top	16.0
Tinted glass	9.2
Whitewall tires	9.2
Remote side-view mirror	9.2
Courtesy light package	7.4
Ram-air option	7.4
Rear defroster	6.1
Only power brakes	1.6
Age distribution of owners:	
15-29	29.8%
30-49	35.3
50 plus	34.7

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

concern: "sloppy paint work," "hard to insert ignition key," curved side windows," and, for one carrier, "no complaints whatsoever."

For a majority of owners, the Coronet gives comfortable, dependable transportation; for the few Super Bee and R/T owners it must give downright thrilling transportation. For a young, hot-rodding, Ohio housewife with a Super Bee, performance is "great," handling is "fabulous."

Comments from most owners, whose massive 426 and 440 V8s must give them a whiz-banger of a ride, are surprisingly bland, however. As an Illinois

factory worker with a 440 and automatic says matter of factly: "I like the smooth, fast takeoff."

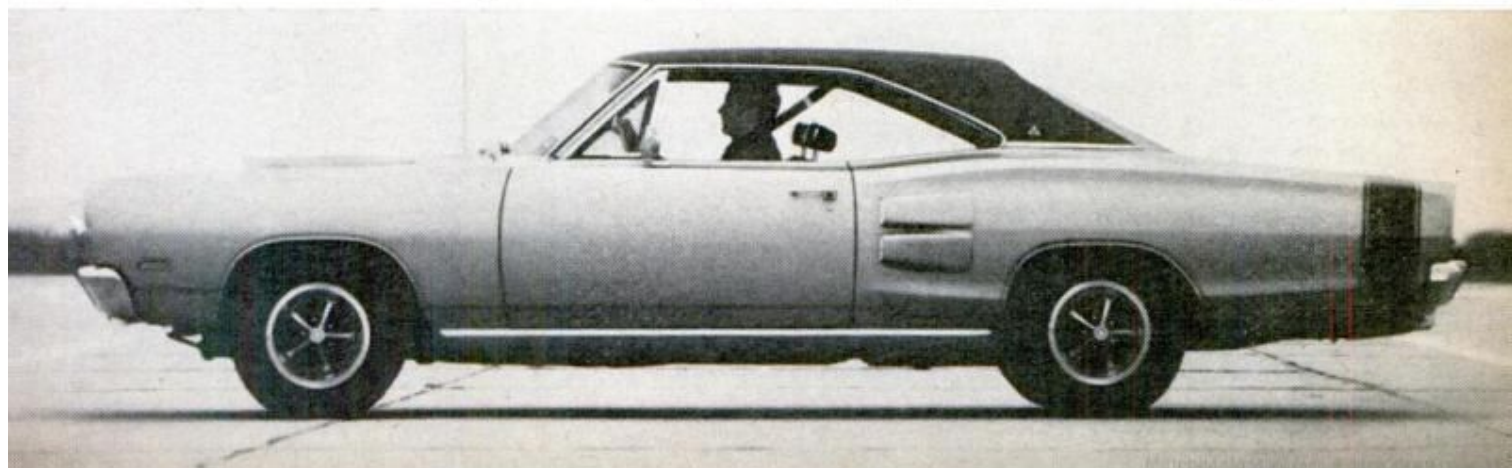
► I guess he regards 0-60 in 6 as normal driving.

A Vermont man is critical of the location of the front seat back release: "It should be higher." He's a physical therapist!

A Washington electronics technician doesn't like something on his Coronet: "It's the covered bricks called head rests. It's a toss-up between a whip lash and a brain concussion."

► They're not supposed to be pillows. They are safety head "restraints." You'll have to play safe with the brain concussion. ★ ★ ★

OWNERS LIKE STYLE. It was a big factor in buying car and is a big factor in their continued enjoyment of it



The Wildest Boat Trip

Just 100 years ago, in the most adventurous exploration in American history, a one-armed army major led four small boats down the unknown canyons of the Green and Colorado Rivers. Last summer PM's editor retraced the journey of Major John Wesley Powell — the hard way — through the ferocious rapids of the Grand Canyon.

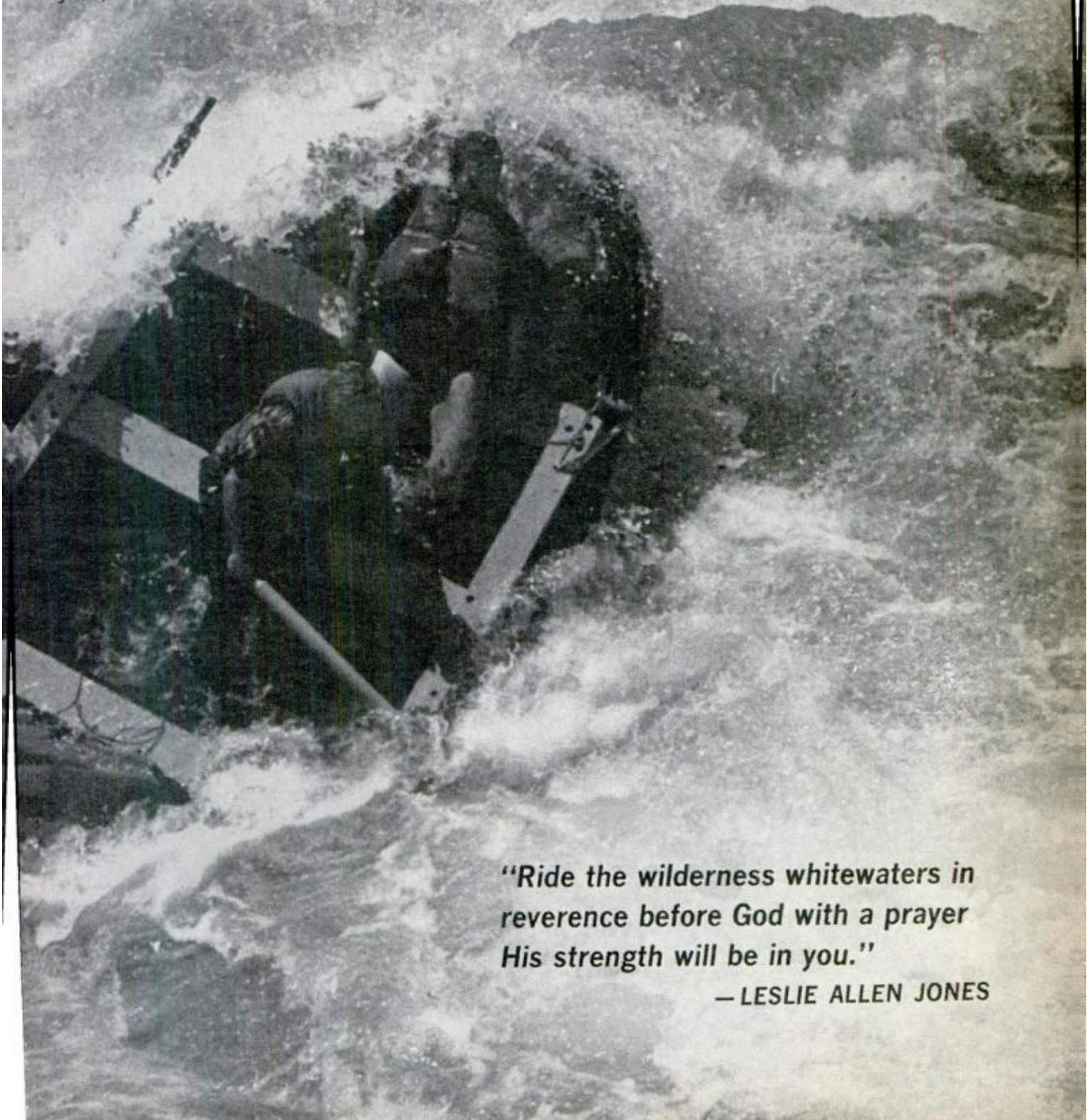


in the World

By ROBERT P. CROSSLEY, Editor

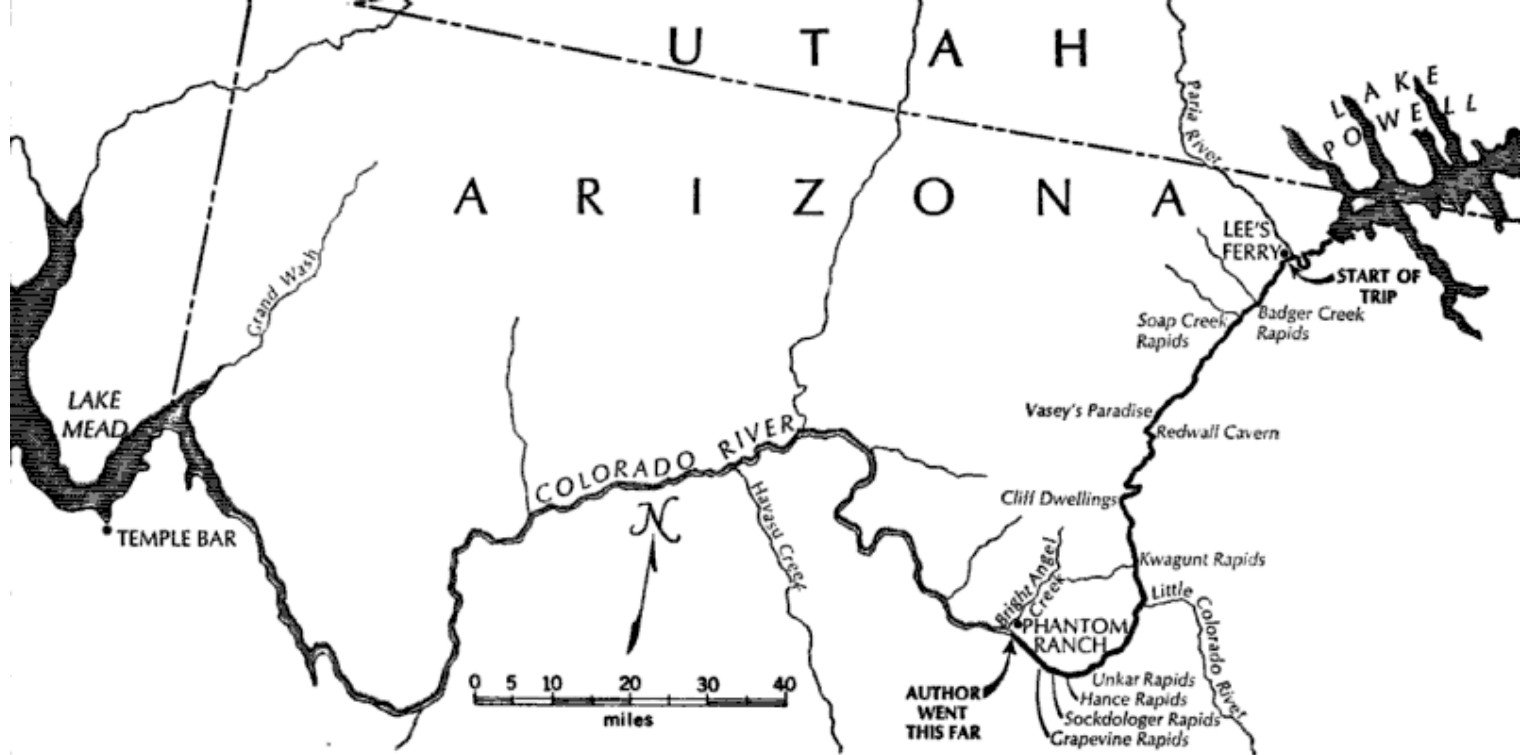
FRANK MASON BROWN was a man with a vision. He dreamed of building a railroad through the awesome canyons of the Green and Colorado all the way to California. In 1889 he started down the rivers with a surveying party. When he got to Marble Canyon, the Colorado drowned him. So

here we are last June at the very spot where the river saved the Grand Canyon from the iron horse. We're climbing over the boulders at the mouth of Soap Creek, gazing in horror at the most ferocious furlong of wild water we've ever seen. And we're supposed to go right smack through it. We've



"Ride the wilderness whitewaters in reverence before God with a prayer His strength will be in you."

—LESLIE ALLEN JONES



Map of Colorado River in the Grand Canyon Country

already run one major rapids, Badger Creek, the afternoon before. Badger was wild enough. The Park ranger who checked us in at Lee's Ferry and made sure we had bought \$12 life preservers that provided all the freedom of a space suit, stood on the bank and took movies. He had never seen a raft like ours go through. I think he wanted documentation to protect the Government if we didn't make it.

Badger had been photographed from a canoe fitted with outrigger-mounted oars. Veteran river-runner Leslie Allen Jones mounted a camera in a helmet and shot movies through a hole in its rear. Ever since, he's been known as "Buckethead" Jones.

Now, after camping on a sandbank below Badger and a prebreakfast swim in the clear, icy water, I was unrolling a 40-foot map I had ordered from Jones. It wound like two rolls of toilet paper in a watertight polyethylene bag. I squinted at Buckethead's scratchy notation by Soap Creek Rapids: "Worst in canyon at high water."

Well, the water wasn't really high, thank God. Or maybe, "Thank Glen Canyon Dam," which has regulated flow since 1963. But it wasn't really low either. The fact is, you can't win on water flow. Soap may be the worst at

high water. Some say Unkar—*Dread Unkar*, our raft captain, photographer Joe Munroe, kept calling it—is the worst in *low* water. It was still ahead of us, along with Hance, with the biggest drop of any rapids in the Grand Canyon, and nearly 30 others.

Soap Creek carried an average rating of "8" on Jones' map. Ten's the worst. Buckethead had also scattered such reassuring notes along the route as: "Brown—upset and drowned," "Upset on Goddard trip—near drowning," "Bert Loper upset, not seen again," "1960—jet boat sunk going upstream."

A voice boomed out above the crashing of the rapids: "Anyone who doesn't want to go through can walk around. We'll pick him up downstream." The voice was Martin Litton's. Martin, long-time travel editor of *Sunset*, now a senior editor of that magazine, was our leader. Like a TV wagon boss, he roused us at 6:00, picked our campsites at night. He also decided how to run each rapids.

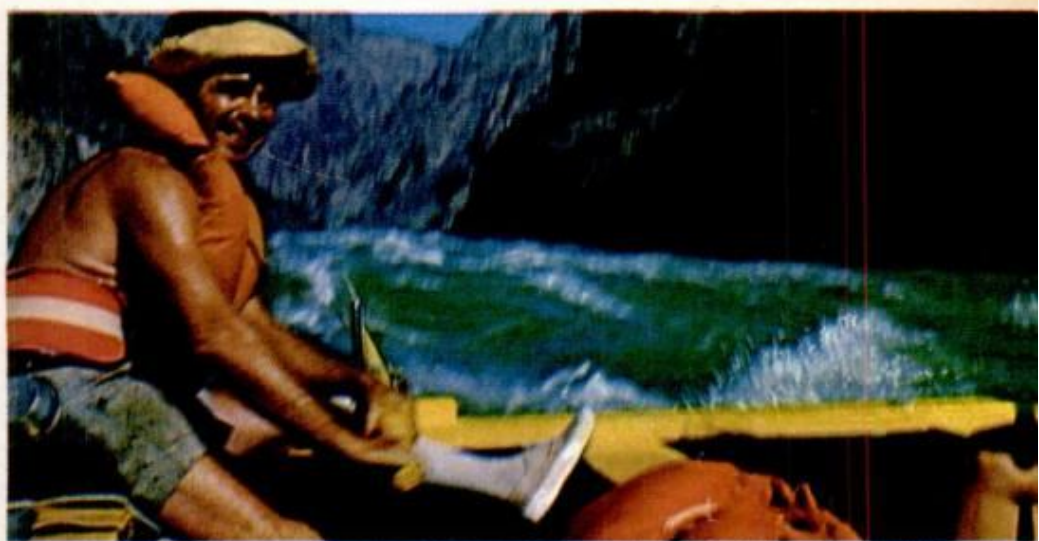
Martin made his first Grand Canyon trip in 1955, has run the river nine times. Like a golfer who keeps going back to a challenging course, he spends three weeks in the Canyon each summer. This year he plans to make *two* trips. He and Clyde Childress, who is



HANG ON! HERE WE GO! Unlike surf, rapids stay in one place. The water moves, hurls you through waves



FROM TURQUOISE POOLS of Little Colorado you see wreckage from 1956 airliner collision



BRONZED CLYDE CHILDRESS, noted for photos of Grand Canyon, is too busy battling river in inner gorge to take pictures. (Below) **PAUL GEERLINGS**, who has run most of the rapids on western rivers, cuts one a bit close



... you can't get off; you can't turn back; you don't know what's coming . . .

in the raft this time, are the only guys who run it the hard way—in small wooden dories. We have four boats, plus the “Arrangement,” clumsy, but unsinkable, made up of three Navy rafts lashed side-by-side with nylon webbing. It belongs to Joe Munroe, whose Glen Canyon pictures you saw in *PM* last month. That's Joe with his hands full manning the downstream oar on the opening spread of this story. Joe invited me to go along as a paying passenger. This meant I didn't have to row—except when the regular oarsmen got bushed, which was every 20 minutes, or couldn't pull the raft around in an eddy.

Unlike the commercial operators, who take 30 or 40 people on big rafts or pontoons, Martin uses no motors. He takes 20 days from Lee's Ferry to Lake Mead. Using outboards, the commercial guides do it in 10 days. I talked to one, Don Hatch, who launched three big rafts ahead of us at Lee's Ferry. Just a year before, he had taken Robert and Ethel Kennedy through the Canyon.

Martin rows one boat, his son, John, a student at San Jose State, another, Paul Geerlings, a husky San Francisco lawyer, a third one. The fourth boat's oarsman is John Berry, of Washington, D. C., a fast-water champion in canoes and kayaks. This is his first trip on a western river. The second night he tells me: “So far the rapids aren't much worse than some in West Virginia. But back there you can walk home.” You don't walk home from the Grand Canyon.

As I weighed Martin's offer to ride or walk, I thought about Maj. John Wesley Powell, who explored the Green and Colorado exactly 100 years ago this year. He didn't run Soap Creek Rapids. He portaged. Brown didn't run them, but got drowned anyhow. *Nobody* ran them until 1927.

Our group is retracing the last and most exciting leg of Powell's great adventure—the 312 river miles from Lee's Ferry to Lake Mead. Because I can spare just a week, I'm going only as far as Phantom Ranch, where trails go up to the rim. I had previously followed another segment of Powell's journey, through the brilliant, winding canyons of the Green above its confluence with the Colorado. Powell, a one-armed Civil War hero, had named those canyons—Labyrinth and Stillwater—just as he had named Glen Canyon, now covered by Lake Powell, and Marble, in the upper end of Grand Canyon.

I think, “What the hell. I came to run the rapids. I'm not going to chicken out.” No one else does either.

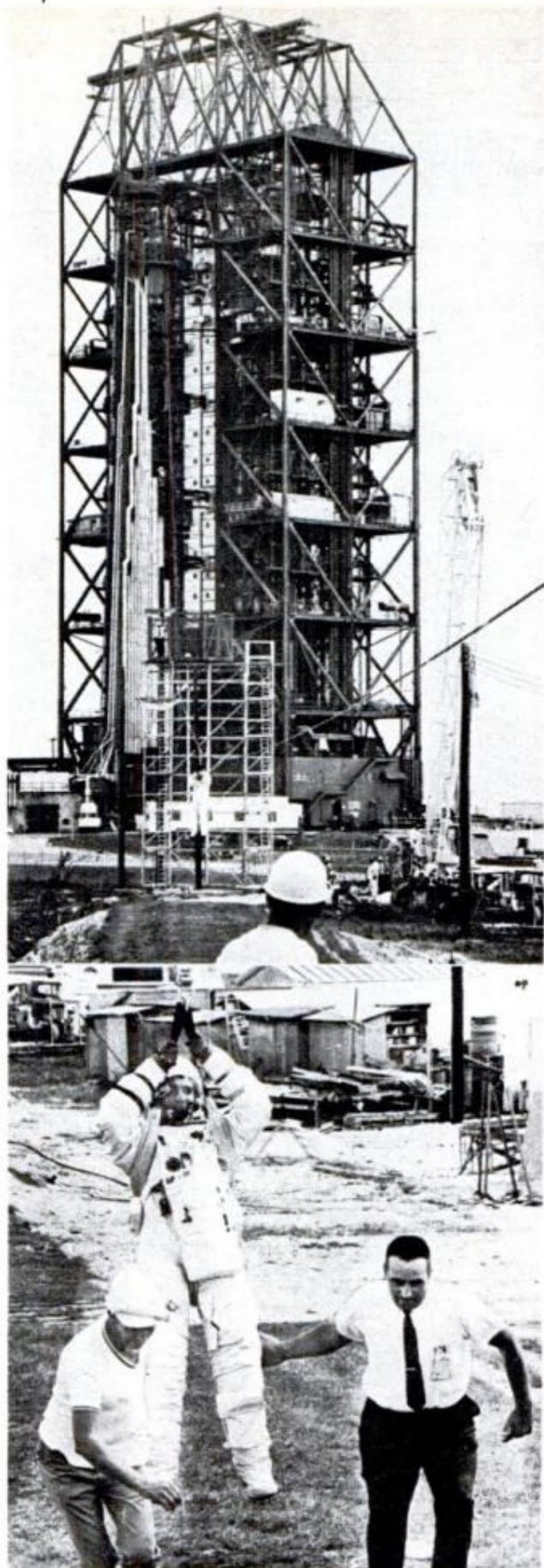
We watch three of the boats go through. They all make it, although Paul gets sidewise, loses an oar, grabs another, and has it snap off in his hands.

It's our turn now. We row hard to get the raft turned sidewise and into midstream. Joe's on the downstream oar, peering anxiously to find the tongue of swift current that can sweep us safely past the first big rocks. It's like approaching the top of a roller-coaster incline. You can't get off; you can't turn back; you don't know what's coming.

Suddenly we're over the brink, plunging madly down the tongue, then, crash, into a towering wall of waves. The first section goes high, followed by the center section as the first plunges into the “hole” that lurks behind each sunken boulder. I'm in the third section. Again it's like the last car on a cold, wet roller coaster. Icy water sweeps over the stern. I hang on with one hand and start bailing. A big rapids has several holes, and sometimes the last one that hits you when you think you're safely through is the worst.

A mile below we rowed close to the left bank to read an inscription: “F. M. Brown Pres. D.C.C. & P.R.R. Co. was

(Please turn to page 237)



Quick exit for astronauts

In case of emergency before launch, all three Apollo astronauts can escape their space vehicle via a long slide in a harness attached to a cable that runs from tower to ground.



Roundhouse for weekends

A plastic vacation house built in Finland has a 26-foot-wide living area plus bath, kitchen and storage space. The sofas are used as beds and can sleep six. Fully insulated and electrically heated, the circular house also has a fireplace in the living room.



Lounge chair for sheep

Geoffrey Norman of England, a retired sheep raiser, has invented a chair that holds the animals securely while their teeth and feet are inspected and cared for.


 MARS PROBES
 SOLAR PROBES
 VENUS PROBES
 MOON PROBES

Ten Years

By WALLACE CLOUD



THIS IS YEAR 12 of the Space Age, counting from Sputnik 1. It's the tenth year of man's exploration of deep space—outside the zone where spacecraft are trapped in orbit by Earth's gravity. The decade began with a Soviet success: the first capsule to go into solar orbit, after nearly hitting its target, the moon. The Russians then called that spacecraft *Mechta*, or dream; now it's officially designated *Luna 1*.

Everyone knows that by now hundreds of man-made objects are in orbit around the Earth. It's not so widely realized that 50-odd machines have been launched on voyages to the moon, toward Venus and Mars, and into free-wheeling orbits around the sun. By this time, more of them have been American than Russian spacecraft, and our successes also greatly outnumber theirs.

This year, too, robots will go in quest of planetary data. During the mid-February-to-mid-April "launch opportunity," two more *Mariners* will be sent toward Mars. Arriving between the end of July and mid-August, they are intended to make closer approaches to Mars than their predecessor, and to take

This illustration depicts major U.S. and Russian deep space probes and their launch dates. Created for *Popular Mechanics* by Ed Valigursky.

in Deep Space



Mariner 1969

MARS

Before the first U.S. probe successfully sent back pictures of the moon, the preceding 15 tries failed in one way or another.

clearer photos than their predecessors.

We already know, from the voyage of Mariner 4 in 1964-65 that Mars is pocked with craters like the moon and that its "canals" are likely to be streaks of material splashed out of those craters. We do not yet know if any form of life exists there to breathe its thin, cold atmosphere. Will the 1969 Mariners answer that question? Probably not; the 141 pounds of scientific instruments included in the 900-pound weight of each spacecraft are designed to provide only information on temperature and the composition of the atmosphere.

To find out if there's life on Mars, it will be necessary to land an instrument package on the planet's surface. Such an experiment was scheduled for 1973, but the project has been drastically cut back—and may be cancelled—in the rash of budget cuts forced by the Vietnam war.

Even though major questions may stay unanswered, close approach planetary missions can yield valuable scientific evidence. The two 1969 probes (now called Mariners F and G—they'll be given numbers after launch) are to pass about 2000 miles from Mars, compared to a 6118-mile approach in 1965. If there's an error in guidance, the odds are 30,000 to 1 that a spacecraft will not crash into and contaminate Mars, according to NASA. They'll be sent on their way by Atlas/Centaur rockets, the first time this combination will be used for planetary exploration.

Each Mariner will carry two cameras, taking wide-angle and narrow-angle pictures; each probe will shoot at least 33 pictures. The first eight in the sequence will show the full disc of the planet, with resolution down to 1½-mile details. Then the cameras will

sweep across the face of Mars. Close-ups will resolve 300-yard objects.

That spacecraft can now be launched confidently to inspect distant planets—without even creating the public excitement they once inspired—is the result of a long, hard struggle to perfect space technology. Before the first U.S. probe successfully sent back pictures of the moon (Ranger 7, in July, 1964), the preceding 15 tries failed in one way or another.

Man's first decade of robot deep-space exploration, then, has been studded with heartbreaking disappointments and heady triumphs. Running through it all has been the neck-and-neck race between the United States and Russia. A few highlights:

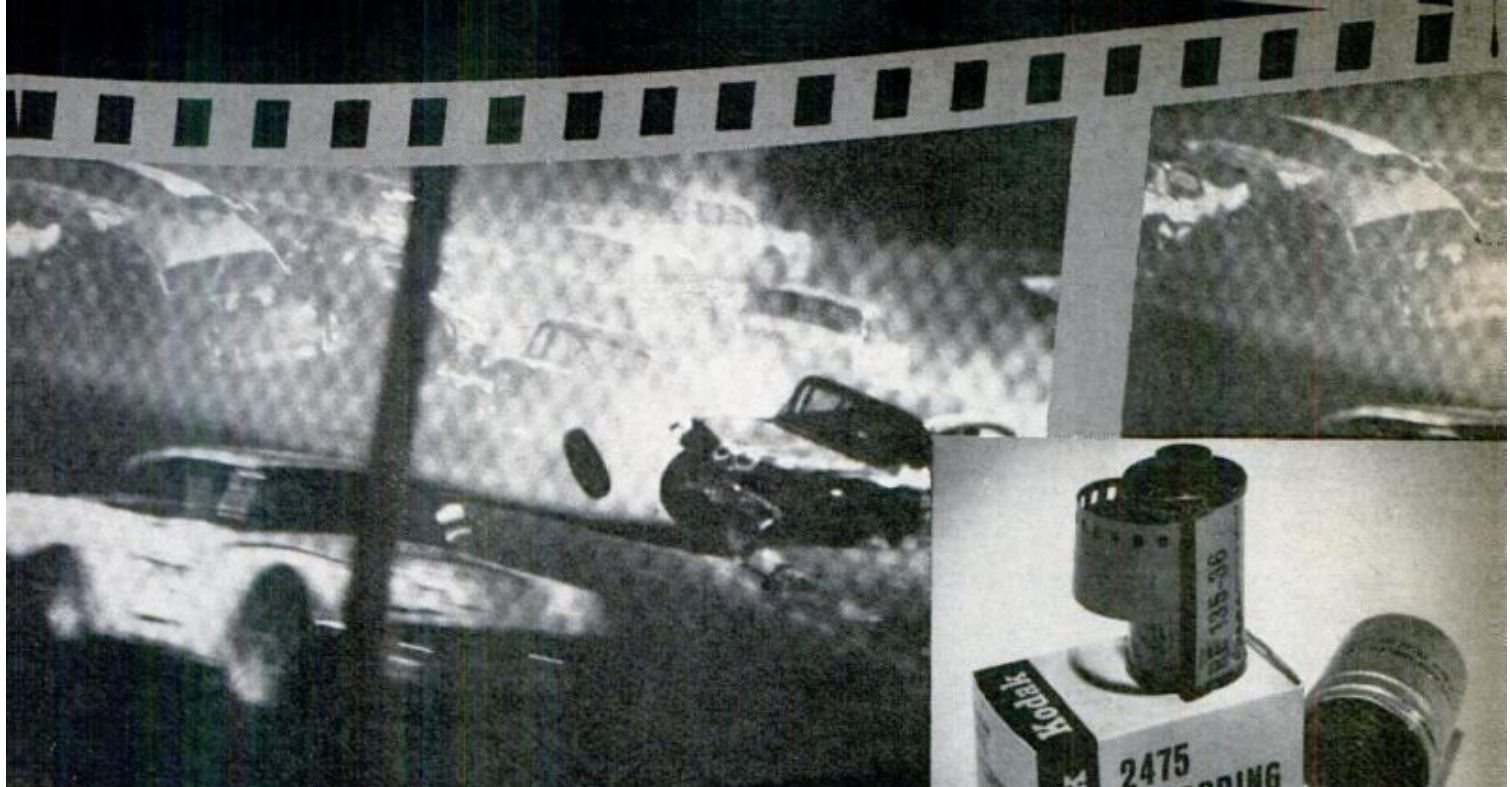
The first two spacecraft to go into solar orbit, after being aimed at the moon, were Russia's *Mechta*, launched Jan. 2, 1959, and the U.S. *Pioneer 4*, fired Mar. 3, 1959. *Mechta* passed closest to the moon, 3728 miles, compared to *Pioneer's* 37,300 miles.

Apollo 8 is first eyewitness

After being the first to hit the moon with *Luna 2*, launched Sept. 12, 1959, the Soviet Union sent the photographic probe *Luna 3* into an elliptical Earth-moon orbit on Oct. 4, 1959, looping around the moon to provide a first look at its hidden far side. But it remained for three U.S. astronauts looping around the moon aboard *Apollo 8* to send back the first eyewitness description of the moonscape.

Pioneer 5, launched into solar orbit Mar. 11, 1960, confirmed the existence of a suspected five-million-ampere electric current flowing in a ring around the Earth outside the Van Allen belts, some 40,000 miles out. The probe continued to transmit data until it was 22,500,000 miles away in June, 1960.

The Soviets launched the first Venus probe, *Venus 1*, on Feb. 12, 1961, but lost radio contact when the spacecraft was 4,700,000 miles out. This was the first of a series of failures in the



Fantastic New Films Let You Almost

SHOOT IN THE DARK!

Films with unheard of speeds of ASA 1250 and 1600 are now showing up on dealers' shelves. You won't want them for a day at the beach, but they can be a lot of fun to experiment with indoors or at night. Here's what you can do with them

By ROBERT HERTZBERG

AT MOST indoor functions, such as stage shows, church weddings, graduation ceremonies and the like, there is usually a polite sign that reads something like this: "Out of consideration for others, we ask you not to use flash cameras."

This is a tacit invitation to shoot without flash—if you can. But few normal films would give you a usable exposure by available light in a darkened theater. Or if you got an exposure at all, you'd have to shoot at too slow a speed to prevent blurring.

This wouldn't be a problem if your camera were loaded with one of the new superfast 35-mm black-and-white films that have slipped quietly onto the market almost unnoticed. Already, there are two such films, with indications of more to follow. Kodak's rather unglamorously named No. 2475 Recording Film is modestly rated at 800 ASA, but the instructions virtually tell you to ignore this and shoot at 1600 ASA. At 1600, the film is two full stops faster than the fastest popularly used black-and-white film, Kodak's Tri-X,



YOU WOULDN'T THINK a movie screen would offer enough light for any film, but this scene from *The Odd Couple* was captured on 2475 at 1/125 and f/2



AGAINST A JET-BLACK STAGE, the famous Rockette dancers at New York's Radio City Music Hall were caught motionless at 1/500th second on 2475 film



MADE AT DUSK, picture above looks almost like a daylight shot. Only tipoff is glowing streetlight visible at rear. In scene below, the sun was almost gone, yet the film picked up plenty of reflected light on cars in foreground. Both shots were made with Agfa Isopan Record film at 1/125 second and f/1.8



rated at 400 ASA. No. 2475 film has actually been around for some time for satellite tracking and night surveillance work by police. It is just now being offered to the general public for fun use.

In addition to this, there's Agfa's Isopan Record, rated at a sizzling 1250 ASA. At 1250, it is more than 1½ stops faster than Tri-X. Only slightly slower is Agfapan 1000 Professional, a 1000-ASA film just recently announced.

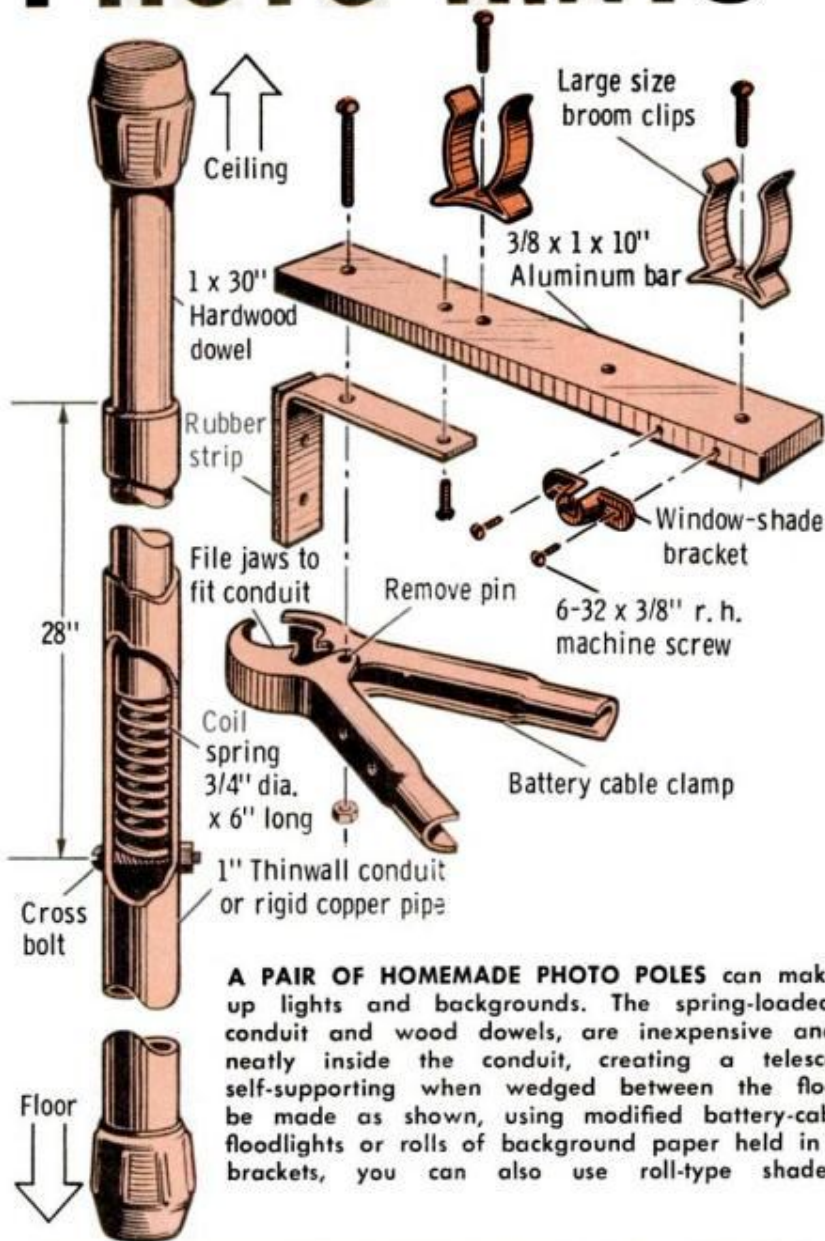
What this means is that these films are practically as versatile in low light as regular films are in bright light. They not only produce pictures that would be otherwise impossible, but they give you better pictures under difficult conditions.

Let's say that, at 400 ASA, your meter gives you a reading of only 1/30th of a second at f/2. Now set the meter for 1600 and see what happens. Suddenly, you have two more stops to play with. You can shoot at 1/125th of a second instead of 1/30th. The difference is simply that 1/30th won't stop motion—1/125th will. If depth of field is more important, you can close down two stops for sharper focus.

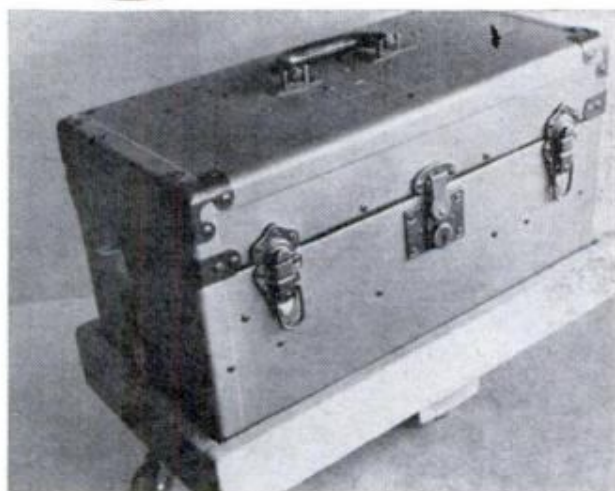
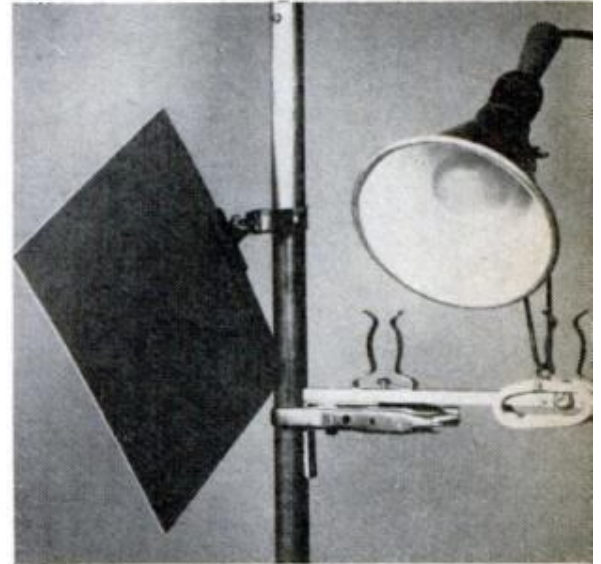
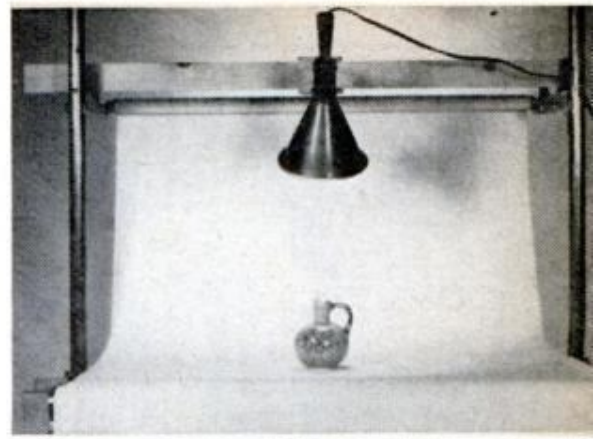
At the moment, these films are available only in 35-mm canisters for use in 35-mm cameras. You won't find them at the corner drugstore. You may have to hunt a bit. Kodak dealers either stock the No. 2475 or can get it for you. Agfa's Isopan Record and Agfapan 1000 are sold by Agfa dealers and by large photo-supply houses.

These films require special processing—they will not be handled by the usual drugstore services. Ask your nearest photo dealer to suggest a custom processor or look for one in your classified telephone directory. One custom house that will handle processing by mail is Faxellent Photo Lab, P. O. Box 83 Yellow Springs, Ohio 45387. If you have any difficulty purchasing the No. 2475 Recording Film, it can be ordered by mail from Spiratone, Inc., 135-06 Northern Blvd., Flushing, N. Y. 11354. Three of the 36-exposure rolls cost \$4.15, postpaid. ★★★

PHOTO HINTS



A PAIR OF HOMEMADE PHOTO POLES can make life a lot easier when you're setting up lights and backgrounds. The spring-loaded poles, made of ordinary electrical conduit and wood dowels, are inexpensive and easy to assemble. The dowels slip neatly inside the conduit, creating a telescoping action that makes the poles self-supporting when wedged between the floor and ceiling. Clip-on brackets can be made as shown, using modified battery-cable clamps. The brackets will support floodlights or rolls of background paper held in broom clips. By adding window-shade brackets, you can also use roll-type shades for backdrops.—Howard R. Clark



HEAVY CAMERA CASES are easier to handle if you put them on wheels. This shallow tray fitted with casters lets you roll a case around without attaching permanent wheels. When you don't need the wheels, you just lift the case off. The tray, made of scrap wood, has two fixed casters in the middle and a movable one centered at each end.—Rod Moon

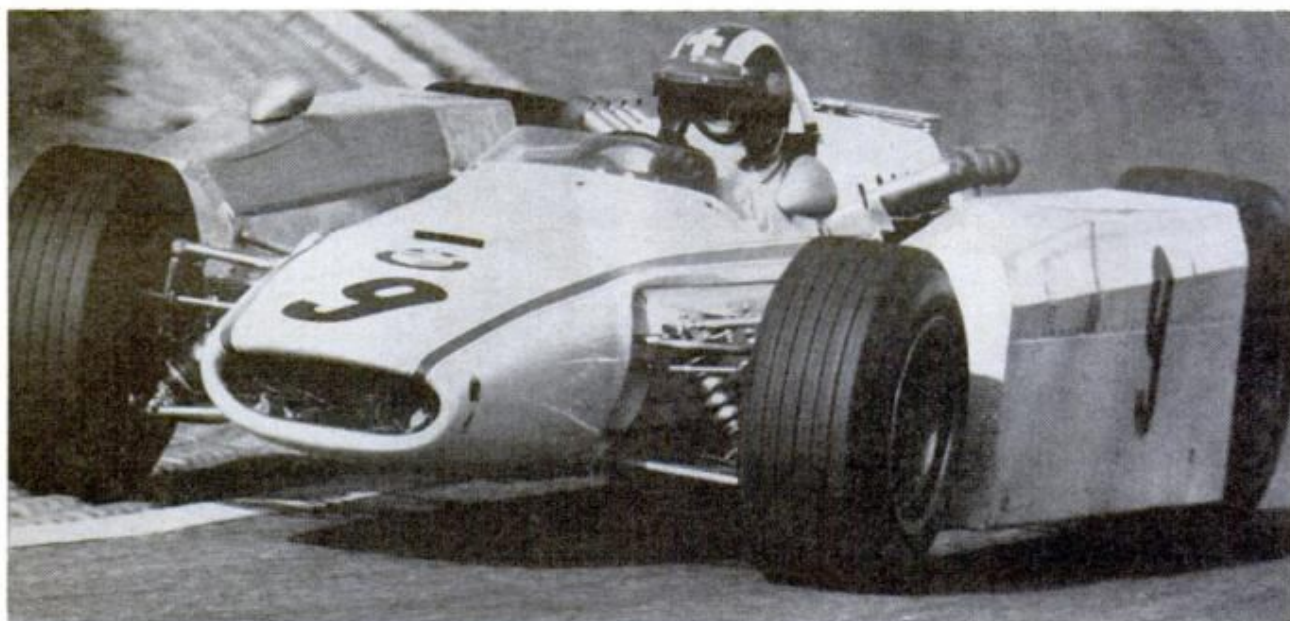


THIS POCKETED APRON, a good project for your wife to make, keeps photo gear at your fingertips, yet frees your hands. Five pockets hold extra lenses, filters, film, a light meter and other accessories, all neatly sorted. The apron can be made of any sturdy fabric, such as canvas, duck or denim, and has a tie-string sewn in around the top edge



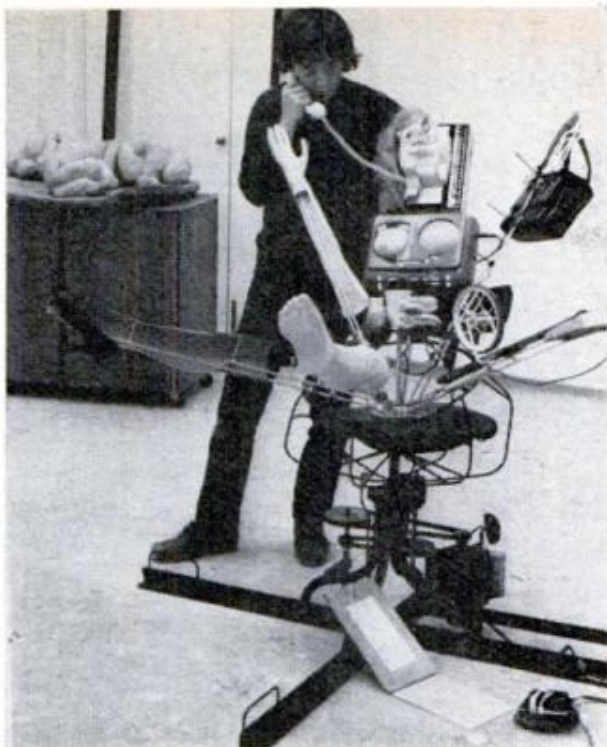
Portable traction unit

Tired of searching for bits and pieces of a traction setup during late-night emergencies, an orthopedic surgeon, Dr. Lewis L. Rogers, Wilkes-Barre, Pa., has invented a folding traction unit that can be erected in 60 seconds. The 38-pound "Quik-Trac" can be put up by a nurse if an orderly is not available. Carried to the patient's bed (above), the unit is assembled by locking the overhead bar in place (upper right), the pulleys are locked in place, and it's ready for use (right).



BMW racing car now has 'wingtip' tanks

Fuel tanks placed between front and rear wheels of BMW's new Formula 2 racer not only give the car additional gas capacity but add to the aerodynamics of the racer. Two cars of this design have undergone recent testing on European racetracks.



The perfect secretary

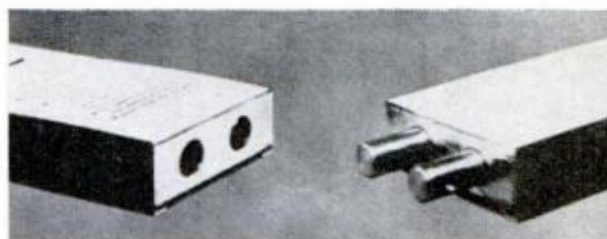
Roger Fulcher, a 20-year-old art student, has assembled a bit of kinetic art which, he claims, embodies all the desirable qualities of a perfect secretary. Included in her makeup is a pen and pad, typewriter and computer (she's businesslike) plus handbag, sandwiches, coffee and some feminine curves (she's beautiful). No one has hired her yet.



It beats walking

The director of an office equipment firm makes use of a Tan-Sad hoverchair to tour a Scottish exhibit on a cushion of air.

MARCH 1969



Break-apart skis

You can carry your skis to the slopes in a golf bag now—that is, if you're using the new Japanese skis that "break apart" (bottom photo) for easy storage.



See-through road signs

It isn't fashion that's brought "see-through" design to road signs, it's German efficiency. Figuring that nontransparent signs created blind spots for drivers at some intersections, police at Kaiserslautern, West Germany, created the new signs to enable drivers to see oncoming traffic.

BIG WHEELS OF

BETTMANN ARCHIVE

THE ORIGINAL FERRIS WHEEL, designed by George Ferris for the World's Columbian Exposition at Chicago, 1893, was a monster. Each of 36 cars held 60 passengers for a total of 2160 passengers. The wheel was 264 feet high and weighed 2100 tons. Its axle alone weighed over 70 tons, was 33 inches in diameter, 45 feet long. The wheel was powered by duplicate 500-hp steam engines. They're still called Ferris wheels.



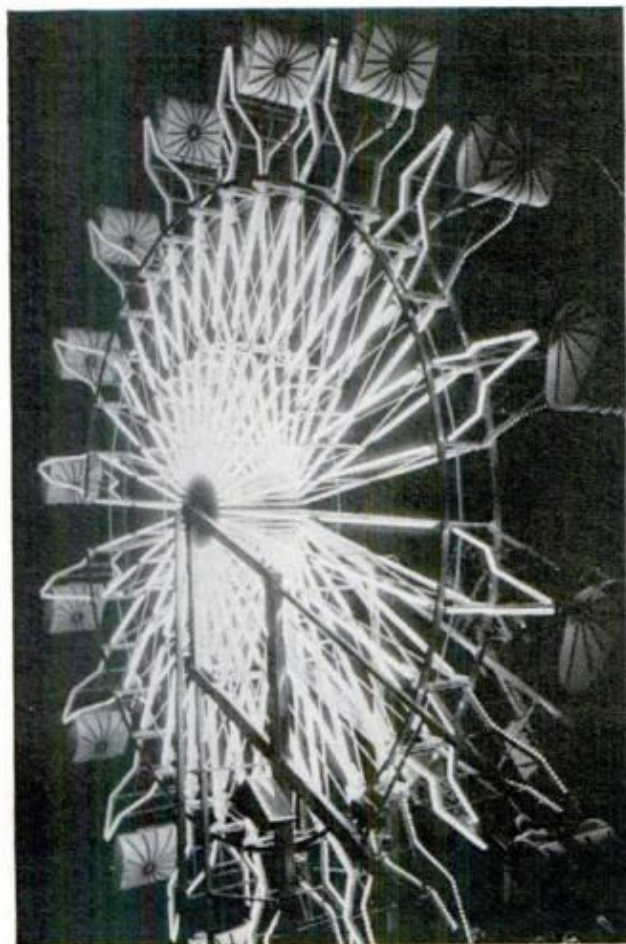
THE FUN BUSINESS

By KATE HOLLIDAY

IN AN AGE of space exploration it is soothing to discover that a 67-year-old firm in Jacksonville, Ill., makes a satisfying living for the third generation of a family by producing nothing but Ferris wheels. The Sullivans may not have 40-foot yachts, but they're not starving. They own the only company of its kind in the world.

The Ferris wheel is the safest amusement ride in existence; only a hurricane-force wind poses a threat to the customers. And for decades people from Boston to Bangkok, from Moscow to Melbourne, have enjoyed the lovely sensation of soaring above the earth in a gentle swing, topping the circle with an eye-popping halt in space, and then pitching breathlessly toward the

TODAY'S BIG WHEELS have diameter of 40 to 55 feet. Lights make them recognized symbol of fun at fairs



MARCH 1969

ground. Kids love 'em, adults and oldsters love 'em. And they make money.

Feel the urge to go into the Ferris-wheel business? Just roll up to the Eli Bridge Co., of Jacksonville, a town a few miles from Springfield, Ill., and order a machine from stock. They come in three sizes: 40 feet, at \$11,660; 45½ feet, at \$12,160; and a big park job, 55 feet, at \$18,902. You can purchase your wheel on time, load it into a van, trailer or freight car (in a space approximately 7½ feet wide by 20 feet long) and set out to make your fortune.

Eli was founded in 1900 by the late William Sullivan, one of whose grandsons, Harvard graduate Liam Sullivan, is, incidentally, a prominent Hollywood actor, starred as Major Mapoy in the TV series, *The Monroes*. Currently its president is Liam's younger brother, 42-year-old Lee Sullivan Jr., while his father, Lee Sr., is chairman of the board. The board also includes sister Peggy and various other relatives.

The Ford of the Ferris wheel business, William Sullivan was a teetotaling, six-foot mechanical genius with little formal education but long on native know-how. His forte until 1900

ELI BRIDGE CO. "WHEELS" in front of factory are from (right): Lee Sullivan Sr., chairman, Lee Sullivan Jr., president, and his brother, Liam Sullivan, actor



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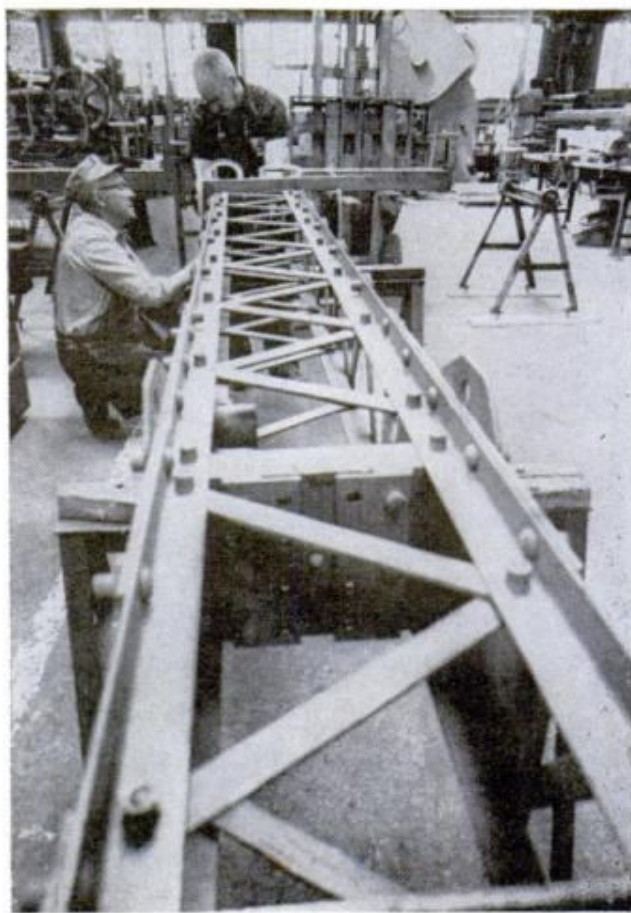
SMALL WHEELS FOR SMALL FRY come complete with ticket booth; wheel is easily disassembled and transported. Several students have put themselves through college by owning wheels. Though Ferris wheels are long-lived (many built 50 years ago are still in use), steady demand for new wheels has kept Eli Bridge Co. factory (below and right) humming a half century

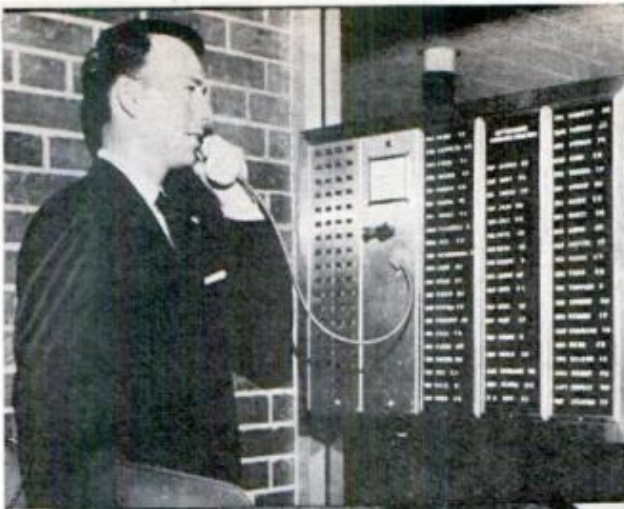


had been carpentering and heavy construction, thus the "bridge" in the corporate name. From an undeniably shaky start, the company today builds wheels in lots of 10, 18 and 25, and there is a remarkably steady demand for them from carnivals, amusement parks and fairs around the world.

The basic idea of a wheel set on its rim as a means of entertainment had been kicking around in this country and Europe for quite a spell before a young Chicago engineer was challenged to come up with something grandiose—like Paris's Eiffel Tower—for the World's Fair of 1893. George Washington Gale Ferris, with the populace sending for the guys in the white coats, drew plans for a contraption 264 feet high, with 36 cars 26 feet long and 13 feet wide, each carrying 60 swivel chairs. His scheme called for 4300 tons of pig iron, and the whole works was set into a 15-foot bed of reinforced concrete. The wheel was so gigantic there were grave doubts two projected 500-hp steam engines would turn it. But, to the cheers of the assembled

(Please turn to page 229)





Dial opens the door

When her guest has identified himself by phone (above), a hostess can now let him in the front entrance of an apartment building simply by dialing "6." The system, by General Telephone and Electronics Corp., works through an existing phone setup.



From the heart

A London safety sticker plays on the fame of the South African heart-transplant surgeon.

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Ticklish paint job

This young lady has the ticklish job of painting identifying marks on locusts so that they can be observed at the Anti-Locust Research Center in London. It's part of a program aimed at tranquilizing locust swarms so they won't destroy British crops.



Machine teaches repair

Audio-visual teaching machines that go through maintenance procedures at the student's own pace are part of Lombard Power Equipment's dealer-shop personnel training.



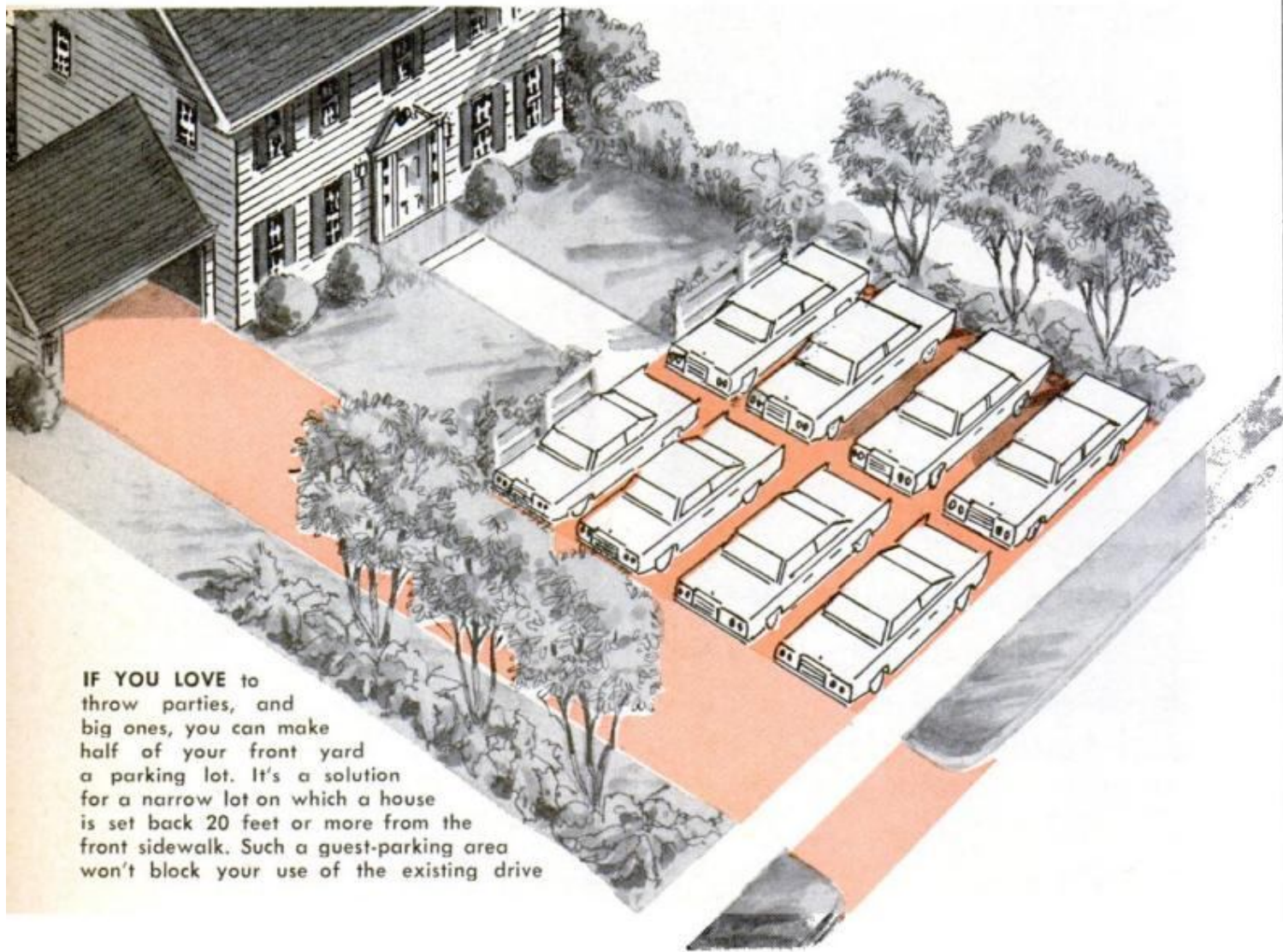
For busman's holidays?

Old streetcars in Turkey wind up on the shores of the Sea of Marmora—as summer cottages. Rent is two shillings a day.

Eight Ways to Get More Off-Street Parking

By GERALD K. GEERLINGS, A.I.A.

Illustrations by Jack Mitchell



IF YOU LOVE to throw parties, and big ones, you can make half of your front yard a parking lot. It's a solution for a narrow lot on which a house is set back 20 feet or more from the front sidewalk. Such a guest-parking area won't block your use of the existing drive

DO YOU RISK an accident backing out of your drive into the street? Can guests park in your drive without blocking the garage? If the answers are no and yes to these two questions, you're a most fortunate homeowner.

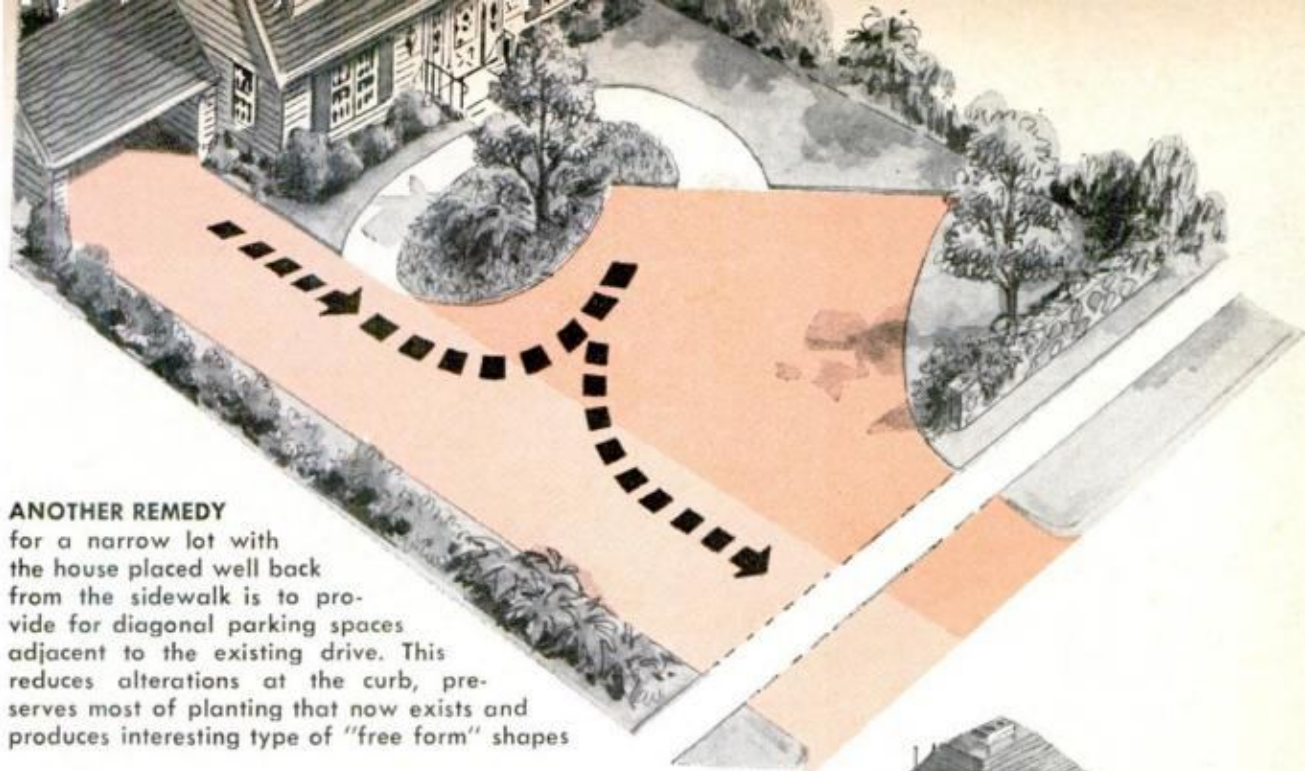
However, if your house has only a ribbon of cement which connects the garage and street, all drivers in your family must be both lucky and quick to pick the right instant to back into traffic.

Accident statistics of busy streets (par-

ticularly after dark) convincingly testify to the safety factor of backing a car from the garage into the family's parking area, then reversing direction so as to be headed forward toward the street.

Cars parked at the curb reduce visibility when you're backing out from a drive. For this reason, lending institutions in some localities insist upon off-street parking before granting a mortgage in currently planned housing developments.

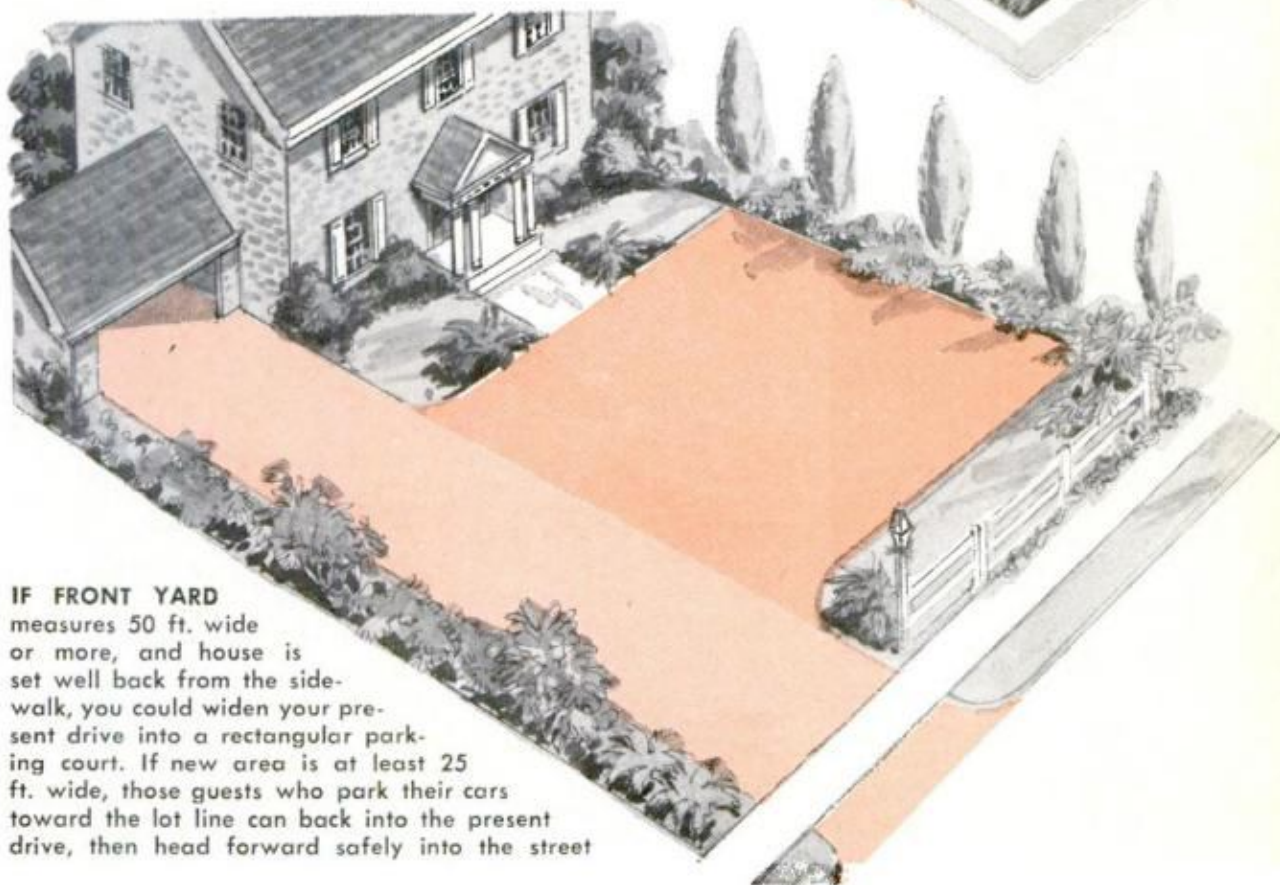
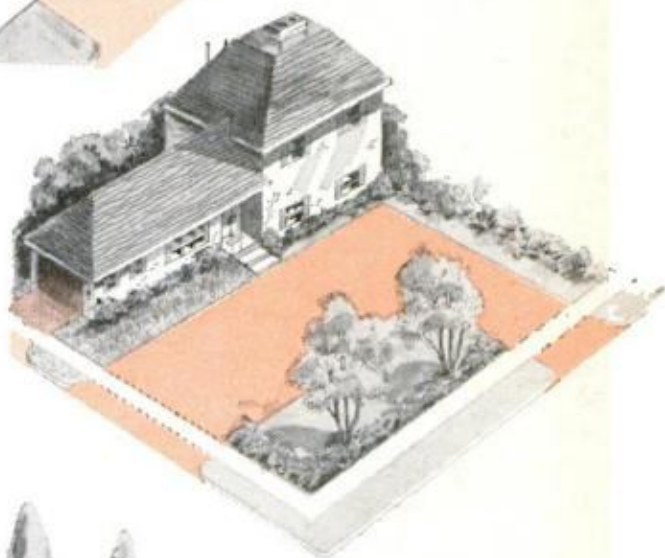
Fine and dandy, but what's the answer



ANOTHER REMEDY

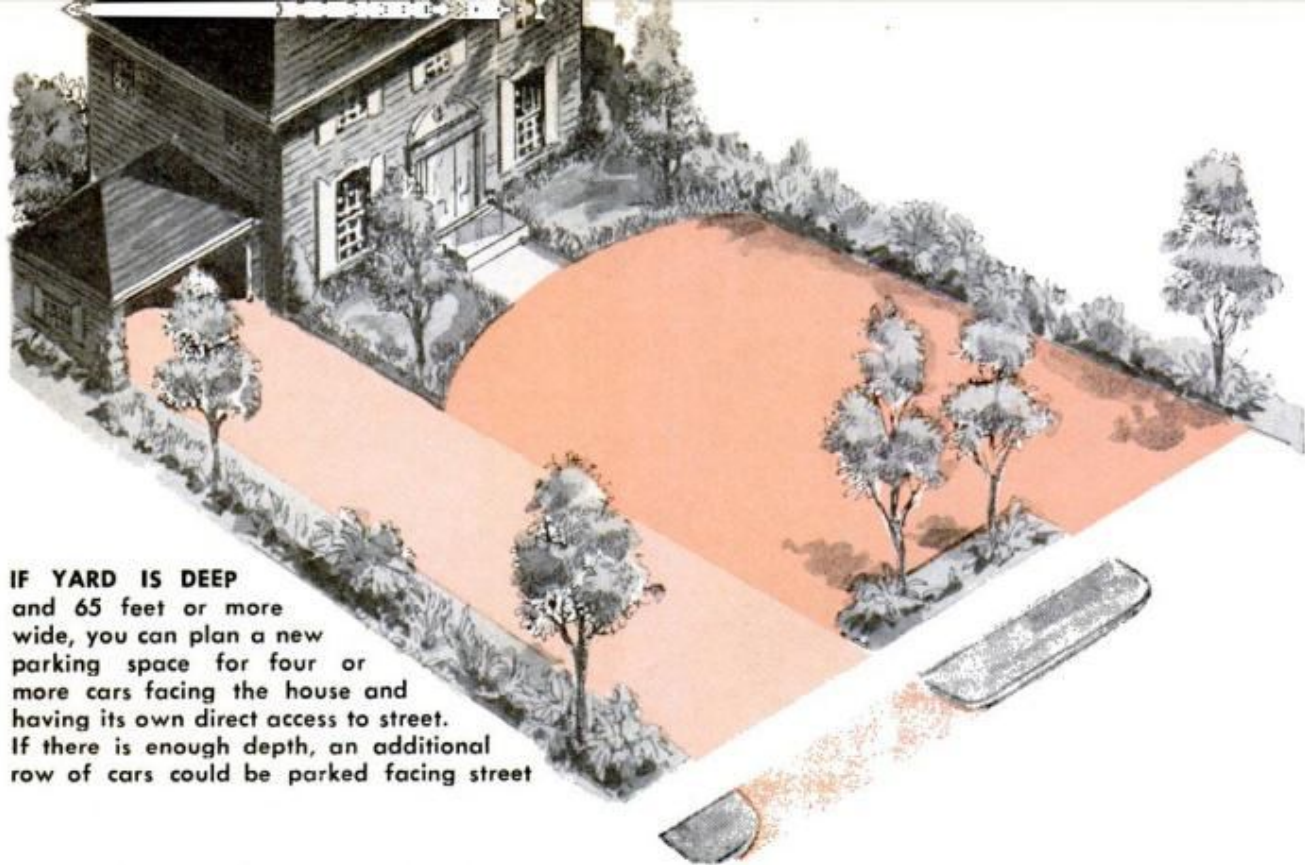
for a narrow lot with the house placed well back from the sidewalk is to provide for diagonal parking spaces adjacent to the existing drive. This reduces alterations at the curb, preserves most of planting that now exists and produces interesting type of "free form" shapes

FOR A WIDE CORNER LOT where the principal setback of your house from the street is only 40 feet or so, creation of a new L-shaped parking area with a separate street access 16 feet in width will permit the guests to enter in one direction and depart in the other, without the need for turning around. Make the area at least 40 feet wide for parking at right angle to house



IF FRONT YARD

measures 50 ft. wide or more, and house is set well back from the sidewalk, you could widen your present drive into a rectangular parking court. If new area is at least 25 ft. wide, those guests who park their cars toward the lot line can back into the present drive, then head forward safely into the street



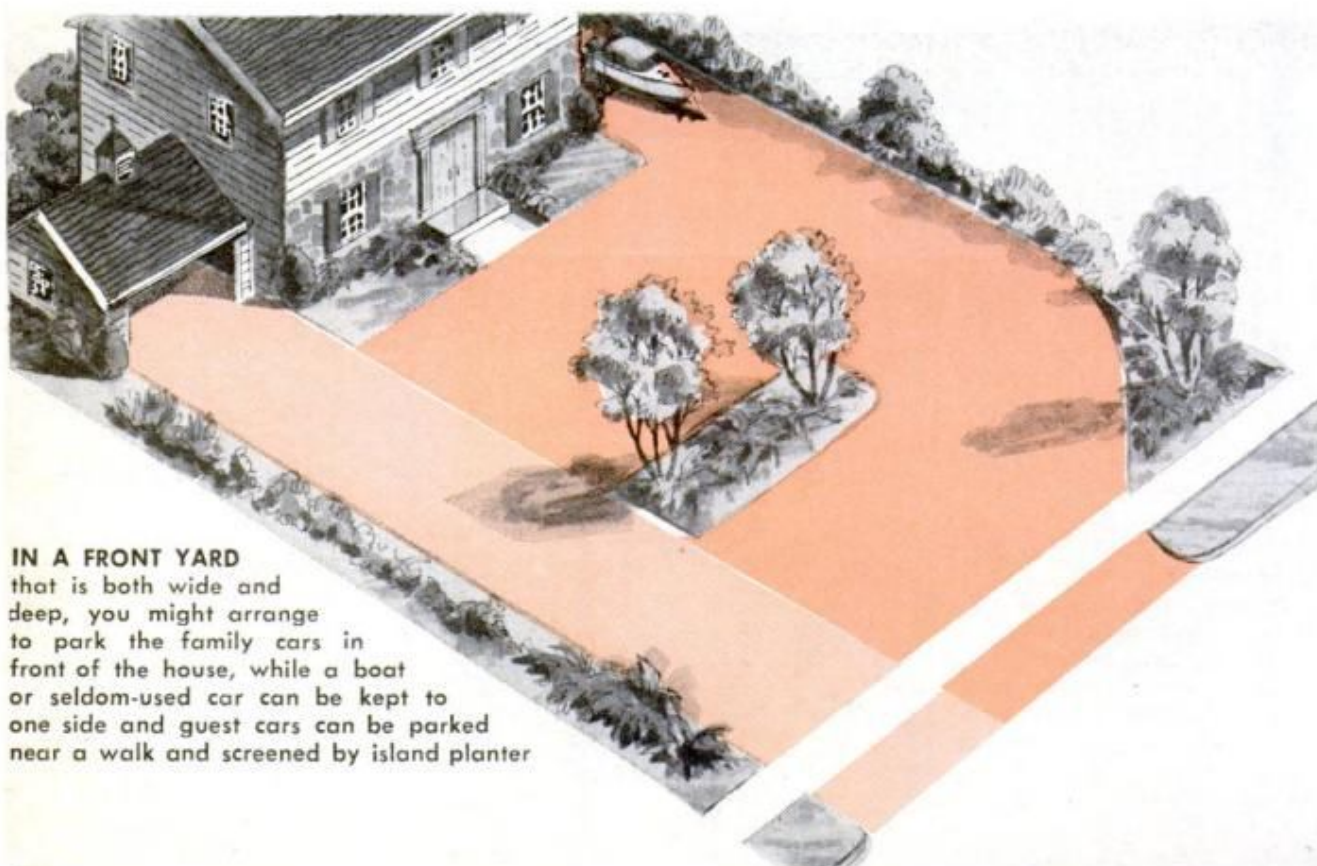
IF YARD IS DEEP
and 65 feet or more wide, you can plan a new parking space for four or more cars facing the house and having its own direct access to street. If there is enough depth, an additional row of cars could be parked facing street

if you own a place which was built when street traffic consisted of an occasional passing car, and if local authorities are now seriously considering a ban on all parking at the curb?

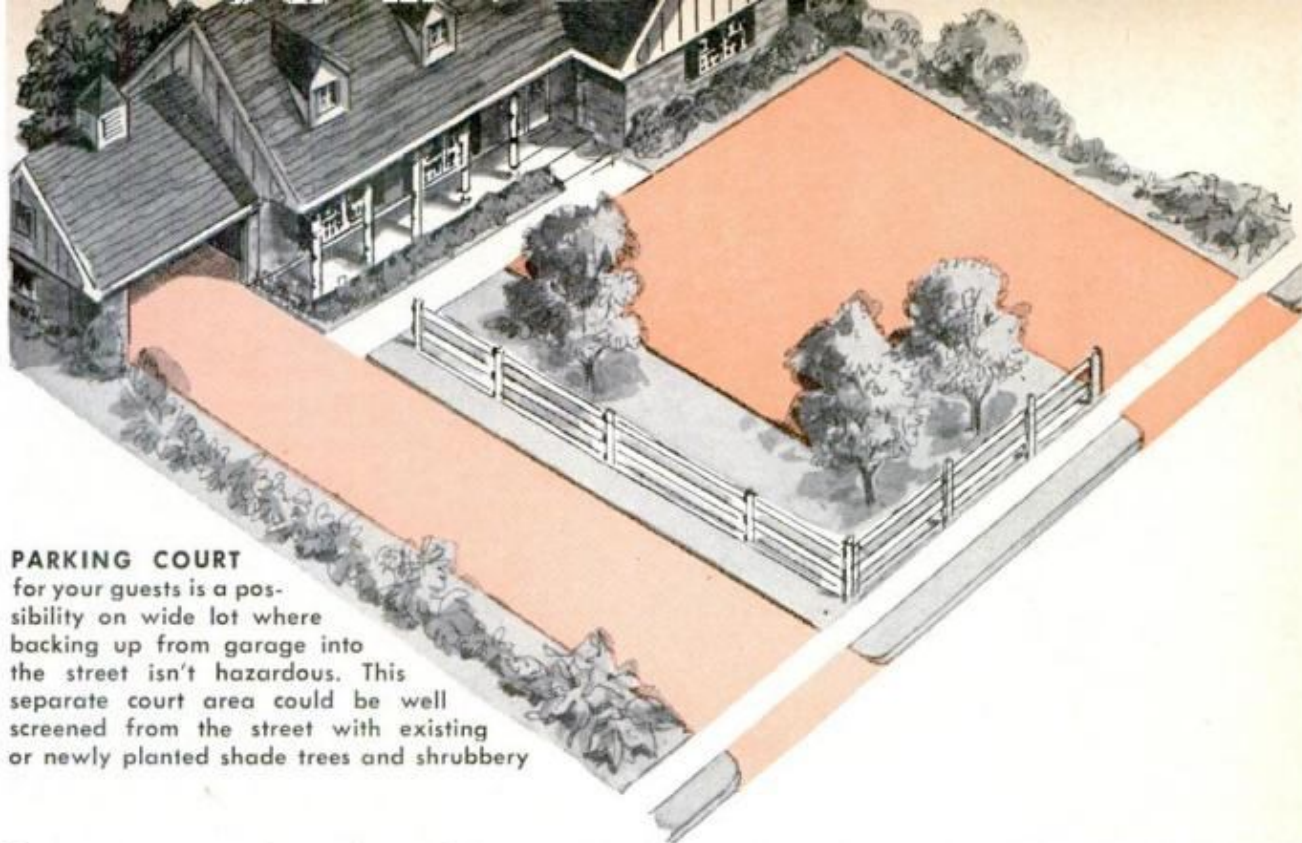
Suggested solutions are shown for lots with varying widths, and houses which set back from the street at varying depths. Since none of these conditions may match yours precisely, or provide the actual

number of 9x20-foot parking spaces you need, a combination of the solutions, plus your own ingenuity, could do the trick.

There are three categories of solutions: (1) enlarge the existing drive, making it possible to back the car from the garage and turn it around to be headed toward the street; (2) enlarge the existing drive and parking area for family and guest cars and (3) provide a new parking area



IN A FRONT YARD
that is both wide and deep, you might arrange to park the family cars in front of the house, while a boat or seldom-used car can be kept to one side and guest cars can be parked near a walk and screened by island planter



PARKING COURT

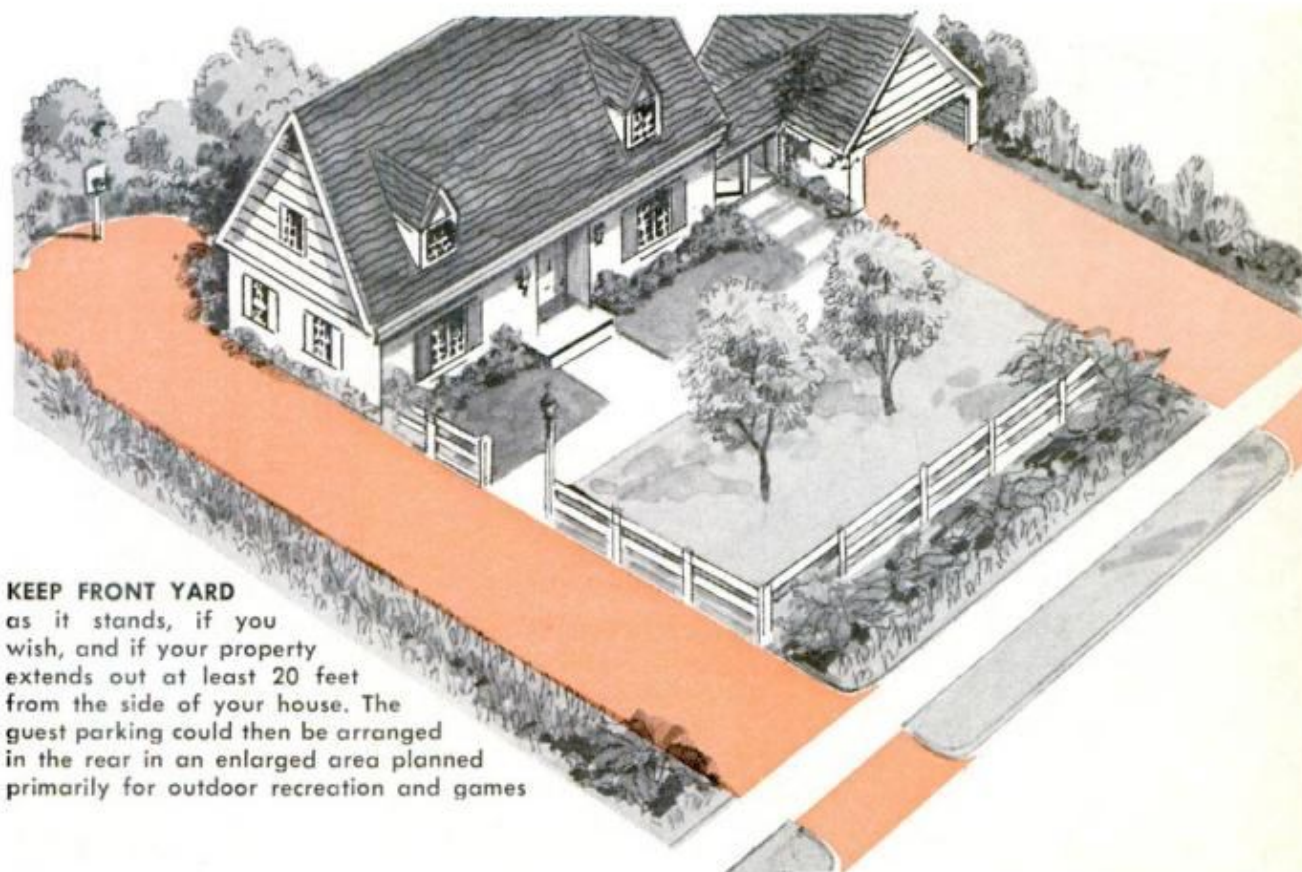
for your guests is a possibility on wide lot where backing up from garage into the street isn't hazardous. This separate court area could be well screened from the street with existing or newly planted shade trees and shrubbery

for guest cars, independent of the existing drive. If the grade pitches considerably up or down from the curb level, try to provide guest parking on a level area near the street.

Be sure to preserve all good trees by planning the parking area around them. If there are no trees, consider planting hemlocks or pines around your new parking area in order to provide a visual and

sound-dampening barrier from the street.

Incidentally, off-street parking offers a fringe benefit you may not have thought of. It reduces the annual cost and labor of maintaining a good lawn. In fact, if you want to substitute year-round greenery for grass, you can plant ground covers like pachysandra, Baltic ivy or myrtle, in addition to broadleafed evergreen shrubs. ★ ★ ★



KEEP FRONT YARD

as it stands, if you wish, and if your property extends out at least 20 feet from the side of your house. The guest parking could then be arranged in the rear in an enlarged area planned primarily for outdoor recreation and games

They Dig for Fish

Using such tackle as sledgehammers and saws, this family of amateur archeologists has dug up fossil seafood in western Wyoming as much as 60,000,000 years old

By JOHN S. FLANNERY

CARL ULRICH and his wife, Shirley, drive wedges between sandstone slabs (above), and Carl and son Wallace (below), survey their "fishing equipment"

HIGH IN THE DRY, windy hills south of Kemmerer, Wyo., is an extinct lake that once was stocked plentifully with fish—something like 60-million years ago—but it is still being fished today.

A dedicated family of archeologists, with the patience that would shame any ordinary fisherman, is seeking out these super game fish and—scraping away the accumulation of millions of centuries, dust speck by dust speck—is bringing them back to museum condition.

The family's fishing technique goes like this: The top layers of dirt and rock, sometimes eight feet deep, are removed with a bulldozer, then a shovel. When the shale layer is reached, the top sandstonelike layer is carefully swept. Then, on hands and knees, family members creep carefully across the surface, feeling, inspecting and marking each tiny bump and rise. When they're sure they have something, careful guidelines for cutting are marked.

Then a circular saw with a carborundum



PATIENT SCRATCHING by Ulrich scrapes away centuries of sediment from perfectly preserved fossil fish



SHIRLEY ULRICH works on prize find, 5½-foot gar. Slab that held it weighed more than 300 pounds



Photos by the Author

blade cuts down through the flat layers. Wedges made from heavy hacksaw blades brazed to cold-rolled-steel handles are spaced along the slab and tapped in place. Slabs are a quarter-inch thick or more.

A waiting period follows until the sound of stone separating from stone is heard, then each of the wedges is given another tap. This slow process is repeated until the entire slab is released.

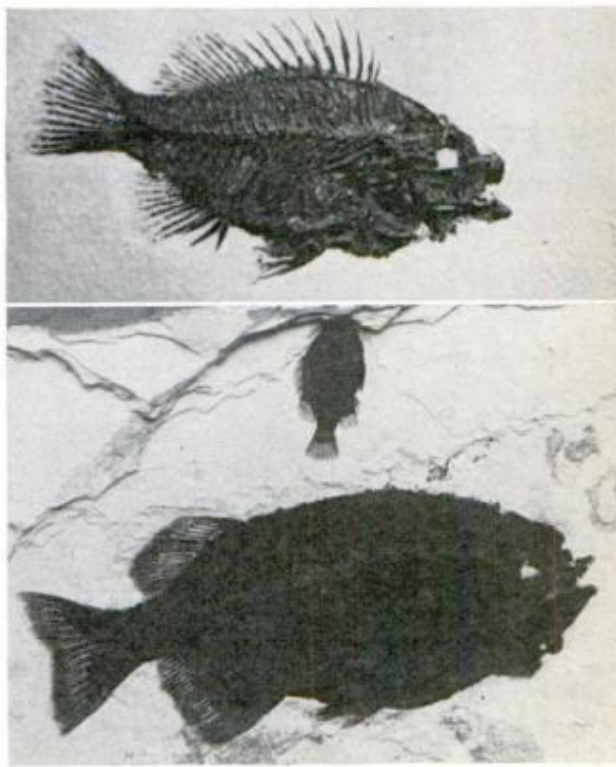
Once removed, it is allowed to dry, then the real artistry begins—removing the sand, grain by grain, with homemade tools, until the fish is revealed.

The family, headed by Carl Ulrich, sells some of the fossils to finance the hobby. Ulrich holds down a full-time job with a local gas company. President Dwight Eisenhower purchased one of the fossils as a gift for Emperor Hirohito of Japan. Their finds go by such names as Knightia, Priscacara, Diplomystus, Mioplosis, Notogoneus and Phareaodus.

Not a catfish in the bunch.

★★★

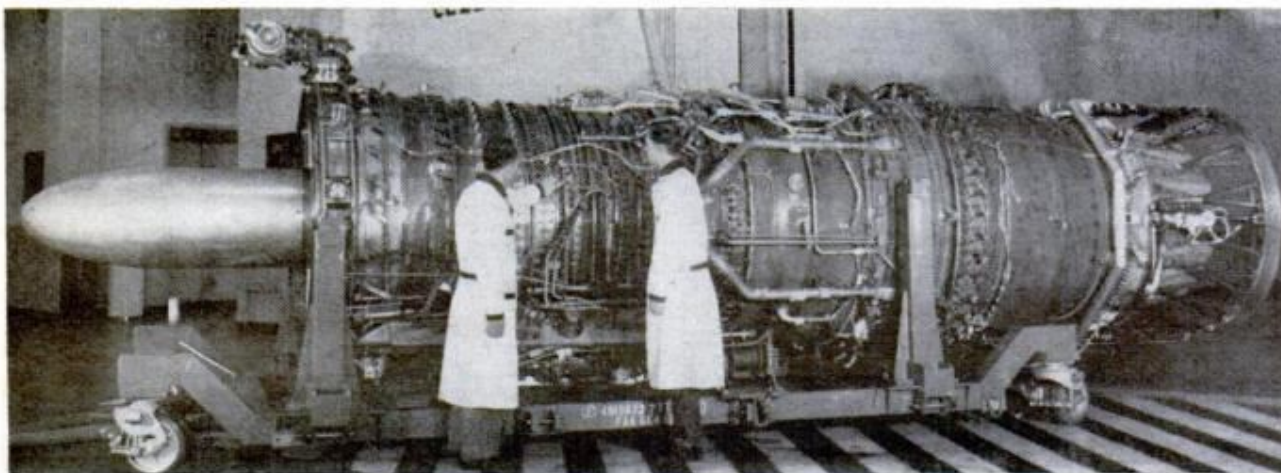
FINISHED SPECIMENS appear dark brown against light background of sandstone. Fossil fish are from Eocene epoch of Tertiary division of Cenozoic era





Deep 6 wastebasket

The Atlantic Ocean is being studied for use as a safe dumping site for incinerated waste. Above, Dr. Candace Oviatt, a marine biologist, starts a trip to the sea bottom 18 miles off Rhode Island; at right, Dr. Oviatt and Dr. Saul Salla, oceanographer, study the proposed dumping area. An IBM computer helps predetermine effects on ecology of the area.



Most powerful jet is ready for the SST

General Electric's GE4 turbojet for the U.S. supersonic transport recently exceeded 63,200 pounds of thrust, making it the most powerful jet engine in the world.



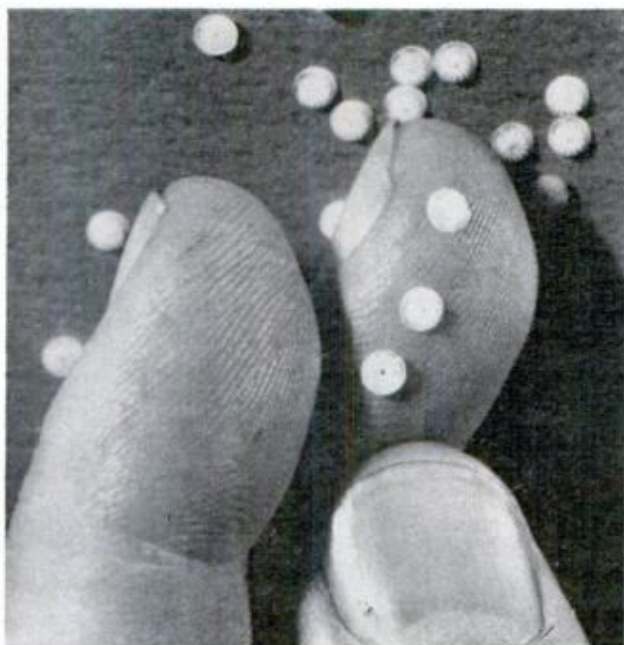
Cessna to offer a new business jet

Cessna's Fanjet 500, a six-passenger, two-crewman business plane, is scheduled to go into production in 1971. The craft will have a top speed of 287 knots.



Rubber blade for plow

The rubber snow-plow blade on this otherwise conventional plow lasts 10 times longer than regular steel snow-plow blades, and also reduces danger of damage to road surfaces. Introduced by B. F. Goodrich Co. last winter, the blade is made of Armorite, a natural rubber compound. It gives service for approximately 1000 miles, compared to the 25 to 125 miles for a steel blade, according to the Goodrich engineers.



Tiniest gears

Believed by the maker to be the smallest gears ever molded, these acetal stopwatch pinions have gear teeth that are $7/1000$ inch thick and a center hole that's less than $1/50$ inch in diameter. They're made by Gries Reproducer Co. in "limited cavity" molding equipment in a high-speed, automatic operation.

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Moon rover for astronauts

A vehicle that in 1972 could provide astronauts with transportation on the moon's surface or operate unmanned by remote control from Earth was recently shown by Grumman. The electrically powered LM/LRV (Lunar Module/Lunar Roving Vehicle) could carry astronauts over a 7-mile radius at 10 mph; using solar cells, it could operate, unmanned, over a 750-mile range for six months.



'Helicopter blade' for subs

This is a model of a new kind of propeller developed for deep-diving submarines at the Westinghouse Ocean Research and Engineering Center. Controlled much like helicopter blades, the new propeller promises to give great maneuverability—up, down, sideways, fore and aft—to undersea craft.

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NEW IN PHOTOGRAPHY

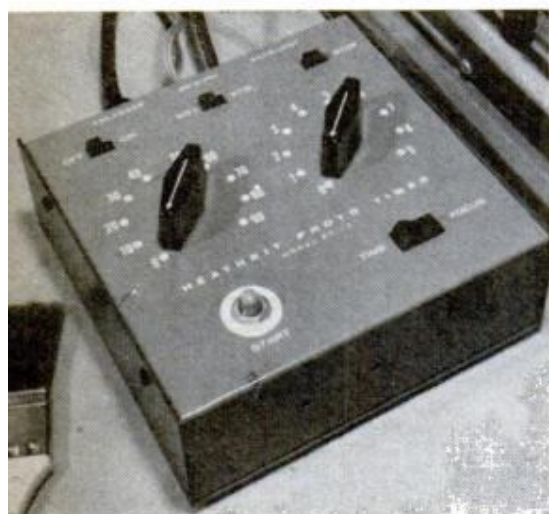
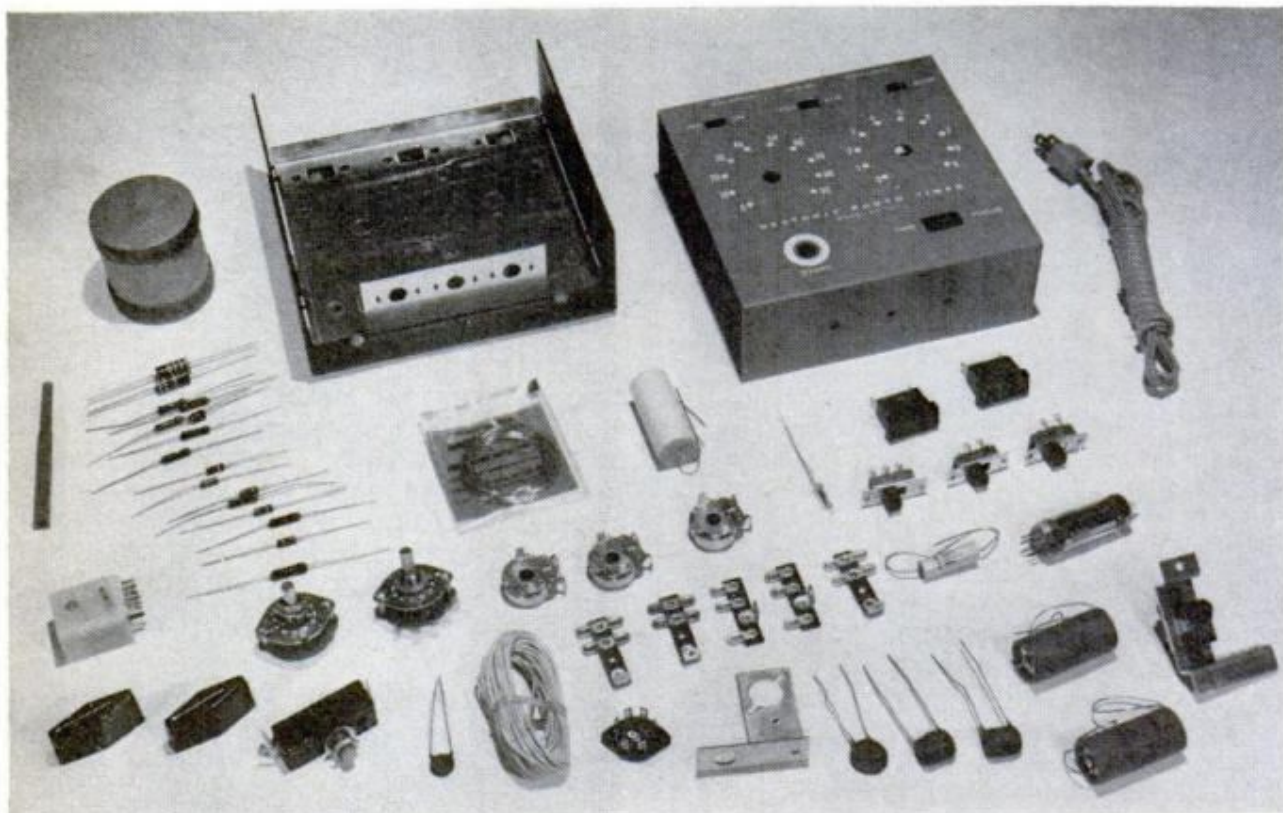
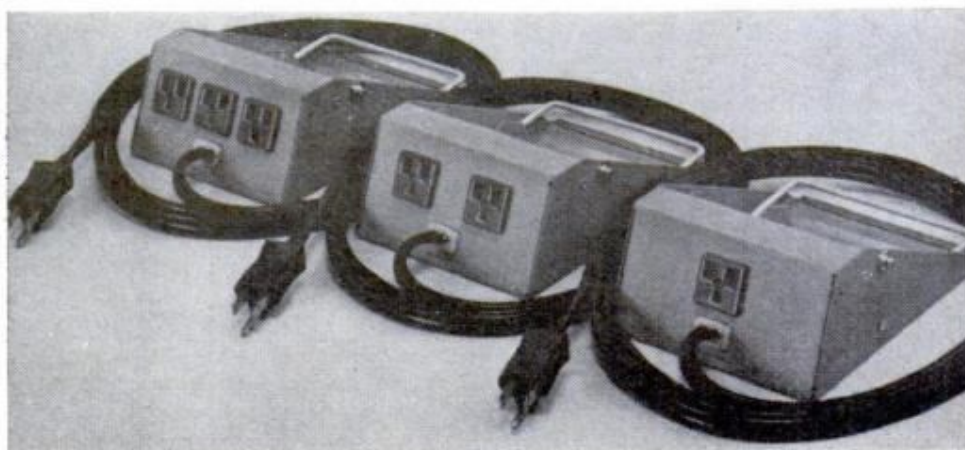


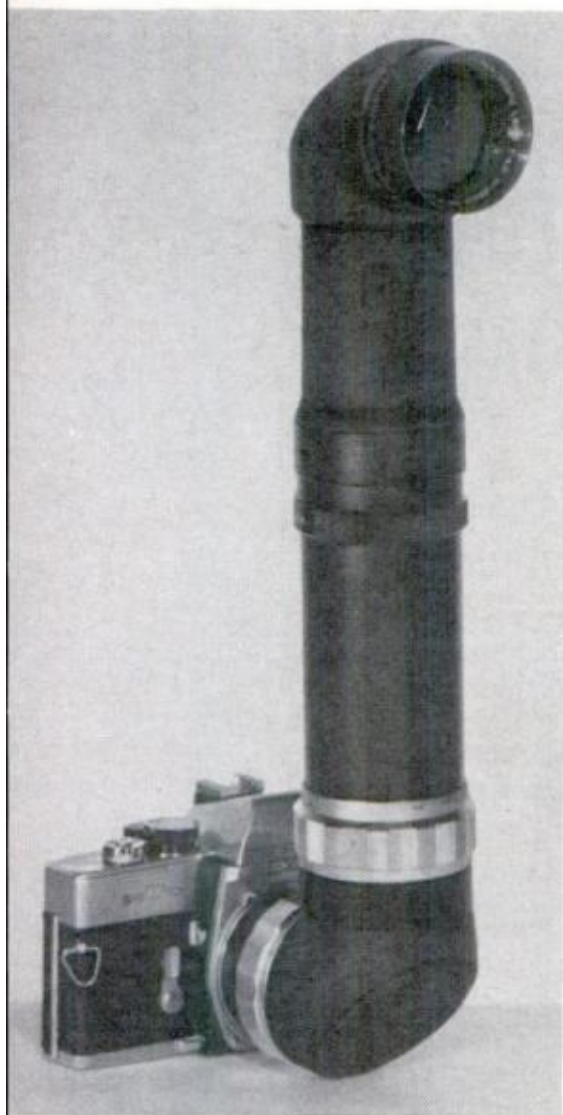
PHOTO TIMER YOU CAN BUILD FROM A KIT

Unlike clock-type mechanical timers, this Heathkit model doesn't have a spring or gear in it—it's entirely electronic. A choice of two scales lets you time enlarger exposures from 1/10th of a second to 9.9 seconds for short intervals and from 1 to 99 seconds for longer periods. Two outlets provide connections for both an enlarger and a safelight. When the timer starts, the enlarger goes on and the safelight goes off. When it stops, the enlarger goes off and the safelight comes back on. Intervals are determined by the time required for capacitors to charge in combination with timing resistors of various values. Because operation is electronic, exposures are accurate to a fraction of a second. The kit sells for \$27.95, takes three to four hours to assemble. Heath Co., Benton Harbor, Mich.

VERSATILE FOOT SWITCHES

at right give you a choice of one, two or three outlets that can be wired normally on, normally off or hot all the time. This way, you can turn one on and another off simultaneously. The Toemotron switches will control enlargers, printers, safelights, floodlights and power tools. About \$15. March Scott Design and Development, 800 W. Barkley Ave., Orange, Calif.





YOU CAN SHOOT OVER CROWDS or around corners with the periscopelike telephoto lens (above, left). 100-mm, f/4.5 lens fits most 35-mm SLR cameras, sells for \$129.95. Converter extends it to 200 mm. Spiratone, 135-06 Northern Blvd., Flushing, N.Y.



YOU CAN SWITCH to either flood or spot with this new two-way movie light designed by GE for Super 8 cameras. A choice of two beams gives you broad, general illumination for lighting the whole scene or a narrow spot for pinpointing individual subjects. The powerful 650-watt light operates on 115-volt current and is bright enough to produce well-exposed movies at up to 20 feet. It weighs under a pound, tilts up for bounce effects and comes with brackets to fit most Super 8 cameras. \$19.95. General Electric, Nela Park, Cleveland.



THE ROTARY SLIDE TRAY in this new Honeywell projector is completely enclosed in a streamlined housing. The novel design lets you carry and store the projector without removing the tray, saving setting-up time. You just plug it in and you're ready to go. The Auto/Sharp 642 holds 100 35-mm slides at a time and has a remote control that shows the slides in either forward or reverse sequence so you can repeat a series whenever you wish. \$129.50 with 4-inch, f/3.5 lens. Three, five, 6½-inch lenses available. Accessory automatic timer is \$11.95.

GIGANTIC PHOTO ENLARGEMENTS are now made by a simplified process in England that turns out 2½ by 3½-foot blowups while you wait. Picture is made on Polaroid film (left, below), then enlarged on special paper that comes out of machine minutes later as dry, developed print (center). A fad abroad, instant wall posters may soon find their way to the United States.





Build These Two Handsome Tables in Your Workshop

ROOM-MATCHING STEP TABLE

Making a matching step table for a newly paneled room is a good way to use up some of those nice leftover scraps which are too good to throw away. By using them for the step, the top and the aprons I only had to stain and finish the turned legs and the exposed edges to match and the table was done.

I started by gluing the $\frac{1}{8}$ -in. paneling (actually $\frac{3}{32}$ -in.) to each side of an inner frame of $\frac{1}{2}$ x 2-in. pine. This was done to build up $\frac{3}{4}$ -in.-thick "boards" for the two tops and the two side supports. I used a single $\frac{1}{2}$ -in. piece as a core for the aprons.

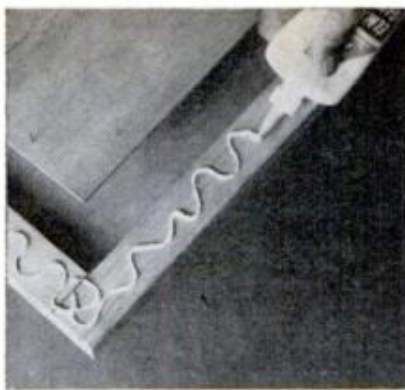
I cut the paneling about $\frac{1}{4}$ in. larger all around than the core and trimmed the sandwiched pieces to final size after the glue had dried.

The blind dadoes for the aprons are made in two adjacent faces of the four turning squares with a straight shaper cutter before the legs are lathe-turned. If you don't have a lathe, or a friend who has one, you can usually buy similar ready-turned legs at your lumberyard or hardware store.

I assembled the table by gluing the aprons to the legs first. Then I attached the tabletop to the assembly with screws up through counterbored holes in the aprons. Next I fastened the step supports to the tabletop with glue and screws from below and, finally I added the step. Glue alone will anchor the latter well enough so you won't have to mar the slick finish with nails.—*Rosario Capotosto*

(For TV table, please turn page)

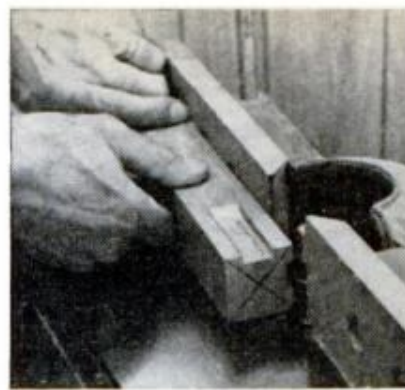




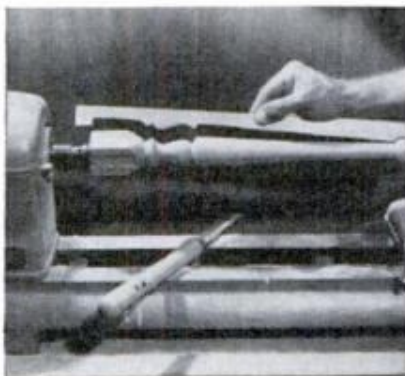
CORE STRIPS of white pine are butt-joined and sandwiched between two pieces of $\frac{1}{8}$ -in. panel



TEMPLATE TACKED to sidewall permits curve to be trimmed with straight shaper cutter



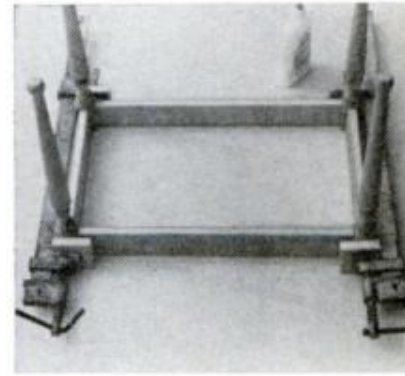
APRON DADOES in legs are cut before they are turned. This is easier to do when work is square



A **TEMPLATE** cut of plywood to the leg profile is a big help in turning all four legs identically

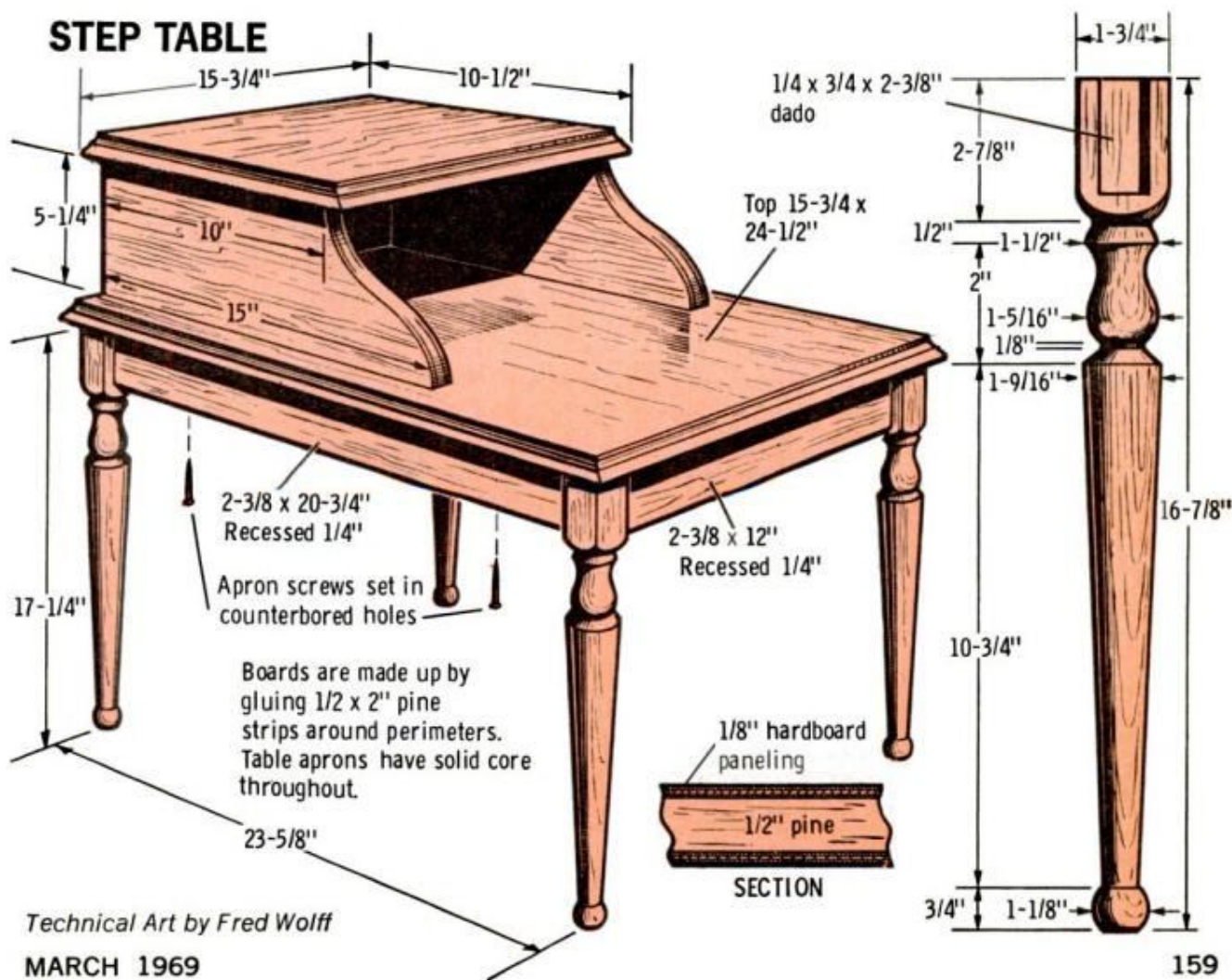


SNUG-FITTING DADO makes a strong glued joint. Apron ends are rounded to conform to blind dado



IF SHORT on bar clamps, glue table in two phases, using side aprons to gain square alignment

STEP TABLE



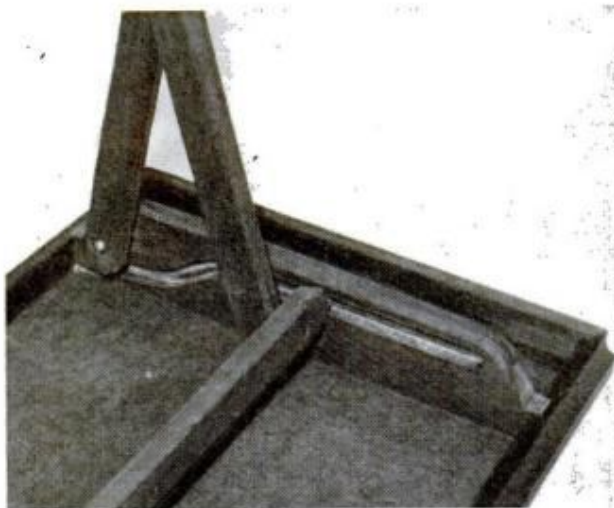
Technical Art by Fred Wolff

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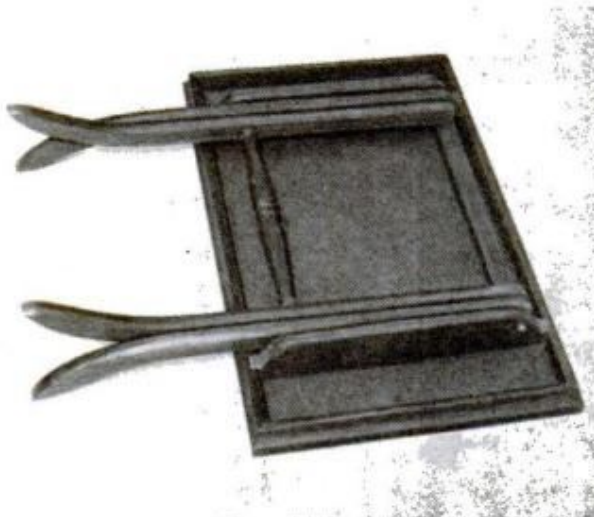
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FOLDED VIEW shows how legs nest flat with table top. Wax applied to tracks helps legs fold smoothly



UNDERSIDE VIEW shows how dowel pins in ends of top leg spreader ride in tracks routed in endpieces



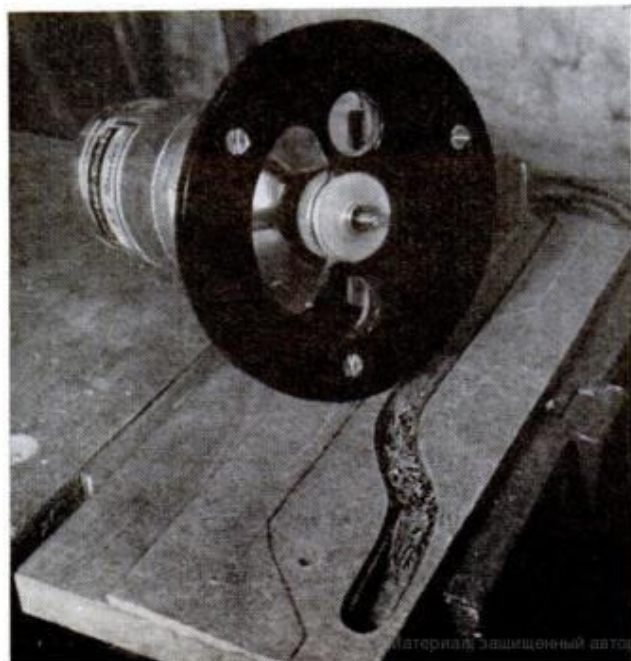
TV TABLE STORES STANDING

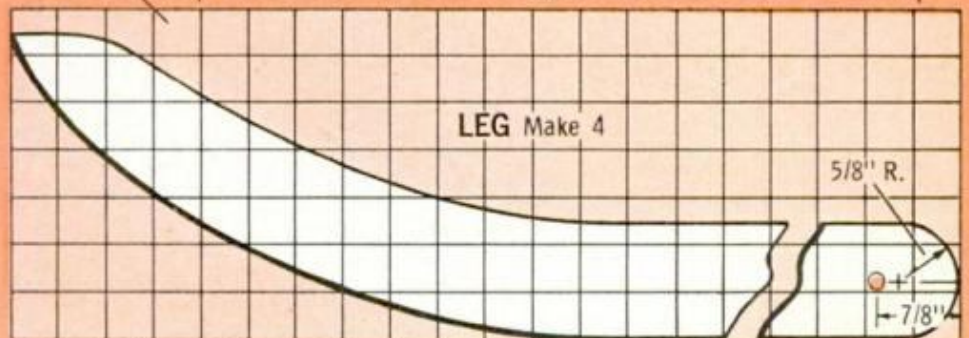
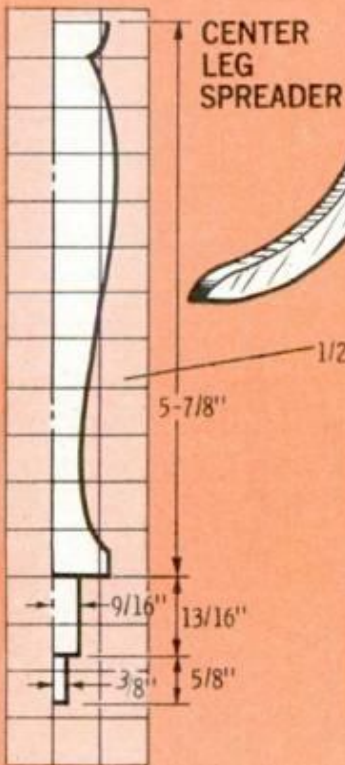
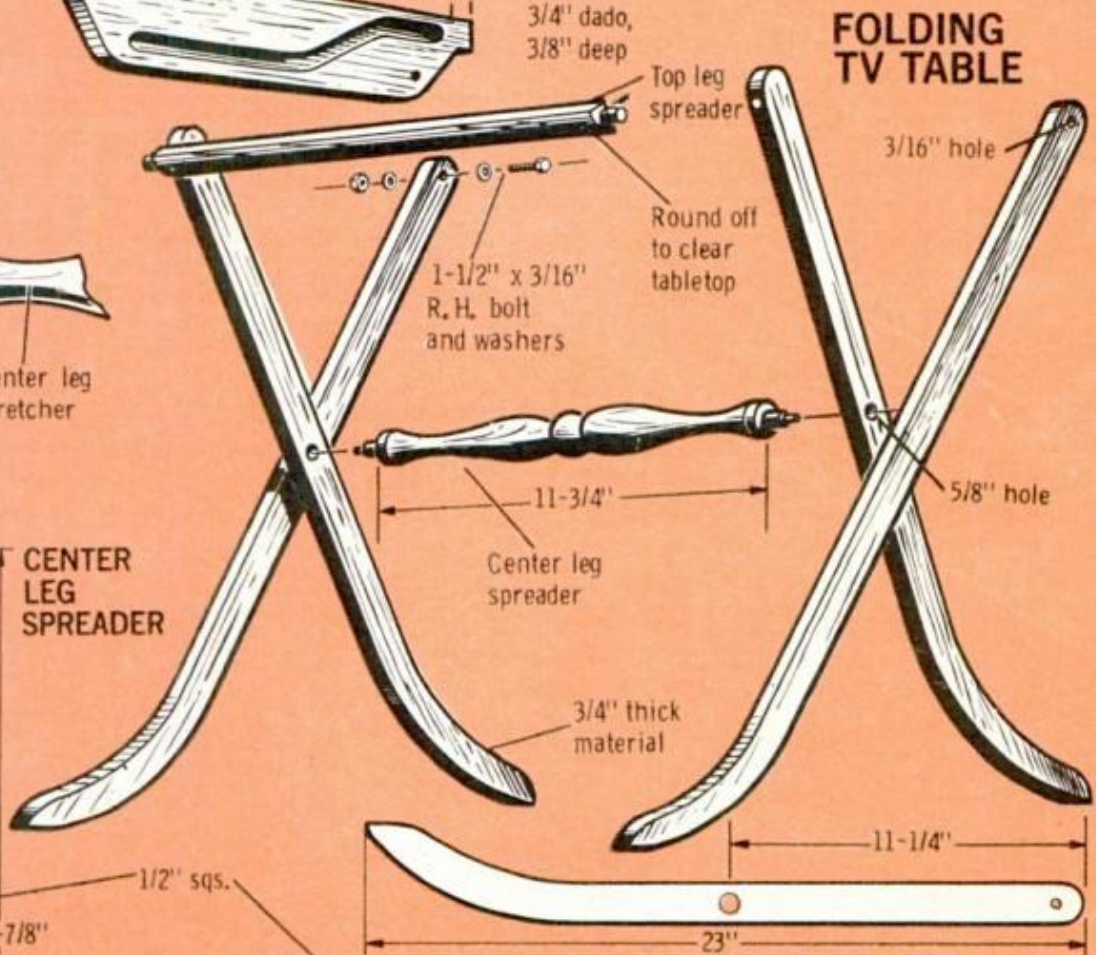
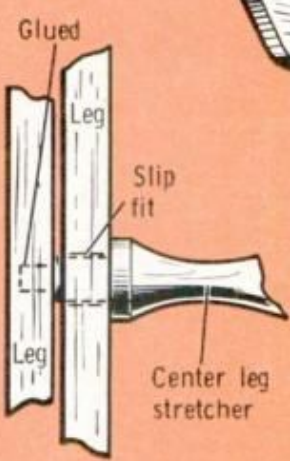
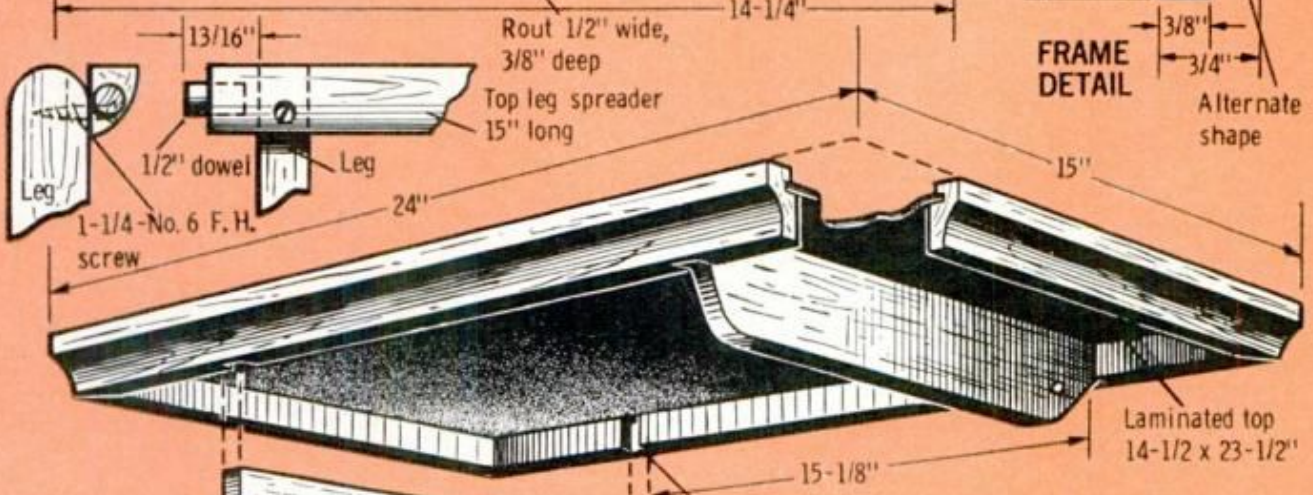
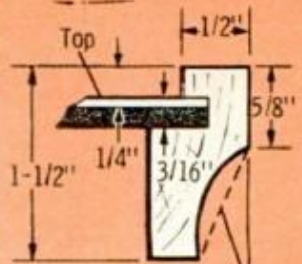
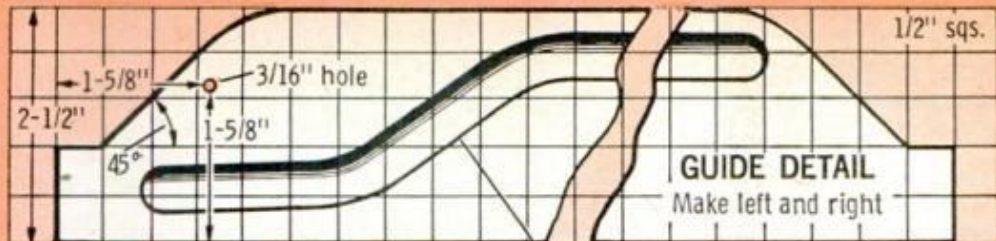
TV tables are handy little pieces of furniture, but the spindly ones you usually see in a store hardly do credit to the other furnishings in your home. Not so with the sturdy little table shown at the top of page 158, however, since it's designed and built like your other fine pieces of furniture. Setting it up is a one-hand operation—just lift the top by one edge and the legs drop right into place. When not in use, the table stands vertically by itself for storing as shown at the left. Its plastic laminate top defies spills.

Here's how you build one table, although you ought to build at least two while you're at it. Make the frame for the top first. Cut some lengths of $\frac{3}{4}$ x $1\frac{1}{2}$ -in. (1 in. nominal) walnut a little longer than you'll actually need for the frame pieces. Shape the cove in the outside edge as shown in the detail on the plan. If you don't have a shaper or molding-head cutter for your table saw, you can just saw a chamfer on the edge as shown. Or, you can use your router to make any kind of decorative edge you like. Next, locate the two dadoes in the sidepieces, measuring from the center of each piece. The $15\frac{1}{8}$ -in. dimension between dadoes is critical for a good fit on the leg assembly, so get it perfect. Now cut the slots in all four pieces to receive the laminated hardboard-and-plastic top, then rip off the little piece to leave a $\frac{1}{2}$ -in. top edge on each frame piece. Carefully miter all four pieces and assemble them in a "dry run" to insure good joints and a frame of the right size.

To glue the plastic laminate to the *(Please turn to page 216)*

ROUTER FITTED WITH GLIDE follows shape of template exactly in routing curved track in table ends





FOLDING TV TABLE

EXCITING
NEW PRODUCTS
 By CATHERINE BILSKI



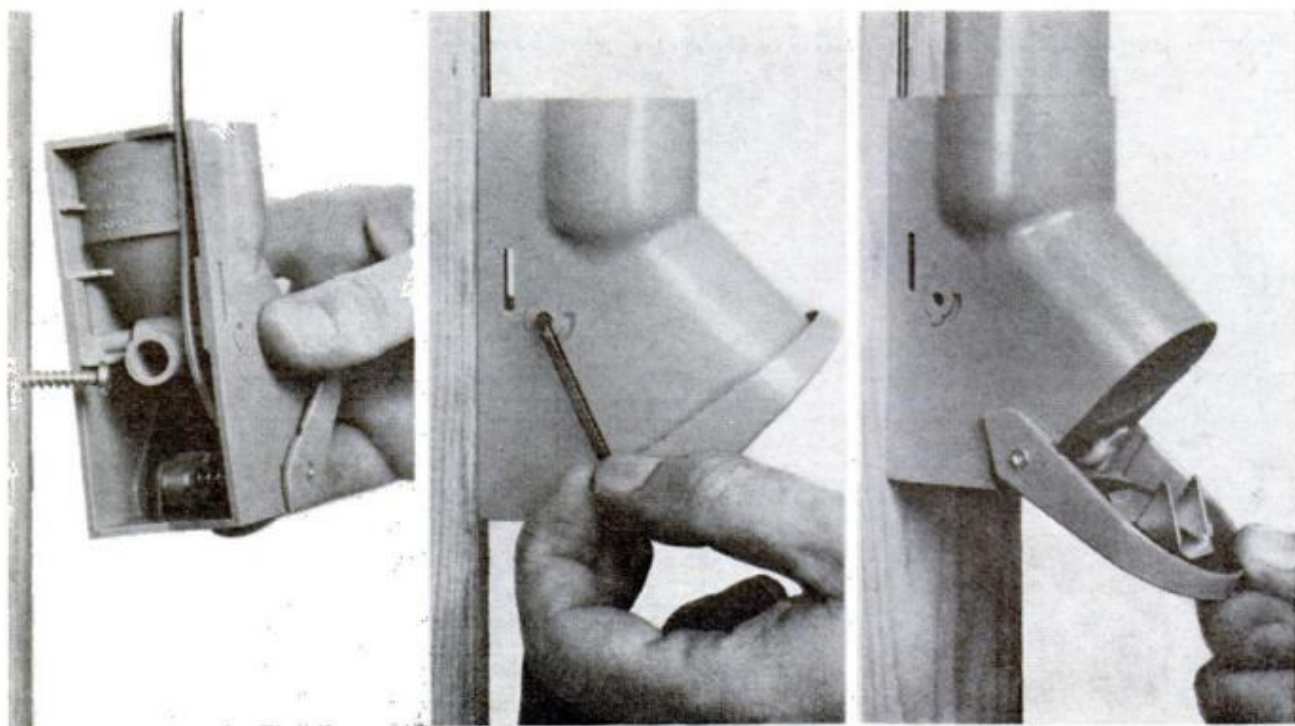
SPRAY ENAMEL KIT consists of both base undercoat and shadow (final coat) in aerosol spray cans. It dries to a hard porcelainlike finish and is ideal for most wood or metal surfaces. Called Epoxy Spray Enamel, the kit is priced at \$2.95 and is manufactured by Luminall Paints, Inc., 2750 S. Garfield Ave., Los Angeles, Calif. 90022.

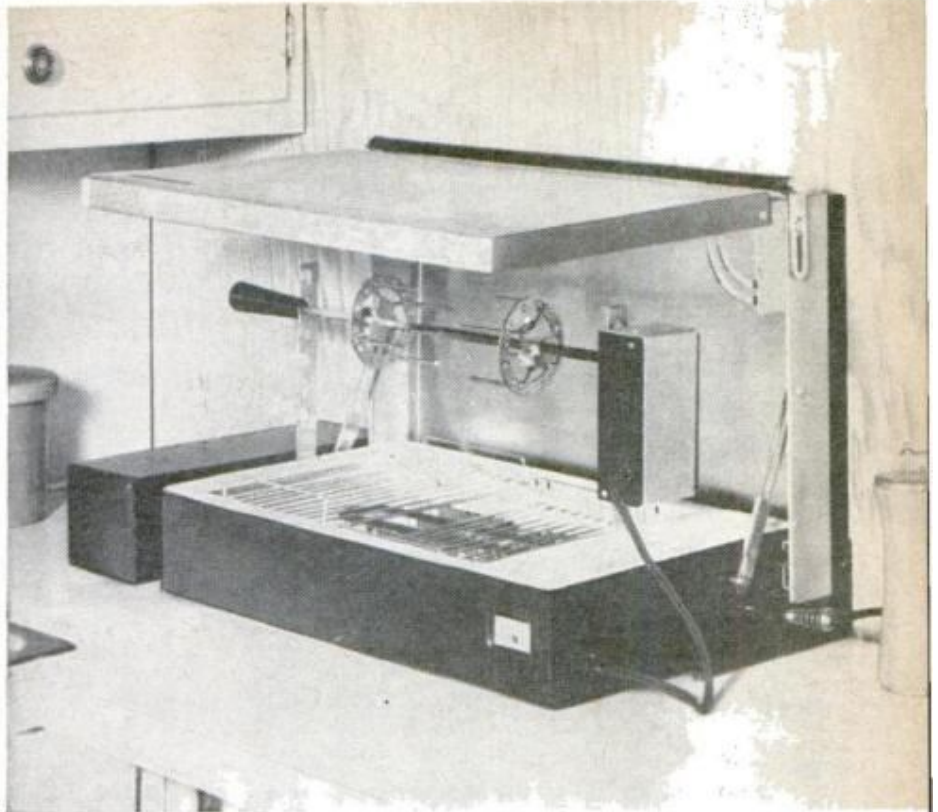
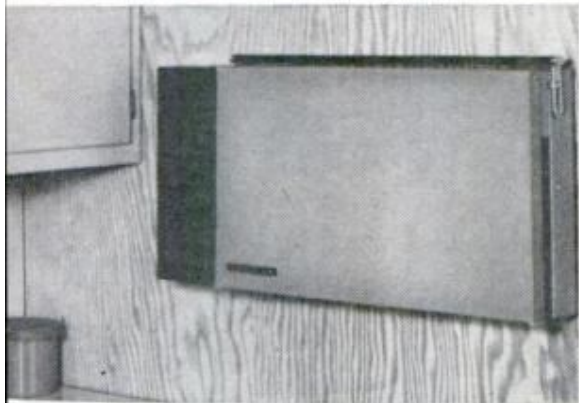
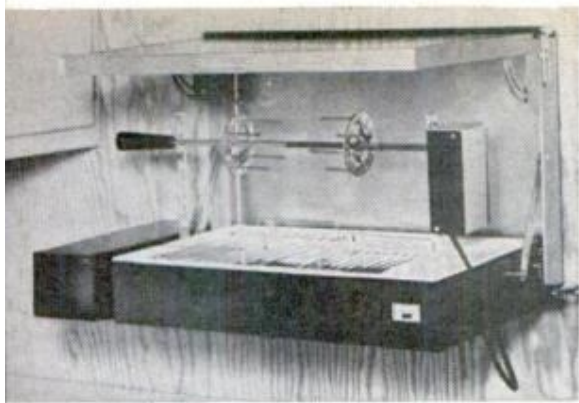


WOOD SHELVING SYSTEM consists of wood pilasters, brackets and a choice of contemporary or traditional carved wood shelves. A pair of 4-foot pilasters (also available in 24 and 36-inch lengths) is priced at about \$19 at local lumber and building material dealers. The shelf system is a product of Masonite Corp., 29 Wacker Drive, Chicago, Ill. 60601.

UTILITY VALVE incorporates a rotary switch for automatic operation of built-in vacuum cleaning systems. When the hose is inserted, the Vacuflo valve cover activates the system.

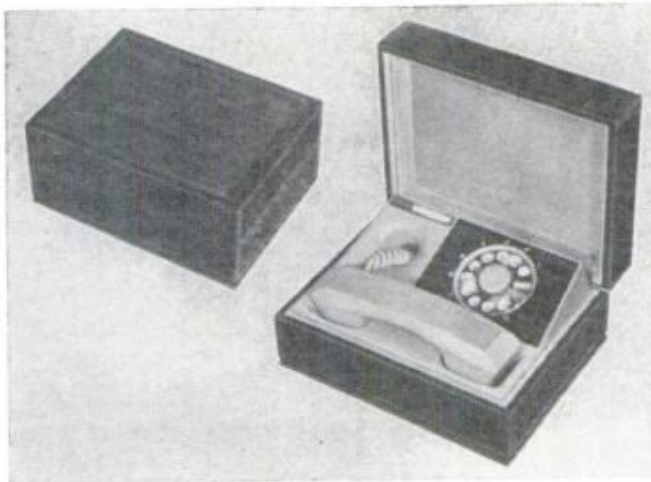
Priced at \$9.50, the valve is designed for 1 3/4-inch-diameter tubing (2-inch adapter is optional). H-P Products Inc., 500 W. Broad St., Louisville, Ohio 44641.





ROTISSERIE-BROILER is an indoor-outdoor smokeless unit that cooks fast and clean without splattering grease. Electric unit may be wall-hung (left) or placed on counter-top (right). Wall-hung broiler closes to 4½-inch

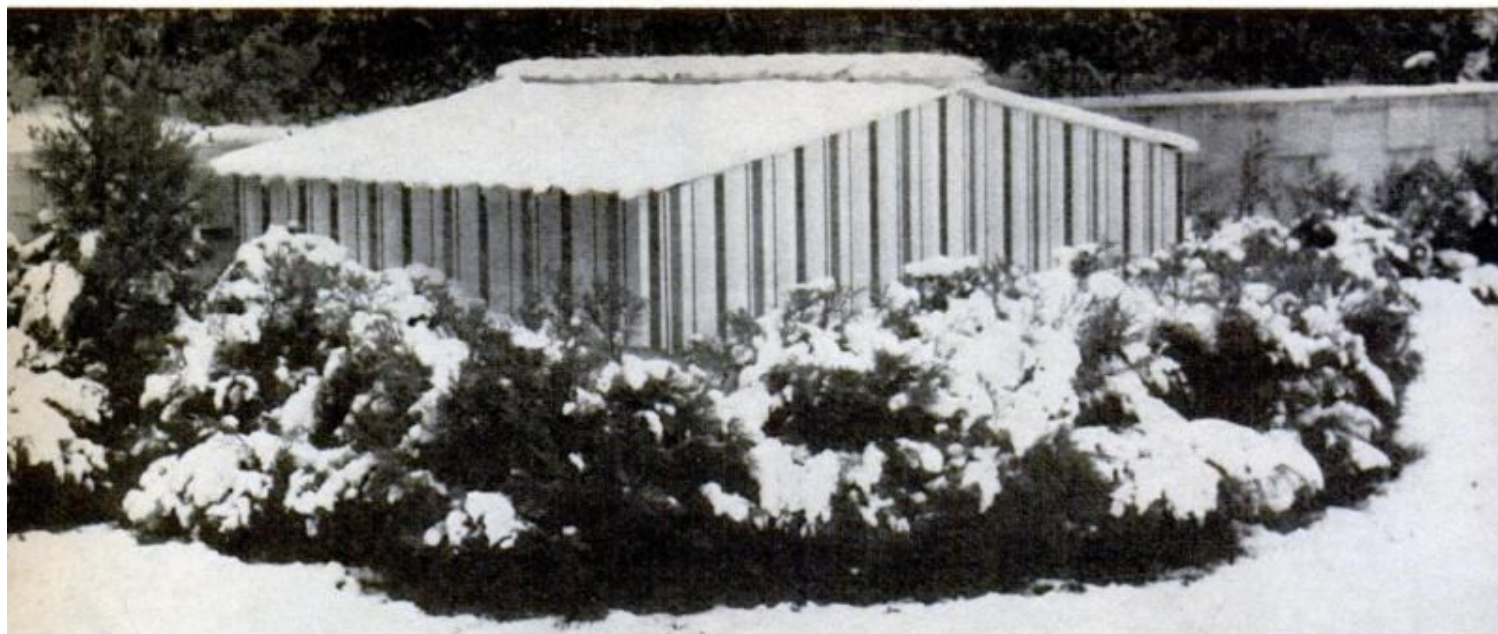
depth. Available at department and appliance stores the unit, called Showcase, costs \$79.95 (enamel finish) or \$85 (brushed chrome). It's manufactured by Nautilus Industries, Inc., 185 E. South St., Freeland, Pa. 18224.



CONCEAL YOUR NEXT TELEPHONE with the Decotel "ChestPhone," a walnut chest with carved side panels, a richly crafted tan handset, an inner top deck and a beige cord that retracts when not in use. Local telephone companies usually will connect the instrument to their lines for a one-time charge of \$10 plus the usual monthly service rate. The unit also is available with charcoal handset and black cord. Sold at most gift and department stores, the "ChestPhone" is priced at \$80 and can also be ordered from America Telecommunication Corp., 1901 Avenue of the Stars, Los Angeles, Calif. 90067.

AIRCONDITIONERS in the Imperial line feature 11 different slide-in reversible decorator panels (right) to suit your furnishings. The eleven models in the series range in capacity from 6500 to 18,000 B.T.U. Their 23¾-inch width is ideal for window or through-a-wall installation. Four units operate on 115-volt circuits; others on 220 volts. Made by Airtemp Div., Chrysler Corp., 1600 Webster St., Dayton, Ohio 45401, they are available at most department and appliance stores.





Get a Jump on Spring With This **Fiberglass Cold Frame**

By beginning now, you can get an early start growing your own flowers and vegetables from seed in the warmth of a sun-heated enclosure such as this

By WAYNE C. LECKEY, Home and Shop Editor

IF YOU'VE HAD YOUR FILL of winter and are itching to get back to digging in the garden, a cold frame can make the next thirty days or so pass in a hurry.

In a little solar-heated greenhouse like this, you can plant seed flats and watch them sprout into sturdy seedlings. Before you know it, they'll be big enough to transfer to the garden when spring rolls around and you will have gained a month's growing time.

Growing your own marigolds, salvias, nasturtiums, petunias, dahlias and vegetables from seed can be a lot of fun if you like to watch things grow, and you'll save money in the bargain. You can buy a lot of seed for the price of a single flat at a nursery.

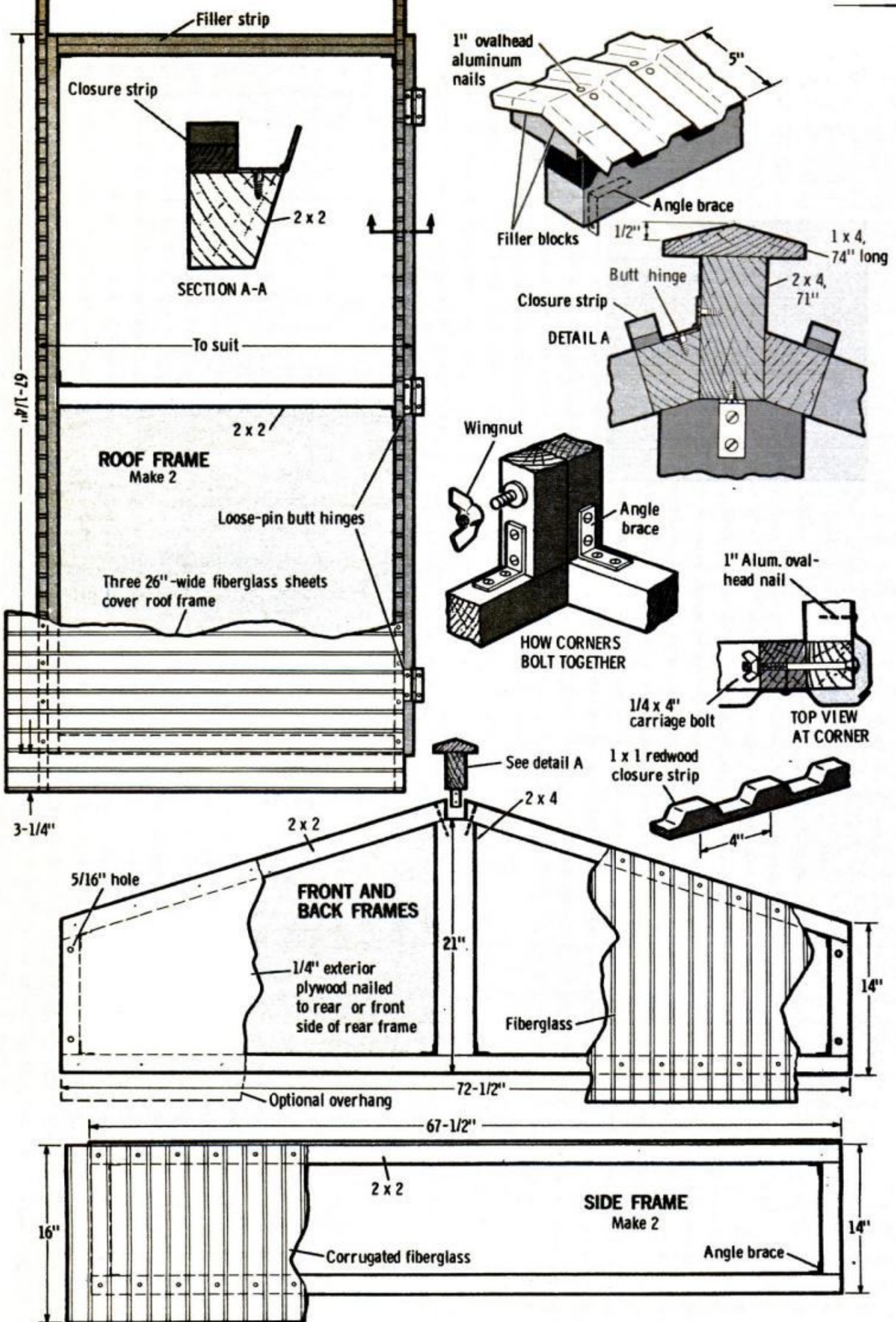
I built this cold frame to perch on top of an existing concrete-block planter, and designed it so it would come apart in easy-to-store sections. In summer I take it apart and put it away. Eight wingnuts and two screws are all that hold it together. Each side opens like the hinged lid of a box for access and ventilation. I

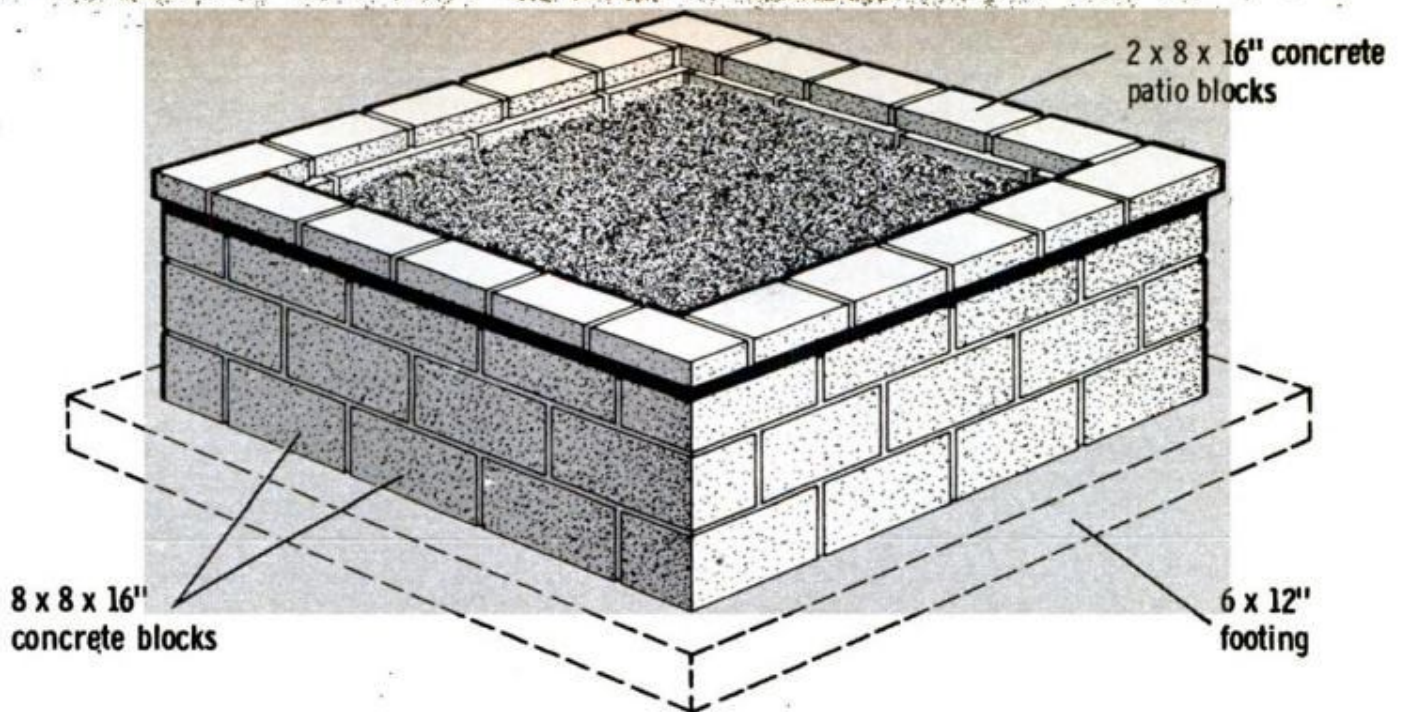
covered the framework of 2x2s and 2x4s with colorful ribbed fiberglass panels called Filon-Stripes. This new awning-like pattern comes in four decorator colors: Bluegrass, Autumn Leaf, Driftwood and Red Oak. I used the latter, pictured on the opposite page. The translucent fiberglass transmits evenly diffused light, is shatterproof and easily drilled and sawed. While it's ideal for a cold frame, this attractive material can be used in many places to beautify your home and make it more livable.

While fiberglass makes an ideal covering for a cold frame and can trap a surprising amount of heat during the day, I used an electric thermostat-controlled heater to protect tender plants on late winter nights when the temperature fell during brief and sudden cold spells. In place of a heater you can cover your cold frame at night with mats or blankets to conserve heat.

The way you support your cold frame is up to you. If you don't want the work of first building a concrete-block planter,







YEAR-ROUND USE of planter such as this is possible when the cold frame is made to sit on top of it

you can set your cold frame right on the ground in a sunny part of the yard, where it will not be subjected to cold winds. A perimeter of bricks or treated 4x4s will provide a level base for it.

How big you make your cold frame depends pretty much on how large you want it. However, if you follow the frame dimensions given in the drawings at the left, three fiberglass panels will space out perfectly to cover the two roof sections and the front and back sections. Thus you won't have to rip them at all for width. When lapped one corrugation, the combined width of three 26-in. panels is 74 in. You will have to rip the fiberglass when it comes to covering the side sections.

Plain butt joints and steel angle braces are used in assembling the six frame sections. Mating holes are made at the four corners for carriage bolts, and a drop-in ridge member is built up as shown to tie the front and rear sections together at the center. You'll notice that the ridge member, which consists of a beveled 1x4 nailed to the edge of a 2x4, is covered with 5-in. strips of fiberglass so that rain will run off the ridge and onto the roof panels. Note that the butting ends of the 5-in. pieces are crosscut at an angle so they meet tight.

Precut redwood closure strips are purchased with the fiberglass and are used to close the openings across the top and bottom of the roof frames. Plain wood strips

(Please turn to page 232)

THE SIDE FRAMES are bolted to the rear frame first. Flange at bottom centers cold frame on planter



FRONT FRAME is added next. Bolts projecting from the corners engage holes in ends of side frames



RIDGE MEMBER ties front and back frames together at the center, then the roof frames are hinged to it





MFG CAPRICE EXPRESS 197, 18-ft. cruiser, deep-vee, fiberglass hull, 120-hp I/O, \$4995

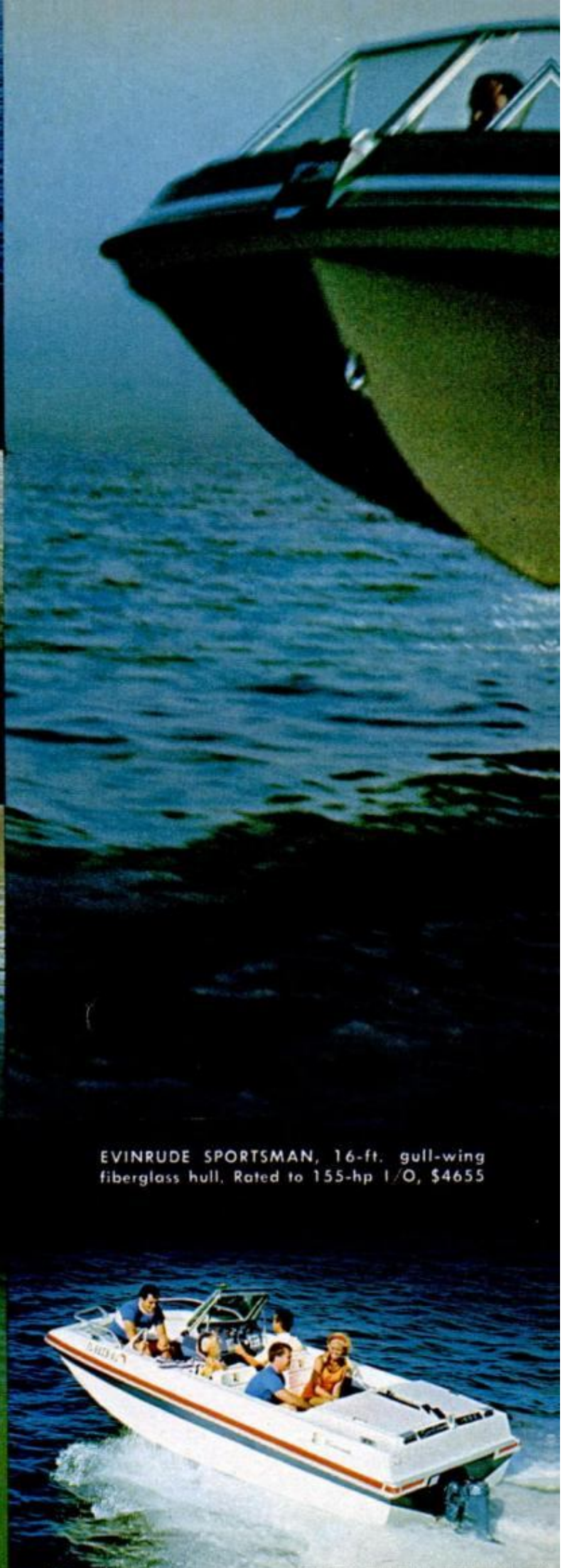


CRESTLINER TIGER MUSKIE, 17-ft. welded-aluminum hull, Rated to 140-hp O.B. \$1795



CHRYSLER VALIANT, 14-ft. cathedral fiberglass hull, Rated to 55-hp O.B., ski boat, \$875

GLASTRON V-143, vee-type 14-ft. fiberglass hull, Rated to 65-hp O.B., ski boat, \$1029



EVINRUDE SPORTSMAN, 16-ft. gull-wing fiberglass hull, Rated to 155-hp I/O, \$4655



Classy, Glassy '69 Boats

Hot power in small boats, swift high-performance boats, big cabins on small hulls are all new trends for '69

By DAN FALES, Boating and Outdoors Editor

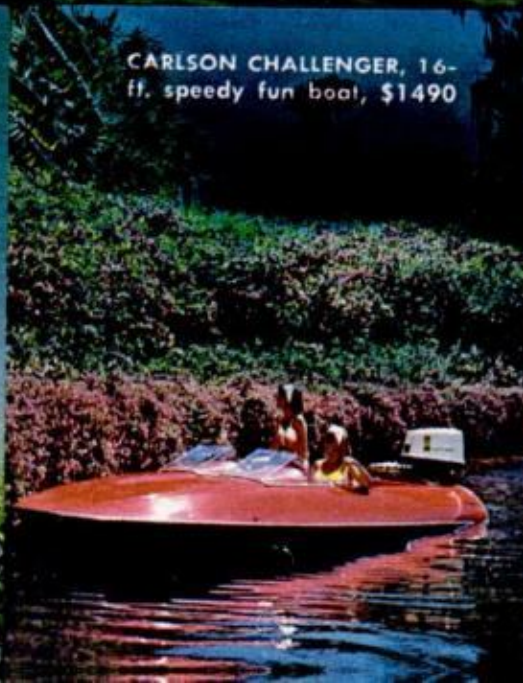


YOU'LL SEE half a dozen new ideas in boats this year. Some of these ideas are dreams; others are here to stay. One of the hottest involves flotation. You'll be hearing a lot about the new systems. Another idea is speedier 14- and 16-footers. One of the dreams, now more of a nightmare, is use of a new plastic in boat construction. But here to stay is the compact cabin cruiser. So is the sexy, rocket-

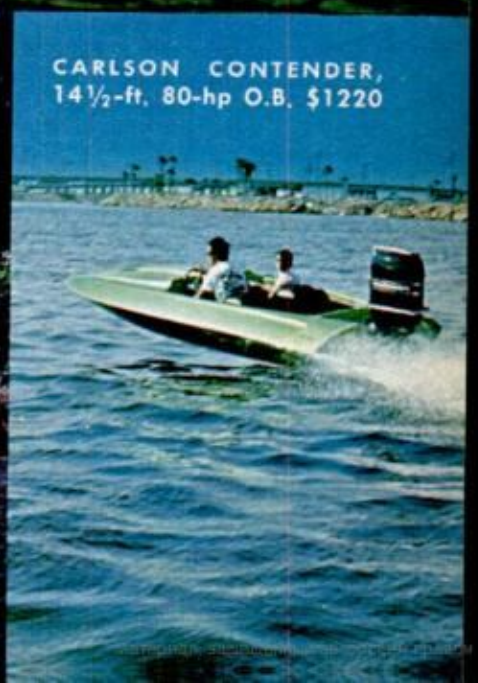
STARCRAFT V-180, vee-type
18-ft. fiberglass hull, \$1995



CARLSON CHALLENGER, 16-
ft. speedy fun boat, \$1490



CARLSON CONTENDER,
14½-ft. 80-hp O.B., \$1220





LAS VEGAS 17-ft. fiberglass is a brand-new series from Arrow-Marine, maker of Sidewinder ski boats



MARK TWAIN 18, fiberglass stern drive with power option up to 225 hp is sturdy ski and pleasure boat



LARSON'S SHARK 155, 15-ft. fiberglass hull with new flotation, has new Larson side-markings. \$1275



GLASSPAR'S TACOMA, 14-ft. fiberglass runabout with new flotation, won't capsize when awash. \$795



like, high-performance boat. Here, too, is the wide-open cockpit boat with a center or offcenter steering console.

But it's the new flotation systems that are making news in 1969. Some companies like Glastron have been incorporating the new flotation for several years. Other companies like Glasspar and Larson are adopting it this year. Still more companies are expected to start next year, especially if the method is incorporated in standards set by the Boat Industry Assn.

Basically, the standards will call for use of flotation systems that keep boats upright even though swamped. For years, there has been a problem with some flotation methods. Though most boats are practically unsinkable, they do flip over when swamped. This means passengers have only the smooth bow bottom to grab for safety. Now, flotation materials are being distributed throughout the boats so they will stay level when awash even with heavy outboard or inboard motors aboard, plus more than 2000 pounds of additional weight. This new system is causing some problems for boat manufacturers, but the benefit to the boating public is obvious.

The new safety feature is also important as builders produce smaller and faster boats this year. Just about every boat maker has snappy 14, 15 and 16-footers with lots of power. These speed-

JUST ANNOUNCED is Johnson's Frontrunner—a wide-open 16-ft. utility boat with steering console up front. See jumping shot on preceding page. This is new concept in interior boat design on a traditional hull

POPULAR MECHANICS



BOATEL'S 35-FT. HOUSEBOAT has new roomy interior design. Fiberglass boat did 32 mph during trials



ROMANY 21, fiberglass, diesel power, is good offshore and heavy-weather boat by Gordon Payne Ltd. \$7200

boats are used for skiing, racing, fun, fishing, day cruising. They cost from \$1000 to \$2500 and come in any of a hundred different designs. Most popular is the 16-foot bow-rider with walk-through windshield driven by a hot 160-hp stern-drive power package, or by 80-hp to 125-hp outboards.

In the shorter boats, less power is needed. In the 14-footers, the 55-hp to 80-hp outboards are popular.

All of these small boats are trailerable—another reason for their popularity. And almost all these boats will be of the cathedral or trihedral hull design. The stability of this type hull is the reason more and more makers are using it. Though the deep-vee is still the design to beat, the multihull design is the best compromise for the average boater.

Far from any compromise, though, are the heavy, short, high-performance boats. These hefty, speedy, sleek boats started to catch on in the West. Their popularity is spreading East, though boats in this class are more expensive than the conventional boats of the same 14 to 18-foot size. But the fun and high speeds are worth the extra cost. Boats like the Sidewinder and Carlson can handle the hottest outboard and most of the high-powered inboard/outboards. These boats are strictly performance jobs with no storage space, little cockpit space, but plenty of umph. They have a good "heavy" feeling at the wheel, and they go through wakes with not so much as a hard bounce. But there's a hard bounce on your pocket-

book: Prices run from about \$1200 for a 14-footer to about \$2000 for an 18-footer. That's without power.

Somewhat lower in price are the center-drive boats. These are the utility type craft that are good for fishing, scuba diving and skiing. All have a center console unit with one seat for the driver. There's plenty of walk-around space in the cockpit; this is especially important to fishermen. Boats of this type are easy to trim, too. These boats run from \$800 for a 15-footer to \$1200 for an 18-footer, without power.

Sister to the center drive is the off-center console unit. This design offers the same advantages of the center drive except for trim.

And it's in utility boat construction that some makers are testing a new plastic. Called ABS (one trade name is Cycolac), this material is being tried in canoes and small boats. It's lightweight and rugged (football helmets are made of it). But so far, there have been some problems getting the material molded so hulls are ripple and dent free. No doubt, ABS plastic is one of the future boat building materials, however.

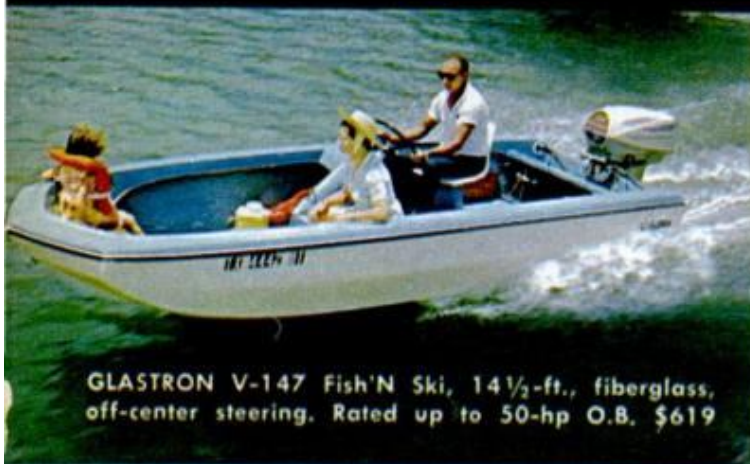
Though not brand new, the trend toward cabin cruisers on small hulls is stronger this year. The increased popularity of small cabin cruisers is most often attributed to the female interest in boating. Often it's easier to get Mother out on the water when she knows there's a cabin cruiser involved. The convenience of cabin living is also a sales point for men. They don't mind



STARCRAFT STAR TREK-V, 15-ft. aluminum sports boat, center steering. Rated up to 45-hp O.B. \$660



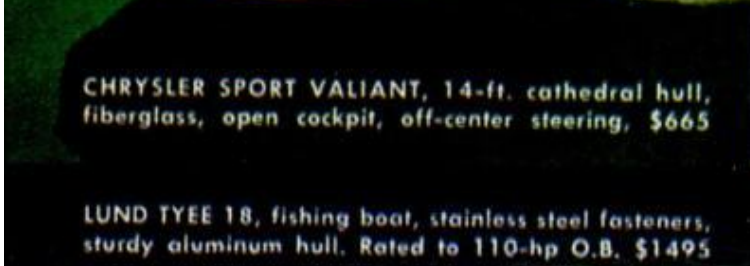
STARCRAFT SUPER-V, 18-ft. concave-vee aluminum hull bowrider. Rated to 80-hp O.B. \$1075



GLASTRON V-147 Fish'N Ski, 14½-ft., fiberglass, off-center steering. Rated up to 50-hp O.B. \$619



CHRYSLER SPORT VALIANT, 14-ft. cathedral hull, fiberglass, open cockpit, off-center steering, \$665



LUND TYEE 18, fishing boat, stainless steel fasteners, sturdy aluminum hull. Rated to 110-hp O.B. \$1495



boats designed for their overnight and weekend comfort in a quiet cover.

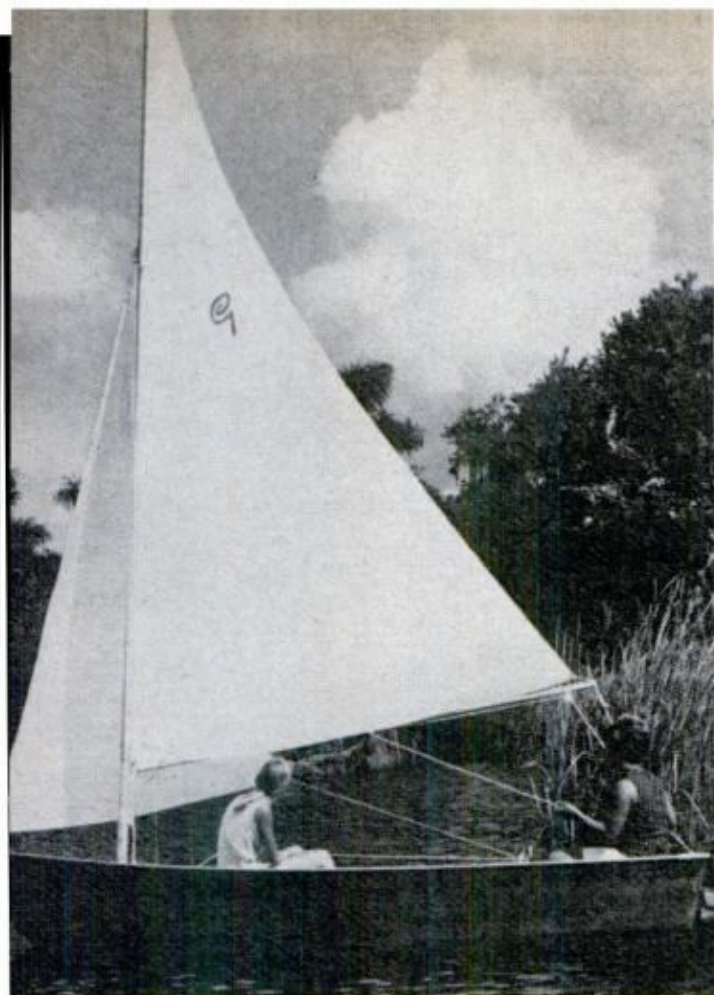
There's a maze of specialty boats that you'll see on the water this year. Heading this parade is the dream child of the boating industry—the houseboat. Houseboats this year are more sophisticated. Interiors are better designed. You have more of a choice in lengths—from 25-footers to 60-footers. Though the price is going up annually, you'll find more boats available this year. About 3000 boats were built last year. There should be 5000 to 6000 in 1969.

You'll also see a close relative to houseboats—the pontoon boat. This year, they range from 15 to 60 feet.

Then you'll see the inflatables. About a half-dozen makers of inflatables are hitting the market with everything from canoes to outboard boats. The material used in inflatables these days is almost puncture proof. It takes the same force to hole an inflatable as it takes to hole a wooden boat.

GLASTRON V-180 Fundeck, 18-ft., fiberglass, center steering. Rated up to 130-hp O.B. \$1999





GRUMMAN'S SAILING CAMPER is a 13-foot aluminum sailboat. New this year is a kit that converts the original cat-rig boat into a sloop by adding a jib



CHRYSLER'S BARRACUDA is a 13-foot, fiberglass-hull sailboat with planing hull. This 180-pound boat comes with either lateen or high aspect ratio cat rigs

Sailboats

The vest-pocket variety of sailboats is full of thrills for the skipper and crew. That's one of the many reasons for their growing popularity. You can see them darting across lakes and sailing in harbors. On reasonably calm days, you can spot them zipping along offshore where only the bigger boats usually venture.

Most of these vest-pocket sailboats are designed with planing hulls. When the wind catches the sail, the boats get right up on plane.

Many of these boats are light—between 175 and 200 pounds. They're easy to haul on a cartop, easy to launch and take out of the water, and they're easy to rig.

Along with their desirable design features, the small sailboats are inexpensive. Most run from \$400 to \$600.

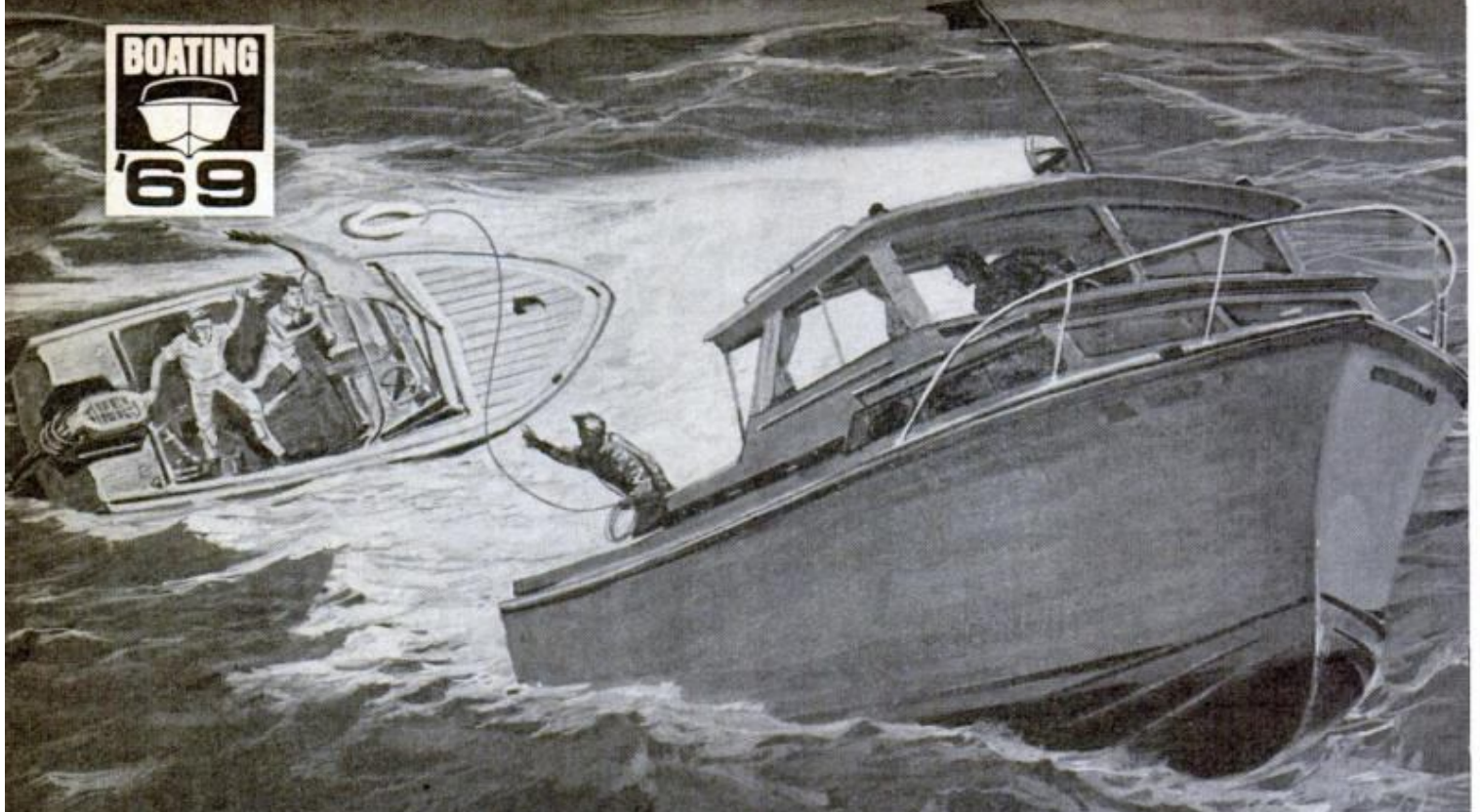
The boats shown on this page are good examples of what is available in small, swift windboats. ★★★

MARCH 1969



MFG'S SIDEWINDER is a 15½-foot planing-hull sailboat that comes rigged as either cat or sloop. Fiberglass hull is self-bailing; weight is under 200 pounds

173



TOWING BEATS ROWING

A boat in distress usually needs a hand.
 Here are the right ways to help or be helped

By W. S. KALS

HALF A GALE was building a tough sea the night the motor quit. The 18-foot boat was only 400 yards from the safety of a breakwater. But wind and current were against the skipper. He was being blown out toward the middle of a turbulent sound.

A larger cabin cruiser nosed out of the harbor and spotted the distressed boat. The captain tried desperately to throw a line to the smaller boat. But the seas were running high, and it was impossible to get close enough. How the cruiser skipper finally took the disabled boat in tow is shown in the heavy-sea rescue diagram at the right.

Whether you boat in heavy seas or in calm water, at some time you'll either need a tow or be asked to tow a boat in distress. Everyone should know the basic towing practices, and how to get a line between the boats.

But who throws the line to whom has always worried some boatmen. Some say that if the rescue boat throws a line to the distressed boat, the rescuer becomes liable for anything that happens to the boat in tow. This is not so, according to marine insurance experts. Liability generally rests with the distressed boat. The only time there's a question of change in liability is when a boat captain attempts to tow another boat without a request for assistance.

A request for help can be given verbally—"I need a hand"—or by signal.

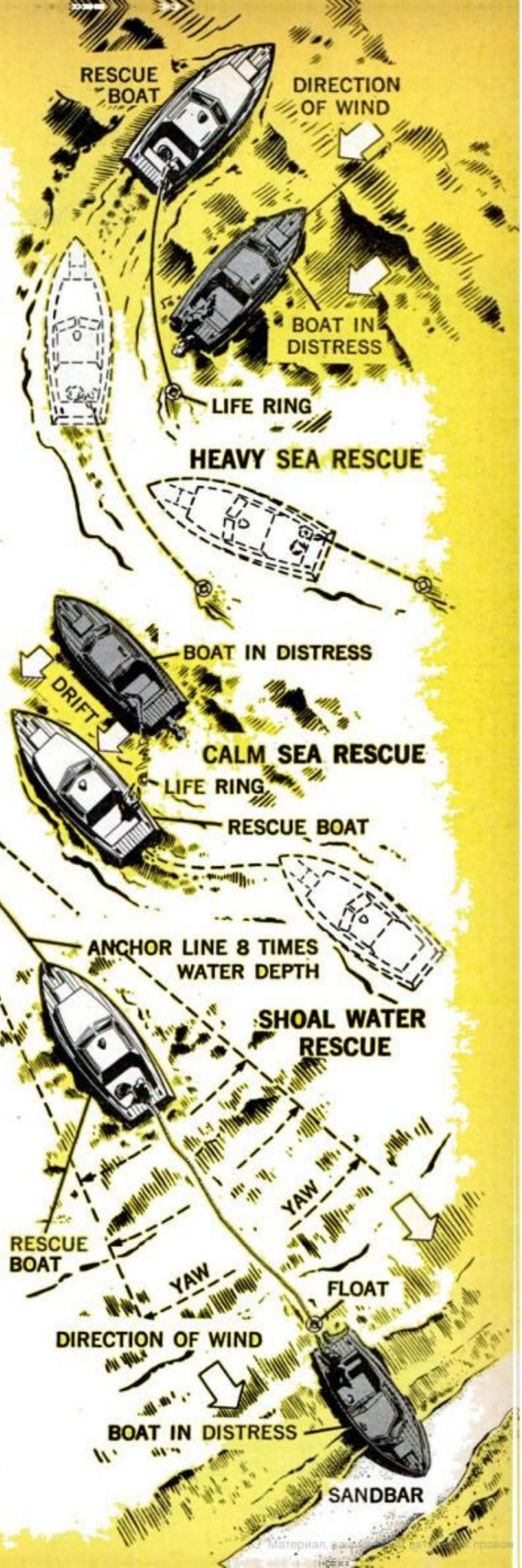
As a matter of courtesy, though, the distressed boat should provide the tow line. Should the line fray or break it's not a loss for the skipper who's helping.

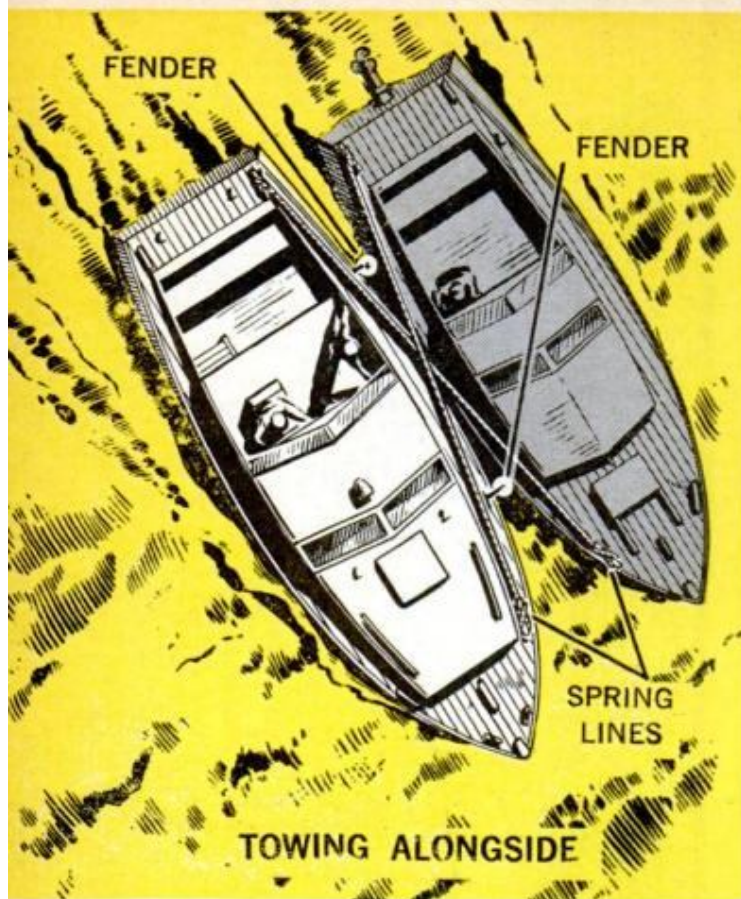
Towing a boat and getting a tow line rigged can be tricky. How to do it in different situations is explained in the next three pages.

HEAVY-SEA CONDITIONS make it almost impossible to get close enough to a disabled boat to toss a line. There's always danger of the seas lifting one boat and crashing it into the other. The best way to take the distressed boat in tow is for the rescue boat to trail the towline near the stern of the disabled craft. Tie a life ring on the line before trailing it. This keeps the line out of your props and makes it easier for the skipper of the disabled boat to retrieve. Start paying out the towline as you near the stern. Remember to trail the line downwind of the distress boat. You'll have better control of your own boat as you round up into the weather. Besides, the disabled boat will drift down onto the towline, making it easier for the skipper to grab it.

CALM WATER is the best condition for towing. But to avoid colliding at the very first, pull your boat just astern and watch the drift of the disabled boat. Once you know his drift speed and direction, you can pull up alongside and wait for him to drift toward you. You can fend off the other boat just before the two boats kiss. This is an excellent system to use when taking a boat in tow on your beam. Once the two boats are close enough together you can easily attach spring lines. With this system you don't have to jockey your boat around the distressed boat or start horsing the two boats together once lines have been tossed between them.

SHALLOW WATER often traps a boat when the skipper is trying to get a towline to a boat already aground. If you're worried about getting too close to a grounded boat use the drift-back system. Pull your boat into the wind quite a distance out from the shallow water. Judge water depth. Drop your anchor. Let the wind and current take your boat back toward the disabled boat. Remember that your anchor could drag if there isn't enough anchor-line scope. Once you're back as close to the disabled boat as you dare get, secure the anchor line. Then tie a life ring or cushion to the towline. Let it drift on back to the distress boat. Remember, wind and current will often cause your boat to yaw. Watch water depth either side of your boat.

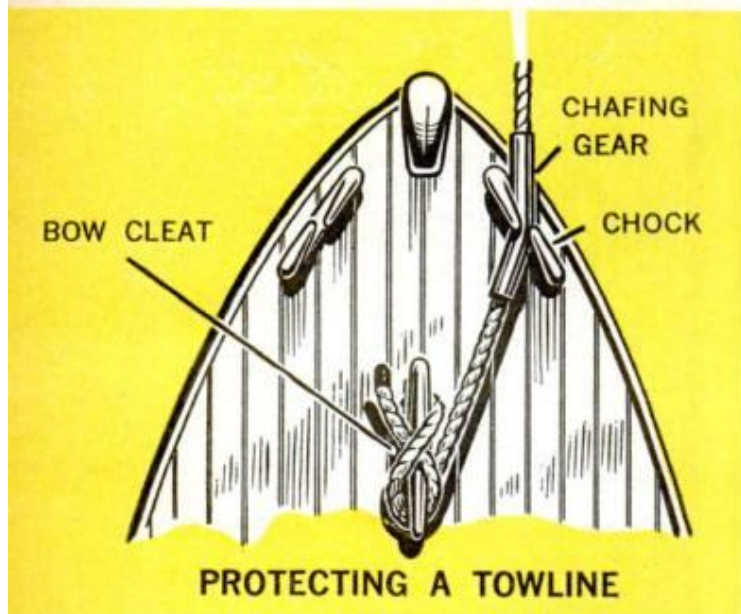




TOWING ALONGSIDE

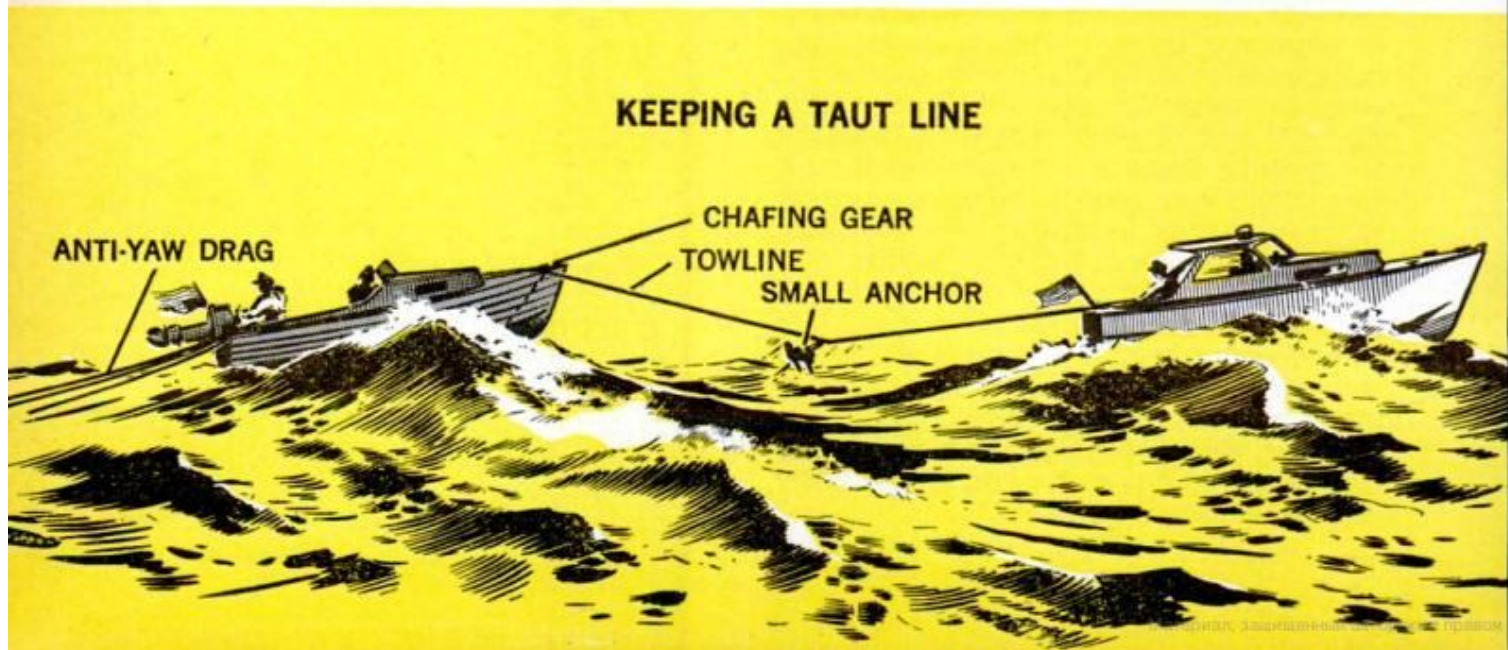
BEAM TOWING is the best system for getting a disabled boat back to port. But this method is good only in calm waters. It's used a lot in harbors or when lakes or sounds are very still. If the water is calm and you decide on beam towing remember to watch for wakes of passing boats. Even on calm water a boat wake can cause damage when two boats are coupled together. If the disabled boat has steering control, you can tow him using spring lines attached from your bow to his stern and from your stern to his bow. If he has no steering, attach bow-to-bow and stern-to-stern lines in addition to springs. Remember that with four lines attached between boats, both boats are really locked together. Should an emergency arise, it may be difficult for you to break free of the tow. Avoid trouble spots and high speeds.

CHAFING GEAR is necessary whenever towlines run through chocks or will rub on gunwales. A taut towline will fray quickly if not protected.



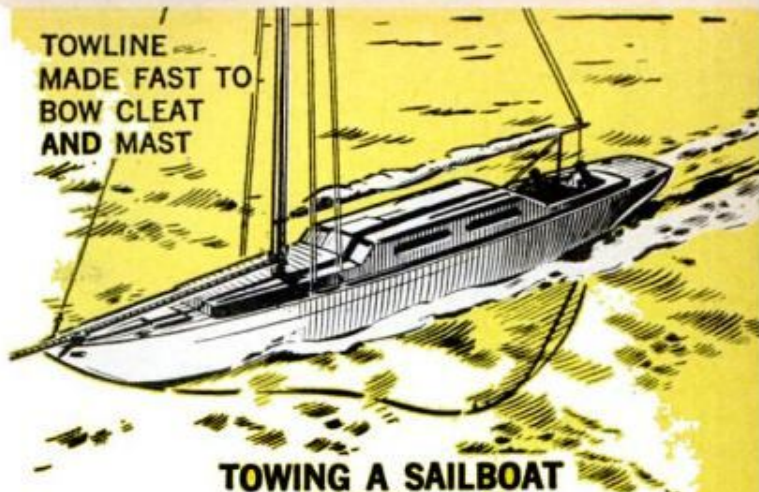
PROTECTING A TOWLINE

ROUGH-SEA TOWING calls for special techniques. Nothing will break a towline quicker or pull out a cleat faster than a snapping strain on the towline. Nylon line, because of its elasticity, is best. But often the strain is too much even for nylon. To prevent slack-then-strain on line in seas, adjust the towline so the disabled boat is a wave behind you. Both boats will then rise and fall together. Also attach a small anchor to the middle of the towline. This will take up slack—keeping a steady strain on the line. Trailing drags (long lines or a small sea anchor) astern of the disabled boat will also keep strain on the towline and dampen yawing.

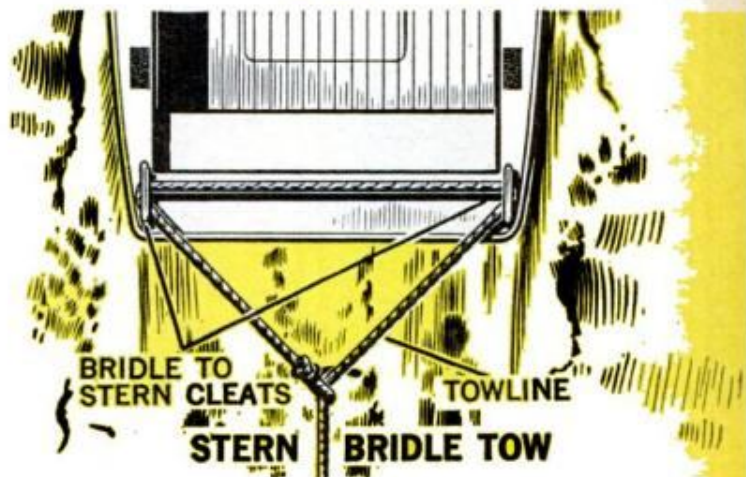


KEEPING A TAUT LINE

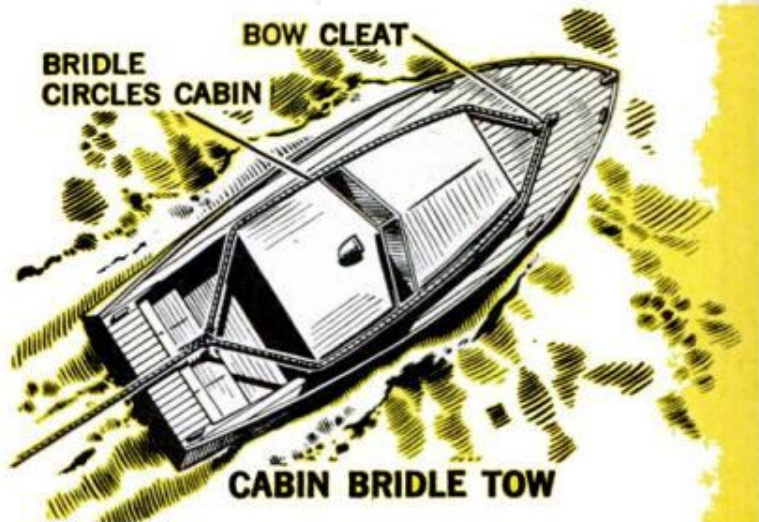
SAILBOAT TOWING can be difficult because of weight. Most sailboats, 25 feet long and longer, have deep, heavy keels below the water. There's tremendous strain on the towline when you start pulling a sailboat. Make sure the towline is attached not only to the cleat of the sailboat but to its mast as well. If the cleat pulls out, the mast will hold the towline. Remember, sailboats have low hull speeds. Tow at five knots.



STERN BRIDLE is always better than just snubbing a towline around one stern cleat. The bridle distributes the load between two cleats lessening the chances of cleat failure and providing better towboat control. One danger in towing is a break-away cleat. When the towline is attached to only one cleat, there is nothing to keep the towline and cleat from rifling back should the cleat pull out. Flying cleats have caused serious accidents.

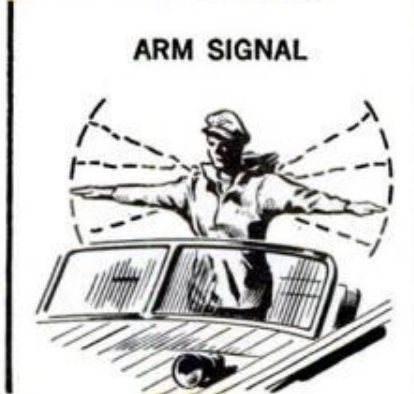


CABIN BRIDLE gives better towboat control. Most pleasure powerboats do not have a mule post in cockpit center. Tying a towline to a mule post (found on Coast Guard boats and yard workboats) lets the tow boat maneuver easily. To get the same maneuverability on a pleasure boat, attach the towline to a line that's snubbed on bow cleat and bridles cabin trunk.



DISTRESS SIGNALS used to summon assistance include an upside-down ensign, slowly raising and lowering extended arms, flares.

DISTRESS SIGNALS





Make Your Next Camp-Out by Boat

Boat camping is different from land camping. It takes special techniques to spend a night at water's edge

By **NORMAN PHILLIPS**

“WHERE CAN I CAMP?” was the strange question of a friend as we walked down the dock to our boats.

I told him about a small cove 20 miles up the coast. He piled sleeping bags, a tent, stove, lantern into his 18-foot runabout and roared off.

What I didn't have a chance to explain was how to camp from a boat. This desire to “overnight” is becoming more and more prevalent among small-boat owners. Boat designs are making it possible to literally camp from a boat on some quiet, picturesque shore. But camping from a small boat requires special techniques which do not apply to land camping.

First, know your boat. Know gas requirements and range. Then chart your trip before leaving. Plan to arrive before dark because it's tough to find a good shoreline at night. Plan menus for the whole trip. Take only what you

need—an overloaded boat is not only unsafe, but is a poor performer.

A small boat loaded with gear plus passengers requires a little more push in the stern. To get this, try buying an extra propeller which has one inch less pitch than the one you normally use. With it, you can carry heavier loads without affecting planing ability.

Once you have load-carrying capacity, you must stow items properly. Boat balance and accessibility of items are very important. Make sure the first things you'll need to pitch camp go on top. In my boat, I load the cooking equipment second. On top goes the tent and maybe a folding chair or two. But don't pack gear so emergency equipment is concealed.

Once the boat is loaded, and before you shove off, learn a little about your cruising area—especially if you've trailered your boat to a new spot. If you're cruising a river, learn about water level. Do dams and locks upstream affect it?

If you're cruising in saltwater, find out about tide drops so you won't get stranded on a beach at low tide. Wherever you cruise, remember to get charts.

Picking a good "campsite" (anchorage) takes some thought. A sheltered cove is better than a completely exposed shoreline. Quick changes in weather can literally catch you napping if you camp on a shoreline that gets pounded during heavy weather.

Try to pick a spot that gets good on-shore breezes at night. This breeze will keep insects and bugs ashore.

Remember that shorelines generally belong to someone. Try not to pick a spot that abuts someone's front lawn, unless you get permission.

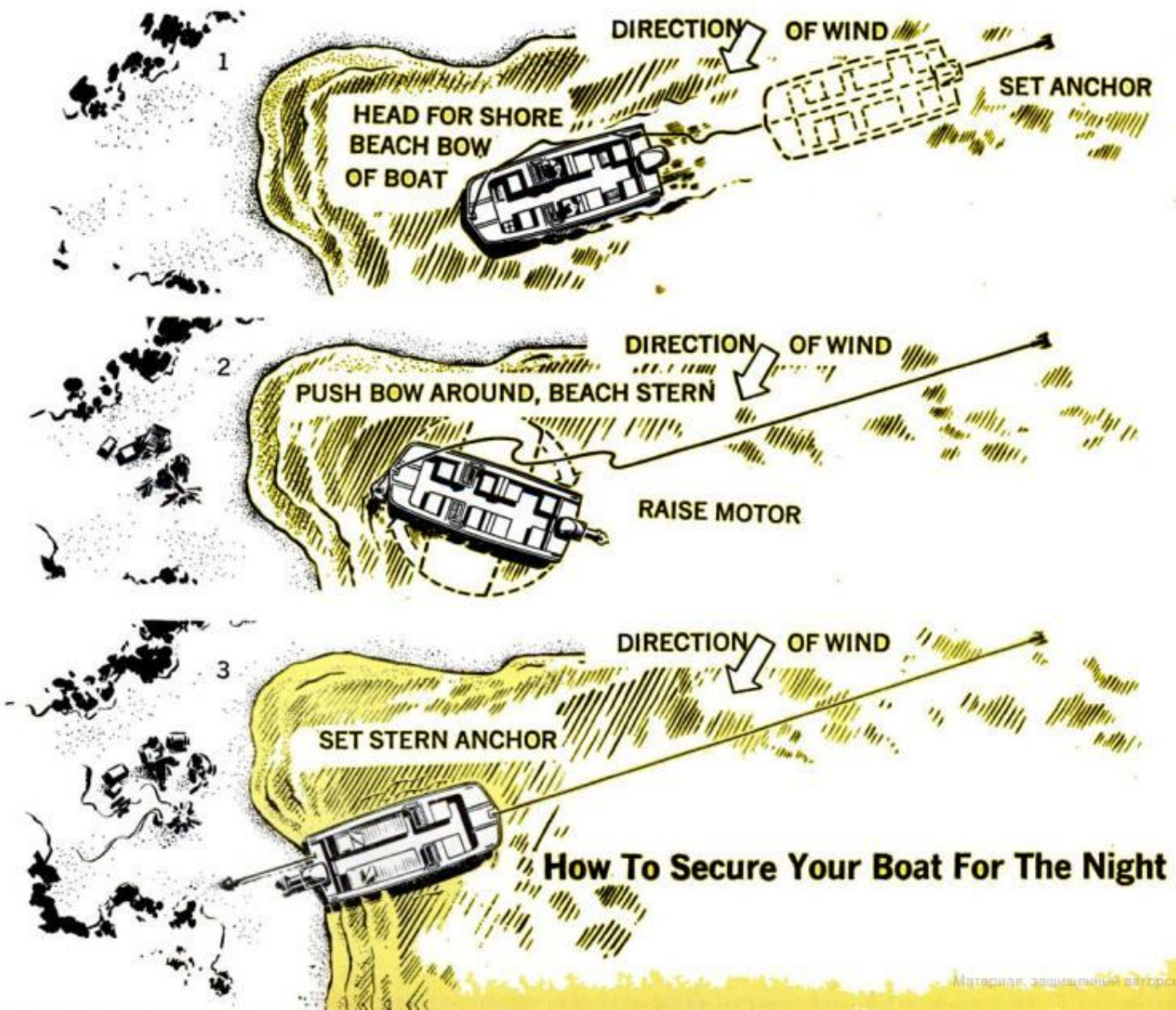
But remember, too, that except in a few rare cases, water is public property. You may find a beautiful cover, but you can't camp ashore. So just throw out the hook and stay aboard all night.

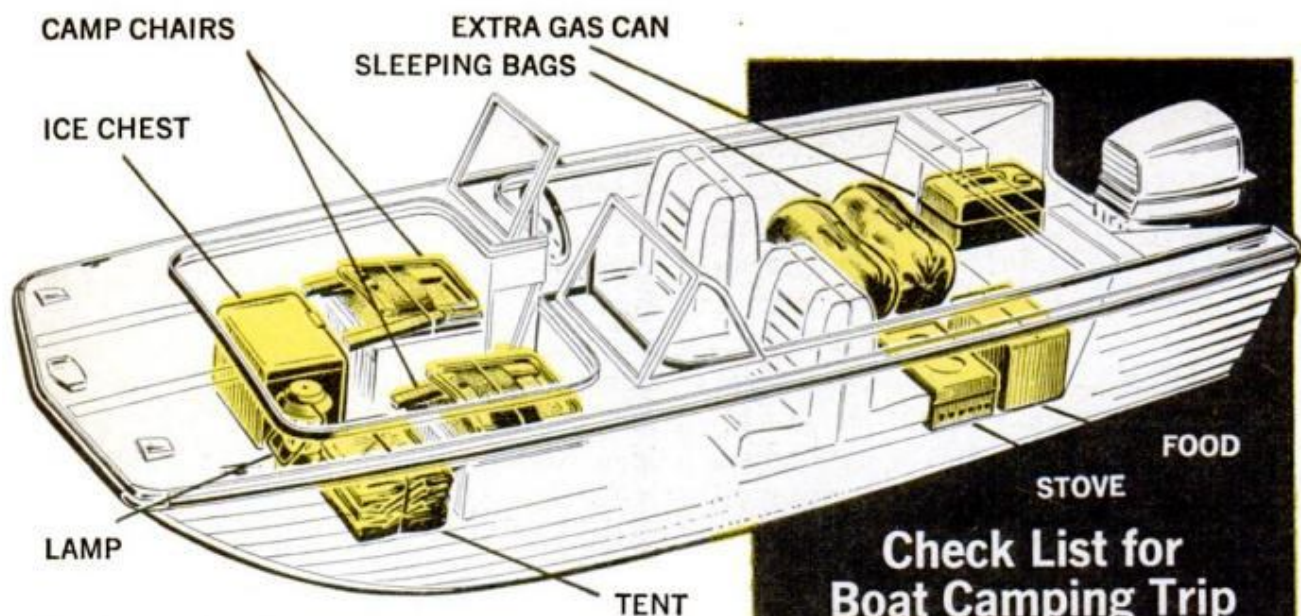
When you have a good shoreline campground, anchor your boat correct-

ly. Not one boat-camper out of 1000 does this properly. The best way is stern on the beach, bow out to water. Then, if a wind comes up during the night and starts to blow spray, the boat won't swamp and the motor won't get splashed making it hard to start in the morning. In a region of heavy tides with a steep beach, the bow-out system is very important. When the tide drops, the boat may settle in sand or mud. The incoming tide may flood over the transom before the boat floats free. But the best reason for bow-out anchoring is sleep. The slap of water against the stern can keep you awake all night.

After trying many systems, here's the best anchoring procedure I've found:

1. Set your bow anchor about 50 feet from shore.
2. Run slowly back to shore, paying out your bow anchor line over the stern. Keep the line out of your propellers!
3. Beach the boat, tilt your outboard or stern-drive unit. Climb out and turn





Check List for Boat Camping Trip

the boat by hand until it's bow out, stern on the beach.

4. Get the rest of your crew to stand in the bow. This will push the bow down and the stern up, thus helping you nudge the stern of your craft even farther up the beach.

5. Finally, secure your anchor line to the bow cleat. Now the anchor will hold your bow on if waves come up. You'll also find it's a lot easier to unload camping gear over the stern.

6. The stern should be secured with a stern anchor buried in the sand of the beach. If there are any trees or stout bushes on shore, a line to them is even better.

Whether anchored or under-way, your big concern as skipper is weather, especially when cruising big water like the Great Lakes or ocean shorelines.

A must for boatmen is a radio receiver. This can be a two-way marine radio or a small inexpensive transistor radio. It's best to have a receiver which has a marine weather report for your cruising area. Even if you only have a radio with standard broadcast frequencies, you can get local weather reports.

With any radio you can set up a "static watch." Oncoming storms can be heard hours before they hit your locale. Lightning creates static on most radios.

When camping or just boating heed the old phrase: "A red sky at night, sailor's delight; red sky in the morning, take warning." ★★★

- Flashlight
- Sleeping bags
- Food (plan all meals ahead)
- Pots and frying pans
- Charcoal
- Starter fire
- Battery jumper cables
- Ax
- Fishing gear
- Life jackets
- Fire extinguisher
- Extra motor oil
- Extra gas
- Ice chest
- Charts
- Rain gear
- Horn
- Tow lines
- Two anchors
- Compass
- Spare prop
- Tent
- Boat registration
- Tool kit
- Lantern
- Stove



WHAT DID HE DO WRONG?

By DAN FALES, Boating Editor

THIS SAILBOAT HULL did not take a nosedive because the shoring or bracing was inadequate. Someone goofed.

In this case, the man painting the bottom ran into a problem. He found he couldn't apply a smooth, continuous coat of bottom paint because braces made it impossible to reach small areas of the hull.

Now, you might think he removed a support and the boat came thundering down. That's not exactly right. He did remove a brace—the one holding the port bow. The boat remained balanced in this precarious position.

With brush in hand, he painted this section. When finished, he moved back, knocking against the stern brace. This slight movement upset the balance and down came the boat.

In those few dramatic seconds, the

bow plunged down, bashing in the door of a parked car (not in photo). The stern reacted by flying up in the air, knocking the filling from between the planks of the brand-new powerboat astern. The painter was knocked to the ground, spilling bottom paint over himself. He ended up snuggled in the small space between the keel and the topsides. Fortunately, he wasn't hurt.

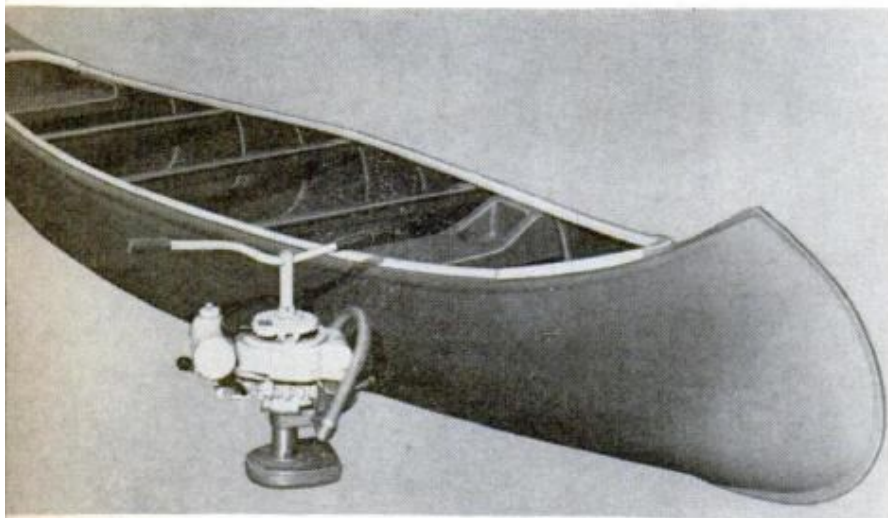
Seconds before, the owner of the small boat alongside passed between the two boats, missing injury by inches.

There was little damage to either sailboat hull, each made of fiberglass.

But can you imagine the car owner having to explain its being hit by a boat?

If you can't wait until your boat is in the slings to paint those brace spots, rig an additional brace before removing any of the main supports. ★★★

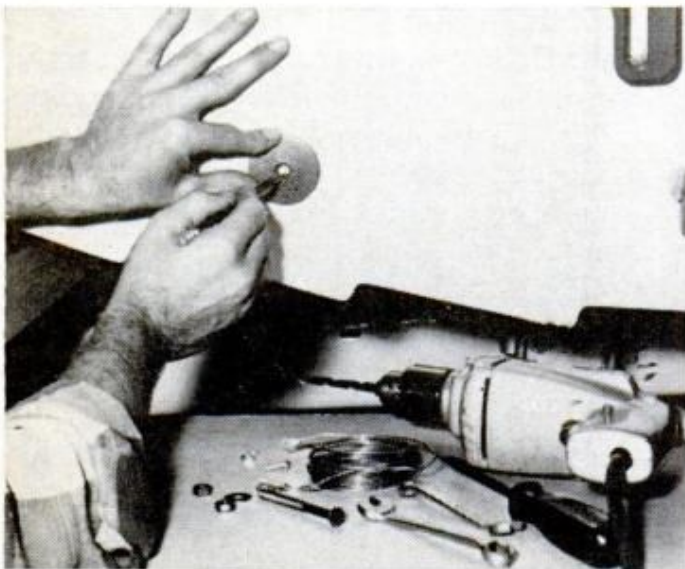
NEW GEAR



NEW ABS PLASTIC is being used to make sturdy and lightweight canoes with a new twist in propulsion units. Technical Products produces the 15 and 17-ft. canoes which weigh about 75 pounds. They are propelled by air-cooled hydrojet motors available in 3.5, 5 or 7 hp. TP's Whitewater canoes require no maintenance and have the strength to resist critical stress, shock and severe impact. The motor and impeller rotate 360°. Price, about \$400. Technical Products is at 1161 Grey Fox Rd., St. Paul, Minn. 55112.



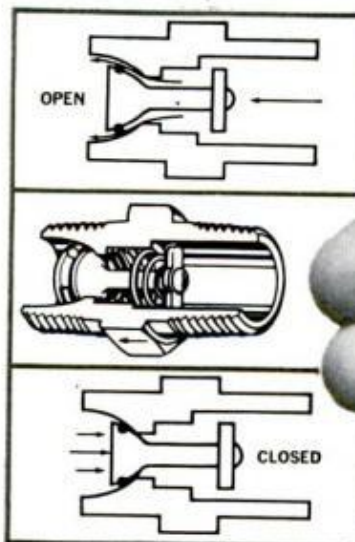
LOADING LEVER is a device that makes it easier to horse a boat on and off your trailer without getting your feet wet. The lever is a sturdy steel Y-shaped arm with an offset hook in the crotch. There's a heavy-duty eye welded to the forward handle end. The hook inserts into the bow eye ring. Grasping the long arm of the "Y" for leverage, you can swing the boat into the correct loading position. Then secure the winch rope to the handle. The Loading Lever is priced at \$12.95 from Tempo Products.



A GROUNDING DEVICE for permanently installed fuel tanks is available from Tempo Products. To eliminate a build-up of static electricity, you can install this bronze disc below the waterline on the hull. The installation kit includes through-hull bolts, nuts, connecting wire and terminals. When properly installed, the fuel tank systems will be grounded so that static electricity is bled off harmlessly into the water. The kit sells for \$6.50 from Tempo at 6200 Cochran Rd., Cleveland, Ohio 44139.

FOR BOATERS

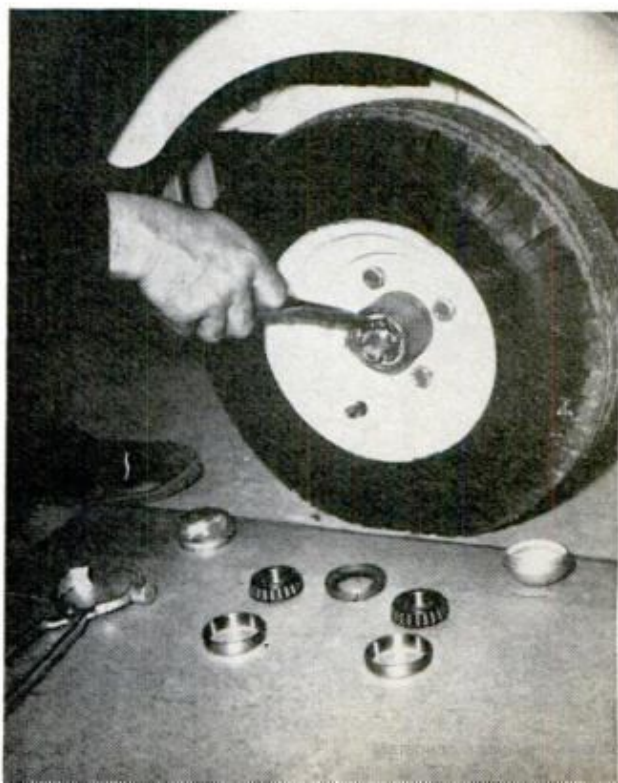
AN ANTISIPHON VALVE can be an important item to have installed to guard against a break in your fuel lines. The valve prevents backflow siphoning of fuel if there's a line break between fuel tank and motor. The valve is normally closed until the fuel pump in the motor develops at least a pound of suction. The valve then opens. If the fuel line breaks or cracks, the suction on the valve will be lost and it will close. Priced at \$7.80 by Tempo Products.



THE CIRCRAFT is a saucer-type hydroplane that can do 40 mph. It's steered by holding a grab handle and leaning to one side or the other. Body weight alone maneuvers the craft—thus no need for a rudder. Circraft, manufactured by Bifort Engineering Ltd., Blackpool, Lancashire, England, will sell in this country for under \$500 without motor. The boat is seven feet in diameter, weighs 120 pounds (without motor), and can handle outboards from 15 to 35 hp. Circraft is made of fiberglass with built-in buoyancy tanks.



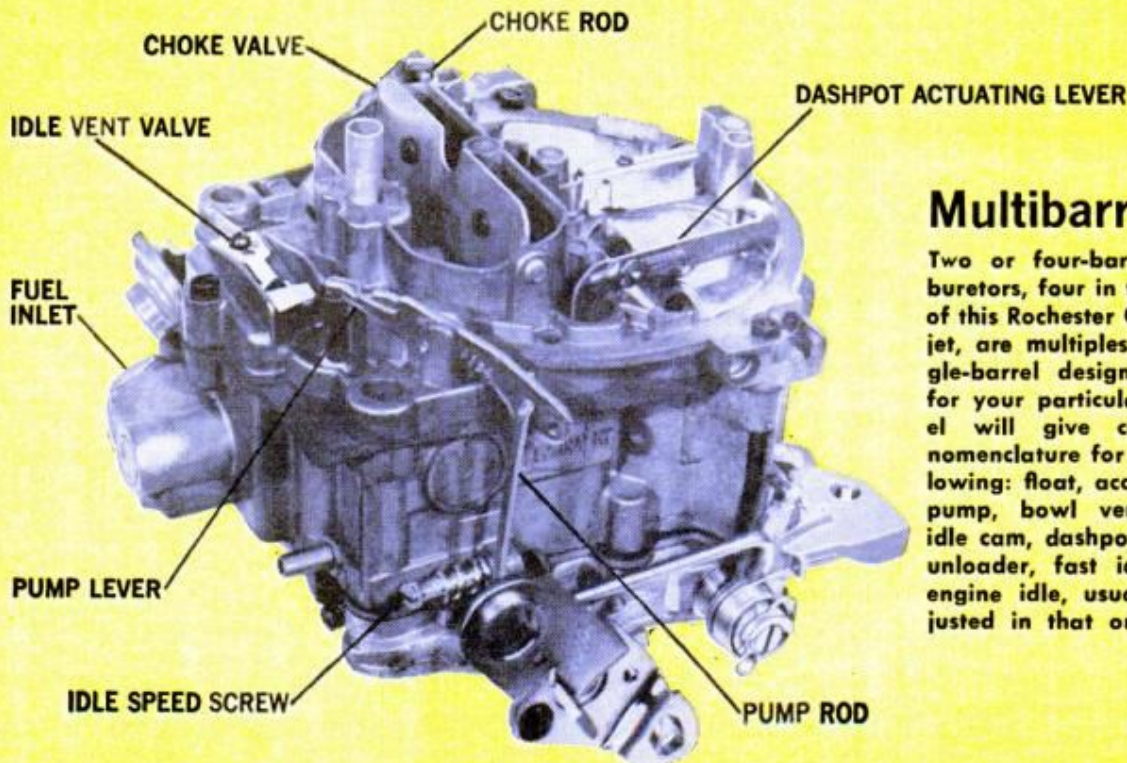
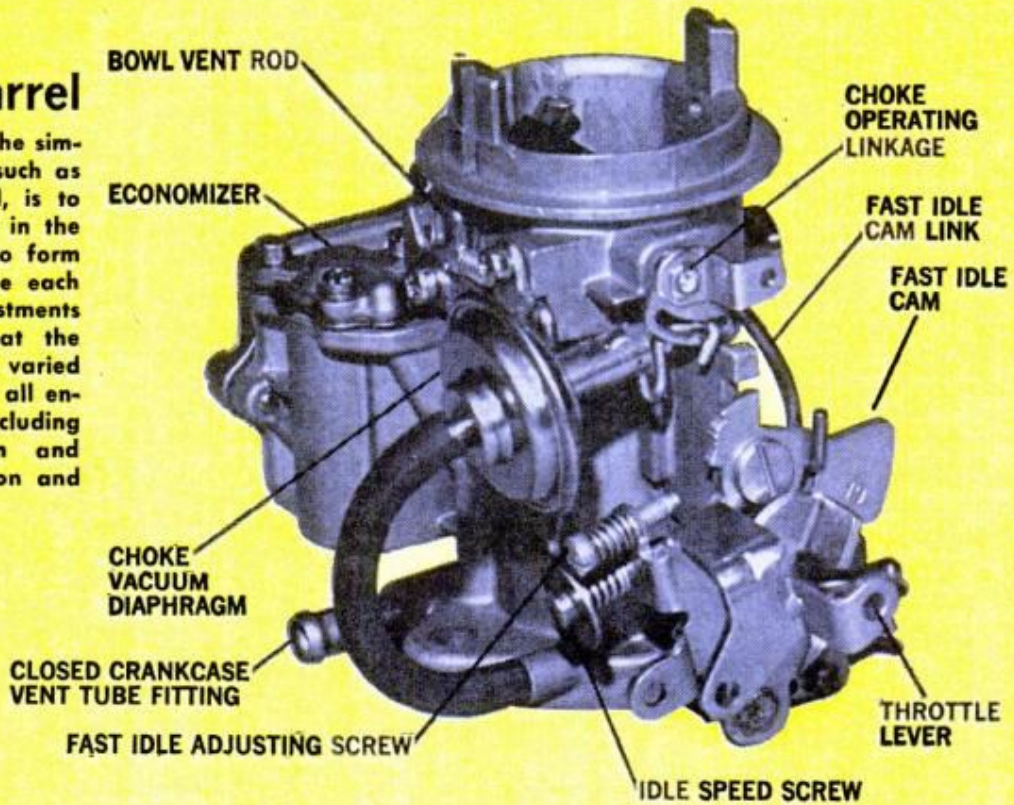
BOAT TRAILERS should have wheel bearings checked frequently. These bearings are used in the worst possible conditions. Overheating of wheel hubs is a pretty sure sign of bad bearings. On most trailers, to install a new bearing set, you jack up wheel, remove dust cap, cotter pin, retaining nut. Slide wheel and bearing parts off spindle. Install new bearings. Dutton-Lainson Co. of Hastings, Neb. 68901, provides bearings for $\frac{3}{4}$ -in., 1-in., 1-1/16-in. and 1-1/4-in. axles. A set for one wheel costs about \$5.72 including inner and outer thrust bearings with races, grease seal, dust cap.



Fine-Tuning

Single Barrel

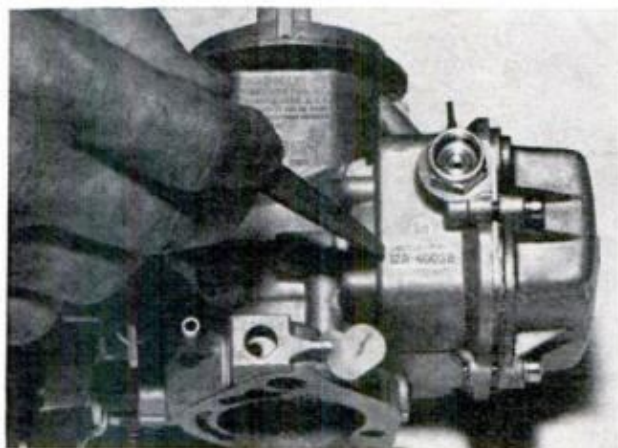
Function of even the simplest carburetor, such as this Holley model, is to mix fuel and air in the right proportion to form a spray to charge each cylinder. All adjustments are made so that the proportion will be varied and delivered for all engine conditions, including temperature, rpm and sudden acceleration and deceleration.



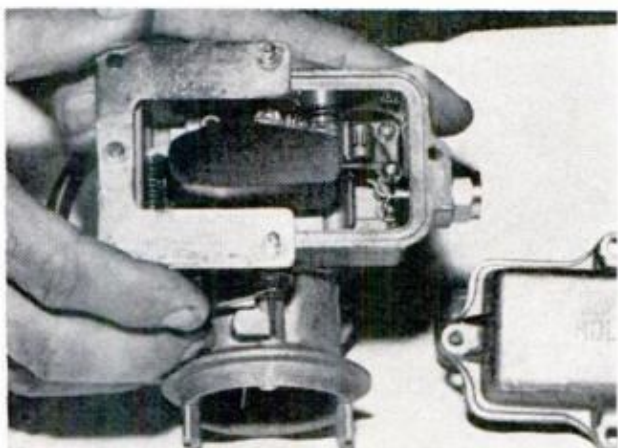
Multibarrel

Two or four-barrel carburetors, four in the case of this Rochester Quadrajet, are multiples of single-barrel design. Specs for your particular model will give complete nomenclature for the following: float, accelerator pump, bowl vent, fast idle cam, dashpot, choke unloader, fast idle and engine idle, usually adjusted in that order.

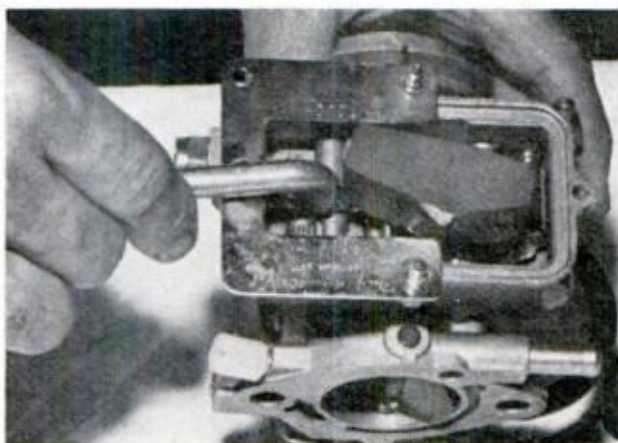
Your Carburetor



CARBURETOR MODEL NUMBER, needed to obtain manufacturer's specs, is on casting or attached tag



FLOAT LEVEL ADJUSTMENT is made with carburetor off the car. Float should ride freely in fuel bowl



FLOAT ARM TANG is actually bent with pliers or inexpensive bending tool to adjust level and drop

IF YOU'VE JUST REBUILT your carburetor (as discussed in *Put Life Back in Your Carburetor*, page 160, Feb. PM) or if it just needs a good tune-up, you've got to make adjustments according to manufacturer's specification or your engine will flood, idle rough, stall and generally act downright ornery.

Some adjustments, such as float level and acceleration-pump travel, are common to all carburetors. Even so, specifications differ from one to another and you should get the specs for your particular carburetor. The model number is usually on the casting or a metal tag on the carb.

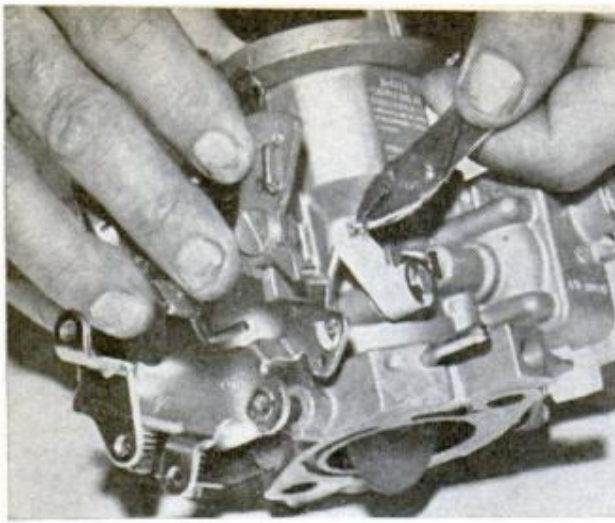
The procedure for some adjustments, however, is not always spelled out in the service literature, and some explanation and emphasis is in order.

Float level adjustment, for example, should be performed with great care. The float controls the amount of fuel in the bowl, and consequently, how much is allowed into the bore. If fuel level isn't kept within close limits, engine performance will suffer.

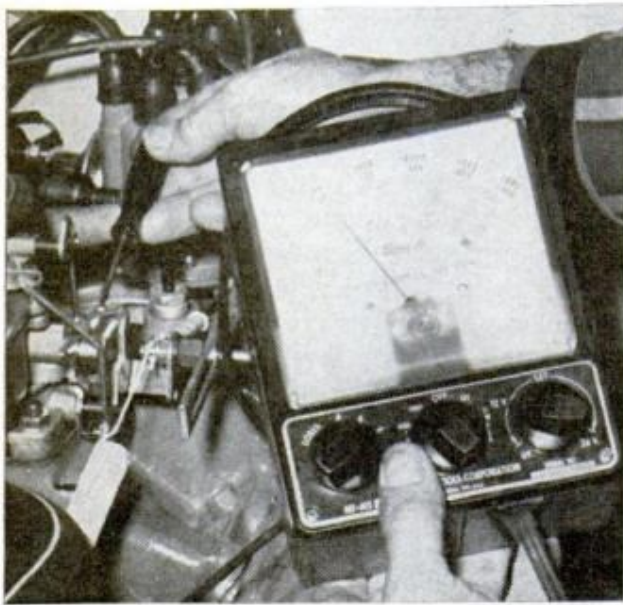
Every tune-up kit containing new parts for a carburetor also contains a gauge that you can use for adjusting float level and drop. A scaled "T" gauge that's marked off in 1/16-inch increments is available in auto parts stores for about \$3.50. It can be used for making carburetor adjustments that require a specific measurement, including float level and drop, pump travel, and bowl vent valve setting.

Double check to make sure you're making the float level adjustment under the conditions outlined in your service literature. Some float levels are measured from the top surface of the float to the edge of the bowl cover, while others are measured from the bottom edge of the float to the edge of the bowl cover with or without the gasket in place.

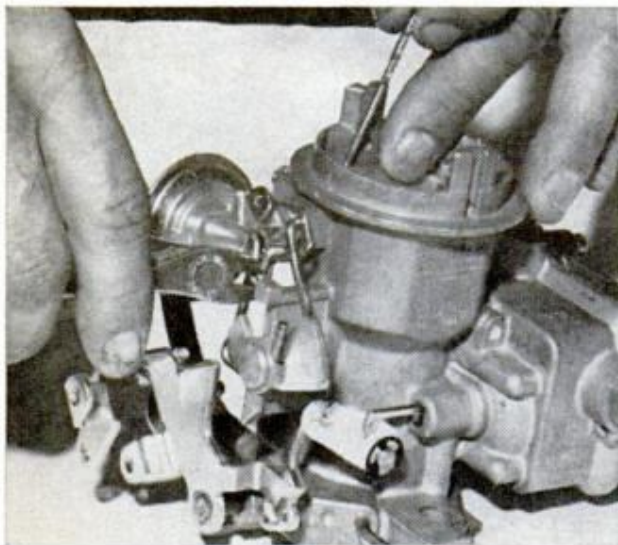
A float drop adjustment assures that the



ACCELERATOR PUMP TRAVEL is adjusted by inserting linkage in one of several holes on the pump cam



FAST-IDLE SETTING with carb on the car is made with tach; off the car, throttle valve is adjusted



CHOKE UNLOADER is adjusted by bending linkage while gauging the butterfly opening to specification

float doesn't exceed a limiting point that would force the needle valve to stay open. This would allow fuel in the bowl to keep emptying into the carburetor bore, causing flooding.

Be sure to adjust float drop in the proper manner for your carburetor. With some, drop is measured from the lower edge of the bowl cover to the top edge of the float at the tip. With others, it's from the lower edge of the bowl cover to the bottom edge of the float at the tip.

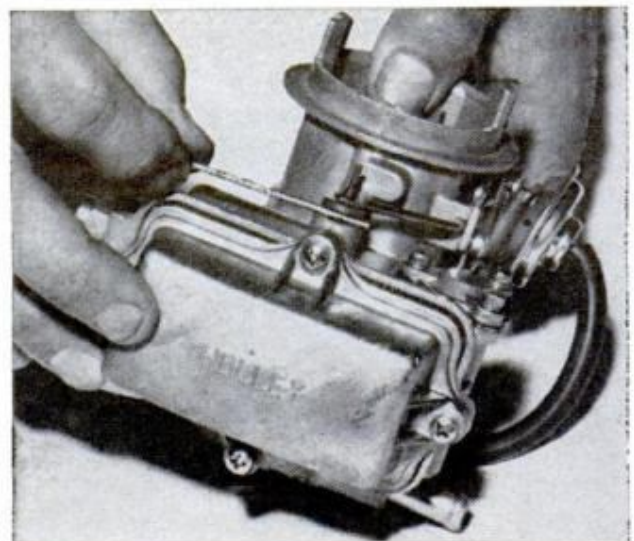
A carburetor's acceleration pump injects fuel into the bore under sudden engine-load changes to compensate for the time it takes the main metering system to open and provide the necessary fuel. If it weren't for this pump, the engine would hesitate as you suddenly pressed down the accelerator because of a lack of fuel.

The amount of fuel that's displaced by the acceleration pump has been predetermined for your carburetor by design engineers. When putting a rebuilt carburetor back together again, you have to readjust the pump travel to this spec.

Keep this important factor in mind when adjusting acceleration pump travel: The throttle valve (or valves) must be seated in the carburetor bore when the adjustment is being done. Back out the throttle stop screw until it clears the pad on the casting to close the valve(s).

The purpose of the carburetor's fast-idle mechanism is to allow a cold engine to operate at a higher rpm for quicker warm-up. Fast idle is also an antistalling preventive for a cold engine.

As the engine warms up, the fast-idle



BOWL VENT is gauged with open choke and closed throttle. Here, 1/16-in. drill bit sets it to spec

mechanism gradually releases. It eventually returns to a position that allows normal engine idling speed.

Some instructions may tell you to adjust fast idle by rotating the fast-idle adjusting screw until the throttle valve(s) is cracked sufficiently to allow insertion of a specified size gauge between the lower edge of the throttle valve and the carburetor base. This is the ancient way of doing it and requires removal of the carburetor from the car every time you want to check fast idle so you can get to the throttle valves.

The modern way of making the fast-idle adjustment is by hooking a tachometer to the engine. Determine the fast-idle adjustment specification for your engine from your service literature. Make sure the engine is cold and turn the fast-idle adjusting screw until the correct fast-idle reading shows on the tach.

One more point: When adjusting fast idle, an adjustment of the fast-idle linkage (or cam) is usually required as the first step. This adjustment is necessary to assure that engine speed, which varies as the engine approaches normal operating temperature, occurs at the proper time during warm-up. Service literature tells you how to make this adjustment.

The chief combatant against flooding your engine is the choke unloader in the carburetor. Flooding occurs when fuel collects in the intake manifold. It can happen under warm or cold engine conditions.

To get a flooded engine started, both the choke valve and throttle valve(s) must be wide open to "unload" the mani-

fold of excess fuel trapped there. A great volume of air is injected into the manifold to clear the gas.

To unload the manifold of fuel, the accelerator pedal is pushed all the way to the floor and kept there as you crank the engine. This action opens the throttle valve(s). Just as important, it activates a linkage in the carburetor which forces the choke valve open.

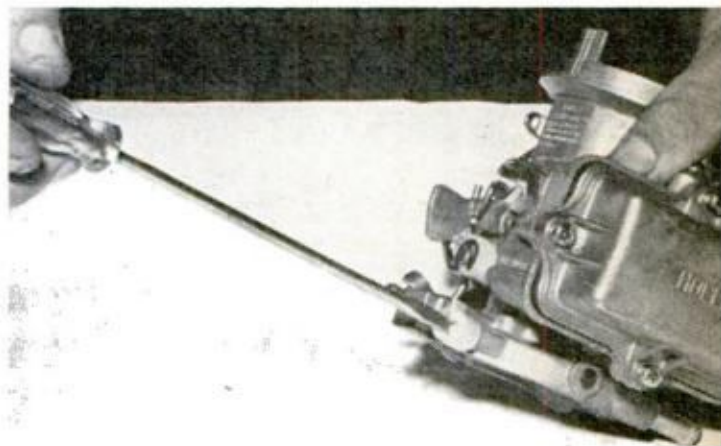
There's nothing difficult about adjusting the choke unloader. Generally, the throttle valve is held in the wide-open position and a gauge is inserted between the upper edge of the choke valve and inner wall of the air horn. If an adjustment is needed, you bend the unloader tang, which in most carburetors is at the end of the throttle shaft-lever extension.

All carburetors have some form of venting device to control the pressure on the fuel in the bowl. This device maintains pressure on the fuel to assure that it flows properly from the bowl into the bore during engine idle operation. If the bowl (idle) vent is restricted, pressure on the fuel is reduced and fuel starvation results.

Another purpose of the bowl vent is to allow vapors which build up in the bowl during hot idle operation to be vented into the atmosphere. The bowl vent automatically closes to restore internal balance after the throttle valve moves from the idle position to part-throttle range.

Some bowls are vented internally; most are vented externally. The external vents are mechanically operated and adjustable. If your car's bowl vent is adjustable,

(Please turn to page 235)

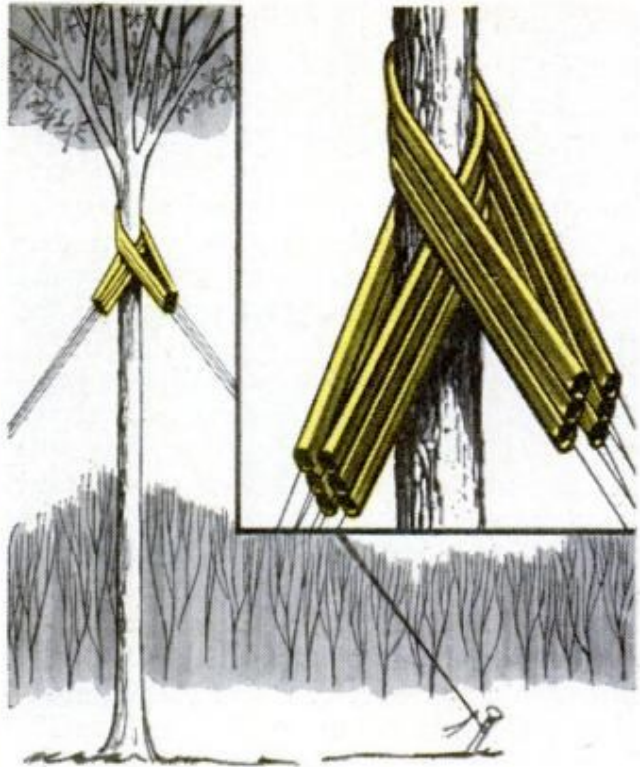


LATE MODEL CARB, shown above, is equipped with idle mixture limiter which prevents too rich a fuel mixture and excessive exhaust emission. Idle mixture screw can be turned only about one-half turn. Final adjustment of carburetor, as shown at left, is idle speed. A tach is much more accurate than your ear

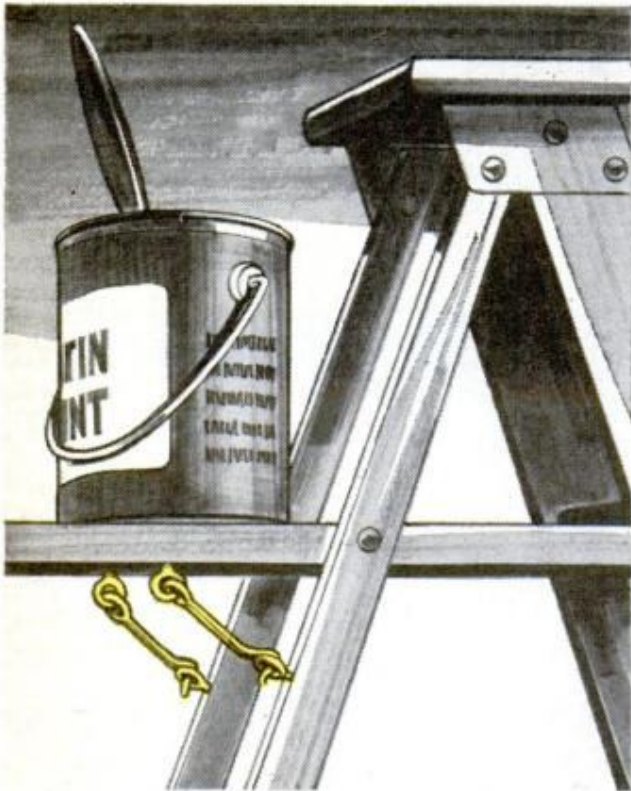
Solving home problems



PLAY IT SMART the next time you cut a piece from a roll of paper by starting the cut a couple of inches down from the top. The uncut portion will support the piece as it's cut so it won't droop and tear



PLASTIC SOAKER HOSE is a better protector than regular garden hose when bracing young trees with guy wires. Being green, it blends better with the tree, and being flat, it "molds" around the trunk better



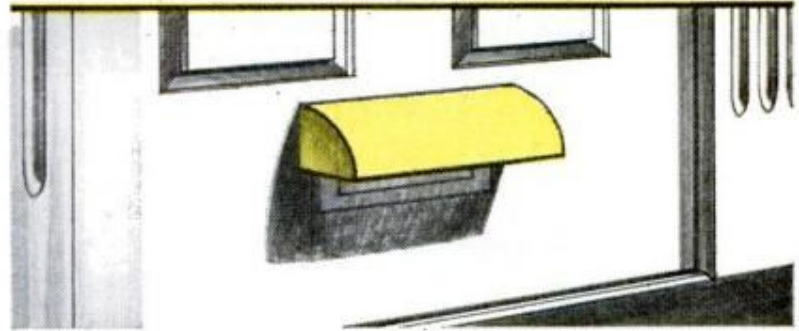
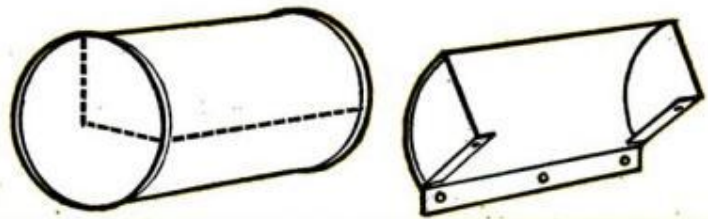
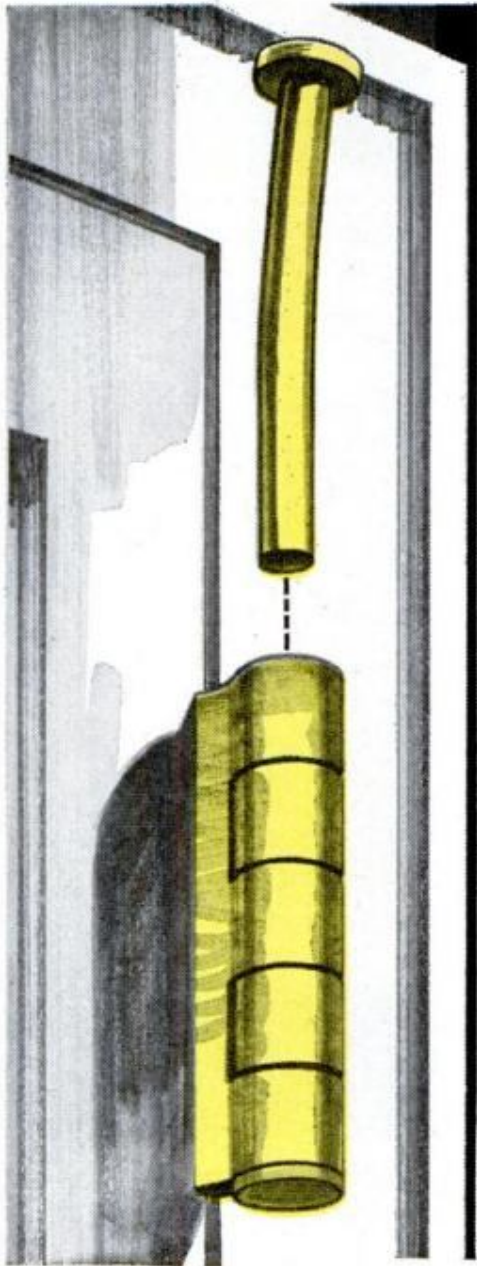
FOLDING SHELF on a stepladder can be locked in its open position by adding a screen-door hook and eye to each side. You'll find they prevent shelf from tipping and also make ladder itself more stable

188

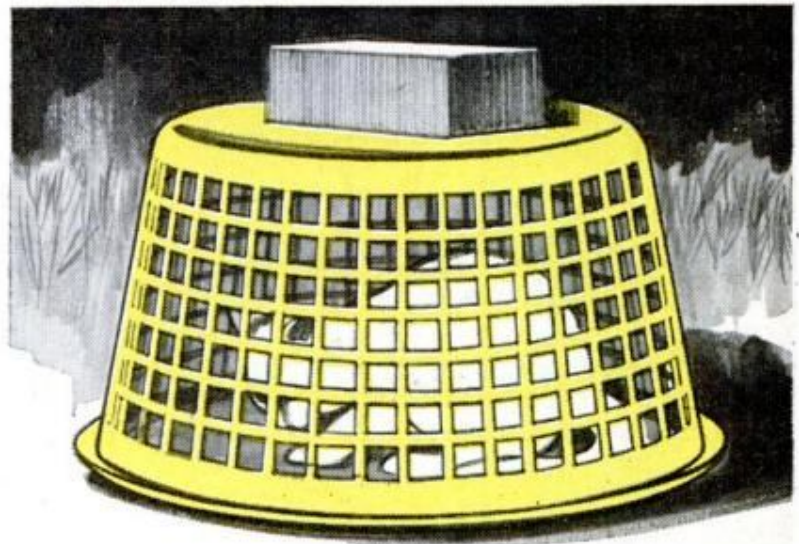


A BETTER JOB can be done when patching a hole with spackling compound if you first ring hole with nails as shown. Radiating like the spokes of a wheel, the nails, when stuck in plaster, will help anchor patch

POPULAR MECHANICS

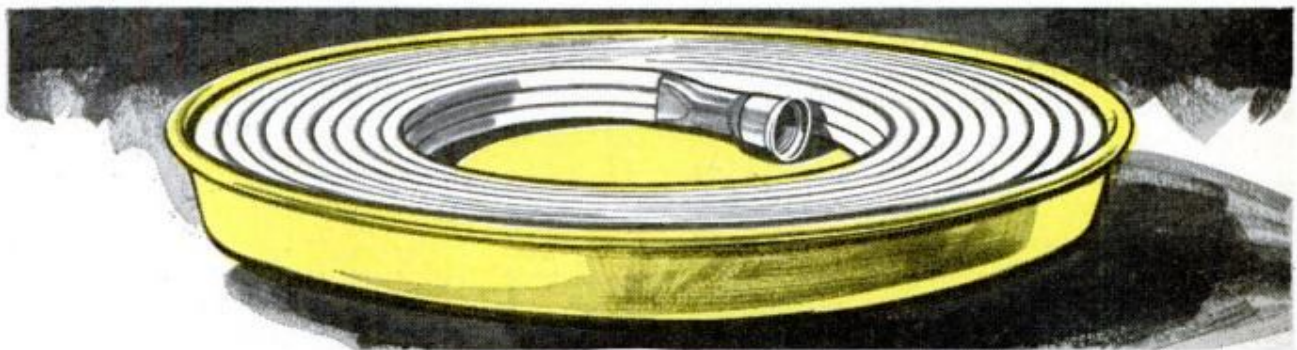


TIN-CAN AWNING attached over the mail slot in a door will protect letters and magazines stuffed in the slot from the rain. It's made as shown in the drawing from a 2-lb. coffee can and painted to look like a little awning. Note how edges are bent

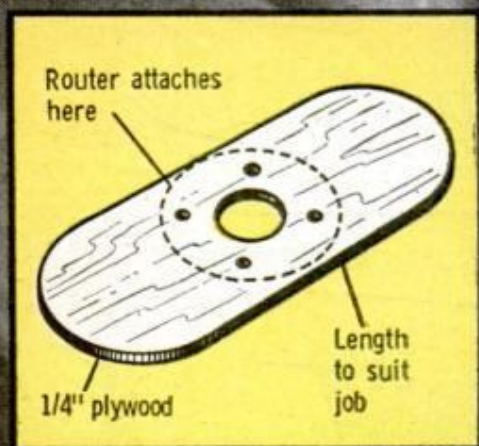


SETTLING WILL CAUSE a door to swing shut when you want it open or vice versa. When this happens, remove the hinge pins and bend slightly with a hammer. Free-swinging door will stay put

PLASTIC LAUNDRY BASKET makes an instant ready-made cage for a cat that likes to wander off when you put it out. Simply turn the basket upside down over the cat and weight it with a heavy object such as a brick. Cat won't want for ventilation



YOU SHOULD THINK TWICE before tossing away the cover of a beat-up garbage can. It's a perfect holder for a soaker hose and keeps it neatly coiled. Cut off the handle so that cover lies flat



Getting More From Your Router

By RAY SHOBERG

ROUTER CAN STRADDLE LARGER AREA than that of the machine itself when this simple attachment is added

LIKE A SEWING MACHINE, a router without attachments is limited to freehand work. Pilot tips on the cutters make you a pro the very first try when shaping edges, but routing is something else. You need attachments to help guide the machine, and here are four homemade ones that will make you equally as proficient when routing and rabbeting.

Regardless of brand or size, every router has a flat base, and most have a removable plastic sub-base. All four attachments shown here are designed to replace this sub-base. If your router doesn't happen to have one, you merely fasten the attachment directly to the main base in which you drill and tap four holes to take 8/32 flathead screws.

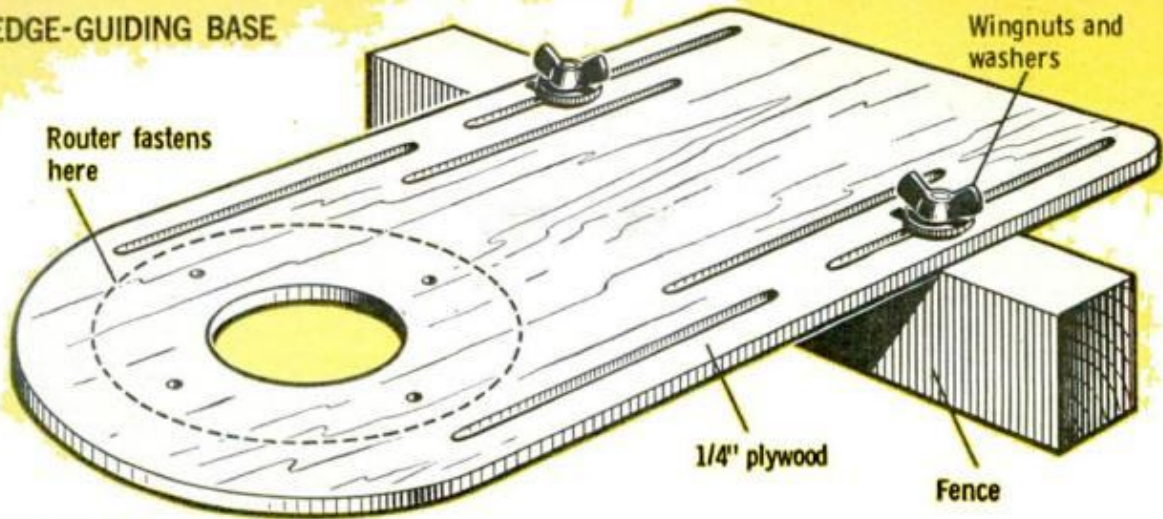
True, some of these attachments are

available ready-made, but by making them yourself, you can tailor them to your specific needs in size, shape and capacity. And I think you'll find some work better than those you can buy.

The attachment shown above is designed to support the router over an area larger than that of the router base. It's a scrap of 1/4-in. plywood made long enough to suit the job at hand and bored in the center to slip over the chuck and bit. With it you can bridge the area when routing a depression in the work. Screw holes in the attachment are spaced to suit the ones in the router, and countersunk so the screwheads will be flush. The wood is waxed so it will slide freely.

The second attachment (see top, next page) features a movable fence and is de-

EDGE-GUIDING BASE

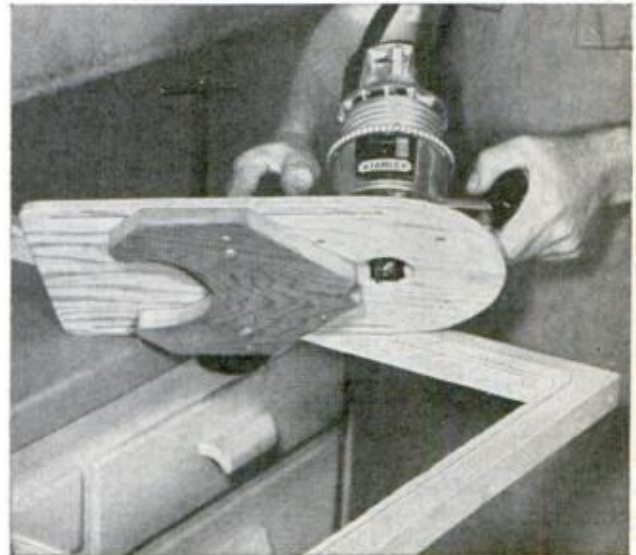


Technical Art by Graphic Presentations

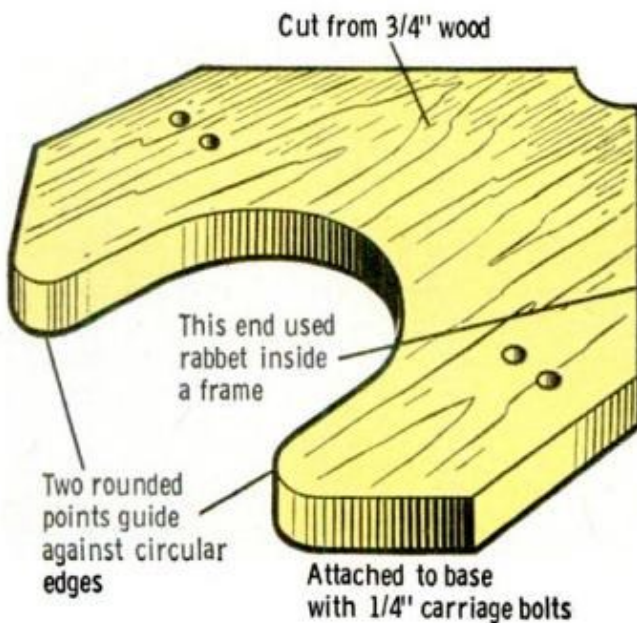
GUIDED BY ITS STRAIGHT FENCE, this attachment lets you rout rabbets along the edge of straight work



SLOTS MAKE FENCE ADJUSTABLE so router can be positioned to form dados along the straightedges. Extra long fence provides a good, positive support

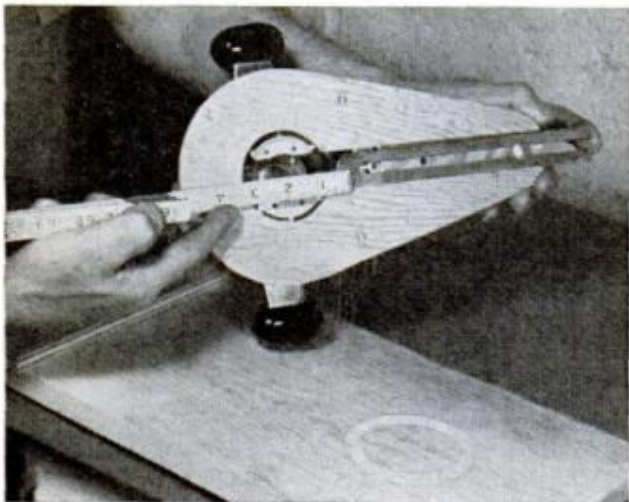


SPECIAL FENCE (below left) can be used to run a rabbet around the inside of a frame (above), or turned end for end to rabbet circular work (below)



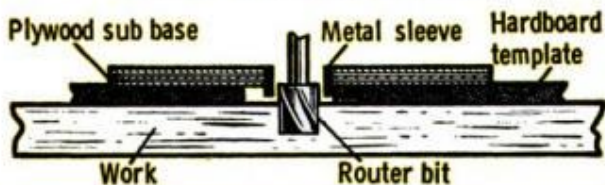


WITH THIS ATTACHMENT, the router can be swung around to rout perfect circles, rabbet edge of work



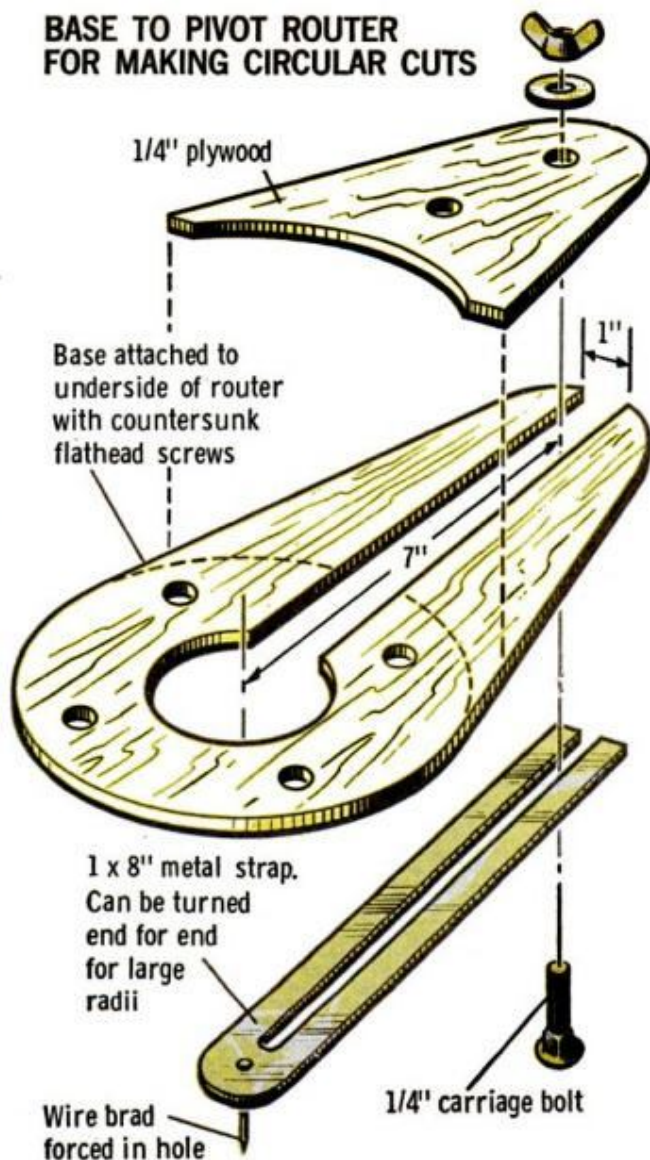
RADIUS OF CUT is set by measuring from center of router bit to pivot point in adjustable metal slide

CROSS SECTION OF TEMPLATE



SLEEVE THROUGH PLYWOOD DISC guides router bit around inside, outside of template tacked to the work

BASE TO PIVOT ROUTER FOR MAKING CIRCULAR CUTS

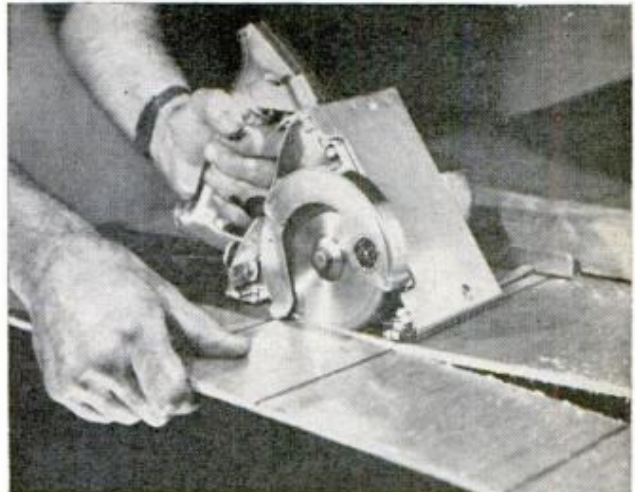
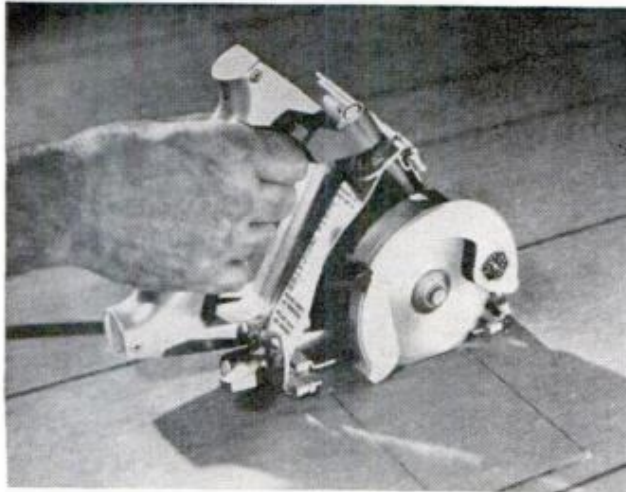


signed to guide the router bit a given distance from the edge of the work. Husky in size, this affair is superior to its commercial counterpart, often too small to guide the machine properly. It's made of 1/4-in. plywood, about 2 in. wider than the diameter of the router base. Slots are provided for fence adjustment by two carriage bolts with washers and wingnuts.

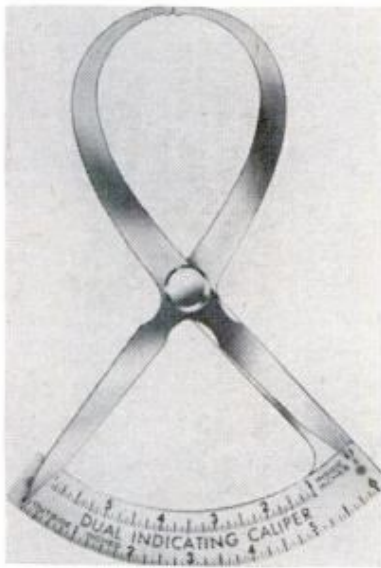
Pairs of additional slots are provided in the plywood to accept a second adjustable fence, detailed at the bottom of page 191. The same wingnuts hold it and it's reversible. With its pointed end facing the cutter, the fence permits cutting a rabbet around the inside of a square frame. When turned end for end, the rounded points of the fence let you run a rabbet around the edge of a disc. The latter operation is performed more conveniently when the attachment is clamped upside down to a bench so you can use the setup as a small spindle shaper.

The third attachment (detailed above) [\(Please turn to page 234\)](#)

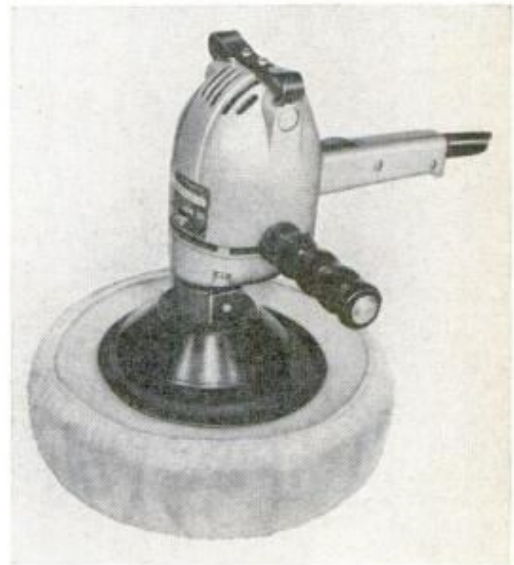
New Tools You Should Know About



TWO-WAY CIRCULAR SAW cuts forward or backward, as needed, just by flipping a switch to reverse blade rotation. Called the Eager Beaver, the 4½-in.-dia. saw also features two bases for right or left-hand use—especially handy when you're working in tight quarters. Maximum depth of cut with blade set at 90° is 1⅞ in.; at 45°, ¾ in. Price of the ¾-hp unit is \$69.50. It's made by Stanley Power Tools, Div. of the Stanley Works, 195 Lake St., New Britain, Conn.

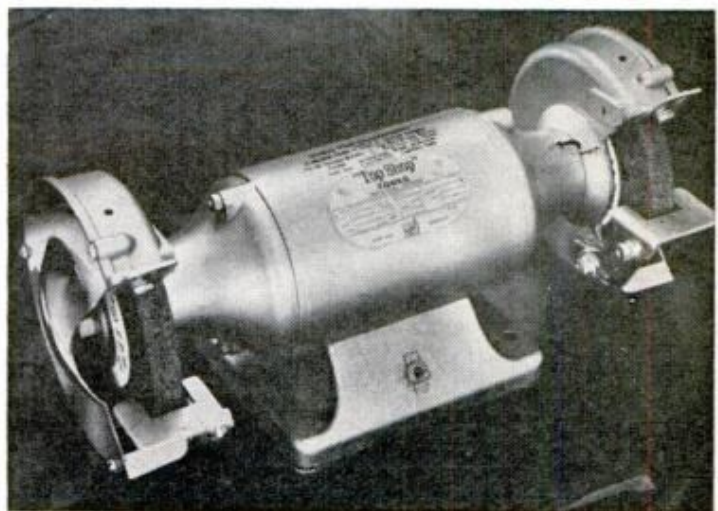


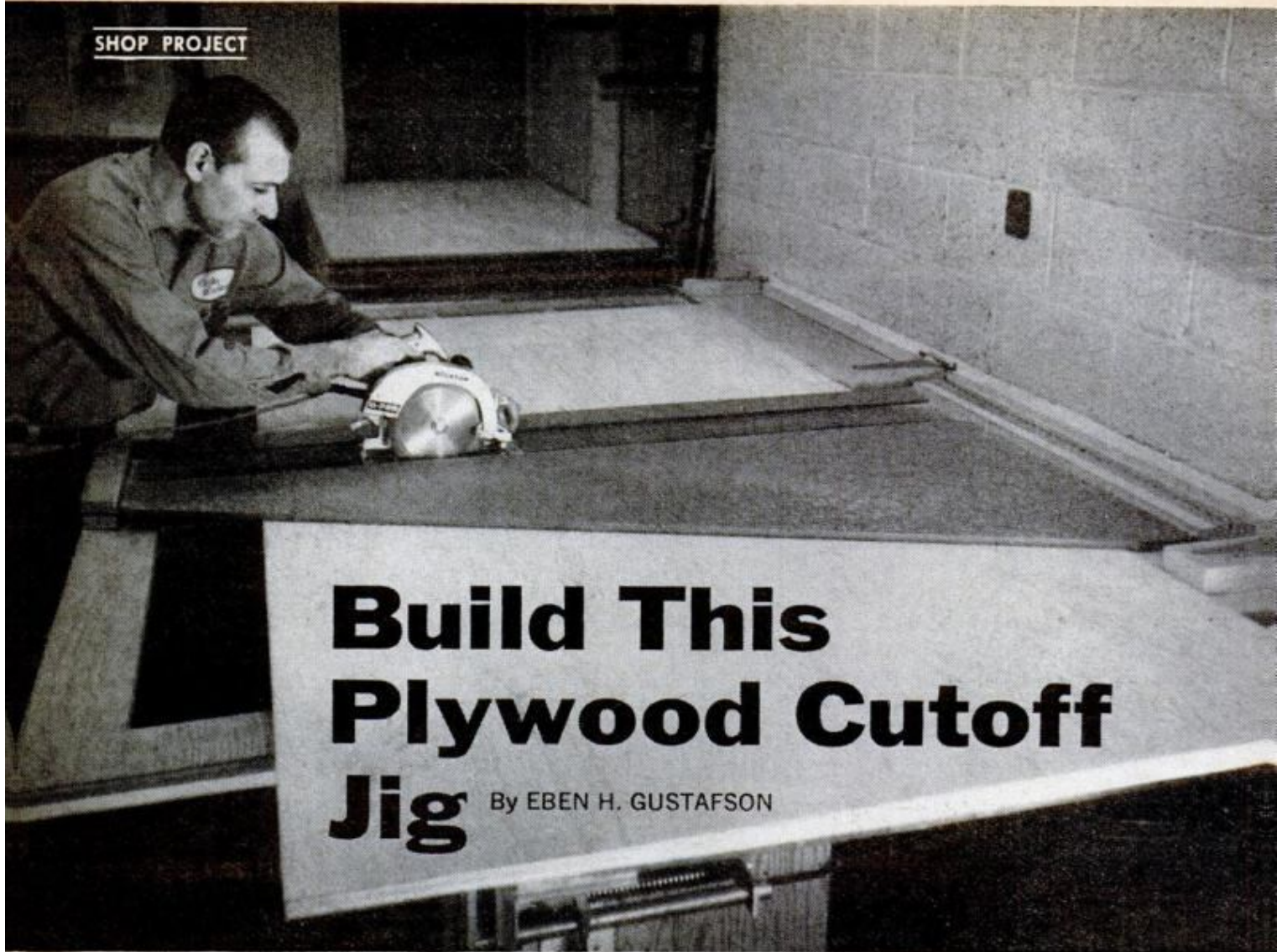
DUAL-USE CALIPER can be used for direct measurements of inside and outside dimensions, can also serve as fixed gauge by tightening thumbnut at leg's pivot point. As shown at left, caliper has a pair of ⅙-in. graduated scales with short leg for inside dimensions, long leg for outside dimensions. \$12 f.o.b. Indicating Caliper Co., Box 51, Oak Park, Ill. 60303.



HEAVY-DUTY POLISHER features an orbital action to eliminate swirls, scratches and burn marks. The 8-lb. unit has a 2½-in.-thick rubber backing pad, while pad diameter is 10½ in. Operating speed is 1500 rpm and the motor draws 5.5 amperes. Price is \$119.95. Skil Corp., 5033 North Elston Ave., Chicago, Ill. 60630.

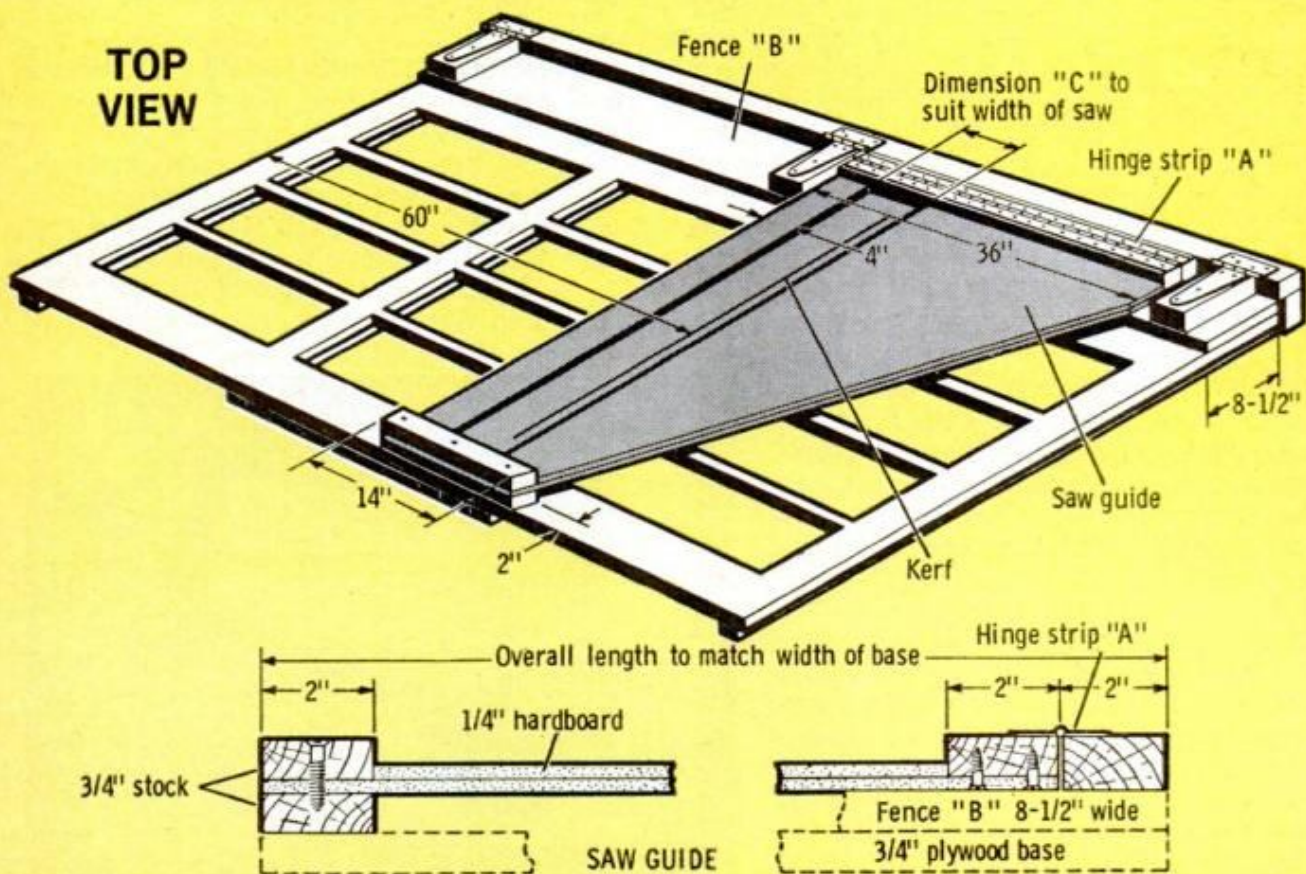
INDUSTRIAL GRINDER with ⅓-hp motor features tapered end bells for maximum working freedom around the grinding wheels. The standard wheels are aluminum oxide in fine grit (No. 60) and coarse grit (No. 36). Both end covers are removable to allow the use of brushes or flexible shafts. Distance between the ¾ x 6-in. wheels is 14⅞ in. and arbor size of the model 3300 is ½ in. Both wheels also feature spark arrestors and angle reference marks on their adjustable toolrests. Speed of the 4.3-amp. motor is 3450 rpm. Wheel guards drilled for accessory eye shields. Price is \$69.60. Top Shop Tools, Burr Oak, Mich.





Build This Plywood Cutoff Jig

By EBEN H. GUSTAFSON

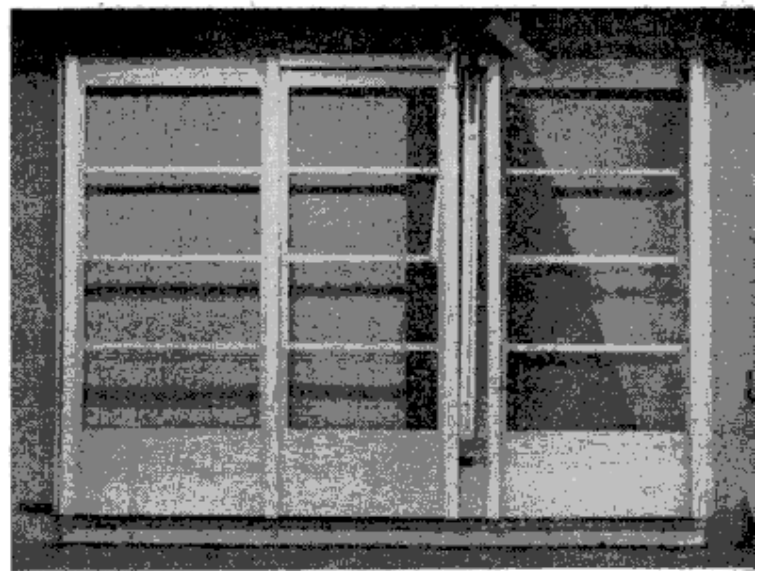


IF ONLY ONCE in a blue moon you have need to cut up a full sheet of plywood, you aren't going to bother making this cutoff jig. You'll first saw it roughly to a size that's fairly easy to handle and take it from there, not caring particularly if you waste some material in doing so.

However, if you run a small cabinet shop where you are working daily with these big, awkward sheets, it will pay you to make this handy labor-saving affair.

It consists of a 60x96-in. base on which the plywood sheet is placed, and a saw guide which is hinged to swing down on top of the work. A built-in track and kerf in the guide, which is made to fit your particular portable electric saw, lets you zip across the sheet in nothing flat, resulting in a perfect 90° cut.

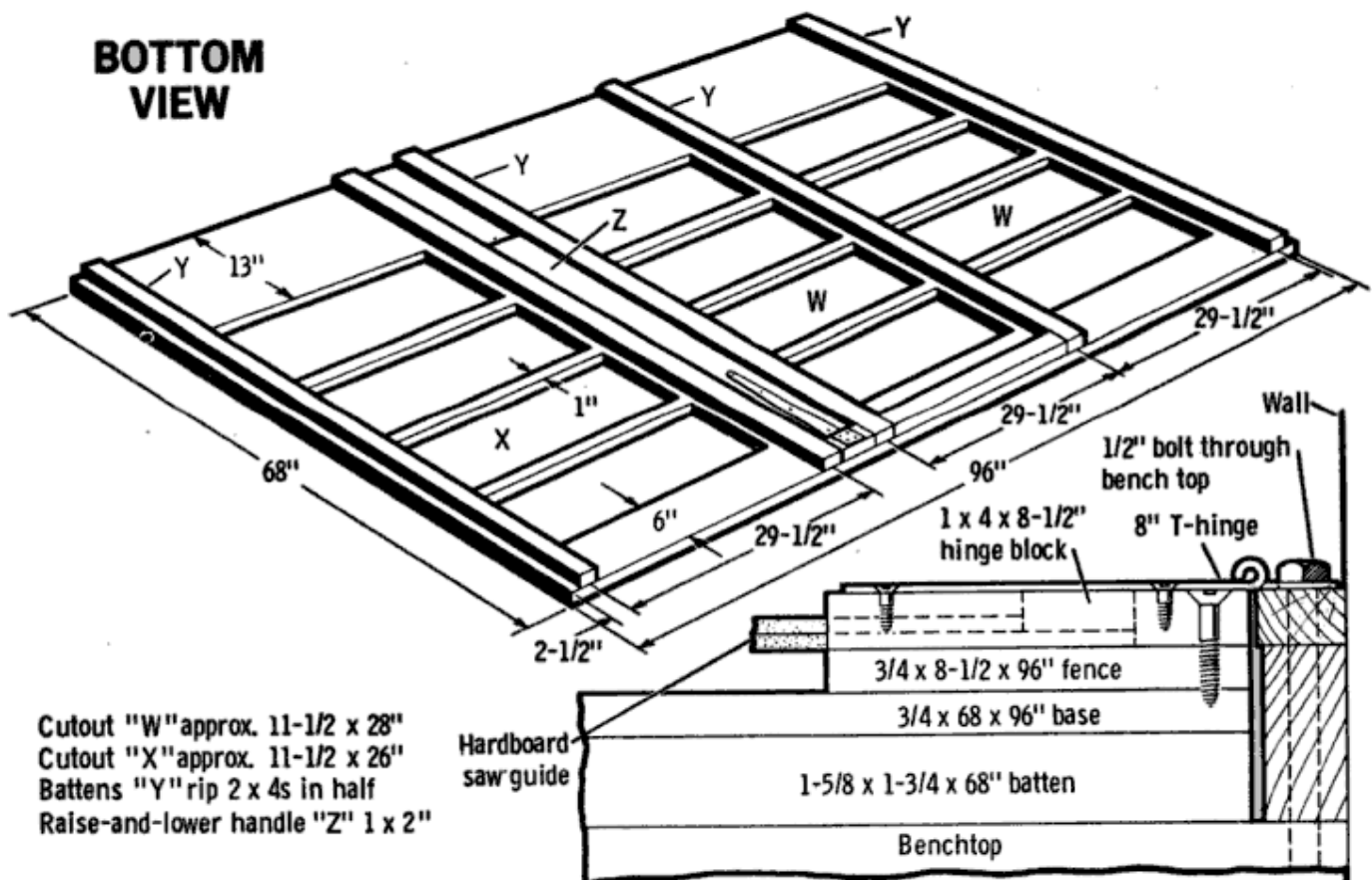
When not in use, the jig is swung up against the wall, clearing the benchtop for other use. Here you can either attach the jig directly to the wall or bolt it to the rear edge of the bench on which it's used. A 1x2 handle hinged under the front of the jig is fitted with a spring-loaded bolt latch and chain to make it handy to swing the jig up against the wall and lock it securely in place. As an extra precaution, a king-size turnbutton will give added assurance that it won't come crashing down accidentally.



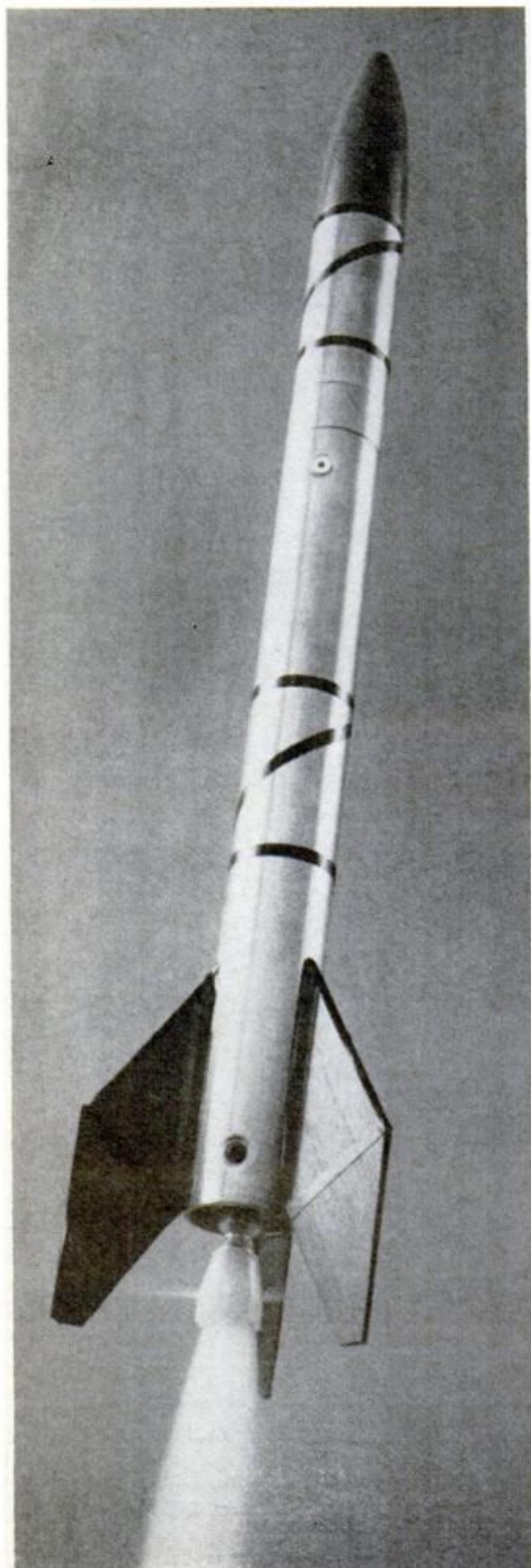
JIG STORES AGAINST WALL when not in use. Note the latch-fitted handle used to raise and lower it

The details show clearly how it's made. The base is a 4x8-ft. sheet with a 20-in. piece splined to it to make it 68 in. wide, then cut as shown to make it lighter and self-clearing of sawdust. It's important in hinging the hardboard saw guide to be sure that it is exactly 90° to fence "B."

The jig will accommodate both plywood and lumber up to 3/4 in. thick. Thinner stock is cut by shimming it up with scrap pieces. The track for the saw is made just wide enough to let it slide smoothly, yet without any side play. ★★★



This \$16 Kit Makes You a



Using a completely harmless liquefied gas, you can't get hurt in firing this 'beginner's' model rocket. Built-in timer releases recovery parachute.

By **WAYNE C. LECKEY**,
Home and Shop Editor

Technical Art by Fred Wolff

I HAD NEVER FIRED A ROCKET before—model or otherwise, and I must admit I was a bit apprehensive as the countdown neared “ignition” and all systems were GO.

It was like lighting your first 5-inch salute on the Fourth or July; you didn't quite know whether to take cover or bury your face in your hands.

As I touched the ignition wire to the battery which blasted the rocket from its pad, I found the Valkyrie-2 was not a firecracker at all, but, instead, a completely safe, nonexplosive model rocket which looked and performed just like a Cape Kennedy bird.

At first, a faint glow indicated that the hairlike igniter wire had melted as it was supposed to, and with a sudden swoosh the electric firing plug blew free of the engine nozzle.

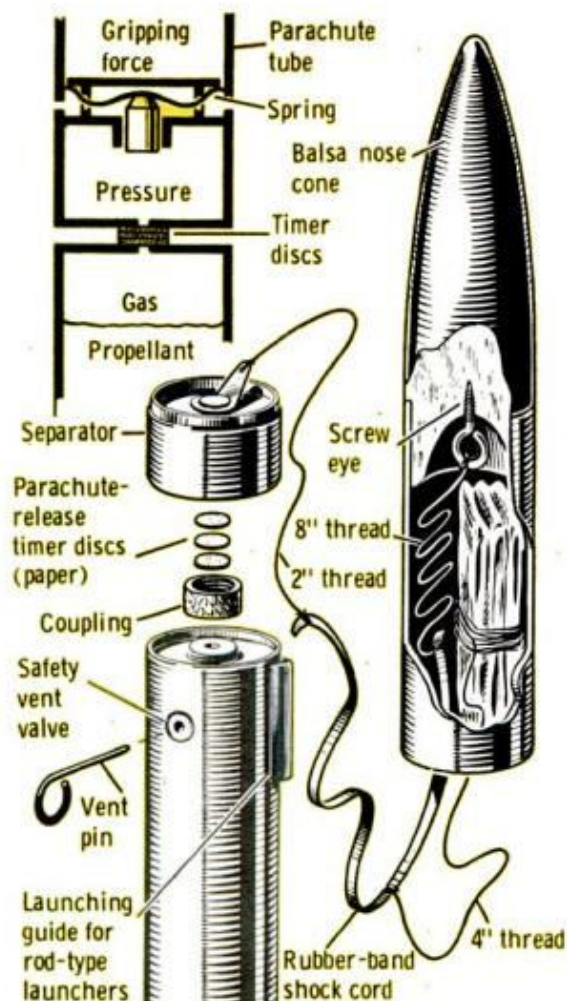
Then, just like its full-size counterpart (the Atlas, Titan or Saturn), the rocket, fuming and hissing, started to lift off slowly at about 4 Gs. As it streaked skyward up its launching rod, spewing its pent-up propellant behind, it soon reached a speed of nearly 300 feet per second and was lost in the sun.

I had no idea how high it soared, although the Vashon people who make the kit claim altitudes up to 1000 feet are reached with a payload capacity of a quarter pound. But it was fascinating to watch it climb realistically, vapor trail and all, and to see the nose cone separate from the engine and then a parachute deploy to bring both engine and nose cone lazily back to earth, ready to be launched again and again. Darned if I didn't feel

AT BURNOUT VELOCITY rocket nears speed of 300 feet per second, a maximum acceleration of 10 Gs

POPULAR MECHANICS

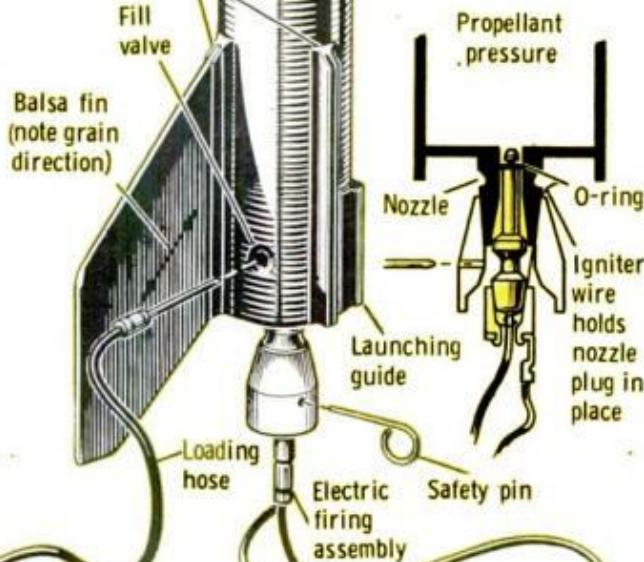
Whiz at Model Rocketry



TIMER DISCS

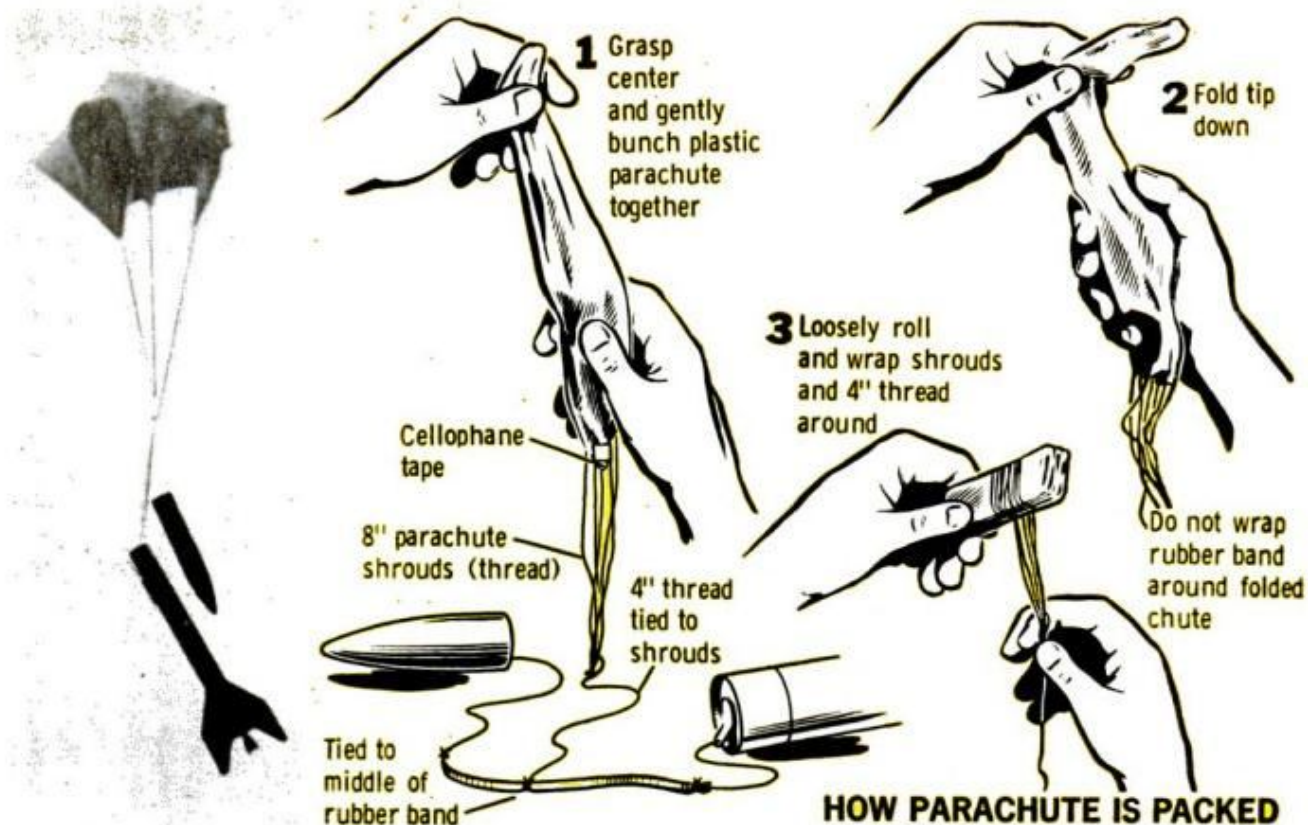
Time delay	White discs	Yellow discs
2		1-2
4		2-3
6		*3-4
8	1	2
10	2	

*Best to start



CHARLES GREEN, aerospace engineer and one of developers of Valkyrie-2, mounts rocket on plastic extrusion launcher. Complete parts kit is shown below





HOW PARACHUTE IS PACKED

THREE STEPS ABOVE show how to prepare parachute. It must fit loosely inside nose cone to fall out freely

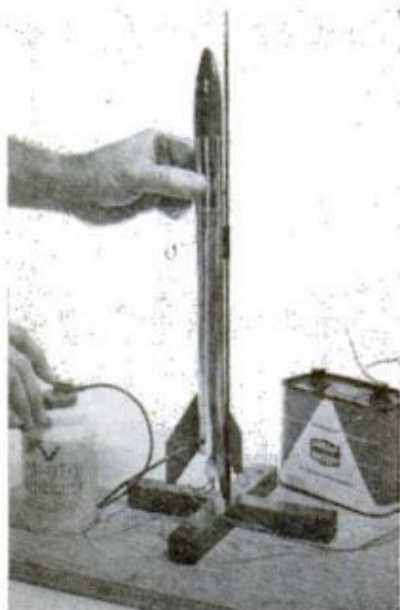
exactly as if I were a full-fledged model rocketeer!

While we had played it smart and headed for the school's football field to have a launching site free of trees, we weren't so smart weatherwise. It was a breezy day and one we should have avoided—for my boy, Dave, had to take off like a bird to retrieve the windblown

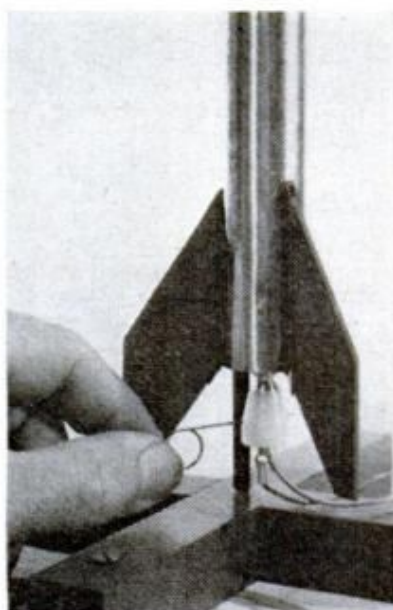
parachute which was heading towards the next county. We picked a calmer day for later flights.

What makes this rocket so safe in comparison with others which use a solid propellant? It's the special low-energy fuel it uses. Called RP-100, this refrigerant-type liquid propellant cannot release

(Please turn to page 227)



NOSE CONE IS HELD a second or two during initial fueling until it locks to end of rocket engine by pressure of the propellant gas



WHEN ENGINE IS FULL, safety pin is removed and countdown begins. Igniter wire still holds engine nozzle intact to rocket engine

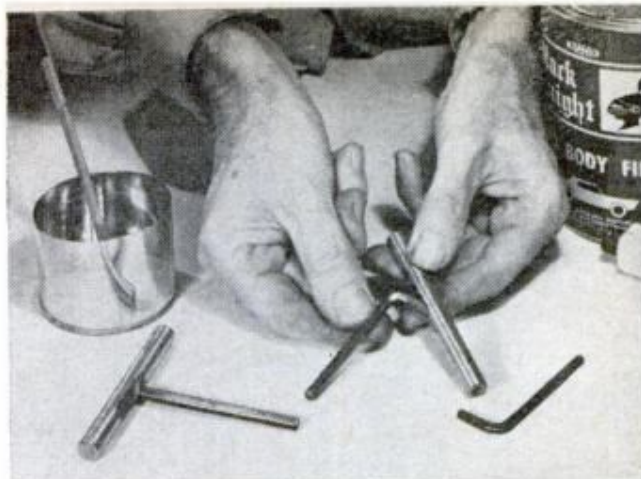


AT ZERO COUNT: ignition wire contacts battery, igniter wire melts, plug blows free, rocket fires. Battery is usually not so near

HINTS FROM READERS

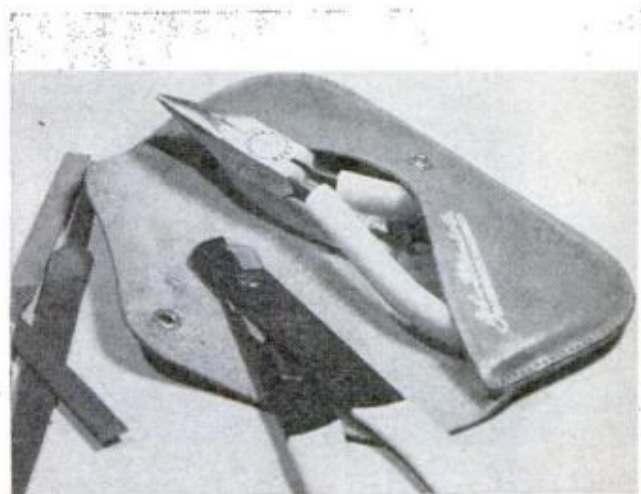
T-handles for Allen wrenches

L-shape socket wrenches are often easier to use when fitted with handles which convert them to T-shape. One way to do this is to form a short slot in one wall of a 3-in. length of $\frac{1}{8}$ -in. pipe to accept the short leg of the wrench. With wrench in place, pack the pipe with autobody filler or epoxy putty to anchor it. A series of overlapping holes will form a suitable slot.



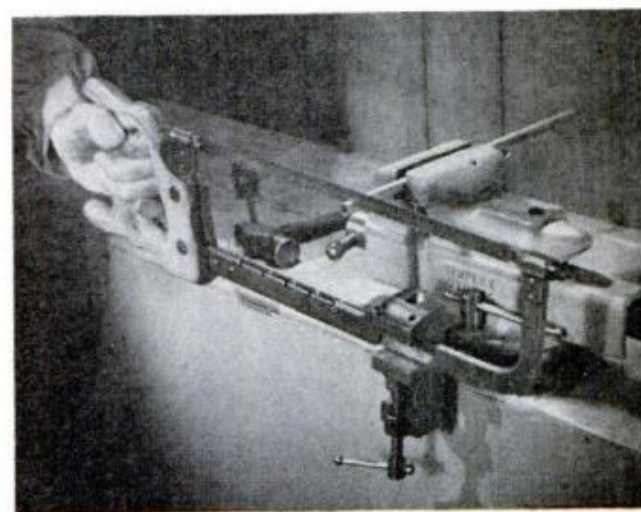
From glass case to tool case

One of the neatest pouches for storing tiny tools and delicate shop instruments is a discarded eyeglasses case and there's hardly a home that doesn't have one going to waste in a drawer. Whether it's pouch or buttoned-flap type, you'll find it just the ticket to keep track of small files, cutting pliers, shop tweezers, drift pins and countless other small tools which have a way of "wandering off." Tuck it in your toolbox or workbench drawer and you'll always know where to look for the tools.



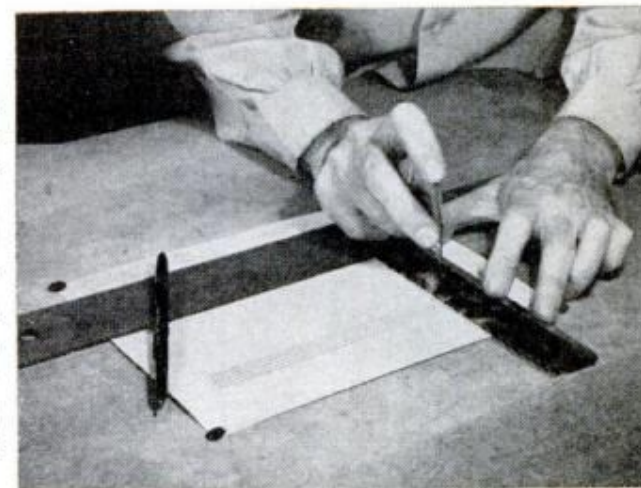
Upside-down hacksaw

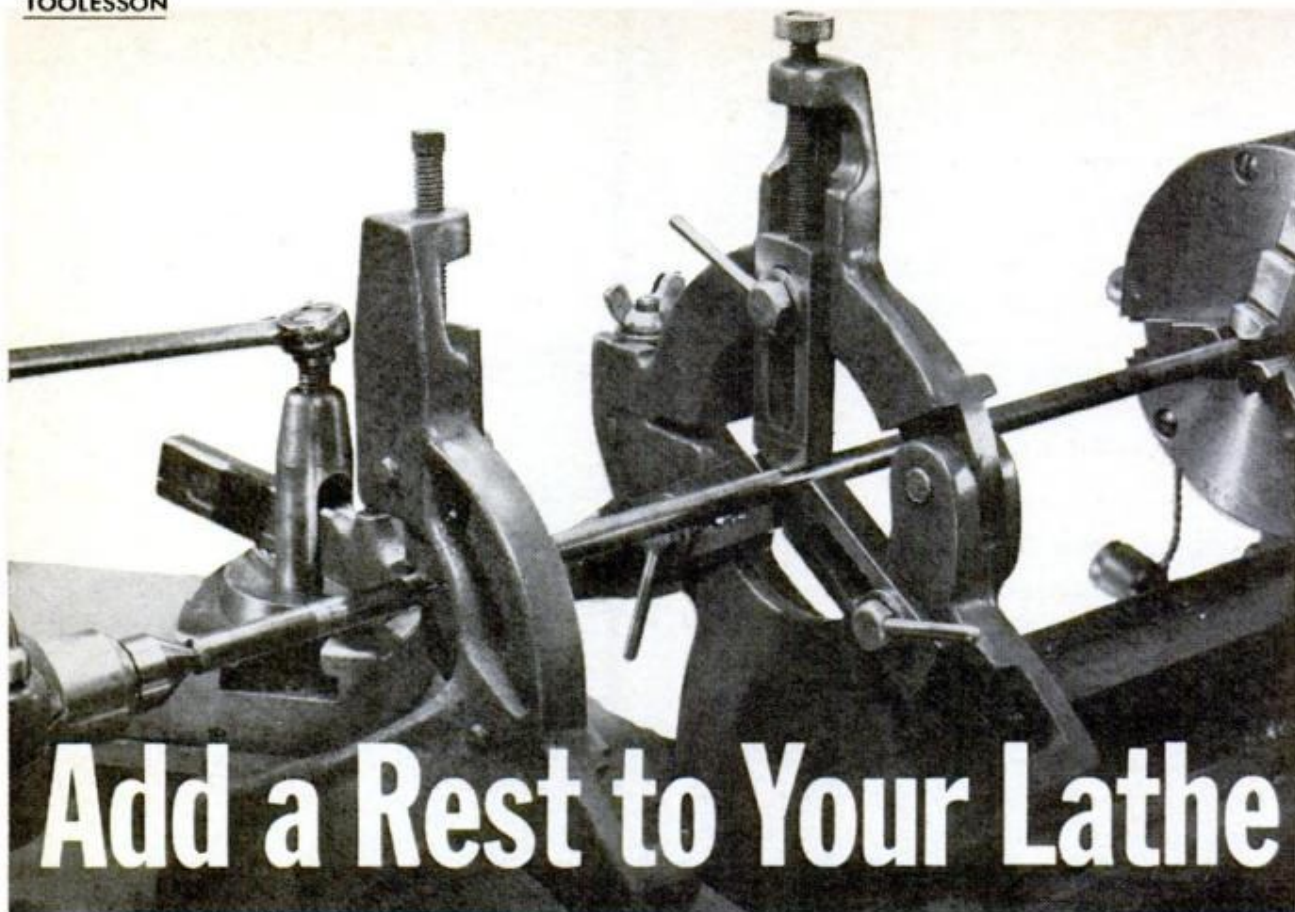
Sometimes it's advantageous to reverse a hacksaw blade so the teeth face the frame. When the saw is held with its center of gravity below the work, the blade is easier to hold and seems to cut more smoothly. In this position it is also possible to increase the cutting pressure by adding weight to the frame, such as the small vise shown. Of course, when the saw is weighted this way, be careful when nearing completion of the cut to avoid letting the saw fall to the floor.



Comb spaces lines

In a pinch an ordinary pocket comb can be used as a gauge to space lines in a drawing. Line positions are spotted with fine pencil marks between the teeth and then drawn with the aid of a T-square or straightedge. By placing the comb diagonally instead of vertically you can even reduce the minimum single-tooth spacing. Maximum spacing is determined by the tooth spacing selected in the comb. It's a good stunt to remember when laying out lines for a music staff.—Walter E. Burton





Getting the most out of your metal-turning lathe requires that you know when and how to use a rest

By **WALTER E. BURTON**

TO REALIZE the full capabilities of your metal-working lathe, you'll need two simple, not-too-costly attachments—a steady rest (sometimes called a center rest) and a follower rest.

A steady rest clamps to the lathe bed and has three equally spaced jaws that bear against the rotating work. It's useful for preventing bending and vibration, supporting the outer ends of long workpieces, and counteracting heavy stresses during knurling and spinning operations. It usually has a hinged upper half for easy insertion and removal of work.

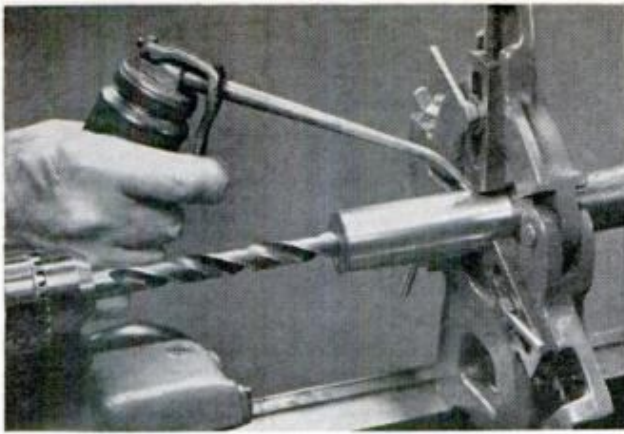
As its name implies, a follower rest bolts to the carriage and travels along with a tool for smoothing, threading or otherwise machining a slender workpiece. It also serves to prevent or reduce bending and vibration.

The rests shown in the photos represent designs long in use. Newer ones often incorporate such features as telescoping jaws, roller-tipped jaws, quick-action locking arrangements that require no wrench, and automatic-centering mechanisms. Some of these features are likely to be found on rests for turret lathes.

With either type of rest, it's important that the work surface be reasonably round and



A STEADY REST usually has a hinged upper half for the easy insertion and removal of the workpiece. Often called a closed-ring type, it has jaws made of steel



TO DRILL INTO END OF ROD, replace tailstock with a drill chuck and bit, then lubricate the jaw tips of the steady rest with some SAE 20 machine oil

smooth. If stock to be machined is a length of drill rod, shafting, pipe or tubing already reasonably round, it may need only filing to remove any scale or roughness.

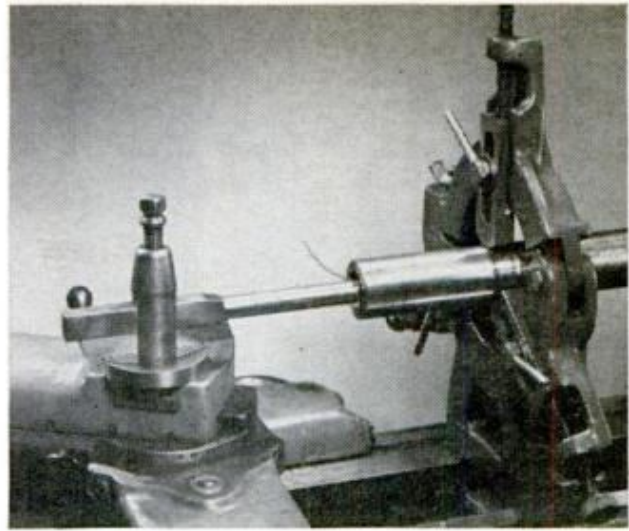
If the workpiece can be mounted between centers, or with one end in a headstock chuck and the other supported by the tailstock center, it can be machined to rotate inside the jaws of a steady rest with high accuracy. Its final exterior machining can be done while between centers or after the rest has been fitted on the lathe, depending on design and purpose of the product to be made.

Some ways to use a steady rest:

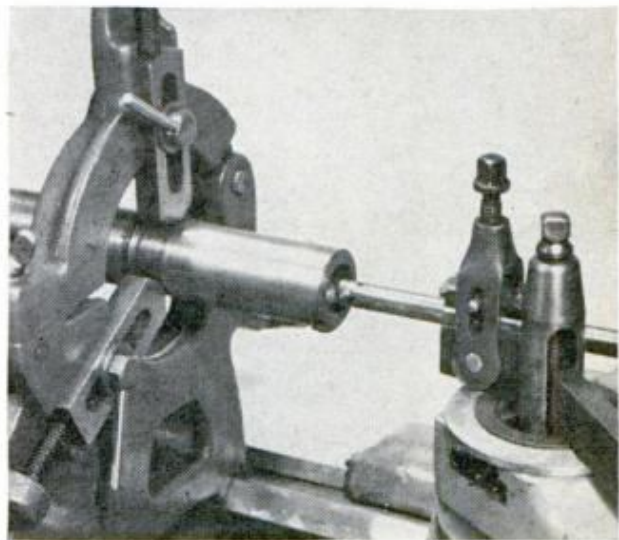
- Supporting the tailstock end of a long workpiece while its other end is being drilled, bored, threaded, faced, knurled, grooved or cut off. A good example is a drill-press spindle with a straight or tapered end hole.
- Supporting a piece of work that is a part of a round bar or one that is mounted on a bar serving as a mandrel, especially when its shape or size is such that it cannot be supported close to a chuck or by a tailstock center. A good example is a pump piston rigidly mounted on a shaft.
- Supporting the free end of a bar while drilling center holes to mount the bar between centers.
- Serving in place of a tailstock to support work longer than the lathe bed.
- Relieving the chuck and headstock of strain during spinning operations.
- Resisting the thrust of a knurling tool, thus lessening the stress on chuck, headstock spindle and bearings.
- Enabling short lengths to be cut from a bar too long to be held by the chuck alone.

Typical uses for the follower rests:

MARCH 1969



AFTER THE HOLE HAS BEEN DRILLED, it can be bored to the exact diameter required by using a boring bar and a single-point bit (see *How to Make and Use Lathe Boring Tools*, page 158, Aug. '68 PM)



IF BORED HOLE IS TO BE THREADED, you can use either a single-point threading bit in a boring bar setup (as shown); or you can cut the thread by using a suitable tap fitted in the tailstock holder



WHEN KNURLING, use a steady rest to relieve the headstock assembly of the pressure exerted by the knurling tool. It's important to apply lubricating oil in liberal amounts to both the work and the tool

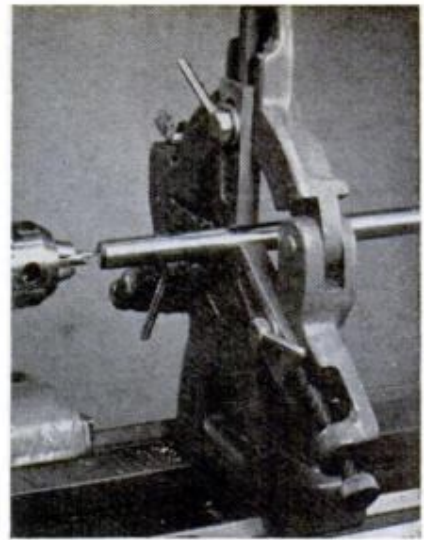
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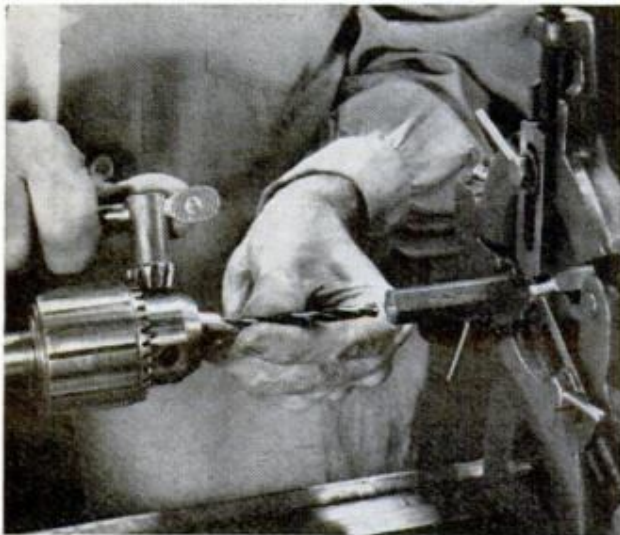
A SLIP OF PAPER inserted between jaws and workpiece will help you set proper jaw clearance



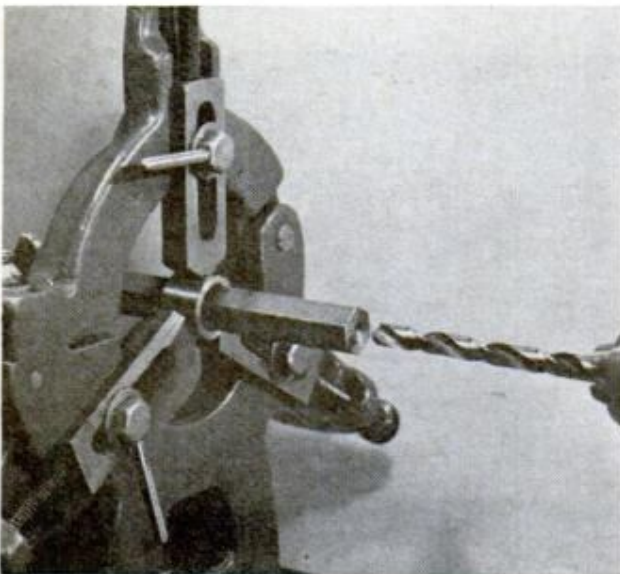
SPINNING THE EDGE of a brass pipe over a wood disc to form a cylinder calls for the use of a rest



STEADY REST proves especially useful for drilling center hole in end of long, slender workpiece



TO SUPPORT NONCYLINDRICAL WORK, such as the hexagonal bar shown, place bar between centers and machine a smooth bearing surface for the steady rest



ALTERNATE METHOD TO SUPPORT odd-shaped work is to drive a suitable ring over the bar, then turn the ring until it provides a round bearing surface

- Preventing tool pressure from bending a slender rod, shaft or tube, thus greatly improving accuracy.
- Reducing the vibration of slender workpieces.
- Assuring more uniformity of threads on a slender piece of work by preventing flexing due to the pressure of the threading tool.
- Operating in conjunction with a steady rest for maximum support and accuracy during machining operations.

When an odd-shaped piece of work is to be steadied by a rest, it's necessary to provide a smooth, cylindrical surface against which the jaws of the rest can bear. With square, hexagonal or other shapes that will not revolve smoothly in the jaws, you can turn a smooth ring in a "scrap" section or force a metal ring over the workpiece and machine the surface to a smooth bearing area. This method is particularly suitable when the work doesn't have a "scrap" section.

When stock having uniform, accurate diameters is being machined, a ball-bearing assembly sometimes can be forced on the piece. When the outer race is clamped tightly in the steady-rest jaws, a ball-bearing action is achieved.

Use machine oil or light grease, perhaps containing some graphite, to lubricate work revolving in center-rest jaws. Jamming, squealing or a rasping noise indicates lack of lubrication or too little clearance between jaws and work. The heat of machining also can cause a bar to expand, reducing such clearance. For a follower rest, brush sulphurized cutting

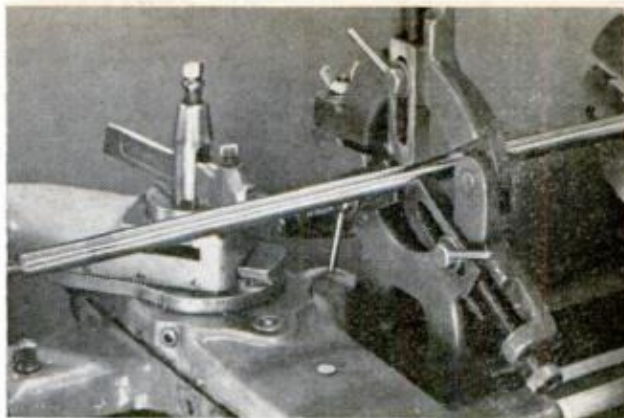
oil along the workpiece. It supplies enough lubrication for the jaws and also improves the lathe bit's cutting action.

Jaws of a steady rest are set properly when work rotates freely against them, but without excessive play. Accuracy of the finished work greatly depends on this. Some machinists use a paper shim to set jaw clearance. They set the two lower jaws snugly against the work, then adjust the top one until tight against the shim slipped between it and the work. Then the paper is removed to leave a paper-thick clearance (usually .002 to .003 in.). If less clearance is needed, use cellulose film (.001-in. thick) as a shim. For extreme accuracy, it might help to use a very thin shim between *each* jaw and the workpiece.

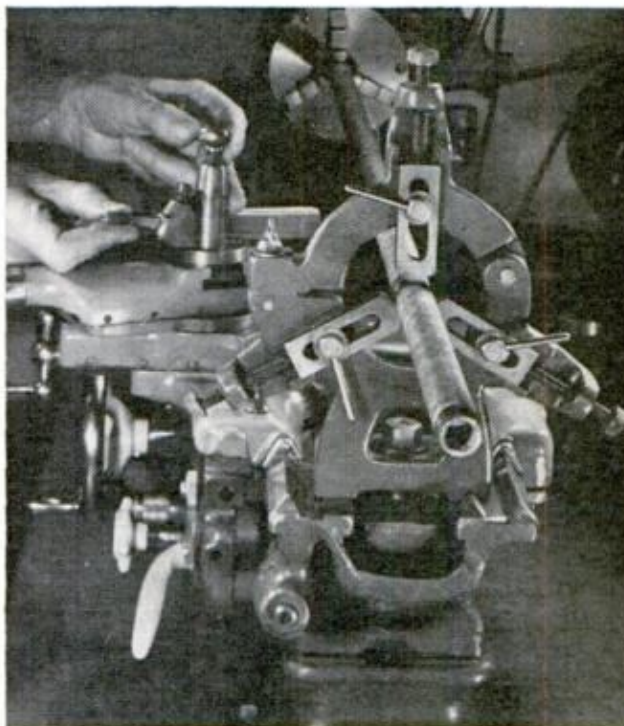
Follower-rest jaws always should be set snugly against the back and the top of the workpiece without pressing hard enough to spring it. Of course, all jaw ends should be virtually glass-smooth and the area on which they bear should be as smooth as possible.

When a follower rest is steadying a slender rod or other workpiece that already has a smooth, uniform diameter (such as that left by a previous cut), the jaws could be set to bear against the existing surface to travel *ahead* of the tool point as the carriage moves along the bed. However, the jaws customarily are set just behind the tool to travel on the newly machined surface. Assuming no change varies the diameter of the workpiece, the jaws will continue to have a

(Please turn to page 234)



PREVENT VIBRATION OF LONG, SLENDER RODS secured between centers by fitting a steady rest near middle of the work and adjusting the jaw clearance



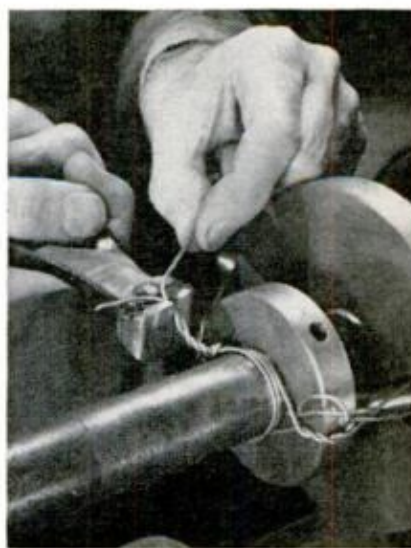
WHEN MACHINING WORK longer than the lathe bed, replace tailstock with steady rest, machine one half of work, then flip work, machine other end



FOLLOWER REST can be attached to the carriage to travel directly in line with tool to support work



WHEN THREADING slender piece of work, set the follower rest so that it travels in front of the bit



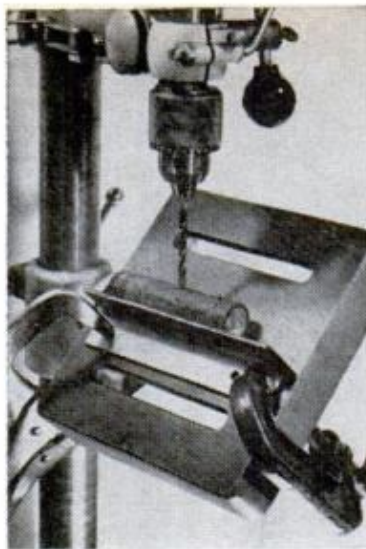
IF YOU'RE USING A DOG to drive the workpiece, always lash it so that it can't crawl forward

HINTS FROM READERS



Deep polishing

Ever tried to polish a tarnished embossed platter? It's a real chore with wads of cloth, polishing compound and finger action. At best you can only reach a portion of the low areas. What you need for such work is a portable hand grinder, such as a Handee or Moto-Tool. Fitted with a cone-shaped rotary brush and charged with metal polish, the tool will let you get into the smallest crevices. A final rub with a cloth and polish will remove any brush marks.



Quickie V-block

It will pay you to keep a short length of angle iron in your shop for many reasons. One excellent use is a V-block to support work for drilling. Here you simply tilt the drill-press table 45° and clamp the angle iron to it with a couple of C-clamps. When positioned to center the work directly under the bit, the angle iron will cradle the work as well as any regular V-block. And if you find it best to clamp the work, do it with a third clamp placed crosswise.



Soilproofing handle

If you take pride in your hand tools and like to keep them looking new, here's a stunt to remember when using your hammer on a job that could get it messed up with paint, tar or other gook. Simply wrap the handle with masking tape before you start. It will improve the grip. When the job's done the tape peels off easily, dirt and all. It's a stunt like first working Vaseline into your hands before starting a greasy job. The grime will wash off easier.

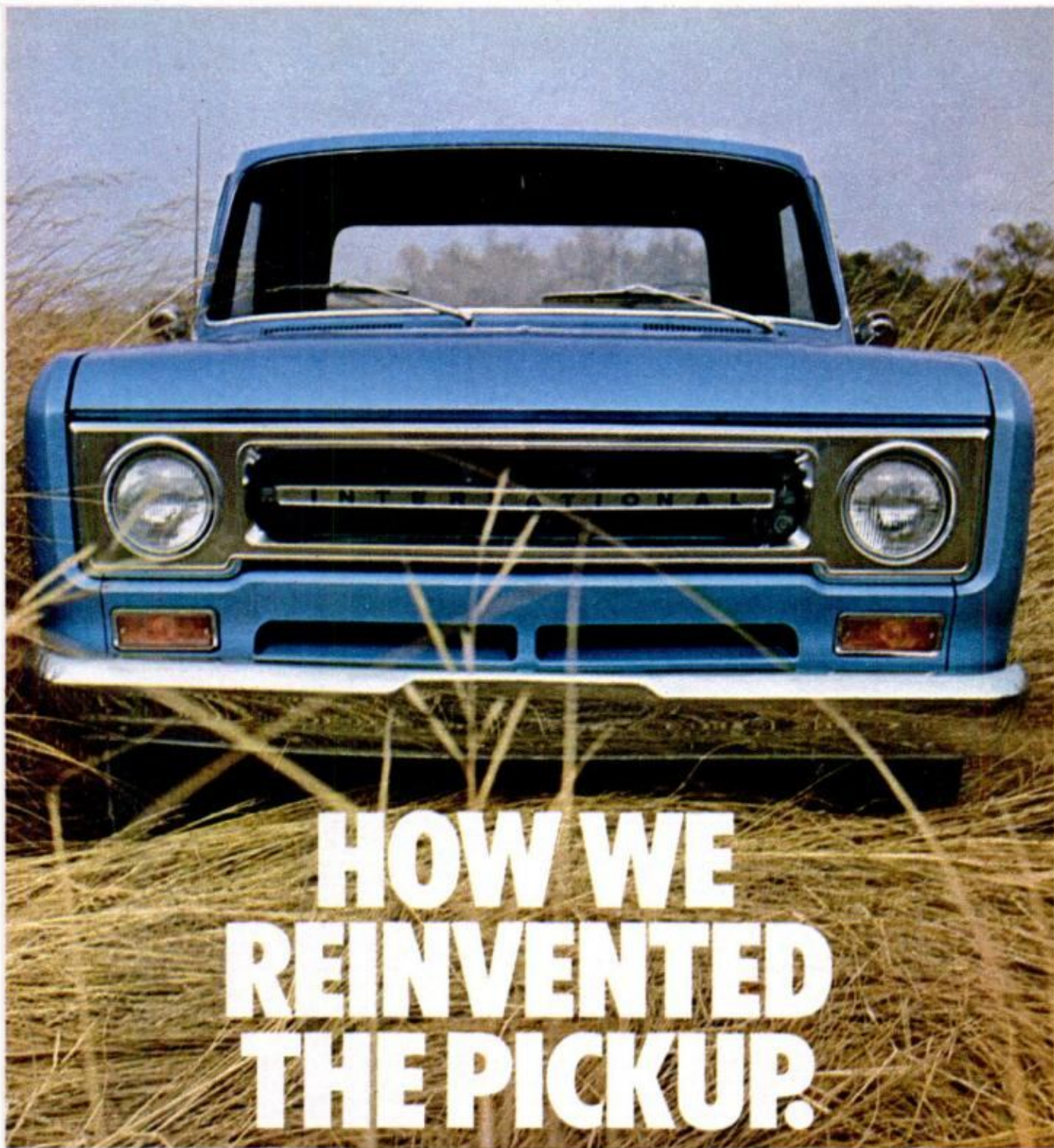
NEXT MONTH IN SHOP AND CRAFTS

14 PAGES OF VACATION HOMES. Next month's collection of new and original second homes includes something for everyone. From a spectacular showcase to a bargain-basement shelter for the weekend camper, *PM's* choice of choice vacation homes is not to be missed. Presented in color, and with complete information on how you can order detailed construction plans, this story is bound to cure your case of spring fever.

HOW TO CHOOSE ONE OF TODAY'S WONDER PAINTS. Ask the counterman at a paint store for a "can of white paint" and he'll likely look at you as if you were Rip Van Winkle. For the complete rundown on the what, why, how and when of the new paints, next month's story is required reading.

HOW TO BUILD A "GROUND-HUGGER." This low-slung, high-style bicycle has to be seen to be believed. It looks like a dragster's "rail-job," yet is easy to build and a pleasure to ride. It's assembled from the parts of an old bike.

HOW TO STORE YOUR GARDEN TOOLS IN A FENCE. Shown in color, this neat-looking structure is actually a tool storage shed that's cleverly disguised as a fence. With separate doors for each storage section, it has enough room for hand tools, mowers, seeders and other garden equipment.



HOW WE REINVENTED THE PICKUP.

We made 83 advancements in engineering and design to create a whole new kind of pickup. The first complete pickup.

Thirty-seven of them make it the smoothest riding, easiest handling pickup on the road. Seventeen make it smarter looking, outside and in. And twenty-nine advancements make the INTERNATIONAL even more reliable and rugged than before.

The INTERNATIONAL pickup is for passengers and payloads. For pleasure and power.

Its 83 new features range from smooth new suspension to roomier



cabs, longer wheelbases, easy shifting. A new Power Thrift Six engine delivers up to 10% greater gas mileage. And the biggest pickup brakes available give you safer, smoother stops. Add to this your choice of striking new metallic colors, and bucket seats with consoles, color keyed interiors, sleek exteriors trimmed with bright chrome, textured ebony panels, and walnut woodgrain.

This is how we reinvented the pickup. With 83 reasons for you to own it.

IH INTERNATIONAL HARVESTER COMPANY
CHICAGO, ILLINOIS 60611

THE INTERNATIONAL TAKE A TEST DRIVE.

KNOCK KNOCK

Loose piston pin? Or is it a loose rod bearing? MOTOR's Manual pinpoints which it is—and helps you fix it fast.

You can't afford guessing games when an auto engine tries to tell you something. That's why MOTOR's Auto Repair Manual tells you exactly what a knock, clatter, ping, or backfire may mean, and then shows you how to fix it fast.

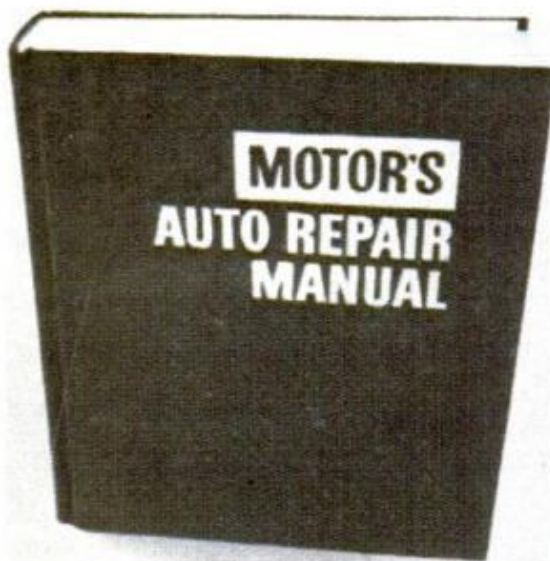
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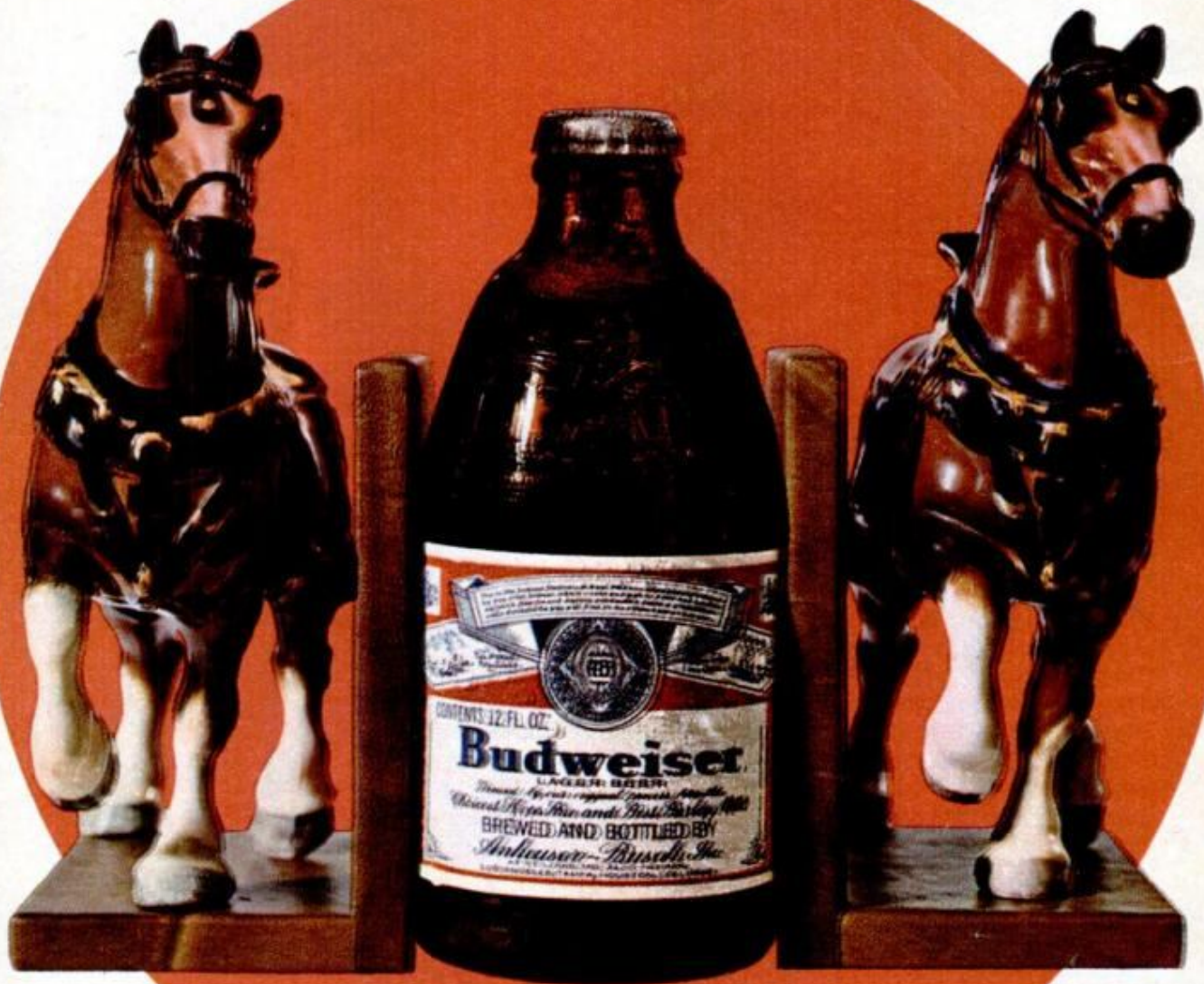


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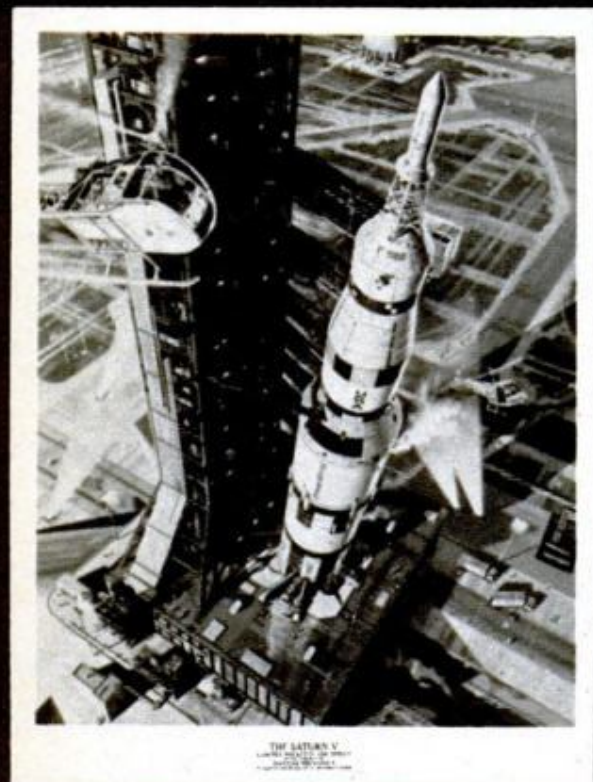
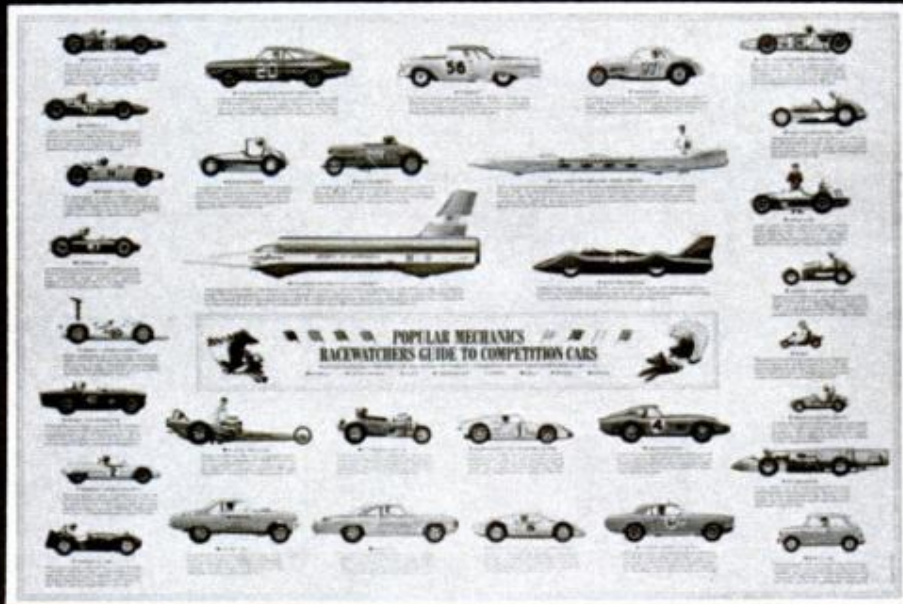
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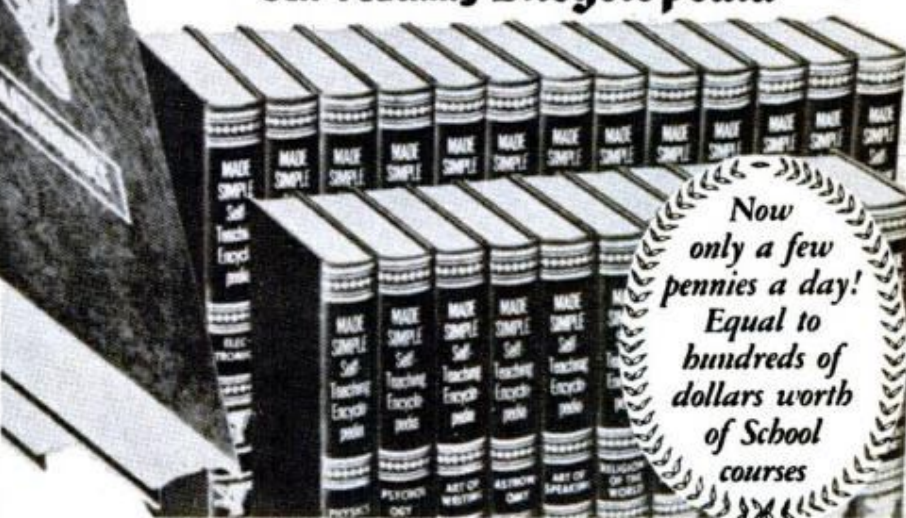
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TV TABLE STORES STANDING

(Continued from page 160)

hardboard top, apply contact cement liberally to both pieces and let dry until a piece of newspaper will not stick. Carefully align one edge and one side and stick them together. Roll with a rolling pin to assure a good bond. Then cut the finished top to exact size to fit the frame. You can now assemble the top and frame as shown in the plan. Use white glue on the miter joints, clamped with picture-frame clamps.

Preparing the guide pieces

There are several ways to make the two guide pieces, depending on the equipment you have. Probably the easiest and most precise is to make a $\frac{1}{8}$ -in. hardboard template for routing out the $\frac{1}{8}$ -in. groove. Lay out the pattern for the guides on a 4 x 14 $\frac{1}{2}$ -in. piece of $\frac{1}{4}$ -in. hardboard. Put a template guide in the base of your router and a $\frac{1}{4}$ -in. straight bit in the chuck. Measure the distance from the bit edge to the outside of the template guide (usually $\frac{1}{16}$ -in.), then enlarge the outline of the groove by this amount. Cut the groove pattern in your template on this line, using a fine-tooth blade in your sabre saw, jigsaw or coping saw.

Cut a piece of walnut for the guides, $\frac{3}{4}$ x 5 $\frac{1}{8}$ x 14 $\frac{1}{2}$ -in. Sand this board smooth on both sides, then fasten your hardboard template to it, aligning the bottom edge with one edge of the board. Use short brads, set slightly below the surface of the hardboard. Set your router bit to extend $\frac{1}{2}$ -in. below the base and rout out the groove. Pry the template loose with a putty knife, turn it over, and fasten it to the board again, aligning the bottom edge with the other edge of the board. Rout the other groove. Now rip the board down the middle, cut the ends to conform to the pattern and you automatically have left and right-hand guides. Drill $\frac{3}{16}$ -in. holes as directed, and round off the top edges of the guides with a $\frac{1}{4}$ -in.-radius, corner-rounding bit in your router. Sand all edges smooth before rounding them over.

If you don't have a router, you can rout the grooves freehand with a drill press, or you can laminate two pieces of $\frac{1}{2}$ -in.-thick walnut for each guide, having first cut the groove in the inside piece with a sabre saw or jigsaw before laminating. If you use this method, you'll have to make the dadoes in the top frame 1 in. wide instead of $\frac{3}{4}$ in. to accommodate these slightly thicker guides.

Next, cut out the four legs according to the pattern. Sand both sides and the edges smooth and round over with your corner-

rounding bit. Locate and drill $\frac{5}{8}$ -in. holes in two legs as shown in the plan. Drill a $\frac{3}{8}$ -in. hole $\frac{5}{8}$ in. deep in the two other legs. Be sure to drill them so that you have a left and a right. On the side where you drill the $\frac{3}{8}$ -in. hole, drill a $\frac{3}{16}$ -in. hole through the legs near the top, and counter-bore this hole with a $\frac{1}{2}$ -in. bit $\frac{1}{4}$ in. deep. This will receive the stovebolt and washer for fastening the leg to the guide piece. The bolthead must be below the surface of the leg to clear the adjacent leg when the table is folded.

Cut the top spreader to size from a scrap of walnut $\frac{3}{4}$ x 15 $\frac{1}{8}$ -in. and set the short lengths of dowel in the ends. When this spreader is in place and the table folded, round off the spreader as shown to clear the underside of the tabletop.

Cut a piece of walnut for the center spreader and turn it on your lathe to the dimensions given. If you don't have a lathe, you can make a spreader by planing off the corners of a $\frac{3}{4}$ x $\frac{3}{4}$ -in. strip and whittling the two shoulders on the ends.

Now you're ready to assemble the table. Slip the two inside legs on the center spreader, then glue on the two outside legs. Lay this assembly on your benchtop so the curved section of the inside legs hangs over the edge, allowing the straight shanks of all four legs to lie flush. Carefully align the top spreader with the tops of the inside legs and with the ends of the spreader flush with the outside edges of the outside legs. Fasten the spreader to the inside legs with 1 $\frac{1}{4}$ -in. No. 6 flathead wood screws.

Insert one guide piece in the dadoes in the tabletop frame. Engage the dowel in the top spreader in the guide slot, then simultaneously engage the dowel in the other end in the other guide slot and fit the guide piece in the other dadoes. Try folding and unfolding the legs several times to insure that all parts work smoothly and all clearances are sufficient. An application of paraffin to the inside of the guide slots is a good idea. You might even want to tape the guide pieces in place temporarily and try the table right side up to see that it sits level when open and stands by itself on all four leg tips when folded. When all parts fit to your satisfaction, glue the guide pieces permanently and bolt the outside legs to the guide pieces. Turn the nuts fingertight and peen over the ends of the bolts a little to lock the nuts in place.

If you've sanded all the pieces as well as you've made them, you have only a little touchup sanding to do before finishing. Finish with sealer and varnish, or just wipe on a few coats of Watco Danish Oil Finish.—David Jordan

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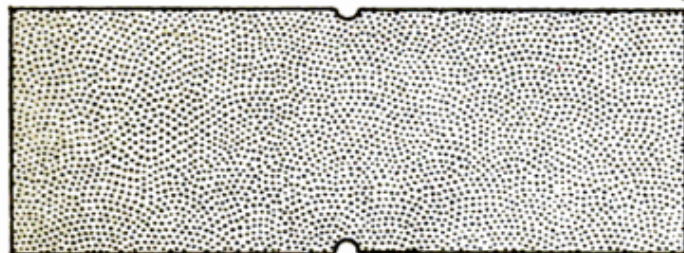
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'SEE' TORNADOES ON TV

(Continued from page 96)

were still trying when power went off."

Van Steenwyk strode outside to look around. Only a few leaves rustled. "Some tornado," he laughed, discounting the power failure. But just then the telephone rang inside. It was for George Vogel. "Your new house just blew away," a distressed voice said, "in a tornado."

Providentially, the Van Steenwyks' house was not in its path but the twister plowed through homes only a few blocks away. Van Steenwyk was so amazed that he issued strict orders that no one was to touch the TV set. When the power came on four hours later, Channel 2 was black.

"I'm glad that 15 adults were there to see that white screen," Van Steenwyk says. "Otherwise, it was all so eerie, who would have believed me?"

Residents recall that, prior to the tornado, they heard no emergency weather announcements. The tornado alert came from two farm families, eight miles south of the town, who saw the funnels heading for Orange City and called the sheriff.

Hunt Davis, staff member of Good Will Industries at Sioux City, who lives in Cherokee, used the Weller Method to spot the Orange City tornado even farther away—33 miles. But his TV was on the top floor of a two-story apartment house on a hill with an outside antenna 25 feet high.

"I read about Weller's method in the paper and decided to have some fun watching the lightning flashes," Davis told us. "It was fascinating—but then came that white screen indicating a tornado."

"Thirty miles or more is an unusual distance," Weller points out. "But most of these families had good TV receptional setups. Ordinarily, the maximum could be 20 miles, but the average is about five, and I'd like to stress that so people will seek shelter fast. Severe storms spawn tornadoes and this could happen right over your home."

The 55-year-old Weller, a self-educated electronics engineer whose laboratory is in his bedroom, did not "just happen" on his method. It was the result of years of study. He has been interested in storms most of his life—they fascinate him—but only after he was the victim of a heart attack some years ago did he devote full time to them. At first, he used an oscilloscope to track storms, but its single horizontal line caused him to ask, "Why not TV with 525 lines on its rasters?"

This transfer to TV eventually brought about the Weller Method. He had long worked with Channel 5 until his computations and experiments showed Channel

2 held the secret. (Many researchers had been tracking tornadoes with an oscilloscope at a low frequency from 150-500 kilocycles, which is a long way from the high frequency of 55 megacycles.)

Weller theorizes that a tornado is detected by pulses of energy. A few researchers doubt that all tornadoes carry pulse generators, but Weller maintains they do. And he adds that "pulse generators are not confined to tornadoes—some severe electrical storms also have them."

Technically, turning down the brightness on your TV changes the bias (differential of voltage) of the grid or cathode circuit (depending on circuiting) to the point where the tube will not permit electrons to flow. If a tornado is near, voltage from the pulse generators will be so strong, it will correct the picture-tube bias and the screen will become white.

Here are questions we asked Weller to answer for *Popular Mechanics* readers:

What if Channel 2 has a program on it?

"It doesn't matter. If you are dark on Channel 13 and get a picture when you turn to Channel 2, it spells tornado. Start with a dark screen, even with a program in progress on Channel 2. A tornado lightens it so the picture is visible."

Do you need an outside antenna to detect a tornado?

"No. Many of the people in Orange City had only rabbit ears or single antenna. My original experiments were made with rabbit ears. An outside antenna will simply expand the range of detection."

When should you turn on your set to detect a tornado?

"When you see threatening clouds on the horizon, or if you feel a thunderstorm is exceptionally intense. (Tornadoes normally occur at the back end of a storm, or if a tornado alert has been issued for your area.)"

If I turn to Channel 2 and do not see a completely white screen, but intermittent wide white bands across it, should I take this seriously?

"By all means. Your set is forecasting an intense storm which could not only do severe damage but could spawn a tornado. The wider the bands, the more severe the storm is becoming. Sometimes lightning will streak the screen only instantaneously, which signals a thunderstorm. But if the flashes fade slowly, it is a dangerous storm, whether or not a tornado is in it."

Why do you turn to Channel 13 and darken it first?

"Only because Channel 13 is a 211-megacycle frequency, so far from 55-megacycle Channel 2 there is no interference. Darkening 13 first, then switching to 2

(Please turn to page 226)

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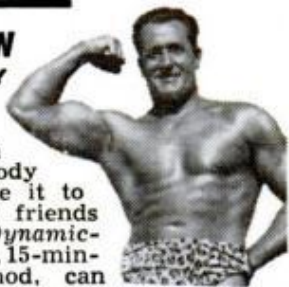
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'SEE' TORNADOES ON TV

(Continued from page 225)

precludes someone turning first to 2, finding it white (a tornado) and unwittingly darkening out the tornado, which is possible on some TV sets."

Many Midwestern tornado experts are excited about the discovery. Dr. Quigg believes the Weller Method should be explored further and that it may be especially effective for "night detection of tornadoes." Dr. L. A. Joos of Kansas City, regional climatologist for the U.S. Weather Bureau, advocates further exploration. Joos and his associate, Paul Waite, have alerted the Weather Bureau in Washington, D.C. to the method's possibilities.

Dr. Grant Darkow, professor of Atmospheric Sciences of the University of Missouri, said, "I am encouraged by this. Utilization of electrical detection of tornadoes is not new. We must ascertain whether all tornadoes discharge electricity and will light up a television screen."

Allen Pearson, director of the National Severe Storm and Forecast Center, and Col. Robert Miller, both of Kansas City, are enthusiastic. The latter supervised the now-discontinued Air Force "sferics" net, of radar and oscilloscope stations to locate tornadoes in a 600-700-mile Midwestern area. Pearson says he believes "further engineering checks should be made to determine whether a tornado funnel really is like a vacuum tube and whether all tornadoes have electrical discharges."

John Beeston, an Iowan whose expertise is communications and broadcasting, says, "Equipment should be set up to investigate pulse distribution versus frequency to determine if the 55-megacycle band is the correct maximum, if there is a maximum."

Least excited, probably, is "Tornado" Jones—Dr. Herbert L. Jones—recently retired professor of electrical engineering at Oklahoma State University. Discoverer of the pulse generator in tornadoes in 1955, he does not discount Weller's finding, but believes that with radar, a cathode-ray oscilloscope and a 150-kilocycle direction-finder (equipment he uses), tornadoes can be pinpointed to within 1½ miles and warning given by other means. It's his opinion that some tornadoes do not have pulse generators.

With all the flurry the Weller Method has caused, many people now ask: "What is Weller getting out of this financially?" Nothing. His answer is: "How can you possibly measure in terms of financial rewards the satisfaction and happiness a man receives out of giving something to the world that will save lives?" ★★

YOU: MODEL ROCKETRY WHIZ?

(Continued from page 198)

heat like conventional propellants. In addition, it's odorless, nontoxic and non-flammable. Thus it cannot start a fire, nor explode. In fact, it's so safe it can be held in the hand while "firing." Just be sure to avoid breathing the vapors.

How does the nose cone disengage in flight? A spring-loaded separator locks the nose cone (which contains the parachute) to the engine when the rocket is pressurized, and a paper timer disc, which works on a pneumatic delay principle, causes the spring in the separator to release its hold on the nose cone near maximum altitude.

The liquid rocket propellant comes in a pressurized can which contains enough fuel for four flights. Fueling is done with the rocket poised on its launch pad and the safety pin in place. The fuel enters the rocket engine through an umbilical fuel line inserted near the bottom. It fumes out of a relief vent near the top when the engine is full.

When all systems are go, the rocketeer warms the rocket body for a moment with his hands to assure maximum specific impulse. Then the safety pin is withdrawn and the final countdown begins. The electrical connection is made, releasing the nozzle plug. The bird blasts skyward, leaving a cloud of cold exhaust behind.

Never carry a loaded rocket

If for any reason you decide not to launch the rocket after loading it with propellant, you must discharge it as you should never carry or store a loaded rocket. To release the propellant, see that the safety pin is in place and apply battery voltage. Then hold the rocket firmly in your hand, pointed in a safe direction, and pull the safety pin. Be prepared to hold it against the thrust when it fires.

The rocket kit comes with complete instructions for assembling and launching. It includes a 9-in. polished aluminum engine 1 in. in diameter, timer discs, separator section, balsawood for the fins, parachute/payload section, parachute and shock cord, fin rails and launching guides, launcher, loading equipment, electric firing assembly and a 15-oz. can of liquid propellant. All you need to provide is sandpaper, thread, masking tape, paint and a 6-v. lantern battery to fire the rocket electrically. The latter is an optional item since it is possible to safely fire the rocket manually.

The Valkyrie-2 rocket kit is available at \$15.95 from Vashon Industries, Inc., Box 309, Vashon, Wash. 98070. ★ ★ ★

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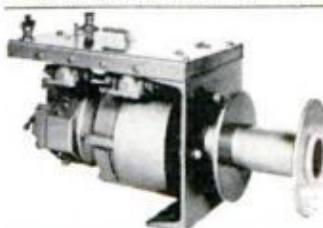
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TEN YEARS IN DEEP SPACE

(Continued from page 131)

floated down to the surface by parachute, transmitting on the atmosphere, but did not continue to transmit from the ground. The U.S. Mariner 5, launched June 14, reached Venus on Oct. 19, passing 2480 miles from the planet and sending back data, but did not attempt a landing.

It's interesting to compare the Russian and U.S. efforts in deep-space exploration, from whatever information is available. The Russians pursue a policy of secrecy (and sometimes deliberate confusion in public statements) about their future plans, and they don't disclose all their failures. For example, U.S. experts estimate a total of 16 to 18 failures in Soviet planetary-probe projects; the Russians have revealed only four failures in any of their announced missions.

Much speculation has been devoted to the questions of whether American or Russian space technology is superior. Appearance, size and weight of the payloads provide some clues. The Soviet spacecraft tend to be bigger and heavier than ours; they generally look like boilers or tanks, with most of the guts inside, while American spacecraft look like bundles tied onto sticks.

Russia started with more power

The massiveness of Russian space machinery, relative to the skeletal U.S. designs, derives partly from the fact that the U.S.S.R. started out with greater booster power. This has been widely attributed to the historical accident that the rockets of both nations were originally developed as boosters for atomic missiles, and the Russians had heavier warheads while ours were somewhat miniaturized.

That argument has been countered by a Russian scientist who said at an international conference that it is all very well to miniaturize machinery, but "you can't cut off a man's head and attach it to a sparrow's body," and rockets had to be designed in the long run to transport men and all their cumbersome life-support gear. Thus, the Russians claimed foresight, while we were slower in developing comparable booster power.

American designers, however, tend to think in terms of the minimum payload that will do a given job with minimum booster power. This might be called a sports-car approach, which combines a certain kind of economy with a certain kind of professional pride.

American space-hardware designs, moreover, show a great variety of styles, whereas the Russian design approach is

more unified. This reflects a little-known fact: The U.S. has always had many designers, each with his own ideas, but the Russian space effort was for many years under the direction of one dominant personality. The man's identity was kept secret, and confusion was encouraged by the implication that there was more than one secret genius. The great man—which he truly was—died, however, in January, 1966, and his identity was finally revealed: Sergei Pavlovitch Korolev, who had the innocent title of laboratory director of the Institute of Machine Science of the U.S.S.R. Academy of Sciences. The Russians said his real job had been kept secret to protect him from assassination by American agents.

But we have caught up

Which way is better, or more successful? Those who think one way or another are passionate in their arguments; it's hard to tell who's right, if anybody. Certainly the Russians were first in attaining certain limited objectives: first to orbit a satellite, first to hit the moon, first to photograph the moon from space, first to orbit a man, first to launch a planetary probe. But with Apollo 8 we have caught up, and perhaps surpassed them. Their space hardware, although seemingly more rugged than ours, has not turned out to be more reliable in operation. However, when the Russians succeeded in attaining some objective, they went on to something else. In some programs, we tended to repeat the same success almost endlessly.

Until last winter the most ambitious space projects of both nations had been lagging. Both the Russians and the Americans have had tragic deaths in the manned-space programs. The U.S. space effort has been cut back sharply, due to the expense of Vietnam; whether anything has affected the Russian space program is unknown. The U.S.S.R. has always surprised us in the past—perhaps it will again. We know how limited our own effort now is to explore the planets. We do not know what the Russians may have in mind for the 1969 launch opportunity, or for others beyond. ★★★

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BIG WHEELS OF FUN BUSINESS

(Continued from page 146)

throng, they did—and history was made at 50 cents a ride. On an investment of \$400,000, Ferris and his backers grossed \$733,086 in the 12 months the Chicago Exposition ran. The wheel had a brief appearance at the St. Louis World's Fair and then, ignominiously, was scrapped.

William Sullivan saw and rode the Ferris invention, was both intrigued and inspired, and three years later had completed plans for smaller wheels which had two distinct features: They were portable and could be made in quantity. He went out on the carnival trail himself, supervising the putting up and taking down of the gadgets, fighting lack of sleep, weather and primitive rail connections. In time, he ventured as far as the San Diego Fair of 1915, Dallas and the carnival towns of the deep South. A notebook he kept in 1905 shows his gross in a 20-week season as \$4500, his average take being about \$250 a week—which in those days was pretty princely! Business grew to such an extent that Sullivan was able to obtain full ownership in less than a decade. By 1936, for example, Eli was selling about 40 wheels a year. In the big golden anniversary year of 1950, it was 51.

With a crew of only 23 men, today's Sullivans can build a wheel a week on a production line.

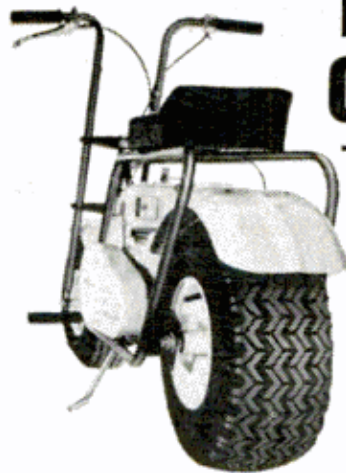
Ferris wheels do not wear out very fast. The world's largest (209 feet) and oldest (70 years) is the *Riesenrad* in Vienna's famous park, the Prater. Coney Island's 150-foot "wonder wheel" has carried 20 million riders since it was built in 1920.

Still popular the world over

Wheels which Eli Bridge built as long ago as pre-World War I are still turning merrily in such places as South Africa, India, China (they think) and New Zealand. Currently, Eli is receiving feelers from such newly awakened areas as the Congo and Southeast Asia.

They are profitable, as carnival people have long known. And there have been cases where students have purchased the wheels on time and put themselves through college and graduate school, playing fairs in summer vacations. Whole families have been supported by their ticket sales, and the wheels have been passed from generation to generation.

The first Ferris wheel the Eli Bridge Co. built in 1900 was bought back from its owner some years ago, and still turns today in front of the Jacksonville factory. But Chairman Lee Sullivan Sr. and his sister don't ride it. They get seasick. ★ ★ ★



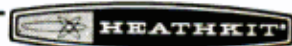
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THE NEW AUTO WARRANTIES

(Continued from page 101)

sales weapon, so at midpoint in the model year, GM, Ford and AMC began offering similar warranties.

However, the makers soon found themselves painted into a very costly and troublesome corner with these new warranties, some of which had been very hastily extended. The cost was soon running into hundreds of millions of dollars a year, despite the fact that all manufacturers suddenly had a compelling incentive to improve the reliability and quality of their cars. Some of the huge warranty costs occurred because the cars were just not as good as their makers expected them to be.

Too much paperwork

In addition, the warranties—especially the five-year agreements requiring validation—produced a mountain of paperwork for both manufacturers and dealers. The job of keeping track of detailed repair histories of 40 million or so vehicles proved to be such an added burden that automakers and dealers decided they just couldn't cope with it.

Arjay Miller, Ford vice-chairman, admitted bluntly that "the industry made a mistake in going too far in extension of warranties." He added that the makers went beyond their ability to perform, and that they miscalculated the complexity of the warranties. Just one complexity was the tremendous amount of "chiseling" by the public, by dealers, and occasionally by the manufacturers themselves.

Despite all the problems and the resultant retrenchments in warranties, some worthwhile motivation has been set up. Some might disagree, but car builders have in effect given themselves a financial incentive that has resulted in better quality cars being built in the 1960s than were built in the 1950s.

An important motivation also has been provided to the nation's 20 million owners with currently valid warranties. If these people will have the required maintenance performed on their cars, if they will get the proper validation of service when required, and if the second owners will have the new-car warranties transferred to their cars, they will substantially reduce their service troubles and expense and increase their driving pleasure.

In addition, it is a provable fact that new-car buyers will increase the value of their vehicles at trade-in time by \$100 to \$500 (the latter figure representing the luxury cars) if they will keep up their warranties.

★★★

THE AMAZING 'BOSTON ARM'

(Continued from page 106)

turn in the opposite direction. The jackscrew unwinds and the arm lowers.

In the Liberty Mutual laboratory, one of the experimental arms was clamped to the edge of a bench. Ohlenbusch asked me to roll up my sleeve and taped several tiny wires to my arm—the kind a doctor uses when he checks your heart on an electrocardiograph.

When I raised my arm, the artificial one followed it up; when I relaxed, the arm on the bench also relaxed. I was amazed to find that, within a few minutes, I could not only control the arm perfectly, but I could tell, without looking, exactly how high I had raised it. When a two-pound weight was attached to the arm, I could immediately feel the difference—it took more effort to raise the arm than it had before.

The mechanical extension weighs about the same as a real arm—4½ pounds. Its motor, jackscrew and mass of tiny electronic parts—transistors, diodes, resistors and capacitors—are enclosed in a flesh-colored fiberglass sheath shaped like a normal arm. The upper part is slipped over an amputee's stump and held in place by shoulder straps. The two-part pincher hook is controlled by a separate cable running to a harness on the opposite shoulder. Hunching the shoulder forward and back opens and closes the spring-loaded metal fingers.

Greater achievements to come

Considerable field-testing of the arm is still required. So far, it has been tried only under laboratory conditions. While potential manufacturers are being explored, the Liberty Mutual scientists caution that it may be some time before the lifelike limb can be made generally available to all who need it.

The future of this achievement is vast, though. Dr Glimcher points out that the principle can be used for patients who have arms but whose muscles are too weak to bend them at the elbow. It could provide an extra muscle "boost"—like the hydraulic boosters used in aircraft controls. There is also the possibility that signals from nerves could be used in the same way as those from muscles. This might prove even more striking in the future, such as in overcoming paralyzing spinal injuries. There might be special prostheses for polio victims, thalidomide children and other crippled persons.

This is the bright hope of a brand-new science that seeks to unite man and the machine into one. ★ ★ ★

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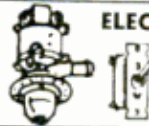


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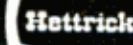
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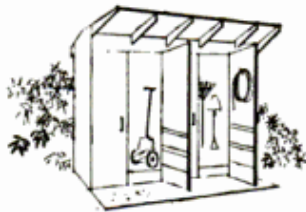
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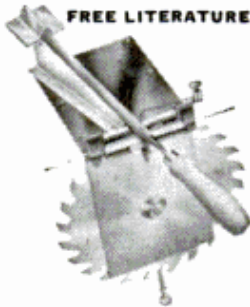
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FIBERGLASS COLD FRAME

(Continued from page 167)

are added along each side. Loose-pin hinges are best for hinging the roof panels since they make it easy to remove the panels from the ridge member. You simply pull out the pins.

If the rear frame is covered with plywood instead of fiberglass, which is optional, you'll need about six 8-ft. panels of Filon-Stripes. The fiberglass overhang along the bottom of the sections permits the cold frame to fit down over the top of the planter. You'd omit this, of course, if your cold frame is to rest on the ground.

I used 1-in. ovalhead aluminum nails (Nichols) to nail the fiberglass to the frame sections and spotted them in the valleys of the corrugations. Remember to insert the bolts in the front frame before applying the fiberglass. Where I lapped the fiberglass I applied a clear silicone rubber sealant which comes in 12-oz. caulking cartridges. I used it also in cementing and nailing the fiberglass strips to the ridge member. Regular 1 3/4-in. roofing nails which have self-sealing neoprene heads are really too big to use in this case. While you can drive nails in fiberglass without first drilling holes, it's best to drill where the nails are to be driven close to the edge of the material. The top-view detail shows how the end corrugations of the fiberglass lap each other at the corners. A couple of sheet-metal screws could be used through the lap to hold the two together, although it's not necessary.

Two swing-down props were added to the hinged roof sections to hold them open, and I found it wise to provide a couple of screen-door hooks and eyes to hold down the roof sections. Here a block of wood fastened to the underside of the roof overhang will provide a means of attaching a hook to the fiberglass.

Although your cold frame must not be over-ventilated it is important that a little ventilation be provided on sunny days; otherwise the inside temperature may soon rise from 80° to 90° F. or more, proving harmful to tender plants.

Your seed flats should be about 3 in. deep and the seeds should be sown in rows rather than broadcast. Spray them lightly with water (do not soak) once or twice on sunny days. When foliage appears, water the plants early in the day so the foliage has time to dry before nightfall. Keep the surface soil around young plants stirred to a depth of 1/2 in. Your cold frame should duplicate the kind of good growing weather to be expected come spring. ★ ★ ★

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ADD A REST TO YOUR LATHE

(Continued from page 203)

satisfactory bearing surface throughout the operation. This setup is like that of a box tool on a turret lathe.

It is necessary to establish a starting point with a diameter the same as that to be produced by the cut. Usually this can be done by machining (without using the rest) near the end of the piece. It also can be accomplished by taking very light cuts elsewhere along its length. Of course, when more than one cut is taken to reduce the work diameter, the follower-rest jaws will have to be reset for each cut.

When thread-cutting with a single-point tool, the steady rest will customarily precede the tool point as the carriage moves along the bed. Therefore, it will have a smooth bearing surface, at least for the first cut. Burrs thrown up by the tool can create some roughness and perhaps a slight diameter increase, but for operations that involve subsequent passes, burrs can be disregarded.

Capacity of different rests can vary, but a steady rest for a 9 or 10-in. lathe usually will take work with a maximum diameter of about 3 in. A follower rest for the same size lathe usually will handle diameters up to about 2 in. ★★★

GET MORE FROM YOUR ROUTER

(Continued from page 192)

is used to "tether" the router to a pivot point. With it, you can swing the router in a circle to cut radii from 1/4 to 14 in. Its two plywood parts are glued together and a slotted metal strap fitted with a nail point. The strip slides in a slot cut in the plywood part screwed to the router base and is locked in place by a carriage bolt and wingnut.

The fourth attachment, a template guide, is used to confine router movement against or within a precut template. It is especially useful for intricate work which you do not want to attempt free-hand, and for duplicate operations. It's cut from plywood and made the same size as the router's base. Then a hole is drilled in the exact center for a metal sleeve. The sleeve can be a short piece of electrical conduit, copper or other tubing and is a press fit in the hole. The sleeve protrudes slightly less than 1/4 in. below the wood base and serves to follow the outline of the template.

In use, the router bit passes through the sleeve and extends the depth of cut. It is important of course, that the bit centers exactly in the sleeve. ★★★

FINE-TUNING YOUR CARBURETOR

(Continued from page 187)

just be sure that the choke valve is open and the throttle valve(s) is closed before determining whether the valve needs adjusting. The vent valve should be opened about 1/16-inch under these conditions. If not, adjusting is usually done by bending the vent operating linkage.

To keep an engine from rolling and stalling when you cut your foot from the accelerator pedal suddenly after a period of heavy acceleration, many carburetors have what's called an antistall dashpot.

The dashpot permits an engine to decrease speed slowly and approach an idling position gradually. It provides the fuel needed to do this when the main supply of fuel is cut off as you pull your foot from the gas pedal.

The important thing to keep in mind when adjusting the dashpot, which is normally done by adjusting the distance between the dashpot plunger and the throttle lever, is that engine idle speed and mixture must first be adjusted to specification, and the engine must be at normal operating temperature. Otherwise, it isn't possible to get an accurate adjustment.

How to adjust engine idle

Before adjusting engine idle, there are certain steps to take, as follows:

- Run the engine to warm it to normal operating temperature. If the carburetor has just been put back on the engine following an overhaul, set the idle adjusting screw(s) by turning it all the way in, and then backing it out one turn. Rotate the throttle stop screw, so the throttle valve(s) is open slightly to keep the engine from dying after it's started.
- Be sure the choke valve is in a wide-open position before doing the adjustment.
- Carburetors of all manual-shift cars have idling speed set with the transmission in neutral. Carburetors of automatic shift cars have idling speed set with the transmission in drive.

With the tach hooked up, turn the idle speed screw until you get the specified idling speed. Then, turn the idle mixture screw to obtain the highest rpm. Return to the idle speed screw and readjust to the correct rpm. Do the same thing if you have another idle mixture screw on your carb, as found on all multibarrel carburetors.

The sequence of these adjustments for fine-tuning your carburetor is provided in the service literature for each particular model and should be followed for the best results. ★ ★ ★

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THE SHIP THAT DIGS HOLES

(Continued from page 111)

a suspended swivel carrying the entire weight of the drill string—up to a million pounds. To keep the gear aloft from swinging as the ship rolls and pitches, the crown block slides between two steel guide beams that hang down inside the derrick and are guyed out by cables. Looking up into the derrick, you realize the damage that could be wrought if the drilling tackle and drill pipe were to flail around, hence the need to keep the rolling of the ship to an absolute minimum. This is accomplished by a gyroscopically controlled tank stabilization system below, and by the ship's intrinsically stable shape.

Drill penetrates the ship

To get down into the sea, the drill string has to pass straight through the ship. Not at all obvious at first glance is that the hull is an elongated doughnut, with a well amidships in which the sea rises. Braced in the center of this well is the massive "guide shoe" through which the drill pipe descends. The pipe is fitted with rubber collars every five feet or so to protect it from damage as it rubs against the guide shoe, the drill string bending and swaying as the ship jockeys around to keep in position over the drill hole.

Dr. Worzel told me what it was like on the *Challenger* during drilling operations. Once on station, with the location confirmed by making echo-sounding passes across the area, the sonar beacons are soaked overboard to check for leaks, then cut loose to drop to the bottom. During the half hour or so that the beacons kept falling, the ship would start position-keeping maneuvers to stay over signal.

At the same time, the drilling crew would start lowering pipe—it took eight to ten hours to scratch bottom. When the bit was within 100 feet of the bottom, the power sub was attached, and started turning the pipe. Actual contact with the bottom was registered by sensors in the crown block as a decrease in weight of the drill string. Then tension in the derrick cables was eased slightly to allow about 30,000 pounds of the string's weight to push on the drill bit.

At the start of drilling, a hole in the center of the bit was closed by a removable plug. When a core was to be taken, a tool lowered through the drill pipe removed the plug, and a 30-foot core barrel, or sleeve, was dropped into the pipe. As drilling continued, a core of bottom material was forced up into the barrel. When it was time to bring up the core, the drill

pipe was pulled up 15 feet or so to break loose the bit and core, and retrieving tools were lowered down the pipe to latch on to the top of the core barrel, which was then hoisted out—a two-hour process.

Drilling a hole took two to five days, according to Dr. Worzel. The drill string got stuck only once during the first leg of the *Glomar Challenger's* voyage; luckily, he said, they were able to break it loose in about three hours. One unexpected difficulty was that layers of rock in the oldest sediment beds explored turned out to be harder than anticipated, consisting of chert (a flintlike stone) and hard limestone. These beds were made of "turbidites"—solidified material washed off the continents and carried into the ocean depths by turbidity currents, or mud flow.

It was a geological surprise that hard turbidites were found very widely distributed in the ocean depths; the oceanographers may not be able to drill all the way through the sediment layers to sample the older basement rock beneath, as they had hoped. Four holes had to be abandoned because the abrasive rock wore out the drill bits. So far there is no practical method of pulling a drill string out of a hole and re-entering the hole in deep ocean, so drilling can go on only as long as one drill bit lasts.

Pacific exploration lies ahead

The *Glomar Challenger* sailed for Dakar, to drill its way across the Atlantic and probe the mysterious Mid-Atlantic Ridge. Drilling holes in the South Atlantic and off the South American coast comes next. The ship will then head through the Panama Canal to follow a complicated track across the Pacific and return to the United States.

Among the most significant findings of the voyage so far, Dr. Worsel said, was that "we have showed that oil can exist and be made in the deep-water environment." While it will be a while before the petroleum industry ventures into the deep ocean on a large scale, since large offshore reserves have been found in recent years, Dr. Worsel pointed out that "we've changed the whole ocean basin into a potential oil province." ★★★

Mapped from space

Color photos taken from space by Gemini 4 and 5 astronauts and the second unmanned Saturn 5 flight have been used to prepare a detailed geologic map of 830 miles of U.S.-Mexico border by the U.S. Geological Survey. It includes parts of Arizona, New Mexico and Texas.

WORLD'S WILDEST BOAT TRIP

(Continued from page 126)

drowned July 10, 1889 opposite this point." It was carved by Peter Hansbrough, one of Brown's companions. A few miles downstream he was drowned, along with a third member of the railroad party. No one volunteered to carve a memorial for Hansbrough; it seemed like tempting fate. However, someone did, below President Harding Rapids, so named because a survey party camped there heard the news of the President's death on their primitive radio. We climbed a hundred feet or so to Hansbrough's shallow grave covered by rocks. Nearby is buried a Boy Scout drowned 62 years later in Glen Canyon.

It's amazing how much you learn about a river when you don't have a motor. I had traveled hundreds of miles on the quieter parts of the Green and Colorado in power boats. All we looked out for were sandbars. Here, besides listening for the warning roar of rapids a half-mile ahead, you learn to seek out the current. You watch for eddies that can spin you around like a top. Once, the first afternoon, we actually floated *upstream* under Navajo Bridge, which we had passed going *down*.

The farther, the deeper

Three miles below Soap Creek we enter a stretch of green water where the river flows swiftly between sheer walls. The farther we go, the deeper we get. At the head of Marble Canyon, or Marble Gorge, as the Sierra Club prefers to call it to indicate it's not a separate canyon, but really part of the Grand, the walls are 200 feet high. At the mouth of the Little Colorado, they're 3500 feet. At Phantom Ranch, the Canyon will be a mile deep!

Here between the sheer walls we stop for lunch on a shelf 40 feet above the river, possibly the same shelf Powell camped on 99 years before.

"About 10 o'clock," he wrote, "we come to a place where the river occupies the entire channel, and the walls are vertical from the water's edge. . . . There is a little shelf, or rather a horizontal crevice, a few feet above our heads. One man stands on the deck of the boat, another climbs on his shoulders, and then into the crevice." It had to be the same place!

Running the cataracts

We run four more cataracts and camp the second night above 24-Mile Rapids. Next day we run nine more. The Canyon is getting deeper and redder. The third noon we pass an "oasis" of mosses and

ferns beneath two faint waterfalls. Powell named it "Vasey's Paradise" after a botanist who accompanied him on earlier expeditions in the Rockies. We had planned to picnic here, but two rafts of young people were already pulled into shore. A mile downstream the river makes a sharp bend to the right beneath an enormous cavern. Powell described it as "a vast circular half-chamber, which, if utilized for a theater, would give sitting to 50,000 people." Just call it Hollywood Bowl with a low ceiling. The entrance was only a few feet above the river, so we climbed up to explore.

Canyon resounds with Romberg

It was Hollywood Bowl all right. Suddenly, *from nowhere* we heard a thrilling soprano voice singing *Indian Love Call*—you know, the "I'm calling you-oo-oo" number made famous by Jeanette MacDonald. Just as suddenly came, close by, an answer from our own Nelson Eddy, Hal Gilliam, a San Francisco newspaperman who had been frightening the deer with *Stout-Hearted Men* each morning. Darned if he didn't know the words to *Indian Love Call*. For five minutes, Hal and the mystery soprano bounced Sigmund Romberg's thrilling duet off the massive walls of Marble Gorge.

We soon traced the soprano to the river. The raft party at Vasey's Paradise had caught up with us. The singer, a blonde in a pink bathing suit, said her name was Carol Neblett and that she sang with the New York City Opera. She was a long way from Lincoln Center.

Six miles below Redwall Cavern we passed the site of the proposed Marble Canyon Dam, abandoned after protests by the Sierra Club. Martin Litton, the kind of a guy who shakes his fist at the sky when a sonic boom shatters the silence of the wild, pointed to the test borings and rickety scaffolds and snorted: "Look what the Government did to the Canyon!" Two twisted aluminum boats lay on the right bank. "You'd think the Reclamation Service would clean up its junk," Martin growled.

Down the Canyon once too often

That night we camped above the Royal Arches, deeply etched in the redwall limestone. We could see the bleached remains of another landmark, "Bert Loper's boat." Bert was past 70 when he went down the Canyon for the last time in 1949. They found his boat, but they never found Bert.

Next morning I switched into Martin's boat. We stopped for lunch under the tamarisks on a long sandy beach below

(Please turn to page 238)

WORLD'S WILDEST BOAT TRIP

(Continued from page 237)

Nankoweap Rapids. Now we're in Grand Canyon National Park, which extends this far up Marble Gorge's west bank. The river flowed swiftly offshore, but the curve of the beach afforded a sheltered bay for swimming. Facing us was a sheer, red cliff; behind us the walls were buttressed by dunes.

"What a place for a Holiday Inn!" I exclaimed. Martin didn't think that was funny. Behind us, 800 feet up, was a string of tiny holes, cliff dwellings built by the long-departed Mokis. I joined an exploring party. The climb came close to separating the Sierra Club members from the boys. There wasn't much to see inside the little apartments, but the view of the river was breathtaking.

Befuddled bullfrog

That night, before turning in, Joe and I went down to check the raft. Somewhere in the brush an outraged bullfrog let us have it. We flashed our lights but couldn't spot him. Every 20 seconds he gave us a Bronx cheer. Joe went back for his cassette recorder. Then every time the frog sounded off, we recorded him for posterity. Joe played it back. The frog answered immediately. He thought he owned Marble Gorge; now he wondered where that other frog came from. Then Paul got *his* recorder and taped *both* the real frog and playback. The frog must still be wondering what happened.

I ran Kwagunt Rapids with Martin the fifth morning. It made me appreciate the skill and strength required of the oarsman. Joe's raft, which I rejoined after lunch, demanded strength, and the kind of bravery that sends a drunk into a bull ring.

At noon we came to the mouth of the Little Colorado, described by Powell as "exceedingly muddy." To my surprise, it entered the main river through clear, almost iridescent turquoise pools. Most of us were soon swimming in this fantastic Shangri-la. Like Shangri-la, it had a darker side. Floating, head back, I could see the shiny wreckage of the United DC-6 which collided with a TWA Constellation in 1956.

Entering Powell's 'great unknown'

Powell had been on the river nearly three months when he camped by the "Colorado Chiquito." On Aug. 13, 1869, he wrote "We are now ready to start our way down the Great Unknown. . . . We are three quarters of a mile in the depths of the earth, and the great river shrinks into

insignificance as it dashes its angry waves against the walls and cliffs that rise to the world above; the waves are but puny ripples, and we are but pygmies, running up and down the sands or lost among the boulders.

"We have an unknown distance yet to run, an unknown river to explore. What falls there are, we know not; what walls rise over the river, we know not. . . . The men talk as cheerfully as ever; jests are bandied about freely this morning; but to me the cheer is somber and the jests are ghastly."

Red walls change to black

Next morning, apparently at the head of Hance, he added: "Heretofore hard rocks have given us bad river; soft rocks, smooth water; and a series of rocks harder than any we have experienced sets in. The river enters the gneiss! We can see but a little way into the granite gorge, but it looks threatening. . . . The canyon is narrower than we have ever before seen it; the water is swifter."

The one-armed major not only had guts; he could write!

After lunch we ran two minor rapids, then Unkar, a long, hair-raising chute curving against an overhanging cliff from which murderous waves ricocheted against us.

By the sixth morning we were well into the inner gorge. The river narrowed between 2000-foot slick, black walls of gneiss. Only occasionally could we see the rim, set back on either side more than a mile above us.

That night we would camp near the mouth of a clear-flowing Bright Angel Creek, which Powell named in contrast to the Dirty Devil at the head of Glen Canyon. I would ride out on a mule next morning. But today we had three of the wildest rapids in the Canyon to run in quick succession. Hance, with the biggest drop of any; Sockdologer, and Grapevine, so-named by Powell for the string of boulders in mid-channel. All three rate "9" or better.

The biggest rapids yet

We pulled in above Hance and clambered over the boulders on the left bank. Here was a RAPIDS! Powell had portaged it. Few try to run it in boats. Powell's observation as to the relationship of rock strata to rapids was clearer here than anywhere else. When strata in the canyon walls are straight and level, he wrote, the water will be swift and smooth. If they incline downstream, it will be swift with a few rapids. But if the strata slant *upstream*—look out! Here at

Hance they tilted sharply toward the on-rushing river.

For the first time, Martin ordered the boat passengers to walk around. He debated about Joe's raft. Joe needed at least four to man the oars, two to an oar. That meant three would walk around. Who would ride and who would walk? At Soap Creek I had butterflies about climbing aboard. Now I felt like a kid waiting to get "chosen" in a ball game—or an astronaut wondering if he's going to make a moon flight. Hance was bigger and meaner than Soap, but now I *wanted* to ride!

Finally Martin turned to Joe and said, "Oh heck, let 'em all go."

We watched three of the boats go through. Clyde Childress, an oarsman on the raft—at home an inventor who sold his company to Monsanto—recorded this play-by-play:

"Martin Litton in the Diablo is just pulling into the stream. You can just see the Diablo coming around the large boulder in front of us. He's rowing hard. He's pulling around the center boulder, dipping. Now he's pulling hard toward the far side of the stream to avoid the big, jagged, sharp boulder directly ahead of us. Behind the rock, he's pulling down the smooth tongue for a moment. Now he's into the rough water, into the first little hole. Now he's approaching a big hole. Perfect! Now he's pulling away from the biggest hole of all. He's coming down this side just right. Just right. Approaching the big, BIG hole. Perfect. He's clear of it nicely, smoothly, along the near side of the stream."

Everyone got through okay, including the raft, although Paul Geerlings, becoming known as "The Great Oarbreaker," lost his balance and fell back into his boat going around that first boulder.

Sockdologer and Grapevine follow closely after Hance and are every bit as hairy. They *have* to be run with all passengers, there's no way to walk around.

We camp where Powell did at the mouth of Bright Angel Creek. Several of us have to leave next morning, but Martin, Joe, and most of the others will go on for 14 days to Lake Mead. They insist that the "real wild part" of the Canyon is yet to come. (Maybe they were right. Paul capsized in Bedrock Rapids, Martin did the same at Lava Falls, and the raft folded under in Upset Rapids.)

As I ride up Kaibib Trail I watch the boats and raft grow ever tinier at each turn of the trail. For two weeks I will dream of moonlight on the Colorado and picture my erstwhile companions hanging on for dear life as they challenge Major Powell's "great unknown." ★★ ★

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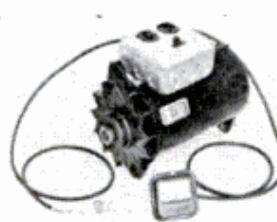
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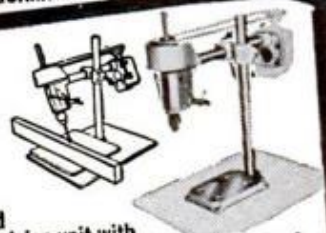
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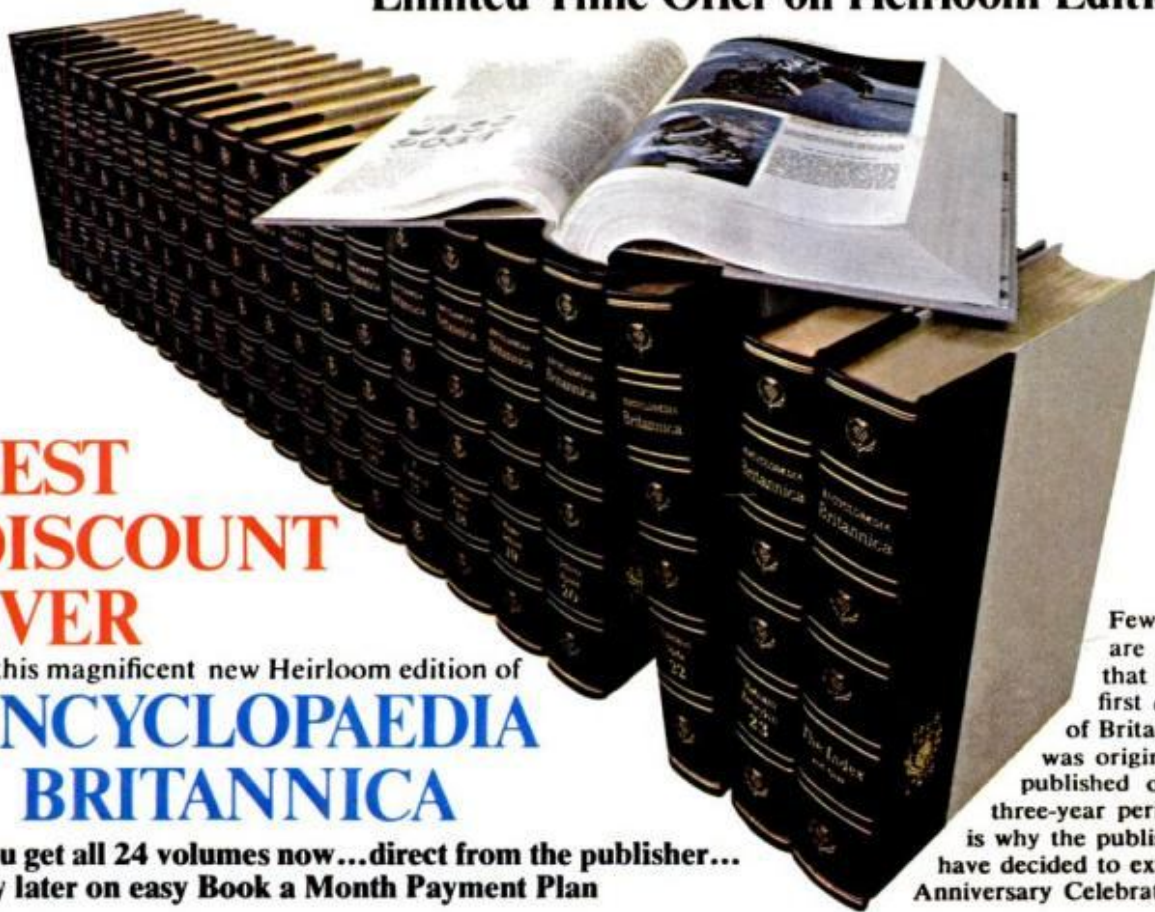
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