

What Owners Say About Toronado and Challenger

POPULAR MECHANICS

JUNE 1970
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Something New
At Last?

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Dan Gurney
On Indy
And Can-Am

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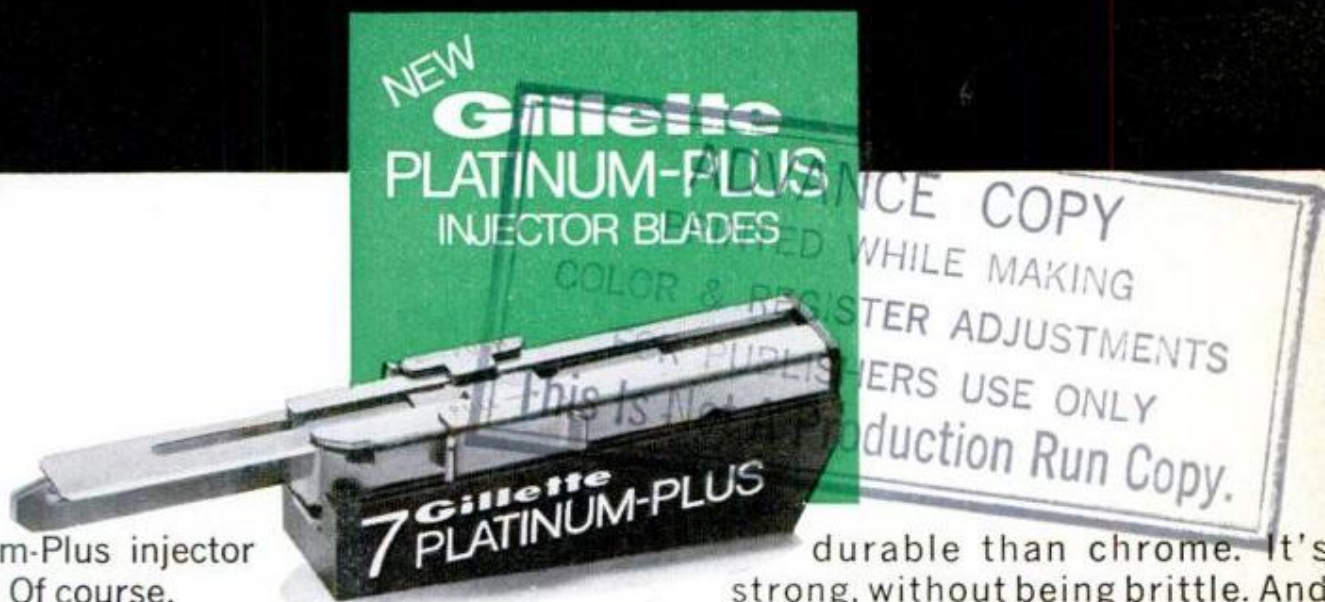
Off! comes in spray, foam or concentrated liquid. It repels mosquitos, chiggers, gnats and ticks hour after hour.

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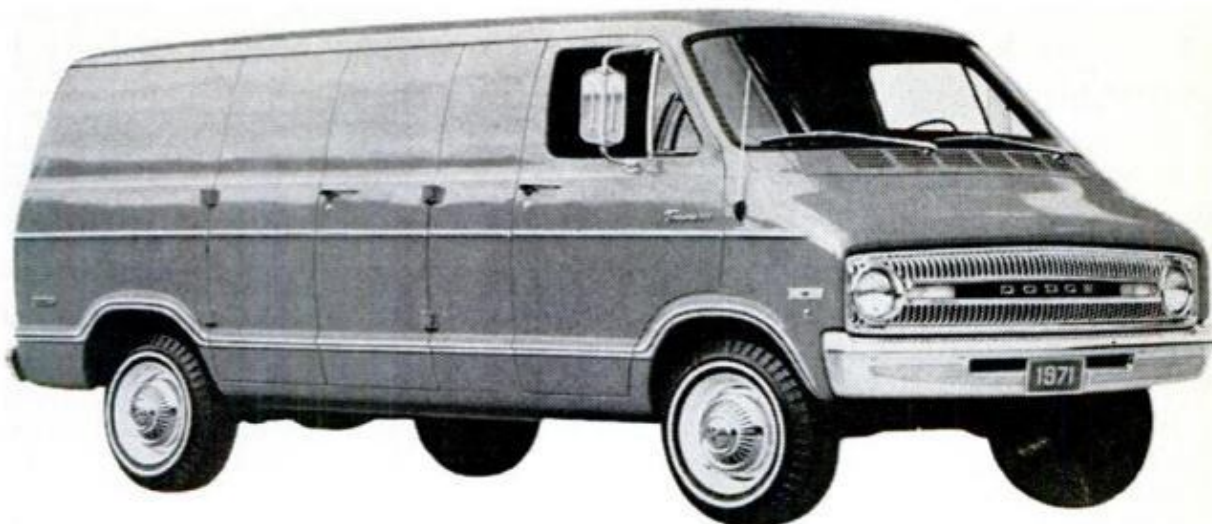
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Dodge



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- Owners Reports:** After thousands of miles, owners size up Cougar and Polara.

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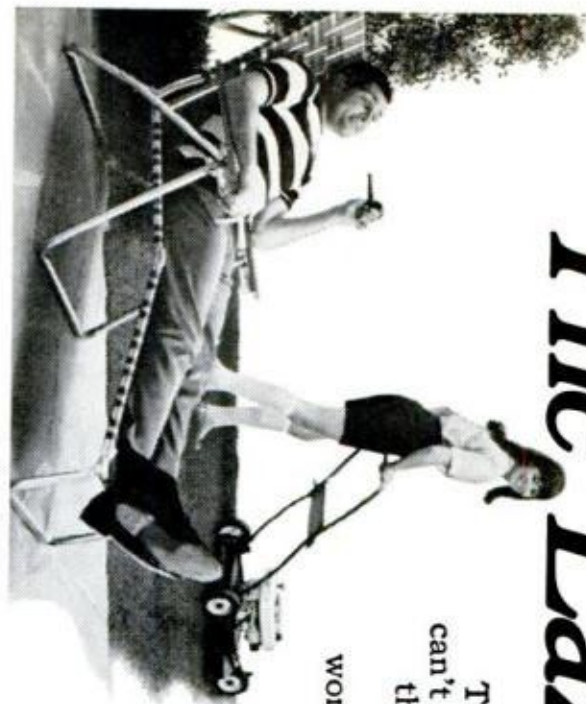
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JUNE 1970



The Lazy Pipe Tobacco

There are some things in this world that you just can't rush. If you're a pipe-smoker, you should know that Bond Street is one of them. A single pipeful, in fact, should last long enough for the little woman to finish up the lawn (depending, of course, on the size of the lawn). You'll certainly enjoy the taste of Bond Street. It's a rich combination of plugs and flakes that delivers a smooth and steady glow. (And if your neighbor's wife drops over, don't be surprised if she has something nice to say about the aroma.) If you think you're lazy, forget it. You're probably a speed demon compared to your pipe tobacco.



LETTERS

TO THE EDITOR

Misplaced water

George Reiger misplaced a chunk of the Pacific Ocean, or else misplaced a fish, in his *An \$800 Reel?* (page 128, April PM). He reported that the late Dr. C. F. Holder caught a tuna off San Francisco on June 1, 1898.

In point of fact, the catch was made off Catalina Island, about 400 miles to the south. It was an extraordinary catch with the reels of those days—but would have been even more extraordinary if it really had been made off San Francisco, for tuna are not common in those waters.

Incidentally, Dr. Holder's catch resulted in the formation of the Tuna Club at Avalon on Santa Catalina Island. I really do not feel strongly concerning this error, but want to get in my licks before George is torn limb from limb by angry members of the Tuna Club. They feel strongly about such things.

THE SALTWATER SPORTSMAN HENRY LYMAN
BOSTON PUBLISHER

With limbs still intact, George replies: Pierre Clostermann's Des Poissons Si Grands (Flammarion, 1969) locates the catch "au large de San Francisco" (page 32). But, then, whoever heard of using a French text for homework on American angling! Thanks, Hal, for catching my (and Mr. Clostermann's) mistake, anyway.

Great first year

I was very pleased with Bill Hartford's *My First Year on a Motorcycle* (page 100, April PM).

The article gave a lot of information some of us cyclists hadn't known about—like the oil slick in the middle of the road and driving to the left of the lane.

MINNEAPOLIS JOHN NICHOLSON

Mr. Hartford said, "To be seen, I sometimes ride with my headlight on." Law requires this in Wisconsin and in many other states. You must have your lights on at all times. (The article was great.)
JACKSON, WIS. RAY MAYER

This is exactly the type of information needed so badly by many novices, and I think the author made his points very well indeed. I would like to see more of the same; so many cycle publications concentrate so heavily on the sporting side.

I am quite sure that more and more

motorcycles will be seen in the role of commuting—and in the near future. The rising costs of new cars, parking, servicing and insurance—not to mention the sheer shortage of space—will bring about many changes.

OTTAWA SAFETY COUNCIL STUART MUNRO
OTTAWA, ONT. CHIEF INSTRUCTOR
MOTORCYCLE COURSES

Oldies are goodies

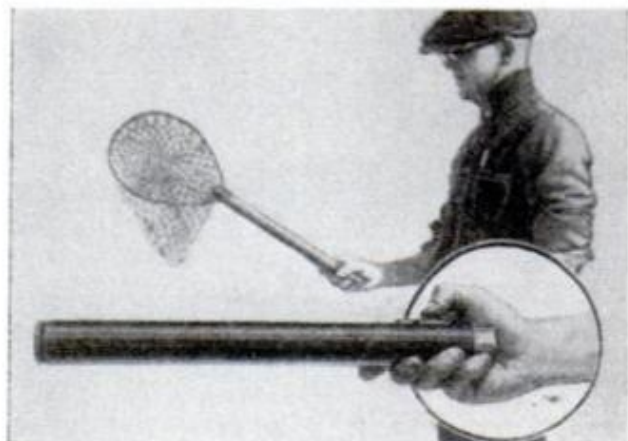
The 3:00 O'clock and All's Well item (page 109, April PM) seems to demonstrate once again that the oldies are often goodies. I recall reading at least 20 years ago that this technique [of having the hands of all dials in the 3:00 o'clock position when the readings are normal] was employed in airplane instrumentation during World War II. The result was less pilot confusion.

WHEELING, W. VA. JERRY W. WEST

This is my first letter to a magazine, but when I found you repeating yourselves, I just had to write. In *Pushbutton Fishing* (page 100, Feb. PM), you featured a landing net from France. Well, check back to page 565 in your April 1924 issue; you showed one then, and it doesn't look as flimsy as the new model.

SALINA, KANS. DAVE LEPKE

Pshaw, it completely slipped our minds. We looked back, and, sure enough, we did



show an "Automatic Fish Landing Net That Opens at a Single Touch." The photo is of the 1924 model as presented in PM.

Cartridge squasher?

Concerning the picture showing a sili-
[\(Please turn to page 8\)](#)

POPULAR MECHANICS

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LETTERS

(Continued from page 6)

cone-seal cartridge being inserted into a caulking gun (*Exciting New Products*, page 174, April PM), the would-be caulker would have to squash the cartridge badly to insert it back-end first.
HUNTINGTON STATION, N.Y. W.A. DOOB, DDS

The angle of the photo makes it look as if the caulking gun is the kind that has a hole for the cartridge nozzle. In that case, the caulker would have to squash it. But the guy who held the gun for the photo assures us it had a notch. So it'll fit the way we showed it.

Most important anniversary

The anniversary of the most important event in my life has just passed.

In the March 1938 issue, an article by Frank M. Lund appeared on how to construct the *Little Giant Portable A.C.-D.C. Receiver* (page 418). I was in fifth grade and keenly interested in electrical devices. Dedicated parents gambled \$10 on a kit of parts, and in September I had it working. These events launched my career in electronics. My thanks to *Popular Mechanics*.

MOUNTAIN VIEW, CALIF. R.G. FINKBEINER

It's rpm, not ratio

I'd like to clear up one point for PM readers regarding *To the Summit* by ATV (page 102, Feb. PM).

Changing the drive ratio of the machine by 25 percent *may* have increased the output horsepower by the same amount, but it was by mere chance. Output horsepower could only be affected by the engine operating at higher horsepower output range due to increased engine rpm.

My concern is that readers not be misled into thinking that changing ratios will proportionally affect output horsepower.
LONGVIEW, TEX. BART MCCOY

Anyone remember Craftmats?

Long-time readers of PM might be able to help us find "Craftmats" that Mr. H. Milnes of Sheffield, England, needs to build the *Sovereign of the Seas* (Nov. '32 through July '33 PM). Craftmats were used for molding intricate carvings for the model ship. If anyone has a set, we'd be glad to put him in contact with Mr. Milnes.

If any other readers want plans for building the *Sovereign*, copies of the PM pages are available for \$7.50 from Reader Service Bureau, *Popular Mechanics*, 224 W. 57th St., New York, N.Y. 10019. ★★

What two golf pros learned at the Spark Plug Handicap.

Spark plug design really does make a difference.

Golfing greats Julius Boros and Tom Weiskopf proved it in a fuel economy test.

Their 1970 Chevrolet Impalas were absolutely identical except Julie's car was powered by Champion Turbo-Action design spark plugs. While Tom's car had a competitive brand of different design.

In the first run, Julie's car went farther . . . with Champions. When they swapped plugs

and ran the course again, Tom's car went farther . . . with Champions.

Tom and Julie agree, spark plug design does make a difference in fuel economy. So do over 20 million other car and truck drivers who've switched to Champions.

So drive with Champions. When golf greats Julius Boros and Tom Weiskopf did, they both drove farther.



ON-THE-GO

CAMPING

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BACKUP WARNING BUZZER FOR RVs. Now you can warn pedestrians of your backup intentions right from the driver's seat of a tall, wide trailer, camper or motor home. An ingenious electrical device from Japan attaches to the rear of your coach. When the prime mover shifts into reverse the Super Back Buzzer emits a sharp, loud BEEP . . . BEEP . . . BEEP continuously. It's transistorized in a rugged waterproof case complete with mounting bracket. About \$12.95 from Super Back Buzzer, Jim Cowman, 4355 East Sheila St., Los Angeles, Calif. 90023.

SLEEPER SLED FOR SNOWMOBILES! How's that for an idea? An enterprising designer has suggested overnight cabs or towable sleeper-coaches for snowmobiles. They'd be lighter weight and more compact than anything ever seen. Think how handy they'd be for hunters, skiers, explorers and line trappers! Expect to see a great new line of snowmobile RVs appear during the winter season, 1971. Don't ask for addresses; nothing's ready yet.

CITY CAMPGROUNDS: VACATION SPOT OF THE FUTURE? We predict that a wave of the future will be campground complexes located on the very fringes of vast metropolitan areas. As one builder put it: "RV travelers use their coaches for visiting friends and sightseeing, too. Not just camping outdoors." He could be right. Several firms are planning *urban* campgrounds in southern California, near famed Cajon Pass along Interstate 15. With millions of tourists entering the state yearly, this could really catch on. And it would certainly shake up the "motel lobby."

GET FRESH AIR IN YOUR 4X4! Why suffer heat-suffocation or smoke inhalation in the back seat of Bronco and Scout 4x4 station wagons where side windows are fixed—unmovable? Mac's Research & Development offers a new sliding window kit for Bronco and Scout wagons that includes windows, frames, parts and instructions. Owner just removes existing glass panel, uses sabre saw to custom-fit. Bus-type windows use no outside fasteners, have beautifully rounded corners with swept-back taper. About \$120 for kit from Mac's Research & Development, Box 168, Whittier, Calif. 90608.

NEW WAY TO TREAT ORGANIC WASTES? A system developed by the Thermasan Corp., Box 1285, Ann Arbor, Mich. 48106, uses the exhaust of your tow vehicle or motor home in a reaction chamber to destroy all waste and water stored in the holding tank. Using a solid-state control package, the disposer burns solids and changes liquids to "dry steam" at over 900° F. (at 40-mph speeds) and expels odor-free, colorless gases through the exhaust system of your vehicle. Development of a marine package for boats is also in the works at Thermasan.

MAKE YOUR PICKUP A DOUBLE-DECKER. The Rolmatic portable rack consists of two driving ramps mounted on a special bracket which angles from cab roof down to the street for loading. Just drive your boat, sand buggy or 4x4 vehicle up and on, retract ramps, and away you go. Advantage is that it frees trunk for towing a second vehicle. The Rolmatic Boat and Sport Tote is made by Beazer Mfg., Inc., Box 156, Bountiful, Utah.

ELECTRONIC TRAILER HITCHING IS HERE! A new device has three sensitive elements that make contact when the trailer touches a car. Lights on front of the trailer let the driver know whether he is too far to the left, or right. Priced at \$29.95, it's called the Hitch-O-Matic. You can get information from Minder Industries, 6011 S. Central Ave., Los Angeles, Calif. 90001. ★★★



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“At Long Beach, we burned 4 gallons tough on our Autolite spark plugs:

Danny Ongais' record-busting win at the Long Beach (Calif.) Grand American Championships wasn't just luck. His trigger toe — and his savvy about the machinery he drives — qualified Mangler Dan as a consistent, almost hoggish Funny Car headliner. When he talks, it pays to listen.

“That nitro feeds under 1600 pounds of pressure — into an 18.1:1 compression situation,” says Danny. “Autolite spark plugs have to burn those chambers absolutely clean for max power. Despite 900° temperature. And the brutal pressure. Autolite:



Autolite
Dan Ongais

Danny Ongais, alias The Mangler, with Ol' Blues a '69 Mustang Funny Car, rated at 1600 hp.

of 88% nitro in 7.25 seconds. That was But you're tougher on yours." – Danny Ongais

park plugs do the job – but don't ask me how."

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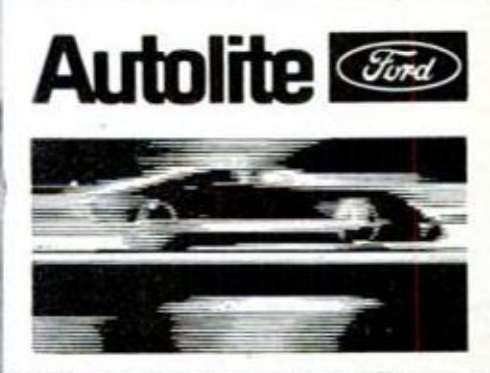
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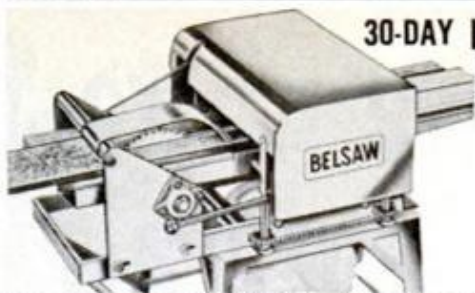
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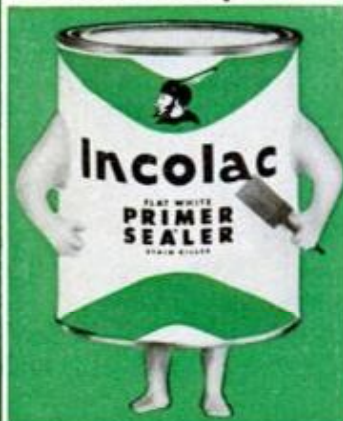
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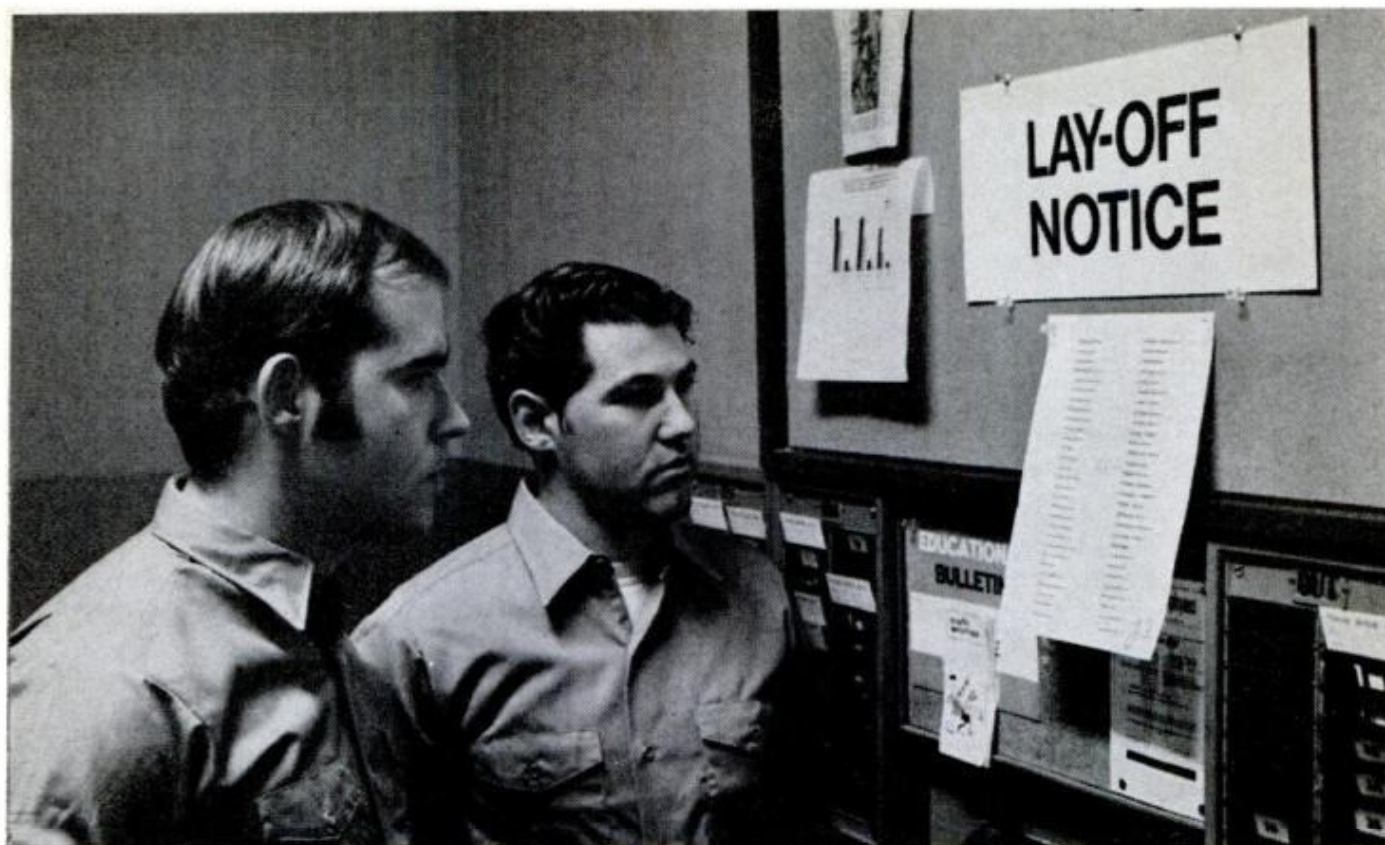
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How the human heart functions can now be probed by sonar, according to scientists at Stanford University and NASA's Ames Research Center. They say that sound waves can provide information about heartbeat and blood circulation that up to now has been obtained by passing a catheter, a long tube, into one of the heart chambers—a procedure that takes hours and usually requires hospitalization. Sonar heart studies can be done in the physician's office. Sonar recordings in a recent Stanford study were made by using a commercially available machine that emits and receives high-frequency sound waves. As sonic impulses were bounced against front and rear walls of the heart, they were recorded and converted into electrical signals that were displayed on a TV screen. From the patterns of sonic echoes, taken when the heart is relaxed and when it contracts, the researchers developed a formula enabling them to calculate the volume of blood ejected by the heart and to determine the presence of abnormalities.

Lamps that can emit light continuously for about 10 years are being developed by Bell Telephone Laboratories, Murray Hill, N.J. To be used as indicator lights in future telephones and switchboards, the lamps are made of synthetically grown phosphide crystal. Gallium phosphide is a transparent solid that resembles amber. A crystal no larger than the head of a pin will give off red or green light with almost no heat when a small electric current is passed through it. The estimated life of the phosphide lamp is over 100,000 hours of continuous use, compared with 10,000 hours for incandescent lamps, which have higher power requirements.

Which freezes faster: an open bucket of hot water or an equal-sized bucket of cold water? The answer is hot water. That fact was established by Dr. George S. Kell, a chemist with Canada's National Research Council, in a recent series of experiments. Reason: 16 percent of the hot water vaporizes as the liquid cools to a freezing temperature. Thus there is less water to freeze in the hot bucket, which more than compensates for the greater temperature range it must cover before freezing. Dr. Kell notes that Francis Bacon, English philosopher and scientist, described the phenomenon 350 years ago in his *Novum Organum*: "Water slightly warm is more easily frozen than quite cold."

Overwhelming opposition to voluntary sterilization as a means of population control was indicated by the results of a survey of more than 1000 faculty and students at New York's Cornell University. Only six percent of the male respondents said they would submit to vasectomy, the sterilization operation for males, once they had achieved a full family. And 52 percent of the males and 61 percent of the females said they would never submit to sterilization under any circumstances.

Gray whales use their "ears" to avoid killer whales. That was demonstrated by scientists from the Naval Undersea Research and Development Center, San Diego, who worked with 135 gray whales on their way to Mexican breeding grounds. By projecting recorded killer whale "screams" under water, the researchers concluded that the big grays, using their keen sense of directional hearing, pinpoint a potential attacker's location and change their course accordingly. Once at a safe distance, the scientists report, the grays may surface and lift their heads out of water, as if to "look" for the predators.

High-intensity anticollision strobe lights keep birds away from planes, according to some airline operators. Recently, two lines flying similar equipment on the same routes compared notes. In one period, airline "A" had one bird strike with strobe-equipped planes. Airline "B"—using no strobe gear—had 12 strikes and total damage of \$176,000. ★ ★ ★

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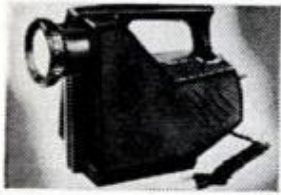
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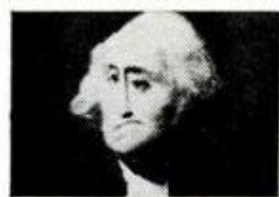
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LISTENING POST

BY ROBERT LUND

INFLATION ISN'T ALL BAD. The high cost of everything is forcing Detroit to re-think its approach to the annual model change and could lead to more imaginative cars a couple of years down the pike. Up to now the formula has been routinely predictable: New car one year and then for the next two years the cosmetics are re-worked and the camouflage is wheeled out as a new creation. The illusion seldom comes off. Cars two and three usually look like what they are: warm-overs of the original. Not that superficial changes come cheap. A once-over-lightly of a grille or taillights can run into millions. The cost of bringing out new cars has soared to a point where even GM and Ford gulp when they get the bills.

What the auto companies are starting to do now is plot future products with derivative cars in mind, before the original is put into production. By working out the changes ahead of production of the master model, auto manufacturers believe they can do a better job of coming up with a fresh look for cars two and three. This approach should also ease some of the panic in the past that's led car firms to make changes for change's sake because they haven't had time to think out and develop new ideas. American Motors is the only company that admits taking the new approach, but the Big Three are exploring the concept and expected to go the same route.

ONE OF THE POWERS AT GM privileged to play with the new toys when they're ready to roll has been batting around GM's Milford, Mich., proving grounds in three different copies of Chevrolet's Vega 2300. *What does he think of it?* "For the money, it's as fine a handling car as GM has ever produced." *What do you mean "handling?"* "I whipped from one lane to another going 65 and it really hugs the road. No sway."

While the source of this information is naturally partial to GM products, he doesn't suffer from the my-company-right-or-wrong affliction that invalidates the opinions of many auto executives. Ride stability is one of several selling points both Chevy and Ford will use to push their small cars against VW. Both cars will have wider front tracks than the Bug, with a wider wheel-spread at the front than the rear. This is said to "nail" the car to the road, cutting down on the floating, wobbly feeling you get with a light car at top speed.

ALTHOUGH THE '71 CARS will show the usual assortment of switches, levers and other gear centered around the steering column—either directly in front of it or attached to the column—you can expect to see a shift away from the column in placement of controls, gauges and accessories beginning with the '72 and '73 cars. There are a couple of reasons for cleaning up the clutter. Air bags are coming, probably in '72, and the fewer the number of items in the area of the steering wheel, the less chance there is of something going wrong. Engineers also feel it's a mistake to concentrate so many components and controls in one area because this makes a focal point for damage in accidents involving left-front and left-side of the car. By repositioning items grouped around the column and spreading them over a wider area, the number of devices exposed to damage in a collision is narrowed down because the bull's-eye area isn't as big.

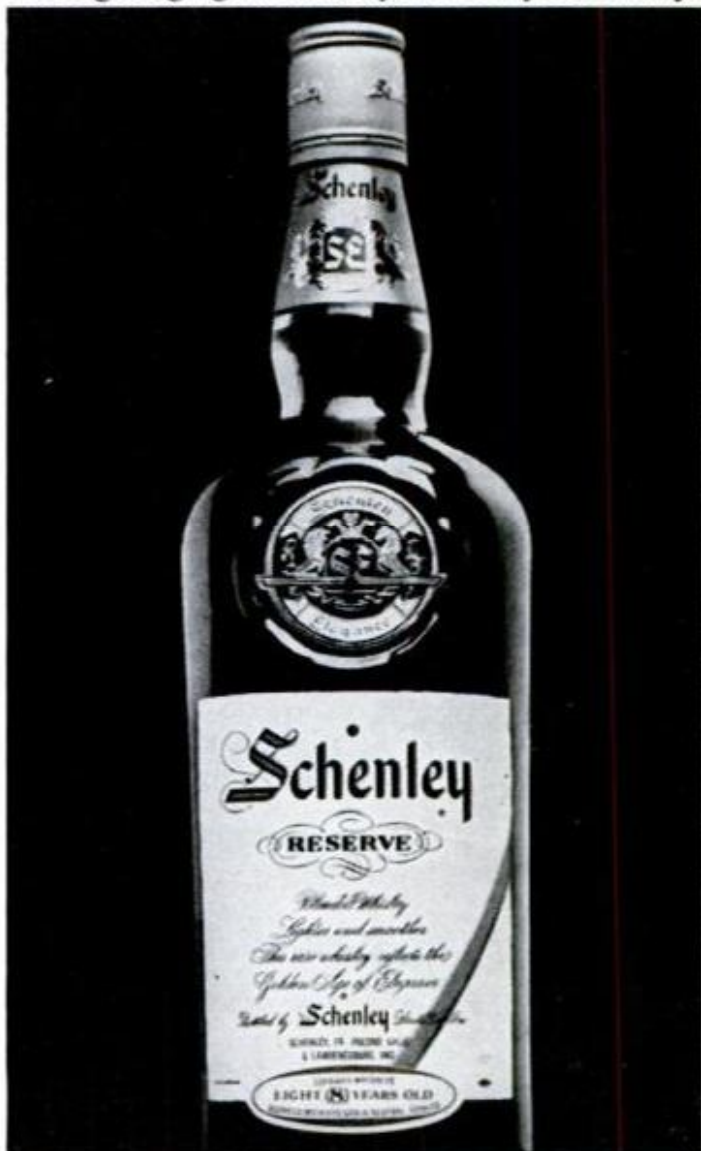
GM HAS REPORTEDLY REVIVED an intriguing project it was working on several years ago. Mechanics of the idea aren't known, but it enables a car to move at a slight side angle while headed straight-on. For example, in a tight parking space against a curb with other cars boxing you in fore and aft, it would be possible to move out by directing the wheels at a side angle without inching the car back and forth. The vehicle doesn't actually move sideways at 180°. It's a gradual, soft angle. Something like the

(Please turn to page 24)

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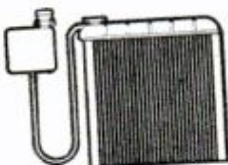
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My car is a _____ (YEAR) _____ (MODEL) _____ (NO. OF CYL.)

DETROIT LISTENING POST

(Continued from page 22)

way a dog lopes along, offcenter and veering to the side. GM has built several experimental cars equipped with the device.

THIS IS SUPPOSED to be the year of the big weed-out in Detroit. There's a lot of overlapping and duplication in car lines, not only among makes in the same family, but within car divisions. The general manager of a GM division has been saying privately he'd like to drop six or seven cars out of the catalog because they're practically carbon copies of other machines carrying the same logo.

Gene Bordinat, v.p. of design for Ford, is betting it won't happen. Mr. B. believes there'll be as many models or more come the '71s as there are this year. "The proliferation, the fragmentation haven't ended yet," he told Listening Post. "One of our principal targets is going to be the customer who's favorably inclined toward a car in our line but who wants a special touch, whether it's trim or engine or body style." If Gene says it, you can believe it. He knows what's being worked up for the next several years, not only at Ford, but in a general way by rival carmakers.

WHAT WILL THE REWORKING of engines to run on unleaded gas do to the zip-and-zoom cars? Help yourself to an opinion. One of Chrysler's top engineers believes the move spells end of the trail for the muscle cars. John Beltz, who came up the engineering route to become head of Oldsmobile, disagrees. He says the switch to lead-free fuel will have little effect on performance cars. At Ford you can get a 50-50 answer, depending on whom you talk to. One school contends the muscle machines will be gentled down. Another says it ain't necessarily so. Choose one.

WOULD YOU PUT a reconditioned part in your car if you got a break on the price and a guarantee from a car manufacturer? Would you be willing to plunk down say two-thirds the price of a new part for a used part? All carmakers remanufacture parts to a certain extent. But they don't push the stuff. Obviously, there's more money in selling new merchandise. Ford, to cite one example, has a sizable engine remanufacturing operation and franchises firms to rebuild engines to factory specifications. But these operations are bush league stacked against what Detroit foresees developing in this area over the next four to five years. More and more parts

(Please turn to page 26)

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DETROIT LISTENING POST

(Continued from page 24)

are going to be installed in clusters, so that when there's a failure, the entire unit can be pulled out and replaced, instead of being repaired. But you don't pitch a \$50 assembly into the trash bin because a two-bit spring gives out. The pulled units will be salvaged via a reconditioning process and, assuming the customer doesn't balk, reinstalled in other cars.

DETROIT AUTO MANUFACTURERS

now have on the market used-car emission control kits. These retro-fit kits are designed for cars vintage 1965 and earlier. Consisting of a vacuum-advance control valve, necessary hoses and locking device for carburetor idle and mixture adjustment screws, the kits can be installed by a knowledgeable do-it-yourselfer or by a



garage or dealer. GM's kit, shown above, has a thermo-vacuum switch that inserts between the upper radiator hose and the radiator. Chrysler's Used Car Cleaner Air Package (UCCAP) retails for \$12.50 plus installation. Installation should be mandatory nationally sooner or later. Some legal action in the works would have the manufacturer foot the bill.—B.H.

A SECRET WISH all drivers have at one time or another is to own a science-fiction-like ray-gun that can be aimed at traffic lights so they'll stay green or change green so the driver can sail right on through. Well, there is such a "ray-gun." It's actually an optical transmitter—part of 3M Company's "Opticon" (for "optical communications") emergency corridor control (ECC) system. The system is being used by several cities for emergency vehicles. The optical energy is beamed at a detector near the traffic signal to do the trick. Needless to say, it's for emergency vehicles *only!*—B.H.



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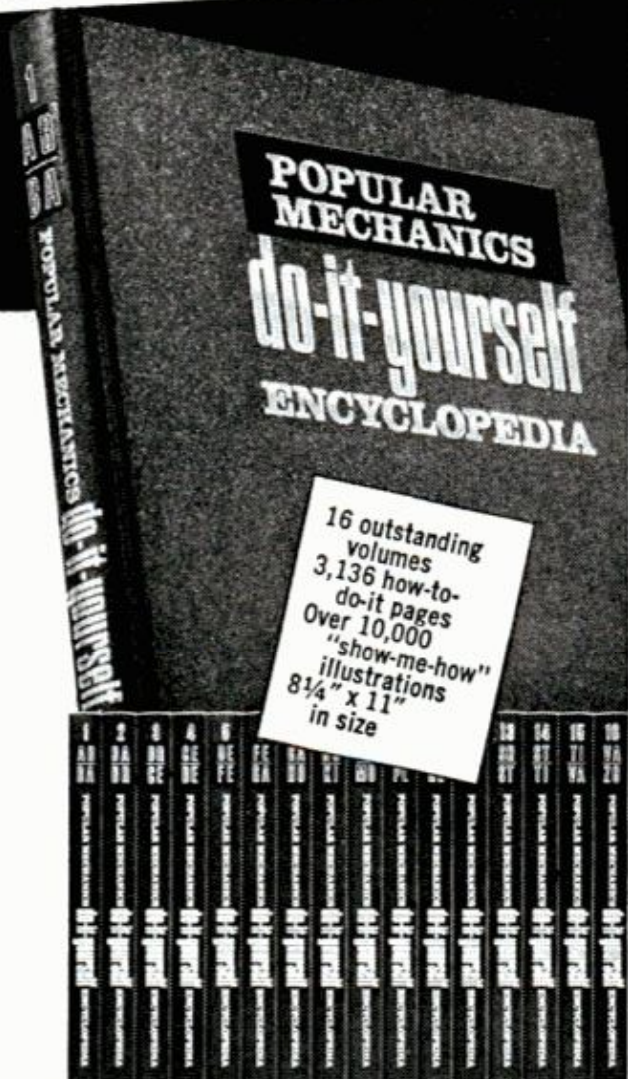
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Drivin' with Dan

Why do stock-block engines dominate Can-Am racing? What's behind the design changes of Indy cars? Does debris on the track bother you at the Indy 500? Dan Gurney answers these and other automotive questions

Q. *Why have stock-block engines dominated Can-Am racing? Aren't entrants allowed to use any engine they want?—Bill Bullick, Fort Worth.*

A. They are relatively cheap, both initially and during maintenance. Nowadays they are not so stock anymore. Aluminum has replaced cast iron. They also have a lot of cubic-inch displacement which makes up for a relatively mild horsepower per cubic-inch ratio. They are also available, and very good.

Q. *Has anything ever won the Can-Am Series besides a McLaren?—Tommy Margolian, Anniston, Ala.*

A. It certainly doesn't seem like it, but yes, John Surtees did it in a Lola in 1966.

Q. *Do you regard a Can-Am car as a particularly fragile racing car? Some of the weights sound very light (1200 pounds?) and the cars seem awfully fast.—Stan Bartz, Burlington, N. C.*

A. The good ones are not fragile at all in terms of doing the job they are intended to do (win Can-Am races). Not like stock cars,

they are more high performance in a power-to-weight sense than other road cars, but are not quite as light as you think. I'd say that 1500 pounds with water and oil, but no fuel, is a light one.

Q. *How much faster would Can-Am cars be if they allowed exotic fuels, such as at Indy, instead of requiring gasoline? Would the engines take it?—Len Snow, Terre Haute, Ind.*

A. I'd guess that it would account for two or three seconds per lap on a one-lap basis, but the cars would have to stop for fuel in about half the time or carry much more fuel since the consumption rate would be much higher.

Q. *As a car builder yourself, perhaps you can tell me what the considerations are for changing the design or shape of an Indianapolis car. I've noticed some fairly big changes in shape and configuration just about every year but I can't see what the designer is trying to achieve.—Thomas Morrison, Springfield, Ill.*

A. The fuel-tank capacity of 75 gallons is one [\(Please turn to page 32\)](#)



DAN TRIES OUT his Trans-Am Barracuda in tests earlier in the season. He's campaigning the car in the popular Sports Car Club of America series this year. Next month's PM will include Dan's own feature story about Trans-Am sedan racing. It will include two pages of color action photos taken at the Trans-Am opener at Laguna Seca in April



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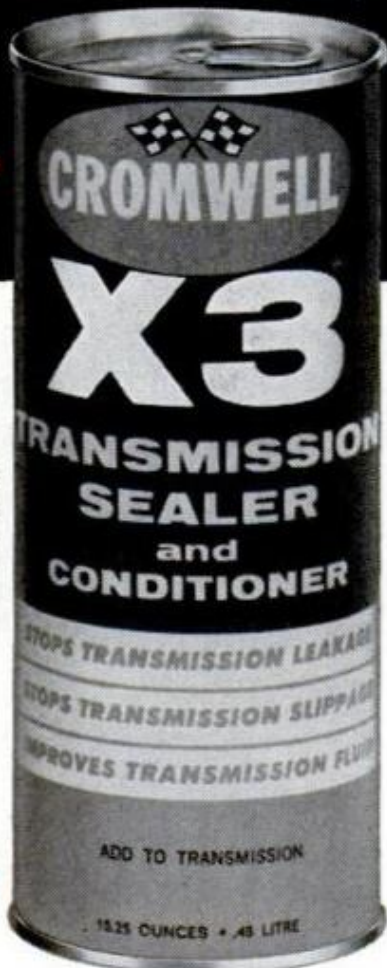


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DRIVIN' WITH DAN

(Continued from page 30)

thing. Today's high-output engines use about every drop of fuel to finish the race. Engines are now requiring more cooling for both water and oil. Aerodynamics are big factors. Trying to achieve low drag without any lift is not so easy. Suspensions have undergone some subtle changes.

Q. *What's the straight story on braking at Indianapolis? I see some drivers quoted as saying they hardly touch the brakes at the end of the long straights and others who swear you have to stand on the pedal plenty hard to make good time.—Rick McManus, Kent, Wash.*

A. I'd say that it is halfway between your two extremes with a slight tendency toward the light touch, but I have yet to run over 170 at Indy, so I may have to change my style.

Q. *I have long argued that you and A.J. Foyt go faster and smoother than any other drivers in the business. I thought I would ask your comment on that. By the way, I don't get many arguments.—R. E. Cashion, Greenville, Tenn.*

A. I've heard comments along these lines; however, I rarely get to see myself, so I really don't know. A.J. is capable of going very fast either smoothly or roughly. I can get rough, but I think you are faster if you are smooth. The best is when you're very rough in the cockpit—working hard on coordinating throttle, brakes, steering and gearbox—but smooth on the outside.

Q. *How much different is your car when you qualify for the Indianapolis 500 than when you put it on the line on race day?—Kenneth Callison, Burbank, Calif.*

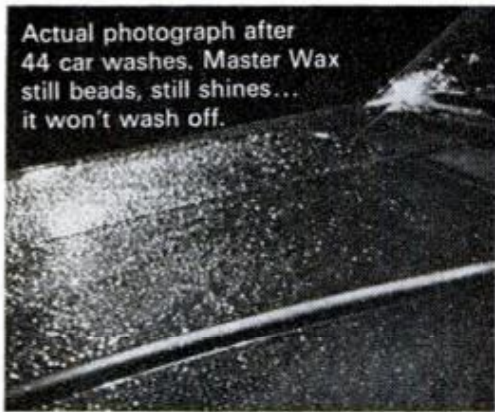
A. It's usually about 3 to 5 mph slower due to a fuel that is not so hard on the engine (less horsepower), maybe a taller gear ratio (less rpm) and 75 gallons of fuel vs. about 20 for qualifying.

Q. *Have you ever been bothered by debris on the track during the Indy 500? It seems like hundreds of hot dog wrappers, and so forth, are constantly coming down out of the stands. Is this a danger?—Mrs. Marilyn Stroud, Oshkosh, Wis.*

A. Debris can certainly be a problem. Any-
(Please turn to page 34)

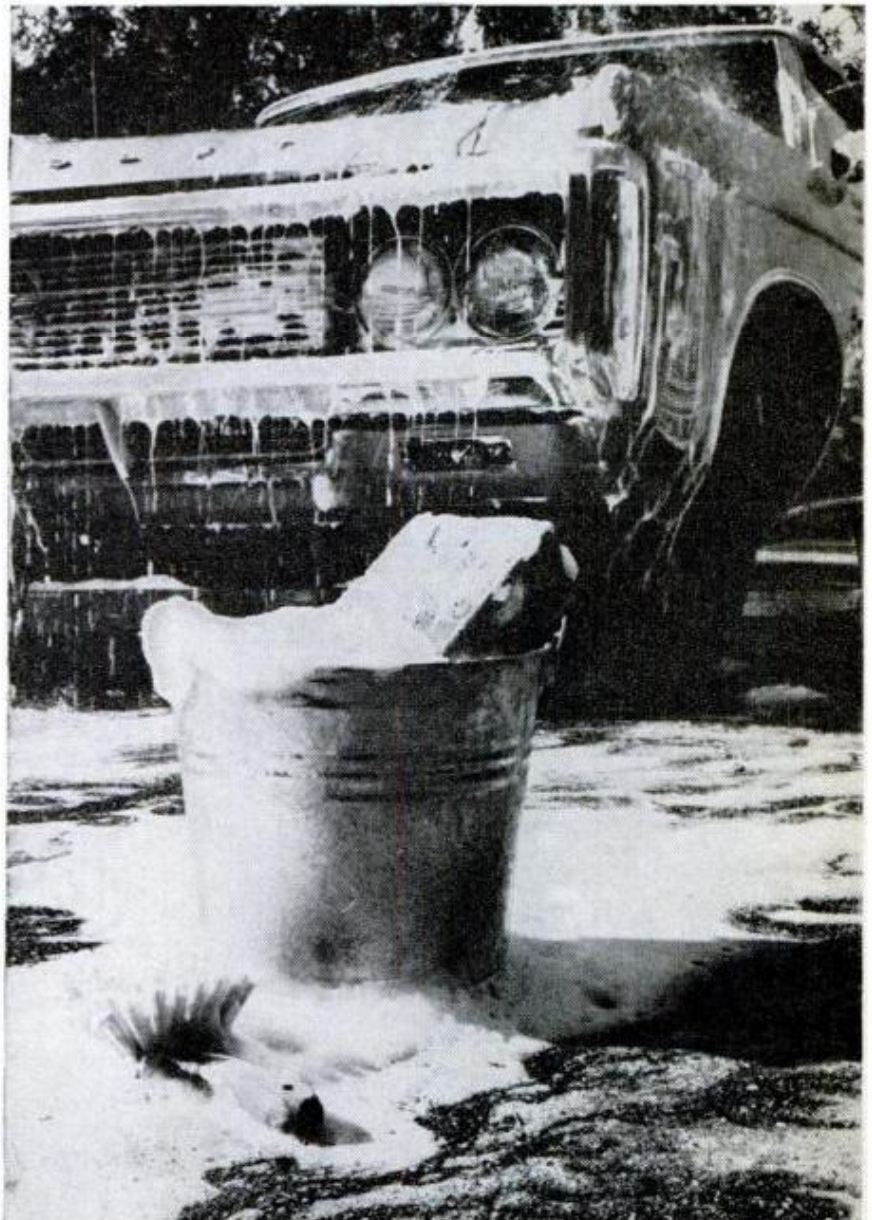
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DRIVIN' WITH DAN

(Continued from page 32)

thing harder than paper can damage suspension or tires or rip a bellypan. The biggest problem with paper is the cutting off of air to the radiator, overheating the engine until you are forced to stop.

Q. How would you rank Indianapolis racing, Can-Am racing and Trans-Am racing in order of toughest to win this year?—Roger Harden, Miami.

A. You may not believe this, but I would call it a toss-up. They are all going to be extremely tough.

Q. I find the decals on racing cars one of the fascinating things about the cars. How can I get pictures or copies of the decals you and other drivers have on your cars?—Chris Hawks, Seaford, N.Y.

A. Yours is a timely question since my decal album has just been published by Sports En-



terprises, Ltd. It's a \$4.95 loose-leaf album in deluxe form, or \$1.95 in standard cover form. A companion 16-page catalog shows all the decals pictured in the album and their prices. It costs a dollar and includes five real decals. To order albums or catalog write to Dan Gurney's All American Racing Decals, Box 3374, Chicago, Ill. 60654.

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 64).

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OH, I GUESS SO — O.K.

HARRY! WHERE HAVE YOU BEEN KEEPING YOURSELF?

OH, YOU KNOW— AROUND. LOOKS LIKE YOU'VE DONE ALL RIGHT, THOUGH.



LATER

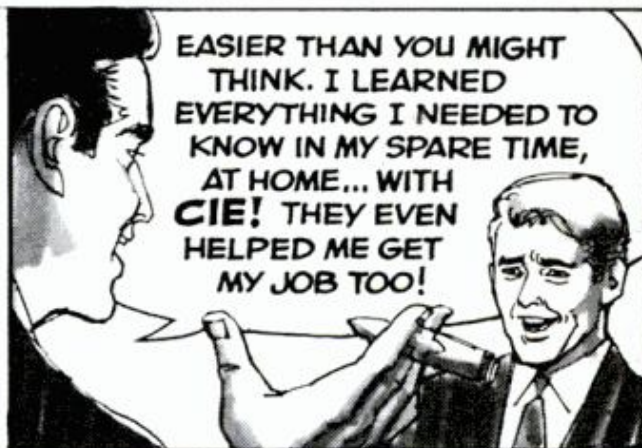


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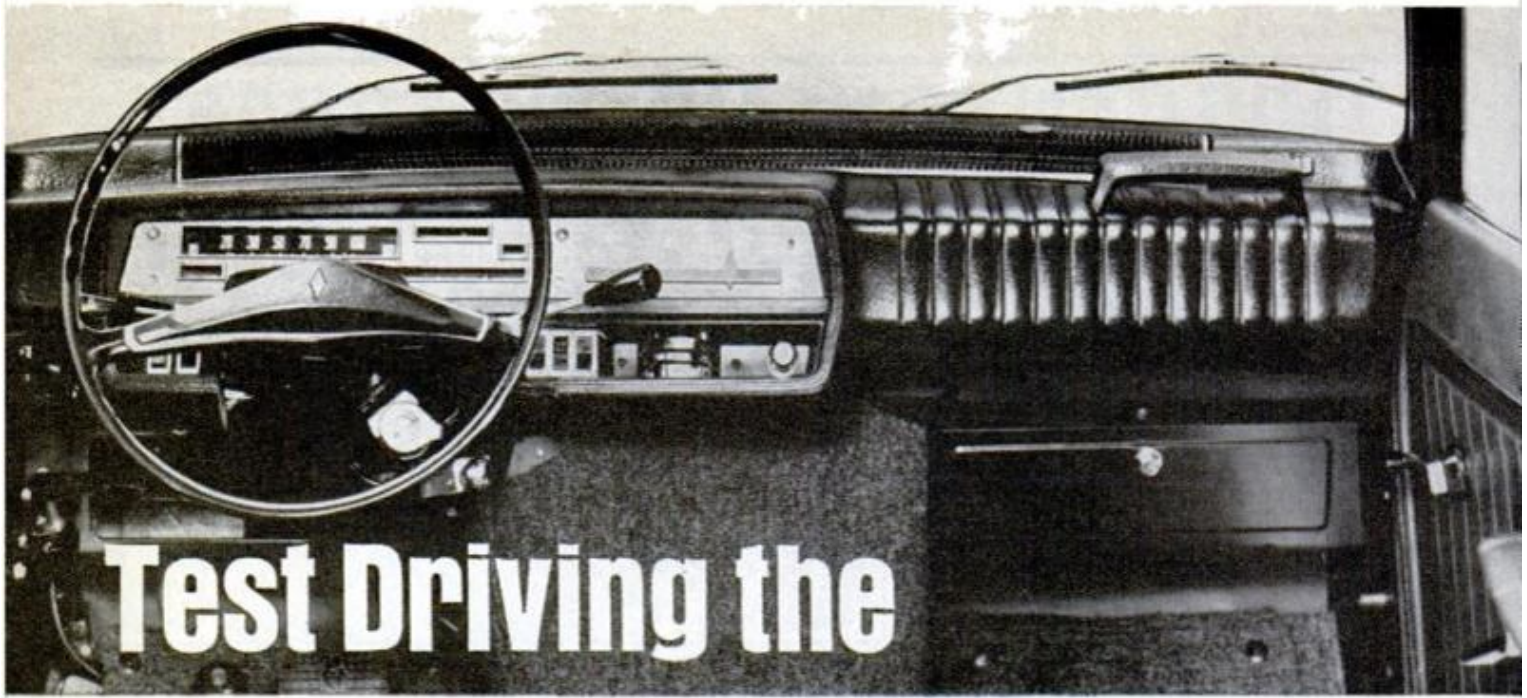
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PM-40



Test Driving the

New Renault 16 Automatic

By **BILL HARTFORD**, Auto Editor



BODY WORK, TRIM AND FINISH of the car exhibit finesse in design and execution. Car has front and rear independent suspension and vacuum-assisted discs in front. Despite roll, handling of the front-wheel drive in fast turns is predictable



AUTOMATIC transmission is the only thing that makes the new 16 different from the Renault 16 sedan-wagon that has been on the highways here and "over there" for the past several years.

The column-mounted, stick-shift 16 is the car in which I learned to power slide around the Arc de Triomphe in ever-widening circles until, fate would have it, I spun off down the street I was aiming for. It's also the car that *PM* Editor Bob Crossley shifted from one end of France to the other, putting on over 2000 miles in all kinds of driving conditions, mostly in the mountains of southern France.

It would have been easier—maybe not as much fun—for both of us if we had been driving with the new transmission—shift lever set in "D."

In the "Drive" range under [\(Please turn to page 40\)](#)

RENAULT 16 AUTOMATIC Dimensions (inches)

Length overall	168.4
Width overall	64.9
Height overall	57.3
Wheelbase: Right side	104.3
Left side	107.0
Front tread	52.8
Rear tread	50.9



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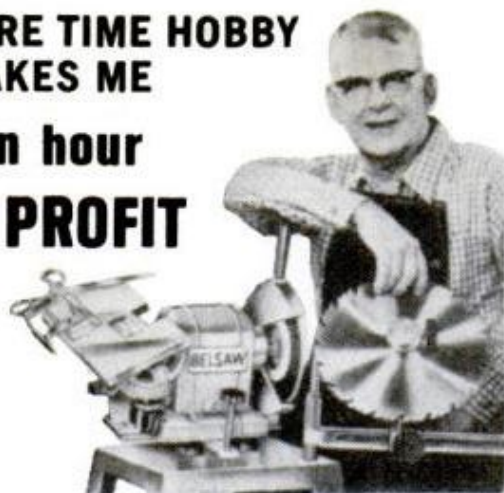
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LUGGAGE CAPACITY of the unique sedan-wagon design of the Renault 16 is 12 cu. ft. with rear seat in the normal position (as shown here), 26 cu. ft. with rear-seat backrest suspended and seat tipped forward and all of 42 cu. ft. with rear seat removed

TESTING THE NEW RENAULT 16

(Continued from page 38)

normal acceleration the shift points of the three-speed automatic are at 15 and 25 mph. Heavy-footing it moves the shift points to 34 and about 60 mph. And it takes about 16 or 17 seconds to get to 60. This performance is comparable to that of the stick-shift model. It's a fast-shifting transmission and a strong one, designed to take a lot more torque than the 16's 1565-cc engine can deliver.

The automatic is electronically controlled, having an alternator (that replaces the conventional governor), electromagnetic check valves and computer to keep tabs on things—like varying road speed and engine load. These components of the automatic are easily accessible for service.

The new unit makes it effortless to get up to speed, but it's on the highway—at over 60 mph and on up over 90—where I still find the performance of any Renault 16 most impressive. That a 2400-pound, 70-hp car can be easy to handle and relaxing to drive at those speeds is always a source of amazement to American drivers.

The new automatic adds about \$200 to the price of the basic 16—upping the total to about \$2600. Among other options available for the sedan-wagon are rear-window electric defogger, airconditioner, radial tires and electrically operated, sliding sun roof.

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HIGHWAY PATROL

10

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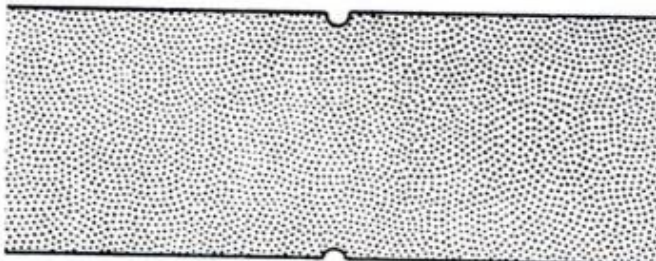


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ORNAMENTAL Iron designs. Book of 1600 beautiful, practical designs for railings, columns, etc. Free literature. Cunningham, 3881 South 3200 West, Salt Lake City, Utah 84119.

WINEMAKERS. Free illustrated catalog of yeasts, equipment, Semp'lex, Box 12276, Minneapolis, Minn. 55412.

HEARING Aid batteries wholesale. Free list. Habs, Box 51, York, Penna. 17405.

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WINEMAKING Kit—\$4.98 Free Catalog and recipes. JIMDANDY, Box 30230M, Cincinnati, Ohio 45230.

IDENTIFICATION CARDS—Send stamped self-addressed envelope for free samples & details to: E.C.S.M., P.O. Box 12117, Las Vegas, Nevada 89112.

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SLOT Machine banks \$5.95. Catalog 35¢. Refundable. Coffco, P.O. Box 522, Lake Zurich, Illinois 60047.

FIFTY Nature Verses \$1.00 prepaid. Also secret mailing place. Everitt Rosenberg, 511 Oxford Rd., Morrisville, Pennsylvania 19067.

YOUR Name sent to 1,000 mailers, importers, wholesalers, etc. on our mailing list. Year \$1.00. Layton Enterprises, Box 267, Houston, Missouri 65483.

HOME Winemaking Supply Guide Catalog—Free. Bacchanalia, 321-X-7 Saugatuck Station, Westport, Conn. 06880.

GENUINE Colored ear tickler 50¢. Three colors \$1.00 postpaid. Box 75069 Oklahoma City, Oklahoma 73107.

PROPHYLACTICS 12 dozen \$7.95. Check or Money Order, 3 weeks delivery. Full Power Inc., P.O. Box 820, Chester, Penna.

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The 742 has proven itself under all kinds of field conditions... even the super-rugged ones we imposed before we introduced it. We put the action through hell, and it passed every test with flying colors. But we haven't just sat back since then and admired our handiwork. We're constantly looking for ways to improve the 742. Our latest move

is a coating of Du Pont "Teflon"-S** on vital operating parts. The self-lubricating action of "Teflon"-S keeps everything operating the way it's supposed to... smooth and easy. Friction is almost eliminated. And we've found that "Teflon"-S helps prevent oil and dirt build-up. So cleaning is a lot easier.

Couple all that with things like our unique way of finishing metal—"vibrating", a special ultra-hard Du Pont RK-W wood finish, easy-loading optional clips, sling strap and swivels. Prices start at only \$184.95¹. Now you have a pretty fair idea of the automatic you really ought to get your hands on.

One last thought. We've been making automatic rifles for more than 64 years. Knowing that probably won't make you shoot any better. What it does mean, though, is that you'll be going into the field with a lot of experience under your arm. If you'd like to know more about the 742 and all the 1970 Remington rifles, send for our 48-page, full-color catalog. Just write: Remington Arms Company, Bridgeport, Conn. 06602, Dept. GG.

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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Blows hot and cold

Can you tell me why hot air from the heater of my 1968 Pontiac suddenly turns to cold air when I accelerate above 60 mph? To get heat again, I must take my foot off the accelerator. Unsuccessful attempts to solve the problem have included installation of a new check valve, vacuum uniflow valve and engine thermostat; adjustment of the heater doors, and examination of the vacuum lines for leaks.—Edward Brenner, Trenton, N.J.

The vacuum reserve tank is probably cracked, allowing sufficient loss of vacuum so the tank is completely drained during acceleration. Vacuum is what holds the spring-loaded heater doors open. When vacuum is dissipated, the doors spring shut. The result is no heat. I'd say that the tank has to be replaced.

Fire eater

I have a 1968 Opel Kadett with 80-hp engine. Timing, dwell and carburetor are set to specs; yet this engine eats spark-plugs. It has burned up 17 AC44XL plugs in 17,000 miles. Help!—David N. Stewart, Lamar, S. C.

You're using the wrong sparkplugs. You should be using AC42XLS—a colder plug. If the problem persists after the switch is made, check generator and coil output for high voltage. Be sure to give that resistor wire going to the regulator a good exam. While performing the regulator test, bend the wire to see if you get a surge of voltage on the voltmeter. If you do, the resistor wire is bad and causing the sparkplug problem.

Sand away squeals?

The brakes of my 1968 Rebel squeal when applied. I was told that sanding the linings would stop this. Well, I've sanded and sanded, but still have squeal. Any suggestions?—Gerald W. Berry Jr., St. Clairsville, Ohio.

Stop sanding. Sure enough, the cause of the squeal is the brake lining, but sanding won't help. Today's linings are harder than they used to be to give longer life. You might not be able to get rid of all that squeal, but you can reduce it by having a

Rambler dealer follow instructions in one of two service bulletins. If you have 9-inch brakes, have him apply a damper kit (part No. 3207107) as called for in service bulletin 10-12, group 8.000 (5/14/68). If you have 10-inch brakes, have him put on drum springs (part No. 3202262) as specified in service bulletin 5, group 8.000 (7/25/67). Although annoying, the squealing doesn't hurt anything.

Gad zerks!

My 1967 Chevrolet pickup has three universal joints that don't have zerk fittings. To grease, I have to take them down. Can I drill and tap these for zerks?—I. N. Cunningham, Salida, Colo.

No dice. They're made of hardened steel. However, you can buy new U-joints that come with zerk fittings from a Chevy dealer.

Fickle fuel requirements

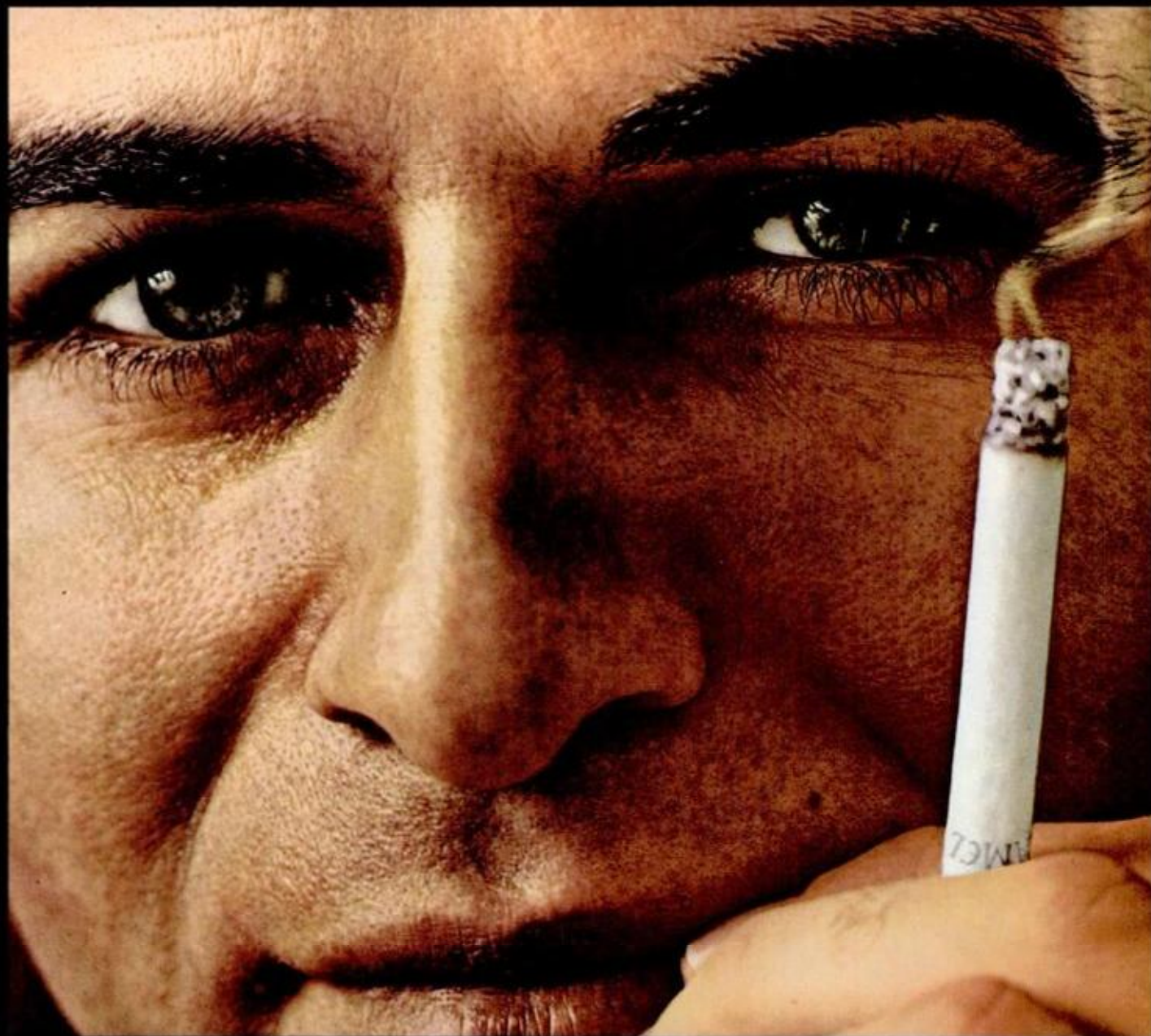
I have a 1968 Plymouth GTX with a 440-cu.-in. engine. At purchase (new), the car ran smoothly on regular gasoline. At present, I have to use premium, because the motor knocks on regular. Why the change?—Ralph Y. Kono, Los Angeles.

Before I answer, let's get one thing straight. The manufacturer recommends that premium fuel be used in this engine. Right? Okay! Octane requirements of an engine are lower when the engine is new. Thus, it will function on lower octane fuel without knocking. However, at about 5000 miles, that requirement increases to a point where a higher octane fuel is needed. The change results from a build-up of lead deposits. This octane requirement stabilizes and doesn't change from then on unless the engine is badly out of tune. The fuel recommended in your owner's manual is not what the engine needs when new, but what it needs after octane requirements stabilize.

Hitting bottom

I have a bottoming problem with my 1969 Oldsmobile Cutlass Supreme. I've installed heavy-duty springs and the best shock absorbers on the market, but the car still bottoms when there are four or
(Please turn to page 68)

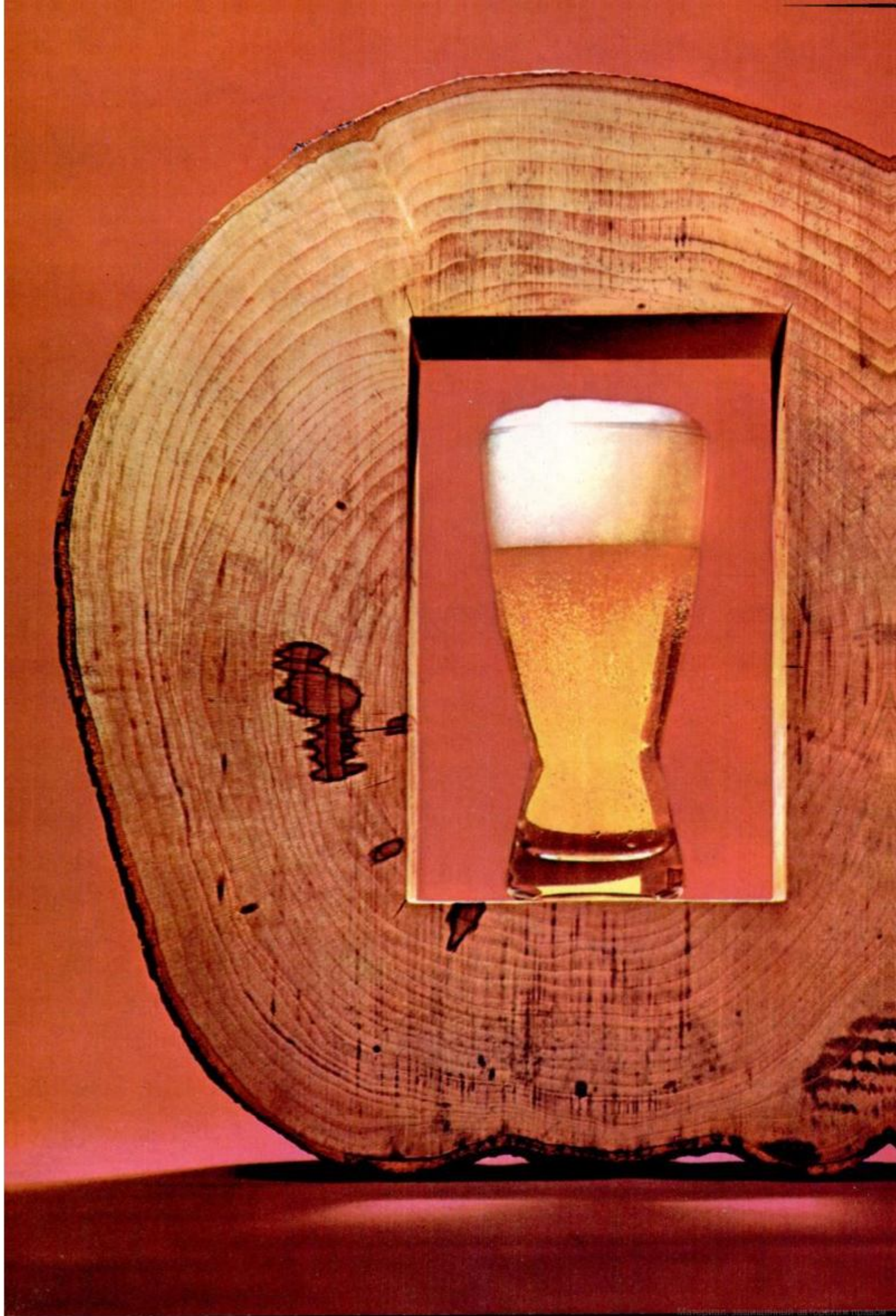
**A touch of Turkish
smooths out taste
in a cigarette.
Who's got it? Camel.
Start walking.**



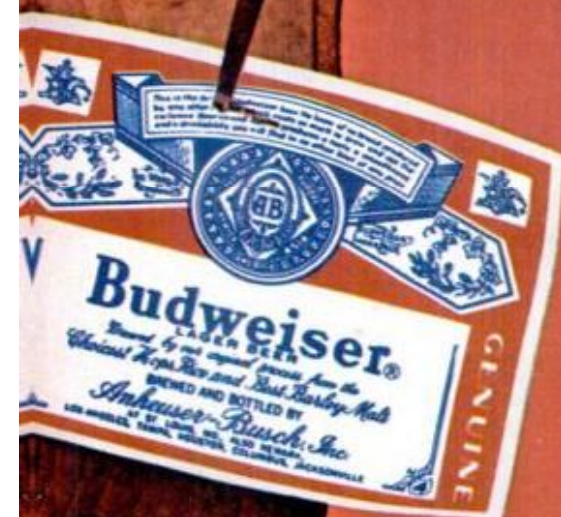
"I'd walk a mile for a Camel."

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Is Beechwood Ageing the secret of Budweiser superiority?



(Secret? Heck...
we even brag about
it on our label!)

AUTOMOBILE CLINIC

(Continued from page 64)

five people as passengers. I would appreciate your help.—Robert W. Shilliday, Arlington, Mass.

Surprise, Bob—your car is not bottoming, although it might feel that way. There is little clearance between the floor pan and driveshaft. What's happening is that the extra weight of the people in the car is causing the floor pan to strike the driveshaft. Have your dealer provide more floor-pan tunnel clearance for the driveshaft. This is done by jacking up on the pan and bending it $\frac{1}{2}$ to $\frac{3}{4}$ in.

Curb the surge

The 383-cu.-in. engine in my 1968 Dodge Charger surges at all speeds, but this is most pronounced at 20 mph. What can cause this problem?—Howard Hasbrook, Blanchard, Okla.

Many times the trouble is the setting of the carburetor. Constant surging will result if the engine is required to run on a fuel mixture that is too lean. If this doesn't prove to be the case, I'd be wary of the vacuum advance unit. A leaky diaphragm inside the unit will cause constant surging. Finally, if all else fails, change the jet size in the low-speed circuit from .028 to .031.

Catchy clutch

I own a 1967 Buick GS400 with four-speed gearbox and heavy-duty clutch. When I activate the clutch pedal, it feels "jaggedy," like it's binding. The dealer has adjusted it so many times, I've lost count. Now they tell me this is the way it's supposed to be. I don't believe them.—Joseph S. Curro, Trinidad, Colo.

Neither do I, Joe. The clutch should come down to check the yoke fulcrum and the throw-out bearing collar. I believe you'll find that the fulcrum is cracked or some such damage, or that the yoke collar has a lip or burr.

Fast-idle cam

After several trips to the service department, the throttle linkage of my 1969 Chevrolet Impala still binds. All parts are clean and the choke works fine. Yet until

the engine is warm, it races unless I depress the gas rapidly. Can this be fixed?—Leon App, North Olmstead, Ohio.

I think you're probably confusing the action of the fast-idle cam with a sticky throttle-linkage condition. The fast-idle cam causes the engine to race when it's cold so it won't stall and will warm up more rapidly. Rapid depression of the gas pedal knocks the cam off its setting, closing the throttle and slowing down rpm. In other words, this is the way it's supposed to be. I'm just surprised the service department hasn't explained this to you.

Service Tips

● Chevrolet makes the important point that regular chassis lubricant is a high-melting-point, water-resistant grease that is suitable for greasing wheel bearings in cars having drum-type brakes only. A special lubricant with an extremely high melting point must be used to grease wheel bearings of cars with disc brakes, because they generate very high temperatures. The Chevy part number for this lubricant is 1051195.

● Dodge owners should be aware that 1970 Darts and Chargers with 340-cu.-in. engines and four-barrel carburetors may not start when cold because of an incorrect carburetor-flange gasket that upsets automatic choke calibration. The correct gasket for the four-barrel is .054 in. thick and carries part No. 2951602. Some cars got out with the wrong gasket.

● According to Oldsmobile, cars that show lack of power or a low top speed could be suffering from a restricted exhaust system between the exhaust manifold and muffler. Some exhaust pipes are laminated with two layers of metal. The inside layer can come loose and bend over, restricting the system. This is tough to diagnose, because you can't see it. The way to check it is to disconnect the exhaust pipe at the manifold and drive the car. If performance becomes normal, the problem is probably caused by a bad pipe.

● 1970 Mercurys with 390-cu.-in. engines which have instrument-panel, temperature-indicator lights that glow continuously should be checked to make sure that the correct temperature-sending unit was installed at the factory. This unit, part No. C8GY-10884-A, can be identified by its offcenter wire attaching post and gray insulator. ★★★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

Make sure the guy who tunes your car hits all the keys

There's more to a tune up than meets the ear. It's not just a matter of points and plugs and timing.

There are other sour notes. Like a dirty, clogged-up air filter. Or a gummy, waterlogged fuel filter. Or a little gadget called the PCV valve you maybe didn't even know you had.

These clinkers can throw your engine out of tune—maybe stop it cold. So have 'em checked.

If they need replacing, replace 'em. Replace 'em with Fram. And when you drive out we'll have you humming a different tune.



Fram Automotive Division, Providence, Rhode Island 02916

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Wallpapered floors?

My floors upstairs are made up of old, painted tongue-and-groove pine boards 6 inches wide. Both paint and floors are still in good shape—no wide cracks, openings, or irregularities. I don't have wall-to-wall carpeting, but prefer rugs and I'm thinking of covering the exposed floor around the rugs and next to the walls with—of all things—wallpaper! What's your opinion?—G.L., W. Va.

I can't go along with this sort of thing all the way. Wallpaper just isn't meant to be used as a floor covering. But if you like wallpaper on the floor, laid as you describe, who am I to stand in the way? Keep in mind that wallpaper will not stand up for long in traveled areas, such as doorways. Here it must be protected by scatter rugs or other means. You'll have to select a paper pattern that will harmonize with the rug in both color and detail.

It would be well to use a plastic-coated wallpaper. Though it's somewhat more difficult to remove—this can be done with a steamer—this type of paper would withstand frequent dusting and "wear" longer. Ordinarily it should be applied with a paste of the same type as that used for walls.

Sagging shelves

I have three open bookshelves supported on old-fashioned, lacy iron brackets. They are 54 in. long and sag at the center under weight of the books. How can I prevent this sagging without installing an unsightly strip on the underside of each shelf?—A.L., Ariz.

Confronted with a similar problem, I measured the length of my shelves—they were 60, 54 and 48 in. long—and then reset the brackets in from the ends a proportional distance. Next, I cut three strips from ½-inch hardwood, each just half the overall length of the shelf to which it was to be fitted. Then I cut an attractive scroll pattern on the lower edge of the strips and attached them to their shelves with screws and glue, taking care that each strip was exactly centered. After staining and finishing the strips to match the wood shelves, the result was quite symmetrical, pleased the eye and, best of

all, eliminated that unsightly "bow" at the center of the shelves.

The supporting strips, or stiffeners are not concealed, but become part of the display. The trick is to design a scroll pattern that's widest at its center. With a bit of pencil doodling, this is not at all difficult. If you have no bandsaw or jigsaw, cut the curves with a hand coping saw and finish with a coarse file and sandpaper.

'Numbered' roof

My house is to be reroofed. The contractor says he will use a No. 235 asphalt shingle, that this is a standard shingle and that he would not recommend a heavier covering on my "roof deck." What's he talking about?—N.H., Wis.

If you have the number correct, he means he's installing a shingle that weighs 235 pounds for each 100 square feet of roof area, that is, an area 10x10 feet. I assume that the new shingles are to be laid over the old. Your contractor has undoubtedly examined the roofing and checked the deck and the rafter size and he feels that this is the heaviest shingle he can use as an "over-roofing." This weight shingle is expected to give at least 15 years' service, usually more except under extreme conditions. The term "roof deck" refers to the boards that are laid over the rafters.

You might ask the contractor if he intends to use a shingle of the self-sealing type. It's recommended because the undersides of its tabs are coated with a self-sealing adhesive to keep them from being turned up and torn during high winds.

Sticking window sashes

Window sashes in my older home are beginning to stick in the muggy weather for some unknown reason. Some open quite easily, but others are almost impossible to lift. What could be the cause and is there any simple remedy?—M.H., Ga.

Although settling of the structure is a common cause of sticking sashes, this seems less likely in an older home. But old sashes do loosen at the joints in time, admitting moisture that causes swelling. New paint on the sash frames, inside and out, will help, but in the meantime saw out a small block of wood that will just fit in the sash channels of your window frames. Cut a coarse sandpaper strip of the same width and attach it to the block with thumbtacks. Sanding the channels with this should free the sashes. A silicone preparation supplied in spray cans also will ease this condition. ★★ ★

Sooner or later, people who tow big tent campers, travel trailers, or boats come into our dealerships. And they bring what used to be perfectly good sedans and station wagons. With twisted frames. Worn-out transmissions. Burned-out engines. Rear ends shot to pieces.

And it isn't the fault of the sedan or station wagon that these things happen. It's just that towing especially heavy loads is often too much to ask of a vehicle that wasn't designed to do it in the first place.

That's why you can select a TRAVELALL® wagon with towing capacities up to 10,000 pounds (that's 4,000 more than the nearest competitor's rating). It'll pull a 5-ton travel trailer or a thirty-foot cruiser with ease.

INTERNATIONAL® TRAVELALL is built on any of three truck style frames . . . so it won't twist. Five special engines, eight different transmissions and increased capacity cooling systems combine to put big muscle ahead of its hitch. So you can get a TRAVELALL equipped to tow just about anything anywhere.

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If you're pulling a trailer or a big boat, chances are you need a TRAVELALL. See them at your INTERNATIONAL dealer's. There are five models to choose from. Then drive them.

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IH INTERNATIONAL HARVESTER COMPANY
CHICAGO, ILLINOIS 60611

**If you're pulling any one of these,
you may be killing your car.**



Situation depicted for demonstration purposes only.

THE '71 CARS

(Continued from page 74)

respectively. The deck, from the roofline back to the tip of the trunk, will come to a tapering point with recessed sections left and right of the taper leading out to the fenders. (If you have trouble following that, visualize a triangle with its base attached to the roof of the car and the apex leading down to the trunk. Got it?) Just below the roofline, where the slope begins toward the trunk, there will be a wrap-around rear window mounted at about a 40° angle. Looks a lot like the Corvette roofline from a few years back.

Also in the high-ticket personal-car category there's Ford's mid-engine de Tomaso Pantera. This will not be a new car for '71. It's the same machine Ford exhibited at the International Auto Show in April. But in terms of what's new for next year, this has to rank near the top. "Elite" Lincoln-Mercury dealers will market it.

INTERMEDIATES: The sparklers in the department will be the Chrysler products. In addition to the picnic-table hood mentioned earlier, Chrysler mid-size makes will have wide, flaring decks, deeply recessed oblong taillights and elliptically shaped grilles. The look will be of a solid, lot of car.

STANDARDS: There's not much new in the category. Ford and Chevy are in a battle to make their bread-and-butter products more Lincolnish and Cadillacish in looks and appointments, but these are surface changes rather than a repackaging of the vehicle. Buick would like to bring out a sun roof, à la the option available on Cadillac Eldorado and DeVille. But the powers-that-be had not approved it for production as this was written.

Chevrolet will spring something new in wagons. Remember the old rolltop desk? How the cover section rolled up into the top? Chevy will apply the same idea to the tailgate of a wagon. The glass top half will roll up into the roof and the solid bottom section will slide away into the floor.

Chrysler is expected to drop one and add one. The Imperial Crown two-door is apparently a goner and a brougham will be added in the New Yorker series.

The wheels responsible for keeping the wheels rolling in Detroit hope that somewhere in that lot there's a car that'll get you to unfold your wallet. This has not been an auspicious year for car trading, as you may have surmised from the forlorn face on your friendly neighborhood dealer. The '71s, Detroit hopes, will provide the tonic to fever up your tire-kicking juices and, just maybe, move you to sign up for a new automobile. ★★

IT MAKES AIRFIELDS OBSOLETE

(Continued from page 83)

45 knots or more, rotate the nozzles forward slowly until fully horizontal."

A vertical landing is almost identical to a STOL landing. Slam the nozzle control back to 98° to decelerate, then reset it at 80° for vertical descent.

Controlling the Harrier in a hovering position is something the pilot doesn't have to learn. When the nozzles are set at more than 20°, reaction controls are automatically activated and they are geared directly to the normal controls. High-pressure air from the engine is bled off to valves at the plane's extremities. Valves at the nose and tail control pitch, two on either side of the rudder control yaw, and two at the wingtips control roll.

The beauty of the system is that the pilot uses his normal flying instincts to point the plane where he wants it, pushing forward on the stick to drop the nose, moving the stick left or right to lift either wing and kicking rudder to turn the plane, the same as he would do at 600 knots.

The Harrier, because of its V/STOL capability, is intended primarily as an attack aircraft, operating principally against ground targets. It can carry a mixture of ordnance (up to 10,000 pounds of bombs and rocket pods on the version the Marines expect to get) on five pylons—four on the wings and one under the fuselage. Two 30-mm gun pods are also carried.

Even so, the men who have flown it claim it would make a superior air-to-air fighter. Consider these situations:

● A Harrier is jumped coming off a strafing run and has an enemy on its tail. Flying straight and level, the pilot pulls back the nozzle control, decelerating his plane until the enemy has flown past him, then jams the control forward again and catches up. Now the pursuer is pursued.

● A Harrier is locked in combat with an enemy, each on opposite sides of a tight circle, neither able to cut the other off. The Harrier pilot slams back the nozzle control, reducing his speed and the plane's wing loading, and tightening his turn so that he pulls inside his adversary with his nose out front ready for a clean shot.

● A Harrier is flying at high altitude when the pilot spots a flight of enemy aircraft below him. If he simply dives at them he will accelerate too fast for an accurate shot and fly right on by. So he slams in reverse thrust and dives anyway, accelerating not at all, though he's going straight down.

No two ways about it—the Harrier is truly a revolutionary plane. It's no exaggeration to say that it has the capability of making airfields obsolete. ★★

When your kid starts telling you what oil to use, listen.



He may be your kid. But that's no kiddy-car he's driving: a 390-cube, 4-barrel V-8 four-on-the-floor muscle machine he's got purring like the family kitten.

He knows cars. He knows motor oils. That's why his motor oil is Quaker State. It's refined only from 100% Pure Pennsylvania Grade Crude Oil, the world's best natural lubricant. And fortified to protect an engine even more than any car maker's warranty demands.

Next time you're due for an oil change, do like your resident car expert. Ask for Quaker State wherever they care about cars. It's America's most preferred motor oil.



Quaker State your car to keep it running young.

BUYING A USED CAR

(Continued from page 88)

reputable mechanic. Tell him what you're doing and have him: a) test compression; b) inspect front and rear brake linings; c) check undercarriage and engine compartment visually for fluid and exhaust leaks, frame damage and body rust; d) check front-end alignment; and e) road-test the car to appraise shocks, suspension, steering, transmission and accessories. Mechanics usually charge \$5 to \$10 for the complete inspection.

On-the-lot tests

Before you invest in a diagnostic or mechanic's check, you can make many tests on your own. Be sure everything works: lights, horn, wipers, gauges, turn signals, power items, heater, airconditioner, radio. Roll all windows up and down.

Detailing (reconditioning) hides just

. . . some dealers do roll back odometers . . . many owners do purposely falsify mileage . . .

about every shred of history you want to know about a car. A detailer will spray steering wheel, seats, rugs, headliner, rear package shelf, dash padding and even the pedal arms to mask signs of wear. So look for traces of overspray on dial faces, step plates, roof lamps and windows.

Also be suspicious of repainted exteriors. Today's acrylic paints should last at least five years with reasonable care. So a newish car with a new paint job means something—bashes or rust-outs or neglect. Plastic body putty, fiberglass and a fresh coat of paint can hide many secrets.

And what about odometer mileage? Yes, some dealers do roll back odometers. Too, many owners do purposely falsify mileage, either by disconnecting speedometer cables or by substituting other odometers bought in wrecking yards.

There are other telltales of a car's mileage. At 50,000, the average rubber brake-pedal pad is just beginning to show a right-side bevel. At 100,000, metal starts to peek through at the corner. A completely new pad means the old one said too much.

Then, too, look for wear marks in carpeting, around light switches, on armrests and by the sag of the driver's seat. If any of these are new, there has to be a reason.

Now trunk mats tend to hide rust-outs. Many detailers spray the trunk interior with original-looking textured paints. And

almost every engine compartment gets compulsive attention—steam-clean and paint, then decals. New decals on the air cleaner and rocker covers don't mean a thing. Detailers order them by the gross.

You can check for worn shocks by the old ritual of bouncing up and down on the back bumper. If the car keeps rocking after you've hopped off, it's shock city. New-looking tires often turn out to be inexpensive recaps—you can tell if lettering on the sidewalls is ground down and the tread looks new. If tires show signs of wear, look for cups and patterns that might indicate front-end misalignment.

Start the car, of course, and listen closely for unusual noises—knocks, rattles, ticks. Rev the engine slowly at first while you listen, then goose it and check behind for whitish smoke. This indicates oil burning. Black smoke means merely a maladjusted carburetor.

Yes, many car lots do tape closing conversations between salesmen and buyers. Some eavesdrop electronically through hidden microphones in the office. But these tend to be the exceptions rather than the rules. In any case, your dealings with the dealer should be honest. A salesman can smell a cheat, just as he can a casual door slammer.

When the time comes for final terms, be sure to read the contract carefully. Ask for explanations of any clauses that don't make complete sense. Watch especially for "as-is" clauses.

An unbelievably low asking price means there's something strange about the car. Fleet cars, for example, easily rack up 70,000 miles a year, at which point they're often sold a year old as front-row specials. Today a fleet car doesn't necessarily have to be a stripped, beige Chevy sedan. Big fleet operators are just as likely to order Firebirds with air. Late-model fleet cars, despite high mileages, usually show superb care. Yet an older car in good condition but with fewer miles, makes a better deal.

If you're looking for just practical, inexpensive transportation, try private parties advertising orphan makes—Comets, Studebakers, Corvairs and the like. Private parties rarely detail their cars, so you can tell more about their true condition. But as with any other prospect, have the private vehicle checked professionally. (You may have more trouble getting a private party to let you do this than with a used-car lot.)

It should be clear by now that the diagnostic check becomes the most important single step you can take in buying a used car. Get it and you take 90 percent of the risk out of shopping. ★★★

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J/WAX Kit:
everything you'd expect
from Johnson Wax.



WHICH MIKES FOR WHAT JOBS?

(Continued from page 95)

speaker. Unless you're recording a symphony orchestra, you're not likely to be concerned with the subtle overtones and high-frequency harmonics that a speaker must reproduce. Most medium-quality dynamic mikes cut off at about 12,000 cycles—adequate for home recording and general entertainment. Professional studio mikes go on up to 15,000 or 20,000 cycles, but their cost zooms sharply, too.

The next thing to consider is a mike's pickup pattern. Basically, most mikes pick up sound almost equally well from all directions no matter which way they're pointed. These are called omnidirectional. But at times you don't want a mike to pick up everything around it so makers have devised a way of venting the case with tiny holes that cause sound waves from the rear to cancel themselves out. Such mikes pick up sound mainly from the front and are called unidirectional. Be-

Cardioid mikes cut down unwanted background noise . . . help eliminate feedback squeal

cause their pickup pattern is heart-shaped, they're also known as "cardioid" mikes.

Cardioid mikes are almost totally dead at the rear, giving them several advantages over omnidirectional types. They cut down unwanted background noise and, being sharply directional, make it easier to maintain the separation needed in stereo recording. They also help to eliminate the feedback squeal you often get when a mike picks up its own sound from a nearby speaker. For these reasons, cardioid mikes are generally considered simpler for amateur use, though they're somewhat more expensive than omnidirectionals.

Bidirectional mikes are still another breed. They pick up sound from the front and the back and are dead at the sides, having a figure-8 pattern. They're useful in certain special situations, such as for recording two people facing each other with the mike in between them.

Besides the dynamic microphone, there are several other types worth knowing about. The ribbon or velocity mike has long been used in professional broadcasting and recording because of its warm, round tone quality. It has good frequency response, extending to about 18,000 cycles, but is usually expensive and bidirectional in pattern. Also, its thin aluminum ribbon is highly fragile—a sudden gust of wind

or loud noise can wreck it. For this reason, a ribbon mike can't be used outdoors.

By contrast, the dynamic mike is probably the most rugged of electronic instruments. Some makers delight in startling prospective customers by banging one on a table or using it to drive nails.

Condenser mikes work on a different principle from dynamics. Their diaphragm is one of two plates that form a capacitor. The capacitor's value changes as the diaphragm moves back and forth, converting sound waves into fluctuating electrical currents. Condenser mikes offer superb performance and are used extensively in professional recording. Like ribbon mikes, they tend to be expensive. One exception is a line of moderate-priced Sony models ranging from about \$29 to \$99.

Communications mikes are a specialized type that usually have a pushbutton switch on the side. You press the switch to talk and release it to listen. Such mikes are used in Citizens Band radios, marine telephones and other two-way equipment. They are not suitable for home recording.

Some mikes come without connectors and you have to install your own to match your equipment. Most home recorders and amplifiers take simple phone plugs. These are easy to wire on, but have only two conductors, while there may be three or four wires coming from your mike. You have to follow the instructions carefully to make the right hookup. Some of the extra wires may be for alternate impedances or they may be part of what is known as a balanced line, one leg of which must be grounded.

Better-quality mikes have detachable cables easy to remove and replace if they become worn. Since the cable is one of the first things to go on a heavily used mike, this is a desirable feature.

One helpful accessory you may eventually want to consider is a mixer. This is an electronic control that lets you connect two or more mikes to a single input without distortion or loss of volume. It has individual volume controls so you can fade smoothly from one sound source to another for special effects. A mixer is especially useful if you plan to make your own sound tracks for movies or slide shows. While there are inexpensive models, the better units start at around \$70.

Some well-known makers of microphones and accessory equipment are Electro-Voice, Shure, Turner, Altec Lansing, University, RCA, AKG and Sony. Large mail-order supply houses like Allied Radio in Chicago, Radio Shack in Boston and Lafayette Radio in Syosset, N. Y., sell mikes under their own brand names and offer many models from other makers. ★★★

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Something New At Last?



MINI-MAGIC from GM is Chevy's fastback with all-new, four-cylinder, ohc engine

The '71 CARS

start rolling come August. First off the line will be two neat, new minis and a Hornet wagon with all the shifted-sheet-metal jobs following behind.

By ROBERT LUND, Detroit Automotive Editor / Art Concepts by ROGER METCALF

YOU'RE CRUISING ALONG at the limit the law allows and a two-ton Something shoots by. Stiletto prow, puce paint job, scrunched-up deck and a zillion taillights. The cosmetics are garish enough so you should be able to hang a name on it.

"What was it?" somebody asks. And you, the expert on cars, have to fake it and mumble, "Well, it looks like . . . maybe not . . . it could be." Stuttering and stalling for time, you attempt to catch a glimpse of the nameplate or an identifying doodad. But the Something has shot out of sight. So you beg off with the familiar excuse, "Who knows? They all look alike. You'd have to put 'em under a microscope to tell the difference."

You won't need as powerful a microscope to tell 'em apart next year. A small magnifying glass, maybe, because cars in the same family will continue to resemble each other. But you shouldn't have the problem of trying to sort out the makes, of distinguishing most GM products from most Fords, of spotting the difference between a Javelin and a Charger.

The way Detroit will bend the metal on the '71 cars isn't exactly what you'd

call a renaissance of originality. The departure from the mainstream school of styling won't be as pronounced as it was 20 years ago with the which-way-is-it-going Studebaker designed by Raymond Loewy, the Kaiser with the heart-shaped backlight, the gunboat Packard, the perky, neat-as-a-pin Ford. But there will be less cannibalizing from the competition on next year's cars and more of a spirit of going it alone. Not a revolution in shapes, but a step in the direction of greater individuality.



JAVELIN will be smaller, lower and a lot racier with its front-wheel-housing bulges and slick snout

You're going to see three or three-and-a-half expressions of what a car should look like. Now, hold it, right there. You notice we didn't say three brand-new, all-new, new-new bell-ringers unlike anything

you've ever seen before. Nobody is going to stray so far from the norm, the accepted, that they can't skitter back to the safety of

conformity if sales fall off. That would take a year, of course, and the turnaround couldn't be accomplished before the '72 cars.

The most visible innovators in styling this year will be GM and American Motors. And there's a puzzlement. How do you get three different themes in styling from two companies changing the lines of their cars? The explanation:

Ever since Mustang—that's going back six years—the car companies have been playing follow the leader on styling. Long hoods, stubby decks. Some of the imitations have been more subtle than others, but when you get down to the basic box, Mustang supplied the textbook silhouette. Ford has been as hypnotized by the shape as its rivals and has turned out car after car patterned after Mustang. The design has been a winner for Ford and the company will stick with it—with variations, of course—on its '71 cars. So you'll see an extension of the stretched-hood, compressed-deck idea on Ford's new cars:

Bill Mitchell, vice-president of styling for GM, doesn't find any glaring fault with the Mustang shape. But Mitchell and his crew of metal modelers snort flame every time they hear Ford credited with pacing the pack on styling. ("If this year's Thunderbird isn't a direct steal from last year's Pontiac," a GM stylist retaliates, "brother, you qualify for the tin cup and cane.") Mitchell decided three years ago to take a new tack in styling. The new shape he has decreed for GM cars consists of a sharper sloping of



HORNET SPORT WAGON will be welcome to meet the need for a small, sensible, domestic station wagon

the hood, lengthening the aft end of the car (but not so it socks you in the eye) and what might be termed a hybrid line—a blend of fastback and bustleback—leading from the roof to the rear.

Some of the most refreshing ideas in car shapes are coming from the other side of town, the biggest little auto company in the world, American Motors. This is an about-face for AMC. For years the company has been wringing its corporate hands and whining that, as the player with the smallest stack of chips, it couldn't afford to buck GM and Ford on styling. That's changed. AMC is getting gutsier and gutsier. One example, Gremlin, is already on the road. The next salvo will be the '71 Javelin, which will be squeezed down in both length and height. Even more noticeable, the front-wheel housings will bulge up and out from the fender line, coming up almost as high as the curve over the rear wheels.

Except for its intermediate-size cars, Chrysler will stay with the styling it has now for '71. This has been a lean year for Chrysler, and the company is keeping a tight rubber band on the bankroll in spending on new models. But the clamp on the styling budget doesn't apply to Dodge Coronet and Plymouth Belvedere.

The company is spending fairly lavishly on these cars, particularly in reworking the front ends. The hoods will be long, broad and as smooth as the dining room table. Throw a tablecloth over it and you could seat eight.

That's the big picture. Ford will stay with modifications of the long-hood, short-deck look. GM will counter with more metal and a different shape in the rear of its cars. American Motors will begin to break with the tradition of trailing at the heels of GM and Ford. Chrysler will hold to its conservative, middle-of-the-road course except for its midsize cars.

There will also be the usual warming over and reworking of the familiar.

Putting on a new necktie in the hope of detracting from the worn shine on the seat of the pants. But that's true every model year. Sixty to 70 per cent of the "new" cars in any model year are new only to the extent that last year's mistakes have been corrected or the lines of the grille run this way instead of that way.

To sort out the grille changes from the meaningful changes on the '71s, you almost have to cull the cars into cate-



COUGAR gets a front-end treatment that has more of the purr of luxury than the growl of sportiness



MUSTANG HARDTOP gets a roofline that smacks of mid-engine designs. Roofline of fastback will be almost horizontal!

gories—minis, intermediates, standards, sports jobs. The problem with trying to call them off alphabetically—A for Ambassador, B for Buick, C for Cougar and down the list—is that you come up with more “Unchanged from last year” entries than points of difference and items of interest. Aside from making dull reading, that approach also distresses the auto company that has invested a whole \$16 in honest-injun changes and would like you to believe they’ve made the biggest break from the ordinary since the switch from tiller to steering wheel. So here they are, by categories:

MINIS: These will be the newest of the new in '71. Gremlin will stay as is. (See what we mean by “Unchanged from last year?”) The next small one out of Detroit will be a Chevrolet. It will come in three two-door versions—sedan, fastback and wagon. (Later, a panel truck.) It will be on a 97-inch wheelbase (vs. 94.5 for VW), 169 inches overall (against 158.6 for VW) and 65 inches wide (VW is 61). A little later, Ford will introduce the Pinto—which is the name the company will be running with. It will be on a 94-inch wheelbase, 162.5 inches long and 69.1 inches wide. Both the Chevy and the Ford will be powered by new four-cylinder engines. Chrysler’s small car won’t be out for at least a year, possibly not until September, 1971.

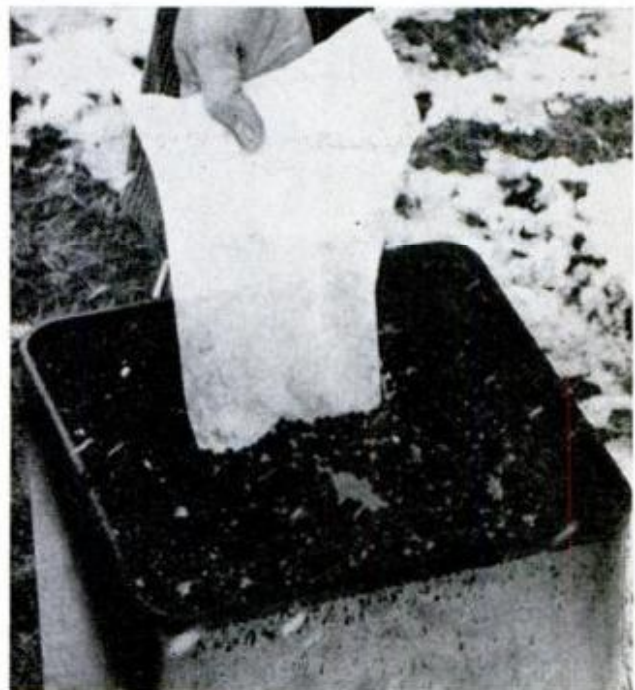
COMPACTS: Hornet will add a two-door wagon. We’ve seen a mock-up of this one and it’s a substantial, roomy vehicle. We wouldn’t swear to it, but the preliminary version we saw appeared to be lower than any other U.S. wagon. Maverick will add two new body styles in '71—a four-door and a deluxe GT version with air scoops on the hood and a V8. Maverick will be noticeably longer and have more interior room than the present car. Ford is also doing a “make” off Maverick, involving a reworking of the rear, that will be sold under the Mercury nameplate.

PERSONAL CARS: Despite what we said about Ford remaining true-blue to the Mustang look that started the trend to long hoods and short decks, Mustang will undergo the biggest single-year change since Car One. And that applies to its cousin-under-the-metal, Cougar. Rear quarter panels will be much higher, giving the car a high-hips appearance back of the C pillar. The fastback roof option will be fastbacked even more, so much so that you almost have to lie down, eyes on the ceiling, to see out the rear window.

The big eye-catchers out of the GM garage will be the high-ticket personal cars produced by Buick, Cadillac and Olds—Riviera, Eldorado and Toronado,
(Please turn to page 70b)



FORD PINTO has high-revving style with engine to match. Overhead-cam four will be coupled to an all-synchro four-speed box



Glass beads for oil spills

Cellulated glass beads a quarter inch in diameter may be the answer to oil spills at sea, according to Pittsburgh Corning Corp., the manufacturer. In a demonstration, oil is spilled in water (upper left) and then the SeaBead nodules are added (upper right). The beads, light enough to float, become covered with oil, which can be set afire (lower left). Capillary action continues to feed oil to the fire until all the oil is gone—as demonstrated by paper dipped in water (lower right).



No-hands umbrella

Anyone who has to work in the rain—this photographer, for example—would find Ralph Hall's "All-Brella" a handy substitute for a third hand to hold an umbrella. The umbrella is held in a socket on the back of a harness the user wears (inset).

How to Carve a Mountain

By JAMES M. LISTON, Executive Editor

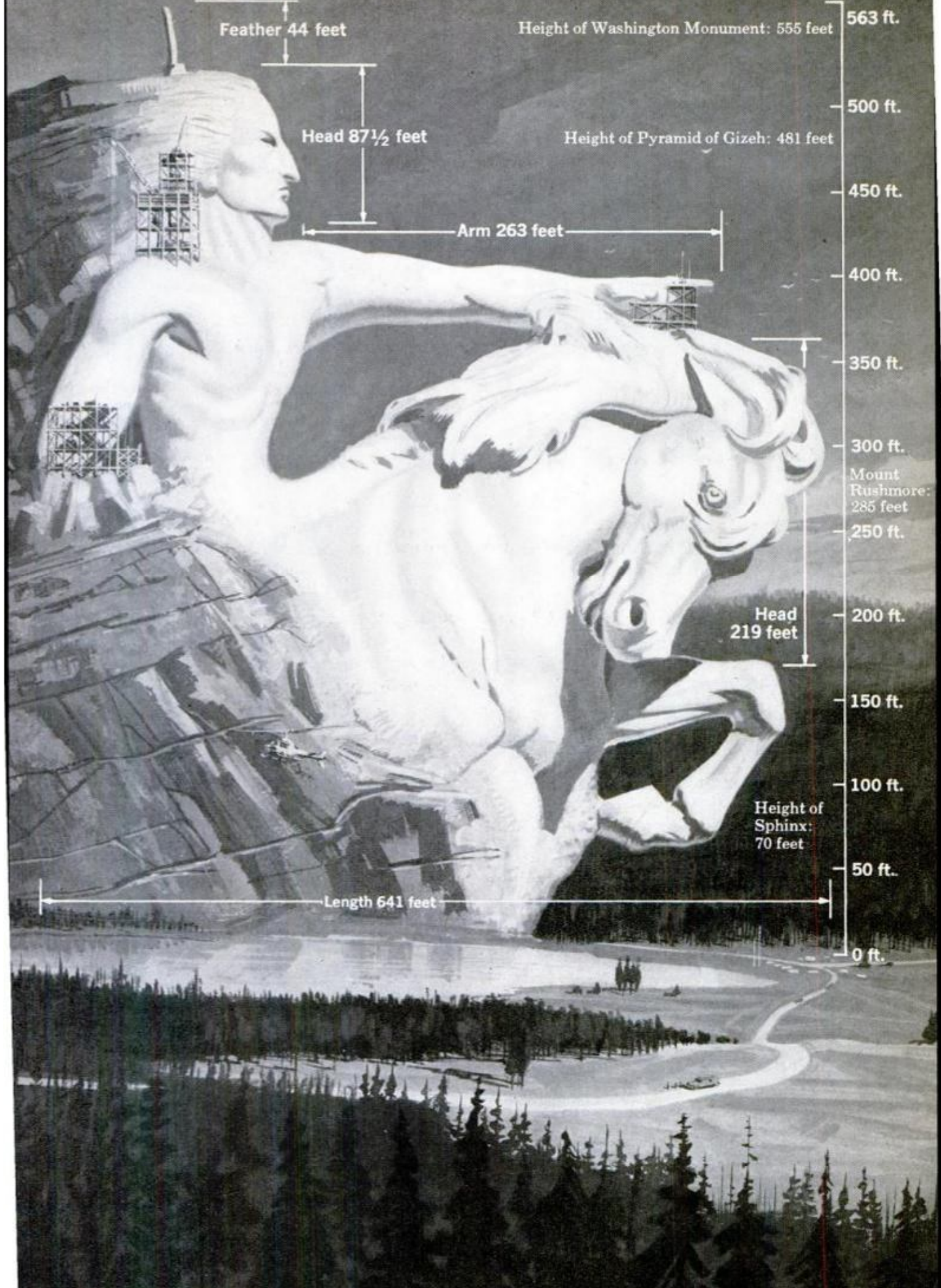
THE HEROIC SIZE of the Indian astride his war pony staggers the imagination. Shown here as it will appear if completed on schedule in 1979, the mountain memorial to Sioux Chief Crazy Horse, who defeated General Custer in the Battle of the Little Big Horn, will be taller than the Washington Monument—four Rushmores would fit on it—and bigger than the largest Egyptian pyramid. It may become the eighth wonder of the world and certainly the most enduring. The granite from which it is being carved will last some 50,000 years.

To most tourists, South Dakota is best known for the faces of the four presidents at Mount Rushmore. Yet only 20 minutes away over the Hearst Highway near Custer you

(Text continues on page 78)

CHIEF CRAZY HORSE, pointing to the lands of his people, will be the focal point of the complete project—an Indian cultural center consisting of a university, medical school and museum where Indian traditions and crafts will be preserved. Sculptor Korczak Ziolkowski hopes that through admissions and contributions the mountain carving will create and maintain the center as a gift to the North American Indian, "a people who have given us so much." To insure that the center will not be forgotten—and the memorial become nothing more than a tourist attraction—Ziolkowski has transferred ownership to a private foundation.





Feather 44 feet

Height of Washington Monument: 555 feet

563 ft.

Head 87 1/2 feet

Height of Pyramid of Gizeh: 481 feet

500 ft.

Arm 263 feet

450 ft.

400 ft.

350 ft.

300 ft.

Mount Rushmore: 285 feet

250 ft.

Head 219 feet

200 ft.

150 ft.

Height of Sphinx: 70 feet

100 ft.

50 ft.

Length 641 feet

0 ft.

Illustration by Ed Valigursky



DRILLING PROGRESS: In the early '50s, Ziolkowski and a hired man were "leaning" on 115-p.s.i. jackhammers (left) to average 40 feet a day. Twelve years later, he hauled a wagon drill up the mountain and boosted rate to 200 feet a day. Sculptor's sons now operate self-propelled Air-Trac rig (right) at rate of a foot a minute

can see Crazy Horse being carved in the round—in three dimensions; Rushmore's figures are in bold relief—and witness history being made. Last year 300,000 visited Crazy Horse Memorial.

The sheer magnitude of the job is exceeded only by the daring of the man who chose to gamble the best years of his life and his enormous talent against the possibility of creating a lasting monument to his own failure. Korczak Ziolkowski ("Core-shock Jewel-cuff-ski"), sculptor and—more aptly at this stage—engineer, has been battling the mountain for 22 years. Now 61, he would like to live to 70 to complete it.

You have to know the man to believe it's possible. I've known Korczak most of those 22 years. Back in 1953 he had two jackhammers going; I tried my hand at one and was convinced that no one could drill 150,000 holes 20-30 feet deep that way in 30 years. He described in detail the kind of big equipment he'd need and it was little wonder that his neighbors in the Hills called him a dreamer. One thing kept me from joining the skeptics: Nothing awed this super do-it-yourself man, whether it was building a house, moving a 13-ton compressor, handling high voltage wires, or delivering his own child. If it could be done, he'd do it.

Ziolkowski has removed 2,560,000

tons of rock, seven times more than was removed from Rushmore. It took Gutzon Borglum, with a crew of 20 and \$989,992 of federal and private funds, 14 years to complete Rushmore. Except for an occasional helper, and recently with the help of his five sons (aged 10 to 22), Korczak has done it pretty much alone. He has spent more than \$1 million for dynamite and equipment—all of it from \$2-a-car admissions and private contributions. The biggest job remains; he must remove another 3.5 million tons—and he aims to do it by the end of this decade

Ziolkowski, a self-taught sculptor (he's never had an art lesson) whose bust of Polish premier-pianist Ignace

TUNNEL under Indian's arm is 182 feet long, 14 feet high. Eventually, it will be a 106-foot-high gap





BIGGEST PIECE OF EQUIPMENT is new 40-ton crawler tractor with Gardner-Denver Rota-Screw portable compressor mounted on the rear, boom and drills mounted in front. Drilling is done from the driver's seat

Jan Paderewski won First Sculptural Award at the 1939 New York World's Fair, worked for a brief time on Mount Rushmore as an assistant to Borglum. Aware of this, the Sioux Chief Henry Standing Bear asked Ziolkowski in 1939 to carve a mountain memorial—"So the white man may know that the red man had great heroes, too." The Indians had nothing except unanimous agreement that the subject be Crazy Horse and the place be the Black Hills, their "sacred burial grounds."

After World War II, Korczak bought a ranch at the foot of the mountain, a cow he didn't know how to milk, and built his studio-home of 70-foot logs he felled with an ax. He had everything he

needed—except money, equipment and manpower. He was 39, 6-foot 3, 212 pounds, and nothing could stop him. He regarded the Sioux's request as a sacred trust and he started alone.

Carving a mountain is sculpturing on a heroic scale. You need a big hammer and chisel. Dynamite is the hammer, air compressors the muscle behind it, and rock drills used for mining are the chisels. The rock that's "chipped" off—250 to 500 tons with each blast—must be pushed off the side of the mountain. That takes a big bulldozer (to move boulders half the size of a car) and two smaller "cats" and a front-end loader for working in

(Please turn to page 192)

SCULPTOR KORCZAK ZIOLKOWSKI rests on bulldozer, which at this stage of job is one of his "chisels"

PROGRESS is "mucking" blasted rock off the mountain with a big "cat" after years of doing it by hand



AIR SPEED: 375 KNOTS

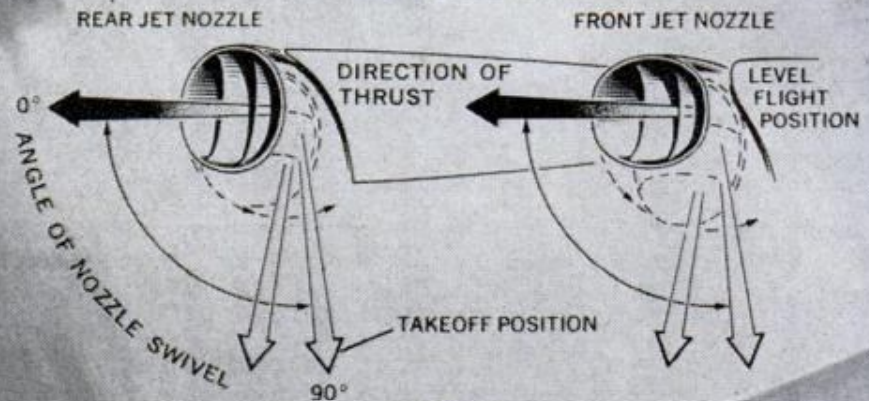
NOZZLES AT 0°

The Plane

AIR SPEED: 120 KNOTS

NOZZLES ROTATED TO 98°

Nozzle Vector System



NOZZLES RESET TO 65°

AIR SPEED: 80 KNOTS

ROLL REACTION NOZZLE

OUTRIGGER LANDING GEAR

HF AERIAL

VHF AERIAL

SECURITY FORCES

Art Concept by Fred L. Wolff and Roy Grinnell

R. Grinnell

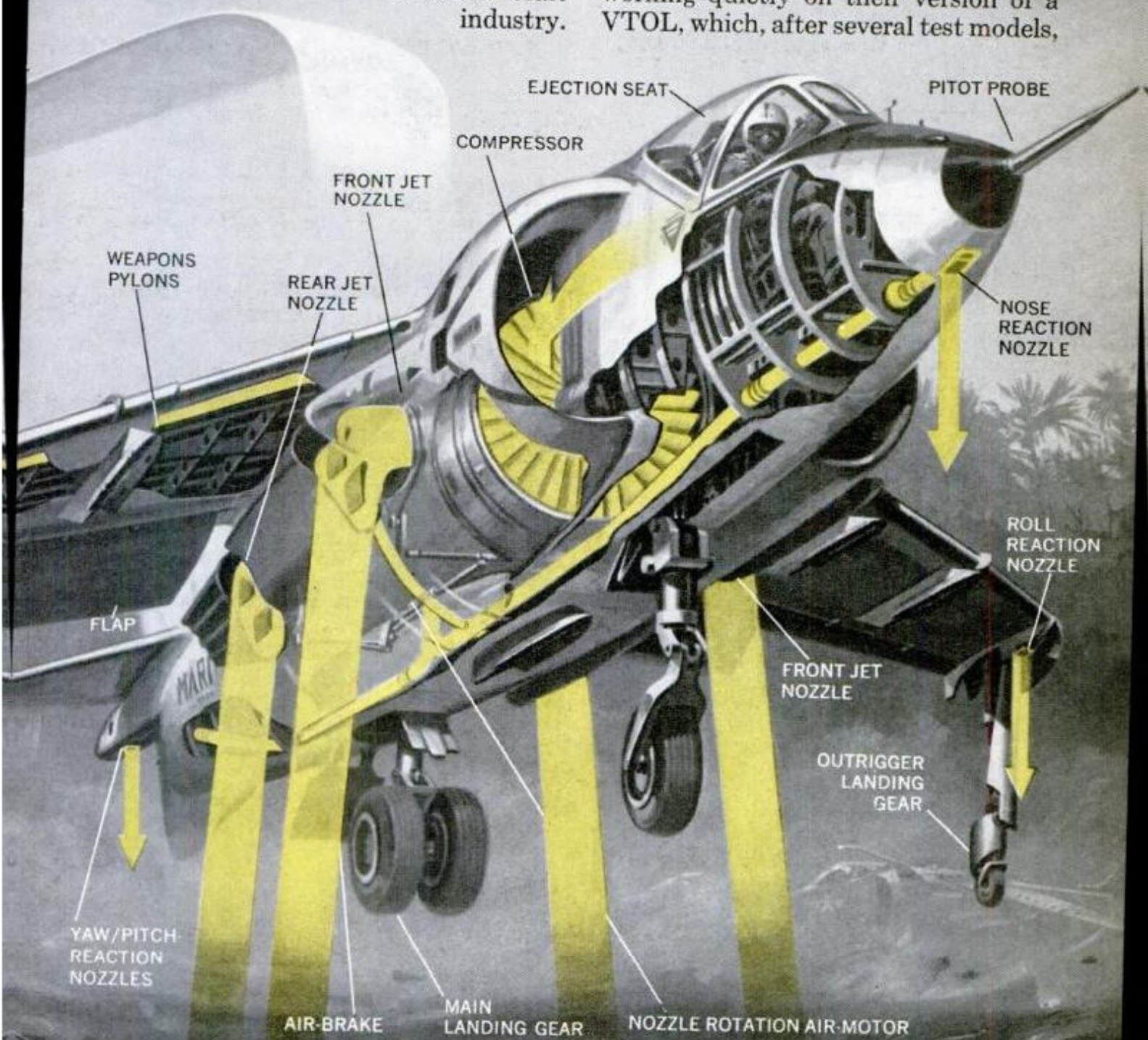
The British-built Harrier can take off or land on a site no larger than a tennis court; it has all the advantages of a chopper and none of the drawbacks That Makes Airfields Obsolete

By KEVIN BROWN

A HIGH-SPEED PLANE that can take off and land vertically without need for long runways—or even an airfield—has long eluded the best efforts of the aircraft industry.

American attempts to develop STOL (Short Takeoff or Landing) and VTOL (Vertical Takeoff or Landing) planes have been spectacularly unsuccessful.

Meanwhile, the British have been working quietly on their version of a VTOL, which, after several test models,



finally has emerged as the Hawker Siddeley Harrier. And the utter simplicity of the aircraft, which is now in operation with the Royal Air Force, makes one wonder what U.S. aeronautical experts could have been thinking of with their Rube Goldberg arrangements.

Unlike the American machines, the Harrier uses no tilting engines, no tilting wings and hardly any extra hardware to achieve both vertical and horizontal flight.

The plane has a single engine nestled inside the fuselage where it belongs. It has normal intakes, but no tailpipe. Air is discharged through four nozzles in the sides of the fuselage, placed so they bracket the plane's center of gravity for greater stability. The nozzles are adjustable to direct the air horizontally or vertically, or anywhere in between, just the way the flow from an air conditioner is changed by moving the air vanes.

As simple as the system is, it would have been wasted if it had made the pilot's job more complicated. Few fixed-wing pilots like flying helicopters. "You have to learn how to rub your stomach and pat your head at the same time," is the complaint.

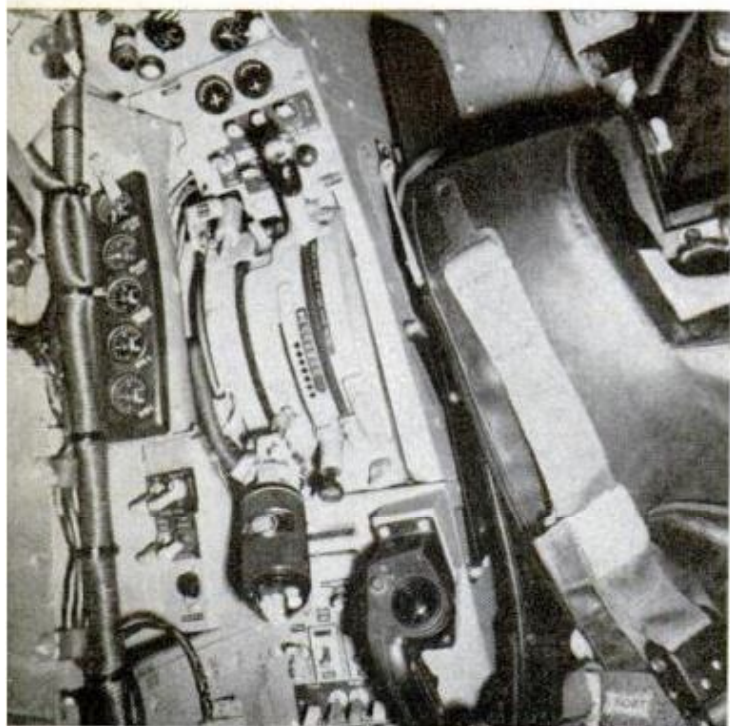
Not so in the Harrier. It's an airplane and flies like one. The pilot has just one extra handle to worry about. It controls

the position of the nozzles: full forward for horizontal flight, full back (about 98°) for reverse thrust, 80° for vertical flight, anything less than 80° for STOL.

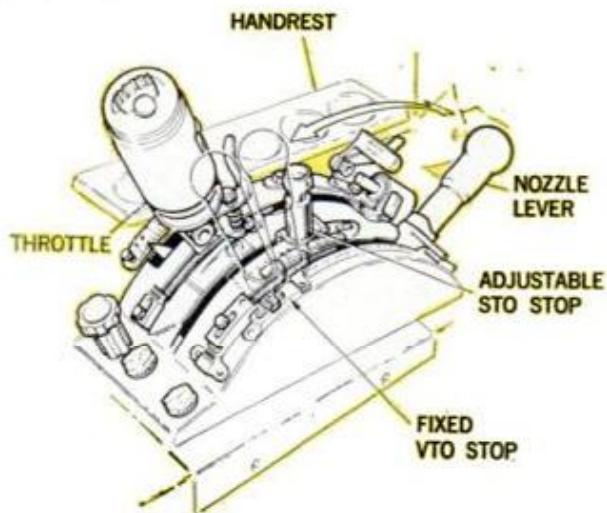
The Harrier concept was developed in Britain in the 1950s, largely in response to a NATO (North Atlantic Treaty Organization) need for a fighter that would combine vertical and short takeoff and landing capabilities (V/STOL, as Hawker Siddeley designates the plane). Later, America and West Germany cooperated with the British in an evaluation of the aircraft. In 1964 America acquired six of the developmental models, and about two years ago the Marines put in an order for operational versions. The Marines hope eventually to equip several squadrons with V/STOL Harriers and already have detailed plans on how to use them.

The advantages of a plane like the Harrier are many. It does not need an airfield. Instead, Harriers can be dispersed, individually, to remote sites no larger than a tennis court. This makes each Harrier less of a target and more of a threat. These planes can be concealed close to the area of action and thus can reach targets much faster than conventional jets that require the two-mile-long runways far behind the lines.

Conventional jets can be knocked out



FOR VERTICAL FLIGHT, nozzle lever is pulled from forward position (drawing) to VTO stop at 80° . Main controls (photo) are close to the pilot's left hand



in mass attacks, as Israeli pilots demonstrated during the 1967 Israeli-Arab war when they destroyed nearly 400 planes parked on Arab airfields.

The Marines envision three classes of combat bases for the V/STOLs. The first would have a minimum of 2200 feet of runway anywhere from 25 to 200 miles behind the lines, and would have major maintenance capabilities.

The second class would have 700 feet of runway and only provide minor maintenance. The third would be just a patch of ground in the boondocks, an alert pad close to the lines. Obviously only Harriers could use it.

The Marines, being part of the Navy, could also operate from carriers, using them as first-class bases; or, possibly, even from smaller ships that now only handle helicopters.

The Marines, of course, are delighted to be getting this versatile new weapon, and many military men are predicting a new era in front-line aerial warfare. Most enthusiastic of all are the pilots who have gone to England as liaison men and flown the Harrier.

One of these pilots, Navy Cmdr. Robert Thomas, has described what it's like to fly this new plane. For conventional takeoffs and landings, from a standard runway, the Harrier operates like a conventional jet.

"Put the nozzle control all the way forward at zero degrees and leave it there, and take off as you would with any jet aircraft," Cmdr. Thomas explains. "You're airborne within 4000 feet at about 180 knots airspeed. About one and a half miles out, I was doing 475 knots."

Conventional landings are just that, except for one thing: The nozzle control can be pulled back to 98° after touchdown, and the reverse thrust will help brake the aircraft.

For STOL operations, anything less than 80° can be used, because you begin getting forward thrust below this setting. The nozzle control has a lock that can be preset before takeoff, say at 65°. Since the nozzles are always horizontal,

or at 0° during engine warmup and taxi operations (to keep the blast of air from tearing up the ground and blowing debris into the engine), the pilot just pulls the control back to the lock stop.

Cmdr. Thomas: "After you've done your instrument checks, and set the lock, you release the brakes and run the engine up to full power. After it's reached a predetermined speed—and you'll be rolling down the runway by then—rotate the nozzles with a very positive pull on the nozzle control. You'll be airborne instantly. Then get up the gear, and go back to the nozzle control, moving it slowly forward, feeling your way until your rate of climb and your forward speed are where you want them."

Hawker Siddeley notes that one of

... 'rotate the nozzles with a very positive pull ... You'll be airborne instantly.'

the advantages of STOL operations over VTOL is an increase in load capacity, explaining that for every foot of forward roll you can add one gallon of fuel or its equivalent in ordnance, because you're adding lift from the wings to thrust from the nozzles.

For STOL landing: "Come in at 500 feet and 375 knots about 5000 feet off the end of the strip. Rotate the nozzles to 98°—don't baby it—and, as you begin decelerating through 120 knots, reset the nozzles to 65°. You'll continue slowing, and at about 1000 feet short and 200 feet altitude you should be doing around 80 knots. Moderate the power setting to control the remainder of the descent."

For vertical takeoffs: "After the usual checks, rotate the nozzles to 80°, then pour on power to 100 percent. You'll leap off the ground right now and you'll have to reduce power almost immediately because the rate of climb would be excessive. Tilt the nose forward, you'll start moving forward. When airspeed is

(Please turn to page 70b)



Horse racing on rubber

The surface of the Roosevelt Raceway track in New York will be the same the year around, no matter what the weather. It's covered with synthetic rubber sheeting that doesn't absorb water and is impervious to temperature changes. The new surface is made of 1800 sheets of Dupont's Nordel. Each sheet is 4 feet wide, 40 feet long and weighs 800 pounds.



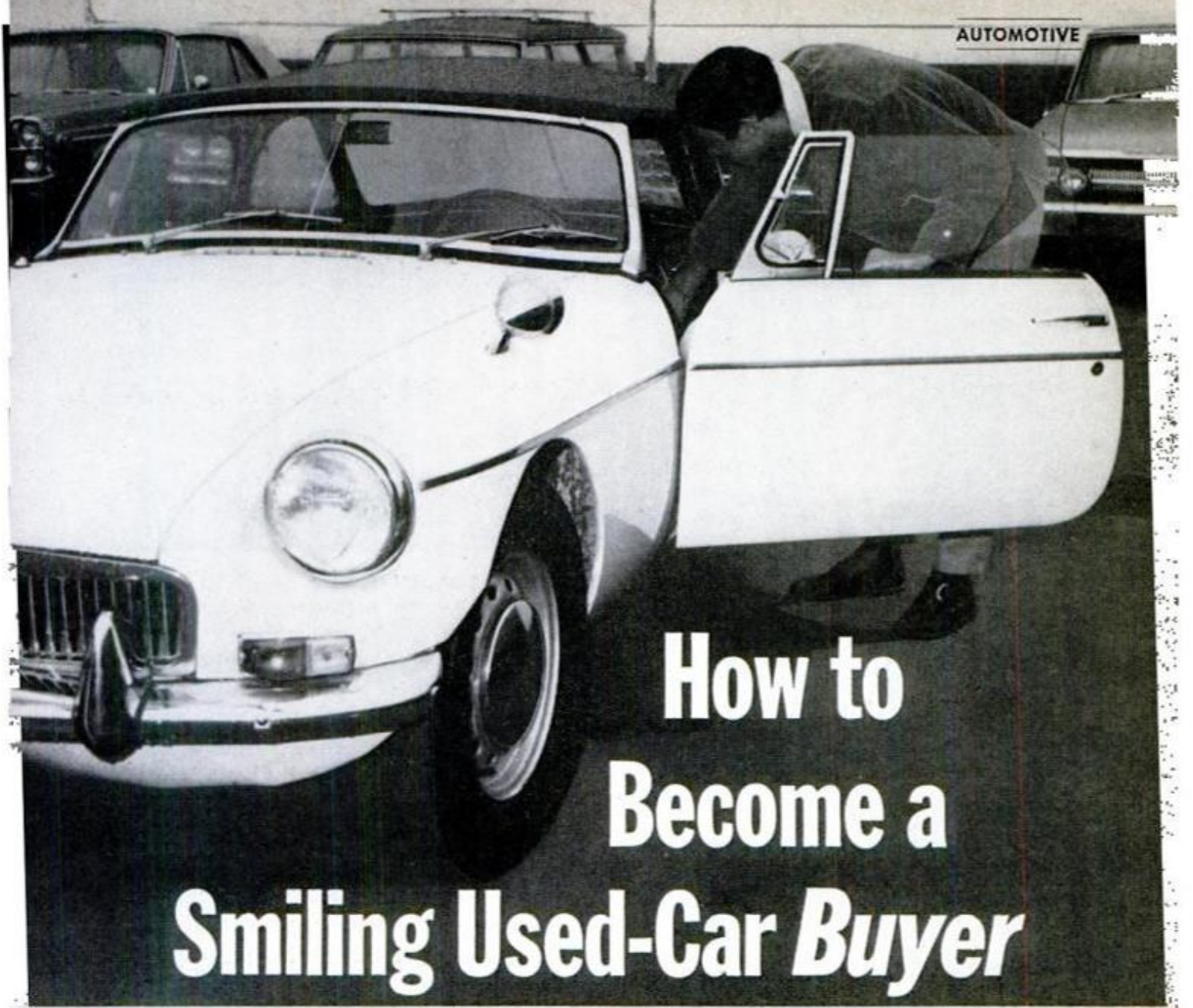
Russian snow-and-water sled

The "Amphibian Aero-Sleigh" is a Russian-built combination boat and snow vehicle that's designed to travel over water, swamp, snow or short distances of dry land. The five-passenger machine has a 250-hp engine and will go 50 mph on water and 80 on snow. The propeller is fitted with a slotted flap eliminating the need for a variable-pitch mechanism.



Rubber-lined reservoir

Nearly 11½ billion gallons of water will be held by the rubber-lined Kualapuu Reservoir on Molokai Island when it's filled in a few years. In the top photo, workmen seal the seams of the nylon-reinforced butyl rubber lining. (Sandbags secure the lining against the constant winds.) The lower photo shows the first water flowing into the reservoir.



How to Become a Smiling Used-Car Buyer

You too, Watson, can outwit an enthusiastic salesman with a little bit of detective work

By MICHAEL LAMM, West Coast Auto Editor

BUYING A USED CAR TODAY isn't nearly so chancy as it was the last time you bought one. Two new developments have changed all that.

One is that auto diagnostic centers have sprung up around the country. That means that now, before you buy a used car, you merely drive it from the lot to a diagnostic center. An hour later you know the truth about the car and the dealer.

Second, during 1969 the swing to small cars continued. This put new cars into the traditional prime used-car price range—\$1700 to \$2500. The

upshot is that you get more selection and bargaining power in used cars all down the line.

The tough choice today is whether to go new or used. Do you want a new Gremlin, Maverick, Toyota, Hornet, Datsun, or VW—or a used Cougar, Polara, AMX, or Town and Country?

Your first task as a car buyer is to determine your needs:

- *Who will drive the car most? And on what sort of trips?* If you're a commuter who drives mostly alone, puts lots of short-trip miles on a car and leaves it parked most of the time,



ENTHUSIASTIC SALESMAN will tell you a lot about a used car, but the real detective work is your job

you'll probably want something small and economical. If it's a second car for your wife, perhaps her first thought is to buy that same small, economical, cute job. But consider that, in shopping, she'll often end up carrying big, bulky items. She'll also likely ferry kids, pets, trees and friends. So you might be better off making *her* car the primary family bus—say a wagon—and buying yourself that small sportster or ponycar for commuting. The important thing in a multicar family is to make all cars mesh, not only in size and purpose but also their ages (so you don't have to trade them simultaneously).

● *How many miles do you drive a year, and how long will you keep the car?* The average driver racks up roughly 15,000 miles a year. That means a two-year-old used car should show 30,000 miles and still be good for 70,000, or 4½ years of service. By buying a big, loaded two-year-old car instead of a small, Spartan one, you save roughly half the used car's original price. Also depreciation will be much less during your ownership.

Study the table (page 89) for de-

BALDY AND RETREAD stick out like sore tires. The recap tire shows scuffed, worn sidewall lettering

POPULAR MECHANICS



PAINT OVERSPRAY can usually be detected around doors, on ID tags. Repaint job may hide a rust-out





LOOK UNDER MATS for signs of leaks and rust out. Water spots under this one indicate a leaky trunk

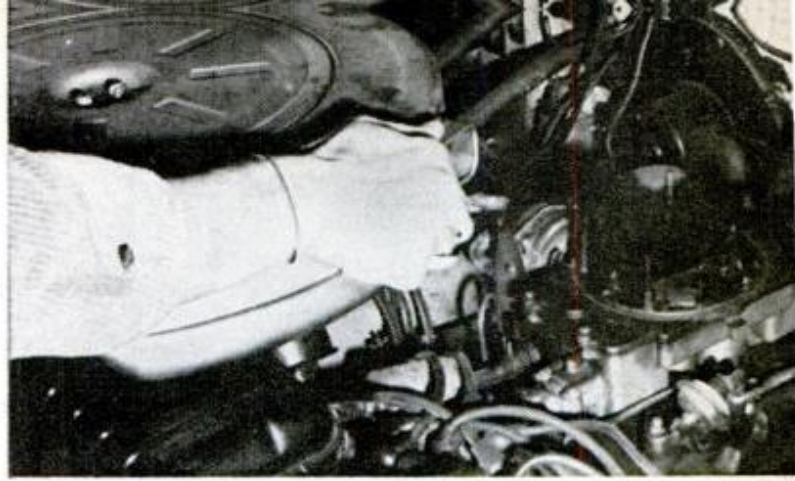
preciation patterns. These patterns tend to be relatively stable, meaning a car that holds its resale today will probably still be worth more when you're ready to sell again. One mistake some people make, though, is to base their calculations on depreciation percentages rather than dollar amounts. True, a Cadillac's depreciation percentage is less than most cars', but in real dollars, a Cad's depreciation is still very steep. The car with the lowest traditional depreciation rate, both in percentage and dollars, is the VW beetle.

● *Also ask yourself, of course, how much you can spend.* This seems self-evident, but people rarely think it through. Don't finance unless you have to—pay cash. If you must finance, don't let the dealer talk payments only. Find out the interest rate, length of contract and the total dollar amount of interest.

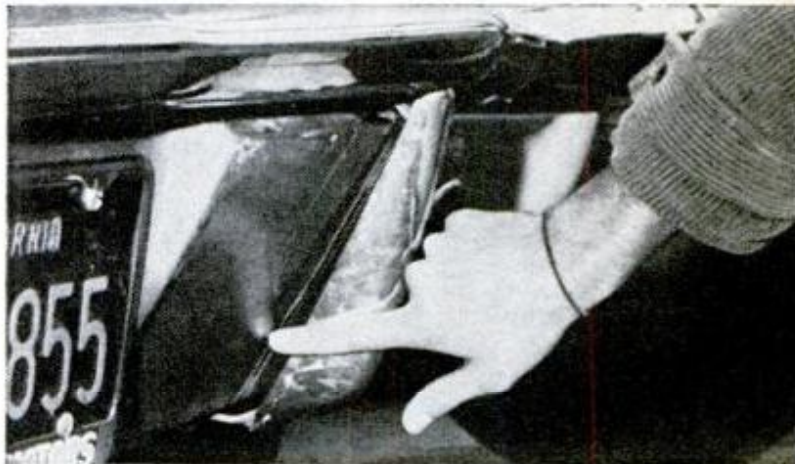
Shop for financing as you do for the car itself. It's usually easiest but most expensive to let the dealer take care of all financing details. Look for potential lenders in this order: a) life insurance, b) credit union, c) local bank, d) savings and loan, e) the dealer's arrangement. Be sure you borrow at simple, not discount, interest. Discount runs roughly twice as much at the same named rate. The shorter the term of contract, the more each payment will be but the less you'll pay in

RAISED DASH PADDING raises question of how it got that way—from being hit hard in an accident?

JUNE 1970



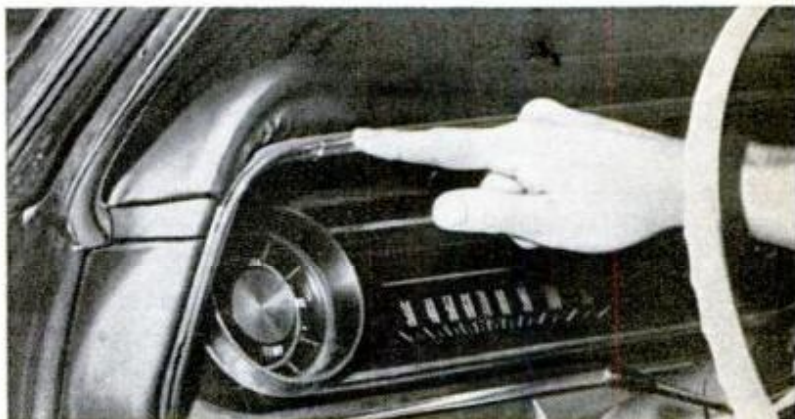
DIRTY CARB under air cleaner was missed in recent steam cleaning, a clue to poorly maintained car

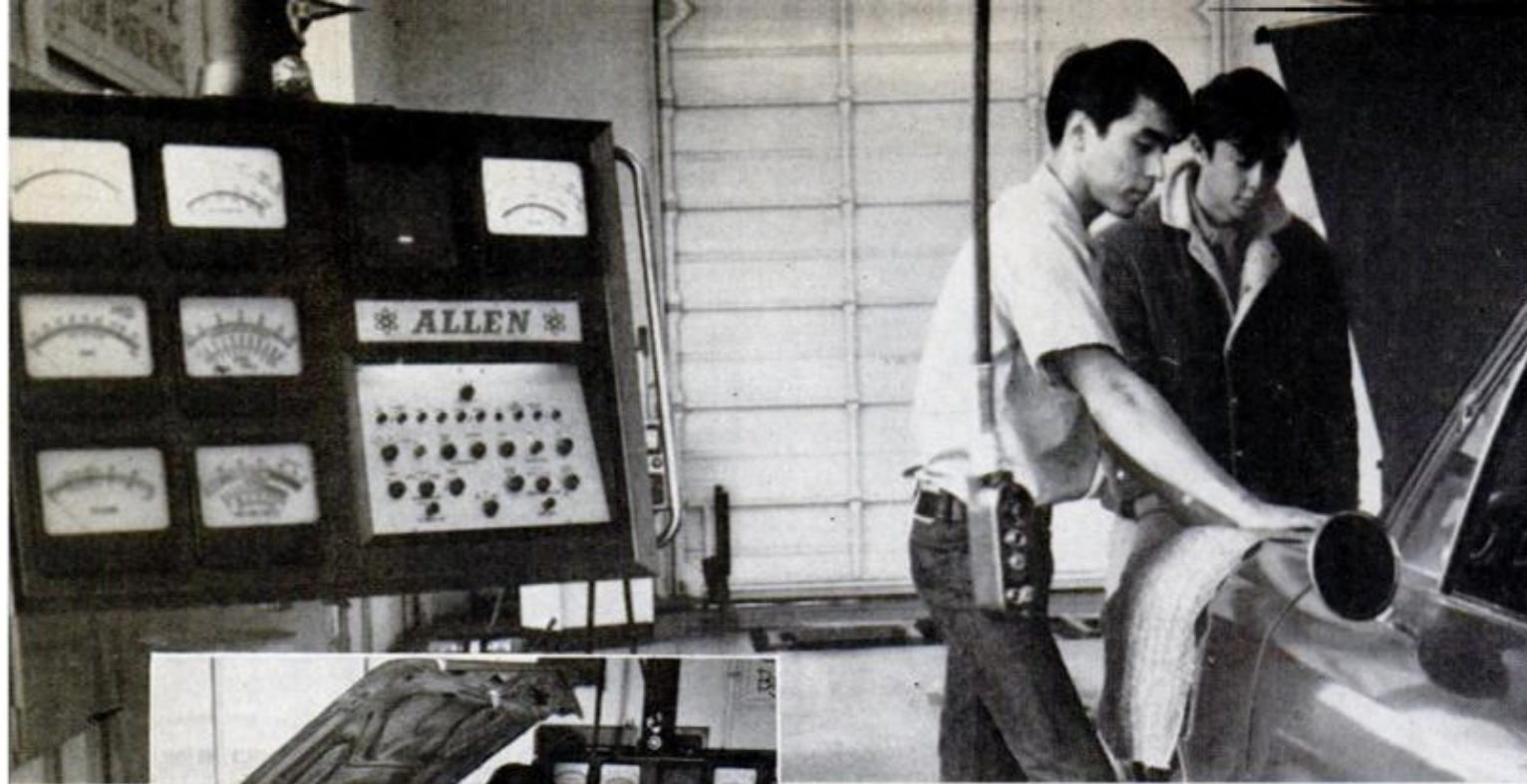


GAP BETWEEN BUMPER GUARD and pan is clue that much sheet metal is new; this car had frame damage



RUBBER WEAR on pedals and the hole in tunnel carpeting indicate dubious 33,000 miles on odometer





DIAGNOSTIC CENTER is the best place to visit for quick, relatively inexpensive used-car evaluation

make appointments with the dealer and the diagnostic center beforehand.

A diagnostic check usually costs between \$6 and \$13. Once you have the diagnostic report in hand, you might be tempted to use it for bargaining. Be careful, though. If you decide to haggle over a defect, go easy. It's probably better just to haggle in general terms. Fewer hurt feelings that way. You can normally expect to get 10 percent to 18 percent knocked off the sticker price of a good used car. The salesman will often come down 5 percent without your uttering a word. But the idea is to shop for a good car, not just a "good deal." Good deals most often turn out not to be.

If you believe there's no diagnostic center near you, you probably haven't really looked hard enough. Most new-car dealers now have banks of testing equipment in their service departments. Be sure you don't take the car to the same dealer who runs the lot, though. Sears, Penney's, many major chain tire stores, and some independent garages also have all the electronic test gear you could want.

But if you still can't find a diagnostic center, take the car to an established,

(Please turn to page 70d)

total interest. On \$1000 borrowed at 8 percent simple interest for 12 months, you'll pay \$44 in interest; for 36 months, you'll pay \$148. At 8 percent *discount*, net interest totals would be \$80 and \$240 respectively.

What's the guarantee?

Many people shy away from used cars because they get no guarantee. Or if you do, it's pretty weak and pitiful.

As mentioned, today's best used-car warranty comes by taking any car you're serious about buying to a diagnostic center. Ask for the dealer's permission straight out. Never play games. Most dealers will gladly give it. If one won't, forget the car. It helps to

CURRENT USED-CAR PRICES

Source: N.A.D.A. Official Used Car Guide, Midwest Edition. Prices are for 4-door sedans with V8 and automatic transmission unless otherwise noted. Charts reflect average on-the-lot prices as of mid-March, 1970. However, prices vary in different areas. Highest used-car prices are found in Pacific Northwest; lowest in Central Plains states. Midwest prices (given) are average; to check more precise figures for your area, use calculator →

PRICE-AREA CALCULATOR

If used car costs \$1000 in Midwest, other areas will rank as follows:

Central	\$ 960
East Coast . . .	977
New England . .	982
Deep South, Southwest . . .	998
Pacific S.W. . .	1035
Mountain States	1037
Pacific N.W. . .	1049

	1970	1969	1968	1967	1966	1965	1964	1963	1962
PONYCARS: 2dr. basic V8, auto. trans.									
AMX	\$3395	2705	2200	---	---	---	---	---	---
BARRACUDA	3164	2070	1775	1500	1150	875	650	---	---
CAMARO	2974	2325	1910	1630	---	---	---	---	---
CORVAIR MONZA	---	1650	1350	1060	750	700	405	250	150
CORVETTE	4871	4070	3605	3100	2550	2100	1905	1500	1210
COUGAR	3114	2450	2045	1700	---	---	---	---	---
FIREBIRD 400	3138	2480	2075	1750	---	---	---	---	---
JAVELIN	2948	2245	1825	---	---	---	---	---	---
MUSTANG	3073	2270	1935	1605	1280	1005	---	---	---
COMPACTS: 4dr. Six, std. trans.									
CORVAIR 500§	---	1420	1185	850	645	525	235	205	105
DART Custom	2650	1775	1400	1105	835	695	475	205	190
FALCON	2438	1605	1355	1090	800	685	440	350	235
AMC HORNET, nee American	2072	1630	1250	935	705	550	320	200	170
NOVA, nee Chevy II	2443	1805	1470	1205	975	795	520	370	205
VALIANT V-100	2250	1775	1365	1110	840	640	440	335	235
INTERMEDIATES: 4dr. basic V8, auto. trans.									
AMC REBEL, nee Classic 770	2921	1930	1650	1250	980	800	595	350	250
BELVEDERE SATELLITE	3037	2020	1730	1235 ²	945 ²	785 ²	---	---	---
BUICK SKYLARK, nee Special Dix.	3155	1995	1680	1440	1100	940	670	480	380
CHEVELLE MALIBU	2949	2020	1775	1455	1215	990	755	---	---
CORONET 440	3091	1955	1675	1375	1070	835	---	---	---
MONTEGO, nee Comet	2736	2045	1685	1320 ³	1010 ³	845 ³	655 ³	450 ⁴	205 ⁴
OLDS CUTLASS, nee F-85	2945	2095	1655	1395	1235	850 ⁵	675 ⁵	485 ⁵	390 ⁵
TEMPEST LE MANS	3077 [†]	2375 [†]	1960 [†]	1525 [†]	1280 [†]	1065	790 [†]	490 [†]	320 [†]
TORINO, nee Fairlane 500	2980	2045	1705	1325	1080	830	665	355	205
FULL-SIZED: 4dr. basic V8, auto. trans.									
AMC AMBASSADOR	3588	2395	2000	1350	1030	900	660	480	260
BUICK LE SABRE	3337	2360	1940	1505	1205	940	670	510	320
CHECKER MARATHON	3745	2400	1710	1480	1110	820	605	340	---
CHEVROLET IMPALA	3203 [‡]	2095	1720	1400	1170	940	750	550	475
CHRYSLER NEWPORT	3514	2490	1905	1580	1200	875	600	460	275
DODGE MONACO	3604	2350	1875	1500	1305	1100 [†]	---	---	---
FORD GALAXIE	3026	2060	1650	1390	1110	825	635	345	320
MERCURY MONTEREY	3248	2020	1625	1275	990	615	570	325	235
OLDSMOBILE DELTA 88	3339	2180	2035	1540	1195	950	720 ⁶	460 ⁶	335 ⁶
PLYMOUTH FURY III	3246 [‡]	2110	1735	1320	1075	845	630 ⁷	435 ⁷	325 ⁷
PONTIAC CATALINA	3164	2360	1800	1380	1125	875	655	460	335
SPECIALTY: 2dr. basic V8, auto. trans.*									
CHARGER	3711	2425	2045	1650	1365	---	---	---	---
ELDORADO	6903	5980	4730	3990	---	---	---	---	---
GRAND PRIX	3985	3115	2435	1975	1535	1475	930	675	385
CONTINENTAL MARK III	7281	6340	---	---	---	---	---	---	---
RIVIERA	4854	4015	3290	2650	2280	1600	1235	940	---
THUNDERBIRD	4961	3395	2710	1950	1770	1350	1085	755	505
TORONADO	5023	3760	2975	2415	1995	---	---	---	---
LUXURY CARS: 4dr. V8, auto. trans.									
BUICK ELECTRA 225 Custom	4677	3490	2770	2165	1600	1275	800	636	360
CADILLAC 60 Special	6953	5290	4500	3450	2625	1975	1335	810	540
CHRYSLER NEW YORKER	4630	3480	2605	1935	1495	1175 [†]	885	630	335
IMPERIAL CROWN	5956 [‡]	4325	3420	2500	2015	1360	895	620	510
LINCOLN CONTINENTAL	6211	4630	3555	2590	2065	1425	990	730	590
OLDSMOBILE 98 Luxury Sedan	4793	3520	2710	2300	1780	1390	1020	735 [†]	365 [†]
TOP 1969 IMPORTS: std. trans.									
VOLKSWAGEN BEETLE 2dr.	1839	1780	1500	1270	1030	855	730	565	510
TOYOTA CORONA 4dr.	1970	1505	1320	1105	915	545	---	---	---
OPEL Sport Coupe Deluxe	2197	1575	1390	1140	870	690	450	---	---
DATSUN PL510 4dr.	2035	1500	1295	995	785	660	---	---	---
FIAT 124/1100	2015	1450	1245	700	550	365	255	180	150
VOLVO 144S/122S 4dr. sedan	3120	2345	1945	1405	1195	980	820	690	570
MERCEDES-BENZ 250/230 4dr. sedan	5208	3735	3010	2500	2080	1705 ⁸	1240 ⁸	995 ⁸	405 ⁸
MG-C/B roadster	2875	2640	1695	1550	1200	995	800	695	510
CORTINA 4dr.	2004	1350	1200	905	715	515	330	270	190
TRIUMPH TR conv.	3375	2630	1785	1530	1225	940	795	640	540
JAGUAR XK-E roadster	5534	4220	3785	3175	2670	2240	1685	1310	1010

Footnotes:

* Automatic transmission standard in all but Charger and Grand Prix
 † sport coupe ‡ 2-door hardtop † 4-door hardtop
 1, Lancer; 2, Belvedere II; 3, Comet Caliente; 4, Meteor; 5, F-85 Deluxe; 6, Dynamic 88; 7, Fury; 8, Mercedes-Benz 220

Testing the All-New BMW... Motorcycle, That Is!

By BILL HARTFORD, Auto Editor
Photos by Irv Dolin

BMW cars and motorcycles are a renowned marque in grand touring, but you may not recognize the '70 bikes with their new sports styling and performance

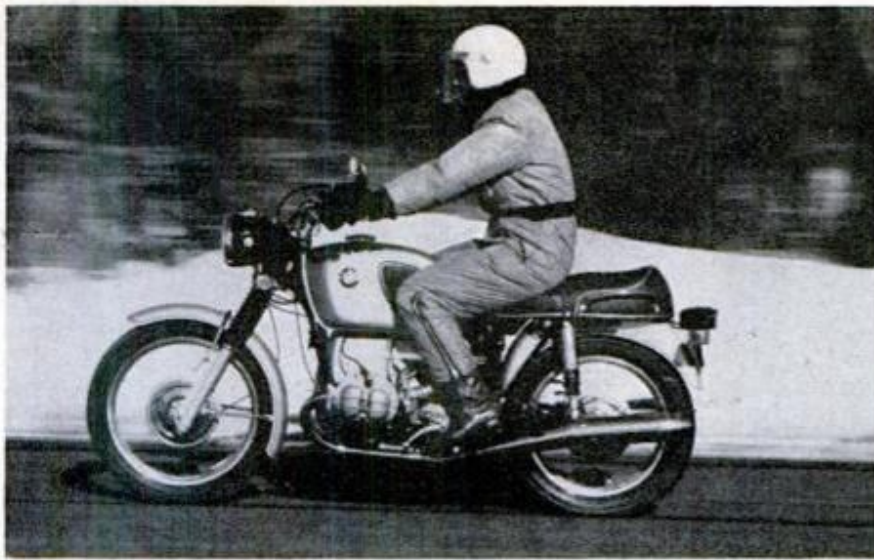
JANUARY IN NEW JERSEY isn't exactly the best time and place to take out an R 60/5—the middle machine in BMW's new line of 500, 600 and 750-cc motorcycles. But the Butler & Smith facility in Norwood didn't have any machines to turn loose before then, and I didn't want to wait for spring to ride one—no BMW rider worth his snow-melting salt is grounded by the cold.

With snowmobile suit, helmet and mittens strapped, tied and zipped, I slowly zigged and zagged over and through sheet ice and snowy ruts to get the 600-cc four-stroke out to the dry road. Revving the 46-hp horizontal twin in neutral produced the expected torque reaction about the fore-aft crankshaft axis. It's a sensation only felt blipping the throttle at standstill.

A positive *clunk* down into first . . . hang on . . . *clunk . . . clunk . . .* finally into fourth just to drop the revs and I found myself miles into the Jersey countryside—the impatient slip and slide ride out to dry pavement miles behind. I didn't time acceleration from 0 to 60 mph, but it felt close to BMW's figure of 7.8 seconds (9.8 and 6.1 are claimed for the 500 and 750-cc motorcycles).

Restyling—in Bavarian Motor Works fashion—was primarily a by-product of redesigning and engineering the machines for improved performance. I happened to like the profile right off, but a better





STILL GREAT TOURERS, the new BMWs have giant, six-gallon fuel tanks. Upswept pipes, higher cylinders allow lean in corners. Saddle locks to hide toolkit. Electric starting is standard on 600, 750-cc machines

indication of BMW's probable success in appealing to sport-machine enthusiasts is the appraising and on-the-verge-of-approving look the 60 got from a chap in a small Jersey town—extraordinary since he turned out to be a tangerine-flake fan with a hot Harley!

The horizontally-opposed cylinder arrangement and shaft drive are all these new machines have in common with the old line of BMWs—aside from the same engineering, of course. It's the engineering that made possible—in the case of the 60—a 46-hp, 105-mph machine in a 421-pound package. Compare this to the 430 pounds, 30 hp and 93 mph of the old R 60 US! On the new bikes steel sleeves have been cast into new aluminum-alloy cylinders; new, light-alloy wheel rims have been given a new profile shape for strength; even the fenders are fiberglass. Everywhere pounds have been pared without compromising ruggedness.

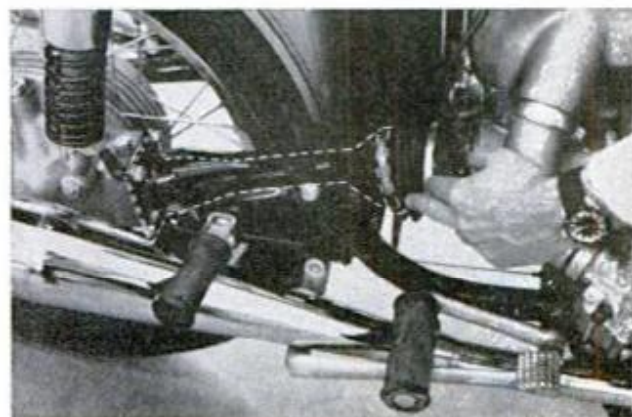
I never came anywhere near bottoming the suspension—don't know if I could have. The telescopic front fork has over eight inches of travel, the rear swing arm with its load-compensating springs, five inches.

The new sport-tourers won't have everything you want (no more side-car!) and they're expensive, but now you get two bikes in one. ★ ★ ★

DRIVESHAFT, BMW trademark, is in hollow swinging-arm tube that's booted to engine, bolted to rear hub
JUNE 1970



IGNITION SWITCH is in headlight. Instrument cluster includes tach, oil pressure, battery charge lights



ELECTRONICS



RCA
STARMAKER HK-104
TWO-CHANNEL
STEREO
CARDIOID
ABOUT \$65



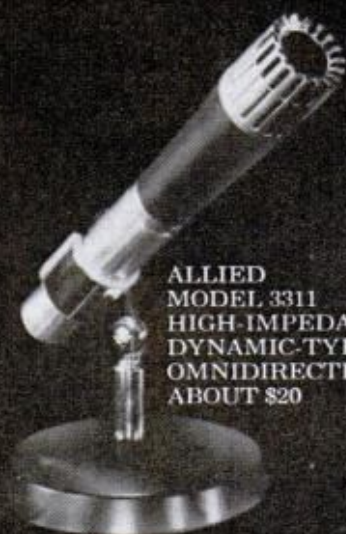
RCA
STARMAKER HK-112
DUAL-IMPEDANCE
DYNAMIC-TYPE
OMNIDIRECTIONAL
ABOUT \$50



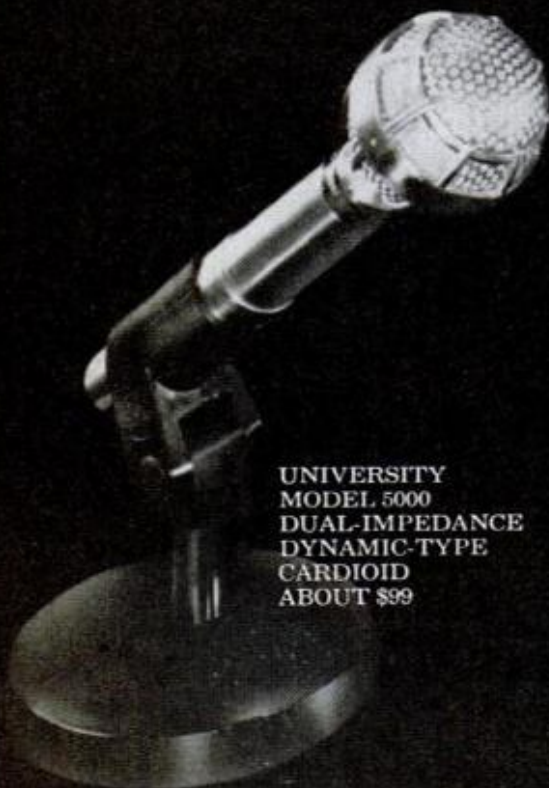
LAFAYETTE
MODEL 99E45981
DUAL-IMPEDANCE
DYNAMIC-TYPE
OMNIDIRECTIONAL
ABOUT \$14



SONY
MODEL ECM-19B
LOW-IMPEDANCE
CONDENSER-TYPE
CARDIOID
ABOUT \$29



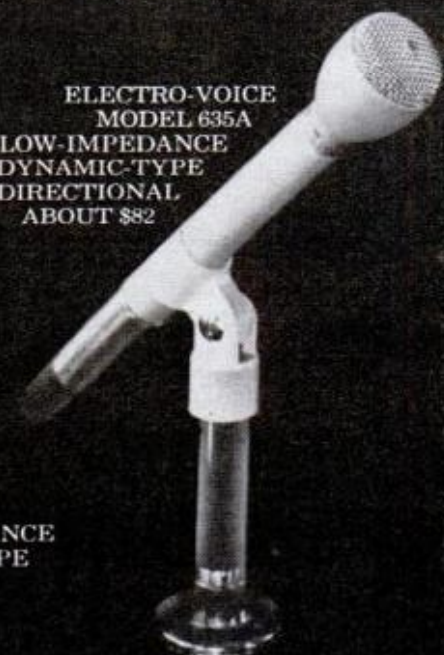
ALLIED
MODEL 3311
HIGH-IMPEDANCE
DYNAMIC-TYPE
OMNIDIRECTIONAL
ABOUT \$20



UNIVERSITY
MODEL 5000
DUAL-IMPEDANCE
DYNAMIC-TYPE
CARDIOID
ABOUT \$99



SONY
MODEL ECM-21
TRIPLE-IMPEDANCE
CONDENSER-TYPE
CARDIOID
ABOUT \$49



ELECTRO-VOICE
MODEL 635A
LOW-IMPEDANCE
DYNAMIC-TYPE
OMNIDIRECTIONAL
ABOUT \$82

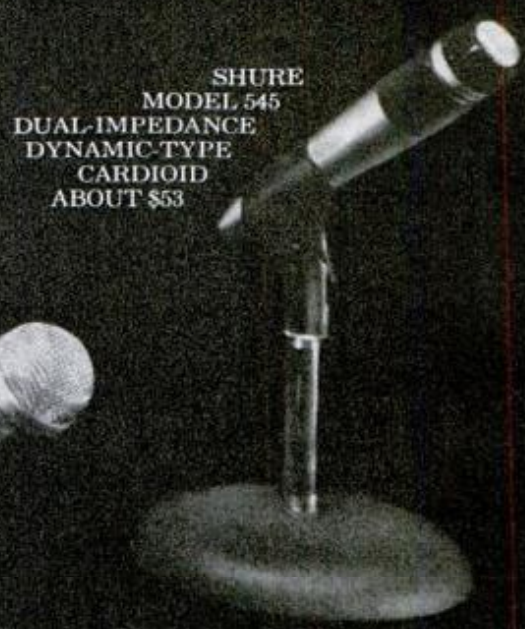
FOREST OF MICROPHONES on this and the facing page includes a wide selection of models ranging all the way from \$14 to nearly \$100. Most are dynamic, but Sony makes a line of condenser types starting at about \$29. Many offer a choice of impedances to make it easier to match their power characteristics to those of your recording or amplifying equipment. Omnidirectional models are equally sensitive in all directions, while cardioids pick up sound mostly from the front and are dead at the sides and rear. Two-channel types like RCA's at the top of the page actually contain two separate mikes in one for stereo recording



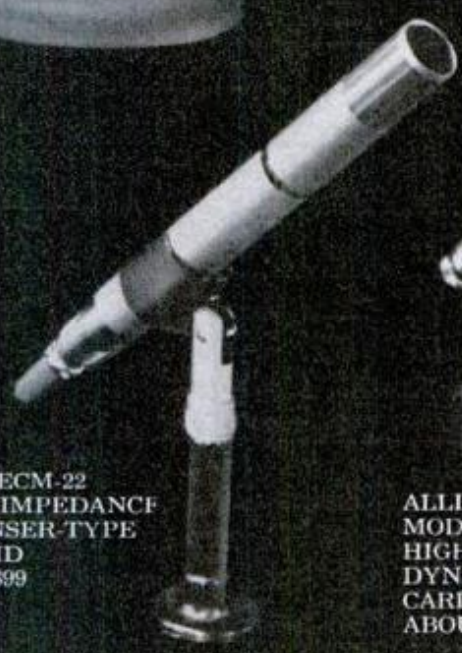
ALTEC LANSING
MODEL 650A
DUAL-IMPEDANCE
DYNAMIC-TYPE
CARDIOID
ABOUT \$85



ELECTRO-VOICE
MODEL 676
DUAL-IMPEDANCE
DYNAMIC-TYPE
CARDIOID
ABOUT \$53



SHURE
MODEL 545
DUAL-IMPEDANCE
DYNAMIC-TYPE
CARDIOID
ABOUT \$53



SONY
MODEL ECM-22
TRIPLE-IMPEDANCE
CONDENSER-TYPE
CARDIOID
ABOUT \$99



ALLIED
MODEL 3310
HIGH-IMPEDANCE
DYNAMIC-TYPE
CARDIOID
ABOUT \$25



HEATH
PUSH-TO-TALK
MOBILE MIKE
ABOUT \$9

Which Mikes for What Jobs?

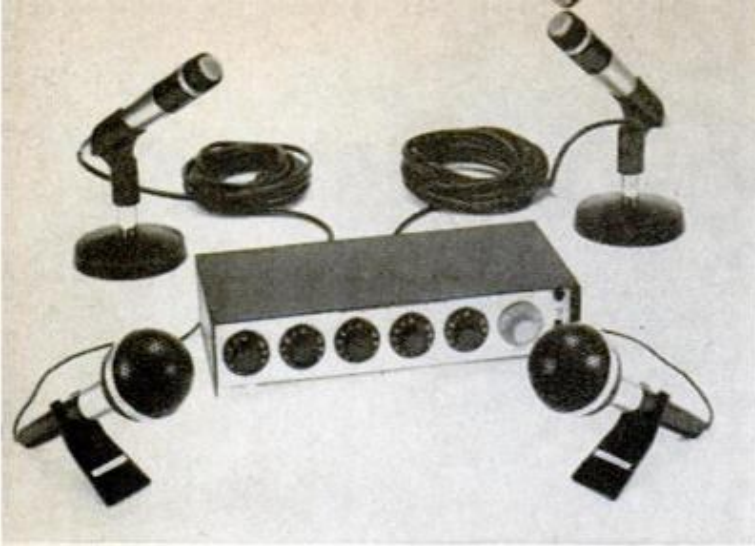
The growing use of microphones in home recording and family entertainment makes it important to get the right type for good sound reproduction. Here's how to pick the best for your equipment and needs

By WALTER SALM

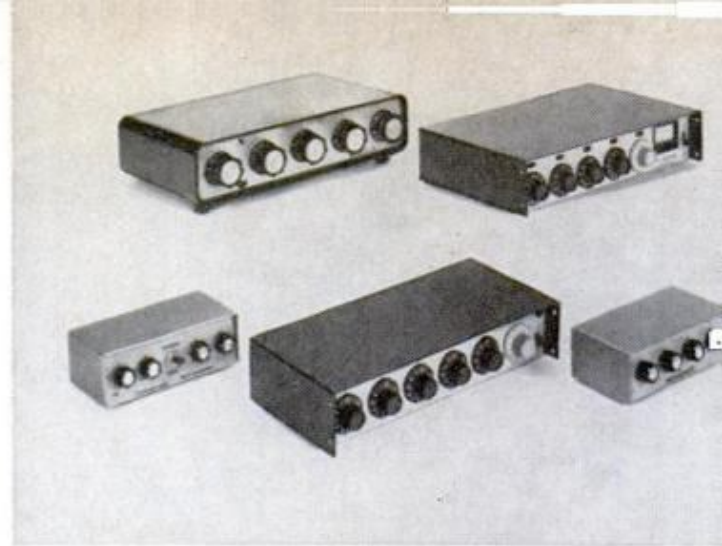
Photos by Robert D. Borst

IF YOUR HOME RECORDINGS turn you off, you may be experiencing what a lot of others have discovered: Your machine sounds pretty good when you're taping directly from radio or records. But when you try to record those family sing-togethers or Junior's trumpet solo, somehow they just don't come off the way you expected. The sound is tinny and rasping and lacks the depth and richness you had hoped for.

Chances are, the fault is in your microphones. Most stereo tape recorders sold in the last few years are capable of playing and recording good-quality sound—if you feed them good-quality sound to begin with. The trouble is that the micro-



MIXERS MAKE IT EASY to feed two or more mikes into one input, have volume and fader controls for special effects. Five-channel Shure mixer at left



is about \$79. Others at right include Switchcraft stereo model (top left) for \$87. Two smaller ones are less-expensive Switchcraft units for about \$15

phones supplied with a tape recorder are often of minimal quality to keep the price tag at an attractive level. Usually, they're low-cost crystal or ceramic models—the cheapest kind. Some makers avoid the problem by providing no mikes, leaving the choice up to you.

In either case, it's important to know what microphones will serve your needs best. Good mikes don't necessarily have to be expensive, but they do have to match your equipment and the type of recording you do. The right ones will not only let you get the most from a fine recorder, but can also help improve the sound of an inexpensive machine, such as the portable cassette type.

A big step up the ladder of quality is the dynamic microphone. This has a moving coil attached to a diaphragm and works much like a miniature loudspeaker except in reverse. Sound waves

striking the diaphragm move the coil back and forth to transform mechanical vibrations into electrical impulses that can be fed to your recorder. Dynamic mikes range from as little as \$12 to more than \$100. Regardless of price, they are basically far superior to crystal and ceramic microphones.

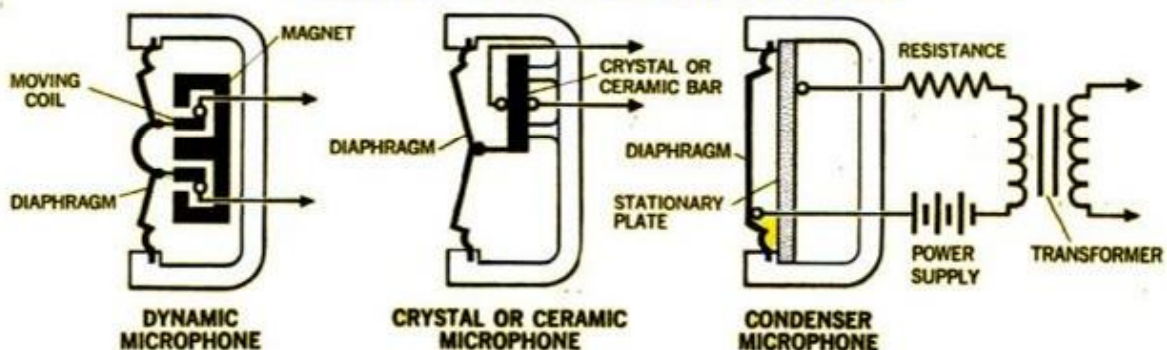
Before you make a choice, first check on impedance. A mike's impedance—its electrical resistance—must match the input impedance on your recorder or amplifier. Impedance is quoted as being "high" or "low," called Hi-Z or Lo-Z for short. Low-impedance (Lo-Z) mikes run around 100 to 500 ohms, high-impedance (Hi-Z) models are typically 40,000 to 50,000 ohms.

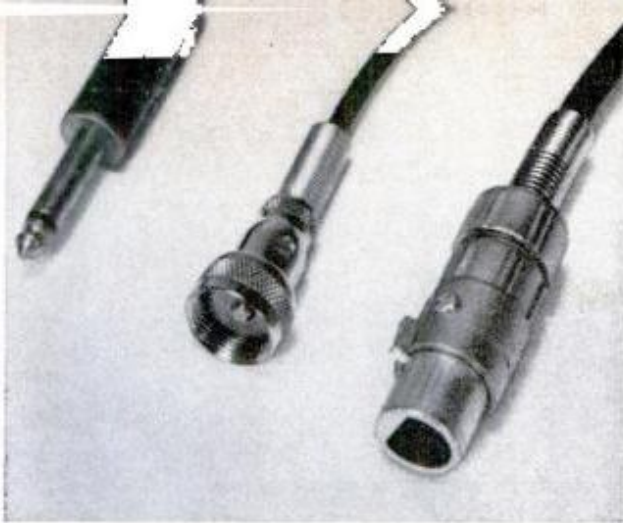
Crystal and ceramic mikes are characteristically of high impedance. So are tube-type tape recorders. This is why crystal or ceramic mikes were often

DYNAMIC MIKES work like tiny loudspeakers, using a moving coil attached to a diaphragm to convert sound waves into electrical impulses. They are preferable to crystal or ceramic types in which the diaphragm moves a crystal or ceramic element

to generate electrical pulses. In condenser mikes, diaphragm and stationary plate behind it form a capacitor. This changes in value as the diaphragm moves, varying the output voltage. Such mikes produce high-quality sound, but are usually expensive

THREE BASIC TYPES OF MICROPHONES





TYPICAL MIKE CONNECTORS are common phone plug (left), screw-on style (center) and professional snap-lock XLR (right). In most cases, adapters en-

able you to convert one type to another. Miniature phone-plug adapter in photo at right lets you connect standard-size mike to a small cassette recorder

supplied with older tube machines—they were inexpensive and provided a convenient impedance match.

one piece of equipment. In some cases, you select the impedance at the time you wire on the plug, connecting either the Hi-Z or Lo-Z lead and ignoring the other. Fancier dual-impedance models have a switch outside that lets you choose the desired impedance at the flick of a finger. Get this type if you want to switch impedances quickly to suit different equipment.

Newer transistor-type recorders can have either high or low impedance. So can dynamic mikes. Here's where you have to know your machine's requirements to make a proper match. Low-cost recorders tend to be of low impedance because this is a more economical system. Many better-quality models incorporate impedance-matching components at the inputs that let you use high-impedance mikes. Choose a mike with an impedance that most closely corresponds to your recorder's.

While it's best to buy the right type of mike to begin with, you can correct a mismatch by using an impedance-matching transformer. These are sold in a variety of impedances by several mike makers. The most convenient type plugs into the line between the mike connector and recorder input jack and can match a Lo-Z mike to a Hi-Z input.

Many modern mikes offer a choice of either high or low impedance and are known as dual-impedance types. These are handy if you aren't sure what impedance you're going to need or if you want to use your mikes with more than

Good frequency response in a mike is important, but not as critical as in a

(Please turn to page 70f)

OMNIDIRECTIONAL MIKES are most common type and least expensive. They are equally sensitive to sound from all directions and thus have a circular pickup pattern. Unidirectional mikes have a heart-shaped or "cardioid" pickup pattern and are sensitive

only at the front and sides. Though more expensive, they are best for most recording work because they minimize background noise and feedback squeal. Bidirectional models are sensitive at the front and back and aren't recommended for most home recording

THREE DIFFERENT SOUND PICKUP PATTERNS



OMNIDIRECTIONAL
(Full round)



UNIDIRECTIONAL
(Cardioid)



BIDIRECTIONAL
(Figure 8)

PM OWNERS REPORT
DODGE CHALLENGER

Love at First Sight, But, Oh, Those Leaky Side Windows

By **MICHAEL LAMM**, West Coast Auto Editor
Photos by the Author

IF YOU READ last month's Barracuda *Owners Report*, you're 80 percent ahead on this one. The 1970 Challenger and the 1970 Barracuda share all basic essentials: body shells, engines, running gear, accessories. You'll see an unsurprising similarity in the summaries.

Yet the Challenger does have its own definite personality. Many owners cited its being the only "new" car for 1970 as one reason for buying the Challenger rather than, say, the Barracuda. But the strongest buying goad, as with the 'Cuda, was styling. Owners like to be seen in their Challengers. One businessman said his associates and customers constantly comment on his car's racy, sleek appearance. He believes this puts him in a sort of lime-light—gets him remembered, helps his business. Other younger owners obviously felt the same—the Challenger impresses their friends.

By and large, Challenger owners feel quite good about their cars. Looks, performance, handling, comfort—all rate very high. However, they thus tend to be matter-of-factly critical of certain flaws and lapses.

Workmanship didn't rate especially high. Some

A Nationwide Survey
Based On 1,400,000
Owner-Driven Miles

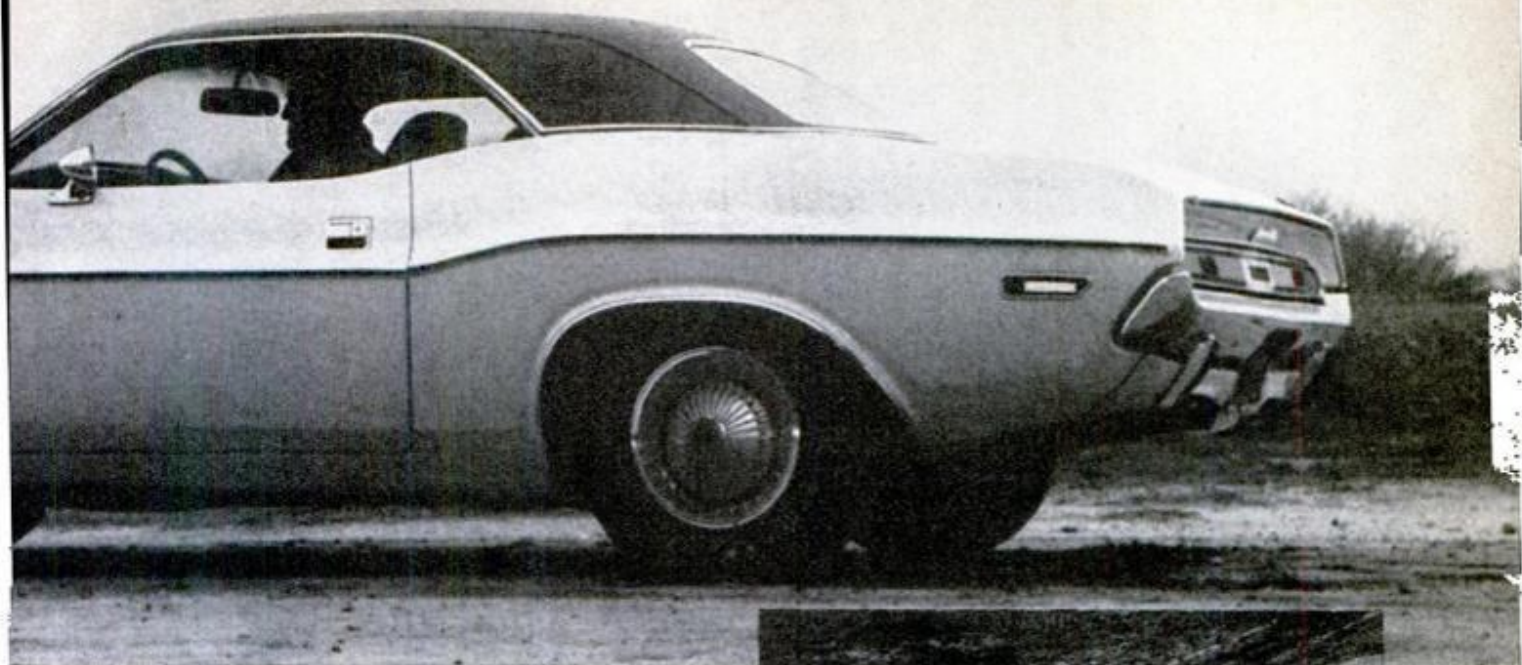


CHALLENGER REAR FENDERS are invisible to short drivers, and many complain of thick A-pillars making backing hazardous



WITHOUT OPTIONAL LOCKING PLUG, gas filler cap can be stolen. Owners also would like cap moved to rear or driver's side

POPULAR MECHANICS



STYLING LEADS as main reason for buying Challenger. Side windows bulge out at 60-70 mph, cause leaks

owners complained about side windows not sealing well. This might be an engineering mistake, because dealers usually couldn't correct it. At 60-70 mph, air pressure inside the car seems to bulge the side glass outward, causing leaks and whistling. Even at a carwash, owners complained of water leaking through windows. They're adjustable, but apparently this takes more time than assembly-line workers or most dealer mechanics can afford.

Many owners felt paint had been poorly applied or was thin. Loose screws, mismatched body panels, tucks in carpeting and headliner were also common grumbles. Major lapses in quality control cited included shocks not attached, mufflers left off, gas tanks collapsed or leaky. One owner said his differential had never been filled.

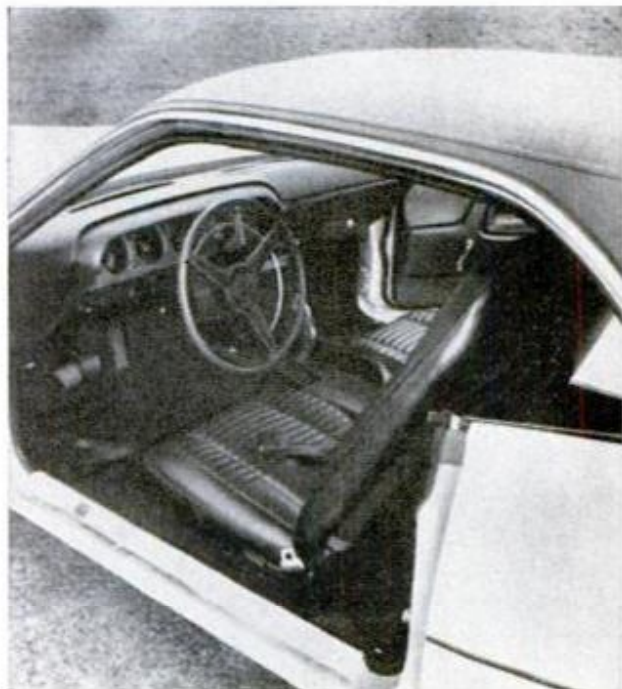
If Challenger owners could re-engineer their cars, judging by their responses, they'd do it like this:

- Move the spare under the trunk floor or at least out of the middle. It presently takes up much precious room. Likewise, hide the gas-fill pipe, which runs through two-thirds of the trunk.
- Somehow incorporate more legroom in the rear. How to do this without restyling the car remains unsolved.
- Move the gas cap from the right rear

JUNE 1970

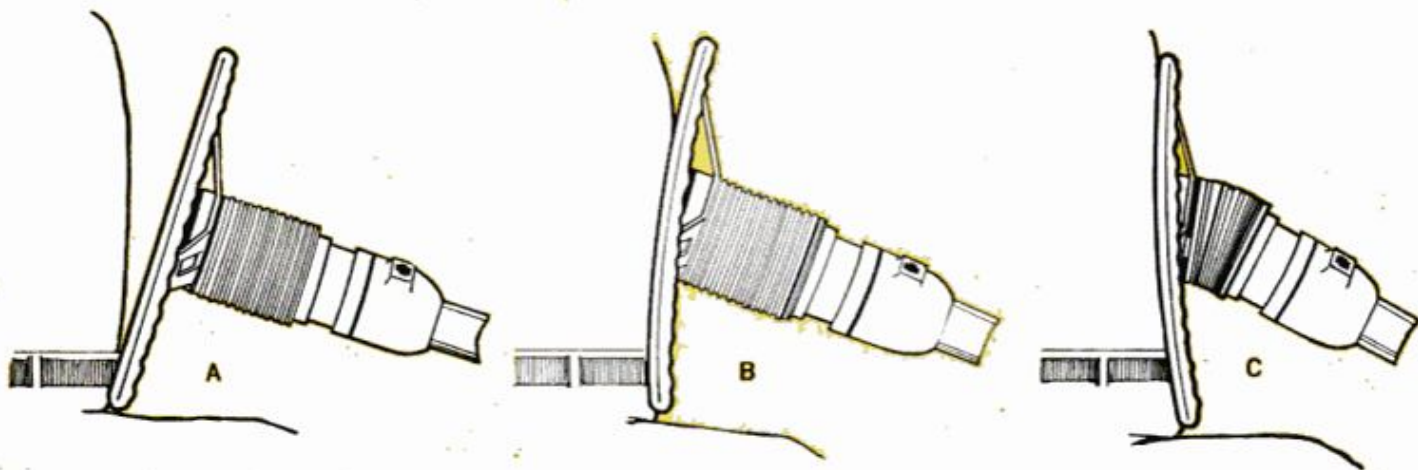


SNOW TENDS to collect in wiper cavity. Without the optional belt molding, dings quickly mar sleek sides



DRIVERS APPRECIATE all those gauges, like buckets. Some say they turn off ignition reaching for radio

97



CHALLENGER COLUMN gives under impact but there's also a thin-wall canister that lets wheel bend flat

fender either to the bustle of the car or to the driver's side—preferably to the rear, because gas always dribbles down the fender.

● Make the rear window bigger or the C-pillars smaller to give better visibil-

ity. Also make the rear fenders higher so short drivers, in backing up, can tell where the car ends. (Perhaps this is one practical spot for a spoiler.)

● Inside door handles are awkward. Change them. There's no ashtray in the

Summary of 1970 Challenger Owners Reports*

Total miles driven 1,400,766

Average miles per gallon (samples too small to tabulate 340 and 426-cu.-in. V8s):

225-cu.-in. Six,	
local driving	17.1
long distance	20.5
318-cu.-in. V8,	
local driving	14.5
long distance	17.7
383-cu.-in. V8,	
local driving	10.9
long distance	14.0
440-cu.-in. V8,	
local driving	10.0
long distance	13.6

Engines:

225-cu.-in. Six	23.9%
318-cu.-in. V8	36.7
340-cu.-in. V8	1.3
383-cu.-in. V8	29.8
426-cu.-in. V8	0.0
440-cu.-in. V8	8.2

Transmissions:

Automatic	75.8%
3-speed manual	14.2
4-speed manual	10.0

Body styles:

Coupe	96.6%
Convertible	3.4

Series:

Std. Challenger	59.1%
Challenger R/T	40.9

Why the Challenger?

Style	82.9%
Size	10.0
Economy	9.7
Performance	9.0
Past experience (Dodge)	5.7
Handling	5.0

Specific likes:

Styling	64.1%
Handling	51.2
Comfort	25.1
Performance	22.7
Economy	16.6
Power	10.9
Ride	10.2

Specific dislikes:

Workmanship	18.5%
Trunk size	13.1
Wind noise	13.1
Rattles	11.8
Rear legroom	10.8
Gas Mileage	8.1
Poor rear vision	6.4

What changes would you like?

More trunk space	18.9%
Better rear vision	13.6
Better workmanship	10.9
More rear legroom	7.9
Lower seatbacks	5.3
More headroom	5.3
Better venting	5.3
Better materials	5.3

Had any mechanical trouble?

No	56.1%
Yes	43.9

What kind of trouble?

Carburetor	17.6%
Transmission	13.7
Windshield wipers	8.4
Clutch	5.3
Ignition	5.3
Gas gauge	5.3

Did you repair it yourself?

No	94.6%
Yes	5.4

Dealer repairs satisfactory?

Yes	55.3%
No	43.8

Is the Challenger your only car?

No	52.2%
Yes	47.9

Other cars owned?

Dodge products	29.6%
Chevrolet	16.4
Ford	10.7
Chrysler	8.2
Oldsmobile	8.2
Plymouth	7.6
Pontiac	7.6
Cadillac	6.9
Volkswagen	6.9

Accessories/power options?

Radio	50.9%
Power steering	50.7
No power options	26.5
Vinyl top	21.9
Airconditioning	20.8
Console	19.8
Power brakes	19.2
Stereo tape	11.7
Light group	10.3
Tinted glass	7.8

What accessories/options would you order next time?

The same	47.6%
Airconditioning	16.8
Stereo tape	10.5
Power brakes	8.4
Power steering	8.0
Bigger engine	5.6

Age distribution of owners:

15-29 years	66.5%
30-49 years	23.5
50-plus	9.8

Would you buy another Challenger?

Yes	62.8%
No	37.2

*Percentages might not equal 100% due to rounding and/or insufficient data.



LIGHT REAR END can be shipped out if car is pushed hard around sharp turns, especially on ice, gravel

rear. Enlarge glovebox. Put ignition to left of steering column so driver doesn't turn off engine in reaching for radio. Brake release is impossible to touch with shoulder harness hooked up.

- Remove chrome strip from trailing edge of hood. This causes glare.
- Eliminate hidden windshield wipers. Snow piles up in cavity, freezes blades and washer nozzles.
- Add front vent panes.

Comments about dealers' sales and service departments varied, but one point of agreement was that there's too often a long wait for parts. "Parts ordered last October came in December," says a Virginia accountant. An engineer from Connecticut laments, "My tach hasn't worked since the day I got the car 3½ months ago, and a new one still hasn't come in." And, "Dealer repaired items as soon as parts arrived, but that took three months."

Ride and handling came in for mixed opinions. The ride was judged harsh by some but the same people praised the car's ability to stick to the road. A few said the rear end should be heavier for better traction on ice.

We'll leave the final word to a New Jersey sales administrator: "I can't speak for owners of the plain Challenger, but of my R/T with heavy-duty suspension I must honestly say I was surprised by its handling. Not so much front-end plow as I expected with the heavy 440 V8. Another pleasant surprise came in gas mileage—14-15 mpg on trips. Whatta fantastic car!" ★★★

JUNE 1970



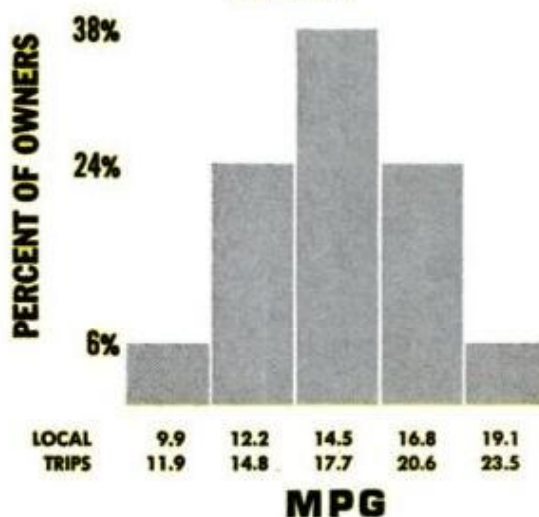
REAR SEAT brings groans from adults but not from kids. Big doors makes egress hard in small garages



LIKE 'CUDA, Challenger's trunk suffers from gas-fill pipe and spare taking up most of usable space

CHALLENGER FUEL MILEAGE CHART

318 cu.-in. V8



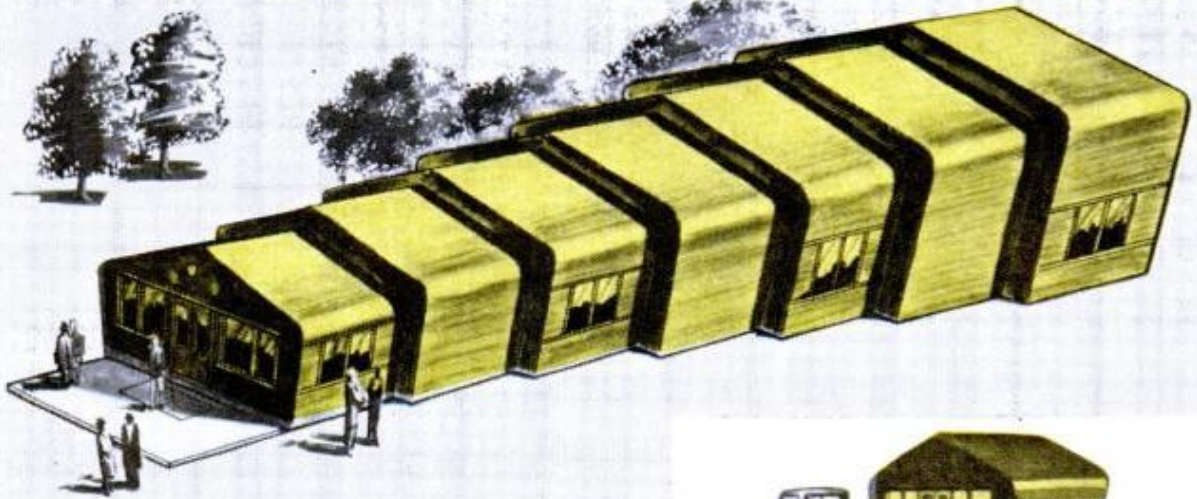
LOCAL TRIPS 9.9 11.9 12.2 14.8 14.5 17.7 16.8 20.6 19.1

MPG

Just patented

PM'S PICK OF THE NEW INVENTIONS

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

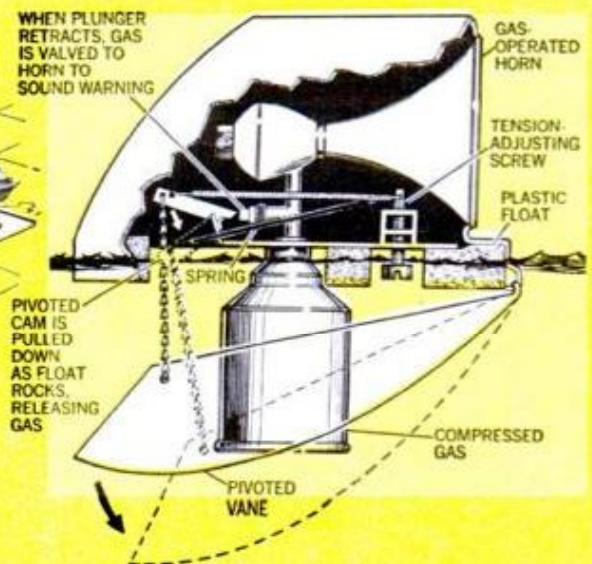
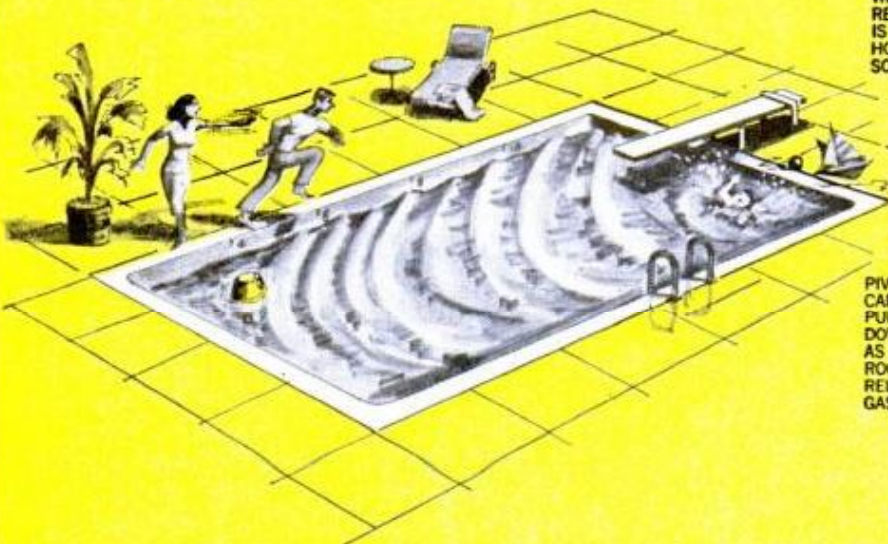


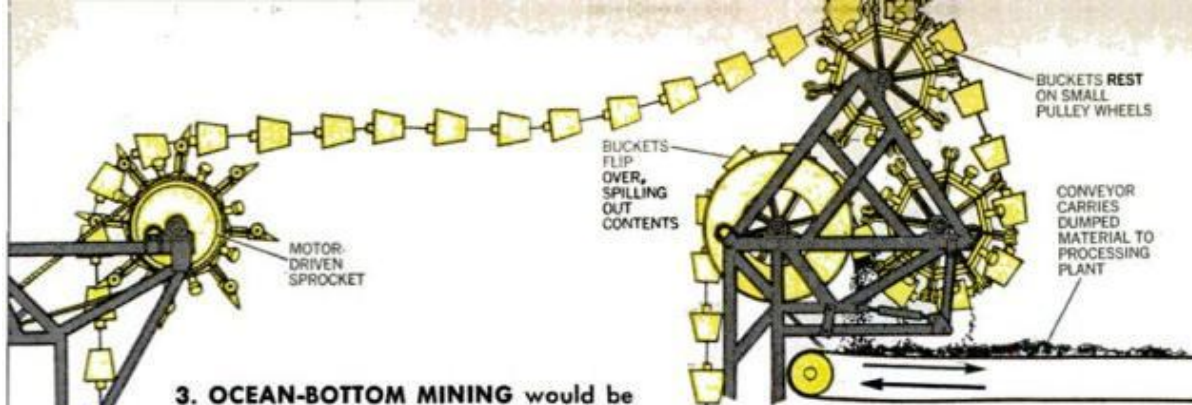
1. **TELESCOPING BUILDING** can be hauled over roads to a site, then pulled apart quickly to form a large structure. It consists of 8-foot-wide sections that nest together like the rings in a collapsible drinking cup. At the site, it's lowered to the ground and the wheels removed. The same tractor used to tow it then pulls the sections apart on sliding rails. The idea is for temporary structures that can be put up fast like military barracks, fair-ground buildings and emergency shelters in disaster areas



2. **AUTOMATIC POOL ALARM** sounds a loud warning if a child or pet accidentally falls in the water when no one is around. The floating horn is triggered whenever a disturbance in the pool causes ripples in the surface. The upper part is free to bob up and down with the water's motion, while a

pivoted vane hanging below it remains relatively stable. As the float is jostled, a chain attached to the stationary vane trips a valve, releasing compressed gas to sound the horn. The release mechanism can be adjusted so that the alarm will not be affected by any light ripples kicked up by breezes





3. OCEAN-BOTTOM MINING would be fast and efficient with this unique digging system for ore ships. An endless string of buckets dragged along the sea floor scoops up material and carries it to the ship above. As the filled buckets reach the top, they pass over and around a set of idler pulleys that turn them upside down, automatically spilling out their contents onto a conveyor belt. The conveyor carries the ore-bearing material to tanks for processing, while the empty buckets continue on to bring up another load. The bucket chain extends down through a well in the center of the ship and is powered by an engine-driven pulley at one end. The buckets are strung together like beads in a necklace and are carried over the pulleys on sprocket-like roller arms that form V-shaped cradles. Unlike mining platforms that are relatively fixed, the ship-borne bucket dredge can be moved quickly from one location to another and can head safely for port if a severe storm threatens

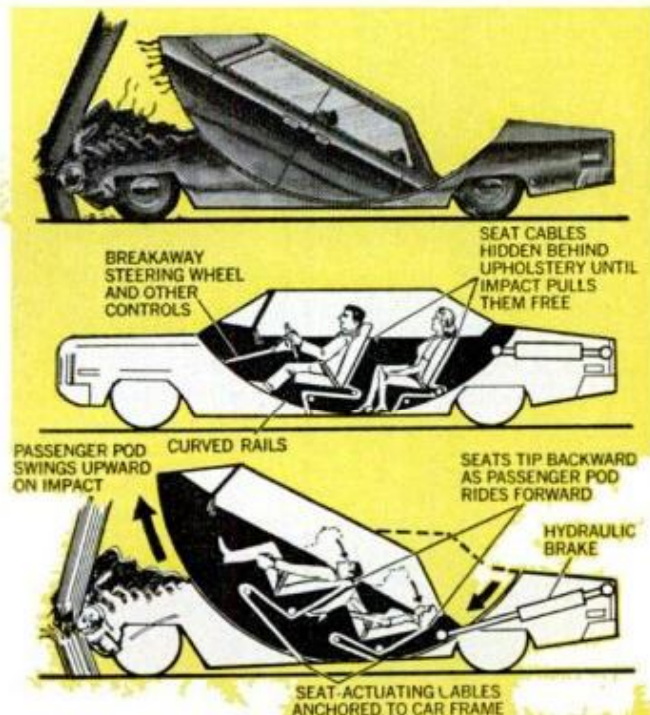


BUCKETS SCOOP UP MATERIAL FROM OCEAN FLOOR



4. A BEAM OF LIGHT types messages in this ingenious electronic system for handicapped persons who can't use their hands. A small flashlight, worn on the patient's head, is aimed at a panel of photocells, one cell for each letter of the alphabet. As the beam strikes a photocell, it triggers the corresponding key on an electric typewriter and the message is gradually typed out letter by letter

5. CAR-CRASH VICTIMS would be saved from serious injury in this breakaway passenger pod. The pod is mounted on curved rails and slides forward and upward in a severe impact. Some of the forward energy is dissipated in the upward motion and a hydraulic brake helps to slow the pod gradually. At the same time, cables attached to the chassis pull the pivoted seats backward so the occupants end up in a reclining position instead of being thrown violently forward



Inventors of the items shown on these pages are as follows: 1. Helmuth Both, Boitzenburg, Germany; 2. Leonard P. Tetrault, Northport, N. Y. (No. 3,468,283); 3. Walter J. Wallace, Dunbar Kapple, Inc., Batavia, Ill.; 4. D. W. Collins, Hugh Steeper, Ltd., Roehampton, London; 5. Harlan D. Hewitt, 1210 Astor St., Chicago, Ill. Readers wishing to bring new inventions to the attention of Roger S. Shashoua can reach him at the International Inventors Assn., Inc., 680 Fifth Ave., New York, N. Y. 10019.



The New Science of Hunting Underwater Treasure

By ROBERT MARX

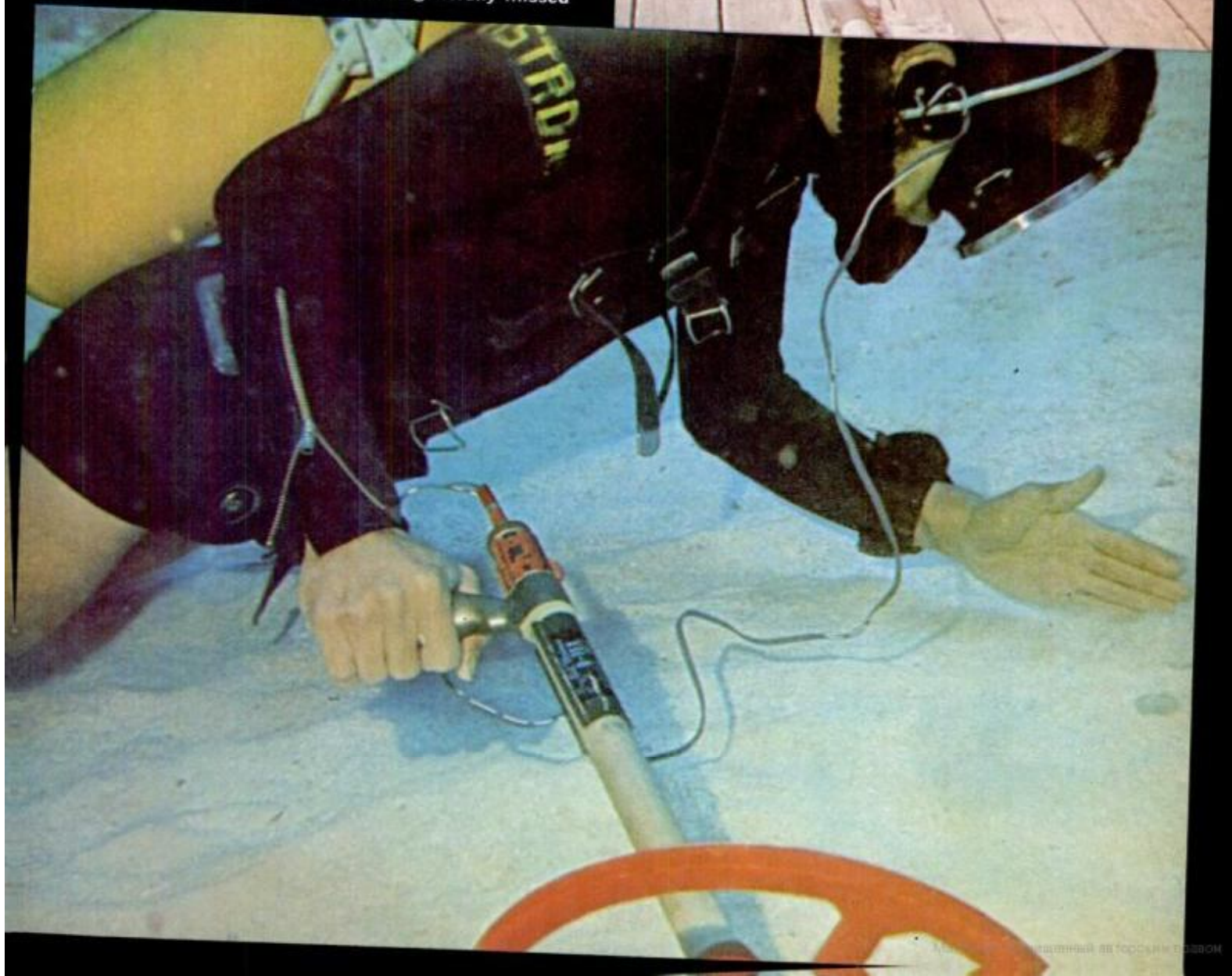
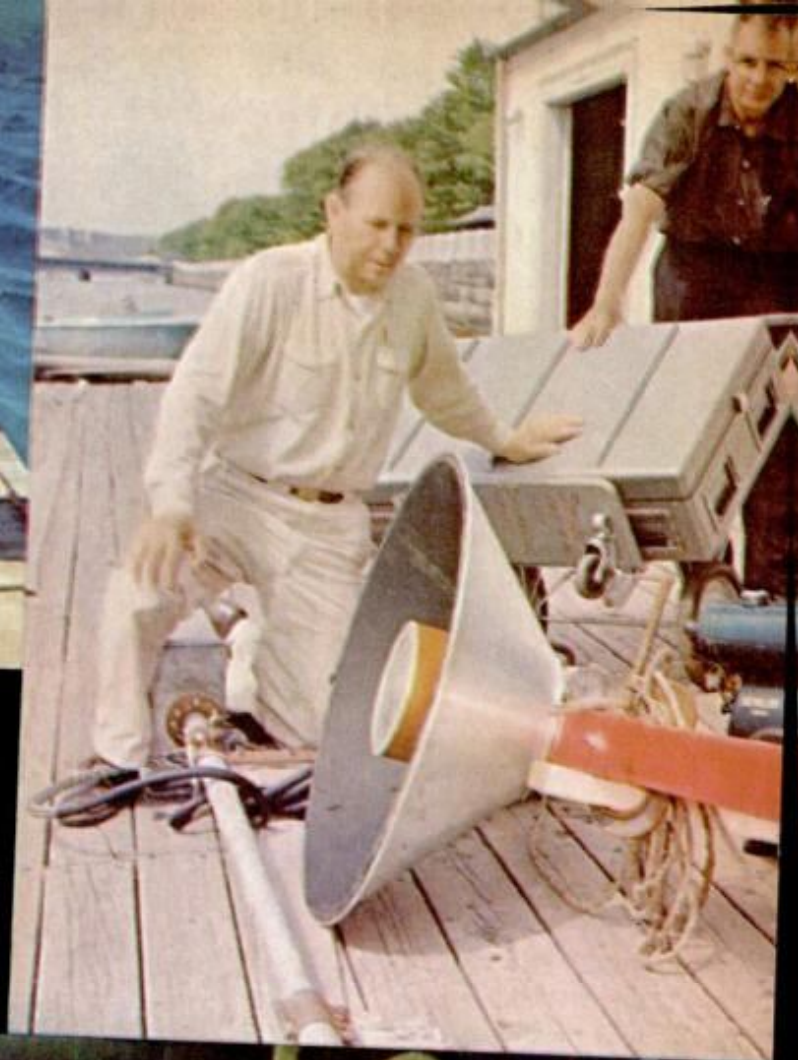
A member of the Real Eight Co., the most successful treasure-hunting group in the world, reveals the techniques used today to locate sunken wrecks.

TEN YEARS AGO, those engaged in quest of sunken treasure were considered romantic crackpots who were foolishly chasing after a pot of gold at the end of the rainbow, with little chance of success. Today treasure hunting is a "big business" with the latest in scientific knowledge being applied to it, and there are major nationally known companies spending as much as \$10,000 a day in the search for sunken treasure.

When I first got started in this field, I must admit, we went about it in a rather unscientific manner. Usually, we would learn of a shipwreck location from some fisherman in a waterfront bar. On many occasions after receiving a handsome fee, the fisherman would fail to relocate the shipwreck, claiming it had either been covered over by shifting sands or "some pirate divers had already got to it and recovered everything off it." If we were fortunate enough to find the wreck, then we set to work using shallow water scuba gear for diving and a small "airlift," which is a type of underwater vacuum cleaner for removing the sand or mud that covers most wreck sites. Using an airlift is a very slow and tedious method of excavating a wreck site and unless we were lucky and just happened to dig our



UNDERWATER MAGNETOMETER that is trolled (left) has yellow heads that are dragged in the water. They're attached (by black cables) to the recorder and the power source aboard boat. (Right) Dr. Harold Edgerton with his invention, the "Pinger" sonar, that enabled author to locate two of Columbus's ships. Hand-held underwater magnetometer (below) is used by diver after a wreck has been located to pinpoint metal objects. Previous to its invention, artifacts hidden under just a few inches of sand were generally missed



first holes in a good area for treasure or artifacts, we were forced because of time and money to give up before even a fraction of the site was excavated.

Today things have changed drastically and we no longer have to rely on tales from old fishermen or on outdated airlifts. Most professional treasure-hunting companies employ full-time historians in Spain and other countries of Europe, who furnish accurate locations and pertinent data on shipwrecks worth locating and salvaging. To locate shipwreck sites, several types of equipment have recently been developed, and for actual excavation, a new tool known as the "prop-wash" has revolutionized the whole method of underwater excavation.

The big breakthrough occurred about 10 years ago. A group of amateur treasure hunters, known today as the Real Eight Co. and the most successful treasure hunting company in the world, located most of the shipwrecks of a fleet which sank in 1715 off Florida with an

HAND-HELD UNDERWATER SONAR is especially useful for locating the ballast piles of old shipwrecks



THE AUTHOR displays some of the silver and pewter artifacts he salvaged during three-year excavation of sunken city of Port Royal, Jamaica

immense amount of treasure on board. At first Real Eight had a difficult time because the wrecks were scattered over a large area and divers had no means to determine the extent of each wreck. Underwater visibility was very limited and prevented them from working except on the clearer days, and most of the treasure and artifacts on these wrecks were buried under thick deposits of coquina (a limestone deposit) which the airlifts could not penetrate.

Underwater magnetometers had already been developed at this time. The Real Eight divers learned that an avid shell collector had developed a magnetometer for use in locating modern shipwrecks, because a certain type of seashell could be found attached to these wrecks. They used his magnetometer on their shipwreck sites and not only were able to locate all the major metallic deposits which defined the area covered by each site, but also discovered many other wrecks in the vicinity.

Regardless of how dirty the water is on the bottom there is always a layer of clear water on the surface. Aware of this, Real Eight divers devised a tool to push clear water down to the work site. To their surprise, this same tool also solved the problem of excavating through the thick coquina.

The prop-wash, in addition to being the most important tool available to

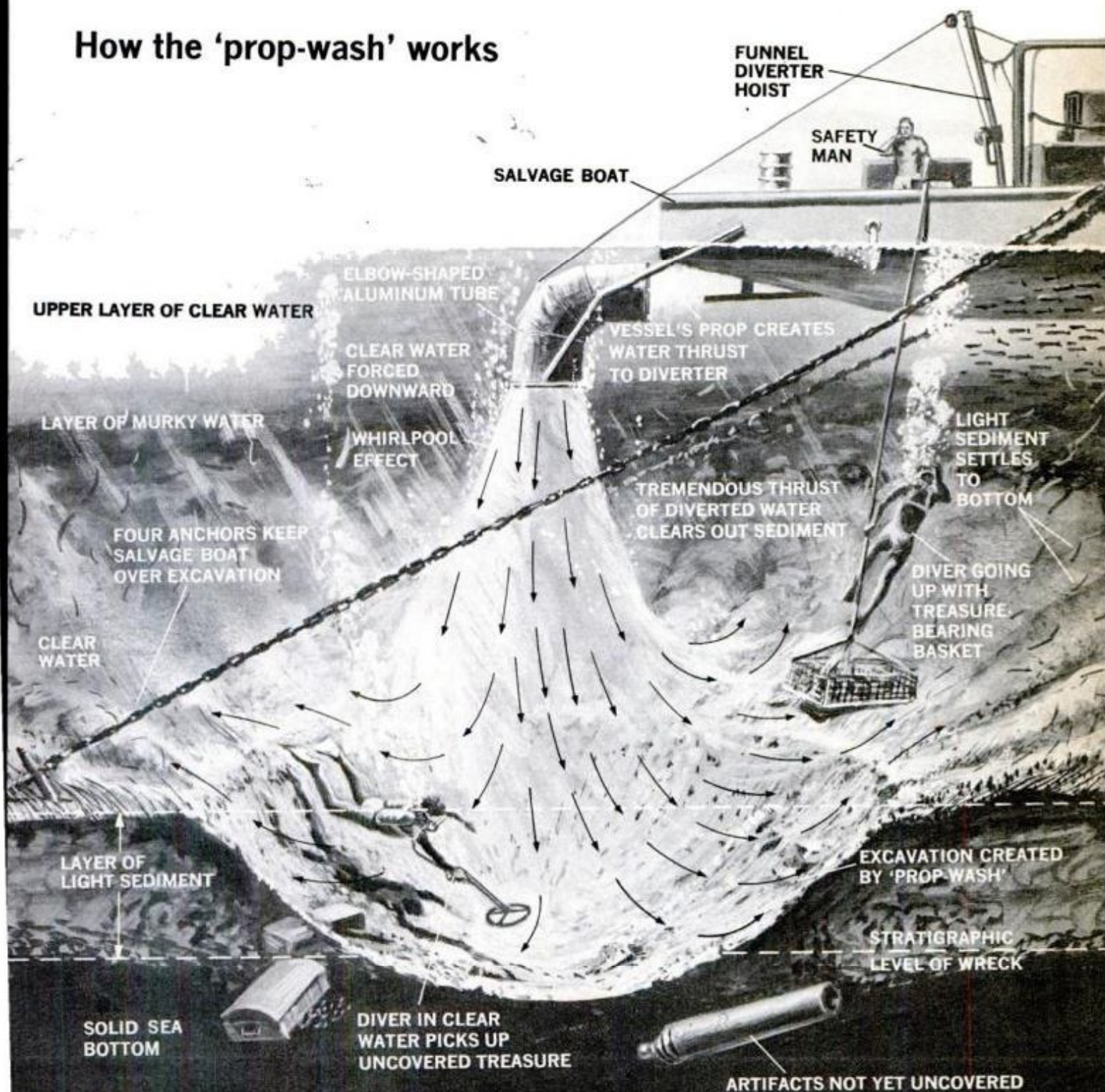
underwater treasure hunters, is also the simplest to construct and operate. It consists of an elbow-shaped aluminum tube which fits over the propeller of the salvage boat. Attached to the boat's transom, it is lowered into the water and attached to the underside of the boat's hull, covering the propeller. Four anchors must be put out to hold the boat in place. When the prop-wash deflects the wash of the propeller downward, it creates a whirlpool action that forces the clear water down

at a terrific velocity and also excavates the area.

In 20 feet of water it will excavate a hole 20 feet in diameter to a depth of 15 feet into the sediment or coquina in minutes. The deeper the water, the wider the diameter of hole. The secret in using the prop-wash is being able to regulate its speed. Since most wrecks have 10 or 12 feet of sand over them, it is run at high speed to remove this overburden. When the stratigraphic

(Please turn to page 210)

How the 'prop-wash' works



By Boat Around the Tip of Florida

The Islander proves its name—and its endurance—in a hard-driving trip around and across the Sunshine State

By GEORGE REIGER, Boating Editor

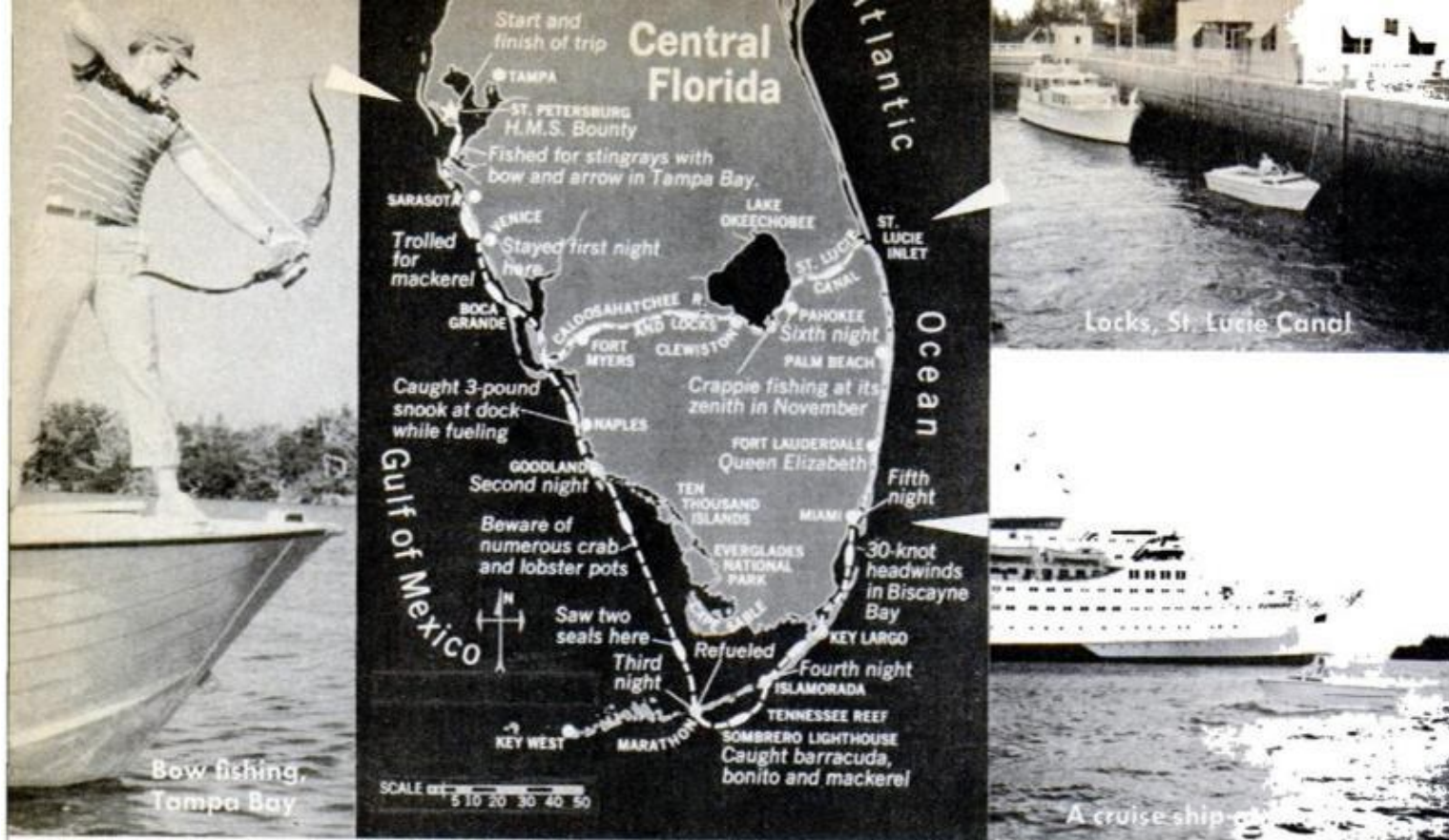
STARCRAFT'S 21-foot aluminum hull crept up the side of one Gulf Stream wave blown over from France, hesitated, then glided headlong down onto a crossing swell from Senegal. Our trolling strip baits alternately fluttered just beneath the surface, then skittered and cartwheeled in the rooster-tail wake caused by our rush down the backsides of such enormous combers.

"Well, you said you wanted a boat test," grinned Pete Brown, Starcraft's jack-of-all-trades and my companion in a week-long trip around the tip of lower Florida.

It was the fourth day of our circumnavigation of the peninsula, and I wonder now whether we would have been so amused by our clinging predicament off Marathon had we known then the small-craft warnings which went up when we left St. Petersburg

1. WE SAY HELLO to an old friend, the *Bounty*, before picking up speed for run down coast to Venice.
2. NOT ONCE did we do more than put down the mast light to get under even the lowest bridges.
3. TRIM LINES of the *Islander* are offset by an array of unstowed gear—a kind of how-not-to-travel shot!
4. PETE PEERS OUT from boat's cuddy cabin, which has more than adequate sleeping space for two.
5. HOW'S THIS FOR LIVING! Pete hoists a 26-pound barracuda he caught near Tennessee Reef tower.
6. COMING IN FROM ROUGH SEAS off Marathon, we find a treasure-diving ship somewhat down on its luck.





would not come down again until our journey was done.

But what a boat and engine! In seven days of continuous running, often pounding for hours into steep six and eight-foot waves, and with several run-arounds at better than 4000 rpm at the edge of inland channels, we lost but a single bow deck rivet and our Mer-Cruiser engine never quit—despite a brief coughing spell after nine hours of continuous trolling at low rpm between Marathon and Islamorada.

Our trip began with a call on the *Bounty*, a vessel I first visited in Tahiti in 1961. Built in Nova Scotia, displayed at the New York World's Fair and now berthed at St. Petersburg's Municipal Pier, this fine replica of Captain Bligh's ill-fated ship has been through nearly as many seas as the 18th century original.

We next tried bow fishing in Tampa Bay with Fred Bear's new take-down bow. I suppose we could have spent the entire afternoon chasing small sharks and rays over the flats had not Pete insisted we start our run south.

The Intracoastal Waterway is decorated with elegant egrets and other shore birds. Porpoises blow in the channels while cormorants sit on pil-

ings drying their wings. Four hours of beautiful scenery and we pulled up at a public boat-launch ramp in Venice.

The *Islander* has a cuddy cabin with cushions that can be laid out to cover the interior space. Life vests, fire extinguisher, anchor, spare rope and other gear can be stored under the sleeping level. Then the cabin is still spacious enough for two horizontal six-footers!

Next morning we went out the inlet and trolled south along the coast. However, the wind picked up, and we ducked inside at Boca Grande to continue our run via the inland waterway.

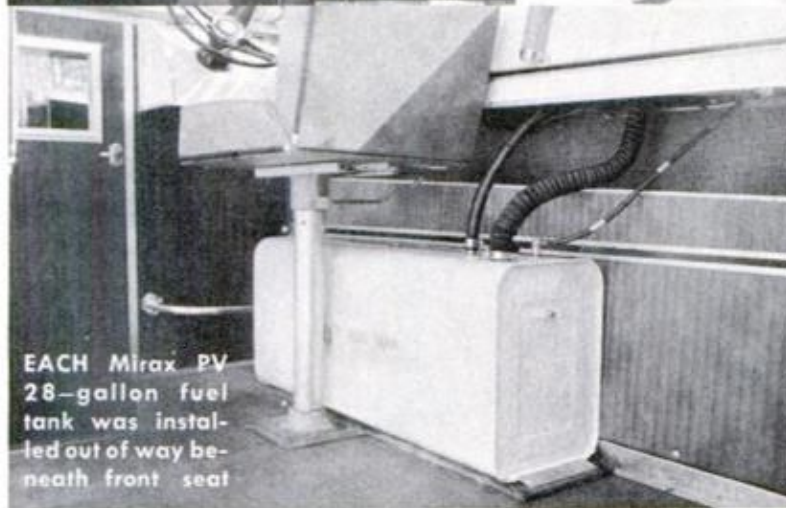
Though we still had ample fuel in two specially installed 28-gallon tanks, we decided to gas up at Naples since we would make a long open-water run to the Keys.

Next day, we passed the Ten Thousand Islands with a quartering tailwind of more than 25 knots. Just south of Cape Sable we saw two seals surfing along the tops of combers, but they vanished as we approached. Amazed to find them in the Gulf of Mexico, we idled for 15 minutes hoping for a camera shot, but they never reappeared.

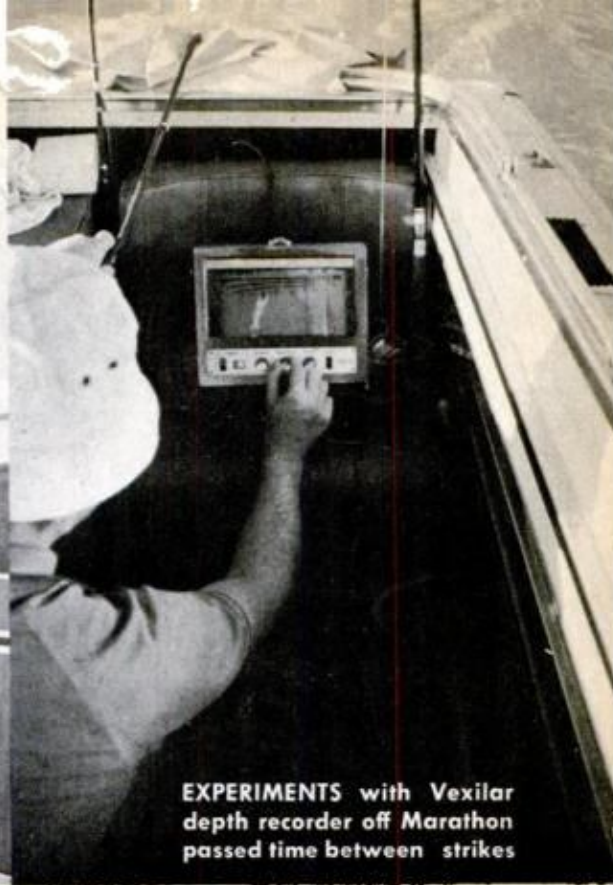
Soggy, and damp in the cuddy cabin where water had pushed between deck



MERCUISER engine is conveniently located between rear seats for easy maintenance



EACH Mirax PV 28-gallon fuel tank was installed out of way beneath front seat



EXPERIMENTS with Vexilar depth recorder off Marathon passed time between strikes

and hull seams, we gratefully crept into Marathon late in the day and recuperated in the evening by catching big mangrove snappers off the lighted docks.

The following morning we trolled offshore to Sombrero Lighthouse and caught a number of small bonito which we quickly converted to strip baits for sailfish and mackerel. We fished all day and at Tennessee Reef Pete came up with a citation-sized barracuda which, that evening, created quite a stir at the Islamorada Yacht Club. After a dinner of fresh fish fillets on our dockside charcoal grill, we were lulled to sleep by the sound of little waves lapping against the hull.

By morning these wavelets had become whitecaps, and the small-craft warnings went back up the flagstaff. But since we were short on time, we ran north along the picket fence of channel markers that guide boatmen to Miami.

Nothing can be more tedious than ceaseless pounding through rough water. But these conditions are ideal for boat testing, and if anyone again suggests that aluminum isn't fit for ocean use, I'll bend his ear about *our* trip!

Marine Aluminum is an aluminum alloy compounded with manganese,

magnesium and chromium for strength and corrosion resistance. The Islander's bottom (one piece, without a keel seam), stern and transom are all at least .085 inch thick, and only compatible aluminum or stainless steel fasteners are used to make electrolytic action negligible. Solid aluminum roundhead rivets are used below the waterline and for structural members, and unitized frames, ribs and stringers form a longitudinal and transverse system of support inside the marine aluminum skin. All this means when we reached Miami that night, the Islander was in far better shape than we were!

Next day we dashed up the inland waterway, slowing down for speed zones, but pushing the boat back to 4200 rpm as soon as we were past. Running through the back yards of Miami and Fort Lauderdale is the best way I know to see some of southern Florida's finest homes without trespassing!

At Palm Beach and Stuart Inlets we slowed down to catch jack crevalle and ladyfish. But to reach Lake Okeechobee by dusk, we couldn't linger.

After many days on the sea, there's something refreshing about speeding in-

(Please turn to page 204)



The Jig Is Up!

Up in popularity, that is. And every season fishermen use and lose a lot of lures. Save money — make your own.

By LOUIS A. GOTH

ANY FISHERMAN CAN MAKE one of the world's most successful lures for less than 10 cents instead of paying up to a dollar or more for the store-bought item.

Jigs, or lead-heads, are consistent fish-getters in fresh water or saltwater. Some sportsmen use them exclusively. Their variety is practically endless, and the spinning or bait-casting enthusiast can design jigs to suit his individual needs. They can be tied with feathers for panfish, with deer hair for walleyes or northern pike and with rubber worms for bass.

Your basic tools are simple to use. A jig mold and a fly-tying vise are the essentials. They're available from any well-stocked sporting goods store or mail-order company. (Kits may be obtained from Worth Fishing Tackle Co., Box 88, Stevens Point, Wis. 54481.)

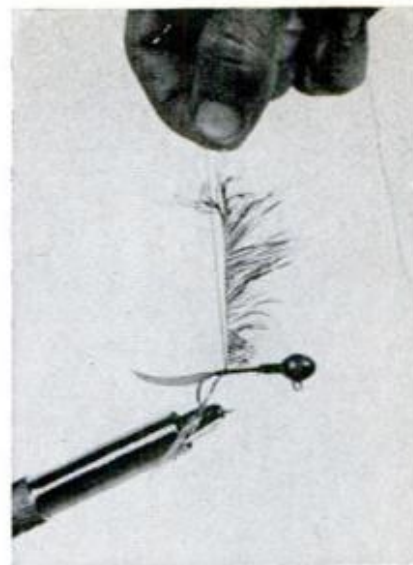
In the beginning, try to get a mold that offers



WHEN BEGINNING to tie lure, you lap the thread over itself with loose end lying along hook shank



PREPARE PALMER TIE or hackle by scraping down from thick end of feather; straighten and fold barbs



FOR FLY TIE, hook shank wrapped with thread is wound back with feather twisted to keep barbs up

a variety of lure weights. A sixteenth, eighth and quarter-ounce weights are a good span. The vise doesn't have to be fancy, but must hold a weighted hook firmly while the dressing is applied.

Hooks, lead and dressing materials complete the ingredients. Jig hooks have a distinctive bend in the shank to keep the points off the bottom when running deep. They come in standard sizes, and most molds will take more than one size. A 1/8-ounce mold, for instance, generally accepts a No. 6 or 8 hook. Whoever sells the molds usually has hooks but lead could be a problem. Printing shops may be willing to part with type metal (an alloy of tin and zinc, it's preferable to pure lead because of its hardness, durability and ease with which it takes the mold).

There are three basic lure patterns for jigs. The **worm** or **trailer** is the easiest to make, requiring little skill. Simply remove a freshly cast jig from the mold and clip off excess metal with small wire cutters. A sandpaper nail file is ideal for final smoothing. Then slip the point of the hook through the end of a rubber worm, sliding the worm on so it covers the entire shank. At least three-fourths of the worm should trail behind the hook for the best action. Painting the lead head to match the worm is the final step. In murky

waters or for night fishing, black or blue models seem to provide the best luck. Largemouth bass, especially, are suckers for a worm jig. Cast it toward a weed bed or sunken log, let it sink, then retrieve it with short, quick jerks.

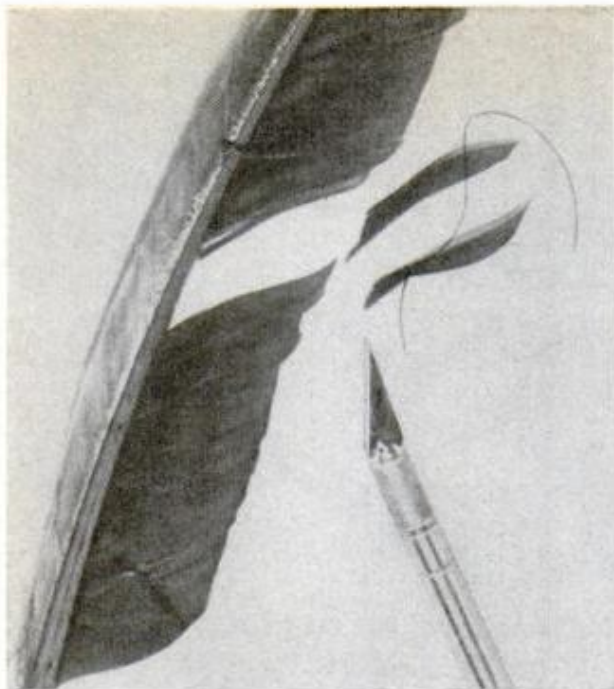
There are variations on this basic jig pattern. Live worms can be substituted for rubber ones. Thin strips of flexible plastic, such as industrial Mylar, offer another substitute. And walleye fishermen should not overlook a plain, even unpainted, jig with a strip of pork rind.

Bucktails typify the second category of jig patterns. All jig molds provide a slight neck on which a skirt of some sort can be attached. It should be wound with silk thread to help hold the skirt material in place, and it's wise, for color matching, to have both black and white thread available.

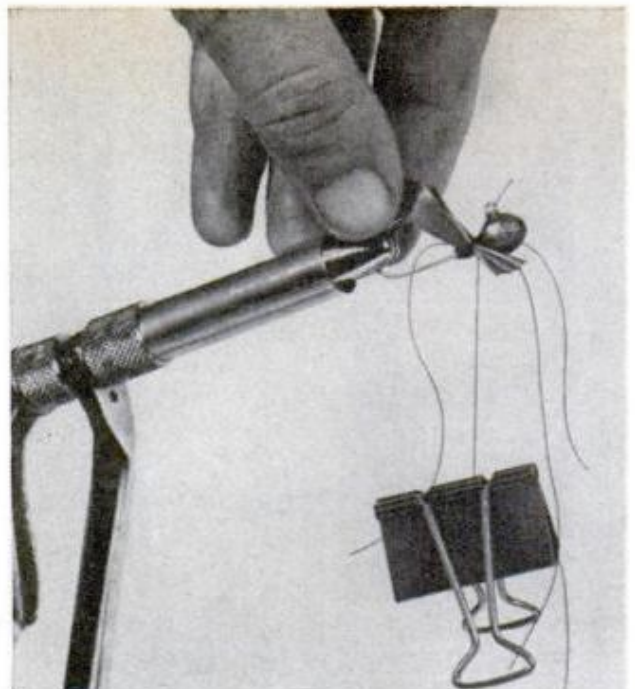
The thread should be waterproofed. You can wax the thread as it's wound with fly-tying wax or coat it with varnish or liquid polyurethane, using a small brush. This creates a tacky working surface which later dries rock hard and acts as a glue. Wind the thread from front to rear, tying it off but not cutting it.

Bucktail is an old favorite with fly tiers because deer hair is hollow and tends to float with a wavy action.

Take a cluster of hair and spread it



WINGS ARE MADE by cutting a section of barbs from feather; section is then pulled into two equal parts



TIE THREAD to wing ends. Place wings on either side of jig neck; attach with turns of thread, then trim

around the thread-wrapped neck with the cut ends toward or butted against the jig head. Tacky varnish will hold hairs in place while you make a turn or two around them with thread. Don't pull the thread tight until the hair is positioned evenly around the hook. Tighten the thread and give it a half-dozen turns before tying it. If a fuller skirt is wanted, simply repeat the process. A common beginner's mistake is to add too much hair, making the lure look like a shaving brush and ruining the action. To make a bushier skirt, build up a cone of thread before adding the hair. Once the final tie is made, cut the thread and trim off surplus hair.

A white bucktail with a pink or red head is a popular bet. Originally intended for panfish, it's been used to catch everything from musky to carp! It's a mystery why this particular pattern has been so successful, but no fisherman's arsenal should be without several sizes. Of course, other combinations of black, green and blue regularly take fish, and yellow is particularly successful in saltwater. Try them all.

A Palmer tie uses a feather instead of hair, and the process is a bit more difficult. The entire shank of the hook from the head and neck all the way back to

the beginning of the curve has to be thread-wrapped. A small sliver of feather can be wound in at the curve for a tail. Tie the thread at this point for convenience, but don't cut it. Now remove the jig from the vise and set it aside. Find a chicken feather three to five inches long and trim the fuzzy down from the quill. Clamp the quill in the vise and, holding the pointed end in one hand, begin combing and pulling the barbs against the grain until they stand straight out from the shaft of the feather. Next, fold and pinch the barbs together until they're at right angles to both the shaft and their original position. Although this process takes time and patience, it's essential to all advanced forms of jig and fly tying.

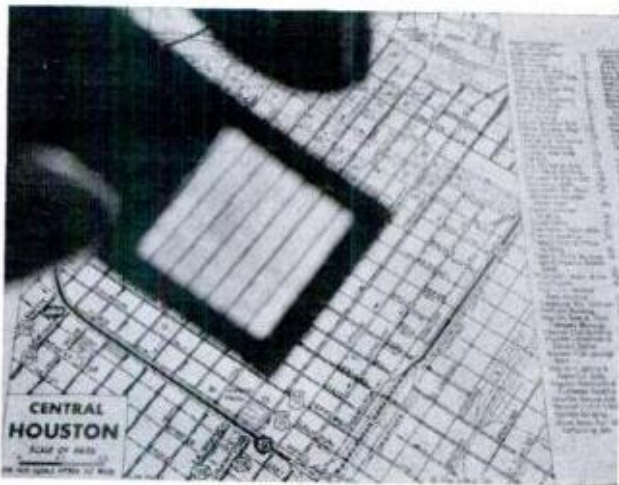
With the jig back in the vise, cut away a half inch of barbs from the small end of the feather close to the shaft. Place this cleared end at a 45° angle to the hook shank and fasten with turns of thread, then wind thread and feather together back to the head. You may need to twist the feather a bit to hold barbs at 90° to the hook shank. Barbs should stand up like the quills of a porcupine. Always keep the thread tight to help bind feather to hook. When

(Please turn to page 212)



Gardening with a can opener

Japanese apartment dwellers can now buy flower gardens in cans. Available at department stores, the cans contain mica, seeds and fertilizer. All that the gardener need do is open the can and add water. The flowers will bloom within two months.



Filter spots 'hidden' patterns

A computer-produced filter, shown here on a street map, transmits only those lines that run parallel to the right side. The IBM filter is expected to help seismologists detect planes of underground strata in seismographic plots, revealing underground rock formations that might indicate oil deposits. Others who might use it to reveal patterns are aerial photo experts and medical researchers.

Budget racer

Shown with its front housing removed is an F100 Royale, first of a line of "budget" (about \$4000) two-seat racers developed by Racing Preparations Ltd. of England.



Lifesaving by rod and reel

Australian lifeguards use a new rod-and-reel rig for rescuing swimmers from the surf. One guard wears a harness to which a line is attached; the other operates a huge rod and reel to pull in the rescuer and victim.



Safe at Any Speed:

A famous former Grand Prix driver takes out a luxurious Chrysler-powered four-wheel-drive car that's sure-footed going (and it goes!) and, with its antilock braking system, just as sure-footed stopping. If it comes over from England and is sold by your friendly Chrysler dealer, you'll be able to buy the safest-handling car on the road.

By INNES IRELAND

A HEAVY FALL OF SNOW which blanketed much of the country two days before I was due to have the Jensen FF delivered to me came as quite a delight. It would mean a tough test for the Ferguson four-wheel-drive system fitted on the car.

London proper didn't get the snowfall and the streets, including the M1 motorway out of town, were bone dry as I headed north. This allowed me to assess the car under power. I had expected to feel some heaviness from the steering and even some tugging at the wheel under maximum acceleration from a standing start, but I experienced neither. The steering is light and quite positive, although for my tastes rather low-g geared and requiring too much wheel turning for comfort. I should add, perhaps, that by American standards, the steering is not so low-g geared. It is power-assisted, but a surprising "feel" is retained; one knows exactly what the front wheels are doing.

The Jensen uses the 6.3-liter (383 cu. in.) Chrysler V8 power unit with the company's TorqueFlite automatic system, one of the best I have come across. With the gear lever in the "low" posi-



LUXURIOUS COCKPIT is divided by handsome console containing shift lever for the Chrysler TorqueFlite

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SWEEPING BACKLIGHT of the greenhouse contributes to superb visibility for the driver and passengers

POPULAR MECHANICS

the Jensen FF

tion I applied full throttle with the car at rest. In the dry I was not surprised to find there was no trace of wheel-spin. It was just like the P99 Ferguson 4wd racing car I used to race.

The FF just surged forward with complete adhesion and an incredible amount of acceleration. I was surprised, however, when I repeated this process on a stretch of soaking-wet road. Again complete adhesion resulted with no snaking from the rear end, nor a tug at the steering wheel from one of the front wheels spinning.

I once tried this with one of Andy Granatelli's Indianapolis Lotus gas-turbine cars at Silverstone. Holding the brake hard I let the turbine whine and roar until the gauge indicated 98 percent power. I then released the pedal—and damn near took off! There was a smattering of wetness on the track, and the front wheels just started to spin a little. As they gripped alternately, I felt a considerable tug from the steering-wheel rim, but even then the car did not try to snake.

On my run north I found how effortlessly and silently the big V8 Chrysler pushed this 4000-pound car along at

80 mph. A burst of acceleration to pass traffic whistled it up to 105 mph before I realized it, and even then the car was just as silent, wind noise being practically nonexistent.

The console layout on the Mk 2 has been completely revised and is infinitely more tidy and attractive than that of the earlier Mk 1. But the transfer box fitted to the back of the Torque-Flite transmission spreads out considerably on the left side of the passenger compartment and restricts the floor space for the passenger's feet.

The ride produced by the semielliptic rear springs and double wishbones at the front is most comfortable—firm but not at all harsh. On open, fast corners the car does not roll very much and is very easy to set up, holding a given line admirably. But on twisting, winding roads taken at speed, with quick changes from right to left corners, the transfer roll of the car becomes rather sudden and a little alarming. However, adhesion at all times is nothing short of incredible.

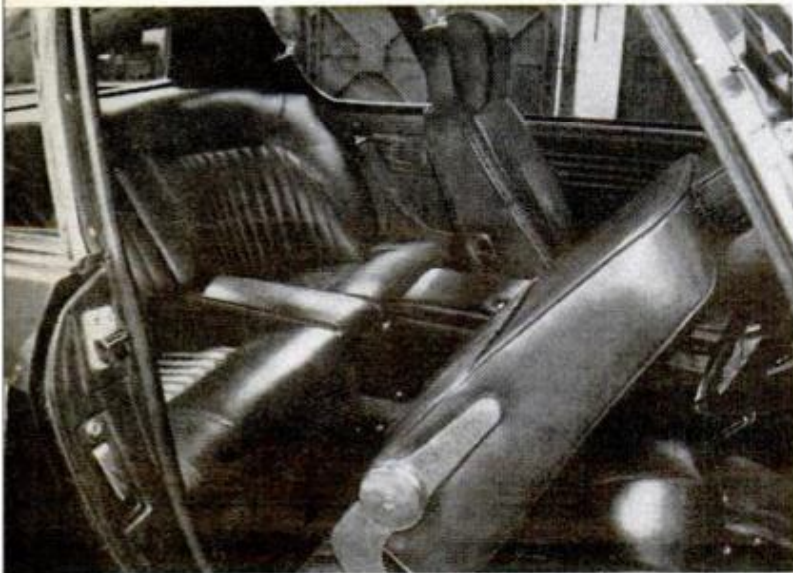
And this applies to driving in snow and slush. It is always possible to drive much faster than with conventional

ALL FOUR WHEELS take FF through turns with little roll; car reacts fast to opposite lock corrections

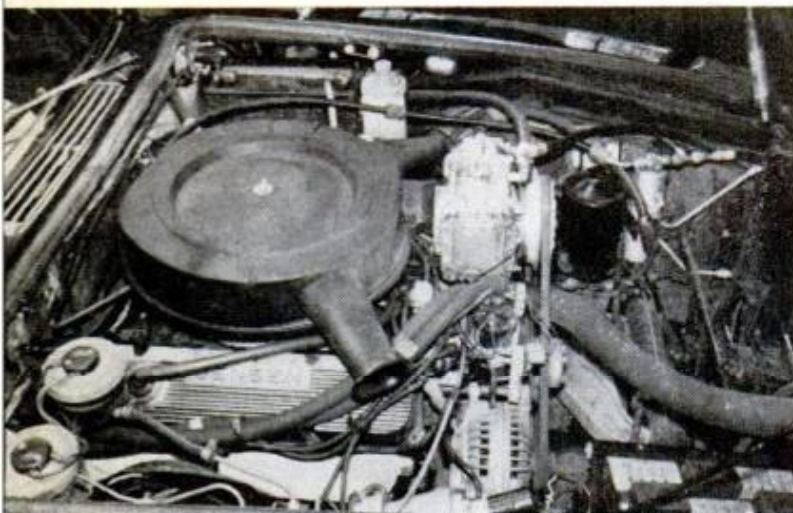




JENSEN INTERCEPTOR, also using Chrysler 383 engine, is two-wheel drive sister-in-skin to the FF



SCULPTED REAR SEATS afford torso grand-touring comfort, but limited kneeroom cramps legs quickly



JENSEN ROCKER COVERS adorn the 383-cu.-in. V8 that the British auto company buys from Chrysler

two-wheel-drive cars—even then with a considerably higher degree of safety. Even relatively hard acceleration is positive, straight-line stuff without the normally attendant snaking tail. But still more impressive is the way this car will stop in such conditions. The Maxaret braking system, which does not allow a wheel to lock, starts working quite early without a high pedal pressure. Stability is always maintained, and the car will even answer to a change of direction, following the front wheels whichever way they are turned. This is particularly true in very wet conditions where a panic stop is completely controlled. The driver can avoid an obstacle, yet maintain maximum braking effect, whereas in a two-wheel-drive car an accident or violent skidding would inevitably result.

Perhaps I should point out that, because of the operation of this braking system, the FF will not stop under panic braking much, if any, quicker than its two-wheel-drive sister, the Interceptor, but this fantastic degree of control makes it so much more safe and secure.

Of course, on snow—or ice—one *will* find a limit of adhesion, even for the FF. On snow, the back will break away at first, in the same way as a rear-wheel drive car. But because the front wheels are driving as well as steering, the corrective opposite lock that is applied brings a much quicker response, the car straightening out almost as soon as the break-away has begun.

I did not drive the car with out-and-out figures in mind, but generally the performance is more than adequate. Acceleration is excellent, with 100 mph coming up in under 20 seconds.

To sum up, the Jensen FF scores on its unsurpassed surefootedness. Under any road conditions it has no equal. Even at the same speeds in adverse conditions that one would use in a rear-wheel drive car, the FF allows very wide margins of safety and a total absence of that tense feeling normally present when the going is difficult. ★ ★ ★



Sailless sailing

Kites launched from the deck of a sailboat will pull the boat at a good clip. Writer Ben Kocivar and kite-flying champ Will Yolen used six, spaced 100 feet apart, to prove it.



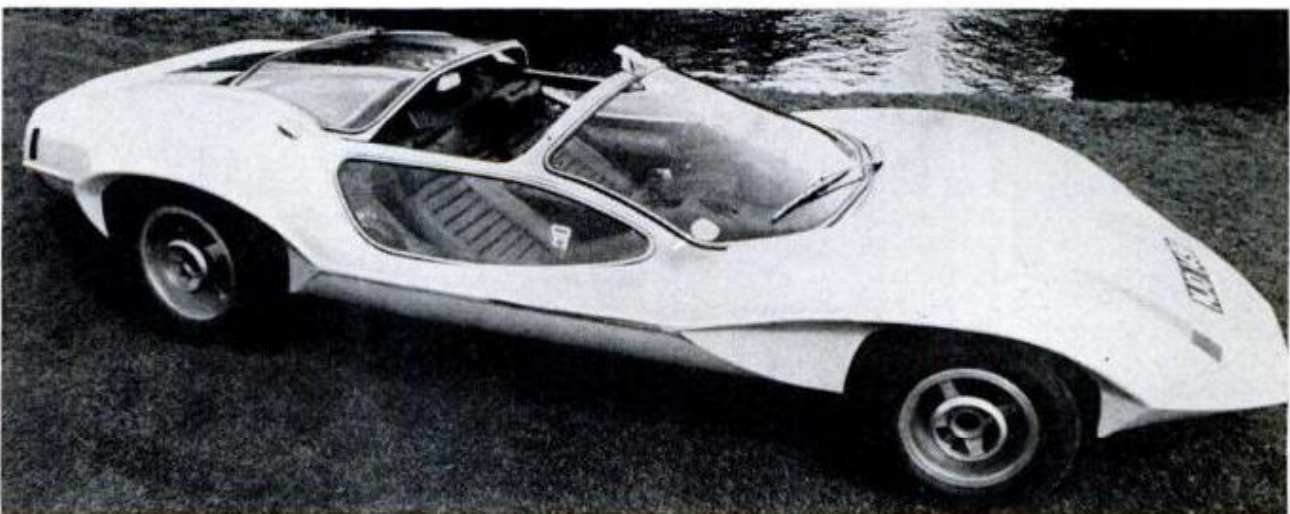
Spacesaver

The Dutch owner of this two-story van says he stacked them to save parking space. However, the piled-up VWs do draw attention to the fact that he operates a garage in Amsterdam.



March Formula 1 racer debuts with great success

Jackie Stewart won the Daily Mail Race of Champions at Brand's Hatch March 22, driving the March Formula 1 car in its European debut. The car was conceived and built in 13 weeks.



Driver climbs in and out through the roof

Composer Jimmy Webb gets in and out of his 34-inch-high car, the Probe 16, via an electrically operated roof. The fiberglass-bodied car was custom-built in Britain.

A Nationwide Survey Based
 On 1,375,000 Owner-
 Driven Miles

Toronado Owners Really Dig Fwd but Say Gas Mileage a Bummer

By MICHAEL LAMM, West Coast Auto Editor

Photos by the Author

WHY BUY A 1970 TORONADO? "Because I like the style, the handling and the size. It's my 25th Olds and my fifth Toronado."

This answer came from a California insurance man and typifies a large percentage of Toronado owners. Many are repeat buyers. What they like best about their cars is the styling and the front-wheel drive. Not one regretted fwd; and most—without being asked—gave the car top marks in traction on ice and snow, stability in crosswinds and overall handling. A few owners complained of short tire life and some admitted front-end alignment problems, but these represented the minority. Let's review some of our owners' replies under specific headings.

First, we'll go a bit more deeply into their reasons for buying 1970 Toronados. "Always bought new T-Birds, but I didn't like styling of '70 model." "Had a 1966 Toro, 120,000 miles, minimum repairs, superb handling, so I figured why not another?" "Believe it to be best car GM makes; have owned 1968 and '69 Toronados." "My third. Best car I ever drove." "Being interested in cars and understanding something about what makes them tick, I can appreciate the pioneering spirit at Olds in perfecting fwd. Have owned '66, '68 and now a '70 model. The people who pro-



duce these cars deserve much more credit than they're getting. With all the differences from conventional design, it's amazing how few problems I've heard in talking to other owners."

► **How about ride and handling with fwd?**

"Car handles beautifully on slippery, icy roads, even without snow tires or studs." "I figure I save \$50 a year not having to buy two sets of tires, even though the Toronado does go through front tires faster than normal." "Outperforms all others on sand, snow, ice. Fwd greatly reduces skid possibilities."

Yet there were a few dissonant notes on ride. "Rear bottoms easily at rail crossings. Took it to the dealer twice, but it still bumps." "Rear passengers find ride rough." "My previous car was a '69 Corvette. The Toronado understeers." "Small turn of wheel and car wants to change lanes."

► **How do owners feel about comfort?**

"Flat floor adds considerably to driver and passenger comfort." "Comfortable in front, but too cramped in rear." "I drive, but also take turns as a passenger in rear. Comfortable both ways." "Short on leg and headroom for a tall fellow." "Not enough headroom for a big man. Seat must be all the way back, then rear passengers get legs chopped off." "Great, smooth, quiet ride; fine seats." "I feel it's silly to have a flat front floor and then buy the console, but the buckets were so comfortable." "A great long-distance car."

► **What about specific complaints?**

"Poor gas mileage." "I tow a house trailer with our '66 Toronado and get about the same mileage as the '70 without a trailer. My '66 ordinarily averages 15 and the '70 is getting 8-9 mpg."

"Price is off," says an Indiana agency manager. A Missouri exec echoes, "Not as good as it should be for the \$."

A small percentage of owners (5.9) would have liked more choice of body styles. "Wish they'd offer a front-drive wagon." "I feel they should have a full line of body styles. Why should I have to buy a two-door to get fwd and other benefits? No telling how many people

JUNE 1970

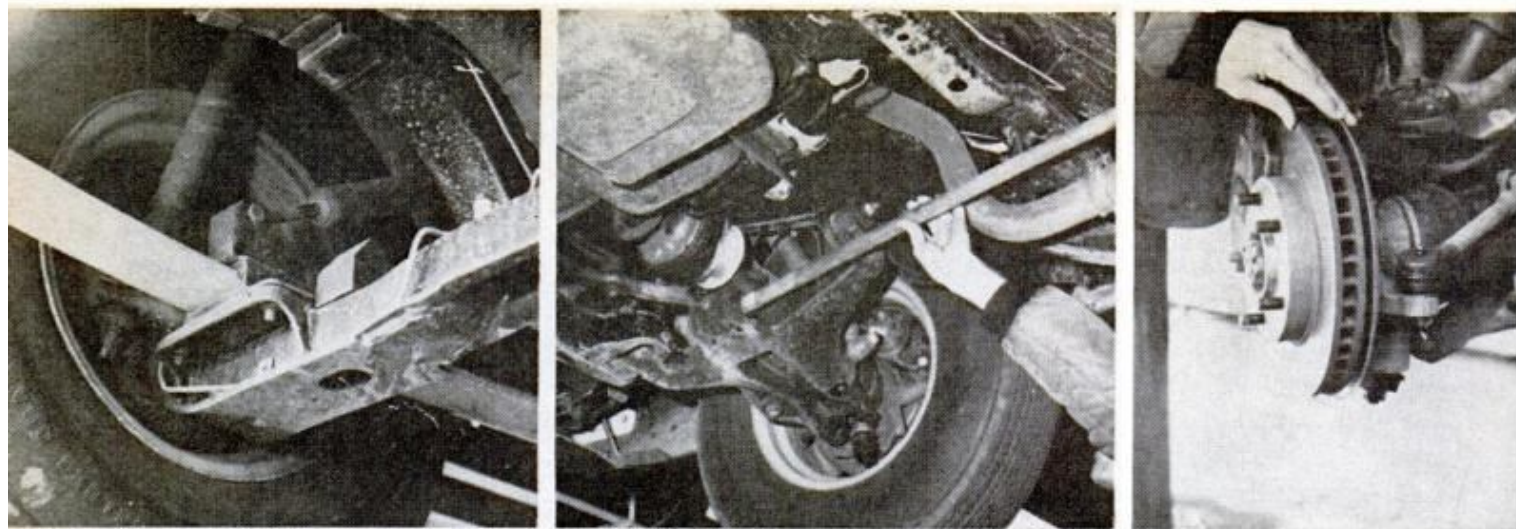


TORONADO'S FRONT DRIVE gets excellent traction due to weight over wheels. Weight transfer going uphill frontwards, though, makes tires spin on gravel

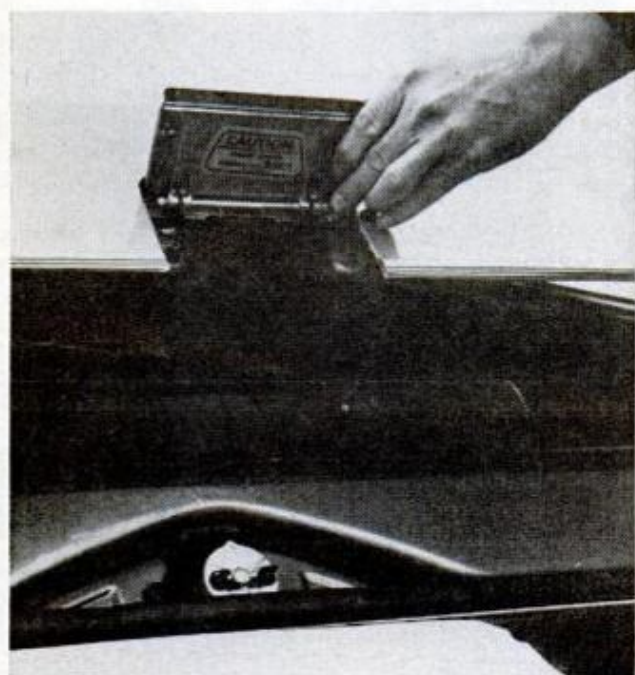


TALL DRIVERS complain of cramping rear passengers when they push seat back. Some owners would like more body styles. Trunk (below) is adequate but has high loading sill, awkwardly placed spare and tools





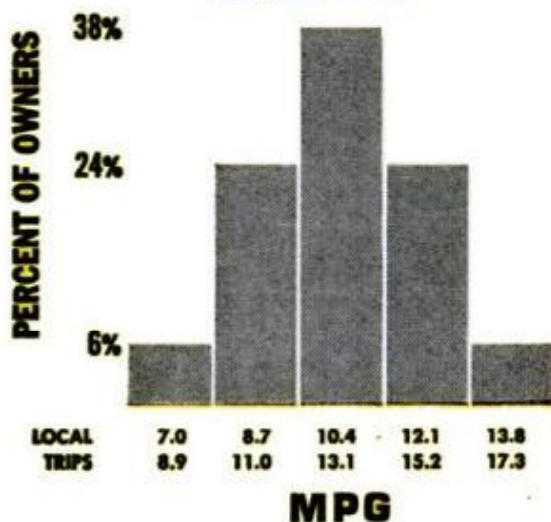
UNCONVENTIONAL SUSPENSION of car includes 1-leaf springs in rear, twin shocks. Torsion bars up front carry stub drive axles, standard discs. Engine/trans/differential are in unit, frighten some mechanics



GAS FILLER DOOR is in trunklid. Spring-loaded lid flies up easily; with filler door open can be lethal

TORONADO FUEL MILEAGE CHART

375 hp, 455 cu.-in. V8



didn't buy because of this single body.

► **What do owners think of the Toronado's general quality and workmanship?**

"The quality of workmanship is perfect as far as I'm concerned," wrote a quality-control supervisor. Another owner: "Overall quality far superior to my three previous Cads." But others disagreed. "Let's have metal instead of plastic." "Major items are all excellent, but a few minor details spoil the effect: headliner material sticks out from moldings, loose screws in dash, etc."

► **What would owners like to see changed?**

"There should be an air inlet without having to turn on the fan." "Bring back quarter panes." "Rear passengers can't see over front seats." "The inside door handles are very awkward, especially for rear-seat riders. Previous Toronados used to have an extra handle at the back of the door. What happened to it?" "Wow—\$33 to replace a taillight lens!" "Trunk lid flies open like a shot; can break your jaw." And an Olds draftsman in Lansing said, "Needs more rear window area for ease in backing."

► **How are owners treated by their dealers?**

"We have a fine Oldsmobile dealer. The service we receive is outstanding." But a physician in Houston says, "Incredibly bad service. They don't seem to understand the car and won't take time to do things. Very courteous, though." Other owners say: "Excellent. Have bought nine new cars from same dealer in past 10 years." "My



NO COMPLAINTS on dash arrangement, seating stance; some object to headrests, lack of vent panes



TORONADO PLOWS, understeers, especially if you back off gas; otherwise general handling is good

dealer is so bad he can't change oil properly. I consider myself lucky I haven't had any major problems."

To sum up, we've picked the following questionnaire as completed by an Ohio manufacturer's rep: *Any mechanical troubles?* "Stiff steering due to U-joint misalignment inside column. Dealer fixed it free." *Why the Toronado?* Need high traction in snow to cope with hilly driveway. I also own a

'67 Toronado." *How's quality?* "Good." *What changes would you like?* "A more roomy rear seat and four doors." *How's comfort?* "Driver's seat good; rear leg-room moderate." *Specific praises:* "Excellent roadability, particularly on slippery or wet surfaces or in crosswinds. Reasonably quiet, easy to park and handle, good high-speed response." *Complaints?* "Trim seems chintzy. Otherwise can find no faults." ★★★

Summary of 1970 Toronado Owners Reports*

Total miles driven 1,375,703

Average miles per gallon:

375-bhp V8, local driving 10.4
 long trips 13.1
 400-bhp V8, local driving 10.7
 long trips 13.3

Engines:

455-cu.-in. 375-bhp V8 78.4%
 455-cu.-in. 400-bhp V8 21.6

Why the Toronado?

Front-wheel drive 41.6%
 Style 35.0
 Past experience 23.4
 Handling 12.8
 Performance 6.6
 Ride 3.4

Specific likes:

Handling 56.1%
 Styling 36.0
 Comfort 24.8
 Ride 23.9
 Front-wheel drive 22.9
 Roadability 13.7
 Power 11.5
 Performance 9.6

Specific dislikes:

Economy 11.8%
 Poor workmanship 8.6
 Poor ride 8.0
 Rattles 7.0
 Tire wear 5.8
 Quality of materials 4.8
 Wind noise 4.8

What changes would you like?

Better styling 15.4%
 Better rear vision 7.3
 Dash layout/style 6.6
 More transmissions 6.2
 More body styles 5.9
 Lower seatbacks 5.5

Had any mechanical troubles?

No 74.5%
 Yes 25.5

What kind of trouble?

Transmission 13.4%
 Carburetor 11.0
 Electrical 9.8
 Oil leaks 8.5
 Ignition 8.5
 Windshield wipers 7.3

Did you repair it yourself?

No 98.7%
 Yes 1.3

Dealer repairs satisfactory?

Yes 63.1%
 No 36.9

Is the Toronado your only car?

No 66.6%
 Yes 33.4

Other cars owned:

Olds products 34.7%
 Chevrolet 17.4
 Cadillac 9.6

Buick 9.1
 Volkswagen 7.3
 Mustang 7.3
 Pontiac 7.3
 Corvair 5.0
 Ford 5.0

Accessories/power options:

Airconditioning 61.2%
 Power windows 54.1
 Radio 51.8
 Stereo tape 48.2
 Power seats 47.3
 Rear defroster 30.2
 Tilt steering wheel 29.8
 Cruise control 18.8
 Vinyl top 16.1
 Tinted glass 12.9

What accessories/options would you order next time?

The same 86.3%
 Rear defroster 4.3
 Cruise control 3.6
 Stereo tape 2.9
 Tilt steering wheel 2.3
 Power windows 2.0

Age distribution of owners:

15-29 years 8.2%
 30-49 years 47.1
 50-plus 44.5

Would you buy another Toronado?

Yes 91.2%
 No 8.8

*Percentages might not equal 100% due to rounding and/or insufficient data.

New Pop-Up TV

Flips Its Lid

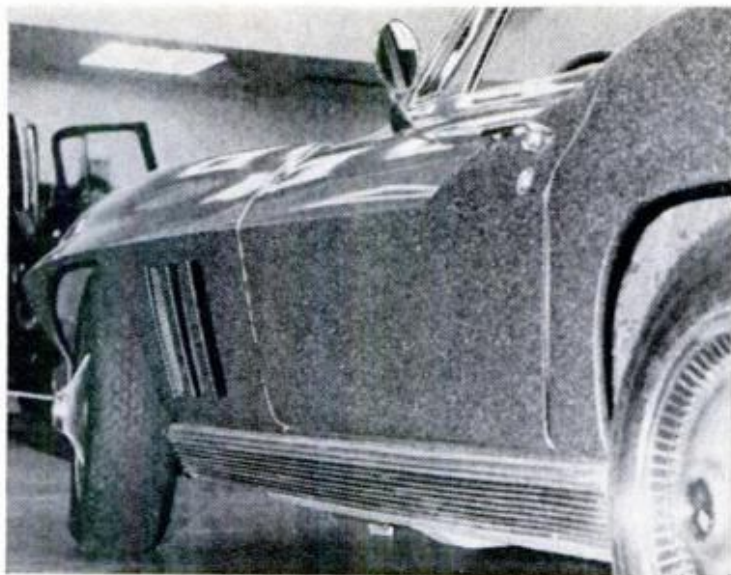


PRESS THE LID on this new portable TV and up pops a five-inch screen. As the screen swings up, the power goes on and the picture appears. Closed for carrying, the slim, compact set is only five inches thick—not much bigger than a briefcase. A telescoping antenna folds down out of the way when not in use.

Called the Pandora, the view-it-anywhere portable, just introduced by Panasonic, runs on self-contained rechargeable batteries away from home and can also be operated on a.c. house current with an adapter. The batteries give up to 3½ hours of viewing on a single charge and can be recharged overnight using the same a.c. adapter. Another adapter lets you use 12-volt d.c. from a car or boat.

In addition to TV, the 13-pound, transistorized set incorporates an AM/FM radio. You operate its novel roller-action tuning control by running your finger over a recessed cylinder in the top. A handle slides out at the front for carrying. Priced at about \$180, the Panasonic Pandora is sold by Matsushita Electric Corp., 200 Park Ave., New York, N.Y. ★★★





Cars with a velvet touch

If you get tired of a shiny paint job on your car, you can have it covered with a fuzzy finish that's soft to the touch and is available in six colors. Powdery felt is applied to the car by an electrostatic process, and it's made weatherproof at the same time with an application of resin. The "Plush Tex Fiber Finish" process was developed by Velvetronics of Sea Cliff, N.Y. Cost of treating side panels, hood stripes and top is about \$300 to \$400.



Cranking transforms trailer into a small house

After arrival at a campground (upper left), it takes Constantin Sfedu just five minutes of cranking (upper right) to unfold his "Trans-Home" travel trailer from its 6½ by 12½-foot towing size to a 13 by 19½-foot home (lower left). Sfedu appears at lower right in the living room. The trailer, which has room for five people, is completely equipped with kitchen, bath, beds and furniture. Sfedu now manufactures the home in Lugano, Italy; price is about \$5000.

Simple Camera Checks For Good Summer Shooting

By PHIL GERACI



GLASS WINDOWS for viewfinders, range finders and exposure meters often become clouded with grime. Keep them clean with a cotton swab and alcohol to dissolve film deposits



EXPERT REPAIRMAN Charlie Scheer, shown in his Washington, D. C., shop, keeps cameras rolling for the nation's top press photographers who cover the White House. His suggestions for good camera care are shown on these pages

A top repairman tells you how to keep your camera working smoothly during vacation months

EIGHTY PERCENT of all camera troubles are caused by dirt. That's the word from one who should know. He's Charlie Scheer, owner of National Camera Repairs in Washington, D. C., and chief consultant on camera problems to top White House news photographers.

Since dirt is a camera's No. 1 enemy, it follows that getting rid of it is the No. 1 step in good camera care. This is especially important when photo equipment has lain around unused for a time, as is often the case during the winter months. Fine dust particles can sift into a camera just sitting untouched on a shelf. Oily fingerprints and moisture attract and hold dirt like glue so that grimy deposits quickly build up.

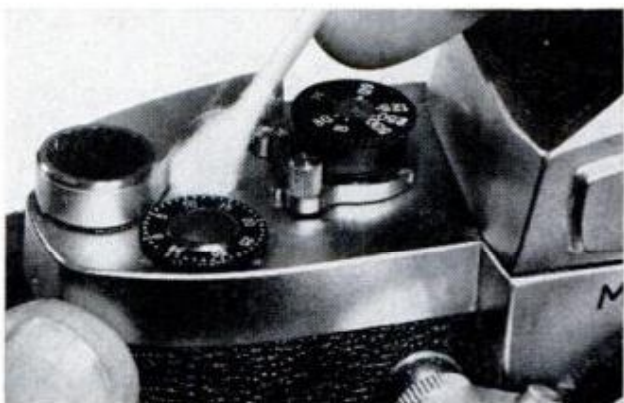
If you just haul out your camera and start banging away with it, you grind the accumu-



KEEP LENSES CLEAN with a soft brush. Use a special photographer's lens brush for this. One shown above combines a bristle tip with a rubber syringe for blowing a stream of air, useful after brushing



DELICATE MIRROR used in a reflex-type camera requires special handling. You can brush it lightly if necessary, but it's even better to use only a gentle air stream from a syringe, as shown below



DIRT AND GRIME collect around a camera's controls and can eventually work their way inside, gumming up intricate mechanisms. Remove such deposits with a cotton swab dipped in rubbing alcohol

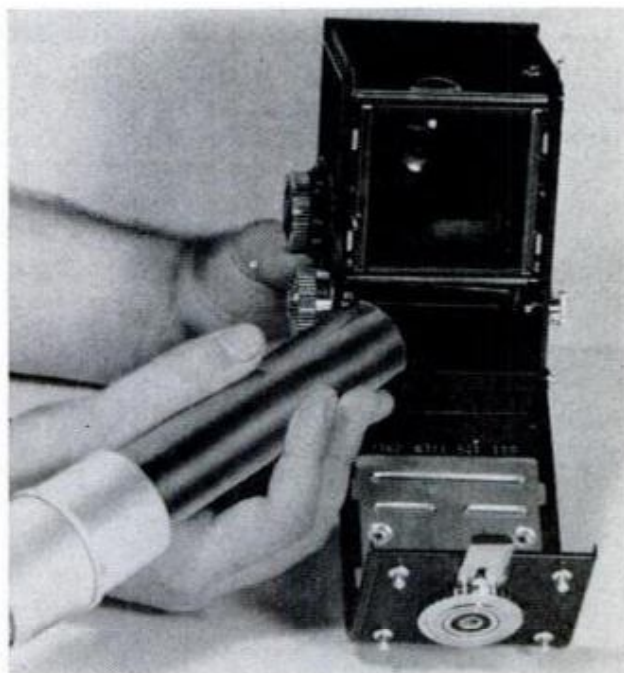


BLOW DUST from inside camera with a small rubber syringe. If the mirror is the type you can lock up, clean it first in the down position, then raise it out of the way and blow out the dirt behind it

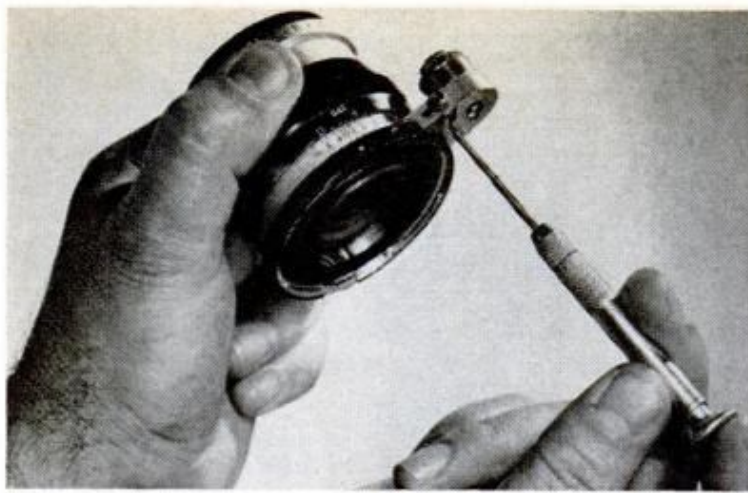
lated dirt deeper into the controls and delicate mechanisms. Your shutter starts to slow down, your flash synchronization goes out, the film advance may jam, and suddenly you're in trouble. The remedy is periodic cleaning to catch dirt before it has a chance to build up.

The most likely spots for dirt to seep into a camera are around the controls. These should be kept clean by regular brushing with a soft camel's-hair brush. Use a small, good-quality paintbrush or a photographer's lens brush. Built-up grime that can't be brushed away can be removed with a cotton swab dipped in rubbing alcohol. Also use a cotton swab and alcohol on the windows for viewfinders, range finders and built-in exposure meters.

Delicate parts like the lens, the film pressure plate and the mirror on reflex-type cameras require special care. The pressure plate is found on the inside of the camera back and its function is to



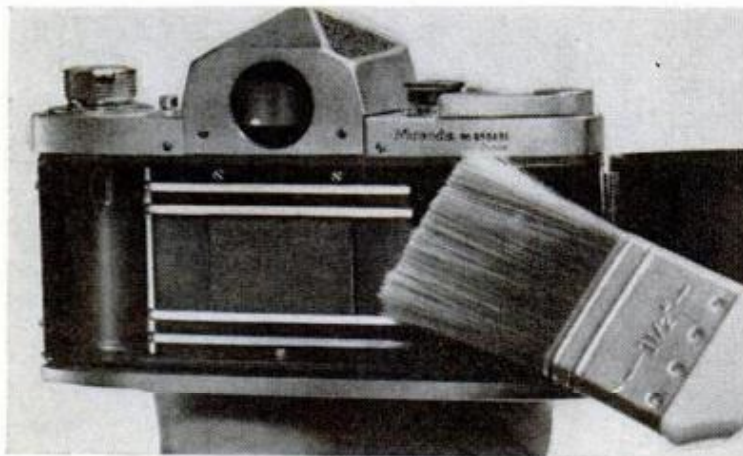
A VACUUM CLEANER is handy for removing dust from hard-to-reach places in the camera. Use it only on suction, though; never when it's on blow. A blast of air can force dust particles deeper into critical parts or add new dirt, complicating the cleaning task



TINY SCREWS in lens barrels and other camera parts frequently work loose and fall out, causing serious damage. Give them a periodic tightening with a small jeweler's or model-maker's screwdriver sold at hardware stores and hobby shops



USE LIQUID LENS CLEANER only as a last resort to remove stubborn gummy deposits. Swab it on gently with a wadded-up lens-cleaning tissue, then wipe the lens dry. Excessive use of liquid cleaning agents can harm the coating on a good lens



A SOFT-BRISTLE PAINTBRUSH of the narrow sash and trim type is useful for getting into crevices inside a camera. Brush out the film compartment, being careful not to damage the thin fabric curtain on cameras with focal-plane shutters

keep the film flat and smooth behind the lens. You can brush gently around it, but be very careful not to scratch it. A scratch on the plate will, in turn, scratch the film pressed against it.

When working with lenses and mirrors, Scheer advises extreme caution. Use the least amount of cleaning that will do the job. Scheer believes that most people overclean their lenses while ignoring the rest of the camera. Excessive wiping can damage the thin antihalation coating on a lens and cause scratches. Start by blowing dust particles away with a small rubber syringe. These are available at camera shops and drugstores. Dirt that can't be blown away can be loosened by gentle brushing. On removable lenses, clean the rear element as well as the front one.

If necessary, the blowing and brushing can be followed by a light wiping with lens-cleaning tissue to remove any remaining film. Use only the special tissue made for this purpose, however—never a handkerchief or other cloth as the threads can cause scratches. Use a liquid lens cleaner only if stubborn deposits still persist. Repeated cleaning with liquid solvents can also damage a lens. When lenses aren't in use, store them in plastic bags and keep both the front and rear elements capped.

On mirrors, use only a combination of blowing and gentle brushing. Never touch or wipe a mirror or you may damage its precise alignment. Also never remove a lens and leave the opening in the camera exposed. Cover the hole with a body cap or keep a lens on the camera at all times.

Dirt inside a camera is even worse than on a lens. Open the back and shake the camera first to dislodge any bits of film or paper that may have been torn off around the sprockets. Then brush out the interior, being very careful around the pressure plate and the thin curtain on cameras with

focal-plane shutters. Follow this with blowing to remove particles loosened by the brush. Always use a syringe for this. Never blow with your mouth or moisture in your breath will collect in the camera and cause rusting.

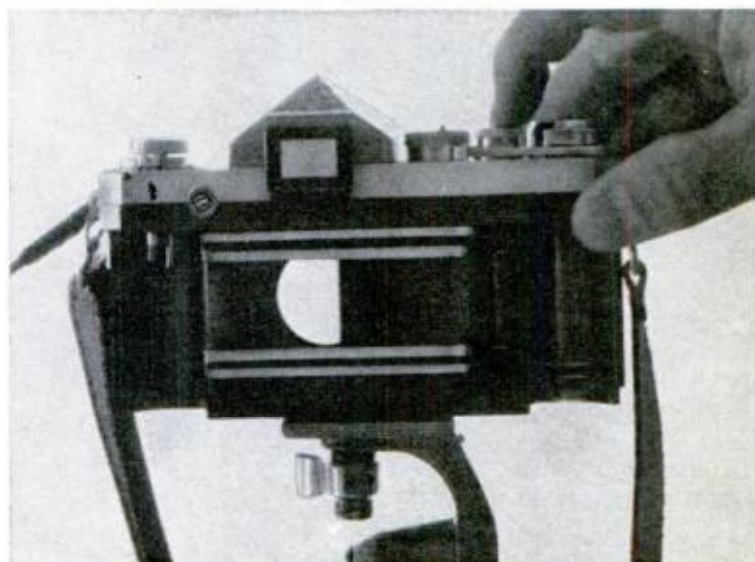
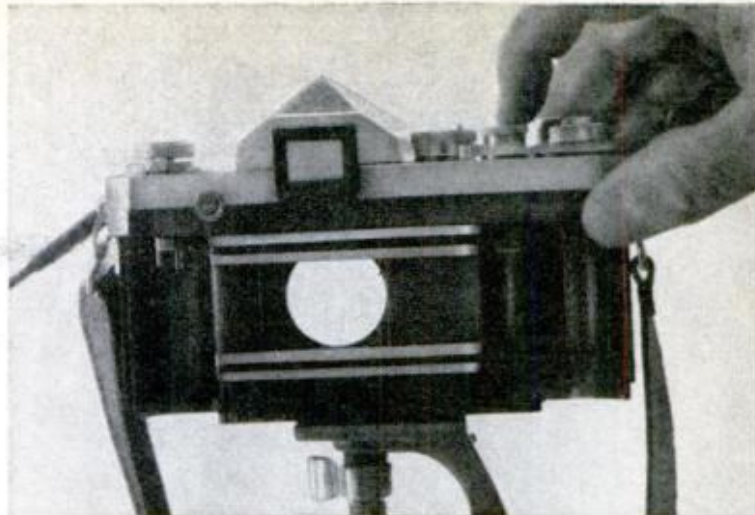
A vacuum cleaner is handy for removing dust, but use it only on suction. If you blow with it, you'll blast more dirt into the camera than you take out. Be careful not to touch anything inside the camera with the metal nozzle. Never attempt to oil any of the mechanisms, either, warns Scheer. This is a job for a professional. Oil in the wrong places can gum up a delicate mechanism and produce sticky surfaces that will only catch more dirt.

After cleaning, the next thing to check on is your shutter. Shutter speeds generally slow down as dirt deposits build up. Run a test roll of film through the camera at different exposures. Try some shots with and without flash. The exposures that are indicated as correct for your test scenes should produce good results, and there should be an even gradation of light and dark pictures on either side of the correct exposure.

Also try a series of tests at the same exposure but using different combinations of shutter speeds and lens openings. Open up the lens a stop at a time as you use progressively faster speeds. If your shutter is working properly, all of your test results will be exactly the same since the exposures are identical. If they aren't, it's an indication that your timing is off. Usually, a sticking shutter shows up at the higher speeds first.

If there are signs of trouble, take your camera to a professional repairman and ask to have the shutter adjusted. Don't attempt to do this job yourself. A quick test for flash synchronization on cameras with focal-plane shutters is shown in the accompanying photos. ★ ★ ★

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TRY THIS QUICK TEST for proper flash synchronization on cameras with focal-plane shutters. Point camera at a white wall, open the back and trip the flash. Sync is good if opening through lens appears round (top photo). If opening is partly blocked by shutter curtain (lower photo), the sync is off



ADDING A SKY FILTER to your lens will protect it from fingerprints and scratches. Such ultraviolet filters have no effect except to reduce the haze on distant shots, require no adjustment in exposure and can be left on a lens permanently



EXHAUST EMISSION VALVE is seated in the engine valve cover of some engines, in the intake manifold or hose lines of others. Pull out the valve, test for adequate vacuum and check condition of the hoses

10-Point Inspection for

By **MORT SCHULTZ**

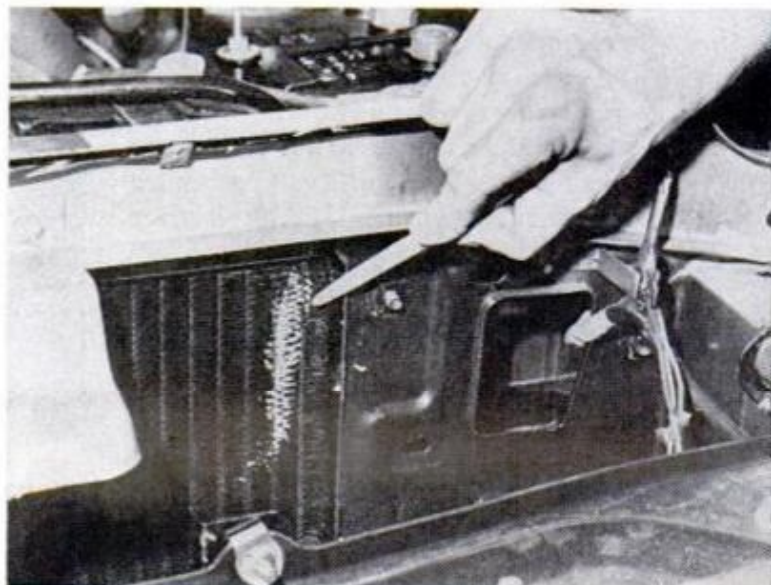
A WEEKEND CAMPING TRIP or a drive to the beach is quickly wiped out by overheating, brake failure, an automatic transmission that won't shift, or other car trouble.

Such a fiasco can be avoided with a good inspection program and about 15 minutes of your time. The objective is to spot a problem in its initial stages—before it can develop and put a damper on your summer fun.

Radiator hoses. Look at the top and bottom radiator hoses first. Are they cracked? Do they show a whitish substance, especially around clamps, which indicates leakage? Squeeze them. If a hose is mushy, it's deteriorating on the inside and should be replaced.

Eyeball the radiator core. Look for

RADIATOR CORE that shows signs of a whitish deposit may be leaking. Try a commercial stop-leak



POPULAR MECHANICS

whitish deposits, especially at corners, that indicate a coolant leak.

One way to seal leaks is by draining old coolant and installing antileak ethylene glycol antifreeze. Polymer particles in this type of antifreeze fill radiator cracks and, under heat and pressure generated by the cooling system, weld them shut. If you don't need new antifreeze, a leak may be sealed by adding a can of stop-leak.

To check coolant condition, remove the radiator cap. If coolant is rusty, it would be wise to replace it. The cooling system should be reverse-flushed if your finger gets coated with brownish sludge as you run it around the inside of the filler neck.

Now start the engine, let it run awhile, shut it off and sweep your hand around the water pump. If there is any sign of wetness, the water pump should be overhauled or replaced.

Drive belts. Pay attention to drive belts, which are often neglected. If belts are damaged or not adjusted tightly, the fan, alternator, power-steering pump, water pump and airconditioner compressor won't function at top efficiency.

Make sure belts are in good condition. Replace one that is cut, cracked, frayed or otherwise looks worn.

Press in on each belt about midway between the pulleys. It should give, but with plenty of resistance. If there's more than 1/4-inch play, tighten the belt by loosening the component holding it and by pulling back against the belt.

Use of a pry bar is necessary to get maximum belt tightness in a car equipped with airconditioning, but watch where you place that bar. Apply pressure in the center of the alternator—never against the end frame, which will crack under force. Never put a pry bar against that soft power-steering reservoir canister.

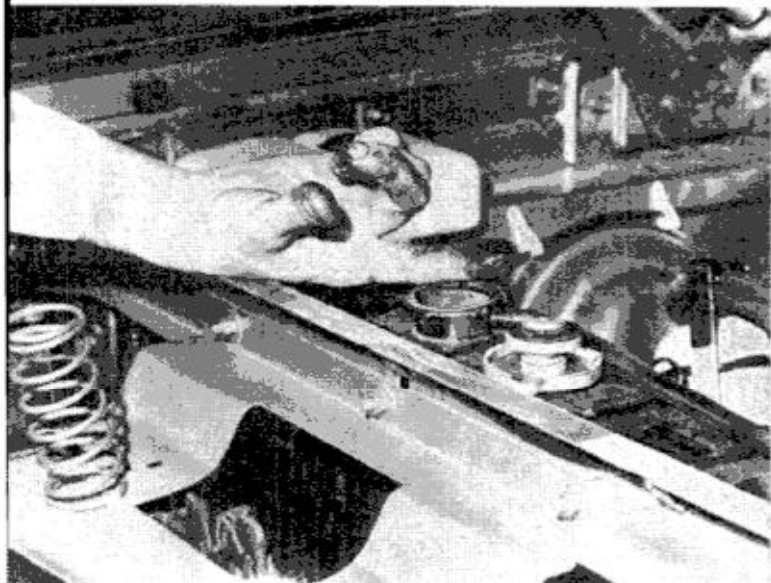
Battery. A quick comparison check of electrolyte specific gravity will warn you of a dying cell that could leave you with a worthless, unchargeable battery. Draw electrolyte into a battery hydrometer from each cell in turn and take readings. If the specific gravity of the highest-reading cell and the specific gravity of the lowest-reading cell differ by .050 or more, the battery hasn't long to live.

Emission system. Although you may have recently cleaned or replaced the carburetor air cleaner, uncover and examine it. It can tell you how the car's exhaust emission system is functioning.

Black oily deposits on the filter indicate

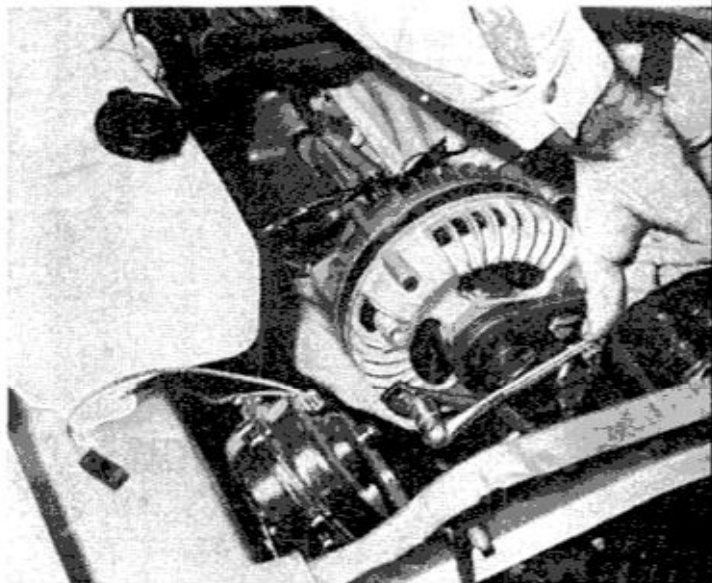
Carefree Summer Driving

RADIATOR FILLER NECK coated with brown sludge is sure sign that the cooling system needs flushing

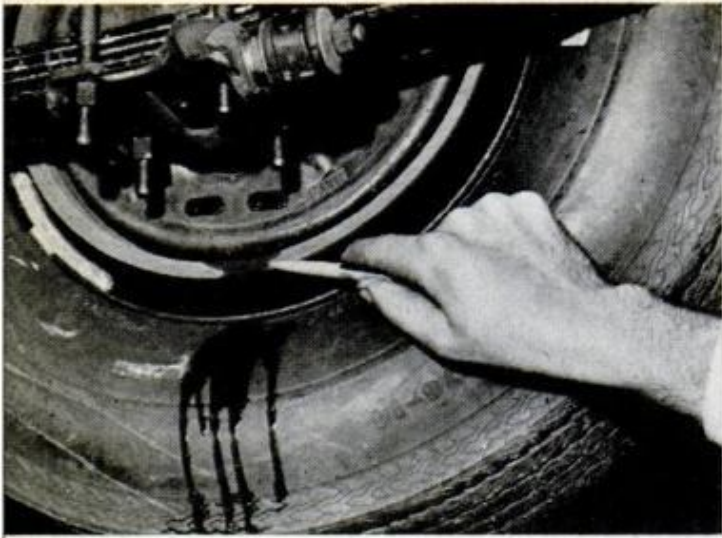


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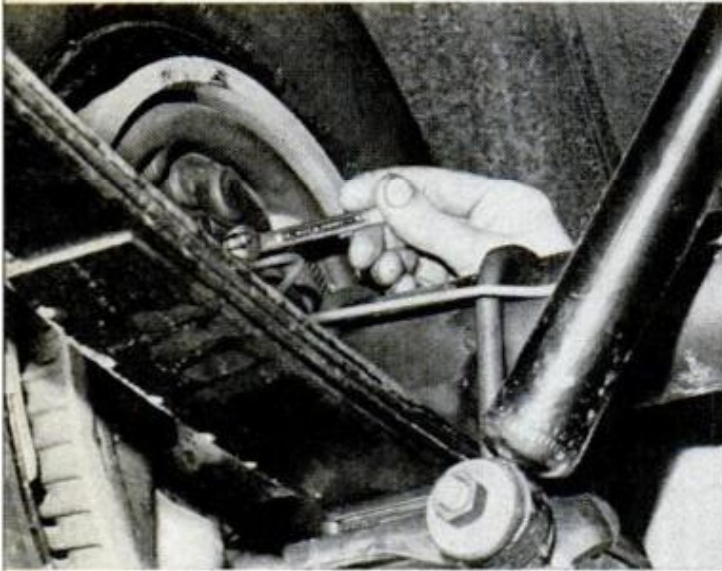
DRIVE BELT on this car is tightened by loosening the alternator and pulling it up to adjust tension



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WHEEL-BRAKE CYLINDER that is leaking is bound to leave tell-tale traces of fluid around drum, tire



BRAKE FLUID is drained from system by opening bleeder valve at the wheel and pumping brake pedal



TRANSMISSION DIPSTICK pulls up sample of fluid: a varnish smell or discoloring indicates trouble

that the emission system is clogging up. When the trouble goes too far, it will affect gasoline mileage, cause oil to be thrown out of the crankcase, and lead to missing and reduced engine power.

A malfunctioning emission system is caused by a damaged emission-control valve, or damaged hose or plugged carburetor port that is reducing vacuum pressure. Pull the valve from its seat and shake it. You should hear clicking. If not, the valve is damaged and should be replaced. To be sure you get the right valve, take the old one with you to the store.

Start the engine and let it idle. Hold your finger over the open end of the valve. You should feel strong suction. If suction is weak or lacking, check the hose carefully for cracks or kinks. Replace damaged hose. Then carefully ream out the port in the carburetor to which the vacuum hose connects.

Brakes. Remove the cover from the master cylinder and check the brake fluid level. If fluid is up to level and brakes have been functioning properly, there's no reason to believe that the system will fail you during the summer. However, a low fluid level is cause for concern. Fluid is going somewhere.

Track it down by getting under the car and wiping dirt off brake lines. Put the system under pressure by applying the pedal and determining if any of the lines are leaking. Pay close attention to inner walls of tires and wheels. Signs of brake fluid here mean that the wheel cylinder is leaking.

Naturally any brake problem while driving (chatter, pulling) is reason enough for a thorough brake examination. However, there is one condition that a driver might disregard and which could cause a sudden emergency later on. This is contaminated brake fluid.

One way to recognize it is when you stop for a traffic light and the brake pedal starts to fall away, but not sufficiently to go to the floor. Brake fluid becomes contaminated when the alcohol content is upset by water, dirt, evaporation or what have you. The solution is to check the system to make sure it is still closed (no leaks), replacing the fluid and bleeding the system.

Automatic transmission. Not enough drivers pay attention to the automatic transmission until shifting problems pop

up. By that time, it may be too late to avert a major overhaul.

Pull the automatic transmission fluid dipstick. Has the fluid lost its reddish color? Is it orange or black? Does it have a smell to it like varnish? If so, bands inside the gear-box are on their way to failure for one of a few reasons, such as misadjustment or misuse of the transmission.

If damage is in its early stages, it can be halted. Drain the fluid; replace the filter screen, pan and valve body; and adjust the bands. Automatic transmission service can be done at home (see next month's *Saturday Mechanic*).

Engine block. Here's one more check to make in the engine compartment. With the engine hot, pull the oil dipstick and let a few drops of oil fall on the exhaust manifold. If the oil sizzles and bubbles, there is water in the oil. The block is probably cracked, which could lead to all sorts of overheating troubles during hot weather. The oil should spread without sizzling and bubbling.

Exhaust, shocks and tires. To finish your quickie presummer inspection, get down and check the exhaust system, shock absorbers and tires. Run your hand over the exhaust pipe, muffler and tail-pipe. If lots of rust comes off, the part soon will have to be replaced.

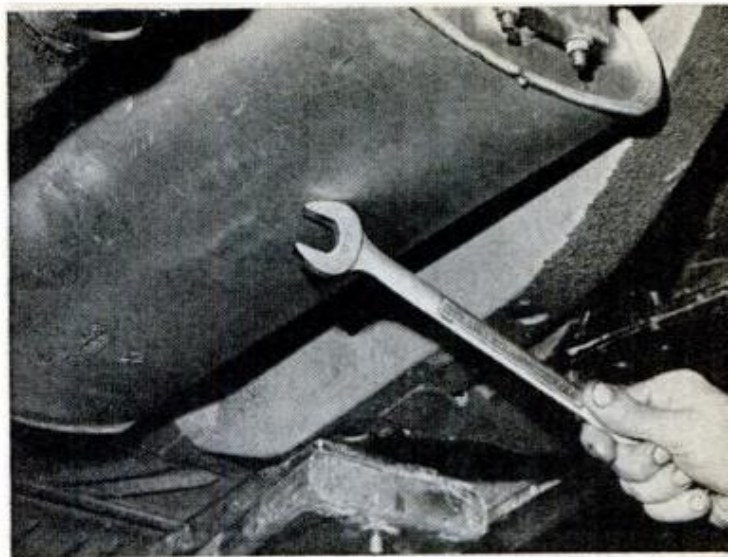
Tap the muffler and pipes with a wrench or pliers to check for internal failure. A dull clank means that the part is being eaten away from the inside.

Look at shock absorbers. Are there signs of oil leaking down the outside of the tube? If so, you've got a bad shock which should be replaced before you do extensive summer driving.

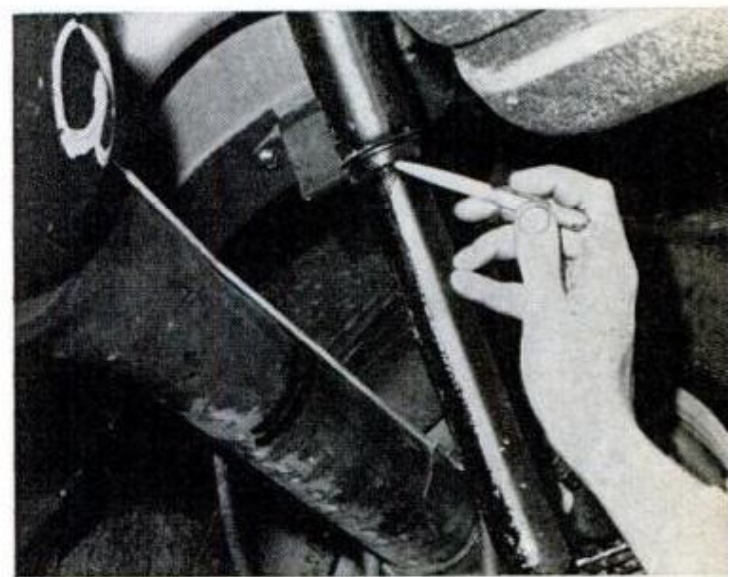
Some mechanics contend that if one shock is bad, its opposite-side mate is also damaged or soon will be, and that shocks should be replaced in pairs. Maybe so, but I think it expensive to replace parts that don't have to be replaced. So I would give that opposite-side shock a good test by disconnecting it and pushing it in to see if it resists pressure. If it doesn't, then you can replace it.

No inspection is complete without a careful analysis of the tires. If tire tread is worn below the safe limits, the tire should be replaced. If tread is wearing abnormally, you should check front-end alignment and wheel balance. ★ ★ ★

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TEST RUSTY MUFFLER by rapping. Wrench might go right through it; dull clank means it's near failure

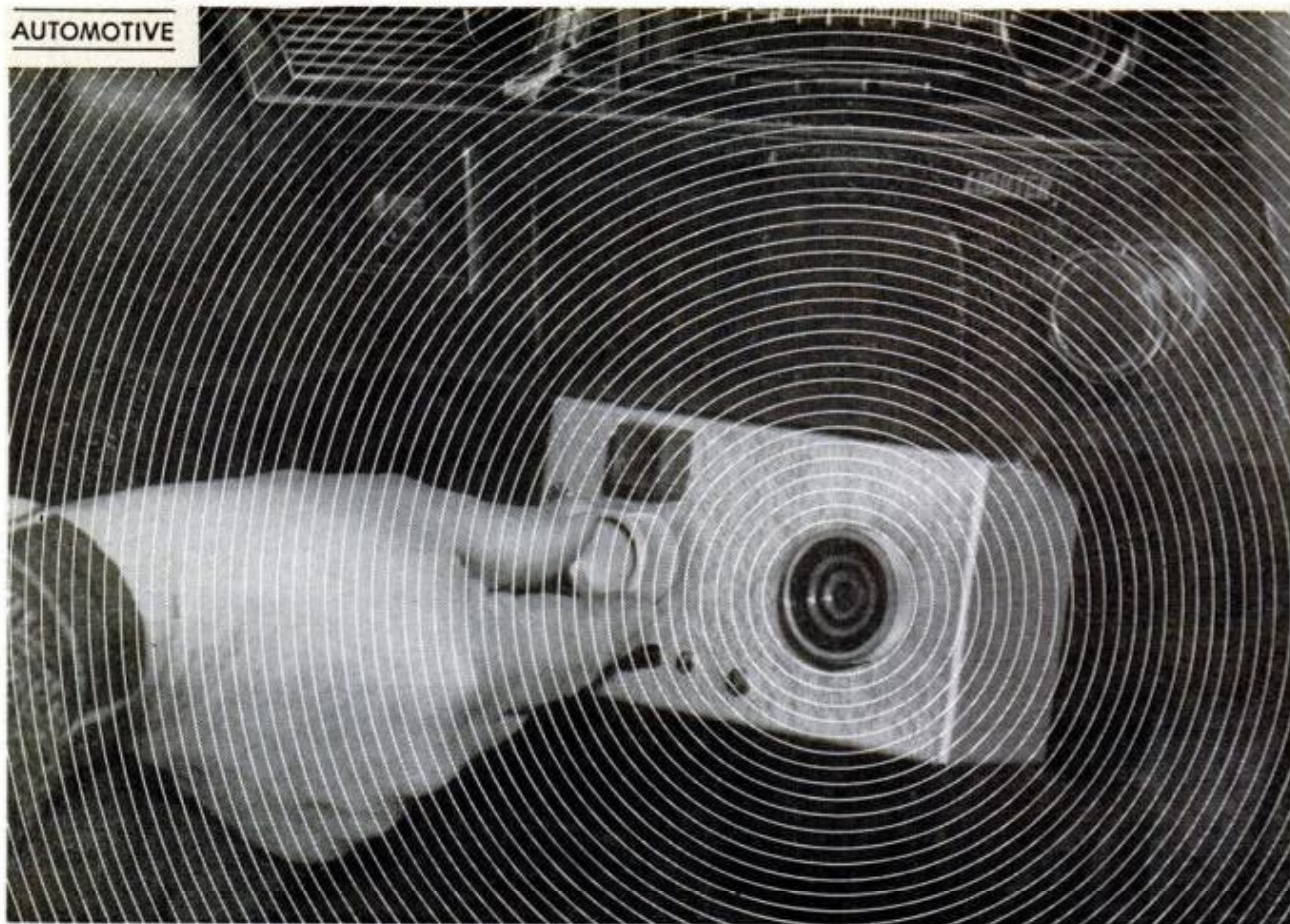


SHOCK ABSORBER that shows signs of leaking hydraulic fluid can't be fixed; remove and replace it



CHECK TREAD for at least $\frac{1}{16}$ -inch remaining; don't wait for tires to go bald. Half a match head is $\frac{1}{16}$ inch

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SAVE YOURSELF A TICKET WITH THIS AUTO SPEED ALARM



This home-built electronic device blares out a loud warning if you unconsciously exceed a preset limit. Result: safer driving—and no troopers on your tail

By **GEORGE J. WHALEN** and **RUDOLF F. GRAF**

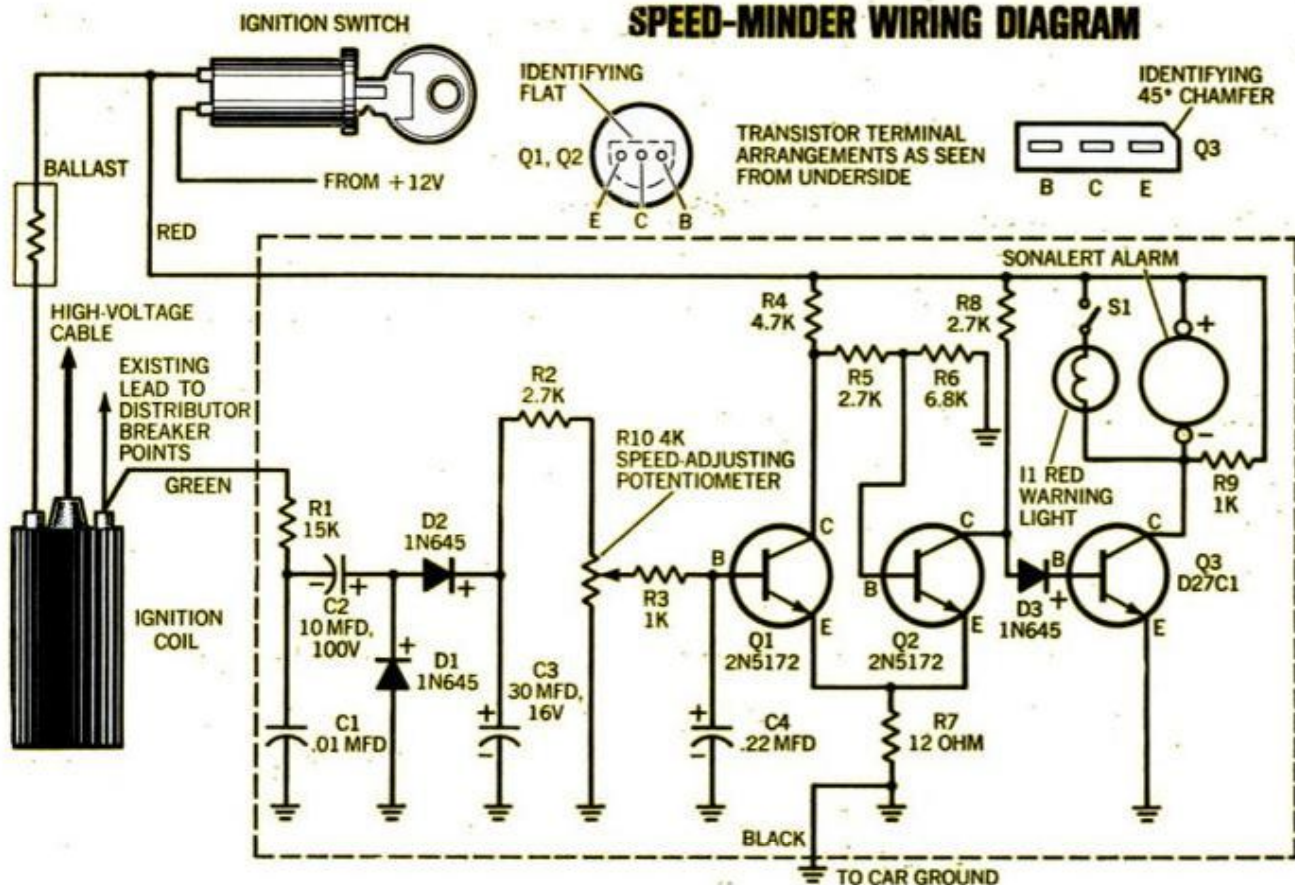
YOU'RE BARRELING ALONG a high-speed turnpike when suddenly you hear the wail of a trooper's siren. You thought you were driving legally, but what often happens on fast roads is that your speed creeps up slowly without your realizing it. Before you know it, you're over the limit and in for trouble.

With this electronic speed-minder under your dash, you're safe. You set it for the speed you want to drive at. If you unconsciously exceed that speed, the alarm gives out a loud screech and a red light flashes on. The circuit senses electrical pulses from your distributor breaker

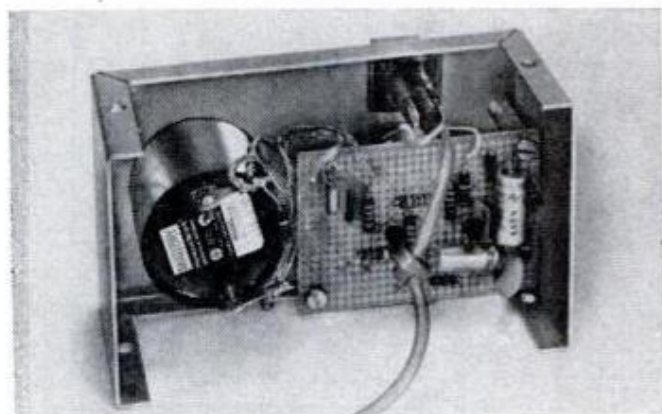
points. When these pulses rise above a preset rate, a transistor fires, turning on the light and a Sonalert alarm that sounds a high-pitched warning.

Small parts are wired on perforated phenolic board mounted on standoffs inside a minibox. A potentiometer adjusts the speed at which the alarm is triggered. To set it, turn the knob on front fully clockwise, drive at the speed you don't want to exceed, then back off the knob until the alarm sounds. Whenever you hit this speed, the alarm will go off. If you should not want the alarm at any time, just turn the knob to clockwise position.

SPEED-MINDER WIRING DIAGRAM



SPEED-MINDER CIRCUIT requires only three connections—to the ignition coil, ignition switch and car ground



TINY CIRCUIT BOARD is mounted on 1-inch standoffs at the corners to space it away from the metal minibox

Hooking up the speed-minder requires only three connections. One wire goes to the car's ground system. A second wire goes to plus 12 volts at the ignition switch so the alarm will be activated when the key is turned on. A third wire goes to the low end of the ignition coil primary. You can identify this terminal because there will be a wire running from it to the distributor breaker points.

All parts except the GE transistors are available from Allied Radio, 100 N. Western Ave., Chicago, and Lafayette Radio in Syosset, N. Y. The GE transistors can be obtained from Newark Electronic Corp., 500 N. Pulaski Rd., Chicago. ★★★

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PARTS LIST

- C1—.01-mfd disc capacitor, 1KV
- C2—10-mfd, 100-WVDC electrolytic capacitor
- C3—30-mfd, 16-WVDC electrolytic capacitor
- C4—.22-mfd disc capacitor
- D1, D2, D3—GE Type 1N645 silicon diode
- I1—12v, 100-ma indicator lamp assembly (Industrial Devices Corp. Type 3061)
- R1—15K, 1/2-watt
- R2, R5, R8—2.7K, 1/2-watt
- R3, R9—1K, 1/2-watt
- R4—4.7K, 1/2-watt
- R6—6.8K, 1/2-watt
- R7—12-ohm, 1/2-watt
- R10—4K linear taper potentiometer
- S1—Single-pole, single-throw slide switch (optional if separate control of red light is desired)
- Sonalert alarm—Mallory Type SC-628P
- Q1, Q2—GE Type 2N5172 NPN transistor
- Q3—GE Type D27C1 NPN transistor
- Case—5 1/4 x 3 x 2 1/8 in. (Premier Metal Products PMC-1006)
- Misc.—Perforated phenolic board for chassis, 1-in. standoffs, 6-32 hardware, 3-conductor cable, wire, solder

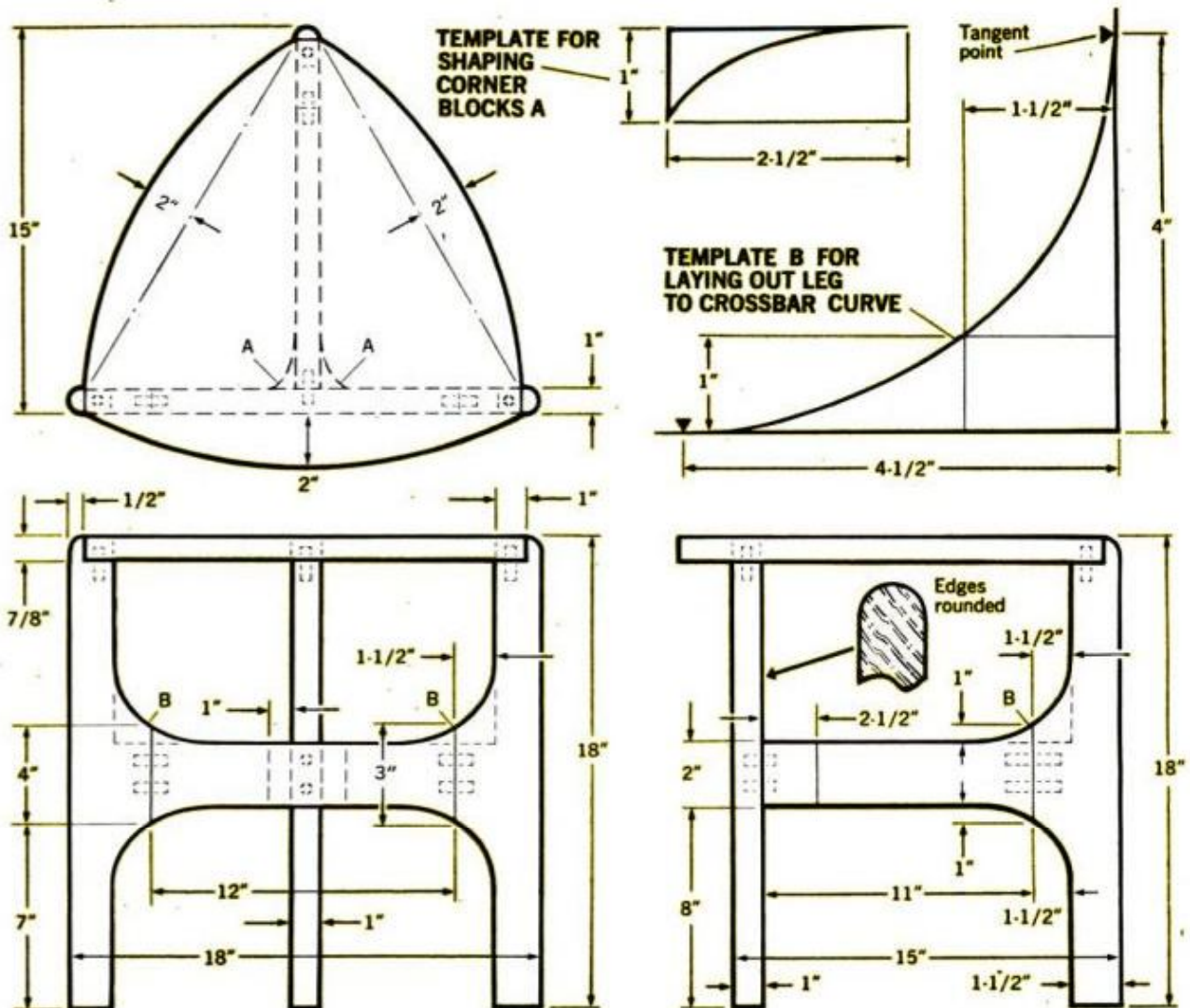
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Five Weekend



Chairside Table

OF CONTEMPORARY DESIGN, this attractive table has solid walnut legs and crossbars and a top surface laminated with matching woodgrain. Though the graceful curves give the appearance of being sculpted joints, they are actually made by gluing in shaped blocks. To cut the top, lay out the curve from corner to corner using a thin strip of straight hardwood. Clamp the first end and form a bow to approximate the shape shown. Pencil the line for cutting and repeat the procedure for the other two curves. Make the curved cuts with a sabre saw or band-saw, and carefully round all (except the top) outside edges with a block plane. After sanding, finish with two coats of Watco Danish Oil. Apply decorative laminate to the top.—*John Fowler*

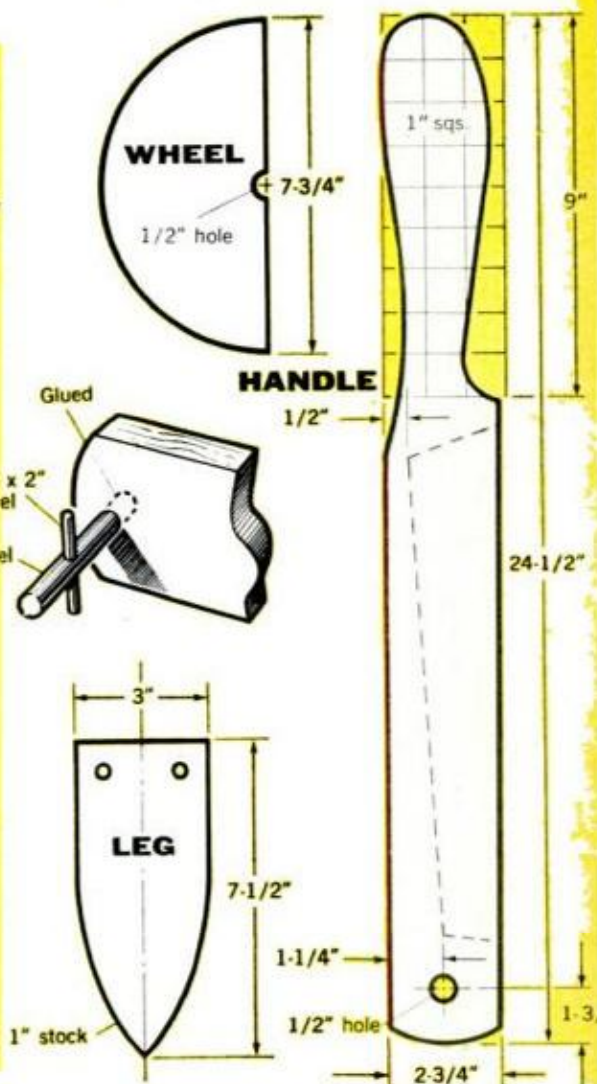
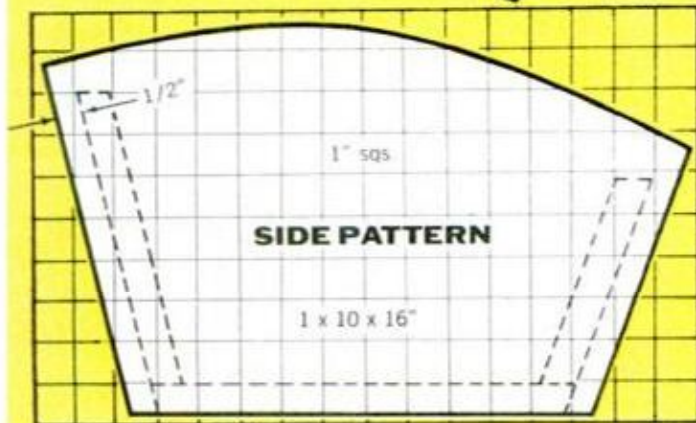
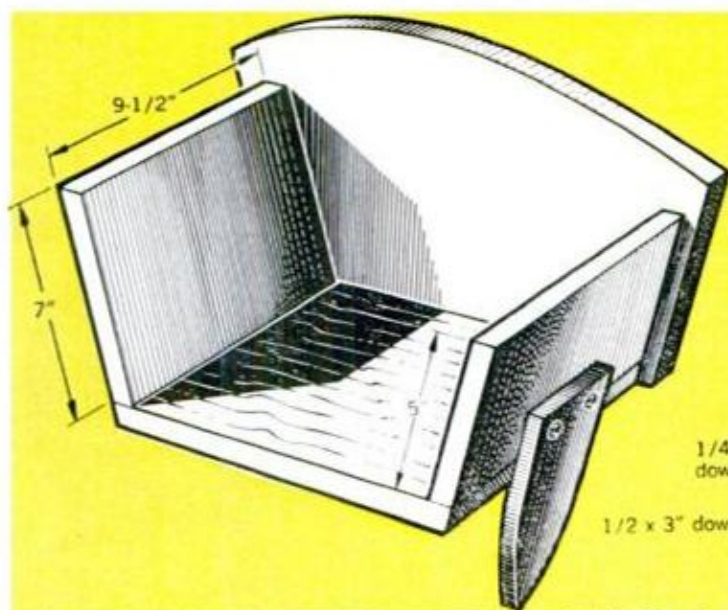
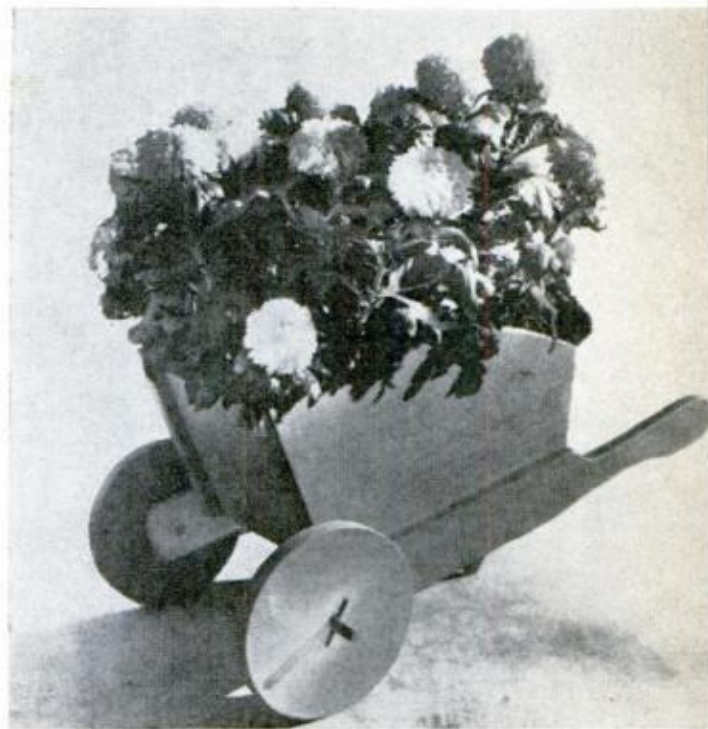


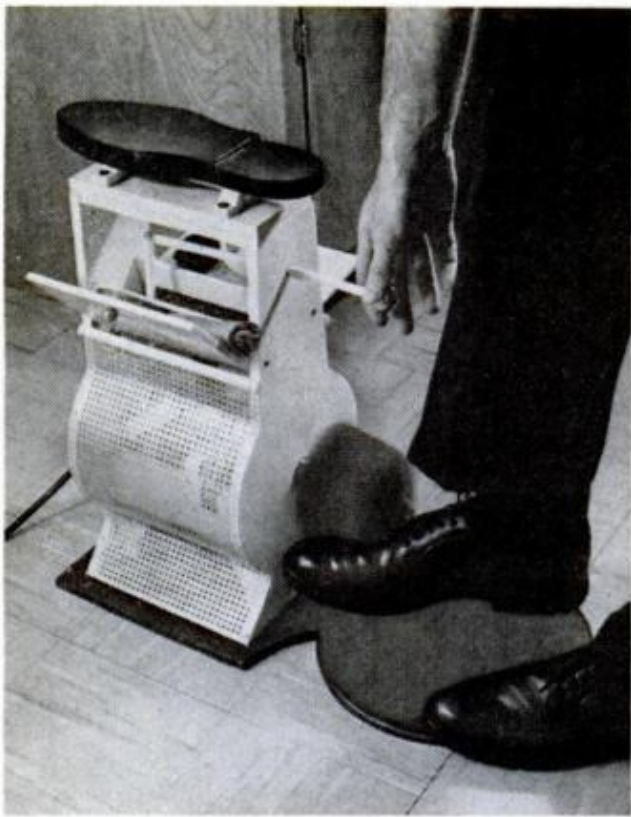
Workshop Projects

Wheelbarrow Planter

THIS LITTLE PATIO PLANTER is fun to build whether you are a dyed-in-the-wool woodworker or a guy taking his first whack at a project. Douglas fir was used here but other material can be used. To start, lay out and make all straight cuts for the bottom, side panels and the two end pieces that make up the wheelbarrow bucket. Next, set the saw blade at a 30° angle and make the bevel cuts in the two end pieces. To keep construction simple, use butt joints for all assembly. But, to insure strong joints, make certain that edges to be joined are perfectly square. Finally, cut the handles and the wheels. The plans call for all parts to be cut from 3/4-in. (actual) stock. The wheel axles are 3-in. lengths of 1/2-in. dowel.

—Bob Corley

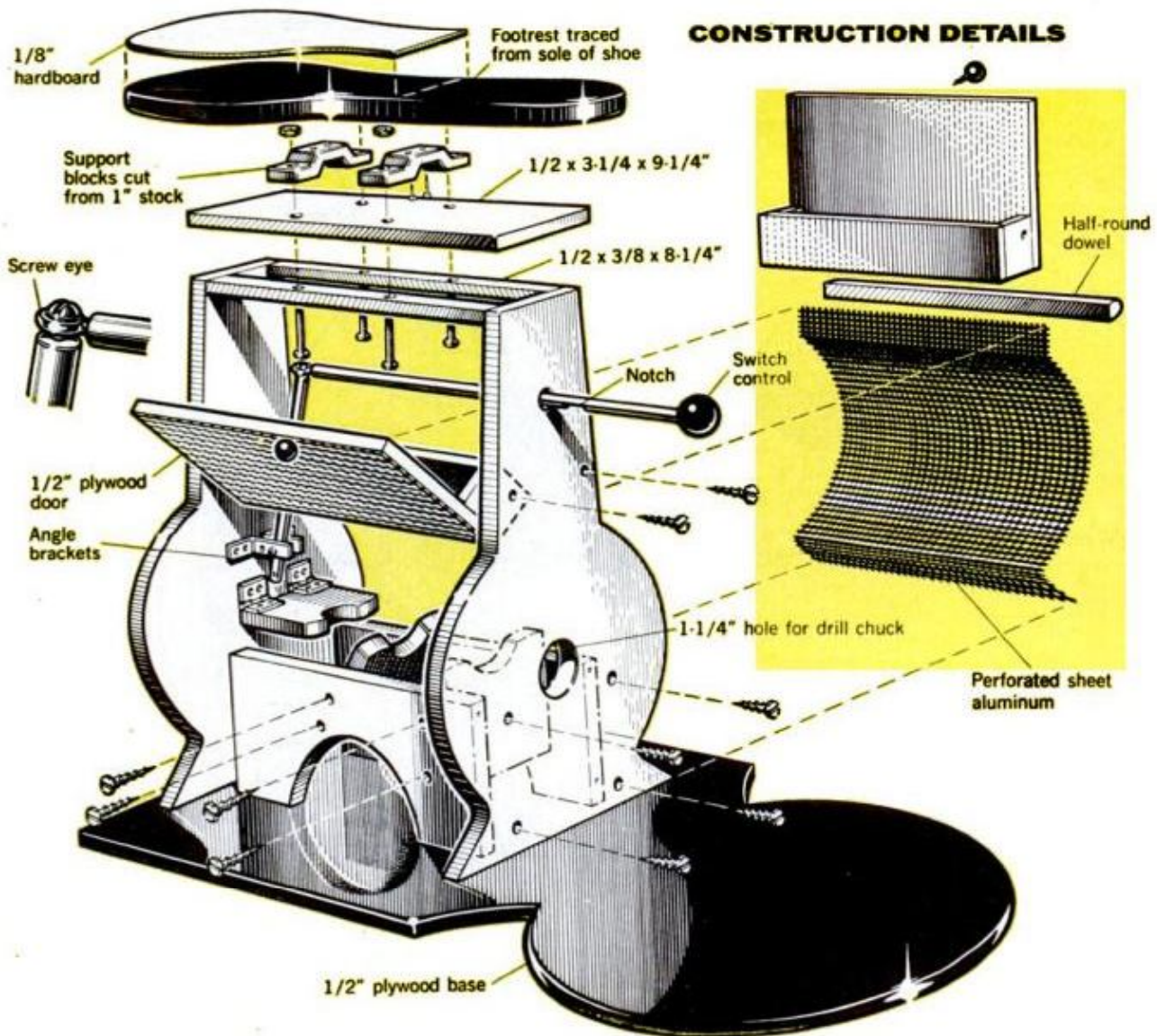


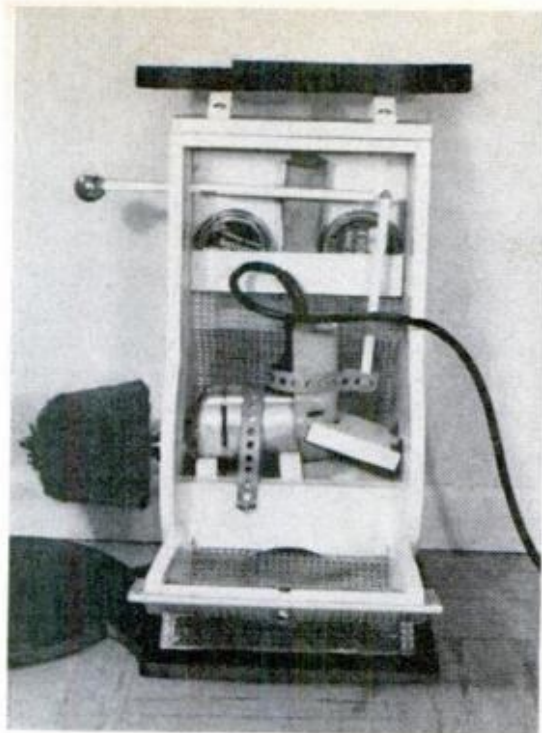


Shoeshine Stand

LIKE MOST POWER TOOLS, a portable drill is used occasionally and stored the remainder of the time. Build this stand and you can put some of its idle time to use as a shoeshine center. All you need to make is a cradle to hold the drill and a frame to serve as a footrest while polishing. And, while you're at it, you can include two open-out doors to hold your polishing gear. The cradle is made of 1x4 pine using two vertical and two horizontal pieces cut to fit the shape of your drill. The frame is of 1/2-in. plywood cut to allow easy drill insertion and removal. The polishing core, over which the buffer bonnet fits, is turned from 4x4 stock to suit the buffer. Buffers are available at stores that sell automatic shoeshine units or, you can sew your own buffer bonnet using lamb's wool as the polisher.

—John Woodward

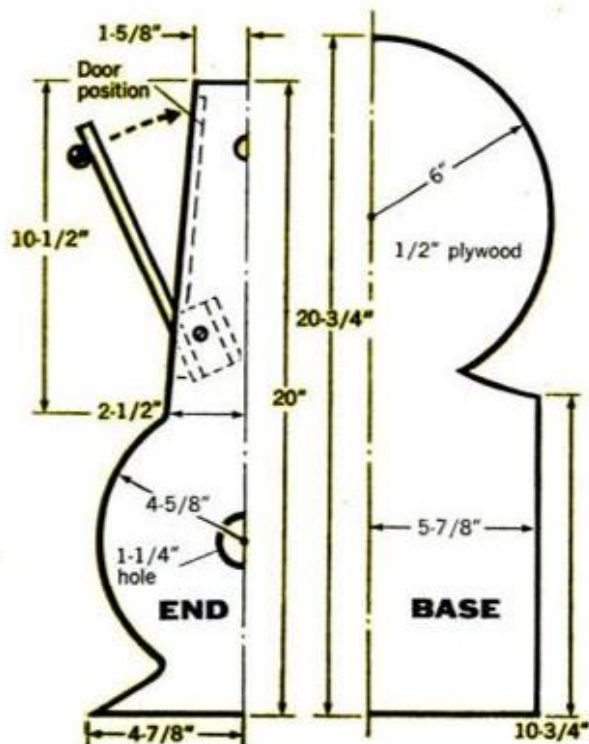
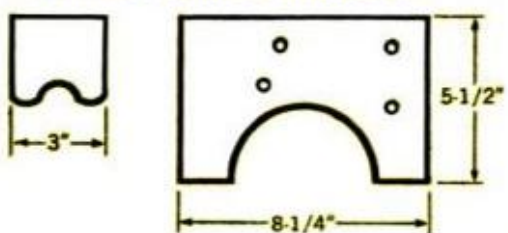




STAND is built to suit drill size and contour. Shelves hold all the polishing materials



DRILL CRADLE BLOCKS



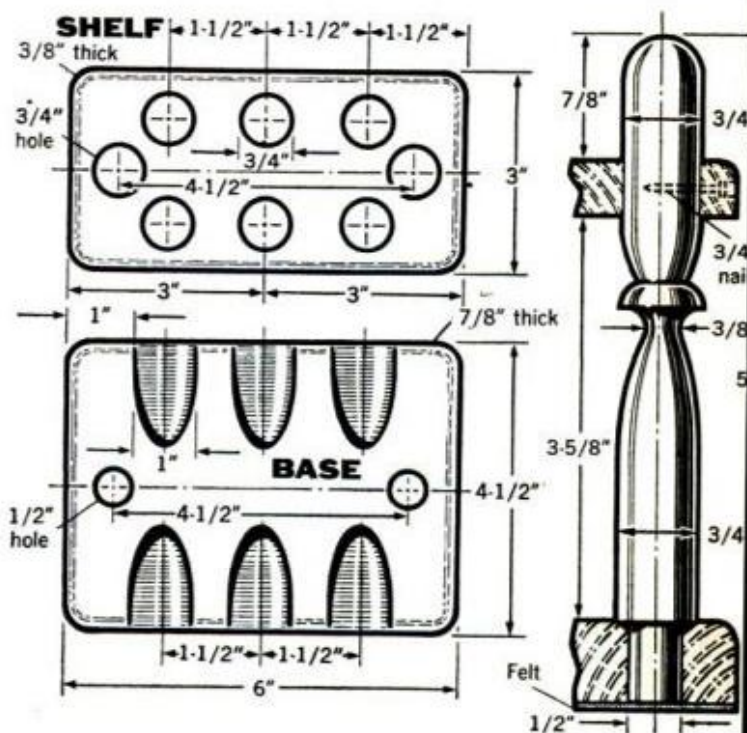
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Pipe Rack

DESIGNED to hold six pipes, the rack above is of solid walnut with a natural finish. Comprised of four parts, the project can easily be completed in a single weekend. After cutting the base to size, lay out the six recesses for the pipe bowl. To make them, chuck a core-box bit in your router and use a simple jig to prevent the router from straying. Mark the two holes for the spindles, using the tenons themselves. Done this way, if there is any variation in the turnings, the holes will be sized to custom-fit the spindles.

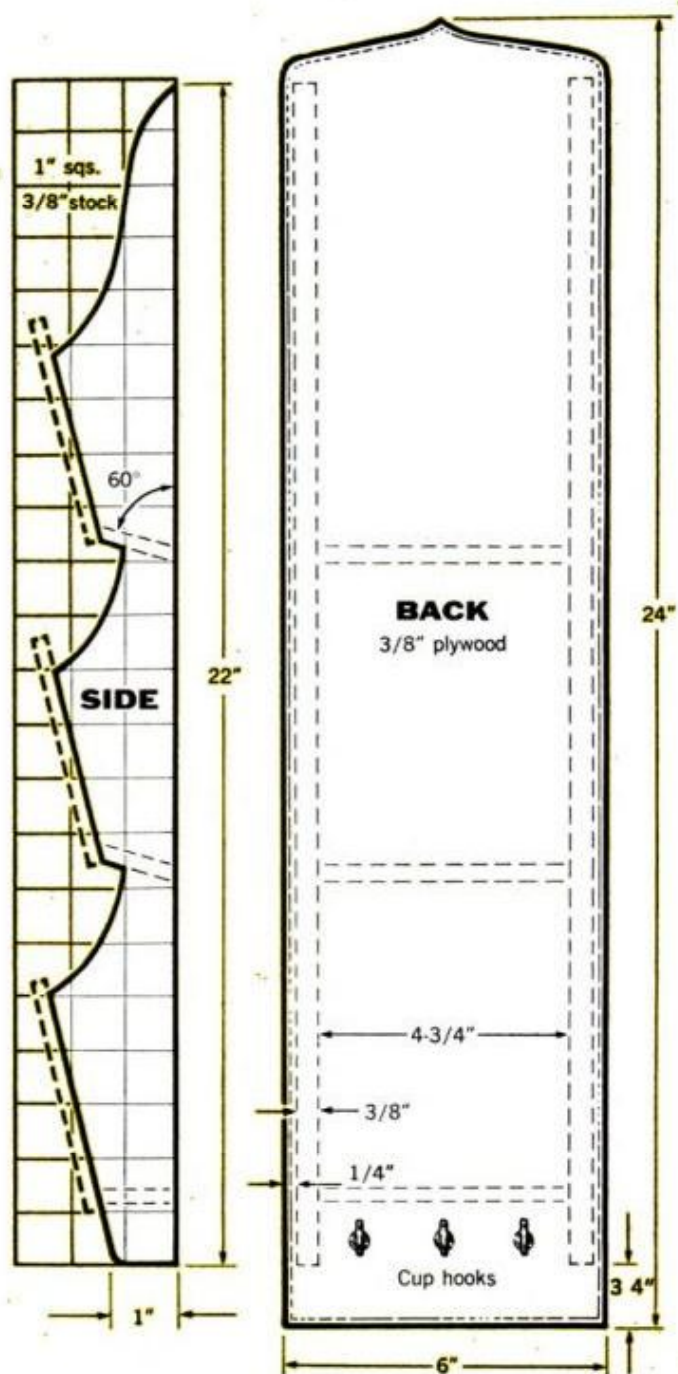
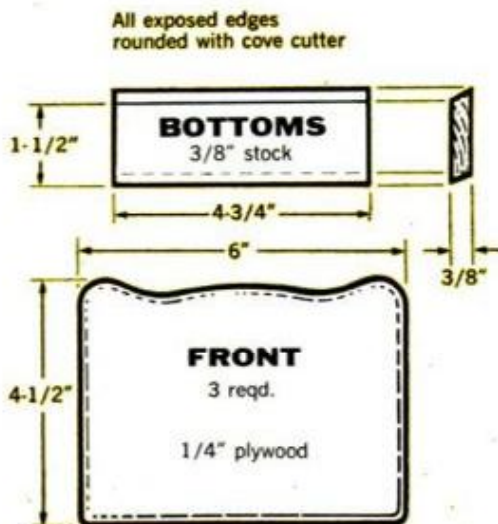
—Hi Sibley



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Reminder Rack

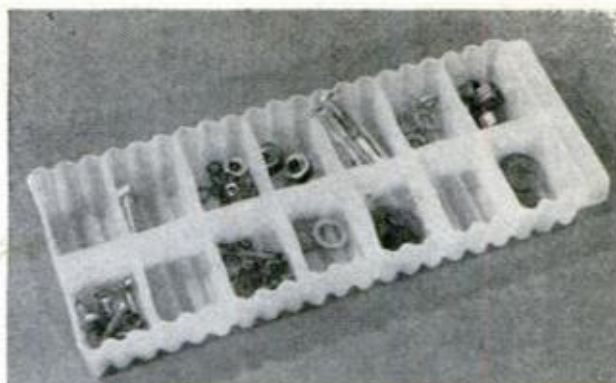
HERE'S A PERFECT WAY to keep track of bills, letters extra keys or any item that tends to get lost in the shuffle. The back panel, sides and three bottoms are all cut from $\frac{3}{8}$ -in. plywood. Front ornamental panels are $\frac{1}{4}$ -in. plywood. Butt joints are used throughout and assembly is with white glue and No. 18 wire brads. To make sure the scrollwork (side panels) is perfectly matched, temporarily tack the pieces together and cut both at the same time. If the cut is uneven, it will be impossible to align the three front panels. After you assemble the back, sides and bottoms, and before you glue on the front panels, sand the entire rack and panels glass-smooth. To finish, use stain and two coats of lacquer. Add stick-on letters last.—*Bob Corley*



HINTS FROM READERS

Small-parts organizer

As in most homes, my shop has limited wall and overhead area for mounting jars or other devices to hold nuts, bolts, and the like. I've found that plastic ice-cube trays make efficient storage bins and stack one atop the other in a minimum of shelf space.—*Ken Patterson*



Parking your lathe chucks

You can save yourself some possible aggravation later when you remove a chuck from a lathe if you place it with its jaws downward. Set down this way, stray chips are not likely to become lodged in the threads and cause jamming when you attempt to remount the chuck on the lathe spindle.—*Walter E. Burton*



Scrap serves as doormat

Next time that you have a new carpet laid, make certain you hold onto the left-over scraps. They can be used on an outside deck or step to provide nonskid footing and a convenient surface for wiping muddy shoes. Here, the scrap is tucked between the deck-boards. On solid decking, double-face tape can be utilized to hold the piece in place without movement.—*Michael Lamm*



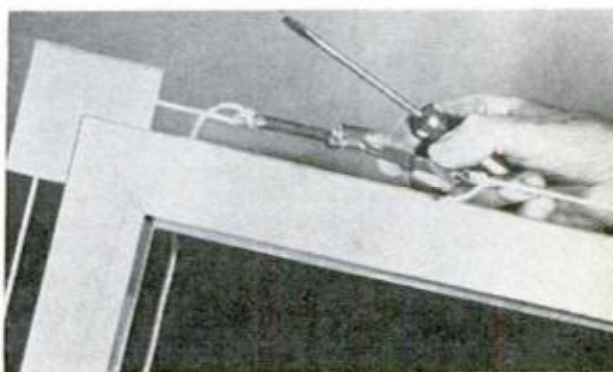
Stop file clogging

If you ever have to file a soft material, such as lead or brass, which has a tendency to clog the file's teeth, try rubbing a generous amount of chalk into the file. The fine powder minimizes clogging, yet does not interfere with cutting action. So that you don't scrape fingertips, use a good-sized piece of chalk such as that used to recharge a chalkline.



Big-mouth clamp

Here's a clamp for holding frames square while glue dries. Simply cut four corner blocks from hardwood and drill intersecting holes in their ends. Thread a strong cord through and fasten it to a gear-type hose clamp which has been halved and its free ends drilled to receive screw eyes. Bend the shanks at right angles andpeen them in place.—*Peter Legon*



Enjoy the Wide Outdoors



on an OPEN DECK

With only the sky overhead, there's nothing like an open deck to give you that true outdoor-living feeling

A WOOD DECK is simply a handsome platform on or above the ground. But it's a platform that adds much to the livability, beauty and value of a house.

A well designed deck can turn a hilly site into a useful, enjoyable outdoor living area at a fraction of the cost of adding an inside room. And there's no substitute for the style of living it can provide as an area for sunbathing, entertaining, dining, conversation, container gardening, children's play and parties.

As an aesthetic assist, good deck design eases the transition from house to garden and is a part of each. Where the land slopes upward from the house, the deck bridges the space with a usable level floor. Where the land slopes down and away, the deck extends the floor of the building out into otherwise wasted space.

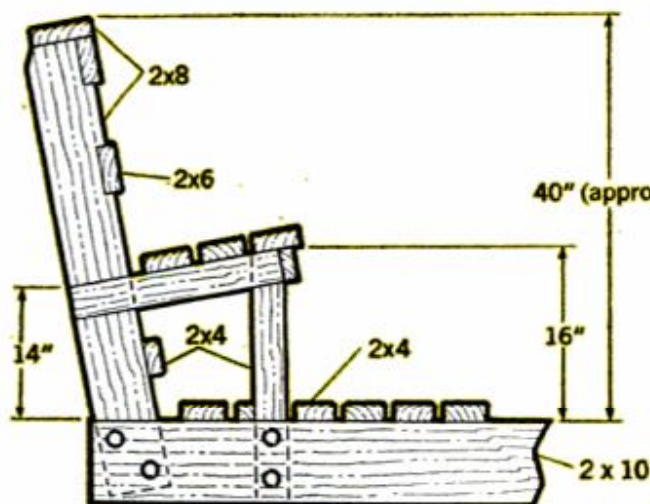
Even on land that is generally flat, the deck can be a floor-level area gently leading to the garden a step or two below. Where paving of a flat area may be a practical expedient, a ground-level deck is often preferred for its resilient comfort

and drainage advantages. For whatever reasons a deck is desired, it can also be counted on to add permanently to the value of a house as well as enhance its sale appeal.

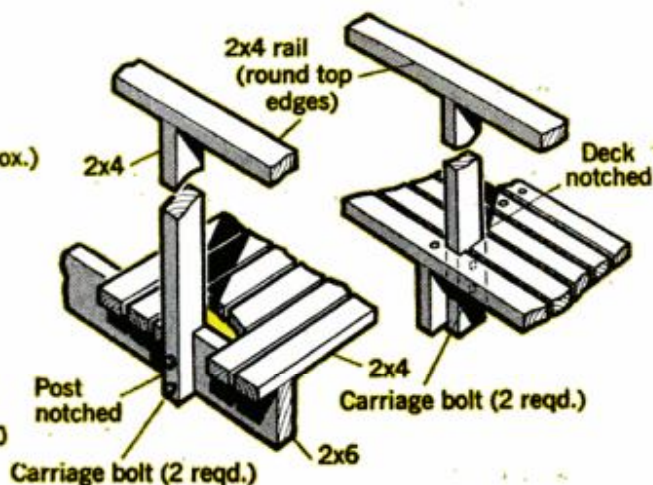
Which lumber to use

Lumber selection for the various parts of the deck is based on its function. Thus, supporting elements are picked for strength, members visible to the eye for looks. Douglas fir or kiln-dried hemlock are good choices for beams, joists and the like. Or, if the advantages of redwood's natural resistance to weather are desired, a heartwood grade should be used. The decking, usually 2x4s on the flat, can be fir if it is to be painted, with redwood preferable if it is to remain natural.

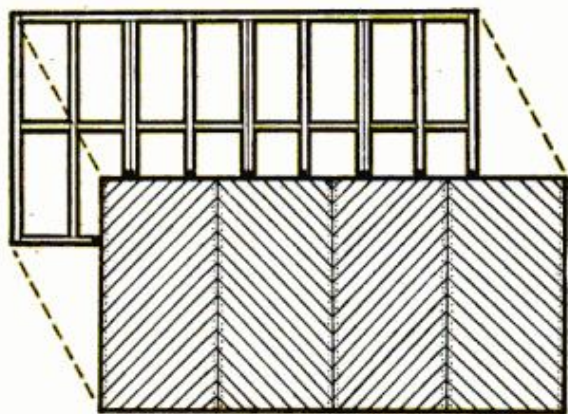
Redwood can vary. In addition to the heartwood, there are clear all-heart, select-heart and construction-heart. A-grade sap-common and merchantable grades permit the presence of some cream-colored sapwood. (Note: Sapwood is not decay-resistant and should only be



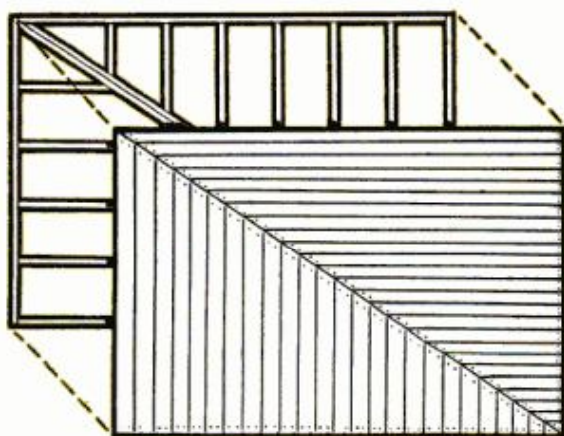
BENCH AND RAIL DETAILS



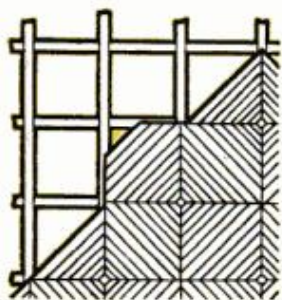
FIVE DECK PATTERNS TO CHOOSE FROM



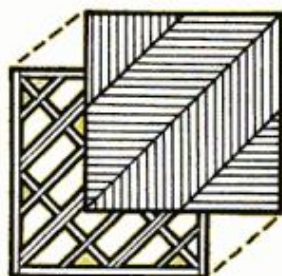
SQUARED HERRINGBONE



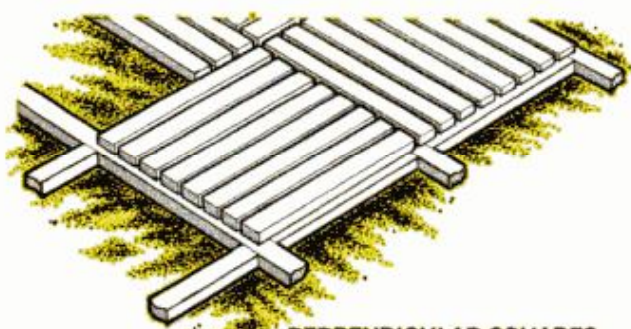
SYMMETRICAL



DIAMOND



DIAGONAL HERRINGBONE



PERPENDICULAR SQUARES

used above ground.) If redwood is your choice for decking, you can use either clear all-heart or construction-heart, depending upon the appearance you desire.

The general approach to laying out a deck is to first decide on its size and then choose a pattern. Next, select the grade material you plan to use and determine the joist layout. With sketch in hand, visit your local building department. It will advise you about the size materials you will need for the structural members—posts, beams and joists.

Structural elements of the deck

● *Decking:* The deck surface—size, lumber grade and design—determines the arrangement and size of the framing. Two-inch (nominal) redwood (or fir if deck will be painted) is recommended for most decking situations. You'll find 2x4s and 2x6s are the most common sizes and minimize chance of cupping. Nominal 1-in.-thick material may be used where joists are 16 in. o.c. or less. If a pattern of narrow lines is desired, use 2x4s on edge.

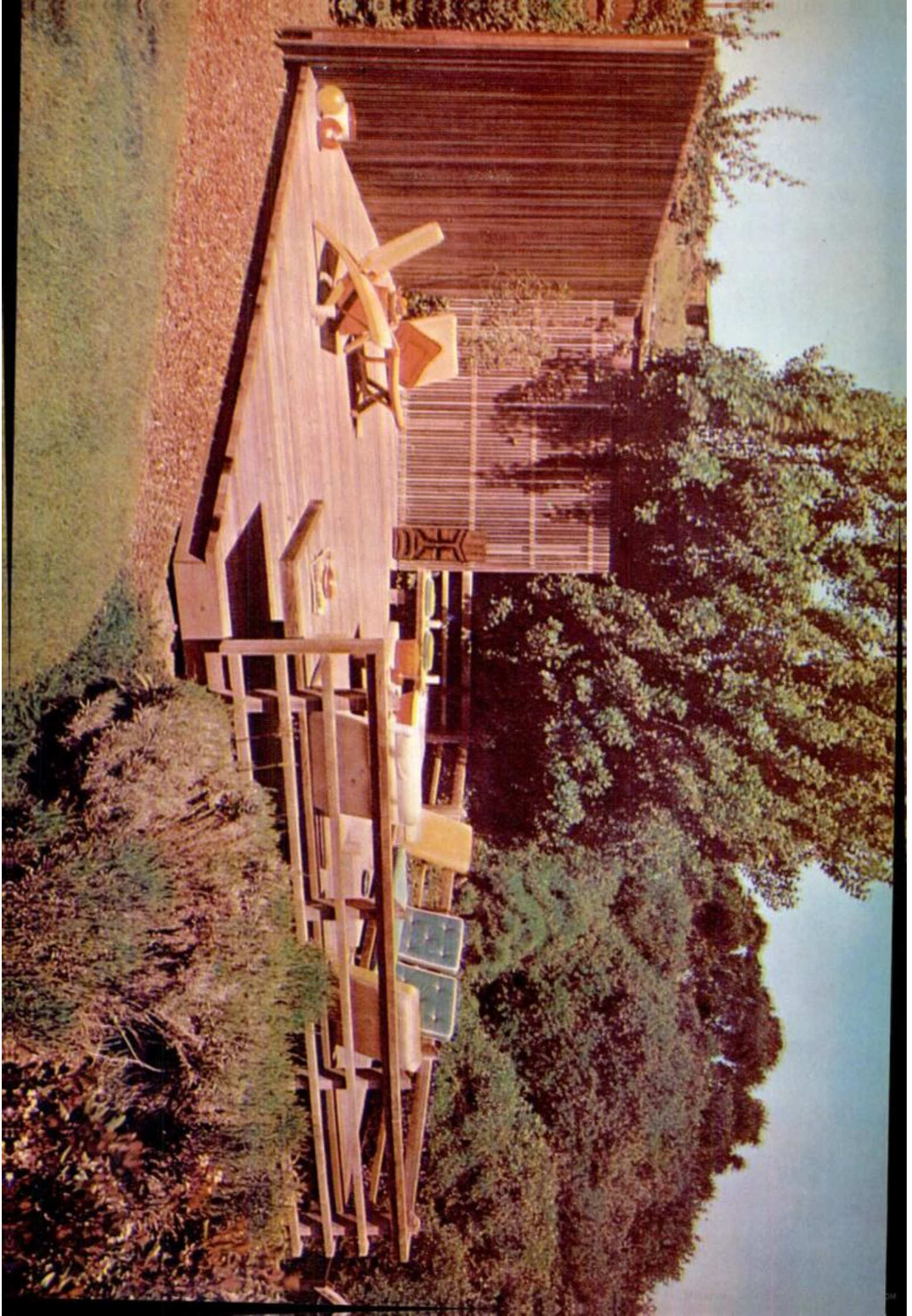
● *Joists:* Joists (usually 2-in. dimension lumber) bear the load of the decking and whatever loads are imposed upon it. It follows that the longer the distance a joist must span, the larger the joist must be to prevent sagging.

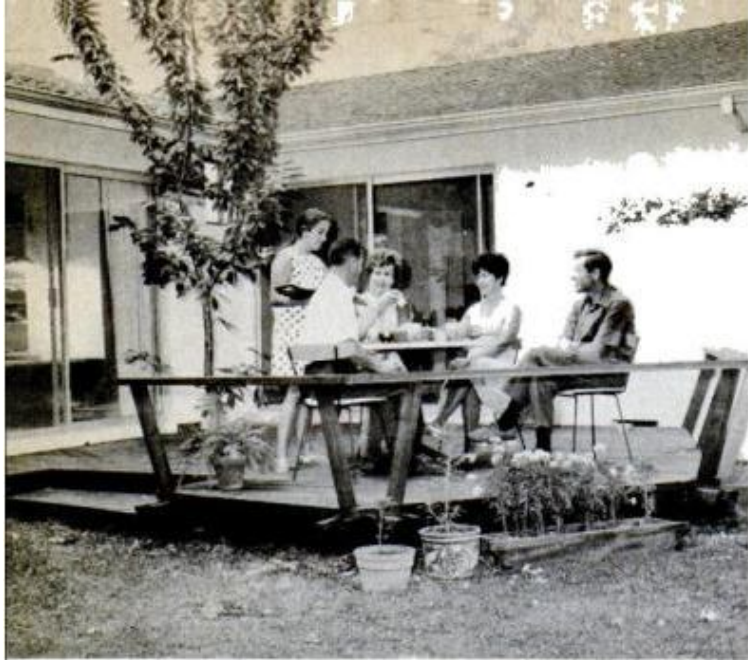
Joists usually rest upon a beam or are fastened to a header. If they must not rise higher than the beam, they may be hung from the beam by a patented joist hanger or fastened to the beam using a ledger strip nailed to the joist. The joists can overhang (cantilever) slightly beyond (outside) the beam for appearance or added size if desired. Overhang limit depends upon width of the joist and should in no case exceed $\frac{1}{4}$ of the joist's length. Bridging is usually installed at mid-span to strengthen joists.

● *Beams:* Beams rest upon the posts and support the joists. The size required depends upon the weight that will be imposed. However, a general rule is to utilize as large a beam as necessary in order to minimize the number of posts and footings. Beams of 4-in. thickness and greater are often used, and since these thicker members are not always readily available, it is sometimes necessary to construct a

AS A SEPARATE PART of the garden, an isolated ground-hugging deck (right) adds to usable yard space and offers low-maintenance landscaping

POPULAR MECHANICS





DECK DESIGN needn't be restricted to square and rectangular shapes. *PM's* West Coast auto editor, Mike Lamm, built this fine five-sider (details below)

"built-up" beam by spiking thinner members together.

The beam can be fastened to post tops by a metal post-connector or a wooden cleat bolted or nailed to the post and beam. When the post must extend above the deck level to support a railing, seat or overhead shelter, the joists may be supported on paired members bolted to the posts. When the beam rests directly on footings, it should be anchored to the footings with nailing blocks or anchor bolts.

Where length of the deck requires splicing a beam, make butt joints over supporting posts and tie two beams together with cleats on each side.

● **Ledgers:** When deck height is of concern, joists can be supported by a ledger strip attached to the house or beam. Care should be taken to insure full bearing on the ledger strip. To prevent rain or snow from wetting interior floors the ledger should be located so that deck surface is at least 1 in. below the house floor.

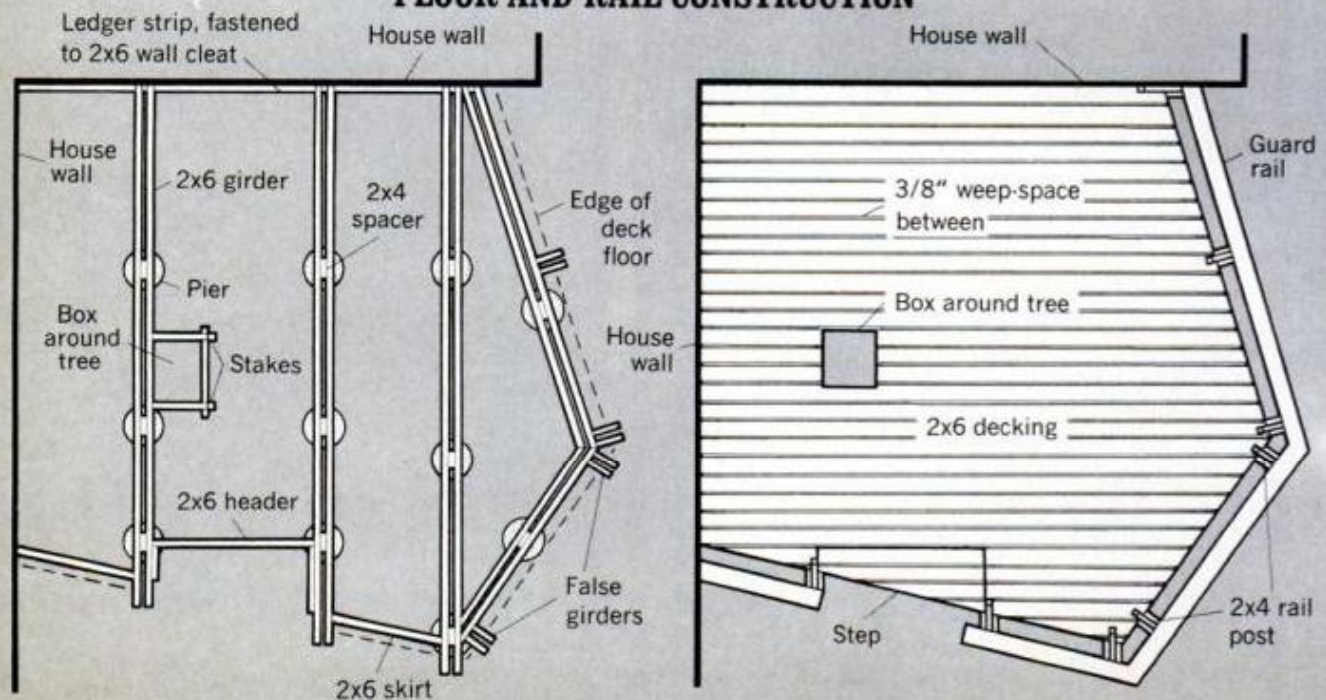
● **Posts:** The posts bear the weight of the deck, transmitting it through the footings to the ground. For most low decks, the 4x4 is an adequate post. For steep sites, or for heavy loads such as a large group of people, snow, or plant containers, larger posts will be required to bear the weight.

Where a beam bears upon the top of a post, the length of the post must be carefully measured and trimmed to insure solid bearing for the beam. Accurate measurement may be achieved by carefully leveling the beam from a reference elevation on the house. Mark the level position, adjust for slope of deck, if any, and trim carefully. The post should be plumb when measured and installed.

Cross bracing may be necessary to prevent lateral movement of the deck, particularly if it is elevated high above the ground. Good connections between post and beam will help brace the deck structure, but diagonal bracing across corners or across the understructure may be the only way to achieve the stability required by local building regulations.

● **Footings:** The footing anchors the entire structure and transmits the weight of the deck to the ground. Building codes are

FLOOR AND RAIL CONSTRUCTION



specific on the subject of footings. Generally, they must extend to undisturbed soil or rock and, in cold climates, must be below the frost line (local codes determine depth). If concrete footings are site-poured, metal post-anchors or steel straps may be set in the wet concrete. Drift pins offer a concealed method of connecting the post to the footing when the underside of the deck is to be in open view. While anchors of metal are the most rigid and are recommended for high decks, wood nailing blocks imbedded in concrete usually are adequate for low decks.

Placement of footings

Locations and placement of footings are determined by the design of the deck's structural members so that weight is properly transmitted to the ground. Placement points can be ascertained with a tape measure, a string, or a long, straight 2x4 and a wooden peg.

If the deck is to extend from a corner of the house, you can simply project a straight line from the nondeck side of the house out to where one corner of the deck will extend. Then measure and mark the points within the line where footings will be needed.

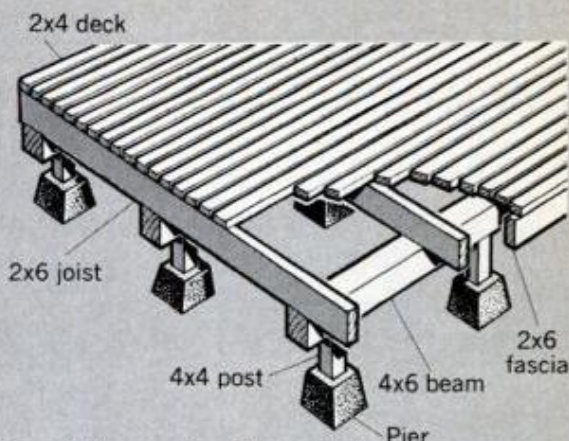
With this right angle (consisting of the line and the deck side of the house) established, two corners of the deck are determined. The length of the deck is then measured along the wall from the corner of the house. With a third corner thus established, location of the other corner footing can easily be fixed with tape measurement from these established points.

Accuracy of the four points can be proven by diagonal measurements between the farthest corners. If these diagonal distances are at variance, the deck is not square. This could be the fault of either an out-of-square house or inaccurate measurement. If the former, design the deck to match the house.

Here is another way to place footings:

If the deck is to project from a wall where a corner line projection is not convenient, a right-angle projection can be made by creating a mathematical right-angle triangle of 6x8x10 ft. or proportionally larger. This is done by marking a point (A) on the house wall which designates one corner of the deck. Measure 6 ft. from point A one way on the wall to establish point B. To establish

TYPICAL DECK CONSTRUCTION



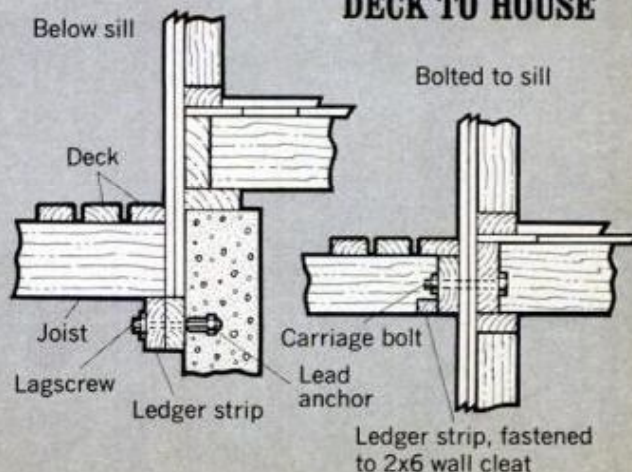
the right angle desired between point A and C (8 ft.), the mathematical triangle which establishes this right angle can be created using a taut string approximately 2 ft. longer than the outside dimension of the deck. This string, nailed to a "batter board," should be pulled out from the wall. Then a long 2x4 marked at 10 ft. can be extended from point B to point C. The string and the marked 2x4 may have to be moved left or right until the marks on each match. When they do, a right angle has been created to use as a reference point for placement of footings where desired inside or outside the triangle. Other footings can be placed by measurements from this reference point and the wall reference points.

Laying the decking

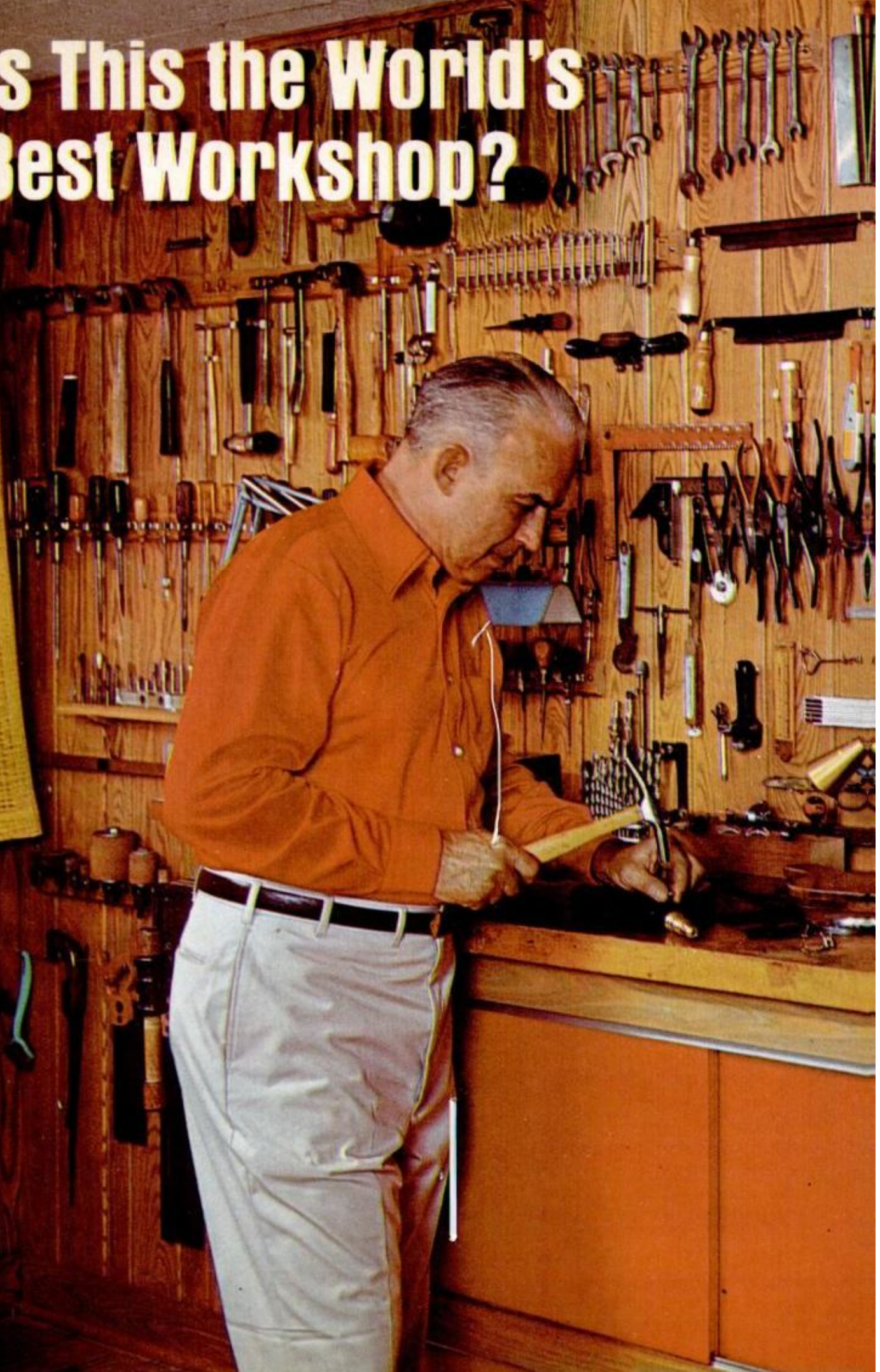
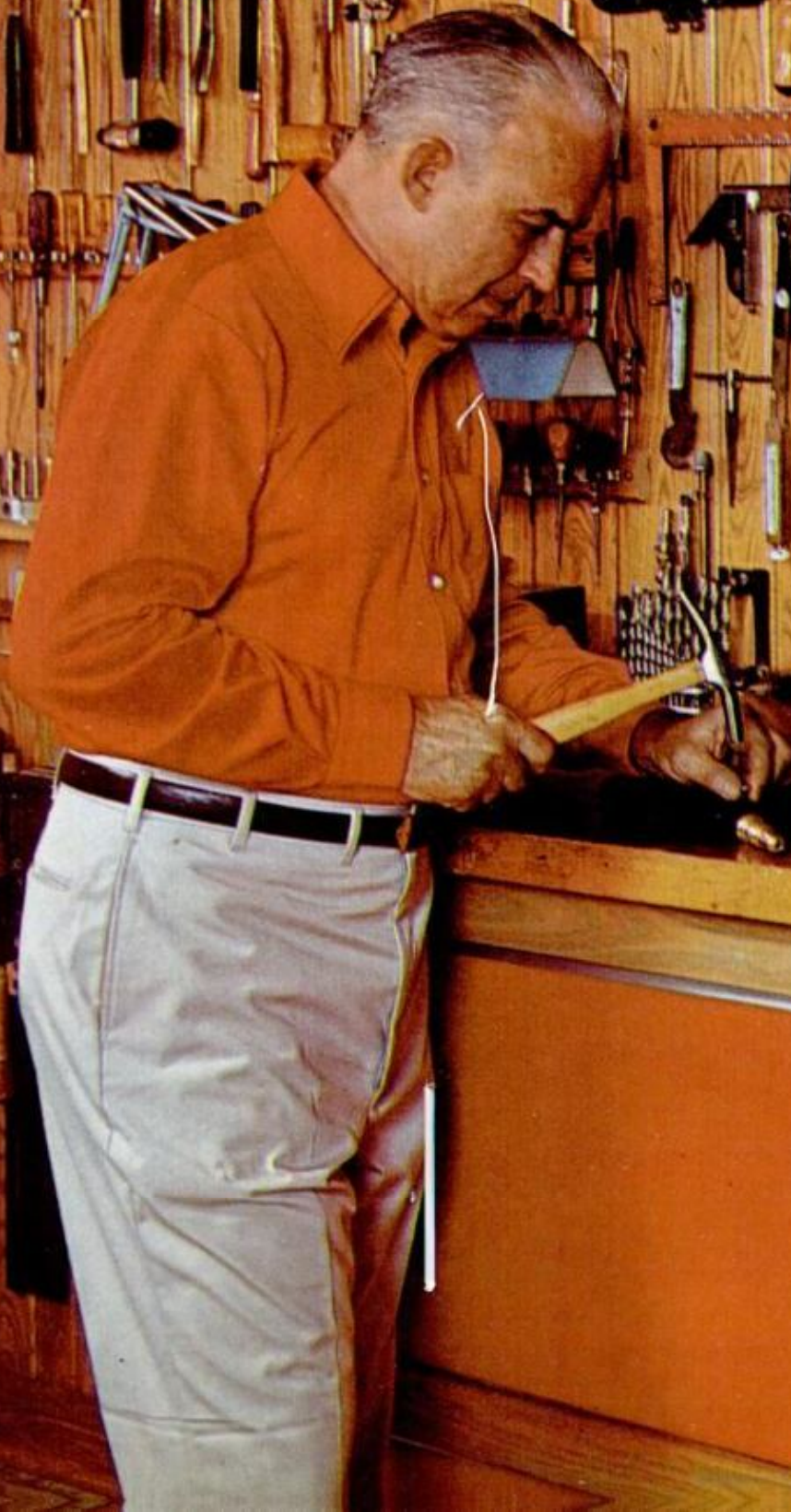
Lay out decking on the joists so that any butt joints that may occur are at random intervals and over joists. Joints should never occur on adjacent pieces of decking unless the pattern dictates. It is

(Please turn to page 196)


METHODS OF ATTACHING DECK TO HOUSE



Is This the World's Best Workshop?





PLEASE TURN PAGE 

Like most workshoppers, at one time or another you've probably reflected upon how, if given carte blanche, you would set up an ideal workshop. Woodworker Al Meagher followed his dream and over the years developed a shop that is second to none.

By HARRY WICKS, Workshop Editor

Photography by George Miles Ryan
Data: Annette Sukov

I'VE JUST SPENT several days in a woodworker's Shangri-la: the most completely equipped and well-planned workshop I have ever seen. And I'm convinced that if I had stayed there for several more weeks, I'd still have found something new every day.

The owner, I. E. Meagher, a successful Minneapolis attorney, has brought into this shop the same verve, logical thinking and organization that pushed him to the top in the legal field. His planning, from layout to tool selection and orderliness, is absolutely complete.

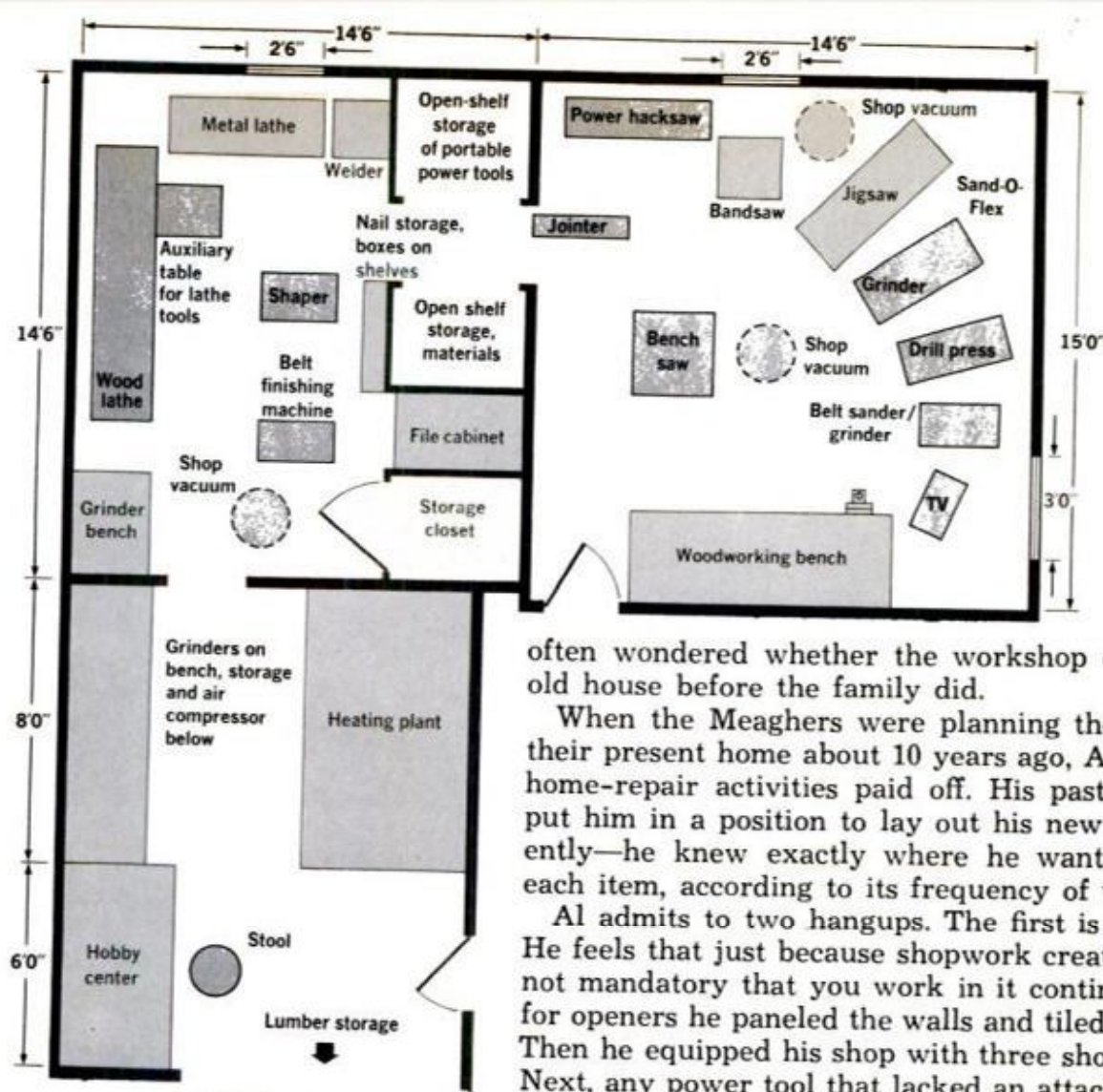
Al, as he prefers to be called, says that he first acquired an affinity for tools back in his college days. Like most college students (then as now) he never seemed to have enough loot on hand for dates and the like. But, unlike many, he did something about it—he taught himself to play the musical saw.

Armed with this talent, he picked up spare cash playing college dances and fraternity parties. Since other students showed considerable interest in the instrument, the ambitious lawyer-to-be then decided he could bolster his income by selling the saws. And he did. After buying several hundred saws wholesale, he placed ads in a couple of magazines and made out just fine. The dozen or so musical saws he still owns occupy a prominent, sentimental place of honor in his workshop.

Out of school, Meagher married and settled down in his first home, where his love for woodworking was born. Like most fledgling homeowners, he soon found that home repairs and improvements were, of economic necessity, do-it-yourself tasks. These chores, plus furniture-building projects, started him on his way. As he admits, "I was hooked. I just plain en-

VACUUM PICKUP NOZZLE is held on drill-press table with two magnets affixed with corner braces (center). For bandsaw, nozzle is removed and hose inserted into shop-built, sheet-metal housing on saw





FLOOR PLAN

FLOOR plan shows a lot of tools in a lot of space. Positioned to suit owner's woodworking preference, tools are immaculate and in state of perfect repair. Author couldn't find a dull tool or any rust in shop

often wondered whether the workshop outgrew the old house before the family did.

When the Meaghers were planning the move into their present home about 10 years ago, Al's shop and home-repair activities paid off. His past experience put him in a position to lay out his new shop efficiently—he knew exactly where he wanted to place each item, according to its frequency of use.

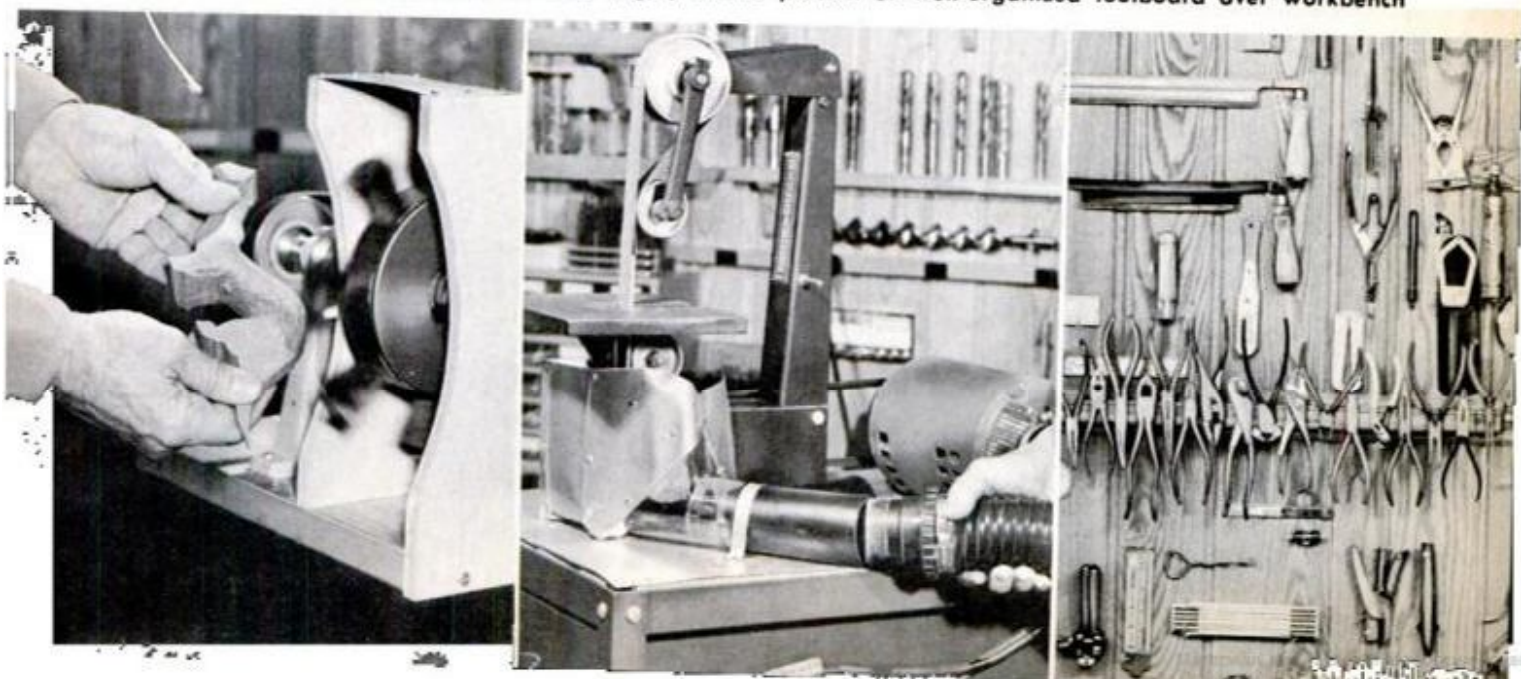
Al admits to two hangups. The first is cleanliness. He feels that just because shopwork creates dust, it's not mandatory that you work in it continuously. So, for openers he paneled the walls and tiled the ceiling. Then he equipped his shop with three shop vacuums. Next, any power tool that lacked an attachment for a vacuum was fitted with a shop-made version. Thus, before any power tool is started, a vac is hooked up and flicked on first. Dust is sucked up as quickly as it is made.

His second strong feeling is that no tool deserves to be flung in a drawer with an assortment of other tools or materials. Thus, just about every square inch of wall space in his shop is covered by tools. Cleverly,

joyed the feeling of creating something with my hands."

As a result, Al built up his tool collection by buying tools as they were needed for particular jobs. In fact, he has

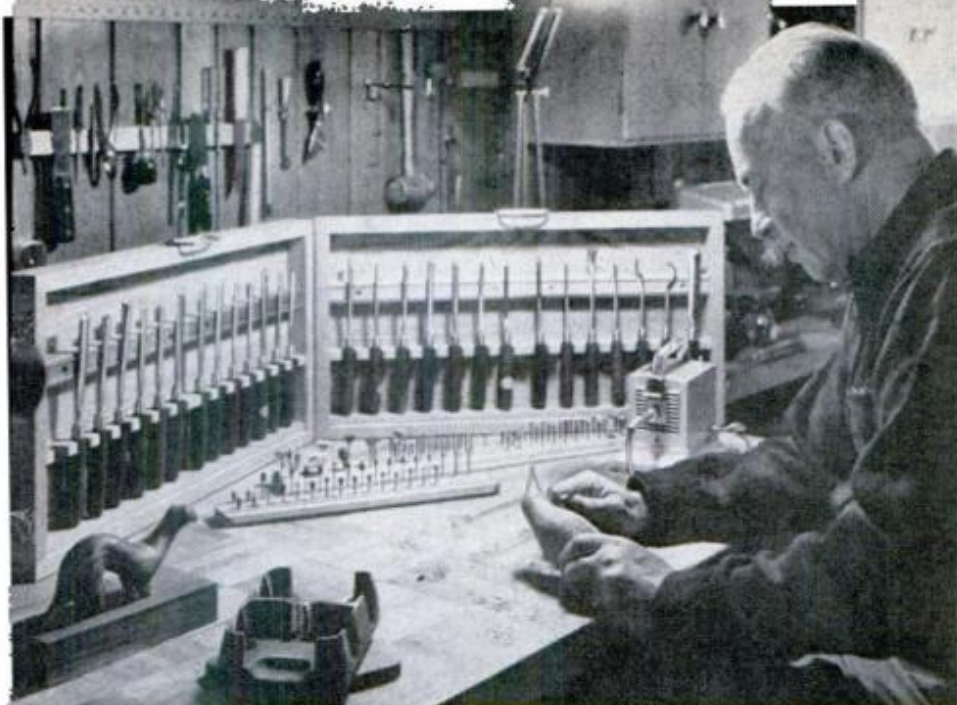
DUST HOODS for Sand-O-Flex (left) and belt sander/grinder are shop-made; vacuum hose is fitted into fixed section of vacuum tube. Closeup (right) shows portion of well-organized toolboard over workbench





HOBBY WORK-CENTER (above) is separated from two heavy-use shop rooms ([see floor plan, page 149](#)). Photo below shows the great expanse of floor and wall area that is rarely available to the average woodworker





COMFORTABLE AREA for big-project planning and light wood-working chores such as carving can be left set up because the clutter does not interfere with normal operations in the shop or at the workbench. Meagher also uses this area when applying finishing touches to projects. The box containing the cutting tools was custom-made to suit the owner's set of fine-steel carving tools. The tools are securely held by a magnetic strip at top, while the handles rest in a notched piece of wood. The case is built to hang on the wall in its open position, or it can be closed up and toted about. As with all other areas of the shop, the hobby center is well lighted and has several electrical receptacles to spare

most of the hand tools are mounted with a magnetic strip or other fastener to strips of wood which he fashioned on his shaper. These strips, in turn, are screw-fastened to the walls.

This thinking paid off handsomely during the move into his new shop. He simply backed out the screws and placed each strip of wood, together with its tools, in a carton. When he arrived at the new shop, he reversed the procedure and attached each strip to the wall where he wanted it permanently.

Since experience has taught him that it is just about impossible to have too many electrical receptacles in a workshop, Al included several extra circuits when planning his own shop. Then, in addition to the standard number of double receptacles required by the electrical code, he in-

stalled strip receptacles along the perimeter of the entire shop. With adequate power available (I'd guess that his shop has more than 100 outlets), he's proud of the fact that he never blows a fuse, no matter what he may have running.

Al's second love is his lakeside retreat in the country. He has a shop setup there, too. When he replaced the power tools in his original shop, rather than sell or trade them, he trucked them up to the lakeside home. And, he adds, "the first power tool that I ever bought—a 1932 Delta saw—is up there and still going strong." ★★★

DO YOU KNOW of a better shop than Al Meagher's? One that should be published in *PM*? If so, send us a photo; we're interested in all kinds. Address: Workshop Editor, Popular Mechanics, 224 W. 57th St., New York, N. Y. 10019.

PRIMARY WORKSHOP (in foreground of photo at left) blossomed and spread to the room next door as owner acquired additional tools. Though few of the power tools are caster-mounted, they all can be easily moved about because the tiled floor is kept highly polished. Inside the lathe room (shown at right), Meagher keeps wood-lathe tools he is using within arm's reach on a small auxiliary table that he built. Duplicating attachment on wood lathe is one that he spotted in *PM* six years ago (*Shopping for Tools*, page 26, March '64). The second arm, an extra that he bought to hold cutoff tool, eliminates changing cutter bits when the turning is completed and he wants to make a cutoff



HOW TO KEEP A SPRAY GUN SPRAYING

With proper care and maintenance, it will give years of satisfactory service.

ALWAYS TIGHTEN NOZZLE by hand, never with a wrench

THERE ARE several good reasons for giving your spray gun the care and attention that any precision tool deserves. That a quality spray outfit represents a pretty fair-sized investment is reason enough for many. But equally important to an active do-it-yourselfer or tradesman is the fact that a tool kept in tip-top shape can mean hours saved on the job. And that's what any maintenance program is all about: to eliminate job downtime, or at least keep it to a minimum.

According to George Lau, manager of Binks Manufacturing Co.'s research laboratory, investigations of complaints of defective guns usually reveal poor care or abusive treatment. Heading the list of causes is improper cleaning *immediately* after use.

It's a simple task to clean a siphon-cup, air-atomized gun. Turn off the air supply and remove the cup from the gun. Allow

as much material as possible to drain back into the cup, then wash it and fill it one-quarter full with solvent. Replace the gun, turn on the air supply and spray solvent until it runs clear. Next, remove the air nozzle, brush it with solvent and replace. Finally, wipe the exterior.

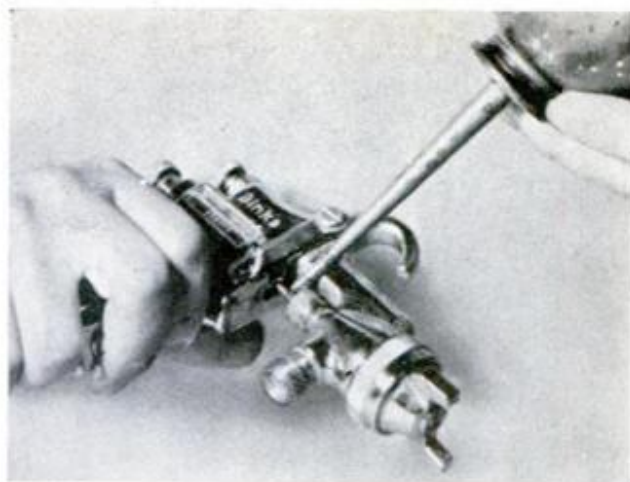
Avoid soaking equipment in solvent, particularly if small orifices are involved; there's always the possibility that when the adhered material dissolves, it will leave a residue of solids on *all* parts of the gun. Also, solvent removes lubrication from the mechanical parts and dissolves packing.

To insure trouble-free operation, certain design characteristics should be understood. For example, all knurled parts should be tightened or loosened with fingers only. Fittings intended for adjustment with a tool will have a hex, square, or slotted accommodation.

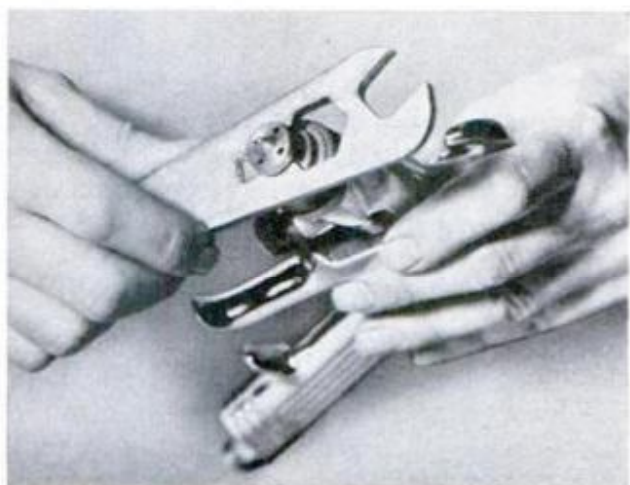
Make certain that you always use the



ONLY ADJUSTMENT for a spray gun is on the fluid needle. This nut can either be tightened or backed off to lengthen or shorten the entire needle assembly



APPLY LUBRICANT frequently to needle valve. Manufacturers recommend light machine oil, warn against using either grease or an oil that contains silicones



USE THE RIGHT WRENCH when you replace the fluid nozzle. This tool should be thin enough so that it will contact only the square portion of the nozzle



CLEAN NOZZLE ORIFICE using a stiff bristle brush (never wire). Brushing with a solvent will usually eliminate clogging; use only wood if pick is needed

proper fitting wrench for fluid-nozzle replacement (never pliers). If too thick, it will override the square portion and possibly damage one or both of the tapered air seats. If these are damaged, the nozzle should be discarded to prevent damage to the matching seats or tapers of the air nozzle.

There are several rules of spray-gun care that should always be followed as a matter of habit:

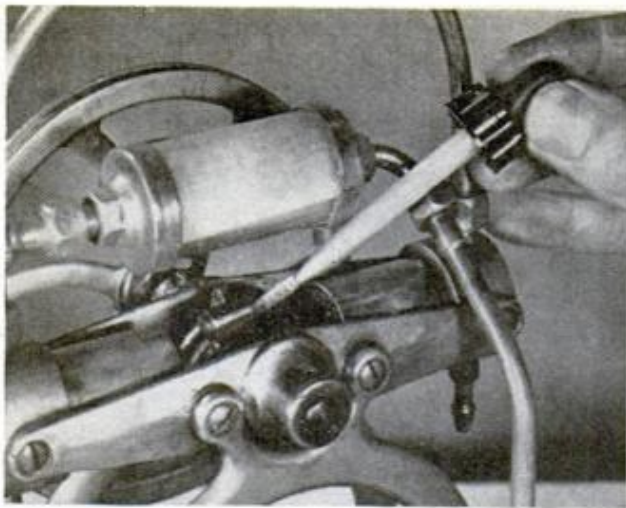
- If working on a spray gun in a vise, use soft jaws to protect the handle.
- Keep the tool lubricated per the manufacturer's instructions. If your gun is used daily, start each day by placing a drop of oil on the needle valve where it enters the fluid packing. Also, place a drop of oil on each side of the trigger stud.
- Lubricate the air and spring-needle valve springs with petroleum jelly about every six months. If your gun is of the

automatic type, the piston leathers should be lubricated with the same grease.

● The only adjustment that must be made on a spray gun is to the fluid needle. Properly adjusted, it allows for the correct sequencing of events as the gun is triggered.

The first movement of the trigger opens the air valve to permit atomizing air to emit from the nozzle. Further depressing of the trigger allows the material (to be sprayed) to enter into the already moving airstream. When the trigger is released, the reverse sequence occurs. The reason for this is that air must always flow longer than the fluid to prevent globs on the workpiece.

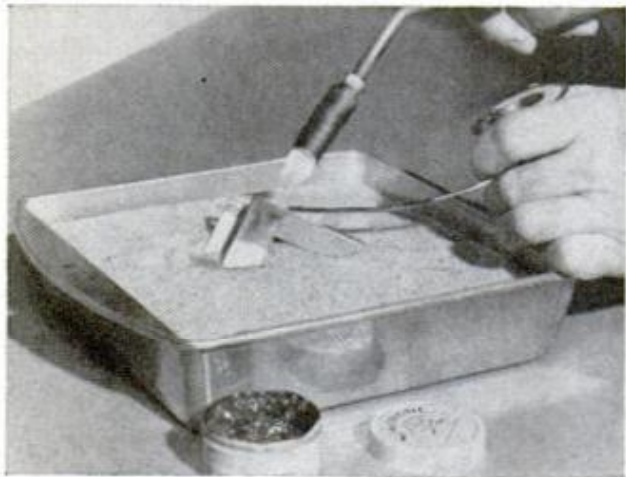
Finally, if you have to correspond with the manufacturer, make certain you supply adequate information—model and parts numbers, material being sprayed, viscosity and solvent type. ★★★



HINTS FROM READERS

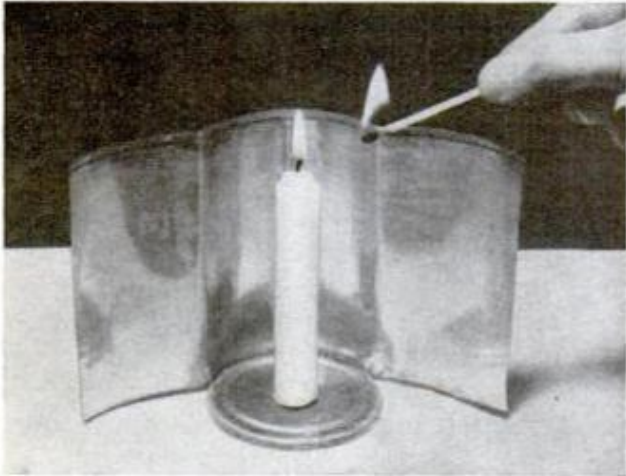
Micro-mini oiler

To work oil into fine gears and small mechanisms, use an eyedropper that has a rubber bulb at one end and a pipe cleaner inserted to serve as a wick. Remove the bulb, insert the cleaner into the dropper and fill with oil. Replace the bulb, point the tip and squirt in small amounts of oil.—*Wilfred Beaver*



'Vise' for soldering jobs

Generally, clamping a small workpiece in a bench vise so you can solder it with a propane torch is less than satisfactory because there is always the possibility that the flame will scorch the bench. Whenever possible, I immerse the object in a trayful of damp sand. The work is held steady and the sand even serves as a heat sink.—*Herbert Y. Moon*



Patching plastic toys

My son had a large inflatable plastic toy that developed a puncture. To mend it, I cut a round circle from a scrap of Con-Tact (the adhesive-backed plastic film), removed the paper backing and applied it to the toy as you would patch an inner tube. To insure a good patch adhesion, make certain the toy's surface is thoroughly clean.—*Charles D. DeGraff*



Tip-proof camper's lantern

A lightweight, low-cost lantern you can carry on a camping trip can be fashioned from a tin can. Just cut a can down the side and part way around the bottom as shown. Then bend out the side pieces and firmly seat the candle in hot wax dripped onto the bottom.—*William Swallow*

Aligning paint-can lid

Paint deposited in the rim of a partly used can makes it difficult to reseat the lid snugly after it has been removed because the dried paint forms a "pattern." But, the lid will readily fit in one position. To make that position easy to find, apply two registration marks with a felt-tip marker, one on the can side (arrow) and the other directly opposite it on the lid. Now, simply line up the marks to replace the lid.—*Walter E. Burton*

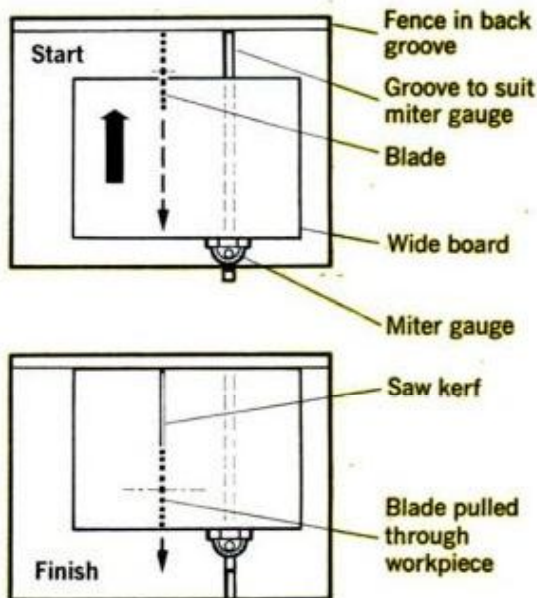
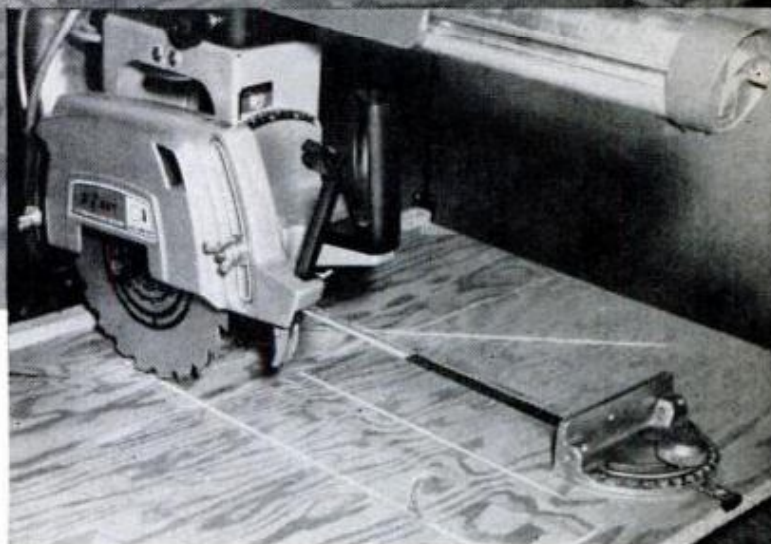
Stretch Your Radial's Crosscut Capacity

YOU CAN ADD several inches to the crosscut limit of your radial-arm saw when you next replace the protective covering on the saw table. Simply make the replacement with two $\frac{3}{8}$ -in.-thick plywood pieces with space left between them to suit your table-saw miter gauge. Locate this groove space on one side of the 45° bevel position of your saw, and you'll add crosscut capacity for straight bevel cuts.

To use the setup, place the saw fence in the back position, lock the saw and push the wide material into the blade. When it reaches the fence, hold the work intact, unlock the saw and finish the cut by pulling the saw through the material in the regular manner. You'll be able to make your cut without moving the fence from front to back on each cut, turning the motor on and off or "jiggling" a partial cut into the blade.—William G. Waggoner

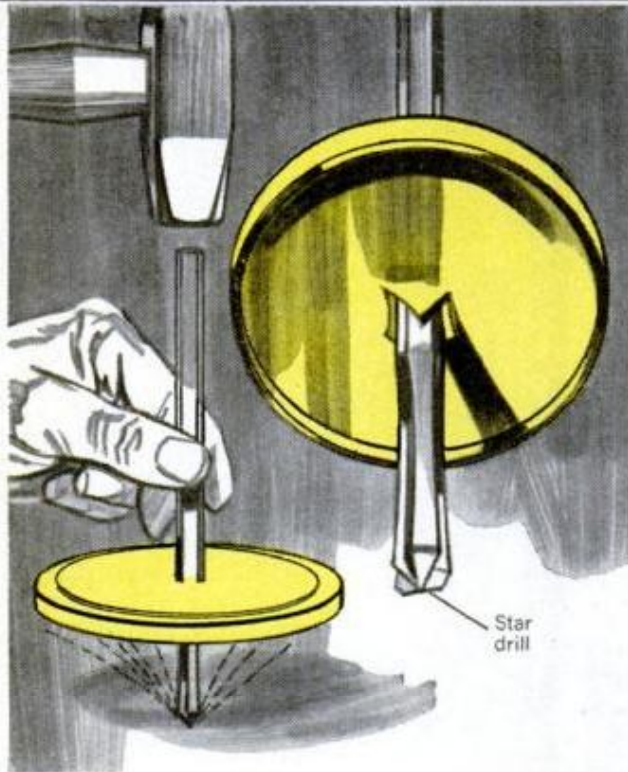
HOW IT WORKS. Fence is placed in back position, saw locked and work pushed into blade (top). Work is held and blade pulled through to complete the cut

JUNE 1970





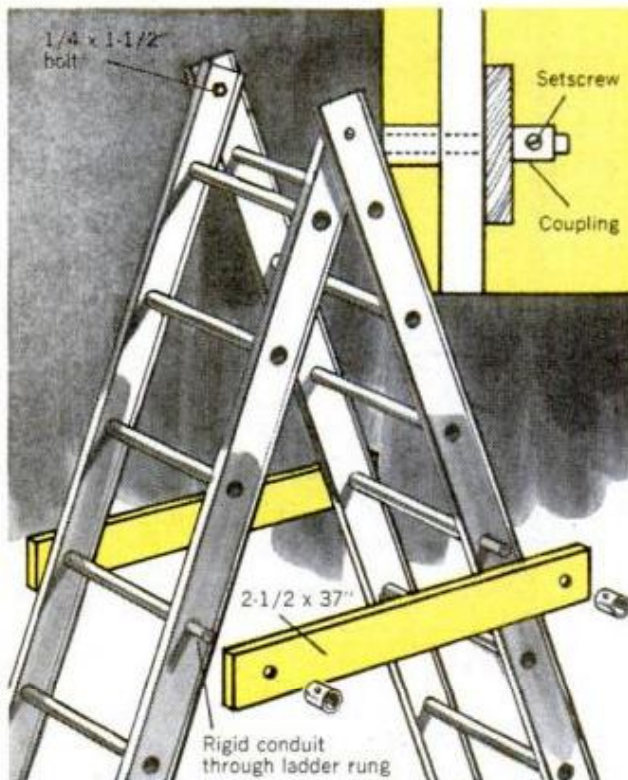
SOLVING



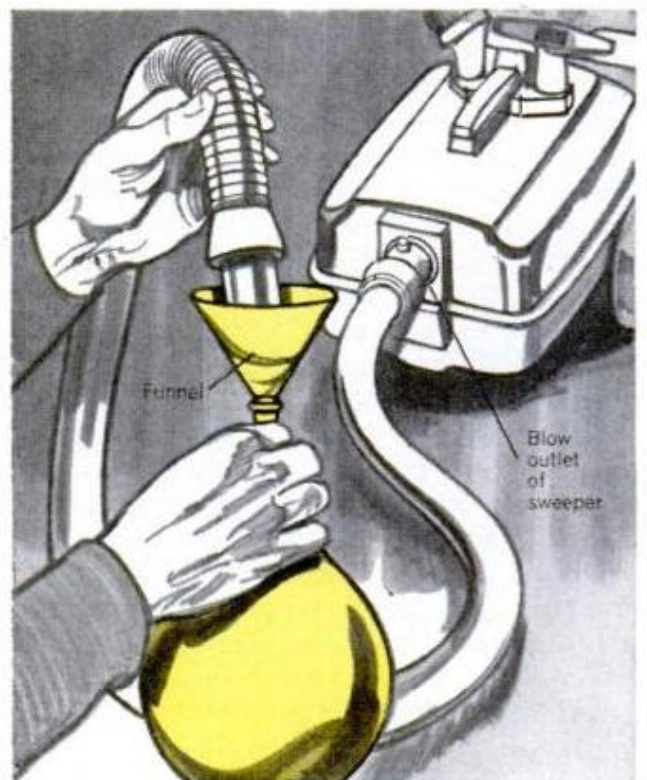
YOU CAN PROTECT yourself from flying concrete chips when working with a hand-held star drill by using a plastic food-container cover. Simply make an X-slit in cover and insert the drill.—Herbert Y. Moon



HUMMINGBIRD FEEDER is easily made from an ordinary pill bottle with a small-diameter hole drilled in cap. Fill with sugar 1 part, water 2½ parts. Hung with hole down, the feeder won't leak.—Stanley Myhalter



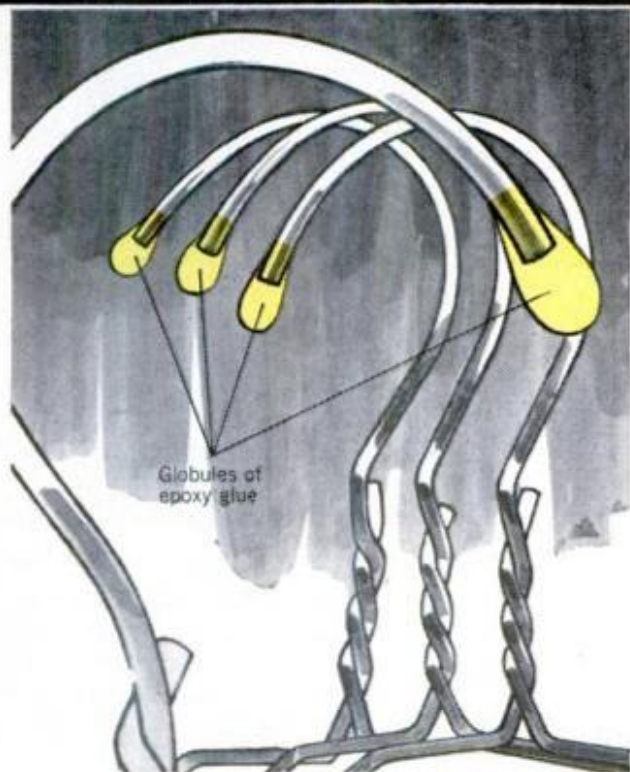
ALUMINUM EXTENSION LADDER serves as temporary stepladder when assembled as shown. Electrical tubing through rungs, couplings and setscrews hold the wood spreader firmly. Use two bolts at top.—G. L. Caffee



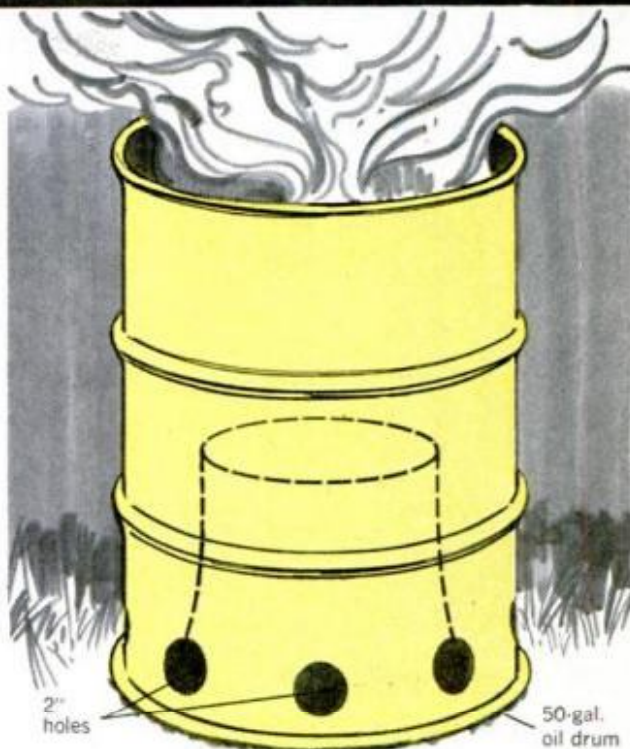
INFLATE LOTS OF BALLOONS QUICKLY with funnel and vacuum cleaner set for blowing. After inserting funnel, grip neck of balloon with fingers and hold end of the cleaner's hose in funnel.—H. G. Bennett

HOME PROBLEMS

Illustrations by Adolph Brotman, Worman Associates



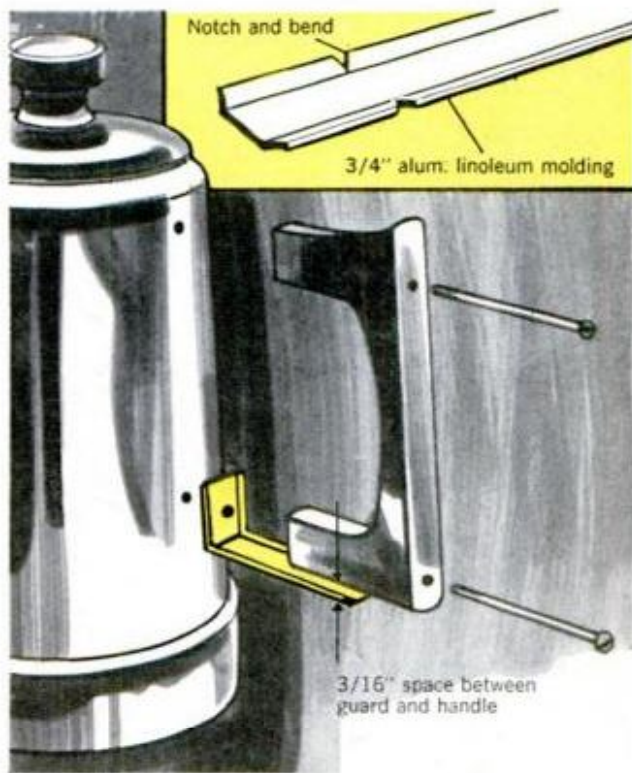
SHARP POINTS on wire coathanger hooks can be eliminated by dabs of epoxy glue. Position each hanger so tip is down. This will cause a uniform globule to form on tip while the glue is drying.—*Burt Walters*



A 50-GAL. BARREL, with its top and bottom removed and a few 2-in.-dia. holes cut in its sides, will act as a furnace when you burn out stumps. Once started, the fire will be self-sustaining.—*D. Griffith, M.D.*



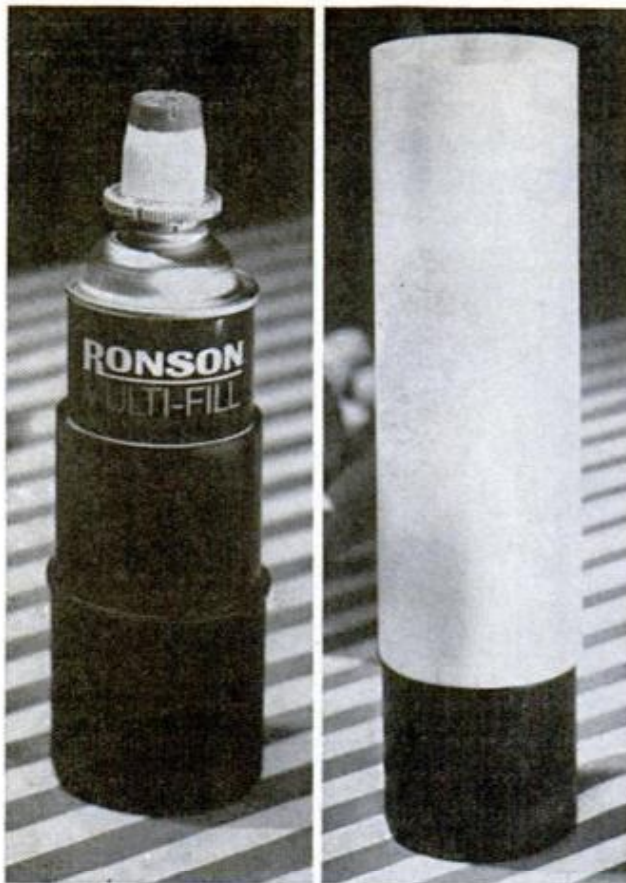
LACKING A CAN OPENER when opening a can of motor oil recently, I used a tire lug wrench with success. This works fine when it's held firmly in place and then given a quick, solid jab.—*Theodore Anastas*



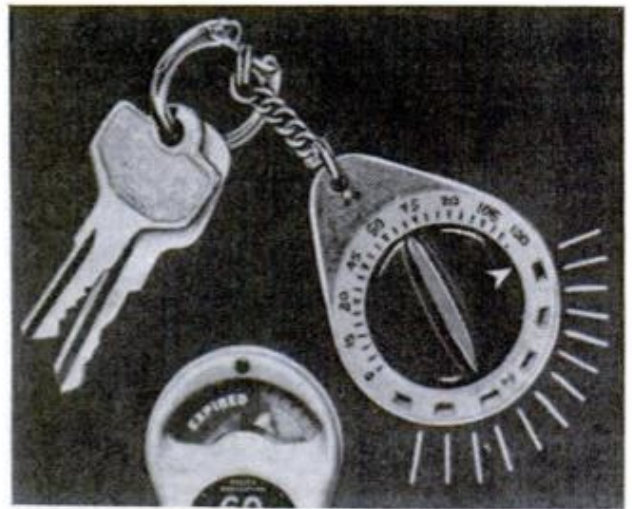
PREVENT CHARRING of coffeepot handles by adding this simple guard made from linoleum edging or aluminum. When fitting the piece, allow about 3/16 in. space between handle and guard.—*J. Van Eerde*

EXCITING NEW PRODUCTS

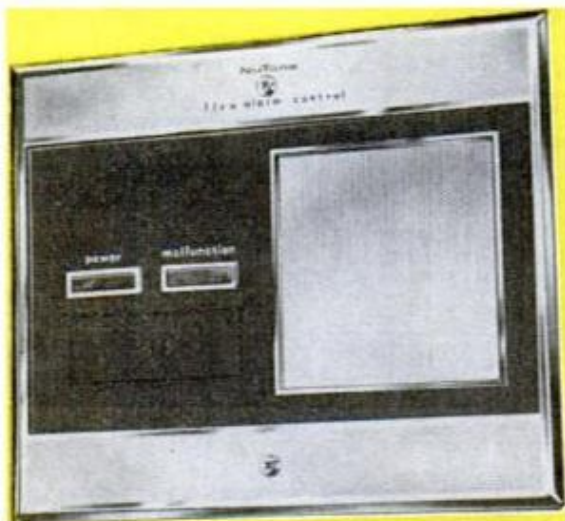
BY CATHERINE BILSKI



AN ELEGANT BUTANE LIGHT for use indoors or out will add charm to any setting. Called BU-T-Lite, it will burn with an inch-high flame more than 50 hours on one 250-gram (about 8 $\frac{3}{4}$ ounces) Multi-Fill which comes with the unit. Made to sell for \$11.95 by Ronson Corp., 1 Ronson Rd., Woodbridge, N.J.

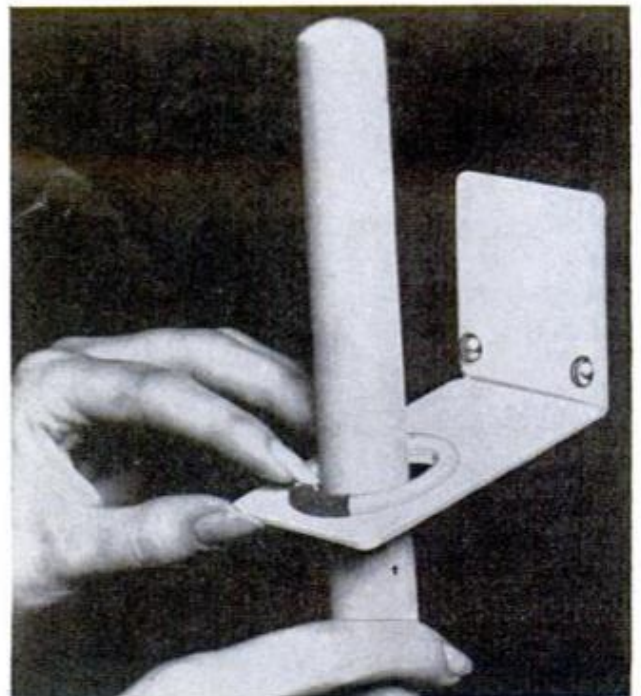


AVOID PARKING TICKETS with this pocket timer-alarm. Just set the timer anywhere from five minutes to one hour. When the time is up, a tiny buzzer sounds to remind you. Also great for timing phone calls, cooking, appointments and the like, it comes attached to a handy key chain and sells for \$5.45 postpaid from James House, 1714 Que St. N.W., Washington, D. C. 20009.



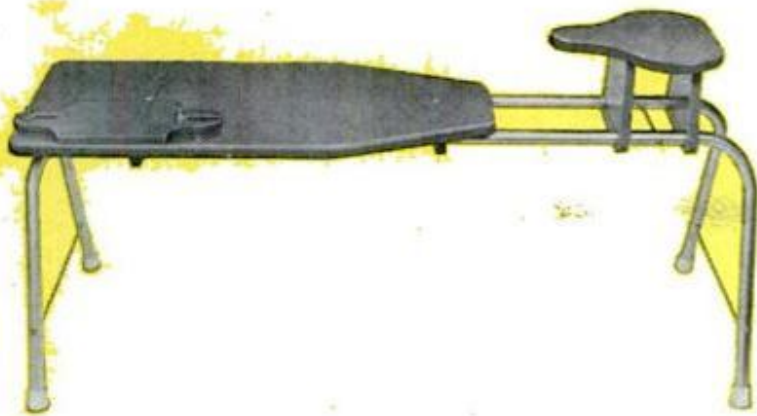
PROTECT YOUR HOME against fire, smoke, prowlers and forced entry with the Nutone alarm system. It has a control/alarm unit which recesses in any wall, and includes an automatic buzzer and visual signal that monitor the detector-circuit and wiring. Priced about \$80 by Nutone Div., Madison and Red Bank Rds., Cincinnati, Ohio.

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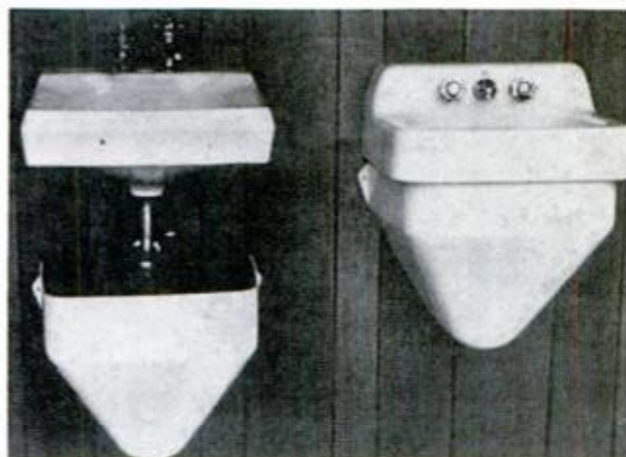
SAVE SPACE and keep brooms, shovels, rakes, whatever, in place with this handy gadget called Hang-Up. Just insert the handle in the friction-lock opening and it's "hung-up." The retail price is \$1 for two units, including mounting screws. Manufactured by the Allen Arthur Co., Box 8414, Minneapolis, Minn. 55426.

POPULAR MECHANICS



PORTABLE WORKBENCH for pottery makers offers an adjustable motor mounting board for a powered pottery wheel plus a seat for the hobbyist. Designed for use with the B & I Pottery Maker, the 50-inch-long bench is made of 1-inch zinc-plated tubing and the legs are protected with rubber to avoid noise and scratching of floor surfaces. It's easy to assemble and sells for \$22.50 from the B & I Manufacturing Co., Burlington, Wis. 53105.

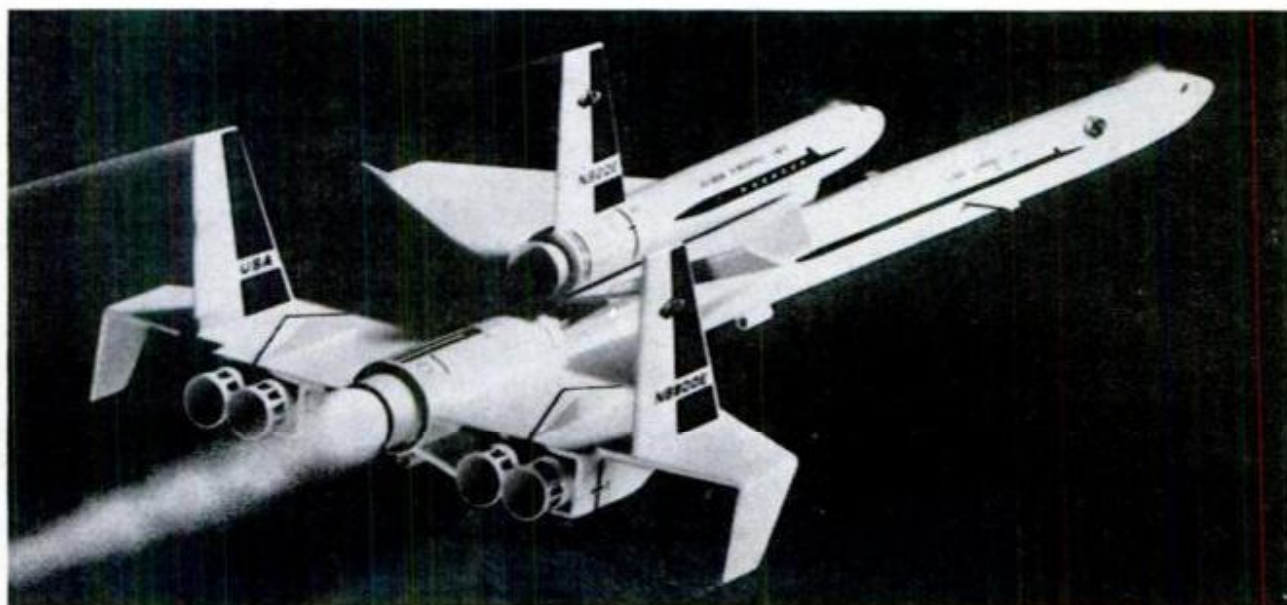
BEAUTIFY YOUR BATHROOM by hiding those unsightly pipes under your lavatory with Hide-A-Pipe, a heavy, molded-plastic cover (right). It fits all 19x17-in. lavatories, with or without legs. It's easy to install and can be washed with soap and water. Available in white and priced at \$10.98 postpaid from Habny's, 261 Huntington Ave., Buffalo, N.Y. 14214.

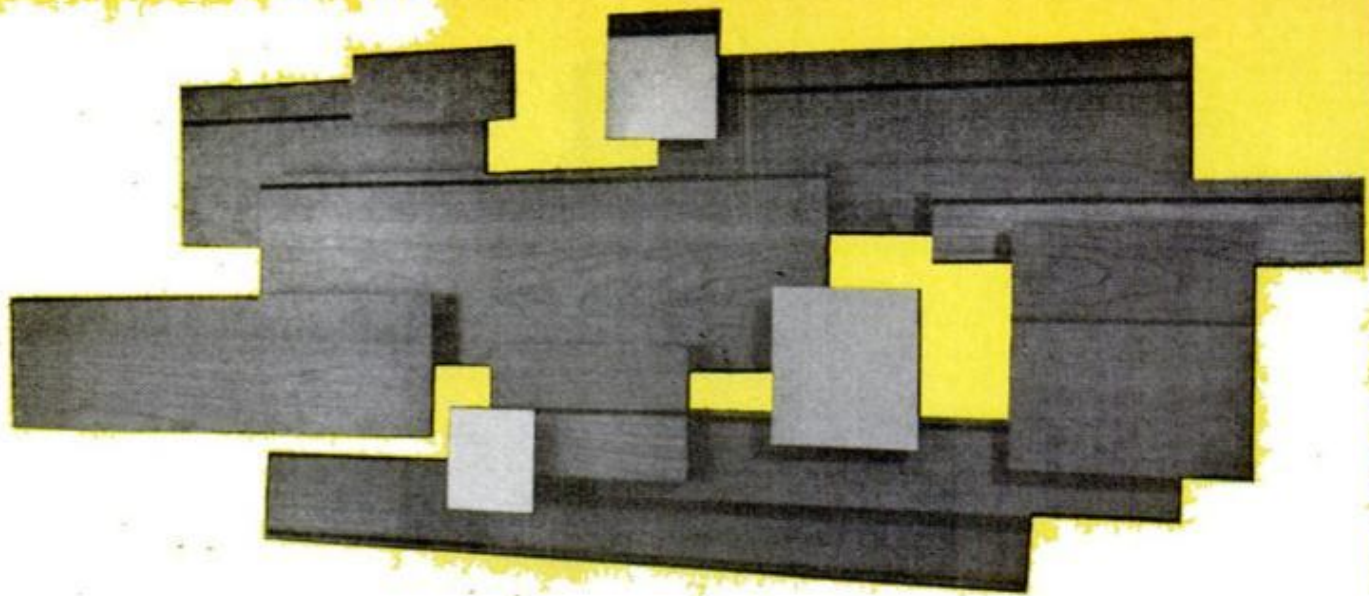


EASIER TO SERVICE and quieter than most central airconditioning units, the compressor of the WeatherKing Golden 800 (left) discharges hot air through the top where it won't harm foundation shrubs. Attractive, too, it's made by Addison Products, Addison, Mich. 49220.



TAKE A STEP INTO THE FUTURE with the Orbital Transport model rocket that you assemble. It launches vertically and climbs to a high altitude, then the piggy-backed glider separates on an earthward glide. \$2.50 from Estes Industries, Inc., Box 227, Penrose, Colo. 81240.





Decorate Your Walls With Leftover Paneling



A RECURRING QUESTION every time you panel a room is "What can I do with leftover $\frac{1}{4}$ -in. plywood?" Since cut-outs from window and door openings can, and usually do, represent considerable square footage, if you're an economy-minded do-it-yourselfer you automatically convert that square footage into dollars and cents to see what it cost you. Then, if you feel as I do, the scrap is stored in the shop for future use as drawer bottoms and cabinet backs.

One good and practical use for that scrap is to make wall plaques as pictured. Simply arrange pieces of wood paneling in layers to give an attractive three-dimensional appeal to wall decoration. Though we've selected two designs to show as a springboard for ideas, your plaques can be made to run the decorating gamut from Early American to traditional, Mediterranean and contemporary. And since the popular approach to home furnishing today is to draw from several sources, each design travels easily from one decor to another.

The plaques can be assembled from one type of paneling, or, if you have some of the recently evolved tinted panelings available, spots of color can be added to create a Mondrian-like design to the dis-

play. (See lead photo). If you lack a variety of paneling, colors or materials in the room can be emphasized by painting several plaque elements or covering them with a fabric.

The beauty of the two designs shown is that if you have no scrap $\frac{1}{4}$ -in. paneling, each arrangement can be made from less than a standard 4x8-ft. sheet of plywood. Thus, it is only necessary to purchase one sheet and the plaques still provide an elegant-looking wall treatment at low cost.

After cutting the plywood pieces to size, and before assembling, shave any "whiskers" on the edges with a block plane and fine sandpaper wrapped around a block of wood.

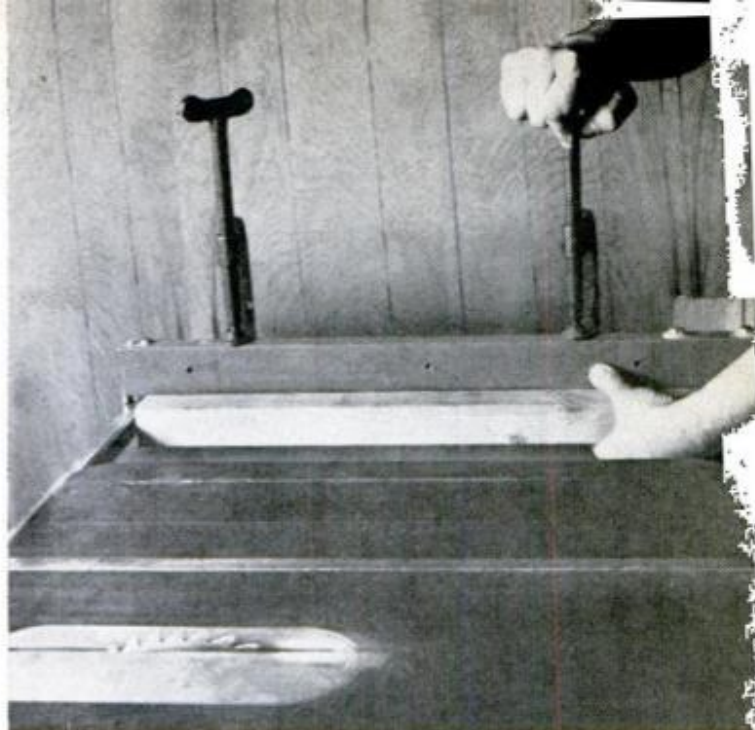
Spacers. The various elements in the design can be placed in a variety of vertical planes by varying the thickness of the spacers. Whether you elect to use $\frac{3}{4}$, $1\frac{1}{8}$ or $1\frac{5}{8}$ -in. stock, minimize any chance of splashing paint on the plywood's finished surface by painting the spacers before assembly. Though flat black enamel is recommended for spacers and plywood edges alike, color judiciously selected to blend with the room could be substituted if desired.

Designing your own plaques. You can turn your imagination loose and dream up one of your own plaque designs or refer to an art book for ideas. Impressionistic and pop art, in particular, are well suited for adaptation to a three-dimensional "painting." To start, lay out the arrangement on scaled graph paper. When satisfied with its looks, determine the size of each part and key it with a number. Working from the drawing, lay out the full-size pieces on the back of the plywood. Then, as you cut each piece on the table saw, a quick glance at the back will tell you what size to cut the scrap. Reference to the drawing also speeds up assembly.

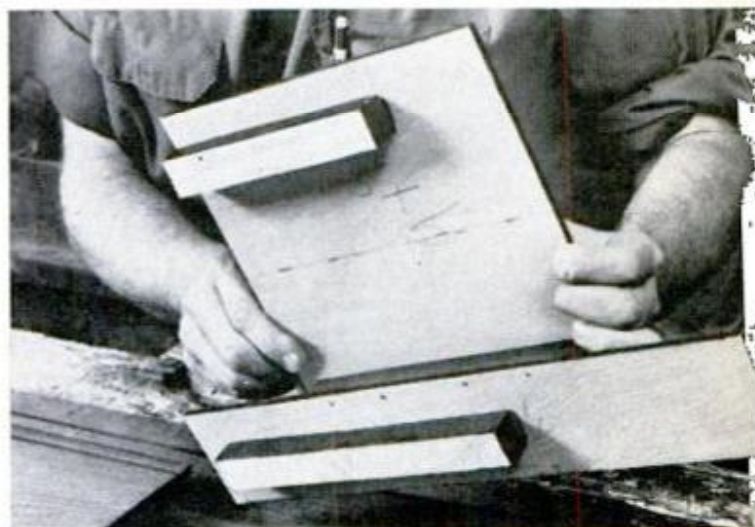
Caution: In addition to white glue, be sure to use an ample number of brads to insure tight joints. And, to minimize the chance of the $\frac{1}{4}$ -in. material warping on large panels, use an adequate number of spacers to keep unsupported areas small.

You can use standard picture hangers (the serrated type) or picture wire and screw eyes to hang the plaques. Just bear in mind that a sizable plaque will have considerable weight and require a hefty hook installed in a wall stud.

—Harry Wicks, Workshop Editor



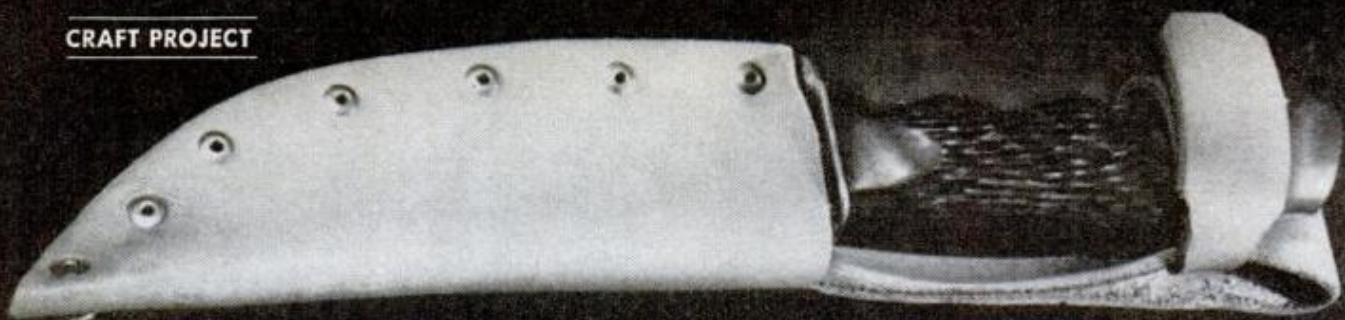
TO PREVENT flexible $\frac{1}{4}$ -in. paneling from sagging under fence, cut a piece of 2x4 stock to fit between the extension arms and clamp it to fence bottom



SPACERS ARE STAINED, then fastened to plywood using glue and $\frac{3}{4}$ -in. brads through the plywood. Glue alone doesn't bond well to prefinished paneling

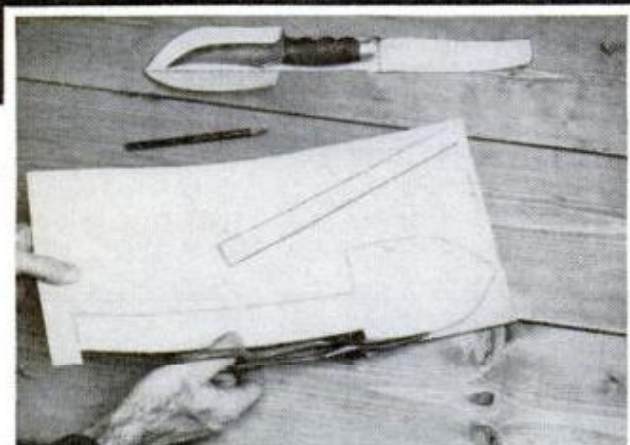


WALL HANGERS are located equidistant from both ends and fastened in place. The panel edges are finished with a single coat of flat black enamel

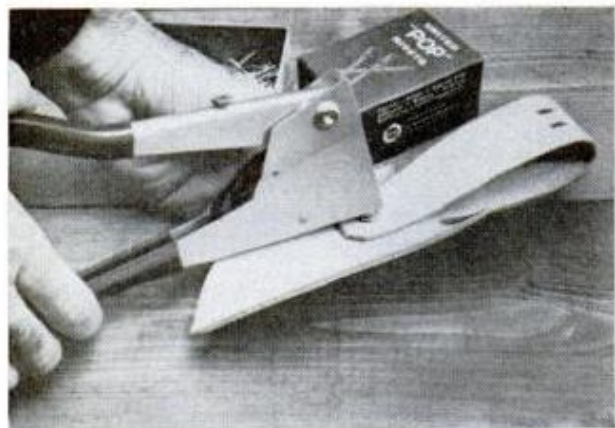


Make This One-Piece Knife Sheath

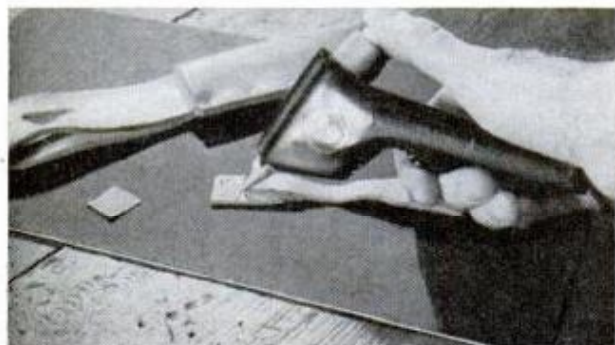
By ROBERT W. BERGER



PATTERN IS MADE on paper, transferred to leather. Use sharp knife or tin snips to cut the leather



LOOP IS FASTENED using Pop RiveTool and 1/8-in. rivet. Backing plates are added to prevent tear-out



THERMO-SETTING GLUE applied with electric gun is used to affix the Velcro fastener to the leather "belt"

IF YOU HAVE a hunting knife which needs a sheath, or a sheath that's seen better days, you can make one in an evening, even if you've never before worked with leather. The one-piece, riveted type shown has no stitching to wear out, and the keeper surrounding the knife is of easy-to-fasten material, even with numbed hands.

Begin by cutting out a paper pattern. Fold it in half and test it for fit by inserting your knife. When satisfied, transfer the outline to the leather and cut out. Next, cut two slots for the keeper and fold the leather to form a belt loop. Fasten the loop with a rivet and backing plate, and cement tabs of Velcro fabric to the keeper.

Suitable leather can be purchased from Tandy Leather Co., 384 Fifth Ave., New York, N.Y. 10018. Specify medium weight, live oak craft-cut, 9x18 in., about \$3. It's the smallest size sold and will make two sheaths. The Pop RiveTool and Thermo-grip hot glue-gun, which make the project easier, are made by USM Corp. and sold in hardware and department stores. ★★



STRIP OF VELCRO serves as an easy-to-operate fastener on keeper that surrounds the knife handle

POPULAR MECHANICS

HINTS FROM READERS

Tailstock center-rest

A tailstock center-rest for supporting centerless armature shafts can be made from the tapered shank of a discarded twist drill. With shank mounted in headstock spindle, it can be cut off, accurately center-bored and reamed to a smooth fit for the armature shaft. A brass bushing supports small shafts.—*C. W. Woodson*

Magnet puts grab in nut driver

A magnet placed in the end of a nut driver will keep hex-head nuts and screws from falling out when you start them in hard-to-reach places. The hollow shank will accept a small rod-type magnet and a bit of epoxy will hold it in place. Let the magnet project a trifle into the hex head of the driver.—*Henry Josephs*

Embedded brads prevent shifting

Recently, while gluing two hardwood members together, I had trouble keeping them from shifting when I applied clamping pressure. Since the joint was inaccessible to nails or screws, I used several small brads cut off as shown to hold the blocks in alignment as the clamps were tightened.—*Eugene Florida*

Nuts start easier

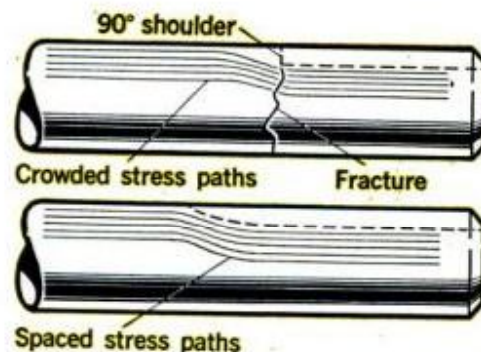
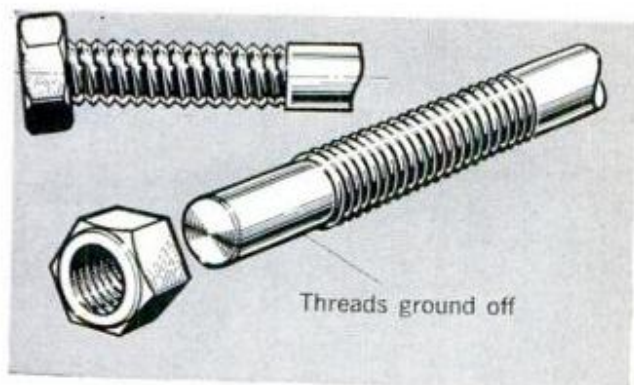
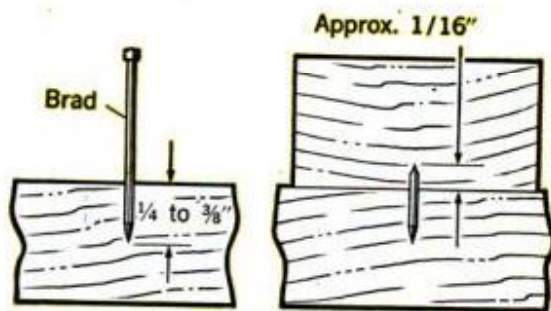
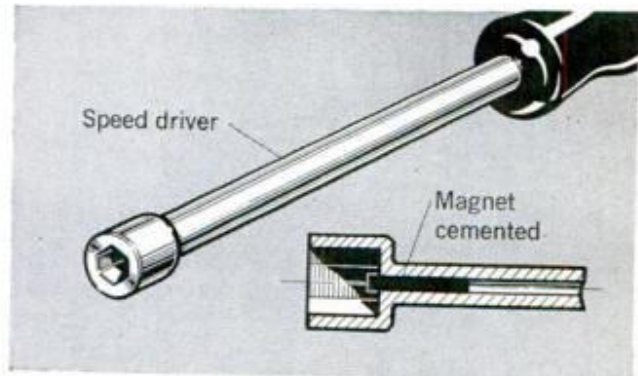
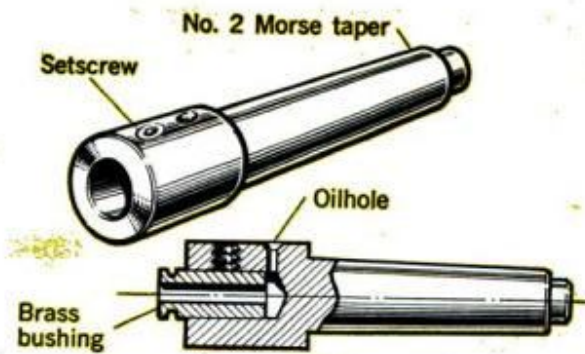
While working on pump equipment with little room to operate, I found it was difficult to start the nuts straight on the studs of the stuffing boxes. Then I hit upon the idea of turning down the threads on the ends of the studs. This automatically aligns the nuts with the threads so they will start without catching.

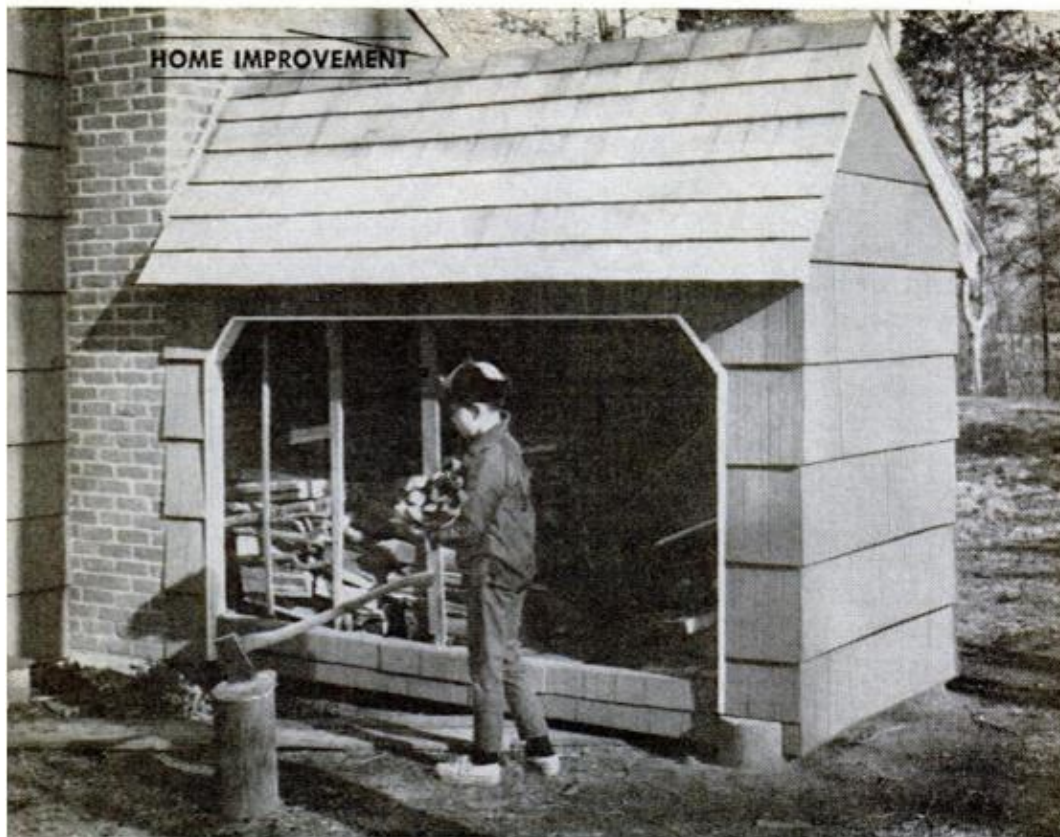
—*Emil Wittman*

Stronger keyway for driveshaft

Keyways which are made with an end mill are known to weaken a shaft, often resulting in a fracture of the metal. There's less chance of a fracture at the end of a keyway when it is cut with a side mill which forms a radius at the end of the cut instead of a 90° shoulder. Thus, stress is more evenly distributed.

—*Emil Wittman*





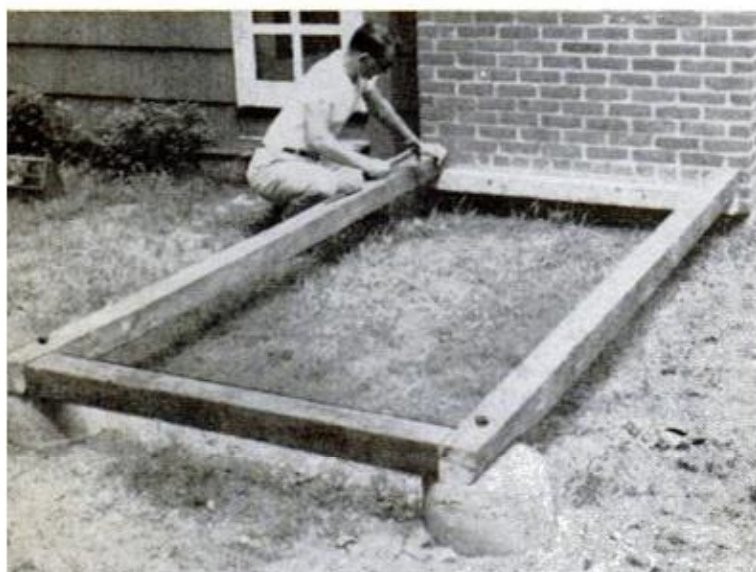
Build This Fire-wood shed

By B. W. POWELL

Though woodsheds used to serve as a disciplinary aid, our carriage-house version is designed strictly for storing a full winter's supply of logs

DESPITE THE INCREASING popularity of woodburning fireplaces, few homes built today come with a woodshed. This can be a nuisance if it means firewood must be stored exposed to weather, dirt and leaves. Having an exterior door near our fireplace, I decided to build a simple attached shed designed to coordinate with existing house architecture. Of stock materials that I had on hand, the

structure is framed using construction techniques similar to that found in old barns. In feet, its overall size is 5 wide, 5 high at the entrance, 10 long and about 7 high at the ridge. The shed rests on two piers at one end and is lag bolted to the chimney at the other. The framing was sheathed vertically with one-by panels and to finish, the building was shingled and painted to match the house. ★★★



SILL IS FASTENED to chimney at one end using lag-screws and anchors in chimney mortar-line. Raised floor provides air circulation and eliminates dry rot

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FOUR CORNER TIMBERS are placed and sill notched to receive corner-post braces. Framing used throughout is a variation of half-timbered barn construction

POPULAR MECHANICS



AFTER PLACING RAFTERS, plumb the ends with level, then cut them off in place with portable circular saw. If using old timbers, check for nails before cutting



SHED IS SKINNED with one-by sheathing applied vertically. Notice horizontal members placed between uprights to provide midpoint nailing and rigidity



FIBER BACKER-BOARD is placed as an overlap above each course of shakes. It produces offset and architectural shadowlines at butt edge of the shingles



WIDE ONE-BY STOCK was used for furring; boards are spaced about 12-in on center so that shingles can be applied with 8 in. exposed to the weather



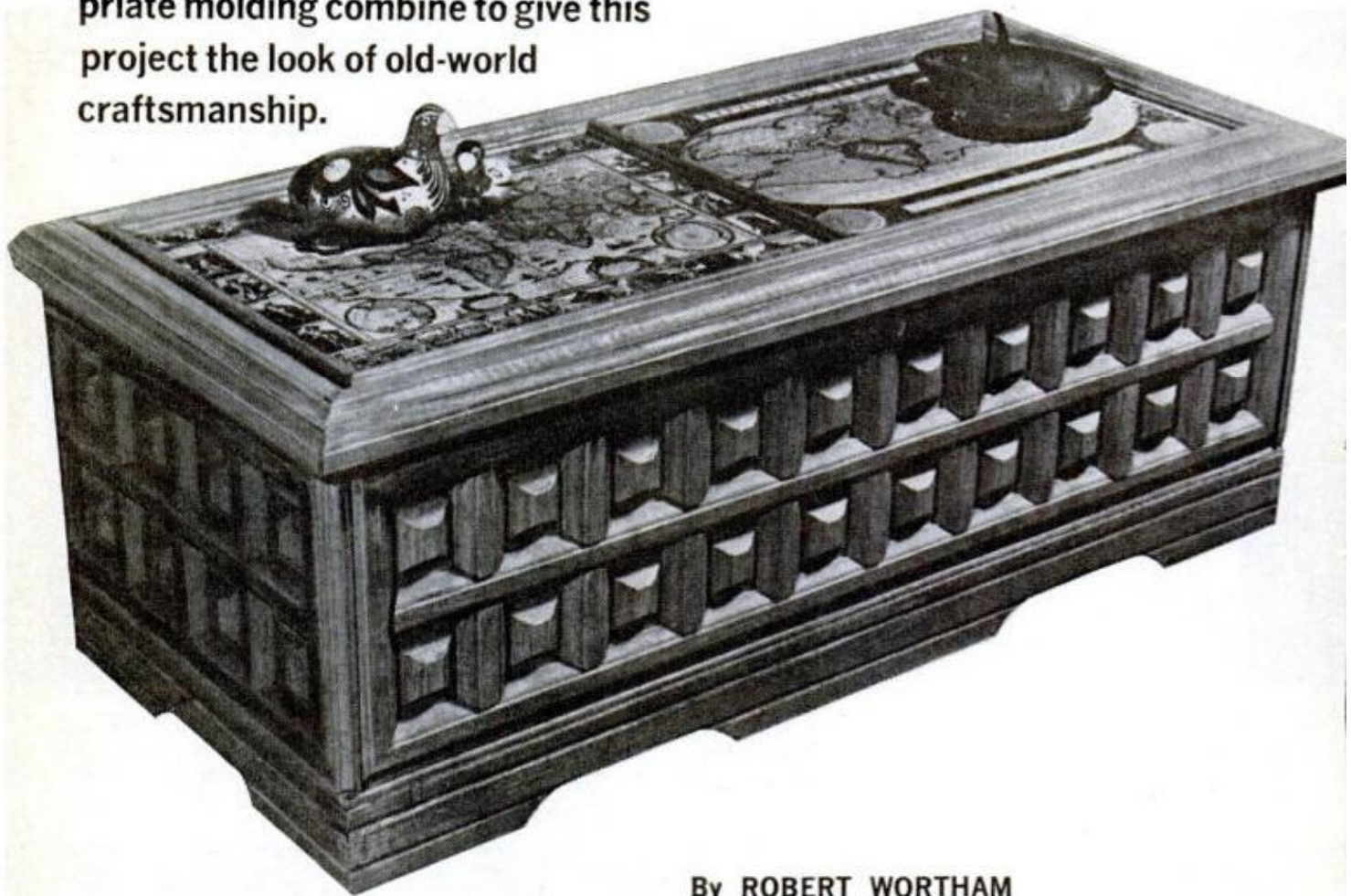
TO INSURE DRY FIREWOOD, roof was carefully flashed where it meets chimney and 15-lb. felt was stapled over upper 10 in. of each course of shingles
JUNE 1970



RESAWN CEDAR SHINGLES used on roof were applied with 4-penny galvanized shingle nails (two per shingle). For long life, preservative was applied next

You Can Create Period Styling With Stock Moldings

A battered trunk and about \$10 worth of appropriate molding combine to give this project the look of old-world craftsmanship.



By ROBERT WORTHAM



BARGAIN-PRICE CEDAR CHEST before moldings were applied. It was bought at a thrift shop for \$2

THERE ARE probably several good reasons why Spanish or Mediterranean-style furniture enjoys the designer and decorator status it does today. The massive, sculpted look of the deeply carved, recessed panels blends well with practically all decors. And the rugged-looking finish can take the abuse that it's certain to receive in a home with youngsters. Minor nicks or dents in the finish are practically invisible and, in fact, can add charm to the piece.

Happily, it's not necessary to be a woodcarver or woodworking artisan to duplicate the look. Using stock moldings available at any lumberyard, you can

achieve the effect with simple butted joints. Or, you can make original moldings using your shaper or router.

The cedar chest shown on the preceding page, was purchased in a junk shop for a couple of dollars. It was battered, its veneer was half peeled off and it was shabby looking. (I still think the shop-keeper is amazed that he sold it).

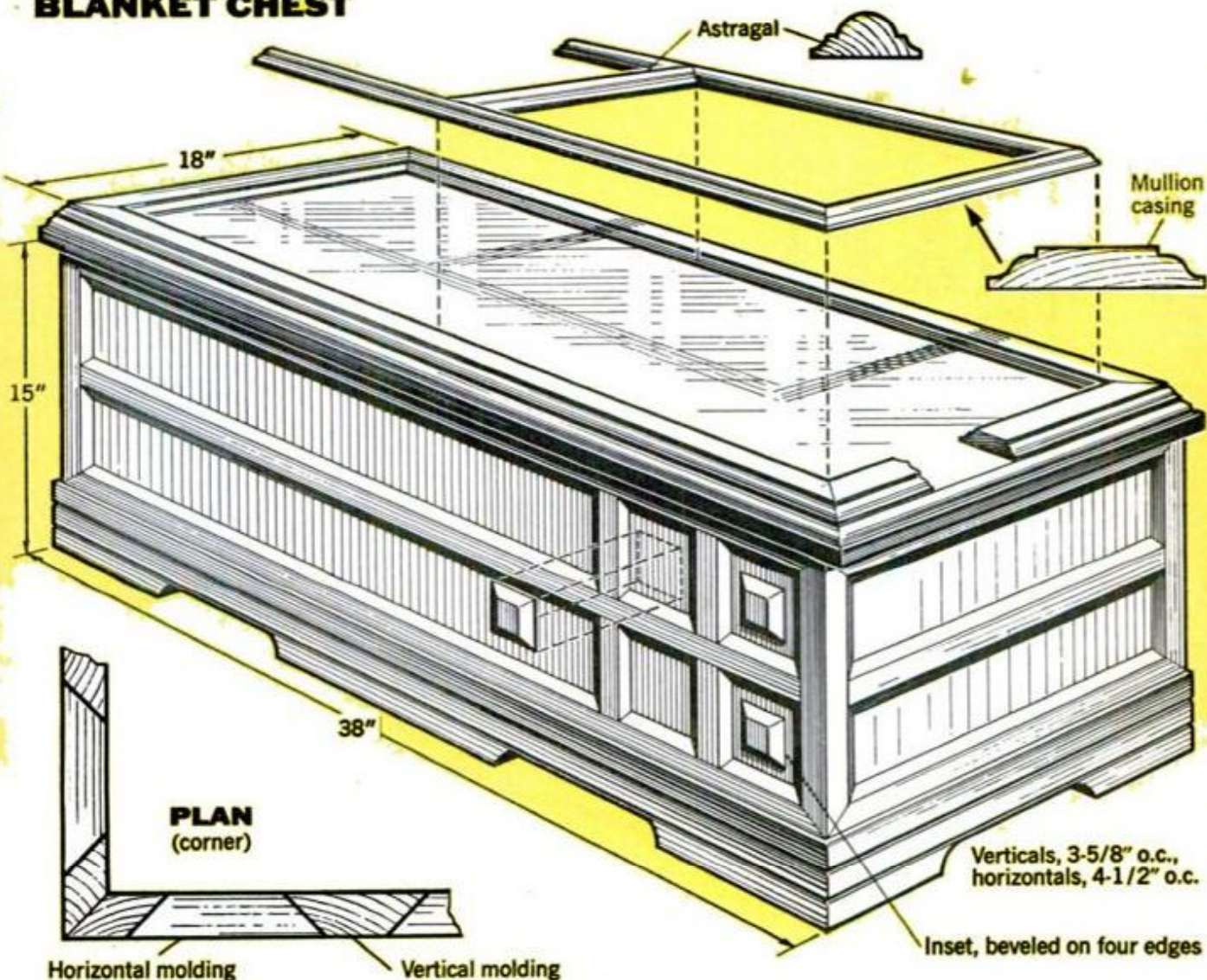
Back in the shop, I reglued the veneer, removed the old ball-type feet and sanded the piece down to bare wood. Once I decided which moldings to use, I made a scale drawing of the piece to determine the on-center locations for verticals and horizontals. With this calculated, all I had to do was cut the required number of pieces.

I used miter cuts at the outside corner joints. On the inside strips of molding, I simply made straight crosscuts with a 45°



MOLDINGS AT CORNERS are miter-joined; horizontals and verticals inside have 45° bevel undercut

BLANKET CHEST





bevel and butted the pieces. But, if the molding you select has a shaped edge, perpendicular joints will have to be made with either 45° saw cuts or by coping. Apply the molding to the outside corners first, then add the interior pieces. Here, since the chest was to be painted and antiqued, I used white glue and brads to assemble. The latter eliminated the need for clamping and kept the job buzzing along.

A final touch, though a matter of personal choice, is to add the small, beveled blocks of the same molding to each recessed square. ★★★

VARIATION on an old chest. In the original state, it had beveled drawer fronts and plain, flat doors

SMALL CABINET

Technical Art by Fred Wolff



Beveled drawer front in existing cabinet

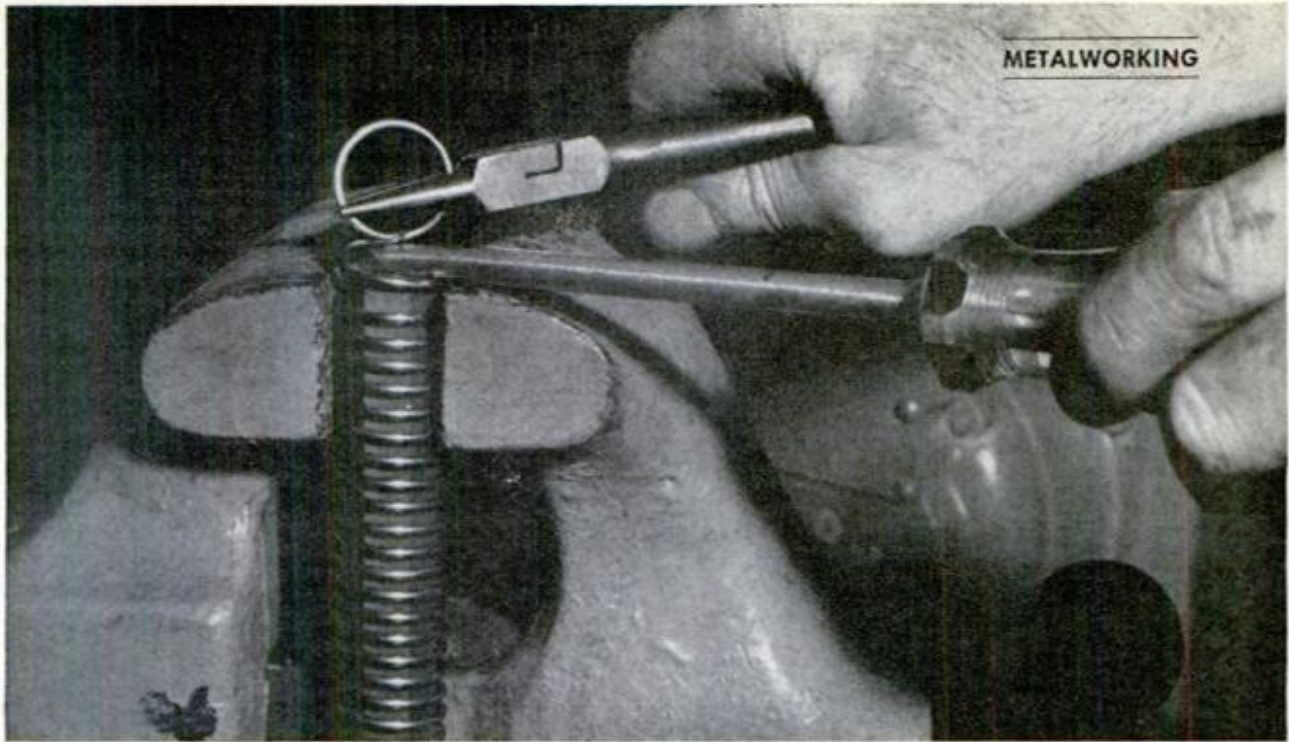
45° bevel undercut

Flush door in existing cabinet

Verticals on door spaced 6" o.c., horizontals 3" o.c.

End horizontals spaced 5" o.c., verticals 6" o.c.

Note: Vertical and horizontal moldings on both pieces are spaced equidistant to suit furniture lengths and widths. Check cabinet dimensions before fastening any moldings.



WITH SPRING IN VISE, loop on end is formed by using a pair of needle-nosed pliers and a screwdriver

Make Your Own Coil Springs

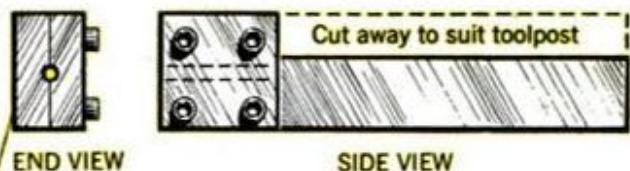
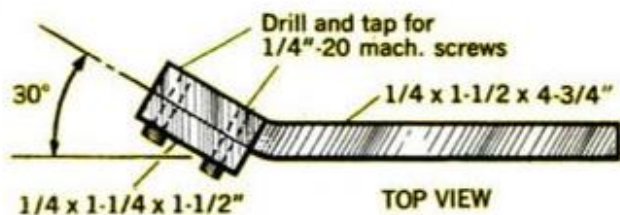
WINDING A SPRING is rather simple, but it's also one of the most satisfying tricks you can do on a metal lathe. Most of the springs you'll ever need can be bought at your local hardware store, but, on those occasions when a customized spring is needed, it's nice to know that you can fashion your own.

To make a spring you need spring wire. Referred to as music wire, it is sold through machinery and tool-room supply dealers with a choice of regular and stainless steel, flat, square and round. Depending on diameter, lengths vary from 10 to over 5000 ft.

Your first step is to make a wire-guide holder. With it you'll be able to feed wire onto a mandrel with the proper tension for your lathe's toolpost.

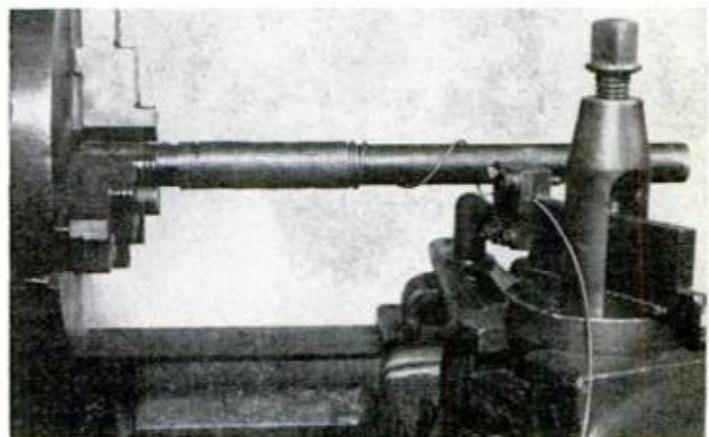
Your next step is gearing your lathe from the chart the same way as for cutting thread (the thread number corresponding with the number of coils you desire). Make certain that the gearing includes the engaging of the lead-screw lever before starting the motor. This

(Please turn to page 200)



Hole dia. smaller than wire used

AS LEAD SCREW FEEDS AWAY from the chuck at the lowest speed, the machine forms a coil spring before your eyes



HINTS FROM READERS

Wrench prevents key loss

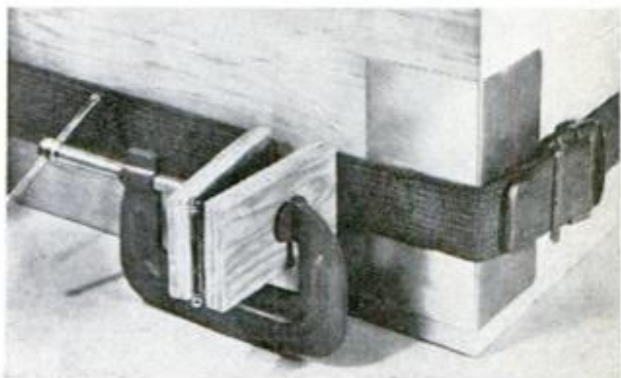
Passkeys and other keys not intended to be carried in pockets can be kept from straying by chaining them to an inexpensive "dog-bone" wrench. Simply slip the keys on a chain or cord and fasten the loop to the wrench's smaller end.

—Walter E. Burton



Updated web clamp

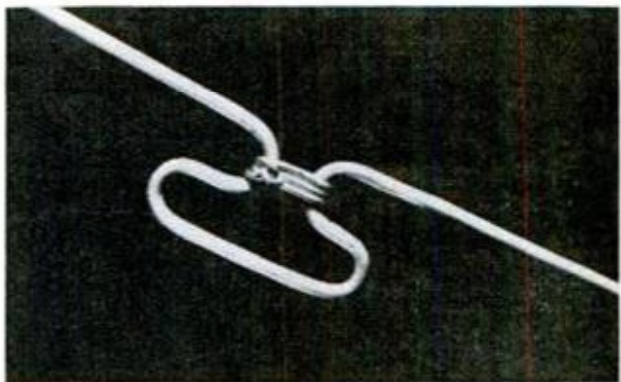
Using an idea that I spotted in *Hints From Readers* (page 181, March '68 PM), I made a couple of web clamps to hold the eight-room martin houses that I turn out on a semiproduction basis. By slipping a piece of aluminum between webbing and corner, I've eliminated the damage to wood that occurred previously.—F. C. Yeager



Shortening a too-long wire

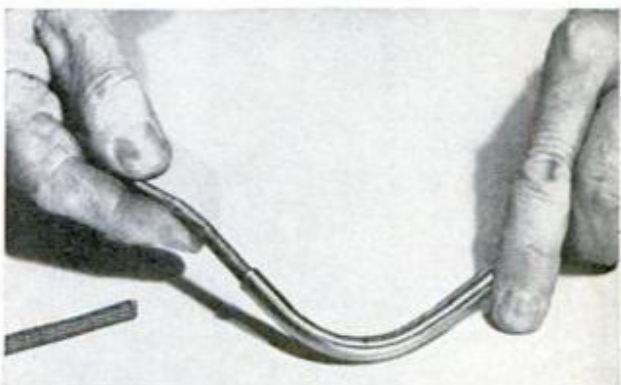
If a guy wire or other wire brace has considerable slack, but it is not feasible to loosen an end for tightening, try making a tied loop in the wire to restore desired tautness. With pliers, bend the wire to form a partial loop to take up slack, then wrap another length of wire around the loop as shown to maintain its tautness.

—W. Edwards



Door spring helps bend tubing

If you need to bend a length of tubing, but have no bending equipment on hand, try this trick to continue working. Insert a length of coiled screen-door spring that fits the tubing snugly and you'll be able to make the bend without collapsing the walls. Pull the spring out, twisting it in the direction that tightens, thus reducing the diameter of the coils.



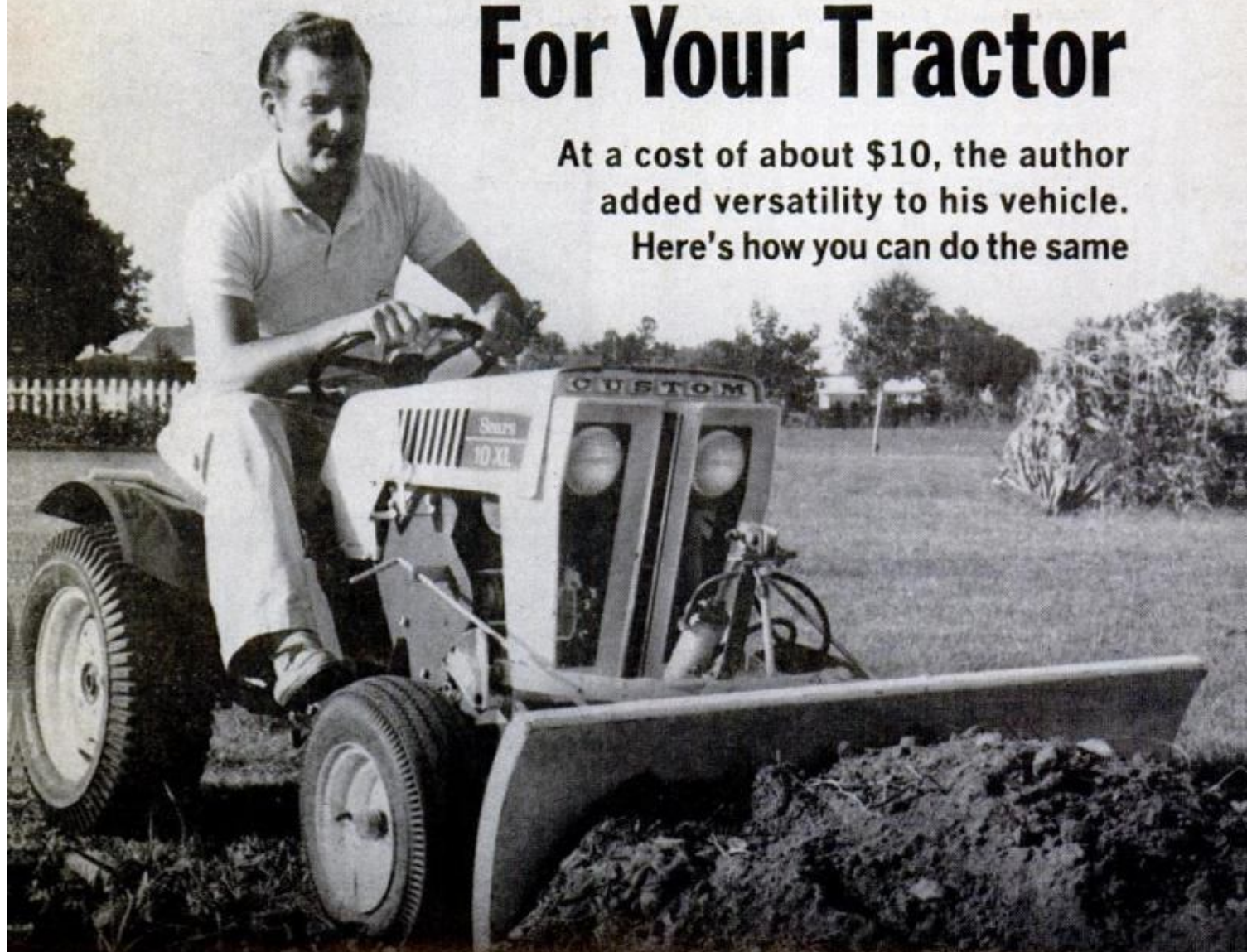
Drill serves as lathe

To make a tapered radio mast for a model boat I was building, I grooved a block of wood to receive a bicycle spoke that was chucked in the drill. With the wood supporting the spoke, I filed it at an angle away from the chuck to prevent chattering. To finish, I used a pocket stone and emery cloth to bring the "mast" to a high polish.—Norman W. Byrne



Build a Hydraulic Lift For Your Tractor

At a cost of about \$10, the author added versatility to his vehicle. Here's how you can do the same



By MAURICE ORLAREY *Technical Art by Peter Trojan*

LIFTING a heavy bulldozer blade manually is for the birds even when it's only a fairly small one on a garden tractor. Pulling a lever to raise and lower the blade can make you arm-weary after only a few hours of grading or snow pushing. That's why I decided to do it the easy way and add a hydraulic lift so a mere push of a button would lift and lower the blade. Now I feel like a big-time heavy-equipment operator!

The first step I took to add this push-button convenience was a trip to the local junkyard to pick up the power

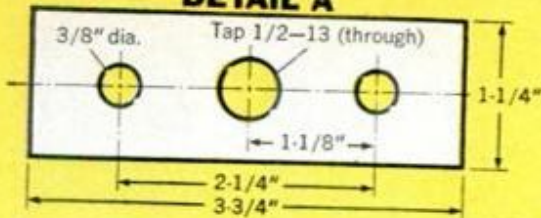
unit—a hydraulic system from the convertible top of a car. (The one I selected happened to be from an Oldsmobile.) For a total cash outlay of \$10 I purchased:

- Motor, pump, reservoir unit.
- Cylinder with bottom plate.
- Hydraulic hose.
- Wiring and dashboard switch for above motor.

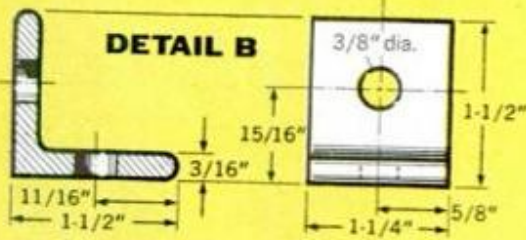
Since at this point I wasn't sure whether one cylinder would provide enough muscle for the job, I also bought the second cylinder (manufac-

HYDRAULIC LIFT

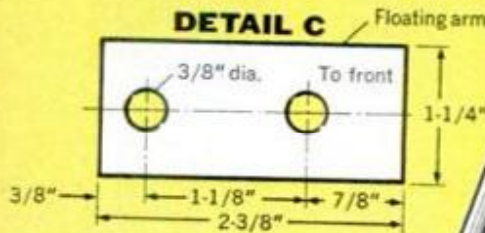
DETAIL A



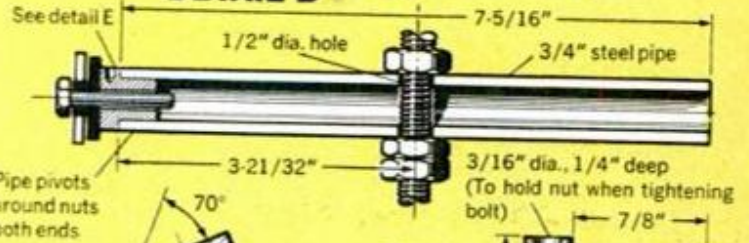
DETAIL B



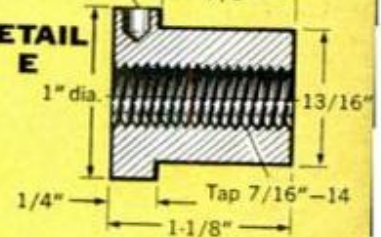
DETAIL C



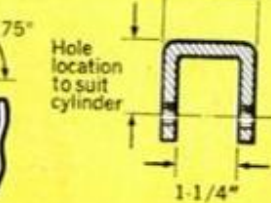
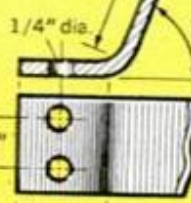
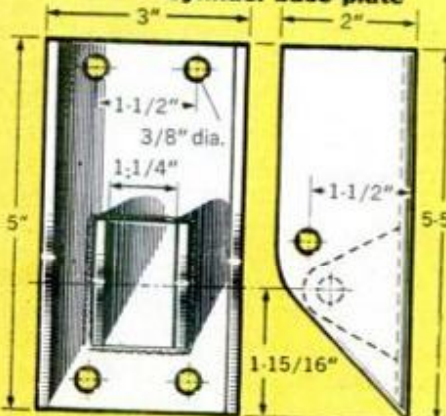
DETAIL D



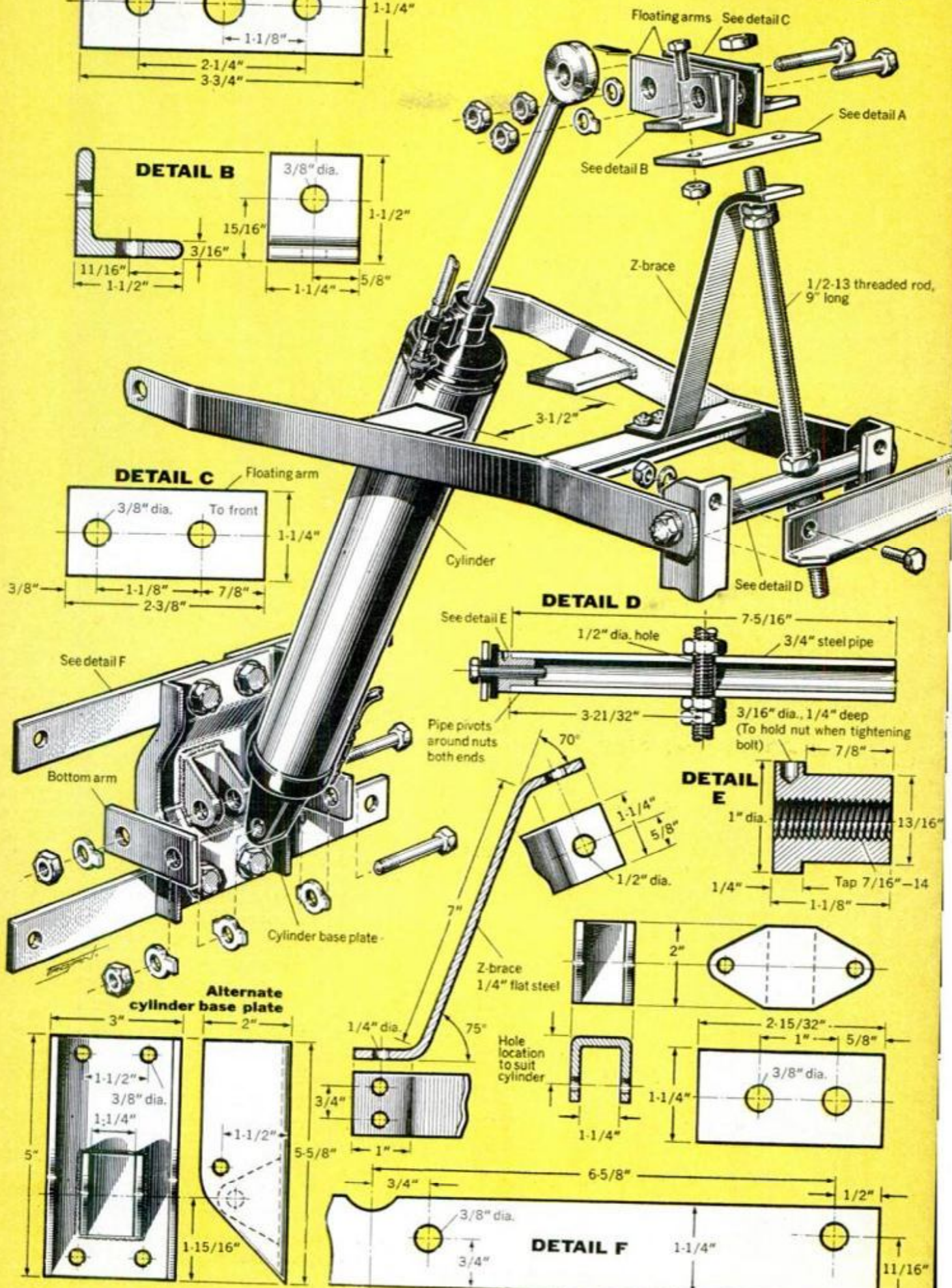
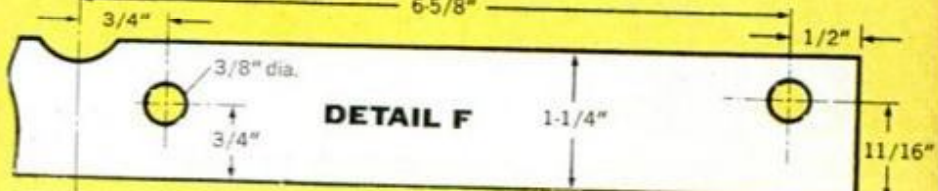
DETAIL E

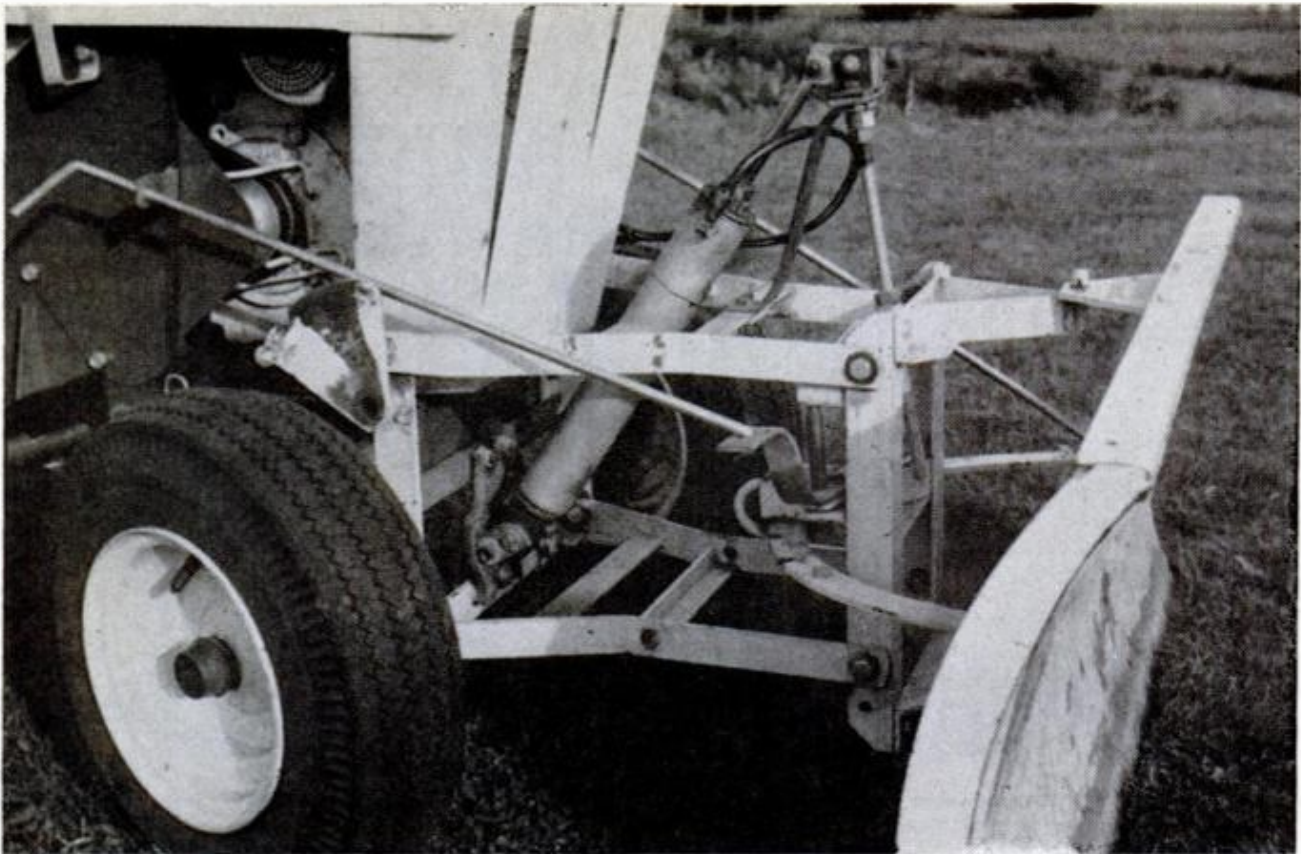


Alternate cylinder base plate

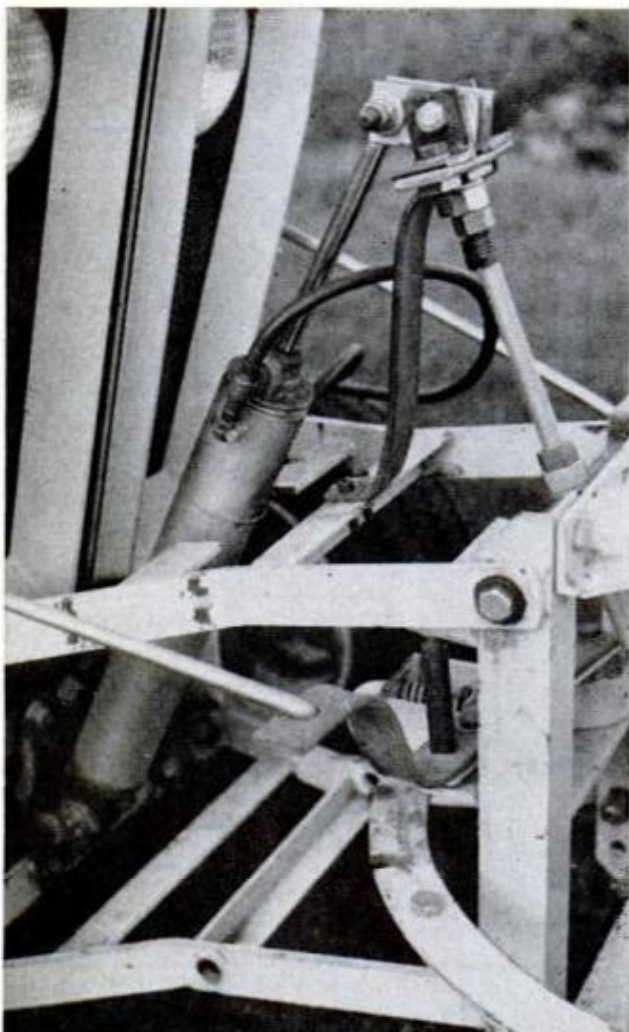


DETAIL F





CYLINDER BOTTOM ARMS are attached to plate with bolt and to cylinder with shaft, washer and cotter pin



BLADE RESTING ON GROUND exposes $\frac{1}{2}$ -in. threaded rod. Extended down, it allows room for adjustment

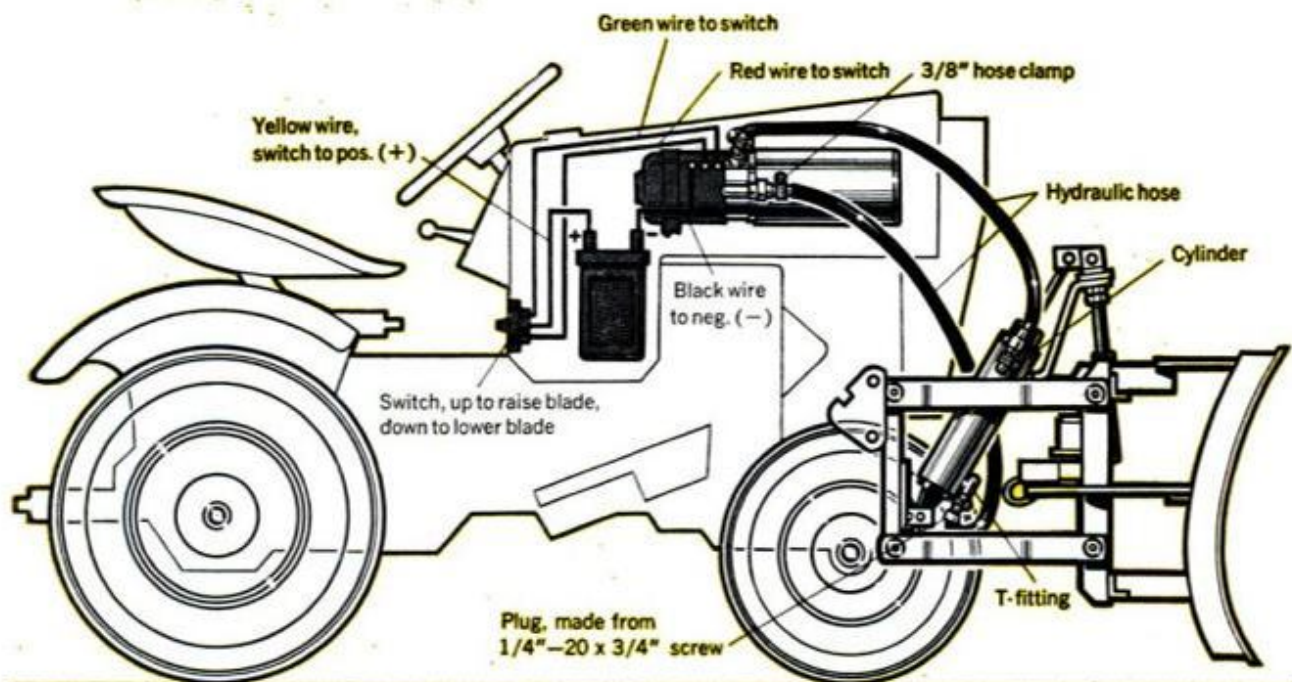
turers use two per car) for an additional \$2. As it turned out, one cylinder was sufficient. It will, in fact, effortlessly raise and lower the blade at a touch of the button, even with an average-size male sitting atop the blade.

Recognizing that prices can vary and probably will, depending upon the number of junkyards in a particular geographical location, a visit to your local junkyard for a materials price quote before starting the job is a practical approach.

Some changes on the manual lifting unit were necessary so that the cylinder could be fitted in place. First, I had to disassemble the lifting lever and linkage that connects it to the upper-lift frame. Then, using $\frac{1}{4} \times 1\frac{1}{4} \times 14\frac{1}{4}$ -in. flat iron, I made a flat brace (Detail F) and fastened it to the tractor as shown on page 173. Finally, I fastened the cylinder base to the upper and lower braces.

The cylinder that I bought came equipped with a base plate which was adaptable to my tractor when bottom arms were added. If this part is missing on the unit that you purchase, you can make the alternate base plate shown in the lower left-hand corner on page 173. With this version, the bottom arms can be eliminated since the cylinder-holding U-

ELECTRICAL AND HOSE CONNECTIONS



AFTER CUTTING HOSE to unused second cylinder, plug T-fitting with $\frac{1}{4}$ -in.-diameter bolt and $\frac{3}{8}$ -in. clamp

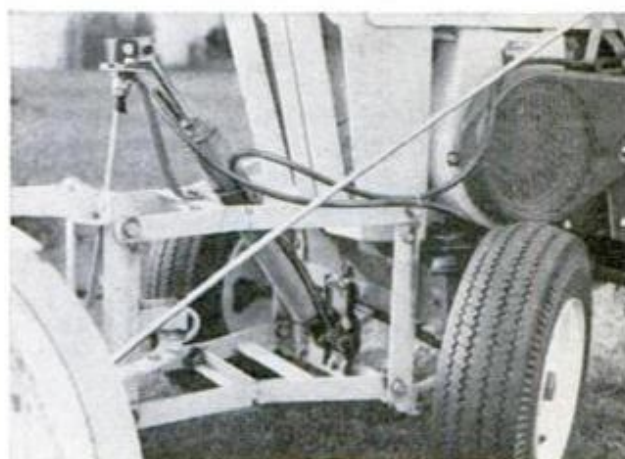
channel provides ample swing-clearance.

The motor-pump reservoir unit fits snugly under the tractor hood (see drawing shown above). On my rig it had to be positioned on the top left side of the engine between the air cleaner, gas tank and left headlight. To make room, it was necessary to move the air-cleaner cover slightly to the right.

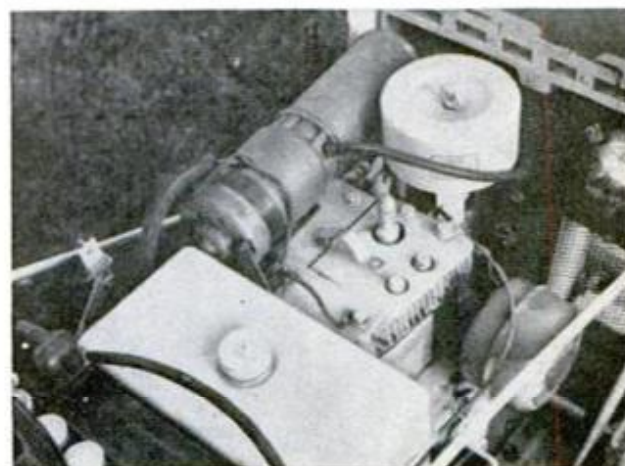
Current draw is given at about 35 amps, which is no problem for my 12-v. heavy-duty battery. The "on" time is very short since the blade is lifted at a speed of roughly 2 in. per second. If your blade doesn't stay up, due to slow leakage through the pump, it can be corrected by stiffening the pivot points of the upper and lower frames by inserting spring lock washers under the bolt heads.

All of the dimensions shown were determined by trial-and-error fitting as I built the lift to suit the tractor (Sears 10-hp XL). For other makes I would recommend experimenting with cardboard and/or plywood templates to check for fit and clearance before cutting, shaping and welding the iron.

Working at a leisurely pace, I completed the setup in my spare time. I'm so pleased with the results that I feel it borders on understatement to say that my effort was worth every minute. ★★★

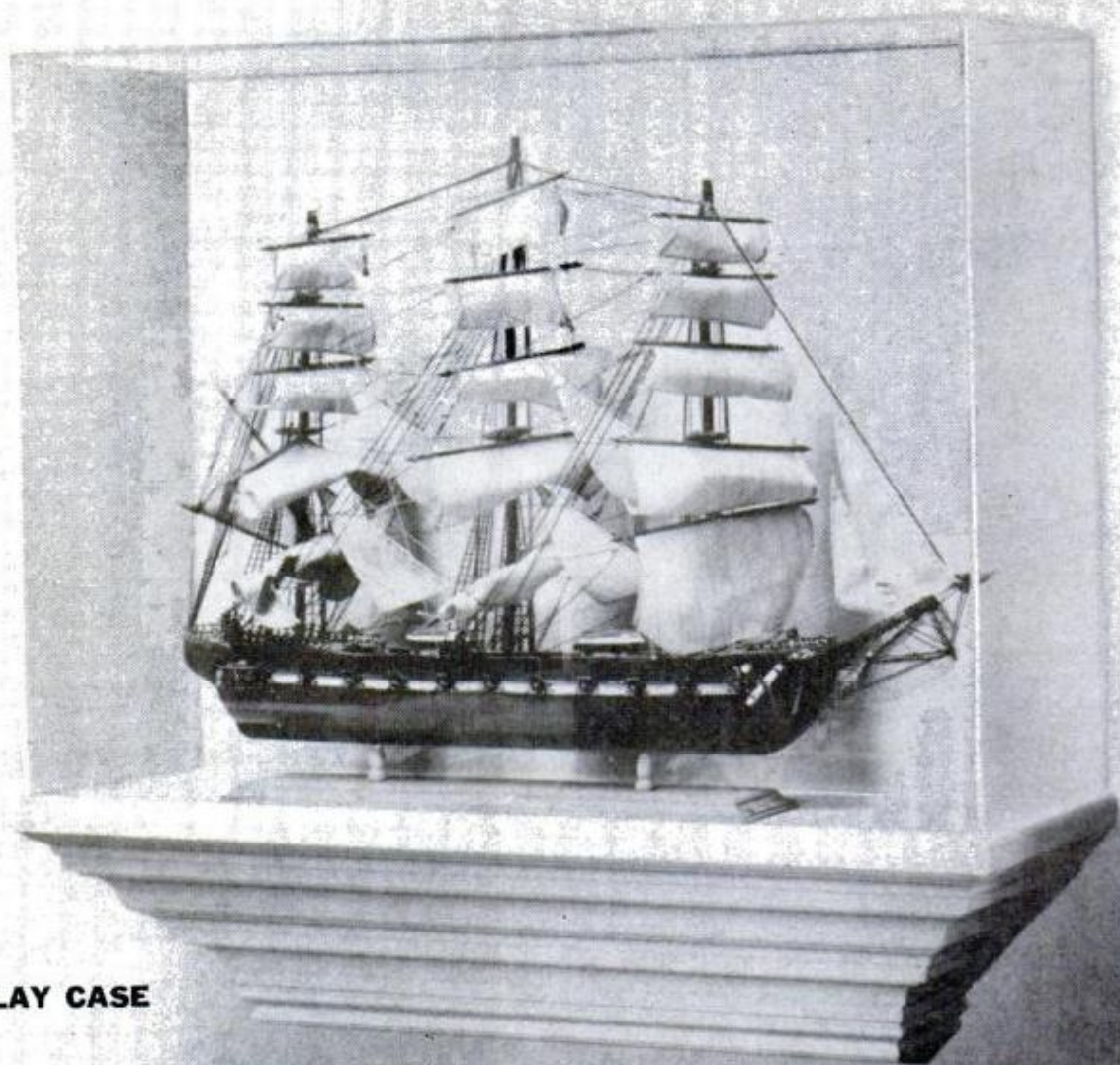


WITH THREADED ROD almost vertical, floating arm position indicates that the blade is free to float

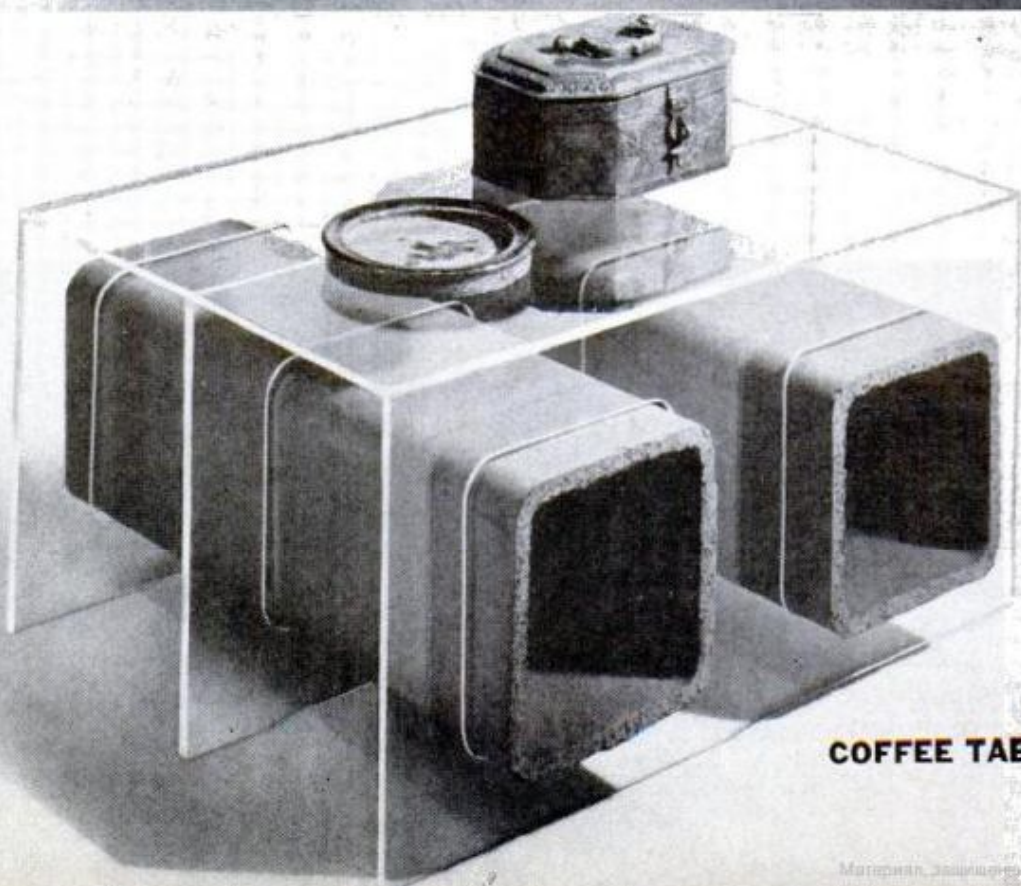


POWER UNIT fit neatly under hood on engine's left side when air cleaner was moved slightly

How to



DISPLAY CASE



COFFEE TABLE

Work With Plexiglass

Glasslike, tough and beautiful, it's fascinating stuff to build with. It saws and drills just as easily as wood and can be bent when it's heated

By WAYNE C. LECKEY, Home and Shop Editor

AS A WORKSHOP MATERIAL, plexiglass is in a class by itself. No other material can match this rigid acrylic plastic when it comes to creating projects that are exciting and truly out of the ordinary.

While it looks like glass and comes in sheets like glass, the plastic is as soft as hardwood—which means you can drill it and saw it with common workshop tools. You can cement it to produce strong transparent joints, and you can heat-form it into interesting curves and shapes.

There's no end to the things you can make with it. The four examples pictured here—the model display case, the ceramic-pipe coffee table, the cube end table and the in-a-wall fish tank—are but a few of the many exciting uses for sheets of acrylic plastic in the home. A booklet loaded with other project ideas can be obtained

for 25 cents from Rohm & Haas Co., Box 9730, Philadelphia, Pa. 19140.

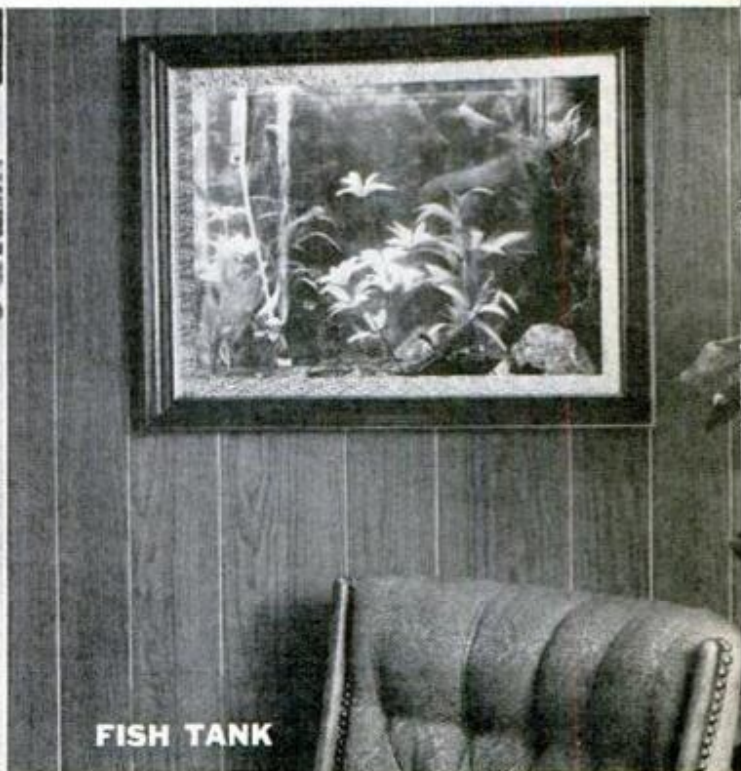
While rigid acrylic plastic has been around for a long time, the exciting news is that Rohm & Haas has just made its own brand, Plexiglas, available to the do-it-yourselfer nationwide through building supply dealers, hardware stores, paint stores, glass and wallpaper outlets. Up to a few months ago, plastic was not readily available, and then only through industrial supply houses. Consequently, it remained a little-used workshop material.

Now that it is readily available, you can buy clear sheets in seven stock sizes ranging from 18x24 in. up to 26x48 in., and in thicknesses from .100 to .250 in. If you want the translucent kind, you can get 24x48-in. sheets in white; red and blue in 4x6-ft. sheets. If you want the transparent

IN ADDITION TO MAKING PROJECTS LIKE THESE, you can use clear plastic to replace the glass in problem windows, mount tissue-paper art, protect tabletops, cover window wells and make sliding cabinet doors



END TABLE



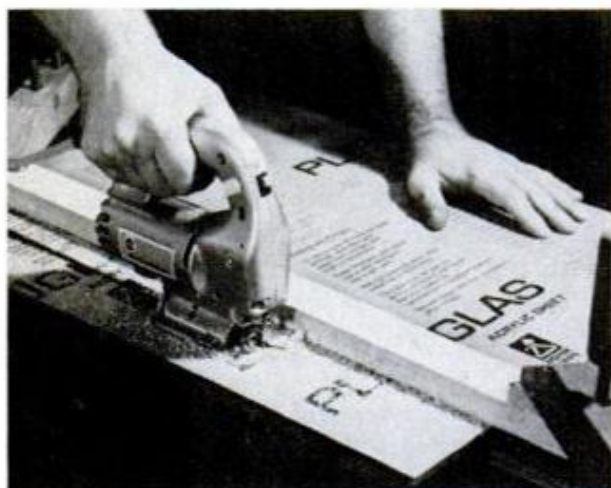
FISH TANK

BASIC FABRICATING STEPS

Cutting—Drilling—Cementing



CIRCULAR SAWING. Use fine-tooth "plywood" blade and set blade a little higher than thickness of plastic. Hold work down firmly; push slowly through saw



SABRE SAWING. Blades of reciprocating saws should have 14 teeth per inch. Use strip to guide saw in straight cuts; hold work firmly when sawing curves



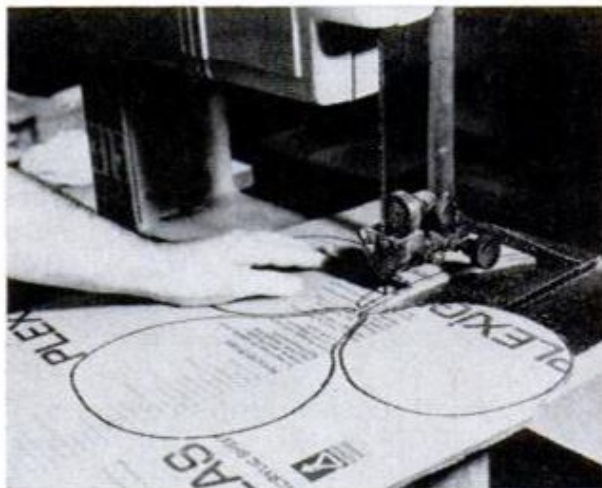
SCRIBING. Plastic up to $\frac{1}{8}$ in. thick can be cut by scoring with pointed tool. Make the score along a straightedge and four or five times through paper

kind, it comes in 4x6-ft. sheets in a choice of bronze, amber or blue. Finally, there's the patterned or textured kind in a choice of blue, green and copper.

You can expect to pay from \$1.60 to \$2.50 per sq. ft. for clear, depending on thickness; 10 percent more for colors.

Although acrylic plastic will scratch more readily than glass, it comes with a protective paper stuck to both sides which is usually left in place while the pieces are being handled and cut. When you cut the material on a table saw, use a fine-tooth blade and hold the plastic down firmly. Move it slowly through the saw; do not force. The same holds true in cutting it with sabre saw or bandsaw.

Plastic up to $\frac{1}{8}$ in. thick can be cut by scoring and snapping. After it is scored four or five times with a scratch awl, the scored line is centered face up over a



BANDSAWING. Blade should have minimum 10 teeth per inch. Pass work slowly through saw. Don't force feed. Use protective paper to draw cutting line



BREAKING. Position score, face up, directly over $\frac{3}{4}$ -in. dowel. Hold sheet with one hand, press down with other. Work along score as breaking continues

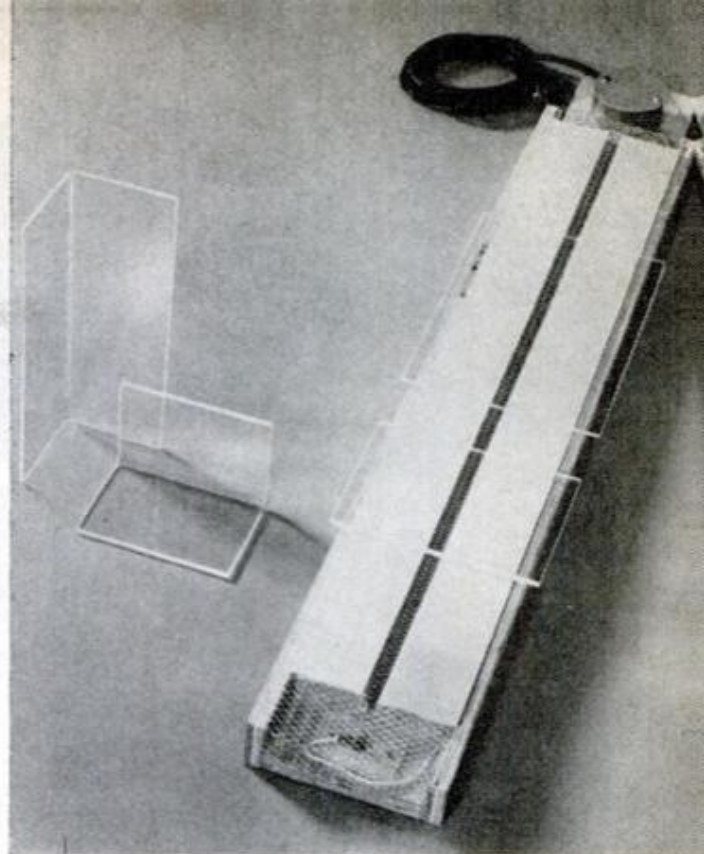
POPULAR MECHANICS

$\frac{3}{4}$ -in. dowel. Then the plastic is pressed down on each side to snap it. The minimum snap-off width is about $1\frac{1}{2}$ in. Patterned plastic cannot be scored and broken; it must be sawed.

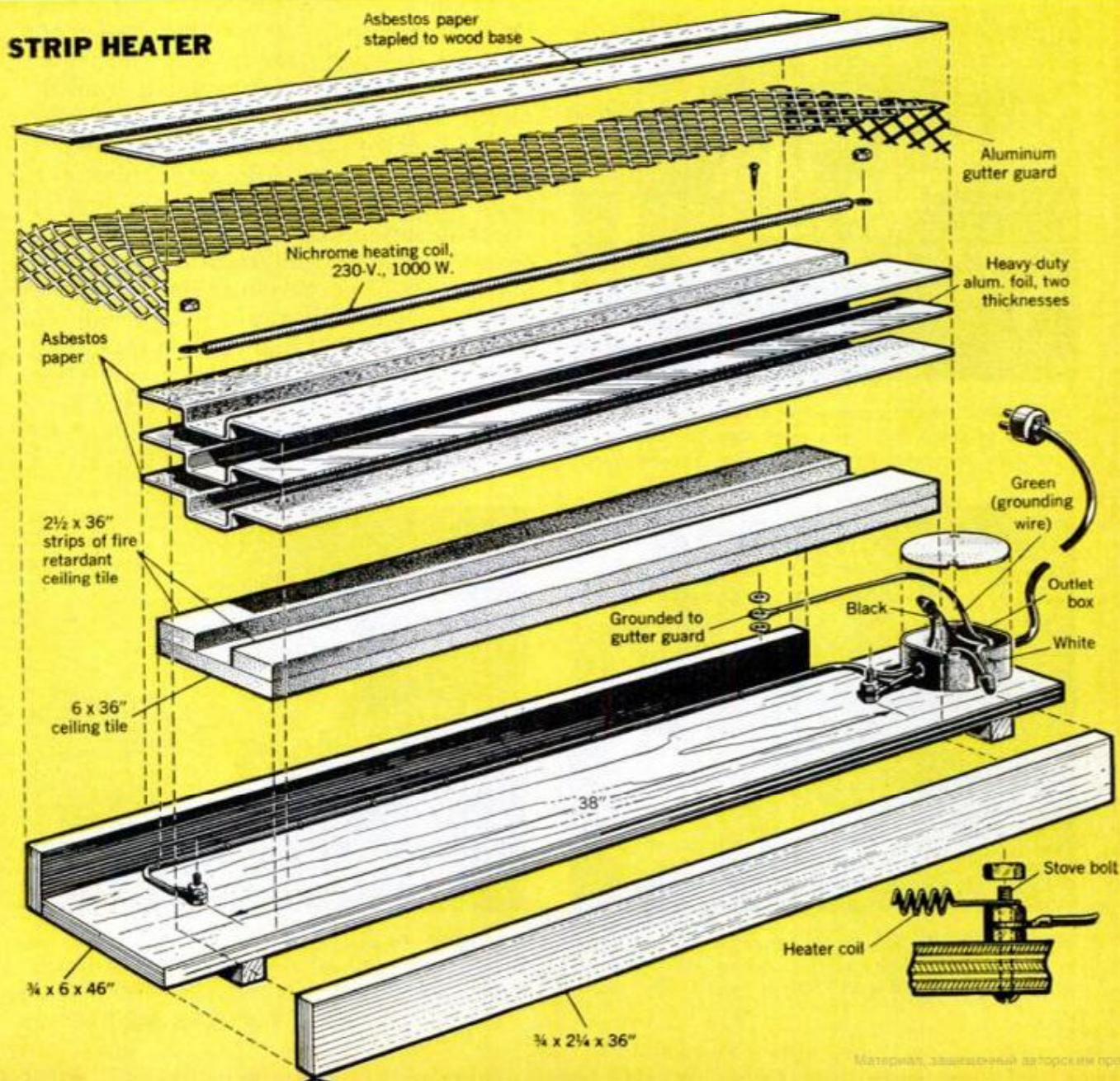
When drilling it by hand or drill press, use the slowest speed and avoid applying great pressure as this can produce chipping on the back. Hold the plastic down firmly.

Saw and other tool marks should be removed by scraping the edge smooth with a sharp knife or by sanding with a medium-grit (60-80) paper, followed by sanding with "wet or dry" (150) grit paper. For a transparent edge, continue sanding with grits to 400, then buff with a clean muslin wheel charged with fine-grit buffing

HEAT FORMING. Plastic is softened for bending by placing bend line over element of electric heater. Remove paper first, then heat and bend the plastic

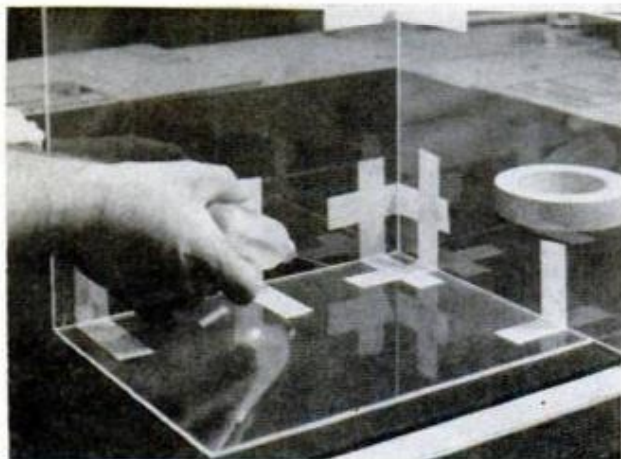


STRIP HEATER





DRILLING. Use regular twist drill, press lightly. Back up work with wood block and clamp. Turn drill slowly to prevent chipping. Don't remove protective paper



CEMENTING. Remove protective paper and sand surfaces to be cemented. Tape work together and apply solvent to joint with hypodermic oiler or eyedropper



EDGE FINISHING. Saw marks are removed from edges by scraping with knife or by sanding with 60 to 80-grit paper, followed with 150-grit "wet or dry" paper

compound. Finish with a clean, soft cotton flannel wheel.

Capillary cementing with a special solvent (ethylene dichloride) is an easy and sure way of joining, literally fusing, two pieces. First remove the protective paper from the plastic and roughen the surfaces to be cemented by sanding. Then place the work together, hold the joint with masking tape and apply the liquid solvent with an eyedropper, syringe or small paintbrush. The liquid will quickly flow into the joint and create an immediate bond. Let it set a few minutes before removing the tape.

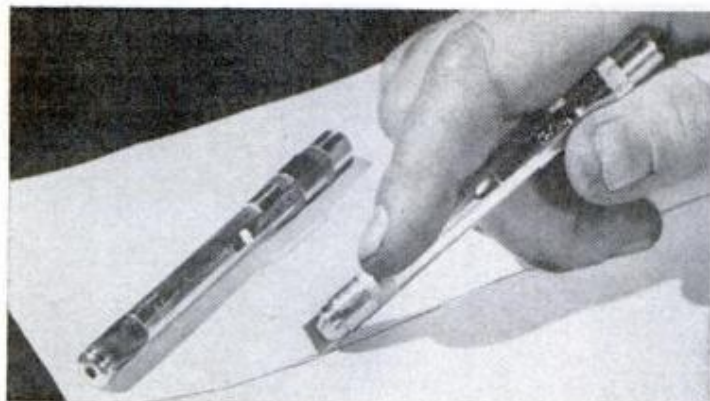
Caution: Avoid dripping solvent on the surface of the polished plastic as it will deface it; also work in a well ventilated room, as solvents may be toxic if inhaled for extended periods of time. They should be kept away from flame and children.

Sheet plastic can be bent and formed into interesting shapes when heat is applied along a straight line. This requires a strip heater such as the homemade one detailed on page 179. To use the heater, you remove the protective paper from the plastic and place the plastic so the bend line is directly over and above the heater's nichrome element. Allow the plastic to heat thoroughly (about 290°F.) until it starts to soften, then gently bend it to the desired angle and hold until the softened plastic cools and hardens. Be careful not to overheat the plastic; it will scorch and bubble if you do. Practice on a scrap first. Temperature should not be greater than 340°F., and don't try to bend plastic more than 1/4 in. thick with the heater. ★★★

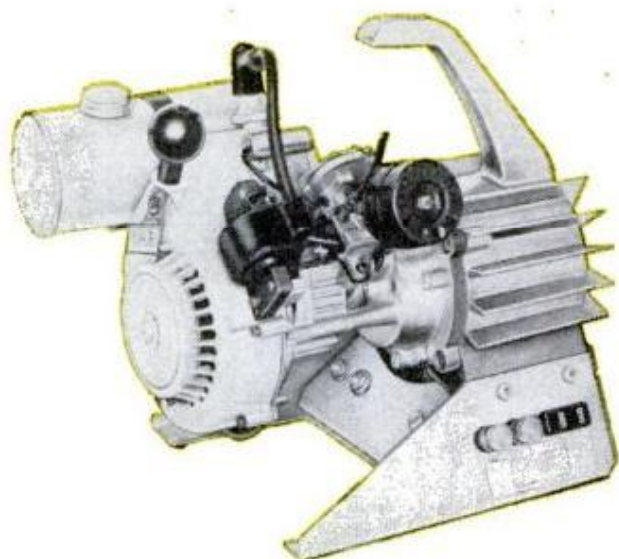


POLISHING. To produce a transparent edge, continue sanding with grits up to 400; buff with compound-coated muslin wheel, later with cotton-flannel wheel

New tools you should know about



POCKET UTILITY KNIFE lets you re-use standard injector-type razor blades when they are no longer sharp enough for shaving. Called Razorsharp, it is claimed to be the only holder that permits varying blade-length exposure. Designed for paper, cardboard, the utility knife sells for \$1.89. For pocket-carrying, blade can be retracted and cap replaced. Razorsharp, 421 Stockholm St., Brooklyn, N.Y. 11237.

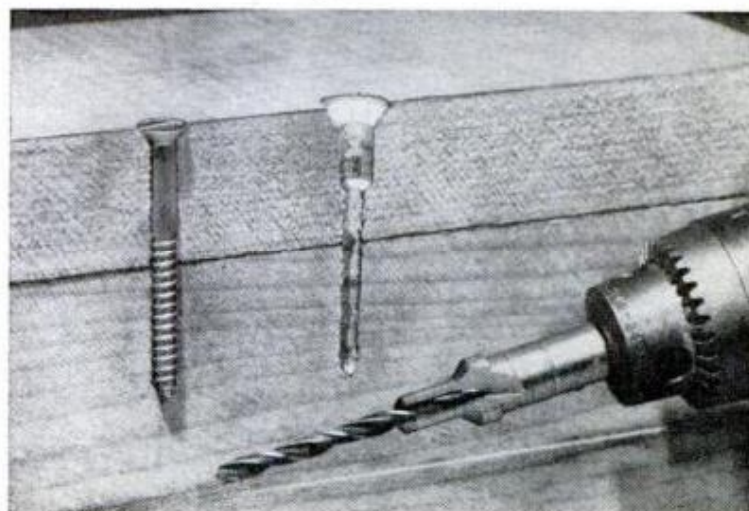


PORTABLE GENERATOR weighing only 12 pounds lets you use power tools when not near electricity. Powered by a 1-hp, 2-cycle O & R industrial engine, Amp-Champ will run five hours on a gallon of fuel. Unit rated at 400 watts can be used for emergency home lighting, provides 115-v. a.c. or d.c. and 12-v. d.c. current. At hardware stores, \$130. Orline Products, 3340 Emery St., Los Angeles, Calif. 90023.



DESIGNED FOR COMFORT, the shaft of this 16-oz. hammer is molded from glass-reinforced Zytel nylon resin, a tough industrial plastic claimed to resist chipping, rotting or splitting. Diamond Head hammer is \$3.89 at hardware stores with lifetime guarantee. Ennis Manufacturing Co., Reading, Pa.

FULLY ADJUSTABLE to any screw length, these bits drill pilot hole, countersink and counterbore in one step. Four-piece set can be used for every No. 6 through 12 wood screw: flat, round or oval head. For round-heads, drill is stopped when bottom of countersink is flush with work. When counterboring, horizontal lines on body mark $\frac{1}{4}$ and $\frac{1}{2}$ -in. depths. Adjustable Screw Drills can be used to bore holes in wood, plastic, fiber and sheet aluminum. Set-screw permits quick depth adjustment. Set No. 1140, \$4.65. Arco Tools, Inc., 421 W. 203 St., New York, N.Y. 10034.

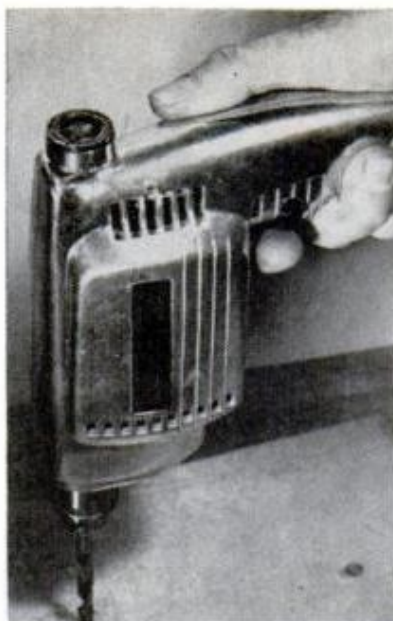


HINTS FROM READERS



Quickie depth gauge

Normally, when drilling several like holes to a particular depth, I have found that it takes more time than it's worth to go to the trouble of setting up a depth gauge on the bit. A fast method that I now use is to measure off the required depth on the bit from the drill point up and at that point wrap a piece of masking tape around it. Make certain that the tape's lower edge is on that mark.—*Herbert Y. Moon*



Keeping drill plumb

Since it is often difficult to keep an electric drill perfectly vertical once the power is turned on, I've provided an accurate guide by mounting a small, inexpensive bull's-eye level on the drill. When positioning it on the upper part of the housing, make certain that the level doesn't interfere with the hand grip. To make it work, be sure that the workpiece is level and check the bubble before drilling.—*Harry D. Badger*



Base from scrap motor

The shell—frame and end shields—of a junked electric motor can easily be converted into one or two sturdy bases for small vises, lamps and the like. To attach the fixture to the shell, run a bolt through the bearing hole or install a setscrew in place of an oil cup. Position it to bear against a rod on which the fixture is mounted. For greater stability (weight), leave the field coil in the frame.—*Walter E. Burton*

NEXT MONTH IN SHOP AND CRAFTS

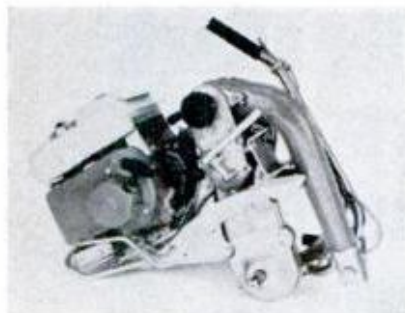
BUILD THIS TURTLE BOAT FOR THE FUN OF IT! It's a hand-operated paddle-wheel flat-bottom boat that's light enough for a six-year-old skipper to handle, and, if Dad's in a rowboat, the pint-size admiral will quickly outdistance him. Whimsically designed in the shape of a stylized turtle, the craft is made of half-inch exterior plywood and is surprisingly easy to build. Pick up the July *PM* and add hours of fun to your summer.

A WELL-OILED HOME RUNS SMOOTHER. More parts in a house need lubricating than you'd ever guess. And by spending a few minutes twice a year applying the proper lubricants, you can cut down costly house maintenance bills. See the July *PM* and learn how to make moving parts perform better, and more important, last longer.

TWO NEW AIRCONDITIONERS FOR PROBLEM WINDOWS. If your home has casement or sliding windows and you wanted summertime comfort, until now you had no choice but to use an airconditioner designed for double-hung sash. But this season two units designed expressly for these windows are on the market. You'll find both in *PM* next month.

HEIRLOOM BEDROOM SUITE YOU CAN BUILD. Of colonial styling, this elegant furniture, shown in full color, is sure to be admired by the entire family. It's presented in two monthly installments, with plans and instructions for building the night table and bed in the July issue. The chest and dresser will follow in Part 2.

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For more facts on the new F-28 write: Power Products Division, American Honda Motor Co., Inc., Dept. BR, Box 50, Gardena, Calif. 90247. Or visit your Honda Dealer. He has the best in the field in the showroom.

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F-28 ROTOTILLER

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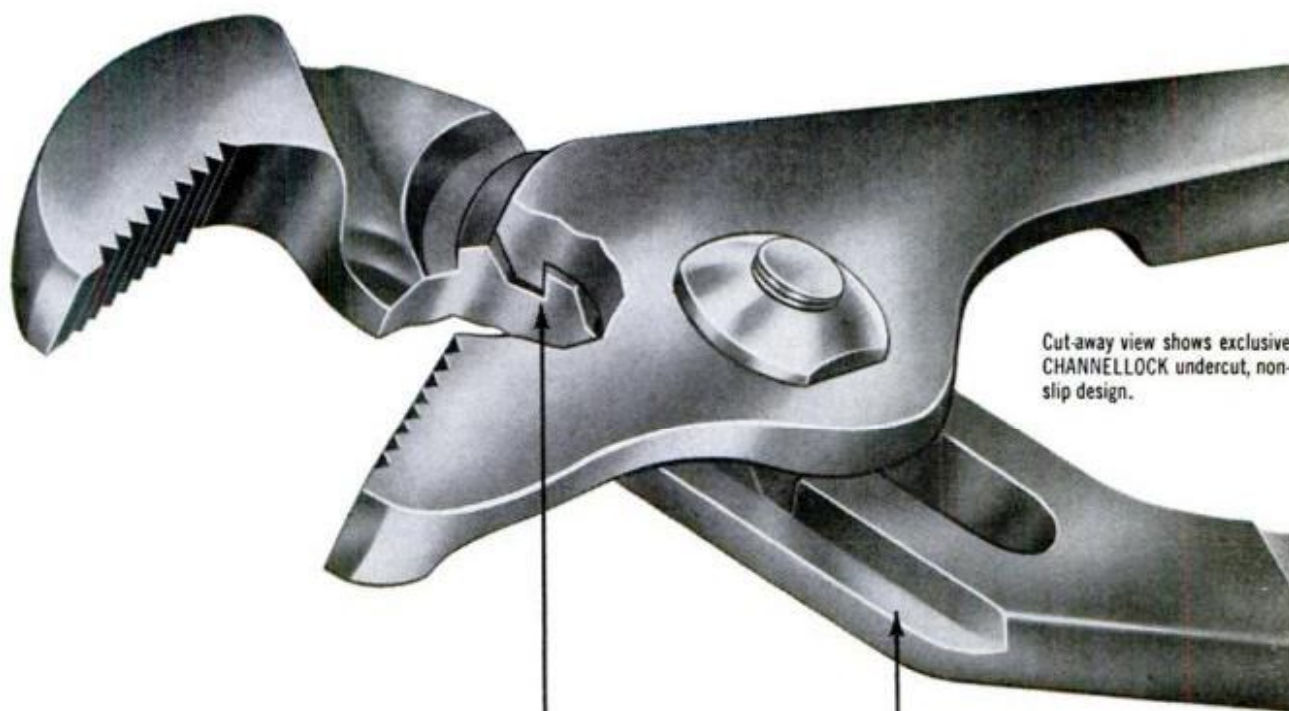
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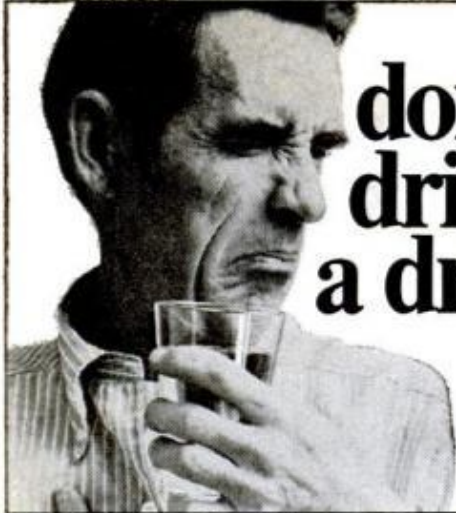
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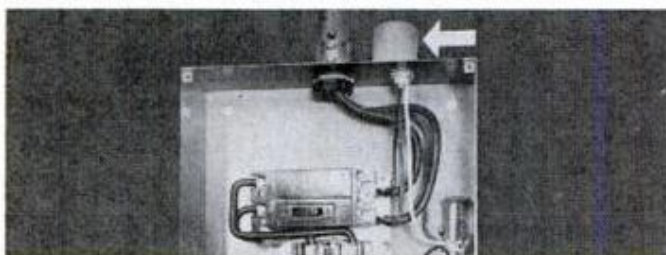
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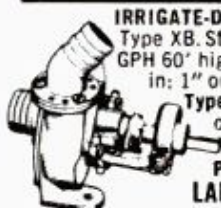
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HOW TO CARVE A MOUNTAIN

(Continued from page 79)

tight spots. And just to get those tools up there where you need them takes engineering know-how.

"So far," says Korczak, "this isn't art. It's mining engineering."

Mining engineers who have visited the project are impressed with the efficient blasting and quarrying techniques Korczak is using. Last year (he can work only from May to October) Ziolkowski blasted 185,000 tons and pierced the mountain with a tunnel (14 feet high, 24 feet wide and 182 feet long) that is the beginning of the 106-foot-high opening under the Indian's outstretched arm.

Before he began the monument, Korczak was aware that to move 6 million tons of granite he needed the kind of equipment he has today. But to get it, he had to start somewhere. In the winter of 1948-49 he built a 741-step stairway up the side of the mountain, in the process

... the Indian's outstretched arm ... is almost as long as a football field ...

carrying 29 tons of lumber on his back. With the help of one man, he moved a 7½-ton, 26-year-old Gardner-Denver air compressor to the foot of the mountain, mounted it on a 13-ton concrete base, and ran a 1540-foot pipeline up to his drill.

To get power to the compressor, he erected two miles of poles to bring in 15,000 volts. To carry tools and dynamite to the top, he built a bucket hoist, using second-hand mining cable and a 1936 truck engine. When the local saw mill closed, he built his own—to provide the millions of board feet of heavy timbers he would need for scaffolding—and operated it at a profit for the project.

To help tourists visualize the statue, he lowered himself by rope and painted the outline in six-foot-wide lines. It took six weeks and 131 gallons of white paint.

He had to build a two-mile road from the highway to the studio so visitors would come. To support his family—which grew to five boys and five girls—he built a modern dairy barn and was at one time milking 70 Holsteins. (Ziolkowski draws no salary, supports his family by doing sculptural commissions during winter.)

In the early '50s, Korczak and a hired man were drilling holes 24 feet deep with 2-inch sinker drills. There was 115 pounds pressure on the jackhammer and by leaning on it all day a man could average

40 feet. After the holes were filled with dynamite and blasted, "mucking"—pushing the rock off the mountain—was back-breaking crowbar work. For 12 years Korczak dreamed of the day when he'd get a dozer. With a used D-6 cat, he bulldozed a "road"—a series of hairy switchbacks that tore the tracks off the cat at least once a day—up the back of the mountain.

The road was the big breakthrough. He didn't have to climb to work carrying what he needed; he could drive up in a Jeep. The dozer cleared off the top of the Indian's arm, cut roads down to the horse's head so rock could be dozed off. Korczak moved more rock in one summer than he had in five. He hauled up a wagon drill that could do 200 feet a day. He brought up two big Gardner-Denver compressors and the power company ran electricity to the mountaintop.

With the top of the Indian's outstretched arm leveled—it's almost as long as a football field—Korczak erected a 40-foot-high scaffold to be used for drilling and finishing the head. The 18-ton scaffold is mounted on 20 cast-iron wheels that ride on rails. A bulldozer will pull it back 150 feet from the face when it's time to blast.

A year ago the Gardner-Denver company donated a new compressor. The two compressors were synchronized so they deliver 125 pounds pressure to the company's latest contribution, a self-propelled Air-Trac drill rig that bores a 3½-inch hole at the rate of a foot a minute. A ratchet mechanism automatically rotates the hollow drill rod. Compressed air directed through the rod flushes the hole clean of cuttings.

This year, Korczak's biggest "chisel" will be a 40-ton crawler tractor with a Gardner-Denver Rota-Screw portable compressor mounted on the rear and a boom and drills on the front. With it he can go anywhere on the mountain.

He's using a bigger hammer, too. He now loads 50-foot drill holes with one stick of dynamite and an electric cap, then fills the remainder with ammonium nitrate and oil. The granular ammonium nitrate is blown from a tank through a hose at 40 pounds pressure. It gets into cracks dynamite can't.

Ziolkowski's original plan was to rough out the whole statue before doing any finishing work. But because visitors have been anxious to see the head emerge and Korczak is grateful for their faith in the project, he has decided to begin the final "wedging" (breaking out small chunks with wedges) this year.

"You do a face as if you were lifting it

(Please turn to page 196)

The only thing standing between you and a Renault 16 is a little information.



It has been written that the ride you experience in the Renault 16 "can be compared only to that of the Mercedes, Rolls, or Citroën."*

Colin Chapman chose the engine of the Renault 16 for his Lotus Europa.

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Someone is sleeping in Detroit.

Road Test is an impartial magazine. At the time of this writing, it did not even take advertising. After exhaustive tests on the Renault 16, Road Test wound up suggesting that "all the automotive designers in Detroit be ordered to spend two weeks behind the wheel of this car in the hopes that their dormant imaginations might be sparked to life." Thank you, Road Test.

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Stirling Moss has written: "There is no doubt that the Renault 16 is the most intelligently engineered automobile I have ever encountered and I think that each British motor-car manufacturer would do well to

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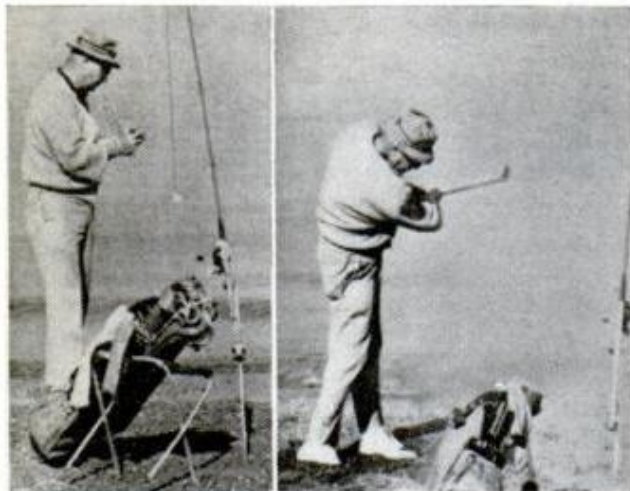
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WHAT'S NEW OUTDOORS

BY ROB KINSON



CAN'T FIT TWO HOBBIES into one weekend? Here's one outdoorsman's novel solution. Howard Brodeur of California likes to fish and golf, but couldn't find time to do both in his spare time. So he devised a golf ball that attaches to his fishing line and acts as a sinker. Then, using a golf club, he slams the ball out into the water, sending it—and his fish bait—90 to 175 yards, depending on the club he uses. Brodeur claims he's pulled in shark, perch, smelt, sturgeon and striped bass with his golf-fishing technique. If you're a two-sport man, it may be the answer. You may not get a hole in one, but the fish will swallow the idea hook, line and golf ball.

BOTHERED BY LURES TANGLING in your tackle box, catching on your clothes or snagging a finger? Are the hook guards made from discarded bottle corks not doing a job? Hook Bonnets from Al's Goldfish Lure Co., fishhook safety covers from Ward & Ward, and a lure wallet from Sports Liquidators are new items that may eliminate these annoying situations.

The buoyant Hook Bonnets, made of red, blue or green fluorescent plastic, fit over treble hooks in sizes 8-12 (small); 2-6 (medium); and 1,1/0 and 2/0 (large). Children can't get hurt, clothing ripped or threads pulled out. Bonnets snap off



with finger pressure and will float. Price is 49 cents a package (10 in small and medium, 7 in large) from Al's Goldfish Lure Co., 516 Main St., Indian Orchard, Mass. 01051.

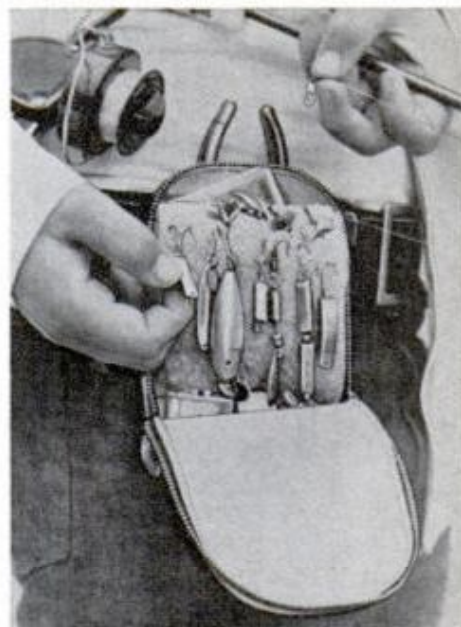
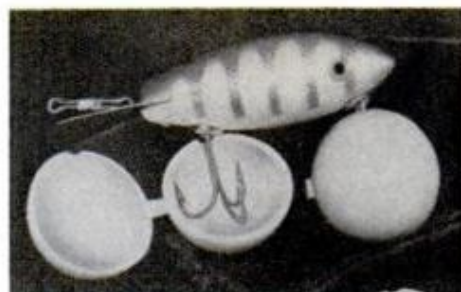
The fishhook safety covers (see top, right) are snap-shut polyethylene plastic containers. Ten balls (5 large, 5 small) in assorted colors are \$1 from Ward & Ward, 5373 State St., Ontario, Calif. 91762.

Wear the fisherman's lure wallet (right) on your belt and have lures, flies, hooks and tackle ready for instant use. Inside the zipper-locked, sheepskin-padded case there's room for license, leaders, tackle, plus a loop for long-nose pliers. Its tough, Naugahyde exterior is unharmed by water, weather and wear. The wallet can be purchased for \$1.95 plus 25 cents for postage and handling, from Sports Liquidators, Box 733, Sun Valley, Calif. 91352.

NIGHT LIGHTS are what's new to aid your after-dark fishing. You'll never again miss a fish because you didn't know it was biting. With Bite-Lite, a bright, glowing signal alerts you the moment a fish is even nibbling. The 3-inch-long, battery-operated light attaches to your rod but doesn't interfere with casting, setting the hook or reeling in. It's lightweight, waterproof and there's never a false signal from wind, rain or waves. Available from D. C. Mattek & Co., Box 145, Rhineland, Wis. 54501 for \$3.95.

Another aid for the night fisherman, the Evans P-26 Underwater Night Fishing Light, attracts fish to a 20-ft. illuminated circle but will not shock them. The water-cooled light is lowered into the water 15 to 30 minutes before you begin to fish and is attached to any 12-volt battery. Certified for legal use in most states, the underwater light has the added advantage of attracting fish, but not insects! You can obtain it for \$5.95 from Farber Brothers, Inc., 821 Linden Ave., Memphis, Tenn. 38101.

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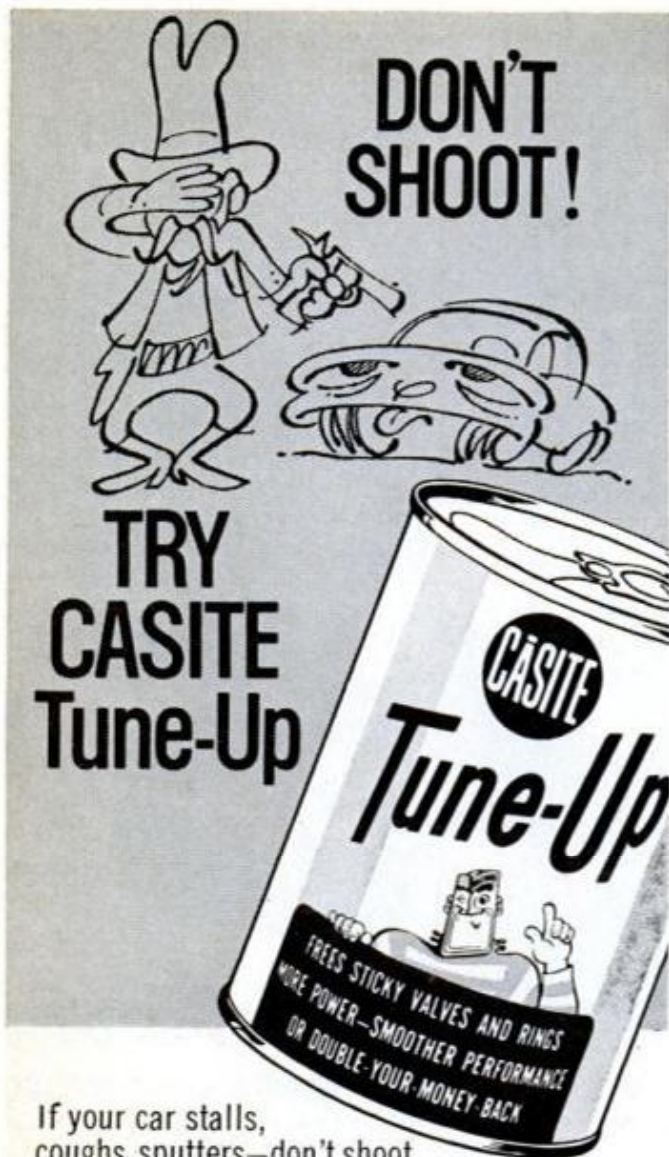
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HOW TO CARVE A MOUNTAIN

(Continued from page 192)

out of water," he says. "Start with the tip of the nose and work back."

He has the measurements in a notebook he carries: 25 feet, tip of nose to bridge, 6½ feet tip of nose to face, 25 feet, tip of nose to bottom of chin, 50 feet, tip of nose to hairline.

He hopes to avoid "bumping" (smoothing the final surface by grinding) which bruises the granite and leaves it white—like Rushmore—until it weathers. He plans to use a fuel oil and a compressed-air torch that produces a flame jet of 4000 feet per second, cuts rapidly, and will bring out the oil in the rock to create a smooth "skin" the color of the natural granite.

The question in every visitor's mind is: Can he finish the job in his lifetime? Korczak is 61; Gutzon Borglum was 60 when he began Mount Rushmore. Borglum needed 14 years; Korczak needs only nine now. But heavy mining equipment is now a big factor in his favor. And five sons. ★★★

ENJOY AN OPEN DECK

(Continued from page 145)

better to trim decking to size as it is used, rather than trimming first, in order to fit to any variations caused by installation of the framing or other decking. When decking is laid parallel to the house, make sure the first piece is properly aligned both with the house and at the proper angle to the joists.

Vertical-grain lumber is recommended for decking, but when flat-grained lumber is used it is important to make sure that the bark side of the piece is up. Either side of a vertical grain piece may be up when the piece is laid.

● **Nails:** Use only corrosion-resistant nails for secure holding power and to avoid rust stains on the wood. Stainless steel and aluminum never cause staining. If these are not locally available, hot-dipped, high-quality galvanized nails with a ring or spiral shank are adequate. For 2-in. decking, use 16d nails; for 1-in. decking, 8d.

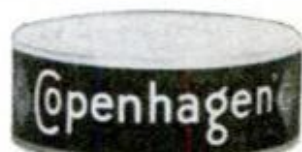
● **Nailing:** Pre-drill holes for nails at the ends of decking pieces to avoid splitting. Seasoned decking material should be spaced a minimum of ¼ in. apart for water drainage. Use only one nail per bearing, alternating from one side of the piece to the other. The nailing on alternate sides overcomes any tendency to pull or cup. Keep nails in alignment for best appearance. ★★★

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MAKE YOUR OWN COIL SPRINGS

(Continued from page 169)

insures immediate winding and proper length. If you want to copy a particular spring, measure wire gauge, count the number of coils per inch and check the diameter of your spring to ascertain the size of mandrel, and then gear your machine accordingly.

Estimating springback is challenging. It can vary with the wire gauge and coil diameter, plus the tension you create on the clamp of the wire guide. Though partially a guessing game, the amount of springback is quite consistent—1/8 in. for a coil of 1-in. diameter, and correspondingly less for smaller diameters. Thus, it is obvious that a smaller mandrel, arbor or bar stock be used.

The mandrel selected should be about three times longer than the spring. Insert the wire through the holder, securely fasten the end under one of the chuck jaws and tighten it against the mandrel. Square your holder about two inches from the mandrel. Recheck gearing to make sure your lead screw is feeding away from the chuck at the lowest speed, then start your motor and watch the machine form a spring before your eyes. Before starting, make certain that the coil of wire is free to feed into the wire guide.

You should know the difference between a compression and an extension spring. For a compression spring you need space between each coil and room for it to contract, the minimum being the thickness of the wire and dependent on the pressure exerted.

Just the opposite is required of an extension or pull spring. These coils must be close together. Wire gauge determines the number of coils per inch.

When you reach the length you want, stop the lathe and disengage the lead-screw. To relieve the strain, release tension by hand-turning the chuck one or two revolutions in the opposite direction to that in which you were winding. Then clip the wire between holder and mandrel. Now, remove wire and mandrel and you have a half-finished spring. The next step is to make it workable.

If you made a compression spring, you'll need flat surfaces on the ends so it'll stand upright. Just clip the excess wire close to the coil and grind the ends flat on your grinder.

On an extension spring, the ends must be looped, which requires a little more effort. An easy way is to vise it and form the loop with needle-nosed pliers and screwdriver as shown.

—Frederick W. Schlueter

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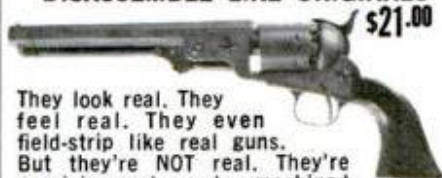
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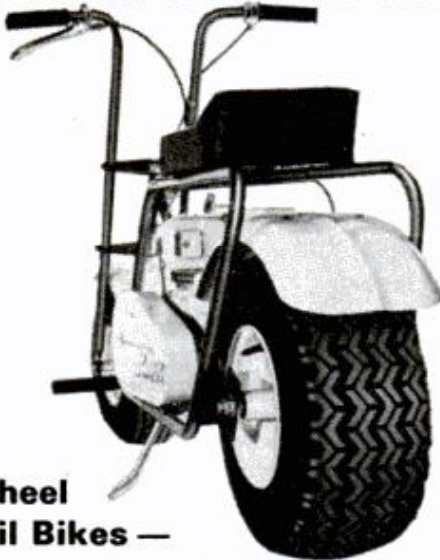
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BY BOAT AROUND FLORIDA

(Continued from page 109)

to sweet water. We washed down the boat as we ran up the St. Lucie River. Our boat had no fresh-water windshield washer-wiper, and believe me, it had been a mighty wet nuisance peering around salt-encrusted windshields to see ahead! If you plan to do much bay or ocean boating, be sure to outfit your rig with a fresh-water washer device.

Some construction repairs were being made on the St. Lucie Locks, and we waited half an hour before being lifted to lake level. Since we never had to wait for a bridge to open, this was our longest delay anywhere on the trip.

There are one or two marinas along the canal, but we decided to push on into the heart of the state and planned our last overnight for Pahokee. Lying 10 miles south of the lake's entrance, Pahokee is primarily a sugar and cattle town. Night had fallen by the time we pulled in off the heaving sea made of Lake Okeechobee by stiff northeast winds. Lights of crappie fishermen dotted the seawall and gave us welcome. We were cold, soaked and tired, but a steak dinner at a downtown restaurant pepped us up before we turned in.

Next morning the wind was still fierce, but by following the lake's shoreline, we traveled behind a windbreak of reeds and trees planted especially for this purpose by the Army Corps of Engineers. Waterfowl, particularly thousands of coot, and shorebirds of all kinds accompanied our passage and gradual drop through a series of locks into the Caloosahatchee River. At Fort Myers, we met Pete's father, a St. Petersburg physician, and the three of us returned the boat to Treasure Island that night despite punishing headwinds.

We had circumnavigated lower Florida and proved that a 21-foot Starcraft is more than adequate to the task. Our only regret: that we didn't have a month to do what we did in a week! But even a two-week vacation will give you more leeway, and your "rooming costs" of 10 to 15 cents per boat foot per night beats motel prices all hollow!

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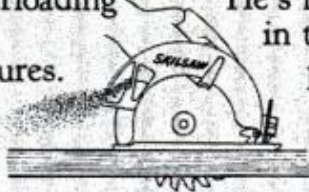
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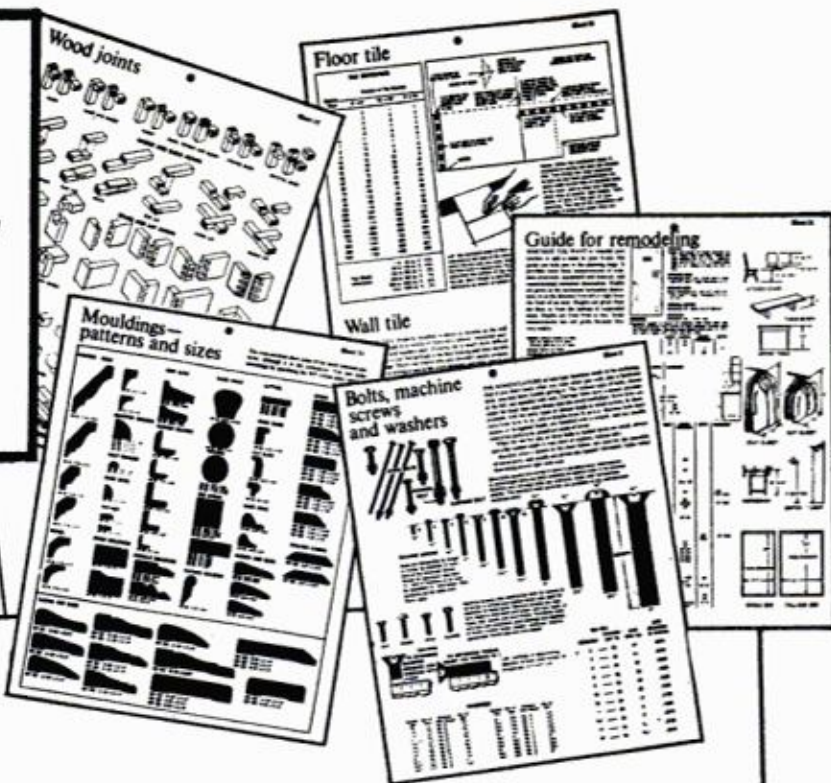
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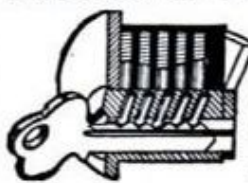
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(Continued from page 105)

level (the layer at which most artifacts are found) of the wreck is reached, it is run at slow speed so divers can lie in the hole and pick up treasure and artifacts as they are slowly uncovered.

Soon after the Real Eight divers proved the value of magnetometers in locating and surveying ancient shipwrecks, several electronic firms brought out more sophisticated models, all priced above \$15,000—too costly for all but professionals. Recently a new firm, MacDowell Electronics of Indian Harbor, Fla., introduced a new underwater magnetometer for \$3500. I evaluated this device, and unlike costlier models that take an electronics technician to operate, it is very simple and as good as, or better than, the others. It can be dragged behind a boat or from a helicopter or plane to locate a wreck, and can also be hand-held on an actual wreck to pinpoint metallic deposits.

... diver actually 'flies' the Pegasus like a plane and has maneuverability of a fish ...

AZA Scientific, Inc., of Saline, Mich., also markets a small hand-held magnetometer for pinpointing work on a wreck site; it costs less than \$500. Several other firms make small hand-held metal detectors which will do the same job, and recently the inventor of one proved his point. He demonstrated that although hundreds of divers had worked an old wreck known as the HMS *Looe* in the Florida Keys, lacking electronic detection equipment they had overlooked many items. Most were lying right on the surface of the sandy sea floor or under only a few inches of sand. With his detector, this inventor discovered hundreds of artifacts, including a silver plate, a pewter tankard and a handful of coins, in a few hours.

Although magnetometers are the best tools for locating shipwreck sites in dirty water or when completely buried, not all wrecks are so hidden. There are faster ways to locate this type of wreck. Some professionals prefer aerial surveys from balloons, planes or helicopters. Either the telltale ballast pile, cannons or anchors are sighted visually, or photographs are taken through polarizing filters or on infrared film, which will penetrate the surface glare and reveal large objects protruding above the sea floor.

Small submarines were once considered

good vehicles for locating shipwrecks, but proved too costly to run and very difficult to maneuver in shallow water.

Lately a new vehicle that's similar to a small submarine has been used to locate wrecks in shallow water. It is the "Pegasus," a self-contained underwater vehicle which carries a scuba diver at three knots (see *Underwater Hot Rod*, page 100, Dec. '67 PM). It is made by Rebikoff Underwater Products of Melbourne, Fla. The diver actually "flies" the Pegasus like a plane and has the maneuverability of a fish to avoid crashing into underwater obstructions. The craft carries a magnetometer to locate metallic deposits hidden from the diver's sight, plus still and motion-picture cameras and, for work in dirty water, powerful lights. Recently I had an opportunity to use the Pegasus in the Bahamas—in less than two hours I located six wrecks visually and two with the magnetometer.

Sonar has also proved very useful in locating old wrecks and underwater archaeological sites. While side-scanning units cannot locate low-profile artifacts such as cannons or anchors, they have been instrumental in spotting large ballast piles and Civil War shipwrecks still fairly intact.

Dr. Harold Edgerton of M.I.T. has invented two types of bottom sedimentation-penetrating sonar, called the "Pinger" and "Boomer," that operate on different sound frequencies. During the past decade he has used them with great success on underwater archaeological sites.

Five years ago when I began my three-year-long excavation of the sunken city of Port Royal, Jamaica, which sank in 1692 during an earthquake, I could have saved two months' work with the help of Dr. Edgerton's equipment. Walls of the buildings were buried 6 to 12 feet under thick mud and my first task was to survey the site and make an accurate chart of where the old buildings were now located. Since the building material had no metallic content, neither magnetometers nor metal detectors were of help. Instead, I used long metal rods as probes to locate the walls. After two months I had surveyed only a small section of the city and had to begin the excavation.

Ironically, when I had excavated approximately five percent of the site, I was able to convince Dr. Edgerton to come down with his detection equipment. Within a week we surveyed the area of several square miles and found the sites of hundreds of old buildings, which we could chart precisely for future excavation.

With this equipment, locating two of Columbus's ships was even easier. In 1504, on his fourth and last voyage, Columbus

was forced to enter St. Anne's Bay on the north coast of Jamaica, and run his two badly leaking ships aground to prevent them from sinking. Although buried under 12 feet of mud and silt, both shipwrecks were located within two hours.

Until a few years ago, the maximum safe working depth for scuba divers was about 150 feet. However, with recent advances in diving technology, this depth has been extended to 1000 feet. Many mixed-gas divers are now employed in the offshore petroleum industry, and a new group led by an American, John Light, has begun salvage work on the *Lusitania*, sunk in 250 feet of water off Ireland.

Many of the richest wrecks are in water exceeding the working depth of scuba or the mixed-gas divers. Yet there are other means to find and salvage them.

In 1952, Dimitri Rebikoff, inventor of Pegasus and archaeologist, invented a unit called the "Poodle," which is similar in appearance, but unmanned and can go much deeper. Connected to the surface-support vessel by an umbilical cable, it will search the ocean depths by closed-circuit television, motion and still cameras, side-scan sonar, a magnetometer and lights. After locating an object, the Poodle can be fitted with arms to pick it up.

Even with all of these sophisticated pieces of equipment, treasure hunting is not always profitable. A year ago a well-known mineral company used its submarine in an attempt to locate a Spanish wreck which went down off Cartagena, Colombia, in 1708 with more than \$20 million in treasure. Although the firm searched more than two months and spent a small fortune, it failed to find the wreck. In this case it was not the fault of equipment, but lack of proper research into all aspects of the sinking of this ship.

Very important discoveries made recently in the Mediterranean, include some exciting work undertaken by the University of Pennsylvania under the direction of Dr. George Bass. He has not only put to the best use the new equipment mentioned in this article, but has developed new methods especially applicable to underwater archaeology. One innovation is the stereophotogrammetric mapping and surveying of shipwrecks. It generally took a team of divers over a month to photograph a shipwreck and its contents with hand-held cameras. Using his submarine, *Asherah*, which has two stereoscopic cameras mounted on it, Dr. Bass and his group do the same work within an hour.

The days of the romantic, swashbuckling underwater treasure hunter are over. Scientific methods and equipment are essential to his success today. ★★

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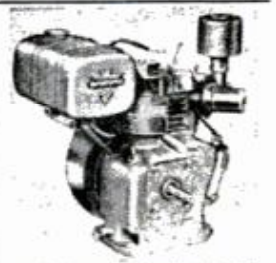
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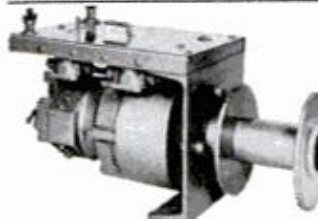
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THE JIG IS UP!

(Continued from page 112)

the head is reached, make a number of turns with the thread and tie it off, snipping the surplus at both ends of the feather. This is basically the same process used by fly tiers when adding hackle to a wet or dry fly—which brings us to the third and most complex jig pattern.

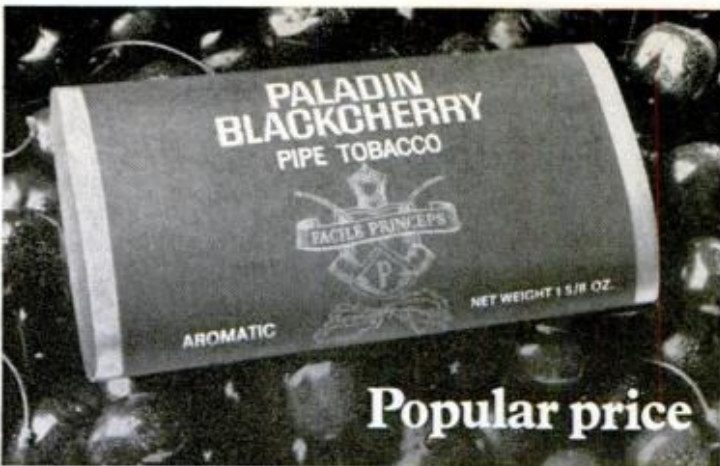
Almost any **wet or streamer fly pattern** can be tied on a jig. Some combinations make nice decorations for hat bands, but others will put fish in the creel when nothing else works. A library copy of a fly tier's guide will show you hundreds of possibilities. The royal coachman and muddler patterns are favorites with trout anglers. But be sure to make your first pattern a simple one. Fly tying is an art, and it's not learned overnight.

A modified muddler makes a good start. The hook's dressed with thread as in the Palmer tie and at the end of the shank a few barbs of mottled duck feather are wrapped in. Then add a thin stringlike strip of gold or silver foil, securing it with thread, and wind them both together to the head. Tie off. The wings come next. They're sections of barbs cut from the shaft of a feather, usually a duck or goose quill. Using a razor blade, remove a quarter-inch section from the central shaft. Divide this cutout into two equal parts with gentle pulling. Tie a tight half hitch with a spare piece of thread over each bit of feather as close to where it was cut as possible. Holding the wings between thumb and forefinger, place the tied ends against the neck of the jig, one on each side, at about 45°. Wrap with several turns of thread and tie off. Cut off any dangling thread and protruding wing feather.

The hackle feather is prepared the same way. It's attached at the neck in front of the wings and wound in tight, parallel bands. The bands must be close together, but not on top of one other. Again, the extra feather is trimmed away after tying. Except for the hackle immediately in front of the wings, all the rest is clipped to a 1/8-inch stubble for this jig. When tied like the original muddler, tail, wings, hackle and head should be a gray-brown color.

Besides the fun of it, making your own jigs will increase your versatility as a fisherman. These weighted lures are excellent for trolling. They're also jumped along the bottom of deep pools, jigged at a set level alongside a boat, and retrieved like a wet fly. But the big advantage of making your own jigs comes when you recoup your original equipment investment by selling your spares to fishing friends. That's the part your wife will appreciate! ★★

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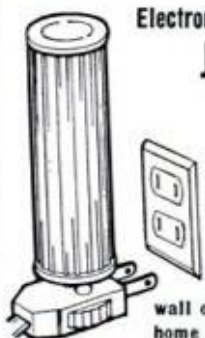
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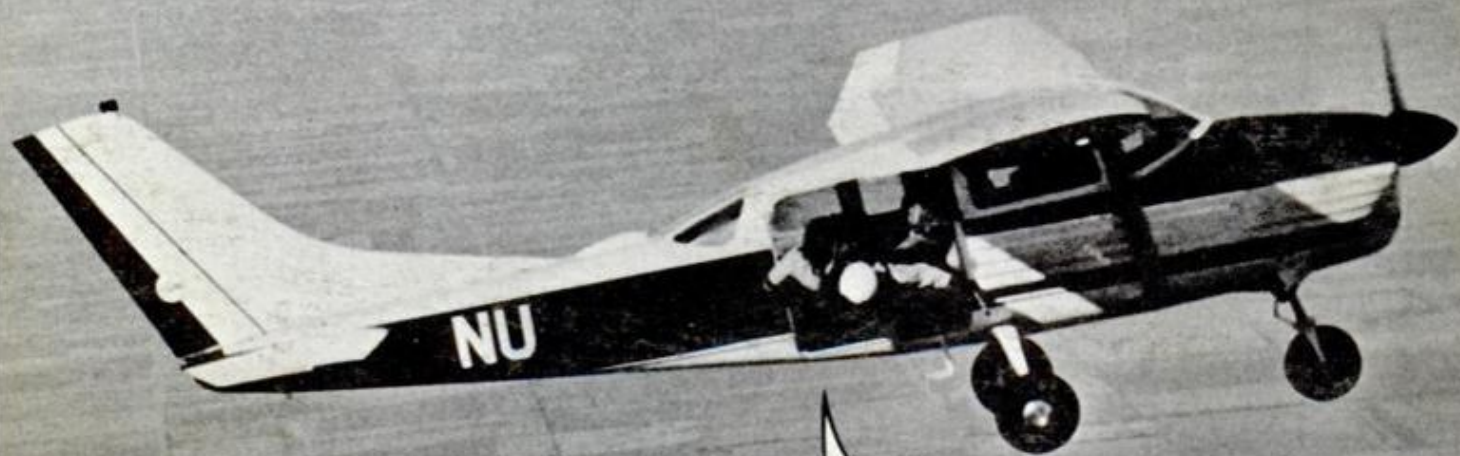
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