

First Report on Ford's 'Answer' to Volkswagen

POPULAR MECHANICS

APRIL 1969
50 CENTS

VACATION HOMES

14 Pages of Plans and Ideas



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DRIVER EDUCATION: DOES IT DO ANY GOOD?

New Evinrude "85" THE "SLEEPER"



Nothing in its power class is in its performance class.

This new Evinrude "85" is a lot more engine than anybody expected an "85" could be.

In fact, it does so many things that engines in the 80-90 hp class normally can't do, it's hard to describe this new easy-going V-4 without seeming to over-rate it.

Take thrust, for example. The "85" was designed to plane heavy loads and big offshore boats; to pull kites and slalom riders and snatch gangs of skiers out of deep water. We didn't require that it be able to hold its own with a 120 hp

stern drive. But it does it with ease. And it's as quick as it is strong.

More important than the things this new Evinrude "85" can do is the way it does them. Easily. Effortlessly. Efficiently. On an absolute minimum of fuel. It has the rare ability to do hard work without working hard. The kind of engine that keeps its youth a long, long time.

The Evinrude "85" delivers a king's ration of everything. Push-button shifting luxury. Sound sealed quieting. Fail-safe reliability. Electronic ignition. Up-



and-down as well as in-and-out boat trim adjustment. Automatic choke and thermostat. Built-in alternator. If it's worth having — the Evinrude "85" has it.

It has everything except size. Its powerhood is just two-thirds the size of last year's "85". And it's no higher in the motor well than a competitor's "65". Another low-down Evinrude engineering trick.

See your nearest Evinrude dealer.
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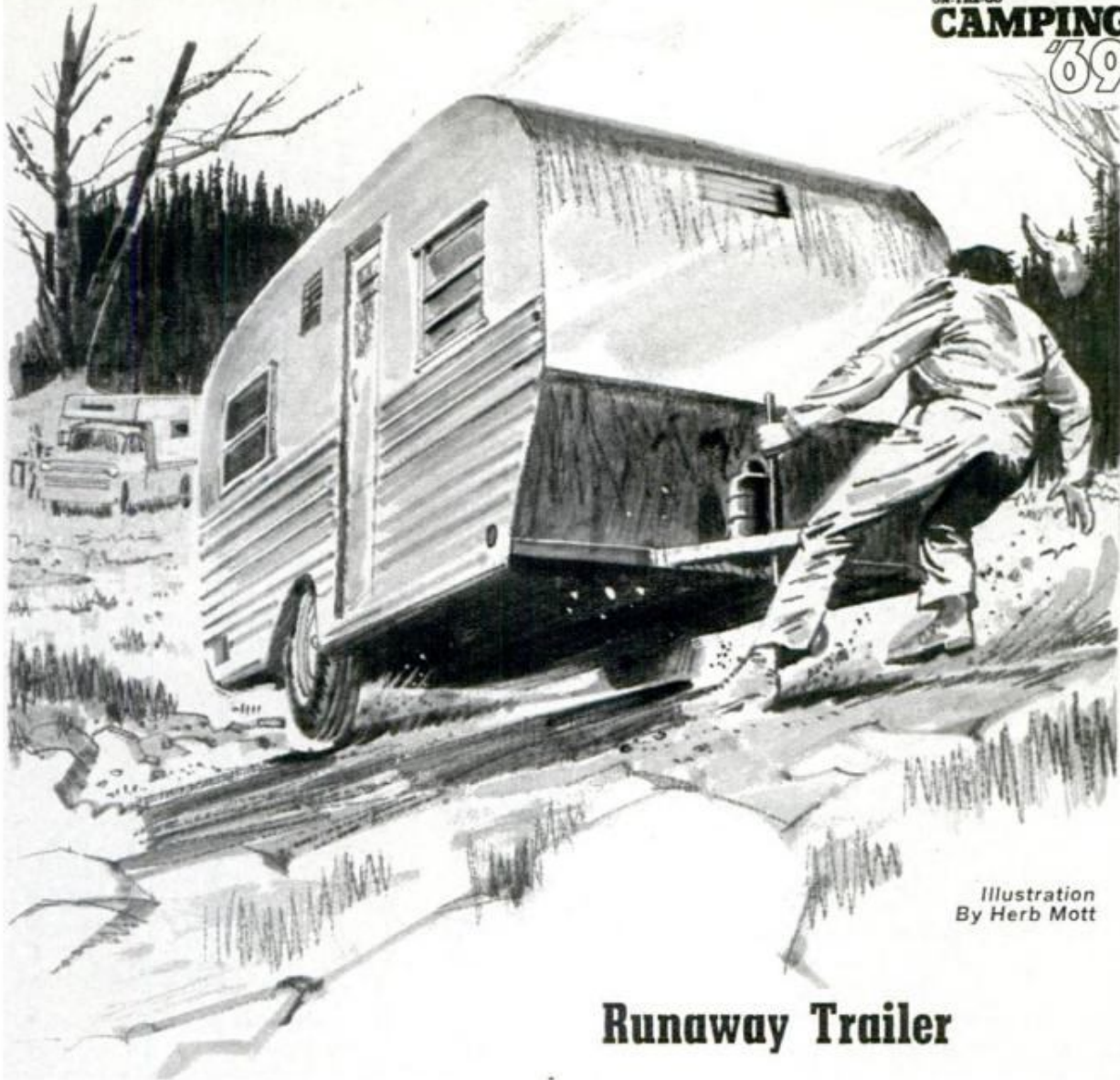


Illustration
By Herb Mott

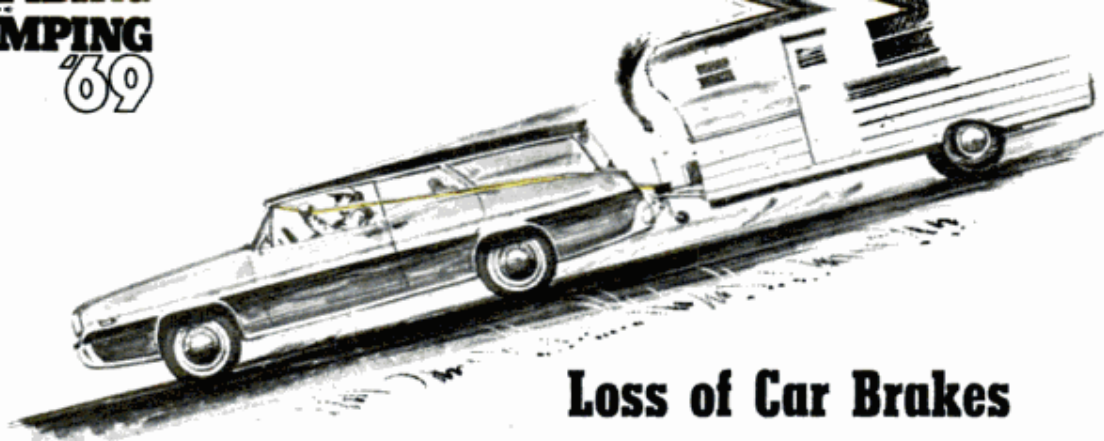
Runaway Trailer

How to Handle 12 Camping Emergencies

THE UNEXPECTED will happen at some point in your camping career. But it won't be disastrous if you know how to handle it. Take a trailer that runs away just after you disconnect it. What do you do? First, try yanking on the safety cable or handle on the trailer tongue to activate the brakes. If this fails, try to change its direction so it will cross the slope—push a front corner sideways, or grab the jack handle and tug toward you, or throw a rock ahead of one wheel. If all else fails, shout a warning to campers in the trailer's path. The next three pages will show you how to handle other camping emergencies.

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VOL. 131, NO. 5



Loss of Car Brakes

If your car has automatic transmission, yank down into second gear, then into low. With a stick shift, keep shifting down until vehicle speed is reduced as much as possible through engine compression. Remember these pointers:

If you're towing a trailer with its own brake system, manually move the electric-brake lever to activate the brakes. Apply the brakes firmly, but don't lock them up. A 20-foot travel trailer with its own brake system can stop its own weight plus that of the towing vehicle, if the driver handles it gently.

If the trailer has hydraulically actuated "surge brake" controls, the only way to stop it when the car brakes fail is with a long emergency cord reaching from car window to trailer-brake master cylinder. Pull on it!

Brakes Fade

On tortuous downgrades that require frequent braking, the brakes may simply fade away. You'll get the pungent odor of an overheated brake lining, too. What to do?

Just pull off the road and let the brakes cool for at least 20 to 30 minutes. Then remove the hub caps. This will give improved cooling to the hubs.

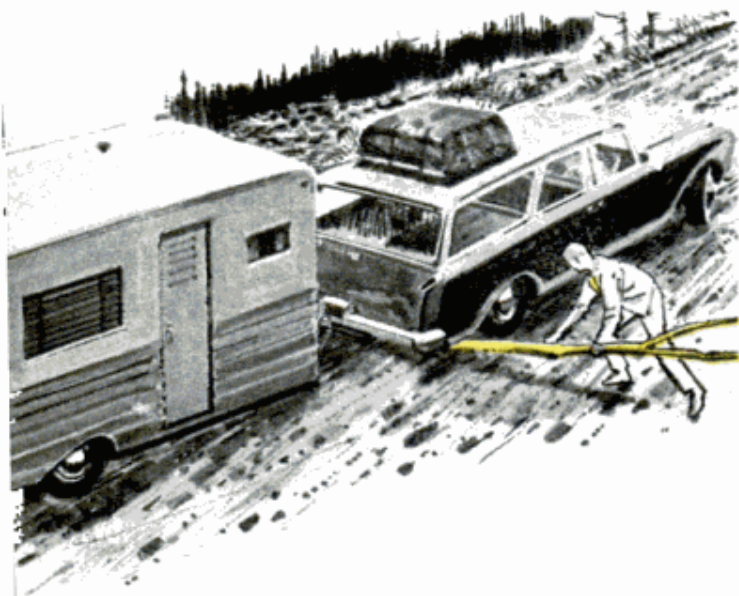
When you start up again, operate in lower gears only. By using the transmission as a brake, you can prevent overheating of the brake linings.

Vapor Lock

The most common problem in hot weather is still old vapor lock. Because of high-temperature operation under the hood, gas simply vaporizes before it reaches the carburetor. Try wrapping a wet rag around the fuel line. Or if you have any fresh fruit handy, cut an orange, grapefruit or melon in half and squash it down over the fuel pump. The fluids in the fruit will cool the pump quickly and usually allow the engine to start again. If the engine is persistently plagued with vapor lock, install an electric fuel pump to end the problem.



Parking Brake Won't Hold



Suppose you are towing a trailer up a steep dirt road in a wilderness area—and the engine dies. You quickly set the emergency brake, but it won't hold. The car starts to roll backward. What to do?

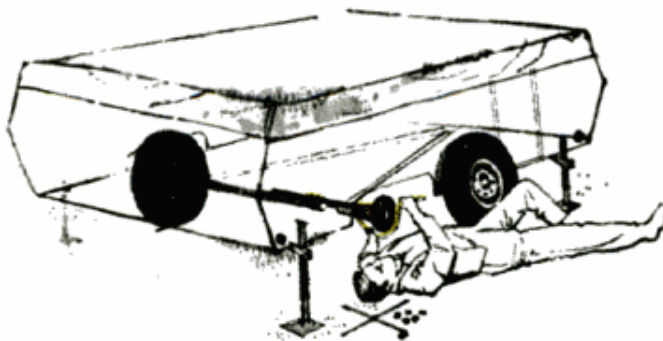
While you hold your foot on the brake pedal, have someone throw rocks or dead limbs under one of the car's rear wheels. If there is nothing handy, an emergency technique is to let the car and trailer purposely jackknife—but slowly. That will prevent it sliding any farther. However, it also will block the road on both of the lanes.

Situations like this illustrate the importance of carrying wheel chocks.

Broken Axle on a Small Trailer

This emergency is rare—but I've personally seen it happen more than once. A friend of mine broke the axle on his tent-trailer by towing it too fast over a rocky road. In my case, I backed a boat trailer into a submerged dock-post which had been torched off. What to do when you can't find a suitable replacement for the axle?

I solved my crisis by scrounging up an old water pipe about two inches in diameter. I cut it with a borrowed hacksaw so that it just about reached from end to end on the boat trailer axle. I used heavy wire to lash the section of old pipe to the axle until I was sure it wouldn't work loose. Crude, perhaps, but with that done I was able to drive 47 miles to the nearest town with welding facilities to make a permanent repair (which consisted

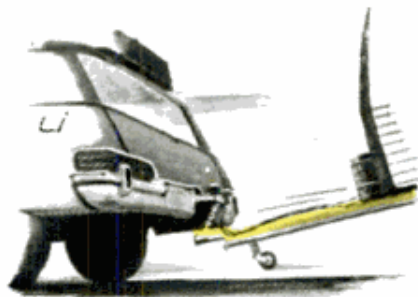


of welding a heavy, solid bar to the broken axle).

In a spot like that, a broken axle could be repaired with a sturdy steel fence post, or even a stout pole. The idea is just to make a temporary stiffener to get back to civilization where you can look up the nearest welding shop.

Trailer Disconnects at High Speed

If a hitch-ball breaks, the driver will feel a slight jerk as the coupler slides or bounces down to the end of the safety chain. This sometimes happens when the trailer is towed at too high a speed over chuckholes, railroad tracks or rocky roads. What to do? Remove your foot from gas pedal and hang onto that steering wheel. When you feel the trailer nudge the back of your car, brake very gently. Keep this up, constantly increasing brake pressure while you steer to the side of the road. Never slam the brakes. The trailer might be at the end of a swing and snap the safety chain. If the trailer breaks completely away, the brake-safety switch should lock the trailer brakes. But only the crown of the highway controls which way the trailer will slide. If you're a good driver you can use your car brakes to help slow down the trailer by letting it ride against your bumper. If you stop too fast the trailer tongue will veer away and you'll lose it; too slow, the trailer may push your car to the left or right.



Blowout at High Speed

A blowout is a special hazard. How well you handle this emergency determines the outcome. Above all else do not hit the brakes! Remove your foot from the accelerator pedal. Get a good grip on the steering wheel and edge the car over gradually to the side of the road. Let it coast until the speed is down, then begin gently braking the vehicle.

If a blowout should happen to your car while on a very busy stretch of a freeway system, don't try to change the tire there. Drive to the next off-ramp and leave the freeway. Vacationers have been maimed and killed just because they tried to save a \$20 tire carcass.



Ripped Holding Tank

A rock puncture in your holding tank can disable the sanitary system, leaving you open for legal liabilities. What to do? First, if it's just a puncture, try sharpening a short stick and driving it into the hole. If it's a slash, it will require a fiberglass patch. Saturate a large patch of glass cloth in catalyzed resin and lay it over the puncture. Tape the cloth to the tank to hold it in place while it dries.



Stream Crossing

Should you attempt to cross? It all depends on the bottom. Park your vehicle. Find a stout stick to test the bottom. Wade out into stream. Be careful not to slip. If the stick clicks down against gravel, rock or hardpan, you can proceed. If the stick disappears in ooze, forget crossing. Take another route out. When towing a trailer, sometimes it's best to drive across the stream without it. Then tow the trailer across with a rope hooked to the vehicle on the other side of the stream.



Roof Gash

A roof gash will let in rainwater, which in turn flows down the walls and warps studs, twists paneling and stains just about everything. Cover that gash! A simple fiberglass patch over the damage will hold until you can reach a service shop. (Actually, it should hold indefinitely.) If you don't have fiberglass, cover the hole with fabric, cardboard, plywood, metal scrap or anything else that you can tape or glue into position. A tip: Sometimes it's better to cut off the branch that caused the gash and pull it through the inside of the trailer. If you try to back the vehicle away, you might enlarge the gash.

Sandstorm

The chance of encountering a dust or sandstorm during a summer vacation is always present—particularly in the Southwest. Should you proceed? Opinion differs. Personally, I'd rather drive through such a storm than try to sit it out. The quicker you get out of a sandstorm, the better, and immediately after driving through it, stop at the next service station. Have the

oil and oil filter changed, the carburetor air filter replaced and the wheel bearings cleaned and repacked.

REMEMBER—Never travel with coach or trailer windows (or roof vents) open. Dirt and debris will be sucked in.

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We just improved it.

Take our camp stoves and lanterns. They're the only ones in the world that burn any kind of gasoline.

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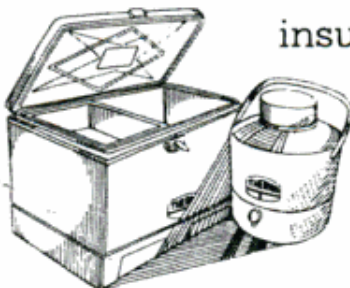
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You can make camping even more fun by knowing some of the trouble-saving tips used by the pros

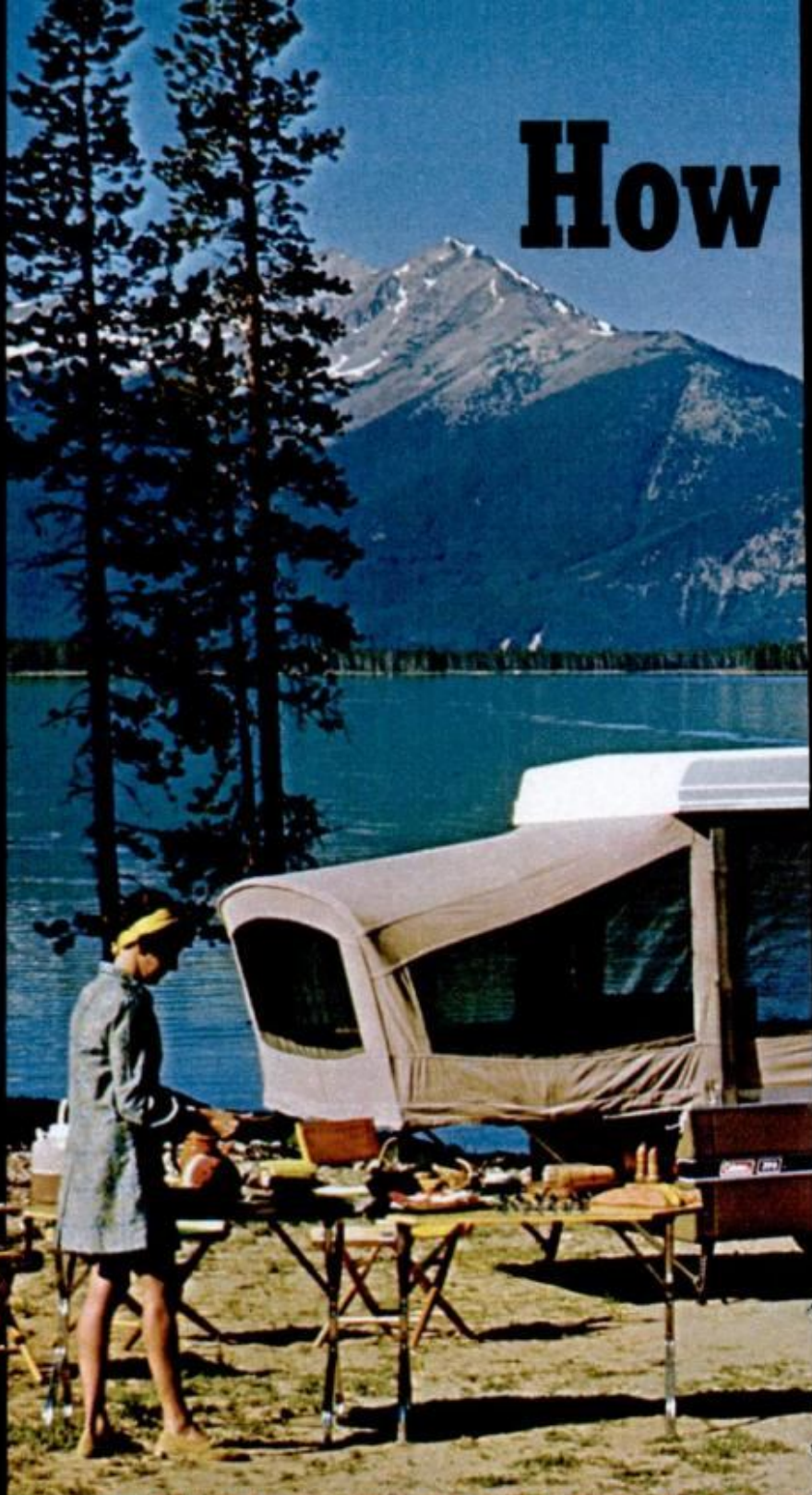
WHETHER YOU CAMP in hot or cold vacation spots, in cities or along the road, having some tips from old-timers can save you a lot of problems.

The biggest problem facing you as a camper is finding a good spot to overnight while en route. Without careful and intelligent pretrip planning, you can run into a blah overnight spot or hit campgrounds that are downright lousy.

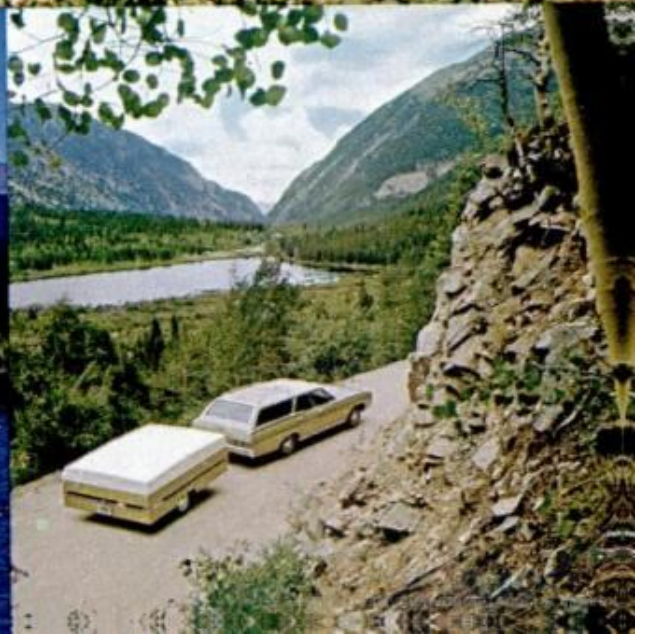
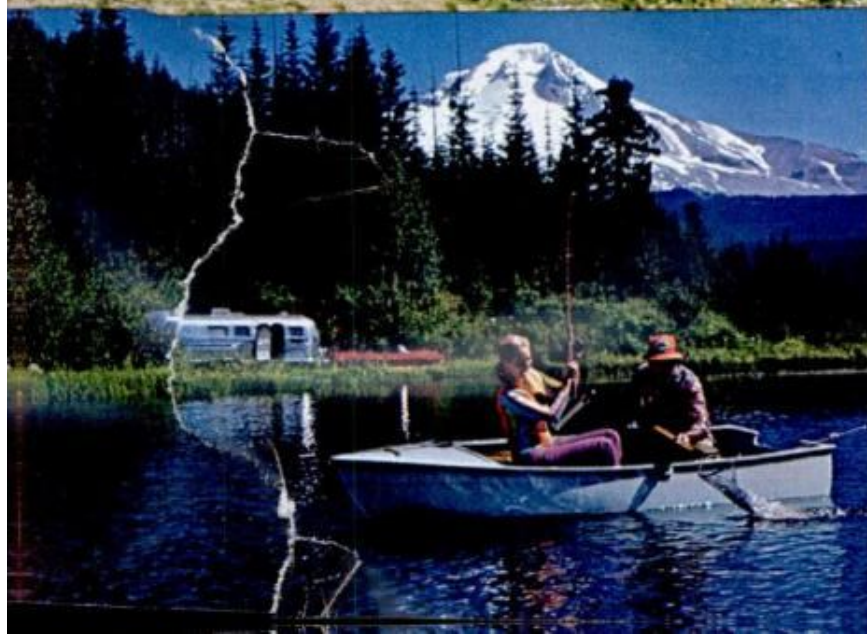
But there are several tips that might swing the odds of getting a good site in your favor. Before starting your trip, talk to friends who may have camped or visited along your chosen route. If you don't get any information from them, get one of the many campground directories, such as Woodall's; Rand-McNally; Campground Atlas of the United States and Canada; Mobil Travel Guide, or Apache Directory. Pick a likely spot. Privately operated campgrounds run from very good to awful. The same is true for some state-operated facilities. Generally, federally operated grounds are good. However, the early

STOPPING by the way can be as much fun as staying at your destination if you know the tricks involved

How



to Camp Anywhere



There are camp facilities that have nationwide reservations



With Citizens Band radio you can get up-ahead info

Skipping heavy-traffic areas may save you an accident

birds in these spots can crowd you out, especially if you arrive late or on a weekend. There're no reservations.

Reservations, though, are possible at many private grounds. And in a few cases you can hit a campground chain that has a nationwide reservations system like hotels. Some of these chains are Safari Club of America and Campgrounds of America (KOA). Even some of the big hotel and motel chains are planning campground sites across the country.

But franchised campgrounds with national standards are just starting up. You're still on a take-a-chance basis for the most part.

Yet, there is a way that many pros use to find decent overnight spots. It has to do with two-way radio. More and more campers are installing Citizens Band radios in their cars and trucks. A vast network of friendly and knowledgeable "listeners" are on the other end of CB. If you monitor a CB in your area, you will hear a camper calling to your local "ham."

"How's XYZ Campground?" he'll ask. A candid opinion will be forthcoming.

Actually, CB radio is a great item for you to add to your rig. It costs from \$70 to \$300 depending on power, and can save you much trouble.

In Ohio, one CB camper ran out of gas on a wintry night far from any gas station. A call to "anyone in the area" not only produced a friendly voice and information on a filling station, but brought a five-gallon can of gas right to his vehicle. The "friend" closed down his radio and drove out to the camper with fuel.

CB is also used by many truckers. These experienced drivers often keep up conversations over their CB rigs like charter-boat captains on the lookout for schools of fish.

Very often you will be able to obtain time-saving road information from drivers heading toward you who have negotiated stretches under construction or have spotted traffic jams along your route.

Skirting heavy traffic areas not only saves time, but might save you a possible accident. Many accidents involving recreation vehicles occur in heavy traffic. Misjudging space between vehicles has caused crinkled fenders in the travel-trailer department.

Lack of awareness of the heft of a pickup with coach has also caused accidents; a driver following too close can't stop his heavy rig in time to avoid a collision.

The best way to avoid heavy traffic weekdays is to plan a roadside dinner between 4:30 and 6:30 p.m. when you're near cities and towns. You'll be tired by then if you've driven all day and ready to take a break.

Tired people can have accidents, too.

This brings up insurance and a little-known fact. Some states—Ohio, Oregon, New Jersey—require \$100,000/\$300,000 minimum liability insurance on all travel trailers—Idaho requires at least \$50,000/\$100,000. Know your coverage. Rates for this insurance vary from company to company, so shop around. But make sure you have enough liability insurance coverage for all states.

In whatever state you're traveling, it may be possible to get a 5 to 10-cent discount on gas. Many gas stations give a trucker's discount. If you have truck license plates on your pickup, ask about this discount when you gas up. Some stations have signs advertising it; others don't. Some stations have a



DISCOVER THE FAMILY

It's a great day for a picnic. The sun.
A soft breeze tumbling the clouds. Everything fresh and green.

You see it in the faces of your family. Scooting across
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There are three other machines in our trail family.
All fully equipped for the trail.
And now that we've met, let's get our families together.
Maybe on a picnic.

Above: 250 Single Enduro DT-1B, 125 Single Enduro AT-1.

Below: 80 Trailmaster YG5-T, 100 Trailmaster L5-T, 175 Single Enduro CT-1.



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minimum order before giving a discount—50 gallons or so. Nevertheless, it does no harm to ask about a discount. But remember that all stations do not have this arrangement, so don't press the point.

However, a point you do want to press is cleanliness at the campground you select for the night. The quickest and generally the best way to check out a campground is to inspect the shower before you decide you will spend the night there. If both the shower and restroom turn out to be clean, it's a good indication the place is reasonably well run. If these facilities are dirty, you should consider moving on.

Another reason for moving on may be the electrical hookup in the campground. This, too, could be "dirty."

One of the most serious problems facing campers today is inadequate electrical fixtures. As most types of recreation vehicles have electrical systems that can use 110 or 220 volts, it's essential to have the right hookup. Make sure your system is grounded. Most campgrounds are equipped with three-prong sockets.

In some cases there's a "green wire" which can be used as a ground. It's generally found where there are only two-prong receptacles. In any case, ask the attendant if the system is, in fact, grounded. Also, ask if the system is 15 or 25-amp. To accommodate either system, carry both types of fuses. But whatever you do, don't cheat. It's dangerous to use an adapter that enables you to use a three-prong plug on a two-prong receptacle. And it's risky business to use a two-prong plug in a three-pronger. If there's any question about grounding your rig, think twice about using juice. Of course, you can always drive a six to eight-foot metal stake in the ground and wire the rod to your rig. But that's a bit tough when your campsite is concrete.

Some other quick tips for road camping: When packing trailers, keep heavy items in the lowest possible place to keep the center-of-gravity down. In pickups, the bulk of weight should be just forward of the rear axle so you won't get sway or fishtailing.

You should also stuff paper or cloth around utensils or other items that can rattle. Stuff clanging in the back can be annoying.

Here's a good tip if your young children are with you. At rest and stretch stops organize footraces for the kids and give them little prizes. These races will use up some of the unspent energy in the youngsters. But don't overdo activities in hot climates.

It's in hot weather, too, that other unsuspected situations can cause trouble. It sounds crazy, but sunburn can be an agonizing and unthought-of problem. This is especially true when you're driving in hot, sunny areas such as desert or beach country. When traveling from east to west, the sun is left of the driver who generally has his left arm out the window. Though you may not realize it, your arm can be burned quite badly. To protect your arm, use long-sleeve shirts or plenty of sunburn lotion.

Another sun problem is glare. Here good polarized sunglasses can really save you from unnecessary fatigue. You can get tired mighty fast fighting the sun's glare as well as rough traffic and hot roads.

And it's hot roads that can cause another

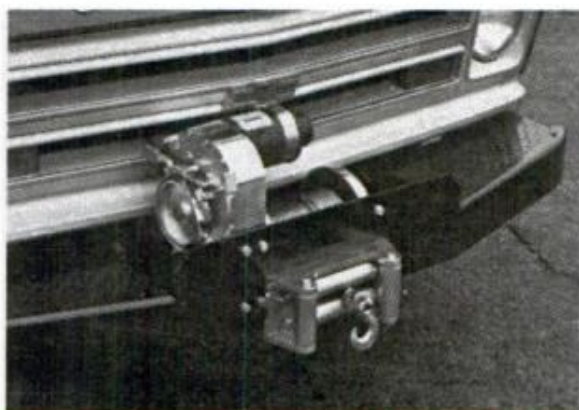


Load heavy gear close to axle for good rig balance

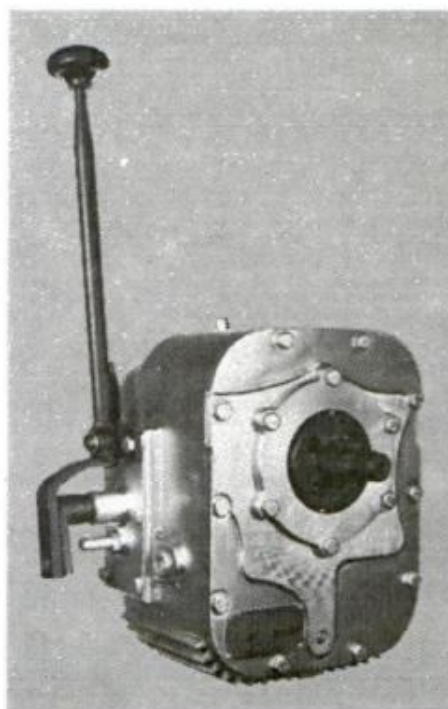
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In hot weather water bag is cooled by evaporation

Precautions are needed for cold-weather camping

Ventilation is vital when you cook on a gas range



problem—tire failure. Never deflate your tires thinking that extra hot beach or desert roads will cause air expansion in tires and overinflate them. Actually, tires are manufactured to handle five to six pounds above recommended inflation figures. Besides, underinflated tires create excessive heat of their own, resulting in tire damage.

But there is a time when you want to take a few pounds out of the tires. That's when you're stuck in the sand. Beach sand is treacherous. As a last resort, release several pounds of pressure. This will also lessen your chances of getting stuck if you must travel some distance on sand. Always carry several ground cloths with you. If stuck, you can toss them under the wheels. This may give you just enough traction to escape.

Several cloths can be used to shield the camper roof and sides during midday heat. If you use tent pegs to secure the edges of sun shields, make sure to bring extra long ones. Normal-length pegs will not hold in sand.

And here's a tip for keeping sand outside your camper: Fill a pail with water and station it outside the door. Swimmers entering can quickly rinse their feet. It's impossible to keep all the sand out, so a small, 6 or 12-volt vacuum cleaner that operates on car or camper batteries is just the answer. You can even get sand out of the bed if it's blown there by a sudden wind.

Wind and sandstorms are more typical of the desert than beaches. If you're camped in desertlike areas, especially in the plains states, remember great winds can hit without warning in the dead of night. Make sure loose gear is secured before retiring. You might want to secure your camper with ropes.

Hot winds and low humidity during the day drain your body of salt. It's always good to take a bottle of salt pills whenever you go to desert or beach. It's also good to take hats along as protection from the blazing sun.

At the opposite extreme, you can have fun camping in cold weather. Winter camping is becoming popular, mainly because recreation vehicle manufacturers are starting to build insulated rigs equipped with heaters.

But before you charge off to zero-degree temperature regions, there are a few precautions you should know about. Make sure that water lines and septic tanks are empty. Use tires that have metal studs. These are legal now in all northern states. Carry your water in plastic bags. These containers will expand should the water freeze. You can also boil melted snow to wash dishes. Use an inexpensive portable toilet. Your self-contained unit will be inoperative.

A problem in cold weather camping is icy floors. The best way to combat this is to spread newspapers on floors. Papers act as insulation. Cheap storm windows can be made by taping plastic over windows. Check for air leaks by placing a trouble light beneath your darkened camper. Seal spots where you see light.

No matter when you plan camping trips, you'll end up in a city at some time or other. Finding a campsite in a large city is a chore. First, check campground directories for spots on the outskirts of town. If you have no luck, try asking a gas-station attendant—after he fills your tank—if you can spend the night. You can stay in some city parking lots, if you pay the price. If you're in a real bind, local police may have suggestions. In smaller towns, the police have been known to permit overnighing in the station parking lot. But cases like this are rare, and it's not likely in large cities. A final possibility is use of a shopping center or supermarket parking lot. But get permission from the owners.

Whenever you ask about overnighing in cities, make it clear that you don't plan to stay long or set up your full rig, and will leave very early. As soon as you can, move on to more enjoyable surroundings. ★ ★ ★

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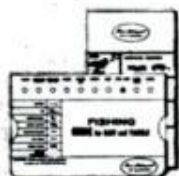
By Dick Kotis, President, Fred Arbogast Company, Inc.



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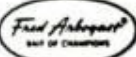
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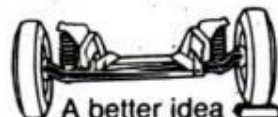
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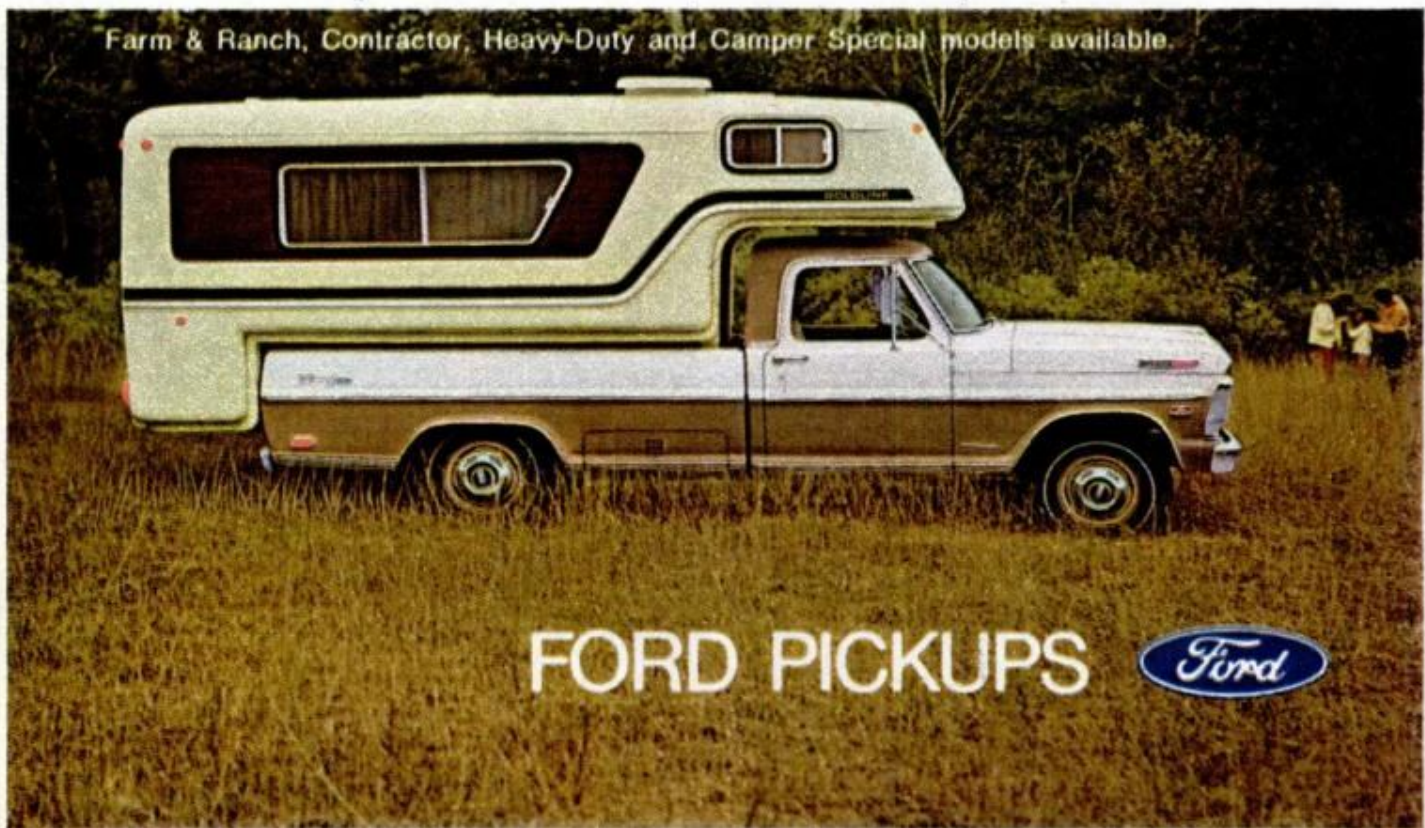
Ford's great road show has twin stars . . . the two front axles in Twin-I-Beam suspension. Forged steel I-beams for strength. Coil springs for easy ride. And what a cast! Roomiest, quietest cab of any pickup . . . Six or V-8 power up to 390 cubic inches . . . optional SelectAire conditioning, front power disc brakes, power steering and SelectShift Cruise-O-Matic transmission. Your Ford Dealer's reserved the best seat in the house for you. Guess where!



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Each of Rolite's nine attractive models for '69 (from 12' to 21') provides the ultimate in comfort and convenience. Fully insulated, dust-proof and waterproof construction ensures the home comfort that women expect—is equally appealing to sportsmen seeking a year 'round portable hunting or fishing lodge.

All models (except 12' Sportsman) set up and take down in two minutes—electrically—at the touch of a button! Interior appointments are rich—vinyl-covered 1½" fibreglass-insulated walls, (6'4" headroom) two double beds, dinette, built-in 2 or 3-burner Olive stove—stainless steel sink unit, ice chest and 12/110 volt lighting.

Sleeping for six, gas/electric refrigeration, air

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Whether you already own a travel trailer, are thinking of stepping up to something better—or are just starting out, get the Rolite Retractable-Wall facts.



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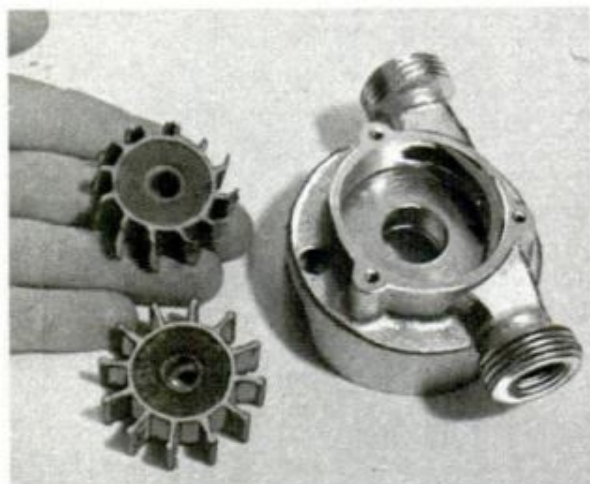
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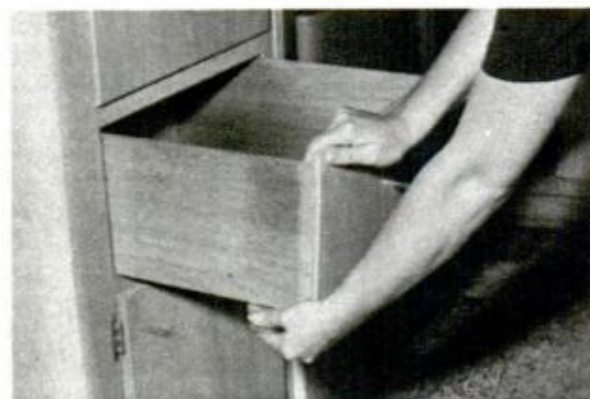
Pretrip Checkout

NOTHING spoils a trip quicker than a breakdown of equipment. To save yourself lost hours on the road, it's best to take a day or so to check out your recreation vehicle before leaving home. The following items are important pretrip checkpoints. Once you have followed through on each point, it's a safe bet that your trip will be troublefree as far as equipment breakdown is concerned. You'll get better service out of your rig, too.



Water pump

A great many RVs have electric water pumps. They are durable, but sometimes the neoprene impellers need replacing. Symptoms of a worn impeller (in hand in photo) are excessive motor whine, high rpm with little water volume, steadily weakening water stream. To repair, remove the pump faceplate and old impeller. Install a new impeller, which you can get from the manufacturer by mail.



Wax Cabinet Drawers

Sticking drawers can really aggravate a camper. Get a piece of beeswax from the local hardware store and rub it on all drawer guides and door slides. They'll op-

erate more smoothly and quietly. Remember that cabinet handles and knobs will loosen as the wood swells and contracts in summer and winter. Tighten these with a screwdriver before they fall off. You can also stop door hinges from squeaking by getting some graphite and applying it to all hinges.

CHECK FOR ODORS

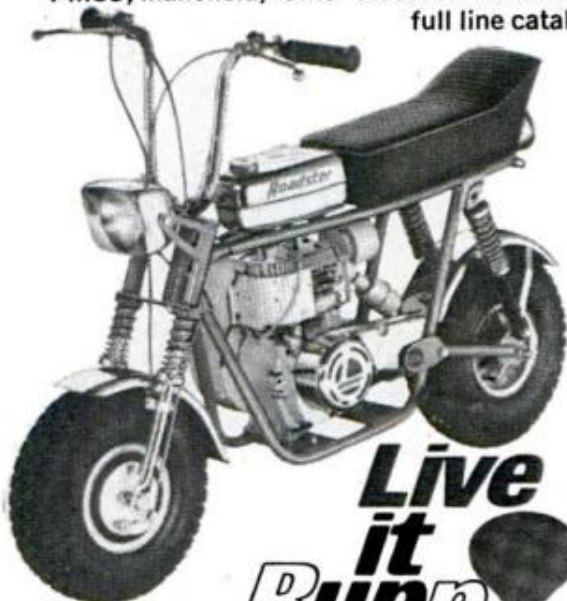
IN AN RV there's nothing worse than a musty or stale smell. If ventilating the rig doesn't work, mix a solution of one part vinegar to two parts water. Work a damp sponge with this solution all over walls and ceiling. This will neutralize odors.

IN AN ICEBOX or refrigerator odors may come from overlooked morsels of food. The most pungent scent can be eliminated with baking soda. Sprinkle the soda on a damp cloth and vigorously wipe both inside and outside of the box. Pour fresh water down the icebox drain hole. If it doesn't drain quickly, poke a thin wire down the hole.

IN A WATER TANK you're sure to collect dust and debris. Every time you fill it with a bucket some unwanted material gets into the tank. A rig with a built-in tank usually has a drain valve. Open the valve and run water through the tank until it's clear. If any bad taste or odor remains, dump a box of baking soda into a bucket of water. Pour the solution into the water tank. Add more water. Take the rig for a 15-minute drive so water sloshes in the tank. Now drain and flush the tank. It should be fresh. Tip: Don't fill the water tank with a gas-station hose. The nozzle is seldom, if ever, clean.

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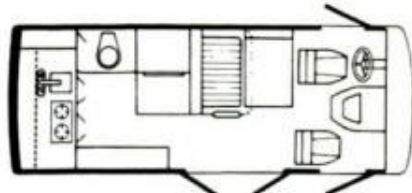
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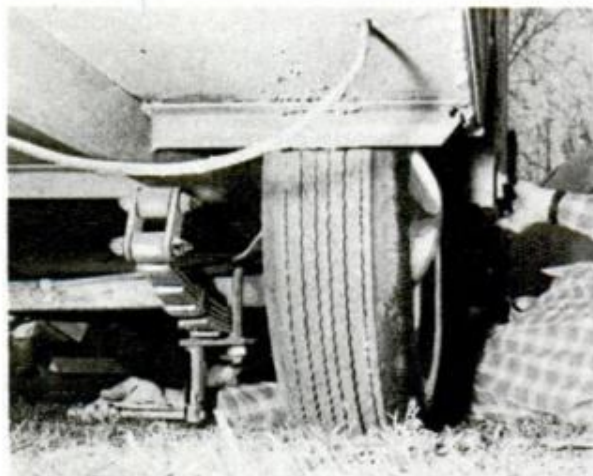
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Tires

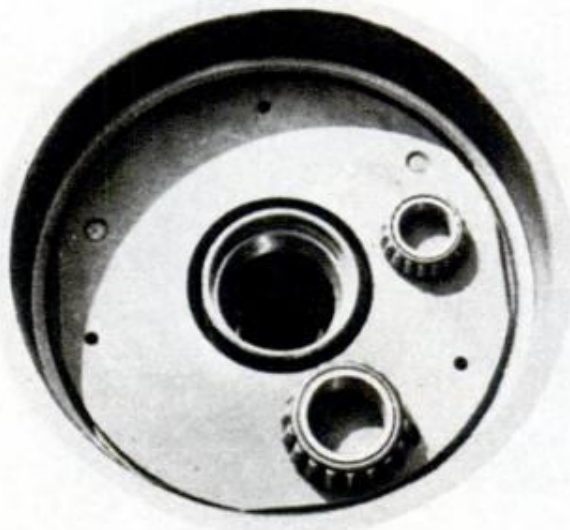
No matter what kind of camping vehicle you own, the tires are the key to smooth operation. Make sure that inflation pressure is from four to six pounds above the recommended level. On any trailer, the pressure should be equal on both sides. Unequal pressure causes sway. Tire tread that is worn and lopsided indicates wheel-alignment problems. While checking the alignment, make sure you have wheel balance checked. Remember that for each ounce a wheel is out of balance a vibrating force of 12 pounds can be generated. Some wheels can be as much as 8 to 12 ounces out of balance. That's a whopping 144 pounds of trouble at 60 mph. On some pickup campers, it's a good idea to get extra-wide flotation tires. These help a lot when driving on wet, rutted wilderness roads.



Suspension System

With age, any camping vehicle will lean toward the curb side. This is normal, but it's also annoying. To correct this, it is worth the trouble to install a new set of leaf springs on the low side. Maybe all you need is the replacement of one or two leaves. The new spring should bring the vehicle back to a level position. Remember to lubricate all springs with a lithium-based grease. Whether or not you need new springs, it's always a good idea to tighten securely the U-bolts that hold

the leaves together. While under your vehicle, look for loose or dangling pipes, wires or panels. They can be dangerous, so make repairs immediately. If any plumbing lines are sagging, tie them up. Check septic tanks to see if there are any punctures or slits. You can fiberglass a damaged tank. Tape over any wiring that looks suspicious.



Grease Bearings

Wheel bearings need periodic lubing. Pull the wheels and hubs, then remove bearings. Wash them in solvent and dry thoroughly. If the bearing surface or races are pitted, it's time to replace them. If bearings are still smooth, lube them and replace in hubs. But remember not to mix two different kinds of bearing grease. Mixing of lubricants only results in a complete breakdown of the grease.

Loose Seams

Check for loose seams along the base of any camping vehicle. If you find any, add sheet-metal screws where necessary to close up seams. If the metal on your rig is riveted, you'll have to find a repair shop to handle the job. Don't start any trip with holes or gashes in the metal.

Leaks

Check the interior for water stains around windows and roof vents, an indication that you may need new caulking around such spots. After a rig is three or four years old, the caulking may dry out. You can pick up a pound of special caulking putty from trailer supply stores. Remove protective coverings, scrape out the old putty and refill with new material. ★★ ★

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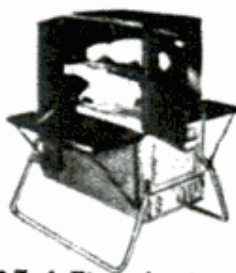
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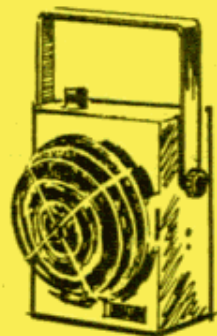
What You Need



THOUGH YOU MAY BUY a "fully equipped" recreational vehicle, there are always extra items that are not available from the vehicle dealer. These accessories will make your camping much more enjoyable. Here are some tips on buying extra gear. **SLEEPING BAGS** may seem ridiculous when you have an RV that sleeps six. But you'll find sleeping bags make a big hit with children. You and your wife can use the RV at night while the children sleep warmly outside in sleeping bags. The best sleeping bags don't need to be the most expensive, down-filled type. Kapok or cotton-batting bags do all right, but tend to lump up at night. Those filled with synthetic fibers, like Dacron, will keep their shape while resisting mildew and moisture. A four or five-pound bag is adequate. New on the market are paper sleeping bags. These bags, costing about \$5, can be used again and again. They are disposable, warm enough for cool summer nights and will hold up at least for a summer of average use. For nighttime activities, **CAMP LANTERNS** are always valuable. The most popular type is still the gasoline (unleaded) mantle variety. It operates for about a penny an hour. Gas lanterns come with either single or twin mantles. Some campers don't like to haul gas and are squeamish about lighting gas lanterns. For them, there are liquid propane mantle lanterns powered by disposable pressurized cans of fuel. These are compact and easy to operate though a bit more expensive to run. **TENTS** have come a long way from the heavy, bulky canvas types. Now you can get tents that fold up into small compact units you can store in any vehicle. Tents are always handy for adding sleeping space to your RV or for letting the kids have a place of their own. Besides the ordinary use of tents, there's another way the pros use them: If you're at a campsite and have to drive off temporarily, use a tent to "stake out" the site so it's not taken when you return. Tents are made from duck, drill, poplin and nylon materials. Avoid using tents made of plastic as they won't "breathe," thus letting moisture condense inside. Tents are now designed so they can be raised and lowered in seconds. Some don't even need tent pegs. Tents should have excellent ventilation especially if you use **HEATERS** inside. Heaters are valuable to RV campers especially in late fall and early spring. Heaters are available as optional equipment in many RVs. These are the fully vented propane type. But little portable heaters are also available for those who don't have one as regular camper equipment. If you use a portable heater, always remember to have good ventilation in your RV. Don't operate one without open windows. The fumes can be dangerous in a tightly sealed RV. The thing you need to know about heaters is the B.T.U. rating. A 3000-B.T.U. heater will take the chill off, while a 10,000 B.T.U.-unit


in Camping Gear

will keep the place quite warm. Probably the safest heater is the catalytic type. This unit produces heat without an exposed flame, though it burns propane gas or liquid fuel. All over the country now you are seeing **TRAIL OR MINI-BIKES** loaded on bumper brackets of RVs. Bikes broaden the fun you can have while out in the wilderness. They expand your range of off-road exploration from your campsite. In a **BASIC TOOLKIT** you need expandable pliers; 6 and 10-inch crescent wrenches; hammer; hatchet; folding camp shovel (military style); screwdrivers including Phillips-type; small roll of bailing wire; fiberglass material and epoxy, and an assortment of nuts, bolts, screws, washers and nails. Socket wrenches and plastic tape can be important, too. Don't forget wheel chocks and tire chains for wilderness camping. It's impossible to use charcoal in an RV so a portable **CHARCOAL STOVE** is necessary. There're many different models on the market today. One of the most impressive is a two-unit charcoal "range" that keeps the coals burning using flashlight-battery-operated fans in the bottom of the two charcoal wells. Another invaluable piece of gear is a metal grill from a charcoal burner. You can use this to cook food in an open wood fire. One of the fun aspects of camping is **BOATING**. You can get a cartop boat or inflatable boat for under \$200. Couple this with a small 1½ or 3-hp outboard and you can expand camping fun by adding fishing. **ICE CHESTS** come in handy. Remember it's better to have two small chests than a large bulky one. Two are easier to store. You can arrange it so one chest has the most-used items while the other has items that you don't need all the time. This means that the ice in one will last a lot longer. You can get ice chests from 98 cents for foam varieties to \$99 for luxurious, always-cold coolers. There are even some baby refrigerators that plug into the cigaret lighter of your vehicle. A **TWO-WAY RADIO** can work wonders. Citizen Band (CB) radios are available to you without your taking a federal test for an operator's license. All you need is a permit available from the Federal Communications Commission, Washington, D.C. Prices on CBs start at about \$70 for a do-it-yourself kit to \$300 for long-range units. You'll find CBers all across the country monitoring stations and ready to help in case of breakdown or other emergency. These enthusiasts are also great sources of information about road conditions, campsites, traffic, fishing and directions. You'll find talking to other campers through CB valuable, too. Surprisingly, **BAKING SODA** has many worthwhile uses. It's a sunburn remedy, general cleanser, dentifrice, gargle, deodorant, fire extinguisher, indigestion cure—and, when added to cornstarch and water, it's modeling clay for children. You can even soften water with it, eliminating the need for shaving cream. ★★



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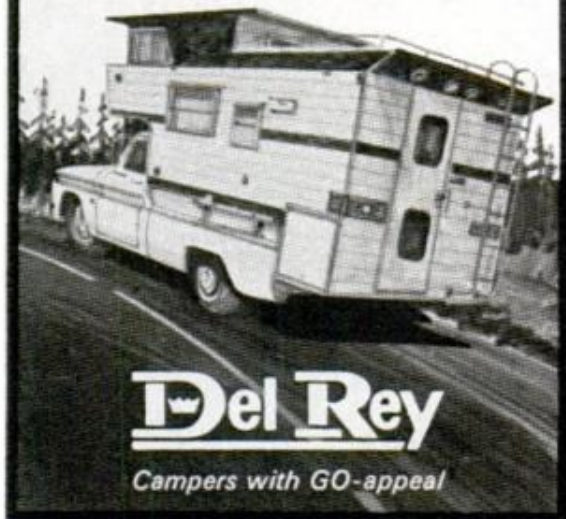
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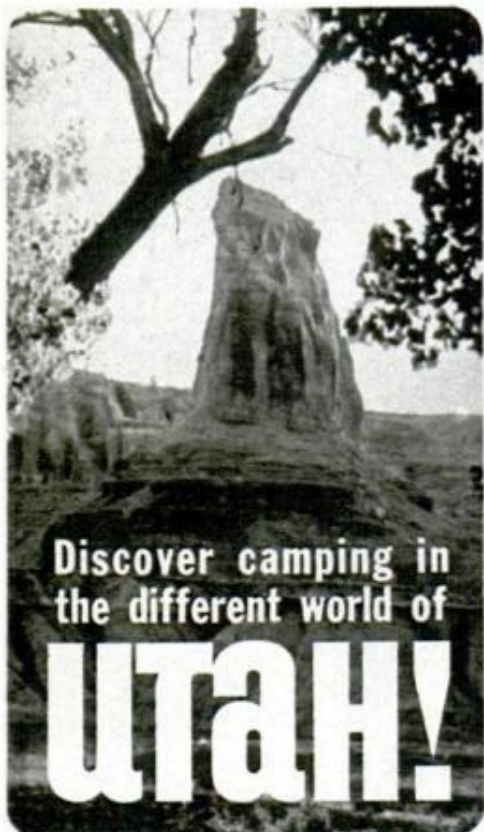
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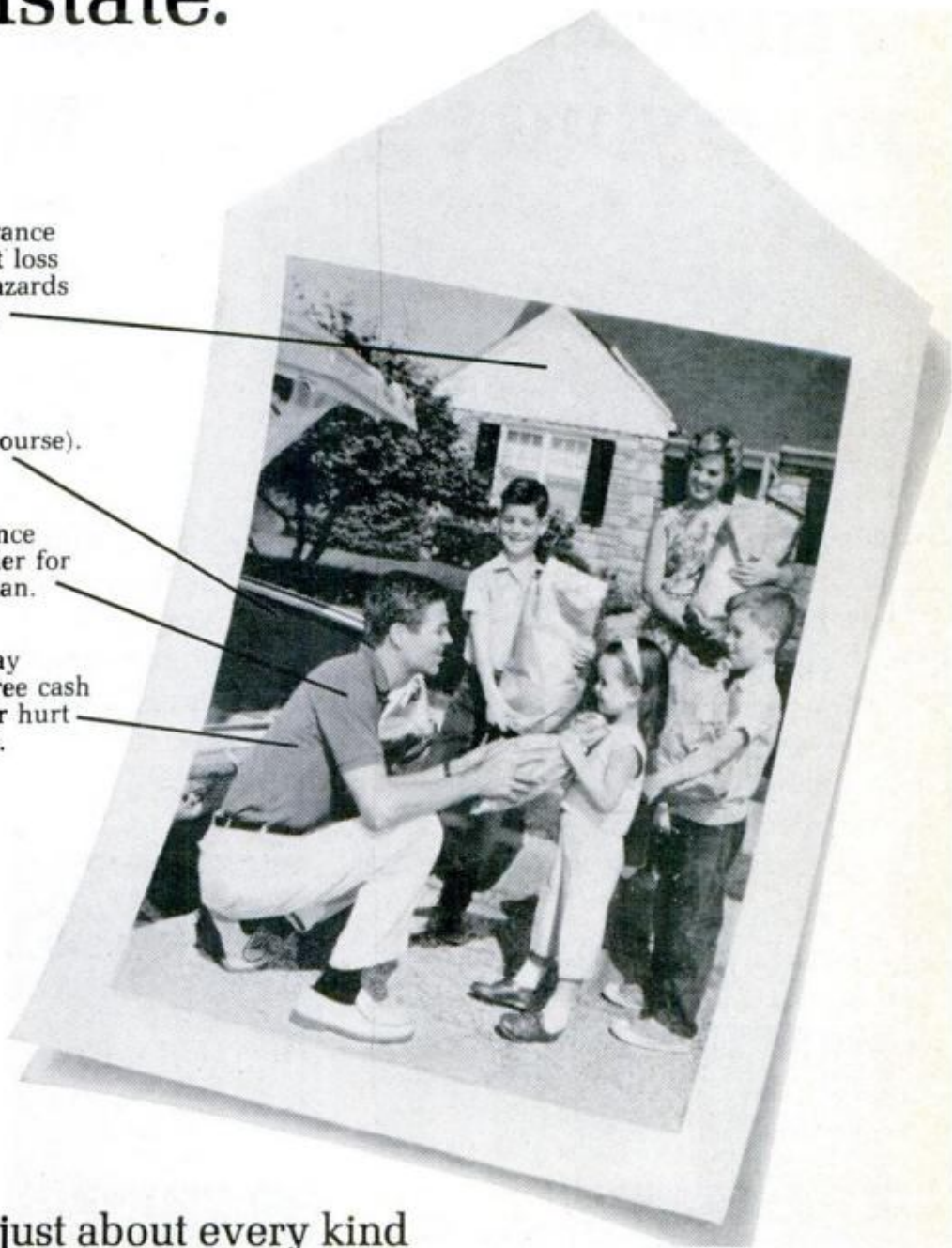
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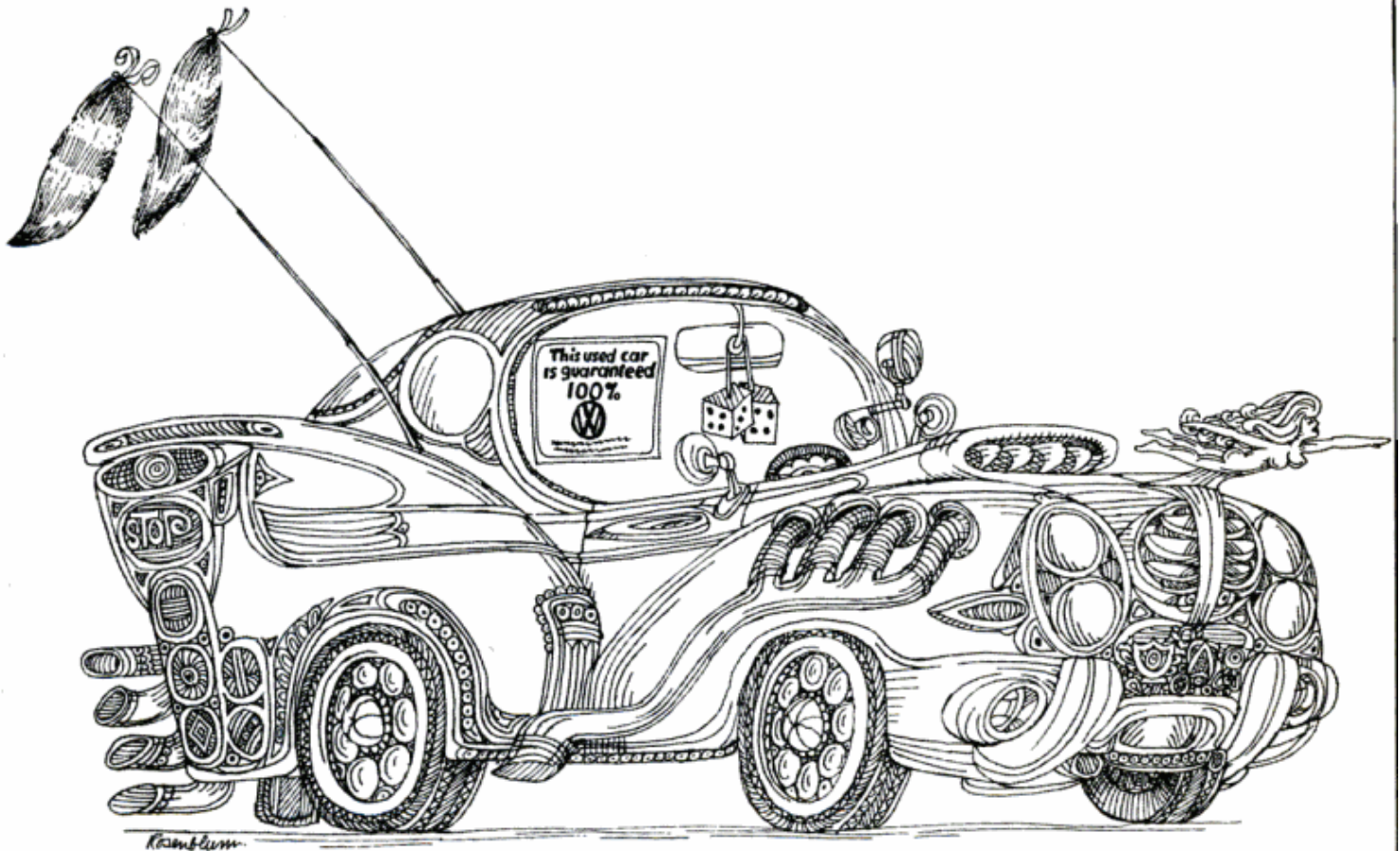
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Rondette—Prefab House in the Round

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LETTERS

TO THE EDITOR

How far with pistons?

How Far Can We Go With the Piston Engine? (page 95, Jan. PM) made like you were trying to re-elect a politician who had wasted all the taxpayers' money and burnt down city hall.

The one thing that perpetuates the piston engine is: It is tooled up for now. Sure, it can be souped up—the more it is souped, the quicker it blows (check Indy). If they can't keep them together after trying 70 years, they never will. One gas turbine can run, with only minor maintenance, in 300 Indy 500-milers. It would take between \$7 million and \$10 million worth of rattling, bone-shaking, rod-throwing, iron-scattering piston trash to go that far.

I have hated piston engines for years, but the smog devices did it. Now they are useless. I have a Chrysler 300H and a '60 Lincoln. They are the last piston jobs. No more, even if I get so old I get my beard tangled up in the fan.

PASADENA, CALIF.

J. T. HORSTMEIER

In general, I believe this is a good statement of the problems of the piston engine and what the likely means are for improving engines and reducing exhaust emissions. The technical quality of the article is better than many similar articles.

The author discusses the question of excessive exhaust restriction. I believe this is a factor that is greatly overemphasized by many hot-rod magazines. I know that is it not common to lose 30 to 40 hp due to back-pressure restriction, as the author states. The thing that bothers me is that the common way of reducing back pressure with streamline manifolds and dual manifold systems is to also open up the system so noise is greatly increased.

I believe that within the next few years we are going to have much more regulation of the noise from vehicles.

AUTOMOTIVE ENGINEERING LAB JAY A. BOLT
UNIV. OF MICHIGAN PROFESSOR-IN-CHARGE

How far can we go with the piston engine? To the nearest junk heap! That goes for its running mate, the transmission. They cost an arm and a leg to fix, so why make the piston engine more complicated?
BREMERTON, WASH. F. W. BRANNAN

I enjoyed the article, but I remain very much unconvinced by Mr. Huntington's
(Please turn to page 8)

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551

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LETTERS

(Continued from page 6)

arguments. Money—big money—is involved in nearly all the potential improvements he lists. You and I both know these have to be passed on to the customer—and Detroit wants to avoid that kind of program like the plague.
BURBANK, CALIF. REV. ROBERT K. GOODWIN

No stars in the sky

I have a slight criticism about the illustration of the LM and Command Module (*The Moon Bug Learns to Mate*, page 121, Feb. PM). The fact is that there are no stars visible in space while the astronauts and their spacecraft are on the daylight side of the Earth or moon!

I know it sounds incredible, but I checked. All the early Gemini photos showed not one star in the sky, so, being curious, I wrote the space agency. They wrote back saying that all astronauts stated emphatically that there were no stars, other than the sun, visible while on the daylight side of our planet.
GREENVILLE, N.H. LAURENCE M. JOHNSON

They're happy

I am an electronics engineer with mechanical interests. After reading three issues from my first subscription, I would like to compliment you on your magazine.

I find that almost all the articles are informative and interesting. I am very happy with my subscription.
HUDSON, MASS. FREEMAN SMITH

I bought your February issue at a newsstand especially to get the drawings in *Model This 24-Pounder* (page 134).

It is most rare these days to find fine-quality model projects—other than aircraft and trains. I hope that once or twice a year you can run something similar, or you might see if the old ship modelmakers are still out there!
TORRANCE, CALIF. GUS MORFIS

I think PM is one of the best magazines published today. Most other magazines print the same type of material that everyone else writes about, but your publication is always different. Your ideas are always new and interesting.

I would be very happy if you could send me some information as to where and how you get your new ideas.
SO. BRAINTREE, MASS. WILLIAM BARSOTTI

Thanks, guys. As for ideas, when your livelihood depends on 'em, you get 'em.★★★

How Harold Dail Made \$7,975.00 In 59 Days!

By Tom Harding

The true story of Harold Dail could happen only in the fantastic world of Accident Investigation.

Where else could a man with no experience and only average education go out and pick up a check for nearly \$5,000 for 22 days work?

Where else could this same man later go out and earn at the rate of \$135.00 a day for 59 straight days?

Is Harold Dail some kind of a money-making genius? Not at all. He's just an average man who had the good sense to take some training in a field that's bursting with opportunity.

It all began when Dail was working as a night clerk in a hotel in Barstow, Cal. It was a dull, low-pay job. There obviously wasn't much of a future. But Dail wasn't about to give up.

The Big Break

He enrolled with Universal Schools of Dallas for correspondence training in Accident Investigation. He started reading lessons-by-mail in his spare time.

Then came the big break. A large furniture store burned in Long Beach. Dail quickly reviewed one of his Universal lessons then hurried out to see the owner of the store. He offered to represent the owner in obtaining an insurance settlement.

In just 22 days, working entirely from directions in his Universal lessons, Dail obtained a settlement for \$91,275. His fee—\$4,563.75!

Almost without knowing it, Harold Dail had become what is known as a Public Adjuster. The Public Adjuster works as an independent operator. He helps people settle insurance claims. It is only one of the many money-making careers open today in the booming field of Accident Investigation.

A New Career Opens

But this was only the beginning for Harold Dail. His new career opened up like the door to a bank vault.

When a large area of Los Angeles was swept by fire, Dail went to work in earnest. His Universal training turned into a jackpot. He helped 21 businessmen handle their insurance claims and made \$7,975.00 in 59 days. That's an average pay of \$135.00 a day!

Today Harold Dail has made so much money in Accident Investigation that he spends his summers on his ranch

Amazing Things Can Happen To You In This Big-Money Industry



near Kingman, Arizona. He's also building a sub-division in Barstow—the same city where he was once merely a night clerk in a local hotel.

"If it hadn't been for my income from Public Adjusting I wouldn't be financially able to carry on this project," Dail writes. "If it hadn't been for the training of Universal Schools I wouldn't have been in the 'know' about Accident Investigation in the first place. I owe a lot to Universal Schools."

You Can Train, Too

The story of Harold Dail is unusual. His income is far above average for the field. But it shows what a man can do in Accident Investigation when he is trained to take advantage of the opportunities around him.

Now you can take exactly the same training Harold Dail had. You can do it easily in your own home, in your spare time, and at low cost.

You need no experience, no college education. There's no equipment to buy. No classes to attend. Keep right on with your present job until ready to switch.

And when you are ready, Universal gives you free, nation-wide job placement service. Universal has trained and placed more men in Accident Investiga-

Approved for Veterans' Training

tion careers than any other organization.

Men Urgently Needed

The need for more trained men in all areas of Accident Investigation is absolutely critical today. This huge, growing \$19 billion industry must investigate and settle some 22 million accidents and losses a year! And the job gets bigger every month as the accident rate goes up and up.

There simply are not enough trained men in the country to handle this enormous workload. That's why hundreds of companies have standing requests with Universal for names and addresses of all our graduates.

Free Book of Facts

We can't begin to tell the whole story of this huge, exciting business here. But we do tell you all about it in an exciting, free book which you can have for the asking. There's no obligation. No salesman will call.

Learn about the 3 major careers open now in Accident Investigation. Read how clerks, truck drivers, laborers, factory hands have moved up to professional pay and standing with the help of Universal. (We give you names, addresses, earnings.)

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103

DETROIT

LISTENING POST

BY BILL KILPATRICK

DUBIOUS IS THE WORD to describe the feelings of industry observers regarding the new Federal Highway Administration regulations requiring automakers to provide consumers with specific safety performance information about new cars. Observers (and admittedly there are cynics among them) think such information will rapidly deteriorate to mere sales fodder. Under new regulations that will become effective Sept. 30, manufacturers will be required to provide minimum stopping distances under various load conditions, information on the tire reserve load (i.e., the difference between the actual wheel load on the tires and the maximum safe load rating specified by the government for the tire size), and a car's acceleration and passing ability stated in time in seconds and distance in feet. Data provided buyers presumably will be developed from proving-grounds trials and will in theory represent averages from thousands of tests. But some fear automakers will strive to gain a competitive edge by putting their best foot forward—posting the very shortest possible braking distances, the most favorable tire-load figures, the quickest acceleration times. If they do, the data will be of little real use to the average car buyer.

Additionally, there is the possibility that manufacturer-provided data won't agree with that developed by such impartial trials as those conducted by the Union/Pure Oil Co. If the data *does* vary significantly, buyers could become more confused than ever.

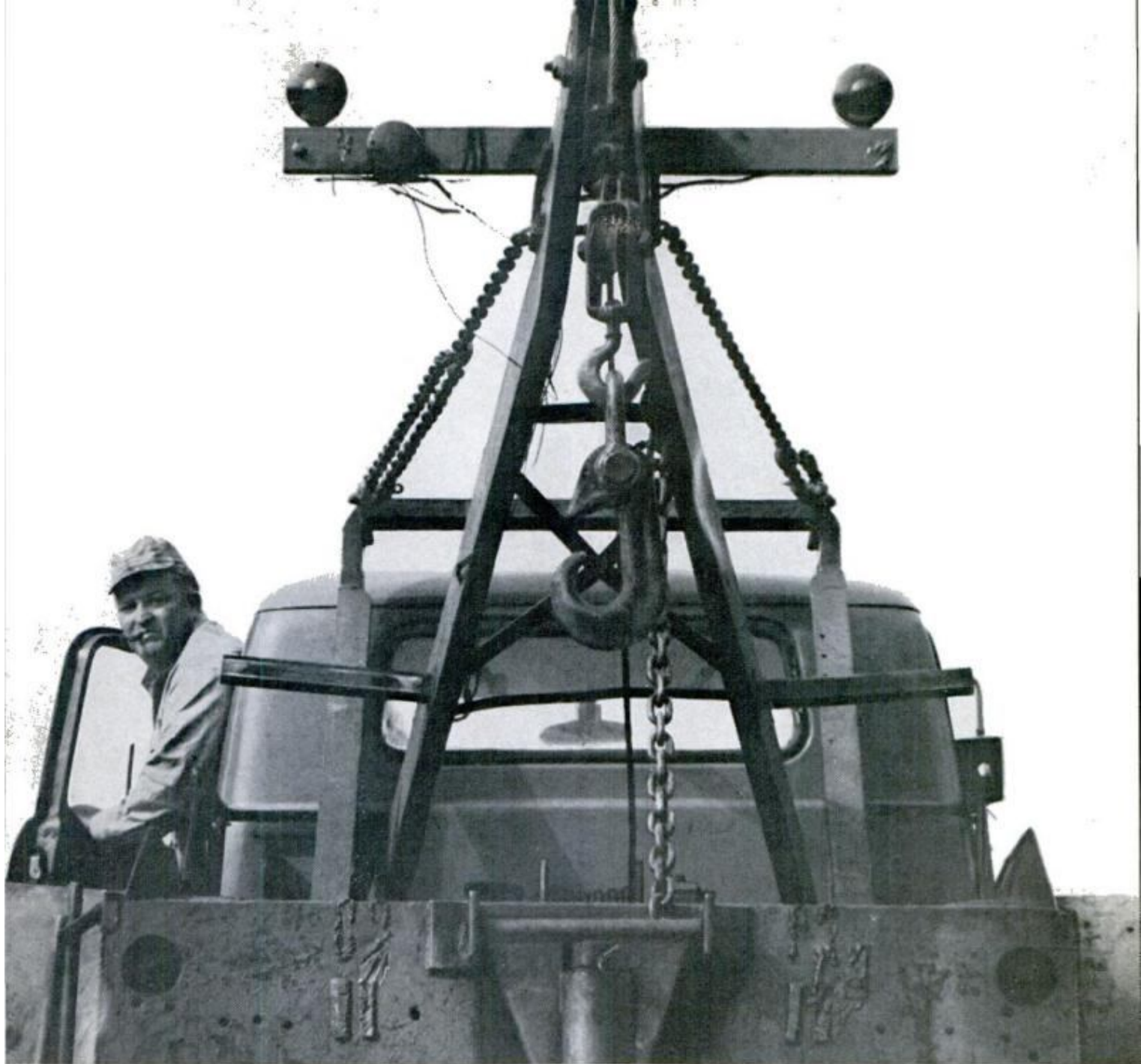
CHEVROLET WILL POP WITH A NEW CAR in its 1970 model line. As yet unnamed (Chaparral is being bandied about), the car will be based on GM's G-body, as is the current Pontiac Grand Prix. The new entry will be marketed at the top of Chevy's line, will offer buyers a genteel four-passenger muscle car priced under the Grand Prix. Standard power for the new car is said to be the 396 with the big 427 honker as the option.

FORD IS READYING a much improved version of its "collapsible" front end. In the new arrangement currently under test, impact energy is absorbed by the entire frame, not just the front end as in the present setup. Talk in Detroit has it that Ford will introduce the new frame on its 1970 cars. However, a Ford source told me the new concept has its opponents within the company. They claim the frame is so constructed that even a slight nose bump would result in extensive body and underpinning damage. Safe, they admit, but potentially expensive.

CHRYSLER, in what may be an entirely new direction for the auto trade winds to blow, recently introduced a line of travel and recreation accessories through its Mopar parts division. Now sharing parts-catalog space with connecting rods and camshafts are golf-club covers, bowling bags, tote bags, carryall bags, and so on. Thought isn't as zany as it may seem at first glance: Cars in showrooms draw potential customers, most of whom presumably have money in their pockets. Once you've got 'em "in your store," why not try and sell 'em a few other things while you're at it? Success in this sort of on-the-side sales activity might keep some of the smaller, marginal dealerships in business.

AMERICAN MOTORS' NEW SUBCOMPACT—due at new-model introduction time this fall—is said to be a very quick and nimble little car, a far sprightlier performer than Ford's new Maverick or GM's still-mysterious subcompact entry, also due this fall. If scuttlebutt proves true, AMC—in the new mini, the AMX and the Javelin—will have an impressive array of hot cars to offer the go-go set. Well-wishers for AMC (me among them) hope the company follows the cars with a complete and imaginative line of so-

(Please turn to page 16)



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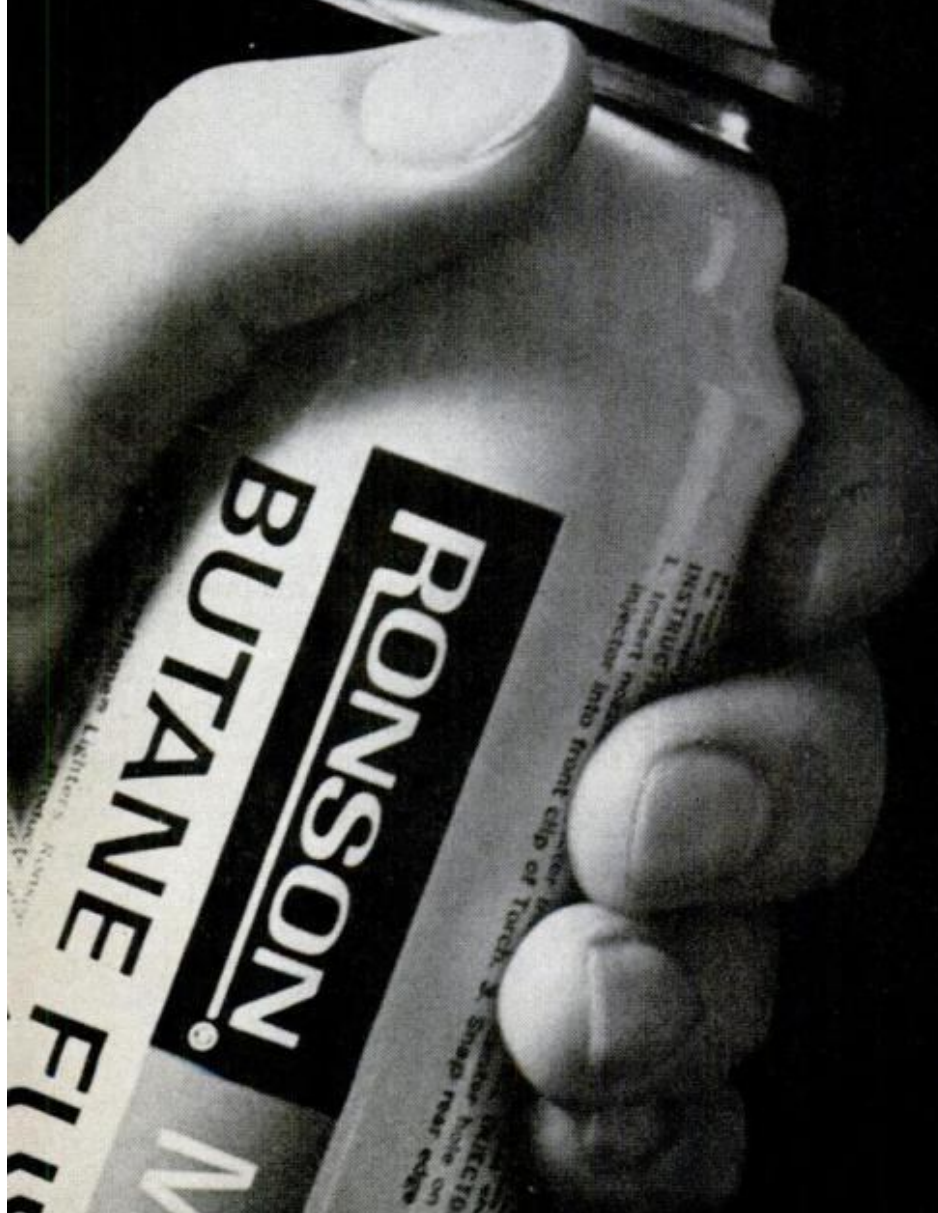
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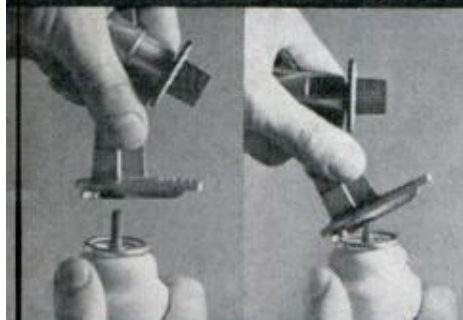
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I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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Sgt. William H. White, Air Force mechanic, Dover, Del. "I looked at four or five of the leading brands and this Bolens 770 tractor beat them all. There was no comparison for the machine that had to do a tough job. The Bolens was the best built and the best engineered of them all, and I have never been sorry on my selection."



Mr. A. C. Foster, an engineer, Weston, Conn. "I use the Estate Keeper every week for a period of 5 to 7 hours continuously. I find that operating at lower speed I get a smooth cut even on rough terrain. As an engineer, I like the idea and principle of the Center Pivot Steering, which makes the Estate Keeper most practical for mowing around trees, wooded areas and shrubbery."



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DETROIT LISTENING POST

(Continued from page 10)

called "speed" equipment; enthusiasm for a given make of performance car is in direct proportion to the number and variety of toys available for it.

THE AUDI, a front-wheel-drive German luxury intermediate, will hit the U.S. market next year. (See *Good Cars You Can't Buy*, page 108, Nov. '67 PM). Manufactured by the Auto Union subsidiary of Volkswagen, the car—along with Porsches—will be sold through a newly-formed Porsche-Audi division of Volkswagen of America. The new importer/distributor setup goes into effect Nov. 1. There are at present 14 VW distributors in the United States, all of whom will be designated authorized Porsche-Audi distributors. Dealers handling the new car will probably include most of the present Porsche dealers (222 in number as of this writing, 172 of whom also sell VWs) plus recruits from among the more than 1000 VW dealers throughout the country. The Audi is built on a 98-in. wheelbase in three power versions: 81, 91 and 102 bhp.

Which of these versions is to be imported hasn't as yet been decided, but the

best bet appears to be either the 91 or 102, perhaps both.

DIESEL FUME SNIFFING is being conducted in the interest of science. That's what's being done as scientists try to figure out a way of measuring the smell from diesel engines. The sniffers require a lot of training, though, it was reported, seriously, in a recent technical paper.

YOU MAY NOT BE READY FOR IT (Lord knows I'm not), but Firestone is toying with the idea of introducing "his" and "her" tires. In what has to be either a zenith or nadir, depending upon your gag threshold, the tire giant's stylists (Yes!) have evolved a "her" tire calling for flowered stripes molded into the outer sidewall and vari-colored plastic studs implanted into the tread surface, and a "his" tire with no frills on a wide tread design with deep circumferential grooves. Neither type is in production, but head Firestone stylist Peter McDonald says the designs "have been received quite enthusiastically by auto stylists and automotive people who have seen them." The seeming purpose? "To improve the esthetics of tires." Truly, we live in a wondrous age. Giddy, anyway. ★★★

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Science Worldwide BY JOHN F. PEARSON

Photos of nudes were used in a Harvard University experiment to determine if people can control their blood pressure. (The experiment followed recent success with lab animals at New York's Rockefeller University; in response to rewards in the form of electronic stimulation of brain pleasure centers, rats were trained to control heart rate, blood pressure, glandular secretions and brain-wave activity.) Twenty Harvard men were hooked to devices that recorded blood pressure at each heart beat and to "reward" mechanisms. Each time a desired lower (or higher) pressure was recorded, a light would flash. After a student had scored 20 flashes, he was rewarded with a five-second peek at a projected slide of an undraped female. Despite the provocative reward, students were more successful in lowering than in raising their blood pressure.

The Orbiting Astronomical Observatory (OAO II), launched last December, collected 20 times more ultraviolet information in a 30-day period than was gathered during 15 years of rocket launchings. That's the word from NASA officials who say that the 4400-pound observatory's 11 telescopes are studying young, hot stars which emit most of their energy in the ultraviolet portion of the spectrum. So far, some 40,000 commands have been sent to OAO and more than four million pieces of information collected.

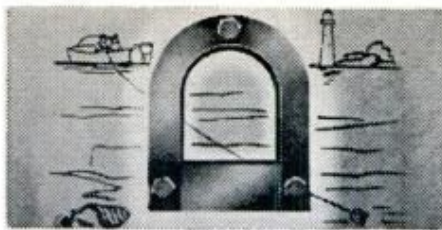
Epoxy resin, asphalt and processed aluminum ore chips are the key ingredients in a new skid-reducing road-surfacing material. Tests conducted in London show a 62 percent reduction in accidents on the treated roads. Skid resistance is provided primarily by the chips.

King Henry VIII became punchy from too many sports contests, which accounts for his erratic behavior in later life. That's the theory held by Dr. Norman Barrett of St. Thomas's Hospital, London. He does not believe that the monarch was a victim of syphilis—a disease that attacks the brain in its late stages—as is commonly thought. Henry was a top athlete, jousting regularly for 20 years and was hurt often. In jousting, knights on horseback battled with lances. After one set-to in 1536, Henry was said to suffer a complete character change.

Platinum, copper, silver and gold deposits may be "concealed" in southeastern Wyoming, according to scientists of the U.S. Geological Survey. They report that studies of the composition of rocks and stream sediments in the vicinity of the New Rambler Mine—active in the early 1900s—suggest the region is a "platinum rich province." A well-planned scientific exploration program would have a "reasonable probability of successfully locating an ore body." And waste from the New Rambler is a resource not to be ignored. Inefficient milling methods left it with a platinum content of 1.7 parts per million and a gold content of 2.5 p.p.m.

Chronic lung disease, usually thought of as an urban problem, is prevalent among natives living in remote mountain areas of New Guinea. That finding was made by Australian scientists who think the cause may be air pollution in the natives' huts. These primitive people keep wood fires burning in the abodes during parts of the day and most of the night.

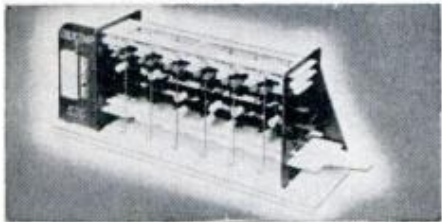
Customers bent on credit-card larceny are spotted quickly by means of a new electronic identification setup. That's the claim of Digital Data Systems Corp., Pennsauken, N.J., developer of a system that consists of a sales-counter card reader about the size of a desk telephone and a computerlike central processor. The clerk places the customer's credit card in the reader and presses a series of buttons. Within 1/30 second the processor has searched its memory for information on the account. Tiny lights on the card reader flash one of four possible messages: the credit card is good; the card is good but the size of the purchase or status of the account requires a phone call to the credit office; the card is listed as lost or stolen and the store detective should be called; the card number doesn't make sense, indicating a clerical error or a possible counterfeit card. ★★ ★



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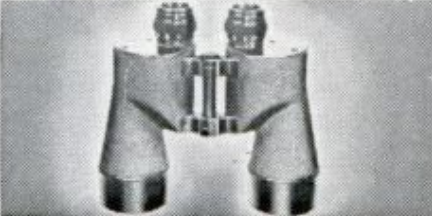
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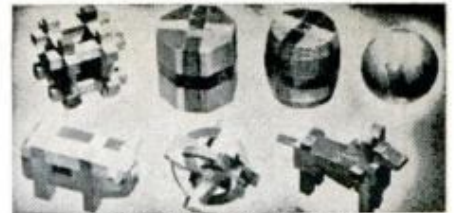
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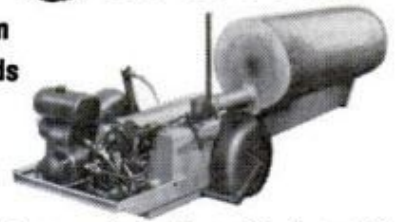
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Drivin' with Dan

What happened to your entry in the Riverside '500'? Is Can-Am replacing Grand Prix as No. 1 in racing? Why are racing-engine connecting rods different? Dan Gurney answers these and other provocative questions



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Q. I know you can't win them all, but everybody I talked to thought your car looked downright impotent from the beginning in this year's Riverside "500". Why was that?—Bill Mayflower, St. Joseph, Mo.

A. In this year's race, I started as usual, just trying to get the feel of the thing first. But everyone was going so fast, I found I would have to go 99 percent flat-out to make any move at all toward the front. I moved from sixth to second, all the time trying to cope with brakes that were not working normally and with the transmission that was giving less than normal shifting performance. The result was that I tried too hard, got into turn nine too fast and hit the wall. The car was never the same afterward. I tried to press on anyway, and sort of burned the car to the

ground. I found that an engine won't last too long at 18,000 rpm.

Q. I understand that most Formula 1 drivers will be entering this year's Can-Am series. It sounds like the Can-Am is replacing the Grand Prix circuit as the No. 1 international motor sports league. Is it mostly because of higher purses in the Can-Am?—Roger Ballinger, San Diego.

A. Yes, mostly. This year the total awards at stake in the 11-race Can-Am series exceed \$1 million. In addition, the Group 7 sports cars, with their unlimited engine size and very aerodynamic shapes, have become the world's fastest road-racing machines. Rumor has it that Lotus and Brabham will soon join the ranks of Can-Am builders and entrants, and I imagine you will see virtually every major marque in the world represented very shortly. It's a tremendous brand of racing.

Q. How much more do the special connecting rods used in racing engines cost than the ones in an ordinary passenger car and why are they made of different materials?—Bruce Weden, Sioux Falls, S.D.

A. My friend, Fred Carillo, tells me that the cost is ten times as much. These special rods are made of different materials—usually steel, aluminum, or titanium—to increase strength and improve reliability, and the more exotic metals are utilized in an effort to achieve that additional strength and reliability at a saving in weight.

Q. Are the Offy and four-cam Ford the only kinds of turbocharged engines allowed at Indianapolis?—L. M. Cranston, Montpelier, Vt.

A. No. The rules also permit supercharged stock-block pushrod engines, which are al-

(Please turn to page 32)

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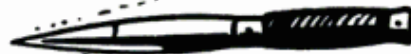
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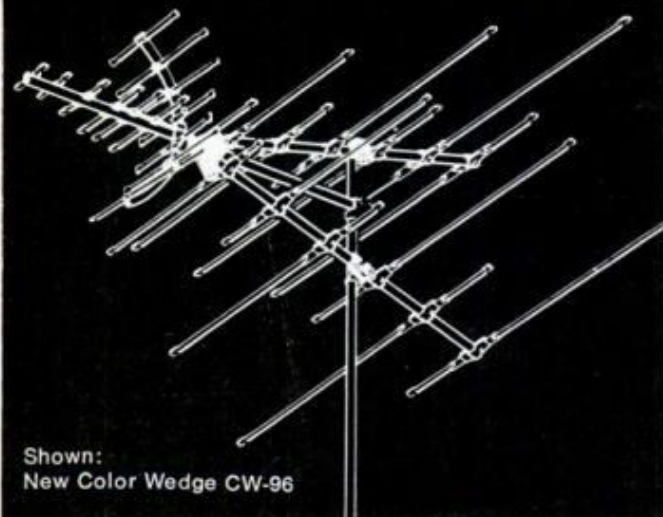
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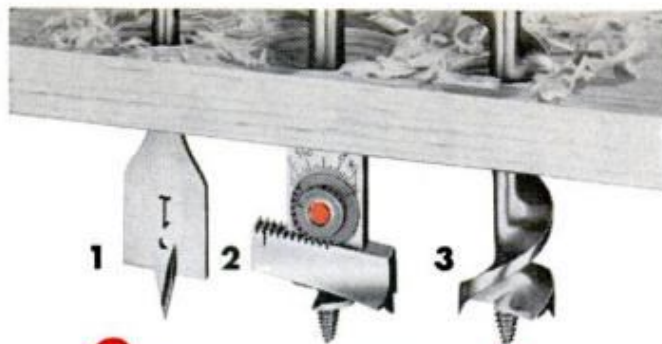
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New and improved Irwin self-chalking design. Durable aluminum alloy box. Practically damage-proof. Fits pocket or hand. 50 ft. and 100 ft. sizes.



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ANY TWO...OR ALL THREE
FULL OR PART TIME!**



■ Von Schrader offers you these three tried and proven money-making businesses. You can start with one Deterger and, by working week-ends, add hundreds of dollars to your monthly income while still employed.

■ Or, you can start your business with any two, or all three Detergers, and build rapidly to a point where helpers and even additional Detergers are necessary. All three Detergers are reasonably priced...and many Associates make more than the price they paid in the first few weeks and from the supplies that came with their original order.

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■ Von Schrader is the oldest and largest company manufacturing machines of this type and we are keenly interested in the success of each of our Associates. Our FREE ENTERPRISE PLAN has been developed and fashioned with your future in mind. Your business always belongs to you...no one can ever take it away. You pay no dues or fees or royalties to anyone. All the money you take in belongs to you...you are truly your own boss in your own business.

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E. L. McLAINE • New York • Wall—"I'm over 60 years old. In my spare time I make \$125 to \$175 per week."

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R. MORTON • Michigan • Wall—"This last month just working Saturdays and occasional evenings I cleared around \$600."

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E. ACTON • Oregon • Upholstery—"I don't work very hard at this but in one day my boy and I made \$170."

S. RALLINGS • California • Upholstery—"I'm averaging about \$200 a week...one month went up to \$1000."

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J. THORNTON • Illinois • Rug—" \$90 and \$100 a day is common with your wonderful deterger."

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Please rush information about your

_____ DETERGER(S)
(Write in name of deterger(s))
and how I can start my own profitable business.

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Address _____

City _____ State _____ Zip _____

DRIVIN' WITH DAN

(Continued from page 24)

lowed a maximum displacement of 203.4 cu. in., as compared to 161.7 cu. in. for the four-cycle, overhead-camshaft Fords and Offies. I expect to see at least one turbocharged Chevy entered somewhere along the line on this year's USAC championship circuit.

Q. *Was that you I saw on the Smothers Brothers show riding a motorcycle? Isn't that dangerous?*
—Jack Hill, Pittsburgh.

A. Not if you don't fall off at the wrong place. Several of us, including Swede Savage, Parnelli Jones, Richie Ginther and Don Prudhomme were practicing my favorite avocation in the scenes you saw—climbing hills on our trail bikes. I find this a great form of relaxation.

Q. *When one of your cars is wrecked, and considered a total loss, what is done with it?*
—Johnnie Hefler, Westlake, La.

A. When a car is extensively damaged, it's usually retired from competition and fixed up into a show car for auto shows and such. I don't sell cars for racing that I wouldn't drive myself. Knock on wood, we haven't had many total-loss wrecks.

Q. *My friend says one or more of the piston-type Indy cars have used straight STP in their engines, and no oil. Is this possible, and if so, how did they pump it?*—Lawrence Wooldridge, Burlington, Pa.

A. I don't know, but I doubt if it occurred, or if it is even possible. STP and similar additives are intended to be used with oil as a help, but I'd guess that they'd need oil more than oil needs them. You can pump almost any liquid if you try hard enough.

Q. *I hear Ford has a new V8 that can be used in drag racing, stock-car racing and even Can-Am racing. What do they call it?*—Gene Radeke, Red Lake Falls, Minn.

A. No doubt you have heard of the new "hemi-like" Ford engine. It probably will see duty on drag strips and in stock-car racing in 429-cu.-in. form, and there's a possibility that an alloy version of close to 500 inches will be entered in the Can-Am series. The cylinder-head design incorporates a hemispherical-

type combustion chamber. You would be correct in calling it a new V8 from Ford.

Q. *What racing cars do you have besides your Eagle and McLeagle? What is the fastest speed you have ever achieved?*—Randy Thomas, Cleveland, Tenn.

A. In addition to my Eagle Indy car, Eagle Grand Prix cars and the McLeagle, I also have a Lola Can-Am car. As for speed, 214 mph is about it—at Indy in a Ford turbopowered Eagle during a tire test. I may have gone that fast at Le Mans in the Mk-4 Ford.

Q. *I would like to get an idea of just how low, long and wide your racing cars are compared to my Cougar. Could you list the length, height and width of your Indianapolis and sports cars?*—Jose Sanchez, El Paso, Tex.

A. Our Indy Eagle, the type that won the 1968 "500", is 155 inches from nose tip to tail and 36 inches high at the top of the roll bar (just behind the driver's head). From outside of the left front wheel to outside of the right front wheel it's 69 inches high. Actual width of the car body at the nose is 28 inches. Height at base of the windscreen (at driver's shoulders) is 25 inches.

Our McLeagle Group 7 sports car measures 156 inches from nose tip to tail, 35 inches high at the roll bar and 68 inches wide from outside of the left front fender to outside of the right front fender. Height at base of the windscreen is 25½ inches. Now get out your Erector set and go to work.

Q. *What does the "Olsonite" that you have been carrying on your race cars the last two years mean?*—Tom Keeler, Vidalia, Ga.

A. It refers to Olsonite Div. of Swedish Crucible Steel, the company owned by Ozzie Olson of Detroit, our car owner and sponsor. We incorporated the company name into our race-car names (Olsonite Eagle, Olsonite McLeagle, Olsonite Lola). Olson is the world's largest manufacturer of toilet seats and produces plastic automotive parts, such as steering wheels. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 82).

The big boys.



On their way. Right to the top. They're college men. With a difference. They belong to the four percent.

Of all men graduated from college, about four percent have had the benefit of Army ROTC training. Yet from this small group have come 22% of the business executives earning over \$100,000 a year. 16% of our congressmen. 14% of our governors.

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What does this have to do with you? Maybe nothing. It depends on the goals you've set for yourself. This much is for sure. If you're going to college, don't you owe it to yourself to look into the benefits of Army ROTC?

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Army ROTC
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Philadelphia, Pa. 19134

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Precisely tapered claws make it easy to pull even headless nails.



The hammer with the handle that packs its own punch

...thanks to **TRUE TEMPER** engineering.

Fiberglass handle adds flex action to your swing, more drive to each stroke.

Epoxy-bonded filaments of unidirectional glass fibers deliver punch all their own. Head is permanently bonded to handle.

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THIS IS IT!!!

Now you can give permanent new beauty to any sound floor (tile, wood, concrete) . . . in one day or less! Roll on amazing 1-2-3-Floor for a long-lasting gloss finish that never needs waxing, won't scuff or dent. Apply it wall-to-wall seamlessly . . . choose from wide range of colors to match your decor. Perfect for counter tops, tables, walls, too. 1-2-3-Floor goes on easy as 1-2-3:



1. Apply base coat on pre-cleaned floor with roller (or brush).
2. Apply clear plastic, sprinkle on decorator chips and seal with another coat of clear plastic.
3. Lightly sand, then finish with final coat of clear plastic.



Ask your hardware dealer or write **TOP LINE DIV. OF OATEY CO.** Cleveland, Ohio 44135

You say you just bought a new spinning reel? Aw, that's too bad.

We know how you must feel.

About like the guy who spent a fortune on gas lights just before Edison invented the electric bulb. Still, it's not the end of the world.

Okay, so maybe your reel doesn't have the new Magnum drag system with fourteen braking surfaces. Only the South Bend Classic has.



Send 25c for the new 80-page South Bend catalog of rods, reels, lures, line and accessories.
South Bend Tackle Co. Dept. DP, Division of Gladding Corp., Box 365 IAB, Miami, Florida 33148

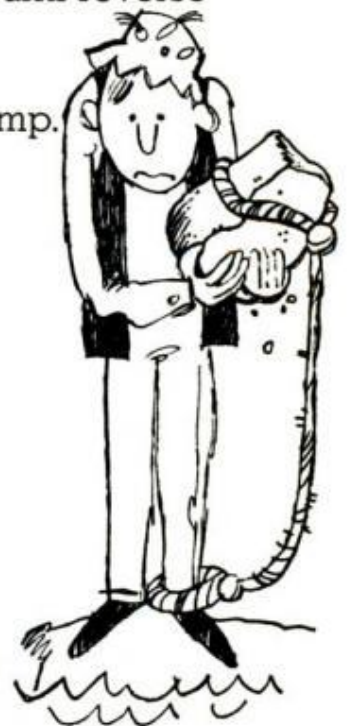
And maybe it doesn't have the new Dynamatic bail with its unbelievably smooth, quiet, positive trip action. Only the Classic has.

But your reel does have a sealed housing, doesn't it? And a line roller with a Teflon* inner sleeve to prevent freeze up? And a one-piece aluminum spool that won't bind under stress like plastic? And a line guard to keep your line from getting behind the spool? And a quick-change spool release?

And a folding crank? And helix gears with ball bearings? And a positive anti-reverse mechanism?

It doesn't?

Go ahead, jump.



Gladding Corp.—Products for Recreation
*Reg. name of DuPont Fluorocarbon

Kodak

Meet the sharper shooter.



The KODAK INSTAMATIC 814 Camera lets you shoot sharper, clearer pictures your very first time out. For three reasons. One, it has the superb new super-sharp 4-element $f/2.8$ KODAK EKTAR Lens. Two, it has a coupled rangefinder. And three, it does practically everything for you automatically.



Just drop in the film. Automatically, the "814" adjusts for the film speed. Automatically

adjusts for the light, too . . . tells you if the batteries are okay . . . warns when to use flash. And for easy shooting, both film and flashcube advance automatically.

See this sharper shooter, less than \$140, at your Kodak dealer's. Price subject to change without notice.

Kodak Instamatic® 814 Camera.

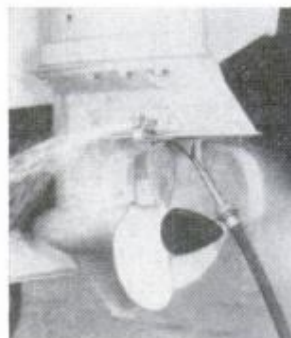
WHAT'S NEW **OUTDOORS** BY DAN FALES

SKUNK ODOR can be eliminated by using one of several items available in drug or grocery stores. Glenn Dudderar, Virginia Tech Extension wildlife specialist, says that liberal application of tomato juice on clothing or pets can control the skunk smell. He also says that a weak chlorine solution or bleach is good, too. Skunk odor in soil can be removed by using lots of chloride of lime, obtainable in most drugstores.

A NEW KIND OF TACKLE BOX is on the market this spring. Called Boat-Tote, it has adjustable clamps so you can hook the box to boat gun-wales. This means you won't accidentally step or sit on the box while fishing. Made of ABS plastic, the box is $13\frac{3}{16}$ inches long; $5\frac{3}{8}$ inches wide; $8\frac{1}{4}$ inches high and weighs $2\frac{3}{4}$ pounds. There's even a well in the middle divider tray to hold steady any standard beverage can. Baits of all sizes hang from a lip on the top. There's also a place for pliers, hooks and leaders, pork-rind bottle, snaps, swivels and the like. Boat-Tote is available for \$10.95 from Plano Molding Co., Plano, Ill. 60545.



NO LONGER do you need a 55-gal. drum to test-run your outboard. No longer do you have to remove your motor from the boat to test or flush it out. Tempo Products has introduced Testit-Flushette — a fixture which lets you attach your garden hose to the water intake of your motor to test, adjust or flush the outboard on dry land. The Testit-Flushette is available for most outboards and some stern drives for \$4.95 from Tempo at 6200 Cochran Blvd., Cleveland, Ohio 44137.



THE FIRST left-handed automatic shotgun ever made by Winchester is now available. A version of the Model 1400 Mark II, it's offered in the 12-gauge field grade, also in skeet and trap models. ★★★

Save up to \$200 or more on auto air conditioning!



Quick 'n easy to install, Comfy-Kit air conditioners give you cooling power that's unsurpassed — yet cost less than half the price of many units. This means you can earn up to \$50 an hour for installation time.

Comfy-Kit is available in three superbly engineered units: Supreme, Super Air and Standard. All give you famous Comfy-Kit durability and performance — plus trim

good looks that rival any unit on the market.

Let someone else pay the high prices for auto air conditioning. You'll have a better unit — save lots of money to boot. Comfy-Kit comes complete — including the loan of tools if you need them.

So, mail in your coupon right away. Enjoy windows-up comfort all year.

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P. O. Box 8585, Dept. PM4 • Dallas, Texas 75216

- Enclosed is \$133* for Standard Unit.
- Enclosed is \$148* for Super Unit.
- Enclosed is \$165* for Supreme Unit.
- Enclosed is \$30 deposit on a Super Standard Supreme Unit. I will pay the balance, plus C.O.D. charges when delivered.
- Enclosed is \$8.00 deposit for a set of four tools, which will be returned to me when I return the tools.
- I would like to see the instruction book before I order. I enclose \$1.00 for the instruction book only. I understand this will apply on any future Comfy-Kit order.
- I would like information on a Comfy-Kit dealership.

Name.....
 Address.....
 City.....State.....Zip.....
 My car is a.....(year).....(model)
 Engine displacement.....Horsepower.....
 Power Steering.....yes.....no
 Floor shift.....Steering column shift.....
 Smog pump.....yes.....no
 *plus state tax where applicable

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CHAMPION
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J-17 LM



NEW

FITS OVER 90%
OF ALL POWER MOWERS

14 mm thread • 13/16 hex

Now—a sure way to get fast power mower starts!

Fast, sure starts all season long!

Delivers maximum cutting power!

Fits over 90% of all power mowers!

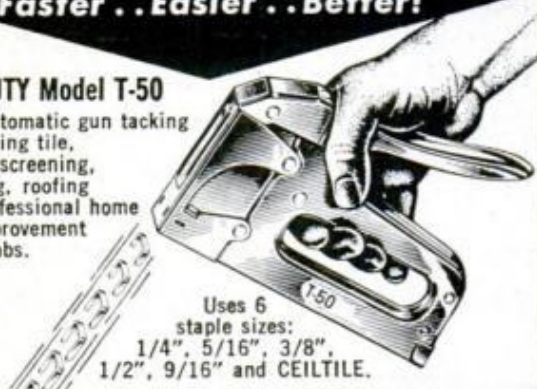
Start the season with Champion's all-new J-17LM. This unique spark plug was created by Champion engineers to spark both 2-cycle and 4-cycle engines. So, it's exactly right for 9 out of every 10 power mowers in use—including *all* popular makes! Look for the J-17LM in the distinctive green and black package at hardwares, garden centers, service stations, and home and auto accessory shops everywhere.

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TOLEDO, OHIO 43601

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HEAVY DUTY Model T-50

Powerful automatic gun tacking tool for ceiling tile, insulation, screening, upholstering, roofing—1001 professional home fix-it & improvement fastening jobs.



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Our new Rod Saw has no teeth. Instead, it has thousands of permanently bonded tungsten carbide cutting edges.

The rod itself fits any standard 10" hack saw frame. But the similarity ends there. Because the Rod Saw cuts through things a regular hack saw blade won't even scratch.

It cuts through spring steel, hardened bolts, welds and cast iron with ease. And because of the tool design, the cutting edges go all the way around the rod. So it not only cuts straight, but also cuts in any direction on brick, glass, flagstone, ceramics, fiber glass, laminates and other hard-to-cut materials. (And does it faster, because it cuts on both forward and backward strokes).

Originally developed for industry, now packaged for home use, the Remington Rod Saw is available at most hardware stores.

You should not have any trouble recognizing it. Just look for the saw without any teeth.

Remington DU PONT

Made in U. S. A. U. S. Patent 3,023,490. Applications pending. Remington is a trademark of Remington Arms Company, Inc., and DU PONT is a trademark of E. I. du Pont de Nemours & Co. (Inc.)



It all started with the hot-selling Dodge compact van. Big, Tough. And ready. And now, by popular demand, its versatility has been expanded to 20 models. Included are 18 Job-Mated units (like the one shown below), outfitted to handle the needs of just about any trade. And this year you can order your Dodge van with air conditioning, power steering or automatic transmission. Only Dodge offers power steering on compacts. More examples of Dodge being first with the most.

Add to these, two revolutionary new Custom Sportsman wagons: the Executive Suite (above), a traveling office, and the Host Wagon, a basic party and play unit that can be adapted to almost any purpose.

RACK UP ANOTHER FIRST FOR DODGE.

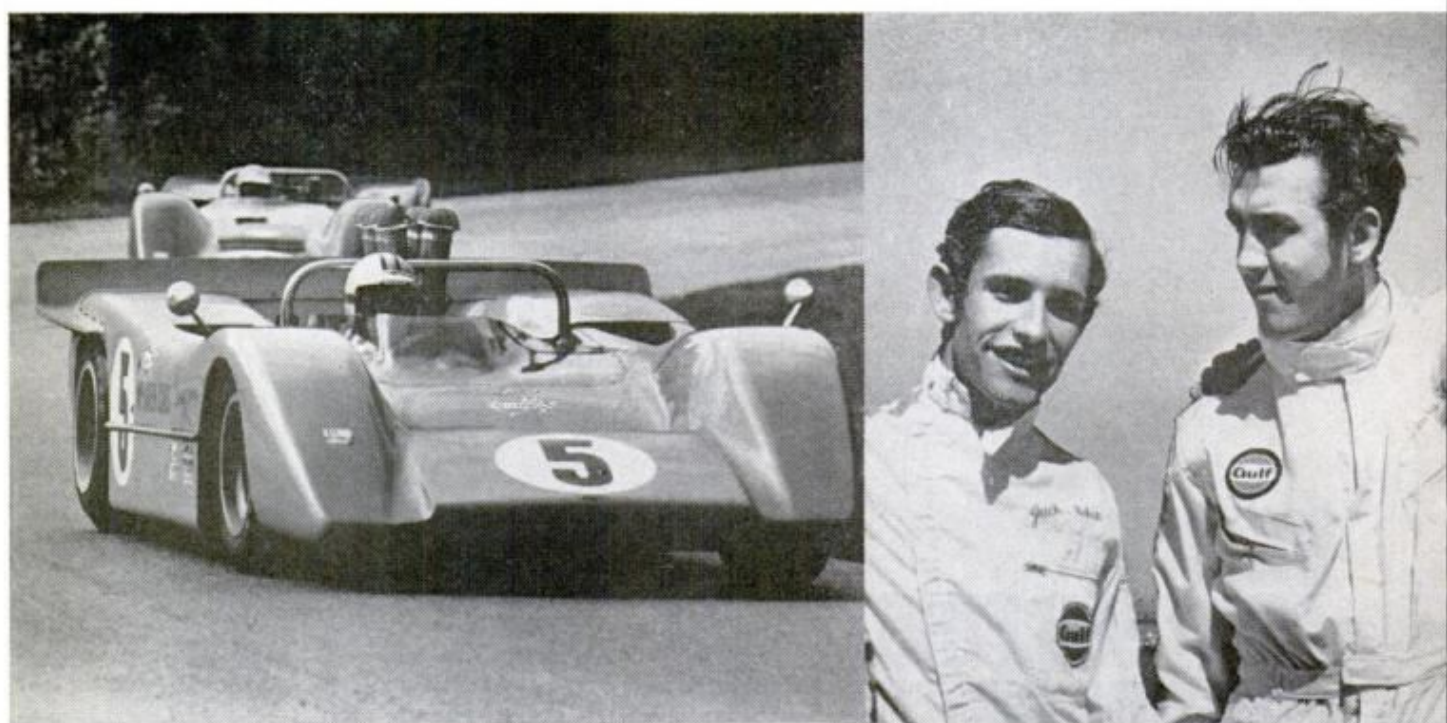
The Custom Van is here, with over two dozen specially installed interiors that meet your business needs. Whether your business is plumbing, heating, air conditioning, appliance repair, dry cleaning or one of dozens more, there's a Job-Mated Dodge Tradesman equipped to make your job easier, more efficient. See the Job-Mated Dodge Tradesman, the hottest idea in trucks since the compact van.

DODGE TRADESMAN PUTS YOUR BUSINESS ON WHEELS

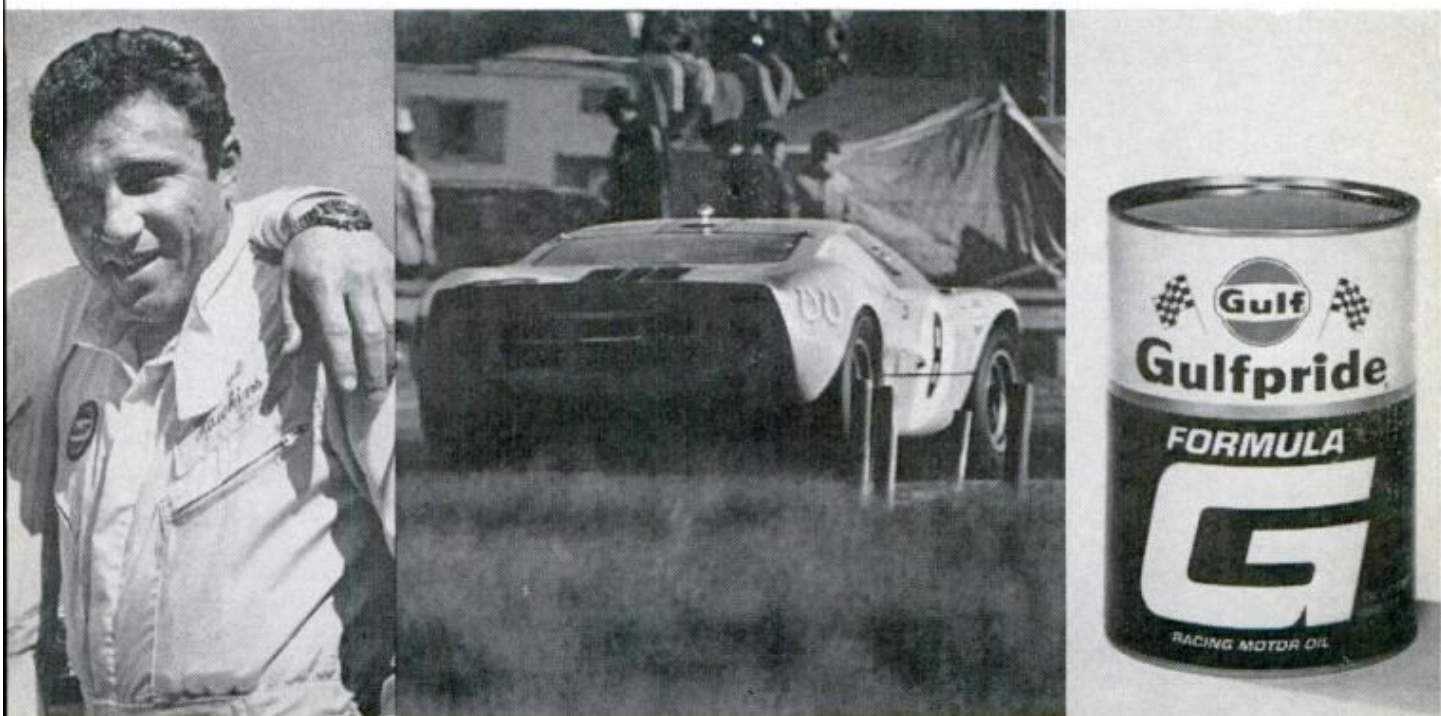


Dodge





Denny, Bruce, Jackie, David,



Paul, Brian...and friend.

A new motor oil, six top racing drivers and some of the world's fastest racing cars.

Those were the basic ingredients in Gulf's program for testing Gulfpride® Formula G.

For over two years, in cars running at least 50% hotter and faster than any passenger car could run, Formula G never once caused a lubrication problem.

Last year it rode with the winners of the World Manufacturer's Championship at Le Mans and the Canadian American Challenge Cup Series.

Now you can get this same oil at any Gulf service station.

You can drive it as hard as you want in the most powerful engine Detroit puts under a hood.

It's the best protection against wear and overheating you can buy.

Ask Hulme, McLaren, Ickx, Hobbs, Hawkins, Redman or your Gulf dealer about it. GULF OIL COMPANY-U.S.





A PACKAGE TRAY is slung beneath the Maverick's dash panel in lieu of standard glove compartment

MAVERICK LINES are graceful, pleasing, somewhat

FORD PICKED the right spot to show this ink-stained wretch its new Maverick—Rancho La Costa, a neo-Miami-to-the-next-power Southern California resort that features unabashed luxury, golf and cholesterol.

In an atmosphere of such Empire-crumbling decadence, it's a chore to keep things in perspective—*any* perspective. Fortunately, Ford brought forth a nifty car but lousy weather.

The Maverick debuted in high winds and a series of driving downpours (Oh, Lord, didn't it rain!), neither of which detracted from what could to prove to be one of the most marketable cars Detroit



REAR-SEAT LEGROOM with front bench all way aft is snug but not uncomfortable. Headroom is adequate



MAVERICK HANDLING, far from sloppy, is not for all-out sporty car buffs. Ride is firm, comfortable

Ford's New Maverick

The first of Detroit's new subcompacts is a trim, stylish little car, but a VW it isn't.

By **BILL KILPATRICK**
Automotive Editor

Photos by Ralph Poole



reminiscent of cars you've seen before

has brought forth in years. In fact, the entire Maverick concept smacks of a skilled, well-executed marketing exercise. The car offers sleek, "upbeat" styling in rational proportions, adequate (albeit "conventional") handling, and power enough to get the job done for all but out-and-out muscle-car enthusiasts.

Be it understood from in front that what the car is *not* is anything remotely like a Volkswagen. The Maverick is bigger, quicker, more expensive. (Ford hadn't announced prices as this is being written—late January. Trade talk, however, pegs them at under \$2000—if only a nickel under—for the Plain Jane, about \$2250-plus

for Fancy Dan.) Nor is it a warmed-over Falcon. Well . . . not *really*. True, the power train, suspension and many of its details and features are Falcon-cum-Mustang, but the packaging is all-new and unique in the domestic car market.

The Maverick, on a wheelbase of 103 in., is 19 in. longer overall than a VW, five in. shorter than a Falcon, and bigger than a breadbox. Overall height is a shade over 52 in., overall width a shade over 70 in. This means any comparisons between it, a VW, or any of the "standard" American compacts is an apples-and-oranges thing; criteria applied to one cannot really be applied to another. Maverick is off by itself in what Ford hopes are greener and lusher pastures.

Standard engine for the Maverick is Ford's tried-and-true 170-cu.-in. Six, the option a 200-cu.-in. Six, both of which have seen extensive service in Falcons, Mustangs and Fairlanes. However, both engines have been revamped for the Maverick, principally via a new, better-breathing head, the result being an increase of five hp. The 170 will now get you 105, the 200, 120. But there's plenty of room under the bonnet for more power; if Ford has done its marketing homework carefully, the kids will be stuffing 289 V8s in the Maverick by the end of the month.

Transmissions include a column-mount-

(Please turn to page 52)

A 10-YEAR TALE

1960 Falcon		1970 Maverick
109.5 in.	wheelbase	103 in.
181.1 in.	length overall	179.3 in.
70 in.	width overall	70.6 in.
54.5 in.	height overall	52.3 in.
33.9 in.	headroom, front	37.6 in.
43.3 in.	legroom, front	41.3 in.
57.1 in.	hiproom, front	53.7 in.
32.8 in.	headroom, rear	36.1 in.
39.4 in.	legroom, rear	31.9 in.
57 in.	hiproom, rear	46.8 in.
144.3 cu. in.	displacement	170 cu. in.
3.5 in.	bore	3.5 in.
2.5 in.	stroke	2.94 in.
90 @ 4200 rpm	horsepower	105 @ 4200 rpm
2320 lbs.	curb weight	2501 lbs.
37.7 ft.	turning diameter	36.3 ft.

WHAT MAKES A



CULTURED MARBLE AND SLATE MANUFACTURING FACILITY THE SUCCESS INVESTMENT FOR YOU



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- \$5,500 working capital
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- Completely stocked opening inventory
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- All internal forms
- Continuing research and development service
- Continuing marketing assistance
- Personnel training program
- Substantial savings through mass purchasing
- A nationally advertised prestige name
- Presold architects and builders
- Continuing raw material sources and services

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NO SPECIFIC EXPERIENCE NECESSARY**

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City..... State..... Zip.....

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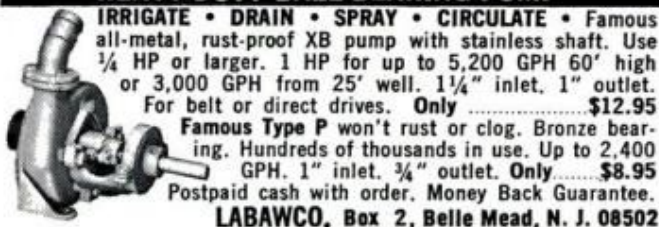
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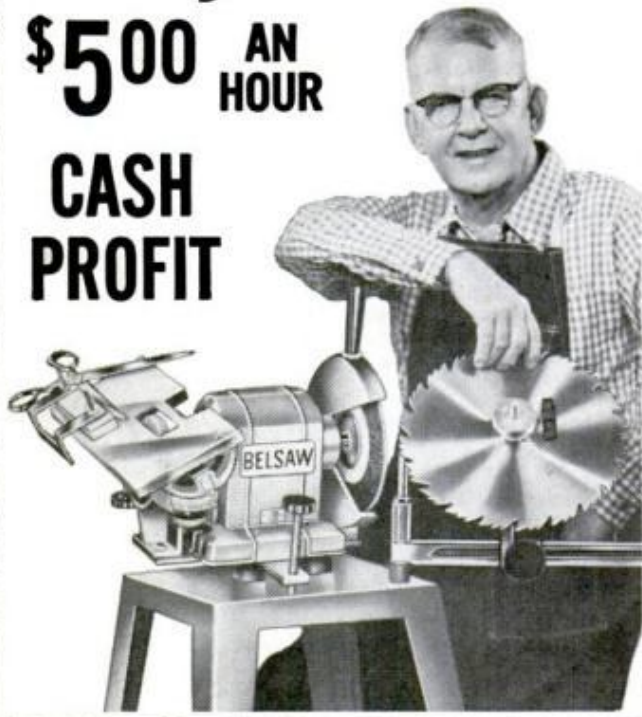
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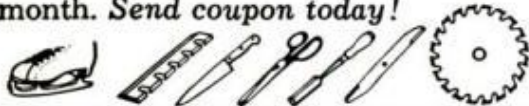
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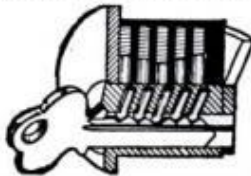
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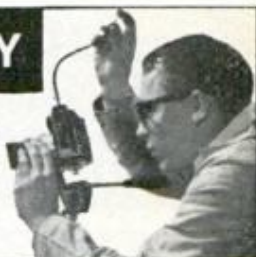


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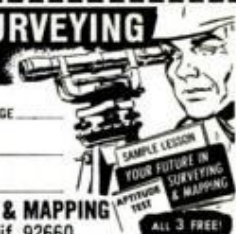
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FORD'S NEW MAVERICK

(Continued from page 43)

ed manual three-speed, a new semiautomatic (you shift, but there's no clutch) and a full automatic. The semi-automatic is available only with the 170 engine.

Curb weight of the minimum Maverick is 2501 lbs., about 325 lbs. less than the Falcon.

So okay, what's it like? It's like a Detroit, that's what it's like. It has better-than-average lines (to me, anyway), comes in pretty, albeit too-cutely-named colors (e.g., Anti-Establish-Mint, Hulla Blue) with "harmonizing" interiors, a surprising amount of trunk space, a package tray rather than a glove compartment, and a lot of bits and pieces you've seen before and—as long as cost accounting holds sway in the Motor City—will see again.

Driving the Maverick is both a pleasure and a mild disappointment. I say "disappointment" because there's always the hope—when a new car is introduced—the boys will come up with something really new. Different, at least.

I would have liked, for example, to see the Maverick take the four-wheel independent suspension plunge. I would have liked a new engine . . . say, a little four-banger that moved things off the dime with dash and elan, that squeezed out 30 or more mpg (Ford claims about 22 mpg for the 170-engine version). I would have liked to see a more thought-out panel design, less of a "We've got these in stock so let's use 'em" look, a look that plainly says a penny saved is a penny earned (comforting to the stockholders perhaps, but disquieting in an age of moon orbits).

Ford says it has \$100 million riding on the Maverick and I guess what I'm trying to say is that for that kind of money I wish they had started off with a clean sheet of paper.

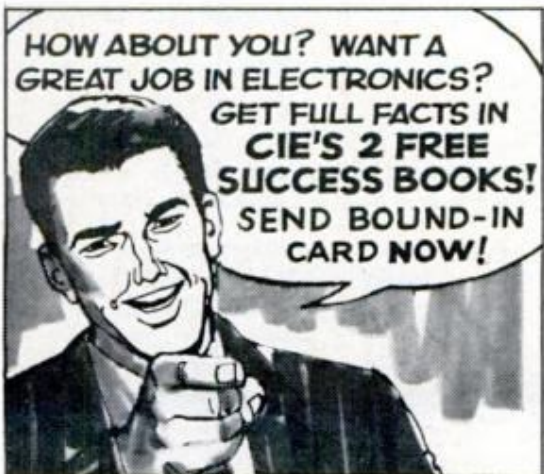
The pleasure derived from driving the Maverick stems from its ordinariness. It's like old shoes—comfortable, dependable, predictable. Acceleration snaps no necks, understeer is apple pie, hard cornering shoots the rear end out, panic braking burns rubber and covers ground. Manual steering (no power now—maybe later) is light enough for Dear Heart to horse the Maverick around in its 36.3-ft. turning diameter, meaning it can be parked in a space somewhat shorter than dockside.

Perhaps what tells the story of the new Maverick better than anything is something I have an idea wasn't supposed to be noticed. On the ignition keys of the Maverick I drove were two dog-eared, somewhat tacky manila tags. Written on both of them was "1970 Falcon." ★★★

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Chevy's Blazer: A DIFFERENT FOUR-WHEEL DRIVE

Chevrolet's entering the 4x4 market with a contender surprisingly roomy and rugged

By V. LEE OERTLE

THEY CALL IT THE BLAZER. It's Chevrolet's entry into the four-wheel-drive market. It's designed to compete with the Ford Bronco, International Scout and the Jeep. It certainly belongs in that general category. But to say that the new Blazer is "just another 4x4" is altogether wrong. True, this stubby-looking, square-shouldered, all-wheel-drive car resembles a cut-down, squeezed-up Chevy Longhorn pickup. Yet, your first ride scuttles any fears about the Blazer being some weird crossbreed between pickup and 4x4.

Right away, you notice that Blazer is a bigger 4x4 than its older competitors. Dimensions prove it. When I measured the wheelbase, I found it was 104 inches—or a full foot longer than Ford's Bronco.

Interior layout of instruments is functional and attractive. It's neither garish with bright trim, nor so Spartan-bare that class buyers will be offended. Seats are very comfortable, and the driving position feels natural. The broad windshield offers excellent vision.

The prototype Blazer was equipped with a Turbo Hydra-Matic transmission with a column-mounted selector lever. On the floor there is a single-shift lever to control the front-drive transfer case. The cockpit combines efficiency and simplicity.

Our testing ground was the construction site of the new Ontario Motor Speedway, an Indianapolis-type supertrack 40 miles east of Los Angeles. The rain-flooded plain, huge mountains of soil for the grandstands and sandy grape vineyards provided a rugged obstacle course to shake down the Blazer.

Our test vehicle was equipped with the

optional 255-hp, 350-cu.-in. V8 engine, so we had no opportunity to check out the standard 155-hp, 250-cu.-in., six-cylinder engine.

The Turbo Hydra-Matic transmission proved to be a smooth, no-slip, fast unit whether the tires start on pavement or on dirt. The driver can select two-wheel or four-wheel drive with one quick motion. Pull the single floor-shift lever to the desired position, set the automatic in Drive, and away you go.

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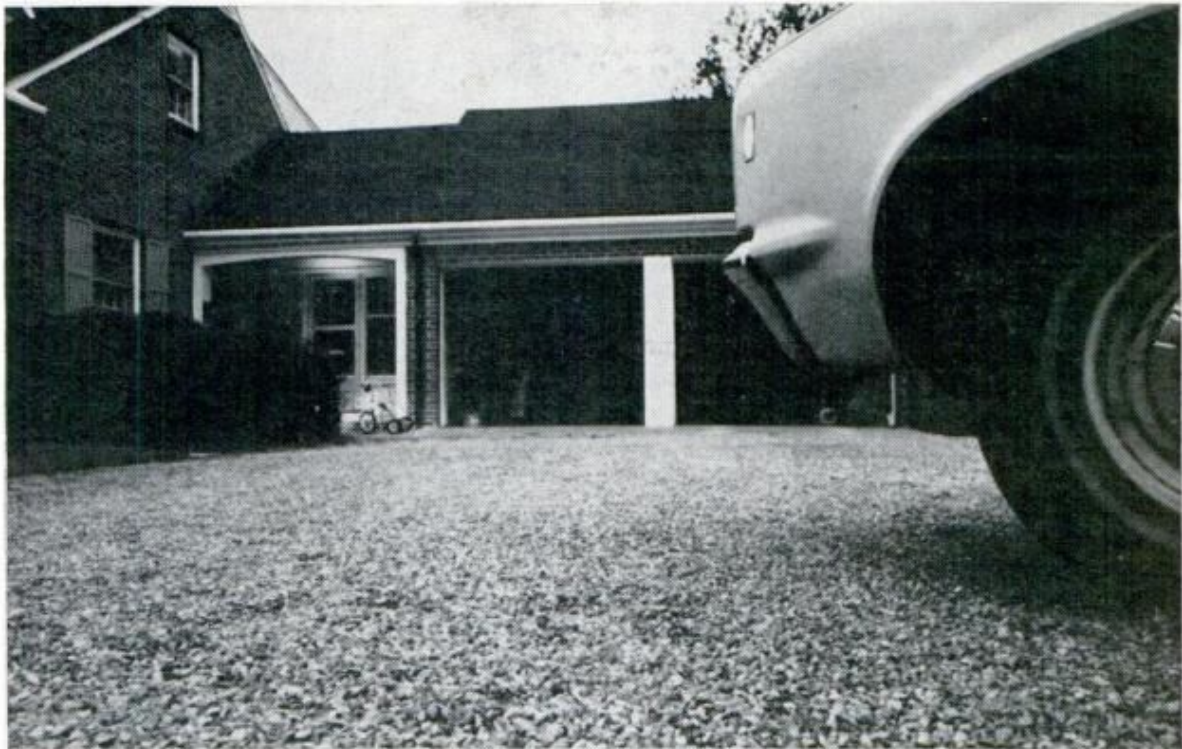
Acceleration is brisk, starting off with a low gear that feels more like raw muscle than speed. Second gear is much better, hurling the Blazer up the scale with a comfortable rush of torque. I got the distinct feeling that with a small trailer in tow, or with a load of six big hunters and their gear, the 255-hp would still come on strong.

I found that Blazer goes quickly from [\(Please turn to page 58\)](#)

BLAZER'S four-wheel-drive capacity is evident in photo showing mud thrown back from front wheels



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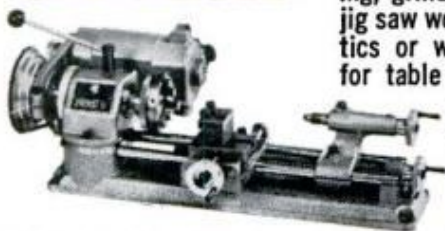
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AN OPTIONAL HARDTOP (left) is available for Blazer. There's a three-engine choice (center)—the 155-hp Six, standard; the optional 200-hp V8 and 255-hp V8. More seats can go in 70-in. Blazer "bed" (right)

CHEVROLET'S BLAZER

(Continued from page 56)

50 to 65. Healthy passing reserve and a surprisingly responsive pedal impressed me. Some of the bugaboos of 4x4 vehicles were almost entirely missing, such as excessive gear-whine, unusual wind noise and an annoying awareness of violent mechanical activity underfoot.

Another surprise was the lack of jarring road vibrations up through that small, slightly oval steering wheel. Steering was simply effortless, even on rough terrain. On one road with deep sand, I cut a dozen tight "S" curves and could have rested one arm behind my back. The steering doesn't tire you, nor does it fight back.

Time after time, I kicked the Blazer up to 45, then abruptly began weaving across the hard-packed and slippery gravel of the Speedway parking lot. Sharp lefts and rights started a gradual skid at that speed, but in every instance the skid-recovery was excellent after steering-wheel corrections. Cornering control is superb at high speeds. It comes around almost square, and even though the steering ratio is quick and positive, I noticed no tendency toward oversteer on fast, slippery surfaces.

The prototype Blazers were equipped with sintered metal brake linings which quickly collected dust and began pulling to right or left. One of the engineers present assured me that production models would have a different brake, probably with organic linings. Certainly, there is enough lining area for the 3700-pound vehicle without worrying about brake fade. I asked about a disc-brake option and was told that within a year disc brakes might be optional on the Blazer.

I got mixed reactions while checking general comfort. Over paved highways, the ride was comparable to any modern pickup truck, regardless of wheelbase. But on rough trails, I got tossed around violently. After several deliberate attempts to find the cause, I traced it to the foam

bench seat in my test Blazer. Any buyer with plans to hit wilderness areas regularly should consider a *harder* seat, with less spring to it.

However, where seat *comfort* is concerned, it's good. I liked it. There is plenty of leg, hip and elbow room. Doors are glassless, of course, unless the buyer orders the optional hardtop kit.

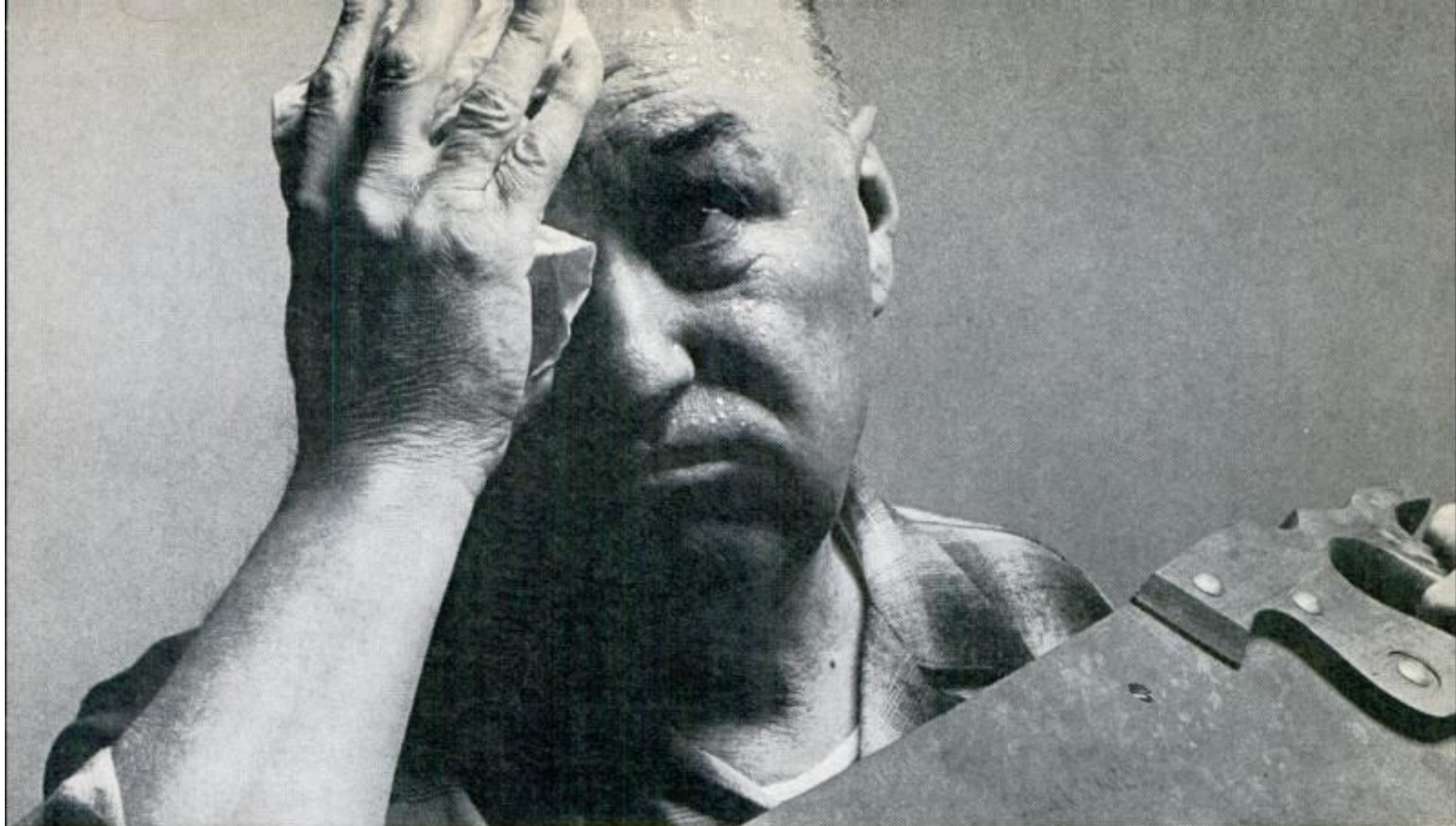
It is quite true that there is considerable difference between a full-sized pickup truck and the average sporty 4x4 vehicle. It's between these two that Blazer will probably camp. And the market may well prove to be large and strong in that quarter.

The Blazer has more load space, more interior room, yet most of the advantages of sport-type 4x4 vehicles. The last hurdle is whether or not the extra long (for this class) wheelbase of Blazer proves a drawback in wilderness travel. Short-wheelbase vehicles can skip over hump-backed ridges without thumping the frame. They can sneak down through a dry wash or gully and come out again without snagging front or rear bumpers. Approach and departure angles on short-wheelbase vehicles gives them considerable maneuverability which is perhaps their primary advantage in off-road situations.

Blazer has an approach angle of 35.2° as against Bronco's 40.6°. Using 7.35-15 tires Blazer has a departure angle of 25°, while Bronco has one of 27.2°. These are factors that hard-eyed four-wheelers will study.

Inside the pickup, the Blazer has roughly 70 inches from back of seat to tailgate, while the Bronco has about 47 inches. Is the Blazer's less maneuverable wheelbase and overall length balanced by a larger load space and, perhaps, more comfortable passenger ride? Obviously, Chevrolet thinks so.

I'm now convinced, after thinking it out, that the Blazer is *not* "just a smaller pickup truck." It looks to me like a clever compromise with the best of both worlds: space and maneuverability. ★ ★ ★



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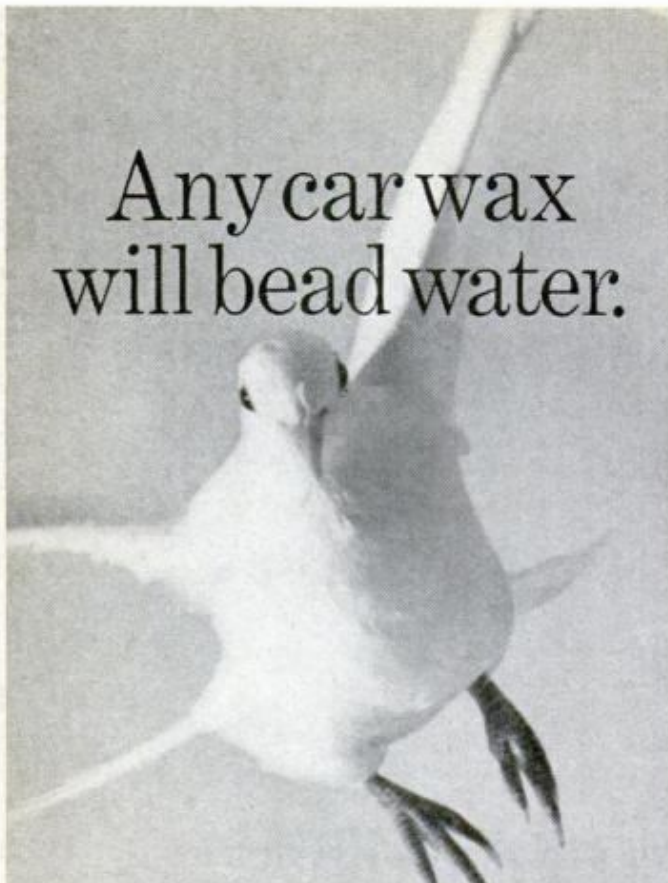
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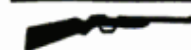
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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Muzzled Mustang

Do you know of any reason why my 1968 Ford Mustang should falter when picking up from a dead stop? New wiring, plugs and gas filter haven't helped. Neither have timing and carburetor adjustments.—David Ballard, Jerseyville, Ill.

It sounds to me as if your Mustang ended up with one of the carburetors with faulty primary circuits. The carb doesn't allow a full flow of fuel to the engine on takeoff. Have your dealer replace the carburetor with a new one under the terms of your warranty.

Distributor dilemma

I can't keep distributor breaker points in my 1966 Rambler. I have had three sets installed by my local gas station in six months. Each has pitted badly. Do you know of any reason why this should happen?—Mel Winters, Portland, Me.

Other than the "normal" reasons, such as a bad condenser, misaligned contacts and a bad resistor—all of which I would assume you've had checked—there's one other. The rubbing block of replacement contact points will wear prematurely if it isn't lubricated or if it is lubricated with the wrong lubricant. A worn rubbing block throws point alignment out of whack, causing fast failure. Each contact point set distributed through Rambler service departments contains a tube of cam lube. If it's not available, use any other good-quality distributor cam lubricant. Apply a thin film to the distributor cam before installing a new point set. But be sure that film is thin. If too much lube is used, it will be thrown from the distributor cam onto the contact points, causing excessive arcing and burning.

How's that grab you?

I've got a tough problem with the positraction rear end of my 1966 Buick Riviera. It grabs something fierce on starts. It's so bad that it feels as if a rear wheel is coming off. When GM discovered the grabbing trouble in 1966 and put out a hurry-up service bulletin and new lubricant, I got the rear end changed. In fact, it has been flushed and the grease changed

several times. It's getting worse. Please help.—James D. Ross, North Syracuse, N.Y.

I don't believe the flushing method used on your car has been effective. If all the old lubricant hasn't been drained, it can cause the clutches inside the rear end to grab. The surest way to get out the old grease is to drain the lubricant now in the rear end and install automatic transmission fluid—a great cleaner that cuts and dissolves rear-end lubricant.

Okay, mount the car on a lift or horses and run it up. Then, drain the transmission fluid and install the grease recommended for your positraction rear. If this doesn't work, the clutches in the rear are shot and you'll have to overhaul the unit.

Crazy gauges

Sometimes while I'm driving along in my 1965 Mercury Montclair the oil pressure, fuel and temperature gauges all suddenly swing to their top points. Can you tell me where and what to look for?—Stanley O. Walk, Coopersburg, Pa.

Where? Underneath the dash!

What for? A voltage regulator that's shorting out!

What to do? Replace it!

Irregular pulse

My 1965 Oldsmobile has a brake problem. I get an annoying pulsating feeling when I apply the brake. New brake shoes have been installed and drums resurfaced. The front end has been aligned, new tires put on and the wheels balanced.—John Burba, Chicago.

Apparently, you have omitted an important procedure. Did you have the brake shoes burnished to the drums to make them the same in roundness? If not, a mismatched configuration could give you this pulse. The procedure has to be done at a brake specialist's shop.

Check the choke

Why is my 1968 Plymouth with 318-cu.-in. engine so hard to start when it's cold? I've asked my mechanic, but he keeps
(Please turn to page 84)



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AUTOMOBILE CLINIC

(Continued from page 82)

telling me to get a tune-up. I didn't mind the first time, but when that failed to solve the problem I decided a tune-up isn't the answer. What is?—Tony Silver, Miami.

It seems rather evident that the problem is the choke. Indeed, the original choke adjustment of Plymouths and Dodges with 273 and 318-cu.-in. engines was found by Chrysler Corp. to be the wrong one. So, remove the choke unit from the intake manifold, loosen the locking nut, and reset the choke index from two notches rich—that's where it's probably set now—to the center calibration line. That's the longest line on the wheel.

Up the 'creak'

I have a 1968 Camaro that's been "creaking" at the rubber mounting of the rear springs since I bought the car. The dealer has lubricated the mountings from time to time, but his best was to stop the noise for 12 hours. Can you do better?—Dr. G. R. Collins, Vermillion, S.D.

I'll try, but you'll have to replace those mountings with new ones. Make sure the man who does the job installs them dry. Once these mountings get oil, grease or any lubricant on them, they start to squeak.

Bursting a bubble

Can I get rid of a bubble in the vinyl top of my 1966 Rambler?—Frank Curtis, St. Louis.

Sure. Pierce the bubble with an ordinary stick pin to expel the air, then heat the area for 10 to 15 seconds with a 250-watt reflector infrared heat lamp held 3 to 5 inches from the surface. This will reactivate the adhesive. Immediately, press and hold the vinyl firmly with a piece of felt padding until the area cools. Don't rub the vinyl, and be sure to apply heat only for the recommended time and at the recommended distance to prevent damaging the vinyl.

Shock treatment

I'm getting tired of replacing worn-

out tires on my 1966 Pontiac. The dealer tells me that front end alignment and wheel balance are perfect. So why do I get uneven tire wear? By the way, the car shimmies at 65 mph.—S. F. Kuiack, Toronto, Ont.

Have the shock absorbers ever been tested? That's one good reason. Another possibility is bad or poorly adjusted front-wheel bearings.

Black gold problem

What causes oil to collect on the engine of my 1965 Oldsmobile F-85, especially around the distributor housing?—David Arlen, Massapequa, N.Y.

If it's more than the normal film of oil and dirt that collects on any engine, it could be a ruptured gasket on the ends of the push-rod cover plate beneath the intake manifold. This will cost about \$20 to replace, but make sure the man knows how to do the job or you'll be back where you are now. He shouldn't use sealer on this gasket—it will cause the gasket to crumble. The gasket should be dipped in oil before being installed. You won't lose enough oil to warrant this repair, but it will keep things cleaner.

Service Tips

● **1969 Corvette owners:** Better check the upper radiator hoses if your car is powered by a 427-cu.-in. engine. The hose could be in contact with the alternator pulley, which will eventually ruin the hose. Loosen the hose clamp at the radiator end of the hose and rotate the hose away from the alternator to provide a clearance of about one inch.

● **New Rambler owners** who find the front seat a bit too low can remedy the situation. There's a front-seat height kit at your Rambler dealer which will give you a boost by shimming up the seat. This shim kit carries part No. 4487152.

● **Thank Oldsmobile** for this tip: Most commercial car washes have a spray wax service. When the wax remains on the windshield, it leaves a residue that smears the glass when the windshield wiper blades are used. Plain water won't wash it off. Use a household cleanser containing chlorine or ammonia. ★★

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



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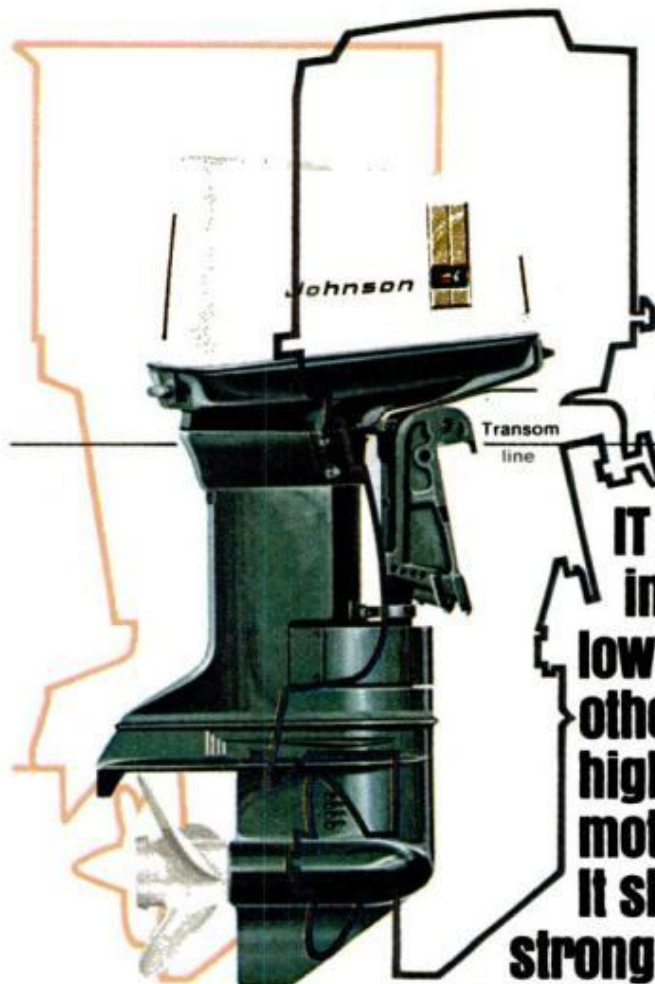
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Tricky plaster patch

A plaster break has me stumped. It's in a corner where the ceiling and two walls meet, the opening being a little over half-foot size. There seems to be no backing; the patching falls out as fast as I apply it. Should I hire a pro or is there some simple trick for this sort of thing?—R.N., N.M.

I know of no sleight-of-hand method, but I once patched a similar opening with a fold of paper, some heavy thread and lots of patience. This opening, similar to the one you describe, was apparently caused by a blow from some heavy object which broke the wood lath.

Inexperienced at that time, I tried several procedures without success. Then I hit on the idea of wrapping several thicknesses of heavy paper around a card strip cut wide enough to cover the opening with some to spare. I bent this to a right angle and needled two short lengths of thread through the paper and cardboard near the center of each flap. With the thread I held the improvised backing in place while I built up the plaster patch to a depth slightly less than that of the original. I let this set, clipped the threads, troweled on a finish coat and then smoothed the surface with sandpaper thumbtacked to a small block. So far as I know, that patch is still there.

Unwinding lipped door

I have a grandfather's clock with a lipped access door so warped it can't be closed easily. The door is in one piece, without glass, and has two hinges and a lock. I want to preserve the original, but how can I get rid of the warp?—G.M., Va.

By "warp" you mean the "wind" or twist; that is, if you remove the door and lay it on a flat surface, it will rock when touched on alternate high corners. To eliminate it, run saw kerfs diagonally across the back of the door from low corner to low corner. Space kerfs $\frac{1}{2}$ to $\frac{3}{4}$ in. apart for a width of 3 to 4 in., depending on the door's size and width. If you have no table saw, try to enlist the help of a friend who has one. You'll have to improvise a guide and then space the cuts by moving the ripping fence after each pass. Ordinarily, the cuts should be run to a depth

of $\frac{3}{4}$ in. or slightly less than the door thickness. As a rule, such cuts will relieve the stresses that produced the warp.

Lay the door on a flat surface, weight it down and rip thin strips that will just drop into the kerfs without wedging. Glue these into the strips and let the glue dry thoroughly. Then trim and sand the strips flush. You can color them to match the old wood by rubbing them with a combination of artists' oil colors.

Landlord cold, tenant warm

I have steam heat in a two-family home. Last winter my second-floor tenant was screaming about being roasted alive while I was freezing (well, maybe not, but I was uncomfortable). What's wrong and what can I do before next winter?—B.E., Minn.

This reverses the usual complaint. What's wrong? Frankly, I don't know off-hand. Pinpointing the cause requires that the system be checked at close range. I'll guess that you require installation of a zoning valve for more uniform heat distribution, but you should call a competent local serviceman. He's in a better position to examine the system and tell you precisely what's wrong.

Everbearings don't everbear

I planted everbearing strawberries a year ago on a "mound" or "tower." I got one crop this spring but there are no signs of a second. The plants don't look too healthy to me, but I'm no green thumb. I keep them watered regularly and pull out all invading weeds and grasses. What might be wrong?—C.O., Ala.

Perhaps you're a bit too anxious and the plants are holding out on you also, I'm not sure what you mean by "mound" and "tower." First, are you sure you have true everbearing plants? If so, there could be other causes for their lack of cooperation. By this time in your locality you should have a second "set" of blossoms. But if berry production doesn't follow, the causes could be lack of proper soil—strawberries generally like a loose, airy loam—a lack of soil fertility, improper or inadequate watering, insufficient sunlight or improper planting. Strawberry plants should be set at proper depth—with the crown, or bud, above the surface and the root spread a little, but entirely below the surface.

If you check these possibilities, the chances are you will isolate a cause. However, you may be expecting just too much of your plants too soon. Give them a little more time. ★★★

**New automatic transmission.
Easy key start.
Ten smooth-handling horses.**

**This new Sears Craftsman® Rider Mower
is guaranteed to make your lot happier.**



Mowing's a real kick when you're on the Craftsman StrongMower Rider. It's Sears Model No. 9671.

The new Craftsman StrongMower Rider has so many features your neighbors' eyes will turn as green as your grass when they see you tooling it across the lawn.

It cuts a big 36-inch swath. Zips through an acre of grass in an hour.

And the StrongMower Rider has an automatic transmission. You go forward, backward or change speeds, by just moving a lever. Another lever lets you adjust cutting height from the comfort of the padded seat.

There's even headlights and a taillight. For mowing at dusk. Or throwing snow at night (with the optional snow thrower attachment).

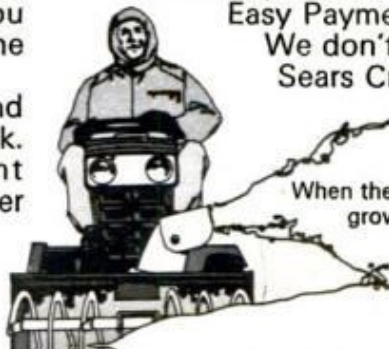
APRIL 1969

Come winter or summer, your StrongMower Rider will start quick and sure. Because its engine and ignition system are made for reliability. And Sears, Roebuck and Co. guarantees* the StrongMower from its parts to its performance.

Sears has riders with cutting widths from 24 to 36 inches, has 5, 6, 7 and 10 hp models. You can pick the one you want for

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Easy Payment Plan.**

**We don't say the
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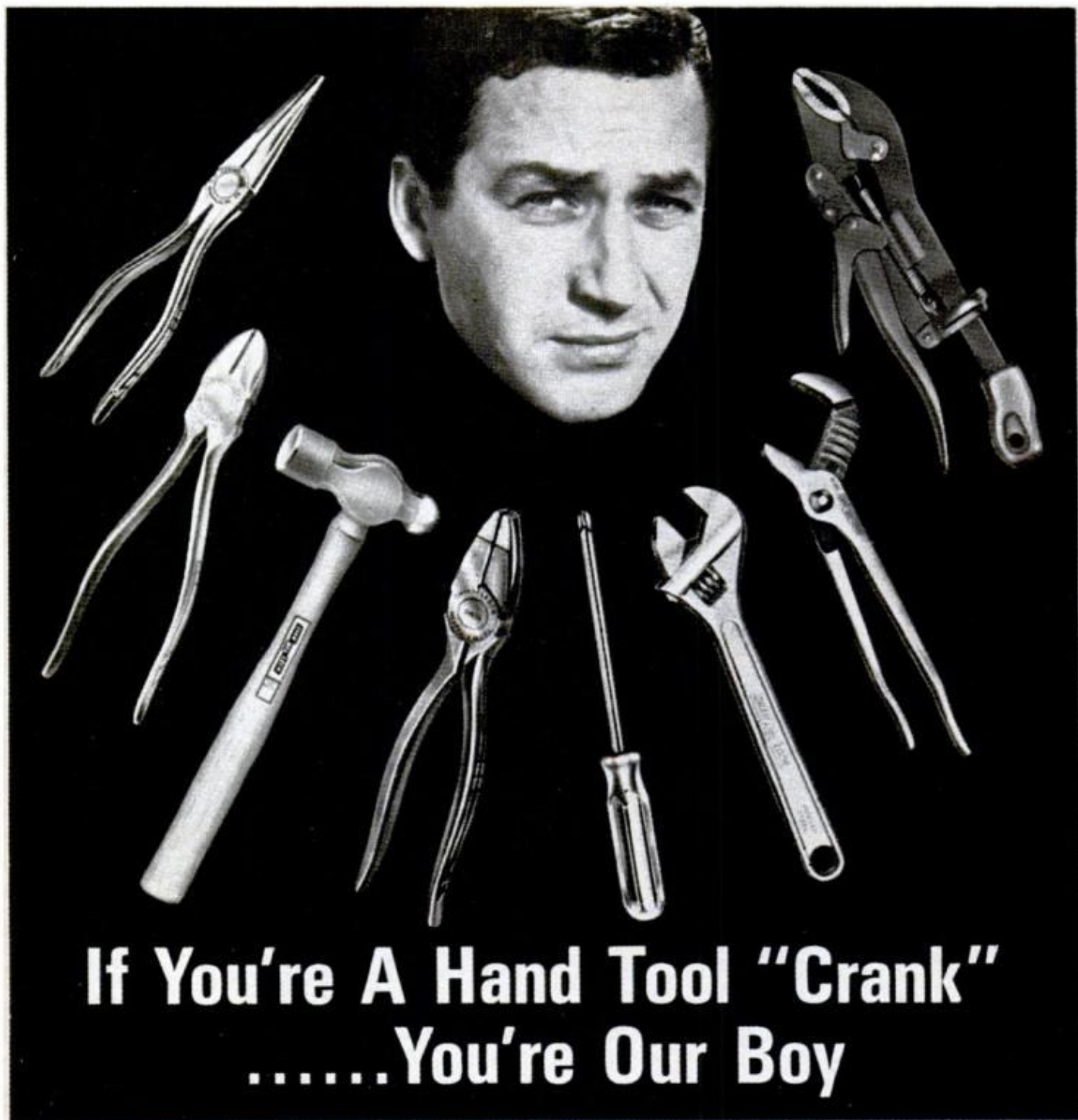
When the grass stops growing, the snow needs throwing.

Riders beat never having to mow. But they're by far the next best thing.

*Craftsman Mowers are guaranteed for one full year from date of sale. If repairs or repair parts are required for proper performance, they will be furnished at no cost. Normal maintenance tuneups, blade sharpening, cleaning, and failures which are a result of abuse are not included in this coverage.

For riding mowers with battery—if battery proves defective and will not hold a charge, in exchange for the battery, Sears will: During first 90 days, replace battery at no charge. After 90 days, replace battery, charging 1/12 of price of new battery for each full month from date of sale.

Sears



If You're A Hand Tool "Crank"You're Our Boy

Definition of a hand tool "Crank": a good mechanic — professional or otherwise — who knows good tools and won't tolerate any other kind.

Definition of Channellock: hand tools designed and made specifically for hand tool "Cranks." Fine polished, highest quality drop-forged steel, precision machined, smooth working moving

parts, hand honed cutting edges . . . just a few of the distinguishing Channellock features that not only *satisfy* but *please* hand tool "Cranks." Next time you buy hand tools, be a "Crank" — specify Channellock (look for the trademark on the handle) . . . You'll be glad you did. Let us send you our catalog, no charge.

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CHAN NEL LOCK[®]

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the way a boat *should* perform. Fishing, skiing, cruising—you'll get your kind of safe family fun.

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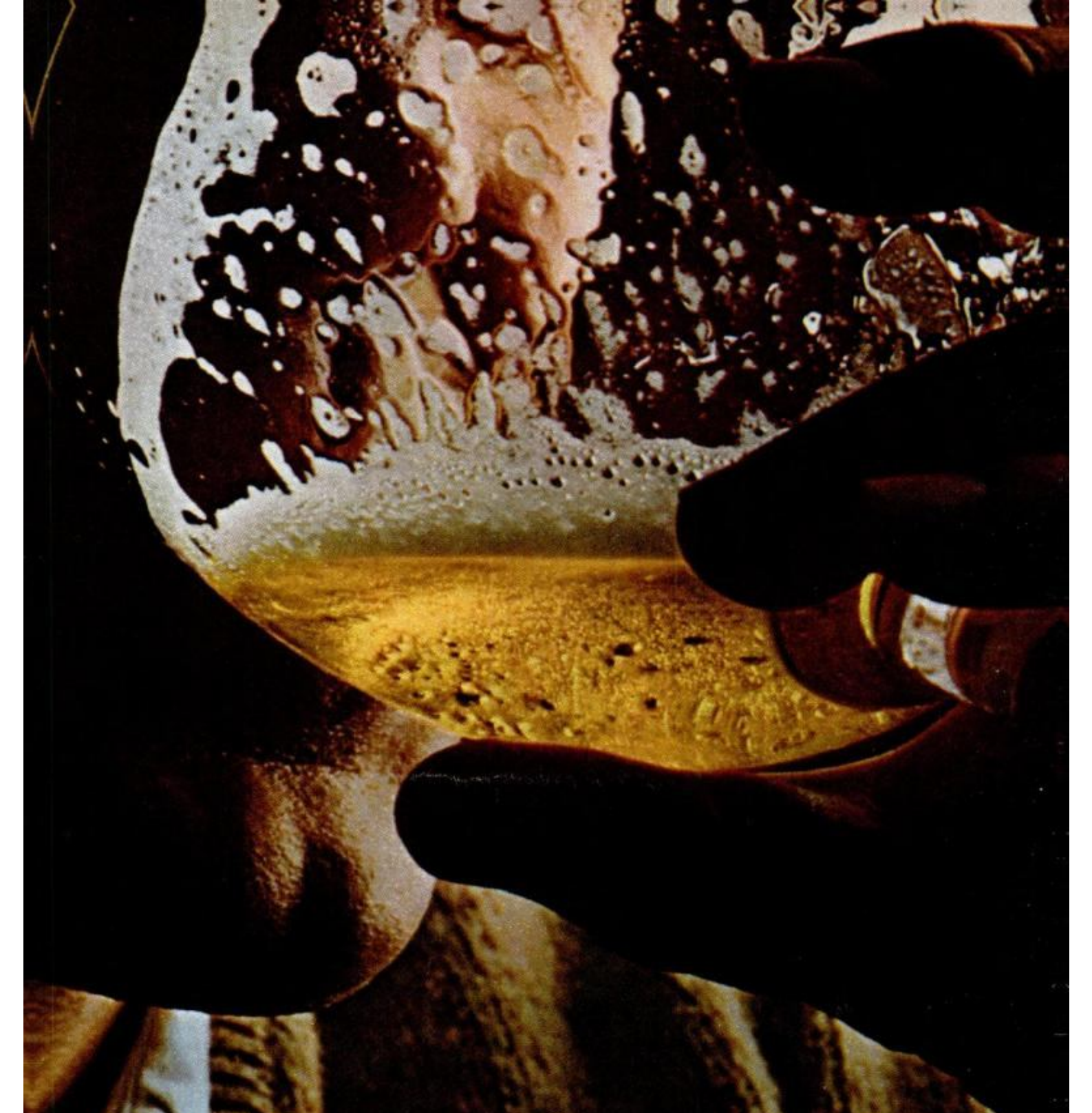
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DRIVER TRAINING: DOES IT REALLY DO ANY GOOD?

By JOSEPH N. BELL

Driver education is a sacred cow. Parents demand it in the schools. Safety organizations praise it. Insurance companies reward it—with reduced rates. But now the California Motor Vehicle Dept. and a distinguished safety expert at the University of California say that *driver training grads have as many accidents as untrained drivers!*

IF YOU'RE UNDER 20, chances are about 50-50 you've had some sort of formalized driver training in school. If you're over 20, you are likely paying out tax money to support driver education. Either way, it has probably never occurred to you to ask a crucial question about this growing program: *Does it work?* Does all this time and money make students better drivers or cut down on traffic accidents?

Some responsible voices now insist that "driver ed." has been oversold. It doesn't cut down on accidents, they say, and even if it increases some driving skills, it probably isn't worth the money.

Critics of the program cite cases—like the one in which a 17-year-old boy, speeding away from a turnpike accident in which he had been involved, fled down an exit ramp at high speed. Unable to stop, he rammed a car waiting at a traffic light and drove it into cross traffic, causing a third accident. The boy had recently completed a driver training course. Supporters of driver ed. say this proves nothing. Others say it proves that driver training isn't the cure-all it's thought to be.

The most recent—and potent—critic



DRIVER EDUCATION TEACHER diagrams proper turns for high school class. Public schools provide a full semester course with a minimum of 30 hours of classroom instruction and six hours of driving per student

is the 1968 winner of the Metropolitan Life Award of Honor for research in accident prevention, a professor of medical psychology at the University of California at Irvine, named Frederic McGuire. With associate Ronald Kersh, Dr. McGuire studied driver ed.—on and off—for seven years and finally concluded that “high-school driver education is a striking example of investing large sums of money in a program of unknown value. It has been taken for granted that driver education results in

‘ . . . high-school driver education is a striking example of investing large sums of money in a program of unknown value . . . ’

lowered accident rates. Our studies rather clearly indicate that formal driver training and driver education *has no cause-and-effect relationship to accident frequency, violation frequency or accident severity.*”

McGuire hit a nerve. Driver education is fast joining baseball, motherhood and the pledge of allegiance as a hallowed American institution. It has

been supported aggressively by insurance companies (who give you lower rates if you’ve had driver ed.), equipment manufacturers, safety officials and the National Education Assn. In the Highway Safety Act of 1966, the Congress of the United States told the various states to shape up their driver education programs or lose a portion of their federal highway aid. American taxpayers will lay out some \$150 million this year—and an estimated \$1.3 billion over the next five years—so their children can be taught to drive in public schools.

Is this money being spent foolishly? Is the teacher who sits in the stands of a Houston speedway radioing instructions to student drivers on the track below wasting his time? Are the TV cameras that transmit live traffic scenes from downtown Miami to DE classrooms little more than technical gimmicks? Are the increasingly complex driving simulators in which students can experience almost every conceivable type of driving situation just expensive playthings?

Yes, say a growing number of critics, *if it is presumed that they cut down traffic accidents.* And these critics sup-



DRIVING SIMULATORS and realistic simulator films are widely used as teaching tools. Critics of the program say that such sophisticated equipment wastes taxpayers' money because training doesn't cut accident rate

port their stand with some impressive figures—while shooting down the statistics long used to make the case for the effectiveness of driver ed.

About 10 years ago, the motor vehicle records of 30 states were searched by computers to compare the traffic violation and accident frequency records of those who took a course in driver training and those who didn't. In most states, driver ed. graduates had significantly fewer accidents and violations. The American Automobile Assn. and the National Education Assn. pulled all these figures together, cast them in concrete and decided forevermore that driver ed. was a major factor in preventing slaughter on the highways.

As a result of these and similar studies, the National Conference on Driver Education recommended a full semester course of at least 30 hours of classroom instruction and six hours of actual driving per student. Today, "30 and 6" is considered the basic minimum, and about three-fourths of the 18,000 public schools now offering driver ed.—and employing some 35,000 part or full-time DE teachers—either reach or exceed the 30 and 6 standard. Costs vary widely, ranging from \$6 per pupil

in Rhode Island to \$100 per pupil in New York. The national average is about \$50 per pupil per year. All states supply some sort of financial support to local DE programs, some directly from traffic fines, others through fees or taxes on licenses and car registrations or by appropriation from state general funds.

So what are you getting for this 50 bucks per year? If you're a student you may be getting some skill training of possible value. But the taxpayer who

' . . . the taxpayer who thinks he's buying highway safety with his investment in driver training is kidding himself . . . '

thinks he's buying highway safety with his investment in driver training, says Dr. McGuire, is kidding himself. Or being kidded.

McGuire compares driver ed. today with the old story about the naked emperor whose subjects saw him fully clothed because they had been conditioned that way. Or with the use of yellow Mae Wests during World War II



FORMER HOUSTON SPEEDWAY serves as a driving course in experiment to find better ways of teaching. Instructors talk to students with mike via cars' FM radios. This frees five teachers for actual traffic work

simply because lifejackets had always been yellow. Scientists working in the field of vision, says McGuire (who was one of them), could have determined quite easily that red offered considerably more visibility in choppy waters than yellow, which disappeared in strong light. But they weren't asked. So this information wasn't turned up until some basic night vision studies were done about 1950. And only after numerous demonstrations in the open sea did the military agree to the change. No one knows how many lost pilots might have been spotted had researchers been turned loose early in World War II to find out what color offered maximum visibility for men bobbing about in the ocean.

Critics say that's where driver ed. is today, rolling on under its own impetus, unchallenged and based to a large extent—at least in public support—on phony premises. "Each year," says McGuire, "we plunge more money and

more people into a program whose validity is proven mostly by 'common sense' and the intuition of its practitioners, an incredible state of affairs in a technocratic society."

McGuire isn't alone in making these charges. For example: Last year, Daniel Moynihan, appointed by HEW Secretary John Gardner to look into various aspects of traffic safety, said: "The present state of knowledge as to the effectiveness of driver education provides no certainty and much doubt that the return on this enormous prospective effort will be commensurate with the investment. A broad and systematic inquiry is needed into the general question of how driving behavior is acquired."

An investigation by Prof. David Klein of Michigan State University concluded that "with very few exceptions, the research attempting to assess driver education is the very shabbiest in the field, largely because it is done

Where Does Your State Stand?

State	Eligible Students	Students Participating	Per- cent
Ala.	61,302	8,459	4
Alaska..	3,939	241	6
Ariz.	30,249	13,017	43
Ark.	NOT REPORTED		
Calif. ...	311,899	231,306	74
Colo.	35,116	20,927	60
Conn.	35,000	16,390	47
Del.	8,588	7,196	84
D.C.	4,387	3,251	74
Fla.	89,260	71,734	80
Ga.	78,152	24,881	32
Hawaii..	10,756	3,758	35
Idaho....	14,829	14,533	98
Ill.	161,267	138,786	86
Ind.	77,560	55,600	72
Iowa....	54,047	54,047	100
Kans.	40,019	33,823	85
Ky.	46,880	12,202	26
La.	66,566	44,401	67
Me.	15,853	10,527	66
Md.	57,142	45,426	79
Mass.	69,426	27,133	39
Mich.	152,510	152,510	100
Minn. ...	50,392	36,008	72
Miss.	40,814	20,759	51
Mo.	68,960	39,424	57
Mont. ...	13,703	9,262	68
Nebr. ...	23,985	18,124	76
Nev.	7,483	4,095	55
N.H.	10,611	5,414	51
N.J.	85,470	54,520	64
N.M.	20,203	14,153	70
N.Y.	192,000	152,880	80
N.C.	99,331	99,331	100
N.D.	10,938	6,121	56
Ohio....	171,540	91,100	53
Okla. ...	38,428	28,043	73
Ore.	39,500	20,659	52
Pa.	170,547	99,680	58
R.I.	14,381	385	3
S.C.	46,211	10,466	23
S.D.	12,940	8,658	67
Tenn. ...	66,417	16,111	24
Tex.	193,195	70,200	36
Utah....	21,455	19,889	93
Vt.	6,668	6,156	92
Va.	72,152	33,620	47
Wash. ...	59,283	52,000	88
W.Va. ...	36,676	7,556	21
Wis.	74,799	66,689	89
Wyo.	5,977	3,953	66
TOTALS	3,078,806	1,985,404	65

by untrained investigators who are usually proponents of driver education."

A 1965 study by the California Motor Vehicle Dept. raised "serious questions about the general effectiveness of statewide driver training in reducing accidents."

The report contains this significant statement: "After considering all the facts available from this study, the authors can find no evidence that on a statewide basis behind-the-wheel driver training is effective in reducing the frequency of accidents."

These and similar reports were buried in the sands of public approval for driver ed. A Los Angeles survey, for example, showed driver ed. to be 10 times more costly per pupil than the regular classes in city schools. Yet, 86 percent of voters with school-age children favored continuing the program despite the cost.

In this climate, the treatment accorded Norman S. Thomas, a statistician for the Boston Edison Co., was fairly typical. Thomas was intrigued by the "shabby" research supporting driver ed. and decided, for his own amusement, to compare the claim frequency of all drivers under 25 with driver ed. graduates. Thomas assumed that fewer claims would be filed as the percentage of trained drivers increased, but this didn't happen. When he tried to show his data to public officials and insurance companies, he got "don't call us, we'll call you" answers from all of them. They never called, and Thomas has decided that "driver education is a super-sacred cow."

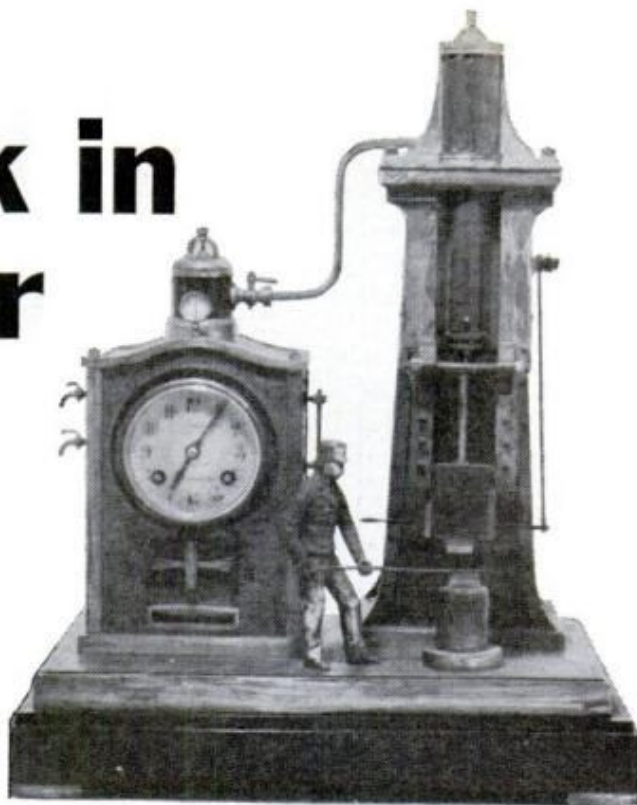
One of the main reasons that McGuire's dissent has been so much more effective is that, early in the game, he tackled the figures which driver ed. supporters have long used—and found them highly inaccurate.

McGuire and Kersh matched 158 driver ed. graduates (from a random list of 2800) with an untrained group in the state of Mississippi. Then, using

(Please turn to page 208)

The Clock in The Boiler Strikes Two!

AUTOMATION began with a clock! At least, that's the claim of Mr. Barny (he's listed that way in the phone book!), operator of a New York clock museum. Most of his prize displays—clocks made to look and act like forges, boilers, windmills and railroad engines—were created in France around the turn of the century. Why? "People are fascinated by moving parts."

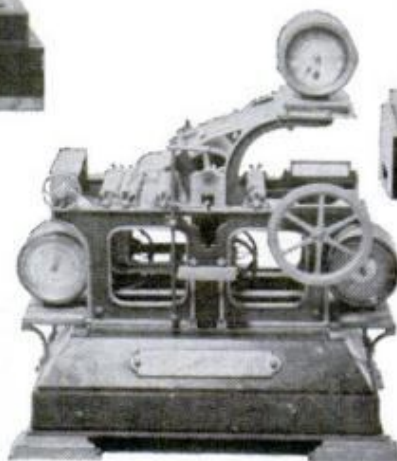


FORGE OPERATOR moves the hammer up and down, counterbalancing pendulum

ANOTHER FORCE, and another way to counterbalance



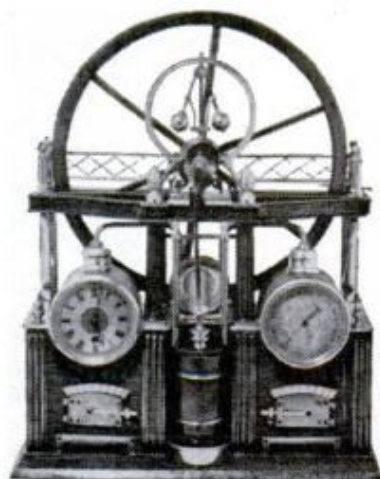
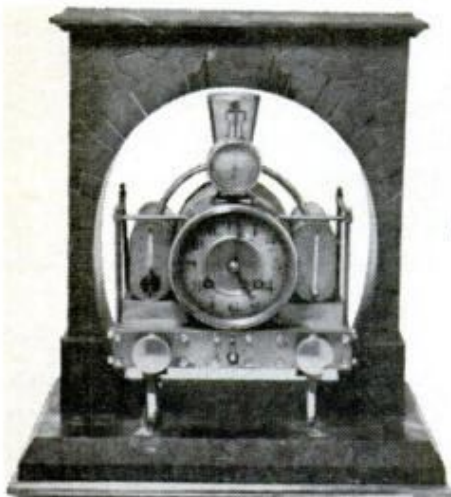
WALKING BEAM. As beam moves up and down, it controls rate of clock



PRINTING PRESS has a moving flywheel, drum and rollers

POWER STATION flywheel revolves as piston moves up, down

RAILROAD ENGINE is made to appear coming through tunnel



POPULAR MECHANICS



MR. BARNY amidst the tick-tick-tick of his clocks—clocks—clocks in his unique museum in New York City

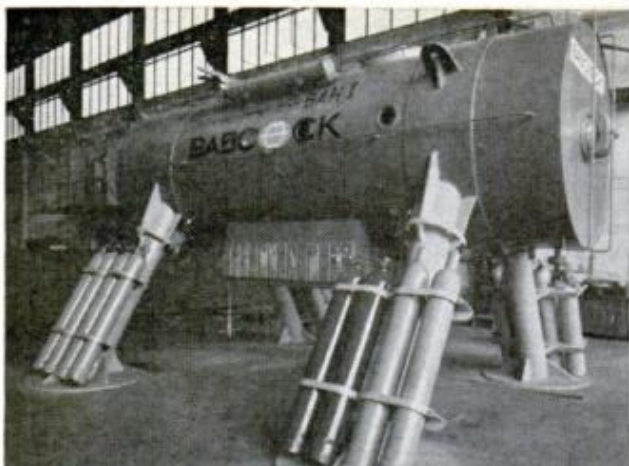
LARGE WHEELS of railroad engine revolve as piston moves in and out



WINDMILL vane revolves as clock ticks off time

TORPEDO PROPELLERS revolve





West Germans build undersea station for research

An underwater station was recently tested in West Germany by the Biological Institution of Helgoland. The station is pictured (above, left) at the Deutsche Babcock & Wilcox factory and (right) being lowered to a depth of nearly 40 feet. During the test, a crew manned the station for 12 days. Future crews will carry out undersea biological research.



DC-10 passes the taste test

Airline stewardesses were able to serve meals to 250 passengers in 69 minutes aboard a mock-up of the McDonnell Douglas DC-10. Two elevators lifted the food carts from a preparation center on a lower deck. The DC-10 will fly short to medium-range routes in the 1970s.



Aid for rescuers

An emergency respirator that operates like a bellows can be used by rescuers to pump air into a victim's lungs while they're awaiting medical help. The device, the Res-Q-Aire, has a special fitting for the mouth and a nose clamp to keep incoming air from escaping. The Crescent Co., Port Richey, Fla., is the manufacturer.



Dog trainer with ideas

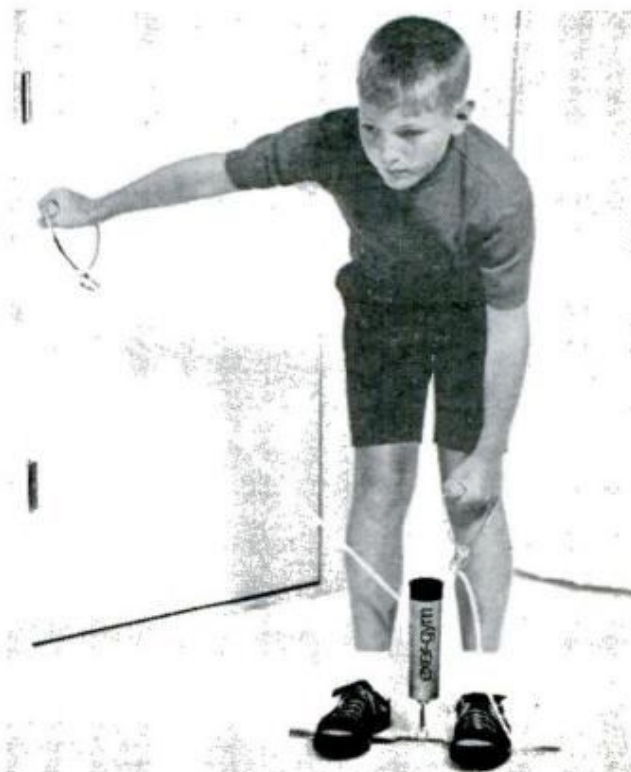
Calvin Anderson of Louisburg, Kans., has come up with a couple of ingenious solutions to problems he faces as a dog trainer. To escape the task of loading 25 bird dogs, water and birds onto his truck every day, he built a mobile kennel (above) that he uses during training season. With the 60-foot rig, he can take the dogs anywhere. He's also found that 50-gallon steel barrels on posts (right) make excellent, all-season housing for dogs.



Exchange 38-24-36

The next best thing to videophone is this new gadget which looks like no other phone. The technical equipment is standard pay phone—coin slots, dial, coin return and the like—and the shape is standard female with a coating of psychedelic art. It's marketed by a Milwaukee firm, where they've named it (what else?) the "Call Girl."

APRIL 1969



Lightweight gymnasium

By turning a dial on the aluminum canister (between the young man's ankles), the user of the Exer-Gym can vary the resistance on the nylon rope from 2 to 400 pounds. Thus, anyone can match to amount of rope "pull" to his own physical requirements. Held by a bar (shown), stirrups or hung at various heights, it offers over 60 different exercises.

101

PM OWNERS REPORT
PONTIAC GRAND PRIX

A Nationwide Survey Based on
575,000 Owner-Driven Miles



**GRAND
PRIX
OWNERS:**

Gassed on Styling, Aghast at Economy!

By **BILL KILPATRICK**, Auto Editor / Photos by Irving Dolin

A LADY advertising director (That should be *directress*, shouldn't it?) from Pennsylvania comes right out *blam! blam!* in stating her reasons for first admiring and then buying Pontiac's new Grand Prix:

"Look," she says, "it gets a lot of attention. It's a sexy-looking car, great

for the image and ego. What did you expect?"

It's such candor that restores one's faith in the Republic; as long as at least a few of Detroit's customers can keep things in focus this way, there's hope for us all. Telling it like it is would keep us from going overboard like



OWNERS HAD HIGH PRAISE for Grand Prix's new styling, ranking it the No. 1 reason for buying the car



NEW "SURROUND" COCKPIT won owner kudos, most reporting controls accessible, instruments readable

an Illinois steelworker who said of his Grand Prix, "It's a work of art."

Somewhere between the lady's frankness and the gentleman's euphoria is what presumably motivated most people to buy the car. A succinct and perhaps universal explanation was offered by a South Carolina chemical plant executive: "It was the car one would keep going back to look at."

As the industry's only all-new car in '69, it figures the Grand Prix's styling would be the principal trigger of the buying impulse. Over 68 percent of those responding to PM's survey said they were attracted by the car's looks, period. That they also got what they feel is excellent handling (over 57 percent), comfort (27.2), a good ride (22.8), performance (21) and power (19.1) is extra.

But in between these posies are such thorns as poor gas mileage (22.8 percent), complaints about wind noise (13.4) and the usual beefs about sloppy workmanship (12.1).

A Connecticut physician thinks eight



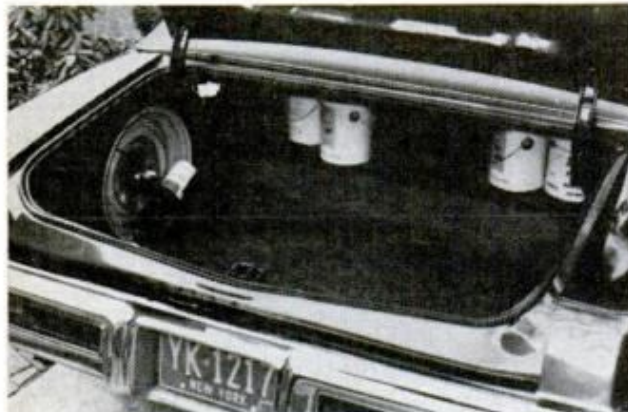
HANDLING was second on Grand Prix owners' praise list. Car is surprisingly agile for its weight, size



OWNERS REPORT Grand Prix as easy to control, even in hard cornering. Body lean is not excessive



INWARD CURVE of rocker panel styling is catchall for dirt, road debris tossed up by both front tires



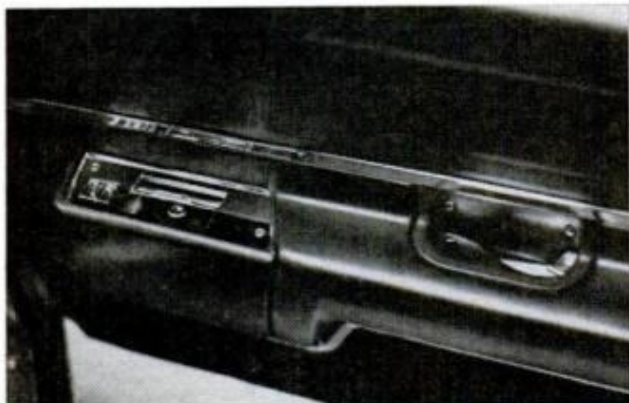
SEVERAL OWNERS said they were less than satisfied with the space available in the Grand Prix's trunk

mpg in local driving is cutting it a bit thin. The 10 mpg he claims he gets on trips doesn't exactly have him in rapture, either. True, he has the 4-bbl. 428, but still. . . . The same eight-and-ten were reported by an Ohio plant manager. However, his Grand Prix has only the 400-cu.-in. engine.

► **Both cases call for a little adjustment somewhere. Even the doctor's go-kart ought to be a bit more miserly.**

A New Jersey attorney says his main

DOOR HANDLE WELL was called dirt-catcher by some owners. Car offers ample armrests, built-in ashtray



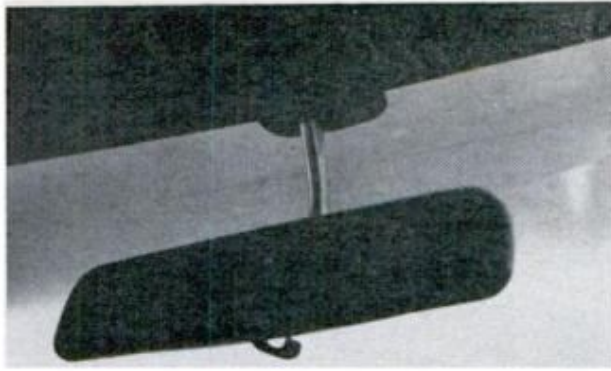
DRIVER COMFORT ranked high on list of owner likes, many terming car most comfortable they've owned

complaint about his Grand Prix is that he gets wind whistles at both windows. "This can drive a guy nuts," he reports. A South Carolina security guard says that if the wind noise could be eliminated, his car would be perfect.

"Poorest workmanship of any new car I've ever purchased," says an Ohio toolroom superintendent. "Doors and hood not properly mated," reports a California flight engineer, who adds, "Too bad it wasn't put together the

SPRING-LOADED exterior door handle earned several owner compliments. A few find it balky, hard to use





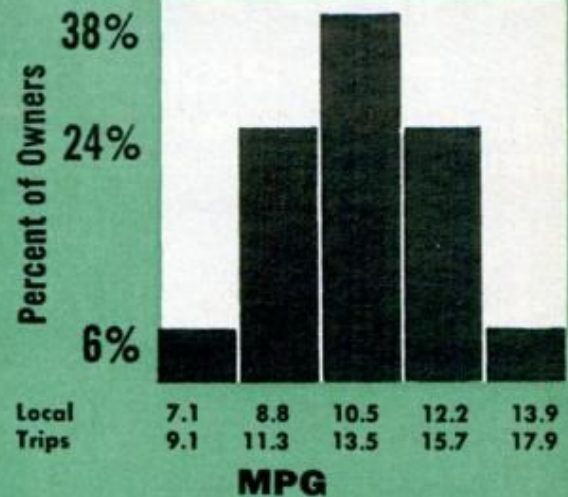
WINDSHIELD ANTENNA got mixed reviews. Some reported distortion and static when wipers are on

way it was supposed to be." Another California engineer says that workmanship is "not equal to the car's price."

An Ohio architect reports he has difficulty seeing out the back of his Grand Prix when backing up. In fact, many owners commented on what they felt was poor visibility, particularly to the rear. Still other complaints were about stingy dimensions. Says a Wisconsin executive, "I can't carry much more than a clean shirt and an eight-iron in that trunk." A New Jersey housewife asks, "Why don't they call that back seat a grocery bag rack? Surely it isn't for people." And then there's the six-

GRAND PRIX FUEL MILEAGE CHART

400-cu.-in. V8 (10.5:1 compression)



foot-four Ohio accountant who keeps banging his head getting in and out.

► **Monday morning quarterbacks, all. Doesn't anyone try before he buys?**

Despite the seemingly unavoidable drawbacks of mass production—the dents, dings, knicks, assembly goofs and so on—the consensus of Grand Prix owners indicates most feel they've bought themselves a fine car.

It's just possible they're right. ★ ★ ★

Summary of 1969 Pontiac Grand Prix Owners Reports*

Total miles driven: 576,439

Average miles per gallon:
 400-cu.-in. V8 (10.5:1 compression ratio)
 local driving 10.5
 long trips 13.5
 428-cu.-in. V8, local driving 10.7
 long trips 13.8
 400-cu.-in. V8 (8.6:1 compression ratio) n.a.

Specific likes:
 Style 68.5%
 Handling 57.4
 Comfort 27.2
 Ride 22.8
 Performance 21.0
 Power 19.1
 Roadability 5.6

Specific dislikes:
 Gas mileage 22.8%
 Wind noise 13.4
 Workmanship 12.1
 Trunk room 8.7
 Rear visibility 8.7
 Legroom 8.7
 Headroom 8.1

What changes would you like?
 Carburetor 16.2%
 Bigger trunk 11.8
 Rear visibility 10.3

Size of car 9.1
 More headroom 8.1

Engine:
 400-cu.-in. V8 (8.6:1 compression ratio) ... 2.5%
 400-cu.-in. V8 (10.5:1 compression ratio) .63.7
 428-cu.-in. V8 33.7

Transmission:
 Automatic 96.9%
 3-speed manual 2.5
 4-speed manual 0.6

Had any mechanical trouble?
 No 54.4%
 Yes 45.6

What kind of trouble?
 Cold start 10.8%
 Heat riser 9.2
 Brakes 9.2
 Window action 7.7
 Fuel pump 7.7
 Carburetor 7.7
 Airconditioner 7.7

Dealer repair satisfactory?
 Yes 57.4%
 No 39.7

Why the Grand Prix?
 Styling 67.4%

Past experience 23.8
 Reputation 8.1
 Performance 6.4
 Handling 5.8

Is the Grand Prix your only car?
 No 65.7%
 Yes 34.3

Other cars owned:
 Pontiac 28.3%
 Chevrolet 28.3
 Ford 13.3
 Volkswagen 8.9
 Buick 7.1
 Plymouth 7.1
 Cadillac 6.2

What options/accessories?
 Power steering and brakes . 95.9%
 Airconditioning 57.5
 Radio 41.2
 Power windows 36.1
 Vinyl top 20.0
 Tinted glass 17.5
 Disc brakes 11.9
 Deluxe steering wheel 10.6
 Stereo-tape 9.4
 Power seats 4.1

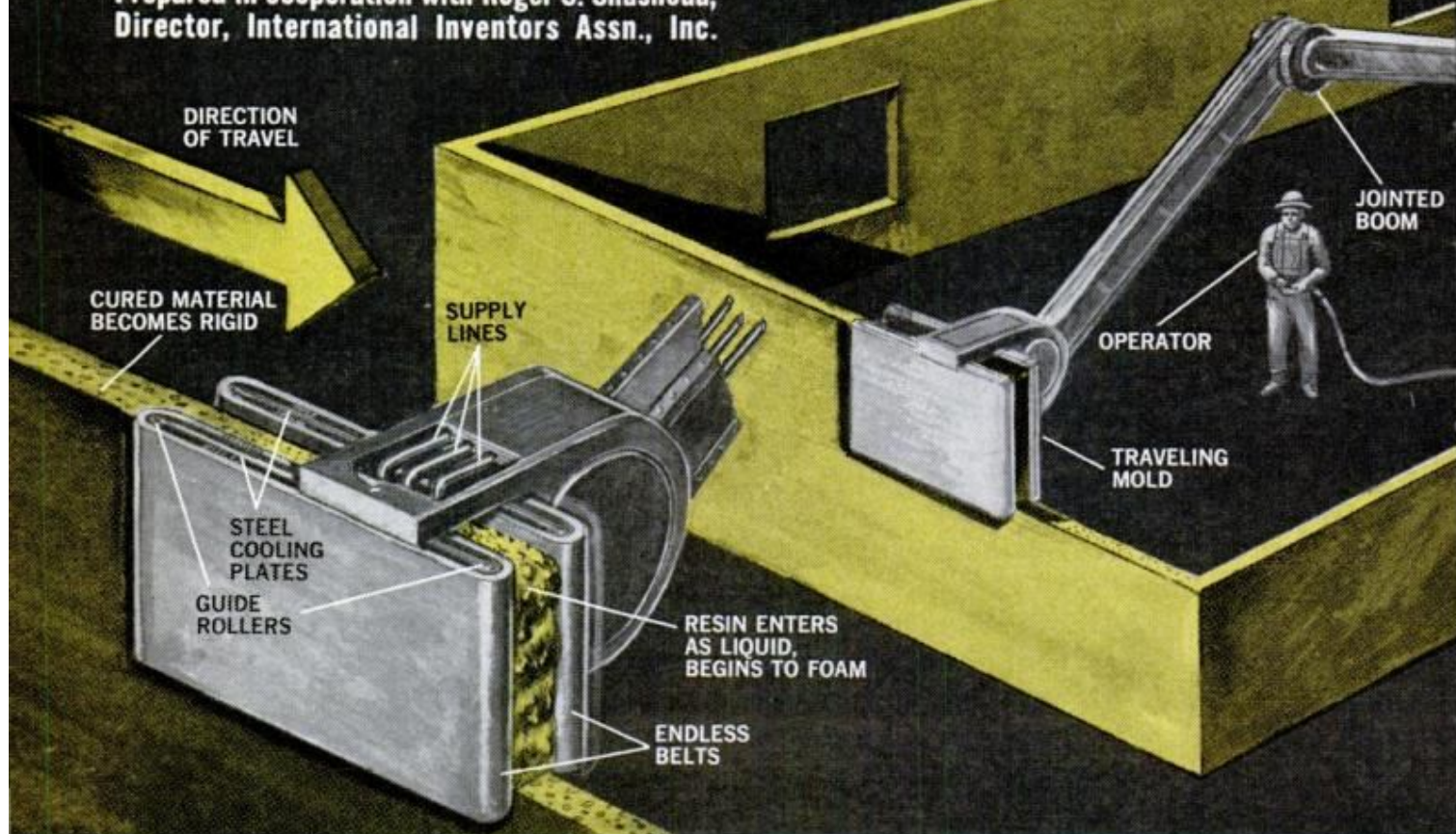
Age distribution of owners:
 15-29 21.6%
 30-49 49.7
 50 plus 28.7

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

Just patented

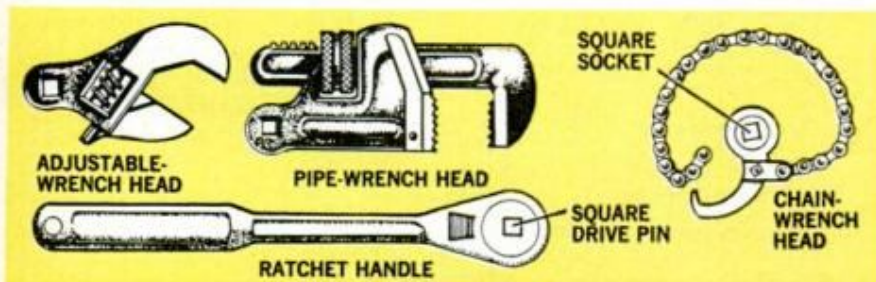
PM'S PICK OF THE NEW INVENTIONS

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



1. BUILDINGS "GROW" MAGICALLY right before your eyes in this new foam-in-place method for forming walls and roofs. A truck-mounted boom carries liquid epoxy resin and a foaming agent to a traveling mold at the end. As the two chemicals mix in the mold, the epoxy starts to foam, forming a thick

cellular slab. Cooling plates in the mold cure the resin almost instantly as the mold moves along, leaving a smooth, hard surface. The mold keeps rolling along, adding one strip after another until the building is completed. The foam is strong, light, fireproof and provides its own insulation

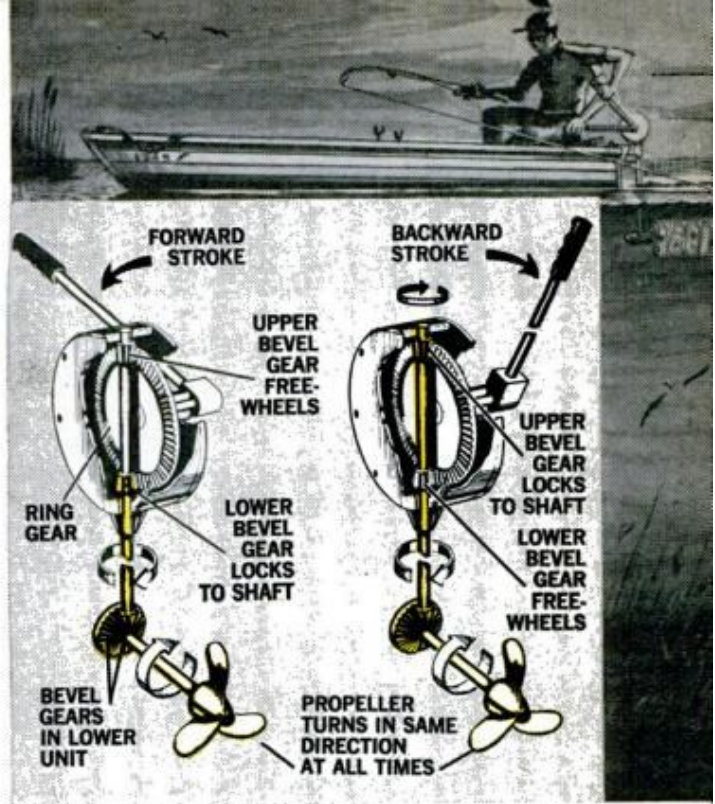
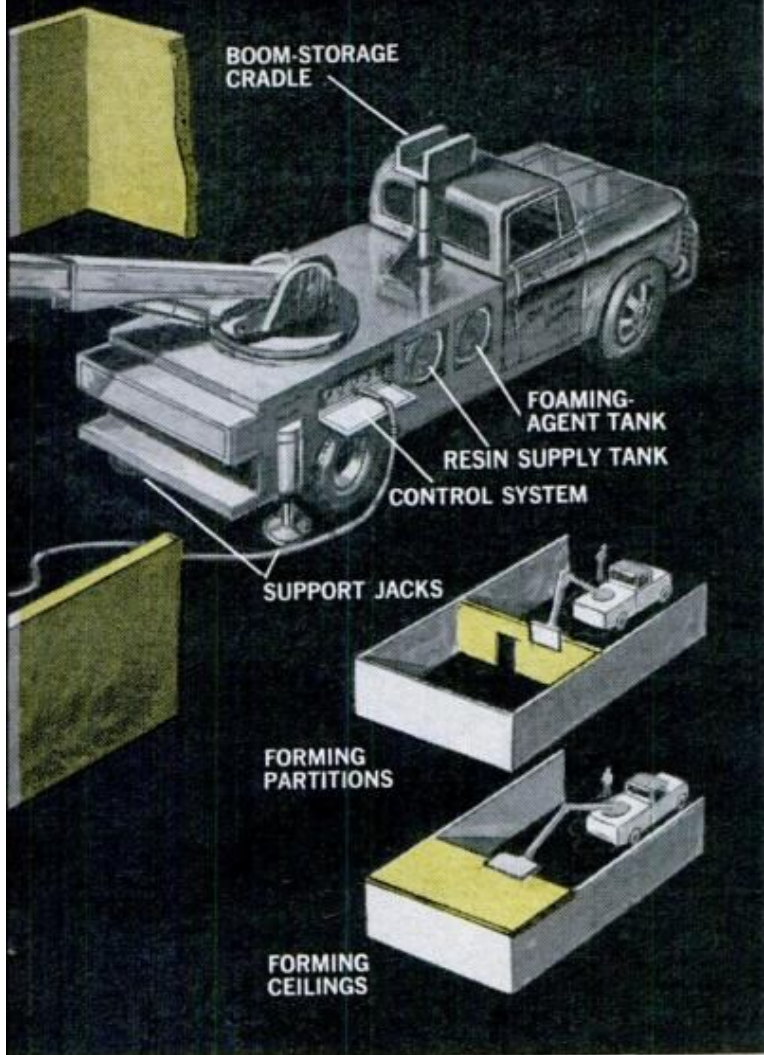


2. INTERCHANGEABLE HEADS

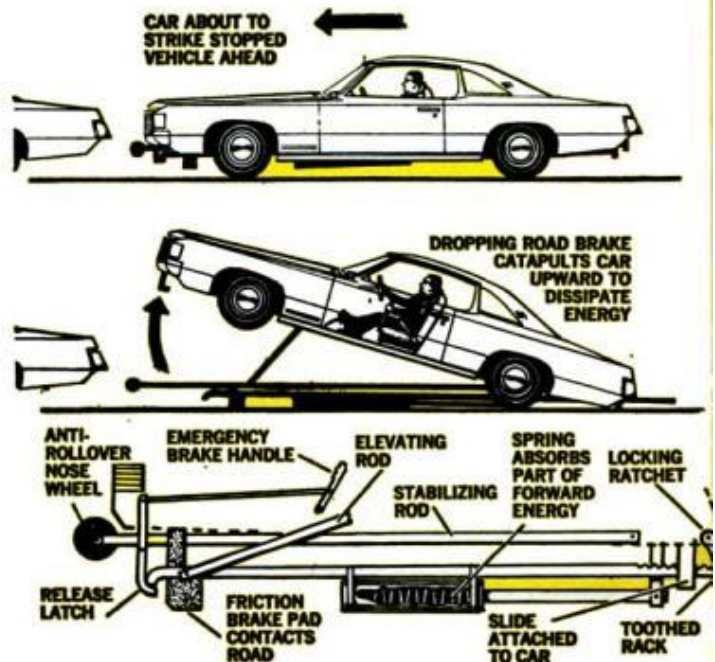
give you a choice of many different kinds of wrenches without taking up much space in a toolbox. Each head has a square socket hole in the end and is designed to snap onto a standard ratchet handle—the kind used with wrench sockets. By carrying only one handle, you can thus have a pipe wrench, monkey wrench, adjustable-end wrench, chain wrench and socket wrench all rolled into one. The ratchet action also speeds up the work of turning a head and makes for easier maneuvering in cramped quarters by allowing you to swing the handle out of the way of obstructions

Inventors of the items shown on these pages are as follows: 1. Midwest Applied Science Corp., 1205 Kent Ave., West Lafayette, Ind.; 2. J. M. Ashley, 136 Lakeshore Dr.,

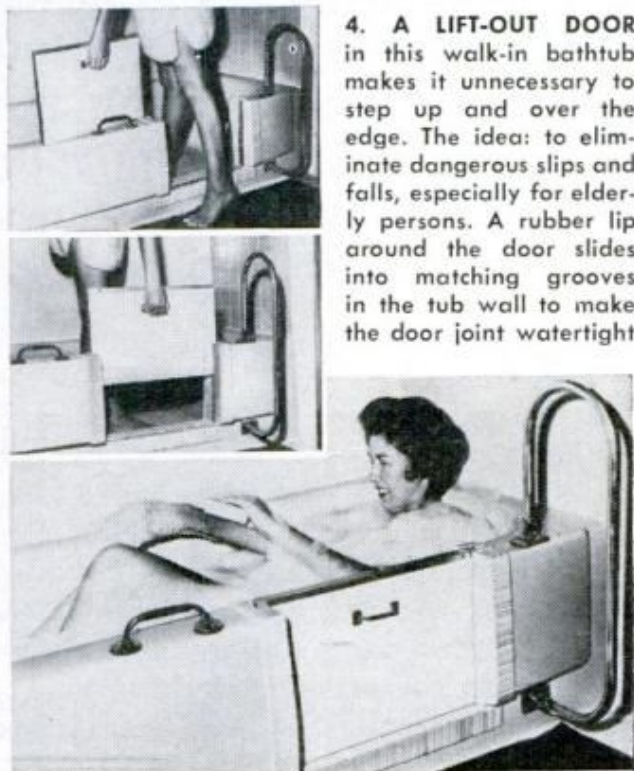
Gadsden, Ala.; 3. Raymond E. Barker, 237 E. 44th St., Jacksonville, Fla.; 4. Ralph Vogel, 475 Fifth Ave., New York, N. Y.; 5. Nicholas Noviello, Jr., 10 Ely Rd., Gulf



3. MUSCLE-POWERED FISHING MOTOR makes no noise to scare off your prey. Pumping a handle moves a ring gear back and forth against two one-way bevel gears. The bottom gear engages the driveshaft on the forward stroke, the top gear on the backward stroke. Between the two, they keep the prop turning the same way no matter which way the handle moves



5. THE EMERGENCY BRAKE on this car is really for emergencies. If you see a crash coming, you pull a handle, dropping a heavy frame onto the road. The frame digs into the road, forcing the car to nose up sharply on a pivoted rod. This transfers forward motion into upward motion, helping to dissipate the car's energy. At the same time, the car's motion compresses a spring, absorbing more of the force. A ratchet locks the car in the tilt-up position so that, if the crash does occur, it will ride up and over the other vehicle instead of into it



Manor, Peekskill, N. Y. Roger S. Shashava of the International Inventors Assn., Inc., can be reached at 680 Fifth Ave., New York, N. Y. 10019.

The next big
breakthrough
in home
entertainment:

TAPE YOUR OWN TV SHOWS

By LEN BUCKWALTER



HOME VIDEO RECORDING is not only fun, but can help youngsters improve speech and musical skills



BUILT-IN MONITOR is an added feature on this compact Sony VTR. Below screen is automatic timer

Home video recorders are beginning to crack the price barrier. Here a PM reporter who tried one tells of the fun you can have watching the family on TV, checking your golf swing and taping shows off the air for replay later

TAPE YOUR OWN TV SHOWS?

As little as two or three years ago, experts were saying, in effect, "Don't hold your breath—the home video tape recorder is a long way off." Now the picture is changing rapidly. The home VTR has already broken the \$1000 price barrier, and a dozen makers have models on the market, ready to go.

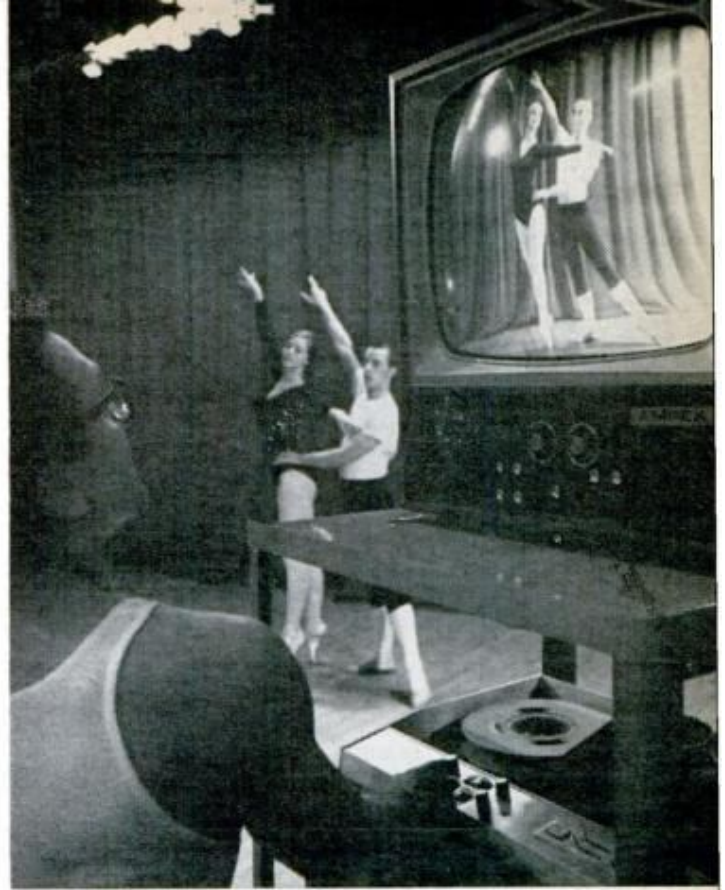
As with a color TV, the price tag is expected to drop quickly when production gets rolling. Five years ago no one thought color sets would catch on; now they're outselling black-and-

whites. The same could happen with the VTR. Manufacturers think the magic number is \$500. When that figure is reached, the home VTR will be off and running. Meanwhile, if you're willing to shell out about what one of the early color TVs cost, you can enjoy video taping right now. The home VTR owes its remarkably fast development to ingenious electronic engineering. When you consider that a professional studio system costs \$100,000 or more, it's amazing that there's a home version at all. Not only are prices dropping, but cabinet dimensions are also shrinking. Today's components are not much bulkier than those in your hi-fi system. There are even some portable models on the market.

Video recording requires three elements: a video camera, a video recording deck and a monitor screen on which to view the pictures. The nice thing about this is that you already own the monitor—your TV set. Most of the present systems on the market are designed to play through a standard TV set or can be adapted to.

Another nice thing is that you don't have to buy the whole system all at once. You can start with just the recording deck. This will let you tape TV programs off the air and replay them at your leisure. Sony, for instance, offers its deck alone for \$695. Later, for a few hundred dollars more, you can add a camera, enabling you to tape your own live-action TV shows right in your living room. Doing it this way is not too much rougher financially than assembling a fine hi-fi system a component at a time.

Although expensive, video recording offers many advantages over home movies. Both sound and picture are recorded simultaneously on the tape. This gives you perfect "lip-sync"—your actors' voices are in exact synchronization with the movement of their lips. Editing a tape is simple because sound and picture run side by side. In movies, the soundtrack runs along a different portion of the film from the



BALLET STUDENTS at a California school perfect their form with help from an Ampex VTR. Instructor tapes dance, then plays it back for them to study

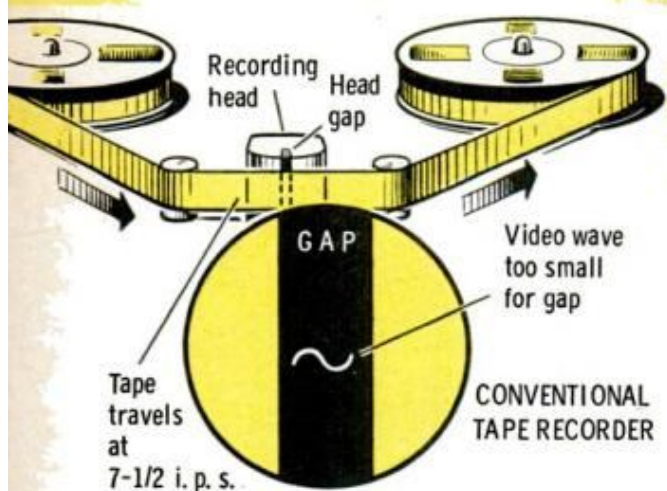


OLYMPIC TRACK STARS are videotaped during time trials to provide visual record for later analysis

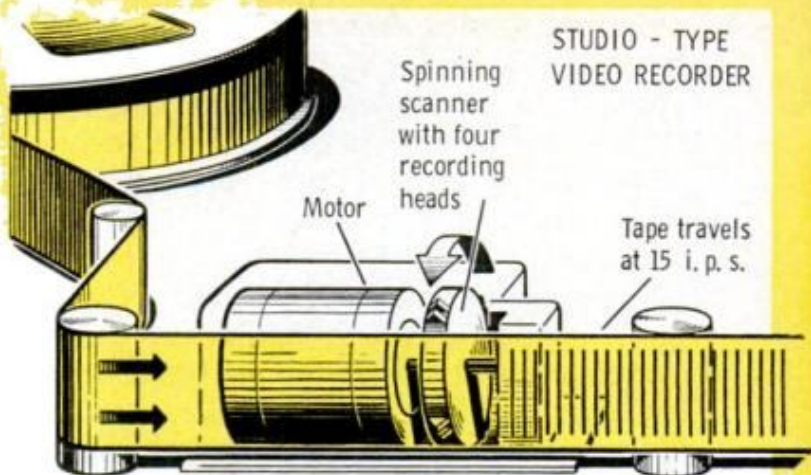


WATCHING REPLAY OF TAPE, Oregon State sprinter Willie Turner (right) discusses form with a coach during preparation for 1968 games at Mexico City

HOW THE BREAKTHROUGH IN THE



CONVENTIONAL TAPE RECORDER is way too slow to record video signals. Video waves, fluctuating millions of times a second, are physically too small to span the gap in the recording head, as shown at left. Speeding up the tape "stretches" video waves



over a greater length, but drastically increases wear and cuts down recording time. The answer is to move the head past the tape, thereby increasing the relative speed between them. In expensive studio systems, four heads on a motor-driven disc are

corresponding picture sequences, making editing difficult.

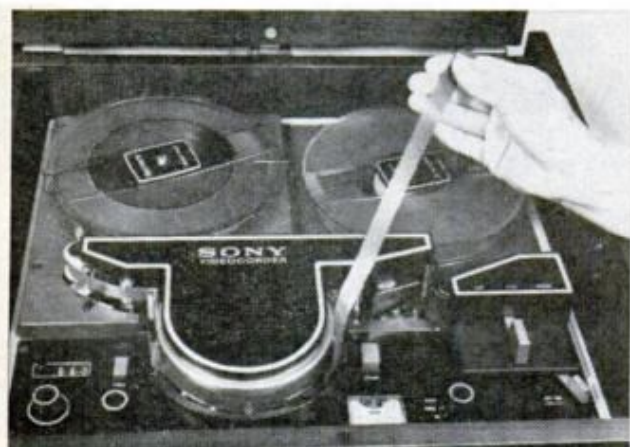
With a VTR, you have instant playback. You can see what you've shot immediately. There's no waiting for film to be processed. If you make an error, such as a poorly lighted scene, you know it on the spot and can reshoot the scene until it's right. If an actor muffs a line, you just erase that section of tape and do it over. There's no waste of costly footage, as with film. When you're tired of a sequence, you can re-record right over it. Tapes can be erased and reused hundreds of times.

For taping programs off the air,

some machines have an automatic timer that lets you set the recorder to go on at a time when you're not home. This way, you can record shows that you otherwise would have missed and enjoy them later when you get home. By taping musical shows and televised concerts, you can build up a library of fine entertainment for showing whenever you want.

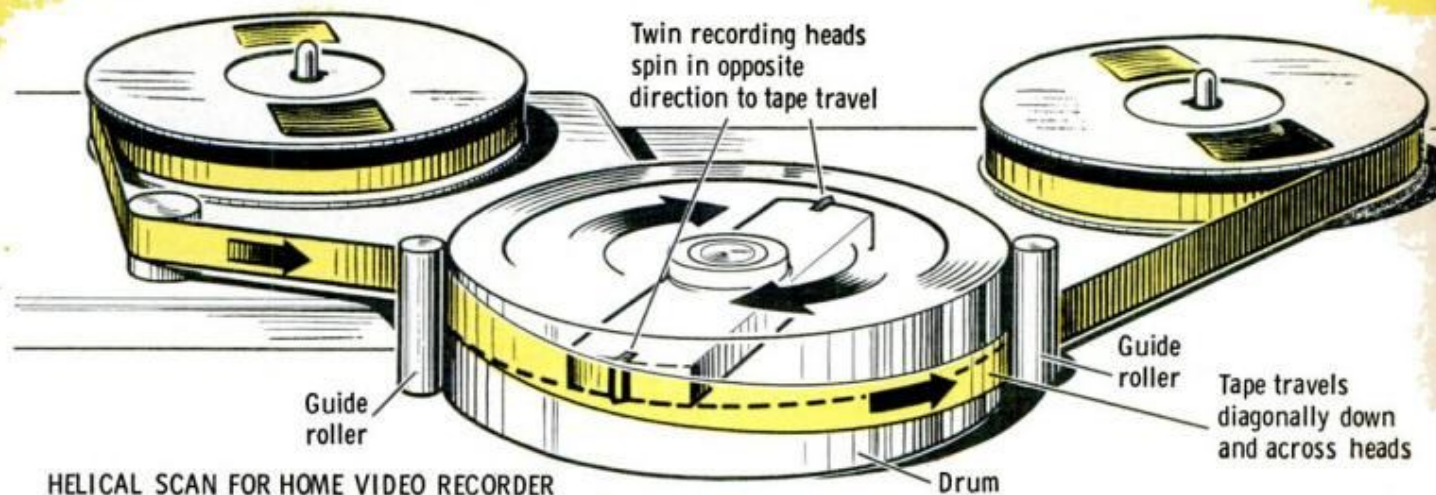
Almost any physical skill that requires form and training can be improved by watching its performance on a TV monitor. Practice your golf swing in front of the camera, then play back the tape and you can quickly see what's causing that hook or slice. Many purchasers of today's VTRs are public figures, mostly actors and politicians (one VTR was reportedly in the White House). The recorder is a fabulous tool for show-business people who want to rehearse or preview their performances while shielded from the critics. A beginners' bowling class in Idaho learns faster when it views mistakes on the TV screen. A charm school in Los Angeles teaches poise, makeup, speech and modeling, helped by a VTR.

Another VTR sharply reduces learning time at an equestrian school by



MOST VIDEO TAPE is half inch wide—double the width of conventional ¼-inch audio recording tape

SMALL HOME VTR WAS ACHIEVED

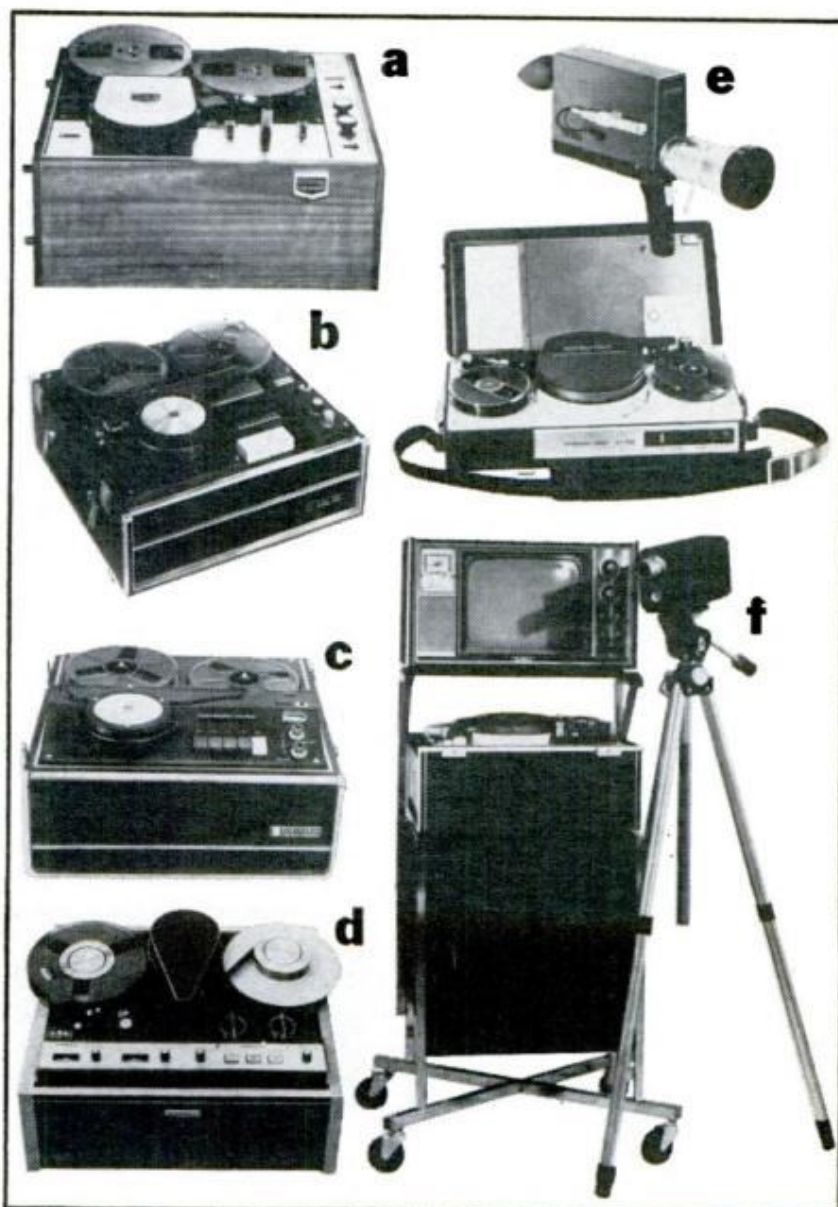


HELICAL SCAN FOR HOME VIDEO RECORDER

spun rapidly across the tape, creating an effective tape-to-head speed of 1500 inches per second at an actual tape speed of only 15 inches per second. This way, video frequencies up to 5 million cycles per second can be recorded. Home-type VTRs

use a modified system called helical scan. Two recording heads spin horizontally while the tape travels diagonally past them, as shown above. This produces a tape-to-head speed of several hundred inches per second—fast enough for home recording

CURRENT CROP OF VTRs includes many shapes and sizes, from lightweight, battery-operated portables you can sling over a shoulder (E) to a complete, mobile TV studio you can roll from room to room (F). Most common form is separate videotape deck, as shown at near right, that can record programs off the air from a conventional TV set or be used with an accessory camera to tape live-action family scenes at home. Tape decks look much like standard reel-to-reel audio tape recorders, but are a little heavier and bulkier. Craig model 6401 (A) weighs 65 pounds, features a slanted supply reel that puts the tape in line with the helical-scan drum, eliminating the need for a step-down idler. Deck alone sells for \$850. Separate camera and TV monitor are available for \$248 and \$197 respectively. Concord model VTR-900 (B) has handy pushbutton controls, plays back through any TV receiver, is priced at \$995. Panasonic model NV-8100 (C) also has pushbuttons and features a detachable cover that closes the machine for use as a portable. Price for deck alone is \$1100. Ampex model VR-5100 (D) records for one hour, but has fast forward or rewind time of four minutes. Price is \$1600. Battery-powered Shibaden portable (E) weighs only 15 pounds, sells for \$1295. It records for 20 minutes in the field, but needs home tape deck for playback. Apeco mobile system (F) includes recorder, camera and monitor for \$1485, with stand extra



. . . even on a small black-and-white screen, the realism is startling.

graphically revealing students' riding errors. Baseball and football teams use VTRs during practice, then study their performance on tape replay. One tennis teacher claims that a VTR corrects in five minutes what it used to take five lessons to do. Instructors often point out that a student understands and corrects an error faster when he sees himself committing it on the screen.

My first experience with a VTR proved to be a pleasant surprise. Video taping invokes none of the tensions of home moviemaking. There's no pressure to make every minute count. Forget about watching the footage counter. With a VTR, you simply let the tape roll, knowing that you can always erase it and make a new recording later. This helps to offset the cost of video tape, which at about \$40 for an hour's viewing is comparable to the price of movie film.

When you wish to save a good recording, it can be snipped out with scissors and easily spliced onto another reel. Video taping needs no frantic flurry of "lights-camera-action." Once the machine is rolling, with the TV camera trained on the scene, you can leisurely stroll into the picture yourself. The tape will continue to record up to an hour with no further attention.

One of the most impressive aspects of video taping is its ability to record synchronous sound. The first time you see your family or friends on a TV screen and hear their voices, too, you'll be delighted. Even on a small screen in black-and-white, the realism is startling.

Some other advantages of video taping: You'll need little more than normal room light for shooting. The TV camera contains an extremely sensitive vidicon tube that performs like extremely fast film. (Even a match can illuminate an area.) Also, you can pre-

view picture quality without wasting tape. Before the tape is started, the camera can display a continuous picture on the TV monitor screen. This allows you to adjust room lighting, set the controls on the machine and focus the camera. Only when conditions are correct do you roll the tape.

Home VTRs borrowed a trick used in professional machines, modified it slightly, and came up with a practical answer to what seemed like an insurmountable obstacle. The problem is that video waves are thousands of times faster than audio waves and thus can't be recorded on a conventional audio tape machine.

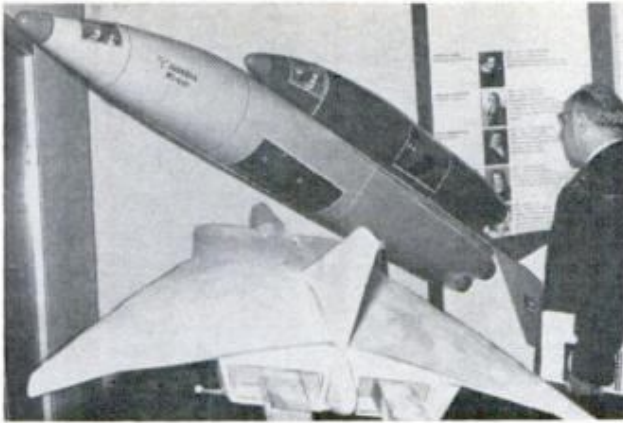
To catch the tiny video waves, the tape must travel many times faster past the recording head. Since it becomes impractical to speed up the tape beyond a certain point, the solution was to spin the recording head past the tape, thereby increasing the relative speed between the two. How this is done is shown in the accompanying drawings.

Most of the major electronics makers offer a compact VTR designed for schoolteachers, businessmen and—eventually—home owners. These include such names as Ampex, Apeco, Bell & Howell, Concord, Craig, General Electric, Panasonic, Philips Broadcast, Revere, Shibaden, Sony and Wollensak.

While most of the machines have standardized on a tape width of half an inch, they do not agree on tape speed. For example, Sony, Shibaden and Wollensak operate at 7½ inches per second (i.p.s.). Craig elects 9½ i.p.s. Ampex runs at 9.6 i.p.s. and also departs with a one-inch tape width. The Concord runs at a top speed of 12 i.p.s. These differences in tape travel make VTRs, for the most part, incompatible with each other—you can't record a tape on one make and play it back on another.

Tape speed is a factor in picture quality. Other things being equal, the higher the speed, the better the results should be. Actual tape speed, however,

(Please turn to page 224)



Futuristic space models

Much of the early technology in rocketry came out of Germany, so it isn't surprising that Munich's "Electronics 68" show featured futuristic craft like the airplane/spacecraft (foreground) and piggyback rocket (background).



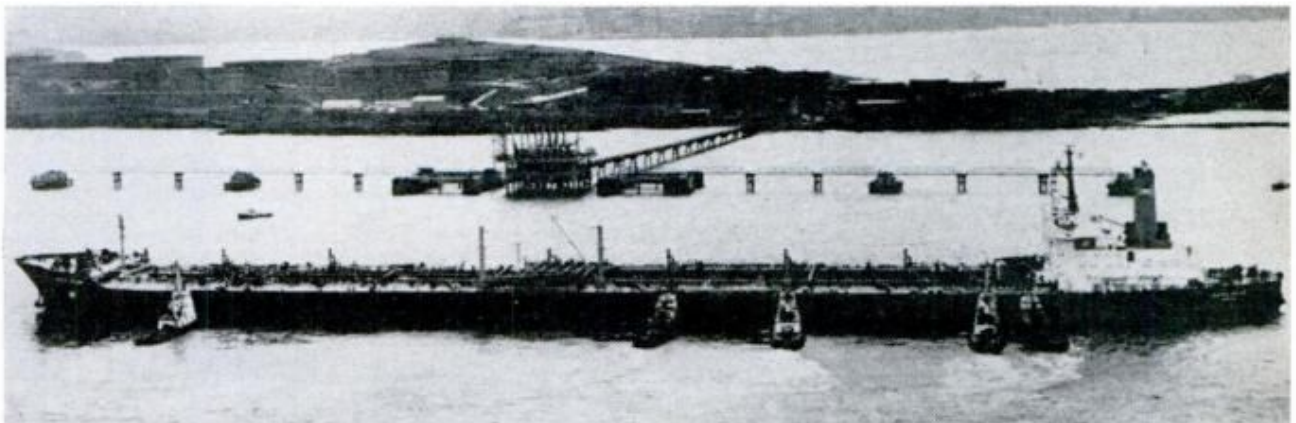
Student project

Students at the Kharkov Aviation Institute in Russia built this experimental ground-effect machine. Called the AVP-4XA1, the machine hovers about 12 inches above the ground and travels across terrain at 10 mph.



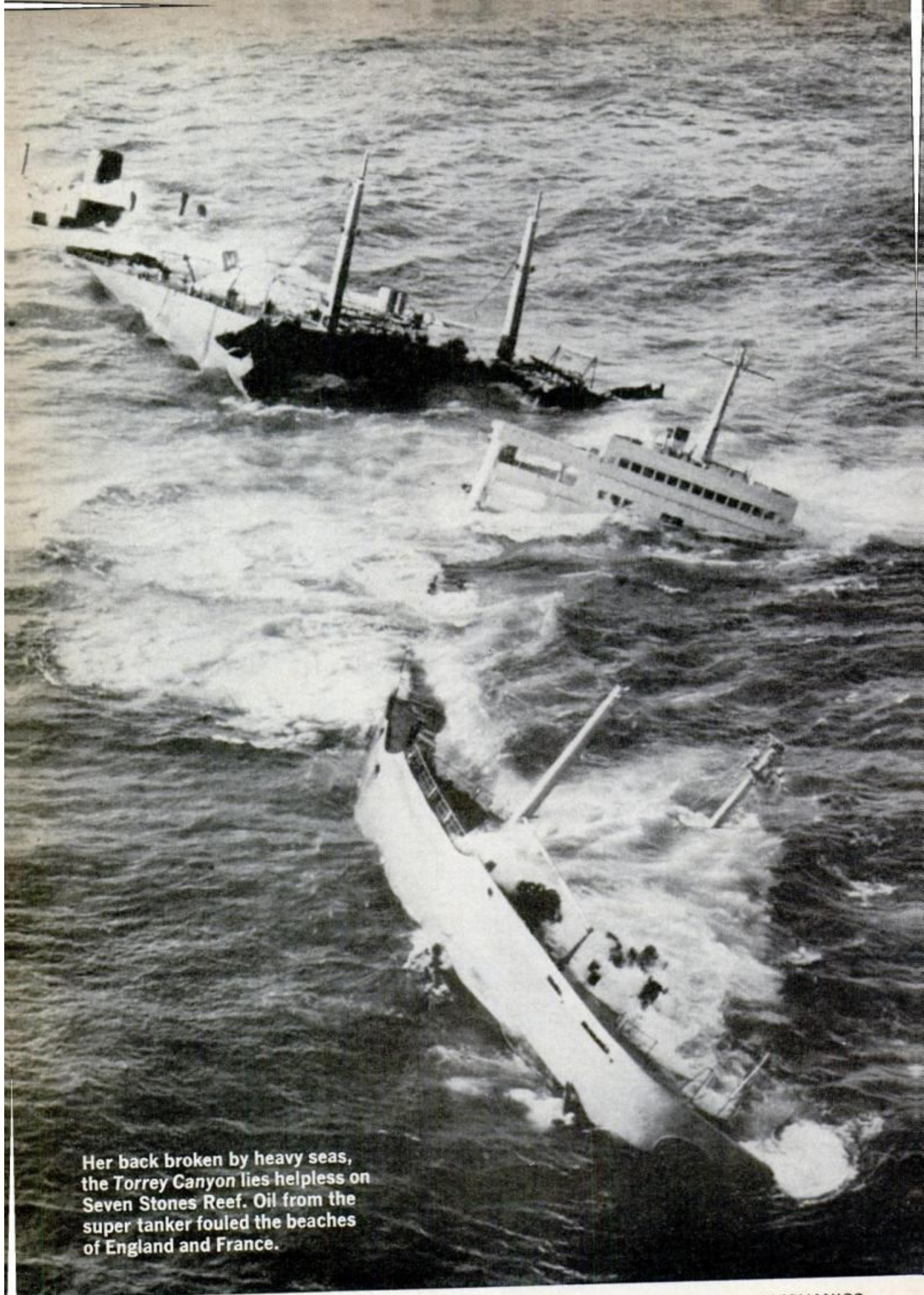
Back-yard chopper

Richard Sanders, Auburn, Wash., flies his back-yard helicopter on the end of a steel boom. The toy is powered by a $\frac{1}{3}$ -hp electric motor from a washing machine; the motor turns the copter's 32-inch propeller.



Biggest tanker now carrying oil from Kuwait to Ireland

Nudged toward her mooring berth in Bantry Bay, Ireland, the *Universe Ireland*, first of a new class of mammoth tankers, prepares to unload her cargo of 1.9 million barrels of oil. The Japanese-built tanker (see *The Biggest Thing That Ever Moved*, page 70, May '68 PM) carries oil from Kuwait to Bantry Bay for Gulf Oil Corp.



Her back broken by heavy seas, the Torrey Canyon lies helpless on Seven Stones Reef. Oil from the super tanker fouled the beaches of England and France.

What Really Caused The Torrey Canyon Disaster?

By RICHARD PETROW

On a clear morning, with a calm sea and in view of the lightship, the supertanker crashed on the reef. Here—based on previously unpublished testimony—is the incredible story of what happened in the ship's last hour

IN THE HOURS after midnight on the morning of Saturday, March 18, 1967, Capt. Pastrengo Rugiati, his mood mellowed by the thought of the landfall he was soon to make, lingered on the bridge of the supertanker *Torrey Canyon* longer than was his usual habit.

Torrey Canyon was a superb ship, awesome in size and capacity. Her 974-foot length made her only 57 feet shorter than the *Queen Elizabeth*. Her width of 125 feet made her as broad as a 10-lane superhighway.

She was owned by the Barracuda Tanker Corp., a Liberian company registered in Bermuda and a subsidiary of the Union Oil Co. of California. On her last voyage, *Torrey Canyon* carried a cargo of 119,193 tons of Kuwait crude oil under a single voyage charter for British Petroleum. She had loaded the oil at Mina al Ahmadi on the Persian Gulf. Her destination was Milford Haven in Wales. Her flag was Liberian. Her officers and crew were Italian, recruited in Genoa by Consulich Co., Italian agents for Union Oil.

By 2:00 a.m. *Torrey Canyon* had reached a position approximately 100 miles south of the southwestern tip of Great Britain. Ahead lay the Scilly Isles, 22 miles from Land's End in Cornwall, England. Standing between the Scillies and Land's End were the treacherous Seven Stones Shoals. It was, however, not Capt. Rugiati's intention to

take his ship between the Scillies and Land's End. He would, as did most skippers coming from the south, pass the Scillies to seaward.

As the tanker sailed northward, Capt. Rugiati could see, to the right of the helmsman's wheel, the lever which controls the Sperry Automatic Steering System. The lever was on "automatic," as it has been for most of the trip. The steering wheel itself was unmanned.

The situation was quite normal. Captain Rugiati and his officers had three steering systems from which to choose—an automatic, a manual and an auxiliary known as "control." Of the three, the automatic was used most frequently, because on ocean voyages ships spend most of the time traversing unrestricted routes, and the need for alteration of course is infrequent.

The manual system was used only when coming into, or leaving, port or when the ship had to maneuver at sea.

The control system was an auxiliary back-up for use if one of the two primary systems failed. When the steering mode selector lever was pushed into "control," the steering wheel became inoperative. In "control," the ship could be steered, not only by the wheel, but by a handle located to the left of the wheel.

Shortly before 2:30 a.m. Capt. Rugi-

*Condensed from the book
In The Wake of Torrey Canyon, by Richard Petrow,
\$5.95, David McKay Co., Inc. 1968*

ati wrote out his night instructions for First Officer Silvano Bonfiglio, who would come on watch at 4:00 a.m. He instructed Bonfiglio to call him as soon as Bonfiglio had picked up the Scilly Isles on radar. In any event, Bonfiglio was to report at 6:00 a.m. whether he had radar contact with the Scillies or not.

When First Officer Bonfiglio took over the watch at 4:00 a.m., he expected that he would eventually see the Scillies, by radar, off the starboard bow.

At 5:00 a. m., Bonfiglio switched on the Raytheon 1400 radar, setting it to its maximum range of 40 miles. Bonfiglio could see only the flashing "lubbers' line" which indicated the heading of the ship.

At 6.00 a.m. Bonfiglio dialed the captain's cabin.

"It is 6 o'clock, Captain," he reported. "I have not yet seen the Scillies on radar."

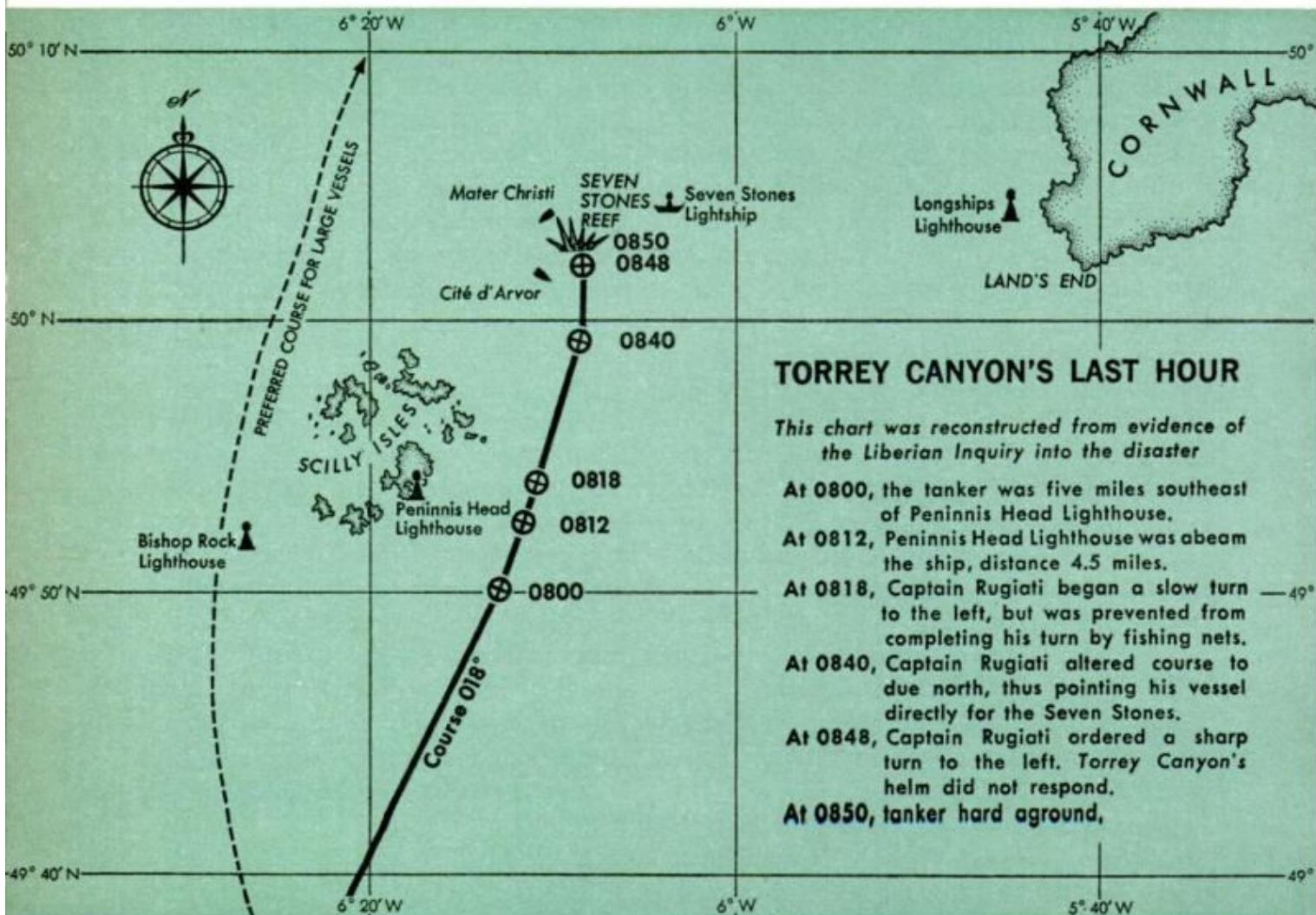
"Call me when you make contact," Rugiati ordered, and clicked off.

Within a half hour, Bonfiglio observed the first shadowy outline of the Scilly Isles begin to appear on the radar screen. The position of the land mass, however, came as a shock. The Scillies, instead of lying to the right off the starboard bow, were appearing to the left, off the port bow. The set of the current, Bonfiglio reasoned, had forced the vessel off course by about eight miles.

When he confirmed that the Scillies were appearing on his left, Bonfiglio changed course, without notifying the captain, from a heading of 018° to 006°.

His expectation was that Capt. Rugiati, once informed, would order another course change to port, to pass the Scillies to seaward as originally planned. Once *Torrey Canyon* had settled on her new course, he immediately telephoned Capt. Rugiati for instructions.

"Captain," he reported, "I have tracked the Scilly Isles on radar. We have moved over to the right of the





CAPT. PASTRENGO RUGIATI, master of the stricken tanker, on the bridge after grounding. He stayed aboard until an explosion killed a salvage worker



LESS THAN TWO MONTHS later, Capt. Rugiati hides under a hospital bed in Italy to avoid photographers. Loss of ship left him emotionally upset and ill

course. I have headed the bow for the Scilly Isles."

Rugiati's angry reaction surprised Bonfiglio. He admonished the first officer for changing course, then demanded, "With our original heading of 018°, would we be free of the Scillies?"

"Yes," Bonfiglio replied.

"Then continue on course 018°," Capt. Rugiati ordered. "I intend to pass to the starboard of the Scilly Isles."

It was the first indication Bonfiglio had that Capt. Rugiati did not plan to pass outside the Scillies. Bonfiglio did not know that Rugiati, as he would later testify, had made his decision while listening to Bonfiglio's report. The first officer had taken his ship left without consulting him; Capt. Rugiati would take his ship to the right.

Capt. Rugiati arrived on the bridge of *Torrey Canyon* shortly after 7:00 a.m. First Officer Bonfiglio had indeed carried out his orders as Capt. Rugiati had directed. *Torrey Canyon* was back on a course of 018° and was headed for the narrow channel between the Scillies and the Seven Stones.

For the next hour, *Torrey Canyon* sailed calmly on. At 8:00 a.m., Bonfiglio was relieved, and went below to have breakfast. A new watch took over.

Two men would share the fateful

hour between 8:00 a.m. and 9:00 a.m. with Capt. Rugiati. They were Biagio Scotto di Carlo, 45, the helmsman; and Alfonso Coccio, the *Torrey Canyon's* inexperienced 27-year-old third officer. In the crisis ahead, the three men would prove a weak and ineffectual team.

Scotto was new to *Torrey Canyon*, having been signed aboard less than two months before.

Third Officer Coccio was also on his maiden voyage aboard *Torrey Canyon*.

Coccio later testified that he had no conversation with the master upon assuming his watch, nor did he know on which side the captain intended to pass the Seven Stones.

At 8:12 a.m., Coccio took his first fix. Penninis Head Lighthouse was 4.5 miles abeam. Six minutes later, Coccio took another bearing on Penninis Head Lighthouse and a tangent bearing on a prominent feature of the Scillies coast. It was his 8:18 a.m. fix.

Torrey Canyon was then 30 minutes sailing time from the shoals, traveling at an estimated speed of 15.75 knots.

From the moment of the 8:18 a.m. fix, everything started to go wrong aboard *Torrey Canyon*, though those on board did not know they had passed the line into danger.

By looking at the chart, Capt. Rugiati

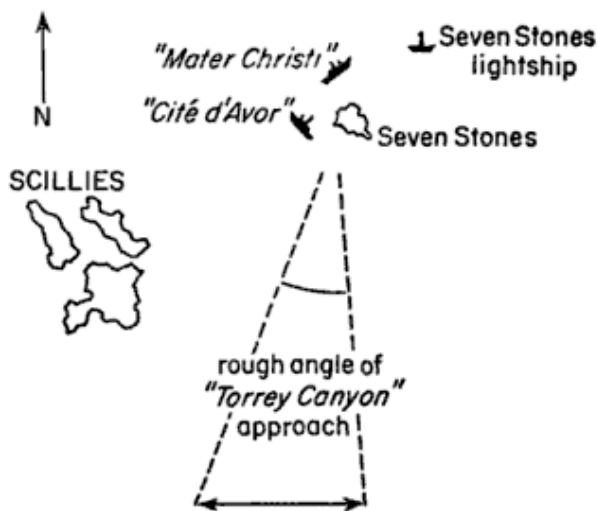


CHART drawn from information given by Guy Follic, master of the French fishing vessel *Mater Christi*. Follic said his and another boat, *Cité d'Arvor*, were only boats fishing Seven Stones morning of the crash

knew that if his ship continued on her present course, he would come perilously close to the Seven Stones reef. As he explained later, it had always been his intention, after clearing the Scillies, to bring his vessel slowly to port and thus gain the center of the channel. The time to begin his maneuver was now.

Rugiati moved to the wheel and changed his ship's heading from 018° . It is a peculiarity of the Sperry Steering System that small deviations in course, up to 3° , can be made without switching into the "manual" position.

During the morning of March 18, however, the current was moving in the direction of 130° true. Its drift was not excessive—less than one mile an hour—but the current's set and drift were turning the bow of *Torrey Canyon* to the right while Capt. Rugiati wanted to go left. The wind, too, coming from the northwest, was also pushing *Torrey Canyon* to the right. While Capt. Rugiati brought his ship's heading toward the north, therefore, the course being made good by *Torrey Canyon* was still 018° . The wind and current had set *Torrey Canyon* to the east of the Scillies in the first place. They were still working on the ship. And they were still being discounted.

Four vessels played a role, either directly or indirectly, in the disaster that was to come. *Torrey Canyon* was

moving toward the Stones like a nautical steamroller of tremendous force and inertia. The Seven Stones Light Vessel rode at anchor, capable only of warning vessels of the dangers close by and of signaling to any ship that came near with flares and rockets. The two French fishing boats, *Mater Christi* and *Cité d'Arvor* hovered around the reef, plucking from it her treasures of red crayfish and bluish-green lobster. The four vessels became aware of each other at approximately the same time: 8:30 a.m.

On the *Cité d'Arvor*, her skipper, Pierre Le Goff, finished listening to Radio Conquet at 8:30 a.m. *Cité d'Arvor* was approximately 500 yards to the west of Seven Stones. To the southwest LeGoff saw "a big black hull coming over the horizon." He thought the big ship had plenty of time to turn to starboard and thus clear the rocks with safety.

Knew ship would hit rocks

Mater Christi was 400 yards north of the reef when *Torrey Canyon* appeared on the horizon. Her skipper, Guy Follic, watched the oncoming tanker for a few minutes, his initial surprise growing with every second. Follic could see that her course was steady. If she continued straight ahead, he knew the ship would hit one of the rocks.

"Incredible," Follic muttered.

On the Seven Stones Light Vessel, Leslie Matthews and Charles Lawrence sighted the ship shortly before 8:30.

"Have you seen this, have you?" Matthews said.

Lawrence replied "Yes. Look at the big bastard coming up."

Neither man pointed the ship out to the master, John James, when he arrived to make his regular morning radio report to the Coast Guard.

Lawrence later explained that he thought the ship was on a safe course.

At 8:30 a.m. *Torrey Canyon* was in a slow sweeping turn to port when a number of submerged fishing nets came into view. Capt. Rugiati could not avoid

them. His ship sliced between the two buoys, shredding the line below.

The ship's heading then was around 010°, and Capt. Rugiati was intending to turn further to the left, but the presence of even more fishing floats to port prevented Capt. Rugiati from continuing his "alteration to the left." Consequently, he put the ship back on a course of 013° for about 10 minutes.

His intention was to continue on the course of 013° until it was clear for him to turn left once again. His maneuver, while not dangerous in itself, did place *Torrey Canyon* further to the right, on a heading that would bring it closer to the Seven Stones.

At the very least, this maneuver indicated that Capt. Rugiati had a poor grasp of the developing situation.

Nor would he get any help from his third officer, Alfonso Coccio. Coccio's testimony later would spell out his failure in dreary detail.

Two fixes were missed, and then:

Question: Now, just a little beyond the last cross line we were talking about—about a quarter of a mile beyond—there appears to be another cross line. Did you make that?

Coccio: Yes.

Question: Were you able to fix a position of the vessel at that time?

Coccio: Yes, but I always had a doubt—.

Question: What made you think that that was not accurate?

Coccio: I could not make out the coast clearly. It could have been correct, but I was not sure.

Capt. Rugiati remembers the time as 8:38 a.m. He hovered over Coccio's shoulder as the fix was plotted. He could immediately see that the last position was in error by at least a mile.

Capt. Rugiati now knew he was in trouble: He didn't know where he was. Whatever faith he had in his third officer's ability disappeared. He would have to take over himself.

"Stop using the Scillies for bearings," he told Coccio. "Use the lightship."

Coccio ran out to the starboard wing to take a bearing on the lightship. The captain took the distance himself by radar. When the position was plotted, Rugiati saw that his ship was only 2.8 miles away from South Stone, the nearest rock of the Seven Stones. The time was 8:40 a.m.

Something close to complete confusion must have settled on the pilothouse in the next 10 minutes. Ahead lay the Seven Stones. There were fishing vessels to port. But to starboard there was open water with no fishing vessel to obstruct his turn; water clear and deep, inviting a turn to the right. Instead, Capt. Rugiati decided to turn left.

The ship was still on automatic pilot when Rugiati made his decision. He had to throw the steering mode selector lever from "automatic" to "manual" before he could turn his ship to its new

The position showed Torrey Canyon only 2.78 miles from the lightship, less than a mile from the nearest rock.

course: due north, 000°. He personally put her on this course and then, as he later testified, he switched the lever back to "automatic" steering position and left the wheel.

Coccio, meanwhile, was trying to get a good fix. He ran to the starboard wing to take another compass bearing on the lightship. From there, he ran to the radar set to obtain a distance. In his hurry and excitement, Coccio forgot the compass bearing. He returned to the starboard wing running, took a second bearing; then, still running, returned to the radar set for a second distance reading. This time he did not forget. The position showed *Torrey Canyon* only 2.78 miles from the lightship, *within less than a mile of the nearest rock.*

At that point the dull realization of his danger hit Capt. Rugiati. He sprinted from the chart room yelling to Helmsman Scotto, standing lookout on the

(Please turn to page 226)



What Price Power?

Before you buy a more powerful version of any car, take a hard-nosed look at what your extra dollars really buy

By BILL KILPATRICK, Auto Editor

Photos by Pal Parker

IT BOILS DOWN to a question of whether it's worth it, whether what you get is worth what you pay.

Forgetting about the fancier trim, is a Dodge Monaco with a 383-cu.-in. engine *really* worth more than a Polara with 318 cubes? Does a 390-cu.-in. Ford Galaxie give you more for your money than a 302-cu.-in. Custom? What will a 350-cu.-in. Chevy Impala do that a 327-cu.-in. Biscayne won't?

Compare the top, medium or lower-powered versions of a given size and type of automobile. Forget the deluxe upholstery. *On performance alone*, do the most expensive models justify their higher price tags?

This was the big question to which we sought an answer at this year's Union/Pure Oil Performance Trials

at Daytona International Speedway. Sanctioned and controlled by the National Assn. for Stock Car Auto Racing (NASCAR), the Trials annually evaluate most models of current American-made cars for mpg, acceleration and braking.

Sixty cars, ranging from the opulent to the spartan, from muscle-cars to economy Sixes, were bought in showrooms throughout the country by Union/Pure and were put through the Trials mill this year. With the exception of one class of 10 compacts, all were V8s. All had automatic transmissions. The cars—elaborately rigged with test gear and instrumentation—were checked for fuel economy, acceleration times from 25 to 70 mph, and braking distances to a complete stop from 65 mph. The



318-CU.-IN. POLARA (left) got more mpg, stopped quicker, accelerated slightly slower than 383 cu.-in. Monaco

Trials do not evaluate many things you might want to know and consider (ride, comfort, handling and so on), but what is tested is tested thoroughly. Thus the event provides what may be the most accurate and impartial criteria available to answer our question, at least in part.

Granted, most people don't buy a car on logic alone. Some are more impressed by bucket seats than by gas mileage or good brakes. But in the three so-called "gut issues"—(mpg, acceleration, braking)—the Trials shed some light on what the big-engine jobs give you that their less powerful stablemates don't, and vice-versa.

The Monaco that Union/Pure bought for this year's Trials had power steering and brakes, airconditioning, a 383-cu.-in. engine (the smallest available in a Monaco) with 4-bbl. carburetor, a 4395-lb. curb weight and cost \$4964.50.

The Polara also had power steering and brakes and airconditioning. It had a 318-cu.-in. engine with a 2-bbl. carburetor, weighed 4050 lbs. and cost \$4237.55, or a nickel less than \$727 under the Monaco.

So how did each perform? Were the differences really significant?

The Monaco won its class (II—Deluxe) overall with an mpg of 16.149, a 25-70 mph acceleration time of 8.67 secs., and a 65-0 mph braking distance of 202.8 ft. The Polara also won its class (III—Medium). It got 18.589 mpg, went from 25 to 70 mph in 11.80 secs., stopped

from 65 mph in 193.3 ft. The smaller-engined car got almost 2½ more miles to a gallon of gasoline, took slightly over three seconds more time to accelerate from 25 to 70 mph, stopped from 65 mph in almost 10 ft. less distance.

Consider, too, that the Monaco not only costs more to start with, it costs more to operate. If we peg the nationwide average retail price of regular-grade gasoline at 34 cents a gallon, the Polara, based on the results above, would go 10,000 miles for \$47.24 less than the Monaco. (The difference is even greater, since the Monaco burns premium-grade gasoline which averages 4 cents more per gallon).

The Ford Galaxie 500 in this year's Trials had power brakes and steering, airconditioning, a 390-cu.-in. engine, 2-bbl. carburetor, a curb weight of 4245 lbs. and cost \$4103.08. The Ford Custom also had airconditioning and



ALL CARS get precise measure of gas for economy test. Insulation keeps fuel at uniform temperature



TRIAL TESTS require thorough instrumentation, are conducted under strict control of NASCAR officials

power brakes and steering. It had a 302-cu.-in. engine with 2-bbl. carburetion, weighed 3953 lbs., cost \$3789.73, or \$313.35 less than the Galaxie. Both cars had front disc brakes.

The Galaxie got 16.276 mpg; the Custom, 18.553. The Galaxie went from 25 to 70 mph in 10.485 secs., the Custom in 12.33 secs. Braking distance for the Galaxie was 236.9 ft.; for the Custom, 197.5 ft. Again, from a purely performance point of view, all the Galaxie owner gets for his extra \$300 is a couple of seconds jump in acceleration and a better chance of hitting something.

The same patterns applied to differences between the big-engined Chevy Impala and smaller-engined Biscayne, the Plymouth Fury I and Fury III. The more expensive models with the big

engines gained a second or two in acceleration, but got less mpg and took longer distances to stop. And, of course, the more expensive, heavier cars cost more to operate per mile.

The Trials class in which the Galaxie, Impala and Fury III competed (IV—Popular) also brought to light an interesting fact that may well tell car buyers more than they care to know. In any event, it proves the spoils don't always go to the victor.

In the same class was an AMC Ambassador DPL four-door sedan powered by a 343-cu.-in. engine with 2-bbl. carburetion. It, too, had power brakes and steering and was airconditioned. It weighed 3697 lbs. and cost Union/Pure \$3868.50, more than \$200 less than its nearest price competitor in the class, the Ford Galaxie.

The Ambassador DPL won economy laurels with an mpg figure of 17.238, the braking prize with a stop of 192.2 ft. But it finished last in acceleration, taking 12.43 secs. to get from 25 to 70 mph (the quickest car of the class was the Fury III, taking 9.86 secs.) Still, it would seem to the reasonably adult mind that a couple of seconds of acceleration time shouldn't turn buyers away from the DPL. Apparently, it does; AMC dealers are not under siege to sell Ambassadors. ★★★

ACCELERATION TEST simulates a typical passing situation, checks how long it takes to go from 25 to 70 mph



RESULTS OF 1969 UNION/PURE OIL PERFORMANCE TRIALS

CAR AND MODEL	CAR AND SPECIFICATIONS				Carb.	ECONOMY MPG	ACCEL. Time in Seconds	BRAKING Stop in Feet
	Wheelbase (Inches)	Curb Wt. (Pounds)	Suggested Retail Price	Cubic Inches				
CLASS I—SUPER DELUXE (2-DOOR HARDTOP)								
Buick Electra 225	126	4580	5789.78	430	4V	14.737	9.13	189.2
Buick Riviera	119	4502	6088.38	430	4V	14.902	8.205	202.9*
Chrysler New Yorker	124	4533	5853.10	440	4V	15.216	8.84	210.4(C)
Oldsmobile 98	127	4560	5795.82	455	4V	15.421	8.89	226.6(D)
Oldsmobile Toronado	119	4632	6393.01	455	4V	13.761	9.16	223.3(E)
Ford Thunderbird	115	4630	5589.29	429	4V	14.554	8.21	266.2(F)
CLASS II—DELUXE 8-CYLINDER (4-DOOR SEDAN OR HARDTOP)								
Buick Wildcat	123	4446	4772.49	430	4V	14.887	8.505	195.7
Chrysler 300	124	4432	5291.55	440	4V	15.685	8.19	209.0(G)
Dodge Monaco	122	4395	4964.50	383	4V	16.149	8.675	202.8*
Mercury Marquis	124	4694	5760.00	429	4V	14.473	8.675	259.7(D)
Oldsmobile Delta 88 Custom	124	4368	4771.37	455	4V	15.835	8.695	201.1
Pontiac Bonneville	125	4647	5578.72	428	4V	13.916(A)	8.58	213.6(H)
CLASS III—MEDIUM 8-CYLINDER (2-DOOR SEDAN OR HARDTOP)								
Buick LeSabre	123	4194	4341.00	350	2V	16.162	13.665	199.2
Chrysler Newport	124	4221	4694.95	383	2V	15.961	10.23	218.9(I)
Dodge Polara	122	4050	4237.55	318	2V	18.589	11.805	193.3*
Mercury Monterey	124	4294	4694.30	390	2V	16.140	10.02	213.1
Oldsmobile Delta 88	124	4231	4624.03	350	2V	16.176	11.825	191.2
Pontiac Catalina	122	4296	4440.26	400	2V	16.408	10.42	314.2(J)
CLASS IV—POPULAR 8-CYLINDER (4-DOOR)								
Ambassador DPL	122	3697	3868.50	343	2V	17.238	12.43	192.2
Chevrolet Impala	119	4114	4385.00	350	4V	16.791	9.915	195.6*
Ford Galaxie 500	121	4245	4103.08	390	2V	16.276	10.485	236.9
Plymouth Fury III	120	4146	4310.50	383	2V	15.452	9.865	201.6
CLASS V—STANDARD 8-CYLINDER (4-DOOR SEDAN AND 2-DOOR HARDTOP)								
Ambassador	122	3576	3583.25	290	2V	18.613	12.16	203.3(G)
Chevrolet Biscayne	119	3947	3865.52	327	2V	17.316	11.605	228.2(K)
Ford Custom	121	3953	3789.73	302	2V	18.553	12.33	197.5
Plymouth Fury I	120	3938	3813.20	318	2V	18.482	11.755	200.5*
CLASS VI—INTERMEDIATE 8-CYLINDER (4-DOOR SEDAN AND 2-DOOR HARDTOP)								
Buick Skylark Custom	116	3587	3621.10	350	2V	16.901	12.01	197.8
Chevelle Malibu	116	3535	3533.15	307	2V	18.766	12.265	214.5(L)
Dodge Coronet 500	117	3413	3636.10	318	2V	19.293	10.63	200.2
Fairlane 500	116	3332	3442.69	302	2V	19.823	10.80	189.1(M)*
Mercury Montego MX	116	3566	3441.20	302	2V	19.318	11.02	188.7
Oldsmobile Cutlass	116	3557	3385.36	350	2V	17.907	9.58	223.9(I)
Plymouth Sport Satellite	116	3360	3364.95	318	2V	18.895	10.80	201.6
Pontiac Tempest Le Mans	116	3801	3675.60	350	2V	17.762	10.56	228.3
Rebel SST	114	3405	3314.40	290	2V	18.396	11.85	224.5(N)
CLASS VII—COMPACT 6-CYLINDER (2-DOOR SEDAN AND HARDTOP)								
Chevy II Nova	111	2979	2681.05	230	1V	22.217	17.61	208.0(D)
Corvair 500	108	2519	2557.65	164	1V	22.378	21.485	186.5
Dodge Dart/Swinger (170)	111	2888	2650.10	170	1V	24.207	20.105	188.2
Dodge Dart/Swinger (225)	111	2943	2799.15	225	1V	22.395	15.92	185.7
Falcon	111	2781	2592.93	170	1V	23.733(B)	26.38	178.7(M)
Falcon Futura	111	2777	2839.99	200	1V	23.766	20.05	184.5
Plymouth Valiant 100	108	2713	2735.45	170	1V	23.501	20.15	194.3
Plymouth Valiant Signet	108	2861	2901.65	225	1V	23.170	15.30	192.8*
Rambler	106	2696	2278.35	199	1V	21.965	18.13	214.0(O)
Rambler Rogue	106	2784	2563.90	232	1V	23.978	16.28	396.1(P)
CLASS VIII—SPORTS INTERMEDIATE (2-DOOR)								
Buick GS 400	112	3718	3770.08	400	4V	16.662	6.91	198.2
Chevelle SS 396	112	3756	3672.35	396	4V	16.558	6.99	253.2(Q)
Dodge Charger RT	117	3836	4057.00	440	4V	14.939	5.565	190.4(R)*
Fairlane Cobra Jet	116	3762	3617.58	428	4V	13.582	5.855	218.0(K)
Mercury Cyclone Cobra	116	3855	3761.30	428	4V	13.466	5.71	170.9
Oldsmobile 442	112	3705	3891.21	400	4V	16.338	6.755	205.8(S)
Plymouth GTX	116	3754	4026.45	440	4V	15.110	5.715	188.9
Pontiac GTO	112	3774	4120.24	400	4V	14.957	6.435	229.9(T)
CLASS IX—SPORTS COMPACT (2-DOOR)								
Chevrolet Camaro	108	3209	3335.45	327	2V	19.031	10.245	185.1
Dodge Dart G.T.	111	3113	3332.20	273	2V	19.337	11.995	197.1(U)
Javelin	109	3147	3162.85	290	2V	19.208	12.27	193.2(V)
Mercury Cougar	111	3426	3658.80	351	2V	17.972	9.84	186.6(V)
Mustang	108	3048	3297.89	302	2V	20.133	10.315	211.7(S)
Plymouth Barracuda	108	3086	3190.55	318	2V	19.897	10.03	194.6(L)*
Pontiac Firebird	108	3462	3779.31	350	2V	18.502	9.645	251.4(S)

FOOTNOTES:

Penalties—(A) 1 mpg, driver error; (B) .1 mpg, driver error; (C) 18 ft., pylons; (D) 26 ft., pylons; (E) 2 ft., driver error; (F) 33 ft., pylons, driver error; (G) 8 ft., pylons; (H) 9 ft., driver error; (I) 24 ft., pylons; (J) 91 ft., pylons, driver error; (K) 34 ft., pylons (L) 1 ft., driver error; (M) 4 ft., pylons; (N) 30 ft., pylons, driver error; (O) 14 ft., pylons; (P) 138 ft., pylons; (Q) 50 ft., pylons; (R) 19 ft., pylons, driver error; (S) 25 ft., driver error; (T) 46 ft., pylons; (U) 5 ft., driver error; (V) 6 ft., pylons.

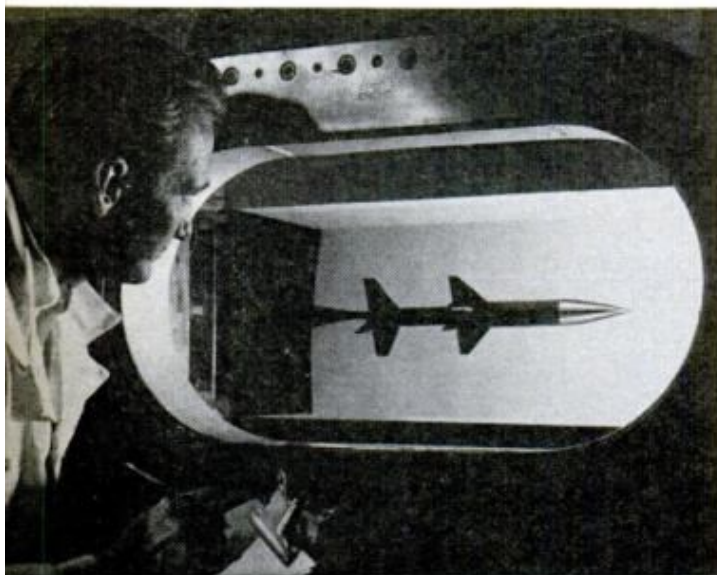
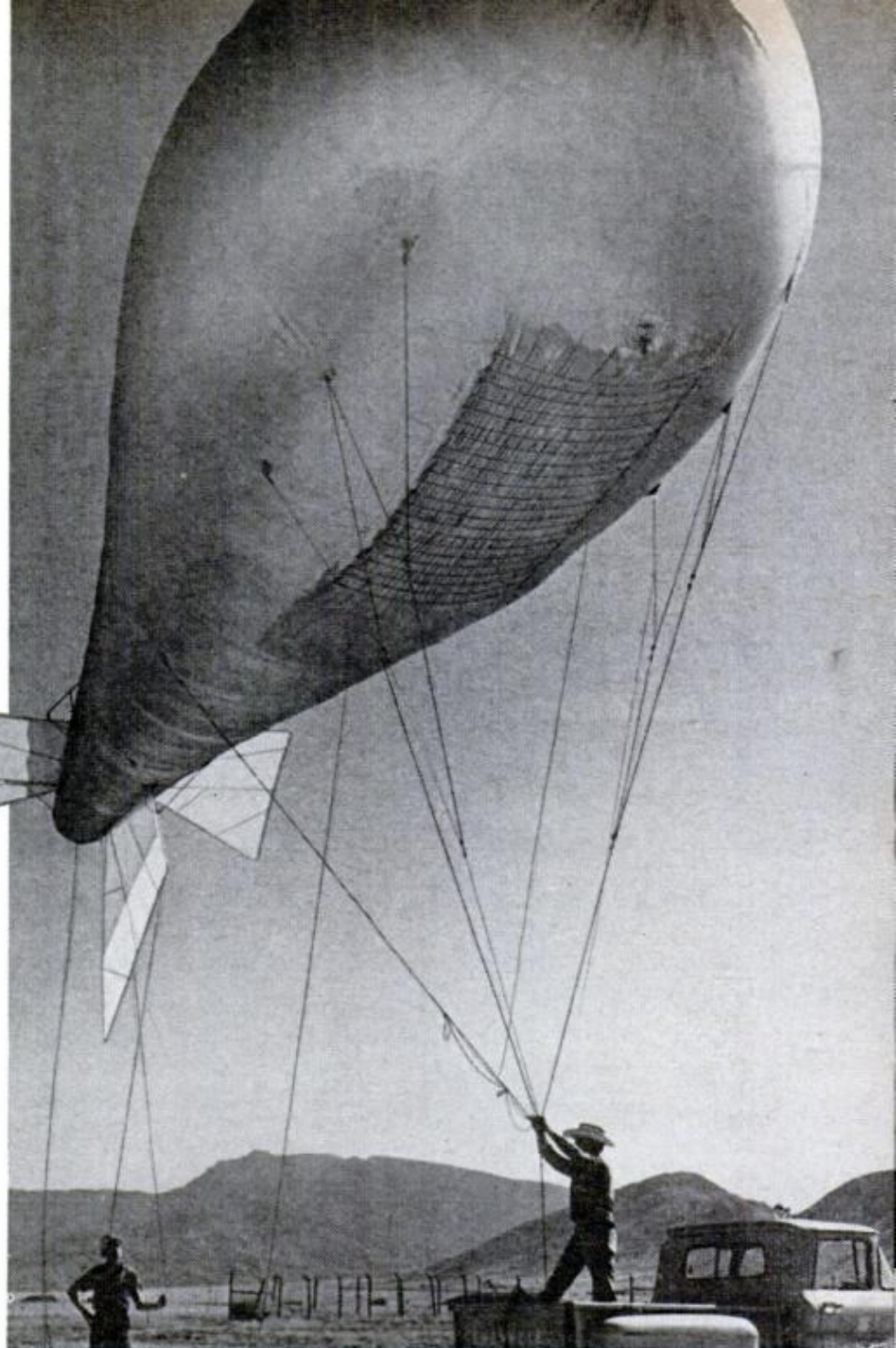
*DENOTES CLASS WINNER

The Super Lab That Nobody Knows

By NORMAN CARLISLE

A little-publicized research center in the New Mexico desert is producing scientific breakthroughs with some of the world's most exotic gadgets.

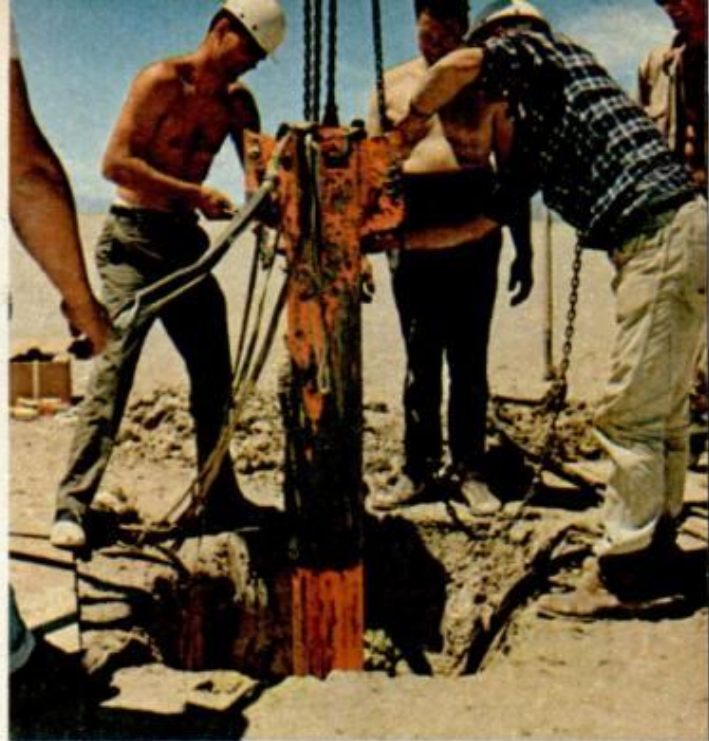
TETHERED BALLOON has instruments to record blast effects of outdoor canal-digging tests. An indoor wind tunnel (below) tests models of supersonic space vehicles



- THE WORLD'S BIGGEST X-ray machine.
- The world's fastest vehicle.
- A new science that reveals secrets of the earth.
- A new way to protect hospital operating rooms from germs.
- Proof that a new canal across Central America can be built with nuclear explosives.
- The first major mechanical invention of the 20th century.

You'd think all of these would have been developed individually at major universities or at separate industrial

POPULAR MECHANICS



SOIL STUDIES created the new science of terradynamics. Penetrators dropped from aircraft pierce soil (two photos above), to record in days terrain data that otherwise takes months. Rocket sled (left) is world's fastest, accelerating test equipment to speeds of nearly 5000 mph. Centrifuge (below) is the world's largest, subjecting test equipment to forces up to 100 Gs, violent rockings and temperatures that range from minus 60° F. up to 300° F. Just about everything at Sandia is the "biggest," "fastest" or the "first ever built"



laboratories. The fact is, they all came from one little-publicized research center sprawled over 32,000 acres of western desert. Even scientists, who know that Sandia Laboratories of Albuquerque, N.M., are operated by Western Electric Co. for the Atomic Energy Commission, may ask, "What is Sandia, anyway?"

The labs are clustered in some 100 buildings in the southeast corner of Albuquerque. But many tests take place



on the rocky desert stretching toward the Manzano Mountains.

An air of mystery hangs over the complex. There are armed sentries and the work on nuclear weapons is top secret. If weapons were *all* they experimented with at Sandia, you'd never hear *anything* about the place. Fortunately, there's more to the story. As a by-product of nuclear research, Sandia technologists are continually coming up with new tools, techniques and materials with peacetime applications.

In the process they have developed a bewildering array of far-out test machines, rating such superlatives as "biggest," "strongest," "fastest," "hottest."

One of the most spectacular is the world's fastest vehicle—this side of a spacecraft. It's Sandia's test rocket sled. At night it streaks like a meteor across the dark mesa. During the day it is just a blur, traveling its one-mile track in about a second.



LARGEST X-RAY machine (left) produces incredible 10,000 times more units than ordinary machine, subjects test equipment to radiation theoretically equivalent to what it would meet in nuclear explosion. Mile-long track (above) carries rocket sled laden with test equipment end to end in less than second

Dave Bickle, a "thirtyish" cigar smoker weathered by long periods outdoors, developed the sled's 22-inch gauge, much narrower than the famous Stapp sled at Holloman Air Force Base, N.M., which runs on an 84-inch track.

Bickle and his crew use the sled to learn how various pieces of equipment behave during extreme acceleration and deceleration and at speeds close to 5000 mph. Later, with more powerful engines and a longer track, they expect to top 6000 mph.

For destructive impact tests, equipment has been fired into walls of wood, earth, metal and reinforced concrete. Braking is by probes which reach under the sled to slam into water tanks.

Another high-speed vehicle in Sandia's centrifuge, one of the world's biggest, which subjects equipment, in a dizzying blur of speed, to as many as 100 Gs. Its master of ceremonies is John Ott, an engineer who makes spin-



DONALD WILKES and his Rolamite invention, hailed as the only great mechanical creation of the 20th century with wide applications for consumers

DESERT BLASTS (above, left) leave gaping holes in wasteland, but with purpose. Sandia tests may pave way for digging new canal in Central America with nuclear explosions—much cheaper and quicker than old ways

ning motions with his hands when describing how the centrifuge works. Ott has helped devise many of the subtle tortures added to the centrifuge. These include shaking chambers that rock and roll furiously as it spins, simulating the worst roughing-up a space vehicle could get. Heating and cooling elements add fierce temperature extremes, from minus 60° to 300° F.

What strikes you most as you watch the centrifuge is its eerie silence in action—just a whirring whisper of sound like that of a small whip lashing through the air. It's out of all proportion to the overwhelming size of the machine and its terrific speed.

A third brutal method to motion-test equipment is to shoot it out of a 92-foot airgun, again the world's largest. It was made of two 16-inch guns from an old battleship. They were machined to 26 inches, then flanged together, muzzle to muzzle.

Test objects are mounted in a piston and seated in the gun bore. The piston is "fired" by the sudden application of high-pressure air, up to 3000 pounds per square inch, at a speed of 900 feet per second. For some tests, the gun barrel is plugged, subjecting a 100-pound test item to 2000 Gs.

To find out more about what space vehicles suffer during re-entry from searing heat, Sandia engineers created a remarkable tool called, appropriately, HEAT (for High Enthalpy Arc Tunnel, enthalpy being a unit of measurement of the specific energy level of a substance).

In the HEAT chamber a mixture of oxygen and nitrogen gas is sprayed through an electrical arc at supersonic speeds, raising temperatures to 10,000° F. Scale models or full-size components are mounted inside the chamber and hundreds of sensors send out data to

(Please turn to page 217)

FIBERGLASS
CONSTRUCTION

AIR DUCTS

FRONT
DIFFERENTIAL

ALTERNATOR

CONDENSATE
HEAT EXCHANGERADJUSTABLE
HORIZONTAL
CANARDS

JET CONDENSER

INBOARD
DISC BRAKESBOILER
FEED PUMPAUXILIARY 125-BHP
TURBINE FOR BOILER &
ACCESSORY DRIVEMONOCOQUE
CONSTRUCTION

Bill Lear's Steam Car

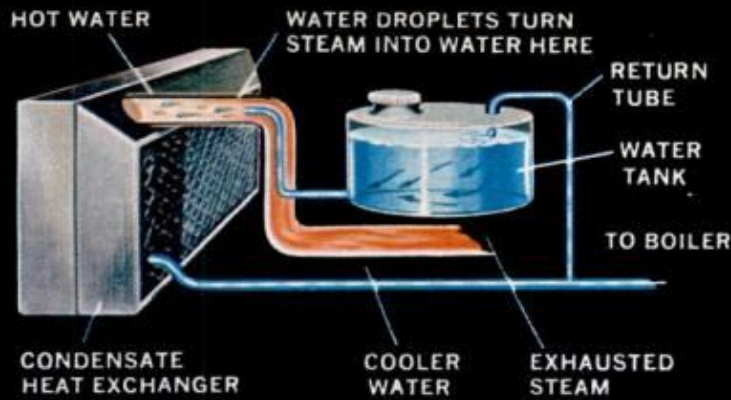
Here's what the genius of the executive jet has been up to in the Nevada desert. Indianapolis, look out!

By MICHAEL LAMM

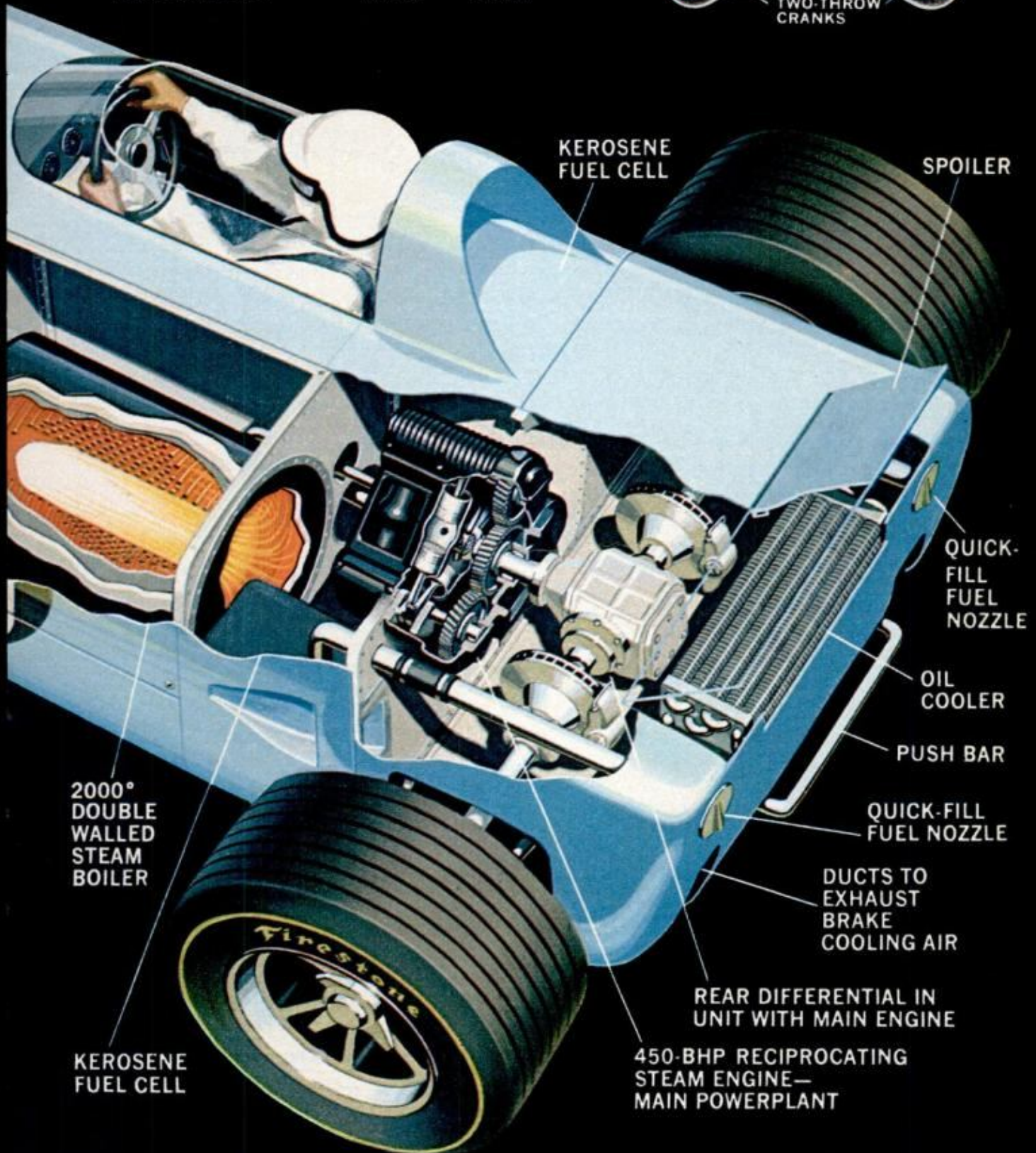
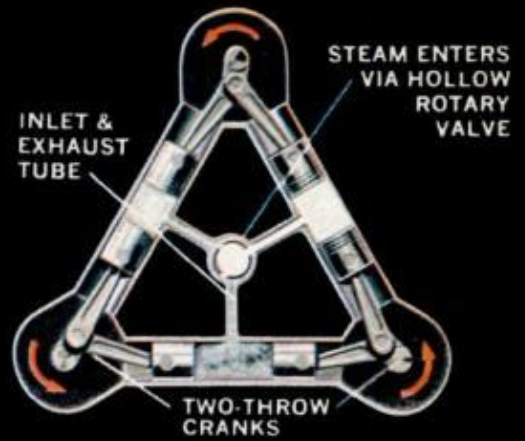
BILL LEAR is building a steam-powered Indy race car out in the middle of the Nevada desert. In fact, he's building two—and on top of that he's also scraping out a full-sized replica of Indianapolis Speedway out there in the same desert.

No one but Bill Lear could get away with it. But William P. Lear happens to have a history of tremendous success—the real golden touch. He's a multi-millionaire who never finished high school; developer and builder of the Lear Jet aircraft; inventor of the eight-

JET CONDENSER



LEAR RECIPROCATING STEAM ENGINE



Art concept created exclusively for Popular Mechanics by Dale Gustafson and Fred Wolff

As PM went to press, Bill Lear told us his steam racer wouldn't be ready for the 1969 Indy '500.' But he insisted the car would be completed and would appear at races later in the season.

track stereo, and entrepreneur without peer.

Lear recently allocated a cool \$10 million for his steam-car project. He's completely serious about launching the Lear Motor Corp. with publicity gained from (he hopes) one or two successful Indy entries this year.

Can he possibly succeed? This is written in late January, with only four months to go until the May 30 event.

The project started a bare five months ago, so the overall task seems impossible at this point. Between now and Memorial Day, Lear's cars will have to be designed, built and tested. Many of the most important components will have to be fabricated from scratch. Bill Lear boasts that each car will have 6000 parts when finished. As I write this, one car looks about 25 percent complete.

But if Bill Lear appears unworried, it might be because he's hired 100 or so of the world's top engineers, metallurgists, steam-car experts, race-car designers, toolmakers and mechanics. When I was in Reno, the huge Lear facilities literally roared with action. No fewer than 50 engineers hunched over drawing boards, whipping out blueprints for components. As one finished, a machinist or mechanic would grab it and start translating the lines into reality.

As this is written, no one knows for sure whether Lear's Indy steamers will use a turbine powerplant or a reciprocating engine. One car might have one, the other the other. Or they could both end up with turbines or reciprocating engines. Final decisions will come from test results.

To explain the workings of these cars, let's first look at Lear's reciprocating steam engine.

This is a six-cylinder powerplant built on a triangular pattern. It has



MILLIONAIRE INVENTOR Bill Lear peers through stainless-steel boiler coils that will be the heart of engine

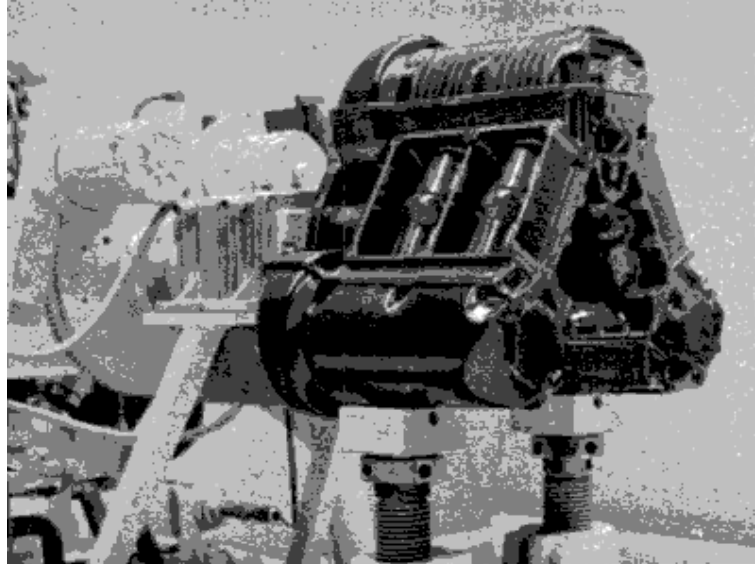
12 pistons and three crankshafts. This engine borrows heavily from the Napier Deltic, a diesel that got workouts in experimental British locomotives and medium-sized warships during the early 1950s. The Napier Deltic proved quite successful as a diesel, and its configuration is even better suited to steam. Actually Lear has hit on a very astute design.

This triangular pattern is good for steam because a reciprocating steam powerplant needs lots of stroke to allow for steam expansion. In other words, it has to have a much longer cylinder than a conventional gasoline engine. Thus, ordinary steam engines end up with loads of friction and don't turn up nearly the rpm that gasoline engines do.

What better way to shorten stroke and add rpm than by having twin pistons in each cylinder, these meeting head-on in the middle? This way, Lear engineers have kept the stroke short while giving ample room for steam expansion.

I would estimate that the Lear reciprocating engine must displace about 150 cu. in. It's a high-revving powerplant capable of an easy 450 bhp, and it gets this power either at stall or at top rpm. Steam engines don't need to rev to develop power and torque. The Lear cars need rpm only because they won't have any transmissions.

The engine's three short crankshafts



WOODEN MOCK-UP shows shape of reciprocating steam engine based on Napier Deltic diesel design



KEN WALLIS, who helped build 1967 Indy turbine, and Lear examine monocoque center part of steam racer

have two throws apiece, making each crank much more rigid than either an in-line or a vee configuration. The Lear 6 is extremely light and compact for its output.

Each crankshaft has a gear on one end. These three gears all connect and help rotate a central power gear that turns the car's wheels.

The triangular cylinder arrangement again adapts well to steam valving. Steam is piped into the middle of each cylinder via short ports that run from the rotary valve system caged inside the triangle itself. The rotary valves are equidistant from all cylinders. Thus all inlet tubes remain short and the same length, giving consistently high pressure to every cylinder. In some steam engines, cylinders farther from the main steam inlet get short-changed on pressure, but not with this design.

Steam pressure is generated inside a fairly conventional multicircuit cylindrical boiler. The Lear people tend to be rather secretive about many aspects of their operation, so they weren't willing to give out details about the steam boiler (or engines or condenser, for that matter). But from the look of it, the boiler uses nine coils, each fitting concentrically inside the other. A burner in the center is fired by kerosene and generates terrific heat, much higher than conventional steam-engine designs. Lear mentioned a figure of 2000°F.

These stainless-steel boiler tubes fit inside a double-walled container, and the whole thing is supposedly explosionproof. Normal steam pressure will be 2000 p.s.i. (the Doble steam cars of the early 1930s ran normal pressures of 1200 p.s.i.). Lear has experimented with his boilers by letting pressure build to 8000 p.s.i., whereupon a pipe burst inside the unit. Yet because of its multitube construction, the only damage was a burst pipe, no explosion.

"There's not enough volume all in one place to really explode," says Ken Wallis, Lear's general manager, formerly with Andy Granatelli and Shelby-Wallis.

To feed the fire inside the middle of the boiler, a high-capacity blower forces in air. This fan is driven by the steam racer's auxiliary power unit, a small steam turbine that also drives the other accessories: oil pump, alternator, boiler feed pumps, water pumps, and so on. This small turbine is about the size, weight and shape of a 2.5-gallon beer keg. It's driven by steam exhausted from the main steam engine, and it's rated at 125 bhp.

When I asked Lear and Wallis how they kept weights so low on their powerplants and supporting components, they answered only with a cryptic, "... space-age technologies." While unsatisfactory, this answer probably carries a good deal of truth. Lear is

(Please turn to page 230)

New Gear Means



New Cheer for Backpackers

Now you can use colorful, lightweight equipment that takes the back-break out of hiking.

By E. P. HADDON

PIONEER TRAILBLAZERS might have been tougher, but today you can be a backpacker as self-sufficient and self-contained as a battleship. Since you're out to enjoy yourself and not merely survive, you can stash gadgets in the pockets of a pack that make for comfortable living. Knowing that ounces quickly become pounds on the trail, you look for miniatures that'll do a man-sized job.

To those of us who've roughed it in back country with cumbersome and heavy gear, today's superb backpacking equipment seems a bit miraculous.

During the past year, I've hiked and climbed almost continuously—living out of a varied assortment of packs. From deserts to peaks above timberline, rainstorms and snows have combined to make it a pleasant and exhilarating experience. With all the comforts of home, my packs have been unbelievably light.

Styles and sizes of packs are as varied as the people who use them. For me, the handsome Camp Trails "Skyline" pack has been a favorite for extended stays in the high country.



NEW PACK called "Skyline" is lightweight and roomy

Four zippered outside pockets, a back pouch and a map pocket in the top flap hold the many hard-to-find items often temporarily lost in big packs. Styled from waterproof nylon, this pack fits the aluminum "Cruiser" frame used in Mount Everest climbs. On long treks, hikers are assured maximum comfort by adjustable backbands and foam-padded shoulder straps.

For colorful, luxurious "homes" on the

PACK GEAR (LEFT) WEIGHS LESS THAN 35 POUNDS

	LBS.	OZ.		LBS.	OZ.		LBS.	OZ.
Plastic snowshoes	2	8	Radio	8		Cups, dishes	4	
Flannel shirt, quilted vest	2	2	Whistle, signal mirror, compass, flint	3/4		Wash kit (toothbrush, soap, and so on)	7	
Tent (including poles and stakes)	13		Flashlight	3		Dry-freeze foods for a week	5	0
Pack and frame	3	9	Egg holder	3		Canteen	4	
Binoculars and case	1	11	Sewing kit	2		Mittens	6	
Sleeping bag, nylon			Knife, fork, spoon, case	1	8	Tubes for food	12	
Carrying bag	3	12	Sewing auger to repair tent, sleeping bag	2		Fuel bottle	2	0
Foam pad of nylon	1	8	Folding cup	3/4		Cook kit	11	
Small camera	1	8	First-aid kit	3		Burner	1	9
Tripod	1	7	Snakebite kit	2		Socks	6	
Washcloth and towel		7				TOTAL	34	1



DRY-FREEZE FOODS and lightweight tubes make it easy to carry enough food for several weeks. Five pounds of food can last for an entire week

trail, Gerry, Inc., and Bauer, Inc., have everything from a one-man tent weighing less than two pounds to a four-man tent with full headroom.

My Camp Trails two-man tent has everything. Hardly a handful, it weighs a mere three pounds and will fit into an oatmeal box. The tent with sitting headroom is seven feet long. It will easily sleep two. This urethane-coated ny-

lon shelter with attached ground cloth is positively weatherproof in rain or snow. Mine has successfully withstood 50-mph winds above timberline on an exposed ridge. Even when water ran two inches deep under its floor, none seeped through to dampen the sleeping bags. And I can zip up the tent, keeping out insects and snakes.

Restful nights mean more than enjoyable days, so I've included a Shorty Foam Pad (mattress) in my outfit. It makes you feel like a magician when you pull the big down sleeping bag and foam pad from the little stuff bag that's lashed to the bottom of the pack frame.

For those who prefer, there's also a backpacker's nylon air mattress that weighs less than a pound and a half.

Once camp has been established, this cleverly designed stuff bag becomes an easy-to-carry day pack. Shoulder straps, easily removed from the bigger Skyline pack, are attached to rings and grommets of the smaller bag. It's just right for carrying lunches, cameras, parkas and other trail necessities.

There's a variety of packs in every conceivable size for the day and weekend hiker—to a he-man size for real wilderness work. They've even made packs for the family pooch to carry.

For those who prefer cooking over an open campfire, there's a three-ounce



PLASTIC BAGS for water are lighter than canteens and easier and more flexible to squeeze into pack



SLEEPING BAG and air mattress slip neatly into carrying bag that straps to the pack-frame bottom

backpacker's grill made of tubular stainless steel. It's truly a handy gadget for keeping small pots and skillets level and slightly above the hot coals.

Even though it adds a couple of pounds to your pack, it's good to have a small stove for occasional use when it rains or snows. One of the favorites is a pack-size, Swedish-made Optimus stove. Using Coleman fuel in its four-ounce tank, it's complete with a built-in grill when open.

Simplest of all is the Bleu et butane stove that gives an instant blue flame, requires no priming and has proved itself on Mount Everest. One disposable tank lasts me a week or more for breakfast and occasional lunch cookery. Extra tanks weigh less than a pound.

Most conventional store-bought food is much too heavy, but there's a vast assortment of freeze-dried foods available to backpackers. Five pounds will feed a man for a week.

Wilson's precooked can of beef or pork patties weighs but two ounces and serves two. The addition of boiling water for a minute is all that's needed before serving. Another popular brand, Sportsman's Choice, has four delicious

freeze-dried beef steaks in a can that only weighs three ounces, yet serves four people.

Bacon and beef bars are precooked and pressed into small bars. They're easily crumbled into soup, eggs and other dishes or eaten on the trail. Powdered eggs, omelets, vegetables, beef and chicken stews are but a few of the fine main dishes available to present-day hikers. You can even have French apple compote.

Once you have detached yourself from civilization, even the simplest accessory may suddenly become important. Miniature sewing kits, first-aid kits, knives, dishes, axes and flashlights have their place in a well-organized pack. Aside from the luxury, midget transistor radios are also quite important in times of violent weather. Every item in the backpacker inventory, kept in the same place at all times, is instantly available—even in the dark.

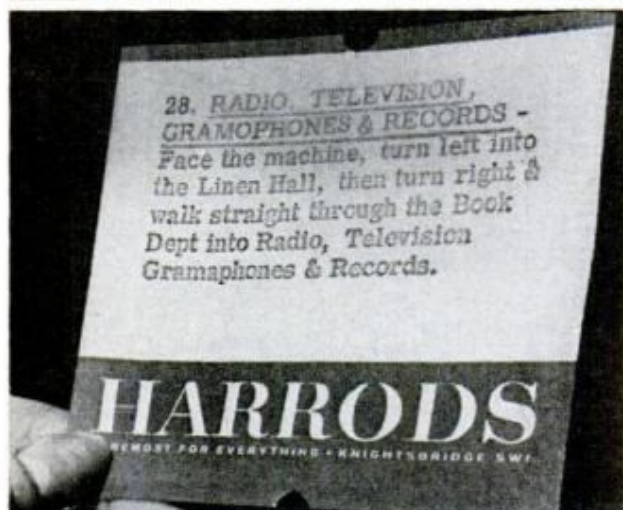
Though we might still rough it occasionally, there isn't one of us who'd exchange today's beautifully designed, highly efficient equipment for the old. A bit of luxury makes trail life more enjoyable for all. ★★★



RAIN PONCHO is so light you hardly know you are carrying or wearing one. It weighs only a few ounces



A RAFT is not impossible to pack to high mountain lakes. Again, lightweight material makes packing easy



Lost? Ask the machine

In Harrods Department Store, London, a customer can punch a button on the "Store Guide," and the machine will type out instructions to get to the desired department.



Underwater dozer

An underwater bulldozer, made by Japan National Development Co., can work on a harbor bed, controlled by a mother ship floating overhead. A diver, hovering nearby, telephones instructions to the dozer operator on the ship.



Well-off well

Most residents of Kirschweiler, Germany, cut, cleave and polish valuable stones. Thus, when they rebuilt an old well in the village square, they made it a monument to their trade. It glitters with agate, amethyst, turquoise, opal and other semiprecious stones.



Three-wheeling is 'skeeling'

Skates with three wheels in a row are "Skeelers," and when you use them, you go "skeeling." The new British sport is much like ice skating, except that you don't need ice. Skeelers come in adult and children's sizes.



How to raise a child—in one easy lesson

No more searching for telephone directories in order to get a youngster up to table height for a meal. All you need is "Kiddy-Up," which will add six inches to the child's chair. Simply lift the top of the unit and two hinges, locked by torsion springs, hold it in place.



Foil wrap for newborns

Looking a little like a baked potato, 3-week-old Hazel Duncan is keeping warm in the Silver Swaddler, a lifesaving foil. The plastic-and-aluminum wrap was invented by an English research group to help keep sick and premature babies from getting cold. The foil, which retains heat better than other materials, may have saved 3½-pound Hazel's life.



It's a bathroom

Visitors to the "Building 68" exhibition in Munich could understandably have gone away believing the bathroom will become the activity center of the home. The "bath of the future" (shown) has a sunken tub for bathing and "swimming." Around the wall (the room is circular) are niches for makeup, television, a small library, a bar and a rest corner.

JOBS

One-Armed High-Wire Artist



By **FRANK TAYLOR**

HIS ARM AMPUTATED after an industrial accident 28 years ago, Fred Beavers refused to give up. Today he's one of the best in a precarious profession—a maintenance man on one of the world's highest aerial tramways.

Beavers' job has few men on its waiting list. The tramway, tacked like a giant spider web of steel on the granite slopes of Mt. San Jacinto in California, has 27 miles of moving cable. It's Beavers' job to inspect every inch of cable, and he does it by climbing out on slippery grease-coated cables up to 1000 feet above the rocky canyon floor.

Scampering about the system, Beavers is a picture of ease and precision. A daily chore is sitting above the tram car on its support carriage inches from the speeding cables where he can get a close-up view.

The tram lifts passengers up one of the sheerest rises in the world, more than a mile in 15 minutes.

Winds topping 100 mph have been recorded, lashing the cars and making inspection extremely precarious. When deep snow shuts down the system, Beavers walks the wires like a tight-rope artist to the trouble spots. ★★ ★

MINUS ONE ARM, Beavers more than holds his own in precarious business of tramway maintenance



FRED BEAVERS rides to work, 1000 feet above canyon floor, just as casually as any other commuter

Photos by the author

TIGHTWIRE ACT is performed when system is halted momentarily and Beavers scampers over cables to trouble spot. Tramway operates summer and winter



**FORD
XL**

Sleek as a Cat—With A 'Dog' of a Dashboard!

By **BILL HARTFORD**, Technical Auto EditorPhotos by *Irving Dolin*

FORD. The name is like magic. It evokes a response unlike that known for any other car. In the minds of the old-timers, Ford started the whole bloomin' business. Myth of the middle-aged Ford fans is that the birth roar of the '32 V8 was the first heard 'round the world—never mind Hewitt, never mind Cadillac. To a couple of million kids now in their 30s a gray-primed

Ford (or "Merc") was the only machine worth looking at—or listening to—in the high school parking lot. The rest were invisible, nowhere cars. To the now generation, Ford means Mustangs, GT40s, USAC, FIA World Manufacturer's and NASCAR championships. And now the Maverick—a whole new scene. Be first with a Ford.

No wonder more owners of '69 XLs

COMING AND GOING, the XL drew loudest hurrahs from owners for style—called sporty for full-size car



chalk up their choice to "past experience" than for any other reason—they're hooked. "I've liked Fords since I was a kid—guess I always will," muses a 30-year-old Virginia machine operator. "I've driven a Ford for as long as I've been driving," says a machine-shop setup man from Illinois. A South Carolina service station manager confides, "We're a Ford family." His other car is a '65 Ford convertible. It could have been predicted: The other cars owned by XL owners are Fords in an unusually high percentage of cases (see summary chart on page 143).

A shipping clerk in Illinois has, he says, "had nine Fords—very good luck with all of them." Another "Ford man," a surgeon in Oregon, doesn't sound as enthusiastic, however. "Habit," he admits, was the reason for his choice.

Habit is also a reason for the generally unfavorable reception to the XL instrument panel. For one thing, everybody knows that a driver operates the radio with his right hand. Put the radio on the left of the steering wheel and you're bound to get some static. "Move over the radio!" yells a right-handed Alabama student. A tractor-trailer driver in New Jersey and a self-employed Oregon owner want it moved to the middle of the dash so both driver and passenger can use it.

Then there's the ashtray. It's placed near the middle of the dash—around



DRIVER'S ASHTRAY, believe it or not, is around the corner of the semi-wraparound instrument panel. Puzzled owners criticized this clumsy arrangement

INSTRUMENT PANEL controls and switches are grouped close to steering column, are actually more difficult to use than if spread out, say XL owners

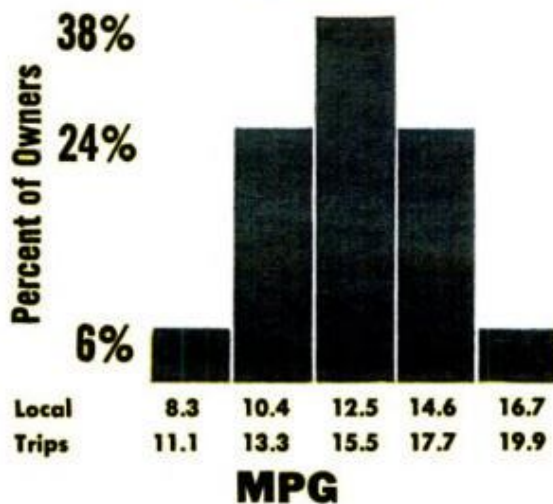


HARD CORNERING is not a habit of XL owners; they like superhighway handling and ride next to style



FORD XL FUEL MILEAGE CHART

390-cu.-in. V8





FRONT END of Ford XL has strong character and is the styling element most often mentioned by design-conscious owners. Extruded aluminum grille sections flip up to reveal dual headlamps, close to blend into radiator air-intake section. Six out of ten owners have the 390-cu.-in. V8, one-quarter of owners have the 429. Some owners with the 302 V8 (220 hp) find it leaves their roughly 3800-pound car a bit underpowered. Rear-seat passengers find the ride comfortable, even in two-door models. For some, rear visibility seemed sacrificed for style

the corner of the new "instrument cluster," as Ford calls it. "It's in the wrong place for the driver," observes an Ohio assembly worker, and dozens of other owners concur.

Then there are the switches and controls—"tightly grouped for easy driver-reach and observation," says the brag book. Many owners would change that to "too tightly grouped. . ." One of the difficulties is having to reach around (or through?) the steering wheel to reach the controls such as heater and wipers that are grouped around the steering column. A North Carolina clerk doesn't get specific, but just sighs, "Rearrange the dash."

Then there are the two switches—lights and ignition—that are down below the dash. "Can't find the light switch and ignition switch," grumbles a Minnesota crane operator. "Impossible with shoulder strap on," adds our Ore-



gon surgeon. His clock doesn't run, either—another minor complaint. An Ohio mail carrier also finds that it's "hard to find the switches at night."

The inside view from the driver's seat is especially dim at night. "Interior lights are useless, placed wrong," criticizes an Indiana oil-company supervisor. Most owners like the low indirect lighting, but an overhead dome light is necessary, too.

Small glove box (should be able to hold *two* pair of gloves, smiles one

Summary of 1969 Ford XL Owners Reports*

Total miles driven: 577,762 Average miles per gallon: 302-cu.-in. V8, local driving 13.4 long trips 15.9 390-cu.-in. V8, local driving 12.5 long trips 15.5 429-cu.-in. V8, local driving 11.9 long trips 15.1 240-cu.-in. Six N.A. Specific likes: Style 46.0% Handling 35.3 Ride 31.7 Comfort 30.2 Performance 17.3 Power 12.2 Specific dislikes: Wind noise 20.3% Gas mileage 9.4 Dealer service 6.0 Workmanship 6.0 Rattles 5.1 What changes would you like? Better workmanship 10.8% Vent system 10.8 Ashtray location 9.0 Dash layout 8.1 Glove compartment 6.3 Engine: 240-cu.-in. Six 0.0%	302-cu.-in. V8 16.4 390-cu.-in. V8 59.2 429-cu.-in. V8 24.3 Model: 2-door sedan 2.6% 4-door sedan 0.7 2-door hardtop formal 12.4 2-door hardtop fastback 76.5 4-door hardtop 0.7 Convertible 7.2 Station wagon 0.0 Transmission: 3-speed manual 1.3% 4-speed manual 1.3 Automatic 97.4 Had any mechanical trouble? No 60.3% Yes 39.7 What kind of trouble? Brakes 27.1% Cold start 16.7 Transmission 10.4 Carburetor 8.3 Dealer repair satisfactory? Yes 60.4% No 39.6 Why the Ford XL? Past experience 39.7% Style 35.8	Economy 15.2 Service 9.3 Performance 5.3 Is the Ford XL your only car? No 51.6% Yes 48.4 Other cars owned: Ford 55.8% Chevrolet 16.1 Plymouth 7.4 Pontiac 6.2 Mustang 6.2 Mercury 4.9 What options/accessories: Power steering & power brakes 69.1% Radio 60.4 Airconditioning 42.5 Power steering 29.6 Tinted glass 17.3 Bucket seats 15.1 Console 13.0 Whitewall tires 13.0 Rear defroster 13.0 Stereo-tape 12.2 Vinyl top 12.2 Power windows 3.9 Age distribution of owners: 15-29 22.9% 30-49 53.1 50 plus 19.0
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*Where applicable percentages may not equal 100 percent due to rounding and/or insufficient sample.

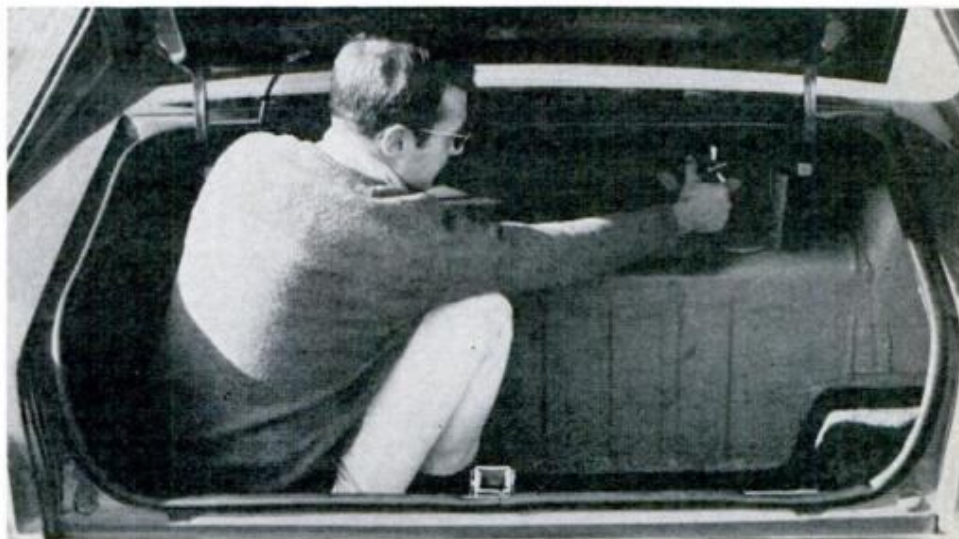
owner) and whistling ventless side windows are further complaints about the interior of the XL, in fact for most '69 Detroit models. But the comfortable roomy interior is a big plus for the car. "Extra room for the front-seat passenger is spectacular," according to a North Carolina salesman. "The ride is so nice it's hard to stay awake," yawns a Pennsylvania mechanic.

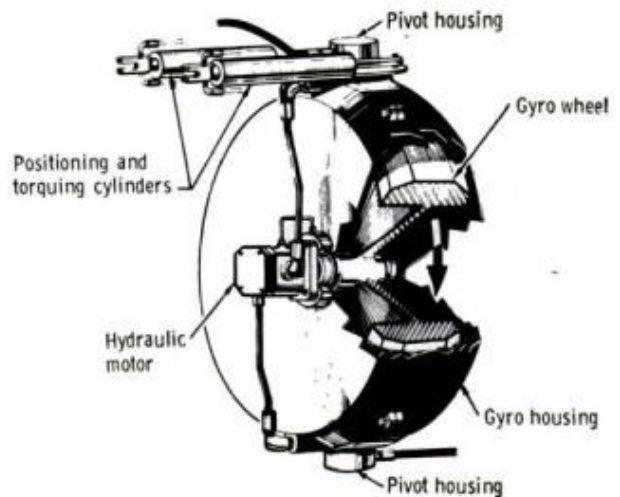
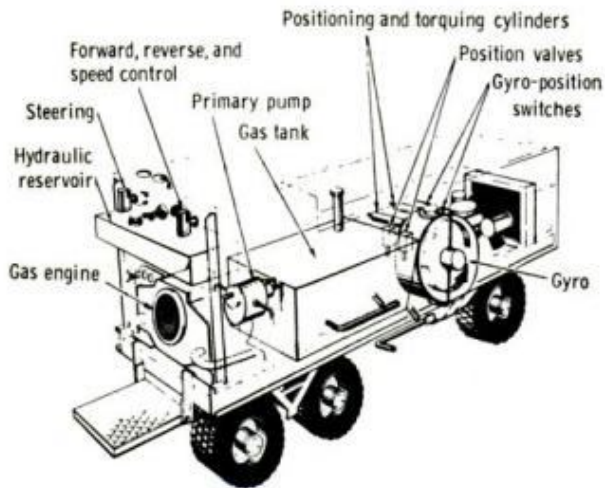
For a Pennsylvania watchmaker, too, comfort is excellent, but he is most impressed that "it's a beautiful car and it

runs perfectly." To a North Carolina industrial developer, "Its design is outstanding—front end especially."

One XL owner from Minnesota sent back a rather one-sided reply. Sample quotes read: "Absolutely tremendous . . . nothing better at any price. . . superb . . . best there is. . . I'd definitely buy another." Turns out he's a Ford sales manager. He winds up with "See me for the best service and deal. Thanks." Put him to the test if you're ever in White Bear Lake. ★ ★ ★

TRUNK DESIGN of the XL puts spare wheel high on shelf. Trunk is deep and lid opens almost down to the rear bumper for easy loading. Most owners say the squared-off design is excellent for carrying suitcases. The volume of the luggage compartment in this two-door formal hardtop is 18 cu. ft. It's the same in all of the other models, except for the convertible which has 15.9 cu. ft.





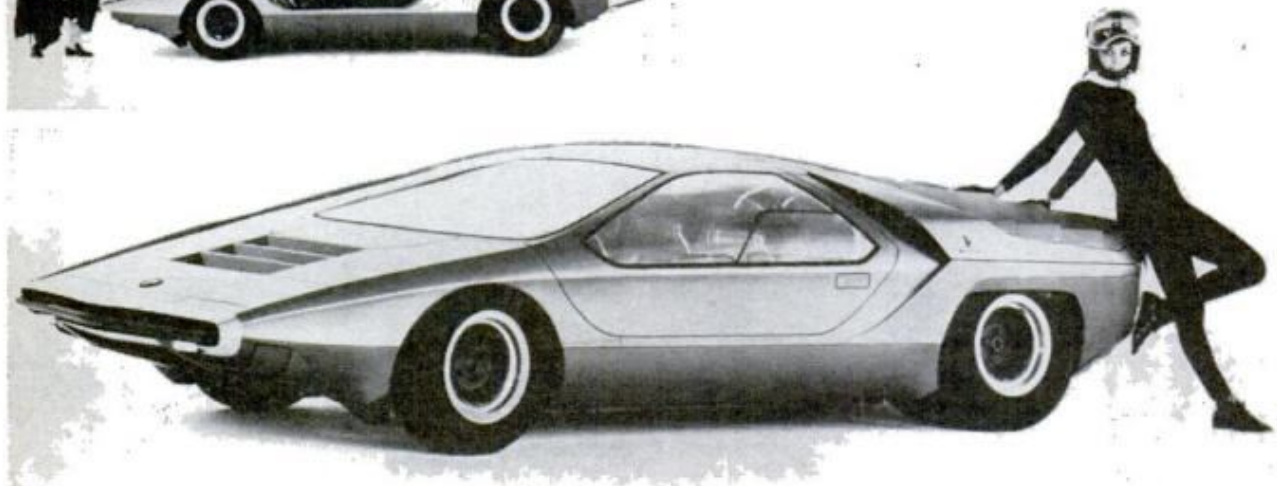
Forest Service develops a gyro-stabilized 'Mule'

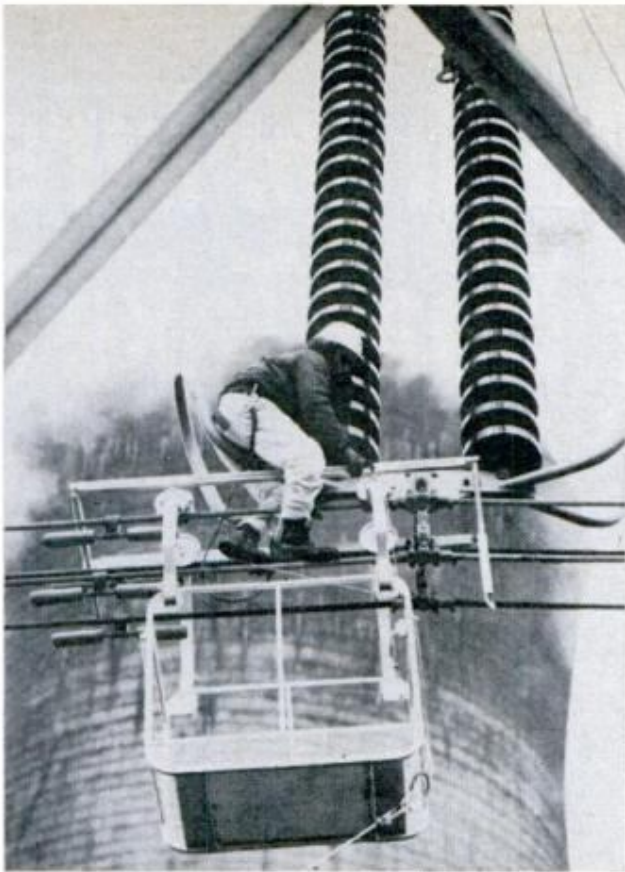
The U.S. Forest Service has developed a gyro-stabilized back-country cargo carrier that will probably replace the horse and mule. It's the Gyro-Mule, an 8-foot by 32-inch vehicle that can carry an operator and 800 pounds of gear. Traveling 6 to 8 mph, and able to climb a 60-percent slope, the Mule (and gyro) are driven by an 18-hp gasoline engine. At upper left, the vehicle travels a trail, and at upper right, it demonstrates on a railroad track the balance its 5500-rpm gyro gives it. Drawings illustrate major features.



Bertone's 'Carabo'

A "star" of the Paris Auto Show was Nuccio Bertone's "Carabo," which he designed for Alfa Romeo on the Alfa Tipo 33 chassis. The sleek car stands just 39 inches high.





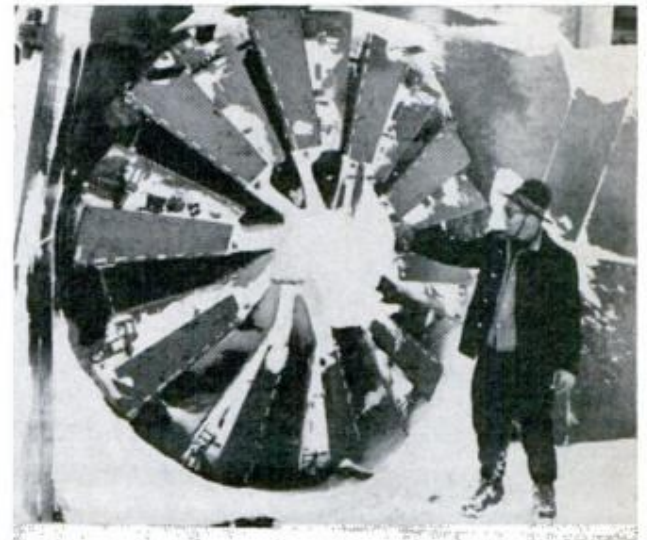
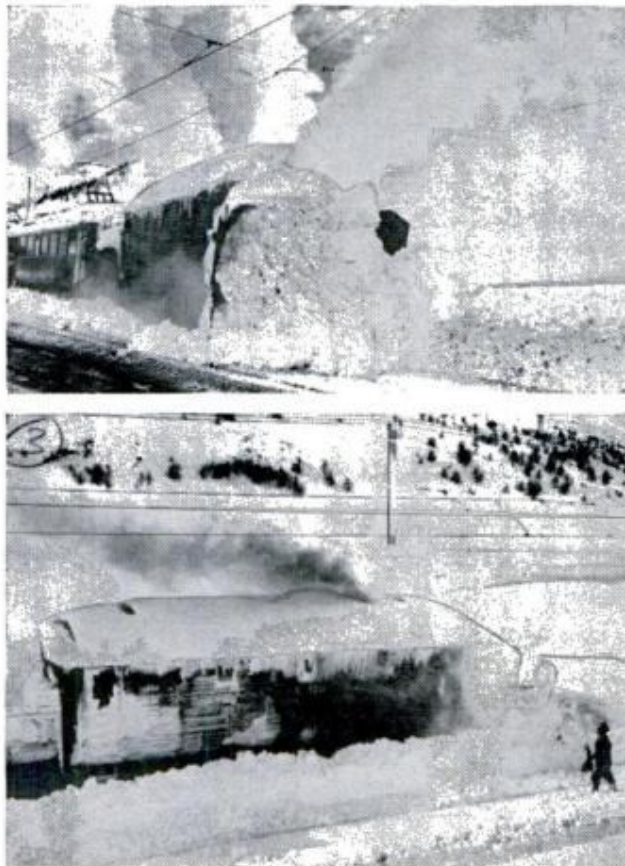
High-power trolley

The Barnsley Power Line Trolley, which can carry a crew of three, is speeding up maintenance and repair work on Britain's high-tension cables. The trolleys can even "jump" suspension insulators in a 3-minute operation.



The long arm gets longer

Shown at a recent police demonstration in England was a mobile facsimile receiver that allows patrolmen to receive photos of criminals or printed information without interrupting radio voice communications.

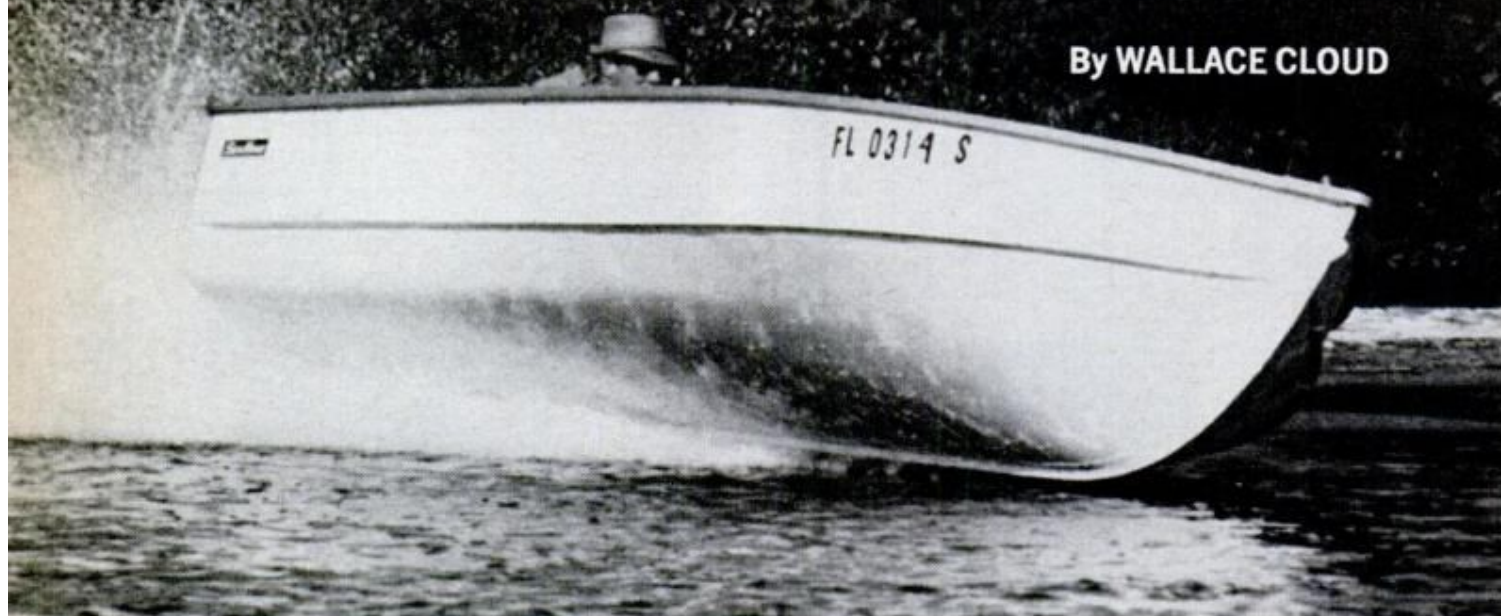


Swiss winter 'sport'

Keeping the Swiss railroads running during the winter is a rugged task that requires hardy men (who often must work 14 hours at a stretch) and big machinery. Most of the work is done by centrifugal throwers that are steam-powered. A giant blade is shown undergoing inspection (above) and at work throwing snow (two photos at left).

How Much Torture Can Your Boat Take?

By WALLACE CLOUD



Experts at Tropical Marine Testers have definite ideas about boat construction, propulsion and accessories. Here's what they've learned about marine equipment and how they test it



TMT TEST DRIVER, Dean Money, modifies 14-foot aluminum test boat by adding tiller extension, cushions and backboard. Now he can take rough water

YOU AND YOUR BOAT can experience almost as much G force on a windswept lake or harbor as astronauts re-entering the Earth's atmosphere. That's one of the things I learned when I got behind the wire fence guarding the Florida marine testing laboratory that checks out boats and equipment for some of the nation's leading manufacturers.

"Want to see what 25 Gs feel like?" asked Marshall Eldredge Jr., of Tropical Marine Testers, Inc. "Climb up on the platform and stand with your legs stiff."

I got up on the test bed of the desk-sized impact testing machine and Eldredge flipped the switch. A drive train powered by a small electric motor raised the platform only about four

inches, then let it drop against a steel framework anchored to the concrete foundation—repeatedly. With my legs stiff it felt like jumping out of a second-story window.

The two impact-testing machines designed and built by TMT are used mainly to test gas tanks for customers. According to Boating Industry Assn. standards, tanks designed to be built in must withstand 25-G impact 1000 times. These tanks must be filled with water (which is heavier than gasoline, increasing the severity of the test) and must not rupture.

Does your boat hit that hard? Dean Money, another of the TMT testers, said impacts up to 25 Gs had been measured in offshore-racing powerboats jumping off 10-foot waves. He added that he had run some tests in conditions more typical of the way most people use boats, and had found that in a poorly designed hull the driver receives as much as 8 Gs in a light chop—as many Gs as astronauts get during re-entry.

Better hull design, said Dean, reduces impacts in a boat to six to seven Gs in fairly big waves. "But that's very uncomfortable," he said. "Anyone in his right mind would slow down to where the impacts are one to two Gs, especially if you're sitting down—although in rough water you might tolerate two or three Gs."

Located at the end of a dirt road near North Palm Beach, where it's easy to keep out uninvited visitors when a client desires secrecy, Tropical Marine Testers is the only independent marine testing lab in the field of consumer boating products. It shares that field only with facilities operated by a few big manufacturers of engines and boats.

The operation is deceptively simple—give equipment hour after hour of hard use.

Although there's a Quonset containing a machine shop and sophisticated test equipment, the basic philosophy is environmental testing. "I've had engineers tell me that they've run a piece of equipment for X hours in a salt-spray



DIP-DRY is the test wheel that rotates once every six hours, submerging items for two hours, exposing them to sun for four. Bob Parker checks paint test

Photos by the Author

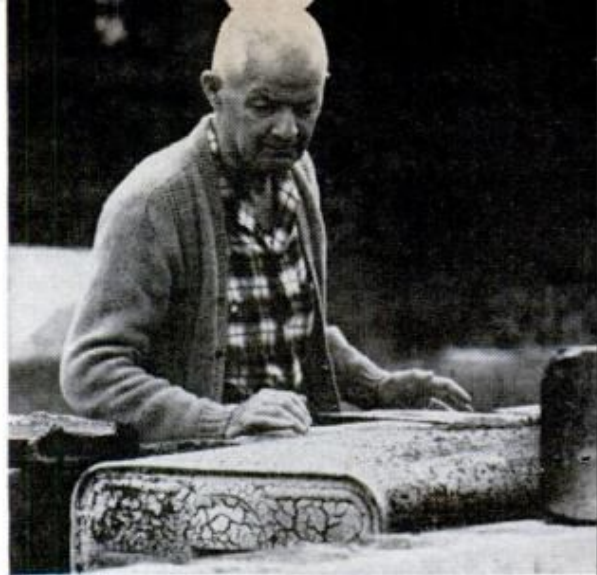
chamber, and then when we put it on a boat it breaks down," said Bob Flagg, president of TMT.

That's one reason why TMT is located in Florida, where the climate is benign from the human point of view but brutal for boats and hardware. The warm water, going as high as 90°F. at times, and the high salinity of the water encourages corrosion and the growth of marine organisms. The climate also makes it possible to give a boat any amount of continuous use.

I rode with three of TMT's waterborne test pilots—Marshall Eldredge Jr., Dean Money and Bob Parker—for several days, and I can testify that they don't slow down for anything except bridges, where another boatman might be hidden by the bridge structure. TMT's "68-mile test track" is a stretch of the Intracoastal Waterway, with five rough inlets out to the sea, providing a variety of fresh, brackish, and salt-water studded with sandbars, logs, oyster beds and the wakes of luxurious cruisers, which make ideal launching ramps to jump the boats and subject



GAS-TANK FIRE TEST subjects gasoline-filled tanks to 1000°F. for 2½ minutes. Tanks must withstand this tremendous heat to pass. Marshall Eldredge Jr., holds a stopwatch waiting for temperature, registered on wall meter, to reach the proper figure



BOB FLAGG, TMT president, checks gas tank after fire test. He's been in engineering and boat racing

them to those G forces.

Much of TMT's work is destructive testing—boat wrecking—which calls upon the drivers to violate the principles of sound boating. "We get some pretty funny looks from people on the waterway," said Eldredge. "There's a sandbar down the middle

of the waterway in one place, and everybody knows it. When we were running destructive tests on plastic propellers a while back, we'd come barreling right down the middle at full speed with the prop throwing up a rooster-tail of mud, and we didn't even look back. I saw some fishermen who just sat there looking stunned."

During the same series of tests on Columbian Bronze plastic propellers—actually a development program that lasted four years—both the propellers and testers proved their ability to withstand shark attack. Bob Parker and Tom Ryan had paused for a break out on salty Lake Worth, with the blue and red props on their boats turning over at idling speed, when a shark began striking at the propellers. The shark hit 20 or 30 times, Parker told me, be-



DROP TEST for gas tank is complete after tank, filled with water, has withstood 25-G impact for 1000 falls. Tanks will be permanent inboard installations

fore the men managed to stun the fish with an oar, get a rope around it, and drag it into one of the boats. It was a six-foot shark; on examination, its stomach turned out to be completely empty. The TMT men think the colored propellers acted like lures, but said sharks sometimes strike at other props, and seem particularly attracted by those with through-hub exhaust.

A recurring subject of conversation was hull design, a very important factor affecting those G forces. The TMT men were not enthusiastic about some of the so-called cathedral hulls. They agreed that such boats have a great deal of stability—at the dock. But this doesn't necessarily hold up when the boat is under way. When one such design they tested reached planing speed, a wall of spray rose from the bow and enveloped the entire boat.

The major criticism was that such boats tend to pound a lot and transmit high impact to the people aboard, since there is a large frontal area hitting the water. The drivers pointed out that there has been a general trend toward modifying the cathedral hull in the direction of a deep-V shape with sponsons that are not in the water very

much at high speeds. They felt that the best hull shape for reducing or cushioning impacts is the deep-V hull, and that this shape can be relied upon for good all-around performance in a variety of water conditions.

Another criticism was that the cathedral hull reduces speed due to its built-in drag. Marshall Eldredge said that actually pleasure-boat speeds have decreased in the last 10 years in spite of the trend toward increasing horsepower. Right after the war, he said, it wasn't unusual for boats to hit 30 to 35 mph with a 35-hp motor. But it's now very hard to get up to those speeds, even with a more powerful motor.

Engines also came up for considerable discussion. I asked about the trend toward putting stern drives in small runabouts; is an inboard engine justified in a 14-foot boat?

There was a difference of opinion among the TMT men, although they agreed that the 80 to 120-hp range of the small stern drives makes them adaptable to small boats. Bob Flagg felt that there is a good case for the inboard-outboard: The boat is easier to handle, since engine weight is lower down, and that also makes for a more

TMT TEST DRIVERS have their own name for rugged trials. They call them "driver tests." These men take a lot of punishment carefully wrecking boats month after month. Surprisingly, they seem to have a good time



Marine aluminum, a special alloy containing no copper, 'is so good, we don't even test it for saltwater endurance any more . . .'

comfortable ride. It's easier to get at the motor for service. Although the engine takes up space inside the boat, this may be considered equivalent to gas-tank space required by an outboard motor, since the gas consumption of a stern drive is less.

Marshall Eldredge, on the other hand, said, "Until you get to where you need 150 hp, you're better off with an outboard motor, because of the power-to-weight ratio." He also claimed that the small stern drives don't give good low-speed performance, and are deficient in acceleration under load, as in getting a water skier up on plane. He also said there's less maintenance with a modern outboard motor—the cost of a year's maintenance of a stern drive can be as high as \$250 to \$300, actually higher than a straight inboard engine, due to the additional mechanism of the outdrive.

The testers agreed that there has been much progress in outboard motors and other aspects of boating in the last 10 years—roughly the length of time TMT has been in business as an independent testing lab. Outboard motors in particular, said Bob Flagg, have been improved greatly. They have better ignition systems, longer-lasting water pumps, give longer sparkplug life, and the lower units retain oil better, he said.

Many synthetics, such as nylon and dacron for rope, have proved to be much better than older materials. Marine aluminum, a special alloy containing no copper, "is so good, we don't even test it for saltwater endurance any more," said Flagg—all reputable manufacturers of aluminum boats use and advertise it.

But when it comes to hardware, Flagg felt that the best is still the old-

fashioned chrome plate that's triple-plated on bronze (the layers of plating are copper, nickel, and chromium). It will last indefinitely, he said, pointing out that cheaper chrome plate is just a thin flashing of chromium on die-cast zinc-aluminum alloy. The cheap chrome plate tends to have pinholes that allow corrosion to start from underneath so the plating peels off. He said galvanized hardware is still a good buy, but it comes in different quality grades and prices.

In structural materials, Flagg said that progress in methods of fabricating fiberglass has made possible boats more comfortable and safer than wooden boats. But this has had an unfortunate by-product: The good reputation earned by fiberglass boats has been tarnished by poorly built craft manufactured by a few fly-by-night builders.

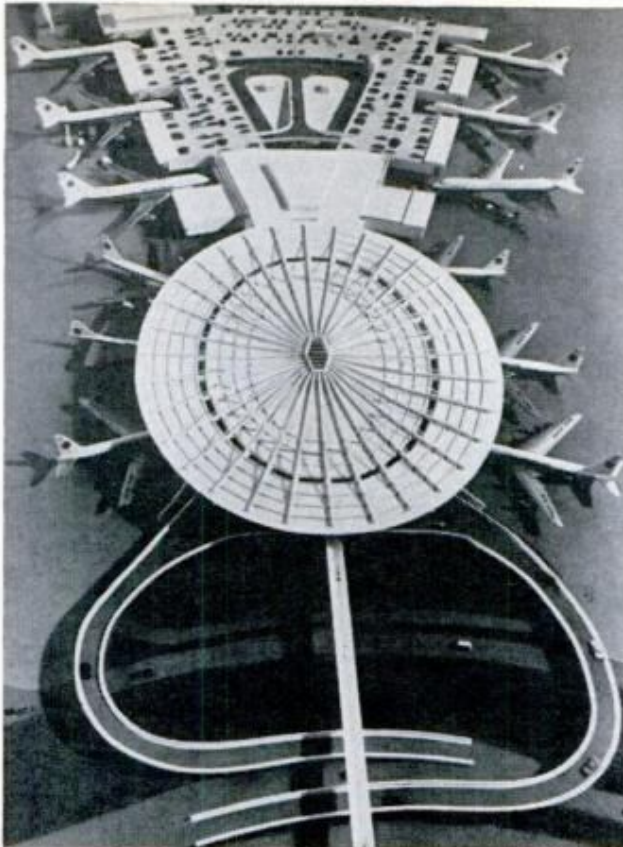
These boats are hard to tell from good fiberglass construction, the testers said—until they are in service. Then, due to skimpy construction of the reinforcing structure concealed under the boat's floor and in other inaccessible places, or to sloppy layup with too much or too little resin in the fiberglass, the boats develop cracks and leaks—sometimes after only a few hours use.

Tough even for an expert

Since all fiberglass boats look shiny, and it's hard even for an expert to spot structural defects while a boat is in the dealer's showroom, the TMT men felt that the prospective buyer should regard the manufacturer's reputation as his best protection, and he should be especially wary of unknown makes and "bargain" boats sold by motor dealers.

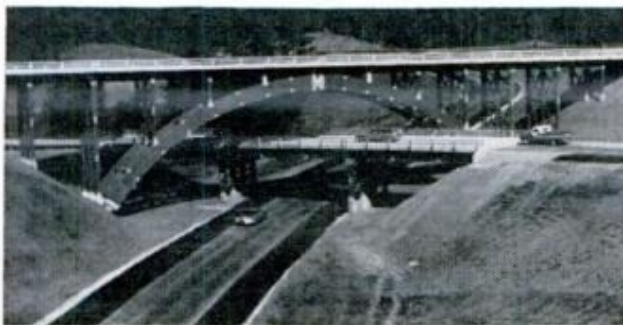
On the other hand, they said a great deal of damage to small boats is due to the beating they take on bad trailers. Fully half the trailers in use, Bob Flagg estimates, are too lightly built to properly support the weight of the boats they carry.

Flagg feels that the boating public
[\(Please turn to page 229\)](#)



New Pan Am terminal

A two-level road system will allow passengers to drive within a few steps of their aircraft in Pan Am's new \$50-million terminal now under construction at Kennedy International Airport. There will be six gate positions for 362-passenger Boeing 747 Superjets and 10 for present-day aircraft.



Largest on laminations

Where U.S. 16 splits at a "Y" near Mount Rushmore, S.D., engineers built the world's largest bridge (290 feet) to be supported by glued-laminated wooden arches.

APRIL 1969



Moon prospector

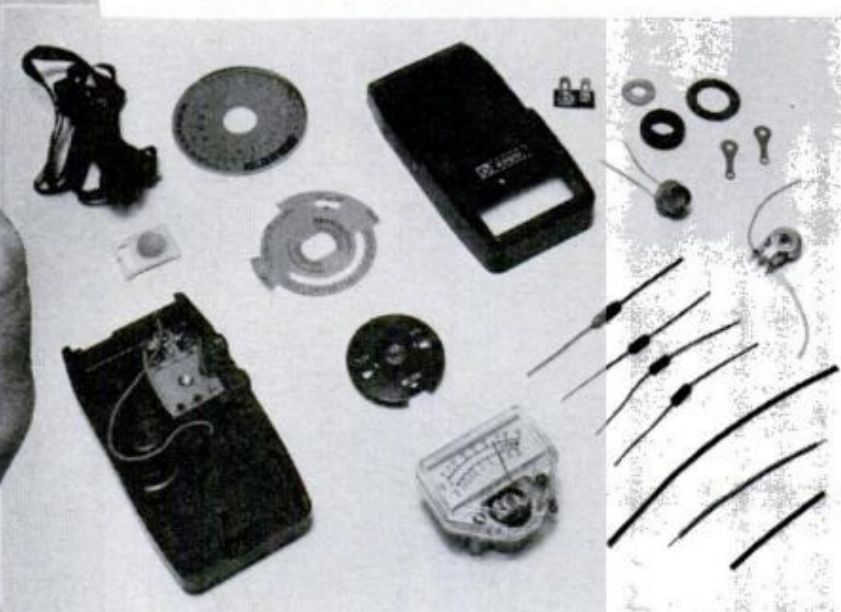
A battery-powered drill will be used by the first U.S. astronauts on the moon to make two three-meter-deep holes in order to obtain core samples and place temperature sensors. Martin Marietta made the tool for NASA.



Floating city

Designer R. Buckminster Fuller (right) explains his Triton "floating city" to a U.S. Housing and Urban Development official. Its site would be on water near a large city.

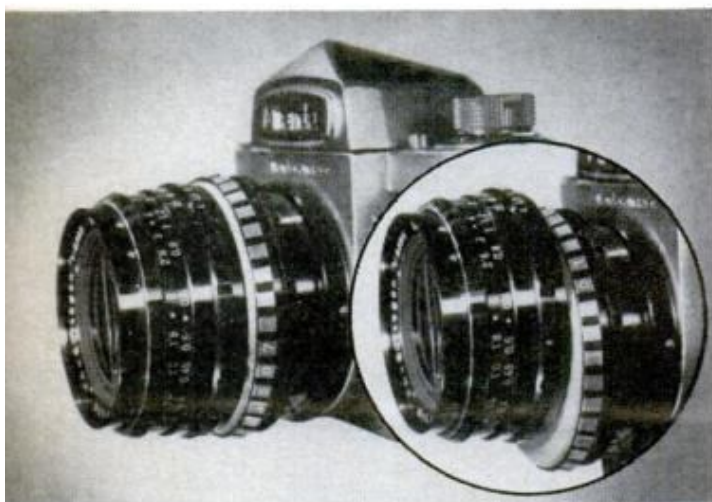
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For the first time: a sensitive exposure meter you can build from a kit

Many things come in kit form these days, but this is the first time for a full-fledged photographic exposure meter. The Knight-Kit meter, incorporating a precision Honeywell CdS light-sensing unit, is claimed to be so sensitive it will give accurate readings even in moonlight. A choice of two ranges lets you switch from normal to extra-sensitive meter-

ing when recording very low light levels. A sliding filter also enables you to read either reflected or incident light. ASA settings range from 6 to 12,000, shutter-speed settings from 1/4000th of a second to 30 minutes. The assembly goes quickly and can be completed in an evening. The price is \$19.95. Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680.



EVER SEE A LENS split apart sideways? This unusual Schneider Curtagon shifts 7 mm above the normal optical axis when you turn it. The effect is the same as raising the lens on a big bellows camera, helping to eliminate distortion when shooting tall buildings and similar subjects. The 35-mm lens fits most 35-mm cameras. \$249. Burleigh Brooks, Inc., 44 Burlews Court, Hackensack, N.J.



NOT MUCH BIGGER than a power-cord plug, this tiny photoelectric triggering device will fire a slave flash up to 50 feet from the camera with no wires in between. You just plug the small cube into the remote flashgun. A light-actuated, silicon-controlled rectifier picks up the main flash and trips the slave at the same instant. Price: about \$20. Graflex, Inc., 3750 Monroe Ave., Rochester, N.Y.

PHOTOGRAPHY



Filmstrip editor helps you mount slides in a hurry

For those who like to mount their own 35-mm slides, this clever device makes the job easy and fun. It incorporates an illuminated viewing stage, a retractable magnifier and a hinged cutter. The strip of film is gripped between rollers and advanced across the viewing stage a frame at a time. A magnifier is swung up and over the film to aid in editing the strip (No. 1). When you reach a frame you want to mount, the magnifier is retracted into a recess and a slide mount is slipped under the film (No. 2). The film can be rolled forward and backward to center the frame perfectly in the mount. The hinged cutter is then pressed down over the film (No. 3). This simultaneously closes the mount and slices off the film at each edge. You just raise the cutter and lift out the mounted slide (No. 4). Price is \$22.95. The special snap-together mounts are plastic and are thin enough to fit into all standard projectors. They cost \$8 for 100 with glass, \$4.50 for 100 without glass. Called Dia Perfektor, the system is sold by Vytron Co., Box 832, Amityville, N. Y.

THE ACCESSORY LENS at right screws directly into a camera's regular lens and converts it to a whopping 350-mm telephoto. It can be used with most single-lens reflex cameras but is especially designed for those having leaf-type shutters—such as the Kowa, Retina, Topcon 100 and Bessamatic—for which long-range telephoto lenses are not generally available. The 12-oz. lens has its own focusing mount and is front-threaded to accept standard filter holders. Price is \$19.95. Spiratone, Inc., 135-06 Northern Blvd., Flushing, N. Y.

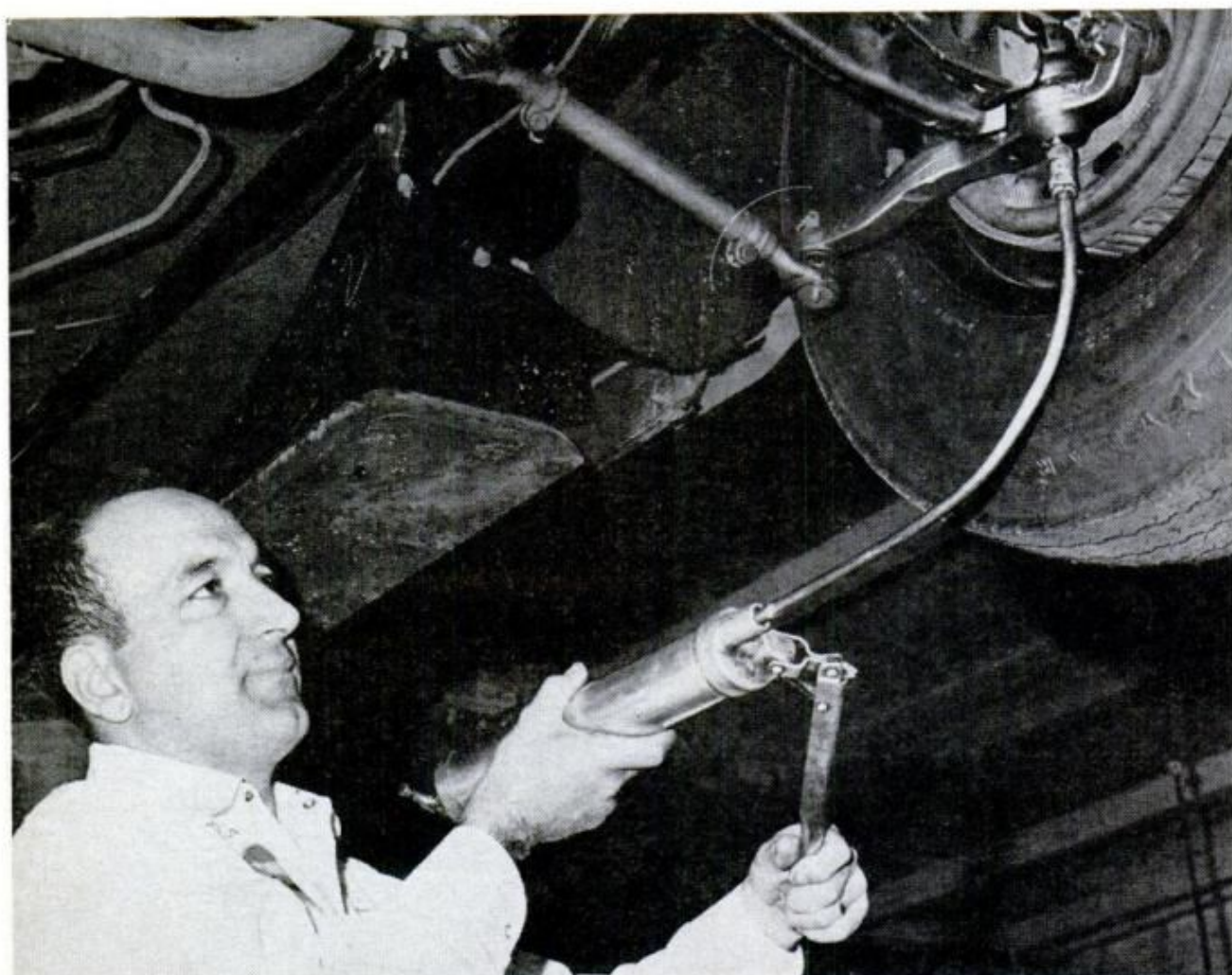


All it takes is a small outlay of money for guns, cans and lubricant, and from there on in you get lubes for pennies. Best of all, your car gets tender loving care as only you can give it



GREASE CARTRIDGES do away with old method of packing your gun with bulk grease. Cartridge slides in, grease is dispensed and cartridge is discarded

HOW TO SET UP YOUR





GREASE GUN CAP is screwed on after cartridge is inserted. Plunger forces grease out of gun under high pressure—approximately 10,000 p.s.i. is required



FLEXIBLE ADAPTER on nozzle of grease gun is sometimes needed to reach fittings hidden among suspension components. Upper ball joints are one example

OWN 'LUBE SHOP'

By **MORT SCHULTZ**

IT PAYS TO GREASE a car yourself. Naturally, you save money, but more important, your car gets the tender loving care that few professional lube shops will give.

Your first lube job may cost as much as \$15—the initial outlay of money for equipment. However, once you've made this investment, future grease jobs will cost only pennies.

First, you'll need an all-purpose grease gun (one that will develop 10,000 lbs. pressure is recommended). Easiest type to use is the cartridge type. All you do is slip the cartridge into the gun as you do a tube of caulking into a caulking gun. The cartridge keeps grease from getting on the inside of the gun and prevents the mess that occurs during hand-filling and cleaning of the gun.

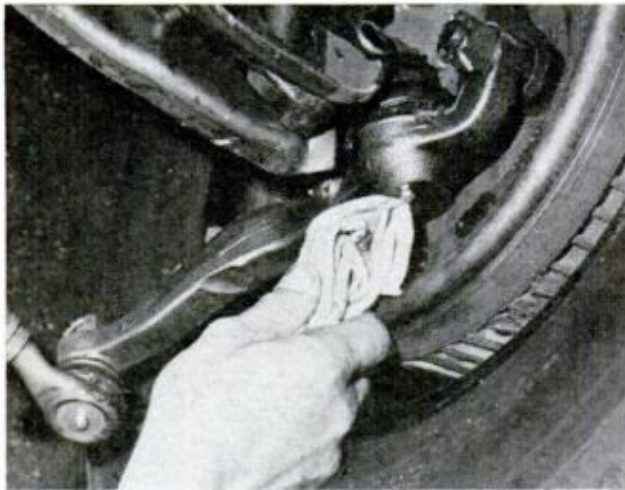
You may have to equip your grease gun with a flexible extension adapter if it doesn't come with one. This equipment, which is about a foot long, is needed to reach places that can't be touched in a straight line with the standard gun, such



OIL CAN with long, curved, needle-nosed spout puts oil right where you want it. SAE 20 is best viscosity to use in places where complete penetration is needed for lubrication, as with hinge pins

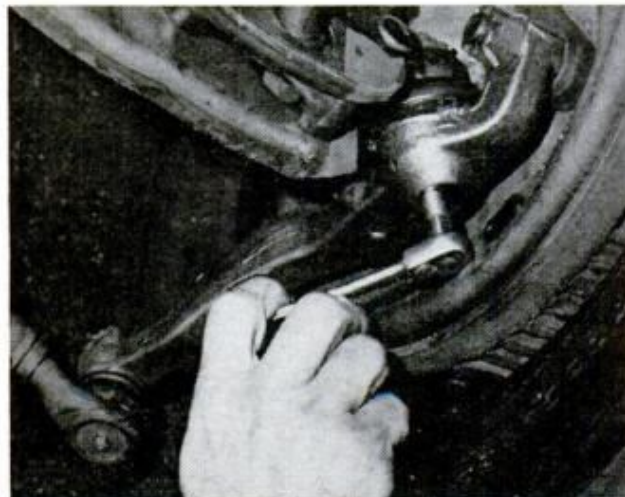


SUCTION GUN tops off lubricant in gear boxes and rear axles, removes it when flushing is necessary



BALL-JOINT PLUGS have to be removed and replaced with fittings before lube job; clean thoroughly first

METAL PLUGS are removed with appropriate wrench; rubber plugs, to be found on some joints, just pull out



as upper ball joints. An adapter costs about \$1.50.

Next, you can buy a regular trigger-type oil can, or a disposable dispenser filled with oil (usually SAE 20). This oil is for use on parts where the lubricant has to penetrate to do its job, such as door-hinge pins. Some distributors, such as those installed on new-model Chrysler products, require periodic lubrication. They are provided with an oil cup that's easily filled.

You can probably wait to buy a suction gun. It's used to add lubricant to manual transmissions and to differentials, but these parts may not need added lubricant for thousands of miles. The suction gun is also good for easily removing lubricant if the transmission or differential is to be flushed.

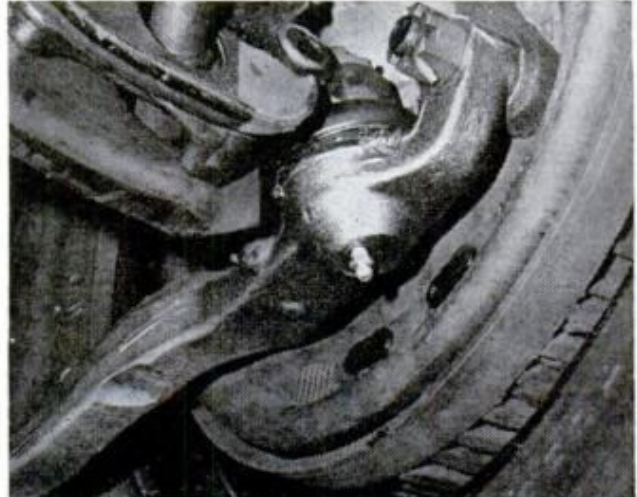
You'll also need the service manual for your car. It contains a section on lubing that's aimed directly at the model you drive and a lubrication chart which shows the location of what to grease. The manual also tells you where to place your jack to take the load off the upper ball joints so that part can take a full load of grease.

A service manual will cost you about \$5 and can be ordered from the technical publications department of your car's manufacturer. Be sure to mention the year and model of car when ordering.

Cars with semipermanently lubricated front suspension and steering-linkage ball joints are designed to go many thousands of miles without grease. When greasing time does roll around, however, you have to remove the plugs in these parts and insert grease fittings.

The fittings vary from car to car and the

GREASE FITTING is inserted in ball joint for lube. Get fittings for your car from an auto parts dealer



information is not always in the service manual. Try your auto parts supplier in this case.

To make your lube job easier, you may want to dig a "grease pit" in the floor of your garage. Old timers used them to take the groans out of greasing. The modern way is to build or buy a pair of ramps to lift either end of your car about a foot or so off the ground.

Your lubricant lineup should include the following:

- Multi-purpose chassis grease—for lubricating the front suspension and steering linkage.
- Multi-purpose gear lubricant or special lubricant for positive traction differentials—used to replenish the supply in a standard-type differential and in a manual transmission. If your car has a positive-traction rear end, you must use a special lubricant specified by the manufacturer, but don't use this in a manual transmission.
- Power steering fluid—for topping off your power-steering reservoir.
- Automatic transmission fluid—to replenish the supply in an automatic gear box.
- All-purpose white grease—to lubricate metal body points that slide or rub against other body points. For example: latches, hinges and catches.
- Engine oil—for lubricating those points where penetration is necessary. Hinge pins, for instance.
- Silicone spray lube—to use on rubberized-type parts that start squealing or binding, such as the channels for a window.
- Manifold heat control valve solvent—in order to keep the valve operating freely.

Lubrication intervals vary from car to car. Some carmakers, General Motors, for example, recommend that chassis parts be lubricated every 6000 miles. Other manufacturers specify that this be done every 36 months or 36,000 miles, whichever comes first.

Sealed joints keep grease inside for these long intervals. Nevertheless, make sure that you inspect the suspension and steering ball joints at least once every six months or 6000 miles to make sure that the seals haven't been damaged and are allowing grease to slip away or become contaminated. ★★★



POWER-STEERING RESERVOIR should be checked regularly. Stock power-steering fluid for topping off



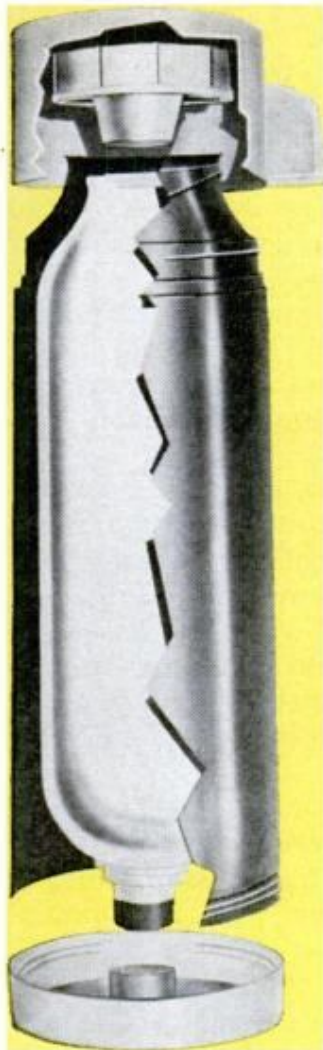
ALL-PURPOSE WHITE GREASE is used on rubbing metal parts such as hood latch, doesn't run like oil

SILICONE SPRAY has dozens of applications in house and garage; lube of car-window channels is one



EXCITING NEW PRODUCTS

By CATHERINE BILSKI



Virtually indestructible polypropylene case, cup and stopper.

One-piece collar and jacket. Cup can't jam.

Shock absorber and tip protector guard against accidental breakage.

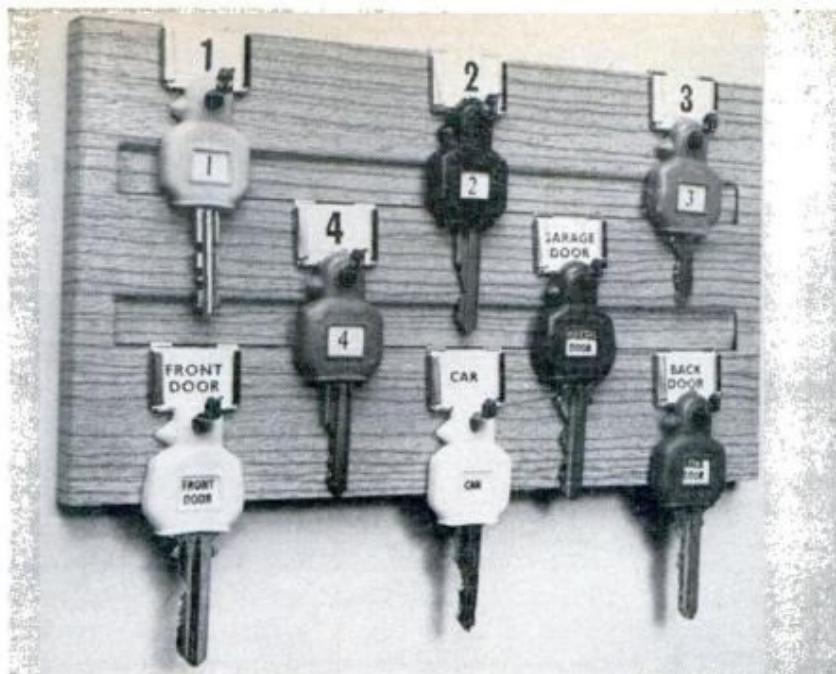
Bottom loading for easy glass-filler replacement.

VACUUM BOTTLES made of polypropylene plastic feature one-piece, vacuum-insulated glass fillers that can be replaced if broken. Jacketed with an attractive printed design, the bottles have insulated plastic stoppers, plastic cup caps with handles and are leak and rustproof. Available in quart, pint and $\frac{1}{2}$ -pint sizes, they cost from \$1.89 to \$3.29. Manufactured by Aladdin Industries Inc., 703 Murfreesboro Rd., Nashville, Tenn.

SHELTER COMBINATION for outdoor use has a molded canopy of fiberglass and a table allowing entry on all sides while providing ample legroom. \$199.50 from Wise Steel, Inc., 1405 S. Liberty St., Muncie, Ind.

INTERIOR DOORS with Spanish motif have deep $1\frac{3}{16}$ -in.-thick panels. All are 80 in. high with a width of 2 to 3 ft. For more specifications, write to Ponderosa Pine Woodwork, 39 South La Salle St., Chicago, Ill. 60603.





KEY CAPS allow visual control of keys in the home or office. Each has its named or numbered location on the enameled-metal board. Complete set of "Colorcaps," including board, eight caps, hooks and insets, sells for \$4.50 ppd. from Jay Smith, Inc., 292 State St., East Westport, Conn. 06880.



DELAYED ACTION switch for lamp sockets ends groping by keeping light on 60 seconds after switch is turned off. \$2.95. American Sales Co., 7114 Third Ave., Brooklyn, N.Y.

FIRE EXTINGUISHER called "Noxfire" is an automatic, self-contained unit that's ideal for high-fire-hazard areas. There are no pipe or electrical connections. The rechargeable unit costs \$79.50 from the Du Pont Co., Wilmington, Del. 19898.

TEFLON PASTE for sealing pipe threads and fittings requires no special skill for application and will not clog valves or other small openings. Called "Formula 8," a 3½-oz. tube sells for \$3.50 from Fluoramics Inc., Box 438, Westwood, N.J.

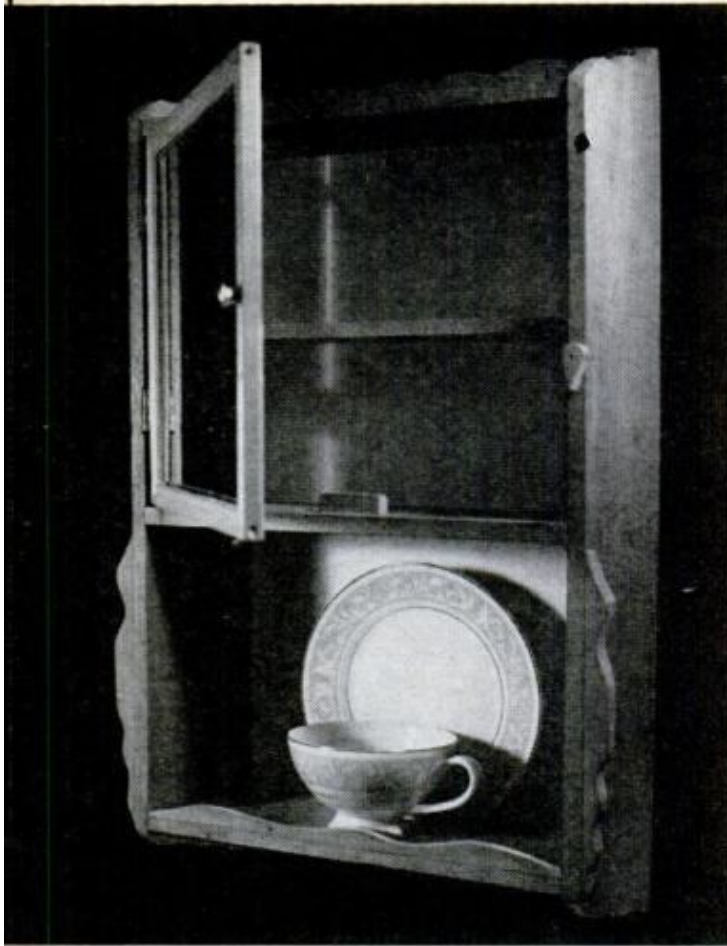


WEEKEND PROJECTS

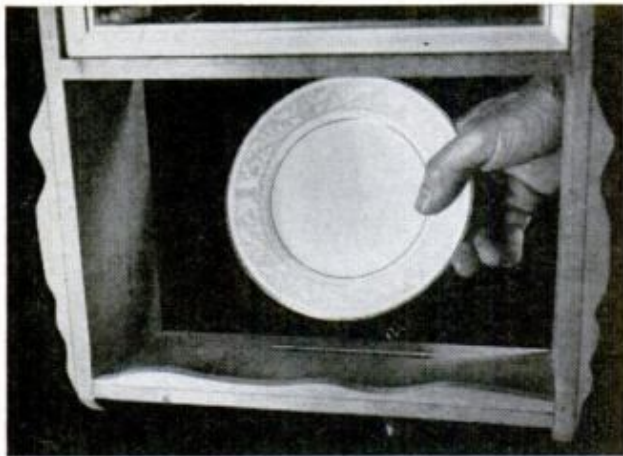
Early American Medicine Chest

Serving more as a shaving cabinet than a medicine chest in colonial days, this charming replica of an Early American piece finds new importance today as a decorator's item in adding a nostalgic touch to your home. The shelf, which held Granddad's fancy shaving mugs, can display a potted plant or a prized cup and plate. The cabinet, which once corraled simple remedies, is a handy place to store a first-aid kit, food stamps or Mom's mad money. And, there's no reason why it can't serve again as a plain medicine cabinet.

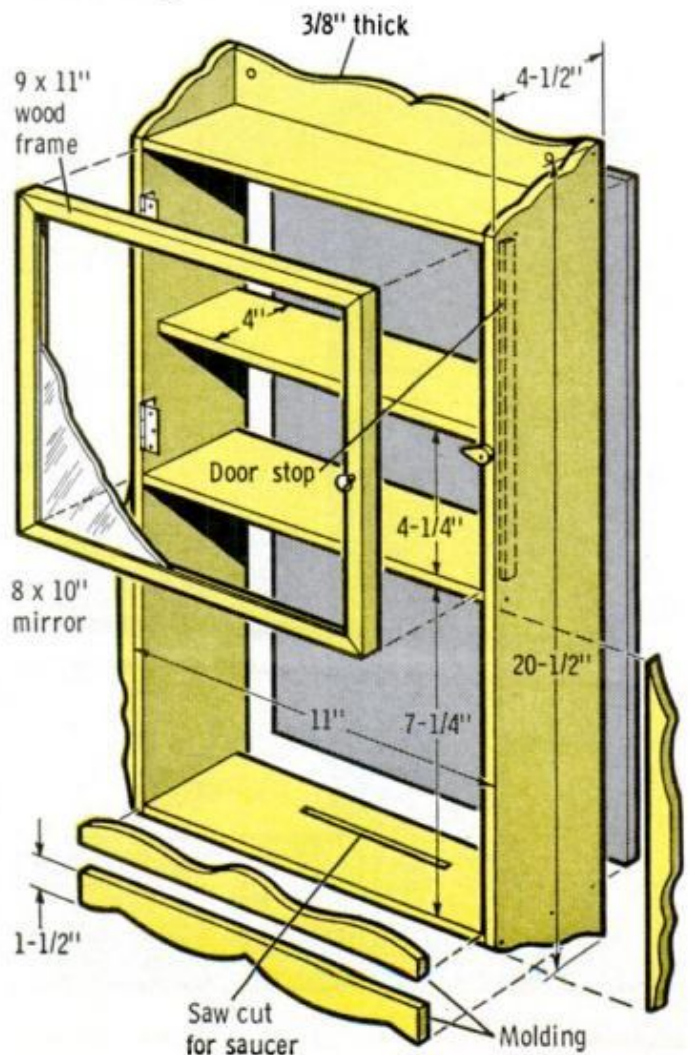
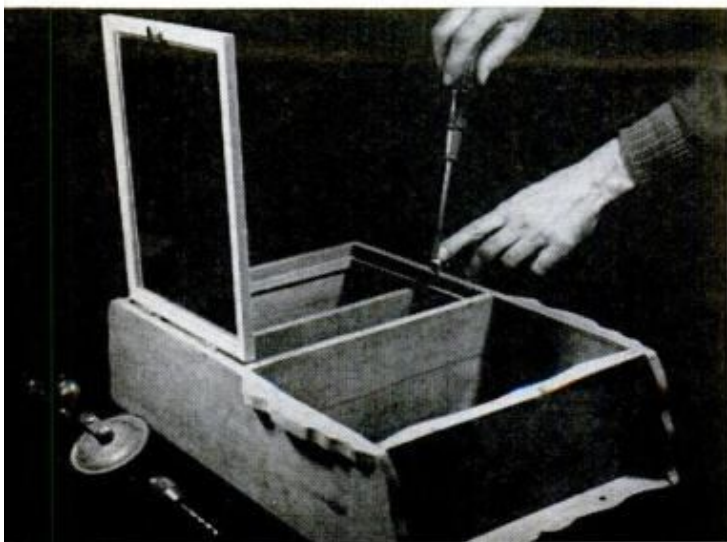
It's built around an inexpensive 8x10-in. metal-frame mirror which you buy first and then fit in a 9x12-in. wooden frame. Except for the back, the whole thing is cut from 1/2-in.-thick pine or wormy cherry. Duplicate scroll pieces are cut in pairs, and all four butt shelves are cut the same length.—Don Shiner



SHALLOW GROOVE in bottom shelf (below) holds saucer on edge. Circular saw is used to cut groove



PENDANT TURNBUTTON screwed to edge of sidepiece (below) latches mirror. Magnetic catch could be used

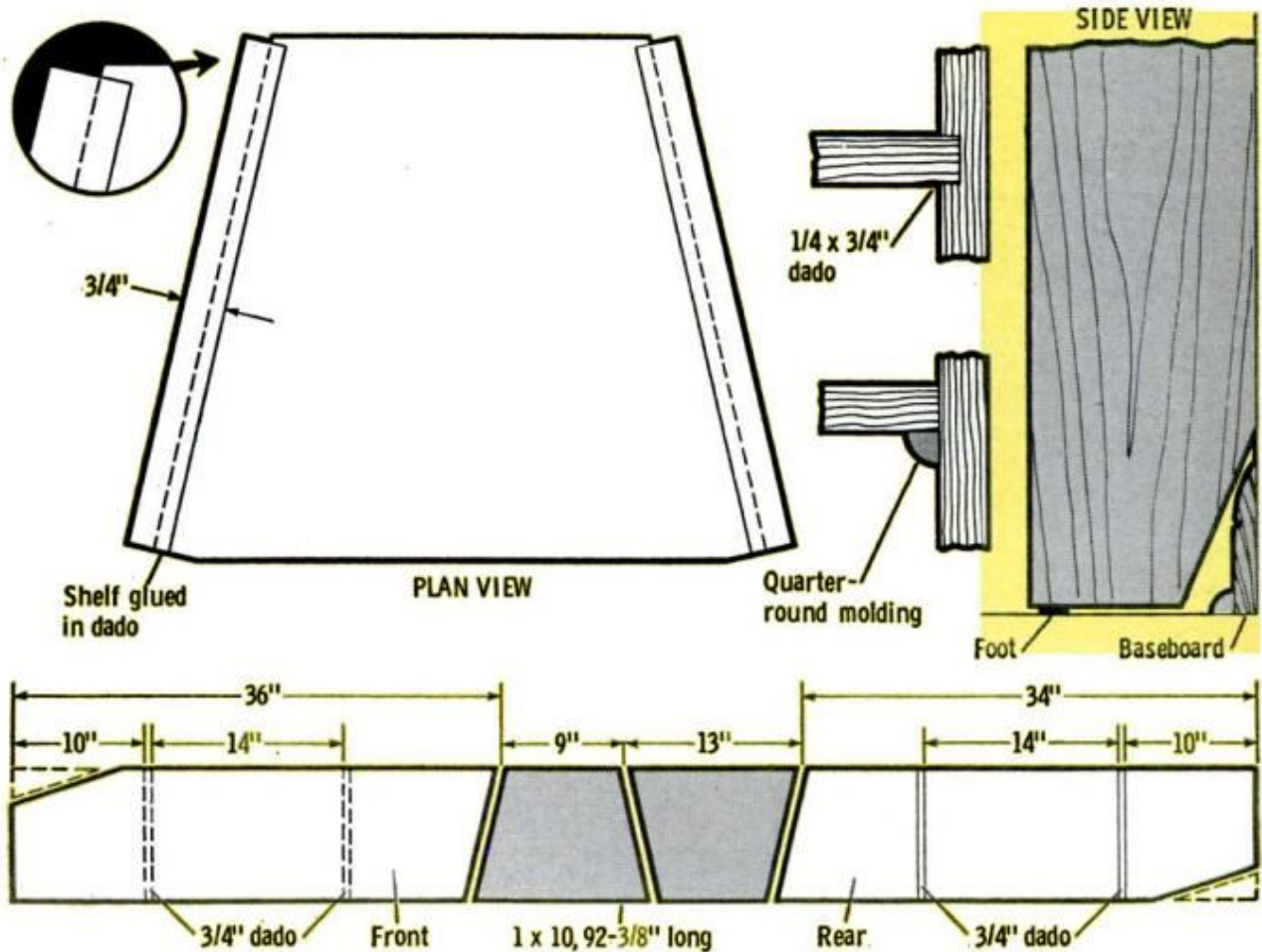


Record Storage Shelf

Keep your records straight—LPs that is—and your platters will spin flat and true. The problem is identification. Store them tight enough to stand up straight and all you can see is the “microscopic” printing on the edges. Store them loose enough to see the fronts of the jackets and they will lean against each other and warp.

The answer is to store them fan-fashion—tight at the back and loose at the front. This keeps them vertical and at the same time makes it easy to pull them out and slip them in. What’s more, you can riffle through the stack for a slanted peek at the face of the jackets. Of course, for the arrangement to work properly, the shelf has to be kept full.

The V-shape shelf in the photo at the right is as easy to make as ABC. The diagram below shows how you can get all four pieces from 1x10 board. If you have power tools, set the shelves in dados. If not, butt the shelves and support them from below with cleats cut from quarter-round molding—*Paul Airomi*

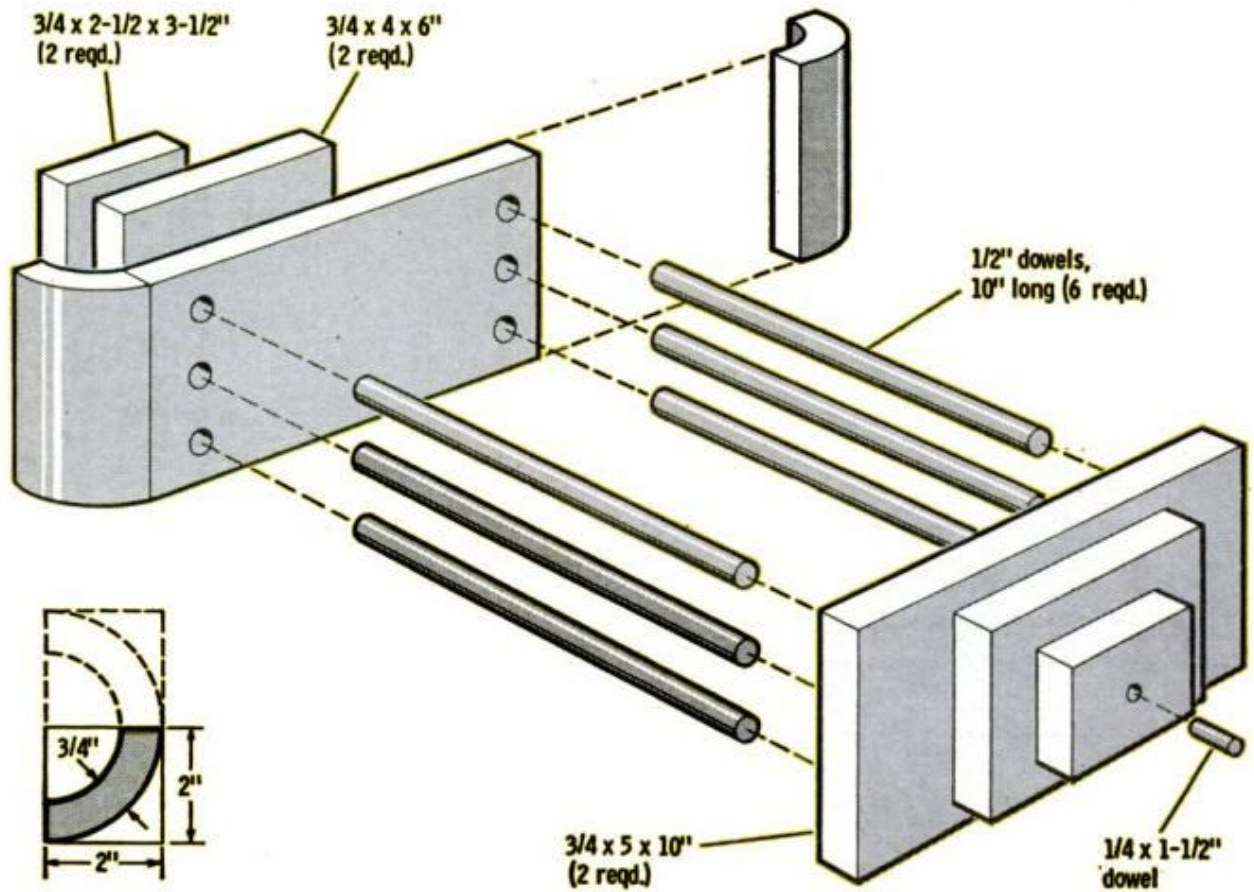




Oriental Wall Shelf

Sprayed flat black and fitted with a gold tassel, this little pagoda shelf will add stark contrast to a plain wall, and color as well, when used with red Mandarin figures. It's as easy to make a pair of them while you're at it, since the three plain blocks, which make the top and bottom, are mere duplicates. In fact, with certain setups on your saw and drill press, you could grind out these shelves by the dozen in no time at all.

Upturned ends at the top are separate pieces merely glued on. Holes for the three 1/2-in. dowels are bored 1/4 in. in from the ends of the large blocks and 3/8 in. deep. Here a jig is helpful to assure identical spacing of the holes in both top and bottom blocks. The detail shows how the curved ends can be bandsawed on end from 2-in.-sq. blocks, 5 in. long. The tassels are window-shade pulls slipped over short dowels projecting from the bottoms and glued. You can fashion suitable hangers to fit over roundhead screws by forming key-hole slots in small pieces of sheet metal and bradding them to the rear edge of the top.—Heath Winston



Kitchen Space Saver

What do you do when a new stove turns out to be 6 in. narrower than the old one and leaves a gap too small for drawer or cabinet? One solution is to fill the space with a tip-out bin and add a longer counter-top. I did this and wound up with such a neat job it looked like an original installation. This was partly because I was able to use a section of an old dishwasher to face the front and make a perfect match with white metal cabinets alongside.

As you see in the drawing, the bin was made pie-shape for balance. The shifting center of gravity will hold the bin fully open as shown at the right, halfway open as shown below, and fully closed. The dotted lines show where I formed hidden storage compartments in the bin, with front space being accessible from one side. The back compartment makes a dandy place to keep cleaning rags which can be grabbed through a hand hole in the side. The bin itself is hinged to a 2x4 toe-board that is painted black to match that on adjoining cabinets.—*E. B. Silsby*

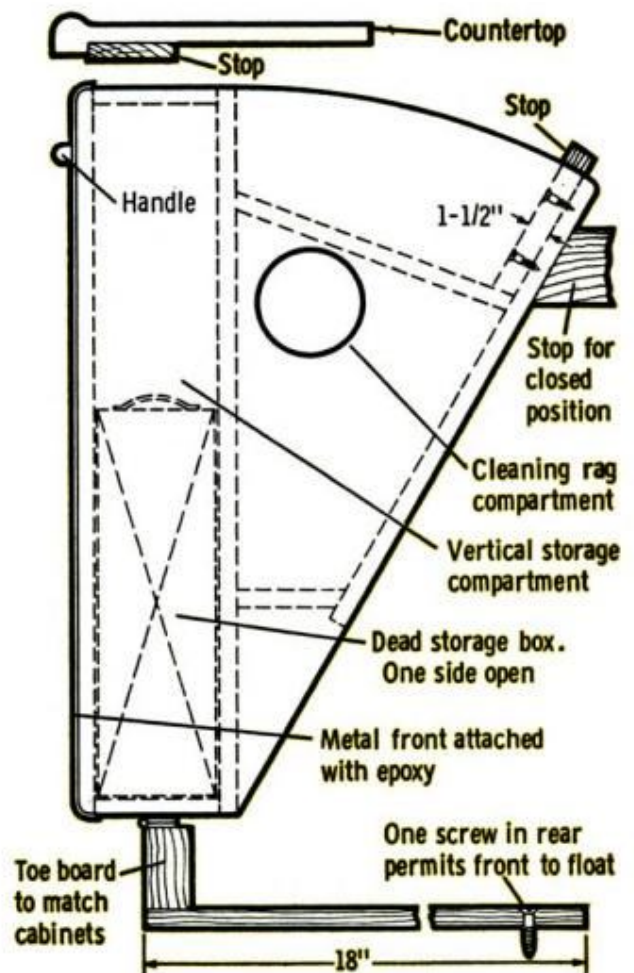
HALF-OPEN POSITION. Bin sides are hardboard painted with epoxy enamel; front faced with sheet metal



APRIL 1969



TIP-OUT BIN fully open. Front compartment stores long kitchen tools, hole provides access to rags

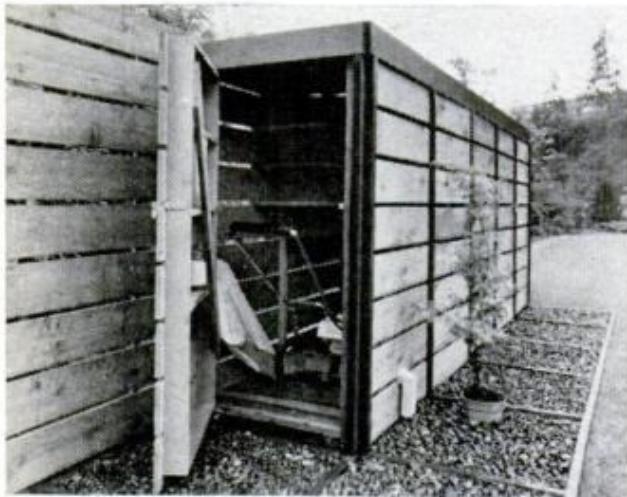


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Build This In-a-Fence

If you dislike 'sore-thumb' toolsheds, you will like this built-in one which becomes part of a back-of-the-lot fence

Technical Art by Graphic Presentations



THE LEFT STALL opens from the end to accommodate a large mower which can poke into the adjacent stall

IF BOTH A FENCE and a toolhouse are on your list of projects to be built this summer, you'll kill two birds with one stone by following this unique plan. It incorporates them in a single project and, what's more, eliminates the objection of having a lonesome toolhouse in the middle of nowhere. Designed as part of a property-line fence, the toolhouse blends in so perfectly with the fence itself, the neighbors will have to look twice to see it.

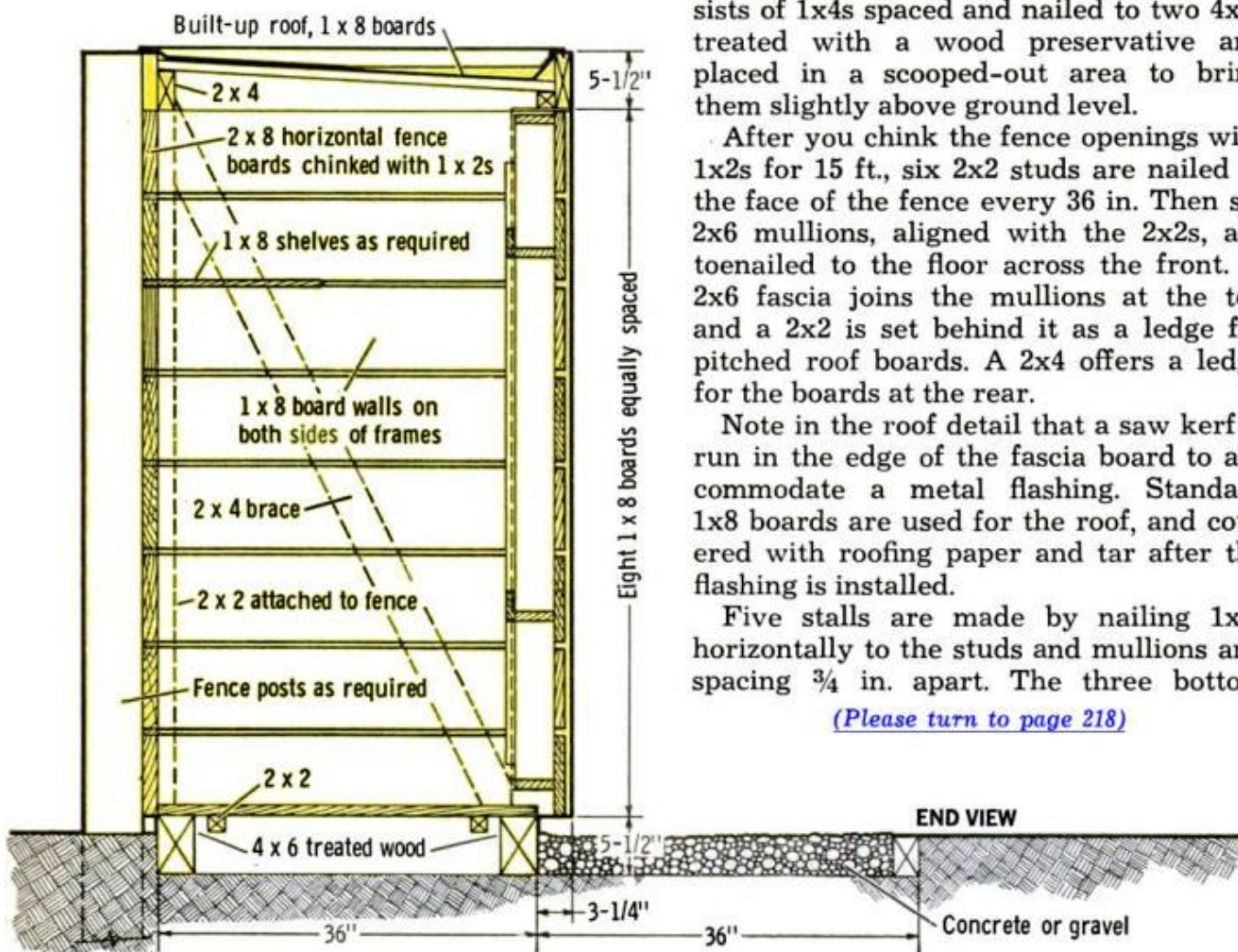
You start out by erecting the fence first, using standard western-wood boards and framing lumber. Here you set 4x4 posts every 6 ft. and nail 2x8s to them with $\frac{3}{4}$ -in. spaces between. The toolhouse floor, shown in the drawing below, consists of 1x4s spaced and nailed to two 4x6s treated with a wood preservative and placed in a scooped-out area to bring them slightly above ground level.

After you chink the fence openings with 1x2s for 15 ft., six 2x2 studs are nailed to the face of the fence every 36 in. Then six 2x6 mullions, aligned with the 2x2s, are toenailed to the floor across the front. A 2x6 fascia joins the mullions at the top and a 2x2 is set behind it as a ledge for pitched roof boards. A 2x4 offers a ledge for the boards at the rear.

Note in the roof detail that a saw kerf is run in the edge of the fascia board to accommodate a metal flashing. Standard 1x8 boards are used for the roof, and covered with roofing paper and tar after the flashing is installed.

Five stalls are made by nailing 1x8s horizontally to the studs and mullions and spacing $\frac{3}{4}$ in. apart. The three bottom

(Please turn to page 218)



Tool Storage



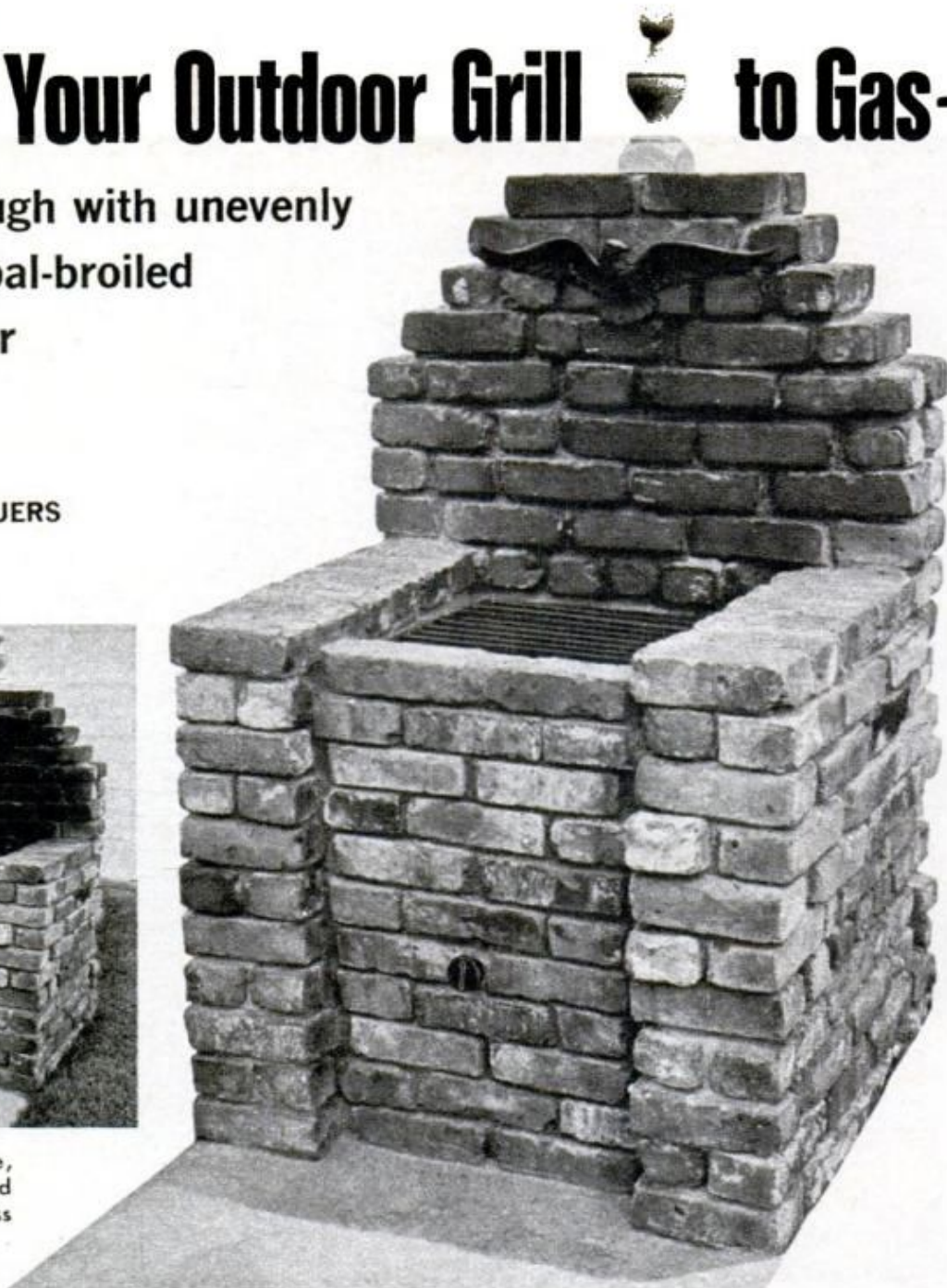
Convert Your Outdoor Grill to Gas—

And be through with unevenly done, charcoal-broiled meals forever

By RAYMOND J. TUERS



SOOTY GRILL, above, was an eyesore. Modified grill, right, is spotless



NO MORE MESSY CHARCOAL or smelly starter fluid for me! When I play back-yard chef now, I only turn a knob, strike a match and start cooking—for I've converted my charcoal grill to gas. Permanent ceramic briquets set over the gas flames retain the charcoal flavor.

Any back-yard chef with a permanent grill, a few tools, about \$30 and a little bit of ingenuity can do the same. The ingenuity is needed only because grill construction varies and no one step-by-step method can be used for all sizes or styles.

You will need the following components: a burner assembly, a bottom grate to hold the artificial briquets, a few concrete building blocks, mortar mix, copper tubing and iron pipe with assorted fittings, and a saddle to tap into the main gas line.

I bought the burner and valve from a local dealer in outdoor gas grills, although you could order these parts from such grill makers as Falcon Mfg. Co., Dallas, Tex.; Chicago Combustion Corp., Hackensack, N. J.; Charmglow Products, Antioch, Ill., or Columbus Iron Works, Columbus, Ga. The rest of the materials are standard items available at most hardware stores.

As shown in the photos, one of the first steps is to feed copper tubing into the grill and connect the inside end to the valve using a flared connector. Then, since the burner should be positioned about 1 in. below the grate, build up the open area in the grill with building blocks and mortar to provide a firm base for the burner. The valve, with a brass extension shaft brazed on to reach beyond the front of the grill,

can be permanently embedded in the mortar. (To make sure the shaft will turn freely, use 1/2-in. tubing as a sleeve.)

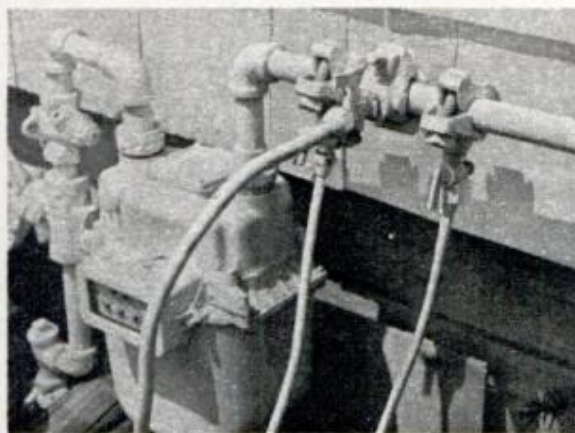
Center the valve below the burner position, then form a well around the orifice so the burner will fit over the valve. Angle the top surface of the mortar slightly and drill a hole through the front of the grill so you'll be able to drain rainwater, grease and wash-down solutions.

You also must drill at least four 3/4-in. holes in the sides to allow air to reach and feed the burner flames. You can use galvanized iron pipe or copper tubing to connect the burner to the main gas line—

I used 3/8-in. pipe buried 6 in. below the surface. Finally, shut off the main gas valve (before the meter), drill through the line and attach the saddle. Be careful not to overtighten and crack the cast-iron saddle. Connect a valve to the saddle outlet, the grill gas line to the valve and turn on the gas supply. Don't forget to relight all household pilots.

If you're careful making connections, the burner should run perfectly the first time. Then just fit it with a weatherproof cover of sheet aluminum and remove the knob from the valve to keep children from tampering with the gas. ★★★

SADDLES SUPPLY GAS to the converted grill (center saddle) and gas lights (two end saddles)



STAR DRILL is used to cut hole in base of grill so combination pipe and tubing gas supply line can be connected



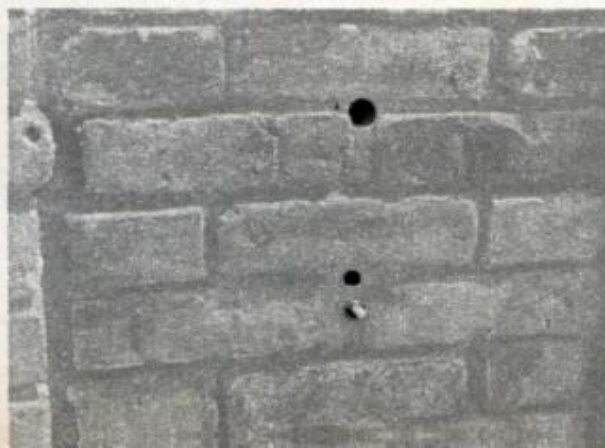
AT LEAST ONE AIR HOLE per side must be cut to allow air to pass to burner. Here, the holes are being cut with star drill



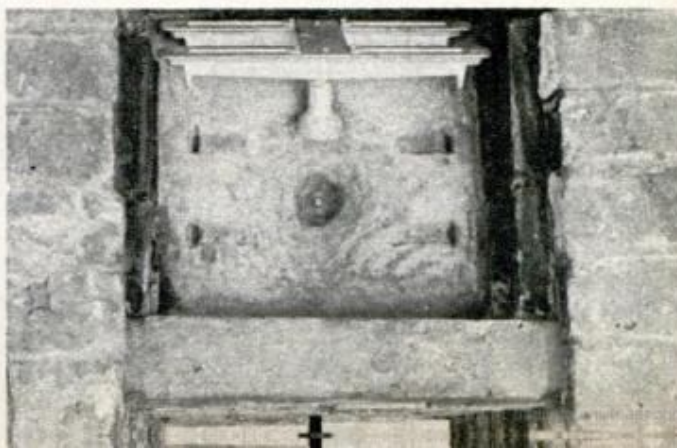
REGULATING VALVE will need an extension shaft brazed onto original knob shaft



EXTENSION SHAFT should project slightly beyond front face of grill. Hole above shaft is for air



TOP VIEW OF COMPLETED GRILL shows how burner slips over the valve orifice. Top mortar surface is sloped





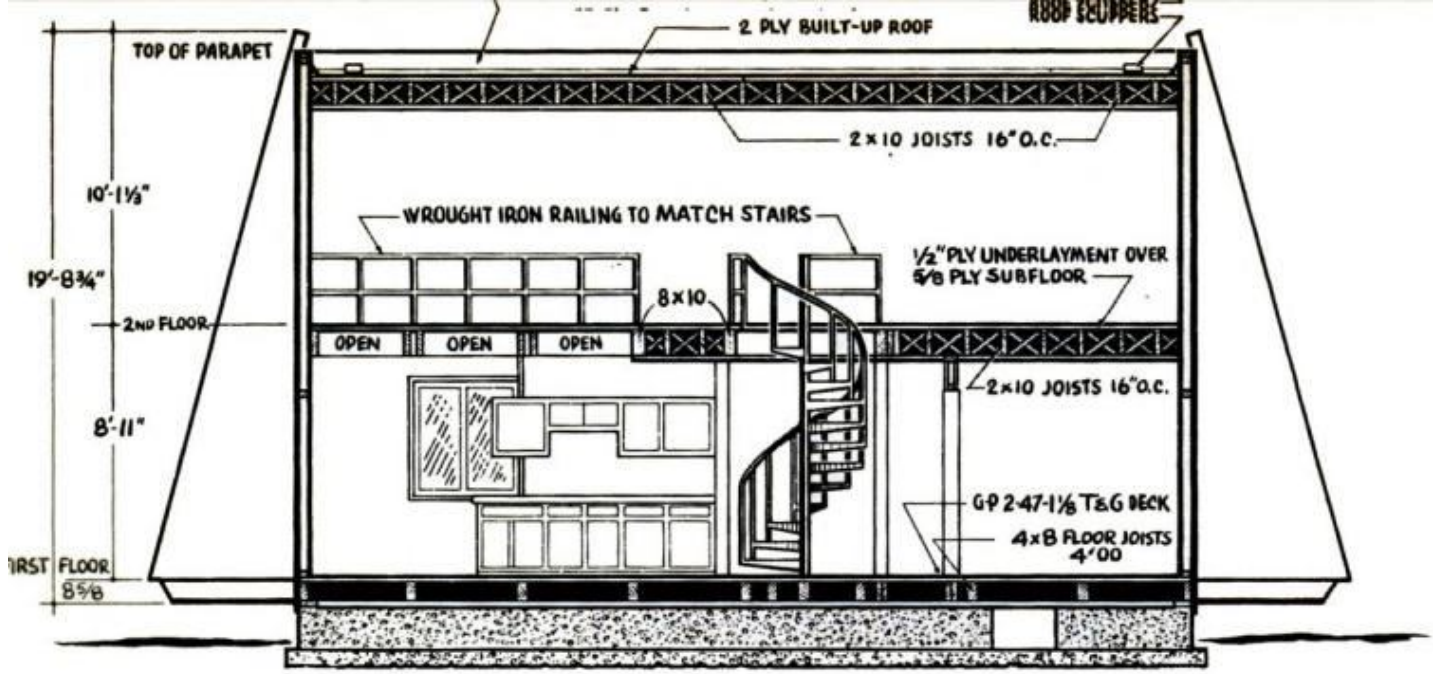
Special
14-Page
Section

VACATION HOMES





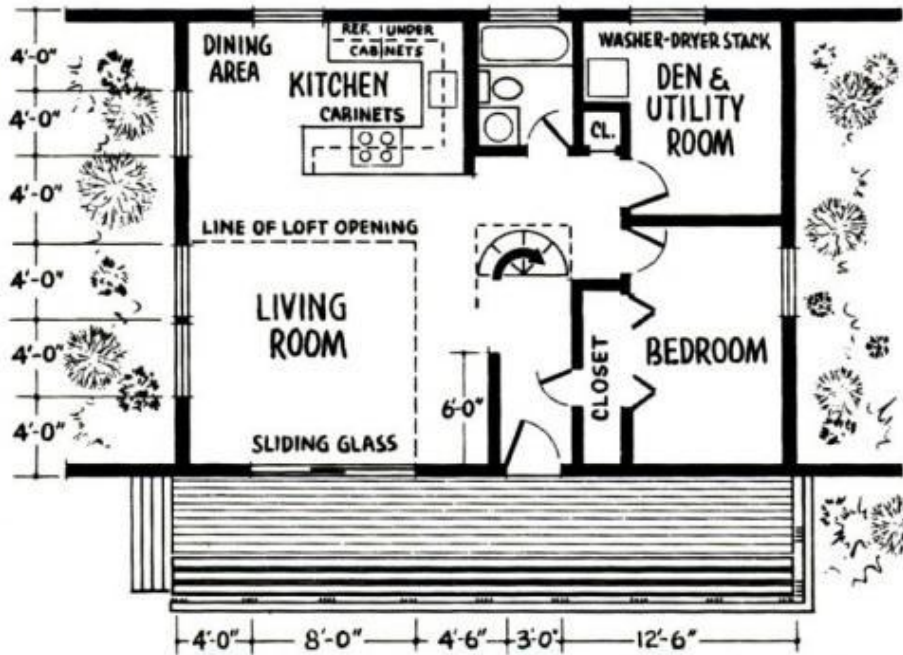
Who says you have to rough it in a vacation home? Simply modify the old saying, "A home is what you make it," and instead practice "A home is how you build it" and you'll discover that you can live in comfort—and at a cost you can afford. An excellent example of the advantages of building is the mansard A-frame shown in these color photographs. Presented



SECTION A-A



INTERIOR of the house is extraordinarily handsome for a vacation home. Gentle slope of the front and rear walls (note that the end walls are vertical) provides the required degree of architectural rigidity, yet doesn't sacrifice headroom or living space as is often the case with a conventional A-frame structure. In fact, the ceiling height in the loft area is a full 8 ft. Another big space-saver is the circular metal staircase, requiring an area of only 4½ ft. square. The interior is well lighted, even on cloudy days, due to the strategic placement of the windows and the sliding door, which seems to extend the living room out onto the large front deck



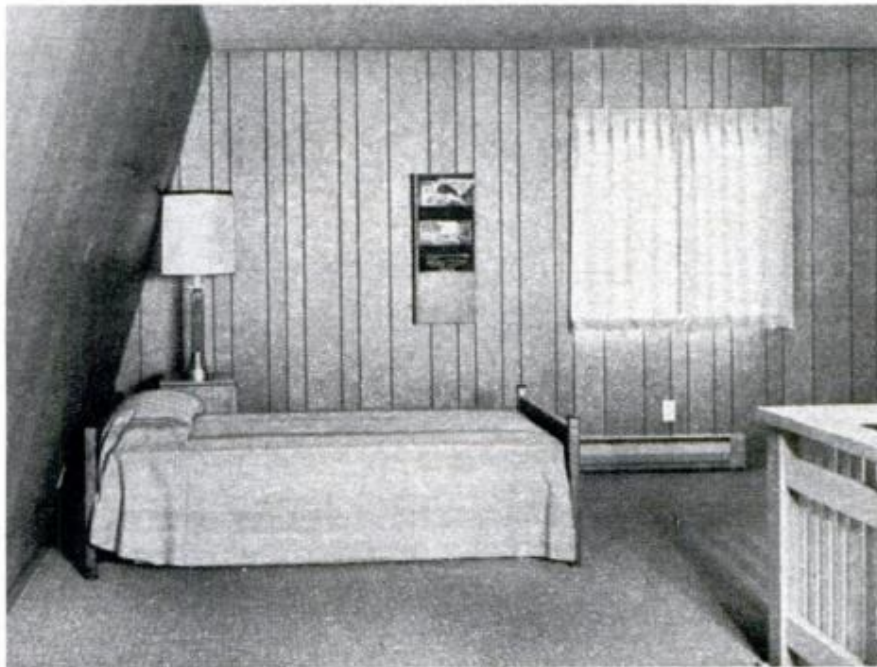
as a basic concept in *PM* last April, the Chateau-Bateau then was built at *PM*'s request to prove that you also could build the house—at a cost as low as \$7500 or as high as \$10,000. The lower figure, of course, applies only if you do all the labor yourself. The complete prototype as shown here, however, cost the developer builder almost three times this amount, for the simple reason that he had only 22 days from site preparation to completion of the house in order to meet our photography schedule. Considering that this included decorating, furnishing, plumbing, painting, carpet-laying and all wiring, the builder, Wylis Bucher of Shoreline Estates in northern Oregon, understandably is still recuperating. His actual cost also included \$240 for freight; \$200 for extra

heavy and deep footings for the sandy site; \$400 for electric heating and fireplace; \$1,000 for the optional deck on one side of the house; \$1150 for the carpeting and installation, and \$669 for appliances, including an automatic laundry. Having 18 workmen on the job also ran labor costs far beyond the normal.

VACATION HOMES

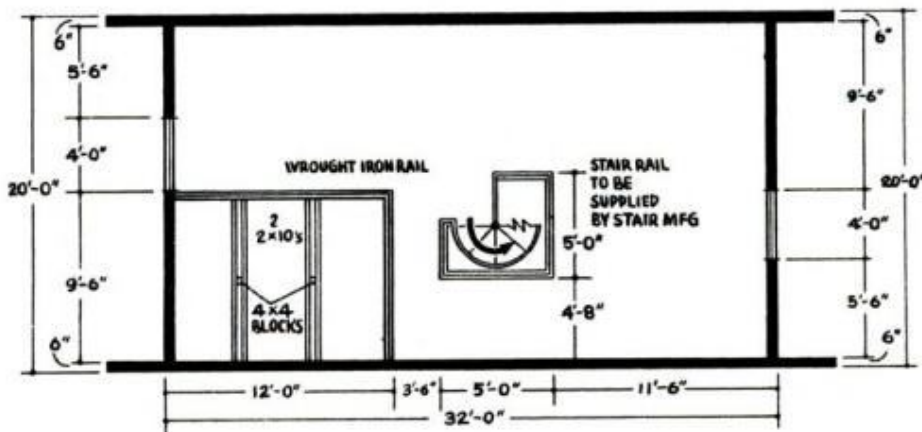


Designed by the architectural department of Georgia-Pacific Corp., the prototype also features G-P's kitchen cabinets with such built-in extras as a drawer that opens to become a desk, a swing-out spice cabinet with see-through shelves, a lazy Susan in a corner cabinet, and a heavy-duty, slide-out chopping board. ★ ★ ★



PROTOTYPE HOUSE featured a guard rail (left) of 2x4s and 2x2s around the open area in loft, but the rail appeared too awkward and cumbersome. Thus, it's recommended that a metal guard rail be used to match the hand rail on the circular metal staircase. Insulating windows and doors (directly above) from G-P's Weather-Seal Div. slide on magnetic fields to reduce the necessary opening and closing force, are known as Kushion Aire doors

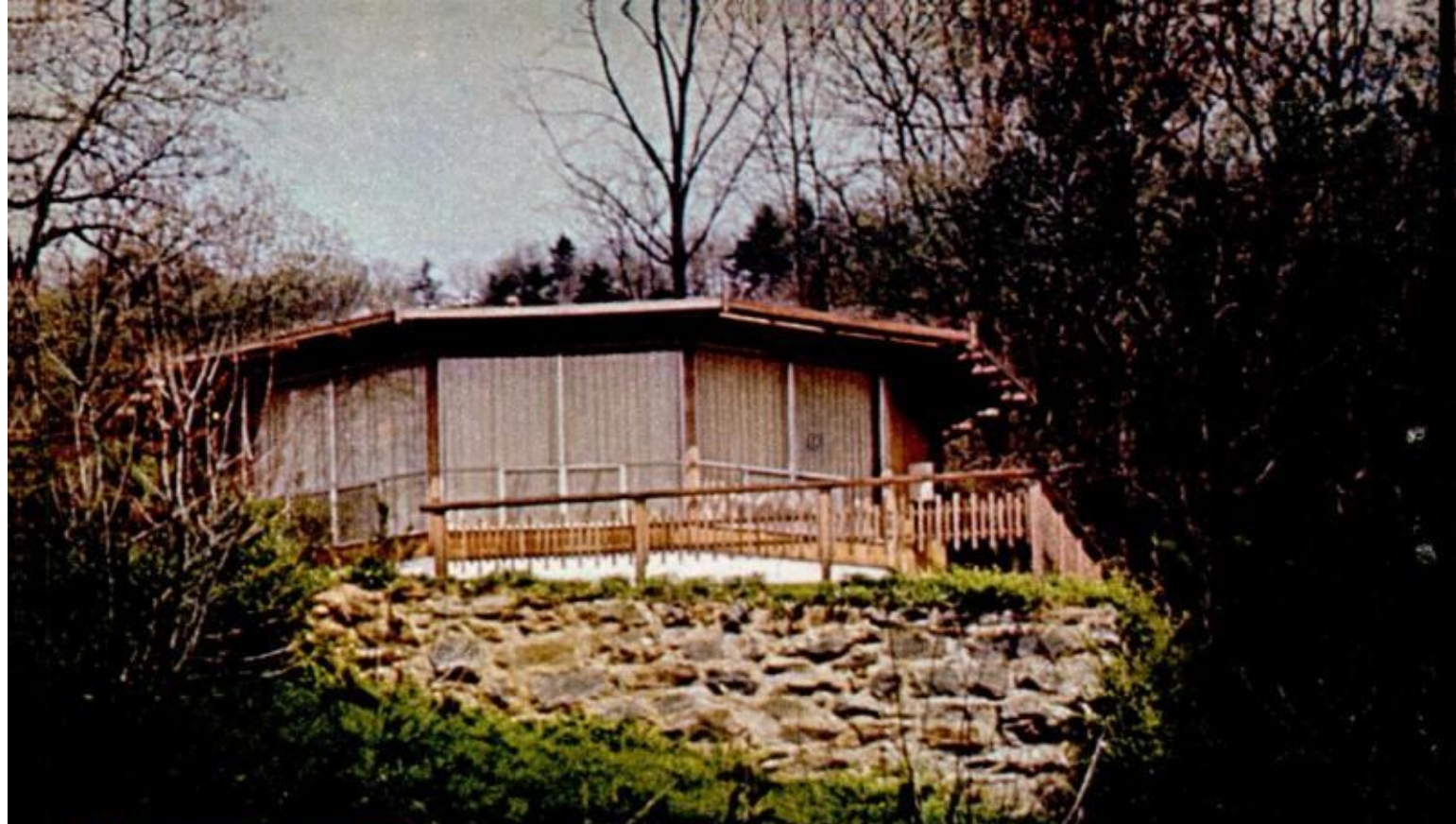
*Chateau-Bateau Photos
By Ron Panfilio*



FLOOR PLAN OF LOWER LEVEL (shown at left) shows how all the necessary living elements are compactly combined in a structure sized for almost any site. Plan of upper level (shown above) reveals how open area above living room makes the living room appear quite spacious

PLANS AVAILABLE

A 13-page set of working drawings of the Chateau-Bateau can be obtained by sending \$5 (for one set) or \$10 (for 4 sets) to Georgia Pacific Corp., Commonwealth Bldg., Portland, Ore. 97204.

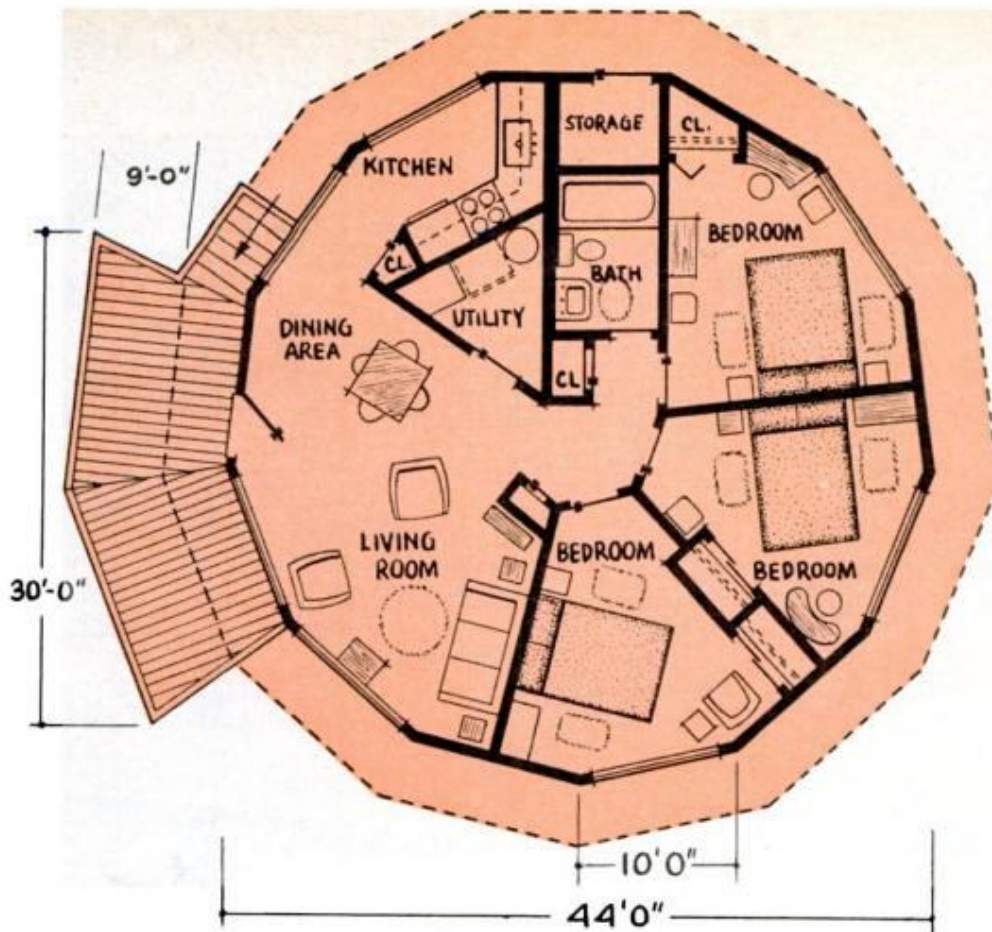


Rondette— Prefab House in The Round

ATTRACTIVE from any angle, models in the Rondette series of prefabricated homes have from 8 to 12 wall panels that go up in a hurry to enclose a maximum of floor area with a minimum of wall materials.

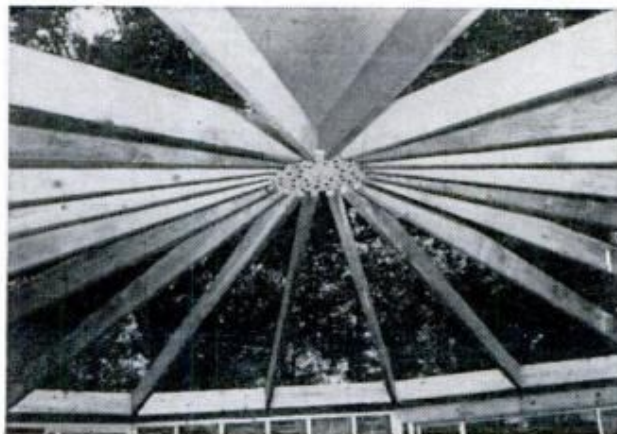
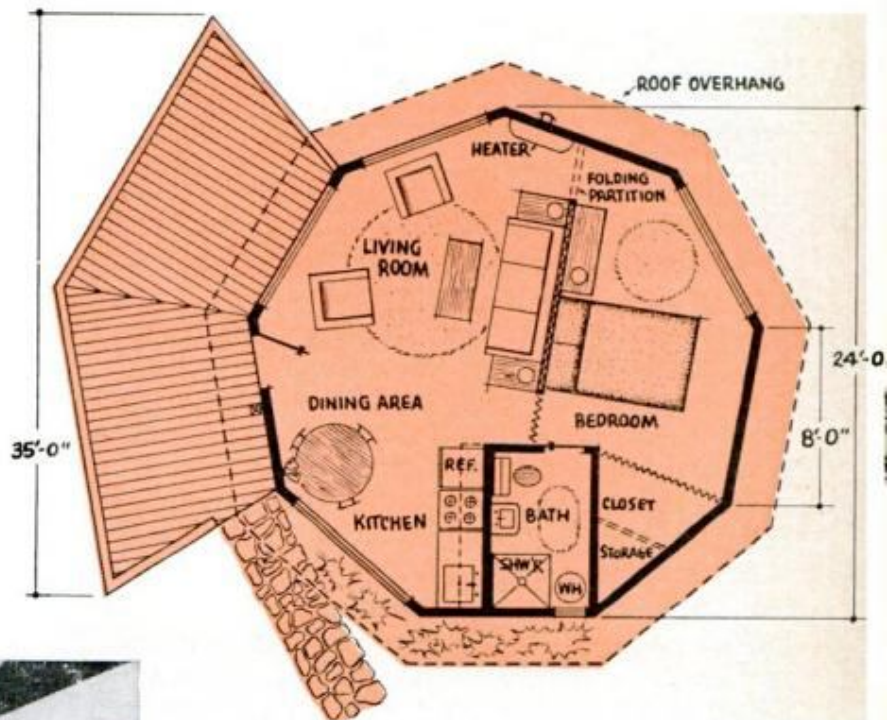
Since the walls of the buildings are basically round, heating and airconditioning efficiency is increased and the shape withstands winds as high as 125 mph. Thus, the Rondette is ideal for tropical locations often hit by sudden storm, yet is attractive enough to blend into wooded or mountainous areas.

Since the window panes can be placed anywhere in the build-



ing, panoramic views are easy to obtain—it's also possible to orient the windows to take full advantage of unusual lighting conditions or prevailing breezes.

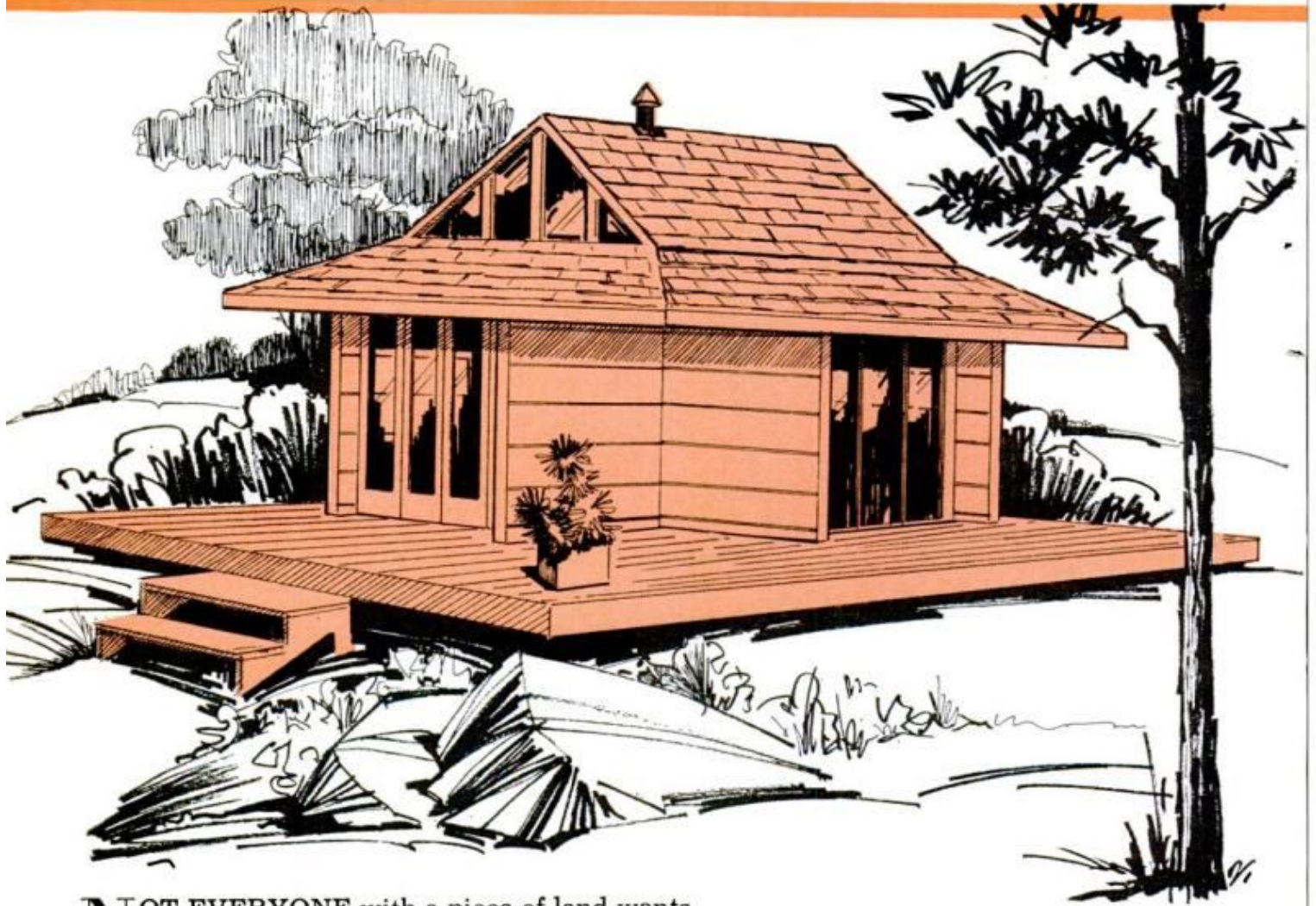
Better yet, the Rondettes are realistically priced. The one-bedroom A-9 model at the right, for example, costs only \$3840, while the large A-13 shown above is priced at \$6702 (both prices are f.o.b. Asheville, N.C.). The real value, however, lies with the completeness of the kits—for these prices also include electric appliances, sinks, bath, toilet, even the decking.



THREE-BEDROOM RONDETTE provides 900 sq. ft. of living space, comes complete with interior trim, partitions, appliances. One bedroom efficiency model (A-9) yields 425 sq. ft. of living space. Both include precut rafters, roof sheathing (shown at left)

FOR MORE INFORMATION regarding the Rondette series of vacation homes, write to Rondetics, Inc., Parkway Offices, 170 Woodfin St., Asheville, N.C.

Build This 'Super Camp'

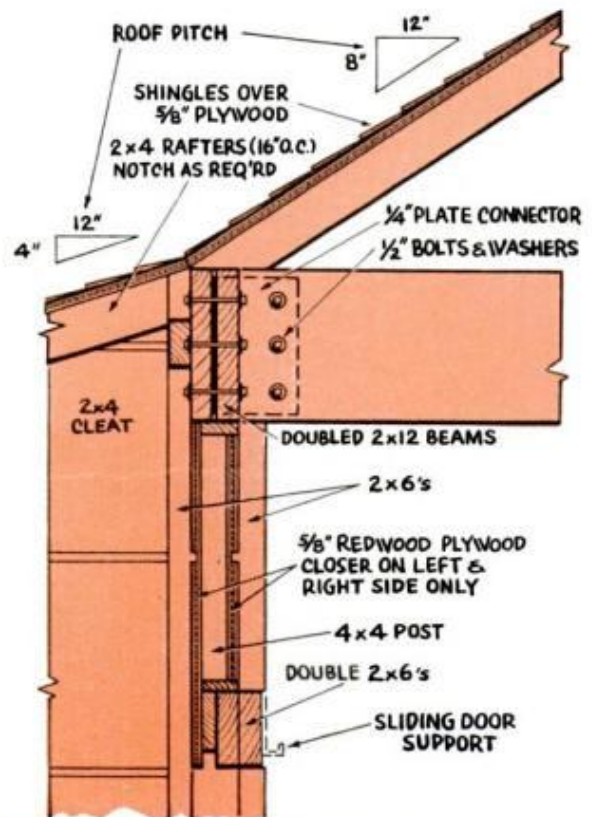


NOT EVERYONE with a piece of land wants—or needs—a true vacation home. Young weekenders especially find themselves “camping-out” and enjoying it more than reveling in a spectacular summer-home showcase.

A “super camp” such as this may be the answer. It will keep you dry on rainy afternoons, keep the wind out at night and minimize the need to pack up your outing equipment and bring it home.

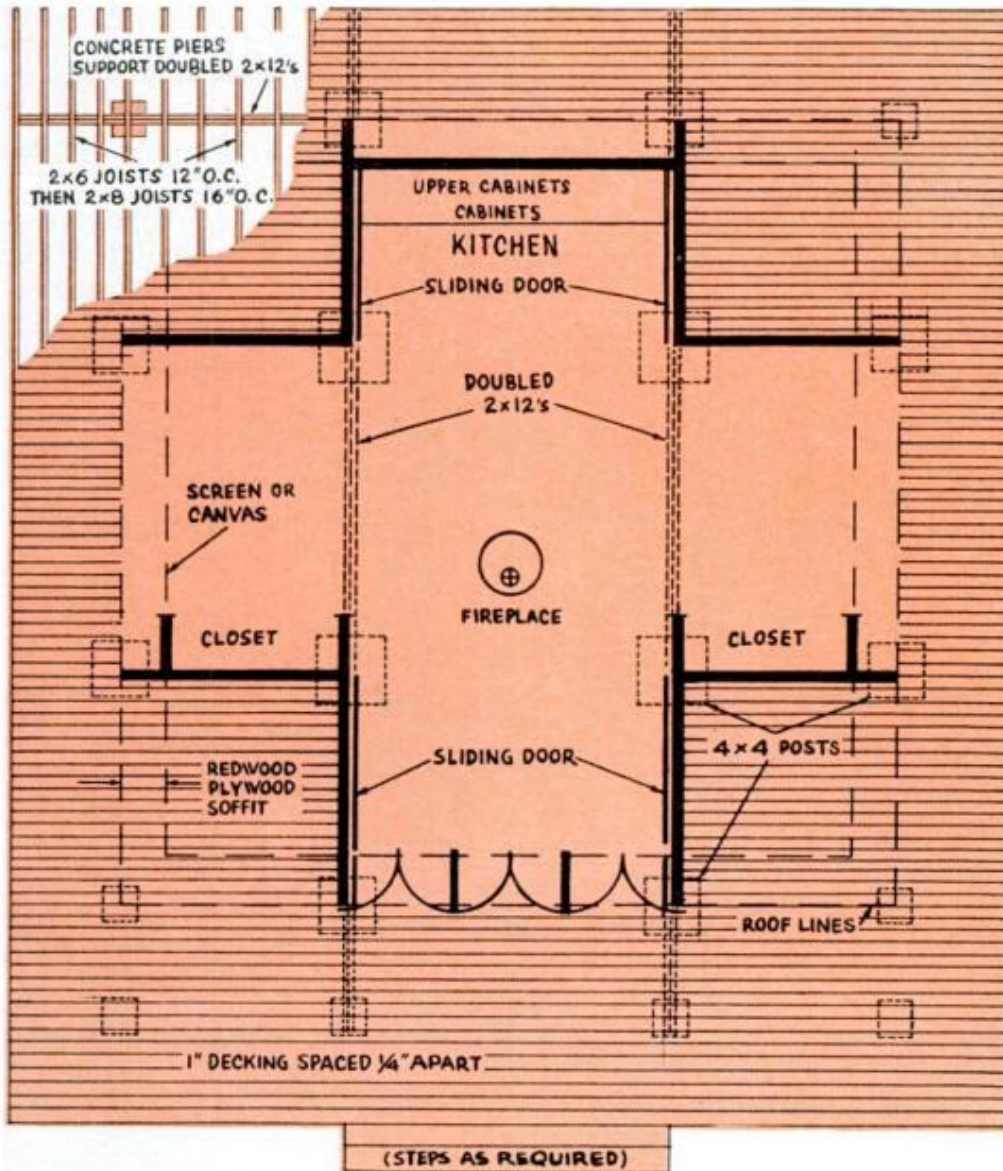
Designed expressly for PM, the shelter fulfills three important requirements—it can be locked securely to discourage pranksters and vandals; it provides over 400 sq. ft. of enclosed living area, and perhaps most important, it is a stylish structure with a pleasing appearance.

The clerestory above the entrance dramatizes the roofline and also provides good interior illumination. Similarly, a prefabricated fireplace adds interest to the center of the shelter, while providing a source of heat. Functionally, the closets and kitchen cabinets make “roughing it” a bit easier, and the sliding doors allow you to lock up the “camp” in a matter of minutes.



For Less than \$1500

VACATION HOMES



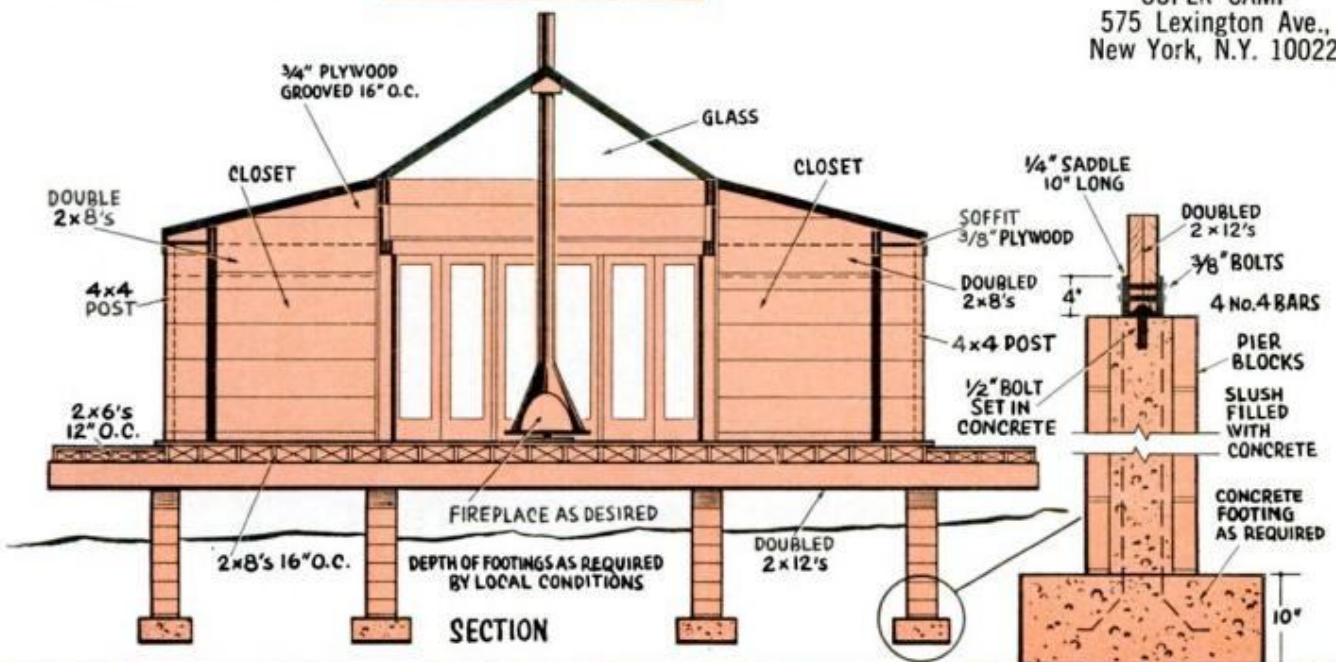
Architect:
Richard H. Krause

Engineer:
Ron Middlebrook

PLANS AVAILABLE

A set of 17x22-in. construction plans is available for \$5 per copy, or four sets for \$10. Address your orders to:

POPULAR MECHANICS
SUPER CAMP
575 Lexington Ave.,
New York, N.Y. 10022



AS PRESENTED on this month's cover, this high-style home is easily adapted to beach, lakeshore or mountainside to provide an unlimited view.

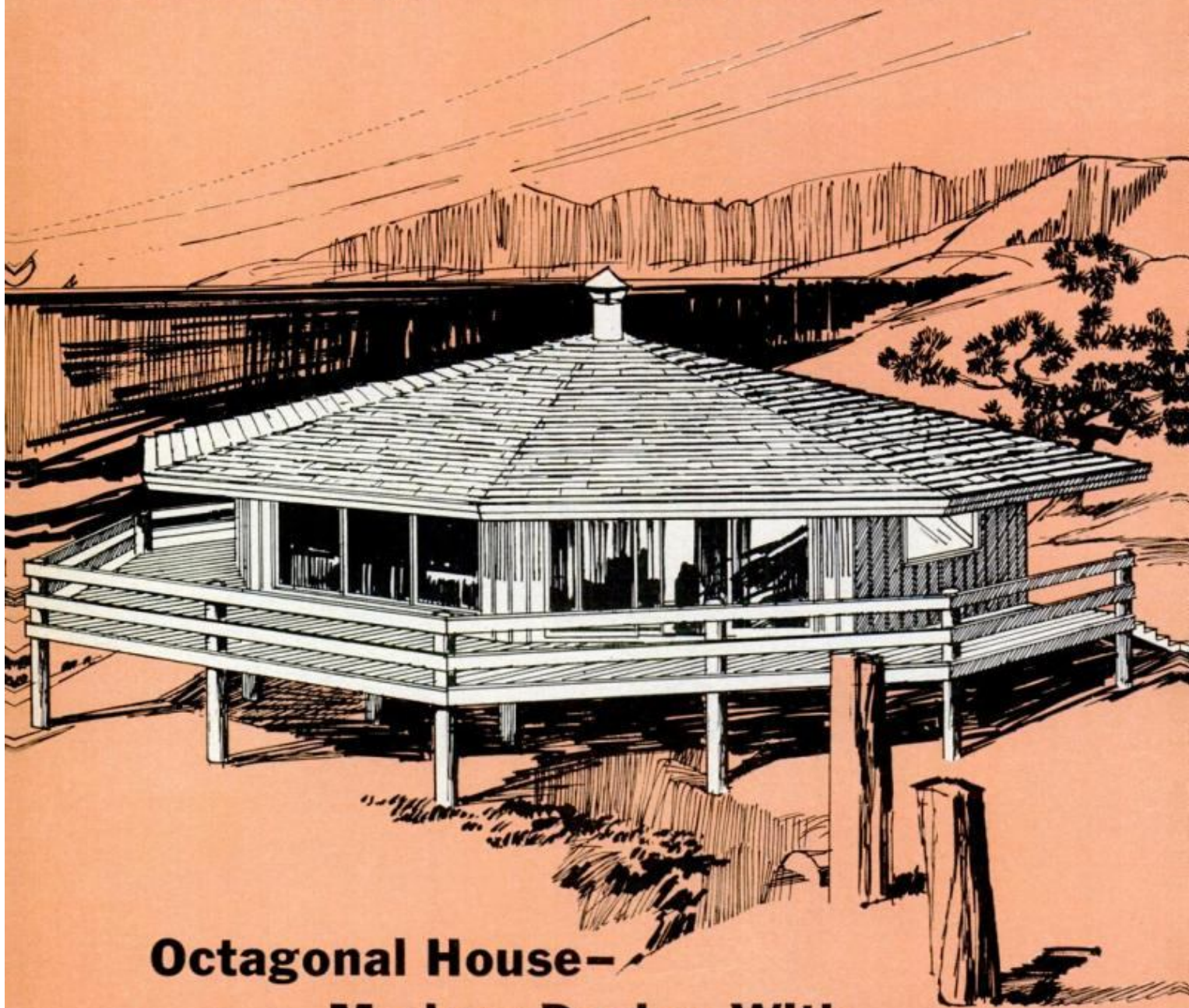
What's more, since the plan is available in three different sizes, there is no restriction because of lot sizes—just pick the floor plan that suits you best.

The smallest version of the octagonal house is basically a comfortable combination of a living-sleeping-dining area with separate bath and kitchen divisions, all built into a 309-sq.-ft. area. The next largest plan has a similar layout, but increases total area to 483 sq. ft.

The largest of the three plans offers 768 sq. ft. and can be built as either a one-bedroom or two-bedroom house.

Designed by Home Building Plan Service for the American Plywood Assn., this plan or any of the four plans on the following pages can be ordered for \$25 each, or \$35 for four copies of any plan (others are needed to obtain permits and consult with contractors).

Each house plan includes a detailed materials list. Be sure, however, that you specify the plan by number. Send your orders to Home Building Plan Service, 2235 N.E. Sandy Blvd., Portland, Ore. 97232.



**Octagonal House—
Modern Design With
Complete Livability**

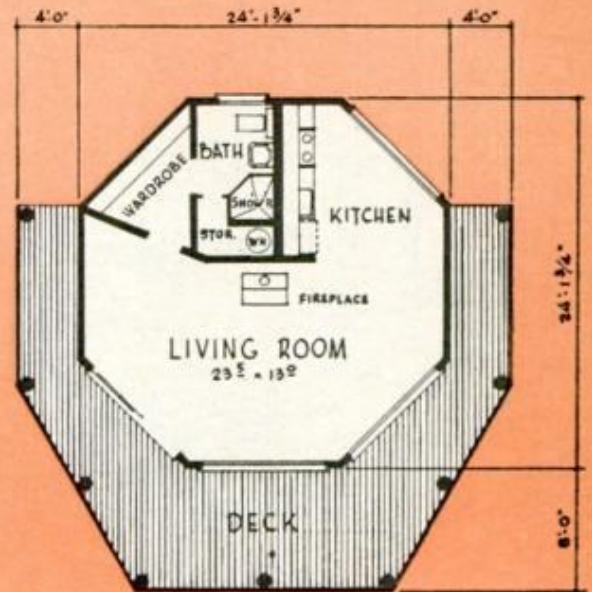


PLAN APA-110-A—309 sq. ft.

A bachelor with a small wooded site high in the mountains would be unlikely to find a better plan for a vacation home. It's comfortable and is laid out for convenience without sacrificing good design

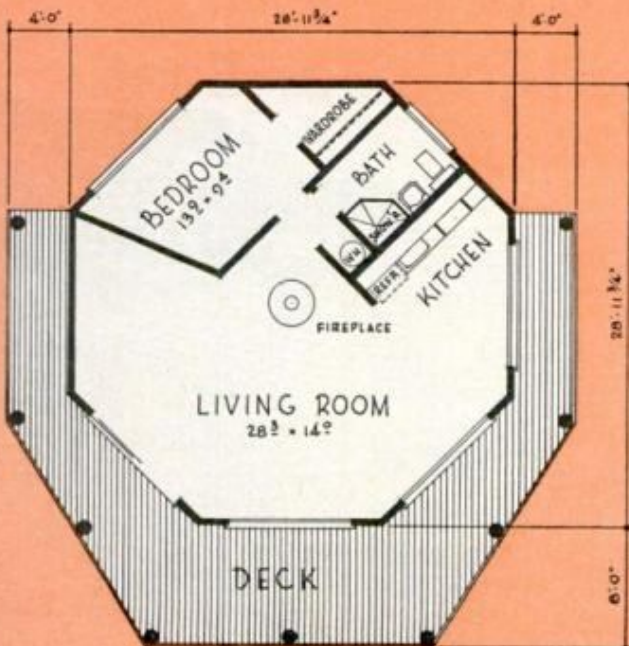
PLAN APA-110-B—483 sq. ft.

A larger version of the octagonal design, this plan requires an additional five feet (in length and width) over the smaller 110-A version, yet it increases the available living space by a little more than 50 percent



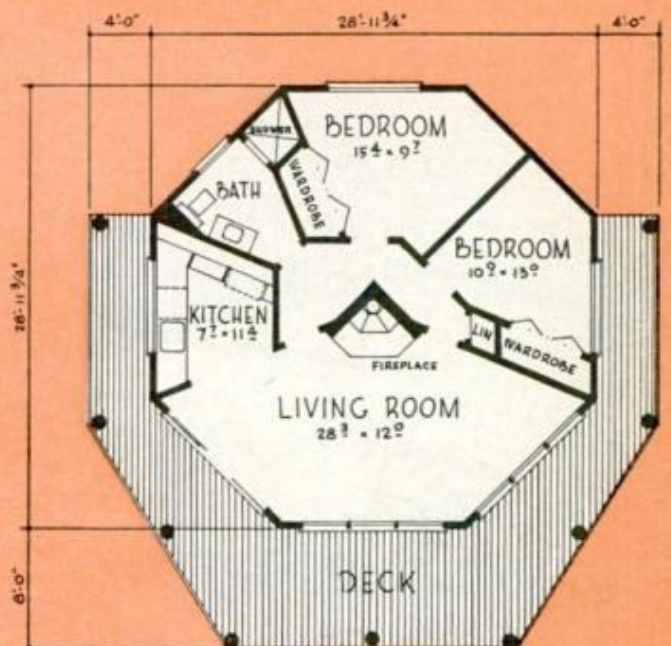
PLAN APA-110-C—768 sq. ft.

"A home away from home" best describes this one-bedroom version of the eight-sided design. Although the deck rings five of the eight sides, the house could be built with more or less deck as required

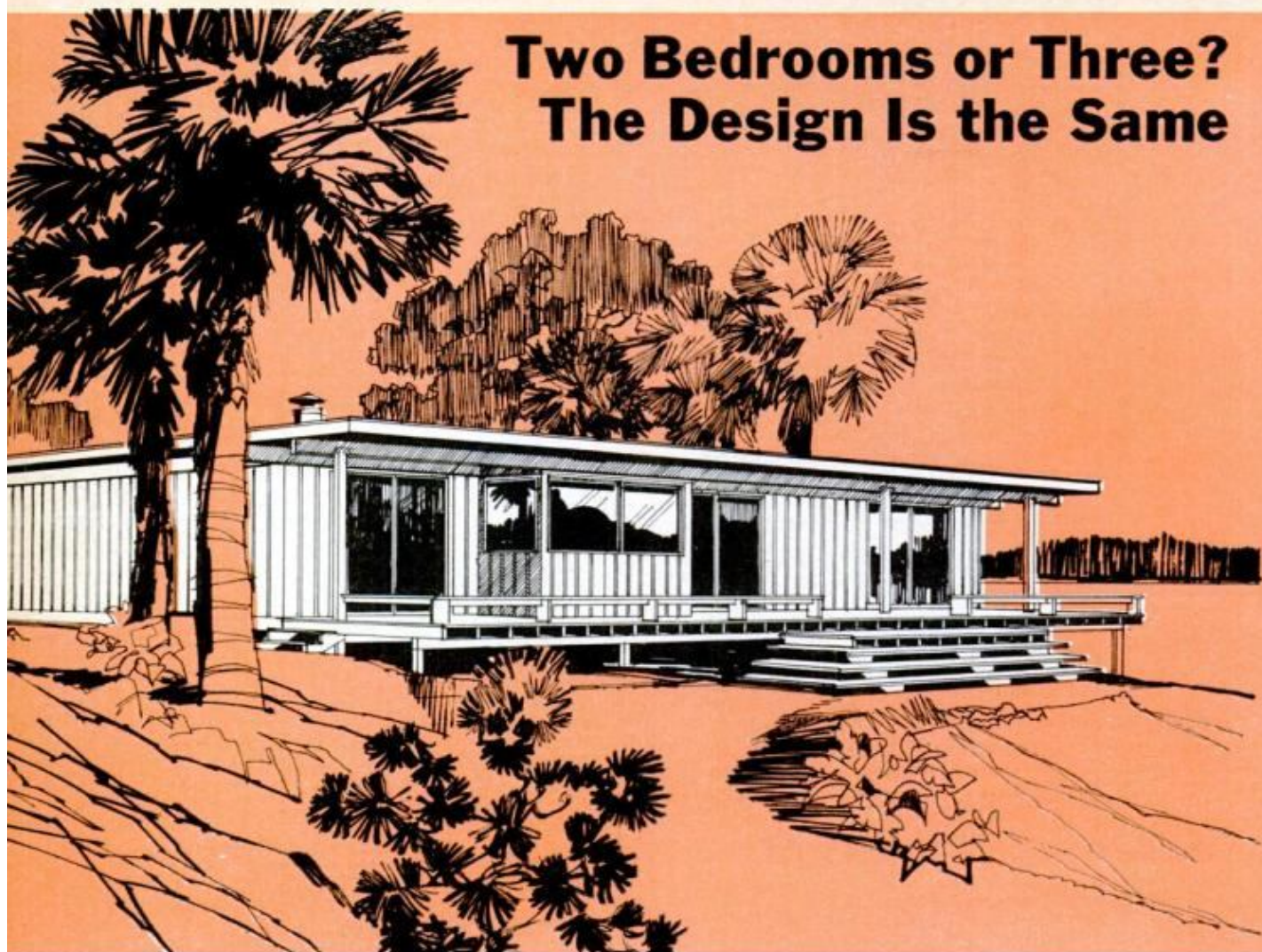


PLAN APA-110-D—768 sq. ft.

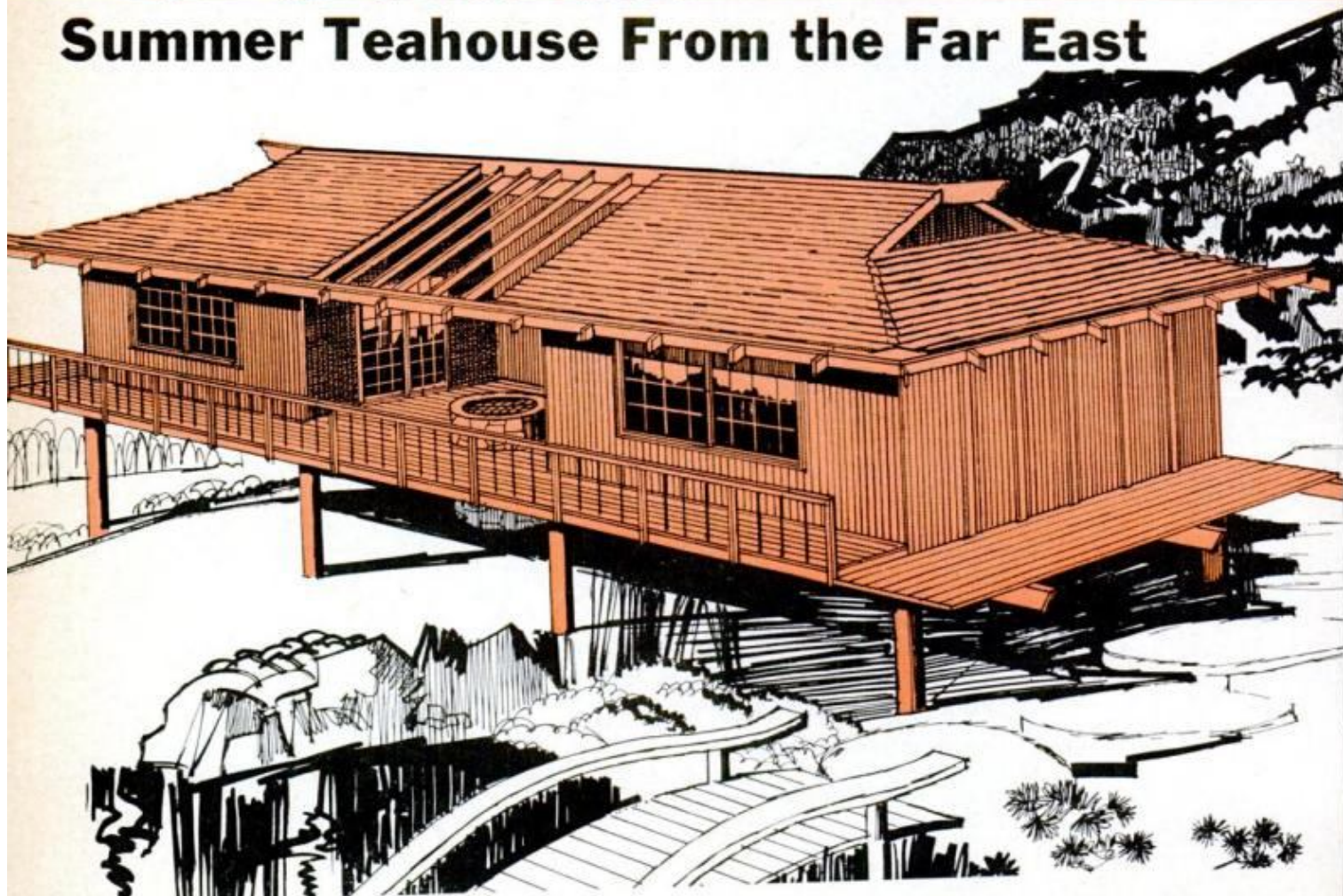
As a year-round vacation home or a retreat solely for summer months, this two-bedroom version leaves little to be desired. Measurements shown in these plans are taken from extreme corners



Two Bedrooms or Three? The Design Is the Same

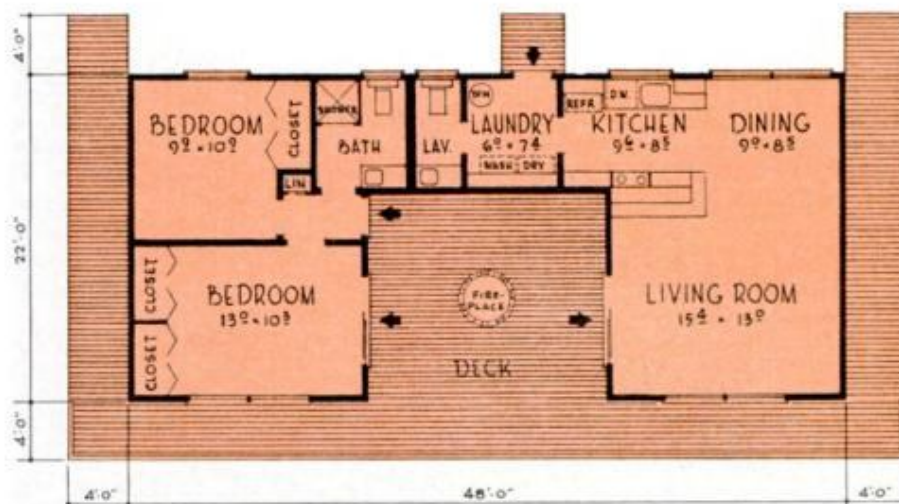
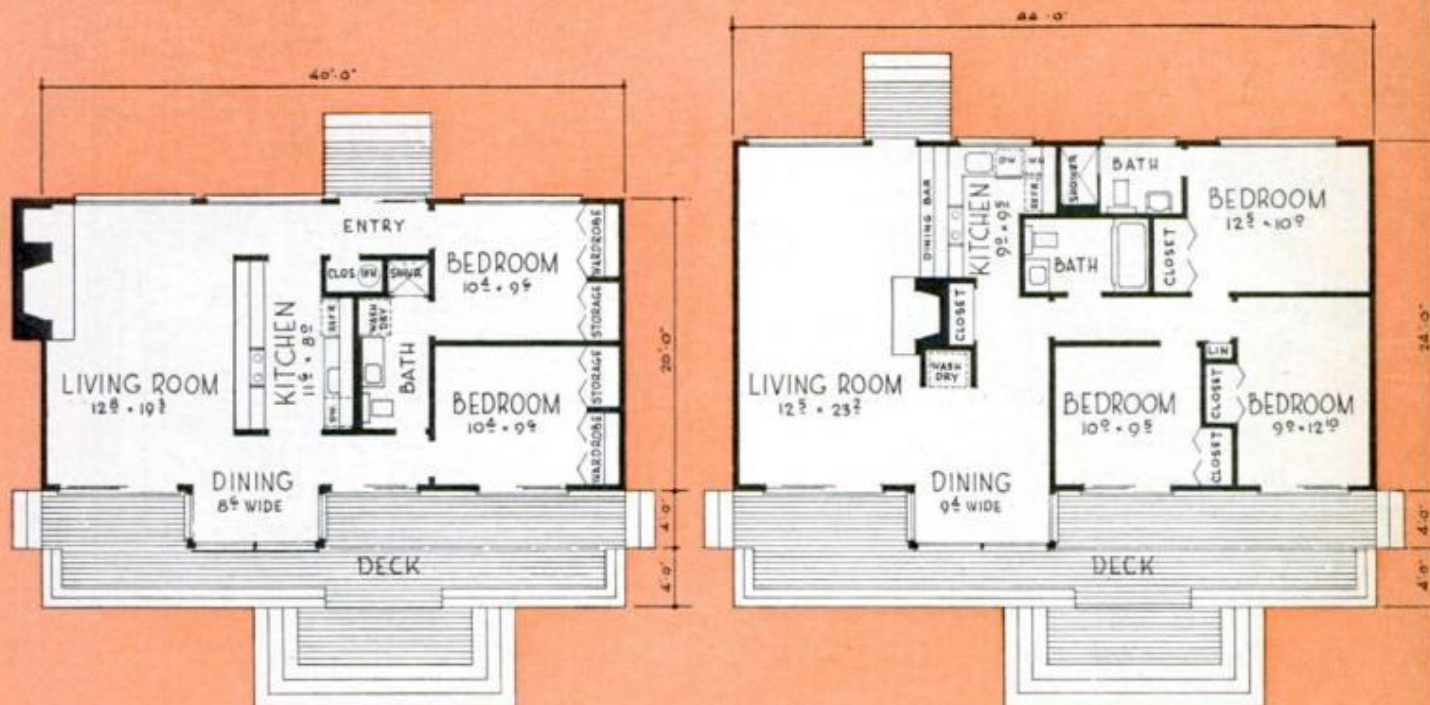


Summer Teahouse From the Far East



STANDING SQUARELY on its own merits, this design lets you choose from two or three-bedroom versions featuring lots of glass, skylights to defy murky afternoons, and a cheery fireplace to take the chill out of cool evenings. The three-bedroom model, designated plan APA-104-B, provides 1096 sq. ft. of living and play space; the smaller APA-104-A model, 838 sq. ft. Although there are some differences in layout, both versions feature good storage space and a sound traffic pattern.

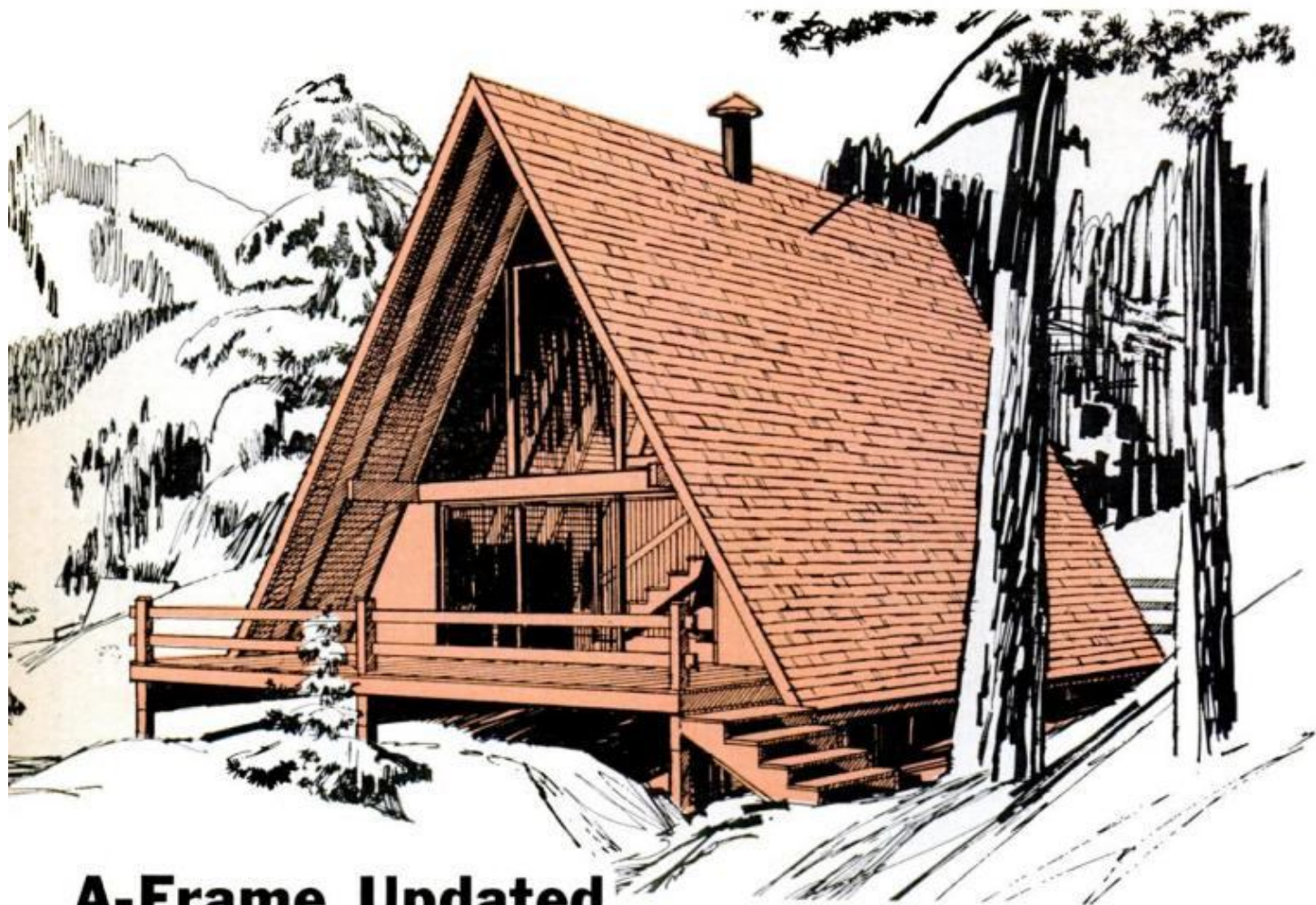
VACATION HOMES



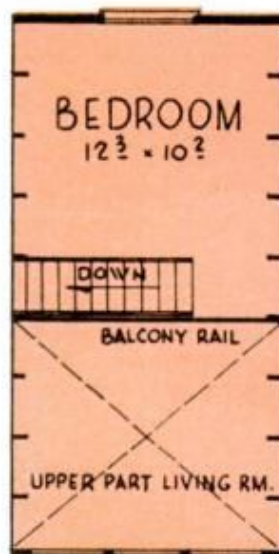
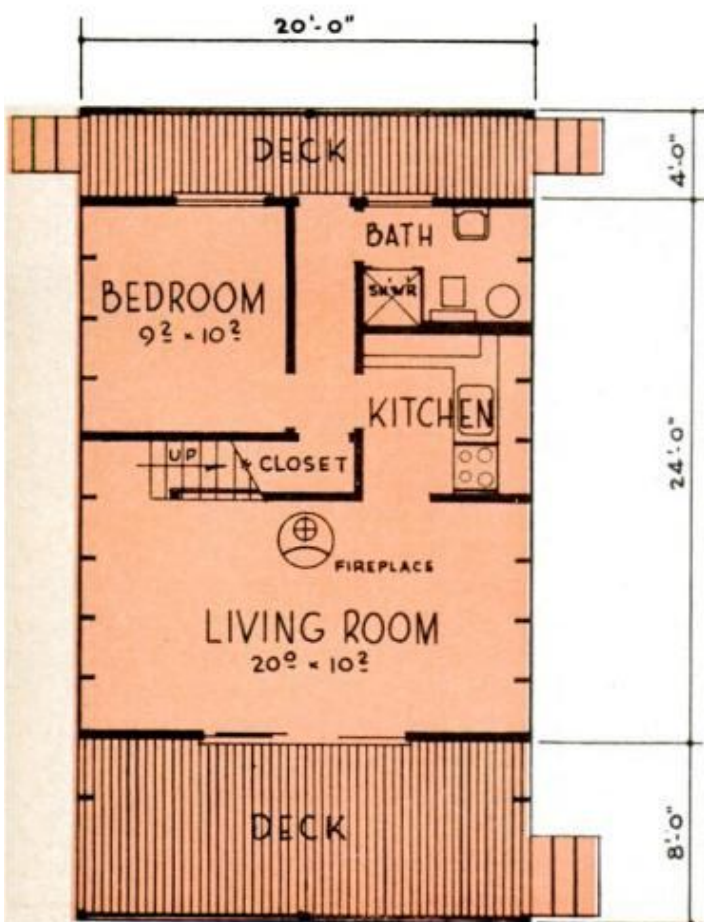
INDOOR-OUTDOOR LIVING during the summer seems natural in this unusual design featuring Far Eastern details in its roof, deck railing and pane windows.

With 832 sq. ft., the plan clusters its rooms around a decked outdoor living room with an imaginative firepit built in its center. Open roof beams in this area admit sunlight, yet the area is protected from the wind on three of its sides.

Since vacation home sites frequently are sloping, hilly or rocky areas, the elevated type of construction shown at the left allows the house to float above rough terrain. Perimeter foundations, of course, can be substituted where building codes or special climatic conditions must be met. Plan APA-102-A is also available with a conventional exterior design built around the same floor plan.



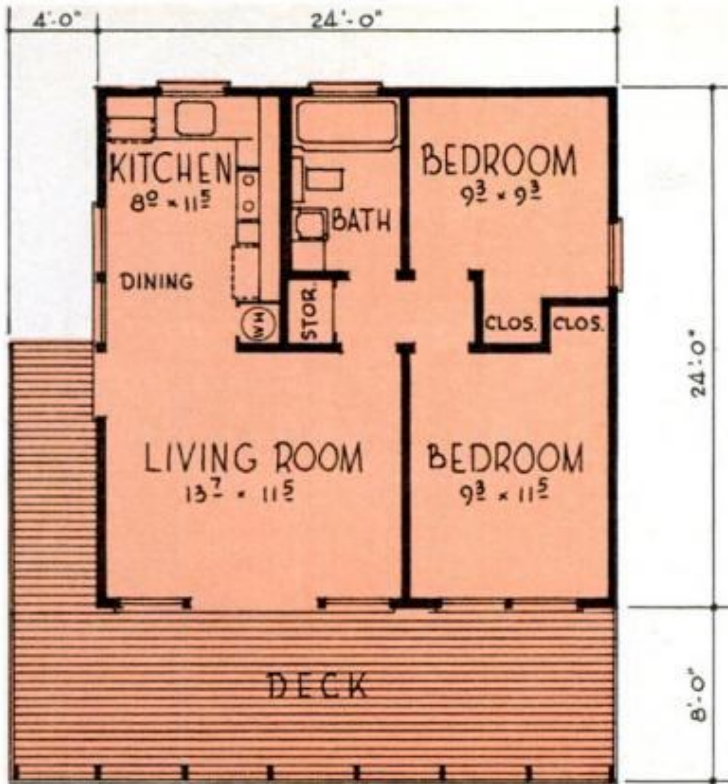
A-Frame Updated For Comfort



PRACTICAL LAYOUT of the A-frame is highly suitable for weekending the full year round. As a concession to modern design, the front wall is almost all glass. Adding a rear door makes traffic pattern sound

ONCE CONSIDERED a radical design innovation, the A-frame has become a classic among vacation home styles. The adaptability of the A-frame has much to do with its popularity, since it can be built on most any site and customized to reflect the owner's individuality.

Plan APA-112 utilizes a large expanse of glass on the front to add spaciousness to the 645-sq.-ft. home (480 sq. ft. on lower floor, 165 sq. ft. on upper level), and includes an often-needed back door.

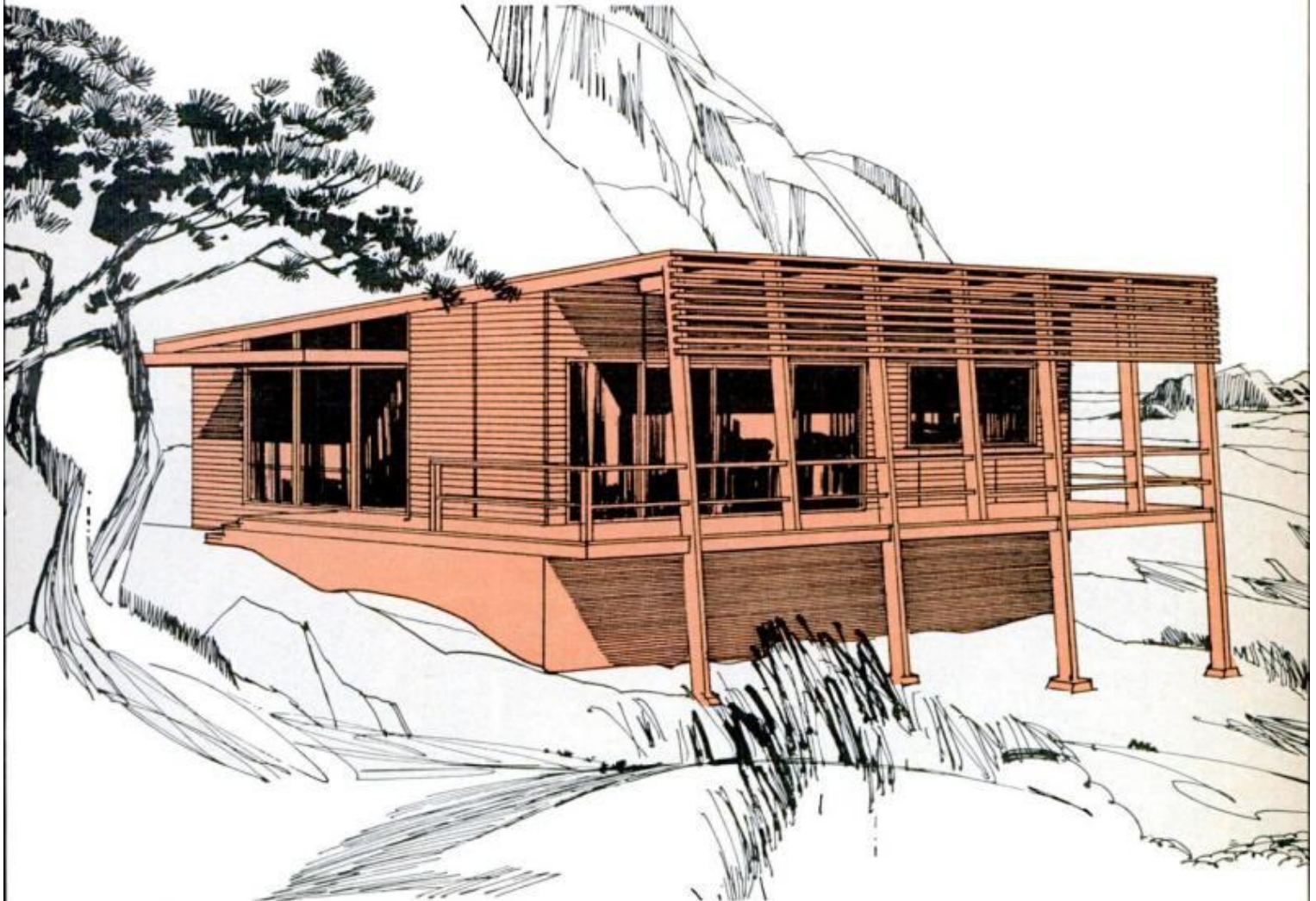


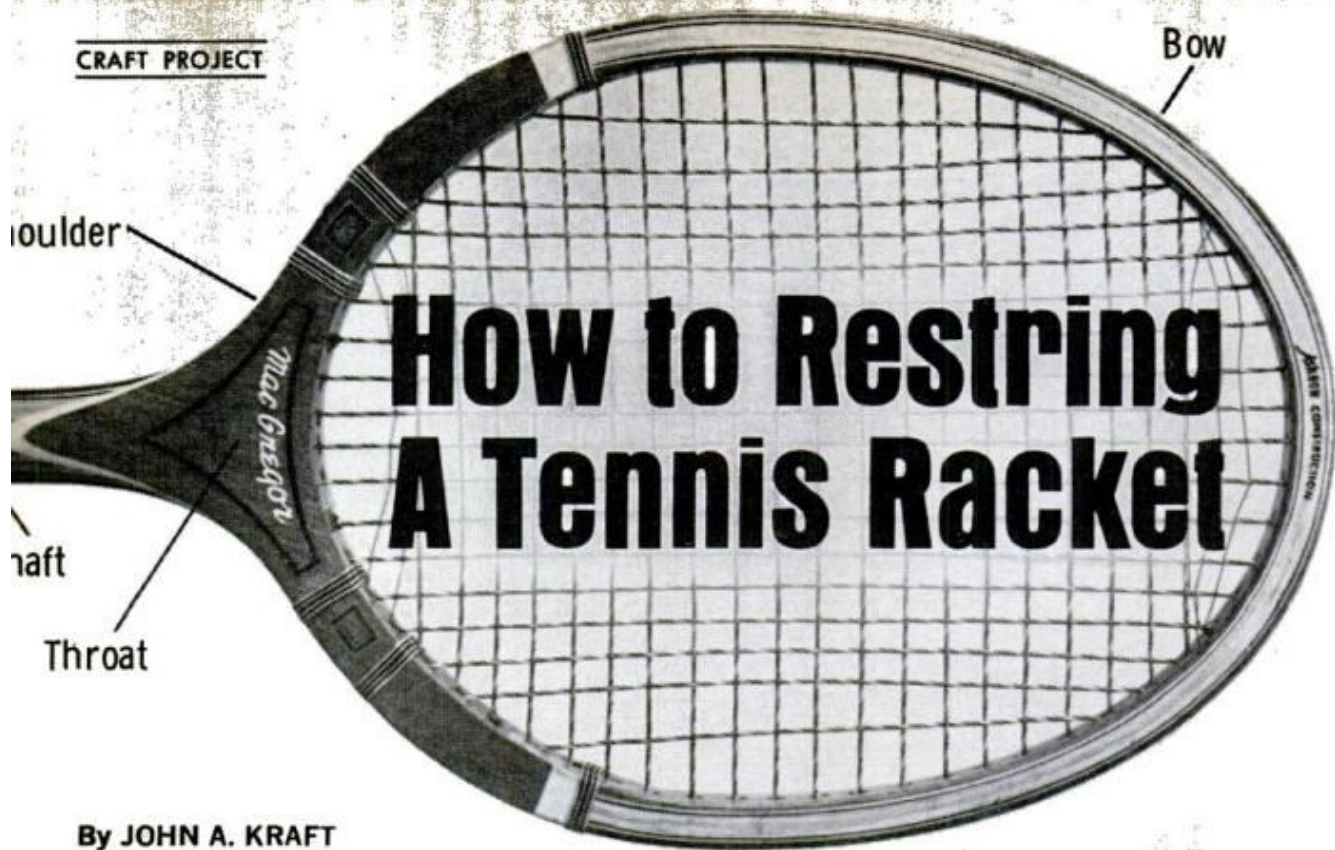
THE WEATHER-WORTHY shed roof has proven itself to be strong, durable and highly practical—and too often, extremely ugly.

However, thoughtful planning in the design stage has made the shed roofline appear clean and contemporary in this plan, APA-113-B. Modestly sized, the house offers 576 sq. ft. of enclosed living space, an additional 272 sq. ft. of deck space, and an exterior that's fronted with supporting posts angled to break both the vertical and horizontal lines of the structure.

Inside, both bedrooms have a separate closet, and provision for a hot-water heater is made at one end of the kitchen. ★★★

Sloping Roof Adds Eye Appeal





How to Restring A Tennis Racket

By JOHN A. KRAFT

IF THE STRINGS of your favorite tennis racket have ever let go, you know how long it can take to get the racket restrung and, you'll be out \$6.50 to \$12.

If you play a lot of tennis, you can expect a restringing job five or six times a year. This is where it pays both in time and money to learn the art yourself, and it really isn't difficult. As for equipment, two awls, an 8-in. dowel and a bottle of white shellac put you in business.

You can use nylon or gut for strings. I recommend that the beginner use nylon.

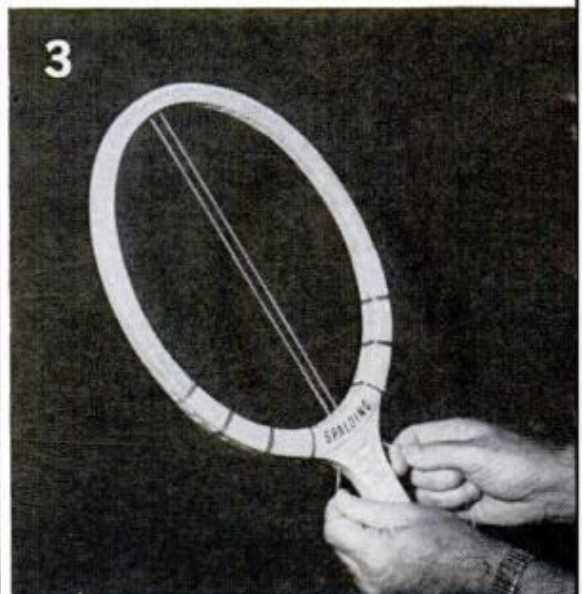
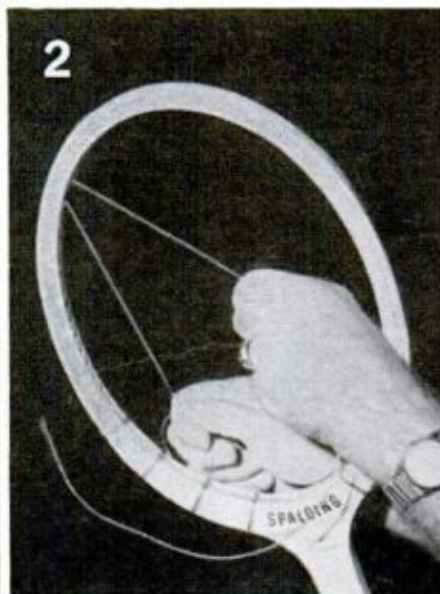
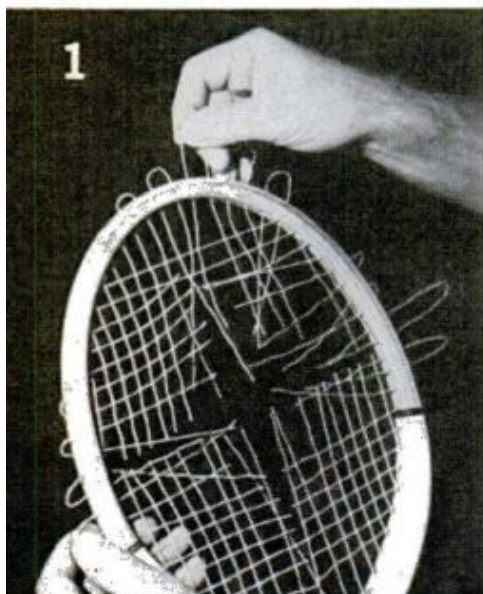
It costs less, is impervious to water and lasts just about as long. It takes roughly 35 ft. for the average frame, 17 ft. being needed for main strings and 15 ft. for cross strings. Best-quality nylon will run about \$2.50 for a 35-ft. coil, or "set," as its called. The next grade sells for about \$1.40, and the lowest grade costs less than a dollar. If gut string is preferred, it will run from \$5 to \$8; it is economical to select sets of 22 and 11 ft.

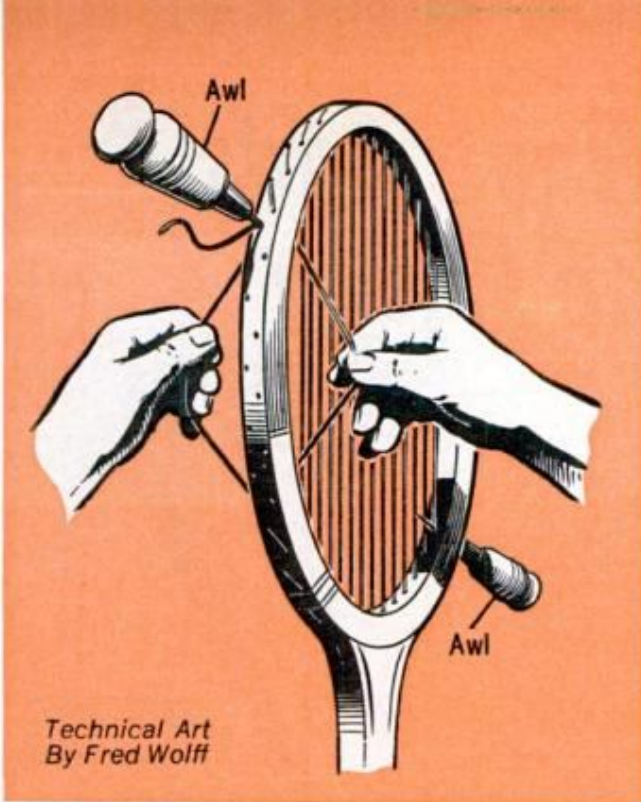
Nylon and gut are sold by mail by the Kendal Co., 1901 W. 43rd St., Chicago, Ill.,

AFTER OLD STRINGS are cut with razor blade, severed strands are pushed out from inside the frame

HOLES IN FRAME are "burned out" by running scrap of string back and forth in shoeshine fashion

DOUBLE 17-FT. LENGTH of nylon string and start stringing at two center holes at the top of racket





AFTER MAIN STRINGS ARE STRUNG next step is to tighten them. Start at center and work each way, pulling strands alternately to take up slack. Awl is used in holes to hold strings taut when properly tensioned

60609; Cragin-Simplex Co., 163 Varick St., New York, N.Y. 10013, and Moody Co., Milford, Conn. 06460.

Getting the frame ready takes time. You first have to cut and remove the old strings. Using a single-edge razor blade, start at the top center of the bow and cut the cross strings from top to bottom. Then cut across the main strings. Next, grasp the loose ends inside the frame and push them outward. Pass an awl point under the raised edges and pull the severed strands from the frame. (Step 1).

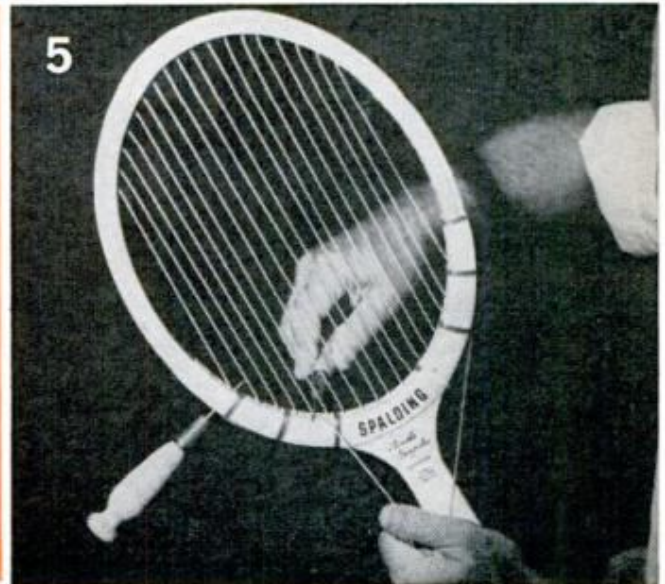
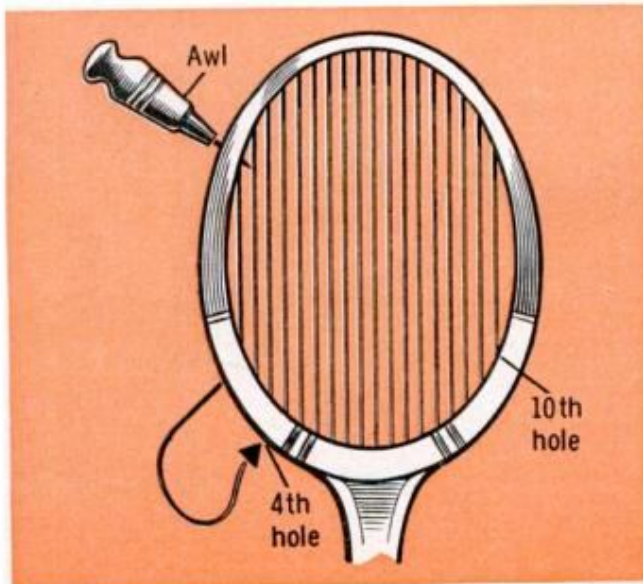
Now clean the stained frame with a

cloth dampened in denatured alcohol, smooth the rough spots with fine sandpaper and finally brush the sanded parts with thinned white shellac.

Before stringing a frame, it is advisable to "burn out" the holes in order to eliminate splinters and rough edges (Step 2). Run a short piece of nylon or gut back and forth through the holes, also along the grooves on the outside of the frame. Run an awl in the holes from the inside to round off sharp spots.

In starting to lace the frame, assume a [\(Please turn to page 228\)](#)

ANCHOR ENDS OF MAIN STRINGS by knotting. Drop of white shellac is added to knot before forcing it tightly against frame. Awl is used to maintain tension while knot is tied. Cut strand 1/16 in. from knot

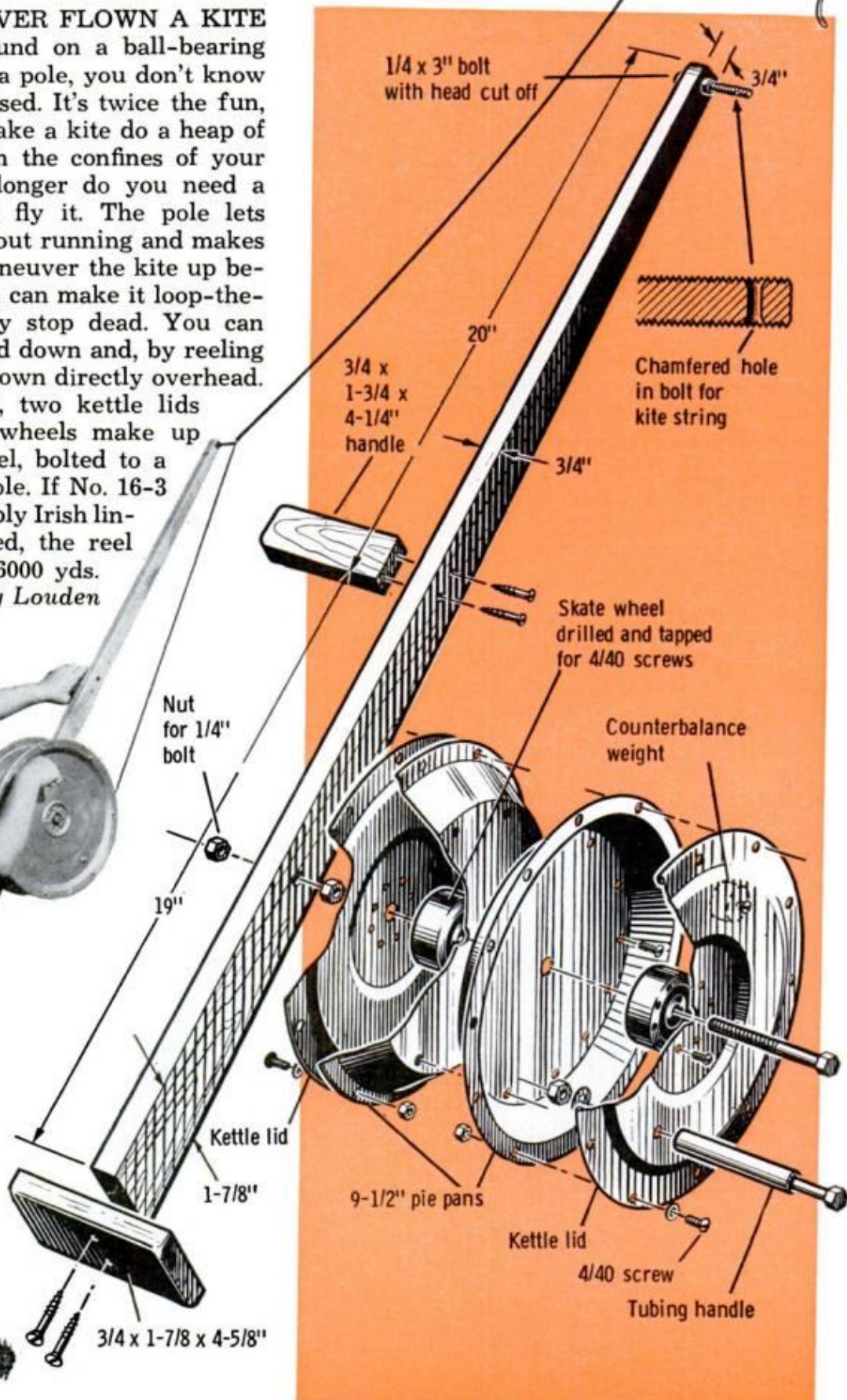


'Fishing-Pole' Reel Adds New Fun to Kite Flying

IF YOU'VE NEVER FLOWN A KITE with thread wound on a ball-bearing reel attached to a pole, you don't know what you've missed. It's twice the fun, since you can make a kite do a heap of tricks right from the confines of your back yard. No longer do you need a football field to fly it. The pole lets you start it without running and makes it possible to maneuver the kite up between trees. You can make it loop-the-loop or suddenly stop dead. You can dip its tail up and down and, by reeling in fast, bring it down directly overhead.

Two pie pans, two kettle lids and two skate wheels make up the king-size reel, bolted to a 39-in. tapered pole. If No. 16-3 bookbinder's, 3-ply Irish linen thread is used, the reel will hold up to 6000 yds.

—Harry Louden



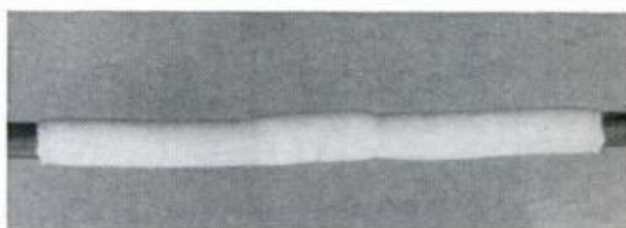
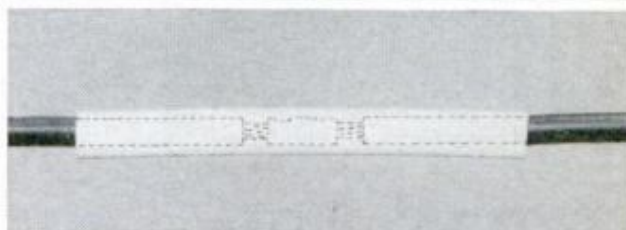
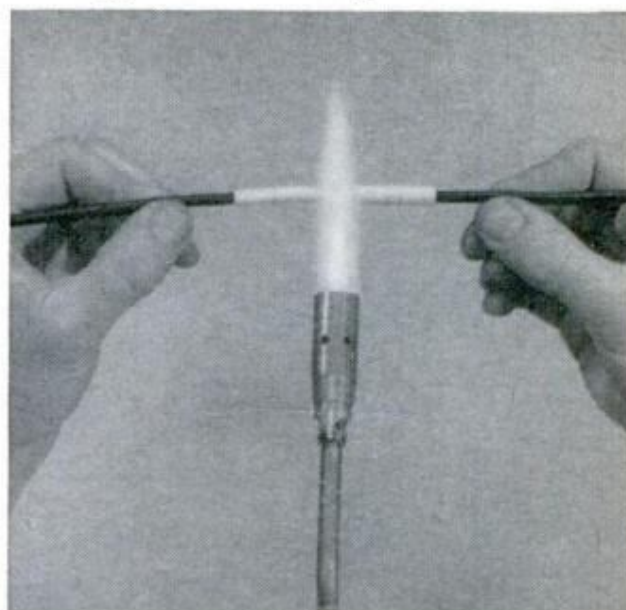
Heat-Shrinkable Plastics—Space-Age Workshop Material

HOW WOULD YOU LIKE to be able to make strong, waterproof splices on all of your electrical projects?

Heat-shrinkable plastic tubing lets you do just that—yet it's as easy to use as conventional insulation tubing (called *spaghetti* in the trade). Just slip a length of it over a splice, apply a bit of heat and the plastic tightly conforms to the shape of the joint.

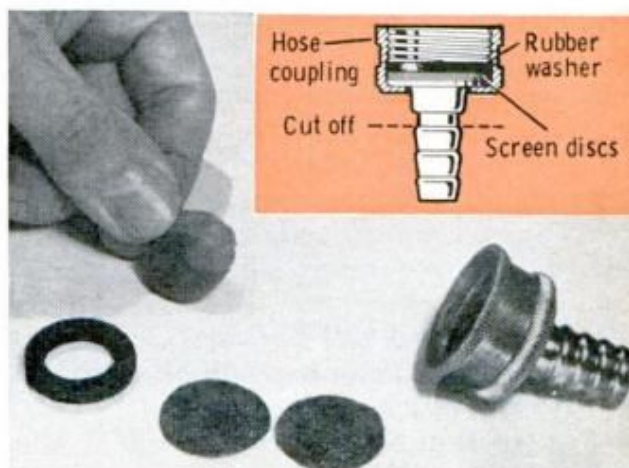
Called Thermofit, this product of aerospace research and development is made by Raychem, 300 Constitution Dr., Menlo Park, Calif. Although it has been available for industrial and military applications for a few years, the price of the forced-air heat gun used to shrink it prohibited widespread use. However, with the advent of popular shop torches, such as the Bernzomatic and Turner units, the electrical heat gun is no longer required for common repair tasks. Thus, Raychem has begun to market packets of 50 and 100 pieces of Thermofit in hardware and electrical supply shops, with instructions on how to use a propane torch to shrink the plastic.

The three small photographs at the right show how the material is used. In the first, dotted lines show the splice joint (here made with a crimp-type connector) covered by the unshrunk plastic. The second shows how the shrinkable plastic conforms to the shape of the splice. Since the outer surface remains firm and the inner surface temporarily becomes very soft when heated, the soft plastic completely fills all voids and some excess is squeezed out of the tubing ends (as shown in the last photo).—*John Robinson*



Make an Antisplash Faucet Strainer From a Hose Coupling

When the strainer on a laundry-room faucet corroded and broke, I used the female half of a garden-hose coupling to make a replacement. The shank beyond the threaded body was shortened to about 3/8-in., then three discs of fine-mesh screen (salvaged from the old strainer) were fitted inside the coupling body. Fitted with a rubber washer, the strainer was then screwed on the faucet for a drip-free installation. What's more, the solid-brass strainer is less likely to corrode, so it will probably outlast the original three or four times.—*Walter E. Burton*





WHAT YOU SHOULD KNOW ABOUT CHOOSING AND USING ABRASIVES

Or: Can you identify a 120-mesh, C-wt., open-coat, aluminum oxide sandpaper—and tell when to use it?

By JAMES P. SCHENLEY

KNOWING EXACTLY what type of abrasive to use for a specific job usually means the difference between a beautiful finishing job and one that's only mediocre. Simple—until you realize there are some 40,000 specifications of abrasives for consumer or industrial use.

For home workshop applications, however, there are only four factors that you will need to consider: abrasive mineral, backing, coating and grade.

Which mineral and backing? There are six minerals and two backings (paper and cloth) from which to choose.

● *Flint* is natural quartz abrasive and is light tan in color. It's available with a

paper backing only, loads up quickly and is the least durable. Use it for small-scale hand sanding jobs on wood only (never for wet sanding). The biggest advantage of flint is price—it's least expensive.

● *Garnet* is also a natural mineral abrasive, reddish in color, and is favored for sanding of wood. It's available only with a paper backing and can be used for dry sanding of woodwork and furniture. Don't use it on power sanders.

● *Aluminum oxide* is a synthetic abrasive with a brownish color and is available with either paper or cloth backing. Paper-backed aluminum oxide is used for hand or machine-sanding of hard-

Guide to Buying and Using Coated Abrasives

TYPE	GRADES				AVAILABLE IN	USES	
FLINT PAPER	Extra coarse	Coarse	Medium	Fine	Extra fine	9x11" sheets, close coat; assorted packs of coarse, medium and fine grades in 4½ x 5" sheets	Hand sanding common woodwork; removing paint and varnish; for small miscellaneous jobs
GARNET PAPER	Very coarse 36-D (2)	Coarse 50-D (1)	Medium 80-D (1/0)	Fine 120-C (3/0)	Very fine 220-A (6/0)	9x11" sheets, open coat	All-around paper for hand sanding woodwork and furniture
ALUMINUM OXIDE PAPER	Very coarse 36-D (2)	Coarse 50-D (1)	Medium 80-D (1/0)	Fine 120-C (3/0)	Very fine 220-A (6/0)	9x11" sheets, open coat; in cut sheets for hand blocks, and for popular brands of machine sanders	Hand or machine sanding of hardwoods, metals, plastics and other materials
ALUMINUM OXIDE CLOTH	Very coarse 36-X	Coarse 50-X	Medium 80-X	Fine 120-X		Belts for popular belt sanders, close coat, X-weight	For sanding of wood, metal, plastic and other materials with stationary or portable belt sanders
SILICON CARBIDE WATERPROOF PAPER			Very fine 220-A	Extra fine 320-A	Super fine 400-A	9x11" sheets, close coat	For wet sanding coats on wood, metal and other materials. Can be used with water or oil
EMERY CLOTH	Very coarse	Coarse	Medium	Fine		9x11" sheets and in assorted packs of coarse, medium and fine of 4½ x 5½" sheets	For general polishing of non-plated metals; removing rust and scale; scouring, other small metal-polishing jobs
CROCUS CLOTH		Very fine grade only				9x11" sheets	Use on metals where a high polish, mirrorlike finish is desired

*Grades may differ slightly from manufacturer to manufacturer. For example, one may offer 50-D as the coarse abrasive, while another may offer a 60-D.

woods, lacquer-coated surfaces, metals and plastics. It's used dry.

Aluminum oxide cloth is used for machine sanding of wood and plastic, and either machine or hand-sanding of metal. In fact, it's the best abrasive to use on metal and will withstand the toughest use. Aluminum-oxide cloth can be employed dry or with oil as a lubricant.

● *Silicon carbide* is another synthetic abrasive, shiny black in color, and is especially suitable for wet sanding (by hand or machine) of primers, undercoats, floors and intermediate coats on wood or metal. Water or oil can be used as a lubricant. It's made only with paper backing.

● *Emery cloth* is a dull black, natural abrasive used for light polishing jobs or for removing rust and scale from metal. For tough jobs, aluminum-oxide cloth is best to use. Emery cloth can be used dry or with oil as a lubricant.

● *Crocus cloth*, made of iron oxide, is used as a polishing agent to give metal a mirror-like finish. It's the only abrasive which comes in one grade—very fine.

The natural abrasives—flint, garnet, emery and crocus—are the least expensive. Aluminum oxide and silicone carbide cost more, but last longer.

Paper and cloth backings come in various weights. Paper is available in A, C, D and E weights.

● *A-weight paper*, called finishing paper, is made from 40-lb. stock and is suitable for light sanding jobs where excessive pressure won't be put on the paper. It's often used on an oscillating power sander for fine finishing jobs.

● *C and D weights*, known as cabinet papers, are made of 70-lb. and 100-lb. stock, respectively. Where heavy sanding is required, D-weight paper will stand up best. Less severe work can be tackled with a C-weight paper. You can use either for machine or hand sanding.

● *E-weight papers*, known as roll stock, are of 130-lb. stock and are made specially for tough sanding jobs with a power sander.

Cloth backing comes in X and J weights. X is heavy, durable and strong and will withstand hard machine sanding. Most jobs done around the home with a belt sander will require X-weight cloth.

J backing is lighter in weight and more flexible. It's used where X-weight cloth is too stiff, as when sanding intricate curved, molded or fluted surfaces.



PAPER STORAGE "INCH" RACK has $\frac{1}{8}$ -in. hardboard shelves 1 in. apart. Compartments of $9\frac{1}{4} \times 11$ in. hold standard 9×11 -in. sheets. Shelves fit grooves in sides of $\frac{3}{8}$ -in. plywood box.—John Burroughs

Home craftsmen employ a dry abrasive for most work. An abrasive that's used wet—usually when working with metal—provides quicker cutting and finer finishing and polishing. Oil is sometimes used as a lubricant for abrasives when sanding wood surfaces.

Before wetting an abrasive, be sure it is designated for wet use. If you wet an abrasive not designed for such use, the abrading minerals will flake off the backing material.








The type of adhesive used to adhere the mineral particles to the backing material will determine whether a coated abrasive can be used wet. Usually, a synthetic resin adhesive makes the coating waterproof.

Which grade? Coated abrasives are made of 22 different mineral particle sizes or grits, ranging from extremely coarse to an almost talc-like form. There are three ways of stipulating grade:

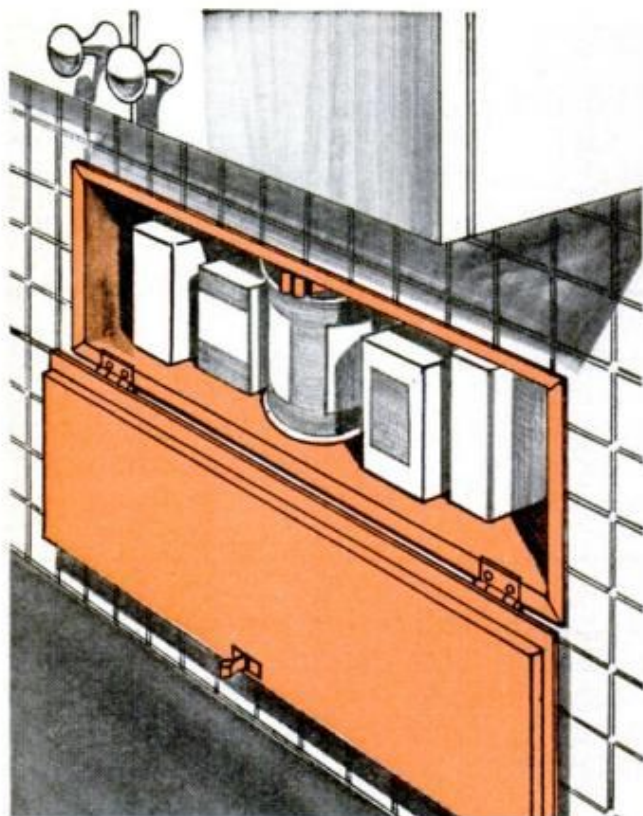
● *By mesh (grit) number.* This is the most accurate and takes in all 22 particle sizes. Mesh number refers to the number of openings in a lineal inch when the abrasive is compared to a standard control screen used by the industry. For example, if you ordered a 120-grit sandpaper, it would have 120 openings to the

[\(Please turn to page 222\)](#)

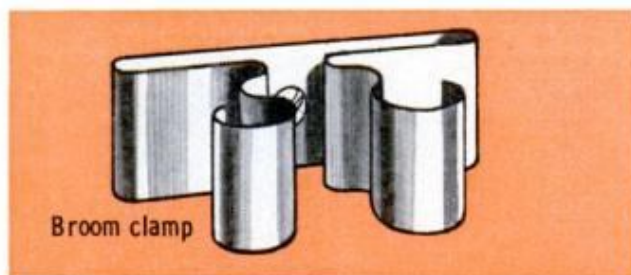
Guide to Buying and Using Steel Wool

GRADE	USES
0000 (Finest) 	Uses for this grade are limited in the home workshop. Its chief use is in rubbing down the final varnished, lacquered or shellacked finish when furniture has been refinished.
000 (Extra fine) 	Some specific uses include removing dried paint from wood (floors and furniture), cleaning rust from chrome (use with kerosene) and cleaning stainless steel (use with scouring powder).
00 (Fine) 	Some uses include removing shallow burns from wood if 000 doesn't work, dulling a high-luster finish on furniture (use with crude or linseed oil) and cleaning footprints from wood floors.
0 (Medium fine) 	This is the grade used for cleaning cooking utensils. Other uses include removing paint from parquet floors, giving brass a high finish and removing stains from glazed and ceramic tile (use with turpentine).
1 (Medium) 	Some specific uses are cleaning glazed-tile fireplaces (use with scouring powder), removing black marks from wood floors (use with turpentine) and removing rust from cast iron (use with turpentine).
2 (Medium coarse) 	Recommended for removing gummy deposits from floors, rubbing down floors between coats of sealer, removing grease, removing scratches from brass and removing paint from tile (use with scouring powder).
3 (Coarse) 	Specific uses include removing paint and rust from leaders (use with kerosene), removing paint from linoleum, removing grime and paint from furniture to be refinished (use with paint remover).

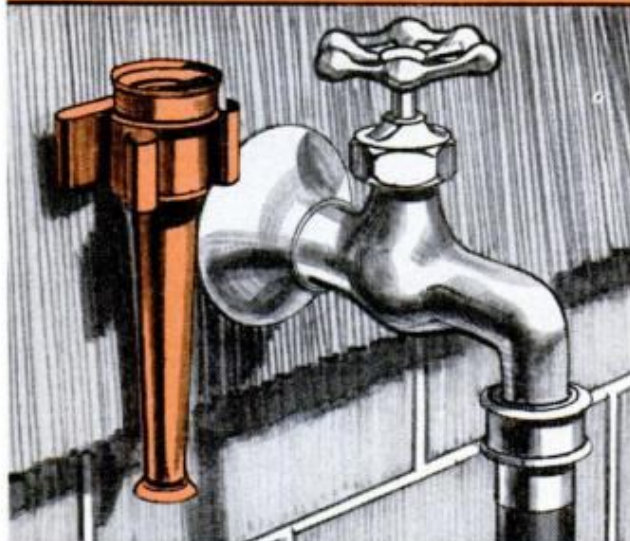
Solving home problems



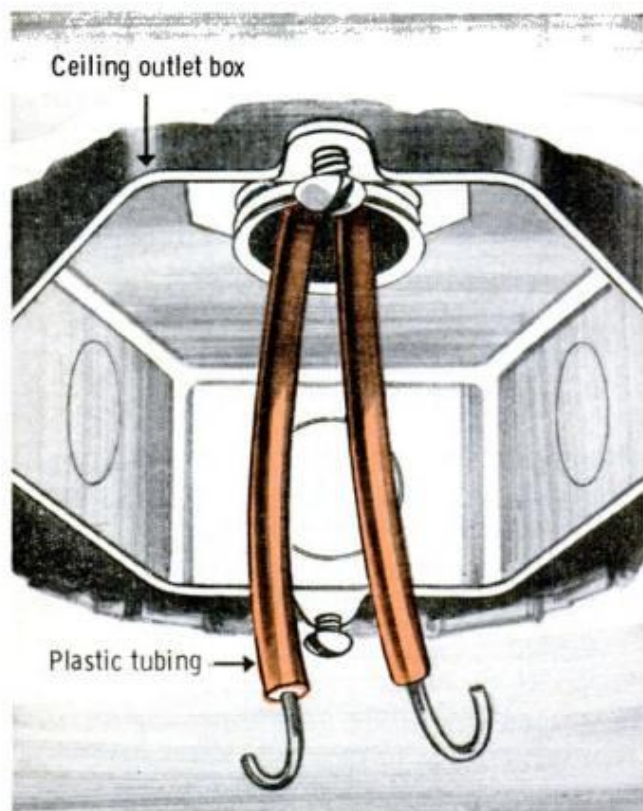
HANDY SPICE CABINET is recessed in kitchen wall, has simple door hinged to open downward. Cabinet is 3½ in. deep, 5½ in. high, fits between wall studs



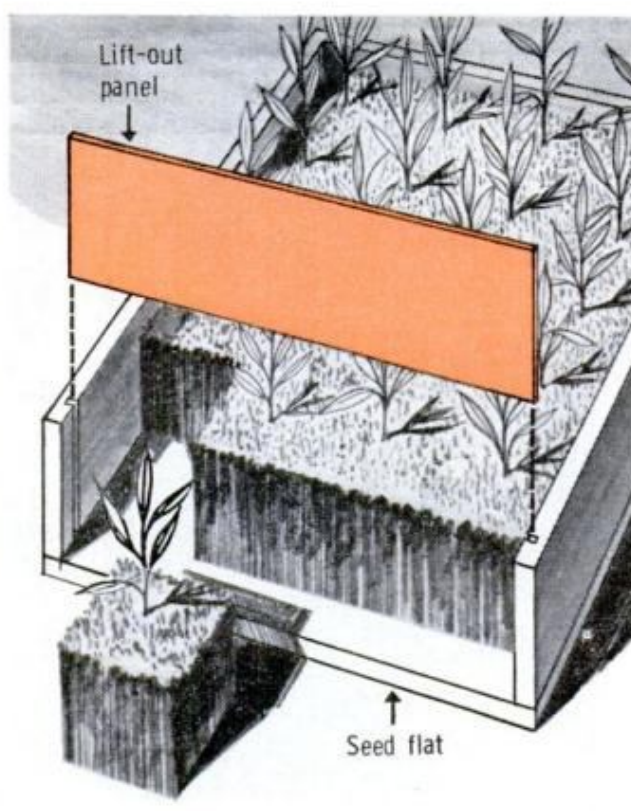
Broom clamp



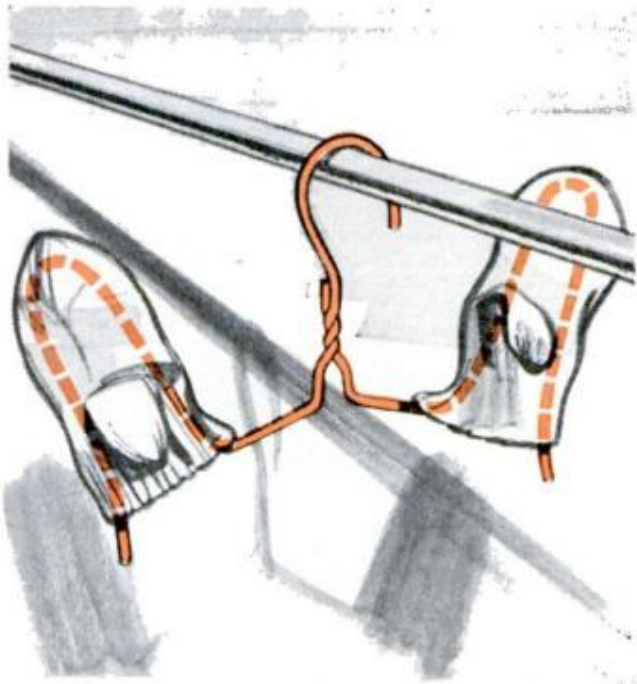
GARDEN HOSE NOZZLE won't be misplaced if kept in a holder secured near the supply valve. A suitable holder, as shown, is a broom clamp screwed to siding



CHARRED INSULATION at ends of electrical wiring sticking out of an outlet box, caused by heat from oversize bulbs, can be replaced by plastic tubing



LIFT-OFF SIDE on a seedling box makes it possible to cut soil into cubes and remove seedlings without scooping into box and possibly damaging the roots



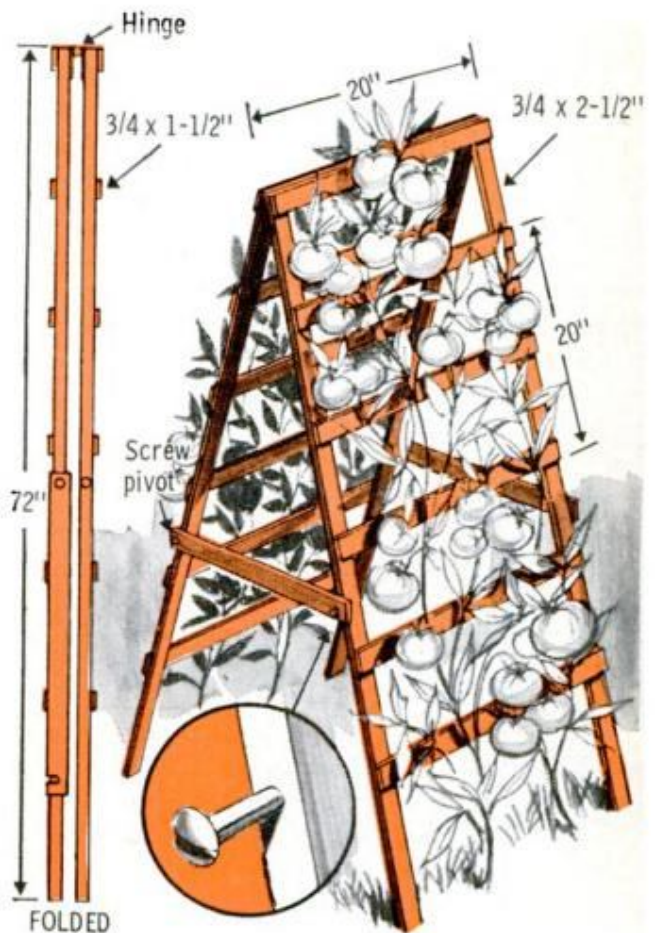
TO DRY YOUNGSTERS' MITTENS, bend a clothes hanger so mittens can be slipped over bent ends, then hang dryer over a warm-air register or other heat source



TEMPORARY BUT RIGID HANDLE for an empty can or similar container can be improvised by tightening a 2 or 3-in. C-clamp over the edge as shown above

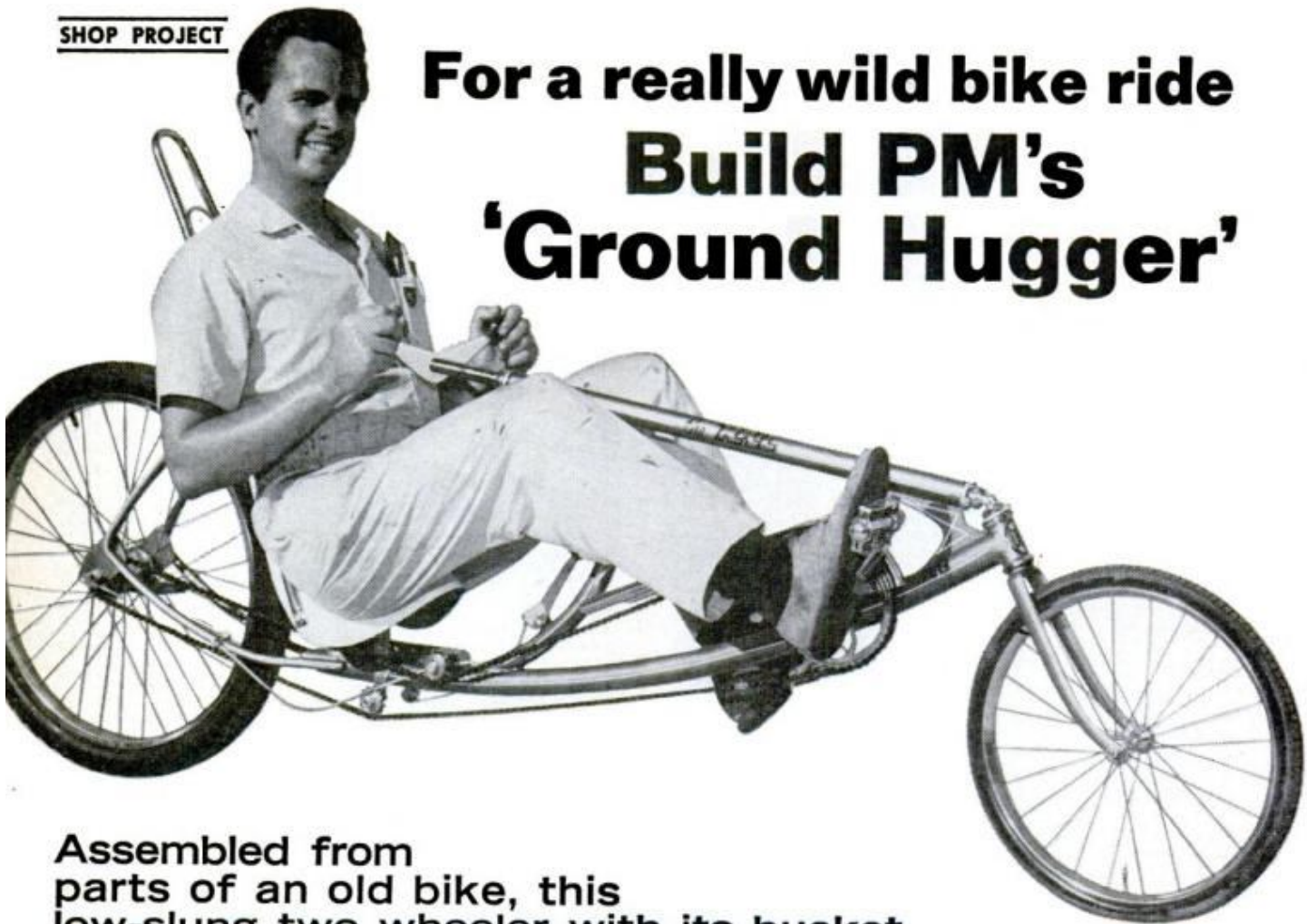


SPONGE-TYPE FLOOR MOP can help make quick work of removing wallpaper, since you can use hotter water than you would by hand. Ladder isn't needed



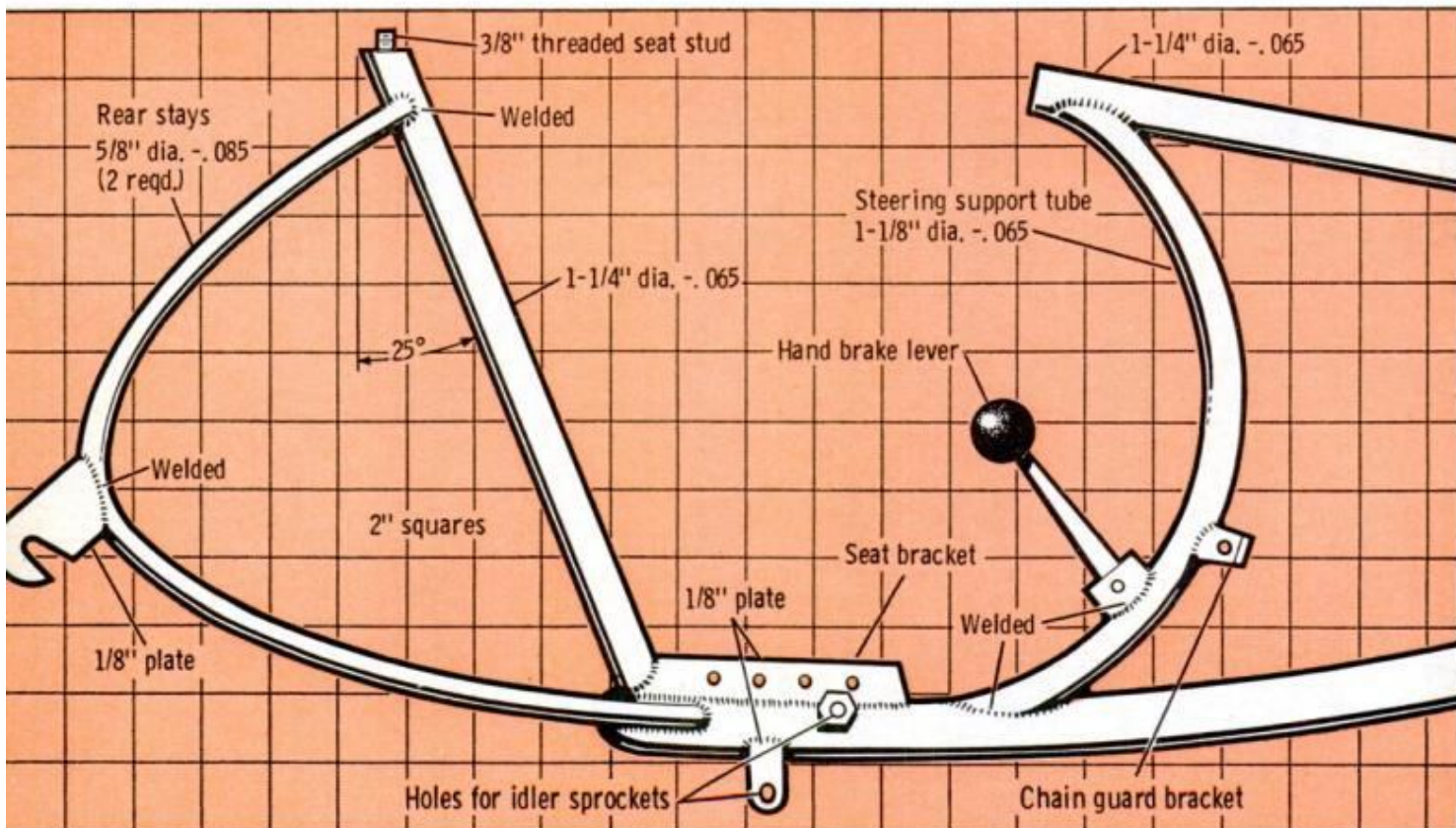
FOLDING BACK-YARD TRELLIS suitable for climbing beans, peas, tomatoes and other vegetables is easy to make from scrap lumber, takes little storage space

For a really wild bike ride Build PM's 'Ground Hugger'



Assembled from parts of an old bike, this low-slung two wheeler with its bucket seat provides a totally new cycling experience

By DAVID CAREY and ROBERT Q. RILEY



IMAGINE SKIMMING ALONG just inches above the ground, listening to the sound of a knobby tire singing in your ears.

You're cradled in a bucket seat and as you lean into a long banking turn, you have the exhilarating sensation of being on a toboggan on wheels. That's what it's like to ride the Ground Hugger!

Unlike any bike you've ever ridden, this radically different design adds a new thrill to cycling. You pedal with your legs in front of you and, being wedged between the seat and the pedals, you can apply great pressure to the pedals. Thus you're able to make jump starts and engage in drag racing. And should you hit a bump, the shock is cushioned by the slight springiness of the bike's long frame.

Learning to ride this novel bike takes a bit of practice. The trick in gaining your balance is to lean back firmly in the seat. This gives you a solid feel of the bike and better steering control. By being low to the ground you feel the same exaggeration of speed experienced in driving a low-slung sports car.

This new design incorporates standard bicycle parts throughout. The only specialized parts are the frame, bucket seat and steering tube. The chain sprocket idlers under the seat are from a Schwinn tandem bike. The crank fittings are standard, as

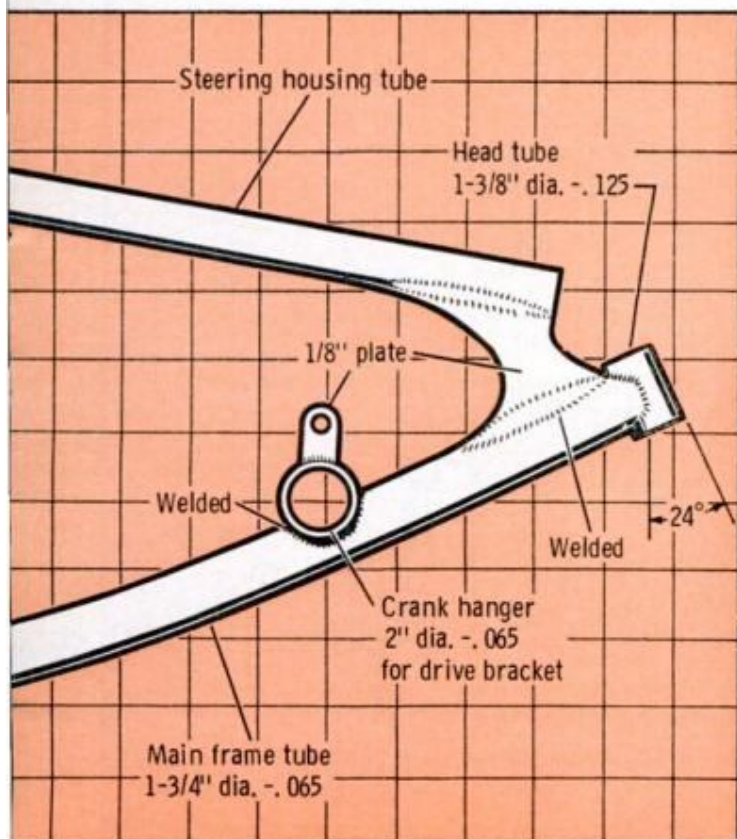
are the chain, fork, fork fittings and bearings. The chain guard is from a standard 26-in. bike. Most of these parts can be salvaged from discarded bicycles. You should be able to build the Ground Hugger for about \$25.

A standard 26 x 2.125 wheel is used on the rear and a 16 x 1.75 wheel on the front. The latter size is available from Schwinn dealers. However you could use a 20 x 1.375 wheel, available at any bicycle shop, for the front.

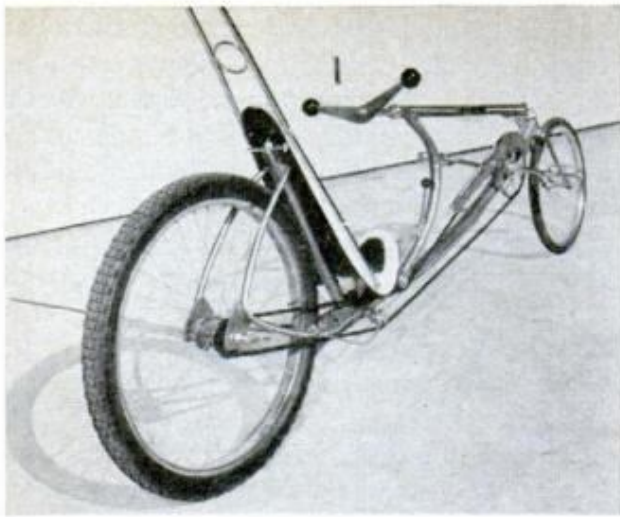
The 90-in.-long frame is made of steel tubing. If you use new tubing, there will be an investment of about \$10 for steel. The cost of used tubing is much less.

All bends can be made with an acetylene torch. To bend the 1 $\frac{3}{4}$ -in. main tube, first fill the tube with dry sand and drive a wood plug into each end. Then, applying most of the heat to the outside radius of the bend, heat an area about 8-in. long and bend the tubing slowly. By making a series of small bends along the length of the tube it can be bent to shape without kinking. Sand need not be used when bending the smaller tubes. To simplify construction, the rear wheel stays can be sawed from an old 26-in. bicycle frame and welded in place on the new frame.

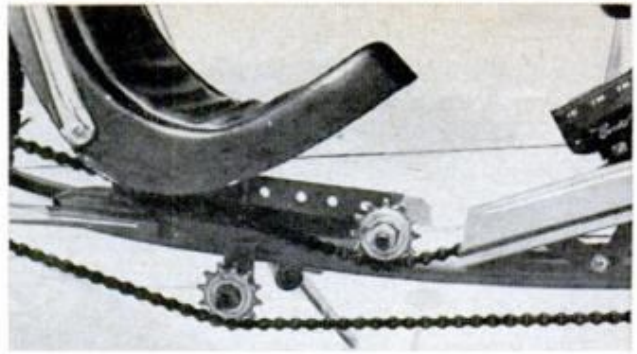
The steering tube is made from a universal adapter for a socket wrench (sold by Proto Tool Co.), which is modified and



BUCKET SEAT is anchored at top to threaded stud in frame's post. High back bar bolts to sides of seat



STANDARD 26-IN. WHEEL is used at rear, 16-in. size at front. Rear-wheel stays are cut from old bike



TWO IDLER SPROCKETS under bucket seat guide the long link chain from large front sprocket to rear one

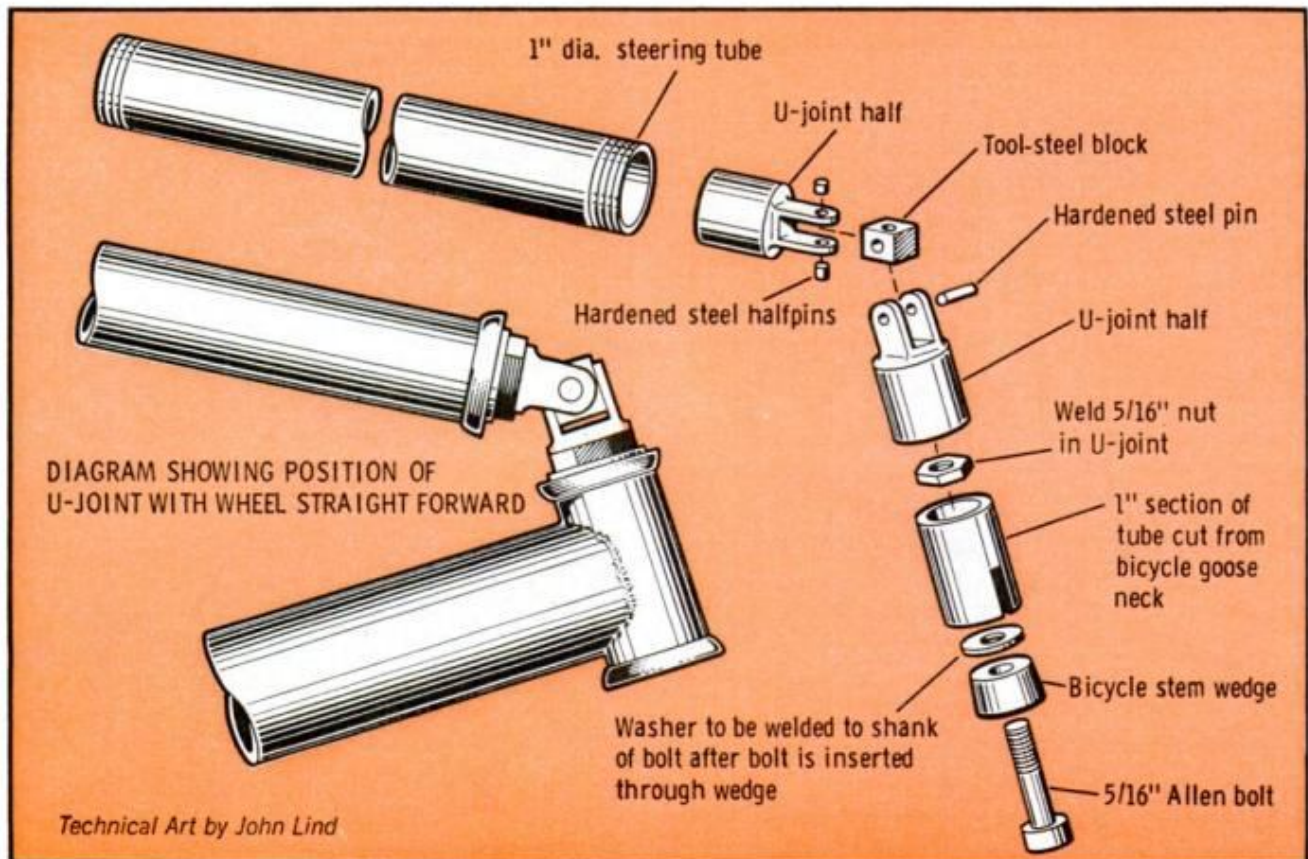
brazed into the end of a length of 1-in. tubing. This tube is then threaded on both ends to accept standard bicycle-fork cones. The steering tube is fitted to the frame using bicycle-fork bearings and cups. When installing the steering tube, be sure the universal adapter pins on the fork side of the U-joint are directly in line with the front wheel—otherwise the steering will be oversensitive.

We cut our steering bar from a piece of 1/4-in. aluminum and glued a 2-in. plastic ball on each end, but a pair of "drop" bars from a 10-speed bicycle can be used. Just saw off the lower part of the

drops and mount them in the steering tube with a standard handlebar stem.

We molded our bucket seat of fiberglass, then upholstered it. We can provide this special seat on order if you prefer to purchase one. However, you can fashion a similar one from wood, pad it with foam rubber and cover it with Naugahyde.

While you can make your own paper pattern of the frame by enlarging the drawing on 2-in. squares, you can obtain a full-size pattern, plus complete construction details, by sending \$5 to the C. & R. Co. 8534 Reseda Blvd., Northridge, Calif. 91324. ★★★

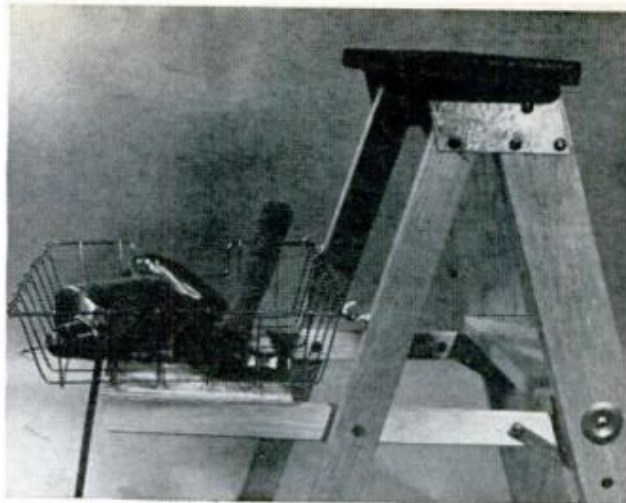


HINTS FROM READERS

Stepladder toolbox

The shelf of a stepladder will hold a few tools but there's always the danger of their falling off and damaging the floor or possibly the tools themselves. To eliminate this chance, clip a wire letter basket to the stepladder with two large cup hooks. This provides a handy tool rack that's easily removed when the ladder is to be folded.

—Ken Patterson



Keeping contacts clean

The oxidation that accumulates in time on the contact surfaces of battery cells in electrically-driven cameras and other devices must be removed periodically. Sometimes layers of oxidation are difficult to remove by ordinary wiping or even washing, but even heavy deposits are removable by using a wire-bristled "suede-shoe" brush. Metal contacts on the camera or other mechanism should also be cleaned, either by wiping with a cloth or with a clean stick.

—Walter E. Burton



Refrigerator-shelf fence

If you don't quite know what to do with that stack of old refrigerator shelves stored in the corner of your garage, consider making a decorative flower-bed fence. Each shelf, when split in two by cutting the rods, yields two comblike sections that have teeth easy to drive into the ground. Many of these shelves are plastic or rubber-coated so corrosion is no problem. If they're made of unprotected metal, treat them with a coat of rust-retardant paint.



Legs from bowling pins

Check your local bowling alley and you'll probably find that old bowling pins are thrown out. I discovered this when my son brought home a wagonful of pins—then I found the pins make excellent legs for benches and stools. They're so hard, however, you'll have to use three or four fluted masonry nails (about 3 in. long) to secure a $\frac{3}{4}$ -in. plywood top to the flat bottom of each pin. Pad or cushion the top and you have an inexpensive, very strong stool or bench.—John Hendry Jr.





Gone forever are the days of simply asking for—and getting—“a gallon of white paint for the living room.” Now, if you don’t specify exactly what paint you want, you may be wasting money

By MORTON J. SCHULTZ

I MADE THE MISTAKE recently of asking a paint dealer for a gallon of exterior paint. Without a moment’s pause, he asked, “Do you want a titanium dioxide pigment in a linseed oil binder, a latex emulsion or a silicone-alkyd with a long oil resin?”

But don’t let my little anecdote upset you. Once you’ve catalogued each type of paint and know what it can do for you, choosing the right one is simple.

Interior paints

Paints for walls and ceilings are of two basic types: gloss and semigloss (considered as one), and flat (nongloss). Gloss and semigloss paints are used in kitchens and bathrooms where spattering of the surface with grease or other dirt is likely. They are washable and will stand a great deal of scrubbing.

There are three specific kinds of gloss and semigloss (also called eggshell) paints: wall paint, enamel and latex. You can ask

for the one that you want by these names.

Gloss (or semigloss) wall paints. Though they are being phased out because the newer enamels offer greater advantages, you may still find some. They have an oleoresinous vehicle, consisting of natural resins and oil. Although easy to apply, they don’t retain their gloss, they yellow, and they can’t withstand regular washing with modern alkaline household cleaners.

Gloss (or semigloss) enamels contain an alkyd vehicle, which is a combination synthetic alkyd resin and oil. They retain gloss extremely well, won’t yellow, and can be cleaned indefinitely with an alkaline cleaner. They also allow immediate washing after drying.

Semigloss latex paints. Newest of the gloss-type finishes for interior use, they have a latex base, which consists of a polymer dispersed in water and not in oil. Thus, they offer certain advantages not provided by other gloss paints, including easy cleanup with water instead of messy

APPLICATION GUIDE TO INTERIOR PAINTS

	Flat Latex	Flat Alkyd	Gloss Enamel (Alkyd)	Semigloss Enamel (Alkyd)	Semigloss Latex	Varnish
Gypsum-board walls and ceilings (kitchens and bathrooms)			X	X	X	
Gypsum-board walls and ceilings (bedrooms, living room and dining room)	X	X				
Plaster walls and ceilings (kitchens and bathrooms)			X	X	X	
Plaster walls and ceilings (bedrooms, living room and dining room)	X	X				
Basement walls, masonry	X					
Wood doors and windows	X	X	X	X	X	X
Metal doors and windows		X	X	X		
Baseboards and woodwork	X	X	X	X	X	X
Wood paneling	X	X		X	X	X
Kitchen cabinets			X	X	X	X
Furniture and built-ins			X	X	X	X
Metal pipes and radiators		X		X		

APPLICATION GUIDE TO EXTERIOR PAINTS

	Oil-Base House Paint	Latex House Paint	Alkyd Enamel (Trim Paint)
Wood siding, clapboard and vertical	X	X	
Wood shingles and shakes		X	
Asbestos shingles		X	
Aluminum siding	X		
Plastic siding	X		
Stucco, brick, cement		X	
Wood windows, doors, screens and storms	X		X
Trim, cornice, fascia			X
Metal windows and doors	X		X
Wood gutters	X	X	X
Metal gutters	X		X
Downspouts	X		X

turpentine or mineral spirits, no odor, and lack of flammable solvents.

However, you have to let this paint cure about five days before washing it, and if you apply it over an old glossy enamel finish, you first must sand the surface for maximum adhesion. New surfaces must be primed first.

Flat (nongloss) paints are used primarily in bedrooms, living rooms and dining rooms where only superficial surface dirt is expected. Although minor smudges can be sponged off, such paints will fail if scrubbed or washed repeatedly.

Usually, you would use the same flat paint for walls and ceilings. However, some manufacturers now make a flat paint designed for ceilings only. They contain more pigment which gives them greater hiding power, allowing badly soiled ceilings to be covered with one coat. They dry flatter than ordinary flat paint and do not look good when used on walls.

Ordinary interior flat paint gives a

smooth finish. However, there are flat paints which provide textured and sand finishes. These are good to use on rough or marred surfaces, although you can use them on any wall or ceiling.

Textured paint. One type is a one-part spray-on mixture; another is a heavy-bodied substance which, when applied with a roller, produces a heavy stippled effect. If it's applied with a brush, you can create a striated appearance by brushing in straight lines or a swirl effect by twisting the brush handle back and forth.

Sand-finish paint dries to a sandy finish that resembles concrete. It contains granules of perlite or a similar gritty substance. If you apply this with a roller, work quickly to avoid lap marks. If with a brush, apply the finish liberally, but don't brush it out since this will create an uneven finish.

There are two basic types of interior flat paint: alkyd and latex.

Alkyd flat wall paint is superior to latex

HOW TO CHOOSE ONE OF TODAY'S 'WONDER PAINTS'



flat in hiding power and early washability. If the surface is very dirty, you can usually avoid a two-coat job by using alkyd.

Many brands of alkyd flat (gloss, too) contain an "odorless" thinner that presents little smell as the paint's applied. This, supposedly, allows you to paint with the windows closed. However, the National Paint Varnish and Lacquer Assn. advises you not to take the chance. Make sure you have adequate ventilation! So-called odorless paints will give off a smell as the paint dries and the vehicle oxidizes.

Latex flat wall paint is free of odor at all times. Paint on tools and spatter marks are washed away with water. However, cleanup should be done before the paint dries. After, this is a tougher job.

These paints are very easy to spread, but this can be a drawback if you're not careful. Don't spread them too thin, which tends to diminish the paint's hiding powers. And never apply latex flat on a porous surface, such as unfinished gypsum wall-board, unless a primer is first used. If you do, the paint will fail to form a coherent film, which will prevent even minor washing without the film being rubbed off.

Many latex paints are of the "no-drip" or "dripless" type. They have an artificially thickened consistency and are easier to handle than conventional latex and alkyd, which are more liquid. Dripless latex may end up costing you more money to use than conventional latex, because it doesn't cover as much area.

Exterior paints

Paints for the outside of your house are of three basic types: oil-base, latex and alkyd enamels (so-called long-oil resins). Oil-base and latex are used primarily on the body of the house; alkyd enamels for painting trim.

Oil-base house paint offers these advantages compared to the latex types:

- Controls "chalking" in the finish of white oil-base paint because of the use of zinc oxide. Thus, it will hold its color longer than a white latex finish. The sur-

face can clean itself, because rain washes off the chalk and, with it, the dirt.

- Provides a glossy finish if you want it. However, in time, the gloss will dissipate.
- Covers more area than an equal amount of latex paint and lays down a heavier film that has better hiding power. Thus, you can often get by with one coat of an oil-base paint where two coats of latex would be needed.

Latex house paint offers you these advantages as compared to oil-base paints:

- Provides better color permanence.
- Provides a matte finish if desired.
- Dries in hours; oil-base paint takes two or three days. There's less danger of bugs and dirt settling on a latex surface.
- Can be applied to a damp surface after a rain. The substrate must be absolutely dry before applying oil-base paint.
- Is more resistant to blistering and peeling, because it provides a semipermeable film that allows water vapor to escape.
- Can be touched up without appearing "artificial," because of the matte finish. A glossy oil-base surface dulled with age will look touched up when a glossy oil-base paint is applied.
- Can be applied to most surfaces, including wood shingle, and are even better to use than flat oil-base house paints, long recommended for shakes and shingles. Water escaping from beneath the shingles can blister a flat oil-base paint.
- Can be used over stucco and other masonry. Oil-base shouldn't be, because it isn't alkali-resistant and will tend to chalk.
- Provides easier clean up.

Neither oil-base paint or latex is recommended for use on most home trim. Oil-base paint loses its gloss too soon and will retain dirt on horizontal surfaces. The matte finish of latex makes it unsuitable for painting trim.

Trim enamels are made with long-oil resins having a high proportion of fatty acids. The paint brushes on easily and retains its gloss and color extremely well. Newer silicone-alkyd trim enamels are substantially more durable than conventional alkyd enamels.

The charts on page 197 are good guides to use in selecting paints for interior and exterior surfaces. Where there is a choice, consider the characteristics of the paints in relation to what you want them to do.

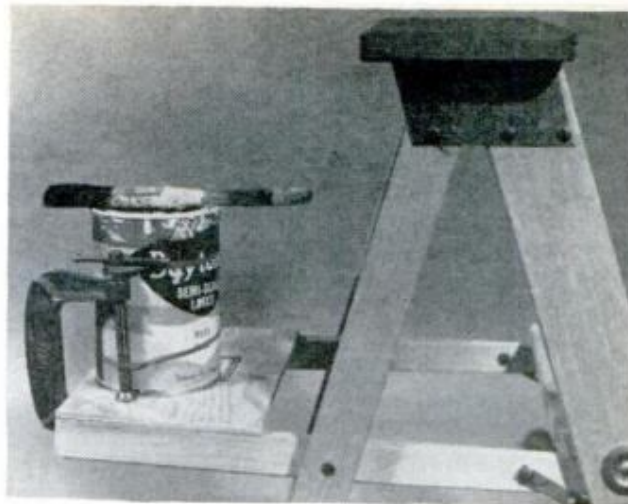
In conclusion, one fact should be offered

(Please turn to page 228)

HINTS FROM READERS

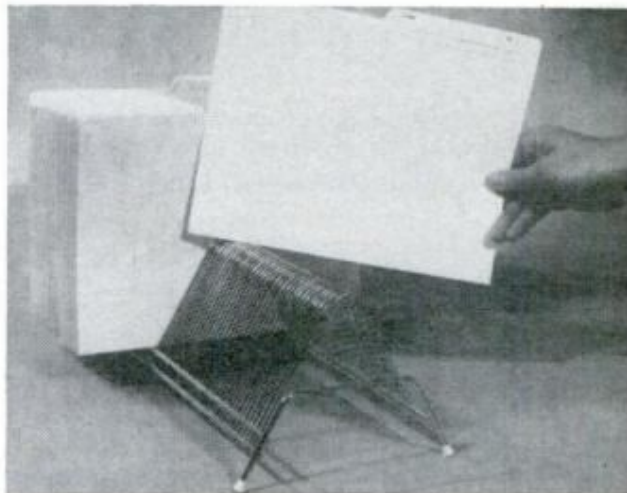
Securing paint can on ladder

Secure a paint can to the shelf of a step-ladder with a pair of heavy rubber bands and a C-clamp. This will reduce the possibilities of spilling the paint if the ladder is accidentally jarred. It will also allow you to slide the ladder along the wall without the can "vibrating" off the shelf. If available, a pair of C-clamps could be used—one on each side of the can.



File on record rack

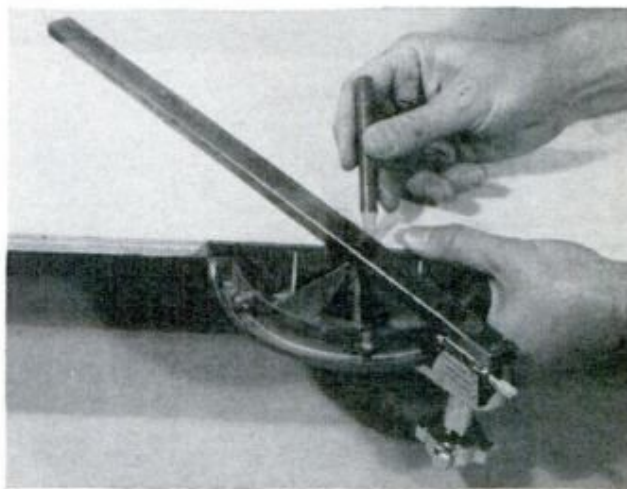
A small portable record rack makes an ideal holder for file folders containing letters, receipts and other common papers. A rack of the type shown at right easily will hold 26 file folders—one for each letter of the alphabet. Thus, if your home filing system has become disorganized, you can quickly reorganize the contents by taking them out of the drawer and rearranging them in alphabetical order. In this case, use the record rack as a file sorter temporarily.



Multi-use miter gauge

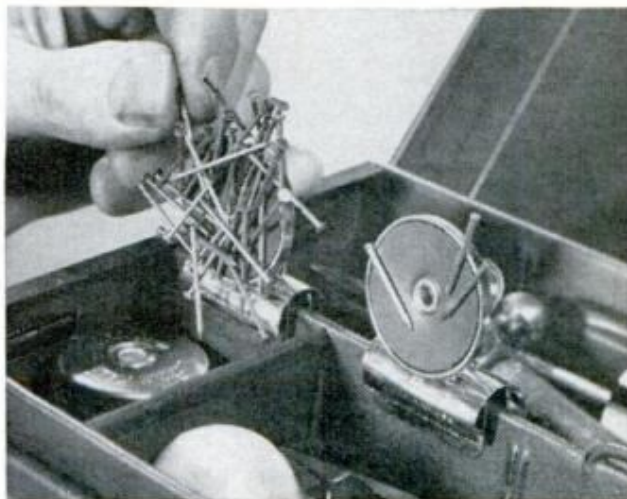
Miter gauges found on power table or bench saws normally are adjustable and therefore can be used for measuring, marking or determining angles for most common workshop tasks.

It's important, of course, that the gauge be accurate in order to assure proper angular measurements. It's best, therefore, to remove the miter gauge and compare its markings against angles known to be precisely marked before relying on the maker's tolerances.—*Ken Patterson*



Magnetic clip holds small parts

A magnetic clip made of a two-jaw spring paper clip attached to a magnetic disc is an especially handy item for holding small brads, screws, washers or other steel parts in a convenient position at most job sites. The clip can be slipped over the edge of a toolbox or other temporary support within easy reach, and it takes but a second to remove the nail or screw you need. To load the magnet with brads or screws, dip it into the supply box and shake off excess brads.—*Walter E. Burton*

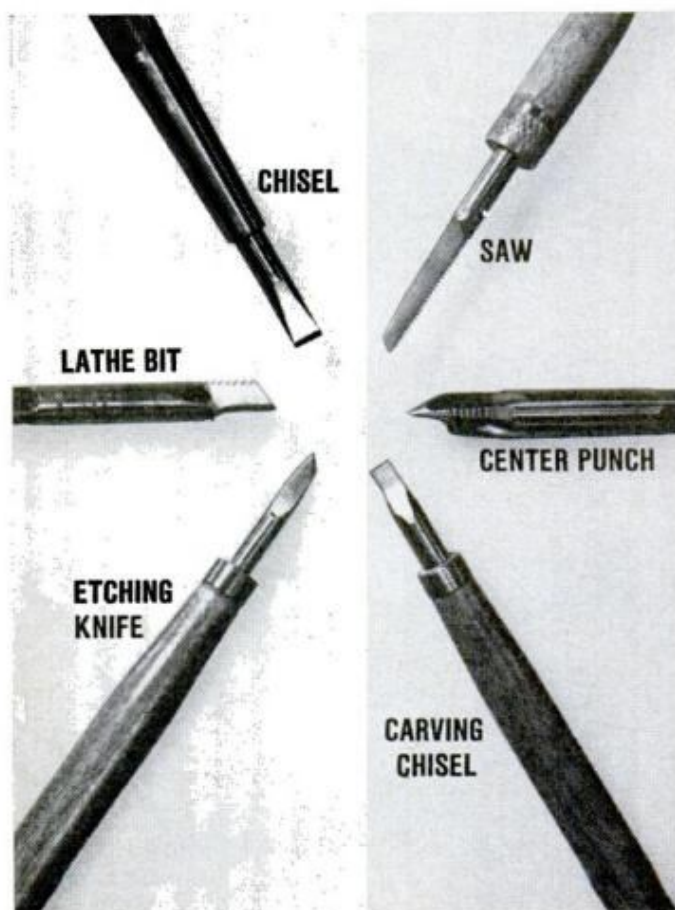




Don't Play 'Taps' For Broken Taps

Do you grind your teeth and get hot under the collar every time you break a tap? Here's how a bit of constructive grinding and a different sort of heat will save it from complete loss

By WALTER E. BURTON



WHEN YOU BREAK A TAP trying to thread a hole, don't be hasty in mourning its loss—perhaps you can convert what's left into a useful tool.

All it takes is a bit of grinding to transform a damaged tap (usually the shank end, including some of the threaded portion) into a metalcutting chisel, center punch, scriber, carving tool for wood and plastic, tiny "saw," etching knife, engraving tool, screwdriver blade, lathe bit, turning chisel, reamer or thread-cleaning tool—to name a few.

The tap may be either high-speed steel or carbon-tool steel. Often, this makes little or no difference. High-speed steel makes durable lathe bits, cold chisels and the like. Carbon steel is likely to hold a keener edge and, therefore, is more suitable for etching knives, carving tools and wood chisels.

For chisels, punches and similar percussion tools, or lathe bits and other tools where high brittleness might be a

hazard, the original tap hardness may be too great. This can be reduced by tempering. (Heat the steel until a polished area turns purple, then quench in water.)

When grinding, avoid "burning" (letting the steel get so hot that discoloration shows). If you do overheat carbon steel and thus reduce hardness, you can re-harden and temper it satisfactorily enough for most purposes. High-speed alloys, on the other hand, usually require special hardening and drawing techniques.

The original tap combination sometimes can be used to form a new tool. For example, one of the tap flutes can form the top surface of a woodcarving gouge. A four-fluted tap can be ground to fit a Phillips-head screw slot. A tap also could be converted into a reamer by grinding down the threads and then grinding relief angles behind the cutting edges. For a lathe bit to fit a standard toolpost holder, you may have to grind some flats on the shank so it will enter the holder—these will also square-up the bit so it can be held at the proper side-rake angle.

To make a tiny "saw," grind the tap into a thin single-edge blade (or a double-edge blade if you started with a two or four-flute tap) with teeth formed by the original tap threads. Unless you reshape each tooth, the saw will cut with a scraping action, and therefore is useful for such chores as cleaning out slots and squaring internal corners of relatively soft materials. By grinding bevels, such a blade also can be converted into a serrated-tooth knife.

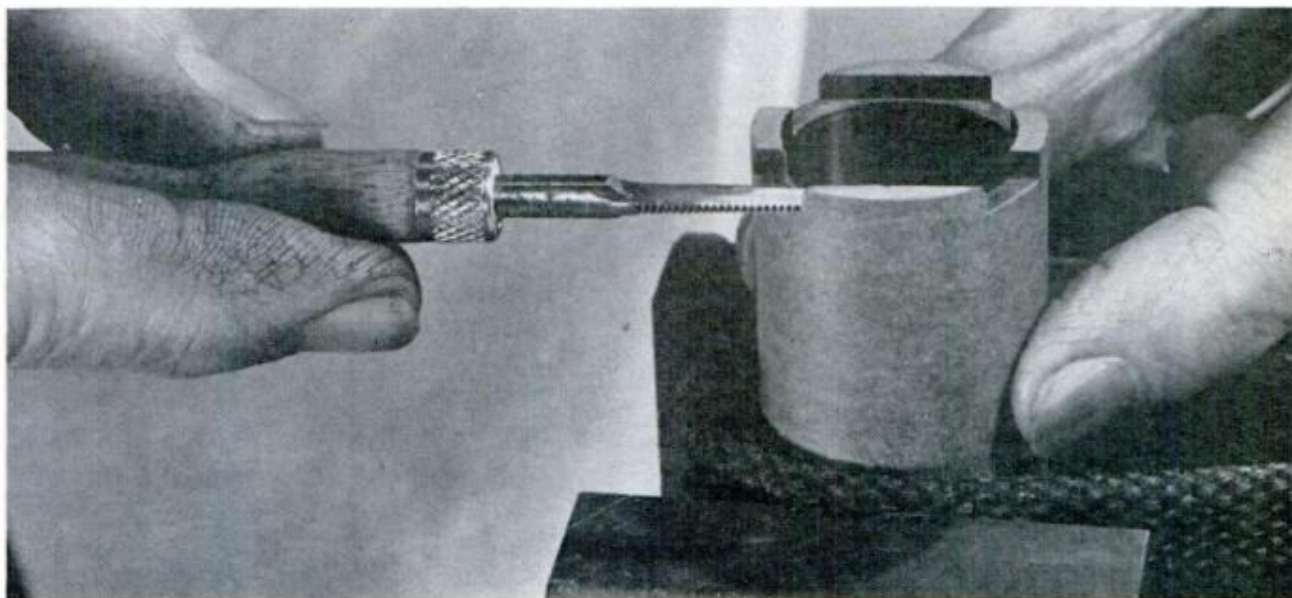
You can use an etching knife having a skewer-type blade for the retouching of



GRINDING WHEEL chucked into drill press offers easy method of grinding taps. Cloth protects the vise

photographic negatives and prints. Of course, you also can make knives and chisels in many other special shapes for etching, engraving and carving. The efficiency of such tools depends on their sharpness. After grinding, work up a keen edge on a medium or fine stone, then give the bevels several swipes on a very fine oilstone (such as an Arkansas stone). For some work, such as print retouching, a faint wire edge may be desirable. Other tools, such as a dissecting knife for use

SIMPLE SAW IS IDEAL for squaring notches in soft materials, such as this short length of plastic pipe

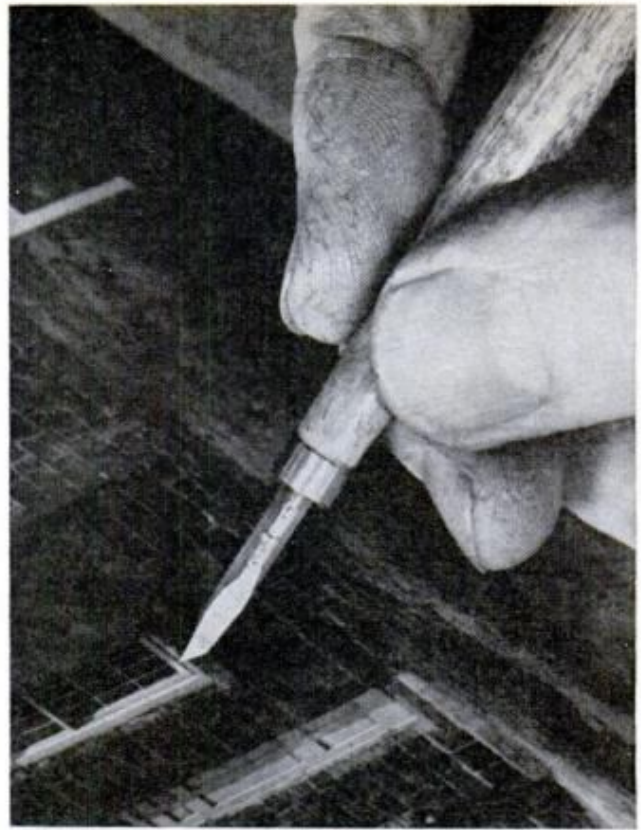




NEAT MODELMAKER'S SAW can be made by using a sharp chisel to notch a strip of carton-binding steel

in a biology lab, may work better if left with a "sawtooth" edge.

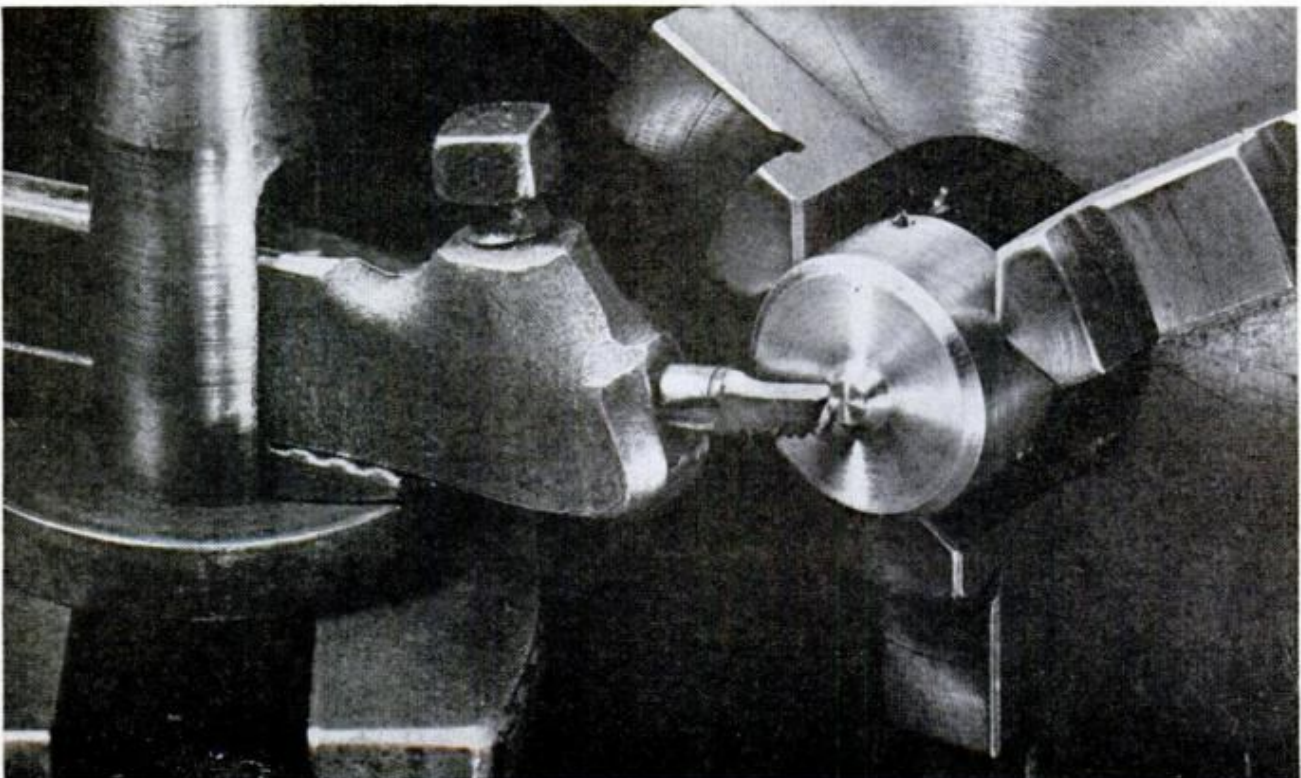
Although you can mount broken-tap tools in a pin vise for easy manipulation, a permanent handle usually is desirable. Several of the tools in the photos were equipped with handles made from $\frac{3}{8}$ -in.



ETCHING KNIFE shaped from a tap makes it easy to lighten photographs by shaving off silver deposits

maple dowels about 5 in. long. Each handle is tapered at the blade end by filing or sanding, then a hole is drilled in the end to receive the bit in a tight drive fit. To discourage splitting, a ferrule of thin-walled steel should be forced over the tapered end of each handle. ★★★

HIGH-SPEED STEEL TAPS can be used for lathe bits. Carbon steel bits are used for soft materials only

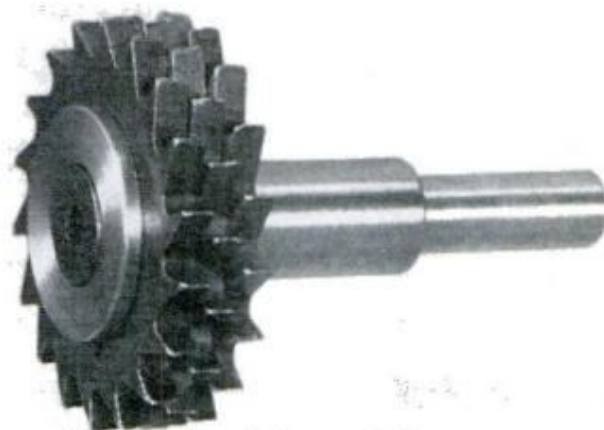


New Tools You Should Know About

CHAIN-SAW KIT consists of two files, file holder, bar scabbard, bar groove cleaner, bucking wedge and a gauge for measuring the depth of chain cutters. The kit is made for use with chain saws having chipper-type chains of $\frac{3}{8}$ -in. or .404-in. pitch. Complete with instructions on how to file chains and how to use each item in the kit, the Oregon kit is available from chain-saw dealers or directly from the manufacturer, Omark Industries, Inc., 9701 S.E. McLoughlin Blvd., Portland, Ore. Suggested retail price is \$8.15.



CHIPPING TOOL for a portable electric drill removes excess concrete from floors and walls; chips paint off concrete blocks; removes putty and paint from steel casement windows when replacing glass, also accumulations that normally require large pieces of equipment. No. 2-A chipping tool shown has a $\frac{1}{4}$ -in. shank, $\frac{3}{8}$ -in.-wide cutting face and $1\frac{5}{16}$ -in. chipper diameter; No. 2-B chipping tool has a $\frac{3}{8}$ -in. shaft. Respective prices are \$1.50 and \$1.60, f.o.b. Kut-Rite Mfg. Co., Box 521, Oak Ridge Station, Royal Oak, Mich. 48073.



ALL-PURPOSE KNIFE for home and shop use stores five blades in the lower part of the handle, which splits lengthwise into two sections. Standard are a whittler's blade; broad blade for light chiseling, shaping and cutting; long-point blade for trimming and template cutting; curved-edge blade for slicing or whittling round surfaces, and a saber-shaped blade for carving and heavy cutting. Called Slimknife, it has a die-cast aluminum handle weighing but $1\frac{3}{4}$ oz. Stanley Tools, Div. of the Stanley Works, 195 Lake St., New Britain, Conn. Price is \$1.79.



GARDEN TOOLS featuring Teflon-S coating on the cutting blades are available as hedge shears (shown), pruning or grass shears and lopping shears. Respective prices are \$3.50, \$7 and \$8.50. Big advantage of Teflon-coated pruning tools is that tree sap and shrub juices won't stick to blades. O. Ames Co., Camden and Thomas Aves., Parkersburg, W.Va.



HINTS FROM READERS



Retouching scuffs

When a shoe dye is not available for treating scuffs on shoes, or when polish doesn't do the job, try using a felt-tipped marker. Since the markers are available in a variety of colors, you can use two or more markers for a perfect color match. It also will help if the leather is bent to make the surface curve convexly, thereby opening cracks and crevices so the color will penetrate fully. Then apply regular shoe wax to protect the restored surfaces.



Wheels work wood

Although it's not generally recommended that abrasive wheels and points be used for grinding wood, they can be used in an emergency if these precautions are followed. Use a coarse-grit point or wheel whenever possible; fine grit points often will glaze or scorch the wood. Either a drill press or a portable power drill can be used, but only at low speeds. Frequently clean the abrasive surface of the wheels with a wire brush to prevent loading.



Fine parallel lines

The toothed edge on a tape dispenser that cuts the tape makes it easy to draw evenly spaced and perfectly parallel lines. Just place a sheet of carbon paper face down on the work surface, then draw the serrated or toothed edge over the carbon paper. Any indistinct lines resulting from uneven pressure on the carbon should be made heavier with pen or pencil. By tracing sets of lines in different directions, you can make diamond or square patterns.

NEXT MONTH IN SHOP AND CRAFTS

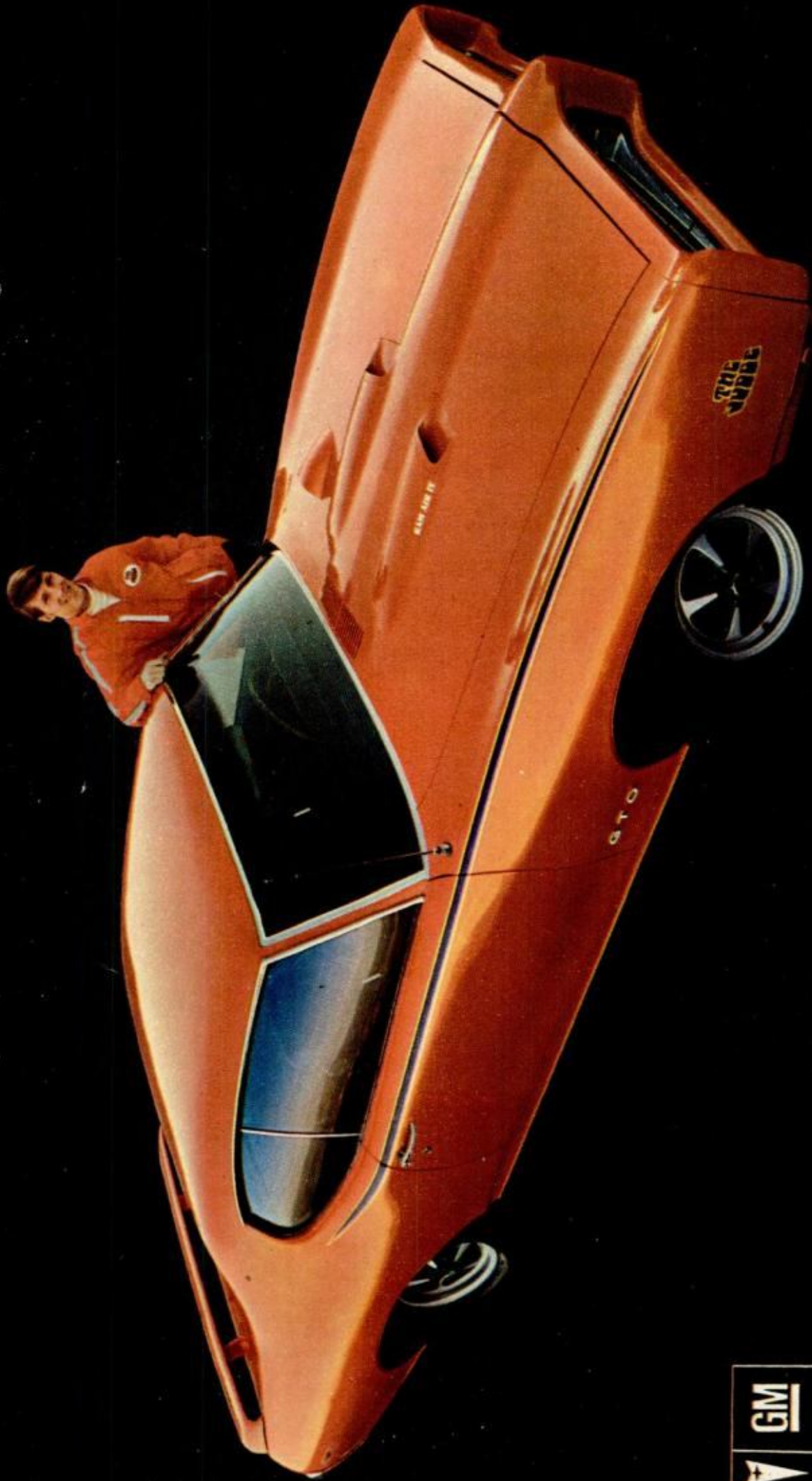
HANDSOME GARDEN PATHS AND WALKWAYS. Here's an idea-packed story on the various ways you can make your yard really stand out, just by adding a walkway or path using one of the methods shown. Be sure not to miss this informative article in the May issue of *PM*.

HOW TO MAKE BAD WATER GOOD. Water purification and filtration devices for the home take many forms, from the surprisingly simple to the highly exotic. For what's best to do the job in your home, next month's story is a must.

HOW TO ADD A SCREENED PORCH. Bring your living room outdoors this summer and spend the evening hours in cool, mosquito-free relaxation. All it takes is a screened porch addition that's a cinch to put up.

HOW TO SAVE WEAR AND TEAR ON YOUR HOME. Little things mean a lot, especially if they increase the resale value of your home and also prevent common damages and accidents. Such a collection of ideas and tips is included in the May *PM*.

SMALL VERNIER CALIPERS—FRILLY OR FUNCTIONAL? These measuring devices have long been considered a professional tool only—but now, they're so inexpensive and so useful they should be a common workshop tool.



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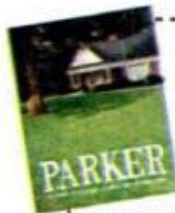




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DRIVER TRAINING

(Continued from page 97)

questionnaires and personal interviews, the researchers began to chink away at the public records on which the previous driver ed. studies had been based. They discovered, for example, that only about 52 percent of all legally reportable accidents got into the records. (This figure varied in other states from 36 percent in Michigan to 81 percent in California.)

DE group has more accidents?

When McGuire added unreported and legally nonreportable accidents over a two-year period to the motor vehicle record figures, the picture changed drastically. Where the driver ed. group had 50 percent fewer accidents before, it now had 15 percent more accidents.

He also tried to control such other variables as the exposure to accident situations—through the amount and type of driving—of the two groups. This was difficult because investigation showed that driver ed. students generally drive many fewer miles than those who don't elect such a course. The main reason would appear to be simply that kids who are fascinated with cars from childhood know how to drive long before they can take such a course in school—and therefore aren't interested. And these same kids—hooked on cars—do a lot more driving when they are legally able to be licensed.

This seems to be borne out by a New York State Dept. of Motor Vehicles study which found that students who volunteer for driver ed. (it is still an elective subject in most states) are generally more introspective, sensitive and esthetic, while those who don't are more active, gregarious and outgoing. A recent investigation by Dr. William Asher shows that students with the greatest academic ability tend to elect DE courses. The bookworms, it appears, need the driving help—or think they do.

Ignoring these differences, says McGuire, practically "insures findings in favor of the driver-educated group." So when his results in Mississippi led to exactly the opposite conclusions, he decided to set up a more detailed study in California to find out if a recognized program of good driver ed. would produce different results.

He matched groups of students on five significant variables in two southern California high schools. One was nationally known for the excellence of its DE program. It used only teachers with a minimum of 12 semester hours in Safety Edu-

cation, and it offered a comprehensive program of 30 classroom hours: three behind the wheel, 12 to 14 hours of in-car observation, and 12 to 14 hours on an Aetna driving simulator. The other school offered only the classroom course, and it had very little enthusiasm for even that limited program.

Detailed investigation turned up no significant differences in driving performance between the two control groups. McGuire thus had to conclude that "accident frequency or severity is not influenced by the addition of simulator or behind-the-wheel training to a standard 30-hour classroom course in driver education."

These two studies form the basis of McGuire's challenge to the accident reduction claims made for driver ed. He is not urging that DE be abandoned but rather that it be re-examined via objective research techniques. "If our results are verified," he says, "then it might be possible to create new and completely different programs that will, indeed, reduce death and injury on the highways."

Charges upset teachers

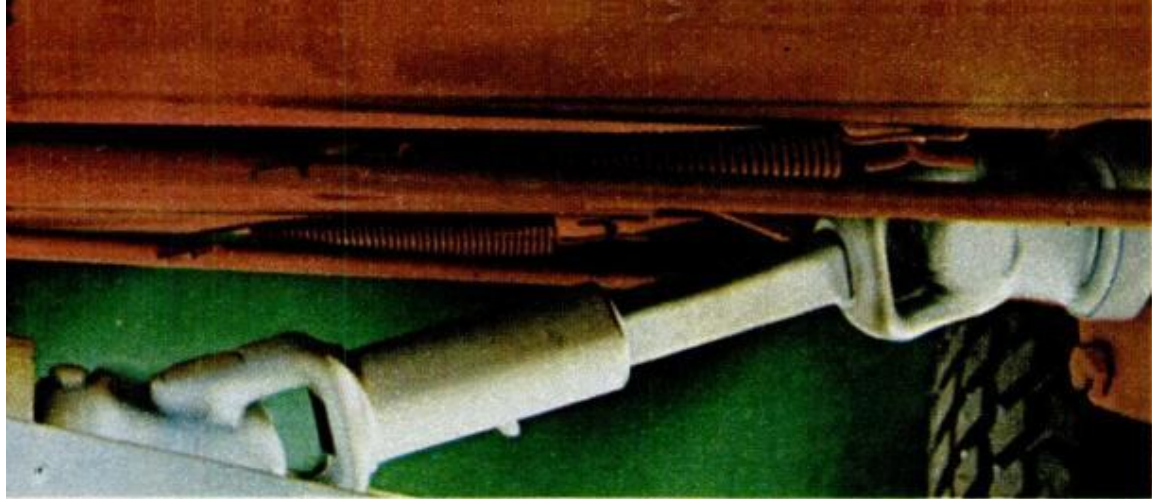
Reaction to his charges has been varied, ranging from outrage by driver ed. teachers' organizations to some hurried backpedaling by other longtime advocates of DE. The federal government has taken notice by ordering the Highway Research Board to come up with some effective means of evaluating current or proposed DE programs, and a report is due in midsummer of 1969. One safety expert told me, however, that the Highway Research Board may be trying to validate driver ed. statistically "even if it can't be done. There are certain values you simply can't prove statistically, and I think driver ed. falls at least partly into that category."

This is the line that most of its defenders are now taking: that nobody ever claimed DE would reduce accidents anyway, so why the big flap? Driver ed. advocates now prefer to stress the positive aspects of the program that they say would be lost if the doubters shoot it down. These include:

- Driver ed. as an "experience in democracy," stressing the response of the driver to himself, his family and his fellow drivers. "The social nature of the driving act," says William D. Cushman of the NEA's National Committee on Safety Education, "is central to the instructional effort."

- The broad benefits of driver ed. in the

(Please turn to page 214)



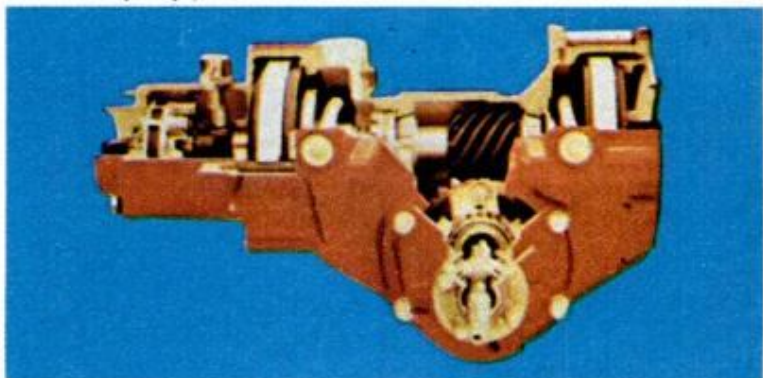
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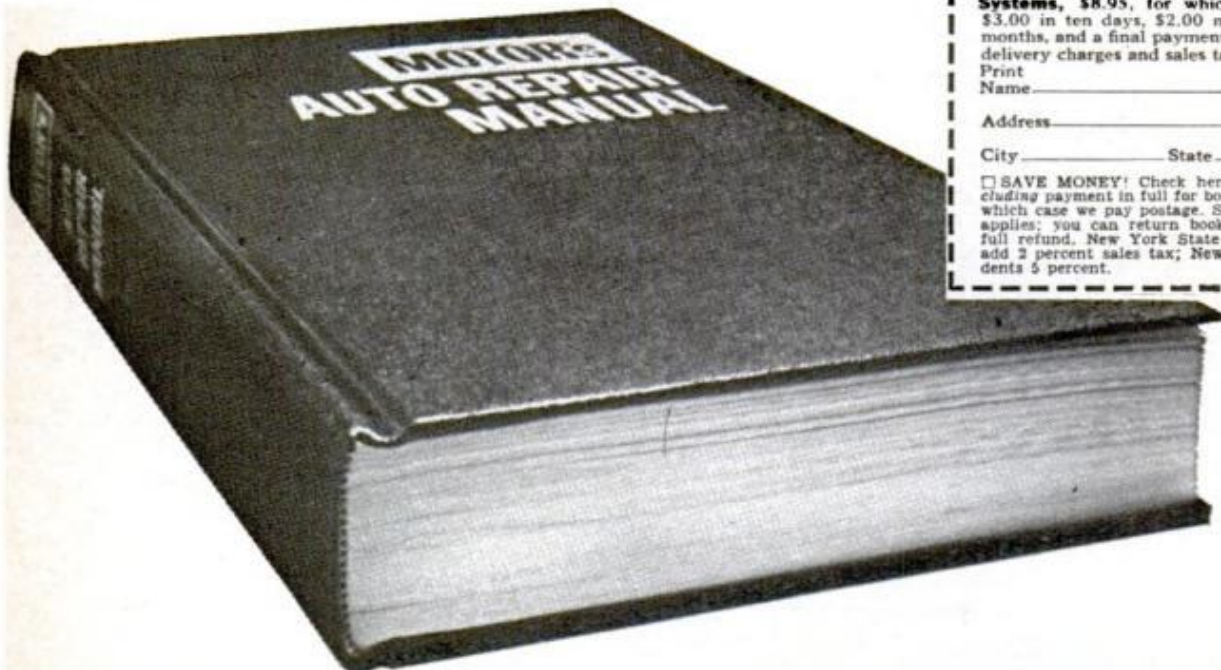
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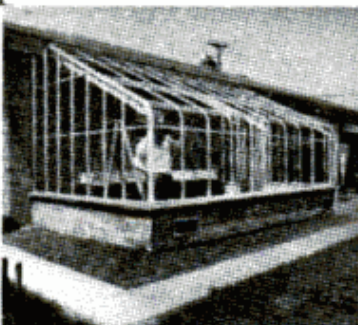
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Two big-game calibers in bolt action

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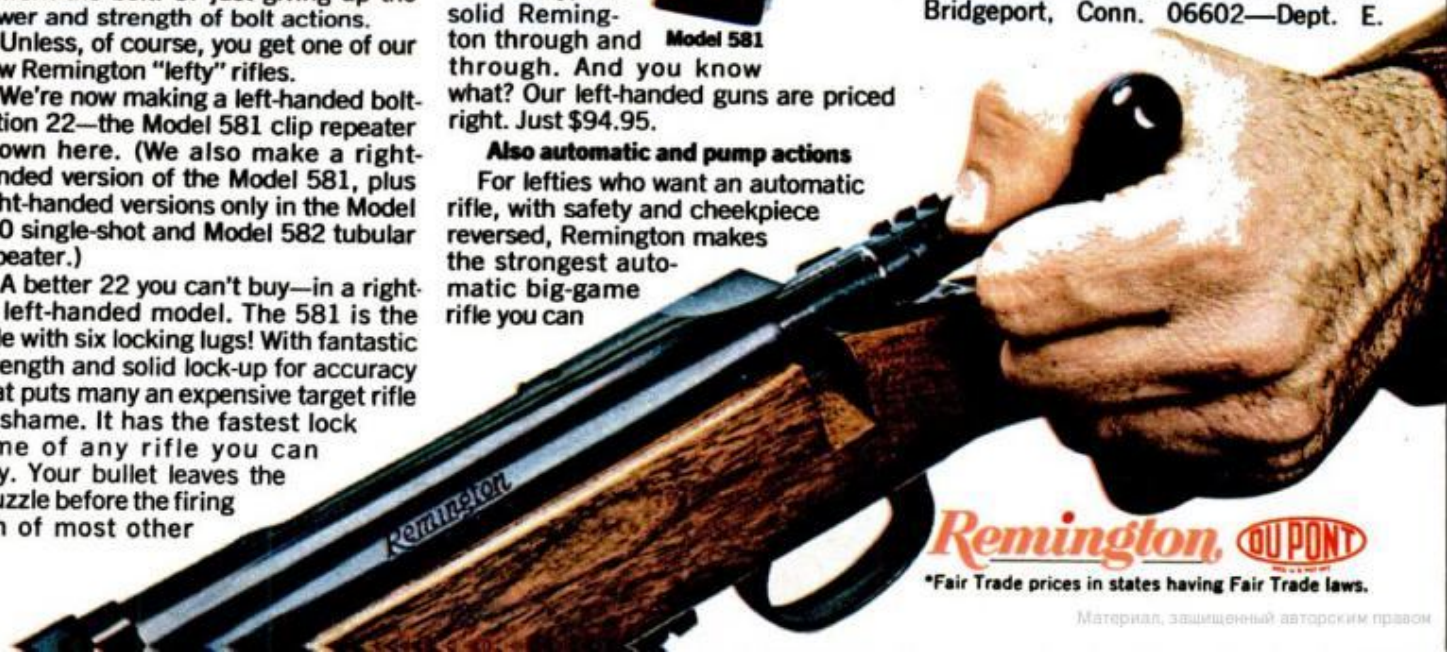
For lefties who want an automatic rifle, with safety and cheekpiece reversed, Remington makes the strongest automatic big-game rifle you can

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DRIVER TRAINING

(Continued from page 208)

entire field of public safety. "These courses," points out Michael Lamm, former managing editor of *Motor Trend*, "place emphasis on safety, not only behind the wheel but also as a pedestrian."

● Help in coping with growing traffic volume and complexity. The National Safety Council believes that "the successful completion of a driver education course which meets the national recommended standards, taught by a qualified and certified teacher, is an essential requirement for the securing of a driver's license by all new drivers."

Technically, all this may be true (the DE manual doesn't stipulate accident reduction as a specific goal of the program), but the fact remains that driver ed. has been sold to you and me as a means of achieving greater safety on our roads and streets. Insurance companies, particularly, have put out all sorts of literature and advertising pushing driver training as socially necessary because it cuts down on accidents. One large auto insurance company predicted recently that driver training was saving 851 lives and \$128 million in accident costs annually. That claim was given credence by a House of Representatives report complaining that "we are investing billions of dollars in educating our children, but we have been unwilling to spend the relatively small additional amount it would take to teach them to stay alive."

What mandatory DE would mean

Small amount? Each year, 3½ million cars are added to American roads and four million teen-agers reach licensing age. This flood of new drivers washed up on a tide of congressional and citizen support for driver ed. is increasing pressures at the state level to make DE mandatory in public schools. If that should happen, you and I will probably be paying more than the \$1.3 billion already projected as the cost of supporting driver ed. over the next five years. There would also be a severe shortage of DE teachers.

Right now, if the man who teaches driver ed. to you or your children has been at it for awhile, he probably got his training via an intense, one-week summer short course at a nearby college or university. Today, about 230 American colleges offer formal courses in driver education for teachers, and the NEA presently recommends that DE teachers take a minimum of 12 to 18 hours in these subjects.

If driver education expands faster or further, however, you can expect short-

cuts in teacher training. Texas, for example, has already requested a federal grant to help train DE teaching aides whose qualifications would simply be a high school diploma, a minimum age of 21, and a clean three-year driving record.

So we've reached a crossroads in driver education. The United States is on the edge of a sizable expansion of this program that may eventually make it mandatory for all drivers (as it is today in Russia, where students are required to take two years of driver ed., and the licensing examinations are so stiff that only half of the applicants pass). Critics like McGuire are simply saying: "Let's stop and have a *really* critical look to see if it works—or what part of it works—before we blunder ahead."

What the critics want

They would urge that we:

1. Check the expansion of driver training where it is now. Freeze it.
2. Channel expansion funds into research aimed at determining whether or not driver education is really effective in reducing accidents.
3. From this research, determine which existing programs—or portions of programs—are effective, and why.
4. Use these programs of proven effectiveness as a basis for restructuring driver ed. with legitimate, achievable goals. (If research indicates that DE doesn't influence accident frequency, notes McGuire, then it can be "returned to the school curriculum as just another skill course, similar to home economics.")
5. Establish teacher training programs to fit these new goals.

"We believe," says Dr. McGuire, "that the behavioral sciences are quite capable of producing at least a few answers if they are given the funds and the opportunity. There is no substitute for knowledge."

In view of what's at stake, we'd better believe it. An investment in research now might save a lot of money and time—yours and mine—that will be poured into driver education in the years ahead. ★ ★ ★

NASA supercritical wing

The National Aeronautics and Space Administration will test a new airfoil shape—the supercritical wing—on a modified Navy F-8 jet. The shape, a flat top with a downward-curved rear section, is expected to improve substantially the performance and efficiency of future aircraft, particularly commercial jet transports.

The supercritical wing was developed at NASA's Langley Research Center in wind-tunnel studies by Dr. R. T. Whitcomb.



The Sears Lawn and Garden Tractors for 1969

Single Lever Control lets you turn on a dime in close quarters

With Single Lever Control there's no clutching or gear shifting. This one lever lets you go forward, backward, stop, or change speeds. Lets you slow to a creep to trim near fences and trees.

In all, Sears has seven different tractors. Three different horsepower (7, 10, and 12). Sears tractors have these "Shortcut to Leisure"

features: Fingertip controls. Electric starting. Solid-state ignition. Extra-wide, turf-saver tires. Craftsman engine with patented super-start. Spring-mounted bucket seat. Over 40 attachments and accessories available. Rotary mowers meet A.S.A. safety standards.

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THE SUPER LAB NOBODY KNOWS

(Continued from page 127)

computers. Engineers can watch through closed-circuit television and cameras provide a continuous record.

To find out how instruments would stand up under hard radiation of nuclear explosions, the Sandians, under engineer Tom Martin, built the world's most powerful X-ray machine.

Ordinary X-ray machines produce one rad (a unit of hard radiation) at one meter. They needed 5000 rads. They built a 25-rad machine, then a scale model of a big one they named Hermes. They ended up with Hermes II, an 80-foot-long bottle-like monster. Inside are the capacitors, immersed in insulating mineral oil.

Hermes changes energy to X-rays by first charging the capacitors, then discharging them in series via spark gaps into a voltage multiplier—three coaxial steel cylinders, the outermost of which is in the wall of the tank. Then, a switch is pulled, energy in the multiplier is discharged into a huge electron tube, producing a high-current electron beam, which is directed against a tantalum target. The collision of fast electrons with the nuclei of tantalum atoms produces X-rays.

The first test of Hermes was a stunning success. Hermes can produce not just the hoped-for 5000 rads, but up to 10,000.

Exploring nuclear peacetime jobs

Out in the desert Sandia engineers are exploring ways to harness nuclear explosions to do peacetime jobs. Using ordinary explosives to simulate the known power of atomic bombs (which, of course, cannot be used), they are blasting holes in the wasteland to perfect methods that might be employed to dig a new canal across Central America.

One discovery is that the wider you make the canal, the cheaper it is.

"Sounds crazy," says Luke Vortman, the project engineer, tugging at his red suspenders, "but with nuclear explosives you can actually make a 1500-foot-wide ditch for less than it would cost to blast one 750 feet wide."

It works like this. The wider the channel, the bigger the nuclear explosive devices you can use. The bigger the devices, the farther apart you place them. Thus, the fewer you need and the lower the cost.

The price tag on a "little atomic bomb," equivalent to 10,000 tons of TNT, is \$350,000. For \$700,000 you can get one that will deliver the equivalent of *two million* tons of TNT!

Probably the most famous development at Sandia is Rolamite, a device hailed as

the only basic mechanical invention of the 20th century. (See *The Amazing Rolamite*, page 92, Feb. '68 PM.)

Conceived by Donald Wilkes, Rolamite consists of a rectangular frame, a flexible band and two rollers placed so that the band is shaped into an "S." It's expected to have a wide range of consumer uses in switches, hinges, valves, relays, locks, shock absorbers, thermostats, power tools and others.

Sandia scientists Bill Caudle and Alan Poe may have created a whole new science when they set out to find a shortcut to soil study without digging or drilling holes, blasting or using seismographic instruments. Why not just drop an instrumented projectile from the air?

So Terradynamics was born. The speed with which the projectile traveled after it hit the ground, and the distance penetrated, they figured might tell much about the nature of the soil.

The toughest problem was to get the information back. Mini-accelerometers mounted inside the penetrators solved it. An accelerometer, when it is at rest or moving at a constant speed, produces a constant voltage. When its vehicle speeds up or slows down, the voltage changes in proportion to acceleration.

Since radio won't work underground, messages from the accelerometers are transmitted by cable which is unreeled from the projectile during descent. Read-outs are picked up aboard aircraft or at ground stations.

Sandia has great hopes for Terradynamics. Without setting foot on rugged or impassable terrain, geologists can learn a lot about remote sites. For a projected dam, for instance, they can collect in days data that would otherwise take months. And, projectiles dropped from orbiting spacecraft might reveal much about planets too inhospitable for human exploration.

In solving the dust problem that confronted Sandia's desert laboratories, physicist Willis Whitfield reasoned: If you can't keep the dust from getting in, find a way to get it out.

In what is now called the Whitfield Ultraclean Room, the basic idea is "laminar airflow." A current of air moves slowly (at 1 mph) through the room at all times, passing through the gridded floor and the battery of filters that line the walls. The results proved that the new clean rooms were 1000 times cleaner than any industrial clean room before—500 times cleaner than the most carefully sanitized hospital surgery room. Laminar-airflow rooms are now used in hundreds of industrial labs and pharmaceutical houses, and in hospitals all over the world. ★★★

IN-A-FENCE TOOL STORAGE

(Continued from page 164)

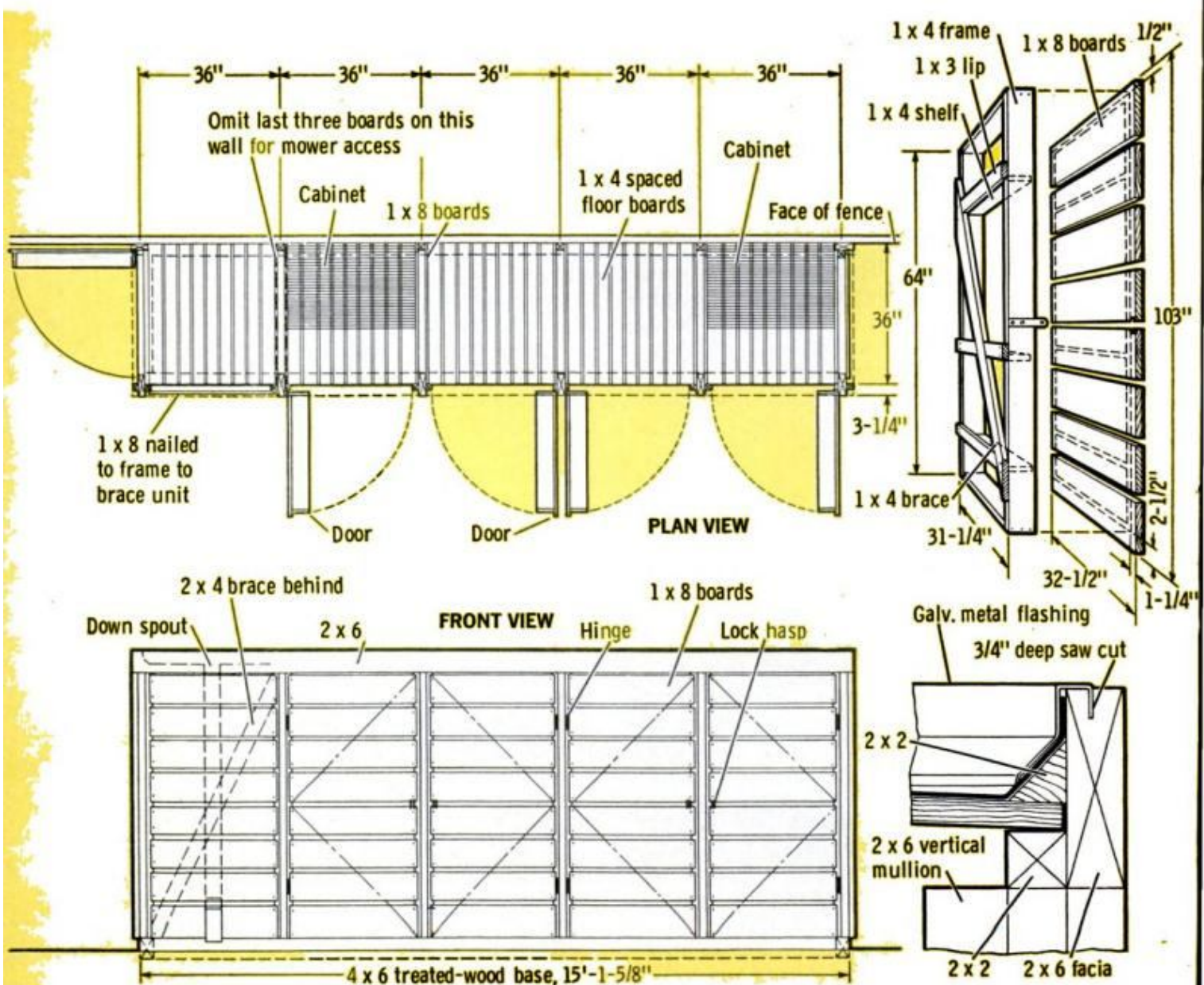
the wall are omitted to provide mower clearance.

The door in the left-hand stall opens from the end; other stall doors open at the front. All five doors are made alike and fitted with shelves. The 1x8s nailed to the fronts are spaced $\frac{3}{4}$ in. to match the fence. To keep rain and snow from blowing through the cracks, clear sheet plastic is tacked across the box frames of the doors before the 1x8s are nailed to them. Note that the doors are made with a lip along one side only, and that 2x2s are nailed to the mullions to provide stops for the door lips. Standard 1x2s are nailed to the mullions along the hinge side of the doors and the hinges are attached to them.

Readers who prefer larger-size plans than those given here can obtain them for 10 cents from Western Wood Products Assn., Dept. 538-L, Yeon Building, Portland, Ore. ★★★



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Krylon® Spray	Description	Uses
Decorator Spray Paints	sprays on evenly; baked-enamel finish; contains Rust Magic®; comes in over 45 colors.	can be used indoors or outdoors. On wood. Rust Magic makes it especially good for metal.
High-Heat Resistant Spray Paint	withstands temperatures up to 1200°F; comes in 4 colors: Aluminum, Black, White, Red.	for painting anything exposed to high heat—steam pipes, boilers, furnaces, ovens, radiators, motors, etc. Also can be used on barbecues.
Car Colors	special formula for auto body painting; comes in wide variety of standard auto colors.	for touch-up work on scratches, covers larger areas after collision repair too. Also good for small home decorating jobs where the wide variety of car colors is desirable.
Automotive Trunk Paint	long lasting and scuff-resistant; covers scratches, scars, soil; gray/white spatter finish.	makes trunk interiors factory-fresh.
Engine Spray Paint	heat and oil resistant; prevents rust; comes in 12 colors.	for refinishing engines and transmissions; also good on steam pipes, radiators, boilers, etc.
All-Purpose Primer	sprays on smoothly to hard finish; may be topcoated with or without sanding; can be covered with almost any finish; colors: white or gray.	a primer for plastics, ceramics, metals, rivets and bolts. Also good on wood.
Rust Magic Metal Primer	penetrates to prevent further rust corrosion; flexible—permits expansion and contraction of metal; recoatable with most finishes.	for general indoor or outdoor use.
Zinc Chromate Primer	hard finish; inhibits rust; can be topcoated with or without sanding; colors: yellow, green.	best for outdoor structural or ornamental work—for galvanized and other white metal surfaces.
Hot Rod Primer	special formula automotive primer; hard, smooth finish is lacquer resistant; can be covered with almost any finish.	best for automotive refinishing; can be used as regular auto body undercoater; also good on sheet metal and cast-iron surfaces, on wood, plastic, ceramic or masonry.
Auto Body Undercoater	tough coating resists rust, road salts, alkali, acids; won't chip or crack; deadens sound.	also good for sealing rain gutters and roof cracks.
Crystal-Clear	a non-yellowing acrylic spray coating; long-lasting; water-resistant; won't crack or dry; high dielectric strength.	electronics: keeps lead-in connections tight; prevents corona in high-voltage sections. general use: protects blue-prints, drawings, etc. Also prevents tarnishing of brass, copper and other metals.



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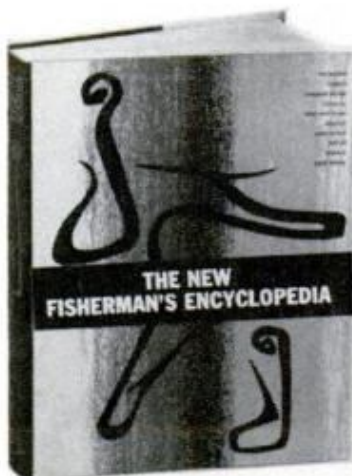


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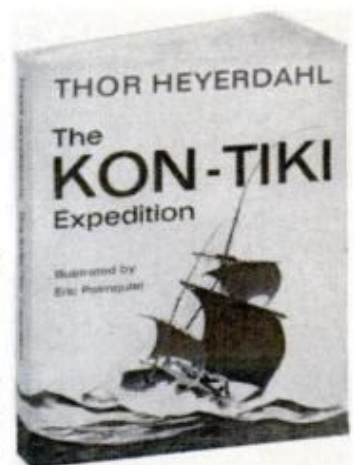


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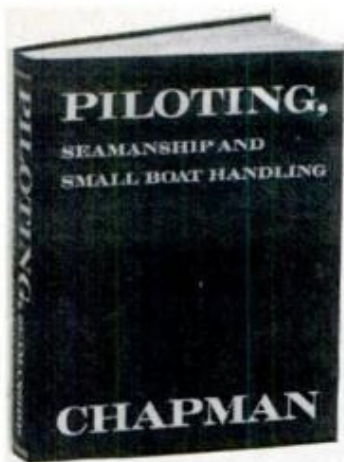
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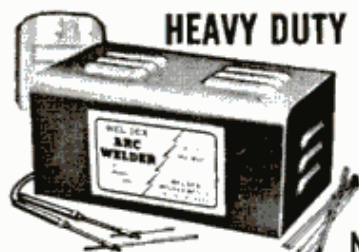
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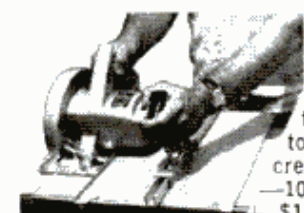
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Saw Guide as shown in Dec. & Feb. ('69) Popular Mechanics
INDEPENDENCE SPECIALTIES, Box 2987, Phila., Pa. 19126

CHOOSING ABRASIVES

(Continued from page 188)

inch. No. 12 grit is the coarsest; No. 600 grit the finest.

● *By symbol.* This is the oldest way of specifying abrasives. It's an arbitrary system that refers to 19 of the 22 numbers on the mesh scale. For example, 4½ (the coarsest) is the same as No. 12 grit, while 10/0 (the finest) is the same as No. 400 grit.

● *Simplified marking.* This system is the least accurate, but is the one most homeowners use. There are only seven designations ranging from extra fine to extra coarse. The confusing part about marking systems is that manufacturers aren't consistent. Some use the mesh number system, others use symbols and still others use simplified markings. The following cross-reference scale is offered for your use as a guide, so you'll know what you're getting, regardless of the marking:

Simplified	Mesh	Symbol
	600	
	500	
Extra fine	400	10/0
	360	
	320	9/0
	280	8/0
Very fine	240	7/0
	220	6/0
	180	5/0
Fine	150	4/0
	120	3/0
	100	2/0
Medium	80	1/0
	60	½
	50	1
	40	1½
	36	2
Very Coarse	30	2½
	24	3
	20	3½
Extra Coarse	16	4
	12	4½

Which coating—open or closed? With a closed-coat abrasive, mineral grains cover the entire area without voids. This provides maximum cutting action for normal sanding operations. However, the abrasive will clog quickly, especially when sanding soft materials. This can be minimized if you frequently unload the paper by knocking your sanding block against a hard surface.

An open-coat abrasive has grains spaced so that only 50 to 70 percent of the surface is covered. This type won't cut as fast as a closed coat, but clogging is reduced. Generally, open-coat abrasives are best for sanding very soft and gummy materials, or when using a machine. ★★

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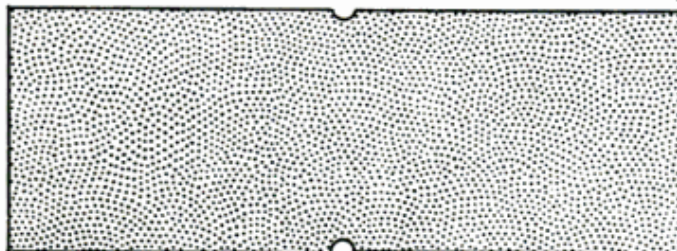
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TAPE YOUR OWN TV SHOWS

(Continued from page 112)

is not as important a figure to look for as relative speed—the speed between head and tape. This is listed in specifications as "Equivalent Tape Speed"—the speed the tap would have to travel if it were moving past a fixed head.

Equivalent speeds vary all the way from about 200 to 1000 i.p.s. or more in the higher-priced professional models. Another factor affecting picture quality is the number of scanning lines used to make up the image. In lower-priced VTRs, the number is reduced to cut the cost. This creates pictures of somewhat less detail than you see on a regular TV screen, but the quality is adequate for home recording. The number of lines used in current sets ranges from 200 up to 450.

Prices range from Sony's \$695 recording deck up to \$1500 or \$1600 for full packages including deck, camera and monitor screen. To save money, most of the home-type VTRs omit such professional features as slow-motion, electronic editing and other special effects. However, some makers offer accessories for mixing, fading and remote control.

Home VTR just two years away?

How soon will the home VTR really be here? Manufacturers are guessing two to four years, but there are still some unresolved questions. One is color. A color camera costs \$10,000, putting it out of the reach of the home market in the foreseeable future. Meanwhile, the public is getting hooked on color in its daily viewing. Will people be satisfied with black-and-white recording after being spoiled by regular TV?

Also, sneaking quietly up in the background is EVR—electronic video recording. This system uses film as the recording medium instead of magnetic tape and in some respects is simpler than VTR (see *His Invention May Make You Your Own TV Producer*, page 88, May '68 PM). Motorola has announced plans to produce an EVR playback unit next year based on the CBS system. It will sell for about \$800 and play through your regular TV set. CBS is also trying to interest TV makers in incorporating EVR right into their standard sets.

For this reason, some experts think that EVR may just possibly beat the VTR into your living room. Whatever happens, being able to watch your family perform on your TV screen and play prerecorded programs as easily as putting a record on a phonograph will be an exciting new form of home entertainment. ★★★

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TORREY CANYON

(Continued from page 119)

starboard wing. "Come to the wheel. Take it hard to port," Capt. Rugiati ordered.

Question: Did the captain sound excited when he called you to come to the steering wheel?

Scotto: Yes, he shouted to me, "Come to the wheel. Come to the wheel."

Scotto put the wheel hard over. For a few seconds he watched in growing amazement as the rudder indicator remained motionless. Scotto shouted a warning to Capt. Rugiati. Capt. Rugiati was too engrossed in examining the chart to hear it.

Question: Where was the third mate at that time?

Scotto: I saw him running back and forth . . .

It took Capt. Rugiati close to a minute to sense that something was vitally wrong, and it took him a few seconds longer to realize what it was. When a ship is making a large change of course the gyro compass can be heard clicking off the degrees. The gyro compass should have been clicking, but it was not. Even then there was time, if only Rugiati could determine what was wrong. He would have to move fast.

Rugiati's first fear was that a fuse had shorted in the steering mechanism. It had happened before on *Torrey Canyon*. Three fuses had to be checked. Rugiati tested each in turn. All checked out. His second thought was that the oil pumps controlling the rudder had broken down.

In desperation, Rugiati leaped for the telephone and dialed the engine room. In his haste, however, he misdialed. His call got him through to the officers' dining room. A solicitous steward answered his frantic call. "Captain," the steward said politely, "are you ready for breakfast?"

Rugiati cursed and slammed the phone down. He was redialing when his fingers halted. From where he stood he had a clear view of the steering control panel. "*Porco Dio*," he swore. The steering lever was not in "manual," it was in "control." *Torrey Canyon* could not turn. Her wheel was disengaged.

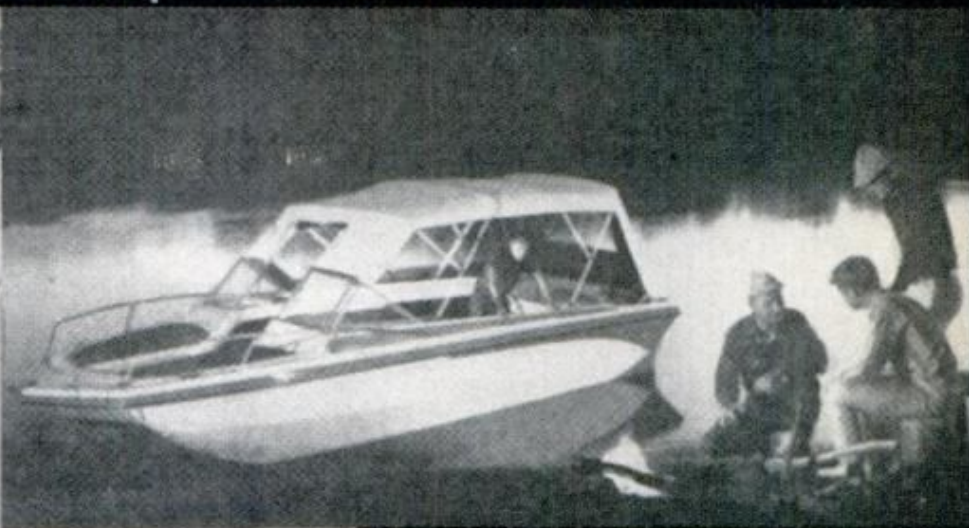
Later Rugiati would explain what happened next. "I rushed to the wheel and pulled the lever back to "hand" and after saying something which I don't remember, I helped the helmsman take the wheel hard to port."

Looking forward, Coccio could see the bow start its turn to port. The ship reached a heading of 350° but it was too late. She was slamming into the Seven Stones at a speed of 15.75 knots. Coccio felt the ship shudder at 8:50 a.m. ★★★

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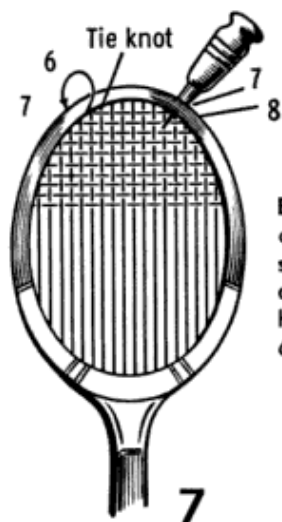
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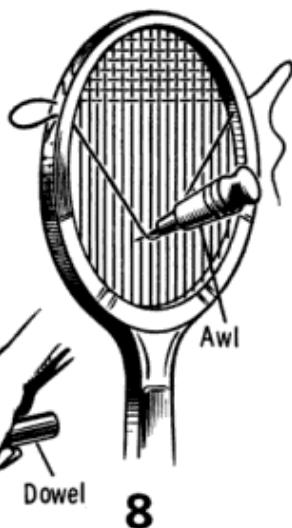
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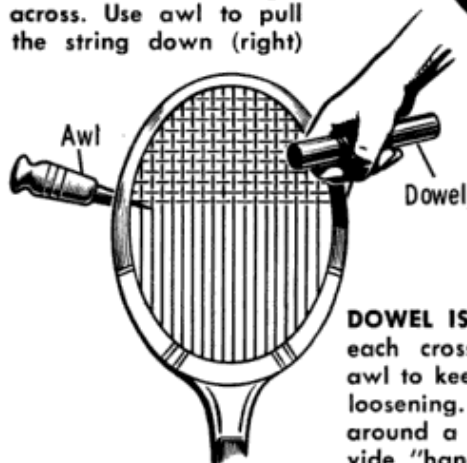
(Continued from page 183)



6
BEGIN CROSS STRINGS at hole 7 on right-hand side. Weave over and under main strings, then out hole 7 and back into hole 6. Knot on main string



TO REDUCE FRICTION the cross strings should be woven over and under in wide arc, not straight across. Use awl to pull the string down (right)



8
DOWEL IS USED to pull each cross string tight, awl to keep strings from loosening. Wrap string around a dowel to provide "handle" to pull it

comfortable sitting position and hold the shaft of the frame between the knees. To start the main strings, double the 17-ft. length of nylon and pull the ends through the two top center holes downward and out through the bottom center holes (Step 3). Use an awl in the 10th hole in each shoulder to hold the two strings. Frames are bored to accommodate 18 vertical (main) strings. Skip only the ninth shoulder holes in continuing to string the main strings to prevent crowding. Use an even rotating motion when inserting the awl in the hole, and avoid excessive pressure—it may flatten the strand and lessen its wear.

To tighten main strings, pull them separately, beginning in the center and working toward the sides of the frame (Step A) Use a steady continuous lift in removing the slack and pull the strands alternately in each half of the front. When strings have been pulled, replace the awls. Repeat this step seven or eight times to gain desired tension.

When sufficient pressure has been ob-

tained, anchor the loose ends of the strings by knotting, (Step 5), after they are brought downward along the outside of the shoulders and into the hole of the fourth string. Use a simple knot, place a drop of shellac on each and press it tightly against the frame to prevent slippage. Cut the strand about $\frac{1}{16}$ in. from the knot.

To lace the cross strings, start them in the seventh hole of the bow (Step 6). Weave 6 to 8 in. of the strand over and under each main strand to the seventh hole on the opposite side of the frame. Run the strand through, then anchor the end in the sixth hole. Make a simple tie knot around the main string.

The remainder of the 15-ft. length is laced similarly, beginning at the eighth hole and working downward. Tighten each strand with the dowel and insert an awl to hold it. To reduce friction, pull cross strings in a wide curve (Step 7).

In applying tension, keep the dowel as close as possible to the frame's outer edge. Wrap the end of the cross-string strand around the dowel and rotate it in the direction of the frame (Step 8). Be certain the string does not slip when the awl is inserted. To check this, hold a finger over the hole. Any movement will be felt. Should slippage occur, remove the awl and pull the strand tight again. ★★★

'WONDER PAINTS'

(Continued from page 198)

in regard to paint in general. It concerns price, because money is a factor when you buy paint.

It stands to reason that there must be a difference between two cans of paint of the same type when one is priced to sell for \$5 or \$6 more than the other. Every manufacturer must pay practically the same for ingredients that go into paint, and each must make a profit or soon cease to remain in business.

Obviously, the cheaper paint doesn't possess the same quality or amount of ingredients as the higher-price product. Lacking this, the cheaper paint will not provide good hiding power, durability or wearability. Thus, it won't last as long and more frequent painting will be needed.

On the other hand, you may encounter two cans of the same type of paint which have a price differential of only \$1 or \$2. In this case, the two are fairly comparable in quality. The higher-priced product is probably marketed by a nationally famous company, while the less expensive paint probably carries the label of a local firm whose costs of marketing are less. The choice, therefore, is yours. ★★★

CAN YOUR BOAT TAKE IT?

(continued from page 150)

could be saved a great deal of unnecessary grief if more manufacturers tested products thoroughly before marketing them. In particular, he said, manufacturers don't adequately test equipment for saltwater use. Their excuse is often that only 10 percent of the boats in the United States are used on saltwater. "But," says Flagg, "no manufacturer can control where his products will be used, and inevitably almost all marine gear will find its way into saltwater service."

There is also a need for better quality-control testing, the TMT men said. In fiberglass boats, the design of a prototype may be good, but molds get worn during the production run, resulting in changed dimensions. Sometimes a boat is removed from the mold before the fiberglass has cured properly, due to pressure for production; this can result in sagging and development of a "hook" that destroys planing performance.

Flagg also maintained that many boats now being built do not have adequate flotation; they tend to turn over if they fill with water, since the flotation material is below the center of gravity. New boating industry standards are expected soon, and, he said, many existing models will have to be redesigned to place reserve buoyancy higher up in the boat. This is likely to be a headache for manufacturers who use foam as structural reinforcement in the bottoms of their boats.

Tropical Marine Testers can afford to be critical of inadequacies in boats and equipment because the lab's value to clients depends on unbiased, objective judgment of the products tested. TMT often works with the Boating Industry Assn. to develop standards for marine equipment. Manufacturers who use TMT's services—and whose products pass the tests—are entitled to display the TMT "Warranty Seal" which lets the consumer know that thorough testing has been done to assure safety and reliability. ★★★

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BILL LEAR'S STEAM CAR

(Continued from page 131)

making good use of the latest knowledge of metallurgy, thermodynamics and race-car design.

The final major part of Lear's steam system is the condenser. His engineers have managed to bring down its size from huge to manageable. In the past, condensers traditionally had to be either very large or very inefficient. When large, they weighed tons and took up terrific amounts of space. They were much too big for race cars. When inefficient, they couldn't condense enough steam to keep the car from stopping every few miles for more water.

The Lear steam car won't use just plain water, and it won't need any refills. Again, no one's giving out a specific formula, but Bill Lear told me; "It's an aqueous solution with a soluble lubricant." Lear's idea is to build a closed system that never (or hardly ever) needs replenishing. The working fluid is also the cylinder lubricant. (Thermo Electros uses a fluorocarbon fluid to the same end.)

At any rate, the Lear steamer will have to have a condenser that's large and efficient enough to turn the used steam back into water so it can be re-used. By again applying "space-age technologies," the Lear people have designed a condenser that's only about twice as thick as a conventional car radiator—very small for what it does.

New use for the jet condenser

Its secret for reasonable size includes the use of a device called the "jet condenser." Jet condensers have been with us for over 50 years, but they've never been used in anything but stationary steam powerplants. Lear is the first to put it into a moving vehicle.

Here's how the jet condenser works. A water tank (called "hot well") is connected into the pipe that carries exhausted steam into the condenser radiator (more properly "condensate heat exchanger"). As the spent steam passes through, a venturi draws drops of water from the tank and mixes them with the steam. This immediately condenses the steam and turns it into very hot water.

The hot water then enters what's essentially a big radiator, where it passes through finned tubes and gets rid of its heat. What makes this system so efficient is that it's a lot easier to cool *water* than it is to cool steam, the reason being that each little steam molecule resists cooling by what amounts to a heat-resistant outer shell. In other words, thermodynamicists have shown that steam molecules encase

themselves somehow in heat-resistant coatings. This fact, plus the much bulkier volume of steam than water, lets Lear's jet condenser cool his working fluid with much less weight and size than conventional steam condensers.

And there you have the basics of the Lear Indy racer with the reciprocating powerplant. As mentioned, Lear also plans a turbine-engined car. This version will be the same except for a steam turbine in place of the triangular engine. Even the turbine racer will have the smaller turbine to drive accessories.

Turbine engine to develop 450 bhp

The main driving turbine will develop in the neighborhood of 450 bhp, same as the recip. Lear told me that he could just as well specify the same turbine to deliver 800 bhp instead of 450. The only differences necessary would be to rework the turbine blades and feed them more steam. But Lear will keep power output well below its potential, probably in the interest of reliability.

Both Lear race machines will have four-wheel drive. Steam engines need no transmissions, so the Lear design puts either powerplant in unit with the rear differential. A power take-off will run to the front differential.

Suspension is conventional from what I could see—inboard disc brakes at all wheels, independent A-arms with spring-enclosed tubular shocks. The final design for wheels and tires hasn't been decided yet.

Ken Wallis is shooting for a dry weight for each car of 1350 pounds. For a steamer, this figure seems unrealistically low. Again, it points to what must be the use of exotic metals, light but extremely strong and durable.

The body is monocoque, made up of a main section that carries the boiler, driving engine, auxiliary turbine, fuel tanks and aft, these to carry suspension, differentials, and condenser.

For drivers, Bill Lear would like to sign Parnelli Jones and Jackie Stewart. Parnelli has been to Reno to talk with him, but neither driver will make a firm commitment until he actually tests a running car. Whether Lear will have anything that runs by May 30 remains a point of much speculation, but wouldn't it be great if a Lear steamer *did* make the race? ★★★

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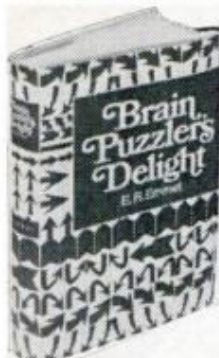
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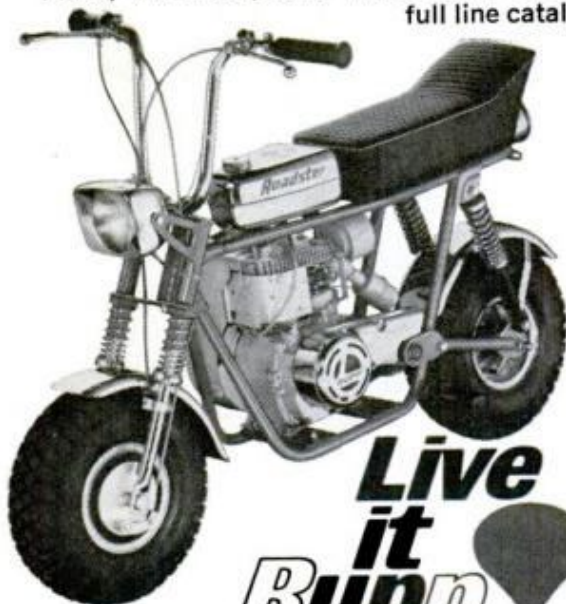
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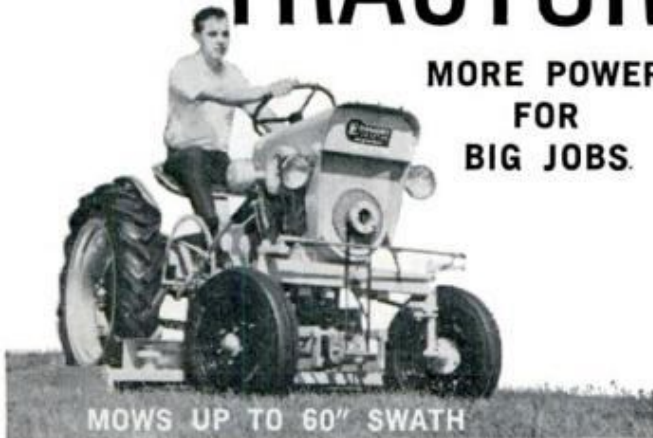
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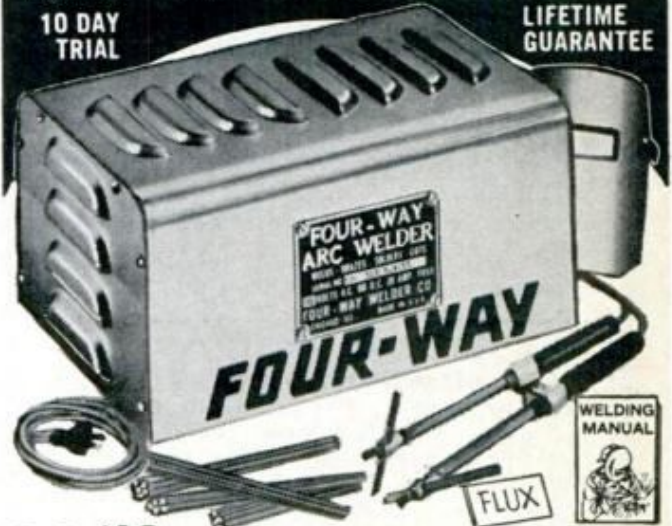
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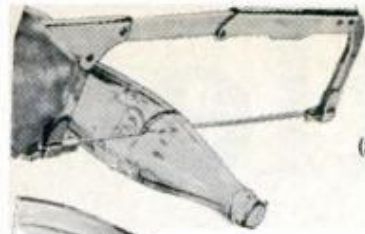
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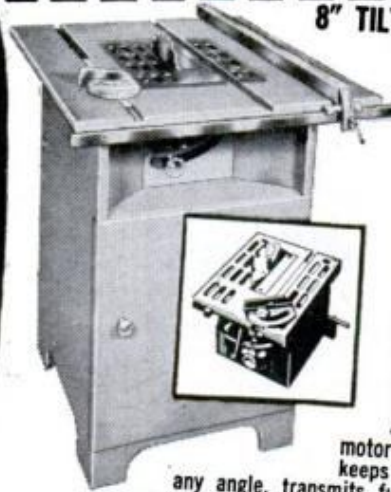
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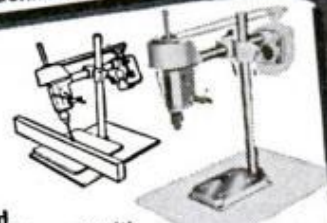
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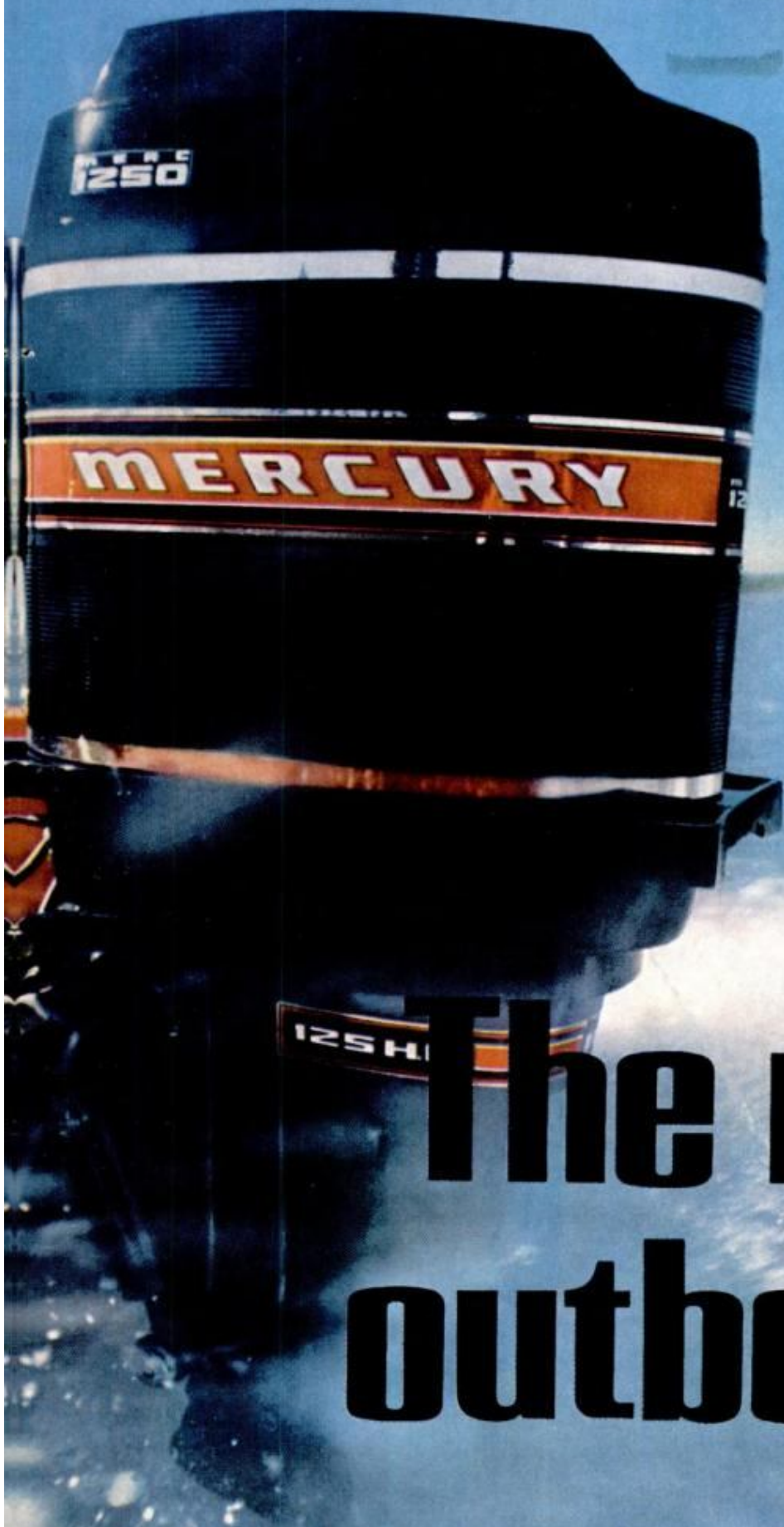
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