

POPULAR MECHANICS

JULY 1966
35 CENTS

LET'S CLAMP DOWN
ON MAIL-ORDER KEYS!

— Before they steal your car!

by Senator Abraham Ribicoff

THE COLDEST SWIM IN THE WORLD
Diving beneath the antarctic ice

How to make furniture look "antique"
Tricks from a real pro

DIY AUTO CLINIC — PLUS MORE TIPS FOR THE SATURDAY MECHANIC

How to put a sharp edge
on your cutting tools

What owners think about
Cadillac — Lincoln — Fairlane

Build your own water skis
and aqua sled — complete plans

“We know that luxury features are big with used car buyers, too.”



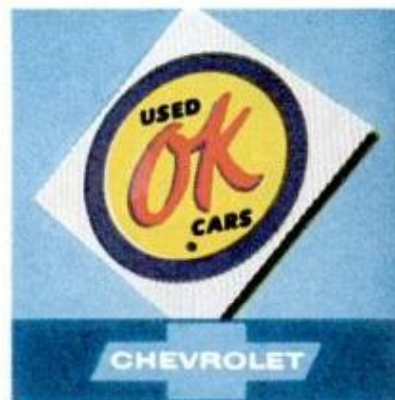
“We’re Chevy dealers.”

Ask any Chevrolet dealer. He’ll tell you that in the past few years new car buyers have been ordering more and more luxury options. Now, plenty of these well-equipped cars are showing up as trade-ins on his OK used car lot.

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luxury items you want. Browse around. He wants you to be satisfied. Because satisfied customers return. Often for a new Chevrolet.

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JULY 1966

1



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RANCHOS
in NEVADA**

**\$1⁰⁰
DOWN \$10⁰⁰
MONTHLY
FULL PRICE
\$495⁰⁰**



THE BOOM THAT HAD TO COME IS NOW ON IN NEVADA. Ground floor buyers have reaped fortunes from small initial investments. A factual example of skyrocketing values is Las Vegas, Nevada. Land that originally sold for \$200.00 an acre, now sells for \$20,000.00 an acre, a profit of 1000%! The first offering of LAS VEGAS land was open to everyone. Buyers who took advantage of low opening prices have become wealthy. The ground floor opportunity of Las Vegas is gone, BUT ANOTHER AREA OF PROSPEROUS NEVADA IS BEING RELEASED FOR PUBLIC SALE!

This area has such a tremendous growth potential, such a fantastic, unlimited future, that wise investors have purchased large acreage. Bing Crosby's ranch was one of the largest cattle ranches in the county. James Stewart is honorary sheriff. Yes, the smart, experienced investors have sensed the future and are buying MEADOW VALLEY RANCHOS in Elko County, Nevada.

MEADOW VALLEY RANCHOS has all the factors needed to boom... to prosper... to skyrocket its land values. Ideally located in the prospering Elko Valley, The Ranchos have the backdrop of the statuesque Ruby Mountains. The sparkling Humboldt River actually flows through the property and is a valuable asset of the Ranchos. Every Rancho fronts on a graded road. The City of Elko, with its long established schools, churches, and medical facilities is MEADOW VALLEY RANCHOS friendly neighbor.



FAMILY RECREATION

FISHING: A fisherman's paradise. Huge Rainbow, Brook Trout and German Browns abound in Alpine-like lakes and mountain-fed bottom streams.

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LAKE OSINO: No charge to Rancho owners for full privileges at nearby Lake Osino. Fish, Picnic and Relax with your fellow Ranch owners at this private lake and recreation area.

HUNTING: You will find the hunting of your life. Big game species such as Mule Deer are abundant. Duck, Quail and Chukar are plentiful.

YOUR PROFITABLE TOMORROW —

YES, wise investors are buying in MEADOW VALLEY RANCHOS, but America's largest corporations, whose research closely follows the trend of increasing land values and population growth, are also busy investing throughout Nevada. U.S. COMMERCE BUREAU FACT: Per capita income in Nevada is highest of all 50 states.

TAX RELIEF — No State Income, Gift or Inheritance Tax. The low Real Estate Property Tax is actually limited by the State Constitution.

WHAT ARE THE TOTAL COSTS?

The full price of the title to your 1 1/4 acre Rancho is only \$495. Total payment schedule is \$1 down, and \$10 per month. No interest, no carrying charges. John D. Rockefeller said, "The big fortunes of the future will be made in Real Estate." You are not required to do anything to your land. You can live or vacation on it, or simply watch its value grow, then sell all or part of it for a profit. Your profitable tomorrow is here today in MEADOW VALLEY RANCHOS.



NOW! DON'T MISS THIS OUTSTANDING OPPORTUNITY!



MEADOW VALLEY RANCHOS

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Yes!—Reserve acreage at MEADOW VALLEY RANCHOS for me—\$495 for each 1 1/4 acre parcel—payable \$1 down and \$10 a month. No other charges. Send purchase contract and map showing exact location of my holding. You will return my \$1 deposit if I request same within 30 days. I enclose \$1 deposit for each 1 1/4 acre Rancho desired.

SIZE ACRES	DOWN	PER MO.
1 1/4	\$1	\$10
2 1/2	2	15
3 1/4	3	20
5	4	25

Name: _____
Address: _____
City: _____ Zone: _____ State: _____

Indicate No. of Ranchos _____ Total enclosed \$ _____

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The Best Driver in the Whole World. PM profile on Dan Gurney, a star in Grand Prix cars, Indy cars, sports cars, stock cars—you name it; Dan drives it.

1000-Mile Test of Ford Thunderbird, Buick Riviera and Chrysler New Yorker. PM drivers tell how these three stack up against each other.

Which Is the Right Glue for Wood? This roundup tells you everything you need to know to choose glue for your shop projects and how to use it.

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LETTERS

TO THE EDITOR

Mobile antiques

Thank you for *Antique Outboards Too Frisky to Retire* (page 142, March PM), which certainly passed on to your readers a measure of the fun that we antique outboarders have.

The response to the article has served to increase membership in the Antique Outboard Motor Club at an astonishing rate. In January of this year, the club moved to Texas. Our new address is 1107 Pueblo Drive, Richardson, Tex. 75080. Richardson, Tex. DAVID R. REINHARTSEN

Off-base bird scarers

In reference to *Bird Scarers* in the April *Aviation* column (page 10), your facts are way out. Mangere International Airport is at Auckland, not Wellington, and is far from being scheduled to open late this year. It has been operating for some months.

USNAS Moffett Field, Calif.

G. H. GILMORE

English Teacher

Your magazine has arrived here regularly for some years. My son, who is now 18 years of age, actually learned English by following the interesting articles in PM. Prague, Czechoslovakia DR. J. TOMAN

Strumming in Norway

I made your *Singing Steel Guitar* (page 129, Aug. PM) and it came out just great.

I'm an American student studying here in Norway. While looking through the issue of PM at the American Counsel's library, I came across the plans. I'm very happy with the finished product, and I recommend it for anyone who likes fine guitar music that is a little different from the ordinary.

Oslo, Norway

GREG GULBRANDSEN

Suburba-Car nostalgia


Your *Sporty Suburba-Car* (page 162, April PM) evoked some nostalgic reminiscences—especially the picture at the bottom of page 163.

Industrialist O. Henry Ingram, now deceased, and I built several "cycle cars" in 1918-21 while still in high

(Please turn to page 8)


WHO ELSE WANTS A BIG RAISE IN PAY?

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Rudolph Urbatis,
Port Chester, N.Y.

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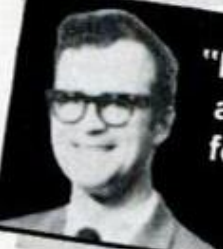
William T. Black,
Canoga Park, Calif.

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James L. Yanning,
Manhattan, Kansas

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Robert Fisher,
Holbrook, Ariz.

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

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

321



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It's not his fault the By-Pass Valve in a Full-Flow Filter does NOT Filter Oil!

Comes time to change your Oil and Filter... the manufacturer recommends you do this at 6,000 miles. What do you do? If you don't insist on a WIX Multi-Cel Oil Filter, chances are 9 to 2 you'll get one engineered for 2,000 to 3,000 miles! You get 2,000 miles of filtration—the pleated paper gets loaded and the by-pass opens. For the next 4,000 miles you might as well have no Filter at all.

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LETTERS continued

school. The last and most successful one was a three-wheeler with one-wheel rear drive. We used a Harley-Davidson twin, an H-D multiple-disc dry plate clutch, and the seasoned white oak rails from an old Franklin for the frame.

We never put a body on the beast and had only token "mudguards."

We found few hills, sand or gravel roads we could not negotiate by the deft slipping of the clutch and the delicate working of the hand throttle.

Of course, your Suburba-Car is more sophisticated, refined and plushier. But then it should be—nearly a half century later.

Thanks for bringing back some pleasant and rich memories.

College of Education
Butler University
Indianapolis, Ind.

J. HARTT WALSH
Dean

Uncamp camping

There's a lot of truth in the statement that trailering is not camping in *Roughing It in High Style* (page 112, May PM).

I have always said that camping in a trailer is no more camping than towing your home on the road.

Camping in my younger days was real. With no car we trudged a couple of miles to the nearest wooded park with what we needed on our backs.

Malden, Mass. PETER LEGON

A cache is not a home

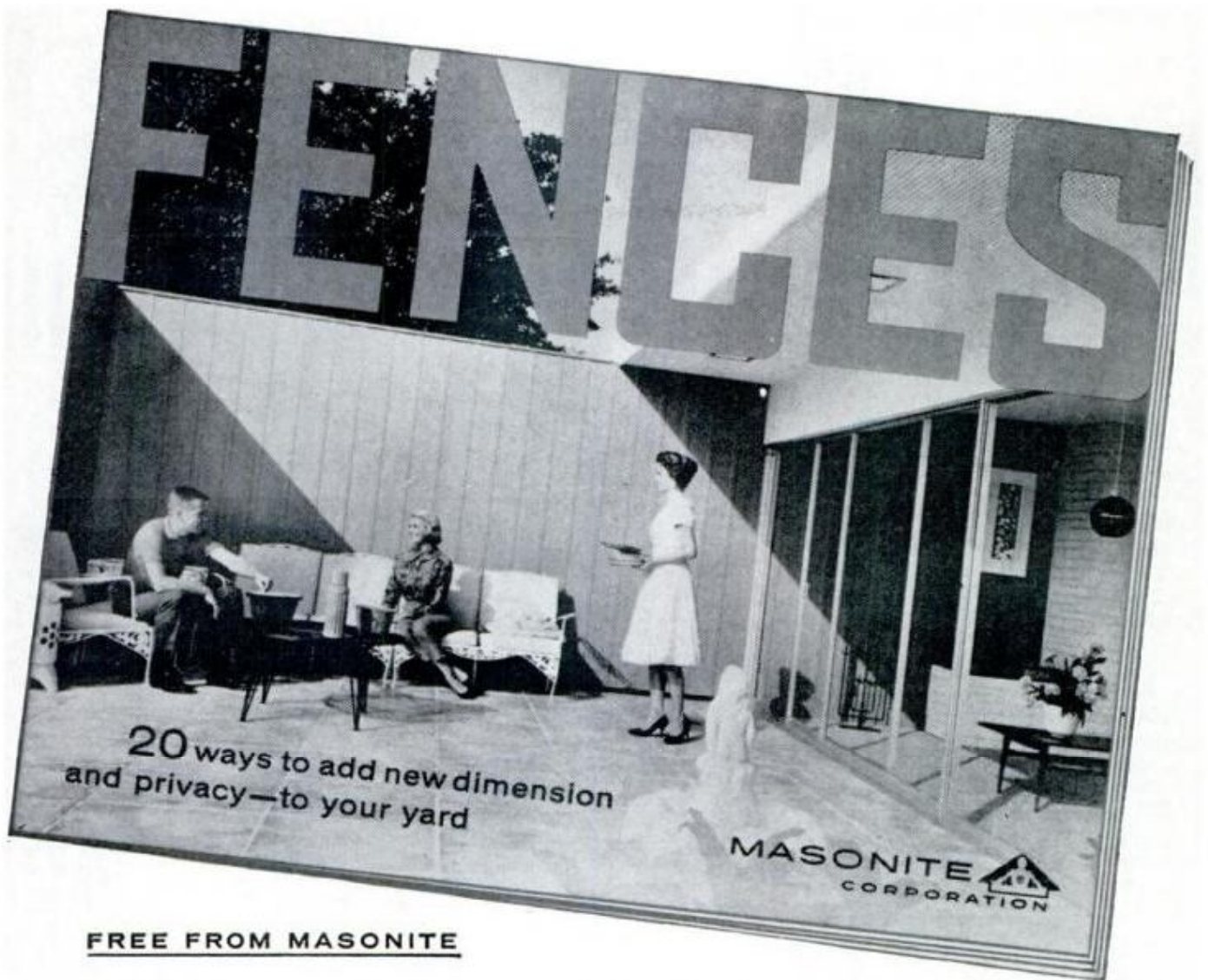
I nearly fell off my chair when I read the caption under a picture in *Here's How to Get That Hideaway Homesite* (page 122, April PM).

The lower photo on page 123 shows an Alaskan cache—but the caption describes it as a "small rustic cabin . . . built on stout poles." The cache was built for storage purposes, generally for food storage.

Spenard, Alaska ROBERT W. HAYES

Our caption writer (who is not the author of the article, by the way) is more familiar with the "line cabins" of the Sierras than he is with the caches of Alaska. They serve somewhat the same purpose—though the former are also used as shelter for travelers—so he escalated the Alaskan food shelter to a people shelter. We're sending him to live in a cache for a week of his vacation. That'll teach him.

—The Editors



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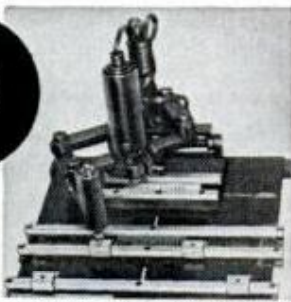
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Maj. Gen. H.W. Doan, Ret. has a prize winning idea.



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Anyone can win in the Schenley Household Hints Contest.

Maj. Gen. H. W. Doan, Ret. of Palatine, Illinois won the **first prize of a De Walt Radial Arm Saw** in the Schenley Household Hints Contest. Every month Schenley will award five prizes for the best money-saving, time-saving, do-it-yourself ideas. Here are the other prizes and winners in this month's contest:

2nd prize: Ansco Camera Kit—Mr. B. Stein, New York, New York.

3rd prize: Melnor Lawn Sprinkler and Reel—Mr. H. A. Holdgrun, Portsmouth, Rhode Island.

4th and 5th prizes: Power Hand Saws—Mr. Paul O. Krumm, Middletown, Connecticut and Mrs. Sidney Julien, Troy, New York.

Send your ideas today to the Schenley "House-Hold-Hints" Contest, Contest Manager, Room 400, 575 Lexington Ave., N.Y., N.Y. Entries must be postmarked no later than midnight, July 31, 1966 to be judged in this month's contest. All ideas submitted become the property of Schenley Distillers Co., and all decisions of judges are final. Offer not made to minors or residents of states where illegal.

Schenley tip for home bartenders:

Drinks should look as good as they taste. Use fruit garnishes for color, and never fill glasses more than $\frac{1}{4}$ " to $\frac{1}{8}$ " from brim.



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BY JOHN F. PEARSON
SCIENCE
WORLDWIDE

Kicking the habit. Today, fewer than 30 percent of the nation's physicians smoke, according to Dr. Luther L. Terry, former surgeon general of the Public Health Service. He says that in the 1950s more than 60 percent were smokers.

Angling by helicopter—that's the plan of a commercial fishery in New Zealand. A chopper will be used to drop lines and hooks, lay nets and crayfish pots, and will be armed with harpoons to knock off sharks that threaten the catch. The fishermen expect that the fast-moving machine will be able to set as many as 50,000 hooks a day.

Why do bees build nests in hollow trees? Experiments by a Cornell University bee expert indicate that they seek escape from intense light, not wind and rain.

First-aid for monuments and historic buildings is in the offing. A liquid developed by a New York University researcher provides a hard surface for building stone susceptible to damage by erosion. Painted on limestone, the liquid is said to make it as hard as marble.

Touring the nation, a traveling lab will soon give public demonstrations of actual radiation research with live fish, insects, animals and plants. Operated by the Atomic Energy Commission, the "Life Science Radiation Laboratory" has five TV monitors for viewing experiments.

Reverse deep six. The world's record for recovery of an intact sunken vessel is claimed by the Rocket Research Corp. of Seattle. Using flotation bags and a gas generator to inflate them, engineers recently raised a 16-foot cabin cruiser to the surface from a depth of 720 feet in Puget Sound. The company now is designing equipment for recovery work at much greater depths.

False teeth with lining. Help is available for people whose oral tissues are made raw by dentures. It comes in the form of a silicone rubber liner.

Tests conducted at the universities of Chicago and Michigan reportedly indicate
(Please turn to page 14)

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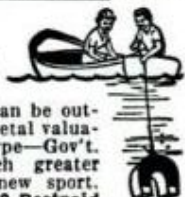
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SCIENCE WORLDWIDE

(Continued from page 13)

that the material doesn't irritate tissues of even very ill patients. Unlike liners that can be bought in drug stores and applied on a do-it-yourself basis, the new silicone liner must be fitted by the dentist. Medical-grade silicone rubber is widely used in surgery because of its remarkable inertness in the human body.

Driest spot on earth is thought to be the Atacama Desert in Chile. So far as is known, not a drop of rain has fallen there during this century. Question is, is the area too dry to support any forms of primitive plant life?

That's what Caltech researchers hope to determine this summer. Their findings might provide clues as to the possibility of life on Mars, another dry-as-dust location.

Slowpoke submarine trip in the Gulf Stream is on the docket for sometime in 1968. It will cover 2000 miles, from Florida to Nova Scotia, and will take about six weeks because the sub will simply be drifting with the current of the Gulf Stream.

Leader of the five-man party will be Jacques Piccard, Swiss oceanographer. The sub, called a mesocaph, will be 50 feet long, 12 feet in diameter and weigh 100 tons. It will sail without power to enable scientists to observe and photograph marine life from close up and to perform sound experiments not possible from a vessel with noise-making engines. The sub will drift along at a depth of about 1000 feet. Four steering devices will enable the crew to keep the craft from drifting out of the Gulf Stream.

First effective vaccine against rubella (German measles) has been developed by two scientists at the National Institutes of Health, Bethesda, Md. Though described as "experimental," the vaccine has proven effective in tests with humans and monkeys. German measles is a major cause of birth defects.

Fast way to dry huge photo prints is with high-frequency radio waves. That's the secret of a machine developed by Canadian engineers that has cut the drying time from hours to minutes. The radio waves generate heat in the excess moisture, not in the fibers of the paper itself. This makes for quick drying and prevents any chance of damage to the print by heat.

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BY KEVIN V. BROWN
AVIATION
JETSTREAM

Gooney birds never die. They just fade away. The venerable DC-3, perhaps the most durable aircraft ever built, celebrated its 30th anniversary this year. Legends about it are still rolling in.

Recently one of them was named as the plane that had logged more time in the air than any other plane in the history of aviation. N21728, last flown by North Central Airlines, was built in 1939 and in the 27 years since spent about 9 1/2 of those years in the air.

Old 728 logged 83,052 hours, flying more than 12 million miles and taxiing another 100,000 miles, averaging about eight hours of service daily. The boys with the pencils at Douglas Aircraft Co. calculated that the distance flown by this one airplane was equivalent to 25 round trips to the moon.

The airframe, Douglas claims, is 90 percent original. However, North Central says No. 728 wore out about 550 main-gear tires and 136 engines.

Collision avoidance may become automatic for airliners if a system now under development turns out successfully. Radio signals would be exchanged between aircraft providing relative speed, range and altitude information continuously and automatically. The system would compute the information from other aircraft and tell the pilot what kind of an escape maneuver to make, giving him at least 60 to 75 seconds of warning to take appropriate action.

No hot pilots. Water-cooled vests, designed originally for astronauts and worn by stock-car drivers, may be used by aircrew members when flying in the tropics. A small ice chest is connected to the vest with hose through which cool water is circulated in tubes on the skin side of the vest. An electric auto fuel pump circulates the water through the vest.

The Air Force has also used it to relieve the discomfort of its crews in humid flying areas. Heat radiation from the sun on the cockpit windows increases the discomfort. Each unit, which weighs about 50 pounds, can keep one man cool for four hours in 115° heat.

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FREE BOOK

QUESTIONS ANSWERED

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Jerry-Built Joist Braces

I've noticed that instead of using 1x4 braces between the joists in my new home, the carpenters cut 2x10s into short lengths and nailed these between the floor joists. Most are tight, but some have opened and I can see the nails in the openings. Is this good construction? Will it hold or should the braces be replaced?—W.S., Minn.

The builder probably figured that was as good a way as any to use up leftover pieces from the framing job. I wouldn't say it's bad construction, though certainly it doesn't make as neat a job as would the use of regular 1x4s. So long as these braces do their job—that is, offer enough cross-sectional support to prevent the joists from deflecting and sagging—they're okay, particularly if the unsupported lengths of the joists do not exceed 12 ft.

Square Pegs in Round Holes

Recently I purchased an antique table of apparently mortise-and-tenon construction. However, it appears that the members are held in place with square pins in round holes. Is this authentic construction, or were the square pins used in a later repair of the table?—P.L., Vt.

Many of the old-time cabinetmakers did use square pins in round holes in much of their joinery work. Whether the pins in your table are the original ones or replacements is impossible to tell. If they're replacements, you can be fairly certain that the craftsman who did the repair work knew what was called for and faithfully copied the originals.

Nailers in an I-beam

To finish a room in my basement I need to house one side of a steel I-beam. I can't box the beam because head clearance is already minimum. I need eight nailers between the legs, or flanges, of the beam. How do I get 'em there, then set 'em into place so they'll stay put?—I.L., Tex.

I presume you don't relish the idea of drilling holes through the web of the beam to permit turning woodscrews into the nailers. Okay, here's an easier way:

Cut eight 2x2s that can be wedge-

fitted between the flanges of the beam. Then coat their ends with epoxy and tap 'em into place. Make sure the metal is bright and clean at the points where the nailers are placed so that the epoxy will "take." Give the adhesive plenty of time to cure before nailing.

To Make a Flagstone Path

I want to lay down a flagstone path between the driveway and the back door of the house. A dirt path has been worn across the lawn already. How is this job best done and where does one go to buy flagstones?—F.S., Fla.

Flagstones can be bought from lumberyards and stone yards. For your purpose they should be about 2 in. thick and 12 to 18 in. across. Smaller "filler" stones might also be purchased, or some of the larger ones you buy can later be broken up for this purpose.

Using a "gauge-board" cut to the desired width of the path, trench the pathway to an even depth of 6 in., leaving the sides vertical. Now lay down an even 2 in. of crushed stone or cinders for the foundation; then tamp. Follow with a 1-in. layer of gravel (also tamped), then with a 1-in. bed of sand, wetted down and

tamped smooth.

Start setting the stones in place at the margins and work toward the center of the path. Use the smaller "filler" stones to fill in gaps between the larger stones. Additional sand can be used to fill in the spaces between the stones. Pour the sand on the surface and use a push broom to distribute it and sweep off the excess.

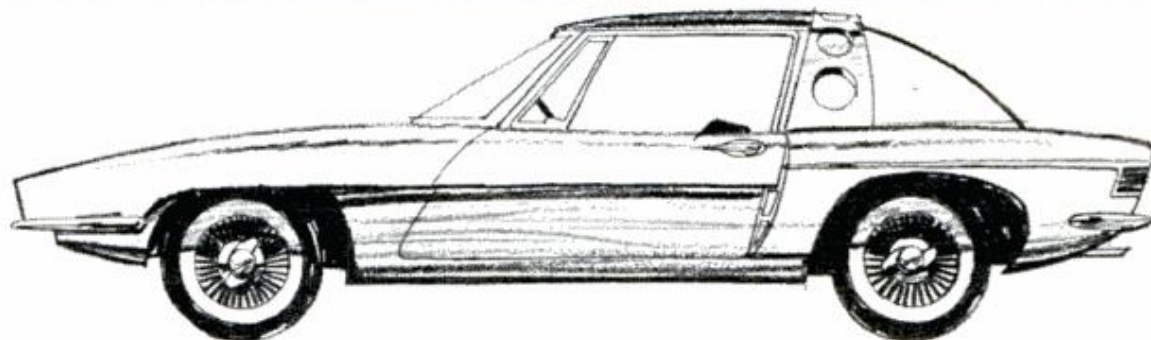
Repairing Cracked Stucco

Last year a few cracks appeared on the outside stucco of our house and near the top of one of the windows. Now there are indications that moisture has penetrated these cracks (a portion of the inside wall is slightly water-stained). How can I repair the stucco? I feel I should close these cracks before the situation worsens.—W.W., N.Y.

I feel you should, too.

Cracks in stucco can be repaired with a mix made up of 1 part cement and 3 parts sand, or you can buy a commercial stucco-patching mixture at any hardware store.

When making the patch, cut back under the edges of the crack, wet down the area, then force in the patching mixture. Keep the patch shaded from the sun until it dries. When dry it can be painted. ★★



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DETROIT LISTENING POST

A STAFF REPORT

Camaro—not Panther—may be the name of the new Chevy entry in the Mustang class. Industry sources say Chevy has put out tooling orders for a nameplate carrying that word. Earlier reports, now discounted, suggested the car might be called Camara or Cheetah. It's also generally agreed that on introduction this fall it will carry a name starting with the letter "C" in keeping with Chevy tradition. Other tooling orders are out for a nameplate bearing the words Rally Sport. It's believed this will be the top series in the new line of cars and will have disappearing headlights.

The new Chevy car will be about three inches wider than the Mustang. The basic engine will be the 194-inch Six. The 283, 327 and 396 inch V8s will be optional. That size comparison is based on the '67 Mustang, which will be a little bigger in length and width than the '66 version. The new Mustang will be two inches longer and two inches wider and will get a major facelift, including a full fastback model, like the Dodge Charger. An option will be the 390-inch engine first developed for the Thunderbird. Grille, taillights and side sculpturing retain their present theme, but the treatment is more pronounced. For example, the three vertical bars that make up each taillight are spread apart slightly, in comparison to the '66 Mustang.

Car prices are probably going up in '67. A guess from one executive was \$75. "The public is going to have to pay for all this safety equipment Washington wants us to install," he said. Actually, the public started paying this year when cars went up about \$50 to cover the cost of six safety items which were made standard equipment, including rear seat belts, side-view mirror, four-way emergency flasher and padded instrument panels. Most cars next year will have an energy-absorbing steering column and dual-cylinder brake systems. But even without the safety items, automakers would be hard-put to hold the line on prices in '67 because of higher material costs. The U.S. General Services Administration has a list of 26 safety features it wants on government vehicles that year, including head rests and roll bars on some cars. The '68 safety items, which are expected to be made standard on all cars, plus the costs of a new labor contract with the United Auto Workers Union, which will be negotiated next summer, are likely to drive prices up again. So from a price standpoint, now is the time to buy.

The great hue and cry over safety may result in "too much" regulation of the industry by various federal, state and local government agencies. That's what Detroit auto executives fear, anyhow. Specifically, the industry doesn't like one bit the thought of any governmental body telling it what it can manufacture.

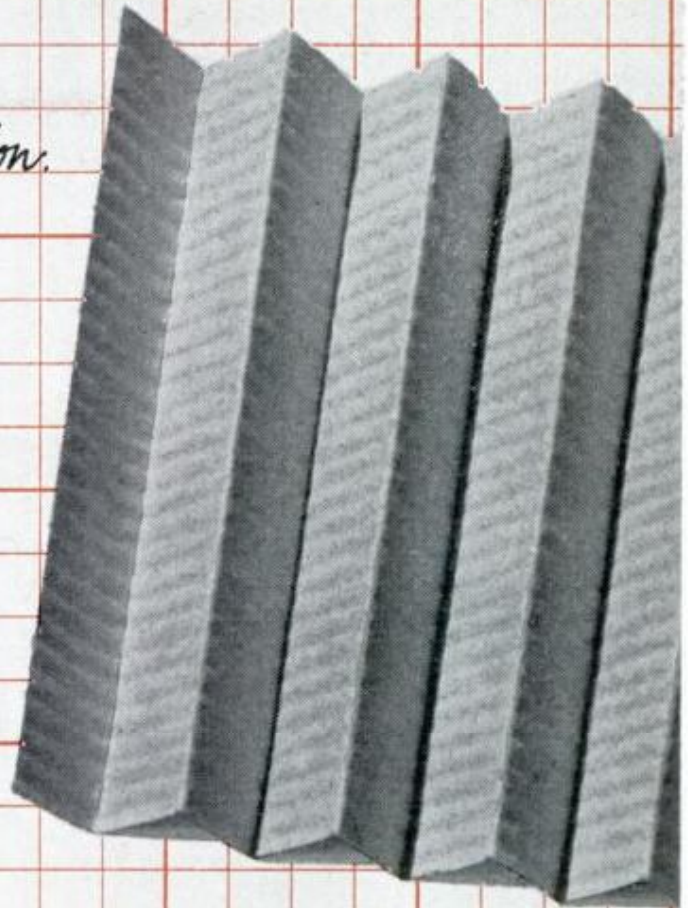
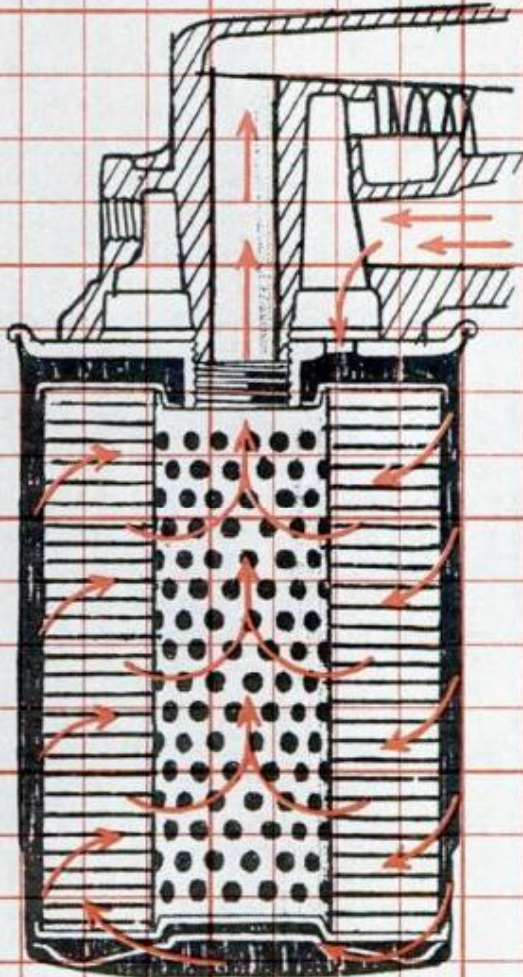
Auto men like to think of themselves as a breed apart, light on their feet and quick to take action. This damn-the-torpedoes self-image dovetails nicely with another genuine fear automakers have—that government's notorious, bureaucratic red tape and ingrained apathy toward updating legislation once it's on the books will hinder, if not actually kill, industry technological advances. In any highly competitive industry, gaining a year's advantage over an opponent can be the difference between sickness and health. And, many executives feel, there won't much point in trying to develop in secret, say, a new brake system if it's going to take a year and a lot of public documents to get it approved and on the production line.

Ford isn't coasting on the collapsible steering column, despite published reports to the contrary (including here). The company had announced its intention to "go along" with the deep-dish steering wheel design it introduced a decade ago, claiming the design meets all government requirements. Then, later, Ford said it would start off the '67 model run with the deep-dish wheel, switching to a truly collapsible column

(Please turn to page 22)

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AC SPARK PLUG DIVISION



DETROIT LISTENING POST continued

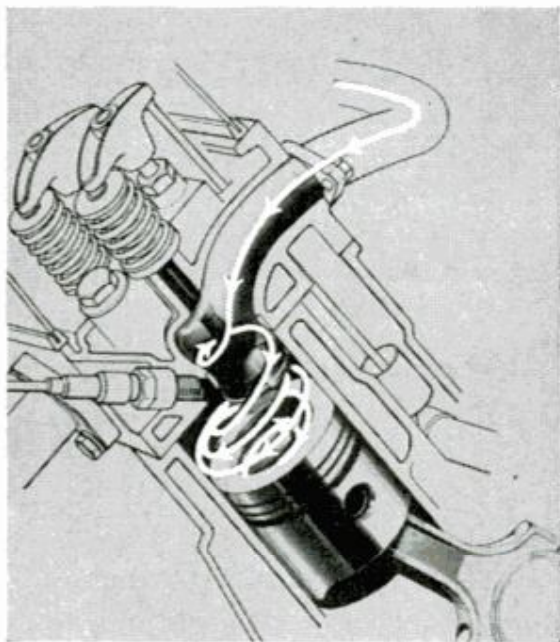
at about the halfway point. But now it looks like Ford may offer one right from the word go. Design and production engineers are reportedly working frantically to get a Ford-built unit ready in time. Through its Saginaw Steering Gear Div., GM at the moment has about the only game in town. American Motors (and, according to rumor, Chrysler) will buy the GM unit. But Ford would rather fight than switch and it's determined to meet fire with fire. So don't be surprised if your friendly Ford dealer touts such a gadget on all his '67 wares.

Front-wheel drive is being quietly soft-pedaled—if not actually downgraded—at both Ford and Chrysler, despite whatever projects the companies had in the works. Neither company has had much, if anything, to say about its plans and efforts to design and produce a front-wheel-drive car. Presumably the attitude was, "Let's wait and see what happens to Toronado, but just in case, have the boys in engineering keep their pencils sharpened." What Ford and Chrysler have seen while they waited is no great stampede by the public to embrace the Toronado and its hotcha power train. As of mid-May, Olds had produced about 21,000 Toronados, not all of which have been swept off dealer shelves. The car is a success, but not the smasher GM is said to have expected. Price could be a factor, which may explain why the concept is being shoved upstream to Cadillac for '67 rather than over to Buick or down to Pontiac.

American Motors will not go gung-ho in racing, regardless of what you may have heard. It's quite true AMC has a modest "experimental and research" garage squirreled away in a corner and presided over by an all-out racing buff. But company sources swear up and down that the purpose of the facility is *not* to get AMC in the racing business. The idea of the setup is to put jazzier machinery in your garage, period.

Report from Germany. An 11.2:1 compression ratio, highest for any production gasoline-powered car, is featured by a new version of the Audi, designed by Mercedes and being built under Volkswagen supervision at the Ingolstadt plant of Auto Union, in which VW now owns a controlling interest. The high ratio is made possible by a revolutionary "double-crown" piston, which has a cupped-out depression on top in which combustion takes place (see drawing). The Audi's water-cooled 1700-cc engine has four cylinders, develops 72 hp at 5000 rpm, and is mounted at a 40° angle over a front-wheel drive. All-in-all, it's a pretty sophisticated piece of machinery in an attractive, American-styled package, but VW has no plans for marketing it in this country.

VW takes the same hard-nosed attitude toward the original 1500 notchback and the handsome new Karmann-Ghia version of the VW 1600. The latter resembles the Karmann-Ghia body of the VW 1300, but is longer and racier. You can buy one from a dealer in Germany, but it will have amber turn signals, lack sealed-beam headlights and a laminated windshield, both standard on VW's built for the American market, and thus, cannot be legally registered in many states.



Your next Volkswagen "Beetle" will probably come from VW's brand-new assembly plant at Emden. Located only 1¼ miles from the North Sea, the plant permits Beetles to be driven directly to one of eight big ships under charter to VW for U.S. deliveries.

With an output of 1000 Beetles a day, the Emden facility is small compared with VW's mile-long factory at Wolfsburg, just three miles from the East German border.

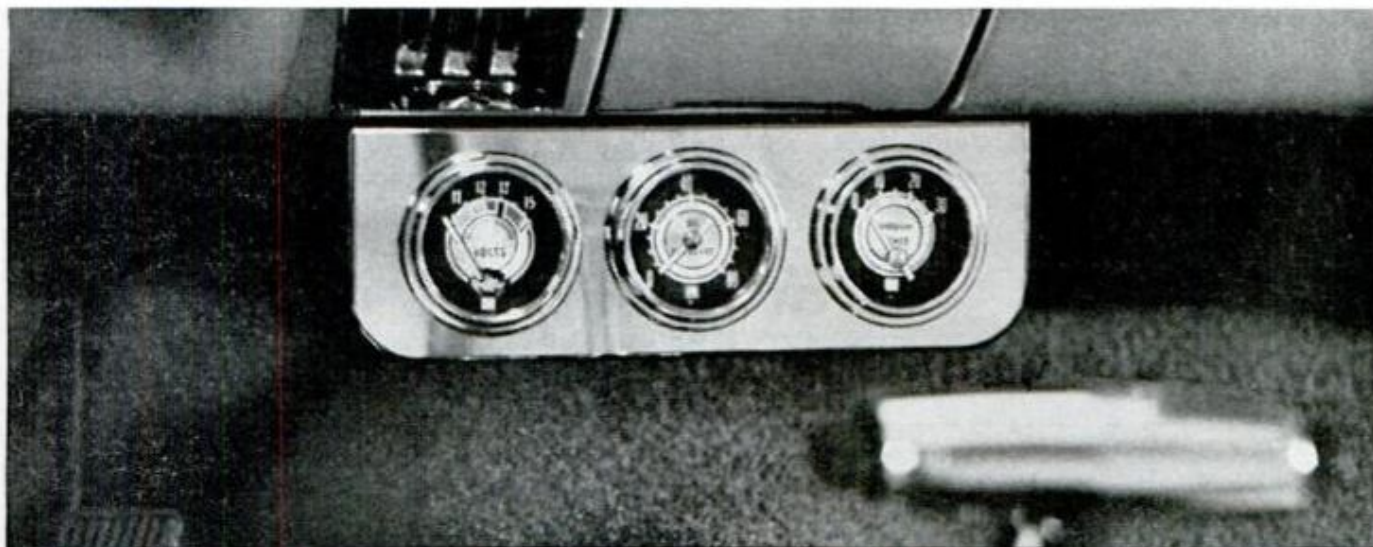
Wolfsburg, world's largest auto plant under one roof, turns out 3500 Beetles a day, plus 1300 of the larger 1500s and 1600s. Of its 49,000 workers, 3271 are assigned to the inspection department.

VW trucks and buses are made in neither Wolfsburg nor Emden, but at another big plant in Hannover, which also makes all of VW's engines. (Transmissions are made at Kassel, front axles at Brunswick.) Some 40 pounds of magnesium go into VW engines and transmissions, making VW the world's largest user of this light metal.

Corvair is at "the bottom of the heap," in the words of one GM official. Whether it will be buried is a \$64 question. Chevy General Manager Pete Estes said it will be built in '67. Asked about '68, he wouldn't comment. A few models will be dropped in '67 to make room in the Chevrolet lineup for the new Mustang-type car. Sales of the '66 model are down more than 50 percent because of court actions and charges by auto critics that it is unsafe.

Sagging Sales as the '66 model year enters its final stages have nothing to do with the safety backwash, many industry observers feel. They point out that the U.S. economy is near the end of the line for exploitation of the "postwar baby" market. The big crop of kids born during and immediately following World War II are in their late 'teens and early 20s and as such—depending upon their parents' affluence—have about all the gadgets (including cars) they're going to have for a few years.

The go-go set, for example, has been a big factor in Mustang sales. But now what does Ford do for an encore? This "saturation" situation may be the main reason for the "settling down" of the past few years' giddy boom. Autos, of course, are no exception and sales are bound to dip a bit. Bright hope for '67 is that kids with Mustangs (or whatever) will have the desire and cash to trade-in their '64s and '65s. Saleswise, the '67 model year promises to be interesting. Many observers feel it will establish significant patterns for the next several years. ★★★



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NEWS FROM THE **MILITARY** BY WILLIAM R. KREH

Unique new bullets turn into clusters of twisting, tearing wires. They were invented by two Navy civilian employees. The "strip bullet," consisting of several wires the length of a normal bullet, can be used in any existing rifle. Wires are squeezed together into a bullet shape and put into an ordinary cartridge. When the strip bullet is fired, the twisting action of the rifling in the barrel tears the wires apart and sends them tumbling through the air in a shotgun pattern. Small, but deadly in their effect, such bullets are considered particularly useful in jungle warfare for spraying a short-range target.

A two-eyed rifle sight being developed by the Army does away with the traditional front and rear sights. It uses a twin optical system to superimpose cross hairs on the target image. Once the rifleman places the hairs squarely on target, he can fire with deadly accuracy.

Bird protection for pilots in the form of a helmet visor is a new wrinkle in the Air Force's Training Command. The helmet, with clear and dark sun visors, will eliminate the danger to a pilot's eyes of flying glass or high-velocity air rushing through a windshield shattered by birds. The clear visor is used at all times in flight, while the dark visor is lowered as light conditions dictate. There have been 154 bird strikes on training aircraft in the past two years, and 52 of them broke windshields or canopies. In the entire Air Force, there were 742 bird strikes during this period.

12 men can ride a new aluminum boat along with 2000 pounds of supplies at 30 mph through swamps and weed-infested waters. It is being developed by Army engineers. The 24-foot boat is powered by a 400-hp aircraft engine with a specially designed four-blade propeller.

Rocks are falling along with the water at Niagara Falls, and Army engineers are studying the honeymoon spot to see what measures can be taken to eliminate the rockfalls. They're using special cameras to optically analyze the substrata and, if necessary, will build a temporary cofferdam upstream to divert the water long enough to make a close examination of cracks and other imperfections. ★★

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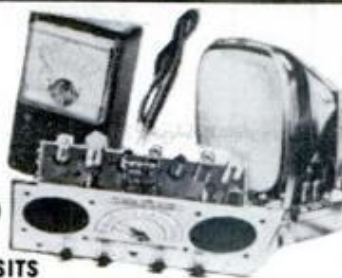
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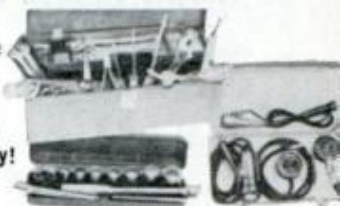
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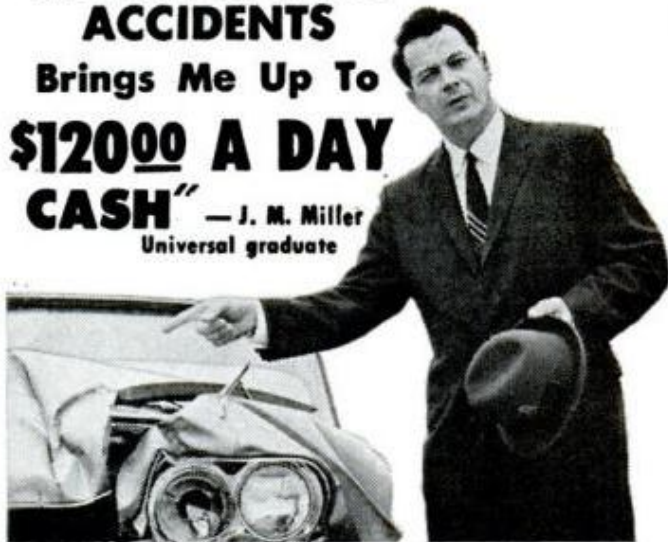
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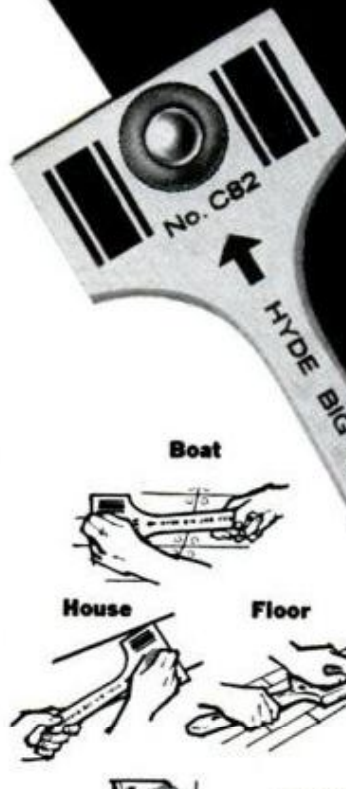
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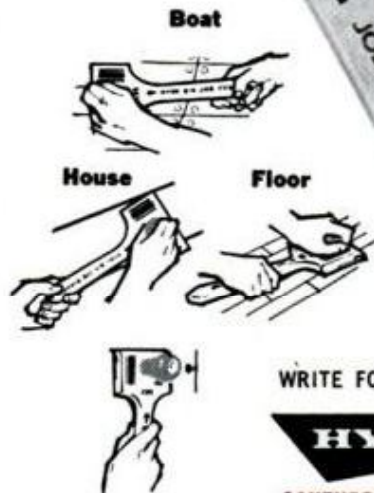
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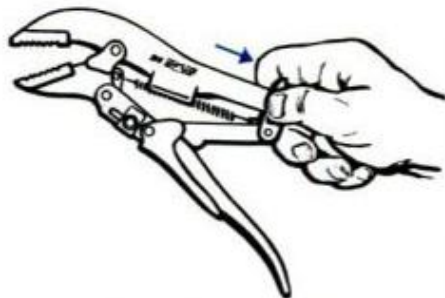
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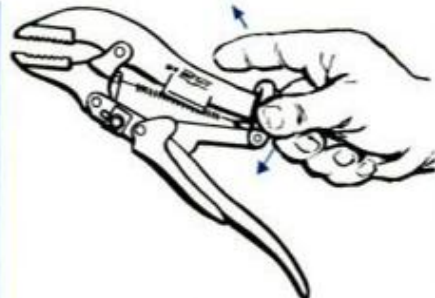
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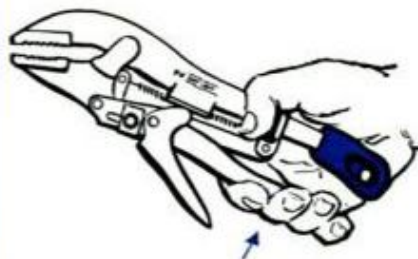
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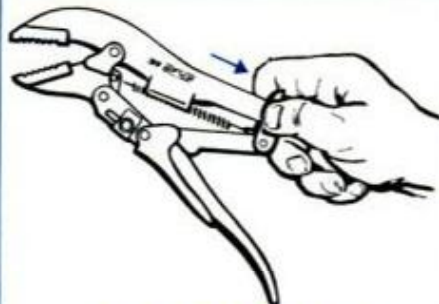
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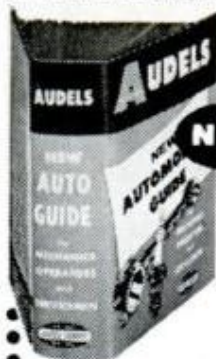
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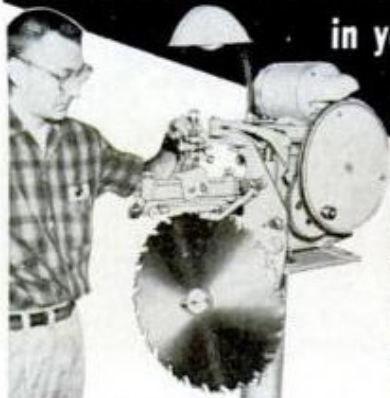
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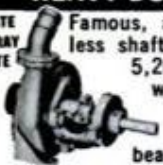
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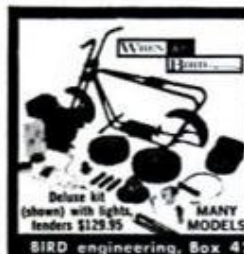


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FROM THE PATENT OFFICE **NEW INVENTIONS**
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Man's dream to fly like a bird draws one step closer to reality with the development of a jet belt that earned patent 3,243,144 for Wendell F. Moore and John K. Hulbert, who assigned rights to the Bell Aerospace Corp., Wheatfield, N.Y. The belt's turbojet principle allows longer flying time than the rocket propulsion system featured in previous designs. In addition to military use, the belts may also provide a final solution for harried commuters.

Laser communication system for use especially by satellites during reentry (when normal radio communications are blacked out), earned patent 3,243,592 for Kiyo Tomiyasu of Scotia, N.Y., and James R. Whitten of Ballston Lake, N.Y.

Stabilizing an orbiting satellite, using the earth's gravity, calls for deploying from and connecting to the main satellite

another object of the same mass. Receiving patent 3,241,142, Dr. Herbert P. Raabe of St. Paul, Minn., said his technique gives complete control over the satellite's roll, pitch and yaw. Such a damping scheme could be used to stabilize an orbiting telescope as well.

Infrared cancer detection depends for its effectiveness on a special kind of camera called a thermograph. The infrared radiation emitted by diseased tissue is much hotter than normal tissue and the thermograph provides a pictorial record of body temperature: troubled tissue, or "hot spots," show up white in the picture; healthy areas, black. This new diagnostic process received patent 3,245,402 for Dr. R. Bowling Barnes, Stamford, Conn. (See page 66 for more information.)

Advance tickets for the International Inventors and New Products Exhibition to be held at the New York City Coliseum, Sept. 9 through 18, may be obtained from the sponsors, Patent Exhibits Inc., 554 Fifth Ave., New York, N.Y. 10036. Price is \$2.50 for adults, \$1 for children 11 years or younger. A 250-page directory, covering some 900 new inventions and products to be displayed, is available at \$2.50.

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BY MARION MOREY

Preventing rust on tools, wrought iron, barbecue grills and other lawn equipment, is a concern of every homeowner. The editors of *Popular Mechanics*, in a booklet called "Rust and Corrosion," tell you how to spot where rust might occur, prevent it from starting and how to apply the protective coating which will do most good. The 35-cent booklet is available from Derusto, Box 306, Chicago Heights, Ill.

Landscaping with wood lets you stretch your living into the outdoors. Fourteen four-color photographs in a large folder may give you inspiration for a patio, deck, gazebo, garden screen or summer house to create an individual look to your home. Send 10 cents to Western Wood Products, Dept. 523-L, Yeon Building, Portland, Oregon, for a copy.

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CAREER BAROMETER

BY CREIGHTON PEET

IF YOU HANKER to be your own boss, there's probably no faster way to get ahead than to operate a service station. The hours may run to 50 a week and you will very likely get your hands dirty. But it is possible to take home \$5000 to \$10,000 the first year and in a good location you can double this.

Very few operators build and own their service stations because of the capital required—often around \$50,000. Most of them lease a station, including building, tanks and pumps, from an oil company.

While the lease covers essential items, you will need some working capital to start—maybe \$2000, \$5000, or more. You'll need this to stock up on accessories, tools and special equipment. If you're known in the area, a local bank may loan what you need, or you may obtain an advance from a prosperous citizen looking for a good investment.

Before opening for business, you will take a service station management course offered by the company. It will run four to eight weeks and you'll be paid a weekly wage—around \$80—while learning.

All oil companies emphasize that the most important things an operator should have are good business sense, ability to keep books and a knack of shrewd salesmanship. Most agree that only half of a man's revenue comes from the gas he sells. Wheel alignment, lube and brake jobs and replacement of such things as tires, batteries, shocks, wipers and fan belts provide the other half.

Failures are fairly high because many operators are careless. They neglect to display and push merchandise. They open too late and close too early. They don't keep accurate books—showing weeks ahead if they are headed for bankruptcy

(Please turn to page 40)

JOB TITLE	CURRENT NATIONAL		STATES WITH HIGHEST DEMAND							
	DEMAND	3-MONTH TREND								
Chemists, Biological	17	Slight increase	N.J. 3	Md. 1	Fla. 2	Ohio 3	Wis. 3			
Chemists, Organic	62	Good increase	N.J. 7	N.Y. 5	Pa. 8	Ohio 6	Ill. 7			
Chemists, Inorganic	16	Demand doubled	Pa. 2	Ohio 1	Ill. 9	Mo. 1	Okla. 1			
Engineers, Metall.	57	Good increase	N.J. 16	D.C. 4	Pa. 4	Ohio 5	Wis. 5			
Engineers, Civil	597	Big increase	D.C. 70	N.C. 26	Mich. 43	Ohio 91	Calif. 94			
Engrs. Elect. & Electron.	1065	Demand steady	D.C. 47	Fla. 116	Ohio 42	Colo. 39	Calif. 243			
Engineers, Industrial	561	Slight increase	N.Y. 48	Pa. 44	Fla. 39	Ohio 64	Calif. 84			
Engineers, Mechanical	1455	Slight decrease	N.J. 85	Fla. 83	Ohio 146	Calif. 287	Wash. 94			
Engineers, Aero.	653	Slight increase	Pa. 71	Ohio 45	Mo. 60	Calif. 239	Wash. 180			
Engineers, Mining	15	Slight increase	D.C. 2	Pa. 2	N.M. 2	Ariz. 3	Calif. 2			
Natural Scientists	240	Big increase	N.J. 20	D.C. 23	Tex. 10	Calif. 6	Wash. 141			
Draftsmen, Architectural	102	Some decrease	Vt. 6	N.Y. 25	Ohio 7	Calif. 16	Wash. 10			
Draftsmen, Electrical	264	Demand doubled	N.J. 14	N.C. 20	Pa. 28	Ohio 15	Calif. 132			
Draftsmen, Mechanical	461	Good increase	Pa. 59	Va. 36	Ohio 58	Calif. 32	Wash. 67			
Draftsmen, all other	385	Demand steady	Pa. 40	Ohio 28	Mo. 53	Calif. 90	Wash. 40			
Tool Designers	184	Good increase	Ohio 10	Ill. 14	Kans. 25	Calif. 51	Wash. 50			
Lab. Tech. & Assistants	109	Demand steady	Pa. 8	Ga. 11	Ill. 10	Ind. 11	Iowa 8			
Sports Instr. & Officials	29	Demand 50% off	Conn. 2	R.I. 3	Vt. 2	N.J. 3	Md. 3			
Surveyors	12	Demand steady	Mass. 1	R.I. 1	Vt. 1	N.C. 2	Va. 3			
Techs. Eng'g & Phys. Sci.	936	Big increase	Ala. 187	Fla. 52	Ohio 68	Calif. 250	Wash. 242			
Tool Planners	44	Some decline	Ohio 22	Ind. 7	Kans. 15					
Systems Engineers	40	Some increase	N.Y. 5	Pa. 1	Kans. 10	Mo. 21	Neb. 2			
Programmers	448	Good increase	Va. 12	Ohio 25	Mo. 13	Calif. 101	Wash. 226			
Systems Analysts	56	Demand steady	N.Y. 5	D.C. 7	Ohio 4	Calif. 14	Wash. 15			
Inspectors Pub. Service	11	Demand steady	Wis. 3	Nev. 1	Wash. 7					

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

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

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

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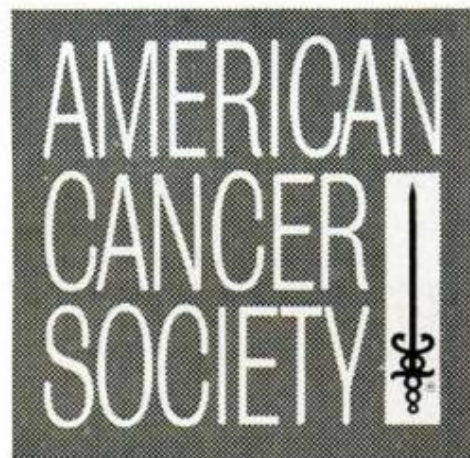
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CAREER BAROMETER

(Continued from page 38)

and should do something to forestall it.

Service stations are rated by the amount of gas sold in a month. If you do 25,000 to 30,000 gallons, you should take home around \$7500 a year—from gas and merchandise sales. To keep open 16 to 18 hours daily, you will need a helper. This is a matter of hiring the right man—or boy—and then managing things to get your money's worth.

Some 1500 high schools and junior colleges now offer distributor education (DE) courses. Many students are glad to work after school hours to pick up a little cash, gain practical experience and find out if this is the job they want permanently. All companies welcome such candidates. Shell Oil Co., alone, says it needs 3000 to 4000 dealers a year.

You should know enough mechanics to help a motorist in trouble, analyze his problem and, if necessary, refer him to the nearest shop where factory-trained mechanics can handle his particular car. The days of good ol' Joe—who could fix anything on wheels—are gone forever.

Chrysler points out that in 10 years car totals are up about 50 percent while auto mechanics increased but 4 percent. Car manufacturers, concerned about this, conduct schools to train mechanics.

Since 1949, Plymouth has had an ingenious and extremely successful program. Every year, 3500 or more high school students participate in the Plymouth national troubleshooting contests. Qualifying students comprise some 50 teams of 2 boys each. They are sent to Detroit for the finals, where each team checks out a "bugged" new car.

Working against the clock, it is up to each team to get its car running perfectly. A judge, standing nearby, supplies all needed tools. Over 74 percent of the 11,000 entrants have had good job offers.

Running a service station, say the oil companies, is like any other business. You have to be attentive and polite, work long hours and do your bookkeeping. You must keep an eye on the restrooms to make sure they're clean. You should stock the extras your customers want, whether soft drinks, ice cream sticks or sandwiches. And, watch your station's appearance! Down in Louisiana, a 23-year-old lad took over an Esso station doing about 28,000 gallons a month. A year later, after some elaborate planting all around his station, his garden-conscious neighbors bought an average of 47,000 gallons a month. It's up to you.



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COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

PROFITABLE Catalog Mailorder Business! Vikari's, 835-PM, First Avenue, Salt Lake City, Utah 84103.

START Your own business on credit. Your own boss. Hundreds of dealers making \$100 to \$300 and more weekly. We supply stocks, equipment on credit. 300 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleigh, Dept. G-U-PPM, Freeport, Ill.

PLASTERCRAFT Molds, liquid rubber, plasters, flocks, candle supplies. Catalog and manual free. Blue Rapids Supply, Blue Rapids, Kansas.

FREE Book "990 Successful, Little-Known Businesses." Work home! Plymouth-972G, Brooklyn, New York 11218.

BUILD Custom cases at home for profit. Get orders by mail. We supply materials, instructions, everything. Free home business details. Customcase, CPL, Sunset, Los Angeles 12.

IMPORT-Export business made easy. Complete setup service. Not just instructions. Hermes, 152 West 42, New York City 10036.

ADDRESSERS And mailers needed. Send stamp for information. Lindbloom, 1508 West Erie, Chicago, 60622.

VENDING Machines. No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, 715 PMB Ensor Street, Baltimore 2, Maryland.

SELL Books by mail. 400% profit. Royal, Box 450-X, Cleveland, Ohio 44127.

DIFFERENT! Outstanding profits from high quality mailorder businesses. Complete setup services; not just instructions. Hermes Co., 152 West 42, New York City 10036.

CONCRETE Facts: Cement artists make big money at home. Simple equipment. Experience unnecessary. Copyrighted methods. Easy to make unlimited cement pottery designs, bird baths, wishing wells, rustic gardens, patio items, etc., without molds. Formulated, chemical coloring, marbling. Free illustrated brochure. Hollywood Cementcraft, 602 Athens, Altadena, California 91001.

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

WORLD'S Largest wholesale supply. Buy from 7853 American, European, Japanese wholesalers. Hong Kong tailored suits. 123 dropship catalogs. Rockbottom prices. Automobiles. Free details. International Buyers, 216-MM Jackson, Chicago 6, Illinois.

DOLLS! Dolls! Dolls! We teach you to repair, make, dress, also how to operate a Doll Hospital. Study at home. Earn while you learn. Or enjoy a fascinating hobby! Free informative booklet. Lifetime Career Schools, Studio MC-76, 11824 San Vicente Blvd., Los Angeles, Calif. 90049.

\$60.00 DAY. Manufacturing concrete posts. Carlayne, 1803 Fremont, Rapid City, South Dakota 57704.

EARN Extra money selling advertising book matches. Sample kit furnished. Lion Matchcorp, Dept. PM-76C, Chicago, Illinois 60623.

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

LEARN Landscaping and the growing of plants. Start a profitable business part or full time. Free information without obligation. Lifetime Career Schools, Dept. MC-76, 11826 San Vicente Blvd., Los Angeles, Calif. 90049.

HUGE Profits! Mail order importing. Free information. ITIS-PM-6, Box 454, Hollywood, Calif. 90028.

MAKE \$32 From 49¢ piece vinyl. PMA-1834 Edgeland, Louisville, Ky. 40204.

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VENDING Machine big catalog. Rake. 1214A West Girard, Phila., Pa. 19123.

SELL Advertising book matches. Write us today; we put you in business by return mail, handling complete line ad book matches in demand by every business right in your town! No investment; everything furnished free! Top commissions daily! Superior Match, Dept. MX-766, 7530 S. Greenwood, Chicago 19, Ill.

BECOME Tax consultant. Our students earn \$1,000-\$3,000 every tax season preparing returns evenings. Accredited State approved National Tax Training School. Monsey P-2, New York.

TRAVELPAK Cartopper camper. Fits most cars. Distributorships available. Cartopper, 123 PM, Napoleon, Ohio.

RAISE Capital fast—easy proven source. Free information. Advisor, Box 48337-PM2, Los Angeles 90048.

BOOKKEEPING System. Substantial profit selling Start Service. Kern, Box 263, North Hollywood, California.

SECRETS! Secrets! Mail order success revealed by internationally famous expert who discovered how to make home business fortunes. Beginners: Get free copy "How to Make Money in Mail Order." Discloses free advertising, profitable products, everything! No obligation. Write Mallico, 1554 Sepulveda, Dept. X707, Los Angeles 90025.

"MAILORDER . . . Stop looking!" Get your own catalogue! Methods, 1817-FD, Lafayette Hill, Pennsylvania 19444.

FREE Report: "609 Unusual, Successful Businesses!" Box 51-PO, Des Plaines, Illinois 60017.

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PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information free. Empire School of Piano Tuning, Box 327, Shenandoah Station, Miami, Florida 33145. (Founded 1935).

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MAKE Extra money — show friends, neighbors—gifts, stationery, Christmas, all occasion cards. Experience unnecessary. Salable samples on approval, free catalog, free name imprinted Christmas card album. Hedenkamp, 361 Broadway, Dept. PM-90, New York.

MAILORDER—Profitable items, drop-shipped. Everything supplied. National Mdrs., 3408½ Motor, Los Angeles 90034.

PACKAGE At home for profit! We supply everything. No "selling." Free home business details. HPC-807HPA, Sunset, Los Angeles 12.

LIQUID Molding rubber also liquid plastic free information. Chaney's, 5415-A San Jose Blvd., Jacksonville, Fla. 32207.

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BIG Money. Learn electric appliance repairing at home in your spare time. How automatic washer-dryers, refrigerators, and all kinds of appliances work, how to find what's wrong, using the Christy Electronic Trouble Tracer, how to fix them. We show you how to get business, what to charge, how to buy parts wholesale. Make \$5-6 per hour by operating your own fix-it shop in your kitchen or basement. No previous experience or training required. Enroll now—pay later from earnings. Send for free book. Christy Trades School, 3214 W. Lawrence Ave., Dept. A-8203, Chicago 60625.

FREE! 128 Page illustrated catalog. More than 2000 name brand items; below wholesale prices. Sell full or part time. Save hundreds of dollars on purchases for yourself! Watches, jewelry, cameras, radios, phonographs, tape recorders, appliances, housewares, cookware, hardware, power tools, luggage, musical instruments sporting goods, toys, many others. Orders shipped within 24 hours. Continuous supply. Send for free catalog now! H. B. Davis Corp., Dept. PM 1177 Main St., Hartford, Conn. 06103.

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SHEET Metal shop—established 20 years — completely equipped — going business with good income 30 minutes from Los Angeles. Write—R. L. Golemon, P.O. Box 128, Temple City, Calif. 91781.

FREE Catalog! Packaging supplies, bags, display racks, etc. Write: Tadco, Lafayette, New Jersey 07848.

DEALERS' Special. Write: Goodall Printing Service, 68-N Joost, San Francisco, Calif. 94131.

FREE Details, unique bookmatch mail-order business, no selling, lifetime commissions. Specialties, P4252 Fremont Seattle, Wash. 98103.

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MAILORDER—Start with Giftime's fabulous giftware color catalogs imprinted with name, address. Amazing bonus free Corning cookware stimulates orders. Lists available. Free catalog, details. Giftime, Dept. PM, 919 Walnut, Philadelphia, Pennsylvania.

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RADIO Mail order. \$50,000 in one month possible. No cost percentage plan. Walthay Box 53-M-7, Los Angeles 90032.

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VACUUM Mold at home. Hundreds full 3-D plastic products. Big profit, spare time, full-time. Free facts, samples. Nationwide Plastics, Box 23321-TA, Los Angeles, Calif. 90049.

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EARN Money advertising. Free information. Box 181M Richmond, Kansas 66080.

YOUR Own, mail order business; from home. Free proof, Taylor, Box 703, Litchfield, Conn. 06759.

LIQUID Molding rubber also liquid plastic. Free information, Chaney's, 5415-A San Jose Blvd., Jacksonville, Fla. 32207.

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WANT To make big money at home? \$10.00 profit in an hour possible with invisible mending. Make tears, holes disappear from clothing, fabrics. Steady year-round demand from cleaners, laundries, homes. Details free. Fabricon, 1585 Howard, Chicago, Ill. 60626.

\$70.00 WEEKLY—home, spare time. Simplified mail bookkeeping. Immediate income, easy. Auditax, 34741a, Los Angeles 90034.

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VENDING Machines. No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, 715 PMP Ensor Street, Baltimore 2, Maryland.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle-1, Wisconsin.

\$200.00 FROM Sheet 1/4" plywood (scrap). 25¢ refundable. Novelties, 610 So. 24th, Elwood, Indiana.

MINK Raising information free. Lake Superior Mink Farm Inc., Superior, EE1, Wisconsin.

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

EARN \$240.00 a month at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1532 Howard, Chicago, Ill. 60626.

CLIP Newspaper items, \$1.00-\$5.00 each. Details free. Walter, Box 1023-P, Erie, Pa.

BIG Money raising fishworms and crickets. Free literature. Carter Hatchery, Plains Georgia.

NEW Instant invisible mending. Learn in one hour, repair in five minutes. Make \$150.00 week. Literature free. Henson, P.O. Box 6136-6, Philadelphia, Pa. 19115.

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OVER \$16.50 An hour. Spare time at home! Rubber stamp industry needs small manufacturers. We furnish all equipment and know-how! Particulars free! Write: Roberts, 1512 Jarvis, Room CR-2-DX, Chicago 60626.

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MAIL Letters featuring real merchandise, get \$12.00 orders in every mail. \$8.00 profit. Everything furnished. Write: Dailley's, Box 4, East Montpelier, Vermont 05651.

MAIL Letters featuring real merchandise—Get \$10 orders in every mail—\$8 profit. Everything furnished. Universal, Dept. 15, 510 First National Bank Building, El Dorado, Arkansas 71730.

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

MAKE Big extra money in spare time as accident investigator. College unnecessary. Keep present job. Work from home. Salary to \$8 an hour, plus expenses. State approved correspondence course trains you quickly. For free information write Liberty School, Dept. B57, 1130 W. Park, Libertyville, Illinois.

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FREE Copy! "Quick profits collecting Old, Odd, Useless items." Send 25¢ handling. Skeeto, Fuquay-Varina, North Carolina.

RAISE Rabbits and fishworms on \$500 month plan. Free details. White's Rabbitry, Mt. Vernon, Ohio.

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

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MAKE Big money taking orders for Stark Dwarf fruit trees. Everybody can now grow Giant Size Apples, Peaches, Pears in their yards. Also Shade Trees, Shrubs, Vines, Roses, etc. Outfit free. Stark Bro's, Desk 30177, Louisiana, Missouri 63353.

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ZIP Code directory 50% profit. Sample, \$1.00. (refundable). Gibson, 405 South Ford, Gallup, New Mexico 87301.

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LIFETIME Income possible without selling. Details free. Moffett, Box 585, Camarillo, Calif. 93010.

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HOW You can net \$250. weekly; Pleasant, mailorder. Write Keystone, Box 106, PMC251, Marshall, Michigan 49068.

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LEARN The secrets of repairing junk batteries. "Fabulous Profits" at home. Details. The Batteryman, P.O. Box 416, Palm Desert, Calif.

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

RAISE Pheasants on \$100 week plan. Little capital and space can make you independent. Free details. Great Central System, Columbus 1, Kansas.

EARN \$240.00 A month at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1586 Howard, Chicago, Ill. 60626.

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AUCTIONEERING—Resident and home study courses. Auction School, Ft. Smith, Ark.

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FREE Book "990 Successful, Little-Known Businesses." Work home! Plymouth-97G, Brooklyn, New York 11218.

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MAKE Money working home. List of 210 firms needing help. Only \$1.00. Lindbloom's, 1508 Erie, Chicago 60622.

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SELL Advertising book matches. Write us today, we put you in business by return mail; handling complete line ad book matches in demand by every business right in your town! No investment; everything furnished free! Top commissions daily. Superior Match, Dept. M-766, 7530 S. Greenwood, Chicago 19, Illinois.

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NEW Keyring cup carrier carries drinks without spilling. Sells wherever drinks are sold. Wonderful souvenirs, advertisers. Satisfaction guaranteed. \$1.00 postpaid. Carsons' Inc., Faxon, Okla.

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MAKE Extra money introducing new runless seamless nylons at amazing low direct-from-mill price. 59¢ a pair! Friends snap them up by the dozen. Write for free sample stocking and kit. American Hosiery Mills, Dept. 128, Memphis, Tennessee 38101.

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FOREIGN Employment: South America, Africa, Europe, Australia, USA. Earnings to \$2,000.00 monthly. Construction, all trades, professions, occupations. Many companies pay fare, housing, benefits, bonuses. Write: Universal, Dept. B-1, Woodbridge, Connecticut 06525.

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CANADA'S Boom. begging for immigrants. 95 page illustrated book gives latest government allowances for children, unemployment pay, job information, business loans, much more. \$2.00. Northern, Box 276, Rouses Point, New York.

JOBS On ships, boats. Best information available, \$1.00. Irv Heyer, 321B SW Salmon, Portland, Oregon.

JOBS Passenger ships, freighters, \$100.00 week. Beginners, men, women. Information: Box 52, Murray Hill Station, New York City 10016.

DIRECTORY Reports. Construction, aviation, shipping, oilfields, government, manufacturing, trucking, etc. foreign—stateside. Helpful information plus job-getting tips on preparing application letters. Unconditional money-back guarantee. Only \$3.00 (\$3.25 airmail) Research Services, Box 6768-PM, St. Louis, Missouri 63144.

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OVERSEAS Jobs—Europe, South America, Far East, etc. 2,000 openings in all trades. Construction, Office Work, Sales, Engineers, etc. \$400 to \$2,500 month. Expenses paid. Free information, write Overseas Jobs, Box 22456, Fort Lauderdale, Florida.

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JAPAN: Mail-Order 26 page catalog, dolls, novelties, Manufacturers' names, addresses \$1.00; 1000 products illustrated trade directory \$3.00. Send cash. Yamagata Office, 814 Togin Bldg., Marunouchi, Tokyo.

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Car stealing made simple!

By Senator Abraham Ribicoff
Connecticut

“... Auto thefts have risen to more than 500,000 cars a year . . . 90 percent of them by amateurs, usually juveniles . . . I firmly believe these figures reflect the easy availability of master keys to anyone who wants them . . . federal legislation is necessary to halt their indiscriminate sale”

RECENTLY, a Westchester County, N. Y., youngster was picked up by the police in the process of unlocking a car door. He already had a police record and, when arrested, was carrying a giant set of master keys.

He admitted to stealing more than 100 autos. He said he specialized in General Motors cars and acknowledged that, with a little trial and error, his keys would fit the ignition of any Chevrolet, Corvette or Pontiac GTO on the road today.

Just as significant as this case is the fact that, after the New York City Police Department's auto-theft squad had broken up



a ring of car thieves in a recent drive, they learned that a few of the culprits had been reprimanded by their own organization. Victims reported that the thieves forced open window vents or otherwise damaged the cars to steal them.

This was considered, by the mob, to be unprofessional conduct for a modern auto thief. The chastised crooks were given several sets of master keys and taught how to use them, and the ring went on to steal 60 cars before being rounded up. Another, more professional ring, using master keys exclusively, later stole 200 cars before the squad brought them to justice.

I mention these cases as prime examples of a new and startling trend in auto theft. And, as any police department knows, auto theft is by no means confined to professionals. The great majority of stolen automobiles—almost 90 percent—are taken by amateurs, usually juveniles who “borrow” them for joyrides.

The number of auto thefts yearly has risen to more than half a million, a jump of 20 percent in the last two years.

If the trend continues, more than a million cars will be stolen every year by 1970—one every 30 seconds.

I am convinced that these figures reflect the recent easy availability of mail-order master keys to anyone who wants them. Auto theft was common enough when thieves had to break windows and jump wires to start cars. Now, for prices ranging from \$3 to \$20, anyone—amateur or professional—can send away for sets of master keys that will open and start almost any General Motors, Ford, Chrysler or American Motors product.

What has me most concerned is that the U.S. government is an unwitting ally in such sales. A number of irresponsible operators not only use the mails to advertise and sell master keys, but also use our mailmen to deliver them.

This is the reason I recently introduced Senate Bill 3176, cosponsored by my colleagues, Sen. Jacob Javits and Sen. Robert Kennedy of New York. If this bill is passed into law, it will become a federal offense to use the mails to sell master keys except for legitimate uses.

Of course, there *are* legitimate purposes, and there *are* some key manufacturers who confine sales to legitimate users. Police departments need master sets for their car fleets and for recovery of stolen vehicles. Other bona fide users are car dealers, fleet operators of taxi cabs, car rental agencies, finance companies and locksmiths.

Sgt. Hubert McKenna, head of the New York City auto squad which broke the theft rings mentioned earlier, uses a simple system for locating legitimate key manufacturers to make the keys it needs. One of his staff, using plain stationery, writes for a set of master keys. If keys arrive without further ado, it's a questionable outfit. If the company refuses to deliver them until he identifies himself properly, he knows it's legitimate and will send in a proper order.

Popular Mechanics, when it asked me to do this article, found a less-than-conscientious manufacturer. Again, using plain stationery, one of the magazine's writers sent away for keys and, without any questions, they arrived by return mail. Pictured on page 57, they will open the door, trunk and ignition locks of any current model General Motors car.

The National Auto Theft Bureau, which has declared its “violent opposi-

tion" to such indiscriminate sale of potential burglar tools, has investigated master-key manufacturers. Under this pressure, one changed his address five times in three years and is still doing a brisk business. Another, the NATB found, had a criminal record.

Some even boast in their ads that *anyone* can make up to \$150 a week in the "lost car-key business."

These are the irresponsible operators that our senate bill will help to put out of business. A federal law is necessary because only one state, Texas, now has a local law forbidding the sale of master keys. Four others are considering it, but even if all states had such laws, the mails could still be used to buy them and states would be powerless to stop it.

The law would help local law enforcement by eliminating the tools that have caused the recent fantastic increase in auto thefts. Professional thieves, unfortunately, we will probably always have with us, but the teen-age thief, the joyrider, must be discouraged by removing the great temptation of master keys. The dockets are loaded with cases in which youngsters are the key-toting culprits. Just to give you a sampling:

Recently, District of Columbia police apprehended several juveniles who were making off with a new Pontiac. They had a ring of master keys which, they boasted, "can open any Pontiac on this street."

A young suspect, already under indictment for two auto thefts, was picked up by Chicago police while monkeying around the lock of a parked car. He had 17 master keys he was "trying out."

The professional thief—as opposed to joyriders—uses the keys for three purposes: to steal the car, parts of the car or what's in the car.

Professional thieves are usually highly organized. Each ring might include specialists—the actual thieves, car strippers and repairmen—salesmen to locate customers who don't ask questions, and businessmen who operate the ring.

Methods vary, but in a typical theft the thieves will locate a car they want, park nearby, then while one man pretends to fix a flat tire on his car and act as lookout, another will go through the master keys on the other car, until one fits. Then, he marks it. Rarely do they steal the car then. Usually they'll come back at night and drive it away.

Most professional thefts are for purposes of resale. However, there is a large underworld market for expensive parts as well as for salesmen's samples. After testing a master key that fits, thieves will follow a salesman around and empty his car when he's out on a call. Luggage, radios, cameras—all are victims of the master-key ring.

Car owners who are not salesmen also

(Please turn to page 192)



MASTER KEYS are tried on locked car until thief finds one that fits. The key is marked, and the thief returns at his convenience to drive it away



JUVENILE THIEVES account for more than 60 percent of car thefts; in some areas for over 90 percent. Easy availability of master keys is a prime factor

Lincoln owners like its precise handling, deplore workmanship

By **BILL KILPATRICK**, Automotive Editor

SOMEWHAT LIKE SPORTS FANS are the owners of the 1966 Lincoln Continental—either all *for* or all *against*. Those who consider their \$5500-plus well spent are lavish in their praise. Those who think of it all as a bad dream say so firmly.

A disgruntled New York executive says he bought the car "because I am stupid." He said it would take six pages to list all the things he considered wrong with it.

On the other hand, an Ohio dentist claims his Continental is "the finest, most beautiful car available in this country."

Topping the list of praises for the new Continental, owners responding to *PM's* survey said they liked best the way the car handles, according this particular attribute an FMR (frequency-of-mention rating) of 44.4 percent. Interestingly, a number of the most indignant, outspoken owners conceded that their cars handled well. Next, owners of the new Lincoln like

the way the car rides (32.6 percent) and the way it looks (28.3 percent). In fourth place on the hit parade was comfort (27.3 percent), which, considered in light of the categories preceding it, gives you a pretty fair summary of why people buy Lincoln Continentals: The car tends to be an all-'round dreamboat.

Not as great in number, but no less heated, however, were comments from owners who see the car as being more like a scow than a dreamboat. Heading the complaint list with an FMR of 19.1 percent was poor workmanship and sloppy quality control. Wind and road noise were ranked next with an FMR of 16.3 percent. Also rated at 16.3 percent on the gripe list was what owners feel is poor economy, although—as pointed out in the Cadillac Owners' Report appearing elsewhere in this issue—you wouldn't think people willing to pay \$5500 and



more for a car would have economy in mind. Another thing many owners aren't exactly wild about is the Continental's air vent and airconditioning setup, a gripe they rank fourth on the "black" list with an FMR of 10.6 percent.

Lincoln owners taking part in PM's survey drove a total of 1,258,449 miles over all kinds of roads during which they averaged overall 11.1 mpg, a figure bound to warm the hearts of petroleum company stockholders.

Specific comments of 1966 Continental owners are in order of frequency mentioned. Boldface comments are mine:

"The car handles beautifully. It's a heavy car, yet gives the impression of medium size and sports car action."—Missouri, retired.

"Handles even mountain roads easily."—California businessman.

"Feel I'm in control, regardless of speed."—Missouri businessman.

"No car 'sits' on the road as well as this new Lincoln."—Massachusetts executive.

Part and parcel of the handling "package," although ranked second on the accolade list, were the car's riding qualities.

"This winter the Lincoln really proved itself to me. During our trip from Boston to Miami we drove long hours without fatigue."—Massachusetts builder.

"A smooth, soft-riding car."—California physician.

"Nontiring over long distances."—Kansas attorney.

Ranked third on the owner praise list was the Continental's styling.

"Clean and simple."—Minnesota salesman.

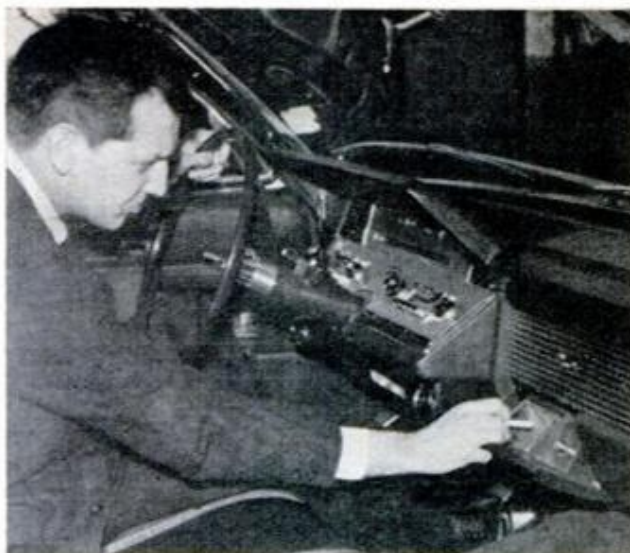
"In good taste."—California fireman.

"Nice smooth body lines."—Oregon businessman.

"I think it's the most beautiful car on the road."—Kentucky businessman.

►Oh, it's a dazzler. Even supposedly jaded New Yorkers gave PM's test car the eye. So glad the car's stylists spurned what must have been a temptation to festoon it with chrome.

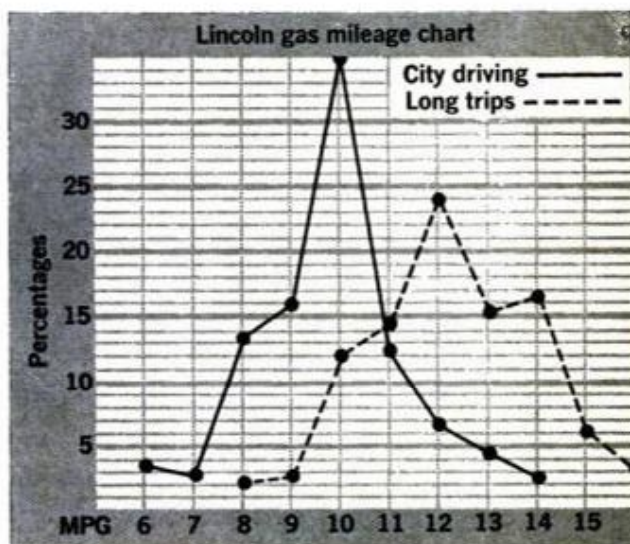
Comfort was ranked next and again we'd have to agree, although we're not



SOMEWHAT AWKWARD is the position of driver's ashtray, a gripe noted by many owners. Overall dash design, however, was deemed handsome by most owners



BIG, DEEP AND CARPETED is the Lincoln's trunk. Emergency jack and appropriate tools are bracketed on one side and are both handy and out of the way



DEFINITELY NO MISER is Continental's big 340-hp powerplant. Owners reported an average of 11.1 mpg in 1,258,449 miles of in-town and long-trip driving

Owners are wild about:

Handling	44.4%
Ride	32.6
Styling	28.3

But aren't wild about:

Workmanship	19.1%
Wind/road noise	16.3
Poor economy	16.3

sure a mobile Barcalounger is necessarily a good thing. Sure is comfy, though.

"Remarkable driving comfort."—Texas housewife.

"Seating is the most comfortable I've ever experienced in a car."—Ohio salesman.

"Front and rear seats provide perfect comfort."—Indiana businessman.

Continental owners were also pleased with the car's performance.

"It performs beautifully."—Colorado doctor.

"Has more zip than other cars."—Michigan, retired.

► That 462-cu.-in. engine—the industry's biggest—helps. It cranks out 340 hp.

"Acceleration is almost effortless."—Kansas, semi-retired.

"Excellent pickup for a 2.5-ton vehicle."—Connecticut dentist.

Ford's "quiet" kick in its advertising and promotion campaigns has obviously filtered upstream. If Fords are quiet, the company's prestige leader has got to be even quieter. Right? In any event, more agree than disagree.

"Most quiet car I've ever owned."—California teacher.

"Can barely hear the engine."—New York businessman.

Turning now to owner complaints about the 1966 Lincoln, poor workmanship heads the list.

"Quality of workmanship is terrible. If Henry Ford could know of the junk the company that bears his name is building he'd turn over in his grave."—California transport operator.

"Vinyl roof has wrinkles in it and the exterior paint is very poor."—Maine supervisor.

"The interior is just falling apart."—Louisiana sales representative.

"The heating system was installed wrong at the factory and had to be reversed."—North Dakota contractor.

► A Ford spokesman told me such bizarre nonsense happened embarrassingly often early in the model run, but that since the turn of the year these problems all but disappeared.

Despite rather elaborate insulation and a determined effort to keep things quiet, many owners feel Lincoln stylists overlooked a few things.

"Above 45 mph, wind noise is extremely bad."—Indiana publisher.

"Even with all windows closed I get a lot of wind noise."—California broker.

"Car rumbles."—South Carolina businessman.

Tied in second place on the gripe list was what owners felt was poor economy.

"Sure would love to see the car get better mileage."—California manager.

► But consider the weight and engine size. The car wasn't designed for economy.

"Gas mileage is much poorer than in

(Please turn to page 174)

Summary of Lincoln Owners' Reports

Excellent 70.1% Good 17.2% Fair 7.8% Poor 4.9%

Best-liked features:

Handling	44.4%
Ride	32.6
Styling	28.3
Comfort	27.3
Performance	24.6
Quietness	15.0
Brakes	14.4
Interior styling	6.4
Weight	5.9
Room	5.9

Least-liked features:

Workmanship	19.1
Wind/road noise	16.3
Poor economy	16.3
Airconditioning/air vents	10.6
Heater/climate control	7.1
Dealer service	5.7
Glove compartment (too small)	5.0
Transmission	5.0
Performance	5.0
Engine vibration	4.3

Most like to see changed:

Gas economy	12.0
Instrument panel	8.5
Styling	8.5
Climate control system	7.0
Workmanship	6.3
"Idiot" lights	5.6
Air vent locations	5.6

Add protective trim (doors). 4.9%

Ashtray location	4.2
Car traded in:	
Lincoln	51.2
Cadillac	19.8
Thunderbird	8.1
Oldsmobile	5.8
Pontiac	3.5
Others	11.6
Dealer service:	
Excellent	51.8
Average	31.5
Poor	16.7
Buy from dealer again?	
Yes	81.7
No	18.3
Buy another Lincoln?	
Yes	90.0
No	10.0
Bought Lincoln because:	
Price or trade-in	28.0
Styling	21.5
Dealer and service	16.1
Past experience	8.6
Something different	6.5
Family wishes	6.5
Interior styling	5.4
Size	5.4
Considered other makes:	
Yes	56.4
No	43.6

Other makes considered:

Cadillac	77.3%
Chrysler	16.4
Oldsmobile	8.2
Thunderbird	4.5
Buick	2.7
Rolls-Royce	1.8
Others	5.5
Own another car?	
No	70.5
Yes	29.5
Make of other car:	
Chevrolet	16.7
Ford	16.0
Mercury	15.3
Thunderbird	10.4
Mustang	9.0
Cadillac	9.0
Oldsmobile	8.3
Lincoln	7.6
Pontiac	7.6
Plymouth	4.2
Buick	4.2
Dodge	4.2
Volkswagen	2.8
Others	15.3
Model of car:	
Sedan	69.0
Hardtop	28.4
Convertible	2.6
Total miles driven:	1,258,449



Canine Charioteers

Bouncing over impossible terrain on bone-rattling wheeled carts, dog mushers have made sledging an all-season sport

By JOHN BOYKIN

WITH THE CRY OF "MUSH!" shrill in the California air, harnessed teams of dogs race at top speed, and behind them, bouncing and skittering over the rugged mountain terrain, is a three-wheeled "sled" and a driver hanging on for dear life.

To the casual observer it looks like a cross between a cross-country chariot race and Peary's dash to the North Pole, but to "dog mushers" it's the newest wrinkle in an exciting, challenging sport.

Sled dog racing has long had a small but ardent following in the Sierra Nevada Mountains but until recently it has been hampered by the need for ideal snow conditions. With introduction of the wheeled "sled," now there are more than two dozen teams in California competing all year long over all sorts of terrain.

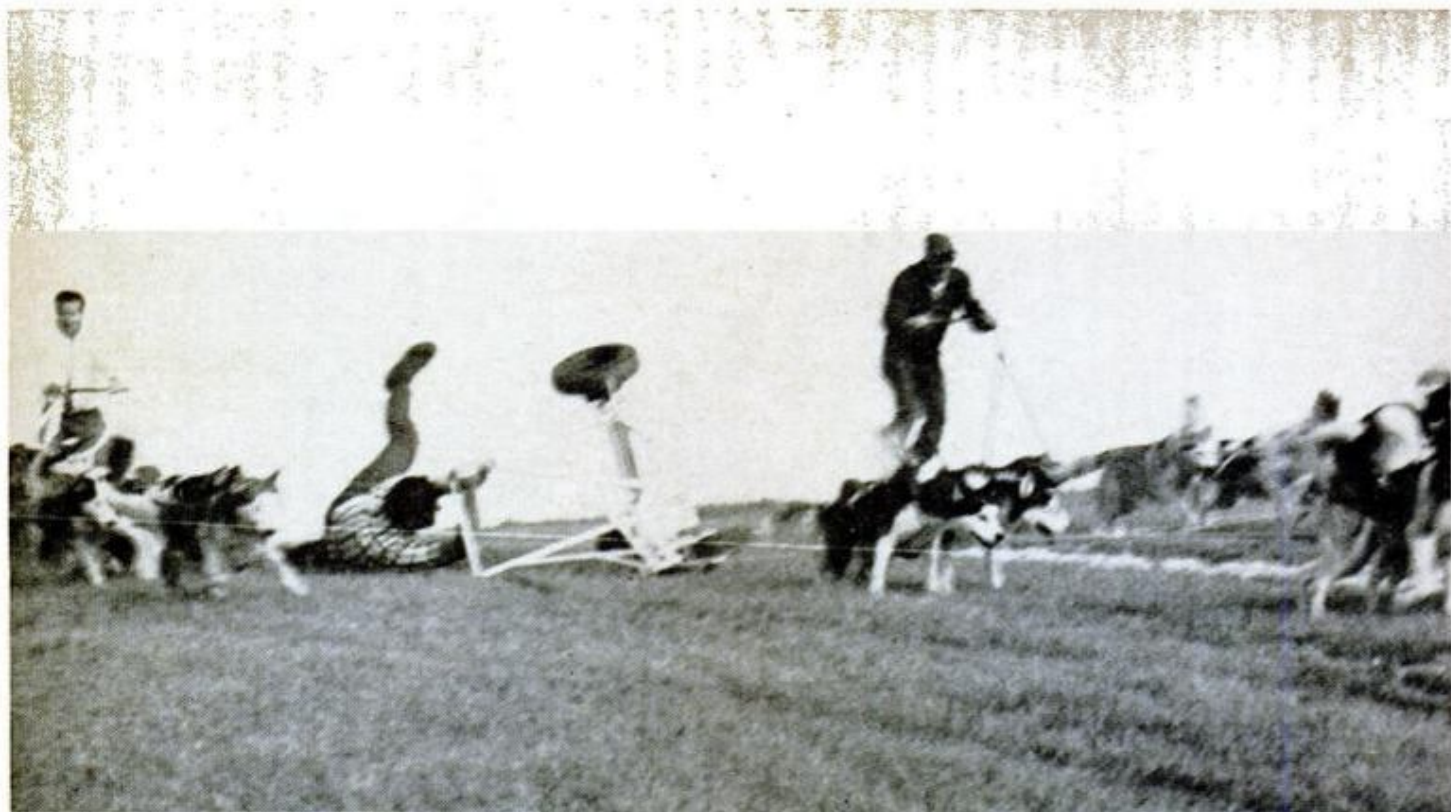
The wheeled sled is a short and narrow

frame of welded steel tubing with two fixed wheels in the rear and a swivel wheel on the front. Unlike a snow sled, it is equipped with brakes to prevent it from gaining on and overrunning the dog team.

Sponsored by the Western Dog Mushers Assn., there are five major meets a year in California and Arizona; a local club sets the course and hosts the contestants.

A typical meet includes races for children, juniors, women, and long-distance marathon and speed races for the men. A popular event is the beer race, where cans of beer are set out on a course and the racers ride the sleds, swooping down to pick up the cans at full tilt. The winner of this event receives a beer-can opener.

Although the open events have no limit on the number of dogs pulling the sled, a nine-dog team is considered large. Five and



ROUGH AND TUMBLE COMPETITION on dry land is newest wrinkle in sled dog racing. Using a three-wheeled tubular-steel cart, racers pit their skill and dogs in long-distance cross-country runs that look like smaller scale (but just as wild) Roman chariot races. Growing in popularity in California, dog mushing is now a year-round event, with local clubs competing all over state. Teams of three to nine dogs are specially trained



WHEELED SLEDS have not replaced the snow sled, and snow racing is still popular, but the three-wheel carts, which are little more than a steel frame with a steel mesh step for the driver, have enabled snow mushers to give added dimension to the sport





COLLAPSING AT FINISH LINE, a mud-spattered driver still clings tenaciously to his sled. Another driver and a spectator attempt to pry his hand loose so that he can be moved to first-aid tent and revived

three-dog teams are much more typical.

Siberian huskies, malamutes and sam-oeds are the common breeds of dog seen on the racing circuit, but with the wheeled sleds you now see teams of Irish setters, hounds and German shepherds.

"There's more action in a dirt race," says veteran musher, Bob Richardson of Riverside, Calif. "The dry land courses are laid out through the same pine and

boulder country as the snow races, but the terrain is much rougher before the snow smooths out all the rills and bumps and covers the jagged rocks. Some of these races are so rough the sleds vibrate to pieces. In a recent race one fellow had his wheeled sled split in two about a half mile from the finish. He completed the race running behind his team with half of his cart in each hand."

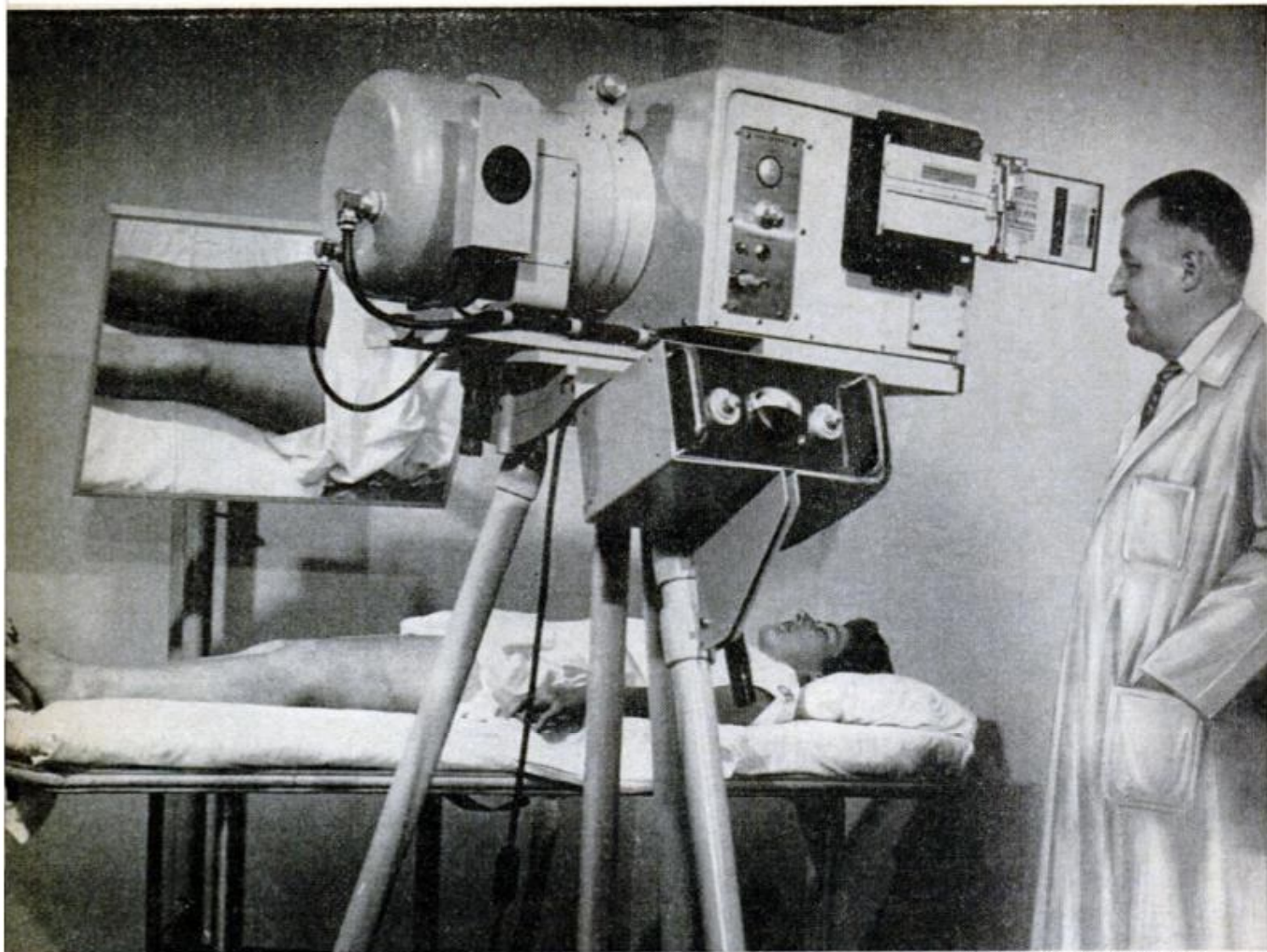
Rugged racing is a combination of snow and dry land. Last year's big event at Lake Tahoe, a 15-mile race with a 4000-foot climb, was supposed to be a snow race, but a thaw had turned the first four miles into a sea of mud. Snow sleds were transported to the snow line, and the race began with the wheeled carts. The wild dash through the mud was fun for the spectators, but brutal for the drivers. One contestant lost his boots in the mud and finished the race in stockinged feet, suffering frostbite from the 10 miles of snow. Bob Richardson suffered several broken ribs.

Slogging his way to the snow line, Bob stopped to change sleds. To save time he wrapped the lines to the team around his wrist instead of snubbing them to a tree. He was wrestling the snow sled into position when another team went yelping past. His dogs took off in pursuit, running pell-mell with Bob bouncing along behind. He slammed into a boulder, breaking his ribs, and finally managed to stop them by plowing his shoulder into the snow.

"It's a rough and tumble sport," says Richardson, "but it's fun. And with the wheeled sleds it should spread all over the country." ★★★

FOLD-AWAY HANDLES make the wheeled carts easy to transport on the top of a car with dogs riding inside





American Cancer Society Photo

THERMOGRAPH MACHINE can accurately detect breast cancers in early stages by measuring differences in skin temperature. Machine takes picture, called thermogram, first new detection method in several decades

HA VE YOU HEARD ABOUT a device that can peer into the ground and “see” a lost city buried underneath? Or another that can predict the eruption of a volcano? And still another that can be focused on your forehead from a distance and tell instantly whether you are likely to suffer a stroke?

Incredible as it sounds, these are some of the extraordinary new jobs now being performed by one of man’s oldest servants, the ubiquitous camera. In a host of fields, from agriculture to medicine, the once-simple camera has outdone James Bond and grown into an amazingly versatile tool that sees in the dark, pokes around corners, penetrates the surface of the earth, moon, planets, and performs

other feats that nobody would have thought possible a few years ago.

These sophisticated cameras are products of a new science with a way-out name—electro-photo-optics—a marriage of scientific techniques that is revolutionizing the world of photography. Visit one of the nation’s two dozen major optical plants and you will find, along with old-time lens grinders, an array of such modern scientific machinery as computers, lasers, fiber-optics devices, and sources of invisible light. At Itek Corp. of Lexington, Mass., a leading manufacturer of advanced cameras, the president, Franklin Lindsay, pointed to the computer and laser as the technological cornerstones in the manufacture of the new cameras.

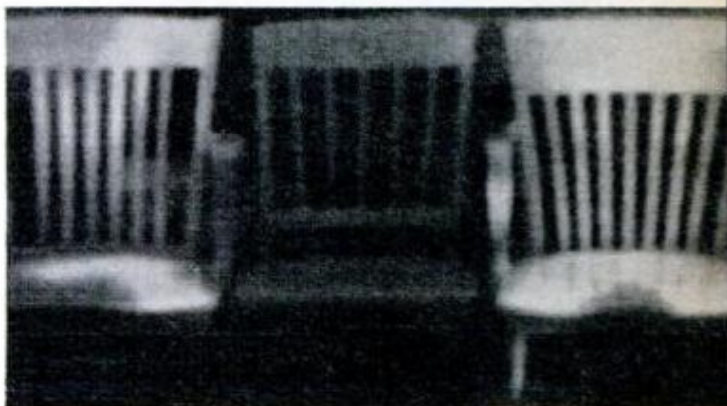


American Cancer Society Photo

THERMOGRAM PICTURE shows cancer as white spot on breast. Difference in skin temperature produces image

"Computers speed up design calculations fantastically," he said, "enabling us to make in a matter of hours instead of months lenses sharp enough to read an eye chart at a quarter of a mile. As for the laser, we use it to test large lenses to an accuracy of one-millionth of an inch, something we could hardly do before."

But that isn't all that marks the new breeds of camera. In many of them a startling new principle is involved. Instead of gathering light directly onto film in the conventional manner, some cameras use the photo-sensitive surface of a vacuum tube instead of film. With it they convert an image formed by invisible infrared or ultraviolet rays, or even gamma rays and



INFRARED CAMERA takes picture of empty chairs and shows which were sat on long after people have left

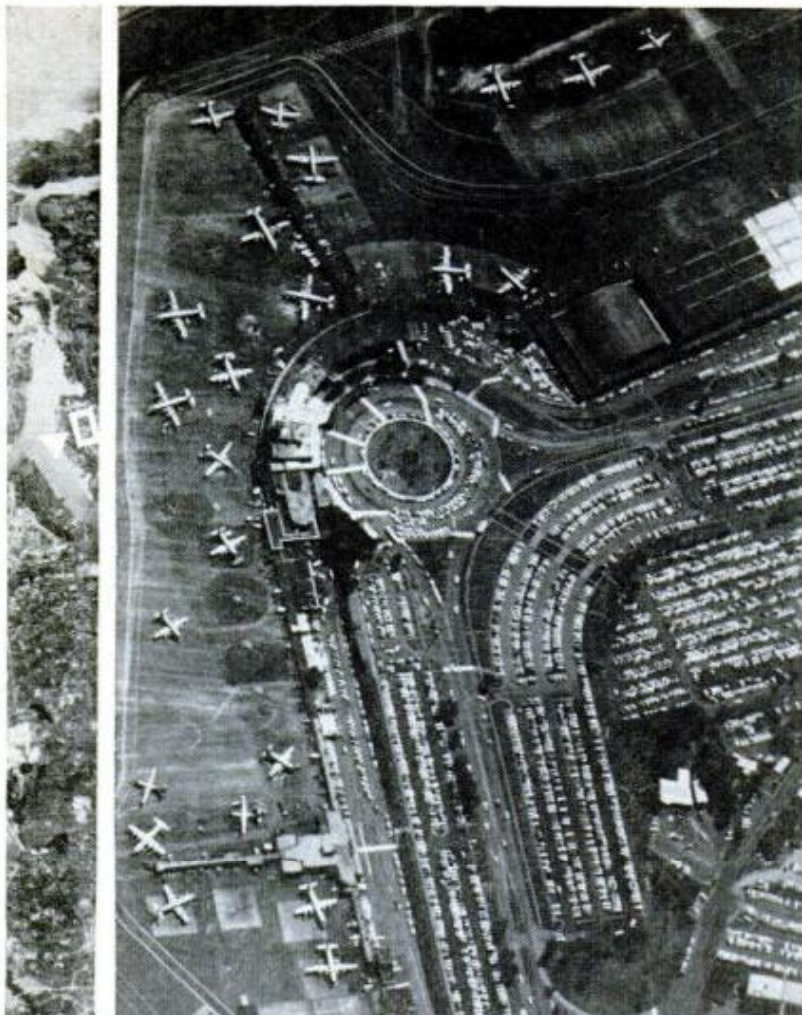
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By LEE EDSON

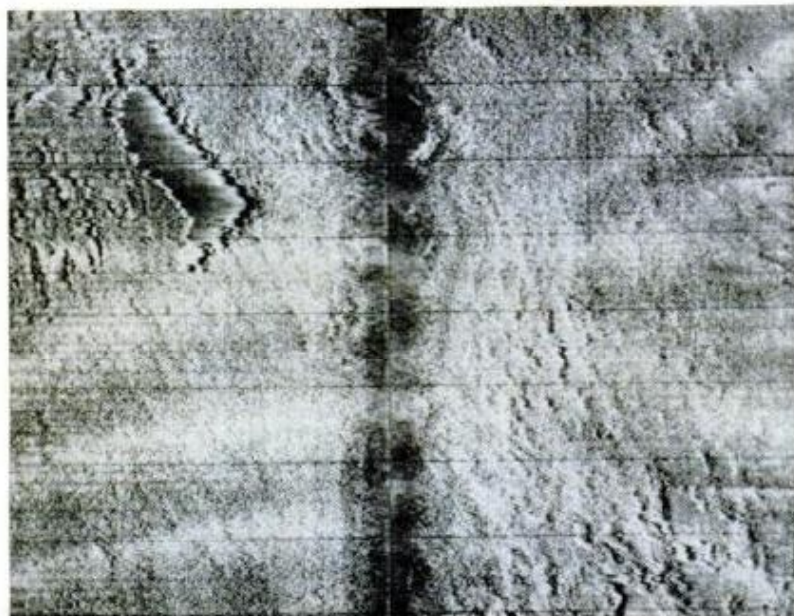
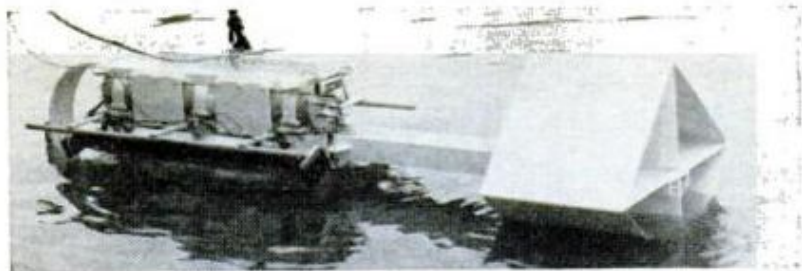
d future—from ocean floor to outer space

X-rays, to a pattern of electrical impulses. A TV camera or similar device then scans this electrical pattern and converts it into a visible image which can be preserved on film. Scientists call the new instruments "sensor cameras," or image-converting devices.

What do some of these space-age cameras look like? One of the latest infrared cameras manufactured by the Barnes Engineering Co. of Stamford, Conn., is about the size and shape of a TV camera, which senses the heat rays emitted by an object or a person. This camera is an outgrowth of the well-known military infrared detector, once used to find tanks and ships in the dark. Today, as a result of numerous developments, the camera



HORIZON-TO-HORIZON picture can be enlarged with remarkable clarity. Picture of Washington National Airport was blown up from small area (white rectangle) in high-altitude strip photo at left



NINE-LENS CAMERA photographs target through nine different filters simultaneously. Two frames above of identical site show remarkable difference. Stream, barely visible in top photo, shows up vividly through another filter

◀ **UNDERWATER CAMERA** can map ocean floor down to 20,000 feet. Seeing with sound, at depths too great for light to penetrate, it bounces signals off bottom to give three-dimensional view. Picture is roughly one-half by one mile



HOLOGRAM DISPLAY: Laser at left illuminates hologram; reconstructed images at right are tank and frame

element that picks up the heat is no bigger than the head of a pin and is so sensitive that it can turn a fraction of a degree of temperature into a picture.

As an example of what the camera can do, consider the photograph of three empty chairs shown on page 67. In two of them you could see a heat portrait—clear evidence that the chairs had been occupied. Indeed you could tell approximate size and shape of the persons who had been sitting there, and that one of them had had his legs crossed—even though he and his companion had left the room 15 minutes before the picture was taken. This “past-seeking” camera has shown its mettle in experiments by photographing an empty parking lot and revealing how many cars were parked there earlier simply by the traces of cool spots where the cars had shielded the ground from the sun.

The new infrared cameras have already rung up an impressive record in medicine in the last few years. Recently, at a conference of doctors sponsored by the New York Academy of Sciences, it was revealed that thermography, as the new heat photography is called, is now able among other things to distinguish a dead tooth from a live one, gauge the depth of a burn, detect hidden bruises in unconscious patients, or spot small cancers on the breast earlier than would be possible by other means.

At Columbia Presbyterian Medical Center in New York, Dr. Ernest H. Wood,

Director of Radiology of the Neurological Institute, has used an infrared camera to pick up early signs of oncoming stroke, an affliction which kills 200,000 Americans a year and disables many more. Most normal subjects, the doctor found, show virtually no difference in the heat pattern generated on both sides of the face and forehead. But in the case of certain stroke victims and those suffering from various other vascular disorders he found that one side of the forehead was slightly cooler than the other. Dr. Wood says that when this loss of heat occurs it is due to the reduction of blood-flow through the carotid artery, the chief supplier of blood to the brain; and this in turn is due to the thickening of the arterial walls. He has discovered that with the thermocamera he can detect the significant thickening at a relatively early stage—when the blood vessel is 50 to 60 percent closed—thus allowing time for the doctor to administer drugs that may prevent the blood vessel from narrowing critically and causing a stroke.

At M.I.T. Dr. Harold Edgerton, who designed underwater cameras for explorer Jacques-Yves Cousteau, has built a device that uses sound to look through the bottom of the sea. Unlike ordinary ships' sonar, which is designed merely to “see” through water, Dr. Edgerton's device generates sound waves in short bursts powerful enough to penetrate the material of the sea floor. When these waves

(Please turn to page 171)



THE COLDEST SWIM IN THE WORLD

Braving the dangers of subfreezing water, scientists probe Antarctica's ice field with divers and a unique recording studio to bring back sounds of the Weddell seal

By DAVID LAVALLEE

THE VOCAL SOUNDS made by the Weddell seal seem very much like the whistle of the Hoboken ferry.

This bit of information may not send up sky-rockets in the world of science, but it took two expeditions to Antarctica, involving dozens of men, the New York Zoological Society, Wood's Hole Oceanographic Institute and a carload of special equipment to find it out.

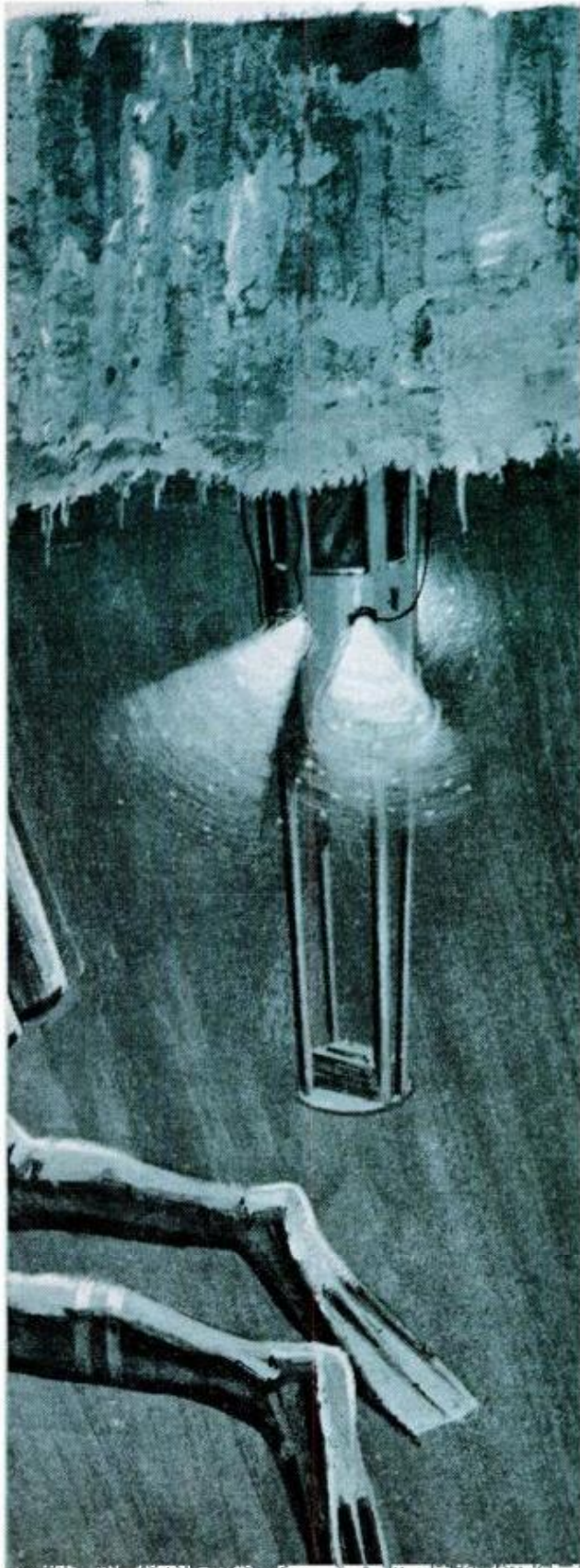
I was a diver on both expeditions, and on the first, in 1963, I was also chief guinea pig for a series of microbiological studies to determine how much the human body could endure in the subfreezing water.

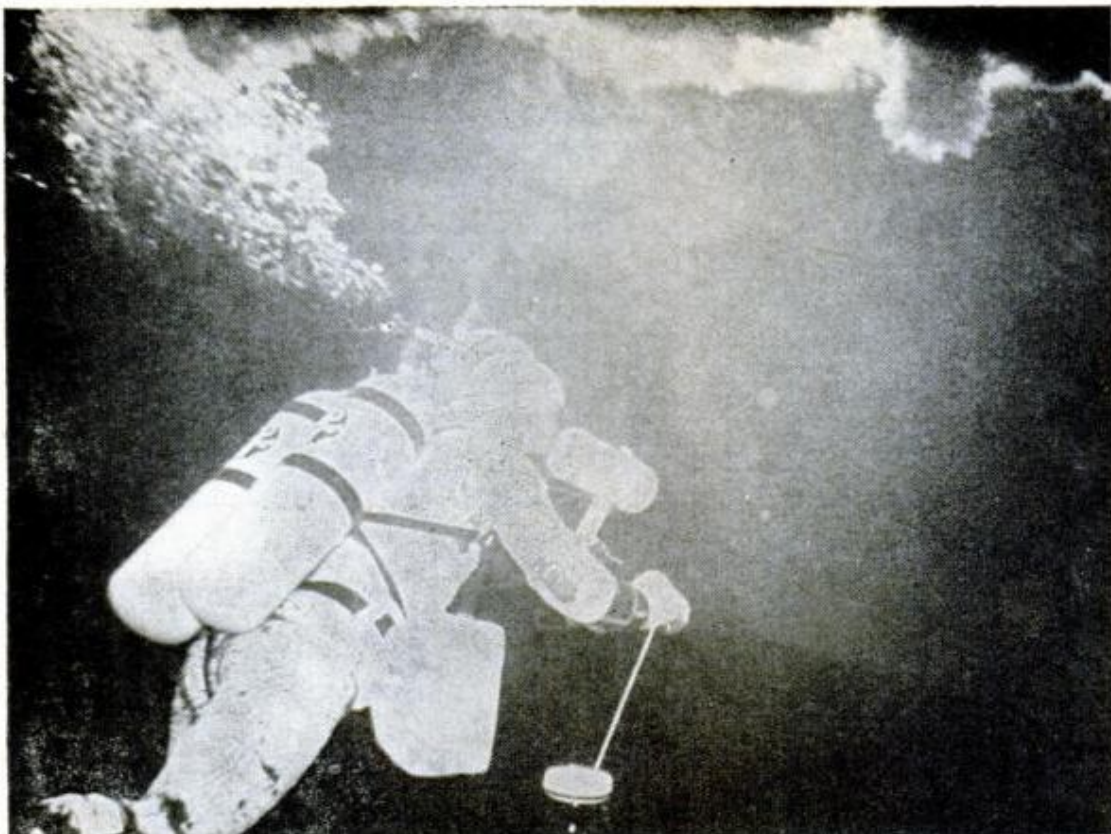
With Dr. Carleton Ray, curator of the New York Aquarium, in charge, we set up house-keeping at McMurdo Sound in October. This is spring in Antarctica, but there was still seven and a half feet of ice covering the bay, a solid platform for the small insulated hut from which we worked. The water under the hut was 335 feet deep.

The initial tests were a torture. With electrocardiograph and temperature leads taped to my ankles and wrists I submerged in the four-foot-square ice hole in the floor of the hut. The water was 28.6° F. I was to stay submerged as long as I could stand it. When the water first seeped into the wet suit it felt like fire and then

SEALS AND DIVERS use the same exit hole in the ice, and on one occasion, with his regulator jammed and unable to breathe, the author found his only escape route occupied

Illustration by Howard Shafer





BENEATH ANTARCTICA'S ICE FIELD a diver seeks out the seals in their own environment. The water is crystal clear, and the light penetrating the ice creates a cobalt blue twilight



SCIENTIST AND SUNBATHING SEAL meet on the ice near McMurdo Sound, part of the study of the Weddell seal in an attempt to learn how they can zero in on a breathing hole

SUBMERGED BENEATH HEAVY ICE, the unique observation chamber has six windows for viewing. Hydrophones are attached to the four long arms extending below the chamber





SUBZERO WATER limits time a diver can work, while scientist in chamber observes in relative comfort

it became intensely cold. I could see Dr. Ray on top of the ice, busily checking gauges, taking air samples and making notes. Usually, I could stay in the water about 30 minutes. On one occasion, after surfacing stupefied with cold and racked with shivers, I heard Dr. Ray—the dedicated scientist—announce gleefully that another few minutes would have produced heart arrest.

There were numerous Weddell seals in the area and, after the initial tests to insure the functioning of our equipment, we made dives to study the conditions of their habitat.

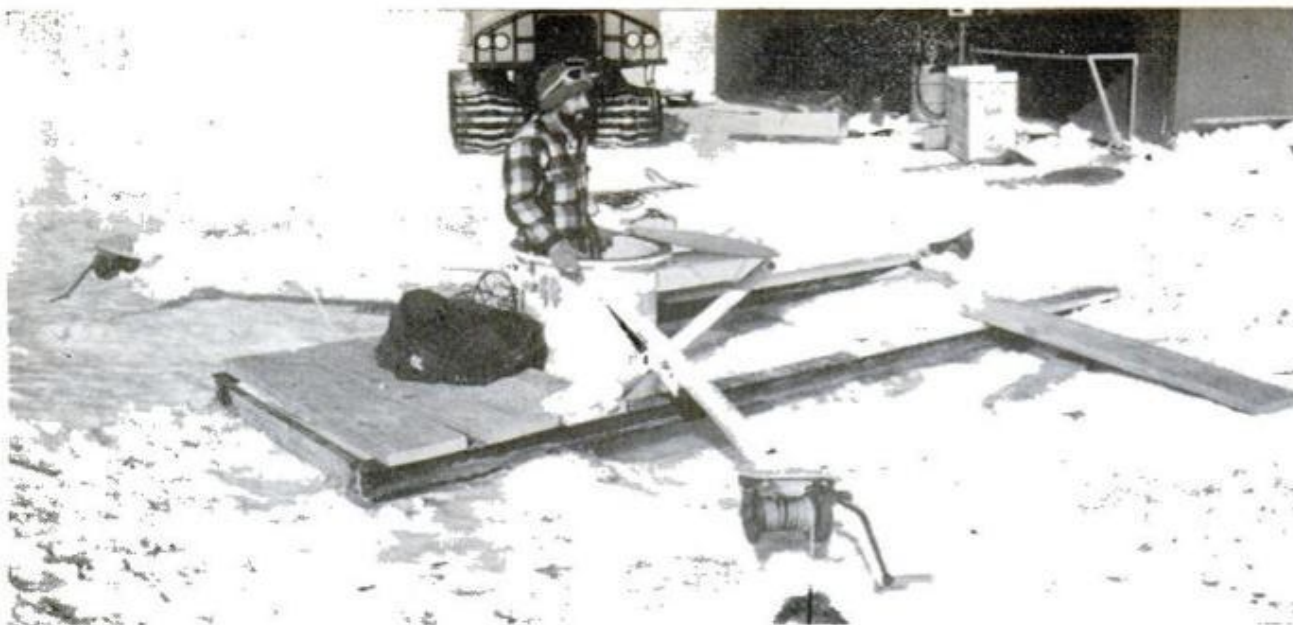
The water was crystal clear and the light penetrating through the ice created a deep cobalt twilight. The underside of the ice was covered with a two-foot layer of fragile crystals in which diatoms (microscopic unicellular algae) lived, giving the ice a light khaki color.

We photographed the activity of the seals and recorded the sounds they made. But the roaring of our air regulators interfered with the recordings.

On the second expedition—in 1964—we solved this problem.

Dr. William Scheville and William Watkins, noted acousticians from Woods Hole, joined the project, and this time we were equipped with SOC (sub-ice observation chamber), a cylindrical steel cabin with six large windows in the walls and a long steel access tube leading to the surface of the ice. It was cramped quarters, but two men could sit in the cabin and observe the seals without disturbing them. And four long arms extending from the bottom of the cabin held the listening devices, eliminating unnatural background noises.

Since SOC was actually a long buoyant tube, a special rig was required to force it down into the water. Three long arms, like a tripod, were bolted to the top of the access tube. At the ends of these outriggers were hand-powered winches, with cables attached to a length of pipe. A hole was drilled in the ice under the end of each arm. The sections of pipe were lowered through the holes and then hauled up until they were horizontal against the underside of the ice. It was then a simple matter of cranking the winches to push the observation cabin down into the water until only the top of the access tube was



WINCHES ON TRIPOD ARMS activate cables attached to pieces of pipe under ice keeping SOC in position

visible above the large hole in the ice.

We installed the chamber about five miles from McMurdo. Three holes were cut in the ice with chain saws, one for SOC, one for divers and seals and one for the recording hut.

The installation of the chamber created tension. If the windows frosted, if it couldn't be held in place, or if there were design deficiencies, it would be worthless.

It was perfect. The cabin was dry and the windows were clear. The cabin was diffused with a deep blue light from the windows. In every direction I could see hundreds of yards of the ice ceiling. The underside had the characteristic layer of soft ice crystals, like a thick cloud cover.

From the beginning the seals were undisturbed by the steel interloper in their icy submarine world. They used our hole in the ice for breathing, and we observed them coming and going. They could glide up from the depths, slip past the window, sometimes with a glance in our direction, performing a slow ballet. After breathing for four or five minutes they would back-paddle clear of the hole and dive.

The chamber, equipped with powerful floodlights, also allowed us to observe and photograph a variety of marine life aside from the seals. I remember a flotilla of pale, ghostly fish drifting by, making absolutely no body movements in their swimming. There was also a giant medusa jellyfish with a body that appeared to be more than three feet in diameter. As it caught the light from the seal hole, the scalloped skirts were edged in purple

fading to pale lavender across the top, and they rippled and flounced in slow motion. Drifting past the window and disappearing into the gloom, it trailed tentacles that were easily 40 feet long.

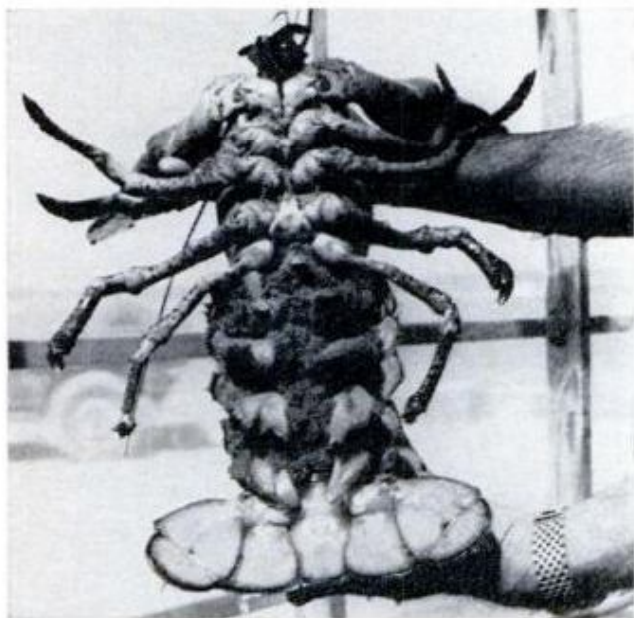
It was during the free dives and the dangers of equipment failure that the safety and practicality of observing from the chamber was most apparent. During a photographing dive I was carrying two 1000-watt floodlights when one of the cables entangled my regulator and valve block. The air stopped abruptly. I headed for the ice hole, but it was occupied by a huge bull seal replenishing his supply of oxygen. We had seen these big bulls in mortal combat, and I knew that they could be vicious when disturbed. But I had to have air and I was on my way, ready to drag the bull out of the hole and take my chances with his temper, when the line was suddenly cleared and I was able to breathe.

Although it was not ascertained that seals use sound to find their food and breathing holes, the hydrophones on the SOC produced excellent reproduction of seal sounds. A characteristic Weddell sound starts out as a high whistle descending the scale and lowering in repetition rate until it bounces out of the sonic range in low animal grunts. Other sounds are described as chirps, hoots and high-frequency clicks.

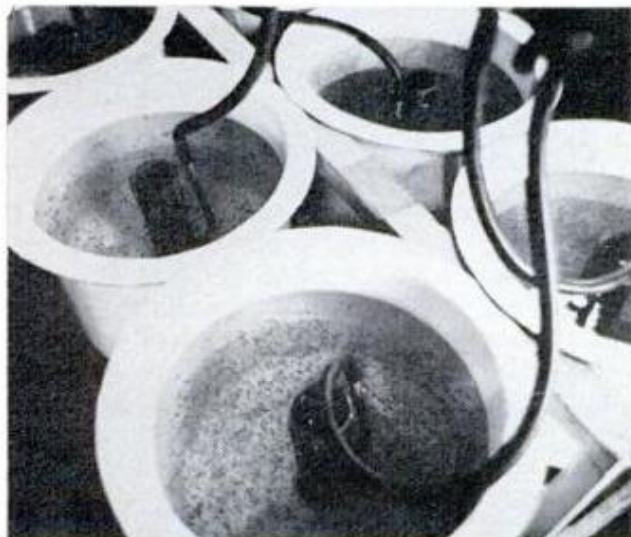
Listening to the tape of a dominant Weddell whistle, a Seabee stationed at McMurdo announced, "That's the Hoboken ferry. I'd know it anywhere." ★★ ★

A Nursery For Lobsters

The private, sea-green world of the lobster is relentlessly probed at a hatchery research station on Martha's Vineyard, an island that lies south of Cape Cod, Mass. Since 1949, when the hatchery was opened, an estimated 250,000 lobsters have provided scientists with information on mating habits, migration patterns and what happens physiologically during the various stages of development. Many of the specimens are born at the hatchery; others are brought in from traps. In either case, they stay only a few weeks before being returned to the sea. Only a few fully mature lobsters are kept on hand.



PREGNANT FEMALE, caught by a local lobsterman, will reside in special tank until she gives birth



NEW-BORN CRUSTACEANS in hatching tanks. Water pumped in from the sea is constantly recirculated

JULY 1966



IF BORN IN THE OCEAN, these tiny specimens would float to surface and make a meal for hungry fish



TWO WEEKS OLD NOW, they're heavy enough to sink to bottom, where chances for survival are better



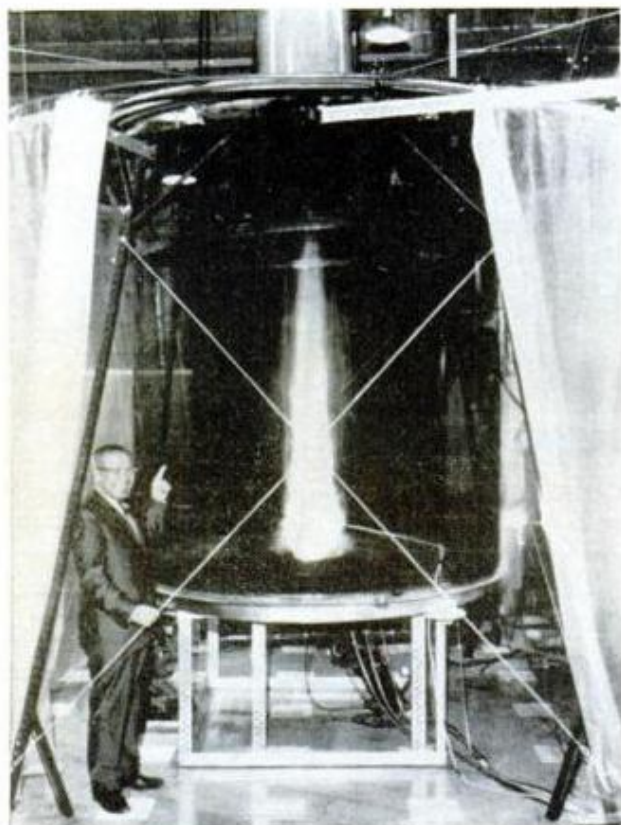
CALIPER IS USED to measure carapace (upper body) in check of growth rate of this year-old crustacean



SPECIMENS ARE TAGGED to provide clue to wanderings. Only trouble is, they shed shells frequently



New and sleek from Germany is this experimental Opel GT sport coupe, unveiled in the U.S. at the New York International Auto Show. Powered by an equally new 116-cu. in., four-cylinder, overhead-cam engine, it features aerodynamic lines, a four-speed box, an experimental coil-spring rear suspension, molded bucket seats and retractable headlamp covers.



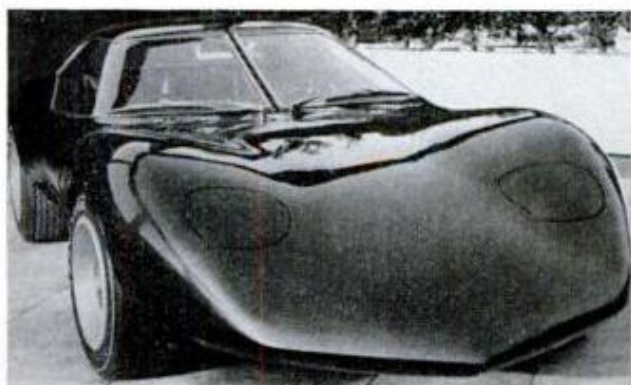
Test-tube tornado, which simulates the conditions that cause destruction by twisters, can be created in the space science laboratory of Catholic University of America. A core of air is made to spin about 50 mph in a rotating "cage" nine feet high, creating a vortex like that of an actual tornado.



Bulbous bow on the destroyer **Willis A. Lee** is a sonar dome that protects sensitive submarine-seeking equipment mounted below the waterline. The inch-thick reinforced rubber walls of the dome have acoustical properties which permit sound to pass through with minimum distortion. The dome, 10 feet high and 20 feet long, was built by B. F. Goodrich Company.



No-runway takeoff. Poised on top of a ZELL (Zero Length Launch) pad at Edwards Air Force Base, Calif., this Lockheed F-104 Starfighter is set to be launched into the air. Secret U.S. tests were made in 1963 (when this photo was taken) and were announced recently as a new series of Super Starfighter ZELL tests got under way.



Mighty low is this experimental design project by General Motors British subsidiary Vauxhall Motors. Called the XVR, the car measures a scant 40 inches in overall height. Access is through special doors that pivot up and out from a single central windshield strut. Designers claim easy entrance and exit, plus unusual driving and riding comfort.



Snow and ice are blasted off of roads with this new gas turbine snow remover. The vehicle blows a 1300° F. gas stream on the road surface. Made in France, the Berliet Defrosting Vehicle has two driver compartments. The operator doesn't have to change the direction of the car; he just changes his seat when he wants to go backward or forward.



Dog pod enables the favorite pet of a California motorcyclist to ride along on the back of his bike. Bob Nist used a plastic radar pod, padded the bottom with foam rubber, attached a windshield from a motorcycle helmet and made roll bars from windshield brackets. He mounted the pod on one-inch board and attached it with wingnuts to the luggage carrier. The pod is interchangeable between bikes and can be removed easily.

Cadillac owners claim you get a lot to like

By BILL KILPATRICK,
PM's New York Automotive Editor

THE PAPER IS OLD, its edges yellowed and brittle to the touch. Yet the print is clear, the message as modern as a moonshot:

"Smooth-riding, powerful, absolutely dependable, the Cadillac is a car surprising alike in performance and cost."

This quote from a 1904 advertisement for the car that once billed itself as the "standard of the world" accurately summarizes the opinions of most 1966 Cadillac owners surveyed by *PM*. Even as the copywriter of over 60 years ago claimed, Cadillac owners still find today's car "smooth-riding, powerful . . . dependable" and they like its performance.

But many owners—based on what they feel they got for their money—think "surprising" is hardly the word to describe the \$5000-plus cost of the car.

"It's time the makers of all cars start producing a car worth what they ask for it," wrote an Illinois businessman.

A Massachusetts claims investigator, however, said of her 1966 two-door Cadillac, "It's an excellent car from the front to rear bumper and in my opinion has no equal."

What has no equal, owners surveyed by *PM* feel, is the way the car handles, an attribute to which they accorded an FMR (frequency-of-mention rating) of 36.8

The affluent folk like:

Handling	36.8%
Comfort	34.4
Ride	29.4

But don't like:

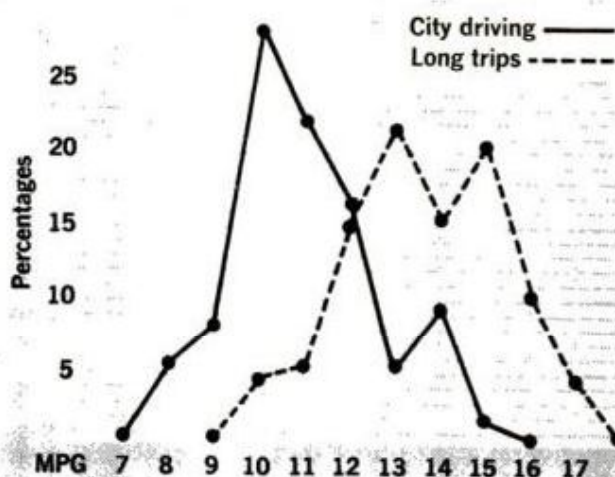
Wind noise	9.8%
Rattles/noise	9.8
Climate control system	8.9

percent. Next in order, Cadillac owners praised comfort (34.4 percent), ride (29.4 percent) and styling (22.7 percent).

But owning a new Cadillac apparently isn't all roses, either. Even owners generally pleased with their cars added to the complaints listed by those who regard their comparatively expensive invest-



Cadillac gas mileage chart



CADILLAC AND THRIFT aren't synonymous, owners say. Engine is 429-cubic-incher, puts out big 340 hp

ments as a waste of money.

Owners didn't like, for example, wind noise, a gripe to which they accorded an FMR of 9.8 percent. Also at this rating level were complaints of various rattles and noises, hardly the sort of thing one expects from the "standard of the world." Tied with FMRs of 8.9 percent were as-

sorted knocks about Cadillac's automatic climate control airconditioning and heater system (it either doesn't work or it works too well) and overall workmanship. Most emphatic, despite an FMR of only 7.3 percent, were owner complaints about location and size of the glove compartment.

All by itself, surprisingly, was an old



AWKWARD AND SMALL glove compartment drew owner ire. Contents tend to spill when it's opened
JULY 1966



CADILLAC PARKS EASILY, many owners claim, citing handling as a big plus. Power steering is standard

lament traditionally expressed by Cadillac owners. An Iowa sales executive wrote, "My biggest complaint is that just because you drive a Cadillac, motels, garages, gas stations and any other place of service will try to take you. Why, just this year a (brand) station tried to tell me I needed new shocks when I had only 5000 miles on my car."

So, accolades aside, realize that wearing a Cadillac crown apparently can be a heavy, expensive responsibility at times.

Cadillac owners responding to PM's survey rolled up an aggregate of 1,011,746 miles of both around-town and long-trip driving during which they averaged overall 12.4 mpg. But discussing Cadillacs and mileage is like J.P. Morgan's commentary on yachting—if you're concerned about cost, you can't afford it. Anyway, here's what the surveyed owners of 1966 Cadillacs had to say for and against. Their comments are listed in order of frequency mentioned. The boldface comments are the author's.

"I like the way the car drives and handles. It's smooth, quiet, and I like the secure feeling of driving a car such as a Cadillac."—Michigan engineer.

"Very easy to handle during parking."—Indiana, retired.

"It's solid, quick steering and precise."—Massachusetts druggist.

"The car holds the road and performs more like a Cadillac than any model of the past 13 years."—California, retired.

"Although it's a large, heavy car, it handles well."—California supervisor.

Next on the praise list was plain old down-home comfort, an undeniable attribute of just about any Cadillac extant. That people often buy a certain car for a specific reason is verified by a Nebraska attorney, who wrote:

"I bought my Cadillac because it was the most comfortable car I could buy."

"Extremely smooth to ride in and tireless on long trips."—Iowa, retired.

"We find our Cadillac spacious, with ample, luxurious room for others."—Ohio housewife.

Listed almost on a par with comfort was ride.

"Excellent ride. No tendency to bottom-out when going over dips in the road."—Michigan tool engineer.

"The car has outstanding riding qualities in both city and mountain driving."—California, retired.

"It's like a cruiser going over small swells in the ocean."—Missouri contractor.

► In Missouri?

One thing most Cadillac owners feel they get for their money is one of the best looking cars on the road. Part of this, I'm sure, stems from the car's prestige mystique—at these prices it *better* be good looking. Actually, however, from a styling point of view, Cadillacs aren't too different from similar Detroit products. Yet a

(Please turn to page 190)

Summary of Cadillac Owners' Reports

Excellent . . . 67.2% **Good . . . 26.8%** **Fair . . . 4.4%** **Poor . . . 1.6%**

Best-liked features:

Handling	36.8%
Comfort	34.4
Ride	29.4
Styling	22.7
Reliability	14.1
Quietness	12.3
Performance	9.8
Climate control	9.2
Roadability	8.0
Workmanship	6.1

Least-liked features:

Wind noise	9.8
Rattles/noise	9.8
Climate control	8.9
Workmanship	8.9
Glove compartment	7.3
Ashtrays	7.3
Finish/paint	7.3
Gasoline consumption	6.5
Styling	5.7
Window glass/lack of molding	5.7

Most liked to see changed:

Glove compartment (size/position)	11.9
Styling	10.4
Ashtrays, lighters (more)	9.0

Better climate control	7.5%
Headroom	6.7
Steering wheel position/size	3.7
Instrument panel/dash	3.7
Better fuel economy	3.7
Price (lower it)	3.0

Car traded in:

Cadillac	77.8
Oldsmobile	8.1
Pontiac	3.4
Buick	3.4
Thunderbird	3.4
Mercury	1.3
Others	2.0

Dealer service:

Excellent	61.9
Average	31.3
Poor	6.8

Buy from dealer again?

Yes	91.5
No	8.5

Buy another Cadillac?

Yes	98.1
No	1.9

Bought Cadillac because:

Value/trade-in	38.5
Past experience	21.2

Styling	13.5%
Prestige	11.5
Comfort	9.6
Availability	7.7
Different (something new)	5.8
Dealer/dealer service	5.8

Considered other makes?

No	68.7
Yes	31.3

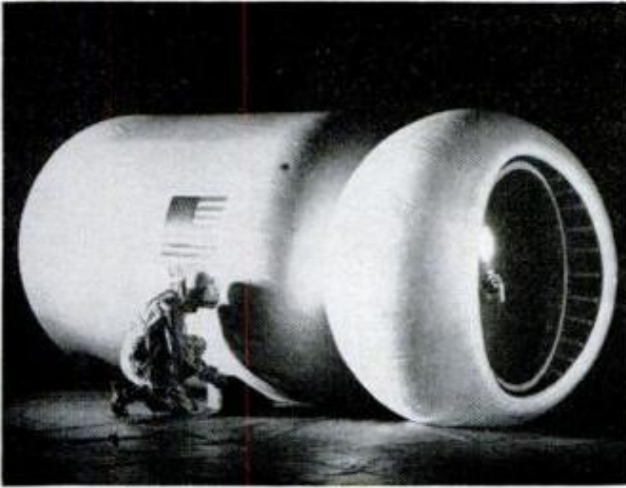
Own another car?

No	68.3
Yes	31.7

Make of other car:

Chevrolet	28.1
Ford	16.5
Pontiac	14.0
Buick	12.4
Oldsmobile	9.9
Cadillac (another one)	7.4
Thunderbird	5.0
Mustang	5.0
Corvair	4.1
Dodge	3.3
Volkswagen	3.3
Mercury	2.5
Others	14.9

Total miles driven: 1,011,746



Apollo pup tent is a moon shelter designed by Goodyear Aerospace Corp., and called the expandable Stay Time Extension Module (STEM). Seven feet round and 13 feet long, the inflatable pop-up may house three astronauts for two weeks of lunar camping.



Goggles au-go-go are the latest craze in sun glasses, and they feature tiny awnings that extend out above the eye glass to reduce glare and—just incidentally—to attract attention. The glasses are available from Westminster Industries, 167 E. 56th St., New York, N.Y.



Midget motorcycle is 10 inches high at the seat and will do better than 30 mph. Custom built by Carl Crouch of Riverside, Calif., the Lilliputian "hog" is powered by a chain-saw engine. The gas tank was fashioned from an auto headlight, and the seat is from a tricycle.



Miniature James Bond car is replica of agent 007's Aston Martin DB 5, complete with working ejection seat, machine guns, extending rams and a bullet-proof shield that slides up in the rear. It's made in England by Playcraft Toys Ltd., London.

Wildest railroad in the West

There's hardly a straight mile of track as this engineering marvel twists through spectacular canyons and over peaks of the rugged Sierra Madre Range on a wild ride through virgin country.



By Richard Dunlop

The author, a prominent travel writer, has a consuming interest in the West, including Mexico. He is the author of *Doctors of the American Frontier* and *Great Trails of the West*

THE ENGINEER INVITED some of us to ride on the front of the locomotive. We stood on the narrow platform beneath the hot headlight, and soon we were rolling down the brand-new track, over trestles where we could look through the ties to the rocky stream beds far below, and past small landslides which crews had shoveled off the tracks.

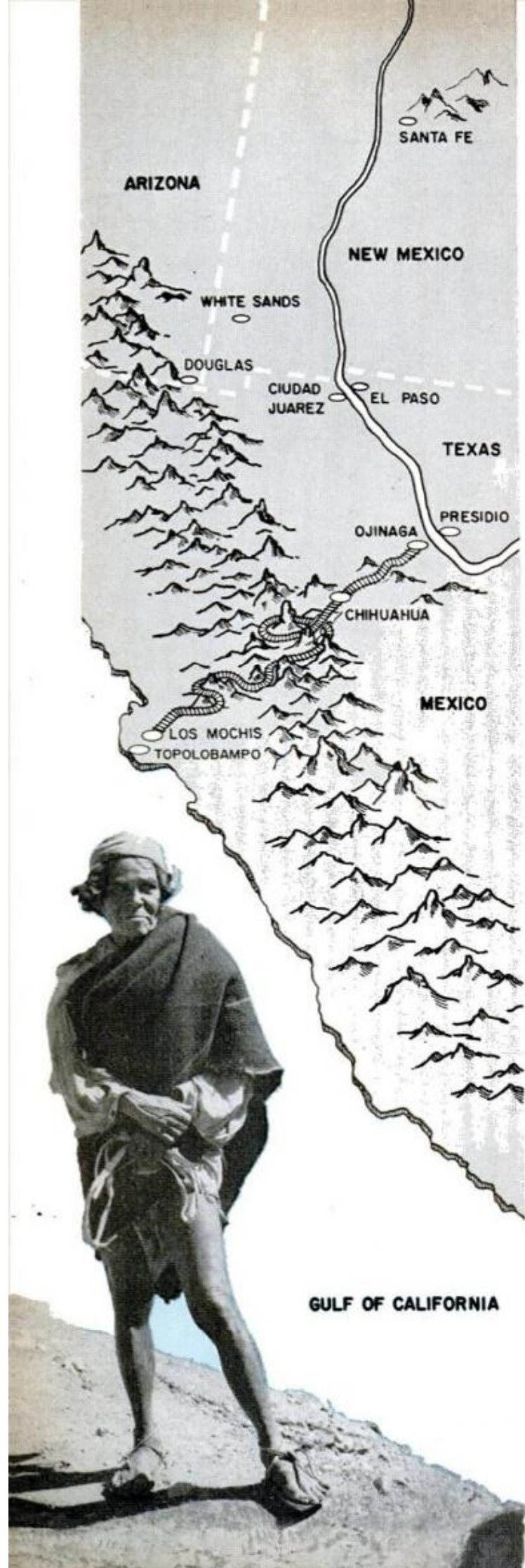
We descended through the sheer canyons of the Mexican Sierra Madres, roared into tunnels with the headlight piercing the gloom and illuminating the mountain's stony ribs. Far away in the dark of the tunnels, a glimmer of light would grow until at last we broke again into the blinding sunlight.

Every time we entered a tunnel we awakened the sleeping bats, and they fled squeaking about us to safety. Once torpedoes exploded beneath the locomotive's wheels to warn us of an obstruction on the track ahead. We swept through the 3000-foot La Pera Tunnel and sped down a canyon side to the Santa Barbara Bridge, where we saw a shattered freight train limping into a siding. A rockslide had caught it as it emerged from the tunnel and bowled the locomotive and many of the cars from the tracks.

It made me wonder what I was doing riding on my precarious perch, or why I was on this wild railroad at all. I was talked into it by an old friend, Joe Wampler of Berkeley, Calif., who, in the days before the tracks came, had led a score of parties into this wilderness region. Now it was his

TOURIST TRAIN travels over one of 39 precarious bridges on Chihuahua al Pacifico (left). At unique bridge-tunnel (right), trains cross bridge then loop around and go under it to enter the tunnel below it





idea to run a train of tourists over the new railroad. Train fans, rockhounds, Indian and wilderness buffs could take a leisurely look at the back country, tramp along mountain trails to cave dwellings and Spanish villages, explore canyons and examine the unique construction details of one of the most spectacular and next-to-impossible railroads in the world.

The Chihuahua al Pacifico had been under construction, off and on, since 1900. Engineers had said it couldn't be built, but today it loops and twists through the 12,000-foot Sierra Madre Occidental of southwestern Chihuahua in Mexico. It bores through summits in 76 tunnels up to a mile long, leaps over chasms and mountain torrents on 39 bridges up to 350 feet high, snakes along windswept rims of canyons which drop 5000 feet to tropical floors where orchids grow and jaguars scream, and it brings northeastern Mexico, Texas and the American Midwest 400 miles closer to Pacific shipping than San Diego. It was this short cut to water routes that started the whole thing.

I got the story in bits and pieces after a diesel coupled onto our cars late one night in Chihuahua and smoothly started us on our journey over the newest passenger line in North America. The railroad was started by Col. Arthur E. Stillwell in 1900. Stillwell, end-of-the-century U.S. railroad-building tycoon, pushed a line to the Texas coast and founded Port Arthur. Then he began construction of a railroad from Kansas City to the Gulf of California town of Topolobampo, then and now a sleepy fishing port. The railroad was to open up a shorter route to the Pacific.

Grading was started in Harper County, Kan., in 1900, and by 1903 Stillwell's crews were placing track from Chihuahua City east to the border town of Ojinaga to link up with the state-side construction. By 1907 he finished a line from Topolobampo northeastward to the west side of the towering Sierra Madre. Then for five years his crews clambered among the mountains looking for a way through shouldering peaks and the 1000 miles of canyons which slash the wilderness. Stillwell ran out of

MEXICAN RAILROAD links United States with Gulf of California, passing through wilderness of western Mexico, home of the primitive Tarahumara Indians

funds and lost control of the railroad.

Early in the 1930s, Benjamin Johnston, another U.S. railroad builder, bought up the Mexican part of the railroad and resumed construction but finally he, too, had to admit defeat. There seemed to be no way to put tracks through the canyon-slashed mountains.

The Mexican Government purchased the part of the railroad on its territory in 1940 and started surveys of its own, and, in 1953, construction began. Railroad men all over the world scoffed at the idea that the Mexicans would succeed where two veteran U.S. railroad builders had failed, but

eight years later they had succeeded. The railroad cost \$87 million dollars, but it was acclaimed one of the world's great engineering feats.

Tourists and rail fans find the new, 405-mile-long railroad opens a colorful region of vaqueros and historic silver mines. In the mountains, Mexicans live in log cabins, and the Tarahumara Indians are so primitive that they live in caves. Ponderosa, oak, juniper and cedars grow along the tracks. Antelope, bear and jaguar live in the woods. At Divisadero passengers leave their cars and hike to a nearby overlook to

(Please turn to page 186)



CONSTRUCTION HAZARDS included working on bridges as high as 350 feet up. This one, over Rio Fuerte, inches out from one concrete pilaster to the next



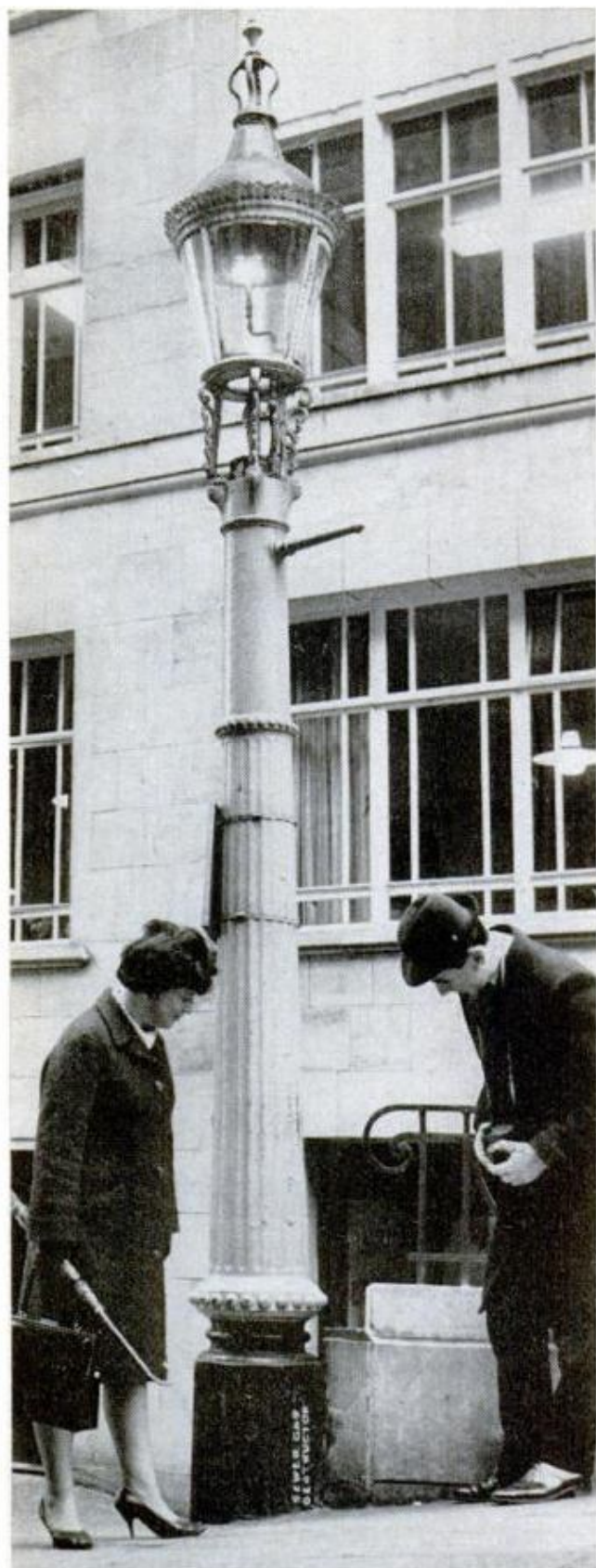
FRENCH TIES were used over most of route. Steel plates are placed on impregnated ties and covered by cushion of rubber before long rails are screwed on



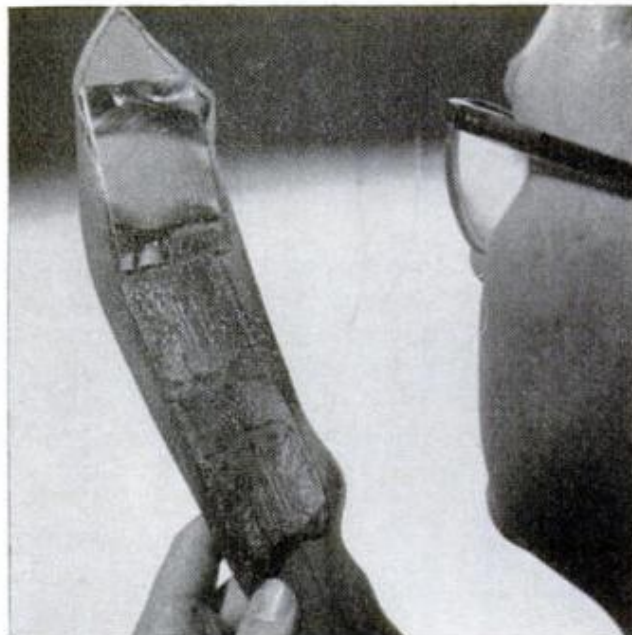
CONSTRUCTION CREWS drive carefully over railroad right-of-way as torrents from heavy mountain rains wash down the steep sides and across their paths



AERIAL VIEW of Chihuahua al Pacifico shows some of the twists and turns necessary to make its way through rugged country of Mexico's wild Sierra Madre



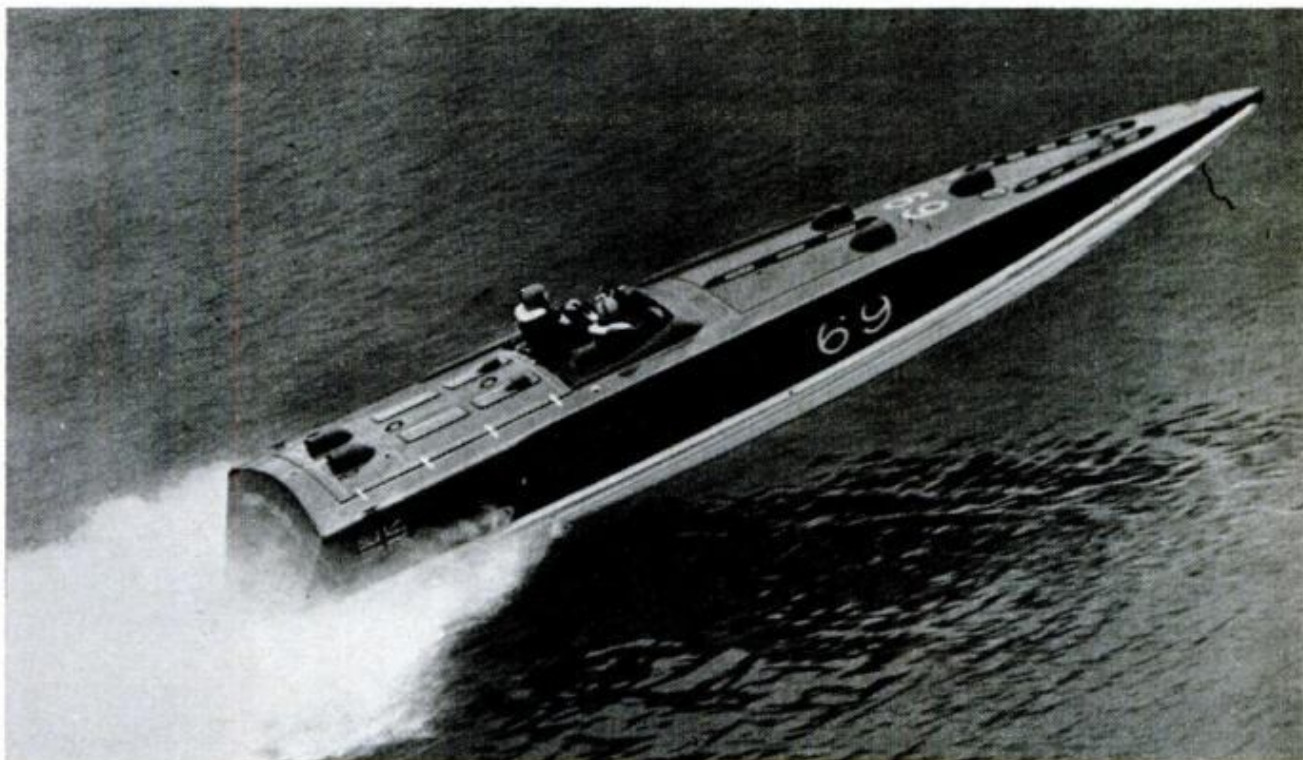
Perpetual flame behind London's Savoy Theatre is commonly known as "The Iron Lily"; it is in fact a sewer-gas destroyer. Burning day and night, the lamp acts as a safety vent for explosive methane or marsh gas which tends to accumulate in the 10-foot-diameter tunnels under the streets. Object of the Londoners' attention is the label on the lamp base.



Primping and preening for a special date is no simple matter without the proper facilities—even for a man. To combat such a deplorable situation, a British manufacturer has come up with a tie which hides a comb and mirror in a case on the reverse side. No excuse now for a disheveled male plumage.



Mods and rockers seeking some individuality sport ornamental crash helmets designed by theatrical designers David and John de-Bethel of Sussex, England. These particular helmets portray cupids and milkmaids mouthing wise sayings such as "Better late in this world than early in the next."



New world's record for diesel-powered craft was recently set by a British speedster with the incongruous name of "Merry-Go-Round," piloted by Sir Max Aitken. Topping the old American-held record by $2\frac{1}{2}$ mph, its two-way average through a measured mile at Southampton was a sizzling 60.21 mph. Charles de Selincourt rode as co-pilot and navigator during the $37\frac{1}{2}$ -foot splinter's record runs.



Two-cushion bowling is the latest innovation to hit the nation's lanes. Brunswick Corp. has developed a new game called Carom Bowl which is played on regulation lanes except that the gutters are replaced by raised rubber cushions. You can score extra points by banking the ball against the cushions before knocking down the pins.



Giant helicopter rotor over 100 feet in diameter is now being tested by a West German firm. Strictly experimental, the big rotor is mounted on a test stand and powered by an 18,000-hp GE two-stage turbine. It achieves a thrust of 36 tons and can lift 20-ton loads. Object of the program is to develop an even bigger rotor to take 50-ton loads.

Can you find water with a forked stick?

Dowsers are all wet, say geologists and water engineers. But at least one scientist's findings indicate that the men with the green twigs actually may be reacting to natural forces

BY JAMES R. BERRY

A DWINDLING WATER SUPPLY had plagued Pine Grove, Calif., for years. By January, 1965, the supply had become so scarce that some among the 600 residents began to talk about moving elsewhere. In February a committee of townspeople called in a consulting geologist and a water engineer to try to find a likely spot for a town well. When the team's efforts failed, the committee asked Jack Livingston to help.

Livingston is a 55-year-old construction supervisor who is well-known in the region as a water dowser. He came to town one day and slowly paced through it, holding a forked whalebone rod stiffly in front of him. In the middle of Pine Grove's municipal park, the rod wrenched downward.

Livingston came to a stop and said he was sure there was a good water supply under his feet. "I felt like I'd been depleted," he later explained. "That only happens when you hit a big source."

At 60 feet drillers hit 20 gallons a minute. On Livingston's advice, they went deeper. At 150 feet a geyser shot up the drilling derrick and soaked the cheering onlookers. Today, the water vein yields 200 gallons a minute, twice as much as the town needs.

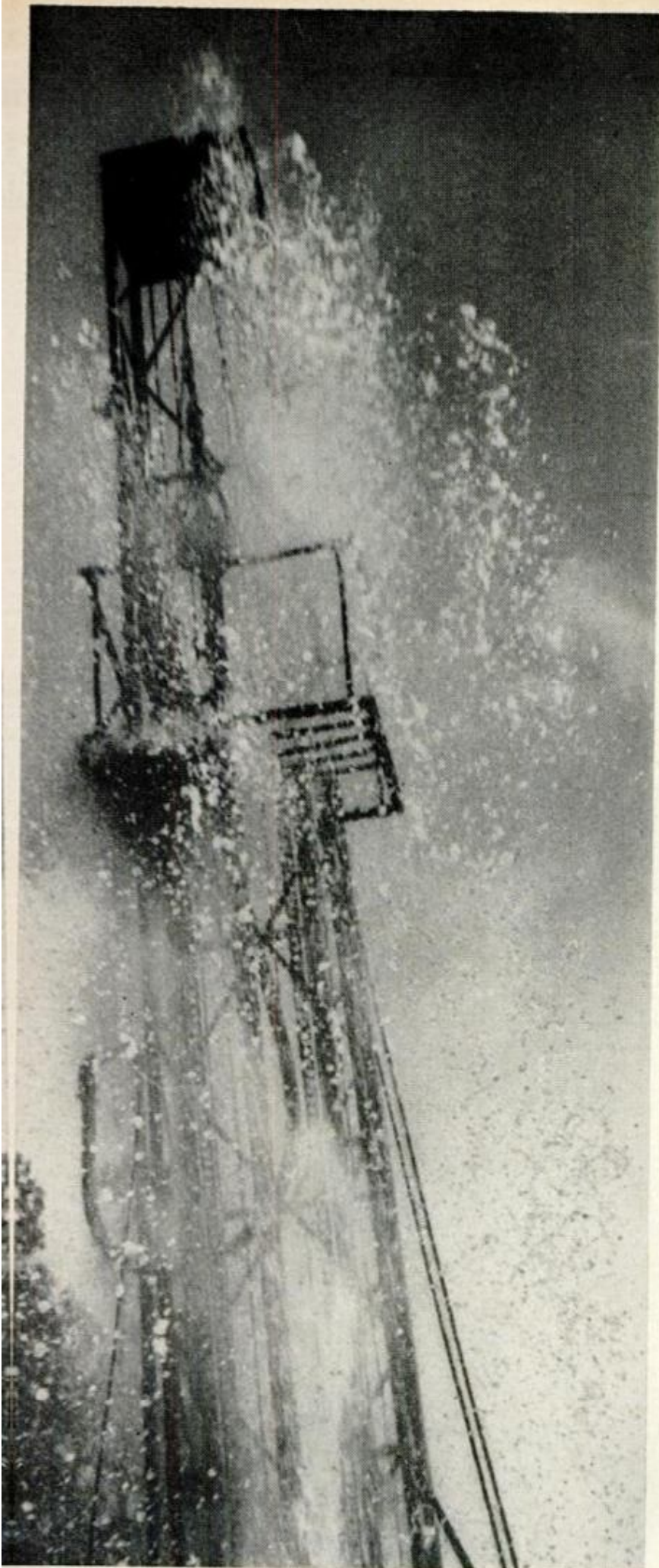
A fluke? Not according to the 25,000 water witchers throughout the country. Demand for their services has grown in recent years because of drought conditions in various areas. (Scientists assure us that the United States is not running out of water; the problem, they say, is one of distribution.) But the gushing bonanza discovered in Pine Grove is far from a typical result of water witching, according to water engineers, geologists and other scientists.

"Water witchers don't publicize their failures, so the times they do find water stand out far more than they're worth," says a prominent geologist. "Water doesn't give off any signal that can be sensed or measured. There's nothing more to divining than clever judgment based on geophysical evidence available to anyone who's not blind."

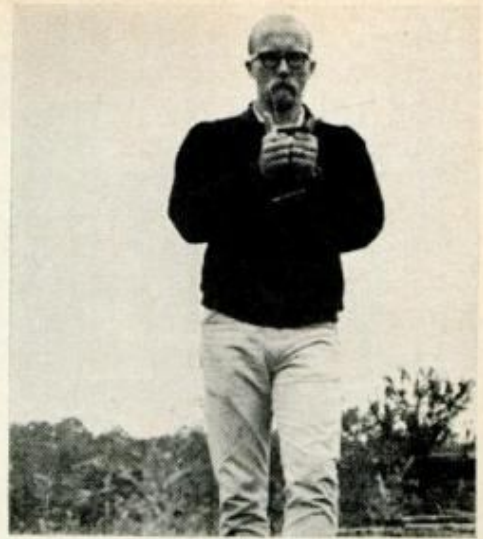
Controversy over water divining is as old as the divining rod itself. Dowsing goes back at least to the 16th century when German miners used a rod to help locate minerals. The practice, attacked then by churchmen as Satanic magic, spread to England when Germans were imported to work tin mines in Cornwall. Credit for popularizing a forked branch to find water goes to a French baron and his wife, who published a book about it in 1640. The book

GUSHING BONANZA DRENCHED PARCHED PINE GROVE, CALIF., when drill hit 150 feet. Site was picked by water dowser after attempts by technical team failed





JULY 1966



WITH WIRE RODS cut from coat hangers, dowser Ross Coates starts to pace a field near Stephentown, N.Y. Note rod position



HALF AN HOUR LATER, taut-faced Coates comes to an untried section. Now, for the first time, rods begin to drift lazily apart



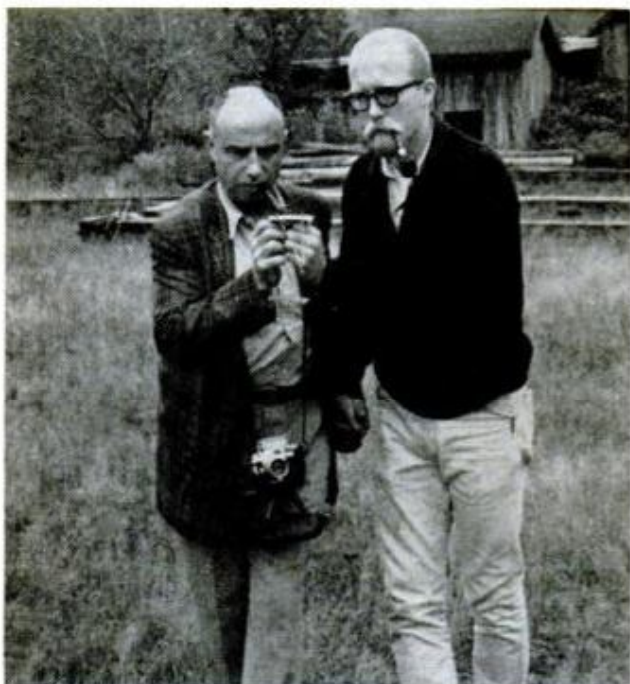
RODS SWING OUT to near-180° angle to mark supposed water site. Two other men failed to get similar reaction at same spot

became a classic but it didn't save the pair from charges of sorcery. They both died in jail. Dutch and English settlers brought dowsing to the United States, where it's been used, mostly in rural areas, ever since.

But believers aren't only hayseed farmers. The German and Italian armies used dowsers during their desert campaigns of World War II, and the Canadian government had official state diviners on

its payroll during the dust-bowl era. Surprisingly, dowsing is strictly a Western custom. Asians, who firmly believe in astrology, consider water witching an amusing superstition.

At least one thing about water diviners is generally agreed on. They're not swindlers. In their antidowsing book, *Water Witching U.S.A.*, anthropologist Evon Vogt and psychologist Ray Hyman report that in every case known to them, water witch-



EACH HOLDING ONE ROD, Coates and PM's Dick Dempewolf traverse area where Coates obtained a strong response. They were unable to duplicate effect



CLASSIC PALMS-UP GRIP of arms of forked branch is demonstrated by farmer Floyd Cummings. Traditionally, dowsing stick should be green and supple



UNDERGROUND PIPES AND CULVERTS are sought out by rods in hands of Duke Diebold, water superintendent of Sheffield Lake, Ohio. "They've often saved us from excavating large areas," says Diebold

ers were “. . . honest men of recognized integrity” who dowsed mostly to help out a neighbor. Since the formation of the American Society of Dowzers, an organization established in 1961 to promote the art, commercial water divining—and fees—have grown. But, in general, the average dowser charges about \$5 for a few hours of friendly witching. Whatever his fee, he has a right to collect. In Charleston, W.Va., dowser James Beckner recently used a

fresh peach branch to find water for the Consolidated Drilling Co., charging \$201. The company wouldn't pay and Beckner sued, winning out in court.

Unlike occult practices such as astrology, palmistry and phrenology, there's nothing for a water diviner to learn or study. “You either have the power to dowse or you don't,” claims the Reverend Norman Evans of Camden, N.J., a well-known lecturer on water divining. “Many people can dowse who don't know it. And it doesn't depend on what you believe. I've had dozens of people tell me it can't work but when they tried, it did. They usually don't know what to say after that.”

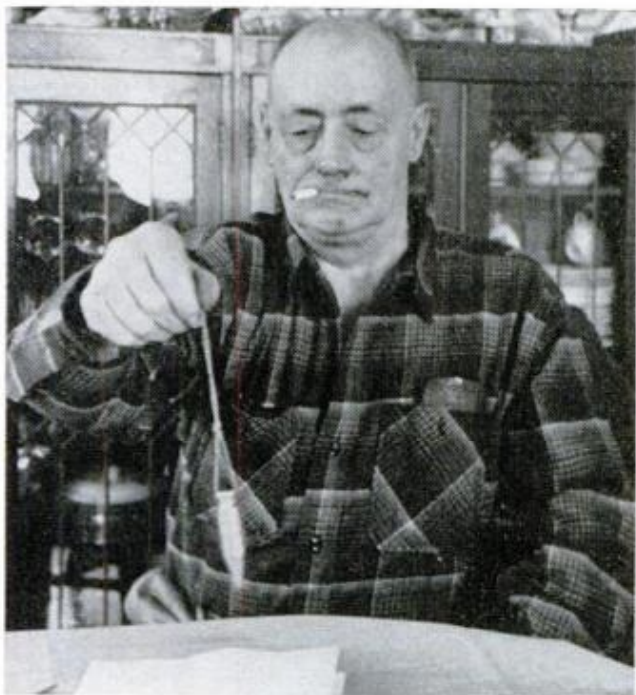
Dowsers use a wide variety of instruments. Some dangle a plumb bob. Others hold a crowbar, fishing rod, snip of wire, straight switch, curved switch, forked stick, or even a blade of grass. When whatever the dowser is holding dips, turns, circles, shakes or vibrates, he claims there's water underneath the ground. But some dowsers don't use anything. “If I hold my hand over a spot with water underneath I get a wallop up to my shoulder,” reports Clint Gray, a retired Vermont laborer.

Other indicators dowsers often use are angle rods, pieces of stiff wire or metal rods with a 90° bend near one end. “You hold the short end like a handle. The long ends point straight ahead,” explains Ross Coates, a young art instructor at New Jersey's Montclair State College. “Over certain spots the rods spread apart. Sometimes it seems too incredible to believe, but it happens.”

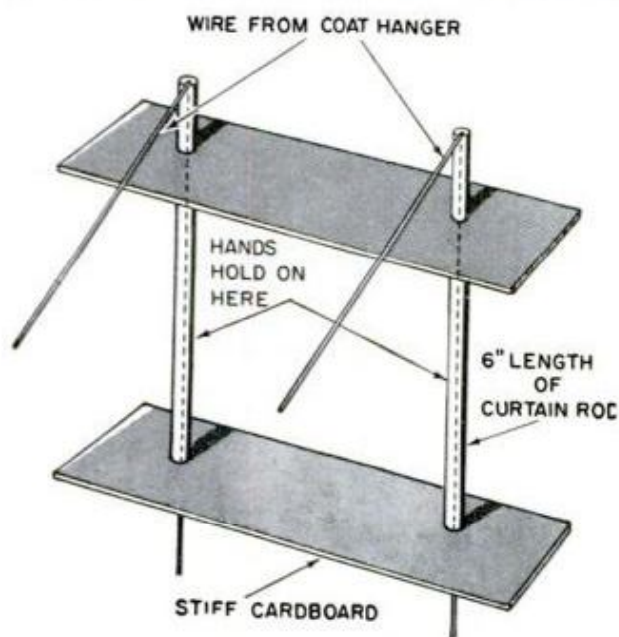
To see water witching in action, I and Dick Dempewolf, executive editor of *Popular Mechanics*, recently watched Coates dowse a field on a farm near Stephentown, N.Y. The angle rods were made from straightened, three-foot-long lengths of coat-hanger wire with a bend eight inches from one end. I made a gadget designed to eliminate the “human” element. I fastened two six-inch sections of hollow curtain rod parallel to each other and four inches apart in a stiff cardboard frame. Then, I slipped the short ends of the dowsing wires into the hollow rods. Coates' fingers, holding the rod sections, couldn't possibly manipulate the wire inside.

For the first half hour nothing happened. Coates, his face taut with concentration, walked with a slow, steady pace. He held

(Please turn to page 180)



SOME DIVINERS claim they can locate water without setting foot on the land. Vermonter Clint Gray demonstrates art of “map dowsing” with plumb bob



SPECIAL RIG shown in diagram was used in *PM's* tests to prevent possible manipulation of rods

Bobbing on the Apple River

It looks like a human log jam — hundreds of families on a Sunday outing, bouncing down the rapids on rented inner tubes

“**T**HERE ARE TIMES,” said an old-timer in Somerset, Wis., “when it looks like the whole danged countryside is clearing out on inner tubes.”

Imagine it, 1500 people—whole families, couples, kids, cousins, uncles and maiden aunts—floating down the Apple River on a Sunday afternoon. This is a traditional activity that has been going on since someone first wondered what he could do with a patched and worn-out inner tube.

Starting point is at Jack Raleigh’s River’s Edge, a plush restaurant on Wisconsin 64, about 35 miles northeast of Minneapolis. This is where you rent an inner tube for 50 cents, wade into the river and let the current take over. For the next five miles you sail along through lush, quiet farmland. You bump over rocks (ugh!), scrape on sandbars (ouch!) and, as you come down into the hamlet of Somerset, the grand finale is a whirling, leaping dash through 200 yards of white water. And then you walk, or pile into cars and trucks to go back and start over.—*Stuart James*



LONG WALK BACK to the starting point faces the floaters at the end of the five-mile jaunt, but the thrill (right) of bobbing the rapids is worth each step of the way





END OF THE LINE is in the center of Somerset, Wis., and it is a mob scene of families and inner tubes. As many as 1500 people have made the float in one Sunday afternoon

BETTER THAN A ROLLER COASTER, the swift current brings a group of laughing teenagers through the rapids. From June to September, this is a popular weekly event



Flossy and frisky is this new luxury Jeep station wagon. The car features such un-Jeeplike extras as padded vinyl top, trim panels of gold-anodized aluminum, contoured bucket seats, carpet throughout, pleated upholstery, walnut trim panels, automatic transmission, power steering and brakes. Engine is a 270-hp V8. The wagon can be shifted from 2 to 4-wheel drive.



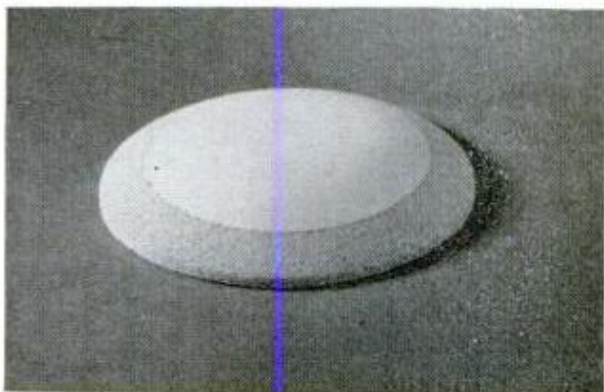
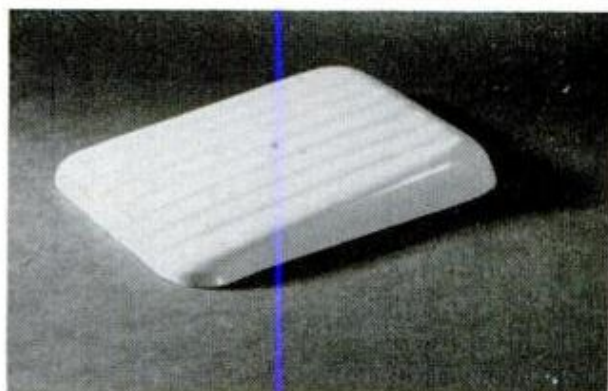
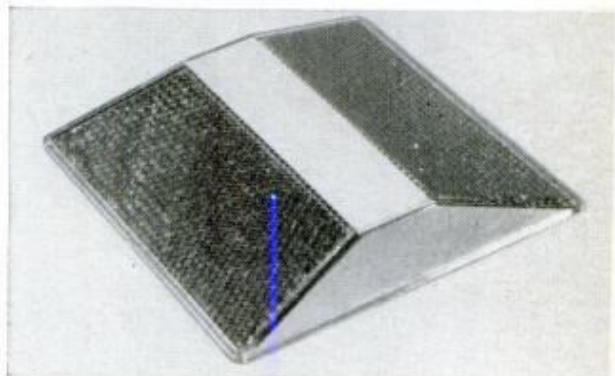
Feather-light, stretch half boots for men give more protection than rubbers. Fitting inside the pants leg, they are six inches high and go on and off as easily as slippers. "Totes" are jet black, pure gum rubber and will fold to pocket size. The new half boots are manufactured by Stadri Products Co., 147-47 Sixth Ave., Whitestone 57, L.I., N.Y.



Collapsible camp dish drainer holds pans, silver and dishes for six. The double "V" frame of welded steel bars, with a zinc finish, folds flat into a box for storage. The "Camp Drainer" is made by the Washburn Co., Worcester, Mass. 01608, or Rockford, Ill. 61101.



Sailboard for two is the 15-foot "Alpha," a fiberglass design from Glastron that can be used for pleasure sailing and racing. A pivot-type rudder permits shoal draft operation and easy beaching. The sail is a lateen rig on a 12-foot anodized aluminum mast. Absence of standing rigging makes the sail easy to mount in a matter of minutes. It sells for about \$600.



Bott's Dots are taking the place of the painted white lines in marking California highways. Molded of epoxy in wedge and flat bubble shapes, the lane dividers are four inches across and three-fourths of an inch high. A double wedge shape reflects light at night. The raised surface creates a mild tire rumble when crossed and drivers on tested areas have been reluctant to change lanes, thus cutting down accidents.



THE MAN WHO CAN

A man, machines and Matthew 6:33 — all that sums up R. G. LeTourneau, who gambled \$25 million on an electric wheel and unshakable faith. / By Stuart James

SHATTERING THE SILENCE of the swamp, a laboring roar sends hordes of birds squalling skyward in a shrapnel pattern above the surface of trackless mire. The deep-throated snarl of a powerful diesel is accompanied by the tortured creak and crackle of splintering wood.



FORTY-TON BITE OF DIRT is scooped up in seconds by world's largest front-end loader (left) and dumped at the press of a button. Tree Crusher (above), newest LeTourneau machine, operates in swamp areas

MOVE MOUNTAINS

Grinding, slogging through the muck is a nightmare of a machine. High in a yellow cab, the diminutive figure of a man sits at the controls. The monster has huge, box-shaped treads for wheels, allowing it to "swim" through terrain where an ordinary machine would sink from sight. Jutting from the front, a pyramid-shaped boom supports a gigantic steel crosspiece.

As the behemoth reaches a stand of thick, deep-rooted trees, the sound of rending bark and limbs echoes sullenly over the dismal forest. Some trees refuse to give. The howl of the diesel increases to a cry of rage. The machine climbs as the boom slides up the shuddering tree trunks; it churns and labors, pushing relentlessly. The sheer weight of hundreds of tons of steel shatters a row of trees,

MAMMOTH LOG STACKER will lift load of logs weighing 60 tons 20 feet into the air and carry them over rough terrain for loading on huge logging trucks



FIVE UNITS of electric digger, operated by one man (arrow) can pick up 150 tons of dirt in minutes

tearing up roots and stumps, crushing trunks into the muck. The "monster" climbs over them, reaching out its boom to embrace the next victim.

Nothing like this machine has ever been seen. It is the only one of its kind. And it is performing what was thought to be an impossible task.

Thousands of miles from the swamp, a man who laughs at the word "impossible" has received a report on the success of his latest brainchild, and his mind is already at work changing the whole design.

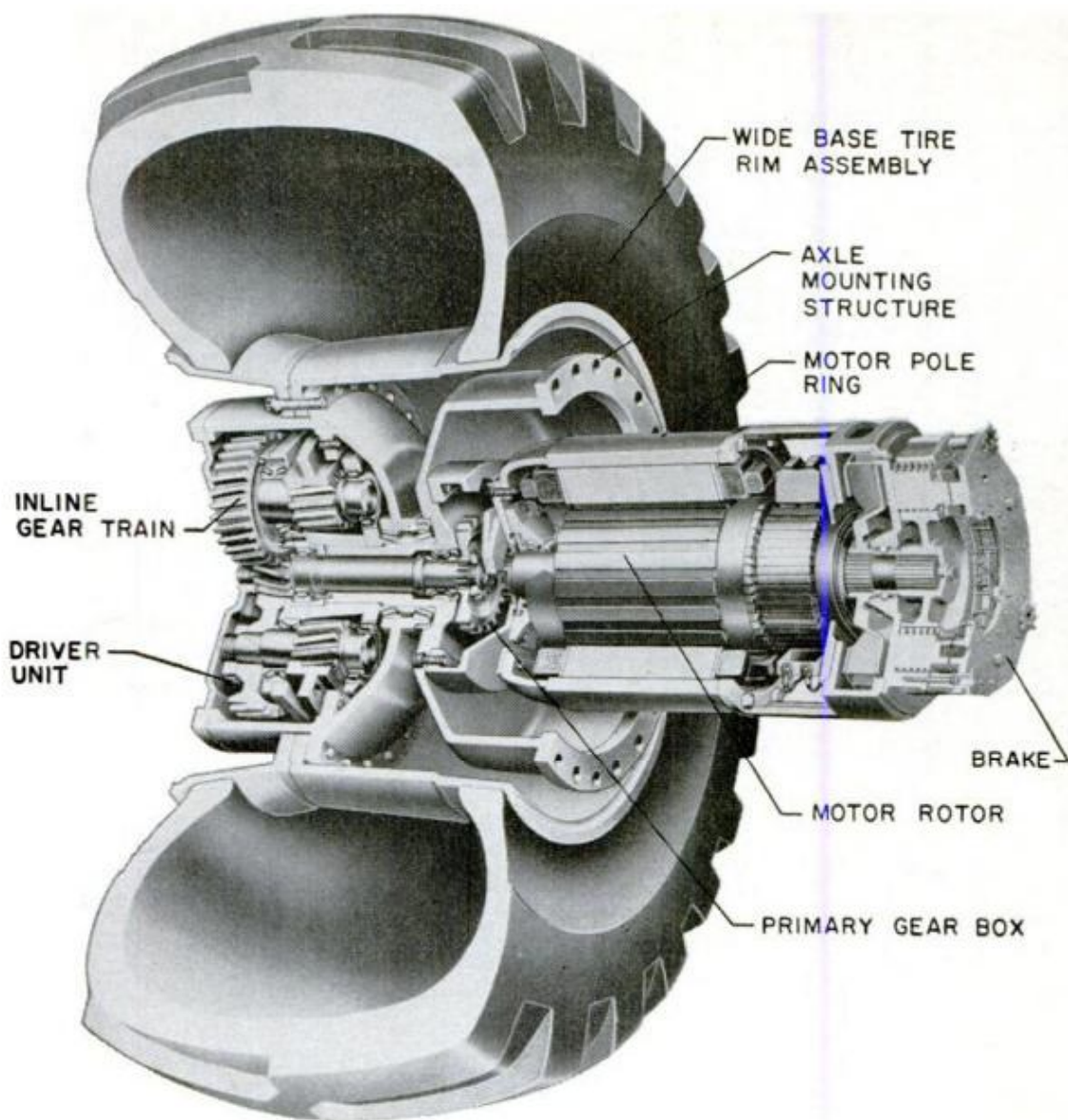
He is in shirt sleeves, scribbling a drawing on the back of a used envelope. The scarred, wooden swivel chair groans as he settles his large-boned frame against the back and turns from a desk jammed into

a corner of the cramped, plain office. He peers through glasses, slightly myopic, and his expression is one of grandfatherly patience. There is a slight tremor in the hand he runs over his bald pate and he smiles, showing long, slightly protruding teeth.

When asked how many people now work for him, he replies, "About half of them." and then he hoots with laughter, slapping a hand to his thigh.

It is difficult to believe that you are in the presence of a legend, a man who has literally changed the face of the earth.

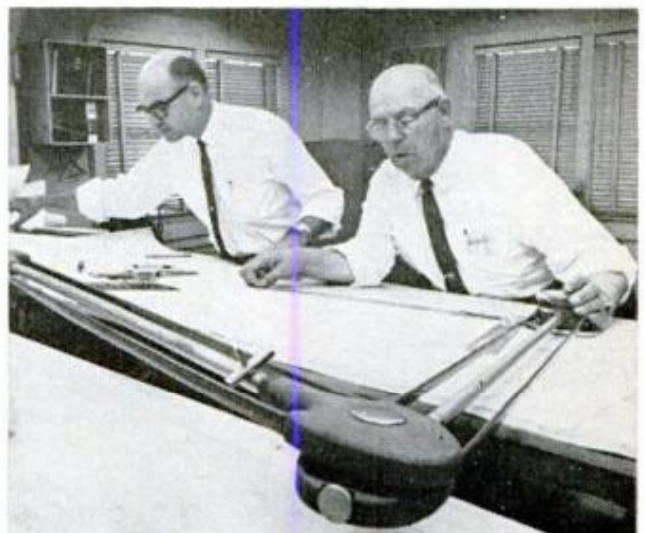
"I'm just a mechanic who was blessed by the Lord," he says. Rummaging in his pants pocket, he brings out a sliding steel rule and holds it aloft. Then he taps his



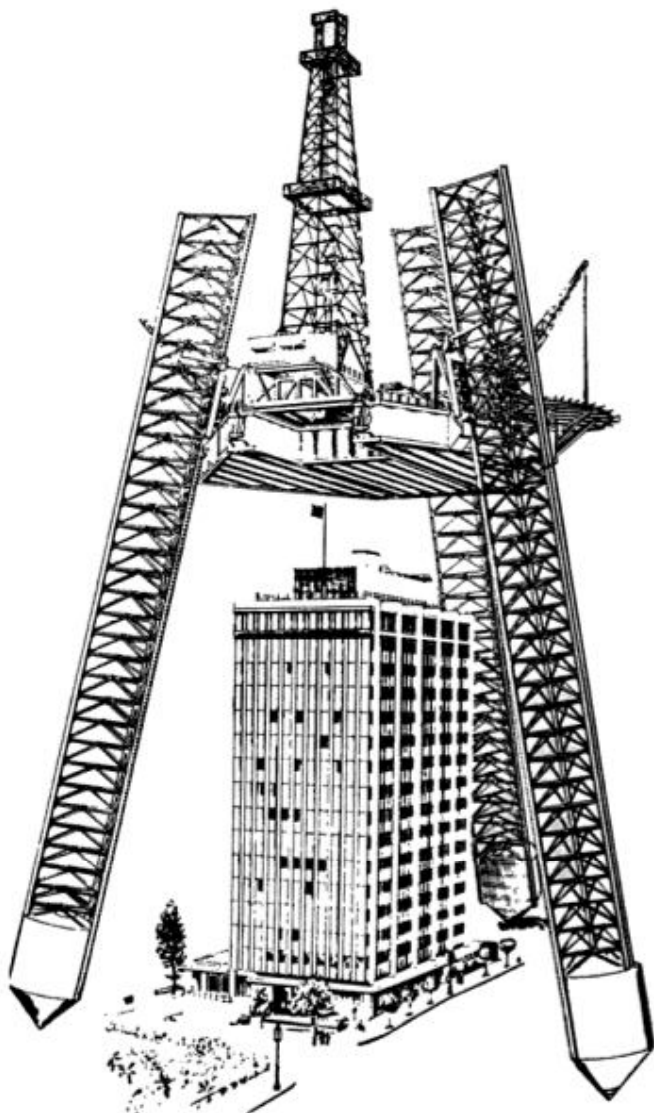
GAMBLE THAT PAID OFF is the electric wheel, main power source for all of LeTourneau's equipment

chest and says, "And His word is in here." He smiles, letting his point sink in, then he points to the ceiling. "That's my boss," he says, then adds: "*Seek ye first the kingdom of God, and his righteousness; and all these things shall be added unto you.*" He tilts the chair, holds his interlaced hands above an expanse of stomach, and smiles with satisfaction. "Matthew six, thirty-three," he says. "Young fellow like you would do well to remember that."

At age 77, R. G. LeTourneau is in a class with the buffalo and the quilting bee, a slice of Americana disappearing from the scene, the self-taught engineer who rose from garage mechanic to president of a multimillion-dollar corporation. In an era when corporations are run by "teams"



A SHIRT-SLEEVE EXECUTIVE, R. G. LeTourneau (right) spends most of his 12-hour workday at a drawing board designing new machines for impossible jobs



ARTIST'S CONCEPTION of a LeTourneau offshore oil drilling platform shows it towering high over the tallest building in Dallas. The huge canted legs are raised and lowered by rack and pinion gears

and committees, he controls his with the dictatorial rule of a benevolent despot.

From his headquarters in Longview, Tex., the voluble R.G. designs and builds machines to do jobs that can't be done—mechanical giants that stun imagination.

"There are no big jobs," he says. "There are just small machines."

This has been his motto since 1919, when he started out as a dirt-moving contractor with a Holt tractor and a borrowed scraper. In those days it took one man to run the tractor and another to operate the scraper. Annoyed that his helper would only work 10 hours a day when he wanted 14, R.G. devised an electric motor run off a generator to raise and lower the scraper from controls near the tractor seat. He not only eliminated the extra man, he raised the scraper's efficiency and doubled the amount of work it could do.

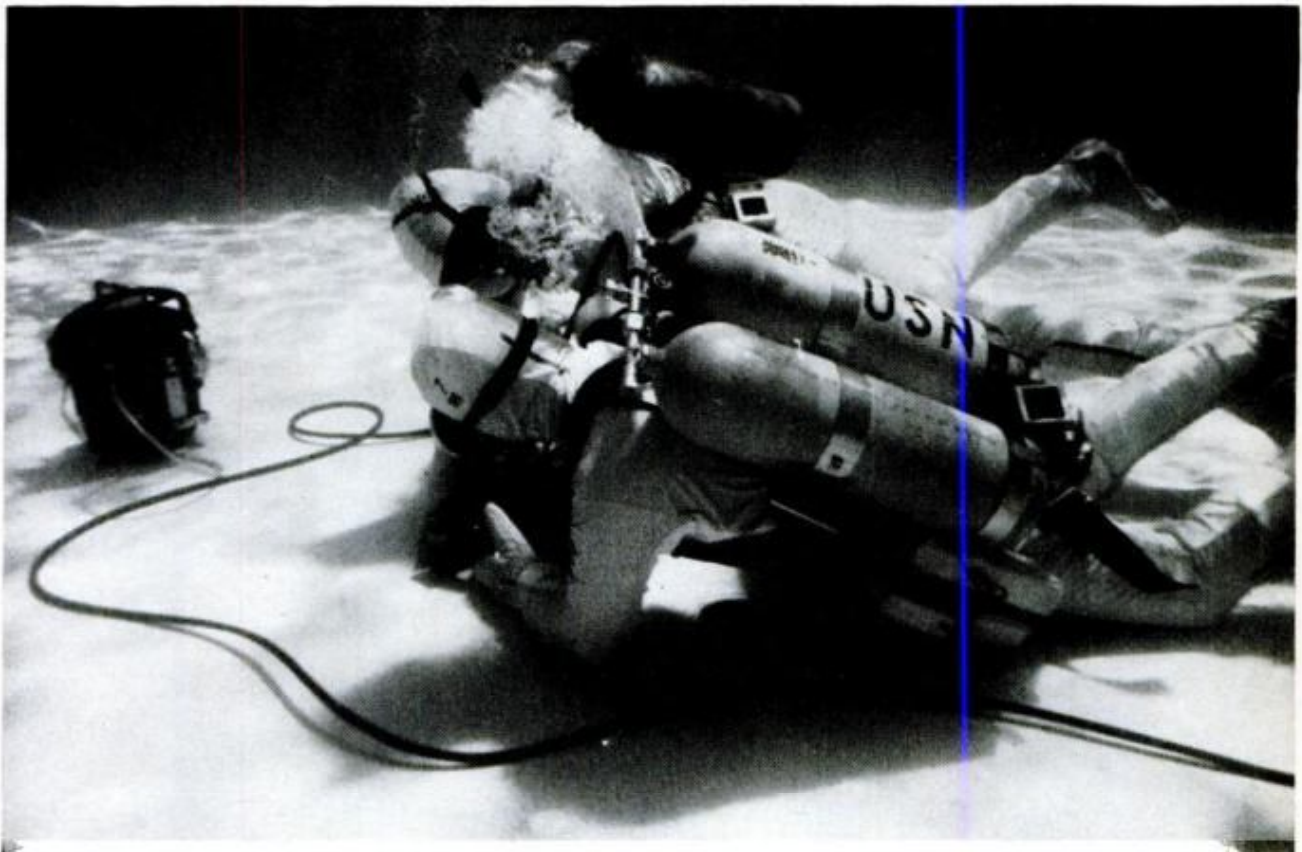
Since then he has invented the first bulldozer that could be raised and lowered, the first trencher that could straddle two hills, the first multi-bucket scraper, the first scraper with flotation tires, the tree crusher, the log stacker, the first train to operate in any terrain without tracks, a ship that can walk over sandbars, and the only offshore drilling platform to weather the Gulf Coast hurricanes of 1957. And he built his machines bigger than anyone had ever imagined possible.

"One of my first jobs was in an iron works in Portland, Ore.," R.G. says. "I had to move a gondola-load of sand from a railroad siding to the furnace room. I shoveled it into a wheelbarrow and wheeled it in. The sand was wet, and I quickly developed an enormous respect for a cubic yard of sand. One of the fellows gave me some advice. He said, 'Pushin' is a rest from shovelin'. Shovelin' is a rest from pushin'. Then there's the trip back with an empty barrow where you don't do nothin' at all. Kid, you got yourself a job that's just one long rest.' Now I guess that was funny, but it also taught me something. One good man on a good machine is better than a thousand men with shovels and wheelbarrows. And the bigger the machine, the better the job."

Always a renegade, R.G. runs his company in a way to make an efficiency expert turn in his slide rule for a Yo-Yo. There are no conferences. When he has an idea for a new machine or an improvement for an existing one, R.G. will make a rough sketch on the back of an envelope. He'll then get on his motor-scooter and drive out into the plant to discuss the idea with one of the foremen who have been with him for many years. They'll get on the floor and sketch it out with chalk. When satisfied it can work, he goes to his staff of young engineers.

"I give them my plan," he says, "and they get out their slide rules and figure out why it won't work. Then I get out my pencil and show them why it will. This is like a chess game. My engineers checkmate every move I make with all their technical skill, or I'll checkmate them with a few things that aren't in the books. If I'm wrong, they win. But if I know I'm right, even though the slide rule says I'm wrong, then I won't give up."

And this is when R.G. seeks advice from a source that makes bankers and other
[\(Please turn to page 176\)](#)



Hot suits for aquanauts. U.S. Navy frogmen will be able to explore deep icy waters for as long as three hours and keep warm while doing it. Heat is supplied to each lemon-yellow suit by electric resistance wires sandwiched between a rubber skin and sponge rubber. Powered by a silver zinc battery worn at the waist, the suits are being developed by U.S. Rubber.

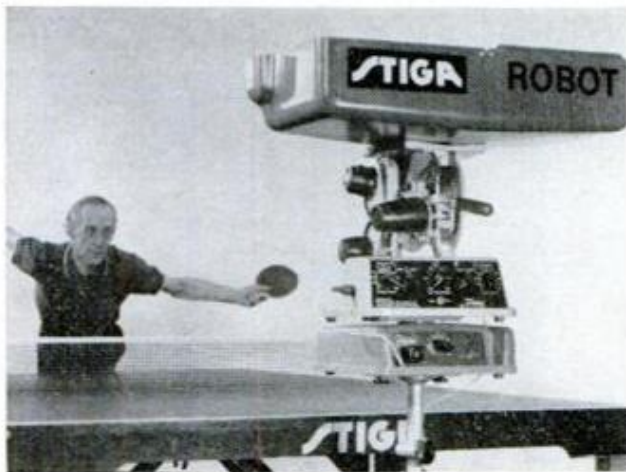
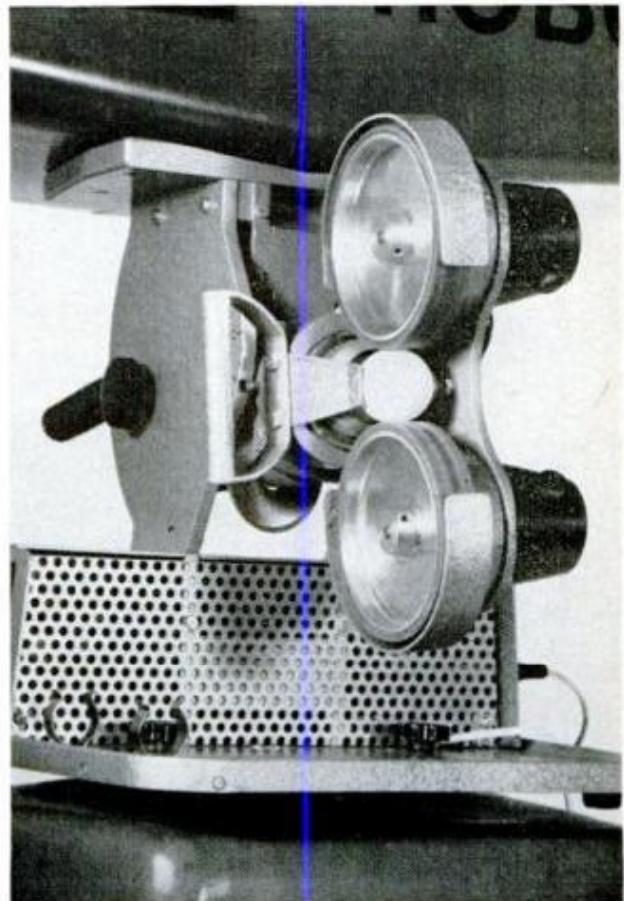
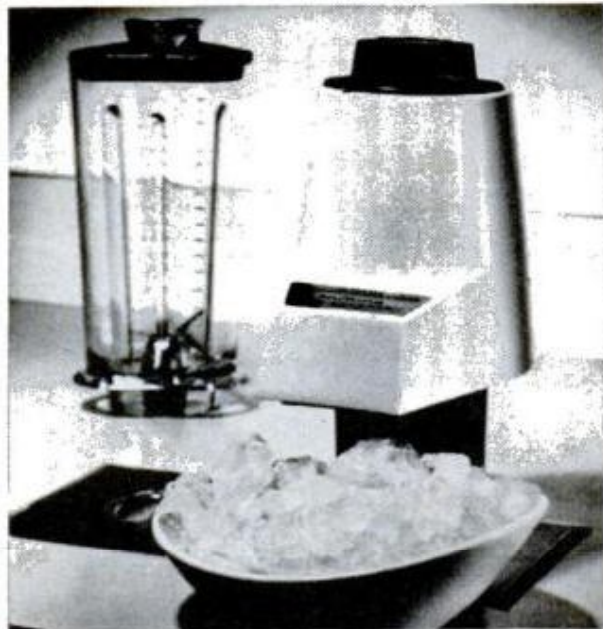


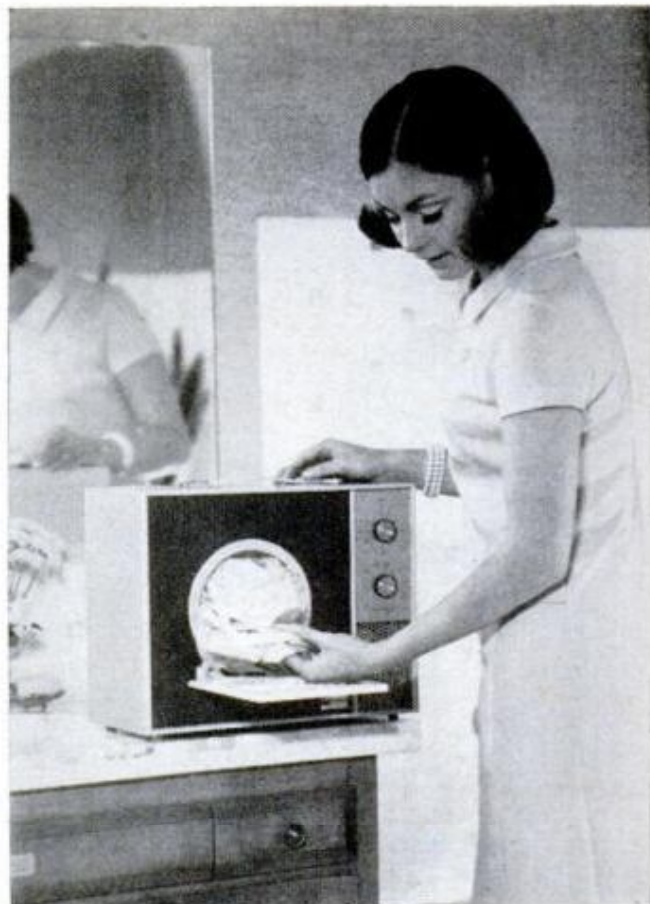
Table tennis robot. A challenge to any human player, this mechanical partner disgorges 30 to 80 balls a minute with side spin, cuts and all sorts of wild serves. Two variable-speed wheels eject the balls; if either wheel is slowed slightly, the ball is given spin. You operate speed and spin intensity by remote control. Returned balls collect in a net in front of the robot, designed by Stiga, Trans, Sweden.



NEW FOR
YOUR HOME
 BY MARION MOREY



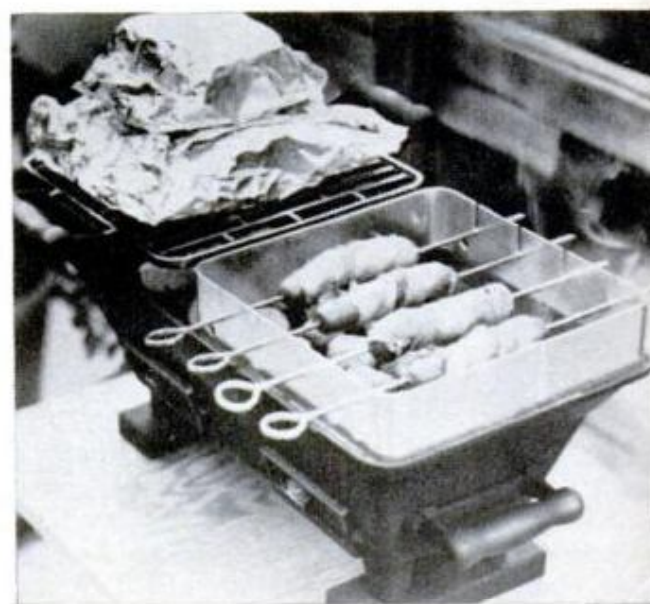
ICE CRUSHER is the newest appliance for a motorized built-in food center. Place aluminum crusher on motor plate, plunk in cubes, dial speed and you're set. \$18.95. By Nutone, Madison and Red Bank, Cincinnati, Ohio.



PORTABLE CLOTHES DRYER looks like a TV, holds 2 lbs. of clothes, plugs into 110-volt socket. Unit, 12 by 16 by 7 inches, is timed up to 60 minutes. \$34.95. By Wagner Mfg., 4611 N. 32nd St., Milwaukee, Wis.



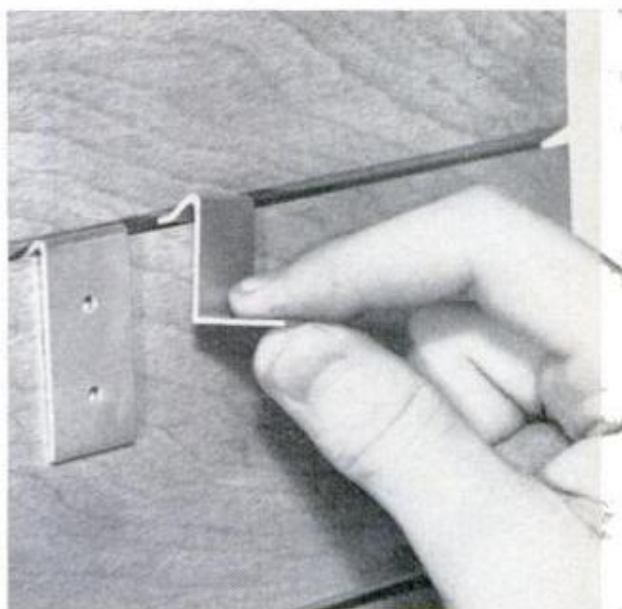
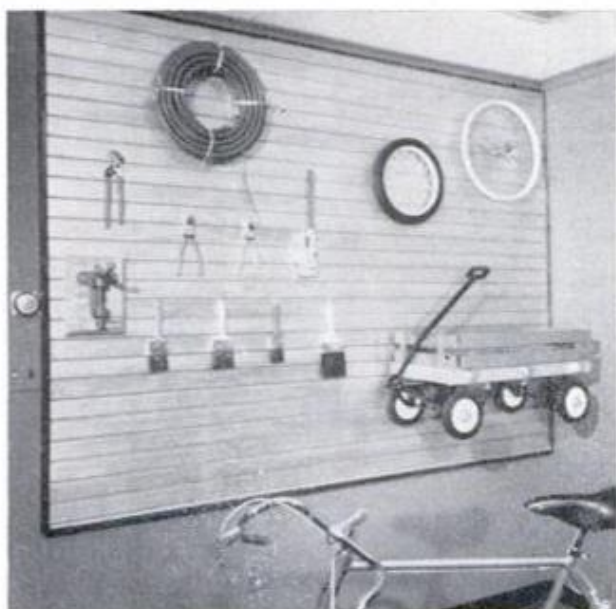
SOAP-HOLDING SINK with splashproof rim ensures a cleaner bathroom. Countertop mounted, it has a 16½ by 11¼-inch bowl; soap receptacles are concealed below front rim. By Crane, 4100 S. Kedzie, Chicago, Ill.



SHISH KEBABBING—cooking on skewers—is done over any grill with this bottomless pan slotted for skewers. Meat is easily seared and turned. \$4.95. From Desco Products, 535 W. Gladstone, San Dimas, Calif.



METALLIC FINISH antiques and decorates in minutes. Squeeze from the tube onto your finger, cloth or sponge, apply thinly and buff to a luster. The finish goes on wood, metal, plastic, leather and even pottery. If the surface is heavily used, spray over it with lacquer. Eight colors from gold leaf to Chinese red suit highlighting or flecking, too. Cost: \$3 per two-ounce tube from American Clay Co., 4717 W. 16th St., Indianapolis, Ind.



WALL PANELS grooved especially for insertion of brackets let you hang and rearrange tools, lawn equipment, toys or paintings without drilling. Aluminum brackets slip into the grooves, come in five configurations for specific hanging jobs. The panels in birch or walnut flakeboard cost from 50 to 75 cents a square foot; brackets are \$1.25 per dozen. Available from Walls Unlimited, 226 Bellevue Avenue, Montclair, N.J.

Take-along boats for

Foldable, inflatable, flat or just plain little—they'll all fit on (or in)

BOATS AND VACATIONS just naturally go together, but on some trips it isn't practical to trailer a regular boat. Perhaps you're already towing a camp trailer or travel trailer. Maybe you've planned a heavy driving schedule and simply don't want to be bothered with a trailer. What do you do for a boat then?

There's a whole class of boats ideally suited for such situations—the "take-

alongs." They're the ultra-compacts of the boating field—no trailer required.

The most common of these is the car-topper. With a couple of carrier bars, you can take anything up to 14 feet or so, depending on the size of your car. Most people prefer aluminum because it's lighter. There are plenty of different hull shapes available, including a number that can be used with power, sail or oars. And

Folding boats

DON'T ASK THE MAN WHO OWNS ONE what he thinks of folding boats. He'll talk your arm off. He isn't just satisfied with his boat, he loves it with a wild passion. It's tough, maneuverable, easy to assemble, truly portable and roomy enough for almost anyone. In short, it's a completely practical boat.

At last count, there were seven companies either manufacturing or importing folding boats in the United States. You can pay up to \$500 for a folding runabout such as Klepper's 12-foot Master (shown below towing a skier), but this is a deluxe model. Prices start around \$100 and most of the standard one and two-man kayaks fall in the \$200-\$400 bracket. If you want to sail, plan on laying out another \$100-\$300 for leeboards, sails, mast and other necessary gear.

As for folded size, you can't expect any 16-foot boat to fit into your glove compartment, no matter how much folding you do. The little ones fold smaller than the big ones, with the average taking up about as much space as a couple of good-sized duffel bags. Hardly pocket-size, but what other boat can be stored in a closet?



18-HP RUNABOUT fits into three bags, can be rigged for sailing for an extra \$200-\$300



vacation fun

By ART MIKESELL
PM's Boating Editor

a car, and the smallest take up no more room than a few suitcases

don't forget canoes. Anything that can be portaged has to be a great cartopper.

Many of these compacts could be called "bag boats" or "closet boats." They come in bags. The folding type goes together by assembling a rigid frame and slipping it inside a tough synthetic skin. Inflatable boats are simply pumped up.

Of course, you may decide to forget about taking a boat with you, choosing in-

stead to depend on rentals for your vacation boating. It's cheaper. The one big drawback is the availability of rental boats. When you stumble on a secluded little lake and decide to do some spur-of-the-moment fishing, there's a law of nature that says you won't find a rental dock for 10 miles in any direction.

No such worries with a take-along, though. All you need is water.



FROM BAG TO BOAT in about 15 minutes, this 17½-foot Folbot sells for \$234 f.o.b. South Carolina factory

SAILING RIG for Klepper's Aerius adds \$119 (cotton) to \$143 (Dacron) to \$369 price tag f.o.b. New York

Cartoppers



13½-FOOT COMBO II by Grumman takes power or sail

MOST CONVENTIONAL of the take-alongs is a cartopper—any boat small enough to carry on top of your car. Prices are low. You can buy a small wood pram for as little as \$50 or a 12-foot aluminum utility for around \$200. Sailing models come higher, though.

You don't have to lose cartop luggage space. With a little ingenuity, it's possible to rig a plywood tray between the carrier bars and use under-hull space for extra luggage.

Keep that boat light, though. Remember that you're going to have to lift it, and a vacation is no time to sprain your back.



12-FOOT ALUMINUM Starcraft sells for about \$230

Boards and such

STRICTLY FUN THINGS for water recreation seldom take up much space. It's easy to make up a cartop rack for a sailboard that leaves plenty of room for lashing luggage around it. The same goes for skis, aquaplanes and skiing discs. There's no reason to leave those water sports at home. Take them along.



SAILBOARD from Lomma (\$269) doubles as swim raft



ANY NUMBER CAN PLAY Scatterball game by Formex



STREAMLINED 4½-foot Zip Sled retails for \$24.95



55-POUND PACKAGE, left, becomes Wiking 11-footer in 10 minutes

THE OLD RUBBER RAFT has come a long way since all those World War II movies starring John Wayne. Today's inflatable boats may use the same principle, but many new configurations have been developed and some welcome improvements added.

For one, more wood is being used in some of the deluxe runabouts—seats, floorboards and transoms.

Klepper's Kontiki goes even further in using rigid materials. The whole cockpit, deck and bow is a single fiberglass unit which is light and easy to cartop. Stability and flotation are provided by two fabric air chambers which fasten to the sides of the cockpit unit. Unfortunately, this is strictly a European item; Klepper has no plans to import it at present.

Prices on these boats range all the way from \$100 to over \$650. Most models are between 7 and 10 feet long, and the majority are priced under \$350.

Modern inflatable boats are almost all made of tough neoprene-coated nylon. Weights are unbelievably low. One little dinghy slightly over seven feet long weighs only 18 pounds. Top load capacity is 1500 pounds; not bad for a boat that fits your trunk. ★★★



RATED TO 40 HP, Wiking 12-foot runabout hits 25 mph, costs \$800



PART FOLDING, PART RIGID Klepper Kontiki has twin air-bag hulls



Owners report on Fairlane's 'first year' pleasures, plagues

By BILL KILPATRICK, *PM's* New York Automotive Editor

THE 1966 FORD FAIRLANE is an all-new "first year" car, restyled and re-engineered from the ground up for the first time since the model was introduced four years ago. And, like all infants, it's having its share of teething pains.

Fairlane owners surveyed by *PM* praise the usual things . . . things proud parents tend to praise in a "first year" child—the way it handles and feels, its comparatively low initial cost and economy of operation and overall looks. But, like an occasional disgruntled parent, more than one Fairlane owner (and some of them downright unhappy, too!) gave the back o' the hand to defective workmanship, an assortment of noises and rattles and what they feel is somewhat high cost of upkeep.

Handling topped the list of owner praises with a Frequency-of-Mention Rating (FMR) of 40.5 percent. Those mentioning this particular attribute cited the car's responsiveness to control, its ease of steering and overall desirable "feel." Economy of operation was next with an FMR of a flat 22 percent. Tied in third place on the owner hit parade was Fairlane styling and ride, both with FMRs of 19.1 percent.

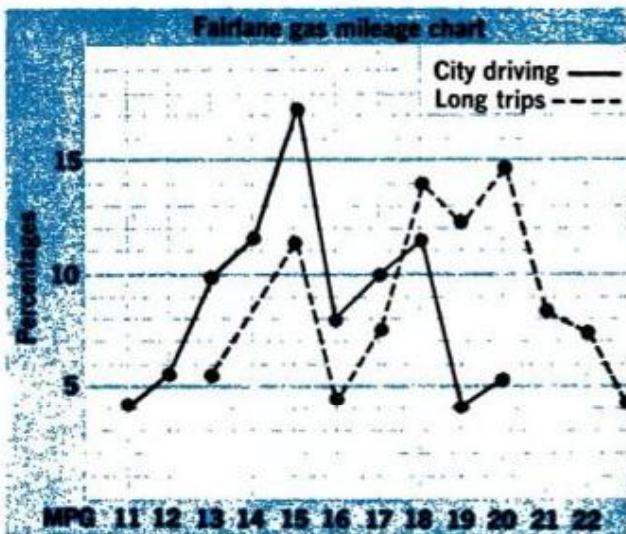
Heading the complaint list—and loudly—was faulty workmanship with an FMR of 15.5 percent. Various noises and rattles were next with 14.7 percent. These two categories, however, may to a certain extent be inter-related; for example, one owner reported finding as the source of an annoying rattle a few surplus screws jiggling around at the bottom of a door, so his complaint could be



REARVIEW MIRROR, according to a number of Fairlane owners, is situated too far back along top of door panel. Driver must "sroonch" back to see out



A FLYTRAP and no Venus is the spring-loaded (and how!) license plate covering the gas-fill location. Owners say access is difficult, tank hard to fill



GAS MILEAGE reported by owners averaged 17.3 mpg overall, almost half by the 120-hp Six. Most owners said the mileage was just about what they expected

both noise and indifferent workmanship.

Third on the knock list with an FMR of 13.2 percent was poor economy, yet good economy ranked second as something Fairlane owners like. Fourth on the dislike list was front-seat position (many owners said it was too low) and the fact it could not be adjusted up and down. Yet a number of owners cited comfort as a definite plus. These apparent contradictions must drive Detroit engineers and stylists nuts and, if anything, prove the truth of the assertion that all the people cannot be pleased all the time.

Specifically, here's what owners of the 1966 Fairlane had to say for and against (all owner quotes are listed in order of FMRs, with boldface comments by the author):

"My Fairlane is so easy to handle I can really enjoy driving."—Virginia school teacher.

"The car handles well on city streets and on the open highway."—Texas police official.

"It holds the road nicely."—Illinois machinist.

"I like the way the car feels, no matter what the speed."—Texas, retired.

Next on the like list was gas mileage.

On the one hand, they like:

Handling	40.5%
Economy	22.0%
Styling	19.1%

On the other, they don't like:

Workmanship	15.5%
Noise/rattles	14.7%
Poor economy	13.2%

Overall, in a total of 742,514 miles of both around-town and long-trip driving, Fairlane owners reported an average of 17.3 mpg. Almost half the owners replying to PM's survey said their cars were powered by the 120-hp Six, so this average figure may indicate some room for improvement.

"It's stingy on gas."—Minnesota salesman.

"I find the car economical to maintain and keep in gasoline."—Alabama draftsman.

"My car-running dollar goes a long way."—U.S. Army, retired.

Ranked third on the praise list were both styling/appearance and ride.

"Has good lines and a very nice general appearance."—Kentucky office manager.

"Because of the straight lines of the

fenders, I can gauge within one inch the space between my car and another."—New York personnel director.

"Both exterior and interior are well designed."—California plumber.

"I like the nice smooth, comfortable ride it gives."—New York store owner.

"Me, too."—New York store owner's wife.

Characteristic of Ford-owner loyalty (usually a fierce, die-hard devotion) is praise for the car's hustle, regardless of model or engine size. Owners of the 1966 Fairlane are no exception.

"I like its peppy pickup and easy starting."—Ohio secretary.

"For a six-cylinder car, it has plenty of get-up-and-go."—Missouri manager.

"Regardless of weather and temperature, I can get in that car, turn on the switch, step on the accelerator and I'm off and running."—Ohio papermaker.

► Wait! You forgot the car!

Drawing the most complaints from owners of the 1966 Fairlane was poor—or at the very least, indifferent—workmanship. Seems this complaint, regardless of car make, is almost universal throughout the auto industry. Note, for example, the Cadillac and Lincoln owner reports appearing elsewhere in this issue; they, too, are indignant about the workmanship on their strictly high-ticket cars. Initial outlay aside, however, no buyer of a new car should have to contend with some of the things described by many Fairlane own-

ers, several of whom were speechless with indignation.

"The day I received the car I put my elbow on the armrest and it fell off at one end."—Iowa letter carrier.

"Upon delivery, the door locks and levers were not working and the rubber gaskets lining the doors were loose."—Virginia educator.

"The doorknobs and inside trim fall off and I have trouble closing the front doors."—Indiana secretary.

"After the car was delivered it was necessary for the local dealers to hook up things that should have been checked at the factory."—Minnesota marketer.

► **You bet.** Each unit is checked, but lots of bugs show up later on the road. Ford quality control engineers explain that the '66 Fairlane is nearly all new this year, requiring all new techniques on the line. Result: bugs this year that will be gone in '67, they claim.

"The damn thing is just thrown together."—Texas railroad man.

Next on the groan list were noises and rattles.

"According to the commercials, Fords are supposed to be quiet. Well, mine isn't. I've had it serviced seven times and can't get rid of a rattle."—D.C. insurance man.

"The drive lever vibrates and is noisy. Dealer says he can't fix it."—Ohio accountant.

► **Sure it isn't just the ticking of the clock at 60 mph?**

"There are several rattles I can't seem

(Please turn to page 184)

Summary of Fairlane Owners' Reports

Excellent 40.9% Good 46.8% Fair 8.6% Poor 3.7%

Best-liked features:

Handling	40.5%
Economy	22.0
Styling	19.1
Ride	19.1
Performance	16.8
Size	15.6
Quietness	13.3
Interior room	12.7
Tailgate (wagon)	9.8

Least-liked features:

Workmanship	15.5
Noise/rattles	14.7
Poor economy	13.2
Seat position	7.8
Gas-tank fill location	7.0
Handling	7.0
Heater	5.4
Poor performance	4.7
Defroster area covered	3.9

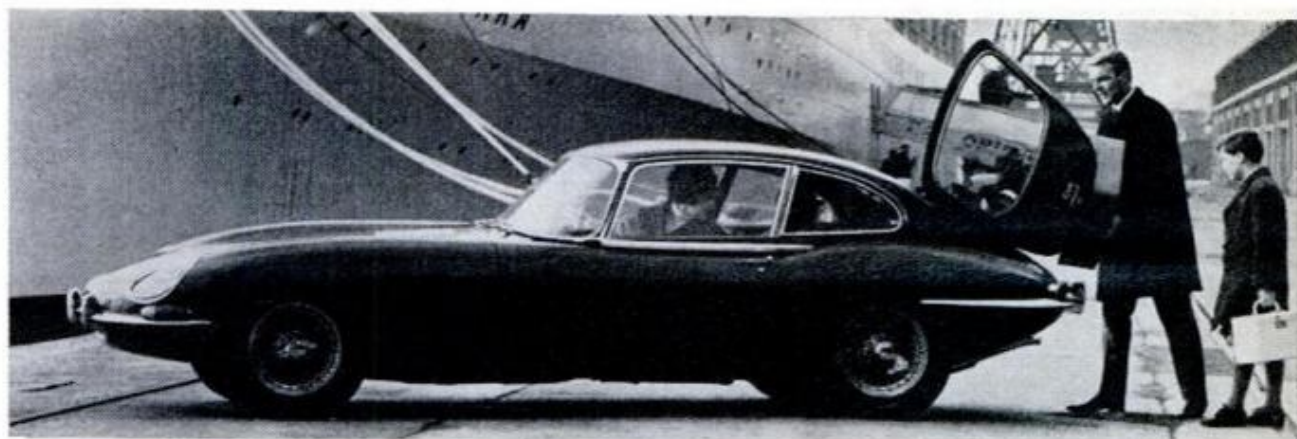
Most like to see changed:

Front seat height, back	11.4
Should have specified	
larger engine	10.6
Gas-tank fill location	7.3
Better mileage	7.3
All-gear synchromesh	5.7
Idiot lights	4.9

Better workmanship	4.1%
Spare-tire location	4.1
Better visibility	3.3
Car traded in:	
Ford	45.8
Falcon	12.9
Chevrolet	12.9
Rambler	5.8
Mercury	3.2
Corvair	2.6
Others	18.6
Dealer service:	
Excellent	43.8
Average	44.9
Poor	11.3
Buy from dealer again?	
Yes	83.4
No	16.6
Buy another Fairlane?	
Yes	85.2
No	14.8
Bought Fairlane because:	
Price or trade-in	48.5
Dealer and service	13.9
Past experience	13.9
Size	10.9
Features	9.9
Style	7.9

Interior room	5.9%
Considered other makes?	
Yes	60.3
No	39.7
Own another car?	
No	59.1
Yes	40.9
Make of other car:	
Ford	25.3
Chevrolet	13.3
Plymouth	9.3
Volkswagen	8.0
Falcon	8.0
Oldsmobile	6.7
Dodge	5.3
Buick	5.3
Others	33.3
Fairlane transmission:	
Automatic	58.5
Three-speed manual	34.0
Four-speed manual	2.7
Not given	4.8
Fairlane engine:	
Six	50.0
V8	44.1
Not given	5.9

Total miles driven: 742,514



Newest in the Jaguar line is this four-passenger XK-E called the "2+2 coupe." Its designation as a "four-seater," however, must be taken with more than a grain of salt; rear seats may be fine for small fry, but adults will find things somewhat cramped. To rear of back seats is luggage space; access is through an ambulance-type door. Automatic transmission is optional.



Hoping for hoop revival is Paul Sakwa, designer of Orbit-Wheel, a stainless steel hoop with a spring steel guidance "stick" for rolling it and putting it through a variety of tricks. Available from EMI, Inc., Box 3721, Washington, D.C.



Floating travel trailer sleeps four and is equipped with icebox, gas stove, toilet and clothes closet. Named the "Corvette Week-End" by its French manufacturer, the 16-foot polyester unit is hauled on a lightweight trailer. It floats off the trailer when backed into the water and is powered by a 14-hp out-board motor.

Weird new world of Old

Flailing machines have solved the nation's pickle-picking problem—and a good many other harvesting problems, too. / By John E. Boykin

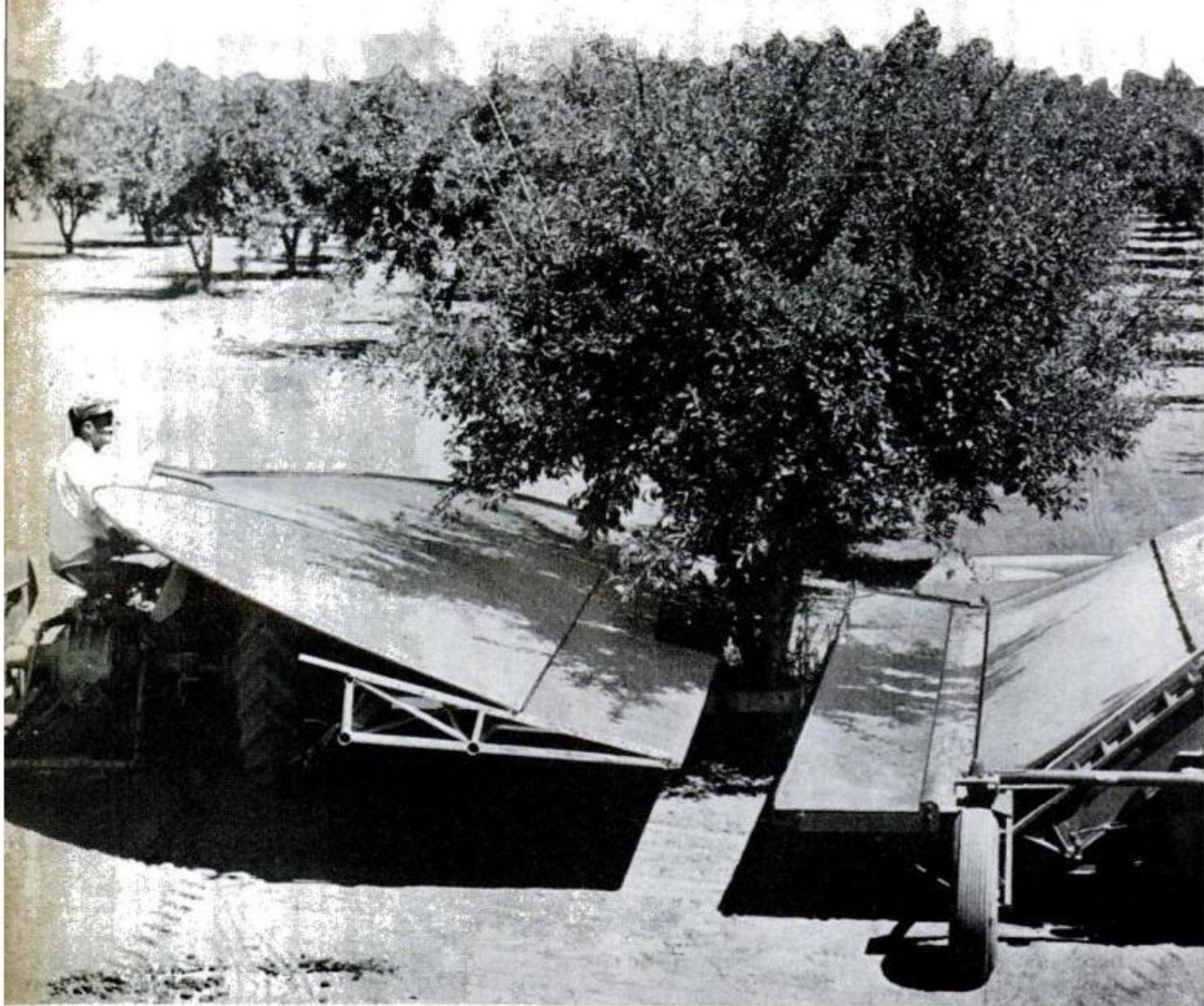
WHACK, GOES THE BLADE, and another head is severed! Cold, deft hands adroitly grasp it and elevate it to a conveyor where it will move to a container and drop along with others which have previously fallen to the guillotine.

The scene isn't an automated beheading orgy during some bloody and violent revolution, but a quiet, flat field a few miles from the Mexican border near El Centro, Calif. A far-reaching revo-

lution, however, is taking place here and in other fields, laboratories and factories across the nation.

In fact, many agriculture experts agree that American agriculture is "in a revolution equally as dramatic and dynamic as the nation's population shift and its attendant political, social and economic vibrations." One authority puts it this way: "We are in the midst of changes that will make the old Industrial Revolution seem like it was running on square wheels."

The drawbridge has already been lowered, allowing this revolution to sweep into our fields by the recent development of many weird and wonderful machines designed to harvest such



MacDonald

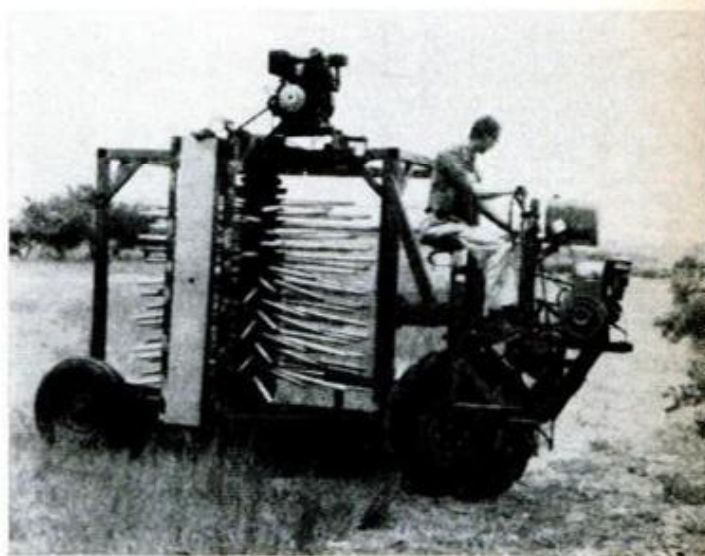
crops as tomatoes, melons, asparagus, citrus fruit, lettuce, grapes, cucumbers and others which farmers have long considered impossible to harvest by any means but hand labor. Many of these pushbutton pickers are still in the developmental stages, but some, such as the tomato and cucumber harvesters are already hard at work in the fields.

Let's return for a moment to the field near the border where a wide-wheeled metal monster moves menacingly down the lettuce rows. The weird-looking ma-

MECHANICAL PRUNE-PICKER grabs tree at trunk and, after closing gap, shakes the . . . well . . . the prunes out of the tree. Rig is tractor-powered



FRUIT PICKER uses group of auger-shaped spindles on end of scissorslike support to spin fruit off trees and drop them uncrushed into long canvas bag



BLUEBERRY PICKER, though weird-looking, can cut cost of harvesting from 8 cents to less than 1 cent per pound. It was designed at Michigan State University



RICE THRESHER, developed for Southeast Asia, sends straw through rotor and concave; removes rice, starting at base of head, without cutting straw

chine moving toward us is a selective lettuce picker, because, like a human, it must determine if a head of lettuce is "ripe."

In operation, this machine, developed at the University of California, is fascinating to watch. The prime mover is preceded down the rows by four sets of mechanical hands which are mounted in circles to resemble spokes on a wagon wheel. As the machine crawls along a roller and belt mechanism, one for each row, it feels a head of lettuce just as a human would by pressing down on it. If the head is firm enough for harvest, a switch is tripped and the message is sent to a memory unit.

When the machine has rolled far enough ahead for the lettuce to be in the proper position, the memory unit sends a chopping knife swishing into action and another head rolls. At the same instant two of the mechanical hands clap onto the head and it is rotated up and around until it reaches the top of the circle, where it is dropped onto a belt.

Many crops, such as lettuce, must be picked over several times to be profitable. For these crops—melons, cucumbers, asparagus and the like—selective harvesters are being developed. Cantaloupe, for example, is one of the crops which in the past has been considered a very unlikely candidate for mechanical harvesting. They have, however, been successfully picked by still another machine developed at the U. of C. The melon machine has picked up to 97 percent of the ripe fruit from the vines during repeated runs over test fields.

The problem of building a cantaloupe harvester was somewhat lessened by the fact that nature makes ripe or near-ripe fruit fall easily from the vine while the green ones cling tenaciously. Before harvesting a crop with the mechanical melon picker, the vines are first trained in one direction. This is done with a comblike machine pulled by a tractor. The melon harvester itself is basically a wide (about 40 inches) inclined belt mounted underneath a wide-wheeled tractor. As the machine proceeds down the rows, the belt runs completely underneath the vines, lifting them from the ground. Friction of the belt against the melons is sufficient to cause the

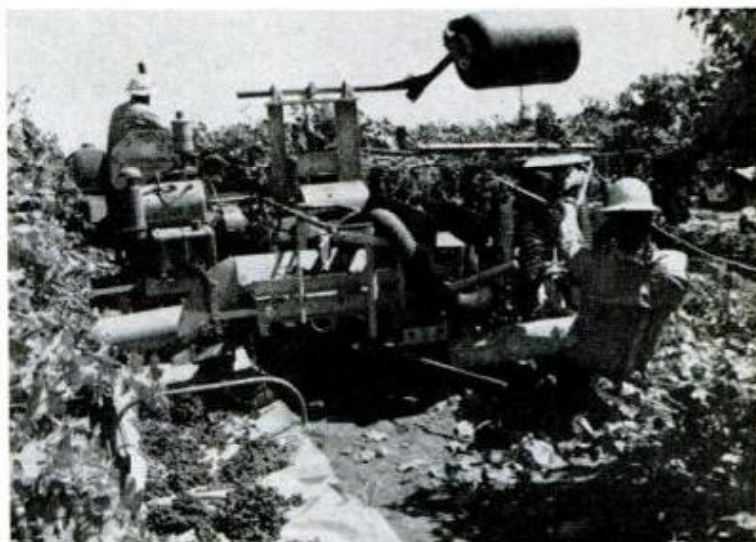
(Please turn to page 169)

CITRUS PICKER stalks up and down rows of groves like giant praying mantis, plucking fruit at end of long boom





LETTUCE PICKER patrols four rows at once, selecting heads ripe for harvest and leaving young ones behind. Feeler device tests hardness and swishing blade severs head from stalk



GRAPE HARVESTER deposits grapes meant for raisins on unwinding strip of brown paper where they will lie in sun and dry. Top wheel presses down on vines so grapes will hang low



CANEBERRY PICKER uses hundreds of foot-long metal fingers on two freely rotating vertical drums to jar ripe berries loose from the plant. Berries then fall onto an endless belt

Turning Reproductions Into 'ANTIQUES'

By Walter Ian Fischman

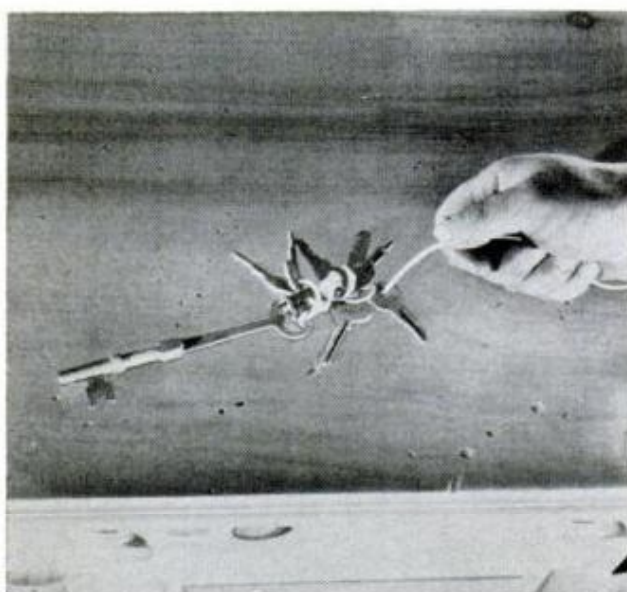


IT'S DISCOURAGING. You buy an unfinished reproduction of a colonial pine chest and take great pains finishing it—plenty of sanding, just the right stain and a fine, no-rush varnish job. But after all that work, what have you got? A raw-looking pine chest which might have just come off a modern assembly line.

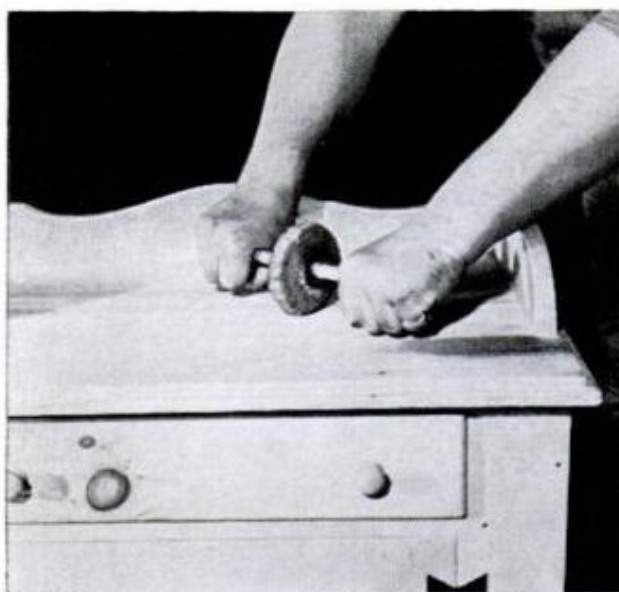
An expert on restoring colonial furniture would have approached the job in an entirely different way, and E. Harold Hull is just such an expert.

Hull and his crew of skilled craftsmen did most of the restoration work of Shelburne Village, a Williamsburg-type museum village in Vermont. He's often called

SECRETS OF INSTANT AGING



TO SIMULATE the random marks and scrapes of age, Hull uses a bunch of ordinary old keys threaded loosely on a cord. He simply slams them down with enough force to dent the wood. Because keys have different shapes and keep changing position, an irregular pattern of convincing authenticity results



DIFFERENT MARKS are produced by an old, chipped grinding wheel with a dowel through the center to act as a handle. Just roll it across the surface with enough force to mark the wood. The larger the wheel, the more widely spaced the marks. Use both keys and wheel sparingly, it's easy to overdo either



A museum expert shows you how easy it is to make a low-cost reproduction look like a genuine antique

upon by other museums to restore rare furniture or to make replacements for missing parts.

Normally, Hull prefers to make replacement parts from well-seasoned lumber, salvaging it from barns, houses and other old structures which are being torn down. Because this supply of antique wood is gradually vanishing, however, he often finds it necessary to substitute new wood. The techniques he uses to blend this new wood with the old can also be used to give any reproduction the mellow look of a genuine antique.

That reproduction chest, for instance. In spite of the fact that its measurements

duplicate those of the museum original, those even edges and smooth unmarked surfaces stamp it unmistakably as a new piece of furniture made with modern woodworking machinery. The original was produced with hand tools and contains a certain number of irregularities. Its edges are rounded with 200 years of wear. The surfaces are marred with all sorts of random dents, scratches and stains.

Hull uses common tools and materials to produce this same result, and he's a master of the art. He can even make "old" hardware. So forget all you've heard about "distressing"; read how an expert does the job on these and the next three pages.

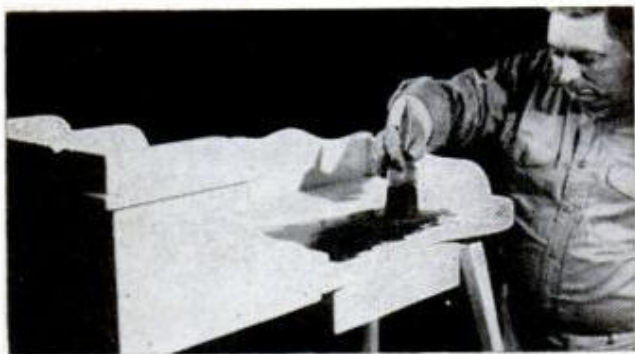


ROUND OFF SHARP EDGES with a wood rasp or coarse mill file to simulate the result of years of wear. Exposed edges standing alone should get more treatment than corners or backs. Edges shaped by machine look much too even for an antique, so if this is too obvious, plane them to resemble hand work



BURN MARK is almost always required. Pour a bit of shellac about the size of a 50-cent piece on the top where a cigar or hot pipe may have rested and touch a match to it. It will burn long enough to give the right amount of charring. Don't get carried away, however; one burn is enough for any piece

EASY ANTIQUE FINISHES



ROUGH COUNTRY GLAZING is a very effective finishing technique. Completely finish the piece in a light shade of semigloss paint, following standard paint procedures and applying two or three coats, as required. Allow the piece to dry thoroughly, then brush on a single heavy coat of gray-brown paint



QUICKLY WIPE OFF almost all of this glazing coat before it has a chance to dry. Use plenty of rags. Coloring should remain in the spots that are hard to clean, giving the effect of old discolored furniture polish which has been accumulating for generations. If handled properly, it's a pleasing effect

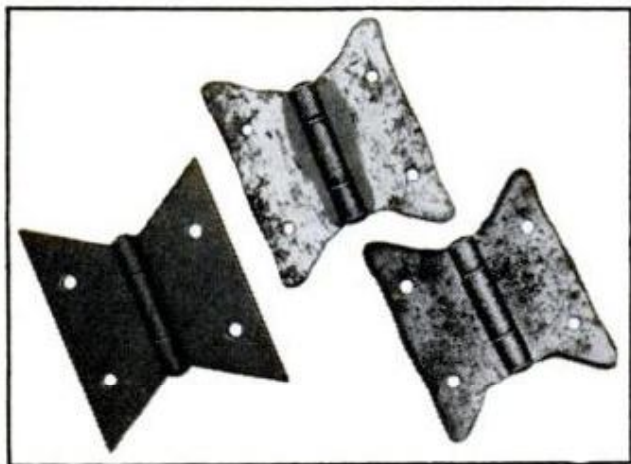


RED BARN PAINT can be used to give appearance of old piece from which paint has been stripped. Let paint settle, then pour off liquid and dab remaining goo on the wood with a cloth. Before it dries, wipe off the excess with cloth (or steel wool moistened with turps if too much remains) and sand lightly

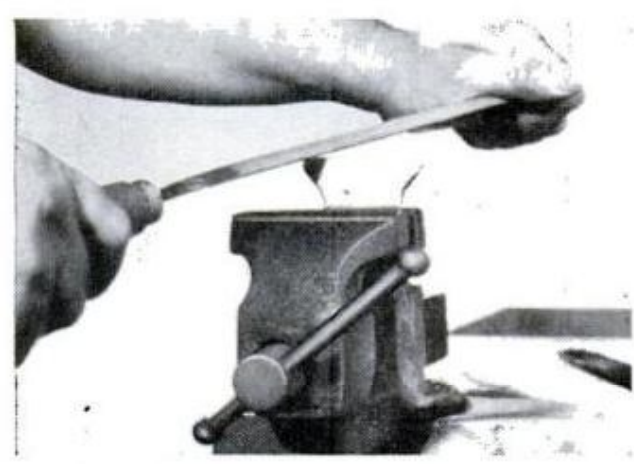


FOR WAX STAIN, you're probably better off using a good commercial brand rather than trying to make up your own from scratch. That's a messy job. After wood has been sanded thoroughly and is free of dust, apply wax liberally with a wad of cheesecloth and rub it in well. Allow it to dry for half an hour

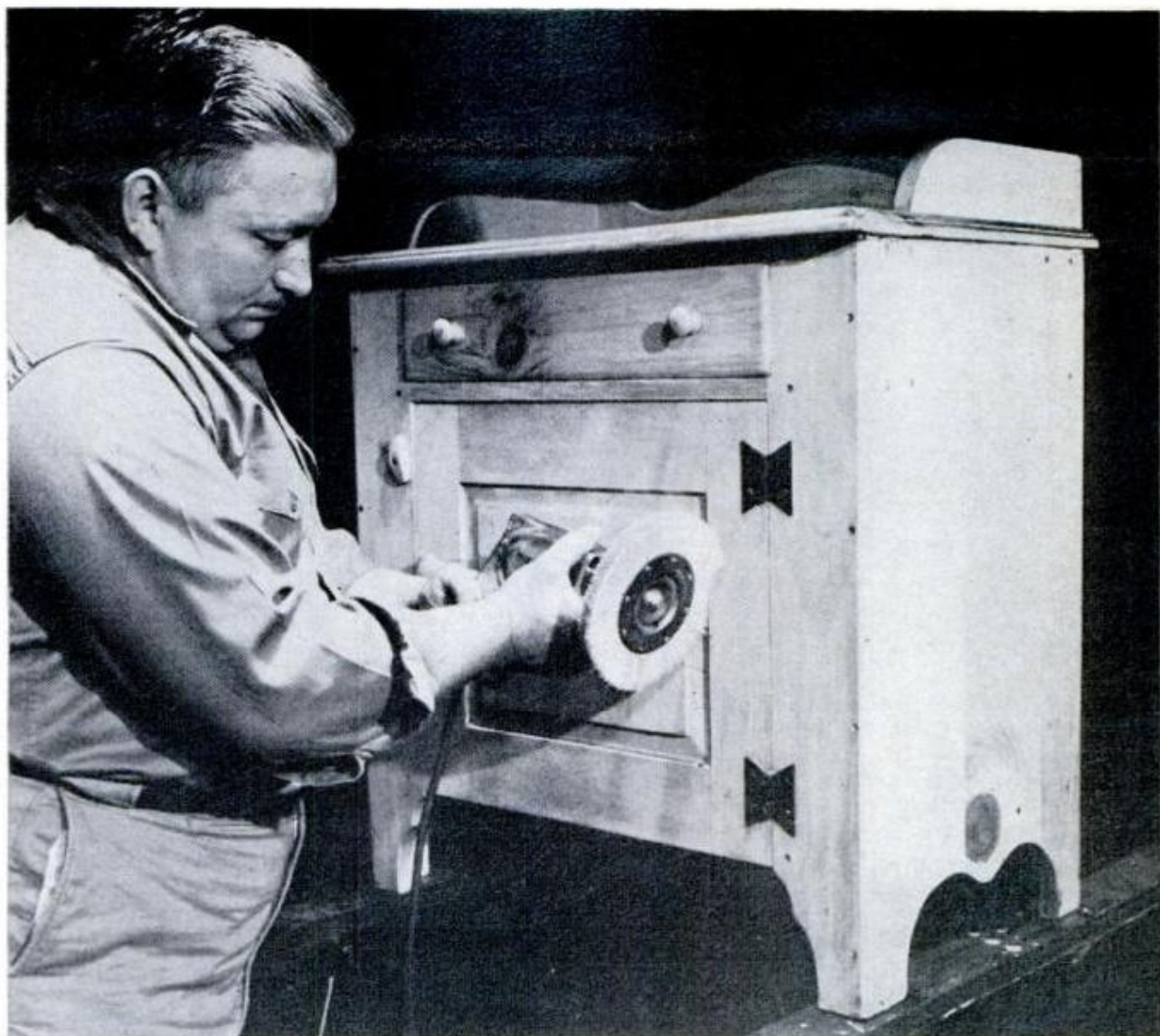
MAKING YOUR OWN ANTIQUE HARDWARE



MODERN STAMPED HARDWARE, like the butterfly hinge at left, is too regular in shape and finish to look really old. It's easy to "distress" the metal and give it the uneven appearance of hand-made fittings. Hinge at right is an example of what can be achieved by following a simple aging treatment in the shop



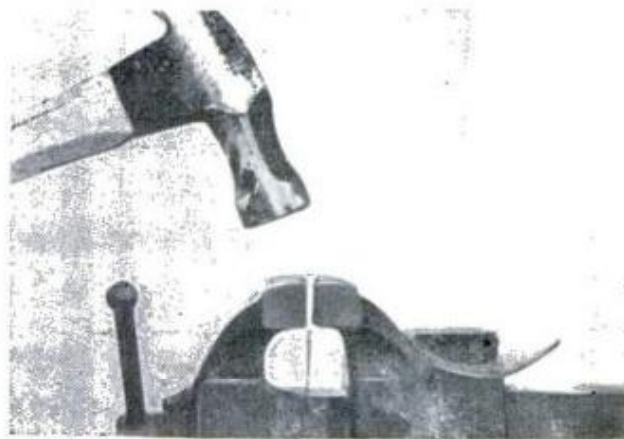
USING FILE AND HAMMER, round off the sharp edges of the hinge and thin down the edges, making them slightly irregular. Daple the surface with light blows of the round end of a small ball-peen hammer. Original colonial hardware was made by blacksmiths and wasn't generally uniform in shape or design



BUFF DOWN WAXED SURFACE thoroughly with a Tampico brush chucked into any small electric drill. Then repeat the whole operation—apply wax, let dry and buff. Figure on doing this three or more times, in order to build up a finish. When completed, the surface should have a soft, warm luster without any gloss

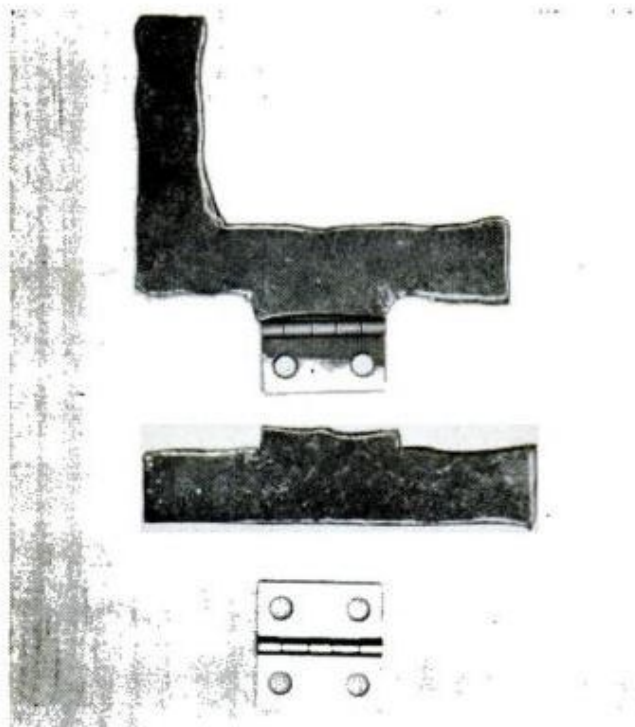


TO DISTRESS METAL, spray lightly with flat black paint and sprinkle with a few bits of sawdust, then repeat, being sparing of sawdust. The effect to be achieved is that of rough-surfaced iron. If the sawdust appears to be too coarse, try substituting the grit from various grades of sandpaper. It's finer

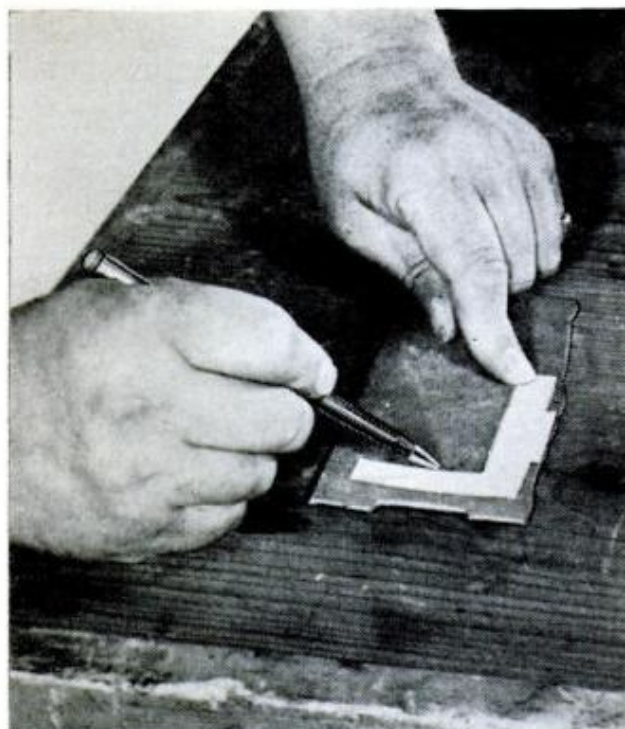


NEW ANTIQUE NAILS to match hinges are easy to make. Use common horseshoe nails (you can still buy them). Clamp in a vise with the head protruding slightly above the jaws and beat it with a hammer at odd angles so as to achieve a domed effect. The more irregular they are, the more handmade they will look

MAKING YOUR OWN ANTIQUE HARDWARE



SMALL BUTT HINGES, like the one just above, lend themselves to conversion into other shapes, such as the antique "L" and "H" shown at top. The trick is to use the new hinges as a base for overlays cut from dull lead flashing that has been exposed to the weather. The effect is surprisingly authentic-looking



AFTER EXAMINING the piece carefully to determine where and how the antiqued hinges should fit, make a cardboard template of the desired size and trace the outline on the lead. Plumbing and roofing supply houses usually sell suitable metal for this, but you can also use pewter from old, damaged dishes



LEAD AND PEWTER, being soft, are easy to cut and work. Use tin snips or ordinary scissors, or score the metal heavily with a knife or scratch awl until it's cut through. Don't attempt to trim evenly. You'll come out with a better result if you take the trouble to be a little careless (it looks more "antique")



IT'S EASY to give the look of hand-hammered metal to lead—just hammer it. Work toward the edges, thinning them out slightly. This may cause the metal to stretch somewhat, so trim and hammer again. Spray center portion of hinge black, then drill holes in lead and mount with "antique" nails clinched on inside

Stand Up and Work

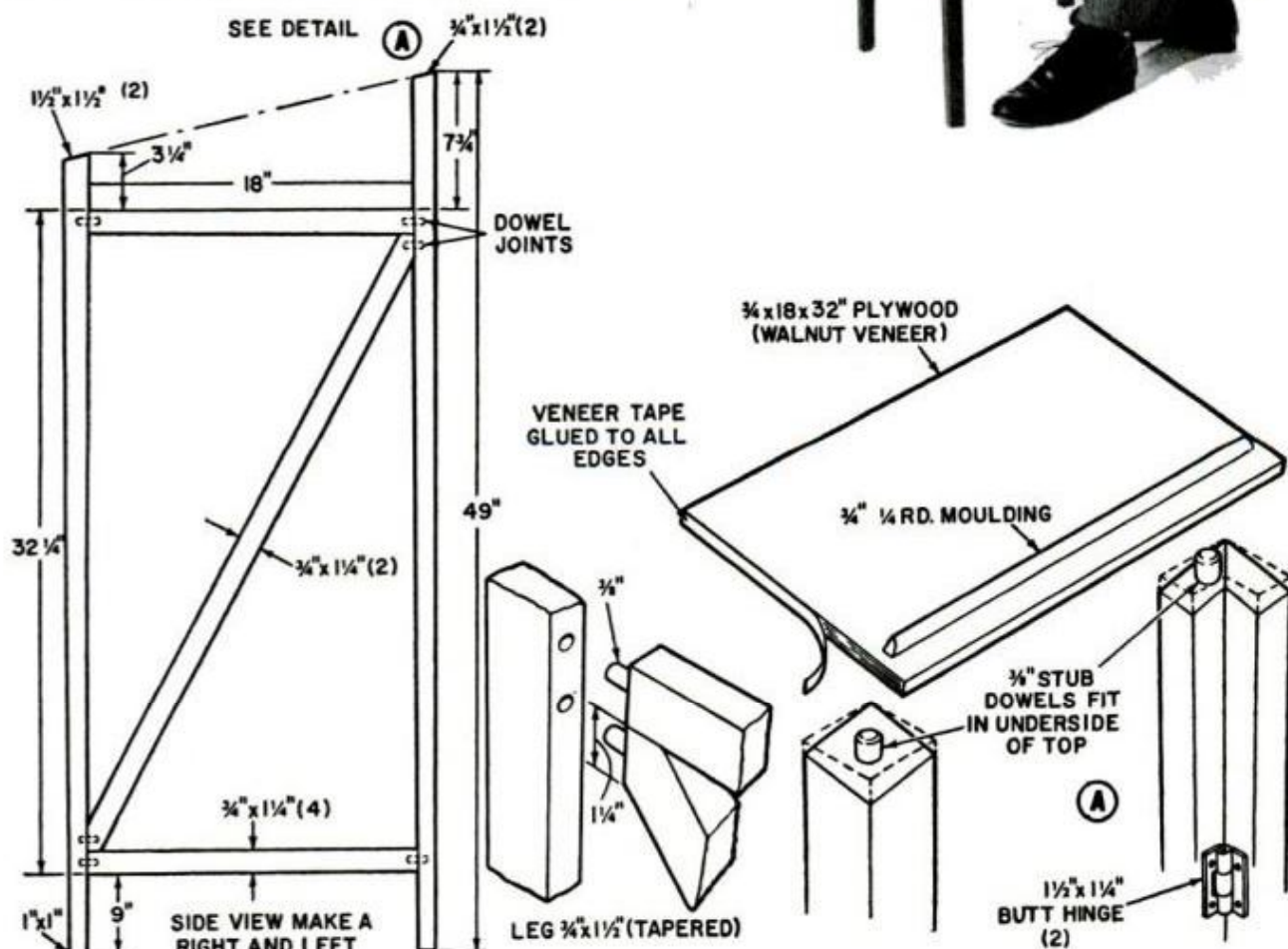
THINK BEST ON YOUR FEET? Here's a simple desk-drafting board for writers, speechmakers and artists of the old school who like to work standing. It sets up in a jiffy and knocks down to store in minimal space.

Make two of the frame shown below. The rear legs taper from 1½ in. square to 1 in. square, while each ¾ x 1½-in. section of the compound front leg is tapered to 1 in. across its width at the bottom. Each front-leg section is mitered along its length at 45°.

Bevel the tops of all legs 20° toward the rear. Since the front leg must have that degree of bevel when opened to a right angle, cut a compound miter on each section, 45° from the front corner.

In the top of each leg, drill a hole and insert a ⅜-in. dowel, leaving ⅜ in. projecting. Drill three ⅞-in. holes in the underside of the plywood top near the lower corners and upper edge at the center.

Apply veneer tape to the edges; glue on a 31-in. length of ¾-in. quarter-round molding with beveled ends ½ in. up from the bottom edge. Finish to suit. ★ ★ ★



12 Ways to attach legs

Whether you're building new furniture or restoring old, sturdy legs are essential

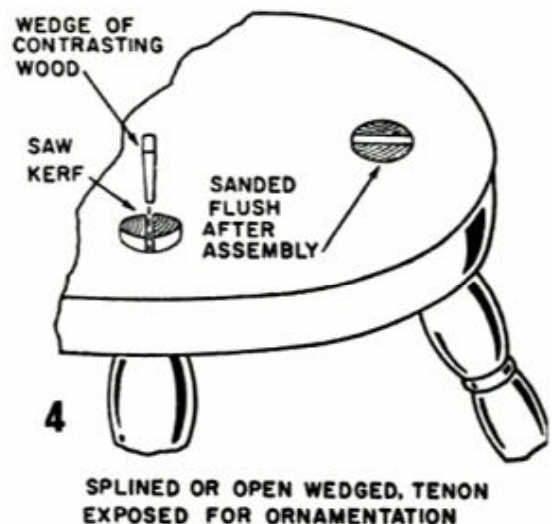
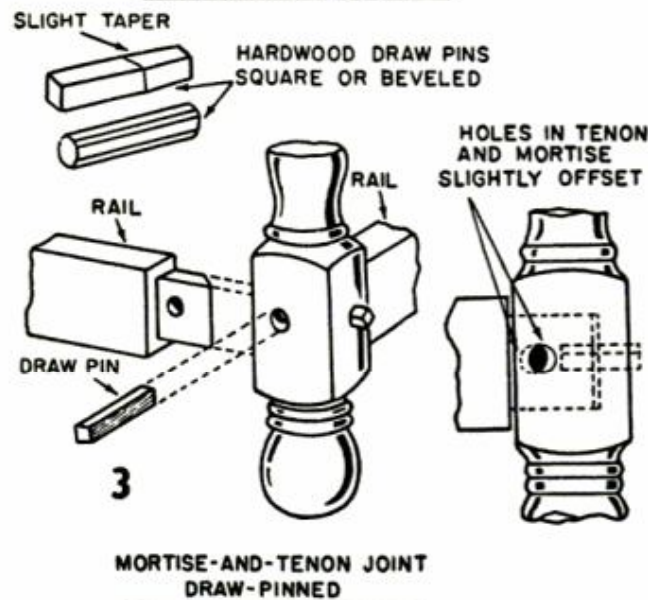
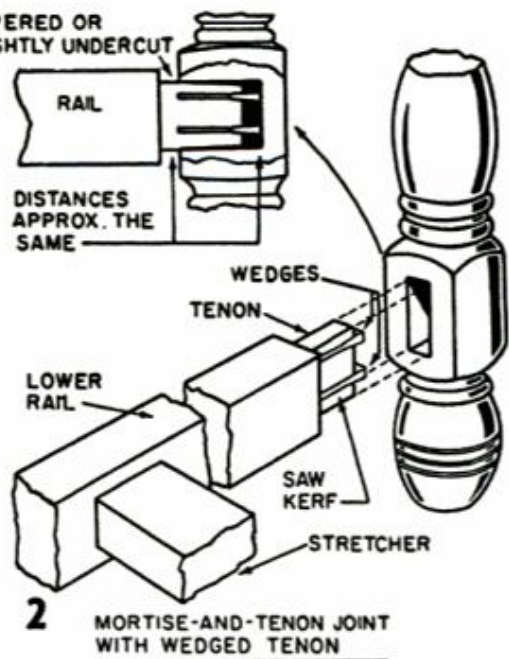
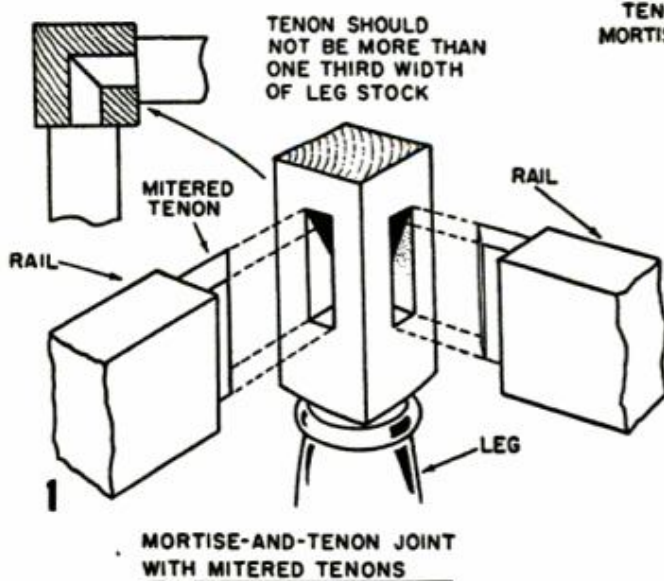
By W. Clyde Lammey

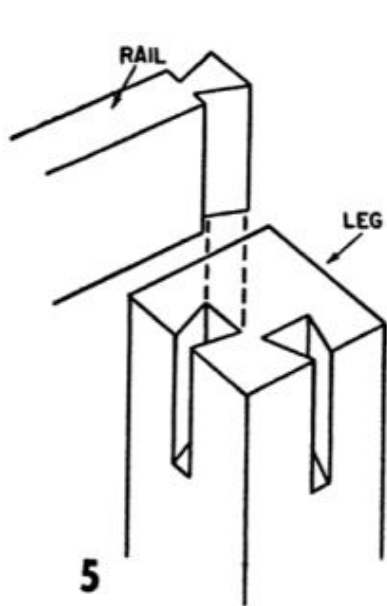
YOUR CHOICE of methods for attaching legs depends on the piece of furniture you're working on—and its style. If you're building a simple modern chest or slab table, you can get by with purchased legs that screw into their own mounting plates. But if you're reproducing or refurbishing a period piece, you'll most likely have to go to hand joinery.

It's easier than you think, and the dozen methods sketched on these pages cover most means of attaching legs to rails and aprons or flat undersides.

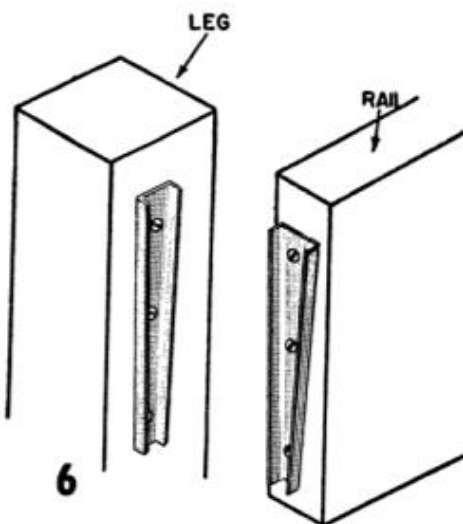
Say you're building a workbench and want a good solid one that won't jiggle or "walk" when you plane stock or do some hammering. For this, you'd use the butt joint with a drawbolt to join the legs to the rails of the frame. With ordinary care in cutting and assembly, you'll get a job that will take the roughest usage—even without bracing or gluing.

In making a cabinet or table with turned legs, on the other hand, you take your choice of the rails-to-legs joints with mitered, wedged or draw-pinned tenons.

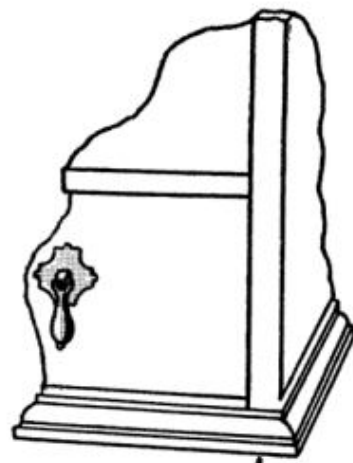




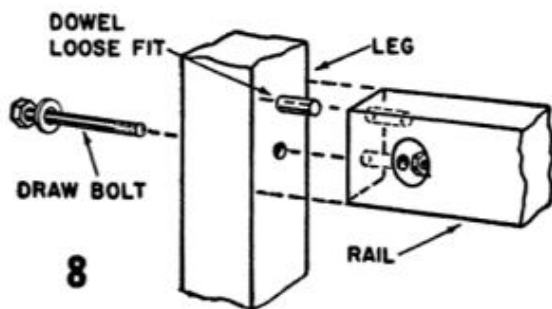
**DOVETAIL MORTISE AND TENON
RAIL-TO-STILE, OR RAIL-TO-LEG JOINERY**



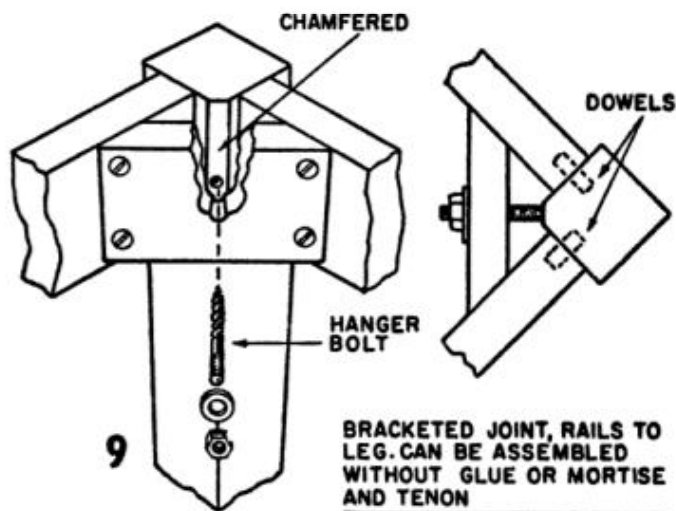
**TAPERED METAL WEDGES
FOR KNOCK DOWN RAIL-TO-
LEG JOINERY**



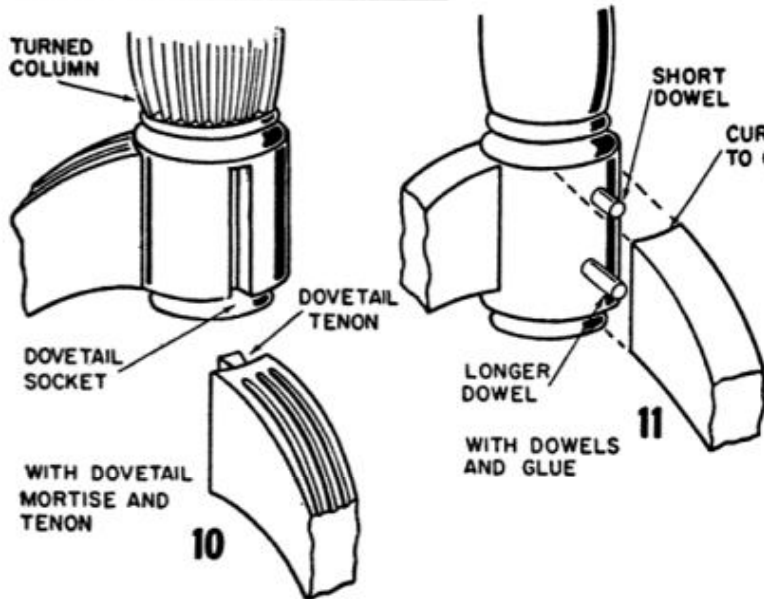
**CABRIOLE AND TURNED LEGS
TO CABINETS WITH
DOWEL SCREWS**



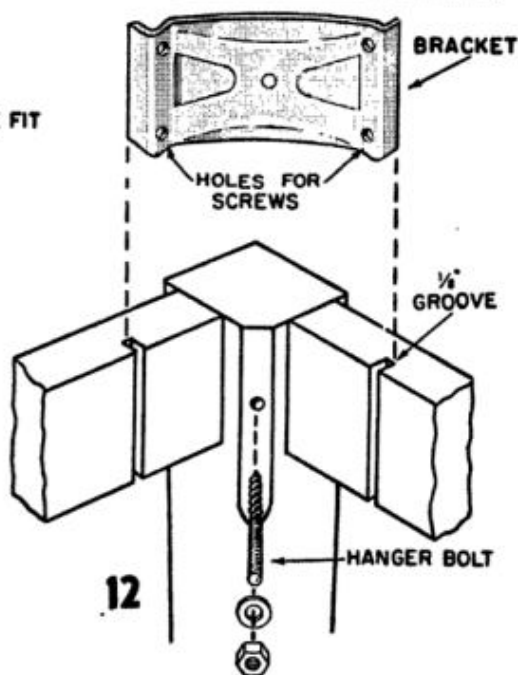
**BUTT JOINT WITH DRAW BOLT, FOR
WORKBENCH FRAMING, SIMILAR CONST.**



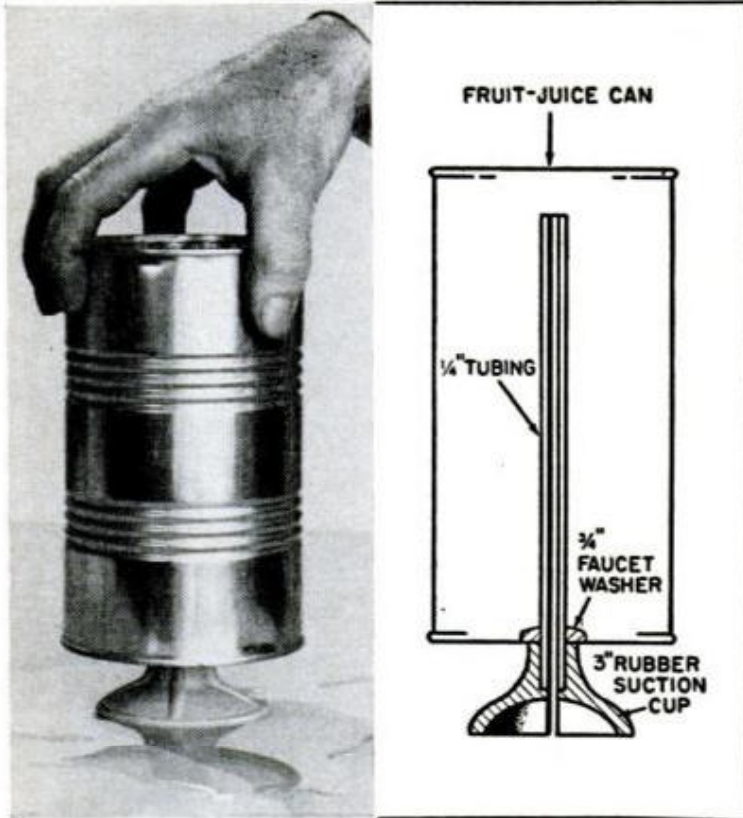
**BRACKETED JOINT, RAILS TO
LEG. CAN BE ASSEMBLED
WITHOUT GLUE OR MORTISE
AND TENON**



**JOINING CURVED LEGS OR FEET TO
SINGLE COLUMN-TWO WAYS**



Shallow puddles pose no problems for percolator pump



Shallow puddles on basement or bathroom floors are a cinch to sop up with this easy-to-make "percolator pump."

Drill a $\frac{1}{4}$ -in. hole in the bottom of a 46-oz. juice can and through the center of a large, deep suction cup, such as from a luggage rack. Cut a length of $\frac{1}{4}$ -in. O.D. brass tubing so it passes almost through the cup and stands inside the can to about 1 in. from the top. Enlarge the hole in a $\frac{3}{4}$ -in. neoprene faucet washer and force it down on the tubing to hold the tube in place and seal the hole in the bottom of the can.

Hand pressure operates the pump. The high tube eliminates the need for a check valve. After each stroke, lift the can to admit more water under the cup.

—Ralph L. Phillips

Hang-up shelf for a tent

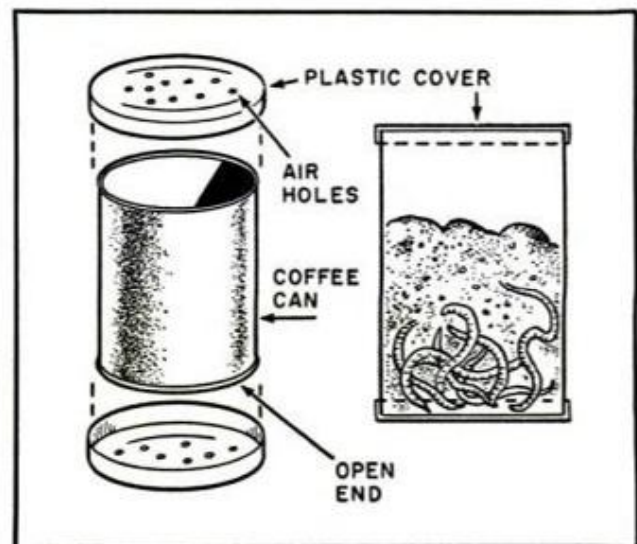
Shelving in a tent? Sure . . . and with a badminton net! Cut the net to the length of a tent eave, weave $\frac{1}{4}$ -in. dowels through loops at each end and crimp S-hooks on the dowel ends. With plastic clothesline stretched between corner tent loops, you can attach the S-hooks. What's left over of the net can be made into a storage hammock. Merely tie the ends with plastic clothesline and, in turn, tie the lines to the tent loops. This setup permits air circulation through the shelves, helps prevent mildew.—Rudy Schulze



Worms, front and center!

Bait worms kept in a can of dirt invariably tunnel their way to the bottom, making it a difficult and messy job for the angler to extract one. To make it easier to grab a worm, Thomas Crowe of St. Louis used a coffee can from which the bottom was cut out. He snapped on both ends the plastic lids that come with coffee cans and then punched several holes for air. When he wants a worm, he simply turns the can end for end. The worms that were on the bottom are now handily at the top.

—Alvin W. Hackir

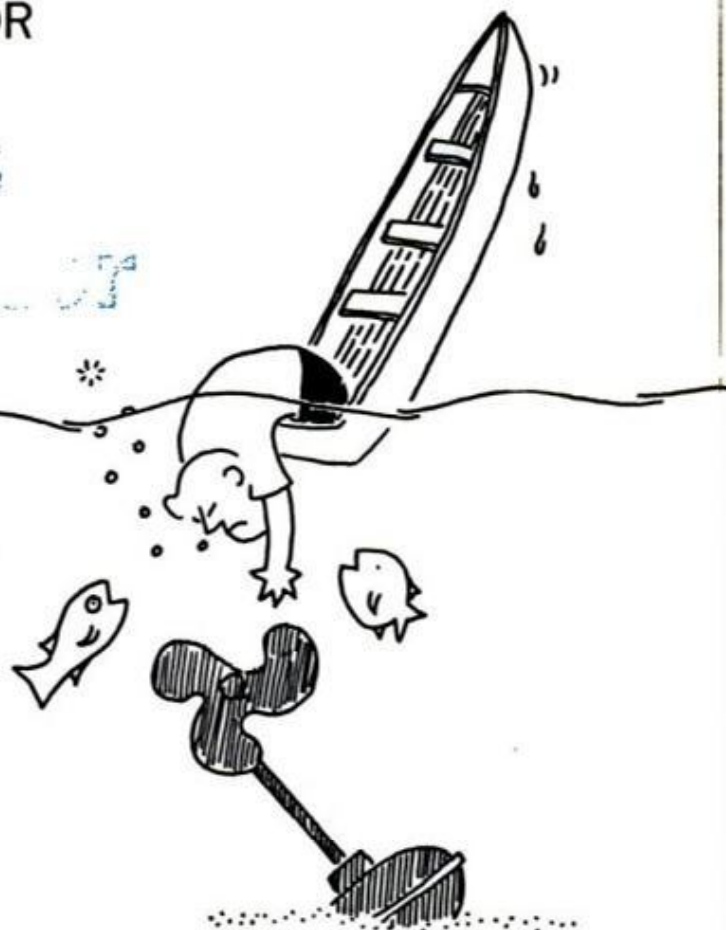


YOUR OUTBOARD MOTOR

Doctoring a Dunked Motor

Any time an engine takes a dive, it's bound to mean big trouble. If you know what to do, however, you can prevent this from turning into total disaster.

BY HENRY B. NOTROM

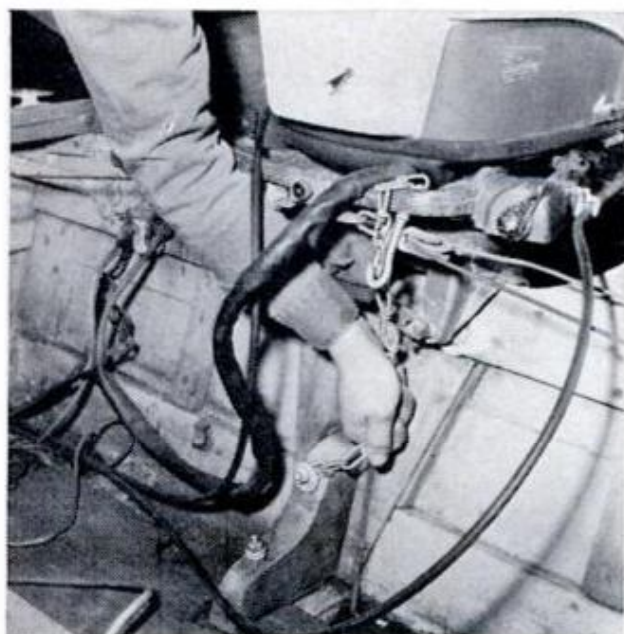


BIG OUTBOARD ENGINES seldom get dunked. They're bolted solidly to the transom, and the only way to submerge one is to capsize or swamp the boat.

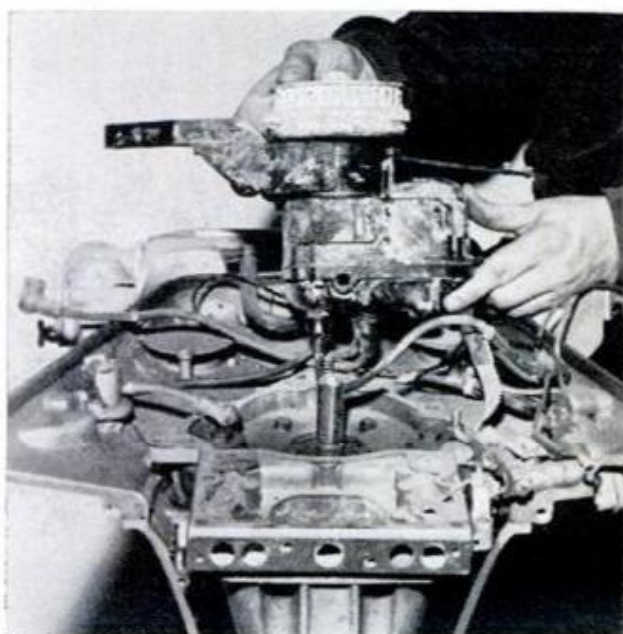
The outboards more likely to be dunked are the small ones—those that are clamped on the transom. Clamps work fine if they're used properly, but some people don't screw them up tight enough and they have been known to work loose without

being noticed. Smart operators use a safety chain or stout rope as insurance against loose clamps (see photo below—left).

Any fishing motor belongs at the top of the most likely-to-be-dunked list, and it's no wonder. What with being lugged around on slippery docks and slung over the transom of many a light, bobbing cartopper, it's a miracle that more of them aren't accidentally pitched into the drink. It's



SAFETY CHAIN snapped around engine bar and bolted to the framing is best insurance against dunking



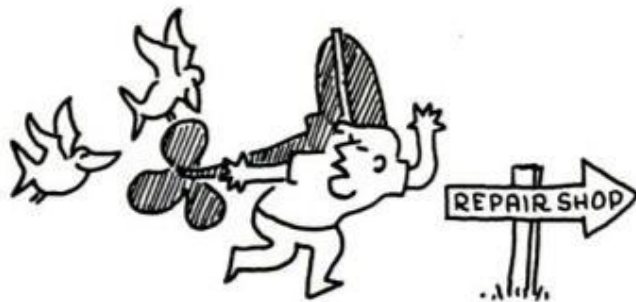
RUSTED MAGNETO from dunked motor which wasn't taken down immediately and wasn't kept immersed



a good thing, too, because submerging is just about the worst thing that can happen to an outboard.

The minute that powerhead sinks beneath the surface, you can start thinking in terms of major overhaul.

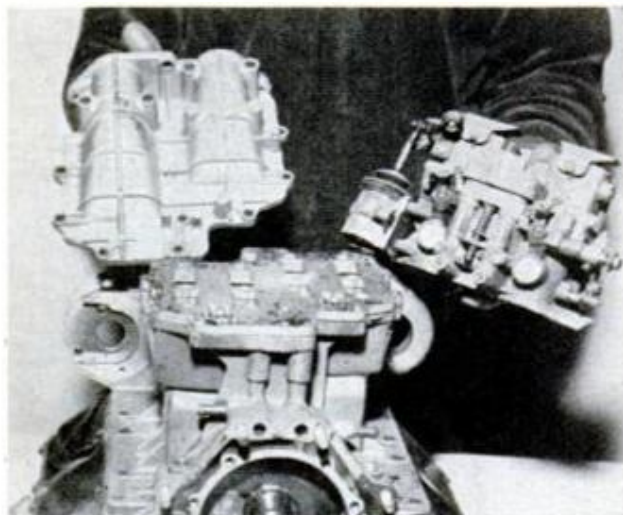
Obviously, however, the first thing to do is retrieve your drowned motor. If it jumped off the transom in the middle of the lake, take a quick bearing on shore objects to make sure you know where to look for it, then either drag for it with a grapnel or go overside and attach a line.



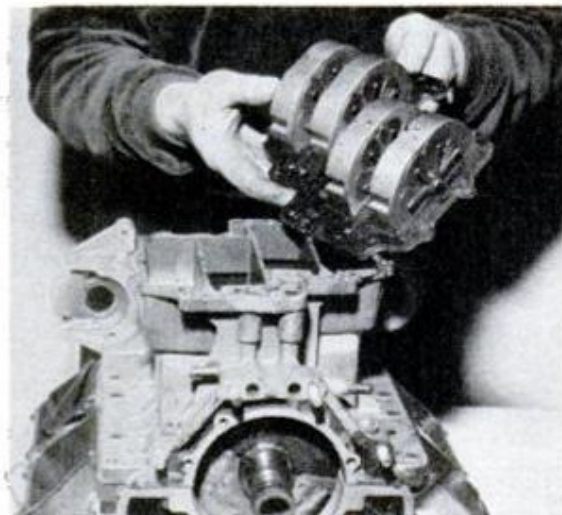
Once you've paddled back to shore, your first stop should be your local outboard shop or, if you intend to do the work yourself, your own workshop.

Think twice before taking this job on, however, because it involves taking the engine completely down. There isn't room to include detailed instructions on how to do it all here—explaining how to disassemble each part that has to come apart would fill most of this magazine—so we'll only hit the highlights.

If it's Sunday and the outboard shop is



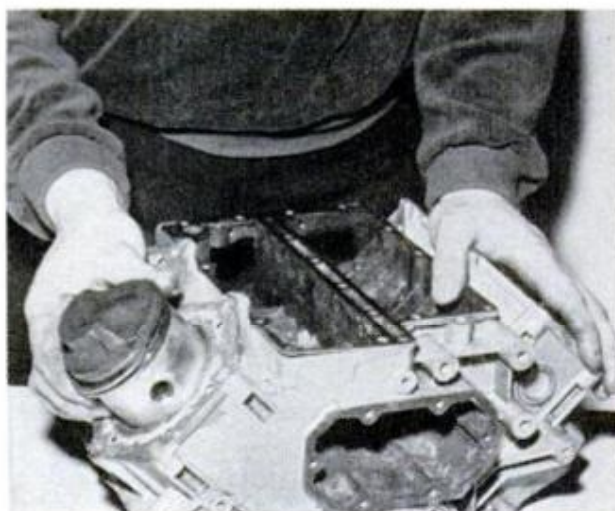
CARBURETOR AND MANIFOLD ASSEMBLY of this 50 has some 60 parts to be washed, air-dried, sprayed



REED VALVES have to be separated from the inlet plate and given the same wash-dry-spray treatment



REMOVE FRONT HALF of crankcase and disconnect the connecting rods, then clean casting thoroughly



PULL OUT PISTONS and take them through the same cleaning procedure used on all the other engine parts

closed, or if you can't attack the job yourself immediately, immerse the engine in fresh, cold water as soon as possible. Air plus wet metal equals rust; keeping the engine submerged will slow up the corrosion process.

Don't plan on keeping the engine in water indefinitely, however. Water contains oxygen and the engine will soon start to rust in spite of the soaking.

Come Monday morning, it's time to get that motor to the shop. After taking it out of the water, remove the cowlings and wash down every exposed part, including the inside and outside of the cowlings, with a mixture of kerosene and gasoline. (By the way, this is also necessary even if you begin the restoration job immediately.)

Washing exposed parts does two things. The kerosene-gas mixture removes grease and water droplets. It also protects external areas until you arrive at the shop.

Upon arriving at the shop, if there is any possibility of delay in ripping the engine apart, that motor should go back into water pronto.

In tearing the engine apart, strip the powerhead down as far as possible. You don't have to do a thing to the lower unit. After all, that's in water all the time.

Every part of that powerhead comes down. Each part is carefully washed in kerosene-gasoline solution as it comes off, then allowed to air-dry. By air-dry, we mean it can sit on a bench while drying or the mechanic can use compressed air to blow it dry.

There's an additional precaution to follow after the parts dry. Treat each with a water-repellent spray and solvent (CRC 6-66 or the equivalent). Your use of this



REPLACE RINGS and hone cylinder walls. The few extra dollars involved will add years to engine's life



Stripping It Down

PART

Heads, crankshaft and related parts, pistons and connecting rods, wrist pins; carburetor (completely disassembled), intake manifold and reed valves, fuel pump (completely disassembled, but discard diaphragm for new one), magneto plate without connecting parts, flywheel, starter pulley

Starter and generator electrical parts, and magneto coils

Plugs, points, condenser and bearings in the magneto turret, if present (generally, in engines larger than 40 hp)

All seals, washers and one-piece bearings

TREATMENT

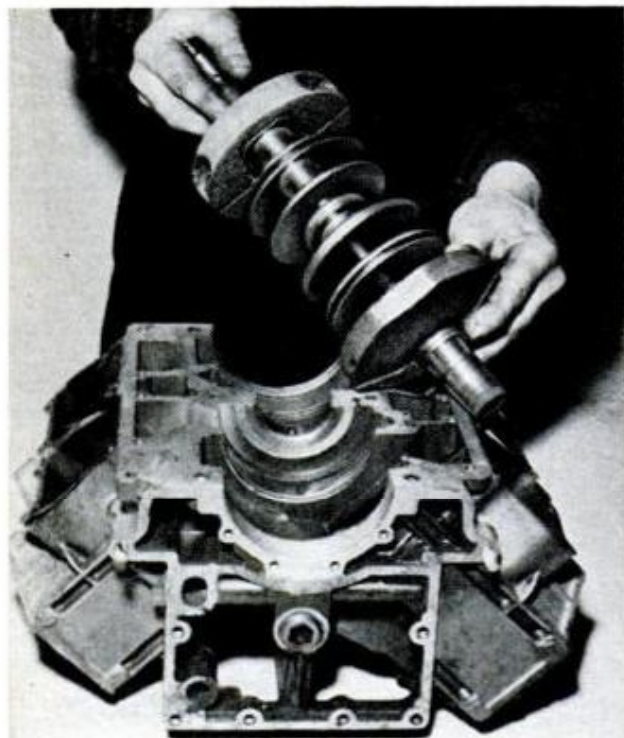
Wash each part individually and thoroughly in kerosene-gasoline solution. Allow to air dry. Spray with water-repellent solvent

Do not wash or spray. Place in oven at 350°F. for about 10 minutes to allow for thorough drying

Discard and replace with new parts

Discard and replace with new parts





DISENGAGE ALL RELATED PARTS from crankshaft—seals, bearings and others. Most must be replaced

spray serves two purposes. If you have missed a spot in washing or accidentally touch a part with wet hands, it prevents that spot from rusting by repelling the water. In addition, the spray provides a certain amount of lubrication for putting the parts back together in the powerhead.

Electrical parts—starter and generator—are treated differently. They are completely disassembled, but the electrical sections of these parts are *not* washed or sprayed. Instead, the casings containing field windings, the armatures and the brushes are put into an oven at 350° F. for about 10 minutes to dry them out thoroughly. Magnetic coils receive the same baking treatment. Mechanical sections of these parts—nuts and bolts, cover plates and starter drive pinions—can simply be washed and sprayed.

A special word about bearings: Each bearing in your engine is either a one-piece bearing or one that comes apart;

(Please turn to page 175)

OUTBOARD CLINIC

Q In the July '65 issue you had an article entitled "Meet Mag." In it, you show an instrument called a magneto tester. I'd like to get one. How do I go about it?—R. W. V., Pennsylvania

A I doubt if you'll be able to get this tester by any other means than through an outboard dealer. The particular one used in the article was obtained through a Mercury shop.

Q I have a 1958 7.5-hp Scott-Atwater. I don't think I've run more than 20 gallons of gas through it since I bought it new. My problem is that the jet in the water pump keeps getting plugged up and stops the water from running out. What can I do to remedy this?—A. E. D., Ohio

A Probably nothing. In most cases of this sort, the plug-up is caused by running the engine in dirty water that's loaded with silt or running it in water that's shallow. The only thing you can try is to drill a somewhat larger hole and see what happens or switch your place of boating.

Q My 5-hp Sea King quit pumping water, so I replaced the impeller and casing, but this hasn't helped. Would you venture a guess as to what is causing my problem?—M. B., Illinois

A I sure would. I'd say that the problem is either a blown head gasket, if you have a detachable head; or a hole in one of the cylinders.

Q My problem concerns the loss of oil from the transmission case of a 1960 75-hp Johnson. All of a sudden, no oil. Just water in the case. Never at any time does any oil show on the outside of the case. No drippings, no nothing. I'd appreciate your ideas.—R. N., Kansas

A The only thing I can tell you for sure is that you have a bad seal. Which one is bad, though, is something I couldn't say without checking into the engine. However, it's probably the shift-shaft seal, the propshaft seal or the driveshaft seal. The oil is apparently being lost when the engine is under load rather than when it's at rest.

Any Questions? For a personal reply to questions concerning repairing your outboard motor, write to Outboard Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Enclose 25 cents in coin

Outboard-Motor Test Stand

IF YOU PLAN on doing much of your own outboard servicing, a test tank is almost a must. It lets you run the motor right at your shop, instead of having to cart it off to the nearest lake or river for operating tests and adjustments.

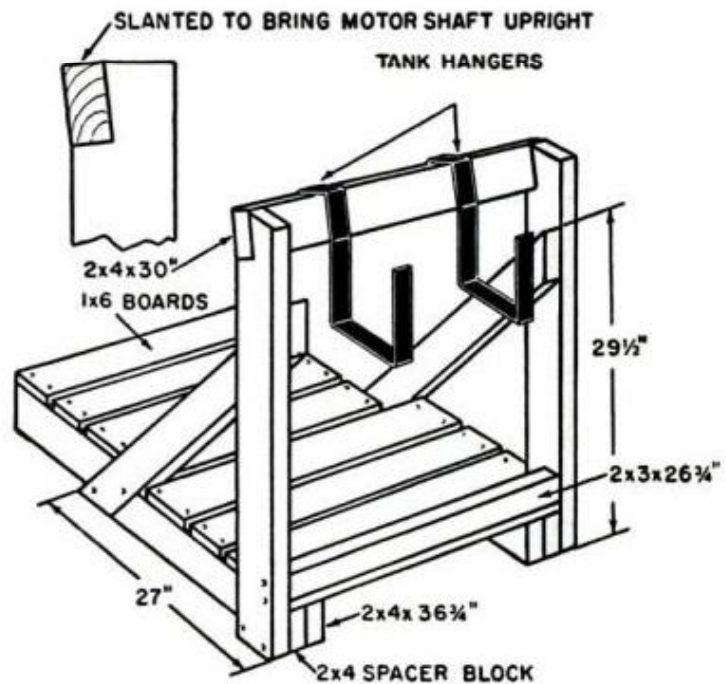
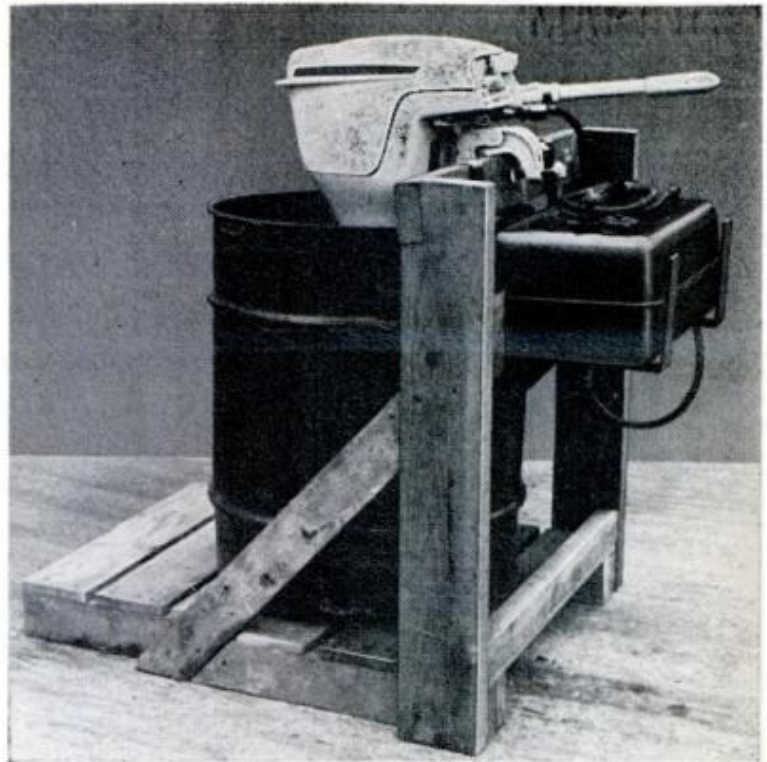
The simple test stand at right can be made from any heavy scrap lumber. Dimensions and materials may be changed as needed to suit your motor and the contents of your scrap box. The shape of the tank doesn't really matter—any old drum or wooden barrel will do so long as it's large enough.

For sills, use double 2x4s, cutting one of each pair at an angle to make a neat fit with the lower ends of the diagonal braces. Use 2x6s for the uprights, nailing the 2x4 braces to the inside surfaces and notching the 2x4 motor board into the top. Space the 1x6 floor boards about $\frac{3}{4}$ in. apart for drainage.

The two hanger brackets for the fuel tank are bent from $\frac{1}{4}$ x 1½-in. strap iron. Cut shallow notches for them in the front and top of the motor board to make a flush no-snag surface.

Caution: Be sure to provide adequate ventilation before running a motor in the tank.

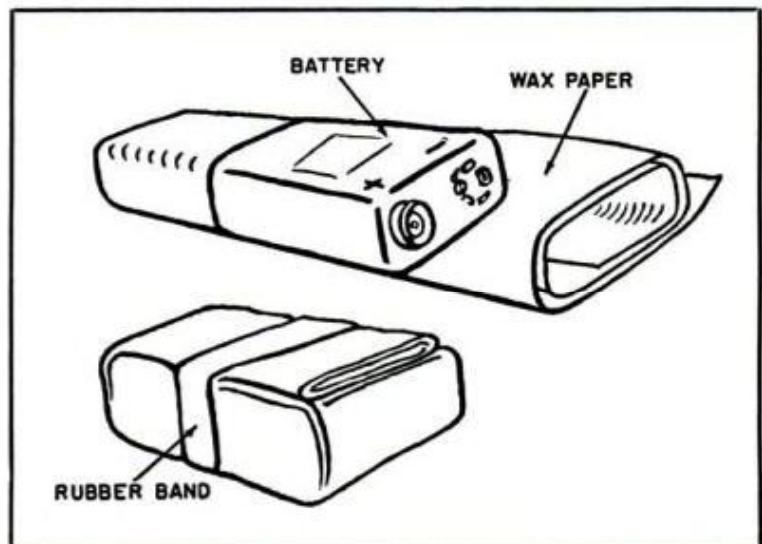
—L.M. Bourne



Storing dry cells

To lengthen the life of spare dry-cell batteries, store them in your refrigerator. Keeping them at a temperature of about 50°F. or slightly below can more than triple their shelf life. To prevent damage from moisture, wrap each cell tightly in wax paper as shown at right. When you remove a battery, let it warm to room temperature before unwrapping to avoid danger of condensation.

—Vladimir Tschernikow



The Ultimate Easel

You can build the world's finest for \$30—
Its solid mahogany frame and gear-driven
elevating mechanism adjust for any canvas

By MANLY BANISTER



IF PAINTING IS YOUR HOBBY, or if anyone else in your family likes to paint, why settle for second best with a commercial easel? This "dream" version is everything an easel ought to be. It's gear-driven in the French style, fully adjustable and can cost you less than \$30, a bargain for almost any easel you can buy.

It can accommodate canvases from the smallest up to four feet high—higher if the top retainer is removed and the frame tilted. The adjustability of the canvas tray and the top retainer permit placing the work at the most convenient height for strain-free rendering. A single turn of the crank handle raises or lowers the tray 6 in. The steel gear rack permits four feet of movement for precision placement, whether you paint sitting or standing.

For the cost cited, the entire easel was built of mahogany. Any other choice is likely to vary the cost, but it should be hardwood because of the tracking.

The most costly individual element is the rack-and-pinion drive. The rack is $\frac{1}{2}$ in. square by 48 in. long. It has a 16-in. pitch and $14\frac{1}{2}^\circ$ pressure angle, as does the pinion, which has 30 teeth, a 1.875-in. pitch diameter and a $\frac{1}{2}$ -in. bore. This pitch and pressure angle make it work smoothly.

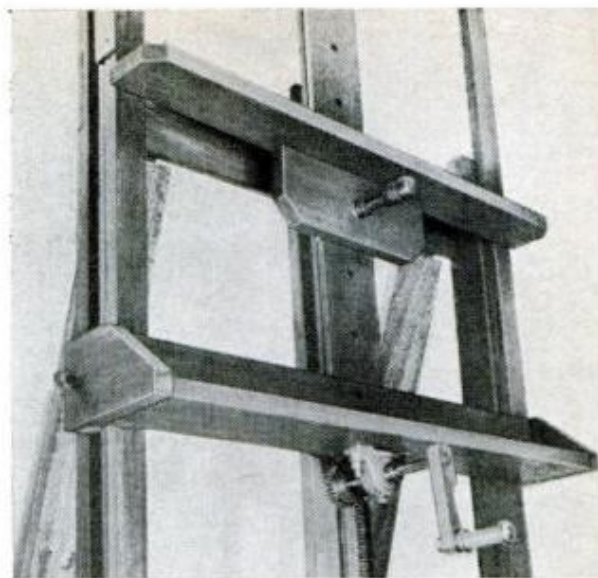
You can buy these gears from your local machine-tool supply house or order them direct from Boston Gear Works, Quincy 71, Mass. The rack is catalog No. L512 and the pinion, No. NB30B. From Boston Gear, the rack cost \$8.36, and the pinion, \$3.18.

Begin with the base, the easiest part, following dimensions given in the drawing on the next page. For a finished look, round or bevel all upper edges.

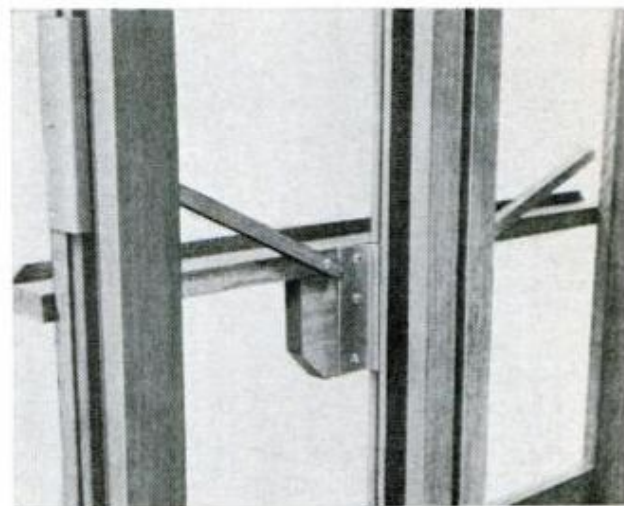
The rear base spreader should fit in a full lap joint to prevent obstructing the casters. Of the four 2-in. casters used, the front pair should have locks to hold the easel steady. Such a set is available on order from Montgomery Ward for \$1.49.

Side members of the base and the main frame were made by ripping mahogany 2x5s down the middle, producing pieces $1\frac{3}{4}$ in. by approximately $2\frac{1}{4}$ in. But check the measurements of the hardwoods you buy and make any necessary adjustments from these figures to insure proper fit.

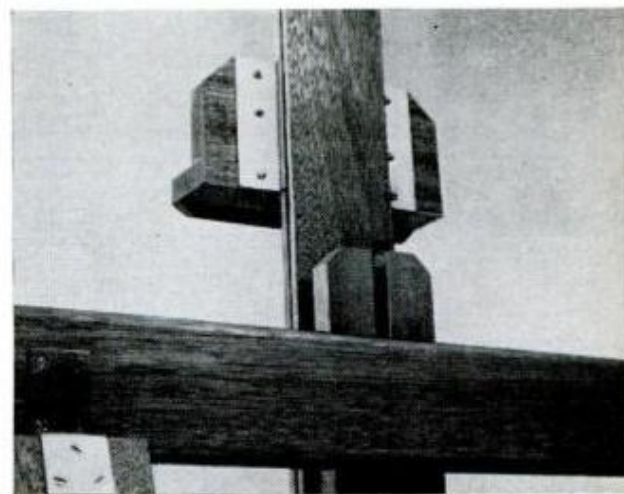
Main-frame side posts are ploughed along the length, providing $1\frac{3}{16}$ -in. grooves to accept $\frac{3}{4}$ -in. blocks mounted on the canvas carriage tray. Make the grooves $\frac{3}{8}$ in. deep. If you don't have a dado set, trim



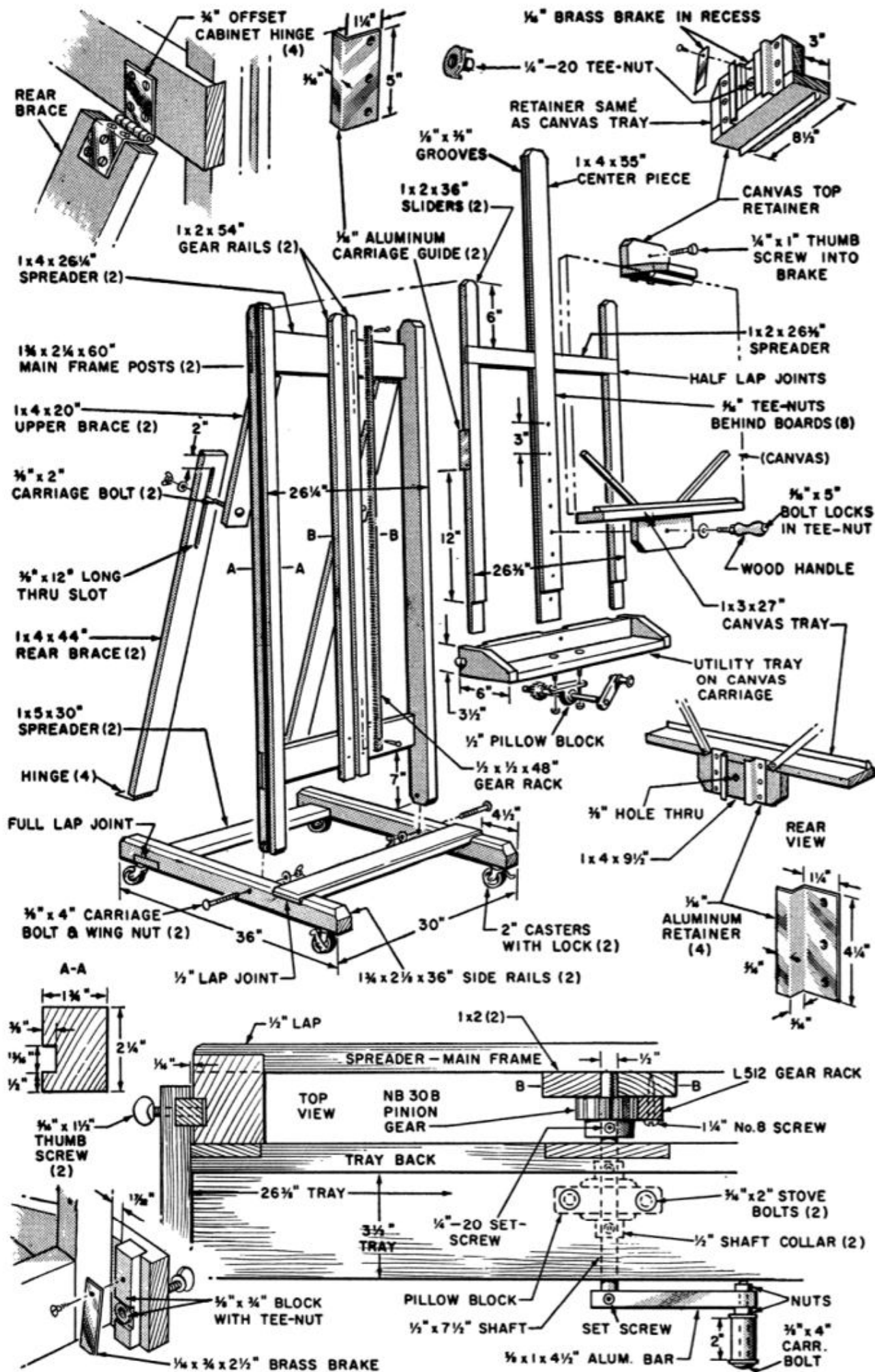
EASEL CARRIAGE has two adjustments for the height of a painting from the floor. The canvas tray at the top has a semi-fixed position, while the utility tray attached to the carriage assembly cranks up



REAR VIEW OF CANVAS TRAY shows pivoting supports for canvases narrower than carriage frame. The guide rides in a groove in the carriage centerpiece and is held in position on the frame with a bolt



CANVAS RETAINER GUIDES ride on the same carriage centerpiece. The retainer is locked on the top of a canvas with a thumbscrew operating against a sheet-brass brake pressed against the centerpiece



the posts $\frac{3}{8}$ in. and glue on wood strips.

Two 1x2s are fastened to the middle of the main-frame spreaders with a gap for the crankshaft tip to ride in. This keeps the pinion gear on the track. Attach the gear rack to the right-hand member.

The main frame is pivoted on the inside of the base with carriage bolts. Combined with rear braces, this permits the easel to tilt back. Use $\frac{3}{4}$ -in. offset cabinet hinges at top and bottom of both braces.

The canvas carriage adjusts three ways. The entire carriage rides up and down on the main frame; the canvas retainer at top rides on the carriage's vertical center-piece, and the bottom canvas tray can be raised or lowered in 3-in. increments.

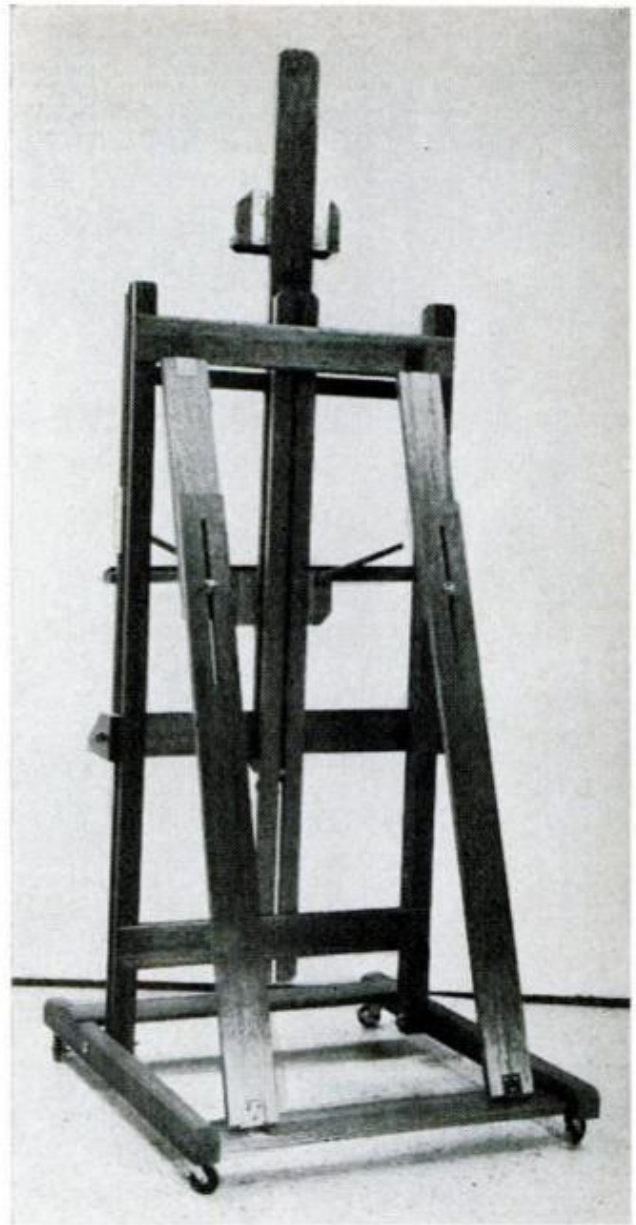
The carriage should be as wide or slightly wider than the main frame. Then the $\frac{1}{16}$ -in. aluminum carriage guides on the carriage side rails will fit snugly into the $\frac{13}{16}$ -in. grooves in the main-frame posts, as will the blocks and brakes on the sides of the utility tray.

These brakes lock the carriage at the desired height. Turning thumbscrews through Teenuts applies pressure to the brass plates in the grooves. If you cannot buy the $\frac{5}{16}$ -in. thumbscrews recommended, make them from $\frac{5}{16}$ -in. bolts with the heads cut off and wingnuts pinned or soldered on. In all cases, the Teenuts are recessed to permit the brass plates to lie flat when the pressure screws are loosened.

The canvas retainer and the canvas tray have aluminum guides that ride in grooves on both sides of the carriage's vertical centerpiece. The retainer has a thumb-screw through a Teenut bearing on a brass plate. The tray, however, has a hole through the block on which the guides are mounted, with a bolt fitted into a wood handle passing through the hole. Down the center of the vertical centerpiece are holes 3 in. apart, backed up by Teenuts.

Half-inch quarter rounds are mounted on both retainer and tray $1\frac{5}{8}$ in. from the rear to prevent the canvas from slipping. On the rear of the canvas tray, affix two pieces of $\frac{1}{2} \times \frac{1}{2} \times 8$ -in. stock on screw pivots at their bottom ends to serve as additional supports for small canvases.

Finally, the drive-gear assembly: Attach the pillow-block bearing to the underside of the utility tray, directly lined up with the slot between the two gear rails, using 2-in. stove bolts. Mount the pinion gear $\frac{3}{4}$ in. in from the end of



TILTING THE EASEL is easily controlled from the rear so that its weight is toward you. Set the caster locks before loosening the adjusting wingnuts

the $\frac{1}{2}$ -in. shaft. Mount shaft collars on both sides of the pillow block to eliminate end play.

The aluminum-bar crank is drilled for the shaft $\frac{5}{8}$ in. from one end on center and for a $\frac{3}{8}$ -in. carriage bolt $\frac{1}{2}$ in. on center from the other. The shaft end of the bar is drilled and tapped for a setscrew. The four places on the shaft for the setscrews should be filed flat.

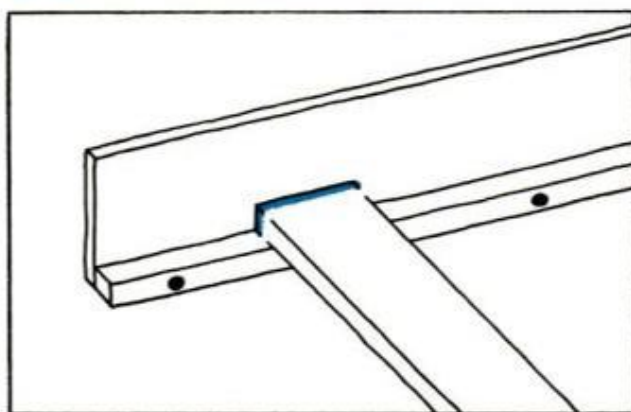
The crank handle consists of a 4-in. carriage bolt fitted with a $\frac{3}{4} \times 2$ -in. dowel. Enlarge one end of the hole to permit the dowel to slip on the bolt's squared shoulder. Place washers at both ends of the dowel. Turn on a nut after the second washer and tighten another over a lock washer on the other side of the crank bar.

Now, get out your paints and go to work . . . with pleasure. ★★★

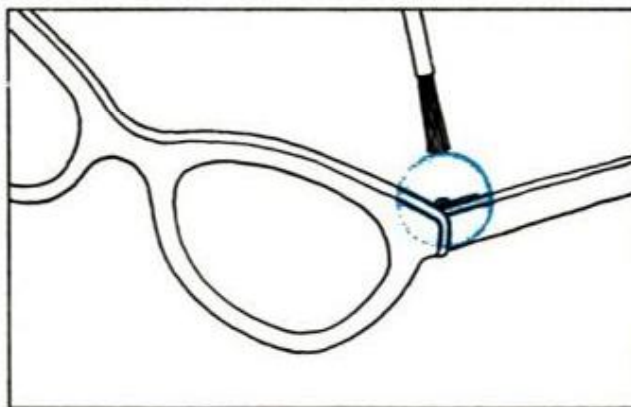
SOLVING HOME PROBLEMS



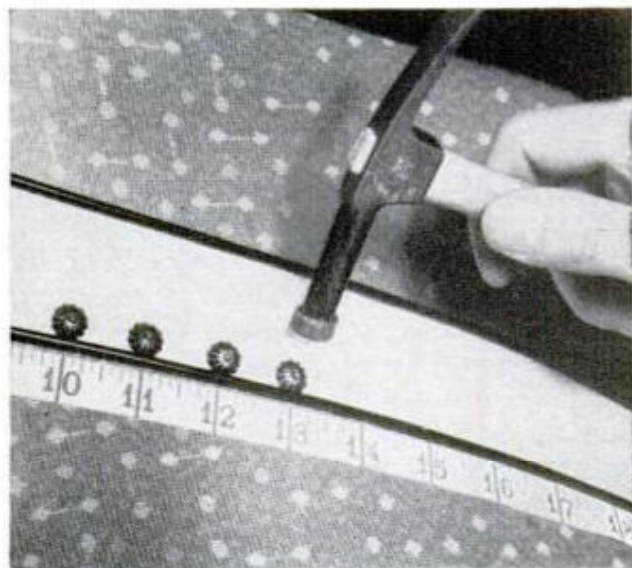
TURPENTINE TIGHTWADS will see the advantage of using a discarded talcum-powder can with the top cut off as a storage bath for a single paintbrush. Use of a narrow can conserves turps, retards evaporation



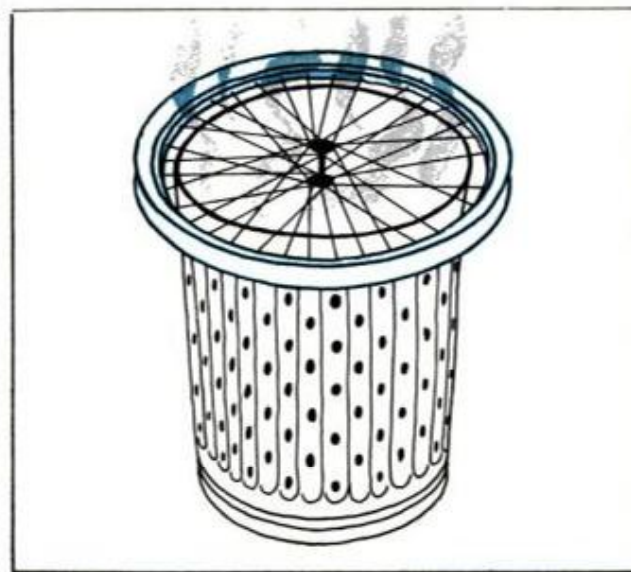
WANT TO ELIMINATE the annoyance of those wooden bed slats slipping off the bedframe and depriving the springs of proper support? Make 'em slipproof by snapping some rubber bands around their ends



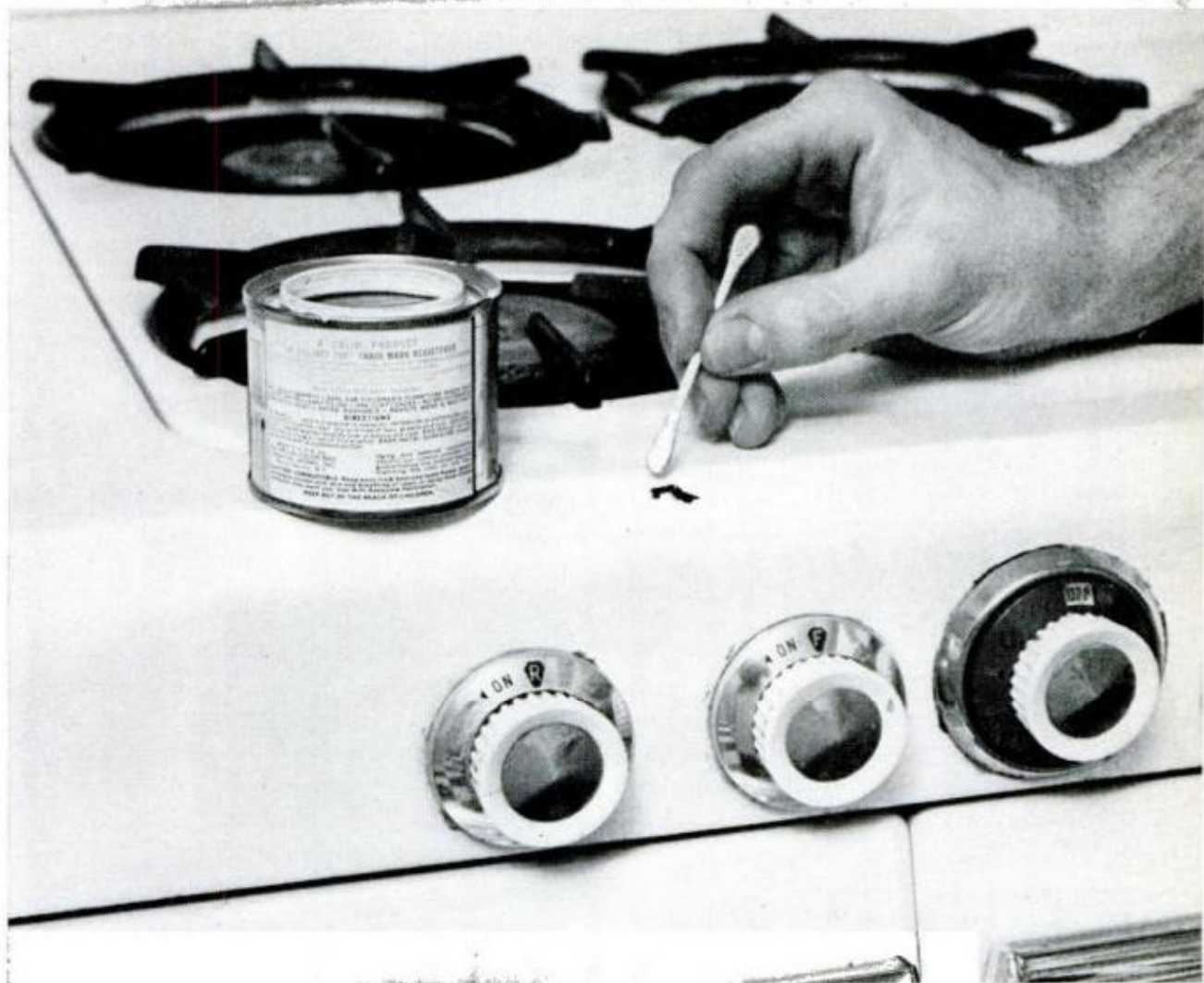
THOSE TINY SCREWS that hold the bows to the frame of your glasses have a habit of working loose and getting lost. Prevent this by dabbing their threads with some nail polish before screwing them in place



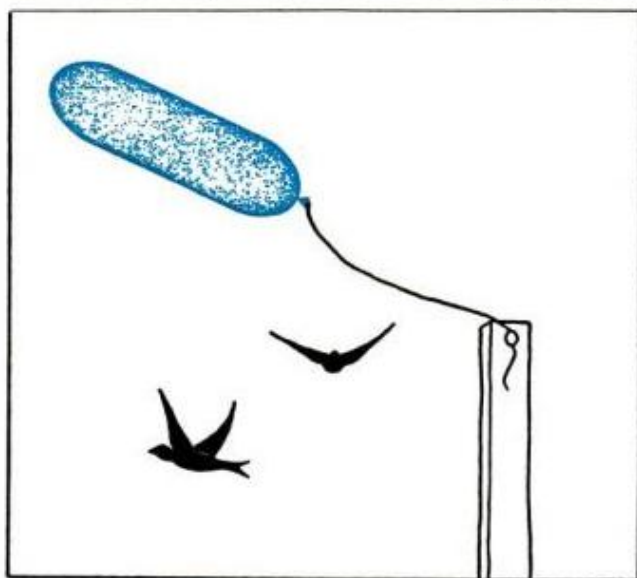
FOR REWARDING UPHOLSTERY JOBS, space those decorative tacks evenly along their rows. Pin a tape measure to the material beside the line to be tacked; then equal spacing of tacks will be a cinch



SMALL HOLES IN COVERS of many can-type incinerators cause smoky fires by preventing adequate draft. Use a discarded bicycle wheel (tireless) instead. Spokes keep embers from flying out, but allow a freer draft

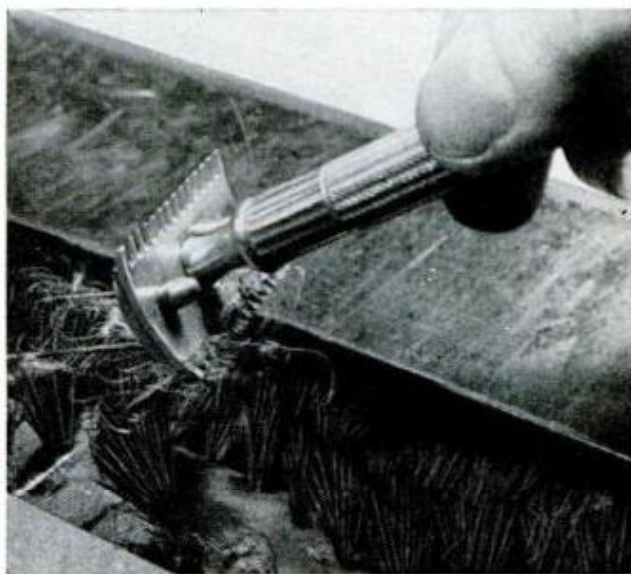


NOW THAT SPRING CLEANING IS BEHIND YOU, why not start improving the looks of those kitchen appliances that have suffered some nicks and scratches? Try a Q-Tip cotton swab to touch up the chipped enamel on your kitchen stove, refrigerator, washer and dryer. These swabs are ideal for a variety of small touch-up paint jobs because they permit pinpoint application, won't shred and are disposable



TOP-HATTED SCARECROWS ARE PASSE. Use balloons tied to stakes to frighten birds from your freshly-seeded garden. The least stir of air makes the balloons dart and flutter so that birds fly away in alarm

JULY 1966



GOT A REAL OLD-TIME SAFETY RAZOR—the kind with teeth along the sides of the head? Don't deep-six it. It makes a great little tool for combing lint, hair and string out of the brushes of your carpet sweeper

135

Kick Up a Spray This Weekend

Anything you can do on snow is more fun on water.
You can make your own skis or sled in jigtime

By Hank Clark

MAKING WATER SKIS

The fastest fun afloat—that's water skiing. And since the skis are simpler than the type you need for snow, you can make a pair for every member of your family. As shown in the sketch at right, you can get an adult's and a kid's pair (or two adult pairs) out of one 4x8 panel of 1/4-in. exterior A-D plywood. If you make one kid's pair, the panel will yield longer triplers—that top layer that beefs up the thickness to avoid too much flex.

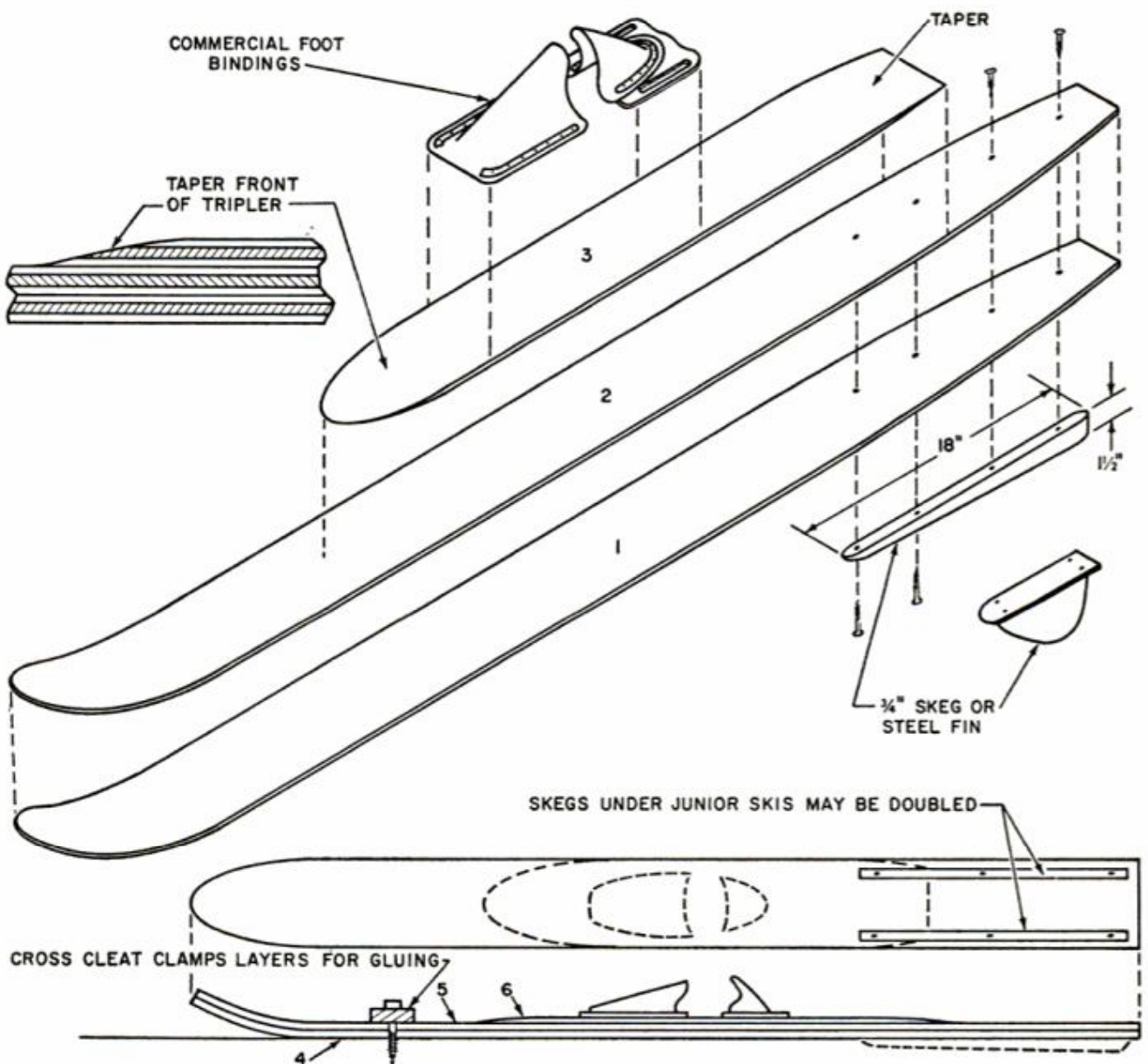
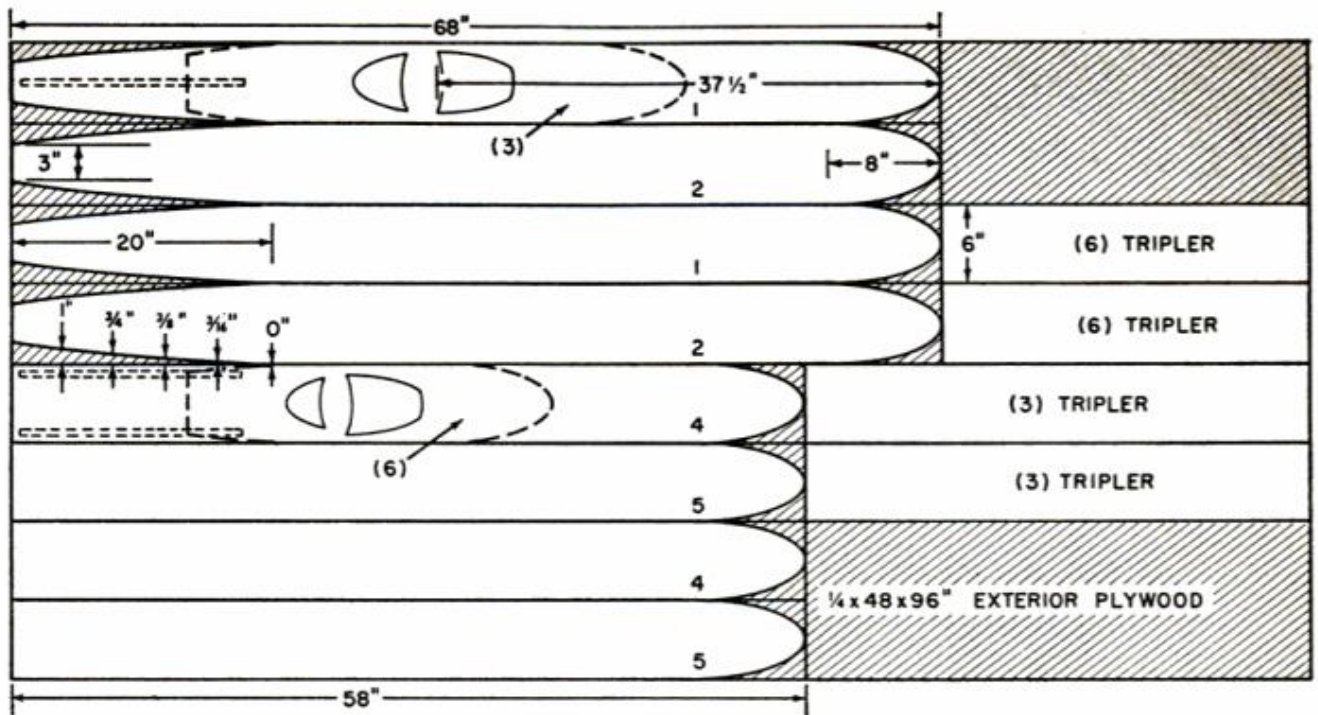
Whatever the size, you must curve the tips up slightly to plane over any wake you hit. You can get all the bend you need with a good soaking to wilt the two plywood strips *before* you glue them together. The best bending method: Place the wet

strips side by side with a 2x4 under the tips and screw a cross batten to the floor (or a plank) to force the strips downward.

When dry, remove the cleat and liberally apply a good waterproof glue to the mating faces. Then nail through the top surface every 2 1/2 in. along both edges, using 5/8-in. brads, which are tapped out and pulled after the glue sets. Now, swab the tripler with glue and nail it on top, spacing your brads about 4 in. apart. These brads are left in place.

You can screw on your own skeg strip or, if you plan to make one ski a slalom, buy a 4-in. metal fin. Note that the shorter skis have a square back with two skegs, set in 3/4 in. from each edge.







CUT,
FOLD,
TAPE

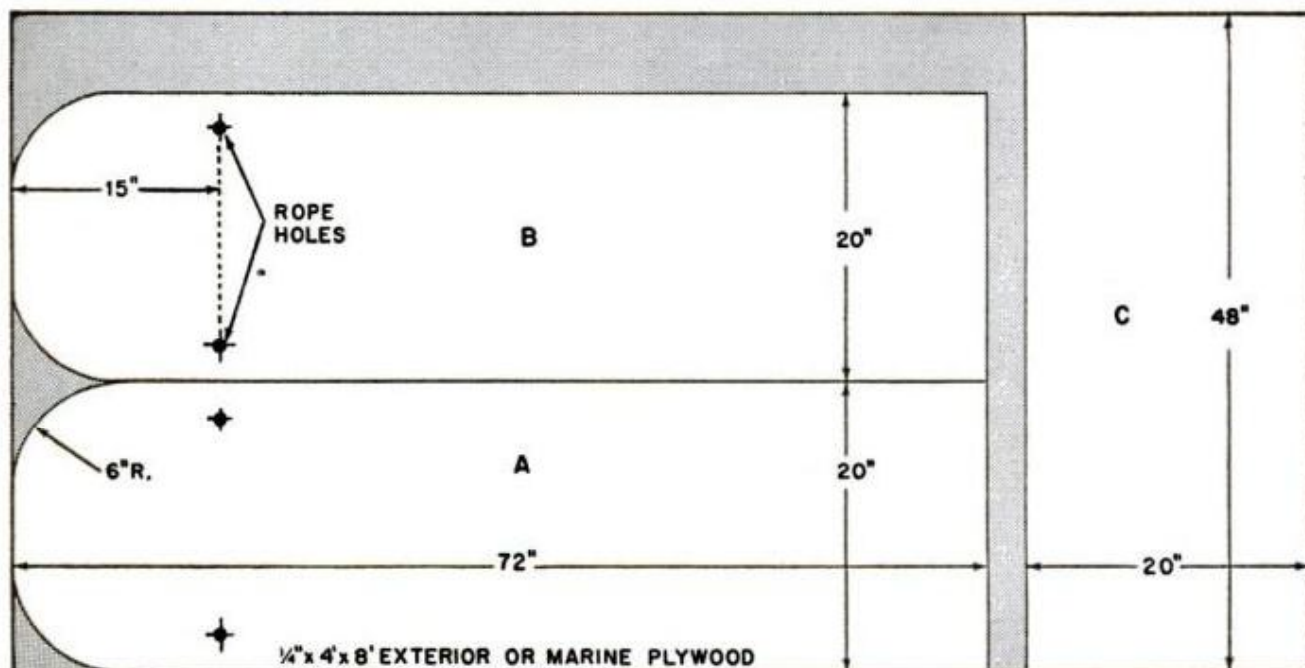
BEACH
FUN

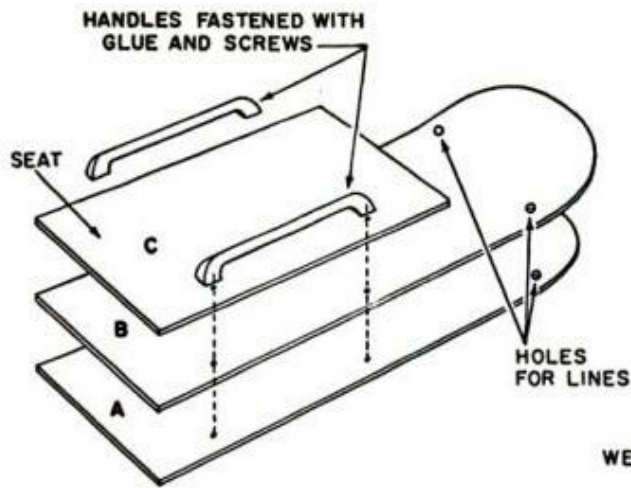
MAKING AN AQUA-SLED

It's like a toboggan, and it's a hit with the wife and kids who are a bit wary of skis. They sit, kneel or stand on the board as the boat slowly accelerates to give a planing action, then signal the driver to level off, and go skimming across his wake—or cutting back and forth across his bow waves—simply by shifting weight.

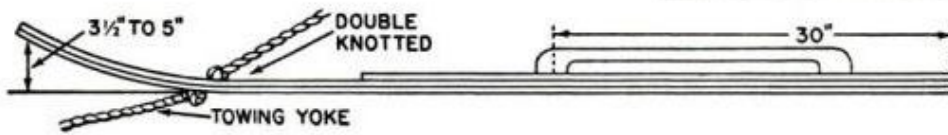
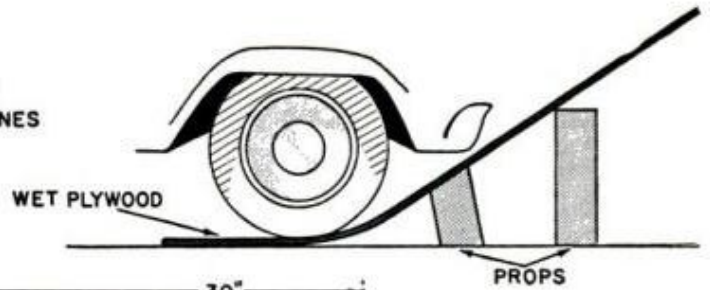
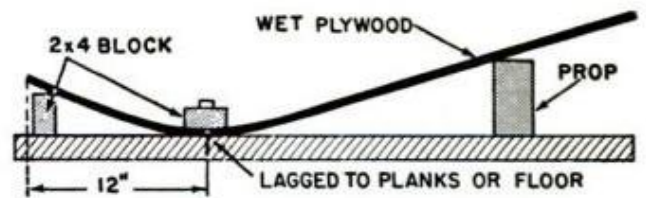
Construction is a matter of making a three-decker plywood sandwich with lots of glue for mustard. The only tricky part is getting the bow bent up enough to smack down waves. Slice the top deck off

one end of a 4x8 ¼-in.-ply panel, then rip out the two longer layers and round the bows with a sabre saw. Soak these for several hours and bend them by one of the methods sketched on the next page. The cleating jig is the same you'd use for skis, except here, since a greater upturn is required, you also prop up the back edge. Or, you can run your car's front wheels onto the flat tips, propping the back edge even higher. Assemble as described for skis—except that the sled requires no skeg or fin. ★ ★ ★





METHODS OF BENDING ENDS



Driver-Skier Signals



OK—Everything's going great



SPEED UP—Pour on the horses



CUT—I'm going to drop off



CHANGE DIRECTION—Head that way



STOP—Let's take a break



SLOW DOWN—Take it easy up there

Build This Creeping Sulky To Ease Grass-Cutting Chores

Driver rides in comfort as two engines, one up front and one in rear, do all the hard work

By Giles W. Bahrt

FOOTSORE from tramping around your yard behind a heavy power mower? I was, so I built an add-on propelling unit with a drive engine of its own. Now I look forward to grass-cutting sessions (and so does my wife, as you can see here) because I can sit comfortably on a padded seat while the mower engine does the cutting and the sulky engine does the pushing.

"The contraption looks like a sulky," commented a neighbor, and that's what I call it. Only it doesn't race. It creeps around surefootedly at about 3 mph, which you'll find fast enough for mowing any yard.

The extra engine is a 2-hp one-lunger from a junked mower. Many of the parts came from mower repair shops and awning supply stores. I did have to do a bit of fairly routine machine work and welding.

Details of the construction are shown in the drawings and the photos. The length of the frame is governed to a large extent by the upward and rearward projection of the handle of the particular mower that is to be converted. In normal operation, when the user is on foot, this handle is somewhat more elevated than it will be when he or she is seated. Allowance must be made for turning it without getting it tangled with toes, knees or clothing.

The position of the pedals is also a matter of careful measurement and possibly some experimenting. Start with a tie rod a little longer than appears necessary, bolt the pedal assembly to the frame, and try the arrangement for ease of control. If the feet interfere with the movement of the mower handle, it is a simple matter to unbolt the pedal blocks, shorten the rod, and move the assembly to the next pair of slots in the frame to the rear.

The spacing of the rear wheels should be slightly less than that of the cut of the mower itself. Since there is no differential for these wheels, as there is in an automobile, turns should be made slowly and smoothly to prevent them from dragging and possibly stalling the engine.

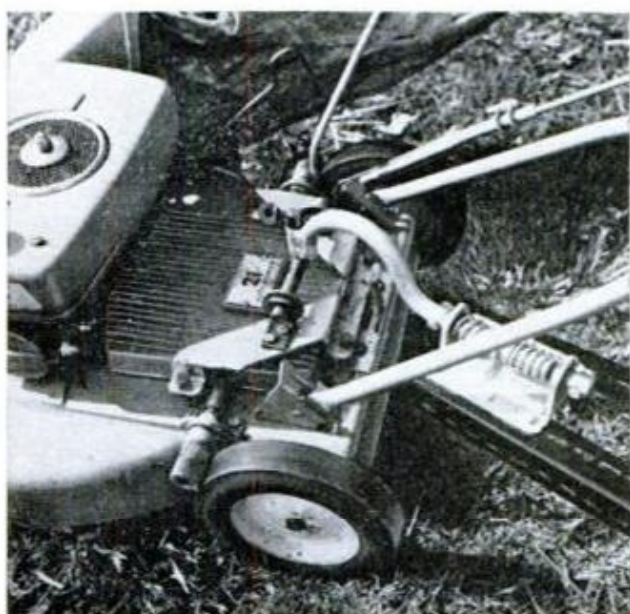
A strong frame is very important, as it carries the weight of both the driver and the second engine. I used $\frac{1}{8}$ x 2-in. slotted steel angle; $\frac{1}{8}$ x 1½-in. or $\frac{3}{16}$ x 1-in. will do just as well. If slotted steel angle is not readily obtainable, steel tubing not less than about 1½-in. in diameter can be substituted. This will require some transverse spacers, welded in place, and the drilling of a few more holes. Welding and drilling must be done anyway, and the additional work doesn't amount to much.

Men who own power saws and are more accustomed to handling wood than steel may think of using two lengths of 2 x 3s or 2 x 4s for the frame. This is definitely not recommended, for several reasons. No matter how it is treated, it is virtually impossible to prevent wood from swelling and shrinking a bit as the humidity of the air changes. A "bit" can readily be enough to twist the whole engine drive mechanism out of line. Also, a couple of dense, straight-grain, knot-free timbers can weigh considerably more than slotted steel angles of the same length. This excess deadweight can tax the torque of the small driving engine and make the machine balk on rises, just where the traction is needed most.

The forward end of the sulky connects to the mower by a detachable, hook-shaped drawbar that slips over a pivot pin on the back of the mower frame. An adapter plate for the pin must be built



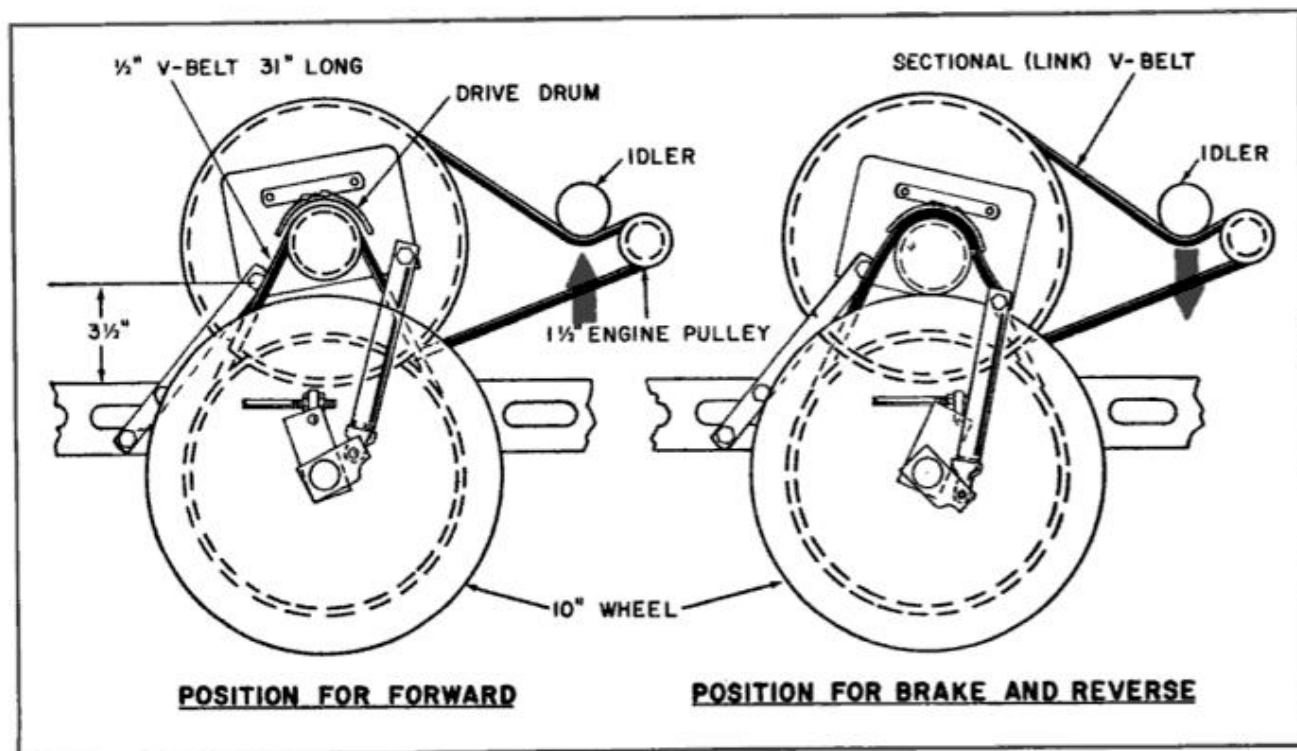
JUST STEER—that's all there is to mowing lawn with this rear-engine driven sulky. Pedals alone, like in Model T Ford, control forward, stop and reverse. Arched hook swivels on body of mower itself for steering



COILED SPRING on end of hook absorbs bumps when the six-wheel sulky-mower combination is started or stopped. The meeting ends of frame are secured by U-shaped plate and three machine bolts and nuts



UNDER VIEW of driver's seat from right side, showing L-shaped throttle handle, sectional V-belt from engine to jackshaft and right roller on wheel. Exhaust is behind driver; doesn't bother him on hot day



up on the latter, to a height that raises the sulky frame parallel to the ground. Steering is very easy because of the mechanical advantage provided by the long handle of the mower, even over uneven ground, and four 1-in. coil springs help absorb shock at the coupling.

It takes only half a minute to hitch or unhitch the two wheeled units. The mower can still be used by itself for trimming in close quarters. The whole assembly being narrow, it can be stored in a small shed next to the house or the garage, or parked under a tree with the additional protection of a tarpaulin.

The equivalent of a gear reduction transmission is obtained with a double-belt-and-pulley arrangement. A single 1½-in. pulley on the engine shaft is belted to an 8-in. pulley on an adjustable jackshaft directly under the driver's seat. Two 2-in. pulleys on the shafts are in turn belted to two 8-in. pulleys on the inside surfaces of two 10-in. drive wheels. Two pedals and an attached tie rod determine the position of the jackshaft. A hand throttle under the seat regulates the engine speed.

"Neutral," for starting, is obtained by dropping the jackshaft slightly; the lower belts are then loose and merely loop around the pulleys. For "forward," the shaft is raised; the belts then tighten and grip the pulleys, and the vehicle moves ahead. For braking, or for stopping in advance of going into "reverse," the shaft is dropped so that the rollers on its ends

bear against the tires lightly. After the sulky is motionless, further pressure makes the rollers engage the tires securely, giving the wheels a backward motion. It takes only a little practice wiggling one's toes to get the hang of the pedals.

My mower is of the self-propelled type, but I find I have much better driving control if I lock out the drive gears and depend on the rear engine for traction.

How much will this worksaver cost to build? This is a difficult question to answer because a great deal depends on what can be picked up in mower shops, auto junk yards and hardware stores. The extra engine is usually the cheapest item, because so many used but perfectly serviceable ones are available. A major item of expense is likely to be the welding, because this requires good equipment operated by skilled personnel. To minimize the time required for the work, and hence the cost, carefully cut and mark all members to be joined and be prepared to show the man exactly where they fit.

Because of its very low speed even at top throttle, the sulky is very safe to run. A woman who doesn't drive a car can be taught to wheel it around with very little instruction, and any boy old enough to reach the pedals will take to it like the proverbial duck to water.

Odd looking or not, this machine has taken most of the sweat out of my lawn grooming. It is well worth the time and effort required to build it. ★★★

Salvaged medicine cabinet cures film-storage problem

If you're tired of having to hunt down that soon-to-expire roll of film you tucked away, a perfect solution to organizing your supplies is an old medicine cabinet. Its adjustable shelves permit you to optimize the space for storing films, photo chemicals and small accessories. Having your films in one place makes it possible to protect them against moisture damage by placing a tin of silica gel in the cabinet. You can reactivate it periodically by warming it in an oven.

Flash for wide-angle shots

Flash reflectors are designed for normal and long focal-length lenses, but do not cover the field of view of wide-angle lenses. Accordingly, if the reflector is removable, poke the bulb socket through an aluminum pie tin and multiply the flash guide number by a factor of 0.7. If you have a folding reflector, fold it out of the way and fire the bare bulb. In the latter case, you should multiply the guide number by 0.4.

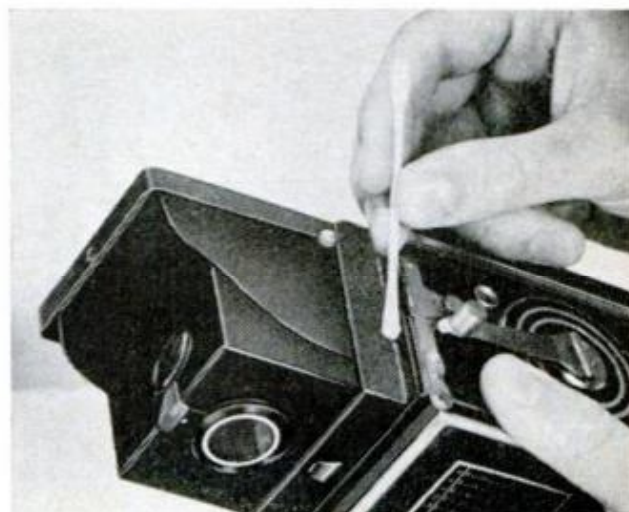
Recording shooting data

Keeping track of shooting data by marking it on the envelope is no problem when the negatives are filed in paper envelopes—a pen or pencil works fine. But when they're filed in glassine envelopes, a pen or pencil won't do. Use a felt-tip marker to record speed, aperture, film type, filters and lighting conditions. You'll find it works better than a grease pencil, since it won't smear or rub off when you are handling and thumbing through the envelopes in your negative file. —Ken Patterson



Tips reach tight spots

When cleaning your camera, a cloth does a fine job in applying saddle soap or a camera dressing to the leather covering and case, but some areas are not easy to reach. This is where cotton swabs, such as Q-Tips, are just the thing. Handy for reaching into crevices, they can be used for applying the dressing and polishing. If you use lighter fluid for cleaning metal parts, keep it away from the leather to avoid softening the bonding cement which it will do if allowed to seep under at the seams.



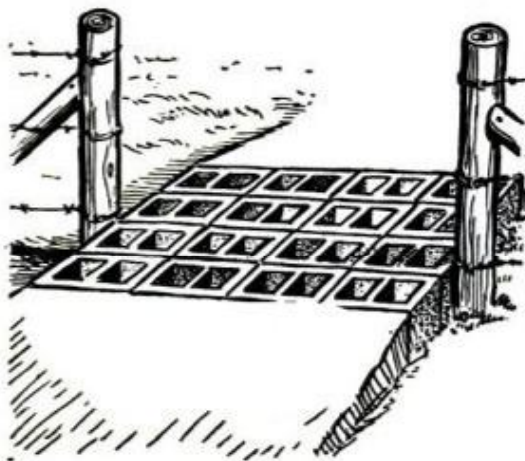
Two Clever Gate Ideas



LIKE A CHAIN and its weakest link, a fence is only as good as its gate. If that gate doesn't halt unwanted traffic, it defeats the whole purpose of the fence.

Here are two security gates you can trust. The one above sees to it that pets and children won't stray into your garden through a gate left standing open: it's self-closing. You just shim up both leaves of the lower hinge with $\frac{3}{4}$ -in. blocks to throw the panel off balance.

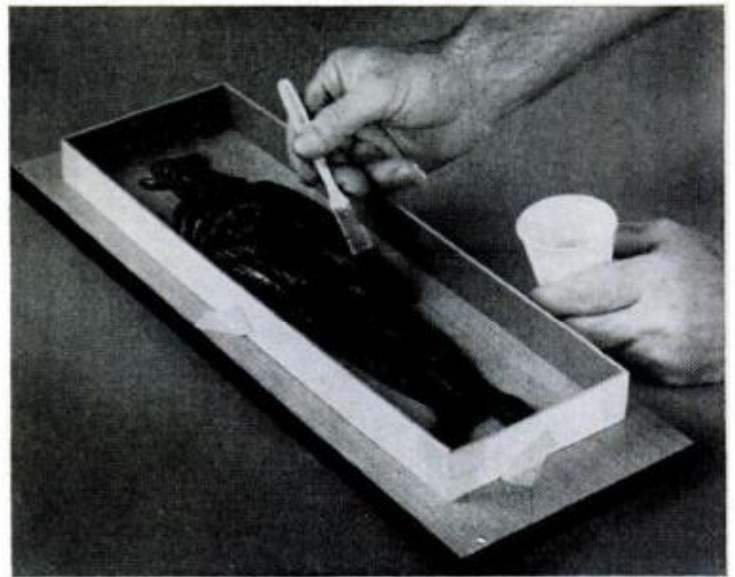
The sketch below shows an easy and economical means of creating a "Texas" gate. Rows of 8x8x16-in. hollow-core concrete block are laid between the posts and ramped on either side, as shown—or the block could be sunk flush in a trench. The honeycomb effect lets foot and vehicular traffic pass but keeps cattle in (or deer out) as effectively as the conventional metal grate.



Now: Making

Space-age silicone rubber

A NEW FLUID RUBBER that vulcanizes at room temperature lets you take a mold of any three-dimensional object so that you can cast one or many reproductions—using a pour of modeling plaster, plaster of paris, liquid epoxies and polyesters, or



ERECT SIMPLE FRAME of taped cardboard strips around original, brush on light coat of release agent (3 to 5 parts detergent to 100 parts water) and let dry



BRUSH RELEASE AGENT—same solution as before—onto face of mold. Note how accurately surface details are reproduced by easy flow of liquid rubber

Molds Is Easy as Pie

simplifies casting exact copies of any object

even lead. The step-by-step photos show how easily a half-round object can be duplicated, but the mold's flexibility also lets you cast full-round items of complex shape. Your master can be wood, plaster, wax, soap, metal, glass or plastic. You can

also pour the rubber in place for firm packing of delicate parts to be shipped.

The rubber, called Silastic RTV, is actually fun to work with. It's made by Dow Corning Corp., Midland, Mich. 48641. Write them for further details. ★★★



MIX SILASTIC WITH CATALYST and pour evenly over model until frame is filled so that highest point of model is covered with at least $\frac{1}{2}$ in. of mixture



STRIP OFF MOLD with firm, even pressure, once RTV has set up at room temperature. Curing time varies with thickness; after 24 hours mold can be handled



POUR CASTING MATERIAL—here, plaster of paris—into mold. Even RTV itself can be used for casting if you coat mold with special paraffin release agent



RELEASE REPLICA by flexing mold, once casting material has set. Flexibility assures easy release from complex contours without chipping or crumble

NEW FOR
CAMERA BUFFS

BY LEONARD SAMUELS



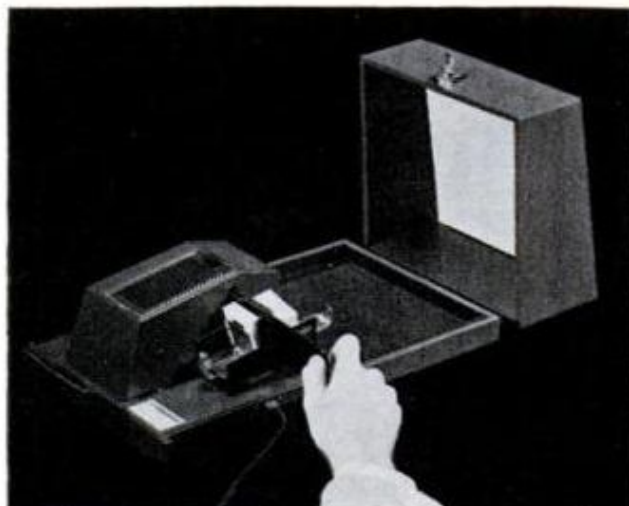
1 Splice standard and Super 8? With DeJur Versatile projectors you can, switching between them by twisting a knob. Model II has built-in previewing screen; sells below \$245. DeJur-Amsco Corp., Northern Blvd. and 45 St., Long Island City, N.Y.



2 Roll your own when flashcubes are scarce. This \$3.95 FC/AG Flash Unit takes 4 AG bulbs, rotates with camera. Built-in ejector removes all bulbs at once. Kalimar, Inc., 2644 Michigan Ave., St. Louis, Mo.



3 Million-to-one is brightness range of Ranger 9 CdS meter. Specs include ASA, 1.5-25,000; aperture, f/0.5-f/64; speeds, 1/4000-2 hrs. \$70. Weston Instruments, 614 Frelinghuysen Ave., Newark, N.J.



4 Desktop Readymatic Viewer requires only 10-sec. setup. It projects 126 and 35mm slides on case lid or standard screen and costs under \$50. Eastman Kodak Co., 343 State St., Rochester N.Y.



5 Nikon-F takes instant, large photos with a Speed Magny-100, which optically enlarges to 3¼ x 3¼ on Polaroid 107 or 108 film. Ehrenreich Photo-Optical Industries, 623 Stewart Ave., Garden City, N.Y.

How to keep the coolest car in town

By MORTON J. SCHULTZ



AN AUTO AIRCONDITIONER IS GREAT! But it's also one more unit that can get out of whack. So let's take a closer look at this popular option that more and more buyers are demanding with their new cars.

It is estimated that in 1966 more than 13 million cars on American roads will be equipped with airconditioning. This means that automotive airconditioning has arrived. And what does this portend for you? Well, if you now have an a/c unit in your car, or are thinking of getting one, you know that it has—like any mechanical thing—the potential for giving you trouble. Happily, airconditioner failure reports have been relatively few; mechanics will tell you that a/c is the one system in a car which might most often be described as “trouble-free.” Nevertheless, airconditioners do require normal care and maintenance, and we'll get to that shortly. First,

let's see how an air conditioner works.

All automobile air conditioners are basically the same. All are governed by the same principles of refrigeration and cooling as the air conditioner in your home. All operate on the natural law of heat al-

erant is forced into the receiver-dryer—which is nothing more than a reservoir. Its job is to insure that an adequate supply of liquid Freon is always present to flow to the expansion valve.

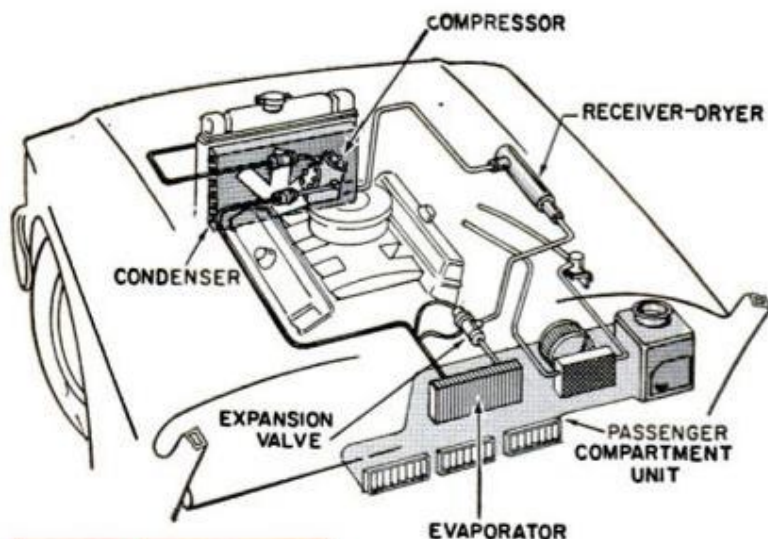
The expansion valve is used to regulate the flow of refrigerant. Under a strong load of coolant, it opens wider to allow more of the refrigerant to flow through the system, thus providing more cooling. Under a reduced force of liquid Freon, less of the refrigerant flows through the valve and, hence, through the system.

When the liquid refrigerant leaves the expansion valve, it passes into the evaporator—the second major component of the system. The evaporator is a low-pressure region. The hot, humid air in the car is drawn to it and circulates around the evaporator core. As it does, the liquid Freon absorbs heat and humidity, begins to boil, then vaporizes. The car cools off, but the refrigerant

doesn't—not at the moment anyway.

A suction line connects evaporator to compressor—the third major part of the system. Through this line the hot vapor is pulled away from the evaporator to the compressor where it is compressed and then pushed on to the condenser, completing the cycle around the system.

Your home air conditioning unit concentrates all the parts in one big box, but in your car these same parts have to be widely separated due to its construction.



TYPICAL LAYOUT of an auto air-conditioner and its components

ways moving from a warm object to a cold object. And all are continuous-cycle types that use the same refrigerant over and over again.

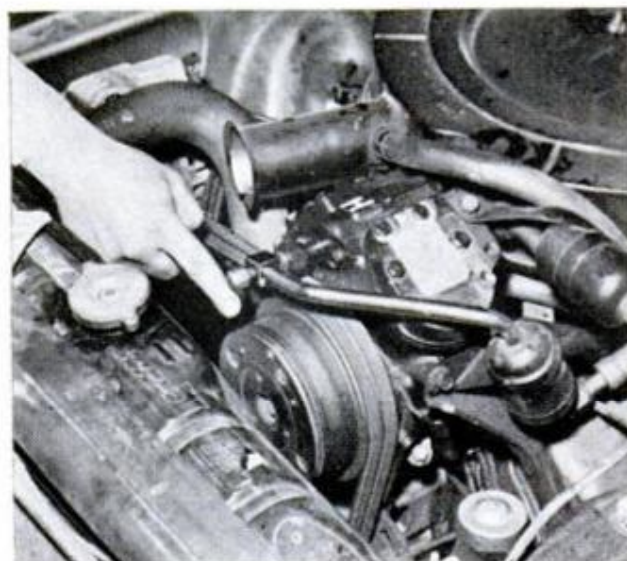
Here, briefly, is how an air conditioning system works in your car:

Heat in the car is drawn to the air conditioner's evaporator unit through which the liquid refrigerant (Freon) circulates. As the Freon absorbs heat it exceeds its boiling point and is transformed into a vapor which purges the absorbed heat from the Freon. This allows the refrigerant to cool off, drop below its boiling point and return to a liquid state to start the cycle all over again.

Let's imagine the cycle starting at one of the three major units of a car's a/c system—the condenser.

The condenser receives the heat-laden, vaporized refrigerant after the latter has done its cooling job. It swamps the condenser coils with cool, circulating air that brings the coolant below its boiling point, where it reverts to liquid form. Simultaneously, the hot, humid air which was pulled out of the car's interior by the refrigerant is dried out as it is blown across the cooling core and converted to water vapor. This water condenses on the cooling core and is drained away.

From the condenser, the liquid refrigerant



IF MAGNETIC CLUTCH (indicated) is shot, it won't turn. The compressor must be removed for this repair



PROPANE TORCH DETECTS coolant leaks in the line and at connectors. Leaks cause flame to change color



AMOUNT AND CONDITION of refrigerant can be seen through sight glass located on the receiver-dryer

Since the job of driving the compressor falls to the engine, that part of the a/c system must line up with the engine's drive belt.

The condenser must be positioned where it will get the fullest blast of outside air, so it's usually found in front of the radiator.

The evaporator must be placed where it can best absorb the hot inside air; hence it is generally installed in the firewall separating the passenger compartment from the engine compartment.

Troubleshooting you can do

The lack of special equipment will probably prevent you from doing a complete servicing job on your car's airconditioning system, but there are a number of troubleshooting jobs you *can* undertake with ordinary tools.

In tracing the cause of a problem, keep in mind that the components of your car's system are interdependent on one another. A problem at any one point can affect the efficiency of the system as a whole and, if serious enough, can even cause a complete breakdown.

It's easy enough to tell when something's gone haywire with your airconditioner. You push the button and the blower doesn't blow, or for some other reason

the desired cool air just isn't forthcoming.

In most cases an inoperative blower can be traced to the fuse which controls it—it's broken down. Replace it, and you're coolly on your way again. Sometimes this fuse will balk and then work the second or third time you try turning on the system. Replace it anyway—it's ready to quit.

A bad switch, loose electrical connection, broken wire or defective blower motor can also cause system failure.

If the blower motor is okay but air output is low, chances are the trouble is a clogged air-distribution system. Or, maybe you forgot to open the air-output valves, so check 'em.

Valves okay? Then look for an obstruction in one of the blower outlets. Sometimes a leaf or twig gets caught in the blower inlet between the fan and the housing. You'll have to remove the blower to clean it out.

Other reasons for low air output when the blower motor is working properly are:

- A low charge in the battery.
- A loose wire connection.
- Short, dirty or loose switch contacts.
- Binding of blower shaft or blades.

Now let's assume the blower is performing beautifully, air is circulating sufficiently, but little or no cooling is taking place. Almost certainly the trouble will be

found somewhere in the refrigerating circuit.

The prime suspect is the belt that drives the compressor. If it's loose and slipping, or plain busted, cooling will be either nonexistent, or nearly so. Check the belt carefully. If it shows the least bit of damage, replace it. If it appears loose, tighten it as much as you can.

To check the belt, start the engine, turn on the air conditioner, then observe the compressor's pulley action. If the belt's slipping, the compressor pulley won't rotate, or it may rotate erratically due to slippage.

While you're at it, check to make sure the compressor's magnetic clutch is working. The clutch activates the compressor when the system is turned on. A faulty clutch can prevent the compressor shaft from turning, hence prevent cooling.

Bugs, leaves and other debris can block up the condenser cores and greatly impair the system's cooling function. Use a compressed-air hose to blow this matter out of the cores, being sure to blow it from inside out.

A pro's five-point checklist

The following checklist will give you a pretty good idea of how a professional air conditioning mechanic would troubleshoot the system. Familiarize yourself with it so you'll know what's happening the next time you have to submit your air conditioning unit to the expert tinkering of a specialist.

1. Check for refrigerant leaks. A propane torch is often used to do this. It is fitted

with a special adapter to which a hose is connected. The bluish flame of the torch is passed along near (but not against) the underside of the a/c lines and connections. At a point in the system where a leak exists the flame will change color. A small leak will turn the flame orange; a big leak will turn it bright green.

Before removing or replacing a leaky hose—or any part of the system through which the coolant passes—all the refrigerant must be removed. To do this, a manifold gauge set (an indispensable tool for air conditioning work) is tied into the compressor.

First connect the inlet-suction line, which goes to the inlet-suction gauge, to the side of the compressor where the refrigerant enters as it comes from the evaporator. The outlet line, which connects to the outlet pressure gauge, is then hooked to the side of the compressor through which refrigerant passes on its way to the condenser.

If you're working inside, a third line—the exhaust—must be connected to an exhaust port which will carry the old coolant safely outside. Freon is dangerous stuff—it can literally freeze your eyeballs. So, a smart mechanic will wear goggles when he does this job.

Okay, the needle and outlet valves of the gauge set are now opened to permit the refrigerant to evacuate through the exhaust line. When the needle of the outlet gauge reads zero, the system is clear.

If a refrigerant leak is coming from a connection, tighten the connection and test again. If it still leaks, replace the connection.



RECEIVER-DRYER UNIT is pulled for a replacement. A clogged filter may require this after a few years



MANIFOLD GAUGE SET, a must for most a/c troubleshooting jobs, tests suction and output in system

2. Test for internal malfunctions. If the system still doesn't come up to par after all leaks are fixed, the manifold gauge set is again hooked into the system to test the adequacy of refrigerant pressure, and to uncover other possible internal causes of the continuing malfunction.

Outlet pressure should be high; if low, faulty cooling is being caused by a low charge of refrigerant, excess moisture in the system or an obstruction or kink in the circulation line.

Inlet-suction pressure is normally low; if it is high, and outlet pressure is normal, this indicates either trouble with the expansion valve or moisture in the system.

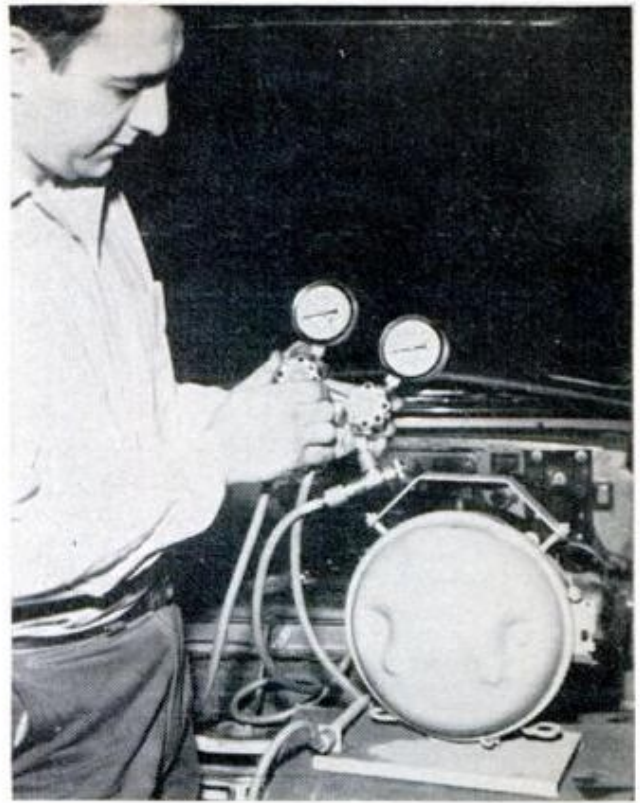
Another (though less accurate) way to check on the condition of the refrigerant is to look into the sight glass normally found on the receiver-dryer unit. Start the engine and let it run at slow speed until the compressor is warm. Look into the sight glass. If there is an insufficient charge of refrigerant or if air has gotten into the system, the Freon will appear cloudy or foamy and may even be bubbling.

3. Vacuuming the system. Once the system has been drained and the necessary repairs made, it is vitally important that it be vacuumed out.

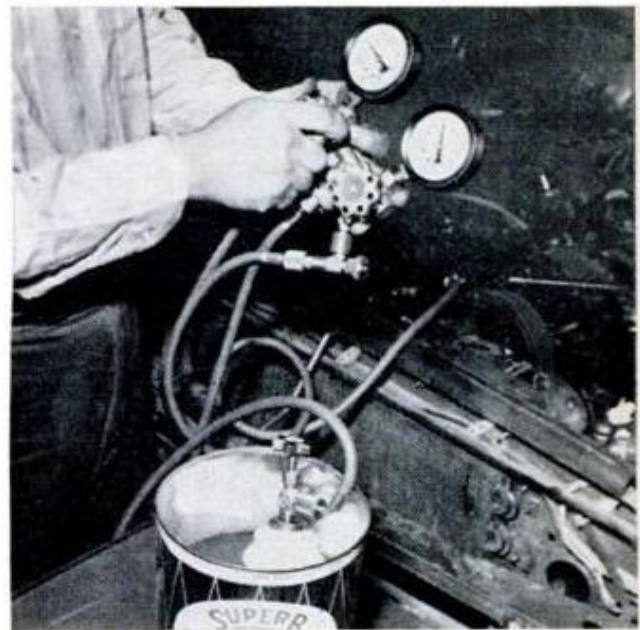
To do this, the manifold gauge set is left in place and the set's exhaust line hooked up to a vacuum pump. Then all valves of the manifold set are opened and the pump started. The system should be pumped out for at least 15 minutes to remove all air and moisture. During this process you'll note that the inlet-suction gauge will drop down past zero, indicating the existence of an almost perfect vacuum inside the system.

4. The receiver-dryer unit. This storage box contains a filter element designed to remove small amounts of moisture and dirt that may work their way into the system. In time, the element can become clogged. A clogged filter may reveal itself by the constant presence of small bubbles in the refrigerant. This can be checked by a look in the sight glass. Another clue to filter trouble is a distinct difference of temperature between the high-pressure line into the receiver-dryer and the outlet line. Since the filter cannot be reached to be cleaned, the entire unit must be replaced.

5. Recharging the system. When refrigerant has been drained or needs replenishing, the system must be recharged. There are several ways of doing this. The point is that this job must be done exactly according to manufacturer's instructions and specifications. In any case, a full load of refrigerant must be put back into the system. There is usually a plate fastened to the compressor that tells you just how much refrigerant your system takes.



WITH OLD COOLANT REMOVED, vacuum pump purges system of air, moisture before new coolant is added



AMOUNT OF NEW REFRIGERANT fed to system is read on manifold gauge set. Follow manufacturer's specs

erant has been drained or needs replenishing, the system must be recharged. There are several ways of doing this. The point is that this job must be done exactly according to manufacturer's instructions and specifications. In any case, a full load of refrigerant must be put back into the system. There is usually a plate fastened to the compressor that tells you just how much refrigerant your system takes.

★★★

SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

His Transmission Is a Drip

A slight but persistent transmission-oil leak from the vent on the side of my '64 Studebaker's automatic gearbox has existed since the car was new. I've been careful to use only factory-approved fluid and have installed a new breather, a new baffle in the transmission and a new yoke, but it still leaks. Any ideas?—Richard Janis, Chicago.

Ask a transmission specialist to look for an air leak around the front transmission pump. He may be able to plug it with a simple repair. If it's big bad trouble, though, you may have to replace the pump. In any case the pump will have to be torn down to make a diagnosis.

No-Go Neutral

My '58 Dodge with pushbutton shift runs pretty well for its age, but lately a problem has cropped up: I'll press the Neutral button, then try and start the car . . . and nothing happens. However, after a couple of tries the car will start. What's the hang-up?—H.J. Borger, Minburn, Ia.

It sounds like one of the two neutral safety switches is fouled up. Play it safe and replace both of 'em (if one is shot, its mate is probably ready to lie down and die too).

The Mighty Roar in the Rear

I recently bought a 1964 Dynamic 88 Oldsmobile and immediately detected a humming, or muffled roaring noise coming from the rear of the car. I questioned the previous owner about it and he informed me that his dealer had told him that this noise was common with the '64 Olds. Other owners of this model have told me the same thing. Is there any cure for the noise, or should I just grin and bear it?—Frank N. Bishop, Portsmouth, Va.

The latter, I'm afraid. I've checked several of my sources, and they confirm that this noise is common to this car. It's called

exhaust roar, and some people like it—very powerful sounding. Anyway, I know of no way to eliminate it. (Any of you other buffs got a cure for this one? If so, lemme know; I'll send your tips along to Frank.)

Medicine-Chest Cure

I have a '64 Buick with aluminum heads. What should I use on the sparkplug threads to keep them from freezing? Also, how tight should I torque the plugs?—Robert R. Church, San Antonio, Tex.

Use iodine. Corrosion in the form of aluminum oxide causes the plugs to freeze in their holes. Iodine prevents the formation of aluminum oxide.

Torque the plugs in an aluminum head to 40 ft.-lbs.—no more.

Dealer Must Paint

The first time I polished my new 1965 Ford I noticed small rust-colored pit marks on the hood. A good cleaner failed to remove them. The paint job on the hood is obviously a poor one. When I showed it to my dealer he said it was "orange peel," but that it didn't look bad and I need not repaint. He said it would take him several days to repaint it, that he would have to remove all the old finish and that the job wouldn't compare with a factory paint job. Since I cannot afford to have the car tied up for several days, what should I do?—Jerry Wymer, Canandaigua, N.Y.

I think your dealer's talking in circles. First of all he's obligated under your new-car warranty to give you satisfaction in this regard. Secondly, any shop worth its salt can do a paint job like this in a day—two days at most. Sure, it may not be as perfectly perfect a job as the factory is supposed to put out, but it should certainly be 100 percent better than the slapdash smear you seem to have gotten with your car. Your dealer is obligated to do this job to fulfill his responsibilities.

Corvair Carb Balance Is Critical

I own a 1961 Corvair Monza 900. There's a spark port on the left-hand carburetor with a removable plastic cap. The spark port on the right-hand carburetor controls the spark advance. With the engine idling, I've checked the vacuum of the left-hand carb through the spark port and gotten a reading of about 14 in. However, on testing the right-hand carb I get a reading of zero. Is this okay or is something wrong?—E. J. Bowser, Rumford, R.I.

"Okay" it ain't. Your carburetor balance is 'way off. This sounds as if the throttle valve on one of the carbs is open, while the valve on the other unit is closed. Correct carburetor balance is critical in this car, and there's a regular detailed procedure which must be followed to balance

these carburetors. Your Chevy mechanic knows the ins and outs of this job, and I advise you to let him do it.

Calling Mr. Hitchcock

Perhaps Alfred Hitchcock would pay to have my '57 Plymouth in one of his horror shows. I can start it when the automatic transmission's in Drive and Reverse, as well as Neutral. It's kind of eerie. Help.—Ed Mueller, New York City.

Look for gremlins in the transmission valve body. The neutral switch is probably not making contact with the detent pin. This being the case, the car acts as if it were in neutral at all times when you go to start it. Two possibilities are a bent detent pin or a switch that isn't run up far enough. Good e-ven-ing!

Service Tips

- **If you're experiencing hard starting or missing with the 352 or 390 CID engine in your '65 Ford, check the secondary wiring harness.** It's been known to become pinched between the coil and the carburetor air cleaner. In time, this can result in chafing of the insulation, grounding of the wire and loss of ignition to the plugs. If your engine's purring like a pussycat, it's still not a bad idea to check the position of this harness the next time you duck your head under the hood.

- **Chevy admits that** some customers have reported problems with the shift lever pivot pin in the '66 Chevrolets, Chevelles and Chevy IIs with three-speed column shift. Difficult shifting has been the result in these cases. Your dealer is bound by the terms of your warranty to correct the trouble as follows—

If the pin is working out of position, it should be replaced with a new pin.

If the pin is too tight in the housing, it should be removed and its cross-over operation tested by using a small-diameter drift or drill butt as a pivot. If this corrects the binding condition, the shift lever should be removed and the hole in the shift-lever housing reamed out with a No. 1 drill (.225 dia.).

- **Speedometer-cable noise** in 1964 Oldsmobiles has been traced to one of two causes. Either the left front hub grease retainer (dust cap) isn't completely seated around the hub, or the speedometer-cable drive sleeve isn't aligned properly in the cap. The cure is to correctly align the cap in the hub, or—if the drive sleeve is off center—install a new cap.

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

KEEP SHARP

The secret of keen cutting edges is choosing the right sharpening stone for each job. Here are the ones you should buy for home and shop tools

SUIT THE STONE to the sharpening, the pros will tell you, and you'll never have a dull moment around your home. With proper and frequent stoning, you can postpone grinding indefinitely, but where a cutting edge has become nicked and blunted by long use or abuse, you'll have to re-establish the edge by holding it against a grinding wheel—taking care not to "burn" the blade, or distort the original bevel. When a wire edge appears along the back of the entire cutting edge, you're ready to transfer to a stone designed for the tool you're sharpening. The photos and captions on these three pages (adapted from material supplied by Behr-Manning Div. of Norton Co.) tell you how to use the most important types.



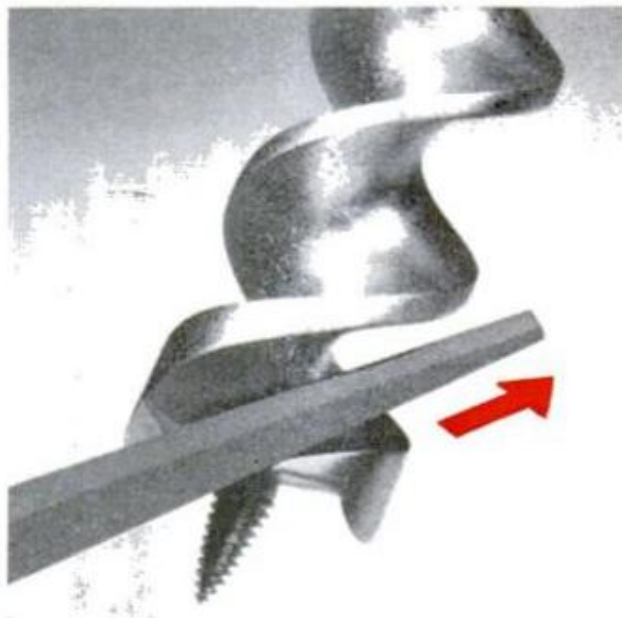
KITCHEN KNIFE

CRYSTOLON KNIFE SHARPENER with handle is easy and safe to use if you hold knife along edge of flat surface with cutting edge straight up. Hold stone against cutting bevel, about 30° from vertical, and revolve stone against edge in small circular motions from heel to blade tip (see color arrow). Repeat on other side. No lubrication is necessary



GOUGE

GOUGE SLIP is curved double-faced unit, like section of a cone. After any necessary grinding, apply convex edge of gouge to concave face of slip and sharpen by pushing forward while rotating, keeping rear of bevel clear of the stone. Photo above shows second step: Concave edge is rotated back and forth on convex face to remove wire edge



AUGER BIT

ALUMINUM OXIDE STONE, made specially for the purpose, is used on upper side of cutting edges. Take care to retain original bevel angle, stroking upward, as indicated above. Lower side is then lightly stoned—only enough to remove any burr that's been formed. To sharpen spurs which score wood in advance of cutters, work inside of bit only



CARVING KNIFE

ROD-TYPE SHARPENER is best for all types of carvers or slicers. Grasp handle firmly in one hand and hold steady while you draw cutting edge of blade diagonally against stone from heel to tip in long, sweeping strokes. Switch blade to other side of stone, and repeat for opposite bevel, alternating sides till the blade feels razor-sharp to your thumb



SCISSORS

COMBINATION BENCH STONE should be placed flush with edges at corner of flat surface, and lubricated with film of household oil. Grasp scissors or shears at pivot and place one blade on stone at slight diagonal. Tip blade up so cutting bevel is flat on stone. Stroke blade toward you—first on coarse side, then finishing up on fine—till both blades are sharp



SCYTHE OR SICKLE

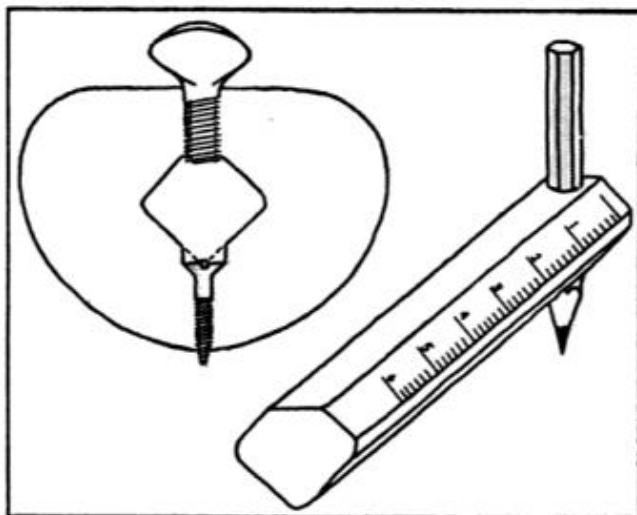
MEDIUM-FINE SCYTHESTONE is stroked from heel to tip as indicated by the color arrow. Take care to follow the bevel established by the manufacturer—not difficult, since stoned area appears much brighter than untouched metal. Remove burr by stroking once or twice with stone clapped flat against back of blade. Scythestones are aluminum oxide or silicon carbide



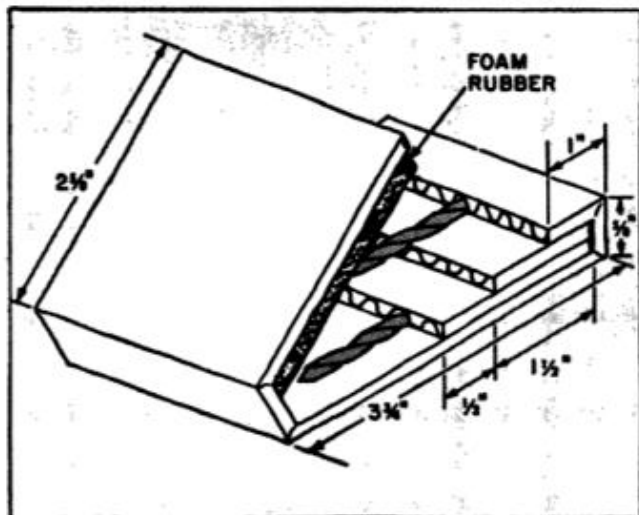
AX OR HATCHET

COMBINATION AX STONE is palm-sized silicon carbide unit that may be lubricated with household oil, kerosene or water. Chopping tools need strong wedge-shaped edge. Using coarse face of stone first, stroke across edge with circular motion, carefully maintaining bevel width and alternating from one side of blade to other to keep bevels about equal

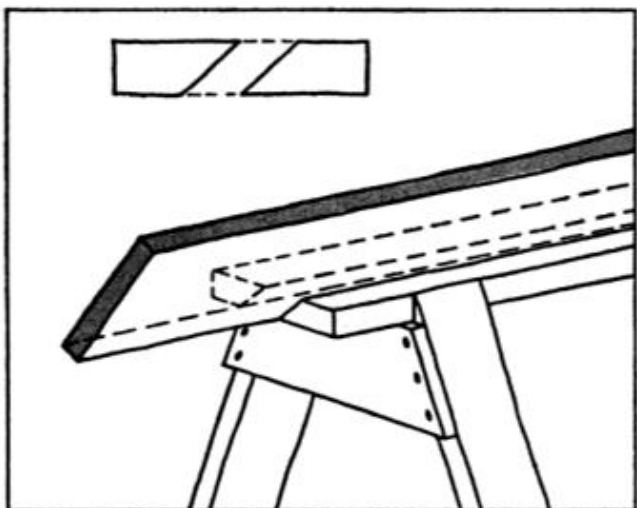
6 Tips to make shop and home chores easier



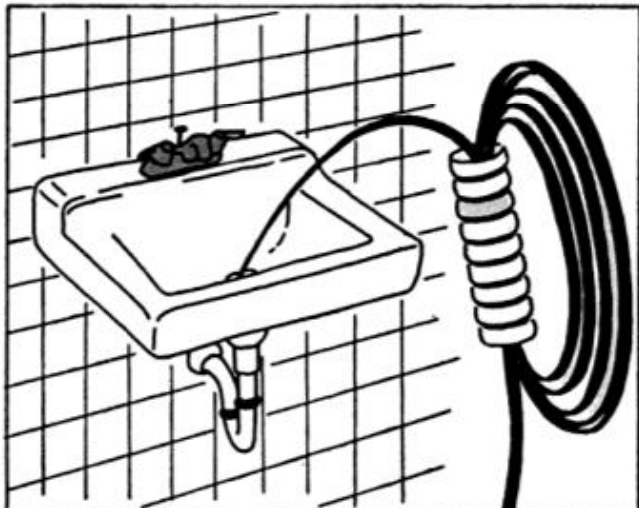
DOUBLE-DUTY MARKING GAUGE functions as a compass. Drill through sliding block via the setscrew hole with a $\frac{1}{8}$ -in. bit and insert a $\frac{3}{4}$ -in. No. 4 screw. Then replace scribe with pencil in tight-fitting hole



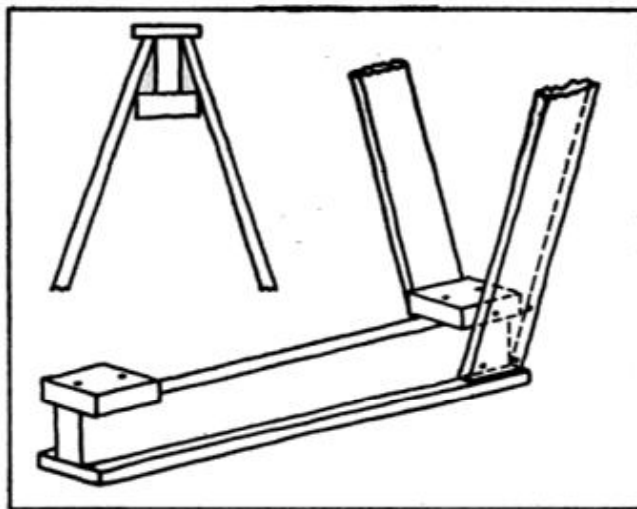
PORTABLE BIT INDEX costs you nothing. Fold lengthwise a 3 x 8 $\frac{1}{2}$ -in. piece of corrugated cardboard as shown and glue in 1 $\frac{1}{2}$ and 2 x 3-in. pieces for tiers. Foam-rubber pad holds the bits in place



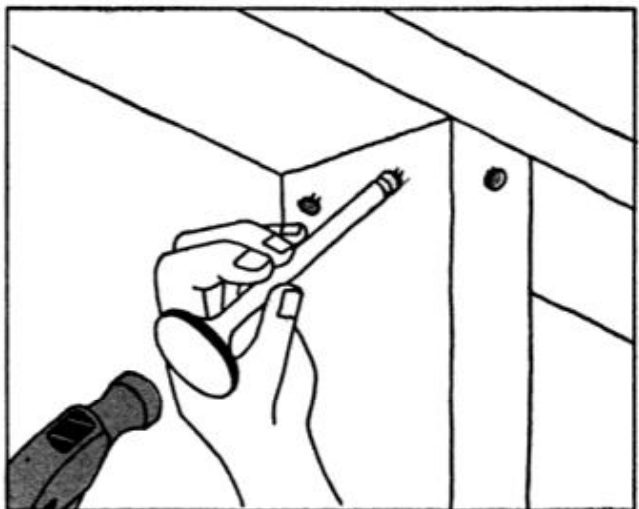
GET A GRIP ON YOUR WORK with this angle-slotted sawhorse. Rip the top 2 x 4 at a 45° angle and nail the two pieces to the leg frames $\frac{7}{8}$ in. apart. The weight of the board will hold it in place for sawing



THIS SNAKE BEHAVES because you control its coiling and twisting by looping it through a short length of Greenfield cable. You can store, pay out and retrieve it, re-coiling it at the same time



NEED A SAWHORSE IN A HURRY? Nail 2 x 4 x 4-in. blocks to both ends of a 2 x 4 rail placed on edge. With these as spacers, attach 1 x 4 legs. Another 1 x 4 nailed to the top edge will steady the work

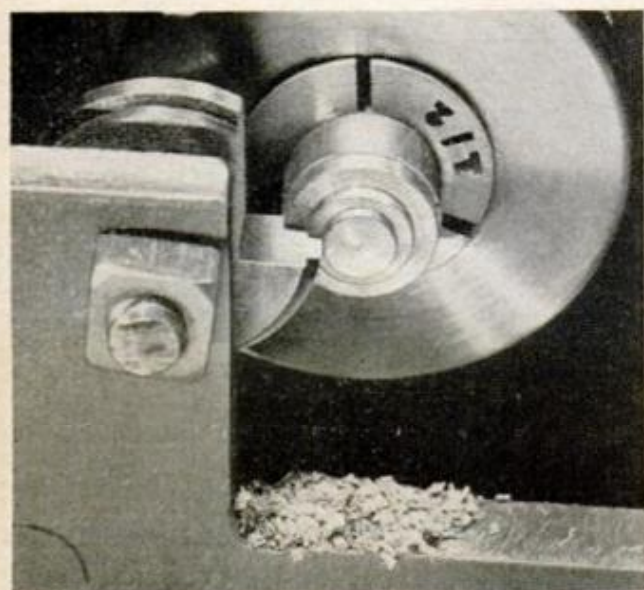
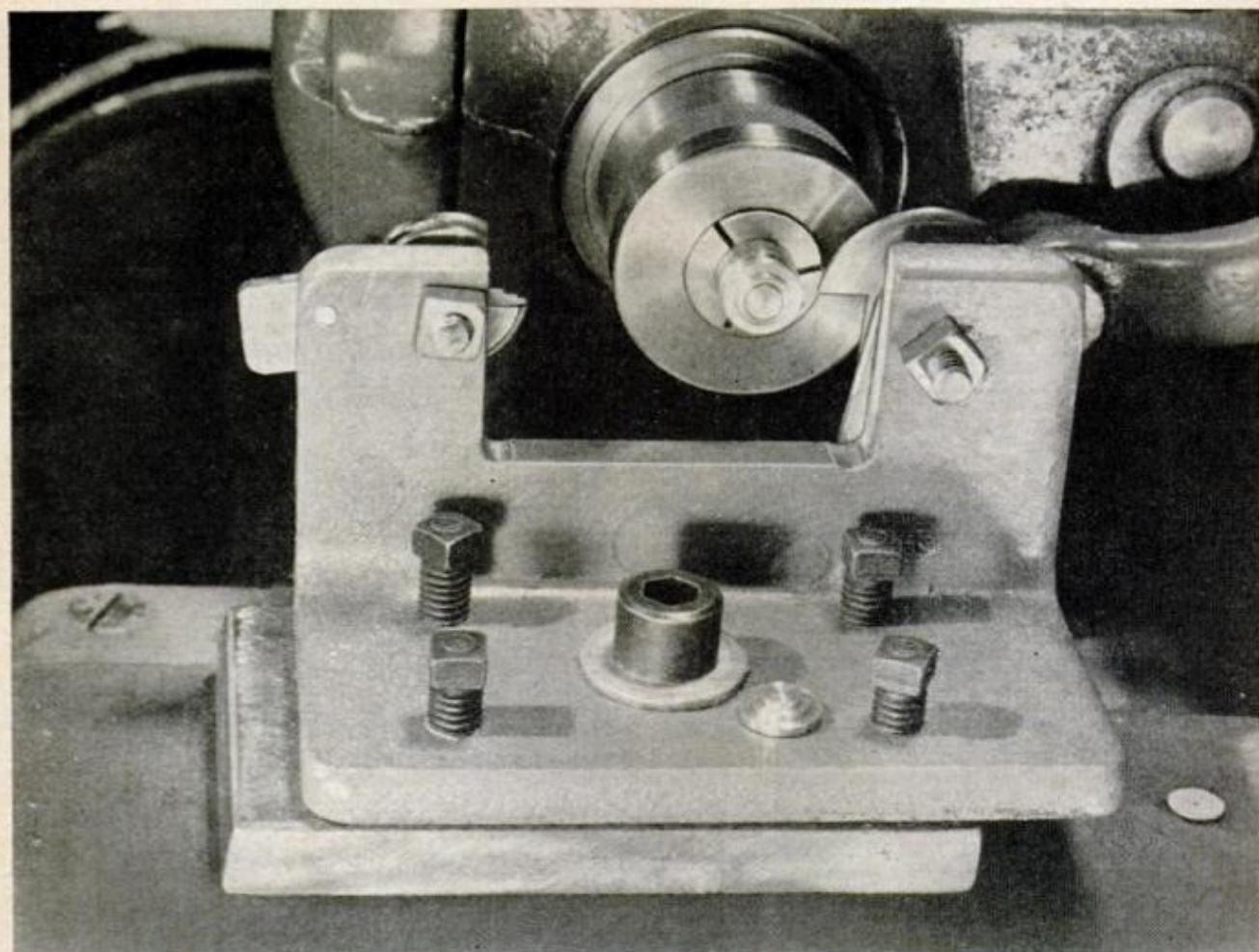


TAPPET IN. It's usually difficult to hammer home the heavy nails used in toenailing rough framing. But access to the corners and driving the nails are easy if you can find an old automobile valve

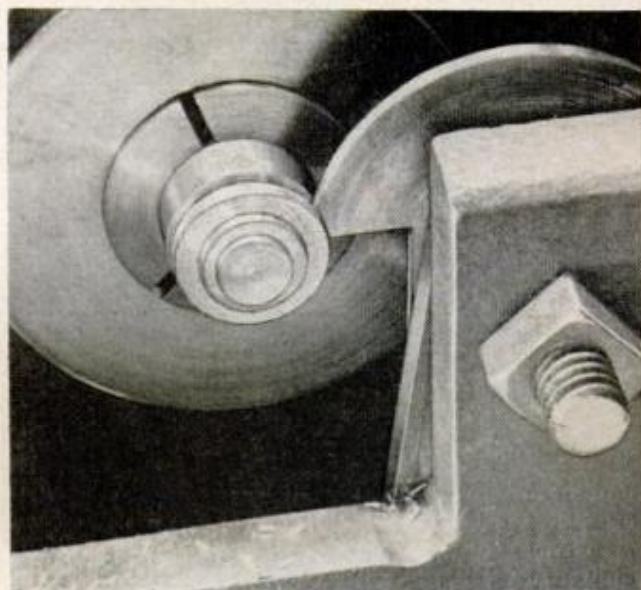
Circular bits for your lathe



Take a tip from industry next time you're turning decorative discs, handles or balls on a metal lathe: use homemade circular cutters



TWO-CUTTER SETUP on 9-in. lathe (top photo) has front bit (above) to cut step design on brass rod



AFTER DESIGN IS CUT, decorative button is separated from blank with other bit used as parting tool

By WALTER E. BURTON

PRODUCTION TURNING in commercial shops is often done with circular cutters. Why? Because such "bits" can be quickly machined on the very lathe they're intended for, and can be custom-made to create intricate shapes in metal, wood or plastics. Also they're easily resharpened—time and again—without altering their cutting shape.

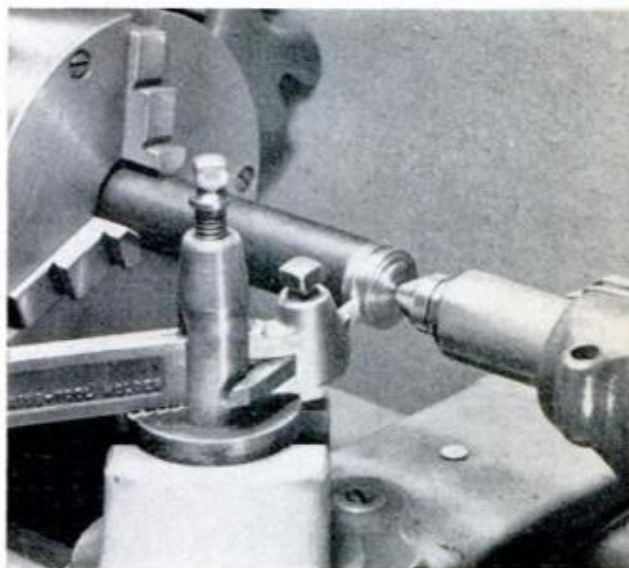
These advantages make circular bits ideal for *your shop*, as well. Often you can use a single form-cutter setup to turn out a variety of shapes by manipulating the lathe feeds and including a cutoff tool in the operation. You can produce handles, drawer knobs, spheres, medallions, discs, rings, gear blanks and other small parts for machinery—in any quantity you need. And circular cutters can also be used in such routine lathe operations as facing, grooving, rounding or chamfering edges.

To design a circular forming tool, you must first determine the shape of cut it's to produce. Then you turn up a tool-steel disc to a shape that, when it's radially cut, produces a cross section to match that cut. That cross section becomes a cutting edge when you notch into the disc as if you were slicing a lopsided wedge from a fresh pie. Then, by means of a center hole, you bolt the cutter to a support mounted on the lathe carriage, adjusting the cutting edge to align with the center line of the workpiece. Since the surface forming the cutting edge is usually parallel to the radius of the workpiece—with no rake—the cutting is accomplished by means of a scraping action—particularly suitable for turning brass.

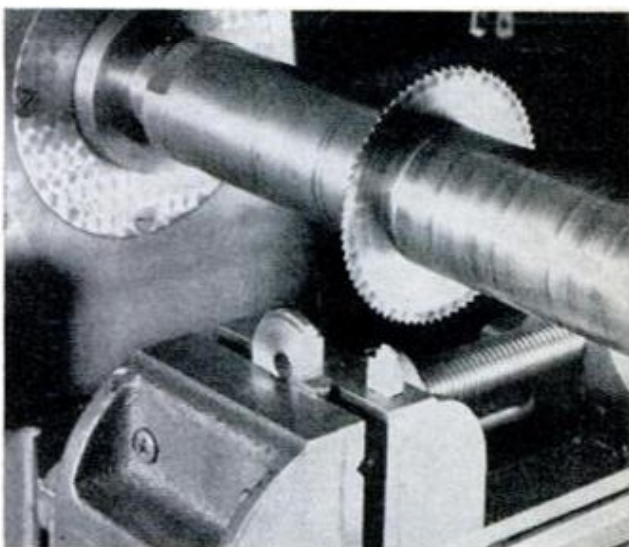
The choice of material for your cutters is important. You could machine them from soft steel, then case harden the cutting portion, but resharpening would destroy the case, making another heat treatment necessary. High-speed steel is most durable, but requires suitable heat-treating facilities and skill. Hardenable tool steel is your best bet.

The cutting edge of the notch is parallel to the disc radius but, in the cutters shown, it's about $\frac{1}{16}$ in. below the radius to provide front clearance. For larger diameter cutters, a greater difference may be

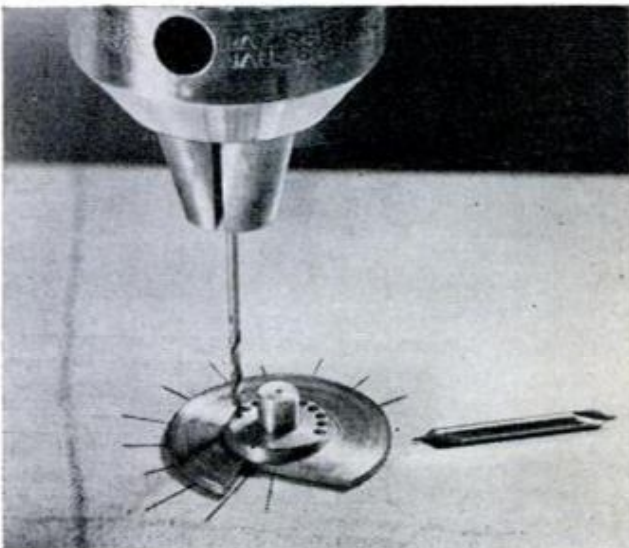
Machining the cutters



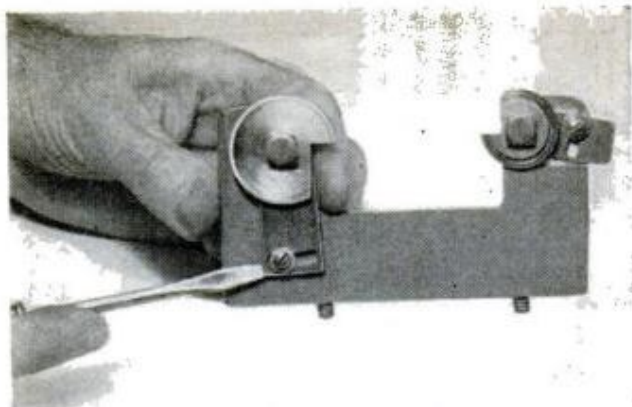
STEP-DESIGN CUTTER is machined from tool-steel rod to cross-section which will make desired cut



SLITTING SAW on milling machine makes precision notch for cutting edge, but hacksaw can be used, too



INDEXING JIG has radial lines 20° apart for drilling pin sockets, after spotting with center drill (right)



ADJUSTABLE ARMS on angle holder let you alter rake of cutters. Positioning pin engages rear face

required for best cutting, but for home-workshop lathes the 1 to 1½-in. diameter shown should be large enough.

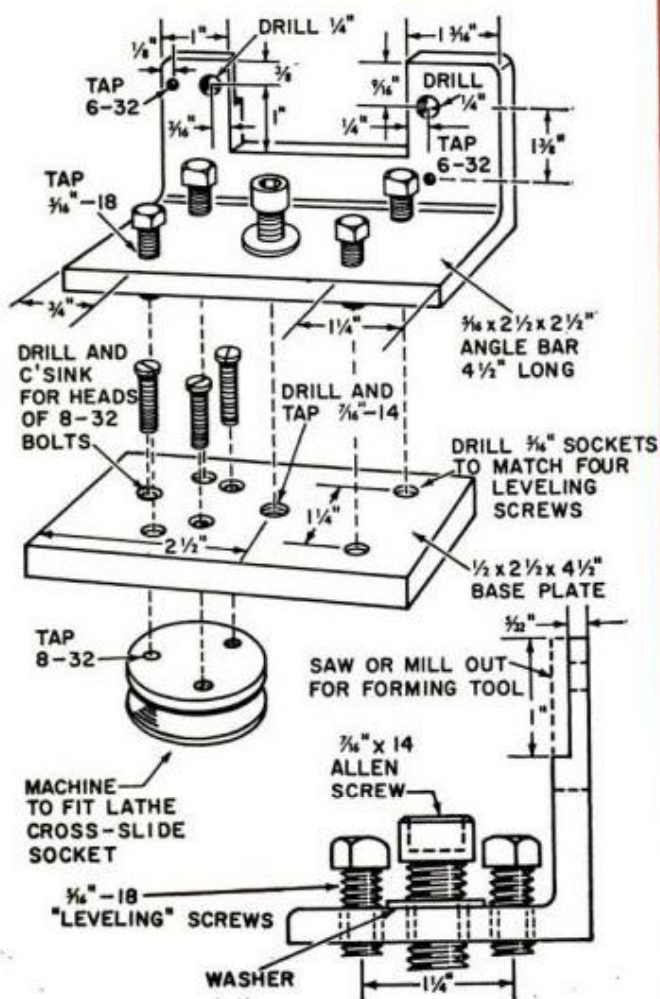
The resulting contour of the cutting edge won't be precisely the same as if the disc had been cut exactly on a radius. In work of great precision, take this difference into account in the cutter design.

The face of the cutter toward the holder has a ring of shallow holes (about 1/16 in. deep) to engage a

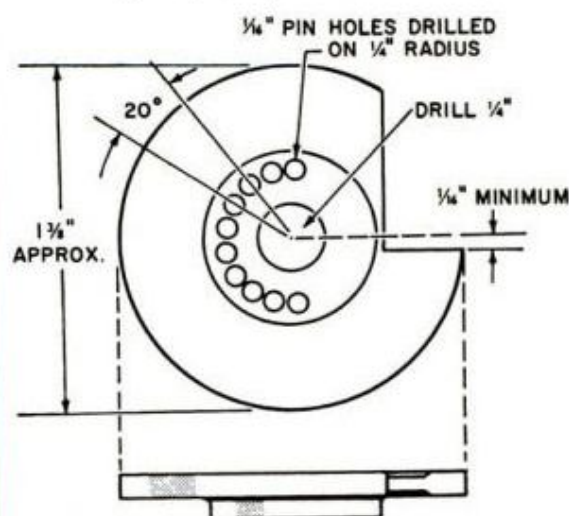
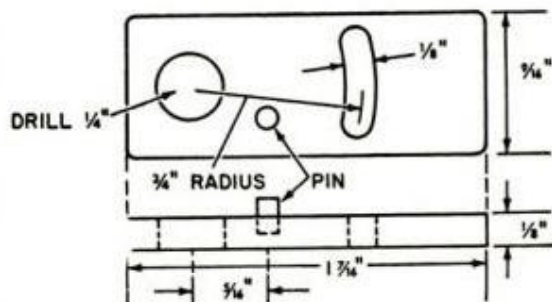
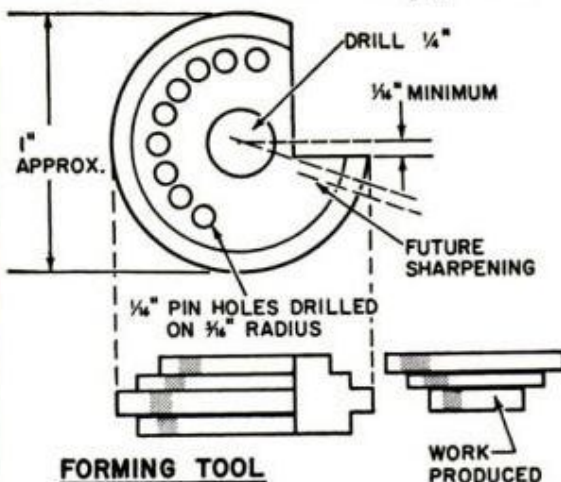
CUT,
FOLD,
TAPE

LATHE BITS

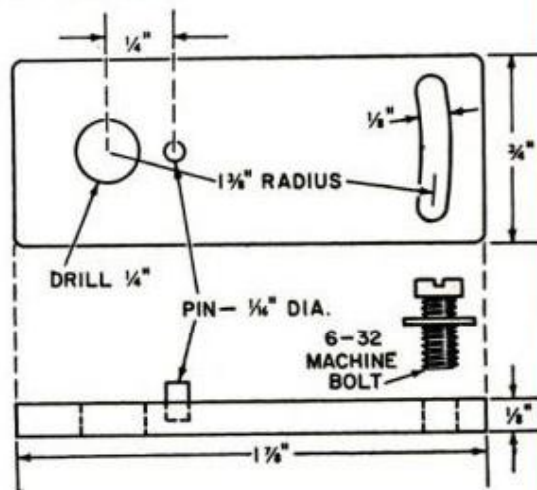
(Please turn to page 182)

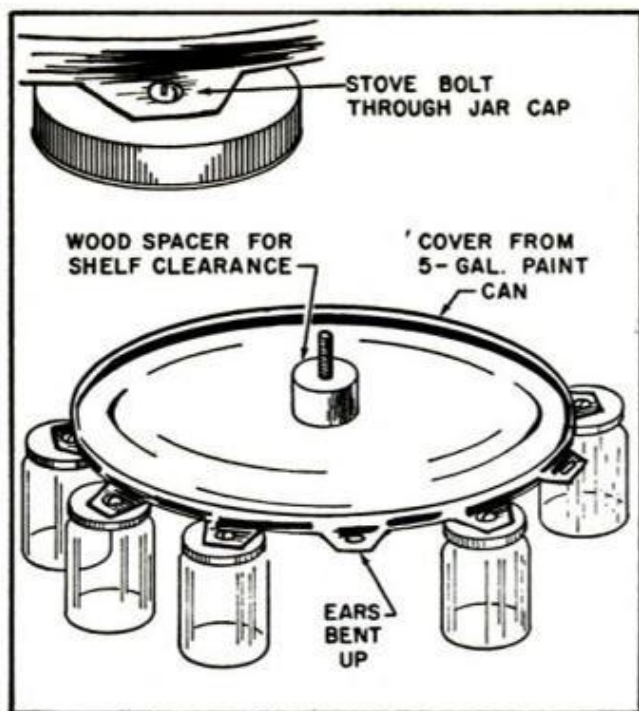


Cutters and supports



CUT-OFF TOOL





Parts caddy costs peanuts

You can make this rotating screw and nail caddy for next to nothing. All you need is an eared lid from a 5 or 10-gallon paint can and a number of baby-food jars. Drill through the lid's center for a pivot bolt, place large washers above and below, run the bolt up through a hole in a shelf and add a nut and lock washer. Then drill through the jar lids and attach them to ears of the paint-can lid with stovebolts, lock washers and nuts.—*Dick Kelly*



How to slice polystyrene

Polystyrene is a versatile material that does well by hobbyists and boat builders, but just you try to cut it! Your tools dull and sawdust clings everywhere. Your soldering gun's cutting tip won't cut deep enough. You'll find, though, that the blade of a tableknife silver-soldered to the gun's replaceable tip will slice through a 3-in. thickness with ease. Hacksaw a slot of the blade down the middle for better heat distribution.—*Dona Meilach*

NEXT MONTH IN SHOP AND CRAFTS

MAD SCIENTIST'S MODEL SAILBOAT. No clipper this! Instead of billowing canvas, a rigid aerofoil which looks like a sinister dorsal fin drives PM's little monster. At speed, it pulls itself up out of the water and scoots along on little foil feet. Our designer calls it an "aerohydrofoil," and you'll have to see the plans to believe it. See next month's PM.

THAT WORKHORSE, THE 'BEETLE.' Volkswagen owners starved for cargo space can expand the versatility of their vehicles with two big-load carriers detailed in the August issue. One is a cartop rack for a boat or lumber, the other, a bin to cart trash or bulky parcels. Both set up on the car in a few minutes and are inexpensive and easy to build.

WHAT GLUE TO USE? With the many different glues on store shelves, little wonder the craftsman is confused as to which kind is the best for the job at hand. A feature you won't want to miss in the August issue explains why you should use one and not another, tells how to work with different glues and includes a handy reference chart for your shop wall.

BENCH-SAW BAND SANDER. An ingenious attachment that fits on the arbor of your bench saw gives you an efficient band sander at virtually no cost. The only tool you need for making the rig is the bench saw itself, when you follow the easy instructions in the August issue.

Put a \$9 WIRELESS FM MIKE in your cigaretet case

Make your own two-transistor shirt-pocket broadcaster. It will transmit to any nearby FM radio or hi-fi tuner. You can put it together in a single evening.



(Shown actual size)

IN JUST A FEW HOURS you can assemble this simple FM wireless microphone. It really comes down to a matter of mounting the parts on the circuit board and wiring in the antenna, on-off switch, microphone and battery. The assembly is a cinch and the circuit board makes a mistake extremely unlikely.

This unit is a two-transistor transmitter. The first stage (Q1) is an audio amplifier. Input signals from the microphone are fed to Q1's base through capacitor C1. The amplified audio signal is then fed through capacitor C3 to the base of the FM oscillator transistor, Q2.

Transistor Q2 is a special high-frequency unit selected for output and stability. Connected to tank circuit L1 and capacitor C5 with a 15-in. antenna in series with the coil, it delivers a stable signal in the FM broadcast band.

Before beginning assembly of your unit, first drill all necessary holes in the circuit board. Use a 1/16-in. drill for the small holes and a 1/8-in. drill for the two large holes for the trimmer capacitor. A 1/4-in. hole will permit adjusting the trimmer capacitor.

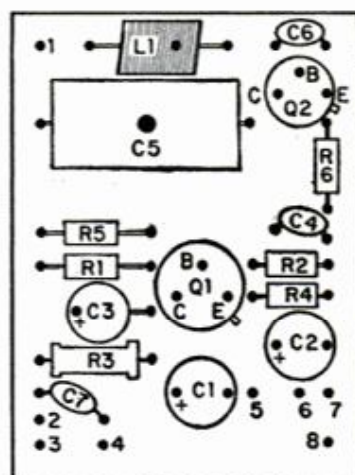
Now insert all resistors, capacitors and transistors into the board. Use 1/4-in. lengths of spaghetti over the transistor leads to keep the transistors above the board. Next, solder the tap into place on the coil and mount it on the board. Then insert capacitor C5. Solder all leads carefully.

Connect the battery clip leads; red to hole 4 and black to hole 3. The microphone leads go to holes 5 and 6; the switch to 7 and 8. Hole 2 is not used. Connect the antenna, mount all the parts in the plastic case, hook up the battery and you're ready to go.

Case preparation. No matter what plastic case you use, you'll have to drill holes for the antenna connector, pushbutton switch and microphone. The antenna connector should be located at the top left rear of the case; a 1/4-in. hole is required. On the upper right side, make a similar hole for the pushbutton switch.

The microphone can be cemented to the front of the case; if you do this, drill a 1/4-in. hole for its leads. For a neater-looking package, cut a hole on the front of the case, equal to the diameter of the mike, and mount it flush. We dressed up our unit with a scrap piece of metal grille obtained from an old transistor radio. You might do that if one is available, or try another grille for improved appearance.

Obey FCC rules. Before we get into tuning and operating instructions, a few words about complying with regulations of the Federal Communications Commission are in order. As the FM wireless mike is a low-power FM transmitter, it must comply with part 15.205 of the



PRINTED CIRCUIT BOARD. Top and bottom views are actual size. They show the layout for parts placement and wiring. Be sure to follow them exactly

Parts List

Resistors:

- R1—62,000 ohms, 1/4-w.
- R2—33,000 ohms, 1/4-w.
- R3—1,500 ohms, 1/4-w.
- R4—3,300 ohms, 1/4-w.
- R5—91,000 ohms, 1/4-w., 5%
- R6—510 ohms, 1/4-w., 5%

Capacitors:

- C1—10 μ fd, 12 v., electrolytic
- C2—30 μ fd, 10 v., electrolytic
- C3—10 μ fd, 12 v., electrolytic
- C4—.001 μ fd ceramic
- C5—6-30 pfd trimmer
- C6—5 pfd ceramic
- C7—.001 μ fd ceramic

Q1—HP-100 (*\$1)

Q2—P-404 (*\$1)

Printed circuit board (*\$1)

Antenna coil—6 turns No. 14 enameled, tap at 1 1/4 turns

Mike—crystal

Ant.—15" 3-pc. collapsible

Battery—9 v. (Burgess 2U6)

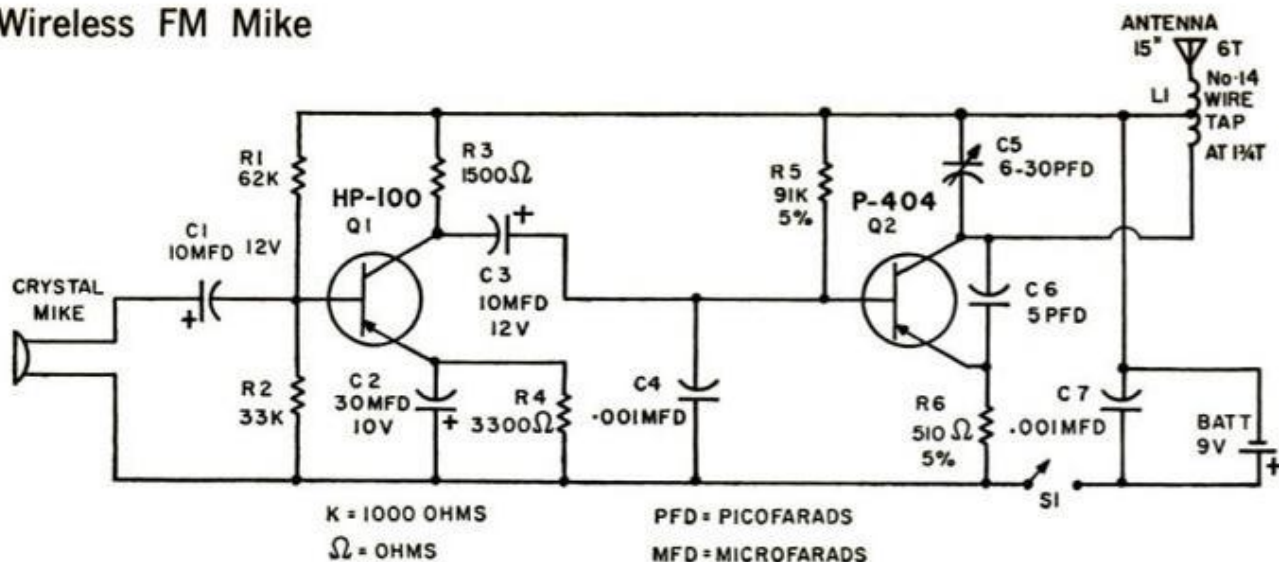
S1—s.p.s.t. pushbutton (open)

Case—3 1/2 x 2 x 1 3/4" plastic

*Complete kit, all parts, \$8.95

*Available AMD Electronics, 668 Dowd Ave., Elizabeth, N.J.

Wireless FM Mike



COMPLETE TWO-TRANSISTOR CIRCUIT of the FM wireless mike. Do not attempt to alter it in any fashion

FCC rules. This means it can be used only on the portion of the FM band which is clear of broadcast stations. You must not tune the unit to frequencies outside this band (88 to 108 mc.). You must check to see that there are no spurious radiations outside the FM band.

Do this by tuning your TV to channels 6 and 7 while operating the transmitter. There should be no interference visible on the screen.

Lastly, the transmitter should be tested by a competent electronic technician. He should determine that the unit meets FCC requirements and give you a written statement to this effect. Attach this certificate to your transmitter.

Tuning and operation. To tune and operate your transmitter, follow these simple instructions:

1. With the antenna in place, open the case to gain access to trimmer capacitor C5. Adjust this capacitor only with an insulated screwdriver. You can reach the adjustment screw through the 1/4-in. hole you made in the board for this purpose.

2. Tune a nearby FM receiver to 88 mc. Depress switch S1 on the transmitter. Hold the mike near the receiver speaker and slowly adjust trimmer capacitor until you hear a whistle or howl from the speaker. This is at the lower end of the FM band.

3. Retune your radio to 108 mc. and repeat step 2. A whistle or howl will be heard, marking the upper end of the FM band. The entire band, you will note, can be tuned with about a half revolution of the adjustment screw. *Caution note:* Do not tune the transmitter outside this range—if you do, you are violating the FCC

regulations covering the operation of this pocket FM radio.

Now you're ready to use your wireless mike. Tune it to a blank portion of the FM band and put it to work. With the 15-inch antenna specified, the range of this unit will never exceed 200 feet. Any extension of this range is not permitted.

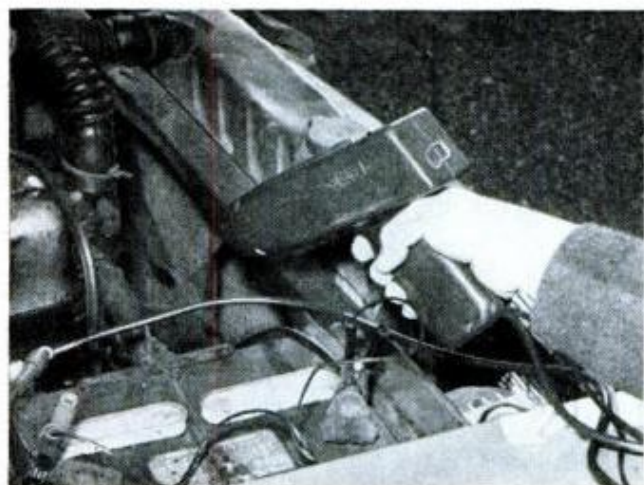
You should find the FM mike fun to build and use as long as you keep the FCC rules governing its use in mind. For more details, you might write the FCC, Washington, D.C. 20554, and ask for a copy of OCE Bulletins 11 and 12. No. 11 is titled *Does My Transmitter Need a License?* and No. 12, *Operation in the Broadcast Band Without a License.*

These bulletins give completely detailed information on all FCC rules governing the use of low-power, license-free operation of radio transmitters, and you should be thoroughly familiar with them before beginning to operate a transmitter of your own. ★ ★ ★



ON-THE-AIR TEST of transmitter found it to be operating perfectly. Voice was clear and distinct

NEW IN ELECTRONICS



Shoot your way to accurate engine timing with this argon timing light from Knight-kit. Its high-intensity light can be used outdoors and does not demand subdued lighting as the more common neon models do. It goes together in a couple of hours, and you can put it to work the same day you get the kit. Model KG-371 is \$19.95.



Complete record-care kit available from Robins includes almost everything you are likely to need. There's a strobe disc and light (left), a stylus pressure gauge (top right), self-stick felt spacer pads (above) and a host of other useful items. A very useful set of accessories for anyone who listens to records. PK-10, \$16.95.

SPEAKER CABINET too small? Most "bargain"-type enclosures are too tiny to handle a full-size speaker system, even though the mounting hole is the right size.

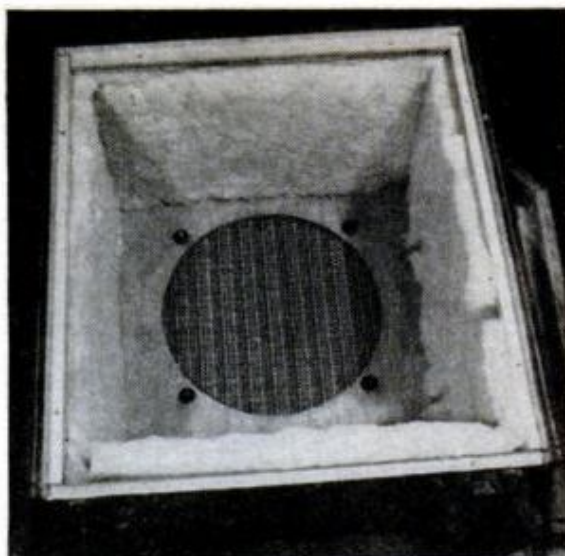
Such a unit is typically an infinite baffle (no bass port or duct) that is just a closed box with a hole for the speaker. Such a box vibrates like mad whenever a decent bass note is fed to the speaker. The best solution is to add a port. But how to do it in a tiny cabinet is a problem.

One variation of the bass-reflex principle uses specially designed ports around the speaker to vent the cabinet. The easy way to do this for your setup is to remove

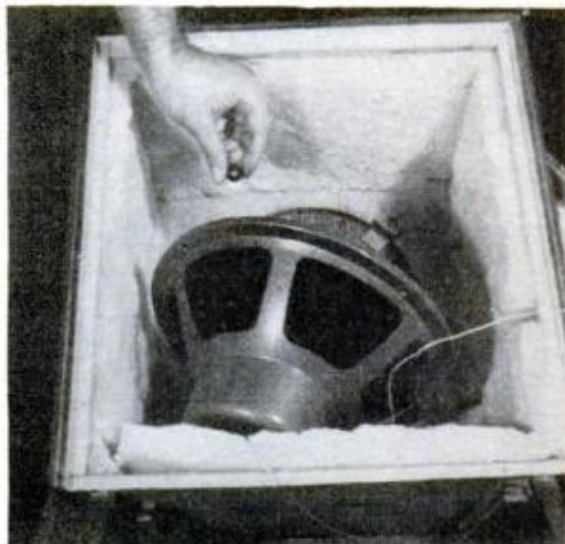
Better sound from any speaker

the speaker and place an ordinary faucet washer over each mounting bolt ($\frac{1}{8}$ -in. to $\frac{1}{4}$ -in. thick). Replace the speaker and retighten the nuts enough to hold the speaker but not enough to flatten the washers. A good way to tell when they're right is to tighten them till the speaker is held in place but does not rattle.

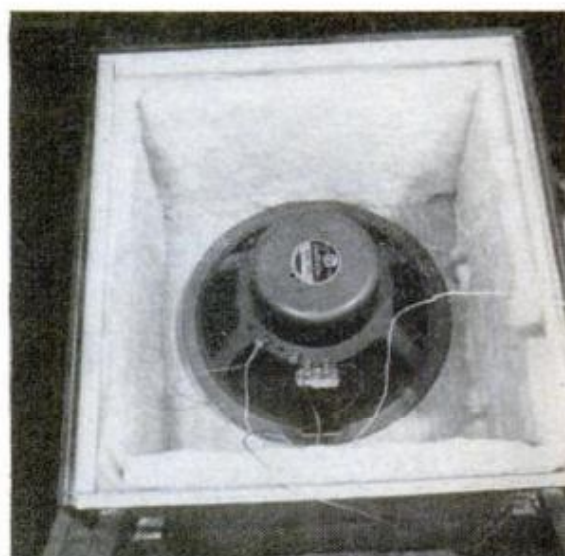
Now those troublemaking low-frequency notes have a nice big air space to get out through all around the sides of the speaker. Sure, you don't have a true bass reflex enclosure, but you will have a definite improvement over the bargain enclosure you had.—Walter G. Salm



OPEN THE CABINET, pull out the speaker and you've taken the first step toward better sound from your present economy speaker enclosure



DROP A FAUCET WASHER over each mounting bolt to provide an air space for the bass tones so they can get out of that tight little box



PUT THE SPEAKER BACK, clamp on the cabinet back panel and for just pennies you've got better bass tones and no more bass vibration

The price of a GMC pickup is \$49* more than others.

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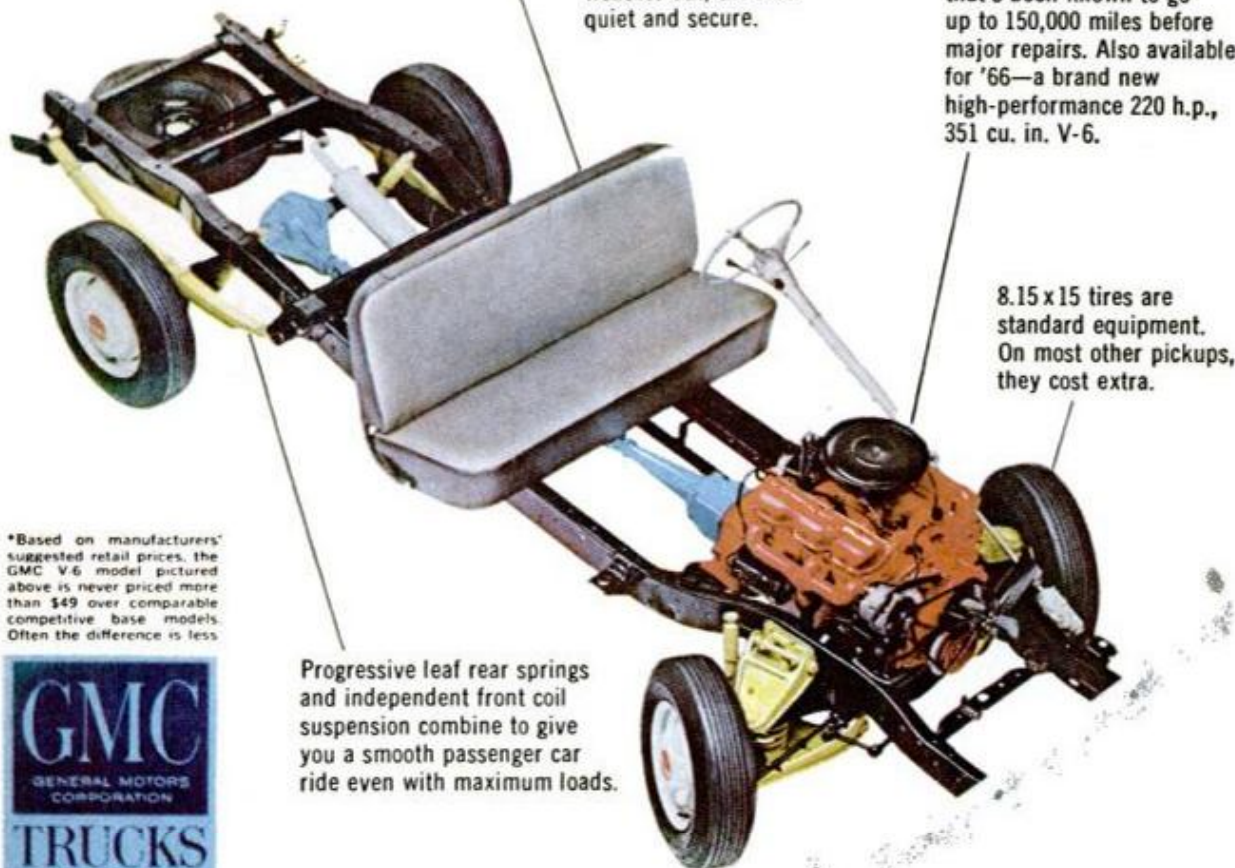
GMC—the name that stands for "built, sold and serviced by truck people." People who know how to give you more truck for your money.

GMC seats are foam-padded for extra comfort. Plus the backs are fully adjustable. And a new custom sports interior, featuring bucket seats, padded door trim and carpeting, is available at extra cost on '66 models.

You get a wood loadbed floor. Not a metal one. You know about wood. It doesn't rust. It's tough. Quiet. And long-lasting.

A GMC cab gives you two walls of steel and a thick pad of insulation over you. Keeps the weather out, the ride quiet and secure.

GMC's 170 h.p. V-6, still the most modern truck engine on the road today. It's the engine that's been known to go up to 150,000 miles before major repairs. Also available for '66—a brand new high-performance 220 h.p., 351 cu. in. V-6.



8.15 x 15 tires are standard equipment. On most other pickups, they cost extra.

Progressive leaf rear springs and independent front coil suspension combine to give you a smooth passenger car ride even with maximum loads.

*Based on manufacturers' suggested retail prices, the GMC V-6 model pictured above is never priced more than \$49 over comparable competitive base models. Often the difference is less.





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50 cc. models start around **\$225**

OLD MACDONALD

(Continued from page 114)

ripe ones to drop off. They are then carried out the right side of the machine on another belt.

Considerable research and time has also gone into the development of a selective pickle picker. There are several under development at the present time and one is already being commercially produced.

Michigan State University has taken a different approach to solving the pickle-picking problem, developing a dwarf variety of cucumber. The vine is only 18 to 24 inches long in contrast to the regular vines which are better than 6 feet in length. It is hoped the lilliputian pickle can be planted much thicker than the king-sized kind and deliver more cucumbers of picking size at one time, making once-over pickle picking profitable.

At the same time that the short pickle was being developed, the university's engineering department was hard at work developing a once-over pickle harvester. This revolutionary machine has two 60-inch spiked belts which catch the vines and suck them into the machine at the same time the plants are being cut loose from the ground by rotating discs just behind the belts. Inside the machine, counter-rotating rollers similar to washing-machine wringers grasp the vines and pull them through. Pickles are squirted off and dropped into a cleaning area.

This machine has been tested extensively with good results. When it is used in combination with the newly developed dwarf-cucumber plant it may very well solve the nation's pickle-picking problems.

More and more, we see horticulturists cooperating with the engineer to solve harvesting problems. One of the most dramatic breakthroughs was the result of such a marriage. Not long ago the tomato was on almost every farmer's list of crops most likely never to be machine harvested. It was planted, transplanted, staked, picked by hand. Today a good portion of the nation's tomato crop is practically untouched by human hands, thanks to new strains of tomato plants and giant picking machines.

A number of different tomato harvesters are already commercially produced. All of them operate in much the same manner. They crawl down the fields at from 4 to 10 mph, gulping up vines and all. Vines are carried into the machine on an inclined belt and the fruit is mechanically separated. The vines are discharged and the tomatoes are carried on a belt to the back of the machine where a dozen human sorters separate the good fruit from the green or overripe. Electronic sorting de-

VICES are being developed for this job and soon even the human sorters will be eliminated. Then only one man, the driver, will be required to operate the machine. These monsters of the tomato fields can harvest 10 to 15 tons of fruit an hour or up to 150 tons a day. And that's a lot of catsup.

While the established companies at first wanted nothing to do with some of the more exotic machines being developed by the universities, there has been considerable interest in pacer machines, such as the cantaloupe harvester. This machine has huge folding wings which spread over 10 or more rows. It is actually a mobile conveyor belt. As it moves down the rows, towed by a tractor or other prime mover, men walking behind it harvest cantaloupes and lay them on the belts which carry them to the center of the machine. There another belt elevates them to a trailer or truck where other laborers pack them in crates. The machine is called a pacing machine because it works on the same principle as Ford's old assembly line—the worker must keep up with the machine.

Gathering grapes in bunches

While considerable effort has been put forth to develop machines to replace the stoop laborer in the field crops, the building of pushbutton pickers for harvesting other crops has not been forgotten. The University of California has developed a fantastic machine for the harvesting of grapes. It looks as if it would be more at home crawling across a Martian landscape than gayly creeping down the trellised rows, snipping bunches of grapes. The grape picker has four flat wheels, three on the bottom and one on the top. The one on top presses down on the vines to make the bunches hang lower.

In actual operation the machine is pulled down the rows by a tractor while the operator directs the cutting head. The grapes, in the case of raisin grapes, drop to a mesh belt which moves them out the side of the machine and deposits them on an unwinding, unending roll of brown paper to dry in the sun. When used for wine grapes, another belt would move the cut bunches into a huge dump trailer of the type already used in the wine fields.

In the past few years the harvesting of some tree crops has become highly mechanized by the use of shaker-catcher type rigs. In this method a pneumatic shaker which is similar to an overgrown jackhammer is attached to the tree and a canvas catcher similar to an upside-down umbrella is spread beneath the tree to catch the dropping fruit. Then the button is pushed and the shaker is turned on for a

(Please turn to page 170)

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OLD MacDONALD

(Continued from page 169)

second or two to dislodge all of the fruit.

A new citrus-picking machine looks like a giant praying mantis and glides through the citrus groves on superwide balloon tires that give it support even on soggy, freshly irrigated land. The machine is guided automatically by a runner which goes down a furrow that has been plowed between the trees. From the base of the machine a double-beam boom extends about 20 feet upward. An arm swings down from the end of the boom and on the end of the arm the picker sits in a comfortable saddle. Between the man's legs is a hole about 10 inches across. As he picks the fruit it will be dropped through this hole and funneled to a "slowerator."

Even pushbuttons to go

The boom and arm are designed so the man hangs down in the tree and has access from the top. The machine is operated by means of controls which are strapped to the picker's legs and a small panel of buttons which rests on his left thigh. From his perch in the saddle at the end of the boom arm the picker has complete control of the machine. If he wants to go up he raises a toe upward and if he wants to go down he points his toe downward. He can also move to the left or the right by the motion of a knee, but other motions of the machine are controlled by pushing buttons on the panel. Eventually all hand-controlled motions will be eliminated, leaving the hands free to pick oranges.

Most of the machines now being developed still utilize humans as operators or, at least, as drivers. It'll be a good many years before we find Old MacDonald sitting in his farm-control center, watching on closed-circuit TV as his menagerie of fully automated machines scurries over the land performing all the various chores, such as plowing, planting and harvesting, and worrying about the day when those "gol-darned" scientists with their new-fangled test-tube farming will put him out of business. But with the recent development and introduction of such sophisticated machines as the tomato pickers, the lettuce pickers, grape harvesters and fruit pickers, there can be no denying the push-button picking revolution is on us.

And according to many farm experts, this revolution has come none too soon because dwindling labor supplies and rising costs of harvests have been on the verge of pricing some crops right off the markets. One expert says, "If a crop can't be harvested mechanically, it won't be grown much longer." ★★

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BOX CAMERAS

(Continued from page 69)

strike a buried object, they are reflected and the picked-up echoes are converted into a cross-sectional profile by electronic means.

Sound-wave photography was employed in the search for the USS *Thresher*, the Navy atom submarine that sank in 1963, and more recently for the U.S. H-bomb lost off the coast of Spain. Dr. Edgerton's device shared in the former hunt, along with a new "side-scanning ultrasonic sonar" system developed by Westinghouse Electric Corp., which makes detailed television images of the sea bottom. The Edgerton device was also able to penetrate 15 to 20 feet of bottom mud to spot the wreckage of a DC-8 jet liner that crashed two years ago in Louisiana's Lake Pontchartrain. Dr. Edgerton now intends to use his sound-wave device to search for the lost Mediterranean city of Helike, which disappeared centuries ago, perhaps because of earthquakes and tidal waves, and has eluded archeologists ever since.

At the University of California in Berkeley, Dr. Robert N. Colwell of the School of Forestry has been working with another novel type of camera that in effect looks through the earth from the air. This camera works with both invisible and visible light and uses a combination of lenses, films and filters to take pictures simultaneously in different wavelengths. The principle is simple. Each object reflects light differently; it has what the scientists call a spectral signature, or light fingerprint, which may show up in one wavelength but not in another. Thus photos taken in several wavelengths can, when compared with one another, reveal changes in the reflectivity of vegetation that are invisible to the naked eye or to the conventional camera. From such changes on the surface scientists can deduce what is happening inside the earth.

In 1959, Dr. Colwell and several of his colleagues wondered whether this principle could be used in detecting secret underground nuclear explosions. If such an explosion had occurred, surely there would be subtle changes in plant life near the site due to radioactivity or to blast. Would they show up in aerial photos?

The Department of Defense wanted the answer, too, and agreed to set up a project. Out of it came a nine-lens camera, manufactured by Itek Corp., which photographs a target simultaneously through nine different filters.

Test flights over a Nevada underground-nuclear-test site produced pictures that

point to damage to roots and to cracks in soil that could have been brought on by underground explosions.

Today, remote multiband spectral sensing, as it is called, has gone to work in many dramatic ways. Itek's pollution expert, Carl Strandberg, has successfully used the aerial spy with the nine eyes to detect deep harmful chemical seepages, which cause a deposit known as "yellow boy," in streams. These seepages, arising mainly from mines, often escape routine pollution surveys, but with the aid of this camera the "yellow boy" can now be traced to its source.

In California, Dr. Colwell reports that a remote multiband sensing aerial camera, using three lenses instead of nine, can detect many different plant diseases—including wheat rust, a disease that takes its toll annually in the millions of dollars—weeks before they would be noticed by observers on the ground. This lets the farmer dust the crop with fungicides to halt the spread of disease more quickly than he could before. "With a multiband camera we can survey forests and orchards from the air," Dr. Colwell says, "and we can pick out the trees that are losing their vigor. In fact we can spot a stand of sick trees in an orchard as much as three years ahead of the time when they would be noticed by observers on the ground. That gives the growers a good chance to remove the ailing trees before the entire orchard is blighted."

Overflying these aerial cameras and a quantum jump ahead of them are the rash of space sensor cameras that are giving us a new dimension of the earth and a front seat on events in the universe. Mounted in orbiting satellites, these sensor cameras are marvelously light and compact devices. Using invisible as well as visible light, they have such an enormously wide range of view as they orbit the earth that they can give us a synoptic picture once a day of the cloud pattern of the entire world, thus warning of coming storms and aiding the forecasting of weather.

"The new sensor cameras in space may also be used in predicting earthquakes and volcanic eruptions," says William Fischer of the U.S. Geological Survey. Two years ago, Fischer flew over Kilauea, in Hawaii, one of the world's most active volcanoes, and reported that the sensor camera was able to reveal the effects of underground heat changes that may imply the build-up of forces before an eruption. "If this is verified in further research, and if we can find comparable thermal or other patterns showing strain

(Please turn to page 172)

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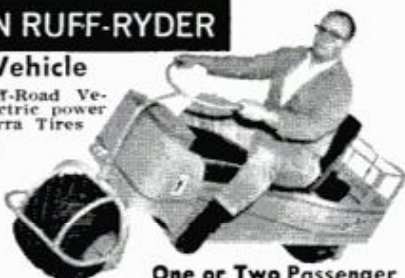
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BOX CAMERAS

(Continued from page 171)

in rocks along earthquake faults," Fischer says, "orbiting sensor imaging devices may ultimately be able to give us an outer-space alarm system. With it we will have a good chance to alert populations to dangerous earth movements before disaster strikes."

While these cameras eye the earth, giant earthbound tracking cameras, with focal lengths up to 500 inches, and looking like stubby Civil War cannons, keep an unceasing watch on the heavens. Some of these cameras are so acute that they can trail the multimillion-mile-long tail of a comet and spot and capture on film the tiny moving buttons of light from meteors, so they can be counted as they flash across space. Other tracking cameras keep all man-made satellites under constant surveillance. One sharp-eyed tracking camera at Cape Kennedy photographed the six-inch Vanguard I satellite at a distance of 3000 miles.

Perhaps the hardest-working photographers in outer space are the robot cameras that scan the surface of alien planets and stars and transmit what they see back to earth. One such camera highlighted the Mars fly-by, which broadcast to millions of viewers 134 million miles away the first closeup pictures of the Red Planet. Similar cameras were incorporated in the various moon shots made by the United States and the Soviet Union. Better photographic devices are coming up. One sophisticated U.S. space camera system is set for the unmanned Surveyor which will land on the moon, and another is contained in the Lunar Orbiter spacecraft, due to fly around the moon—in an orbit 29 miles above its surface—some time this year. This high-powered camera will take pictures of the surface of the moon, process its own film, and transmit the photos back to earth by electrical signal.

May look into an atom

Exciting though these outer-space applications are, an even more revolutionary prospect for photography is only now emerging from the laboratory. This is a camera that for the first time may photograph the heart of inner space itself—the inside of an atom.

The camera that may accomplish this extraordinary feat—which has eluded the keenest scientific minds up to now—is known as a holographic camera and was invented by Dr. Dennis Gabor, a Budapest-born physicist now at the University of London. As a youth Dr. Gabor won-

dered why you needed a lens to take pictures. Why not just gather up the jigsaw of light waves reflected from an object and reconstruct them into an image? In 1947, Dr. Gabor found a way of doing this with carefully controlled light. But it took another 13 years, and work in another nation, to steer holography into the photographic wave of the future.

The key was the invention in 1960 of the laser, which turns ordinary light, a jumble of many wavelengths or colors radiating in all directions, into coherent light, a single intense wave length moving in one direction. At the University of Michigan two young scientists named Emmet Leith and Juris Upatnieks successfully applied the laser to Gabor's idea of lensless photography. The resultant photos, or holograms, as they're called, don't look like photos at all. They consist of a montage of globs on a plate, but if you shine a laser beam through this odd amorphous mass, an amazing thing occurs—the image leaps out vividly in three dimensions.

Experts see some fascinating uses ahead for holography. Some scientists are looking into a technique whereby holograms can be used as the element of a "reading machine," a computer that will scan your day's reading and give you a photographic summary on demand. They're also considering holograms for 3-D television and movies. Other scientists are using holographic technique with radar to take pictures of the earth through fog and smoke. But the most startling potential of the holographic camera by far lies in its application to the microscope—especially to see the hidden world within the atom. At present there is no way of looking into an atom; it is too small for ordinary light waves to penetrate, and X-rays, which are small enough to get inside, cannot be focused well enough on a film to make a clear image.

But with a holographic camera it is known that a pattern of light made by means of an X-ray laser beam could theoretically be turned into a magnified image when it is reconstructed with a light laser beam of a longer wavelength. Dr. Gabor used this principle to develop the world's first holographic microscope, a primitive device that magnifies only 150 times. By using a coherent beam of either X-rays or electrons to make the hologram of the atom, a feat not yet accomplished, Dr. Gabor believes (and others agree) that the subsequent magnification by laser can be boosted many millions of times—enough to probe the atom and illumine its insides.

If this comes to pass, a new age of photography will have dawned. ★ ★ ★

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LINCOLN OWNERS' REPORT

(Continued from page 62)

past Continentals I've owned."—Colorado broker.

Next to workmanship, owners fired their heaviest verbal ammunition at the air vent/airconditioning arrangement, ranking it fourth on the gripe list just above complaints about the heater and the automatic climate control device.

"One thing I'd like to see on my Lincoln is decent fresh-air ventilation."—Kansas political official.

"Airconditioning is needed in the rear compartment."—California, retired.

"No matter how I sit to drive the car, I get a blast of air on my chest."—New York businessman.

"Airconditioner has never worked properly. Blows cold air instead of heat and at times doesn't work at all."—Washington jeweler.

"Have had a lot of trouble with the automatic temperature control."—Illinois executive.

"System takes in exhaust fumes from other cars."—New Jersey executive.

"With the windows closed the air is foul."—Illinois transport worker.

Almost as salty were owner comments about dealers and dealer service.

"My dealer is indifferent, inefficient and impolite."—California executive.

► Take that! And that!

"On a recent trip, Lincoln dealers—other than the one our car was purchased from—treated us like dogs."—Louisiana businessman.

"Dealer doesn't seem to know what to do to fix or adjust things that go wrong on the car."—Michigan, retired.

"Service in my town is lousy."—Ohio technician.

Disc brakes up front are standard on the new Lincolns and owners like the idea, ranking it seventh on the praise list.

"The disc brakes influenced me to buy a Lincoln, and I haven't been disappointed."—Federal government official, New Jersey.

"Fantastic. No fade."—California housewife.

"An outstanding feature of the car."—Maine executive.

Another thing owners seem to like about the new Continental is the car's interior design and styling.

"The plain leather upholstery and wood grain trim is very stylish."—Oregon physician.

"Everything on the dash is in front of the driver."—California, retired.

"The interior is designed with classic

simplicity and beauty in mind."—California executive.

"Inside is great for looks."—New York office manager.

Winding up the list of praises were kind words from owners who liked the idea of a big car.

"It gives one a secure feeling to drive it."—Ohio executive.

"I feel that if I ever had an accident I'd have an edge over smaller, lighter cars."—California, self-employed.

► A top gun turret would probably help, too.

"Lots of room inside."—Texas rancher.

"Plenty of room, even in the back seat."—Washington, retired.

And so on, all pretty much in the same vein, the point being a big, heavy car will always have its enthusiasts.

Ranked seventh on the gripe list were complaints about the glove compartment. All of them read the same—it's too small. Actually, the thing—in all cars—is misnamed; in practice it rarely holds gloves, instead is a sort of automotive Fibber McGee's closet. Because there's a certain amount of pack rat in all of us, I'm sure bigger and bigger glove compartments would just get filled with more and more stuff. Still, this Continental arrangement seems to be cutting it a bit too fine.

Next on the "I'm not happy about . . ." list was the transmission.

"Not as smooth as it's supposed to be. Produces an annoying hum."—Connecticut physician.

"It's noisy and I get a shock when changing gears."—California executive.

"Won't down-shift for passing. Had transmission trouble four weeks after taking delivery."—Ohio consultant.

A number of owners felt the car's performance was somewhat less than sparkling.

"Lincoln lacks the powerful takeoff of the competitive Imperial."—Ohio businessman.

► Imperial is lighter, has a more powerful engine.

"It lacks the immediate surge of power for passing, even using the passing gear."—Washington, retired.

Last on the grip list was engine vibration.

"Get a noticeable vibration at speeds of 30 to 35 mph."—Washington jeweler.

"Engine vibrates at 75 mph."—California, retired.

► So do I. You're driving too fast, regardless of what the car will do.

"Miserable vibration at all speeds."—Arizona businessman. ★★★

DOCTORING A DUNKED MOTOR

(Continued from page 128)

those that can be taken apart should be disassembled into components, washed in kerosene and gas, air-dried and sprayed as described earlier.

One-piece bearings, however, are a different story. Don't take any chances—replace them. No matter how carefully you clean a one-piece bearing, you can never be sure you've removed all traces of the silt which often get into parts when an engine is submerged.

It's a lot cheaper to put in new one-piece bearings now, rather than to reuse the old ones, have a particle of silt destroy the bearing and find it necessary to rip the engine completely apart again.

Before reassembling the engine, it's a good idea to have the cylinder walls honed and install new piston rings. Honing takes off any glaze that may have formed on the walls, thus giving the rings a better surface on which to bite.

Replacing rings doesn't cost much, and it's always a good precaution to take when the engine is ripped apart. Besides, if the engine dropped overboard while it was running, there's a good chance the rings were damaged anyway. You should also

carefully check such parts as connecting rods and connecting rod bearings.

The best reason for honing cylinder walls and replacing undamaged rings isn't because the engine was submerged. These are jobs that can only be accomplished when the engine is ripped down. They'll add useful years of life to your motor, so it's only common sense to take care of them once you've spent all that time (or money) dismantling the engine.

Well, that's it, and quite a job it is. It's logical to ask, "How can I avoid all this in the first place?"

About the only thing you can do is to be cautious. Make sure those clamps are tight at all times. It takes only a couple of seconds to reach back and check them once in a while.

You might also consider installing a safety chain. (You'll find a photo of one on page 133.) Always make sure it's attached to a secure spot on the engine before ever leaving the dock. Then if the motor should work loose from the transom, it won't fall all the way into the water.

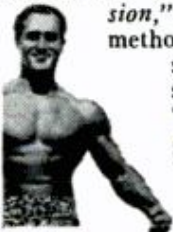
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LE TOURNEAU

(Continued from page 100)

industrialists shake their heads incredulously, muttering that LeTourneau's a lunatic. In office or home, R.G. kneels and prays, appealing to God for guidance.

"Nothing strange about that," R.G. says, his eyes suddenly flashing with apostolic zeal, his voice booming with evangelistic eloquence. "By accepting God as your partner, no limit can be placed on what can be achieved. When you go into partnership with God, you've got a Partner closer and more active than any human partner you can ever get. He participates fully in everything you let Him do, and when you start putting on airs and thinking you're doing it with your own head of steam, He can set you down quicker and harder than a thunderbolt."

Three years ago people were of the firm opinion that God had decided to get out of the heavy equipment business.

R.G. LeTourneau Inc. was on the brink of bankruptcy. Ten years and \$25 million had been poured into R.G.'s latest invention, an electric wheel that would power all his equipment.

This revolutionary prime mover went on the drawing board in 1953, after R.G. sold three of his five plants and all his patents to Westinghouse Air Brake Co. for \$31 million and the stipulation that he would not be involved in earthmoving equipment for five years. Utilizing his deep-water factory site at Vicksburg, Miss., R.G. invested \$3 million in an offshore drilling platform that could be floated to a site where three legs would then be lowered by rack-and-pinion gears to raise the platform above the waves. It was a successful venture, as were other huge machines. But R.G.'s obsession with the electric wheel was draining off the money faster than it was being earned.

In 1958, when the ban on making earthmoving equipment was lifted, the wheel still wasn't ready. But R.G. refused to go back to making conventional equipment.

Gamble beat bankruptcy

By 1962 he couldn't borrow a dime, his creditors were threatening lawsuits and he had an unpaid \$100,000 electric bill. He called in his attorney and accountant.

"You never saw two sadder looking fellows," he said. "I said to them, 'Boys, we seem to be in a bit of a pinch. What would you suggest?' The lawyer said, 'R.G., you've got to declare bankruptcy.' I turned to the other fellow and he said, 'It's the only thing you can do.' So I said, 'Okay, boys, I'll call you if I need you.'

"Well, I'll tell you I was a little worried.

So I knelt here in this office and asked His guidance. And then I went to work."

The gamble paid off. The bugs were ironed out of the electric wheel and it went into production as the power for all LeTourneau equipment. In two years the company moved into the black and the wheel is revolutionizing earthmoving.

Explaining the company's spectacular recovery, R.G. said, "The Lord chooses the weak to confound the mighty."

Regarded by many as an engineering genius and by others as the paragon of Christian virtue, R.G. also has his critics.

A former LeTourneau executive said, "If you have ideas of your own, R.G. is impossible to work for. He can't keep good, imaginative engineers, for instance, because he'll just browbeat them until they come around to his thinking. And if you argue, he'll start spouting the Bible. I mean, how can you disagree with God?"

This clash of power personalities was most evident when R.G.'s son, Roy, then executive vice-president, set out to prove that he was a chip-off-the-old-block. When he locked horns with his father over policy matters, R.G. fired him.

Critics confound him

When he moved his Stockton, Calif., plant to Peoria, Ill., in 1935, he faced a labor problem. Over the years, he has had to design machine tools to turn out the unusual parts for his mammoth machines, and he has also had to train workers in their operation. In Peoria, he opened his first technical school, turning out welders, press operators, lathe operators and machinists, hiring them into the factory upon graduation, and in many cases letting them work part-time while in school. In 1939, he opened a plant in Toccoa Falls, Ga., and again trained 400 unskilled laborers. He did the same in Longview.

His critics contend that LeTourneau teaches just those skills that will make a boy valuable to the operation, then hires him for below-union wages.

This criticism dismays him. When it was brought up, the smile left his face. His expression then was a kaleidoscope: perplexity, anger, hurt resignation. "That's one thing I don't understand," he said. "I take a country boy who doesn't know a screwdriver from a crowbar and I send him to school for free. When he becomes a welder or whatever, I give him a good job. Now, I realize we don't pay the highest wages, but we make it a rule that a man can work all the overtime he wants."

This is the sincere belief of a staunchly puritanical Fundamentalist, an anachronism in the age of fringe benefits.

Born in Vermont of French Huguenot

parents in 1888, transported to Duluth, Minn., at the age of 2, and later to Portland, Ore., LeTourneau grew up amidst the sprawling, rough-and-tumble expansion of the West. Engaged in a man's work at 12, he spent nights in a machine shop and the rest of the time reading.

"When I learned to read," he says, "I knew I had enough of school. The world's knowledge was in books and the books were there to be read. A brain is a muscle like any other. It just has to be continually exercised."

A boy with grit who worked hard, lived clean and believed in the letter of the scripture could become a millionaire.

On the job at 7 a.m. daily

When you're talking to a man who did it just like that, it's pointless to tell him that times have changed. And when that same man at age 77 is at a drawing board punctually at 7:00 o'clock every morning and never leaves until 9:00 o'clock at night, then to take his rest on a converted A-26 bomber rushing him to speaking engagements on behalf of the Christian Missionary Alliance Church, you might as well save your breath rather than tell him that a much younger man should attain the luxuries of the modern economy without working overtime. His four sons started in the plant at 10, working Saturdays and summers for 10 cents an hour.

There is considerable speculation about what will happen to R.G. LeTourneau, Inc. when the "Old Man" steps down.

"Things are bound to change," says Ben LeTourneau, 31, the youngest son and manager of the Vicksburg, Miss., plant building the offshore drilling platforms. "I'm sure we'll continue to be a company that flies by the seat of its pants, but there will be more diversification of command." Mentioning himself and his brothers as successors, he says, "Collectively, we're as good as R.G., but it takes all four of us."

Ted LeTourneau, a large, affable young man of 33, is chief engineer at the Vicksburg operation. Most like his father in looks and personality, Ted is the family mechanic. He learned to weld at 11, has worked at every machine in the plant and spent six months operating a bulldozer on a roadbuilding job in Liberia.

Ted is generally regarded to be his father's choice as a successor, but R.G. scoffs at retirement. "I don't feel a bit different than I did 30 years ago," he said. "I'm going to retire into a pine box."

When he made this same statement during a family gathering, his sister-in-law added: "Yes, and you'll kick the lid off to give some last-minute instructions."

An ambiguity in the LeTourneau char-

acter is his attitude toward formal education. "You can lead a horse to water," he says, "but you can't make him drink. You can send a boy to school, but you can't make him think."

Although he is openly scornful of schooling, and felt that his own sons should move into the business rather than go on to college, his technical school in Longview has blossomed into an accredited four-year liberal arts college bearing his name and his son, Richard, is the president.

When fired by his father, Roy LeTourneau went back to college, receiving his B.A. degree this past summer at the age of 36. Though he expressed some mystification at his son's interest in schooling, R.G. was busily juggling his schedule to attend the graduation, and beamed with pride over the news that Roy would continue to work toward a master's degree.

"Education is useless unless it is applied to some useful purpose," he says. "Every machine I have built has helped to produce a better life for a number of people. I'll go a step farther. Living together in harmony is more important than the big machinery. Science is concerned with conquering space, but the real question in our time is whether or not we're going to kill each other."

As a tyrant, a humanist, an evangelist or industrialist, LeTourneau is always an intriguing, original personality, but it is as a dreamer that he is at his best.

"I have a scraper that will pick up 360 tons of dirt and move it at 20 miles an hour, but that's nothing. I'm working on a conveyor system that will move 100 tons of dirt a minute. Think of it, 500-foot sections, each powered with electric wheels and independent of the others. A digger on the front section just chewing up the earth and passing it on, and the rear section dumping it where you wish.

"I'm just itching to build a shovel with a 25-yard dipper that will roll across dry land or swim rivers, the idea being that such a machine can reclaim millions of acres of rich land that is now nothing but marsh or tidal flats.

"We now have our offshore platforms in 600 feet of water. But why not in 1000 feet of water? That's our next step."

The future project that most interests LeTourneau is the proposed sea-level canal across the Isthmus of Panama. It is also a prime example of the attitude that has made him a legend in his own time.

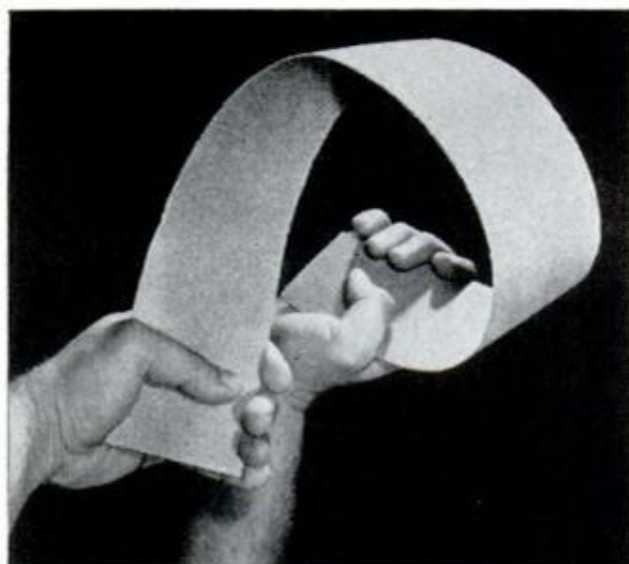
Seated next to a top official of the Atomic Energy Commission at a Washington, D.C., luncheon, where the canal was being discussed, R.G. leaned across to the AEC man and said, "If you fellows will loosen it up, I'll move it." ★ ★ ★

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WATER WITCHING

(Continued from page 91)

the angle rods in front of him, their tops a few inches apart and pointing slightly downward. Then the rods slowly began to drift apart. As Coates walked forward they separated about two feet, then gradually closed again.

We asked him to repeat the demonstration. Over the spot where the rods were farthest apart, Dempewolf told Coates to halt and lower the rods about 45° below the horizon. The tips edged together as the rods dipped down, but stayed about 15 inches apart. Dempewolf pushed the tips together with his fingers and let go. As though powered by weak springs, they drifted lazily apart again.

Dempewolf tried the rods to see if he could get a reaction. Nothing happened. Then I tried. Nothing. Coates tried again. The rods separated.

Conclusions? Not many. The test was skimpy, we agreed, and had too many variables, including possible illusions and errors in the frame I built. "It's intriguing," Dempewolf said. "But that's as much as I'll say without a lot more tests."

A variety of explanations

Dowsers come up with various explanations for their powers. "It's a divine gift beyond what's normal," explains Vermont's Clint Gray.

"Electricity in the ground makes the stick turn down," declares Floyd Cummings of Stephentown, N.Y.

"It's a vestigial adaptive response once useful for man's survival in finding water," says Dr. Berthold Schwartz of Montclair, N.J.

Scientists, water engineers and geologists offer different reasons. "There's water almost everywhere under the ground. A dowser can't miss if the drill goes deep enough," states consulting geologist Ralph Licherson. "I'll bet no water witch will risk \$100 he'll come up with a *dry* hole. A forked stick turns down because of twitching muscles, nothing more."

Hardly a doubt exists that Licherson's observation about the forked stick is correct. With palms up, a dowser grasps the end of each arm of the forked branch, pointing its tip skyward. Spreading the arms apart builds up tension in the branch, one reason diviners insist on one that's freshly cut. Loosening the grip even slightly, an act the eye is hard pressed to spot, allows the branch to turn to its point of equilibrium—downward.

Studies have proven the dowser causes the reaction. In 1962, Dr. Berthold Schwartz recorded the arm muscle move-

ments of the famous dowser Henry Gross with an electromyograph. Each time the branch dipped, the instrument indicated a movement in Gross's arm muscles. According to Dr. Schwartz, a dowsing supporter, arm muscles, not attraction to water, cause the branch's movement.

Other specialists in the fields of water engineering and geology blast dowsing with a backhanded compliment to dowsers. Namely, that they're good at judging location of water from the lay of the land. According to Thomas Riddick, a consulting waterworks engineer, a diviner's powers are normal for anyone with experience in locating simple dug wells. If the diviner knows his section of the country—the usual situation—chances of finding water increase even more. In such instances, it really may pay to hire a dowser rather than drill at random. But, says Riddick, discovery of water has nothing to do with special powers.

Bad day for dowsers

But, then again, it may *not* pay to hire a dowser. The book, *Water Witching U.S.A.*, calls the evidence for divining's accuracy "appallingly negative," and cites many cases of how dowsers struck out. In one experiment, 58 diviners were asked to find water, then locate the spot again blindfolded. In addition, two or more of the witchers were asked to verify the findings of a third. According to the books, not a single dowser bettered the laws of chance. Water witchers refute such tests, claiming they're not valid for reasons ranging from dowser fatigue to prejudiced judgments.

Paradoxically, many dowsers aren't searching for water at all. In utility companies in many parts of the country, employees use angle rods—often bent pieces of welding rod—to locate underground pipes, culverts and mains. "I've used angle rods for 16 years to find buried pipes town maps don't show," says Duke Diebold, water superintendent of Sheffield Lake, Ohio. "They've often saved us from excavating large areas or damaging existing pipes. I'm not superstitious about the rods, but it's a fact they work."

Foremen in the Detroit Water Department carry a set of rods in their car trunks at all times. The rods are considered "just another piece of equipment."

Significant tests

In France, Professor Yves Rocard, director of physics laboratory in one of the country's top universities, the Ecole Normale Supérieure, has probed water divining with some repeatable scientific tests.

In a large rural lot, Rocard measured

the variations of the ground's magnetic fields with highly sensitive instruments and found that the magnetic intensity varies greatly in some spots. He attributes these uneven magnetic fields to electricity resulting from water filtering through porous soil, a known phenomenon called electrofiltration. Rocard asked a dozen or so dowzers to walk over the lot, noting where their rods flipped over. The great majority of reactions, says Rocard, occurred where there were variations in the pattern of magnetic fields. From this, he speculated that cutting across a variable magnetic field triggered a nervous reflex, resulting in the dowser's grip loosening and the branch turning down.

To test the theory, he built a rectangular wire coil a yard long and two feet wide and asked each dowser to stand with his back to it. At random moments, an assistant would turn on the current in short bursts. Usually the rod circled down.

Other, more refined, tests gave the same results. The water witcher, says Rocard, is probably a detector of variable magnetic fields caused by electrofiltration.

Elbow is most sensitive

Rocard didn't stop there. He built a coil about the size of a saucer. As an assistant turned the current on and off, Rocard moved the coil up along each dowser's back, noting when a reaction came. He discovered that the most sensitive part of the body to uneven magnetic fields is the elbow.

Rocard's discoveries, if they are scientifically sound, have implications well beyond dowsing. For years, scientists have investigated biological clocks and other phenomena such as the homing instinct of certain pigeons. Many researchers point to biomagnetic effects as the explanation for these mysteries. Rocard's conclusions support this contention.

Naturally, before scientists accept Rocard's results, the tests made will have to undergo careful duplication. There's good reason why this might happen. Rocard, also on the physics faculty of the University of Paris, is a respected scientist. The scholarly journal *Physics Today* reviewed his book and stated: "... nothing whatsoever of the occult exists in Rocard's approach... [he] has given a definite and detailed prescription for a test, the first objective one ever proposed for dowsing."

Water diviners, expecting such tests to prove their claims, hope that Rocard's experiments will be duplicated in this country soon. Many scientists and water engineers, sure the experiments will show dowsing to be nothing more than a persistent superstition, hope so too. ★ ★ ★

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CIRCULAR BITS FOR YOUR LATHE

(Continued from page 162)

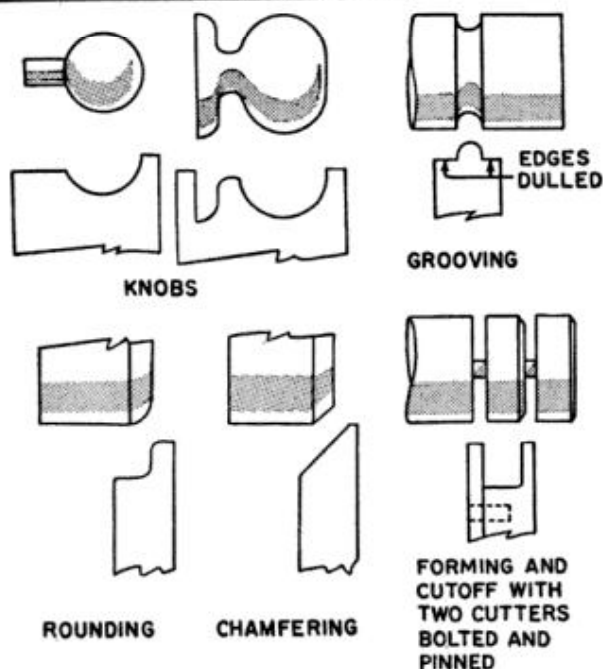
small pin on the adjustable mounting arm. This pin locks the cutter to the arm for each adjustment of the cutting-edge position, and also prevents slippage under cutting pressure.

After the disc has been formed and its cutting edge honed smooth, harden and temper it in the manner required for the steel you chose.

In the large photo, page 160, the discs are mounted in the cutter holder detailed on page 162. The gap and cutters accommodate work over 1½ in. in diameter. Of course circular cutters can be used singly, on a simpler mount, or on shank-type holders fitting standard toolposts.

The holder shown here is made from heavy angle and a flat steel block. The vertical portion holding the forming tool was machined with a slitting saw to reduce its thickness by half. This provides

SUGGESTED WORK SHAPES



offsetting of the two bits without the use of shims. You can accomplish final positioning of this cutoff tool (after you've used the forming bit) by either moving the lathe carriage along the bed or—with the carriage locked—by shimming out the mounting arm with washers. Place washers of equivalent total thickness around the 6-32 locking bolt, as well.

Drill and tap the base block for the central mounting bolt and drill four shallow holes for the "leveling" screws. Actually the purpose of these screws is to facilitate height adjustment. When this adjustment is set (to bring the cutting edge to the center line of the workpiece),

tighten the center mounting bolt and the lock bolts for the cutter and adjustable arm. I machined a tapered stud to fit the lathe cross-slide socket that normally holds the compound rest and I fastened this to the bottom of the block with three small bolts.

Make the two adjustable cutter arms from ⅛-in. cold-rolled flat stock or flat-ground tool steel. The ⅛-in.-dia. pin that engages the cutter is a tight drive fit in its hole in the arm.

It's a good idea to use a suitable cutting fluid when machining metal with these circular bits. It'll improve their performance and prolong periods between sharpenings. When resharpening by grinding, keep the bottom of the notch parallel to the cutter radius.

The decorative stepped disc being turned out in our demonstration photos has no practical purpose. I made quite a number and spaced them around a picture frame, along exposed shelf edges and in a circle around the hands of a recessed wall clock. Depending on whether they are applied to wood or metal, such buttons can be equipped with tack-like points, fastened with epoxy cement or soldered. Since circular bits are ideal for production turning, you can quickly make such items in any quantity you can use. ★★

Urban Renewal Circa 450 A.D.

Larger than imperial Rome, an ancient Mexican city named Teotihuacan probably suffered from urban problems strikingly similar to those of the modern metropolis.

Recent archaeological excavations made by Dr. Rene Millon, a University of Rochester anthropologist, reveal a city so congested as to require a drastic program of urban renewal around 450 A.D.—suggesting the existence of a strong central political authority. A grid pattern of square blocks and broad avenues was laid out to handle Teotihuacan's traffic and bring order to the "downtown" area, which till then had followed a rather haphazard growth pattern.

However, Teotihuacan's most important contribution to urban living, past and present, may reside in its architects' design for apartment buildings. Occupying entire square blocks, these buildings featured private, enclosed patios, which, Dr. Millon feels, may have provided a partial solution to the spatial and psychological pressures of life in the crowded city.

Using low altitude aerial photography, Dr. Millon and his crew of American and Canadian archeologists hope to produce a detailed, building-by-building map of the entire ancient city.

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PM-7

FAIRLANE OWNERS' REPORTS

(Continued from page 110)

to correct."—New York tool designer.

"Even with nobody sitting on it, the rear seat squeaks when I'm driving."—New Jersey steel worker.

"The car is much too noisy all around."—Texas patrolman.

Despite being ranked second on the plus side, economy (rather, the lack of it) wound up in third place on the minus side. Not only were there specific complaints about poor mileage, but several owners reported oil consumption akin to a gusher. Consider the following comment from a Missouri mail contractor:

"The gas and oil consumption is in excess of what it should be for a car of this size."

"It burns too much fuel for a car equipped with a single barrel carburetor."—Illinois postal worker.

"The oil consumption is extreme. I've added eight quarts in 5116 miles."—Kentucky, retired.

► **Never mind. They'll love you in Texas if not in Dearborn.**

"I hope when I finally get all the bugs out it will be cheaper to operate."—Texas transportation worker.

Some of the most outspoken complaints from Fairlane owners concerned the seats; most considering them too low. A New Jersey man, employed as a New York City cab driver, said:

"Please, please, please raise the front seat. It is much too low."

"The front seat should be higher and the back seat more upright."—Oklahoma physician.

"The range of forward-to-rear positions of the front seat is too short."—Rhode Island teacher.

"The low front seat makes it difficult for me to get in and out of the car."—Kansas farmer.

"It should be possible to raise or lower the front seat to accommodate the driver."—Virginia educator.

► **Sounds reasonable to me.**

Deemed a real knuckle-buster by both owners and service station personnel (several of whom apparently said so to many owners) was the Fairlane's lower mid-bumper gas fill location. And the beefs are justified; My own hand bears a scar (small, granted) from a wound incurred by a spring-loaded license plate that snapped back at me. What's more, filling the tank is awkward.

"The gas tank opening is below the body of the car and it is difficult to have the tank filled to capacity."—Alabama executive.

"The service station operator has a tough time filling the gas tank."—Nebraska director.

"I have yet to get the car filled above the three-quarter mark."—Indiana college professor.

Back on the sunny side of the street (at least from Ford's point of view), owners reporting what they liked about the Fairlane next named the car's size.

"It's small enough to be parked and driven in congested areas and yet there's plenty of room on the inside."—Wisconsin, retired.

"Car is small enough to be handled easily, but big enough for long distance driving."—Minnesota businessman.

"I find I can get it in tight places without any trouble."—Michigan key punch operator.

► **According to keepers of accident statistics, any number can play this game.**

"Spacious inside, yet looks trim and 'smallish' outside."—New Jersey cab driver.

You'd have a hard time convincing Detroit that people are not responsive to advertising claims; i.e., tell someone the new Ford is quiet—and keep telling him so—and eventually he'll believe you (whether or not he happens to be a European nobleman). Ford advertises that its big model is quiet. Owners of all kinds of Ford cars evidently apply it to their own version.

"The car is very quiet."—Ohio contractor.

"It seems to be a very quiet car with little or no road noise."—Indiana manager.

► **But he's not sure.**

... and so on, with any number of quotes more or less parroting Ford ads.

Next in owner favor was interior room.

"I am 6 ft. 2 in. and have adequate head and legroom, both front and rear."—New York lens designer.

"Fits six to seven people easily."—New York bookkeeper.

"By taking the rear seat out I have room for my skis or for taking a nap."—California foreman.

► **Sounds like an all-round sport to me!**

Rounding out the Fairlane huzzah list is a somewhat specialized category—the dual-action tailgate on the station wagon.

"Best feature of the car is the new tailgate."—New York electrician.

"I have found the new two-way swing tailgate to be a tremendous advantage."—Tennessee housewife.

"It's a useful feature."—U.S. Army pilot.

"The new tailgate makes it much easier to put the baby's stroller in the back."—Louisiana housewife.

Fairlane handling, beloved by many, is

the bane of a few and ranks a barely significant sixth on the complaint list.

"The car doesn't corner well. There's too much roll."—Illinois factory worker.

"The car seems to weave when the wind is blowing and when passing trucks."—Indiana teacher.

► **Maybe it's allergic to trucks.**

"It sways at highway speeds and is hard to handle."—Kentucky grocer.

Ranked seventh in the dislike department was the Fairlane's heater. Many owners said it was too noisy, but most heater complaints agreed with the Michigan salesman who said simply:

"It responds very slowly."

More to the point, perhaps, was the Iowa railroad fireman (presumably an expert in heat) who said:

"The heater takes too long to heat the car."

Getting down toward the bottom of the gripe list we find what a number of owners consider poor performance. However, many of those who complained thus felt they should have specified a larger engine than the 120-hp Six.

"I don't think the car will cruise too well in freeway driving. Possibly with a larger engine the problem would be solved."—Illinois teacher.

"Doesn't have much poop."—Texas oil worker.

"Once at 60-65, acceleration is slow for passing."—Alabama, retired.

"It's a nice car, but the horsepower is too low for quick pickup."—North Carolina shipfitter.

Winding up Fairlane complaints, a number of owners said the defroster left a lot to be desired.

"The defroster doesn't clear the entire window. I've found this to be especially true on the driver's side."—New York factory worker.

"It's slow to defrost the outer edges of the windshield."—Connecticut manager.

'Gooney Bird' still flying

The durable "Gooney Bird," workhorse C-47 transport of the military forces since the '30's, and, as the DC-3, mainstay of the pre-World War II commercial airlines, is back in action, flying as an attack plane in Vietnam. Now known as the AC-47, it's been armed with three side-firing 7.62-mm Miniguns, the six-barrel Gatling-type guns which spit out 6000 rounds per minute. Prime mission of the armed transports is to lay down a barrage of fire—a total of 18,000 rounds a minute from the three guns—in support of ground troops.

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RIDGID

WILDEST RAILROAD IN THE WEST

(Continued from page 85)

gaze into the stupendous Barranca de Urique, a canyon only a shade less magnificent than the Grand Canyon.

Beyond Bocoyna station, trains round a curve and without warning plunge into a 4134-foot tunnel, first of the great new tubes. Engineers thrust it through the mountain to bring Stillwell's old railroad up to the grade standards of the new construction. The tunnel saved 2.17 miles in track and reduced a locomotive-pounding two-and-a-half percent grade to two.

Loop the loop

After passing through Creel, trains jerk and turn over an agony of loops and horseshoes as the railroad crosses the jumbled mountains that blocked railroad builders for half a century. At Kilometer Post 583, tracks climb to 8071 feet, the highest point on the line. Over 50 years ago Stillwell's engineers optimistically built a bridge at what is now Kilometer 585, but his rails never reached it. Mexican engineers found the old bridge sound, and today's trains roll over it, then swing in a circle and tunnel back through the mountains to pass precisely 500 feet below.

Rocky cliffs overhang the railroad, and sometimes heavy rains sent torrents of rocks and mud cascading down onto the tracks. When the line was first finished, the Mexican Government prepared to run an inaugural train over it filled with the guests of President Lopez Mateos. Vast slides wiped out 32 kilometers of rail and caused the inaugural train to be delayed from July until November. Since then other trains have been knocked off the rails by slides, but engineers now feel that the slopes are reasonably stabilized.

Railroaders find the bridges to be of extraordinary construction, too. Most are made of concrete and steel although some are built entirely of concrete. Cement for the construction was shipped up from a mill in Chihuahua, but the aggregate was scooped from the beds of mountain rivers. Mixing was done by hand.

"The form lumber was cut right here in the forests," explains Joe Wampler. "Workmen put it together with something of the precision of an old cabinet-maker."

Pilasters were reared over 100 feet from the riverbeds. Concrete and steel beams to support the tracks were inched from one pier to the next by muscle power.

Track laying on the Chihuahua al Pacifico was done in the latest French manner. Steel plates were placed on the impregnated ties and then covered by a cushion of rubber. Ninety-pound steel rails,

formed at Pueblo, Colo., were clamped to the plates and secured by large steel screws in place of spikes. Forms of sand and clay were shaped around joints in the rails. Then welders preheated the rails with gas burners to bond them together. Molten steel from a portable foundry was poured into the mold to fill the cracks between the rails. While the steel was still glowing, the workmen cut away metal. Then another man ground and polished the joint so that only an expert can tell where the rails are tied together. New machines shook ballast down over the tracks, leveled it off and tamped it down. The tracks were ready for the first train. Al-

Riding the Chihuahua al Pacifico

National Railroad of Mexico trains from Ciudad Juarez connect with Chihuahua al Pacifico trains at Chihuahua City. Reservations for daytime Fiat or Pullman service from Chihuahua City to Los Mochis can be made through Pan American Travel Service, Del Camino Motor Hotel, El Paso, Tex., or Chihuahua al Pacifico Railroad, P.O. Box 46, Chihuahua Chih., Mexico.

One-way first-class fares from Chihuahua to Los Mochis are \$9.79 for a lower berth; \$9.16, upper; \$19.57, bedroom; \$25.41, compartment; \$31.87, drawing room. A reclining seat on a Fiat is \$7.42.

The railroad freight office in Chihuahua will arrange to ship your auto over the railroad on a freight train if you give at least 15 days' notice. Cost is \$34.17 for each 1000 kilograms (2204 lbs.), with a minimum charge of \$51.25.

Joseph Wampler, Box 45, Berkeley, Calif., plans fall and spring Pullman tour trains over the railroad for rail fans, rockhounds and Indian buffs.

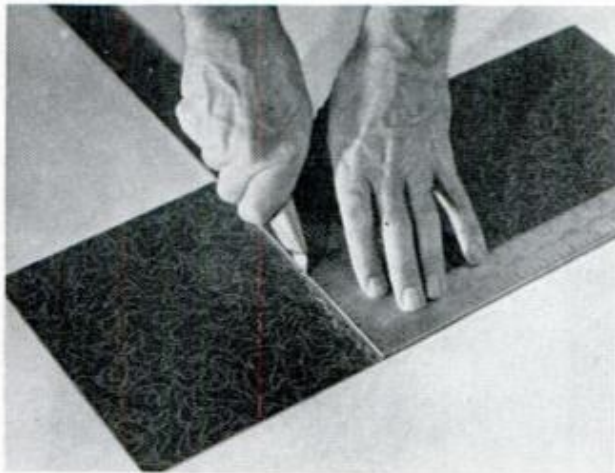
though 60 percent of the railroad curves, the right of way was constructed with such care that freight trains can average 37 miles per hour.

"Everyone worked on the railroad," says Wampler. "On one hand there was Francisco de Tagno, one of the world's great engineers, and his fellow engineers, trained mostly at the University of Mexico, and on the other hand there were the Tarahumara Indians, who cut ties in the forests."

Six thousand men labored on the construction, dressing grades after crews of dynamiters had blasted their way through mountain shoulders. By 1960 crews were racing to finish the job. When tracklayers overtook the grade-builders at La Laja, engineer Mariano Garcia Malo skipped over the area to lay 31 miles of track in a more forward zone without the help of a construction train. When the graders were finished, his men returned to fill in the

(Please turn to page 188)

SHOPPING FOR
TOOLS
BY RICHARD HOWE



You'll be hooked on Stanley Tools' new scoring blade (No. 5194) for use on decorative laminates, composition roofing materials, plastic flooring products and wall-board. Hooked point of blade cuts deep and clean and is more easily maneuvered around curves. Fits in most conventional utility knives. A two-blade package sells for 50 cents in hardware stores. Product of The Stanley Works, New Britain, Conn.



You'll do wrench work twice as fast using the new *Adjustamatic* ratchet wrench from Weil Tool Co., Inc., P.O. Box 64, Woodmere, N.Y. Wrench is self-ratcheting and self-adjusting for one-hand operation. Use it on nuts and bolts and pipe. Tool is made of drop forged steel and features a tempered steel spring. Available in four sizes—6, 8, 10 and 12 in.—the wrench retails for \$1.95, \$2.50, \$3.50 and \$4.50 respectively.

JULY 1966

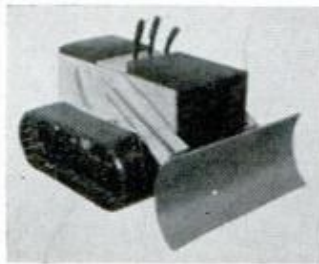
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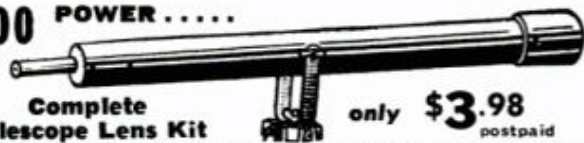
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WILDEST RAILROAD IN THE WEST*(Continued from page 186)*

break. Railhead moved forward at as much as 1500 yards a day.

At La Junta, workmen trimmed and creosoted 400,000 crossties. After the railroad had surmounted the Sierra and was descending the tortuous canyon of the Pacific Coast side, this huge supply of crossties was exhausted. Engineers substituted a new type of crosstie. Blocks of reinforced concrete were poured around the two ends of a piece of old rail cut to tie length, and the rails were fastened to this. Engineers estimate that such ties will last 50 years, compared to 30 years for a wooden tie.

Treat for camera buffs

Rail fans touring the Chihuahua al Pacifico find that railroading on the line is informal. Joe Wampler hitches a tour train of stateside Pullmans to a Mexican locomotive and rolls down the rails. The train crew shunts his cars off onto mountain sidings from where tourists can examine the construction and explore the countryside along the tracks. When Wampler's train reaches the Cuiteco Bridge, it stops on the far side. Passengers get out, climb up a rocky hill and cock their cameras. Then the engineer backs the train across the bridge and comes across again for their benefit. There are fiestas in Mexican villages to attend, trails which lead to Tarahumara caves and unscheduled train stops. At Jesus Cruz, train crews often quit the train to drink *tesvino*, the corn beer brewed by the Tarahumara.

Trains pass over the Chinipas Bridge at Kilometer 748. It is 955 feet long. Not long afterward, trains reach the Rio Fuerte Bridge, at 1638 feet, the longest bridge on the railroad. Then they roll down into a rich valley beyond the mountains. Bougainvillea, palm trees and wide fields of sugar cane speak of the lush tropics, where new dams and the railroad have brought prosperity to thousands of people. Paved roads put in an appearance. Irrigation ditches run brimful of water from the dams in the mountains. This is Sinaloa State where the Mexican West Coast agricultural boom is in full swing. The train finally stops as Los Mochis.

Only freight trains are permitted over the last 16 miles which separate Los Mochis from Topolobampo. The old Kansas City, Mexico and Orient rails are too worn to permit safe operation of passenger trains, and travelers must go the last few miles in a bus. New rails, fabricated in a Canadian mill, are being delivered, and soon passengers from Chihuahua City will be making the complete journey. ★★

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CADILLAC OWNERS' REPORT

(Continued from page 80)

Michigan engineer feels: "Overall style is far ahead of other so-called luxury cars."

"I appreciate the simple, uncluttered lines and lack of gingerbread."—Florida engineer.

"Tops for beauty and luxury, inside and out."—Virginia salesman.

Another thing Cadillac owners feel they obtain with their bill-of-sale is reliability.

"I have found the Cadillac to be the most dependable car I have ever owned."—New Mexico, retired.

"I can drive it a full year with little or no service."—New York optometrist.

"Car offers good all-'round dependability."—New Jersey technician.

Despite the positive note struck by owner praises, however, America's Motoring Majesty has some loyal (generally) opposition, most of it like communists in the French Assembly—small in percentage, but loud.

"There's a lot of noise around the windows and door frames."—District of Columbia showman.

"We have a wind whistle with our '66 that we didn't have with our '64."—South Dakota housewife.

"I get a lot of noise through and around the front windows."—Wisconsin educator.

Added to wind noise are complaints about rattles and road noise.

"It rattles like a truck."—Michigan broker.

"Body isn't as tight as in previous Cadillacs I've owned."—California executive.

"Rumbling noise from the road seems to come right up into the car."—New Hampshire clergyman.

In theory the automatic climate control system sounds peachy, but in practice a number of owners think it's a dud, or at least something less than its billing.

"The climate control does not operate fully automatically, as the salesman said it did. I think the thermostat is too sensitive and the warm air suddenly changes to cold before a comfortable temperature is reached."—Connecticut physician.

► I found this to be true in PM's test car, too.

"Climate control has no manual override; when on freeways or behind buses and trucks, fumes fill the car."—Mississippi, USAF.

"It's hard to control the heater part of the climate control."—Michigan engineer.

Next on the complaint list is a category one hardly expects to find when it comes to a Cadillac: workmanship. As pointed out in previous owners reports, poor and/

or indifferent workmanship seemingly dogs the entire auto industry. Still, with the "little" Caddy selling for just under \$5000, it's more than out of place, particularly with the "standard of the world." A Maryland businessman makes the point:

"A car in this price field shouldn't have as many faults in workmanship as does mine. For example, there were several loose bolts, the rubber window molding was twisted, and so on. The car has several signs of negligent workmanship."

"More attention should be paid to small details of workmanship. There were loose thread ends hanging all over my new car's upholstery."—New Jersey businessman.

"The doors have never fit properly and the rear speaker rattles."—Virginia executive.

"They ought to do a better job of assembly. With my last ten Cadillacs it has taken me almost 7000 miles to get all the bugs out."—Florida, retired.

► This is no fair-weather friend, either. He has owned 32 Cadillacs.

Owners aren't too happy with the glove compartment. It's a minor item, granted, but one would think that in a Cadillac it would be both copious and efficient.

"It's awkward."—Michigan doctor.

"It's too small."—Iowa sales manager.

"Things tumble out when its opened."—California contractor.

"It's next to useless."—Maryland executive.

And so on, all pretty much in the same vein. So are comments about the front seat ashtray.

"It's unhandy."—Florida businessman.

"Inconvenient."—Michigan physician.

"Too small."—California businessman.

"The ashtrays up front are just terrible."—Illinois accountant.

Ranked sixth on the praise list by Cadillac owners was the car's quietness; again, something one would think comes with possession of the ignition key.

"The engine is very quiet."—Iowa executive.

"Car just whispers along at high speeds."—Pennsylvania designer.

"Road noise is minimal."—Tennessee sales executive.

Many owners had kind words for their cars' pickup and performance.

"Best performing car yet."—Kentucky businessman.

"Responds well when I step on the gas."—Virginia manager.

"Acceleration characteristics are superb."—Ohio supervisor.

Although, as mentioned earlier, many owners deemed the climate control system bad news, a few owners had kind words to

say for it. Typical comments:

"I like it and find it keeps both driver and passengers comfortable at all times."
—Illinois executive.

"The climate control device is my favorite interior feature."
—Michigan contractor.

Again it may be part of the Cadillac mystique, but owners are quite certain their cars offer outstanding roadability.

"Feels solid on the road, something I find especially assuring."
—Alabama, retired.

"Cornering and steering control are excellent."
—Ohio engineer.

"A stable and solid car."
—Florida research analyst.

"It's the best road car I have ever owned."
—Minnesota salesman.

Winding up the list of owner praises is a tip o' the hat to overall workmanship.

"Car is well finished—good paint, good fit of chrome trim and so on."
—Michigan engineer.

"The quality of this year's model seems much better than that of previous years."
—New York attorney.

However, a number of owners disagree; certainly in regard to the paint job.

"Poor paint job. There are rust spots appearing already in many places."
—New York surgeon.

"Metallic paint was sloppily applied."
—Missouri businessman.

"Paint job could be much better."
—Vermont engineer.

You wouldn't think Cadillac owners would lose much sleep over poor mileage. They do.

"The car needs a more economical engine. It burns too much gas."
—Florida technician.

"Gas mileage is very poor."
—Tennessee housewife.

"I've owned Cadillacs since 1948 and average gas mileage in the past has been 25 percent better."
—Connecticut executive.

Near the bottom of the complaint list is a surprising item: styling.

"The car is too long and too low. I have difficulty getting in and out of it."
—Minnesota businessman.

"It's too big, really. It's difficult to park."
—Ohio businessman.

"Interior should be more plush for the name the car carries."
—Kansas executive.

Finally, many owners reported they didn't think much of the frameless, curved glass windows. Comments:

"Curved door glass with no molding cannot be seen at night; people often open the doors and hit their faces. It's very dangerous."
—New York travel agent.

"Those frameless windows have got to go!"
—New York salesman. ★ ★ ★



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CAR STEALING MADE SIMPLE

(Continued from page 59)

have problems with loss of valuables. They pay extra insurance premiums to cover such losses, but usually claims are allowed only if the locked vehicle shows evidence of "forcible entry." If master keys are used, the owner cannot prove his claim and there is no legal recourse.

However, as most police know, professional thefts, bad as they are, constitute only a small part of the problem. The frequency of auto thefts by teen-agers runs to 92 percent in some areas.

Nationwide, more than 60 percent of juvenile crimes are auto thefts, according to the NATB. The bureau reports that contributing factors are the numbers of cars available today, public apathy and softening in the courts. The juvenile offender, the bureau says, has no fear of being punished—"He's a nice boy, Judge, just a little wild. . . ." In one case cited, a juvenile, arrested 12 times for car theft without punishment, was let go the twelfth time and stole the probation officer's car to go home!

The number of arrests of juveniles under 18 for auto theft has more than doubled the last five years. The New York

City auto-theft squad reports that auto theft is almost a game among teen-agers in some communities. Recently, it rounded up a group of six, all with master keys, who actually staged a contest to see how many cars each could steal in a given time. In another case, seven girls—one 17, five 14 and one 11—were caught by police after a tire-squealing chase, in what turned out to be a stolen car. The 17-year-old had 27 master keys.

What makes these cases more frightening is that these youngsters, who are deliberately stealing cars by joyriding, are endangering every motorist on the street.

Car manufacturers are beginning to realize the dangers of master keys. I understand that, on their 1967 models due out in a few months, some manufacturers will have increased the number of key combinations on their automobiles, making more new master keys necessary.

However, while valuable, such solutions are not the ultimate answer. I believe that federal action is necessary to halt the indiscriminate sale of master keys, perhaps the most easily available of burglar tools. This would aid local authorities, eliminating tools for professional thieves and removing temptation from youngsters. ★★★

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